Spectrum Efficient Antenna Research

Technology Integration Project

"SPEARTIP"

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Disclosure

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Overview

- Background
- Describe effort
- Describe research
- Challenges
- Benefits

SPEARTIP Background

- The tip of the "SPEAR" - an informal label for military personnel actively engaged in battle operations
  - the "front line" troops putting "steel on target"
- SPEARTIP – SPectrum Efficient Antenna Research Technology Integration Project
  - Antennas actively putting "bits on target" while simultaneously improving spectrum use
- Communications antennas today are largely passive – often compromised to conform to packaging ….
- SPEARTIP uses active antennas for improved efficiency
  - ***omni antennas waste power and cause interference***

Description of SPEARTIP

- 1. Bio Safety - able to direct RF away from users
- 2. Eco conscious - less power emitted – improves battery life or allows smaller battery
- 3. Spectral efficiency – lower power emitted allows greater opportunity to reuse spectrum in given area
- 4. Interference reduction – not emitting toward unintended receivers - reduces interference to others
- 5. LPI/LPD - reduce energy heard by a intercept receiver… or even detected
- 6. Network redundancy - mesh/network node down, steer beam away from failed or stressed node

Description of SPEARTIP

- 7. Improve data throughput - cross-polarized signals to increase spectral efficiency/BW
- 8. Fix the altitude problem – Satellite/DACA platforms "see" too much ground area, steer and limit beam area to just cover the useful spot
- 9. More efficient coupling of antenna to radio - antenna can be "tuned" to environment – more RF energy out
- 10. Wider coverage antenna - antenna can be "tuned" to better match the frequency being used – multiband
- 11. Coverage – directing energy to needed direction can allow greater coverage from given location

Describe Research

- Not just phased array of antenna elements - also using reactive elements and arrays of reactive elements.
  - Research reactive elements for UHF and SHF
  - Benefit of beam steering and polarization control
- Need for standards
  - Antenna control parameters - radio queries what antenna can do - antenna tells radio it's capabilities – radio has "cognition" to best use what it's given
  - Like DSA, SPEARTIP requires two radios to coordinate efforts – like DSA, what is the "meeting point" (rural, public safety, ad-hoc, mobile, tactical – to form a network where no network existed before)

SPEARTIP Challenges

- Form factor and size of arrays of antennas and "re"active elements
  - Tower and vehicle not too bad - handheld device a problem
- Location awareness needed for many of the benefits
  - problem of GPS position indoor
  - problem of both ends of link communicating position to each other (pilot link – beacon – other?)
- Standards development needed; otherwise connectors, control message format, signaling format, power delivery – all become proprietary

(Potential) Benefits

- Less interference
- Spectral efficiency (reuse) improvement
- Improved battery life (or smaller batteries)
- Higher data throughput
- Better coverage
- Improved network reliability
- LPI/LPD

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