ARMS transmit waveform and source level during the Dabob Bay 2020 trail

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The transmit waveform is an LFM (linear-frequency-modulated) signal centered at 3500 Hz with two-sided bandwidth of 100 Hz (3450 Hz to 3550 Hz) with a duration of one second:

$$s_0(t) = a\ Re\{env(t)e^{12\pi f_c t}\}$$

Where *a=1.4142 10^10* is the amplitude, so the RMS source level is 200 dB re 1muPa. The envelope of the signal is tapered at the ends as

$$\begin{aligned} env(t) &= \ sin^2\left(\frac{\pi t}{0.2}\right), && 0 < t < 0.1 \\ env(t) &= \ 1, && 0.1 < t < 0.9 \\ env(t) &= cos^2\left(\frac{\pi(t-0.9)}{0.2}\right), && 0.9 < t < 1.0 \end{aligned}$$

Repeatedly using the identity

$$cos^2(x) = \frac{\cos(2x)}{2} + 1,$$

one finds

$$\int_0^1 dt\ env^2(t) = 0.875.$$

So the total energy of the transmitted signal in decibel is E_0 = 200 + 10*log10(0.875) = 199.4 dB. When estimating transmission loss, one can compare the received energy against the source energy.