becker
nachrichtentechnik

# TSQA-1X8PME

8 Channel, 10 W Precise Automatic RF Component Test System, 300 … 6000 MHz

**Features**
- compact 19”, 3 U design
- USB and LAN remote interfaces
- Graphic User Interface (GUI)
- high level accuracy and stability
- integrated CW signal source
- LAN and USB remote interface
- intuitive setup of complex tests
- intermittent in-situ measurement of DUT frequency response


**Options**
- pulse modulator
- automatic test sequencing

**Variants**
- additional medium power range extension

**Applications**
- qualification of e.g., active and passive cellular and wireless front-end components
- quality assurance for new designs and batch verification
- research and development (R&D)
- HTOL testing
- SSALT testing

## At a Glance

TSQA-1X8PME is a compact, automatic RF component testing system, suitable for the frequency range 300 … 6000 MHz in 50 ohms technology. TSQA-1X8PME offers an output power capability of up to 10 W per channel. Each channel has its own power amplifier and an ALC. The device also offers 8 input channels in order to monitor the DUT output power levels. In standard version. TSQA-1X8PME is equipped with an internal CW RF signal source and implements software to automate the complete testing process of e.g., electronic components like semiconductors, SAW/BAW filters and LTCC (Low Temperature Cofired Ceramics) components.

Due to its frequency range up to 6 GHz the HTOL system is suitable for tests with components for the 5G (FR1) standard.

### HTOL Testing

High-temperature Operating Life Time (HTOL) testing is an intense stress test performed to simulate aging and accelerate thermally activated failure mechanisms.

During HTOL testing a large set of devices under test (DUTs) is put under extreme temperature and absolute maximum rating conditions. Typically, it is performed at 125°C and according to JEDEC JESD22-A108 specification.

HTOL tests require RF systems with many output channels each delivering output power with high level precision and stability over time. TSQA-1X8PME offers extremely stable output power over time while compensating for external influences such as temperature

### SSALT Testing

Stepped-Stress Accelerated Lifetime Testing (SSALT) is used to identify weak points in devices under test (DUT). The input power at the DUT is gradually increased until the DUT is deliberately destroyed.

TSQA-1X8PME features real-time capable software that allows these steps to be approached extremely accurately and with precise duration.

### High TX to TX Isolation

RF component test systems must offer a high isolation between the RF output ports. A failing DUT should not have any influence to the other DUTs during the tests. The TSQA-1X8PME offers very high isolation of typical 85 dB between the ports to avoid this effect.

### High RF Level Precision

Each output channel provides a very precise RF output level with closed-loop level control (ALC), and virtually no visible steps. As a consequence, the symmetry between the 8 outputs as well as the long stability is guaranteed. Also, the control loop's smooth characteristic guarantees avoidance of overshoot. The dynamic output level range is large to cover a big variety of DUT categories.

### High precision RF level detection

Corresponding to each output channel, the TSQA-1X8PME subsystem provides one input channel to precisely measure the power at the DUT output.

### Harmonic Suppression

The RF energy in RF component tests should be concentrated on the fundamental of the signal to avoid additional stress to the DUTs coming from harmonics. The TSQA-1X8PME has an adaptive harmonic filter for effective suppression of harmonics.

### Pulse Modulator

With option pulse modulator installed, the TSQA-1X8PME is able to generate CW and pulse modulated signals.

### Input for External Generator

For HTOL tests with complex modulated signals like e.g., UMTS or LTE TSQA-1X8PME has an input for the connection of external signal generators.

### Medium Power Extension

TSQA-1X8PME is available in a variant with "Medium Power Range Extension". In this variant the output power range extends from -20 dBm (10 µW) up to +40 dBm (10 W). High and medium power section are provided on separate RF connectors.

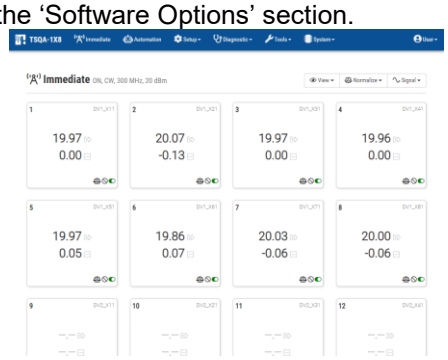
### Minimizing RF Cable Losses

Losses of RF cables to and from the DUTs have important consequences with respect to performance. High cable losses must be compensated by the power stages to avoid reduction of power level at the DUT input.

