TSQA-16XMF

16 Channel, Precise High Dynamic HTOL RF System, 300 … 8500 MHz

Features

- 16 channels
- Compact 19” 1U device
- Wideband
- High level dynamic range
- High level accuracy and stability
- LAN remote interface
- CW and Pulse signal source
- Support of vector signal sources

Applications

- Qualification of RF components
- Quality assurance
- Research and development (R&D)

At a Glance

The High Temperature Operating Life Test (HTOL) is an intense stress test performed to simulate aging and accelerate thermally activated failure mechanisms. HTOL testing exposes a large number of devices under test (DUT) to extreme temperatures and absolute peak performance conditions. Typically, it is performed at 125°C and according to the JEDEC JESD22-A108 specification.

TSQA-16XMF integrates 16 channels into a compact device to subject 16 active DUTs to an HTOL test procedure at the same time and to monitor their function simultaneously.

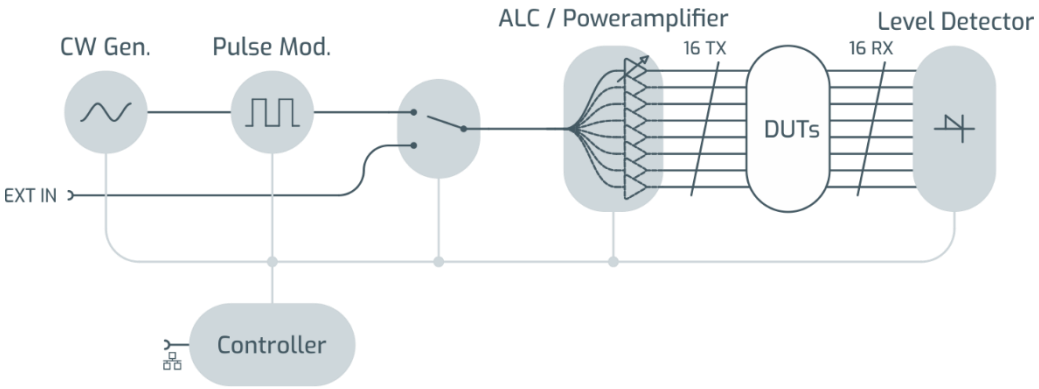
Scope

To conduct power stress testing and HTOL testing, it is essential to have RF systems equipped with numerous output channels, ensuring precise and stable output power over an extended period. The TSQA-16XMF system is ideally suited for this purpose, covering a wide frequency. This capability positions the system to effectively test components for the most current RF communication standards such as GSM900, GSM1800, UMTS, LTE-4G, LTE-5G FR1, IEEE 802.11a/b/g/n/ac (W-iFi 6E) and 802.11be (Wi-Fi 7).

Robust Design

The TSQA-16XMF features an industrial-grade 19” rack enclosure, simplifying the scalability of the system by allowing the addition of multiple devices.

Principle Block Diagram



RF Interfaces for DUTs

The TSQA-16XMF offers 16 stimulation and measurement channels for DUTs. The system provides 16 RX and 16 TX ports with SMA female connectors located on either the right or left side of the device.

High Port Isolation

HTOL systems necessitate a substantial level of isolation between their RF output ports. It is important that a malfunctioning DUT does not affect the performance of other DUTs during a test. The TSQA-16XMF provides a high port-to-port isolation, effectively mitigating any potential interference between DUTs.

High Precision of RF Output Level

Every output channel delivers an extremely accurate RF output level with closed-loop level control (ALC), resulting in virtually imperceptible steps. Consequently, it ensures the symmetry among all 16 outputs and maintains long-term stability. Additionally, the control loop's smooth characteristics prevent overshooting.

Pulse Signal Source

The TSQA-16XMF includes an internal pulse signal source in addition to the continuous wave (CW) source. This signal source can also be controlled through the device's LAN remote interface.

Suppression of Harmonics

In HTOL tests, it's essential to focus RF energy primarily on the fundamental signal to prevent undue stress on the DUTs caused by harmonics. The TSQA-16XMF incorporates an adaptive harmonic filter designed to efficiently suppress harmonics, ensuring precise testing conditions.

Remote Control

The TSQA-16XMF device can be controlled remotely through the central LAN interface. You can easily configure settings such as test frequency, RF level, CW or pulse mode, and access readouts using straightforward SCPI-oriented ASCII commands.

