

Regulatory Trends in Wireless U.S. and EU Approvals

Convergence of Wireless Technologies Can Increase Compliance Issues

by Greg Kiemel

The proliferation of cell phones, wireless LAN, and other wireless devices marks a significant trend in the telecommunications industry. Not only has the number of dedicated radios grown, but convergent technologies have emerged where computing devices that historically contained no radios, now have two, three, or even four different radio modules. For example, many notebook PCs can be integrated with Wi-Fi®, Bluetooth®, and GSM™ radio modules. Optional features for a barcode scanner might include RFID, as well as Wi-Fi®, Bluetooth®, and GSM™ radio modules.

Market forces dictate “cable replacement” strategies such as Bluetooth® and ZigBee™ on more and more products. The desire for internet connection “anytime – anywhere” has spurred cellular carriers to shift their services from voice-only networks to more data-centric services. Novel antenna technologies such as MIMO promise to increase data rates while improving coverage. It is clear that consumers want more convenient and faster access to their data networks.

If a design team hasn’t yet fielded a marketing request to add wireless features to their next product, they soon will. There doesn’t appear to be any slowdown in these growing wireless trends. Unfortunately, many hardware designers encounter a steep learning curve when it comes to radio technologies. At least in the area of regulatory approvals, they will find some relief.

In the U.S. and EU, all radios require regulatory approval. Historically, this has been a difficult process, but now manufacturers have faster, more convenient options for product approvals. The TCB authorization process in the U.S. offers manufacturers more than one approval body from

which to select. Competition between TCBs has kept costs low and processing times fast, providing a faster, more convenient option than the Federal Communications Commission’s authorization process. In Europe, the R&TTE Directive has removed many regulatory hurdles and allows manufacturers to self-declare compliance to the applicable harmonized standards.

The following article provides an overview of the wireless product approval process for EMC in the United States and in Europe. We’ll discuss the current Federal Communications Commission (FCC) authorization process through TCBs, and how the R&TTE Directive is implemented in the European Union (EU).

Considering Compliance Up Front

Prior to the development of a wireless device, it is imperative that the EMC requirements for the target market are thoroughly investigated. Incredibly, there have been cases when a company has spent hundreds of thousands of dollars on the development of a radio, and are on the verge of product release, only to discover that operation of the radio would be illegal in their target markets! Obviously, this nightmare scenario can be avoided with just a minimal amount of up-front research. However, more common compliance issues require periodic attention throughout the product development cycle.

With the recent advent of low-cost wireless technologies, many companies are looking to add wireless features to their existing products. Experienced RF design engineers are familiar not only with performance and inoperability issues, but with EMC requirements as well. Unfortunately, that level of expertise can be difficult to retain in-house, especially if wireless products are not the core focus of the company.

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In the long run, a great deal of time and money can be saved by consulting with an expert in the EMC authorization of wireless products. The expert should be able to provide rules interpretations, test plan creation, and EMC design strategies. And, as with other professional services (e.g. doctors and lawyers), the best value is not always found with the lowest bidder!

However, whether or not a company decides to seek expert advice, it's best not to wait until the end of the design cycle to test. In order to avoid costly rework, or last minute board-turns, it is always advisable to test early in the design cycle, and several times prior to the final certification test.

The Importance of a Test Plan

The most economical use of test time can be achieved through the use of a test plan. The information contained in a test plan allows test laboratories to provide more competitive rates, better preparation in advance of testing, and consequently, more effective use of test time. The test plan should include a thorough functional description of the product, and should specify the following parameters: output power (fixed or variable), data rates, modulation scheme(s), channel assignments, wired I/O ports, power supply requirements, accessories, and installation options.

All too often during the authorization process, an untested feature is revealed in the user manual that was not obvious in the sample presented to the testing laboratory. A test plan is a key strategy in preventing delays during the equipment authorization process.

From the very beginning, EMC compliance must be a design consideration. Fortunately, the principles of good EMC design and smart RF design share common ground. Although some may rely entirely on shielding as their suppression strategy, single solutions do not exist in most cases. Rather, a combination of strategies is required to achieve compliance. The focus of EMC design should include not just shielding,



Figure 1: An example of a test set-up for a wireless device

but also grounding, filtering, component selection, and PCB layout. If experienced EMC design talent is not available in-house, seek the advice of an EMC consultant who is familiar with your radio technology. Involve your expert at regular intervals during the design cycle.

