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TECHNICAL EVALUATION PROGRAM REPORT

NARROWBAND HIGH FREQUENCY

OSAN COMMANDO ESCORT STATION

OSAN AIR BASE, KOREA

PREPARED BY

1815th TEST AND EVALUATION SQUADRON/TEOR (AFCC)

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*C Escort of
Osan
did not
work.*

11 JAN 1983

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1961 CG/LGM, APO San Francisco 96274	0	0	1
1982 CS/LGM, APO San Francisco 96264	0	0	1
1982 CS/DOY, APO San Francisco 96264	1	1	0
1956 CG/LGM, APO San Francisco 96328	0	0	1
1957 CG/LGM, Hickam AFB, HI 96853	0	0	1
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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AGC	automatic gain control
ALC	automatic load control
CEMI	Communications Electronics Maintenance Instruction
dB	decibel
dBm	decibel referenced to one milliwatt
FOT&E	follow-on operational test and evaluation
HF	high frequency
Hz	Hertz
IAW	in accordance with
IMD	intermodulation distortion
JCN	job control number
kW	kilowatt
LPA	linear power amplifier
LSB	lower sideband
MHz	megahertz
PA	power amplifier
PCD	Pacific Communications Division
PIM	patch intercept module
PMI	preventive maintenance inspection
RF	radio frequency
RLP	rotatable log periodic
SNR	signal-to-noise ratio
TGC	transmitter gain control
TO	technical order
URG	Universal Radio Group
USE	upper sideband
VDC	volts direct current
VSWR	voltage standing wave ratio

EXECUTIVE SUMMARY

TYPE AND PURPOSE OF EVALUATION: The 1815th Test and Evaluation Squadron conducted a Follow-on Operational Test and Evaluation of the Osan Commando Escort Station. The operation and maintenance were the responsibility of the 2146th Communications Group. This evaluation was conducted under the provisions of AFR 80-14, AFR 100-55, and AFCCR 100-55 to determine system capabilities and limitations.

Location: Osan AB, Korea

Dates: 2 November-19 November 1982

OBSERVATIONS:

a. **Receiver Performance:** The test results revealed degraded receiver performance. All four equipment levels required extensive maintenance actions. One equipment level met all specifications after alignments were performed. One equipment level was inoperative and awaiting parts. The remaining two equipment levels were operational but required further maintenance actions.

b. **Transmitter Performance:** All four ^{Transmitters} equipment levels required extensive maintenance actions. Two equipment levels met all specifications after corrective actions were performed. One equipment level still required an alignment; and the remaining level was not operational and awaiting a replacement part.

c. **Bandpass Filter Performance:** All receiver bandpass filters were tested. One filter was aligned while the remaining filters met specifications during preliminary testing.

d. **Antenna Performance:** The discone antenna was not operational and was awaiting maintenance actions. The two log periodic antenna systems were tested and found to be degraded due to various deficiencies.

e. **Operator Console Equipment:** Several deficiencies were discovered during testing. The problems were identified and corrective actions were initiated.

CONCLUSION:

Most major subsystems contained serious deficiencies. The majority of problems found during the evaluation could have been identified by either the site maintenance or the operations personnel. The degraded condition of the equipment questions the ability of this Commando Escort Station to perform its mission.

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EVALUATION SUMMARY

1.0 General

The performance of the Osan Air Base Commando Escort Station was evaluated in accordance with Air Force Regulation 80-14 and Air Force Communications Command Regulation 100-65, from 2 Nov-19 Nov 82. This Follow-on Operational Test and Evaluation (FOT&E II) was conducted to determine system capabilities and limitations. The 2146th Communications Group was responsible for the operation and maintenance of this station.

1.1 System/Equipment Description

This station consisted of four 671B-1 receiver/exciter, four 208U-3 linear power amplifiers, one Quick Track console, two rotatable log periodic antennas, one omnidirectional antenna, and ancillary equipment.

1.2 Key Personnel Contacted

<u>NAME</u>	<u>RANK/GRADE</u>	<u>POSITION</u>
Waltman, Richard P.	Lt Col	Chief of Maintenance
Lee, Delmar J.	CMSgt	Radio Branch Chief
McWilliams, Douglas	CMSgt	Maintenance Superintendent
Leninsky, Walter	SMSgt	Wire Branch Chief
Duryea, William T.	MSgt	Chief, Radio Operations
Holloway, Christopher	TSgt	Commando Escort Maintenance Supervisor
Robinson, Dale M.	SSgt	Ground Radio Equipment Repairman

