WASHINGTON LABORATORIES, LTD

T&E Update

Testing • Engineering • Consulting

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The Buzz About Bluetooth®

What is the buzz about Bluetooth? First, let's ask who was Bluetooth? Poster child for Pepsodent? No, he was the Swedish Viking King "Harald Blatand" who ruled Norway, Sweden & Denmark around 1000 A.D. His Danish name, "Blatand", translates roughly to Bluetooth. He conquered various countries in Scandanavia and fostered networks of commerce and trade in those years.

In this millennium, Bluetooth has been developed, supported and promulgated by notables in the wireless industries, namely: Ericsson, IBM, Intel, Lucent, Nokia, 3COM, Microsoft and Motorola.

The objective is to build a network of low-power, wireless inter-communicating devices that can transmit both voice and data. This should provide an easier way for a variety of computing, mobile communications and other devices to communicate with one another without the need for cables. For lack of a better term, it may be described as a "wireless bus", where devices can communicate point-to-point or via point-to-multi-point. Each Bluetooth device can either be a Master or Slave and can poll and identify all the devices in range.

What's missing, so far, are enough devices to make a difference, but that is bound to change, as witnessed by the well-capitalized sponsors.

Bluetooth Nitty Gritty

The network will provide about 1 Mbit/sec data over a local personal area network or piconet operating at a frequency of 2.4 GHz. Short-range, low power and data robustness are the keys to the Bluetooth operation.

Bluetooth employs a frequency-hopping mechanism to minimize the effects of "collisions" with other protocols and Bluetooth devices.

In practice, each device-to-device messaging employs the Bluetooth "Telephony Control Specification" (TCS) for point-to-point signaling and may use point-to-multipoint signaling. Point-to-point signaling is used when it is known to which Bluetooth device a message needs to be sent over an established single-point configuration. Point-to-multipoint signaling may be used when there are more devices that may need to be alerted and contacted; e.g. when an incoming call requires a home base station to alert all phones in range.

A group of Bluetooth devices employing TCS is referred to as a Wireless Users Group (WUG). The entry into a WUG is usually via a gateway device that has been designated as such and is referred to as the WUG Master. All communications from the local WUG go through the WUG master, hence the gateway function.

The radio frequency part of the issue is not much of a challenge. The Frequency Hopping Spread Spectrum (FHSS)

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2000 Testing Workshop Series

At Washington Laboratories November 10, 2000

A Special Session on Wireless Technologies

Including Everything You Wanted to Know about Bluetooth®

Wireless products are all around us. Emerging technologies for short-range unlicensed devices are being converted into products for business, home and education.

Bluetooth® devices are being developed and will form the backbone of small information networks ("pico-nets") that will connect devices without wires.

Washington Laboratories, in its continuing series of Workshops, is pleased to present the latest technologies that affect the testing and certification of wireless products in a workshop format. Learn about these devices, the functionality of the products and the way which we'll be connected.

Representatives from Ericsson and Rhode & Schwarz, leaders in the development and testing of wireless products, will provide an overview of the Bluetooth® program and measurement processes.

The engineering professionals from Washington Labs will provide insight into the compliance measurement process. What tests, conditions and measurements are necessary for compliance? And of course, we'll include our popular practical demonstrations and Q&A troubleshooting sessions.

Be sure to register early for this FREE Workshop as space is limited! Call Patty or Michelle at 301/417-0220 or e-mail us at info@wll.com

Bluetooth continued from page 1

techniques are well known and have been extensively employed in short (few hundred meters) and medium range (few kilometers) devices.

In addition, the 2.4 GHz frequency spectrum is essentially harmonized (plus or minus a few hundred MHz) in the developed world.

The parts and pieces necessary to construct a Bluetooth transmitter are available as nominal commodities at this point and can be kept to a relatively low price.

So the real driving point in the Bluetooth topology-and the basis of its ultimate implementation-is the interoperability of the piconets under the Bluetooth regimen.

The protocols and operation specifics are embodied in "Specification of the Bluetooth System V1.0B." See www.bluetooth.com for a complete downloadable version of the Specification.

Bluetooth Qualification Body

As the Bluetooth scheme is an industry, rather than government specification, the concept is to provide an industrial license to equipment developers to allow them to use the Bluetooth trademark on their product. To qualify, it is necessary to gain the approval of a "Bluetooth Qualification Body" or BQB. This entity has been "blessed" by the Bluetooth Special Interest Group (SIG) as having cognizance and independence to assess and evaluate devices to the specification.

