

Synthetic

STI 1000C+ Satellite Payload Test Environment

AEROFLEX
A passion for performance.



- **Complete synthetic test environment**
Hardware, software, processes, support
- **Optimized for satellite tests**
- **Connectivity for up to 384 channels**
- **Full test suite for common satellite tests**
- **Highest test throughput available**
- **Proven systems deployment**
5th generation solution – major customers worldwide
- **Full range of required mixed signal capabilities**
DC, digital, analog, RF/Microwave
- **System Level Architecture**
Calibration, verification, alignment
- **Open System Architecture**
System Hardware and Software, Test Program Sets (TPS)

The STI 1000C+ Satellite Test Environment is a complete test environment from Aeroflex. The STI 1000C+ encompasses hardware, software, test practices and support along with standard and customizable test programs tailored to the specific problems of testing high performance payloads. Such payloads consist of many channels, with possibly hundreds of connections, between the test system and payload under test.

The Aeroflex STI 1000C+ Test Environment is based upon the 5th generation evolution of Aeroflex's synthetic test technology. Aeroflex synthetic test systems are successfully deployed in a variety of high performance test applications including satellite payload test, advanced T/R module test and military ATEs.

A Synthetic Test System is comprised of stimulus and measurement channels which are made available to the test system engineer, payload developers, and production engineers in the form of a functionally integrated collection of hardware and software components. For example, a multi-stage up-converter consisting of a digital baseband signal source or a high quality oscillator (or both on a multiplexed basis) with IF up conversion and filtering, and tunable RF up conversion and filtering, can effectively provide the same functionality of a high performance microwave synthesizer. A functionally integrated set of modules consisting of an RF/microwave down-converter with signal conditioning and an IF down-converter with filtering and digitizing functions, coupled with Digital Signal Processing software, readily performs measurements traditionally requiring a rack-and-stack combination of power meters, network analyzers, and spectrum analyzers instruments. This modular approach in a synthetic system yields an architecture that by means of stimulus and measurement functions provides distinctive configuration and reconfiguration) system footprint, test accuracy and speed, and reliability.

Aeroflex began shipping synthetic test systems for satellite testing in 1999, providing the highest throughput and high accuracy testing of satellites available. With these test environments, customers have literally reduced complex satellite test times from weeks to nominally days for the same test suite.

The STI 1000C+ brings about the advantages of integrating COTS system components from multiple vendors in the Aeroflex hybrid test environment thus providing a cost effective test solution fully optimized for the requirements of the devices to be tested. The STI 1000C+ provides greater configurability through COTS modularity characterized by the use of recognized and well established industry standards, a highly developed software suite, proven operational test practices, and long-term, leadership support programs. The finely balanced combination of these attributes is what makes the STI 1000C+ a complete environment offering with the convenience and advantages brought by a single-vendor system responsibility.

Synthetic test environments offer the lowest total cost of test, largest throughput increases, and typically take less than half the rack space, weight, and power consumption/heat generation of conventional, rack-and-stack, instrument-based systems. In addition, even for hybrid configurations, the number of instruments and associated dedicated measurement paths is reduced. Thus, the scope and complexity of calibration is also reduced. Furthermore, since most groups of measurements for any given configuration utilize the same down-converter – digitization channel, there is a much greater time correlation and lower uncertainty among these measurements than when individual instruments are sequentially multiplexed.

TYPICAL STI 1000C+ CHARACTERISTICS

An STI 1000C+ Satellite Test Environment may be flexibly composed of various combinations of the following hardware, software and support elements.

HARDWARE

Stimulus Subsystem Including

- One or more Synthetic RF/microwave Stimulus Channels operating to 32 GHz
- Multi-tone wideband signal generator
- Auxiliary stimulus channel(s) for multi-tone measurements or other multi-source applications
- Power amplifier units

Measurement Subsystem Including

- Synthetic RF/microwave response measurement channel configured for operation to 32 GHz with RF bandwidth of 400 MHz. Utilizes either narrowband or both narrowband and broadband digitizer subsystems
- Optional auxiliary measurement channels implemented as synthetic channels or as specific purpose instrumentation components
- Switched low noise amplifier units
- High performance digitizers which may be used for a variety of signal capture functions

Signal Calibration and Routing

- Local Calibration Unit (LCU) for calibrating RF/microwave signals to NIST traceable standards
- Multiple port Remote Calibration Units (RCUs) for connection to the payload

SOFTWARE

- Microsoft® Server 2003 operating system and Microsoft® Office
- National Instruments TestStand - Test Management Software
- .NET framework 3.5
- Aeroflex Measurements Console (AMC), sequencer and user operating interface
- Aeroflex designed API DLL functions for enabling customer driven interfaces to the system
- T/R Module measurements library
- General measurements library
- Test customization
- Simulator software.

Test Practices

- Hierarchical calibration
 - Base, operational, reference plane extensions
 - Base cal requires calibration of only a few transfer standards, not the synthetic components
- System verification while UUT is connected
- Built-in reference plane extension from the calibration plane to the test ports' plane via measurement or s-parameter files
- Uncertainty specifications at the system level

Satellite Testing

Using the STI 1000C+

Aeroflex has more than ten years of experience in fielding and maintaining satellite test systems.

Even though there are similarities among satellite payloads no two are exactly alike and no two manufacturers have precisely the same test strategies and methodologies. Consequently, while there are common core elements for each of the satellite test systems Aeroflex has implemented, there are also unique aspects associated with each type of system sold to any single customer.

From a test system vendor perspective, the objective is to create a test environment solution based upon a necessary and sufficient set of core capabilities which fully address the common aspects of satellite test but remain flexible enough to be easily customized to match the unique requirements of a given payload and customer specific requirements.

