



RADIO NOTES

AMERICAN TELEPHONE AND TELEGRAPH COMPANY

Volume 15, No. 1

January 26, 1960

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Printed in U.S.A.

1. TELEPHONE SERVICE FOR AIRPLANES

The F.C.C. has issued proposed rule making to provide for establishment of Air-Ground Public Radiotelephone Service sharing the frequency band in the 450 mc range now allocated to the Domestic Public Land Radio Service. This frequency space is considered far short of that needed for an adequate nationwide air-ground development and will considerably limit the initial service until more frequencies become available. We are hopeful that additional frequencies will be forthcoming as a result of the recent 25-890 mc frequency allocation proceedings where sufficient space was requested for both broadband air-ground and land mobile services.

The F.C.C. has also issued construction permits for the installation of ground stations in the Pittsburgh, Washington, D.C. and New York areas. These authorizations will permit enlargement of the Chicago-Detroit air-ground trial to include a corridor 200 miles wide and cities estimated to originate approximately one-third of all commercial air travel in this country and more than one-fourth of all private flights.

In developing the air-ground service on the land mobile frequencies careful planning will be necessary to avoid interference with land operations, particularly rural radio where multiplex transmissions cover several or all channels of the available frequency space.

We have responded to the Commission's Proposed Rule Making pointing out the limitations being imposed upon the development of air-ground as well as the land services. This applies particularly in metropolitan areas where the land services must be expanded and where the air-ground service is also most needed.

2. MIND YOUR TYPE ACCEPTANCE

Just a reminder that the fatal date (January 1, 1960) with respect to type acceptance for transmitters authorized under Part 21 has passed. As of that date all such transmitters with the exception of certain microwave transmitters for which the Commission granted a one-year extension (See P.E.L. 6594), must be type accepted or must be taken out of service. The most recent type acceptance list showing equipment acceptable as of November 2, 1959 was forwarded with P.E.L. 6597.

3. WESTERN UNION TRANSCONTINENTAL MICROWAVE

The Western Union Telegraph Company is planning to build a transcontinental microwave system using frequencies in the 4000 and 6000 mc common carrier bands. This system will serve the cities of Los Angeles, San Francisco, Salt Lake City, Denver, Omaha, Kansas City, St. Louis, Indianapolis, Toledo, Cleveland, Syracuse, Albany and Boston. The Los Angeles-San Francisco portion is scheduled for completion late this year. The entire transcontinental route is to be in operation by late 1961.

Since the Western Union system may closely approach many Bell System routes, the Western Union route layout must be followed very closely and studies made of all situations where the possibility of inter-system interference exists. We are arranging to furnish Western Union with information in regard to our station locations and other data to assist in avoiding interference situations. More details of the project will be included in a letter to Chief Engineers now being prepared.

4. EMERGENCY RADIO TRAILERS

The photograph shows three trailers recently equipped by Southern Bell in South Carolina for emergency use in the restoration of damaged toll facilities. Two thirty-foot trailers house terminal radio and carrier equipment, and a twenty-six foot trailer (shown at the base of the tower) houses radio repeater equipment. Each trailer has its own emergency "No-Break" AC power source.

Farinon PT-450-150B3 UHF radio equipment and Lenkurt 45BX carrier equipment is used to provide 24 voice circuits. This transportable two-hop microwave system will first be used for service between Charleston and Beaufort (an overall distance of about 48 miles) while the regular facilities are undergoing repairs of damage incurred during Hurricane Gracie on September 29.



5. ILLINOIS BELL TRIES PUSH BUTTON MOBILE DIALING

Illinois Bell State Area Engineers recently conducted a unique mobile telephone experiment. Making use of equipment associated with the Elgin Central Office Trial, a mobile unit was equipped to "push-button" dial its calls to land telephones. While admittedly a temporary lashup, the experiment proved that push button dials could be used in mobile 2-way dial systems.

The push button and tone generator unit, lifted from a station set, was mounted in the car near the control unit. Electrically, it was wired into the radio set in parallel with the handset. At the switchboard, the mobile service operator would establish a circuit from the mobile position to a tone-to-dial pulse converter and on into the telephone exchange. With this circuit, the mobile user could pulse any telephone number. Numbers could be "dialed" as fast as desired with no apparent loss in reliability.

At least one commercial system is being used that employs push buttons in place of rotary dials for mobile use. This system uses non-compatible signaling methods and has the drawback of needing a fairly long interval ($1\frac{1}{2}$ to 2 seconds) between digits to allow for tone to dial-pulse translation.

6. PGVC 10th NATIONAL MEETING

The tenth national meeting of the Institute of Radio Engineers Professional Group on Vehicular Communications (PGVC) was held at St. Petersburg Beach, Florida on December 3 and 4. Bill Chaney, who is a member of the PGVC executive committee, and Jim Stubner attended as representatives of the "195" Radio Section.

The two day session included five technical papers presented by Bell System people. A look into the future of vehicular communications and broadband system planning was given in three papers presented by Bell Laboratories men: (1) "Applications of Semi-conductors in an 850-900 mc Radio Receiver" by L. G. Schimpf, (2) "Coordinated Broadband Mobile Telephone System" by W. D. Lewis and (3) "Spectrum Economy and Interference Reduction Through Use of a Multi-Area Coverage Plan" by W. A. Cornell and H. J. Schulte. More current matters were covered in papers titled "Precision Carrier Frequency Control and Modulation Phase Equalization of Base Transmitters in Mobile Radio Systems" by E. A. Steere and D. S. Dewire of the New York Telephone Company and "Comparison of Wideband and Narrowband Circuits at 150 mc" by H. W. Nylund of B.T.L. Harry Nylund's findings and conclusions in the above subject will be included in a P.E.L. soon to be issued.

