LWA1 DRX Gain Setting Test

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1 Observational Information

Using the live buffer capability of the LWA1 data recorders, we took captures while in different DRX filter settings and cycled through DRX gain settings to determine the most effective settings for filter code and gain. The default DP gain is 6 for all DRX filter codes and should be specified for most observations. Changing the DRX filter code corresponds to a doubling of bandwidth for raising and halving the bandwidth for lowering. Also, changing the DP gain setting corresponds to a power level change of a factor of 4, for example, lowering the gain by one raises the power level by a factor of 4. We kept ASP set to split for all of our observations. To analyze the data, the script "drxGainCheckParse4.py" was used primarily to determine the optimal settings for DRX gain by keeping clipping under one percent and having an optimal power between 3 and 10. Our criteria for determining clipping was $I^2 + Q^2 > 49$. The initial observations were made by executing "drxGainCheckSession.sh" on 4 beams with tunings set to 74.09, 60, 42 and 37.9 MHz. The script takes a DRX filter code and a range of DRX gain values and forms a beam that is stationary on zenith. The data that were collected are currently being stored in the /home/op1/beaminfo/ directory on mcs-tp and will be available in a tar file along with all the scripts that are mentioned in this memo. Observations were taken on various days in November and December 2013 over a wide range of local sidereal times (LSTs), while there were no other observations or maintenance scheduled.

