6-Meter Filter-Preamp

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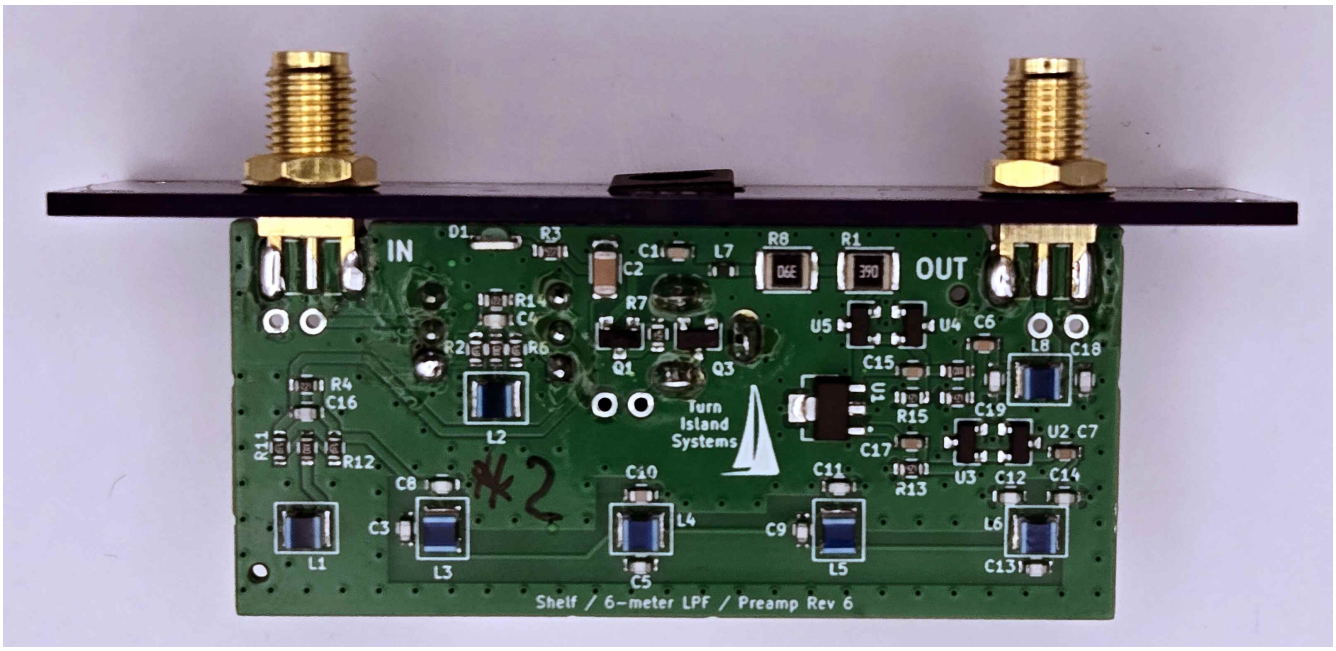
Introduction

This document covers the Turn Island Systems 6-Meter Filter-Preamp (FP6M).

The FP6M is designed to provide frequency-compensated gain below 54 MHz and an aggressive low-pass response above 60 MHz, providing good anti-aliasing performance for modern SDR receivers. The stopband response has been carefully tailored to give maximum attenuation of the 88-108 MHz FM broadcast band, providing in excess of 80 dB relative attenuation.

The FP6M contains a two-section low-frequency shelf filter (one section bypassable), followed by a four-section elliptic low-pass filter designed to strongly attenuate signals above 60 MHz. These filters feed a low-noise high dynamic-range amplifier, with the amplifier output connected to a second low-pass filter. The overall gain at 30 MHz is about +20 dB, and about +19 dB at 54 MHz.