Depending on the location of the DUTs, the TSQA-1X8PME features RF output and input ports on the left or the right site allowing keep cables as short as possible.

### Software Functionalities

Physical remote interfaces: LAN or USB. TSQA-1X8PME is controllable via GUI (Graphic User Interface) without any additional effort of application software development and regardless of location. Alternatively, the system offers the control via an SCPI inspired ASCII string protocol for ATE (Automatic Test Equipment) applications. The extensive software functionalities are described in the 'Software Options' section.




GUI appearance (example)

### System Self-Monitoring

TSQA-1X8PME can run without human intervention during entire test periods of multiple months. It contains automatic self-checking like current consumption, module temperature and logging of errors.

### Optimized Power Consumption

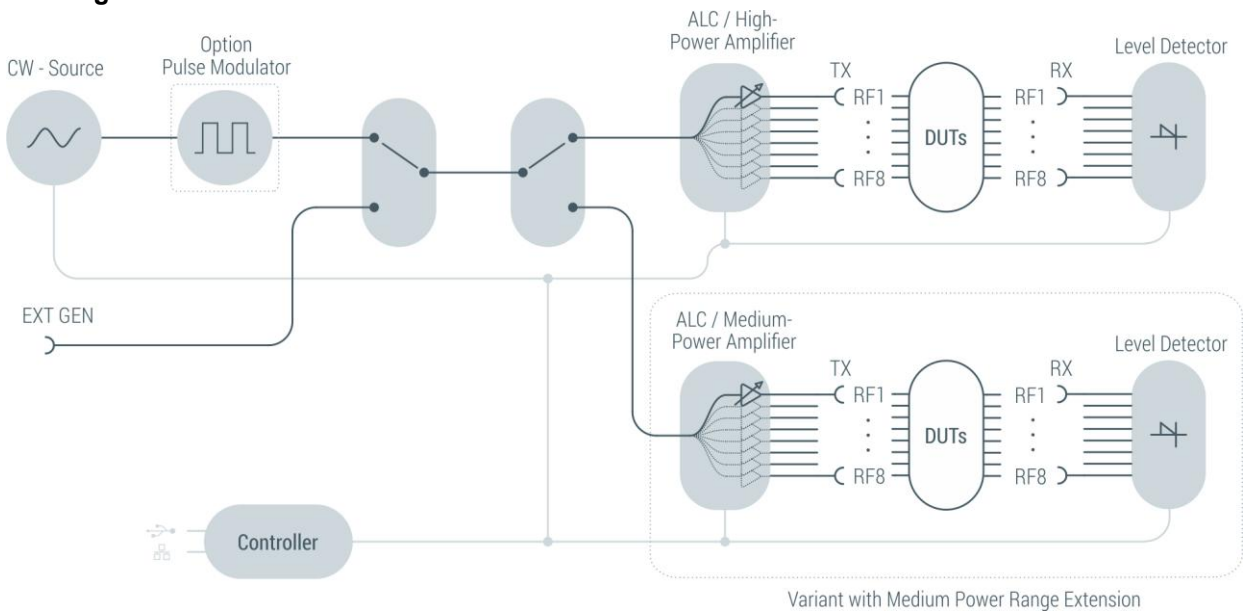
The power consumption and efficiency are adapted to the required RF output power level in 3 power classes. Dependant on the desired RF output power the supply voltage of the power amplifier stages is varied. This optimizes cost for electrical power and heat generation.

### Higher Number of Channels

Often batches of 77 DUTs are tested simultaneously in a HTOL test. Higher number of test channels can be provided by stacking TSQA-1X8PME subsystems in a 19" system rack. 10 subsystems are needed to realize an 80 channel HTOL system and can be provided in just 42 U, which is extremely compact. In this case all 80 channels will be controlled by only one GUI page.

Becker Nachrichtentechnik GmbH offers turnkey solutions with higher number of channels on customer demand.

