Model SM-5320
Data/Waveform Generator/Tester for Vector Modulation
Flexible Multi-Mission Solution for Signal Generation & Test

Applications
• Integrated Programmable Waveform Generator, Noise Generator, and BER Test System with Optional Modulator
• Link and Range Setup, Testing and Operation
• SatCom Science, and Military Missions
• SGLS and STDN Ground Stations
• Payload and Product Integration, Simulation and Testing
• Supports ARTM PCM/FM, SOQPSK, and Multi-h CPM

Key Features
• Multiple External Data Inputs or Internal Programmable Pattern Generators for Main and/or Subcarriers
• Analog, Digital or Complex Waveform Modulator for PM, AM, FM and B-, Q-, O/SQ-, U- and A-QPSK to 50 Mbps
• Dual Data Encoder with Convolutional Encoding, PCM Conversion, Scrambling, and Ranging Generation
• Internal Rate and Pattern Generator including Single Error Insertion for a flexible telemetry and data test source
• Programmable Noise for Eb/No and SNR measurements
• Programmable Front Panel Ports for Setup and Monitoring
• Front-Panel Graphic Display with Spectrum, I/Q Plots
• Integrated Solution Replaces Separate Noise Source, BERT and Hours of Calibration
• Compact 1U chassis without 3rd party Operating System or Hard Drive for increased reliability and security
• Also available as PCI PC-Cards for integration options

The SM-5320 is a versatile data and waveform generator, providing fully programmable data and signal processing and advanced waveform creation. The digital implementation provides for the small form/fit of this product while fully satisfying applications requiring ruggedized packaging, minimum power consumption, and high spectral purity. The standard design supports a multitude of digital or analog modulations, or complex combinations of modulation formats.

Data generation, coding, and modulation can be driven from a variety of external digital inputs or via internal pattern and waveform generation sources. Dual data processing paths are included to allow creation of independent I and Q streams.

The design also supports link test and verification applications. A single SM-5320 can replace a BERT, waveform generator, noise source, attenuators, power meter, and spectrum analyzer. Combining these capabilities in one small, simple-to-use unit allows quick and accurate setup and testing without in-depth system knowledge.

The SM-5320 can provide a low frequency IF output (up to 50 MHz) or may be provided with an optional fixed frequency embedded vector modulator (70 MHz, 140 MHz, or custom). Independent in-phase and quadrature analog outputs can also be utilized to drive an external vector modulator or signal.

Up to 32 Configuration Profiles can be stored with user-defined link names and recalled with a single command, simplifying fast and accurate configuration changes.

Configurable front panel BNC connectors provide operators with ready access to internal operating signals. The SM-5320 can also optionally support a station clock input for external frequency reference.

The firmware-intensive implementation of the SM-5320 readily accommodates custom features and signal processing tasks. Using the latest generation digital signal processing techniques allows upgrades via firmware changes, even for previously fielded systems.

The SM-5320 Data/Waveform Generator is available as a standard 1U 19 inch rack mountable chassis or as PCI cards and API for integration into other systems. The Chassis version is not based on a PC platform, avoiding the requirement for 3rd Party Operating Systems and hard drives and reducing the need for system patches and IT security concerns.
Model SM-5320 Data/Waveform Generator Specifications

**Data Inputs**
- 2 TTL Data/Clocks: 50bps to 50Mbps
- 2 Differential Data/Clocks: 50bps to 50Mbps
- 1 Analog Input
- 2 Internal Digital Pattern Generators
- 2 Internal Clock Generators (With Outputs)
- Internal Analog Waveform Generator

**Coding Formats**
- **PCM:**
  - NRZ: Mark (NRZ-M), Space (NRZ-S), Level (NRZ-L)
  - BiØ: Mark (BiØ-M), Space (BiØ-S), Level (BiØ-L)
- Convolutional:
  - Bypass, Rate 1/2, or Rate 3/4 (Punctured)
  - Constraint Length 7, Industry Standard Polynomials
  - G1/G2, G1/-G2, G2/G1, -G2/G1 Symbol Ordering
  - Dual Encoder Mode for Quad Modulations
- Scrambling:
  - Bypass, Intelsat (V.36), or CCITT (V.35)

