

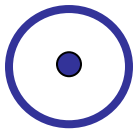


### Some General Instructions for Pre-Project 1

There is a large collection of what should be open-circuit stubs that you should find on the center table in JEC 4107 (placed there by the TAs). On either side of this table, you will also find a metal ruler that you can use to measure the length of the stub. The actual functional length of the stub is not necessarily easy to determine since there may be some additional length due to the Tee which may even add a little capacitance to the circuit. However, to keep things simple and consistent, you are to only measure the full length of the stub cable when it is not connected. See below.



Length from the end of the F-type connector to the open-circuit at the other end of the cable.



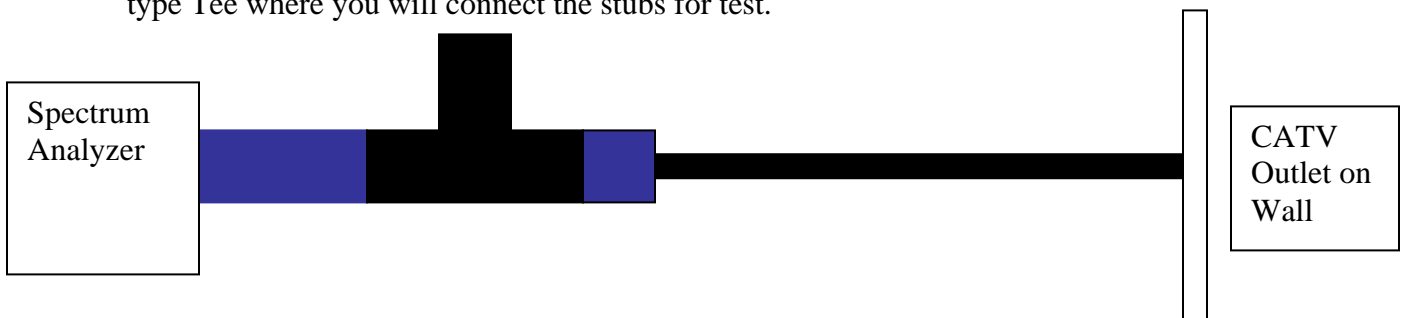
Check across the F connector to be sure that the other end of the cable is indeed open.

You should fill out a table like this one with your stub measurements. Note that this info is not real, but provided to show some examples.

Stub #	Open Circuit ?	Length (meters)
1 (not its real number)	Yes	0.250
2 (not its real number)	Yes	0.500
3 (not its real number)	Yes	1.00

### Spectrum Analyzer Tests

There are two CATV feeds in JEC 4107. One is found under the center table. The TAs will connect a piece of standard cable to the spectrum analyzer. The spectrum analyzer uses BNC connectors, but CATV cables use F connectors. Thus, there is a BNC-F adaptor at the input to the spectrum analyzer. Between the adaptor and the cable is an F-type Tee where you will connect the stubs for test.