2 Observations for 74.09 and 60 MHz

There are multiple gaps in the LST times and some gain values are extrapolated from LST vs. power level figures provide by Frank Schinzel. Details on these figures will be outlined in a future memo. The data in Frank's figures were captured using filter setting 3 and DP gain 4.
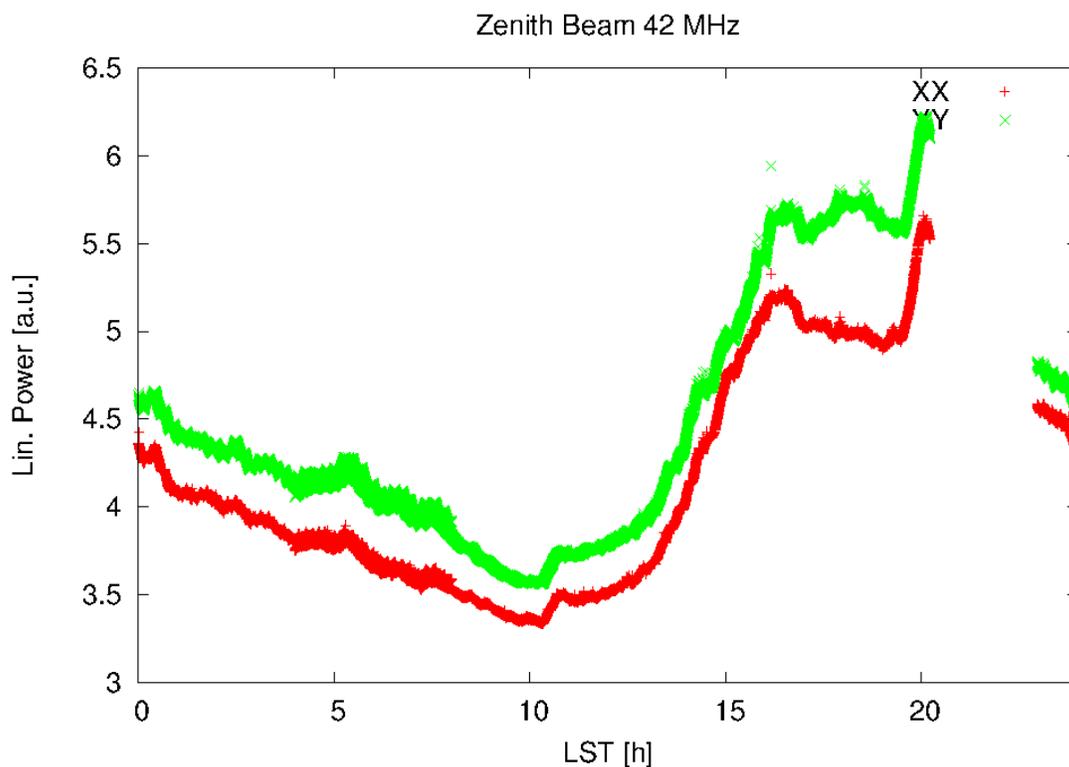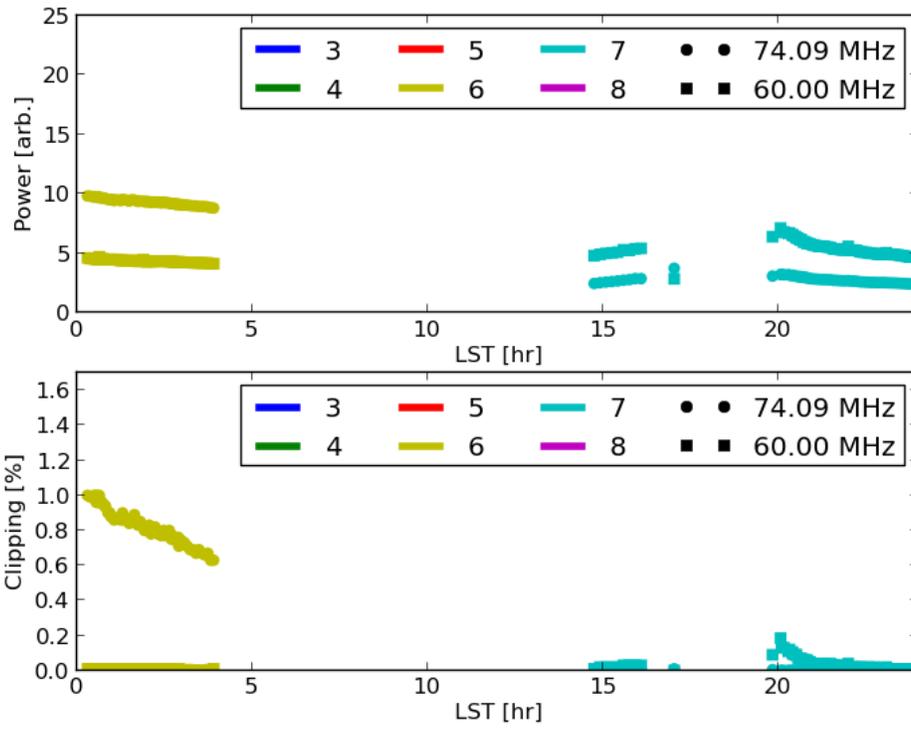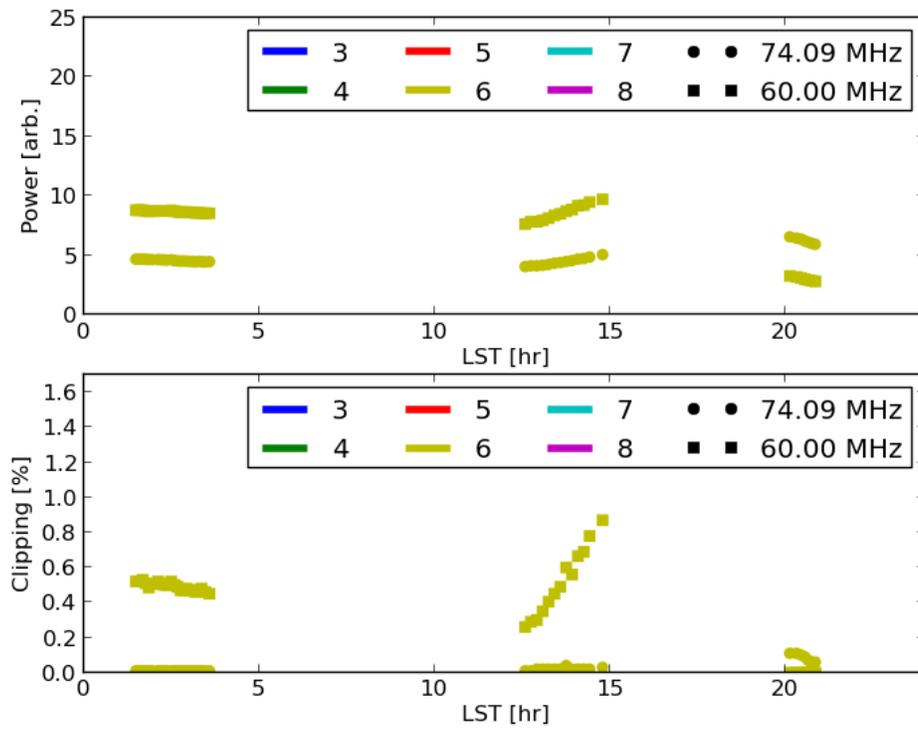

