

RADIO SERVICE BULLETIN

ISSUED MONTHLY BY BUREAU OF NAVIGATION, DEPARTMENT OF COMMERCE

Washington, April 1, 1922—No. 60

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ABBREVIATIONS.

The necessary corrections to the List of Radio Stations of the United States and to the International List of Radiotelegraph Stations, appearing in this Bulletin under the heading "Alterations and corrections," are published after the stations affected in the following order:

Name	= Name of station.
G. loc.	= Geographical location: O=west longitude, N=north latitude, S=south latitude.
Call	= Call letters assigned.
System	= Radio system used and sparks per second.
Range	= Normal range in nautical miles.
W. l.	= Wave lengths assigned: Normal wave lengths in italics.
Service	= Nature of service maintained: PG=General public. PR=Limited public. P=Private. O=Government business exclusively.
Hours	= Hours of operation. N=Continuous service. X=No regular hours. m=a. m. (12 m.=midday). n=p. m. (12s.=midnight).
Rates	= Ship or coast charges in cents: c=cents. (The rates in the interna- tional list are given in francs and centimes.)
I. W. T. Co.	= Independent Wireless Telegraph Co.
R. C. of A.	= Radio Corporation of America.
S. O. R. S.	= Ship Owners' Radio Service.
Co.	= Company.
Corp.	= Corporation.
&	= And.
Do.	= Ditto.
C. w.	= Continuous wave.
V. t.	= Vacuum tube.
FX.	= Fixed station.

CERTIFICATE: By direction of the Secretary of Commerce this publication is issued as an administra-
tion report and is required for the proper transmission of the public business.

NEW STATIONS.

Commercial land stations, alphabetically by names of stations.

[Additions to the List of Radio Stations of the United States, edition of June 30, 1931, and to the International List of Radiotelegraph Stations published by the Berns Bureau.]

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by--
Albany, N. Y. ¹	WNI	300	PR(FX)		Shotton Radio Manufacturing Co.
Altadena, Calif. ²	KOO	360	PR(FX)		Altadena Radio Laboratory.
Atlanta, Ga.	WGM	360, 485.	PR(FX)		Atlanta Constitution.
Do.	WSB	360, 485.	PR(FX)		Atlanta Journal.
Austin, Tex. ³	WCM	360, 485.	PR(FX)	X	University of Texas.
Bahaboe, P. I.	KEW				Philippine Insular Government.
Baltimore, Md. ⁴	WKO	360	PR(FX)		Joseph M. Zampetaki & Co.
Barnegat, N. J.	WCI	300, 600, 16, 900	PR(FX)	N	R. C. of A.
(Tuckerton) ⁵					
Bay City, Mich. ⁶	WTP	360	PR(FX)		George M. McBride.
Birmingham, Ala. ⁷	WSY	360	PR(FX)		Alabama Power Co.
Bongran, P. I.	KEU				Philippine Insular Government.
Berkeley, Calif. ⁸	KBE	360	PR(FX)	X	Maxwell Electric Co.
Buffalo, N. Y. ⁹	WGR	300, 485.	PR(FX)		Federal Telephone & Telegraph Co.
Do. ¹⁰	WWT	360	PR(FX)		McCarthy Bros. & Ward.
Cagayan de Sulu, P. I.	KEV				Philippine Insular Government.
Camden, N. J. ¹¹	WRP	360	PR(FX)		Federal Institute of Radio Telegraphy.
Canton, Ohio ¹²	WWB	360	PR(FX)	X	Daily News Printing Co.
Charlotte, N. C. ¹³	WBT	360	PR(FX)		Southern Radio Corp.
Chicago, Ill. ¹⁴	WGU	360	PR(FX)	X	The Fair.
Chignik, Alaska ¹⁵	KNF	300, 525, 600, 1650.	PR(FX)	X	Columbia River Packers' Association.
Cincinnati, Ohio ¹⁶	WLW	360	PR(FX)	X	Crosley Manufacturing Co.
Dearborn, Mich. ¹⁷	WWI	360	PR(FX)	X	Ford Motor Co.
Denver, Colo. ¹⁸	KLZ	360, 485.	PR(FX)	X	Reynolds Radio Co.
Do. ¹⁹	KOA	485.	PR(FX)	X	Young Men's Christian Association.
Des Moines, Iowa ²⁰	WGF	360	PR(FX)		The Register and Tribune.
Do.	WHK	360	PR(FX)		Iowa Radio Corporation.
Detroit, Mich. ²¹	KOF	360	PR(FX)		Detroit Police Department.
Elizabethtown, Kans. ²²	WAB	440, 485.	PR(FX)		Midland Baking Co.
Erie, Pa. ²³	WJT	360	PR(FX)		Electric Equipment Co.
Do. ²⁴	WSX	360	PR(FX)		Erie Radio Co.

¹ Loc. 0.73° 45' 00", N. 42° 30' 00"; range, 75; system, composite (v. t. telephone); hours, 7.30-9.45 p. m.; rates, none.

² Loc. 0.118° 07' 37", N. 34° 11' 34"; range, 25; system, composite (v. t. telephone); hours, 1-2 and 6-7 p. m.; rates, none.

³ Loc. 0.57° 44' 10", N. 39° 17' 00"; range, 300; system, De Forest (v. t. telephone and telegraph) and composite, spark 450; rates, none.

⁴ Range, 50; system, composite (v. t. telephone); hours, 7.30-8.30 p. m. on Tuesday, Thursday, and Saturday; rates, none.

⁵ Loc. (approximately) 0.74° 27' 00", N. 39° 37' 00"; system, Alexanderson alternator; rates to Germany, 25 c. per word.

⁶ Range, 50; system, De Forest (v. t. telephone); hours, 12 m.-1.30 p. m., 6-7 p. m., and 10.30-12 p. m.; rates, none.

⁷ Loc. 0.68° 49' 00", N. 33° 50' 00"; range, 100; system, composite (v. t. telephone); hours, 7-10 p. m.; rates, none.

⁸ Range, 50; system, composite (v. t. telephone); rates, none.

⁹ Loc. (approximately) 0.75° 53' 00", N. 42° 53' 00"; range, 100; system, composite (v. t. telephone); hours, 10 a. m.-10 p. m. intermittently; rates, none.

¹⁰ Range, 30; system, composite (v. t. telephone); hours, 3.20-5 and 7-8.20 p. m.; rates, none.

¹¹ Loc. 0.74° 07' 24", N. 39° 54' 30"; system, composite (v. t. telephone); hours, 1-4 and 7.30-9.30 p. m.; rates, none.

¹² Loc. 0.51° 23' 15", N. 40° 45' 01"; range, 100; system, composite (v. t. telephone); rates, none.