7. NEW OVER-THE-HORIZON SYSTEM

On January 17 the Long Lines placed in service their second over-the-horizon radio system. This one spans a 186 mile hop from Florida to the Bahama Islands. Initially, this system will carry 24 voice circuits. In contrast to the Cuba system no video service is being provided. Prior to the official opening of service the system was turned up for test and limited traffic during the Christmas period.

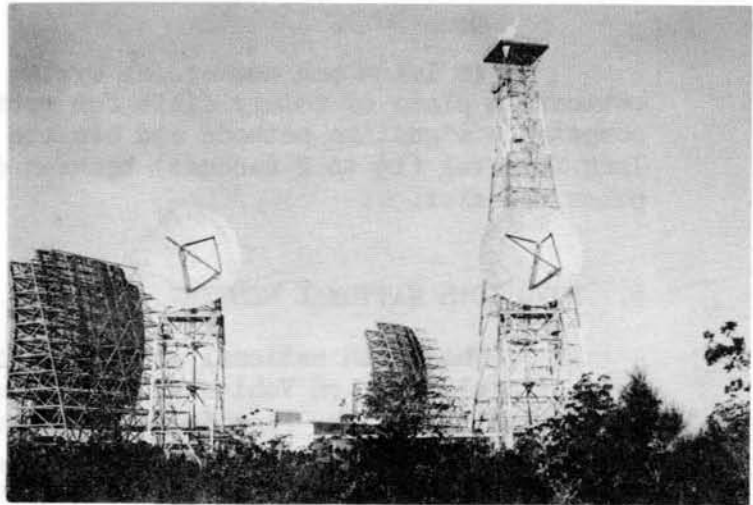
Both space and frequency diversity protection with IF and baseband combiners are utilized on the new system. Ten kilowatt transmitters operating in the 2 kmc range with 30 foot parabolic dishes are used.

The photograph shows the antenna layout at Florida City. The dish antennas in the foreground are directed toward the Bahamas. The "billboard" antennas to the left are used on the Cuba system. The horn

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reflector antenna on the 200 foot self-supported tower is part of the two hop TD-2 system connecting the OH circuits to Miami.

A five mile 7.4 kmc microwave entrance link is used at the Bahama terminal. L carrier at the Florida terminal is working with similar British made carrier equipment at the Bahama terminal.



8. F.C.C. AUTHORIZES AIRBORNE EDUCATIONAL TV RELAY

The F.C.C. recently granted experimental authorizations to Purdue University permitting transmission of educational TV programs on UHF frequencies to an airplane for relay to classrooms within a radius of 150 to 200 miles of Montpelier, Indiana.

Two standard 6 mc channels and two 3 mc channels will be used to simultaneously transmit two separate programs to a DC-7 plane making a 10 mile circle 23,000 feet above Montpelier. The programs will be retransmitted from the plane to educational institutions in Indiana, Illinois, Kentucky, Michigan, Ohio and Wisconsin. The standard and narrow band channels will be used to compare the two transmission systems.

The plan called "stratovision," which will cost some \$7,000,000, is financed by grants from the Ford Foundation with others and is intended to explore the possibility of using this method to reach thirteen thousand schools and colleges instead of the limited number being reached by present educational systems.

9. MONITOR EQUALIZERS FOR RCA TV MICROWAVE

It is usual practice in the operation of RCA TVM-1A television microwave equipment to equalize the gain-frequency response rolloff of through signals caused by a long transmitter camera cable. An adjustable equalizer (MI26721) made by RCA is adequate for this purpose. However, if a particular TVM-1A transmitter is equipped with optional arrangements for monitoring and maximum monitoring fidelity is desired, a second equalizer should be provided. This will equalize the rolloff incurred in transmitting video monitor signals back down long (100 feet and over) transmitter camera cables to the control unit.

RCA has indicated that not all Bell System Company orders request the second equalizer under the above circumstances. This may or may not be intentional. Companies using this equipment may wish to review their requirements in this regard.

10. VOLUME IV OF F.C.C. RULES

The F.C.C. announced in December the availability in new looseleaf form of Volume IV of the F.C.C. Rules, which includes Parts 7 (Stations on Land in the Maritime Services), Part 8 (Stations on Shipboard in the Maritime Services), and Part 114 (Public Fixed Stations and Stations of the Maritime Services in Alaska). The cost of this volume is \$2.50 and may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C.

Purchase of the original volume entitles the buyer to automatically receive all amendments to the rules for an indefinite period. This new system was outlined in P.E.L. 6362, dated November 1958.

Other F.C.C. Rules available under the new system are:

Volume II	- covering parts 2, 5, 15, and 18	\$2.00
Volume III	- " " 3 and 4	4.50
Volume V	- " " 9, 10, 11 and 16	2.50
Volume VI	- " " 12, 19 and 20	1.25

11. TYPE ACCEPTANCE ON CERTAIN MOTOROLA UNITS

The F.C.C. staff has informally advised us that all Motorola units of the FSTM-30 M117, MA253, MA255 and MA259 series are now considered type accepted regardless of letter suffixes which may follow these codes. The current type acceptance list includes only the FSTM-30, M117AA, MA253AA, MA255AB, and MA259AA units. For example: From the above it may now be assumed that the FSTM-30 MA255 or FSTM-30 MA255AA are also type accepted. Accordingly, license applications and authorizations no longer require the suffix letters.

12. ORGANIZATION CHANGE

Miss Frances Arnone (Fran) has joined the Mobile Radio Group replacing Miss Theresa Concheiro (Terry) who has accepted a position in the Market Planning Section.

