

# Perspectives on Aircraft Wireless System Certification



Federal Aviation  
Administration

CANEUS/NASA Fly by Wireless Workshop

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# Presentation Topics

- **Aircraft *fly by wireless* system certification issues**
  - Aircraft electromagnetic interference
  - Wireless system coexistence
  - Wireless system security
- **Status of FAA regulations and guidance**

# Aircraft Wireless Applications are Widespread

... Boeing has taken the first step at the OEM level by contracting with Securaplane for a *Wireless Emergency Lighting System* (WELS) on their 787 aircraft. This is recognized as the industry's first "essential" system to rely on wireless intra-cabin communication technology for a commercial aircraft manufacturer.

Harvey Blair, SecuraPlane,  
CANEUS/NASA Fly by Wireless  
Workshop abstract, March 27, 2007

Boeing has selected Intellex Corp. to provide silicon chips to enable radio frequency *identification (RFID)* "smart labels" on maintenance-significant parts of the 787 Dreamliner.

... Smart labels contain part identification as well as maintenance and inspection data in accordance with Air Transport Association standards.

Boeing media release, April 3, 2006

# But Not Without Difficulties

## ***Boeing cuts 787 wireless system***

**Boeing has abandoned its plan to install a *wireless inflight-entertainment system* on the 787 Dreamliner ...**

**Boeing made the decision earlier this month because of performance problems with the technology and the lack of bandwidth spectrum in some parts of the world. ...**

**Seattle Times, January 25, 2007**

# Aircraft Wireless System Are Not New

- **There are many certified aircraft wireless RF systems**
- **Most of these are aircraft communication, navigation, and surveillance radio systems**
  - Primarily air-to-ground or air-to-satellite radio systems
  - Several, such as the instrument landing system radios, support highly critical aircraft functions
- **But these operate in internationally protected frequency spectrum**
- **And, for these systems, annunciated loss of the function may be less critical than the system providing misleading data**

# Aircraft Wireless System Certification

- **FAA has certified on-aircraft wireless RF systems on aircraft, including:**
  - Wireless smoke and fire detection systems
  - Passenger wireless network systems
  - Cabin emergency lightning systems with wireless controls
- **Generally less critical systems**
- **These typically operate in unlicensed spectrum**

# Aircraft Wireless System Regulations

- **No specific regulations for aircraft wireless systems**
  - Existing certification regulations are applied
  - Certification aspects of wireless systems are handled on project-by-project basis
- **Special conditions are typically needed for new and novel technology applications**
  - Special conditions have the same authority as regulations
  - Applied to a specific aircraft certification

# Are Regulations Ready for Wireless?

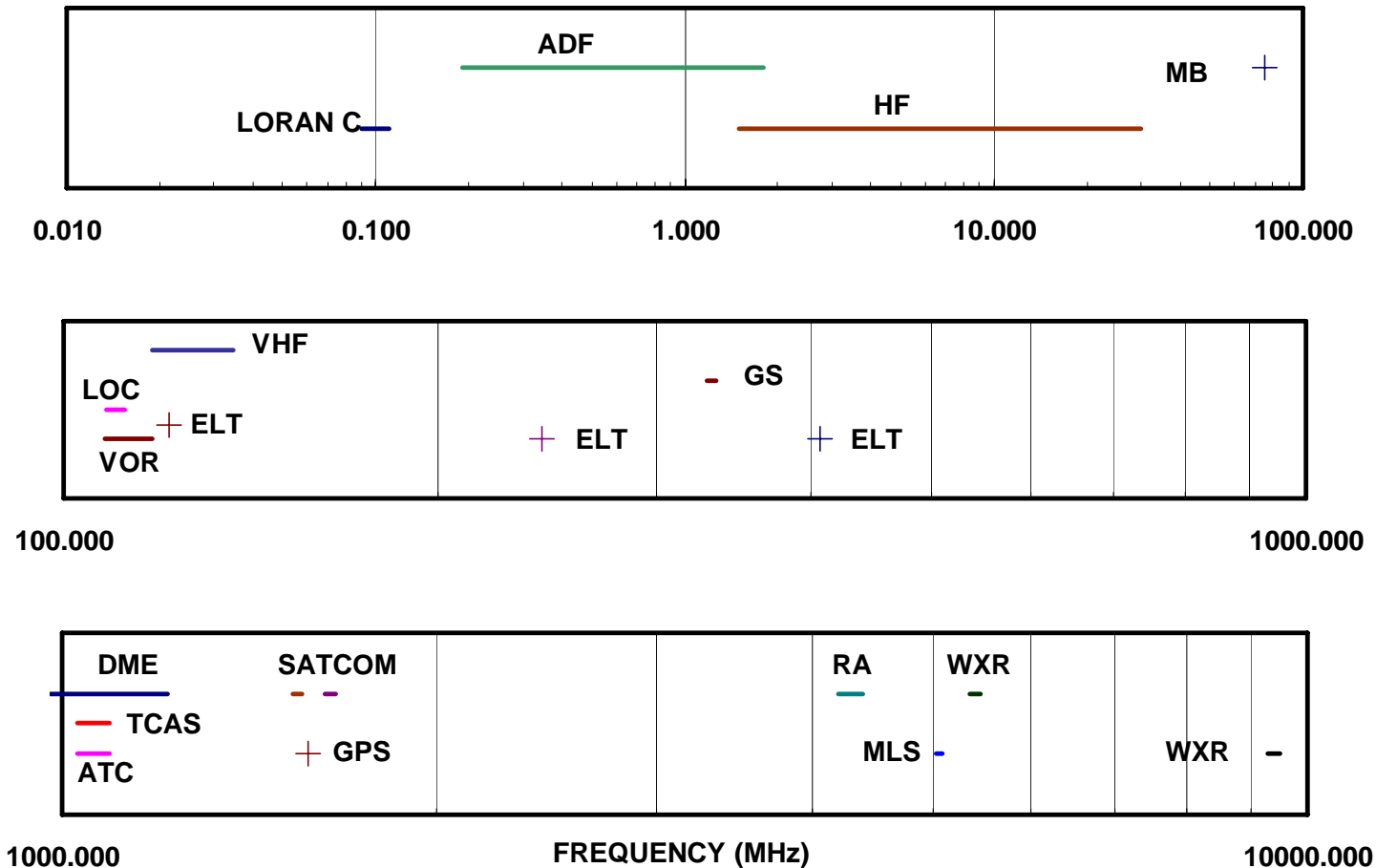
- **Many aircraft certification regulations are not technology-specific**
- **Example: 14 CFR 25.1309(b)(1)**
  - ... airplane systems and associated components, considered separately and in relation to other systems, must be designed so that the occurrence of any failure condition which would prevent the continued safe flight and landing of the airplane is extremely improbable ...
- **Expect special conditions for *fly by wireless* aircraft systems to address unique aspects of these systems**