Details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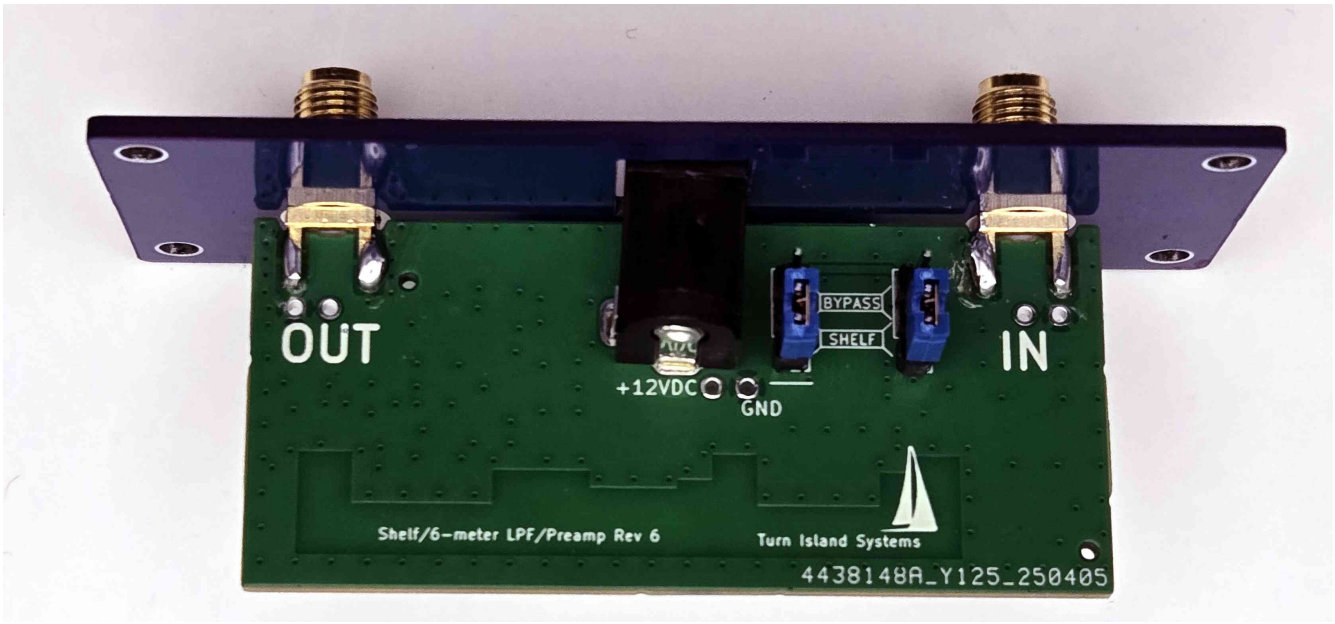
OUT
Turn Island Systems
Shelf / 6-meter LPF / Preamp Rev 6


OUT
IN
BYPASS
SHELF
+12VDC
GND
Shelf/6-meter LPF/Preamp Rev 6
Turn Island Systems
4438148A_Y125_250405

