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VLA TEST MEMO. 168

EFFECT OF 74 MHz SYSTEM ON G/T PERFORMANCE AT L-BAND

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The 74 MHz cross dipoles are located at prime focus in front of the 327 MHz dipoles on the subreflector. Therefore they are likely to have interaction with these dipoles as well as may effect the performance at some of the Cassegrain frequency bands where feeds are looking at these dipoles. Initially when the 74 MHz system was tested, effects of these dipoles on the performance at other frequency bands were also checked. It was very roughly a few percent. It was difficult to make an accurate determination of the effect due to the following reason. The antenna temperature measurements were made on three antennas having the 74 MHz dipoles, and then the measurements were repeated after removing the dipoles from these antennas. The two sets of measurements were compared to estimate change in the performance. As it took some time to make the modifications on the antennas, the measurements were separated by several hours in time. This resulted in very poor accuracy. Also the elevation of the source, on which antenna efficiency measurements were made, changed considerably during this testing. The fact that antenna system temperature at L-band changes considerably with elevation was not realized at that time. Further, with upgraded L-band receivers we have much reduced system temperature now than we had when these tests were made. In view of these considerations, and the importance of the upcoming VLA L-band survey, it may be useful to see the effect of 74 MHz feed on the performance at L-band.

Of the 21 antennas with upgraded L-band receivers on 1993Feb01, 8 antennas had 74 MHz feed. Therefore we can make a comparison of antenna gain to system temperature (G/T) for the antennas with and without 74 MHz feed to learn about the effect (of 74 MHz system on the L-band performance).

Table 1 gives ratio of G/T (as a function of frequency over 1360 to 1560 MHz range) for antennas without the 74 MHz feeds (antennas #4,5,8,13,15,18,19,22,23,24,25,27, and 28) and those with the 74 MHz feeds (antennas #3,7,10,11,14,20,21, and 26). We have used measurements on only antennas with upgraded L-band receivers. The 74 MHz dipoles were still present on antenna #10 when these tests were made, though the 74 MHz receiver was moved from antenna #10 to antenna #14 (which had a new set of 74 MHz dipoles). The measurements were made at night time (around 4 hours IAT) on 1993Feb01 using Crab Nebula (0531+219) with backend bandwidth of 12.5 MHz. The average value of the laboratory measurements (from receiver data sheets) for the receiver temperature at 1400 MHz give about 14 °K for the antennas without 74 MHz feeds and about 12 °K for the antennas with 74 MHz feeds. From these results it appears that the 74 MHz dipoles reduce upgraded L-band system G/T by $\approx 12\%$ over 1360-1560 MHz range. If the decrease in the L-band G/T is due to increase in the system temperature rather than fall in the antenna aperture efficiency (a likely possibility due to the fact that the 74 MHz dipoles are located in the shadow of the quadrupole legs), then as the system is finally optimized

(i.e. later type receivers with lower receiver temperature are installed on all antennas, noise calibration levels are optimised, etc.) the fractional reduction in the G/T value due to the 74 MHz feed may be even somewhat higher.

TABLE 1: RATIO OF G/T for antennas without 74 MHz feed (Ant. # 4, 5, 8, 13, 15, 18, 19, 22, 23, 24, 25, 27, and 28) to antennas with 74 MHz Feed (antenna # 3, 7, 10, 11, 14, 20, 21, 26)

Freq MHz / IF →	A	B	C	D
1366	1.134	1.085	1.138	1.172
1378	1.180	1.108	1.155	1.152
1391	1.154	1.122	1.126	1.174
1404	1.106	1.06	1.083	1.118
1416	1.095	1.084	1.101	1.104
1428	1.08	1.084	1.105	1.128
1440	1.08	1.056	1.113	1.125
1453	1.08	1.064	1.101	1.118
1466	1.088	1.067	1.118	1.13
1478	1.087	1.036	1.103	1.108
1491	1.086	1.064	1.121	1.138
1503	1.091	1.069	1.116	1.14
1516	1.104	1.074	1.13	1.142
1528	1.098	1.064	1.106	1.124
1541	1.101	1.064	1.08	1.181
1553	1.09	1.069	1.106	1.124