

Understanding RF LLC

Studio Beta

User Manual

VNA Data Acquisition • Touchstone Analysis • Advanced PASS/FAIL
Analysis

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This manual is based on the Help documentation included in the current Studio Beta build.

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1. Quick Start

UNDERSTANDING RF STUDIO: QUICK START

Understanding RF LLC Studio combines VNA data acquisition and Touchstone analysis in one application.

ACQUIRE DATA

1. Select Acquire on the home screen.
2. Choose Base Acquisition for a quick measurement, or Advanced Acquisition for a geometry-based site sequence.
3. Configure and test the analyzer connection.
4. Select an analyzer state file if the measurement requires one.
5. Choose the output location and acquire the data.

ANALYZE DATA

1. Select Analyze on the home screen.
2. Open a Touchstone file (.s1p through .s4p).
3. Select LogMag, Phase, or VSWR.
4. Select the desired S-parameters and add a figure group.
5. Optionally select a group and open Figure Settings to change its limits, figure title, or axis titles.
6. Plot the configured groups. Use View, Markers, Export, and Quick Analysis in each figure window to inspect and document the result.

Use the Back button in the lower-right corner to return to the previous workspace.

2. Single Acquisition

BASE ACQUISITION

Use this workflow for bench measurements, troubleshooting, and quick checks. Base Acquisition is also available from the mobile Test page and supports the one-word voice command "Acquire."

1. CONFIGURE THE ANALYZER

Open Configure Network Analyzer. Select the vendor and connection type, then enter either the TCP/IP host and port or the VISA resource address. Select Test Connection. The status must show Connected before acquisition is allowed. Save the configuration.

2. SELECT A STATE FILE (OPTIONAL)

Select an analyzer state, setup, calibration, or LibreVNA calibration file when the analyzer must recall a saved measurement configuration. Leave this blank to use the analyzer's current setup.

3. DEFINE THE OUTPUT

Choose the output directory, enter a measurement name, and select .s1p, .s2p, .s3p, or .s4p. The selected format determines which S-parameters are collected.

4. ACQUIRE

Select Acquire Data on desktop or Acquire Measurement on mobile. The application triggers a sweep, reads the complex S-parameter data, and writes a Touchstone file in real/imaginary format. On mobile, the selected .s1p/.s2p/.s3p/.s4p format is synchronized with Studio Voice so the spoken "Acquire" command uses the currently selected format.

Important: Do not change cables, fixtures, calibration, sweep settings, or port connections during acquisition unless the measurement procedure calls for it.

3. Advanced Acquisition

ADVANCED DATA ACQUISITION

Use this workflow for repeatable testing across named locations, ports, channels, or physical test sites.

1. CREATE OR UPLOAD A GEOMETRY

Select Generate to build a .urfgeom file. Enter site names manually, one per line, or load them from a CSV file. Select the data directory, geometry name, Touchstone format, and save directory. Alternatively, select Upload to load an existing .urfgeom file.

2. PREPARE THE UNIT

Enter the unit serial number. If it does not begin with SN, the application adds that prefix automatically. Select Create Folder. A serial-number folder and Final subfolder are created in the geometry's data directory.

3. CONFIGURE THE ANALYZER

Select Configure, enter the analyzer connection details, and run Test Connection. A successful test is applied to the acquisition page immediately. Select State File if a saved analyzer setup or calibration must be recalled before each site.

4. RUN AN INITIAL TEST

Select Run Initial Test. The site dialog presents one site at a time. Make the required physical connection, then select Acquire Current Site. The application acquires and saves the measurement before advancing.

If final data already exists, choose whether to overwrite all existing files or resume only the missing sites.

5. RUN A RETEST

Select one or more entries in Uploaded Sites, then select Retest Sites. Retest data is stored separately in Retest 1, Retest 2, and subsequent numbered folders; final data is not overwritten.

4. Analyzer Setup

SUPPORTED ANALYZERS AND CONNECTIONS

Keysight, Rohde & Schwarz (R&S), Anritsu ShockLine, Copper Mountain Technologies, LibreVNA, and Signal Hound are available for acquisition. Keysight and R&S acquisition is beta/unverified hardware support based on the manufacturers' documented SCPI command sets; validate against known standards before production use.

