Part 15.255 Rules Amendment

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Note: The views expressed in this presentation are those of the author and may not necessarily represent the views of the Federal Communications Commission.

FCC Report and Order

- The Commission adopted a Report and Order on March 18th, 2023, that amended the 15.255 rules to provide flexibility for operation of short-range, Field Disturbance Sensors (FDS) in the 60 GHz (57-71 GHz) frequency band
  - FCC 23-35
  - ET Docket No. 21-264
- The amended 15.255 rules became effective on August 23rd, 2023,
  - 30 days after publication in the Federal Register
- The new rules allow for expanded use of FDS/Radar devices at higher output power levels in segments of the 57-64 GHz portion of the frequency band

Highlights of the Rule Amendment

- Clarifies the relationship between Radar and FDS applications by declaring that Radars are a sub-category of FDS as defined in both sections §15.3(l) and 2.1 of the FCC rules
- Removes fixed requirement for FDS/Radar operations over the entire frequency band, including the 61.0-61.5 GHz (ISM) band segment, where higher output power is permitted
- Removes “Short-Range Interactive Motion Sensing” (SRIMS) exception to fixed operation requirement
- Permits operation on-board unmanned aircraft (UA) at altitudes up to 400 ft (122 meters) above ground level within the 60-64 GHz band segment
- Allows for operation over various segments of the 57-64 GHz band at higher output levels (up to 20 dBm), dependent upon operational frequency range, use- case and radar transmitter off-time or duty cycle

Options for Certification of Short Range, mmWave Radar under §15.255

- **§15.255(c)(2)** permits unrestricted radar use-case operation anywhere within the 57-71 GHz frequency band (14 GHz BW), with a conducted output power limit of -10 dBm and a peak EIRP limit of 10 dBm.
  - Only effective modification was to remove the previous ‘fixed operation’ requirement and the Short-Range Interactive Motion Sensing (SRIMS) exception
  - Does not eliminate challenges associated with measuring the conducted power associated with PCB-embedded components (e.g., antennae)
- **§15.255(c)(2)(v)** permits unrestricted radar use-case operation in the 61.0-61.5 GHz ISM band segment (500 MHz BW) with EIRP allowances up to 40 dBm average and 43 dBm peak.
  - Only effective modification was to remove the prior “fixed operation” requirement

Options for Certification of Short Range, mmWave Radar under 15.255 (cont.)

- **§15.255(b)(3)** is a new option that permits low-power radar operation onboard unmanned aircraft (UA) in the 60.0-64.0 GHz band segment (BW= 4 GHz) at altitudes up to 400 ft AGL with a peak EIRP limit of 20 dBm, if transmissions are limited to no more than 16.5 ms within any contiguous time interval of 33 ms, which equates to a maximum duty cycle of 50%.
- **§15.255(c)(2)(i)** is another new alternative that permits unrestricted radar use-case applications over the 57.0-59.4 GHz band segment (BW= 2.4 GHz) with a 20 dBm peak EIRP limit for indoor operation and a 30 dBm peak EIRP limit for outdoor operation, including all vehicular applications (e.g., in-cabin radars).

Options for Certification of Short Range, mmWave Radar under 15.255 (cont.)

- **§15.255(c)(2)(ii)** is another new option that permits for unrestricted radar use-case applications over the 57.0-61.56 GHz band segment (BW= 4.56 GHz) with a peak EIRP limit of 3 dBm.
- **§15.255(c)(2)(iii)(A)** is another alternative that permits unrestricted radar use-case operations over the 57.0-64.0 GHz band segment (BW= 7.0 GHz) with a peak EIRP limit of 14 dBm, if radar transmissions are limited to 7.5 ms within any 33.0 ms time window, which equates to a maximum transmitter duty cycle of 23%.

Options for Certification of Short Range, mmWave Radar under 15.255 (cont.)

- **§15.255(c)(2)(iii)(B)** is a new option that is specific to fixed and vehicular (other than in-cabin) radar usage over the 57.0-64.0 GHz band segment (BW= 7.0 GHz) with a peak EIRP limit of 20 dBm, if transmissions are limited to 16.5 ms within any 33.0 ms time window, which equates to a maximum transmitter duty cycle of 50%.
- **§15.255(c)(3)** is a new section that permits pulse-based radar transmitters with a maximum pulse duration of 6 nanoseconds to operate over the 57.0-64.0 GHz band segment (BW= 7.0 GHz) with an average EIRP limit of 13 dBm, if the transmitter duty cycle does not exceed 10% during any 0.3 µs time window, and the average integrated EIRP within the 61.5-64.0 GHz band segment does not exceed 5 dBm during any 0.3 µs time window.