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13. RADIO INFORMATION

The following have been forwarded since the last issue of
RADIO NOTES:

BSPM 696	R90.410.00, Issue 1 - Mobile Telephone Service - Mobile Stations
	R90.413.00, Issue 1 - - Mobile Stations - Maintenance
	R90.414.00, Issue 1 - - Mobile Stations - Station Maintenance
	R90.414.01, Issue 1 - - Radio Receivers and Selectors
	R90.414.02, Issue 1 - - Radio Transmitters
	R90.414.03, Issue 1 - - Overall Talking Tests
	R90.414.10, Issue 1 - - Analysis of Mobile Station Troubles
	R90.414.11, Issue 1 - - Trouble Location - Primary Power
	R90.414.12, Issue 1 - - Trouble Location - Radio Receivers
	R90.414.13, Issue 1 - - Trouble Location - Mechanical Selectors
	R90.414.14, Issue 1 - - Trouble Location - Electronic Selectors
	R90.414.15, Issue 1 - - Trouble Location - Radio Transmitters
	R90.414.16, Issue 1 - - Trouble Location - Control Unit, Junction Box and Wiring
	R90.415.00, Issue 1 - - Mobile Stations - Description
	R90.415.01, Issue 1 - - Mobile Telephone Service - General Electric Co. Progress Line Sets - Types BA-13 and BE-13
	R90.415.02, Issue 1 - - General Electric Co. Progress Line Sets - Types BA-10 and BE-10
	R90.415.03, Issue 1 - - General Electric Co. Sets - Types MC-206WE and MC-216WE

- R90.415.04, Issue 1 - - General Electric Co. Progress Line Sets - Types BA-33 and BE-33
- R90.415.05, Issue 1 - - General Electric Co. Progress Line Sets - Types BA-30 and BE-30
- R90.415.06, Issue 1 - - General Electric Co. VHF Maritime Sets - Type MC-271-WE
- R90.415.07, Issue 1 - - General Electric Company VHF Maritime Sets - Types JA/E-33 and JI-33
- R90.415.08, Issue 1 - - General Electric Co. Progress Line Sets - Types BA-42 and BE-42
- R90.415.09, Issue 1 - - General Electric Co. Progress Line Sets - Types BA-40 and BE-40
- R90.415.15, Issue 1 - - Motorola Co. Research Line Sets - Type W41A
- R90.415.16, Issue 1 - - Motorola Co. Twin "V" Line Sets - Types W41GGV/D
- R90.415.17, Issue 1 - - Motorola Co. Research Line Sets - Type W43A
- R90.415.18, Issue 1 - Mobile Telephone Service - Motorola Co. Twin "V" Line Sets - Types W43GGV/D
- R90.415.20, Issue 1 - - RCA Co. Type CWR-U1V-A
- R90.415.25, Issue 1 - - Western Electric Co. Sets - Types 2A and 2B
- R90.415.26, Issue 1 - - Western Electric Co. Sets - Types 1A and 1B
- R90.415.30, Issue 1 - - Control Units and Junction Boxes
- R90.415.35, Issue 1 - - Selective Signaling Selectors
- R90.415.40, Issue 1 - - Optional Accessories

R90.416.00, Issue 1 - - Mobile Stations - Installation Procedures

R90.416.01, Issue 1 - - Two-Way Service - Passenger Cars

R90.416.03, Issue 1 - - One-Way Service

R90.416.04, Issue 1 - - VHF Maritime Service

BSPM 696A -

BSPM 697 R60.464, Issue 1 - J68349E Video Pilot Supply
J68349H Video Pilot Distribution Circuit

R60.465, Issue 1 - J68349E Video Pilot Supply
J68349H Video Pilot Distribution Circuit

BSPM 698 AA367.418, Issue 1 - 425B Plants - 12-, 24-, 130-, and
250-Volt Power Supplies - For Secondary
Route TD-2 Radio Systems - Power
Systems

BSPM 698A -

BSPM 699 R10.480, Issue 1 - 540A Radio Transmitting Equipment

AA367.409, Issue 3 - 425A Plants - Positive 250 Volts, 0.5
to 20 Amperes - Plate Supply -
Power Systems

BSPM 699A -

BSPM 699B -

BSPM 700 R60.524, Issue 2 - Television - KS-15654, List 1,
E37.421 Video Monitor

R90.330.00, Issue 2 - TJ Radio System

BSPM 701 AA266.036, Issue 5 - TD-2 Radio Test Bench Equipment -
Toll Systems

BSPM 702 Cancel

E34.088.1, Issue 1 - Type A Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

Cancel

E34.088.2, Issue 1 - Type B Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

Cancel

E34.088.3, Issue 1 - Type C Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

358-120-500, Issue 1 - Type A Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

358-120-501, Issue 1 - Type B Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

358-120-502, Issue 1 - Type C Wire Line Entrance Link for
Interconnection of TD-2 Radio and
L1 Carrier Facilities

BSPM 702A -

P.E.L. 6581:
P.O.L. 1857 TD-2 Radio System - FM Terminal Transmitter Improvements
(1S3.1-96)

P.E.L. 6587 TD-2 Microwave System - Increasing Coupling Loss Between
Parabolic Antennas (1S3.4-137)

P.E.L. 6582 Amendment of Parts 10 and 11 of the F.C.C. Rules which
Extend the Cut-off Date for Use of Frequencies in the
46 and 49 Mc Bands (1S4.1-219)

P.E.L. 6599 TJ Radio System - Waveguide Component Losses (1S3.9J-13)

P.E.L. 6595 F.C.C. Rules - Amendment of Part 21 to Exempt Certain
Transmitters from Low-Pass Audio Filter Requirements
(1S4.1-220)

P.E.L. 6954 F.C.C. Permits Operation of Non-Type Accepted Microwave
Equipment Unit 1-1-61 (1S4.1-220)

P.E.L. 6597 F.C.C. Equipment List (1S4.1-222)

P.E.M. 7122 Maritime Mobile Telephone Service - Availability of
General Electric Five-Channel VHF Maritime Mobile Sets
and A-C Power Supply Panels (1S3.9C-10)

P.O.L. 1858 Mobile Radio Cost Results Plan

Unnumbered Letter to Chief Engineers

12-28-59 Radiation - Training Courses in Radiological Health
Activities

Unnumbered Letter to Traffic Managers

12-18-59 "Bellboy" Personal Signaling Service

Unnumbered Letter to Plant Supervisors

12-31-59 Mobile Radio - Bell System Practice R06.080 Mobile
Service Trouble Summary Form E-3605

