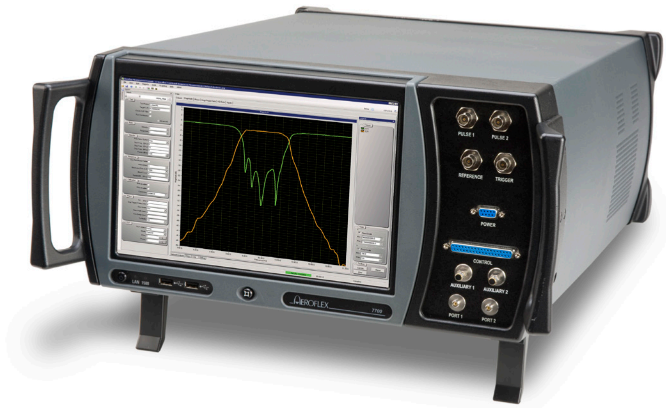
7700 Integrated Microwave Test Solution

AEROFLEX
A passion for performance.



A complete test environment for automated production and integration test of RF components and modules

A Complete RF Test Environment

- Delivered ready to test with a fully featured execution and development environment
- Full set of common RF measurements
- Fully integrated Device Under Test (DUT) power and multi-state control
- Fully integrated control of peripherals such as temperature chambers
- Architected to support ATE

A True Synthetic Architecture

- Utilizes a common set of hardware for all stimulus and response functions
- Smaller footprint than traditional instruments based systems
- Mature system level calibration scheme
- Reduced hardware cost compared to full instrument-based test system
- New capability can be added incrementally at low cost with little impact to existing measurement sequences

Complex Device Testing Capable

- Frequency range 1 MHz to 26.5 GHz (with all options)
- Complete measurement suite including S-parameters for full characterization of devices such as LNAs, VCOs and transceiver modules.
- Control of device states built into measurements

The 7700 Integrated Microwave Test Solution provides RF component, module and system manufacturers an advanced and flexible test environment to meet today's requirements and tomorrow's challenges. By leveraging the architecture of the synthetic product family and hardware from the Aeroflex Common Platform product line, the 7700 offers unprecedented capability in a condensed footprint.

The 7700 provides best-in-class performance up to 26.5 GHz for the most demanding RF testing applications. The 7700's unique synthetic architecture allows for measurement throughput faster than traditional instrument based systems. It also comes standard with several built-in measurement, test executive and reporting tools to accelerate automated test development. Many additional measurement personalities are also available from Aeroflex or may even be developed by the end user.

The 7700 provides the most capable, flexible and scalable synthetic test instrumentation with the lowest cost of ownership in the industry. While the base model is fully featured, our state-of-the-art modular hardware and software components allow a 7700 to be configured with options to provide a total measurement solution with unmatched operational efficiency, upgrade capability and obsolescence protection.

