



MS-TestPro HDBT™ Test Device Model MS103TDs / MS104B

User's Manual

Revision A13

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Revision History

Revision	Date	Description
A1	November 2016	First issue
A2	February 2017	General update
A3	March 2017	<ul style="list-style-type: none"> • Explanation of HDBaseT Link classes • How to connect the test device for EDID • Description of test cases • USB connectivity indicator
A4	April 2017	Cable certification – report generator
A5	July 2017	GUI screenshots update
A6	November 2017	Tx and Rx FW upgrade added
A7	January 2018	GUI-related updates
A8	January 2018	Physical/Mechanical measurement update
A9	April 2018	Model MS104B replaces model MS102TD
A10	Jul 2018	<ul style="list-style-type: none"> • Wi-Fi Client GUI updated • New DC Resistance module
A11	Nov 2018	Date/Clock settings added
A12	June 2019	<ul style="list-style-type: none"> • GUI modifications • Local PDF certification report
A13	September 2019	New HDMI Cable Tester module

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1. Introduction

This document is intended as a guide for installation and operation of the **MS-TestPro** HDBaseT Test Device from Media Solutions Ltd.

The MS-TestPro test device provides a practical, easy to use solution for field testing of HDBaseT-based communications systems and cabling.

Use the MS-TestPro device to test and certify the HDBaseT performance and link quality of CATx cabling **before** performing installations. In addition, the MS-TestPro's built-in monitoring, logging, and diagnostics capabilities allow for quick, efficient analysis and troubleshooting.



Figure 1: The MS-TestPro HDBaseT Test Device

MS-TestPro is the ultimate testing device for installers, developers, and integrators. The device is supplied with an HDBaseT transmitter, receiver, and PoH (Power over HDBaseT) functionality, providing a highly-efficient testing platform for HDBaseT source and sink nodes, powered devices, and CATx cabling intended for use in HDBaseT networks.

IMPORTANT!

The MS-TestPro requires use of CAT5e (or higher quality) cable – referred to in this manual as *CATx cabling*. **The HDBaseT standard supports a cable length range of 20 to 100 meters (66 to 328 feet).**

Why do you need the MS-TestPro HDBaseT test device?

You've finished wiring the audiovisual system, and have connected the audio/visual devices over the HDBaseT link. You can see the picture and hear the sound. Everything is OK, right?

Wrong! A link test is essential in guaranteeing perfect performance. You certainly don't want to come back to perform the installation again.

When you connect the test device and see error levels in the red zone – *even if the link is up and you see a picture in your display* – the probability of a link failure is high. Any EMC interference, caused by switching on lights or an air conditioning unit for example, can cause a transmission breakdown and a drop in the video link.

With the MS-TestPro test device, you can identify faulty cabling and systems **before installing them**, saving time and money.



Figure 2: Faulty Link

1.1 MS-TestPro Models

Users can choose between two MS-TestPro models:

- Wi-Fi Client Model, with 3.5" screen, ***built-in HDMI pattern generator***, and Wi-Fi interface for browser-based management (MS103TDs)



Figure 3: MS103TDs

- Battery based Wi-Fi Client Model, with 3.5" screen, ***built-in HDMI pattern generator*** and Wi-Fi interface for browser-based management (MS104B)



Figure 4: MS104B

1.2 Standard Modules

- The HDBaseT Tester is supplied with Spec 1.0 Tx and Rx Modules that can be used with either of the above-mentioned tester models.



Figure 5: HDBaseT Spec 1.0 Tx/Rx Modules

1.3 Optional Add-On Modules

- The HDBaseT Spec 2.0 Modules (Tx and Rx units) are available as an optional add-on that can be used with any of the above-mentioned tester models.



Figure 6: HDBaseT Spec 2.0 Tx/Rx Modules

- The DCR (DC Resistance) and Looper Modules are available as optional add-ons that can be used with any of the above-mentioned testers.



Figure 7: DC Resistance and Looper Modules

- The HDMI Cable Tester and Looper Modules are available as optional add-ons that can be used with any of the above-mentioned testers.



Figure 8: HDMI Cable Tester and Looper Modules

2. Product Description

2.1 Overview

The basic MS-TestPro HDBaseT test device is composed of 3 units:

- Main unit – the MS-TestPro chassis – containing a power supply, USB connector, and 3.5-inch touch screen.
- HDBaseT transmitter module – for transmitting HDBaseT traffic to sink devices, such as projectors or television sets
- HDBaseT receiver module – for receiving HDBaseT traffic from source devices, such as a PCs, set-top box (STB), DVD or Blu-ray player.

2.2 Models

The MS-TestPro HDBaseT Test Device is supplied in a variety of models and add-on modules:

Table 1: MS-TestPro Models

Model	Description
MS103TDs	HDBaseT tester main unit with 3.5" touch display, built-in HDMI pattern generator, and Wi-Fi connection for smart devices
MS104B	Battery based HDBaseT tester main unit with 3.5" touch display, built-in HDMI pattern generator, and Wi-Fi connection for smart devices

Table 2: MS-TestPro Modules

Model	Description
Standard Modules	
HDBaseT Spec 1.0 Transmitter and Receiver Modules	The MS-TestPro HDBaseT Test Device is supplied with HDBaseT Spec 1.0-standard Tx and Rx modules.
Optional Add-On Modules	
HDBaseT Spec 2.0 Transmitter and Receiver Modules	The HDBaseT Spec 2.0 Modules (Tx and Rx units) are available as an optional add-on that can be used with any of the test devices listed in Table 1 above.
DCR Module	The DC Resistance feature enables installers and integrators to easily and reliably check DC resistance unbalance – both within and between twisted pairs – ensuring system integrity in even the most advanced, high-powered Power-over-HDBaseT systems.
HCT Module	The HDMI Cable Tester module allows installers and integrators to test the quality of HDMI cables before their installation. The module identifies missing and shorted wires in HDMI cable that will render the cable incapable of stable, sustained 4K streaming.
Looper Module	The Looper module is a remote-end module with RJ45 and HDMI ports that is used to create the loop at the other end for DC Resistance and HDMI cable testing.

2.3 Subsystems

Table 3 below describes the MS-TestPro test device's subsystems.

Table 3: MS-TestPro Subsystems

Subsystem	Description
Main unit MS103TDs	<ul style="list-style-type: none"> Power supply, 48V, 0.5A, positive polarity central pin USB 2.0 port – for memory stick connectivity Ethernet connection for future use HDMI pattern generator
Main unit MS104B	<ul style="list-style-type: none"> Battery based Charger, 12.6V, 3.0A, positive polarity central pin USB 2.0 port – for memory stick connectivity Ethernet connection for future use HDMI pattern generator
HDBaseT Spec 1.0 Transmitter module	<ul style="list-style-type: none"> HDBaseT Spec 1.0 output port HDMI input, supporting pixel clock speed of up to 340 MHz (4K/60 Hz, 4:2:0) PoE (PoH, powered device)
HDBaseT Spec 1.0 Receiver module	<ul style="list-style-type: none"> HDBaseT Spec 1.0 input port HDMI output, supporting pixel clock speed of up to 340 MHz (4K/60 Hz, 4:2:0) PoE (PoH, powered device)
HDBaseT Spec 2.0 Transmitter module*	<ul style="list-style-type: none"> HDBaseT Spec 2.0 output port HDMI input, supporting pixel clock speed of up to 340 MHz (4K/60 Hz, 4:4:4) PoE (PoH, powered device)
HDBaseT Spec 2.0 Receiver module*	<ul style="list-style-type: none"> HDBaseT Spec 2.0 input port HDMI output, supporting pixel clock speed of up to 340 MHz (4K/60 Hz, 4:4:4) PoE (PoH, powered device)
DC Resistance module*	<ul style="list-style-type: none"> RJ45 output port
HDMI Cable Tester module*	<ul style="list-style-type: none"> HDMI output port
Looper*	<ul style="list-style-type: none"> RJ45 input port HDMI input port

* Optional equipment

2.4 HDBaseT Support

The MS-TestPro test device integrates a Valens VS100 HDBaseT Class A or VS2310 HDBaseT class C chipset, including transmitter and receiver ICs. The class A chipset supports HDBaseT Specification 1.0, and is compatible with HDBaseT Specification 2.0, allowing it to work with HDBaseT devices of the following classes:

Table 4: MS-TestPro Compatibility with HDBaseT Classes

Class	HDBaseT Specification	Media Type	Maximum Resolution	Supported Cabling	
				Maximum Length	Category
Class A	1.0	Copper	1080p	100 m	CAT5e
			4K	70 m	CAT5e
Class B	1.0	Copper	1080p	70 m	CAT6a
			4K	35 m	CAT5e
Class C	2.0	Copper	1080p	100 m	CAT5e
			4K	90 m	CAT5e
			4K	100 m	CAT6a
Class D	2.0	Copper	1080p	30 m	CAT6a
Class E	2.0	Fiber	4K	Not supported by MS-TestPro	

3. Installation

3.1 Unpacking the Unit

The complete MS-TestPro HDBaseT Test Device kit is depicted in Figure 9 below.



Figure 9: MS-TestPro HDBaseT Test Device Kit



Figure 10: MS-TestPro HDBaseT Test Device Kit Contents

The TestPro system is supplied with the following components:

Table 5: MS-TestPro Components

Number	Component
1	Main unit
2	Transmitter module
3	Receiver module
4	External 48 VDC power supply for MS103TDs or 12.6 VDC charger for MS104B
5	Pluggable PoH Adapter – allows the remote transmitter or receiver module to serve as a PoH powered device (PD)
6	Stylus pen for operating the touch screen
7	HDMI Cable

4. Operating the Touchscreen

4.1 Test Setup

This section describes the physical setup and connectivity schemes used to perform tests using MS-TestPro.

- Testing MS-TestPro Modules
- Connection to System Under Test (SUT)

IMPORTANT!

- * Make sure that you complete all cable connections **before** powering up the MS-TestPro test device.
 - * Always power down the unit for cartridge replacement.
-

4.1.1 MS-TestPro Test Setup

In the MS-TestPro Modules test setup mode, the transmitter and receiver modules of the MS-TestPro device are directly connected to each other using a CATx cable of up to 100 meters (328 feet) in length, as shown in Figure 11 and Figure 12 below.

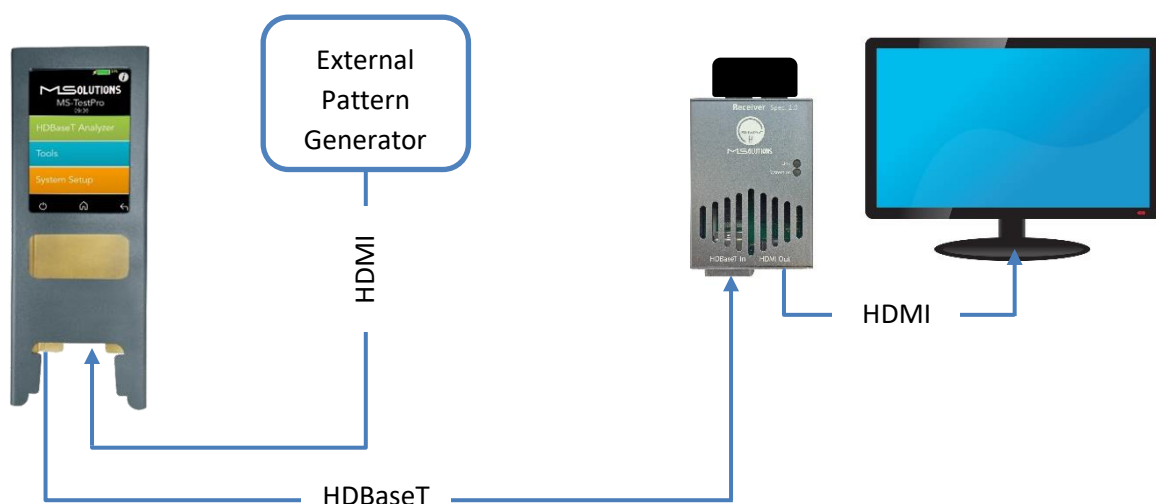


Figure 11: MS-TestPro Modules Test Setup using External Pattern Generator

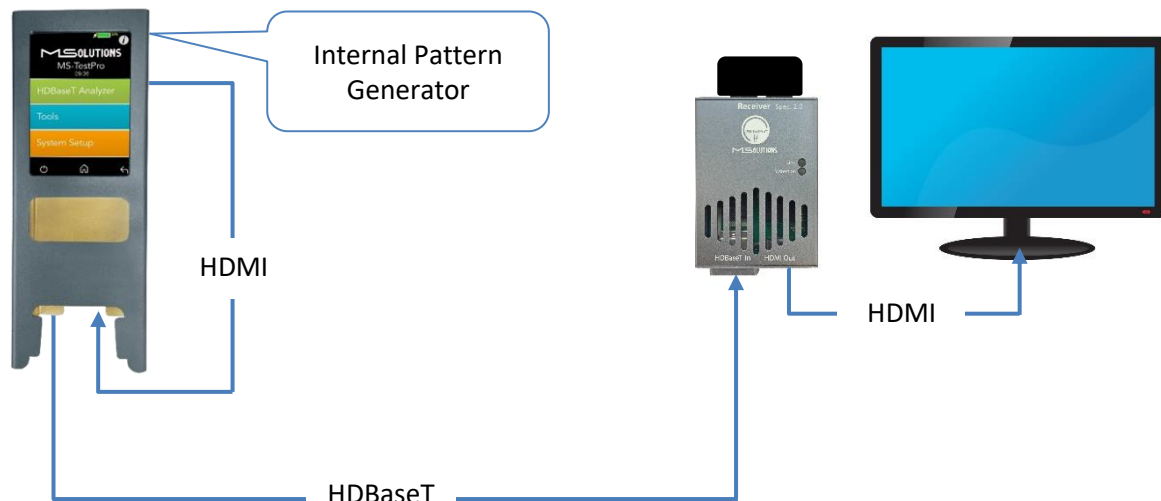


Figure 12: MS-TestPro Modules Test Setup using Internal Pattern Generator

➔ **To setup the system for testing:**

1. Insert the Transmitter or Receiver module into the MS-TestPro main unit in the lower slot – this module will be defined as the *local* module. The other module will be defined as the *remote* module.

IMPORTANT!

Only the *lower slot* is used to connect modules to the MS-TestPro main unit. The upper slot is used for module storage only.

2. Using a CATx cable, connect the HDBaseT port (RJ45) of the local module to the HDBaseT port of the remote module.
3. Attach the pluggable PoH adapter to the remote module so that it will function as a PoH powered device (PD).



Figure 13: Pluggable PoH Adapter on Remote Module

4. Insert the 48 VDC power supply connector into the designated socket in the main unit to power the device.

IMPORTANT!

The device will not power up unless a local module has been inserted into the lower slot of the device.



Figure 14: MS103TDs and MS104B Input Powering Sockets

4.1.2 Connection to System Under Test (SUT)

Use the following guidelines to connect the MS-TestPro to an HDBaseT *source* device (i.e. an HDBaseT transmitter such as Matrix or Blu-ray). The MS-TestPro acts as a sink device.

➔ **To test an HDBaseT source device:**

1. Insert the receiver module into the MS-TestPro main unit in the lower slot – the module will be defined as the local module.
2. Using a CATx cable, connect the HDBaseT input port of the receiver module to the output port source device, using one of the following methods:
 - Connecting the CATx cable directly to an integrated or 3rd party HDBaseT output port in the source device.
 - Connecting the CATx cable to the MS-TestPro transmitter module, and connecting the transmitter module to the source device with an HDMI cable.
3. Insert the 48 VDC power supply connector into the designated socket in the main unit to power the device.

Use the following guidelines to connect the MS-TestPro to an HDBaseT *sink* device (i.e. an HDBaseT or HDMI receiver such as a display). The MS-TestPro acts as a source device.

➔ **To test an HDBaseT sink device:**

1. Insert the transmitter module into the MS-TestPro main unit in the lower slot – the module will be defined as the *local* module.
2. Using a CATx cable, connect the HDBaseT output port of the transmitter module to the input port sink device, using one of the following methods:
 - Connecting the CATx cable directly to an integrated HDBaseT input port in the sink device.

- Connecting the CATx cable to the MS-TestPro receiver module, and connecting the receiver module to the sink device with an HDMI cable.
- 3. Insert the power supply connector into the designated socket in the main unit to provide power.

IMPORTANT

The MS103TDs should be powered by a 48V Power Supply.
For the MS104B, use a 12.6V Power Charger.

4.2 Performing the Tests

4.2.1 Main Screen

The main screen (see the figure below) offers the following functionalities:

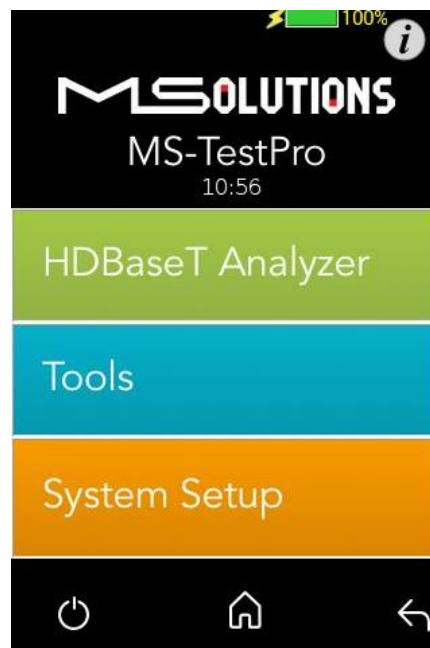






Figure 15: MS-TestPro Main Screen

- **Information.** The  icon provides access to informative guidelines and system documentation.
- **HDBaseT Analyzer**
 - Basic Analysis: Basic Pass/Fail report.
 - Performance: Real-time access to HDBaseT cable performance data.
 - Configuration: Read-only access to the system configuration.
- **Tools**
 - HDMI Generator: HDMI Pattern Generator.
 - EDID Analyzer: Access information on the display capabilities of HDMI sink devices.
 - Certification report: Collect the data required to produce the HDBaseT test report.

- Log Analyzer: For continuous testing up to 24 hours.
- HDBaseT Firmware Update: To update the firmware of 3rd party HDBaseT units.
- DC Resistance testing (supported if the DCR module is inserted)
- HDMI cable testing (supported if the HCT module is inserted)
- **System Setup.** Used to perform system configuration, tester firmware upgrades and maintenance operations.
 - System Upgrade
 - System Reboot
 - System Settings
- **Power Off.** Tap the on/off icon  at the left side of the bottom line of the screen to power down the system. To safely shutdown the system, see the shutdown instructions in section 4.4.
- **Home.** Tap the Home button  in the middle of the bottom line of the screen to return to the Main screen.
- **Back.** Tap the Back button  at the right side of the bottom line of the screen to return to the previous screen.

4.2.2 Information Menu

Using the information menu (see Figure 16 below), you can access the following materials:

- The latest version of this user's manual
- The MS-TestPro application note
- A link to MS-Pro video tutorials (available in a future release)

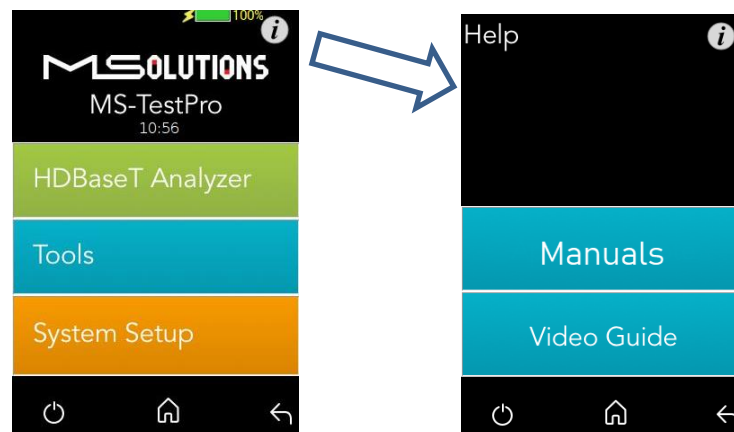


Figure 16: Information Menu

4.2.3 HDBaseT Analyzer

To get to HDBaseT Analyzer menu, tap on the HDBaseT analyzer button as shown in the figure below:

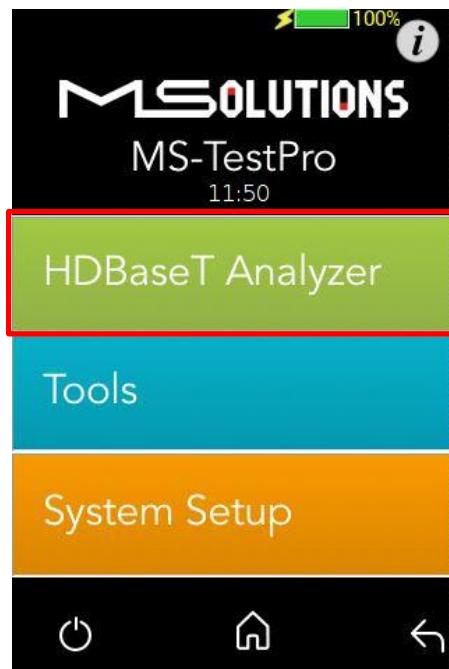


Figure 17: Selecting the HDBaseT Analyzer Menu

The following screen will appear:

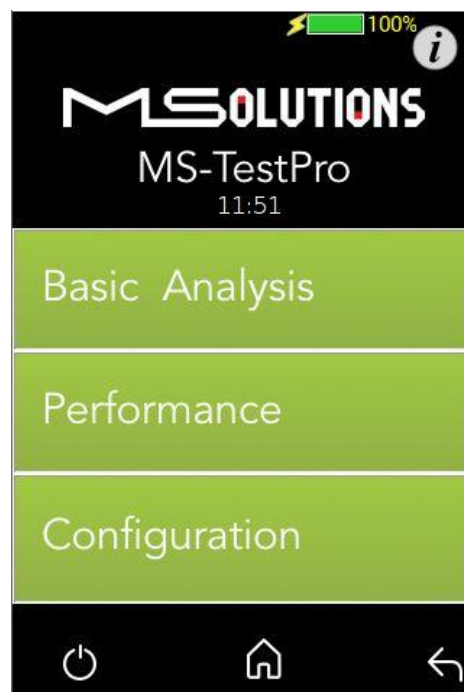


Figure 18: HDBaseT Analyzer Screen

4.2.3.1 Basic Analysis

The Basic Analysis function is used to report on HDBaseT link quality.

To analyze the link, tap on the **Basic Analysis** button, as shown in the figure below.

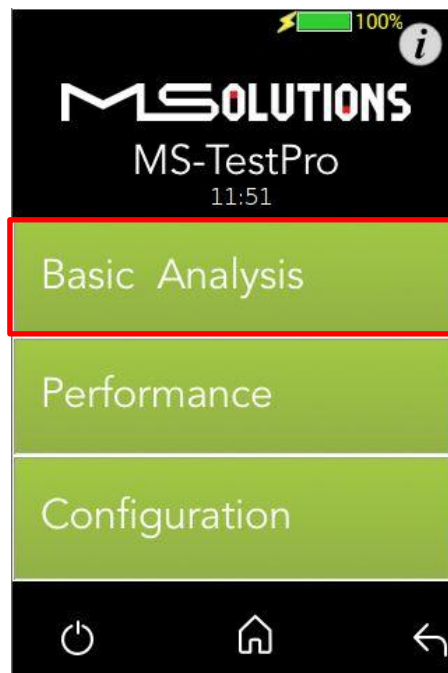


Figure 19: Selecting Basic Analysis

The Basic Analysis page appears as shown in the figure below.



Figure 20: Basic Analysis Page

The basic analysis page displays the following information:

- **General Link Quality.** Red, yellow, green as defined below.
- **Transmitter Link Quality.** Red, yellow, green as defined below.
- **Receiver Link Quality.** Red, yellow, green as defined below.
 - **Green.** The link is functional.
 - **Yellow.** The link is unstable.
 - **Red.** The link is faulty resulting in a high probability of failure
- **Pixel Clock.** The clock frequency of the video transmission. The Pixel Clock values in the receiver and transmitter screens should be similar.
- **Chip Type.** The chip model/part number.
- **Cable Length.** Approximate cable length calculation (accuracy level $\pm 10\%$), in Meters or Feet.
- **HDMI HPD.** Hot Plug Detection.



4.2.3.2 Performance Management

To access performance management functionality, tap on the **Performance** button, as shown in the figure below.

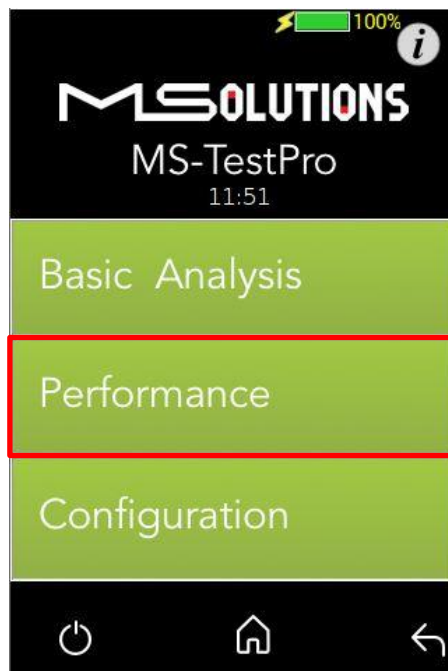


Figure 21: Selecting Performance Monitoring

The system provides performance monitoring of the four HDBaseT channels (each associated with a twisted pair) in the CATx cable – designated A, B, C, and D.

IMPORTANT

When monitoring performance, the transmitter controls are always displayed on the left side, the receiver controls are always displayed on the right, as shown below in Figure 22.

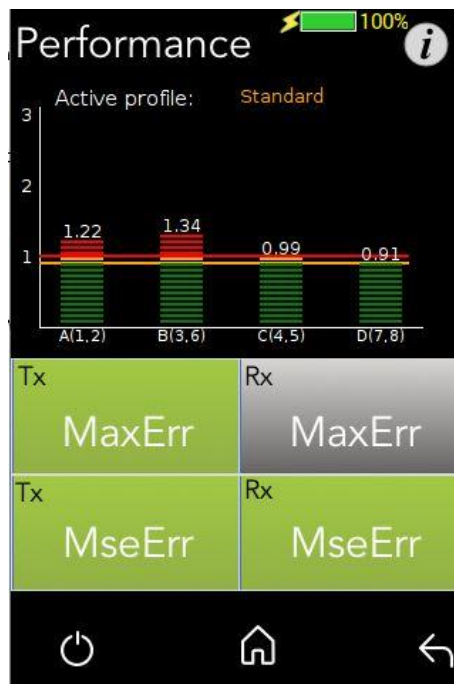


Figure 22: Performance Monitoring Screen. MaxErr Screen – Displaying Graph & Data.

The screen appears, displaying receiver (Rx) data. To display transmitter data, tap on a Tx button.

Note the yellow and red horizontal lines in the display. These are performance thresholds:

- **Yellow.** The link is unstable.
- **Red.** The link is faulty with a high probability of errors.

Two types of measurements are tracked by the system:

- **MaxErr.** The per-channel maximum recorded value of the residual error for PAM-8/16.

The Max Error measurement is the absolute value of the maximal distance between the input signal on a given channel and the decision threshold in the HDBaseT modulation detection scheme. This measurement behaves as a peak detector, so the value read is always the maximal error witnessed on the channel.

- **MseErr.** The per-channel mean square of the residual error for PAM-8/16.

The actual MSE value is a fractional negative number of db. The higher the absolute value of the MSE, the better the quality of the HDBaseT reception (i.e. -19.8 is better than -18.3).

To display data, tap on the **MaxErr** or the **MseErr** button on the Transmitter or Receiver side. The background of the tapped button appears in gray.

The data appear in the graph that is displayed on the top of the screen, as shown in Figure 22 above. The graphical display is continuously updated.

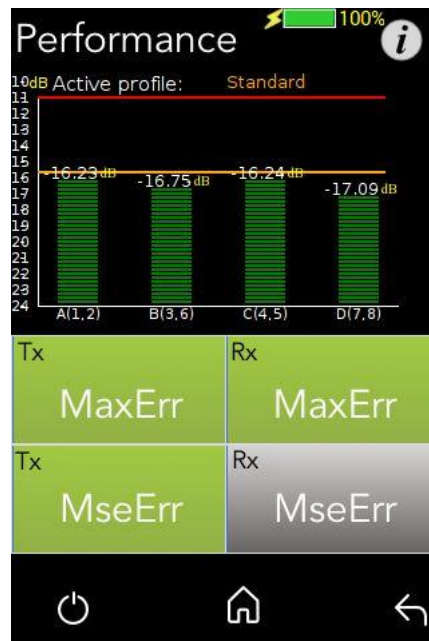


Figure 23: MseErr Screen – Displaying Graph & Data

4.2.3.3 Configuration

To view the current system configuration, tap on the **Configuration** button, as shown in the figure below.

