RSMS-4 Development

Outputs

- Functional data acquisition and system control software.
- Integrated measurement system — including spectrum analyzers, digital oscilloscopes, vector signal analyzers, and signal detection devices.
- Fully operational RSMS 4th generation measurement vehicle.

The 4th generation Radio Spectrum Measurement System (RSMS-4) consists of state-of-the-art tools for making measurements to characterize spectrum occupancy, ensure equipment compliance, determine electromagnetic compatibility, and analyze interference problems. The development of RSMS-4 originated out of the need to upgrade to the latest technology used in RSMS operations. RSMS operations directly supports NTIA by providing critical measurement support for determining policies affecting both the public and private sectors. The following new capabilities have been added to the system.

SOFTWARE: The RSMS-4G software has an open-ended architecture that allows nearly unlimited expansion and flexible system configurations. Integral to this flexible architecture are instrument and measurement dynamic link libraries (DLLs).

DLLs have been developed on several key pieces of measurement equipment (including several spectrum analyzers, oscilloscopes, VSAs, modulation domain analyzers, and preselectors). These DLLs contain carefully defined command/query modules that interpret commands common to the different equipment categories. Also included is a Virtual Panel that provides a user friendly graphical interface for manually controlling the device from the computer. So as to standardize their use, each DLL, in turn, has a general instrument interface common to all measurement devices. These DLLs, when completed, provide access for rapid development of automated measurements.

DLLs have also been developed for several different automated measurement procedures. These "Measurement" DLLs also have a user friendly graphical interface for setting up and monitoring the progress of a measurement. Common to all "Measurement" DLLs is a carefully defined interface so that their use can be standardized. Three of these measurement routines were used extensively during the broadband-over-power-line measurements — a calibration procedure, a stepped frequency measurement, and an amplitude probability distribution (APD) measurement. A newly designed Land Mobile Radio (LMR) channel occupancy measurement was utilized during measurements in Washington, DC, this fall (see photo). In addition, a stepped frequency APD measurement has been developed, and an automated swept frequency measurement is in the works.

Features added to the software in FY 2004 include the system configuration module and the preselector manager. The system configuration module provides the user with an easy-to-use graphical interface for designating the configuration and making the control connections to the various instruments in the measurement system. Included is a device database where instrument and discrete device specifications are stored. The preselector manager integrates any and all preselectors in the system so that the measurements simply need to designate a frequency without knowledge of path characteristics.

HARDWARE: Several new pieces of equipment, all of which provide improvements and/or new capabilities, have been added to the already extensive inventory of measurement tools.

- Four spectrum analyzers with powerful digital signal processing capabilities that provide features never before possible in older models.
- Two vector signal analyzers (VSAs) that allow digitization with a bandwidth of 36 MHz, and a instantaneous dynamic range of 90 dB. Included is a suite of software capabilities that allow complex signal analysis and demodulation.
- Two VXI-based signal intercept and collection systems that allow digital acquisition when signals meet specified characteristics and can be used to trigger digitization and analysis by the VSAs. Also included are high speed digital signal processing chips that can be programmed using open-architecture software.
- Two quad input digital oscilloscopes with a front-end bandwidth of 500 MHz and maximum sampling rate of 4 GS/s. Also included are

Radio Spectrum Measurement System (RSMS) 4th generation vehicle performing Land Mobile Radio channel occupancy measurements in the Washington DC area. (photograph by B.L. Bedford).

special smart-triggering capabilities and segmented memory. The latter makes for efficient acquisition of pulsed signals with small duty cycles.

- One wide-bandwidth digital oscilloscope with a front-end bandwidth of 1 GHz and maximum sampling rate of 5 GS/s. This device has specialized peak and sample detection capabilities making it suitable for wide bandwidth acquisition and analysis — including pulsed signals.
- Three new custom-built preselectors that filter and amplify the desired signals. A new flexible configuration preselector was used extensively in recent land mobile radio channel occupancy measurements.

VEHICLE: The following added features in the new measurement vehicle make it possible to perform measurements efficiently and effectively.

- The enclosure has 60 dB effective shielding from all points, making this vehicle particularly suited for measurements in strong signal environments, as well as for noise measurements.
- Internet connections and routers are located throughout the enclosure. There are fiberoptic control lines, multiple power outlets, overhead cable racks, and 3 full instrument racks.
- There are both internet and shore power connections on the outside of the enclosure.
- Racks can be moved forward for rear access, locked into place, or removed entirely.
- There is plenty of counter space, storage space, and head room.
- The enclosure has three 10-meter masts — two in the rear and one in the front.
- There is easy enclosure entry, including retractable staircase with handrails.
- Extra brackets on the roof make it easy to mount antennas.
- The enclosure is powered by a 20 kWatt diesel generator capable of handling demands. for power from full equipment racks — plus air conditioning, and lighting.
- Both air conditioning and heating allow for enclosure temperature control in extreme weather conditions.
- The vehicle is powerful, easy-to-handle, and has sleeping space in the cab.

For more information, contact:
J. Randy Hoffman
(303) 497-3582
e-mail rhoffman@its.bldrdoc.gov