

OVERALL SYSTEM ADMINISTRATION
MICROWAVE RADIO
RADIO ADMINISTRATION

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1. GENERAL

1.01 The purpose of this section is to establish Bell System standards for uniform instructions and responsibilities for the maintenance of radio stations. Minor deviations from this section may be required due to local operating company instructions or conditions but in no case should the deviation result in a violation of Federal Communications Commission (FCC) or Federal Aviation Administration (FAA) rules or regulations. The information in this section was formerly contained in Section 410-100-010. Appendix 1 describes a number of concepts and conditions and their relationship to the overall maintenance of microwave systems.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 The title for each figure includes a number in parentheses which identifies the paragraph in which the figure is referenced.

1.04 Some of the terms used in this section are defined as follows:

(a) **Radio Station**—One or more fixed transmitters under a common FCC authorization (license, construction permit, special authority) including the accessory equipment required for the operation of a radio communications service.

(b) **Maintenance Center**—The central reporting location of a maintenance force delegated the responsibility of maintaining one or more radio stations.

(c) **Maintenance Center Supervisor**—The supervisor responsible for the maintenance of one or more radio stations.

Figure

NOTICE

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(d) **Alarm Center**—The 24-hour attended location(s) at which alarms and indications are received from remote, partially manned, and normally unattended radio stations.

(e) **Alarm Center Supervisor**—The supervisor assigned the responsibility of receiving, interpreting, and referring alarm indications or trouble reports.

(f) **Routine Maintenance Visit**—This refers to visits made for the performance of **scheduled** work on station equipment, buildings, and grounds. These work items and the routine intervals are described in the Equipment Test List.

(g) **Demand Scheduled Maintenance**—The performance of **corrective** maintenance procedures when existing prescribed in-service tests, transmission surveillance tests and alarms indicate that equipment performance is deteriorating to the point that, if allowed to continue, service may be affected. These tests are described in the Equipment Test List.

(h) **Trouble Visits**—This refers to visits made to a radio station for the purpose of clearing troubles as evidenced by alarm indications or trouble reports.

(i) **Overall Radio Section Control Office**—The office having overall radio section control responsibility for an end-to-end radio line. The radio line may consist of one or more switch sections in tandem and will normally be an MUR, DMUR, DUR, or TVS.

(j) **Switching Section Control Office**—The office having responsibility for a radio switching section. This is normally the office at the receiving end of the radio protection switching system, (100A, 400A, 400B, TDAS, THAS, TL/TM, etc).

of information should be referred to the maintenance center supervisor.

2. SAFETY REQUIREMENTS

2.01 The company recognizes the need for an effective safety program. This program should be designed to combine knowledge and identification of hazards with enforcement and periodic inspections to prevent accidents. The safety plan should comply with company standards and policies to ensure a safe working environment and also comply with local, state and federal laws.

2.02 The maintenance supervisor and employees have the primary responsibility for the administration and enforcement of any safety plan. This safety requirement covers all work performed at any location, whether the person is an employee or contract type individual, which comes under the responsibility of the maintenance supervisor.

2.03 If it is necessary for an employee to go onto the roof, he shall, before ascending, notify the alarm center of his intentions and approximately how long it will be before he descends, and again notify the alarm center when he does descend. Extreme care should be used when working on roofs, especially during inclement weather. Local company policy should be reviewed before performing this type of work.

2.04 For the protection of personnel, interlock switches have been installed on equipment having hazardous voltages present where testing and maintenance work is to be performed. These interlock switches should never be disabled.

2.05 Some radio repeater sites are located in isolated areas and may be reached only by means of hazardous access roads. Observe extra driving precautions, especially during bad weather.

2.06 Extreme caution should be exercised in snake-infested areas. Do not overlook the possibility of snakes entering unattended radio stations or adjacent buildings. Where appropriate, standard snake-bite kits and first-aid kits shall be kept available in all maintenance vehicles and all radio stations.

1.05 The maintenance center supervisor is responsible for the stations he supervises. All requests for inspections or information regarding stations should be promptly referred to the maintenance center supervisor.