TX Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
impedance	Z_{IN}/Z_{OUT}		50		Ω	
number of outputs	n_{OUT}		16			
low frequency	f_{MIN}			300	MHz	
high frequency	f_{MAX}	8500			MHz	
output power range	P_{OUT}	-20		+15	dBm	f ≤ 6000 MHz, peak power
		-20		+11	dBm	f > 6000 MHz, peak power
ALC resolution	ΔP_{OUT}			0.05	dB	
TX power accuracy	dP_{TX}		± 0.2*1	± 0.8*1	dB	f ≤ 5500 MHz CW, RMS detector
	dP_{TX}		± 0.5*1	± 1.0*1	dB	5500 < f ≤ 7500 MHz CW, RMS detector
	dP_{TX}		± 0.8*1	± 1.3*1	dB	f > 7500 MHz CW, RMS detector
	dP_{TX}		± 0.3*1	± 1.0*1	dB	f ≤ 5500 MHz Pulse*2, PEAK detector
	dP_{TX}		± 0.6*1	± 1.2*1	dB	5500 < f ≤ 7500 MHz Pulse*2, PEAK detector
	dP_{TX}		± 0.9*1	± 1.5*1	dB	f > 7500 MHz Pulse*2, PEAK detector
	dP_{TX}		± 1.0	± 2.0	dB	
harmonics	D		-30		dBc	
error vector magnitude	EVM		5	8	%	64 QAM, f ≤ 6 GHz, Pout 0 dBm RMS
	EVM		5	8	%	64 QAM, f > 6 GHz, Pout -4 dBm RMS
output isolation	S_{23}		-60		dB	adjacent channels, full gain
number of inputs	n_{IN}		16			power measurement
detection			RMS			CW (continuous wave)
			Peak			Envelope
RX min. level	P_{RX_MIN}		-20	-15	dBm	ATT LOW
	P_{RX_MIN}		+5	+10	dBm	ATT HIGH
RX max. level	P_{RX_MAX}	+10	+15	+20*3	dBm	ATT LOW
	P_{RX_MAX}	+20	+27	+30*3	dBm	ATT HIGH
RX meas. accuracy	dP_{RX_M}		± 0.2*1	± 0.8*1	dB	f ≤ 5500 MHz CW, RMS detector
	dP_{RX_M}		± 0.5*1	± 1.0*1	dB	5500 < f ≤ 7500 MHz CW, RMS detector
	dP_{RX_M}		± 0.8*1	± 1.3*1	dB	f > 7500 MHz CW, RMS detector
	dP_{RX_M}		± 0.3*1	± 1.0*1	dB	f ≤ 5500 MHz Pulse*2, PEAK detector
	dP_{RX_M}		± 0.6*1	± 1.2*1	dB	5500 < f ≤ 7500 MHz Pulse*2, PEAK detector
	dP_{RX_M}		± 0.9*1	± 1.5*1	dB	f > 7500 MHz Pulse*2, PEAK detector
	dP_{RX_M}		± 1.0	± 2.0	dB	
RF connectors	X_{RF}		SMA female			outputs and inputs

*1: With Option 'PRECISION_CAL'

*2: Period: 1.0 ms, Width: 0.1 ms

*3: Absolute maximum

Source Specification

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Ext. Generator Input						
impedance	Z_{IN}		50		Ω	
low frequency	f_{MIN}			300	MHz	
high frequency	f_{MAX}	8500			MHz	
input power	P_{GENEXT}		-8		dBm	Nominal, PEP
maximum input power	P_{GENEXT}			+5	dBm	
Int. Generator with Pulse Modulation						
frequency range	f_{GEN}	300		8500	MHz	
resolution	Δf_{GEN}		10		kHz	
accuracy	df_{GEN}		± 5		ppm	
pulse length	t_W	50		5000	µs	adjustable in 1 µs steps
period	t_P	1		5	ms	adjustable in 1 µs steps

Common Specifications

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
power supply	u_{AC}	90	230	260	V	50 / 60 Hz
power consumption	P		90		W	
power socket	X_{AC}	IEC-60320 C14				country specific mains cable
dimensions	W x H x D	approx. 483 x 44 x 440			mm	
weight			13		kg	
remote interface		RJ45	10/100BaseT			ASCII commands
operating temp. range	T_o	+ 20		+ 40	°C	within specification
storage temp. range	T_s	- 40		+ 70	°C	