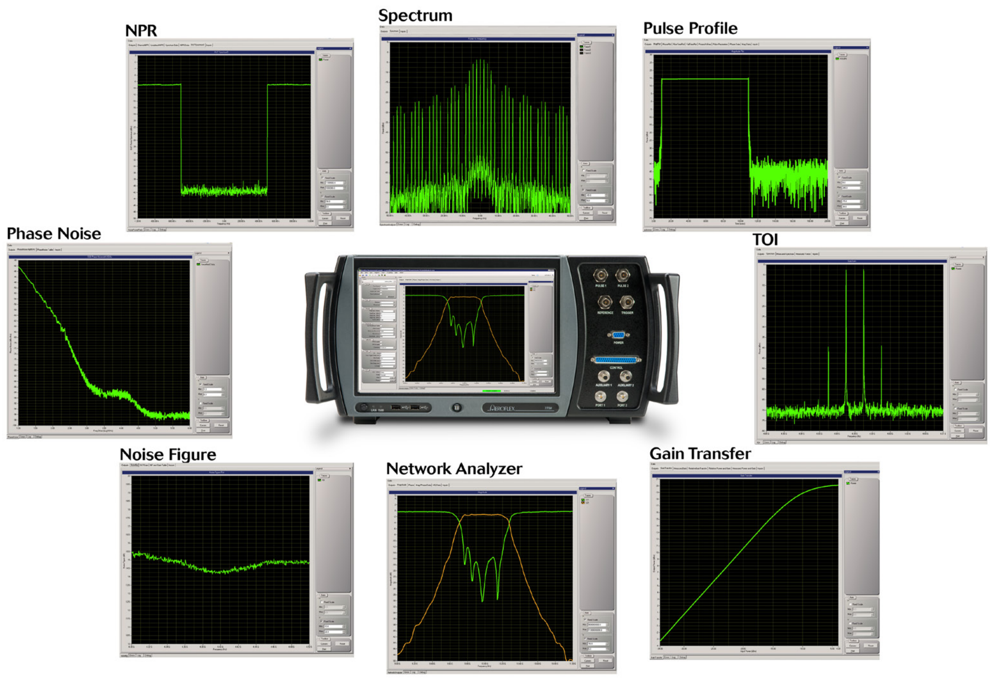


Figure 1. The 7700 includes a complete measurement suite that would normally require a full rack of instrumentation.

Comprehensive ATE Solution

The 7700 is a complete automated test system housed in an incredibly small footprint. The solution includes a fully-functional test executive called the Aeroflex Measurement Console (AMC). Using the production test sequences provided with the base model, the 7700 includes the capability to emulate the functionality of the following instrumentation:

- Vector signal generator
- Spectrum analyzer
- Vector network analyzer
- Power meter
- Frequency counter
- Noise figure meter
- Phase noise analyzer

But the 7700 does not just replace test equipment. It is a fully integrated ATE solution that has the capability to control all aspects of production test including the Device Under Test (DUT), remote switching hardware, thermal chambers, etc.

Reduced Cost of Test

The cost of production testing does not end with the price of the hardware. In fact, ATE development and maintenance costs are often much greater than the initial hardware investment. Aeroflex understands the importance of reducing the total cost of test and has specifically designed the 7700 to do just that. Unlike traditional rack and stack instruments, the 7700 is a synthetic solution that provides tight coupling of signal generation, measurements, and DUT control. This removes the additional software overhead and measurement processing necessary to make independent calls to several instruments and the DUT when executing a test.

In addition, by providing a complete turnkey ATE solution, the 7700 saves device manufacturers months of test system development and integration time. Finally, calibration of the 7700 is handled at the system level, using traceable standards. This approach produces the best possible system performance and reduces the errors and overall system uncertainty associated with piecewise calibrations. In addition, system level calibration increases system availability and reduces support costs by eliminating the need for long calibration cycles, calibration services, and calibration equipment carts.

Future-Proof Design

When selecting a test solution, RF device manufacturers are often faced with a difficult decision: acquire a system with just enough performance to meet today's needs or procure a more expensive solution to cover the unknown requirements of tomorrow. The 7700's true synthetic architecture makes this decision much easier. With traditional instrumentation, when new measurements or increased performance are required, the test engineer is forced to replace the instruments used in the test system. Measurement software which was developed using these instruments will need to be modified or completely rewritten as well. When considering these factors, it is often more economical to simply replace the entire system rather than upgrade to new capability. With the 7700's modular synthetic approach, most new measurements will require only a new software sequence. When new hardware is needed to meet new requirements, such as higher instantaneous bandwidth, typically only a couple of PXI cards will need to be replaced. Since the 7700 measurement sequences utilize a synthetic hardware driver layer, none of the existing measurement sequences will be affected with the addition of the new hardware.

Aeroflex Measurement Console (AMC) – A Complete Test Executive and Measurement Development Environment

The Aeroflex Measurement Console (AMC) provides a complete measurement and development environment, including test execution, sequencing of multiple tests, and reporting of test data as well as test development and debug. In addition, the overall software architecture of the 7700 provides a flexible platform that can fit into most existing operational scenarios.

AMC – Test Execution

Figure 2 illustrates the major features of an AMC measurement panel. From this interface, the test engineer or operator may select and execute tests, create sequences of tests, input variable parameters, access test results, set up default settings and parameters, and perform a wide variety of test related functions. The display includes a tree view of available test sequences, an area for user interactive input of variable parameters and a window for viewing the test results.

