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Brandhorst / BI

Ref.: Clarification “Limited Modular Approval” on TCB GRANT(s)

Dear Mr. Liebig,

Many thanks for your inquiry – please find below our response to clarify the modular type applied to some radio modules as listed in the FCC database.

The Federal Communications Commission (FCC) may designate a Telecommunications Certification Body (TCB) to approve equipment under the Certification procedure based on an application with all the specified information. The TCB shall process the application to determine whether the product meets the Commission's requirements and shall issue a written grant of equipment authorization.

There are transmitter modules for the licensed radio service rules certified by us (TCB Phoenix Testlab GmbH) and listed in the FCC database under Grantee Code “QIP” as “Limited Single Modular Approval”.

“Limited Single Modular Approval” was selected to cover the integration limitations as defined in the Grant Note section and listed inside the integration manual, such as

- integration limited into fixed and mobile host devices, where a separation distance of at least 20 cm from the radiating part to all persons can be assured, and
- the device and it's antenna(s) must not be co-located or operating with any other antenna or transmitter, and
- the integrator must be instructed not to hand-out the integration manual to the end-user of the host device.

This was a common practise and adopted by other TCBs at that time, as a “(Full) Modular Approval” with several integration limitations would make the approval look absurd.

In 2009 the FCC has also introduced the so-called "multi-transmitter policy" which defines the previous co-location of multiple transmitters and antennas inside a single host device.

In 2010, the FCC has released the attached "Transmitter Module Equipment Authorization Guide" (KDB 996369), that covers modular transmitters for the licensed radio service rules for the very first time. Before that, licensed RF modules should be handled similar to the unlicensed module - which was again corrected by the FCC to a case-by-case decision. This KDB declares that modular approval for devices operating in mobile or fixed exposure conditions are not automatically considered to be limited modular approvals.

Grants issued after the release of this KDB should have modular type "Single Modular Approval", as long as no restrictions for specific host or particular product configurations may result in limited modular conditions for other reasons.

Yours sincerely,

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Federal Communications Commission
Office of Engineering and Technology
Laboratory Division

Transmitter Module Equipment Authorization Guide

I. Introduction:

A transmitter with a modular or limited modular grant¹ can be installed in different end-use products (referred to as a host, host product, or host device) by the grantee or other equipment manufacturer; and the host may not require additional testing or equipment authorization for the transmitter function provided by that specific module or limited module.

A modular grant is obtained by requesting certification for equipment as a modular device, or requesting a permissive change to convert an equipment certification from a non-modular to a modular device grant - in both instances using the FCC Form 731 application procedures (Section 2.1033, etc.). An applicant for a modular filing must indicate on the Form 731:

- The appropriate modular approval type and;
- Submit the following additional exhibits:
 - A cover letter requesting modular approval that includes an itemized list documenting compliance with the modular approval requirements in the Section 15.212 rules for unlicensed modules, or the licensed module approval conditions in Section III of this document and;
 - Clear and specific instructions describing the conditions, limitations and procedures for third-parties to use and/or integrate the module into a host device (see Comprehensive integration instructions below).
 - For non-Software Defined Radio transmitter modules where software is used to ensure compliance of the device, technical description of how such control is implemented to ensure prevention of third party modification must be provided (see KDB 594280).
 - For Software Defined Radio (SDR) transmitter modules must provide software security description (see KDB 442812).

When the grant is issued it shall state the device description modular type and, if applicable, the limiting conditions of the authorization. A host product incorporating a certified device cannot take advantage of the pre-existing certification of the component transmitter module without conformity with these specific requirements.

¹ FCC Public Notice DA 00-1407 initially established policies that allowed for Part 15 unlicensed transmitter equipment authorization certification for a modular device. The Second Report and Order FCC 07-56 (Docket 03-201) established rules under Part 15 (Section 15.212 Modular Transmitters), provided clarification for modular grants, and established a new class for modular devices called split modular transmitters. FCC Public Notice DA 08-314 is a guide to help small businesses; small organizations (non-profits), small governmental jurisdictions, etc. comply with the Section 15.212 rules.

