U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Use of Portable Electronic Devices Aboard Aircraft

Date: 5/7/15 **AC No:** 91.21-1C

Initiated by: AFS-300 **Change:**

1. PURPOSE. This advisory circular (AC) provides aircraft owners, operators, and the public with information and guidance for assistance in compliance with Title 14 of the Code of Federal Regulations (14 CFR) part 91, § 91.21. Section 91.21 was established because of the potential for portable electronic devices (PED) to interfere with aircraft navigation or communication systems. It prohibits the operation of PEDs not installed aboard U.S.-registered civil aircraft while operating under instrument flight rules (IFR). This rule permits the use of specified PEDs and other devices that the operator of the aircraft has determined will not interfere with the safe operation of that aircraft. The recommendations contained herein are one means, but not the only means, of complying with § 91.21 requirements pertaining to the operation of PEDs.

2. CANCELLATION. This AC cancels AC 91.21-1B, Use of Portable Electronic Devices Aboard Aircraft, dated August 25, 2006.

3. RELATED 14 CFR REGULATIONS. Part 91, § 91.21; part 121, § 121.306; part 125, § 125.204; and part 135, § 135.144.

4. BACKGROUND.

a. Section 91.21. Section 91.21 (formerly § 91.19) was initially established in May 1961 to prohibit the operation of frequency modulation (FM) receivers since they were determined to interfere with the operation of aircraft navigation and communication systems. The Federal Aviation Administration (FAA) subsequently determined that other PEDs could be potentially hazardous to aircraft systems if operated aboard aircraft. Amendment 91-35 amended the scope of former § 91.19 to prohibit the use of additional PEDs aboard certain U.S.-registered civil aircraft. Section 91.21, as adopted, was drafted to require the air carrier or commercial operator to determine whether a particular PED will cause radio frequency (RF) interference when operated aboard its aircraft. This AC uses the term “operator” throughout to mean pilot-in-command (PIC), renter-pilot, or air carrier certificate holder.

b. RTCA/Document Number (DO)-199. RTCA Special Committee (SC)-156 accomplished a study of the potential for interference from PEDs and in September 1988 released RTCA/DO-199, Volumes I and II, Potential Interference to Aircraft Electronic Equipment from Devices Carried Aboard.

NOTE: To obtain any documents referenced in this AC, see paragraph 10.

c. RTCA/DO-233. RTCA SC-177 did a further study of these devices and in August 1996 released RTCA/DO-233, Portable Electronic Devices Carried Onboard Aircraft. The findings and conclusions from these two studies helped the FAA establish policy which allows the use of non-transmitting PEDs during non-critical phases of flight.

d. RTCA/DO-294. In March 2003, the FAA requested that RTCA form an SC to evaluate and develop guidance to assess the impact and risk related to the use of intentionally radiating PEDs, or transmitting PEDs (T-PEDs), that passengers may bring onto civil aircraft. These include mobile telephones, computers with wireless network capabilities, and other wireless-enabled devices such as Personal Digital Assistants (PDA). On December 16, 2008, RTCA released RTCA/DO-294, prepared by RTCA SC-202, Guidance on Allowing Transmitting Portable Electronic Devices (T-PEDS) on Aircraft. RTCA also released RTCA/DO-294 versions A, B, and C.

e. RTCA/DO-307. In October 2007, RTCA released RTCA/DO-307 (and Change 1 in December 2008), prepared by RTCA SC-202, Aircraft Design and Certification for Portable Electronic Device (PED) Tolerance. RTCA/DO-307 defines aircraft system and equipment radio frequency (RF) susceptibility qualification recommendations that provide tolerance to RF from intentionally transmitting PEDs. Also, RTCA/DO-307 defines acceptable interference path loss between aircraft radio receivers and spurious RF emissions from transmitting and non-transmitting PEDs.

f. AC 20-164. In March 2010, the FAA published aircraft certification guidance AC 20-164, Designing and Demonstrating Aircraft Tolerance to Portable Electronic Devices. This AC refers to RTCA/DO-307 as an acceptable method for demonstrating aircraft tolerance to intentional transmissions and spurious emissions from PEDs. The AC also provides guidance for aircraft certification applicants to gain FAA approval for data that demonstrates aircraft tolerance to PEDs.