Circuit Description

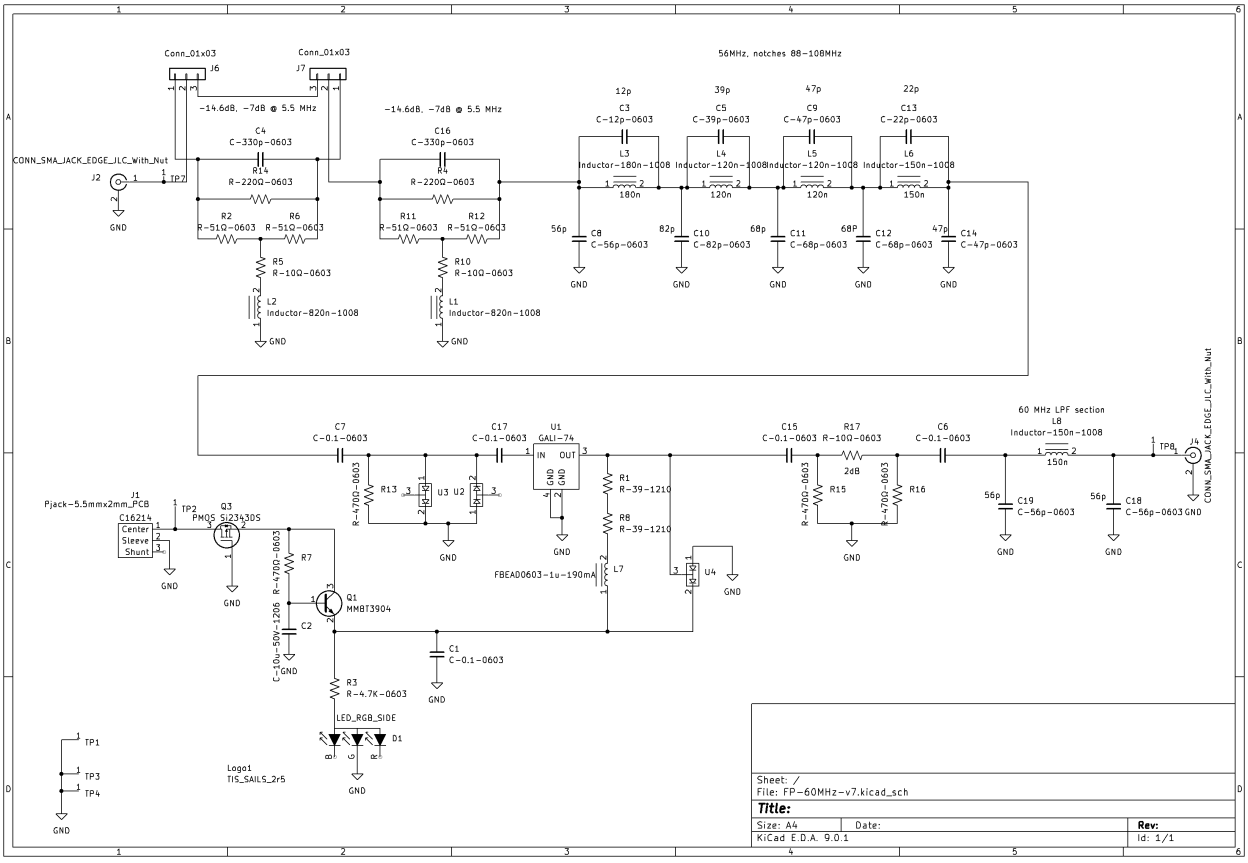


Illustration 1: Schematic

The FP6M contains a two-section low-frequency shelf filter (one section bypassable).

Following the shelf filters is a four-section elliptic low-pass filter. The elliptic filter is designed to strongly attenuate signals above 60 MHz, with particular attention paid to attenuation of the 88 – 108 MHz FM broadcast band. Some SDRs (the RX-888, for example, running a 130 MHz sample clock) have a marginal anti-alias filter which allow the FM BCB signals to alias down into the 23 – 43 MHz region.

These filters feed a low-noise high dynamic-range amplifier, with the amplifier output connected to a resistive 2 dB attenuator which provides some degree of stability when the preamp is connected to a non-50 Ohm load.

This is followed by a second pi-network low-pass filter, rolling off at 60 MHz. This filter is included in order to improve the ultimate high-frequency attenuation and reduce unwanted peaks above 200 MHz in the elliptic filter stop-band, caused by series-resonance in the notch capacitors.

The overall gain at 30 MHz is about +20 dB, and about +19 dB at 54 MHz.

The FP6M +12V power is first passed through a PMOS FET which blocks inadvertent reverse polarity connection. The next stage is a simple but effective active filter, which reduces power supply ripple and noise. Note that this will not remove ground-loop noise or related issues. There is a green LED that indicates the presence of power.

Performance

This plot shows the FP6M gain and frequency response.