Modular approvals are for tangible, clearly delineated, devices that operate when installed within, or attached to, a host in one of the following four physical configurations:

1. **Single-modular transmitter:**² a complete RF transmission sub-assembly,³ designed to be incorporated into another device, that must demonstrate compliance with FCC rules and policies independent of any host;
2. **Limited single-modular transmitter:** a single-modular transmitter that complies with the Section 15.212(a)(1) modular rules, only when constrained to specific operating host(s) and/or associated grants condition(s);
3. **Split-modular transmitter:** a RF transmission system that complies with the requirements for a single-modular transmitter, that is separated into a radio front-end section and a control-element section, and can demonstrate compliance for a range of similar type hosts;
4. **Limited split-modular transmitter:** a split-modular transmitter that complies with the definition and technical rules for split modules only when constrained to specific operating host(s), and/or associated grant condition(s).

A host product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15B), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., Bluetooth and WiFi transmitter modules may also contain digital logic functions) as appropriate.

To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements. Since this may depend on the details of how the module is integrated with the host, the grantee (the party responsible for the module grant) shall provide guidance to the host manufacturer for compliance with the Part 15B⁴ requirements.

² Also called self-contained transmitter module (FCC DA 08-314).

³ The definition as given in Item 3 of FCC DA 08-314 - "A module generally consists of a completely self-contained transmitter that is missing only an input signal and power source to make it functional. A module is designed to be incorporated into another device, such as a personal computer, personal digital assistant (PDA) or utility meter."

⁴ In some cases, a transmitter with an equipment authorization may be both a module and Class B personal computer peripheral, separately authorized under a Declaration of Conformity or a grant of certification and marketed as both. When used inside a host that is not end-user accessible/replaceable, the transmitter can only be permitted as a module. In the case that the transmitter is end-user accessible/replaceable and also a Class B personal computer peripheral, then the host manufacturer may have the option to treat it as a certified component, and market it as an integrator of separately authorized components.

Single or limited-single modules and the RF front-end section of a split or limited split-module must be a separate physical assembly that can be installed into (or attached to) a host as a separate sub-assembly (daughter-board sub-assembly). The method used for input and output electrical connections⁵ to the host can be soldered, cabled, wired, or use plug-in connectors.⁶ A module cannot be solely the implementation of a design specification. Only the control-element section of a split-module device may comprise software certified as companion code to a specific RF front-end (section).

A host using a component that has been authorized as a module may, subject to the requirements described below and the conditions of the grant, (1) be marketed and sold with the module built inside that does not have to be end-user accessible/replaceable, or (2) be marketed with the module being end-user plug-and-play replaceable.^{7,8}

Comprehensive integration instructions

For proper integration of modules in the final products it is required that detailed and comprehensive instructions must be provided to the integrators so that any subsequent associated party (grantee, host manufacture, original equipment manufacturer (OEM), integrator, or end-user) can clearly understand the conditions and limitations for authorized uses of the modular transmitter. These instructions must be included as one of the Form 731 exhibits,. While modules can provide great flexibility for third parties without requiring additional compliance demonstrations, additional technical requirements may call for separate equipment authorization information for compliance demonstration (e.g. for RF exposure and hearing-aid compatibility, for devices with specific antennas, or specific host/enclosure configurations.) A transmitter module grantee is responsible for including the necessary details for ensuring compliance for RF exposure requirements and the associated usage conditions for portable, mobile and fixed-mount equipment configurations as applicable.

II. Modular Transmitters Subject to Section 15.212 Rules:

A. Single-modular transmitter is a self-contained, physically delineated, component for which compliance can be demonstrated independent of the host operating conditions, and which complies with all eight requirements of Section 15.212(a)(1) as summarized below. See Section

⁵ Electrical connections to a module generally consist of input signal and power source to a completely self-contained transmitter module.

⁶ When the antenna is not on board the module, the applicant must demonstrate how the antennas and/or restrictive host environments that have been approved are ensured [e.g., Sections 15.204(b), 2.929(b)]. Appropriate testing, installation instructions and/or grant conditions are required.

