

# Fax Transmission Analyzer Option

For T.30 (PSTN) and T.38 (PSTN/IP) Fax Testing

## APPLICATION NOTE



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# Chapter 1, Introduction

The Fax Transmission Analyzer is a software option available on the Hermon Laboratories [TCA 8200 Telecom Conformance Analyzer](#) and on the [TCA 4100 Telephony Conformance Analyzer](#).

The Fax Transmission Analyzer option provides in-depth analysis of the communication characteristics of T.30 and T.38 fax transmission devices, verifying their adherence to international fax transmission standards.

## The Challenge: Bringing a New Fax to Market

Every fax transmission requires the sending and receiving devices to take part in a delicate and complex synchronization process in order to ensure the transmission's success. Prior to bringing a new fax device to market, a number of interoperability and compliance issues must be addressed:

- **Multiple Fax Models – Backward Compatibility:** More than 100 million existing fax devices function worldwide. The introduction of new fax models is challenged by the need for compatibility with both the latest fax models, as well as with pre-existing fax equipment that may have been installed over a generation ago.
- **Multiple Networks:** Fax transmission is regulated by ITU-T standards. It is defined over two different networks (T.30 for telephony networks and T.38 for IP networks) that feature a wide variety of communication rates and modulation techniques.
- **Interoperability Issues:** Compatibility problems often arise as vendors may differ in their implementation of transmission standards, or may even deviate from these standards. In some cases, they may provide a different feature set.
- **New Protocols and Faster Networks:** The development of new data transmission protocols and faster networks further complicates the challenge of accurately transmitting and receiving fax images.

Despite all of the above, all fax devices are required and expected to communicate flawlessly and consistently – without exception.

The validation of new fax equipment is further challenged by the lack of testing standards. Both the T.30 and the T.38 standards define protocols for transmitting document facsimiles over analog phone lines and over an IP network. However, neither standard defines testing procedures.

## The Solution: The Fax Transmission Analyzer

The Fax Transmission Analyzer (FTA) from Hermon Laboratories is a fax testing application intended to reduce the complexity of introducing a new fax device to the marketplace. The FTA emulates the operation of a remote fax device, communicating with the Fax under Test, testing its compatibility with an array of protocols and standards, and monitoring its performance under a variety of working conditions.

The FTA's extensive display, analysis and report capabilities facilitate identification and troubleshooting of communication and image processing problems. Those capabilities include Pass/Fail verdicts, test reports, trace logs with time-stamped signaling, data and errors.

The Fax Transmission Analyzer is provided with two test suites:

- **ITU-T T.30 Fax-over-Analog PSTN Test Suite:** Analyzes compliance with the ITU-T T.30 requirements for fax transmission over the analog public switched telephone network.
- **ITU-T T.38 Fax-over-IP Test Suite:** Analyzes compliance with the ITU-T T.38 requirements for fax transmission over IP networks.

The test suites can be customized and saved for future use.

Various modulation types and data rates in accordance with the following standards are supported:

ITU-T Standard	Data Rates (bit/s)	Modulation Method
V.27	4800, 2400	PSK
V.29	9600, 7200, 4800	QAM
V.17	14400, 12000, 9600, 7200	TCM

**Table 1: Facsimile Modulation Methods and Bit Rates**

A variety of line and network conditions can be simulated by the FTA.

Multi-page and multi document fax transmissions can be tested.

## Key Features

The following describes the main features and benefits of the Fax Transmission Analyzer:

- ITU-T T.30 (fax transmission over analog PSTN) transmit and receive testing
- ITU-T T.38 (fax transmission over IP network) transmit and receive testing
- T.30 – Fully configurable analog PSTN loop and line characteristics, such as:
  - Termination
  - Feed voltage
  - Series resistance
  - Complex line simulation (Artificial line)
- T.30 – Simulation of degraded phone line conditions in the telephony network, using noise and spike insertion
- T.30 – Full control of level and frequency of the modulated data signals
- User-friendly Windows-based graphical user interface
- User-selected test results, signaling and data logs with time-stamps, errors and verdicts presented during and after the test execution
- Captured PSTN and IP transmission files enable offline analysis
- Reproduction of the fax image for visual inspection and for transmitted vs. received image comparison using third-party software
- Pre-defined and user-defined tests

# Technical Specification

- **ITU-T T.30 Fax-over-Analog PSTN Network Analysis:**

- Supported Protocols: V.17, V.29, V.27, T.30, T4/T6
- T.30 Raw Data and Information
- T.30 Frames
- Improper T.30 Protocol Flow Indication
- Repetitive T.30 Frames Detector
- T.4/T.6 Bad Line Statistics
- T.4/T.6 Page Coding Information
- CRC Error Detector
- ECM Failure to Correct Error Frames Indication
- Suspicious ECM retransmission indication
- Unexpected End of Fax Indication

- **ITU-T T.38 Fax-over-IP Analysis:**

- Fax Phase Changes
- Fax Data Rates
- Connection Parameters
- Structures Interchange: Rate Sequences
- T.30 Raw Data and Information
- T.30 Frames
- Bad Packets Indication
- Packet Collision Detection
- T.4/T.6 Page Coding Information
- T.4/T.6 Bad Line Statistics
- CRC Error Detector
- ECM Failure to Correct Error Frames Indication
- Suspicious ECM Retransmission Indication
- Unexpected End of Fax Indication

# Chapter 2, Fax Testing Suites

This chapter describes the features and configuration options of the Fax Transmission Analyzer's testing suites:

- **ITU-T T.30 Fax-over-Analog PSTN Network Testing Suite**
- **ITU-T T.38 Fax-over-IP Testing Suite**

For detailed instructions on how to run a specific test, please refer to the Fax Transmission Analyzer's online help facility.

## ITU-T T.30 Fax-over-Analog PSTN Testing Suite

The Fax Transmission Analyzer T.30 Fax Testing Suite is located in the TCA main application navigation tree under the ITU-T family of suites: **Test Suites → Standard Suites → ITU-T International → ITU-T T.30 (2005, Fax Analog)**.

