PIP-II LLRF 325 MHz 4-Channel Upconverter

Features

- 20 MHz I & Q IF input 500mV p-p max
- 345 MHz LO Input @ 0 dBm
- 325 MHz Output, +12 dBm max
- Channel to Channel Isolation > 80 dB
- Spurious Signal Suppression > 70 dB
- High isolation (>60 dB) TTL RF switch on each channel
- RF Monitors @ 18 dB
- LO Monitor @ 12 dB
- IF Monitors @-10 dB
- Power Supply 6V, 2 Amp

Description

The PIP-II LLRF 4-Channel Upconverter is a RF board designed to convert 20 MHz IF I & Q signals from the DAC's of the LLRF digital signal processer to 325 MHz RF signals for driving PIP-II cavities. The board has been designed with careful attention paid to spurious signal rejection, channel to channel isolation, output noise, and IF to RF linearity.

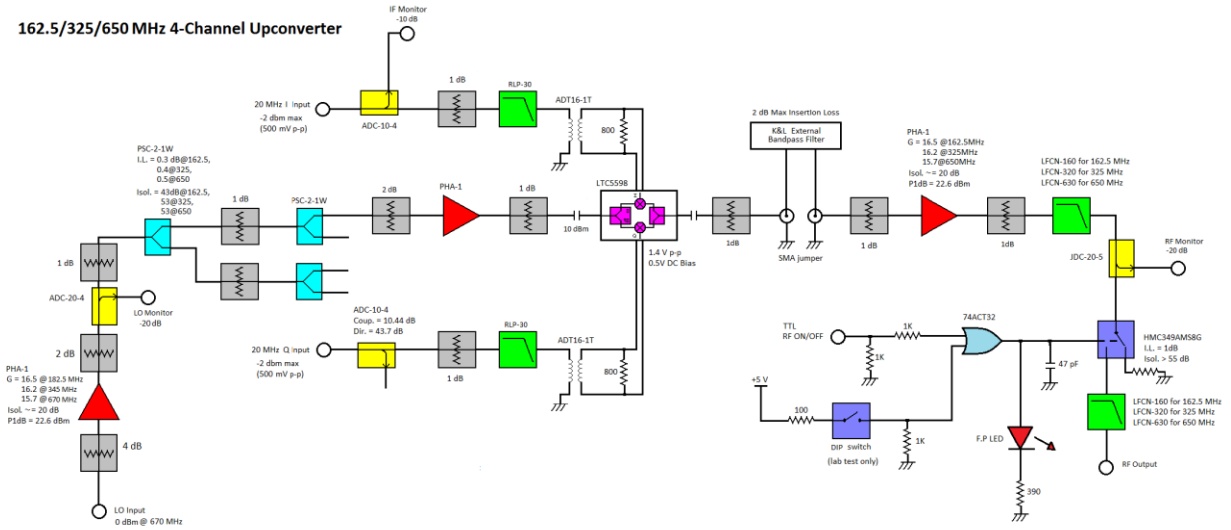
Several design choices were made to minimize spurious signals at the RF output. One design choice was to use single sideband IQ modulator. The IQ modulator has a high carrier suppression and sideband suppression. The modulator has a good enough specification so that no nulling was requiring to reducing the spurious signals. Removal of a nulling circuit also minimized the possibility of the spurious signals becoming larger than specification under drifting component conditions.

To achieve channel to channel isolation better than 60 dB without shielding, the spacing between channels was maximized given the allowed board space. A transmission line was also designed to reduce radiation and via walls were placed around the transmission lines. Filtering of common lines to both channels was also required to maintain isolation between channels. Common lines include power supplies and RF switch circuitry.

The output noise was minimized by using a center tapped balun to convert the single ended I and Q signals to differential signals at the input of the IQ modulator instead of a using a single ended to differential amplifier, which usually contributes a significant amount of noise to the circuit.