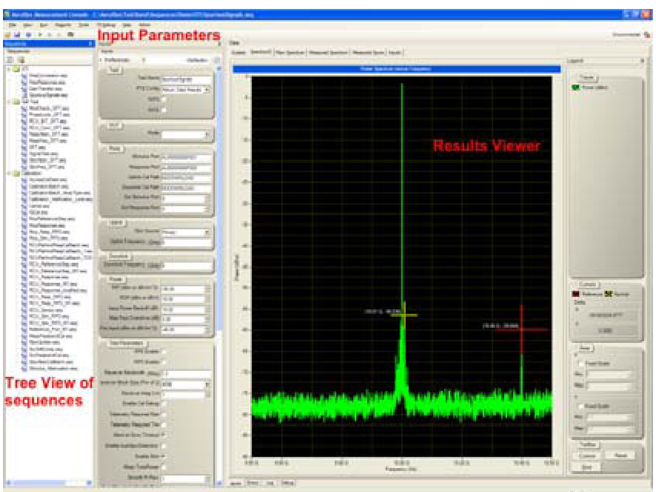


Figure 2. The 7700 user interface screen

The user input area of the panel is defined within the measurement sequence and may be modified by any user with the appropriate privileges. This allows test developers to customize the look and feel of the display provided to the user, without the need to modify any compiled software. Additionally, since measurement sequences are editable, a developer may customize standard Aeroflex measurement sequences to provide the exact look, feel and operation required to meet individual needs.

The AMC presents measurement data in both graphical and tabular form. The results window provides a series of tabs, allowing the operator to select available plots and tables. Graphical displays provide analysis tools, including cursors and readouts, to provide enhanced, interactive interpretation of the data. Various scalar values associated with each measurement are also stored, including test execution times, measurement parameters and software revisions, as well as event and error logs.

Measurement results can be automatically saved to XML files with file names reflecting the test name, date and time of execution. Integration with existing data storage schemas is easily implemented. Results can also be exported to Microsoft® Excel. Results stored to an Excel workbook are transferred with each tab from the AMC results window mapped to a worksheet on a one-to-one basis as illustrated in Figure 3.

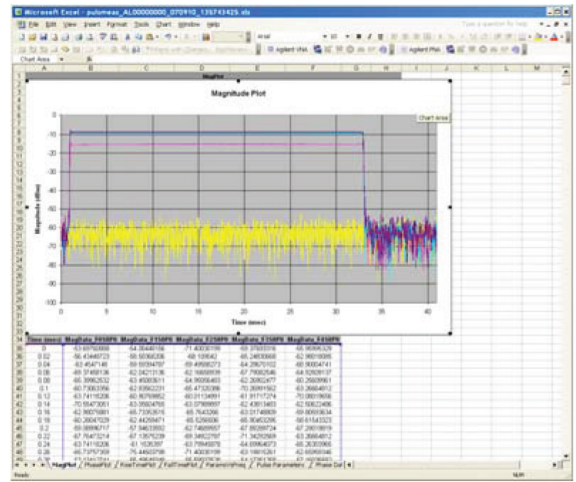


Figure 3. Test results exported to excel workbook

AMC – Test Sequencing

The AMC provides the ability to build a complete test profile for the device under test, including application and sequencing of DUT power, execution of multiple tests, application of pass/fail criteria (limits), and the generation of a report. The AMC provides this capability using a queue mode of operation as shown in Figure 4. In queue mode, the operator may select individual sequences to be executed in series, each with a different set of input parameters (called preferences). The operator may also specify pass/fail limits and data sets to be included in the final report.

