ARMY TM 11-5895-825-14
NAVY NAVELEX 0967-LP-465-3010
AIR FORCE TO 31Z3-640-31

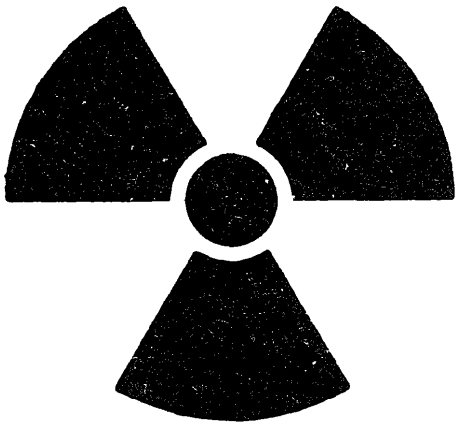
SYSTEM OVERVIEW MANUAL
SATELLITE COMMUNICATIONS TERMINAL AN/TSC-54
AS USED IN THE EARTH TERMINAL COMPLEX

DEPARTMENTS OF THE ARMY, THE NAVY, AND THE AIR FORCE
SEPTEMBER 1976

The following in general safety precautions that are not related to any specific procedures and, therefore, do not appear elsewhere in this publication These are recommended precautions that personnel must understand and apply during many phases of operation and maintenance

W A R N I N G

ELECTROMAGNETIC RADIATION



STD-RW-2

DO NOT **STAND IN** THE DIRECT PATH **OF THE ANTENNA WHEN THE POWER IS ON!**
DO NOT **WORK ON** THE WAVE GUIDE**S WHILE THE POWER IS ON!**

High frequency electromagnetic radiation can cause fatal internal bums It can literally "cool" internal organs and flesh If you feel the slightest warning effect while near this equipment MOVE AWAY QUICKLY!

WARNING

This equipment radiates electromagnetic waves of dangerous frequencies. Comply with the requirements of AR40-583 before using this equipment.

WARNING

DANGEROUS VOLTAGES EXIST IN THIS EQUIPMENT

HIGH VOLTAGE is used in this equipment. DEATH ON CONTACT may result if safety precautions are not observed. Under no circumstances should any personnel reach within or enter an equipment enclosure for the purpose of servicing or adjusting the equipment without the immediate presence of another person capable of rendering aid and assistance.

WARNING

Operator and maintenance personnel should he familiar with the safety precautions before attempting installation or operation of the equipment covered in this manual. Failure to follow requirements and observe safety precautions could result in injury or DEATH.

WARNING

Do not operate the equipment without suitable ground connections. Electrical defects in the equipment can cause DEATH by electrocution when contact is made with an ungrounded system.

WARNING

For the successful execution of methods of equipment destruction involving the use of demolition materials, all personnel should become familiar with the pertinent provisions of FM 5-25.

WARNING

DANGEROUS EXHAUST GASES ARE **PRODUCED-Exhaust gases produced by diesel engine generator sets are poisonous. Inhalation may result in illness or DEATH. Provide adequate ventilation if the generator sets are operated in enclosed or covered areas. Exhaust gas pickup by the air conditioners should he carefully avoided.**

WARNING

When filling the diesel generator sets fuel tanks, do not smoke or use an open flame in the immediate vicinity. Always provide metal-to-metal contact between the container and the fuel tank. This will prevent a spark from being generated as fuel flows over the metallic surfaces. Do not fill the generator fuel tank while the diesel engine is in operation. Failure to observe these warnings may result in DEATH to personnel.

WARNING

GASES UNDER PRESSURE-Careful handling and proper use of equipment in pressurized systems are required to prevent injury to personnel. Observe warning labels and he familiar with manufacturer's instructions.

WARNING

Under no circumstances should the Cesium Beam Frequency Standard C-field be adjusted, the phase lock opened, or time changed.

LIST OF EFFECTIVE PAGES

Insert latest changed pages dispose of superseded pages in accordance with applicable regulations

NOTE On a change page the portion of the text affected by the latest change is indicates by a vertical line or other change symbol, in the outer margin of the page Changes to illustration are indicated by miniature point hands Changes to wiring diagrams are indicated by shaded areas

Total number of pages in this manual is 104 consisting of the following

Page No	#Change No	Page No	#Change No
A	0	5-1-5-10	0
B Blank	0	6-1	0
i-iv	0	6-2 Blank	0
1-0-1-14	0	A-l-A-4	0
P-	0	B-1-B-5	0
2-1-2-9	0	Index 1 -Index 5	0
3-1-3-19	0	Glossary 1 Glossary 2 Blank	0
4-1-4-4	0	FO-1-FO-4	0

#Zero in this column indicates an original page

TECHNICAL MANUAL
NO. 11-5895-825-14
TECHNICAL MANUAL
NAVELEX 0967-LP-465-3010
TECHNICAL ORDER
TO 31Z3-640-31

DEPARTMENT OF THE ARMY,
THE NAVY AND THE AIR FORCE

WASHINGTON, DC, *20 September 1976*

SYSTEM OVERVIEW MANUAL

SATELLITE COMMUNICATIONS TERMINAL AN/TSC-54
AS USED IN THE EARTH TERMINAL COMPLEX

TABLE OF CONTENTS

Section — Page

LIST OF ILLUSTRATIONS iv
LIST OF TABLES iv

CHAPTER 1-INTRODUCTION

I. GENERAL
1-1. Scope. 1-1
1-2. Reporting of errors. 1-1
1-3. Maintenance forms and records 1-1
II. DESCRIPTION AND DATA
1-4. ETC purpose and use 1-1
1-5. ETC equipment tree 1-1
1-6. ETC technical characteristics 1-4
1-7. ETC physical site configuration 1-4
1-8. Major subsystems and major subgroups of the ETC using the Satellite Communications Terminal AN/TSC-54 1-7
1-9. Satellite Communications Terminal AN/TSC-54 1-7
1-10. Radio Communications Subsystem AN/URC-61 1-8
1-11. Multiplexer Set AN/TCC79 1-8
1-12. Power Distribution-Switching Unit SA-1901/TSC-54 1-8
1-13. Static Frequency Converter CV-3061/TSC-54 1-8
1-14. Digital Data Modem MD-920/G 1-8
1-15. Digital Data Modem MD-921/G 1-8
1-16. Analog-Digital Converter CV-3634/G 1-8
1-17. Diesel Engine Generator Sets PU-401/M and PU-495/G 1-8
1-18. Electrical Equipment Shelter S-483/TSC 1-8
1-19. Electrical Equipment Shelters S-484/TSC-54 and S-XXX 1-9

CHAPTER 2-ETC PLANNING AND INSTALLATION PROCEDURES

I. ETC INSTALLATION PLANNING PROCEDURES
2-1 ETC planning considerations 2-1
2-2. Installation planning procedures 2-1
2-3. Service upon receipt and equipment placement 2-1
2-4. Equipment requirements for installation 2-2
2-5. Equipment installation and cable interconnection 2-2
II. PREPARATION FOR USE
2-6. General 2-7
2-7. Preliminary visual inspections of the ETC 2-7
2-8. AC power application 2-7
2-9. Subsystem turn-on and checkout 2-8
III. ANALYSIS AND SYSTEM CHARACTERIZATION
2-10. General 2-8
2-11. Tests for performance by TEP team 2-8
2-12. Test for performance by each ETC 2-8
2-13. ETC system adjustments 2-8

This technical manual is a system o**verview and does not conform with the forma**t and content s**pecified in AR 310-3.**

Section

2-14. ETC transmit power calibration
2-15. Link performance test
IV. PREPARATION FOR RESHIPMENT
2-16. General
2-17. ETC cable disconnection and equipment removal

CHAPTER 3-OPERATION

I. OPERATIONAL CAPABILITIES AND LIMITATIONS
3-1. General
3-2. Capability and limitations of the ETC using the Satellite Communications Terminal AN/TSC-54
II. SYSTEM OPERATING PROCEDURES
3-3. General..
3-4. ETC normal configuration
3-5. Preoperational procedures
3-6 Frequency **Modulator** OM-46(V)2/TCC IF. output level adjustment.
3-7. Electronic Frequency Up-Converter CV-3984/MSC-46 frequency change procedure.
3-8. Electronic Frequency Down-Converter CV-3085/MSC-46 frequency change procedure
3-9. Satellite acquisition
3-10. Electronic Frequency Up-Converter CV-3984/MSC-46 IF. input level adjustment
3-11. ETC Transmit Power Calibration
3-12. Orderwire configuration
3-13. FM link establishment
3-14 PSK link establishment
3-15 URC link establishment
3-16 Precise time and time interval (PTTI) measurement
3-17. Maintaining and changing RF power **3-10**
3-18. FM receive baseband adjustment 3-11
3-19. Key Indicators Used in Monitoring Overall Operation 3-12
III. SYSTEM DEGRADATION AND FAILURE 3-13
3-20 General. **3-13**
3-21 ETC Failures that Affect all Transmit and Receive Communications 3-14
3-22. ETC failures that affect transmit communications 3-15
3-23 ETC failures that affect receive communications 3-17
3-24 ETC failures that affect antenna tracking 3-17
3-25. Emergency operation 3-18
3-26. Identification of jamming
IV CONTROL/OPERATION
3-27 General 3-19
3-28. DSCS SATCOM control 3-19
3-29 ETC reports . 3-19

CHAPTER 4-ETC THEORY

4-1. Introduction . 4-1
4-2 Functional operation of the ETC . 4-1

CHAPTER 5-ETC MAINTENANCE

I. ETC MAINTENANCE PHILOSOPHY
5-1. General 5-1
5-2 Nature and extent of maintenance . . 5-1
5-3. Preventive and correctwe maintenance 5-1
II. SYSTEM TESTING
5-4 General 5-2
5-5 Carrier-to-noise density ratio (C/kT) measurement 5-2
5-6 Test tone-to-noise ratio (TTNR) measurement ..5-5
5-7 Out-of-band noise (OBN) measurement **5-7**
5-8 Digital error rate measurement . 5-8
5-9 Satellite downlink monitor **5-9**
5-10. Noise power density measurement . 5-10

CHAPTER 6-ETC INTRODUCTION DIAGRAMS

6-1. Introduction 6-1
6-2. Interconnect cable diagrams 6-1
6-3 Signal flow and level diagrams 6-1

APPENDIX A-DOCUMENTS AND TECHNICAL MANUALS

A-1 Scope. A-1
A-2 Explanation of columns A-1
A-3 Requisitioning of Publications A-1

Section Page

APPENDIX B-ETC TEST EQUIPMENT

B-1. Scope. B-1
B-2. Explanation of columns B-1
GLOSSARY ..... Glossary 1
ALPHABETICAL INDEX ..... Index 1

LIST OF ILLUSTRATIONS

Figure No	Title	Page
1-1	Typical ETC Using the Satellite Communications Terminal AN/TSC-54	1-0
1-2	Typical Communications Network within the DSCP Phase II Satellite System	1-2
1-3	Typical Equipment Tree for ETC using the Satellite Communications Terminal AN/TSC-54	1-3
1-4 (1)(2)	Satellite Communications Terminal AN/TSC-54 Equipment Identification (2 sheets).	1-10, 1-11
1-5	Multiplexer Set AN/TCC-79 Equipment Identification	1-12
1-6	Electrical Equipment Shelter S-483/TSC-54	**1-13**
1-7	Electrical Equipment Shelter S-484/TSC-54 and S-XXX	1-14
3-1	Electronic Frequency Up-Converter CV-3084/MSC-46 MISSION LOG Tag	3-5
3-2	Electronic Frequency Down-Converter CV-3085/MSC46 MISSION LOG Tag	3-6
5-1	Teat equipment setup for carrier-to-noise density ratio (C/kT) measurement using the wave analyzer	5-3
5-2	Special graticule for Tektronix 491 spectrum analyzer	5-4
5-3 (1)(2)	Test equipment setup for teat tone-to-noise ratio (TTNR) measurement (2 sheets).	.. 5-6, 5-7
5-4	Test equipment setup for out-of-band noise (OBN) measurement	5-7
FO-1	Typical physical site configuration for an ETC using the Satellite Communications Terminal AN/TSC-54	(Located in back of manual)
FO-2	ETC using the Satellite Communications Terminal AN/TSC-54, simplified block diagram	(Located in back of manual)
FO-3	Interconnect cable diagram for ETC using the Satellite Communications Terminal AN/TSC-54 (2 sheets)	(Located in back of manual)
FO-4 (1)(2)	Signal flow and level diagram for ETC using the Satellite Communications Terminal AN/TSC-54 (2 sheets)	(Located in back of manual)

LIST OF TABLES

Table No	Title	Page
1-1	Technical characteristics of ETC using the Satellite Communications Terminal AN/TSC-54.	1-4
1-2	List of Major Subsystems and Major Subgroups comprising the ETC Using the Satellite Communications Termin AN/TSC-54.	1-7
2-1	Interconnect Cables and Wiring for ETC Using the Satellite Communications Terminal AN/TSC-54	2-3
3-1	Frequency Demodulator OM-47(V)2/TCC IF Input attenuator (AT1) minimum settings.	3-4
3-2	FM receive baseband adjustment test frequencies.	3-12
3-3	Key indicators used in monitoring overall operation of the ETC using the Satellite Communication Terminal AN/TSC-54	3-12
3-4	Transmit and receive communications failure symptoms	3-13
3-5	Transmit communications failure symptoms	3-15
3-6	Receive communications failure symptoms.	3-16
3-7	Antenna tracking failure symptoms	... 3-17
5-1	Out-of-band TTNR test tone frequencies.	5-7
5-2	OBN module output to TTNR conversion table.	5-8
A-1	Documentsand technical manuals for ETC using the Satellite Communications Terminal AN/TSC-54	A-1
B-1	Test equipment requirements for ETC using the Satellite Communications Terminal AN/TSC-54	A-1

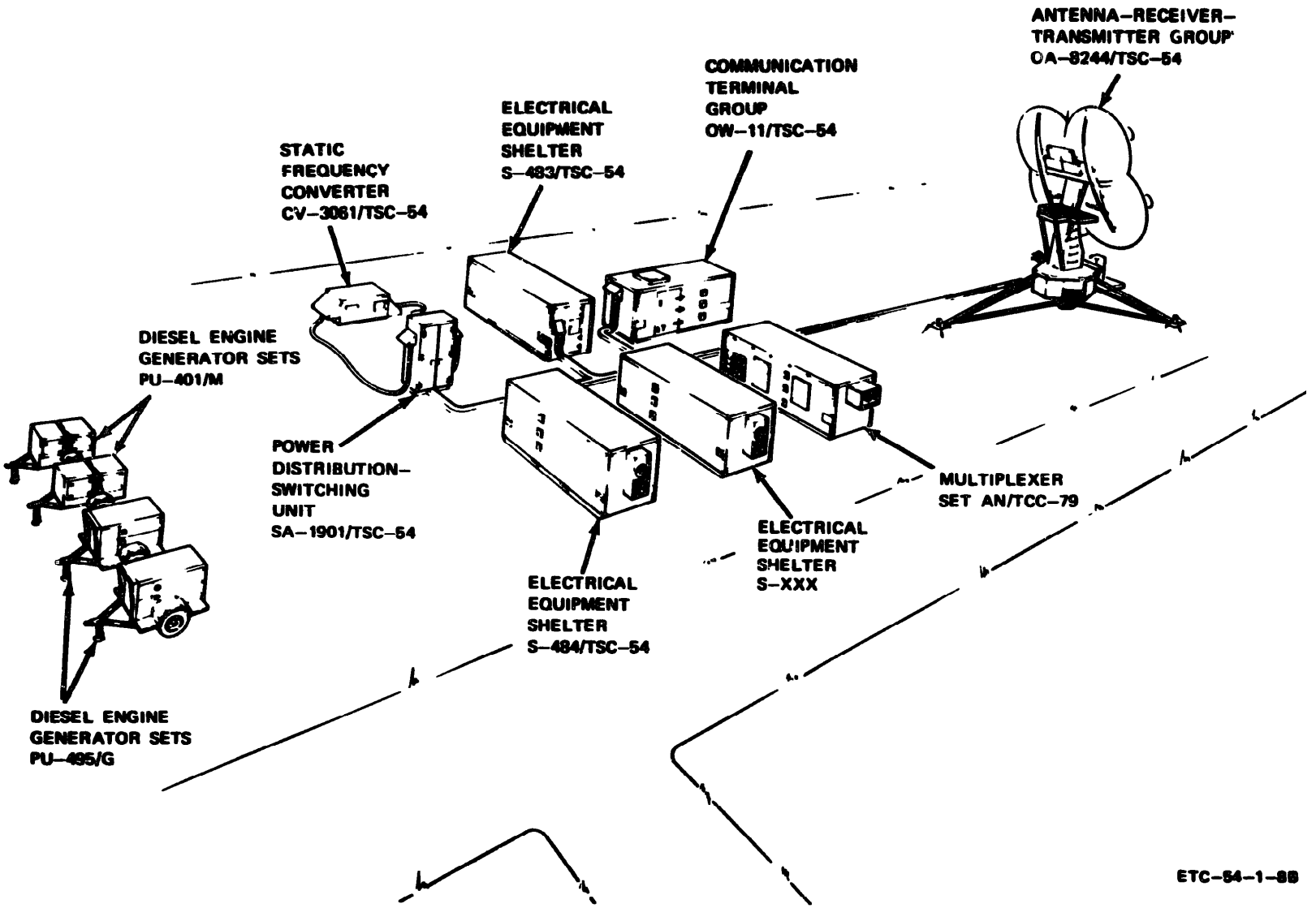


Figure 1-1. Typical ETC using the Satellite Communications Terminal AN/TSC-54.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope.

The purpose of this technical manual is to provide the equipment user and/or site planner with an overview of the Earth Terminal Complex (ETC) Using the Satelliter Communications Terminal AN/TSC-54. The scope of this manual is addressed to coverage of the Major Subsystems of the ETC and Major Subgroups of the Satellite Communications Terminal AN/TSC-54 as deplayed for Phase II, Stage 1b. Extensive references are made to technical manuals that cover the individual Major Subsystems and Major Subgroups. However, all details concerning interconnection, interfaces, input and output data will be provided in detail in this manual. A complete listing of applicable documents and technical manuals associated with the operation and maintenance of the equipment located in this ETC can be found in appendix A. A perspective view of a typical ETC Using the Satellite Communications Termanial AN/TSC-54 is illustrated in figure 1-1.

1-2. Reporting of Errors

Reporting of errors, omissions and recommendations for improvement of this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, U.S. Army Electronics Command, ATTN: DRSEL-MA-Q, Fort Monmouth, NJ 07703.

1-3. Maintenance Forms and Records,

a. Department of the Army forma and procedures used for equipment maintenance will be those prescribed by TM 38-750.

b. Department of the Air Force forms and procedures used for equipment maintenance will be those prescribed by AFM 66-1, Volume X and applicable *00-20* series T.O.'s.

c Department of the Navy forms and procedures used for equipment maintenance will be those prescribed by Maintenance and Material Management (3-M Manual) OPNAV 43-P2.

Section II. DESCRIPTION AND DATA

1-4. ETC Purpose and Use

a. Purpose. The ETC Using the Satellite Communications Terminal AN/TSC-54 is an air-or-vehicular transportable facility. The ETC provides communications with one or more satellite communications terminals or systems through a synchronous repeater satellite. There are thirteen of these ETC's strategically located throughout the world The ETC mission is to provide highly reliable, global communications to the users in the DSCS network. These ETC's are operated by the Army, Navy and Air Force as assigned by the Joint Chiefs of Staff (JCS).

b Use In a typical configuration the ETC Using the Satellite Communications Terminal AN/TSC-54 provides an FM communications path for its Technical Control Facility (TCF) and local users. Communications are accomplished through a repeater satellite to the TCF associated with another ETC using FM communications equipment. The ETC Using the Satellite Communications Terminal AN/TSC-54 can also communicate with another satellite communications terminal using the Radio communications subsystem AN/URC-61 or Digital Modem MD-921/G (PSK Modem) as required.

c System Configuration. An example of how individual ETC's can be organized into a communications network within the DSCS Phase II Satellite System is shown in figure 1-2. As depicted, a single ETC Using the Satellite Communications Terminal *AN/MSC-46* (Nodal) provides communications paths for four ETC's Using the Satellite Communications Terminal AN/MSC-46 (Non-Nodal) and three ETC's Using the Satellite Communications Terminal AN/TSC-54. However, the DSCS Phase II satellite system also incorporates other compatible satellite communications systems not depicted in figure 1-2.

1-5. ETC Equipment tree

Provided in figure 1-3 is the equipment tree for the major equipments of a typical ETC Using the Satellite Communications Terminal AN/TSC-54. This equip ment as designated for use within the ETC is depicted in either a "part of" or "used with" relationship to the Satellite Communications Terminal AN/TSC64.

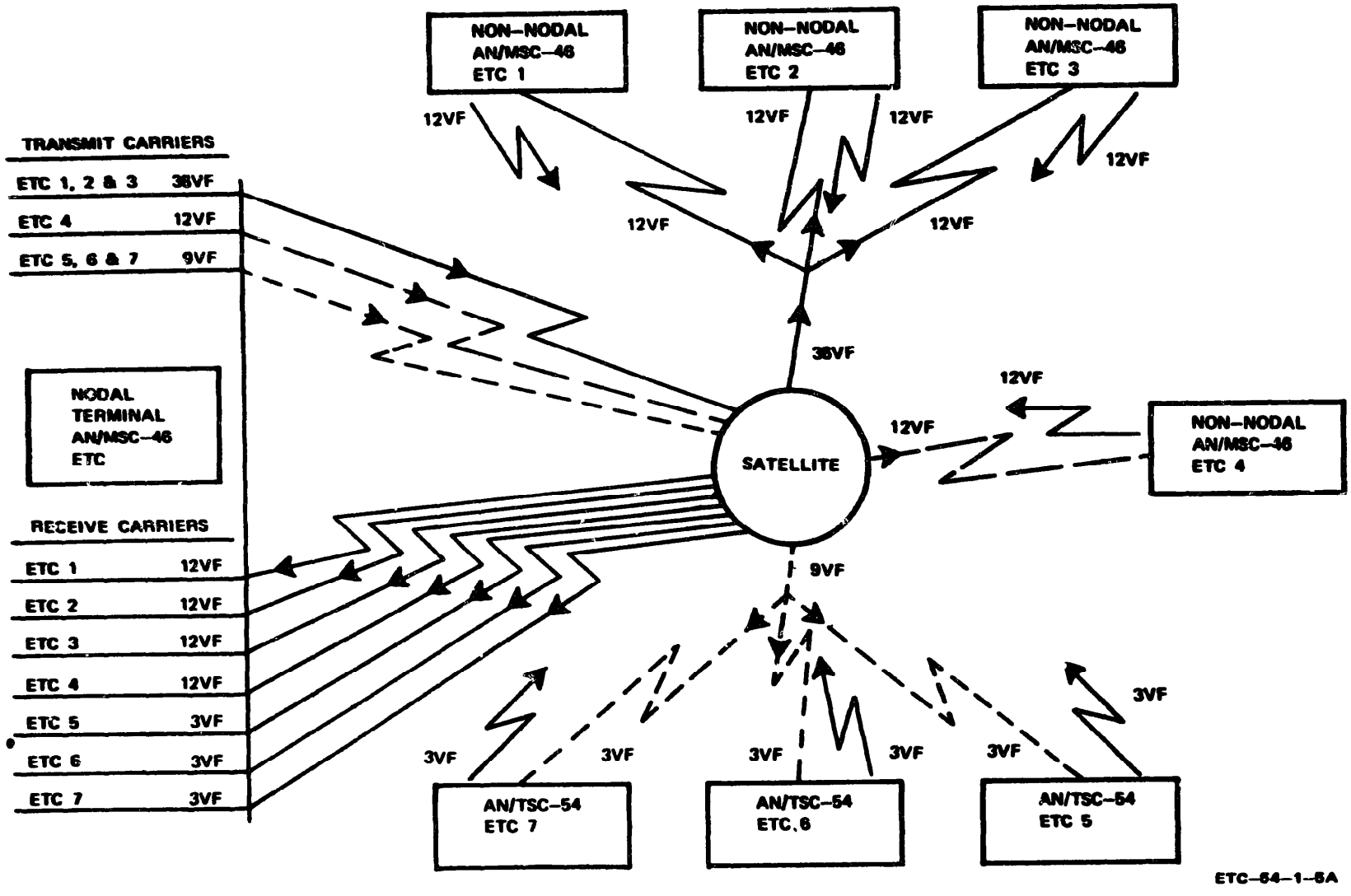


Figure 1-2. Typical Communications Network within the DSCD Phase II Satellite System

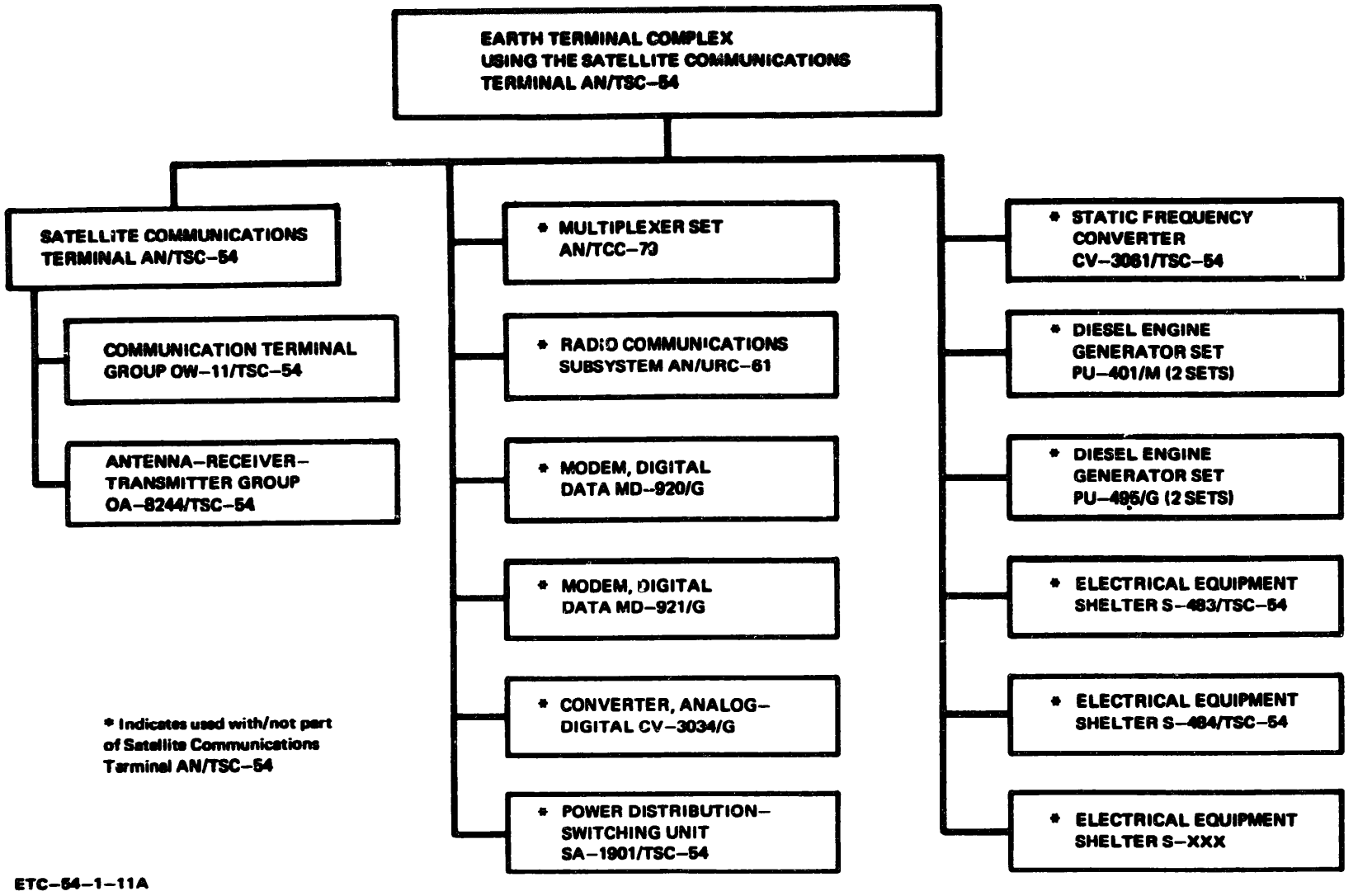


Figure 1-3. Typical Equipment Tree for ETC Using the Satellite Communications Terminal AN/TSC-54.

1-6. ETC Technical Characteristics

Provided in table 1-1 is a listing of technical characteristics of the Major Subsystems of an ETC Using the Satellite Communications Terminal AN/TSC-54. For detailed characteristics refer to appendix A for applicable equipment technical manuals.

1-7. ETC Physical Site Configuration

A typical site configuration for the ETC Using the Satellite Communications Terminal AN/TSC-54 is shown in figure FO-1. The actual size and shape of the available site location, along with the length of the interconnecting cables, will determine the grouping configuration of the equipment. At any geographical location the antenna should be pointed toward the equator at zero cable wrap.

Table 1-1. Technical Characteristics of ETC Using *the the Satellite Communications Terminal AN/TSC-54*

Major subsystem	*Technical characteristics*	
Satellite Communications Terminal AN/TSC-54	*IF inputs:* (expandable to 3)	
	frequency	70 MHz
	bandwidth	±20 MHz at ±1.0 dB
	level	−10 to +10 dBm
	RF output:	
	frequency	7 9 to 8.4 GHz
	bandwidth	500 MHz at ±0.5 dB
	power (maximum into feed) transmitter	5 kW
	RF input:	
	frequency	7.25 to 7.75 GHz
	bandwidth	500 MHz at 0.5 dB
	IF outputs: (expandable to 3)	
	frequency	70 MHz
	bandwidth	±20 MHz at ±1.0 dB
	level	0 ±0.5 dBm for input signal of −43 dBm
	Power requirements:	
	voltage	120/208 V ac, 400 Hz, 3-phase
	power	45 kW
Radio Communications Subsystem AN/URC-61	*Transmitter:*	
	Input:	
	channel capacity	1 VF channel and 1 TCF to TCF orderwire channel with 1 ETC to ETC TTY orderwire *or* 1 digital data channel with 1 ETC to ETC TTY orderwire
	bandwidth	0 to kHz per channel
	level	0 dBm per channel
	Output:	
	modulation	pseudonoise
	frequency	70 MHz nominal
	bandwidth	spread spectrum
	Receivers: (No. 1 and No. 2)	
	Input:	
	frequency	70 MHz nominal
	bandwidth	spread spectrum
	Output:	
	channels	1 VF channel and 1 TCF to TCF orderwire channel with 1 ETC to ETC TTY orderwire *or* 1 digital data channel with 1 ETC to ETC TTY orderwire
	bandwidth	0 to 4 kHz per channel
	level	0 dBm per channel
	Power requirements:	
	voltage	120 V ac, 400 Hz, 3-phase
Multiplexer Set AN/TCC-79	*Inputs:* (from TCF and users)	
	Voice	
	capacity	12 VF user channels and 1 VF orderwire channel
	bandwidth	0 to 4 kHz per channel
	level	0 dBm per channel

Table 1-1. Technical Characteristic of ETC
Using the Satellite Communications Terminal AM/TSC-54- Continued

Major subsystem	*Technical characteristics*	
Multiplexer Set AN/TCC-79—Continued	*TTY*	
	capacity	15 TTY user signals and 1 TTY orderwire signal
	bandwidth	0 to 4 kHz (multiplexed into 1 of the 12 VF channels)
	Basic Group (may be used instead of voice and TTY inputs)	
	capacity	12 multiplexed VF channels
	bandwidth	60 to 108 kHz
	level	−12 dBm
	Supergroup	
	capacity	60 multiplexed VF channels (Supergroup 1 or Supergroup 2)
	bandwidth	60 to 300 kHz (Supergroup 1) 312 to 552 kHz (Supergroup 2)
	level	−28 dBm
	Output: (to Satellite Communications Terminal AN/TSC-54)	
	modulation	angle modulated
	frequency	70 MHz
	bandwidth	±20 MHz at ±1 dB
	level	0 to +17 dBm
	Input: (from Satellite Communications Terminal AN/TSC-54)	
	modulation	angle modulated
	frequency	70 MHz
	bandwidth	±20 MHz at ±1 dB
	level	−55 to −5 dBm
	Outputs: (to TCF and user)	
	Voice	
	capacity	12 VF user channels and 1 VF orderwire channel
	bandwidth	0 to 4 kHz per channel
	level	0 dBm per channel
	TTY	
	capacity	15 TTY user signals and 1 TTY orderwire signal
	bandwidth	0 to kHz (demultiplexed from 1 of the 12 VF channels)
	Basic Group (output instead of voice and TTY outputs)	
	capacity	12 multiplexed VF channels
	bandwidth	60 to 108 kHz
	level	−35.5 dBm
	Supergroup	
	capacity	60 multiplexed VF channels (Supergroup 1 or Supergroup 2)
	bandwidth	60 to 300 kHz (Supergroup 1) 312 to 552 kHz (Supergroup 2)
	level	−18 dBm
	Power requirements	
	voltage	120/208 V ac, 50/60 Hz, 3-phase
	load	50 A nominal
Power Distribution—Switching Unit	*Power requirements*	
	Inputs:	
	voltage	120 V ac, 50/60 Hz, 3-phase (source from commercial or generator); 120 V ac, 400 Hz, 3-phase (source from generator or Static Frequency Converter CV-3061/TSC-54), 24 V dc (source from generator)
	power	100 kW (at 50/60 Hz) 45 kW (at 400 Hz)
	Outputs:	
	voltage	120 V ac, 50/60 Hz, 3-phase; 120 V ac, 400 Hz, 3-phase

Table 1-1. Technical Characteristics of ETC Using the Satellite Communications **Terminal AN/TSC-54- Continued**

Major subsystem	Technical characteristics	
Power Distribution—Switching Unit SA-1901/TSC-54 - Continued	*Power requirements:*—**Continued**	
	power	100 kW (at 50/60 Hz) 45 kW (at 400 Hz)
Static Frequency Converter CV-3061/ TSC-54	*Power requirements:*	
	Input:	
	voltage	114 to 139 V ac (line to neutral) or 197 to 240 V ac (line to line), 48 to 62 Hz, 3-phase
	power	65 kW maximum
	Output:	
	voltage	120 V ac nominal (line to neutral), 400 Hz, 3-phase
	power	45 kW nominal
Modem, Digital Data MD-920/G (ICF Modem)	*Modulator:*	
	Input: (digital data)	
	data rate	19.2 kbs to 9.9999 Mbs
	one state	+6 ± 1.5 V dc
	zero state	−6 ± 1.5 V dc
	Output:	
	data rate	19.2 kbs to 9.9999 Mbs
	level	−12 dBm (radio link) + 23, + 10 or 0 dBm (RF cable)
	Demodulator:	
	Input: (bipolar)	
	data rate	19.2 kbs to 9.9999 Mbs
	level	−25 to −35 dBm (radio link) +5 to − 15 dBm (RF cable)
	Output: (digital date)	
	data rate	19.2 kbs to 9.9999 Mbs
	one state	+6 ± 1.5 V dc
	zero state	−6 ± 1.5 V dc
Modem, Digital Data MD-921/G (PSK Modem)	*Power requirements.*	
	voltage	120 V ac ± 10%, 45 to 420 Hz, single phase
	power	300 W maximum
Converter, Analog-Digital CV-3034/G	*Modulator:*	
	Input:	
	data rate	19.2 kbs to 9.9999 Mbs
	level	−25 to ±35 dBm (radio link) +5 to − 15 dBm (RF cable)
	Output:	
	modulation	binary phase-shift keying (PSK)
	frequency	70 MHz
	level	+10 dBm
	Demodulator	
	Input:	
	modulation	binary phase-shift keying (PSK)
	frequency	70 MHz
	level	0 to − 55 dBm
	Output:	
	data rate	19 2 kbs to 9 9999 Mbs
	level	−12 dBm (radio link) + 23, + 10 or 0 dBm (RF cable)
	Power requirements.	
	voltage	120 V ac ± 10%, 45 to 420 Hz, single phase
	power	500 W maximum
	Transmitter:	
	Input:	
	voice mode	
	capacity	1 VF channel
	level	−16 to − 46 dBm (low level) 0 to −30 dBm (high level)

Using the Satellite Communications Terminal AN/TSC-54-Continued Table 1-1 Technical Characteristics of ETC

Major subsystem		Technical characteristics
Converter, Analog Digital CV-3034/G—Continued	*Transmitter—Continued*	
	hybrid mode	
	capacity	1 VF channel or 50 kbs data signal
	level	0 to −30 dBm (voice)
	Output.	
	data rate	50 kbs
	level	±3 V bipolar
	Receiver	
	Input:	
	data rate	50 kbs
	level	±3 V bipolar (minimum acceptable 0 1 V)
	Output.	
	voice mode	
	capacity	1 VF channel
	level.	0 to −30 dBm (low level) +7 to −23 dBm (high level)
	hybrid mode	
	capacity	1 VF channel or 50 kbs data signal
	level	0 to −30 dBm (voice) 0 ±1 dBm (data)
	Power requirements	
	voltage	120 V ac ±10% 45 to 420 Hz, single phase
	power	30 W
Diesel Engine Generator Set PU-401/M (ETC includes 2 diesel engine generator sets)	*Output.*	
	voltage	120/208 V ac 400 Hz, 3 phase
	power	45 kW (each diesel engine generator set)
Diesel Engine Generator Set PU-495/G (ETC includes 2 diesel engine generator sets)	*Output.*	
	voltage	120/208 V ac, 50/60 Hz 3 phase
	power	100 kW (each diesel engine generator set)

1-8. Major Subsystems and major Subgroups of the ETC Using the Satellite Communications Terminal AN/TSC-54

Provided in table 1-2 is a list of the Major Subsystems and Major Subgroups of a typical ETC Using the Satellite Communications Terminal AN/TSC-54 However, all the equipments listed will not necessarily be present in the different configurations of the ETC depending upon ETC mission and location. A list of test equipment required to maintain the ETC is contained in appendix B

1-9. Satellite Communications Terminal AN/TSC-54

The Satellite Communications Terminal AN/TSC-54 a self-contained mobile communications facility containing transmit and receive equipment that provides the RF link via satellite between the ETC's The Satellite Communications Terminal AN/TSC-54 consists of the following Major Subgroups

***a* Antenna Receiver Transmitter Group OA-8244/TSC-54(fig 1-1)**

b Communication Terminal Group (fig 1-4 2)

Table 1-2 List of Major Subsystems and Major Subgroups Comprising the ETC Using the Satellite Communications Terminal AN/TSC-54

Nomenclature	Common name	Qty	Ref rn
Satellite Communications Terminal AN/TSC-54			TM 11-5895-389-12 NAVSHIPS 0967-377-7010
Antenna Receiver Transmitter Group OA-8244/TSC-54	Antenna receiver transmitter group	1	
Communication Terminal Group OW-11/TSC-54	Electronic equipment shelter	1	
Electrical Equipment Shelter S-483/TSC-54	Maintenance shelter	1	IM 11-5895-389-15-1
Electrical Equipment Shelter S-484/TSC-54	Storage shelter	1	IM 11-5895-389-15-1
Electrical Equipment Shelter S-XXX	Storage shelter	1	IM 11-5895-389 15-1
Radio Communications Subsystem AN/URC-61	URC	1	DTM 11-5820-614-12
Multiplexer Set AN/TCC-79	Comm subsystem	1	DTM 11-5895-796-12-3

Table 1-2. List of Major Subsystems and Major Subgroups Comprisingthe ETC Using the Satellite CommunicationTerminal AN/TSC-54-Continued)

Nomenclature	Common name	Qty	Reference
Power Distribution — Switching Unit SA-1901/TSC-54	Power distribution-switching unit	1	DTM 11-5895-783-12
Static Frequency Converter CV-3061/TSC-54	Static frequency converter	1	DTM 11-5820-802-12
Modem, Digital Data MD-920/G	ICF modem	1	DTM 11-5820-804-12
Modem, Digital Data MD-921/G	PSK modem	1	DTM 11-5820-803-12
Converter, Analog-Digital CV-3034/G	A/D converter	1	IM 11-5895-797-14
Diesel Engine Generator Set PU-401/M	Motor generator	2	TM 5-6115-235-10
Diesel Engine Generator Set PU-495/G	Motor generator	2	TM 5-6115-203-12 TO 35C2-3-329-1

1-10. Radio Communications Subsystem AN/URC-61

The Radio communications subsystem AN/URC-61 is a spread spectrum multiple access (SSMA) modem which provides an anti-jam capability through spread spectrum modulation techniques. Refer to figure 1-4 for equipment location. The Radio Communications Subsystem AN/URC-61 consists of the following Major Subgroups:

a. Link Terminal Timing Central TD-85/URC41.
b. Doppler Augmentor Range Corrector.
c. Transmitter.
d. Receiver No. 1.
e. Receiver No. 2.

