WASHINGTON LABORATORIES, LTD

T&E Update

Testing • Engineering • Consulting

Issue 13

"Quickstart" Guide to Wireless Technologies

What's new in wireless? With expectations of one billion wireless users by 2004, the proliferations of technologies and standards, with their accompanying acronyms and terms, are somewhat boggling. The US industry alone is projected to reach $121 Big Ones by 2008.

This "Quickstart" provides an overview of some of the technologies being promulgated by designers and developers of the new communications technologies, along with some of the applications and technical comparisons of the various schemes.

The drive to get data anytime, anywhere has created a society of information junkies (checked your email lately?). We're gluttons for information and the feasting has just begun-so strap on your feedbag; here's some Alphabet Soup for you.

TALKING 'BOUT MY 3-GENERATION

WLL, WAP, I-Mode, GPRS, 802.11? What do these acronyms and have going for them?

Well, the overarching development of emerging services are generically referred to as "3G", which is an attempt to develop harmonized standards and protocols to push the operability and interconnectedness of wireless services to the next level.

First, here's a snapshot of where we are: Even while a number of us might admit to being in the X-Generation or Y-Generation (but certainly not this pre-mid-lifer), on the technology front we're also smack-dab in the middle of the 2G (or 2-1/2G or 2+G) Generation. Meanwhile, our friends in Japan are posed to come on line with "3G" technology soon.

1G: First Generation wireless includes analog cell phones that first came on the market circa 1992. The analog-based systems were susceptible to fading, noise and other interference, and offered limited phone and voice services.

With the opening of additional spectrum in the US-which was made possible by the very profitable rounds of spectrum auction by the FCC-more services were made possible.

2G: Second Generation technologies includes presently-used digital, voice data, and fax. Technologies are used for GSM, US-TDMA, CDMA, and PCS systems. Clearer reception (with decent coverage areas), additional features, and lower costs pushed the proliferation of cell phones to the masses.

Enhancements of digital services offering relatively high data rates have created the 2.5G (or G+) evolution, which has increased the data rates up to 384 kbits/second).

3G, or-what does it stand for? that's right-Third Generation, promises to increases the services beyond personal communications, with data rates in the 384kbits/second range for mobile and 2 Mbps for fixed applications. It will add multimedia applications and other services. 3G, also referred to as IMT-2000, expects to be widely implemented by 2005, with upwards of 40 million subscribers projected. Wireless Web surfing-already becoming more commonplace-will stretch to include full video communications. Real Dick Tracy stuff!

Currently, target/advertised data rates on personal wireless networks don't often exceed 9.6 kbit/sec. However, "actual mileage may vary", and in real-world use the data rates are a lot slower; especially in crowded areas, or when the network is "congested". Enhanced speed is expected in the 3G realm, with data rates increased by up to 200 times (around 2 Mbps) in the final implementation of the systems.

Hey Siberia, You've Got Mail! One of the important distinctions of 3G technologies will be global roaming (important for watching your portfolio during your next trip to Botswana.) To achieve this, the 3G scheme includes the addition of satellite radio communications.

What & Who? 3G communications technologies will be based principally on Wideband CDMA (Carrier Division Multiple Access). The partners in the harmonization of 3G standards include ETSI in the European Union; ARIB & TTC in Japan; ANSI in the United States, TTA in Korea; and CWTS in China.

WAP! POW! BANG! What I really meant was "Wireless Application Protocol," which is an initiative started by Unwired Planet, Motorola, Nokia, and Ericsson to develop a standard for wireless content delivery on the next generation of mobile communicators. WAP uses so-called WML, or Wireless Markup Language (similar to HTML) that is used to create Web pages. While having achieved a beachhead in Europe, WAP hasn't become a real force in the web-surfing world because of the limitations of the system. In its current form, WAP has some disadvantages when compared to the protocol known as I-Mode.

I-Mode is in favor in Japan, where users can send email, look at the weather forecast, look at sports results, play games, do online banking, online stock trading, purchase air tickets, download cartoons and images, look for restaurants, and look for new friends.

Comparing I-mode with WAP is not straightforward. In a sense, I-mode and WAP- based services are already in

continued on page 2

"Quickstart" continued from page 1

competition in Japan, and possibly world wide in the future. Both I-mode and WAP are complex systems, and it is really only possible to compare present implementations of these applications, because some aspects of the infrastructure and devices are still being developed.