Unnumbered Letter to Plant Managers

1-4-60 Bellboy Personal Signaling Service - Receiver Warranty

ASSOCIATED COMPANY
SHORT HAUL MICROWAVE SYSTEMS
(EXCLUDING TV SERVICES & LONG LINES)

SYSTEMS IN SERVICE UNDER CONSTRUCTION OR PLANNED IN '60	TYPE RADIO EQUIPMENT	NUMBER OF HOPS	ROUTE MILES	NUMBER OF VOICE CIRCUITS	TYPE OF CHANNELIZING	SERVICE DATE	REMARKS
CANADA							
FORT WILLIAM - LONGLAC	MOTOROLA	2	60	31	LENKURT 45	10-56	
FORT WILLIAM - NIPIGON	MOTOROLA	3	84	9	LENKURT 45	10-56	
NIPIGON - GERALDTON	MOTOROLA	1	30	4	LENKURT 45	10-56	
GERALDTON - LONGLAC	MOTOROLA	2	52	12	LENKURT 45	6-58	
TADOUSSAC - CAP A L'AIGLE	REL DF						800 MC OVER-THE-HORIZON SYSTEM
CLARKE CITY - KNOB LAKE - GOOSE BAY							
CLARKE CITY - EMERIL	REL	2	223	50	L	6-58	
EMERIL - KNOB LAKE	REL	1	118	4	L	6-58	JOINT BELL AND IND.
EMERIL - GOOSE BAY	REL	2	216	46	L	6-58	
CHESAPEAKE AND POTOMAC							
OCEANVIEW - CAPE CHARLES, VA.	REL 756 N	1	26	12	K	2-52	
OCEANVIEW - CAPE CHARLES, VA.	REL 756J N	1	26			2-54	STANDBY FOR OTHER SYS.
OCEANVIEW - MILITARY SITE, VA.	LENKURT 72C DF	1	20	68	LENKURT 45	1-58	
HAMPTON - MILITARY SITE, VA.	TJ	1	23	40	LENKURT 45	2-59	
LYNCHBURG - MILITARY SITE, VA.	MOTOROLA	1	21	48	LENKURT 45	4-55	
ROANOKE - MILITARY SITE, VA.	MOTOROLA	2	30	24	LENKURT 45	2-59	
SHENANDOAH NATIONAL PARK, VA.							PARK SYS. WORKING FROM CDO
LEWIS MT. - BIG MEADOWS	MOTOROLA N	1	7	3	MOTOROLA	8-57	
BIG MEADOWS - SKYLAND	MOTOROLA N	1	5	9	MOTOROLA	8-57	
SKYLAND - ELKWALLOW	MOTOROLA N	1	12	5	MOTOROLA	8-57	
RICHMOND - WARSAW, VA.							
RICHMOND - KING WILLIAM	LENKURT 74A	1	24	56	LENKURT 45	6-58	JOINT BELL AND IND. Co.
KING WILLIAM - WARSAW	LENKURT 72C N	1	24	56	LENKURT 45	6-58	INDEPENDENT Co.
WASHINGTON, D.C. - MILITARY SITE, MD.	MOTOROLA	1	23	SEE REMARKS			CUSTOMER OWNED CHANNELIZING
MICHIGAN							
MACKINAC CITY - ST. IGNACE	LENKURT 72B N	1	5	20	N	11-54	
MACKINAC CITY - SAULT STE. MARIE	LENKURT 72B N	3	53	12	N	11-54	
TRAVERSE CITY RPTR. - MILITARY SITE	MOTOROLA	1	18	36	MOTOROLA	2-60	JOINT BELL AND IND. Co.
ST. IGNACE - MACKINAC ISLAND	COLLINS	1	3	12	N	6-60	
MARQUETTE - DEAD RIVER	MOTOROLA	1	8	60	L	1-60	
DEAD RIVER - MILITARY SITE	MOTOROLA	4	99	60	L	1-60	
DEAD RIVER - FORSYTH	TJ	1	22	120	L	12-59	
FORSYTH - ESCANABA	TJ	2	42	120	L	12-59	
ALLENVILLE - FORSYTH	TJ	6	143	108	L	12-59	
SAULT STE. MARIE - ALLENVILLE	TJ	2	46	48	L	12-59	
MT. CLEMENS - ATLAS	TJ	2	40	36	L	9-59	
PORT AUSTIN - ATLAS	TJ	4	83	36	L	9-59	
MOUNTAIN							
MONARCH PASS - SALIDA, COLORADO	TJ	2	19	72	L	6-59	
MONTROSE - DURANGO	MOTOROLA	6	108	72	L	1-58	
GRAND JUNCTION - GRAND MESA, COLORADO	MOTOROLA N	1	18	8	LENKURT 45	9-58	
LAMAR - SHERIDAN LAKE	MOTOROLA	2	41	12	MOTOROLA	12-60	
SHERIDAN LAKE - TOWNER	MOTOROLA	1	8	6	MOTOROLA	12-60	
FORT MORGAN - ANTON	MOTOROLA	2	48	8	MOTOROLA	12-60	
FLAGSTAFF - PHOENIX, ARIZONA	TJ	5	137	156	L	12-58	
YUMA - MILITARY SITE, ARIZONA	MOTOROLA	1	15	48	LENKURT 45	4-57	
