

## 300 Series Outdoor Communication Converters



Single Band, Synthesized Frequency  
Up- and Downconverters covering  
L- through Ka- SATCOM bands

RF Frequency (GHz)	Model Number
<b>Upconverters</b>	
<b>Standard Frequency Band</b>	
0.95 – 1.75	U-368-1
2 – 2.4	U-368-4
5.725 – 6.725	U-373-6
6.7 – 7.1	U-373-2
7.9 – 8.4	U-374
12.75 – 13.25	U-375-2
12.75 – 14.5	U-376-7
13.75 – 14.5	U-376-3
13.75 – 14.8	U-376-6
17.3 – 18.4	U-377-2
27.5 – 31	U-358-3
28.3 – 30	U-358-4
29 – 31	U-358-2
<b>Reverse Frequency Band</b>	
3.4 – 4.2	U-321-R1
4.5 – 4.8	U-322-R2
7.25 – 7.75	U-325R
10.7 – 12.75	U-328-R6
17.7 – 21.2	U-313-R4
18.3 – 20.2	U-313-R5
<b>Downconverters</b>	
<b>Standard Frequency Band</b>	
0.95 – 1.75	D-320-3
2 – 2.4	D-320-6
3.4 – 4.2	D-321-1
4.5 – 4.8	D-322-2
7.25 – 7.75	D-325
10.7 – 12.75	D-328-6
17.7 – 21.2	D-313-4
18.3 – 20.2	D-313-5
<b>Reverse Frequency Band</b>	
5.725 – 6.725	D-373-R6
6.7 – 7.1	D-373-R2
7.9 – 8.4	D-374R
12.75 – 13.25	D-375-R2
12.75 – 14.5	D-376-R7
13.75 – 14.8	D-376-R6
17.3 – 18.4	D-377-R2
27.5 – 31	D-358-R3
28.3 – 30	D-358-R4
29 – 31	D-358-R2
<b>Narrow Band for TT&amp;C Applications</b>	
<b>Upconverters</b>	
2.02 – 2.12	U-368-5
2.2 – 2.3	U-368-6
<b>Downconverters</b>	
2.02 – 2.12	D-320-7
2.2 – 2.3	D-320-8

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.

The 300 series of synthesized frequency converters is designed for both single and redundant operation in an outdoor environment. An internal synthesizer provides frequency tuning. All units are fully compliant with INTELSAT requirements IESS-308/309.

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

### Features

- 1 kHz step size frequency selection
- Compact outdoor unit
- Better than IESS-308/309 phase noise
- Support external redundancy for 1:1 switch
- Dual conversion
- No spectral inversion
- Ethernet and RS485 remote control
- Automatic switching to external 5/10 MHz reference and electronic frequency adjust of internal reference
- Low intermodulation distortion
- Downconverter supply DC for external LNA with current monitoring
- Simple installation
- Date and time-stamped event log
- System temperature monitor
- CE Mark

### Options

- Higher stability reference
- 140 MHz IF frequency
- Higher gain (downconverter)
- Selectable 70/140 MHz IF frequency
- 50 ohms IF impedance
- Group delay equalization
- LO level alarm

