

CHAPTER EIGHT

COMMUNICATIONS-ELECTRONICS (CE) EQUIPMENT

SECTION 1. MAINTENANCE

8-1. COMMUNICATIONS-ELECTRONICS EQUIPMENT

Effective command, control, and communications depends on keeping a variety of CE equipment operational through timely repairs. Equipment to be supported includes the following:

- Radios.
- Teletypewriters.
- Switchboards.
- Telephones.
- Multichannel equipment.
- Night observation devices.
- COMSEC equipment.
- Avionics equipment.
- Ground support radar.
- ADP equipment.
- Special purpose TMDE used with or in support of the above.

SECTION II. ORGANIZATION FOR SUPPORT

8-2. MAINTENANCE ORGANIZATION

Maintenance responsibility for CE equipment is shared by the various divisional units as shown in Table 8-1 on the following page.

8-3. MAINTENANCE FUNCTIONS

MACs for CE equipment organize maintenance support into the four levels common to all Army equipment. The following discussion describes the CE maintenance functions done in the division.

Unit Maintenance. The operator/crew performs limited maintenance functions. These are normally limited to external cleaning/dusting, checking and tightening external connector, and sight/touch inspection of the equipment and its operating controls. No internal tightening or adjusting is performed at this level.

Unit maintenance personnel perform PM and analyze the cause of equipment malfunction to the line replacement unit (LRU). The unit maintenance personnel use built-in test equipment (BITE) and authorized special and general purpose tools and TMDE. Items requiring higher level repair are sent to the supporting DS maintenance activity.

Table 8-1. Communications-electronics maintenance organization.

Unit/Activity	Equipment/Units Supported	Type Spt	Remarks
Using Unit	Organic C-E equipment	Unit	
Aircraft Operating Unit (10 or more aircraft)	Organic avionics equipment	AVUM	
Trans ACFT Main Co	Avionics equipment in supported units	AVIM	Also AVUM for units with less than 10 aircraft
Signal Bn and CEWI	Organic C-E equipment	Direct Support	
Maint Co FSB Fwd Spt Maint Co	C-E equipment in supported BSA units	Direct Support	
Light Maint Co MSB Headquarters & Spt Co Headquarters & Light Maint Co	C-E equipment and COMSEC in supported units	Direct Support	Except MSL/ADA peculiar items. Also provides backup support to Sig Bn, MI Bn (CEWI), and Maint Co FSBs
Msl Spt Co, MSB/Mnt Bn	MSL/ADA peculiar C-E items in DSA units	Direct Support	

DS Maintenance. DS maintenance is performed in support of the user. The repairer may perform unit maintenance functions when proper tools/TMDE and expertise are available.

DS diagnostics and repair is done with authorized TMDE, automated test equipment (ATE), and tools. Repair, adjustment, and calibration of LRUs is done as authorized by the MAC. Equipment beyond the DS maintenance activities capacity/capability is evacuated to a backup COSCOM DS maintenance unit, or to the supporting EAC GS level activity.

8-4. MAINTENANCE OPERATIONS

Maintenance of CE equipment involves special considerations, which affect the way support is provided. Diagnostic checks and troubleshooting procedures normally require TMDE and maybe time consuming. This limits the amount of on-site maintenance which can be performed. Items are usually brought to the electronics shop to be diagnosed and repaired. Initial or acceptance inspections check for obvious damage and completeness.

RX expedites support to using units. Many CE items are not accounted for by serial number. A transaction for these items may be made on an RX rather than a property book basis. The exchanged

unserviceable item is sent to the shop for repair and returned to RX stocks.

The BITE and the TMDE brought along by the MST may identify the fault to a specific part or sub-assembly. When the faulty part can be identified, on-site repair may be possible by replacement or exchange. The nature of most failures limits the quantity and type of parts which can be carried by the MST.

8-5. COMMUNICATIONS SECURITY (COMSEC) EQUIPMENT MAINTENANCE

The maintenance of COMSEC materiel is greatly affected by security requirements concerning personnel, operations, and maintenance. The requirements are contained in AR 380-40 and AR 640-15. Signal security includes COMSEC electronics security (ELSEC) and TEMPEST. COMSEC involves crypto security, transmission security, emission security, physical security of COMSEC equipment and information, and measures to ensure communications are genuine. ELSEC protects electromagnetic transmissions other than communications devices. It includes approved operating procedures, proper siting techniques, maintenance practices, and training programs. TEMPEST invol-

ves the study, evaluation and control of compromising emanations, COMSEC equipment maintenance support is integrated into the overall division, COMSEC operations, and support organization. Details of COMSEC logistics support are found in TB 380-41 series.

The division CE officer implements the COMSEC policy within the division. This officer provides overall staff management of operational COMSEC matters and establishes priorities for issue of COMSEC material.

