300 SERIES OUTDOOR COMMUNICATION CONVERTERS

SINGLE BAND, SYNTHESIZED FREQUENCY UP AND DOWNCONVERTERS COVERING L- THROUGH Ka- SATCOM BANDS

FEATURES

- 1 kHz step size frequency selection
- Compact outdoor unit
- Better than IESS-308/309 compliant phase noise
- Support external redundancy for 1:1 switch
- Dual conversion
- No spectral inversion
- Ethernet and RS-485 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

The L3 Narda-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 continously updated log of time-stamped records of activity is also provided.

300 SERIES OUTDOOR COMMUNICATION CONVERTERS

RF FREQUENCY (GHz)	MODEL NUMBER
UPCONVERTERS	
STANDARD FREQUENCY BAND	
0.95 to 1.75	U-368-1
2 to 2.4	U-368-4
5.725 to 6.725	U-373-6
6.7 to 7.1	U-373-2
7.9 to 8.4	U-374
12.75 to 13.25	U-375-2
12.75 to 14.5	U-376-7
13.75 to 14.5	U-376-3
13.75 to 14.8	U-376-6
17.3 to 18.4	U-377-2
27.5 to 31	U-358-3
28.3 to 30	U-358-4
29 to 31	U-358-2
REVERSE FREQUENCY BAND	
3.4 to 4.2	U-321-R1
4.5 to 4.8	U-322-R2
7.25 to 7.75	U-325R
10.7 to 12.75	U-328-R6
17.7 to 21.2	U-313-R4
18.3 to 20.2	U-313-R5

RF FREQUENCY (GHz)	MODEL NUMBER
DOWNCONVERTERS	
STANDARD FREQUENCY BAND	
0.95 to1.75	D-320-3
2 to 2.4	D-320-6
3.4 to 4.2	D-321-1
4.5 to 4.8	D-322-2
7.25 to 7.75	D-325
10.7 to 12.75	D-328-6
17.7 to 21.2	D-313-4
18.3 to 20.2	D-313-5
REVERSE FREQUENCY BAND	
5.725 to 6.725	D-373-R6
6.7 to 7.1	D-373-R2
7.9 to 8.4	D-374R
12.75 to 13.25	D-375-R2
12.75 to 14.5	D-376-R7
13.75 to 14.8	D-376-R6
17.3 to 18.4	D-377-R2
27.5 to 31	D-358-R3
28.3 to 30	D-358-R4
29 to 31	D-358-R2

RF FREQUENCY (GHz)	MODEL NUMBER
NARROW BAND FOR TT&C APPLICATIONS	
UPCONVERTERS	
2.02 to 2.12	U-368-5
2.2 to 2.3	U-368-6

RF FREQUENCY (GHz)	MODEL NUMBER
NARROW BAND FOR TT&C APPLICATIONS	
DOWNCONVERTERS	
2.02 to 2.12	D-320-7
2.2 to 2.3	D-320-8

SPECIFICATIONS	UPCONVERTERS	DOWNCONVERTERS
Type	Dual conversion	Dual conversion
Frequency step size	1 kHz	1 kHz
Frequency sense	No inversion	No inversion
Input characteristics Frequency	70 ±20 MHz (140 ±40 MHz Option 4)	Refer to model number table on page two
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 (non-damage)	+15 dBm maximum	+15 dBm maximum
Output characteristics Frequency	Refer to model number table on page two	70 ±20 MHz (140 ±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	-20 dBc nominal
LO leakage	-75 dBm maximum	N/A
Power output (P1dB)	+15 dBm minimum	+20 dBm minimum
Transfer characteristics Gain	30 dB to 35 dB at 23 °C	43 dB to 50 dB at 23 °C, 55 dB to 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	80 dB minimum
Level stability	±0.25 dB/day maximum at constant temperature, ±2.0 dB typical from -40 °C to +60 °C	
Amplitude response 70 ±20 MHz	±0.3 dB/±20 MHz	±0.3 dB/±20 MHz
140 ±40 MHz	±0.45 dB/±40 MHz	±0.45 dB/±40 MHz
Group delay (70 ±18 MHz) Linear	0.03 ns/MHz maximum	0.03 ns/MHz maximum
Parabolic	0.01 ns/MHz^2 maximum	0.01 ns/MHz^2 maximum
Ripple	1 ns peak-to-peak maximum	1 ns peak-to-peak maximum
Group delay (140 ±36 MHz) Linear	0.025 ns/MHz maximum	0.025 ns/MHz maximum
Parabolic	0.0035 ns/MHz^2 maximum	0.0035 ns/MHz^2 maximum
Ripple	1 ns peak-to-peak maximum	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	0.04 °/dB maximum to 0 dBm output
Gain slope 70 ±20 MHz	0.03 dB/MHz typical (10 MHz maximum)	0.03 dB/MHz typical (10 MHz maximum)
140 ±40 MHz	0.05 dB/MHz typical (10 MHz maximum)	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	30 dB in 0.2 dB steps
Amplitude slope adjust	±3 dB typical in 0.2 dB steps	±3 dB typical in 0.2 dB steps
Frequency stability	±5 x 10^{-8}, -40 °C to +60 °C (higher stability options available), ±5 x 10^{-9}/day typical (fixed temperature after 24 hours on time)	
Upconverter mute	60 dB minimum	N/A
External reference	5 MHz 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 chart on next page	See chart on next page
Noise power density	-124 dBm/Hz maximum, -121 dBm/Hz maximum above 22 GHz	N/A
Remote interface	RS-485/RS-422: 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.