¹³ Loc. (approximately) 0.80° 51' 00", N. 35° 13' 00"; range, 100; system, composite (v. t. telephone); hours, 10-11.45 a. m. and 7.30-9.45 p. m.; rates, none.

¹⁴ Loc. (approximately) 0.87° 37' 00", N. 41° 53' 00"; range, 100; system, De Forest (v. t. telephone); rates, none.

¹⁵ Loc. (approximately) 0.124° 23' 00", N. 56° 17' 00"; range, 300; system, composite, 240; rates, none.

¹⁶ Loc. (approximately) 0.84° 30' 00", N. 39° 05' 00"; system, composite (v. t. telephone); rates, none.

¹⁷ Loc. (approximately) 0.63° 14' 06", N. 42° 18' 00"; range, 150; system, composite (v. t. telephone); rates, none.

¹⁸ Loc. (approximately) 0.103° 00' 00", N. 39° 45' 00"; range, 20; system, composite (v. t. telephone); rates, none.

¹⁹ Loc. (approximately) 0.103° 00' 00", N. 39° 45' 00"; range, 100; system, composite, 1,000; rates, none.

²⁰ Range, 150; system, composite (v. t. telephone); hours, 5-11 p. m.; rates, none.

²¹ Range, 200; system, composite (v. t. telephone and telegraph); hours, 8 a. m.-5.30 p. m.; rates, none.

²² Loc. (approximately) 0.80° 05' 00", N. 42° 07' 00"; system, De Forest (v. t. telephone); hours, 7.30-9.30 p. m. Monday, Wednesday, and Friday; rates, none.

²³ Loc. (approximately) 0.80° 05' 00", N. 42° 07' 40"; range, 50; system, composite (v. t. telephone); hours, 12.15-1.30 and 10-11 p. m.; rates, none.

Commercial land stations, alphabetically by names of stations—Continued.

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by—
Fort Morgan, Ala. ¹⁰	WIO	350, 450, 600, 1700.	PR(FX)	X	Tropical Radio Telegraph Co.
Fort Worth, Tex. ¹⁰	WCV	440.	PR(FX)		Midland Refining Co.
Do. ¹⁰	WFA	350.	PR(FX)	X	Fort Worth Record.
Fresno, Calif. ¹⁰	KMJ	350.	PR(FX)		San Joaquin Light & Power Corporation.
Honolulu, Hawaii. ¹⁰	KGU	350.	PR(FX)		Marion A. Mahony.
Houston, Tex. ¹⁰	WEV	350, 485.	PR(FX)	X	Hurlbert-Stubb Electrical Co.
Lacey, Wash. ¹⁰	KOY	350.	PR(FX)		St. Martin's College (Rev. S. Ruth).
Little Rock, Ark. ¹⁰	WSV	350.	PR(FX)		L. M. Hunter and G. L. Carrington.
Los Angeles, Calif. ¹⁰	KHF	350.	PR(FX)		C. H. Kierulff & Co.
Do. ¹⁰	KPS	350.	PR(FX)	X	Bible Institute of Los Angeles.
Mail, P. I.	KPZ				Philippine Insular Government.
McKeesport, Pa. ¹⁰	WIK	350.	PR(FX)		R. J. L. Electric Co.
Memphis, Tenn. ¹⁰	WKN	350, 485.	PR(FX)	X	Raleghman-Creech Co.
Do. ¹⁰	WFO	350.	PR(FX)		United Equipment Co.
Monterey, Calif. ¹⁰	KLN	350.	PR(FX)		Nagata Electric Works.
Morgantown, W. Va. ¹⁰	WHD	350.	PR(FX)		West Virginia University.
Newark, N. J. ¹⁰	WBS	350.	PR(FX)	X	D. W. May.
New Lebanon, Ohio. ¹⁰	WFG	350.	PR(FX)		Nashawq Poultry Farm.
New Orleans, La. ¹⁰	WGV	350.	PR(FX)		Interstate Electric Co.
Do. ¹⁰	WWL	350.	PR(FX)	X	Loyola University.
New York, N. Y. ¹⁰	WYZ	350.	PR(FX)		John Wanamaker.
Norfolk, Nebr. ¹⁰	WKH	440.	PR(FX)		Midland Refining Co.
Oakland, Calif. ¹⁰	KLS	350.	PR(FX)	X	Warner Brothers.
Oklahoma City, Okla. ¹⁰	YKY	350, 485.	PR(FX)		Oklahoma Radio Shop.
Omaha, Nebr. ¹⁰	WDV	350.	PR(FX)		John O. Yelver, jr.
Paris, Tex. ¹⁰	WTK	350.	PR(FX)		Paris Radio Electric Co.
Philadelphia, Pa. ¹⁰	WFI	350.	PR(FX)		Strawbridge & Clothier.
Do. ¹⁰	WIF	350.	PR(FX)		Gimbel Brothers.
Do. ¹⁰	WGO	350.	PR(FX)		John Wanamaker.
Portland, Oreg. ¹⁰	KGO	350.	PR(FX)		Hallock & Watson Radio Service.

¹⁰ Loc. (approximately) 0.87° 07' 00", N. 32° 00' 00"; range, 150; system, U. S. Signal Corps, 1,000; rates, ship service, 15c. per word; limited public service to Mobile, Burrwood, and New Orleans, 10c. per word.

¹¹ Range, 150; system, composite (v. t. telephone and telegraph); hours, 8 a. m.—5.30 p. m.; rates, none.

¹² Loc. (approximately) 0.97° 20' 00", N. 32° 44' 00"; range, 100; system, composite (v. t. telephone); rates, none.

¹³ Range, 150; system, composite (v. t. telephone); hours, 5-9 p. m. Sunday and 7-8 p. m. Tuesday and Friday; rates, none.

¹⁴ Range, 30; system, composite (v. t. telephone); hours, 8-9 p. m.; rates, none.

¹⁵ System, composite (v. t. telephone and telegraph); also composite spark, 240; rates, none.

¹⁶ Loc. 0.122° 47' 59", N. 47° 30' 00"; range, 25; system, composite (v. t. telephone); hours, 9.30-9.30 p. m. Sunday, Tuesday, and Friday; rates, none.

¹⁷ Range, 150; system, composite (v. t. telephone); hours, 7-10 p. m.; rates, none.

¹⁸ Loc. (approximately) 0.118° 14' 30", N. 34° 03' 00"; range, 150; system, composite (v. t. telephone); hours, 9-10 a. m. and 12.30-1.30, 3-5, and 7-8 p. m.; rates, none.

¹⁹ Range, 50; system, composite (v. t. telephone); rates, none.

²⁰ Loc. (approximately) 0.74° 30' 00", N. 43° 15' 00"; range, 30; system, composite (v. t. telephone); hours, 6.30-7 p. m. daily; 1.30-2.30 p. m. Sunday and 9.30-10.30 p. m. Tuesday and Thursday; rates, none.

