Broadband Signal Analyzers and Generators

CS9000 Instrument Family

AEROFLEX
A passion for performance.

Other analyzers tell you what happened. The Aeroflex BSA shows you why.

The CS9000 family of instruments is designed to find and solve the toughest RF issues. It combines live and off-line signal processing capabilities to address multiple test applications, including:

- Communications
- Radar
- Satellite
- Electronic Warfare (EW)
- Electromagnetic Environment (EME)
- Drive (mobile collections)

The CS9000 provides record, playback, analysis, and generation capabilities in a modular architecture that allows it to be configured for nearly any application. Table 1 highlights the elements that can be combined to create a unique instrument aimed at a particular RF challenge.

In the table below, a Broadband Signal Analyzer (BSA) is a recorder and analysis channel. A Broadband Signal Generator (BSG) is a playback and generator channel.

All the elements below come with 32 GB RAM and digital up or down converter (DUC or DDC) standard. Additionally, up to 14 TB of streaming RAID recording/playback storage can be added as an option to extend record and/or play times. The elements can be combined to support systems with up to eight channels in various packaging schemes with different controller computers. The systems composed from these elements are BSAs, BSGs, or Broadband Signal Analyzer and Generators (BSAGs) when both analyzer and generator channels are combined in a single system.

RF Module	Frequency Range	SFDR	Instant Bandwidth (1 dB)	Store Time @ Max BW (32 GB RAM)	Extended Store Time at Max BW (14 TB RAID)
BSA 06-N	2 MHz - 6 GHz	65 dB	60 MHz	81 s*	610 min
BSA 06-W	2 MHz - 6 GHz	48 dB	400 MHz	28 s	213 min
BSA 06-NW	2 MHz - 6 GHz	65 dB 48 dB	60 MHz or 400 MHz	81 s* 28 s	610 min 213 min
BSA 18-N	10 MHz - 18 GHz	65 dB	60 MHz	81 s*	610 min
BSA 18-W	10 MHz - 18 GHz	48 dB	400 MHz	28 s	213 min
BSA 18-NW	10 MHz - 18 GHz	65 dB 48 dB	60 MHz or 400 MHz	81 s* 28 s	610 min 213 min
BSG-06-N	2 MHz - 6 GHz	65 dB	60 MHz	81 s*	610 min
BSG-06-W	2 MHz - 6 GHz	55 dB	400 MHz	28 s	213 min
BSG-06-NW	2 MHz - 6 GHz	65 dB 55 dB	60 MHz or 400 MHz	81 s* 28 s	610 min 213 min
BSG-18-N	10 MHz - 18 GHz	60 dB	60 MHz	81 s*	610 min
BSG-18-W	10 MHz - 18 GHz	55 dB	400 MHz	28 s	213 min
BSG-18-NW	10 MHz - 18 GHz	60 dB 55 dB	60 MHz or 400 MHz	81 s* 28 s	610 min 213 min

Table 1. CS9000 frequency and bandwidth specifications

*Record and play times can be extended using the built in digital tuners by decreasing the effective bandwidth.

The CS9000 also supports system options for:

- Additional gain
- GPS
- GPS/IRIG time latch/match and 10 MHz reference
- Accelerated/multiple monitor graphics
- Transit case or rack packaging
- NIST traceable calibration to ANSI Z540

More detailed performance information for each RF module and the NIST Z540 calibration is available in the specification sections below.

The heart of every CS9000 systems is the software that provides the user control over the instrument. BSA software provides graphical recording and analysis operations, while Vector Signal Simulator (VSS) supports signal generation and Vector Signal Player (VSP) controls file playback.

BSA and VSS support a rich set of processing options described in more detail in the software options section below.

SPECIFICATIONS

BSA-06-N SPECIFICATIONS

Parameter	6 GHz NB	Notes
Frequency Range	*2 MHz to 6 GHz*	
Instantaneous Bandwidth	*60 MHz*	*Limited by IF filtering*
Digital Tuner Bandwidths	*42 MHz to 41 kHz*	*/4 to /4096 (powers of 2)* *Max BW dependent on system configuration (powers of 2)*
Input Power	*+15 to -10 dBm*	*CW average power, full-scale ADC input*
Gain Range/Resolution	*25 dB/1 dB*	
Passband Flatness	*1.6 dB p-p*	*Typical. Maximum variation across any passband*
Spurious Free Dynamic Range	*65 dB*	*Typical. CW, -1 dB from full-scale*
Input VSWR	*2:1*	*50 ohms input impedance*
Input Filtering	*IF Bandpass* *Anti-Aliasing Filters*	
Tuning Frequency Resolution	*1 Hz*	
Internal Reference	*10 MHz*	*External reference input also provided*
Phase Noise	*<-125 dBc/Hz @ 1 MHz*	*Typical*
ADC Resolution	*12-bits*	
Clock Rate	*210 MHz*	*Reduced clock rate when using digital tuners*