g. PED Aviation Rulemaking Committee (ARC). On January 7, 2013, the Administrator of the FAA established the PED ARC to provide a forum for the U.S. and European aviation communities and government regulatory groups to review PED policy and guidance. The ARC was tasked to make recommendations to further clarify and provide guidance on allowing additional PED usage without compromising the continued safe operation of the aircraft. The ARC reviewed current available data submitted by the FAA, other federal agencies including the Federal Communications Commission (FCC), industry associations, and ARC member subject matter experts (SME). The ARC also reviewed current guidance material and information on PEDs, including documents developed by the FAA, RTCA, and the FCC. The ARC spent nine months completing a report that details the considerations to expand PED use. The ARC submitted its final report and recommendations to the FAA on September 30, 2013. The report contained recommendations that could be implemented in the very near term, as well as changes in policy and guidance that need additional time to consider and implement.

h. Information for Operators (InFO) 13010 and 13010SUP. Based on some of the PED ARC recommendations, the FAA published InFO 13010, Expanding Use of Passenger Portable Electronic Devices (PED), on October 31, 2013, and InFO 13010SUP, FAA Aid to Operators for the Expanded Use of Passenger PEDs, on June 9, 2014. These companion documents provide a

near term method for an operator to determine if it can safely expand PED use to additional phases of flight and what actions it should take when making that determination. InFO 13010 and InFO 13010SUP provide acceptable methods for aircraft operators to expand PED use in compliance with §§ 91.21, 121.306, 125.204, and 135.144.

5. TECHNICAL SUBSTANTIATION.

a. Permitting the Use of PEDs. The related 14 CFRs in paragraph 3 allow for the operation of PEDs that the operator of the aircraft has determined will not interfere with the navigation or communication systems of that aircraft. By regulation, the responsibility for permitting the use of a particular PED technology lies solely with the operator. The decision to allow the use of PEDs is based on determining the potential for PED interference on the aircraft communication, navigation, surveillance, and other electronic systems. For aircraft operated by the holder of an air carrier certificate or other operating certificate, that decision must be made by that operator (i.e., certificate holder). In all other cases, the operator, upon completion of an electronic interference evaluation using acceptable methods, must make the determination as to which PEDs may be used and when they may not be used. Acceptable methods published in paragraph (b), (d), (f), or equivalent methods specifically accepted by the FAA may be used as the evaluation basis. If the operator lacks the personal knowledge of these methods, no determination should be made to permit the use of these devices without consulting an appropriately trained and knowledgeable expert.

b. Evaluating Potential Interference. Policies for allowing the use of PEDs originally addressed analysis of individual transmitting and non-transmitting PEDs to determine possible interference. However, the number and variety of PEDs in use today make it impractical to analyze individual devices. Guidance in the latest versions of RTCA/DO-294 and RTCA/DO-307 provides methods to determine aircraft tolerance to PEDs. These approaches eliminate the need to evaluate potential interference from individual PEDs and allow an operator to expand use of PEDs based on the aircraft's ability to tolerate PED emissions. The determination made by the operator may be based on type certification data, PED tolerance tests, and risk evaluations relying on acceptable methods as published in or referenced in this AC.

c. Determining Potential Interference. RTCA/DO-294C identifies processes for evaluating acceptable use of T-PEDs, particularly when considering specific types of wireless technologies. The operator may want to obtain the services of a person or facility capable of determining non-interference to the aircraft's communication, navigation, surveillance, or other electronic systems. Personnel specifically designated by the operator for this purpose may make this determination using the process described in RTCA/DO-294C.

d. Demonstrating Tolerance. Showing that an aircraft meets the requirements of RTCA/DO-307 is most easily demonstrated by aircraft manufacturers that have access to data that defines the aircraft electronic system qualification and the aircraft radio receiver antenna installations. The operators may be able to obtain statements of any such demonstrations from the aircraft manufacturer for use in substantiating PED tolerance of the aircraft. The methods in RTCA/DO-307 may also be used by operators in demonstrating PED tolerance of their aircraft. RTCA/DO-307 has separate methods for demonstrating tolerance to intentional transmissions from T-PEDs and demonstrating tolerance to spurious emissions from PEDs. Aircraft with an