This suite contains two main fax-testing groups (for direct and network-based transmission) that are further divided into sending and receiving groups. Each group contains three tests, in which each test is configured with the fax modulation protocols and frequencies listed on page 4:

- **Sending/Receiving Testing Group for Direct Fax Transmission:** In this test, the EUT is directly connected to the TCA 4100 or 8200, which simulates the PSTN central office or the company's PBX, as shown in Figure 1 below:

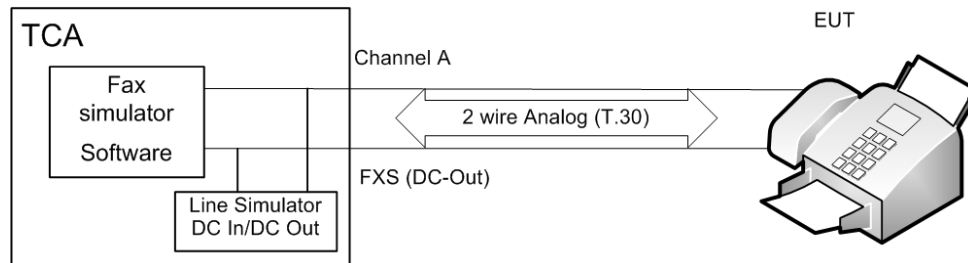


Figure 1: Test setup for T.30 Sending and Receiving Tests for Direct Fax Transmission

- **Sending/Receiving Testing Group for Fax Transmission over a Network:** In this test, the TCA 4100 or 8200 communicates with the EUT over a telephony network (PBX and/or PSTN), as shown in Figure 2 below:

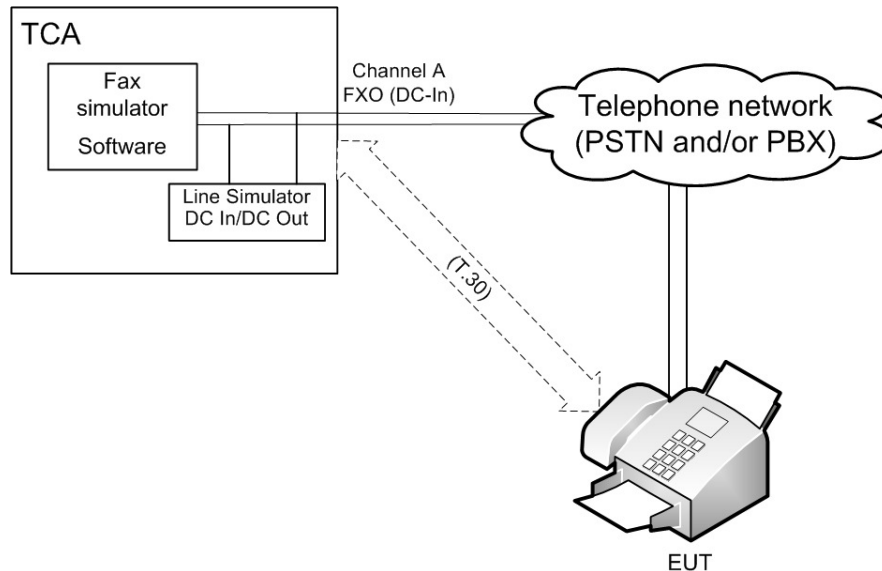


Figure 2: Test setup for T.30 Sending and Receiving Tests for Fax Transmission over a Network

For purposes of clarity, *sending* refers to fax transmissions from the EUT to the Fax Transmission Analyzer, while *receiving* refers to fax transmissions from the Fax Transmission Analyzer to the EUT.

The ITU-T T.30 fax testing suite's four testing groups appear in the **Tests** folder on the right side of the window displayed in Figure 3 below.

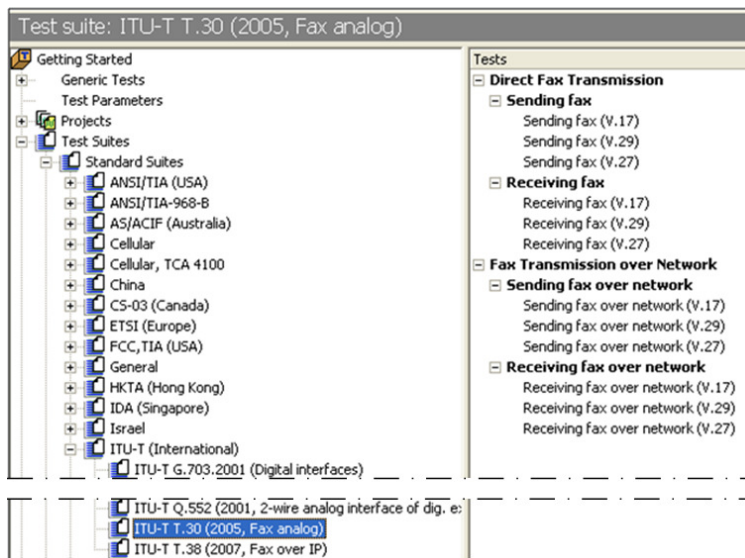


Figure 3: ITU-T T.30 (2005, Fax Analog) Testing Suite



## ITU-T T.38 Fax-over-IP Testing Suite

The Fax Transmission Analyzer T.38 Fax-over-IP Testing Suite is located in the testing navigation tree under the ITU-T family of suites: **Test Suites → Standard Suites → ITU-T International → ITU-T T.38 (2007, Fax-over-IP)**.

This suite contains a sending test group and a receiving test group. Each group contains three tests, in which each test is configured with the fax modulation protocols and frequencies listed on page 4. The ITU-T T.38 protocol compensates for an interposed IP (packet) Network and makes it transparent to the two T.30 terminals.

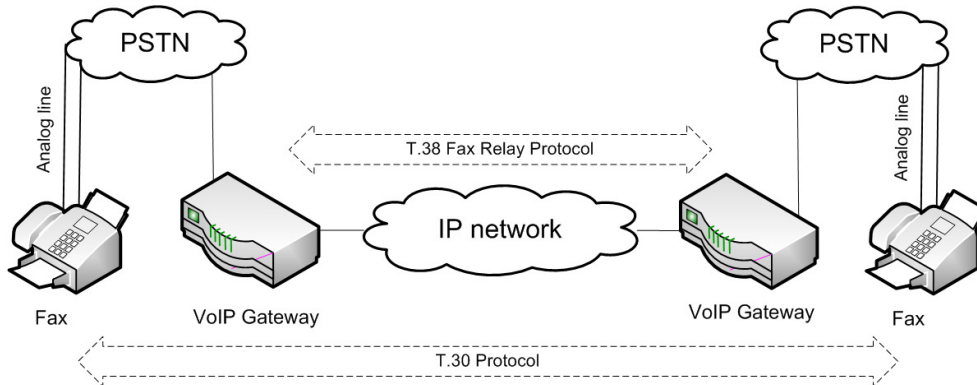


Figure 4: T.38 Fax Relay Protocol

The T.38 recommendation defines the use of both Transmission Control Protocol (TCP) and User Datagram Protocol (UDP) to transport the T.38 packets over the IP Network. However, because TCP requirements introduce significant delays, most implementations of T.38 use UDP and cope with packet loss by transmitting redundant data packets. Therefore, the T.38 Testing Suite uses UDP as its transport protocol.

T.38 does not include a Call Setup Protocol. Thus, the T.38 devices must use standard Call Setup Protocols, either ITU-T H.323 or IETF SIP, to negotiate the T.38 call. For example, fax devices use the SIP RE-INVITE message.

The diagram in Figure 5 below illustrates the interaction between the Fax Testing Analyzer, the EUT, and the VoIP Gateway.