Specifications	Upconverter	Downconverter
Type	Dual conversion	
Frequency step size	1 kHz	
Frequency sense	No inversion	
Input characteristics		
Frequency	70 $\pm$ 20 MHz (140 $\pm$ 40 MHz Option 4)	Refer to model number table
Impedance	75 ohms (50 ohms Option 15)	50 ohms
Return loss	18 dB minimum	18 dB minimum, 17 dB minimum > 22 GHz
Signal monitor	-20 dBc nominal	-20 dBc nominal (optional above 17.7 GHz)
LO leakage	N/A	-80 dBm maximum
Input level (nondamage)	+15 dBm maximum	
Output characteristics		
Frequency	Refer to model number table	70 $\pm$ 20 MHz (140 $\pm$ 40 MHz Option 4)
Impedance	50 ohms	75 ohms (50 ohms Option 15)
Return loss	18 dB minimum, 17 dB minimum > 22 GHz	18 dB minimum
Signal monitor	-20 dBc nominal	
LO leakage	-75 dBm maximum	N/A
Power output (P1dB)	+15 dBm minimum	+20 dBm minimum 43–50 dB at 23°C, 55–61 dB at 23°C (Option 16C)
Transfer characteristics		
Gain	30–35 dB at 23°C	55–61 dB at 23°C (Option 16C)
Noise figure at min. atten.	15 dB maximum, 18 dB above 22 GHz	12 dB maximum, 15 dB above 22 GHz
Image rejection	80 dB minimum	
Level stability	$\pm$ 0.25 dB/day maximum at constant temperature, $\pm$ 2.0 dB typical from -40 to +60°C	
Amplitude response		
70 $\pm$ 20 MHz	$\pm$ 0.3 dB/ $\pm$ 20 MHz	
140 $\pm$ 40 MHz	$\pm$ 0.45 dB/ $\pm$ 40 MHz	
Group delay (70 $\pm$ 18 MHz)		
Linear	0.03 ns/MHz maximum	
Parabolic	0.01 ns/MHz <sup>2</sup> maximum	
Ripple	1 ns peak-to-peak maximum	
Group delay (140 $\pm$ 36 MHz)		
Linear	0.025 ns/MHz maximum	
Parabolic	0.0035 ns/MHz <sup>2</sup> maximum	
Ripple	1 ns peak-to-peak maximum	
Intermodulation distortion (third order) at 0 dBm output	50 dBc minimum (+25 dBm IP3 pt.)	54 dBc minimum (+27 dBm IP3 pt.)
AM/PM conversion	0.04°/dB maximum to 0 dBm output	
Gain slope		
70 $\pm$ 20 MHz	0.03 dB/MHz typical (10 MHz maximum)	
140 $\pm$ 40 MHz	0.05 dB/MHz typical (10 MHz maximum)	
Spurious outputs		
Signal related	65 dBc up to 0 dBm output, 60 dBc above 22 GHz	
Signal independent	-70 dBm maximum	-75 dBm maximum, -65 dBm maximum (Option 16C)
Gain adjustment	30 dB in 0.2 dB steps	
Amplitude slope adjust	$\pm$ 3 dB typical in 0.2 dB steps	
Frequency stability	$\pm$ 5 $\times$ 10 <sup>-8</sup> , -40 to +60°C (higher stability options available), $\pm$ 5 $\times$ 10 <sup>-9</sup> /day typical (fixed temperature after 24 hour on time)	
Upconverter mute	60 dB minimum	N/A
External reference	5 or 10 MHz, +4 $\pm$ 3 dBm Unit will automatically switch to internal reference if external reference level falls below +1 dBm nominal	
Phase noise	See chart	
Noise power density	-124 dBm/Hz maximum, -121 dBm/Hz maximum above 22 GHz	N/A
Remote interface	RS485/RS422: user selectable port 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.

## 300 Series Outdoor Communication Converters

### Phase Noise Specifications

### Standard

### Option 31 - Ultra-Low Phase Noise

Model Number	10	100	1K	10K	100K	300K	1M	10	100	1K	10K	100K	300K	1M	Offset [Hz]
U-368-1	-57	-77	-92	-97	-99	-99	-117	-60	-80	-96	-100	-101	-101	-122	Maximum Phase Noise (dBc/Hz) (1 Hz bandwidth) Straight line curve defined by the points in the table
U-368-4, U-368-5, U-368-6	-60	-78	-88	-96	-96	-96	-117	-65	-86	-100	-102	-105	-107	-125	
U-373-2, U-373-6	-57	-77	-90	-97	-99	-99	-117	-65	-85	-96	-99	-100	-100	-120	
U-374	-57	-77	-90	-97	-99	-99	-117	-62	-82	-96	-98	-100	-100	-120	
U-375-2	-51	-69	-87	-91	-93	-93	-111	-60	-79	-91	-93	-95	-95	-118	
U-376-3, U-376-6	-50	-66	-87	-91	-93	-93	-111	-59	-75	-91	-93	-95	-95	-118	
U-376-7, U-377-2	-50	-66	-85	-90	-93	-93	-111	-59	-75	-90	-92	-95	-95	-118	
U-358-2, U-358-3, U-358-4	-49	-63	-69	-79	-91	-91	-109	-56	-71	-84	-86	-91	-91	-113	
D-320-3	-57	-77	-92	-97	-99	-99	-117	-60	-80	-96	-100	-101	-101	-122	
D-320-6, D-320-7, D-320-8	-60	-78	-88	-96	-96	-96	-117	-65	-86	-100	-102	-105	-107	-125	
D-321-1, D-322-2	-57	-77	-93	-97	-99	-99	-117	-65	-85	-96	-99	-100	-100	-120	
D-325	-57	-77	-92	-97	-99	-99	-117	-60	-80	-96	-100	-101	-101	-122	
D-328-6	-51	-69	-87	-91	-93	-93	-111	-60	-79	-91	-93	-95	-95	-118	
D-313-4, D-313-5	-49	-63	-69	-79	-91	-91	-109	-56	-71	-84	-86	-91	-91	-113	

