Attachment for STA application.

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The table and verbiage below is a technical summary of what is being requested from the FCC in support of the NIJ funded Technology Research demonstration. Authorization to operate in support of demonstration is requested for March 16th & March 17th, inclusive.

The demonstration site will be limited to an interior conference room, located within the main FCC building, on 12th Street SW, in Washington DC. Room use coordinated, via NIJ & NTIA, through *Susan K. McLean* Outreach Coordinator, Federal Communications Commission Public Safety & Homeland Security Bureau.

Location:
The Federal Communications Commission
445 12th Street SW Washington
Washington, DC 20554
Site coordinates: 38.883417 N, 77.028397 W

Table 1. Summary: NIJ PI Demonstrations

Demo/ PI's	RF Bands	RF Equipment	RF Power	RF Emission	Notes:
UCI/USU Drs. Ahmed Eltawil (UCI) & Bedri Cetiner (USU)	5.15-5.25GHz (U-NII-1)	WARP SDR Develop. Board, all bands	18dBm, adjustable USU antenna gain of 8dBi nets ~ 26dBm maximum	(See Table 27909, below)	PI website: http://newport.eecs.uci.edu/~aeltawil/Publications.html Equipment specific information: http://warp.rice.edu/ http://mangocomm.com/products/boards/warp-radio-board-v1
Stevens Dr. R. Chandramouli (Mouli)	2.4GHz GHz, Wi-Fi bands 5 GHz, Wi-Fi band 4.9GHz, Part 90	Ettus Research xcvr2450 (USRP daughter board) COTS Wi-Fi RF boards (unmodified, Part 15 Certified) Ubiquiti SR4C COTS 4.9GHz PCI card	100mW (20dBm), adjustable Per Mfg. type acceptance Per Mfg. type acceptance	OFDM, per 802.11a,b,g specifications OFDM, per 802.11a,b,g specifications Proprietary 4.9GHz based on OFDM 802.11a with QPSK/16QAM/ 64QAM	PI website: http://www.ece.stevens-tech.edu/~mouli 2.4GHz daughterboard specific information: http://www.ettus.com/downloads/ettus_ds_USRP_TXRX_v5b.pdf COTS Wi-Fi RF boards (unmodified, Part 15 Certified) Equipment specific information: http://www.ubnt.com/sr4c
VA Tech Dr Charles Bostian	700 & 800MHz LMR band UHF FRS frequencies (channels 8-14) VHF Itinerant & business Frequencies	Ettus Research WRX (USRP daughter boards)	*WRX development boards* ***All frequencies :*** 100mW (20dBm) max, adjustable by 25dB	700MHz Low power Itinerant paired channels 9 & 969* 12.5KHz Channel: 8K10F1E 700MHz Low power Itinerant paired channels 11 & 971* 12.5KHz channel: 11K0F3E Standard FRS frequencies: 2K40F3E 151.625MHz 151.955MHz 12.5KHz channel: 8K10F1E	PI website: http://www.cognitiveradio.wireless.vt.edu/dokuwiki/doku.php?id=home http://www.wireless.vt.edu/ Equipment specific information: http://www.ettus.com/WBX
	700 & 800MHz LMR band	COTS EF Johnson 51SL ES & 5100 ES portable radios	EFJ 51SL & 5100 ES radios: 1W (+30dBm) ***w/10 dB atten. Inline*** net	700MHz Low power Itinerant paired channels 9 & 969* 12.5KHz Channel:	http://www.efjohnsontechnologies.com/products/portables/51SLes http://www.efjohnsontechnologies.com/products/portables/5100es

			EIRP ~ 100mW.	8K10F1E 700MHz Low power Itinerant paired channels 11 & 971* 12.5KHz channel: 11K0F3E	
	UHF Part 95, FRS band (channels 8-14)	COTS FRS equipment	500mw Max for COTS FRS radios	Standard FRS frequencies: 2K40F3E	*Simulate UHF Public Safety channel*
	151.625MHz (red dot) 151.955MHz (purple dot) VHF GMRS Frequency	COTS VHF Itinerant Business radios (e.g.,, Motorola RDV2020)	1W (+30dBm)	12.5KHz channel: 8K10F1E	*Simulate VHF Public Safety channel*

- **§ 90.531** (4) *Narrowband low power itinerant channels.* The following narrowband channels are designated for low power use for on-scene incident response purposes using mobiles and portables. These channels are licensed nationwide for itinerant operation. Transmitter power must not exceed 2 watts (ERP): Channels 9–12 paired with Channels 969– 972 and Channels 959–960 paired with Channels 1919–1920.