## Block Diagram



**RF Specification**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| impedance | $Z_{in}$ / $Z_{out}$ | | 50 | | ohms | |
| number of outputs | $n_{DUT}$ | | 8 | | | |
| low frequency | $f_{min}$ | | 300 | 500 | MHz | |
| high frequency | $f_{max}$ | 6000 | | | MHz | |
| min. output power | $P_{TX\_MIN}$ | | | +20 | dBm | |
| max. output power | $P_{TX\_MAX}$ | +40 | +43 | | dBm | f = 2 GHz |
| | $P_{TX\_MAX}$ | +40 | +42 | | dBm | f = 4 GHz |
| | $P_{TX\_MAX}$ | +38 | +39 | | dBm | f = 6 GHz |
| ALC resolution | $\Delta P_{TX}$ | | | 0.05 | dB | |
| output power accuracy | $dP_{TX}$ | | ± 0.5*1 | ± 1.0*1 | dB | f < 500 MHz<br>CW, RMS detection |
| | $dP_{TX}$ | | ± 0.3*1 | ± 0.5*1 | dB | 500 MHz ≤ f ≤ 5500 MHz<br>CW, RMS detection |
| | $dP_{TX}$ | | ± 0.5*1 | ± 1.0*1 | dB | f > 5500 MHz<br>CW, RMS detection |
| | $dP_{TX}$ | | ± 1.0 | | dB | CW, RMS detection |
| harmonics | HD | | -25 | | dBc | f = 3 GHz, $P_{TX}$ = + 36 dBm |
| output isolation | $S_{23}$ | | -85 | | dB | full gain |
| number of inputs | $n_{RX}$ | | 8 | | | power measurement |
| detection | | | RMS | | | CW (continuous wave) |
| | | | Peak | | | envelope (pulse modul. option) |
| measuring level range | $P_{RX\_MIN}$ | | +10 | +20 | dBm | RF level measurement inputs |
| | $P_{RX\_MAX}$ | +40 | +44 | | dBm | |
| abs. meas. accuracy | $dP_{RX\_M}$ | | ± 0.5*1 | ± 1.0*1 | dB | f < 500 MHz<br>RMS detection |
| | $dP_{RX\_M}$ | | ± 0.3*1 | ± 0.5*1 | dB | 500 MHz ≤ f ≤ 5500 MHz<br>RMS detection |
| | $dP_{RX\_M}$ | | ± 0.5*1 | ± 1.0*1 | dB | f > 5500 MHz<br>RMS detection |
| | $dP_{RX\_M}$ | | ± 1.0 | | dB | RMS detection |
| rel. meas. accuracy | $dP_{RX\_M}$ | | ± 0.1*1 | ± 0.3*1 | dB | DUT I.L. < 2 dB |
| | $dP_{RX\_M}$ | | ± 0.5 | | dB | DUT I.L. < 2 dB |
| RF connectors | $X_{RF}$ | | SMA female | | | RF outputs and inputs |
| **Variant with Medium Power Extension** | | | | | | |
| impedance | $Z_{in}$ / $Z_{out}$ | | 50 | | Ohm | |
| number of outputs | $n_{OUT}$ | | 8 | | | |
| low frequency | $f_{min}$ | | 300 | 500 | MHz | |
| high frequency | $f_{max}$ | 6000 | | | MHz | |
| output power range | $P_{TX}$ | -20 | +27 | | dBm | |
| ALC resolution | $\Delta P_{TX}$ | | | 0.05 | dB | |
| output power accuracy | $dP_{TX}$ | | ± 0.3 | | dB | |
| harmonics | HD | | -30 | | dBc | |
| output isolation | $S_{23}$ | | -70 | | dB | adjacent channels, full gain |
| number of inputs | $n_{RX}$ | | 8 | | dBm | power measurement |
| detection | | | RMS | | | CW (continous wave) |
| | | | Peak | | | Envelope |
| measuring level range | $P_{RX\_MIN}$ | -15 | | +15 | dBm | RF level measurement inputs |
| abs. meas. accuracy | $dP_{RX\_M}$ | | ± 0.3 | | dB | RMS detection |
| rel. meas. accuracy | $dP_{RX\_M}$ | | ± 0.2 | | dB | I.L. DUT < 2 dB |
| RF connectors | $X_{RFLO}$ | | SMA female | | | outputs and inputs |
| **CW signal source** | | | | | | |
| low frequency | $f_{min}$ | | | 300 | MHz | |
| high frequency | $f_{max}$ | 6000 | | | MHz | |
| frequency resolution | $\Delta f_{GEN}$ | | 10 | | kHz | |
| frequency accuracy | $df_{GEN}$ | | ±2.5 | | ppm | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Ext. Generator Input** | | | | | | |
| impedance | $Z_{in}$ / $Z_{out}$ | | 50 | | ohms | |
| low frequency | $f_{min}$ | | | 300 | MHz | |
| high frequency | $f_{max}$ | 6000 | | | MHz | |
| input power | $P_{IN}$ | | 0 | | dBm | nominal |
| maximum input power | $P_{INMAX}$ | | | +10 | dBm | |
| **Option Pulse Modulator** | | | | | | |
| pulse lenght | $t_W$ | 577 | | | µs | |
| period | $t_P$ | 4.6 | | 1000 | ms | |