⁷ A transmitter can be certified as a module and also marketed as an end product to be used as a stand-alone device or a computer peripheral when it is end-user accessible and plug-in replaceable, and does not provide any control that will cause operation of the device in violation of the regulations.

⁸ If an authorized transmitter that is not certified as a modular device is used within a host, it must be user accessible and plug-and-play replaceable. If an authorized transmitter is not accessible and is not plug-and-play replaceable, then the host requires a separate certification under a new FCC ID (see KDB 178919 for enclosure permissive change guidance).

15.212 for more detailed information, and Section 2.901 (and sub-sections that follow) for general certification requirements.

- i The radio elements must have the radio frequency circuitry shielded. Physical components and tuning capacitor(s) may be located external to the shield, but must be on the module assembly;
- ii The module must have buffered modulation/data inputs to ensure that the device will comply with Part 15 requirements with any type of input signal;
- iii The module must contain power supply regulation on the module;
- iv The module must contain a permanently attached antenna, or contain a unique antenna connector, and be marketed and operated only with specific antenna(s), per Sections 15.203, 15.204(b), 15.204(c), 15.212(a), 2.929(b);
- v The module must demonstrate compliance in a stand-alone configuration;
- vi The module must be labelled with its permanently affixed FCC ID label, or use an electronic display (See KDB Publication 784748 about labelling requirements);
- vii The module must comply with all specific rules applicable to the transmitter including all the conditions provided in the integration instructions by the grantee;
- viii The module must comply with RF exposure requirements (see discussions below).

B. Limited single-modular transmitter is a transmitter that does not meet all eight requirements listed in Section 15.212(a) (1), and compliance can be demonstrated only for specific host and applicable operating conditions in which the transmitter will be used. For example, manufacturers have flexibility with respect to requirements such as module shielding, buffered modulation/data inputs and power supply regulation. If one or more of these functions (shielding, buffered modulation/data inputs and power supply regulation) are provided by a specific host or hosts, then the module can be granted as a limited module that is limited to that specific host or hosts. The responsible party must demonstrate how it will retain control over the final installation of the device, such that compliance of the product is ensured by limiting the installation to a specific host or hosts, for example.

A limited modular approval is based on conditions established in the application such as the host device(s) into which the module can be installed; documented requirements for professional installation; the antenna separation distance from persons; or, the locations where a device may be used (e.g., outdoor only).

C. Split-modular transmitter is comprised of two basic components: (1) the “radio front-end” or radio elements and (2) the transmitter control element (may be a firmware/software element). Split transmitter modules must comply with the single modular requirements of Section 15.212(a)(1) summarized in II A above, with the exception of me and v; plus the additional split-module transmitter requirements of Section 15.212(a)(2) as summarized below:

- i Only the radio front-end must be shielded. The physical components, crystal and tuning capacitor(s) may be located external to the shielded radio elements. The interface between the split sections of the modular system must be digital, with a minimum signaling amplitude of 150 mV peak-to-peak;

- ii Control information and other data may be exchanged between the transmitter control elements and radio front-end;
- iii The sections of a split-modular transmitter are installed for testing on a host platform that is representative of the platform(s) intended for use. It is the responsibility of the applicant to demonstrate the appropriateness of the test platform for compliance to a widespread range of common host platforms, i.e. not restricted to a specific host. For example, compliance may be demonstrated on an open (not within a specific host enclosure) reference design board to demonstrate conformity independent of the host environment. Therefore, note that when compliance is tested with the module enclosed in a specific host, then the split module must be limited.
- iv The radio front-end and transmitter control element must be certified as amalgamated elements by the responsible party. The responsible party must demonstrate the authentication method to guarantee that only this coupling will operate the radio. Manufacturers may use means including, but not limited to, coding in hardware and electronic signatures in software to meet these requirements, and must describe the methods in their application for equipment authorization.

