



# Technical Seminar Series

*Be Smart — Choose the Right Part*

## Welcome to “Increasing in Frequency – RF In New Designs”



**Tune in as passives guru, Dennis M. Zogbi from Paumanok Publications and product experts from AVX, Murata and Spectrum Control discuss RF Capacitors, SAW Filters and Specialty Filters.**

**Sit back, relax and learn more about RF components and their new designs!**



# Technical Seminar Series

*Be Smart — Choose the Right Part*

Welcome – Mark Burr-Lonnon, TTI, Inc.

## Technology Line-Up

### **Paumanok Publications**

- Dennis M. Zogbi

### **AVX**

- Larry Eisenberger

### **Murata**

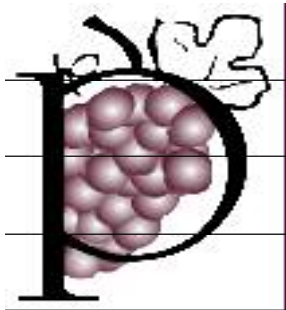
- Mike Johnston

### **Spectrum Control**

- Dave Arthurs

## Q&A

April 2006



### RESEARCH & PRESENTATION

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# High Frequency Ceramic Capacitor Markets: > 1 Ghz

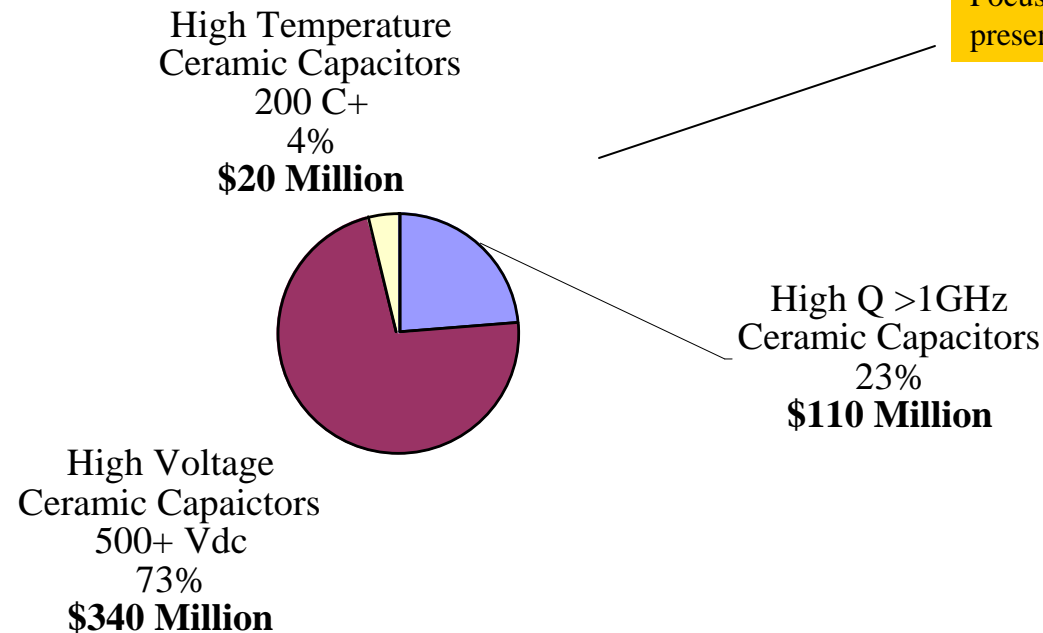
## TTI Webcast April 2006



Source: "Value-Added & Application Specific Ceramic Capacitor Markets: 2005-2010" Paumanok Publications, Inc. [info@paumanokgroup.com](mailto:info@paumanokgroup.com)

# Value-Added & Application Specific Ceramic Capacitors: World Markets: 2005

Global Consumption Value For Value Added & Application Specific Ceramic Capacitors: 2005 (\$470 Million Global Market)



Source: "Value-Added & Application Specific Ceramic Capacitor Markets: 2005-2010" Paumanok Publications, Inc. [info@paumanokgroup.com](mailto:info@paumanokgroup.com)

