AC 170-6C

DATE 2/13/81

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: USE OF RADIONAVIGATION LAND TEST STATIONS AND SIGNAL GENERATORS

CHAPTER I. GENERAL

1. PURPOSE. Information vital to all users of radionavigation land test stations is now incorporated in Parts 2 and 87 of the Federal Communications Commission's (FCC) Rules and Regulations (47 CFR, Sections 2 and 87). This circular gives information as to the frequencies on which the FCC will license these stations within the scope of its regulations. This advisory circular also discusses the potential source of electromagnetic interference presented by signal generators and how this interference can be alleviated. We hope that users of signal generators will examine their operations and modify those which could interfere with aeronautical services.

2. CANCELLATION. Advisory Circular 170-6B dated 3/14/78 is canceled.

3. INTERFERENCE WITH AERONAUTICAL SERVICES. The Federal Aviation Administration (FAA) goes to great length to provide an interference-free air traffic control environment. With a safety service, it is not sufficient to depend on correcting interference problems after they occur. It is a basic FAA objective to prevent interference from occurring by every means possible. With authorized transmitter stations, a number of techniques are used to preclude interference. With signal generators, however, only a few techniques for avoiding interference are sufficiently fail-safe to be considered practical.

Initiated by: ARD-450

CHAPTER 2. RADIONAVIGATION LAND TEST STATIONS

4. BACKGROUND - RADIONAVIGATION LAND TEST STATIONS. A radiated test signal is sometimes useful for checking navigation receivers; i.e., VOR, localizer, glide slope, DME, etc., without removing them from the aircraft. Uncontrolled radiation of such test signals creates a potential hazard since it may cause errors in aircraft receivers tuned to operating navigational facilities. Authorized receiver test facilities are assigned specific frequencies and power limits which are selected to avoid such interference to operating facilities.

5. PROTECTED FREQUENCIES. Radionavigation test generators will be licensed by the Federal Communications Commission to operate on the following frequencies with up to 1 watt power output authorization (47 CFR, Section 87.521(d); FCC Rules, Part 87, paragraph 87.521(d)).

Marker	75.0 MHz
VOR (X Channel)	108.0 MHz
VOR (Y Channel)	108.05 MHz
Localizer	108.1 MHz
Glide Slope	334.7 MHz
DME	978.0 MHz
	979.0 MHz
Beacon[1/]	1030 MHz
DME (Y Channel)	1104 MHz

6. OPERATION OF RADIONAVIGATION LAND TEST STATIONS ON FREQUENCIES OTHER THAN THE PROTECTED FREQUENCIES.

a. Under certain circumstances, Federal Communications Commission licenses will be issued for operation on other frequencies. Radiation on these frequencies will be restricted to a maximum field intensity level. The levels listed below have been determined to be adequate for ramp testing and nonhazardous to operational facilities (47 CFR, Section 87.521(c); FCC Rules, Part 87, paragraph 87.521(c)).

b. The suggested generator outputs, to produce the specified maximum field limits at a distance of 100 feet using omnidirectional antennas attached directly to the generators, are as follows:

Band	Maximum Field Intensity	50 ohm Generator Output
VOR/Localizer	20 uv/m RMS @ 100 feet	4 millivolts RMS
Glide Path	60 uv/m RMS @ 100 feet	12 millivolts RMS
DME	600 uv/m Peak @ 100 feet	23 millivolts Peak (.01 milliwatts Peak)

1/ The pulse repetition rate (PRR) for the 1030 MHz ATC beacon test set will be 235 pulses per second (pps) ±5 pps.

7. POWER LIMITATIONS. The power levels indicated in paragraphs 5 and 6 are maximum levels. However, FCC Rules require that Radionavigation Land Test Stations be designed and operated with the minimum power necessary to satisfy requirements (47 CFR, Section 87.63(a); FCC Rules, Part 87, paragraph 87.63(a)). The FAA supports this requirement.

8. REQUESTS FOR INFORMATION ABOUT RADIONAVIGATION LAND TEST STATIONS. Additional information may be obtained from the FAA or the FCC at the following Washington offices or from the FAA regional frequency management offices (See Appendix 1). Questions concerning specific assignments should be directed to either the Frequency Engineering Branch of the Airway Facilities Service in Washington or to the regional frequency management offices. Questions concerning FAA review of FCC Type Acceptance Applications should be directed to the Spectrum Management Branch of the Systems Research and Development Service.

