



**Federal Communications Commission
Office of Engineering and Technology
Laboratory Division**

October 23, 2015

FREQUENTLY ASKED QUESTIONS AND ANSWERS ABOUT 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 actual end-use configurations often require changes in the scope of an authorization for devices that have been granted as modules.

Parties other than a module manufacturer may:

a) File for a new FCC ID:

- 1) 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.
- 2) 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.
- 3) 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.

- 4) 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) File for a change in ID Certification (§ 2.933).

- 1) 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.
- 2) 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, which 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 U-NII modules with DFS and radar detection capability handled?

Answer 2: U-NII 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, standalone module approval can be obtained for devices with radar detection capability on a case by case basis. Further, the U-NII devices must also comply with the additional guidance in KDB Publication 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 Clause VI in KDB Publication 996369 D01.

Other options to a BIOS lock mechanism may be considered, but must be FCC endorsed prior to a TCB 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 cannot 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 § 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 labeling requirements.

See KDB Publication 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 is required to the grant condition that states that this transmitter cannot be co-located with other transmitters or not used within a certain distance from the body of a user or nearby persons. In addition, other electronic functions not associated with the certified module or certified transmitter may require additional equipment authorization, if applicable.

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

Answer 10: In order to qualify as a standalone module, the RF circuitry must be shielded even if the module meets the limits in a standalone 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, 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 standalone 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 microstrip trace on the host's printed circuit board to an antenna connector or a trace antenna on the host circuit board?

Answer 11: The following provisions apply for both unlicensed device and licensed device modular approvals.

A modular transmitter may be certified when the connection to the antenna is made through a host's printed board microstrip 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 dimensions for the trace design, in addition to the required OEM instructions (see Clause II in KDB Publication 996369 D01) for all trace designs approved with the module. In particular, the integration instructions shall include the following:

- a) Trace layout and dimensions including specific designs for each type:
 - 1) Layout of trace design, parts, antenna, connectors, and isolation requirements;
 - 2) Boundary limits of size, thickness, length, width, shape(s), dielectric constant, and impedance must be clearly described for each type of antenna;
 - 3) 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;
 - 4) The above data is to be provided by a Gerber file (or equivalent) for PC layout.
- b) Appropriate parts by manufacturer and specifications.
- c) Test procedures for design verification.

d) Production test procedures for ensuring compliance.

Only trace designs approved with an original grant or through permissive change can be used by an OEM. PCB circuit designs have an increased potential for design mishandling, and 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 a specific host, a standalone 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, the most recent test procedures and guidance must be followed, as discussed in Clause VI of KDB Publication 996369 D01 and all the relevant KDB publications, and in particular the conditions defined in Clause 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.

Question 12: Aside from RF exposure evaluation considerations (which are covered in, e.g., Question 13), is there guidance for multiple certified modules when integrated in a host and transmitting simultaneously in the same or different bands?

Answer 12: Over the years, the numbers and types of modules used in end products has evolved, in particular products with MIMO capabilities and a large number of multi-transmitter products. KDB Publication 662911 specifies additional procedures for host products with combinations of certified modular transmitters and/or built-in transmitters.

For EMC/radio-parameter compliance purposes, when an evaluation is done by the grantee or host provider (see Clause IX in KDB Publication 996369 D01) and there are no additional emissions generated due to simultaneous-transmission operations compared to single transmitter operations testing (i.e., not transmitting simultaneously), it is not necessary to file the additional simultaneous transmission test data. The host manufacturer is responsible for ensuring compliance with the applicable FCC rules for the transmitters operating individually and simultaneously. This includes compliance for the summation of all emissions from all outputs occupying the same or overlapping frequency ranges, as defined by the applicable rules.

Question 13: As described in the following three questions, we would like to check the limitations and possibilities with regard to combining or co-locating transmitters, such as modules, using the FCC RF Exposure procedures in effect as of mid-2015.

Answer 13: In the following paragraphs, the three questions are denoted as QUESTIONS 13A), 13B), 13C), and are answered under ANSWERS 13A), 13B), 13C).

QUESTION 13A): The first question relates to using a device in an RF exposure configuration for which it was not certified.

It was noted at the April 2015 FCC-TCB conference that many low power modules are certified as mobile devices; even though the output power is actually very low such that a mixed mobile and portable certification of the module might have been possible.

