



Review of RF Exposure Evaluations and Present Technology Requirements

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Overall scope

- **Review present RF exposure evaluation procedures according to**
 - Present products and types
 - Identify certain procedures that require update
 - Identify and consider new products and technologies
 - Identify situations where procedures are not available, and which
 - May need further research & investigation
 - May need interim procedures

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Other considerations & goals

- To establish framework for “top-down” approach to procedures to meet future needs
- Request your outlook about future products to anticipate test and procedure needs
- Align and simplify FCC & TCB test and evaluation requirements for existing products where possible

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Other considerations & goals

- **Prepare and provide applicable procedures & training to test labs and TCBs for evolving technologies**
- **Address test requirements for issues that affect majority of present applications and products**
 - **Collocation and simultaneous transmission**
 - **Modular operations and configurations**
 - **Grant comments and other administrative procedures**

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Collocated/co-transmit conditions

- **No overlapping signal transmissions**
 - Independent RF evaluation of collocated devices
 - What device configurations – independent, composite, integral etc What test setup considerations?
- **Limited overlapping signal transmissions**
 - Independent evaluations may be appropriate
 - What conditions are applicable? Not applicable?
 - How to configure tests and analyze results?
- **Simultaneous transmission**
 - Independent evaluation may or may not be appropriate
 - Multi-band – e.g., phones, LAN
 - Single-band – e.g., new complex antenna configurations

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Collocated/co-transmit SAR

- Identify fundamental requirements for evaluation & compliance
- Develop consistent procedures for top-down plans rather than case-by-case
- Collocation in itself is generally not a problem, but co-transmission (co-Tx) can cause issues in some collocated situations or devices where higher power may produce higher SAR
- Streamline procedures to concentrate on configurations that have potential to exceed limits and avoid penalizing low power collocations

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Collocated/co-transmit SAR

- **What conditions require RF exposure evaluation to account for simultaneous transmission?**
- **Device specific**
 - Stand-alone small or handheld devices with additional transmitters incorporated, built-in or as accessories
 - Cellphones, PDAs, etc.
- **Transmitters designed to operate in common product platform configurations which may contain other transmitters**
 - Platform-specific, e.g., laptop
 - User-installed, externally-attached
 - Intended for multiple platforms, e.g., other consumer products
 - Modular operating configurations
 - Standard interface connectivity, e.g., PCMCIA, USB

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Collocated/co-transmit SAR

- **Considerations for SAR evaluation for co-transmission conditions of portable devices**
 - Compliance is with respect to SAR requirements in any one gram of tissue in the shape of a cube
 - When multiple peak SAR locations exist in collocation and simultaneous transmission conditions
 - 1-g average SAR should be determined according to the SAR of all relevant transmitters, superposed grid by grid for all measured and interpolated results using the same test position (registration)
 - conditions that may allow simplified procedures
 - low power and low SAR
 - independent SAR peaks with little or no influence upon each other

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Collocated/co-transmit MPE

- **What RF exposure evaluation criteria can be applied to account for simultaneous transmission in mobile operating configurations?**
 - Exposure conditions can usually be estimated according to the operating and installation configurations of intended devices and antenna systems
 - A perimeter that ensures compliance with applicable power density limits may be established according to the defined operating configurations
 - Higher output conditions may require MPE evaluation to reduce overestimation to satisfy installation and operating conditions

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Collocated/co-transmit MPE

- **Considerations for MPE evaluation for simultaneous transmission conditions of mobile devices**
 - Mobile transmitters are required to maintain a separation distance of 20 cm or more from persons
 - Higher output conditions require larger separation distance
 - A conservative distance may be estimated according to isotropic source assumption to establish required perimeter
 - MPE measurements may be used to establish required separation distance and perimeter
 - Installation and operating configurations must satisfy perimeter determined in applicable procedures to satisfy compliance

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Transmitter module configurations

- **Present procedures may no longer be keeping pace with changing technologies**
 - Relatively simple procedures may no longer be suitable
 - Common interface connectors allow collocation and/or co-transmit with little or no restriction for increasing number of product configurations
 - New technologies with complex antenna configurations need additional considerations
 - Output power can vary substantially among various modular configurations, which can increase exposure potential in collocation/co-transmit conditions
 - Potential for exceeding 1-g SAR in certain configurations and conditions needs review to develop procedures

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Transmitter module configurations