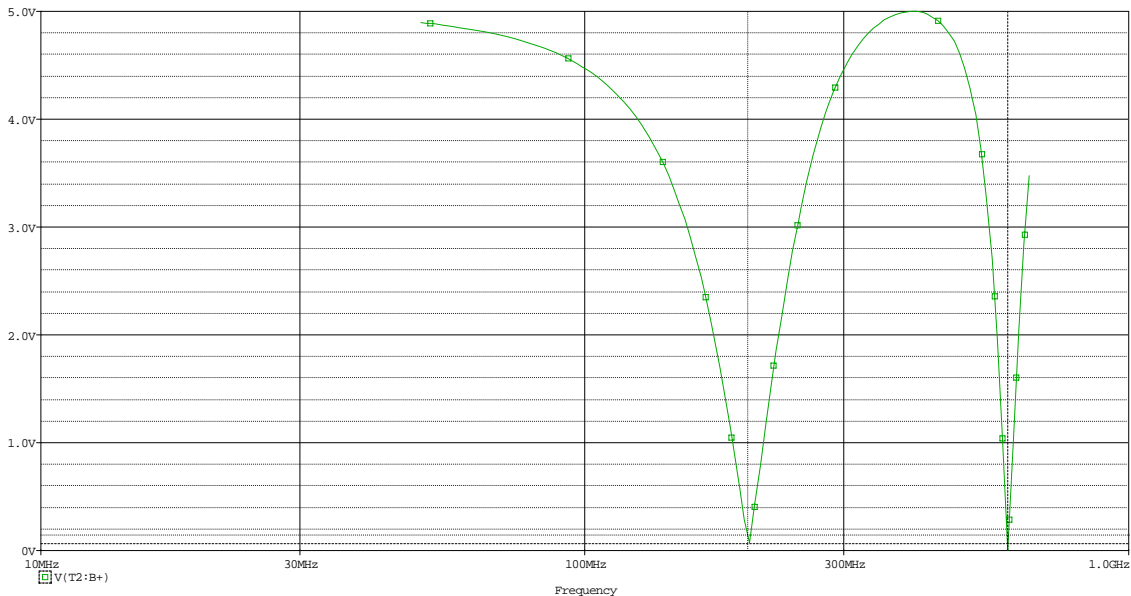




There are three large buttons that permit the display to be adjusted.

Frequency	Span	Amplitude
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1. Amplitude Button – this function is obvious. You should not have to adjust this since the default value is generally fine.
2. Frequency Button – This sets the center frequency of the display. The value can be set two ways. Start with 350MHz.
  - a. Input numbers using the # pads. Then select the units (you only need MHz). This is similar to using the number input with the function generator.
  - b. Turn the knob. You will need to use this to make adjustments, but should start with the buttons.
3. Span Button – This sets the range of frequencies displayed. Start with 600MHz, which will display the range from 50MHz to 650MHz. First be sure that you can generally recognize the groups of channels. Then attach the stub cable and find the frequencies where the minimas are located. To clearly identify the frequency, use the frequency adjustment to move the min to the center of the display. Write down the frequency. Be sure to carefully observe the entire display since there may be more than one min and the min may occur in one of the ranges where there are no channels (eg. in the FM band). Shown below is the output one might obtain from using PSpice to simulate the stub setup. When you do this analysis, you will need to have a value for the AC source in your VSIN voltage source.



You can assume that all of the stubs have a characteristic impedance of 75 Ohms, but the propagation velocity is usually not indicated. There may be some exceptions to this, so be sure to check on the side of the cable for any identifying marks which may help you find this information. Typically, the cables have a velocity factor of 67% or 85%, or



something close to that. You should assume that one or the other of these values is correct and see which one fits your data better. If neither do, you should note that. For example, for the three fictional cable stubs listed in the table above, we have the following possibilities.

First, if the velocity factor is 67%, then  $v = 2 \times 10^8$ . For a 25cm stub, the frequencies where blocking should occur will be

$$\frac{\lambda}{4} = 0.25 = \frac{v}{4f} \text{ or } f = \frac{v}{4(0.25)} = v = 200 \text{ MHz}$$

and also odd multiples of this value or

$$f = 200 \text{ MHz}, 600 \text{ MHz}$$

in the CATV frequency range. For a 50cm stub, the frequencies are

$$\frac{\lambda}{4} = 0.5 = \frac{v}{4f} \text{ or } f = \frac{v}{4(0.5)} = \frac{v}{2} = 100 \text{ MHz}$$

or  $f = 100 \text{ MHz}, 300 \text{ MHz}, 500 \text{ MHz}$ . For

a 1m stub, the frequencies are  $f = \frac{v}{4} = 50 \text{ MHz}$  or

$$f = 150 \text{ MHz}, 250 \text{ MHz}, 350 \text{ MHz}, 450 \text{ MHz}, 550 \text{ MHz}$$

in the CATV frequency range. If the velocity factor is 85%, then  $v = 2.55 \times 10^8$  and the frequencies change to

$$\frac{\lambda}{4} = 0.25 = \frac{v}{4f} \text{ or } f = \frac{v}{4(0.25)} = v = 255 \text{ MHz}$$

and also odd multiples of this value or  $f = 255 \text{ MHz}$  in the CATV frequency range. The other possibilities in the table are found the same way.

As noted, it is not usual to have perfect agreement with the measured lengths and frequencies since we have not taken the Tee into account. Thus, for each case, find the value of the velocity that comes the closest to explaining the data and then also determine the real effective length of the stub.

### Testing the Stubs with the VCR CATV Signal

Identify the likely channels for each of the mins you have observed for the three stubs. Then hook up your stubs to the Tee that feeds the VCR. The CATV cable to the VCR is located to the right of the audio rack under the instructor's station. To display the video using the projectors, the display must be changed to composite (RGB is used for computer display). If the video signal is not displayed, use the source button on the projector remote to change the display source mode. Once you have observed the quality of the displayed signal, identify and write down the channels most affected by the stub. These should agree with the frequencies you measured with the spectrum analyzer.