For example, a low power Bluetooth or Zigbee transmitter of 1 mW or less might be below the SAR test exclusion threshold, but the module might have been certified expeditiously as a mobile device.

Is it acceptable for an installer to use such a module in a portable device without any associated Class II permissive change, as long as the integrator confirms a SAR test exclusion calculation per KDB Publication 447498?

In other words, which of the following applies?

- 1) Class II permissive change by module grantee.
- 2) Class I permissive change by module grantee.
- 3) “Verification” exercises for SAR test exclusion by the integrator.

ANSWER 13A): Concerning the inquiry text “configuration for which it was not certified,” firstly we note that § 2.907(a) in general means that a Certification pertains for whatever representations and test data are in filings under an FCC ID.

Concerning “certified as a mobile device,” for reference we note that relevant RF exposure KDB provisions discouraging mobile-only grants for modules include the following:

[447498 D01 v06, 3. c);¹ 447498 D01 v06, 5.1 ¶4²].

¹ 447498 D01 v06, 3. c): “Transmitter modules must be approved according to one of the following host platform exposure conditions, with respect to the product configurations tested or evaluated for equipment approval for incorporation in qualified host products. The approved host platform exposure condition(s) must be identified on the grant of equipment certification. ...”

² 447498 D01 v06, 5.1 ¶4: “Modular transmitters are approved according to the operating configurations and exposure conditions tested for compliance to support qualified host device configurations. Unless a transmitter or module is designed to operate in host devices that do not support portable exposure conditions or simultaneous transmission operations, seeking equipment approval for mobile exposure conditions or standalone operations in the initial equipment approval may require new filings to qualify for other operating and exposure conditions. To avoid subsequent equipment approval requirements and complexities, it is recommended that the initial applications for equipment authorization for such transmitters take into account all the applicable operating modes. The qualified installation and use conditions must be clearly identified in the equipment approval and OEM integration requirements, including all restrictions. ...”

In general a SAR test exclusion calculation [per 447498 D01 v06 4.3.] needs to be on file under the FCC ID of the module.

In other words, for supporting FCC RF exposure compliance, most or all module grants must identify the allowed host-platform exposure conditions and contain appropriate representations and evaluation data [per 447498 D01 v06, 3. c), etc.³].

From the options listed, Class II permissive change by the module grantee is generally appropriate.

For reference, relevant RF exposure KDB publication provisions include the following:
[447498 D01 v06, 5.1 ¶1,⁴ 447498 D01 v06, 5.1 ¶3⁵].

QUESTION 13B): The second question relates to co-locating modules in a mobile installation.

Consider the situation where a WWAN (e.g., WCDMA) module is co-located within an end product with a WLAN (e.g., Wi-Fi) module and a WPAN (e.g, Bluetooth) module.

Each module was originally certified for mobile device use only, without co-location considered.

Now all three are combined in an end product and simultaneous transmission exists.

The end product host is a mobile device only.

The installer performs a new MPE calculation and determines a new minimum compliance boundary, which may or may not be 20 cm in all directions.

1) Would it be sufficient for RF exposure compliance that the otherwise-undocumented end product combination is confirmed only through exclusion analyses done by the integrator?

³ 447498 D01 v06, 3. c) 1): “Mobile exposure host platform evaluation procedures can only be applied if all transmitters in the host devices support mobile exposure conditions. Transmitters and modules approved only for use in the mobile exposure host platform cannot operate in hosts and product configurations that require standalone or simultaneous transmission operations in portable exposure conditions. The portable exposure host platform or the mixed mobile and portable exposure platform is required to support portable exposure conditions in qualified host configurations.”

⁴ 447498 D01 v06, 5.1 ¶1: “Modules and peripheral transmitters are approved for either standalone operations only, or for standalone and simultaneous transmission with other transmitters in a host. The transmitters and antennas operating in a host device must remain compliant for the standalone and simultaneous transmission operations required by all host configurations. Whether additional equipment approval is required for separately approved transmitters installed in a host device or a previously approved host with integral transmitter generally depends on influences introduced by the newly added transmitter(s) to the existing transmitters, with respect to the host device form factor, transmitter/antenna configurations and exposure conditions etc. Preliminary assessment is normally required to determine if Class I or Class II permissive change requirements apply.”