- **Primary intent for most modular configurations**
 - **Minimize further testing/certification required**
 - **Allow operation in additional hosts or platforms**
 - **With similar operating configuration and exposure conditions**
 - **Within a range of acceptable operating configurations and exposure conditions**

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Transmitter module configurations

- **Primary concerns in RF exposure compliance**
 - **How to test for compliance**
 - **Across defined/specific host platform**
 - **Across multiple host platforms (generic platform)**
 - **When operating configurations and exposure conditions are not fully known**
 - **How to account for exposure variations across hosts & platforms**
 - **How to maintain conservative levels of compliance while reducing unnecessary testing**

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Transmitter module evaluations

- **Present modular evaluation procedures may need review and update**
 - **To align with needs of present technologies**
 - **Standard interface connectivity**
 - **Highly integrated device configurations**
 - **Host, operating system, software & firmware interactions, power supply, data buffering etc.**
 - **Output power & SAR levels may be applicable to establish simplified procedures**
 - **Very low power configurations – few or no tests**
 - **Low to medium power levels – minimal testing may be suffice**
 - **To ensure proper handling for exposure conditions that can potentially exceed limits – all required tests are necessary**

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Transmitter module evaluations

- **With many modern portable products, collocation, co-transmission, and modular operations cannot be considered independently**
- **Establish applicable test platforms for portable devices to facilitate test and approval for intended operations**
- **Examine the procedures necessary to extend certain modular configurations to higher output & SAR conditions while maintaining compliance**
 - **Additional considerations**
 - **Certain operating restrictions**
 - **Other appropriate mechanisms**

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Transmitter module evaluations

- **Consider well-defined platforms according to**
 - Output power & measured SAR levels
 - Simplify certain test requirements
 - Ensure compliance for high exposure configurations
- **Consider partially defined platforms according to**
 - Additional testing based on other consideration
 - Test at multiple separation distances as necessary
 - Test in multiple configurations
- **Consider mostly unknown platforms according to**
 - Establish generic test requirements
 - May need to limit output power or SAR to establish required margin for expected variations

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Grant comments

- **Grant note and some permissive change issues are often related to collocation, co-Tx, modular approval, or combination of these**
 - Establishing applicable colloc, co-Tx, & module procedures should alleviate related grant note issues
- **Other typical grant note issues to examine/update**
 - Occupational exposure requirements
 - Antenna configuration requirements
 - OEM conditions
- **Consider common sense approach to simplify current administrative practices, maintain uniformity, and minimize interpretations**

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Grant comments

- **Certain details of restrictions could be explained in filing to minimize lengthy grant notes**
 - Devices should be fully evaluated to satisfy compliance
 - Grant conditions generally do not substitute for RFX evaluation - especially for consumer devices
- **Consider to consolidate across common device categories or platforms**
 - May prepare standard notes with similar language, style & format
 - Consider to update present e-filing numbered & lettered grant note set

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RF exposure rule listings

- Summaries and updates due to recent Orders
 - Part 15
 - Renumbered: 15.247(i) = former 15.247(b)(4), as ref. Suppl C
 - 15.407(f) [=NII], 15.319(i) [=UPCS]
 - Millimeter wave (mmw) bands
 - 15.257(g) 92-95 GHz [routine eval.]
 - 15.253(f) 47,77 GHz; 15.255(g) 57-64 GHz [routine eval.]
 - 15.249 24 GHz [categ. excl.]*
 - Part 15 fixed, i.e., 15.407(f), mmw, 15.319(i) [routine eval.]**
 - Licensed – updates to 1.1307, 2.1093



MPE for advanced antennas

- MIMO and phased array systems have multiple simultaneous-Tx antennas
- Aggregate power can generally be used to estimate MPE perimeter when antennas are very close together
- Above may be used for simple beam-forming systems with two antennas, but also need to ensure maximum gain conditions
- For sectorized antenna systems, each antenna generally considered independently without overlap
- For other complex antenna systems, antenna separations relative to each other and to observation points, and separate output powers, are used to calculate (estimate) compliance boundary



New technologies

- TCBs should not process applications for new technologies unless test, review, and approval procedures are available and all TCBs are trained on any new or special requirements
- Example new technologies which may need specific procedures
- CDMA-2000, Ev-Do, WCDMA, (Wi-Max & HSDPA or similar, etc.)
- Please consult with FCC Lab before starting application processing



Wrap-up

- **Please let us know your comments, questions, suggestions!**
- **Please contact FCC Lab for guidance if unclear or undefined review & approval procedures, and/or new technologies, are encountered!**