1. The radiated emissions of a cable are being measured as shown in the figure below at 100 MHz. The antenna factor at 100 MHz is 15 dB and the antenna is oriented parallel to and in the plane of the wires. Calculate the magnitudes of the radiated electric field due to the differential-mode component and due to the common-mode component measured by the spectrum analyzer at 100 MHz.
2. A current probe having $Z_T = 15 \text{ dBV}$ at 100 MHz measures a current on a 0.5-m wire as shown in the figure below. The spectrum analyzer is connected to the current probe with a 300 ft length of RG58U coaxial cable, and reads a level of 20 $dB\mu V$. Determine the radiated electric field in a FCC Class B radiated emission test. Will this emission pass FCC Class B test?
3. The common-mode current in a 1-m cable is measured, and consists of a 10-MHz trapezoidal pulse train having a 50% duty cycle and rise/falltimes of 20 ns, as shown in the figure below. The radiated emissions of this cable are measured at a distance of 3 m parallel to the wire using an antenna that has an antenna factor of 8 dB at 30 MHz and 13 dB at 100 MHz. Draw the envelope of the emission as measured on the spectrum analyzer between 30 and 100 MHz.
4. Consider a 1-m ribbon cable. The wires are 28-gauge with radius $r_w = 7.5$ mils and are separated by 1 cm. The termination impedance are $R_s = 50\,\text{Ω}$ and $R_L = 100\,\text{Ω}$. An antenna located 1000 m away illuminates this cable. The radar is transmitting an average power of 1 kW, and the gain in this direction is 20 dB. Assume the transmission to be a sinusoid at the transmission frequency of 100 MHz. The incident uniform plane wave is traveling in the $xy$ plane with angle $\phi = 30^\circ$ as shown in the figure below.

\begin{itemize}
\item[a)] Determine the per-unit-length inductance and per-unit-length capacitance of the cable. (Assume $\epsilon_r = 1$ inside the cable)
\item[b)] Calculate the incident $|\hat{E}_i|$ and $|\hat{H}_i|$ at the ribbon cable.
\item[c)] Determine the received voltage level $\hat{V}_s$ and $\hat{V}_L$ at the two terminals.
\end{itemize}
5. A 1 m shield cable is illuminated by a 1-MHz incident uniform plane wave. The shield has diameter of 2.95 mm and thickness of 0.275 mm. The conductivity is $5.8 \times 10^7$ S/m.

a) Determine the net shield resistance ($r_{dc}$).

b) Determine the surface transfer impedance of the shield at 1 MHz.

c) The interior circuit is terminated in 300 Ω and 50 Ω resistors. If the current induced on the exterior of the shield is 10 mA, determine the magnitude of the voltages induced across two loads.