

U-Tube

Integrated X-Band Conversion System

Optional Transmit Bandpass Filter (with 90 dB of Rx Isolation)

The best X band LNB in the world, with 45 dB (min) built-in Transmit Reject Filter, an Elliptical Notch Filter at 7825 MHz, matched to a 'tight skirt' Receive Bandpass Filter (35dB Tx reject), a high isolation orthomode transducer, and a polarizer with excellent axial ratio (0.5 dB) for a System Transmit Reject of greater than 90 dB, all in the size of a 3 pound shoe box.

Polarizer, OMT, Receive Bandpass Filter, & LNB



Orbital Research takes the conventional X-Band LNB, OMT, Polarizer and filtering system and:

- Shrinks it (distributes filters and integrates design to minimize size)
- Lightens it (overall weight ~3 pounds without Tx Bandpass Filter)
- Folds it in half (envelop the size of an average shoe box)
- Improves rejection of transmit signals (custom tuned filters)
- Improves cross-pol isolation and preserves axial ratio
- Improves overall VSWR (through optimal matching of components)
- Keeps Noise Figure low (through optimal matching of components)
- Optional Transmit Bandpass Filter (with 90 dB of Rx isolation)

U-Tube Part Number:

UTX-PASLX-WN60

Tx Bandpass Filter part number:

TXBPFX-WF12N90 or
TXBPFX-WF12WF12-90

Components:

