# 9900 Series Frequency Converters

The MITEQ frequency converters are designed for advanced satellite communication systems and are available for a wide variety of frequency plans. Phase noise, amplitude flatness and spurious outputs have been optimized to provide the user with a transparent frequency conversion for all video and data applications.

A strong feature set of monitor and control functions supports powerful local and remote control. Among the features are control of frequency, attenuation and 64 memory locations for each converter where various setups can be stored and recalled.

A continuously updated log of time-stamped records of activity is also provided.

| RF Frequency (GHz) | Model Numbers | |
|---|---|---|
| **Upconverters** | | |
| 5.725 - 6.725 | U-9953-6-1K | |
| 13.75 -14.8 | U-9956-6-1K | |
| **NEW** 17.3 -18.4 | U-9957-2-1K | **NEW** |
| **Downconverters** | | |
| 3.4 - 4.2 | D-9901-1-1K | |
| 10.7 - 12.75 | D-9908-6-1K | |

## Features

- **Supports expandable NSU 1:N Switchover Series (D-323)**
- **Amplitude slope adjust**
- **Three monitor and control ports:**
    1. **RS485/RS422 remote interface (J6A) changes to RS232 with Option 17C**
    2. **RS485/RS422 control interface (J7) is provided for use with NSU redundancy system (D-323) or as an alternative interface**
    3. **10/100Base-T Ethernet interface (J6B)**
- **RF, IF and LO monitor ports**
- **Automatic switching to external 5/10 MHz reference and electronic adjust of internal reference frequency**
- **Low intermodulation distortion**
- **Better than IESS-308/309 compliant phase noise**
- **64 programmable memory locations**
- **30 dB level control**
- **External alarm input via contact closure**
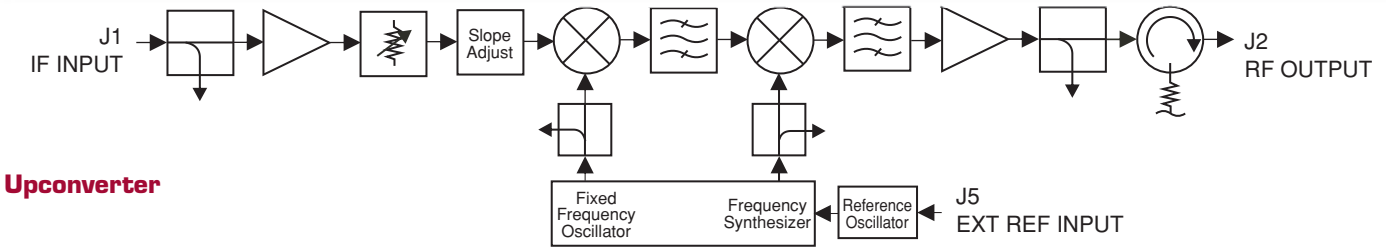- **Date and time-stamped event log**
- **CE Mark**

## Options

- **Higher stability reference**
- **Remote RS232**
- **140 MHz IF frequency**
- **50 ohm IF impedance**
- **Type "N" RF connector**