YUMA - MILITARY SITE, ARIZONA	MOTOROLA	1	45	2	LENKURT 33	1-59	
TUCSON - SAN MANUEL, ARIZONA							
TUCSON - MT. LEMMON	MOTOROLA SB	1	19	14	MOTOROLA	6-54	
MT. LEMMON - SAN MANUEL	MOTOROLA SB	1	14	6	MOTOROLA	6-54	
TUCSON - MILITARY SITE, ARIZONA	MOTOROLA SB	1	20	48	LENKURT 45	5-56	
MINGUS MT. - PRESCOTT, ARIZONA	TJ	1	22	120	L	6-60	
FLAGSTAFF - WINSLOW	TJ	1	54	36	L	6-60	
SANTA FE - CHAMA, NEW MEXICO	LENKURT 72B DF	1	56	12	LENKURT 45	6-56	
SANTA FE - LOS ALAMOS, NEW MEXICO	PHILCO CLR-7	1	25	12	LENKURT 45	12-53	
HOLLOMAN - MILITARY SITE, NEW MEXICO	MOTOROLA SB	1	18	12	MOTOROLA	5-54	
POCATELLO - IDAHO FALLS, IDAHO	TJ	2	50	144	L	10-58	
IDAHO FALLS - ARCO, IDAHO	MOTOROLA SB	2	45	36	LENKURT 45	10-54	
BOISE - DEER POINT, IDAHO	LENKURT 74A	1	10	4	LENKURT 45	4-60	
GREAT FALLS - P-24	TJ	7	141	24	L	12-60	
GREAT FALLS - HAVRE	TJ	5	110	24	L	12-60	
GREAT FALLS - TM-178	TJ	4	108	24	L	12-60	
MISSOULA JUNCTION - TM-179	TJ	3	83	48	L	1-60	
GLENDIVE JUNCTION - GLASGOW	TJ	4	131	48	L	12-60	
GLENDIVE JUNCTION - GLENDIVE RADIO	TJ	1	11	96	L	1-60	
FT. PECK JUNCTION - P-26	TJ	2	57	24	L	11-60	
NEW ENGLAND							
BARNSTABLE - FALMOUTH, MASS.	TJ	1	16	48	ON2	6-60	
BARNSTABLE - NANTUCKET, MASS.	REL 756J N	1	29	24	ON2	8-52	
BARNSTABLE - NANTUCKET, MASS.	REL 756J N	1	29	40	ON1	11-53	
BOSTON - MILITARY SITE, MASS.	FEDERAL 10D SB	2	58	23	FEDERAL	11-53	
NARRAGANSETT - BLOCK ISLAND, R.I.	LENKURT 72B N	1	18	12	ON	7-55	
NARRAGANSETT - BLOCK ISLAND, R.I.	LENKURT 72B N	1	18	12	ON	7-56	
LITTLETON - EAST MTN., N.H.	LENKURT 72B DF	1	25	23	LENKURT 45	11-56	
NEW YORK							
POTSDAM - MASSENA	MOTOROLA	1	18	62	STROMBERG-CARLSON	7-57	
BUFFALO - NIAGARA FALLS	MOTOROLA	1	17	90	" "	7-57	
AUBURN - SYRACUSE	MOTOROLA	2	28	46	" "	1-58	
NORTHWESTERN							
RAYMOND - WAVERLY, IOWA	COLLINS	1	21	24	ON	11-59	
DES MOINES - OTTUMWA, IOWA	TJ	4	87	60	L	10-59	
OMAHA, NEB. - MILITARY LOCATIONS							
OMAHA - MISSOURI VALLEY, IA.	TJ	1	19	48	ON	4-60	
OMAHA - ARLINGTON, NEBR.	TJ	1	24	48	ON	4-60	
ARLINGTON, NEBR. - MISSOURI VALLEY	TJ	1	26	24	ON	4-60	
ARLINGTON, NEBR. - MEAD, NEBR.	TJ	1	22	28	ON	4-60	JOINT BELL AND IND. Co.
BENNINGTON, NEBR. - MEAD, NEBR.	TJ	1	22	48	ON	4-60	JOINT BELL AND IND. Co.
CHAPMAN - FULLERTON, NEBR.	TJ	1	25	40	ON	12-60	
ELLSWORTH AFB, SD - RAPID CITY, SD	TJ	1	10	48	L	4-60	
GETTYSBURG, S.D. - LINTON, N.D.	MOTOROLA	3	92	36	L	9-59	
LINTON, N.D. - WISHEK, N.D.	MOTOROLA	1	30	10	ON	2-56	
BISMARCK, N.D. - LINTON, N.D.	MOTOROLA	2	44	62	26 ON, 36 L	2-56	
BISMARCK, N.D. - BENEDICT JCT.	TJ	3	80	228	L	2-60	
BENEDICT JCT., N.D. - MINOT, N.D.	TJ	1	23	108	L	2-60	
MINOT, N.D. - MILITARY SITE (IND.CO.)	MOTOROLA	1	15	29	LENKURT 45	6-58	JOINT BELL AND IND. Co.
MINOT, N.D. - WILLISTON, N.D.	MOTOROLA	6	112	36	LENKURT 45	2-55	
MINOT - TIOGA JCT., N.D.	COLLINS	3	76	60	LENKURT 45	11-60	
TIOGA JCT. - WILLISTON, N.D.	MOTOROLA	2	37	36	LENKURT 45	11-60	
TIOGA JCT. - AMBROSE, N.D.	COLLINS	2	50	24	LENKURT 45	11-60	