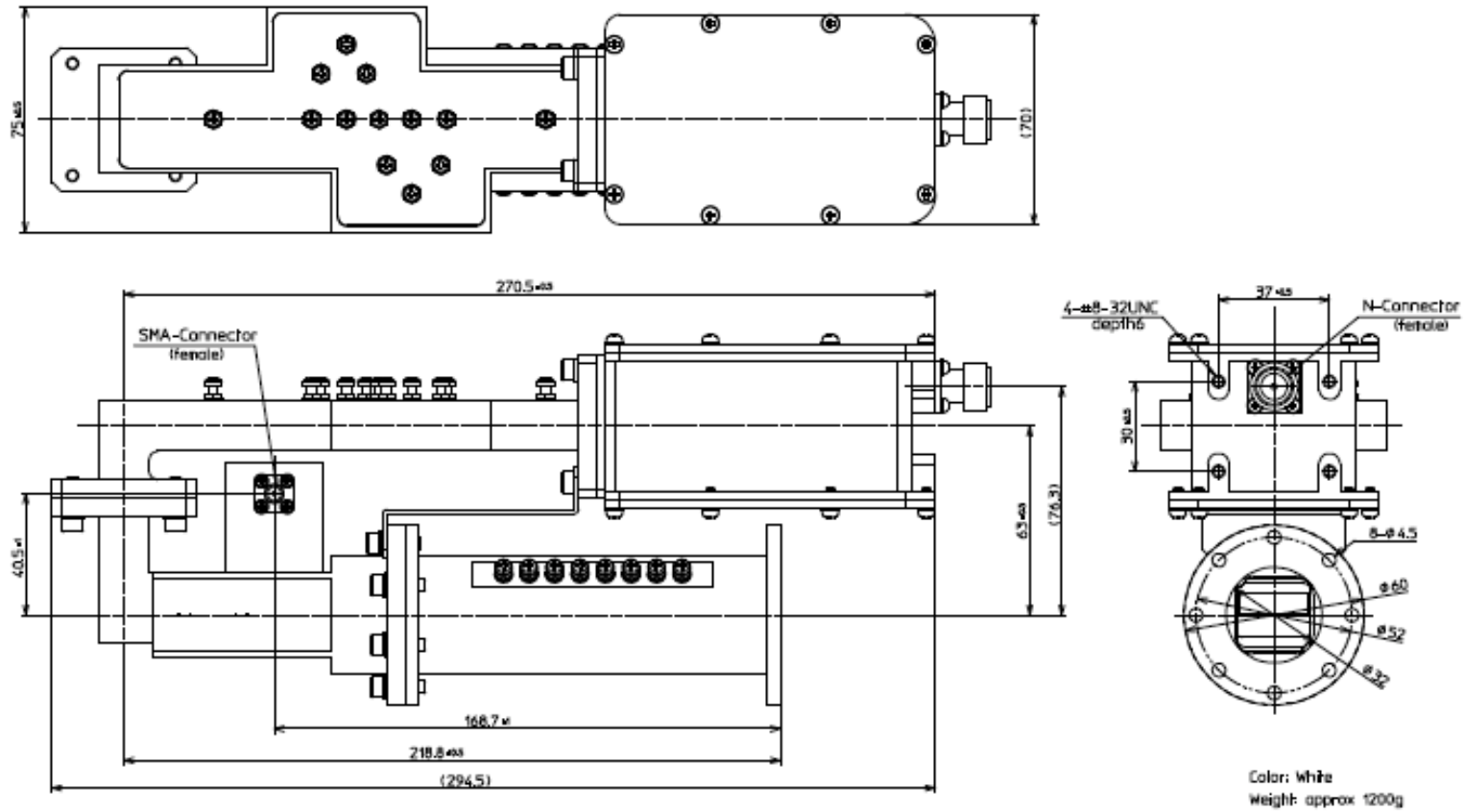
PCLX: Polarizer

OMXUS: OMT (SMA input (Tx))

