App Note:

Antenna Soldering and Assembly, System Improvisation

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I. Objective:

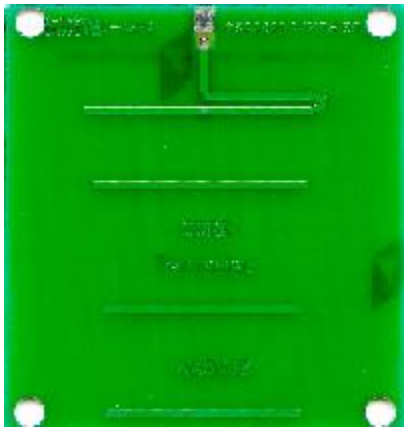
The purpose of this app note is to provide perspectives and experiences regarding the antenna assembly for either patch or yagi antennas, as well as improvisations can be made to systems with sudden component changes.

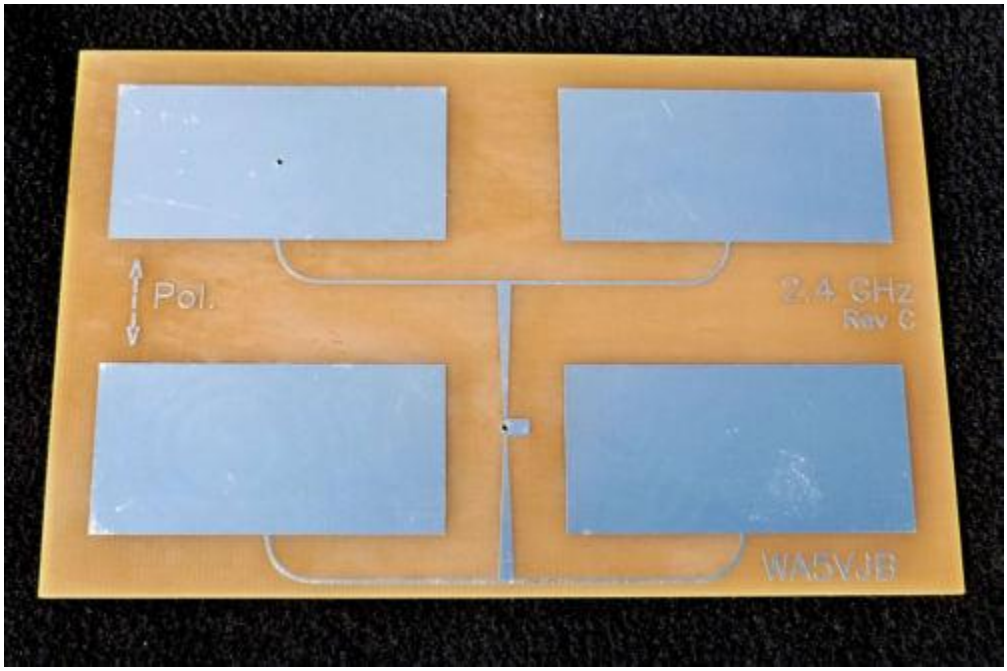
II. Introduction:

The second quarter of the radar system involves the assembly of a customized radar to replace the coffee cans for reduced weight and better directivity and gain. In addition, this year the project went into some unusual circumstances involving running out of proper components, as well as having only one PCB window. These conditions imposed great constraints on over system design and configurations. Although we had to fall back to over quarter one system in the end. I wish that our experiences can help future groups.

