

INCH-POUND
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A-A-58047D

23 December 2016

SUPERSEDING

A-A-58047C

5 September 2005

## COMMERCIAL ITEM DESCRIPTION

### SIGNAL GENERATOR

The General Services Administration has authorized the use of this commercial item description (CID) for all federal agencies.

1. **SCOPE.** This signal generator generates a highly stable, continuous wave (CW), and modulated signal. The unit generates amplitude modulation (AM), frequency modulation (FM), phase modulation (ØM), and pulse modulation (PM) signals with internal or external signals for modulation on demand as required by the user.

2. **CLASSIFICATION.** The signal generator covered by this CID shall be commercially-available equipment that has factory-installed options and/or may be modified to the extent necessary to meet the following description. The test set shall be class 3, in accordance with MIL-PRF-28800.

2.1 Order of precedence. In the event of a conflict between the text of this CID and the references cited herein (except for associated detail specifications, specification sheets, or MS standards), the text of this CID shall take precedence. Nothing in this CID, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

### 3. SALIENT CHARACTERISTICS.

3.1 Item description. Signal generator.

3.2 Radio frequency operating bandwidth. The signal generator shall have a minimum operating bandwidth span from 10 MHz to 26.5 GHz.

3.3 Modulation. The signal generator shall provide RF output with AM, FM, ØM, and PM modulation and have external modulation capability. The signal generator shall have external pulsed carrier function capability.

Beneficial comments, recommendations, additions, deletions, clarifications, etc., and any data that may improve this document should be sent to: WR-AFMC 404 SCMS/GUEEB, 235 Byron St., Robins AFB, GA 31098 or email <a href="mailto:SPEC99@us.af.mil">SPEC99@us.af.mil</a> . Since contact information can change, you should verify the currency of this information using the ASSIST Online database at <a href="https://assist.dla.mil">https://assist.dla.mil</a> .
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- 3.4 Internal time base aging. The internal reference frequency aging shall be  $\leq \pm 5 \cdot 10^{-9}$  per 24 hours or  $\leq \pm 8 \cdot 10^{-7}$ /year with a 10-MHz time base.
- 3.5 Radio frequency resolution. The signal generator frequency resolution shall be  $\leq 0.01$  Hz.
- 3.6 Marker frequencies. The signal generator shall have the capability of generating  $\geq 8$  marker frequencies.
- 3.7 RF spectral harmonics content. The signal generator shall have  $\leq -30$  dB of harmonic content at +10 dBm up to the L band 1 to 2 GHz spectrum segment in CW mode. The signal generator shall have  $\leq -50$  dB of harmonic content at +10 dBm up to the K band 18 to 27 GHz spectrum segment in CW mode. See [table II](#).
- 3.8 Sweep functions. The signal generator shall be capable of performing  $\geq 16$  linear, logarithmic, and/or continuous-step frequency sweeps with a minimum time span from 120  $\mu$ s to 60s, and output level variation  $\leq \pm 5.0$  dB in automatic or “on demand” by user.
- 3.9 Spurious signals. The total spurious signal content of the signal generator, including side bands and sub-harmonics, accompanying the desired RF signal shall be  $\leq -30$  dB below the maximum signal level.
- 3.10 Power output level. The signal generator shall be able to provide a minimum of +10 dB @ 50 Ohms ( $\Omega$ ) throughout the spectrum.
- 3.11 Power output range. The signal generator shall have a power output span  $\geq -130$  dBm to +10 dBm throughout the spectrum.
- 3.12 Stepped attenuator. The signal generator shall have user selectable attenuation levels in linear mode providing 1dB @ 50  $\Omega$  steps spanning the amplitude range specified in [section 3.11](#) throughout the spectrum.
- 3.13 RF output amplitude tolerance. The signal generator shall have a minimum power output amplitude variation tolerance of  $\pm 0.5$  dBm.
- 3.14 RF output amplitude resolution. The signal generator shall have a minimum power output amplitude resolution of  $\pm 0.1$  dBm.
- 3.15 Broadband noise. The level of broadband noise in the RF signal shall be  $\leq -130$  dB below the carrier output level, as measured at the RF OUT connector and into a 50  $\Omega$  load. The frequency bands are designated by IEEE 521-2002, shown here for reference and guidance. Frequency response spectral flatness and amplitude characteristics shall exhibit a continuous function slope without acute changes or stepped responses in magnitude as frequencies extend and overlap from band to band. The instrument band selections need not follow IEEE spectrum span or coverage.
- 3.16 Phase noise figures. The signal generator broadband noise figures shall be measured at 0 dBm @ 50  $\Omega$ . See [table I](#).