TCP/IP SOCKET

Enter the analyzer's IP address or hostname and its SCPI socket port. Port 5026 is common for LAN-controlled VNAs. The computer and analyzer must be reachable on the same network.

VISA

Enter a complete VISA resource string, such as a TCPIP, USB, or GPIB resource. A compatible system VISA library must already be installed for VISA connections.

LIBREVNA

LibreVNA uses the LibreVNA-GUI TCP server. Start LibreVNA-GUI, connect the physical instrument, enable its TCP server, and use the configured server address. The typical local endpoint is 127.0.0.1:19542.

SIGNAL HOUND

Signal Hound acquisition communicates with the Signal Hound VNA desktop software over its SCPI network socket. Start the Signal Hound VNA software, connect the VNA, and use the SCPI port configured in Preferences. The manual uses localhost:5026 as its example. Signal Hound VNA400 acquisition supports .s1p and .s2p output.

TEST CONNECTION

Test Connection sends *IDN? and verifies that the instrument responds. LibreVNA additionally verifies that a physical device is connected. Signal Hound verifies that a VNA is active in the Signal Hound software. Anritsu Auto Detect probes port 5001 and accepts an endpoint only when *IDN? identifies Anritsu. Changing the vendor or endpoint invalidates the previous connection test.

Instrument firmware and SCPI implementations vary. Validate the workflow with known standards before using it for production decisions.

5. Analysis

TOUCHSTONE ANALYSIS

OPENING DATA

Select a Touchstone file. Analysis supports RI, MA, and DB data formats in .s1p, .s2p, .s3p, and .s4p files. The File Summary displays the detected port count, frequency range, point count, and data format. Available S-parameters appear in the selection list.

CHOOSING A PLOT TYPE

- LogMag: logarithmic magnitude in dB for any S-parameter.
- Phase: phase in degrees for any S-parameter.
- VSWR: reflection parameters only, such as S11, S22, S33, and S44.

CREATING FIGURE GROUPS

1. Choose the plot type.
2. Select one or more compatible S-parameters.
3. Select Add Selected to New Figure.
4. Repeat to build independently configured figures.

Each item in Figure Groups to Plot becomes a separate plot window. Use Remove Selected Group to delete one or more groups, or Clear Figure Groups to start over. The group list reports whether each figure uses Auto axes or Custom axes.

FIGURE SETTINGS

Select exactly one figure group, then select Figure Settings.

Automatic axes:

- The dialog displays the exact X and Y limits calculated by the plotter.
- Automatic values remain visible in locked fields.
- X spans the measured frequency data in GHz.
- LogMag and Phase Y-limits expand to clean 10-unit divisions and include zero.
- VSWR begins at 1.0 and uses a practical calculated upper limit, capped at 20:1.

Custom axes:

- Select Custom to unlock the displayed automatic values.
- Edit X minimum and maximum in GHz.
- Edit Y minimum and maximum in dB, degrees, or VSWR ratio according to the plot type.
- Minimum values must be smaller than maximum values; VSWR cannot begin below 1.0.

Titles:

- Figure title changes the heading shown above the plot and the suggested PNG filename.

- X-axis title replaces Frequency (GHz).
- Y-axis title replaces the default LogMag, Phase, or VSWR label.
- Axis limits and titles are stored independently for each figure group.

PLOTTING

Select Plot Figure Groups to open every configured group in its own window. Select Plot All S-Parameters for a quick automatic plot of every parameter compatible with the chosen plot type. Plot All does not use individual group settings.

QUICK ANALYSIS

Select Quick Analysis in any open figure to generate a brief summary from the measured samples. Reflection LogMag summaries identify extrema and reflected power at the lowest point. Transmission LogMag summaries identify the strongest and weakest measured levels and their total range. Phase summaries report the displayed phase range without unwrapping the data. VSWR summaries identify extrema and the widest region at or below 2:1.

Quick Analysis works locally and does not require an internet connection. It describes the plotted measurements but does not declare pass or fail because no device specification has been supplied.

ZOOMING AND NAVIGATION

- Zoom In: magnifies around the center of the plot.
- Zoom Out: expands the visible range around the center.
- Mouse wheel: zooms around the pointer location.
- Drag a box: hold the left mouse button and draw around the exact region to inspect.
- Reset View: returns to the figure's original automatic or custom limits.
- Double-click: also resets the original view.