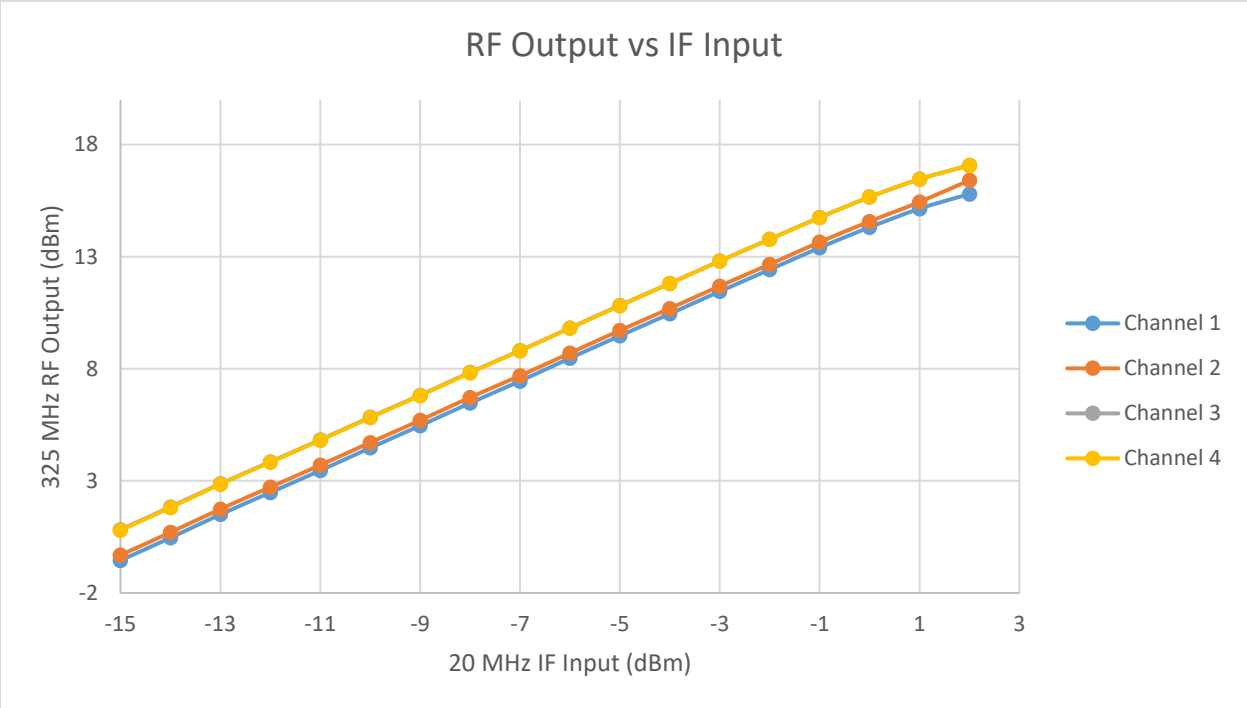
To maintain good linearity from the IF input to the RF output, high IP3 RF amplifiers were used, along with proper balance of attenuators throughout the signal chain.

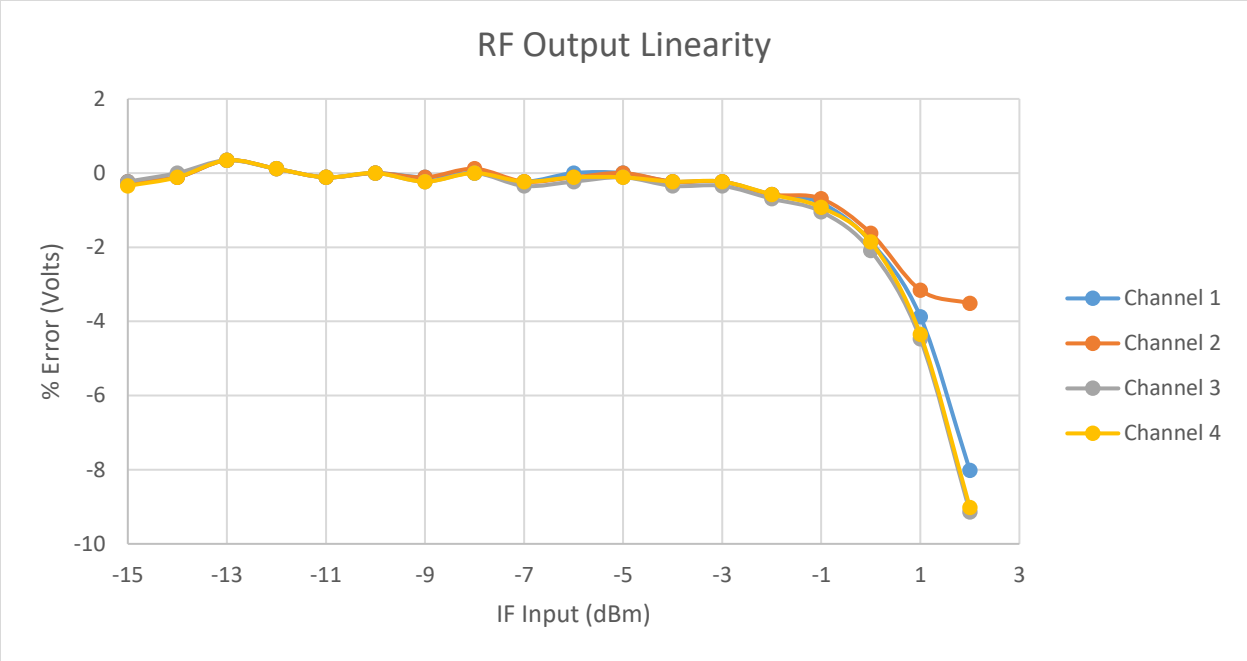
Block Diagram



Measurement Data

RF to IF Conversion:





Channel to Channel Isolation:

RF Output \ IF Input	channel #	1	2	3	4
	1		-94	-100	-100
	2	-91		-84	-97
	3	-90	-80		-92
	4	-105	-96	-87	