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**TABLE I. Frequency Distribution Broadband Noise.**

Phase Noise by Frequency Bands dB/Hz 0% Mod (Frequency Offset ≤ 100 Hz)				
ITU Band	Frequency	Designation ( EEE)	Frequency Band (IEEE)	Phase Noise (dB)
5	30 kHz ~ 300 kHz	Ultra Sound		≤ -90
6	300 kHz ~ 3000 kHz	Hyper Sound		
7	3 MHz ~ 30 MHz	HF*		
8	30 MHz ~ 300 MHz	VHF*		
9	300 MHz ~ 3000 MHz	UHF*	300 ~ 1000 MHz	≤ -90
		L Band	1 ~ 2 GHz	≤ -85
		S Band	2 ~ 4 GHz	≤ -80
10	3 GHz ~ 30 GHz	C Band	4 ~ 8 GHz	≤ -73
		X	8 ~ 12 GHz	≤ -70
		Ku	12 ~ 18 GHz	≤ -65
		K	18 ~ 27 GHz	≤ -60*
11	30 GHz ~ 300 GHz	Ka	27 ~ 40 GHz	
		W	-	-
* Extended value of overlapping frequencies.				

**TABLE II. Frequency Bands Harmonic Noise Levels.**

Harmonic Noise(dB Values are <b>not</b> absolute; there is a typical overlap of 3 to 6dB)			
Frequency Bands (ITU)	Frequencies (IEEE)		Magnitude
Band 4	3 kHz ~ 30 kHz		≤ -30 dB/Hz (typical)
Band 5	30 kHz ~ 300 kHz		
Band 6	300 kHz ~ 3 MHz		
Band 7	3 MHz ~ 30 MHz		
Band 8	30 MHz ~ 300 MHz		
Band 9	300 MHz ~ 3 GHz	(UHF 300 MHz ~1 GHz)	≤ -35 dB/Hz (typical)
		(L Band 1 GHz ~ 2 GHz)	≤ -30 dB/Hz (typical)
		(S Band 2 GHz ~ 4 GHz)	≤ -50 dB/Hz (typical)
Band 10	3 GHz ~ 30 GHz	(C Band 4 GHz ~ 8 GHz)	
		(X Band 8 GHz ~ 12 GHz)	
		(Ku Band 12 GHz ~ 18 GHz)	
Band 11	30 GHz ~ 300 GHz	(K Band 18 GHz ~ 27 GHz)	≤ -40 dB/Hz (typical)
		(Ka Band 27 GHz ~ 40 GHz)	
		(V Band 40 GHz ~ 75 GHz)	-
		(W Band 75 GHz ~ 110 GHz)	-

3.17 **Triggering.** The signal generator shall have external triggering inputs that trigger the sweep function for analog frequency, step frequency, and CW power sweep functions as selected by user. Sweep control shall be menu-driven with internal and external capability. The external

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modulation and sweep must be controlled through a variable, proportional voltage source (typical 0 ~ 10 VDC).

3.18 Internal and external reference. The signal generator shall have an external reference input and output connector for calibration and comparison procedures.

3.19 Modulation. The signal generator shall have internal and external modulation capability for AM, FM, ØM, and PM.

3.20 Design and construction. The signal generator shall be used in both bench-top and rack-mount environments. The signal generator is a commercial item subject to commercial products regulatory standards. The signal generator shall be designed and constructed in accordance with all applicable European Union (EU) requirements with the “CE” marking affixed, International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU), Underwriters Laboratories (UL), and the American National Standards Institute (ANSI). The signal generator shall be compliant with the Restriction of Use of Hazardous Substances (RoHS) and Waste from Electrical and Electronic Equipment (WEEE) guidelines and policies. It shall be designed and constructed so that no parts will work loose in service, and to withstand the strains, jars, vibrations, and other conditions incident to shipping, storage, installation, and service.

