



SIMPLE CIRCUITS

FCC Part 15 Regulation

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Welcome to Simple Circuits.

Innovation is alive and well within the Traffic and Transportation industry. It seems like every month new and exciting products are being released which make our roadways safe and operate more efficiently.

For this installment, I thought it might be interesting to review some of the aspects of the FCC Part 15 Federal Code of Regulation.

“FCC Part 15 is a common testing standard for most electronic equipment. FCC Part 15 covers the regulations under which an intentional, unintentional or incidental radiator can be operated without an individual license.”**

Integration of wireless modules into many new products is abundant so I will explore this aspect of the Part 15 regulation.

Support circuitry within new products can also contribute to radiated and conducted emissions, so wireless capable products must therefore be tested as complete devices to ensure compliance with FCC and Industry Canada guidelines.

To help understand the process and intent of compliance testing and certification, I have enlisted the assistance of Joe Jackson, Vice President of Marketing, of Communication Certification Laboratory (CCL).

CCL is a government recognized test facility, based in Salt Lake City, Utah, which conducts FCC Part 15 emissions testing (as well as many other types of tests including product safety etc.). Manufacturers from several continents, encompassing all corners of the electronics industry, submit their products to CCL for compliance testing and independent lab verification before going to market.

The reasons for testing are simple: Governments jealously guard and regulate

the use of airwaves within their geographic boundaries. Frequencies are carefully accounted for and assigned specific usages. Virtually every frequency in the spectrum is defined, not only for function but for transit power, propagation method etc.



Outside photograph of an open area test site where radiated EMC testing is performed. The metal ground plane is extended outside the composite plastic building to provide for repeatable testing results.



Inside photograph of an open area test site where radiated EMC testing is performed. The table on turntable where the equipment under test is placed is in the foreground with the receiving antennas in the back 10 meters away from the equipment under test. The composite of the building is all plastic, no metal. Measuring equipment is located below the metal ground plane.

Governments insist upon appropriate use of their airwaves, and those who choose not to comply can face significant penalty.

This is where independent, qualified labs enter the equation. Labs such as

CCL assume the burden from what would otherwise be extensive government lab facilities, testing every new product destined for market, and providing certification.

So what do these tests involve?

For FCC Part 15, our governments require that each and every product be tested such that it will not interfere with other electronic devices in the surrounding area and that the product is capable of accepting a certain level of interference.

When it comes to electronic products there are three basic classifications of electromagnetic radiators: (1) Intentional, (2) Unintentional and (3) Incidental.

A good definition for the “Intentional Radiator” can be found on CCL’s website: It is “A device that intentionally radiates and emits radio frequency energy by radiation or induction”.

Products such as cell phones, CB radios, spread spectrum radio modems, etc. fall into this category. There is no distinction between commercial and residential applications. A transmitter is a transmitter, and all devices fall under the same scrutiny.

Manufacturers of Intentional Radiators such as FreeWave and GE MDS must design their products to rigorous standards and submit their products for testing to an independent lab. The successful results of these tests are then submitted to the FCC (or the equivalent government agency), who will then grant actual Certification.

Intentional emissions are carefully measured to ensure that output power, frequency accuracy, the generation of harmonics, etc. all meet acceptable government standards as defined by the FCC and Industry Canada (for North American deployment).

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If requirements are not met during testing, the product is rejected and must be re-engineered and successfully retested before Certification will be awarded. The product will not be legal for sale or import until Certification is awarded.

Most electronic products today however, are not wireless in nature and are therefore tested for unintentional and incidental emissions only.

Unintentional emissions for industrial or commercial products are defined in Part 15, Sub part B, Class A.

These are basically industrial or commercial products, which are digital in nature, or which contain circuits that oscillate at 9000 Hz or greater.

Unintentional emissions can be produced from several sources within an application. Two very common sources for potential emission are circuits such as CPU oscillators and switching power supplies.

Any product containing such circuits must be submitted to an independent lab for testing to ensure that potential emissions do not exceed government regulated levels.

Products are tested for worst-case potential emission, and connected as though they were operating normally in an application.

A typical power supply (or fresh battery), wire leads coming from all ports, with the device performing the function for which it was designed, are all part of the test procedure.

In the case of CCL, the product under test is placed on a turntable, inside an RF quiet room. A "stationary" wideband antenna is placed 3 meters from the device, which monitors emissions, looking for hot spots as the product rotates. The antenna height is actually adjusted during the course of testing to ensure all potential angles of emission are measured.

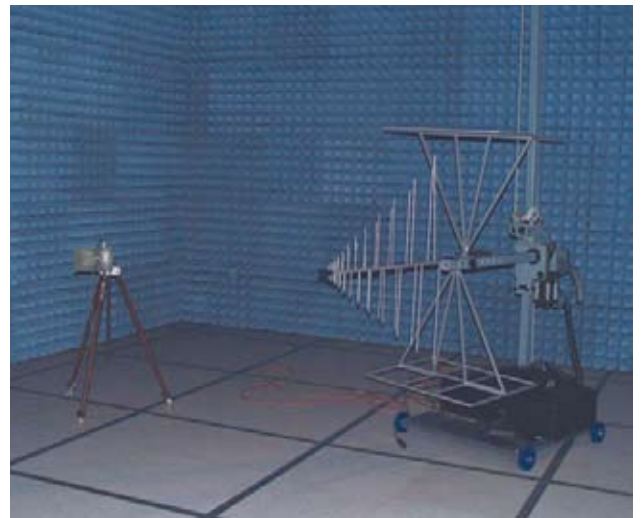
If a product, within its enclosure and performing its usual function were to exceed government established guidelines for emissions, it would be deemed not compliant and unlawful for use within North America.

