Unlicensed Device Interference to the Terminal Doppler Weather Radar
December 2012

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Overview

- Background
- San Juan Interference Investigation
- Laboratory Measurements
- Field Measurements
- Conclusions from Measurement Efforts
- Interference Reports at Other Locations
- Recommendations to Resolve Interference

Background

1996 to 1998 - Federal Communications Commission (FCC) rulemaking proceeding to permit Unlicensed National Information Infrastructure (U-NII) devices to operate in the 5150-5250 MHz, 5250-5350 MHz, and 5725-5875 MHz bands used by federal radar systems.

2002 – United States proposal for the 2003 World Radio Conference to add a new allocation for a new mobile unlicensed service in the bands 5250-5350 MHz and 5475-5725 MHz requiring devices to employ Dynamic Frequency Selection (DFS) to protect radar systems.

2003 – FCC rulemaking proceeding to expand the frequency range for U-NII devices employing DFS.

2006 – U-NII devices employing DFS are commercially available.

2009 – NTIA gets reports from FAA the TDWR's are getting interference.

What is U-NII

- U-NII devices are devices authorized under the FCC Part 15 Rules and are used for a wide array of high data rate mobile and fixed systems:

  - laptop internet connections
  - local area networks (e.g., WiFi)
  - backhaul communications between buildings
  - Wireless Internet Service Providers (WISP)
  - off load traffic from broadband 3G and 4G networks

What is DFS

- DFS is mechanism that dynamically detects signals from other systems and avoids co-channel operation with these systems, notably radar systems.

- DFS parameters include:
  - detection threshold;
  - non-occupancy period;
  - channel availability check;
  - channel move time; and
  - channel closing time

- U-NII devices operating in the 5250-5350 MHz and 5470-5725 MHz bands must employ DFS.

U-NII Interference Problem

- In 2009 the Federal Aviation Administration reported that interference was being caused to Terminal Doppler Weather Radar (TDWR) systems operating in San Juan Puerto Rico.

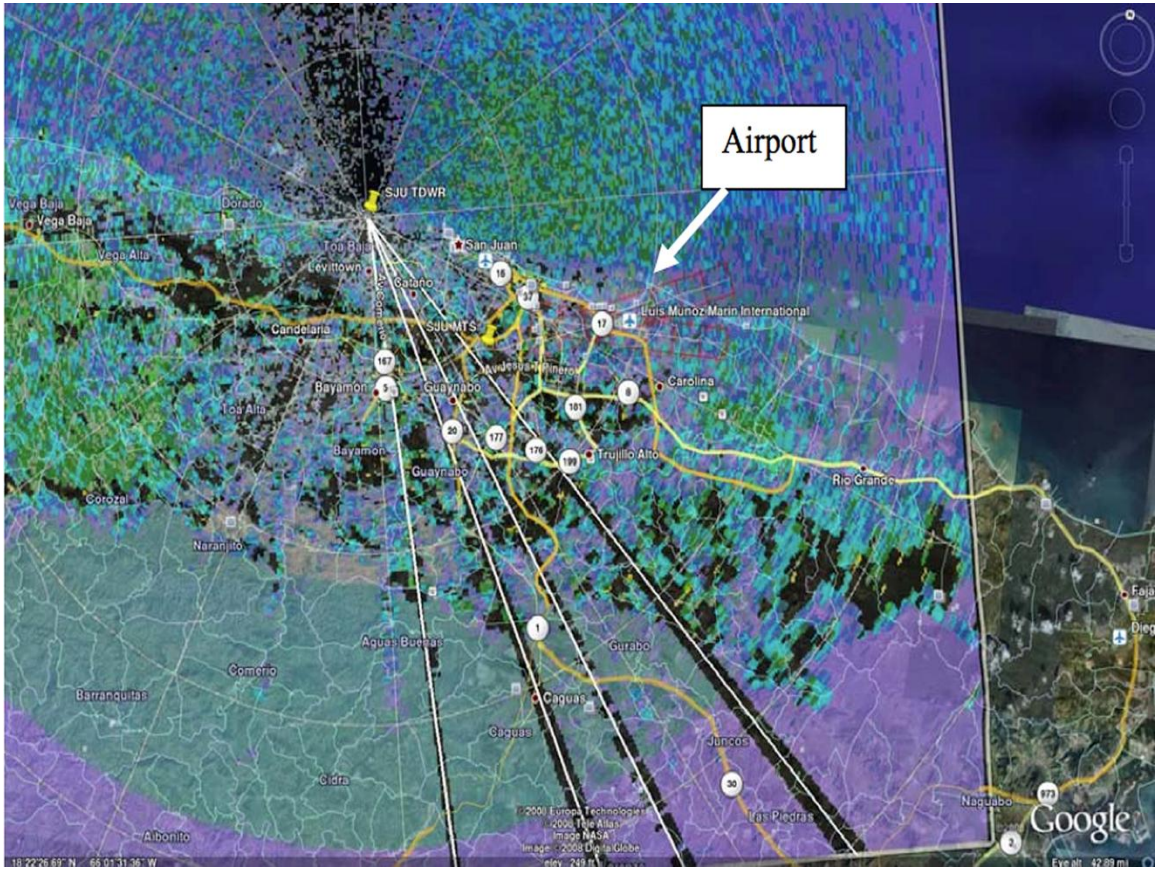
- Forty five TDWR systems are deployed across the United States operating in the 5600-5650 MHz band and used to provide microburst-warnings. TDWR data is used for general weather monitoring as well, combined with Nexrad systems.