Zooming changes only the open figure's current view. It does not overwrite the limits stored in Figure Settings.

USING MARKERS

1. Open the Markers menu and choose Marker 1 or Marker 2.
2. Select the S-parameter that marker should follow. The marker appears near the center of the visible trace.
3. Click or drag across the plot to move the active marker. It remains locked to the selected S-parameter and snaps to the nearest measured sample.
4. Switch markers or change either marker's S-parameter through the Markers menu. Each marker remains at its selected point until its assigned S-parameter changes.
5. Read the marker number, S-parameter, frequency, and plotted value in its label.
6. Select Finish Marker Placement to return to box zooming. Clear either marker individually or clear both together from the same menu.
7. Select Show Frequency Delta to display the absolute frequency difference between Marker 1 and Marker 2. The delta updates continuously when either marker moves.

Markers and the frequency delta use only the samples contained in the Touchstone file. Values are never estimated or interpolated between measurement points. Marker 1 is blue and Marker 2 is orange. LogMag markers display dB, Phase markers display degrees, and VSWR markers display ratio values.

EXPORTING A PNG

1. Resize and zoom the figure to the desired view.
2. Open Export in the figure toolbar.
3. Select Standard PNG, IEEE Single Column PNG, or IEEE Double Column PNG.
4. Choose the filename and destination folder, then save the image.

The PNG contains the rendered figure title, custom axis titles, tick labels, grid, traces, legend, and any visible marker at the current figure size and zoom level. The toolbar is intentionally excluded. PNG export is dependency-free on Windows and does not require Matplotlib, Pillow, or another installation.

IEEE Single Column exports a 1050 by 700 pixel figure corresponding to 3.5 inches wide at 300 dpi. IEEE Double Column exports a 2148 by 1350 pixel figure corresponding to 7.16 inches wide at 300 dpi. Both presets use Arial publication typography, heavier line weights, compact legends, and distinct trace patterns so the data remains readable when printed in grayscale. Each PNG includes 300 dpi resolution metadata and is rendered at its fixed publication size regardless of the current window dimensions.

These presets are publication-ready defaults based on general IEEE graphics guidance. Requirements can vary by journal or conference, so the selected publication's current author instructions take precedence.

For readable engineering plots, group traces that answer the same measurement question and use matching custom limits when comparing separate figures.

6. Figure Tools

FIGURE TOOLS

Every plotted figure includes a compact toolbar for detailed inspection and export. These tools affect only the open figure and do not modify the source Touchstone file.

VIEW AND ZOOM

- Select View, then Zoom In or Zoom Out to change the visible range around the plot center.
- Use the mouse wheel to zoom around the pointer.
- Drag a box over the plot to inspect a specific region.
- Select Reset View or double-click the plot to return to the figure's original automatic or custom limits.

CUSTOM LIMITS AND TITLES

Return to the Analysis window, select one figure group, and open Figure Settings. Automatic mode shows the exact limits selected by the plotter. Switch to Custom to retain those values while making them editable. The same window lets you change the figure title and the X-axis and Y-axis titles. Settings are stored separately for every figure group.

MARKERS

Open Markers and choose the S-parameter for Marker 1 or Marker 2. Click or drag on the plot to move the active marker. A marker always snaps to the nearest measured Touchstone sample and reports its S-parameter, frequency, and plotted value. Select Finish Marker Placement when you want left-button dragging to create zoom boxes again.

Marker 1 is blue and Marker 2 is orange. Each marker can follow a different S-parameter. Use Clear Marker 1, Clear Marker 2, or Clear Both Markers to remove them.

FREQUENCY DELTA

After placing both markers, enable Show Frequency Delta in the Markers menu. The figure displays the absolute frequency difference between the two selected samples and updates it whenever either marker moves. Delta frequency does not require the markers to use the same S-parameter.

QUICK ANALYSIS

Select Quick Analysis for a local summary of the plotted samples. Depending on the plot type, it reports measured extrema, range, reflected power, or VSWR regions. It never invents intermediate samples, uses an internet service, or declares pass or fail without a supplied product specification.