How The FCC Authorizes Wireless Devices

FCC rules for wireless devices are found in Title 47 of the Code of Federal Regulations (CFR). Title 47 is organized into "Parts" that cover the various radio services. Here is a list of several key Parts of Title 47:

- Part 2 - Authorization and Measurement Procedures, Frequency Allocations, General Rules
- Part 15 - Receivers and Unlicensed transmitters (intentional radiators)
- Parts 22 & 24 - Cellular Radio & PCS
- Part 90 - Specialized Mobile Radio Service (Land Mobile)
- Part 95 – Personal Radio Service (FRS, GMRS, CB, R/C), WMTS, & MICS
- Part 101 - Fixed Microwave Radio Service

The FCC Equipment Authorization Process has been considerably simplified in recent years. In the past, there were five authorization procedures:

- *Type Acceptance*: Required an application to the FCC. Applied to licensed transmitters.
- *Certification*: Similar process to type acceptance. Applied to unlicensed low power transmitters that operated under FCC Parts 15 and 18.
- *Notification*: Required an application, but no measurement data. Used for products with a good record of compliance, such as most receivers.
- *Declaration of Conformity (DoC)*: A self-approval procedure that required no application to the FCC. The product must have been tested at a NVLAP or A2LA accredited lab. Previously used for personal computers and peripherals only.
- *Verification*: A self-approval procedure that did not require testing at an accredited lab. Used for non-residential devices operating under FCC Parts 15 and 18.

Now, there are only three authorization procedures:

- *Certification*: Applies to all transmitters, transceivers, scanning receivers, and radar detectors.
- *Declaration of Conformity (DoC)*: Applies to most receivers, personal computers and peripherals, and residential Part 18 devices.
- *Verification*: Used for non-residential devices operating under FCC Parts 15 and 18, and receivers that are part of a certified transceiver.

The FCC authorization process has been made easier in other ways as well. For years, lengthy FCC processing times burdened radio manufacturers. The application process was so complex that manufacturers often required an in-house

expert to shepherd the transmitter through regulatory hurdles. In comparison with other international regulatory agencies, the FCC was becoming increasingly unique in its system of product authorizations and, over time, the FCC certification process was viewed as incompatible with international mutual recognition agreements (MRAs).

In an effort to address these concerns, the FCC devised an alternate authorization process that was intended to remedy these problems, and established Telecommunications Certification Bodies (TCBs) to provide an alternative approval path for manufacturers. Without replacing the existing FCC approval process, the new process allowed private entities designated by the FCC to issue transmitter and telecom certifications.

TCBs function like the FCC by certifying a product based on the test results of one representative sample. The TCB authorization process also parallels the product certification processes in other countries – an essential step in the MRA process. The FCC designated the initial group of TCBs on June 1, 2000. Now, manufacturers have the choice of using either the FCC or a TCB to certify their products.

TCB Advantages

The TCB authorization process offers manufacturers more than one approval body from which to select. In many cases, TCBs provide a faster, more convenient option than the FCC’s own authorization process. Competition between TCBs has kept costs low and processing times fast. Not surprisingly, TCBs now grant more certifications than the FCC, as shown in Figure 2.

TCB Activities

TCBs certify devices in accordance with FCC rules and policies. They issue written grants of certification based upon applications that contain the same information currently required by FCC rules. The party issued the grant (the “grantee”) remains responsible to the FCC for compliance. TCBs accept and review test data from manufacturers or test laboratories. However, TCBs are responsible for the accuracy of the test data, and may perform laboratory audits or ask for sample units for testing before accepting test data. TCBs verify that all FCC labeling requirements, including the FCC ID, are met.

Upon successful review of the application, the TCB will grant a certificate of equipment authorization. The TCB then submits an electronic copy of the application and a completed Form 731 to the FCC, whereupon the FCC posts a TCB grant of equipment authorization on their website. TCBs can also approve permissive changes, regardless of who

originally certified the equipment. The FCC also requires TCBs to perform post-market audits of equipment they certify.

TCB Prohibitions

TCBs are strictly prohibited from granting waivers to FCC rules and regulations, certifying new technologies where FCC rules do not exist, and/or imposing their own requirements. In addition, TCBs may not certify products on the FCC Exclusion List or grant transfers of control of Certifications.