The DMMC is the focal point for division COMSEC management. COMSEC maintenance support is integrated into the DISCOM and other maintenance elements. The signal battalion and military intelligence (MI) battalion perform DS maintenance on organic peculiar COMSEC equipment.

The COMSEC materiel management section of the DMMC manages overall COMSEC logistics operations and translates the staff guidance from the division CE office into daily operations. COMSEC materiel management functions performed by this section include--

- Requisitioning, receiving, storing, issuing, accounting for, and destroying COMSEC materiel.
- Processing and controlling all transactions which affect COMSEC accounting records in the division.
- Issuing COMSEC materiel based on priorities from the division communications electronics officer (CEO).
- Monitoring physical security measures and accounting procedures.
- Ensuring MWOs are applied and reported.
- Submitting COMSEC materiel readiness reports.
- Establishing subaccounts and/or hand receipts as required.
- Authorizing and positioning ORF to meet mission requirements.

- Maintaining the division COMSEC parent account.

The DISCOM MSB, with the light maintenance company, performs the following functions:

- Plans and directs forward direct support maintenance for COMSEC material.
- Maintains the division ASL.
- Operates the division COMSEC RX program.
- Establishes a COMSEC materiel subaccount / hand receipt.

COMSEC maintenance support is provided by the light maintenance company of the MSB, the signal battalion, and the MI battalion. Each supporting element does the following functions:

- Establishes a subaccount.
- Performs COMSEC DS maintenance for supported equipment.
- Maintains a shop stock of COMSEC repair parts and RX items in support of organic maintenance operations.
- Requests disposition instructions from the DMMC for excess COMSEC materiel.

The maintenance companies of the FSBs and transportation aircraft maintenance company (TAMC) maintain a limited RX of COMSEC equipment.

8-6. ELECTROMAGNETIC PULSE (EMP)

CE operations in a nuclear environment present unique problems which may greatly affect the maintenance work load. In addition to the effects from the blast, thermal effects, and radiation, CE equipment is subject to damage from EMP, EMP begins with the release of nuclear radiation, primarily gamma rays. A process of ionization forms strong electromagnetic fields. EMP is a high amplitude, broad band width, pulse of short duration. The frequency generated by EMP covers most of the usable frequency band. Most of the EMP energy is in the high frequency and very high frequency range. FM 11-50 contains a further discussion of EMP characteristics.

8-7. EMP DAMAGE

EMP damage results from excessive electrical energy being introduced into equipment. Systems using semiconductor technology and low voltages are most affected. Damage may range from tripped circuit breakers or blown fuses, loss of information being stored or processed, to burned-out transistors and coils, and destruction of power supplies and complete assemblies

8-8. PREVENTIVE MEASURES

EMP may enter electrical systems through intentional antennas, unintentional antennas, and direct penetration. Cables, wires, antenna systems, and other metal structures are good electrical conductors and all absorb EMP energy to varying degrees. These conductors interact with the electromagnetic energy to induce voltages and currents. The key to protection from EMP damage is to install and operate equipment so as to minimize the induced energy and keep it from reaching sensitive components.

Intentional antennas are standard radio antennas. Damage may be lessened by using the highest frequencies possible and by using horizontal antenna polarization. The best protective measure is to disconnect the antenna. To minimize damage, all spare equipment must be disconnected from coax cables, antennas, power sources, and all cables and wires.

Unintentional antennas may be devices that act as antennas, such as masts, wiring loops, and cables. Unintentional antennas can be avoided by--

- Keeping the lengths of cable and wire as short as possible since the amount of energy collected is directly related to the length of the cable or wire.
- Burying all cables and wires, including power cables, at least 18 inches deep.
- Ensuring wire or cable coiled on a reel is not connected to equipment. The coil will pick up more EMP than straight cable,
- Using a common ground for all equipment, shelters, and power sources.
- Ensuring that all antenna guy lines are properly insulated.
- Ensuring commercial power sources are not used. This type power is extremely susceptible to EMP.

Direct penetration of EMP into equipment results from a lack of shielding. Internal electronic components can act as loop antennas and allow strong electromagnetic fields to be created inside the equipment. Shielding equipment prevents direct penetration of EMP. Shielding effectiveness is related to the shielding material and its thickness. For effective electrical field shielding, any metal (iron, aluminum, and so forth) can be used; for magnetic shielding, iron or steel is required.

Unit SOPS and directives concerning installation, operation, and storage are essential to minimize the effects of EMP. CE items in the current inventory are not designed (hardened) to withstand the effects of EMP. Thus, measures to reduce vulnerability of CE equipment must be used in the field.

PM and daily inspection have added importance in an NBC environment. Cables and wires with damaged shielding or connectors must be replaced. Power system filters must be checked and replaced or repaired as necessary. Alternate or backup equipment must be kept ready; however, this equipment may be inoperable because of EMP. Maintenance personnel must respond with required repair parts.

If possible, disconnect all external cabling, turn off or unplug all equipment, and disassemble antennas.