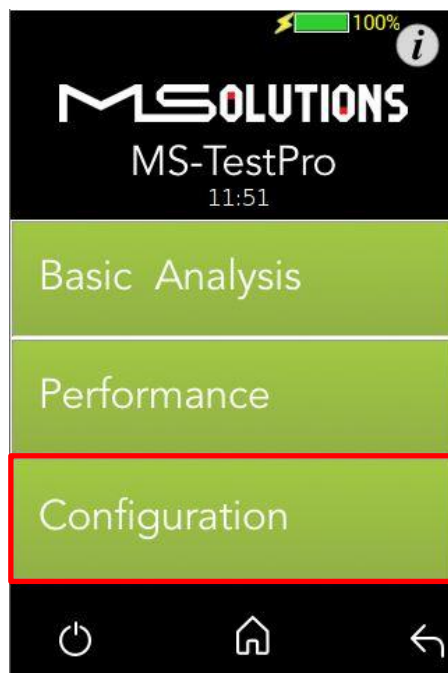


Figure 24: Selecting Configuration Management

The configuration screen appears as shown in the figure below:

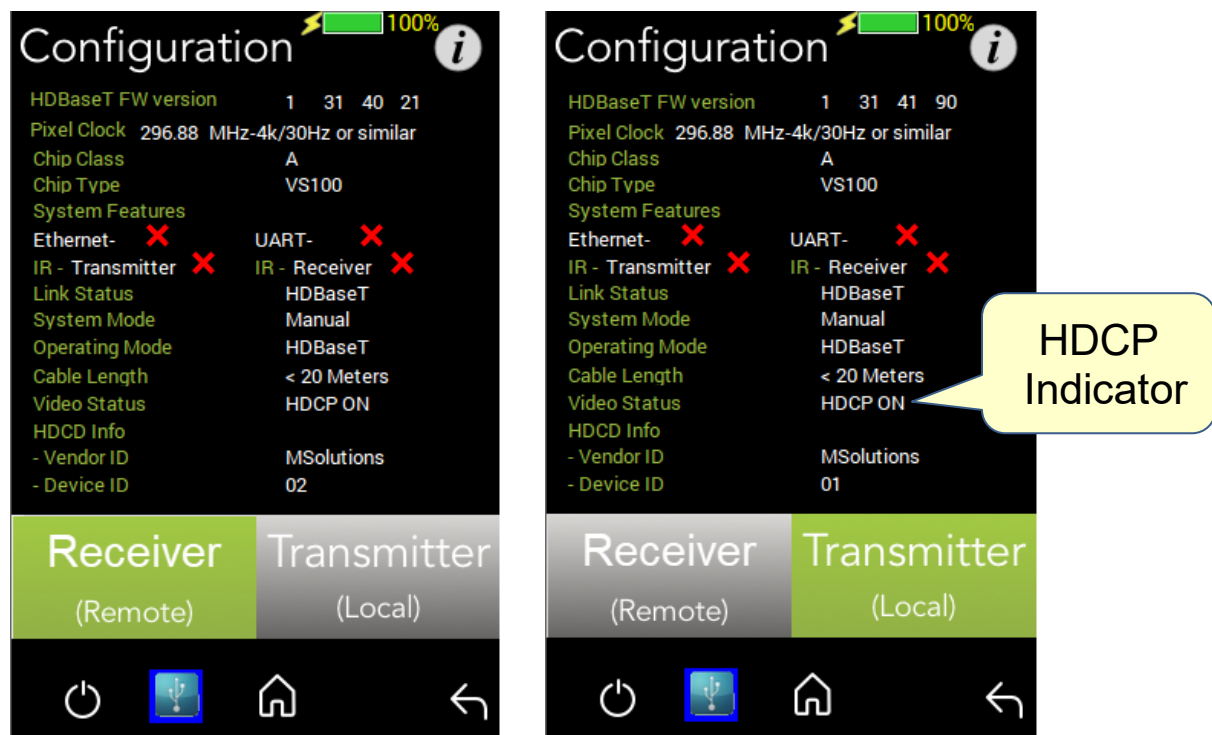


Figure 25: Rx and Tx Configuration Screens

The remote and local HDBaseT transceivers are identified – as either transmitter or receiver – and displayed at the bottom of the page. Tap to select **Receiver** or **Transmitter**. The current selection appears on a gray background.

IMPORTANT!

The system correctly identifies the local and remote transceivers – even when both are transmitters or both are receivers.

Tap on either the local or the remote entity to display configuration information (read only):

- **FW Ver.** The HDBaseT chip's firmware version.
- **Pixel Clock.** The clock frequency of the video transmission. The Pixel Clock values in the receiver and transmitter screens should be similar.
- **Chip Class.** Class of HDBaseT chip, according to the HDBaseT Standard.
- **Chip Type.** The chip model/part number.
- **Supported System Features.** The interfaces that are extended by the chip over the HDBaseT link, such as: Ethernet, RS232, IR (Infrared support provided by the chip).
- **Link Status.** HDBaseT or No link.
- **System Mode.** Specifies whether Operating Mode changes are performed automatically or manually.
- **Operating Mode.** Current HDBaseT operating mode – HDBaseT, LPPF1/2, Disconnect, FB (Ethernet Fallback), or Bypass Mode.

- **Cable Length.** Approximate cable length calculation (accuracy level $\pm 10\%$), in Meters or Feet.
- **Video Status.** Indicates whether HDCP content is being transmitted.
 - **Video On.** HDMI transmission without HDCP content.
 - **HDCP On.** HDMI transmission *with HDCP content*.
- **HDCD Information.** Vendor and Device ID, as specified in the HDBaseT standard.

4.2.4 Tools

To access Tools menu options, tap on the **Tools** button, as shown in the figure below.

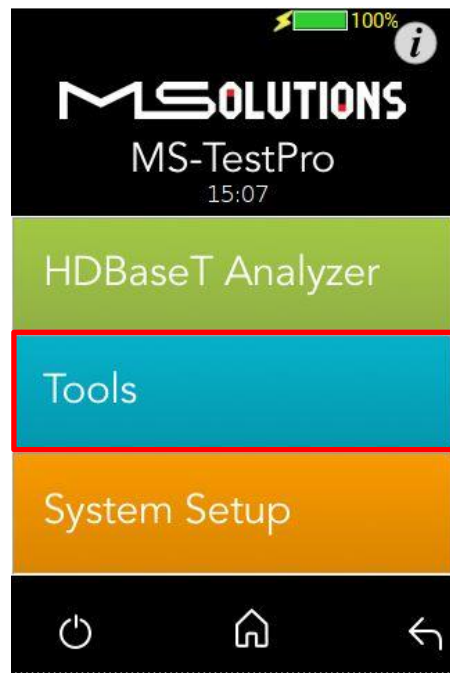


Figure 26: Tools menu access

The Tools page, which provides access to the following tools, is depicted in the figure below:

- [HDMI Generator](#)
- [EDID Analyzer](#)
- [Certification Report](#)
- [Log Analyzer](#)
- [HDBaseT FW Update](#)
- [DC Resistance Tester](#) (appears only if the DC Resistance module is inserted in the lower slot in the MS-TestPro main unit)
- [HDMI Cable Tester](#) (appears only if the HDMI Cable Tester module is inserted in the lower slot in the MS-TestPro main unit)

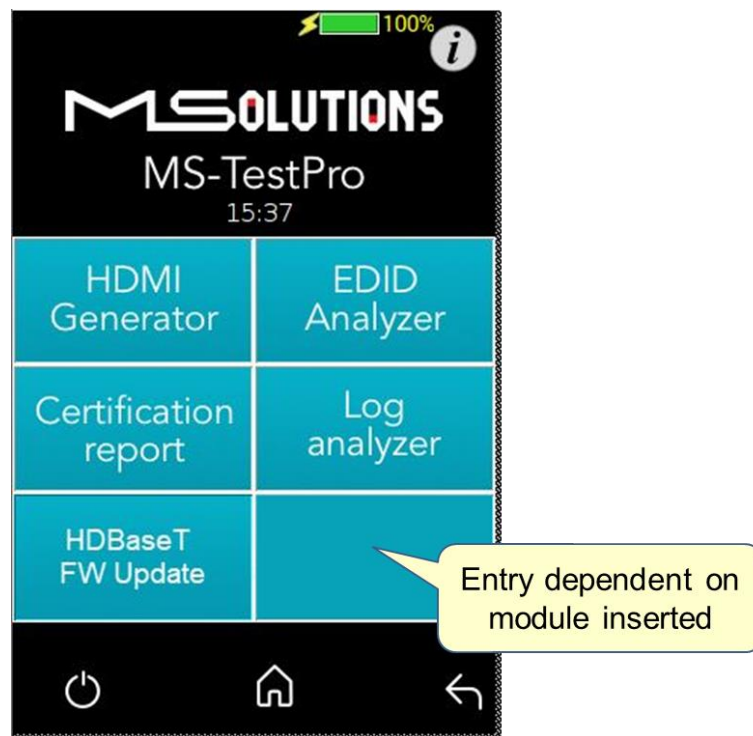


Figure 27: Tools Page

4.2.4.1 HDMI Generator

The HDMI pattern generator provides ability to generate a variety of HDMI display patterns in a wide range of resolutions.

The HDMI pattern generator screen appears as shown below in Figure 28.

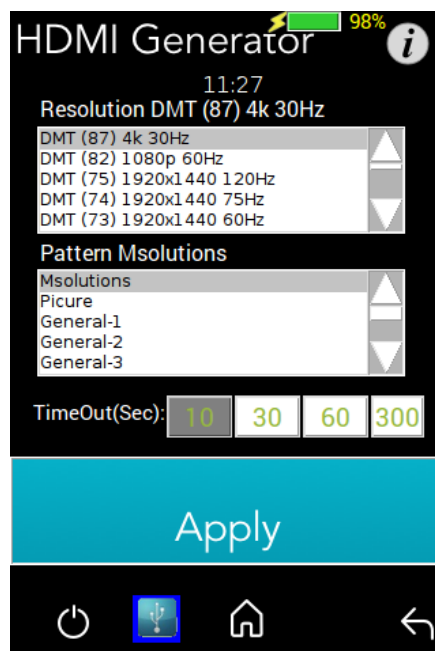


Figure 28: HDMI Generator Screen

To begin generating HDMI pattern, select the **Resolution** and **Pattern** from the list boxes, select the duration – 10, 30, 60, or 300 seconds (5 minutes) – and tap **Apply**.

The selected pattern will be activated for the duration selected, and then will resume normal testing activity.

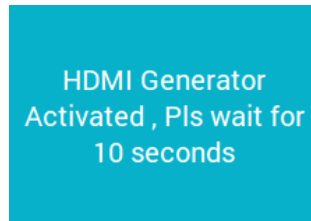


Figure 29: Pattern Generator Activation Message

4.2.4.2 EDID Analyzer

You can use EDID to access information on the display capabilities of HDMI sink devices. There are two test setups that you can use to access the information:

- Connecting the MS-TestPro test device to an HDMI sink device via an HDBaseT link.
- Connecting the MS-TestPro test device directly to an HDMI cable.

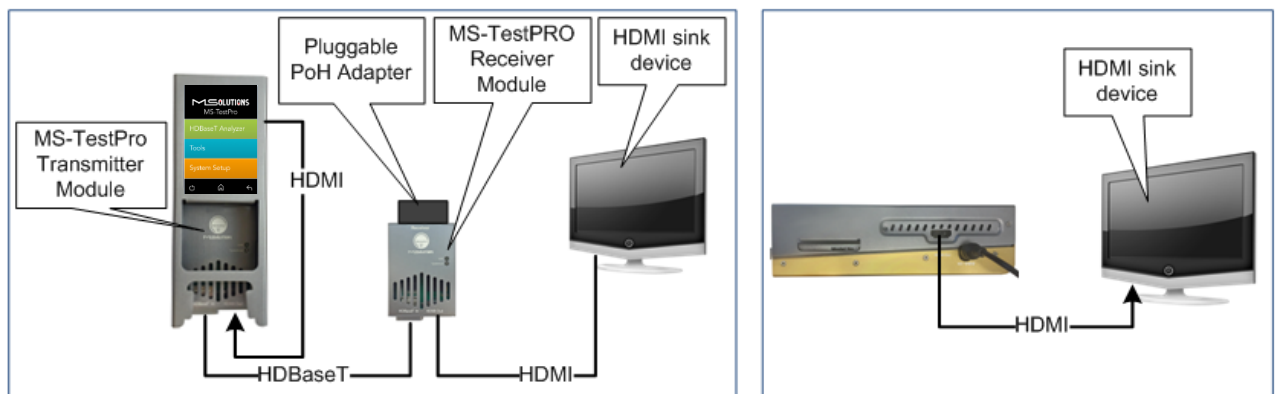


Figure 30: Connecting the MS-TestPro to the HDMI Sink Device

➔ **To access display capabilities using EDID:**

1. Connect the MS-TestPro test device to the HDMI sink device using one of the methods described above.
2. Tap on the **EDID Analyzer** button to access information on the display capabilities of the HDMI sink device. The following screen appears, presenting the sink device display information, and supported display resolutions.



Figure 31: EDID Information Page

3. To save EDID data to the tester's internal memory, tap the **Save** button. To download EDID data, connect the USB memory stick and tap the **Download** button. Two files will be saved – *EDIDXXXX.txt* and *EDIDXXXX.bin*.
4. To delete EDID data from the tester, select the files to delete and tap the **Delete** button.

4.2.4.3 Certification Report

The certification report menu provides the following capabilities:

- **Run** – report data generation
- **Download (Report Data)** – saves the report data from the tester to the USB memory stick
- **Profile** – profile configuration
- **Download (PDF Creator Software)** – downloads PDF Creator Software

4.2.4.3.1 Run (Generate Data)

The HDBaseT report data collection feature is used to collect the data required to perform HDBaseT cable analysis.

➔ **To access data for HDBaseT cable analysis:**

1. Connect the MS-TestPro test device to both ends of the CATx cable, as shown below in Figure 32:
 - The HDMI cable **must** be connected to the Internal Generator to ensure that HDMI traffic is running on the HDBaseT link.
 - The “local” side of the cable is connected to either the transmitter or receiver module, housed in the MS-TestPro chassis.
 - The “remote” side of the cable is connected to the other MS-TestPro module.
Make sure that the remote module is terminated by a Pluggable POH Adapter as shown below.

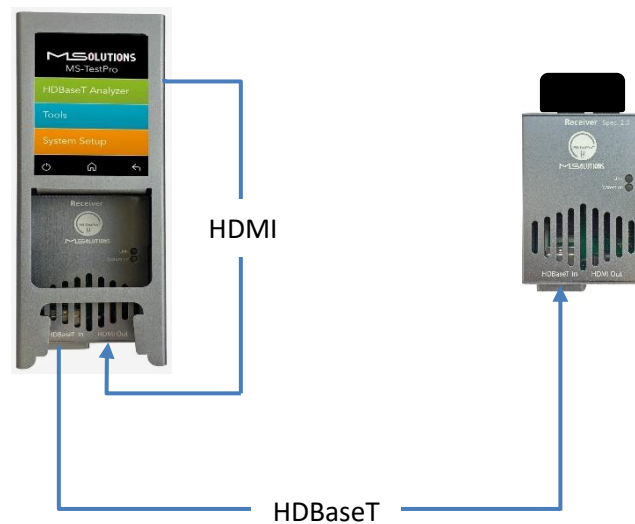


Figure 32: Cable Test Setup

IMPORTANT!

The HDMI cable must be connected to the Internal Generator to ensure that HDMI traffic is running on the HDBaseT link.

2. Select **Certification report >> Run (Generate Data)**, as shown below in Figure 33:

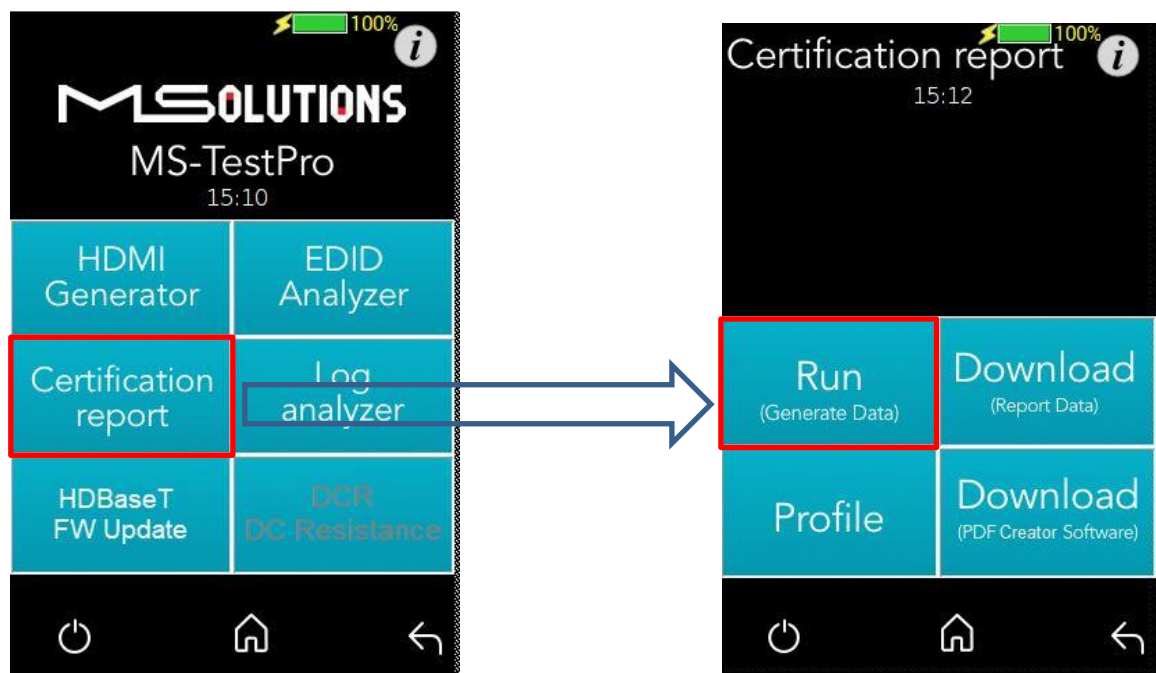


Figure 33: Generate Report Data

A progress bar appears in the window:

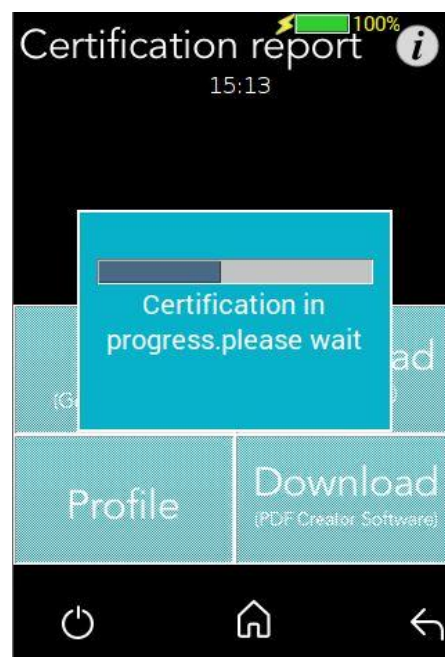


Figure 34: Generating Report Data

3. After the data is generated, the line certification results appear at the top of the screen, as shown in the figure below. To save the generated data files, insert the USB memory stick and tap on the **Download (Report Data)** button (see the figure below).

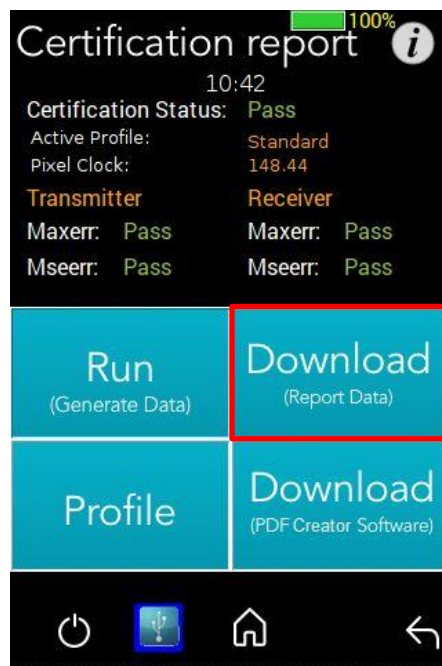


Figure 35: Downloading Report Data

In the following screen appears a list of certification tests that were run in the unit:

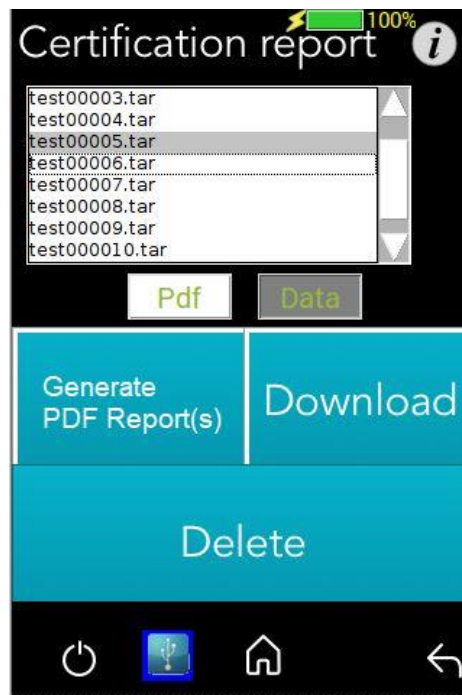


Figure 36: Certification Report Data File Options

4. Insert a USB memory stick into one of the USB ports of the MS-TestPro device. Select a report data file or files from the list as shown in Figure 36, and tap **Download** to save the file to the memory stick. Wait until the following message disappears before removing the USB stick:

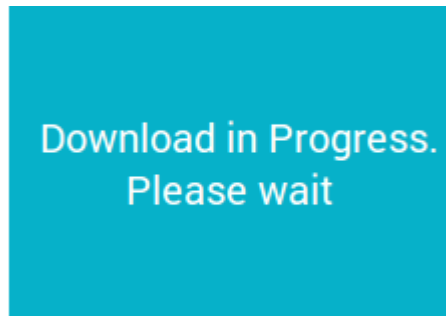


Figure 37: Message - Downloading Report Data

5. To delete files, select one or more report data files from the list, and tap **Delete**.
6. To generate PDF Report(s), select one or more report data from the list, and tap **Generate PDF Report(s)**. Wait until the following message disappears:



Figure 38: Message - Generating PDF

In the following screen appears a list of selected PDF certification tests:



Figure 39: PDF Certification Report

7. To generate a printable certification report based on the downloaded data, see Appendix D: *Generating an HDBaseT Certification Report*.

4.2.4.3.2 Profile Configuration

To choose the appropriate profile, tap the **Profile** button based on the cable which is used. If the desired cable is not on the list, tap on **Standard Profile**, note the selected profile appears on a grey background.

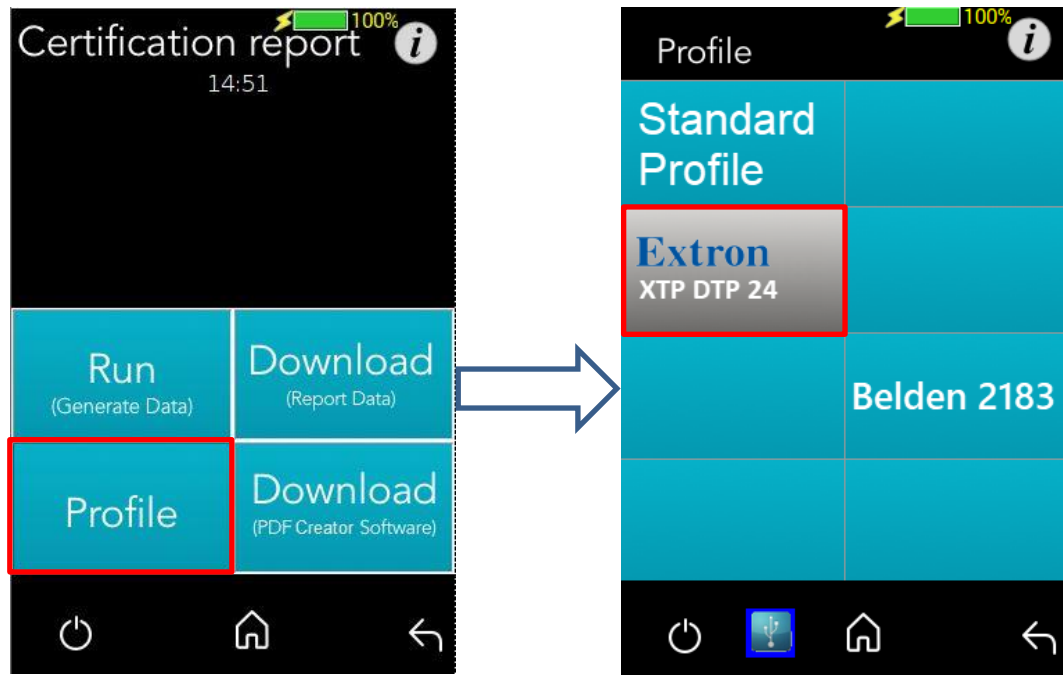


Figure 40: Profile Configuration Process

4.2.4.3.3 Download PDF Creator Application

To Download the Report Generator Tool, insert a USB memory stick into one of the USB ports of the MS-TestPro device, and tap on the **Download (PDF Creator Software)** button. A detailed explanation can be found in Appendix D and a report example on page 85.

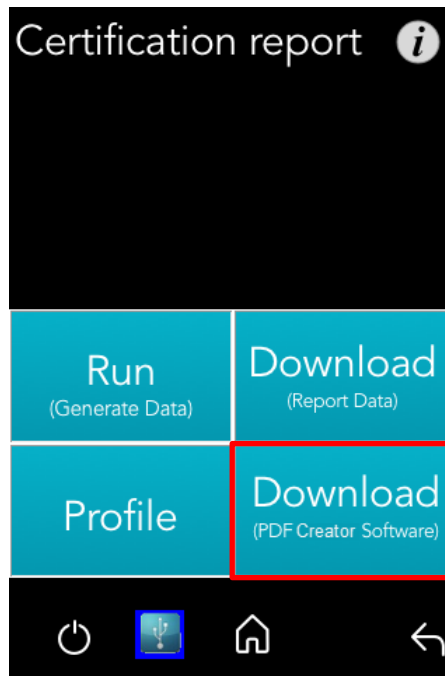


Figure 41: Download PDF Creator Software

4.2.4.4 Log Analyzer

The comprehensive Log Analyzer function measures over sixty different parameters. It is intended to track random failures over a long period of time. The recommended test duration is 24 hours, enabling you to capture the performance of the cable during the course of an entire day. This allows you to perform an in-depth analysis of any problem. Log files are generated in pairs – one for the transmitter module and one for the receiver module. Up to 5 pairs of log files are stored in the system. When a 6th pair of log files is generated, the oldest log file pair in the system is automatically deleted.

4.2.4.4.1 Log Generation

➔ To perform log generation:

1. To begin log generation, tap on the **Log Analyzer**, then the **Start** button.
2. To manually end log generation, tap on **Stop** button as shown in the figure below. The system generates transmitter *and* receiver logs.

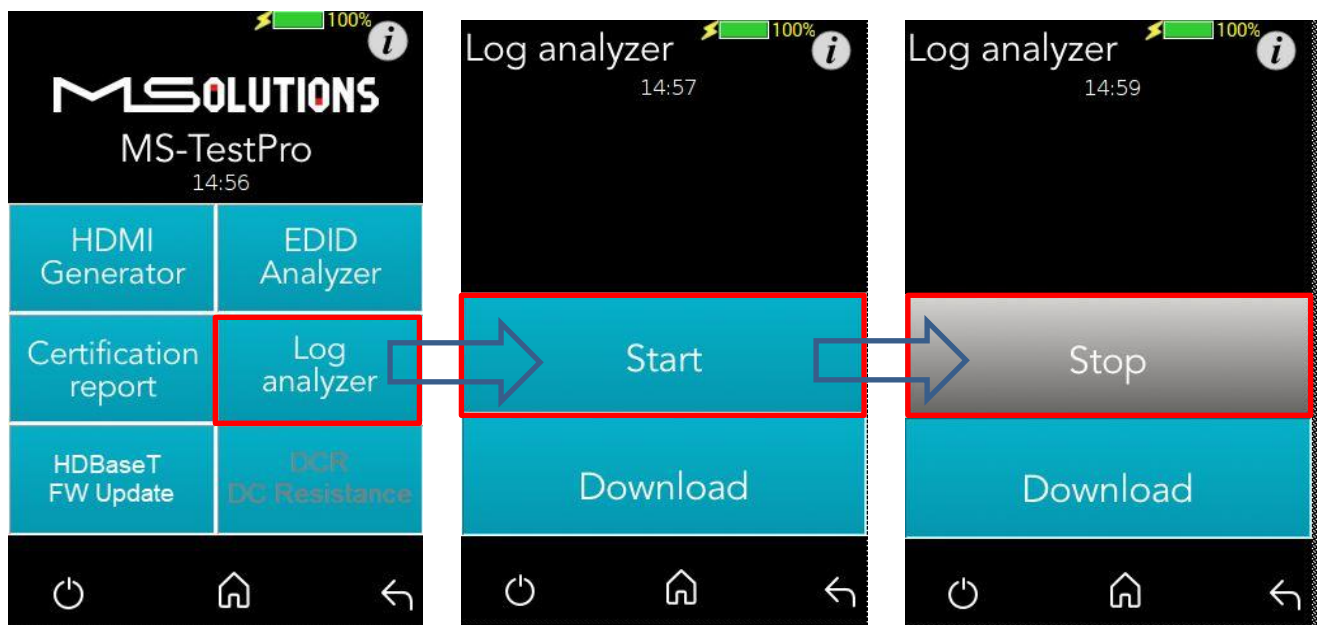



Figure 42: Starting Log Generation

4.2.4.4.2 Log Analysis

You can export log files to a USB memory stick for further processing.

