BBDEV. MEMO #014

Spurious signal test in DBE1

A. Niell

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1. Introduction

Spurious signals have been seen in the spectrum of the X-band broadband system at MV3, but only in IF0. A test setup is described in this note.

2. Summary of the problem seen in IF0 at MV3 (bbda013)

There are spurious signals in the IF0 channel at MV3. The spectrum is shown in the figures. If there are similar signals in IF1, they are sufficiently weak that they do not show up in a fourfit plot.

By switching the IF0 and IF1 inputs after the Dewar, it is clear that the signal arises after the Dewar, implicating the fiber, UDC, or DBE (assuming the Mk5B+ is not responsible). By switching the inputs from the UDC, the problem is isolated to the DBE or Mk5B+.

The data are from the second Nyquist Zone, so are in the lower sideband. The signals are shown in Figure 1. The spectrum is symmetric about 768 MHz in the A2D input, or about 256 MHz in the second 512 MHz Nyquist Zone.

Note that there is no information in every other 32 MHz interval (where the red marks are) since only half of the channels in each IF are recorded.

Notice the triplets at -100 +/- 0.5, -156 +/- 0.5, -356 +/- 0.5, and -412 +/- 0.5. These correspond to 924, 868, 668, and 612 MHz relative to the IF frequency, which is the zero-frequency of the A2D input. The actual value of the 0.5 MHz offset is uncertain due to the low resolution of the fourfit plot.

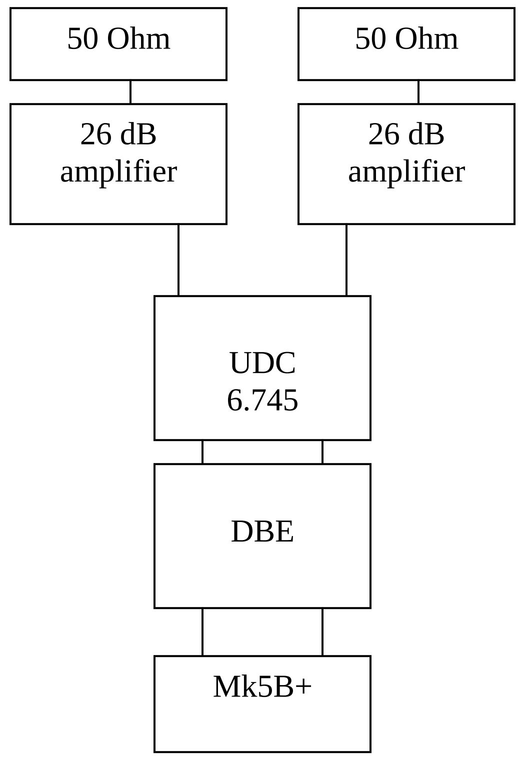
While the power in the signals is not enough to affect the VLBI data, many of the signals are on multiples of 4 MHz, so the choice of phase cal frequencies may be restricted.

3. Testing for spurious signals

To remove the possibility of external signals getting in (although this seems to be excluded by the tests above), use a 50 ohm load as the input. Follow this by a 26 dB amplifier to get an appropriate level to the UpDown Converter. Alan Rogers spec for the UDC is a maximum of -41 dBm. In the UDC an attenuator setting of 11 dB should give an output of approximately -12 dBm in 512 MHz, appropriate for the DBE. Levels and settings are shown in the Table for a 290K load. The column for 1 MHz gives the value for 1 MHz resolution bandwidth on a spectrum analyzer. This has been measured at 750 MHz in the IF input level monitor of the DBE where the value should be 15 dB lower because of the coupler for the output (i.e. -54 dBm in 1 MHz at the IF monitor).

If the level needs to be adjusted to get -54 dBm (+/- 2 dBm), change the attenuation in the UDC.