BSA-06-W SPECIFICATIONS

Parameter	6 GHz WB	Notes
Frequency Range	*10 MHz to 6 GHz*	
Instantaneous Bandwidth	*400 MHz*	*Limited by IF filtering*
Digital Tuner Bandwidths	*None*	
Input Power	*+15 to -10 dBm*	*CW average power, full-scale ADC input*
Gain Range/Resolution	*25 dB/1 dB*	
Passband Flatness	*2.0 dB p-p*	*Typical. Maximum variation across any passband*
Spurious Free Dynamic Range	*48 dB*	*Typical. CW, -1 dB from full-scale*
Input VSWR	*2:1*	*50 ohms input impedance*
Input Filtering	*IF Bandpass* *Anti-Aliasing Filters*	
Tuning Frequency Resolution	*1 Hz*	
Internal Reference	*10 MHz*	*External reference input also provided*
Phase Noise	*<-125 dBc/Hz @ 1 MHz*	*Typical*
ADC Resolution	*8-bits*	
Clock Rate	*1.2 GHz*	

BSA-06-NW SPECIFICATIONS

Parameter	6 GHz WB	Notes
Frequency Range	10 MHz to 6 GHz	NB low end limited to 10 MHz in WB/NB configuration
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Digital Tuner Bandwidths	None	
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	48 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	1 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	<-125 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits	
Clock Rate	1.2 GHz	Reduced clock rate when using digital tuners
Parameter	**18 GHz NB**	**Notes**
Frequency Range	2 MHz to 18 GHz	
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	65 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits	
Clock Rate	210 MHz	Reduced clock rate when using digital tuners

BSA-18-N SPECIFICATIONS

Parameter	18 GHz NB	Notes
Frequency Range	2 MHz to 18 GHz	
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	65 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits	
Clock Rate	210 MHz	

BSA-18-W SPECIFICATIONS

Parameter	18 GHz WB	Notes
Frequency Range	10 MHz to 18 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Digital Tuner Bandwidths	None	
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.5 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	48 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits	
Clock Rate	1.2 GHz	

BSA-18-NW SPECIFICATIONS

Parameter	18 GHz WB	Notes
Frequency Range	10 MHz to 18 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Digital Tuner Bandwidths	None	
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.5 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	48 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits	
Clock Rate	1.2 GHz	
Parameter	**18 GHz NB**	**Notes**
Frequency Range	10 MHz to 18 GHz	NB low end limited to 10 MHz in WB/NB configuration
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input
Gain Range/Resolution	25 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range	65 dB	Typical. CW, -1 dB from full-scale
Input VSWR	2:1	50 ohms input impedance
Input Filtering	IF Bandpass Anti-Aliasing Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits	
Clock Rate	210 MHz	Reduced clock rate when using digital tuners

BSG-06-NW SPECIFICATIONS

Parameter	18 GHz NB	Notes
Frequency Range	10 MHz to 18 GHz	
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Input Power	+15 to -10 dBm	CW average power, full-scale ADC input

BSG-06-N SPECIFICATIONS

Parameter	6 GHz NB	Notes
Frequency Range	2 MHz to 6 GHz	
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Reduced clock rate when using digital tuners
Output Power	-10 to -60 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	50 dB/1 dB	
Passband Flatness	1.6 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	65 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	1 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	<-125 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits/14-bits	
Clock Rate	210 MHz	Reduced clock rates when using digital tuners

BSG-06-W SPECIFICATIONS

Parameter	6 GHz WB	Notes
Frequency Range	10 MHz to 6 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Output Power	-10 to -60 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	50 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	55 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	1 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	<-125 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits/14-bits	
Clock Rate	1.2 GHz	

BSG-06-NW SPECIFICATIONS

Parameter	6 GHz WB	Notes
Frequency Range	10 MHz to 6 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Digital Tuner Bandwidths	None	
Output Power	-10 to -60 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	50 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	55 dB	Typical. CW, -1 dB from full-scale
Spurious Free Dynamic Range (8-bit)	45 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	Reconstruction and IF Bandpass Filters	
Tuning Frequency Resolution	1 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	<-125 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits/14-bits	
Clock Rate	1.2 GHz	
Parameter	**6 GHz NB**	**Notes**
Frequency Range	10 MHz to 6 GHz	NB low end limited to 10 MHz in WB/NB configuration
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Output Power DAC Output	-10 to -60 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	50 dB/1 dB	
Passband Flatness	1.6 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	65 dB	Typical. CW, -1 dB from full-scale
Spurious Free Dynamic Range (8-bit)	60 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	1 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	<-125 dBc/Hz @ 1 MHz	Typical
ADC Resolution	14-bits	
Clock Rate	210 MHz	Reduced sample rate when using digital tuners