➔ **To export log files to a USB memory stick:**

1. Insert a USB memory stick into one of the USB ports. Upon connection, the USB indicator  is displayed at the bottom of the screen.
2. To distribute a log for analysis, mark files and tap **Download** button. The transmitter and receiver logs that you generated are copied to the USB memory stick.

Up to 5 pairs of transmitter/receiver logs can be stored in the main unit. Generation of additional logs will cause the oldest log pair to be deleted.

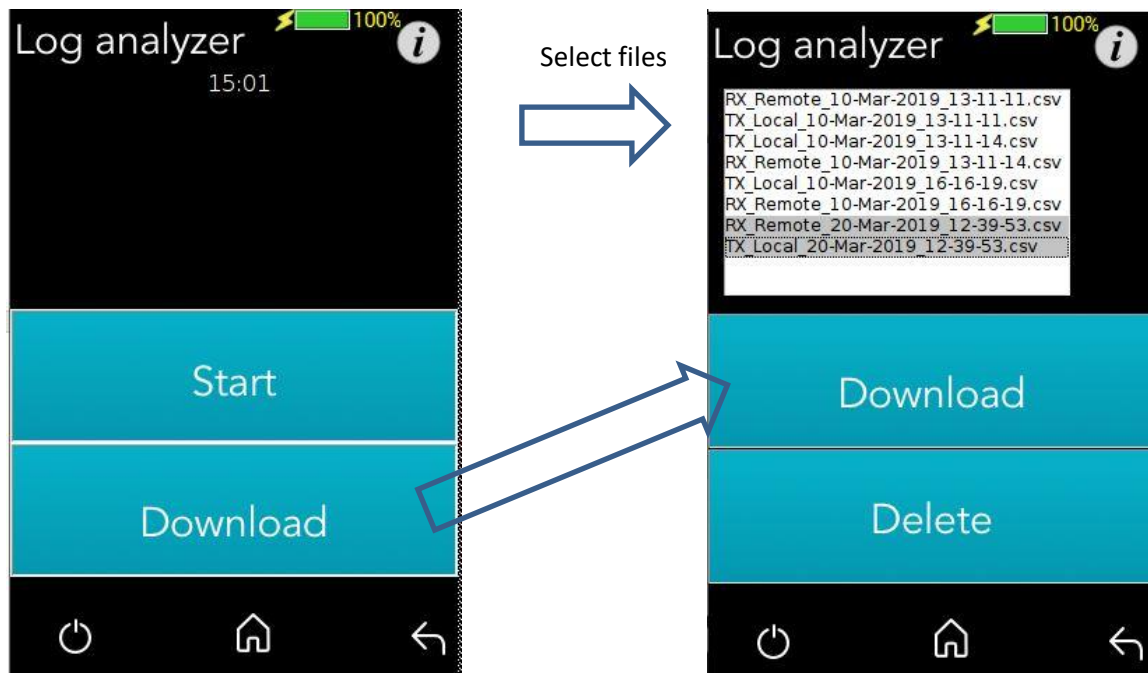


Figure 43: Downloading Files

You can choose to move any of the file pairs to the USB memory stick.

3. To delete files, select a file or files from the list, and tap **Delete**.

Figure 44: Log Report

4.2.4.5 HDBaseT Firmware Update

➔ To upgrade **3rd party** Tx or Rx remote unit firmware:

1. Prepare a USB memory stick with the upgrade file *xxx.Hex* in the **root** folder of the stick.
2. Connect the stick to one of the USB ports in the MS-TestPro device.
3. Tap on the **HDBaseT FW Update** button on the Tools screen.
4. Mark **Tx (Rx)** and **Reset** on the next screen.
5. Select the related file.
6. Tap on the **Apply** button as shown in the figure below.

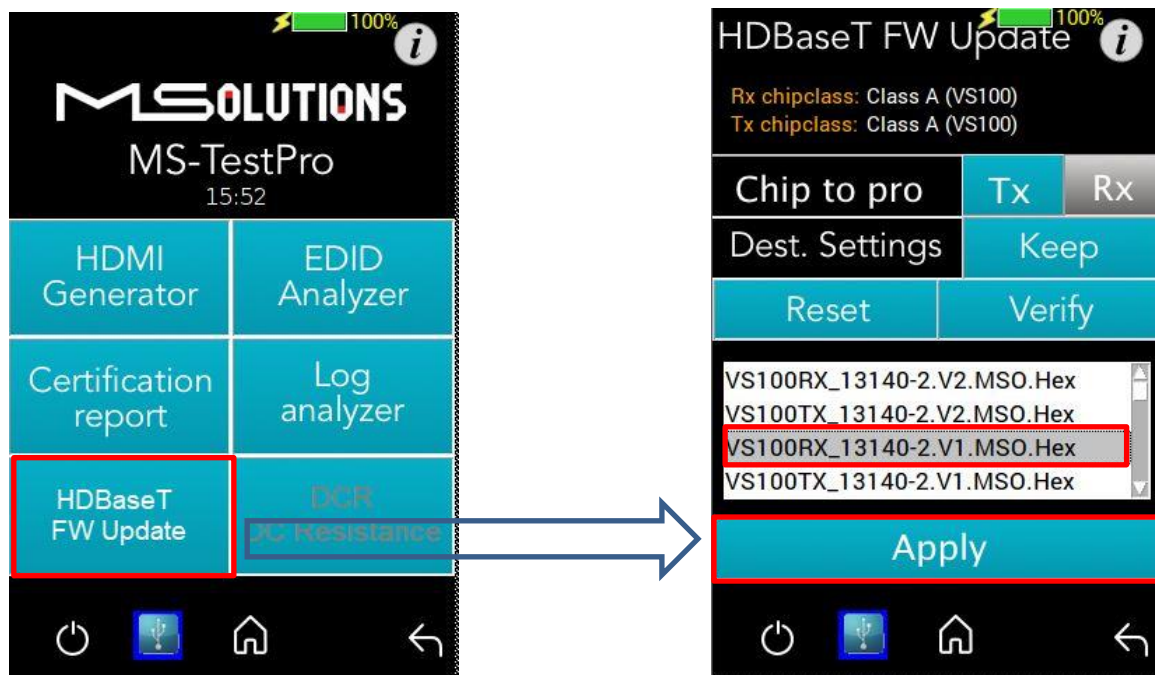


Figure 45: HDBaseT Firmware Update

IMPORTANT!

- * Do not switch off the device's power during the upgrade!
- * Firmware updates are available only to 3rd party remote Transmitter or Receiver units.
- * The HDBaseT firmware of the MS-TestPro Transmitter and Receiver cannot be upgraded.
- * An upgrade should only be done by an expert technician and with a file supplied by the manufacturer of the equipment that will be upgraded.

GUI buttons:

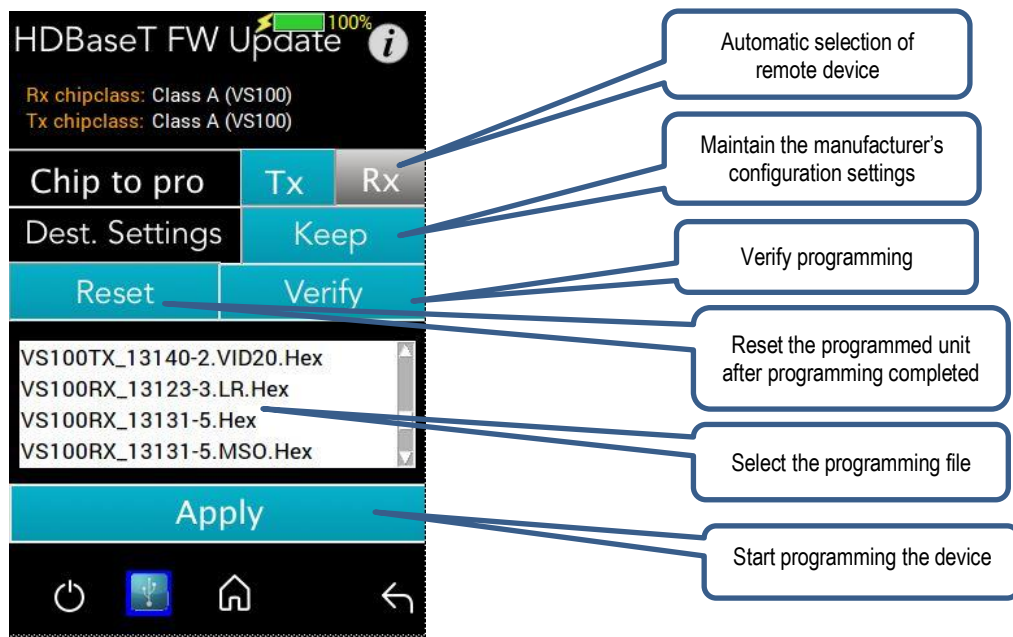


Figure 46: Firmware Upgrade GUI

Wait for the progress bar to disappear:

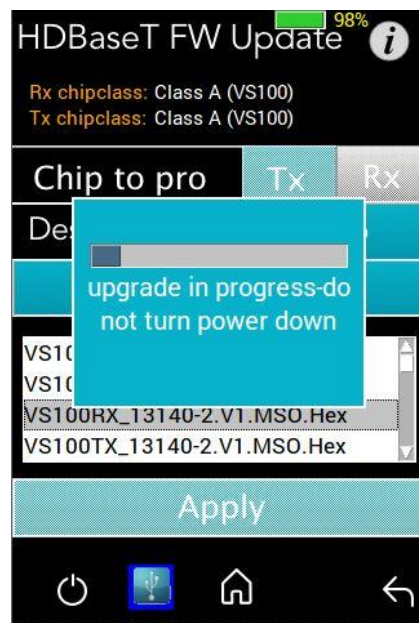


Figure 47: Firmware Update in Progress

To verify if the upgraded unit was successfully upgraded, access the **Configuration** menu and read the current HDBaseT firmware version. See Figure 25.

4.2.4.6 DC Resistance Testing

Using the MS-TestPro **DC Resistance** and **Looper** modules, you can test the DC resistance of CATx cables, and check their ability to provide a sufficient level of PoH (Power over HDBaseT) power.

The DC Resistance module is inserted into the lower slot in the MS-TestPro main unit, while the CATx cable is connected to the DC Resistance module at one end, and to the Looper module at the other end, as depicted in the figure below:

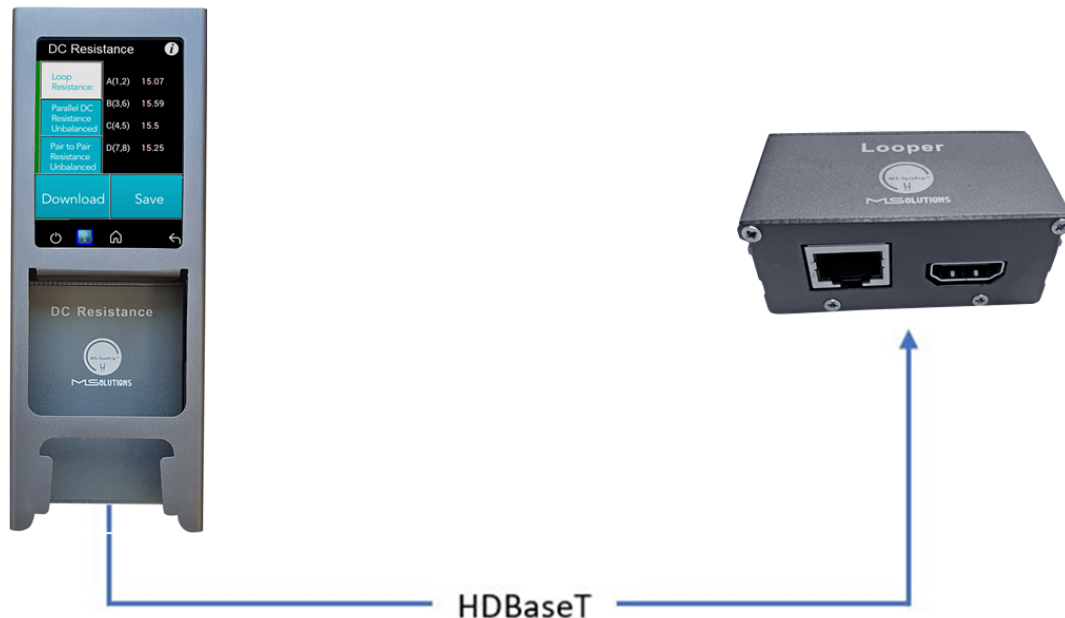


Figure 48: DC Resistance Test Setup

➔ **To test the DC resistance of a CATx cable:**

1. Attach the cable to the DC Resistance and Looper modules as shown in the figure above.
2. From the Tools page, tap on the **DCR** button. The DCR page appears, together with three buttons:
 - Loop Resistance
 - Parallel DC Resistance Unbalanced
 - Pair to Pair Resistance Unbalanced
3. Tap on the **Loop Resistance** button to display Loop Resistance data, as shown in the figure below. Loop resistance represents the DC resistance (in ohms) of a single twisted pair in a cable, and is calculated as the sum of the DC resistance of the two conductors of the twisted pair.

Resistance of *under 20 ohms* indicates that the pair should be capable of delivering the minimum of 80% of the power to the remote side.

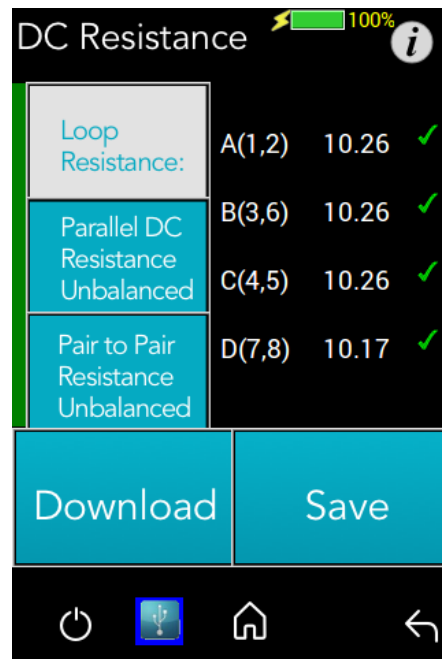


Figure 49: Loop Resistance Results

4. Tap on the **Parallel DC Resistance Unbalanced** button to display the parallel resistance of the CATx two conductors in each cable pair. For each pair, the difference is expressed in ohms, as shown in the figure below.

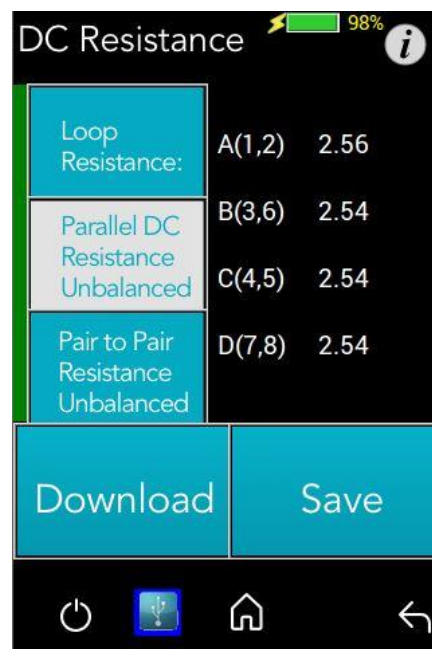


Figure 50: Parallel DC Resistance Unbalanced Results

5. Tap on the **Pair-to-Pair Resistance Unbalanced** button to display the difference in DC resistance between the four pairs in the cable. For each pair, the difference is expressed in ohms, as shown in the figure below.

A difference of *under 0.2 ohms* or 5% (the higher between the two) indicates that the pair should be capable of delivering the required common-mode current needed to effectively support PoH and data transmission over the pair.



Figure 51: Pair-to-Pair Resistance Unbalanced Results

6. To save DCR data to the tester internal memory, tap the **Save** button.
To download DCR data to a USB memory stick, tap the **Download** button. A screen containing a list of DCR data files appears as shown in the figure below.

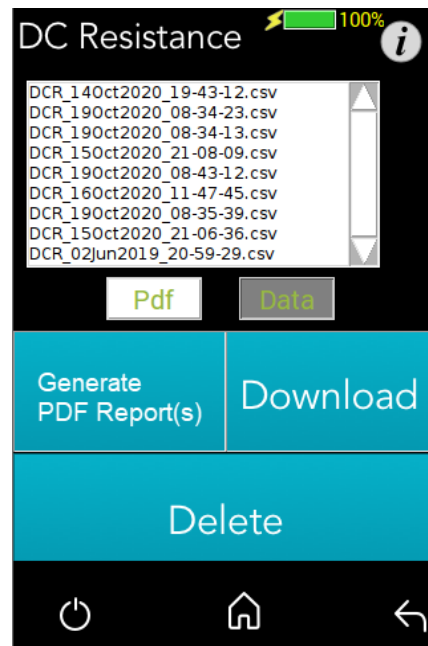


Figure 52: List of DC Resistance Reports in CSV Format

7. Select one or more CSV files, and perform one of the following actions:
- Tap on **Generate PDF Reports** to create PDF-format report(s). Tap **PDF** to view a list of PDF-format reports (see Figure 53 below).
 - To download the file(s) to a USB memory stick, connect the stick and tap on **Download**.
 - Tap on **Delete** to delete the selected files.

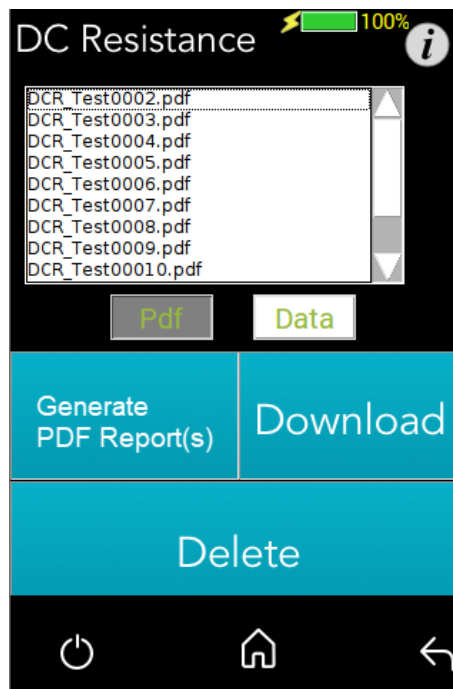


Figure 53: List of DC Resistance Reports in PDF Format

8. Select one or more PDF files, and perform one of the following actions:
 - To download the file(s) to a USB memory stick, connect the stick and tap on **Download**.
 - Tap on **Delete** to delete the selected files.

IMPORTANT!

The MS-TestPro modules are not 'Hot Swappable'. Make sure to shut down and turn off the unit before swapping modules.

4.2.4.7 HDMI Cable Testing (HCT)

Using the MS-TestPro **HDMI (HCT) Cable Tester** and **Looper** modules, you can test the quality of HDMI cables before their installation. In order to reduce costs and boost profits, some HDMI cable suppliers sell cables with missing or shorted wires. These substandard cables are usually discovered only when trying to stream high resolutions like 4K or run CEC (Consumer Electronics Control) commands. With the MS-TestPro HDMI Cable Testing function, you will identify the problem immediately, and not in a post-installation service call.

Just insert the HDMI Cable Tester module into the lower slot of the MS-TestPro main unit, attach one end of the HDMI cable to the module's HDMI port, and attach the other end of the HDMI cable to the HDMI port on the Looper module, as shown in the figure below.



Figure 54: HDMI Cable Tester Setup

The MS-TestPro HDMI modules (HCT & Looper) perform physical layer quality tests on each of the cable's conductors and the cable shielding, providing instant feedback on missing or defective wiring:

- Checks the presence of each of the 19 HDMI-standard conductors and cable shielding.
- Tests the ability of the cable to support an array of HDMI bandwidth requirements, as specified in the HDMI 1.4, 2.0, 2.1, and future 2.3 standards.
- Ensures that none of the cable's conductors are shorted or missing.
- Measures the gauge (AWG) of each of the conductors, detecting resistance imbalances within the cable that cause degraded transmission quality. (planned for a future release).

➔ To test the quality of an HDMI cable:

1. Attach the cable to the HDMI Cable Tester and Looper modules as shown in Figure 54 above.
2. From the Tools page, tap on the **HDMI Cable Tester** button.

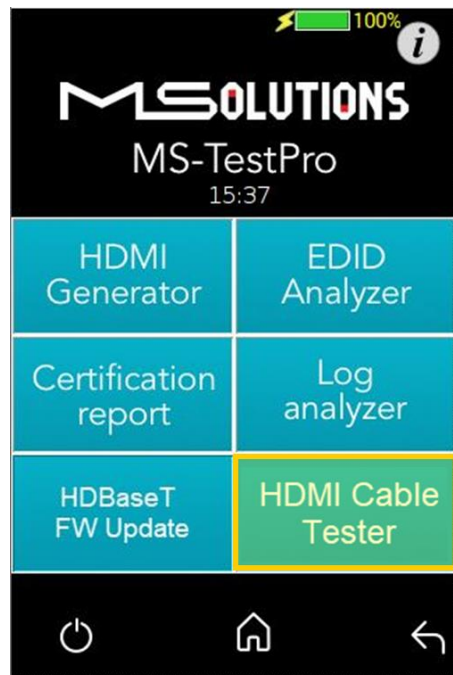


Figure 55: HDMI Cable Tester Button

The HDMI Cable Tester page appears as shown in the figure below.

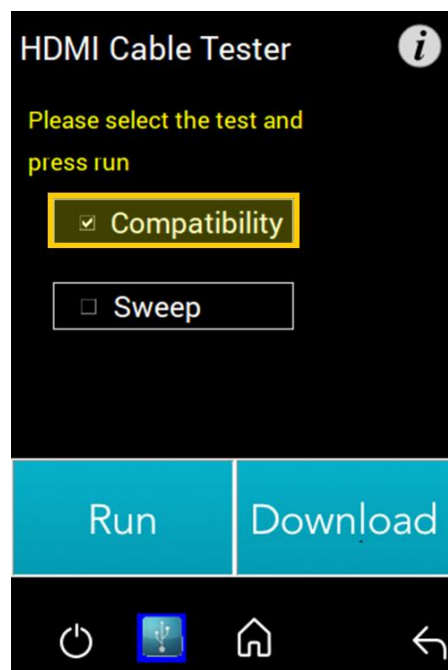


Figure 56: Run Compatibility Tests

3. Check the **Compatibility** box, and tap **Run**.

IMPORTANT!

In this description, the Compatibility and Sweep tests are presented separately. You can check *both* the **Compatibility** and **Sweep** boxes to run both tests simultaneously.

4. The MS-TestPro begins testing the cable's compatibility with the HDMI bandwidth. When the test is complete, a summary screen appears. In the example shown below, the cable failed the 4K/60Hz test. A list of shorted wires (wires that were interconnected within the cable, thus neutralizing their functionality) appears as well. If needed, tap **Run** to perform another compatibility test.

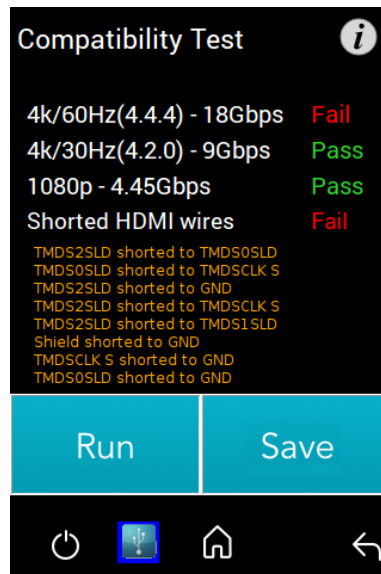


Figure 57: Compatibility Test Results

5. If the message "Cable not found" appears on the screen, check the physical connection of the cable to the modules, and tap **Run** again.

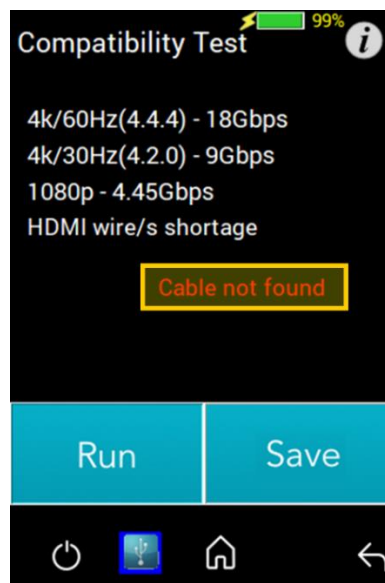


Figure 58: "Cable not found" Message

6. Tap **Save** to save the test results in a report format. Following generation of the report, tap **Download** to copy the report to a disk-on-key attached to the tester's USB port (planned for a future release).
7. To perform the Sweep test, return to the HDMI Cable Tester page appears as shown in the figure below.

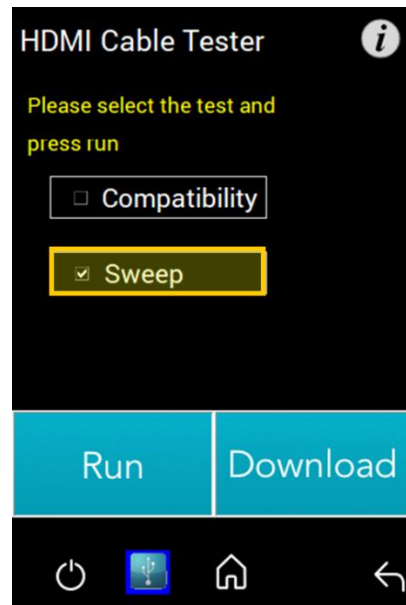


Figure 59: Run Sweep Tests

8. Check the **Sweep** box, and tap **Run**.





NOTE

In this description, the Compatibility and Sweep tests are presented separately. You can check *both* the **Compatibility** and **Sweep** boxes to run both tests simultaneously.

9. The MS-TestPro begins to test the quality of each of the wires in the cable. If needed, tap **Run** to perform another Sweep test.

The existence of each wire tested is indicated by a color, as listed in the table below:

Table 6: Wire Quality Color Code

Color	Severity
	Wire exists
	Wire is missing
	Wire is shorted
	Test in progress

The figure below shows the sweep test in progress. If necessary, you can tap **Stop** to cancel the test.

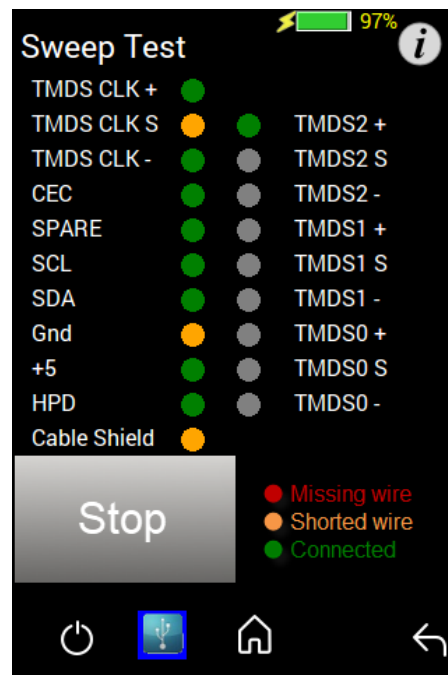


Figure 60: Sweep Test in Progress

10. At the end of the test, the **Start** button appears. Click on the button if you wish to run another Sweep test.

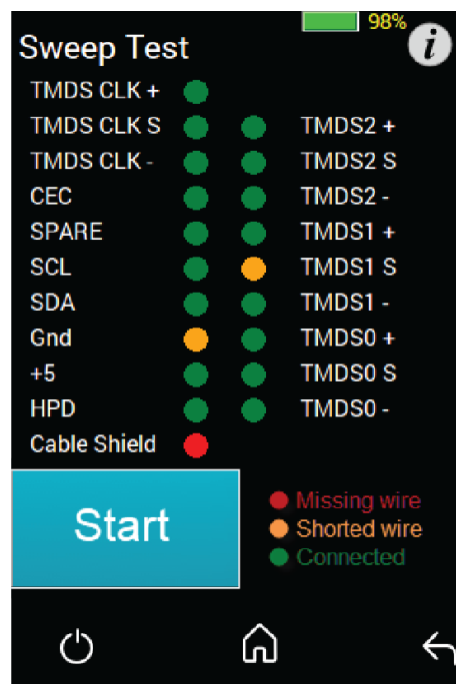


Figure 61: Sweep Test Complete

4.3 System Setup

To perform setup functions, tap on the **System Setup** main screen button, as shown in the figure below.