# Aircraft Electromagnetic Compatibility

- **Existing RF protection requirements focus on:**
  - Aircraft radios with externally installed antennas
  - External high-power transmitters - high intensity radiated fields (HIRF)
- ***Fly by wireless* systems may have transmitters and receivers inside the aircraft as well as on external areas, such as engines**

# Aircraft Radio Systems



# Aircraft System RF Immunity

- Aircraft system RF immunity depends on system criticality
- Highest immunity – systems with *catastrophic* failure conditions (100 v/m +)
- Lower immunity – systems with *hazardous* or *major* failure conditions (5 to 20 v/m)
- No immunity requirements – systems with *minor* or no safety impact

# EMC Impacts of *Fly By Wireless* Systems

- **The certification applicant must show electromagnetic compatibility (EMC)**
  - Demonstrate *fly by wireless* system transmitters do not affect other aircraft systems
  - Demonstrate that existing airplane radio transmitters do not interfere with *fly by wireless* radio systems
- **Need to consider effects of portable electronic devices carried by passengers and crewmembers**

# Wireless System Coexistence

- **No worldwide spectrum allocated specifically for *fly by wireless* systems**
- **Unlicensed spectrum is shared, in US and other countries**
- **If unlicensed spectrum is used for *fly by wireless* systems, they must coexist with other less critical systems**
  - For example, WiFi and microwave ovens both use 2.45 GHz unlicensed band

# Wireless System Security

- **Wireless systems must address the same security issues as wired aircraft control systems and information services**
- **Must identify security threats and risk mitigation strategies**
- **Must consider threats to integrity and availability**
- **Existing FAA regulations and guidance do not explicitly address system security**
  - Typically require special conditions

# Aircraft Control and Information Security Considerations

- **Automatic and multi-layer protection**
- **Protect against:**
  - unauthorized modification
  - unauthorized deletion
  - unauthorized introduction of data
  - interference on aircraft data buses
  - denial or loss of service
  - gradual degradation of service
  - introduction of false or misleading data

# Other Security Considerations

- **Currently, FAA expects physical isolation between aircraft control networks and passenger entertainment networks**
- **Implementation of *fly by wireless* networks may make physical isolation challenging**
- **RF networks must address this isolation, particularly for systems that share spectrum**



# FAA Policy and Guidance

- **No general guidance on aircraft wireless systems**
- **Existing guidance addresses specific wireless systems, such as WiFi networks**
- **FAA prepares issue papers for certification of wireless RF networks for passenger and crewmember use, such as WiFi networks**
  - Particular concern with potential interference from the portable electronic devices

