



# **Meeting Flame Resistance Requirements for Green Electronics**

## **Issues & Opportunities for Halogen-free Laminates**

April 2013

# Introductions

- **David Bedner**
- **Principle Scientist, Isola Group S.a.r.l.**
- **Isola supplies both halogen and non-halogen materials for PWBs**



# Overview

- **Market Trends for Halogen-free (HF) Copper-clad Laminates and Prepregs**
- **Perceived Needs vs. Actual Needs**
- **Barriers to Market Entry**
- **Requirements for HF Materials**

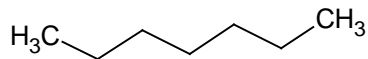
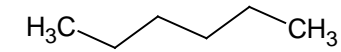
# Market Trends for HF CCL

- **Non-governmental Organizations are Demanding Stricter Legislation for Flame Retardants**

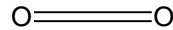


# Generation of Toxins

## Dioxins And Furans

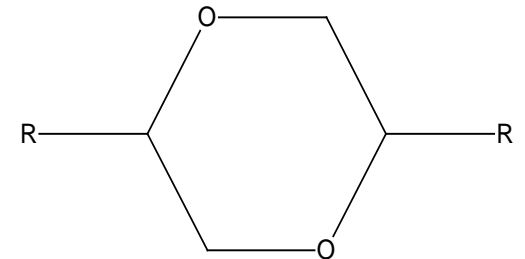
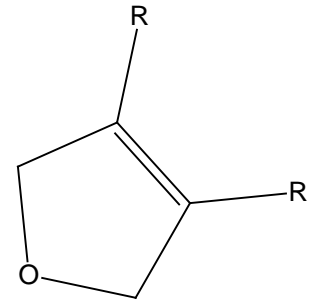
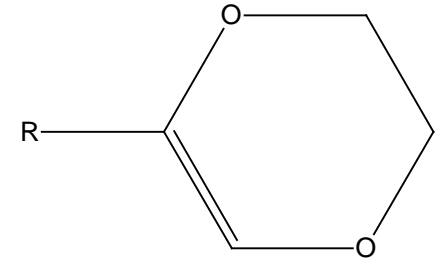
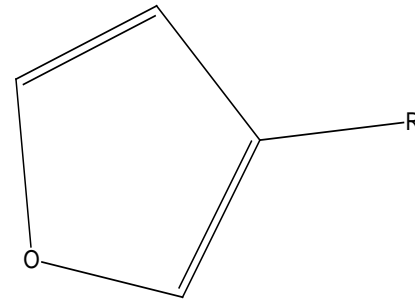