²¹ Range, 50; system, R. C. of A. (v. t. telephone); rates, none.

²² Loc. (approximately) 0.90° 00' 00", N. 35° 00' 00"; range, 200; system, composite (v. t. telephone); hours, 7-9.30 p. m.; rates, none.

²³ Range, 50; system, composite (v. t. telephone); hours, 7 a. m.—8 p. m.; rates, none.

²⁴ System, composite (v. t. telephone); hours, 4-6 and 7.30 p. m. daily; 10.45 a. m.—12 m. Sundays; rates, none.

²⁵ Loc. 0.74° 10' 08", N. 40° 44' 15"; range, 30; system, De Forest (v. t. telephone); rates, none.

²⁶ Range, 150; system, composite (v. t. telephone); hours, 1-3 and 7.30-9.45 p. m.; rates, none.

²⁷ Range, 100; system, composite (v. t. telephone and telegraph); hours, 11 a. m.—12 m. and 7-10 p. m.; rates, none.

²⁸ Loc. 0.90° 00' 12", N. 29° 36' 54"; range, 100; system, composite (v. t. telephone); rates, none.

²⁹ Rates, none.

³⁰ Range, 300; system, composite (v. t. telephone and telegraph); hours, 8 a. m.—5.30 p. m.; rates, none.

³¹ Range, 20; system, composite (v. t. telephone and telegraph); rates, none.

³² Loc. 0.15° 30' 00", N. 35° 30' 15"; range, 100; system, composite (v. t. telephone); hours, 12-1 and 7.30-9.30 p. m. daily and 3-4; 7.30-9.30 p. m. Sunday; rates, none.

³³ Range, 100; system, composite (v. t. telephone); hours, 7.30-9.30 p. m.; rates, none.

³⁴ Loc. 0.95° 35' 00", N. 33° 49' 00"; range, 150; system, composite (v. t. telephone); hours, 10 a. m.—5 p. m. and 7-10 p. m.; rates, none.

³⁵ Range, 50; system, composite (v. t. telephone); hours, 7.30-9.30 p. m.; rates, none.

³⁶ Loc. 0.75° 00' 44", N. 30° 57' 06"; range, 190; system, composite (v. t. telephone); hours, 12 m.—1 p. m. and 7-8 p. m. Monday, Wednesday, and Saturdays; rates, none.

³⁷ Loc. 0.75° 00' 44", N. 30° 57' 06"; system, De Forest (v. t. telephone); hours, 1-5 and 7-10 p. m.; rates, none.

³⁸ Loc. 0.122° 45' 00", N. 45° 30' 00"; range, 100; system, composite (v. t. telephone); hours, 4-10 p. m.; rates, none.

Commercial land stations, alphabetically by names of stations—Continued.

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by—
Portland, Oreg. ¹⁸	KON	360	PR(FX)		Northwestern Radio Mfg. Co.
Do. ¹⁹	KQW	390	PR(FX)		Oregonian Publishing Co.
Do. ²⁰	KQY	360	PR(FX)		Stable Electric Co.
Do. ²¹	KYG	380	PR(FX)		Willard P. Hawley, Jr.
Redley, Calif. ²²	KMC	360	PR(FX)		Lindsay-Woodford & Co.
Ridgewood, N. Y. ²³	WHN	360	PR(FX)		Ridgewood Times Printing & Publishing Co.
Rockland, Me. ²⁴	WME	300, 425, 600	PR(FX)	X	Swans Island & Rockland Radio Communication Service.
San Francisco, Calif. ²⁵	KSL	360	PR(FX)	X	The Emporium.
Schenectady, N. Y. ²⁶	WHL	360	PR(FX)	X	Union College.
Seattle, Wash. ²⁷	KTB	360, 485	PR(FX)	X	Vincent I. Kraft.
Idaho, P. I. ²⁸	KBY	360	PR(FX)		Philippine Insular Government.
Spokane, Wash. ²⁹	KFV	360	PR(FX)		Doerr-Mitchell Electric Co.
St. Louis, Mo. ³⁰	KSD	360	PR(FX)		Post Dispatch.
Do. ³¹	WXY	485	PR(FX)	X	St. Louis University.
Swans Island, Me. ³²	WTI	300, 425, 600	PR(FX)	X	Swans Island & Rockland Radio Communication Service.
Tacoma, Wash. ³³	KMO	360	PR(FX)		Love Electric Co.
Tarrytown, N. Y. ³⁴	WRW	360	PR(FX)		Tarrytown Radio Research Lab.
Tulsa, Okla. ³⁵	WTH	440, 485	PR(FX)		Midland Refining Co.
Urbana, Ill. ³⁶	WRM	360, 410	PR(FX)		University of Illinois.
Utica, N. Y. ³⁷	WST	360	PR(FX)		J. & M. Electric Co.
Washington, D. C. ³⁸	WTL	360	PR(FX)		Continental Electrical Supply Co.
Do. ³⁹	WMI	360	PR(FX)		Doubleday-Hill Electric Co.
Do. ⁴⁰	WPM	360	PR(FX)		Thomas J. Williams.
Wehita, Kans. ⁴¹	WBY	360, 485	PR(FX)	X	Cosradio Co.
Worcester, Mass. ⁴²	WCN	360, 485	PR(FX)		Clark University.
Yakima, Wash. ⁴³	KFV	360	PR(FX)		Foster-Bradbury Radio Store.
Do. ⁴⁴	KQT	360	PR(FX)		Electric Power & Appliance Co.
Youngstown, Ohio ⁴⁵	WMC	360	PR(FX)		Columbia Radio Co.

¹⁸ Loc. 0.122° 38' 40", N. 45° 30' 54", range, 150; system, composite (v. t. telephone); hours 4-6 and 7-10 p. m.; rates, none.

¹⁹ Range, 100; system, composite (v. t. telephone); hours, 1-5 p. m. and 7.30-9.30 p. m.; rates, none.

²⁰ Loc. (approximately) 0.122° 43' 00", N. 45° 30' 00"; range, 50; system, Westinghouse (v. t. telephone); hours, 7.30-9.30 p. m.; rates, none.

²¹ Loc. 0.122° 40' 44", N. 45° 31' 30"; range, 160; system, composite (v. t. telephone); hours, 4.30-5.30 and 7-10 p. m.; rates, none.

²² Range, 30; system, composite (v. t. telephone); hours, 8-9 p. m.; rates, none.

²³ Range, 30; system, composite (v. t. telephone); hours, 7.30-9.30 p. m.; rates, none.

²⁴ Loc. (approximately) 0.63° 07' 00", N. 44° 07' 30"; range, 300; system, Wireless Specialty Apparatus Co., 1.00; rates, to Swans Island, Me., 3 c. per word.

²⁵ Range, 50; system, composite (v. t. telephone); rates, none.