1-11. Multiplexer Set AN/TCC-79. (fig. 1-5)

The Multiplexer Set AN/TCC-79 processes TCF baseband signals and user VF/teletype inputs and outputs providing the IF interface with the Satellite Communications Terminal AN/TSC-54. The Multiplexer Set AN/TCC-79 consists of the following Major Sub groups:

a. Multiplexer/Demultiplexer Equipment
b. Modem Group OM-45(V)2/TCC.
c. Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC.
d. Voice Orderwire Equipment
e. DC Telegraph Equipment
f. Line Conditioning Equipment

1-12. Power Distribution-Switching Unit SA-1901/TSC-54.

The Power Distribution-Switching Unit SA-1901/TSC-54 is a self-contained unit that selects, controls and monitors the primary ac voltages applied to the ETC. Refer to FO-1 for physical location of this unit

1-13. Static Frequency Converter CV-3061/TSC-54

The Static Frequency Converter CV-3061/TSC-54 provides conversion of primary ac voltage from 50/60 Hz to 400 Hz for the purpose of accommodating the 400 Hz load of the Satellite Communications Terminal AN/TSC-54. Refer to figure FO31 for physical location of Static Frequency Converter CV-3061/TSC-54.

1-14. Digital Data Modem MS-920/G

The Digital Data Modem MD-920/G (ICF Modem) provides the digital interface between the user and the Digital Data Modem MD-921/G (PSK Modem) allowing the user to be located remotely. Refer to figure 1-5 for equipment location.

1-15. Digital Data Modem MD-921/G

The Digital Data Modem MD-921/G (PSK Modem) processes the digital data from the user into a phase-shift keyed (PSK) signal providing the IF interface with the Satellite Communications Terminal AN/TSC-54. Refer to figure 1-5 for equipment location.

1-16. Analog-Digital Converter CV-3034 / G

The Analog-Digital Converter CV-3040/G processes an analog (voice) signal or 50 kbs secure voice signal and provides the digital interface to/from the Digital Data Modem MD-921/G (PSK Modem). Refer to figure 1-5 for equipment location

1-17. Diesel Engine Generator Sets PU-401/M and PU-495/G

The Diesel Engine Generator Sets PU-101/M and PU-495/G provide 400 Hz and 50/60 Hz ac prime power to the ETC when commercial power is not available. When the Satellite Communications Terminal AN/TSC-54 is operated under Contingency Conditions, Diesel Engine Generator Sets PU-401/M are used for supplying ac prime power. Refer to figure FO-1 for physical location of the Diesel Engine Generator Sets PU-401/M and PU-495/G in an ETC *configuration.*

1-18. Electrical Equipment Shelter S-483/TSC-54 **(fig. 1-6)**

The Electrical Equipment Shelter S-483/TSC-54 (Maintenance Shelter) **is a self-contained mobile shel-**

tur that provides an enclosed area for the purpose of performing maintenance. This shelter is a Major Subsystem of the ETC that is "used with" but "not part of" the Satellite Communications Terminal AN/TSC-54.

1-19. Electrical Equipment Shelters S-484/TSC-54 and S-XXX (fig. 1-7)

The Electrical Equipment Shelters S-484/TSC-54 and S-XXX (Storage Shelters) are mobile shelters that provide enclosed areas for the storage of repair parts. These shelters are Major Subsystems of the ETC that are "used with" but "not part of" the Satellite Communications Terminal AN/TSC-54

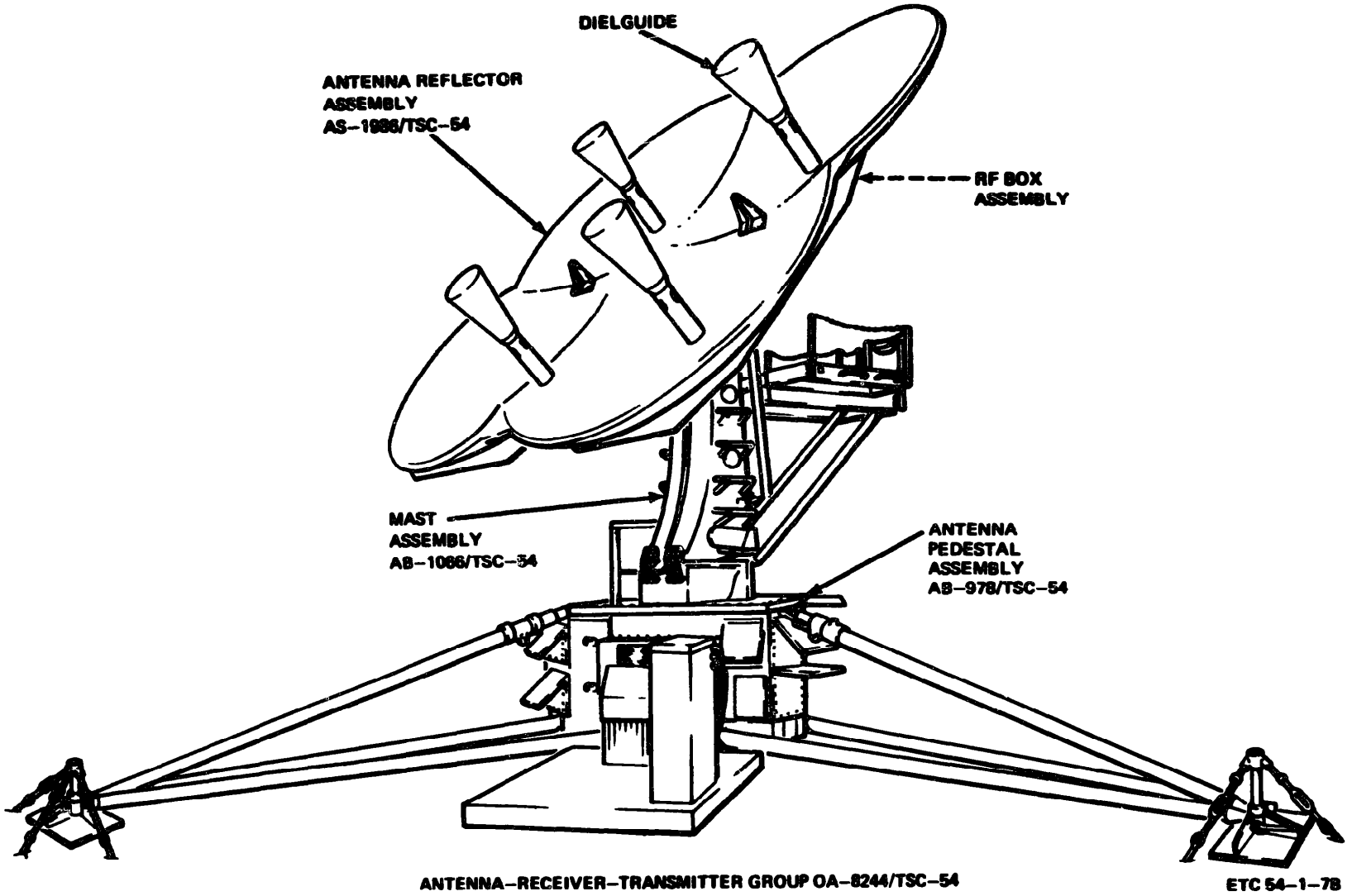


Figure 1-4 (1). Satellite Communication Terminal AN/TSC-54, equipment identification (Sheet 1 of 2).

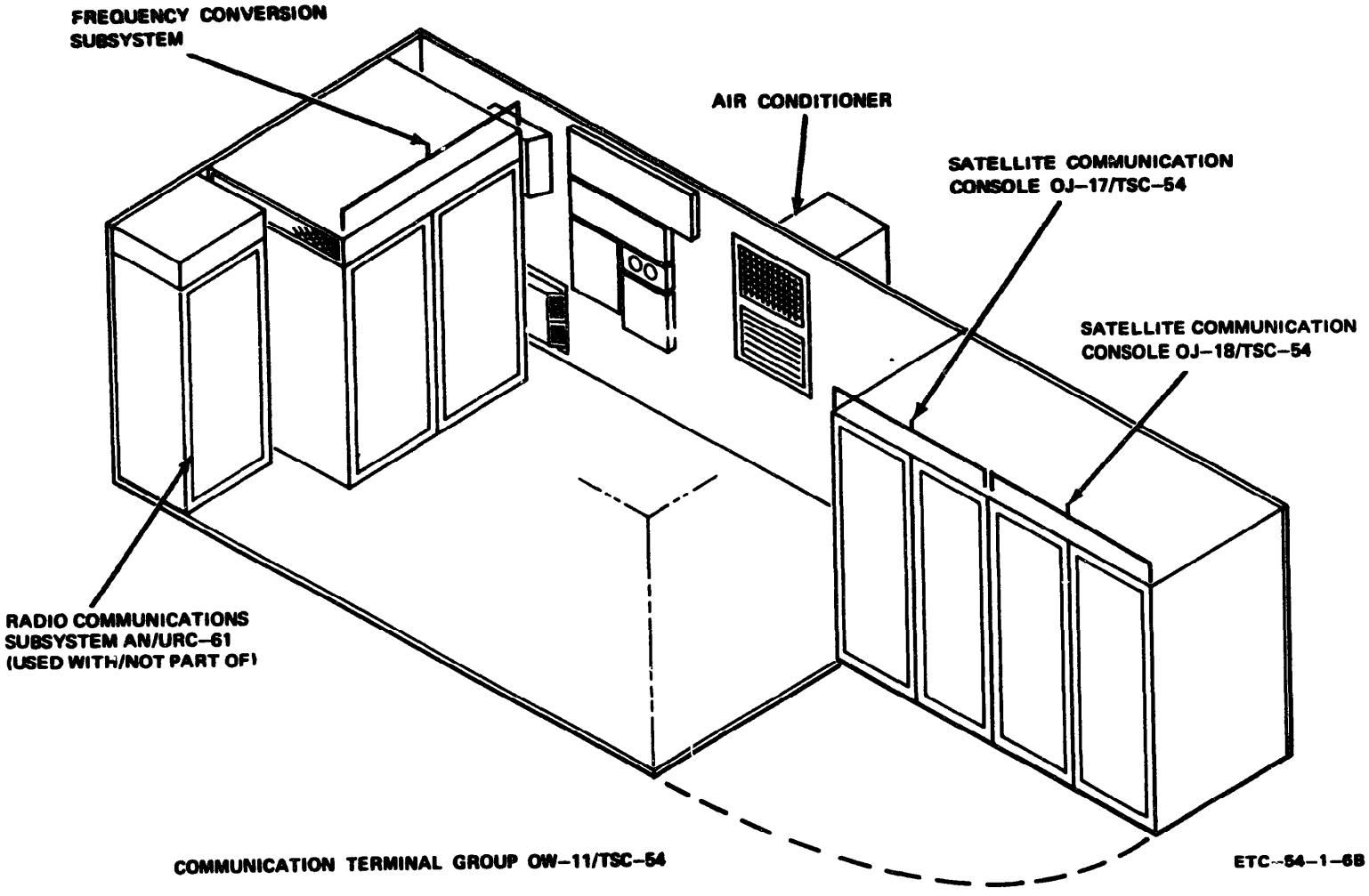


Figure 1-4(2) Satellite Communication Terminal AN/TSC-54, equipment identification (sheet 2 of 2).

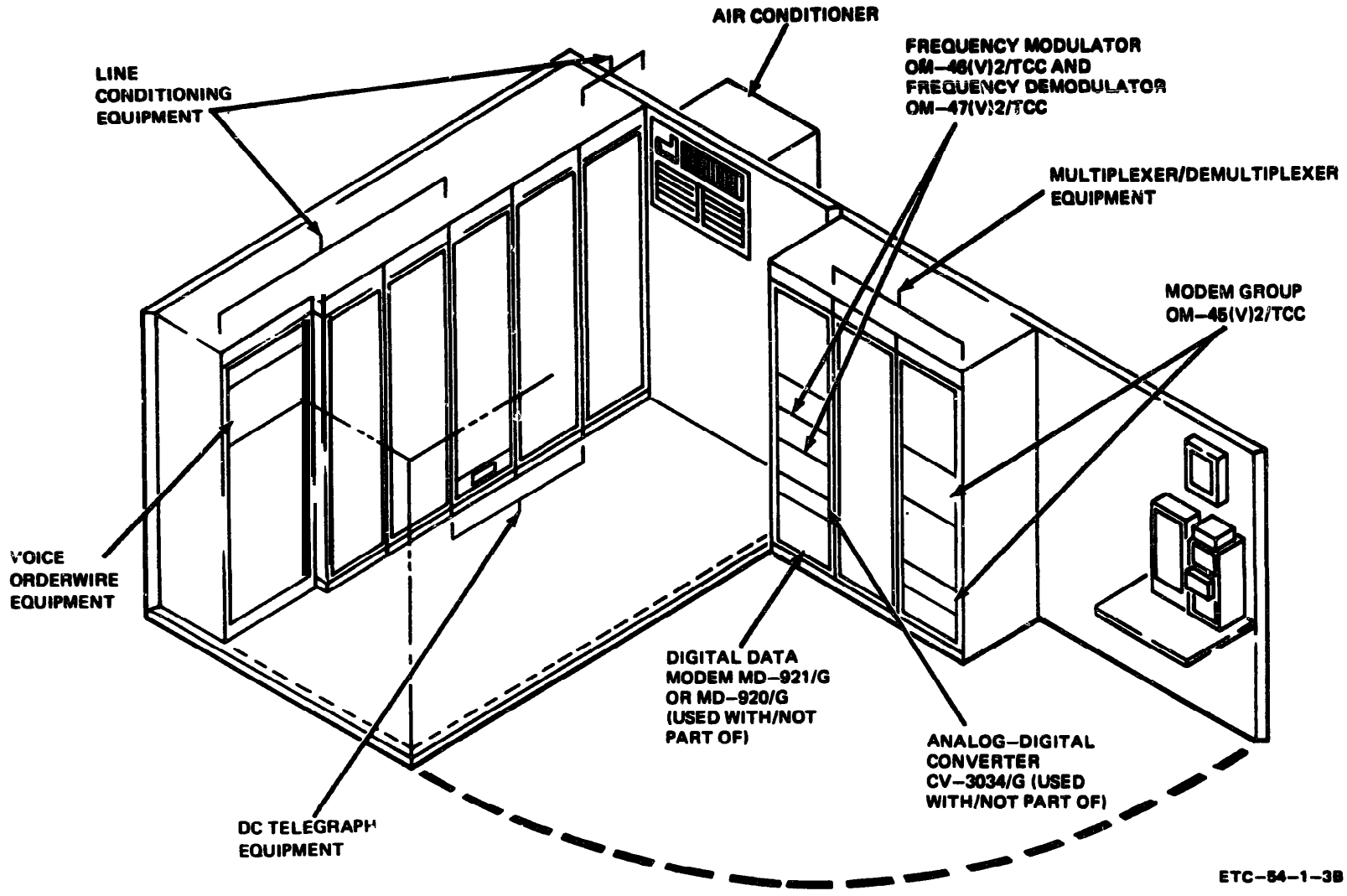


Figure 1-5. Multiplexer Set AN/TCC-79, equipment identification.

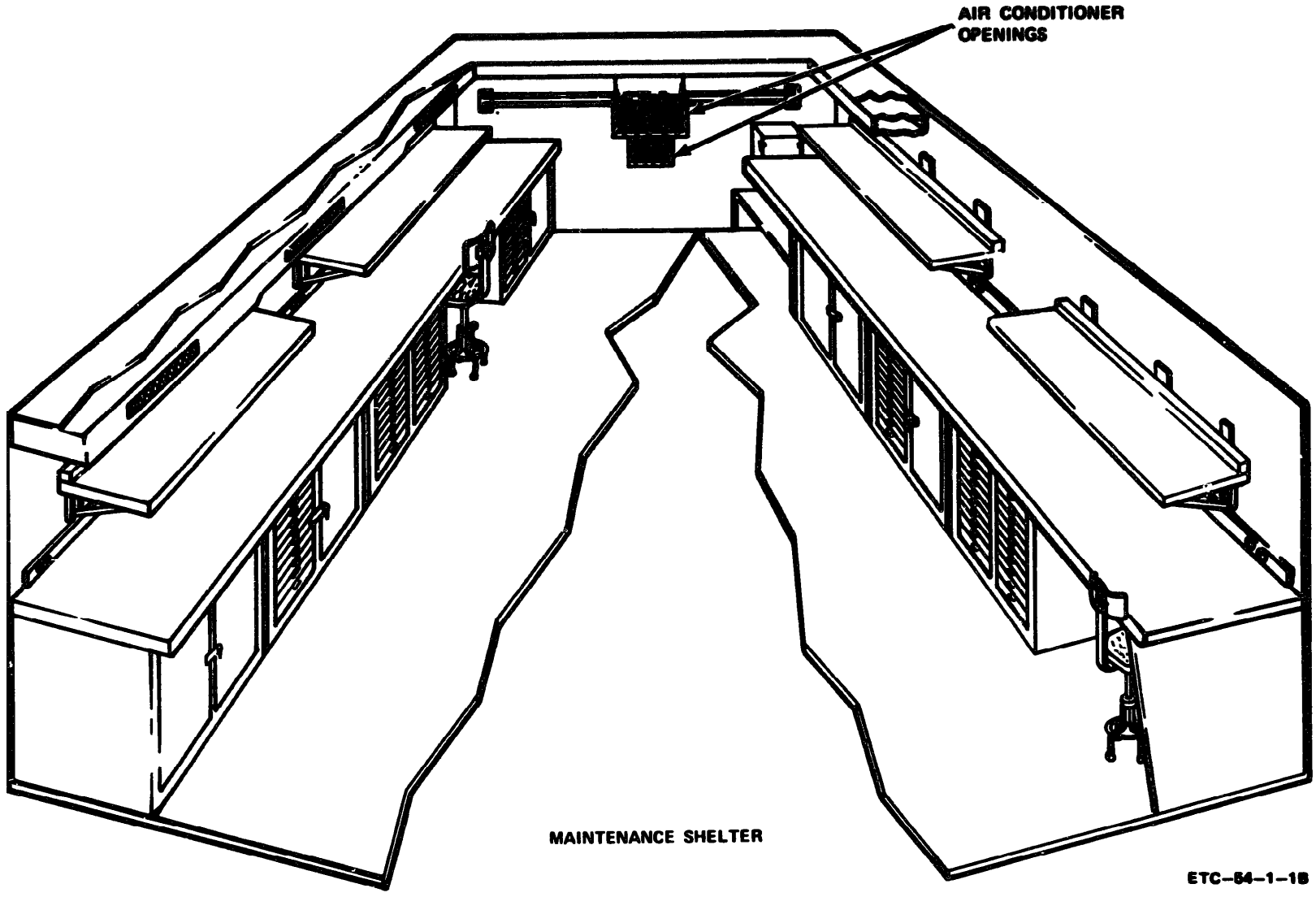


Figure 1-6 Electrical Shelter S-483/TSC-54

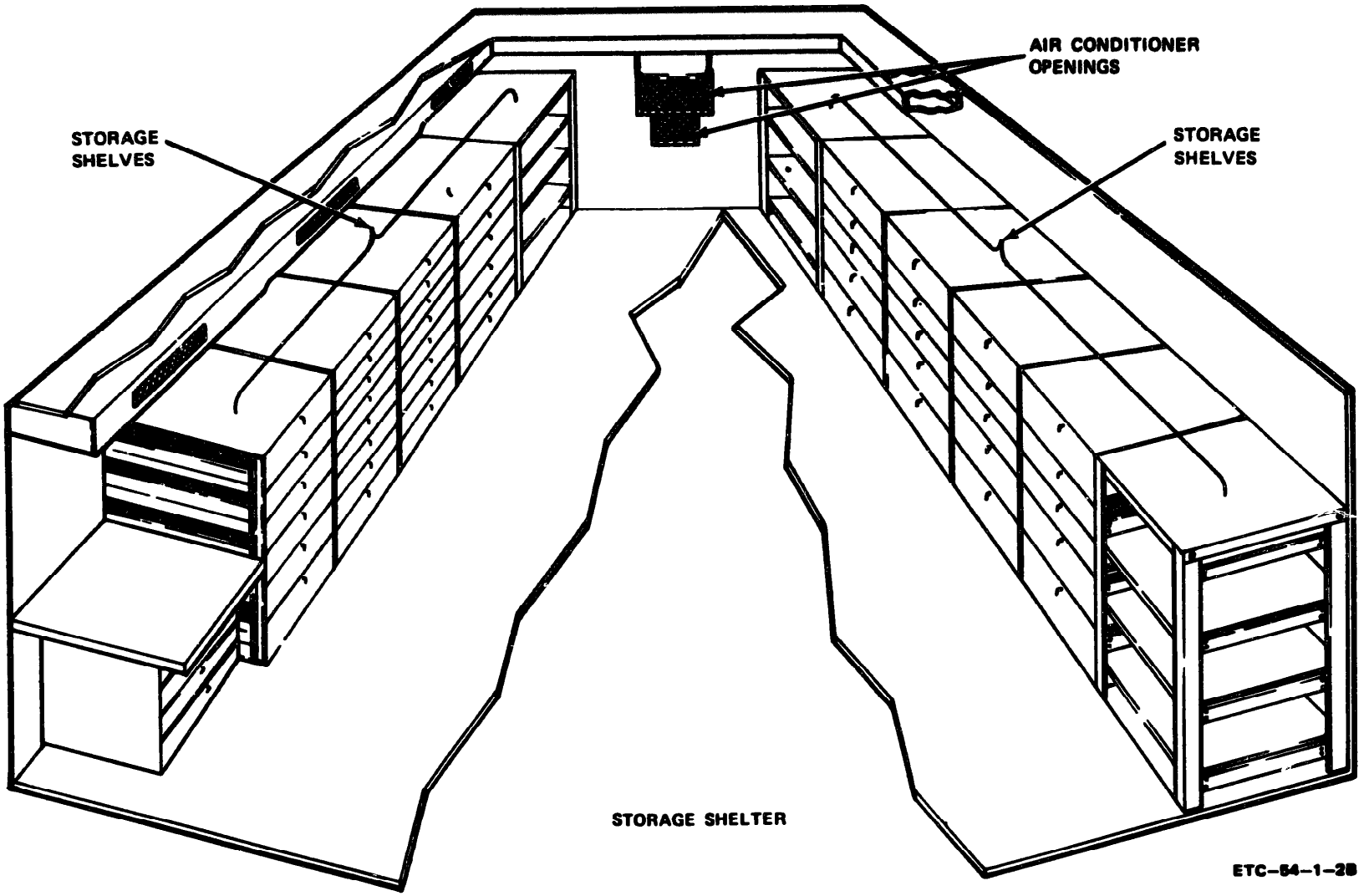


Figure 1-7. Electrical Equipment Shelters S-484/TSC-54 and S-XXX.

CHAPTER 2

ETC PLANNING AND INSTALLATION PROCEDURES

Section I. ETC *INSTALLATION* PLANNING PROCEDURES

2-1. ETC Planning Consideration

Deployment of an ETC is by direction of the Joint Chiefs of Staff (JCS) through the Defense Communications Agency (DCA) Consideration is given to mission requirements, available geographical site locations and satellite position.

2-2. Installation Planning Procedures

The following subparagraphs provide basic requirements to he considered in site selection for an ETC Using the Satellite Communications Terminal AN/TSC-54.

a Site Selection. ETC site selection is governed by mission requirements. However, when selecting a site, consideration should be given to the following:

(1) A minimum ETC site area of approximately 86 feet by 156 feet is required. Additional space must he provided if landing of a helicopter is a necessity.

(2) The site area should be relatively level and dear of gullies, ditches, trees, large boulders or other debris. Additional consideration must be given to an area clear of overhead obstructions and loose material, if landing of a helicopter is required.

(3) The site area should have a supporting ground surface that is sufficiently firm, level and well drained. Marshy areas should be avoided. The slope of *the land should be no less than 2°* in order that minimum standards for water drainage can he met

(4) The site area should have terrain features which help to provide protection from high winds and inclement weather. Possible effects of drifting snow due to prevailing winds should be carefully considered.

(5) The site area should be accessible to terminal support vehicles.

(6) When possible, the ETC should he located away from electrical interference sources such as radar sets, field hospitals, X-ray equipment, and power transmission lines.

b. Soil Consideration. In selection of the ETC site, soil consistency should be considered. Selection should be made of an area that is dry and level with firm ground and good drainage. A soil or clay surfaced area (rather than rock) is desirable to facilitate driving electrical grounding rods in the ground field system. Marshy areas should be avoided.

c. Site Clearing and Earth Grading. In most cases, ETC sites will require some preparation prior to installation of the equipment. This must be considered in the site selection. The site should be selected so that any necessary clearing can be done with hand tools. The extent of the clearing should be limited to brush, small trees, small rocks and debris. These materials should be removed completely from the site. At ETC sites where landing of helicopters is required, all loose materials which might interfere with landing *or introduce* hazards from flying objects must be cleared from the area. ETC site preparation should include excavation only to the extent required for adequate drainage. Ditches, ravines, and gullies should not be filled, even when dry, since they provide natural drainage during heavy rains, and filling them may create a flooding hazard on the site.

d. Installation of Ground Field. Installation of the ETC site ground field should he accomplished prior to the installation and interconnection of the ETC equip ment. It is normally done during site clearing and earth grading operations. With the ground field estab *lished, each* piece of equipment can he properly grounded at the time of it's installation. This reduces the hazard of electrical shock. Location of the ground field should be such that it will not interfere with normal operation and maintenance of the diesel engine generator sets, operation of the ETC equipment or power and signal cables. *Refer to* figure FO-1 for location of the ground field in a typical ETC site configuration.

2-3. Service Upon Receipt and Equipment Placement.

Upon arrival at the site, the ETC shelters and equipment are positioned within the cleared site area in a typical arrangement as shown in figure FO-1. At any geographical location the antenna should be pointed toward the equator at zero cable wrap. After positioning of the ETC equipment, inventories should be performed and inspections held for missing or damaged equipment. Normally, the sequence of the equipments arrival is not critical as preliminary installation of each unit does not depend on the immediate access of other equipment. However, if a priority is established, the arrival of the equipment should be in the order as listed below:

a. Antenna-Receiver-Transmitter Group OA-8244/TSC-54.

b. **Communication Terminal Group OW-11/TSC-54 (electronic equipment shelter).**

c. **Diesel Engine Generator Sets PU-401/M and PU-495/G.**

d. **Electrical Equipment Shelter S-483/TSC-54 (maintenance shelter).**

e. **Electrical Equipment Shelter S-484/TSC-54 (storage shelter).**

f. **Electrical Equipment Shelter S-XXX (storage shelter).**

g. **Power Distribution-Switching Unit SA-1901/TSC-54.**

h. **Multiplexer Set AN/TCC-79.**

i. **Static Frequency Converter CV-3061/TSC-54.**

2-4. Equipment Requirements for Installation

A list of test equipment required for the installation of the ETC Using the Satellite Communications Terminal AN/TSC-54 is contained in appendix B.

2-5. Equipment Installation and Cable Interconnection

This paragraph provides the sequence for installation and interconnection of the Major Subsystems and Major Subgroups of the ETC Using the Satellite Communications Terminal AN/TSC-54. Provided in table 2-1 is a list of the interconnect cables and wiring. Refer to figure FO-3 for the interconnect cabling diagram for a typical ETC site configuration.

a. Equipment Installation. **Installation of the ETC equipment should be performed in the order as listed below. Detailed procedures for installation are contained in applicable equipment technical manuals. Refer to appendix A for a list of applicable technical manuals.**

(1) Ground field installation (para 2-2d) (TM 11-5895-389-12/ NAVSHIPS 0967-377-7010/ TO 31R5-2TSC54-11).

(2) Ground cable installation.

WARNING

Ground field grounding cables must be installed on each major unit cable interconnection. Ground potential differences may exist between major units if they are not properly grounded resulting in a serious electrical hazard to personnel. Insure that ground cables are installed on each of the following units as it is installed and before proceeding to the next unit.

(3) Power Distribution-Switching Unit SA-1901/TSC-54 (DTM 11-5895-783-12).

(4) Diesel Engine Generator Sets PU-401/M and PU-495/G (TM 5-6115-235-10 and TM 6-6115-293-12/ TO 35C2-3-329-1).

(5) Static Frequency Converter CV-3061/TSC-54 (DTM 11-5820-802-12).

(6) Electrical Equipment Shelter S-483/TSC-54 (maintenance shelter) (IM 11-5895-389-15-1).

(7) Communications Terminal Group OW-11/TSC-54 (electronic equipment shelter) (TM 11-5895-389-12/NAVSHIPS 0967-377-7010/ TO 31R5-2TSC54-11).

(8) Antenna-Receiver-Transmitter Group OA-8244/TSC-54 (TM 11-5895-389-12/NAVSHIPS 0967-377-7010/TO 31R5-2TSC54-11).

(9) Multiplexer Set AN/TCC-79 (DTM 11-5895-796-12-3).

(10) Electrical Equipment Shelter S-484/TSC-54 (storage shelter) (IM-5895-389-15-1).

(11) Electrical Equipment Shelter S-XXX (storage shelter) (IM 11-5895-389-15-1).

b. ETC Cable Interconnection.

(1) ***Grounding of equipment.***

WARNING

To reduce the hazard of electrical shock, the Power Distribution-Switching Unit SA-1901/TSC-54 and associated equipment of the ETC must be properly grounded before connecting one to the other.

Connect a grounding cable from the Power Distribution-Switching Unit SA1901/TSC-54 to the system ground terminal block which is connected to the ground field system. Connect grounding cables from each Major Subsystem and Major Subgroup of the ETC to the system ground terminal block. For detailed procedures for installations of lightning arrester grounding system refer to applicable equipment technical manuals.

(2) ***Cable connections.*** **After having completed the grounding of equipment, interconnect the Major Subsystems and Major Subgroups of the ETC with the cables supplied. During interconnection, connect both ends of a cable or hose prior to the connection of another cable or hose. Check connections to ensure that excessive pressure is not exerted on the connector and that the cable or hose is not resting on sharp objects. Refer to table 2-1 for a listing of interconnect cables and wiring for the ETC and figure FO-3 for the interconnect cable diagrams. For detailed interconnecting procedures refer to appendix A for applicable technical manuals.**

c. Erecting the Antenna.

WARNING

Prior to applying prime power to the Antenna-Receiver-Transmitter Group OA-8244/TSC-54, verify that all ETC equipment has been properly grounded.

Preliminary installation of the antenna, less erection can be started before ETC cable interconnection is completed. However, antenna erection requires 120 V ac, 400 Hz, 3-phase power applied to the antenn

pedestal to operate the electric drill used during antenna installation. For detailed antenna installation procedures and power application refer to TM 11-5895-389-12/NAVSHIPS 0967-377-7010/TO 31R5-2TSC54-11

Table 2-1 Interconnect Cables and Wiring for Using the Satellite Communications Terminal AN/TSC-54

Cable No.	Part No.	Cable P or J No. (from)	Panel or J box P or J No. (from)	Major subsystem/ subgroup panel or J box identification (from)	Cable P or J No (to)	Panel or J box P or J No (to)	Major subsystem/ subgroup panel or J box identification (to)	Cable length
	(4/0 Bare copper wire)		E1	System Ground Terminal Block			Ground Field System	100
	(4/0 Insulated wire)		GND	Power Distribution Switching Unit SA-1901/TSC-54 DC Input Connector Panel		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GND Stud	Diesel Engine Generator Set PU-401/M (Gen No 1 400 Hz)		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GND Stud	Diesel Engine Generator Set PU-401/M (Gen No 2 400 Hz)		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GND Stud	Diesel Engine Generator Set PU-495/G (Gen No 1 50/60 Hz)		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GND Stud	Diesel Engine Generator Set PU-495/G (Gen No 2 50/60 Hz)		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GROUND STUD	Static Frequency Converter CV-3061/TSC-54		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		E1 GND Stud	Antenna-Receiver Transmitter Group OA-8244/TSC-54 Primary Power Distribution Panel 2A3A14		E1	System Ground Terminal Block	100
	(4/0 Insulated wire)		E1 SHELTER GND	Communication Terminal Group OW-11/TSC-54 External DC Panel		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		E1 GND Stud	Multiplexer Set AN/TCC-79 Signal Panel 1A3		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GROUND TERMINAL	Electrical Equipment Shelter S-483/TSC-54 Power Entrance Panel		E1	System Ground Terminal Block	50
	(4/0 Insulated wire)		GROUND TERMINAL	Electrical Equipment Shelter S-484/TSC-54 Power Entrance Panel		E1	System Ground Terminal Block	
	(4/0 Insulated wire)		GROUND TERMINAL	Electrical Equipment Shelter S-XXX Power Entrance Panel		E1	System Ground Terminal Block	
W7	SM-D [illegible]1923	W7P1	J2	Antenna Receiver Transmitter Group OA-8244/TSC-54 Primary Power Distribution Panel 2A3A14 (400 Hz Power)	W7P2	J13	Communication Terminal Group OW-11/TSC-54 Power Panel	
W13	SC-D-629410	W13P1	J124	Power Distribution Switching Unit SA-1901/TSC-54 AC Input Connector	L0 L1 L2 L3	L0 L1 L2 L3	Diesel Engine Generator Set PU-401/M (Gen No 1 400 Hz)	100

Table 2-1. Interconnect Cables and Wiring for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Cable No.	Part No.	Cable P or J No. (from)	Panel or J box P or J No. (from)	Major subsystem/ subgroup panel or J box identification (from)	Cable P or J No. (to)	Panel or J box P or J No (to)	Major subsystem/ subgroup panel or J box identification (to)	Cable length
				Panel (400 Hz Power)	(Pig Tails)			
W13	SC-D-629410	W13P1	J126	Power Distribution-Switching Unit SA-1901/TSC-54, AC Input Connector Panel (400 Hz Power)	L0, L1, L2, L3 (Pig Tails)	L0, L1, L2, L3	Diesel Engine Generator Set PU-401/M (Gen No. 2, 400 Hz)	100'
W15	SC-D-629409	W15P1	J123	Power Distribution-Switching Unit SA-1901/TSC-54, AC Input Connector Panel (50/60 Hz Power)	W15P2	A2J1	Static Frequency Converter CV-3061/TSC-54, INPUT Connector (50/60 Hz Power)	50'
W19	SM-D-778477	W19P1	J140 REMOTE ALARM	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel (Remote Alarm)	W19P2	J21 REMOTE ALARM	Communication Terminal Group OW-11/TSC-54, External DC Panel	100'
W20	SM-D-778506	W20P1	J1	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Primary Power Distribution Panel 2A3A14 (400 Hz Power)	W20P2	J117	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W23	SC-D-629419	W23P1	INPUT 120/208 VAC 3Ø 400 Hz	Electrical Equipment Shelter S-483/TSC-54, Power Entrance Panel (400 Hz Panel)	W23P2	J113	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W23	SC-D-629419	W23P1	INPUT 120/208 VAC 3Ø 400 Hz	Electrical Equipment Shelter S-484/TSC-54, Power Entrance Panel (400 Hz Power)	W23P2	J114	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W24	SC-D-629414	W24P1	J121	Power Distribution-Switching Unit SA-1901/TSC-54, AC Input Connector Panel (60 Hz Power)	L0, L1, L2, L3 (Pig Tails)	L0, L1, L2, L3	60 Hz Utility Power Source (Commercial)	100'
W24	SC-D-629414	W24P1	J122	Power Distribution-Switching Unit SA-1901/TSC-54, AC Input Connector Panel (50/60 Hz Power)	L0, L1, L2, L3 (Pig Tails)	L0, L1, L2, L3	Diesel Engine Generator Set PU-495/G (Gen No 1, 50/60 Hz)	100'
W24	SC-D-629414	W24P1	J125	Power Distribution-Switching Unit SA-1901/TSC-54, AC Input Connector Panel (50/60 Hz Power)	L0, L1, L2, L3 (Pig Tails)	L0, L1, L2, L3	Diesel Engine Generator Set PU-495/G (Gen No 2, 50/60 Hz)	100'
W26	SC-D-629408	W26P1	A1J3	Static Frequency Converter CV-3061/TSC-54, OUTPUT Connector (400 Hz Power)	W26P2	J111	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	50'

Table 2-1. Interconnect Cables and Wiring for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Cable No.	Part No.	Cable P or J No. (from)	Panel or J box P or J No. (from)	Major subsystem/ subgroup panel or J box identification (from)	Cable P or J No. (to)	Panel or J box P or J No (to)	Major subsystem/ subgroup panel or J box identification (to)	Cable length
W29	SM-F-736313	W29P1	J3 POWER IN	Multiplexer Set AN/TCC-79, Power Panel 1A4 (50/60 Hz Power)	W29P2	J112	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W30	SC-D-629413	W30P1 W30P2	J1 J2	Diesel Engine Generator Set PU-495/G (Gen No. 1, 50/60 Hz)	W30P3	J131	Power Distribution-Switching Unit SA-1901/TSC-54, DC Input Connector Panel	100'
W30	SC-D-629413	W30P1 W30P2	J1 J2	Diesel Engine Generator Set PU-495/G (Gen No. 2, 50/60 Hz)	W30P3	J132	Power Distribution-Switching Unit SA-1901/TSC-54, DC Input Connector Panel	100'
W31	SC-D-629411	W31P1	INPUT 115 VAC 1ϕ 60 Hz	Electrical Equipment Shelter S-483/TSC-54, Power Entrance Panel (50/60 Hz Power)	W31P2	J115	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W31	SC-D-629411	W31P1	INPUT (60 Hz)	Electrical Equipment Shelter S-XXX, Power Entrance Panel (50/60 Hz Power)	W31P2	J116	Power Distribution-Switching Unit SA-1901/TSC-54, AC Output Connector Panel	100'
W32	SC-D-629412	W32P1	INPUT (60 Hz)	Electrical Equipment Shelter S-484/TSC-54, Power Entrance Panel (50/60 Hz Power)	W32P2	OUTPUT (60 Hz)	Electrical Equipment Shelter S-XXX, Power Entrance Panel	50'
W3	SM-D-571915	W3P1	J4 SCAN PULSE NO 1	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W3P2	J2	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Signal Entrance Panel	50'
W4	SM-D-571916	W4P1	J5 SCAN PULSE NO. 2	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W4P2	J3	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Signal Entrance Panel	50'
W5	SM-D-571917	W5P1	J6 SCAN PULSE NO. 3	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W5P2	J4	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Signal Entrance Panel	50'
W6	SM-D-571918	W6P1	J7 SCAN PULSE NO. 4	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W6P2	J5	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Signal Entrance Panel	50'
W9	SM-D-571921	W9P1	J12 SERVO CONTROL	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W9P2	J5	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Primary Power Distribution Panel 2A3A14	50'
W10	SM-D-571922	W10P1	J11 COMM CONTROL	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W10P2	J6	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Primary Power Distribution Panel 2A3A14	50'

Table 2-1. Interconnect Cables and Wiring for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Cable No.	Part No.	Cable P or J No. (from)	Panel or J box P or J No. (from)	Major subsystem/ subgroup panel or J box identification (from)	Cable P or J No (to)	Panel or J box P or J No (to)	Major subsystem/ subgroup panel or J box identification (to)	Cable length
W11	SM-F-736309-1	W11P1	J17	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W11P2	J8	Multiplexer Set AN/TCC-79, Signal Panel 1A3	100'
W12	SM-F-736309-2	W12P1	J18	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W12P2	J9	Multiplexer Set AN/TCC-79, Signal Panel 1A3	100'
W16	SM-A-573403-5	W16P1	J18	Communication Terminal Group OW-11/TSC-54, Servo & Signal Entrance Panel (Signal)	W16P2	J8 (PWR METER)	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Waveguide Panel 2A3A22	50'
W17	SM-A-778189-1	W17P1	J20	Communication Terminal Group OW-11/TSC-54, Waveguide Panel (UP-CONVERTER Connector)	W17P2	J2	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Waveguide Panel 2A3A22	70'
W18	SM-A-778189-1	W18P1	J19	Communication Terminal Group OW-11/TSC-54, Waveguide Panel (DOWN-CONVERTER Connector)	W18P2	J1	Antenna-Receiver-Transmitter Group OA-8244/TSC-54, Waveguide Panel 2A3A22	70'
W21	SM-F-736311-1	W21P1	J15 TCC-79 RCV	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W21P2	J11 FM/PSK DEMOD	Multiplexer Set AN/TCC-79, Signal Panel 1A3	50'
W22	SM-F-736311-2	W22P1	J16 TCC-79 XMT	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W22P2	J10 FM/PSK MOD	Multiplexer Set AN/TCC-79, Signal Panel 1A3	50'
W25	SM-F-736312-1		(BINDING POSTS)	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W25P2	J9	Multiplexer Set AN/TCC-79, Signal Panel 1A5	50'
W27	SM-F-736312-2		(BINDING POSTS)	↕	W27P2	J10	↕	50'
W28	SM-F-736312-3		(BINDING POSTS)	Communication Terminal Group OW-11/TSC-54, External Signal Distribution Box 1A10 (Signal)	W28P2	J2	Multiplexer Set AN/TCC-79, Signal Panel 1A5	50'
W5	SM-F-736308-1	W5P1	J12	Multiplexer Set AN/TCC-79, Signal Panel 1A3 (Signal)			Interconnect Facility	100'
W6	SM-F-736308-2	W6P1	J13					100'
W8	SM-F-736308-3	W8P1	J15					100'
W9	SM-F-736308-4	W9P1	J16	Multiplexer Set			Interconnect	100'

Table 2-1 Interconnect Cables and *Wiring for ETC Using the Satellite Communications* Terminal AN/TSC-54- Continued

Cable No.	Part No.	Cable P or J No (from)	Panel or J box P or J No. (from)	Major subsystem/ subgroup panel or J box identification (from)	Cable P or J No. (to)	Panel or J box P or J No (to)	Major subsystem/ subgroup panel or J box identification (to)	Cable length
				AN/TCC-79, Signal Panel 1A3 (Signal)			Facility	
W13	SM-F-736310-1	W13P1	J11 USER VF SEND/REC	Multiplexer Set AN/TCC-79, Signal Panel 1A5 (Signal)			Junction Box Enclosure Assembly A1-12762D (Cable Termination Box J-1077A/U)	100'
W14	SM-F-736310-2	W14P1	J12 USER VF SPARE	Multiplexer Set AN/TCC-79, Signal Panel 1A5 (Signal)			Junction Box Enclosure Assembly A1-12762D (Cable Termination Box J-1077A/U)	100'
W15	SM-F-736310-3	W15P1	J3					100'
W16	SM-F-736310-4	W16P1	J4	Multiplexer Set AN/TCC-79, Signal Panel 1A5 (Signal)			Junction Box Enclosure Assembly A1-12762D (Cable Termination Box J-1077A/U)	100'

Section II. PREPARATION FOR USE

2-6. General

This section provides the sequence for preliminary visual inspections, prime power application and subsystem turn-on and checkout of the ETC. Procedures are provided in applicable manuals listed in appendix A.