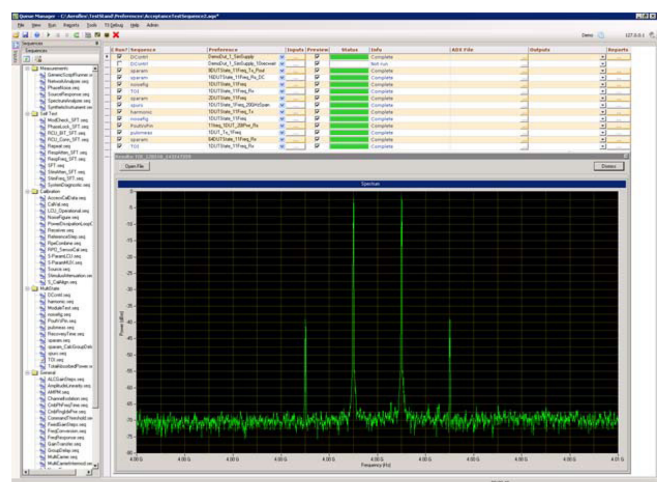


Figure 4. AMC in queue mode

AMC – Test Development and Debug

The AMC provides a full-featured test development environment. Tests are implemented in the AMC using National Instruments TestStand™ sequences. Test sequences can be generated from within the AMC environment or using the National Instruments sequence editor. Once generated, sequences may be interactively edited and debugged within the AMC environment, allowing the developer to see real-time results on the target system software and hardware. Common debugging features such as breakpoints and step modes are provided to allow test developers to debug tests. Figure 5 shows a typical AMC debug screen.

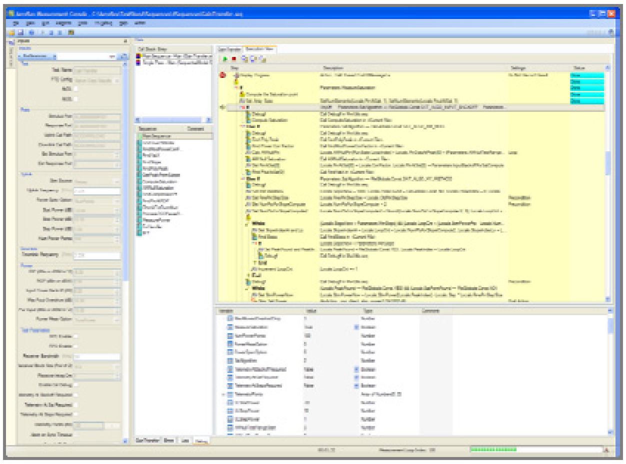


Figure 5. AMC in debug mode

AMC measurement sequences can also call code modules developed using various, industry-standard programming environments and languages, including LabVIEW™, LabWindows™/CVI™, C#, VB, .NET, C/C++, HTBasic and ActiveX. Measurement sequences can be built utilizing code modules provided by Aeroflex, available from existing software applications, or developed by in-house experts.

Device Under Test Control – User Configurable and Flexible

With traditional instrumentation, system engineers are often forced to develop an independent DUT control scheme separate from the measurement instruments. This usually requires additional hardware and software to be added to the system architecture.

The 7700 approach provides integrated DUT control, which results in faster measurement throughput due to reduced software overhead, less equipment handshaking, and shorter delays between data collections. This approach also saves engineering cost by minimizing the number of software and hardware components that must be changed to support new devices.

There are multiple programmable power supply options available for the 7700. If one or two relatively low current supplies are required, the supplies can be housed within the 7700 base unit. For high power or for a large number of supplies, the supplies are located externally to the 7700 unit. DUT control is provided via a programmable pattern generator which supports high-speed digital I/O as well as timing pulse generators with sub-nanosecond placement in time. The power supplies, pattern generator, and pulse generator modules are completely controlled via system software, allowing for tight coupling to the measurement to maximize speed and efficiency.

Tying the DUT power supplies, the DUT control and the measurement sequences together is the DUT DLL. One DLL contains all of the DUT-specific information associated with the DUT itself and the required control elements. The strength of this approach is that neither the hardware, such as the power supplies and digital control, or the measurement sequences requires any detailed knowledge of the DUT. Therefore, the measurement sequences are completely DUT independent and may be shared across many different applications and test stations. In addition, the DUT DLL may be developed by the end user, thus removing the dependence of the end user on the test equipment manufacturer.

Multiple Interfaces Offers Programming Flexibility

The 7700 presents several different interfaces to the user to support integration into existing test infrastructures. These interfaces include a remote interface, a local interface and an instrument DLL for direct control of the hardware. Figure 6 shows a functional diagram that shows these interfaces.

