Telephony 101 – Matching Impedances December 7, 2012

Hello All,

As always, please send any questions about the reading assignment directly to me at oldtimetelephones@goeaston.net. I will bundle questions if necessary, repeat the questions, and give answers in an e-mail to the TCI List Server before moving on to the next reading assignment. This way everyone will benefit from these questions and answers. By sending questions directly to me, we will avoid unnecessary clutter on the List Server. Previous reading assignments, notes, questions, and answers are available in the TCI Library at http://www.telephonecollectors.info/telephony-101/.

Please read again the last part of the Appendix section called Transformer about equivalent resistance, and also read the section called Matching Impedances on p. 224-225. Once we get past this subject, we will go directly to Chapter 4.

Notice what we are doing leading up to Eq. 9. We are looking at a transformer (N_1 turns in the primary and N_2 turns in the secondary) and a resistor R_2 and treating them together as an imaginary resistor R_1 connected directly across the voltage source V_1. So by putting a transformer between a voltage source (V_1 in this case) and its load (R_2 in this case), you can make the load look different (R_1 in this case). Thus in the example discussed, we have taken a load of 800 ohms and made it look like a load of 50 ohms by inserting a transformer (an induction coil) between the voltage source and its load.

We can see the value of changing the apparent load (resistance) by examining three cases indicated in Fig. A-7, Case A, Case B, and Case C. Here you have to recognize that we want to deliver a lot of power to the telephone line rather than just a big voltage. So in the example we have multiplied voltage by current to get the power. The example is a little tedious and you can follow it if you like, but the bottom line is that you can deliver only 0.17 milliwatts with a 500-ohm resistor or a 5-ohm resistor. But you get a big 0.51 milliwatts when the resistor has the same value as the transmitter, namely 50 ohms as in Case B.

Now the example in Fig. A-7 did not have a transformer in it. But if the load were 500 ohms in reality, you could put a transformer between the transmitter and the load and trick the transmitter into thinking the load was just 50 ohms. Then you would deliver the maximum power to the load. Therefore, you can use a transformer to step-up or step-down a voltage, but you can also use a transformer to change the apparent impedance on one side of the transformer as viewed by the other side of the transformer. You may gain a considerable amount of efficiency by doing this.

If there are any questions about the current reading assignment, we will deal with the questions before moving on to the next reading assignment.

Ralph

P.S. I have used a little more formatting (subscripts) in the above text than I ordinarily use in an e-mail, so if you can't read it just go to the TCI library and look at the pdf version.