SYSTEMS IN SERVICE UNDER CONSTRUCTION OR PLANNED IN '60	TYPE RADIO EQUIPMENT	NUMBER OF HOPS	ROUTE MILES	NUMBER OF VOICE CIRCUITS	TYPE OF CHANNELIZING	SERVICE DATE	REMARKS
NORTHWESTERN (CONT'D.)							
FARGO, N.D. - SABIN, MINN.	MOTOROLA N	1	9	8	MOTOROLA	5-60	
FARGO, N.D. - FINLEY, N.D.	MOTOROLA	3	71	132	84 L, 48		
FINLEY, N.D. - GRAND FORKS AFB	MOTOROLA	2	39	132	LENKURT 45	2-55	
GRAND FORKS AFB - GRAND FORKS, N.D.	MOTOROLA	1	16	60	84 L, 48	3-59	
GRAND FORKS, N.D. - DOROTHY, MINN.	COLLINS	1	25	36	LENKURT 45	3-59	
DOROTHY, MINN. - CROOKSTON, MINN.	COLLINS	1	11	12	LENKURT 45	11-59	
DOROTHY - THIEF RIVER FALLS, MINN.	COLLINS	1	20	36	LENKURT 45	7-60	
THIEF RIVER FALLS - BAUDETTE, MINN.	COLLINS	5	107	24	LENKURT 45	11-59	
BAUDETTE - INTERNATIONAL FALLS, MINN.	COLLINS	4	82	52	LENKURT 45	11-59	
INTERNATIONAL FALLS - VIRGINIA, MINN.	COLLINS	3	61	48	LENKURT 45	12-58	
DULUTH - MILITARY SITE, MINN.	LENKURT 72B SB	2	60	48	LENKURT 45	11-54	
MINNEAPOLIS - MILITARY SITE, WISC.	LENKURT 72B SB	1	25	48	LENKURT 45	11-54	JOINT BELL AND IND. CO.
WYOMING, MINN. MILITARY SITE, WISC.	LENKURT 74A	1	20	24	LENKURT 45	11-59	JOINT BELL AND IND. CO.
LUVERNE - MILITARY SITE, MINN.	MOTOROLA SB	1	19	20	ON	11-54	
MINNEAPOLIS - SODERVILLE, MINN.	TJ	1	22	24	LENKURT 45	11-59	
BRainerd - WADENA, MINN.	TJ	2	48	48	LENKURT 45	4-59	
BRainerd - SODERVILLE, MINN.	TJ	5	108	48	LENKURT 45	4-59	
OHIO							
CLARINGTON - BARKESVILLE	MOTOROLA	1	20	24	MOTOROLA	5-57	
TOLEDO - BRYAN	COLLINS	3	49	96	COLLINS	11-57	
TOLEDO - DEFIANCE	COLLINS	1	18	24	COLLINS	11-57	
DEFIANCE - BRYAN	TJ	6	131	72	L	12-60	
PACIFIC							
SEATTLE, WASH. - VICTORIA, B.C.	LENKURT 72A SB	2	63	20	LENKURT 33	7-53	
SEATTLE - PT. ANGELES	(900 mc)						
PT. ANGELES - VICTORIA	LENKURT 72A SB	1	20	8	LENKURT 33	7-53	JOINT BELL AND IND. CO.
BALD HILL - RATTLESNAKE LEDGE, WASH.	(450 mc)						
TACOMA - KTNT-TV, WASH.	RCA MM9CL N	1	7	2	H	10-56	
PASCO - MILITARY SITE, WASH.	REL 792 SB	1	18	1	NONE	9-54	STL PROGRAM CIRCUIT
PORTLAND, ORE. - SKAMONIA, WASH.	LENKURT 72B SB	1	42	12	ON	11-54	
ANGELES PT. - FORKS - MILITARY SITE, WASH.	G.E. UA9B N	1	36	2	H	1-55	
ANGELES PT. - MT. ELLIS	LENKURT 74A	1	36	33	LENKURT 45	3-60	JOINT BELL AND IND. CO.
MT. ELLIS - FORKS	LENKURT 74A	1	13	9	LENKURT 45	3-60	INDEPENDENT CO.
MT. ELLIS - MILITARY SITE	LENKURT 74A	1	23	24	LENKURT 45	3-60	INDEPENDENT CO.
SEATTLE - VIEW PARK, WASH.	PHILCO TLR-2B N	1	14	1		1-58	STL PROGRAM CIRCUIT
EUGENE - COOS BAY, ORE.	LENKURT 72C	2	84	48	ON	10-54	TWO WORKING RF
EUGENE - FLORENCE	LENKURT 72C	2	84	60	LENKURT 45	3-57	CHANNELS AND ONE PROTECTION
FLORENCE - COOS BAY	LENKURT 72C DF	2	43	60	LENKURT 45	3-57	WITH AUTOMATIC SWITCH
THE DALLES - MILITARY SITE, ORE.	LENKURT 72B DB	2	46	24	ON	12-54	INDEPENDENT CO.
SALEM - TILLAMOOK, ORE.	LENKURT 72C	1	40	47	ON	7-55	REPLACE WITH TD-27-60
SALEM - MT. HEBBO	LENKURT 72C	1	40	36	LENKURT 45	8-57	TWO WORKING RF
MT. HEBBO - TILLAMOOK	LENKURT 72C	1	17	38	ON	7-55	CHANNELS AND ONE PROTECTION
	LENKURT 72C	1	17	36	LENKURT 45	8-57	WITH AUTOMATIC SWITCH