BSG-18-N SPECIFICATIONS

Parameter	6 GHz NB	Notes
Frequency Range	2 MHz to 18 GHz	
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Output Power	-10 to -45 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	35 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	60 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits/14-bits	
Clock Rate	210 MHz	Reduced clock rates when using digital tuners

BSG-18-W SPECIFICATIONS

Parameter	18 GHz WB	Notes
Frequency Range	10 MHz to 18 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Output Power DAC Output	-10 to -45 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	35 dB/1 dB	
Passband Flatness	3.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	55 dB	Typical. CW, -1 dB from full-scale
Spurious Free Dynamic Range (8-bit)	45 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits/14-bits	
Clock Rate	1.2 GHz	

BSG-18-NW SPECIFICATIONS

Parameter	18 GHz WB	Notes
Frequency Range	10 MHz to 18 GHz	
Instantaneous Bandwidth	400 MHz	Limited by IF filtering
Digital Tuner Bandwidths	None	
Output Power DAC Output	-10 to -45 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	35 dB/1 dB	
Passband Flatness	3.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	55 dB	Typical. CW, -1 dB from full-scale
Spurious Free Dynamic Range (8-bit)	45 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	8-bits/14-bits	
Clock Rate	1.2 GHz	
Parameter	**18 GHz NB**	**Notes**
Frequency Range	10 MHz to 18 GHz	NB low end limited to 10 MHz in WB/NB configuration
Instantaneous Bandwidth	60 MHz	Limited by IF filtering
Digital Tuner Bandwidths	42 MHz to 41 kHz	Max BW dependent on system configuration (powers of 2)
Output Power	-10 to -45 dBm	CW average power, full-scale DAC output
Gain Range/Resolution	35 dB/1 dB	
Passband Flatness	2.0 dB p-p	Typical. Maximum variation across any passband
Spurious Free Dynamic Range (14-bit)	60 dB	Typical. CW, -1 dB from full-scale
Spurious Free Dynamic Range (12-bit)	55 dB	Typical. CW, -1 dB from full-scale
Output VSWR	2:1	50 ohms input impedance
Output Filtering	IF Bandpass Reconstruction Filters	
Tuning Frequency Resolution	4 Hz	
Internal Reference	10 MHz	External reference input also provided
Phase Noise	Below 6 GHz: <-125 dBc/Hz @ 1 MHz Above 6 GHz: <-118 dBc/Hz @ 1 MHz	Typical
ADC Resolution	12-bits/14-bits	
Clock Rate	210 MHz	Reduced clock rate when using digital tuners

NIST TRACEABLE CALIBRATION TO ANSI Z540 SPECIFICATIONS

Test ID	Specification
Test 1: Input Power Verification	Input power accurate to ±1.25 dB at all frequencies at nominal input gain setting of +10 dB.
Test 2: Input Frequency Verification	Input frequency accurate to ±2 parts in 10^ ^8 (e.g. ±2 Hz at 100 MHz, ±20 Hz at 1 GHz, etc.) at all frequencies
Test 3: Output Power Verification	Output power accurate to ±1.25 dB at all frequencies at nominal output gain setting of -10 dB
Test 4: Output Frequency Verification (Below 12 GHz)	Output frequency accurate to ±2 parts in 10^ ^8 (e.g. ±2 Hz at 100 MHz, ±20 Hz at 1 GHz, etc.) at all frequencies
Test 5: 10 MHz Reference Frequency Verification	10 MHz reference frequency accurate to ±2 parts in 10^ ^8

BROADBAND SIGNAL ANALYZER (BSA) OPTIONAL SIGNAL ANALYSIS MODULES

Some of the signal analysis modules have functionality subject to export control by the US Government. Please contact Aeroflex Cupertino if any of these software modules will be installed on systems shipping outside the United States of America.

BSA Basic Standard Graphical User Interface (GUI) software package for BSA Analyzer/Recorder controls and basic analysis. Controls include RF and input power, signal recording into memory, and signal previewing from stored data in memory. GUI includes spectrum, time, waterfall, and parameter strip chart plotting. Signal parameters from ACPR and other optional analysis software modules can be plotted on the strip chart and logged to data files. ACPR software application includes channel power, band power, and adjacent channel power measurements. Recorded data can be reviewed and saved to mass storage devices.

BSA Basic (File) File-based version of BSA Basic signal analysis software. Has all functionality of BSA Basic and accepts all optional signal analysis software modules. Loads and analyzes data from files. Requires standard Windows XP or Windows 2000 computer (other operating systems supported – please contact Aeroflex Cupertino). Application is licensed for use on a single computer (multiple seat licenses are available).