Aeroflex routinely provides complete test systems with all of the standard tests associated with satellite payload testing. The Aeroflex supplied standard measurement library is shown in Table 1.

Table 1 - Satellite Test Library

| | |
|-----------------------------------|---------------------------------|
| Gain Transfer/ALC Characteristics | Group Delay/Phase vs. Frequency |
| Frequency Response | Noise Power Ratio (NPR) |
| Frequency Conversion | Passive Intermodulation (PIM) |
| Spectrum, Spurious | Fixed Gain Steps |
| Amplitude Linearity | ALC Gain Steps |
| AM to PM | Command Threshold |
| Channel Isolation | Multicarrier |
| Noise Figure | Multicarrier Phase Peak |
| Modulation Index | Relative Amplitude and Phase |

Aeroflex has also introduced a generic test management interface called the Aeroflex Measurement Console (AMC). 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.

Figure 1 illustrates the topology of the AMC encompassing a tree view of test sequences saved in a file, an area for user interactive input of variable parameters and a window for viewing the results of the tests. Test data are presented as graphs, tables and records of various scalar values associated with the test such as test execution times and all the parameter settings active at the time of execution of the test. Error logs or logs of the steps individually followed in executing the test are also made available. The test results area displays a tabbed window in which the various measurement results are displayed. Results can be automatically saved to files with formula names reflecting tests, date and time of execution. Integration with existing data storage schemas is easily implemented. All results can also be exported to Excel and XML.

The test results may be exported into an Excel workbook with tabbed results mapped to spreadsheets on a one-to-one basis as illustrated in Figure 5.

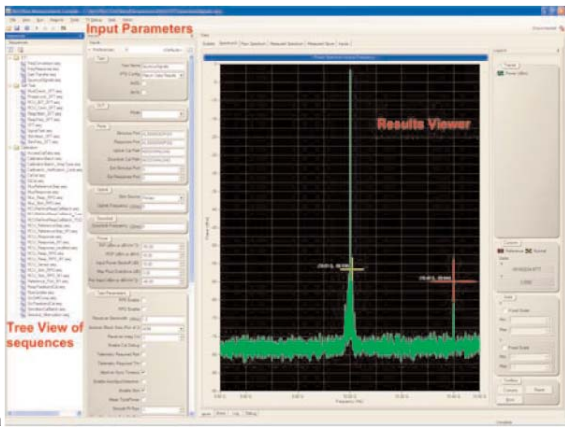


Fig 1. Topology of the Aeroflex Measurement Console (AMC)

Figure 2 illustrates the application of the AMC to a satellite payload in which the frequency response of a channel is being measured.

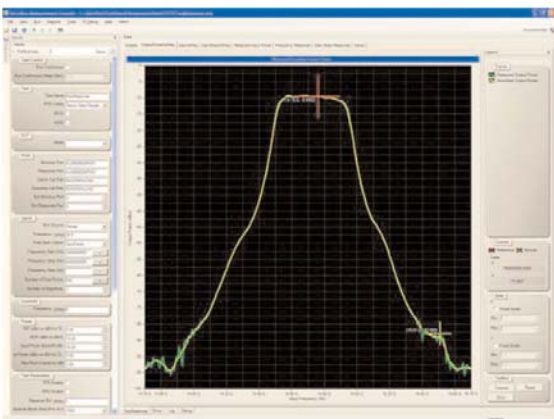


Figure 2. Frequency Response Measurement

In Figure 3, selecting another tab in the results display window provides access to the gain slope characteristics, which is obtained from the Frequency Response Data. Other tabs can be selected to present tabulated data from the tests as shown in Figure 4.

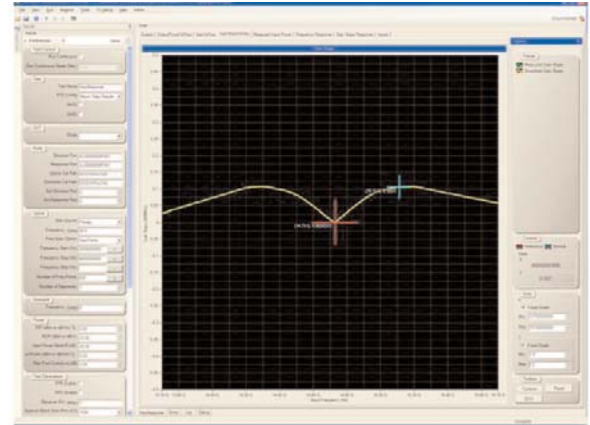


Fig 3. Gain Slope Measurement

Fig 4. Tabulated Measurement Results

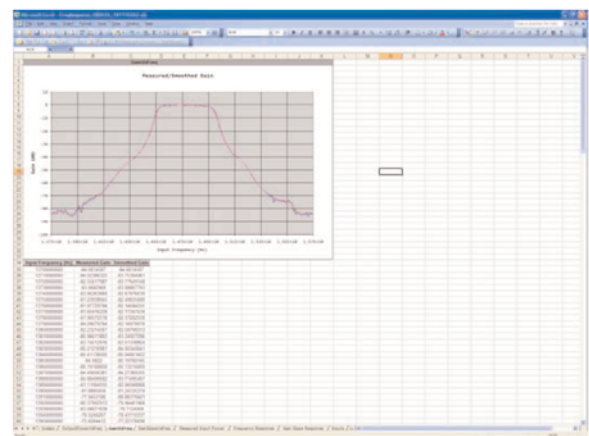


Fig 5. Example of Data Exported to Excel

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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.