# Ensuring Wireless USB quality assurance

These five steps can help manufacturers ensure a positive experience for users of products based on Wireless USB.

By Mario Pasquali

As a technology, USB enjoys an excellent reputation. With millions of USB devices sold, users are confident that they can connect any USB eripheral to their PC and have it work immediately. Users will expect this same ease of operation and high level of interoperability from Wireless USB. In order to ensure that their products are commercially successful, manufacturers will need to deliver on these expectations. This means that manufacturers must test their products during development and production.

## Five key steps

The following five steps play an important role in any manufacturer's Wireless USB quality assurance program:

***1. Design in interoperability.*** A source of technological risk when working with emerging technology is that specifications are subject to misinterpretation. Clever developers "design in" interoperability from the beginning by testing prototypes against a protocol analyzer instead of connecting two prototypes back-to-back.

Back-to-back testing saves the purchase of an analyzer, but costs more in the long run since it takes longer to find and fix protocol errors. A high-quality Wireless USB analyzer should have been validated against many products from major industry players. This means that the analyzer can automatically detect errors and display any misinterpretation of the Wireless USB specification—thereby avoiding common interoperability errors and improving the chances of passing certification tests.

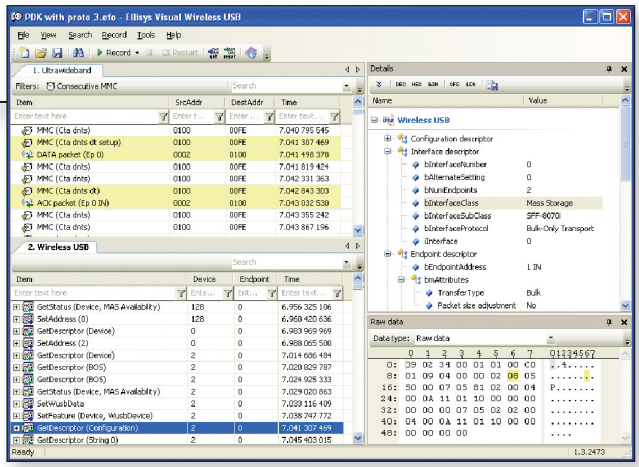


*Figure 1. Shown are various UWB and corresponding Wireless USB decode views that are possible using the Ellisys Wireless USB Explorer 300 solution.*

Because the Wireless USB protocol is quite different from USB 2.0, developers need an interface tailored to Wireless USB with multiple views that show all protocol levels. Developers will also want to be able to display how the Wireless USB protocol is transmitted over UWB to verify low-level detail such as timing (Figure 1).

Some analyzers interpret and display Wireless USB in the same way as USB 2.0. This lets developers learn the new protocol thanks to their previous knowledge.

***2. Reproduce error scenarios to ensure resolution.*** Nothing is harder than resolving intermittent errors without the proper tools. When this happens, the usual testing procedure is to capture data until an intermittent error

« We received the protocol analyzer and the guys love it. They're fighting over it in the lab! »

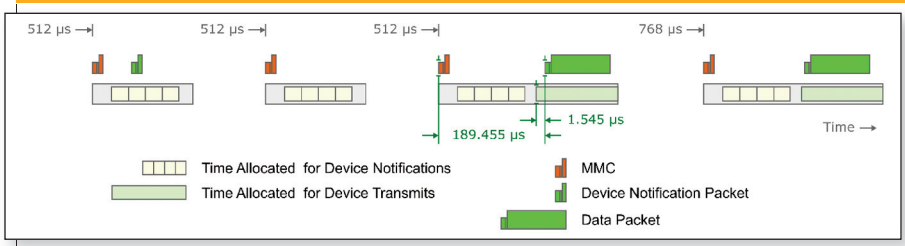


*Figure 2. The Ellisys Wireless USB Explorer 300 protocol analyzer provides the user with an InstantTiming view—in this case, a view of Wireless USB micro-scheduled management command (MMC) timing.*

occurs, analyze what happened and then design a fix. But how do developers ensure that the fix worked? If the problem doesn't re-occur, most developers assume everything is fine.

There is a better way. If the analyzer has traffic generation capabilities, create a script from captured traffic to reproduce the error scenario. Then, replay the scenario as many times as needed to understand and correct the problem.

***3. Optimize Wireless USB device battery life.*** Wireless USB has a sophisticated power management scheme designed to maximize the battery life of portable devices. Unfortunately, this scheme is too complex to explain here. Readers can download "Migrating to Wireless USB" at www.ellisys.com.

Successful power management requires powering down the radio as much as possible, thereby decreasing the average power consumption to extend battery life. However, poor RF design or improper protocol implementation can cause the opposite to occur, powering on the radio for excessive retransmissions. Use of a protocol analyzer with visualization capability measures timing and performance to help understand which parameters can be improved (Figure 2).

***4. Characterize the overall transmission quality.*** A Wireless USB link is theoretically more prone to errors than a USB link using a shielded cable. Not only are longer packet lengths preferred in wireless medium to optimize throughput and reduce overhead, but Wireless USB will be used by peripherals that exchange large amounts of data. Unfortunately, the longer the packet length the greater the probability of a data error. These two factors combined—a higher inherent data error rate and long packet lengths—present a serious engineering challenge that can negatively influence usability.

RF performance can be affected by design factors, including the antenna, RF chip and printed circuit board layout. Designers need a reliable setup to understand the impact of their 'tweaks.' A traffic generator is helpful. Connect the device-under-test to a traffic generator and exchange a known sequence of frames between the units. Then, verify that the frame error rate is in the acceptable range. Repeat the test at different data rates to characterize the RF transmission quality as well as the device's performance. Next, use the same setup with a variable attenuator connected between the UWB traffic generator and its antenna. Increase the attenuation to simulate increasing the distance between the two units.

***5. Validate the proper operation of production units.*** Manufacturers' production test beds need to be upgraded with UWB transmission testing. It is impractical to validate production units by using a manual procedure. A more efficient alternative is to program a traffic generator to produce a known scenario suitable for the product in question. This sequence is then used to verify the proper operation of production units. Note that for this process, a traffic generator with a programming interface is needed in order to integrate it into the manufacturer's setup.

## Summing it up

Quality gurus know that quality assurance (QA) is a philosophy that encompasses product development through production. The steps just described will help developers and QA engineers ensure that their Wireless USB products pass certification tests and are accepted by customers. In turn, high-quality USB peripherals with outstanding wireless capabilities will create opportunities for manufacturers. EWT

**ABOUT THE AUTHOR**

*Mario Pasquali is the co-founder of Ellisys, a test and measurement company committed to the design and timely introduction of advanced protocol analysis solutions for USB devices, Certified Wireless USB and UWB. For more information on designing Wireless USB interfaces, download "Migrating to Wireless USB" at www.ellisys.com.*