Ordering Information

Name	P/N	Description
TSQA-16XMF	2307.6002.1	16 Channel, 30 mW Precise RF Level HTOL Test System, 300 … 8500 MHz RF Connectors on the right
TSQA-16XMF	2307.6002.2	16 Channel, 30 mW Precise RF Level HTOL Test System, 300 … 8500 MHz RF Connectors on the left

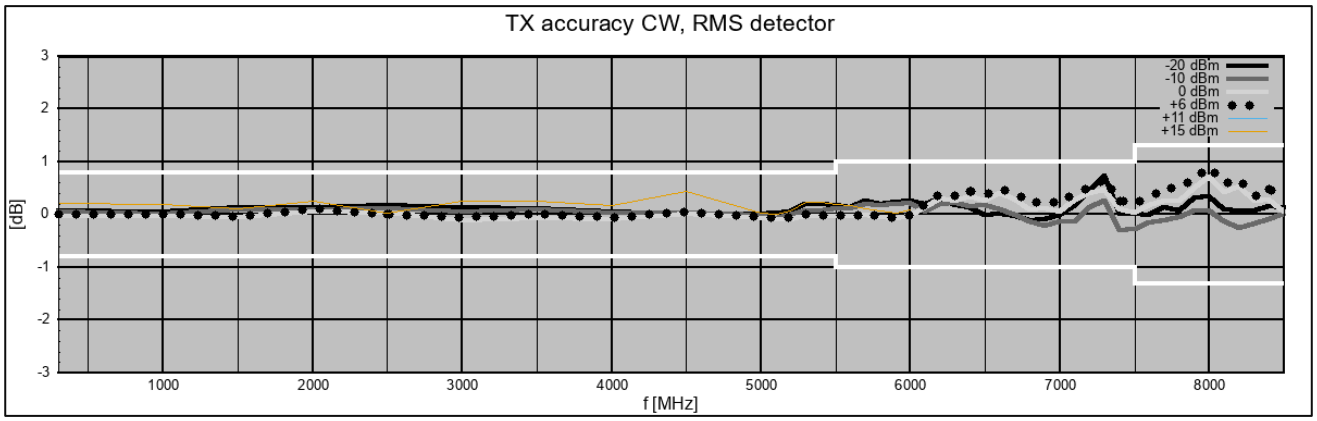
Device Options

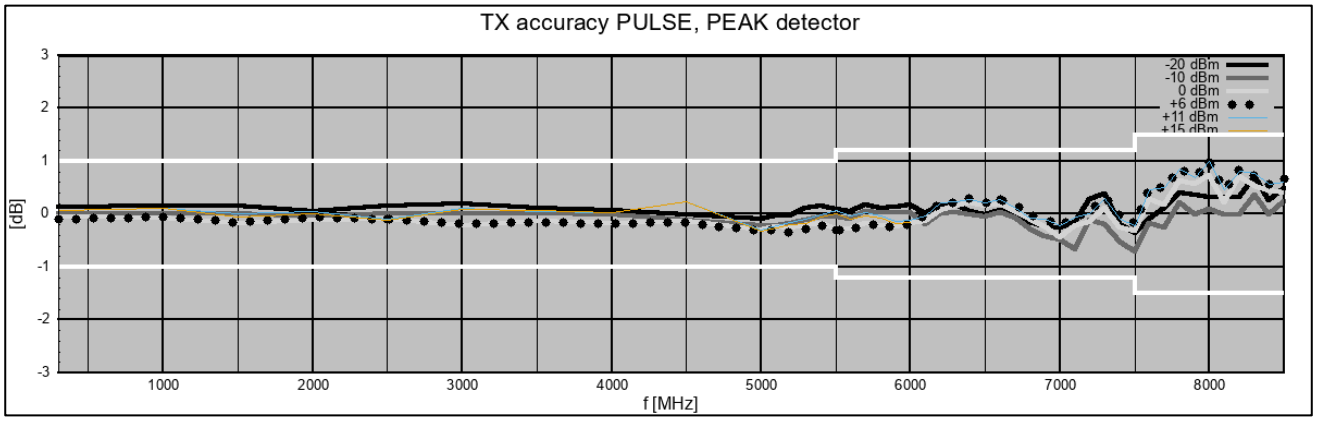
Name	P/N	Description
TSQA-PRECISION CAL		Option for Ultra Precise Output Level Calibration License Name: PRECISION_CAL Extends the abs. level accuracy of the device to typ. ± 0.3 dB. Includes a 72-hour continuous run calibration of the device. Factory calibration required and included.

