Meeting Date: 02-Oct-2003

#### Participants:

Australia: Mike Kesteven <u>USA:</u> Bob Martin, M.T. Chen, F. Patt, T.H. Chiueh, C.J. Ma, Kyle Lin, P. Ho Taiwan: C.T. Li, Robert Hu, H. Jiang, P. Shaw, Eugene Hwang, Johnson Han

USA Dial-in = 1-800-653-5390, 6668081# Minutes Recorder: C.T. Li previous weeks comments

#### I.New Action Items:

#### II. Previous Action Items (still open):

**AI-25Sept03-1:** Bob/Huei - Figure out our obligation to those residual MMIC Bob received. Are we supposed to get back to Todd Gair or not? Are they residual extra, or we're supposed to send somebody to Todd to package them?

Paul Ho - One of the questions last week was whether expansion project can use these MMIC or not? Do we have enough, or we need to order more (for expansion)? Paul Shaw - think the first foundry is sufficient enough for the whole project. The reason to have the second run is we think there might be some improvement. Bob - the point of second run is to revise and build up new design and capability. Also in the beginning, scheduling two was that in case the first one fails. Paul Shaw - That means that if we succeed in the first run, we don't need to have the 2<sup>nd</sup> run. Bob - Have to check all these with Huei when he is back, the quantity in the package. Paul Ho - This is one of things we have to figure out how much money we can squeeze out the direction. If there is something we don't need to buy, we don't need to order, or push off later, then we can manipulate some of the money.

**AI-25Sept03-2:** Ming-Tang - Volunteered to review all the specs as much as we can, and collect them into one place so that we can look them up.

AI-18Sept03-1: Bob - Re-visit the testing of phase shifter in a month.

AI-14Aug03-1: Warwick - Become directly involved with offset issue

Kyle - No update on offset. Recently focus on the delay and frequency response of correlator. We measured the IF spectrum before and after the equalizers. After equalizers, there are still about 10 dB gain slope. At higher frequencies, the spectrum is below the noise floor of the spectrum analyzer. The spectra beyond 10 GHz start to drop very fast, at least 20 dB. After equalizers, the correlator only see maybe 2 to 10 GHz. Ming-Tang - will go up with them to check on the instrument. All 4 IF channels from receivers behave quite weird.

Derek - Checked the PIN diode attenuator, which is only spec for 48 GHz. Tried it at 21 GHz yesterday on ML. In fact, it does work still, a little bit lossier. We can still control the attenuation. Ended up connecting the TTL phase signal to a solid-state switch. Was able to manually set the feedback circuit using a pot to control the attenuation, synchronized with the phase switch. We are actually able to level out the AMing from 21 GHz LO of the receiver 2. We were able to get very close to 0dB difference between the two phase states. We did find another problem, which has to do with the latency that is created inside the phase switch. We can solve the timing issue by blanking. There is a un-usual offset that happens when we have offset below 50. It's possible that this is another source of offset.

## III.<u>Closed Action Items (as of this meeting):</u>

## IV.Miscellaneous Discussions:

### MMIC:

Bob - There was an initial response from State department asking more questions on the export license. They put decision on hold. Have circulated those questions around. Paul (Cenward) responded. Paul's comment was that they just becoming seemingly careful. He did again make them aware that there was a previous approval. The good news is that they didn't rightly say No. The bad news is the process drags on. Paul took the action to send those questions around and explain the answer he is giving. We now wait to see what their response is.

Bob - Received residual chips that will not be shipped to him. Ferdinand has ordered a desiccator to put them in. They are sealed in anti-static wrapping.

#### Receiver:

Ming-Tang - In the process of testing quartz vacuum windows. New development this week is that we found the LO power fluctuation with temperature. Prof. Chu is investigating the problem we found on the prototype. In the mean time, we want to make some temperature variations on the module we got. The temperature on the LO module, without circulation, will rise up to 40 ~ 50 degrees on the outside. By installing a small fan, Joshua found it we can cool it down to around 30 degrees.

T.H. Chiueh - That is also found the IF power to be anti-correlated with LO power. When LO power drops, IF power rises, and that also correlated with day time. In the day time, the IF output becomes factor of 2 higher, but LO power drops by maybe 30%. The question was why the IF power increases by factor of 2 in day time compared to night time?

Ming-Tang - Got the quartz vacuum windows. Found some error there. We specified to have window thickness of 2mm. They came in as 3mm. After Talking to people in the factory (Thomas Kieting), the coating they put in makes it thicker. We have to modify our clamps to accommodate it. About 2 or 3 pieces, the coating at factory e-laminated? We are going to send them back to replace them. Todd Gaier just found out that in this batch of LNA, they used slightly smaller DC bias connectors. That actually caused the problem we found on 2 amplifiers - the connectors are loose. He suggests curing the problem by putting some epoxy. Todd also found that in their bias circuitry, they made a mistake by not putting 2 bypassing capacitors. He is investigating whether this is going to affect the performance. However, we didn't find anything peculiar from our room temperature tests. Another group using these amplifiers also reports it's OK. Will do some tests in Hilo to close on this issue. The time for Todd to fix these problems will be a few days if we are sure this is a major problem.

