| Coaxial Cables | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| RG # | AWG Material | Insulation | # Shields | Jacket | Nom. O.D. (inch) | Nom. Imp. (Ohms) | Nom. Vel. Of Prop. | Nom. Cap. (pF/ft.) | Nom. Attenuation per 100' MHz | dB | Standard Spool Lengths |
| 14/U | 20 Copper | Poly-ethylene | 1 | Black Vinyl | .420 | 95 | 66% | 16.0 | 100<br>200<br>400 | 3.0<br>4.5<br>6.0 | 100, 500 |
| 14A/U | 20 Copper | Poly-ethylene | 1 | Black Vinyl | .420 | 92 | 66% | 16.0 | 100<br>200<br>400 | 3.5<br>5.0<br>7.0 | 100, 500 |
| 16A/U | 18 Copper | Cellular Poly-ethylene | 1 | Black Vinyl | .195 | 50 | 78% | 30.8 | 100<br>200<br>400 | 5.0<br>7.0<br>9.5 | 100,500 1000 |
| 18/U | 18 Copper | Cellular Poly-ethylene | 1 | Black Vinyl | .280 | 75 | 78% | 24 | 100<br>200<br>400 | 2.0<br>3.0<br>4.5 | 100,500 1000 |

**Problem #1**) A **800 MHz, 2∠0° volt**, incident waveform is applied to a **30 cm** long lossy transmission line with a propagation constant of **γ = 0.32 Np/m + j19.95 rad/m**. The transmission line is terminated with a **matched load**.

Determine the **voltage** (in polar form) at the load and the **velocity** of the wave on the line.

$\widetilde{V}_{load}$ = ______**1.817∠17.08°** _____ (V)

ν = _________**$2.52x10^8$**_______(m/sec)

**Problem #2**) A **5∠0° volt, 100 MHz** incident waveform is applied to the input of a **10 meter** long (lossy) transmission line having a propagation constant of **γ = 0.04 Np/m + j3.035 rad/m** at the applied frequency. The line is terminated with an "ideal" **open-circuit**.

Determine the actual steady-state **voltage** at the load (in polar form), and the **input impedance** of the line at this frequency.

$\widetilde{V}_{load}$ = ______________________________ **(V)**

***(Note – This Problem has changed)***

$Z_{in}$ = ______________________________ **(Ω)**

**Problem #3**) Given the following characteristics of a transmission line:

**R = 20 Ω / km** **L = 0.5 mH / km**
**G = 0.1 mS / km** **C = 50 nF / km**

A **100 MHz** voltage is applied to the transmission line,

a) Determine the **characteristic impedance** (**$Z_o$**) of the line in ohms.
b) Determine the **attenuation constant** (α) of the line in Np/km.
c) Determine the **phase constant** (β) of the line in rad/km.
d) Determine the **velocity** of the wave (ν) on the transmission line in km/sec.

a) **$Z_o$** = _______**100**_____________Ω

b) α = _______**0.105**________Np/km.

c) β = _______**3141.6**_______rad/km.

d) ν = _______**$2x10^5$**_______km/sec.

**Problem #4**) A **400 MHz, 10∠0° volt** wave is applied to the sending end of a **200 foot** long piece of **RG 14/U** cable. The cable is terminated with a **matched load**. (Note: 1Np = 8.686 dB)

a) Determine the **attenuation (α)** of the line in Np./ft.
b) Determine the **phase delay (β)** of the line in rad./ft.
c) Determine the value of the **voltage** that reaches the load (in polar form).

**α** = ________**0.00691**_________ Np./ft.

**β** = ________**3.87**____________ rad./ft.

$\mathbf{V_{load}}$ = ______**2.51∠-54.54°** ______ (V)

**Problem #5**) An incident voltage waveform is traveling down a **lossless** piece of **50Ω** cable. When the waveform reaches the receiving end, it has a value of **5∠20° volts**. If the load terminating the cable has a value of $\mathbf{Z_R}$ **= 100+j100Ω**, determine the value of the **reflected voltage** in polar form.

$\mathbf{E^-}$ = ________**3.1∠49.7°**__________ V

**Problem #6**) Determine the **input impedance** of a **0.6 meter** long, lossless piece of **50Ω** coaxial cable if the cable is terminated with a **matched load**.

$\mathbf{Z_{in}}$ = __________**50**______________Ω

**Problem #7**) A **100 MHz, 10∠0° volt** wave is applied to the input of an ***infinitely long*** (lossy) transmission line with a propagation constant of **γ = .001 Np/m + j3.035 rad/m**.
Determine the **voltage** (in polar form) at a distance of 1 kilometer down the line.

$\mathbf{V_{2km}}$ = ______**3.68∠-12.7°**_______ (V)

**Problem #8**) A **5∠0° volt, 100 MHz** incident waveform is applied to the input of a **10 meter** (lossy) transmission line having a propagation constant of **γ = 0.04 Np/m + j3.035 rad/m** at the applied frequency and a characteristic impedance of $\mathbf{Z_o}$ **= 100Ω**. The line is terminated with an "ideal" **short-circuit**.
Determine the actual steady-state **voltage** at the load (in polar form), and the **input impedance** of the line at this frequency.

$\tilde{V}_{load}$ = ___________**0 (zero)**___________ (V)

$Z_{in}$ = ____________**110-j105**__________ (Ω)

**Problem #9**) A **2∠0° volt, 100 MHz** incident waveform is applied to the input of a (lossless) transmission line that has a **75Ω** characteristic impedance and a propagation constant of **γ = 0 Np/m + j3.04 rad/m** at the applied frequency. The line is terminated with an **open circuit**.

a) If the transmission-line is **0.75 meters** long, determine the ***actual steady-state voltage*** (in polar form) ***at the sending-end of the line*** (i.e. – a position of "0" meters).
b) Also determine the ***sending-end voltage*** if the line ***length is increased to a total of 1.55 meters***.

$\tilde{V}_{S(0.75m)}$ = ________________________________ (V)

$\tilde{V}_{S(1.55m)}$ = ________________________________ (V)