To: RFI Group  
From: Alan E.E. Rogers  
Subject: Absolute calibration of an active antenna

An active antenna could be calibrated by placing the antenna in an anechoic chamber and using another antenna to send a noise signal of known strength. The spectrum with the noise turned off is

\[ P_0(w) = b(w)T_{amb} + c(w) \]

where \( b(w) \) = bandpass function

\( c(w) \) = receiver noise

\( T_{amb} \) = temperature of chamber walls (assumed perfectly absorbing)

when the noise source is turned on

\[ P_{\text{cal}}(w) = b(w)(T_{amb} + T_{cal}(w)) + c(w) \]

given \( P_0 \) and \( P_{\text{cal}} \) we can solve for \( b(w) \) and \( c(w) \) provided we can calculate \( T_{cal}(w) \). \( T_{cal} \) can be calculated using

\[
T_{c}\left(1-|\Gamma|^2\right)\frac{G_T G_R \lambda^2}{(4\pi)^2 d^2}
\]

where \( T_c \) = output of noise source

\( \Gamma \) = calibration antenna reflection coefficient

\( G_T \) = gain of calibration antenna

\( G_R \) = gain of active antenna

\( \lambda \) = wavelength

\( d \) = separation of antennas (assumed to be in the far field)

\( G_T \) and \( G_R \) are estimated from the directivity of the antennas using NEC simulation. Alternately the path loss can be measured using copies of the active antenna with amplifier replaced with adjustable matching section. This method of calibration avoids the need to estimate the active antenna losses, VSWR and amplifier noise reflected back by the mismatch to the antenna.