FAA-approved system (e.g., Onboard Mobile Telecommunications System (OMTS), WiFi, Airborne Access Systems (AAS), Network Control Units (NCU)) are considered PED-tolerant for those specific types of PEDs intended to be used with the installed system. If an aircraft model has demonstrated tolerance for both transmitting and non-transmitting PEDs, the operator may allow PED use during all phases of flight on these aircraft models. If the aircraft model has not demonstrated tolerance for non-transmitting PEDs, the operator should prohibit the use of PEDs during descent and approach when the aircraft landing guidance radios are required.

e. Action Taken if Interference Occurs. If the operator has not demonstrated PED tolerance for their aircraft, they may allow PEDs to be operated during cruise flight. If interference to aircraft systems from PEDs is experienced during cruise flight, the types of devices causing interference should be isolated, and the applicable conditions recorded. The device responsible for the interference should be turned off.

f. Conducting a Safety Risk Assessment. If an operator does not have a PED-tolerant aircraft and chooses not to test its aircraft fleet types according to RTCA/DO-307, including Change 1, then the operator may choose to conduct a safety risk assessment derived from the PED ARC Final Report, Appendix F: Avionics System Functional Hazard Risk Assessment. The operator's assessment must assess the avionics configuration of its fleet and the failure modes associated with different types of communication, navigation, surveillance, and other electronic systems with respect to electromagnetic interference. This assessment outlines mitigations and controls that the operator needs to adopt to expand PED use into various phases of flight. For more information, refer to InFO 13010 and InFO 13010SUP, which provide processes and procedures for performing the safety risk assessment and applying the appropriate mitigations.

6. OPERATIONAL CONSIDERATIONS.

a. Operator Procedures. If an operator allows the use of PEDs aboard its aircraft or the aircraft being operated, procedures should be established to control their use during aircraft operations. The procedures should address:

(1) PEDs approved for use onboard its aircraft;

(2) Times when approved PEDs can and cannot be used;

(3) How and when PEDs must be secured or stowed;

(4) PEDs' modes of operation that can and cannot be used; and

(5) How and when to inform passengers of the aircraft operator's PED policies and procedures.

NOTE: Refer to InFO 13010SUP for detailed information for operators to address when choosing to expand PED use on aircraft.

b. Passenger Communication. Methods to inform passengers of permissible times, conditions, and limitations when various PEDs may be used. This may be accomplished through the departure briefing, passenger information cards, captain's announcement, and other methods

deemed appropriate by the operator. For air carrier operations conducted under parts 121 or 135, the limitations, at a minimum, should state that the use of all such devices (except all medical electronic devices such as heart pacemakers or portable oxygen concentrators (POC)), are prohibited during any phase of operation when their use could interfere with the communication or navigation equipment onboard the aircraft or the ability of the flightcrew to give necessary instructions in the event of an emergency.

(1) Procedures to terminate the operation of PEDs suspected of causing interference with aircraft systems.

(2) Procedures for reporting instances of interference by a PED to a local Flight Standards District Office (FSDO) or, in the case of an air carrier, the Certificate Holding District Office (CHDO).

(3) Cockpit-to-cabin coordination and cockpit flightcrew monitoring procedures.

(4) Procedures for determining acceptability of those PEDs to be operated aboard its aircraft. Acceptable PEDs should be clearly spelled out in oral departure briefings and by written material provided to each passenger to avoid passenger confusion.

(5) Preparation procedures for takeoff and landing phases of flight must be considered when allowing the operation of any PEDs during these phases of operation. It must be recognized that the potential for personal injury to passengers is a paramount consideration, as well as the possibility of missing significant safety announcements during important phases of flight. InFO 13010 and InFO 13010SUP provide guidance to address these considerations.

c. Use of a PED as an Electronic Flight Bag (EFB). An EFB is a function, not a device. An EFB is the combination of PED hardware and authorized software applications in accordance with the current edition of AC 120-76, Guidelines for the Certification, Airworthiness, and Operational Use of Electronic Flight Bags.

(1) If an aircraft has been determined to be eligible for passenger PED use in all phases of flight, without restriction, then the same determination of electromagnetic compatibility may apply to PEDs that have been authorized for use as EFBs in accordance with OpSpec/MSpec/LOA A061, Use of Electronic Flight Bag.