1.06 No information regarding facility layout, routing, or other details shall be divulged to unauthorized persons. All requests for this type

2.07 Employees should be alert for other hazards such as:

- (a) Poison oak, ivy, or sumac adjacent to access roads, gates, and in the vicinity of radio stations.
- (b) Hunters during hunting season.
- (c) Earth slides, snow slides, or avalanches on access roads during winter.
- (d) Fire hazards.

2.08 Emergency engines are normally arranged for automatic start following failure of commercial power. This automatic start feature shall be disabled before performing any inspection or maintenance work on the engine or the associated equipment, keeping in mind the following:

- (a) At some stations, should commercial power fail at the time the engine is disabled, the station may be subject to service failure.
- (b) Before working on the engine or the associated components at locations described in (a) above, consideration should be given to service protection by reroute or provision of standby portable power.

2.09 Additional safety requirements may be applicable to work being performed on other equipment not mentioned in this section. These additional safety requirements, as outlined in specific sections, should be used when such work is being performed.

3. LOCK AND KEY SECURITY

3.01 In order to provide adequate protection against unauthorized entry into a radio station, doors shall be kept locked at all times.

3.02 The record of keys issued shall be reviewed by the maintenance center supervisor annually. The number of master keys and individual station keys shall be limited to those employees actually having a need for them. Keys should be recalled from those employees who no longer have a need for them. The keys issued shall be strictly accounted for by the maintenance center supervisor.

3.03 When a key cannot be accounted for, it shall be the maintenance center supervisor's responsibility to ensure that the radio stations affected are not subject to unauthorized entry.

4. MAINTENANCE OF GROUNDS

4.01 The control of insidious weeds and the appearance of the grounds surrounding the buildings and towers shall be maintained consistent with local environmental requirements.

4.02 No surplus material or rubbish shall be permitted to accumulate in areas adjacent to buildings or in tower yards. The burning of trash or rubbish is not permitted.

4.03 Local forces should ensure that parking areas and access roads are properly maintained and do not present a safety hazard.

5. BUILDING MAINTENANCE

5.01 It is recommended that periodic inspections be made and corrective action taken to ensure the proper upkeep of all buildings. (*Any condition involving safety of personnel or property should be corrected immediately.*)

5.02 Good housekeeping is the responsibility of the maintenance supervisor. It is his responsibility to exercise his authority to control all work operations at radio stations by Western Electric and outside contractors to ensure the compliance with safety and housekeeping standards conforming to Bell System standards.

5.03 Reference may be made to Bell System Practices—Division 770 for specific maintenance requirements.

6. ANTENNAS AND ANTENNA STRUCTURES

6.01 Essentially, all antennas and antenna structure inspections and maintenance work will be performed by contractors or employees who are authorized to perform antenna or structure maintenance. All such work should be under the direction of the maintenance center supervisor; it may be desirable to have an authorized company representative present at all times to ensure a safe and satisfactory performance. The total safety of all individuals should never be compromised.

6.02 In order to comply with FCC regulations, all tests, inspections, and maintenance associated with antennas and antenna structures should be entered on Form E-5176. Detailed instructions relating to the requirements for antennas and antenna structures are covered in Section 400-100-003.

7. POWER AND BUILDING SUPPORT EQUIPMENT

7.01 Power and building support equipment should be maintained in accordance with Equipment Test Lists. Power and building support equipment includes:

- Rotating Motors
 - (1) Motors
 - (2) Pumps
- Heating
- Air Conditioning
- Power
 - (1) Batteries
 - (2) Rectifiers
 - (3) Inverters
 - (4) Converters
 - (5) Switch Gear
 - (6) Emergency Engines
- Dehydrator
- Sanitation
- Ventilation
- Safety
- Fire Equipment

7.02 Except when particular equipment must be maintained within a specified constant temperature range, the heating and air conditioning thermostats should be operated at temperature

settings as outlined in the local company energy management program.