1.3 Evaluation Team Composition

<u>NAME</u>	<u>RANK</u>	<u>AFSC</u>	<u>DUTY TITLE</u>
Kowalczyk, William J.	1st Lt	3055	Team Chief
Long, David A.	MSgt	30474	Transmitter Evaluator
Gunn, Byron W.	TSgt	30474	Receiver Evaluator

1.4 Test Procedures

System tests are outlined in Air Force Communications Command Regulation (AFCCR) 100-60, Volume IV, and AFCCR 100-65, Attachment 11. Preliminary data that met specifications was considered final data. The last data taken even though not meeting specifications was termed final data. The tests were implemented through equipment workcards, technical orders (TOs), and manufacturer's equipment manuals. Standards for this station were based on technical orders, the Pacific Communications Division (PCD) Communications Electronics Maintenance Instruction (CEMI), manufacturer's equipment specifications, calculated values, and measured performance data, as appropriate. The evaluation team used the same test equipment

authorized for use by site maintenance personnel. The test results, conclusions, and recommendations are summarized in paragraphs 2.0 through 5.3.

2.0 Test Results

2.1 Receivers

The solid state radio frequency (RF) tuners were installed by site personnel during the evaluation. The preliminary test results indicated that the four levels required extensive corrective maintenance actions. Initially, the equipment did not meet frequency accuracy, sensitivity, and signal-to-noise ratio (SNR) specifications. Level three met technical order (TO) specifications after alignments were performed. Level one was awaiting a complete alignment. Level two was inoperative and awaiting a replacement solid state RF tuner. Level four was awaiting replacement cards (See paragraphs 4.1 through 4.3.).

2.2 Transmitters

Performance tests were done on three of the four transmitters. Level four was inoperative during the evaluation. Level two did not meet TO specifications and was awaiting an alignment (See paragraphs 4.2 and 4.4.). Levels one and three met TO specifications after corrective actions such as alignments and parts replacement were performed.

2.3 Receiver Bandpass Filters

All four 635V-1 receiver bandpass filters were tested for gain and bandpass characteristics. The filter for level two met specifications after an alignment was performed. The remaining filters met specifications during preliminary tests.

2.4 Antennas

The two log periodic antenna systems were tested for voltage standing wave ratio (VSWR), transmission line loss, and orientation. The discone antenna was not operational and was awaiting maintenance actions (para 4.5). Preliminary testing on the rotatable log periodic (RLP) one transmission line indicated an open line. Antenna maintenance personnel locally fabricated a connector pin to correct the problem. Both log periodic antennas were operational but were degraded due to various deficiencies (See paragraphs 4.6 through 4.9.).

2.5 Line Equipment

The line adaptors, link units, and RT 10Bs were performance tested and adjusted as required. All specifications except audio output for option card C5 were met (para 4.10).

2.6 Operator Console

The single position operator console was performance tested and adjusted as required. Maintenance actions included replacement of a zener diode in level four and replacement of defective transistors in the patch logic cards for levels one, two, and four. All tested functions except one met specifications (para

4.11).

3.0 Omitted or Incomplete Tests

None of the required tests were omitted or incomplete.

4.0 Deficiencies

For HQ PCD/DOY: Request you process responses to deficiencies in accordance with procedures listed in AFCCR 100-65, Paragraph 26. Request you provide 1815 TES/TEOQ with information on all correspondence pertaining to deficiency corrections. This information will be used with that of other reports, in analyzing deficiencies, to determine whether a common problem exists at all atations.

4.1 Receiver One (OSAN-Nov 82-01)

Discussion: This receiver did not meet the automatic gain control (AGC) threshold and SNR specifications. Isolated alignments did not solve the deficiencies. (JCN: 3220013)

Recommendation: Site maintenance personnel should perform a complete alignment as outlined in CEMI 600-1. Proper operation should then be verified.

4.2 Transmitter/Receiver Two (OSAN-Nov 82-02)

Discussion: The receiver portion did not have an output when tuned to frequencies in the 27 MHz range. Preliminary testing on the transmitter portion revealed that the exciter output was fluctuating and this caused the transmit levels to fluctuate. These problems were attributed to the solid state tuner which was recently installed. (JCN: 3200015)

Recommendation: The replacement tuner should be installed when received from the depot. The performance tests for both the transmitter and receiver should then be done to verify proper operation.

4.3 Receiver Four (OSAN:Nov 82-03)

Discussion: This receiver did not produce any output signals. The receiver was moved to the work bench where investigation revealed that a number of printed circuit cards in the 789X-1 box were defective. These cards were placed on order but were not received prior to evaluation completion. (JCN:3210018)

Recommendation: The replacement cards should be installed, a complete alignment should be performed, and a performance test should be done to verify proper operation.