One difference between the systems is that presently in Japan I-mode is implemented with a packet switched system, which is in principle "always on", while WAP systems in Europe are at present circuit-switched (i.e. dial-up). Another difference is that at present I-mode users pay on a "per bit" basis, and WAP customers pay for connection time.

SMS: Short message service (SMS) is a globally accepted wireless service that enables alphanumeric messages to be sent between mobile subscribers and external systems. Some examples include communications between electronic mail, paging, and voice-mail systems.

SMS is characterized by out-of-band packet delivery and low-bandwidth message transfer, which results in a highly efficient means for transmitting short bursts of data. As the technology and networks have evolved a variety of services have been introduced, including e-mail, fax, and paging integration, interactive banking, information services such as stock quotes, and integration with Internet-based applications.

The Other WLL. Another acronym (besides the ever-popular one for Washington Laboratories, Ltd.) being bandied about is Wireless Local Loop (WLL), which is the wireless implementation of subscriber loops to connect Public Switched Telephone Network (PSTN) End Office (EO) to Customer Premises Equipment (CPE), and also CPE to CPE. That means that once the phone company gets to your building, everything inside the building goes wireless. This also means that there are several technologies to take advantage of, particularly of the unlicensed variety. Which brings us to...

THE CROWDED 2.4GHz BAND(WAGON)

The next groups of technologies are similar in that they use the same unlicensed Industrial, Scientific and Medical (ISM) band. The potential for interference exists, not only from other wireless users, but from microwave ovens. Leakage from the magnetron inside an oven can easily bully the 98lb weakling signal from one of these unlicensed devices. However, it is my contention that the incidence of interference is likely to be low when you consider that-if your habits are similar to mine- the microwave is primarily used for 3 functions: warming yesterday's coffee, heating up pizza, and popping popcorn. Bearing in mind that those three items take, oh, eight minutes on a busy microwave day, I'd say that the potential may be low. However, your microwave usage might vary-and then there's the dern neighbors...

Anyway, the next three technologies make use of unlicensed operation in the 2.4 GHz frequency band under Part 15 of the FCC Rules. They also live in the band that has become (for the most part) opened on the international front for these types of uses.

HomeRF: A new standard that will provide data services, internet connectivity, entertainment, and telephony connection, principally focused on the home environment. File sharing, large file transfer, printing, and use of fixed resources can be performed without the use of external wiring. The peak data rates are intended to be up to 10 Mbps (with 20+Mbps envisioned), as well as "fallback" modes of 5, 1.6 and 0.8 Mbps for backwards compatibility. HomeRF uses constant envelope FSK modulation and Frequency Hopping Spread Spectrum (as does Bluetooth). The intent of this network is to provide robust, secure, and varied local connection in the Home environment and in small offices. Promoters include Motorola, Proxim, Compaq, Intel, National Semiconductor, and Siemens.

Bluetooth: The Bluetooth protocol also uses FHSS and is primarily for very short range (10m) communications at 1 Mbps data rates. The power output of the

THIRD GENERATION ("3G") WIRELESS

Key features of 3G systems are: commonality of design, compatibility of services, use of small terminals, worldwide roaming, access to Internet and other multimedia applications, and a wide range of services and terminals.

3G Wireless is also referred to as (IMT-2000), which is derived from the International Telecommunication Union (ITU) International Mobile Telecommunications 2000 initiative ("IMT-2000").

The following table summarizes the main features and capabilities of 3G systems:

3G SYSTEM CAPABILITIES

Capability to support circuit and packet data at high bit rates:

- 144 kilobits/second or higher in high mobility (vehicular) traffic
- 384 kilobits/second for pedestrian traffic
- 2 Megabits/second or higher for indoor traffic

INTEROPERABILITY AND ROAMING

Common billing/user profiles:

- Sharing of usage/rate information between service providers
- Standardized call detail recording
- Standardized user profiles

Capability to determine geographic position of mobiles and report it to both the network and the mobile terminal Support of multimedia services/capabilities:

- Fixed and variable rate bit traffic
- Bandwidth on demand
- Asymmetric data rates in the forward and reverse links
- Multimedia mail store and forward
- Broadband access up to 2 Megabits/second

"Quickstart" continued from page 2

device is typically 0 dBm (1 mW) for 10m range, but, when necessary, the range can be extended to 100m by boosting the output power to +20dBm (100 mW). The Bluetooth protocol builds so-called "pico-nets" with other Bluetooth devices, with the connection of multiple devices. The push on the Bluetooth front is to achieve very low costs; it is essential for the cost of the encoding, modulating, and transmitter and receiver circuitry be as low as possible to help achieve the "critical mass" of Bluetooth products availability.