D. Limited split-modular is a transmitter that does not meet all the requirements of a split-modular device. As is the case for limited single-modular devices, compliance can be demonstrated under specific host and applicable operating conditions in which the transmitter will be used. Currently TCBs are not permitted to certify split or limited split-modular transmitters - see current TCB exclusion list KDB Publication 628591.

For guidance on FCC ID labeling of modules, see KDB Publication 784748 (section on Module Labeling).

III. Modular Transmitters Subject to the Licensed Radio Services Rules:

Licensed transmitter modules are not subject to specific modular approval rules as are Part 15 intentional radiators. However, applications for single or limited-single modules under the rules for licensed devices are permitted for the following conditions:

- i Split-modular approvals or limited split-modular approvals are not permitted for licensed modular devices;
- ii The applicant can use Section 15.212 provisions for additional guidelines for good engineering practice. In this case, the modular approval cover letter must also include an itemized list documenting compliance with analogous conditions (see Section II A of this document);
- iii The grantee is required to provide to other parties (e.g., host manufacture, Original Equipment Manufacturers) and end users, clear documented instructions as described in Section I.
- iv The grantee is responsible for full compliance;
- v Licensed modular grant conditions shall be listed on the grant:
 - a) The maximum antenna gain to ensure compliance with rules, such as EMC (e.g. EIRP, PPSD limits),

- b) RF exposure requirements and
 - c) Host product limitations;
- vi For guidance on FCC ID labeling see KDB Publication 784748 (section on Module Labeling).
- vii Licensed modular devices must be compliant to all specific applicable licensed radio service rules.

IV. RF Exposure Considerations:

KDB Publication 447498 provides more detailed guidance to determine SAR test requirements for modular transmitters for use in mobile and portable devices. When these modules can be installed by an end-user in host products with pre-installed antennas, some type of bi-directional authentication function must be used to ensure that only the combinations of approved hosts and modules can be used together. This must be documented in the filing.

Modular approvals for devices operating in mobile or fixed exposure conditions are not automatically considered to be limited modular approvals; however, restrictions for specific host or particular product configurations may result in limited modular conditions for other reasons.

See KDB Publication 616217 to determine conditions for a module to be used in various laptop and netbook configurations with minimal subsequent SAR evaluations in qualified hosts.

In general modular transmitters for portable devices (hosts) that use trace antenna implemented on third party hosts the approval will be limited to specific host platform depending on the operating conditions to address the SAR test requirements. If the module design uses host trace antenna and operates at power levels below the exclusion thresholds (for SAR) and is intended for standalone use it may be approved as single module if pre-approved by the FCC. This approval must be made through a non-TCB PBA inquiry. See question 11 below for some additional guidance.

Transmitters which permit power management based on various sensor operations on the host, for example proximity sensors, orientation sensors, etc. can only be approved as limited modular transmitters under special restrictions on the host. Such application must be approved through a non-TCB PBA inquiry.

V. Multiple Transmitter Modules Used in a Host:

Combining multiple modular approved transmitters within a host is only permitted for modules granted authorization to cover such configurations; and all required and submitted test data must include compliance information for any simultaneous transmission configurations. Each module must have a unique FCC ID. A transmitter module capable of transmitting simultaneously can be granted as an original grant, or Class II permissive change, by following the applicable simultaneous transmission test procedures. Additional tests for RF exposure and EMC are necessary to modify simultaneous transmission restrictions through permissive changes for all modules in the host, unless not required by a specific FCC procedure or policy. Applicability of such a policy must be

explained within a filing when a justification for no testing is submitted. The OEM integrator or the host manufacturer is responsible for the overall compliance of the host products.

If the host device supports the installation by end-users of different modules or module-like transmitters that are independently approved, the host manufacturer must ensure that the host will continue to comply under the various configurations that may be possible with multiple transmitters.

VI. Permissive Changes (For an Original Responsible Party):

Changes from a non-modular to modular certification, and from a full modular to a limited modular certification, are permitted if the changes meet the requirements for a permissive change in Section 2.1043 (also, see KDB Publication 178919), and the modular approval requirements discussed above.