BSA ESP The Environmental Signal Parameterization (BSA ESP) Analysis Function analyzes BSA memory or recorded files and automatically develops a spreadsheet 'table of contents' in ASCII .csv data format of time, frequency, power, bandwidth, and SNR parameters for all signals in the file exceeding a user settable threshold and within a user defined-spectral band.

BSA SAT Spectral Allocation Table Software module that links a passband around a spectral cursor frequency to user-defined .csv table that includes start frequency, stop frequency, priority 1/2/3 settings, user named frequency band, and user entered notes for each row. SAT output window displays cursor frequency, band name, and user notes if cursor frequency contained in frequencies in table. User can create multiple SAT tables, which can be selected for use in SAT table. Data can continue to be added by user as new information is obtained, providing timely growth in user-assisted spectral information on the BSA system.

STANDARD SIGNAL ANALYSIS SOFTWARE MODULES

BSA AM/FM/PM Signal analysis software module for measuring AM, FM, PM and SSB modulation parameters, plus demodulating these signals and saving as standard .WAV files. The SSB demodulator is selectable for either lower or upper sideband. Control parameters include center frequency, bandwidth, and demodulation selection. Measurements include RF error, RF power, carrier frequency, audio frequency, FM deviation, AM modulation, and modulation bandwidth. Demodulated data in .WAV files can be processed using commercial audio analysis software for audio spectrum analysis, distortion measurements, and SINAD measurements.

BSA ASK Signal analysis software module for measuring the parameters of a signal with ASK modulation. Par metric signal measurements include carrier power, carrier frequency, carrier frequency error, carrier PEP, symbol rate, symbol rate error, symbol values, bit values, and symbol amplitude. The module produces plots of the AM, FM and PM waveforms, signal spectrum, and the ASK state histogram. Resultant digital data is written to a file in an Excel-readable spreadsheet format.

BSA Channel Power Signal analysis software module measures RMS power in band-limited channels in the BSA passband. Any number of measurement bands can be selected, selectable with minimum and maximum frequency parameter settings. The resultant power for each band is shown in the analysis measurement window, and can be plotted in the parameter strip chart display and logged as time-tagged ASCII values.

BSA FM DBL DMOD Analysis software module for double-modulated FM signals. The BSA analog demodulation analysis function allows the FM demodulated signal can optionally be written to a .WAV file or binary data file with header, suitable for use from the BSA file analyzer. The BSA file analyzer could then be used to demodulate any sub-carriers present in this FM-demodulated signal.

BSA FSK Signal analysis software module for measuring the parameters of a signal with FSK and MSK data. Parametric signal measurements include carrier power, carrier frequency, carrier frequency error, carrier PEP, symbol rate, symbol rate error, symbol values, bit values, and symbol frequency separation. The module produces plots of the AM, FM and PM waveforms, signal spectrum and the FSK state histogram. Resultant digital data is written to a file in an Excel-readable spreadsheet format.

BSA Modulation Domain Signal analysis software for simultaneous signal data, amplitude, frequency, and phase plotting in time domain. A frequency selective filter can be applied prior to signal demodulation and plotting, allowing selective bands to be processed. Cursors allow measurements of amplitude, frequency, and phase. Plots include signal vs. time, signal envelope vs. time, frequency vs. time, and phase vs. time. User selectable time durations can be plotted, as well as the amplitude, power, frequency, and phase values on a GUI window. These can be strip charted to measure the signal dynamics and statistics. Other plots include time-time raster of any of the demodulated data formats (raw, AM, FM, and PM), and signal spectrum.

BSA PSK/QAM Signal analysis software module which includes robust PSK demodulation and analysis up to 256 PSK and QAM demodulation and analysis up to 1024 QAM. Symbol rates up to 80% of system bandwidth (RRC with 25% excess bandwidth factor) are achievable. Software includes constellation, eye-diagram, eye closure, and bit plots. Parametric signal measurements include error vector magnitude (EVM), I/Q balance, eye closure, carrier power, carrier frequency,

carrier frequency error, carrier PEP, symbol rate, and symbol rate error. Demodulation types include Square nQAM (4 – 1024), nPSK (2 – 256), OQPSK, and Pi/4 DQPSK. Software module is subject to export restrictions (order 64QAM or less).