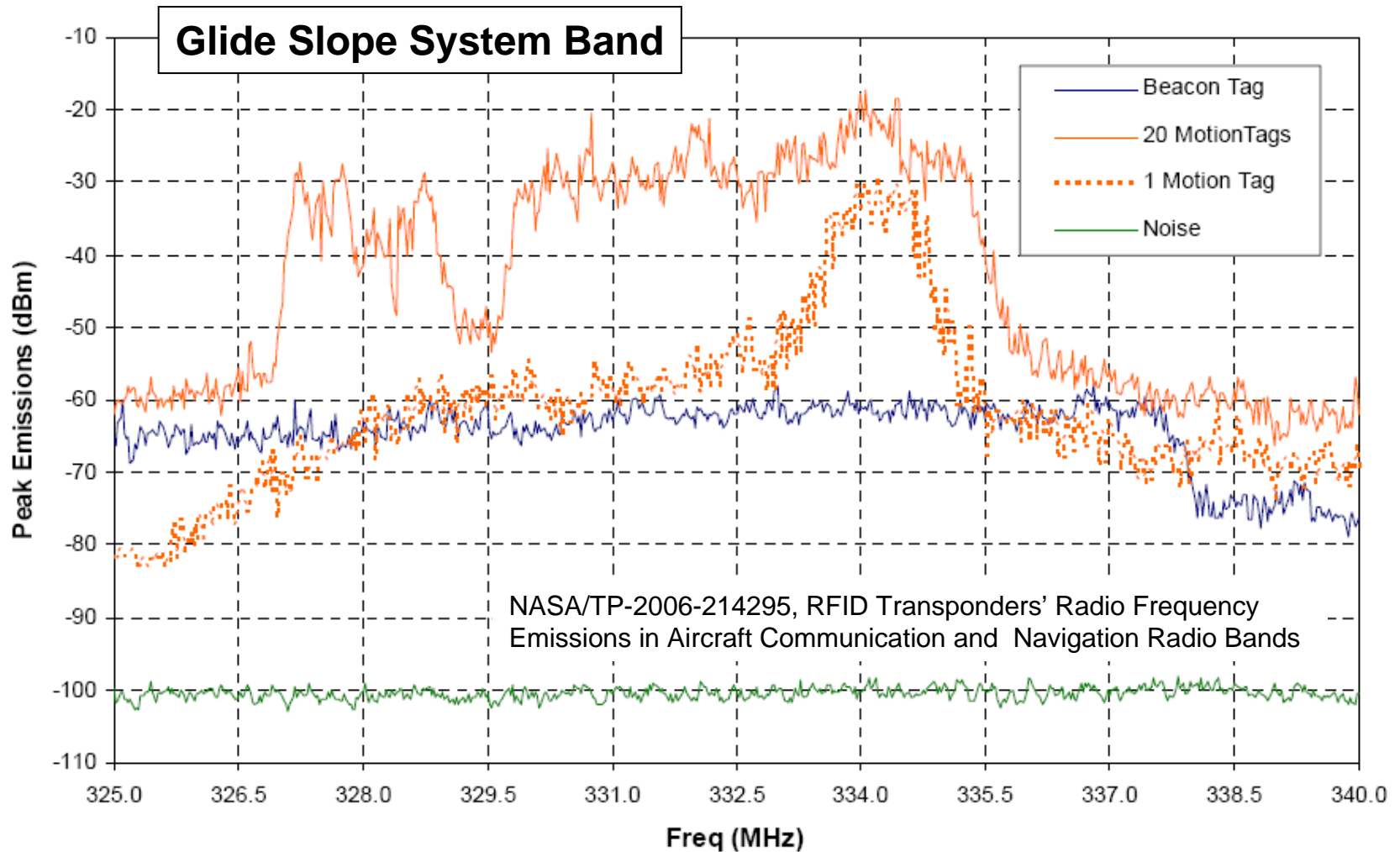
# RTCA SC-202 Portable Electronic Devices Committee

- **FAA is working with this committee**
- **Acceptance process for use of transmitting portable electronic devices on aircraft – RTCA/DO-294B**
- **Aircraft design and certification for portable electronic device tolerance – report due in July**
  - Draft report addresses aircraft tolerance to both transmitting and non-transmitting portable electronic devices

# RFID Tags

- **FAA policy letter accepts use of passive RFID tags on aircraft**
- **FAA advisory circular in work for active (battery powered) RFID tags**
  - Lee Nguyen, FAA AIR-130
- **FAA contributed funds to NASA research on EMI from active RFID tags**
  - NASA/TP-2006-214295, RFID Transponders' Radio Frequency Emissions in Aircraft Communication and Navigation Radio Bands

# RF Emissions from Active RFID Tag



# Additional FAA Resources

- **FAA Aircraft Certification Office (ACO) for your geographic area**

[http://www.faa.gov/aircraft/air\\_cert/locate\\_office/aco/](http://www.faa.gov/aircraft/air_cert/locate_office/aco/)

- **FAA Certification Directorates**

- Regulations, policy and standardization

[http://www.faa.gov/aircraft/air\\_cert/design\\_approvals/](http://www.faa.gov/aircraft/air_cert/design_approvals/)

- Small Airplanes, Kansas City, MO

- Transport Airplanes, Seattle, WA

- Rotorcraft, Ft. Worth, TX

- Engines and Propellers, Burlington, MA

# Wrap-Up

- **Addressed aircraft fly by wireless certification issues**
  - EMC
  - Security
  - Coexistence
- **FAA regulations and guidance**

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