

## Measuring Session by K6TD & K9YC

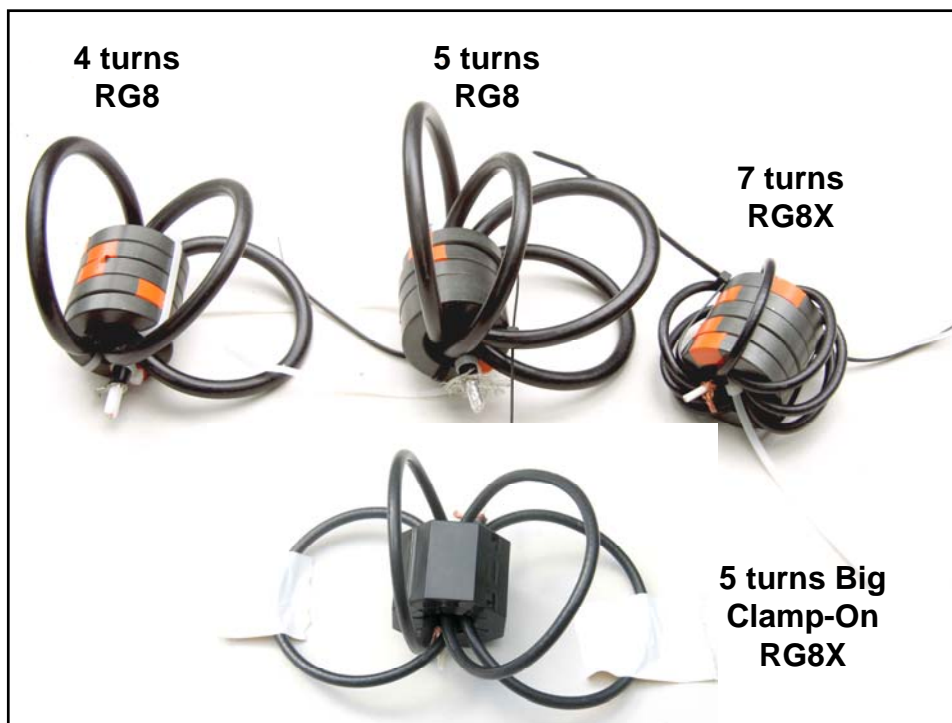
- HP 4396A, calibrated to measuring plane at test leads
- Impedance measurements using reflection parameters ( $S_{11}$ ) have poor accuracy at the outer limits of the Smith chart
- A better way to measure high values
  - Connect unknown between transmit and receive ports as a series element, measure  $S_{21}$
  - Connect coax shields at measurement plane
  - Compute  $Z$  as series element of divider w/ $50\Omega$