PNG EXPORT

Open Export and choose one of three options:

- Standard PNG captures the current figure size, visible zoom, labels, legend, markers, and frequency delta.

- IEEE Single Column PNG creates a fixed 1050 by 700 pixel, 300 dpi publication figure.
- IEEE Double Column PNG creates a fixed 2148 by 1350 pixel, 300 dpi publication figure.

The IEEE presets apply publication-oriented typography, line weights, legends, and grayscale-distinguishable trace patterns. They are based on general IEEE graphics guidance; always check the requirements of the specific journal or conference receiving the figure.

7. Files and Folders

OUTPUT ORGANIZATION

BASE ACQUISITION

The selected output directory contains the named Touchstone file.

ADVANCED ACQUISITION

Data directory

- └─ SN[serial number]
- └─ Final
 - | └─ [site 1].sNp
 - | └─ [site 2].sNp
- └─ Retest 1
- └─ Retest 2

Site names are converted to Windows-safe filenames. Each generated Touchstone file includes comments identifying the site, serial number, analyzer connection, state file, and creation time.

ADVANCED ANALYSIS RESULTS

Each Analysis GUI execution creates its own self-contained run folder instead of piling outputs into the serial-number directory:

SN[serial number]

- └─ Analysis Results
- └─ YYYY-MM-DD_HH-MM-SS_[program name]
 - └─ Analysis_Result.txt
 - └─ Analysis_Result.json
 - └─ [program name]_Report.pdf
- └─ Figures
 - └─ Figure_01_[name].png
 - └─ Figure_02_[name].png
 - └─ All_Figures.png

If a run-folder name already exists, Studio adds a numeric suffix rather than overwriting it. The combined All_Figures.png provides one image containing every generated analysis figure.

On desktop, Open Serial Number Folder / the post-run folder prompt opens the applicable results location in Windows Explorer. On mobile, View Results on Phone displays the text report directly, generated figures can be tapped to view as images, and Open Results Folder on PC opens the run location on the Studio computer.

GEOMETRY FILES

A .urfgeom file stores the geometry name, ordered site list, data directory, output format, and creation time. It does not contain measurement data or analyzer credentials. Keep it with the test procedure so the same site sequence can be reused.

8. Troubleshooting

TROUBLESHOOTING

NOT CONNECTED

Confirm the analyzer is powered on, remote control is enabled, and the IP address, port, or VISA resource is correct. Verify basic network reachability and run Test Connection again.

ACQUISITION IS BLOCKED

Advanced mode requires a loaded geometry, a serial-number folder, and a successfully tested analyzer connection.

STATE FILE ERROR

Confirm the file exists and is compatible with the selected analyzer. Some analyzers require the state file to exist on the instrument rather than only on the computer.

EMPTY OR INVALID TRACE

Confirm the active channel contains the requested S-parameters and that the selected Touchstone port count matches the measurement configuration.

LIBREVNA DOES NOT CONNECT

Open LibreVNA-GUI, connect the physical LibreVNA, enable the TCP server, and confirm the host and port. The application cannot acquire through the GUI server if no device is attached.

WRONG OR UNEXPECTED RESULTS

Verify calibration, cables, adapters, port assignments, sweep range, source power, IF bandwidth, averaging, and fixture connections. Compare a known through, load, or other verification standard before trusting unknown-device measurements.

FILES ARE NOT WHERE EXPECTED

For advanced tests, inspect the geometry's data directory and the unit's SN-prefixed folder. Initial data is under Final; retests are stored in numbered Retest folders.

9. Advanced Analysis

ADVANCED ANALYSIS - STEP-BY-STEP GUIDE

Advanced Analysis is the repeatable PASS/FAIL workflow in Understanding RF LLC Studio Beta. Engineering creates the test definition once; operators run that approved definition against serial-number data.

