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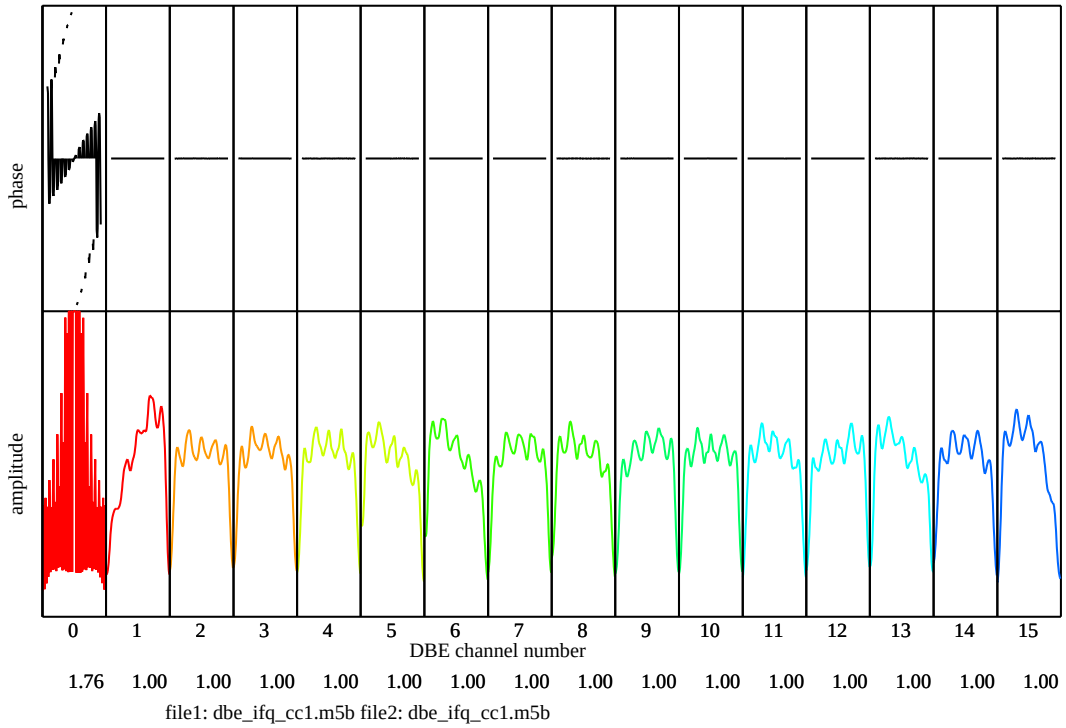
Subject: Cross-talk in dual channel DBE

Zero baseline tests made of the dual channel DBE show some ripple in the bandpass response of each channel and cross-talk between the channels. In the first test the same analog noise signal (~500 MHz bandwidth centered at 750 MHz) was fed to both channels via an iso-tee. Figure 1 and 2 show the autocorrelations of 1-bit data from each channel of the DBE. The bandpass slopes in channels 1 and 15 are largely due to the edges of the analog bandpass filter. The bandpass slope in channel 13 of the *i*-*i* autocorrelation and in channel 6 of the *q*-*q* autocorrelation is thought to be due to cross-talk between the digital and the analog signals on the PC board.

Further evidence of cross-talk is evident in the phase ripple present in the cross-correlation between the channels labeled "*i*" and "*q*" shown in Figure 3. The ripple in phase seen in Figure 3 has a period of about 64 MHz or a delay of 16 samples at the 1 Gs/s sample rate.

In the second test independent noise was connected to each channel. In this case we should expect very low correlation between channels as the ADC should have at least 50 dB isolation between channels. The observed correlation shown in Figure 4 runs around 0.01 or -40 dB but peaks to about 0.03 or -30 dB in channel 13. Further the mean slope in the cross-spectral phase in channel 13 is about 180˚ over 32 MHz or a delay of 16 samples. A mechanism which might explain this cross-talk is a cross-coupling between the digital output of the ADC which is delayed by a 16-bit word and the analog inputs.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amplitude
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DBE channel number
1.76 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
file1: dbe_ifq_cc1.m5b file2: dbe_ifq_cc1.m5b
Sat Nov 18 08:38:44 2006

Figure 1.