For a more in-depth Bluetooth overview, see T & E Update Issue 11, October 2000.

IEEE802.11: The last member of the 2.4GHz group that we'll look at is warmly known as IEEE802.11. Its *raison d'etre* is to provide robust high-speed wireless connectivity. Similar to HomeRF in objective, 802.11 is primarily intended to be used for professional networks, extending beyond the local network into WAN-sized nets and data rates that are currently at 11 Mbps (increasing to over 50 Mbps in the future).

And all of this might be re-configurable on the fly. Consider "Software Defined Radios" that can be reprogrammed to function in a different "space" simply by downloading new code that will re-program the use, function, modulation, and spectral usage.

Summary: Keeping up with the array of terms and technologies can sometimes be a challenge. As soon as a new service comes on line it is challenged and eclipsed by a competing technology. What is certain is that in some way we will be connected in more ways than we can ever imagine.

On October 13, 2000, the President of the United States executed a memorandum that articulated the need to select radio frequency spectrum to satisfy the U.S.'s future needs for mobile voice, high-speed data, and Internet-accessible wireless capability. The Presidential Memorandum established for the guiding principles of the Executive Agencies to be used in selecting spectrum that could be made available for 3G wireless systems, and strongly encouraged independent federal agencies to follow the same principles in any actions they take related to the development of 3G systems.

Noting the joint spectrum management responsibilities of the Executive Branch and the Federal Communications Commission the Presidential Memorandum directed the Secretary of Commerce to work cooperatively with the FCC as follows: (1) to develop a plan to select spectrum for third generation wireless systems by October 20, 2000; and (2) to issue by November 15, 2000 an interim report on the current spectrum uses and potential for reallocation or sharing of the bands identified at the 2000 World Radiocommunication Conference that could be used for 3G systems. These actions were taken to enable the FCC to identify spectrum for 3G systems by July 2001 and auction licenses by September 30, 2002.

In accordance with the Presidential Memorandum, the Department of Commerce released a Plan to Select Spectrum for Third Generation (3G) Wireless Systems in the United States' (Study Plan) on October 20, 2000. The Study Plan noted that although various frequency bands have been identified for possible 3G use, the FCC and the National Telecommunications and Information Administration (NTIA) needed to undertake studies of the 2500-2690 MHz and the1755-1850 MHz frequency bands in order to provide a full understanding of all the spectrum options available. The Study Plan called for the FCC to complete an Interim Report on the 2500-2690 MHz band and for NTIA to complete an Interim Report on the 1755-1850 MHz band by November 15, 2000.

PRACTICAL ASPECTS OF GLOBAL EMC COMPLIANCE TESTING

Sponsored by HV Technologies

May 31, 2001
Hilton Alexandria Old Town
Alexandria, Virginia

This practical hands-on workshop is an excellent learning opportunity for those who wish to get up-to-speed or stay up-to-speed on current EMC test requirements and techniques.

PRESENTATIONS INCLUDE:

- Overview IEC/EN 61000-4XX series of transient immunity standards.
- Methodology comparison of Radiated Emissions testing using Spectrum Analyzer vs. EMI Receiver
- Challenges and requirements of CE marking in the year 2001
- Harmonics and Flicker measurements in accordance with IEC/EN 61000 3-2/3
- Use of a Click analyzer for CE compliance

GUEST SPEAKERS INCLUDE:

Andrea Lupo, El. Eng.
EMI Product Specialist
AFJ International EMC & Safety
Milano, Italy

Martin Lutz, El. Eng.
Managing Director
EMC- Partner AG
Laufen, Switzerland

Christopher Faust, BSEE
Manager, EMC Division
HV Technolgies, Inc.
Manassas, VA, USA

Greg Snyder. P.E.
Chief EMC Engineer
Washington Laboratories, Ltd.
Gaithersburg, MD, USA

HANDS-ON DEMONSTRATIONS

Product and testing demonstrations with the following equipment and software:

- Transient Immunity Tester
- EMI Receiver
- Harmonics & Flicker Measuring System
- Click Analyzer

Tuition is $95 and includes workshop materials, binder and lunch!