⁵ 447498 D01 v06, 5.1 ¶3: “When subsequent equipment approval is required for modules to support additional host and antenna configurations, compliance of individual transmitters may be addressed through Class II permissive changes submitted by the grantee of a corresponding transmitter to enable it to be incorporated in qualified host devices. ...” (see KDB 178919)

- 2) Alternatively, would Class I permissive change documentation be needed for any of the module grantees?
- 3) Alternatively, would Class II permissive change filings be needed for any of the module grantees?

ANSWER 13B): Concerning the term “co-located”, as a general remark such terms are deprecated for equipment authorization purposes. Rather, discussion in terms of a multi-transmitter end product supporting simultaneous transmission is preferred, based on KDB Publication 447498 and §§ 15.31(h) and 15.31(k) *composite system* and § 2.1 *end product* terms and concepts.

Concerning the inquiry text: “Each module was originally certified for mobile device use only, without co-location considered,” further again to [5.1 ¶4 of 447498 D01 v06 ⁶], such types of initial grants are discouraged.

In general, for reference the following RF exposure KDB provisions would apply to such a composite-system multi-transmitter product:
[447498 D01 v06, 7.2 ¶1; ⁷ 447498 D01 v06, 3. c) ⁸]

Class I permissive change may apply, as indicated in the preceding paragraph.

For reference, the following RF exposure KDB cross-reference indicates where Class II permissive change could apply, i.e., if the conditions are not met:
[447498 D01 v06, 7.2 ¶1 ⁹]

QUESTION 13C): The third question relates to co-locating modules in a portable device installation.

Consider the situation where a WWAN (e.g., WCDMA) module is co-located within an end product with a WLAN (e.g., WiFi) module and a WPAN (e.g., Bluetooth) module.

⁶ 447498 D01 v06, 5.1 ¶4: “...Unless a transmitter or module is designed to operate in host devices that do not support portable exposure conditions or simultaneous transmission operations, seeking equipment approval for mobile exposure conditions or standalone [only] operations in the initial equipment approval may [subsequently] require new filings to qualify for other operating and exposure conditions. To avoid subsequent equipment approval requirements and complexities, it is recommended that the initial applications for equipment authorization for such transmitters take into account all the applicable operating modes. ...”

⁷ 447498 D01 v06, 7.2 ¶1: “...When simultaneous transmission MPE test exclusion applies, transmitter modules may be incorporated in host devices according to Class I permissive change requirements to document the test exclusion conditions.”

⁸ 447498 D01 v06, 3. c): “...When transmitter modules are incorporated in host devices that qualify for RF exposure test exclusion and no other testing or equipment approval is required, the standalone and simultaneous transmission configurations and test exclusion conditions must be fully documented in the grantee’s records according to Class I permissive change requirements.”

⁹ 447498 D01 v06, 7.2 ¶1: “For mobile exposure host platform to qualify for simultaneous transmission MPE test exclusion, all transmitters and antennas in the host must be either evaluated for MPE compliance, by measurement or computational modeling, or qualify for the standalone MPE test exclusion in section 7.1. When modular transmitters are used, the minimum test separation distance required for each simultaneous transmitting antenna installed in the host device must be greater than or equal to that approved for standalone transmission. ... The antenna installation and operating requirements for the host device must meet the minimum test separation distances required by all antennas, in both standalone and simultaneous transmission operations, to satisfy compliance.”

Each module was originally certified for mobile device use only, without co-location considered.

Now all three are combined in an end product and simultaneous transmission exists.

The end product host is a portable device.

The power levels exceed the SAR test exclusion threshold, so the installer has SAR tests performed on the host device, measuring the SAR from the WCDMA and WiFi modules.

The contribution from the Bluetooth is calculated (per KDB Publication 447498 provisions).

- 1) Is it mandatory for all three of the modules to have a Class II permissive change, to show the SAR results under the specific FCC ID record and to acknowledge the portable use?
- 2) Alternatively, is it possible to perform the Class II permissive change for only the highest power module, such as the WCDMA?
- 3) Is it possible to avoid a Class II permissive change on the Bluetooth, because its contribution was only calculated?
- 4) It is seen from KDB 447498 that it is possible to achieve this through Class II permissive change on only the highest power module if the installer has performed a Change in FCC ID on all of the modules; but alternatively is it also possible to restrict the Class II permissive change to the highest power module if the Change in FCC ID process has not been done?
- 5) As another scenario, if the host itself has its own certification (own FCC ID), perhaps because it contains some other transmitter built-in or perhaps it is a Class B Computer (equipment class JBP) or has a Computer Peripheral function (equipment class JBP); is it possible to cover all the RF Exposure issues and list the SAR test values on the Grant of the host device, then avoid Class II permissive changes for all of the modules?

