



# X-BAND UPCONVERTER AND DOWNCONVERTER

**Models U-94-25020 and D-94-25020**  
**7.25–7.75 GHz (Downconverter)**  
**7.9–8.4 GHz (Upconverter)**  
**Synthesized, 1.0 kHz Step Size**



These converters operate at the standard X-band military communication frequencies of 7.25–7.75 GHz (downlink), and 7.9–8.4 GHz (uplink). The converters have been designed for exceptionally low phase noise and spectral purity. An internal microwave synthesizer provides frequency tuning in 1.0 kHz minimum frequency steps over the RF frequency band. Local control is with front panel keyboard and remote control is by RS485 input command. Up to 30 discrete frequencies may be programmed into a nonvolatile memory.

## FEATURES

- Dual conversion with 1.0 kHz frequency step size
- Local (keyboard) or remote control (RS485)
- Low intermodulation distortion
- No spectral inversion
- Low phase noise
- Status monitors
- Summary alarm
- 30 programmable frequencies
- Nonvolatile memory

## UPCONVERTER SPECIFICATIONS

Type .....	Dual conversion
Tunability .....	Second local oscillator only, 1.0 kHz minimum frequency step size
Frequency sense .....	No inversion
Input characteristics	
Frequency .....	70 ±20 MHz
Impedance .....	75 ohms (50 ohms optional)
Return loss .....	26 dB minimum
Signal levels .....	-10 dBm maximum for +10 dBm output, +20 dBm minimum non-damage
Output characteristics	
Frequency .....	7.9–8.4 GHz
Impedance .....	50 ohms
Signal level .....	+10 dBm for 70 MHz input of -10 dBm to +10 dBm
LO leakage (output) .....	-85 dBc minimum at any setting of upconverter gain
Power output	
(1 dB compression) .....	+10 dBm minimum for any gain setting from 0 dB to 20 dB
Residual AM .....	66 dBc minimum
RF output monitor .....	-10 dBc nominal, not affected by mute control
Output muting (see note) .....	60 dB minimum
Return loss .....	20 dB minimum
Transfer characteristics	
Noise figure .....	20 dB maximum
Gain .....	20 dB minimum, 25 dB maximum
Gain adjustment range .....	0 dB to 20 dB in 0.2 dB steps
Amplitude flatness .....	±0.15 dB over any 12 MHz segment, ±0.20 dB/20 MHz, ±0.25 dB/40 MHz
Gain stability .....	±0.25 dB/24 hours for any 15°C change in temperature from 0–50°C, ±0.1 dB/minute
Spurious outputs	
(+10 dBm carrier output) .....	-80 dBc maximum for f greater than 1 MHz offset from carrier, -60 dBc maximum for f between 300 Hz and 1 MHz offset from carrier, -45 dBc maximum for f less than 300 Hz offset from carrier

## DOWNCONVERTER SPECIFICATIONS

Type .....	Dual conversion
Tunability .....	First local oscillator only, 1.0 kHz minimum frequency step size
Frequency sense .....	No inversion
Input characteristics	
Frequency .....	7.25–7.75 GHz
Impedance .....	50 ohms
Return loss .....	20 dB minimum
Signal level .....	-41 dBm maximum operating, +10 dBm maximum non-damage
LO leakage (input) .....	-80 dBm maximum
RF test input .....	-10 dB nominal, not affected by mute command
Input mute (see note) .....	60 dBc minimum
Output characteristics	
Frequency .....	70 ±20 MHz
Impedance .....	75 ohms (50 ohms optional)
Return loss .....	26 dB minimum
Signal level .....	0 dBm ±1 dB, for -45 dBm RF input
Power output	
(1 dB compression) .....	+10 dBm minimum for any gain setting from 25 dB to 45 dB
Transfer characteristics	
Noise figure .....	16 dB maximum
Gain .....	45 dB minimum, 50 dB maximum
Gain adjustment range .....	25 dB to 45 dB in 0.2 dB steps
Amplitude flatness .....	±0.15 dB over any 12 MHz segment, ±0.20 dB/20 MHz, ±0.25 dB/40 MHz
Gain stability .....	±0.35 dB/24 hours for any 15°C change in temperature from 0–50°C, ±0.1 dB/minute
Image rejection .....	80 dB minimum
Third order intermodulation .....	With two -46 dBm in-band input signals, 65 dBc minimum
Spurious outputs	
(input signal -41 dBm) .....	-80 dBc maximum for f greater than 1 MHz offset from carrier, -60 dBc maximum for f between 300 Hz and 1 MHz offset from carrier, -45 dBc maximum for f less than 300 Hz offset from carrier