(2) If an aircraft is not eligible for PED use for all phases of operation, then follow the guidance in AC 120-76 as amended for other EFB PED noninterference compliance test methodologies.

(3) During operations conducted under part 121, if a crewmember uses an EFB displaying an application which is not authorized for use in accordance with OpSpec/MSpec/LOA A061, then this action is in violation of part 121, § 121.542(d).

7. CELLULAR AND ONBOARD TELEPHONE SYSTEMS.

a. Restricting Airborne Cellular Telephone Use. There are additional considerations for PEDs with cellular or mobile telephony capabilities. These PEDs include mobile telephones and

computers with cellular wireless network capabilities. The FCC prohibits cellular telephone operation while airborne, as noted in Title 47 of the Code of Federal Regulations (47 CFR) part 22, § 22.925. This restriction is valid for all aircraft without having technical provisions (e.g., OMTS, Global System for Mobile Communications (GSM), AAS, NCU) that enable control of onboard mobile devices and eliminate interference between ground-based cellular stations with airborne cellular devices. If technical provisions are installed, compliant with, or exempt from § 22.925, then usage of cellular-enabled PEDs is acceptable.

b. Compliance With FCC Rules. The FAA supports this restriction on airborne cellular telephone use. The FAA does not prohibit the use of cellular telephones in aircraft while on the ground. While airborne, operators should instruct passengers to turn off cellular telephones, disable a PED's cellular transmitting functions, or place PEDs with cellular or mobile telephony capabilities in airplane mode. The operator's procedures should be clearly described in oral briefings prior to departure or in written material provided to each passenger.

(1) If an aircraft operator allows passengers to use an installed mobile telephone system, then the operator should instruct passengers to turn off cellular telephones, disable their PED's cellular transmitting functions, or place PEDs with cellular mobile telephony capabilities in airplane mode as soon as the airplane is entering U.S. airspace. An automatic indication of this event should be provided by the system.

(2) In case the FCC will revise the restrictions mentioned above, the switch-off procedures, necessary for entering U.S. airspace, would then become obsolete.

c. Procedures for Air-to-Ground Communication. Installed telephone systems that are authorized by the FCC for passenger air-to-ground communication may be used while airborne or on the ground. Such airborne passenger telephone systems are installed, tested, and certified in accordance with FAA aircraft certification and airworthiness standards. The operator's procedures for the use of these installed telephone systems should be clearly described in oral briefings prior to departure or in written material provided to each passenger.

8. Cargo Tracking Devices, Data Loggers, RFID, and Electronic Bag Tags. This section applies to PEDs that are designed for use on aircraft in locations inaccessible to the flightcrew during flight. Because this class of PEDs cannot be turned off manually in the event of an emergency, the device manufacturers and aircraft operators must ensure certain design and operational considerations are addressed. The operator must ensure that these PEDs meet the following criteria prior to allowing use on aircraft:

a. The cargo tracking device meets the RF radiated emissions limits defined in RTCA/DO-160, Environmental Conditions and Test Procedures for Airborne Equipment, Section 21, Category H during all modes of operation. Testing of the device must include any peripheral devices that will be used with the device during normal operations. Typically, peripherals include external sensors or associated wiring. For additional Guidance, refer to RTCA/DO-357, User Guide: Supplement to DO-160G.

b. The device is designed with a minimum of two independent means to turn off completely, turn off cellular or mobile functions, or a combination of both when airborne. These

independent methods must use different sources to identify flight. For example, a cargo tracking device designed to sense rapid altitude changes and acceleration to turn off cellular transmissions is an acceptable design feature that meets the requirement. Redundant sources of the same information, such as two vertical accelerometers, would not be an acceptable design.

c. The device manufacturer substantiated data includes:

(1) Pictures of the device and any peripherals,

(2) Product label,

(3) Operational description of device and peripherals,

(4) Manufacturer statement of strict design and production controls, and

(5) If device contains a lithium battery, battery design standard and relevant battery qualification documentation (e.g., TSO-C142a, Non-Rechargeable Lithium Cells or Batteries, dated August 7, 2006, approval; RTCA/DO-311, Minimum Operational Performance Standards for Rechargeable Lithium Battery Systems, dated March 13, 2008, qualification report; etc.).

d. The device must not be capable of generating a dangerous evolution of heat.

e. The device must not be capable of emitting disturbing signals, such as buzzing alarms or strobe lights, during transport.

f. The battery must be compliant with the requirements of Title 49 of the Code of Federal Regulations (49 CFR) parts 171-180 and meet the size exceptions. For batteries of devices attached to the outside of cargo (e.g., luggage, packages), the FAA recommends a limit of not more than 0.3 grams per lithium metal cell or 2.7 Watt-hours per lithium ion cell.