²⁶ Loc. 0.73° 55' 47", N. 42° 49' 00"; range, 200; system, composite (v. t. telephone); rates, none.

²⁷ Loc. 0.122° 18' 24", N. 47° 40' 43"; range, 30; system, composite (v. t. telephone); rates, none.

²⁸ Loc. (approximately) 0.117° 25' 00", N. 47° 40' 00"; system, composite (v. t. telephone); hours, 7-10 p. m.; rates, none.

²⁹ Loc. 0.90° 17' 17", N. 38° 38' 00"; range, 100; system, De Forest (v. t. telephone); hours, 10 a. m.-10 p. m. intercity; rates, none.

³⁰ Loc. 0.90° 13' 58", N. 38° 38' 17"; range, 150; system, composite (v. t. telephone) and composite spark, 55; rates, none.

³¹ Loc. (approximately) 0.68° 57' 00", N. 44° 10' 00"; range, 100; system, Wireless Specialty Apparatus Co., 1.00; rates, to Rockland, Me. 3 c. per word.

³² Loc. 0.122° 27' 54", N. 47° 15' 48"; range, 30; system, composite (v. t. telephone); hours, 7-10 p. m.; rates, none.

³³ Loc. 0.73° 51' 30", N. 41° 04' 40"; system, composite (v. t. telephone); hours, 8 a. m.-12 p. m.; rates, none.

³⁴ Loc. (approximately) 0.51° 20' 00", N. 32° 30' 00"; range, 150; system, composite (v. t. telephone and telegraph); hours, 8 a. m.-5.30 p. m.; rates, none.

³⁵ Loc. (approximately) 0.86° 15' 00", N. 40° 07' 00"; range, 100; system, composite (v. t. telephone and telegraph) and composite spark, 30; hours, 7-10 p. m.; rates, none.

³⁶ System, De Forest (v. t. telephone); hours, 10 a. m.-6 p. m.; rates, none.

³⁷ System, composite (v. t. telephone); hours, 7.30-9.30 p. m. Monday and Wednesday; rates, none.

³⁸ System, composite (v. t. telephone); hours, 4.30-5.30 p. m. Monday, Wednesday, and Friday; rates, none.

³⁹ Range, 75; system, composite (v. t. telephone); hours, 12-1 p. m. and 7.30-9.30 p. m., Monday; rates, none.

⁴⁰ Loc. (approximately) 0.65° 08' 00", N. 32° 30' 00"; range, 150; system, composite (v. t. telephone) and composite spark, 35; rates, none.

⁴¹ Loc. 0.71° 49' 37", N. 42° 14' 37"; range, 150; system, composite (v. t. telephone and telegraph); hours, 7.30-9.30 p. m.; rates, none.

⁴² Loc. (approximately) 0.126° 36' 00", N. 40° 30' 00"; range, 150; system, composite (v. t. telephone); hours, 12 m.-10 p. m.; rates, none.

⁴³ Loc. (approximately) 0.130° 30' 00"; N. 47° 30' 00"; range, 50; system, De Forest (v. t. telephone); hours 10 a. m.-10 p. m.; rates, none.

⁴⁴ Range, 150; system, composite (v. t. telephone); hours 8.30-9.45 p. m.; rates, none.

NOTE.—Stations having a wave length of 360 meters transmit news, concerts, etc., and those having a wave length of 485 meters transmit market and weather reports.

Commercial ship stations, alphabetically by names of vessels.

[Additions to the List of Radio Stations of the United States, edition of June 30, 1921, and to the International List of Radiotelegraph Stations published by the Bureau.]

Name of vessel.	Call signal.	Rates.			Hours.	Owner of vessel.	Station controlled by—
		North and South Amer. coast service.	Transoceanic service.	Surf-let.			
Daniel Kern.....	KDXG	Cents.	Cents.	PG	X	Independent Towing Co.	H. C. of A.
Hera ¹	KDGA	s	s	PG	X	Standard Oil Co. of N. J.	
Jacob Luckenbach.....	KDXE			PG	X	Luckenbach S. S. Co.	Owner of vessel.
La Jota ²	KDXF			P	X	W. W. Wilson	
Mandarin.....	KDXD			PG	X	Dallas S. S. Line.....	

¹ Range, 150; system, Teletanken, 1,000; w. l., 300, 450, 600.

² System, composite (c. w.-v. t.); w. l., 300, 450, 600; rates, none.

Commercial land and ship stations, alphabetically by call signals.

[b=ship station; c=land station.]

Call signal.	Name.	Call signal.	Name.
KDGA	Hera.....b	WEY	Wichita, Kans.....c
KDXD	Mandarin.....b	WFI	Philadelphia, Pa.....c
KDXE	Jacob Luckenbach.....b	WGF	Des Moines, Iowa.....c
KDXF	La Jota.....b	WGM	Atlanta, Ga.....c
KDXG	Daniel Kern.....b	WGR	Buffalo, N. Y.....c
KED	Sassi, P. I.....c	WGU	Chicago, Ill.....c
KEO	Hongwa, P. I.....c	WGV	New Orleans, La.....c
KEV	Cagayan de Sulu, P. I.....c	WHB	Morgantown, W. Va.....c
KFW	Balabac, P. I.....c	WHN	Ridgewood, N. Y.....c
KFV	Yakima, Wash.....c	WHX	Des Moines, Iowa.....c
KFZ	Spokane, Wash.....c	WIK	McKeesport, Pa.....c
KGO	Portland, Oreg.....c	WIL	Washington, D. C.....c
KGN	Portland, Oreg.....c	WIO	Fort Morgan, Ark.....c
KGO	Ajladena, Calif.....c	WIP	Philadelphia, Pa.....c
KGU	Honolulu, Hawaii.....c	WJT	Erie, Pa.....c
KGW	Portland, Oreg.....c	WKO	Baltimore, Md.....c
KHY	Lacey, Wash.....c	WKH	Neotoma, Neb.....c
KIH	Los Angeles, Calif.....c	WKN	Memphis, Tenn.....c
KIR	Seattle, Wash.....c	WKY	Oklahoma City, Okla.....c
KIS	Los Angeles, Calif.....c	WLW	Cincinnati, Ohio.....c
KLN	Monterey, Calif.....c	WMC	Youngstown, Ohio.....c
KLE	Oakland, Calif.....c	WME	Hockland, Me.....c
KLZ	Denver, Colo.....c	WMU	Washington, D. C.....c
KMC	Redley, Calif.....c	WNJ	Albany, N. Y.....c
KMJ	Fresno, Calif.....c	WDO	Philadelphia, Pa.....c
KMO	Tacoma, Wash.....c	WFA	Fort Worth, Tex.....c
KNF	Chignik, Alaska.....c	WFG	New Lebanon, Ohio.....c
KOA	Denver, Colo.....c	WFM	Washington, D. C.....c
KOP	Detroit, Mich.....c	WFO	Memphis, Tenn.....c
KPZ	Mari, P. I.....c	WRI	Schenectady, N. Y.....c
KQT	Yakima, Wash.....c	WRM	Erie, Pa.....c
KQY	Portland, Oreg.....c	WRP	Camden, N. J.....c
KRE	Berkeley, Calif.....c	WRW	Tarrytown, N. Y.....c
KSB	St. Louis, Mo.....c	WEB	Atlanta, Ga.....c
KSL	San Francisco, Calif.....c	WSL	Utica, N. Y.....c
KTO	Portland, Oreg.....c	WSV	Little Rock, Ark.....c
WAH	El Dorado, Kans.....c	WSX	Erie, Pa.....c
WBE	Newark, N. J.....c	WSY	Birmingham, Ala.....c
WBT	Charlotte, N. C.....c	WTI	Swains Island, Me.....c
WCI	Harrington, N. J. (Tuckerton).....c	WTK	Pats, Tex.....c
WCM	Austin, Tex.....c	WTY	Bay City, Mich.....c
WON	Wrentham, Mass.....c	WWB	Canton, Ohio.....c
WCV	Fort Worth, Tex.....c	WWI	Dearborn, Mich.....c
WDV	Omaha, Neb.....c	WWL	New Orleans, La.....c
WEH	Tulsa, Okla.....c	WWT	Buffalo, N. Y.....c
WEY	Houston, Tex.....c	WWZ	New York, N. Y.....c
WEW	St. Louis, Mo.....c		