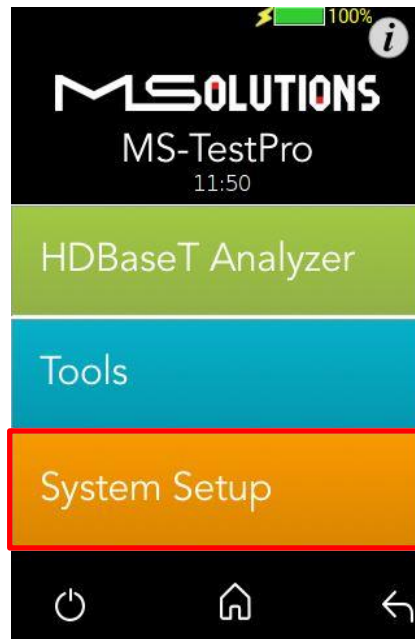


Figure 62: Selecting System Setup

The System Setup screen (see Figure 63 below) offers the following information and functionality:

- **MS-TestPro Application Software Version.**
- **System upgrade.** Upgrades the MS-TestPro system firmware.
- **System Settings.** Provides information about the system's main features.
- **System Reboot.** Restarts the MS-TestPro test device.

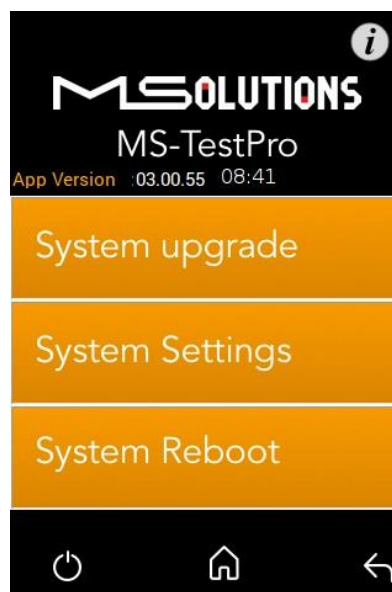


Figure 63: System Setup screen

4.3.1 System Upgrade

➔ **To upgrade the MS-TestPro System Software:**

1. Prepare a USB memory stick with the upgrade file **updateXXX.mst** in the root folder. Connect the stick to one of the USB ports in the MS-TestPro device.
2. Select the **updateXXX.mst** file and tap on the **System Upgrade** button (see the picture below). The system performs the upgrade and reboots using the new version in approximately 10 seconds.

IMPORTANT!

1. For firmware version 2.00.30 or earlier, the file name is **update.mst**.
 2. Latest updated FW can be found at <https://www.m4sol.com/support/>
 3. **Do not switch off the device's power during the upgrade!**
-

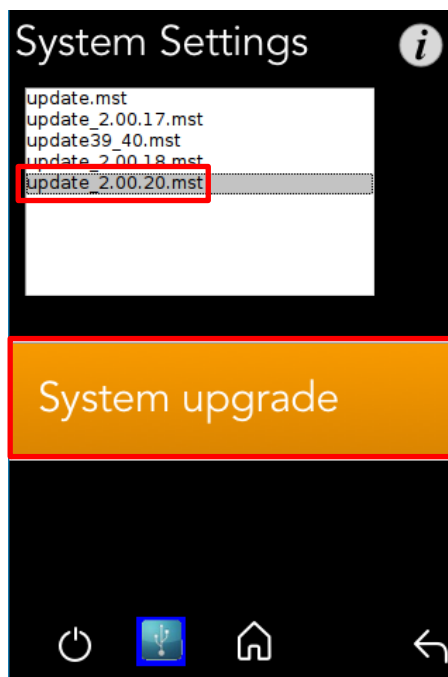


Figure 64: System upgrade

4.3.2 System Reboot

To restart the MS-TestPro test device, tap the **System Reboot** button and click **Yes** on the next screen, as shown in the figure below.

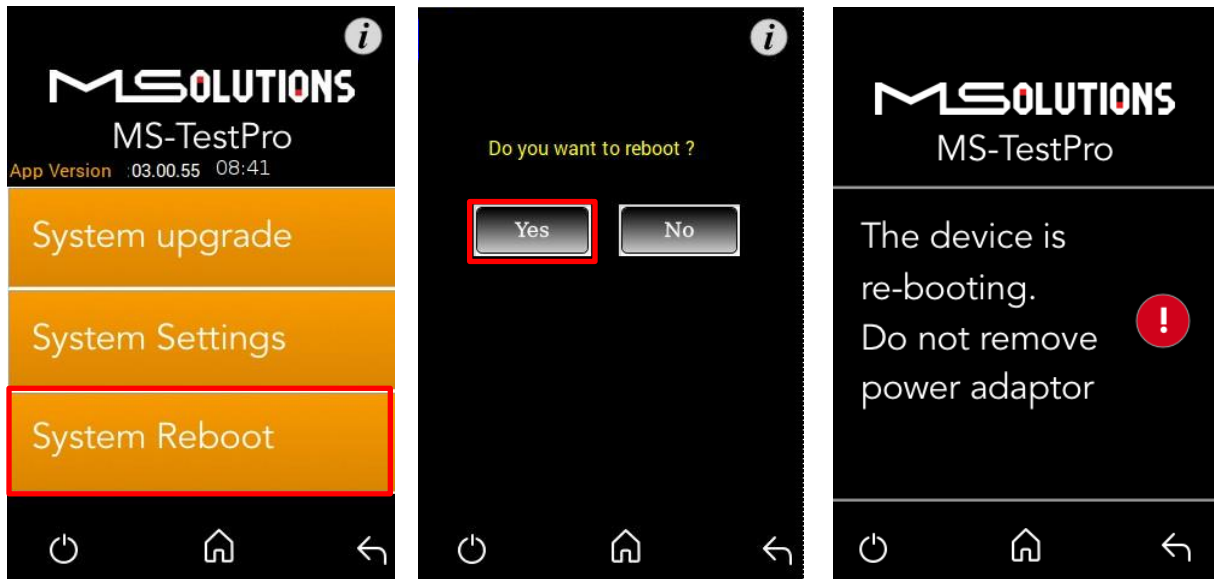


Figure 65: System Reboot Screens

The system will reboot in about 15-20 seconds.

4.3.3 System Settings

The System Settings screen provides access to the system configuration. The System Settings screen is depicted in the figure below. The upper part of the screen displays read-only system information.



Figure 66: System Settings screen

The System Settings page provides the following information and configuration options for the MS-TestPro system:

- **App Version.** Tester firmware version.
- **Local IP.** Allocated IP address (for future use).
- **Features.** A list of supported features:
 - **Wi-Fi AP.** Whether Wi-Fi connectivity is supported.
 - **HDMI Gen.** Whether the HDMI traffic generation feature is supported.
 - **AP.** The name of the AP (access point) used to establish Wi-Fi connectivity.
 - **Local PDF.** Indicates where the unit is capable for creating a PDF report file locally- if it is indicating “Not supported” please contact our support@m4sol.com for a Firmware upgrade.
- **Units.** Tap to select the unit of measure to be used (feet/meters). The current selection appears on a white background.
- **Wi-Fi.** Tap to **Enable** or **Disable** Wi-Fi connectivity. The current selection appears on a white background.
- **Date/Clock Settings.** Tap on the button configure date and time settings.

4.3.3.1 Date/Clock Settings

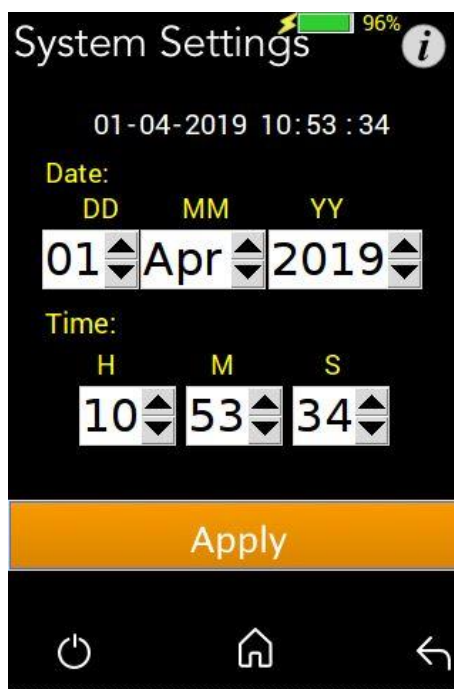


Figure 67: Date/Clock setting screen

Set Date/Clock values and press the Apply button.

Note: Date and time will be set automatically when connecting Tester to a PC using a Wi-Fi connection.

4.4 Shutdown

This section describes how to safely shut down the MS-TestPro test device.

➔ **To shut down the test device:**


1. Tap on the on/off icon  to exit the system. The following messages appears on the screen:



Figure 68: Confirmation and Shutdown Screens

2. Wait for the screen to turn white.
3. Switch off the tester with the on/off switch on the rear of the tester (MS104B).
4. Remove the power supply connector from the tester (MS103TDs).

5. Operating the Wi-Fi Client

You can manage the MS-TestPro tester using a Wi-Fi enabled computing device (mobile phone, tablet, PC) equipped with a browser. The device connects as a client to the web server software embedded in the test unit.

5.1 Connecting the Wi-Fi Device

The following steps describe how to connect your Wi-Fi client device to the MS-TestPro test unit.

➔ **To connect your Wi-Fi device to the MS-TestPro test unit:**

1. Power on the MS-TestPro test unit.
2. Using your Wi-Fi enabled device, scan for Wi-Fi networks. The "**Media-Solutions**" network should appear on the scanned list with the tester's unique identifier which is a four character & digit number, as shown in Figure 69 below.

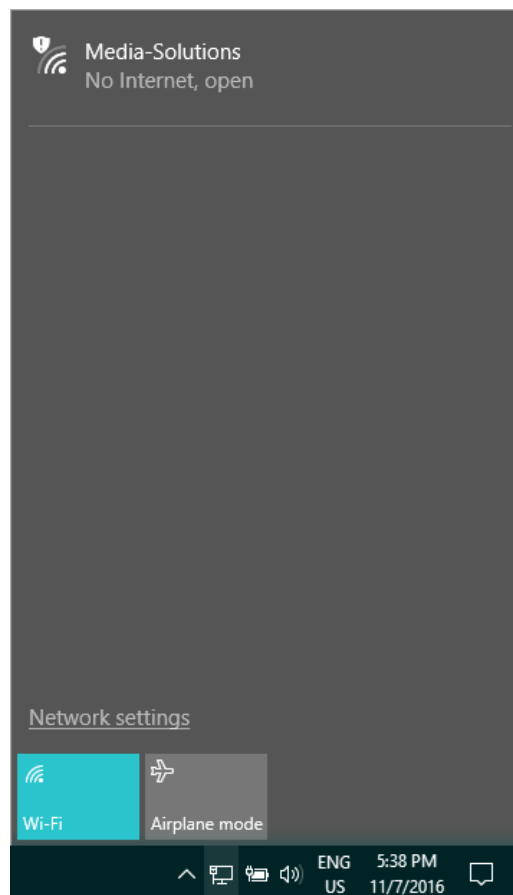


Figure 69: Scanning for Available Wi-Fi Networks

3. Select the "**Media-Solutions**" network from the list, and tap on the **Connect** button that appears on the screen (see Figure 70 below).

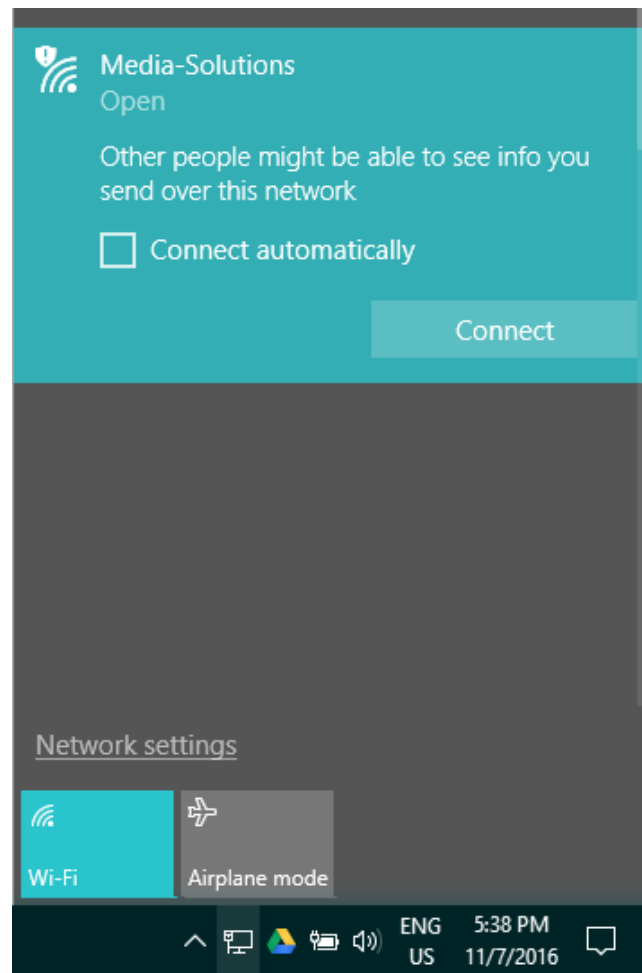


Figure 70: Connecting to the Media-Solutions Network

4. Initialize the system as described in the following section.

5.2 System Initialization

The following steps describe how to initialize the MS-TestPro client on your Wi-Fi device and connect it to the test unit.

➔ **To initialize the MS-TestPro system on your Wi-Fi client:**

1. Open your browser and enter the URL of the MS-TestPro System: **192.168.11.1** as shown in the figure below.



Figure 71: Entering the MS-TestPro System URL

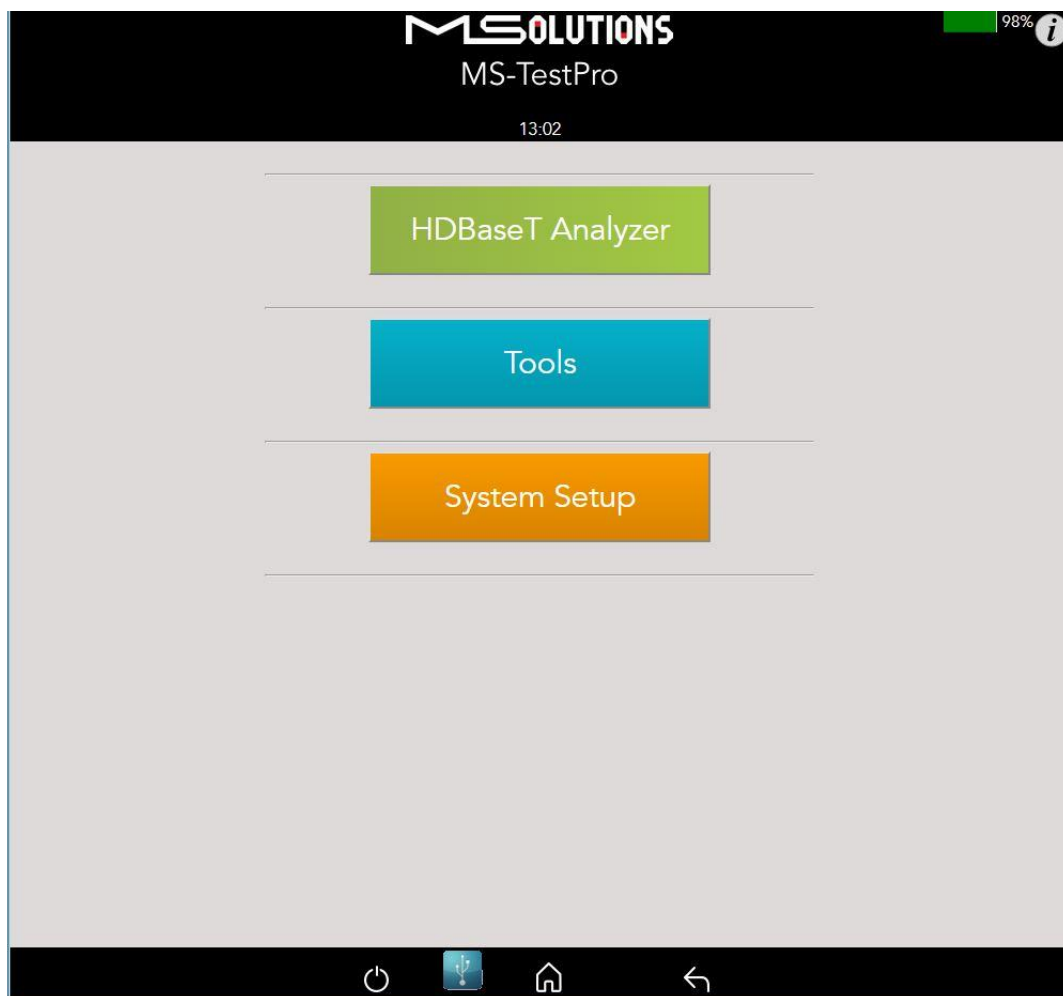






Figure 72: MS-TestPro Home Page

5.3 Performing the Tests

5.3.1 Main Screen

The main screen (see the figure above) offers the following functionalities:

- **Information.** The  icon provides access to informative guidelines and system documentation.
- **HDBaseT Analyzer**
 - Basic Analysis: Basic Pass/Fail report.
 - Performance: Real-time access to HDBaseT cable performance data.
 - Configuration: Read-only access to the system configuration.
- **Tools**
 - HDMI Generator: HDMI Pattern Generator.
 - EDID Analyzer: Access information on the display capabilities of HDMI sink devices.
 - Certification report: Collect the data required to produce the HDBaseT test report.
 - Log Analyzer: For continuous testing up to 24 hours.
 - HDBaseT Firmware Update: To update the firmware of 3rd party HDBaseT units.
 - DC Resistance: To test the DC resistance of CATx cables, Check cable quality and check their ability to provide a sufficient level of PoH
- **System Setup.** Used to perform system configuration, tester unit upgrades and maintenance operations.
 - System Upgrade
 - System Reboot
 - System Settings
- **Power Off.** Tap the on/off icon  at the left side of the bottom line of the screen to power down the system. To safely shutdown the system, see the shutdown instructions in section 4.4.
- **Home.** Tap the Home button  in the middle of the bottom line of the screen to return to the Main screen.
- **Back.** Tap the Back button  at the right side of the bottom line of the screen to return to the previous screen.

5.3.2 Information Menu

Using the information menu (see Figure 16 below), you can access the following materials:

- The latest version of this user's manual
- The MS-TestPro application note
- A link to MS-TestPro video tutorials

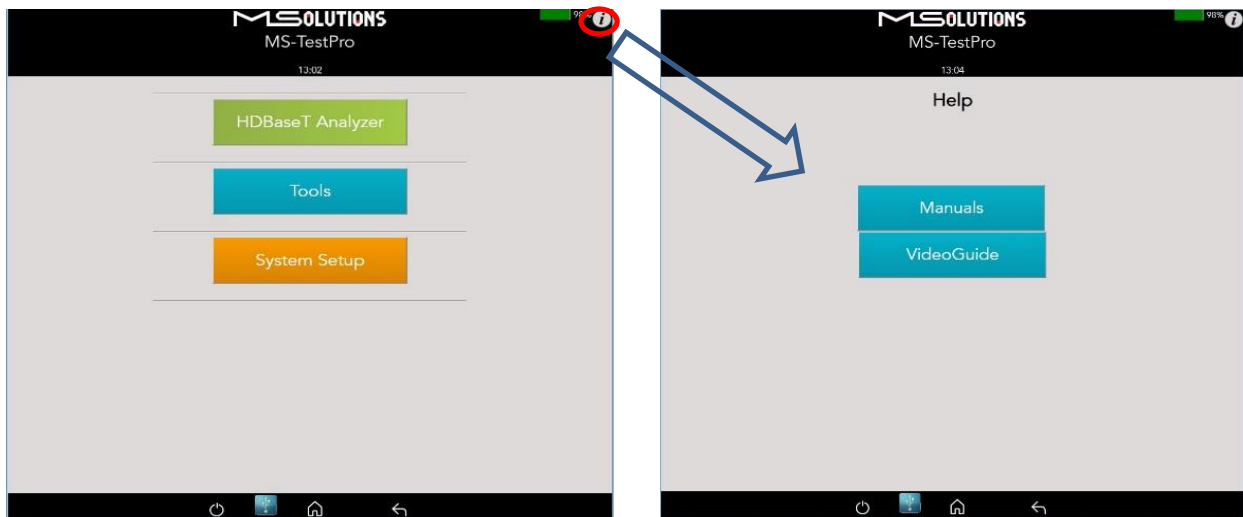


Figure 73: Information Menu

5.3.3 HDBaseT Analyzer

To get to HDBaseT Analyzer menu, tap on the HDBaseT Analyzer button as shown in the figure below:



Figure 74: Selecting the HDBaseT Analyzer Menu

The following screen will appear:

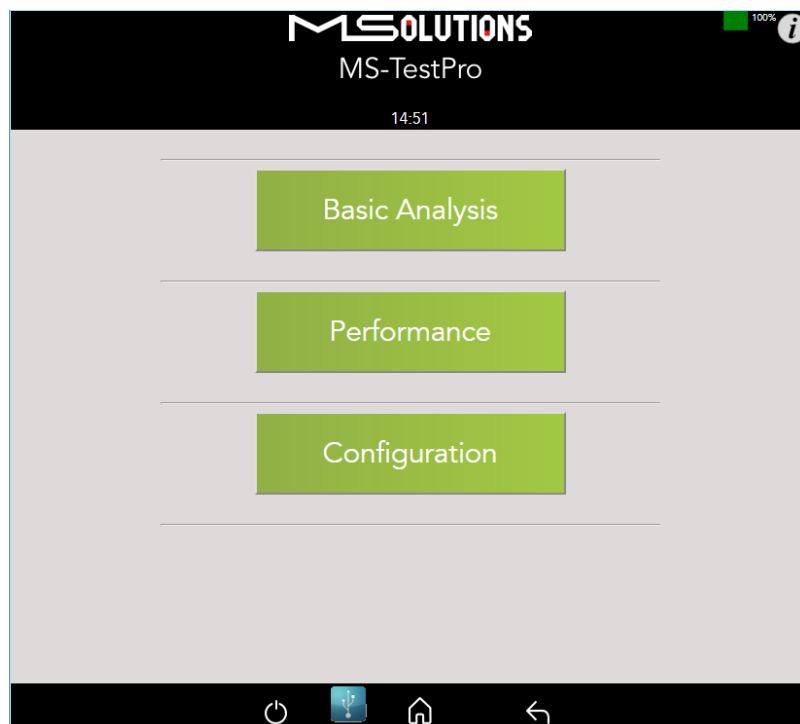


Figure 75: HDBaseT Analyzer Screen

5.3.3.1 Basic Analysis

The Basic Analysis function is used to report on HDBaseT link quality.

To analyze the link, tap on the **Basic Analysis** button, as shown in the figure below.

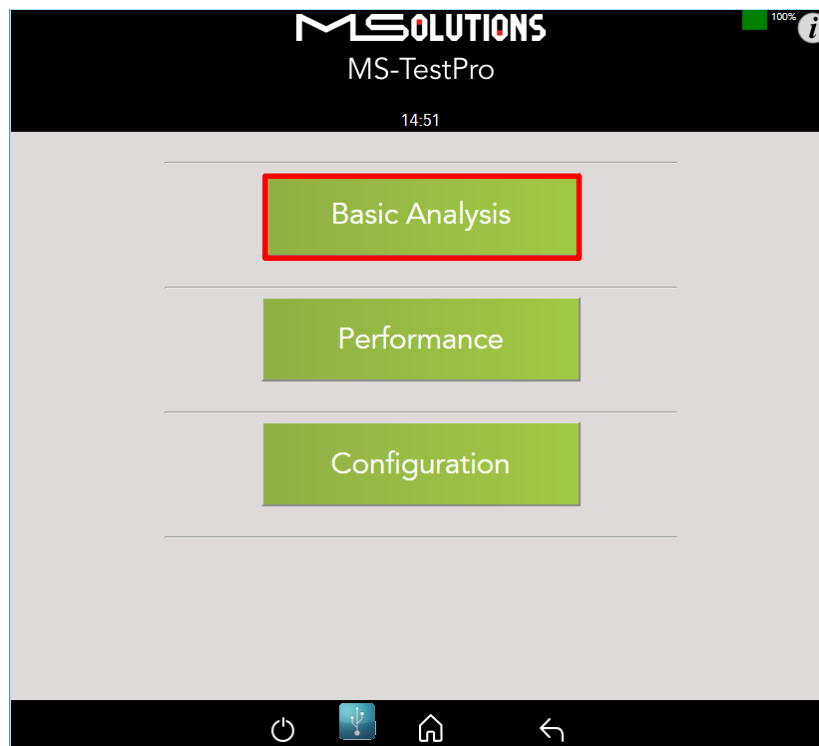


Figure 76: Selecting Basic Analysis

The Basic Analysis page appears as shown in the figure below.



Figure 77: Basic Analysis Page

The basic analysis page displays the following information:

- **General Link Quality.** Red, yellow, green as defined below.
- **Transmitter Link Quality.** Red, yellow, green as defined below.
- **Receiver Link Quality.** Red, yellow, green as defined below.
 - **Green.** The link is functional.
 - **Yellow.** The link is unstable.
 - **Red.** The link is faulty with a high probability of failure.
- **Pixel Clock.** The clock frequency of the video transmission. The pixel clock values, in the receiver and transmitter screens should be similar.
- **Chip Type.** The chip model/part number.
- **Cable Length.** Approximate cable length calculation (accuracy level $\pm 10\%$), in meters or feet.
- **HDMI HPD.** Hot Plug (HCT module) Detection.



5.3.3.2 Performance Management

To access performance management functionality, tap on the **Performance** button, as shown in the figure below.

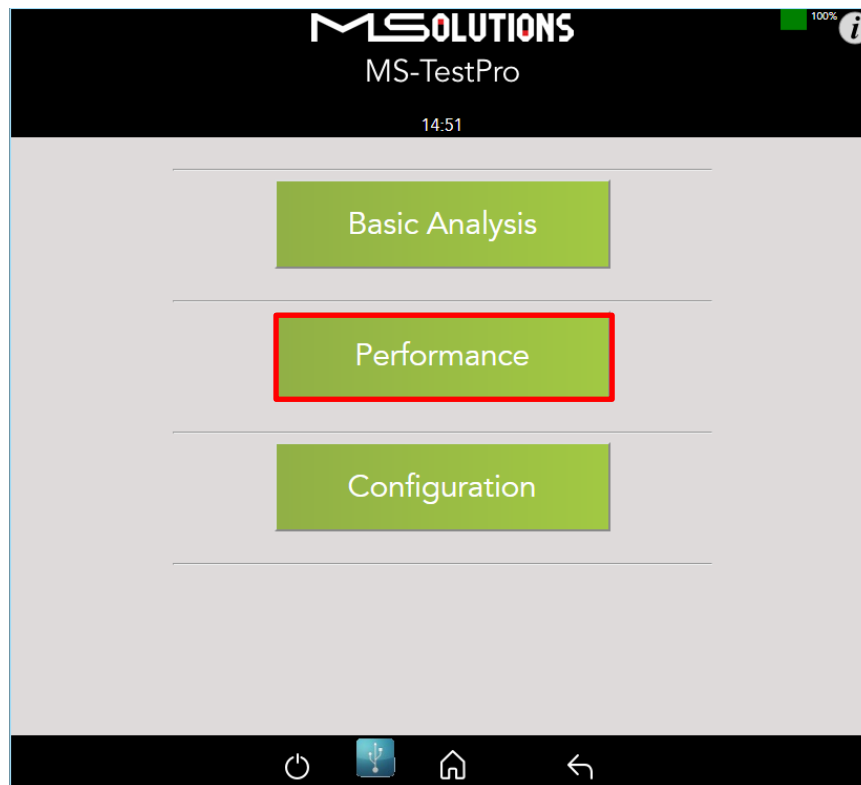


Figure 78: Selecting Performance Monitoring

The system provides performance monitoring of the four HDBaseT channels (each associated with a twisted pair) in the CATx cable – designated A, B, C, and D.

NOTE

When monitoring performance, the transmitter controls are always displayed on the left side, the receiver controls are always displayed on the right, as shown below in Figure 22.

