

Wireless Network Challenges for the Smart Grid

With demand for energy consumption projected to increase by 49 percent from 2007 to 2035¹, the utility industry is looking for ways to improve the efficiency, predictability and reliability of their networks. Over the past several years, the concept of a “smart grid” has been developed as a means to service those energy requirements as well as to lay the foundation for future growth. Smart grid technologies include the deployment of new measurement and communications equipment to enable real-time monitoring and deployment of energy throughout the grid.

An important innovation with smart grid technology is the development of two-way communications between the consumer and utility company. Users will be able to monitor not only their energy usage, but also the price of that energy based on time of day and overall system demand. For the first time, consumers will become active participants in the energy distribution process. For the utility company, costly outages can be averted during peak demand by reducing supply for select customers with pre-arranged agreements that trade participation with favorable pricing discounts.

A big challenge for utilities will be the development of these two-way communication systems that can support a large range of applications and requirements. See Figure 1 below for an illustration. All wireless connections are shown with dashed lines.

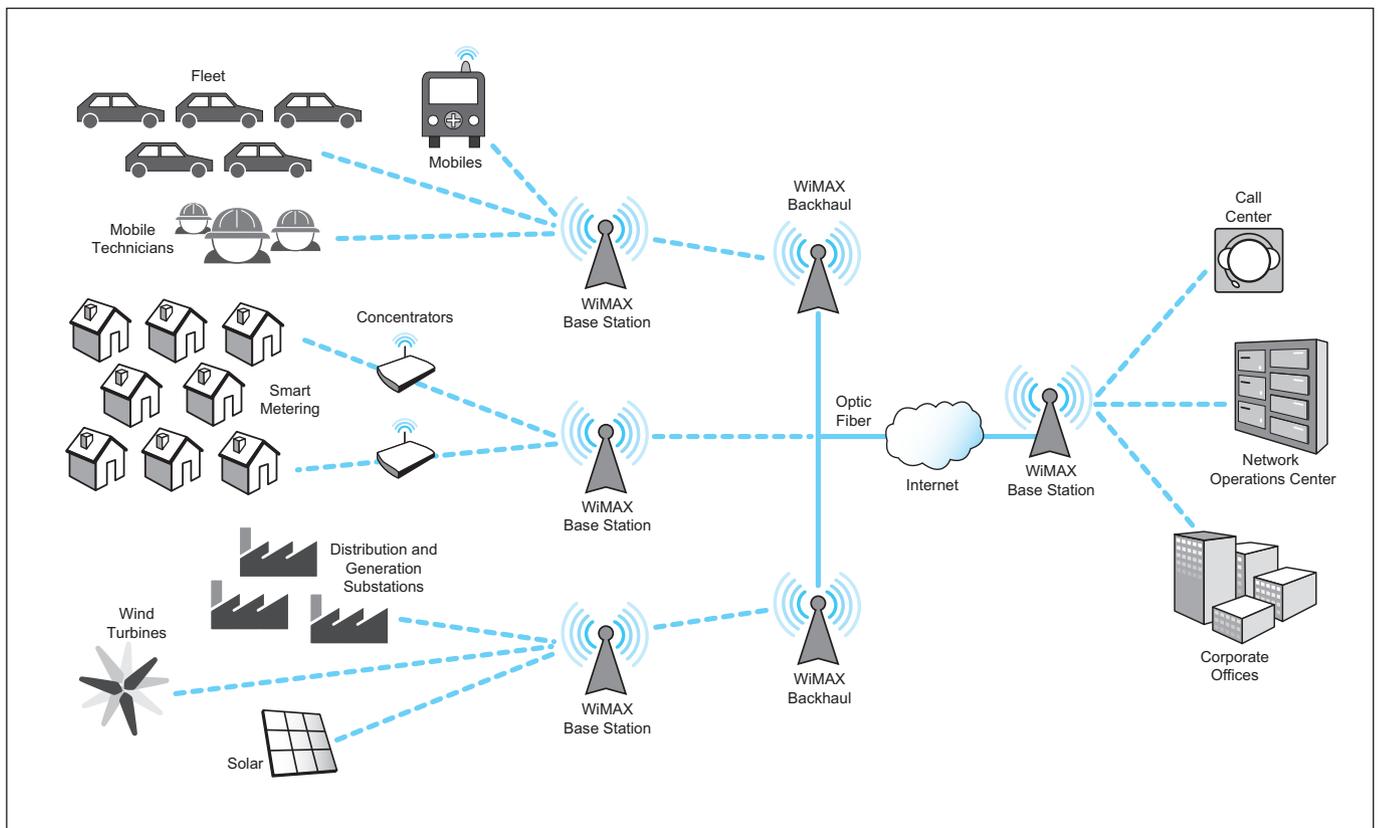


Figure 1. Smart grid connectivity supported by WiMAX

¹ U.S. Energy Information Administration (Outlook 2010), www.eia.doe.gov

The smart grid system consists of several basic networks.