### Reverse Frequency Converters

U-321-R1, U-322-R2	-57	-77	-93	-97	-99	-99	-117	-65	-85	-96	-99	-100	-100	-120
U-325R	-57	-77	-92	-97	-99	-99	-117	-60	-80	-96	-100	-101	-101	-122
U-328-R6	-51	-69	-87	-91	-93	-93	-111	-60	-79	-91	-93	-95	-95	-118
U-313-R4, U-313-R5	-49	-63	-69	-79	-91	-91	-109	-56	-71	-84	-86	-91	-91	-113
D-373-R6, D-373-R2	-57	-77	-90	-97	-99	-99	-117	-65	-85	-96	-99	-100	-100	-120
D-374R	-57	-77	-90	-97	-99	-99	-117	-62	-82	-96	-98	-100	-100	-120
D-375-R2	-51	-69	-87	-91	-93	-93	-111	-60	-79	91	-93	-95	-95	-118
D-376-R6	-50	-66	-87	-91	-93	-93	-111	-59	-75	-91	-93	-95	-95	-118
D-376-R7	-50	-66	-85	-90	-93	-93	-111	-59	-75	-90	-92	-95	-95	-118
D-377-R2	-50	-65	-85	-90	-93	-93	-111	-59	-75	-90	-92	-95	-95	-118
D-358-R2, D-358-R3, D-358-R4	-49	-63	-69	-79	-91	-91	-109	-56	-71	-84	-86	-91	-91	-113

### Maximum External Reference To Achieve Above Phase Noise with 10 MHz Reference

	10	100	1K	10K	100K	300K	1M
Systems without Option 31A, C, D or 10 E	-120	-150	-160	-160	-160	-160	-160
Systems with Option 10 E	-95	-130	-140	-140	-140	-140	-140

