

# Introduction to the IMA Working Group

The logo for the IMA Working Group. It features a stylized red symbol on the left, which consists of a vertical line with a horizontal crossbar and two curved lines extending from the top and bottom of the vertical line. To the right of this symbol are the letters 'I', 'M', and 'A' in a bold, black, serif font.

# About the IMA

- Global trade group made up of companies involved in the soft magnetics industry.
- Includes manufacturers and distributors.
- Organized as a working group within The Transformer Association (TTA).
- Was formerly known as the MMPA (Magnetic Materials Producers Association).



# Mission

- The mission of the IMA is to promote the worldwide growth, development, understanding and use of magnetic materials and devices



# Industry Standards

- The IMA develops, maintains and distributes industry standards. The IMA is currently in the review process of updating and revising the soft ferrite standards
- *Current available standards:*
  - [Soft Ferrite Cores User Guide](#)
  - [Standard Spec for Ferrite Pot Style Cores](#)
  - [Standard Spec for Ferrite Toroid Cores](#)
  - [Standard Spec for Ferrite U E I Cores](#)
  - [Standard Specification for Ferrite Threaded Cores](#)

# Education

- The IMA presents seminars and workshops in conjunction with major trade shows.



# Statistics

- The members of the IMA gather market information and benchmark activity in order to better understand business and technology events that impact the industry.



# Meetings

- The IMA meets regularly through the year and at TTA meetings.





# Members List

- **Distributors**

- Allstar Magnetics, LLC
- Amidon, Inc
- Dexter Magnetics Technologies
- Elna Magnetics
- Kreger Components, Inc
- MTL Distribution

- **Manufacturers**

- EPCOS Inc.
- Fair-Rite Products Corp.
- Ferroxcube USA
- Magnetics
- Micrometals Inc.
- National Magnetics Group, Inc.
- TSC Ferrite International
- VAC Sales USA, LLC



# Current Initiatives

- Core Loss Testing
  - Working group initiated a round robin testing of wound cores to determine industry consistency in
    - Inductance measurements ( $\mu\text{H}$ )
    - Core Loss ( $\text{W}/\text{cm}^3$ )
  - No specifications were given for equipment or test method



# Testing

- Experiment
  - Take two similar inductor designs and have each manufacturer test for inductance and core loss, indicating conditions.
  - Each manufacturer tests the same inductors and used their internal core loss setup.
  - Six manufacturers agreed to test



# Testing Criteria

- Coils Used (wound by MFG A)
  - Toroid 1
    - Designation T21/13/6.4-77
    - Part Number 5977000601
    - 10 Turns
  - Toroid 2
    - Designation T32/19/9.5-78
    - Part Number 5978001701
    - 10 Turns



# Inductance Testing

- Equipment Used (Inductance Test)
  - HP 4284A , T.F. 16047E
  - Voltech 3600
  - Industry standard inductance test is at 10 kHz 10 Gauss



# Inductance Testing

- Inductance Test Results (coil 1)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	5.5 mV	5.5 mV	5.5 mV	5.5 mV	5.4 mV	6mV
Test Frequency	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10kHz
sample#11-	140.7	140.3	137.3	140.3	160.3	151.8
sample#12-	129.5	129.6	126.5	130.1	145.9	138.9
sample#13-	131.1	131.2	128.8	137.8	146.5	140.6
sample#14-	147.0	146.0	142.4	138.2	165.1	157.3
sample#15-	149.3	148.7	145.8	140.8	168.6	159.7
sample#16-	133.0	133.1	131.2	132.7	150.1	143.1
sample#17-	143.0	141.5	139.3	138.8	160.1	151.9
sample#18-	140.9	140.8	138.5	141.3	160.1	150.7
sample#19-	142.3	142.8	140.5	145.3	163.1	155.2
sample#20-	144.5	144.3	142.6	147	162.4	155.8

# Inductance Testing

- Inductance Test Results (coil 1)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	55 mV	55 mV	55 mV	55 mV	53.9 mV	55 mV
Test Frequency	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz	10kHz
sample#11-	140.7	140.6	137.3	141.7	160.4	159.5
sample#12-	129.5	129.7	126.4	130	146.6	146.6
sample#13-	131.0	131.4	128.8	131.9	147.1	149.4
sample#14-	147.1	146.3	142.5	139.5	166.1	164.9
sample#15-	149.4	148.9	145.5	142.8	169.6	168.1
sample#16-	133.6	133.4	131.3	135.4	151.0	151
sample#17-	142.3	141.9	139.5	141.5	161.1	160.4
sample#18-	141.3	141.3	139.1	141.7	161.1	159.2
sample#19-	142.1	143.5	140.6	144.5	164.1	164.1
sample#20-	144.8	145.4	142.8	146.3	163.4	164.3



# Inductance Testing

- Inductance Test Results (coil 2)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	13.5 mV	13.5 mV	13.5 mV	13.5 mV	13.1 mV	13 mV
Test Frequency	10 kHz	10 kHz	10 kHz	10 kHz	10 kHz	10kHz
sample#11-	209.1	212.2	209.5	203.6	228.2	218.92
sample#12-	207.3	214.7	209.8	206.2	226.4	226.97
sample#13-	209.3	207.8	204.2	203.2	227.1	229.48
sample#14-	206.3	206.4	202.1	202.8	226.6	226.53
sample#15-	209.1	210.5	206.3	207.3	229.6	234.66
sample#16-	199.0	199.9	195	194.2	218.6	221.91
sample#17-	205.8	207.2	202.2	203.2	226.9	218.16
sample#18-	209.1	211.1	206.7	203.6	229.5	232.12
sample#19-	207.3	209.2	205	205.3	227.2	231.23
sample#20-	210.1	205.3	201.2	203.8	223.7	219.54

