MEASURING COAX WITH THE NANO VNA

- LENGTH OR DISTANCE TO FAULT USING TRANSFORM FUNCTION

- SMITH CHART FUN -
  - IMPEDANCE TRANSFORMATION & SWR
  - 1/4 λ STUBS

COAX LENGTH USING TRANSFORM

- DISPLAY > TRACE > TRACE Ø ONLY
  - FORMAT = LINEAR OR REAL
- FOR MEASURING LENGTH OR DISTANCE TO FAULT IT IS BEST TO USE:
  - LOW PASS IMPULSE
- TRANSFORM "ON"
- SET VELOCITY FACTOR % (NOT DECIMAL)
- STIMULUS SETTINGS
  - START = 50kHz
  - STOP = (SEE BELOW)
- DISTANCE RANGE & RESOLUTION DETERMINED BY <u>STOP</u> FREQUENCY

  HIGHER FREQ = SHORTER DISTANCE RANGE
  LOWER FREQ = LONGER DISTANCE RANGE

- SET STOP BASED ON MAXIMUM EXPECTED DISTANCE

$$\text{STOP FREQ (MHz)} = \frac{5850}{\text{MAX DIST (m)}} \cdot VF$$

(START WITH LOWER FREQ, THEN INCREASE)

INTRODUCTION TO TRANSMISSION LINES ON THE SMITH CHART

- TRANSMISSION LINES ALTER THE IMPEDANCE WHEN NOT MATCHED
  - DUE TO PROPAGATION DELAY
  - UGLY MATH!
  - EASY ON SMITH CHART

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ADDING/REMOVING TRANSMISSION LINE ROTATES THE IMPEDANCE AROUND THE CENTER

- KEY POINTS:
  - COMPLETE TRIP AROUND IS $\frac{1}{2}\lambda$ LONG LINE
    - Z REPEATS EVERY $\frac{1}{2}\lambda$ INCREMENT
  - HALFWAY AROUND CHART IS $\frac{1}{4}\lambda$ LONG LINE
    - Z "INVERTS" $\frac{Z_L}{Z_0} \Rightarrow \frac{Z_0}{Z_L}$

OPEN $\Leftrightarrow$ SHORT

Q: WHEN DOES A 100Ω RESISTOR LOOK LIKE 25Ω?

A: WHEN IT IS AT THE FAR END OF A $\frac{1}{4}\lambda$ LINE?
(ANY ODD $\lambda/4$ MULTIPLE)

> ADDING/REMOVING TRANSMISSION LINE DOES **NOT** CHANGE THE SWR

(NOT COUNTING LOSSES)

QUARTER-WAVELENGTH LINES $\lambda/4$

- OFTEN USED IN SWITCH, FILTER, MATCHING, ETC. APPS
- EASY TO MEASURE ON SMITH CHART