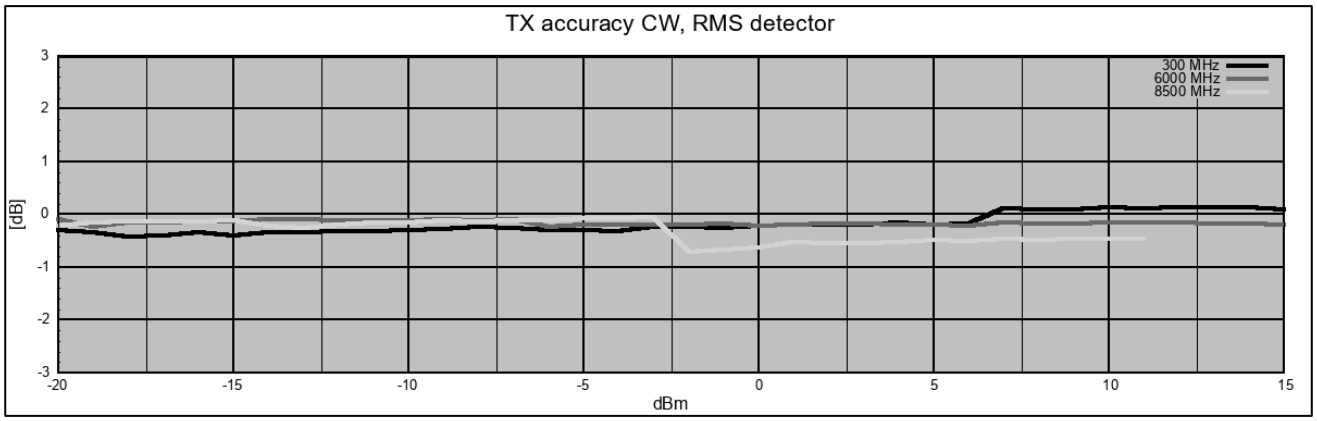
Software Options

Name	P/N	Description
SW-GUI	2300.620SW.O1	Software Option for Graphical Web Interface License Name: WEB_CONTROL Included in the basic delivery
TSQA-PULSE MOD	2300.620SW.O2	Software Option for RF Pulse Modulator License Name: PULSE_MODULATION Installation via license key by the customer
TSQA-CIPC	2300.620SW.O3	Software Option for Channel Individual Power Control License Name: INDEP_CH_CONTROL Installation via license key by the customer
TSQA-AUTOMATION CSALT	2300.620SW.O4	Software Option for Fully Automated Constant-Stress Accelerated Lifetime Testing License Name: AUTOMATION_CSALT Installation via license key by the customer
TSQA-AUTOMATION SSALT	2300.620SW.O5	Software Option for Fully Automated Stepped-Stress Accelerated Lifetime Testing License Name: AUTOMATION_SSALT Installation via license key by the customer
TSQA-AUTOMATION SWEEP		Software Option for Scalar Frequency Sweep on all RF Channels License Name: AUTOMATION_SWEEP Installation via license key by the customer
TSQA-MULTI TASKING		Software Option for Automatic Multi Test Sequencing License Name: MULTI_TASKING Installation via license key by the customer
TSQA-CABLE NORMALIZATION		Software Option for Test Cable Compensation License Name: CABLE_NORMALIZATION Installation via license key by the customer

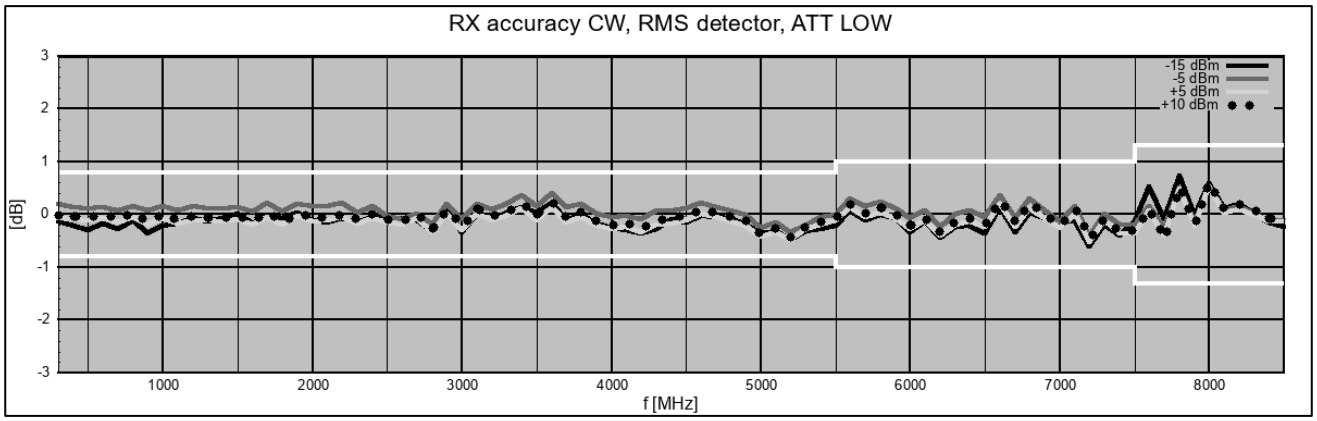
TX accuracy (typical values)