#### LO/IF:

Ming-Tang - Homin and Joshua found out that the IF/LO module is getting pretty hot after turning it on over-night. The outside temperature gets up to 50 degrees Celsius. Asked Prof. Chu's suggestion on this. During the week, Joshua has put a fan outside the module, reducing the temperature down around 30 degrees. One simple solution is to find a place to put more fans.

For each module, the relative phase difference between channels is 90 degrees. But the absolute phase change in each channel is different.

For the future maintenance of these modules, we need more detailed documentation if Prof. Chu prefers us to do it. The current documents only including assembling and performance. Operationally, we prefer to have one or two extra modules. If we found something suspicious, we can swap the entire module.

Jeff Peterson - Changing the overall phase of one of the Los, it is changing the phase of interference pattern on the sky. We find that phase basically by using the lag in the lag correlator.

#### Correlator:

T.H. Chiueh - C.J. replaced the engineering model with another production model. That new production unit performed similarly to the engineering model, different from the first production unit. We have to check all the production modules.

C.T. - Still checking the timing of the data acquisition circuits. It's delayed already. Hopefully we can have the design finished soon.

T.H. Chiueh - Another thing mysterious is the noise from 4 lags. The noise from 4 lags should come from the common source, and they should be highly correlated. It's found that adjacent lags have higher correlation than distant lags. Kyle - We're correlating noise from receivers. We think that these 4 correlations would be almost the same. We should see the same correlation between any two lags. Mike - I thought that is very puzzling. I don't think you should. I really wonder if you're looking at the effect of DC offset. The receiver noise shouldn't be correlated. You're outside of that window. I don't have explanation of DC offset. It strikes me that(DC offset) is more likely to be the cause of correlation than receiver noise itself. We should go through the numbers, and calculate quite correctly what you gonna see the different lag. But I think it certainly stop? the noise in the multiplier stage. I think you're getting 2<sup>nd</sup> order type correlation, certainly should be very small. I'll work through that to see one of opinion based on the algebra.

Derek - Finished integrating 14 Marki correlator modules with DC amplifiers. Power them up and align the pots. We found one defected module of 39 - lag 4 has diodes that were not responding. Turned that back to Marki. Still waiting for covers from the machine shop. Will send 32 Suhner SMA-BMA connectors to Taipei. Ted has agreed to design CFRT bracket. Asked him to do it in parallel. Ted sent out the quad pack for correlator frame for manufacturing. He also designed the enclosure.

T.H. Chiueh - For the production correlator module on prototype, the lags are not what we expected. What's been found was that the delay (phase?) between lag 1 and lag 4 is not 270 degrees, rather it's 90 degrees. That means that somehow most of peak power on the correlator shifts from 10 GHz to 3 GHz. On the other hand, for the engineering model, with the translation stage, adjacent lags differ by 90 degrees in fringe. If you do a "zero-delay cross correlation", in other words, you take the time string data of lag 1, multiplied by the time string data of lag 2, with no delay, then sum them up, treat them as vectors, do the inner product. One would see a very huge response because they are basically the same noise. It turns out when you do this kind of zero delay cross correlation, lag 1 and lag 2 have response, lag 1 and lag 3 have smaller response, and lag 1 and lag 4 have even smaller response. That means that the noise for different lags are not coming from the same noise. The data dump is 2.2Hz. You integrate for 0.5 sec, then you take a dump. You compare the RMS of this 0.5 sec integration.

Platform/Mount:

### Calibration System:

DC Power/ Distribution:

#### Enclosures:

Site:

Ferdinand - Received the blue prints from Neil Harrison. There is some changes, mainly to the rail running from the top of the wall. They made the suggestion to minimize the excavation, and digging the back? rock. May have the effect on

seeing of telescope. We have to look into some details. Got a quote for the shelter. That looks OK, didn't change from the budget - 65,000 USD, including shipping. Got a quote for the grounding system, and look into some details to see if the quote I got is different than the bid from contractor. Sure they're (different). If we have these ordered by the contractor, we will pay almost twice the money. So there is the money saver.

Ferdinand - sent out the update for site yesterday. Bob/Paul Shaw/Paul Ho - Will schedule a meeting for detailed discussion about whether we're going to send people from Taiwan. Will talk to Bill Liu and Jerry for the possibility. We're running out of budget. We have to look for places to save money. Site is the only area where we haven't committed money. There is no other area to look for saving. We are projecting short fall of 6 or 7 million NT\$.

### Dishes:

Ferdinand - Putting things together. Finished couple of noise measurements. I got the transmitter gunn working again. Got a blue print from the shutter. Everything will fit in the housing of shutter, sub-reflector box. Just one simple cable going down, feeding to the telescope. Very much possible (running out of time of doing that). We will need the shutter. There is too much work to replace the shutter by the metal stretcher.

2-Element Prototype Issues:

Schedule: