



Memorandum

To: File

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Date: 10 Jun 2008

Revisions: 9 Jun 2008 jee Initial
10 Jun 2008 jee Updated comments from Morgan about [Figure 5](#)
Added VNA settings for time domain

Subject: Investigation of Image Rejection Problem in B6-005 Cartridge

This note shows time domain plots of the IF outputs in the cold cartridge section of B6-005 to help debug the low image rejection and IF power from Pol 1 LSB.

The 8722D VNA was configured using the procedures documented previously¹. Time domain is achieved using the keys System/Transform/Transform On. The VNA was recalibrated for operation from 3 to 13 GHz (future measurements might benefit from a wider span which would provide better time resolution).

[Figure 1](#) through [Figure 4](#) are time domain plots looking into the IF output ports of the cartridge. The anomalous channel is shown in [Figure 1](#) and clearly differs from the other three channels.

[Figure 5](#) shows the time domain plot with the cable under test disconnected, which was the VNA cable along with 25.4 cm (10") of cable made from flexible braid. The secondary reflection in [Figure 5](#) is probably from the open end of the 10" flex cable. The reflection occurs at exactly twice the delay of the primary reflection from $t=0$. The wave just bounces back and forth along that 10" length of cable, reflecting at each end and getting weaker each time (i.e. a standing wave). A hint of the tertiary reflection can be seen, though it's too far down in the noise to be significant. Artifacts of this nature serve as a warning that time domain techniques require careful interpretation.

For comparison, data from B6-002 is shown in [Figure 6](#) through [Figure 9](#) and when [Figure 7](#) is compared to [Figure 1](#), one sees that the problem is most likely at the 2 dB attenuator, hybrid, or preamp to hybrid cables.

Further work is required to understand the cause of different time delays in the plots between B6-005 and B6-002.

¹ "Investigation of Suck-Outs in B6-002 Cartridge Gain and Power Density," NRAO memo, dated 26 Mar 2008, available at <http://www.cv.nrao.edu/%7Ejeffland/B6-002GainSuckOut1.pdf>