- U-NII devices were suspected as the cause of the interference which was confirmed by NTIA field and laboratory measurements.

- Interference reports were received from other cities where TDWR systems are located.

U-NII Interference Problem

- The interference from U-NII devices causes strobes to appear on the TDWR Plan Position Indicator (PPI) display.



U-NII Interference Investigation

- The FAA, FCC, and NTIA worked together to investigate the U-NII interference to TDWR.

- Based on this investigation it was determined that the source of interference was from U-NII devices used for backhaul communication systems and deployed on buildings and towers. Indoor devices not found to be a problem or generate interference.

- The following U-NII interference cases were identified:
  - devices not certified by the FCC;
  - device and antenna combinations not certified by the FCC;
  - devices that could not detect radars;
  - devices where there was a user capability to disable DFS functionality; and
  - devices that were modified to operate outside of their authorized band.

• The FCC has levied fines against network operators in San Juan, Colorado, and other locations.

http://www.fcc.gov/encyclopedia/weather-radar-interference-enforcement

•The FCC has levied fines against U-NII manufacturers and WISP operators and continues to investigate cases of interference.

Solutions to U-NII Interference

- Short-Term

  - based on the field and laboratory measurements performed by NTIA distance and frequency separations were established to protect TDWR;
  - limit outdoor U-NII operations in the band 5600-5650 MHz.

- Long-Term

  - equipment certification measurement procedures need to be modified to add new test waveforms;
  - rulemaking proceeding is necessary to modify existing DFS rules;
  -Test devices off-the shelf for compliance to FCC rules (hardware and software);
  -Database of TDWR locations and frequencies for professional U-NII installers to access for frequency and spatial separation to ensure EMC.

DFS Related References

FCC References

- FCC 96-193, ET Docket No. 96-102: Unlicensed NII/SUPERNet Operations in the 5 GHz Frequency Range.

- FCC 97-5, ET Docket no. 96-102: Unlicensed NII Devices in the 5 GHz Frequency Range.

- FCC 98-121, ET Docket no. 96-102: Unlicensed NII Devices in the 5 GHz Frequency Range.

- FCC Code of Federal Regulations (CFR) Part 15 Devices.

ITU-R References and Activities

- International Telecommunication Union Radio-communication Sector, Dynamic frequency selection (DFS) in wireless access systems including radio local area networks for the purpose of protecting the radiodetermination service in the 5 GHz band, ITU-R Recommendation M.1652.

•ITU-R Joint Task Group (JTG) 5-7-8 is reviewing rules and studying other bands for unlicensed applications for the Word Radio Conference (WRC) to be held in 2015. Possibly 5350-5475 MHz. 1st Meeting concluded in November, next one scheduled for July 2013 in Geneva, Switzerland.

NTIA Published reports

- NTIA Report TR-06-444, Effects of Interference on Radar Receivers.
http://www.its.bldrdoc.gov/publications/2481.aspx

- NTIA Report TR-11-473 Case Study: Investigation of Interference into 5 GHz Weather Radars from Unlicensed National Information Infrastructure Devices, Part I.
http://www.its.bldrdoc.gov/publications/2548.aspx

- NTIA Report TR-11-479 Case Study: Investigation of Interference into 5 GHz Weather Radars from Unlicensed National Information Infrastructure Devices, Part II.
http://www.its.bldrdoc.gov/publications/2554.aspx

- NTIA Report TR-12-486 Case Study: Investigation of Interference into 5 GHz Weather Radars from Unlicensed National Information Infrastructure Devices, Part III.
http://www.its.bldrdoc.gov/publications/2677.aspx

- NTIA Report TR-12-287 The Rabbit Ears Pulse-Envelope Phenomenon in Off-Fundamental Detection of Pulsed Signals.
http://www.its.bldrdoc.gov/publications/2678.aspx

QUESTIONS????