**Modulated Outputs**
- **BASIC:**
  - Intermediate Frequency:
    - Frequency: Baseband (DC) to 50MHz
    - Resolution: 0.25Hz
    - Output Level: +9 to -10dBm
  - In-phase/Quadrature Baseband:
    - Compatible with External Vector Modulator
    - Adjustable and Independent Levels, Balance, Offset
- **OPTION 1:**
  - Embedded Vector Modulator with Frequency Reference
    - Frequency: Specify (70MHz, 140MHz, ...)
    - Output Level: +9 to -10dBm
    - Stability, Phase Noise: Specify
- **OPTION 2:**
  - Embedded Vector Modulator with Ext. Frequency Input
    - Frequency: Specify (L-Band, S-Band, X-Band)
    - Output Level: +3dBm (typical)

**Supported Waveforms**
- **DIGITAL:**
  - Phase Shift Keyed (PSK)
  - Frequency Shift Keyed (FSK)
  - Amplitude Shift Keyed (ASK)
- **ANALOG:**
  - Phase Modulation (PM)
  - Frequency Modulation (FM)
  - Amplitude Modulation (AM)
- **COMPLEX:**
  - PM/PSK
  - FM/FSK

**PM or PSK Waveform Specifications**
- Digital Modes: BPSK, QPSK, AQPSK, UQPSK, OQPSK, or DPM
- Analog Modes: External In, Digital Modulator In
- Shaping: Phase Transition over 0 to 100% of Baud Period
- Modulation Rates: 50bps to 50Mbps or Up to 20MHz Analog
- Mod Indices: 0 to 180 degrees for DPM, Adjustable I/Q power ratios for A or UQPSK

**FM or FSK Waveform Specifications**
- Digital Mode: Binary FSK
- Analog Modes: External In, Digital Modulator In
- Modulation Rates: 100bps to 20Mbps or Up to 20MHz Analog
- Deviation: 200Hz to 20MHz

**ARTM Waveform Specifications**
- Modulation Types:
  - ARTM Tier 0 (PCM/FM) to 25 M bit/s
  - ARTM Tier I (SOQPSK) to 50 M bit/s, 25 M baud/s
  - ARTM Tier II (Multi-h CPM) to 50 M bit/s, 25 M baud/s
- Modulation Characteristics:
  - Premodulation Filtering per IRIG 106

**Additional Features**
- Bit-Error-Rate Testing: Monitors Bit Error Rate for Returned Data of Internally Generated Data Patterns
- AWGN Noise Generator: Adds Simulated AWGN to Output Waveform to Establish Accurate Eb/No or SNR Levels
- Bit-Synchronizer: Auto-baud detect to adapt shaped waveforms and/or Modulation Indices.

**Remote Status/Control Specifications**
- Serial RS-232 (10/100baseT Option)
  - Commands: Control Over All Configurable Parameters
  - Status:
    - Lock Status
    - Self-Test Status
    - Detailed Operational Information

**Other Specifications**
- **Chassis:**
  - 19” Rack Mountable, 1U (1.75”), 15” Depth
- **Connectors:**
  - 2 BNC For In-Phase and Quadrature or Monitor Ports
  - 1 BNC for IF Output
  - 1 15 PIN D for Differential Data/Clock Inputs/Outputs
  - 4 BNC for TTL Data/Clock Input
  - 1 9 PIN D for Remote Status/Control
  - RJ-45 for 10/100baseT (Option)
- **Standard 3 Prong Male Primary Power Input**
- **Primary Power:**
  - 120 VAC (+/- 10%) 50-60 Hz
- **Temperature:**
  - -25° TO 60° C Operational, -45° TO +65° C Storage
- **Humidity:**
  - To 95% non-condensing
- **Altitude:**
  - 15K feet AMSL (Operational), 50K feet AMSL (Storage)

* All specifications subject to change without notice or obligation to retrofit.

Consult factory for custom options and/or alternate specifications.