Government land stations, alphabetically by names of stations.

[Additions to the List of Radio Stations of the United States, edition of June 30, 1921, and to the International List of Radiotelegraph Stations published by the Bureau.]

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by—
Boston, Mass. ¹	NAD	600, 675, 1620, 4350, 5000	O	N	U. S. Navy.
Chicago, Ill.	WVT		O	X	U. S. Army.
Fort Omaha, Nebr.	WVP		O	X	U. S. Army.
Governors Island, N. Y.	WVF		O	X	U. S. Army.
Shanghai, China ²	NPJ	324, 600, variable	O	X	U. S. Navy.

¹ Loc. 42° 01' 01" N, 71° 02' 28" W, system, U. S. Navy.² Loc. 0.121° 39' 00" E, N. 31° 15' 00", range, 100; system, U. S. Navy (receiving station only).

Government land and ship stations, alphabetically by call signals.

[b—ship station; c—land station.]

Call signal.	Name of station.	Call signal.	Name of station.
NAD	Boston, Mass. c	WVT	Chicago, Ill. c
NPJ	Shanghai, China c	WVP	Fort Omaha, Nebr. c
WVP	Governors Island, N. Y. c		

Special land stations, alphabetically by names of stations.

[Additions to the List of Radio Stations of the United States, edition of June 30, 1921.]

Station.	Call signal.	Wave lengths.	Station controlled by—
Amarillo, Tex.	5ZH	400, 375	J. Laurance Martin, 605 East Fourth Street.
Atlanta, Ga.	4XA	Variable 400 to 1000.	Emory University.
Austin, Tex.	5XX	Variable.	Tom L. Gray, 3208 Avenue F.
Bakersfield, Calif.	6ZB	400, 375	Lindley Winsor, 200 Twenty-second Street.
Bangor, Me.	1XC	Variable 400 to 500.	Bangor Railway & Electric Co., Graham Building.
Berkeley, Calif.	6ZQ	400, 375	Fred L. Wisner, 1906 Chestnut Street.
Brownwood, Tex.	5XF	400, 375, variable	Howard Payne College.
Buffalo, N. Y.	8ZM	400, 375	Cyrus H. Fraser, 49 Glenwood Avenue.
Chicago, Ill.	9XB	400, 375	City of Chicago, Room 614, City Hall.
Colorado Springs, Colo.	9XC	400, 375	Colorado College.
Columbus, Ohio.	8XA	400, 375	Ohio State University.
Do.	8ZO	400, 375	Lozen G. Windom, 1375 Franklin Avenue.
Dallas, Tex.	5ZAQ	400, 375	City of Dallas, Police and Fire Signal Department.
Ellsworth, Me.	1XC	Variable, 400 to 500.	Bangor Railway & Electric Co., Graham Building, Bangor, Me.
El Paso, Tex.	5ZAN	400, 375	Elite Electric Shop, 407 Mees Avenue.
Fort Worth, Tex.	5YS	400, 375	Oba R. Garrett, 514 Main Street.
Houston, Tex.	5XN	400, 375	Ernest Hubner, 1507 McKee Street.
Knoxville, Tenn.	5XO	Variable, 400 to 375.	Philip Stout, 182 Riverside Drive.
Lenning, Mich.	8XM	700	Maurice H. Hancock, 1101 Carnax Street.
Mayville, N. Dak.	9YF	400, 375	State Normal School.
Mount Carroll, Ill.	9ZG	400, 375	Albert C. Mast.
New Orleans, La.	5XM	400, 375	Electron Engineering Co., 1115 Whitney Central Building.
Do.	5YR	400, 375	Loyola University.
New York, N. Y.	2XM	Variable.	Columbia University.
Do.	2XY	Variable.	American Telephone and Telegraph Co., 24 Walker Street.
Pasadena, Calif.	6XI	400, 375, variable	Samuel C. McKeon, 581 South Los Robles Avenue.
Polytechnic, Mont.	7YI	400, 375	Bilings Polytechnic Institute.
Portland, Oreg.	7XI	400, 375, variable	Halle's & Watson Radio Service, 102 Park Street.
San Marcos, Tex.	8YF	400, 375	San Marcos High School.
Washington, Pa.	8XO	400, 375	Washington and Jefferson College.

Special land stations, grouped by districts.

Call signal.	District and station.	Call signal.	District and station.
1XC 1XG	First district: Ellicworth, Mo. Bangor, Mo.	6XI 6ZQ 6ZS	Sixth district: Pasadena, Calif. Berkeley, Calif. Bakersfield, Calif.
2XM 2NY	Second district: New York, N. Y. Do.	7XI 7YI	Seventh district: Portland, Oreg. Polytechnic, Mont.
4NA	Fourth district: Atlanta, Ga.	8XG 8XI 8XM 8ZN 8ZO	Eighth district: Washington, Pa. Columbus, Ohio. Lansing, Mich. Buffalo, N. Y. Columbus, Ohio.
5XF 5XM 5XN 5XO 5XX 5YK 5YB 5YT 5ZAQ 5ZAR 5ZII	Fifth district: Brownwood, Tex. New Orleans, La. Houston, Tex. Knoxville, Tenn. Austin, Tex. New Orleans, La. Fort Worth, Tex. San Marcos, Tex. Dallas, Tex. El Paso, Tex. Amarillo, Tex.	9XB 9XG 9YF 9ZG	Ninth district: Chicago, Ill. Colorado Springs, Colo. Mayville, N. Dak. Mount Carroll, Ill.