4.4 Transmitter Four (OSAN-Nov 82-04)

Discussion: Testing was not done on this equipment as it was inoperative prior to arrival of evaluation team and awaiting a

replacement power amplifier plate tuning coil. (JCN: 2820005)

Recommendation: The tuning coil should be installed when received, the necessary alignments should be performed, and proper operation should be verified.

4.5 Discone Antenna (OSAN-Nov 82-05)

Discussion: This antenna was inoperative prior to and during the evaluation. Antenna maintenance personnel had connected the antenna prior to team departure. The excessively high VSWR caused most of the transmitter power to be reflected back to the transmitter. (JCN: 2950009)

Recommendation: The antenna maintenance team should continue working on the antenna. The high VSWR problem should be corrected and a VSWR test should be performed before the job is closed.

4.6 Rotation Light for RLP-1 Antenna (OSAN-Nov 82-06)

Discussion: The antenna rotation indication light on the operator console was inoperative. This indication light was designed to be the only source of rotation information the operator receives other than physical observation of the antenna. By depending solely on the light, the operator must determine if the antenna had stopped rotation or if the antenna had even moved. Further testing revealed that the antenna rotation indication circuitry in the station building was fully operational. It appeared that the problem was external to the station building.

Recommendation: Antenna maintenance personnel should work with the cable maintenance personnel in resolving this deficiency.

4.7 Orientation for RLP-1 Antenna (OSAN-Nov 82-07)

Discussion: The antenna orientation was measured with a transit and was found to be 11 degrees west of the intended orientation. (JCN: 3220018)

Recommendation: The antenna maintenance personnel should correctly orient the antenna and verify the orientation with a transit.

4.8 Antenna RLP-2 Rotation (OSAN-Nov 82-08)

Discussion: Antenna RLP-2 would not rotate. At first it appeared that only the antenna rotation light was inoperative. When the antenna orientation test was attempted, it was found that the antenna did not rotate. (JCN: 3060027)

Recommendation: Antenna maintenance personnel should repair the antenna rotation problem, verify proper antenna orientation, and

verify that the rotation indicator works properly.

4.9 Antenna RLF-2 VSWR (OSAN-Nov 82-09)

Discussion: An antenna system performance test indicated a VSWR marginally greater than the maximum specified 2:1 ratio. This high VSWR was measured between the frequency range of 12 and 19 MHz. (JCN: 3220019)

Recommendation: Antenna maintenance personnel should periodically monitor the VSWR performance to ensure that the VSWR does not increase to any great extent. This antenna was scheduled to be replaced Oct 83 under scheme number 0506A9K0 and no further action on this deficiency is recommended.

4.10 Line Equipment Option Card (OSAN-Nov 82-10)

Discussion: Option card C5 located in the line equipment cabinet did not meet the audio output specification. A replacement card was ordered but not received prior to the end of the evaluation. (JCN: 3070022)

Recommendation: The replacement card should be installed when received and proper operation should be verified.

4.11 Operator Console Patch Intercept Module (OSAN-Nov 82-11)

Discussion: The operator console patch intercept module for radio level four could not be patched to link four.

Recommendation: Site maintenance personnel should perform additional tests, isolate the problem, and correct as necessary.

5.0 Technical Recommendations

5.1 ~~Many deficiencies~~ were discovered during the evaluation that ~~should have been previously identified~~. These deficiencies were not limited to any particular piece of equipment. While troubleshooting problems in the receivers and transmitters, it was found that many modules required thorough alignments. Also, several functions on the operator console were found to be inoperative. This situation could have been alleviated if the preventive maintenance procedures in CEMI 600-1 were strictly followed. On several occasions the CEMI or the equipment were suspected of being deficient, but when the alignment procedures in the CEMI were accurately followed, the deficiencies were corrected. Performance tests should be done at the intervals prescribed in the CEMI, and recorded on appropriate AFCC forms. These test results could then be filed and used as a management tool in detecting equipment degradation.


5.2 Site maintenance personnel did not have a spectrum analyzer. Power amplifier intermodulation distortion tests and antenna VSWR tests could not be performed without this test:

equipment. The test equipment would also be useful in troubleshooting many other problems which might arise. A Hewlett-Packard 141T spectrum analyzer with tracking generator or equivalent test equipment should be ordered.

5.3 The 789X-1 test sets were in need of local shop calibration. Difficulty was encountered in aligning the equipment because these test sets introduced a frequency translation error. Test set serial number 3 was 12 Hz off frequency and serial number 57 was 27 Hz off frequency. These test sets should be repaired or calibrated as necessary.

6.0 Acknowledgements

The team thanks all those in the 2146th Communications Group who directly and indirectly provided support. The positive responses we received to our requests helped make this evaluation rewarding and successful.

