

Portable multi-frequency  
and multi-amplitude  
susceptibility meter for  
direct mass-specific  
magnetic susceptibility  
measurements

**Heritage Geophysics**  
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# Motivation

- Magnetic susceptibility at different frequencies
  - Bartington MS2B
  - 0.47 and 4.7 kHz
  - $10^{-5}$  SI
- Magnetic susceptibility at different amplitudes
  - AGICO KLF-4A/4M (2 kHz, 5-300 A/m,  $10^{-6}$  SI at 300 A/m,  $10^{-5}$  SI at 5 A/m)
  - AGICO KLY-4S (875 Hz, 3-450 A/m,  $3 \times 10^{-8}$  SI at 300 A/m)
- Only laboratory measurements, no tool to measure *in field*
- *Sampling – effect of variable density on volume susc. data - need for mass-specific measurements in field*

# Task

- Portable susceptibility meter
- Simple operation
- Weight measurements – built-in balance
- Variable frequencies
- Variable amplitudes
- Comparable sensitivity
- Temperature drift and stability

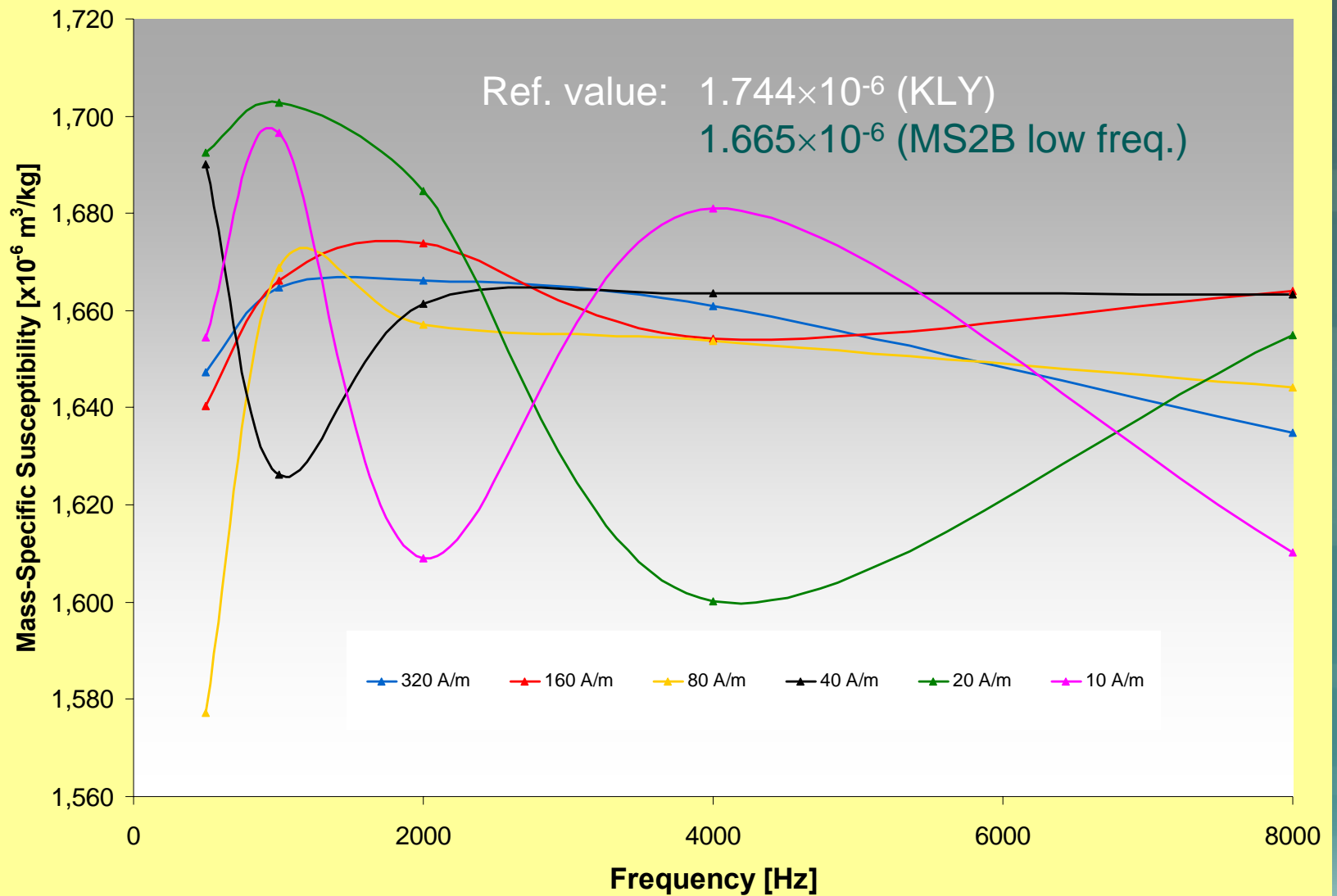
# Result: SM100



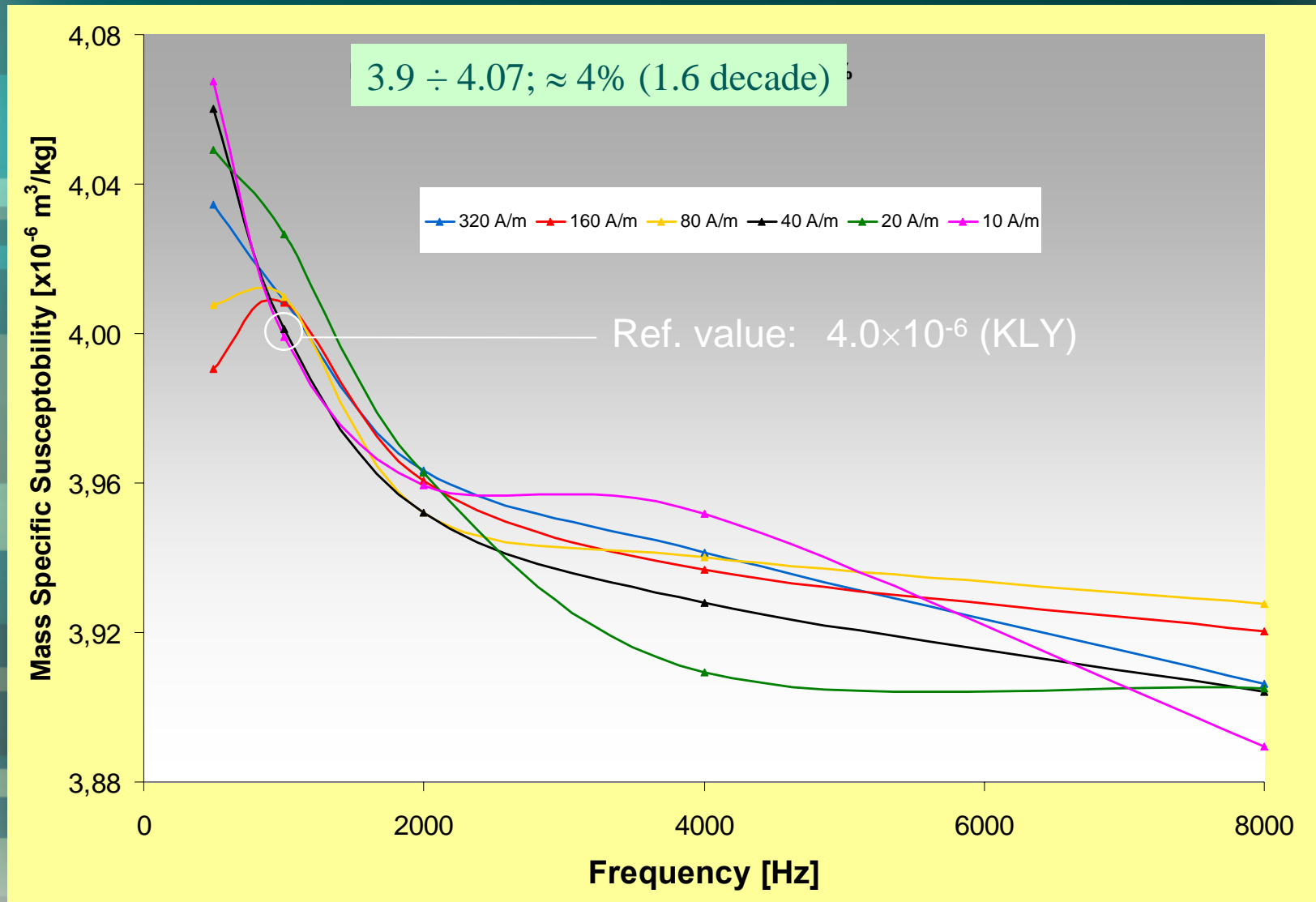
# Result: SM100

- Built-in tensometric balance
  - noise  $\approx 0.03$  g
- Operating frequencies
  - **0.5**, 1, 2, **4**, 8 kHz
  - set with error  $< 1\%$
- Operating amplitudes
  - 10, 20, 40, 80, 160, **320** A/m
  - noise  $2 \times 10^{-7}$  at 8 kHz

