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| **MEETING MINUTES – Sponsor Meeting** |
| DATE: January 28, 2015 |
| POSTING TIME: 01/30/15 12:15:21 AM EST |
| OWNER: Julia Kim |

Present: Julia Kim, Joshua Cushion, Patrick Delallana, Benjamin Mock, Jasmine Vanderhorst

Time: 5:00 p.m. – 6:00 p.m.

Josh asked about the level shift circuit he was working on. He was looking at other comparators as the original one picked out would be a bit slow to work with and the bandwidth was not included in the data sheet. Pete said that it didn’t need such a high bandwidth as one of about 500 kHz would be alright for the system. One of our backup plans is to put a simple voltmeter at the IQ demodulator at the I and Q outputs. We would get an analog voltage that’s 0.4 and -0.4. At that point, we can take those values and put them in the signal processing program.

Josh sent information on a field strength meter that was the cheapest and bet option available. Pete said to go ahead with that. Josh wasn’t able to get any power detector to fit our needs that would work at 10 GHz. Pete had some information on that from a company called PMI, where they have a series of detectors that might fit our needs.

Pete asked if the SP4T from RF Lambda got ordered, and Ben said that it was already ordered. We already got the power amplifier, low noise amplifier, and attenuators from Fairview today. Ben hasn’t gotten the quote from Fairview about the multiplier yet.

Pete asked about the cabling that were to be done by the MEs. Josh let him know that they’re waiting on all the components to be received as the data sheets do not have all the information about the dimensions available. Pete said that they should just estimate and not get all the dimensions exact since there are no size constraints instead of waiting for all the components to be received.

Ben said that he got an email from the company supplying the isolators saying that they need more specific information and that the lead time is about 6 to 8 weeks. Pete said that we should just forget about the isolators as the power amp has some protection and would have to be careful. Josh said that he would account for that in the design in terms of dB drops and such.

Julia discussed with Pete the image formation calibration tasks that he assigned. When the distance from the horns to the target is very big at around 24,000 inches compared to the actual distance of 240 inches, then the distance from each horn is pretty much the same. So the differences would be negligible. If the target is moved 5 degrees down, then the distances from each transmit/receive combination are different. The x axis would be the cosine of the angle found in Task 1, and the y axis would be the sine of that angle.

The path lengths are all different, and as the target is brought in on boresite, now the phases aren’t going to line for all the transmit/receive combinations as all the distances are different. The combinations for the ones at the edge are going to be further than the ones near the center. That distance change manifests itself in the phase change in the hardware. So we are calculating that distance difference and the associated phase difference in the complex plane. If we were to take the I and the Q and plot those, we would get a vector in the complex plane, and that’s the phase difference we would measure for something that’s on boresite that’s coming in closer. What we want to do is, we want the hardware to appear as though the far field where all the distances are the same. And that’s what the processing does. The only variation we have is d\*sin(theta), once we have the angle.

We would expect the hardware to measure the values because the distances change. Since they are all different, in order to make them look the same, when we have a target at boresite we want it to look at amplitude 1 and constant phase across all the transmit/receive combinations. That’s how we get the sinc function in the image math, you get a rectangular function and that’s how you get the sinc function. The only way to get that is to have equal amplitude and phase for all the transmit/receive pairs. So we’re going to take these values that correspond to the phase difference that the hardware should measure and we’re going to multiply them by the conjugate. So we would then end up with zero phase and the same amplitude; the imaginary part goes away. So that I and Q become the cal factor that we’re going to multiply with the conjugate. If we plot all those, the I and Q in the complex plane, we can see that they’re all the same magnitudes and different phases. And the rotations correspond to phase difference between the different transmit and receive paths. Besides that, there are going to be hardware errors as every combination might not be the same as there is variability in the hardware. We’ll put the target at boresite and all those errors would be filled in to the cal and all the residual errors come from the measurement. This is the ideal cal factor and the hardware is perfect; this represents the error out in free space from the horn to the target.