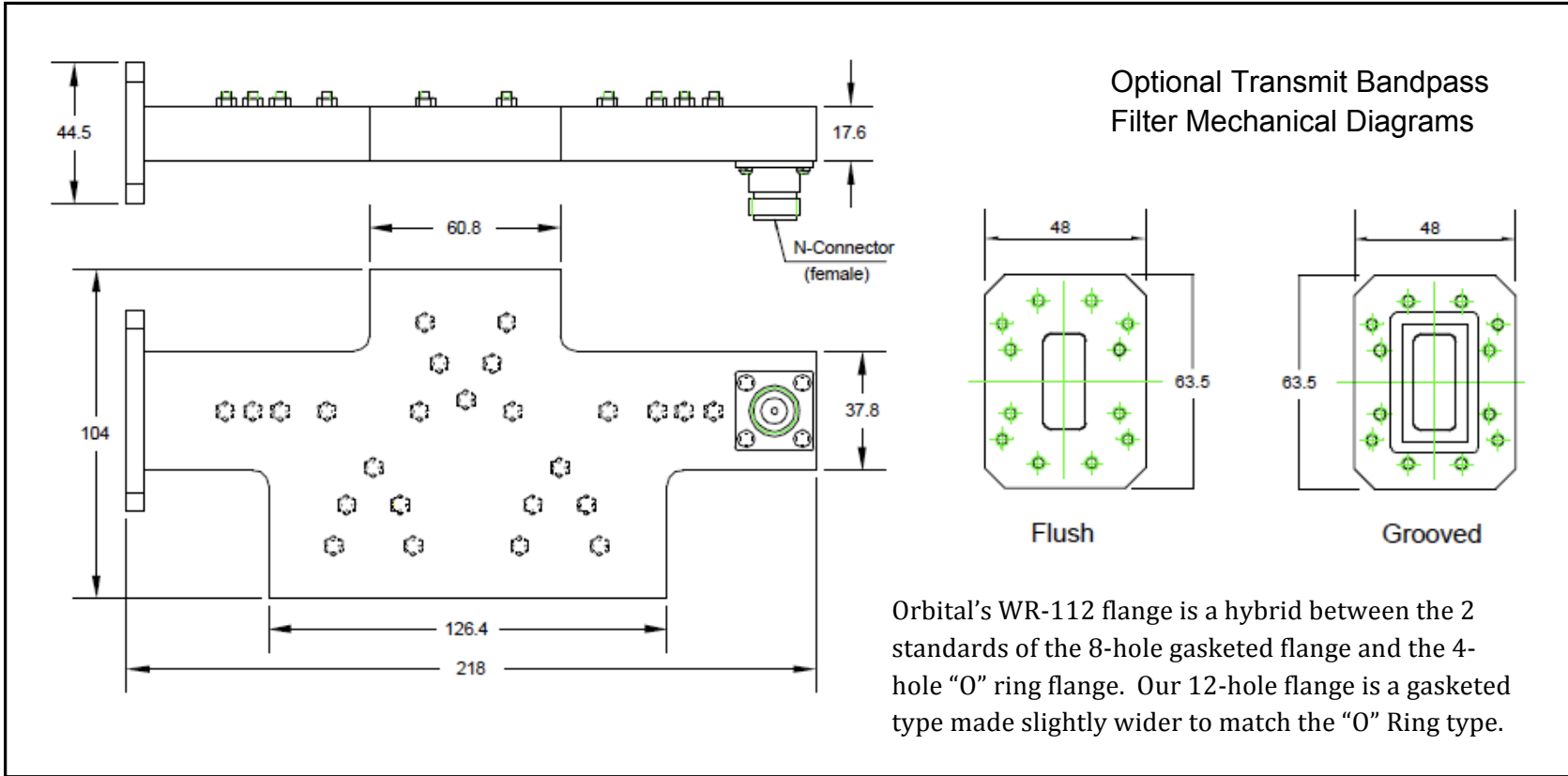
RBPXU-WW35: RX Bandpass Filter

LNB630S-500X-WN60: LNB

Mechanical Diagrams



Description	Specification	Comment
Dimensions	12.5 x 3.0 x 5.0 inches, 318 x 75 x 127 mm	Overall envelope
Weight	2.7 lbs, 1,225 grams	With LNB



Description	Specification	Comment
Pass Band	7.9 to 8.4 GHz	
Insertion Loss	0.4 dB max	
Attenuation	90 dB	in receive band: 7.25 to 7.75 GHz
VSWR	1.20 : 1	
Connectors	Input: WR-112 flat flange. Output: SMA, N or WR-112 gasketed flange	
Dimensions	8.5 x 4.1 x 0.7 inches, 216 x 104 x 18 mm	
Weight	0.9 lbs, 400 grams	

Isolators

Isolators are used in microwave to establish **impedance matching** to minimize the destructive effects of reflected energy upon the incoming signal as it passes through each component. Isolators are very effective in this role, but the price paid for reduced **VSWR** is **Insertion Loss**. Any **insertion loss** is effectively added to the **noise figure** of the active device, in this case, the **LNB**. Therefore, the savings in losses from destructive signal cancellation from reflected standing waves, **VSWR**, must be greater than the **insertion loss** of signal in going through the isolator. Orbital achieves this with careful design integration of all components in the conversion assembly.

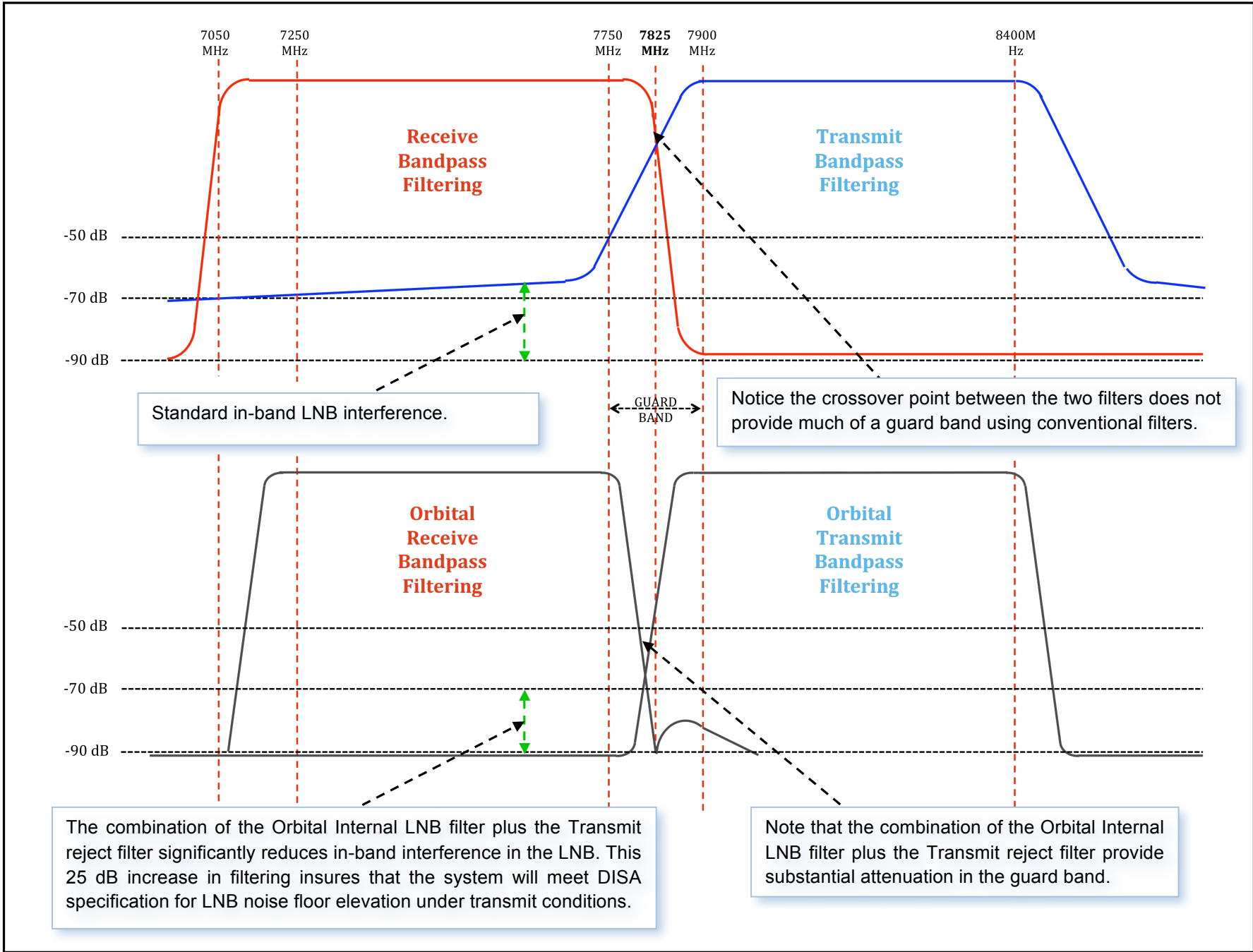
VSWR, Insertion Loss & Noise Figure

The signal levels are so small in today's mobile satellite terminals, and the Noise Figure so low in today's sophisticated LNBS that **insertion losses** as low as 0.1 or 0.2 dB are very significant additions to **Noise Figure** of 0.5 to 0.7 dB. Therefore, it is very desirable to design an integrated system where each component is carefully matched to each other in the signal chain to minimize **VSWR** and **insertion loss** and eliminate the need for the isolator. Not only can you improve **Noise Figure**, but you eliminate the size, weight, and cost of the isolator. When you are buying parts from different vendors, you have no control of the match or any ability to optimize **VSWR** or **insertion loss**. With the U-Tube system, this optimization has been done for you, and the savings in weight, size, cost and Noise Figure are now yours.

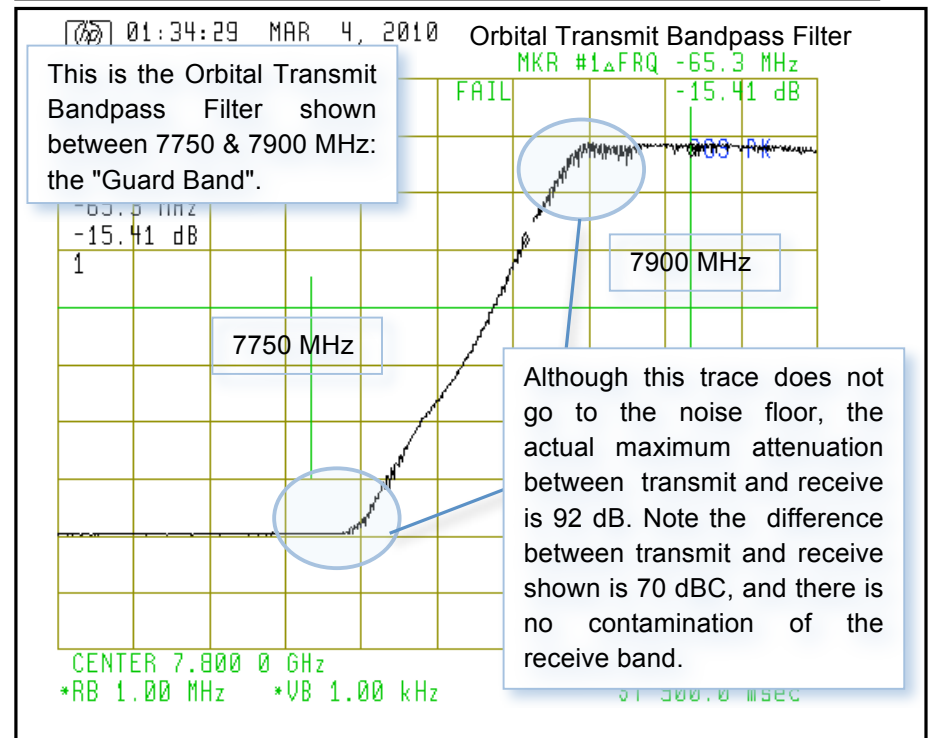
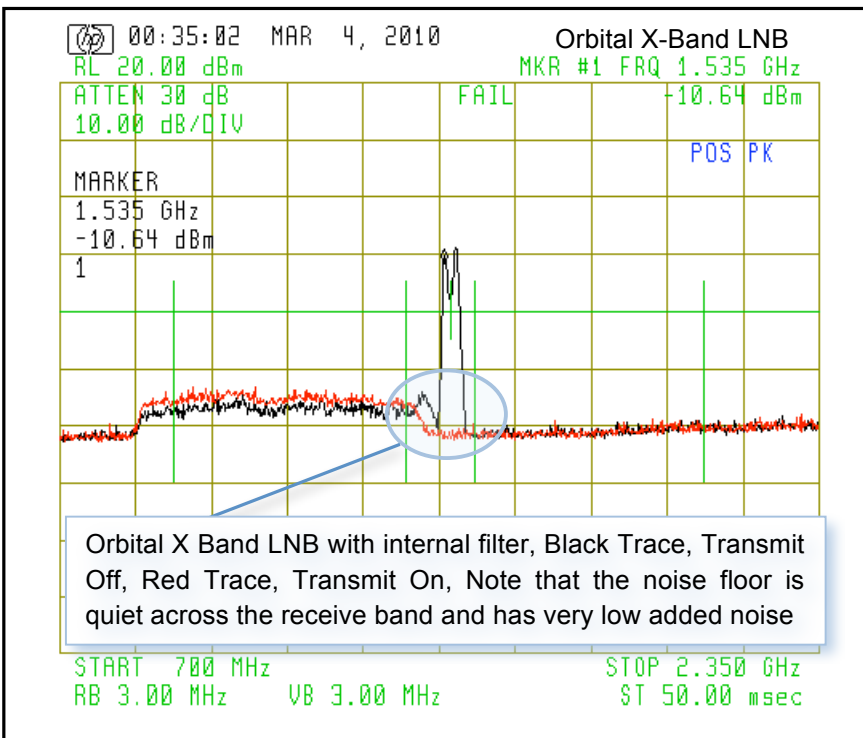