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Br\*

Incomplete  
Combustion



# Perceived Threat from Halogens



**Open Pit Burning Toxins**



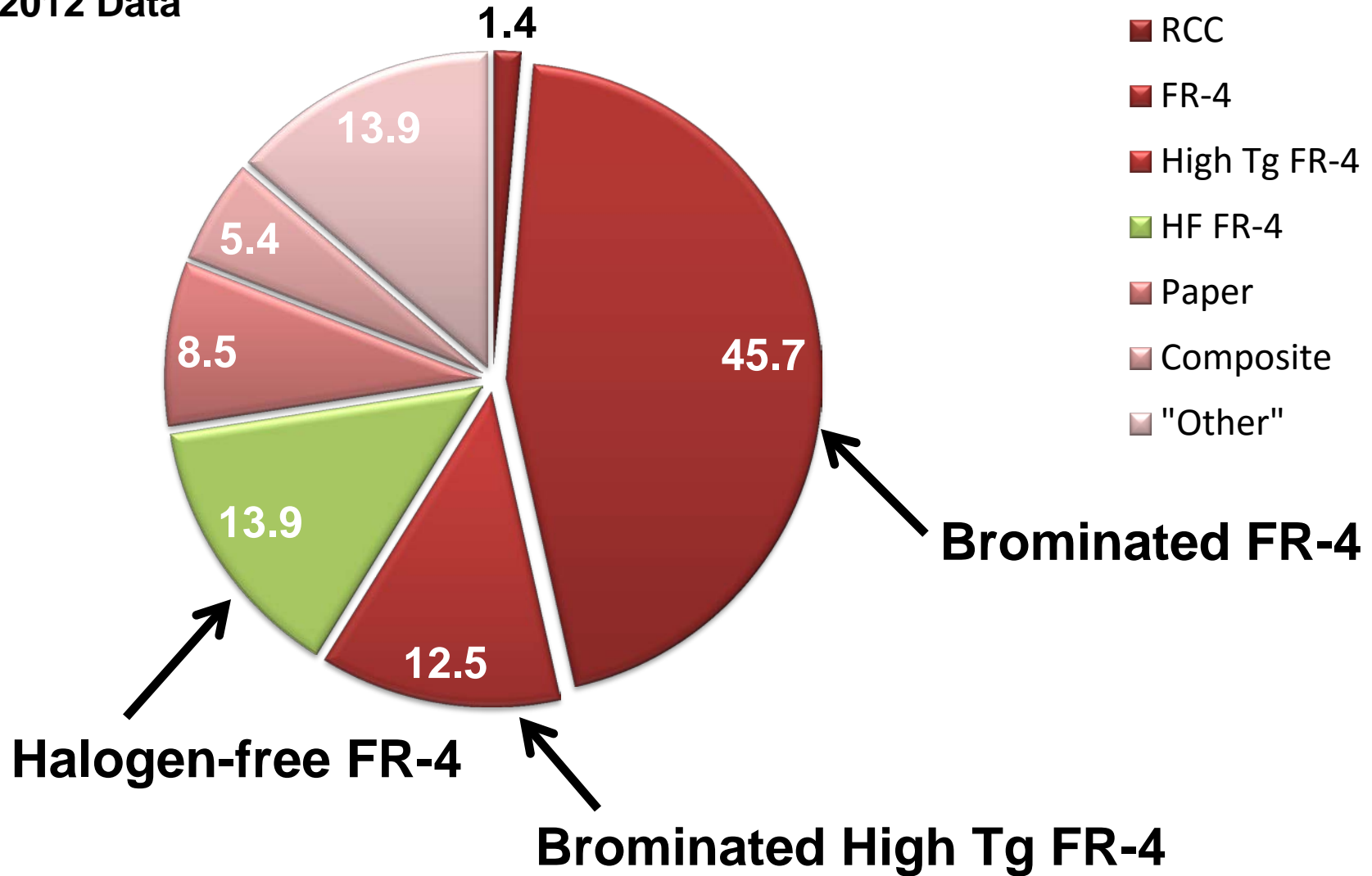
# Actual Threat from Halogens



**Forrest Fires Releasing Toxins**

# PWB Material Sales by Type

2012 Data

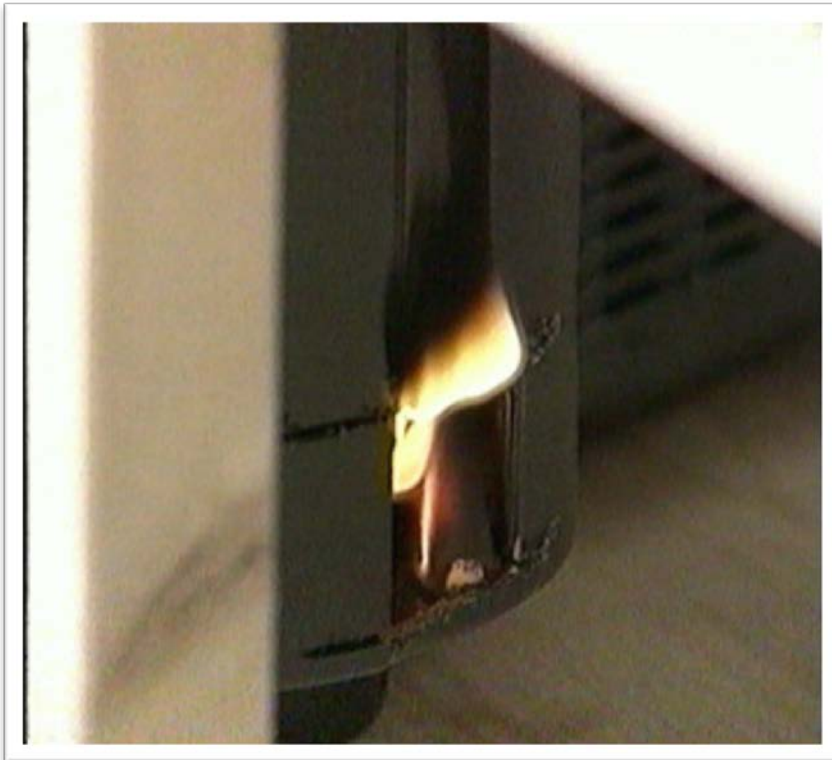




# The Need for Flame Retardants

## Television without Flame Retardant

8 seconds



7 minutes 23 seconds

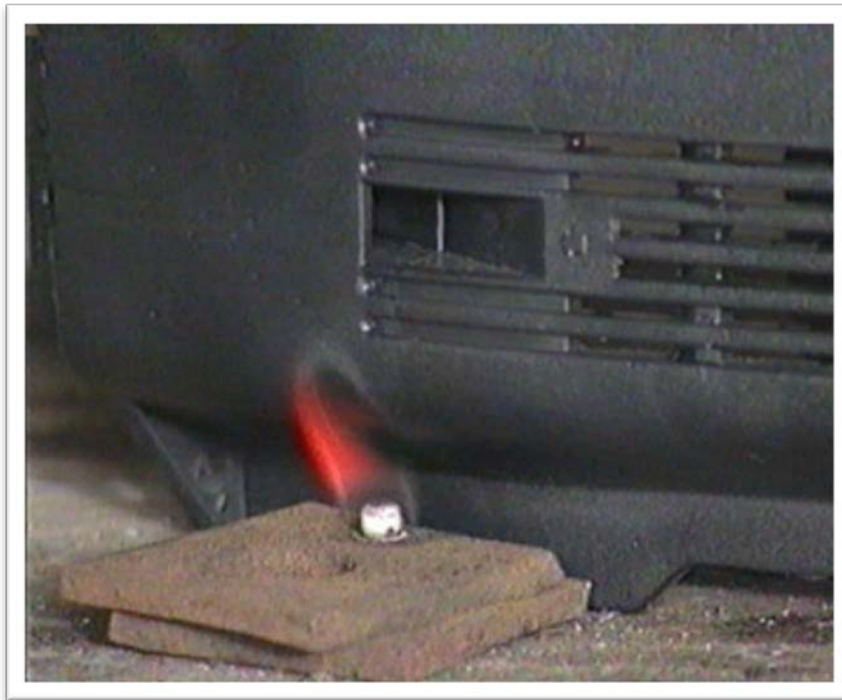


# The Need for Flame Retardants

## Television without Flame Retardant

5 seconds

1 minute 45 seconds



# Flame Retardants Available



**Brominated**



**Phosphorous**

# Comparison of Flame Retardants

## Brominated FRs

- **>95% of FR-4 PWB use TBBPA**
- **Inexpensive**
- **Well Studied**
- **Easily Extracted**
- **Very Efficient**
- **TBBPA NOT RoHS Restricted**
- **REACH Registered as of Oct 2010**

## Phosphorous FRs

- **Finite Supply**
- **Has to be Strip Mined**
- **Not as Efficient**
- **Many Phosphorous Compounds are Explosive & Neurotoxic**



Issues and Opportunities for  
**Halogen-free Materials**



# Barriers to Market Entry

## UL Certification

- **HF Materials are Classified Outside of Product Family**
  - Full registration can take over a year
  - >\$72,000 for each new material