Prior to submitting to a BQB, a Bluetooth Qualification Test Facility (BQTF) is used to perform the interoperability and functional testing to assure that the device complies with the specifications. The report is submitted to the BQB for review and approval.

FREQUENCY BANDS OF OPERATION

Country	Frequency	Channels
USA, Europe and most other countries[1]	2.400-2.4835 GHz	F=2402 + kMHz, k=0,...,78
Spain[2]	2.445-2.475 GHz	F=2449 + kMHz, k = 0,...,22
France[3]	2.4465-2.4835 GHz	F=2454 + kMHz, k=0,...,22

Frequency Bands of Operation

The table above shows the allocated and allowed frequency bands for the operation of Bluetooth devices. These generally fall in the ISM bands and have been around for a long time.

NOTES:
Note 1. Japan, the Ministry of Postal and Telecommunications (MPT) announced at the beginning of October 1999 that the Japanese frequency band would be extended to 2400-2483.5 MHz, effective immediately. Testing of devices by TELEC may however need some time to change. The previously specified special frequency-hopping algorithm covering 2471-2497 MHz remains as an option.

Note 2. There is a proposal in Spain to extend the national frequency band to 2403-2483.5 MHz. The Bluetooth SIG has approached the authorities in Spain to get a full harmonization.

Note 3. The Bluetooth SIG has established good contacts with the French authorities and are closely following the development of harmonization.

Note that devices that comply with the limited channels available in France and Spain may not function with the full set of channels available in the other markets

Summary of Characteristics

The following is a summary of the characteristics of a Bluetooth device. Note that the power (<100 mW) is about the same as the power normally employed in your average remote keyless entry device.

NOTES:
Note 1. Minimum output power at maximum power setting.

Note 2. The lower power limit Pmin<-30dBm is suggested but is not mandatory, and may be chosen according to application needs.

Note that traditional cell phones operate up to 1 Watt and PCS phones (like Sprint & Nokia PCS phones) operate on upwards of 0.8 watts.

Summary of Regulations

Regulatory requirements exist in each of the major markets for this type of technology. For the USA, FCC parts 15.247, 15.249, 15.205 and 15.209 are applicable regulations. For Japan, RCR STD-33 applies and, for Europe, ETSI 300 328.

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SUMMARY OF CHARACTERISTICS

Power Class	Maximum Output Power (Pmax)	Nominal Output Power	Minimum Output Power [1]	Power Control
1	100mW (20dBm)	N/A	1 mW	Pmin<+4dBm to Pmax Optional: Pmin[2] to Pmax
2	2.5mW (4dBm)	1mW (0dBm)	0.25mW (-6dBm)	Optional: Pmin[2] to Pmax
3	1mW (0dBm)	N/A	N/A	Optional: Pmin[2] to Pmax

Bluetooth continued from page 2

Summary of Test Requirements

In addition to meeting various masks, protocols, bit timing and messaging requirements, the hardware must meet the following requirements under the conditions noted in the table below.

Steps to Compliance

It is necessary to be a supporting member in the Bluetooth Special Interest Group (SIG). To do so, one must complete the application form (available on the website) and submit the necessary fees. For companies with sales less than $100M, the fee is $7,000 per year. For companies with sales greater than $100M, the fee is $40,000/year.

Then, it is critical to procure and align the product's operation with the Bluetooth Specification. Next, or rather in concert with this process, the FCC certification must be obtained. Then, submission of a test report from a Bluetooth Qualification Test Facility is required.

The hook is that there are no BQTF listed yet. Basically, then, it is up to the manufacturer to make the case to the BQB that they are in compliance with the specification.

Following that, it's off to market. But, seeing as there are less than a dozen products approved to date, it will take a little time for a "critical mass" of devices and applications to assemble. However, if the specification lives up to its promise, and designers can take advantage of the interoperability, the use of this technology could have as profound an impact on our modern lives as the cell phone and the Internet.