Pre-Approval Guidance (PAG) Requirements

- Section §2.964 of the FCC rules specifies that Pre-Approval Guidance (PAG) procedures be applied when compliance review procedures are not fully developed.
  - There are unique complexities associated with having eight or more possible certification options
  - It has been common practice to place new technologies on the PAG list until such time that familiarity is achieved
- In consideration of the above, applications for certification of FDS/Radar devices pursuant to §15.255 will be subject to PAG approval.

PAG Check List

- Identify the specific rule section under which certification is being sought
- Describe the radar modulation (e.g., pulsed, FMCW, other)
- State the intended use case(s), e.g., unmanned aircraft, indoor or outdoor, vehicular in-cabin, etc.
- If applying under **§15.255(c)(2)**:
  - Describe how conducted output power is determined
- If applying under **§15.255(c)(2)(v)** for operation in the 60.0-61.5 GHz ISM band
  - Demonstrate that the transmitter occupied bandwidth (OBW) is wholly contained within the 61.0-61.5 GHz band
- If applying under **§15.255(b)(3)** for operation onboard unmanned aircraft
  - Show that the transmitter OBW is contained within the 60-64 GHz band segment
  - Describe how altitude restriction will be satisfied
  - Provide time domain data that demonstrates compliance to the off-time requirement

PAG Check List (cont.)

- If applying under **§15.255(c)(2)(i)** for operation over 57.0-59.4 GHz
  - Show that the transmitter OBW is contained within the 57.0-59.4 GHz band segment
  - State whether usage will be limited to outdoor or indoor only, and if so, describe how will such limitations be ensured
- If applying under **§15.255(c)(2)(ii)** for operation over 57.0-61.56 GHz
  - Show that the transmitter OBW is contained within the 57.0-61.56 GHz band segment
- If applying under **§15.255(c)(2)(iii)(A)** for operation over 57.0-64.0 GHz
  - Show that transmitter OBW is contained within 57-64 GHz band segment
  - Demonstrate with time domain data plots that the off-time requirement is satisfied

PAG Check List (cont.)

- If applying under **§15.255(c)(2)(iii)(B)** for operation over 57.0-64.0 GHz
  - Show that transmitter OBW is contained within 57-64 GHz band segment
  - Explain how ‘fixed’ requirement is satisfied and maintained (if applicable)
  - Explain the intended vehicle application and how the device will be limited to vehicular use (if applicable)
  - Demonstrate with time domain data plots that the specified off-time requirement has been satisfied
- If applying under **§15.255(c)(3)** for pulsed radar operation over 57-64 GHz
  - Show that transmitter OBW is contained within 57-64 GHz
  - Specify the maximum pulse duration and provide supporting time domain data
  - Provide time domain data plot that demonstrates the maximum duty cycle in any 3 µs time window

General Measurement Guidance

- Equipment Class: FDS
- Radiated measurements likely due to inaccessibility of PCB-integrated radar components
- Clause 9 of C63.10-2020 (and 2013) provides general guidance for performing radiated measurements at mm-wave frequencies with following permissible variations:
- C63.10-2020 Clause 9.4 shall be used to measure and report radar transmitter occupied bandwidth (OBW) OBW)
- C63.10-2020 Clause 9.9, footnote 79 and C63.10-2013 Clause 9.11, footnote 73, specifying mandatory use of an RF detector, are not applicable to new §15.255 radar certifications

General Measurement Guidance (cont.)

- Power measurements performed with a spectrum analyzer rather than a dedicated RF detector are permitted; however, the following precautions must be considered and addressed:
  - Pulse desensitization can affect peak power measurements performed with an analyzer on a pulse-modulated signal, dependent on the shape of the RBW filter and the radar pulse bandwidth
  - Decreased sensitivity and resolution can result when a CW signal is swept by a spectrum analyzer IF amplifier at a high rate compared to the resolution bandwidth squared
  - Consult manufacturers technical bulletins to determine how to calculate and apply correction factors to peak power measurement results to compensate for inaccuracies introduced by instrumentation desensitization
  - Accurate mean (RMS) power measurements performed on an FMCW radar require a slow analyzer sweep time relative to the EUT cycle time
- KDB Publication with detailed guidance forthcoming