



National Center for Radio Astrophysics

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Analysis and Correction of Self Variations in GSB data

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ABSTRACT

For self-correlations, the amplitudes should be, the correlation coefficients, i.e.

$$A = T_{\text{ant}} / (T_{\text{ant}} + T_{\text{sys}})$$

where $T_{\text{ant}} = S \times G$;

S the source flux density (Jy),

G the gain (K/Jy) and

T_{sys} the system temperature (K).

For a working antenna, there should be constant self counts over the time.

Problem Statement :

Large variation in self power problem was reported by Shri. Ishwar Chandra in Nov, 2013 seen in GSB data. This problem was also observed previously at W03 antenna, please refer annexure A (callsheet no. 2013.1082).

For proper understanding of the problem and to find the cause, we had carried out various experiments which are described in this report. Also after finding the problem we had corrected the identified components etc. which is also explained in this report.

During troubleshooting the problem, We understand that due to aging of the electronics components mainly Capacitors in IF system are major effecting factors. We had also described about the aging effect and solution of the problem identified in this report.

This report includes Problem statement with callsheet reference, solution identified and correction done in IF system, corrected antennas data plots.

To understand the problem we had carried out a set of experiments regarding the same which are as follows:

Experiment No 1 : -

Aim:- A test was carried out by giving CW signal to the input of BB system & confirmed that the BB + GSB is not contributing any amplitude /self Variation

Setup: Noise injected @ BB receiver system 175channel
Giving CW signal as a input to 175 channel of Baseband system and recorded data.

Output:- From the plot shown below we can conclude that for 175 channel antenna shows stable count, and on otherside 130 channel shows the same variation as seen in problematic data. Annexure A .

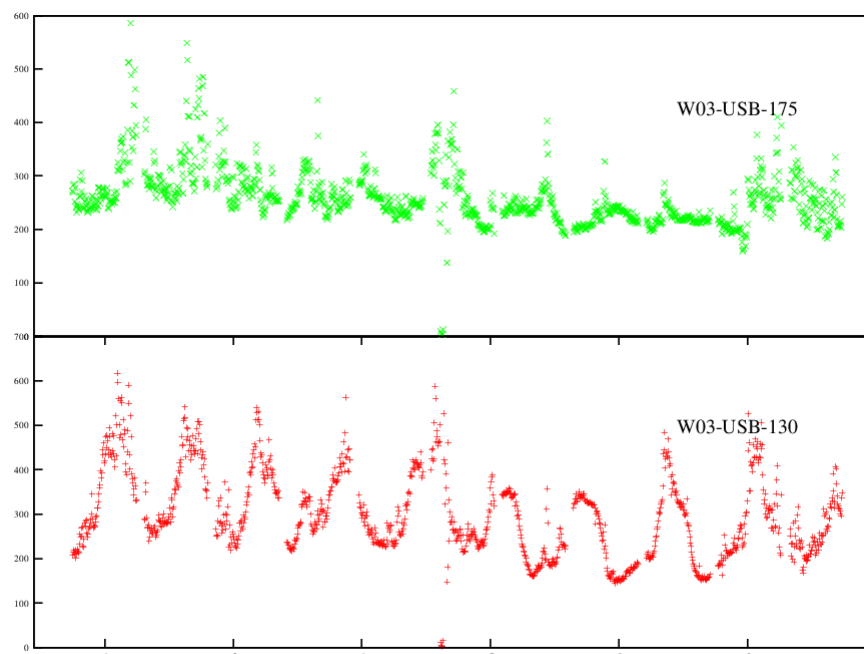


Fig.:- Data recorded at CW i/p to 175 channel of Baseband.

Conclusion:

A experiment carried out by giving CW input to BB system & confirmed that BB + GSB is not contributing any amplitude Variation.

Experiment No 2 :-

Aim: A test was carried out by injecting CW signal at Antenna base receiver & check for variation in Self.

Setup: Noise injected @ I/p of IF system 175channel
Giving CW signal as a input to 175 channel of IF system at antenna base and recorded data.

