24 GHz Transverter

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Design Objectives

• Stable frequency control
  – <1KHz drift over normal temp range
  – <1KHz drift over time (1 day)

• Inexpensive (<$200)

• Common available parts
  – Surplus 24G Tx & Rx modules
  – Surplus 10132 brick
  – Other standard parts

• Acceptable power & sensitivity
  – 200mW
  – <10dB NF front end
# Frequency Plan

<table>
<thead>
<tr>
<th></th>
<th>Jim's</th>
<th>Common LO</th>
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</thead>
<tbody>
<tr>
<td>RF</td>
<td>24192</td>
<td>24192</td>
</tr>
<tr>
<td>LO2</td>
<td>20272</td>
<td>20448</td>
</tr>
<tr>
<td>LO2 /2</td>
<td>10136</td>
<td>10224</td>
</tr>
<tr>
<td>IF2</td>
<td>3920</td>
<td>3744</td>
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<tr>
<td>LO1</td>
<td>3488</td>
<td>3600</td>
</tr>
<tr>
<td>IF1</td>
<td>432</td>
<td>144</td>
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</table>
Overall Picture

- RF Relays
- 3.6G Mixer
- 10MHz Osc
- 10G Splitter
- 3.6G LO
- TX module
- 10136 Osc
- PS board
Circulator

- TX/RX modules use WR42 so either a waveguide switch or circulator is needed
- A circulator is used because of cost & availability
- The impact to design is a couple dB in power & NF (acceptable for rover use)
Celeritek TX / RX Modules

- Rx module is about 4.5dB NF
- Tx module is about 250 mW
- Both have an LO doubler inside
- Both are capable of IF up to 4GHz
- Power supplies are +8, +12, +5 depending on particular unit.
10136 Oscillator

- M/Acom brick – 10.136 GHz, +10dBm
- -21V Vcc
- Available from Pyrojoseph
3.6GHz Amp

• MAR-5 amplifier to boost the output of the mixer into the TX module.
• Mixer output is -6dBm
• Amp is about 10dB
• Amp output is +4dBm
RF Relays

- SPDT 4GHz relay with 12 volt coil
- 432MHz transfer relay with 30dB attenuator for 1W to 0dBm
Mixer

- Minicircuits 4212 4GHz mixer
- Can be found on Ebay or other mixers can be substituted
- LO +7dBm
- IF/RF +1dBm
- 6dB conversion
3.6GHz PLL board

- PLL: LMX2487 fractional N dual PLL
- VCO: Zcomm smv3590a
- Controller: COP8SAA with Jim’s code for setting PLL frequencies
- ERA6SM – amplifier to get up to +7dBm
Power Supplies & Control

- 2 commercial power supplies 12V to 15 & 12V to 22V (This requires 2 12V sources, one for negative supply, one for positive supply)
- Linear regulators for 5, 8, 10, 12V from the 15V supply
- Control board for PTT control of IF relay and power relay for TX/RX subsystems