*1: With Option 'PRECISION_CAL'

**Common Specification**

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|---|---|---|---|---|---|
| power supply | $u_{AC}$ | 90 | 230 | 260 | V | 50 / 60 Hz |
| power consumption | P | | 780 | | W | full RF power |
| power socket | $X_{AC}$ | IEC-60320 C14 | | | | country specific power cable |
| dimensions | W x H x D | approx. 483 x 133 x 431 | | | mm | 19", 3 U |
| weight | | | 20 | | kg | |
| remote interface | | RJ45 10/100BaseT | | | | ASCII commands |
| operating temp. range | $T_o$ | + 20 | | + 30 | °C | within specification |
| storage temp. range | $T_s$ | - 40 | | + 70 | °C | |
| Electromagnetic compatibility | EU: in line with EMC directive (2014/30/EC) | | | | | applied harmonized standards: EN61326-2-1, (for use in control and laboratory environments), EN55035, EN55032, EN61000-3-2, EN61000-3-3 |
| Electrical safety | EU: in line with low voltage directive (2014/35/EC) | | | | | applied harmonized standard: EN 61010-1 |

## Ordering Information

| Name | P/N | Description |
|---|---|---|
| TSQA-1X8PME | 1804.6202.1 | 8 Channel, 10 W Precise Automatic HTOL RF Sub System, 300 … 6000 MHz<br>RF connectors on left side |
| TSQA-1X8PME | 1804.6202.2 | 8 Channel, 10 W Precise Automatic HTOL RF Sub System, 300 … 6000 MHz<br>RF connectors on right side |
| TSQA-1X8PME | 1804.6202.4 | Variant with medium power extension,<br>RF connectors on left side |
| TSQA-1X8PME | 1804.6202.5 | Variant with medium power extension,<br>RF connectors on right side |