- 1) Home area network (HAN) – which covers the communications between a building’s interior and a smart meter
- 2) Field area network (FAN) – covers communication between the user’s smart meter and a concentrator (or aggregator)
- 3) Wide area network (WAN) – a high bandwidth backhaul communication link between the concentrator and the utility

Although there is no standard set on the types of wireless technologies used in each coverage area, a typical setup might include the use of WiFi or Zigbee for the HAN, WiMax for the Field Area Network and Cellular, Satellite or WiMax for the backhaul. For each of these wireless segments, it is important to insure robust signal coverage as well as to avoid potential sources of interference.

The ability to analyze signal integrity in a wireless environment has long been realized by cellular carriers, satellite companies and other network providers as a crucial element in deploying and maintaining a secure system. As utilities deploy the smart grid with various wireless technologies, the need to access signal coverage and sources of interference will grow exponentially. Similar to cellphone carriers, utilities need to be able to analyze communication problems quickly and insure that their wireless network continues to run under a variety of conditions.

Coverage Mapping and Interference Analysis for the Smart Grid

Over the past year, Anritsu has introduced several innovative measurement options designed to insure a secure and trouble-free wireless network. Available as options with Anritsu’s line of SpectrumMaster™, CellMaster™ and SiteMaster™ products., both Indoor/Outdoor Coverage Mapping and Interference Analysis tools provides the Smart Grid utility with powerful and sophisticated analysis capabilities directly suited to their networks.

Indoor/Outdoor Coverage Mapping

To plan and optimize wireless networks, utilities must identify the coverage their transmissions provide in a given geographical area. For indoor signal analysis in areas such as airports, train stations or office environments, coverage mapping allows the technician to easily identify coverage quality throughout any given facility. See Figure 2 showing a map of indoor coverage measurements.

As the user walks through the coverage area, taking signal strength measurements is as simple as walking through the facility with the analyzer. Measurements of signal quality are automatically acquired, stored and made available for later post-processing, visualization and analysis. The technician can also receive real-time updates of signal quality by viewing the analyzer screen at any time during the process. In this way, network planners can identify areas where additional transmitters or repeaters may be needed to insure good signal quality.

Outdoor coverage mapping (with the GPS option) enables the utility provider to optimize the network by identifying signal coverage in an outdoor environment. An example of Outdoor Coverage Mapping is shown here in Figure 3.

