

Striper Solutions LLC

52 Flint Pond Drive
Hollis, NH 03049 USA
1-603-475-5053



Streamline Equipment Development With Modular Approvals

By: David Connor

FORWARD

In the United States, RF devices are regulated by the Federal Communications Commission (FCC). All radios must be approved for use by the FCC and if a radio is incorporated into equipment, the equipment manufacturer is then responsible for obtaining radio approval for the entire product.

Radio devices such as cellular, WiFi, Bluetooth, Zigbee, and RFID are becoming common in modern equipment. Product manufacturers with no prior radio experience are now faced with a complicated radio testing and approval process, which adds time and cost to product development. An option for streamlining the process is to use FCC Modular Approvals. A Modular approval certifies the radio device for use in specific product applications, removing the requirement to certify the entire product, saving development time and money..

This paper is intended to give the equipment manufacturer an overview of Modular Approvals, advice on using off-the-shelf radios, and an introduction to the Modular Approval process.

FCC EQUIPMENT AUTHORIZATION

In the United States, the Federal Communications Commission (FCC) requires products to be assessed under [US 47 CFR part 2](#) before being placed on the market. Equipment Authorization ensures that products sold in the United States operate safely, without causing harmful electronic interference or disrupting radio communications.

The [Equipment Authorization process](#) consists of:

1. Determine the specific FCC rules that apply to your product
2. Determine which Equipment Authorization Procedure(s) are applicable
3. Perform compliance testing at an authorized testing laboratory
4. Obtain the required approval(s)

5. Label the product with the required information and include compliance information in the user manual
6. Maintain compliance information and records

For equipment containing electronics, there are two possible paths for obtaining required approvals (Step 4), *FCC Supplier's Declaration of Conformity (SDoC)* or *FCC Certification*.

A product that does not contain a radio would obtain approval by using FCC Supplier's Declaration of Conformity, defined in [Subpart J 2.906](#). The process is relatively straightforward, requiring EMC testing to verify that the product complies with [FCC Part 15, Subpart B](#) (Unintentional Radiators). The manufacturer is not required to file with the FCC when using a Supplier's Declaration of Conformity.

If the product contains an RF device, the manufacturer must obtain certification from the FCC before placing the product on the market. Certification is obtained using the more complicated FCC Certification method defined in [Subpart J 2.907](#). Certification requires specific testing of the entire product as a transmitter to ensure compliance with FCC rules as well as submission and approval of equipment by the FCC or a Telecommunications Certification Body (TCB).

MODULAR APPROVAL

An FCC Modular Approval grant certifies a radio module for a specific application. An approved radio can be used in any product meeting the module's intended application. In most cases this means any host product using a modular approved radio can use the simplified FCC Supplier's Declaration of Conformity process, rather than submit the entire product for full equipment certification. This can significantly reduce product development time and money.

Using a modular radio can also 'future-proof' product designs. As technology evolves, radio modules can be interchanged with limited product testing and without re-certifying the equipment. SDoC testing would still be required to ensure the product's unintentional radiator compliance with the new radio module installed.

Previously Approved Radio Module

The easiest way to incorporate a radio in your product is to buy a previously approved module. When purchasing a radio module, it is important to review the following:

Verify Modular Approval

Verify the radio you are planning to purchase is approved by the FCC for Modular use. Have the manufacturer send approval documentation or check yourself by performing an [FCC Equipment Authorization Search](#) on the FCC website. It is important to note that a device without modular

approvals (for example, a desktop WiFi router) or not intended for the product application, cannot be used in the equipment without full FCC Certification.

Application

The radio manufacturer will provide information on the proper use and installation of the module. This may include information on the power supply, antenna type and gain, location, shielding, RF exposure, etc. These instructions must be followed to ensure proper application of the Module in the end-use equipment.

It should be noted that most modular radios do not permit *colocation* with other transmitters, meaning you can't use two radios in the same piece of equipment due to potential interference. A few modular radio manufacturers have tested their different radios for use with other specific radio equipment under defined conditions. Check with the module manufacturer before starting design work.

All RF transmitters include the risk of exposure to RF energy. The modular documentation will include requirements for location of the antenna and the minimum distance from the antenna to a user of the equipment. Antenna location needs to be considered as an important part of the product design.