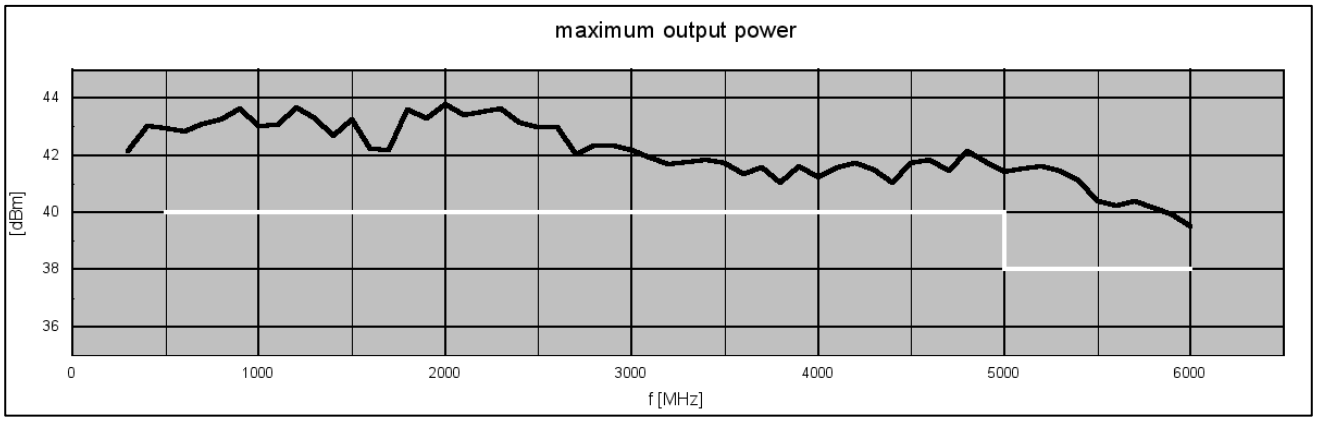
## Device Options

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

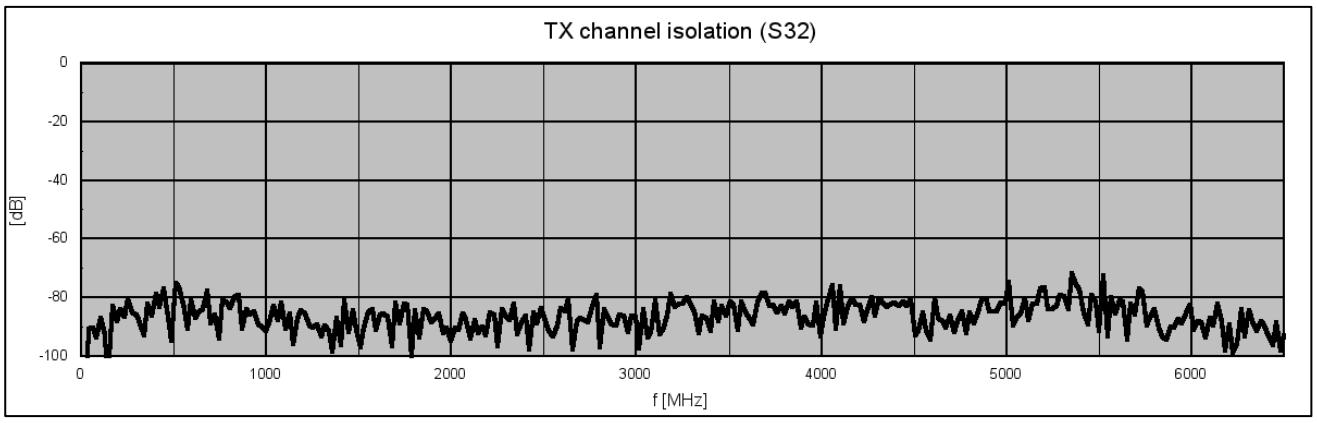
## Software Options

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

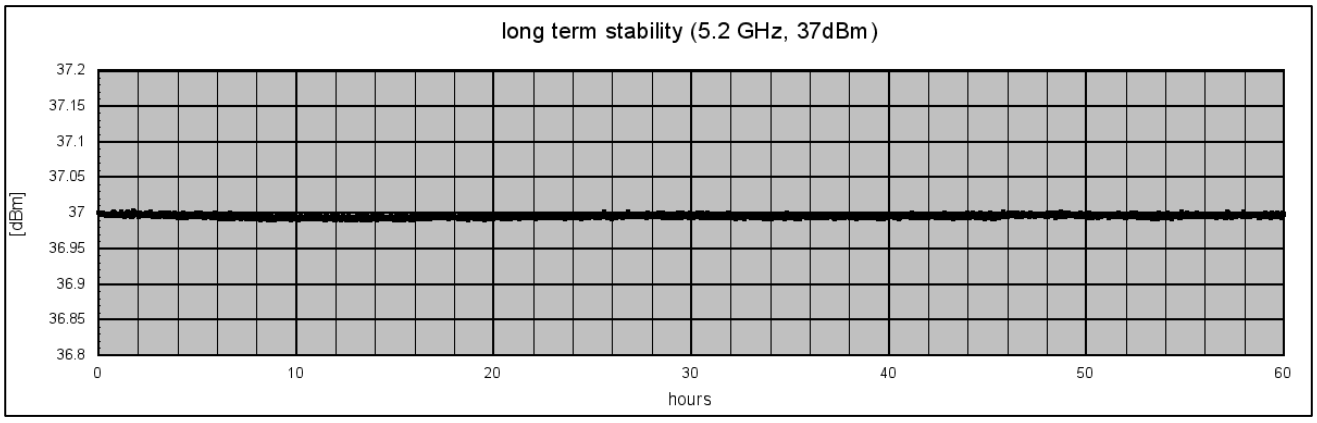
## **TX Output Power High Power** (typical response)