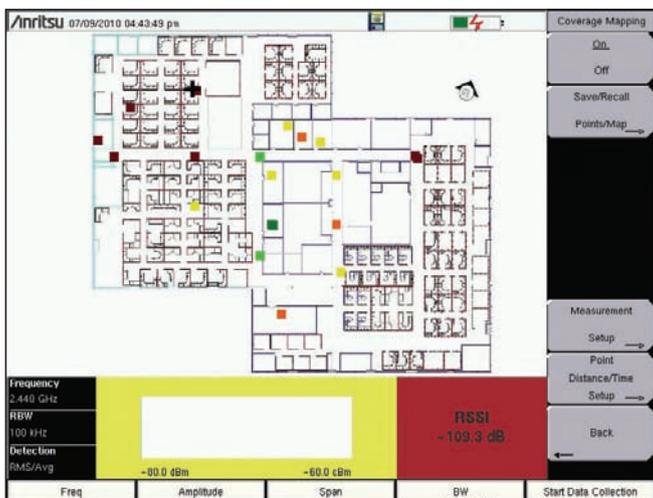


Figure 2. Indoor Coverage Map

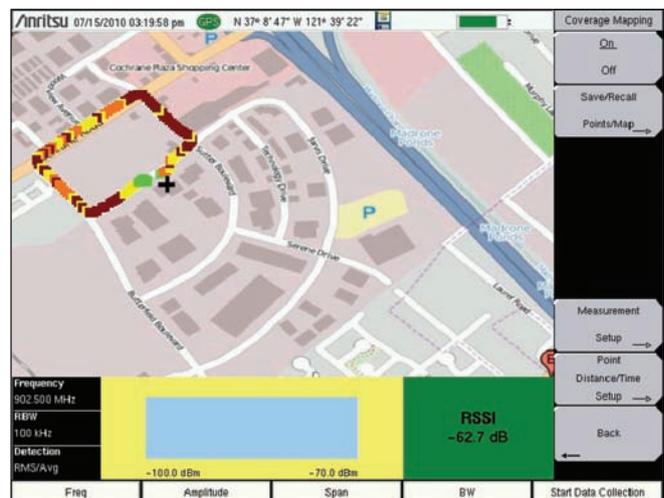


Figure 3. Outdoor Coverage Map

Assisted with GPS, areas of relative signal strength can be automatically measured and precisely correlated with location. The analyzer can be set up to take automated measurements either as a function of distance or time. For distance, the technician can simply turn the instrument on, set the distance intervals where measurements are to be taken, and drive within the coverage area. The GPS receiver automatically determines the distance moved, triggering new measurements. Data can be displayed later in a variety of formats, including third-party vendors such as GoogleEarth™ as shown in Figure 4.

Interference Analysis

Wireless communications systems must coexist in extremely complicated signal environments. This is particularly true at ISM frequencies, such as the popular 2.4GHz band used by technologies such as WLAN, Zigbee, and Bluetooth, which must all compete for limited frequency resources. Household items such as microwave ovens are also potential sources of interference. Additionally, interference can be generated by various cellphone frequencies, WiMax and other technologies. These environments are comprised of multiple wireless networks ranging from mobile communication services to specialized mobile radio and paging/broadcast systems.

Anritsu's Interference Analysis solution provides an easy to use automated system for identifying interfering signals, measuring their strength and locating the positions where the interferes are generated. The Interference Analyzer provides the following capabilities:

- Spectrogram
- Signal Strength
- Received Signal Strength Indicator (RSSI)
- Signal ID
- Interference Mapping

These features allow the technician to not only analyze potential sources of interference in a wireless network, but also to measure the interfering signal properties over a period of time. This capability is particularly important for identifying pulsed or intermittent signals whose presence vary as a function of time.

Innovative Testing and Measurement Solutions for the Smart Grid

As Smart Grid systems are deployed in an increasing crowded wireless environment, it is imperative that utilities have the tools necessary to plan their systems, rapidly diagnose problems and maintain the security of their wireless network. Typical measurement needs for the Smart Grid might include:

- Cable / antenna test of WiMax antennas positioned on towers
- Signal strength measurements and mapping of Wimax coverage
- Signal strength measurements and mapping of cellular data in areas of Smart Grid deployment
- Identification, measurement and location analysis for interference sources
- Zigbee or WLAN communication problem identification

The Anritsu line of handheld analyzers are designed to meet these smart grid measurement needs using innovative and user-friendly tools that save the utility time and money.

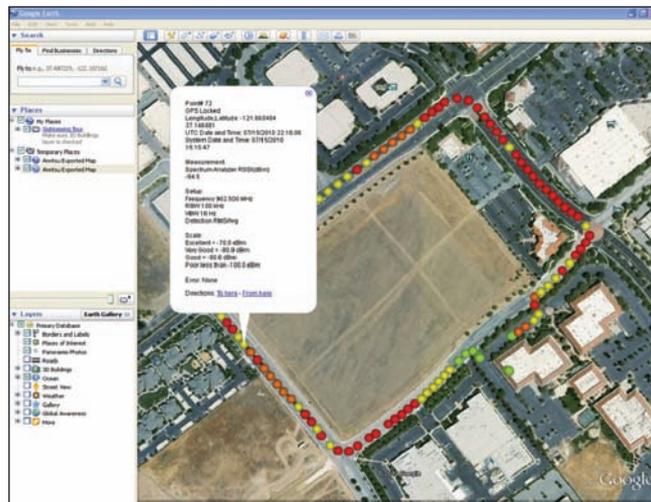


Figure 4: Outdoor Coverage Displayed on GoogleEarth™

Anritsu

Anritsu Corporation

5-1-1 Onna, Atsugi-shi, Kanagawa, 243-8555 Japan
Phone: +81-46-223-1111
Fax: +81-46-296-1238

• U.S.A.

Anritsu Company

1155 East Collins Boulevard, Suite 100,
Richardson, TX, 75081 U.S.A.
Toll Free: 1-800-ANRITSU (267-4878)
Phone: +1-972-644-1777
Fax: +1-972-671-1877

• Canada

Anritsu Electronics Ltd.