BSA PSK/QAM Est Signal analysis software module that estimates the modulation of a signal within a user supplied frequency band. The estimation works for signals: 1) with BPSK, QPSK, OQPSK, 8 PSK, or 16 QAM modulation, 2) having a square-root raised-cosine pulse response filter, 3) having good SNR (e.g. 20 dB or more) and appear in their band, 4) with no severe distortion (e.g. no severe multipath) and no strong interference, and 5) having essentially equally-likely symbol values. For these signals, modulation, carrier frequency, symbol rate, EVM, and excess bandwidth are estimated. A spectral fit plot shows the real signal compared to the fitted modulation. Estimated demodulation parameters can be "dragged and dropped" into the BSA PSK/QAM software module for complete demodulation analysis. Requires BSA PSK/QAM analysis module.

BSA PSK/QAM Signal analysis software for estimating passband gain and phase variations of a PSK

Gain/Phase Est or QAM signal based on the input signal. Gain vs. frequency and phase vs. frequency plots are displayed over the range of the signal bandwidth. Gain, phase, and group-delay plots can be used as a reference for differencing to show gain, phase, and group-delay variations. Requires BSA PSK/QAM analysis module.

BSA CW Bundled Package of BSA AM/FM/PM, ASK, Channel Power, FM DBL DMOD, FSK, Modulation Domain, PSK/QAM, PSK/QAM Est., PSK/QAM Gain/Phase Est., BSA SAT Analysis Modules.

RADIO AND RADAR-CENTRIC SIGNAL ANALYSIS SOFTWARE MODULES

BSA ASK Burst Signal analysis software module for measuring the parameters of a bursted frequency-hopped signal with ASK data. The GUI of displayed parameters include burst rise time, burst fall time, burst on time, burst-to-burst time interval, burst center frequency, burst fractional bandwidth, ASK modulation amplitude deviation, and ASK data rate. The module also produces demodulated mark-space data for each burst. The module produces plots of the AM and FM waveforms, burst leading and trailing edge transitions, signal spectrum, stray signal energy (spurs and harmonics), and the ASK state histogram. Resultant data is written to a file in an Excel-readable spreadsheet format. Software module is subject to export restrictions.

BSA FSK Burst Signal analysis software module for measuring the parameters of a bursted frequency-hopped signal with FSK and MSK data. The measurement parameters include burst rise time, burst fall time, burst on time, burst-to-burst time interval, burst center frequency, burst fractional bandwidth, FSK modulation frequency deviation, FSK mark frequency, FSK space frequency, and FSK data rate. The module also produces demodulated mark-space data for each burst. The module produces plots of the AM and FM waveforms, burst leading and trailing edge transitions, signal spectrum, stray signal energy (spurs and harmonics), and the FSK state histogram. Resultant data is written to a file in an Excel-readable spreadsheet format. Software module is subject to export restrictions.

BSA PSK/QAM Burst Signal analysis software module, which includes robust parameterization of burst BPSK, QPSK, PSK/QAM OQPSK, 8 PSK, and 16 QAM, modulated signals. A digital bandpass filter can be selected to provide frequency selectivity and reject undesired signals outside of the signal band. Analysis includes the following parametric measurements, which can be displayed in a local window as well as logged to a data file: burst start time, burst power spectrum and signal power, burst rise time, burst fall time, burst width, carrier frequency error, symbol rate error, EVM, and symbol values. Logging will occur to files in spreadsheet-readable formats, with burst parameters as columns and the signal burst index as rows. Data plots include burst AM, FM, and PM waveforms vs. time. BSA BURST PSK/QAM operates in both monitor and recorded data modes. Only a fraction of all bursts will be analyzed in monitor mode. BSA BURST PSK/QAM provides robust analysis of burst PSK/QAM signals under the following conditions: burst duty cycle is less than 99% where the burst envelope is at least 10 dB lower between bursts, burst contains between 100 and 10,000 symbols, modulation uses root raised-cosine filtering, symbol rate is known to within +/-1% of nominal, carrier frequency is known to within +/-1% of nominal and is non-hopped in frequency, and burst SNR is greater than 20 dB over the signal bandwidth with no major signal distortion. Software module is subject to export restrictions.

BSA Standard Burst The Standard Burst Analysis Instrument allows the measurement, display and Analysis testing of various characteristics of a bursted (pulsed) signal conforming to a predefined standard. The instrument displays analysis results in three basic forms: measurements with pass/fail testing, spectral mask display, and AM/FM/PM plots. In the pass/fail display, various measurements are made for a signal burst, and then these measurements, the specified bounds on these measurements, and an indication of whether each measurement is consistent with its bounds (the pass or fail indication) are displayed. Software module is subject to export restrictions.