The original grantee may submit new test data to modify the existing limitations of the grant as permitted under the permissive change rules (Section 2.1043). For example, modifying simultaneous transmission restrictions for EMC and RF exposure can be done under a Class II permissive change, typically for specific end-use or product configuration. Evaluation requirements include:

- i. All transmitters must have the required simultaneous transmission test data;
- ii. Simultaneous transmission evaluation requirements for RF exposure are described in KDB Publication 616217 for laptop and netbook computers, KDB Publication 648474 for mobile-phone handsets and KDB Publication 447498 for other mobile and portable devices.

VII. Related KDB Publications:

- i. KDB Publication 447498 for evaluation of SAR for portable and mobile configuration
- ii. KDB Publications 616217 to determine SAR and simultaneous transmission test requirements for laptop and netbook configurations to minimize subsequent evaluations for use in other hosts;
- iii. KDB Publication 784748 Labelling requirements (see section on Module Labelling);
- iv. KDB Publication 178919 Permissive Change Policy;
- v. KDB Publication 442812 SDR Apps (Application) Guide
- vi. KDB Publication 594280 Software Configuration control

VII. Additional Frequently Asked Questions and Answers Related to Modules:

Question 1: What options are available for parties other than the grantee or responsible party to apply or make changes to an existing modular grant?

Answer 1: The following options are for certified modules and for many other types of certified devices. The following discussion addresses modules, because manufacturers frequently require changes to devices that have been granted as modules.

Other parties can:

A. File for a new FCC ID:

Obtain a new certification for the entire host including the module, or obtain a new certification for the module. The new party is responsible for full compliance to all applicable rules for the new grant. There are no vested or transferable conditions in the original grant (initial grant or permissive changes) that are conveyed to the new grant. The new party must follow all the engineering and operations guidelines as specified by the original grantee.

For the new filing, it is permissible to upload relevant test reports from an original module filing, if they accurately represent test results under the new conditions described in the new application(s). When original results are used, the new applicant must provide a statement and explanations that the original test reports accurately represent test results under the new conditions. For each original test report, this statement must list the associated FCC ID, specific test report identifiers, and a description explaining how the report accurately represents test results under the new conditions. All exhibits for uploaded original test reports must represent the new device in its entirety. In this case, the module must be identical, and in the same configuration, in order for the original tests to apply. Thus, the original test report exhibit must, in its entirety, be the same as the test report contained in the original filing. A reference to only a section of an original test report, or uploading only a portion of an original test report, is not permitted. However, certain test data may be re-used if properly justified. For instance, conducted signal tests may be re-used if the power is verified to be the same. Any changes to hardware, hosts or co-location configuration require new radiated emission and SAR evaluation and/or testing.

Additional test reports can be provided to demonstrate full compliance under any new conditions of use. This includes testing to demonstrate new grant conditions without limited conditions (where imposed on an original module) or limitations, but with additional capabilities.

For example:

- Limitations on simultaneous transmission conditions may be modified to include additional transmitters, or;
- Restrictions to a specific host may be changed to include additional hosts.

B. Change in ID Certification (Section 2.933).

An applicant can only file for a change in ID for a certified module if they have written permission from the original grantee. The written permission from the original grantee shall be filed as a Cover Letter exhibit with the change in ID application and shall be signed or endorsed by an authorized representative of the original grantee.

The party filing for the change in ID may subsequently file a Class II permissive change to amend a grant and expand the operating environments tested by the original party, that may not have been applicable or necessary at the time. In some cases, the original party may be willing to file the permissive change, making the change in ID unnecessary.

Question 2: How are UNII modules with DFS and radar detection capability handled?

Answer 2: UNII modular devices with radar detection are typically filed as limited modules for the specific receive antennas. The performance of radar detection is affected by the receive antennas. The module is limited to the specific host / antenna used for the DFS compliance tests. However, stand alone module approval can be obtained for devices with radar detection capability on a case by case basis. Further, the UNII devices must also comply with the additional guidance in KDB 443999.

Question 3: Can unlicensed Part 15 transmitter modules and antennas be marketed separately?