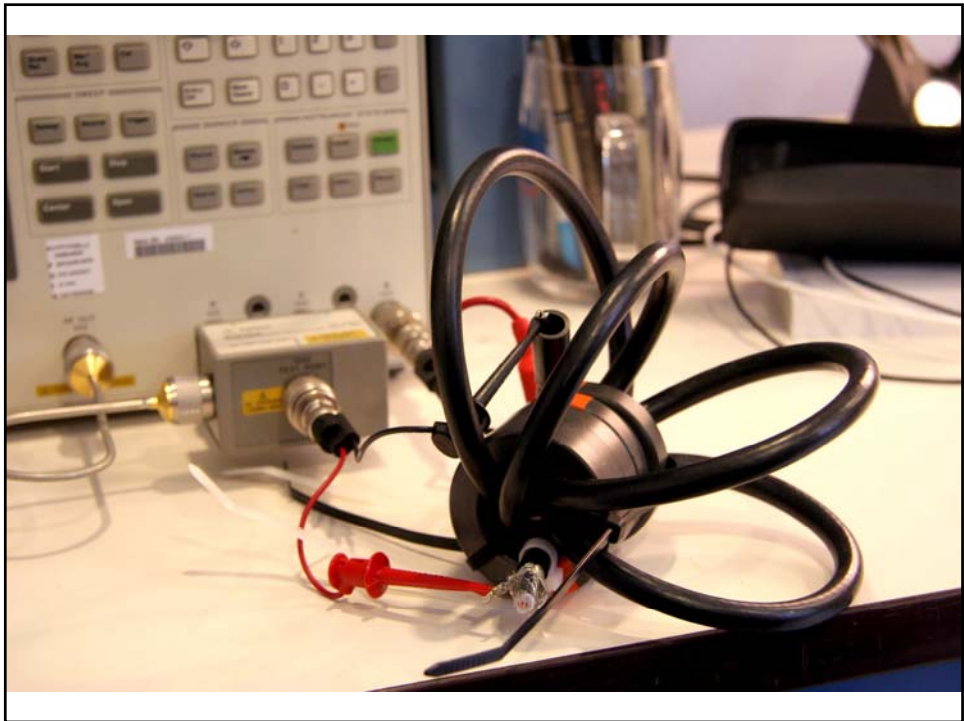
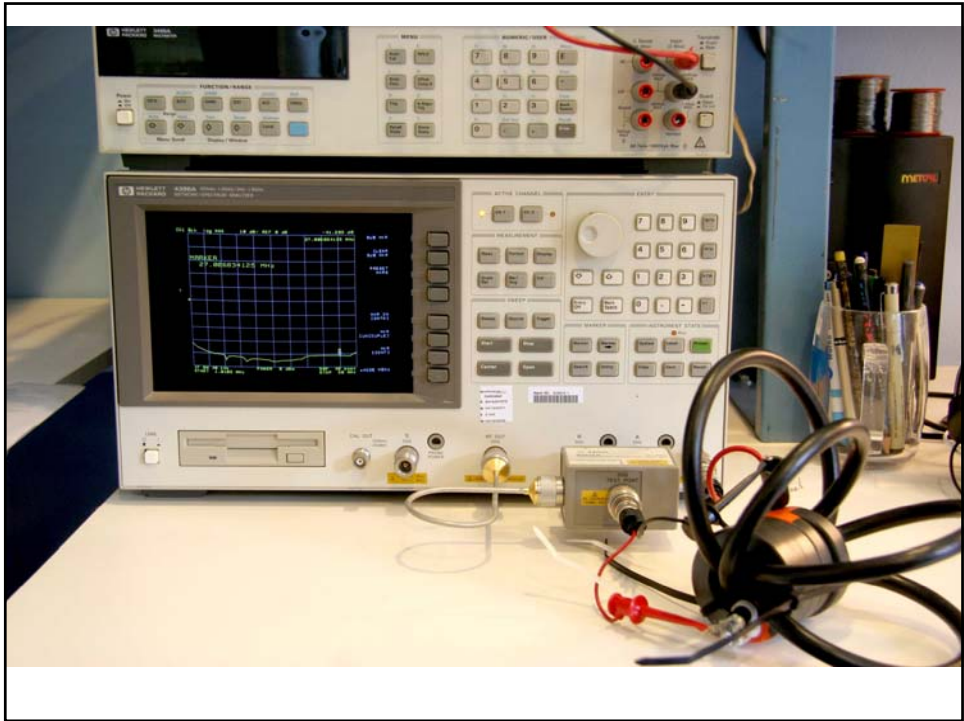
## What we Measured