BSA Pulse Signal analysis software module, which includes robust pulse parameterization of signals, recorded in memory. Analysis includes CW and frequency, phase, and amplitude modulated pulsed waveforms that may also be frequency hopped. The measured parameters include: pulse repetition rate, pulse width, pulse amplitude, pulse carrier frequency, modulation on pulse (chip rate), pulse rise time, and pulse fall time. Measured MOP includes linear FM, quadratic FM, BPSK, and OOK Barker code. The module plots pulse parameters including AM, FM and PM demodulated waveform, spectrum plots for each pulse, and pulse aligned carrier frequency vs. pulse and PRI vs. pulse plots. Resultant data is written to a file in an Excel-readable spreadsheet format that is compatible with the VSS Pulse signal generation module. Software module is subject to export restrictions.

BSA Pulse (Multichannel) Analysis software that allows two RF disk files or two memory files to be processed and compared for missing and added pulses. Includes macro-micro view, where macro can include selectable parameter sets (two channel) to be plotted in time over record duration (parameter strip chart). Missing or additive pulses are highlighted with vertical cursors in strip chart. Micro view allows any pulse pair to be viewed in AM, FM, and PM verses time waveform view. Software module is subject to export restrictions.

BSA Burst Bundled Package of BSA ASK Burst, FSK Burst, PSK/QAM Burst Analysis Modules. Software modules are subject to export restrictions.

SPECIAL OPERATIONAL SIGNAL ANALYSIS MODULES

BSA SV DDC Tune When Saving Feature. Allows a user to optionally tune, filter, and decimate with 1 Hz resolution (perform software Digital Down Conversion (DDC)) when saving a file to disk. This feature allows users to only save the bands of interest to disk for later analysis.

BSA FACS BSA FACS is a semi-automated collection mode using scenario-based recording capability based on bands of interest. The system performs automatic or fixed gain adjustments automatically and then saves the recorded signal to data files. Module performs scenario based recording, with each repetitive scenario entry being saved to a single data file.

BSA SWSEQ BSA Sequencing Control is a script driven sequencer for BSA that automates RF tuning, gain setting, and record times for monitoring, recording, and saving recordings to files. Graphical tools are provided for constructing sequencer script files, which can be saved as .csv format. Both manual step and automated step sequencing modes are provided. In automated step mode, sequencer steps through user-selected scenarios of RF, gain, and record time, automatically saving the recording with a frequency and time tag file name before stepping to the next scenario. All selected scenarios can be sequenced through once or repetitively, depending on the user setup. A frequency and spectrogram view is available for monitoring during this process. Auto gain can be enabled, which automatically sets the input gain for optimal recording levels prior to each recording in the sequence.

BSA Mission Analysis Mission Analysis software is used to analyze Aeroflex FACS and SWSEQ data sets covering a range of frequency bands. Includes applications: Collection Processor, Event Navigator, Mission Summary and Google™ Earth RF-power verses position plots. Software module is subject to export restrictions.

1. Collection Processor, CP

   CP allows the user to analyze FACS and SWSEQ data sets automatically. Multiple data sets can be queued up to run as resources are available. CP will use multiple processors if they are available on the computer. CP has three components: Preview, ESP, and Channel Power. Preview will generate a Quick Look report for each data set. This includes summary information and statistics, average composite spectrum, and spectrogram of all bands collected and map with collection location/route overlaid.

2. Event Navigator, EN

   EN allows the user to quickly sort through and analyze large data sets. The ESP output file can be accessed to quickly go to the start, end or max power times of any detected signal. The EN main window allows navigation through all recordings. For FACS recordings, this allows any burst to be analyzed. A map will have cross hairs of the location for the specific burst being analyzed. All of the licensed Aeroflex BSA analysis functions can be used to analyze the signal. The Quick Look spectrum and spectrogram are available as navigation aids for EN.

3. Mission Summary, MS

   MS provides a spread sheet with summary information of every mission collected. This can be automatically run on an entire disk drive containing multiple data sets.

4. Google Earth Power Plots, GEPP

   GEPP can be used to post process the channel power vs. position data to produce a wall with the minimum and maximum power observed over the track. A different color is used for the min and max wall heights corresponding to the min and max power values. The user can enter the resolution cell length for regions to computer the power statistics. Google Earth directories will be created for each dataset to easily turn on and off each frequency band on the GE display.

BSA Event Viewer The Event Viewer application displays consolidated spectral and time domain views of long duration recordings using FACS and CVDR applications. Details include spectrum and raster display thumbnails, statistics, and an event based window detailing all events during the recording period to include recording and triggering events. NOTE: Only works with BSA FACS and BSA FACS CVDR recordings. Software module is subject to export restrictions.

BSA FACS CVDR This mode of operation is a trigger based recording application that allows the CVDR or Mission Recorder platforms to record specific amounts of time based on specific trigger events. BSA FACS CVDR has three modes of operation: Mode 1 only looks at the RF environment during countermeasure look through periods, Mode 2 records both the countermeasure look through and attack periods, and Mode 3 is a full-memory long stare period for the duration of the memory or as specified by the operator. Software module is subject to export restrictions.