Documentation

Use of a module requires specific labeling and documentation to inform the user about the radio, its usage, and any restrictions. This includes a special label on the product (in some cases this can be done electronically) and instructions in the product user manual that are specific to the radio.

The FCC also requires the product manufacturer to [maintain specific technical documentation](#) pertaining to the equipment, including information about the modular radio, for a period of one to two years after the product has been permanently discontinued.

Custom Modular Radio

In some cases an off-the-shelf radio solution is not available or not appropriate for the needs of the product. A manufacturer can design their own radio solution and submit the custom design to the FCC for Modular Approval. Once approved, the custom radio module may be used in any equipment design that meets its intended application.

A custom modular radio may be appropriate for a number of reasons:

- The manufacturer has a proprietary design or need for a specialized radio or communications
- The manufacturer wants to build their own radio to prevent issues with module obsolescence
- The manufacturer wants to colocate a number of disparate radios that don't already have approval to be used together

When designing a custom modular radio the manufacturer must get approval from the FCC, using the *FCC Modular Approval Process*.

FCC MODULAR APPROVAL PROCESS

The following is an overview of the approval process for a single-modular transmitter. It is intended to give the equipment manufacturer an idea of the process, documentation, and testing required to obtain their own modular radio certification. Specialized radios or applications may differ somewhat but the overall process elements remain the same.

FCC Modular Approval involves three major entities; the manufacturer, who is responsible for the radio design and documentation, an accredited testing laboratory that performs the testing according to established FCC standards, and a Telecommunications Certification Body (TCB), that acts on behalf of the FCC to review the application and test data and grant approval. Although a manufacturer could submit directly to the FCC for approval, using a TCB simplifies the process and significantly reduces the amount of time required to obtain a grant.

When submitting a Modular Approval the testing laboratory needs to be accredited by the FCC to ensure test procedures are performed according to current standards. The FCC provides a [Recognized Accredited Testing Laboratories](#) search page for verifying laboratory accreditation.

The FCC also maintains a search page for accredited [Telecommunications Certification Bodies](#). The manufacturer can submit directly to the TCB, however it is recommended that the manufacturer find an accredited testing laboratory with an existing established TCB relationship. This will expedite the Modular Approval process.

FCC Representative

The manufacturer must assign a person of authority as the FCC representative. This person will be listed by the FCC as a contact for all matters pertaining to the FCC submission and operation of the Module. The FCC Representative is responsible for obtaining an *FCC Registration Number*, Obtaining the *FCC Grantee Code*, and establishing the *Equipment Product Code*.

FCC Registration Number (FRN)

If the manufacturer has never submitted to the FCC before, the FCC Representative must first apply for an FCC Registration Number (FRN), using the FCC [Commission Registration System](#) (CORES). The FRN is essentially a registration number that identifies a company 'doing business' with the FCC. Only one FRN is assigned per company, so large corporations should [search for existing FRNs](#) before applying for a new one.

FCC Grantee Code

All devices submitted for certification require an FCC ID number. The ID number consists of two elements, a [Grantee Code and an Equipment Product Code](#). The Grantee Code is a three or five character code representing the applicant (all new applicants are five characters). The FCC Representative must [register all new Grantees with the FCC](#) and pay a registration fee.

Equipment Product Code

The Equipment Product Code is assigned by the manufacturer to uniquely identify the equipment submitted for certification. It is important to decide on a unique Product Code early in the submission process, since this will be a part of the FCC ID number and used for all documentation submissions.

Required Photo Exhibits

A Modular Approval submission requires specific photo exhibits of the radio. These exhibits should match the photos contained in the reports from the testing laboratory.

Test Setup Exhibit

An exhibit showing the equipment test setup is required for submission. This should be provided by the testing laboratory as part of the certification testing.

Internal Structure Exhibit

A photo exhibit illustrating the internal structure of the device is required. This may be provided by the manufacturer but should be coordinated with the testing laboratory to ensure photo exhibits in the test reports match exhibits in the Modular submission.

Label Exhibit

A photo exhibit showing the module label with required FCC information.

If the modular transmitter is only approved for use by the grantee in its own products, a sample product label should also be provided to illustrate the end user labeling requirements.

External Product Exhibit

A photo exhibit illustrating the external structure of the device is required. This exhibit must include photos illustrating placement of the labeling on the product.