2-7. Preliminary Visual Inspections of the ETC

Prior to application of power to the ETC, visual inspections contained in applicable technical manuals, should be made to locate any obvious damage. Special attention should be given the following:

a. Electrical Inspections.

(1) Insure that the commercial power source and Diesel Engine Generator Sets PU-401/M and PU-495/G are OFF.

(2) Check that all equipment is properly grounded to the station ground field.

b. Mechanical Inspections.

(1) Check that all equipment is securely mounted and that mountings and hardware are tight

(2) Check all equipment for signs of oil leaks and proper lubricant levels (TM 5-6115-235-10, TM 5-6115-293-12/TO 35C2-3-329-1 and 'I'M 11-5895-389-12/NAVSHIPS 0967-377-70109/TO 31R5-2TSC54-11).

(3) Check heat exchangers for proper coolant levels (TM 11-5895-389-12/ NAVSHIPS 0967-377-7010/TO 31R5-2TSC54-11).

4. Check for obvious damage to shelter exteriors, antenna reflector, and dielguide feed system.

c. Power Inspections.

(1) Verify that all main power circuit breakers and power distribution panel circuit breakers are set to ml?.

(2) Verify that all equipment front panel switches are set to OFF.

(3) Verify that all connections from the commercial power source and Diesel Engine Generator Sets PU-401/M and PU-495/G are correct and the connections are tight and not damaged. Refer to figure FO-3 for interconnect cable diagram.

d. Interconnect Cable Inspections.

(1) Check all interconnect cables for proper installation and tight connection. Refer to table 2-1 for cable listing.

(2) Check all interconnect cables for damage or possible cutting by installation vehicles.

(3) Check all interconnect cable connections for undue stress and ensure that protective covers are installed at cable entrance panels.

2-8. AC Power Application

Prior to subsystem turn-on and checkout, a.c. power must be applied to the ETC and connections from commercial power source and Diesel Engine Generator Sets PU-401/M and PU-495/G must be verified for proper phase relationship as described in TM 11-5895-389-12/ NAVSHIPS 0967-377-7010/ TO 31R5-2TSC54-11. Power Distribution-Switching Unit SA-1901/TSC-54 and Static Frequency Converter CV-3061/TSC-54 checks must also be performed. The ac power application sequence and checks are contained in chapter 3, section II.

2-9. Subsystem Turn-On and Check out

a. General This paragraph provides the turn-on and checkout sequences for the ETC Using the Satellite Communications Terminal AN/TSC-54. For detailed turn-on and checkout procedures for ETC subsystems refer to applicable equipment technical manuals.

b. Order of Turn-On and Checkout. The following turn-on and checkout procedures ensure that the ETC Using the Satellite Communications Terminal AN/TSC-54 meets operational requirements.

(1) Perform Generator power application in accordance with TM 5-6615-293-12/ TO 35C2-3-329-1 and TM 5-6115-235-10. If commercial power is available; turn-on, checkout and secure Diesel Engine Generator Sets PU-401/M and PU-495/G, then apply commercial power.

(2) Perform commercial power application in accordance with TM 11-5895 -733-12.

(3) Perform Power Distribution Switching Unit SA-1901/TSC -54 turn-on and checkout in accordance with DTM 11-5895 -733 -12.

(4) Perform Static Frequency Converter CV-3061/TSC-54 turn-on and checkout in accordance with DTM 11-5820-802-12.

(5) Perform Satellite Communications Terminal AN/TSC-54 turn-on and checkout in accordance with TM 11-5895-389-12/NAVSHIPS 0967-377-7010/TO 31R5-2TSC54-11.

(6) Perform Multiplexer Set AN/TCC-79 turn-on and checkout in accordance with DTM 11-5895-796-12-3.

(7) Perform Radio Communications Subsystem AN/URC-61 turn-on and checkout in accordance with DTM 11-5820-614-12.

(8) Perform Digital Data Modem MD-920/G (ICF Modem) turn-on and checkout in accordance with DTM 11-5820-804-12.

(9) Perform Digital Data Modem MD-921/G (PSK Modem) turn-on and checkout in accordance with DTM 11-5820-803-12.

(10) Perform Analog-Digital Converter CV-3034/G turn-on and checkout in accordance with IM 5895-797-14.

Section III. ANALYSIS AND SYSTEM CHARACTERIZATION

2-10. General

Upon completion of turn-on and checkout of individual subsystems, ETC system adjustments and characterization tests are performed. These tests and adjustments ensure that the ETC meets performance standards prior to entering the satellite network. A list of the tests and adjustments is provided below.

a. Tests as cited in DCA Circular 310-70-57, Supplement 6, for performance by the Technical Evaluation Program (TEP) team

b. Tests as cited in DCA Circular 831-70-( ) for performance by each ETC

c. ETC System Adjustments

d. Link Performance Tests

2-11. Tests for Performance by TEP TEAM

A comprehensive set of performance-measurement test procedures are provided in DCA Circular 310-70-57, Supplement 6. Selected tests from this circular may be performed by the TEP team as directed by the SATCOM Net Controller.

2-12 Tess for Performance by each ETC

A catalog of tests which may be requested by the SATCOM Net Controller to establish/confirm ETC performance baseline are included in DCA Circular 831-70-( ). These tests fall into three categories provided below.

a. Tests to be performed prior to establishing each link

b. Tests to be performed immediately after establishing each link

c. Tests to be performed periodically

2-13. ETC System Adjustment

ETC system adjustments are performed to ensure that interface signal levels between Major Subsystems are correct. These adjustments should not be attempted until turn-on and checkout procedures for individual subsystems have been completed. ETC system adjustments include setting; IF interface levels, receive baseband gain, RF transmit frequency and RF receive frequency. Detailed ETC System Operating Procedures are provided in chapter 3, section II.

2-14. ETC Transmit Power Calibration

Transmission of multiple carriers through a single repeater satellite requires that power allocations be assigned to each transmit carrier. Prior to accessing the satellite, it is necessary to calibrate each Electronic Frequency Up-Converter CV-3084/MSC-46 RF POWER meter. Such calibration is essential for multiple carriers and is recommended even for single carrier assignments. This ensures that addition of carriers and substitution of the spare upconverter can be accomplished with minimum system outage. For multiple carriers, this calibration permits setting, readjustment and monitoring individual carrier powers without interrupting transmissions. Detailed Transmit Power Calibration procedures are contained

in chapter 3, section II.

2-15. Link Performance **Tests**

Control of the satellite assets requires that certain indicators of ETC performance be reported to the SATCOM Net Controller. These reports enable the Controller to maintain correct satellite power distribution and thus provide the desired communication services. The most useful parameter for determining overall performance of an FM link is the circuit test tone-to-noise ratio (TTNR). Routine measurement of TTNR is not practical since it requires interruption of traffic channels. Performance of FM channels can be characterized by measuring Out-of-Band Noise (OBN). OBN is monitored to note any substantial change in system performance. Spread Spectrum Multiple Access (SSMA) link performance is monitored using equipment threshold margin meters. PSK link performance is monitored using Bit Error Rate.

Section IV. PREPARATION FOR RESHIPMENT

2-16. General

This section provides information relating to disassembly and preparation for reshipment of the ETC. The following paragraphs provide the sequence for disconnecting cables, removing equipment and preparation for transport If a radome is installed, the O & M Service will arrange for its disassembly and reshipment. Refer to Transportation and Storage Plan, appendix II, of Logistic Support Plan for Earth Terminal Complex Using Satellite Communications Terminal AN/TSC-54 Phase II Stage lb and applicable technical manuals for detailed procedures.

2-17. ETC Cable Disconnection and Equipment Removal

This paragraph provides the order in which ETC cables are disconnected and equipment removed. Detailed procedures are contained in applicable technical manuals.

a. Preliminary Disassembly of Antenna. **Preliminary disassembly of antenna requires 120 V ac, 3-phase, 400 Hz power applied to the antenna pedestal for operation of the electrical drill used during antenna disassembly. Therefore, all prime power to the ETC systems should be turned off with the exception of prime power to the antenna pedestal. Refer to TM 11-5895-389-12/ NAVSHIPS 0967-377-70109/ TO 31R5-2TSC54-11 for detailed procedures on antenna disassembly.**

b. Cable Disconnection.

WARNING

Prior to disconnecting any cable ensure that the Diesel Engine Generator Sets PU-401/M and PU-495/G have been turned off. All commercial power circuit breakers have been set to OFF and all circuit breakers that control power for the assemblies to be disconnected are set to OFF. Serious injury or death can result from power being applied to the cable during disconnection.

The procedure for disconnecting interconnect cables and wiring is in general the reverse of the installation procedure. *Care* should be taken to prevent damage to cable connectors and protection covers should be installed. After all cables have been disconnected, protective covers should be installed on the shelter distribution boxes. ETC interconnect cables should be disconnected in the following order:

(1) Commercial power cable

(2) Power and signal cables from the Major Subsystems and Major Sub-Groups of the ETC

(3) Grounding cables from the Major Subsystems and Major Subgroups of the ETC.

c. Equipment Stowage and Preparation for Transport. **Under normal conditions preparation for transport of the Major Subsystems of the ETC should be performed in the order listed below. However, if a priority is established for the arrival of the equipment at the next ETC site, refer to paragraph 2-3 for the order of the equipment arrival. During stowage of equipment account for all items, except those discarded as expendable, and store them in their appropriate area. Detailed procedures for the stowage of the equipment and preparation for transport are contained in applicable technical manuals.**

(1) Antenna-Receiver-Transmitter Group OA-8244/TSC-54 (TM 11-5895-389-12/ NAVSHIPS 0967-377-7010/ TO 31R5-2TSC54-11).

(2) Communication Terminal Group OW-11/TSC-54 (electronic equipment shelter) (TM 11-5895-389-12/ NAVSHIPS 0967-377-7010/ TO 31R5-2TSC-54-11).

(3) Diesel Engine Generator Sets PU-401/M and PU-495/G (TM 5-6115-235-10 and TM 5-6115-293-12/ TO 35C2-3-329-1).

(4) Power Distribution-Switching Unit SA-1901/ TSC-54 (DTM 11-5895-783-12).

(5) Multiplexer Set AN/TCC-79 (DTM 11-5895-796-12-3).

(6) Electrical Equipment Shelter S-483/TSC-54 (maintenance shelter) (IM 11-5895-389-15-1).

(7) Electrical Equipment Shelter S-484TSC-54 (storage shelter) (IM 11-5895-389-15-1).

(8) Electrical Equipment Shelter S-XXX (storage shelter) (IM 11-5895-389-15-1).

(9) Static Frequency Converter CV-3061/TSC-54 (DTM 11-5820-802-12).

CHAPTER 3

OPERATION

Section I. OPERATIONAL CAPABILITIES AND LIMITATIONS

3-1. General

This section defines the maximum and minimum capabilities of the ETC Using the Satellite Communications Terminal AN/TSC-54.

3-2. Capability and Limitations of the ETC Using the Satellite Communications Terminal AN/TSC-54.

a. The ETC Using the Satellite Communications Terminal AN/TSC-54 has a maximum capability of three Electronic Frequency Up-Converters CV-3084/MSC-46, providing three transmit communications carriers. A maximum of three Electronic Frequency Down-Converters CV-3085/MSC-46 provide two receive communications carriers and one receive beacon carrier. The receive beacon carrier is dedicated to the Beacon Demodulator MD-705/TSC-54. However, a typical ETC configuration will only use two Electronic Frequency Up-Converters CV-3084/MSC-46 and three Electronic Frequency Down-Converters CV-3085/MSC-46. The ETC is capable of a maximum output power of 5 kW nominal into the feed. The transmit frequency range of the ETC is 7.9 to 8.4 GHz. The receive frequency range of the ETC is 7.25 to 7.75 GHz.

b. The Multiplexer Set AN/TCC-79 provides the capability of one FM transmit trunk using the Frequency Modulator OM-46(V)2/TCC and one FM receive trunk using the Frequency Demodulator OM-47(V)2/TCC. The FM trunk is capable of handling from three to seventy-two FM voice channels, one of which may contain sixteen individual user teletype signals, plus an FM voice orderwire. Channel capacity is selected through use of preset channel density modules. The seventy-two FM voice channel capacity may be utilized in any one of the following manners:

(1) A maximum baseband input/output of twelve local user voice frequency channels, plus one ETC to ETC voice orderwire channel and either Supergroup 1 or Supergroup 2 from/to TCF.

(2) A maximum baseband input/output of eleven local user voice frequency channels, sixteen individual user teletype signals, plus one ETC to ETC voice order channel and either Supergroup 1 or Supergroup 2 from/to TCF.

(3) A maximum baseband input/output of eleven local user voice frequency channels, fifteen individual user teletype signals and one local teletype orderwire signal, plus one ETC to ETC voice orderwire channel and either Supergroup 1 or Supergroup 2 from/to TCF.

(4) A maximum baseband input/output of one basic group (twelve voice frequency channels) from/to TCF, plus one ETC to ETC voice orderwire channel and either Supergroup 1 or Supergroup 2 from/to TCF.

c. The Digital Data Modem MD-921/G (PSK Modem) is capable of transmitting and receiving data from 19.2 kbs to 9.9999 Mbs.

d. The Radio Communications Subsystem AN/URC-61 provides a spread spectrum multiple access (SSMA) capability to the ETC. The SSMA capability supports high priority communications under conditions of severe electronic environment. The Radio Communications Subsystem AN/URC-61 provides one voice channel, one teletype channel and one teletype orderwire channel or one digital channel and one teletype orderwire channel provided the digital data rate is higher than 2400 bps. When used with an external Time Transfer Unit CM-427(XB-1) /URC(TTU), the Radio Communications Subsystem AN/URC-61 can be utilized to perform Precise Time and Time interval (PTTI) measurements for accurate time transfer.

e. At selected points throughout the ETC Using the Satellite Communications Terminal AN/TSC-54, switchable and patchable spare equipment has been provided. Therefore, service can be quickly restored in the event of failure or degradation of the online unit. In addition to the switchable and patchable spare equipment, alternate configuration modes are available. These modes permit either full or limited communications capability in the event of equipment degradation or failure. Some examples of alternate configuration modes are; reduced FM channel density and quality, use of SSMA during severe electronic conditions and manual antenna tracking when autotrack capability is lost. The Satellite Communications Terminal AN/TSC-54 may also be operated without the Multiplexer Set AN/TSS-79 as described in TM 11-5895-389-12.

Section II. SYSTEM OPERATING PROCEDURES

3-3. General

This section contains system operating procedures that are performed by the ETC Operator. These procedures assist the Operator in fulfilling his primary responsibility; providing a highly reliable, full-time communications link to the Defense satellite communications system (DSCS). In the performance of his duties, the ETC Operator will continuously monitor the overall performance of the ETC. The Operator must respond to directions of the SATCOM Net Controller, identify and react to ETC degradation or failure symptoms. In addition, the Operator will maintain station logs and make status reports as necessary. To satisfactorily perform these duties, the ETC Operator must be thoroughly familiar with the capabilities, limitations and available configurations of the ETC equipment. The Operator must also be familiar with the key indicators of system performance and be prepared to quickly respond to audible and visual indications of system degradation or failure.

a. Operator Duties. During routine operation of the ETC, the Operator is responsible for performing the following tasks:

(1) Monitor overall system performance. A list of key indicators to be used in monitoring overall operation of the ETC is provided in table 3-3. The Operator must be thoroughly familiar with the location and established normal indication for each of these indicators. In addition, the Operator should remain alert to detect audible and visual indicators of degraded equipment performance.

(2) Respond to directions of the SATCOM Net Controller. To maintain the communications quality of assigned circuits, the Operator may be directed by the SATCOM Net Controller to change transmit power, reconfigure ETC equipment or perform measurements and tests on an unscheduled basis. To insure a timely response to these requests, the Operator should be thoroughly familiar with the established procedures for adjustment of link parameters.

(3) Identify and react to ETC degradation or failure symptoms. Due to the full time commitment of ETC equipment to its assigned mission, it is essential that the Operator be prepared to restore equipment to operation as quickly as possible. At key points throughout the system, switchable or patchable spare units have been provided to facilitate rapid restoration of service. The Operator should be thoroughly familiar with those units which have standby replacements and the procedures for placing them on-line to restore service.

(4) Maintain logs and make reports as required.

b. Operating Restrictions. To insure that the ETC is operated within established restrictions and to prevent unauthorized radiation, the Operator should be thoroughly familiar with and observe the following restrictions:

(1) Unless specifically directed by the SATCOM Net Controller, no transmission is authorized other that at assigned carrier power, frequency and mode during assigned schedule.

(2) Unless specifically directed by the SATCOM Net Controller, no transmission is authorized in any direction other than assigned satellite.

(3) Unless specifically authorized by the SATCOM Net Controller, no carrier will be transmitted without normal modulation. This required that the Frequency Modulator OM-46(V)2/TCC dispersal generator be turned on, the Digital Data Modem MD-921/G (PSK Modem) not be allowed to transmit a steady single-state carrier and that the Radio Communications Subsystem AN/URC-61 not be allowed to transmit a coherent (nonspread) carrier.

(4) Unless specifically directed by the SATCOM Net Controller, no changes will be made to equipment configuration that will alter uplink power, frequency or deviation.

(5) When switching the transmit power amplifier from offline (dummy load) to on-line (antenna), the switch will be accomplished at minimum drive power with the transmitter turned off to prevent accidental radiation in excess of assigned output power.

(6) During periods when transmissions are not scheduled and satellite tracking is maintained, beam power will be removed from the power amplifier to prevent transmission of noise.

3-4. ETC Normal Configuration

This paragraph provides the recommended configuration of ETC switchable and patchable equipment. The recommended readiness condition of off-line spare equipment is also provided.

a. Electronic Frequency Up-Converter CV-3084/MSC-46 Configuration. The Electronic Frequency Up-Converters CV-3084/MSC-46 (up-converters) are patched and adjusted to, meet mission requirements Selection of upconverters to meet these requirements is left to the preference of the site supervisor. It is recommended that any spare upconverters be turned on, with their RF OUTPUT switch set to the OFF-LINE position. The spare upconverters should be adjusted to the assigned carrier frequency and power level of the highest priority link assignments.

b. Electronic Frequency Down-Converter CV3085/MSC-45 Configuration. The Electronic Frequency Down-Converters CV-3085/MSG-46 (down-converters) are patched and adjusted to meet mission

requirements. Selection of down-converters to meet these requirements is left to the preference of the site supervisor. It is recommended that any spare down-converter be turned on and tuned to the carrier frequency of the highest priority link assignments.

c. Interfacilities Link Amplifier Configuration. **The selection of the on-line Interfacilities Link Amplifier** (IFL Amplifier) is left to the preference of the site supervisor. The standby IFL amplifier should be tested off-line, weekly, to maintain readiness confidence. The online IFL amplifier should be tested for gain during Preventive Maintenance Downtime (PMDT)

d. Pammetric Amplifier AM-6676/TSC-54 Con-&u&ion. The selection of the on-line Parametric Amplifier AM-6676/TSC-54 (paramp) is left to the preference of the site supervisor. It is recommended that the off-line paramp be turned on to avoid a delay in service restoration when the on-line paramp fails. The off-line paramp should be exchanged with on-line during each Preventive Maintenance Downtime (PMDT) period to maintain readiness confidence.

e. Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC Configuration. The Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC are patched and configured to meet mission requirements. If the assigned mission does not require use of the Multiplexer Set AN/TCC-79, it is recommended that it be turned off.

f. Digital Data Modem MD-921/G(PSK Modem). The Digital Data Modem MD-921/G (PSK Modem) is patched and configured to meet mission requirements. If the assigned mission does not require use of the PSK Modem, it is recommended that it be turned off.

g. Radio Communications Subsystem AN/URC-61. The Radio Communications Subsystem AN/URC-61 is patched and configured to meet mission requirements. When the assigned mission does not require use of the Radio Communications Subsystem AN/URC-61, it is recommended that it be turned on and maintained operational in a back-to-back configuration through the Satellite Link Simulator-Test Adapter MX-560 to maintain readiness confidence.

h. Performance Monitoring Equipment. An FM out-of-band noise monitor as described in paragraph 5-7 should be maintained on-line when there is an FM mission It is recommended that a suitable Spectrum Analyzer be configured to monitor the satellite downlink as described in paragraph 5-9.

i. Frequency Generation Equipment. The Cesium Beam Frequency Standard HP-5061/A is normally selected as the online frequency standard. It is recommended that the Frequency Standard Model FE-12A (crystal standard) be turned on and ready to restore service in the event of a Cesium Beam Frequency Standard HP-5061/A failure.

3-5. Preoperational Procedures

This paragraph provides the recommended sequence of operations to be followed in preparing tne ETC for operation. This sequence assumes that Major Subsystem turn-on and checkout procedures referenced in paragraph 2-9 have been accomplished and that mission configuration instructions have been received.

a. Verify that the Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC have appropriate plug-in modules installed. Verify Frequency Modulator OM-46(V)2/TCC dispersal generator is operating by observing that DEVIATION meter indicates between -3 dB and 0 dB.

b. Remove all analog or digital inputs to Frequency Modulator OM-46(V)2/TCC, Radio Communications Subsystem AN/URC-61, and Digital Data Modem MD-921/G to prevent the possible transmission of undesired signals.

C. Verify that all necessary patches have been installed at the IF PATCH panel 1A3A2 to meet mission requirements.

d. Perform Frequency Modulator OM-46(V)2/TCC IF output level adjustment as provided in paragraph 3-6.

e. Verify that Frequency Demodulator OM-47(V)2/TCC, DEMOD BB AMPL A4 module attenuators S1 and S2 are set for 14 dB attenuation. When returning to operation after a short non-operating period, verify S1 and S2 are set to 14 ±3 dB. Verify MANUAL OVERRIDE switch is set to OFF. Refer to DTM 11-5895-796-34-1 for parts location illustration

f. Change, as necessary, Electronic Frequency Up-Converter CV-3084/MSC-46 and Electronic Down-Converter CV-3085/MSC-46 operating frequency as provided in paragraphs 3-7 and 3-8 to meet mission requirements.

g. Acquire and autotrack the assigned cpmmunications satellite as provided in paragraph 3-9.

h. Perform Electronic Frequency Up-Converter CV-3034/MSC-46 IF input level adjustment as provided in paragraph 3-10.

i. Perform ETC transmit power calibration as provided in paragraph 3-11.

j. When scheduled receive RF carriers are available from associated partner ETC's, verify and set receive IF signal levels as follows:

(1) At the Frequency Demodulator OM-47(V)2/TCC, set the input attenuator (AT1) for 0 dB indication on CARRIER INPUT LEVEL meter. Once set, input attenuator AT1 should not be changed to compensate for short term changes in signal strength. Refer to table 3-1 for the minimum amount of attenuation that should be set into input attenuator (AT1) for the assigned mode. Insufficient attenuation indicates

probable degradation of receive system gain and may prevent operation in lower channel capacity modes. Refer to DTM 11-5895-796-34-1 for illustration providing location of input attenuator (AT1).

(2) At the Digital Data Modem MD-921/G (PSK Modem) set METER selector switch to AGC position. Verify MONITOR meter indicates on scale, adjust, if necessary, using procedure provided in DTM-11-5820-803-12

k Perform FM, PSK, and URC link establishment procedures as provided in paragraphs 3-13, 3-14 and 3-15

Table 3-1 Frequency Demodulator OM-47(V)2/TCC Input Attenuator (AT1) Minimum Setting

Channel capacity	AT1 minimum setting
3T	5 dB
6T	6 dB
9T	7 dB
3	8 dB
6	10 dB
9	10 dB
12	13 dB
24	15 dB
36	16 dB
48	17 dB
72	18 dB

l. Verify that all necessary orderwire patches have been installed at the IF/BB patch panel and establish orderwire communications

m At Frequency Demodulator OM-47(V)2/TCC, adjust DEMOD BB AMPL A4 module attenuators as provided in paragraph 3-18

n. Upon completion of link establishment, perform the following measurements and report results to the SATCOM Net Controller as required by DCA Cir 831-70-( ).

(1) At Frequency Demodulator OM-47(V)2/TCC, perform a Test Tone to Noise Ratio (TTNR) measure ment as provided in paragraph 5-6

(2) At Digital Data Modem MD-921/G (PSK Modem) perform a Digital Error Rate measurement as provided in paragraph 5-8

(3) At Radio Communications Subsystem AN/URC-61 verify that DB MARGIN meters indicate nominal threshold margins

(4) At the Electronic Frequency Down-Converter perform a Noise Power Density Measurement as pro vided in paragraph 5-10

o. At this point, if results of any measurements performed above are abnormal, the SATCOM Net Con troller may require readjustment of carrier powers as provided in paragraph 3-17 If FM receive carrier levels are changed, *J* (1) above should be repeated for Demodulator OM-47(V)2/TCC

p Verify that the following upper and lower trip set alarms are as indicated below or as directed by the SATCOM Net Controller

(1) Electronic Frequency Up-Converter CV-3084/MSC-46, RF POWER meters set to assigned carrier level ± 0 5 dB.

(2) RF PWR MON/CONTROL power meter set to authorized total power ±1 dB

(3) Frequency Modulator OM-46(V)2/TCC, CARRIER OUTPUT LEVEL meter set to ±05 dB of current normal indication, within 2dB of center scale.

(4) Frequency Modulator OM-46(V)2/TCC, CABRIER DEVIATION meter set to ±1 dB of current nor*mal indication, within 2 dB of center scale*

(5) Frequency Demodulator OM-47(V)2/TCC, *CARRIER INPUT LEVEL meter set to 0 ±2 dB*

(6) Frequency Demodulator OM-47(V)2/TCC, CARRIER DEVIATION meter set to ±1 dB of current normal indication, within 2 dB of center scale

(7) If Out-of Band Noise (OBN) monitor meter is equipped with a trip set alarm, rt should be set to normal indication ±2 dB

q Upon completion of testing, notify the associated Technical Control Facility (TCF) that trunk is ready for TCF to TCF testing and link characterization tests

3-6. Frequency Modulator OM-46(V) 2/TCC IF. Output Level Adjustment

To establish a standard IF interface level, the Frequency Modulator OM-46(V)2/TCC output is adjusted to 0 dBm using output attenuator (AT1). The output attenuator (AT1) is located at the inside top rear of the Frequency Modulator OM-46(V)2/TCC cabinet Refer to DTM 11-5895-796-34-1 for location drawing

a On Frequency Modulator OM-46(V)2/TCC, set output attenuator (AT1) for 20 dB attenuation

b Turn on and warmup an RF power meter, Boonton 42B or equivalent

c At IF Patch Panel 7A1, located in the Communications Terminal Group OW-11/TSC-54, remove patch cord associated with Frequency Modulator OM-46(V)2/TCC Connect RF power meter, set to read 0 dBm in its place

d Set output attenuator (AT1) on Frequency Modulator OM-46(V)2/TCC for a 0 dBm indication on power meter Verify that output attenuator (AT1) is set to 20 dB ±3 dB, if out of tolerance, refer to DTM 11-5895-796-34-1 for troubleshooting and repair procedures.

e Verify that the dispersal generator ON/OFF switch S1, located on MOD BB AMPL A2 module is set to ON

f Reconnect patch cord removed in step c

3-7. Electronic Frequency Up-Converter CV-3084/MSC-46 Frequency Change Procedure

Upon receipt of transmit carrier frequency

ssignments, it may be necessary to change the perating frequency of the Electronic Frequency Up-Converter CV-3084/MSC-46 as provided below. For front panel illustration providing Electronic Frequency Up-Converter CV-3084/MSC-46 controls and ndicators, refer to DTM 11-5895-833-12.

a. On front panel of Electronic Frequency Up-Converter CV-3084/MSC-46 requiring frequency change, set RF OUTPUT switch to OFF-LINE.

b. Insure that POWER ON/OFF switch is set to ON and observe that POWER ON lamp is lit.

c. Set TRANSMIT FREQUENCY SELECTOR MHZ thumbwheel switches to new operating frequency.

a Check status of RF LEVEL and RF LO lamps and RF AUDIBLE alarm. Observe that lamps are lit and audible alarm sounds.

e. Press and hold down AUDIBLE ALARM DEFEAT pushbutton to silence audible alarm.

f. Set status selector switch to RF LO TUNE and adjust TRANSMIT FREQ FINE TUNE control for center-scale indication on STATUS meter.

g. Release AUDIBLE ALARM DEFEAT pushbutton and observe that audible alarm remains silent.

h. Verify that RF LEVEL and RF LO lamps are not lit.

i, Leave RF OUTPUT switch in OFFLINE position.

j. Verify that for FM operations, MODE SELECTOR is set to FM For all other operations set MODE SELECTOR to DGTL.

k. Record new operating frequency and MODE SELECTOR setting on MISSION LOG tag (fig. 3-1)

l Repeat steps a through *k* for remaining up-converters, as necessary.

3-8. Electronic Frequency Down-Converter CV-3085/MSC-46 Frequency Change Procedure

Upon receipt of receive carrier frequency assignments, it may be necessary to change the operating frequency of the Electronic Frequency Down-Converter CV-3085/MSC-46 as provided below. This procedure used for setting both communications and satellite beacon carrier frequencies into the appropriate Electronic Frequency Down-Converters CV-3085/MSC-46. When setting the Electronic Frequency Down-Converter CV-3085/MSC-46 that is assigned to the satellite beacon, it is set to a frequency exactly *20.00* MHz higher than the beacon carrier frequency. For the earth coverage (EC) beacon, which operates at 7250.1 MHz, the Electronic Frequency Down-Converter CV-3085/MSC-46 is set to 7270.100 MHz For a front panel illustration providing Elec tronic Frequency Down-Converter CV-3085/MSC-46 Operator controls and indicators refer to DTM 11-5895-833-12.

a On front panel of Electronic Frequency Down-

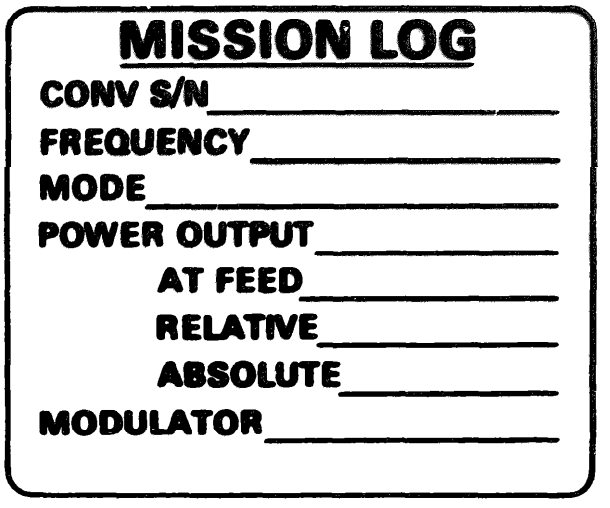


Figure 3-1. *Electronic Frequency Up-Converter CV-3084/MSC-46 MISSION LOG tag.*

Converter CV-3085/MSC-46 requiring frequency change, verify that POWER ON/OFF switch is set to ON and observe that POWER ON lamp is lit.

b. Set *RECEIVE FREQUENCY* SELECTOR MHZ thumbwheel switches to new operating frequency.

c. Check status of RF LO lamp and LO AUDIBLE alarm. Observe that lamp is lit and audible alarm sounds.

d. Press and hold down AUDIBLE ALARM DEFEAT pushbutton to silence audible alarm.

NOTE

Filter A2F1 is required for receive frequencies between 7.25 and 7.55 GHz. Filter A2FL2 is required for receive frequencies *between 7.55* and 7.75 GHz. Check filter in use placard to insure that filter connected between connector J2 on RF input stripline assembly and connector J1 on RF conversion stripline assembly will accommodate new fre quency assignment.

e. Set STATUS SELECTOR switch to RF LO TUNE and adjust RECEIVE FREQUENCY FINE TUNE control for center-scale indication on STATUS meter.

f. Release AUDIBLE ALARM DEFEAT pushbutton and observe that LO AUDIBLE alarm remains silent.

g. Verify that RF LO lamp is not lit.

h. Set STATUS SELECTOR switch to each position and observe following indications on STATUS meter:

Switch position	*meter indication*
+24V	Green scale
STD LVL	Blue scale
RF LO	Blue scale
IF LO	Blue scale
700 MHz	Approximately 0 to 3
70 MHZ IF	Varies with **input signal** level
RF LO TUNE	Red scale

i. Verify that for FM operations, MODE SELECTOR is set to FM. For all other operations set MODE SELECTOR to DGTL.

j. Record new operating frequency and MODE SELECTOR setting on MISSION LOG tag (fig. 3-2)

k. Repeat steps a through j for remaining down-converters, as necessary.

3-9. Satellite Acquisition

Acquisition data for the assigned communications satellite is provided by the SATCOM Net Controller. Since the DSCS Phase II satellites are in synchronous orbits, acquisition data is nearly time independent. However, since small variations so occur during the course of a day, acquisition data is provided for several time periods during the day. The Operator is cautioned that during the process of acquiring the satellite, beam power should be removed from the power amplifier. This is to prevent accidental interference with communications traffic already in progress on the satellite. For front panel illustrations providing the Antenna Control C-7243/TSC-54, Primary Power Distribution Panel, Test Translator Control SMD-778525/TSC-54 and Beacon Demodulator MD-705/TSC-54 controls and indicators refer to DEP 11-5895-389-12.

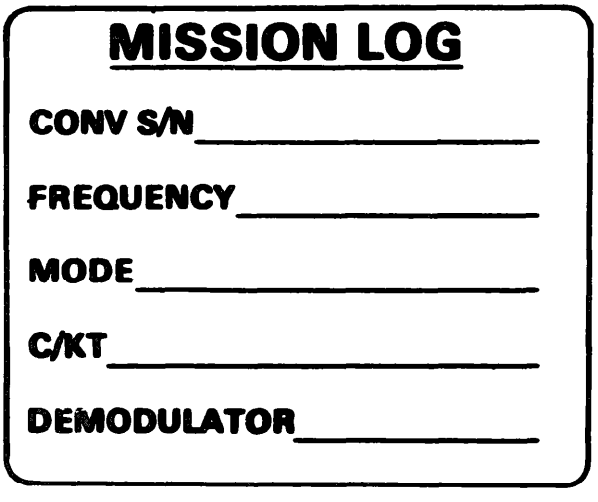


Figure 3-2 Electronic Frequency Down-Converter CV-3085/MSC-46 MISSION LOG tag

a. Verify that beam power is removed from the power amplifier.

b. At the Antenna Control C-7243/TSC-54, (antenna control panel), verify the following:

(1) SIGNAL SELECT switch (located on the back of the panel) is set to BEACON.

(2) SUPPLEMENTAL CONTROL, PENCIL **BEAM** and NARROW BAND switch lamps are not lit; **if necessary, press appropriate switchlamp and verify that it goes out.**

(3) AZIMUTH and ELEVATION, ELECTRIC LIMITS lamps are not lit:

(a) If either ELECTRIC LIMITS lamp is lit; go to step c.

(b) If both ELECTRIC LIMITS lamps are not lit and MODE CONTROL, STANDBY switchlamp is lit; go to step d.

c. Move antenna out of limits as follows:

(1) At the antenna pedestal primary Power Distribution Panel 2A3A14, set the MOUNT SAFE switch to the on (up) position.

(2) Manually release the brakes at the antenna **pedestal.**

(3) using manual handcranks, rotate antenna away from the limit.

(4) Engage brakes and set MOUNT SAFE switch to the off (down) position.

(5) Verify that antenna control panel AZIMUTH and ELEVATION, ELECTRIC LIMITS lamps are not lit and that MODE CONTROL, STANDBY switchlamp is lit.

d. Verify that the Test -*Translator Control SMD-778525/TSC-54, INJECTION SIGNAL switchlamp is set to OFF.

e. At the Beacon Demodulator MD-705/TSC-54 (beacon demod), set the mode selector to NORMAL and TUNING MODE switch to AFC; verify that the VCO TUNING meter starts sweeping.

f. At the antenna control panel, press MODE CONTROL, MANUAL switchlamp; verify that it lights and MODE CONTROL, STANDBY switchlamp goes out.

g. Determine predicted satellite angles for time of day -using the angle prediction chart for the geographical location of the ETC.