## GENERAL SPECIFICATIONS, UPCONVERTER AND DOWNCONVERTER

5 MHz reference input.....	3 dBm to +10 dBm, +16 dBm minimum non-damage
Input impedance (5 MHz).....	50 ohms unbalanced, 1.5:1 VSWR maximum
Phase linearity .....	$\pm 0.025$ radian in any 12 MHz segment, $\pm 0.05$ radian $\pm 10$ MHz, $\pm 0.10$ radian $\pm 20$ MHz

Spectral purity (total spurious content imparted to carriers including phase noise and discrete spurious signals):

- At least 28 dB below the carrier level, integrated over a single-sided bandwidth covering the range of offsets from the carrier of 0.6 to 75 Hz.
- At least 36 dB below the carrier level, integrated over a single-sided bandwidth covering the range of offsets from the carrier of 10 Hz to 5 MHz.
- At least 36 dB below the carrier level, integrated over a single-sided bandwidth covering the range of offsets from the carrier of 5 MHz to 20 MHz.
- At least 57 dB below the carrier level, integrated over any single-sided 3 kHz bandwidth covering the range of offsets from the carrier of 12 kHz to 20 kHz.
- At least 63 dB below the carrier level, integrated over any single-sided 3 kHz bandwidth covering the range of offsets from the carrier of 20 kHz to 60 kHz.
- At least 71 dB below the carrier level, integrated over any single-sided 3 kHz bandwidth covering the range of offsets from the carrier of 60 kHz to 300 kHz.

	Offset (Hz)	SSB Phase Noise in 1 Hz BW
The spectral purity specifications shall be met with the following 5 MHz reference spectral purity performance:	0.1	-72 dB, maximum
	1.0	-93 dB, maximum
	10.0	-120 dB, maximum
	100.0	-126 dB, maximum
	1000.0	-140 dB, maximum

Remote control bus.....	RS485 (other remote bus configurations available)
MTBF .....	10,000 hours minimum
MTR .....	20 minutes maximum

Notes: Muting will occur for failure of converter or remote mute command on RS485 bus.  
Test and monitor points are not affected by mute control.

## OPTIONS

**2.** LO level alarm. Summary alarm (contact closure) is generated for loss of power in any of the required local oscillators.

**10.** Internal reference (stability of reference).

- $\pm 2 \times 10^{-8}$ , 0 to 50°C;  $\pm 5 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time).
- $\pm 1 \times 10^{-8}$ , 0 to 50°C;  $5 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time).
- $\pm 5 \times 10^{-9}$ , 0 to 50°C;  $1 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time).
- $\pm 2 \times 10^{-9}$ , 0 to 50°C;  $1 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time).

**15.** 50 ohm IF impedance.

**17.** Remote control. RS485 is supplied as standard.

- RS422.
- RS232.
- Contact closure selection of up to sixteen pre-programmed frequencies.
- IEEE 488.

**24.** 10 MHz reference frequency.

Note: Missing option numbers are not applicable to this product.

# X-BAND UPCONVERTER AND DOWNCONVERTER

## PRIMARY POWER REQUIREMENTS

Voltage .....	100, 120, 220, 230/240 VAC +10%, -13% (rear panel selectable) 250 VAC maximum
Frequency .....	45–65 Hz
Power consumption .....	175 W maximum

## SUMMARY ALARM

Contact closure/open for DC voltage alarm  
Contact closure/open for DC voltage and/or LO alarm

## PHYSICAL

Weight .....	30 pounds nominal
Overall dimensions .....	19" x 3.5" panel x 22" maximum (chassis depth 20")
Connectors (rear panel)	
RF .....	Type N female
IF .....	Type BNC female
Reference input .....	Type BNC female
RF test input (downconverter) .....	Type N female
RF test output (upconverter) .....	Type N female
Remote interface .....	DEM-9S for RS485 and RS422, DB-25P for RS232, DB-25S for contact closure, and BCD contact closure, IEEE-488 receptacle for GPIB
Summary alarm .....	DE-9P
Redundancy alarm .....	DE-9P
LO frequency/power monitor .....	SMA female (front panel)

## ENVIRONMENTAL

Operating	
Operation .....	Continuous (24 hours per day)
Temperature .....	3 to 50°C
Relative humidity .....	Up to 100%, noncondensing
Altitude .....	Elevations up to 13,500 feet above sea level
Nonoperating	
Temperature .....	-40 to +60°C
Relative humidity .....	Up to 90% at air temperature below 0°C, Up to 100% at air temperature above 0°C
Elevation .....	Up to 40,000 feet above sea level

Note: For literature describing local control (front panel) and remote control (bus protocols), refer to MITEQ's Technical Note 25T010.



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