Answer 3: Yes, the radio component portion of a transmitter module and its associated antennas each may be marketed separately, but only if the module and antenna incorporate an authentication protocol to ensure that only authorized modules and authorized antennas work together.

Question 4: Can Part 15 transmitter modules and associated antennas be sold separately when the certification authentication protocol is performed by the host?

Answer 4: It is permissible to use the host to provide compliance for the authentication requirement between the authorized module and antenna. The module shall not transmit until the host authentication ensures that the proper certified antenna is present. The grantee is responsible for providing the certification authentication protocol, and must also provide clear instructions to the host manufacturer on integration of the code within the host for the module to remain compliant.

Question 5: Can an applicant obtain a limited modular approval for a transmitter that operates under specific host conditions and is installed by end users?

Answer 5: Yes, for user-installed limited module radios in a host (laptops, etc), a two-way certification authentication protocol or two-way BIOS lock implementation is required to ensure compliance. This ensures the module verifies that the proper laptop is used and the laptop verifies that the proper module is used.

The Grant condition must state: "This device must use a BIOS lock mechanism which ensures that it only operates with the hosts as specified in the Certification filing." This ensures the module verifies that the proper host (laptop) is used, and the host verifies that the proper module is used. For guidance on RF Exposure Considerations, see Section IV above.

Other options to a BIOS lock mechanism may be considered, but must be FCC endorsed prior to an FCC approval.

Question 6: Can end users install transmitter modules into a laptop that has an integrated antenna built into the laptop screen, or on the motherboard?

Answer 6: Yes. However, since the antenna is built into the laptop screen or on the motherboard and the module can not be tested as a stand-alone module; it can only be approved as a limited module. Further, the approval requires a two-way certification authentication protocol between the host and the module. See Answer 5 above.

Question 7: Can a module be a reference design layout intended as a portion of a host and manufactured onto the host board during assembly?

Answer 7: No, this is considered to be a reference design, not a physical discrete component, and is not permitted.

Question 8: Can a module be a Software Defined Radio (SDR)?

Answer 8: A physically delineated, tangible module may be granted as software defined radio if it meets all the security requirements imposed by Section 2.944, in addition to the requirements for a modular transmitter. The host manufacturer or the OEM integrator must not have the ability to modify the RF parameters or configuration options of the module through software. See KDB Publication 442812 and the attachment for additional information.

Question 9: What are the requirements for using already certified transmitters inside an enclosure, or inside another device, without having to re-certify the entire enclosure or device under a new FCC ID?

Answer 9: If the transmitter is certified as a module it may be integrated or used inside another device. No further approval is required when the module is used in accordance with the FCC grant conditions and any limitations or usage conditions required by the manufacturer's instructions, as discussed in this publication and KDB Publication 784748 for appropriate labelling requirements.

See KDB 178919 for further guidance on changing the enclosure or permitting the use of a certified transmitter not approved as a module in another enclosure.

In both cases above, compliance with all grant conditions must be observed. For example, adherence to the grant condition that states that this transmitter can not be co-located with other transmitters or not used within a certain distance from the body of a user or nearby persons is

required. In addition, other electronic functions not associated with the certified module or certified transmitter may require additional equipment authorization, if applicable.

Question 10: In order to qualify as a stand alone module, must the shield enclose the entire module or just the RF circuitry? If the module can meet the technical standards in a stand alone configuration without shielding, is this acceptable to qualify the module as a stand alone module?

Answer 10: In order to qualify as a stand alone module, the RF circuitry must be shielded even if the module meets the limits in a stand alone configuration without any shielding. The shielding design must fully enfold the RF circuitry - that includes shielding the top, all sides and the bottom. The bottom may be a shielding ground plane and must be expressly designed as an effective shield made of materials such as sheet metal, metal mesh, or a metallic ink coated material. Any holes in the shield must be significantly smaller than the wavelength of the radiation that is being blocked, in order to effectively approximate an unbroken conducting surface.

