



Wireless Networks

Institute for Telecommunication Sciences (ITS)



- Commercial air interface testing.
- Outdoor wireless LAN measurements and analysis.
- Experimental wireless LAN topologies.
- PCS interference modeling and analysis.
- Wireless packet performance measures.
- Channel usage measurements.

The Wireless Networks Research Center (WNRC) provides a centralized lab dedicated to the exploration of wireless networks and wireless network access technologies. In particular, the Center allows the Institute to focus on several areas, such as the RF/network interface. This work uses RF link characterization correlated with low-level network management protocols to develop PCS-to-PCS interference models, wireless network propagation models, non-cooperative wireless measurements and wireless network discovery.

RF/network interface measurement devices, such as the Tool for Outdoor Measurement (TOM) and the CDMA Air Interface Tester (CAIT) are used by the Institute to make detailed measurements of PCS and cellular networks. The TOM uses a series of PCS/cellular phones to extract low-level protocol messages, network management information and RF signal quality parameters. CAIT has the ability to perform provider independent PN offset scans and cdma2000 level 3 message logging.

The WNRC contains an experimental IEEE 802.11b Wireless LAN (WLAN). ITS has conducted a series of wireless Voice over IP (VoIP) tests utilizing this infrastructure. The WLAN resources include IP packet logging equipment that can be used in network measurements. The Center is also conducting experiments in autonomous and Ad Hoc networks.

The Center houses efforts in the area of inter-PCS interference, historically supporting the Telecommunications Industry Association (TIA) committee TR-46.2 (Mobile and Personal Communications 1800 - Network Interfaces) and more recently the Alliance for Telecommunications Industry Solutions (ATIS) subcommittee T1P1.2 (Wireless/Mobile Standards - Radio Aspects of GSM/3G and Beyond). ITS also has the capability to simulate PCS interference using a series of ITS developed interference models.

ITS recently added a code domain analyzer (CDA) measurement capability which will allow for the examination of CDMA Walsh Codes. The CDA operates in both the cellular and PCS frequency bands and can be used in fixed or mobile environments. The CDA allows for the collection of short and long term Walsh



PCS interference workstation.



CDMA and multi-technology drive test systems.

channel data for a particular base station sector. By examining base station channel occupancy over varying time frames a metric is determining the characteristics to gauge base station congestion. This requires a careful analysis of channel occupancy statistics. ITS is developing analysis tools that use this data and other data sets to locate areas of cellular congestion. The goal is to help identify network “hotspots” that may be vulnerable during periods of high volume use.

The CDA and other complementary measurement tools give ITS the ability to examine wireless networks from a multitude of perspectives. Analysis of sophisticated wireless networks requires multidimensional viewpoints since RF resources are managed dynamically by higher protocol level algorithms. The tools underdevelopment at ITS can access wireless networks from RF modulation to protocol messaging.

The National Telecommunications and Information Administration (NTIA) directly supports research within the Institute in this area via technical standards contributions. The Institute also recently completed a feasibility study detailing the use of VoIP technology within the Project 25 communications environment. This study was sponsored by the NTIA’s Office of Spectrum Management (OSM). Work at the Center has been instrumental in recent efforts for the National Communications System (NCS) in National Security and Emergency Preparedness (NS/EP) WLAN deployment. The most recent exercise of the Center’s resources concerns a U.S. Air Force project examining the vulnerabilities of PCS/cellular communications.



Close up of multi-technology drive test system.

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