Task 8: Waves on Transmission Lines

(Laboratory G1-116)

Determine by measurement the voltage waveforms at the reflection of waves on different terminations of a transmission line.

a) Verify the wave impedance of coaxial cable 198 meters long and determine the speed of electromagnetic wave propagation in the cable.

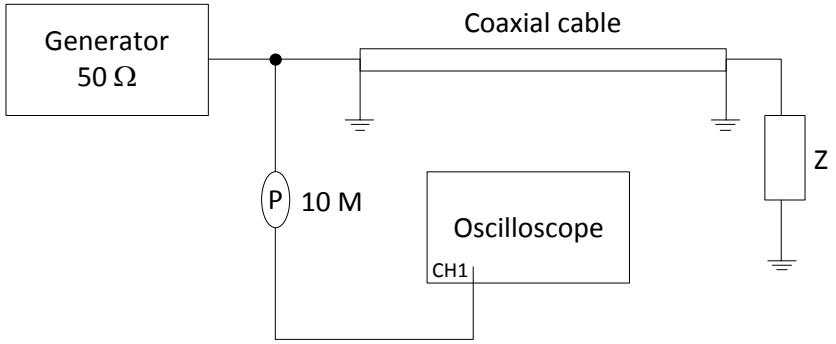
b) Record the voltage waveforms in the showed measurement circuit for these different cable terminations:

- no-load
- short circuit
- resistance higher and lower than the wave impedance
- resistance equal to the wave impedance
- capacitance 10 nF
- inductance 31 μH

Used equipment:

G . . . . . function generator
OSC . . . Digital oscilloscope LeCroy
P . . . . . voltage probe 1:10
C . . . . . coaxial cable 198 meters long
Z . . . . . terminating impedance (resistor, capacitor, inductor)

Measurement circuit:



- The generator output is with impedance 50 Ω
- The coaxial cable is supplied by a square pulse signal with amplitude 4 V under 50 Ω output, measured voltage is led by voltage probe to oscilloscope input (the same time decay is chosen for all types of terminating → 500 ns/div)
- The offset should be set at +2 V → output is square pulses 0 - 4V - 0 - 4V ....
- Used terminating capacitance is C = 10 nF (decade) and inductance is L = 31 μH (between top and bottom terminals of the small air coil)
- The wave resistance is 50 Ω, need time for a wave transmission to the end of the cable and back is about 1 μs
- The comparison between waveforms should be a laboratory result (plots of waveforms in the XY plot for each type of terminations)