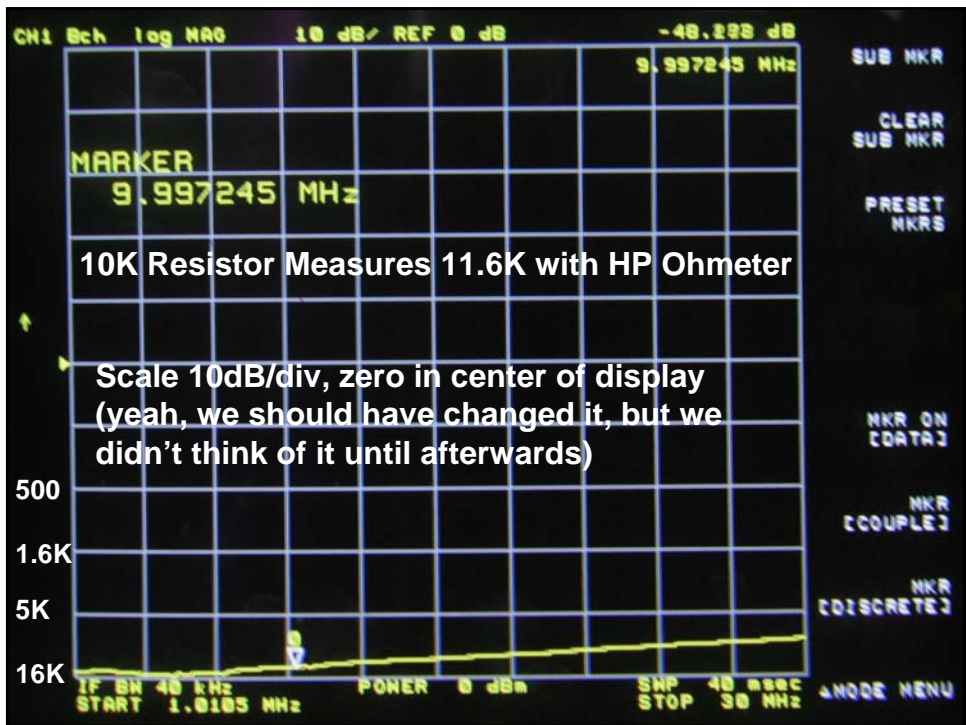
- Two sizes of coax
  - RG8X (Belden)
  - RG8 (Commscope 3127)
- Two types of cores
  - Five #31 2.4" o.d., 1.4" i.d. toroids (FT-240)
  - "Big Clamp-on" #31
- 4, 5, and 7 turns
  - Mostly small diameter coils
  - Mostly widely spaced turns
  - A few close-spaced for comparison

## How Data is Presented

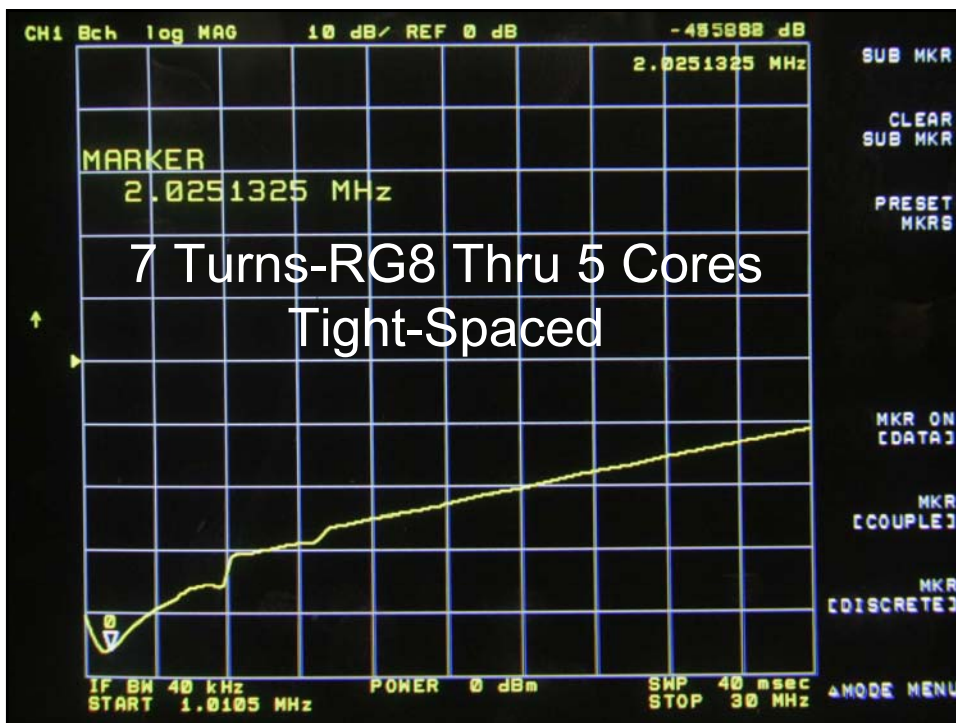
- Log magnitude of  $S_{21}$ 
  - Would like to have presented complex data, but we couldn't figure out how to make the analyzer give it to us (AARGH!)
  - 40 dB is 5K $\Omega$
  - Each 10 dB is related by  $\sqrt{10}$
- We'll go back and do it again when we figure out how to get complex data
- I can do these measurements with my TenTec TAPR VNA, and it does give me comma-delimited complex data