A Rotate the antenna to the predicted satellite angles using the antenna control panel AZIMUTH and ELEVATION, SLEW controls for coarse positioning and POSITION RATE handwheels for fine positioning.

i. When the satellite is acquired, the following sequence should occur:

(1) Antenna control panel, BEACON RECEIVER, SIGNALDIRECT lamp lights.

(2) Beacon demod, VCO TUNING meter stops sweeping.

(3) Antenna control panel and beacon demod, SIGNAL STRENGTH meters indicate signal level greater than zero.

(4) Within four seconds, the beacon demod BEACON TRACK ACQ lamp and antenna control panel BEACON RECEIVER, PHASE LOCK lamps light **and SIGNAL DETECT lamp goes** out

J. Press MODE CONTROL ACQUISITION/AUTO **TRACK** switchlamp. Verify that MODE CONTROL,

MANUAL switchlamp goes out and AUTO TRACK lamp lights. This indicates that the antenna is automatically tracking the satellite If autotrack is not achieved: proceed to step k.

k. Set antenna BAR SCAN CONTROL selectors as follows:

(1) AZ SECTOR to 2.

(2) EL SECTOR to 2.

(3) AZ RATE to .4.

(4) EL INCREMENT to .4.

l. Press MODE CONTROL, BAR SCAN and ACQUISITION/AUTORACK switchlamps. Verify that they light and that antenna scans about the predicted satellite angle as indicated on antenna control panel AZIMUTH and ELEVATION position indicators.

m. When the satellite is acquired, the following sequence should occur:

(1) Antenna control panel, BEACON RECEIVER, SIGNAL DETECT and POSITION MEMORY lamps light and beacon demod VCO TUNING meter stops sweeping.

(2) Beacon demod and antenna control panel SIGNAL STRENGTH meters indicate signal level greater than zero.

(3) Within four seconds, the beacon demod BEACON TRACK ACQ lamp and antenna control panel BEACON RECEIVER, PHASE LOCK and MODE CONTROL, AUTOTRACK lamps light. The antenna control panel BEACON RECEIVER, SIGNAL DETECT and POSITION MEMORY lamps and MODE CONTROL, ACQUISITION, MANUAL and BAR SCAN switchlamps go out.

n. Press MODE CONTROL, MANUAL and then ACQUISITION/AUTOTRACK switchlamps; verify that MODE CONTROL, AUTOTRACK switchlamp is lit. This programs the antenna to MANUAL mode rather than BAR SCAN in the event of loss of autotrack.

3-10. Electronic Frequency Up-Converter CV-3084/MSC-46 IF. Input Level Adjustment

Upon completion of IF. patching to configure the ETC for mission requirements, it may be necessary to adjust the IF. input level to the Electronic Frequency Up converter CV-3084/MSC-46 as provided below. For front panel illustration providing Electronic Frequency Up-Converter CV-3084/MSC-46 controls and indicators refer to DTM 11-5895-833-12.

a. On front panel of Electronic Frequency Up-Converter CV-3084/MSC-46 requiring input signal level change, set RF OUTPUT switch to OFFLINE.

b. Verify patching from Multiplexer Set AN/TCC-79 to Electronic Frequency Up-Converter CV-3084/MSC-46 to be adjusted.

c. Set POWER ON/OFF switch to ON and observe that POWER ON lamp is lit.

d. Set status selector switch to 70 MHZ IF. and set IF. LEVEL *ATTENUATOR* switches for center-scale indication on STATUS meter.

e. *Verify* that RF LEVEL, RF LO, AND IF. LO lamps are not lit and audible alarm is not sounding.

f. Set status selector switch to each position and observe following indications on STATUS meter:

Switch position	Meter indication
70 MHZ IF	Blue scale
700 MHZ IF	Blue scale
+24V	Green scale
RF LO TUNE	Red scale
STD LVL	Blue scale
RF LO	Blue scale
IF LO	Blue scale

g. Leave RF OUTPUT switch in the OFFLINE position.

h. Verify that for FM operations, MODE SELECTOR is set to FM. For all other operations, set MODE SELECTOR to DGTL.

i. Repeat *steps a* through *h* for remaining upconverters as necessary.

3-11. ETC Transmit Power Calibration

This procedure assumes that turn-on and checkout procedures provided in equipment operation manuals have been completed. For front panel illustration providing Electronic Frequency Up-Converter CV-3084/MSC-46 and RF PWR MON/CONTROL indicators refer to DTM 11-5895-833-12.

a. Calibrate Electronic Frequency Up-Converter CV-3084/MSC-54 RF POWER meters as follows:

(1) On front panel of each Electronic Frequency Up-Converter CV-3084/MSC-46, verify that RF OUTPUT switch is set to OFF-LINE.

(2) Set the frequency assignment of the highest priority link in the spare upconverter.

(3) Check the zero set on the RF POWER meter of each upconverter by disconnecting the coaxial jumper between the RF POWER METER INPUT and RF POWER MONITOR connectors. Adjust, if necessary, the POWER METER ZERO ADJ control. Reconnect coaxial jumper.

(4) Set POWER METER RANGE switch on each upconverter to 0 DBM position.

(5) On first upconverter, disconnect RF output cable from output connector J1 (located on top rear of unit) and connect an RF microwattmeter, Boonton 42B *or* equivalent, in its place.

(6) Set upconverter RF OUTPUT switch to ON-LINE and adjust RF OUTPUT LEVEL ADJ control for a 0.5 milliwatt indication on RF microwattmeter.

(7) Observe up-converter RF POWER meter and adjust POWER MONITOR ATTENUATOR for a 0.5 milliwatt indication on RF POWER meter.

(8) Set up-converter RF OUTPUT switch to OFF-LINE disconnect RF microwattmeter and reconnect

RF output cable to up-converter output connector J1.

(9) Connect RF microwattmeter to up-converter RF TEST OUTPUT connector; read and record RF TEST OUTPUT level in milliwatts for future recalibration.

(10) **Repeat** *steps (4) through (9) for each remaining up-converter.*

b. At the RF PWR MON/CONTROL Panel press TRANSMIT CONTROL, XMTR toggle switch to the off (down) position, then release. Set LCL-PED keyswitch to PED.

c. At the Antenna Pedestal AB-978/TSC-54 set the waveguide-dummy load switch to dummy load (fully clockwise). Select the HPA klystron channel that beat covers the frequency to be transmitted.

d. At the up-converter assigned to the carrier having the highest authorized power, set RF OUTPUT LEVEL ADJ fully counterclockwise and set RF OUTPUT switch to ON-LINE.

e. At the Transmitter Control Panel 2A3A7, perform the following:

(1) Set XMIT POWER toggle switch to ON. Verify that after approximately one minute the PREHEAT lamplights.

(2) Press and release RESET toggle switch Verify no fault indicator lamps are lit.

(3) **Press and hold XMIT OUTPUT toggle switch to INCREASE until motor driven attenuator (AT6) is at minimum attenuation.**

f. At the Antenna Pedestal AB-978/TSC-54, perform the following:

(1) Set klystron input variable attenuator (AT10) fully clockwise.

(2) Set IPA input variable attenuator (AT1) fully clockwise.

(3) Connect an HP-431B, **or equivalent, to the IPA directional coupler (DC4) forward power monitor port Power meter should be connected to a calibrated 20 or 30 dB attenuator.**

CAUTION

In the following steps, do not increase AT1 beyond the point where maximum indication is obtained. Excessive input power may damage *the IPA.*

(a) Observe power meter and adjust the IPA inpot variable attenuator (AT1) counterclockwise for a maximum indication.

(b) Readjust IPA **input variable attenuator (AT1) clockwise until the power meter reads 7 dB less than maximum indication.**

g. At the Transmitter Control Panel *2A3A7* **perform the following:**

(1 Set BEAM power switch to ON.

(2) Adjust klystron input variable attenuator (AT10) for full rated transmitter output power.

(3) Press and hold XMIT OUTPUT toggle switch to DECREASE position until motor driven attenuator **(AT6) is at maximum attenuation (minimum** output **power).**

(4) Set BEAM POWER toggle switch to OFF.

(5) Set XMIT POWER toggle switch to OFF.

h. At up-converter assigned to the carrier having the highest authorized power adjust RF OUTRPUT LEVEL ADJ fully clockwise and set RF OUTPUT switch to OFF-LINE.

i. AT RF PWR MON/CONTROL Panel set LCL-PED key switch to LCL then perform the following:

(1) set TRANSMIT CONTROL, XMTR toggle switch to ON.

(a) Verify that after approximately one minute the PREHEAT lamp lights.

(b) **Verify the STBY lamp lights approximately eight minutes after PREHEAT lamp lights.**

(2) Set TRANSMIT CONTROL, BEAM toggle switch to ON.

j. At the upconverter assigned to the carrier having the highest authorized power set RF OUTPUT LEVEL ADJ control to 5 (5 dB of attenuation).

k. **At RF PWR MON/CONTROL Panel, press and hold RF OUTPUT INCREASE switchlamp until Power Meter indicates the power of the highest carrier.**

l. On the up-converter MISSION LOG tag; record assigned carrier power on POWER AT FEED line, RF POWER meter indication on POWER RELATIVE line, and RF TEST OUTPUT level as measured with RF microwattmeter on POWER ABSOLUTE line.

m. **At the upconverter assigned to the carrier having the highest authorized power, set RF OUTPUT switch to OFF-LINE.**

CAUTION

Once step *m* **has been accomplished, do not operate RF PWR MON/CONTROL Panel RF OUTPUT INCREASE or DECREASE switchlamps until all up-converters have been adjusted.**

n. On the up-converter having the next highest power assignment, perform the following:

(1) Set RF OUTPUT switch to ON-LINE.

(2) Adjust RF OUTPUT LEVEL ADJ control until RF PWR MON/CONTROL Panel Power Meter indicates assigned carrier power.

(3) On associated MISSION LOG tag, record assigned carrier power on POWER AT FEED line, RF POWER meter indication on POWER RELATIVE line, and RF TEST OUTPUT level as measured with RF microwattmeter on POWER ABSOLUTE line.

(4) **Set RF OUTPUT switch to OFF-LINE.**

o. Repeat step n for remaining up-converters.

p. At the RF PWR MON/CONTROL Panel, perform the following:

(1) Press and hold RF OUTPUT DECREASE swtichlamp until lamp lights.

(2) Press TRANSMIT CONTROL, BEAM toggle switch to OFF (down) position the release.

q. **At the Antenna Pedestal AB-978/TSC-54, set the waveguide-dummy load switch to antenna (fully counterclockwise).**

r. When authorized by SATCOM **Net Controller to radiate, perform the following:**

(1) At RF PWR MON/CONTROL Panel, set TRANSMIT CONTROL, BEAM toggle switch to ON.

(2) On assigned Electronic Frequency Up-Converter CV-3984/MSC-46 set RF OUTPUT switches to ON-LINE.

(3) At RF PWR MON/CONTROL Panel, press and hold RF OUTPUT INCREASE switchlamp until Power Meter equals the sum of assigned carriers.

s. Notify SATCOM Net Controller that assigned carriers have been established and proceed with link establishment procedures.

3-12. Orderwire Configuration

The configuration of orderwires will be established by DCA directives issued in connection with the establishment of the ETC and/or its links. Operation and use of orderwire facilities will be in accordance with DAC Cir 310-55-1. The SATCOM Net Controller will specify orderwire configuration when it is not inherent to the link. Normally, the following orderwires will be established.

a. On FM voice orderwire in the 4 to 8 kHz baseband for each FM link, to be used for ETC to ETC coordination.

b. **A ground TTY Critical Control orderwire between the SATCOM Net Controller at the Area Communications Operation Center (ACOC) and the ETC for control purposes.**

c. A TTY and/or voice orderwire between the associated Technical Control Facility (TCF) and the ETC for coordination.

3-13. FM Link Establishment

Prior to establishment of an FM communications link, an offline precalibration of the Frequency Demodulator OM-47(V)2/TCC must be performed for at least the receive channel capacity assigned. In addition, it is recommended that any spare unit be calibrated in all assigned receive channel capacities. The pre-calibration procedure is provided in DCA Cir 831-70-( ) Initial link establishment is accomplished by reinstalling coaxial looping plugs that were removed in paragraph *3-5b.* **Scheduling and coordination of FM link establishment is carried out on the critical control orderwire. When the initial full duplex link is achieved, system adjustmenta and Test Tone-to-Noise Ratio (TTNR) measurements are performed using the link FM voice orderwire for coordination. Patching procedures for initial link establishment using the Multiplexer Set AN/TCC-79 are as follows; at the** Multiplexer **Set AN/TCC-79, IF/BB Patch Panel 11A4, install monitor type coaxial looping plug, whistler W.B.P.-7/BNC, between FM MOD (TX In and P A/B (TX) jacks.**

3-14. PSK Link Establishment

The establishment of a PSK communications link requires that several measurements and adjustments be performed, in the sequence provided in paragraph *3-5,* **prior to completing the end to end link. An offline calibration of the Digital Data Modem MD-921/G (PSK Modem) error rate and signal-to-noise meters, as a function of E_b/N_o, should be** *performed* **using the procedure provided in TM 11-5820-803-12. This procedure uses the Modem Test Set TS-7580( )/G and should be performed for at least the receive modes and data rates specified by the SATCOM Net Controller. The results of these calibrations may be requested by the SATCOM Net Controller. It is also recommended that calibration data be used to plot curves of bit error rate versus signal/noise meter readings similar to the example provided in TM 11-5820-803-12. When error correcting codes are used, the range of the error rate curve should be linearly extrapolated to 10-10. The stepby-step procedures for establishing a PSK link are as follows:**

a. Measure the IF output level of the Digital Data Modem MD-921/G (PSK Modem) using an RF power meter with its calibrated thermistor mount.

b Verify that switch S1 on the PSK Modem Input Filter Card is set to POSITION 2; refer to TM 11-5820-803-12 **for illustration providing location of** S1.

c. Perform Electronic Frequency Up-Converter CV-3084/MSC-46 frequency change and IF input *level* **adjustment procedures provided in paragraphs 3-7 and 3-10, if necessary, for the upconverter assigned to the PSK Modem.**

d. Perform Electronic Frequency Down-Converter frequency change procedure provided in paragraph 3-8, if necessary, for the down-converter assigned to the PSK Modem.

e. Perform PSK Modem preliminary starting and self test procedures provided in TM 11-5820-803-12.

f. Verify that front panel TRANSMIT and RECEIVE controls are set as required for assigned mission, the METER selector switch is set to AGC position and the SOURCE selector switch is set to LINK.

g. Verify and adjust, if necessary, the Electronic Frequency Up-Converter CV-3084/MSC-46 to assigned carrier output level as provided in paragraph 3-11 **and place its RF OUTPUT switch to ON-LINE when authorized. Coordinate with partner ETC using orderwire circuit designated by the SATCOM Net**

controller for use with the PSK link.

h. When receive PSK carrier is acquired, verify that MONITOR meter indicates on scale; then set METER selector switch to SIG/NOISE position and observe signal-to-noise indication. Perform a digital error rate measurement as provided in paragraph 5-8.

i. Report results of error rate measurement to SATCOM Net Controller.

j. Monitor SIG/NOISE indication on MONITOR Meter and report to the SATCOM Net Controller any change greater than 1 order of error rate. For example: if the established normal error rate is 10-7, any change resulting in an error rate poorer than 10-6 or better than 10-8 should be reported=

3-15. URC Link Establishment

The initial establishment of a spread spectrum multiple access (SSMA) link using the Radio Commnnications Subsystem AN/URC-61 is accomplished using the critical control orderwire for scheduling and coordination. After link establishment, an internal TTY orderwire will normally be used for coordination on the URC link. The procedures for establishing a communications link with another Radio Communications Subsystem AN/URC-61 or with a Radio Communications Subsystem AN/URC-55 are identical. However, the URC-61/URC-55 interoperability switches on Receiver No. 1 and Receiver No. 2 must be set accordingly. When operated in conjunction with an FM or PSK link, the URC link can cause considerable reduction of performance on those links with frequency assignments within approximately 10 MHz of the center of the SSMA band. This is caused by an increase in background noise and is evidenced by an increase in channel noise and out-of-band noise (OBN) on FM links and an increase of digital error rate on PSK links. It is important that the Operator is aware of this possibility during establishment of an URC link and not attribute these symptoms to ETC equipment degradation or failure. The step-by-step procedures for establishing an URC link are as follows:

a. Verify that the RF OUTPUT switch on the Electronic Frequency Up-Converter CV-3084/MSC-46 assigned to the Radio Communications Subsystem AN/URC-61 is set to OFF-LINE.

b. At the Radio Communications Subsystem AN/URC-61, set switches and controls as described in preliminary control settings table provided in DTM 11-5820-614-12.

c. When authorized by the SATCOM Net Controller, set the Electronic Frequency Up-Converter CV-3084/MSC-46, RF OUTPUT switch to ON-LINE. Adjust the RF OUTPUT LEVEL ADJ control until RF POWER meter indicates assigned carrier power authorized by the SATCOM Net Controller for acquisition.

d. Accomplish code synchronization with the partner ETC using procedures provide in DTM 11-5820-614-12. The particular method used to achieve synchronization, Reset synchronization or Timing Control normal start procedure, is dependent upon specified link establishment procedure and conditions existing at the time of link establishment.

e. After the two way communications link is established, readjust the Electronic Frequency Up Converter CV-3084/MSC-46 RF OUTPUT LEVEL ADJ control until the RF POWER meter indicates assigned carrier power authorized for operation. Verify that partner ETC has readjusted power to the assigned operational level.

f. Observe DB MARGIN meter indications and report to SATCOM Net Controller.

g. At this point, the SATCOM Net Controller may direct readjustment of carrier output levels to achieve proper link quality and/or margins.

h. When normal performance has been established, read and record the Radio Communications Subsystem AN/URC-61 DB MARGIN meter indications. Monitor DB MARGIN meter indications and report any change greater than ±3 dB to the SATCOM Net Controller.

i. In the event of failure of the URC link, restart time is established and coordinated using the link orderwire. Restart procedures are provided in DTM 11-5820-614-12.

3-16. Precise Time and Time Interval (PTTI) Measurement

The Precise Time and Time Interval (PTTI) measurement capability of the ETC is employed for synchronization of timing equipments in support of a worldwide PTTI program. Step-by-step PTTI procedures are as follows:

a. Establish a full duplex SSMA Link with the partner ETC for the PTTI measurement as provided in paragraph 3-15.

b. Perform the Calibration of a Remote Time Reference procedure provided in DTM 11-5820-614-12 at time specified by the SATCOM Net controller.

c. Compute and record time difference.

d. Complete necessary PTTI reports as required by NAVOBSY TS/PTTI-01M and DCA CIR 310-55-1.

3-17. Maintaining and Changing RF Power

ETC participation in the multiple access satellite system requires that the assigned power of each carrier accessing the satellite be carefully controlled and maintained. After a communications link has been established, the SATCOM Net Controller may direct readjustment of carrier powers to normalize communications quality due to non-nominal conditions at linked ETC's changes in satellite performance or loading and changes in propogation conditions. The maintenance of assigned carrier power levels requires

that the RF PWR MON/CONTROL Panel, RF power meter and Electronic Frequency Up-Converter CV-3084/MSC-46 RF POWER meters be monitored to quickly detect any change in assigned output power levels. Procedures for maintaining and changing both individual carrier RF power levels and total RF power levels are provided below:

a. Maintaining and Changing Individual Carrier Power Levels. Individual carrier powers are maintained and changed by adjusting the associated Electronic Frequency Up-Converter CV-3084/MSC-46 as follows:

(1) Check and reset, if necessary, RF POWER meter zero by disconnecting the coaxial jumper connected between RF POWER METER INPUT and RF POWER MONITOR connectors and adjusting POWER METER ZERO ADJ control. Reconnect coaxial jumper.

(2) Verify that Electronic Frequency up Converter CV-3084/MSC-46, STATUS meter indication is normal when set to 70 MHz position. If STATUS meter indication is abnormal, adjust associated IF. input level as follows:

CAUTION

When making attenuator adjustments while passing traffic, the desired adjustment (adding and/or removing attenuation) must be made in a single action to avoid incorrect in-line attenuation, even momentarily.

(a) To raise the IF. input level; observe RF POWER meter and adjust RF OUTPUT LEVEL ADJ for an indication of 1 dB below the assigned carrier power. Remove 1 dB of attenuation at the IF. LEVEL ATTENUATOR. Repeat procedure until STATUS meter indication is normal.

(b) To reduce the IF. input level; observe RF POWER meter and adjust RF OUTPUT LEVEL ADJ *for* an indication at the assigned carrier power. Add 1 dB of attenuation at the IF. LEVEL ATTENUATOR. Repeat procedure until STATUS meter indication is normal.

(3) Carriers are maintained by adjusting the RF OUTPUT LEVEL ADJ control to provide an RF POWER meter indication as posted on the POWER RELATIVE line of the appropriate MISSION LOG label. Carrier levels are changed in response to direction received from the SATCOM Net Controller. The RF OUTPUT LEVEL ADJ control is adjusted until the RF POWER meter indicates an increase or decrease in output level by the number of dB requested.

b. Maintaining and Changing Total RF Power Output. The total RF power output is set and maintained at the RF PWR MON/CONTROL Panel. In normal operation, the RF PWR MON/CONTROL Panel RF power meter audible alarm is set to the assigned total power output ±0.5 dB (10%). When an audible alarm occurs, total RF power output is corrected as follows.

(1) Check and reset, if necessary, RF PWR MON/CONTROL Panel, RF power meter zero set by placing ALARM ACTIVE/INACTIVE switch to INACTIVE and adjust ZERO SET control for meter zero.

CAUTION

Fake to r&ore ALARM ACTIVE/INACTIVE switch to ACTIVE position leaves TOTAL POWER METER connected to its dummy load making it possible to transmit large amounts of unmonitored power.

(2) Set ALARM *ACTIVE/INACTIVE switch* to *ACTIVE.*

(3) *Adjust* total output power to assigned level by pressing TRANSMIT CONTROL, RF OUTPUT INCREASE switchlamp to raise power or TRANSMIT CONTROL, RF OUTPUT DECREASE switchlamp to lower power until RF power meter indicates assigned total RF power output.

3-18. FM Recieve Baseband Adjustment

The Frequency Demodulator OM-47(V)2/TCC, DEMOD BB AMPL A4 module attenuator was initially set to 14 dB attenuation for link establishment. After link establishment through the satellite, the Frequency Demodulator OM-47(V)2/TCC should be readjusted to interface with the Frequency Modulator OM-46(V)2/TCC at the associated transmit ETC This adjustment should be accomplished off-line, prior to carrying traffic or following changes in equipment, however, it may be performed on-line without affecting traffic. To perform this procedure on-line, it is necessary to use monitor type looping plugs for baseband connections to Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)/TCC. The FM receive baseband adjustment procedure is provided below, refer to DTM 11-5895-796-34-1 for illustration providing location of DEMOD BB AMPL A4 module attenuators.

a. At the transmit ETC, set Transmission Test Set Assembly switches and controls as follows:

(1) Oscillator frequency dial and RANGE as appropriate for assigned channel capacity test signal: refer to table 3-2.

(2) Oscillator AMPLITUDE fully counterclockwise.

(3) Patch Panel INPUT and OUTPUT IMPEDANCE to 900.

(4) Patch Panel MEAS-CAL to MEAS.

NOTE

This procedure describes use of the built-in

Sierra 303A Frequency Selective Levelmaster. When necessary, a suitable wave analyzer (HP-310A, HP-312A or H05-312A) may be used. However, equivalent switch settings and appropriate correction factors must be used. The correction factor for an HP-310A Wave Analyzer is −9 dB. The corection factor for an H05-312A Wave Analyzer is +2 dB. No correction factor is required for an HP-312A Wave Analyzer.

b. At transmit and receive ETC's, set Frequency Selective Levelmeter (Sierra 303A) switches and controls as follows:

(1) INPUT to 75 ohms.

(2) BRIDGING/TERMINATING (IN) to BRIDGING (out position).

(3) UNBALANCED/BALANCED (IN) to UNBALANCED (out position).

(4) SENSITIVITY to NORMAL.

(5) SELECTIVITY to 3.1 kHz.

Table 3-2. FM Receive Baseband Adjustment Test Frequencies

Channel capacity	*Test frequency*
3 global	25 kHz
6 global	37 kHz
9 global	49 kHz
12 global	61 kHz
24 global	109 kHz
36 global	157 kHz
48 global	205 kHz
72 global	301 kHz
3 tactical	25 kHz
6 tactical	37 kHz
9 tactical	49 kHz

(6) TUNE pushbutton in.

(7) COARSE and FINE TUNE as required for test frequency from table 3-2.

(8) INPUT LEVEL to −30.

c. At transmit ETC, connect Transmission Test Set, Patch Panel OUTPUT to a frequency counter, HP-5245L or equivalent.

d. On transmission Test Set, Oscillator; adjust AMPLITUDE control clockwise until frequency counter begins to count, adjust frequency dial to test frequency ±100 Hz, and reset AMPLITUDE control fully counterclockwise.

e. At transmit ETC, connect Transmission Test Set and Sierra 303A using a BNC T adapter to the monitor jack on the coaxial looping plug connected to the Frequency Modulator OM-46(V)2/TCC input.

f. At transmit ETC, adjust Transmission Test Set, Oscillator AMPLITUDE control for −30 dBm indication on Sierra 303A.

g. At receive ETC, connect Sierra 303A to monitor jack on coaxial looping plug connected to the output of the Frequency Demodulator OM-47(V)2/TCC.

h. At receive ETC, readjust COARSE and FINE TUNE controls as required for peak indication on levelmeter. When operating in a 3 channel mode, set SELECTIVITY selector to 80 Hz and repeak.

NOTE

Adjustment of Frequency Demodulator OM-47(V)2/TCC, DEMOD BB AMPL A4 module attenuators S1 and S2 may require a corresponding adjustment of voice channel levels.

i. Observe Sierra 303A levelmeter and adjust Frequency Demodulator OM-47(V)2/TCC, DEMOD BB AMPL A4 module attenuators S1 and S2 as required below:

CAUTION

When adjusting attenuators on-line, use judgement to avoid adding or removing excess attenuation which affects traffic quality.

(1) If levelmeter indicates −30 dBm ±1 dBm, no adjustment is necessary.

(2) If levelmeter indicates −30 dBm ±3 dBm, adjust S1 and S2 to within −30 dBm ±1 dBm.

(3) If levelmeter indicates beyond −30 dBm ±3 dBm, there is a probable maladjustment of receive ETC Frequency Demodulator OM-47(V)2/TCC or transmit ETC Frequency Modulator OM-46(V)2/TCC, refer to DTM 11-5895-796-12 for fault isolation and adjustment procedures.

3-19. Key Indicators Used In Monitoring Overall Operation

Provided in table 3-3 is a list of key indicators used in monitoring overall operation of the ETC. In addition to the indicators listed in table 3-3, the ETC Operator must monitor built-in audible alarms to detect system degradation and the on-line spectrum analyzer tuned to display the satellite beacon as required by DCA Circular 831-70-( ).

Table 3-3. *Key Indicators Used in Monitoring Overall Operation of the ETC Using the Satellite Communications Terminal AN/TSC-54*

Name	*Location*	*Upper/lower limit*
RF Power Monitor meter, A4	RF Power Monitor/Control, 1A2A27 (Electronic equipment shelter)	Assigned output power ±0.5 dB
SIGNAL STRENGTH meter	Beacon Demodulator MD-705/TSC--54, 1A3A4 (Electronic equipment shelter)	Nominal ±1 dB
VCO TUNING meter	Beacon Demodulator MD-705/TSC--54, 1A3A4(Electronic equipment shelter)	0 ±0.5 kHz
ELEVATION digital readout indicator	Antenna Control C-7243/TSC-54, 1A2A5 (Electronic equipment shelter).	Steady indication, tracking smooth

Table 3-3. Key Indicators Used in Monitoring Overall Operation of the ETC Using the Satellite Communications **Terminal** AN/TSC-54- Continued

Name	*Location*	*Upper/lower limit*	*Name*	*Location*	*Upper/lower limit*
AZIMUTH digital readout indicator	**Antenna Control C-7243/TSC-54, 1A2A5 (Electronic equipment shelter)**	**Steady indication, tracking smooth within ±0.5°**	**DB. MARGIN meter**	**tions Subsystem AN/URC-61 Modem Control Drawer 1A4 (Electronic equipment shelter)**	**dB**
RECEIVER NO. 1 DB MARGIN meter	**Radio Communications Subsystem AN/URC-61, Modem Control Drawer 1A4 (Electronic equipment shelter)**	**Green area above 1 dB**	**Out-of-Band Noise Monitor Meter**	**Multiplexer Set AN/TCC-79**	**Upper and lower limits established by Controller**
RECEIVER NO. 2	**Radio Communica-**	**Green area above 1**	**MONITOR meter (METER selector set to ERROR COUNT position)**	**Digital Data Modem MD-921/G**	**Established normal reading for data link**

Section III. SYSTEM DEGRADATION AND FAILURE

3-20. General

This section provides guidance to assist the ETC Operator in the identification of and recommended response to degradation or failure of a communications link. ETC degradation symptoms, limited to built-in audible and visual alarms are provided with recommended corrective actions. Corrective actions are limited to replacement of a faulty component with a switchable or patachable spare unit.

3-21. ETC Failures that Affect all Transmit and Receive Communications.

ETC equipment failures that result in the loss of all transmit and receive capability are grouped for discussion as follows; primary power and power distribution failures, frequency generation and frequency distribution failures, Interconnect Facility failures, antenna tracking failures **and adverse weather conditions. A list of transmit and receive failure symptoms, with their probable cause and recommended action, is provided in table 3-4.**

a. **When a primary power failure occurs, service is restored by switching to an alternate power source. If commercial power is available, it will normally be selected as the prime power source for the ETC and the Static Frequency Converter CV-3061/TSC-54 used to provide 400 Hz power. When a commercial power failure occurs, service is restored by placing a Diesel Engine Generator Set PU-495/G on-line to provide 60 Hz power and either the Static Frequency Converter CV-3061/TSC-54 or a Diesel Engine Generator Set PU-401/M to provide 400 Hz power.**

Table 3-4. Transmit and Receive Communications Failure Symptoms

Symptom	*Probable cause*	*Recommended action*
1. Fault indications as follows:		
a. All up converter and down-converter audible alarms sounding	***a.* Cesium beam frequency standard failure**	***a.* At frequency distribution unit 1A2A22, press FREQ REF SELECT, XTAL STD switchlamp and restore service.**
***b.* All up-converter and down-converter RF LO and IF. LO FAULT lamps lit**	***b.* Distribution amplifier 1A2A33 failure**	***b.* Perform necessary patching procedures for operation with a cesium beam frequency standard failure provided in DEP 11-5895-389-12.**
	***c.* Radio Frequency Amplifier AM-6631/MSC-46 failure**	***c.* Same as *b* above**
2. Commercial power and static frequency converter selected to provide power	***a.* Commercial power failure**	***a.* Perform emergency operation procedure for commercial power failure; paragraph 3-21.*a*.**
***a.* All power is lost**		
***b.* External power distribution box 1A14, SA-1901 ALARM lamp lit and audible**	***b.* Power distribution switching unit failure**	***b.* Troubleshoot power distribution-switching unit; refer to DTM 11-5895-783-12.**
3. Commercial power and static frequency converter selected to provide power	***a.* Primary power distribution panel failure**	***a.* Troubleshoot primary power distribution panel; refer to DEP 11-5895-389-12.**
***a.* All power is lost**		
***b.* External power distribution box 1A14, SA-1901 ALARM lamp not lit and audible alarm silent**	***b.* Power distribution panel 1A15 failure**	***b.* Same as *a* above**

Table 3-4. Transmit and Receive Failure Symptoms-Continued

Symptom	Probable cause	Recommended action
	c Power Distribution Assembly 1A12 failure	c. Same as *a* above
4 Commercial power and static frequency converter selected to provide power		
a. 400 Hz power is lost	a. Static frequency converter failure	a Perform emergency operation procedure for static frequency converter failure paragraph 3-21 c
b 60 Hz power is normal	*b* Power distribution switching unit failure	*b.* Troubleshoot power distribution-switching unit, refer to DTM 11-5895-783-12
5 Diesel Engine Generator Set PU-495/G and static frequency converter selected to provide power		
a. All power is lost	*a* Diesel Engine Generator Set PU-495/G failure	*a* Perform emergency operation procedure for Diesel Engine Generator Set PU-495/G failure paragraph 3-21 *b*
b External power distribution box 1A14 SA-1901 ALARM lamp is lit and audible alarm is sounding	*b.* Power distribution switching unit failure	*b.* Troubleshoot power distribution-switching unit, refer to DTM 11-5895-783-12
6. Diesel Engine Generator Set PU-495/G and Diesel Engine Generator Set PU-401/M selected to provide power		
a 400 Hz power is lost	*a* Diesel Engine Generator Set PU-401/M failure	*a* Perform emergency operation procedure for Diesel Engine Generator Set PU-401/M failure paragraph 3-21 *d*
b 60 Hz power is normal	*b* Power distribution switching unit failure	*b* Troubleshoot power distribution switching unit refer to DTM 11-5895-783-12

Procedures for restoring power to the ETC when a failure occurs are provided in emergency operation paragraph 3 25 There are no standby units provided for the Power Distribution Switching Unit SA-1901/TSC-54, Power Distribution Assembly SM-D-570735 (1A12), Power Distribution Box Assembly SM-D-778541 (1A15) or Primary Power Distribution Panel SM-D-573130 Therefore, if any of these units fall, service cannot be restored until fault Isolation and repairs are accomplished

b When the Cesium Beam Frequency Standard HP-5061A fails, limited service can be restored by placing the Frequency Standard Model FE-12A (crystal standard) on line When the Distribution Amplifier HP-5087A, Radio Frequency Amplifier AM-6631/MSC-46 or Frequency Distribution Unit SM-D-778523 fails, limited service can be restored utilizing the internal of an Electronic Frequency Synthesizer 0-1658/MSC-46 and emergency patching procedures

c When the Interconnect Facility (ICF) associated with the ETC fails, service cannot be restored until repairs are made or circuits restored

d When an antenna tracking failure occurs that disrupts all transmit and receive communications, service can normally be restored by alternate tracking methods A more detailed discussion of antenna tracking failures is provided in paragraph 3-24

e When adverse weather conditions occur that affect both transmit and receive capability, service is normally maintained by adjusting the transmitter powers of the ETC's involved The ETC Operator is directed to take no Independent action to restore service by adjusting transmitter power without specific direction from the SATDOM Net Controller

The Operator should keep the SATCOM Net Controller informed of any anticipated signal degradation due to adverse weather or radome icing conditions and be prepared to respond to directions

3-22. ETC Failures that Affect Transmit Communication

ETC failures that result in reduced transmit capability are normally accompanied by the RF Power Monitor and Control Panel 1A2A27, TRANSMIT STATUS audible alarm In some cases, when the power level assigned to an individual trunk is less than approximately ten percent of the total assigned power, failure of its upconverter or modulation source will not result m a TOTAL POWER METER audible alarm To simplify identification, separate discussions are provided of those failures that affect all transmit trunks and those that affect individual trunks A list of transmit communications failure symptoms, with their probable cause and recommended action, is provided m table 3-5 When reconfiguration of equipment is necessary to restore service, the Operator must he careful to take no action that will result in transmission of unauthorized carrier power, frequency or deviation.

a. ETC Failures that Affect ***all*** *Transmit Trunks* The failure of any equipment unit located between the output of the up-converter combiner and the antenna transmit feed will affect all transmit trunks The units that will affect all transmit trunks are the transmitter, the exciter and their associated waveguide and antenna feed components. The failure of any of these units cannot be corrected by substitution of standby units and require fault isolation and repair to restore service

Table 3-5. Transmit Communications Failure Symptoms

Symptom	Probable cause	Recommended action
1. Fault indications as follows:	a. Transmitter failure	a. Troubleshoot transmitter; refer to DEP 11-5895-389-12.
a. RF PWR MON/CONTROL panel TRANSMIT STATUS audible alarm sounding and lamp lit		
b. All up-converter RF AUDIBLE ALARM silent	b. Exciter failure	b. Troubleshoot exciter; refer to DEP 11-5895-389-12.
2. Fault indications as follows:	a. Up-converter failure	If a standby up-converter is available:
a. RF PWR MON/CONTROL panel TRANSMIT STATUS audible alarm and XMIT FAULT lamp may or may not be activated		a. Tune standby up-converter to frequency assigned to failed unit if necessary.
b. Up-converter RF AUDIBLE ALARM sounding		b. Patch modulator associated with failed up-converter to standby unit
c. Up-converter STATUS Meter indicates midscale on 70 MHz IF position		c. Set standby up-converter output to power level assigned to failed unit.
		d. Place standby up-converter ON-LINE.
		If no standby up-converter is available, troubleshoot up-converter; refer to IM 11-5895-539-31-1.
3. Fault indications as follows:	a. Modulator failure	Troubleshoot failed modulator
a RF PWR MON/CONTROL panel TRANSMIT STATUS audible alarm and XMIT FAULT lamp may or may not be activated		a. Frequency Modulator OM-46(V)/TCC, refer to DTM 11-5895-796-34-1
b. Up-converter RF AUDIBLE ALARM sounding		b. Modem, Digital Lata MD-921/G, refer to DTM 11-5820-803-34.
c. Up-converter STATUS meter indicates out of blue scale on 70 MHz IF position		c. Radio Communications Subsystem AN/URC-61; refer to DTM 11-5895-796-12-3.

b. ETC Failures that Affect Individual Transmit Trunks. The failure of an Electronic Frequency Up Converter CV-3084/MSC-46 (upconverter) or the modulator equipment associated with an individual trunk will result in a failure of that trunk only. When an up-converter failure occurs, service can be restored by patching the associated modulator to *a spare* up-converter and adjusting its frequency and output level as assigned for that trunk. The spare upconverter is normally adjusted to the frequency and level of the highest priority link. Therefore, when restoring a trunk other than the priority trunk, care must be taken to insure that the frequency and level of the standby up-converter are correct before placing it on-line. In cases when there is no spare upconverter, the SATCOM Net Controller may direct the Operator to terminate a lower priority trunk and use its up-converter to restore a higher priority trunk. At an ETC Using the Satellite Communications Terminal AN/TSC-54, there will not be a spare Frequency Modulator OM-46(V)2/TCC available. Therefore, in the event of failure, full service cannot be restored without fault isolation and repair. In an emergency, the SATCOM Net Controller may direct the Operator to restore limited FM capability using the Radio Transmitter Modulator MD-707/TSC-54 and Communications Demodulator MD-706/TSC-54, as provided in DEP 11-5895-389-12. There are no standby spares provided for the Radio Communications Subsystem AN/URC-61 Transmitter, Digital Data Modem MD-921/G modulator, Analog-Digital Converter CV-3034/G transmitter and *their associated intercabling and patch facilities. Therefore, a failure in any of these units cannot be restored by substitution and will require fault isolation and repair.