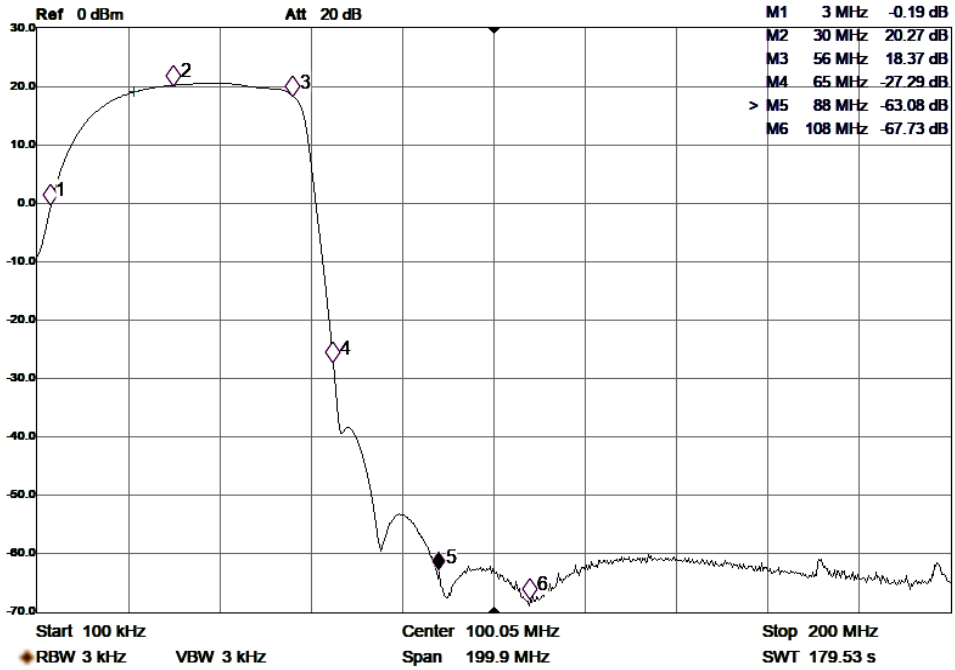


Illustration 2: Filter-Preamp Gain vs Frequency

Below is a log-frequency plot (simulation, no preamp or other filters) of the dual shelf filter, which gives a better idea of the this filter shape. As you can see, the attenuation is roughly 30 dB below 1 MHz, with the output climbing from 1 to 30 MHz where it flattens out close to zero attenuation. This behavior compensates for the characteristics of the typical RF background noise floor and does provide useful attenuation of strong AM broadcast band signals.