PHASE NOISE SPECIFICATIONS - OFFSET (Hz)

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

Missing option numbers are not applicable for this product.

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 peak-to-peak maximum/70 ±18 MHz IF

   2 ns peak-to-peak maximum/140 ±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. ±5 x 10^{-9}, -40 °C to +60 °C, 1 x 10^{-9}/day typical (fixed temperature after 24 hours on time).

    E. ±5 x 10^{-9}, -40 °C to +60 °C, 1 x 10^{-9}/day typical (fixed temperature after 24 hours on time). See Note 1 below.

    Note 1: Analog reference phase lock: External 5 MHz 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.

    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. Frequency stability on internal reference: ±5 x 10^{-9}, -40 °C to +60 °C, 1 x 10^{-9}/day typical (fixed temperature after 72 hours on time). 5 x 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. Frequency stability on internal reference: ±2 x 10^{-9}, -40 °C to +60 °C, 1 x 10^{-9}/day typical (fixed temperature after 72 hours on time). 5 x 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^3/min leakage rate.

    -2. WR-34 grooved flange, 2 psi 10 cm^3/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^3/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^3/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 ±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 (CONTINUED)

Missing option numbers are not applicable for this product.

31D. 10 MHz reference only (no internal provided) at +4 ±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.

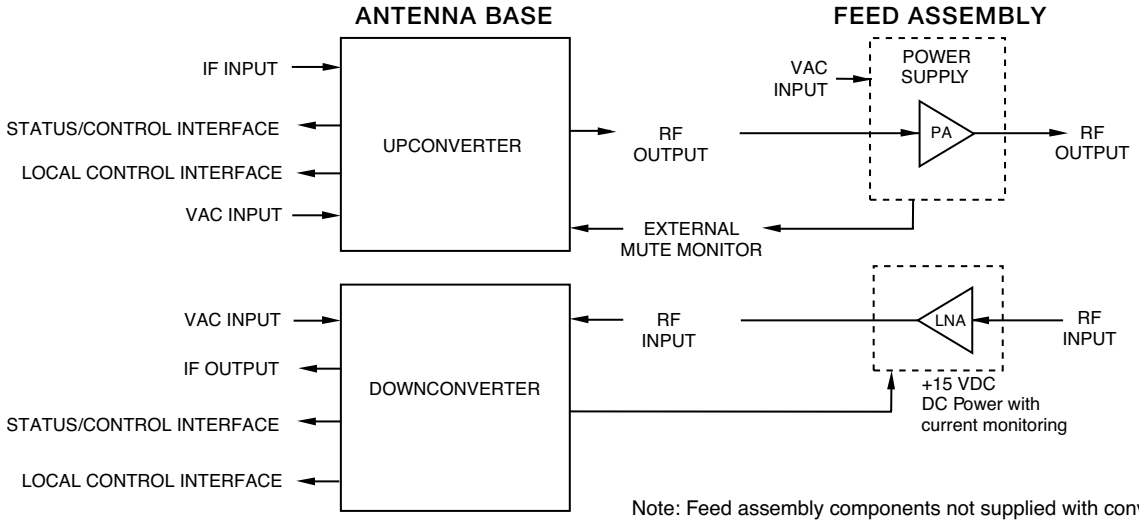
(U-20log(M) -3) dBc/Hz

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 MHz or 10 MHz) divided into the operational RF frequency (Fo) of the model selected.

M = Fo (MHz)/10 (MHz) or Fo (MHz)/5 (MHz)

Notes: For literature describing local control and remote control (bus protocols), refer to L3 Narda-MITEQ Technical Note 25T074. Protocol backward compatible with 25T032 (with minor exceptions). Please consult factory for compatibility chart. For SATCOM low-noise amplifiers, refer to L3 Narda-MITEQ Catalog C-39.