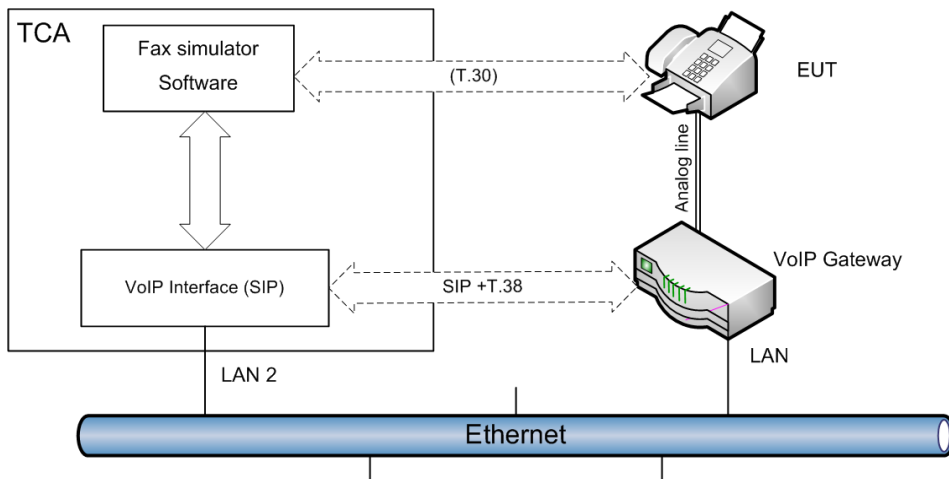


Figure 5: Test Setup T.38 Fax-over-IP Testing

The ITU-T T.38 fax testing suite's sending and receiving testing groups appear in the **Tests** folder on the right side of the window displayed in Figure 6 below.

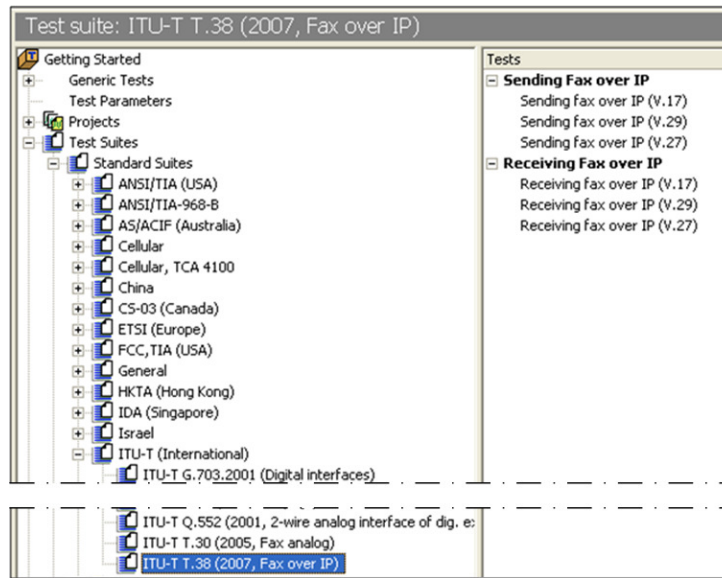


Figure 6: ITU-T T.38 (2007, Fax-over-IP) Test Suite

## Configuring T.30 Tx/Rx Port Signaling

When running the T.30 suite to test fax transmissions over the analog PSTN, the TCA 4100 and TCA 8200 ports are configured as follows:

Channel A (the analog port) is configured in one of the following modes:

- **DC-out** (FXS) mode, connected directly to the EUT, or
- **DC-in** (FXO) mode, connected via the telephone network.

The signaling procedure is preconfigured in each test according to the connection type and call direction. The signaling procedure is used to establish a voice communication path between the Fax Transmission Analyzer and the EUT, and enables the simulation and analysis of various PSTN signals and conditions such as DTMF, progress tones, rings, on-hook, off-hook and so on.

Multiple combinations (event test cases) of the simulations, detection methods and measurements together with time criteria, programmable user messages, remote device commands and user verdicts are defined in the Signaling procedure in the test properties.

When a test runs that includes a signaling procedure, the events are executed one by one, sending the signals (Tx events) and monitoring the Rx events defined in each test case (event) row in the Events table.

The predefined signaling procedures used in the four tests group are shown below:

Port Configuration: ch A [DC-out, called party (tone)]; ch B [Off]; 1.5M/2M [Off]; VoIP [Off]

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
1	None	None		Ch A	On-hook	100000 Ohm	0 30	T: --> 2	<input checked="" type="checkbox"/>
	None	Command	Line error prompt	No...	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
2	None	Command	Display prompt	No...	None		0 0		<input type="checkbox"/>
	None	None		Ch A	Off-hook	0.012 A	0 30	F: --> 1	<input type="checkbox"/>
	Ch A	Progress tone	DT 425Hz -10dBV cont.	Ch A	DTMF, MF	DTMF, 1	0 10	<?> T: --> <end>	<input type="checkbox"/>
	None	Command	Call not detected	No...	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>

Figure 7: Signaling Procedure: Receiving Fax from Directly Connected EUT

Port Configuration: ch A [DC-out, calling party]; ch B [Off]; 1.5M/2M [Off]; VoIP [Off]

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
1	None	None		Ch A	On-hook	100000 Ohm	0 10	T: --> 2	<input checked="" type="checkbox"/>
	None	Command	Line error prompt	None	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
2	Ch A	Ring	Ring signal 25Hz/50V 1.0/3.0	Ch A	Off-hook	0.012 A	0 15	T: --> 3	<input type="checkbox"/>
	None	Command	Fax connection error	None	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
3	Ch A	Delay	1 s	Ch A	Energy detector	2000 - 2200 Hz, -25 dBV	0 5	T: --> <end>	<input type="checkbox"/>
	None	Command	CED not detected	None	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>

Figure 8: Signaling Procedure: Sending Fax to Directly Connected EUT

Port Configuration: ch A [DC-in, tone calling/called]; ch B [Off]; 1.5M/2M [Off]; VoIP [Off]

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
1	Ch A	On-hook	100000 Ohm	None	None		0 0		<input checked="" type="checkbox"/>
	None	Command	Display prompt	None	None		0 0		<input type="checkbox"/>
	None	None		Ch A	Energy detector	10 - 100 Hz, 15 V	0 120	T: --> 2	<input type="checkbox"/>
	None	Command	Fax connection error	None	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
2	Ch A	Off-hook	400 Ohm	Ch A	None		0 0		<input type="checkbox"/>
	Ch A	Delay	1 s	None	None		0 0		<input type="checkbox"/>

Figure 9: Signaling Procedure: Receiving Fax from a Remote EUT via Telephone Network

Port Configuration: ch A [DC-in, tone calling/called]; ch B [Off]; 1.5M/2M [Off]; VoIP [Off]

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
1	Ch A	On-hook	100000 Ohm	None	None		0 0		<input checked="" type="checkbox"/>
	Ch A	Delay	3 s	None	None		0 0		<input type="checkbox"/>
	Ch A	Off-hook	400 Ohm	Ch A	Energy detector	200 - 800 Hz, -30 dBV	0 3	T: --> 2	<input type="checkbox"/>
	None	Command	No dial tone detected	None	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
2	Ch A	DTMF/MF call	102	Ch A	Energy detector	2000 - 2200 Hz, -25 dBV	0 15	T: --> <end>	<input type="checkbox"/>
	Ch A	Command	Fax connection error	Ch A	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>

Figure 10: Signaling Procedure: Sending Fax to a Remote EUT via Telephone Network

## Configuring T.38 Tx / Rx Port Signaling

When running the T.38 suite to test fax transmissions over the packet switched network, the TCA 4100 and TCA 8200 ports are pre-configured as follows:

- The TCA mode of both channels A and B is set to **off**.
- The VoIP interface and the Acoustic interface are enabled.

