Wideband HF Waveform Development at Rockwell Collins

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Rockwell Collins

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Topics

- Background
- Wideband HF Workshop
- Waveform Development Activities
- Preliminary Test Results
- Issues to Resolve
- Way Forward

Background

- STANAG 4539 and MIL-STD-188-110B maximum data rate is 9600 bps in 3 kHz channel or 19.2 kbps in 2ISB
- Users are demanding higher data rates over HF (to mitigate satellite denied environment)
- Wider contiguous HF channel bandwidths allow using “wasted” ISB channel guard bands
  - 2ISB uses 6 kHz & has one guard BW
  - 4ISB uses 12 kHz & has three guard BW
- Better Peak-to-Average Transmit Power with single tone in wide band width vs. in each channel of 2ISB or 4ISB

Wideband HF Workshop

- Hosted by New Mexico State University Aug. 5, 2009
- Rockwell Collins and Harris Participated
- Put Together Preliminary Waveform Structure and Parameter Definitions
  - Bandwidths: 3, 6, 9, & 12 kHz (Mandatory); 15, 18, 21, & 24 kHz (Optional)
  - Modulation: USB Only; Single Tone with subcarrier located at Fc + 300 + (n/2*3,000) Hz. Where Fc=suppressed carrier frequency & N=1, 2, 3, 4, ……)
  - Single Tone Modulations: Walsh, GMSK, PSK, & QAM
  - Operational Modes: Broadcast & ARQ
  - Other Parameters Defined: Code Rates, Data Block Sizes, Interleavers, and Constraint Lengths

Waveform Development Activities

- Refine Waveform Definitions
- Prototype the Waveforms
- Conduct Lab Bench Testing
- Conduct On-the-Air Testing (beginning October 2009)
  - Three Rockwell Collins HF Stations:
    - Oxford Junction, Iowa to Dallas, Texas; Sky Wave at 1,120 km
    - Oxford Junction, Iowa to Cedar Rapids, Iowa; Surface Wave at 64 km
  - 1kW HF Transmitters and Broadband Vertical Antennas
  - Application for Experimental License:
    - 12 kHz Bandwidth
    - 30 Frequencies
    - 3 to 15 MHz
  - 2nd order transmit & receive diversity combining trials (skywave between Cedar Rapids & Dallas)
  - Spatial and frequency diversity trials to be conducted

Preliminary Test Results

- Nothing available at this time
- Laboratory tests beginning “as we speak”

Some Issues Yet to Resolve

- HF Channel Simulator for 12 to 24 kHz Bandwidths – Is the Watterson Model Still Valid?
- ALE for Data over WB HF – How do we know the entire bandwidth is useable?
- Auto-Baud + Auto-Bandwidth Features ?
- WB Data Issues Unique to Aircraft HF Systems:
  - High Q Antenna/coupler limit bandwidth at low HF
  - Antenna/coupler tune bandwidth not symmetrical with data bandwidth

Way Forward

- Testing; Sept – Dec 2009
- Present Test Results at HFIA – Feb 2010
- Interoperability Testing (RCI & Harris) – Feb/Mar 2010
- New Appendix to MIL-STD-188-110C Draft to TAC – Feb 2010
- MIL-STD-188-110C Draft Ready for DoD Approval – Aug 2010