Finally, TCBs have no authority to enforce FCC rules. In fact, all TCB actions are subject to FCC review. In cases of dispute, the FCC will be the final authority.[2]

Almost since its inception, the TCB program has been considered a huge success. There are now about 30 TCBs from which manufacturers can choose to obtain certification of their wireless devices.

EU Authorization Process – The R&TTE Directive

On April 1, 2000, Directive 1999/5/EC, also known as the R&TTE Directive, went into effect, and dramatically changed

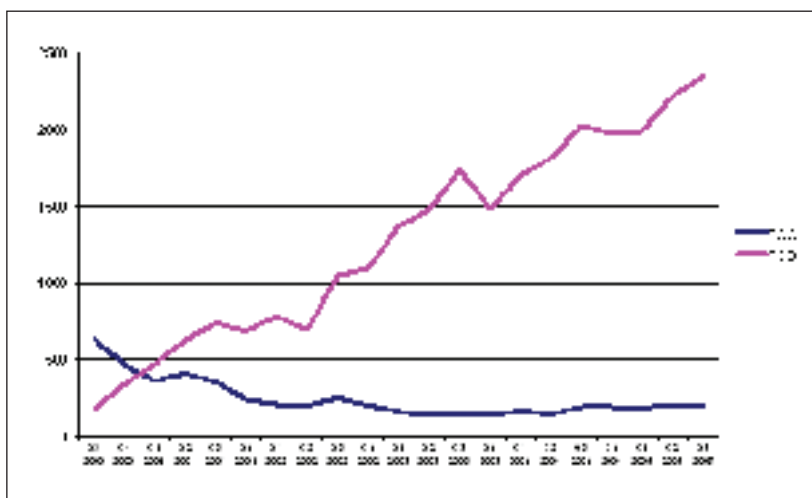


Figure 2: TCB Application Trend [1]

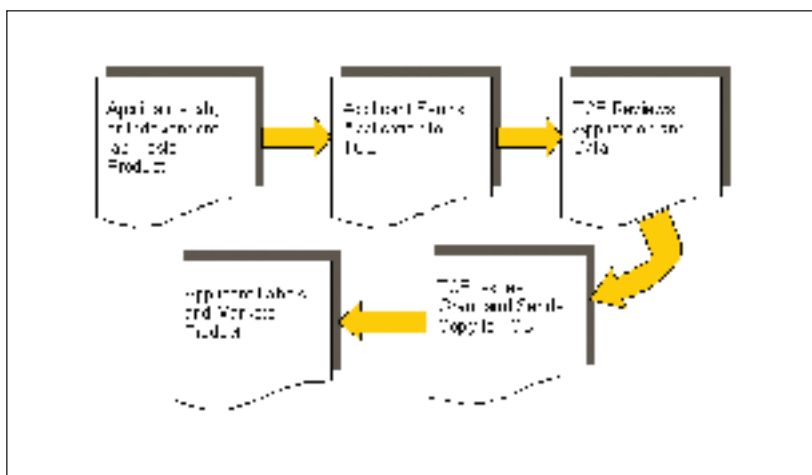


Figure 3: TCB Approval Process

the way manufacturers obtain authorization for their wireless devices in the EU. Previously, authorization was obtained from the spectrum authority in each country. Since few MRAs existed, the Notified Body in each country played a primary role in the certification process, and the process of obtaining country-by-country approval was long and arduous.

Now, under the R&TTE Directive, compliance is based on a manufacturer's Declaration of Conformity. The role of a Notified Body in the compliance process is greatly diminished, and is required only when harmonized standards don't exist, although manufacturers can still voluntarily elect to use their services. A guiding principle of the R&TTE Directive is that manufacturers take full responsibility for their products and should test to verify compliance.

Unlike U.S. requirements promulgated by the FCC, no certification is required prior to marketing wireless devices within the EU. However, in the absence of tight pre-market controls, post-market surveillance is the primary enforcement strategy, and several member states have comprehensive surveillance and testing programs. Not only is compliance with the applicable technical standards spot-checked by enforcement authorities, but labelling and user information are also thoroughly reviewed.

The requirements of the R&TTE Directive are legal, not technical, and are designed solely to safeguard the radio frequency spectrum. ETSI and CENELEC provide the technical requirements in the form of "harmonized standards".[3] An ETSI standard (<http://www.etsi.org>) is considered harmonized once it is published in the *Official Journal of the European Union*.

