MTSU FSX-6S (12-bit) Spectrograph Step Calibration

**HP461A noise source + Kay 431D step attenuator + MCL Splitter**

**Calibration Plane:** 90 Deg Hybrid Inputs

<table>
<thead>
<tr>
<th>T0 (K)</th>
<th>290</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noise source temperature (MK)</td>
<td>35.7</td>
</tr>
<tr>
<td>Feed loss, cal plane to antenna (dB)</td>
<td>2.4</td>
</tr>
<tr>
<td>Receiver noise figure (dB)</td>
<td>6.0</td>
</tr>
</tbody>
</table>

**RSS Color Offset:**
- Side A: 1750
- Side B: 1750

**RSS Color Gain:**
- Side A: 2.00
- Side B: 2.00

### Temperature and ADC Counts

<table>
<thead>
<tr>
<th>Att. dB</th>
<th>Source Temp (kK)</th>
<th>Equiv. Ant. Temp. (kK)</th>
<th>Side A ADC Counts</th>
<th>Side B ADC Counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>34,888</td>
<td>59,933</td>
<td>3703</td>
<td>3695</td>
</tr>
<tr>
<td>3.1</td>
<td>17,486</td>
<td>30,038</td>
<td>3559</td>
<td>3551</td>
</tr>
<tr>
<td>6.1</td>
<td>8,764</td>
<td>15,055</td>
<td>3410</td>
<td>3402</td>
</tr>
<tr>
<td>9.1</td>
<td>4,393</td>
<td>7,545</td>
<td>3259</td>
<td>3250</td>
</tr>
<tr>
<td>12.2</td>
<td>2,152</td>
<td>3,696</td>
<td>3105</td>
<td>3097</td>
</tr>
<tr>
<td>15.1</td>
<td>1,104</td>
<td>1,896</td>
<td>2954</td>
<td>2945</td>
</tr>
<tr>
<td>18.1</td>
<td>554</td>
<td>950</td>
<td>2799</td>
<td>2791</td>
</tr>
<tr>
<td>21.0</td>
<td>285</td>
<td>487</td>
<td>2662</td>
<td>2653</td>
</tr>
<tr>
<td>23.9</td>
<td>147</td>
<td>250</td>
<td>2512</td>
<td>2505</td>
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<tr>
<td>26.9</td>
<td>74</td>
<td>126</td>
<td>2368</td>
<td>2360</td>
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<tr>
<td>29.9</td>
<td>38</td>
<td>63</td>
<td>2228</td>
<td>2221</td>
</tr>
<tr>
<td>32.9</td>
<td>19</td>
<td>32</td>
<td>2100</td>
<td>2093</td>
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<tr>
<td>35.9</td>
<td>10.3</td>
<td>16</td>
<td>1991</td>
<td>1985</td>
</tr>
<tr>
<td>39.0</td>
<td>5.7</td>
<td>8</td>
<td>1904</td>
<td>1899</td>
</tr>
<tr>
<td>41.8</td>
<td>3.5</td>
<td>4.3</td>
<td>1847</td>
<td>1844</td>
</tr>
<tr>
<td>44.8</td>
<td>2.3</td>
<td>2.3</td>
<td>1807</td>
<td>1805</td>
</tr>
<tr>
<td>47.8</td>
<td>1.8</td>
<td>1.3</td>
<td>1784</td>
<td>1781</td>
</tr>
</tbody>
</table>

**Image from RSS 2.2.25**

- **Offset:** 1750
- **Gain:** 2.00
Raw ADC Output Value & Color vs Antenna Temperature for 2.4 dB Feed Loss

Color Bar Corresponds to RSS Color Offset = 0, Color Gain = 1
MTSU FSX-6S (12-bit) Spectrograph Step Calibration

Adjusted Output Value & Color vs Antenna Temperature for 2.4 dB Feed Loss

Color Bar Corresponds to RSS Color Offset = 1750, Color Gain = 2.00

Antenna Temperature (kK)

Adjusted Output Value

Side A
Offset: 1750
Gain: 2.00

Side B
Offset: 1750
Gain: 2.00
Adjusted Output Value & Color vs Antenna Temperature for 2.4 dB Feed Loss
Color Bar Corresponds to RSS Color Offset = 1775, Color Gain = 2.50

MTSU FSX-6S (12-bit) Spectrograph Step Calibration
25-Mar-2017 16:32 UTC

Offset: 1775  Offset: 1775
Gain: 2.50      Gain: 2.50

Balun Output Temperature (kK)

Adjusted Output Value & Color vs Antenna Temperature for 2.4 dB Feed Loss
Color Bar Corresponds to RSS Color Offset = 1775, Color Gain = 2.50

JUPITER
Side A Detector Output vs Frequency vs Temperature Observed at 90 Deg Hybrid Inputs

ADC Voltage Reference = 4.096 V    Receiver Noise Figure = 6 dB

- Blue line: 34,900 kK
- Orange line: 8,760 kK
- Green line: 2,150 kK
- Brown line: 554 kK
- Red line: 147 kK
- Black line: 38 kK
- Yellow line: 10 kK
- Green line: 3.5 kK
- Dark green line: 1.8 kK
MTSU FSX-6S (12-bit) Spectrograph Step Calibration

Side B Detector Output vs Frequency vs Temperature Observed at 90 Deg Hybrid Inputs

ADC Voltage Reference = 4.096 V  Receiver Noise Figure = 6 dB

Frequency (MHz)  Detector Output (mV)

34,900 kK  8,760 kK  2,150 kK  554 kK  147 kK  38 kK  10 kK  3.5 kK  1.8 kK

14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Side A & B Detector Output vs Frequency vs Temperature Observed at 90 Deg Hybrid Inputs

ADC Voltage Reference = 4.096 V  Receiver Noise Figure = 6 dB

- Side B 8,760 kK
- Side A 8,760 kK
- Side B 10 kK
- Side A 10 kK
MTSU FSX-6S (12-bit) Spectrograph Step Calibration

Side B – Side A Response Mismatch

Average Temperature at Calibration Plane (kK)

Response Mismatch, dB