ALTERATIONS AND CORRECTIONS.

COMMERCIAL LAND STATIONS.

- BOLINAS, CALIF. (KET).—Loc. $0.122^{\circ} 40' 45''$, N. $87^{\circ} 54' 30''$; system, R. C. of A. alternator; w. l., 18,330; rates, from Bolinas or San Francisco, Calif., to Kahuku or any point on the island of Oahu, Hawaii, 25 c. per word; Government rate, 12½ c. per word; press rate, 5 c. per word; lettergrams, \$1.50 for the first 12 words and 10 c. each additional word; week-end lettergrams, \$2.50 for the first 24 words and 8 c. for each additional word. From Bolinas or San Francisco, Calif., to Japan, 72 c. per word; Government rate 36 c. per word; press rate, 27 c. per word; urgent rate, \$2.16 per word.
- CAPE MAY, N. J.—W. l., 300, 600, 1610 (1610 meters used for limited commercial service between stations of the R. C. of A.).
- CHARLESTON, W. VA.—Strike out all particulars.
- CHICAGO, ILL. (KYW).—System, Westinghouse (v. t. telephone and telegraph); W. l., 360, 485; hours, X.
- CLEVELAND, OHIO (WIK).—Hours, 1.30-2, 3.30-4, and 8-9.30 p. m.
- CORAM HILL, N. Y.—W. l., 19,000.
- DALLAS, TEX. (WRR).—System, composite (v. t. telephone); w. l., 360, 485.
- DETROIT, MICH. (WBL).—Call signal changed to WWJ.
- EASTHAMPTON, N. Y.—Rates, effective April 1; all ship traffic, 10 c. per word.
- EDWIGHT, W. VA.—Strike out all particulars.
- LOS ANGELES, CALIF. (KYJ).—W. l., 360, 485; hours 4-5 and 7.45-9 p. m.
- LOS ANGELES, CALIF. (KZC).—Call signal changed to KOG.
- MARION, MASS. (WCC).—W. l., 300, 600, 2800 (2800 meters used for limited commercial service between stations of the R. C. of A.).
- NEW BRUNSWICK, N. J.—Range, 4,000.
- NEW LONDON, CONN. (WLC).—Loc. $0.72^{\circ} 05' 02''$, N. $41^{\circ} 18' 01''$; range, 400; system, R. C. of A., 120; w. l., 300, 450, 600; hours, 7 a. m.-11 p. m.; rates, ship service, 10 c. per word; station operated and controlled by R. C. of A.
- NEW YORK, N. Y. (WSE).—Rates, effective April 1, all ship traffic, 10 c. per word.
- OMAHA, NEBR.—Station operated and controlled by Metropolitan Utilities District.
- ROCHESTER, N. Y.—Range, 100.
- SAN DIEGO, CALIF.—System, composite (v. t. telephone); w. l., 360; hours, 7.30-9 p. m.

- SAN FRANCISCO, CALIF. (KDN).—W. L., 360, 455.
 SAN FRANCISCO, CALIF. (KGB).—Strike out all particulars.
 SAN FRANCISCO, CALIF. (KUG).—Hours, X.
 STAMFORD, MASS.—W. L., 300, 600, 1610 (1610 meters used for limited commercial service between stations of the R. C. of A.).
 TOLEDO, OHIO (WDZ).—Strike out all particulars.
 TUCKERTON, N. Y.—W. L., 15,900; rates, to France, 14 c. per word.
 WASHINGTON, D. C. (WDM).—Hours, 10 a. m.—12.30 p. m. and 7—9.30 p. m.

COMMERCIAL SHIP STATIONS, ALPHABETICALLY BY NAMES OF VESSELS.

[Alterations and corrections to be made to the List of Radio Stations of the United States, edition of June 30, 1921, and to the International List of Radiotelegraph Stations, published by the Berns Bureau.]

- ABRON.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600; hours, X.
 ADMIRAL RODMAN.—System, R. C. of A., 1000.
 AGUIBAY.—Range, 300; system, I. W. T. Co., 1000; w. l., 300, 600; hours, X.
 AJAX.—Strike out all particulars.
 ALA.—Station operated and controlled by S. O. R. S.
 ALASKAN.—Range, 300; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 8 c. per word.
 ALLIANCE.—Hours, X; rates, North and South American service, 4 c. per word.
 ALLOWAY.—System, Navy, 1000; w. l., 300, 450, 600; hours, X.
 AMPETCO.—Strike out all particulars.
 ANACORYTES.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600; hours, X.
 ASHEN, J. HUNSON.—Sabine Towing Co. owner of vessel.
 BARTHENY.—Name changed to De Bardleben; W. G. Coyle & Co. owner of vessel.
 BETHORE.—Range, 300; system, R. C. of A., 1000; w. l., 300, 600.
 BOGOTA.—Range, 200; system, Navy-Simon, 1000; w. l., 300, 600.
 BRISTOL.—Coastwise Transportation Co. owner of vessel.
 CAMBRIDGE (KGR).—Rates, North and South American and transoceanic services, 8 c. per word.
 CARPLAKA.—Range, 300; system, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
 CATHAY.—Station operated and controlled by R. C. of A.
 CELESTIAL.—Station operated and controlled by I. W. T. Co.
 CERRO-EBANO.—Range, 300; system, R. C. of A., 1000.
 CHAMBERINO.—System, Navy-Marconi, 1000; w. l., 300, 450, 600.
 CHATTANOOGA.—Range, 300; system, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
 CITY OF LOWELL.—Range, 150; system, Cutting & Washington, 1000; w. l., 300, 500, 600; hours, X; rates, North and South American and transoceanic services, 8 c. per word; station operated and controlled by I. W. T. Co.
 COAXET.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 CLIFFWOOD.—W. L., 300, 450, 600.
 COLON.—Rates, strike out transoceanic rate.
 COMMACK.—Range, 300; system, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600.
 COMMERCIAL PILOT.—Strike out all particulars.
 CONCORD.—Rates, North and South American and transoceanic services, 8 c. per word.
 CONDOVA.—System, Kilbourne & Clark, 1000.
 CRABTREE.—System, Navy-Marconi, 1000; w. l., 300, 450, 600.
 CRAIGSMERE.—System, Navy-Marconi, 1000; w. l., 300, 450, 600.
 CRANESNEY.—System, Navy-Marconi, 1000; w. l., 300, 450, 600.
 CHAWL KEYS.—System, Navy-R. C. of A., 1000.
 CUBA (KDRJ).—Range, 150; system, R. C. of A., 1000; w. l., 300, 450, 600.
 DAVID McKELVY.—Range, 300; system, R. C. of A., 1000.