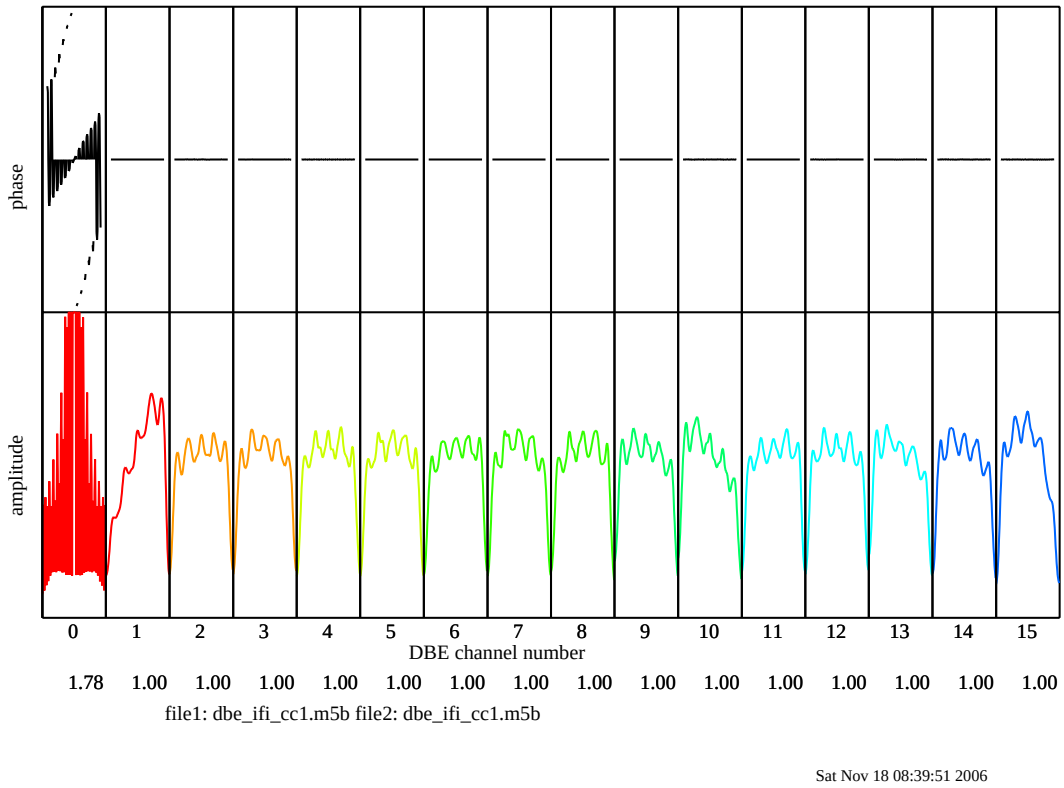
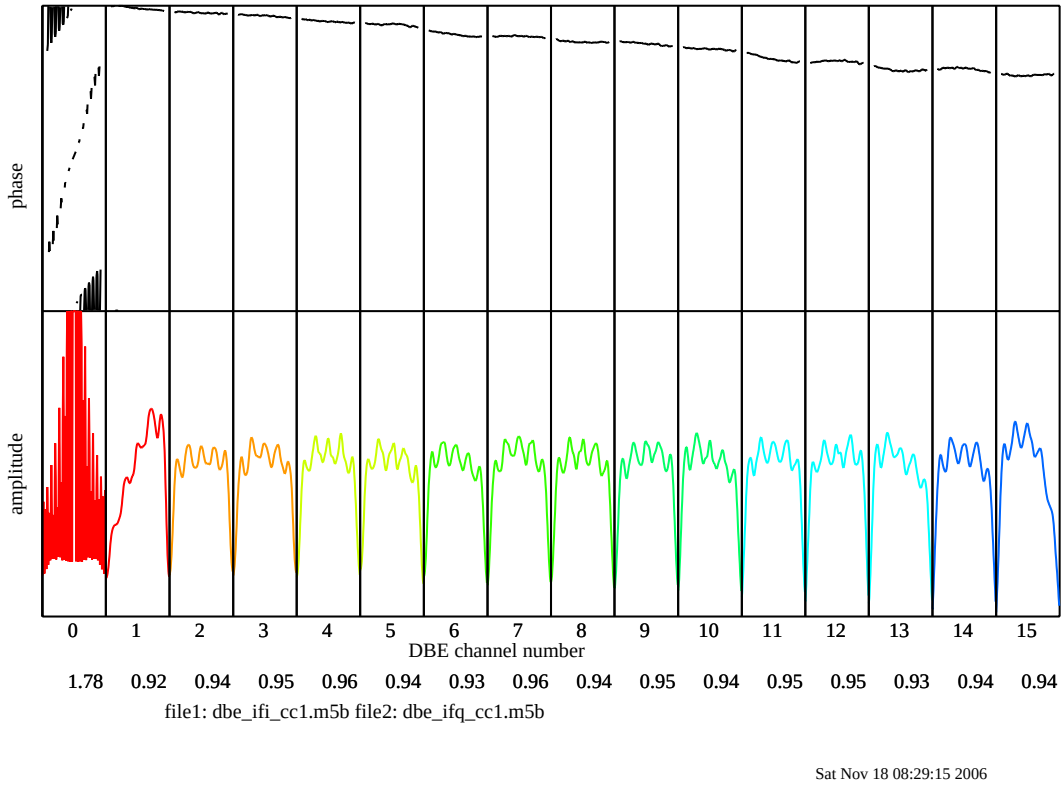