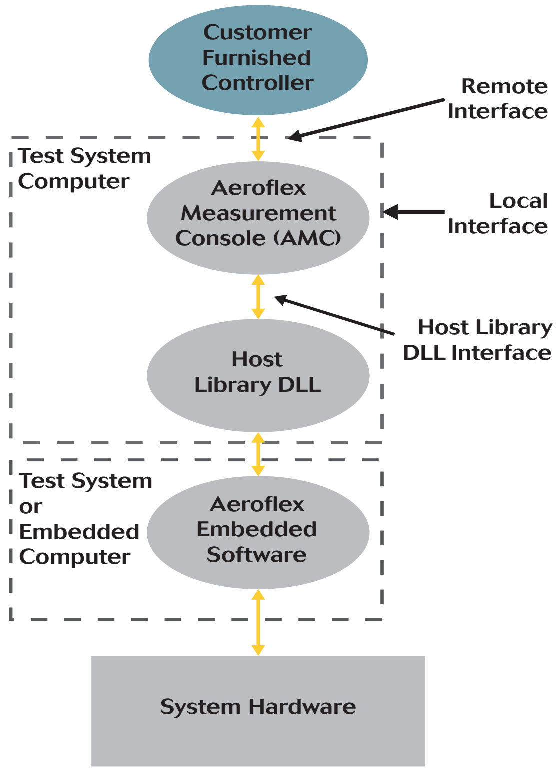


Figure 6. Interface options

The remote interface supports infrastructures in which a customer furnished system controller controls the DUT, sequences the tests and manages the flow of data results. The remote interface supports both execution of tests (input parameters and execution) and the retrieval of results from the system.

The local interface supports cases in which the user operates the 7700 as a stand-alone unit. Using AMC, all aspects of DUT control, test sequencing and data management are controlled from within the 7700 environment.

The DLL interface supports cases in which the user treats the 7700 as an embedded instrument. In this case, the user controls the 7700 via the DLL much like any other traditional instrument, such as a spectrum analyzer or vector network analyzer. However, unlike a traditional instrument, the DLL presents a signals based interface to the software that supports stimulus signal generation, signal routing and measurements. This approach allows the programmer to think about the measurements they are trying to make, not the interfacing and configuration details of an entire suite of test equipment

A True Synthetic Architecture

The 7700 is a true synthetic architecture. Figure 7 shows the fundamental building blocks contained in the 7700.

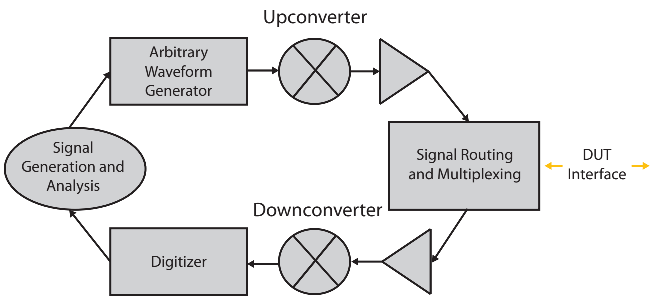


Figure 7. System architecture

The system utilizes a common set of hardware for stimulus and response functions. This common utilization reduces hardware costs, results in a smaller footprint than conventional systems and allows for a system level calibration scheme that provides superior performance as compared to a traditional rack and stack approach.

Configurations and Measurements for Many Applications

The base 7700 is delivered with measurement sequences that provide basic measurement capability including the emulation of signal generators, spectrum analyzers, and vector network analyzers. In addition to the basic sequences, comprehensive libraries are available that provide many measurements typically performed during the characterization and test of RF devices. In general, these measurement sequences provide the ability to generate complex stimulus signals, receive the response signals from the DUT, and process the data to derive the required data product, all while providing tightly synchronized control of the DUT. The tables below show some of the additional measurement personalities that are available for the 7700.