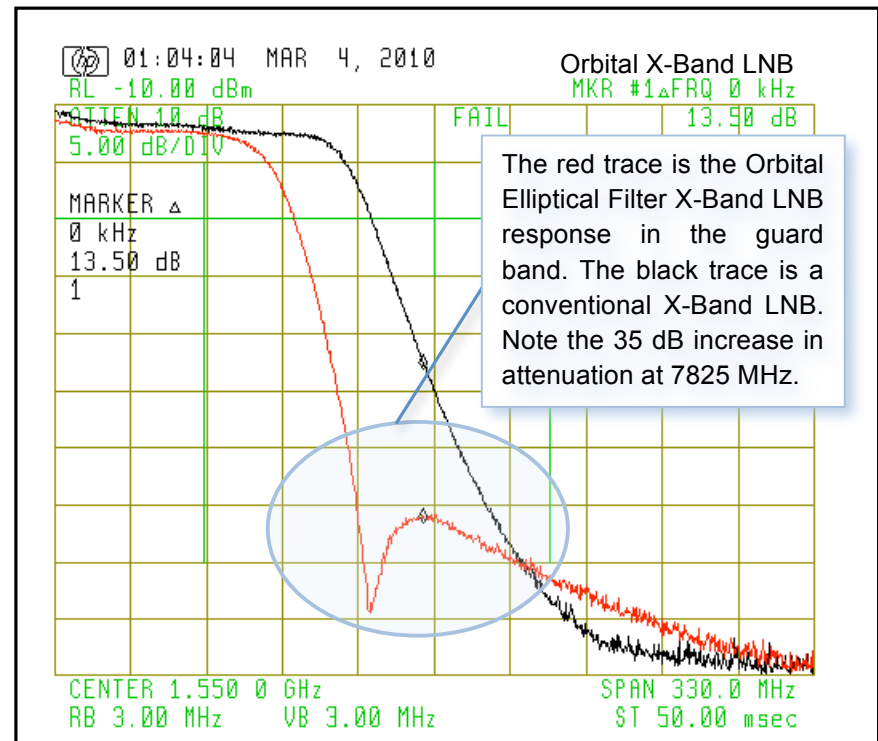
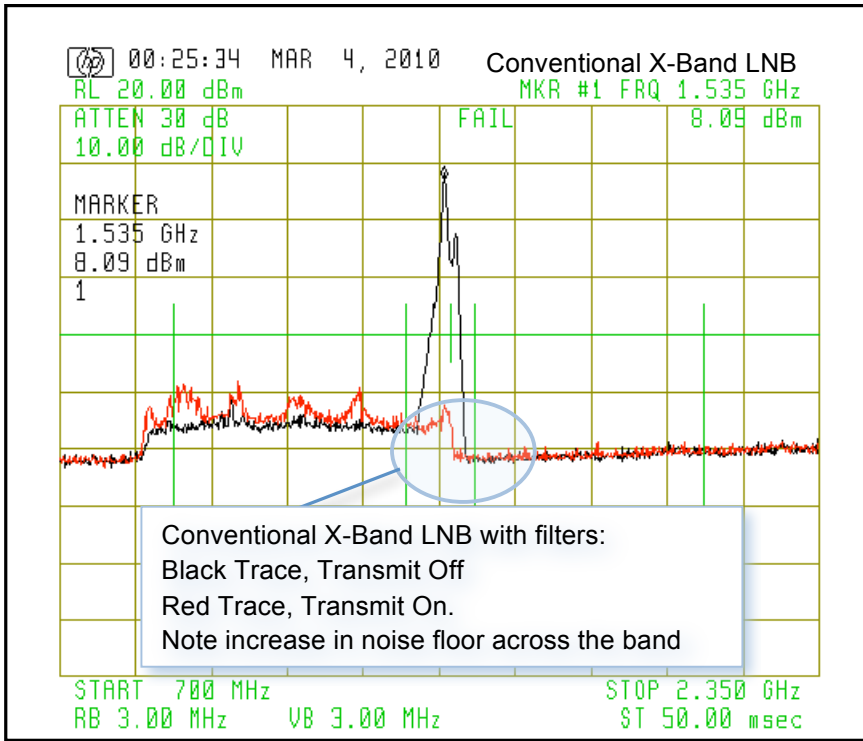
U-Tube - Noise Figure

