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
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
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
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
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
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
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

CONCEPTS FOR DISCUSSION ONLY
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!