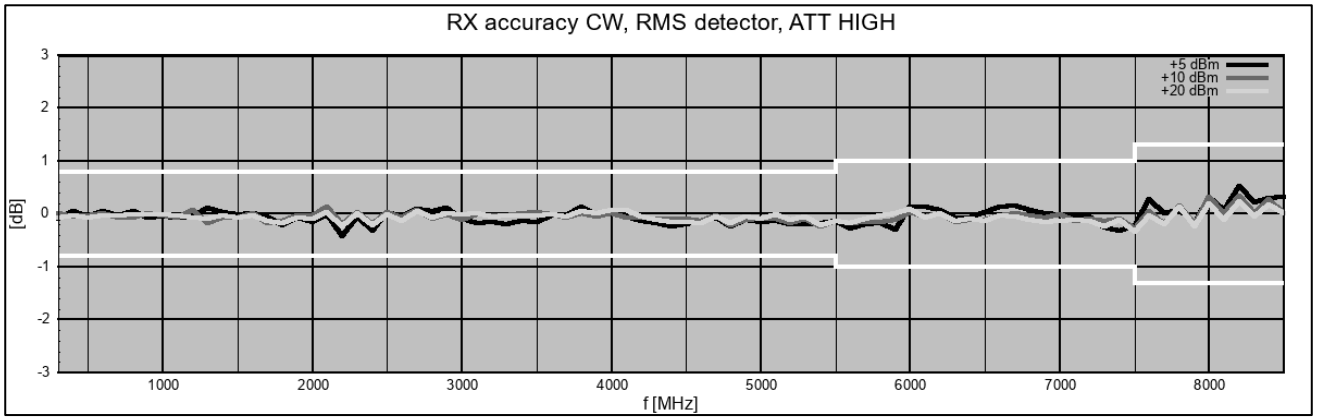


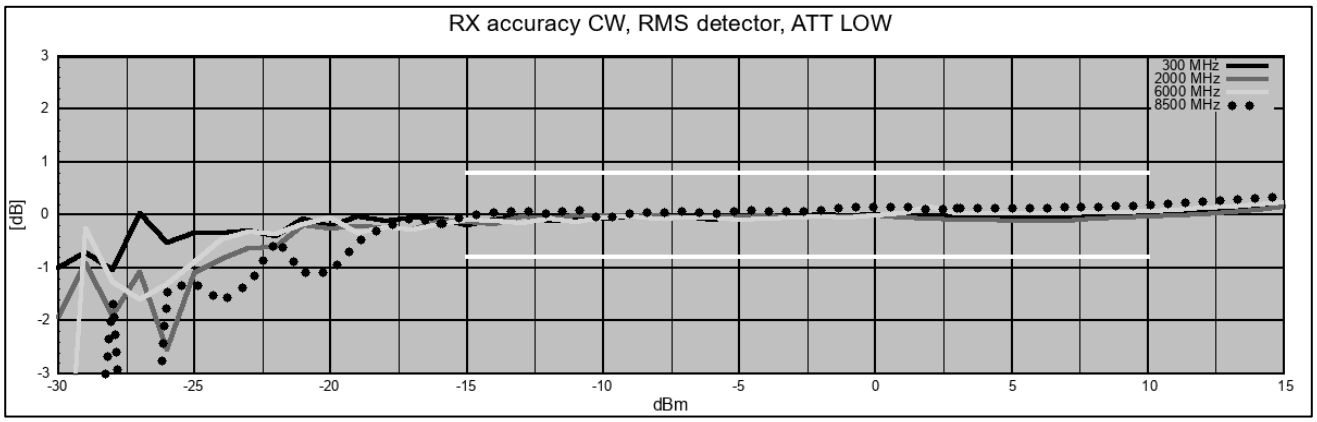


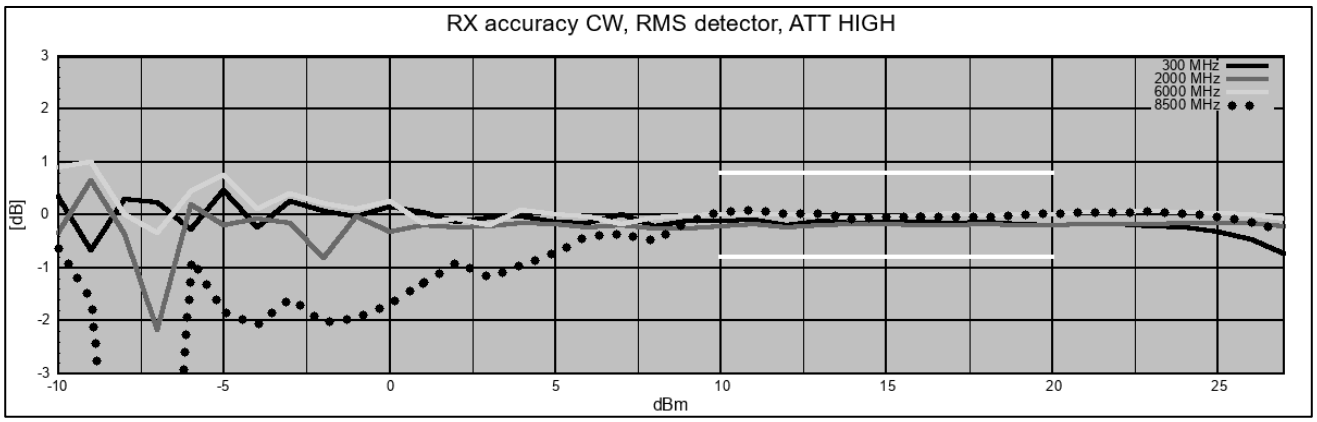


RX accuracy (typical values)









Appearances

Front View

Rear View

Side View

Variant with RF connectors on left side

Software Capabilities

Through years of experience with the requirements of characterization and qualification of RF components, Becker has developed a range of customer-oriented software options that support the user in the preparation, execution and reporting of various test procedures. All software options can be installed remotely by the customer via a license key – no additional hardware required.

Default Device Operation: Immediate Mode

Each TSQA device is delivered with a web interface as standard, which can be used to control all device functions and display a wide range of status information from the device.

With ‘Immediate Mode’, the user can instantly set and activate the generator frequency and output power for all channels at once – quick, simple, and efficient. Essential device functions such as Automatic Level Control (ALC), VSWR cut-off, and more come built-in, ensuring seamless performance right out of the box. For application requiring highest calibration accuracy, the GUI allows to manually adjust each channel's power level.