Required Technical Exhibits

A Modular Approval requires specific technical documents to be included with the submission. The technical documents should include the product FCC ID number obtained for the submission.

Block Diagram Exhibit

A block diagram showing the frequency of all oscillators in the device. The signal path and frequency must be indicated at each block, including the tuning range(s) and intermediate frequency(ies).

Schematic Exhibit

The device schematic is required as an exhibit for all intentional transmitters.

Operational Description Exhibit

A brief description of the circuit functions of the device along with a statement describing how the device operates. This statement should contain a description of the ground system and antenna, if any, used with the device.

Application for Equipment Authorization

FCC Form 731 will be completed by the TCB and submitted electronically to the FCC. TCBs typically have a custom Form 731 to gather all the necessary information about the submitting company, the product, and the test laboratory. The form will need to be completed and signed before starting the application process.

Submittal Letters

A number of official letters, signed by an authorized company representative (FCC Representative) should accompany the Modular submittal.

Modular Attestation (Cover Letter)

The Modular Attestation letter (often used as a cover letter) declares that the design of the module meets requirements set forth in [47 CFR 15.212](#). It is usually accompanied by a list of each requirement, stating how the submitted design complies or providing a statement of deviation for the requirement.

FCC Confidentiality Letter

FCC submissions and related documents are public records. Since some materials in the submission may contain trade secrets and proprietary information, [limited confidentiality](#) can be petitioned by including a letter of confidentiality with the submittal.

Letter of Agency

When using a testing laboratory as your agent with the TCB, it is necessary to include a signed letter with the application, authorizing the laboratory to submit information on your behalf. The letter must also include a statement certifying that the entity is not subject to denial of federal benefits.

User Documentation

A Modular device requires specific documentation for installation and use. Several key elements must be included in the user documentation for TCB Review.

Integration Instructions

Specific integration instructions must be provided for the host product manufacturers. The integration documentation must include all necessary installation and use instructions needed to maintain compliance in the host product.

If the modular transmitter is only approved for use by the grantee in its own products and not intended for sale to third parties, the integration instructions may not be detailed, and this must be declared in the filing. In that case, it is permitted to place the instructions in the Operational Description exhibit.

List of Applicable FCC Rules

A list of the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies.

Use Conditions

A description of the use conditions applicable to the modular transmitter, including for example any limits on antennas, etc. If the use condition limitations extend to the user, then instructions must state that this information also extends to the host manufacturer's instruction manual.

Limited Module Procedures

If a modular transmitter is approved as a 'limited module,' then the module manufacturer is responsible for approving the host environment. The manufacturer of a limited module must describe the alternative means necessary to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

RF Exposure Considerations

The module grantees must clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions and (2) any additional text needed for the host product manufacturer to provide to end users in their end-product manuals.

Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer.

Label and Compliance Information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID" with their finished product.

Additional Testing

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host..

If the modular transmitter is only approved for use by the grantee in its own product, a statement should be provided indicating that the final host product will undergo Part 15 Subpart B compliance testing with the modular transmitter installed.

Test Laboratory Documentation

Several test reports from an FCC Certified Test Laboratory are also required for the Modular Approval, including an FCC Radio Test report, based on the standards applicable to the particular radio transmitter and an RF Exposure Report. The RF Exposure report may be based on actual measurements or calculations, based on the transmitter and antenna configuration.

SUMMARY

Using radio transmitters with modular approvals can streamline equipment development by placing the burden of FCC approval on the radio, not the equipment. The approved radio can be used across multiple product lines without having to go through the FCC radio approval process for each product. Future radio upgrades are also possible with limited equipment testing.

Although the Modular Approval process is somewhat involved, manufacturers requiring custom radios can benefit by certifying a custom radio module. Once approved, the custom module can be used across multiple product lines, the same as an off-the-shelf module.

ADDITIONAL RESOURCES

1. The [Striper Solutions LLC](#) website has additional resources. A detailed checklist for FCC and ICES Modular Approvals can be found [here](#).
2. More information on the steps required to obtain Steps to Obtain an Equipment Authorization can be found on the FCC.gov website [here](#).
3. A Modular Certification Guide issued by the FCC can be found [here](#).
4. The FCC Application for Certification instructions can be found on the US Government eCFR site [here](#).