Federal Aviation Administration
Airway Facilities Service
Frequency Engineering Branch, AAF-730
800 Independence Ave., S.W.
Washington, D.C. 20590

Federal Aviation Administration
Systems Research and Development Service
Spectrum Management Branch, ARD-450
400 Seventh Street, S.W.
Washington, D.C. 20590

Federal Communications Commission
Safety and Special Radio Service Bureau
Aviation and Marine Division
Washington, D.C. 20554

CHAPTER 3. SIGNAL GENERATORS

9. BACKGROUND - SIGNAL GENERATORS. Signal generators are used for a variety of purposes including the maintenance of aviation ground systems, avionics, and aircraft antennas. Maintenance is essential to the operation of the National Airspace System. However, the use of signal generators for maintenance and other activities can be a source of electromagnetic interference. Aviation receivers are highly sensitive. Consequently, even a very low-level radiated signal can cause disruption and interference to aeronautical services out to a substantial distance. Under some circumstances, for instance, a signal generator with an output of -30 dBW (1 milliwatt) can cause interference out to a distance of several miles. Interference is possible from both modulated and unmodulated signals. A signal generator is not an authorized station (47 CFR, Section 2.905; FCC Rules, Part 2, paragraph 2.905). Users should therefore take adequate precautions to insure that their operations do not cause disruption or interference to aeronautical services. Users should note the difference between radionavigation land test stations and signal generators. A radionavigation land test station is an authorized transmitter. Unless special temporary authorization has been obtained from the FCC, a signal generator is not. Due to these and other differences, different methods are used to preclude interference.

10. TECHNIQUES TO AVOID INTERFERENCE WITH AERONAUTICAL SERVICES. One way that signal generator users can avoid interference is simply not to connect them to antennas or other radiating devices. A second method, should radiation be unavoidable, is to confine this radiation to a shielded enclosure. This need not be a copper plated, anechoic chamber. Sometimes, the shielding provided by a typical building may be sufficient. Users should scrutinize any operation which results in the radiation of a signal (directly or indirectly) by a signal generator. In the interest of avoiding electromagnetic interference and the accompanying hazard to safety services, users should take all practical steps to avoid radiation. Radiation, in the selected bands given in Appendix 2, should be confined to shielded areas. Even then, users should minimize the duration of radiating tests, avoiding local aeronautical frequencies to the maximum extent possible, and using the lowest power necessary. A careful consideration of this matter is particularly appropriate for signal generator operations on or adjacent to airports.

11. SHIELDING ADEQUACY. If the use of a signal generator results in the radiation of a signal, it is considered a restricted radiation device by the Federal Communications Commission (FCC) (47 CFR, Section 15.7; FCC Rules, Part 15, paragraph 15.7). FCC Rules and Regulations require that such equipment shall not exceed certain power limitations (see FCC Part 15, paragraph 15.7(c)). The total electromagnetic field, produced at any point away from the apparatus a distance equal to the wavelength divided by 2 pi, shall not exceed 15 microvolts per meter. (Expressed in feet, this distance is 157,000 divided by the frequency in kHz. Expressed in meters, this distance is 47,853.6 divided by the frequency in kHz.) Although the FCC

Rules and Regulations do not explicitly prohibit the use of antennas to radiate signal generator test signals, the field strength limitation of 15 microvolts per meter practically precludes such an operating practice unless adequate shielding is available. This 15 microvolts per meter limitation is recommended as a test for determining shielding adequacy. Since the enclosure itself may be larger than the distance given above, testing should be conducted at this distance from the outside of the enclosure. Testing at numerous points is recommended.

12. SIGNAL GENERATOR MANUFACTURERS. The FAA envisions that signal generator manufacturers may wish to provide their customers a copy of this AC at the time of sale and/or to include its cautionary remarks in their equipment manuals. Manfacturers could limit the distribution of this information to those signal generators that can tune the selected aeronautical bands shown in appendix 2.

