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**

CONCEPTS FOR DISCUSSION ONLY

Other considerations & goals

- To establish framework for “top-down” approach for 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

CONCEPTS FOR DISCUSSION ONLY

Other considerations & goals

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

CONCEPTS FOR DISCUSSION ONLY

Collocated/co-transmit conditions

- **No overlapping signal transmissions**
  - Independent RF evaluation of collocated devices
  - What device configurations – independent, composite, integral, etc., and 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

CONCEPTS FOR DISCUSSION ONLY

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 minimize penalizing low-power collocations

Collocated/co-transmit SAR

- What configurations 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

CONCEPTS FOR DISCUSSION ONLY

Collocated/co-transmit SAR

- **Considerations for SAR evaluation for co-transmission conditions of portable devices**
  - **Compliance is with respect to SAR limits 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 from 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**

Collocated/co-transmit MPE

- **What RF exposure evaluation criteria should apply 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 can be established according to the defined operating configurations**
  - **Higher output conditions may require MPE evaluation to reduce overestimation to better comport with installation and operating conditions**

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 of 20 cm or more**
  - **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**

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**

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**

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**

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**

Transmitter module evaluations

- With many modern portable products, collocation, co-transmission, and modular operations cannot be considered independently
- Determine 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

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

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

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 notes 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**

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!**