phase
amplitude
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DBE channel number
1.78 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
file1: dbe_ifi_cc1.m5b file2: dbe_ifi_cc1.m5b
Sat Nov 18 08:39:51 2006

Figure 2


phase
amplitude
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DBE channel number
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file1: dbe_ifi_cc1.m5b file2: dbe_ifq_cc1.m5b
Sat Nov 18 08:29:15 2006

Figure 3

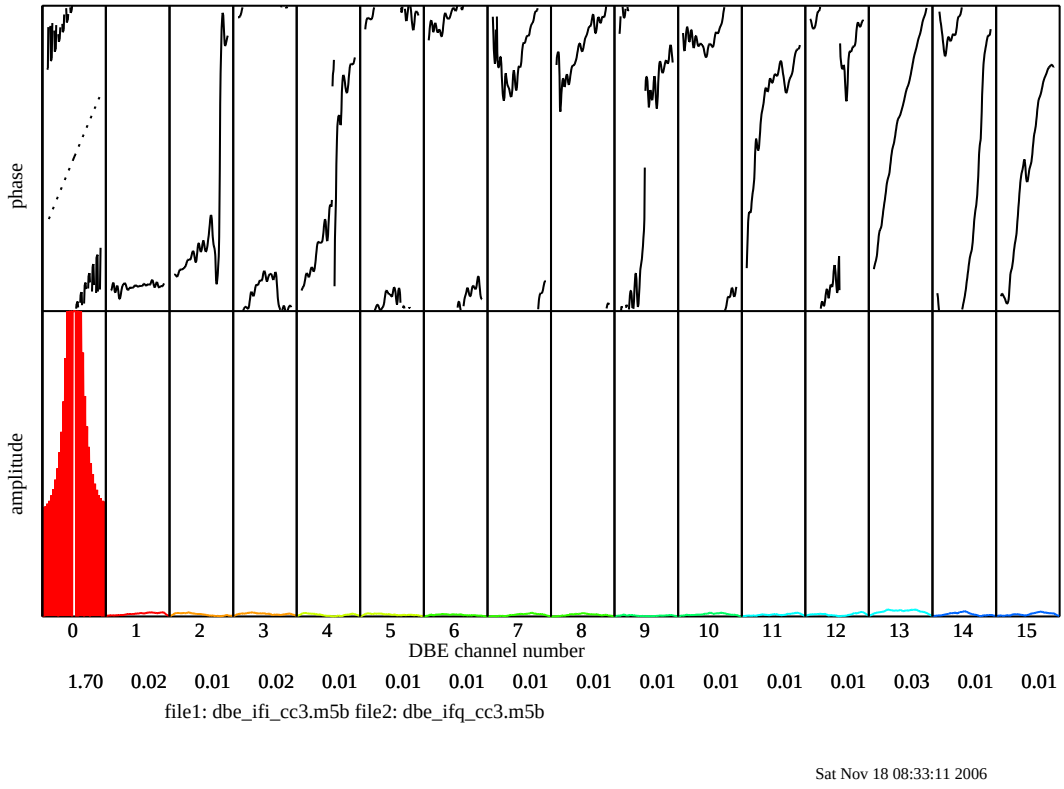
phase
amplitude
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
DBE channel number
1.70 0.02 0.01 0.02 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.03 0.01 0.01
file1: dbe_ifi_cc3.m5b file2: dbe_ifq_cc3.m5b
Sat Nov 18 08:33:11 2006

Figure 4