SUMMARY OF TEST REQUIREMENTS

Parameter	Temperature	Power source
Output Power	ETC	ETC
Power control	NTC	NTC
Modulation index	ETC	ETC
Initial Carrier Frequency accuracy	ETC	ETC
Carrier Frequency drift	ETC	ETC
In-band spurious emissions	ETC	ETC
Out-of-band Spurious Emissions	ETC	ETC
Sensitivity	ETC	ETC
Interference Performance	NTC	NTC
Intermodulation Characteristics	NTC	NTC
Out-of-band blocking	NTC	NTC
Maximum Usable Level	NTC	NTC
Receiver Signal Strength Indicator	NTC	NTC

ETC = Extreme Test Conditions defined for Temperature and Supply voltage:

a. Temperature = the combination of the operating conditions specified by the manufacturer and the minimum temperature range 0 ∞C to +35 ∞C.

b. Power Source:

AC Mains +10%; DC Supply Lead Acid: 0.9 and 1.3X nominal rating

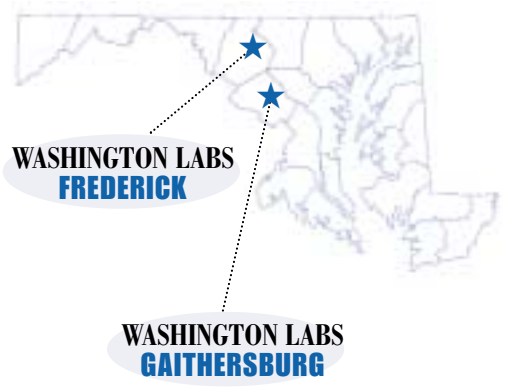
DC Supply Lechance, alkaline or lithium: 0.85 and 1.15X nominal rating

DC Supply, Mercury or NiCad: 0.9 and 1.15X nominal rating

NTC = Nominal Test Conditions

Washington Labs Announces It's Newest Location

As of October 1, Washington Labs opened a new test facility in northern Maryland in the city of Frederick. This location will offer EMC and Safety testing services in cooperation with the headquarters location.



A four-year WLL veteran, Berri Remenick will be managing the Frederick lab site. His expertise is in Safety Compliance testing and trouble-shooting. EMC testing services will be offered by several of the WLL engineers.

"We are extremely excited to be adding a new location in Frederick. This will increase our capabilities and services to our expanding client base in mid- and northern Maryland and lower Pennsylvania. Berri brings a wealth of testing experience to the job. Plus, his familiarity with the area will ensure our customers have the comfort level they deserve," said Mike Violette, President of Washington Labs.

For more information, please contact us at 800/839-1649.

Annual IEEE EMC Society Symposium Attracts Record Crowds

The 2000 IEEE International Symposium on Electromagnetic Compatibility held at the Washington Hilton and Towers in Washington, D.C., recently hosted over 2500 attendees from all over the world. This is one of the highest attendance figures the association has had at its annual event. The week included active technical interchange, marketing and networking. The symposium is a pivotal event in the EMC industry.

The focus of the symposium was to showcase and share techniques for controlling Electromagnetic Interference (EMI), which manifests itself in ways that include the mundane and the life-threatening. The increase in wireless technologies (with attendant concerns about interference and health), the increased density of sophisticated consumer, industrial and military systems and the profusion of electronics into our everyday lives all "push the bar higher" for practitioners in the EMC community.

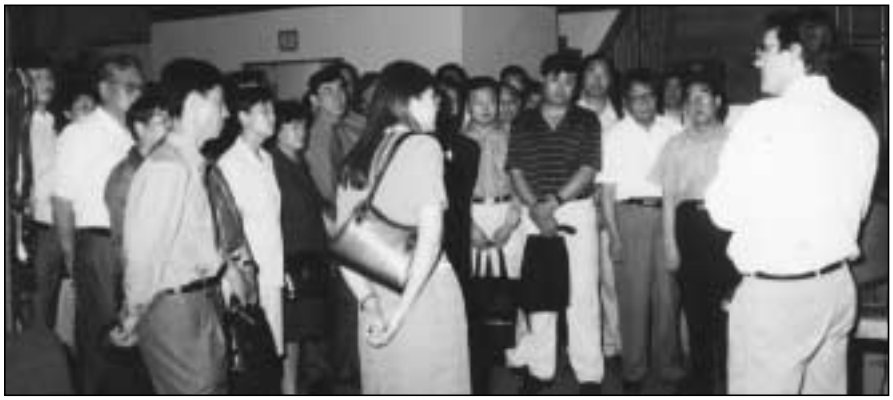
William Duff, Chair of the 2000 Steering Committee said "The objective for this event was to spread knowledge to help engineers combat the EMI difficulties inherent in sophisticated electronics. This symposium brings together some of the best minds in the EMC community from all over the world. It is an opportunity for everyone to sharpen their technical skills and to find out about the latest information in this industry."