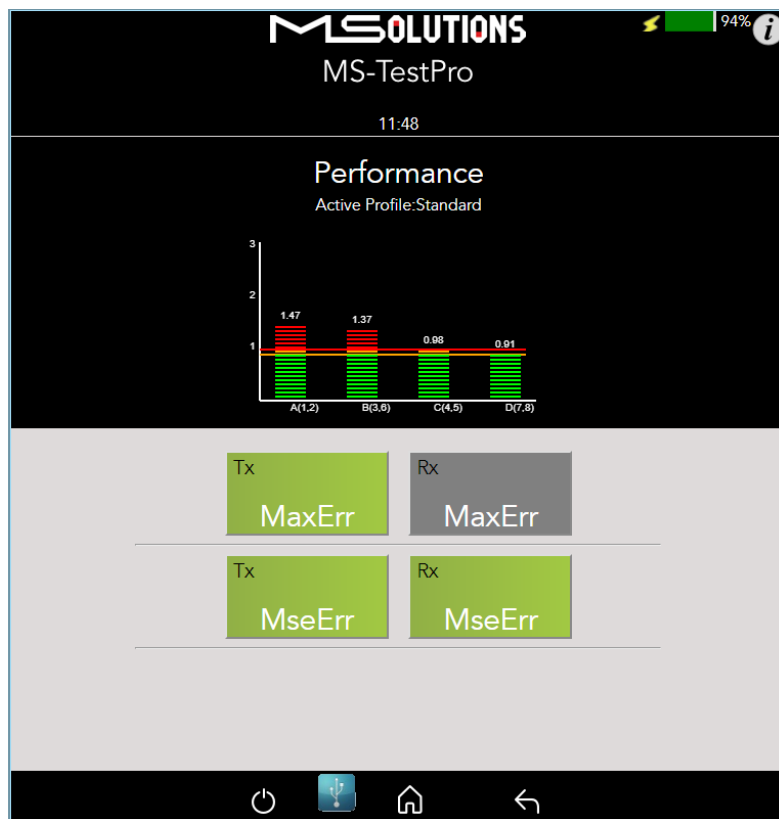


Figure 79: Performance Monitoring Screen. MaxErr Screen – Displaying Graph & Data.

The screen appears, displaying receiver (Rx) data. To display transmitter data, tap on a Tx button.

Note the yellow and red horizontal lines in the display. These are performance thresholds:

- **Yellow.** The link is unstable.
- **Red.** The link is faulty with a high probability of errors.

Two types of measurements are tracked by the system:

- **MaxErr.** The per-channel maximum recorded value of the residual error for PAM-8/16.

The Max Error measurement is the absolute value of the maximum distance between the input signal on a given channel and the decision threshold in the HDBaseT modulation detection scheme. This measurement behaves as a peak detector, so the value read is always the maximum error witnessed on the channel.

- **MseErr.** The per-channel mean square of the residual error for PAM-8/16.

The actual MSE value is a fractional negative number of db (decibels). The higher the absolute value of the MSE, the better the quality of the HDBaseT reception (i.e. -19.8 is better than -18.3).

To display data, tap on the **MaxErr** or the **MseErr** button on the Transmitter or Receiver side. The background of the tapped button appears in grey.

The data appears in the graph that is displayed on the top of the screen, as shown in the figure below. The graphical display is continuously updated.

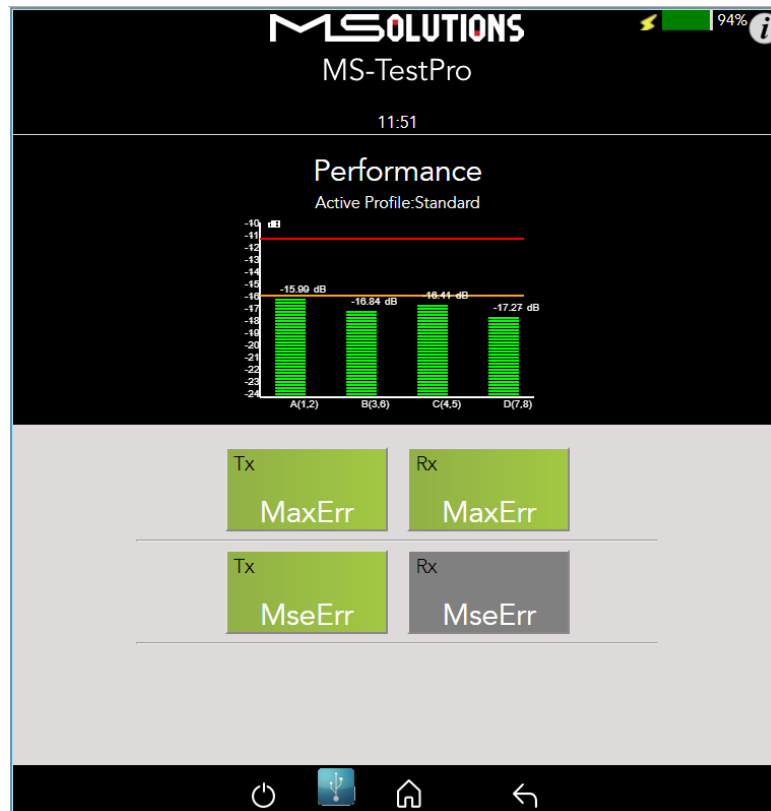


Figure 80: MseErr Screen – Displaying Graph & Data

5.3.3.3 Configuration

To view the current system configuration, tap on the **Configuration** button, as shown in the figure below.

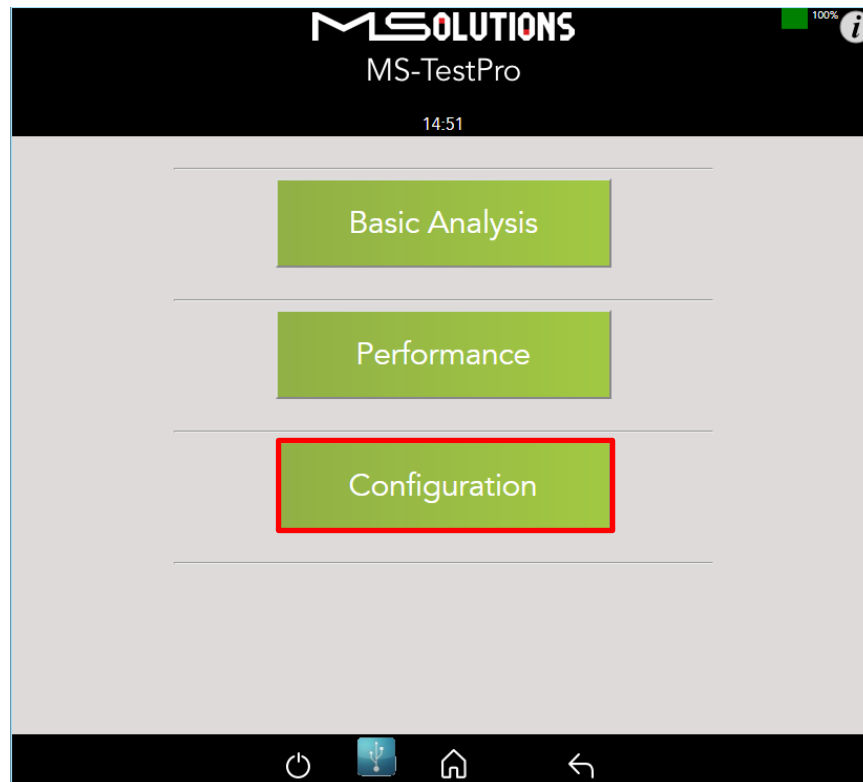


Figure 81: Selecting Configuration Management

The Rx configuration screen appears as shown in the figure below:

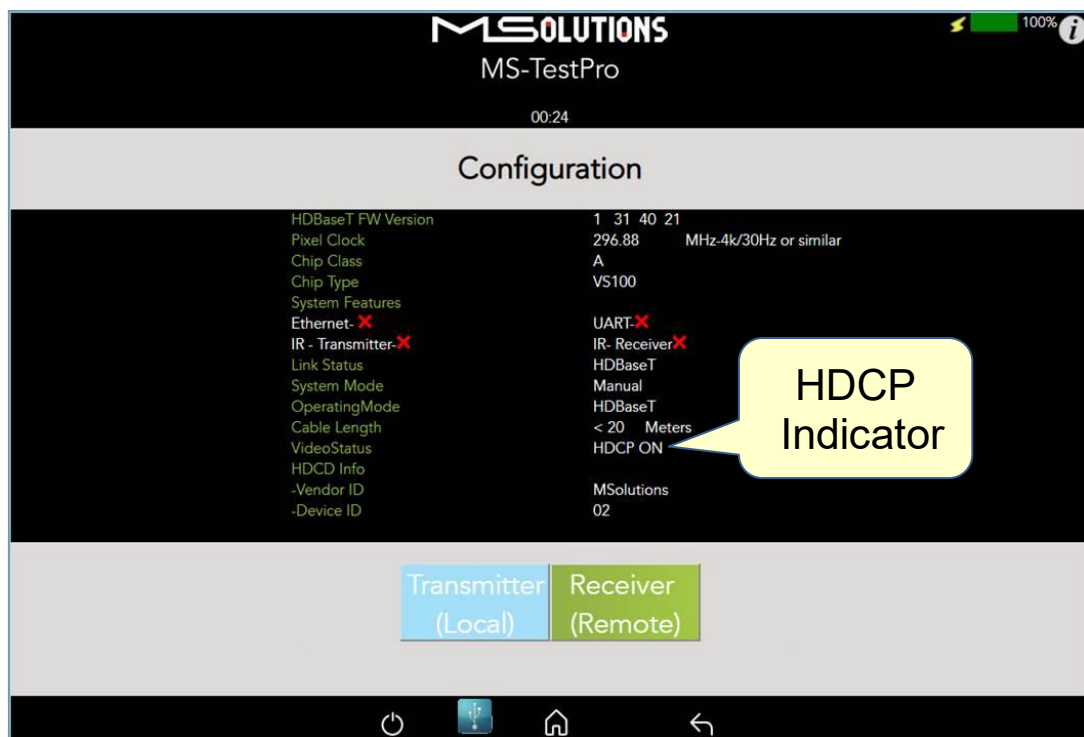


Figure 82: Rx Configuration Screen

The Tx configuration screen appears as shown in the figure below:

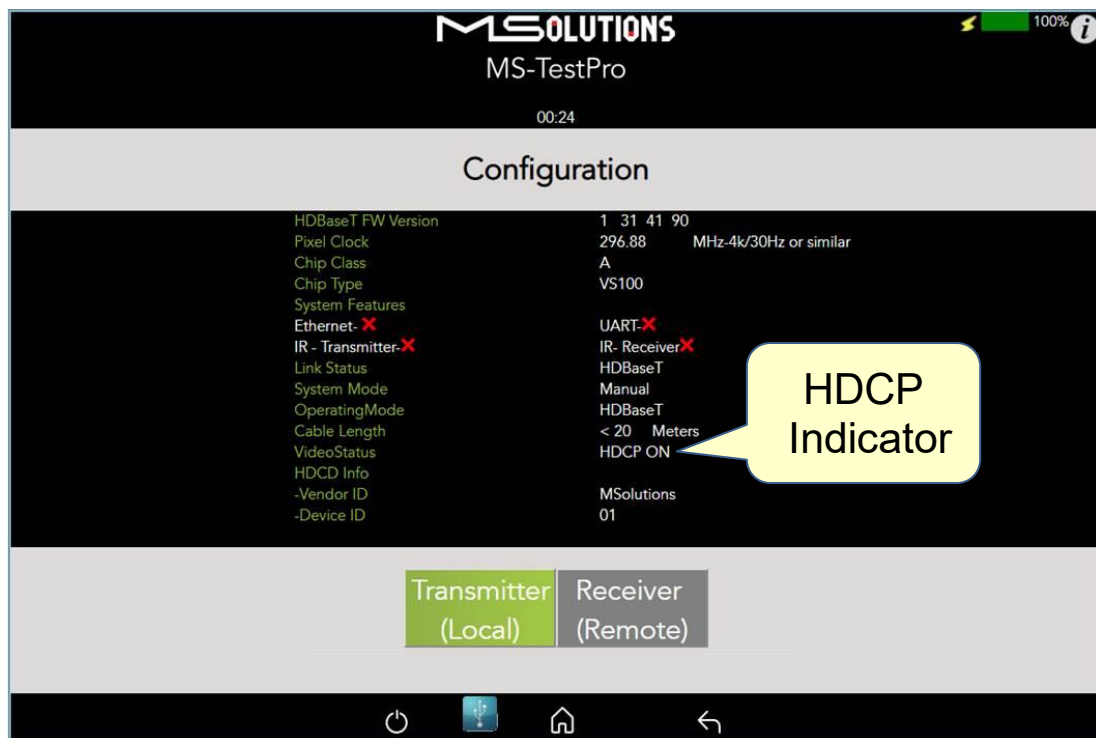


Figure 83: Tx Configuration Screen

The remote and local HDBaseT transceivers are identified – as either transmitter or receiver – and displayed at the top of the page.

IMPORTANT!

The system correctly identifies the local and remote transceivers – even when both are transmitters or both are receivers.

Tap on either the local or the remote entity to display configuration information (read only):

- **FW Ver.** The HDBaseT chip's firmware version.
- **Pixel Clock.** The clock frequency of the video transmission. The Pixel Clock values in the receiver and transmitter screens should be similar.
- **Chip Class.** Class of HDBaseT chip, according to the HDBaseT Standard.
- **Chip Type.** The chip model/part number.
- **Supported System Features.** The interfaces that are extended by the chip over the HDBaseT link, such as: Ethernet, RS232, IR (Infrared support provided by the chip).
- **Link Status.** HDBaseT or No link.
- **System Mode.** Specifies whether Operating Mode changes are performed automatically or manually.
- **Operating Mode.** Current HDBaseT operating mode – HDBaseT, LPPF1/2, Disconnect, FB (Ethernet Fallback), or Bypass Mode.

- **Cable Length.** Approximate cable length calculation (accuracy level $\pm 10\%$), in Meters or Feet.
- **Video Status.** Indicates whether HDCP content is being transmitted.
 - **Video On.** HDMI transmission without HDCP content.
 - **HDCP On.** HDMI transmission *with HDCP content*.
- **HDCD Information.** Vendor and Device ID, as specified in the HDBaseT standard.

5.3.4 Tools

To access Tools menu options, tap on the **Tools** button, as shown in the figure below.

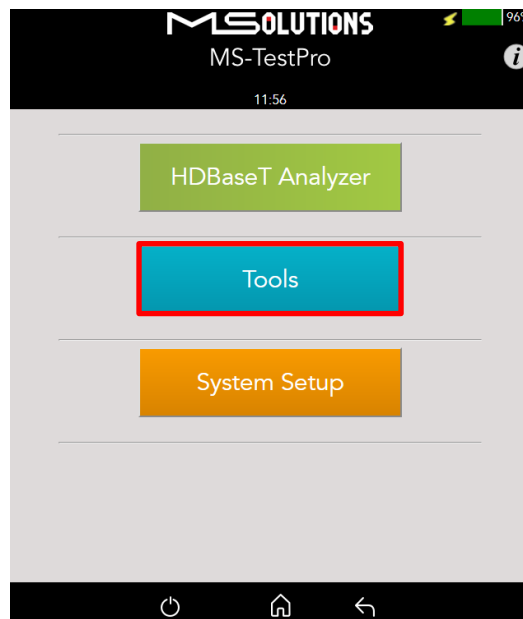


Figure 84: Tools Menu Access

The Tools page is depicted in the figure below.

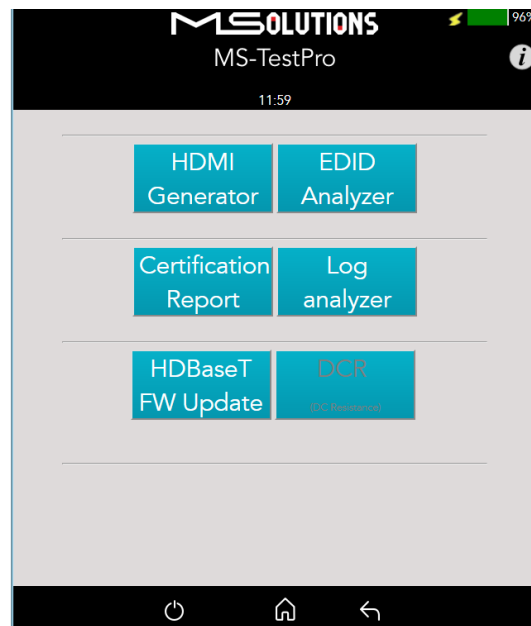


Figure 85: Tools Page

5.3.4.1 HDMI Generator

The HDMI pattern generator enables you to generate a variety of HDMI display patterns in a wide range of resolutions.

The HDMI pattern generator screen appears as shown below.

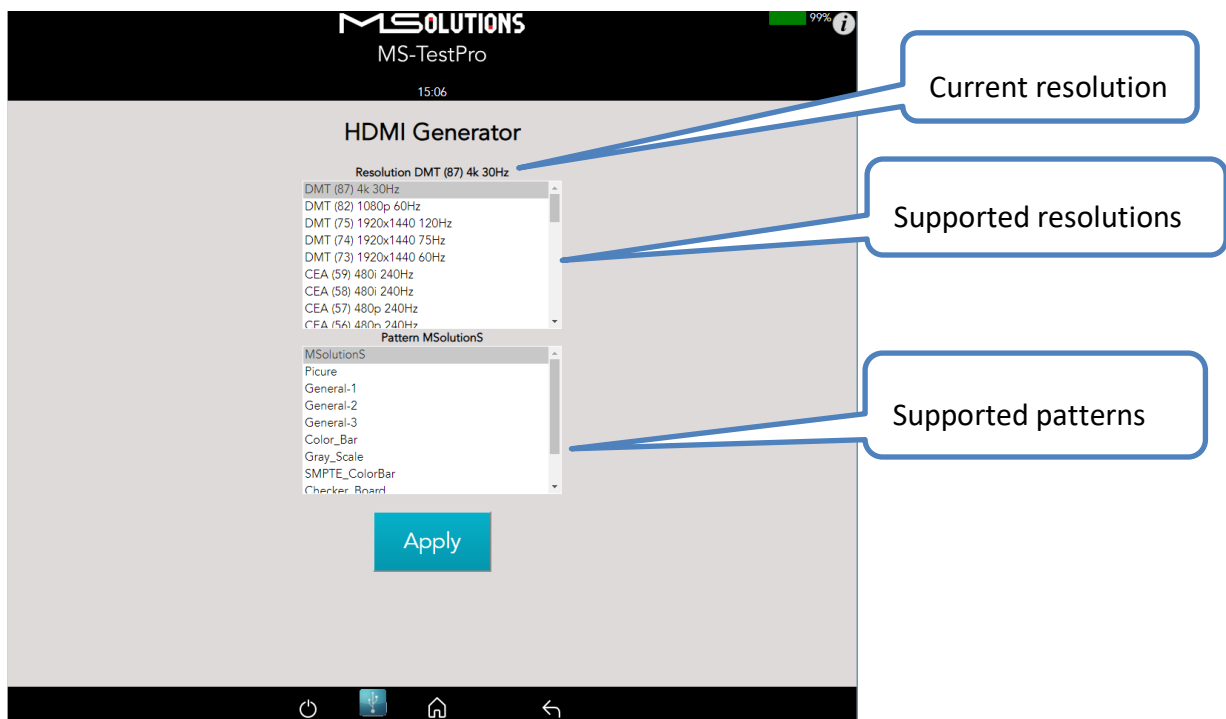


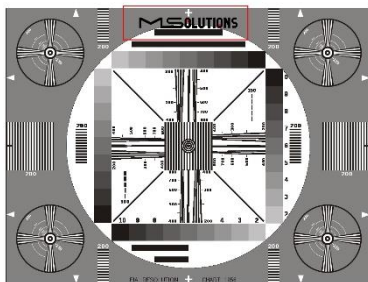
Figure 86: HDMI Generator Screen

To begin generating HDMI pattern, select the **Resolution** and **Pattern** from the list boxes and tap **Apply**.

Table 7: Supported HDMI Resolutions

Resolution	Frequency	Resolution	Frequency
1080p	24Hz	720p	60Hz
1080p	25Hz	1080i	60Hz
4kp	30Hz	480i	60Hz
1080p	30Hz	1080i	100Hz
1080p	50Hz	720p	100Hz
1080i	50Hz	1080i	120Hz
720p	50Hz	720p	120Hz
1080i	50Hz	480p	120Hz
1080p	60Hz	480i	120Hz
480p	60Hz	480i	240Hz
1080p	60Hz	480p	240Hz

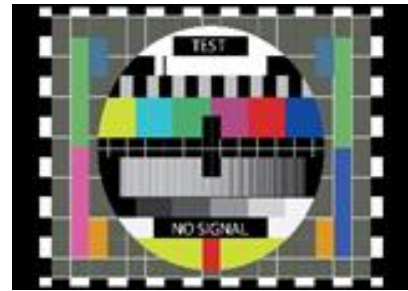
The supported HDMI patterns appear in the figure below.



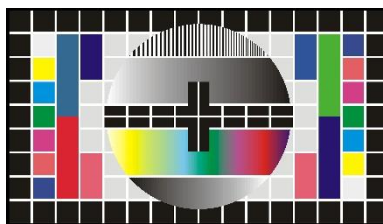
MSolutions



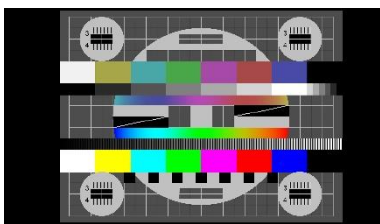
Picture



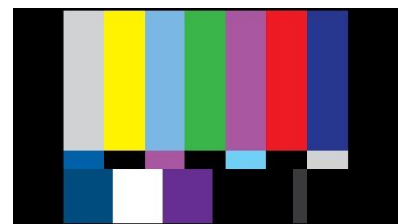
General 1



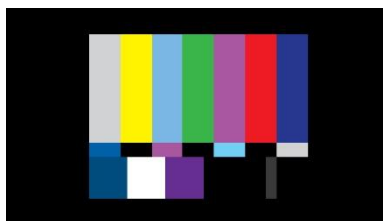
General 2



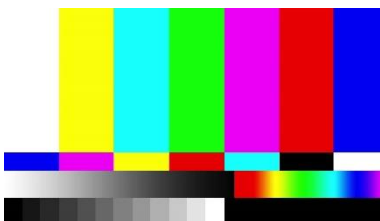
General 3



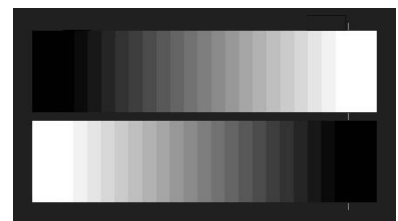
Color Bar 1



Color Bar 2



SMTP Color Bar



Grey

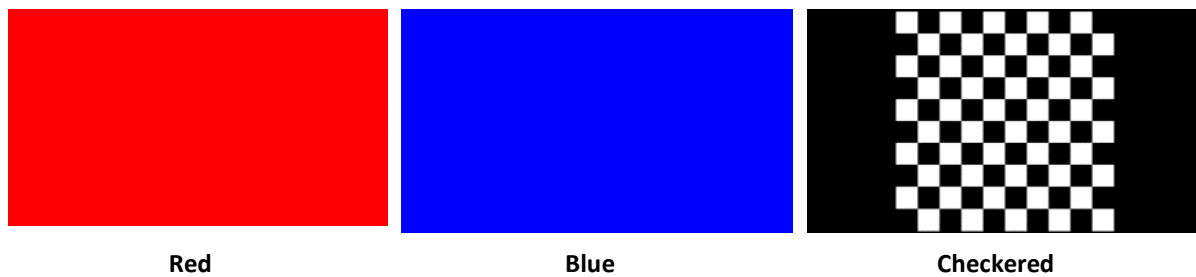


Figure 87: Supported HDMI Patterns

The pattern will be activated for an indefinite period, as shown in the figure below. To deactivate the pattern, reset the MS-TestPro device.

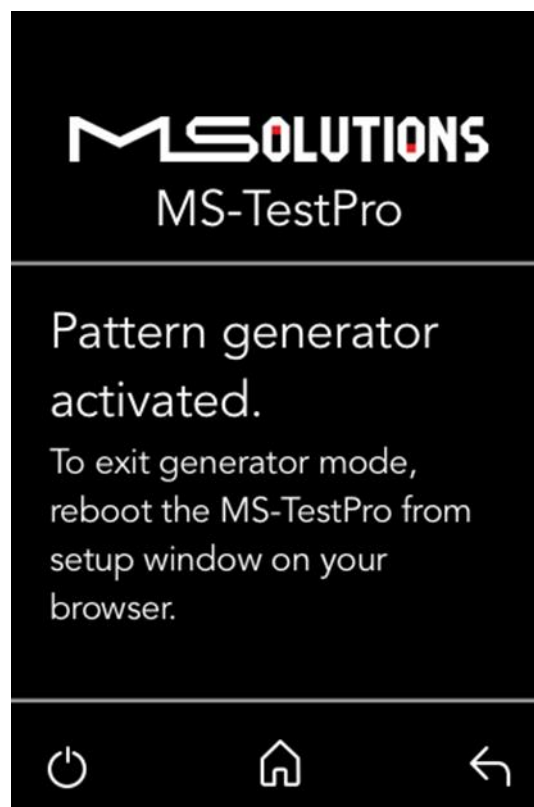


Figure 88: Reset the MS-TestPro to Deactivate the Pattern

5.3.4.2 EDID Analyzer

You can use EDID to access information on the display capabilities of HDMI sink devices. There are two test setups that you can use to access the information:

- Connecting the MS-TestPro test device to an HDMI sink device via an HDBaseT link.
- Connecting the MS-TestPro test device directly to an HDMI cable.

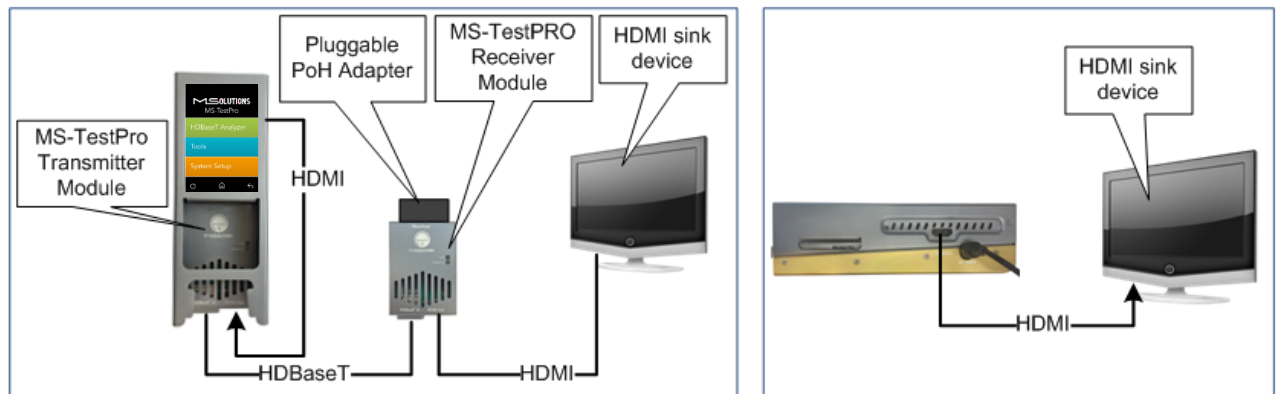


Figure 89: Connecting the MS-TestPro to the HDMI Sink Device

➔ To access display capabilities using EDID:

1. Connect the MS-TestPro test device to the HDMI sink device using one of the methods described above.
2. Tap on the **EDID Analyzer** button to access information on the display capabilities of the HDMI sink device. The following screen appears, presenting the sink device display information, and supported display resolutions.

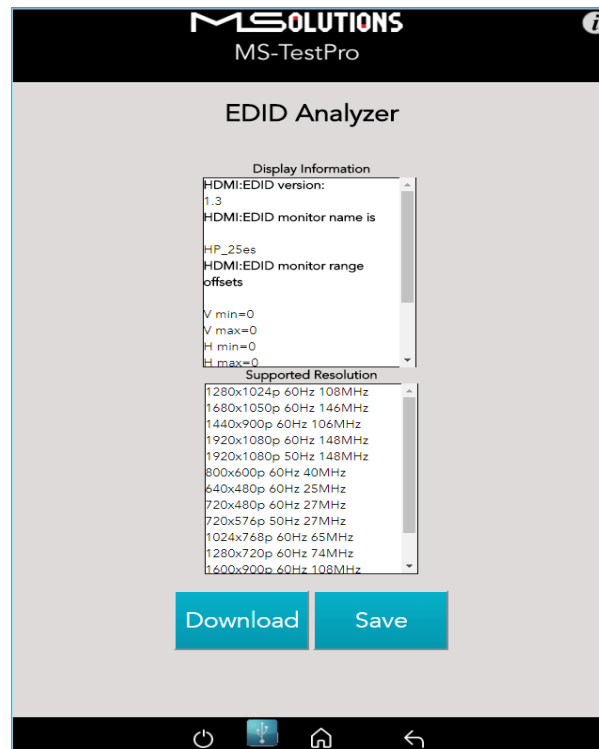


Figure 90: EDID Information Page

3. To save EDID data to the tester internal memory, tap the **Save** button.
To download EDID data, connect the USB memory stick and tap the **Download** button.
Two files will be saved – *EDIDXXXX.txt* and *EDIDXXXX.bin*.
4. To delete EDID data from the tester, select the files to delete and tap the **Delete** button.

