NMR NOTES #7
NODE-1 SELECTIVE EXCITATION SHAPED PULSE

The shape file node1.RF is a computer generated shape for selective non-excitation of water resonances. It was tailored for a relatively broad null at the carrier position and a flat passband response elsewhere. It has a linear frequency dependant phase response which should be correctable with the LP phase correction. Since this phase error is due to delayed acquisition of the first data point, it is possible to use the fixSS macro to remove the large LP phase correction by linear predicting the missing point(s), just as in the case of the S and SS pulses. The 3 msec. pulse has approximately 360 degrees of LP phase correction, and left shifting 1 data point is adequate to remove the LP correction. The fixSS maco may be used to correct the phase shift exactly, the same way it does for the S and SS shaped pulses.

Calibration of this pulse is non-intuitive. The following list summarizes the pertinent values extracted from the original literature article[1].

Pulse width	3.0 msec	
cH_1	5.41 Khz	(PW90=46.2 lsec.)
Dx_n	496 Hz	Null Notch width
Dx_t	578 Hz	Transition width
Dx_p	4574 Hz	Pass Band width

Pulse width refers to the total width of the excitation shaped pulse. cH_1 refers to strength of the RF field, and will be set by choosing an appropriate value of tpwr. The Null notch width is the nominal width of the notch at the bottom of the non-excitation region. This is the region that should see no excitation at all. In practice, signals here should be reduced by something on the order of 2 orders of magnitude. The pass band width refers to the width of the region of uniform excitation with a linear phase shift. This is the region that should contain the peaks of interest. The Transition width refers to the region where the response is making the transition between notch and pass band. In this region the amplitude response is not uniform and the phase response is non-linear. You can see signals from this region, but will not be able to phase them or trust their amplitudes.

To modify the excitation profile, one simply changes the pulse width. The notch width, transition width, and pass band width are all proportional to 1/(pulse width). Reducing the pulse width to 1.5 msec will double the pass band width to 9150 Hz and double the width of the null notch to 1000 Hz. The transmitter power must also be changed keeping the product (pulse width)*cH_1 constant. Thus, reducing the pulse width to 1.5 msec would require increasing the cH_1 value to 10.82 Khz, corresponding to a hard pulse PW90 of 23.1 lsec. This is would require a change of +6 db for the transmitter power value.

1. Journal of Magnetic Resonance, Series A, **105**:184 (1993).