# Barriers to Market Entry

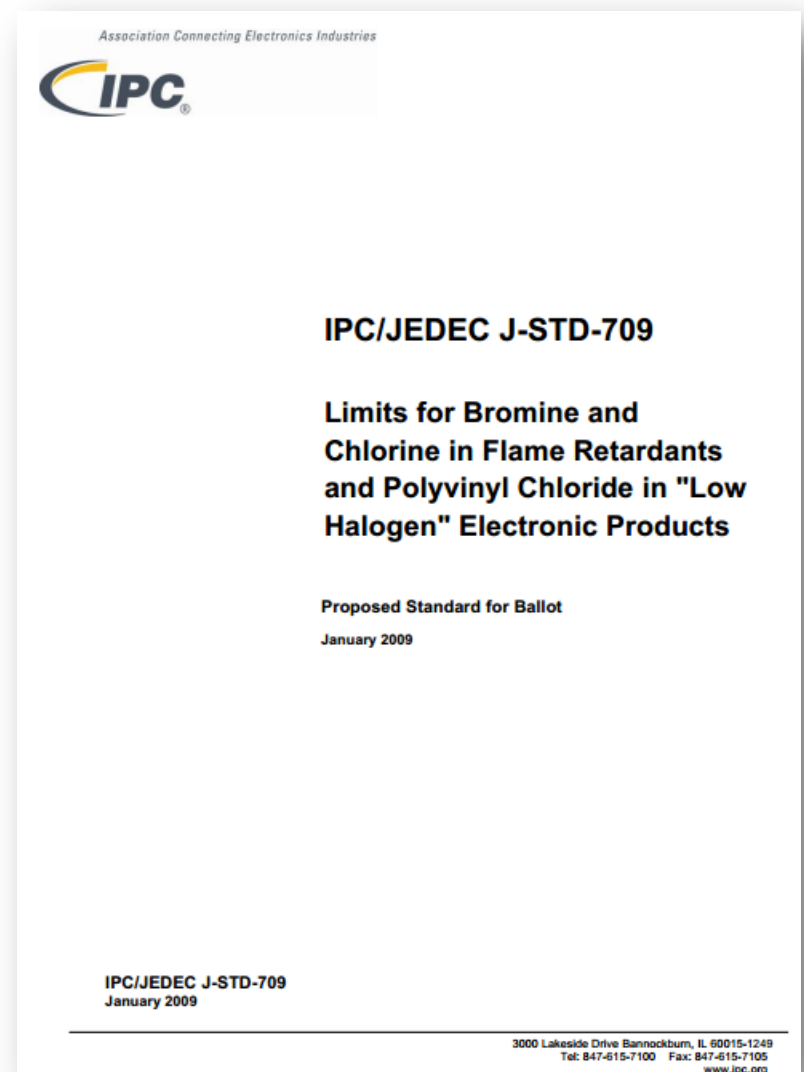
- **UL Requirements for FR-4**
  - MOT of 130°C minimum
  - Retention of 50% of properties
- **Provisional UL Certification**
  - May or may not reach an MOT of 130°C
  - Market “mind-set” requires 130°C min

# Typical Technical Requirements

- **Must be Halogen-free**
- **Meets UL-94 Flammability Test**
- **Passes Pb-free Assembly**
- **Has a Shelf Life**
- **Flame Retardant Needs to Remain in the Laminate**