## Options

1. 45 dB level control.
2. RF signal monitor with -20 dBc nominal level - for units above 17.7 GHz, applicable to downconverters only.
4. 140 MHz IF frequency.
5. Group delay equalization.  
1 ns p-p maximum/70  $\pm$ 18 MHz IF.  
2 ns p-p maximum/140  $\pm$ 36 MHz IF.
8. LO level detect.  
Summary alarm is generated for loss of power in any of the required local oscillators.
10. Higher frequency stability reference.  
  - C.  $\pm 5 \times 10^{-9}$ , -40 to +60°C,  $1 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time).
  - E.  $\pm 5 \times 10^{-9}$ , -40 to +60°C,  $1 \times 10^{-9}$ /day typical (fixed temperature after 24 hour on time). See Note 1 below.  
 NOTE 1: Analog reference Phase Lock: External 5 or 10 MHz at +4  $\pm$ 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.
  - G. Self calibrating tracking reference with controlled slew rate. Internal reference tracks external reference and uses external reference to correct for aging of the internal reference. The internal reference changes frequency at a maximum rate of 0.06 ppm/second. When external reference is lost, the reference frequency is held at the previous value. Frequency stability on internal reference:  $\pm 5 \times 10^{-8}$ , 0 to 50°C,  $1 \times 10^{-9}$ /day typical (fixed temperature after 72 hour on time).  
5  $\times 10^{-8}$ /year typical
  - H. Self calibrating tracking reference with controlled slew rate. Internal reference tracks external reference and uses external reference to correct for aging of the internal reference. The internal reference changes frequency at a maximum rate of 0.06 ppm/second. When external reference is lost, the reference frequency is held at the previous value. Frequency stability on internal reference:  $\pm 2 \times 10^{-9}$ , 0 to 50°C,  $1 \times 10^{-9}$ /day typical (fixed temperature after 72 hour on time).  
5  $\times 10^{-8}$ /year typical
15. 50 ohm IF impedance.
16. Higher gain (downconverter only).  
  - C: 55 dB nominal RF/IF gain.  
 Specification of signal independent spurious increases with increase in IF/RF gain (e.g., if without option, specification is -75 dBm maximum, an increase of 10 dB in gain will result in signal independent spurious of -65 dBm maximum).
20. Selectable 70 MHz and 140 MHz IF frequencies.  
One IF connector provided (N female). Selection of IF frequency is available over the remote bus.
25. Front panel RF connector option.
  - 1. WR-42 grooved flange, 2 psi 10 cm<sup>3</sup>/min. leakage rate.
  - 2. WR-34 grooved flange, 2 psi 10 cm<sup>3</sup>/min. leakage rate.
  - 3. 2.92 mm female per standard outline.
  - 4. 3.5 mm female per standard outline.
  - 5. WR-28 grooved flange, 2 psi 10 cm<sup>3</sup>/min. leakage rate.
26. Pressurization of enclosures capable of 0.5 PSI.  
 Leak rate 3.0 standard cubic feet per hour maximum.  
 3/8" NPT thread with 1/4" hose barb supplied.  
 NOTE: Waveguide units capable of waveguide pressurization (standard) 10 cm<sup>3</sup>/min leak rate.
- 31A. Ultra-low phase noise (See Phase Noise Specifications chart). Option 10E (analog reference phase lock) supplied as standard and an internal reference U-link is provided (an external 10 MHz reference may be applied to the U-link).
- 31C. 5 MHz reference only (no internal provided) at +4  $\pm$ 3 dBm. For ultra-low phase noise reference (no reference suppression) or direct reference multiplication inside 100 kHz. See below for calculation of required external reference phase noise (for Option 31C and 31D).

## Options (Cont.)

**31D.** 10 MHz reference only (no internal provided) at  $+4 \pm 3$  dBm. For ultra-low phase noise reference (no reference suppression) or direct reference multiplication inside 100 kHz. See below for calculation of required external reference phase noise (for Option 31C or 31D).

Formula for calculation of external reference only (Option 31C or 31D):

External reference phase noise required to meet the ultra phase noise system characteristics.

$$(U - 20 \log(M) - 3) \text{ dBc/Hz.}$$

Where U is the ultra phase noise characteristic at a specific frequency offset for a specific model and M is the multiplication factor of the reference frequency (5 or 10 MHz) divided into the operational RF frequency ( $F_o$ ) of the model selected.

$$M = F_o \text{ (MHz)}/10 \text{ (MHz) or } F_o \text{ (MHz)}/5 \text{ (MHz)}$$

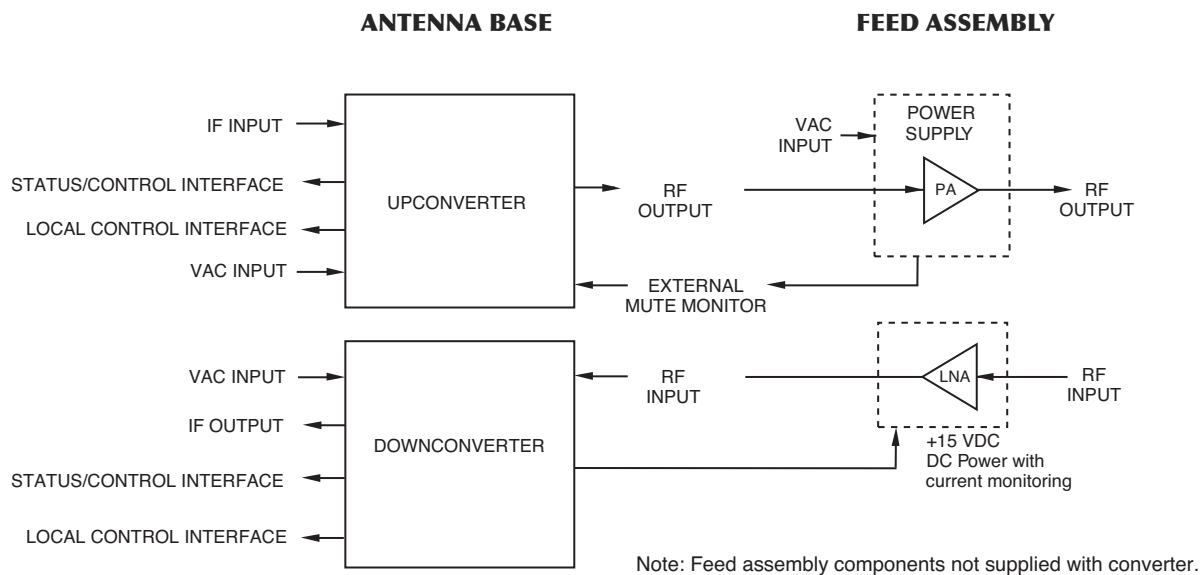
NOTES: Missing option numbers are not applicable to this product.