3-23. ETC Failures That Affect Receive Communications

ETC failures that result in reduced receive capability can be quickly isolated to a faulty unit by evaluation of front panel visual and audible alarms. To simplify identification, separate discussions are provided of those failures that affect all receive trunks and those that affect individual trunks. A list of receive communications failure symptoms with their probable cause and recommended action, is provided in table 3-6.

a. ETC Failures that Affect all Receive Trunks. The failure of any equipment unit located between the antenna receive feed and the input to the down-converter signal divider will affect all receive trunks. The units that will affect all receive trunks are; the on-line parametric amplifier, the on-line IFL amplifier and their associated waveguide and antenna feed components. When a failure occurs on the on-line Parametric Amplifier AM-6676/TSC-54, service is restored by placing the standby Parametric Amplifier AM-6676/TSC-54 on-line. When a failure occurs in

the on-line Interfacilities Link Amplifier (IFL TWTA), service is restored by placing the standby IFL TWTA on-line. Other failures that affect all receive trunks, such as; waveguide and waveguide switch failures, antenna feed failures and receiver control failures cannot be corrected by substitution of standby units and require further troubleshooting.

b. ETC Failures that Affect Individual Receive Trunks. The failure of an Electronic Frequency Down-converter CV-3085/MSC-46 (down-converter) or the demodulator equipment associated with an individual receive trunk will result in a failure of that trunk *only.*

Table 3-6 Receive Communication Failure symptoms

Symptom	*Probable cause*	*Recommended action*
1. Fault indications as follows:		
a. Antenna control panel, SIGNAL STRENGTH meter indicates loss of signal (full left scale indication)	*a.* Paramp failure	*a.* At test translator control panel, press switchlamp at the input to LNA1 and LNA2 as required to switch parametric amplifiers.
b. Antenna control panel, BEACON RECEIVER, PHASE LOCK AND SIGNAL DETECT lamps not lit	*b.* IFL amplifier failure	*b.* At test translator control panel, press switchlamp located at the output of TWT1 and TWT2 as required to switch IFL amplifiers
c. Beacon demodulator, BEACON TRACK ACQ lamp not lit and SIGNAL STRENGTH meter indicates loss of signal (full left scale indication)		
d. Frequency demodulator audible alarm is sounding with DEVIATION FAULT, LEVEL FAULT AND SQUELCH lamps lit		
2. Fault indications as follows:	Down-converter failure	
a. Individual demodulator audible alarm is sounding, with DEVIATION FAULT, LEVEL FAULT and SQUELCH lamps lit		*a* If a spare down-converter is available, patch associated demodulator to standby down-converter and tune to assigned frequency and power unit
b. All other demodulator audible alarms silent		*b* If a spare down-converter is not available, the down-converter assigned to beacon tracking may be substituted and manual tracking initiated
3. Fault indications as follows:	Demodulator failure	*Troubleshoot failed demodulator*
a Individual demodulator audible alarm sounding and SQUELCH lamp lit, CARRIER INPUT LEVEL meter indicated normal		*a* Frequency Demodulator OM-47(V)2/TCC, refer to DTM 11-5895-796-12-3
b. PSK modem audible alarm sounding and RECEIVE SECTION FAULT lamp lit		*b* Digital Data Modem MD-921/G, refer to DTM 11-5820-803-12
c. Radio Communications Subsystem AN/URC-61 RECEIVER NO. 1 MARGIN meter indicates below normal threshold		*c* Radio Communications Subsystem AN/URC-61; set RECEIVER NO. 2 to assigned code for RECEIVER NO 1 and restore service Refer to DTM 11-5895-796-12-3 for troubleshooting

When a downconverter failure occurs, service can be restored by patching the associated demodulator to a spare downconverter and setting its frequency to the assigned trunk frequency. The spare downconverter is normally set to the frequency of the highest priority link. Therefore, when restoring a trunk other than the priority trunk, care must be taken to ensure that the spare down-converter is tuned to the new trunk frequency. In cases when there is no spare down-converter, the beacon downconverter may be substituted or the SATCOM Net Controller may direct the Operator to terminate a lower priority trunk and use its down-converter to restore a higher priority trunk. At an ETC Using the Satellite Communications Terminal AN/TSC-54, there will not be a spare Frequency Demodulator OM-47(V)2/TCC available. Therefore, in event of failure, full service cannot be restored without fault isolation and repair. In an emergency, the SATCOM Net Controller may direct the Operator to restore limited FM capability using the Radio Transmitter Modulator MD-707/TSC-54 and Communications Demodulator MD MD-706/TSC-54, as provided in DEP 11-5895-389-12. When a failure occurs in the Radio Communications Subsystem AN/URC-61, Receiver No. 1 (communication receiver), service can be restored by substituting the Receiver No. 2 (monitor receiver) and making necessary patches. There are no standby spares provided for the Digital Data Modem MD-921/G demodulator, Analog. Digital Converter CV-3034/G receiver, or their asso-

ciated intercabling and patch facilities. Therefore, a failure in any of these units cannot be restored by substitution and will require fault isolation and repair.

3-24. ETC Failure that Affect Antenna Tracking

ETC failures that result in the loss of satellite tracking or antenna positioning capability will normally cause a loss of all transmit and receive communications until corrected or alternate procedures are employed. A failure in the Beacon Demodulator MD-705/TSC-54, Waveguide Scanner SM-D-572654, Antenna Control C-7242/TSC-54 or the Electronic Frequency Down-Converter CV-3085/MSC-46 assigned to the Beacon Demodulator MD-705/TSC-54 will result in a loss of satellite tracking capability. When a failure occurs in the Beacon Demodulator MD-705/TSC-54, service is restored by substituting a Communications Demodulator MD-706/TSC-54. A failure in the Azimuth or Elevation Servo Assembly SM-D-570343, Azimuth Drive Assembly SM-E-572395, Elevation Gear Head Assembly SM-D-572393 or Antenna Control C-7242/TSC-54 will result in a loss of antenna positioning capability. When a failure of antenna positioning equipment occurs, communications can be maintained by manually positioning the antenna using manual handcranks. A list of antenna tracking failure symptoms, with their probable cause and recommended action, is provided in table 3-7.

3-25. Emergency Operation

a. Emergency Operation of the ETC when Commercial Power Fails. If a power failure occurs when operating on commercial power, perform the following sequence to restore the ETC to operation:

(1) Set all Major Subsystem and Major Subgroup main power circuit breakers to OFF.

Table 3-7 Antenna Tracking Failure Symptoms

Symptom	*Probable cause*	*Recommended action*
1. Fault indications as follows:		
a. Antenna control panel, SIGNAL STRENGTH meter indicates loss of signal and BEACON RECEIVER, PHASE LOCK and SIGNAL DETECT lamps are not lit	*a.* Beacon demodulator failure	*a.* If a spare Communications Demodulator MD-706/TSC-54 is available, it may be used to autotrack the assigned satellite provided the antenna control panel, RECEIVE MODE selector (located on the rear of the panel) is set to COMM 1 or COMM 2 position, as applicable and the comm demod matrix board has been configured as provided in DEP 11-5895-389-12. If a spare Communications Demodulator MD-706/TSC-54 is not available, press antenna control panel, MODE CONTROL, MANUAL switchlamp and use AZIMUTH and ELEVATION, POSITION NON RATE handcranks to track satellite.
b. Antenna control panel, MODE CONTROL, AUTOTRACK lamp is not lit *c.* Beacon demodulator, SIGNAL STRENGTH meter indicates loss of signal and BEACON TRACK ACQ lamp is not lit	*b.* Antenna comparator or azimuth/elevation scanner failure	*b.* At antenna control panel, press MODE CONTROL, MANUAL switchlamp and use AZIMUTH and ELEVATION, POSITION RATE handcranks to track satellite.
2. Power distribution panel 1A2A4, ANTENNA STATUS, OVERLOAD and/or ANTENNA DRIVE fault lamps are lit	Antenna servo system failure	At the antenna control panel, press MODE CONTROL STANDBY switchlamp. Maintain satellite tracking using manual handcranks installed at the azimuth and elevation gear boxes; refer to DEP 11-5895-389-12.

(2) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-switching Unit SA-1901/TSC-54 to OFF.

(3) Start Diesel Engine Generator Set PU-495/G No. 1 or No. 2 in accordance with TM 5-6115-293-12/ TO 35C2-3-329-1.

(4) Perform Power Distribution-Switching Unit SA-1901/TSC-54 operating procedures as outlined in DTM 11-5895-763-12.

(5) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1901/TSC-54 to ON.

(6) Set all Major Subsystem and Major Subgroup main power circuit breakers to ON and restore the ETC to operation.

b. Emergency Operation of the ETC when Diesel Engine Generator Set PU-495/G Fails. If a power failure occurs when operating on Diesel Engine Generator

Set PU-495/G power, perform the following sequence to restore the ETC to operation:

(1) Set all Major Subsystem and Major Subgroup main power circuit breakers to OFF.

(2) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1901/TSC-54 to OFF.

(3) Stop operation of defective Diesel Engine Generator Set PU-495/G in accordance with TM 5-6115-293-12/ TO 35C2-3-329-1.

(4) Start spare Diesel Engine Generator Set PU-495/G in accordance with TM 5-6115-293-12/ TO 35C2-3-329-1.

(5) Perform Power Distribution-Switching Unit SA-1901/TSC-54 operating procedures as outlined in DTM 11-5895-783-12.

(6) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching SA-1901/TSC-54 to ON.

(7) Set all major Subsystem and Major Subgroup main power circuit breakers to ON and restore the ETC to operation.

(8) Notify the motor generator repair personnel of the Diesel Engine Generator Set PU-495/G failure.

c. Emergency Operation of the ETC when Static Frequency Converter CV-3061/TSC-54 Fails. If 400 Hz power fails when operating oncommercial or Diesel Engine Generator Set PU-495/G power due to Static Frequency Converter CV-3061/TSC-54 failure, perform the following sequence to restore the ETC to operation:

(1) Set all Major Subsystem and Major Subgroup main power circuit breakers to OFF.

(2) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1901/TSC-54 to OFF.

(3) Stop operation of defective Static Frequency Converter CV-3061/TSC-54 in accordance with DTM 11-5820-802-12.

(4) Start Diesel Engine Generator Set PU-401/M No. 1 or No. 2 in accordance with TM 5-6115-235-10.

(5) Apply commercial power if available or Start Diesel Engine Generator Set PU-495/G No. 1 or No. 2 in accordance with TM 5-6115-293-12/ TO 35C2-3-329-1.

(6) Perform Power Distribution-Switching Unit SA-1901/TSC-54 operating procedures in accordance with DTM 11-5895-783-12.

(7) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1901/TSC-54 to ON.

(8) Set all Major Subsystem and Major Subgroup main power circuit breakers to ON and restore the ETC to operation.

(9) Notify the motor generator repair personnel of the Static Frequency Converter CV-3961/TSC-54 failure.

d. Emergency Operation of the ETC when Diesel Engine Generator Set PU-401/M Fail. If power failure occurs when operating on Diesel Engine Generator Set PU-401/M power, perform the following sequence to restore the ETC to operation:

(1) Set all Major Subsystem and Major Subgroup main power circuit breakers to OFF.

(2) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1991/TSC-54 to OFF.

(3) Stop operation of defective Diesel Engine Generator Set PU-401/M in accordance with TM 5-6115-235-10.

(4) Start spare Diesel Engine Generator Set PU-401/M in accordance with TM 5-6115-235-10.

(5) Perform Power Distribution-Switching Unit SA-1901/TSC-54 operating procedures in accordance with TM 11-5895-783-12.

(6) Set all ac circuit breakers on the 400 Hz and 50/60 Hz Circuit Breaker Panels of Power Distribution-Switching Unit SA-1901/TSC-54 to ON.

(7) Set all Major Subsystem and Major Subgroup main power circuit breakers to ON and restore the ETC to operation.

(8) Notify the motor generator repair personnel of the Diesel Engine Generator Set PU-401/M failure.

e. Emergency Operation of the ETC Resulting from a Decrease in Complex Capability. The ETC can be satisfactorily operated under reduced capability through patching and reconfiguration, however, no changes in equipment configurations or settings will he made without specific direction from the SATCOM Net Controller. For detailed patching and reconfiguration procedures refer to appendix A for applicable technical manuals.

f. Emergency Operation of the ETC Resulting from External Electronic Interference. As soon as it is determined that external electronic interference exists, notify the SATCOM Net Controller. Make no changes in equipment configuration or settings without direction from the SATCOM Net Controller.

3-26. Identification of Jamming

Jamming signals that are encountered are of two basic types; undesired signals that enter the satellite receiver and are retransmitted to the ETC and undesired signals that enter the ETC receive system from local sources. Some possible sources of local interference are radiation from defective industrial equipment, off-channel or maladjusted communications equipment and ETC transmit signals cross feeding into the receive system. Identification of locally generated interference is the responsibility of the affected ETC. In addition, the SATCOM Net Controller may request the assistance of the ETC Operator in evaluating the

effect of undesired signals present in the satellite spectrum. To effectively evaluate the characteristics of the satellite spectrum, the ETC Operator must be thoroughly familiar with the operation of available spectrum analyzers. Upon noting any loss in communications quality which in not attributable to ETC equip ment or local weather conditions, the SATCOM Net Controller should he immediately notified. Since the characteristics of jamming signals cannot be predetermined, the ETC Operator must use judgment in selecting IF. bandwidth, sweep width and sweep time for observations. In general, use the narrowest bandwidth for bandwidth measurement and spectrum shape observations and the widest bandwidth for power measurements.

Section IV. CONTROL/OPERATION

3-27. General

This section contains information concerning the DSCS SATCOM control. Refer to DCA Circular 831-70-( ) for Standard Operating Procedures for Operation and Control of the Defense Satellite Communications System (DSCD).

3-28. DSCS SATCOM Control

Satellite Communications Control involves the technical management of the portion of the SATCOM system that lies between the input to the modulator at one end of a link to the output of the demodulator at the other end of the link. Control of the DSCS during Phase II differs from Phase I and conventional communications in the following respects: first, because a large number of ETC's must access a single satellite, close coordination must be exercised to prevent interference among the complexes; second, because the total communication capacity is limited, a central authority is required to manage and control the satellite's use to the many links in proportion to requirements. The central authority is the SATCOM Net Controller.

a. The DSCS Phase II Control Subsystem involves the responsive participation of each ETC accessing a satellite. The participation required of each ETC is the timely and accurate response to directions received from the SATCOM Net Controller. Control requires adherence to requirements dictated by the SATCOM Net Controller. ETC operators are directed to take no action that will alter the ETC's uplink power, mode, deviation or other RF or IF characteristics. Responsibility *for* carrying out functions dictated by the *SATCOM* Net Controller will be delegated by the ETC Commander.

b. The principal functions of the communications ETC's that relate to Control are described in Circular 831-70-( ). They include the following

(1) Prior to establishment of an operational link, the ETC will accomplish baseline data tests and furnish the data to the SATCOM Net Controller.

(2) Receive assignments from the SATCOM Net Controller.

(3) Coordinate with associated TCF both before and during passage of traffic.

(4) Comply with procedures for link establishment and maintenance.

3-29. ETC Reports

ETC reports that are required by the SATCOM Net Controller are defined in DCA Circular 831-70-( ). In general, these reports consist of ETC characterization data, ETC link establishment data, ETC operating reports and special reports requested by the SATCOM Net Controller.

a. Link Establishment Data Reports. During the process of establishing a communications link, the results of the following measurements should be reported to the SATCOM Net Controller and recorded at the ETC for future use as an ETC data base:

(1) Output power of each assigned transmit carrier and the total power output of the on-line power amplifier

(2) Test Tone-to-Noise Ratio (TTNR) measurement of each assigned FM link

(3) Digital Error Rate measurement of each assigned PSK link

(4) Threshold Margin indication of the SSMA link

b. ETC Operating Reports. During operation, the following link parameters are monitored and reported to the SATCOM Net Controller as follows:

(1) TTNR for each FM link; reported every four hours or when it changes by more than ±2 dB from established normal.

(2) Digital Error Rate for PSK link; reported every four hours or when the error rate changes by more than ±1 order of error rate.

(3) Threshold margin of SSMA link; reported every four hours or when it changes by more than ±3 dB from established normal.

(4) Current or anticipated adverse weather conditions that affect ETC operation.

(5) Any change in ETC configuration or capabilities.

CHAPTER 4

ETC THEORY

4-1. Introduction

This chapter contains general discussions relating to the overall functional operation at the ETC Using the Satellite Communicationa Terminal AN/TSC-54. Provided in figure FO-2 is a simplified block diagram of the ETC.

4-2. Functional Operation of the ETC

The DSCS Phase II satellite system in the Stage 1b configuration provides multiple access capability to the ETC's that operate in the DSCS. In addition, greatly increased channel capacity and quality are available. As deployed for Phase II, Stage lb, the ETC using the Satellite Communications Terminal AN/TSC-54 has the capability of providing a maximum of twelve voice frequency channels, one of which may contain sixteen individual teletype signals, and one Supergroup, consisting of sixty voice frequency channels, on a single FM carrier for local users and/or TCF. Brief functional descriptions of the Major Subsystems and Major Sub-Groups of a typical ETC Using the Satellite Communications Terminal AN/TSC-54 are contained blow. However, some ETC's, depending upon mission and location, will not contain all of this equipment Refer to figure FO-2 for a simplified block diagram of the ETC.

a. Multiplexer Set AN/TCC-79. The Multiplexer Set AN/TCC-79 processes baseband signals from/to TCF and user VF/teletype inputs and outputs to provide the IF interface with the Satellite Communications Terminal AN/TSC-54. Brief functional descriptions of the Major Sub-Groups of the Multiplexer Set AN/TCC-79 are contained below.

(1) *Multiplexer/demultiplexer equipment. The* multiplexer/demultiplexer equipment performs multiplex/demultiplex operations on the voice/teletype signals from and to the users resulting in a 60 to 108 kHz group signal. This signal group is applied to and from the Modem Group OM-45(V)2/TCC. When desired, a 60 to 108 kHz basic group signal from TCF can be applied to the Modem Group OM-45(V)2/TCC in place of the user voice/teletype signals. In addition to the user voice/teletype signals, the multiplexer/demultiplexer equipment processes baseband signals containing Supergroup 1 (60 to 300 kHz) or Supergroup 2 (312 to 522 kHz) from and to TCF. These supergroup signals are also applied to the Modem Group OM-45(V)2/TCC. However, when selected, Supergroup 2 is translated to 60 to 300 kHz for application to the Modem Group OM-45(V)2/TCC.

(2) *Modem group OM-45(V)2/TCC. The* Modem Group OM-45(V2/TCC (Group *A* Modem) equipment process the baseband inputs and outputs, from and to the multiplexer/demultiplexer equipment and TCF, to interface with the Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC. The signal group selected for processing, either the user voice/teletype signal group (60 to 108 kHz) from the multiplexer/demultiplexer equip ment or basic group (60 to 108 kHz) from TCF, is applied to the modulator/demodulator equipment in the Modem Group OM-45(V)2/TCC. The bit group signal (60 to 108 kHz) is translated to 12 to 60 kHz in the modulator/demodulator for application to and from the hybrid combiner. The hybrid combiner forms the ETC to ETC voice orderwire channel (4 to 8 kHz), basic group signal (12 to 60 kHz) and selected supergroup signals, either Supergroup 1 or Supergroup 2 (60 to 300 kHz), into a 4 to 300 kHz baseband for input to the Frequency Modulator OM-46(V)2/TCC in the transmit direction. In the receive direction, the hybrid combiner separates the elements of the 4 to 300 kHz baseband received from the Frequency Demodulator OM-47(V)2/TCC and routes them to their respective processing functions.

(3) Frequency modulator OM-46(V)2/TCC and frequency demodulator OM-47(V)2/CC. The Frequency Modulator OM-46(V)2/TCC and Frequency Demodulator OM-47(V)2/TCC process the 4 to 300 kHz baseband from and to the Modem Group OM-45(V)2/TCC. In the transmit direction, the Frequency Modulator OM-46(V)2/TCC provides a 70 MHz IF input to the Electronic Frequency Up-Converter CV-3084/MSC-46 in the Satellite Communications Terminal AN/TSC-54. In the receive direction, the Frequency Demodulator OM-47(V)2/TCC extracts the baseband by demodulating the 70 MHz IF carrier received from the Electronic Frequency Down-Converter CV-3085/MSC-46.

(4) Voice orderwire equipment. The Multiplexer Set AN/TCC-79 contains voice orderwire equipment for one ETC to ETC voice orderwire circuit (4 to 8 kHz). In the transmit direction, the voice orderwire signal is applied to Modem Group OM-45(V)2/TCC where it is hybrid combined into the 4 to 300 kHz baseband and forwarded to the Frequency Modulator OM-46(V)2/TCC. In the receive direction, the voice orderwire signal is hybrid extracted from the 4 to 300 kHz baseband received from the Frequency Demodulator OM-47(V)2/TCC.

(5) *D.c. telegraph equipment.* **The d.c. telegraph equipment has the capability of processing up to 16 teletype signals from/to local users. These signals are processed into frequency-shift keyed (FSK) signals and applied to one of the twelve user voice channels in the multiplexer/demultiplexer equipment for multiplexing into the 60 to 108 kHz group signal A Teletype Page Printer AN/UGC-77 is available for local orderwire use as one of the 16 teletype signals.**

(6) Line conditioning equipment. **The line conditioning equipment provides signaling, level coordination, and echo suppression functions for up to 12 local user voice (VF) channels. These VF channels are processed by the line conditioning equipment and applied to multiplexer/demultiplexer equipment for multiplexing into the 60 to 108 kHz group signal in the transmit direction. In the receive direction, the 60 to 108 kHz group signal is demultiplexed and forwarded to the line of conditioning equipment for processing/forwarding to the users.**

b. Radio Communications Subassembly tern AN/URC-61. **The Radio Communications Subsystem AN/URC-61 is a spread spectrum multiple access transmitter/receiver which is capable of handling one voice frequency channel, one TTY channel and one ETC to ETC TTY orderwire channel or digital data and one ETC to ETC TN orderwire channel. Brief functional descriptions of the Major Subgroups of the Radio Communications Subsystem AN/URC-61 are provided below.**

(1) *Link terminal timing central TD-851/URC-61.* **The Link Terminal Timing Central TD-851/URC-61 (LTTC) is a highly accurate time reference, which provides timing signals for the transmitter/receiver group coders of the Radio Communications Subsystem AN/URC-61. The LTTC also interfaces with the Cesium Beam Frequency Standard HP-5061A through the Time Transfer Unit CM-427(XB-1)URC (TTU) for timing signal comparison and calibration of the LTTC.**

(2) Doppler augmentor range corrector. **The doppler augmentor range corrector provides the means for offsetting the frequency of the transmit and receive local oscillators to correct for Doppler errors associated with Doppler shift to and from the satellite repeater.**

(3) Transmitter. **The Radio Communications Subsystem AN/URC-61 transmitter operates in either of two modes to transmit voice/teletype information or digital data. The transmitter output is a pseudonoise, double-sideband, suppressed-carrier, 70 MHz IF. signal that is applied to the Satellite Communications Terminal AN/TSC-54 for up-conversion and transmission.**

(4) ***Receiver*** *No.* **1. The Radio Communications Subsystem AN/URC-61 receiver No. 1 (communication receiver) demodulates and demultiplexes the received 70 MHz spread spectrum signal from the Satellite Communications Terminal AN/TSC-54 to recover the voice/teletype or digital data signals. The wideband characteristics of the receiver, made possible by spread spectrum transmission methods, makes the receiver highly resistant to jamming.**

(5) *Receiver No. 2.* **The Radio Communications Subsystem AN/URC-61 receiver No. 2 (monitor receiver) functions identically to the communications receiver. The monitor receiver monitors local transmissions as they are retransmitted by the satellite for round-trip propagation time or range measurements and verification of back-to-back link through the satellite.**

c. Digital Data Modem MD-92l/G (PSK Modem). **The Digital Data Modem MD-921/G (PSK Modem) provides a digital data interface between ETC's. The PSK Modem is capable of processing data at rates between 19.2 kbs and 9.9999 Mbs. The 70 MHz IF. output from the PSK modulator is applied to an Electronic Frequency Up-Converter CV-3084/MSC-46 in the Satellite Communications Terminal AN/TSC-54. The 70 MHz IF. input to the PSK de modulator is supplied from an Electronic Frequency Down-Converter CV-3085/MSC-46 in the Satellite Communications Terminal AN/TSC-54.**

d. Satellite Communications Terminal AN/TSC-54. **The Satellite Communications Terminal AN/TSC-54 provides the radio frequency (RF) interface between the ETC and the satellite repeater for transmitting and receiving communication signals. The Satellite Communications Terminal AN/TSC-54 consists of the following Major Subgroups:**

(1) *Communication terminal group* **OW-11/TSC-54. The Communication Terminal Group OW-11/TSC-54 contains upconversion (transmit), downconversion (receive) and beacon demodulator (satellite tracking) equipment as well as control and monitor equipment for the Satellite Communications Terminal AN/TSC-54. The Electronic Frequency Up-Converters CV-3084/MSC-46 accept as inputs the FM 70 MHz IF signal from the Multiplexer Set AN/TCC-79, pseudonoise (PN) 70 MHz IF signal from the Radio Communications Subsystem AN/URC-61 and phase-shift keyed (PSK) 70 MHz IF. signals from the Digital Data Modem MD-921/G for upconversion to a transmit frequency of 7.9 to 8.4 GHz The outputs of the Electronic Frequency Up-Converters CV-3084/MSC-46 are combined and routed to the Antenna-Receiver-Transmitter Group OA-8244/TSC-54 for amplification and transmission. The Electronic Frequency Down-Converters CV-3085/MSC-46 receive RF signals from the Antenna-Receiver-Transmitter Group OA-8244/TSC-54 in the 7.25 to 7.75 GHz range and down-convert to 70 MHz IF. signals. The down-converted signals are routed to the Multiplexer Set AN/TCC-79, Radio Communications Subsystem AN/URC-61 and Digital Data Modem MD-921/G. The**

Beacon Demodulator MD-705/TSC-54 operates as a satellite tracking receiver. It detects the satellite beacon signal, locks on if and produces the azimuth and elevation tracking error signals to control the position of the antenna Reference signals for the Electronic Frequency Up-Converters CV-3084/MSC-46, and Electronic Frequency Down-Converters CV-3085/MSC-46, the Multiplexer Set AN/TCC-79, Radio Communications Subsystem AN/URC-61 and Digital Data Modem MD-921/G are provided by the Cesium Beam Frequency Standard HP-5061A through a distribution amplifier.

(2) Antenna-receiver-transmitter group OA-8244/TSC-54. The Ante-Receiver-Transmitter Group OA-8244/TSC-54 contains the antenna reflector consisting of four lo-foot parabolic dishes integrally assembled as a cloverleaf *reflector,* Parametric Amplifier AM-6676/TSC-54 and transmitter for the Satellite Communications Terminal AN/TSC-54. The combined output from the Electronic Frequency Up-Converters CV-3084/MSC-46, in a frequency range of 7.9 to 8.4 GHz, is received by the transmitter section where it is amplified, routed to the antenna through pressurized waveguide and radiated to the satellite from the antenna Dielguide feeds as a 5 kW maximum signal. The 7.25 to 7.75 GHz signal received from the satellite enters the four Dielguide feeds and is applied to the Parametric Amplifier AM-6676/TSC-54. The output from the Parametric Amplifier AM-6676/TSC-54, a three-stage uncooled metric amplifier, is applied first to the TWT Amplifier WJ3106 and then to the Electronic Frequency Down-Converters CV-3085/MSC-46 in the Communication Terminal Group OW-11/TSC-54. Positioning of the antenna for satellite tracking is accomplished automatically by the Beacon Demodulator MD-705/TSC-54 and antenna control section or manually if so desired.

e. Digital Data Modem MD-920/G (ICF Modem). The Digital Data Modem MD-920/G (ICF Modem) is used in conjunction with the Digital Data Modem MD-921/G (PSK Modem) allowing the user to be located remotely. The ICF Modem accepts user uplink data, in bipolar form, from a microwave link and converts it to nonreturn to zero (NRZ) form for application to the PSK Modem. The ICF Modem accepts downlink data, in NRZ form, from the PSK Modem and converts it to bipolar form for transmission to the user over the microwave link. The ICF *Modem* is normally located remotely at the user, however, when installed at the ETC, it will be housed in the Multiplexer Set AN/TCC-79.

f. Analog-Digital Converter ***CV-3034/G. The*** Analog-Digital Converter CV-3034/G (A/D Converter) interfaces on the digital side with the Digital Data Modem MD-920/G (ICF Modem) or Digital Data Modem MD-921/G (PSK Modem). When the input signal to the A/D Converter is analog (voice) it operates as an analog-to-digital converter (voice digitizer) providing a 50 kbs digital output. When the input is 50 kbs, digital data, the A/D Converter operates as a digital data repeater. If both digital, and analog signals are present at the input, the digital data signal automatically takes precedence. When the receiver section recognizes a pseudo random (PR) sequence imbedded in the 50 kbs digital stream, it functions as a digital-to-analog converter providing the original analog (voice) signal at its output. If no PR sequence is present, the receiver operates as a digital data repeater.

g, Power Distribution-Switching Unit ***SA-1901/*** TSC-54. The Power Distribution-Switching Unit SA-1901/TSC-54 provides selection, control and monitoring of the primary ac voltages applied to the ETC. The Power Distribution-Switching Unit SA-1901/TSC-54 has the capability of applying commercial power or either one of two Diesel Engine Generator Sets PU-495/G to the ETC for the 60 Hz ac *prime* power. It also has the capability to apply the Static Frequency Converter CV-3061/TSC-54 or one of two Diesel Engine Generator Sets PU-401/M to the ETC for the 400 Hz ac *power.* if the Static Frequency Converter CV-3061/TSC-54 has been selected for ETC use, 60 Hz ac power is routed from the Power Distribution-Switching Unit SA-1901/TSC-54 to the Static Frequency Converter CV-3061/TSC-54 where it is converted to 400 Hz ac *power.* This 400 Hz ac power is forwarded back to the Power Distribution-Switching Unit SA-1901/TSC-54 for distribution to the *Ma*jor Subsystems and Major Sub-Groups of the ETC. For distribution of the prime power to the ETC. refer to figure FO-2.

h. Static Frequency Converter ***CV-3061/TSC-54.*** The Static Frequency Converter CV-3061/TSC-54 provides the conversion of 60 Hz ac voltage to 400 Hz ac voltage when commercial power or one of the two Diesel Engine Generator Sets PU-495/G is utilized by the ETC. The Static Frequency Converter *CV-3061/TSC-54* converts the 60 Hz dc voltage received from the Power Distribution-Switching Unit SA-1901/TSC-54 to 400 Hz ac. This 400 Hz ac is then applied to the Power Distribution-Switching Unit SA-1901/TSC-54 for distribution.

i. Diesel Engine *Generator Sets PU-401/M and* ***PU-495/G.*** The ETC contains two Diesel Engine Gen*erator* Sets PU-495/G for the purpose of providing 60 *Hz ac prime power* when commercial *power is* not available and two Diesel Engine Generator Sets PU-401/M for the purpose of providing *400* Hz power when the Static Frequency Converter CV-3061/TSC-54 is not available. Each diesel engine generator set consists of a diesel engine that is directly coupled to its main generator. The main generator of

the Diesel Engine Generator Set PU-401/M is a 3-phase, 400 Hz, 45 kW unit. The main generator of the Diesel Engine Generator Set PU-495/G is a 3-phase, 50/60 Hz, 100 kW unit. In ETC operation when commercial power is not available, one Diesel Engine Generator Set PU-495/G and the Static Frequency Converter CV-3061/TSC-54 is utilized to supply the 120 V ac, 400 Hz and 60 Hz, prime power required for ETC operation. The alternate Diesel Engine Generator Sets PU-401/M and PU-495/G are kept available in standby.

CHAPTER 5

ETC MAINTENANCE

Section I. ETC MAINTENANCE PHILOSOPHY

5-1. General

The ETC is a component of a fulltime high priority communications network usually carrying traffic which cannot be carried by other means It is therefore essential that maintenance procedures, described in applicable equipment manuals, he carefully followed and orgainized to minimize the system downtime Redundant and Switchable Spare equipments are provided in certain critical areas so that operation can be continued with minimal interruption and/or system *degradation* thereby permitting repair of defective units off-line Throughout the ETC, equipment design supports a repair by replacement concept in which subassemblies and/or modules are replaced to restore operation in a minimum of tune On site-repair actions which require unusual skills, special tools and test equipment or extended maintenance periods are minimized Normally these repair actions are referred to the appropriate maintenance facility

5-2. Nature and Extent of Maintenance

The following paragraphs describe the types of maintenance functions to be accomplished at each echelon of maintenance

a Organizational/Direct Support Maintenance (On Site/Off-Site) Organizational through direct support maintenance may he accomplished by on-site maintenance technicians as outlined in applicable technical manuals for each subsystem The following maintenance functions will be accomplished on-site

(1) Scheduled preventive maintenance

(2) Troubleshoot, repair, and align electronic, electro-mechanical, and mechanical units to the subas sembly or module level This includes

(a) Replacement of units

(b) Repair of subassemblies and/or modules as authorized by the Repair Parts and Special Tools List (RPSTL).

(c) Replacement of piece parts not integral to modules and/or subassemblies such as switches, knobs, fuses, connectors, etc This applies to test equipment except when such replacement affects calibration

(3) Realign subsystem after unit, subassembly, and/or module replacement.

(4) Perform organizational maintenance on power generation and environmental equipment.

(5) Request for test equipment calibration services

(6) Arrange for visits of off-site higher echelon maintenance teams when required

b. General Support or Base Support Facility The following maintenance functions are to be performed at General Support or Base Support Facility

(1) Repair test equipment within limits of facility

(2) Repair all teletype, telephone, and other standard communications equipment

(3) Repair any modules or subassemblies within the existing capability of the facility

(4) Repair all power generation and environ mental equipment (this service normally provided by an Area Support Command or Base Support Unit).

(5) Provide structural and heavy machine shop support.

(6) Provide test equipment calibration service

c. Depot Level Maintenance The following mainte nance functions are to be accomplished by the applica ble depot

(1) Repair of all satellite communication peculiar units, subassemblies, and modules beyond General Support or Base Support capability

(2) Arrange and manage repair contracts with equipment manufacturers for repair and return of units, subassemblies, and modules beyond depot repair capability

(3) Provide on-site support of ETC equipment when required

(4) Maintain a repair cycle float to replace units returned for overhaul

5-3. Preventive and Corrective Maintenance

Preventive maintenance is scheduled periodic maine nance (dally, weekly, monthly, semiannually) for the routine replacement of expended material and the identification of problems within the subsystems of the Earth Terminal Complex Corrective maintenance IS the additional maintenance required for the repair of problems identified during normal operation or preventwe maintenance Preventive and corrective maintenance may be performed either in-service or out-of-service The ETC's, mod&d for Phase II opera tion, have added selective redundant equipment which allows considerable preventive and corrective mainte nance to be performed in-service Due to the high degree of availability required from the ETC's, one of the goals for Phase II operation is the performance of

required out-of-service preventive maintenance with minimum impact on availability. As a result, distinctly separate preventive and corrective maintenance downtimes are recognized.

a. Preventive Maintenance Downtime (PMDT). Preventive Maintenance Downtime (PMDT) is a regularly scheduled downtime which is used exclusively for the inspects, check and lubricate phase of that maintenance which must be accomplished out-of-service. Scheduling of this maintenance will be a responsibility and coordinating function of SATCOM control. Each DSCS SACOM Controller assigned operational control of a Phase II satellite will coordinate with ETC's accessing that satellite to establish downtime requirements.

b. Corrective Maintenance Downtime (CMDT). Corrective Maintenance Downtime (CMDT) is the additional downtime to be requested as required to repair problems identified during PMDT. This downtime will be requested as required. In-service checks and inspections made during normal operation may also reveal deteriorating conditions, particularly with nonredundant units, which require CMDT for repair. CMDT requests are the responsibility of the Site Commander.

c. *PMDT Versus CMDT.* A policy of fix-after-failure is not implied by separating out-of-service maintenance into PMDT and CMDT. PMDT provides a means to detect degraded operation of the ETC prior to marginal performance or catastrophic failure. When PMDT or in-service checks reveal the need for DMDT, a request for CMDT will be made.

Section II. SYSTEM TESTING

5-4. General

This section provides ETC System Testing procedures that are performed by the ETC Operator immediately prior to and/or during operation to evaluate system performance.

5-5. Carrier-to-Noise Density Ratio (C/kT) Measurement

Carrier-noise density ratio (C/kT) measurements are normally made at the 70 MHZ SAMPLE connector of the associated Electronic Frequency Down-Converter CV-3085/MSC-46. These measurements are made using suitable spectrum analyzers or wave analyzers and can be accomplished on-line without disrupting service. CkT measurements can be made at RF frequencies using suitable spectrum analyzers, when necessary. Although the Field Strength and Noise Meter NF-105 has been used for C/kT measurements in the past, its use is not recommended. NF-105 noise power measurements are in error because metering is not rms. In addition, the IF bandwidth is not calibrated during depot maintenance. C/kT measurement procedures using suitable wave analyzers and spec trum analyzersare provided below.

a *C/kT* Measurement *Using an HP-310A or HP-312A Wave Analyzer.* This procedure provides accurate results only when measuring unmodulated carriers or modulated carriers whose bandwidth is substantially less than 3.0 kHz. Therefore, this procedure is recommended for off-line measurement of unmodulated carriers or on-line measurement of beacon carriers only. Before using this procedure examine the measurement and image frequency spectrum (2 MHz above measurement frequency) using a suitable spectrum analyzer. There can be no signal other than noise at the image frequency. Noise densities at measurement and image frequencies must be equal within 1 *dB.*

(1) Connect test equipment as provided in figure 5-1.

(2) Set wave analyzer switches and controls for 3000 Hz bandwidth and tune to 1 MHz.

(3) Set signal generator controls as required for a 71 MHz output at 0 dBm.

(4) If necessary, reset the wave analyzer RANGE selector for an on scale indication. Fine tune signal generator for a peak indication. Record reading.

(5) Adjust wave analyzer COARSE and FINE taming controls to 1010 kHz and reset RANGE selector for an on scale indication. Adjust FINE tuning control for a minimum indication within ±100 kHz and record as noise level.

(6) Repeat step (5) at 990 kHz.

(7) Average the noise levels measured in steps (5) and (6) and algebraically subtract the result from the signal level measured in step (4) to obtain $\frac{C+N}{N}$ in dB.

(8) Add a 37 dB correction factor and report as C/kT.

b. C/kT Measurrement Using Tektronix 491 Spectrum Analyzer. This procedure provides accurate results only when measuring unmodulated carriers or modulated carriers whose bandwidth is less than 100 kHz. When using this procedure, a special graticule (figure 5-2) must be installed on the spectrum analyzer display screen.

(1) Connect the Tektronix 491 Spectrum Analyzer to the 70 MHZ SAMPLE connector on the associated Electronic Frequency Down-Converter CV-3085/MSC-46.

(2) Set Tektronix 491 Spectrum Analyzer switches and controls as follows:

(*a*) DISPERSION RANGE to MHz/DIV.

(*b*) DISPERSION to 5.

(*c*) RESOLUTION coupled to DISPERSION.