The difference in Noise Figure between a stand alone LNB and the U-Tube system with an added Polarizer, OMT, and Receive Bandpass Filter in front of the LNB, is only 0.4 dB. This is less than the insertion loss of some filters alone. A La Carte construction cannot compete with integrated engineered efficiency.

Description	Specification	Comment
Insertion Loss	0.39 dB max	Adds to the LNB Noise Figure of 0.7 dB for the overall N.F.
Noise Figure	1.1 dB nominal	Overall system Noise Figure which includes LNB but no isolator
VSWR	Input - 1.3 : 1, Output - 2.0 : 1	Overall system VSWR
Gain	62 dB typical @ 23°C	
Gain Ripple	±0.5 dB over any 10 MHz segment	Overall U-Tube system



Orbital X-Band U-Tube Filtering System



ELECTRICAL SPECIFICATIONS

Item	Value	Comment
RF Input Frequency	7.25 to 7.75GHz	LNB spec
IF Output Frequency	950 to 1450MHz	LNB spec
Local Frequency	6.3 GHz	LNB spec
Local Frequency Stability	Phase locked to external 10MHz reference	LNB spec
10MHz Reference	@ Multiplexed on the IF coaxial connector [Input level] -5 to +5dBm [Phase Noise] -165dBc/Hz max. @100Hz -155dBc/Hz max. @1KHz -160dBc/Hz max. @10KHz -165dBc/Hz max. @100KHz	Orbital POP module, stock, OCXO reference oscillator, Orbital MuxTee, 50 ohm config Level to LNB, 0 dBm.
Local Phase Noise	-66dBc/Hz max. @100Hz -76dBc/Hz max. @1KHz -86dBc/Hz max. @10KHz -96dBc/Hz max. @100KHz -106dBc/Hzmax. @1MHz	LNB minimum spec – actual results may be different dependent on the 10 Mhz external reference quality
Input LO Leakage	Virtually eliminated	
Noise Figure	1.1 dB typ. @+23C	LNB >0.7 dB nf, insertion loss of filter, OMT, and Polarizer >0.4 db, across the band
Gain	62dB±4dB @Over temp. and freq.	
Gain Flatness	±2.0dB max. @Over band	
Gain Stability	±1.0dB max. @Over a 24hr at +25°C	
Input VSWR	1.3:1 max.	
Output VSWR	2.0:1 max.	
Image Rejection	-99 dBc max.	Internal LNB 21 element integrated bandpass filter with elliptical pole filter at 7875 Mhz
P1dB	+15dBm min.	
Signal Independent Spurious	-60dBm max. @Rx-band	Actual spurs below measurement threshold
Signal Related Spurious	-65dBc max. @0dBm output, Rx-band	Actual spurs can be -90 dBc down
Desense level	-40dBm, 7.9-8.4GHz @No more than 0.1dB of noise figure degradation	
Overdrive	-20dBm @Non-damaging	
Input DC Power	+15 to +24VDC, 500mA Multiplexed on a single coaxial connector with the IF and 10MHz reference signal.	LNB spec

INTERFACE

Item	Value	Comment
Transmitter Input Interface	SMA, N or waveguide	Through OMT
LNB Output Interface	50Ω, N-type female coaxial connector	
Polarizer Axial Ratio	0.5 dB typical	

MECHANICAL SPECIFICATIONS

Item	Value	Comment
Size	(L) 165mm x (W) 85mm x (H) 55mm 6.5 x 3.4 x 2.2 inches	Without transmit bandpass filter
Weight	1.625 kg (3.6 lbs) 1.225 kg (2.7 lbs)	With transmit bandpass filter Without transmit bandpass filter
Color	White Munsell N9.5 semigloss standard, other colors available	

ENVIRONMENTAL SPECIFICATIONS

Item	Value	Comment
Operating Temperature	-40°C to +60°C	
Operating Altitude	10,000 ft ASL	
Operating Relative Humidity	100%, condensing	
Non-operating Temperature	-50°C to +70°C	
Non-operating Altitude	50,000 ft. ASL	
F Shock	20g, 11ms, half sine	

David Zuvic
Tel: (604) 856-0305
dzuvic@orbitalresearch.net

Orbital Research Ltd.,
14239 Marine Drive, White Rock,
BC, V4B-1A9 Canada
www.orbitalresearch.net

Doug Macdonald
Tel: (647) 992-1210
doug.macdonald@orbitalresearch.net



Orbital Research Ltd. designs and builds products for satellite communications applications. Copyright © 2011 Genie in the Bottle Enterprises Inc. All rights reserved. Specifications subject to change without notice.

U-Tube_Integrated_X-Band_Conversion_System-110315