| Specifications | Upconverter | Downconverter |
|---|---|---|
| Type | Dual conversion | |
| Frequency step size | 1 kHz | |
| Frequency sense | No inversion | |
| **Input characteristics** | | |
| Frequency | 70 ±20 MHz (140 ±40 MHz Option 4) | Refer to model number table |
| Impedance | 75 ohms (50 ohms Option 15) | 50 ohms |
| Return loss | 26 dB minimum (70 ±20 MHz), 20 dB minimum (140 ±40 MHz) | 21 dB minimum |
| Signal monitor | -20 dBc nominal | |
| Input level (non-damage) | +15 dBm maximum | |
| **Output characteristics** | | |
| Frequency | Refer to model number table | 70 ±20 MHz (140 ±40 MHz Option 4) |
| Impedance | 50 ohms | 75 ohms (50 ohms Option 15) |
| Return loss | 21 dB minimum 20 dB minimum (17.3 – 18.4 GHz) | 26 dB minimum (70 ±20 MHz), 20 dB minimum (140 ±40 MHz) |
| Signal monitor | -20 dBc nominal | |
| **Power output (P1 dB)** | | |
| C-band | +16 dBm minimum/17 dBm typical | |
| Ku-band, DBS-band | +10 dBm minimum/12 dBm typical | +16 dBm minimum/17 dBm typical |
| **Transfer characteristics** | | |
| Gain | +31–34 dB at 23°C | +44-48 dB at 23°C |
| Noise figure at min. atten. | 14 dB maximum | 11 dB maximum |
| Noise power density | -125 dBm/Hz maximum | N/A |
| Image rejection | N/A | 80 dB minimum |
| Level stability | ±0.25 dB/day maximum at constant temperature ±0.5 dB typical from 0 to 50°C | |
| Amplitude response | ±0.3 dB maximum/40 MHz, ±0.45 dB maximum/80 MHz (140 ±40 MHz Option 4) | |
| Slope adjust | ±1 dB typical in 0.2 dB steps | |
| **Group delay (70 ±18 MHz)** | | |
| Linear | 0.03 ns/MHz maximum (15 to 50ºC) | |
| Parabolic | 0.01 ns/MHz$^2$ maximum (15 to 50ºC) | |
| Ripple | 1 ns peak-to-peak maximum | |
| **Group delay (140 ±36 MHz)** | | |
| Linear | 0.025 ns/MHz maximum (15 to 50ºC) | |
| Parabolic | 0.0035 ns/MHz$^2$ maximum (15 to 50ºC) | |
| Ripple | 1 ns peak-to-peak maximum | |
| **Intermodulation distortion (third order)** | Two signals each at 0 dBm output | Two signals each at 0 dBm output |
| C-band | 55 dBc minimum (+27.5 dBm IP3 pt.) | 60 dBc minimum (+30 dBm IP3 pt.) |
| Ku-band, DBS-band | 45 dBc minimum (+22.5 dBm IP3 pt.) | 60 dBc minimum (+30 dBm IP3 pt.) |
| AM/PM conversion | 0.1°/dB maximum to 0 dBm output | |
| Gain slope | 0.03 dB/MHz typical, 0.05 dB/MHz maximum (10 MHz minimum) | |
| Frequency stability | ±2 x 10$^{-8}$, 0 to 50°C (higher stability options available) ±5 x 10$^{-9}$/day typical (fixed temperature after 24 hour on time) | |
| Frequency accuracy | C-band: ±10 Hz, Ku-band: ±22 Hz, maximum using external reference, DBS-band: 0 Hz | |
| **Spurious outputs** | | |
| Signal related | 65 dBc up to 0 dBm output | |
| Signal independent | -80 dBm maximum | |
| LO leakage at RF port | -75 dBm maximum | -80 dBm maximm |
| Gain adjustment | 30 dB in 0.2 dB steps | |
| Upconverter mute | 80 dB minimum | N/A |
| External reference | 5 or 10 MHz, +4 ±3 dBm Unit will automatically switch to internal reference if external reference level falls below +1 dBm nominal | |
| Phase noise | See graph | |
| Remote interface | RS485/RS422: 2 ports user selectable each port (1 port with Option 17C) Ethernet interface: HTTP based web server, SNMP 1.0 configuration, Alarm reporting via SNMP trap, Telnet access, Password protection | |

Note: All specifications guaranteed at maximum gain unless otherwise noted.
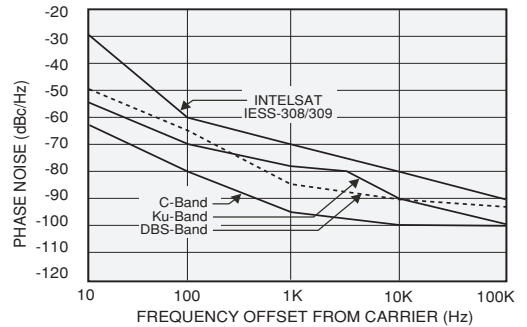
## Representative Block Diagrams

**Upconverter**

J1 IF INPUT → ... → Slope Adjust → ... → J2 RF OUTPUT

Fixed Frequency Oscillator — Frequency Synthesizer — Reference Oscillator — J5 EXT REF INPUT