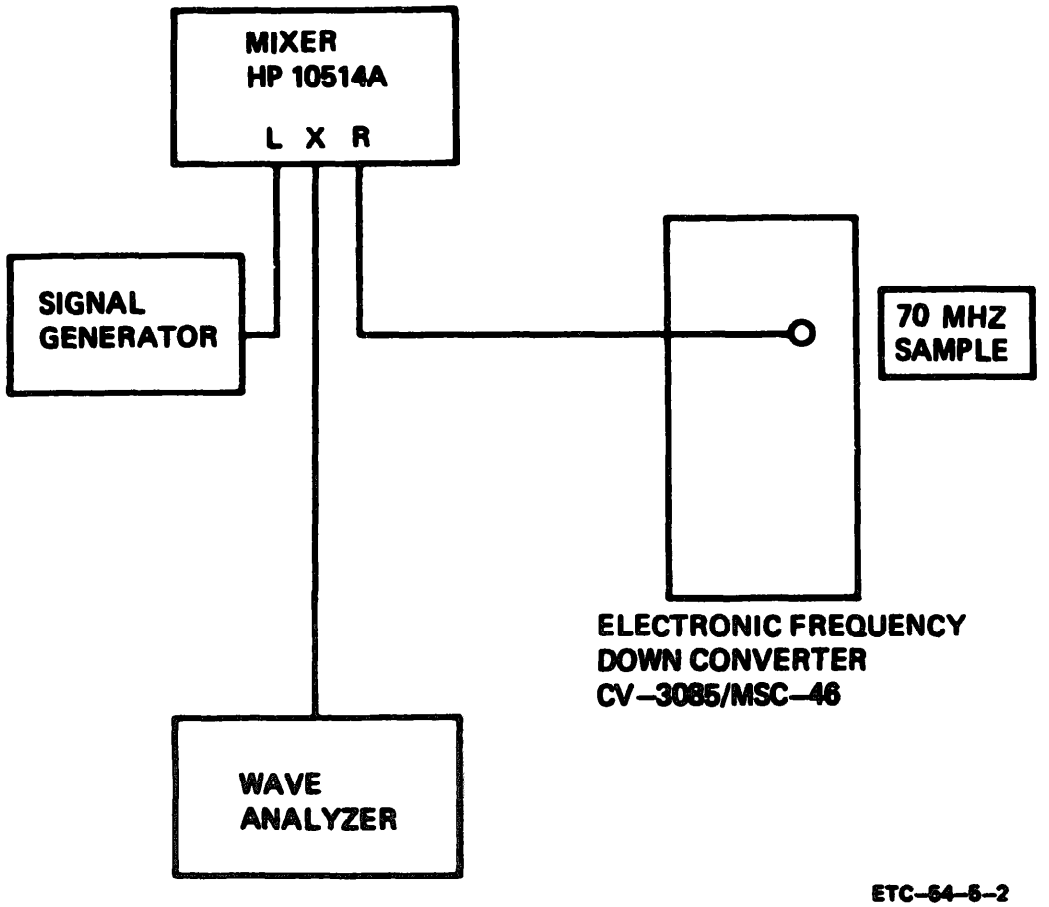


Figure 5-1. Test Equipment Setup for Carrier- to-Noise Destine Ration (C/kT) Measurement Using the Wave Analyzer

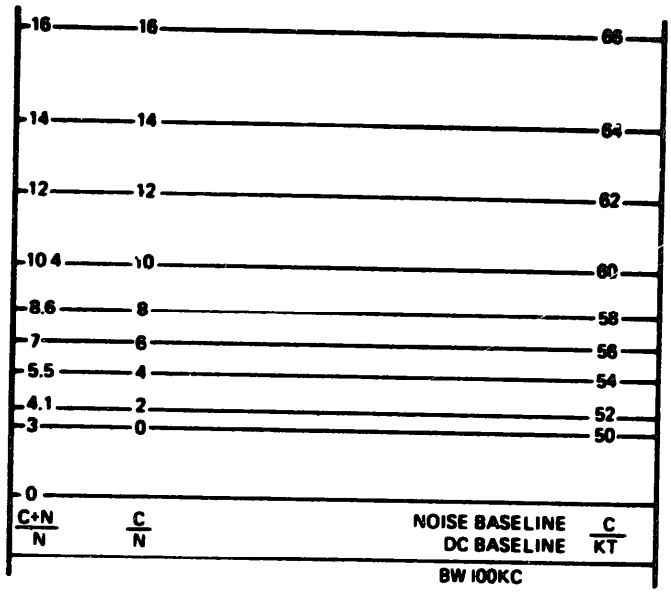


Figure 5-2. Special Graticule for Tektronix 491 Spectrum Analyzer

(*d*) VIDEO FILTER to OFF.

(*e*) VERTICAL DISPLAY to LIN.

(*f*) TRIGGER SOURCE to LINE.

(*g*) TIME/DIV to .5 SEC/DIV.

(*h*) IF ATTENUATOR dB to 51 dB (all switches up).

(*i*) RF CENTER FREQUENCY band selector to 1.

(*j*) RF CENTER FREQUENCY tuning control to 70 MHz for assigned receive communications or beacon carriers or as appropriate for other carriers having an IF. between 50 MHz and 90 MHz.

(3) Carefully adjust vertical POSITION control until the display baseline coincides with the DC BASELINE on the special graticule; refer to figure 5-2 for illustration of special graticule.

(4) Adjust RF CENTER FREQUENCY tune control, IF. ATTENUATOR dB switches and/or GAIN control until the desired carrier is displayed on the center line of the display screen and has an amplitude of at least one-half the screen height.

(5) While observing the display, sequentially reduce the spectrum analyzer dispersion and resolution using the DISPERSION/RESOLUTION controls until the displayed carrier occupies at least one-third of the display screen width; measure the 3 dB bandwidth of the displayed carrier (bandwidth at approximately 70 percent of maximum height).

(6) Uncouple the DISPERSION/RESOLUTION controls and set RESOLUTION control (outer knob) to the extreme clockwise position. This sets the spectrum analyzer bandwidth (resolution) to 100 kHz. The other resolution settings provided are not calibrated and cannot be used for C/kT measurements.

(7) Set VIDEO FILTER toggle switch to the ON (up) position.

(8) Adjust the IF ATTENUATOR DB switches and/or GAIN control until the noise level on the display coincides with the NOISE BASELINE on the special graticule.

NOTE

The C/kT indication may be in error if the sweep is too fast or the carrier bandwidth is greater than 100 kHz.

(9) Observe the vertical height of the displayed carrier over a period of several sweeps and using the highest indication, read the C/kT directly from the special graticule if a C/kT scale is provided. If no C/kT scale is provided, read C/N from the special graticule and convert to C/kT by adding a conversion factor of 50 dB. When measuring carriers exceeding the 100 kHz bandwidth as determined in step (5), report and record the carrier bandwidth in addition to the C/kT.

(10) If the carrier level results in an off-screen indication, reduce IF gain using the IF ATTENUATOR dB control until an on-screen indication is obtained. It should be noted that the noise baseline will no longer coincide with the NOISE BASELINE on the special graticule; this is a normal indication. Repeat step (9), add the number of dB by which the IF ATTENUATOR dB control was adjusted and report and record as C/kT.

(11) Periodically check and reset, if necessary, DC BASELINE as provided in step (3). The NOISE BASELINE should also be periodically checked and reset, if necessary, as provided in step (8) However, if the IF. ATTENUATOR dB was adjusted in step (10), it must be normalized before resetting the NOISE BASELINE.

c. C/kT Measurement Using an HP-141T/8555A Spectrum Analyzer. **This procedure provides acceptable results only when measuring unmodulated carriers or modulated carriers whose bandwidth is less than 300 hHz. C/kT measurements using the HP-141/8555A Spectrum Analyzer can be up to 3 dB in error. Therefore, all results obtained using this procedure should be regarded as estimates. This procedure is recommended for C/kT measurement of beacon carriers only when no other procedure can be used.**

(1) Connect the HP-141/8555A Spectrum *Analyzer to the 70* **MHZ SAMPLE connector on the associated Electronic Frequency Down-Converter** *CV-3085/MSC-46.*

(2) **Set** *HP-8555A* **Spectrum Analyzer-RF Section switches and controls as follows:**

(a) FREQUENCY as required.

(b) BANDWIDTH to 100 kHz.

(c) SCAN WIDTH PER DIVISION to 100 kHz.

(d) INPUT ATTENUATION as required.

(3) **Set HP-8552B Spectrum Analyzer-IF Section switches and controls as follows:**

(a) SCAN TIME **PER DIVISION to 10 MILLISECONDS.**

(b) VIDEO FILTER to 100 Hz.

(c) 2 dB LOG/10 dB LOG/LINEAR to 10 dB LOG.

(d) SCAN MODE to INT.

(e) SCANT TRIGGER to AUTO.

(4) Set HP-141T Display Section **controls for nonstorage mode at a convenient brightness.**

(5) ***Adjust*** *HP-8555A RF Section, FREQUENCY* **FINE TUNE control to display desired signal on center line of display screen**

(6) Observe HP-141T Display Section screen and adjust noise baseline to coincide with the −60 dB graticule line. Use HP-8552B IF Section, LOG REF LEVEL control for coarse adjustment and LINEAR SENSITIVITY control for fine adjustment. If noise baseline is irregular, use noise level at left edge of signal trace for adjustment.

(7) Count the number of divisions that the displayed signal rises above the baseline and multiply by 10.

(8) **Add a 52.5 dB conversion factor to obtain approximate C/kT.**

5-6. Test Tone-To-Noise Ratio (TTNR) Measurement

Test tone-to-noise ratio (TTNR) measurements are normally made at the voice frequency (VF) interface by the associated Technical Control Facility (TCF). When an ETC has a VF channel interface capability, the Operator may be requested to make a TTNR meas urement at the VF interface as provided in DCA Circular 310-70-57, Supplement 1. Normally, TTNR measurements will be made at the output of the Frequency Demodulator OM-47(V)2/TCC at the top channel or an out-of-band frequency. TTNR measurements taken at the VF interface or the top channel frequency require that the VF channel under test he terminated, disrupting service for the duration of the measurement. Step-by-step procedures for performing TTNR measurements at both baseband and out-of-band frequencies are provided below.

a TTNR. Measurement at In-Band Baseband Frequency. **Performance of this TTNR measurement requires that the channel under test be terminated for the duration of the measurement and that Pomona LPA-50 monitor type coaxial looping plugs are used for baseband connections to Frequency Modulators OM-46(V)2/TCC and Frequency Demodulators OM-***47(V)2/TCC.*

(1) At the transmit ETC, set Transmission Test Set Assembly switches and controls as follows:

(a) Oscillator frequency dial and RANGE as ap propriate for baseband test tone frequency of channel under test; refer to DTM 11-5895-796-12-3 for modulation plan.

(b) **Oscillator AMPLITUDE fully counterclockwise.**

(c) Patch Panel INPUT and OUTPUT IMPEDANCE to 900.

(d) Patch Panel MEAS-CAL to MEAS.

(2) At transmit ETC, connect Transmission Test Set, Patch Panel OUTPUT to a frequency counter, HP-5245L or equivalent

(3) On Transmission Test Set Oscillator; **adjust AMPLITUDE control clockwise until frequency counter begins to count. Adjust frequency dial to baseband test tone frequency of channel under test ±100 Hz. Reset AMPLITUDE control fully counterclockwise.**

NOTE

This procedure describes use of the built-in Sierra 303A Frequency Selection Levelmeter. When necessary, a suitable wave analyzer (HP-310A, HP-312A or HO5-312A) may be used. However, equivalent switch settings

and appropriate correction factors must be used. The correction factor far an HP-310A Wave Analyzer is -9 dB. The correction factor for an HO5-312A Wave Analyzer is +2 dB. No correction factor is required for an HP-312A Wave Analyzer.

(4) At transmit and receive ETC's, set Frequency Selective Levelmeter (Sierra 303A) switches and controls as follows:

(a) INPUT to 75 ohms

b) BRIDGING/TERMINATING (IN) to BRIDGlNG (out position)

(c) UNBALANCED/BALANCED (IN) to UNBALANCED (out position)

(d) SENSITIVITY to NORMAL

(e) SELECTIVITY to 3.1 kHz

(f) TUNE pushbutton in

(g) COARSE AND FINE TUNE as required for baseband test frequency of channel under test

(5) At transmit ETC, connect a BNC T-adapter to the monitor jack on the coaxial looping plug connected to the Frequency Modulator OM-46(V)2/TCC input as shown in figure 5-30①.

(6) At transmit ETC connect the Sierra 303A to one input of the BNC T-adapter as shown in figure *5-3*①*Coordinate* with TCF and verify that channel under test has been properly terminated. A properly terminated channel should indicate leas than −80 dBm.

(7) Connect Transmission Test Set Patch Panel OUTPUT to the remaining input of the BNC T adapter as shown in figure 5-3①.Adjust Transmission Test Set Oscillator AMPLITUDE controi for a −30 dBm indication on Sierra 303A.

(8) At receive ETC, connect Sierra 303A to monitor jack on coaxial looping plug connected to the output of the Frequency Demodulator OM-47(V)2/TCC to be tested, as shown in figure 5-3②.

(9) At receive ETC, readjust COARSE and FINE TUNE controls as required for peak indication on levelmeter. Indication should be −30 ±3 dBm.

(10) The test tone measured in step (7) is being transmitted at −10 dBm0 to avoid overloading baseband equipment Therefore, add 10 dB to the measured level and record as test tone level for channel under test. Test tone level should be -20 ±3 dBm.

(11) At receive ETC, coordinate with transmit ETC to have test tone removed.

(12) At receive ETC, readjust INPUT LEVEL control on Sierra 303A for on-scale indication and adjust FINE TUNE control for minimum indication.

(13) Convert measured noise level from step (12)

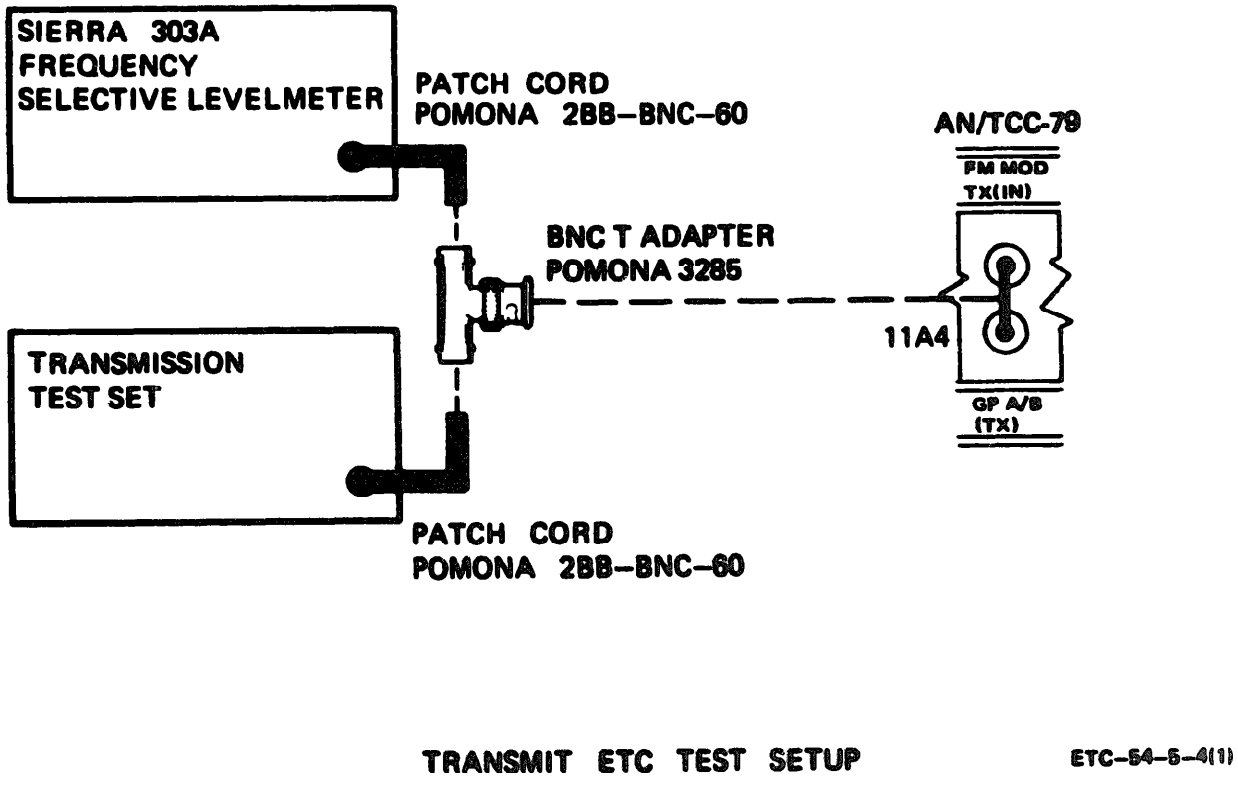


Figure 5-3① Test equipment setup for test tone-to-noise ratio (TTNR) measurement (Sheet 1 of 2)

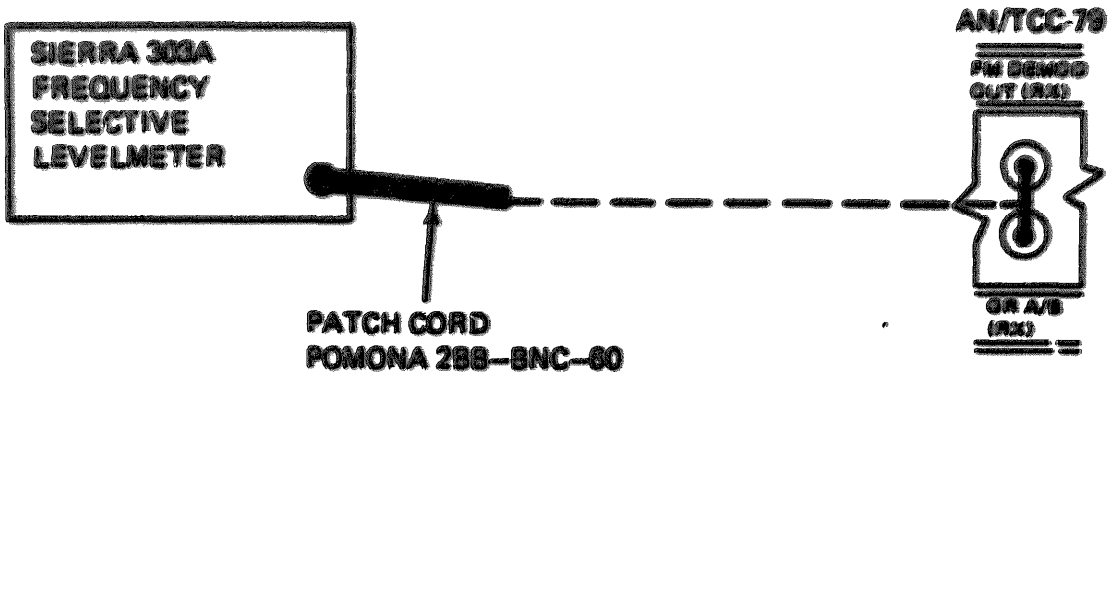


Figure 5-3(2). Test equipment setup for test tone-to-noise ratio (TTNR) measurement (sheet 2 of 2).

to C-message weighted noise by subtracting 1 dB. (*Example:* if measured noise level is −64 dBm, C-message weighted noise = −64 dBm −1 dB = −65 dBm.)

(14) Algebraically subtract C-message weighted noise level from test tone level and report as TTNR. (*Example:* test tone level is −20 dBm and C-message weighted noise level is −65 dBm, TTNR = −20 dBm—(−65 dBm) = 45 dB).

b. TTNR Measurement at Out-of-Band Frequency. TTNR measurements can be performed during normal operations, without interrupting traffic by making measurements at frequencies beyond the normal baseband limits. The procedure for measuring TTNR at an out-of-band frequency is the same as the in-band measurement provided in paragraph 5-6*a*, except that the test tone frequency is selected from table 5-1 for the assigned channel capacity and quality.

5-7. Out-of-Band Noise (OBN) Measurement

Out-of-Band Noise (OBN) measurements are performed on-line, without interrupting or degrading communications traffic, to provide an indication of circuit quality. Two methods of measuring OBN are provided: one method uses a Frequency Selective Levelmeter (Sierra 303A or equivalent), and a second method uses a DC millivoltmeter connected to the Frequency Demodulator OM-47(V)2/TCC OBN module.

Table 5-1 Out-of-Band TTNR Tone Frequencies

Channel capacity	*Test frequency*
3 global	25 kHz
6 global	37 kHz
9 global	49 kHz
12 global	61 kHz
24 global	109 kHz
36 global	157 kHz
48 global	205 kHz
72 global	301 kHz
3 tactical	25 kHz
6 tactical	37 kHz
9 tactical	49 kHz

a. OBN Measurement Using a Frequency Selective Levelmeter.

NOTE

This procedure describes use of the built-in Sierra 303A Frequency Selective Levelmeter. When necessary, a suitable wave analyzer (HP-310A, HP-312A or HO5-312A) may be used. However, equivalent switch settings and appropriate correction factors must be used. The correction factor for an HP-310A Wave Analyzer is −9 dB. The correction factor for an HO5-312A Wave Analyzer is +2 dB. No correction factor is required for an HP-312A Wave Analyzer.

(1) Set Sierra 303A switches and controls as follows:

(*a*) INPUT to 75 ohms.

(*b*) BRIDGING/TERMINATING (IN) to BRIDG-

ING (out position).

(c) UNBALANCED/BALANCED (IN) to UNBALANCED (out position).

(d) SENSITIVITY to NORMAL.

(e) SELECTIVITY to 3.1 kHz.

(f) TUNE pushbutton in.

(g) COARSE and FINE TUNE as required to achieve LOCK light at test frequency from table 5-1.

(h) INPUT LEVEL to −30.

(2) Connect Sierra 303A to monitor jack on Pomona LPA-50 coaxial looping plug connected between baseband equipment and Frequency Demodulator OM-47(V)2/TCC to be tested.

(3) Reset INPUT LEVEL control as necessary to obtain an on-scale meter indication.

(4) Adjust FINE TUNE control 3 kHz above and below measurement frequency and observe meter for minimum indication. Record minimum indication as measured noise level.

(5) Convert measured noise level to C-message weighted noise by subtracting 1 dB. (*Example:* measured noise level is −64 dBm, C-message weighted noise = −65 dBm.)

(6) Algebraically subtract C-message weighted noise level from the measured standard test tone level (−20 dBm nominal) to obtain TTNR. (*Example:* C-message weighted noise level is −65 dBm, TTNR = −20 dBm—(−65 dBm) = 45 dB).

(7) Repeat steps (1) through (5) for remaining Frequency Demodulators OM-47(V)2/TCC.

b. OBN Measurement Using a D.c. Millivoltmeter. Prior to using this procedure for measuring OBN, the FM Receive Baseband Adjustment provided in paragraph 3-18 must be performed and the OBN module output must be calibrated as follows:

(1) Connect a DC millivoltmeter, (John Fluke 871A or equivalent) across TP5 and TP2 (ground) on the Frequency Demodulator OM-47(V)2/TCC OBN module to be tested, as provided in figure 5-4.

(2) Perform a test tone-to-noise ratio (TTNR) measurement as provided in paragraph 5-6*a* or 5-6*b* as appropriate.

(3) Using measured TTNR and table 5-2, determine nominal millivolt output of OBN module for assigned channel quality (global or tactical).

(4) On Frequency Demodulator OM-47(V)2/TCC, set squelch MANUAL OVERRIDE switch to ON.

Table 5-2. OBN Module Output to TTNR Conversion Table

OBN module output (mV)	Tactical TTNR (dB)	Global TTNR (dB)	OBN module output (mV)	Tactical TTNR (dB)	Global TTNR (dB)
40	37.5	50.5	205	29 5	42.5
45	37	50	230	29	42
51	36.5	49.5	250	28.5	41.5
55	36	49	280	28	41
61	35.5	48.5	305	27.5	40.5
68	35	48	340	27	40
75	34.5	47.5	375	26.5	39.5

Table 5-3. OBN Module Output to TTNR Conversion Table-Continued

OBN module output (mV)	Tactical TTNR (dB)	Global TTNR (dB)	OBN module output (mV)	Tactical TTNR (dB)	Global TTNR (dB)
83	34	47	415	26	39
92	33.5	46.5	465	25.5	38.5
100	33	46	510	25	38
112	32.5	45.5	560	24.5	37.5
125	32	45	620	24	37
137	31.5	44.5	690	23.5	36.5
155	31	44	755	23	36
167	30.5	43.5	860	22.5	35.5
185	30	43	930	22	35

(5) Observe DC millivoltmeter and adjust R-16 on the OBN module to the value determined in step (3).

(6) On Frequency Demodulator OM-47(V)2/TCC set squelch MANUAL OVERRIDE switch to OFF.

(7) Repeat steps (1) through (6) for remaining Frequency Demodulators OM-47(V)2/TCC.

(8) Future measurements of the OBN module output in millivolts can be converted to TTNR using table 5-2. (*Example:* If the Frequency Demodulator OM-47(V)2/TCC is configured for 12 channel Global operation and the OBN module output is 155 millivolts, the TTNR is 44 dB.)

(9) Any adjustment of R16 on the OBN module will affect the level at which the SQUELCH alarm occurs; therefore, following an adjustment of R16, the squelch threshold potentiometer (R44) should be adjusted to alarm at 900 to 1000 millivolts on the OBN meter at the earliest opportunity to go off-line.

5-8. Digital Error Rate to Measurement

The digital error rate measurement is performed immediately after establishing a PSK link to determine link quality and to verify the calibration of online error rate indicators.

NOTE

This procedure may be performed at any time when directed by the SATCOM Net Controller and digital data traffic can be interrupted.

a. Connect an HP 5245L, Electronic Frequency Counter to the ERROR jack on the Digital Data Modem MD-921/G; refer to TM 11-5820-802-12 for location of ERROR jack and front panel controls and indicators.

b. Coordinate with SATCOM Net Controller, the associated TCF and partner ETC and set SOURCE selector switch to LINK.

c. Observe error count on frequency counter. The time interval required for this measurement depends upon the data rate and link carrier-to-noise conditions. Practical, time intervals limit error rate measurements to approximately the following:

(1) For 20 kHz; $1O^{-5}$ to 10^{-6}

(2) For 200 kHz; 10^{-6} to 10^{-7}

(3) For 1 MHz; 10^{-7} to 10^{-8}

(4) For 10 MHz; 10^{-8} to 10^{-9}

d. Set METER selector switch to ERROR COUNT:

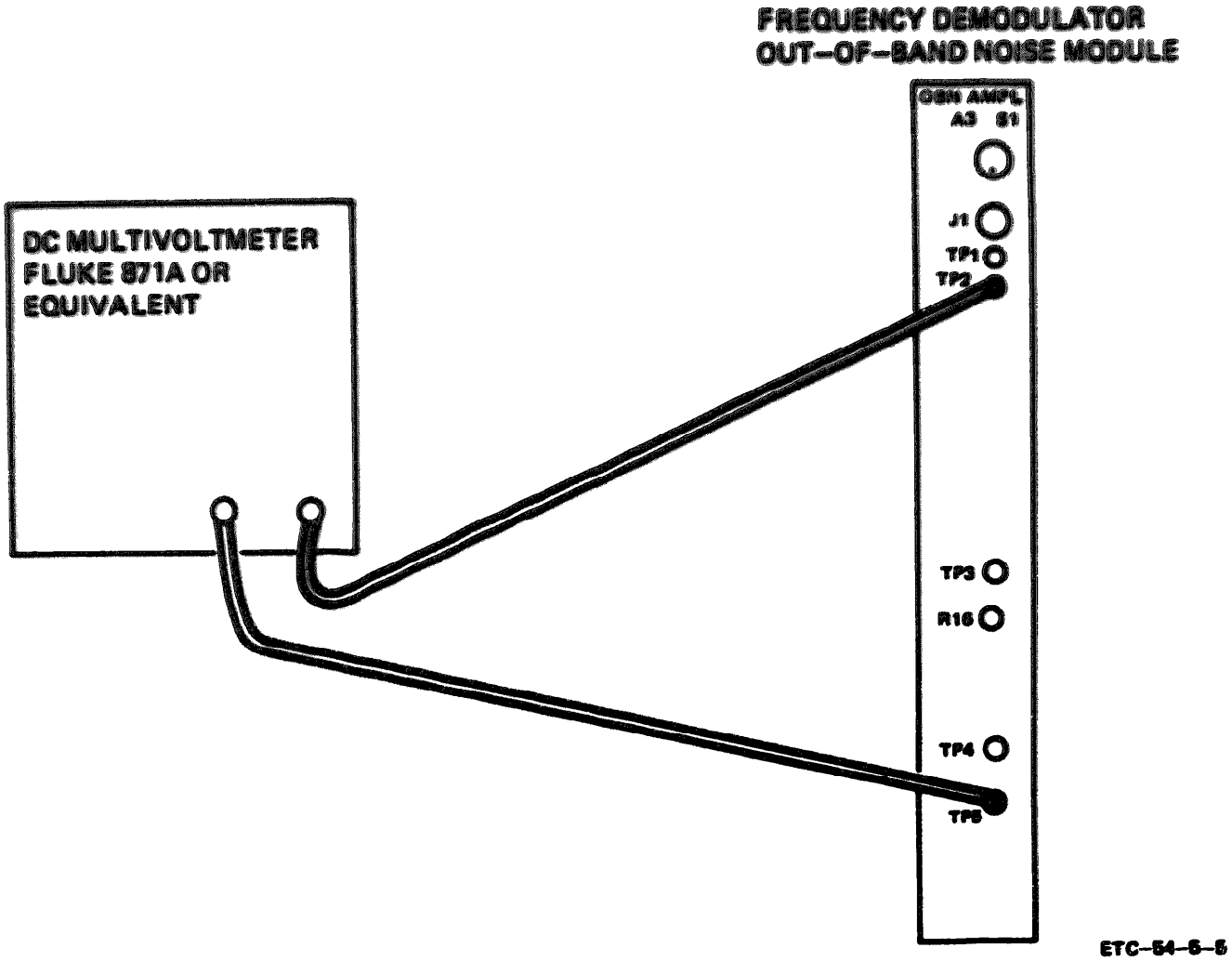


Figure 5-4. Test equipment setup for out-of-band noise (OBN) measurement.

read and record indication. (This step applicable only for error rates in excess of 1%.)

e. **Set METER selector switch to SIG/NOISE; read and record indication. (This step applicable for all coded modes and non-coded modes above error rates of 10^{-6} only.)**

f. **When authorized by SATCOM Net Controller, set SOURCE selector switch to OPERATE.**

g. **Compare results of steps *d* and *e* with calibration plot prepared during turn-on and checkout to identify any significant correction that must be applied to on-line error rate indicators.**

5-9. Satellite Downlink Monitor

Satellite downlink monitoring provides the ETC Operator with information regarding satellite output as received at the ETC. In addition, the SATCOM Net Controller may request assistance to identify changes in satellite performance or presence of jamming signals in the satellite spectrum. Monitoring may be accomplished routinely or upon request as directed by the Site *Commander*. The Tehronix 491 or HP-141T/ 8556A Spectrum Analyzer is used to perform this monitoring. Due to the different characteristics of them two instruments, general instructions only are provided for their use.

a Single Carrier Monitoring. In **normal operation, a single assigned receive carrier will be selected for monitoring. This carrier is usually the beacon carrier, the highest priority communications carrier, or the carrier having the poorest margin.**

(1) Connect the spectrum analyzer to the 70 MHZ SAMPLE connector on the Electronic Frequency Down Converter CV-3085/MSC-46 assigned to the **selected carrier.**

(2) Tune spectrum analyzer to 50 MHz to monitor

the beacon or 70 MHz to monitor a communications carrier.

(3) Set spectrum analyzer IF. bandwidth controls to the widest available bandwidth. (300 kHz for HP-141T/8555A or 100 kHz for Tektronix 491.)

(4) Set spectrum analyzer sweep speed to the slowest sweep that is visually acceptable.

(5) Set spectrum analyzer sweep width so that displayed signal is 2 to 4 centimeters wide.

(6) Adjust spectrum analyzer gain until amplitude of displayed carrier coincides with a convenient reference line on display screen. Reference line should be at approximately 80 percent of screen height. Mark or record position of gain control so that it can be reset if disturbed.

b. Multiple Carrier Monitoring. Multiple carriers can be monitored only when all the carriers of interest fall within ±20 MHz of an assigned receive carrier frequency. This monitoring is accomplished at the 70 MHZ SAMPLE connector of the Electronic Frequency Down-Converter CV-3085/MSC-46 assigned to that carrier group.

5-10. Noise Power Density Measurement

Noise power density measurements are made to determine that the receive system gain is adequate for the demodulators. Unsatisfactory results indicate degradation of the Parametric Amplifier AM-6676/TSC-54 IFL TWT amplifier, Electronic Frequency Down-Converter CV-3085/MSC-46 or associated cabling or waveguide components. Measurements are normally made at the 70 MHZ SAMPLE connector on the associated Electronic Frequency Down-Converter CV-3085/MSC-46 while in operation. Measurements can be made either on or off the satellite. When out of operation, however, noise powers will be lower.

a Connect a suitable spectrum, Tektronix 491 or HP-141/8555A, to the 70 MHZ SAMPLE connector on the associated Electronic Frequency Down-Converter CV-3085/MSC-46.

b. Tune spectrum analyzer to display the desired carrier and its adjacent noise baseline.

c. Set spectrum analyzer bandwidth to 100 kHz, video filter on, (100 Hz position for HP-8552A IF. Section), and log/linear controls for 10 dB log display.

d. Set spectrum analyzer sweep speed control for the slowest visually acceptable sweep. Set spectrum analyzer scan width control until the displayed carrier is 2 to 4 centimeters wide.

e. Observe noise baseline adjacent to displayed carrier and adjust spectrum analyzer gain for a convenient noise reference level. The noise reference level should be approximately one-third of display screen height.

f. Disconnect spectrum analyzer from Electronic Frequency Down-Converter CV-3085/MSC-46. Reconnect spectrum analyzer to a suitable VHF signal generator, Tektronix 191 or equivalent.

g. Adjust signal generator frequency and output level to display its output signal on the spectrum analyzer display screen.

h. Reset, if necessary, spectrum analyzer sweep width until displayed signal is approximately 2 to 4 centimeters wide. Fine adjust signal generator frequency until displayed signal coincides with center line of display screen.

i. Fine adjust signal generator output level until the top of the displayed signal coincides with noise reference level of step *e*.

j. Measure signal generator output level in dBm using an RF microwattmeter, Boonton 42B or equivalent.

k. Algebraically subtract a 47.5 dB correction factor from signal generator output attenuator setting and record as normal noise power density. This corrected power density should not be more negative than −117 dBm to insure operation of demodulators nor significantly mom negative than previously recorded normal values. *(Example: -40 dBm -47.5* dBm = -87.5 dBm)

CHAPTER 6

ETC INTERCONNECTION DIAGRAMS

6-1. Introduction

his chapter provides interconnect cable and signal ow diagrams for the ETC Using the Satellite Communications Terminal AN/TSC-54 which are located llowing the Alphabetical Index. These diagrams entify the input/output signal flow, levels and external cables between the Major Subsystems and Major ubgroups of the ETC. A listing of interconnect cables nd wiring for the ETC is provided in chapter 2, section I, of this manual. For detailed circuit diagrams ertaining to this equipment refer to appendix A for applicable technical manuals.

6-2. Interconnect Cable Diagram

Interconnect cable diagrams for the ETC are furnished in figure FO-3. These diagrams show interconnection of external cables between the Major Subsystems and Major Subgroups of the ETC.

6-3. Signal Flow and Level Diagram.

Signal flow and level diagrams are furnished in figure FO-4 for the ETC. These diagrams depict signal flow and level through the ETC system.

APPENDIX A

DOCUMENTS AND TECHNICAL MANUALS

A-1. Scope

Appendix A contains a list of documents and technical manuals required for the operation and maintenance of the ETC Using the Satellite Communications Terminal AN/TSC-54. Publications necessary for the clarification of symbols, designations, abbreviations, etc., such as applicable specifications standards and exhibits used in the preparation of this ETC System Manual, are also listed in this appendix.

A-2. Explanation of Columns

The following is an explanation of the columns in the documents and technical manuals listing (table A-1).

a. Publications Number Column. This column indicates the publication number cf the document or technical manual listed. Publication numbers listed in this column are in numerical sequence.

b. Nomenclature Column. This column indicates the official nomenclature of the document or technical manual, with model number or other identifying information.

A-3. REQUISITIONING OF Publications

Draft technical manuals (DTMs) and instruction manuals (IMs) are not available through AG publication channels. Requests for the DTMs and IMs listed below should be sent to Commander, US Army Satellite Communications Agency, ATTN: DRCPM--SC-8, Fort Monmouth, NJ 07703.

Table A-1. Documents and Technical Manuals for ETC Using the Satellite Communications Terminal AN/TSC-54

Publication number	*Nomenclature*
	Logistic Support Plan for Earth Terminal Complex Using Satellite Communications Terminal AN/TSC-54 Phase II Stage 1B (May 1974).
DCA Circular 300-195-4 Supplement 1	DSC Technical Evaluation Program (TEP) Performance Measurement Procedures for Multichannel Broadband Telecommunications Systems.
DCA Circular 310-70-1	DSC Technical Control Methods and Procedures.
DCA Circular 831-70-( )	Operation and Control of the DSCS (Draft) Standard Operation Procedures.
Plan 25	Plan 25 for Earth Terminal Complex Technical Manuals.
MIL-M-38784	Manuals, Technical: General Requirements for Preparation of.
MIL-M-63000C (TM)	Manuals, Technical: General Requirements for Manuscripts.
MIL-M-63019 (TM)	Manuals, Technical: Telecommunications Equipment (Except Teletypewriter).
TM 38-750	Technical Manual: The Army Maintenance Management System (TAMMS).
TM 750-240	Maintenance and Repair Procedures for S-141/G, S-144/G, S-250/G, S-280/G, and S-318/G Type Shelters.
TM 5-6115-235-10	Operator's Manual, Generator St, Diesel Engine: 45 KW, AC, 120/208, 240/416 V, 3 Phase, 400 Cycle; Skid Mounted (Consolidated Diesel Model 4060) FSN 6115-624-0385 (Diesel Engine Generator Set PU-401/M).
TM 5-6115-235-20	Organizational Maintenance Manual, Generator Set, Diesel Engine: 45 KW, AC, 120/208, 240/416 V, 3 Phase, 400 Cycle; Skid Mounted (Consolidated Diesel Model 4060) FSN 6115-624-0385 (Diesel Engine Generator Set PU-401/M).
TM 5-6115-235-25P	Organizational, Direct and General Support, and Depot Maintenance Repair Parts and Special Tools List, Generator Set, Diesel Engine: 45 KW, AC, 120/208, 240/416 V, 3 Phase, 400 Cycle; Skid Mounted (Consolidated Diesel Model 4060) FSN 6115-624-0385 (Diesel Engine Generator Set PU-401/M).
TM 5-6114-235-35	Field and Depot Maintenance Manual, Generator Set, Diesel Engine: 45 KW, AC, 120/208, 240/416 V, 3 Phase, 400 Cycle; Skid Mounted (Consolidated Diesel Model 4060) FSN 6115-624-0385 (Diesel Engine Generator Set PU-401/M).
TM 5-6115-293-12 TO 35C2-3-329-1	Operator and Organizational Maintenance Manual, Generator Set, Diesel Engine: Precise Power; 100 KW, AC 120/208 V, 240/416 V, 3 Phase, 60 Cycle, at 1800 RPM, 83.3 KW, 120/208 V, 240/416 V, 3 Phase, 50 Cycle at 1500 RFP; Skid Mounted (Detroit Diesel, General Motors Model 6910A) FSN 6115-798-3444 (Diesel Engine Generator Set PU-495/G).
TM 5-6115-293-20P	Organizational Maintenance Repair Parts and Special Tools Lists, Generator Set, Diesel Engine: Precise Power; 100 KW, AC, 120/208 V, 240/416 V, 3 Phase, 60 HZ, at 1,800 RPM, 83.3 KW, 120/208 V, 240/416 V, 3 Phase, 50 HZ, at 1,500 RPM, Skid Mounted (Detroit Diesel Div., General Motors Corp. Model 6910A) FSN 6115-798-3444 (Diesel Engine Generator Set PU-495/G).