TEST COVER PAGE		<input checked="" type="checkbox"/> Preliminary	PAGE <u>1</u> OF <u>2</u> PAGES
		<input checked="" type="checkbox"/> Final	DATE 16 Nov 82
TEST NO. <u>T N/A</u>	TEST TITLE RECEIVER PERFORMANCE		
DCS LINK NO. N/A	STATION UNDER TEST OSAN COMMAND ESCORT	DISTANT STATION N/A	
THROUGH STATIONS N/A			
<p>COMMENTS:</p> <p>1. Conclusions: The Commando Escort Station utilized four Collins 671B-1 receiver/exciter. During preliminary evaluation, all four levels required extensive corrective maintenance actions because the 789X-1 IF translation boxes were not aligned in accordance with PCD CEMI 600-1. After site maintenance personnel completed the necessary alignments on the 671B-1 receiver/exciter for level three, it met TO specifications. The remaining receivers did not meet TO specifications because alignments in accordance with PCD CEMI 600-1 had not been completed by the end of the evaluation.</p> <p>2. Deviation to Test Procedure: During the evaluation, the solid state RF tuners were installed by the site maintenance personnel. These RF tuners were believed to be causing a SNR problem and a frequency translation problem. Further investigation on the work bench showed that the 671B-1 receiver/exciter frequency translation problems were due to the 789X-1 IF translation boxes not being aligned in accordance with PCD CEMI 600-1. The SNR problems were caused by defects in the solid state RF tuners.</p> <p>3. Technical Summary:</p> <p>a. Commando Escort level one failed to meet the AGC threshold and the proper SNR on the A1 upper sideband (USB) channel. Alignment action had not started on this unit by the end of the evaluation. (JCN: 3220013)</p>			
<p>STANDARDS/SPECIFICATIONS:</p> <p>PCD CEMI 600-1, Pages 52 and 53, Steps 20 through 22</p> <p>Frequency: 2.000 to 29.999 MHz</p> <p>Sensitivity: Should be within 10 dB from the lowest signal generator output in dB, to the highest level in dB. If the signal generator output level varies by more than 15 dB (-107 dBm to -122 dBm) maintenance is required on the receiver.</p> <p>AGC Threshold: If the required drive level exceeded -107 dBm, maintenance on the receiver is required.</p> <p>Audio Output: Audio level limiting should maintain the audio output</p>			
TEAM CHIEF CERTIFICATION			
TYPED NAME, RANK/GRADE and TITLE		SIGNATURE	
WILLIAM J. KOWALCZYK 1st Lt, USAF Chief, Tech Eval Team			

COMMENTS (continued):

b. Commando Escort level two, the newly installed solid state RF tuner failed to have an output when tuned to 27 MHz. Testing was halted and this unit was turned over to maintenance personnel. While bench testing the 671B-1 receiver/exciter, the maintenance personnel discovered that the B1 100 kilocycle IF amplifier has a poor SNR performance. No maintenance action had been performed on the B1 100 kilocycle IF amplifier by the end of the evaluation. A new solid state RF tuner had been ordered. No AGC threshold data could be obtained. (JCN: 3200015)

c. Commando Escort level three had a frequency translation problem during preliminary testing. This unit was turned over to maintenance personnel and required extensive corrective maintenance actions because the unit had not been aligned in accordance with PCD CEMI 600-1. After the alignments were completed the 671B-1 receiver/exciter met TO specifications.

d. During preliminary evaluation of Commando Escort level four, no output signal could be obtained. This unit was turned over to site maintenance personnel. While maintenance action was being performed on the bench, the 789X-1 IF translation box was found to have the following bad modules: A1 bandpass filter, B1 relay assembly, A1 IF/AF amplifier, AM IF/AF amplifier, and dual line amplifier. These modules were ordered. (JCN: 3210018)

e. During this evaluation both 789X-1 test sets were found to be off frequency. Test set serial number 57 was 27 Hz off frequency and test set serial number 3 was 12 Hz off frequency. Site maintenance personnel should perform alignments listed in TO 31D-38-22-2, Paragraph 5-12 to make sure that the test sets perform correctly.

STANDARDS/SPECIFICATIONS (continued):

level within 4 dB from channel AGC threshold, approximately -107 dBm to -7 dBm and within 3 dB from -87 dBm to -7 dBm. The audio output should be -10 dBm at -77 dBm RF input.
Harmonic Distortion: SNR should be 35 dB or better at the composite AGC threshold. The composite AGC threshold point can be identified by the change in composite AGC polarity from approximately +0.5 VDC to a negative voltage of -0.1 VDC.