5.3.4.3 Certification report

The certification report menu provides the following capabilities:

- **Run** – report data generation
- **Download (Report Data)** – saves the report data from the tester to the USB memory stick
- **Profile** – profile configuration
- **Download (PDF Creator Software)** – downloads PDF Creator Software

5.3.4.3.1 Run (Generate Data)

The HDBaseT report data collection feature is used to collect the data required to perform HDBaseT cable analysis.

➔ **To access data for HDBaseT cable analysis:**

1. Connect the MS-TestPro test device to both ends of the CATx cable, as shown below in Figure 32:
 - The HDMI cable **must** be connected to the Internal Generator to ensure that HDMI traffic is running on the HDBaseT link.
 - The “local” side of the cable is connected to either the transmitter or receiver module, housed in the MS-TestPro chassis.
 - The “remote” side of the cable is connected to the other MS-TestPro module.
Make sure that the remote module is terminated by a Pluggable POH Adapter as shown below.

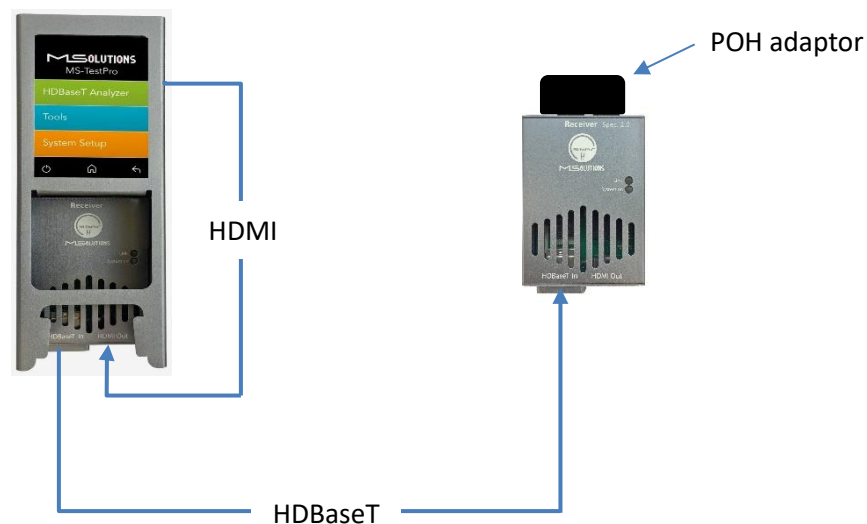


Figure 91: Cable Test Setup

IMPORTANT!

The HDMI cable must be connected to the Internal Generator to ensure that HDMI traffic is running on the HDBaseT link.

2. Select **Certification report >> Run (Generate Data)**, as shown below:

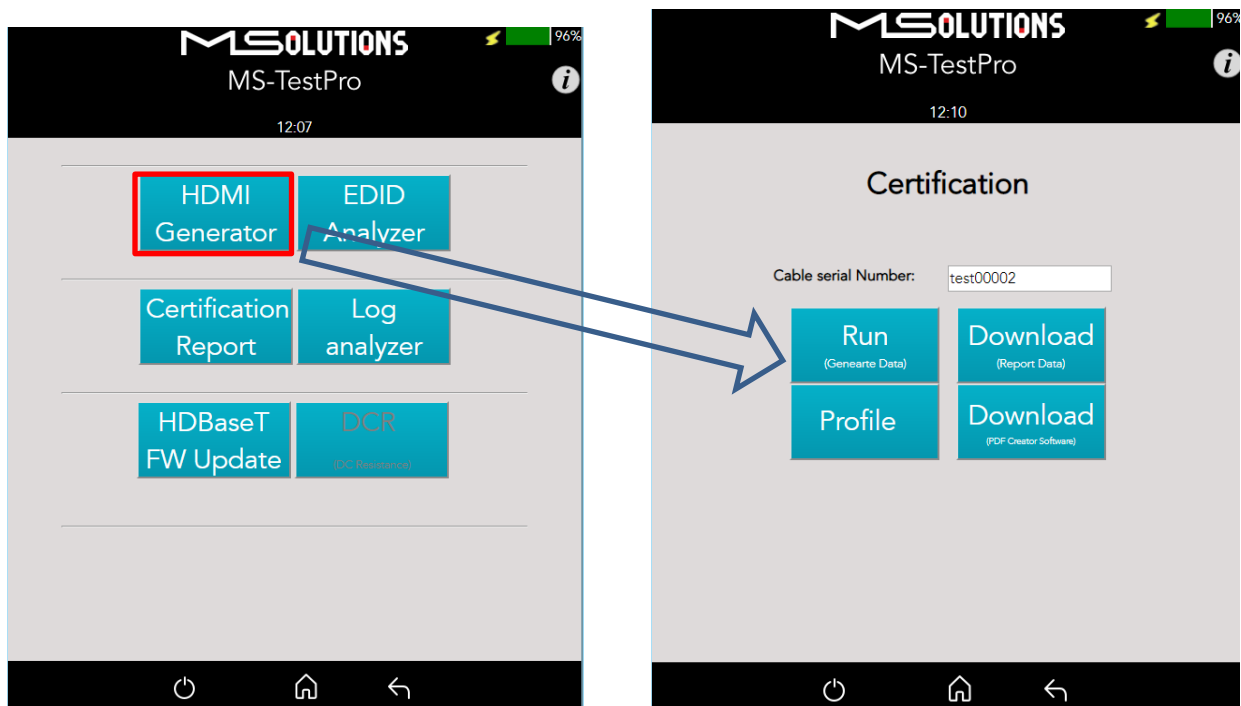


Figure 92: Generate Report Data

A progress bar appears in the window:

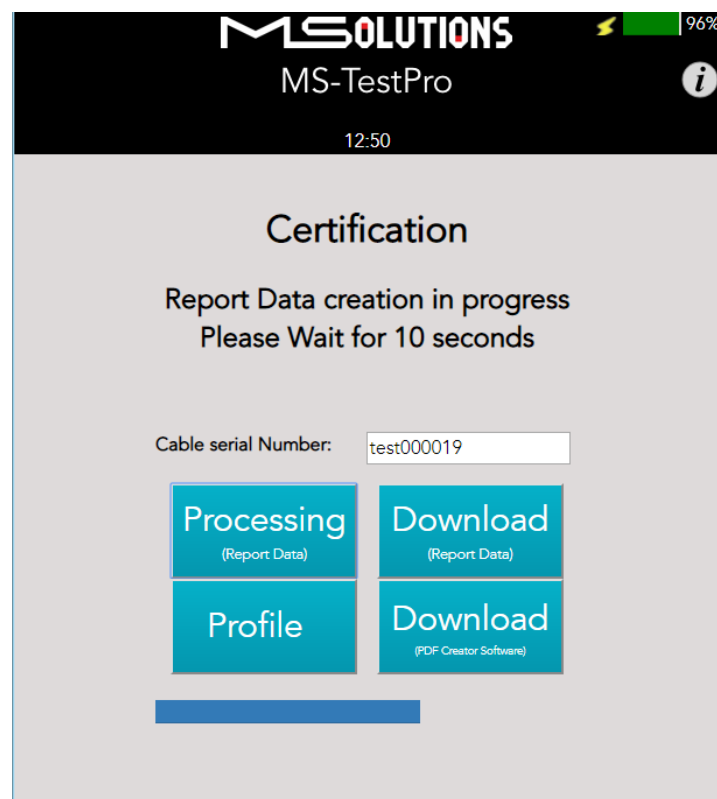


Figure 93: Generating Report Data

3. After the data is generated, the line certification results appear at the top of the screen, as shown in the figure below. To save the generated data files, insert the USB memory stick and tap on the **Download (Report Data)** button (see the figure below).

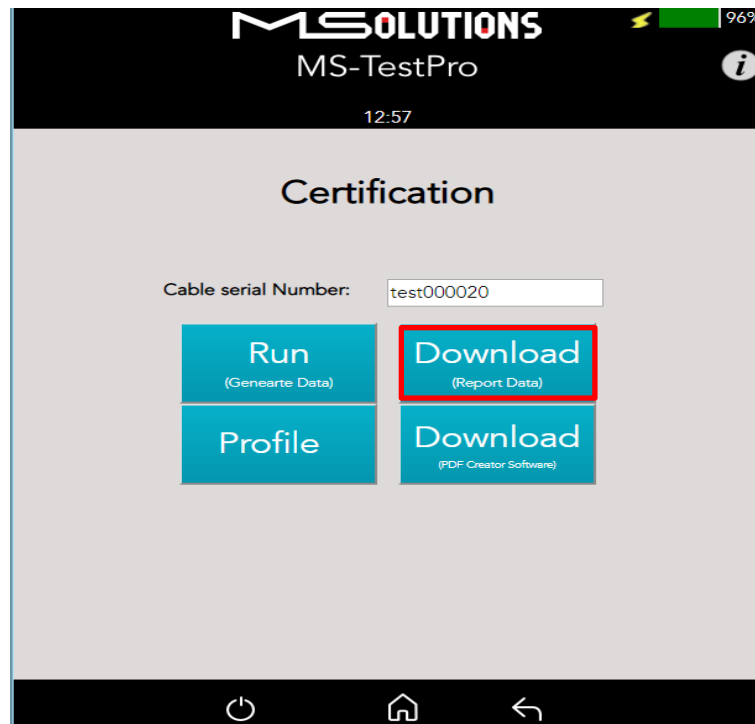


Figure 94: Downloading Report Data

In the following screen appears a list of certification test data files:

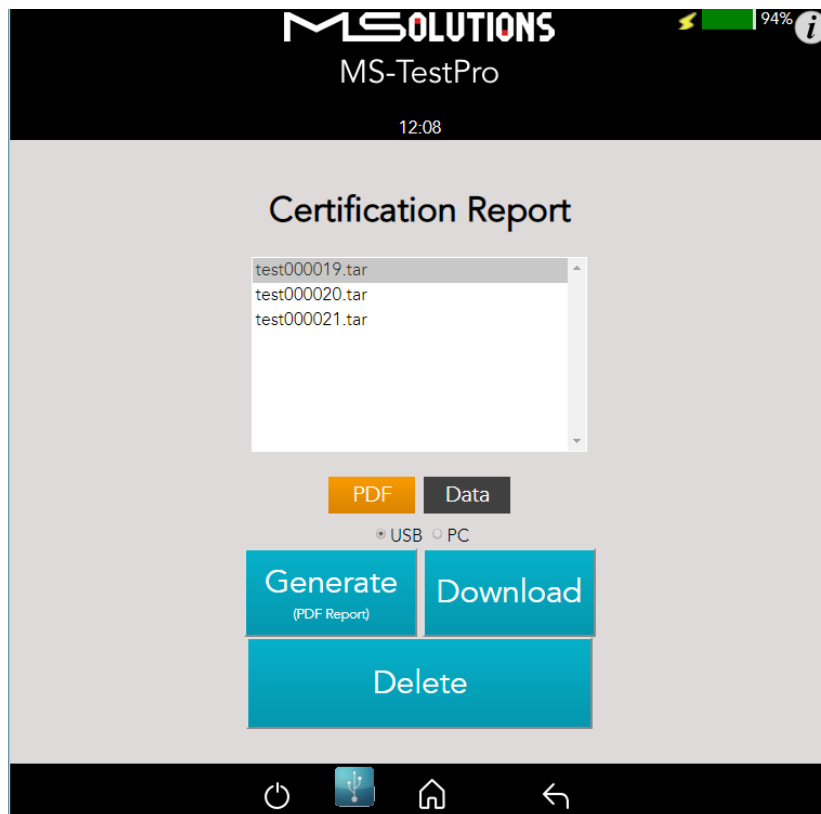


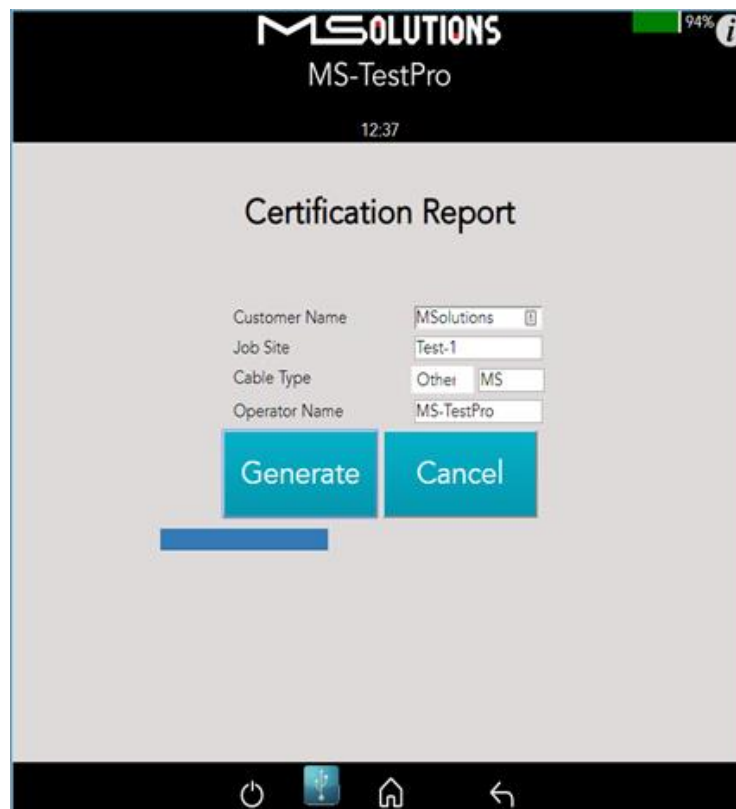
Figure 95: Certification Report Data File Options

4. To download file to USB flash memory, select the USB radio button, insert a USB memory stick into one of the USB ports of the MS-TestPro device. Select a report data file or files from the list as shown in Figure 36, and tap **Download** to save the files to the memory stick. Wait until the following message disappears:



Figure 96: Message - Downloading Report Data

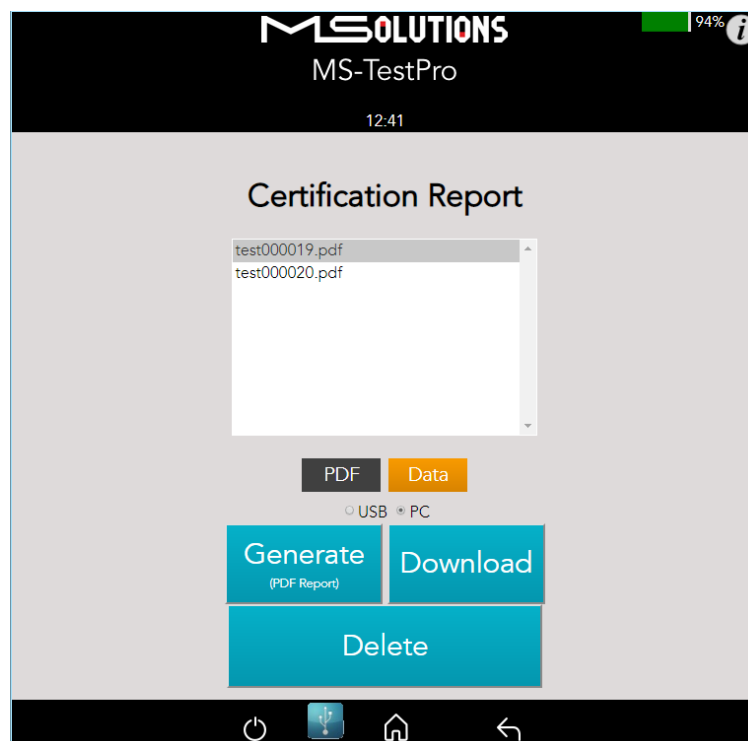
5. Data files may be downloaded to the PC as well. Mark the **PC** radio button, select one or more report data files from the list, choose the PC target directory, and tap **Download**.
6. To create a PDF Report, select **Generate (PDF Report)**, and select one or more report data files from the list, as shown in Figure 95. Tap **Generate**, as shown in Figure 97.



The screenshot shows the 'Certification Report' screen of the MS-TestPro application. At the top, the MSOLUTIONS logo and 'MS-TestPro' are displayed, along with a battery level of 94% and a time of 12:37. The main area contains a form with the following fields: 'Customer Name' (MSolutions), 'Job Site' (Test-1), 'Cable Type' (Other MS), and 'Operator Name' (MS-TestPro). Below the form are two large blue buttons: 'Generate' and 'Cancel'. A small blue progress bar is visible below the 'Generate' button. The bottom of the screen features a navigation bar with icons for power, USB, home, and back.

Figure 97: Certification Report

To see generated PDF Report check PDF on the Figure 95 and Download to PC or USB.



The screenshot shows the 'Certification Report' screen with a list of generated PDF files: 'test000019.pdf' and 'test000020.pdf'. Below the list are two buttons: 'PDF' (highlighted in orange) and 'Data'. Under these buttons are radio buttons for 'USB' and 'PC', with 'PC' selected. At the bottom are three large blue buttons: 'Generate (PDF Report)', 'Download', and 'Delete'. The top of the screen shows the MSOLUTIONS logo, 'MS-TestPro', a battery level of 94%, and a time of 12:41. The bottom navigation bar is the same as in Figure 97.

Figure 98: PDF Certification Report Download

7. To delete files, select a report data file or files from the list, and tap **Delete**.
8. To generate a printable certification report based on the downloaded data, see Appendix D: *Generating an HDBaseT Certification Report*.

5.3.4.3.2 Profile Configuration

To choose the appropriate profile, tap the **Profile** button based on the cable which is used. If the desired cable is not on the list, tap on **Standard** → **Apply**, note the selected profile appears on a grey background.

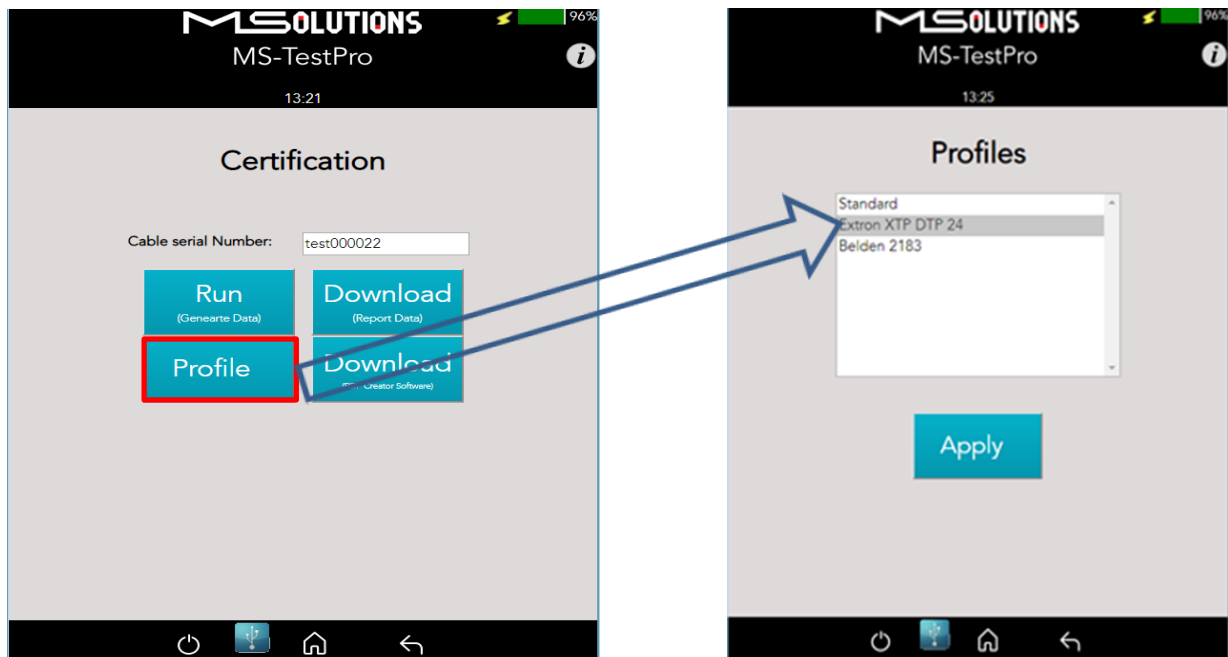


Figure 99: Profile Configuration Process

5.3.4.3.3 Download PDF Creator Application

To Download the Report Generator Tool, insert a USB memory stick into one of the USB ports of the MS-TestPro device, and tap on the **Download (PDF Creator Software)** button. A detailed explanation how to use it can be found in Appendix D.



Figure 100: Download PDF Creator Software

5.3.4.4 Log Analyzer

The comprehensive Log Analyzer function measures over sixty different parameters. It is intended to track random failures over a long period of time. The recommended test duration is 24 hours, allowing you capture the performance of the cable during the course of an entire day. This enables you to perform an in-depth analysis of any problem. Log files are generated in pairs – one for the transmitter module and one for the receiver module. Up to 5 pairs of log files are stored in the system. When a 6th pair of log files is generated, the oldest log file pair in the system is automatically deleted.

5.3.4.4.1 Log Generation

➔ **To perform log generation:**

1. To begin log generation, tap on the **Log Analyzer**, then the **Start** button.
2. To end log generation, tap on **Stop** button as shown in the figure below. The system generates transmitter *and* receiver logs.

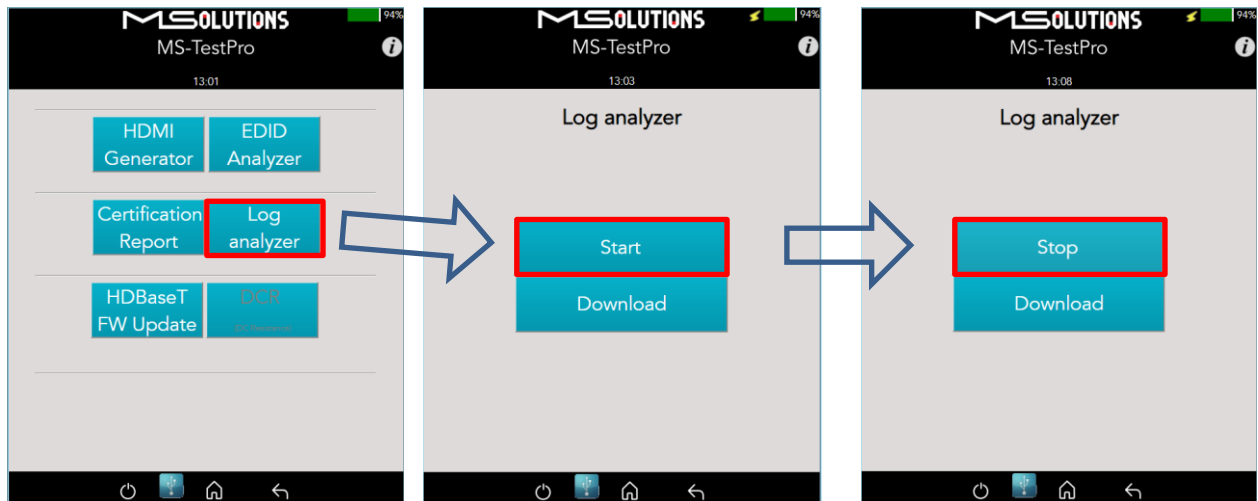



Figure 101: Starting Log Generation

5.3.4.4.2 Log Analysis

You can export log files to a USB memory stick for further processing.

➔ **To export log files to a USB memory stick:**

1. Insert a USB memory stick into one of the USB ports. Upon connection, the USB indicator  is displayed at the bottom of the screen.
2. To distribute a log for analysis, mark files, USB or PC radio button and tap **Download** button. The transmitter and receiver logs that you generated are copied to the USB memory stick.

Up to 5 pairs of transmitter/receiver logs can be stored in the main unit. Generation of additional logs will cause the oldest log pair to be deleted.

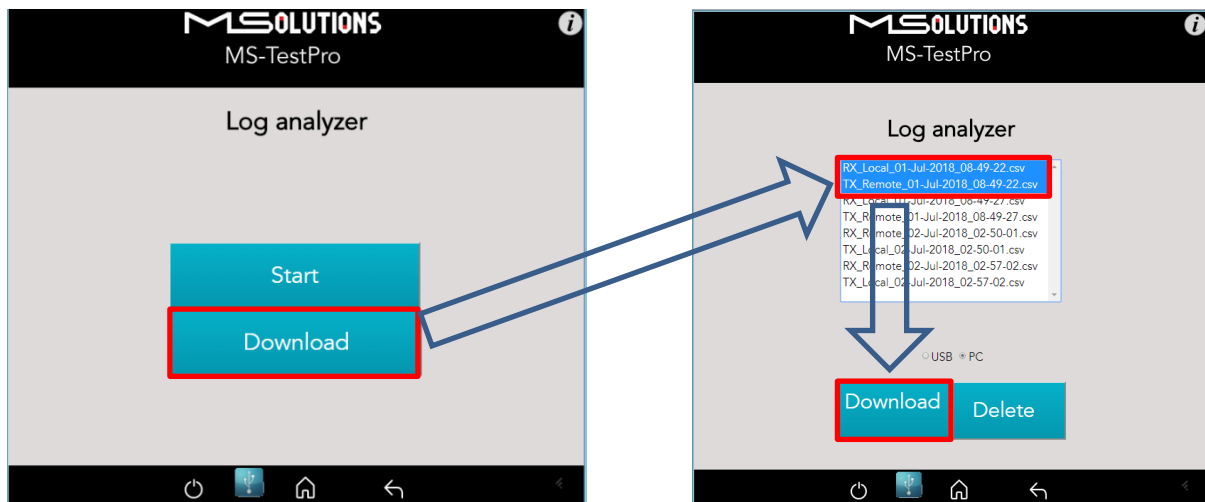


Figure 102: Downloading Files

You can choose to copy any of the file pairs to the PC or USB memory stick.

3. To delete files, select a file or files from the list, and tap **Delete**.

5.3.4.5 HDBaseT Firmware Update

➔ To upgrade 3rd party Tx or Rx remote unit firmware:

1. Prepare a USB memory stick with the upgrade file *xxx.Hex* in the **root** folder of the stick or directory with the same file on PC.
2. Tap on the **HDBaseT FW Update** button on the Tools screen.
3. Mark **Reset** checkbox on the next screen.
4. Select the related file from PC or USB stick.
5. Tap on the Upgrade button as shown in the figure below.

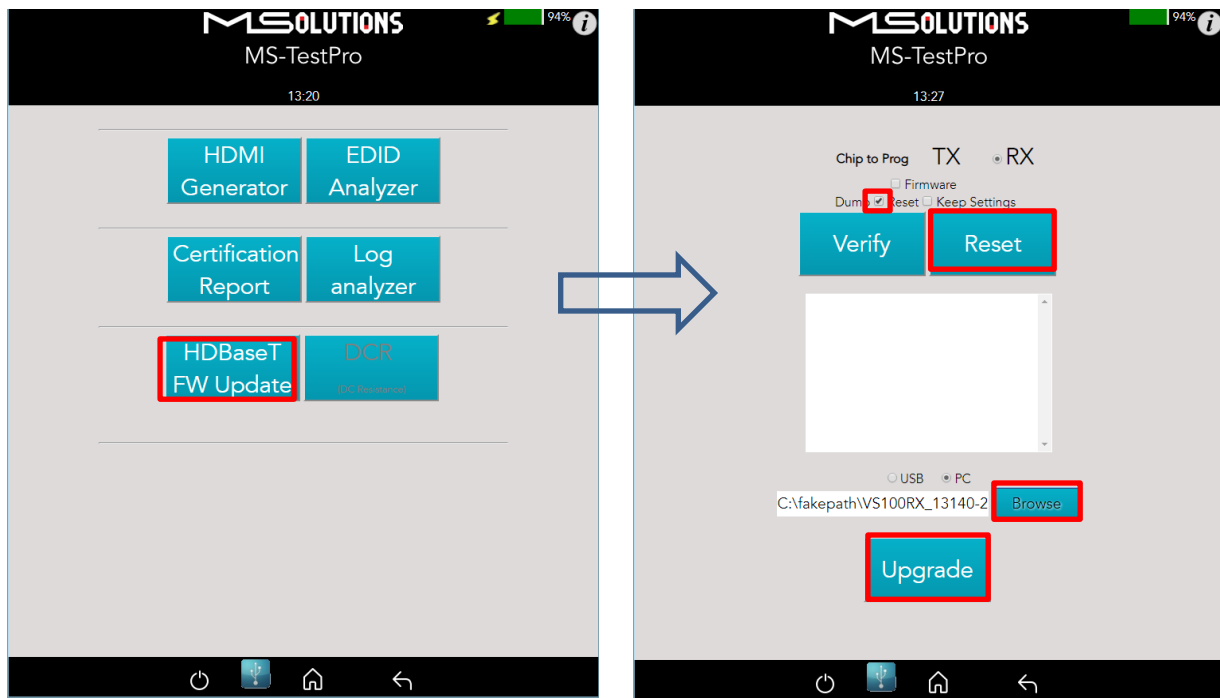


Figure 103: Remote Unit HDBaseT Firmware Update

IMPORTANT!