While harmonized standards are voluntary, compliance with them gives a presumption of conformity with the Directive. Therefore, testing to verify compliance with harmonized standards is the easiest route for manufacturers who wish to demonstrate compliance with the essential requirements of the R&TTE Directive. In the absence of harmonized standards, manufacturers can use other methods, either developed in-house or under the guidance of a Notified Body.

Harmonized Standards and Harmonized Spectrum

Note that there is a difference between harmonized standards and harmonized spectrum. Although there are many harmonized standards, few portions of the EU radio spectrum are completely harmonized. Unlicensed transmitters used in harmonized spectrum, or receive-only devices, are considered Class 1 equipment. (For a list of Class 1 equipment, go to: <http://www.ero.dk/rtte>, then click on the "Subclass" number to see the exact parameters for Class 1 operation.) Licensed transmitters, or transmitters used in non-harmonized spectrum, are categorized as Class 2 equipment. Most radio products are considered to be Class 2.

Compliance with the applicable harmonized standards is sufficient to apply the CE mark, but notification to the

spectrum authority in each member state is still required prior to marketing Class 2 equipment. However, the notification process is relatively simple and can be accomplished on-line or via email. First, complete one form (http://www.bmvit.gv.at/sixcms_upload/media/70/eu_notification_form.pdf). Then email the completed form to the spectrum authorities in each member state where the equipment will be marketed (<http://europa.eu.int/comm/enterprise/rtte/spectr.htm>).

If no reply is received within 30 days of notification, then the manufacturer is free to market its device. That's because the R&TTE Directive provides free movement of radios within the EU, unless the spectrum authority in a Member State has good reasons to bar products (usually due to spectrum allocation issues).

A Closer Look at the R&TTE Directive

The essential requirements of the R&TTE Directive are outlined in Article 3, and mandate the following:

- Electrical safety and health (e.g. Low Voltage Directive, RF Safety)
- Electromagnetic compatibility (as in EMC Directive)
- No harmful interference to the spectrum (as in compliance with harmonized ETSI standards)

Another important requirement, specified in Article 4, is that wireless devices must operate in accordance with national frequency plans. A useful database containing the spectrum allocation of EU member states can be found online (see EFIS at <http://www.ero.dk>).

The conformity assessment process is outlined in Article 10 of the Directive. Again, the main principle is that manufacturers take full responsibility and should test to verify compliance. The procedures described in Annex III or Annex IV are the most common compliance routes. The following is a brief description of each procedure:

Conformity Assessment: Annex II – Internal Production Control

Per Article 10(3), this procedure is only available to telecommunications terminal equipment & receivers, not transmitters. Technical documentation is assembled to demonstrate conformity with the essential requirements of Article 3. Documentation covers design, manufacture and operation of the product, and may include test reports. The documentation is kept on file by the manufacturer and /or their representative in the EU. In either case, it should be readily available should surveillance authorities request evidence of compliance.

Conformity Assessment: Annex III – Internal Production Control Plus Specific Apparatus Tests

The requirements of Annex II, plus all the essential radio test suites must be performed. In the absence of harmonized standards, a Notified Body identifies the essential radio test

suites in the form of a test plan. Otherwise, manufacturers may test to the applicable harmonized standards, and apply the CE mark.

Conformity Assessment: Annex IV – Technical Construction File

The requirements of Annex III, plus a Technical Construction File (TCF) that contains a Declaration of Conformity to specific radio test suites. A Notified Body reviews the TCF and issues an “Opinion.” However, note that this Opinion is not a certification. Notified Bodies do not issue certifications under the R&TTE Directive.

Conformity Assessment: Annex V – Full Quality Assurance

More complex, only some Notified Bodies are approved to perform this process. The manufacturer must operate an approved quality system for design, manufacture and final product inspection. A Notified Body must assess whether the quality control system ensures conformity with the requirements of the directive. Manufacturing facilities are then subject to on-site surveillance by a Notified Body.

Manufacturer’s Obligations under the R&TTE Directive

A new guide for manufacturers is available on-line. It provides useful links, definitions, as well as labelling and packaging information.

<http://europa.eu.int/comm/enterprise/rtte/guide7.htm>.

European Perspective

The European Commission reports a positive experience with the implementation of the R&TTE Directive. Manufacturers are particularly pleased with the new, streamlined process while spectrum authorities report that there has been no visible increase in radio interference.[4] ■

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