3.21 System safety. The signal generator shall comply with all sections of UL 1449 standard for electrical safety and the IEC 61010-1.

3.22 Sound levels. The signal generator acoustic noise shall conform to sound-level requirements of ISO 7779 and measured in accordance with ISO 8253, section 2.

3.23 Electrostatic discharge (ESD). The design of the signal generator shall preclude equipment damage due to ESD, protect personnel from electrical shock due to static charging, and prevent ignition of explosive atmospheres due to sparking in accordance with MIL-STD-1686, section 5.2.2.3, and ANSI/ESD-S20.20-2014, section 7.0, ESD Control Program.

3.24 Electromagnetic interference (EMI). The signal generator’s EMI emissions shall be in accordance with the following radiated emission and susceptibility requirements of MIL-PRF-28800; MIL-STD-461, sections RE102 and RS103; IEC 1000-2-5; and emitted radiation absorption and radiation limits of CFR, Title 47, Parts 15.109 and 15.209.

3.25 Service life. The design of the signal generator shall be such that under normal use and operation, the service repair can be performed according to MIL-PRF-28800, sections 3.14.2 and 3.14.3.

3.26 Port damage. The output port shall withstand up to 10 VAC or VDC, or 33 dB levels (typical, 2W) without damaging the internal circuitry.

3.27 Connectors. The system shall have an APC 2.4-mm type connector and an APC 3.5-mm adapter for the microwave radio frequency output. It shall have BNC-type connectors for other front- and rear-panel inputs and outputs. A general-purpose-interface-bus (GPIB) interface with an IEC 60488 (formerly IEEE-488.2) protocol connector is required for compatibility and control functions.

3.28 Operating temperature range. The signal generator shall meet the specifications listed herein with full capabilities within the temperature range of 32 to 122 °F (0 to 50 °C) after tests

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in MIL-PRF-28800, section 4.5.5.1.1, have been performed for class 3 equipment classification per MIL-PRF-28800, table 11.

3.29 Storage temperature range. The signal generator shall meet or exceed manufacturer's specifications for stored equipment after tests of MIL-PRF-28800, section 4.5.5.1, have been performed for instruments in the range of class 3 equipment classification per MIL-PRF-28800, table 11.

3.30 Altitude requirements. The signal generator shall meet its operating performance and accuracy while operating at an altitude of 8,000 feet (2,438 meters). The equipment shall meet its performance and accuracy requirements for operating and non-operating storage as specified in MIL-PRF-28800, sections 3.8.3 and 4.5.5.2 respectively, at this altitude.

3.31 Heat dissipation and ventilation. Ventilation shall be sufficient to allow for proper heat dissipation that can be achieved by either passive or active methods in order to meet MIL-PRF-28800, section 4.5.5.1, under temperature and humidity tests for class 3 equipment classification per MIL-PRF-28800, table 11.

3.32 Calibration and maintenance adjustments. No special tools, software, technical manuals, or documentation shall be required for the alignment, adjustment, repair, and calibration of the signal generator, except those provided with the signal generator. A software license shall be issued for each physical instrument when the system is designed for computer-based calibration. Software licenses needed to perform the alignment/adjustment process (where required by the manufacturer) shall be valid for the life of the instrument, and shall be included with the signal generator. Any special or unique accessories not common to a secondary calibration laboratory required for calibration of this item shall be furnished by the manufacturer, to include, but not limited to, software, fixtures, tools, and standards.

3.33 Calibration period. The design of the signal generator shall provide readily-accessible calibration and maintenance adjustments. The calibration adjustments shall be accessible without removal of the test-set case or modules. The calibration interval shall be based on a period of one calendar year or an operating interval of 2,080 hours, whichever occurs first. At the end of this interval, 85 percent of the units shall remain within calibration tolerances in accordance with MIL-PRF-28800, section 3.12.