Pulse Amplifier Measurements
S-parameter (CW and Pulsed)
Pout versus Pin
Time Domain Measurements and Pulse Characterization
Total Absorbed Power
Noise Figure (Y-factor)
Hot S22
CW and Frequency Translated Measurements
Pout versus Pin
Frequency Response/conversion
Spectrum, Spurs, Harmonics
Third Order Intercept
AM/PM
Channel Isolation
Noise Figure (cold source)
Group Delay
Absolute Time Delay
Phase Noise
Multi-tone Measurements
Noise Power Ratio
Passive Intermodulation (PIM)
Multi-carrier Relative Amplitude and Phase

Expansion to Higher Frequencies

The 7700 is available in configurations to support up to 26.5 GHz in a single unit.

The baseline single chassis supports 6 GHz operation. The 26.5 configuration requires an additional chassis. Figure 8 shows an example 26.5 GHz system.

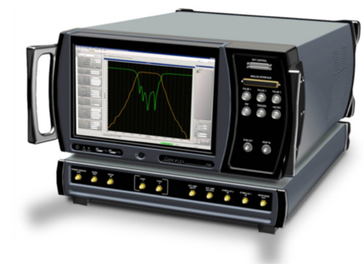


Figure 8. High Frequency Configuration

Contact your Aeroflex representative today to arrange a demonstration and see for yourself why the 7700 provides the industry's fastest and most complete automated test solution.

7700 PRODUCT SPECIFICATIONS

The specifications for the 7700 are dependent on the various system options. The key specifications for the 7700 are specified in separate sections based on frequency coverage.

STIMULUS (6 GHz)

Frequency Range

1 MHz - 6 GHz

Frequency Resolution

1 MHz to 3 GHz	1 Hz
3 to 6 GHz	2 Hz

Output Power

Typical 1MHz to 2GHz	+10 dBm
Typical 2 to 4GHz	+7 dBm
Typical 4 to 6GHz	+5 dBm

Output Power Range

>100 dB

Output Power Resolution

0.02 dB

Frequency Switching Times

<1 msec

RF Modulation BW

90 MHz

Dual Channel AWG Memory (Options to 512 Msamples)

128 Msamples

Modulation Types

AM, FM, PM, Pulse, Vector (loaded waveform)

Phase Noise (2 GHz, 20 KHz offset)

-115 dBc/Hz

Spurious (>10 KHz offset, CW)

-70 dBc typical

PULSE MODULATION

Rise/Fall Time

<10 nsecs

Minimum Pulse Width

20 nsecs

Maximum PRF

5 MHz

On/Off Ratio

80 dB Typical

NOISE SOURCE

ENR (10 MHz to 3 GHz)

20 dB

ENR (3 to 6 GHz)

15 dB

Level Control

31 dB

RESPONSE (6 GHz)

Frequency Range

1 MHz to 6 GHz

Instantaneous BW

90 MHz

Digitizer

14 bits, 250 MS/sec

Sample Memory

Up to 512 MByte

Residual Noise Floor

<-100 dBm

Maximum Input Power

+28 dBm

Input Attenuator

0 to 50 dB, 10 dB steps

Frequency Switching Times

<1 msec

Phase Noise (2 GHz, 20 kHz offset)

-110 dBc/Hz

Spurious (>10 KHz offset, CW)

-75 dBc typical

GENERAL MEASUREMENTS (6 GHz)

POWER

Frequency Range

1 MHz to 6 GHz

Modes

Tone power, total power

Amplitude Uncertainty

±0.25 dB (to -50 dBm)

FREQUENCY

Frequency Range

1 MHz to 6 GHz

Modes

CW, modulated

Frequency Resolution

1 Hz

Sensitivity

-60 dBm

Time Base Accuracy

See Frequency Reference

NOISE FIGURE

Frequency Range

10 MHz to 6 GHz

Measurement Uncertainty

0.3 dB

TIME DOMAIN

Frequency Range

1 MHz to 6 GHz

Sensitivity

-60 dBm

Resolution

4 nsecs

VECTOR NETWORK ANALYSIS (6 GHz)

Frequency Range

100 MHz to 6 GHz

Modes

CW, pulsed

S21 Amplitude Uncertainty

0.125 dB (10 dB insertion loss)

S21 Phase Uncertainty

1.5 deg (10 dB insertion loss)

S11 Reflection Coefficient Uncertainty

0.015 (Linear)