ROSEBERG - COOS BAY, ORE.	TJ	2	26	17	LENKURT 45	11-59	
ROSEBERG - KENYON	LENKURT 74A	3	35	17	LENKURT 45	11-59	
KENYON - COOS BAY	TJ	2	32	60	L	6-60	INDEPENDENT CO.
SILVERTON - ADAIR, ORE.	TJ	1	13	24	LENKURT 45	6-60	
ADAIR - PROSPECT, ORE.	LENKURT 74	1	33	24	LENKURT 45	6-60	
PROSPECT - MARY'S PK., ORE.	TJ	1	13	84	L	7-60	
BAKER - AUBURN, ORE.	TJ	2	59	48	L	7-60	PASSIVE REPEATER INTO JOHN DAY
AUBURN - JOHN DAY, ORE.	MOTOROLA	1	28	24	LENKURT 45	7-56	
LAS VEGAS - MILITARY SITE, NEV.	MOTOROLA	1	31	24	LENKURT 45	5-59	
LAS VEGAS - ANGEL PEAK	TJ	1	34	120	L	6-60	TWO WORKING CHANNELS
ANGEL PEAK - MILITARY SITE	LENKURT 74A	3	134	60	L	6-60	
PEAVINE MTN. - EAGLE RIDGE, NEV.	LENKURT 74A	5	192	60	L	6-60	
EAGLE RIDGE - WINNEMUCCA MTN., NEV.	TJ	4	75	60	L	2-60	
EAGLE RIDGE - TONOPAH, NEV.							
WOLF CREEK - MILITARY SITE, NEV.							
EUREKA - MILITARY SITE, CAL.	LENKURT 72B N	1	22	12	LENKURT 45	11-54	JOINT BELL AND IND. CO.
EUREKA - CRESCENT CITY	LENKURT 72B N	3	46	12	LENKURT 45	11-54	INDEPENDENT CO.
CRESCENT CITY - MILITARY SITE	RCA CW5-BL N	1	26	5	LENKURT 33	11-57	
EUREKA - MT. PIERCE, CAL.	RCA CW5-BL N	1	9	3	LENKURT 33	11-57	
CANTO PEAK - LAYTONVILLE, CAL.	RCA CW5-BL N	1	32	3	LENKURT 33	11-57	
CLOVERDALE PEAK - DRUSH MT., CAL.	RCA CW5-BL N	1	29	3	LENKURT 33		
CLOVERDALE PEAK - WALKER RIDGE, CAL.	LENKURT 74A	2	57	16	ON	11-59	
SANTA ROSA - MILITARY SITE, CAL.	RCA CWS-BL N	1	17	6	LENKURT 33	11-57	
HIGH PLATEAU - MARYSVILLE, CAL.	LENKURT 74A	1	38	8	ON	2-59	
STOCKTON - ANGELS PEAK, CAL.	RCA CW5-BL N	1	32	4	LENKURT 33	9-56	
STOCKTON - MT. OSO, CAL.	COLLINS	1	28	20	ON	2-58	
MERCED - MT. BULLION, CAL.	LENKURT 72B DF	2	42	48	LENKURT 45	6-56	
MERCED - TURTLE DOME, CAL.	MOTOROLA SB	1	7	8	ON	5-56	
TURTLE DOME - SENTINEL DOME, CAL.	RCA CW5-BL N	1	16	4	LENKURT 33	11-55	
SAN JOSE - LOMA PRIETA, CAL.	RCA CW5-BL N	1	45	4	LENKURT 33	9-56	
JOAQUIN RIDGE - FRESNO, CAL.	RCA CW5-BL N	1	65	3	LENKURT 33	9-56	
JOAQUIN RIDGE - PANOCHÉ MT., CAL.	RCA CW5-BL N	1	41	3	LENKURT 33	9-56	
JOAQUIN RIDGE - PYRAMID HILLS, CAL.	RCA CW5-BL N	1	40	4	LENKURT 33	11-55	
TEMBLOR RANGE - BAKERSFIELD, CAL.	TJ	1	11	360	L	12-58	
LOS ANGELES - COMPTON, CAL.	TJ	1	11	120	L	6-59	
LOS ANGELES - COMPTON, CAL.							
SAN PEDRO - MILITARY SITE, CAL.	REL 756 SB	1	27	8	LENKURT 45	7-51	
SAN PEDRO - CATALINA	REL 756 SB	1	27	36	LENKURT 42	7-51	
CATALINA - MILITARY SITE	REL 756 SB	1	37	36	LENKURT 42	8-51	
SANTA BARBARA - MILITARY SITE, CAL.	MOTOROLA SB	1	47	3	MOTOROLA	1-57	
LOS ANGELES - SANTIAGO PEAK, CAL.							
PRIVATE LINE SYSTEM - CUSTOMER FREQUENCIES FOR REMOTE OPERATION OF VHF BASE STATION							
SAN DIEGO - BOREGO, CAL.	MOTOROLA	1	45	40	LENKURT 45	3-55	
SAN DIEGO - MT. LAGUNA	MOTOROLA	1	25	12	LENKURT 45	9-56	
MT. LAGUNA - BOREGO	PHILCO CLR 6 SB	1	24	9	LENKURT 45	5-52	
ANAHEIM - SANTIAGO PK., CAL.	TJ	2	46	360	L	3-60	
LOS ANGELES - EL MONTE	TJ	1	27	120	L	4-60	
LOS ANGELES - OAT MTN.							
BAKERSFIELD - MT. ADELAIDE	MOTOROLA N	1	16	4	ON	2-60	PART OF LA SANTA MARIA TD-2 SYSTEM