PART 1 - ENGINEERING: CREATE THE ANALYSIS PROGRAM

1. From Home, select Analyze → Advanced Analysis → Create Analysis Program.
2. Enter the Engineering password. On a new installation, Studio offers to create this password during first-run setup.
3. Enter a Program Name that identifies the product/test.
4. Select the Main Data Directory containing the SN-prefixed unit folders created by Advanced Acquisition.
5. Choose Specification Source: Internal, or Customer-Defined. Customer-Defined requires the customer specification number so it is carried into results and reports.
6. DEFINE LIMIT RULES. For each required S-parameter, enter its evaluation frequency band and applicable minimum, maximum, or both. Add every rule the product must satisfy.
7. DEFINE FIGURES. Create the plots that should be generated automatically on every run. Choose plot type, displayed S-parameters, titles, axis labels/ranges, and limit visualization.
8. Review the complete definition. This program becomes the reusable engineering source of truth for operator evaluation.
9. Save the native Studio program as a .urfanalysis file. Engineering may also export standalone Python (.py) or MATLAB (.m) versions when needed.

PART 2 - OPERATOR: RUN THE APPROVED PROGRAM

1. From Home, select Analyze → Advanced Analysis → Analysis GUI.
2. Select the approved .urfanalysis program.
3. Studio reads the program's Main Data Directory and loads the available serial-number folders.
4. Select the serial number to evaluate. If a newly tested unit is missing, select Refresh Serial Numbers.
5. Select Run Analysis. Normal operator execution does not require the Engineering password.
6. Read OVERALL PASS/FAIL first.
7. Confirm Specification Basis and Test Limits / Acceptance Criteria.
8. Review Measurement Results for the compact rule-by-rule summary.
9. If the unit fails, open Exceptions / Failed Sites. Each failed entry identifies the site/file, S-parameter, controlling MIN or MAX, measured value, required limit, and frequency of the controlling extreme.
10. Review the generated figures and PDF report, then use the results-folder controls to open the saved run.

LIMIT SEMANTICS

Every rule is evaluated against every applicable Touchstone file in the selected serial-number folder, only inside that rule's evaluation frequency band.

Reflection LogMag parameters (S11, S22, S33, S44):

- For a conventional maximum-reflection requirement, the controlling value is the HIGHEST / least-negative LogMag value in the band. Example: -8 dB is worse than -15 dB for $S_{11} \leq -10$ dB.

Transmission parameters such as S21 and S12:

- MIN evaluates the minimum measured value in the band.
- MAX evaluates the maximum measured value in the band.
- MIN/MAX evaluates both boundaries.
- Reports identify which boundary controlled the result or was violated.

OUTPUT LOCATION

Each run is saved under:

SN[serial number] / Analysis Results / YYYY-MM-DD_HH-MM-SS_[program name]

The run folder contains Analysis_Result.txt, Analysis_Result.json, the PDF report, individual figure PNGs, and All_Figures.png. Existing runs are not overwritten.

IMPORTANT

Advanced Analysis is only as valid as the Engineering program, measurement data, calibration, and specification entered into it. Confirm the correct .urfanalysis program and specification basis before using the result for an engineering or production decision.

10. Contact

CONTACT UNDERSTANDING RF LLC

For Understanding RF LLC Studio Beta questions, bug reports, feature feedback, or help with a crash/diagnostic report, contact:

understandingrfllc@gmail.com

CRASH / DIAGNOSTIC REPORTS

Use More → Send Crash / Diagnostic Report. Studio creates the report locally and does not transmit it automatically. Review it before sending, remove anything you do not want to share, and send it to understandingrfllc@gmail.com.

Do not include customer-confidential information, passwords, pairing codes, proprietary specifications, export-controlled information, or measurement data unless you are authorized to disclose it.

11. Remote / Mobile

REMOTE / MOBILE CONTROL

Remote Mode provides a simplified phone interface for analyzer control, acquisition, and analysis. The phone begins on a branded Welcome page. Navigation uses four large buttons: Welcome, Analyzer, Test, and Analysis.

ANALYZER

Use Analyzer to view connection status, choose Keysight, R&S, Copper Mountain, Signal Hound, or LibreVNA, enter connection information, and connect/disconnect the analyzer.

TEST

Test contains two explicit workflows:

- Base Acquisition — quick one-file measurement. Choose an optional state file, select .s1p/.s2p/.s3p/.s4p, then acquire manually or by voice.
- Advanced Acquisition — choose a .urfgeom geometry, optional state file, enter the serial number, start the initial test, then acquire the current site manually or by voice.

Long state-file and geometry-file paths wrap inside their cards so they remain readable on narrow phone screens. Measurement plots are displayed on the phone and can be tapped to open as a large image.