Table A-1. Documents and Technical Manuals for ETC Using the Satellite Communication Terminal AN/TSC-54- Continued

Publication number	Nomenclature
TM 5-6115-293-35 TO 35C2-3-339-22	Field and Depot Maintenance Manual, Generator Set, Diesel Engine: Precise Power; 100 KW, AC, 120/208 V, 240/416 V, 3 Phase, 60 Cycle, at 1800 RPM, 83.3 kW, 120/208 V, 240/416 V, 3 Phase, 50 Cycle, at 1500 RPM; Skid Mounted (Detroit Diesel Divn. General Motors Corp. Model 6910A) FSN 6115-798-3444 (Diesel Engine Generator Set PU-495/G).
TM 5-6115-293-35P	Direct and General Support and Depot Maintenance Repair Parts and Special Tools Lists, Generator Set, Diesel Engine: Precise Power; 100 KW, AC, 120/208 V, 240/416 V, 3 Phase, 60 HZ, at 1800 RPM, 83.3 KW, 120/208 V, 240/416 V, 3 Phase, 50 HZ, at 1500 RPM; Skid Mounted (Detroit Diesel Div General Motors Corp. Model 6910A) FSN 6115-798-3444 Engine Generator Set PU-495/G).
TM 5-6115-365-15 TO 35C2-3-1-441	Organizational, DS, GS, and Depot Maintenance Manual, Including Repair Parts Generator Sets, Gasoline and Diesel Engine Driven, Trailer Mounted (Includes PU-401M FSN 6115-823-2217; PU-495/G FSN 6115-823-2215).
TM 11-5805-507-15/1 TO 31W1-2UCC4-2 NAVSHIPS 0967-337-7180	Multiplexer Set AN/UCC-4(V) (Service).
TM 11-5805-507-15/2 TO 31W1-2UCC4-3 NAVSHIPS 0967-337-7190	Multiplexer Set AN/UCC-4(V) (Circuit Diagrams).
TM 11-5805-507-15/3 TO 31W1-2UCC4-4 NAVSHIPS 0967-337-7200	Multiplexer Set AN/UCC-4(V) (Illustrated Parts Breakdown).
TM 11-5805-507-15/3P	Organizational Maintenance Repair Parts List, Multiplexer Set AN/UCC-4(V).
DTM 11-5820-614-12	Operator and Organizational Maintenance Manual, Radio Communications Subsystem AN/URC-61.
(S) DTM 11-5820-614-34/1	Direct Support and General Support Maintenance Manual, Radio Communications Subsystem AN/URC-61 (Functional Description and Performance Testing) (U).
DTM 11-5820-614-34/2	Direct Support and General Support Maintenance Manual, Radio Communications Subsystem AN/URC-61.
DTM 11-5820-614-34/3	Direct Support and General Support Maintenance Manual, Radio Communications Subsystem AN/URC-61.
(S) DTM 11-5820-614-34/4	Direct Support and General Support Maintenance Manual, Radio Communications Subsystem AN/URC-61 (U).
DTM 11-5820-802-12	Operational and Organizational Maintenance Manual for Converter, Frequency, Static CV-3061/TSC-54.
DTM 11-5820-802-20P	Organizational Maintenance Repair Parts and Special Tools; Converter Frequency, Static CV-3061/TSC-54.
DTM 11-5820-802-34	Direct Support and General Support Maintenance Manual for Converter, Frequency, Static CV-3061/TSC-54.
DTM 11-5820-802-34P	Direct Support and General Support, Maintenance Repair Parts and Special Tools (Including Depot Maintenance Repair Parts and Special Tools) Converter, Frequency, Static CV-3061/TSC-54.
DTM 11-5820-803-12	Operator and Organizational Maintenance Manual for Modem, Digital Data—Phase Shift Keying MD-921/G.
DTM 11-5820-303-20P	Organizational Maintenance Repair Parts and Special Tools List for Modem, Digital Data—Phase Shift Keying MD-921/G.
DTM 11-5820-803-34	Direct Support and General Support Maintenance Manual for Modem, Digital Data—Phase Shift Keying MD-921/G.
DTM 11-5820-803-34P	DS, GS and Depot Maintenance Repair Parts and Special Tools List for Modem, Digital Data—Phase Shift Keying MD-921/G.
DTM 11-5820-804-12	Operator and Organizational Maintenance Manual for Modem, Digital Data—Interconnect Facility MD-920/G.
DTM 11-5820-804-20P	Organizational Maintenance Repair Parts and Special Tools List for Modem, Digital Data—Interconnect Facility MD-920/G.
DTM 11-5820-804-34	Direct Support and General Support Maintenance Manual for Modem, Digital Data—Interconnect Facility MD-920/G.
DTM 11-5820-804-34P	GS, DS and Depot Maintenance Repair Parts and Special Tools List for Modem, Digital Data—Interconnect Facility MD-920/G.
DTM 11-5820-819-12	Operator's and Organizational Maintenance Manual Including Repair Parts and Special Tools List, Amplifier, Parametric AM-6676/TSC-54(V).
DTM 11-5820-819-34	Direct and General Support Maintenance Manual Including Repair Parts and Special Tools List, Amplifier, Parametric AM-6676/TSC-54.
TM 11-5895-389-12 NAVSHIPS 0967-377-7010 TO 31R5-2TSC54-11	Operator and Organizational Maintenance Manual, Satellite Communication Terminal AN/TSC-54.

Table A-1 Documents and Technical Manuals for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Publication number	Nomenclature
TM 11-5895-389-15-1	Operator's, Organizational, DS, GS and Depot Maintenance Manual (including Repair Parts Lists), Maintenance and Storage Shelters in Support of Terminal, Satellite Communication AN/TSC-54 (S-483/TSC-54, S-484/TSC-54 and S-XXX).
TM 11-5895-389-34/1 NAVSHIPS 0967-377-7020 TO 31R5-2TSC54-22	DS and GS Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Functional Analysis).
TM 11-5895-389-34/2 NAVSHIPS 0967-377-7020 TO 31R5-2TSC54-22	DS and GS Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Detailed Circuit Analysis).
TM 11-5895-389-34/3 NAVSHIPS 0967-377-7020 TO 31R5-2TSC54-22	DS and GS Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Functional Diagrams).
TM 11-5895-389-34/4 NAVSHIPS 0967-377-7020 TO 31R5-2TSC54-22	DS and GS Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Maintenance Data).
TM 11-5895-389-34/5 NAVSHIPS 0967-377-702 TO 31R5-2TSC54-22	DS and GS Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Alignment, Calibration, and Testing Procedures).
TM 11-5895-389-34P NAVELEX 0967-377-7040 TO 31R5-2TSC54-24	Direct Support and General Support Maintenance Repair Parts and Special Tools Lists (Including Depot Maintenance Repair Parts and Special Tools), Terminal Satellite Communications AN/TSC-54.
TM 11-5895-389-50/1 NAVSHIPS 0967-377-7030 TO 31R5-2TSC54-33	Depot Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (General Repair Data).
TM 11-5895-389-50/2 NAVSHIPS 0967-377-7030 TO 31R5-2TSC54-33	Depot Maintenance Manual, Satellite Communication Terminal AN/TSC-54.
TM 11-5895-389-50/3 NAVSHIPS 0967-377-7030 TO 31R5-2TSC54-33	Depot Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Module Testing and Troubleshooting Data).
TM 11-5895-389-50/4 NAVSHIPS 0967-377-7030 TO 31R5-2TSC54-33	Depot Maintenance Manual, Satellite Communication Terminal AN/TSC-54 (Alignment Procedures and Depot Overhaul Standards).
DTM 11-5895-783-12	Operator's and Organizational Maintenance Manual for Power Distribution-Switching Unit SA-1901/TSC-54.
DTM 11-5895-783-20P	Operator and Organizational Repair Parts and Special Tools List for Power Distribution-Switching Unit SA-1901/TSC-54.
DTM 11-5895-783-35	Direct Support, General Support and Depot Maintenance Manual, Power Distribution-Switching Unit SA-1901/TSC-54.
DTM 11-5895-783-35P	Direct Support, General Support and Depot Maintenance Repair Parts and Special Tools List, Power Distribution-Switching Unit SA-1901/TSC-54.
DTM 11-5895-796-12-3	Operator and Organizational Maintenance Manual, Multiplexer Set AN/TCC-79 (Communications Subsystem). AN/TCC-79 Multiplexer Set Maintenance Allocation Chart (MAC).
DTM 11-5895-796-20P-3	Organizational Maintenance Repair Parts and Special Tools List, Multiplexer Set AN/TCC-79.
DTM 11-5895-796-34-1	Direct Support, General Support, and Depot Maintenance Manual, Frequency Modulator OM-46(V)1/TCC, OM-46(V)2/TCC and OM-46(V)3/TCC and Demodulator OM-47(V)1/TCC, OM-47(V)2/TCC and OM-47(V)3/TCC (Multiplexer Sets AN/TCC-78, AN/TCC-79 and Non-Nodal).
DTM 11-5895-796-34-2	Direct Support and General Support Maintenance Manual, Communications Subsystem (Modem Group OM-45(V)/TCC).
DTM 11-5895-796-34-3	Direct Support, General Support and Depot Maintenance Manual, Communications Subsystem (Voice Orderwire Equipment).
DTM 11-5895-796-34-4	Direct Support, General Support and Depot Maintenance Manual, Communications Subsystem (Signal Line Conditioning Equipment).
DTM 11-5895-796-34-5	Direct Support, General Support and Depot Maintenance Manual, Communications Subsystem (DC Telegraph Equipment).
DTM 11-5895-796-34P-1	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools); (Frequency Modulator OM-46(V)1/TCC, OM-46(V)2/TCC and OM-46(V)3/TCC and Demodulator OM-47(V)1/TCC, OM-47(V)2/TCC and OM-47(V)3/TCC) (Multiplexer Sets AN/TCC-78, AN/TCC-79, and Non-Nodal) (Consists of Volume I, Volume II, Volume III and Volume IV).
DTM 11-5895-796-34P-2	Direct Support, General Support Maintenance Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts and Special Tools); (Modem Group OM-45(V)/TCC) (Multiplexer Set AN/TCC-79.

Table A-1. Documents and Technical Manuals for ETC Using the Satellite Communication Terminal AN/TSC-54- Continued

Publication number	Nomenclature
DTM 11-5895-796-34P-3	Direct Support, General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools); (Voice Orderwire Equipment) (Multiplexer Set AN/TCC-79).
DTM 11-5895-796-34P-4	Direct Support, General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools) for Line Conditioning Equipment (Multiplexer Set AN/TCC-79).
DTM 11-5895-796-34P-5	Direct Support, General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools) (DC Telegraph Equipment) (Multiplexer Set AN/TCC-79).
DTM 11-5895-796-34P-11	Direct Support, General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools); Multiplexer Set AN/TCC-79.
IM 11-5895-797-14	Operator, Organizational, Direct/General Support, and Depot Maintenance Manual Including Repair Parts and Special Tools List of Convertar, Analog-Digital CV-3034/G.
DTM 11-5895-833-12	Operator's and Organizational Maintenance Manual, Frequency Conversion Subsystem for Satellite Communication Terminal AN/TSC-54.
DTM 11-5895-833-12P	Operator's and Organizational Maintenance Repair Parts and Special Tools List Manual, Frequency Conversion Subsystem for Satellite Communication Terminal AN/TSC-54.
DTM 11-5895-833-34	Direct Support and General Support Maintenance Manual, Frequency Conversion Subsystem for Satellite Communications Terminal AN/TSC-54.
DTM 11-5895-833-34P	Direct Support and General Support Maintenance Repair Parts and Special Tools List (including Depot Maintenance Repair Parts and Special Tools) Manual, Frequency Conversion Subsystem for Satellite Communication Terminal AN/TSC-54.
DMWR 11-5895-833-50	Depot Maintenance Work Requirements Manual, Frequency Conversion Subsystem for Satellite Communication Terminal AN/TSC-54.

APPENDIX B
ETC TEST EQUIPMENT

B-1. Scope

Appendix B contains a list of test equipment required for maintenance and operation of the ETC Using the Satellite Communications Terminal AN/TSC-54.

B-2. Explanation of Columns

The following is an explanation of the columns in the Test Equipment Requirements listing (table B-1).

a. Nomenclature Column. This column indicates test equipment by item name and type designator. The test equipment contained in this column is listed in alphabetical order.

b. FSN/Mfr Column. This column indicates the FSN, when applicable, and manufacturer of the test equipment item.

c. Maintenance/Calibration Publications Column. This column indicates the maintenance and calibration publication applicable to the test equipment item, when available.

d. Systems Column. This column indicates the Major Subsystem for which the test equipment is required.

Table B-1. Test Equipment Requirements for ETC Using the Satellite Communication Terminal AN/TSC-54

Nomenclature				
Item name	Type designator	FSN/mfr	Maintenance/calibration publications	Systems
Adapter, Test Plug, BNC Female	AD-1	5935-463-8071 Trompeter		AN/TSC-54
Adapter, N Male — N Female, Right Angle	UG-27B/U 82-98	5935-518-8846 5935-280-2251 Amphenol		AN/TSC-54
Adapter, N Male — N Female, Right Angle	UG-27C/U 82-213	5935-204-8382 Amphenol		AN/TSC-54
Adapter, Straight Type N, Male to Male	UG-29B/U	5935-643-9875		AN/TSC-54
Adapter, Straight BNC Male to BNC Male	UG-914/U	5935-280-1454		AN/TSC-54
Adapter, Coax to Waveguide, N Female — WR112	UG-1054/U H281A	5985-295-9824 Hewlett-Packard	TO 33A1-13-373 17-20GV-08	AN/TSC-54
Adapter, BNC Jack and Banana Plug	UG-1917/U GR274QBJ	5935-709-5709 General Radio		AN/TSC-54
Adapter to BNC Female, 50-ohm	UG-1918/U 0874QBJA	5935-671-8325 Tektronix		AN/TSC-54
Adapter, BNC 50-ohm	MX-4528/U 91-8B	6625-973-2296 Boonton		AN/TSC-54
Adapter, SRM, Plug to Jack (2 Req'd)	50-672-6701-89	Sealectro		AN/TSC-54
Adapter, SRM, Plug to BNC Jack (2 Req'd)	50-674-6801-89	Sealectro		AN/TSC-54
Adapter, Rt. Angle Plug to SRM Jack (2 Req'd)	50-678-0000-3L	5935-420-0433 5935-917-5437 Sealectro		AN/TSC-54
Adapter, BNC Bulkhead to Conhex, Snap-On, 50-ohm	51-075-6801	5935-988-5646 Sealectro		AN/TSC-54
Adapter, Conhex, Subminiature Tee, Snap-On, Female/ Male/Female	51-086-0000	5935-134-5304 Sealectro		AN/TSC-54
Adapter, N Female - N Female	3080-0000	Amerıcon		AN/TSC-54
Adapter, N Female — BNC Female	3080-2320	Amerıcon		AN/TSC-54

Table B-1. Test Equipment Requirements for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Nomenclature				
Item name	Type designator	FSN/mfr	Maintenance/alteration publications	Systems
Adapter, N Male - N Male (2 Req'd)	3081-0000	Amphenol		AN/TSC-54
Adapter, N Male - BNC Female (2 Req'd)	3082-2320	5935-759-0847 Amphenol		AN/TSC-54
Adapter, N Female - BNC Male	3082-2321	Amphenol		AN/TSC-54
Adapter, BNC Male — BNC Male (2 Req'd)	3281-0000	5935-758-5531 Amphenol		AN/TSC-54
Adapter, BNC Female — TNC Male	3182-2320	Amphenol		AN/TSC-54
Adapter, BNC Female — BNC Female	3280-0000	5935-758-5330 Amphenol		AN/TSC-54
Analyzer, Spectrum 10 MHz to 40 GHz	AN/USM-366(V)1 491	6625-494-2937 Tektronix	TB 9-6625-2467-14 TO 33K3-4-1-07(692) 17-20GW-09	AN/TSC-54 and AN/URC-61
Analyzer, Wave 1 KHz to 18 MHz	TS-3066(V) 1/U H05-312A	6625-160-0535 6625-689-7685 Hewlett-Packard	TB 9-6625-1867-50 TO33K3-4-1-15(1480)	AN/URC-61
Attenuator, Variable 0 to 101 dB; 0 to 1000 MHz	CN-796/U 432C	5985-831-5991 Kay Electric	TO 33K4-4-1-1(25)	AN/URC-61
Attenuator, Variable 0 to 12 dB, dc to 1 GHz	CN-970/U 355C	5985-993-1377 Hewlett-Packard	TB 9-5985-310-50 TO 33A1-13-140 TO 33K4-4-1-1(25) 17-20AN-07	AN/TSC-54 and AN/TCC-79
Attenuator, Variable 0 to 120 dB, dc to 1 GHz	CN-1128/U 355D	5985-957-1860 Hewlett-Packard	TO 33A1-13-140 TO 33K4-4-1-1(25) 17-20AN-14	AN/TSC-54
Attenuator, Fixed 10 dB	CN-1364 757B-10	5985-835-3934 Narda Microwave	17-20GA-05	AN/TSC-54
Attenuator, Variable, Waveguide, Precision 0 to 50 dB, 7.05 GHz to 10 GHz	CN-1367/U H382A	6625-679-0625 Hewlett-Packard	TB 9-6625-765-50 TO 33K4-4-1-1(30) 17-20GA-07	AN/TSC-54
Attenuator, Variable 0 to 101 dB (2 ea)	432D	5985-087-2547 Kay Electric	TM11-5985-237-12P TM 11-5985-237-45P TM 33K4-4-1-1(25) TM 33K4-4-1-1(325) 17-20GA-15	AN/TSC-54
Attenuator, Fixed 3 dB	757C-3	5985-222-0465 Narda	17-20GA-05	AN/TSC-54
Attenuator, Fixed 6 dB	757C-6	5985-118-7985 Narda	17-20GA-05	AN/TSC-54
Attenuator, Fixed 20 dB	757C-20	5985-121-4979 Narda	TO 33K4-4-1-1(25) 17-20GA-05	AN/TSC-54
Converter, Frequency Electronic, 50 to 512 MHz	CV-2002/U 5253B	6625-266-3483 Hewlett-Packard	TB 9-6625-1360-50 TM 11-6625-1515-15 TM 11-6625-1682-15/1 & 15/2 TO 33A1-7-89 TO 33K3-4-1-1(53) 17-20AF-22	AN/TCC-79, AN/TSC-54 and AN/URC-61
Converter, Frequency, Plug-In for H-P 5245L, 3 to 12.4 GHz	CV-3059/U 5255A	6625-058-3042 Hewlett-Packard	TB 9-6625-1374-50 TO 33A1-5-272 TO 33A3-4-1-1(53) 17-20GF-14	AN/TSC-54
Converter, Frequency	5255	6625-058-3042 Hewlett-Packard	TB 9-6625-1374-50	AN/TSC-54

Table B-1. Test Equipment Requirements for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Nomenclature				
Item name	Type designator	FSN/mfr	Maintenance/calibration publications	Systems
Counter, Electronic, Frequency Measuring 0 to 50 MHz	CP-772/U 5245L	6625-973-4837 Hewlett-Packard	TB 9-6625-781-50 TM 11-6625-1548-15 TO 33A1-10-76 TO 33K3-4-1-1(53) 17-20AF-11	AN/TSC-54, AN/TCC-79, AV/URC-61, and CV-3061/TSC-54
Coupler, Directional	B-D3-10V	Olektron		AN/TSC-54
Coupler, Directional	CR-10-2.5	Merrimac		AN/TSC-54
Coupler, Directional	CU-1984/U 752C	5985-729-6971 Hewlett-Packard	17-20GN-09	AN/TSC-54
Coupler, Directional 10 dB	3004-10	5985-485-3735 5985-788-6962 Narda Microwave	TO 33K4-4-1-1(2) 17-20GN-06	AN/TSC-54
Detector, Crystal	RF-253/U 423A	6625-880-4978 Hewlett-Packard	TO 33A1-5-330	AN/TSC-54
Detector, Directional	1025	Kruse		AN/TSC-54
Divider, Current (Shunt)	MX-8699/U 11028A	5895-242-4031 Hewlett-Packard	TO 33K1-4-1-8(713)	AN/TSC-54
Extender, Card (50 pin)	218573-801	Magnavox		AN/URC-61
Extender, Card (56 pin)	218573-802	Magnavox		AN/URC-61
Extender, PCBD	01G006331-000	Louis Allis		AN/TSC-54
Extender, PCBD	01G006332-000	Louis Allis		AN/TSC-54
Generator, Signal UHF	AN/URM-61A TS-403A/U 616A	6625-519-2056 Hewlett-Packard	TB 9-6625-124-50 TO 33A1-8-160 TO 33K3-4-1-1(15) 17-20GG-01	AN/TSC-54
Generator, Signal Frequency Response	AN/USM-272 191	6625-957-0421 Tektronix	TB 9-6625-1473-50 TM 11-6625-2384-15 TO 33A1-8-518 TO 33K3-4-1-13(1266) 17-20AG-108	AN/TSC-54 and AN/URC-61
Generator, Signal 5 Hz to 560 kHz 5 bands	SG-632/U 204B-01	6625-986-4625 Hewlett-Packard	TB 9-6625-029-50 TM 11-6625-1589-15 TO 33A1-8-543 TO 33K3-4-1-7(638) 17-20AG-109	AN/TSC-54 AN/URC-61
Generator, Signal SHF	SG-944/U 620B	6625-107-8173 Hewlett-Packard	TB 9-6625-791-50 TO 33K3-4-1-1(87) 17-20GG-01	AN/TSC-54
Generator, Signal VHF, 10 MHz—480 MHz	TS-510B/U 608E	6625-176-5708 6625-857-4352 Hewlett-Packard	TB 9-6625-1437-50 TO 33A1-8-564 TO 33K3-4-1-13(1280) 17-20AG-118	AN/TSC-54
Hybrid Ring	715731-801	Magnavox Research Lab		AN/URC-61
Junction, Broadband, Hybrid	HV-50	Anzac		AN/TSC-54
Meter, Power, RF	AN/USM-260 431C	4931-913-3008 6625-917-3099 Hewlett-Packard	TB 9-6625-086-50 TO 33K1-4-1-10(991) 17-20GP-11	AN/TSC-54
Meter, Multi Clamp-On	633VA-1	6625-506-0003	TB 9-6625-005-50	AN/TSC-54
Mixer, Double Balanced, Coaxial 0.2 to 500 MHz	CV-2343/U 10514A	5985-087-4714 Hewlett-Packard		AN/TSC-54
Mount, Thermistor	MX-2144A/U 477B	6625-519-2414 Hewlett-Packard	TO 33K4-4-1-1(24) 17-20GD-08	AN/TSC-54
Mount, Thermistor	MX-7772/U 478A	6625-886-1955 Hewlett-Packard	TB 9-6625-086-50 TO 33A1-7-47 TO 33K4-4-1-1(52) 17-20GD-08	AN/TSC-54

Table B-1. Test Equipment Requirements for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Nomenclature				
Item name	Type designator	FSN/mfr	Maintenance/calibration publications	Systems
Multimeter, General Purpose, AC and DC Voltages	AN/PSM-6B 199-5002	6625-957-4374 Bruno Ind.	TB 11-6625-475-35/1 TB 9-6625-755-50 TM 11-6625-475-10, 25P TO 33A1-12-2 TO 33K1-4-1-2(141)	AN/TSC-54
Multimeter, Volt-Ohm	AN/USM-210 260	6625-019-0815 6625-149-6301 Simpson	TB 9-6625-961-50 17-20AQ-14	AN/TSC-54 CV-3061/TSC-54
Multimeter, Volt-Ammeter, Clamp-On	633 Type VA-1	6625-907-8360 6625-506-0003 Weston	TB 9-6625-005-50 TO 33A1-4-1-9(853) TO 33A1-12-212 17-20AQ-32	AN/TSC-54
Noise Source	(Not Identified)			AN/URC-61
Oscillator, RF, Sweep, Mainframe	MX-8364P/ USM-308(V) 8690A	6625-928-0364 Hewlett-Packard	Mfr Manual TO 33A1-8-484 17-20GG-31	AN/TSC-54
Oscillator, Plug-In, Sweep, Microwave 7 to 11 GHz	RF-254/U HO2-8694A	6625-159-2224 6625-689-6787 Hewlett-Packard	TO 33K4-4-1-5(402) 17-20GG-31	AN/TSC-54
Oscilloscope 200 mV to 200 V	AN/USM-254 130C	6625-069-5477 Hewlett-Packard	TB 9-6625-977-50, 35 TM 11-6625-1615-15 TO 33A1-13-281 TO 33K3-4-1-9(855) 17-20AW-43	AN/TSC-54
Oscilloscope, dc to 50 MHz	AN/USM-273 453	6625-930-6637 Tektronix	TB 9-6625-1451-50 TO 33A1-13-336 TO 33K3-4-1-13(1204) 17-20AW-65	AN/TSC-54, AN/URC-61 CV-3061/TSC-54
Oscilloscope, Dual Trace, 25 MHz Bistable Storage	434 (with 2 ea. P6007 Probes)	Tektronix		AN/TSC-54
Plug-In Unit, Generator Sweep	5008-4	Kruse-Storke		AN/TSC-54
Potentiometer	MIL-R-94/3 RV4LAYSA252A	5905-643-5641		AN/TSC-54
Prescaler, Plug-In Unit	PL-1303/U 5252A	6625-441-1871 Hewlett-Packard	TB 9-6625-781-50 TO 33K3-4-1-1(53)	AN/URC-61
Probe, AC	MX-8881/U 11036A	6625-910-5973 Hewlett-Packard	TO 33K1-4-1-12(1116)	AN/TSC-54
Probe, AC Clamp-On	MX-8891/U 456A-01	6625-076-0806 Hewlett-Packard	TB 9-6625-1135-50 TO 33K1-4-1-6(559)	AN/TSC-54
Probe, Adapter	MX-8885/U P6028	6625-964-9267 Tektronix		AN/TSC-54
Recorder, X-Y General Purpose	7035B	6625-463-6042 Hewlett-Packard (Moseley)	TB 9-6625-1496-35 TB 9-6625-1496-50 TO 33A1-8-482 TO 33K1-4-1-19(1828)	AN/TSC-54
Satellite Link Simulator Test Adapter (Tester, Back-to-Back)	MX-560	Magnavox Research Lab	MRL Commercial Manual R-4566	AN/URC-61
Shunt, 100A, 50 mV DC		Sealectro		AN/TSC-54
Test Cable (2 Req'd)	2129003215-1	Comtech Labs		AN/TSC-54
Test Cable	2129003215-2	Comtech Labs		AN/TSC-54
Test Cable	2129003215-3	Comtech Labs		AN/TSC-54
Test Cable (2 Req'd)	2129003216-1	Comtech Labs		AN/TSC-54
Test Cable (6 Req'd)	2129003217-1	Comtech Labs		AN/TSC-54
Test Cable (2 Req'd)	2129003218-1	Comtech Labs		AN/TSC-54
Test Cable	2129003219-1	Comtech Labs		AN/TSC-54
Test Cable	2129003220-1	Comtech Labs		AN/TSC-54

Table B-1. Test Equipment Requirement for ETC Using the Satellite Communications Terminal AN/TSC-54- Continued

Nomenclature				
Item name	Type designator	FSN/mfr	Maintenance/calibration publications	Systems
Test Cable	2129003220-2	Comtech Labs		AN/TSC-54
Test Cable (2 Req'd)	6003-205765	Fluke		AN/TSC-54
Test Cable	6003-205789	Fluke		AN/TSC-54
Test Cable	6003-205806	Fluke		AN/TSC-54
Test Cable (2 Req'd)	SOL-SOL-D-000.06.0	Solitron		AN/TSC-54
Test Cable (2 Req'd)	SOL-SOL-D-000.12.0	Solitron		AN/TSC-54
Test Cable (2 Req'd)	SOL-SOL-D-000.24.0	Solitron		AN/TSC-54
Test Cable (2 Req'd)	SOL-SOL-D-000.36.0	Solitron		AN/TSC-54
Test Cable	PCX-96-40	Trompeter		AN/TSC-54
Test Cable	PCX-144-50	Trompeter		AN/TSC-54
Test Fixture, Remote Frequency Control	4040003461	Comtech Labs		AN/TSC-54
Test Fixture, Remote Frequency Control	4040003462	Comtech Labs		AN/TSC-54
Transformer, RF	TF-547-U 11005A	5980-678-0343 Hewlett-Packard	TO 33A1-12-664	AN/TSC-54
Voltmeter, RF	ME-407/U 91DA	6625-947-7559 Boonton	TB 9-6625-025-50 TM 11-6625-1527-15 TO 33A1-12-658 TO 33K1-4-1-18(1723) 17-20AE-22	AN/TSC-54
Voltmeter, Differential	ME-408/U 891A	6625-456-7459 John Fluke	TB 9-6625-1495-59 TO 33A1-12-879 TO 33K8-4-1-7(627)	AN/TSC-54
Voltmeter, Multifunction	ME-303/U 410C	6625-902-7140 Hewlett-Packard	TB 9-6625-046-50 TM11-6625-1614-15 TO 33A1-12-704 TO 33K1-4-1-12(1116) 17-20AQ-47	AN/TSC-54
Voltmeter, RF, 3 V to 300 mV	AN/URM-145 91C	6625-985-5331 6625-817-8908 Boonton Elect	TB 9-6625-025-50 TO 33A1-12-254 TO 33K1-4-1-8(718) 17-20AE-22	AN/TSC-54
Voltmeter, RMS	AN/USM-224(U)A ME-318/U 3400A	6625-727-4705 Hewlett-Packard	TB 9-6625-011-50 TM 11-6625-1541-15 TO 33A1-12-643-1 TO 33K1-4-1-13(1248) 17-20AE-42	AN/TCC-79
Wavemeter, Frequency, 7.05 GHz to 10 GHz	FR-194/U H532A	6625-730-8570 Hewlett-Packard	TB 9-6625-120-35 TO 33K4-4-1-2(196) 17-20GF-04	AN/TSC-54
Wavemeter, Frequency Coaxial	ME-409/U N414A	6625-877-4368 Microlab/FXR	TO 33K4-4-1-4(348) 17-20FG-10	AN/TSC-54
Waveguide Assembly	CG-3674/U 5088A	5985-168-9453 Waveline		AN/TSC-54
Waveguide Assembly	CG-3673/U 594B	5985-061-5536 Waveline		AN/TSC-54

GLOSSARY

C

CARRIER-TO-NOISE DENSITY RATIO (C/kT) -The ratio of carrier power to noise density usually expressed in dB, as measured at the input to the associated demodulator. Carrier power is the total energy of the carrier over its entire bandwidth, usually measured as the input to the demodulator. Noise density is the noise power measured at the same interface point, divided by the noise bandwidth of both the measuring equipment and the equipment to which it is connected. Noise density is expressed in terms of noise power in watts per cycle of bandwidth and is proportional to Boltzmans constant times absolute temperature in degrees Kelvin.

CMDT- Corrective Maintenance Downtime.

D

DCA **-Defense Communications Agency.**

DSCS - Defense Satellite Communications System.

E

ETC - Earth Terminal Complex.

F

FM - Frequency Modulation.

I

ICF - Interconnect Facility.

IF - Intermediate Frequency.

O

OUT-OF-BAND NOISE (OBN) - The measure of noise power at a frequency approximately ten percent above the highest baseband frequency. Monitoring out-of-band noise permits evaluation of FM circuit quality without interrupting service.

P

PMDT — Preventive Maintenance Downtime.

PSK --Phase Shift Keying.

R

RF -Radio Frequency.

S

SSMA- Spread Spectrum Multiple Access.

T

TCF -Technical Control Facility.

ALPHABETICAL INDEX

Subject	Paragraph, *Figure, Table, Number*
A	
AC power application	2-8
Adjustments:	
Electronic frequency up-converter CV-3084/MSC-46 IF Input level adjustment	3-10
ETC system Adjustments	**2-13**
FM receive baseband adjustments	**3-18**
Frequency modulator OM-46(V)2/TCC IF output level adjustment	**3-6**
Analog digital converter CV-3034/G	**1-16.** *4-2f*
Antenna, erecting of	**2-5c**
Antenna, preliminary disassembly of	**2-17a**
Antenna-receiver transmitter group OA-8244/TSC-54	**4-2d**
B	
Block diagram, ETC using the satellite communications terminal ANTSC-54.	**FO-2**
C	
Cable connections	**2-5b(2)**
Cable disconnection	**2-17b**
Cable interconnection, ETC	**2-5b**
Capability and limitations of the ETC using the satellite communications terminal AN/TSC-54	**3-2**
Carrier-to-noise density ratio (C/kT) measurement	**S-S**
Communication terminal group OW-11/TSC-54	**4-2d(1)**
Corrective maintenance downtime (CMDT).	***5-3b***
D	
DC telegraph equipment	***4-2a(5)***
DSCD STACOM control	***3-28***
Decrease in complex capability, emergency operation of the ETC resulting from	***3-25e***
Demodulator OM-47(V)2/TCC, frequency modulator OM-46(V)2/TCC and	***4-2a(3)***
Depot level maintenance	***5-2c***
Diagrams:	
ETC using the satellite communications terminal AN/TSC-54. simplified block diagrams	***FO-2***
Interconnect cable diagram for **ETC** using the satellite communications terminal AN/TSC-54	***FO-3***
Signal flow and level diagram for **ETC** using the satellite communications terminal AN/TSC-54	**FO-4**
Diesel engine generator sets PU-401/M and PU-495/G	**1-17** **4-2i**
Diesel engine generator set PU-401/M fails, emergency operation of the ETC when	***3-25d***
Dieselengine generator set PU-495/G fails. emergency operation of the ETC when	***3-25b***
Digital error rate measurement	***5-8***
Digital data modem **MD-920/G** (ICF modem)	**1-14** **4-2e**
Digital data modem MD-921/G (PSK modem)	**1-15**
Disassembly of equipment	
Cable disconnection	**2-17b**
Preliminary disassembly of antenna	**2-17a**
Documents and technical manuals for ETC using the satellite communications terminal AN/TSC-54	**TA-1**
Doppler augmentor range corrector	**4-2b(2)**
Downlink monitor, satellite	**5-9**
Downtime	
Corrective maintenance downtime (CMDT)	**5-3b**
Preventive maintenance downtime (PMDT)	**5-3a**
E	
Electrical equipment shelter S-483/TSC-54..	**1-18** F1-6
Electrical equipment shelter	**1-18** **F1-6**

Subject	Paragraph, Figure Table Number
Electrical equipment shelter S-484/TSC54 and S-XXX	1-19 F1-7
Electrical inspections	2-7a
Electronic frequency down-converter CV-3085/MSC-46 frequency change procedure	3-8
Electronic frequency downconverter CV-3085/MSC-46 MISSION LOG tag	F3-2
Electronic frequency up-converter CV-3084/MSC-46 frequency change	3-7
Electronic frequency up-converter CV-3084/MSC-46 IF input level adjustment	3-10
Electronic frequency upconverter CV-3084/MSC-46 MISSION LOG tag	F3-1
Emergency operation	
Emergency operation of the ETC resulting from a decrease in complex capability	3-25e
Emergency operation of the ETC resulting from external electronic Interference	*3-25f*
Emergency operation of the ETC when commercial power fads	3-25a
Emergency operation of the ETC when diesel engine generator set PU-401/M fails	3-25d
Emergency operation of the ETC when diesel engine generator set PU-495/G fails	3-25b
Emergency operation of the ETC when static frequency converter CV-3061/TSC-54 fails	3-25c
Equipment identification and location	
Analog-digital converter CV-3084/G	1-16
Diesel engine generator sets PU-401/M and PU-495/G	1-17
Digital data modem MD-920/G (ICF modem)	1-14
Digital data modem MD-921/G (PSK modem)	1-15
Multiplexer set AN/TCC-79	1-11
Multiplexer set AN/TCC-79 equipment identification	F1-5
Power distribution switching unit SA-1901/TSC-54	1-12
Radio communications subsystem AN/URC-61	1-10
Satellite communications terminal AN/TSC-54	1-9
Satellite communication terminal AN/TSC-54 equipment identification.	F1-4
Static frequency converter CV-3061/TSC-54	1-13
Equipment installation and cable interconnection	2-5
Equipment requirements for installation	2-4
Equipment tree for ETC using the satellite communications terminal AN/TSC-54 typical	F1-3
ETC cable disconnection and equipment removal	2-17
ETC cable interconnection	2-5b
ETC equipment installation	2-5a
ETC equipment tree	1-5 F1-3
ETC normal configuration	3-4
ETC physical site configuration	1-7
ETC planning considerations	2-1
ETC purpose and use	1-4
ETC receive adjustments	5-5b
ETC system adjustments	2-13 5-5
ETC technical characteristics	1-6
ETC transmit power calibration	3-11
ETC using the satellite communications terminal AN/TSC-54 simplified block diagram	FO-2
ETC using the satellite communications terminal AN/TSC-54 typical	FO-1
ETC using the satellite communications terminal AN/TSC-54 typical physical site configuration for an	FO-1
Erecting the antenna	2-5c
External electronic interference emergency operation of the ETC resulting from	1-25f
F	
Failures:	
ETC failures that affect all transmit and receive communications	3-21
ETC failures that affect all transmit trunks	3-22e
ETC failures that affect individual transmit trunks	3-22b
ETC failures that affect all receive trunks	3-23a
ETC failures that affect individual receive trunks	3-23b
ETC failures that affect antenna tracking.	3-24
FM link establishment	3-13
FM receive baseband adjustment.	3-18
Frequency change	
Electronic frequency down-converter CV-3085/MSC-46 frequency change procedure	3-8
Electronic frequency up-converter CV-3084/MSC-46 frequency change procedure	3-7
Frequency demodulator OM-47(V)2/TCC IF input attenuator (AT1) minimum settings	TA-1
Frequency modulator OM-46(V)2/TCC IF output level adjustments	3-6

Subject	Paragraph, Figure Table Number
Functional operation:	
Analog-digital converter CV-3934/G;	*4-2f*
Antenna-receiver-transmitter group OA-8244/TSC-54	4-2d(2)
Communication terminal group OW-11/TSC-54	4-2d(1)
D.c. telegraph equipment	4-2a(5)
Diesel engine generator sets PU-401/M and PU-495/G	4-2i
Digital data modem MD-92O/G (ICF modem).	2-4e
Doppler augmentor range corrector	4-2d(2)
Frequency modulator OM-46(V)2/TCC and demodulator OM-47(V)2/TCC	4-2a(3)
Line conditioning equipment	4-2a(6)
Link terminal timing central TD-851/URC-61.	4-2b(1)
Modem group OM-45(V)/TCC	4-2a(2)
Multiplexer/demultiplexer equipment	4-2a(1)
Multiplexer set **AN/TCC-79**	4-2a
Power distribution-switching unit SA-1901/TSC-54	4-2g
Radio communication subsystem AN/URC-61	4-2b
Receiver No, 1	4-2b(4)
Receiver No *2*	4-2b(5)
Satellite communications terminal AN/TSC-54	4-2d
Static frequency converter CV-3061/TSC-54	2-4h
Transmitter	***2-2b(3)***
Voice orderwire equipment.	4-2a(4)
Functional Operation of the ETC	4-2
G	
General support or base support	***5-2b***
Ground field, installation of	***2-2b***
Grounding of equipment	***2-5b(1)***
I	
IF. input level adjustment, electronic frequency up-converter CV-3084/MSC-46 . .	3-10
IF. output level adjustment frequency modulator OM-46(V)2/TCC . .	3-6
Inspections:	
Electrical inspections	***2-7a***
Interconnect cable inspections	2-7b
Mechanical inspections . . .	2-7b
Power inspections . .	2-7e
Installation, equipment .	2-5a
Installation of ground field .	2-2d
Installation planning procedures	2-2
Interconnect cables and wiring for ETC using the satellite communications terminal AN/TSC-54	T2-1
Interconnect cable diagram . . .	6-2
Interconnect cable diagram for ETC using the satellite communications terminal AN/TSC-54	FO-3
Interconnect cable inspection	***2-7d***
K	
Key indicators used in monitoring overall operation of the ETC using the satellite communications terminal AN/TSC-54	T3-1
L	
Line conditioning equipment	4-2a(6)
Link establishment:	
FM link establishment	3-13
PSK link establishment	3-14
URC link establishment	4-15
Link performance tests	2-15
Link terminal timing central TD-851/URC-61:	2-2a(1)
List of major subsystems and major subgroups comprising the ETC using the satellite communications terminal AN/TSC-54	T1-2
M	
Maintenance forms and records	
Maintenance functions	
Depot level maintenance	3-2a
General support or base support facility	3-2b
Organizational/direct support maintenance (on-site/off-site)	3-2d
Maintenance, preventive and corrective	1-18
	F-16

Subject	Paragraph, Figure, Table, Number
Maintaining and changing RF power.	3-17
Major subsystems and major subgroups of the ETC using the satellite communications terminal AN/TSC-54	1-8
Measurements:	
C/kT measurement using an HP-310A or HP-312A wave analyzer.	5-5a
C/kT **measurement** using Tektronix 491 spectrum analyzer	*5-5b*
C/kT **measurement** using and HP-141T/8555A spectrum analyzer	5-5c
Digital error rate measurement.	5-8
Noise power density measurement	5-10
OBN measurement using a frequency selective levelmeter	5-7a
OBN measurement using a d.c. millivoltmeter	***5-7b***
Precise time and time interval (PTTI) measurement	3-16
TTNR measurement at in-band baseband frequency	5-6a
TTNR measurement at out-of-band frequency	***5-6b***
Mechanical inspections	***2-7b***
Modem group OM-45(V)2/TCC.	2-4a(2)
Multiplexer/demultipleer equipment	4-2a(1)
Multiplexer set AN/TCC-79	1-11; 4-2a
Multiplexer set AN/TCC--79, equipment identification	F1-5
N	
Nature and extent of maintenance.	5-2
Noise power density measurement	5-10
O	
OBN module output to TTNR conversion table.	T5-2
Operation of satellite communications terminal AN/TSC-54 under **contingency** conditions.	3-7
Operating restrictions	*3-36* *2-9b*
Oderwire configuration	3-12
Organizational/direct support maintenance (on-site/off-site)	5-2au
Out-of-band noise (OBN) **measurements**	5-7
Out-of-band TTNR test **tone** frequencies	T5-1
P	
Planning considerations, ETC	2-1
PMDT versus CMDT	5-3c
Power application, a.c.	2-8
Power distribution-switching unit SA-1901/TSC-54	1-12; 4-3g
Power failure	
Emergency operation of the ETC when commercial power fails	3-6a
Emergency operation of the ETC when diesel engine generator set PU-401/M fails.	3-6d
Emergency operation of the ETC when diesel engine generator set PU-495/G fails	***3-6b***
Emergency operation of the ETC when static frequency converter CV-3061/TSC-54 Fails	3-6c
Power inspections	2-7c
Precise time and time interval (PTTI) measurement	3-16
Preliminary disassembly of antenna .	2-17a
Preliminary visual inspections of the ETC.	2-7
Preoperational procedures.	3-5
Preventive and corrective maintenance	5-3
Preventive maintenance downtime (PMDT)	5-3a
Prime power to the ETC. application of	3-5
PSK link establishment	3-14
Purpose and use of ETC	
Purpose	1-4a
Use	1-4b
Purpose of system manual	1-1
Radio communications subsystem AN/URC-61	1-10; 4-2b
Receive adjustments. ETC	2-5b
Receiver No. 1	4-2b(4)
Receiver No. 2	4-2b(5)
Reporting of errors	1-2

Subject	Paragraph, Figure, Table, Number
RF power, maintaining and changing	3-17
S	
Satellite acquisition	3-9
Satellite communications terminal AN/TSC-54	1-9; 1-2d
Satellite communications terminal AN/TSC-54, equipment identification	F1-4
Satellite downlink monitor	6-9
Scope	1-1
Service upon receipt and equipment placement	2-3
Signal flow and level diagram	6-3
Signal flow and level diagram for ETC using the satellite communications terminal AN/TSC-54	FO-4
Site clearing and earth grading	2-2c
Site configuration;	
ETC physical site configuration	1 - 7
Typical physical sire configuration for an ETC using satellite communications terminal AN/TSC-54	FO-1
Site Selection	2-2a
Soil Consideration	*2-2b*
Static Frequency Converter CV-3061/TSC-54.	1-13; 4-2h
Static Frequency Converter CV-.30661/TSC-54 Fails, Emergency Operation of the ETC when	3-6c
Storage Shelters S-484/TSC-54 and S-XXX	F1-7
Subsystem Turn-On and Checkout	2-9
System Adjustments, ETC	2-13; 5-5
T	
Technical Characteristics:	
ETC Technical Characteristics	1-6
Technical Characteristics of ETC using the Satellite Communications Terminal AN/TSC-54	T1-1
Tests:	
Link Performance Test	2-15
Tests for Performance by each ETC	2-12
Tests for Performance by TEP Team	2-11
Test equipment requirements for TEC using the satellite communications terminal AN/TSC-54.	TB-1
Teat equipment setup for carrier-noise ratio (C/kT) measurement using the wave analyzer.	***F5-1***
Teat equipment setup for out-band noise (OBN) measurement	F5-2
T&equipment setup for test tone-to-noise (TTNR) measurement	F5-3
Transmit power calibration, ETC	3-11
Transmitter	4-2b(3)
Turn-on and checkout, order of	2-9b
Turn-on and checkout, system	2-9
Typical communications network within DSCS phase II satellite system	F1-2
Typical ETC using the satellite communications terminal AN/TSC-54.	F1-1
Typical physical site configuration for ETC using the satellite communications terminal AN/TSC-54	FO-1
U	
URC link establishment	3-15
V	
Visual Inspections of the ETC, Preliminary..	2-7
Voice Orderwire Equipment	4-2a(4)

★U.S. GOVERNMENT PRINTING OFFICE: 1976—603-770:392

By Order of the Secretaries of the Army, the Navy, and the Air Force:

FRED C. WEYAND
General, United States Army
Chief of Stuff

Official:

PAUL T. SMITH
Major General, United States Army
The Adjutant General

JULIAN S. LAKE
Rear Admiral, United States Navy
Commander Naval Electronic
Systems Command

DAVID C. JONES, General USAF
Chief of Staff

Official:

F. MICHAEL ROGERS, General, USAF
Commander, Air Force Logistics Command

Distribution:

To be distributed in accordance with DA Form 12-51, Operator TM literature requirements for AN/TSC-54.