The other tests pertaining to unintentional emissions are that of Conducted emissions. Conducted emissions can be defined as undesired emissions that are "conducted" back onto incoming power lines.

Both tests require approximately ½ day total to execute, so testing is not a time consuming process.

While the FCC does not require that unintentional emission test results be submitted for actual Certification, due diligence must be taken by the manufacturer to ensure that their product falls within acceptable guidelines as per independent lab results. This process is called "Verification", and a copy of the product test results must be kept on file at the manufacturer.

Should an interference complaint be filed against the manufacturer's product, and emission test results be unavailable for review, significant penalties can be imposed, and the manufacturer may even be disallowed to continue production of the offending product(s).



Anechoic Chamber - Transmitting and receiving antennas used for EMC testing shown in an anechoic chamber which can be used for emissions testing similar to an open area test site.



Lab Eq Anechoic Controls - Laboratory measuring equipment rack used to measure radiated and conducted emissions testing.

Once approved, a product can still be subject to further testing, should certain circuit or PCB layout modifications be required for future upgrades.

While the letter of the law regarding compliance verification is clearly stated in the regulatory document, this can still tend to be a bit of a gray area. Due diligence and engineering expertise now play greater

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roles in determining when a product might breach emission standards and require retest.

For example, if a product, during initial testing, is deemed well below acceptable emission levels, circuit changes, such as substituting a memory device, may have little effect on emission output levels.

Should an engineer choose to not submit the product for further verification testing, based on his or her previous knowledge of circuit performance in the original test and the modification in question, they must be prepared to demonstrate their due diligence to the FCC should future justification be required.

On the other hand, when a product barely meets emission standards, more care must be taken when revising the product, and retesting would be a prudent choice.

Certainly, a major change such as substituting one manufacturer's switching power supply module for another's, would definitely warrant retesting to ensure product compliance.

Sooo, for any designers who might chose to incorporate wireless functionality, or simply produce an electronically based product, there are a few simple rules to follow:

- 1) Always incorporate an FCC/Industry Canada certified wireless modem module into your product and apply any restrictions such as antenna type into your design.
- 2) If your product employs potentially emissive circuits as previously described, make sure to get your products successfully tested and compliant before going to market.
- 3) Ensure that you have the product test results in hand should future access by a governing authority be required.
- 4) Take care to exercise due diligence when upgrading or revising your compliant product(s).

Manufacturers such as FreeWave and GE MDS continue to produce leading edge wireless platforms. These platforms provide easy access to wireless capability for the average design house and their latest product innovations.

These intentionally radiating modules contain a transmitter and as such must be fully certified with the FCC and Industry Canada for operation within North America.

Many of these products are OEM (Original Equipment Manufacturer) type modules, which are of small form factor and which can add wireless capability to new and innovative applications.

Testing and compliance is essential, if we are to keep electronic products from electro magnetically cluttering the airwaves, and interfering with one another.

Fines and penalties for bypassing these compliance tests are steep and severe, so please budget the necessary dollars for testing when beginning new product development. Also make sure to allow for testing delays as there is often a queue of products to be tested, and yours will not likely be the 1st in line for lab time.

The bottom line to FCC Part 15 testing is to make sure any product you take to market is verifiable as compliant and therefore legal for sale, import and operation.

To this point I have discussed verification and certification. There is one other compliance procedure known as "Declaration of Conformity". Much of this procedure relates to personal computers and their peripherals. It is similar to verification and requires that a product be labeled indicating that it has been tested and found acceptable by the manufacturing party.

Further to the labeling requirements, the FCC Part 15 document contains extensive guidelines pertaining to product labeling:

Verification labels will not display the FCC logo, but will contain text indicating testing to FCC standards.

Certification labels on the other hand will clearly display the FCC logo and FCC ID number indicating certification.

The FCC Part 15 document is also very specific as to the materials and print method that are to be used when manufacturing the associated labels. The labels must be resilient and so specific standards are defined.

Other interesting aspects to compliance include components such as antenna connectors.

When incorporating a wireless OEM module into your product, you must ensure that your antenna interface is non-standard. By this, the regulation means that the mate to the connector on your product must not be commonly available.

An example of a non standard RF connector would be the reverse SMA connector. This is not something your average teen could pick up at a consumer electronics distribution outlet. It helps to ensure professional installation and application.

The FCC Part 15 regulation is available from the FCC and is a substantial document. I know that sounds daunting, but is actually a very interesting read. I encourage you to take some time to review this regulation and I promise you some interesting facts pertaining to the world of electronic product development.

I would like to thank Joe Jackson from the Communication Certification Laboratory for sharing his time and knowledge regarding the FCC Part 15 regulation. Much of this article is based on his practical understanding of the regulation, having applied it for many years to all manner of products testing.

As you develop products for our industry, I would encourage you to contact CCL to determine the best course of action as applied to compliance testing. They are an excellent resource and will provide great insight as to the requirements for your specific product. Further information can be accessed on CCL's website at www.cclab.com, or they can be contacted at (801) 972-6146.

Until next time, Take care out there.

References

Communication Certification Laboratory website: www.cclab.com **
FCC Website: www.fcc.gov