ANALYSIS

Analysis contains Base Analysis and Analysis GUI. Base Analysis opens a Touchstone file and displays the selected S-parameter plot on the phone. Analysis GUI runs reusable .urfanalysis programs against serial-number folders, displays PASS/FAIL, allows serial-number refresh, exposes the text report on the phone, and displays the combined and individual PNG figures as tappable images.

FEATURES BUTTON

The Welcome page includes Features / How to Use. It opens a phone-sized guide describing Analyzer, Base Acquisition, Advanced Acquisition, Voice Control, Base Analysis, Analysis GUI, result organization, and image viewing without leaving the Remote interface.

TESTING SECURITY NOTE

The current testing build allows the remote file browser to navigate files readable by the Studio process. Pairing/session/request protections remain, but release builds should restore a restricted file sandbox. Remote transport is local HTTP in this testing configuration.

12. Voice Control

VOICE-COMMANDED ACQUISITION

Remote Voice Control is intentionally limited to acquisition and one command: "Acquire." This keeps the workflow predictable and reduces accidental or ambiguous actions.

BASE ACQUISITION

1. Open Remote Mode > Test > Base Acquisition.
2. Choose the desired Touchstone format.
3. Select Enable Voice Control.
4. Say "Acquire."

The selected .s1p/.s2p/.s3p/.s4p format is synchronized with Studio Voice, including changes made while voice control is active.

ADVANCED ACQUISITION

1. Load the geometry and state file if required.
2. Enter the serial number and start the initial test.
3. Enable Voice Control.
4. Studio displays the active site. Make the physical connection and say "Acquire."
5. The measurement is queued for the current site and the geometry workflow advances normally.

RECOGNITION PATHS

When the phone browser supports its speech-recognition interface, Studio can use it. If browser recognition is unavailable or microphone permission is blocked, Studio falls back to Studio Voice Recognition on Windows using the PC's default microphone. The fallback is designed specifically around the single Acquire command.

Voice acquisition still honors normal readiness checks: the analyzer must be connected and the applicable acquisition workflow must be ready. Disable Voice Control when it is not needed.

13. Quick Limit Analysis

QUICK LIMIT ANALYSIS

Quick Limit Analysis sits between descriptive Quick Analysis and reusable Advanced Analysis. It applies temporary PASS/FAIL limits to one LogMag Touchstone measurement without requiring an Engineering .urfanalysis program.

Each rule selects one S-parameter, an evaluation frequency band, and a MIN dB limit, MAX dB limit, or both. MIN evaluates the minimum measured value in-band. MAX evaluates the maximum. MIN/MAX evaluates both and identifies the controlling or violated boundary. For conventional reflection maximum limits, worst case is the highest / least-negative LogMag value.

LIMIT FIGURES

A limit-box figure may contain only one S-parameter. Different S-parameters with independent limit boxes cannot be superimposed on the same limit-analysis plot. Normal Base Analysis remains unrestricted when no limit boxes are active.

REPORT

The optional PDF includes overall PASS/FAIL, measured sweep, acceptance criteria, compact results, exact failure cause, and one visual limit-box figure per S-parameter. The same rule definition drives both the plotted forbidden region and the numerical evaluation.

The existing Standard Quick Analysis report is unchanged.

14. Quick Limit Analysis - Reflection Limits

REFLECTION LIMITS

For ANY LogMag reflection S-parameter (S11, S22, S33, S44, etc.), Quick Limit Analysis intentionally uses a simple Less Than field instead of MIN / MAX terminology.

Example:

S11 | 2.3 to 4.3 GHz | Less Than -10 dB

Studio interprets this as $S_{11} \leq -10$ dB throughout the evaluation band. The worst-case reflection value is the highest / least-negative measured LogMag value in that band.

Transmission S-parameters retain MIN and MAX fields because transmission specifications may legitimately use a lower bound, upper bound, or both.

This simplification affects the Quick Limit Analysis user interface; the underlying evaluator and report still retain explicit MAX semantics for reflection so the numerical and plotted limit behavior remain consistent.

15. Base Analysis Toolbar

BASE ANALYSIS TOOLBAR

The Base Analysis plot toolbar is intentionally kept compact.

Frequent plot-inspection controls remain visible. Secondary analysis and output actions are consolidated under Analysis & Export.