To register, call:

HV Technologies, Inc.
703/365-2330

What's Up with Flicker & Harmonics?

We still get questions regarding the status of Flicker and Harmonics requirements for equipment bound to the European market. Here is the scoop on the requirements, reduced to a tasty morsel.

Harmonics:

Equipment that is rated less than 16 Amperes per phase must comply with EN61000-3-2 as of January 1, 2001. Equipment that is rated greater than 16 Amps per phase has draft, unpublished requirements (EN61000-3-12) with no fixed time frame–yet.

A summary of the timeframes and standards is shown below.

STANDARD	MANDATORY DATE
EN61000-3-2:1995 Electromagnetic compatibility (EMC)– Part 3-2: Limits–Limits for harmonic current emissions (equipment input current up to and including 16A per phase) (including Amendments A1:1998 & A2:1998)	1/1/2001
EN61000-3-2:1995* Amendment A14: 2000	1/1/2004

*Amendment 14 removes the Class D Waveshape limits for all equipment except Personal Computers, TV Receivers and Computer Monitors. All other equipment must comply with the less stringent Class A Waveshape. This can be used immediately for qualifying equipment.

Voltage Fluctuations (Flicker):

Equipment that is rated less than 16 Amps per phase must comply with flicker requirements as of January 1, 2001.

Equipment that is rated greater than 16 Amps per phase must comply with flicker requirements as of November 11, 2003.

A summary of the timeframes and standards is shown below.

STANDARD	MANDATORY DATE
EN61000-3-3:1995 Electromagnetic compatibility (EMC)– Part 3-3: Limits– Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current up to 16A	1/1/2001

STANDARD	MANDATORY DATE
EN61000-3-11:2000 Electromagnetic compatibility (EMC)– Part 3-11: Limits– Limitation of voltage fluctuations and flicker in low-voltage supply systems–Equipment with rated current ≤75A and subject to conditional connection.	1/11/2003

At the recent Washington Labs Workshop, Bill Hurst with the FCC provided an update on the latest Bluetooth rules and regulations. His presentation was followed by practical demonstrations on designing to avoid EMC problems. Over 60 engineering professionals attended this workshop – our largest ever! The next workshops will be held May 18 at the Gaithersburg location and June 15 at the Frederick lab.

2001 Testing Workshop Series

Washington Labs has set its Free Workshop Schedule for 2001. These popular seminar/practical workshops include demonstrations, guest speakers, the latest EMC and safety compliance news, and lunch!

MAY 18

JUNE 15*

AUGUST 24

NOVEMBER 9

EMC Testing and Measurements

Designing to Avoid EMC Problems Down the Road

Our engineers will discuss and demonstrate several testing techniques that uncover EMC flaws in electrical and electronic equipment– problems which can be avoided before the testing stage. You'll have the opportunity to "get specific" with the engineering staff on particular problems you may be encountering with current R&D designs. ***A special workshop on design and safety testing will be held at our Frederick location on June 15.**

Be sure to register early as positions fill up quickly.

Call Patty or Melissa at 301-417-0220 to register today.

* Frederick location

Employee Spotlight

OUR ITALIAN CONNECTION – MEET SANTO LAVORATA

Santo V. Lavorata is a Senior Compliance Engineer for Washington Laboratories. He is responsible for day-to-day EMC testing with on-site clients and is charged with ensuring that the highest quality standards are observed with each test.

Before joining the WLL team in 1999, Santo was EMC Test Manager with F2 Laboratory in Damascus, Maryland where he was responsible for all EMC Lab functions such as test plans and testing troubleshooting.

From 1995 to 1998, Santo worked for the Patton Electronics Company where he started as a Compliance Engineer and then moved up to Chief Compliance Engineer. There he was responsible for test and compliance management and securing new and existing products to the EMC, Safety and Telecommunications Regulatory Standards, both domestic and worldwide. Before Patton, Santo was with NSI Services, Inc. (Division of Management Technology, Inc.) from 1974 to 1995 where he was promoted to EMC Engineer III.

After earning an associates degree in Industrial Electrical Engineering from the Public Industrial Technical Institute, "Enrico Fermi" in Rome, Italy, Santo moved to the States. Then he attended Capitol College and earned a bachelors degree in Electronic Engineering Technology.

