The ISU radiometer system.
The block diagram of the ISU radiometer.
The “RF front end” of the ISU radiometer.
Filters are used to reject unwanted frequencies.

- **Pre-LNA filter**
  - low insertion loss

- **Intermediate Filter**
  - high rejection

- **Band Definition Filter**
  - steep skirts

- **Cumulative filtering**
A lot of amplification is needed!
But amplification depends on the temperature of the amplifiers!

Total Power design

120dB of amplification
71 dB net gain

Amplifiers stabilized by cycling operating temperature while powered (10 times) and soaking at 45°C for 24 hours.
The RF front end temperature must be controlled to $< 0.1$ K.
Despite challenges, the overall system is quite linear!

- V-pol $T_{REC}=153.9$K
- H-pol $T_{REC}=167.2$K
- Noise Diode: adds $130$K

**Receiver Linearity**

![Graph showing output power vs. brightness at receiver input.](image)
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>1413.5 MHz</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>21 MHz</td>
</tr>
<tr>
<td>Polarization</td>
<td>H- and V- pols</td>
</tr>
<tr>
<td>Integration Time</td>
<td>1 ms to 42 sec</td>
</tr>
<tr>
<td>Receiver Noise Temp</td>
<td>&lt; 170K</td>
</tr>
<tr>
<td>Sampling frequency</td>
<td>102.8 MHz</td>
</tr>
<tr>
<td>Sampling jitter</td>
<td>10ps</td>
</tr>
<tr>
<td>Beamwidth</td>
<td>18-21deg</td>
</tr>
<tr>
<td>Sidelobes</td>
<td>&lt; 26dB</td>
</tr>
<tr>
<td>Weight - antenna</td>
<td>85 lbs</td>
</tr>
<tr>
<td>Weight - receiver</td>
<td>100 lbs</td>
</tr>
<tr>
<td>Weight - power supplies</td>
<td>92 lbs</td>
</tr>
<tr>
<td>Power</td>
<td>400 W on 110VAC</td>
</tr>
</tbody>
</table>
Other radiometers... think about electrical size.

L-band
1.4 GHz
\( \lambda = 21 \text{ cm} \)

satellites:
*none yet!*
SMOS ’07?
Aquarius ’10?

Antenna size is proportional to wavelength

19 GHz
\( \lambda = 1.6 \text{ cm} \)
satellites: SSM/I etc. ’87 to present

37 GHz
\( \lambda = 0.8 \text{ cm} \)

C-band
6.7 GHz
\( \lambda = 4.5 \text{ cm} \)
satellites: AMSR-E ‘02