7.03 At stations requiring both gasoline and fuel oil, deliveries should be made only during periods when maintenance personnel are present, or other precautions taken to ensure that the proper fuel is placed into the proper tank. Fuel oil and gas tanks should also be properly secured to prevent contamination of fuel.

8. INSTRUCTIONS FOR ENTERING OR LEAVING RADIO STATIONS

8.01 Local instructions covering admissions should be followed to maintain building security. In general, the following should be observed immediately upon entering the building. The alarm center should be notified of your presence. Immediately preceding your departure, the alarm center should be notified of your intention to depart.

8.02 Form E-5181 (Fig. 1) should be completed and posted inside and near the regular entrance. These instructions are primarily for individuals who visit a station infrequently and may not be familiar with the procedure.

9. RADIO STATION RECORDS AND LOGS

9.01 The FCC, as well as the company, requires certain radio station records and logs be kept orderly and current. The specific records and logs required and the information that must be entered on each can be found in Section 400-401-000.

9.02 Type acceptance is an equipment authorization issued by the FCC for equipment to be used as authorized by a station license. Type acceptance is based on representations and test data submitted by the applicant (manufacturer). This test data demonstrates that the equipment meets FCC performance requirements for operations in services governed by its rules and regulations. All transmitters used in Point-to-Point Microwave Radio services must have FCC type acceptance per FCC Part 21.120 (a).

Identification Plates and Labels

9.03 Each piece of equipment for which type acceptance has been granted must be uniquely identified with a name and type or model number inscribed on a plate. This plate or label must be

permanently affixed to the equipment by the manufacturer. The plate or label must contain the following information:

- (a) The name of the grantee (manufacturer) of the type acceptance.
- (b) The words "FCC TRANSMITTER DATA" followed by the model number assigned by the grantee.

9.04 For equipment type acceptance prior to September, 1975, the FCC will accept alternative methods of identification other than that described above; however, the grantee's name ie, Western Electric and the model number must be on the equipment. This information must be separate and distinct from any other number or designation on the equipment and should not be confused with the "RADIO TRANSMITTER IDENTIFICATION" tag Form E-4973 (see Section 400-401-000).

10. RADIO STATION RESPONSIBILITY

10.01 Maintenance personnel at radio stations must ensure that the alarm center has been provided accurate data in writing, describing the status and command assignments at the remote location. This would include any information required by the alarm center to carry out its responsibilities. This information must be updated as changes occur.

10.02 The accuracy of the status and commands connected to the remote station versus what is displayed at the alarm center should be verified in conjunction with the alarm center at scheduled intervals.

10.03 Local written instructions should be provided to the alarm center for the operation of remote stations by the alarm center.

10.04 The alarm center should be advised of the prospects for clearance of all alarms.

10.05 Maintenance personnel shall assume full responsibility for remote station alarms while performing maintenance work at the remote station. Prior to logging out of the station, clear any clearable alarms and notify the alarm center of any existing alarms and status indications.

10.06 Notify the alarm center of all releases and follow standard instructions in Section 400-400-004 for channel release procedures.

11. EFFECTS OF TRANSMISSION IMPAIRMENTS ON SERVICE

11.01 Radio channels in a switch section must be maintained to the required transmission performance requirements to assure that the message, data, and video services being carried by them will not be degraded to the point of providing less than satisfactory service to our customers.

11.02 The following are a few examples of how poor transmission performance of a radio channel will affect service being carried by it.

Poor Gain Frequency Response

11.03 If baseband amplitude variations are greater than 6-dB, it will cause end-of-range alarms in the terminal multiplex equipment. When the baseband levels are permitted to exceed the range of the automatic gain control circuits in the multiplex equipment as indicated by end-of-range alarms, message and data services will be affected. In the case of data circuits, the signal-to-noise ratio will be reduced, increasing the probability of data errors. Poor high frequency response on a channel carrying video signals will cause reduction in the picture resolution and the color information in the signal. Poor baseband gain frequency response of a radio channel can affect the operating point of the initiators in the protection switching equipment. Excessive high-end roll-off may change the switch point and will cause message and data circuits to become noisier before the channel is switched to the protection channel.