Output:- From the plot shown below, we can conclude that for 175 channel , antenna shows more count as same as 130channel. That shows the same variation as seen in problematic data. Annexure A

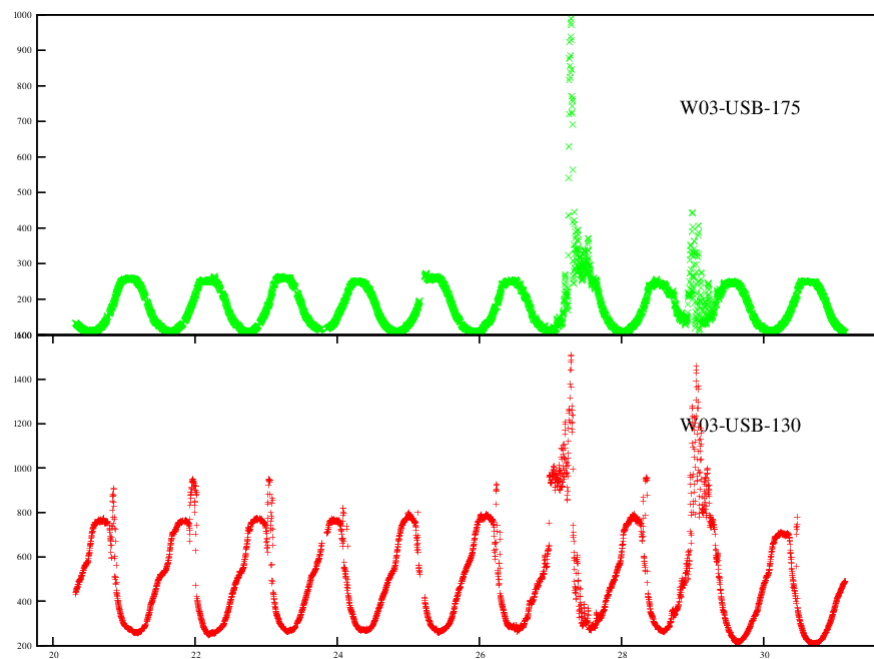


Fig.:- Data recorded at CW i/p to 175 channel of IF system.

Conclusion:-

This experiment carried out by injecting CW at Antenna base shows variation in self.

Steps taken to Solving problem

After detailed analysis we understand that problem is in IF system of ABR receiver.

Procedure followed to resolve the problem:

To resolve the problem we had tried following methods:

- Soldering Touch up to the units.
- RF cabling loss measurement
- RF connectors re-tightened
- DC wiring check

After performing the above steps, we found that due to 15-20 years life of electronics component, Some components went into non linear region. Mostly capacitor in RF path and coupling capacitor were traced in fault finding.

In ceramic capacitors, capacitance decreases over time, this behavior is called "aging". This aging occurs in ferroelectric dielectrics, where domains of polarization in the dielectric contribute to the total polarization. Degradation of polarized domains in the dielectric decreases permittivity and therefore capacitance over time. The aging follows a logarithmic law. This defines the decrease of capacitance as constant percentage for a time decade after the soldering recovery time at a defined temperature. Due to ageing its performance not in linear range, this affects our band shape which also change gain of our system.

In simple words, variation in self power over the time called self variation.

Experiment No 3 :-

Aim :- Further study can be carried by replaced IF units-on
4/8/2013

Setup:- This experiment done for confirmation, Replaced IF system for 175 channel and recorded data. In this experiment we had replaced IF units

Output:- From given below fig we can conclude that for 175 channel antenna shows stable count, in other hand 130 channel shows same variation as seen in problematic data. Annexure A .