- DELAWARE SUN.—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600.
- DIXIE ARROW.—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600; hours, X.
- DRYDEN.—Range, 300; system, Federal arc, w. l., 300, 450, 1800.
- EASTERNER.—System, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600; hours, X.
- EAST WIND.—System, Navy-Marconi, 1000; w. l., 300, 450, 600; hours, X.
- EDGEHILL.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
- ELDRIDGE.—W. l., 300, 450, 600.
- FEDERAL.—Range, 300; system, Westinghouse, 100; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 8 c. per word; station operated and controlled by owner of vessel.
- GAFNEY.—W. l., 300, 450, 600.
- GARFIELD.—Range, 200; system, Navy-R. C. of A., 1000.
- GENERAL G. W. GOETZALS.—Range, 200.
- GEORGIAN.—W. l., 300, 450, 600.
- GLADYSHE.—Range, 300; system, Navy-Marconi, 1000; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 4 c. per word.
- GLYMONT.—Range, 200.
- HAGOOD.—Range, 300; system, Navy-R. C. of A., 1000.
- HAHATONKA.—Range, 300; system, Navy, 1000; w. l., 300, 450, 600.
- HAMMAC.—Range, 300; system, Federal arc, w. l., 300, 450, 1800; station operated and controlled by S. O. R. S.
- HAMPDEN.—Coastwise Transportation Co., owner of vessel.
- HANNAWA.—Range, 300; system, Federal arc, w. l., 300, 450, 1800.
- HARRY LUCKENBACH.—Range, 300; system, Kilbourne & Clark, 1000; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 4 c. per word.
- HERBERT I. PRATT.—Range, 300; system, Navy-Lowenstein, 1000.
- HERMAN FRASCH.—Range, 200; system, Kilbourne & Clark, 1000; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 8 c. per word.
- HULVER.—System, Navy-Simon, 1000.
- INDEPENDENT.—Strike out all particulars.
- JACONA.—System, Navy, 1000; w. l., 300, 450, 600.
- JEAN.—Range, 200; system, I. W. T. Co., 1000.
- JOLEE.—Range, 300; system, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600.
- KATRINA LUCCENBACH.—Range, 300; system, Kilbourne & Clark, 1000; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 8 c. per word.
- LAKE FREEZEOUT.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
- LXNINGTON.—Rates, North and South American and transoceanic services, 8 c. per word.
- LIBRE.—Rates, North and South American and transoceanic services, 8 c. per word.
- LILMAR.—Range, 300; system, Navy, 1000; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 4 c. per word.
- MANITOWOC.—Range, 300; w. l., 300, 450, 600; rates, North and South American and transoceanic services, 8 c. per word; Manitowoc S. S. Corp., owner of vessel.
- MIDDLESSEX.—Coastwise Transportation Co., owner of vessel.
- MOHAWK (KXE).—Range, 100; system, Cutting & Washington, 1000; rates, North and South American services, 8 c. per word; station operated and controlled by I. W. T. Co.
- MOHEGAN.—Range, 150; system, Cutting & Washington, 1000; w. l., 300, 450, 530, 600; hours, X; rates, North and South American and transoceanic services, 8 c. per word; station operated and controlled by I. W. T. Co.
- MORRISTOWN.—W. l., 300, 450, 600; hours, X.

- MOUNT SIDNEY.—Strike out all particulars.
- MOUNT SUMMIT.—Strike out all particulars.
- MUNISLA.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 600.
- NANTASKET.—W. l., 300, 450, 600.
- NEBRASKAN.—Station operated and controlled by owner of vessel.
- NEW ENGLAND.—Range, 300; system, Navy, 1000; w. l., 300, 450, 600.
- NEW HAMPSHIRE.—Station operated and controlled by I. W. T. Co.
- NISHMAHA.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600.
- NORFOLK.—Coastwise Transportation Co., owner of vessel.
- OHIOAN.—Rates, North and South American and transoceanic services, 8 c. per word.
- OKLAHOMA CITY.—Range, 300; system, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
- OPRIJKA.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
- OPHIS.—W. l., 300, 450, 600.
- OSAGE.—W. l., 300, 600.
- OSAKIB.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
- OZETTE.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600.
- PAN AMERICA.—Station operated and controlled by S. O. R. S.
- PANUCCO (KMM).—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600.
- PENINSULA STATE.—Range, 500; system, Federal arc; w. l., 300, 450, 600, 1800; station operated and controlled by S. O. R. S.
- PLYMOUTH (KXH).—Range, 100; system, Cutting & Washington, 1000; w. l., 300, 450, 530, 600; hours, X; rates, North and South American and transoceanic services, 8 c. per word; station operated and controlled by I. W. T. Co.
- POINT LOMA.—Range, 300.
- PRINCETON.—Range, 300; system, R. C. of A., 1000.
- PROVIDENCE.—Range, 350; system, Cutting & Washington, 1000; w. l., 300, 450, 550, 600; hours, X; rates, North and South American and transoceanic services, 8 c. per word; station operated and controlled by I. W. T. Co.
- PUGET SOUND.—System, Navy-R. C. of A., 1000.
- QUEEN.—System, R. C. of A., 1000; w. l., 300, 600.
- RADNOR.—System, Navy-R. C. of A., 1000; w. l., 300, 470, 600; hours, X.
- REDONDO (KYT).—Range, 300; w. l., 300, 450, 600; hours, X.
- RICHMONDAL.—Range, 300; system, Navy-Marconi, 1000.
- ROCKAWAY PARK.—Station operated and controlled by I. W. T. Co.
- SAN JUAN (KGJ).—Hours, X.
- SANTA ALICIA.—Name changed to Edna Christenson.
- SANTA FLAVIA.—Harry W. Crosby, owner of vessel.
- SATARITA.—Range, 300; system, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600.
- SCOTTSBURG.—Station operated and controlled by R. C. of A.
- SELMA.—Strike out all particulars.
- SILETZ.—System, Navy-Kilbourne & Clark, 1000.
- SOLANA.—Range, 300; system, Federal arc, 1000 with chopper; w. l., 300, 600, 1800.
- STEEL NAVIGATOR.—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600.
- SUFFOLK.—Coastwise Transportation Co., owner of vessel.
- SUSQUEHANNA (KOLN).—Station operated and controlled by I. W. T. Co.
- SWIFTSTAR.—Range, 300; system, B. C. of A., 1000; w. l., 300, 450, 600.
- TAMZEL.—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600.
- TOHILA.—W. l., 300, 450, 600.
- TOTECO.—W. l., 300, 460, 530, 600.
- TRANSPORTATION.—Coastwise Transportation Co., owner of vessel.
- TRUMPH.—System, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600.
- WAHKEENA.—Range, 300; system, Gray & Danielson, 240.
- WALDEN.—System, Navy-R. C. of A., 1000; w. l., 300, 450, 600; hours, X.

