

## 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

## AM or ASK Waveform Specifications

Digital Mode: Binary ASK or OOK  
Analog Modes: External In, Digital Modulator In  
Modulation Rates: 100sps to 10Msps or Up to 10MHz Analog  
Mod Index: 0.1 to 100% in .1% increments

## 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: 50sps to 50Msps 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: 100sps 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