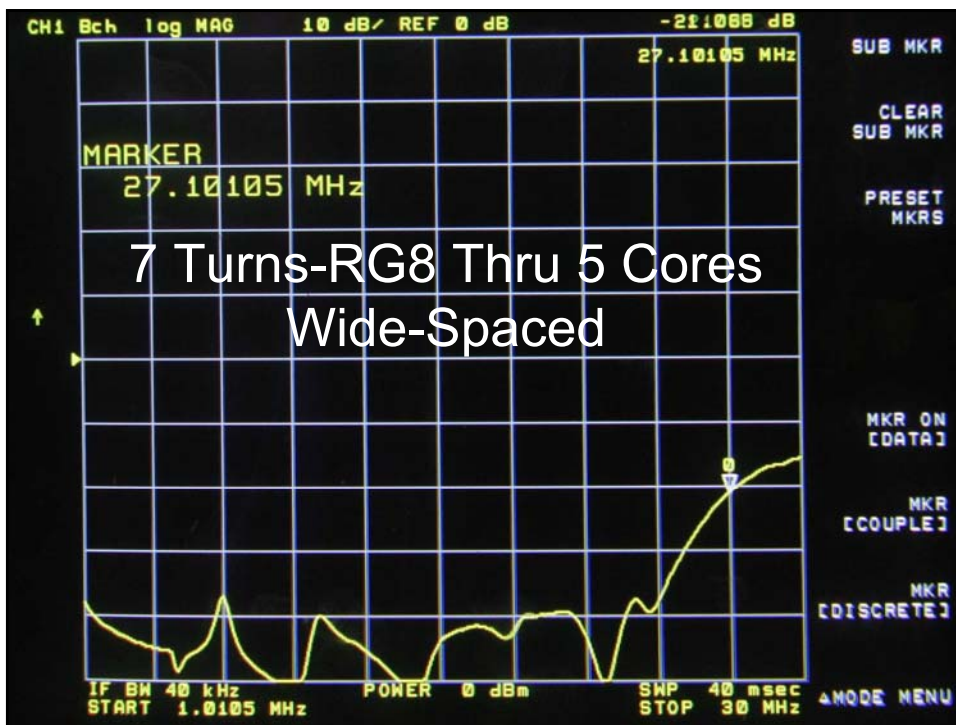


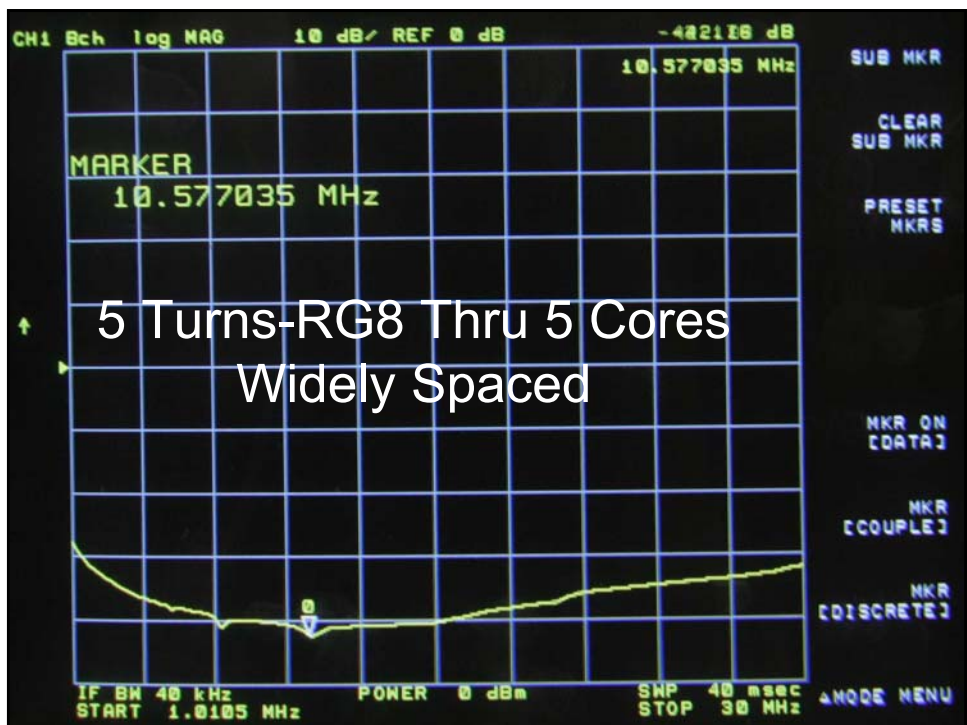
# 7 Turns-RG8 Thru 5 Cores Tight-Spaced

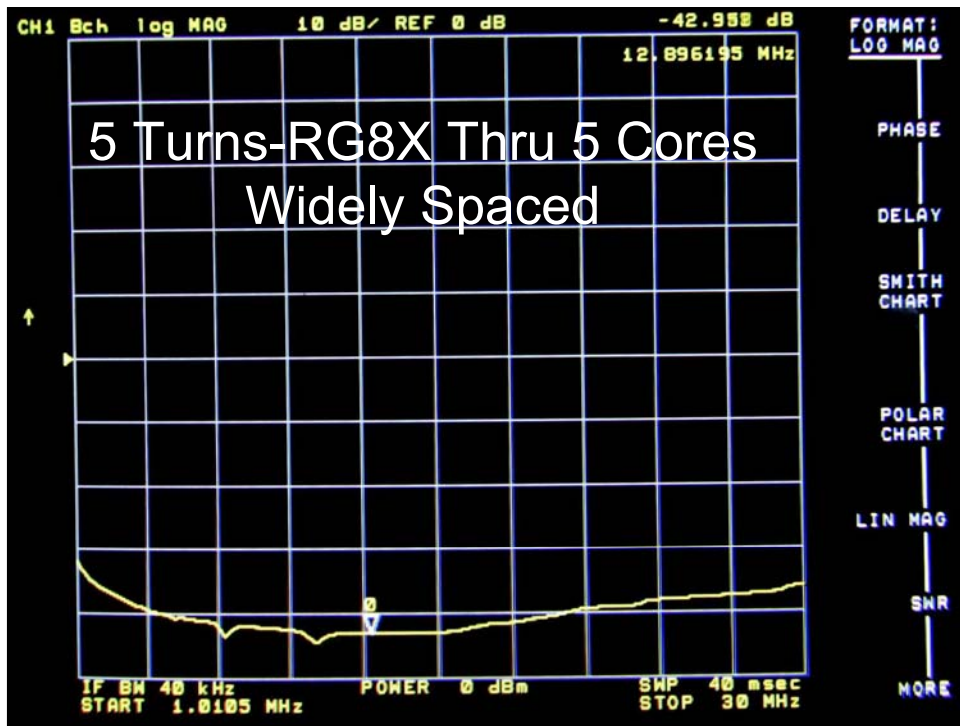




# 7 Turns-RG8 Thru 5 Cores Wide-Spaced













## Conclusions

- Coaxial chokes on #31 toroids are clearly practical for the HF ham bands
  - Impedance is very sensitive to spacing of turns
- Close spacing lowers resonant frequency a **lot** by adding both L and C
  - Adds reactance, but no resistance
  - Resistance is what we want, and we get that from the ferrite
- Wide spaced turns are required for good choking performance

## **Conclusions**

- $S_{21}$  measurement needed to get good data on chokes
- If you've been measuring by the reflection parameter method, we suggest you verify its accuracy by measuring a 10K resistor over the same frequency range
- I found the method in an HP applications note on impedance measurement