Santo is a member of the IEEE EMC Society and IEEE Microwave Society. He and his wife, Mary Jo, live in the Olney area. Santo is fluent in conversational and written Italian – just ask him something (if you can!) Starti bene!

Glad You Asked

Here are some of the most frequently asked questions that come our way when a new client utilizes our testing services.

Q: How does Washington Labs work with customers?

A: Washington Laboratories assigns a Project Coordinator to each of their clients. This person acts as the client advisor and representative. The Project Coordinator follows the client through the entire process; from the proposal to project initiation, to the follow-up after the project is fully complete. Throughout the process, our knowledgeable Engineers are always on hand and ready to answer the clients' technical questions and advise the client of the latest regulatory test standards as they relate to their product and the compliance needed for the products' intended markets. Technical oversight is provided by the Chief EMC Engineer, EMC Lab Manager or Safety Lab Manager, as appropriate.

Q: How are projects managed?

A: Each project is closely monitored by both the Lab Manager and the assigned Project Coordinator, to ensure that the project is accurately completed in a timely manner. Weekly staff meetings provide a forum for discussion of each project and it's particular needs. Furthermore, all projects are tracked by our custom project tracking program that allows for the entire history of each project and client to be individually tracked and completely documented.

Q: Are clients allowed to witness the testing?

A: Washington Labs welcomes all our clients, who wish to do so, to be present during the testing and work directly with our engineers. In this way we hope to educate our clientele on the processes that the test sample must go through in order to achieve compliance for it's intended market. Our staff works directly with the client to solve any test failures that may occur and offers real-time solutions to these failures. Our friendly staff also provides for a pleasant atmosphere during the testing and a satisfying lunch is always complimentary.

Of course, lots of our clientele are unable to accompany their product for geographical and other reasons. But they

continued on page 6

Glad continued from page 5

quickly learn from experience that they can feel confident that their project will be handled professionally and timely and that they will be kept informed on the status of their project from start to finish.

Q: How soon can we expect our test report?

A: Our competent staff of Documentation Specialists and Compliance Engineers work closely with our clients to obtain all the documentation and information necessary for the technical report. Our report generation team has established internal reviews and checks to ensure that the test report is both accurate and timely. The average turn around time is two to three weeks.

Q: How does the WLL staff stay current?

A: Our personnel all complete in-house training, appropriate to their positions and bi-monthly in-house training sessions are held to keep all staff updated. Furthermore, employees are regularly sent for additional training courses in specific areas of regulations, measurements, technical capabilities and management.

Q: How many years have your key management personnel been with the company?

A: The key management personnel of WL have an average of seven years service, with the newest member on board since 1998.

Q: Whom do you work with in Europe?

A: Washington Laboratories is a Conformity Assessment Body (CAB) so designated by the US National Institute of Standards and Technology (NIST). In addition our results are accepted by several Authorities in the EU (LCIE in France, Technology International and Radio Frequency Investigations in England, and TUV-Rheinland in Germany).

Q: What are your credentials for CE testing? For the United States?

A: For most of the efforts performed to support CE Marking Claims, it is necessary and sufficient to demonstrate compliance with the existing standards. We provide testing results to the standards to issue the CE Marking. In addition we are a UL-Certificated Agent which support UL testing under review. Our safety test data and processes for evaluation are recognized by two Nationally Recognized Testing Laboratories (NRTLs).

Q: What happens if a CE Marked product is challenged by a member of the European Union (EU)?

A: As a designated Conformity Assessment Body (CAB), we are authorized to make a final determination on certain types of CE Marking approvals (Technical Construction Files). In all cases, it is the manufacturer-or his designated agent-that makes the CE Declaration. If an approval is challenged, we will stand behind our work and would act to resolve the cause of the concern. Most likely, our engineers could resolve the issue with a technical discussion/clarification with the EU.

If we could not solve the EU's issue or we inappropriately judged a product, we would support corrective action and a new evaluation within the bounds of our terms and conditions. We employ a double technical review on all projects.

The evidence of our work - the Test Report - is prepared in a format which is generally acceptable to the most critical reviewers and is intended to reduce the likelihood of challenges in the field. All Test Reports are reviewed and counter-signed to further convey the quality of our work and the validity of the report's contents.

For more information contact Patty Sullivan at 1-800-839-1649.

Watch this spot for late-breaking Battlebot® updates!

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, MD 20879

Presort Standard
U.S. Postage
PAID
Permit No. 110
Frederick, MD
21701