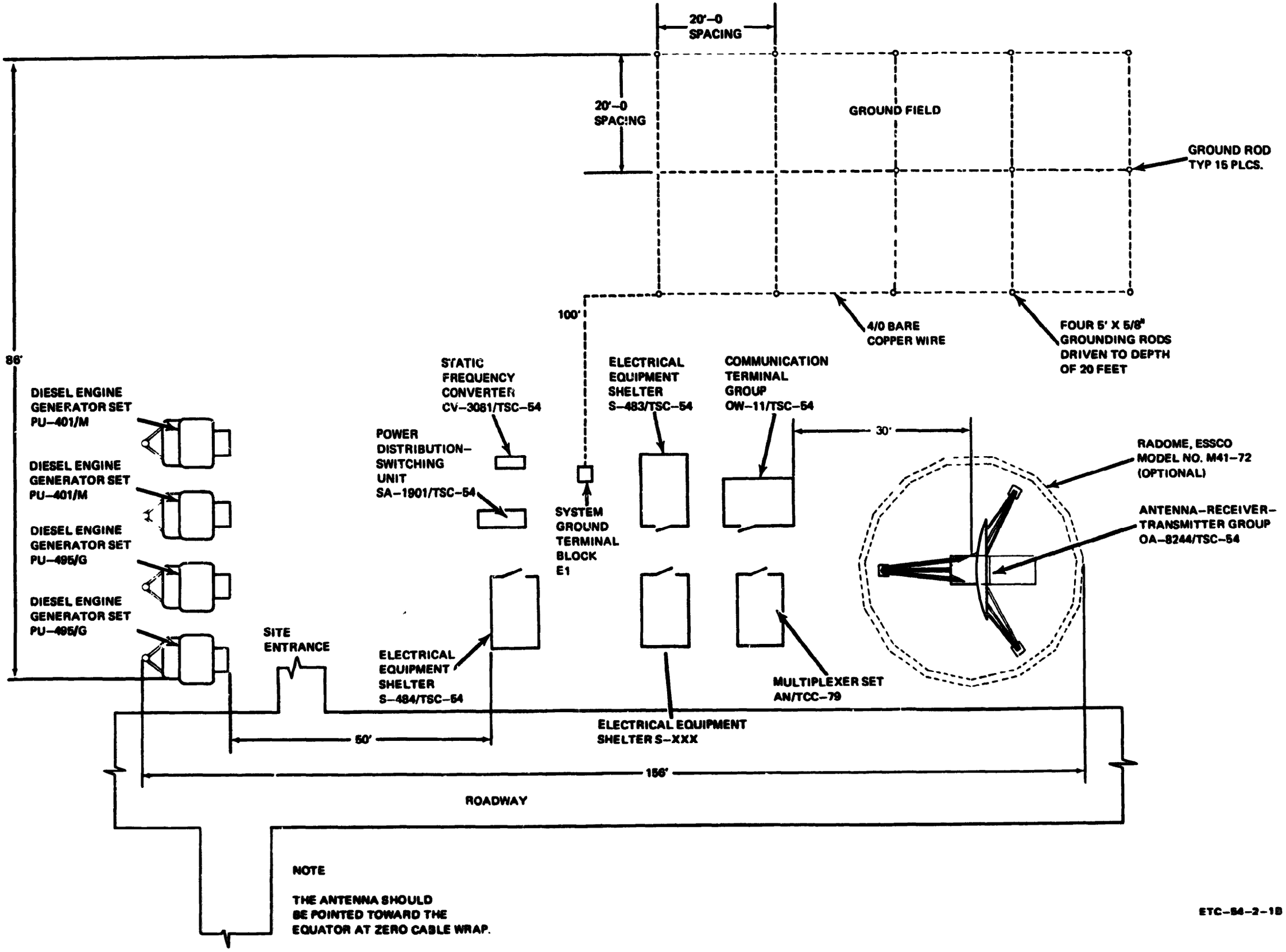
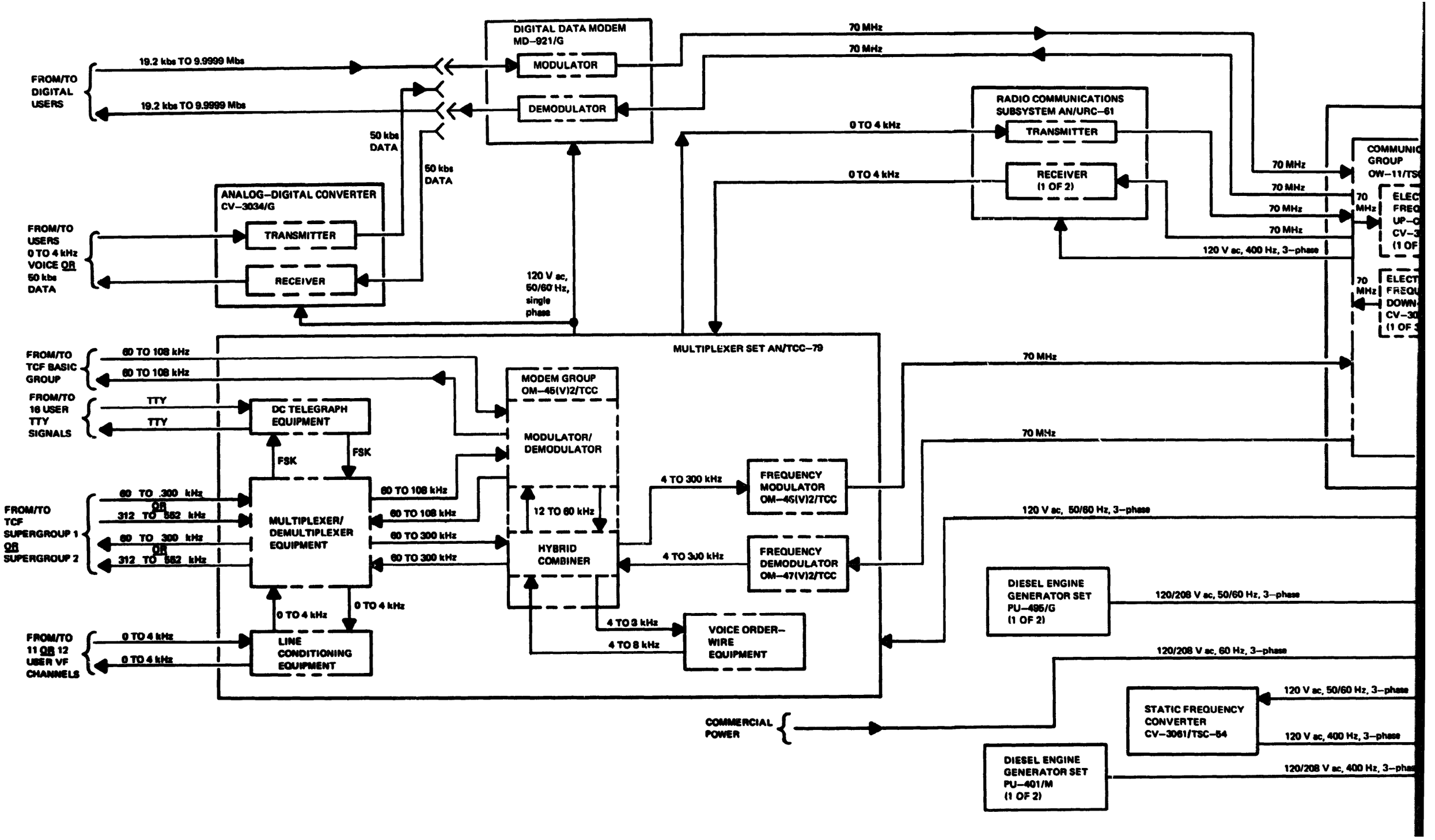


Figure FO-1 Typical physical site configuration for an ETC using the satellite communications terminal AN/TSC-54


DIGITAL DATA MODEM
MD–921/G
MODULATOR
DEMODULATOR
FROM/TO
DIGITAL
USERS
19.2 kbs TO 9.9999 Mbs
19.2 kbs TO 9.9999 Mbs
50 kbs
DATA
50 kbs
DATA
70 MHz
70 MHz
RADIO COMMUNICATIONS
SUBSYSTEM AN/URC–61
TRANSMITTER
RECEIVER
(1 OF 2)
0 TO 4 kHz
0 TO 4 kHz
70 MHz
70 MHz
70 MHz
70 MHz
120 V ac, 400 Hz, 3–phase
ANALOG–DIGITAL CONVERTER
CV–3034/G
TRANSMITTER
RECEIVER
FROM/TO
USERS
0 TO 4 kHz
VOICE OR
50 kbs
DATA
120 V ac,
50/60 Hz,
single
phase
MULTIPLEXER SET AN/TCC–79
FROM/TO
TCF BASIC
GROUP
60 TO 108 kHz
60 TO 108 kHz
MODEM GROUP
OM–45(V)2/TCC
FROM/TO
16 USER
TTY
SIGNALS
TTY
TTY
DC TELEGRAPH
EQUIPMENT
FSK
FSK
MODULATOR/
DEMODULATOR
FROM/TO
TCF
SUPERGROUP 1
OR
SUPERGROUP 2
60 TO 300 kHz
OR
312 TO 552 kHz
60 TO 300 kHz
OR
312 TO 552 kHz
MULTIPLEXER/
DEMULTIPLEXER
EQUIPMENT
60 TO 108 kHz
60 TO 108 kHz
60 TO 300 kHz
60 TO 300 kHz
12 TO 60 kHz
HYBRID
COMBINER
4 TO 300 kHz
4 TO 300 kHz
FREQUENCY
MODULATOR
OM–46(V)2/TCC
FREQUENCY
DEMODULATOR
OM–47(V)2/TCC
0 TO 4 kHz
0 TO 4 kHz
4 TO 8 kHz
4 TO 8 kHz
VOICE ORDER–
WIRE
EQUIPMENT
FROM/TO
11 OR 12
USER VF
CHANNELS
0 TO 4 kHz
0 TO 4 kHz
LINE
CONDITIONING
EQUIPMENT
70 MHz
70 MHz
120 V ac, 50/60 Hz, 3–phase
DIESEL ENGINE
GENERATOR SET
PU–495/G
(1 OF 2)
120/208 V ac, 50/60 Hz, 3–phase
120/208 V ac, 60 Hz, 3–phase
STATIC FREQUENCY
CONVERTER
CV–3061/TSC–54
120 V ac, 50/60 Hz, 3–phase
120 V ac, 400 Hz, 3–phase
COMMERCIAL
POWER
DIESEL ENGINE
GENERATOR SET
PU–401/M
(1 OF 2)
120/208 V ac, 400 Hz, 3–phase

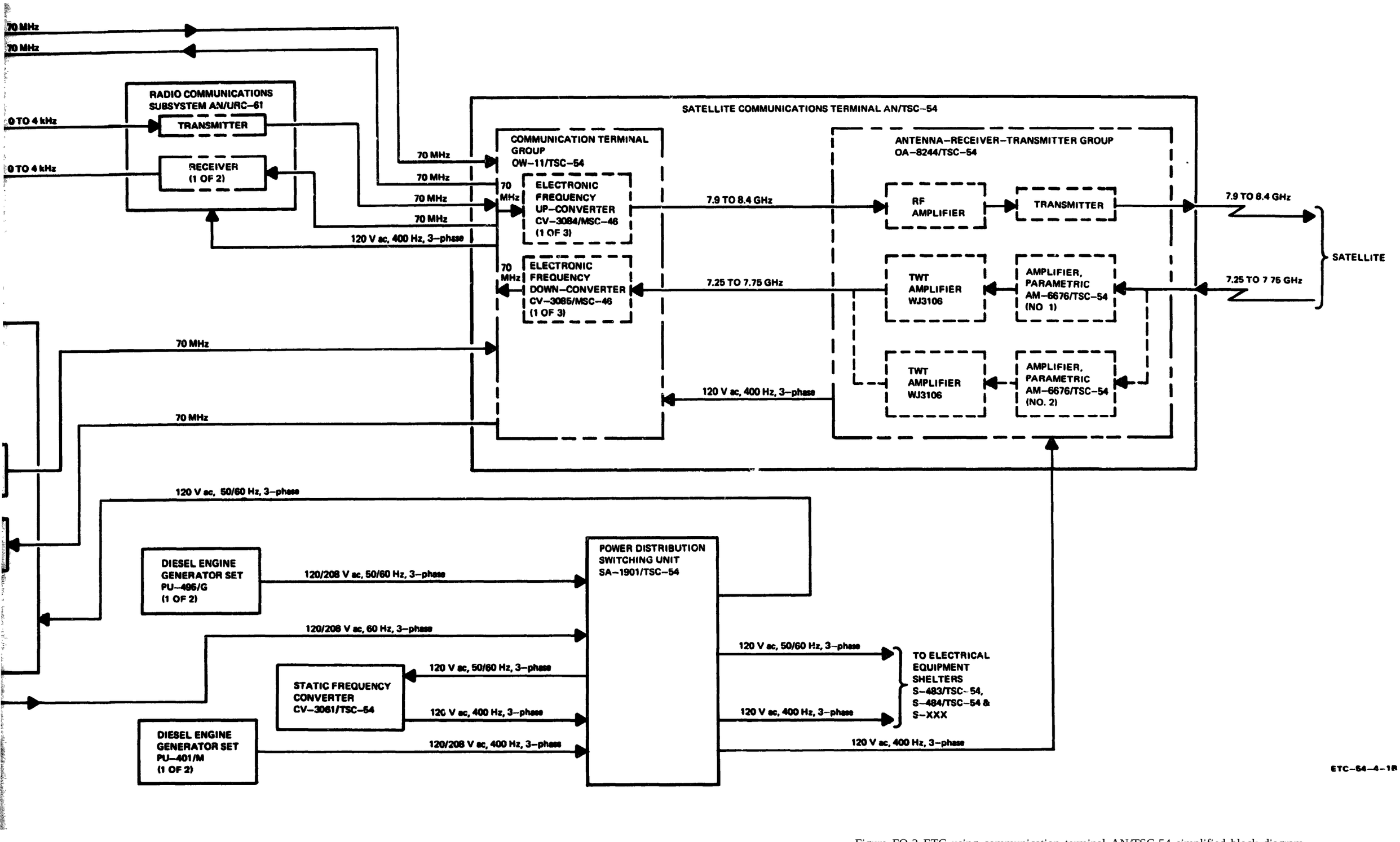


Figure FO-2 ETC using communication terminal AN/TSC-54 simplified block diagram

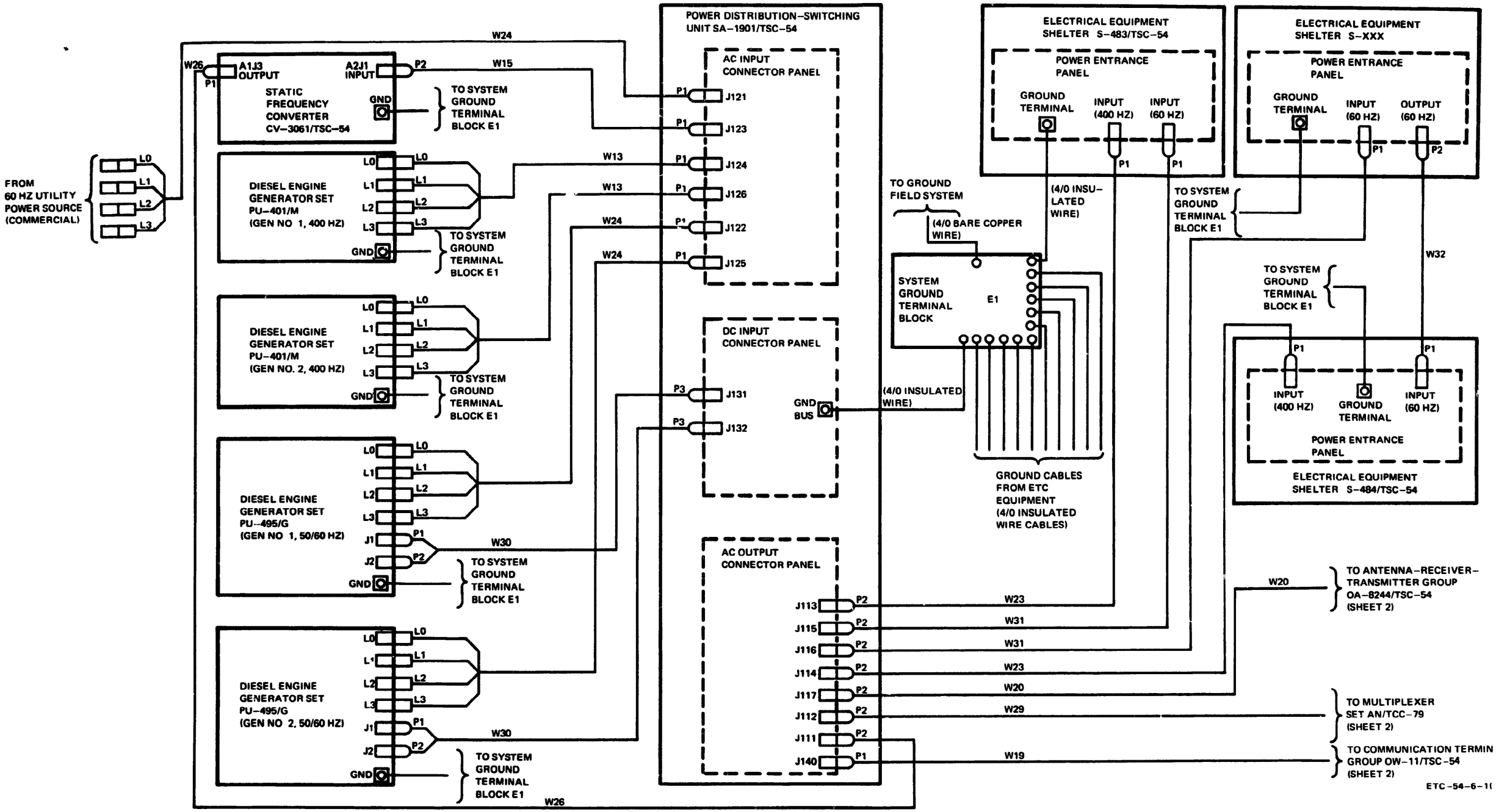


Figure FO-3 ⓪ *Interconnect cable diagram for ETC using the satellite communication terminal AN/TSC-54* ***(sheet 1** of 2)*

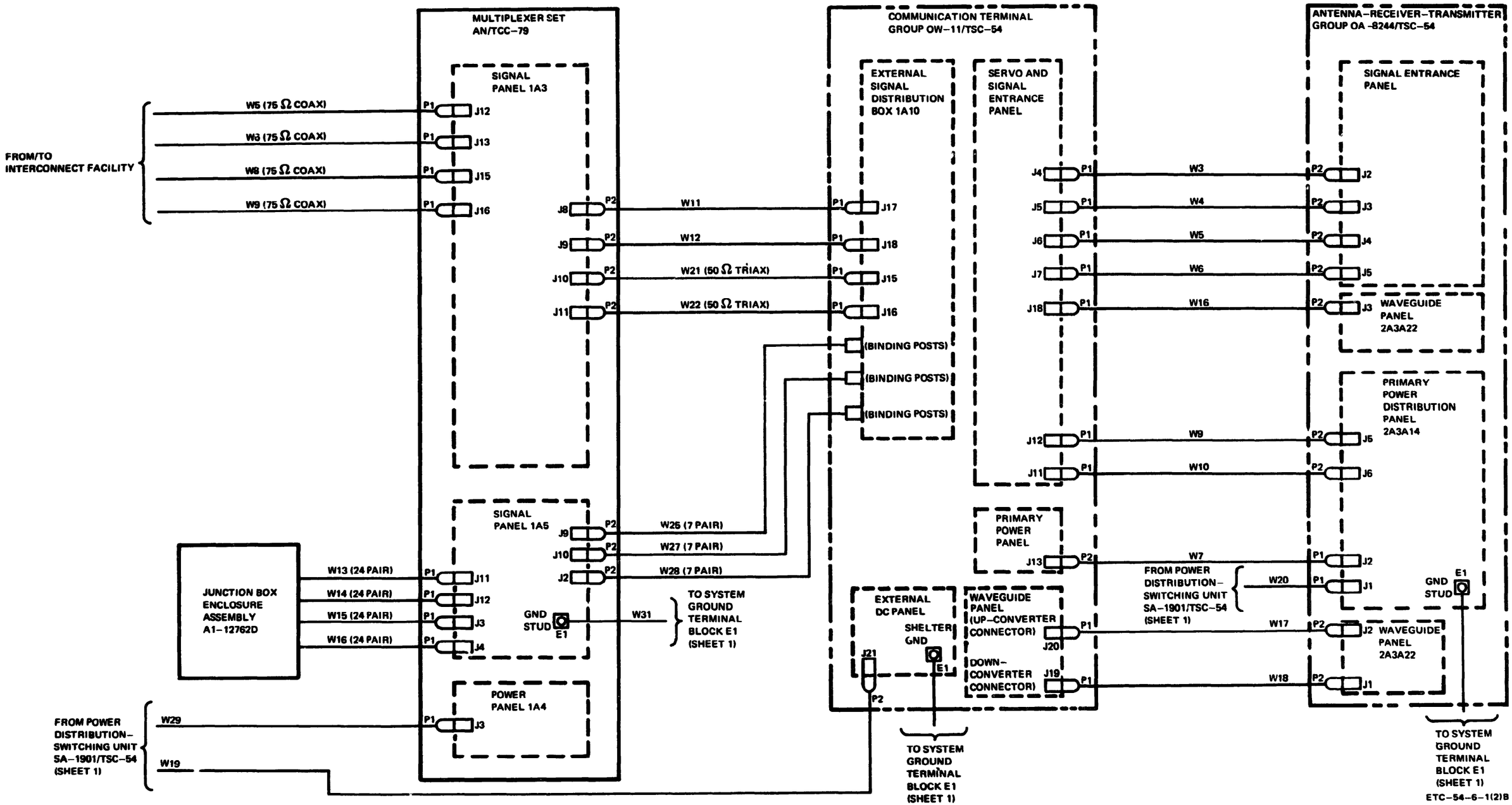


Figure FO-32. Interconnect cable diagram for ETC using the satellite communications terminal AN/TSC-54 (sheet 2 of 2)

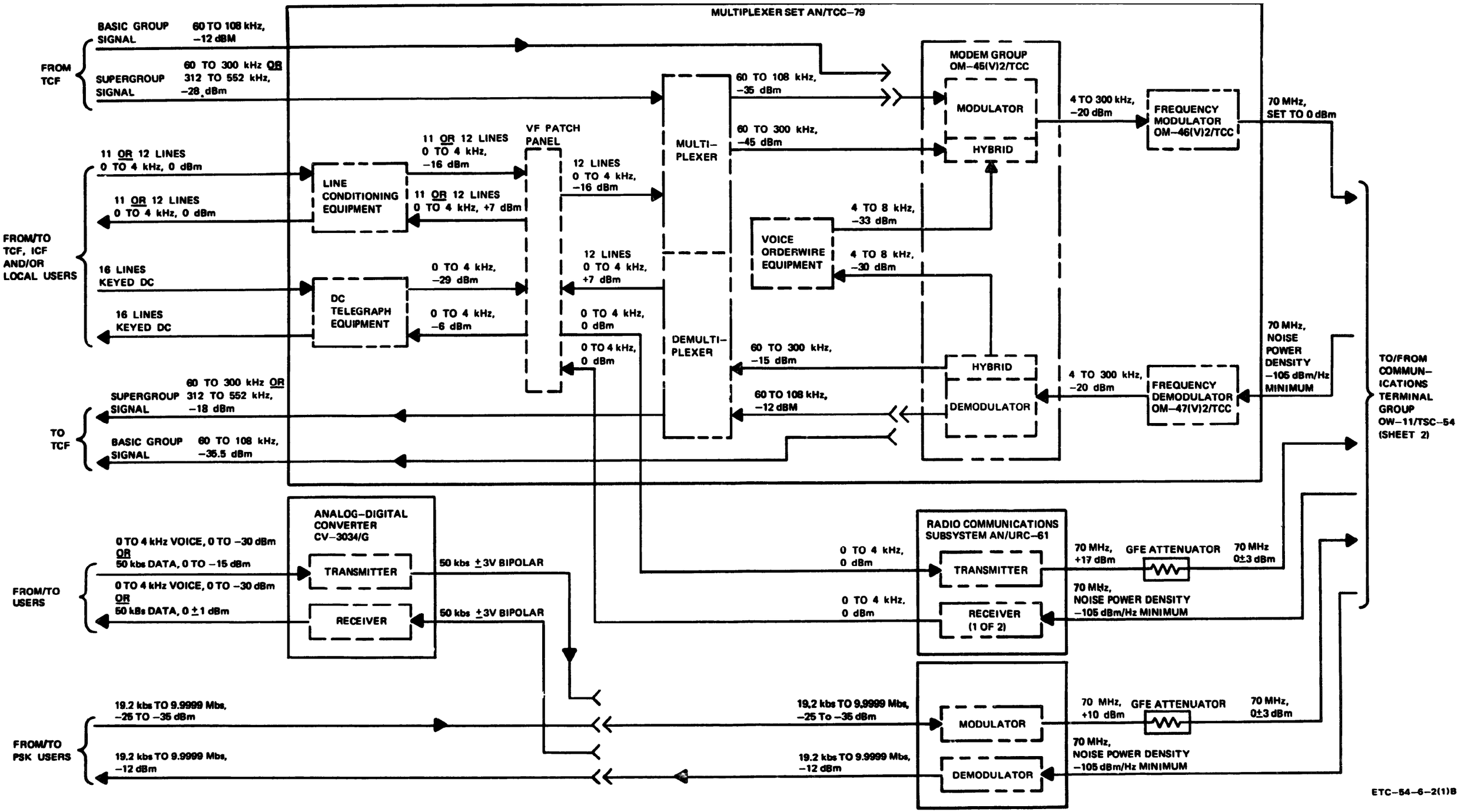


Figure FO-4 ⓫ *Signal flow and level diagram for ETC using satellite communications* ***terminal AN/TSC-54 (sheet 1 of 2).***

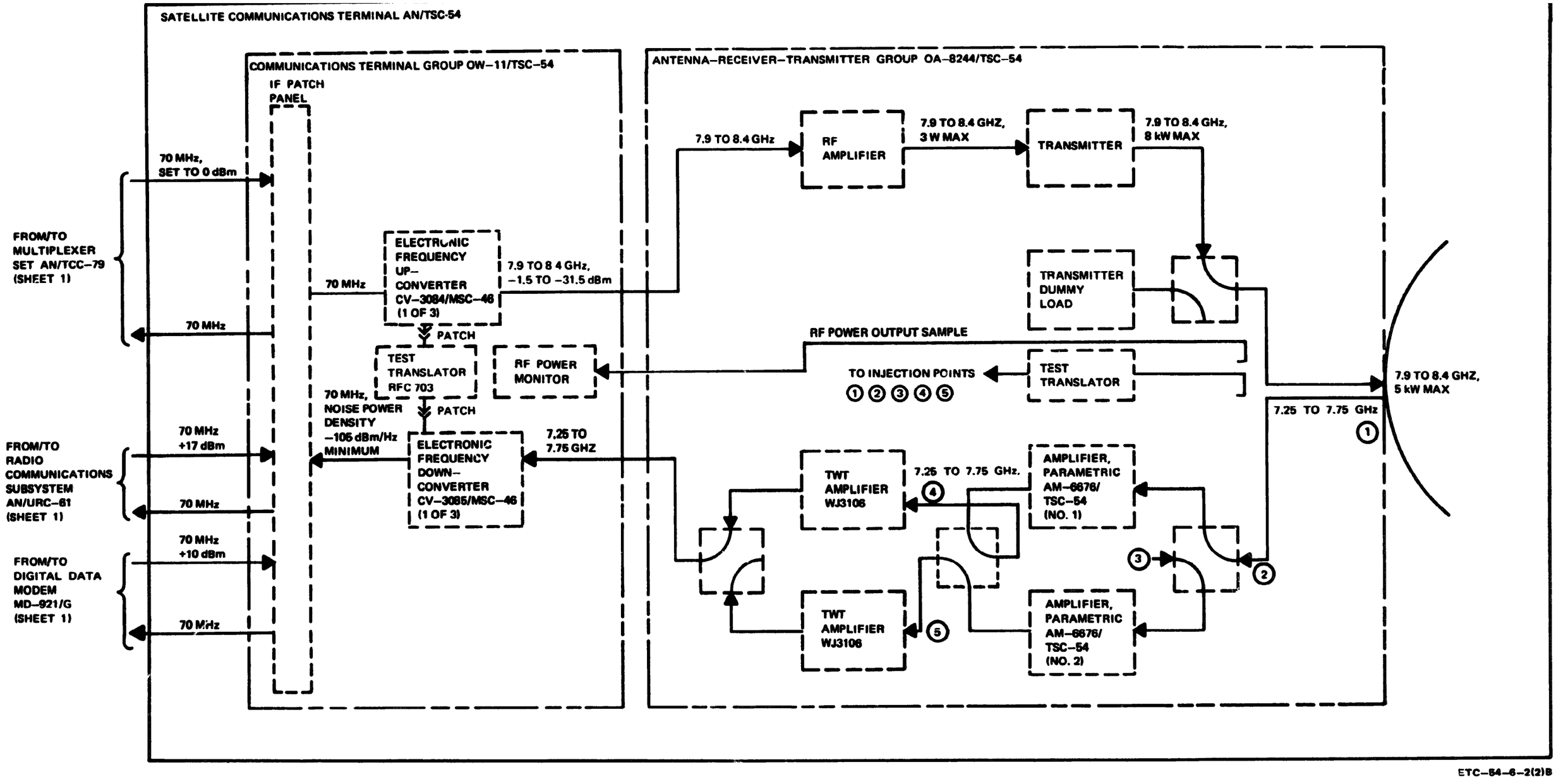


Figure FO-4(2) Signal flow and level diagram for ETC using satellite communications terminal AN/TSC-54 (sheet 2 of 2)

DEPARTMENT OF THE ARMY
US ARMY AG PUBLICATIONS CENTER
1655 WOODSON ROAD
ST LOUIS MISSOURI 63114

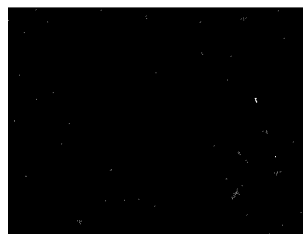
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314

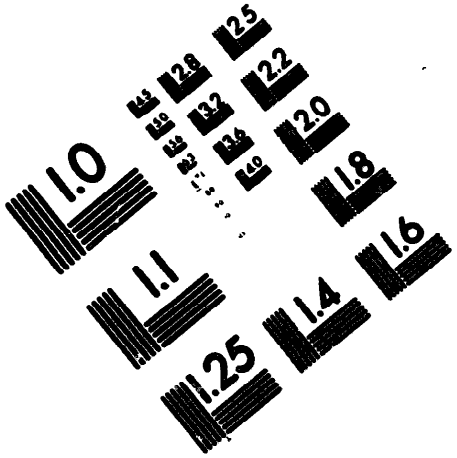
END

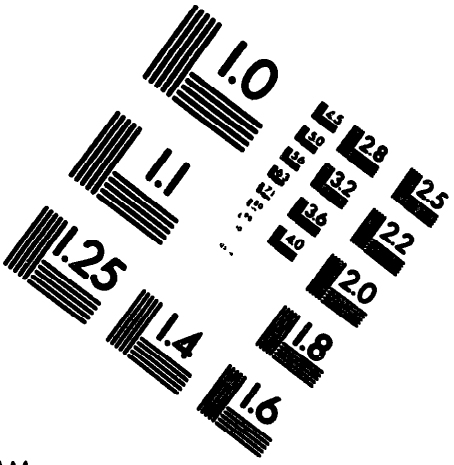
03-04-83

DATE



MICROFORM
TEST TARGET





150 MM

10 mm (e= 81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

15 mm (e= 109 mm)

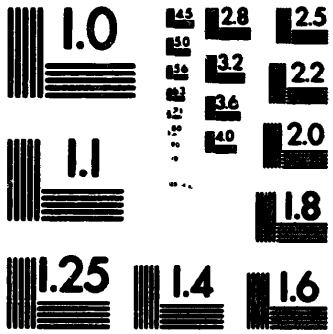
ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

2.0 mm (e= 1.37 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*



10 mm (e= 81 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

15 mm (e= 109 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890
abcdefghijklmnopqrstuvwxyz$¢£/%#½¼¾—=+×&@*

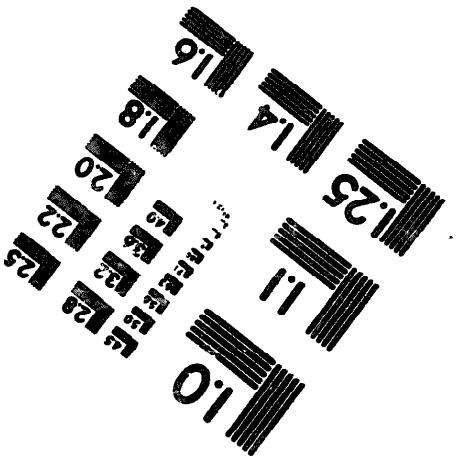
2.0 mm (e= 1.37 mm)

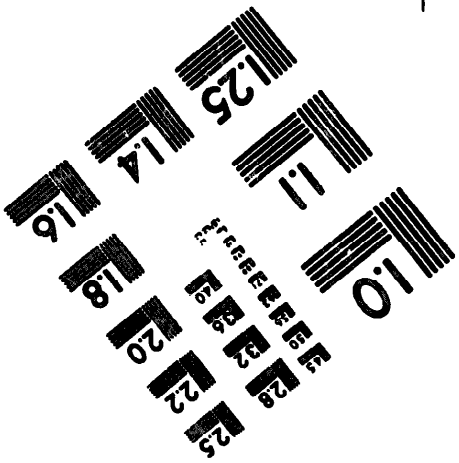
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

2.5 mm (e= 1.77 mm)

ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz
1234567890$¢£/%#½¼¾—=+×&@*

200 MM





250 MM