**Downconverter**

J1 RF INPUT → ... → Slope Adjust → ... → J2 IF OUTPUT

Frequency Synthesizer — Fixed Frequency Oscillator — Reference Oscillator — J5 EXT REF INPUT
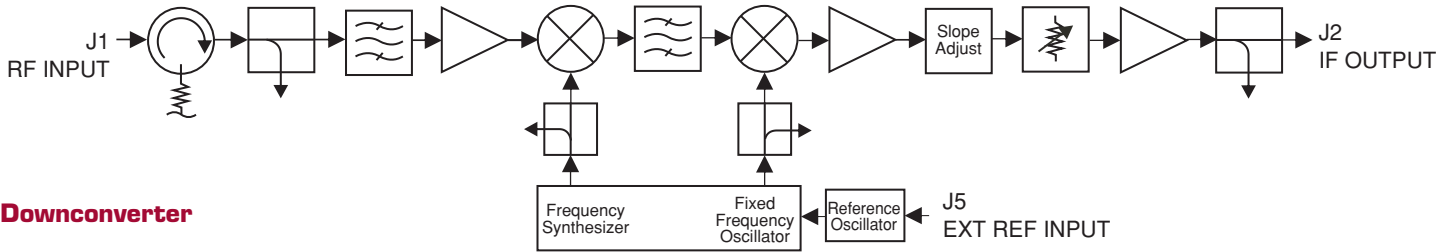
## Phase Noise Specifications

**Maximum External Reference To Achieve Above Phase Noise**

| Model | 10 | 100 | 1K | 10K | 100K |
|---|---|---|---|---|---|
| All Systems | -120 | -150 | -160 | -160 | -160 |

**MAXIMUM PHASE NOISE CHARACTERISTICS (1.0 Hz BANDWIDTH)**

PHASE NOISE (dBc/Hz) vs FREQUENCY OFFSET FROM CARRIER (Hz)

INTELSAT IESS-308/309

C-Band
Ku-Band
DBS-Band

## Options

**4.** 140 MHz IF frequency.

**10.** Higher frequency stability reference.
   **B.** $\pm5 \times 10^{-9}$, 0 to 50°C,
     $1 \times 10^{-9}$/day typical (fixed temperature after 24 hour on time).
   **C.** $\pm2 \times 10^{-9}$, 0 to 50°C,
     $1 \times 10^{-9}$/day typical (fixed temperature after 24 hour on time).
   **E.** $\pm5 \times 10^{-9}$, 0 to 50°C,
     $1 \times 10^{-9}$/day typical (fixed temperature after 24 hour on time).
     Analog reference Phase Lock: External 5 or 10 MHz at +4 ±3 dBm. If external reference is below +1 dBm nominal, the converter will automatically lock to the internal reference. Reference oscillator acts as an analog phase lock with a 0.1 Hz nominal loop bandwidth. Typical loop suppression of the external reference is as follows: 28 dB at 1 Hz offset; 65 dB at 10 Hz offset and 100 dB at 100 Hz offset.

**15.** 50 ohm IF impedance.

**17.** Remote control.
   **C.** RS232 remote interface.

**NRF.** Type N-female RF connector (Note: Monitor remains SMA female; not available above 17 GHz).

Notes: Missing option numbers are not applicable for this product. For literature describing Local control (front panel) and remote control (bus protocols), refer to MITEQ's Technical Note 25T063.

   Protocols are backwards compatible with Technical Notes 25T010 and 25T009.

## General Specifications

### Primary Power Requirements

Voltage ......................................................................... 90-250 VAC
Frequency .................................................................... 47-63 Hz
Consumption ............................................................... 25 W typical

### Physical

Weight ......................................................................... 12 pounds nominal
Chassis dimensions ..................................................... 19" x 1.75" panel height x 20" maximum
Connectors
    RF............................................................................ SMA female (N female, Option NRF)
    RF monitor............................................................... SMA female
    IF ............................................................................ BNC female
    IF monitor ............................................................... BNC female
    LO monitors............................................................ SMA female
    Alarm ...................................................................... DE-9P
    External reference .................................................. BNC female
    Remote interface .................................................... DE-9S for RS485, RS422 and RS232,
                                                  RJ-45 female for Ethernet
    Primary power input ................................................ IEC-320
    Auxiliary control interface ....................................... DE-9S

### Environmental

Operating
    Ambient temperature............................................... 0 to 50°C
    Relative humidity ..................................................... Up to 95% at 30°C
    Atmospheric pressure ............................................. Up to 10,000 feet
Nonoperating
    Ambient temperature............................................... -50 to +70°C
    Relative humidity ..................................................... Up to 95% at 40°C
    Atmospheric pressure ............................................. Up to 40,000 feet
    Shock and vibration................................................. Normal handling by commercial carriers

## Typical Rear Panel View



RSM Switch Module Location
(see D-323 for more information)

**100 Davids Drive, Hauppauge, NY 11788**
**TEL.: +1-631-436-7400 · FAX: +1-631-436-7431**
**www.miteq.com**