# Inductance Testing

- Inductance Test Results (coil 2)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	135 mV	135 mV	135 mV	135 mV	131 mV	135 mV
Test Frequency	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz
sample#11-	209.4	212.7	210	204	230.6	210.49
sample#12-	207.6	215.3	210.1	208.1	228.7	217.48
sample#13-	209.0	208.6	204.5	203.7	229.4	220.19
sample#14-	206.1	207.1	202.3	204.7	229.0	217.04
sample#15-	209.0	211.2	206.6	207.4	232.0	224.23
sample#16-	198.9	200.4	195.2	196.4	220.8	212.72
sample#17-	206.1	208.1	202.5	204.4	229.3	209.4
sample#18-	209.2	211.8	207	204.9	231.9	222.72
sample#19-	207.7	209.6	205.3	206.8	229.6	221.99
sample#20-	210.0	205.5	201.5	205	226.0	210.82

# Core Loss Testing

- Equipment Used (Core Loss Test)
  - CH258, ENI 2100L, HP3324A
  - CH 2335 KH7500
  - CH258
  - Tektronix CFG253 & TDS 200; Kron-Hite 7500 Amplifier; Clarke-Hess V-A-W Meter Model 258
  - Tektronix TDS 3032B; Agilent 33120, Amplifier 75A 250M4
  - HP4284A + Tektronix TDS 5032B + Agilent 33120A + TC Power Conversion AG1018

# Core Loss Testing

- Core Loss Test Results (coil 1)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	10.8 V	10.8 V	10.8 V	10.8 V	10.8 V	100mT
Test Frequency	100 kHz	100 kHz	100 kHz	100 kHz	100 kHz	100kHz
sample#1-	0.575	0.691	0.246	0.345	0.238	0.200
sample#2-	0.540	0.525	0.25	0.327	0.254	0.215
sample#3-	0.420	0.733	0.252	0.34	0.262	0.223
sample#4-	0.525	0.562	0.252	0.407	0.250	0.212
sample#5-	0.725	0.755	0.241	0.341	0.249	0.208
sample#6-	0.490	0.481	0.261	0.503	0.273	0.230
sample#7-	0.674	0.732	0.273	0.346	0.297	0.248
sample#8-	0.577	0.583	0.276	0.358	0.280	0.233
sample#9-	0.612	0.722	0.24	0.352	0.249	0.205
sample#10-	0.593	0.623	0.253	0.361	0.259	0.214

# Core Loss Testing

- Core Loss Test Results (coil 2)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***	26.2	26.26			26.2 V	
Test Frequency	100 kHz	100 kHz			100 kHz	
sample#11-	0.73	0.615			0.620	
sample#12-	0.76	0.674			0.654	
sample#13-	0.76	0.678			0.650	
sample#14-	0.74	0.665			0.636	
sample#15-	0.72	0.695			0.641	
sample#16-	0.77	0.689			0.652	
sample#17-	0.75	0.667			0.628	
sample#18-	0.78	0.689			0.657	
sample#19-	0.79	0.679			0.641	
sample#20-	0.85	0.698			0.631	



# Core Loss Testing

- Core Loss Test Results (coil 2)

	MFG A	MFG B	MFG C	MFG D	MFG E	MFG F
Test Voltage ***		10.8 V	10.8 V	10.8 V	10.8 V	
Test Frequency		100 kHz	100 kHz	100 kHz	100 kHz	
sample#11-		0.064	0.064	0.066	0.0735	
sample#12-		0.066	0.069	0.068	0.0744	
sample#13-		0.067	0.069	0.068	0.0749	
sample#14-		0.067	0.069	0.067	0.0742	
sample#15-		0.064	0.067	0.066	0.0724	
sample#16-		0.067	0.07	0.069	0.0759	
sample#17-		0.064	0.066	0.066	0.0731	
sample#18-		0.065	0.069	0.068	0.0765	
sample#19-		0.064	0.068	0.069	0.0756	
sample#20-		0.065	0.068	0.068	0.0748	



# Inductance Testing

- Conclusions
  - Inductance Testing
    - Similar equipment used by all manufacturers
    - Similar test methodology used by all manufacturers
    - Results consistent within each manufacturer
    - 4 of 6 manufacturers consistent with each other



# Core Loss Testing

- Conclusions
  - Core Loss Testing
    - Different equipment used by all manufacturers
    - Method of test not revealed by manufacturers
    - Results consistent within each manufacturer
    - Manufacturers inconsistent with each other
    - Frequency , gauss level and heating contributed to inconsistent results.



# Core Loss Testing

- Next Steps
  - Test larger and smaller test inductors
  - Test shapes other than toroids
  - Determine inconsistencies between manufacturers



# Future Testing

- Groundwork has been laid for working with the PSMA for testing criteria at higher frequencies