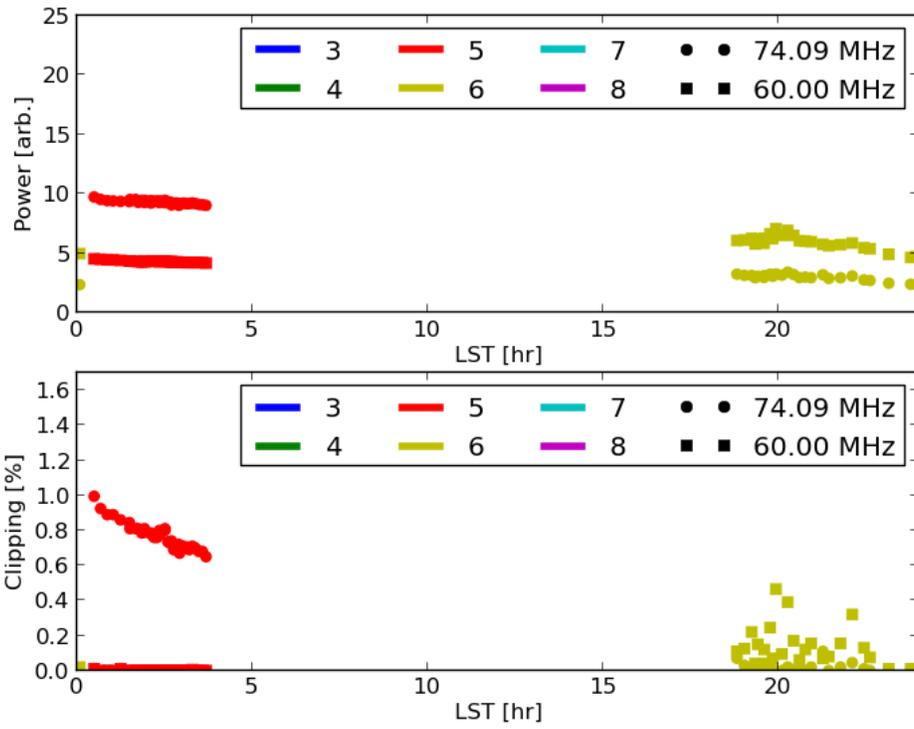Figure 1: LST vs. Power (arbitrary units) for 74 MHz, filer code 3, DP gain 4