3.34 Reliability. The design of the signal generator shall be such that under normal use and operation, the mean time between failures (MTBF) shall exceed 2,080 hours of operation with a statistical certainty equal to or greater than 95 percent in accordance with MIL-PRF-28800, section 3.13, based on an 8-hour workday, 40-hour week, and 52-week interval. The manufacturer shall be able to reasonably establish the claim and certify with NIST traceability that the offered equipment is capable of the required level of reliability by meeting or exceeding MIL-PRF-28800, sections 3.13 and 4.5.8.1.

3.35 Built-in test equipment and diagnostics. The signal generator shall be equipped with built-in test and diagnostic capability that performs a system test evaluating all functional characteristics of the instrument at "Power On" or "Cold Start" in accordance with MIL-PRF-28800, section 6.5.2.6.

3.36 Maintainability. The signal generator shall meet the human engineering factors of ergonomics for operational and maintainability criteria providing access to controls, internal

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components, and adjustments in accordance with MIL-STD-1472, sections 5.9 through 5.9.18, and MIL-PRF-28800, section 6.6.2.4.

3.37 Preventive maintenance. Preventive maintenance shall not require more than 15 minutes per 30-day period. Preventive maintenance shall not require breaking of the equipment seams where calibration seals would normally be placed in accordance with MIL-PRF-28800, section 3.14.2.

3.38 Corrective maintenance. The signal generator shall be designed to meet reparability criterion in accordance with MIL-PRF-28800, section 3.14.1.

3.39 Electrical power sources and connections. The signal generator equipment shall operate from nominal commercial, military, and shipboard power sources with a nominal voltage of 120 Vrms, single-phase AC ( $\pm 10\%$ ) at line frequencies of 50 Hz and 60 Hz, in accordance with MIL-PRF-28800, sections 3.5.1.12 and 3.5.1.12a.

3.40 Electrical surge. The signal generator shall be able to provide surge protection that meets UL 1449, section 38; IEC 61000-4-4; and IEC-61010-1.

3.41 Noise suppression. The signal generator shall be able to operate with electrical noises and harmonic content present on the alternating current power source with frequencies in the 30 Hz to 50 kHz range, and levels varying from line level of 41.6 dB  $\pm 1$  dB (108 to 132 VAC) measured at the power input in accordance with UL 1283, IEC/EN 60939-1, and under the guidance of the IEEE-519 standard.

3.42 Dimensions. The signal generator shall comply with the width and depth of the EIA/ECA-310-E standard equipment rack configuration.

3.43 Rack mount. The signal generator shall be capable of being rack-mounted in a standard EIA/ECA-310-E equipment rack and, if required, include a rack-mount conversion kit that meets the requirements of MIL-PRF-28800, section 3.6.4.14.1.

3.44 Weight. The total weight of the signal generator, excluding accessories and manuals, shall comply with MIL-STD-1472 for weight and size restrictions for single-person lift and handling, and shall not exceed a one-person lift  $\leq 35$  pounds (15.6 kilograms).

3.45 Markings. All warning decals and instrument-category ratings must conform to commercial safety standards and be visible by the user in accordance with commercial product safety labeling regulations and MIL-STD-130. Markings shall be applied with paint, decals, engraving, or molding and shall be the largest size possible. Warning/Danger text shall be lusterless red.

4. REGULATORY REQUIREMENTS. The offeror/contractor is encouraged to use recovered materials or biobased content to the maximum extent practicable, in accordance with Federal Acquisition Regulation, Part 23.403.

5. PRODUCT CONFORMANCE. Verification of the delivered signal generator set will be performed by the end user at the delivery point.

## 6. PACKAGING.

6.1 Packaging. Preservation, packing, and marking shall be as specified in the contract or order.

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## 7. NOTES.

7.1 Source of documents.

7.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks listed below form a part of this specification to the extent specified herein.

## DEPARTMENT OF DEFENSE SPECIFICATIONS

- |               |   |   |
|---------------|---|---|
| MIL-PRF-28800 | - | General Specification for Test Equipment for use with Electrical and Electronic Equipment |
| MIL-PRF-39012 | - | Connectors Electrical Circular, Screw & Bayonet Coupling                                  |

## DEPARTMENT OF DEFENSE STANDARDS

- |              |   |  |
|--------------|---|--|
| MIL-STD-461  | - | Requirements for the Control of Electromagnetic Interference   |
| MIL-STD-810  | - | Environmental Test Methods   |
| MIL-STD-1472 | - | Human Engineering  |
| MIL-STD-1686 | - | Electrostatic Discharge Control Program for Protection of Electrical and Electronic Parts, Assemblies and Equipment (excluding electrically initiated explosive devices) |
| MIL-HDBK-263 | - | Electrostatic Discharge Control Handbook for Protection of Electrical and Electronic Parts   |

(Copies of these documents are available at <https://assist.dla.mil>.)