# Frequency Ranges

Band	Nomenclature	Frequency	Wavelength
ELF	Extremely Low Frequency	3 - 30 Hz	100,000 - 10,000 km
ULF	Ultra Low Frequency	300 - 3000 Hz	1,000 - 100 km
VLF	Very Low Frequency	3 - 30 kHz	100 - 10 km
LF	Low Frequency	30 - 300 kHz	10 - 1 km
MF	Medium Frequency	300 - 3000 kHz	1 km - 100 m
HF	High Frequency	3 - 30 MHz	100 - 10 m
VHF	Very High Frequency	30 - 300 MHz	10 - 1 m
<b>UHF</b>	<b>Ultra High Frequency</b>	<b>300 - 3000 MHz</b>	<b>1 m - 10 cm</b>
<b>SHF</b>	<b>Super High Frequency</b>	<b>3 - 30 GHz</b>	<b>10 - 1 cm</b>
<b>EHF</b>	<b>Extremely High Frequency</b>	<b>30 - 300 GHz</b>	<b>1 cm - 1 mm</b>

Focus of This Presentation



# Global Product Markets By Frequency >1Ghz: 2006

## High Frequency Applications >1 GHz (Microwave)

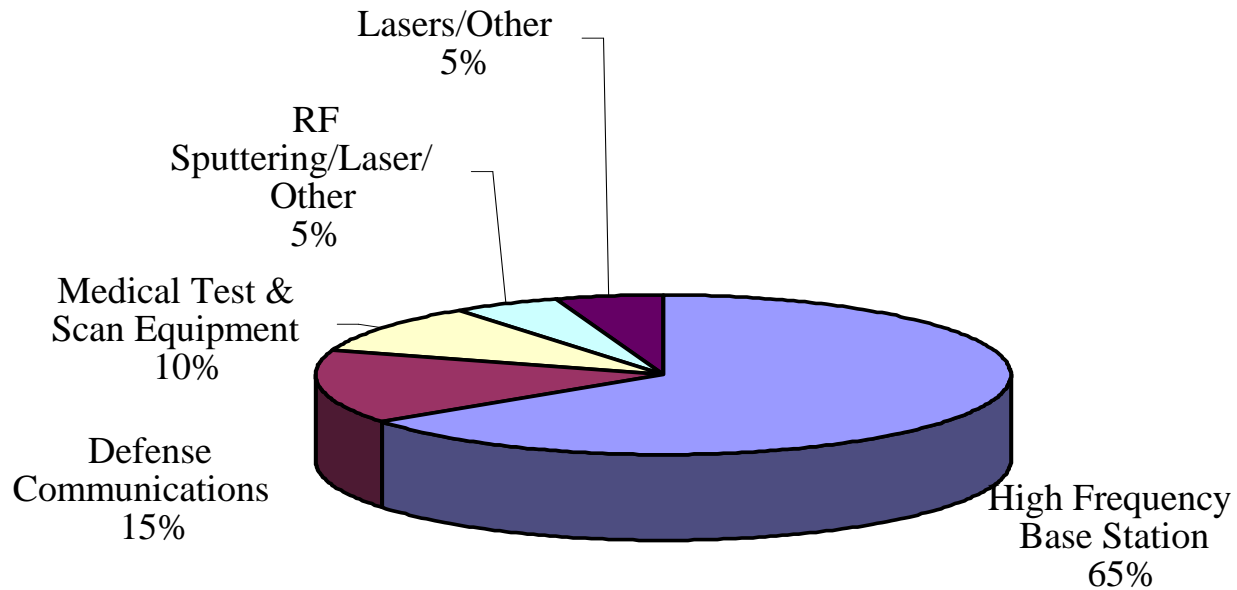
1 GHZ	Application	Segment	Notes
UHF to 1	Magnetic Resonance Imaging (Magnetron)	Medical	Also High Voltage
UHF to 1	Sputtering (Magnetron)	Semiconductor	Also High Voltage
1.1	Aircraft Transponder	Aerospace	
1.2	Pulse Radar	Aerospace	Pulse Discharge
1.215	Aviation/Aero Radio Nav	Aerospace	
1.22	GPS	Commercial/Defense	Growth In Auto
1.24	Space to Earth Satellite RadioNav	Aerospace	
1.3	Radiolocation	Aerospace	
1.4	Radio Astronomy	Scientific	
1.5	Inmarsat	Aerospace	
1.47	Earth to Space	Aerospace	
1.57	GPS	Commercial/Defense	Growth in Auto
1.6	Pulse Radar	Aerospace	Pulse Discharge
1.8-1.9	PCN Phone	Commercial	Growth in 2004
1.9-2.0	PCS Phone	Commercial	Growth in 2004
2.15	Wireless CATV Cameras (MDS)	Commercial	
2.2	DOD Satellite	Defense/Aerospace	
2.36	XM Radio Repeaters	Commercial	Growth Market
2.4	Wireless Local Area Network	Commercial	
2.45	Microwave Oven (Magnetron)	Consumer	Also High Voltage
2.59	Wireless CATV Cameras (FTS)	Commercial	
2.7	Satellite	Aerospace	
2.8	Aeronautical Radio-Navigation	Aerospace	
2.9	Maritime Radionavigation	Aerospace	
<b>3 GHZ</b>	<b>Application</b>	<b>Segment</b>	
3.1	Mobile Radar	Defense	
3.2	Missile Links	Defense	
3.0-3.5	Cellular Telephone (3G)	Commercial	Growth Market
<b>4 GHZ</b>	<b>Application</b>	<b>Segment</b>	
4.4	Defense Communications	Defense	
<b>5 GHz</b>	<b>Application</b>	<b>Segment</b>	
5.7-5.8	Cordless Phones	Commercial	
<b>10 GHz</b>	<b>Application</b>	<b>Segment</b>	
10 GHz	Ham Radio	Commercial	
<b>30-300 GHz</b>	<b>Application</b>	<b>Segment</b>	
30-300 Ghz	Millimeter Wave	Experimental	