The following graphs are for different DRX filter codes with tuning 1 set at 74.09 MHz and tuning 2 set at 60 MHz. They are color coded for gain setting and show power levels and clipping vs. LST times.
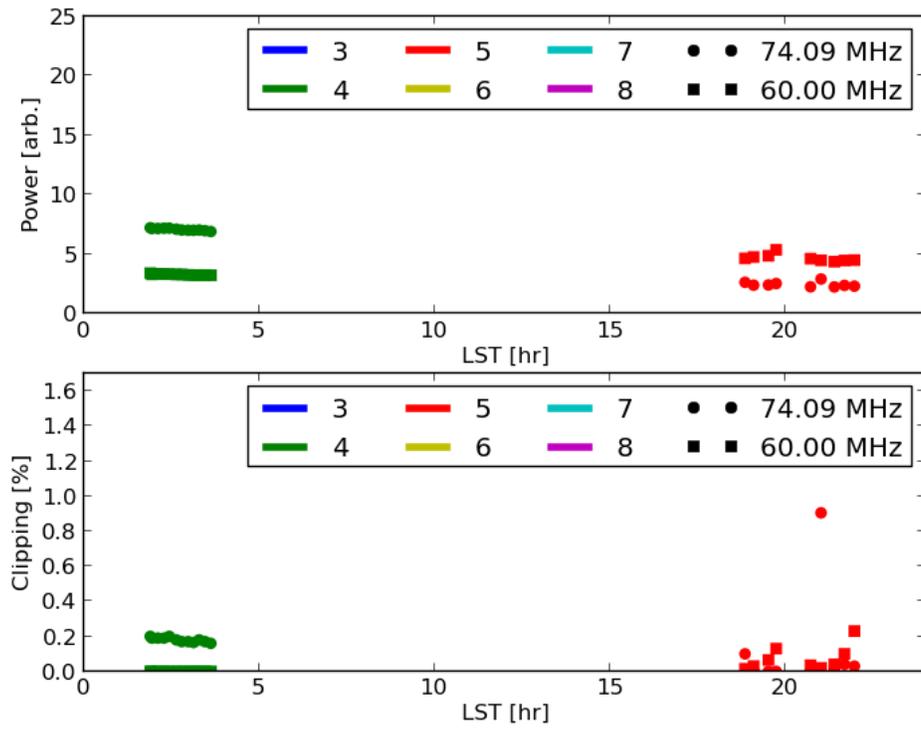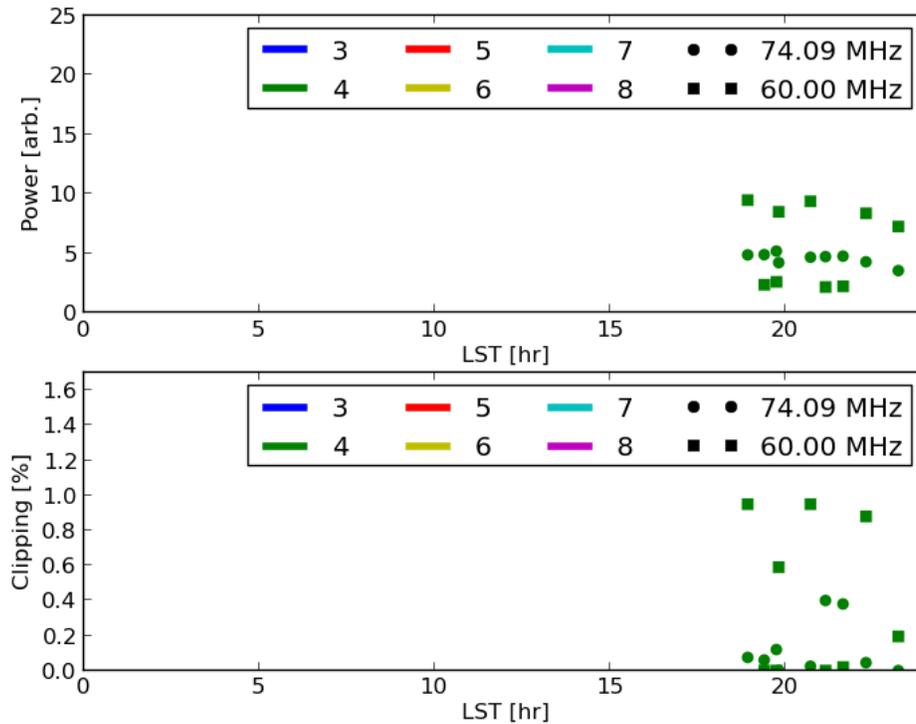
Graph 1: DRX filter 7