Or, must each module have a Class II permissive change?

Re-stating, the basis of this question is:

In the case of co-located simultaneous transmitters where a SAR test is performed or a change of condition exists; is it possible to address the RF Exposure in only one of the FCC Grants associated with the installation, or must the exercise be completed for every FCC Grant associated with the installation?

- 6) Does the answer to 5) change if the Grantees of each module are the same company, as in the case of a Change in FCC ID being done on each module?

ANSWER 13C): As a first general remark, concerning the inquiry text: “Each module was originally certified for mobile use without co-location considered,” the remarks about mobile-only module and “co-location” in ANSWER 13A) and ANSWER 13B) also apply here.

Item 4) of QUESTION 13C) includes text “It is seen from KDB 447498 that it is possible to achieve this through Class II permissive change ...”

For reference, the KDB Publication 447498 specific provision(s) cited in the inquiry are as follows: [447498 D01 v06, 5.1 ¶3¹⁰].

Answer 13C1): Per the KDB provision listed in the preceding paragraph, Class II permissive change for only one of the FCC IDs is acceptable, with including simultaneous-transmission exclusion analysis information or testing, as applicable. As seen, there are options besides doing the Class II permissive change for the highest power device.

Answer 13C2): See Answer 13C1).

Answer 13C3): See Answer 13C1).

Answer 13C4): See Answer 13C1).

Answer 13C5): See Answer 13C1).

Answer 13C6): Such a one-party approach does obviate an ancillary concern that the new SAR data is otherwise “unconnected” relative to each original module grant when using only the single-FCC ID Class II permissive change approach.

Question 14: Can a host manufacturer integrate a non-modular approved transmitter (e.g., USB dongle) into a non-accessible enclosure, then label the device with the FCC identifier such as “This product contains transmitter FCC ID XXXYYYZZZ.”

Answer 14: This it is acceptable under the following conditions:

- a) The host manufacturer must adhere to all guidance provided in KDB Publication 996369, including RF exposure requirements,
- b) The transmitter is also approved as a computer peripheral under DoC or certification, and must use a standard computer peripheral connector (such as USB),
- c) No modifications done to the transmitter (i.e., the device integrated is identical to what is approved),
- d) Only antennas already approved with the device are used, and in accordance with all grant conditions and installation requirements,

¹⁰ 447498 D01 v06, 5.1 ¶3: “When subsequent equipment approval is required for modules to support additional host and antenna configurations, compliance of individual transmitters may be addressed through Class II permissive changes submitted by the grantee of a corresponding transmitter to enable it to be incorporated in qualified host devices. Compliance of all transmitters in a host device can also be addressed through a new equipment approval filing submitted by the host device manufacturer, where all transmitters are approved under a new host FCC ID. Alternatively, the manufacturer of the host device, or [grantee of] the transmitter with the highest maximum output power, or [grantee of] the most recently added transmitter that triggers the additional approval requirements, may choose to apply for a change of FCC ID for the transmitter modules that require additional approval, and address all subsequent approval issues under its direct responsibility through Class II permissive changes, to enable the transmitter module to be incorporated in qualified host devices. The host manufacturer may also consider a mixed modular and dedicated host approach, to address compliance for transmitters with higher output power and SAR in dedicated host configurations and apply the modular approach to certain low power transmitters that have low SAR or do not require any SAR testing. ... The grantee of a dedicated host and/or the grantees of the individual modular transmitter(s) incorporated in the host are all responsible for coordinating and ensuring the final implementations are compliant.”

- e) The host manufacturer performs verification testing that the device still complies (See Clause IX in KDB Publication 996369 D01),
- f) The host manufacturer provides appropriate Part 15 user information including any appropriate RF exposure warnings.

Note if any of the preceding conditions cannot be met, a new certification and filing is required by the host manufacturer.