	Spectral power	*10 GHz*	*512 MHz*	*1 MHz*
50 ohm	-174 dBm/Hz	-74 dBm	-87 dBm	-114 dBm
after 26 dB gain	-148 dBm/Hz	-48 dBm	-61 dBm	-88 dBm
after 49 dB gain (UDC)	-99 dBm/Hz		-12 dBm	-39 dBm



4. Figures

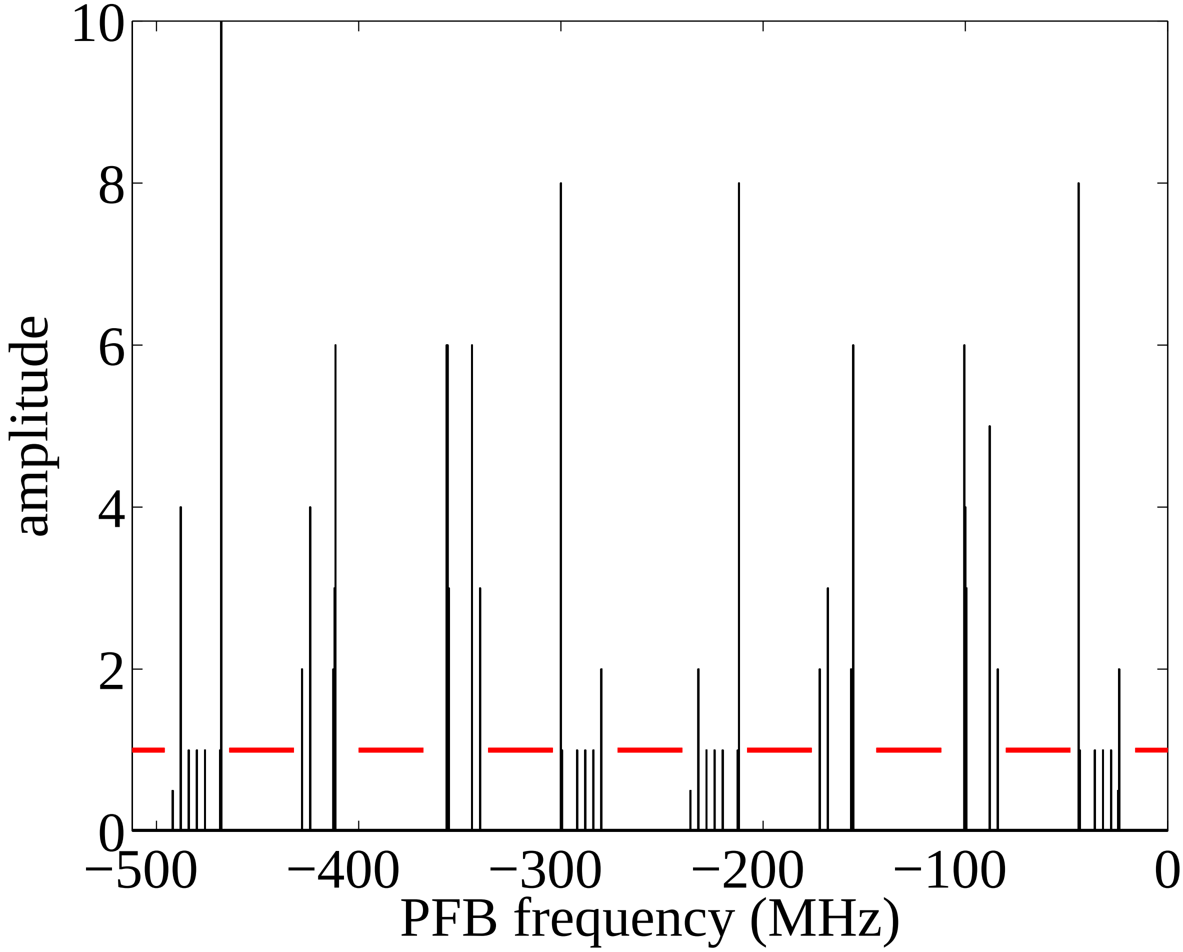


Figure 1. Spectrum of spurious signals at MV3 in IF0 showing frequencies relative to the sampling frequency (1024 MHz) of the DBE. The input data are in the second Nyquist Zone (512-1024 MHz) in the input to the A2D converter.