Option: Channel Individual Power Control

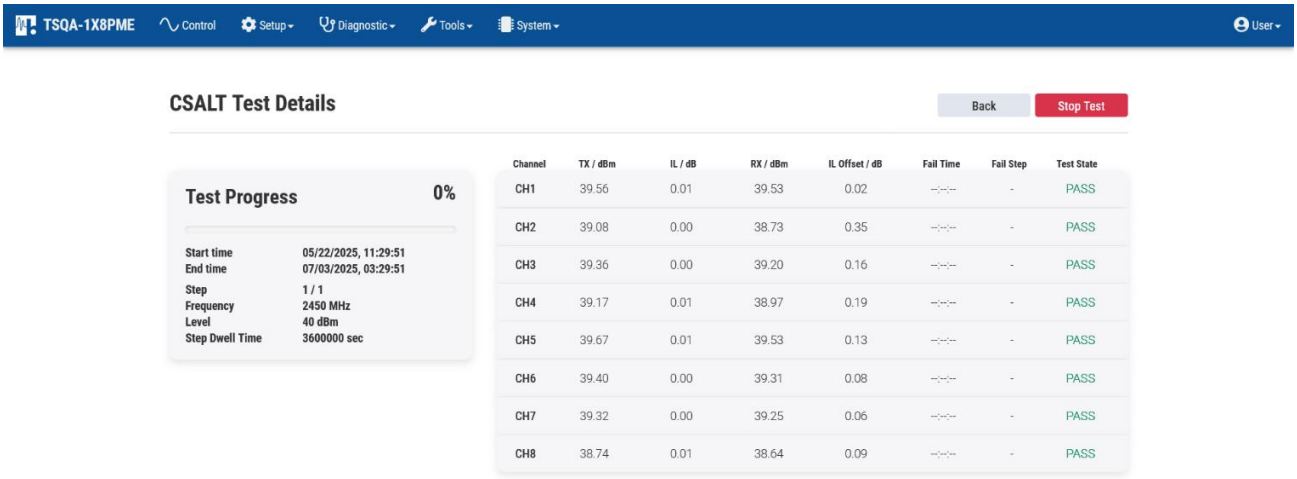
ID: INDEP_CH_CONTROL

Some applications demand greater flexibility – for example, the ability to adjust the output power on each channel individually to test multiple small batches of DUTs simultaneously at different levels. For this purpose, a software option is available that enables per-channel output power control.

Option: Fully Automated Constant-Stress Accelerated Lifetime Testing (CSALT)

ID: AUTOMATION_CSALT

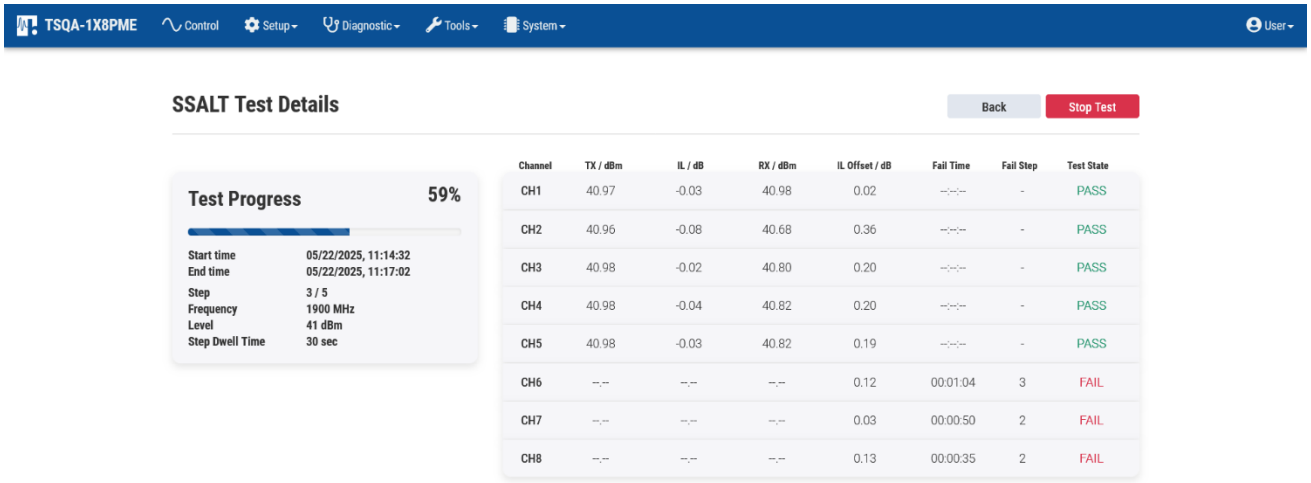
Setting up an HTOL test involves numerous external factors and requires extensive calibration. An incorrect configuration can quickly lead to significant time losses – and high costs. Becker offers an intuitive wizard that enables even inexperienced personnel to quickly and efficiently configure an HTOL test procedure. The user is guided through multiple steps to define parameters such as test duration, frequency, power, pass/fail criteria, warm-up phases, and result logging. Created configurations can be easily saved, exported, and reloaded. No further intervention is required by the operator for the entire duration of the test. In order to allow optimal failure analysis, the device offers the possibility to take off the RF stress from failed DUTs individually and immediately after the failure occurs.



Option: Fully Automated Stepped-Stress Accelerated Lifetime Testing (SSALT)

ID: AUTOMATION_SSALT

To characterize components and determine their destruction limits, an SSALT test is typically performed. In this test, the output power on all channels is gradually increased until the DUT reaches its point of destruction. The exact conditions at the moment of failure are then recorded and protocolled. For this test type as well, Becker offers a wizard that enables intuitive SSALT test configuration – including step size and duration, pass/fail criteria, and detailed logging.