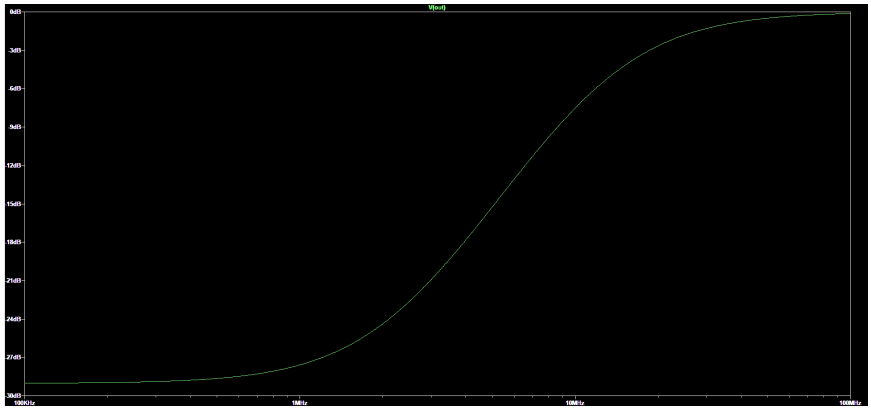


Illustration 3: Dual Shelf Filter Frequency Response

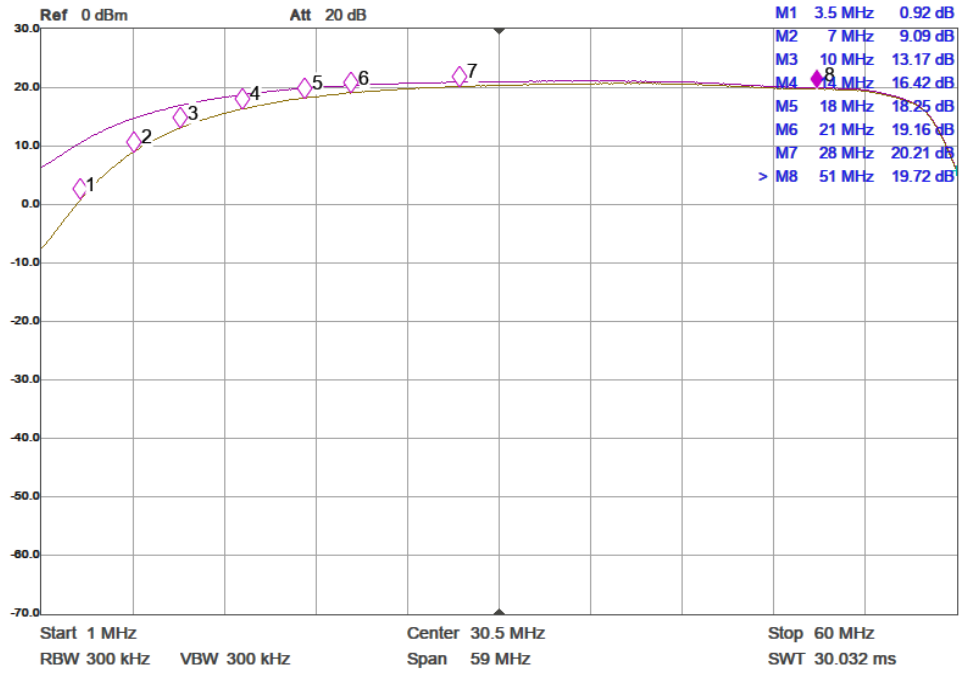


Illustration 4: With / Without Shelf Filter Bypass

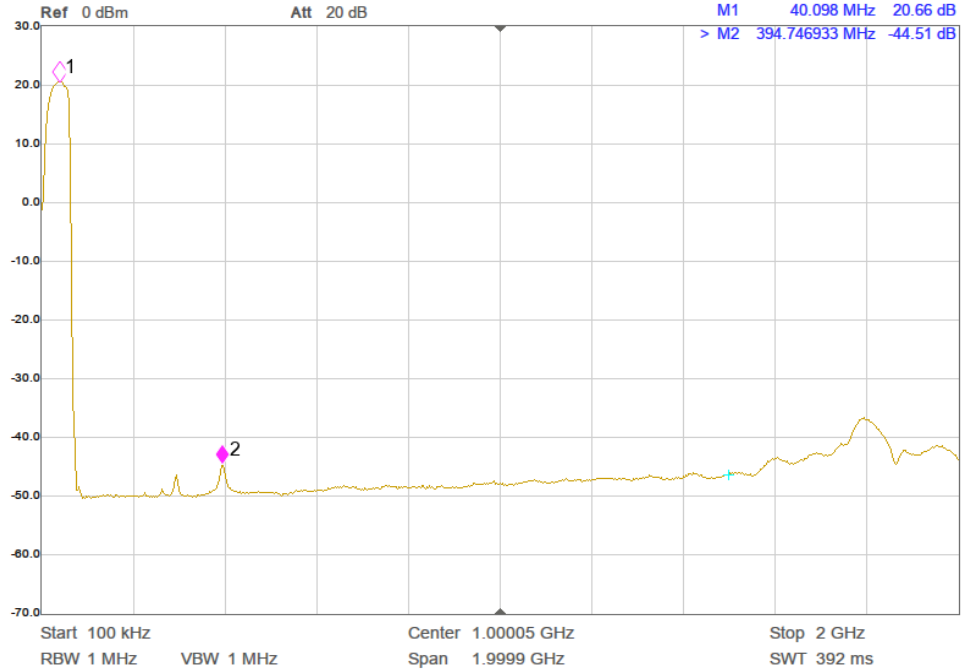


Illustration 5: Frequency Response, 100 KHz - 2 GHz

Specifications

Dimensions:

83mm wide x 32mm high x 40mm deep (including SMA jacks)

Weight: 2.5 oz

Power:

+12VDC input, 5.5mm x 2mm barrel jack, pin-positive

Current: 80 mA

Gain / Frequency:

Frequency (MHz)	Gain (dB)
0.1	-10
1	-7
3.5	1
7	9
10	13
14	16
18	18
21	19
28	20
51	20
56	18
65	-27
88	-63
108	-67
>108	-60 (minimum)

Dynamic Range

Measured at 30 MHz	
1 db Gain Compression	+18 dBm
3rd Order Output Intercept	+30 dBm
Input Noise Figure	4dB