7.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## CODE OF FEDERAL REGULATIONS

- |                   |   |   |
|-------------------|---|---|
| Title 47, Part 15 | - | Federal Communications Commission (FCC),<br>Radio Frequency Devices |
|-------------------|---|---|

(Copies of these documents are available at <http://www.ecfr.gov/cgi-bin/ECFR?page=browse>.)

7.1.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

## ELECTRONIC COMPONENTS INDUSTRY ASSOCIATION (ECIA)



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- |               |   |   |
|---------------|---|---|
| EIA/ECA-310-E | - | Cabinets, Racks, Panels, and Associated Equipment |
|---------------|---|---|

(Copies of these documents are available at <http://www.ecianow.org/standards-practices/standards/>.)

### INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

- |               |   |  |
|---------------|---|--|
| IEC 61000-4-1 | - | Electromagnetic Compatibility (EMC)<br>Application & Mitigation International Electro-<br>Technical Commission Edition 3.0                             |
| IEC 61000-4-4 | - | Electromagnetic compatibility (EMC) – Part 4-4:<br>Testing and measurement techniques – Electrical<br>fast transient/burst immunity test - Edition 3.0 |
| IEC 61010-1   | - | Safety Requirements for Electrical Equipment for<br>Measurement, Control and Laboratory Use  |
| IEC 60488-1   | - | Standard Digital Interface for Programmable<br>Instrumentation: Part 1 General   |
| IEC 60488-2   | - | Standard Digital Interface for Programmable<br>Instrumentation: Part 2, Codes, Format, Protocol<br>& Common Commands                                   |
| IEC 60939-1   | - | Passive filter units for electromagnetic<br>interference suppression – Part 1: Generic<br>specification  |

(Copies of these documents are available at [http://www.iec.ch/emc/basic\\_emc/](http://www.iec.ch/emc/basic_emc/).)

### INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

- |          |   |  |
|----------|---|--|
| ISO 7779 | - | Measurement of airborne noise emitted by<br>information technology and telecommunications<br>equipment |
| ISO 8253 | - | Audiometric test methods — Part 1: Pure-tone air<br>and bone conduction audiometry                     |

(Copies of these documents are available at <http://www.iso.org/>.)

### ESD ASSOCIATION, INC.

- |                      |   |  |
|----------------------|---|--|
| ANSI/ESD-S20.20-2014 | - | Protection of Electrical and Electronic Parts,<br>Assemblies and Equipment (Excluding<br>Electrically Initiated Explosive Devices) |
|----------------------|---|--|

(Copies of these documents are available at <https://www.esda.org/standards/>.)



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INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

- |          |   |  |
|----------|---|--|
| IEEE-519 | - | IEEE Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems |
|----------|---|--|

(Copies of these documents are available at <http://standards.ieee.org/>.)

UNDERWRITERS LABORATORIES (UL)

- |         |   |  |
|---------|---|--|
| UL 1283 | - | Standard for Safety Electromagnetic Interference Filters               |
| UL 1449 | - | Underwriters Laboratories Standard for Safety Surge Protective Devices |

(Copies of these documents are available at <http://www.ul.com/>.)

7.2 Ordering data. Procurement documents must specify: title, number, date of this CID, the issue of the ASSIST Online, <https://assist.dla.mil> to be used in the solicitation, and preservation and packaging requirements.

7.3 Key words.

Calibration

7.4 Changes from previous issue. Marginal notations are not used in this revision due to the extent of changes made within the document. Please read the document in its entirety.

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## MILITARY INTERESTS

Custodian:  
Air Force - 84

Preparing Activity:  
Air Force - 84

Reviewer:  
Army – MI  
Air Force - 99

Agent:  
Air Force - 99

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