Dynamic Range

>100 dB

SPECTRUM (6 GHz)

Frequency Range

1 MHz to 6 GHz

Resolution Bandwidth Range

1 Hz to 10 MHz

Video Bandwidth Range

RBW / N (1 < N < 65536) N in powers of 2

Reference Level Range

+28 dBm to noise level

Amplitude Resolution

0.02 dB

RELATIVE POWER UNCERTAINTY

Input Level >-60 dBm

0.5 dB

-90 dBm < Input Level <-60 dBm

1.0 dB

Spurious Free Dynamic Range

75 dB nominal

DANL (1 Hz res bandwidth)

1 MHz to 2 GHz

-150 dBm/Hz

2 to 4 GHz

-145 dBm/Hz

4 to 6 GHz

-140 dBm/Hz

STIMULUS (26.5 GHz MICROWAVE VECTOR SOURCE)

Frequency Range

6 to 26.5 GHz

Frequency Resolution

4 Hz

Output Power

6 to 20 GHz	+10 dBm
20 to 26.5 GHz	+5 dBm

Output Power Range

>100 dB

Output Power Resolution

0.01 dB

Frequency Switching Times

<5 msec

RF Modulation BW

90 MHz (other options available for larger bandwidths)

Dual Channel AWG

128 Msamples

Modulation Types

AM, FM, PM, Pulse, Vector (loaded waveform)

Pulse Modulation

Rise/Fall Time

<10 nsecs

Minimum Pulse Width

20 nsecs

Maximum PRF

5 MHz

On/Off Ratio

80 dB typical

Spurious (>10 KHz offset, CW)

-60 dBc typical

Harmonics

-25 dBc (typical)

Internal 10 MHz Reference Stability

<±3 x 10^{-8}/year or

<±2.5 x 10^{-10}/day after 30 days

RESPONSE (26.5 GHz)

Frequency Range

6 to 26.5 GHz

Instantaneous BW

90 MHz (Higher bandwidth options available)

Digitizer

14 bits, 250 MS/sec

Residual Noise Floor

<-110 dBm

Maximum Input Power

+30 dBm Average

+45 dBm Average (with optional power dissipation loop)

+51 dBm Pulsed (20% duty cycle, power dissipation loop)

Input Attenuator

0 to 90, 10 dB steps

Frequency Switching Times

<5 msec

Spurious (>10 KHz offset, CW)

-70 dBc typical

GENERAL MEASUREMENTS (26.5 GHz)

POWER MEASUREMENT

Frequency Range

6 to 26.5 GHz

Measurement Uncertainty

(Power >-50 dBm)

6 to 20 GHz	0.2 dB
20 to 26.5 GHz	0.3 dB

Resolution

0.1 dB

FREQUENCY

Frequency Range

6 to 26.5 GHz

Modes

CW, modulated

Frequency Resolution

1 Hz

Sensitivity

-60 dBm

Time Base Accuracy

See Frequency Reference

NOISE FIGURE

Frequency Range

6 to 26.5 GHz

Resolution

0.01 dB

Measurement Uncertainty

6 to 26.5 GHz 0.3 dB

TIME DOMAIN

Frequency Range

6 to 26.5 GHz

Sensitivity

-60 dBm

Resolution

4 nsecs

Risel/Fall Time

±20 nsecs

Droop

0.1 dB minimum

0.1 dB resolution

VECTOR NETWORK ANALYSIS

Frequency Range

6 to 26.5 GHz

Modes

CW, Pulsed

S21 Amplitude Uncertainty (±) (at 10 dB insertion loss)

6 to 20 GHz	0.125 dB
20 to 26.5 GHz	0.25 dB

S21 Phase Uncertainty (±) (at 10 dB insertion loss)

6 to 20 GHz	1.5 deg
20 to 26.5 GHz	2.0 deg

S11 Reflection Coefficient Uncertainty (±, Linear)

6 to 20 GHz	0.015
20 to 26.5 GHz	0.020

Dynamic Range

>110 dB

SPECTRUM (26.5 GHz)