Envelope Delay Distortion

11.04 Poor envelope delay characteristics in a radio channel can cause intermodulation noise which will result in noise in message circuits, poor signal-to-noise ratios in data circuits making it more likely for data errors to occur and noise in video signals. It can also cause distortion in the color information in the video signals.

Output Power

11.05 Decreases in the output power of radio transmitters contribute to the background

noise in message, data and video circuits. It also decreases the fade margin of the radio channel which, during periods of abnormal radio propagation, can have serious effects on the circuits working on the radio channel and possibly all the circuits on the radio route. A radio channel with a poor fade margin will switch to the protection more often, tying up the protection channel and denying its use by other channels. Each time a switch occurs, it causes hits on data circuits and picture rolls on video signals. Just one channel in a switch section with a poor fade margin can significantly reduce the reliability of all the other working radio channels in the switch section.

Frequency Accuracy

11.06 It is important that the frequency of FMTs, microwave generators, shifters and carrier resupplies be set and maintained accurately. Although this is an FCC requirement, it is also important for the proper operation of the radio systems. In most cases, the Bell System frequency accuracy requirements are more stringent than what is required by the FCC. Out-of-limit transmitter frequencies will worsen the effect of interference in the baseband signals of other channels operating on the same frequency (co-channel interference). This can manifest itself as noise into other channels or affect the switch point of the initiators of the interfered channels.

12. REQUIRED ACTION ON DEGRADED TRANSMISSION SYSTEMS

12.01 The overall switch section transmission performance characteristics of a radio channel can be represented by one of the following three categories:

- (a) All individual transmission performance tests within limits: This type of radio channel requires no further action.
- (b) Selected individual transmission performance tests exhibit a marginal out-of-limit condition: The degree of deviation must be analyzed based on system objectives. Those which could lead to deterioration of overall system performance should be given trouble clearance priority.
- (c) Selected individual transmission performance tests grossly out-of-limits: Radio channels

exhibiting this performance condition indicate immediate corrective action.

13. REFERENCES

SECTION	TITLE
190-201-010	Alarm Center Administration
400-100-003	Antenna Structure—Marking and Lighting Compliance
400-400-004	Radio Release Procedures
400-001-XXX	Point-to-Point FCC Compliance Requirements
402-XXX-XXX	Antennas, Transmission Lines, and Outdoor Waveguide
408-XXX-XXX	Motorola, RCA, REL and Other Non-Western Electric Microwave Radio
409-XXX-XXX	TJ, TL, TM and TM-A1 Microwave Radio
410-XXX-XXX	TD2 Microwave Radio
411-XXX-XXX	TD3 Microwave Radio
412-XXX-XXX	TH1 Microwave Radio
413-XXX-XXX	TH3 Microwave Radio
415-XXX-XXX	TD Microwave Radio
416-XXX-XXX	TN-1 Microwave
417-XXX-XXX	3A-RDS
420-XXX-XXX	Microwave Radio—Common Equipment
422-XXX-XXX	Common Microwave Radio Transmission System
682-000-015	Control Office Responsibility
770-XXX-XXX	Building Operation

14. FORMS

E-4973—Radio Transmitter Identification

E-5176—Antenna Structure Lighting Log

E-5181—Instructions for Entering, Reporting
and Departing

INSTRUCTIONS FOR ENTERING, REPORTING AND DEPARTING NOTICE

TO ALL INDIVIDUALS ENTERING THIS STATION:

Opening the door of this station operates an alarm at the _____ office. It is necessary that you call that office immediately, reporting your name, the nature and probable duration of your visit. One member may report for a group.

INSTRUCTIONS FOR REPORTING:

**DO NOT WORK ON EQUIPMENT WITHOUT
CLEARANCE FROM THE CONTROL OFFICE**

CONTROL OFFICE

INSTRUCTIONS FOR DEPARTING:

Please help to keep the building and grounds clean and in an orderly appearance. Do not burn any paper or other refuse on these grounds.

TITLE

WORK SAFELY

Fig. 1—Instructions for Entering, Reporting and Departing—Form E-5181 (8.02)