- * Do not switch off the device's power during the upgrade!
- * Firmware updates are available only to 3rd party remote Transmitter or Receiver units.
- * The HDBaseT firmware of the MS-TestPro Transmitter and Receiver cannot be upgraded

GUI buttons:

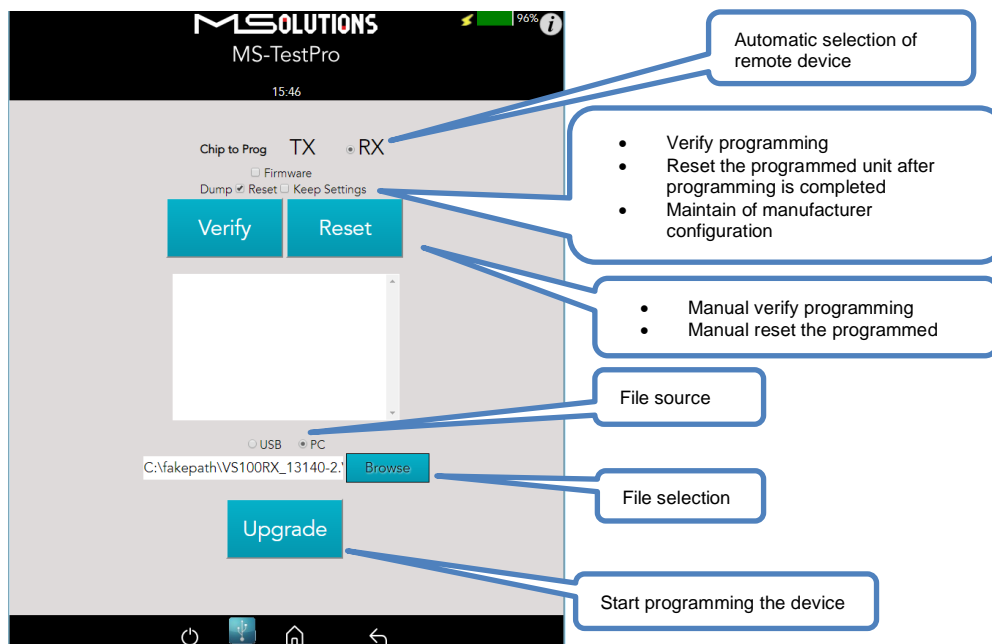


Figure 104: Firmware Upgrade GUI

Wait for the progress bar to disappear.

To verify if the upgraded unit was successfully upgraded, access the **Configuration** menu and read the current HDBaseT firmware version. See Figure 82.

5.3.4.6 DC Resistance Imbalance Testing

Using the MS-TestPro **DC Resistance** and **Looper** modules, you can test the DC resistance of CATx cables, and check their ability to provide a sufficient level of PoH (Power over HDBaseT) power.

The DC Resistance module is inserted into the lower slot in the MS-TestPro main unit, while the CATx cable is connected to the DC Resistance module at one end, and to the Looper module at the other end, as depicted in the figure below:

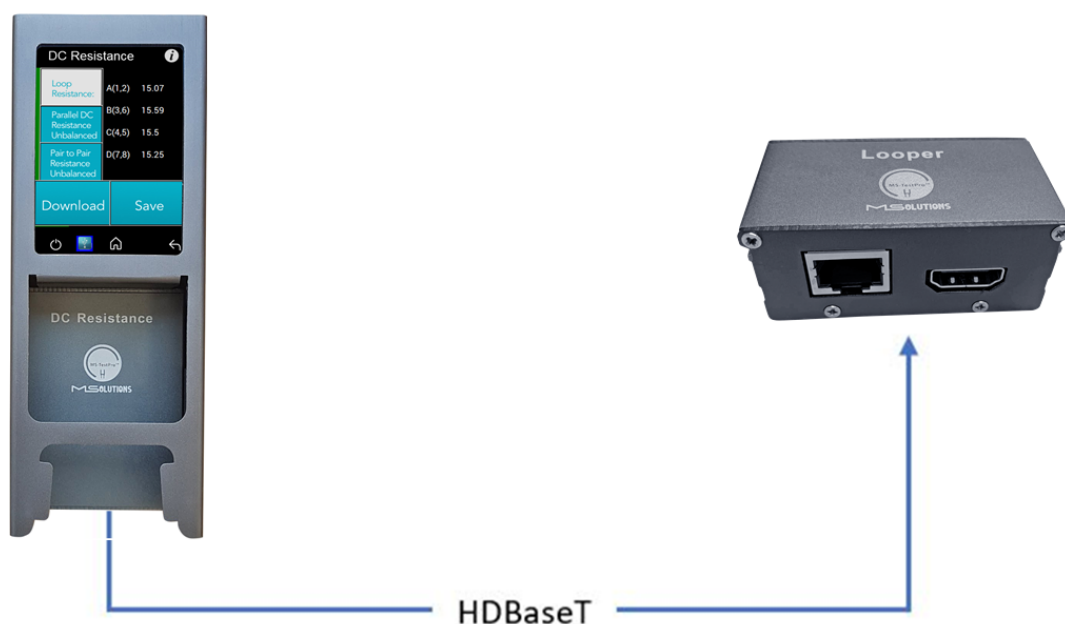


Figure 105: DC Resistance Test Setup

➔ **To test the DC resistance of a CATx cable:**

1. Attach the cable to the DC Resistance and Looper modules as shown in the figure above.
2. From the Tools page, tap on the **DCR DC Resistance** button. The DC Resistance page appears, together with three buttons:
 - Loop Resistance
 - Parallel DC Resistance Unbalanced
 - Pair to Pair Resistance Unbalanced

3. Tap on the **Loop Resistance** button to display Loop Resistance data, as shown in the figure below. Loop resistance represents the DC loop resistance (in ohms) of a cable, and is calculated as the sum of the DC resistance of the two conductors in a pair.

Resistance of *under 20 ohms* indicates that the pair should be capable of delivering the minimum of 80% of the power to the remote side.

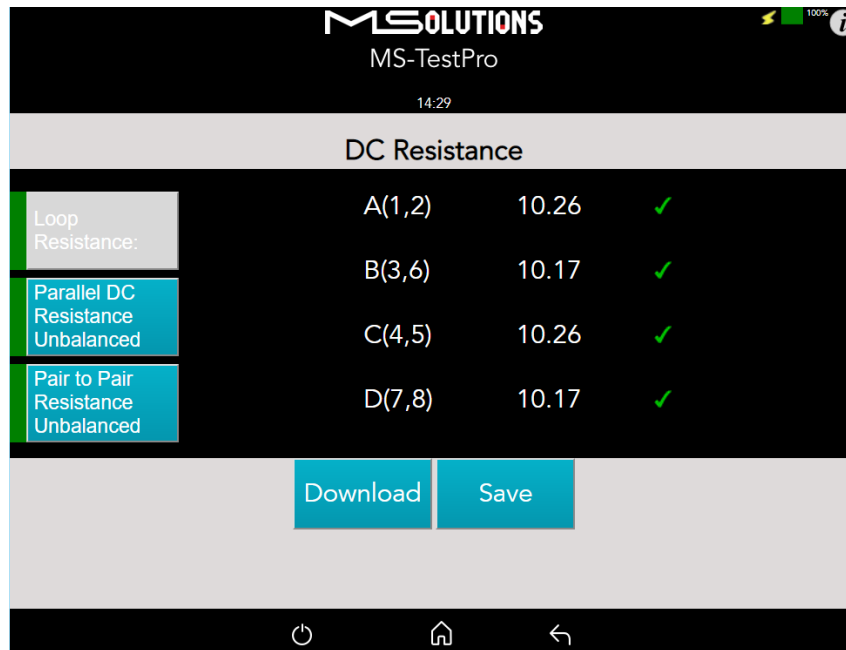


Figure 106: Loop Resistance Results

4. Tap on the **Parallel DC Resistance Unbalanced** button to display the parallel resistance of the CATx two conductors in each cable pair. For each pair, the difference is expressed in ohms, as shown in the figure below.

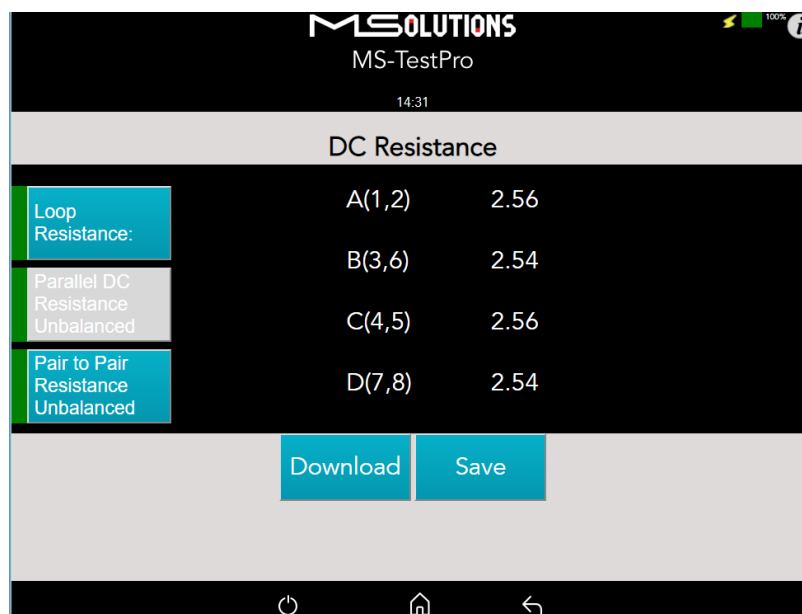


Figure 107: Parallel DC Resistance Unbalanced Results

5. Tap on the **Pair-to-Pair Resistance Unbalanced** button to display the difference in DC resistance between the four pairs in the cable. For each pair, the difference is expressed in ohms, as shown in the figure below.

A difference of *under 0.2 ohms* or 5% (the higher between the two) indicates that the pair should be capable of delivering the required common-mode current needed to effectively support PoH and data transmission over the pair.

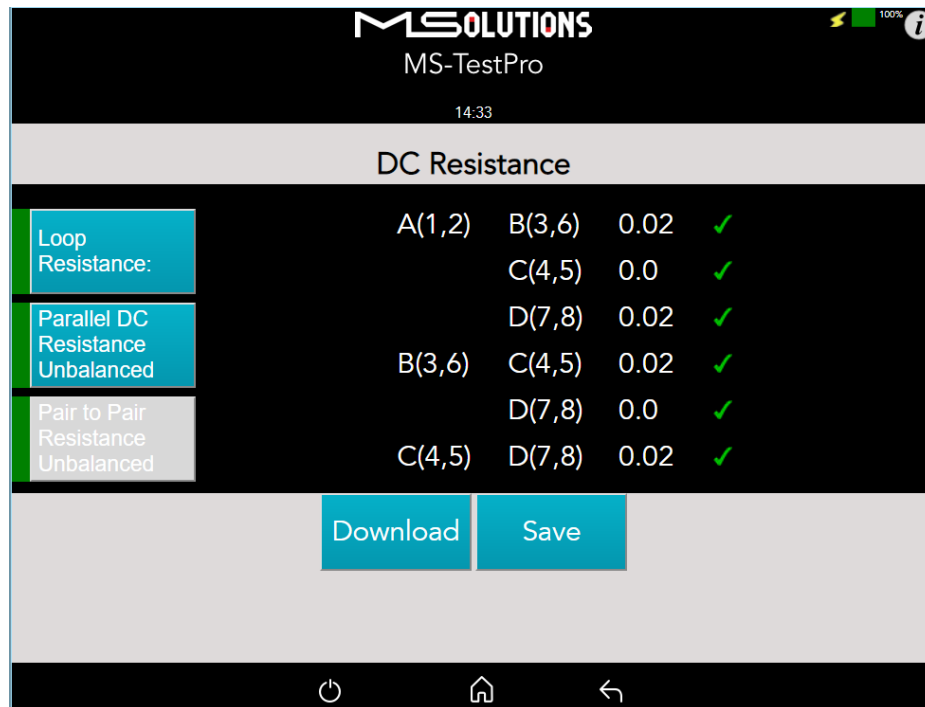


Figure 108: Pair-to-Pair Resistance Unbalanced Results

5.3.4.7 HDMI Cable Testing

Using the MS-TestPro **HDMI Cable Tester** and **Looper** modules, you can test the quality of HDMI cables before their installation. In order to reduce costs and boost profits, some HDMI cable suppliers sell cables with missing or shorted wires. These substandard cables are usually discovered only when trying to stream high resolutions like 4K or run CEC commands. With the MS-TestPro HDMI Cable Testing function, you will identify the problem immediately, and not in a post-installation service call.

Just insert the HDMI Cable Tester module into the lower slot of the MS-TestPro main unit, attach one end of the HDMI cable to the module's HDMI port, and attach the other end of the HDMI cable to the HDMI port on the Looper module, as shown in the figure below.



Figure 109: HDMI Cable Tester Setup

The MS-TestPro HDMI modules perform physical layer quality tests on each of the cable's conductors and the cable shielding, providing instant feedback on missing or defective wiring:

- Checks the presence of each of the 19 HDMI-standard conductors and cable shielding.
- Tests the ability of the cable to support an array of HDMI bandwidth requirements, as specified in the HDMI 1.4, 2.0, 2.1, and future 2.3 standards.
- Ensures that none of the cable's conductors are shorted or missing.
- Measures the gauge (AWG) of each of the conductors, detecting resistance imbalances within the cable that cause degraded transmission quality (planned for a future release).

➔ To test the quality of an HDMI cable:

1. Attach the cable to the HDMI Cable Tester and Looper modules as shown in Figure 109 above.
2. From the Basic Tools page, tap on the **HDMI Cable Tester** button.

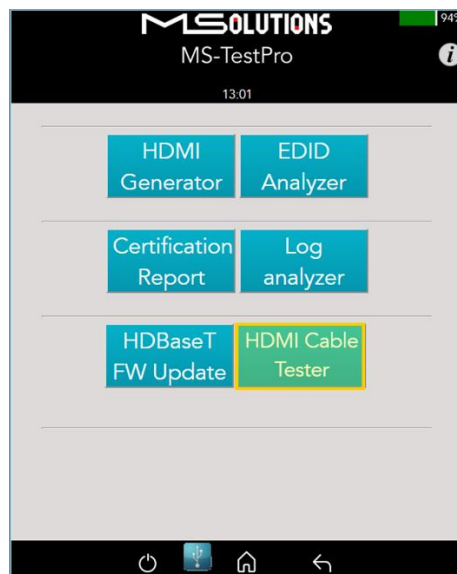


Figure 110: HDMI Cable Tester Button

The HDMI Cable Tester page appears as shown in the figure below.

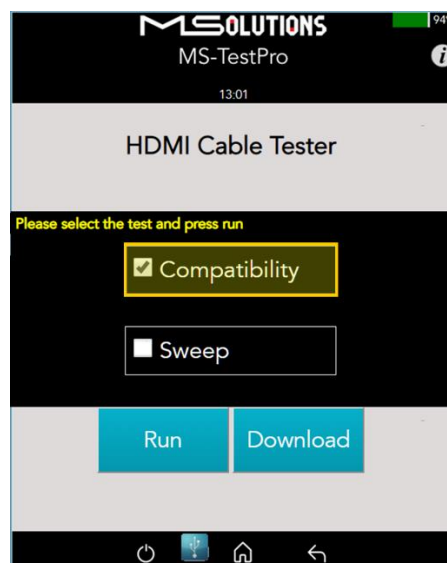


Figure 111: Run Compatibility Tests

3. Check the **Compatibility** box, and tap **Run**.

IMPORTANT!

In this description, the Compatibility and Sweep tests are presented separately. You can check *both* the **Compatibility** and **Sweep** boxes to run the two tests simultaneously.

4. The MS-TestPro begins testing the cable's compatibility with the HDMI standard. When the test is complete, a summary screen appears. In the example shown below, the cable failed the 4K/60Hz test. A list of shorted wires appears as well. If needed, tap **Run** to perform another Compatibility test.

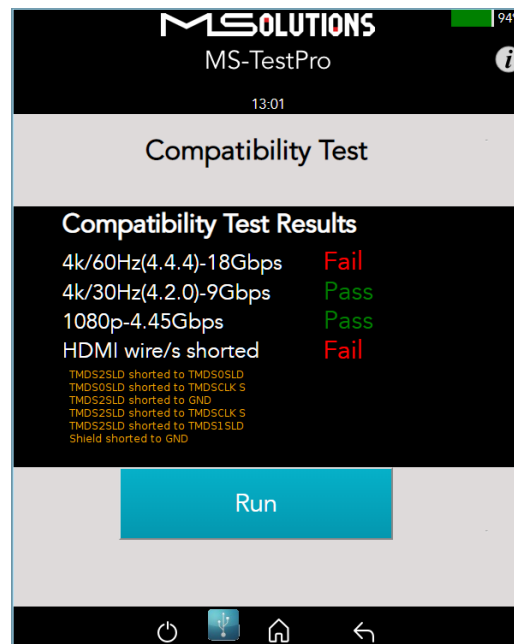


Figure 112: Compatibility Test Results

5. If the message "Cable not found" appears on the screen, check the physical connection of the cable to the modules, and tap **Run** again.

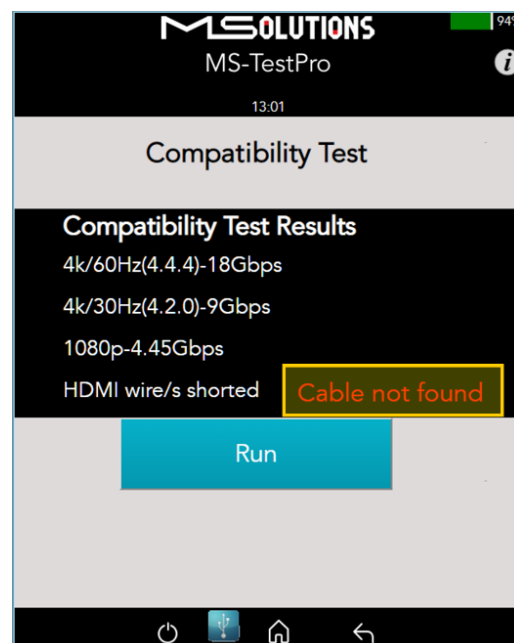


Figure 113: "Cable not found" Message

6. Tap **Save** to save the test results in a report format. Following generation of the report, tap **Download** to copy the report to your PC or to a disk-on-key attached to the tester's USB port.
7. To perform the Sweep test, return to the HDMI Cable Tester page appears as shown in the figure below.

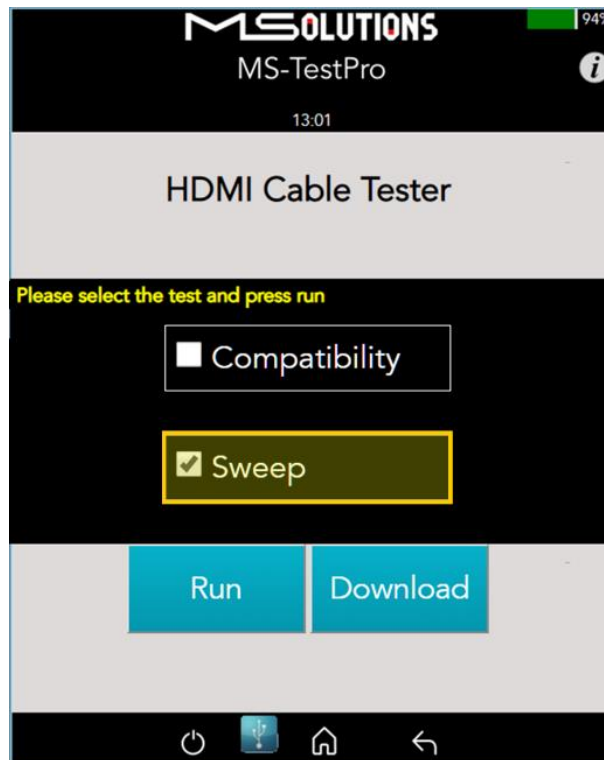


Figure 114: Run Sweep Tests

8. Check the **Sweep** box, and tap **Run**.


IMPORTANT!

In this description, the Compatibility and Sweep tests are presented separately. You can check *both* the **Compatibility** and **Sweep** boxes to run the two tests simultaneously.

9. The MS-TestPro begins to test the quality of each of the wires in the cable. If needed, tap **Run** to perform another Sweep test.

The existence of each wire tested is indicated by a color, as listed in the table below:

Table 8: Wire Quality Color Code

Color	Severity
	Wire exists
	Wire is missing
	Wire is shorted
	Test in progress

The figure below shows the sweep test in progress. If necessary, you can tap **Stop** to cancel the test.

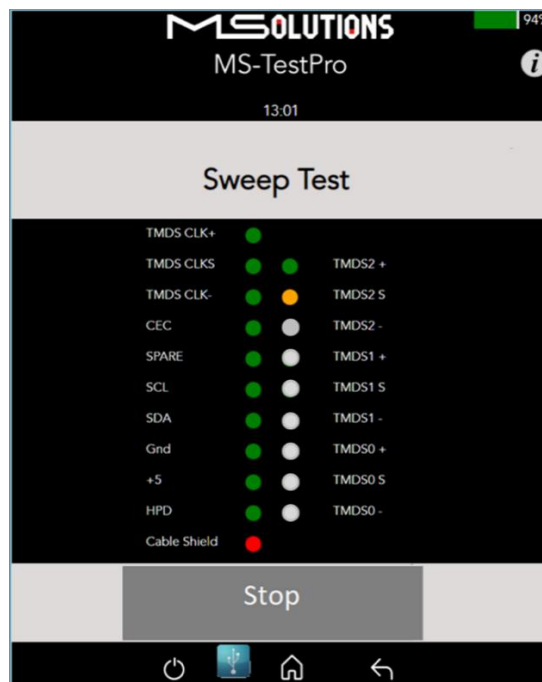


Figure 115: Sweep Test in Progress

- At the end of the test, the **Run** button appears. Click on the button if you wish to run another Sweep test.

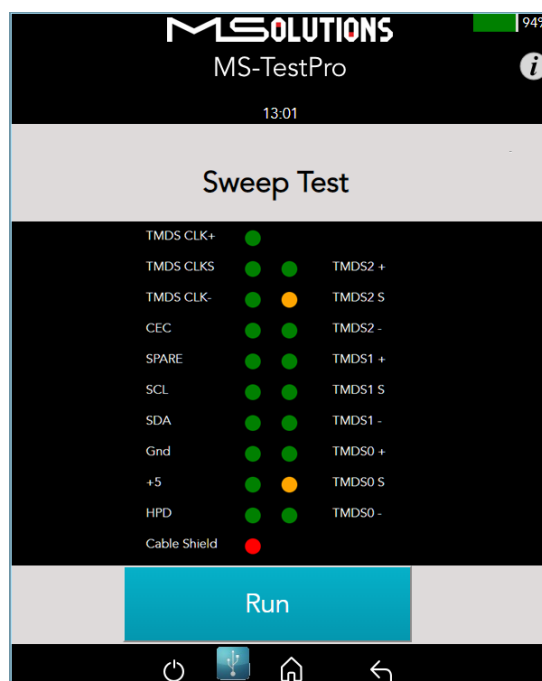


Figure 116: Sweep Test Complete

5.4 System Setup

To perform setup functions, tap on the **System Setup** main screen button, as shown in the figure below.



Figure 117: Selecting System Setup

The System Setup screen (see Figure 63 below) offers the following information and functionalities:

- **MS-TestPro Application Software Version.**
- **System upgrade.** Upgrades the MS-TestPro system software.
- **System Settings.** Provides information about main system features.
- **System Reboot.** Restarts the MS-TestPro test device.

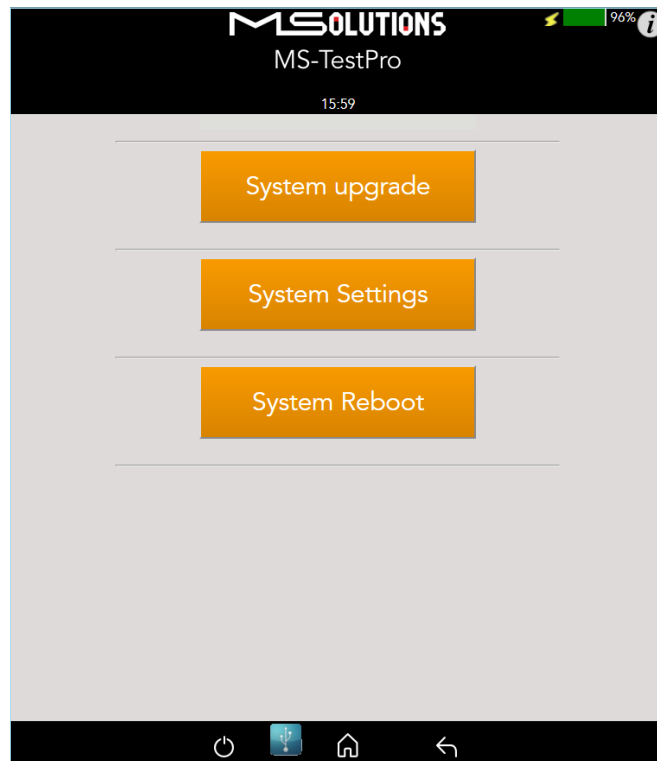


Figure 118: System Setup screen

5.4.1 System Upgrade

➔ **To upgrade the MS-TestPro System Software:**

1. Prepare a USB memory stick with the upgrade file **updateXXX.mst** in the root folder or copy the file to the PC directory.
Connect the stick to one of the USB ports in the MS-TestPro device.
2. Select the **updateXXX.mst** file and tap on the **Upgrade** button (see the picture below). The system performs the upgrade and reboots using the new version in approximately 10 seconds.

IMPORTANT!

- * For firmware version 2.00.30 or earlier, the file name is **update.mst**.
 - * Do not switch off the device's power during the upgrade!
-



Figure 119: System Upgrade

5.4.2 System Reboot

To restart the MS-TestPro test device, tap the **System Reboot** button and **OK**, as shown in the figure below.

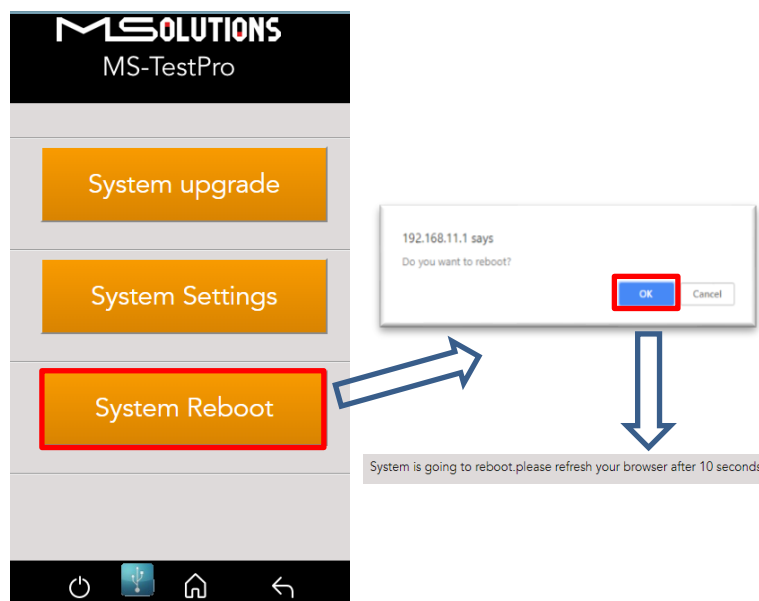


Figure 120: System Reboot Screens

The system will reboot in about 10 seconds.

5.4.3 System Settings

The System Settings screen provides access to the system configuration. The System Settings screen is depicted in the figure below. The upper part of the screen displays read-only system information.