Analysis & Export contains:

- Quick Analysis — the original descriptive min/max/variation workflow.
- Quick Limit Analysis — temporary single-measurement PASS/FAIL limits and limit-box report.
- PNG / IEEE figure export actions when available.
- Help when available.

This consolidation does not remove functionality; it reduces the number of permanent buttons competing for space at the top of the plot.

QUICK LIMIT REPORT AXES

Limit figures continue to auto-range so the complete measurement and configured limit regions are visible. Axis boundaries and tick spacing are rounded to clean engineering increments from the 5/10 family rather than arbitrary values. Typical LogMag report plots therefore use clean 5 dB or 10 dB Y-axis divisions.

16. Base Analysis Options Menu

BASE ANALYSIS OPTIONS MENU

Base Analysis plot windows now open substantially larger so the graph, legend, axis labels, and controls are not compressed.

All graph actions are consolidated beneath one Options menu instead of presenting a row of permanent buttons.

OPTIONS

- View — zoom/reset/autoscale controls.
- Markers — marker and delta-marker controls.
- Analysis — Quick Analysis and Quick Limit Analysis.
- Export — standard PNG and IEEE figure export actions.
- Help — plot help when available.

The graph itself remains the dominant element of the window. The mouse-wheel / drag-to-zoom hint remains as unobtrusive instructional text.

Quick Limit Analysis report figures continue to auto-range while using clean 5/10-family engineering tick spacing.

17. Quick Limit Analysis - Plot and Transmission Fixes

QUICK LIMIT ANALYSIS PLOT / TRANSMISSION BEHAVIOR

REPORT AXES

The X-axis is tight to the actual measured sweep. It is not padded or rounded beyond the measurement start/stop frequencies.

The Y-axis auto-ranges to show the complete measured trace and configured limits, but tick marks are always placed at 5 dB increments.

TRANSMISSION MIN / MAX

For a transmission rule such as MIN = -1 dB and MAX = 0 dB:

- Values below -1 dB are forbidden.
- Values from -1 dB through 0 dB are allowed.
- Values above 0 dB are forbidden.

The report evaluates and displays BOTH boundaries independently. It no longer shades the allowed -1 to 0 dB region as though that region were forbidden.

LIMIT ENTRY WINDOW

The Quick Limit Analysis setup window opens larger so the report-generation controls remain comfortably visible.

18. Quick Limit Analysis - Report Figures

QUICK LIMIT ANALYSIS REPORT FIGURES

The report now includes three kinds of visual context:

SUPERIMPOSED OVERVIEW

The original LogMag traces are included together as a superimposed overview. This overview does not contain limit boxes; it exists to preserve the full measurement context.

REFLECTION LIMIT FIGURES

Reflection S-parameters use a clean single-parameter limit figure. The forbidden limit box is shown without extra vertical evaluation-band guide lines.

TRANSMISSION LIMIT FIGURES

Every transmission parameter receives two views:

- Normal View — full measured sweep with the configured MIN/MAX forbidden regions.
- Zoomed View — tight evaluation-band view so small insertion-loss / gain differences around the transmission limits are easy to see.

All Y axes use 5 dB increments. X limits remain tight to the measured sweep for normal views and tight to the evaluation band for transmission zoomed views.

19. Quick Limit Analysis - Figure Styling v5

LIMIT FIGURE STYLING

Reflection LogMag limit regions are drawn as complete rectangular boxes with visible top, bottom, left, and right borders. The side borders terminate at the limit boundary and never extend downward through the rest of the graph.

Normal full-sweep figures retain 5 dB Y-axis increments.

Zoomed transmission figures use a tighter automatic Y range with clean human-readable engineering increments such as 1 dB, 0.5 dB, 0.25 dB, 0.2 dB, or 0.1 dB rather than arbitrary decimal tick spacing.

20. Quick Limit Analysis - Superimposed Legend

SUPERIMPOSED OVERVIEW LEGEND

The Quick Limit Analysis report places the S-parameter legend in a dedicated column outside the plotting rectangle. Measurement traces therefore cannot run through, obscure, or visually compete with the legend.

The plotted X range remains tight to the measured sweep and the Y axis retains clean 5 dB divisions.