For literature describing local control and remote control (bus protocols), refer to MITEQ's Technical Note 25T074.

Protocol backward compatible with 25T032 (with minor exceptions). Please consult factory for compatibility chart.

For SATCOM low-noise amplifiers, refer to MITEQ's Catalog C-39.

## Typical System Diagram



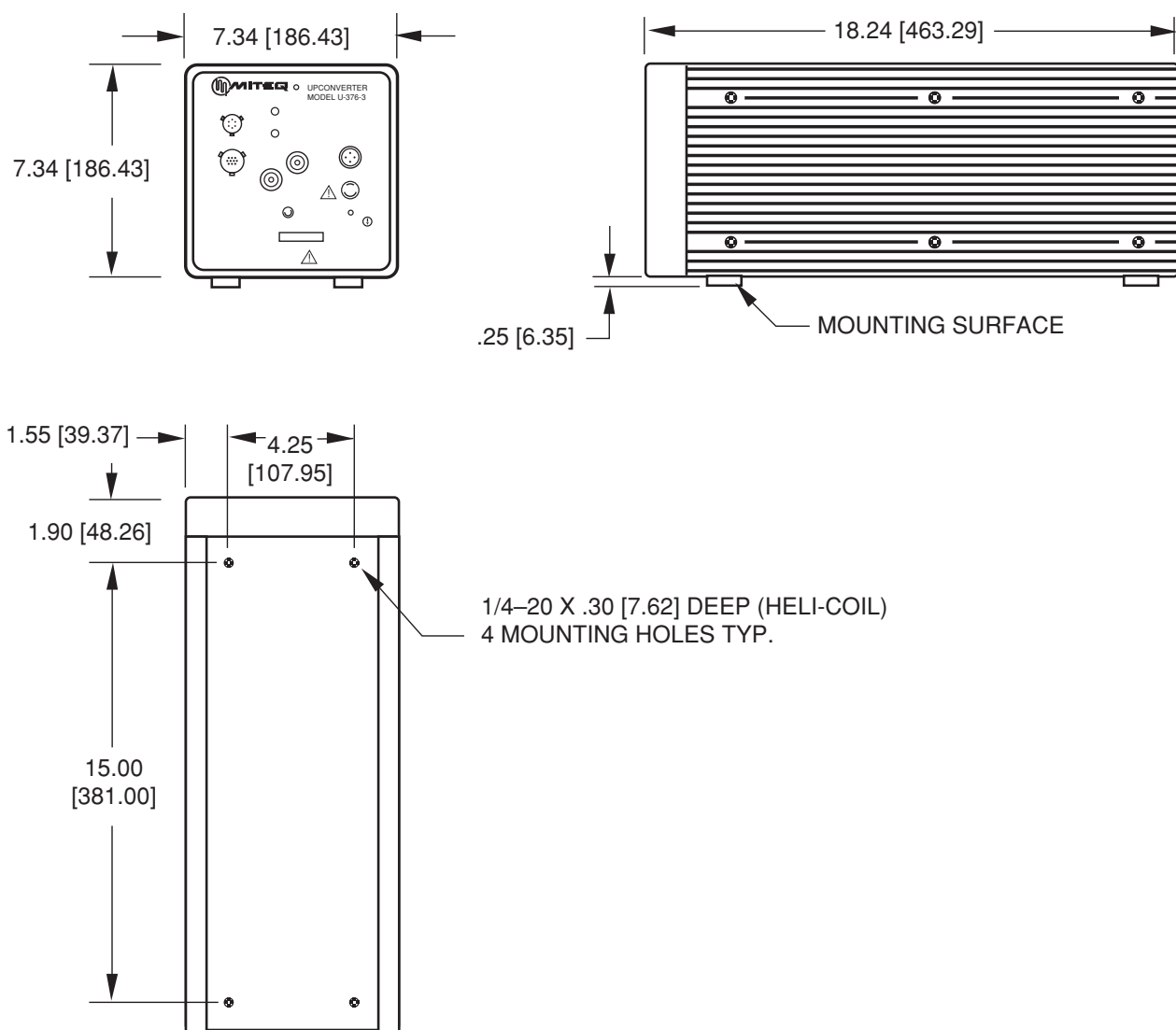
## Rack Mount Control Unit



19" Rack-mount control unit MITEQ Number RCT-300 (sold separately)

## Outline Drawing

### Up or Downconverter



NOTE: DIMENSIONS SHOWN IN [ ] BRACKETS ARE IN MILLIMETERS.

## General Specifications

### Primary Power Requirements

Voltage .....	100–240 VAC (-10%, +6%)
Frequency .....	47–63 Hz
Power consumption.....	60 W typical

### Summary Alarm

Contact closure/open for DC voltage and/or LO alarm  
Status alarm readout on remote control bus

### Physical

Converter enclosure ..... Refer to outline drawing

#### Connectors

##### Front panel connectors

##### RF band

Below 25 GHz .....	SMA female compatible
25 – 27 GHz.....	WR-34 grooved, 2 psi 10 cm <sup>3</sup> /min leakage rate (see Option 27 for alternatives)
Above 27 GHz .....	WR-28 grooved, 2 psi 10 cm <sup>3</sup> /min leakage rate (see Option 27 for alternatives)

IF-band ..... N female

RF band monitor ..... SMA female compatible, 2.9 mm female > 22 GHz  
(available as option for Ka-band Down)

IF-band monitor ..... N female with termination

External reference input ..... BNC female with termination

Status/Control interface\* ..... MS3116F14-18S for summary alarm, RS422/485, and LNA power