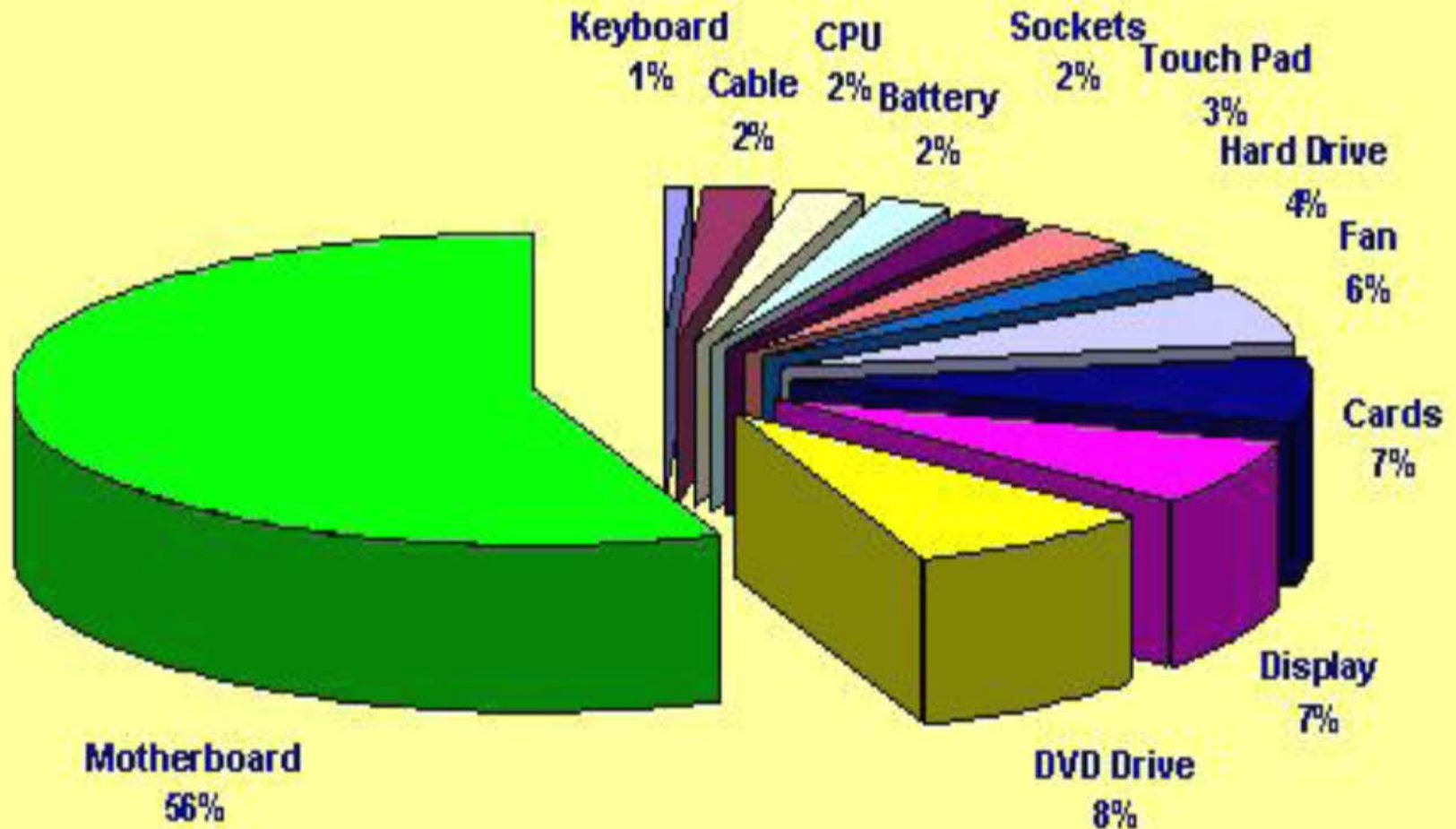
# Must Be Halogen-free

- **Low/non-Halogen Materials Defined by IPC/JEDEC J-STD-709**
  - 900/900
  - 1500 ppm Max



# Sources of FR in a Typical Laptop

Weight Analysis - Halogen Contribution, By Assembly





# Considerations for Halogen-free FRs

- **What is the origin of the flame retardant?**
- **Is it reacted in or additive?**
- **How stable is the flame retardant?**
- **How well is it dispersed?**

# Meets UL-94 Flammability Test



- Needs to Extinguish a Flame
- Needs to Resist Ignition
- Most PWBs require a V-0 rating
  - Total Burn <50s
  - Longest Burn <10s

# Typical Technical Requirements

- **Passes Pb-free Assembly**
  - Manufacturers want to market “Green” Products
- **Has a Shelf Life**
- **Flame Retardants Need to Remain in the Laminate**
  - Can't poison chemical baths