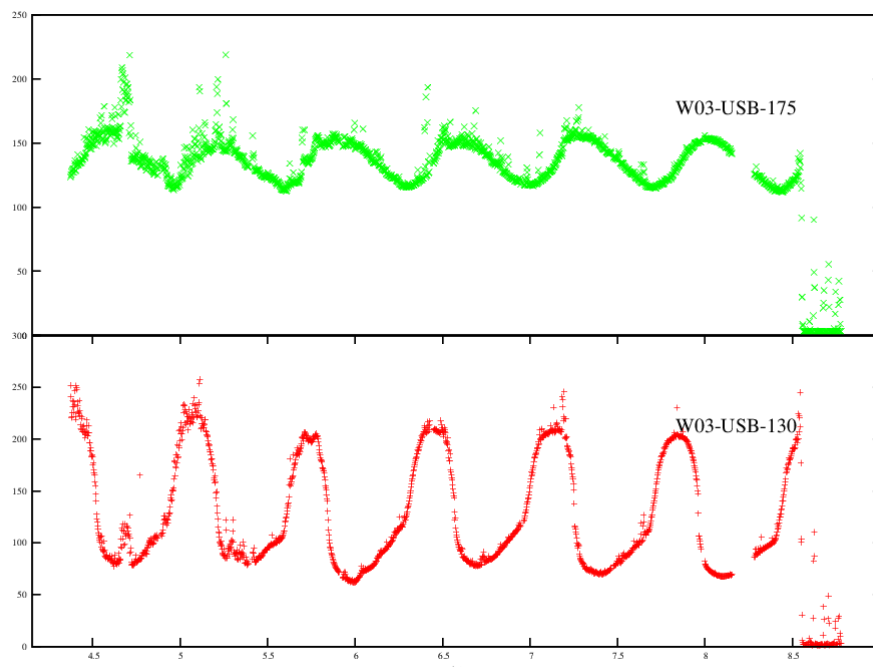
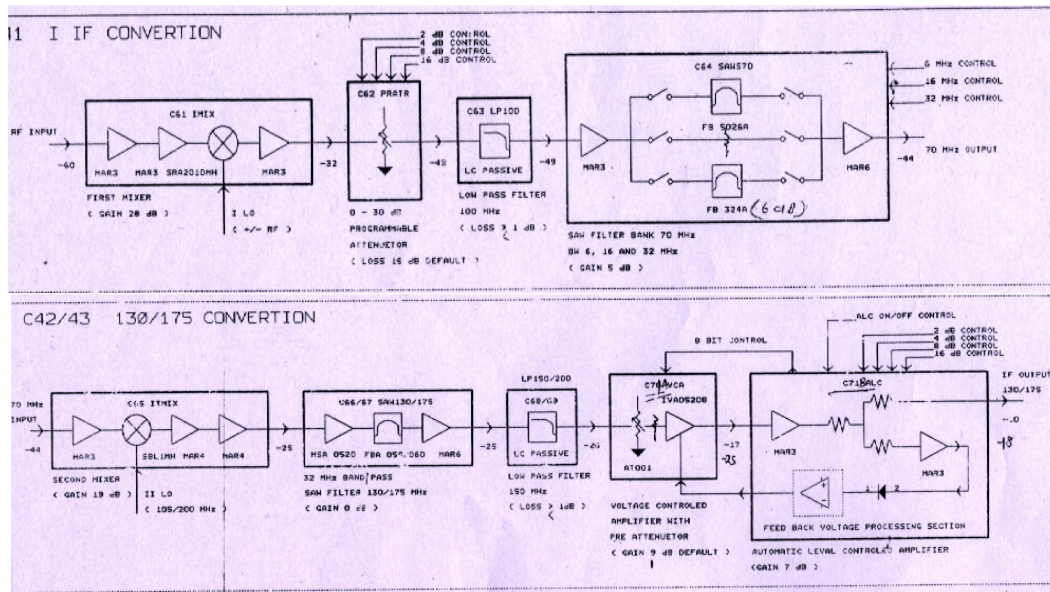


Fig.:- Data recorded after replacing IF system

Conclusion: Confirmed that IF system played an important roll for contribution of variation in data.

C41 - I IF Conversion



C42 - II IF Conversion

Fig :- IF system Block diagram

Conclusions

After finding the solution all antennas are corrected during MTAC2014. we have again recorded data at same set of observation and data analysis done by our team and also verified by Prof Ishwara chandra C.H.

Note: Prof. Ishwar chandra give us reply and send output in pdf format.