Graph 2: DRX filter 6

Graph 3: DRX filter 5

Graph 4: DRX filter 4

Graph 5: DRX filter 3

3 42 and 37.9 MHz Observations

The same analysis was used on the lower frequency observation. Tuning 1 is set at 37.9 MHz and tuning 2 is set at 42 MHz. The dates of observations are from various days in November 2013 and times are LST for Soccoro, NM (GMT – 7:00).
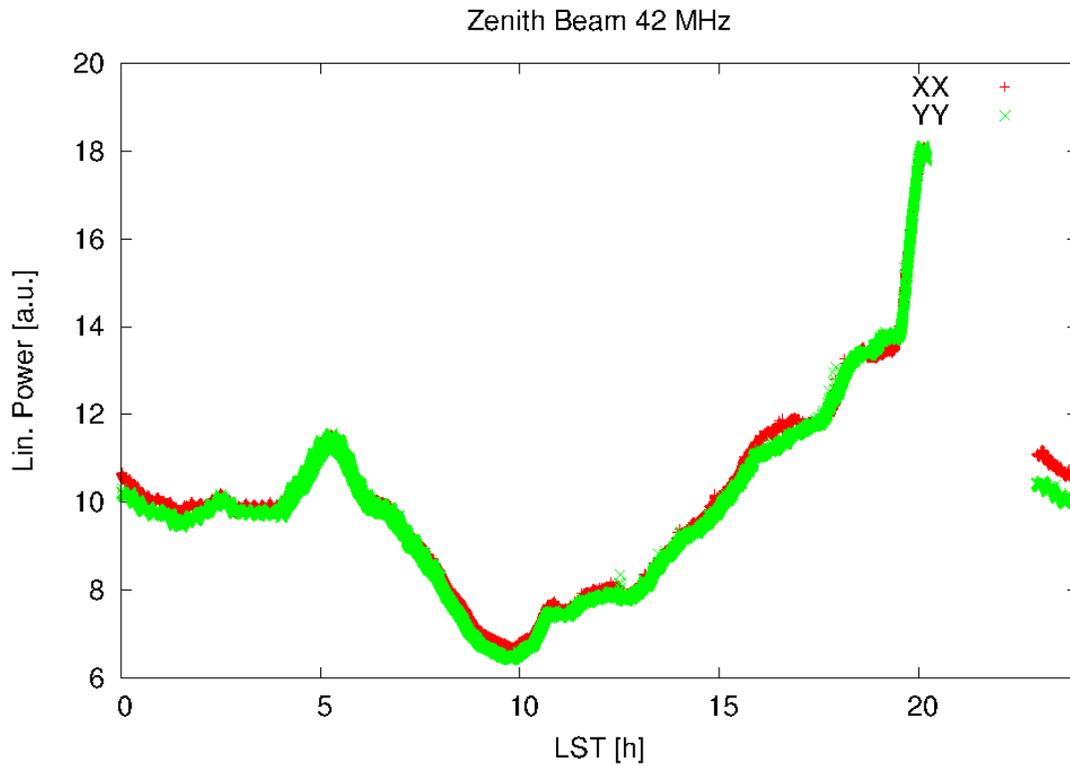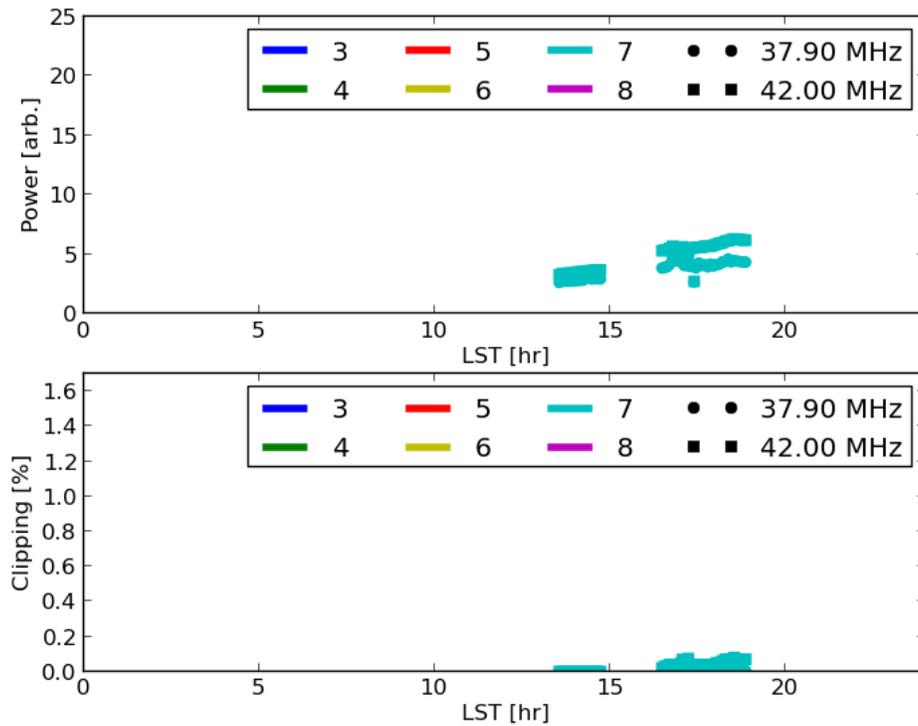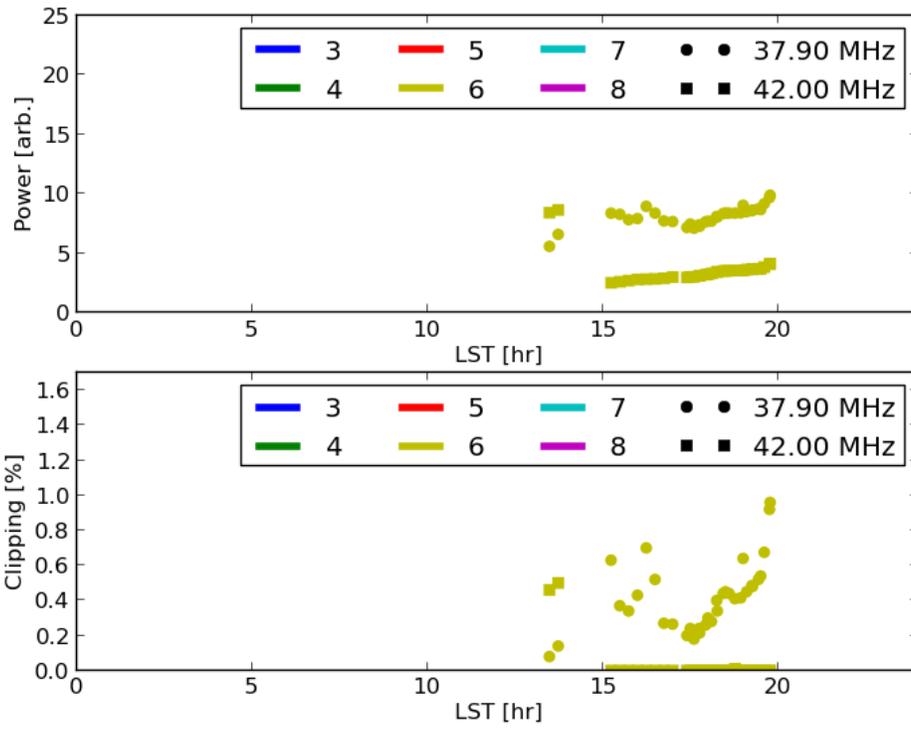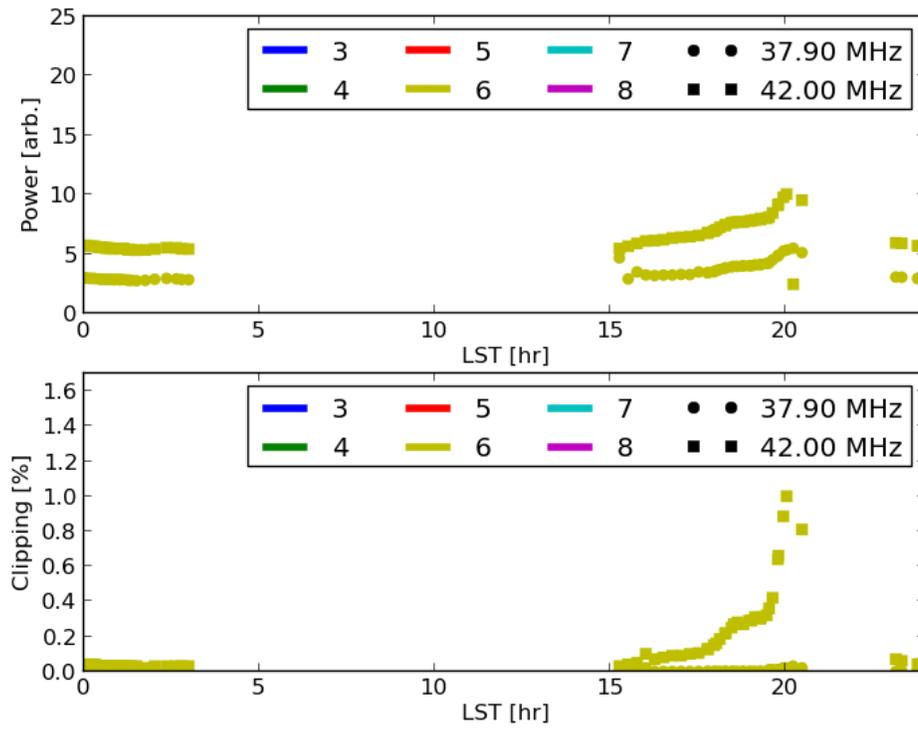
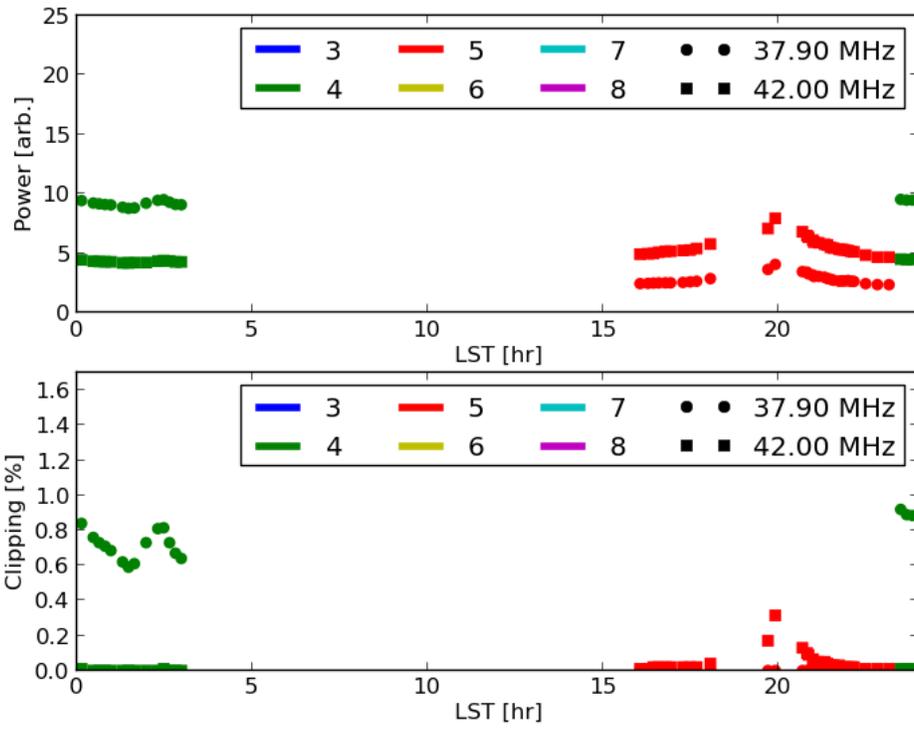Figure 2: LST vs. Power (arbitrary units) for 42 MHz, filter code 3, DP gain 4
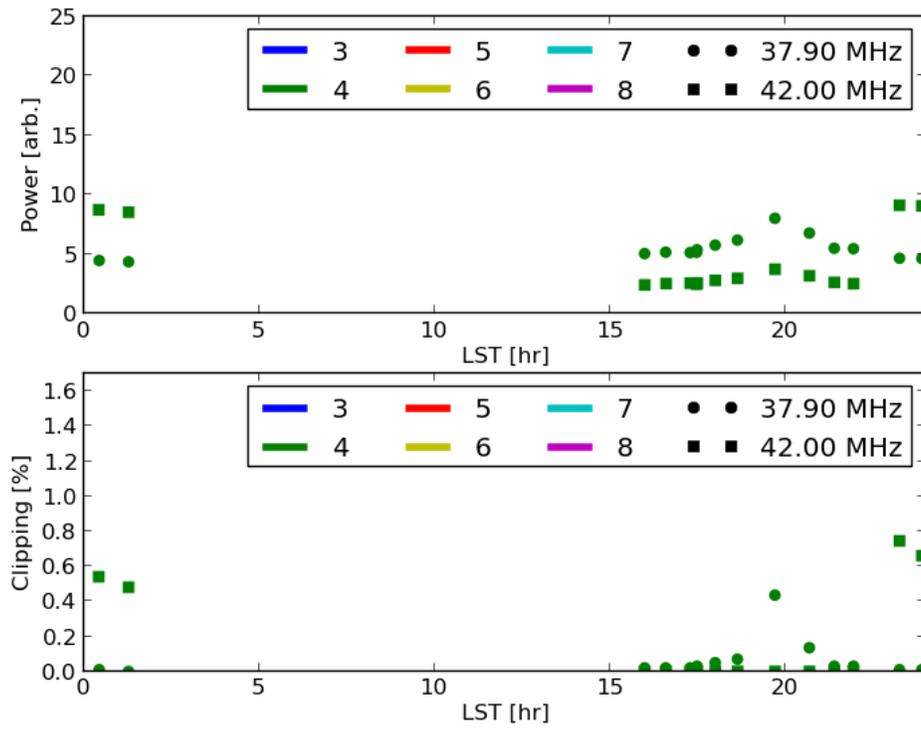

Graph 6: DRX filter 7

Graph 7: DRX filter 6

Graph 8: DRX filter 5

Graph 9: DRX filter 4

Graph 10: DRX filter 3

4 Summary of Results

From the previous graphs and figures, we compiled a table of the best DRX gain to use for each filter code. In each table, the first column lists the DRX filter code, the second the optimal DRX gain for a LST ~10 hours, and the third column the optimal DRX gain setting for a LST ~20 hours.

Table 1: 74.09 MHz

Filter Code	DRX Gain Setting (~10 LST)	DRX Gain Setting (~20 LST)
7	6	7
6	6	6
5	5	6
4	4	5
3	4	4

Table 2: 60 MHz

Filter Code	DRX Gain Setting (~10 LST)	DRX Gain Setting (~20 LST)
7	6	7
6	6	7
5	5	6
4	5	5
3	4	4

Table 3: 42 MHz

Filter Code	DRX Gain Setting (~10 LST)	DRX Gain Setting (~20 LST)
7	7	7
6	6	6
5	6	6
4	4	5
3	4	4

Table 4: 37.9 MHz

Filter Code	DRX Gain Setting (~10 LST)	DRX Gain Setting (~20 LST)
7	7	7
6	6	7
5	6	6
4	4	5
3	4	4