TYPICAL SYSTEM DIAGRAM

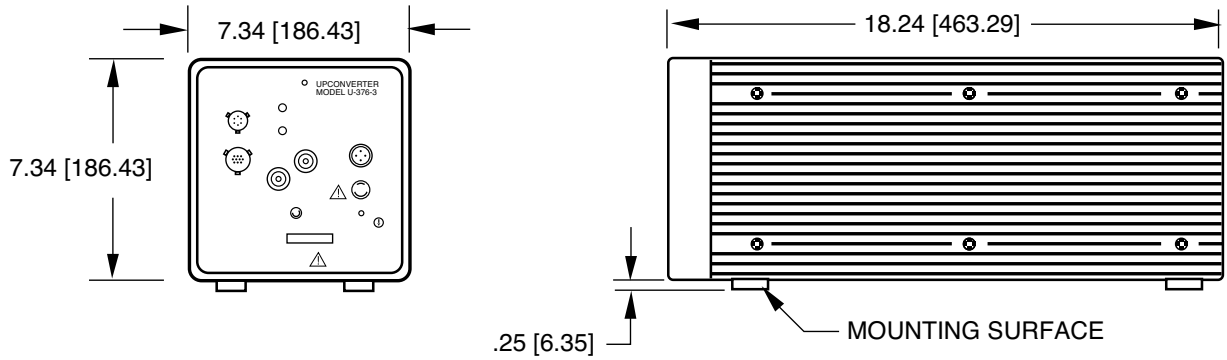


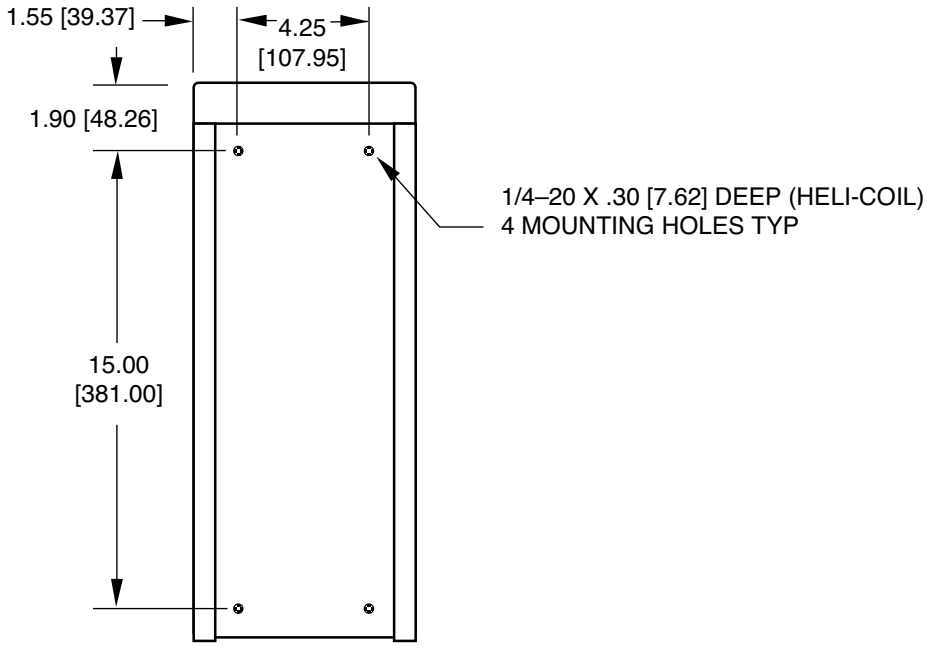
Note: Feed assembly components not supplied with converter.

RACK-MOUNT CONTROL UNIT

19' Rack-mount control unit L3 Narda-MITEQ Number RCT-300 (sold seperately)

UP OR DOWNCONVERTER





Note: Dimensions shown are in inches and those shown in brackets [ ] are in millimeters.

300 SERIES OUTDOOR COMMUNICATION CONVERTERS

GENERAL SPECIFICATIONS

PRIMARY POWER REQUIREMENTS

Voltage.....100 VAC to 240 VAC (-10%, +6%)
Frequency .....47 Hz to 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 on previous page
Connectors
  Front panel connectors
    RF-Band
      Below 25 GHz.....SMA female compatible
      25 GHz to 27 GHz.....WR-34 grooved, 2 psi 10 cm3/min leakage rate (see Option 27 for alternatives)
      Above 27 GHz .....WR-28 grooved, 2 psi 10 cm3/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 an option for Ka-Band downconverter)
    IF-Band monitor .....N female with termination
    External reference input .....BNC female with termination
    Status/Control interface*.....MS3116F14-18S for summary alarm, RS-422/RS-485, and LNA power
    Remote interface*.....RJ-45 female for Ethernet, RS-422/RS-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 lb. [10 kg] typical, 30 lb. [13.64 kg] maximum

ENVIRONMENTAL

Operating
  Ambient temperature.....-40 °C to +60 °C
  Atmospheric pressure .....Up to 10,000 feet
Nonoperating
  Ambient temperature.....-50 °C to +70 °C
  Atmospheric pressure .....Up to 40,000 feet
  Shock and vibration .....Normal handling by commercial carriers

D-358E/01.30.18

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