Remote interface\* ..... RJ-45 female for Ethernet, RS422/485 available on status connector

Primary power input\* ..... FCI clipper series CL1M1102

\* Note: Unit supplied with mating connector.

#### Converter enclosure weight

Up or downconverter units..... 22 pounds (10 kg) typical, 30 pounds (13.64 kg) maximum

### Environmental

#### Operating

Ambient temperature .....	-40 to +60°C
Atmospheric pressure.....	Up to 10,000 feet

#### Nonoperating

Ambient Temperature.....	-50 to +70°C
Atmospheric pressure.....	Up to 40,000 feet
Shock and vibration .....	Normal handling by commercial carriers



# SATCOM LNAs

for critical mission requirements



## For Either Fixed Or Transportable Satellite Base Station Operation.

*LNAs In The Following Bands: L, S, C, X, Ku, And Ka-Bands  
1:1, 1:2 And Dual 1:1 Redundant Units Are Also Available*

### FEATURES

- Noise Temperature as Low as 28K
- Internal Regulation and Reverse Voltage Protection
- Waveguide Input and SMA Female Output
- Fully Weatherproof
- Operating Temperature of -40 to +60 C
- Compliant to MIL-STD-810E for Salt/Fog
- Can be Optimized for Custom Solutions for Specific Applications

### OPTIONS

- Fault Alarm Circuitry
- DC Bias applied through the RF Output
- 110/220 VAC Internal Power Supplies
- Higher Output Powers
- Improved Gain Variation over Temperature
- N-Type Female Output Connector
- Input Limiter



For additional information or technical support,  
please contact our Sales Department at (811) 436-7400 or e-mail [sales@miteq.com](mailto:sales@miteq.com)

**\* Call for our new Ka-band LNB datasheet D-366**