MISCELLANEOUS OPTIONAL SOFTWARE FOR AEROFLEX CUPERTINO SYSTEMS

CS RMT Software (driver library with API) that allow a third-party software application running on local or remote configuration control of a BSA, BSG, or BSAG instrument via Ethernet, or local port, using standard TCP/IP messaging. An instrument is assigned a LAN IP address via standard system administration procedures. Libraries are provided to communicate with the instrument and are available with ANSI C interfaces. Documentation and example C program are included. The control function calls are for basic hardware control such as loading a file from disk for signal generation, taking a recording and saving the signal to disk, setting the gain and RF center frequency, and choosing the trigger. Control of advanced software analysis capabilities, such as those found in the optional VSS and BSA software modules (e.g. calculate EVM, build a CDMA and TDMA signal, etc.) are not currently supported. Drivers included for Windows (2000, XP) and Linux (SuSE, Redhat), Makefiles for gcc and Microsoft Visual C++ provided.

SSD Image Seat Single-seat license of application software to create and restore Linux OS hard disk images to/from DVD. Includes application software, user manual, and factory OS hard disk image for one designated system. Enables user to update OS drives with new factory images following system upgrades.

VECTOR SIGNAL SIMULATOR (VSS) OPTIONAL SIGNAL CREATION MODULES

Some of the signal generation modules have functionality subject to export control by the US Government. Please contact Aeroflex Cupertino if any of these software modules will be installed on systems shipping outside the United States of America.

VSS Basic Standard playback/generation control and signal creation software, which includes Vector Signal Player (VSP) signal file management for 'one-touch load and play' signal playback capability, including RF and output power controls. VSS provides basic signal creation capability, including real signal import, IQ signal import, and CW and multiple tone (CW or PM) signal generation. VSS software computes RF spectrum and Complementary Cumulative Distribution Function (CCDF) for created signals, which are plotted and included as files along with primary data file. Files are created and stored as VSS signal files on disk.

STANDARD SIGNAL GENERATION SOFTWARE MODULES

VSS Gain/Phase Signal creation software module for adding precise arbitrary gain and phase filtering to generated signal file. This filter can be used to model system bandwidth effects or channel impairments, apply equalization, and select a signal from an imported signal. Filter files are used to create the required waveform. A filter editor is provided to create the filter files, allowing any number of frequency offset (in MHz), relative gain (in dB), and phase offset (in degrees) triplets to be generated to form the desired gain and phase frequency response. Requires VSS Basic software and desired signal creation software module.

VSS Mix Signal creation generation software module that allows mixing of signal types into composite complex multi-signal, multi-format environments including co-channel, adjacent channel, and CW interference. Can mix over 25 unique signal waveforms and formats. Also includes Additive White Gaussian Noise (AWGN) (thermal) software for creation of precision Signal to Noise Ratio (SNR) over a selected signal bandwidth. VSS software computes RF spectrum and Cumulative Count Distribution Function (CCDF) for created signals, which are displayed as plots and included as files along with primary data file. Requires VSS Basic software and any other VSS modules desired to be mixed.

VSS NPR Signal creation software for adding precision noise power ratio (NPR) waveforms, ideal for power amplifier and TWTA testing. Includes control of digital Additive White Gaussian Noise (AWGN) noise pedestal bandwidth plus frequency location and notch width of up to 16 notches within the noise pedestal bandwidth.

VSS PNG Signal creation software module for adding precise realistic double side band phase noise to signal file. Software can add continuous and spurious phase noise with controls from 1 Hz to 1 MHz offsets with accuracies of 0.1 dBc/Hz to any of the VSS signals. Requires VSS Basic software and desired signal creation software module.

VSS PSK/QAM Signal creation software module for generating PSK and QAM modulations. Creates PSK modulated signals up to 256PSK and QAM modulated signals up to 1024 QAM, with control of carrier frequency, symbol rate, carrier power, root raised cosine (RRC)/rectangular filter selection, and IQ imbalance (gain, phase, DC offset). Selection of modulated data types, including random, PN, Extended PN, bit file, or symbol file. VSS software computes RF spectrum and CCDF for created signals, which are displayed as plots and included as files along with primary data file. Modulation types include Square nQAM (4 – 1024), nPSK (2 – 256), OQPSK, and Pi/4 DQPSK. Software module is subject to export restrictions.