The shielding of the RF section is to help prevent RF coupling when installed in a host. It is therefore not sufficient for the module to meet only the stand alone configuration requirement. Other circuitry such as flash memory, a temperature sensor, input voltage regulators, input data buffering circuits, etc. may not be RF, and therefore need not be shielded. However, the grantee must use good engineering judgment to reduce any possible RF coupling that might affect a host.

Question 11: Can a module be certified where the host device must use a micro-strip trace on the host's printed circuit board to an antenna connector or a trace antenna on the host circuit board?

Answer 11: A modular transmitter may be certified when the connection to the antenna is made through a host's printed board micro-strip trace layout to an external connector, trace antenna or component (chip) antenna on a printed circuit board (herein referenced as "trace design"). This can be extended to include passive parts for antenna attenuation padding, impedance matching or providing test ports. Other components such as amplifiers and active drivers are not considered a trace layout and must be contained on the module.

The Form 731 application shall include detailed engineering reference designs for the trace design in addition to the required OEM instructions (see Comprehensive integration instructions above) for all trace designs approved with the module. In particular the integration instructions shall include the following:

1. Trace layout and dimensions including specific designs for each type:
 - a. Layout of trace design, parts, antenna, connectors and isolation requirements;
 - b. Boundary limits of size, thickness, length, width, shape(s) dielectric constant, and impedance must be clearly described for each type antenna;
 - c. Different antenna length and shapes affect radiated emissions and each design shall be considered a different type; e.g., antenna length in multiple(s) of frequency wavelength and antenna shape (traces in phase) can affect antenna gain and must be considered;
 - d. The above data is to be provided by a Gerber file (or equivalent) for PC layout.

2. Appropriate parts by manufacturer and specifications.
3. Test procedures for design verification.
4. Production test procedures for ensuring compliance.

Only trace designs approved at the time of grant or through permissive change can be used by the OEM. PCB circuit designs have an increased potential for design mishandling and they are susceptible to cross-talk and increased unintentional radiation. The applicant must provide compliance test data for all antenna circuit trace designs being marketed or used. Different antenna length and trace layouts can affect radiated emissions and each design shall be considered a different type.

For demonstrating compliance, when not limited to specific host, a stand-alone reference open board PCB test board design that is representative of the worst case boundary limits (as constrained by the design rules documented in the integration instructions) for each trace design (type) shall be used.

For SAR consideration, all current test procedures and guidance must be followed as discussed in Section IV on RF Exposure considerations and all the relevant KDB publications and in particular the conditions defined in Section 2 of KDB Publication 447498.

It is recommended that the grantee have an agreement with the Host manufacture to build in accordance with instructions, in order to ensure compliance.

Grant comment: This module can only be used with a host antenna circuit trace layout design in strict compliance with the OEM instructions provided.

Change notices:

02/03/2011: 996369 D01 Module Equip Auth Guide v01 has been changed to 996369 D01 Module Equip Auth Guide v01r01.

- a. Minor editorial changes have been made to correct spelling and grammar.
- b. Answer to Question 1 B has been changed - Change in ID Certification (Section 2.933) - to clarify that an applicant can only file for a change in ID for a certified module if they have written permission from the original grantee.
- c. Question 10 has been added - must the shield enclose the entire module.
- d. Question 11 has been added – a device that uses a micro-strip trace in the antenna design.

06/17/2011 996369 D01 Module Equip Auth Guide v01r01 has been changed to 996369 D01 Module Equip Auth Guide v01r02.

- a. Clarification added in the filling requirements for software configuration controls for [non-Software defined radios](#) and [software defined radios](#).
- b. Changes made [IV. RF Exposure](#) Considerations to for RF exposure requirements for modules.
- c. Changes made [to question 11](#) to reiterate and clarify question 11 for RF exposure and OEM instructions.

07/12/2011 996369 D01 Module Equip Auth Guide v01r02 has been changed to 996369 D01 Module Equip Auth Guide v01r03

- a. 996369 D01 Module Equip Auth Guide v01r02 was mislabeled in the footer as 996369 D01 Module Equip Auth Guide v01r01. This version 996369 D01 Module Equip Auth Guide v01r03 updates the footer to agree with the current posted version and revision. No other changes have been made.