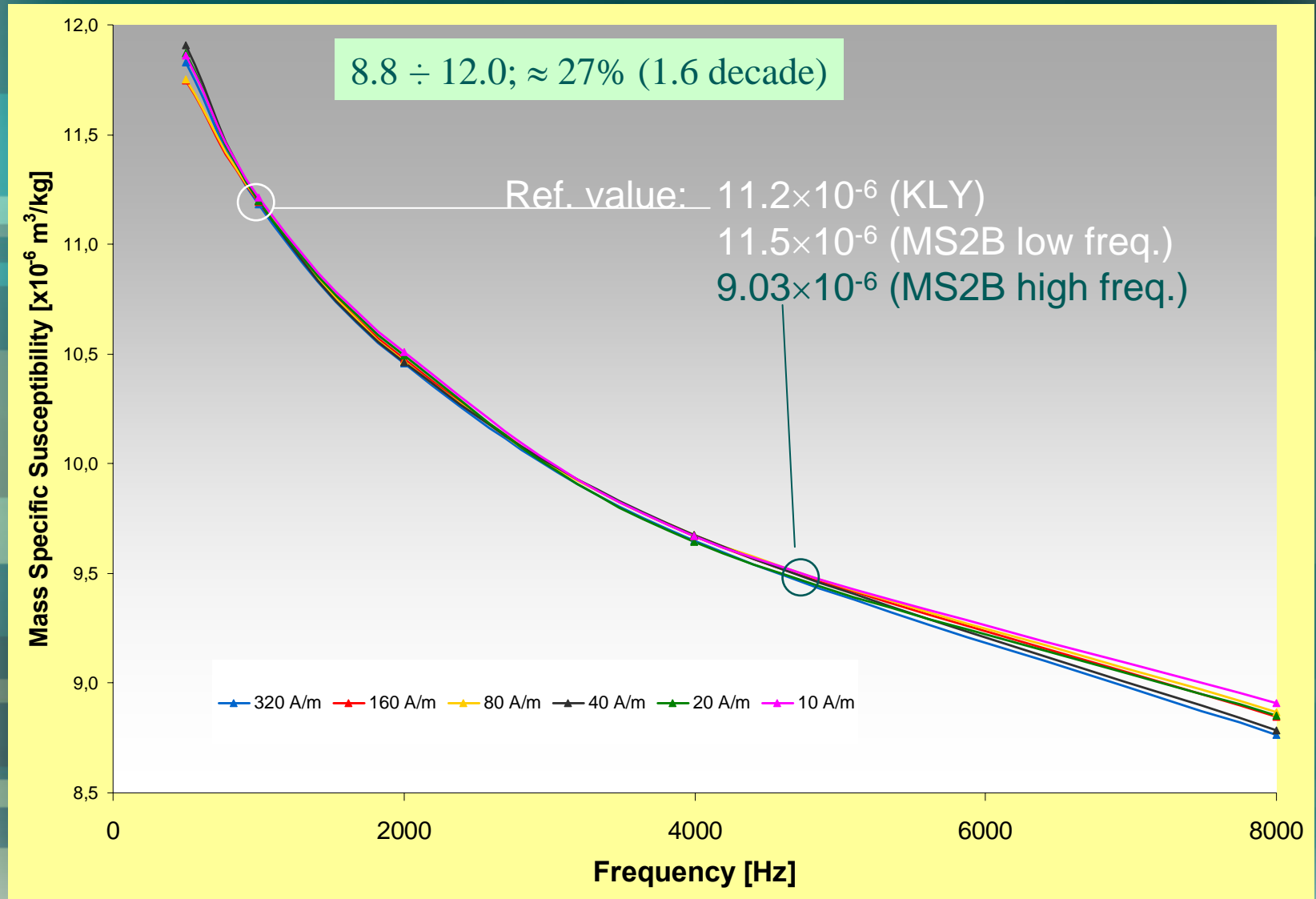
# Gd<sub>2</sub>O<sub>3</sub>



# Pozzolana Cement

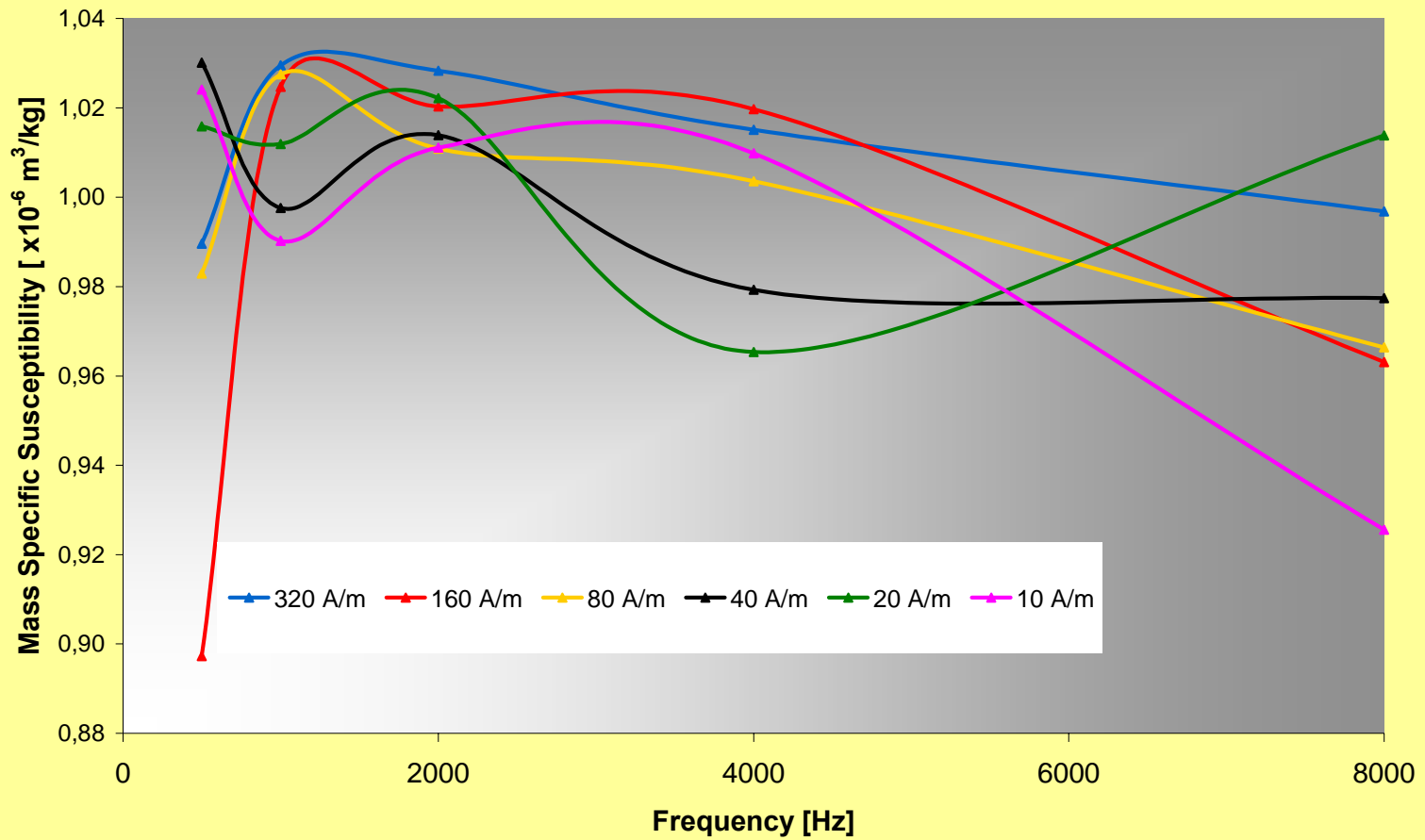


# Tiva Canyon Tuff

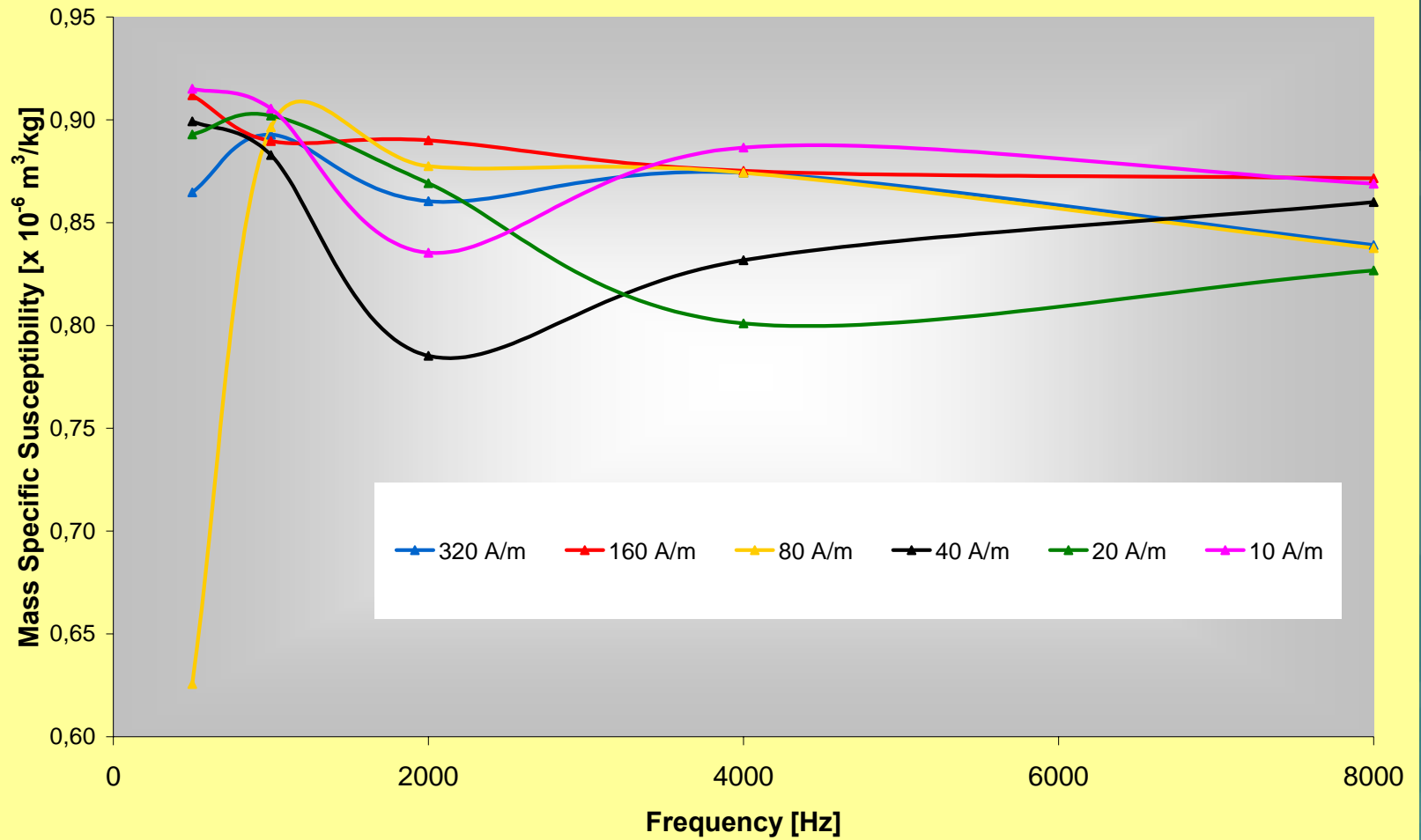




# Fe<sub>3</sub>O<sub>4</sub>



# $\gamma\text{-Fe}_2\text{O}_3$



# Conclusions

- Portable, battery-charged susceptibility meter
- Direct measurements of mass-specific susceptibility
- 5 different operating frequencies
  - 0.5, 1, 2, 4 and 8 kHz
- 6 amplitudes of magnetizing field
  - 10, 20, 40, 80, 160 and 320 A/m
- Sensitivity of  $2 \times 10^{-7}$  SI at 8 kHz
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