

VLA Test Memo #187
National Radio Astronomy Observatory

VLA - VLBA INTERFERENCE MEMORANDA No. 1

RFI Emissions from Vac Ion Pumps

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November 1992

Recent tests on the Oscilloquartz EFOS Maser and the Sigma Tau Corp. VLBA maser have shown R.F. emissions in the 300 - 350 MHz (P-Band) region. The emissions are several MHz wide. Both masers use 20 liter per second pumps but the EFOS uses the triode and the VLBA uses the diode configuration.

The oscillation mode in the VAC ION pump is generated by the Penning¹ discharge characteristics. This implies a large space charge in a vacuum with a high magnetic field. The P-Band RFI source is from the rotational oscillations. The frequency is proportional to High Voltage (H.V.) bias and inversely proportional to the magnetic field.

In EFOS the 310 and 330 MHz levels were about -40 dBm at the external input D.C. power cables. The oscillation starts at the Vac Ion pump, travels in the shielded H.V. cable (RG58), passes through the DC/DC H.V. power supply then out the external input D.C. power cables. The EFOS maser has poor RFI shielding/filtering in this area of the maser.

In the VLBA maser the three Vac Ion pumps showed levels of -60 dBm at the input A.C. cables. The VLBA has better RFI packaging except for the H.V. connection to the Vac Ion pump where the shield is not connected to the chassis of the pump. On the HV DC/DC power supply end the H.V. cable passes through a grommet on the supply chassis rather than an RF (H.V.) connector.

A reasonable solution to reduce the emission from the EFOS was to replace the factory H.V. cable (RG58) with an R.F. lossey H.V. shielded cable² made by Capcon Inc. A new 3 foot cable (S001-5K-10S) provides 32dB of dissipative loss at 300MHz and retains the d.c. properties for the H.V. bias. A longer cable could be used for additional isolation.

The VLBA maser requires a specially made connector for the H.V. connection on the pump to insure R.F. shielding.

- 1) Ref. J.C. Helmer "Electrical Characteristics of a Penning Discharge"; Proceeding of IRE Dec. 1961
- 2) Capcon S001-5K-10S (3 feet)

10MHz	-2dB
30MHz	-4dB
100MHz	-12db
300MHz	-32db
1000MHz	-92db