Highlights of the event included standing-room-only attendance at the first day's "Fundamentals of EMC Workshop", an active calendar of technical sessions, high activity among the over 130 exhibitor booths and a healthy measure of social activities.

Attendance at the Symposium's premier event, the exclusive Welcome Reception at the world-renown Smithsonian Air and Space Museum also exceeded expectations. Attendees were treated to free reign of the museum, which highlights the achievements in flight from Lilienthal's manned gliders to the Wrights' flight over the dunes of Kitty Hawk to inter-planetary travel and exploration.

Planning for the year 2001 is already underway. Montreal is the site for the next year's symposium and the planning committee is off to a good start, planned for August 13-17, 2001. For more information on the 2001 Symposium phone: 514-287-1070; emc2001@jpdl.com.

For more information on the Washington, DC show, contact Mike Violette at (301) 417-0220.



Washington Laboratories recently hosted a visiting delegation from the People's Republic of China. Thirty-five visitors representing manufacturers, regulatory bodies and trade organizations toured our laboratory. WLL President, Mike Violette, provided an overview of the regulatory approvals market, along with the necessary testing and certification processes for electronics and electrical products. A reception followed the presentation and tour.

AN ATCB UPDATE

Wireless Certifications Taking Too Long?

Fast FCC Certifications are now available from AmericanTCB for wireless customers. Since June, ATCB has been actively working with manufacturers who produce a variety of wireless products. With particular focus on Spread Spectrum, low power and licensed equipment, AmericanTCB provides full-services FCC Approval services.

For speed and convenience, AmericanTCB has innagurated its electronic filing over the Internet - that means speedy submission, review and approvals times.

AmericanTCB operates as an independent body. Chief Technical Officer, William Graff, is an internationally recognized expert on radio regulations. Bill recently returned from London, where he provided technical instruction to over 70 prospective TCB's and manufacturers.

For more information contact **Liv Syvrud, ATCB Business Development Manager**, at e-mail: Liv@AmericanTCB.com or telephone at 703/847-4700 e-mail: **info@americantcb.com**

Or visit us on the web at **www.AmericanTCB.com**

2001 Testing Workshop Series

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

FEBRUARY 16

MAY 18

AUGUST 17

NOVEMBER 9

Be sure to register early as positions fill up quickly. Call Patty or Michelle at 301-417-0220 to register today.

EMC Testing and Measurements

Designing to Avoid EMC Problems Down the Road

Watch as our engineers 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.

Meet the Staff

Since 1996, **Patty Sullivan** has been working with Washington Labs in a variety of positions: she started as an administrative assistant and then worked as a project coordinator eventually moving into more marketing responsibilities. Now she is the Business Development Manager for the company.

Patty is responsible for full-service marketing at WLL which includes customer services, scheduling, new project set-up and coordination, job troubleshooting, new inquiries and quotes. Her marketing communications duties include contact database management and promotional marketing.

Originally from Totowa, New Jersey (yes, we asked the same thing - it's in northeast Jersey), Patty earned a Bachelors degree from Rutgers State University with a double major of Psychology and Sociology. (That major helps explain why she's able to survive around all of these EMC engineers!)

What Patty has to say about working with Washington Labs: "Because we're a growing organization, we can be very responsive and flexible to meet clients' needs. And since WLL is primarily a firm of engineers, we like to cater to clients who need testing and troubleshooting services that are challenging. So if you need something odd or different done, we can figure out a way to make it work, which is exciting for everybody — that keeps the job fresh for us and it makes the clients happy too."

Patty and her fiancee' Mike Mills live in Gaithersburg, close to Washington Labs headquarters. They share their home with their Cocker Spaniel, Maggie - or actually it's Maggie's home and Patty and Mike have visiting privileges. Be sure to ask to see Maggie's pictures next time you visit the Lab. When she's not at the Lab, Patty loves to travel, read and shop. Plus she's been spending a lot of time decorating their (Maggie's) new home.

Whether you need a quote, need to get into the testing schedule or have a question about your job's status, Patty is ready to talk with you at 301/417-0220 or e-mail at pattys@wll.com.