Figure 1: Time Domain, Pol 1 LSB, B6-005

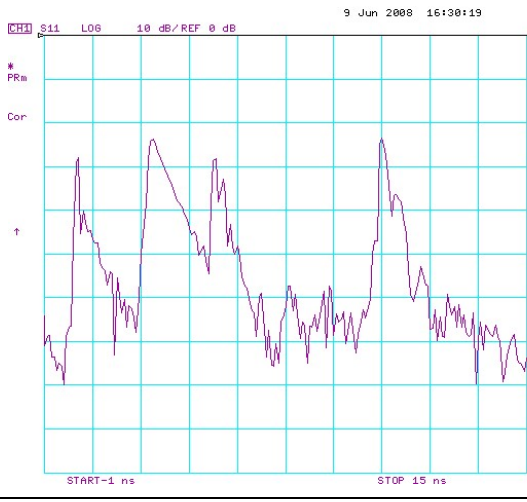


Figure 2: Time Domain, Pol 1 USB, B6-005

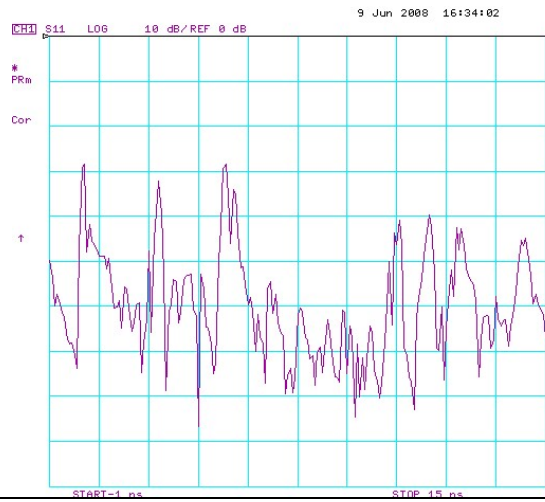


Figure 3: Time Domain, Pol 0 LSB, B6-005

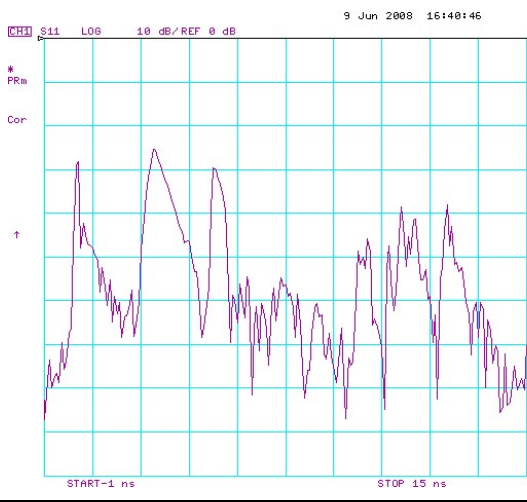


Figure 4: Time Domain, Pol 0 USB, B6-005

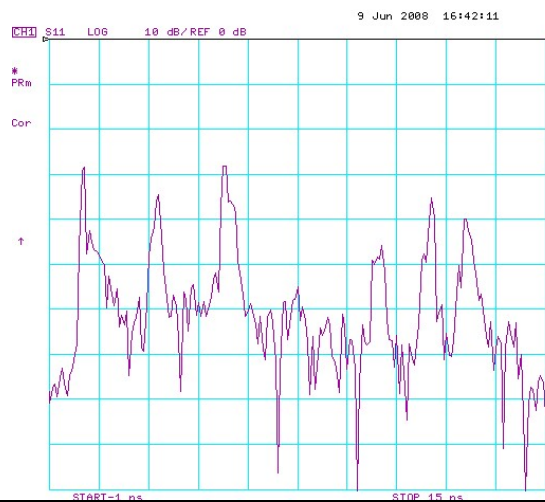


Figure 5: Time Domain, Disconnected Cable with VNA cable and 25.4 cm (10'') of flex braid

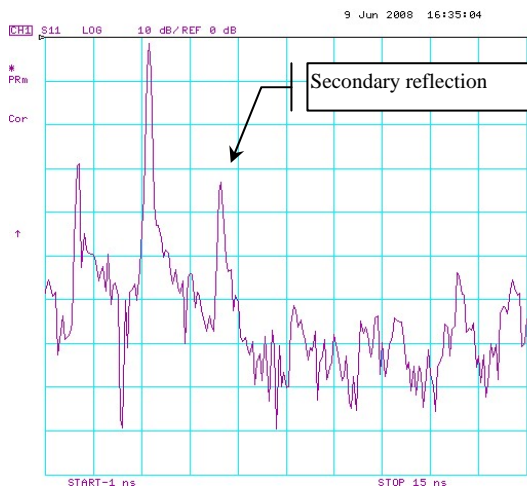


Figure 6: Time Domain, Pol 1 USB, B6-002

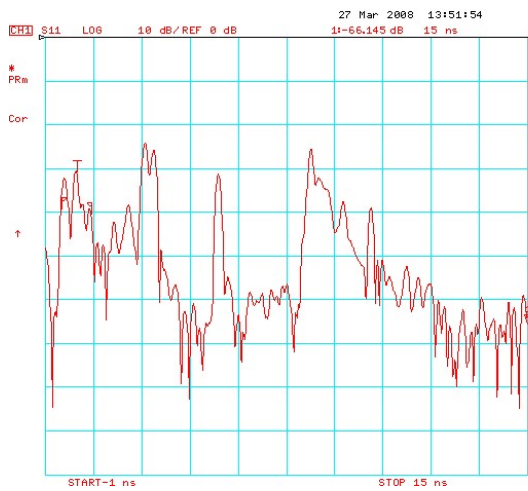


Figure 7: Time Domain, Pol 1 LSB, B6-002

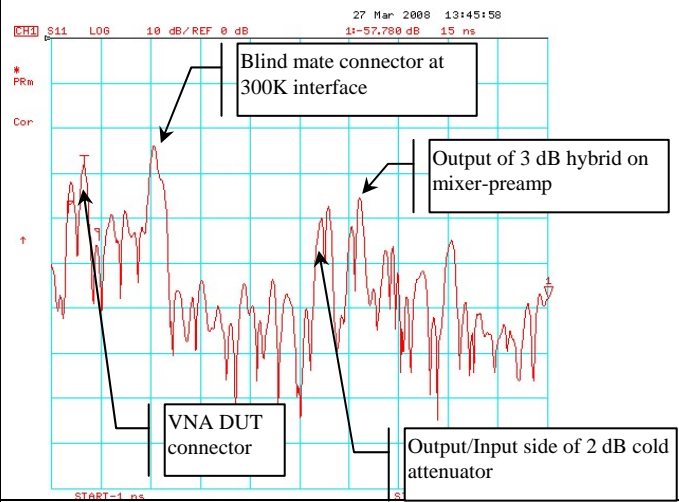


Figure 8: Time Domain, Pol 0 LSB, B6-002

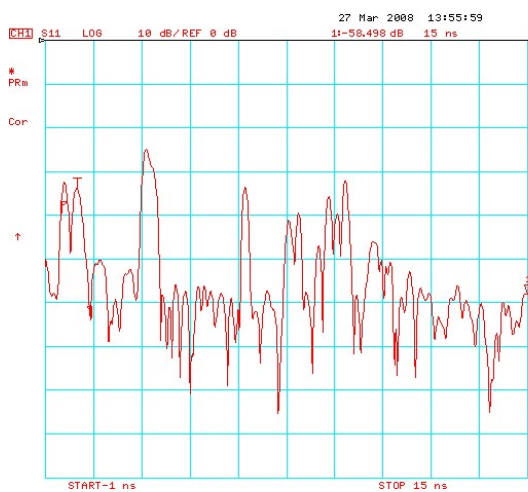


Figure 9: Time Domain, Pol 0 USB, B6-002