9. MEDICAL-PORTABLE ELECTRONIC DEVICES (M-PED). This section applies to M-PEDS, which are devices that are medically necessary to support physiological functions, may be used at all times, and do not need to be switched off.

a. Considerations for M-PEDs. The FAA believes that sufficient risk mitigation can occur to allow for safe operation of M-PEDs during all phases of flight. The FAA does not have a safety regulation that would prevent M-PEDs from being voluntarily included in an operator's carry-on baggage program, general operating procedures manual, or personal items policy as part of the general class of passenger-supplied and passenger-operated PEDs. The FAA encourages operators to include M-PEDs in their carry-on baggage program and personal items policy in order to increase accessibility in air travel for people with disabilities. Some M-PEDs are life-sustaining, like a ventilator, and cannot be turned off at any time during flight. M-PEDs have safely been in use during all phases of flight for decades as part of emergency medical service and commercial operations. An airline's risk assessment and crewmember procedures would need to address proper stowage of larger M-PEDs and the inability to turn off certain types of these devices during aircraft operations. Small M-PEDs must be secured (not loose) during surface movement, takeoff, descent, approach, and landing. Passengers should be encouraged to secure small M-PEDs on their person by placing them in an armband or garment pocket.

b. POCs. To comply with part 121, §§ 121.574(e)(1)(ii), 125.219(f)(1)(ii), and 135.91(f)(1)(ii), POC manufacturers must ensure their POCs do not cause interference with the electrical, navigation, or communication equipment on the aircraft on which the device is to be used. When considering aircraft electromagnetic compatibility with POCs, the following are acceptable methods that allow unrestricted use of POCs.

(1) Accept POC manufacturer qualified radiated RF emissions testing,

(2) Accept the electromagnetic compatibility testing required for Class II medical devices intended for use in aviation by the Food and Drug Administration (FDA), or

(3) Include specific POC makes and models in the airline's carry-on baggage program and personal items policy. These POC makes and models either bear a label or are listed in § 121.574(e)(1)(v), 125.219(f)(1)(v), or 135.91(f)(1)(v).

c. Nondiscrimination Requirements. Air carriers should be aware of Department of Transportation (DOT) requirements in 14 CFR part 382, Nondiscrimination on the Basis of Disability in Air Travel, that address the use of certain M-PEDs. More information on part 382 can be found at: http://airconsumer.dot.gov/SA_Disability.htm.

10. HOW TO OBTAIN REFERENCED DOCUMENTS.

a. RTCA Documents. Order RTCA documents from RTCA, Inc. at 1150 18th Street NW, Suite 910, Washington, DC 20036. Telephone 202-833-9339, fax 202-833-9434. You may also order copies online at http://www.rtca.org.

b. Title 14 CFR Documents. Order copies of 14 CFR parts from the Superintendent of Documents, Government Printing Office (GPO) at P.O. Box 37154, Pittsburgh, PA 15250. Telephone 202-512-1800, fax 202-512-2250. You may also order copies online at http://www.access.gpo.gov. Select "Access," then "Online Bookstore." After that, select "Aviation," then "Code of Federal Regulations."

c. ACs. You can find a current list of ACs at http://www.faa.gov/regulations_policies/advisory_circulars.

d. InFOs. You can find a current list of InFOs at http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos.

e. PED ARC Recommendation Report. You can find the PED ARD Recommendation Report at http://www.faa.gov/regulations_policies/rulemaking/committees/documents/index.cfm/committee/browse/committeeID/337.

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Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Aircraft Maintenance Division (AFS-300) at: 9-AWA-AFS-300-Division-Directives@faa.gov, or the Flight Standards Directives Management Officer.

Subject: AC 91.21-1C, Use of Portable Electronic Devices Aboard Aircraft

Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

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☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

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☐ Other comments:

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☐ I would like to discuss the above. Please contact me.

Submitted by: _____ Date: _____