Link http://gmrt/~losys/gab/ABR/variation%20in%20self/self_multi_freq-joint2.pdf

In this pdf red part shows variation problem and green part shows after work self power over the time.

Results are also checked by AD8302 (gain and phase detector) project kit.

Last two years we are tracking regularly problematic antenna and solved it after tracing.

All data are available on following link

<http://gmrt/~losys/gab/ABR/variation%20in%20self/>

References

ANNEXURE:- A

SOLVED ACTION CALLSHEET : 2013.1082 _ ANTENNA : W03 _ FREQUENCY : 1280		
Callsheet has 4 attachments. Click here to View attachments		
System configuration :FE 1280,1280 S0 OFF UNSWAP LO 1210,1210 IF C1-4,12 C2-4,12 32-32 ON-ON BB 16M16M16M16M 0000 51,51 OFFOFFOFFOFF GSB BW:A33 MHzFOFFTotal_Intensity- BOFF:OFFLO32:149-156CH2568 SRV AZ EL 1- 2- 3- 4-		
Solution Section(History No:LATEST)		
Description : After replacing the IF system		
Diary : After replacing the IF system variation does not observed.		
Solution on : 19-Oct-2013 14:10:14	System : IFS	
Status : SOLVED	Solved By : ATD001	Entry By : ATD001
Solution Section(History No:7010)		
Description : Amplitude variation observed		
Diary : A Expt carried out by giving CW input to BB system & confirmed the BB + GSB is not contributing any amplitude Variation. Next expt carried by injecting CW at Antenna base & found variations. Further study can be carried by replaced IF units-on wed (4/8/13)		
Solution on : 04-Sep-2013 10:21:30	System : ABR	
Status : IN-PROGRESS	Solved By : AMV001	Entry By : AMV001
Problem Section(History No:LATEST)		
Problem Date & Time : 26-Aug-2013 10:44:52	Observer : JRK012	System : IFS
Assigned on : 27-Aug-2013 09:27:51	Assigned by : SNA117	Assigned To : AMV001
Description : Large variation in self power.		
Diary : W03 shows large variation in self power (peak to peak variation) at all frequencies. * File 1 Attached. * File 2 Attached. * File 3 Attached. * File 4 Attached.		

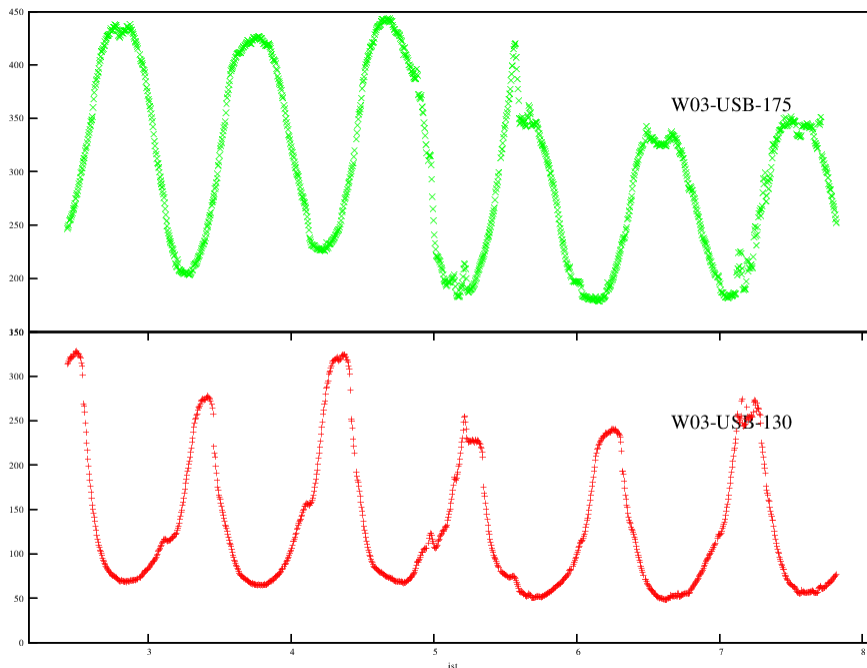


Fig :- Problem seen @ W03