SYSTEMS IN SERVICE UNDER CONSTRUCTION OR PLANNED IN '60	TYPE RADIO EQUIPMENT	NUMBER OF HOPS	ROUTE MILES	NUMBER OF VOICE CIRCUITS	TYPE OF CHANNELIZING	SERVICE DATE	REMARKS
<u>PENNSYLVANIA</u>							
ALTOONA - MILITARY SITE	MOTOROLA	1	18	24	MOTOROLA	7-54	JOINT BELL AND IND. CO. SECOND N SYSTEM TO BE ADDED 5-1-60
ALTOONA - COALPORT	COLLINS	1	13	12	N	12-58	
SCRANTON - MILITARY SITE	MOTOROLA	1	35	36	LENKURT 45	2-55	JOINT BELL AND IND. CO.
DOVER - WILMINGTON	COLLINS	2	43	96	ON	10-60	
<u>SOUTHERN</u>							
SPRUCE CREEK - VERO BEACH, FLA.	MOTOROLA	8	142	SEE REMARKS L		4-57	CHANNELIZING FOR SPECIAL APPLICATION SO. OWNS PANAMA CITY CONN. OWNS REST OF ROUTE SO. OWNS WEST BAY REPEATER, CONN. OWNS REST
PANAMA CITY - CARRABELL, FLA.	LENKURT 74A	3	81	60	LENKURT 45BX	12-59	
FORREST BEACH - TYNDALL AIR FORCE BASE, FLA.	LENKURT 74A	2	50	SAGE ONLY	LENKURT 45BX	12-59	
COCOA - TITUSVILLE	MOTOROLA MR10	2	37	36	L & COLLINS	11-60	
MAXTON - WILMINGTON, N.C.	LENKURT 72C	4	91	48	LENKURT 45	5-57	PASSIVE REPEATER INCLUDED
COLUMBIA - SUMPTER, S.C.	COLLINS MW-102	3	54	12	COLLINS	5-60	
FLORENCE - SILLON, S.C.	COLLINS MW-102	2	38	37	COLLINS	7-60	PASSIVE REPEATER INCLUDED
BIRMINGHAM, GADSDEN, ALA.	LENKURT 74A	3	59	36	LENKURT 45BX	7-59	
SELMA - GUNTER, ALA.	LENKURT 74A	3	46	20	LENKURT 45BX	4-60	PASSIVE REPEATER INCLUDED
THOMASVILLE - MOBILE, ALA.	LENKURT 74A	5	94	76	LENKURT 45BX	4-60	
TURNERVILLE - DAUPHIN IS., ALA.	LENKURT 74A	3	55	24	LENKURT 45BX	4-60	PASSIVE REPEATER INCLUDED
MONTGOMERY - TROY - EUFULA, ALA.	LENKURT 74A	4	88	36	LENKURT 45BX	4-60	
DECATUR - REDSTONE, ALA.	LENKURT 74A	1	21	28	LENKURT 45BX	11-58	PASSIVE REPEATER INCLUDED
WINCHESTER - PIKEVILLE, KEN.	LENKURT 74A	5	108	68	ON	7-58	
NEW ORLEANS - BURAS, LOUISIANA	MOTOROLA MR10	3	55	40	ON	12-57	PASSIVE REPEATER INCLUDED
BURAS - PILOTTOWN, LA.	MOTOROLA MR10	1	22	20	ON	'60	
CLARKSDALE - GREENWOOD, MISS.	LENKURT 74A	2	48	96	ON	10-60	PASSIVE REPEATER INCLUDED
CLEVELAND - GREENWOOD, MISS.	LENKURT 74A	2	47	96	ON	12-60	
LAUREL - HATTIESBURG, MISS.	TJ	2	28	36	L	7-59	PASSIVE REPEATER INCLUDED
CRYSTAL SPRINGS - STAR, MISS.	TJ	1	14	24	LENKURT 45BX	2-60	
NASHVILLE - SPRINGFIELD, TENN.	TJ	2	26	96	L	11-58	PASSIVE REPEATER INCLUDED
BRISTOL - JOHNSON CITY	TJ	2	23	39	L	'60	
<u>SOUTHERN NEW ENGLAND</u>							
NEW HAVEN - CANAAN	TJ	2	31	48	ON	7-60	PASSIVE REPEATER INCLUDED
NEW HAVEN - WOLCOTT	TJ	1	5	72	ON	7-60	
WOLCOTT - WATERBURY	TJ	1	5	12	ON	12-60	PASSIVE REPEATER INCLUDED
WOLCOTT - BRISTOL	TJ	1	11	12	ON	8-60	
WOLCOTT - HARWINTON	TJ	1	3	24	ON	8-60	PASSIVE REPEATER INCLUDED
HARWINTON - TORRINGTON	TJ	2	26	12	ON	9-60	
HARWINTON - CANAAN	TJ	2	13	12	ON	10-60	PASSIVE REPEATER INCLUDED
BRIDGEPORT - DERBY	TJ	2	13	12	ON	10-60	
<u>SOUTHWESTERN</u>							
COLORADO CITY - SILVER, TEXAS	MOTOROLA SB	1	22	12	MOTOROLA	4-53	DROPS EN ROUTE
GALVESTON - PT. BOLIVAR, TEXAS	COLLINS	1	6	20	ON	10-57	
DODGE CITY - LIBERAL - HUGOTON, KAN.	TJ	7	88	96	L	12-60	DROPS EN ROUTE
DODGE CITY - LIBERAL	TJ	5	58	37	ON	12-60	
DODGE CITY - RSW	TJ	5	58	36	ON	12-60	DROPS EN ROUTE
DODGE CITY - RSW	TJ	2	30	18	ON	12-60	
RSW - LIBERAL	TJ	2	31	60	ON	12-60	DROPS EN ROUTE
LIBERAL - HUGOTON	TJ	4	57	88	ON	8-60	
SWEETWATER - STAMFORD, TEXAS	LENKURT 74A	1	18	26	LENKURT 45	12-58	JOINT BELL AND CONNECTING CO. CONNECTING CO.
ABILENE - BROWNWOOD, TEXAS	LENKURT 74A	2	59	26	LENKURT 45	12-58	
ABILENE - LYTEL GAP	LENKURT 74A	1	18	26	LENKURT 45	12-58	JOINT BELL AND CONNECTING CO. CONNECTING CO.
LYTEL GAP - BROWNWOOD	LENKURT 74A	2	59	26	LENKURT 45	12-58	
<u>WISCONSIN</u>							
STEVENS PT. - MILITARY SITE	MOTOROLA SB	2	25	23	MOTOROLA	11-54	

ALL SYSTEMS INCLUDE FREQUENCY DIVERSITY UNLESS OTHERWISE INDICATED.
 SB INDICATES SYSTEM EQUIPPED WITH STANDBY RADIO TRANSMITTERS AND RECEIVERS.
 DF INDICATES DUAL FREQUENCY SYSTEM.
 N INDICATES NO STANDBY OR DIVERSITY RADIO EQUIPMENT.

SUMMARY 12-31-59

No. RF SYSTEMS IN SERVICE - 118
 TOTAL NUMBER OF HOPS - 221
 TOTAL ROUTE MILES - 5,422
 TOTAL CIRCUIT MILES - 229,880