III. Antenna Assembly

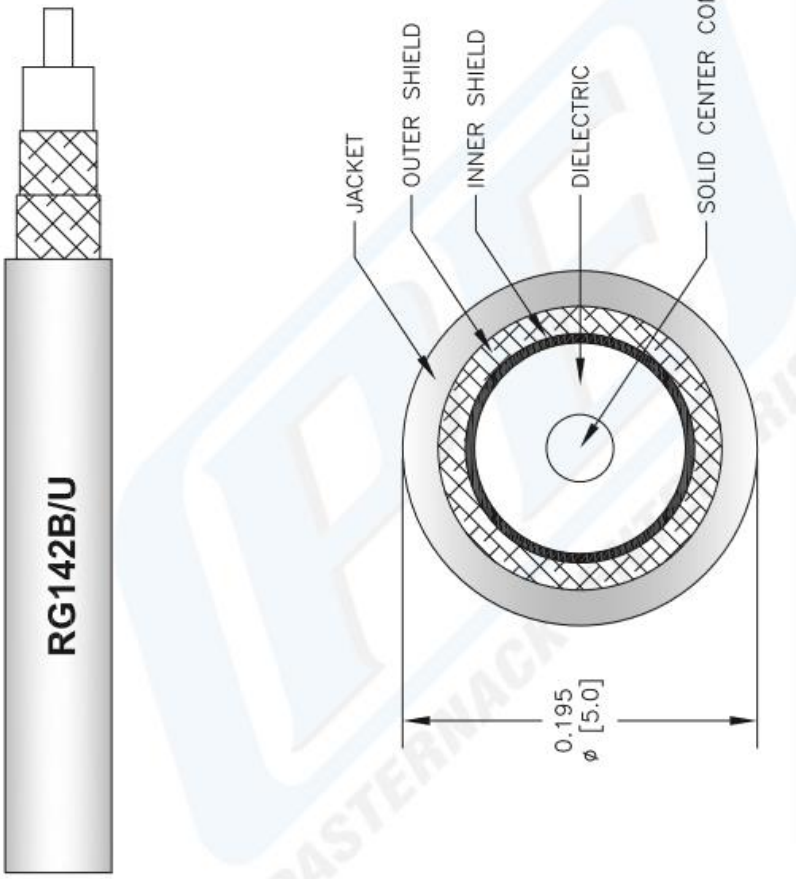
Market antennas require manual attachment of SMA cables. For the yagi and patch antennas we used for the system





It requires direct attachment of SMA cables to the antenna ports. Cables recommended for the assembly is the RG142. It is an extremely thick cable compared to the ones we used in quarter one. The dissection of the cable is shown below. Also because of the need of direct attachment, market rg142s with SMA ports attached needs to be split in half to allow soldering of core. This limits the available length once the exposed core requires adjustments, given the soldering process requires

multiply tries and adjustments, it is recommended to assembly the SMA ports to raw RG142s directly for easier adjustments as well as save of budget.



To prepare the RF cable, we need to create exposing cores as shown as the left part of the upper graph at both sides for a certain length of cable. As mentioned above the large diameter of the cable renders most clipping and stripping tools available in our lab useless. Specific RG142 tools are available online but they are expensive thus

not recommended, simple blades are easy to cut through the jacket but the two layers of shielding comprised of silver plated copper braid is tough with blades but doable, be sure to utilize other tools to create a clean cutting face. The removal of the dielectric layer is recommended to use clipping tools of 0.1mm diameter, so it won't damage the core of the cable.

To accommodate for the PCB SMA ports, we need to attach SMA male ports to our cable, SMA male pins sold on the market consists of three parts as shown in the graph below. The pin is directly attached to the cable core and use clipping tools of 0.8mm to hold the pin in place. The silver ring is used to cover the exposed shielding and dielectrics and to hold the port in place. Be sure to use electric tapes to reinforce it. At the end, be sure to use a millimeter to test the continuity between the center pin and the outer shell of the SMA port to ensure there are no shortage cause during the process of assembly.

On the other end, it is recommended to first tape the cable to the antennas first and solder the shielding part of the cable to the ground plate of the antennas to provide

a structural point for the RF cable, the RG142 is a heavy cable, relying on the sole solder point between the cable core and the antenna is impossible to hold the connection in place. In addition, it is also crucial to follow lab manual 5's procedures to determine the core length to have appropriate S11 parameters. We have overlooked this process and in the end our gain of built antennas were of 1 dB less than the coffees cans.

IV. System Improvisation

This quarter we couldn't obtain the desired VCO that has an operation range of 0 to 5 volts. Instead the operation range of the VCO is 0 to 10 volts, which creates a frequency offset by 100 MHz if we operate it in the original system. To solution to this issue is to include a single-stage op-amps we learned from the EEC100 to linearly increase the DC input linearly from 0 to 5v to 0 to 10v. Also adjust the cut-off frequency with appropriate RC components to maintain around 15 kHz.

The troubleshooting of the PCB is trivial and complicated, here I highly recommend dividing the PCB in two separate pieces for the baseband and the RF part of the system. Unlike direct voltage, current measures RF signals is hard to measure from PCBs without SMA ports, it is easier to determine the signal for each system separately, the larger and the more complicated the PCB is, it is harder to diagnose the problems caused to the RF systems.