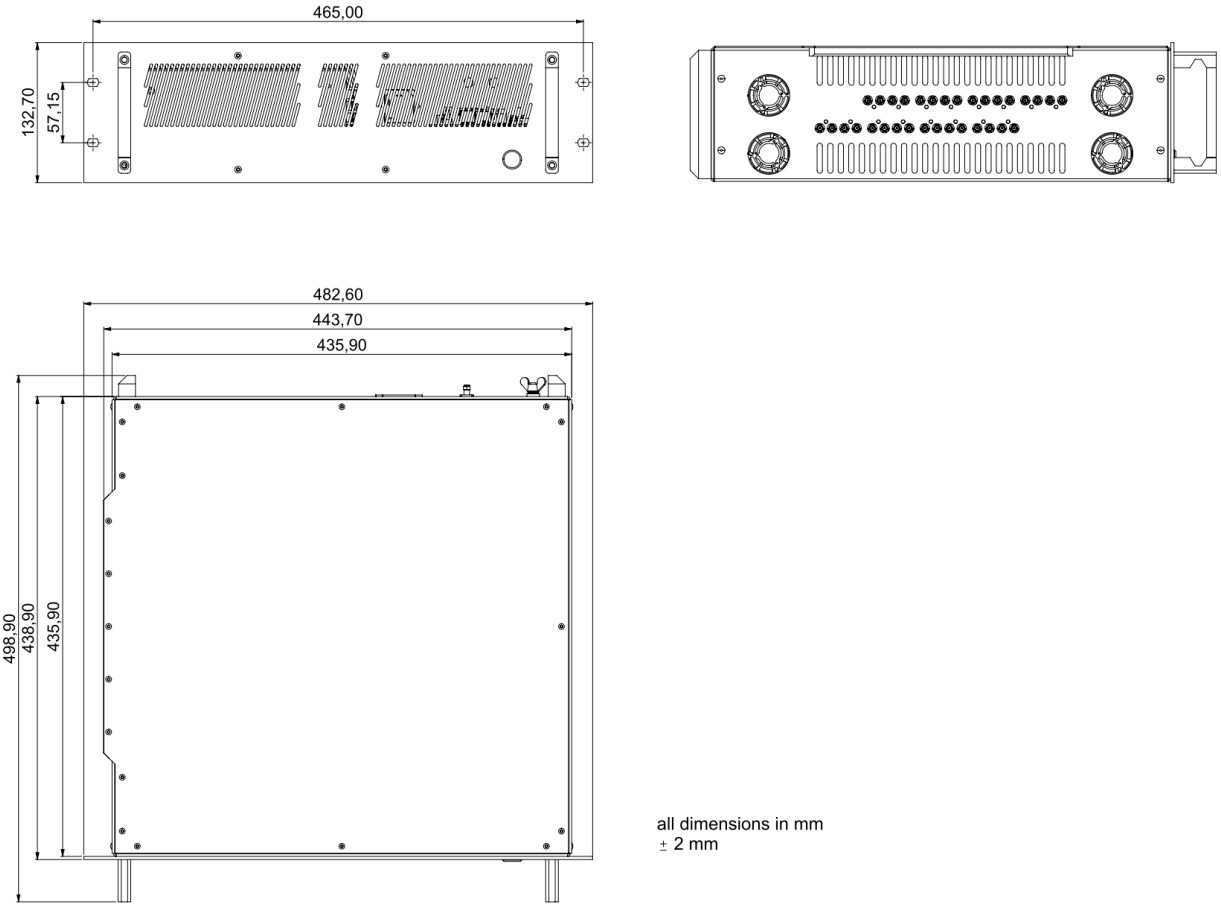

## **TX Output Isolation High Power** (typical response)




## **TX Power Stability High Power** (typical response)



## Dimensions




all dimensions in mm
± 2 mm

## Appearances

TSQA-1X8PME with RF ports on right side

TSQA-1X8PME with RF ports and power/remote

TSQA-1X8PME with option “Medium Power Range Extension” with additional RF ports (right side version).

**Network Operation**

80 Channel Automatic HTOL Test System

Arrangement of 10 TSQA-1X8PME subsystem units in a 19”, 42 U system rack optimized for short RF cable lengths to cable inlets of temperature chamber.

## 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

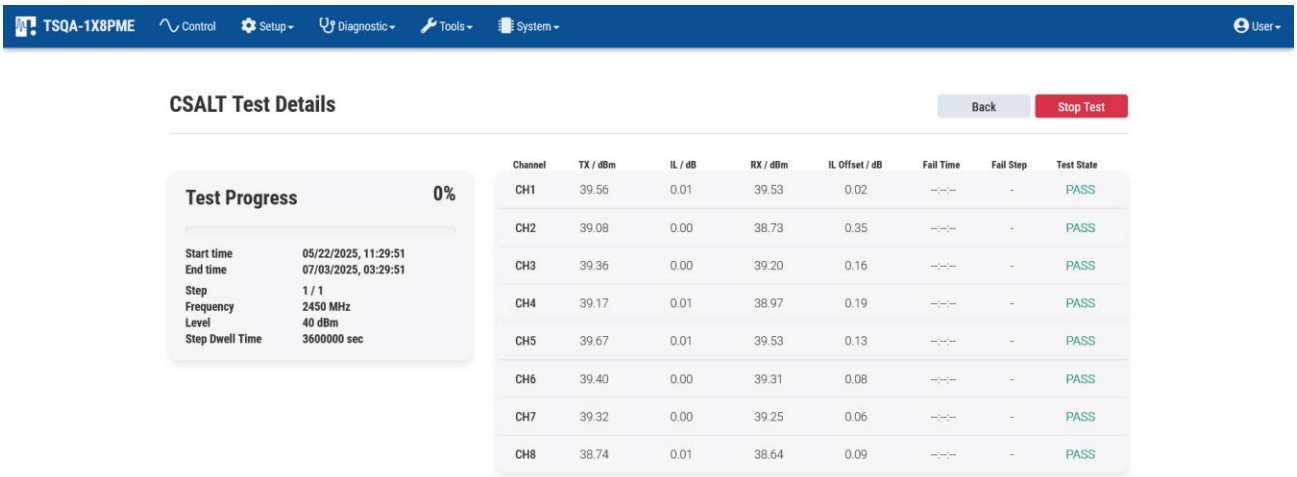
*ID: INDEP_CH_CONTROL*

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*

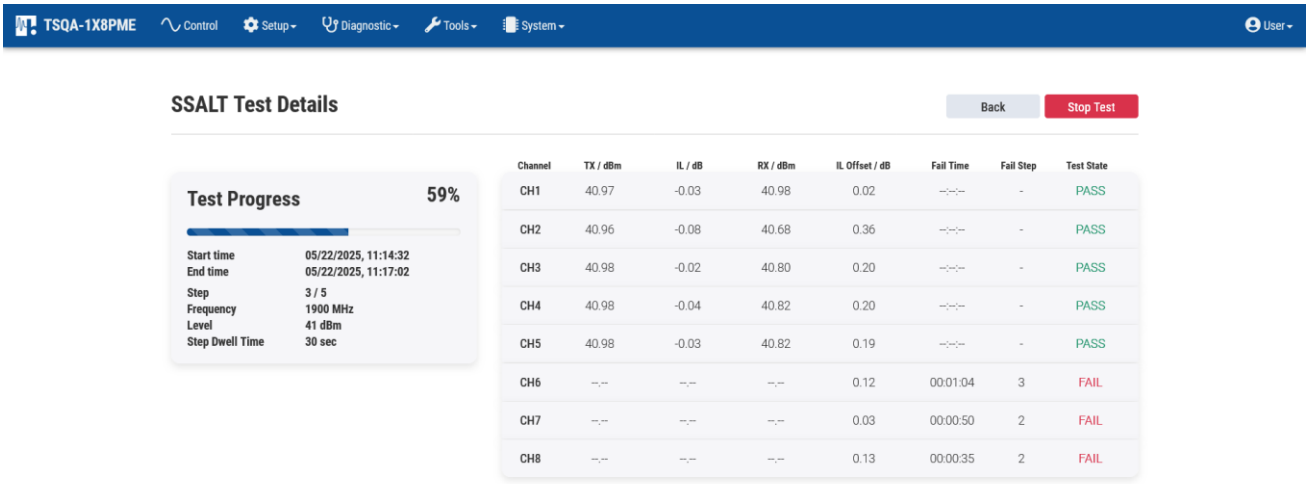
Setting up an HTOL test involves numerous external factors and requires extensive calibration. An incorrect configuration can quickly lead to significant time losses – and high costs. Becker offers an intuitive wizard that enables even inexperienced personnel to quickly and efficiently configure an HTOL 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.