Table 2. UCI System parameters

Name	Value
No. of subcarriers	128
Cyclic prefix length	16
No. of sub-channels	3
Modulation	QPSK, 16-64 QAM
Coding	Conv. encoding
Viterbi decoder TB length	42
Maximum MS supported	3
Subcarrier allocation scheme	PUSC
No. antennas	2x2
MIMO encoding	OSTBC
Carrier frequency	2.4GHz/5.1GHz
Bandwidth	10MHz

University of California Irvine & Utah State University:

Dr. Eltawil & Dr Bedri will demonstrate NIJ supported (wireless data centric) research using SDR and Cognitive radio based OFDM, OFDMA technology, MIMO and reconfigurable MEMS antennas.

Authorization requested:

- UCI/USU needs authorization to transmit via prototype in 5 GHz Wi-Fi band.
- UCI/USU needs authorization to transmit via prototype in 4.9GHz PS band (if needed)

Demonstration overview:

- OFDM and OFDMA technology via reconfigurable SDR/CR waveforms on a development platform
- Spectrum in the 5.15-5.25 GHz (U-NII-1) band for the combined demonstration (considered analogous to the 4.9GHz Public Safety Band, but unlicensed).
- Potential use of 4.9GHz Public Safety Band for an alternate RF & data path
- OFDM feed between two nodes (e.g., single user and base)
- Reconfiguration of same SDR platform to use OFDMA between many nodes (e.g., many users, one base)
- Inclusion of MIMO technology to enhance performance.

- Simulate how USU prototype MEMS antenna technology will be incorporated into the UCI radio prototype
  - Cognitive engine and hooks between the UCI SDR prototype and the USU MEMS antenna
  - Demonstrate how beam steering *will* be incorporated
  - Demonstrate using four discrete antennas how beam steering, via *forthcoming* USU MEMS based prototype, is expected to enhance performance with a single electronically steered, MEMS based antenna.

Stevens Institute:

Dr. Chandramouli will demonstrate NIJ supported (wireless data centric) research prototype

Authorization requested:

- Stevens Institute needs authorization to transmit via prototype in 2.4 GHz Wi-Fi band.
- Stevens Institute needs authorization to operate COTS 4.9GHz radios
- Wi-Fi radios operate in unlicensed Part-15 spectrum. COTS end user radios do not require a license

Demonstration overview:

- Cognitive channel management & network bonding via a development platform
- Spectrum in the 5 GHz Wi-Fi band for one RF & data path (analogous to the 4.9GHz Public Safety Band, but unlicensed)
- Commercial wireless (e.g., 3G) data service for a second, parallel, data path (if 3G/4G service is available)
- Potential use of 4.9GHz Public Safety Band for an alternate RF & data path

- Stevens Spider CR/DSA technology
  - Improved throughput via channel bonding (need not be contiguous spectrum to be bonded)

- Channel bonding within one band (in-band spectrum) is done at layer 2.5
- The process of adding new paths in a different band is done in layer 3.5
- Prototype ISO layer 3.5 protocol inserted between TCP and IP in the standard IP stack for multiband channel bonding
- CR technology to find/use spectrum
  - Improved/surge capacity
  - Maintain capacity during changing band/path/propagation conditions
  - Multi-network diversity
  - Security enabled via path/route diversity, on a per IP packet basis

Virginia Tech:

Dr. Bostian plans on demonstrating NIJ supported (voice interoperability centric) research

Authorization requested:

- VA Tech needs authorization to transmit, via prototype, using noted frequencies.
- FRS radios operate in unlicensed UHF spectrum. COTS end user radios do not require a license.
- VA Tech needs authorization to operate 700MHz UHF radios using noted frequencies.
- VA Tech needs authorization to operate 150MHz business band radios using noted frequencies.

Demonstration overview:

- Land mobile radio channel waveform identification, configuration and interoperability via SDR & cognitive radio development platform
- Prototype covers all public safety (voice) bands between ~150MHz ~ 800MHz
- Over the air waveform recognition via RF sensing
- Prototype platform reconfiguration to proper/interoperable RF waveform
- Bridging of two incompatible/non-interoperable SDR based RF interfaces following CR sensing &SDR configuration

- VT prototype is based on:
  - Android based control & operator interface
  - TI “Beagle Board” for Digital Signal Processing (i.e., The NIJ Public Safety CR engine)
  - USRP1 based SDR & RF boards
    - Ettus Research WBX daughter RF boards (~ 50MHz ~ 2.2GHz)
    - 50-100mW (17-20dBm)
  - CR technology PSCR residing in the Beagle Board Is used for
    - Waveform identification (via scan & classify functionality)
    - SDR (USRP) control & configuration