A Tester's Perspective

After nearly two decades of providing measurement services to the electronics industry, we recognize patterns in the testing of electrical and electronics systems. We find that radiated emissions testing, either performing the measurements or, more often, fixing the testing problems, consumes at least one-half of all testing and re-engineering time required for passing most EMC programs. Recognizing, and planning for this can ease the testing effort.

From our experience, the most Common Failures (in approximate order of occurrence) are as follows:
1. Radiated and Conducted Emissions (FCC or CISPR 22)
2. Radiated and/or conducted immunity (IEC 1000-4-3 & -6)
3. ESD (IEC 1000-4-2)
4. Surge (IEC 1000-4-5)

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Future WLL Staff

Our congratulations go out to **Berri and Megan Remenick** on the August 28 birth of their second child, daughter Olivia Paige. Many of you know Berri as our Safety Engineer and he'll be moving to our new Frederick office to assume the Manager position there this month. Olivia Paige weighed in at 6 lbs. 10 oz. And Mom, 3-year old brother, Griffin and new baby are doing well. It's Dad we've got to pull off the ceiling now.

And we're still growing . . .

WLL Project Coordinator, **Michelle Dukes** and her husband, Brad, are expecting a baby in March. You know Michelle by her wonderful British accent — she's always happy to work with you on quoting and scheduling. **Jennifer Bennett** and her husband Rob are also expecting, they're due in January. Jennifer is our Administrative Assistant, (chief meeter and greeter,) the always perky person you speak with everytime you call us.

We look forward to welcoming all these new members of the WLL family.

5. EFTs (IEC 1000-4-4)
6. Harmonics (will likely increase in ranking as requirements are fully implemented)

Some systems are more prone to failures than other systems. For example, high speed digital systems suffer from radiated emissions problems, but are often quite immune to radiated and conducted susceptibility testing. On the other hand, low-speed, analog systems (particularly systems with instrumentation measurement circuits) often fail radiated and conducted immunity testing.

Top Ten Common Design Mistakes

1. Improperly shielded cables: The major source of radiated emissions are cables. The principal problem is the cable-to-backshell termination. If the impedance is too high, the cable is likely to radiate.

2. Poor source control: High Frequency sources; radiated from high frequency sources; conducted from improperly "snubbed" drivers. This points to reducing overshoot, ringing and risetimes on clock and power supply switching signals. Uncontrolled time domain performance creates chaos in the frequency domain.

3. Case seams and apertures: Poor/no gasket, or improper mating surfaces. Seal up the case. As a rule of thumb, if you can slip a business card in a seam, it will likely radiate.

4. Poor bonding. Take care to minimize non-conductive contact.

5. Ground plane/power plane "isolation" techniques. Don't cut up the board planes-if you do, take care not to route high speed signals over the plane break.

6. No high frequency filtering on analog inputs: Radiated and conducted immunity can affect instrumentation circuits. Filter at the connector.

7. Not accounting for the high frequency effects of ESD. "Grounding" for ESD means a low impedance connection; as a rule of thumb, design for 300 MHz.

8. Inadequate filters on I/O cables for emissions. Often, low frequency and I/O ports are overlooked as points for filter treatment. These can be "back door" escapes for high frequency noise.

9. Average conducted emissions filtering: Most often due to harmonics of SMPS (40-200 kHz). Often, FCC-compliant power supplies may fail below 450kHz. Make sure to check the frequency range from 150kHz-450kHz.

10. Missing power line filters. Don't neglect the power entry-it can be a point of leakage for radiated emissions and a point of entry for induced interference.

A USCC UPDATE

Oiled Chilis and Bowling Lanes

Requests for assistance from China are exceeding expectations! US Conformity Consultants (USCC) support for their Beijing partners is in full swing. The Beijing representation office ("CCUS") has been busy promoting the full-service certification activities offered by USCC.

USCC was set up to provide testing and certification services in Electronics, Foods and Textiles. Inquiries having to do with everything from power supplies to sportswear, water skiing equipment to foodstuffs (teas, chilis, herbal medicine) have been coming fast and furious. This is an interesting indication of the types of products that China intends to produce for world markets.

With its network of partner laboratories (ITS and Bodycote International), USCC provides services to Chinese manufacturers hoping to take full advantage of China's emerging status as a world trade partner.

For more information, contact Mike Violette at 301/417-0220.

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