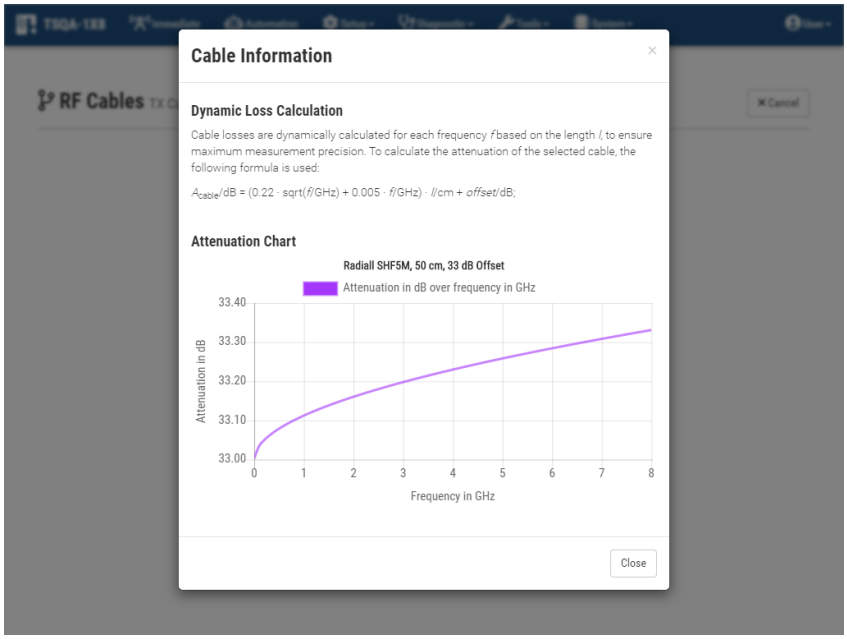
After the predefined test time has elapsed, the test procedure stops automatically and the RF levels will be turned down to remove the RF stress from the DUTs.

**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-1X8PMF | 8 Channel, 5 W Precise Automatic HTOL RF Sub System<br>1700 MHz … 9800 MHz | 2003.6202 |
| TSQA-80PMF | 80 Channel 5 W Precise Automatic HTOL RF Test System<br>1700 MHz…9800 MHz | 2003.6302 |
| TSQA-80PME | 80 Channel 10 W Precise Automatic HTOL RF Test System<br>300 MHz…6000 MHz | 1804.6302 |
| TSQA-1X80PM | 80 Channel 2.5 W Precise Automatic HTOL RF Test System<br>20 MHz…3000 MHz | 1606.1012 |
| TSQA-1X16PM | 16 Channel 2.5 W Precise Automatic HTOL RF Test System<br>20 MHz…3000 MHz | 1606.1027 |
| TSQA-80XME | 80 Channel, 500 mW Precise Automatic HTOL RF Test System<br>300 MHz…6000 MHz | 1804.6002 |
| WSDU-1X232 | 232 Channel 125 mW HTOL RF Testing System 350 MHz…2500 MHz | 1004.1002 |