# Halogen-free Laminates

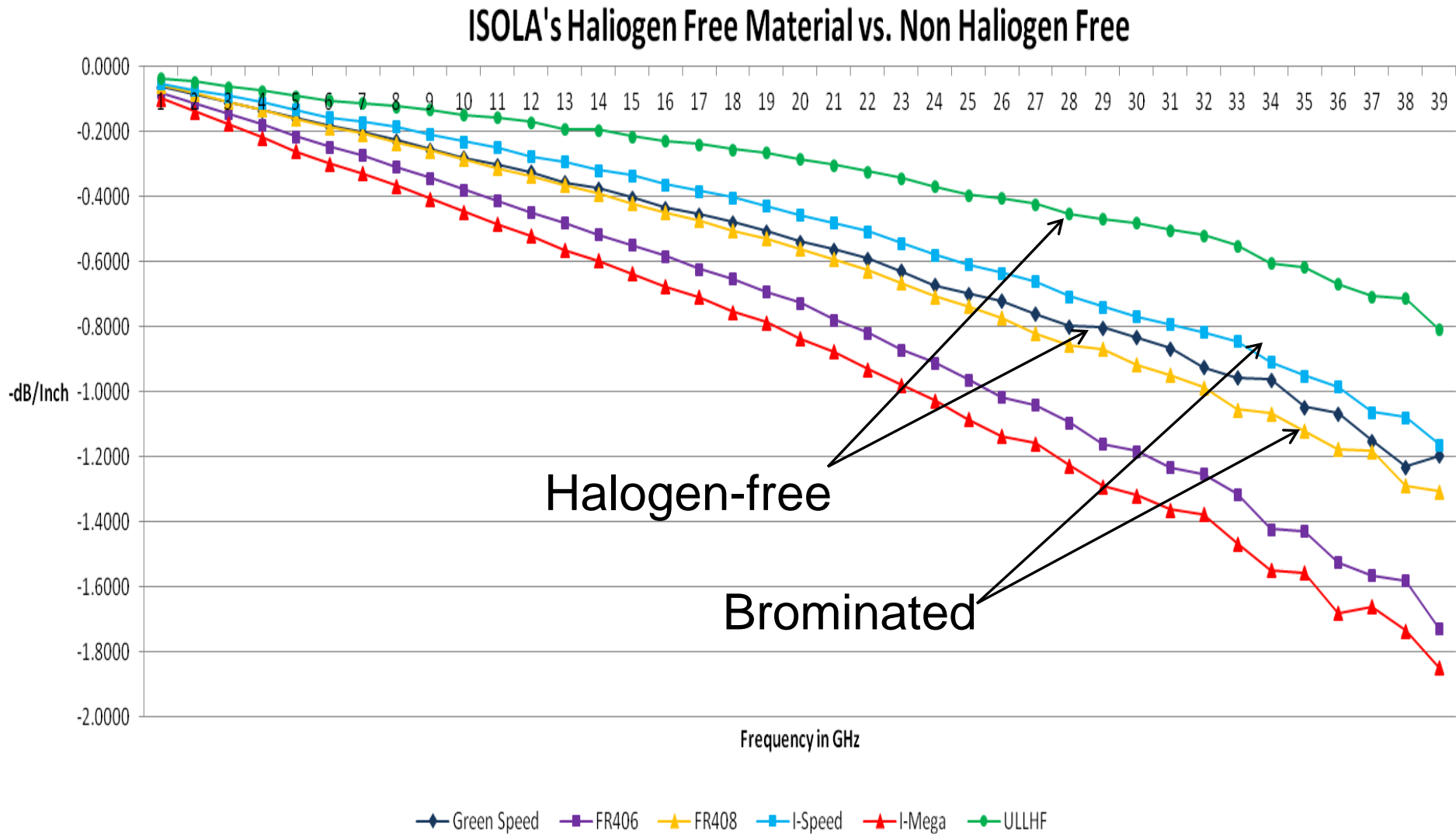
## The Pros

- Green “Feels Good”
- Can get much better thermal properties
- Can get better than FR-4 properties

## The Cons

- HF flame retardants are expensive
- May need new fabrication processing
- Long-term unknowns

# Halogen-free Performance





# Summary

- **While not legislated, HF material market is growing**
- **UL certification is a significant barrier to entry**
- **New HF materials can outperform traditional brominated material**
- **Selection of HF materials will be driven by manufacturers marketing “green” products**