RADIO AND RADAR-CENTRIC SIGNAL GENERATION SOFTWARE MODULES

VSS Agile Signal creation software for adding gating/bursting and frequency hopping to selected VSS waveforms. Frequency hopping controls include hop sequence (random, sweep or sequence file), hop bandwidth, and hop frequency resolution. Gating/bursting controls include burst on time, burst period, burst rise and fall time taper, and burst to symbol time delay. VSS software computes RF spectrum and CCDF for created signals, which are displayed as plots and included as files along with primary data file. VSP control software manages the files, and loads and plays the files in hardware to create the output RF signals. Software module is subject to export restrictions.

VSS AM/FM/PM Signal creation software for generating AM, FM, PM, and SSB modulations. Graphical interface allows for full control of center frequency, bandwidth, and modulation characteristics. Selection of modulated waveforms includes single tone, two tone, or audio (.WAV) files. Files are created and stored as files on disk. VSP control software manages the files, and loads and plays the files in hardware to create the output RF signals.

VSS FSK/MSK Signal creation software for generating FSK and MSK modulations. Creates MSK modulated signals and FSK modulated signals up to 256 FSK with control of signal center frequency, total signal power, symbol rate, symbol-frequency separation, symbol-frequency transition time, and filter selection. Selection of modulated data symbol values, including random, PN, extended PN, and bit or symbol files. VSS software computes RF spectrum and CCDF for created signals, which are displayed as plots and included as files along with primary data file. VSP control software manages the files, and loads and plays the files in hardware to create the output RF signals.

VSS Pulse Signal creation software module for generating precision CW and frequency, phase, and amplitude modulated pulsed waveforms that can also be frequency hopped. Standard GUI controls include pulse repetition rate, pulse width, pulse amplitude, pulse carrier frequency, CW, modulation on pulse, pulse rise time, pulse fall time, and output bandpass filtering. Modulation on Pulse (MOP) includes linear FM, quadratic FM, BPSK and OOK Barker code, and ASK/PSK from a file. MOP controls include: linear rate in MHz/μsec for linear FM, linear and quadratic rates for quadratic FM, MOP symbol rate and arbitrary symbol values for ASK/PSK, and MOP symbol rate and Barker code or arbitrary bits for BPSK and OOK modulations. File based operation allows generation of pulses from a table of pulses, where each pulse can be defined with the parameters described above. Software module is subject to export restrictions.

CELLULAR COMMUNICATIONS SIGNAL GENERATION SOFTWARE MODULES

VSS ETSI Signal creation software for GSM, EDGE, and WCDMA 3GPP(FDD) modulations. Bursting supported on GSM and EDGE modulations. Creates modulated RF waveforms in accordance with downlink standards for testing cellular power amplifiers and multi-carrier power amplifiers. Includes selection of data formats of PN, EPN, random, and bits and symbols from user provided data file. Controls include individual time slot power for GSM and EDGE, and of individual code domain power and bit rate for WCDMA/3GPP(FDD). Generates multiple carriers of same standard with user specified carrier offset frequency. Modulation can be disabled on individual carriers.

VSS TIA Signal creation software for IS-136, IS-95, and CDMA2000 modulations. Application module creates modulated RF waveforms in accordance with downlink standards for testing cellular power amplifiers and multi-carrier power amplifiers. Interface includes selection of PN, EPN, and random data formats from user provided data files. Graphical user interface allows for full control of individual code domain power and bit rate for IS-95 and CDMA2000. Application module generates file containing multiple carriers of same standard with user specified carrier offset frequency.

SPECIAL OPERATIONAL SIGNAL GENERATION MODULES

VSP-HWSEQ The sequencing data generation module allows sequencing of individual data files, preloaded into signal memory, into a continuous stream while also controlling and tuning the upconverter (if applicable). Sequencing is controlled by a user-generated scenario file which is loaded and updated on system firmware sequence controller. Each entry in the scenario consists of: data file, number of times to loop that data file before moving to the next entry, LO and upconverter tuning frequency, and output attenuator setting. Triggering the start of the scenario can be done with external trigger or software start. Triggering the movement from one data file to the next can be done with external trigger, or automatically moving after completing the number of loops specified on the previous data file.

VSP-SWSEQ The Sequencing data generation module allows sequencing of individual data files, located in signal memory or on RAID streaming device, into a continuous stream while also controlling and tuning the upconverter (if applicable). Sequencing is controlled by a user-generated scenario file which is read sequentially from the operating system storage device. Each entry in the scenario consists of: data file, number of times to loop that data file before moving to the next entry, LO and upconverter tuning frequency, and output attenuator setting. Triggering the start of the scenario can be done with external trigger or software start. Triggering the movement from one data file to the next can be done with external trigger, or automatically moving after completing the number of loops specified on the previous data file.

VSP-CW Bundle Package: VSS AM/FM/PM, ETSI, FSK/MSK, NPR, PNG, PSK/QAM, TIA data

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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.

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