RF Book

RF Note 65

July 28, 1980
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Topics

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1. K500 RF test results and present status

During the week of July 8, 1980 it became apparent that something was wrong with the dee coupler capacity (our spark monitor under it kicked us off. Suspecting trouble with the feed through insulator we had machined a pair of corona rings to hide the solder joints, leaving only a 1/4 inch gap where the middle of the insulator could be seen. On Saturday we pulled the coupler and found the vacuum side of the insulator cracked and covered with silver. The air side was broken and much evidence of air sparking existed. On Monday we welded in a new insulator with the new corona rings attached and exercised great care on assembly to not break the air side tube.

Unfortunately we had vacuum leaks on reinstallation and weren't able to try RF testing until Wednesday evening. Thursday we finally got on, but only after decreasing the turn-on time to 1 μs. For turn-on times longer than this the voltage would rise to 1500 V in 1 μs then fall to about 500 and stay there.

Quickly we got up to 100 kV and everything worked well. The delivered power was 80 kW and the anode power supply was providing 8 1/2 amps at 17 kV. We scheduled graduate students to run overnight and everything worked well, the total continuous running time being about 20 hours, and at one 2 1/2 hour period there were no sparks at all.

Then at 6:30 a.m. we got a high powered operator (H.B.) and things immediately went sour, the manifestations being inability to achieve 100 kV and the driver anode current increased from 1.1 to 1.5 amps. Later we found that the anode output coupling capacitor was shorted out. We replaced it and found the operation still bad and after running a bit at 98 kV found the replaced output coupling capacitor to be scrogged. Also we noted sparking in the anode box.

So we looked for parasitics, and horrors, the ugly beast was there! We will discuss the parasitic problem in the next section. After spending a week on the parasitic problem

we decided that we had accomplished the purpose of these series of tests, to wit: the new finger design seems o.k., we can hold 100 kV across 1 cm and the feed through insulator design can work. On pulling a dee stem panel we noted that the fingers looked pristine--same with the dee coupling capacitor. So our plan is to remove the upper dee stem the week of July 28 and prepare for single stem operation to permit us to work on the phase servoes and other electronics problems.

2. Parasites Again!

We have spent a week trying to solve the parasitic problem and or understand it, but with no success. We have an old fashioned spectrum analyzer which is suspected of giving spurious information in-as-much as its results below 500 MHz cannot be duplicated with our Tecktronics analyzer which can only go to 500 MHz. We have fairly solid evidence that it is there, appearing always at a centain level of anode rf voltage for both the transmitter as a whole and for driver only operation. Varying the dc plate voltage changes the level at which it manifests itself, so it seems it is a transit time phenomena in both the driver and the final. Placing damping resistors in the few places we have access to hardly affects it. If we operate at a level above where it comes in, we soon sense a powerful stench coming out of the grid box reminiscent of the odor from an overly hot composition resistor.

We are deferring further testing until we receive a rental modern analyzer good to 1800 Mhz. The main hope of curing it seems to be to put suppressors on the screen grid flange, and next week after making measurements with the new analyzer we will pull the tube to modify the hardware to permit more access to the flange. At the same time we will replace the tubes. And pray.

4. K800 plans

We are building a 1/2 scale model but very little progress is being made because of the competition for shop time from K500 work.

RF Note delineated a tentative plan for modifying the rf test stand to do high power testing of the transmitter, develop and test a vacuum finger design and investigate the sparking problems at 200 kV. No design work has been done.

We are in the process of ordering a final tube (RCA4648) and tentative plans exist on how to build the transmitter. Present plan calls for resonating out the grid capacity with a meter long 4" OD 50 Ω transmission line with moving short and driving the tube with a 1 kW solid state amplifier. The anode circuitry would be a duplicate of the K500 anode circuitry including an identical anode box and hexagonal 17 ft. stem.

5. Filament Power Supply

The RCA4648 requires a monster for the filament supply: 3.7 volts at 1700 amps. We will build the first one for our tests and have gone out on bids for the components.

6. Tube Tester

Since RCA furnishes very little information on tube performance,we propose to build a tube tester. This is something that we would always keep so that in the future we can test any suspect tube. This will be a very simple tester, consisting only of the anode box, some globar resistors and some power transistors as used in the K50 transmitter to permit it to be used as a shunt regulator for the anode supply we are using in our present test stand.

We propose to modulate the plate current from 0 to up to 100 amps at plate voltages from 2 to 10 kV at a .1% duty factor using 100 μs pulses . Therefore, we request that a duplicate of the anode box be made with two exceptions, that the material be brass rather than aluminum, and the top plate on which the tube is supported have a different size hole in it (D. Lawton has the proper dimensions).

7. Tred 2

We have figured out a technique to permit us to write a program in BASIC to calculate the coupled 3 dee + transmission lines + transmitters problem for 3 ϕ operation. T. Miyanaga is busily churning this out.