► **To configure T.38 Tx / Rx Port Signaling:**

- 1 Click the **Settings** button of the **Tx & Rx Setup** parameter in the **Test properties – Conditions** to display the **Tx & Rx Setup Settings** window.
- 2 Click the **Ports Configuration** button to display the following window:

The screenshot shows the 'Ports' configuration window. It has a blue title bar and a close button. The window is organized into several sections:

- Analog ch A:** Includes dropdowns for TCA mode (set to 'Off'), Termination (600 Ohm), Artificial line (None), DC voltage (0 V), Polarity (Normal), and Ground (None). There is also a 'Series resistance' field set to 100 kOhm.
- Analog ch B:** Includes dropdowns for TCA mode (set to 'Off'), Termination (external), and a DC voltage field (0 V).
- 1.5M / 2M:** Includes dropdowns for Interface (None), Line coding (NA), Termination (NA), Tx Clock (NA), Frame format (NA), Signaling (None), Tx Timeslot (0), Rx Timeslot (0), and Idle code (0).
- VoIP:** Includes a 'Configure registration...' button, a dropdown for TCA IPs (192.168.0.177 (LAN1)), a dropdown for Codec (T.38 Fax), a dropdown for Sampling rate (8000 sps), a dropdown for T.38 redundancy (Off), and a dropdown for Redundancy level (1).
- Audio:** Includes a dropdown for Interface (Off), a checkbox for 'Volume control', and dropdowns for Tx device (None) and Rx device (None).
- Acoustic:** Includes a dropdown for Interface (On) and a checkbox for 'Use as electrical'.

Red arrows in the original image point to the 'Configure registration...' button in the VoIP section and the 'Acoustic' section.

**Figure 11: Configuring the Ports for T.38 Testing**

- 3 Click the **Configure registration** button in the window above to display the following dialog box:

The screenshot shows the 'VoIP registration' dialog box. It has a blue title bar and a close button. The dialog box contains the following fields:

- SIP registration:** A section header.
- Host:** A text field with the placeholder text 'server IP or DNS name'.
- User name:** A text field with the placeholder text 'user name'.
- Password:** A text field with the placeholder text 'password'.

At the bottom of the dialog box are 'OK' and 'Cancel' buttons.

**Figure 12: VoIP registration**

A SIP call between the EUT and the Fax Transmission Analyzer can be performed in either of two ways:

- Using a third entity, called a SIP Registrar, or
- Peer-to-Peer (direct) mode (without a third entity).

If the EUT supports direct SIP calls, then it is not mandatory to configure **VoIP registration**. This is the simplest method to use.

If the EUT does not support Peer-to-Peer calling, then the SIP registrar server must be introduced to the network (the description of which is not in the scope of the document) and its parameters (host name, user name and password) must be configured in the VoIP registration dialog box shown above.

By default, SIP configuration in the Fax Transmission Analyzer does not require the use of a SIP registrar server. If the EUT can operate without a SIP registrar server, then it is recommended to use a Peer-to-Peer protocol to call the EUT.

However, if the EUT does not support Peer-to-Peer protocol, and requires the use of a SIP registrar, then click the **Configure registration** button in the **VoIP** area of the **Ports** configuration window, shown in Figure 11, to open the SIP registration window.

The signaling procedure is preconfigured in each test according to the connection type and call direction.

Two possible signaling procedures for issuing a SIP call and receiving a SIP call are listed below:

Port Configuration: ch A [off]; ch B [Off]; 1.5M/2M [Off]; VoIP

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
	VoIP	Command	Start of signaling	VoIP	Connected		0 3	T: --> 3	<input type="checkbox"/>
1	VoIP	Command	Call	VoIP	None		0 0		<input type="checkbox"/>
	VoIP	Call	sip:300@10.0.0.2	VoIP	None		0 0		<input type="checkbox"/>
	VoIP	None		VoIP	Connected		0 20	T: --> 3 F: --> 2	<input type="checkbox"/>
2	VoIP	Command	Repeat a call	VoIP	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
3	None	Delay	1 s	None	None		0 0		<input type="checkbox"/>

Figure 13: Signaling for Sending Fax via SIP/T.38

Port Configuration: ch A [off]; ch B [Off]; 1.5M/2M [Off]; VoIP

Events:									
#	Tx Events			Rx Expected events					
	Ch.	Event	Settings	Ch.	Event	Settings	Time after T...	Conditions	Results
							Min (s) Max (s)		
1	VoIP	Command	Outgoing call	VoIP	None		0 0		<input type="checkbox"/>
	VoIP	None		VoIP	Call		0 20	T: --> 3 F: --> 2	<input type="checkbox"/>
2	VoIP	Command	SIP call not detected	VoIP	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
3	VoIP	Answer		VoIP	None		0 0		<input type="checkbox"/>
	VoIP	None		VoIP	Connected		0 10	T: --> 5 F: --> 4	<input type="checkbox"/>
4	VoIP	Command	SIP call was no answered	VoIP	None		0 0	T: --> 1 F: --> 1	<input type="checkbox"/>
5	VoIP	Delay	1 s	VoIP	None		0 0		<input type="checkbox"/>

Figure 14: Signaling for Receiving Fax via SIP/T.38

## Additional Configurable Parameters

The Fax Transmission Analyzer conforms to ITU-T T.30 and T.38 requirements. Its test parameters are based on the requirements' parameters, and cannot be customized.

However, when you create your own user suite or project, some T.30 and T.38 specific parameters can be customized to suit your specific requirements.

**NOTE:** For detailed information about user suites and projects, please refer to the Fax Transmission Analyzer's online help facility.

## Configurable Properties

Select the **Conditions** tab of the **Test Properties** window to display the parameters that can be modified, as shown in the following window:

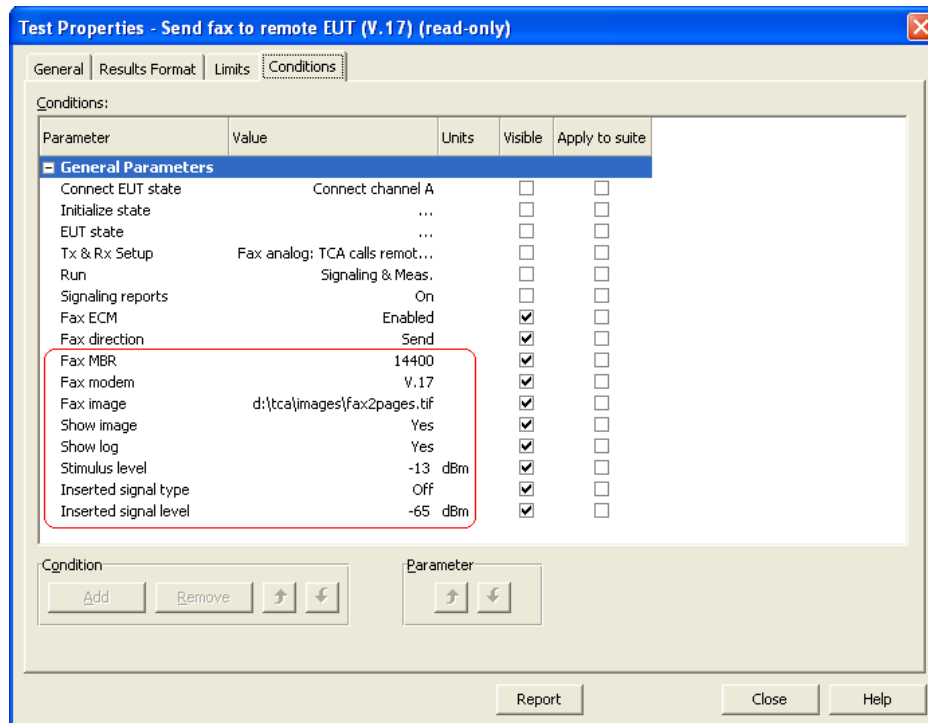


Figure 15: Modifiable Parameters

You can modify and customize the following parameters according to the specific requirements of the test:

- **Fax MBR (maximum bit rate):** The system automatically selects the default MBR value for the fax transmission, from one of the options listed in Table 1 on page 4. During the initial fax transmission handshake process, the MBR may be reduced by the fax device itself because of data distortions or fading. You can change this value if required.
- **Fax modem:** Selects the ITU-T Fax modem standard (V.17, V.27 or V.29) that applies to the EUT. Each test is preconfigured to a different standard. Generally, all three fax modem standards should be tested.
- **Fax image:** Sets the location of the fax testing image file. In a sending test, this is the location of the fax test image that is transmitted from the EUT. In a receiving test, this is the location of the fax test image transmitted to the EUT. For more details, please refer to the *Test Image Files* section on page 16.
- **Show image / Show log:** Controls (Yes/No) the display of the runtime image and log. For more details, please refer to the *Runtime Test Log and Test Image* section on page 20.
- **Stimulus level:** Defines the level of the fax signal generated by the Fax Transmission Analyzer.
- **Inserted signal type and Inserted signal level:** Sets the Fax Transmission Analyzer to insert Gaussian noise during fax transmission over analog lines, thus simulating degraded phone line conditions. By default, this option is not active (off).

## Setting Up Test Configurations

The Fax Transmission Analyzer tests three ITU-T fax transmission modem standards (V.17, V.29 and V.27) for each sending group and receiving group, as shown in the **Tests** folder on the right side of the window displayed in Figure 16 below.

By default, the Fax Transmission Analyzer executes all three tests in the suite.

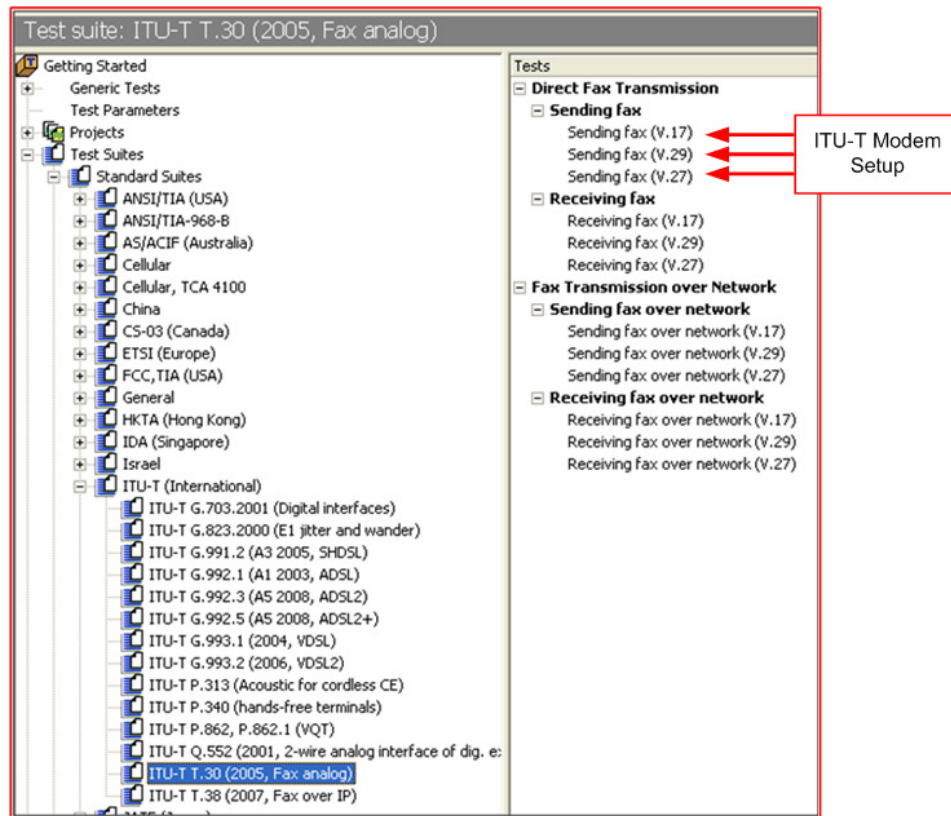


Figure 16: Three Tests per Sending and Receiving Group

## Test Image Files

An ITU-T compliant test image file is included with the Fax Transmission Analyzer. Other test image files can be specified in the **Fax image** parameter, described on page 14.

- **Test Image File Sent to the EUT**

This is a two-page image file (one of the pages is displayed below). This file is sent from the Fax Transmission Analyzer to the EUT during a receiving fax test sequence, and is located in the directory specified in the **Fax image** parameter, with the filename fax2pages.tif.

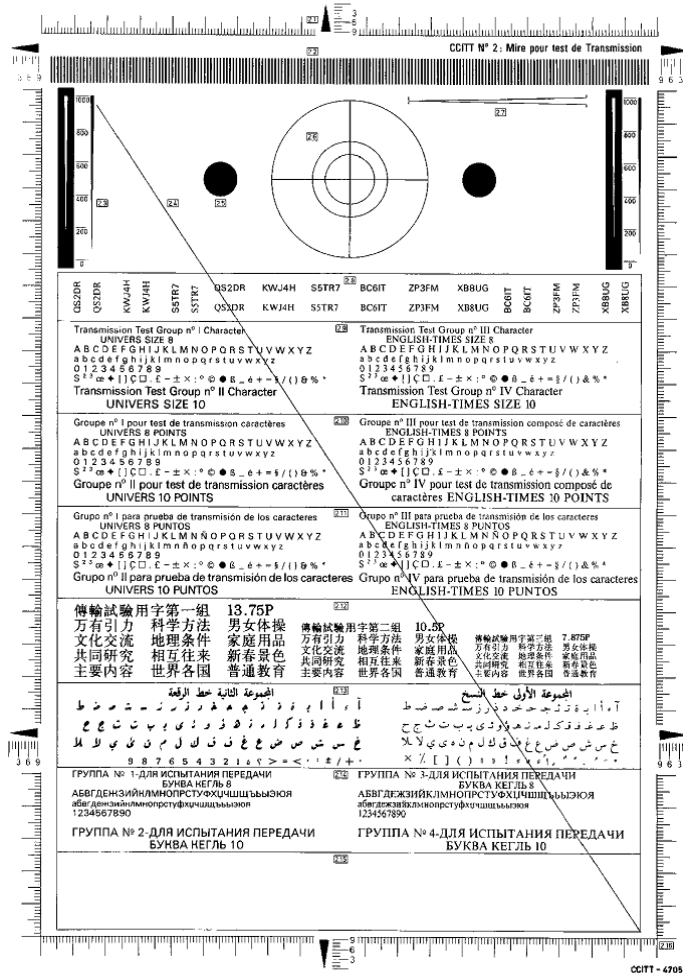


Figure 17: Page 2 of File Sent from Fax Transmission Analyzer to ETU

- **Test Image File Received from the EUT**

This is the image file received by the Fax Transmission Analyzer from the EUT during a sending fax test sequence. It is stored by default in the directory specified in the **Fax image** parameter, with the filename ReceivedFoo.tif.



# Chapter 3, Fax Transmission Analysis Results

The Fax Transmission Analyzer provides a variety of options for viewing fax transmission test results, both during and after the completion of a test; all of which enable the precise identification of transmission errors and failures. The Fax Transmission Analyzer also provides the option of displaying a test log and/or a test image.

- **Test Execution Window:** This window displays detailed test information, including Pass/Fail test results and result descriptions, following completion of the test. The window allows you to configure which test trace details are displayed, and which are hidden.
- **Test Log:** This option displays test trace information during the test as it progresses. It provides a detailed and comprehensive dump of all types of test information, but does not provide the option to configure or filter the type of information that appears. Please refer to *Runtime Test Log and Test Image* section on page 20 for more information.
- **Test Image:** This option displays the image that was sent or received.
- **Fax Testing Report:** This option is a MS-Word document generated by the Fax Transmission Analyzer after the test is completed. These results also appear in the Test Execution Window, described above.

## Test Execution Window

During a test run and after the completion of a test, results are displayed in the Test Execution window, as shown below:

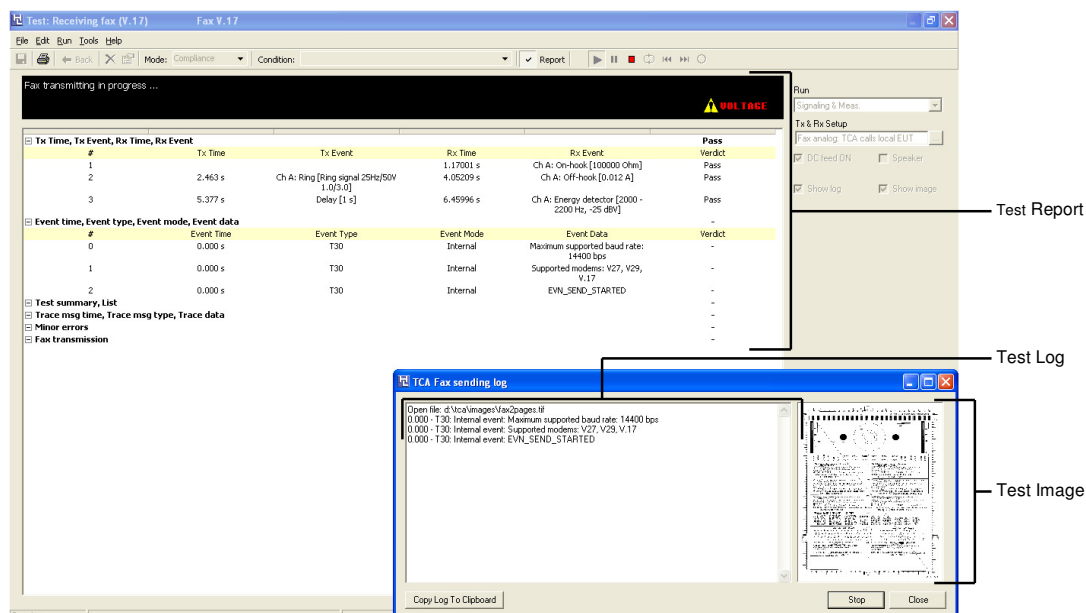


Figure 18: Test Execution Window, Test Log and Test Image – Example

## Test Execution Window – Results and Verdicts

The Test Execution window tracks and reports test events and results. This window presents a collection of relevant data – each data type appears in its own section and can be configured to be displayed or hidden:

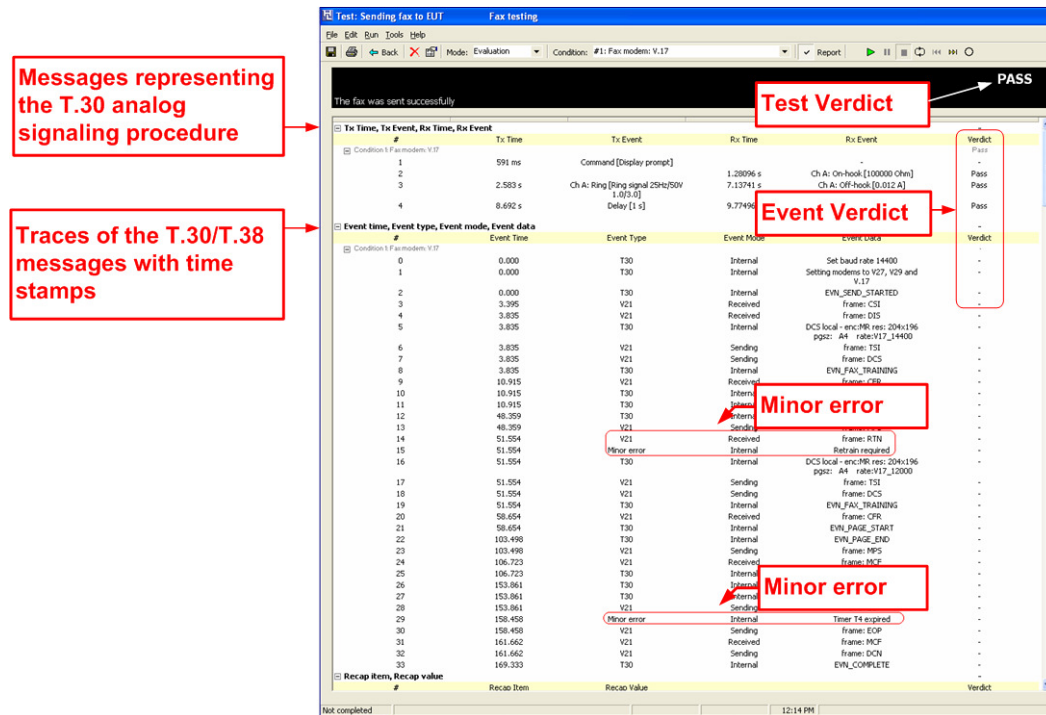


Figure 19: Test Execution Window – Example

- **Test Verdict:** Shows the overall test result: PASS / FAIL.
- **Tx Time, Tx Event, Rx Time, Rx Event:** These messages only appear during a T.30 test. They represent analog signaling events. A Pass/Fail verdict is also shown when relevant.
- **Event Time, Event Type, Event Mode, Event Data:** Shows traces of T.30 messages, along with their time stamps. Minor errors are also displayed when they occur.

