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.
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
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
§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
§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).
§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%.
§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.
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
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)
  - 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.