RSMS-4 Development

Outputs

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

The 4th generation Radio Spectrum Measurement System (RSMS-4) consists of state-of-the-art tools (vehicle, software and hardware) necessary 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 recognized need to upgrade to the latest technology used in RSMS operations. RSMS operations, in turn, directly supports NTIA by providing critical measurement support for determining policies affecting both the public and private sectors.

The new RSMS 4th generation measurement vehicle (photograph by W.A. Kissick).

VEHICLE

A new measurement vehicle makes it possible to perform measurements efficiently and effectively. The vehicle 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 (where noise originating inside the vehicle could contaminate the measurements). Internet connections and routers are located throughout the enclosure, along with fiber optic control lines, multiple power outlets, and overhead cable racks. Three full-height instrument racks are available, with ample counter space, storage space, and head room. The racks can be moved forward for rear access, locked into place, or removed entirely.

The vehicle is powerful, easy-to-handle, and has sleeping space in the cab. A 20-kilowatt diesel generator provides for all electrical power demand, including full heating and air conditioning for extreme climates. Internet and shore power connections on the outside of the enclosure allow easy hook-up to local facilities. There are three 10-meter telescoping masts — two in the rear and one in the front. Extra brackets on the roof make it easy to mount antennas. All of this is accessible through a wide rear door and retractable staircase with handrails.

HARDWARE

Much new measurement equipment has been added, which provides substantial improvements to the already extensive inventory of measurement tools. The heart of the measurement system is four new spectrum analyzers that have excellent RF characteristics and powerful new digital signal processing capabilities. Two new vector signal analyzers (VSAs) allow 14-bit digitization in a 36-MHz IF bandwidth, backed up with an extensive software suite to perform complex signal analysis and demodulation. Two new, stand-alone, VXI-based channel analyzers allow surveying the radio environment, as well as digital acquisition when signals meet specified characteristics. They can also be used to trigger analysis by the VSAs. Also included are high speed digital signal processing chips that can be programmed for advanced detection criteria using open-architecture software.

Two new quad-input digital oscilloscopes with a front-end bandwidth of 500 MHz and maximum sampling rate of 8 GS/s have special smart-triggering capabilities and segmented memory. The latter allows efficient acquisition of pulsed signals with small duty cycles. Another new digital oscilloscope with a front-end bandwidth of 1 GHz and maximum sampling rate of 5 GS/s has specialized peak and sample detection capabilities, making it suitable for wide bandwidth acquisition and analysis — including pulsed signals. Finally, two new preselectors have been designed and tested and are currently under construction. They will filter and amplify, improving system sensitivity and allowing operation in large-signal environments.

SOFTWARE

The RSMS-4G software has an open-ended architecture that allows nearly unlimited expansion in many possible directions. Integral to this flexible architecture are instrument and measurement dynamic link libraries (DLLs). DLLs have been developed for several key pieces of measurement equipment (including spectrum analyzers, oscilloscopes, and preselectors). These DLLs contain command/query modules that interpret standardized commands common to the different equipment categories and a Virtual Front Panel that provides a user-friendly graphical interface for “manually” controlling the device via the computer. These DLLs, when completed, will provide a basis for rapid development of automated measurements with a wide range of instruments.

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 (BPL) measurements: a calibration procedure, a stepped frequency measurement, and an APD measurement.

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