- **Test Summary:** After the fax transmission procedure is completed, a detailed summary of the process is displayed. These details include comprehensive statistics and Pass/Fail verdicts, where relevant.

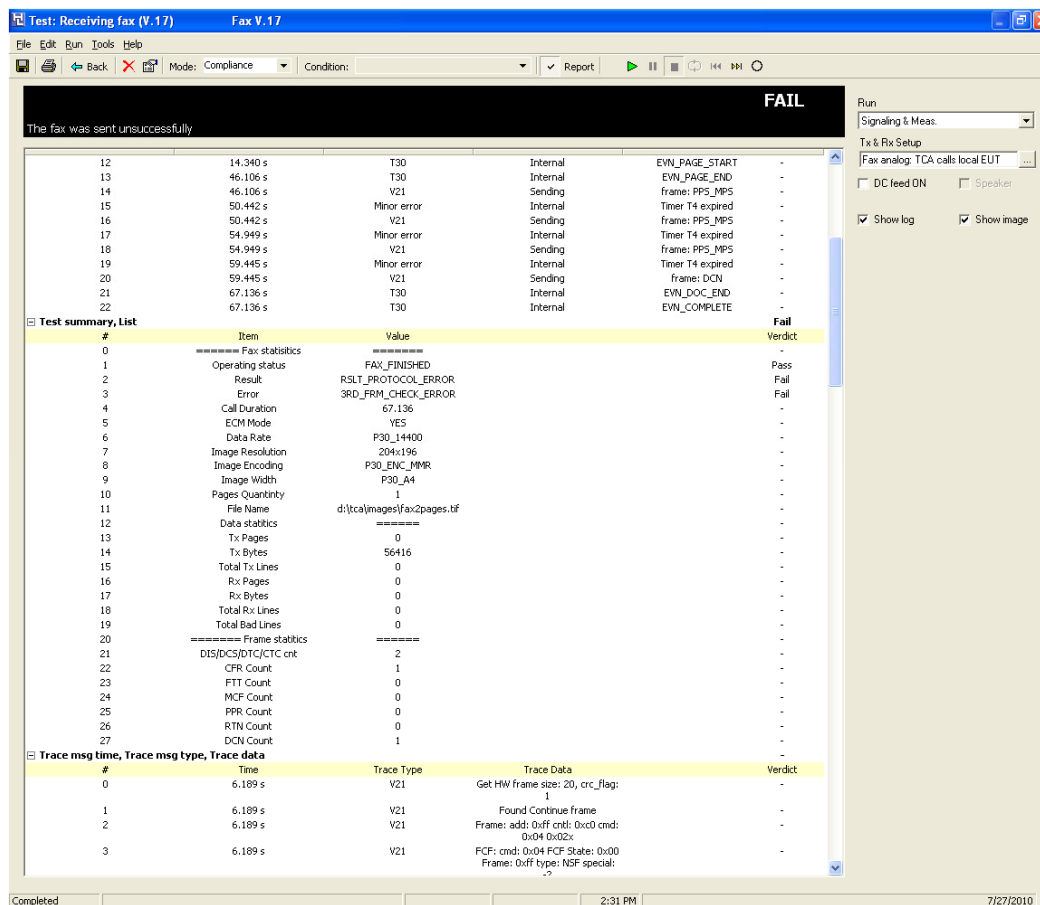


Figure 20: Test Summary and Traces Data Lists – Example

- **Trace MSG Time, Trace MSG Type, Trace Data:** The next section contains a detailed trace of test sequence states, events, and messages, along with associated timestamp and binary data. It also displays Pass/Fail verdicts, where relevant.
- **Minor Errors Report:** Displays the quantity of minor errors that were detected along with the respective Pass/Fail verdict.

**Note:** The quantity of minor errors that is displayed is verdict-related and, by default, is limited to four. This quantity can be configured in the test's properties window.

- **Fax Transmission Report:** Displays a Yes/No indication of whether the fax was sent, along with the respective Pass/Fail verdict, as shown below:

Minor errors		Pass
Minor errors	Limit	Verdict
Condition 1: Fax modem: V.17		Pass
0	4	Pass
Condition 2: Fax modem: V.29		Pass
3	4	Pass
Condition 3: Fax modem: V.27		Pass
3	4	Pass
Fax transmission		Fail
Fax sent		Verdict
Condition 1: Fax modem: V.17		Pass
Yes		Pass
Condition 2: Fax modem: V.29		Fail
No		Fail
Condition 3: Fax modem: V.27		Fail
No		Fail

Figure 21: Minor Errors and Fax Transmission Messages – Example

**NOTE:** When several conditions are applied during the compliance test, the output for each condition appears collated in the order shown above.

## Additional T.38 SIP Traces

The Fax Transmission Analyzer's T.38 Test Window is very similar to the T.30 Test window, with the exception that the T.38 Signaling procedure uses SIP instead of analog port Channel A.

However, the trace provided by the Fax Transmission Analyzer only contains T.30 messages. In the event of problems with the SIP connection, or in order to generate a more detailed T.38 trace, the trace must be executed on the networking layer.

In order to trace the networking layer, Hermon Laboratories recommends using Wireshark, a free and open-source packet analyzer used for network troubleshooting and analysis. Wireshark can be downloaded from: <http://www.wireshark.org/>.

For information on Wireshark and SIP, see: <http://wiki.wireshark.org/SIP>.

## Runtime Test Log and Test Image

The Fax Transmission Analyzer displays the test process and verdicts in the Test Execution window, as described above, and, optionally, in both a textual log report and a graphical image report.

The **Test Log** displays test trace information during the test as it occurs. It provides a very detailed and comprehensive dump of all types of test information, but does not provide the option to configure or filter the type of information that appears.

The **Test Image** displays the image that was sent or received.

The log report can be displayed by checking the **Show log** checkbox in the Test Execution window. The Image report can be displayed by checking the **Show image** checkbox, as shown below.