700 Silver Seven Road, Suite 120, Kanata,
Ontario K2V 1C3, Canada
Phone: +1-613-591-2003
Fax: +1-613-591-1006

• Brazil

Anritsu Eletrônica Ltda.

Praça Amadeu Amaral, 27 - 1 Andar
01327-010 - Bela Vista - São Paulo - SP - Brasil
Phone: +55-11-3283-2511
Fax: +55-11-3288-6940

• Mexico

Anritsu Company, S.A. de C.V.

Av. Ejército Nacional No. 579 Piso 9, Col. Granada
11520 México, D.F., México
Phone: +52-55-1101-2370
Fax: +52-55-5254-3147

• U.K.

Anritsu EMEA Ltd.

200 Capability Green, Luton, Bedfordshire LU1 3LU, U.K.
Phone: +44-1582-433280
Fax: +44-1582-731303

• France

Anritsu S.A.

12 Avenue du Québec,
Bâtiment Iris 1-Silic 638,
91140 VILLEBON SUR YVETTE, France
Phone: +33-1-60-92-15-50
Fax: +33-1-64-46-10-65

• Germany

Anritsu GmbH

Nemetschek Haus, Konrad-Zuse-Platz 1
81829 München, Germany
Phone: +49 (0) 89 442308-0
Fax: +49 (0) 89 442308-55

• Italy

Anritsu S.p.A.

Via Elio Vittorini, 129, 00144 Roma, Italy
Phone: +39-06-509-9711
Fax: +39-06-502-2425

• Sweden

Anritsu AB

Borgarfjordsgatan 13, 164 40 KISTA, Sweden
Phone: +46-8-534-707-00
Fax: +46-8-534-707-30

• Finland

Anritsu AB

Teknobulevardi 3-5, FI-01530 VANTAA, Finland
Phone: +358-20-741-8100
Fax: +358-20-741-8111

• Denmark

Anritsu A/S (for Service Assurance) Anritsu AB (for Test & Measurement)

Kirkebjerg Allé 90 DK-2605 Brøndby, Denmark
Phone: +45-7211-2200
Fax: +45-7211-2210

• Russia

Anritsu EMEA Ltd.

Representation Office in Russia

Tverskaya str. 16/2, bld. 1, 7th floor.
Russia, 125009, Moscow
Phone: +7-495-363-1694
Fax: +7-495-935-8962

• United Arab Emirates

Anritsu EMEA Ltd.

Dubai Liaison Office

P O Box 500413 - Dubai Internet City
Al Thuraya Building, Tower 1, Suite 701, 7th Floor
Dubai, United Arab Emirates
Phone: +971-4-3670352
Fax: +971-4-3688460

• Singapore

Anritsu Pte. Ltd.

60 Alexandra Terrace, #02-08, The Comtech (Lobby A)
Singapore 118502
Phone: +65-6282-2400
Fax: +65-6282-2533

• India

Anritsu Pte. Ltd.

India Branch Office

3rd Floor, Shri Lakshminarayan Niwas, #2726, 80 ft Road,
HAL 3rd Stage, Bangalore - 560 075, India
Phone: +91-80-4058-1300
Fax: +91-80-4058-1301

• P. R. China (Hong Kong)

Anritsu Company Ltd.

Units 4 & 5, 28th Floor, Greenfield Tower, Concordia Plaza,
No. 1 Science Museum Road, Tsim Sha Tsui East,
Kowloon, Hong Kong, P.R. China
Phone: +852-2301-4980
Fax: +852-2301-3545

• P. R. China (Beijing)

Anritsu Company Ltd. Beijing Representative Office

Room 2008, Beijing Fortune Building,
No. 5, Dong-San-Huan Bei Road,
Chao-Yang District, Beijing 100004, P.R. China
Phone: +86-10-6590-9230
Fax: +86-10-6590-9235

• Korea

Anritsu Corporation, Ltd.

8F Hyunjuk Bldg. 832-41, Yeoksam-Dong,
Kangnam-ku, Seoul, 135-080, Korea
Phone: +82-2-553-6603
Fax: +82-2-553-6604

• Australia

Anritsu Pty Ltd.

Unit 21/270 Ferntree Gully Road, Notting Hill
Victoria, 3168, Australia
Phone: +61-3-9558-8177
Fax: +61-3-9558-8255

• Taiwan

Anritsu Company Inc.

7F, No. 316, Sec. 1, Neihu Rd., Taipei 114, Taiwan
Phone: +886-2-8751-1816
Fax: +886-2-8751-1817