13. REQUESTS FOR INFORMATION ABOUT SIGNAL GENERATORS. For additional information, please contact the Spectrum Management Branch of the Systems Research and Development Service at the address given in paragraph 8.

ROBERT W. WEDAN
Director, Systems Research
and Development Service

APPENDIX 1. REGIONAL FREQUENCY MANAGEMENT OFFICERS' ADDRESSES

Office	Area of Responsibility
Frequency Management Officer, AAL-430B Federal Aviation Administration 632 Sixth Avenue Anchorage, Alaska 99501	Alaska
Frequency Management Officer, ACE-432 Federal Aviation Administration 601 E. 12th Street Federal Building Kansas City, Missouri 64106	Iowa; Kansas; Missouri; Nebraska
Frequency Management Officer, AEA-426 Federal Aviation Administration JFK International Airport Federal Building Jamaica, New York 11430	Delaware; District of Columbia; Maryland; New Jersey; New York; Pennsylvania; Virginia; West Virginia
Frequency Management Officer, AGL-437 Federal Aviation Administration O'Hare Lake Office Center 2300 East Devon Avenue Des Plaines, Illinois 60018	Illinois; Indiana; Michigan; Minnesota; Ohio; Wisconsin
Frequency Management Officer, ANE-464 Federal Aviation Administration 12 New England Executive Park Burlington, Massachusetts 01803	Connecticut; Maine; Massachusetts; New Hampshire; Rhode Island; Vermont
Frequency Management Officer, ANW-426 Federal Aviation Administration FAA Building, Boeing Field Seattle, Washington 98108	Idaho; Oregon; Washington
Frequency Management Officer, APC-430.3 Federal Aviation Administration P.O. Box 4009 Honolulu, Hawaii 96813	Hawaii; Guam; Samoa

Office (cont)	Area of Responsibility
Frequency Management Officer, ARM-406 Federal Aviation Administration 10455 East 25th Avenue Aurora, Colorado 80010	Colorado; Montana; North Dakota; South Dakota; Utah; Wyoming
Frequency Management Officer, ASO-434 Federal Aviation Administration P.O. Box 20636 Atlanta, Georgia 30344	Alabama; Florida; Georgia; Kentucky; Mississippi; North Carolina; South Carolina; Tennessee
Frequency Management Officer, ASW-406 Federal Aviation Administration P.O. Box 1689 Fort Worth, Texas 76101	Arkansas; Louisiana; New Mexico; Oklahoma; Texas
Frequency Management Officer, AWE-406 Federal Aviation Administration P.O. Box 92007 Worldway Postal Center Los Angeles, California 90009	Arizona; California (including offshore islands); Nevada

APPENDIX 2. SELECTED AERONAUTICAL BANDS

190-415	kHz	Aeronautical Radio Beacons
510-535	kHz	Aeronautical Radio Beacons
1605-1800	kHz	Aeronautical Radio Beacons
74.6-75.4	MHz	Marker Beacons
108-118	MHz	VOR and ILS Localizer
118-137	MHz	VHF Air/Ground Communications and Emergency Locator Transmitters (121.5 MHz)
225-400	MHz	UHF Air/Ground Communications, Emergency Locator Transmitters (243 MHz), and ILS Glide Slope (328.6-335.4 MHz)
960-1215	MHz	DME, TACAN, ATCRBS (1030/1090 MHz), Discrete Access Beacon (DABS: 1030/1090 MHz), Beacon Collision Avoidance System (BCAS: 1030/1090 MHz)
1250-1350	MHz	Air Route Surveillance Radar (ARSR)
2700-2900	MHz	Airport Surveillance Radar (ASR)
5000-5250	MHz	Microwave Landing System (MLS)
5350-5470	MHz	Airborne Weather Radar
7115-7250	MHz	Radar Microwave Link (RML)
7300-7975	MHz	Radar Microwave Link (RML)
8025-8400	MHz	Radar Microwave Link (RML)
9000-9200	MHz	Precision Approach Radar (PAR)
9300-9500	MHz	Airborne Weather Radar
14.4-15.35	GHz	Television Microwave Link (BRITE)
15.7-16.2	GHz	Airport Surface Detection Equipment (ASDE III)
24.25-25.25	GHz	Airport Surface Detection Equipment (ASDE II)

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