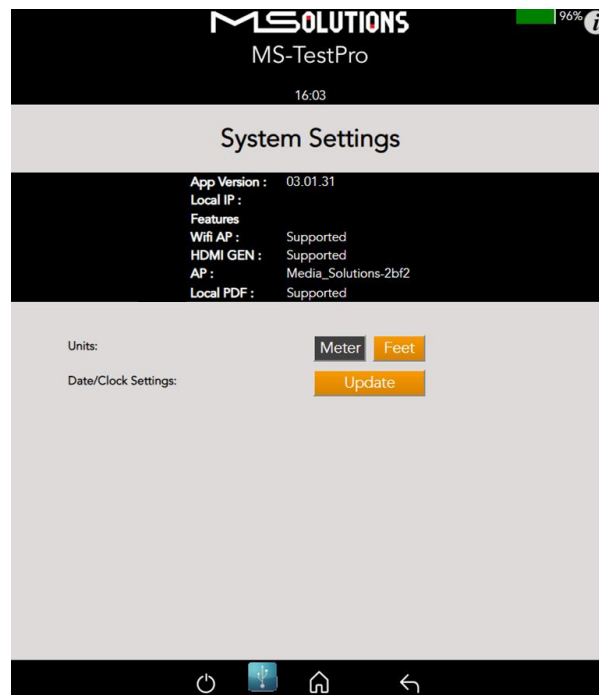


Figure 121: System Settings Screen

The System Settings page provides the following information and configuration options for the MS-TestPro system:

- **App Version.** Tester firmware version.
- **Local IP.** Allocated IP address (for future use).
- **Features.** A list of supported features:
 - **Wi-Fi AP.** Whether Wi-Fi connectivity is supported.
 - **HDMI Gen.** Whether the HDMI traffic generation feature is supported.
 - **AP.** The name of the AP (access point) used to establish Wi-Fi connectivity.
 - **Local PDF.** Indicates where the unit is capable for creating a PDF report file locally
- **Units.** Tap to select the unit of measure to be used (feet/meters). The current selection appears on a dark gray background.
- **Date/Clock Settings.** Tap on the button to configure date and time settings.

5.4.3.1 Date/Clock Setting

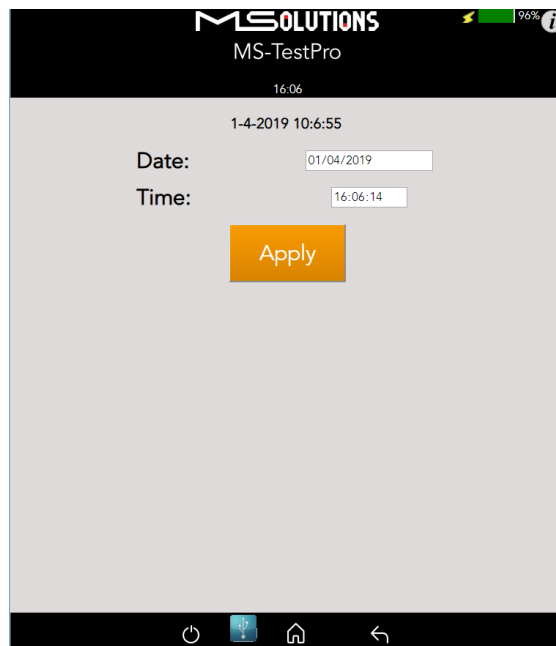


Figure 122: Date/Clock settings screen


Set Date/Time values and press the Apply button.

Note: Date and time will be set automatically when connecting Tester to a smart device using a Wi-Fi connection.

5.5 Shutdown

This section describes how to safely shut down the MS-TestPro test device.

➔ **To shut down the test device:**

1. Tap on the on/off icon  to exit the system. The following message appears on the screen:

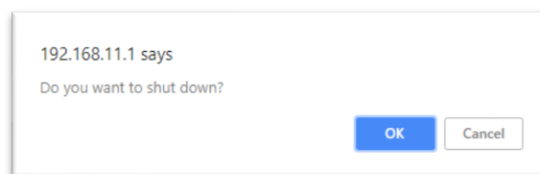


Figure 123: Shutdown confirmation message

2. Tap OK button
3. Wait for the tester's screen to turn white.
4. Turn off the power on/off switch.
5. Remove the power supply connector from the input powering socket.

6. Example Usage Scenarios

This chapter contains use cases for a variety of deployment scenarios.

6.1 Cable Test

Using the MS-TestPro, you can test the ability of a CATx cable (CAT5e and above) to transmit HDBaseT signals over lengths of 100m and more.

- A Basic Analysis window indicating the ability to carry HDBaseT traffic, and indicating:
 - Overall cable performance.
 - Calculation of the cable length according to the HDBaseT standard
 - Report generator for creation of HDBaseT cable certification which can be issued to your customer to certify the quality of the installation.
- Performance screen indicating per-pair signal quality indications:
 - **MaxErr** predicts the likelihood that a data link (cable) will have a bit error.
 - **MseErr** essentially describes the signal to noise ratio of the data link (Signal attenuation over length).



Figure 124: Cable Test Setup

6.2 Crimping Quality Test

Check the quality of your RJ45 crimping. MS-TestPro provides signal quality indications for each pair. A significant differential in MaxErr or MSE indicates the existence of a crimping issue.

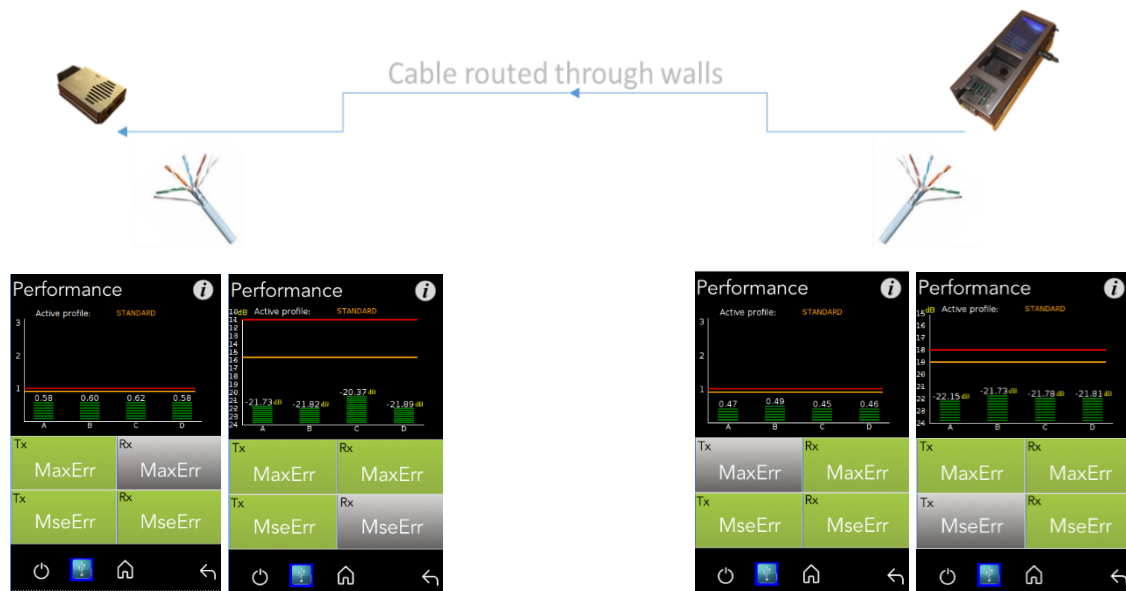


Figure 125: Crimping Test Setup

6.3 Inconsistent Video Drops i – (Source Side)

Collect source-side log data for up to 24 hours to identify time-dependent interference in the HDBaseT transmission line.

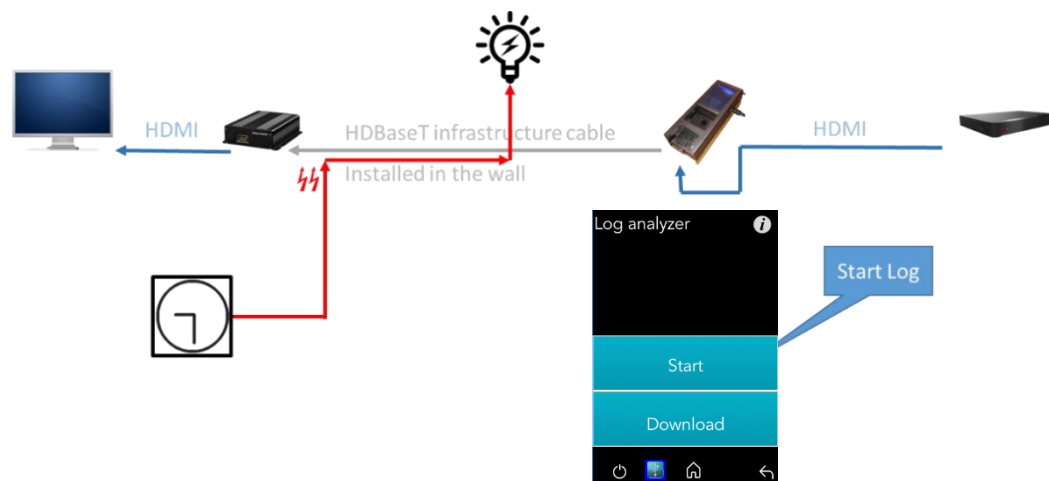


Figure 126: Inconsistent Video Drops – I (Source Side) Test Setup

6.4 Inconsistent video drops – ii (Sink side)

Collect sink-side log data for up to 24 hours to identify time-dependent interference in the HDBaseT transmission line.

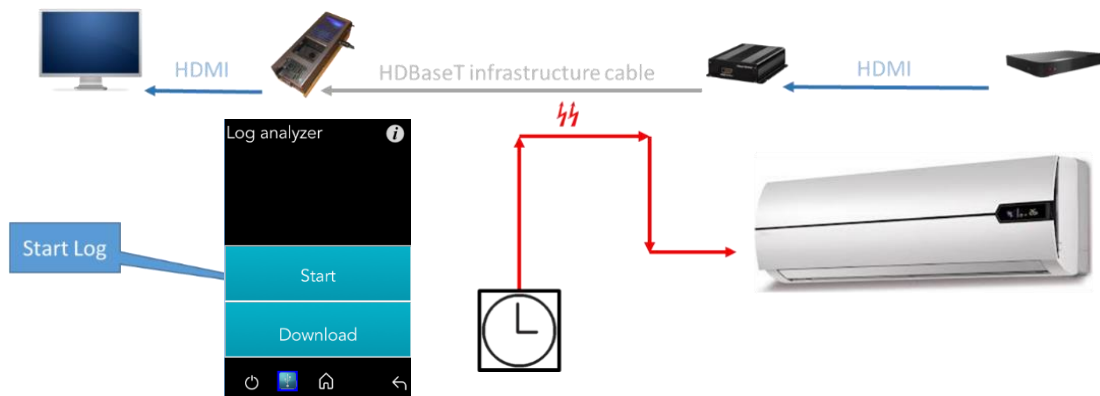


Figure 127: Inconsistent video drops – II (Sink side) Test Setup

6.5 Third-Party Product Information

Provide detailed information about devices connected to the HDBaseT receiver and transmitter ports:

- Port HDBaseT class
- Chip part number
- Supported system features (HDBaseT 5Play)
- HDBaseT operating mode
- Manufacturer ID and name
- And more...

Transmitter-Side Device

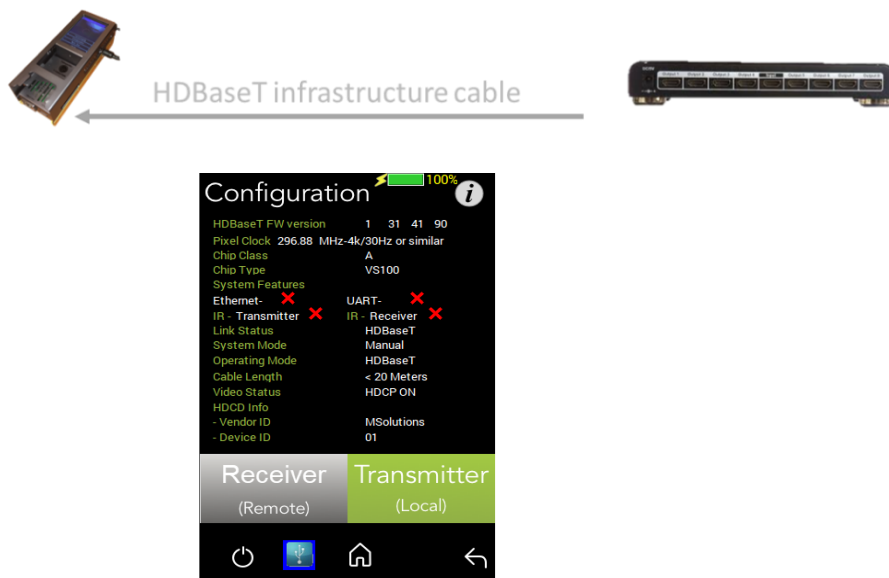


Figure 128: Product Information – 3rd Party Transmitter Side Test Setup

Receiver-Side Device

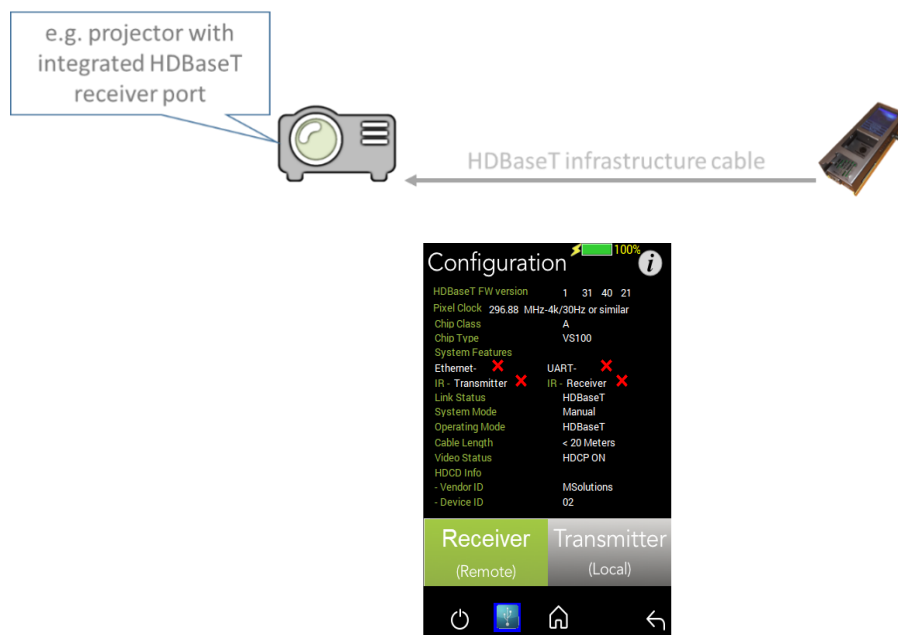


Figure 129: Product Information – 3rd Party Receiver Side Test Setup

Appendix A

Glossary

Term	Definition
HDCD	High Definition Compatible Digital
HDMI	High-Definition Multimedia Interface
IR	Infrared
MaxErr	The maximum recorded value of the residual error
MSE	The mean square of the residual error
Rx	Receive
SUT	System Under Test
Tx	Transmit
USB	Universal Serial Bus
FW	Firmware
HPD	Hot Plug Detection
DCR	DC Resistance
HCT	HDMI Cable Tester

Appendix B

Specification

Physical/Mechanical

- Chassis Construction: Anodized Aluminum
- Ingress Protection for hard carry case: IP67
- Size (W x L x H):
 - MS103TDs 67mm x 180mm x 55mm (2.6" x 7" x 2.1")
 - MS104B 67mm x 180mm x 79mm (2.6" x 7" x 3.1")
- Weight:
 - MS103TDs 487 Gram (1.07 Pounds)
 - MS104B 895 Gram (1.97 Pounds)

Electrical

- Power Adapter: AC to DC, 98V-250V to 48V / 0.5A
- Power Input:
 - MS103TDs 48V 0.5A
 - MS104B 12.6V 3A

Environment

- Operating temperature: 15°C to +40°C (59°F to 104°F)
- Storage Temperature: -20°C to 50°C (-4°F to 122°F)
- Relative Humidity: 80% max, at temperatures up to 31°C, decreasing linearly to 50% at 40°C
- Standards Compliance: CE, RoHS

Appendix C

Ordering Information

MS-TestPro HDBaseT Testing Device

Part Number	Product Code	Product Description
MS103TDs	MS TestPro TDs	HDBaseT 1.0 mains only tester with 3.5" touch display, built-in HDMI pattern generator, and Wi-Fi connection for smart devices.
MS104B	MS TestPro Battery	Battery-based HDBaseT 1.0 tester with 3.5" touch display, built-in HDMI pattern generator, and Wi-Fi connection for smart devices.
MS2310	Spec 2.0 Modules	HDBaseT-T SPEC 2.0 based Tx and Rx units are optional and can be used with any of the above testers.
DCR	DC Resistance	Module that enables testing of the DC Resistance imbalance both within and between twisted pairs, ensuring system integrity. The DCR is supplied with a Looper module for the remote end of the cable.
HCT	HDMI Cable Tester	Module used to test the quality of HDMI cables and indicate the existence of missing or shorted wires. The HCT is supplied with a Looper module for the remote end of the cable.

Appendix D

Generating an HDBaseT Certification Report

The HDBaseT Certification Report Generator is a PC/Windows-based application used to produce certification reports based on the HDBaseT data collection described earlier in this document.

- For MS-TestPro touch screen users, see section 34.2.4.3.
- For MS-TestPro Wi-Fi Client users, follow the instructions in this appendix.

Operating the report generator

If you have not yet installed the report generator, follow the installation procedure that appears at the end of this appendix.

➔ **To produce a report:**

1. Double-click on the file “m4solReportGenerator.exe” to initialize the report generator. The report generator’s main window appears as shown in Figure 130 below.

MS-Report Tool

File Option Help

Load User Info

Please fill in the following information(* fields are mandatory)

Customer Name(*)	John Doe
Job Site(*)	New York
Date	21/04/2017
Test Time	07:59
Cable Type(*)	CAT6A
Operator Name(*)	Media Solutions

Save User Info

Select DataSource F:\test00015.tar

Save F:\00015.pdf

Open Report

Generate Report

Figure 130: Report Generator Main Window

If the message depicted in Figure 131 below appears, click **OK** to start a Java Runtime Environment installation.

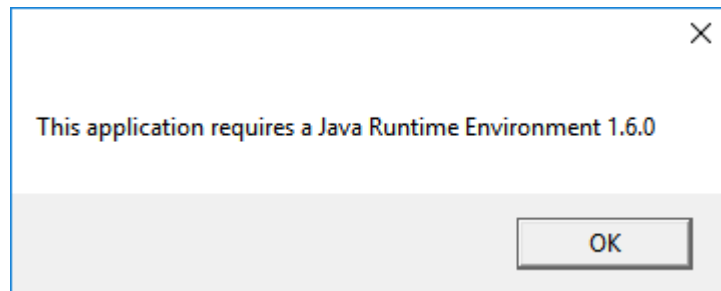


Figure 131: Java Runtime Environment Required

If the download page does not appear in your browser, enter the following address in your browser's URL box to access the page: <https://java.com/en/download/>

2. Enter user information data in the text fields in the window:

- Customer Name
- Job Site
- Cable Type
- Operator Name

Alternatively, if you have already saved your user information data, click **Load User Info**. The Open dialog box appears, as shown in Figure 132 below. Select the user info file, and click **Open**. Skip to step 4 below.

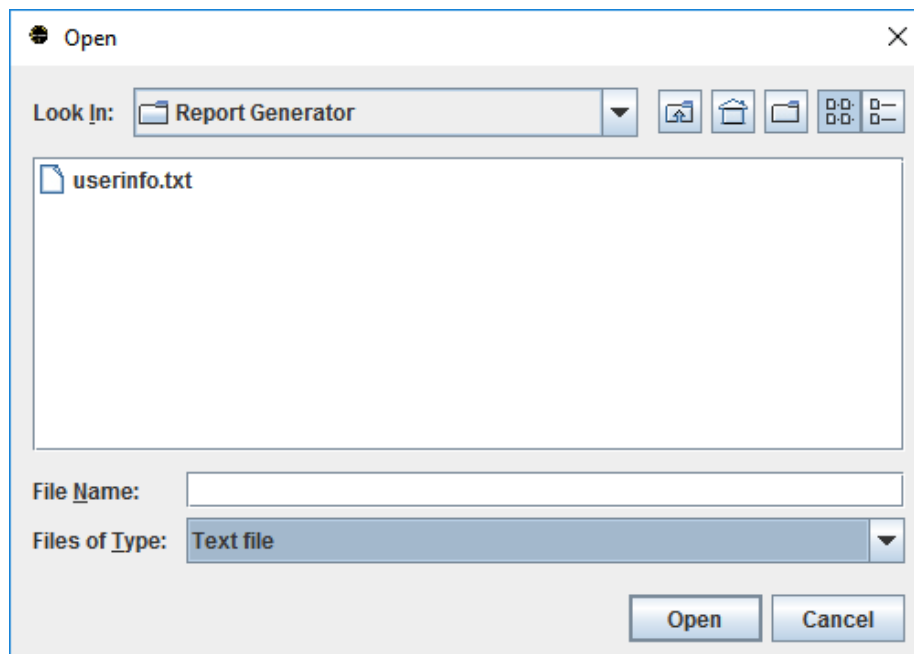


Figure 132: Open User Info Data

3. To save the user data for future use, click **Save User Info**. The Save As dialog box appears, allowing you to specify a user info file name and location.

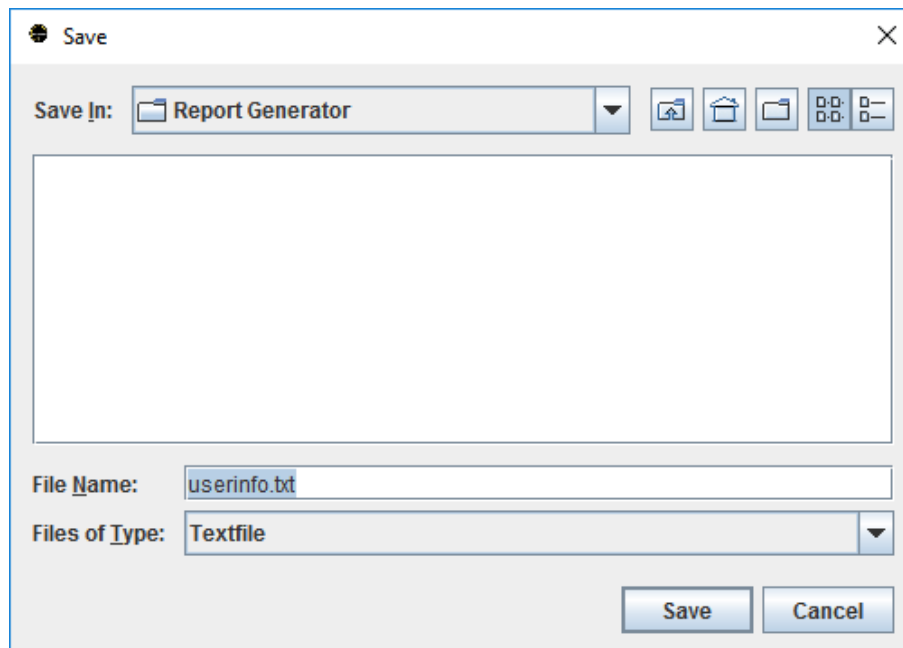


Figure 133: Saving User Info Data

4. Choose a file name and location for the user information, and click **Save**. The main window reappears.
5. Click the **Select Data Source** button to specify a file containing HDBaseT certification data.
6. Click the **Save** button to specify a file name for the certification report.
7. Click **Generate Report** to create the certification report.
8. Click **Open Report** to view the certification report. A sample, 3-page report appears in the figures in the following pages.

**HDBaseT Test Report**

Customer Name: New York
Job Site: John Doe
Test Date: 21/04/2017
Test Time: 19:59
Cable Type: CAT6A
Operator Name: Media Solutions

Figure 134: Sample HDBaseT Certification Report – Page 1 (User Data)



HDBaseT Test Report

Test Number: 00015

Tester ID: Media_Solutions-2e0f

Test Status:

Date: 24/02/17

System Setup: Tx - Media Solutions

Pass

HDBaseT Spec: 1.0

Local Setup Information

Chip Class: A

Chip Type: VS100

Chip FW Version: 1 31 31 51

Vendor ID: Media Solutions

Cable Length: < 20 Meters

Pixel Clock Rate: 0 MPixel



Pass MaxErr			
Pair	Max	Min	Expected
A	0.496	0.496	< 1
B	0.479	0.438	< 1
C	0.496	0.458	< 1
D	0.488	0.488	< 1

* MaxErr-Predicts the likelihood that a data link(cable) will experience a bit error



Pass MseErr (db)			
Pair	Max	Min	Expected
A	-21.62 db	-21.906 db	< -18
B	-21.66 db	-22.211 db	< -18
C	-21.693 db	-22.211 db	< -18
D	-22.006 db	-22.428 db	< -18

* Mse Err-Describes the signal-to-noise ratio of the data link (cable)



Figure 135: Sample HDBaseT Certification Report – Page 2 (Transmitter Data)



HDBaseT Test Report

Test Number: 00015 Tester ID: Media_Solutions-2e0f Test Status: **Pass**
 Date: 24/02/17 System Setup: Rx - Media Solutions
 HDBaseT Spec: 1.0

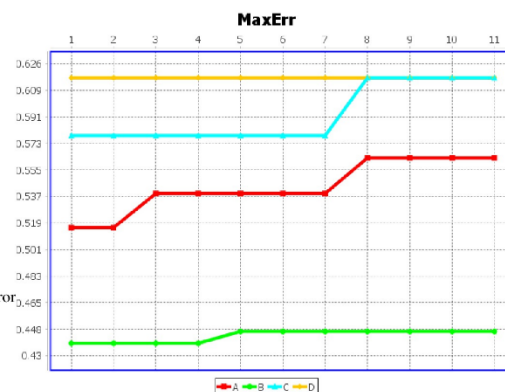
Remote Setup Information

Chip Class: A
 Chip Type: VS100
 Chip FW Version: 1 31 31 50
 Vendor ID: Media Solutions
 Cable Length: < 20 Meters
 Pixel Clock Rate: 0 MPixel



Pass MaxErr			
Pair	Max	Min	Expected
A	0.563	0.516	< 2
B	0.446	0.438	< 2
C	0.617	0.578	< 2
D	0.617	0.617	< 2

* MaxErr-Predicts the likelihood that a data link(cable) will experience a bit error



Pass MseErr (db)			
Pair	Max	Min	Expected
A	-22.659 db	-23.151 db	< -11
B	-21.235 db	-21.983 db	< -11
C	-23.013 db	-23.571 db	< -11
D	-21.743 db	-22.338 db	< -11

* Mse Err-Describes the signal-to-noise ratio of the data link (cable)

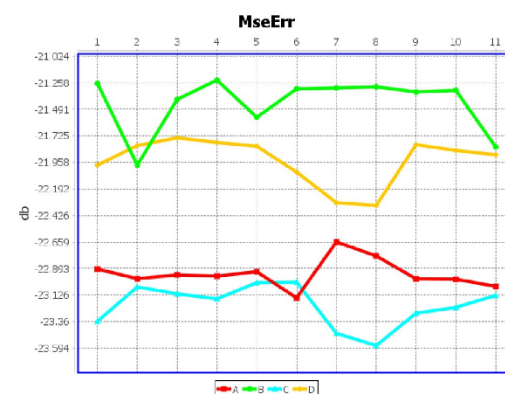


Figure 136: Sample HDBaseT Certification Report – Page 3 (Receiver Data)

Installing the Report Generator

➔ To install the report generator:

1. Open the downloaded **m4solReportGenerator.zip** archive file.
2. Extract the file in the archive, and copy them to a directory that you select.

IMPORTANT!

Both files should be copied to the *same* directory

3. Double-click on the file “m4solReportGenerator.exe” to initialize the report generator. If the main window depicted in Figure 137 below appears, then the installation is complete, see the operating instructions at the beginning of the appendix.

MS-Report Tool

File Option Help

Load User Info

Please fill in the following information(* fields are mandatory)

Customer Name(*)	John Doe
Job Site(*)	New York
Date	21/04/2017
Test Time	07:59
Cable Type(*)	CAT6A
Operator Name(*)	Media Solutions

Save User Info

Select DataSource F:\test00015.tar

Save F:\00015.pdf

Open Report Generate Report

Figure 137: Report Generator Main Window

If the message depicted in Figure 138 below appears, click **OK** to start a Java Runtime Environment installation.

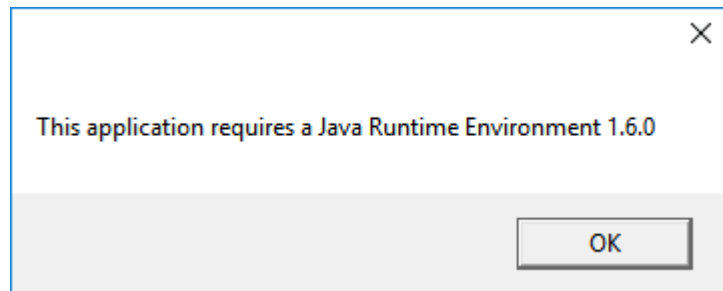


Figure 138: Java Runtime Environment Required

If the download page does not appear in your browser, enter the following address in your browser's URL box to access the page: <https://java.com/en/download/>

END OF DOCUMENT