Source: "Value-Added & Application Specific Ceramic Capacitor Markets: 2005-2010" Paumanok Publications, Inc. [info@paumanokgroup.com](mailto:info@paumanokgroup.com)

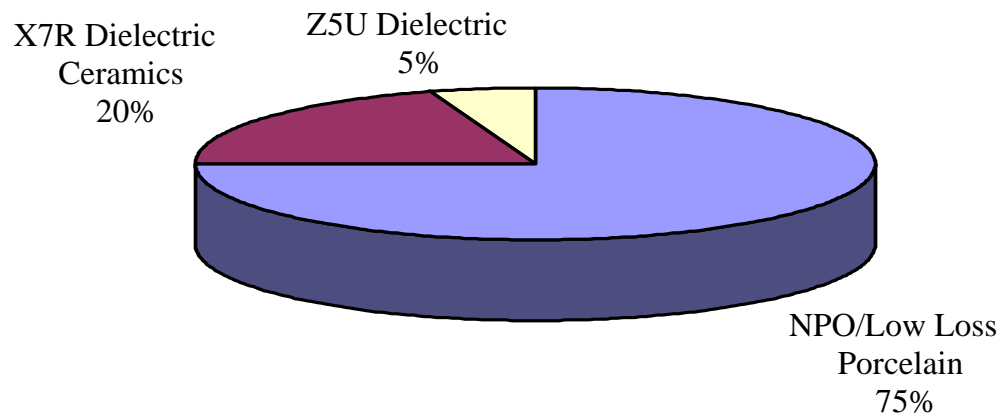
# High Q Ceramic Capacitor Consumption By End-Use Market Segment: 2005

Global Consumption Value For High Frequency Ceramics >1 Ghz by End-Use Market Segment: 2005



# Global Consumption Value For High Q Ceramics By Dielectric: 2005

Global Consumption Value For High Frequency Ceramics By Dielectric: 2005



# Competitive Environment In High Q Ceramics > 1 Ghz

High Q Ceramic Capacitors	1 GHz-3GHz	3 GHz - 10 GHz	11 GHz-40 GHz	38-100+ GHz
<b>Vendor</b>				
AVX Corporation				:(to 100 Ghz)
American Technical Ceramics				:(to 100 Ghz)
Murata Manufacturing				:(to 100 Ghz)
Temex France				:(to 50 Ghz)
Dielectric Labs			:(to 20 GHz)	
Johanson Dielectrics			:(to 23 GHz)	
Eurofarad			:(Defense)	
Syfer Technology		:(to 10 GHz)		
TPL Microelectronics		:(to 10 GHz)		
Presidio	:(to 1.2 GHz)			
Taiyo Yuden	:(to 1.2 GHz)			
American Electric Ceramics	:(to 3 GHz)			

**The Majority of  
Companies Compete  
In The markets between  
1 and 3 GHz**

**Competition Declines  
As The Frequency  
Increases**