Frequency Range

6 to 26.5 GHz

Resolution Bandwidth Range

1 Hz to 10 MHz

Video Bandwidth Range

RBW / N (1 < N < 65536)
N in powers of 2

Reference Level Range

+30 dBm to noise level

Amplitude Resolution

0.02 dB

RELATIVE POWER UNCERTAINTY

Input Level >-60 dBm

0.5 dB

-90 dBm < Input Level <-60 dBm

1.0 dB

-100 dBm < Input Level <-90 dBm

2.0 dB

DANL (1 Hz Bandwidth)

6 to 20 GHz

-150 dBm/Hz

20 to 26.5 GHz

-145 dBm/Hz

Spurious Free Dynamic Range

75 dB (nominal)

GENERAL (ALL CONFIGURATIONS)

DUT CONTROL

Number of Bits

32

Logic Level

LVDS

Clock Rate

Up to 100 MHz

TIMING SIGNAL GENERATION

Number of Pulses

6

Resolution

0.1 nsecs

Pulse Repetition Interval Max/Min

1 Hz to 5 MHz

Pulse Repetition Interval Resolution

20 nsecs

FREQUENCY REFERENCE

Frequency

10 MHz

Modes

Internal/external

Temperature Range

0°C to 50°C

Warm-up Time

10 min.

Temperature Stability

Tipically better than +/- 1×10^{-8}

Aging

1 in 10^9 per day

1 in 10^7 per year

DC Power Supply

Multiple options available

AC INPUT POWER

Input Voltage (Single Phase)

100 to 250 VAC

47 to 63 Hz

1000 w max

Mains Supply Voltage Fluctuations

≤10% of the nominal voltage

Fuse Requirements

10A, 250V, Type F

DIMENSIONS AND WEIGHT (6 GHz)

Height

8 in. (5 Rack Units)

Width

17.5 in. (19" Rack Mount)

Depth

24 in.

Weight

52 lbs.

DIMENSIONS AND WEIGHT (26.5 GHZ)

Height

12.25 in (7 Rack Units)

Width

17.5 in (19" Rack Mount)

Depth

24 in

Weight

80 lbs

ENVIRONMENTAL (ALL CONFIGURATIONS)

Operating Temperature[1]

0 to 50°C (single 7700 chassis)

Storage Temperature[1]

-40 to 71°C

Warm Up Time

30 min.

Relative Humidity[1]

80% up to 31°C decreasing linearly to 50% at 40°C

Altitude[1]

4.600 m (15, 092 ft)

Shock and Vibration[1]

30 G Shock (Functional Shock) 5-500 Hz random vibrations

Use

Pollution degree 2

Safety Standards

EN 61010-1, IEC 61010-1

EMC

Mil-PRF-28800F EN 61326-1: Class A EN61000-3-2 EN61000-3-3

[1] Tested in accordance with MIL-PRF-28800F Class 3

SYSTEM OPTIONS

The 6 GHz and 26.5 GHz configurations of the Aeroflex 7700 can be used as completely integrated microwave test system. However, since the 7700 has the capability to control many external devices, the 7700 can also be used as a system building block in a larger test system environment. External devices such as additional microwave sources, RF multiplexers, external test equipment and Device Under Test power supplies can be fully integrated into a single system solution including measurements, calibration and diagnostics. Several common options are listed below. Contact Aeroflex to learn how to use the 7700 in your unique system configuration.

Item	Description
Base 7700 Unit - 6 GHz	Stimulus and response coverage to 6 GHz AWG based stimulus signal generation, Includes Aeroflex Maintenance Console with instrument panels and integrated measurements Analog and vector source Spectrum analyzer Network analyzer Noise figure meter
Frequency Extension to 26.5 GHz	Extension of stimulus and response frequency coverage to 26.5 GHz
12 port RF Mux and S-parameter with test set (26.5 GHz)	Addition of external 12 port RF Multiplexer with integral S-parameter test set
DUT DC Power	Multiple options available for DUT DC Power
UPS	Addition of uninterruptible power supply
Amplifier	Addition of high power amplifier
Source	Addition of source for multi-tone measurements

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AEROFLEX
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Our passion for performance is defined by three attributes represented by these three icons: solution-minded, performance-driven and customer-focused.

Part No. 46891/497, Issue 3, 08/14