MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886
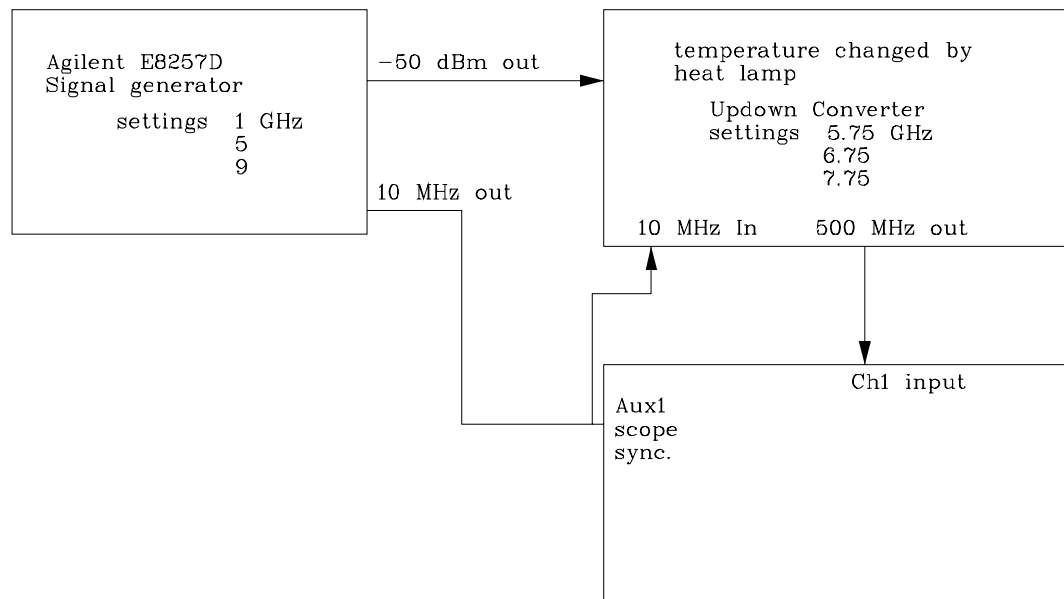
November 19, 2007

To: Mark 5 Group
From: Alan E.E. Rogers
Subject: Temperature sensitivity of Updown converter

The Updown converter (see Mk5 Memo #059) uses a Luff (TLSD57508250/100K) digital local oscillator to shift input up to an I.F. center frequency of 21 GHz and then shifted down with a second Luff (SCSM3-11250) oscillator at a fixed 11.25 GHz and doubled to 22.5 GHz. The conversion is net upper sideband. A positive phase delay shift in the first local oscillator results in a negative phase delay shift in the signal and a positive delay shift results in a positive phase delay in the signal so that if identical synthesizers were used for the LOs their phase shifts would cancel.

Using the set-up shown in Figure 1 the phase delay sensitivity to temperature was measured. The table below shows the change in output phase measured with oscilloscope for a temperature change from 86 to 96 F.

Input freq GHz	Luff syn GHz	Cycles change	TempCo ps/degC
1	5.75	-0.5	-90
5	6.75	-0.3	-11
9	7.75	-0.2	-4

The negative sign indicates that the phase delay through the UpDown converter decreases with increased temperature. The tempCo is computed using the input frequency.

```
┌─────────────────────────┐              ┌─────────────────────────────────┐
│                         │  −50 dBm out │  temperature changed by         │
│ Agilent E8257D          │─────────────▶│  heat lamp                      │
│ Signal generator        │              │                                 │
│                         │              │     Updown Converter            │
│   settings   1 GHz      │              │   settings   5.75 GHz           │
│              5          │              │              6.75               │
│              9          │              │              7.75               │
│                         │  10 MHz out  │                                 │
│                         │              │  10 MHz In    500 MHz out       │
└─────────────────────────┘              └─────────────────────────────────┘
```

Test set−up for measurement of phase delay change with temperature