Option: Scalar Frequency Sweep on all RF channels

ID: AUTOMATION_SWEEP, requires AUTOMATION_CSALT or AUTOMATION_SSALT

Often it is required to perform S-parameter measurements at certain intervals during long test durations. In most laboratories, VNA measurements require to disconnect all DUTs, take them out of the climate chamber and measure each DUT manually. Then reassemble the setup and continue the test. With the AUTOMATION_SWEEP feature, this cumbersome process can be avoided, since rough scalar S-parameter measurements are possible fully automatic in-situ in the climate chamber without any operator intervention.

Option: Automatic Multi Test Sequencing

ID: MULTI_TASKING, requires AUTOMATION_CSALT or AUTOMATION_SSALT

This software option offers the ability to run different automation tests simultaneously or sequentially on individual channels of a single device. This allows the device's full flexibility to be utilized and reduces significantly the number of operator interventions.

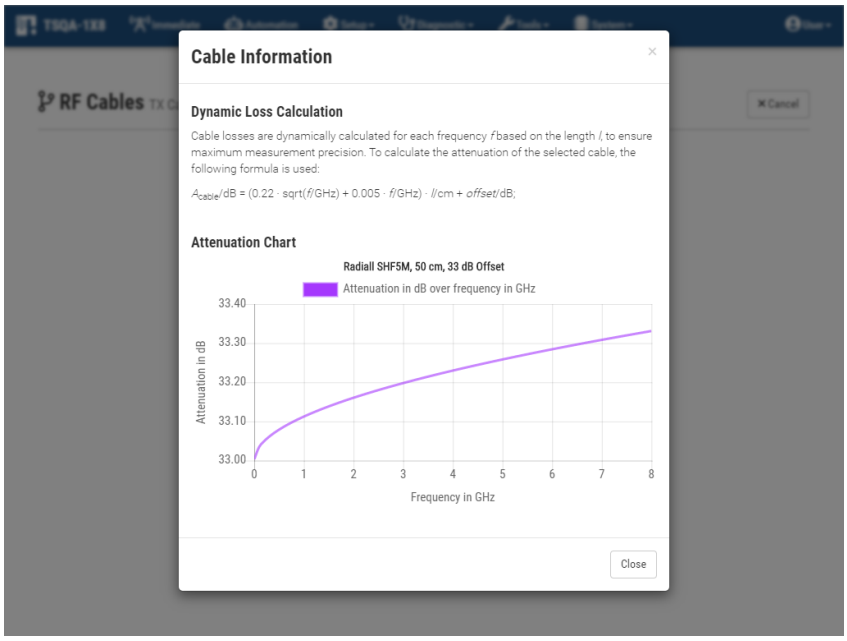
After the predefined test time has elapsed, the test procedure stops automatically and the RF levels will be turned down to remove the RF stress from the DUTs.

Option: Test Cable Compensation

ID: CABLE_NORMALIZATION

Cables have a significant impact on the measurements in a test setup. The cable loss has to be taken into account for all measurements. In order to simplify the operation for the operator, this option allows to display and log all signal power values with respect to the DUT input/output reference plane, which makes the test more transparent and intuitive. Cable defects due to aging effects, that distort the DUTs' fail statistics, can be identified much more easily, as additional cable loss stands out versus the values of other correct channels.

The frequency depending nature of the cable loss is automatically considered by the software, based on the known cable parameters. A set of widely used cable types and their parameters is already integrated in the software.



Related Products

Product	Description	P/N
TSQA-80PMF	80 Channel, 5 W Precise Automatic HTOL RF Test System 1700 MHz … 9800 MHz	2003.6302
TSQA-1X8PMF	8 Channel, 5 W Precise Automatic HTOL RF Sub System 1700 MHz … 9800 MHz	2003.6202
TSQA-80PME	80 Channel 10 W Precise Automatic HTOL RF Test System 300 MHz…6000 MHz	1804.6302
TSQA-1X8PME	8 Channel, 10 W Precise Automatic HTOL RF Sub System 300 MHz…6000 MHz	1804.6202
TSQA-80XME	80 Channel, 500 mW Precise Automatic HTOL RF Test System 300 MHz…6000 MHz	1804.6002
TSQA-1X8XME	8 Channel, 500 mW Precise Automatic HTOL RF Sub System 300 … 6000 MHz	1804.6002