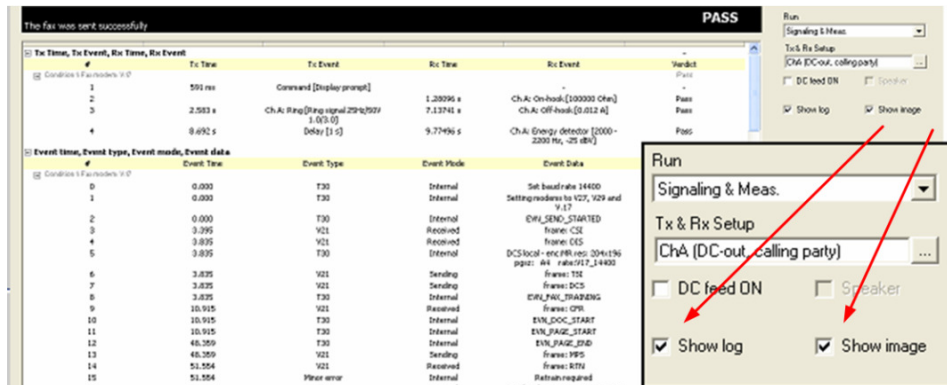


Figure 22: The T.30 Test Execution Window

The log differs from the customizable Test Execution window, described on page 17, in the following:

- The log displays all available information (Results, Events, Signaling, Data, Errors).
- The log displays information during the execution of the test in a scrollable window.
- The log can be generated without displaying a test report in the Test Execution window.
- The log contains an additional block of trace messages that do not appear in either the Test Execution window or the Test Report. This block is called **Fax synopsis** and contains fax state machine messages that are intended for internal review only.
- The fax image display provides a means of visual quality inspection. Also transmitted vs. received images can be compared using third-party software

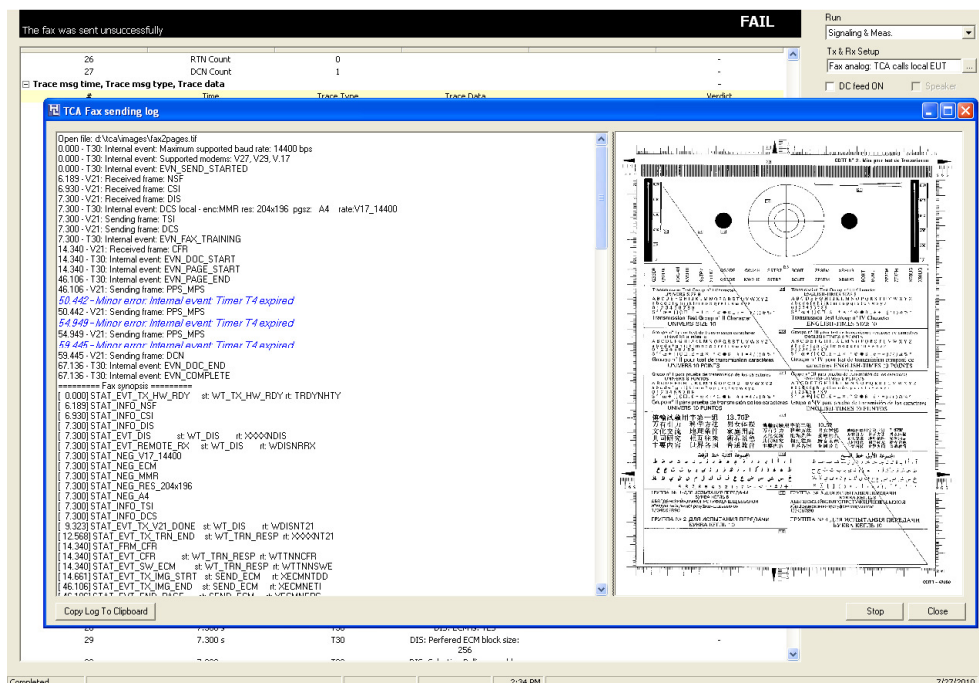


Figure 23: Fax Transmission Analyzer Fax Log with Image Displayed

## Display, Significance and Minor Error Types

The Fax Transmission Analyzer emulates the faxing environment and detects minor errors during fax transmission. These errors are then displayed in the log and, optionally, in the Test Execution window.

The identification of minor errors enables the troubleshooting of the EUT.

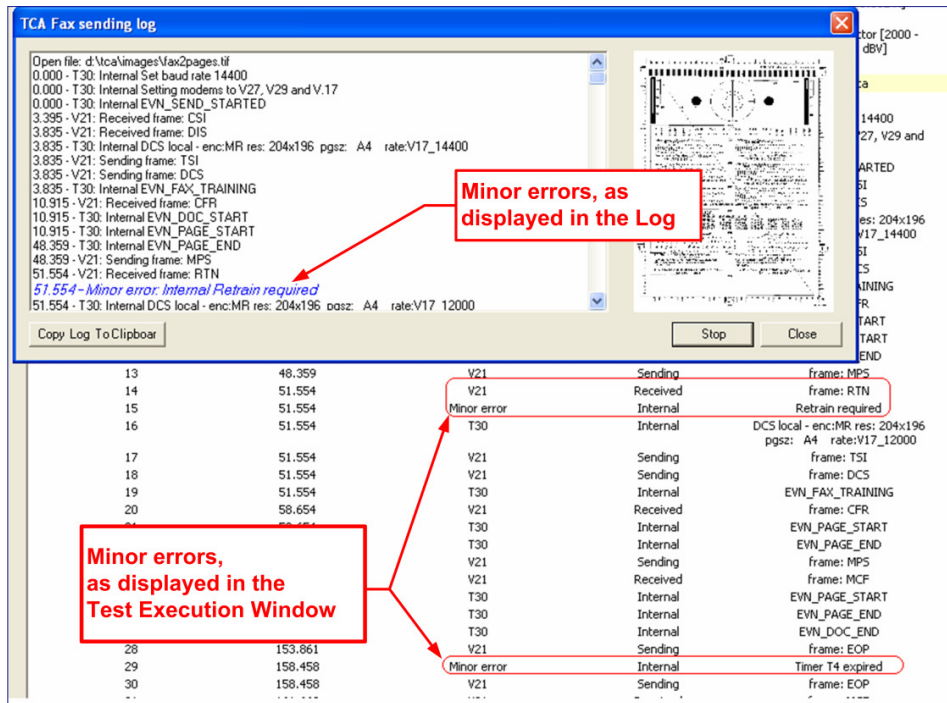


Figure 24: Minor Errors as Displayed in the Log and in the Test Execution Window

There are three types of minor errors:

- **Retrain Required:** Specifies that retraining of the fax is required because the receiving device was unable to receive the fax transmission. During the fax transmission handshake process (also called the *training* process), the MBR may be reduced by the fax device itself because of data distortions or fading.
- **Protocol Violation:** The T.30 standard defines several timers. Violation of any of them is reported as a minor error.
- **FCS Errors:** FCS (Frame Check Sequence) error messages are generated when there is a problem parsing incoming data. Examples of FCS errors are **bad crc in frame** and **unknown frame type**.



Cellular Analog FXS & FXO VoIP xDSL  
Acoustic ISDN PRI T1/E1



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