- WALTER D. MUNSON.—Range, 150; system, R. C. of A., 1000; w. l., 300, 600.
 WARD.—Range, 200; system, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600.
 WERIKA.—Range, 300; system, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 WEST APAUM.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600; hours, X.
 WEST CAVANAL.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 WEST COHAS.—System, Navy-Kilbourne & Clark, 1000.
 WEST COMPO.—System, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600.
 WEST CORUM.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 WEST ELBARA.—System, Navy-Marconi, 1000; w. l., 300, 450, 600; hours, X.
 WESTERN HOPE.—System, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600; hours, X.
 WESTERN KNIGHT.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 WEST GAMBO.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600; hours, X.
 WEST INEPI.—System, Navy, 1000; w. l., 300, 450, 600.
 WEST IRA.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600.
 WEST LASHAWAY.—Hours, X.
 WEST SAGINAW.—Range, 200; system, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600.
 WEST TOTANT.—System, Navy-Lowenstein, 1000; w. l., 300, 450, 600.
 W. H. TILFORD.—Range, 300; system, R. C. of A., 1000; w. l., 300, 450, 600.
 WILLIAM A. WHITNEY.—Strike out all particulars.
 WILLIAM M. MILLS.—Range, 150; rates, North and South American and transoceanic services, 8 c. per word.
 WILLSOLO.—System, Navy-Marconi, 1000; w. l., 300, 450, 600.
 WISLA.—Range, 200; system, I. W. T. Co., 1000; w. l., 300, 600.
 W. L. CONNELLY.—System, R. C. of A., 1000; w. l., 300, 450, 600.
 ZAREMBO.—System, Navy-Kilbourne & Clark, 1000; w. l., 300, 450, 600.

COMMERCIAL LAND AND SHIP STATIONS, ALPHABETICALLY BY CALL SIGNALS.

- KIZD, *read* De Bardeleben; KZC, *read* KOG; WBL, *read* WWJ; WSJ *read* Edna Christ. ensoo; strike out all particulars following the call signals KGB, KJC, KMAU, KOJ, KQP, KUKQ, KUSS, WCK, WDZ, WMB, WPI, and WPJ.

GOVERNMENT LAND STATIONS, ALPHABETICALLY BY NAMES OF STATIONS.

- ANNAPOLIS, MD. (NAK).—Service, PG; rates, ship service, 8 c. per word.
 ASTORIA, OREG.—Loc. $0.123^{\circ} 50' 51''$, N. $46^{\circ} 11' 05''$.
 BALBOA, C. Z.—Loc. $0.79^{\circ} 46' 20''$, N. $09^{\circ} 07' 15''$.
 BAR HARBOR, ME. (regular station).—Loc. $0.68^{\circ} 18' 00''$, N. $44^{\circ} 14' 15''$.
 BOSTON, MASS. (WYCA).—Call signal changes to WVO.
 CAPE MALA, PANAMA.—Loc. $0.79^{\circ} 59' 30''$, N. $07^{\circ} 27' 30''$.
 CAPE MAY, N. J.—Loc. $0.74^{\circ} 55' 46''$, N. $38^{\circ} 55' 50''$.
 CAYRY, P. R.—Loc. $0.66^{\circ} 09' 50''$, N. $18^{\circ} 07' 10''$.
 CHARLESTON, S. C.—Loc. $0.79^{\circ} 57' 49''$, N. $32^{\circ} 51' 36''$.
 CHATHAM, MASS.—Loc. $0.69^{\circ} 58' 56''$, N. $41^{\circ} 42' 11''$.
 COCO SOLO, C. Z.—Service, 0; hours, N.
 COLON, C. Z.—Loc. $0.79^{\circ} 54' 01''$, N. $09^{\circ} 21' 56''$; service, PG; rates, ship service, 8 c. per word.
 CORDOVA, ALASKA.—Loc. $0.145^{\circ} 25' 30''$, N. $60^{\circ} 28' 30''$.
 DUTCH HARBOR, ALASKA.—Loc. $0.166^{\circ} 33' 07''$, N. $53^{\circ} 53' 14''$.
 EAGLE HARBOR, MICH.—Loc. $0.88^{\circ} 08' 45''$, N. $47^{\circ} 27' 49''$.
 EUREKA, CALIF.—Loc. $0.124^{\circ} 16' 24''$, N. $40^{\circ} 41' 45''$.
 FORT BENJAMIN HARRISON, IND.—Call signal changed to WVS.

- FORT CROOK, NEBR.—Strike out all particulars.
- FORT D. A. BESSEL, WYO.—Call signal changed to WWV.
- FORT DOUGLAS, UTAH.—Call signal changed to WVX.
- FORT DRUM, P. I.—Call signal changed to WUAL.
- FORT HOWARD, MD.—Call signal changed to WVQ.
- FORT McPHERSON, GA.—Call signal changed to WVR.
- FORT SHERIDAN, ILL.—Strike out all particulars.
- FORT WINT, P. I.—Call signal changed to WUAK.
- FORT WOOD, N. Y.—Strike out all particulars.
- GUANTANAMO, CUBA.—Loc. $0.75^{\circ} 08' 35''$, N. $19^{\circ} 54' 38''$.
- HEEIA POINT, HAWAII.—Read Honolulu, Hawaii (Heeia Point); loc. $0.157^{\circ} 58' 00''$, N. $21^{\circ} 20' 45''$.
- HONOLULU, HAWAII (Pearl Harbor).—Loc. $0.157^{\circ} 58' 00''$, N. $21^{\circ} 20' 45''$.
- JEFFERSON BARRACKS, MO.—Call signal changed to WVV.
- JUNEAU, ALASKA.—Loc. $0.134^{\circ} 24' 45''$, N. $58^{\circ} 18' 35''$.
- JUPITER, ALASKA.—Loc. $0.80^{\circ} 05' 02''$, N. $26^{\circ} 56' 54''$.
- KETCHIKAN, ALASKA.—Loc. $0.131^{\circ} 38' 51''$, N. $55^{\circ} 20' 45''$.
- KEY WEST, FLA.—Loc. $0.81^{\circ} 48' 21''$, N. $24^{\circ} 33' 22''$.
- KODIAK, ALASKA.—Loc. $0.152^{\circ} 21' 45''$, N. $57^{\circ} 40' 45''$.
- LAKEHURST, N. J.—Loc. $0.74^{\circ} 19' 48''$, N. $40^{\circ} 02' 15''$.
- LA PALMA, PANAMA.—Loc. $0.78^{\circ} 08' 30''$, N. $08^{\circ} 26' 00''$; service, PG; rates, ship service, 6 c. per word.
- MACKINAC ISLAND, MICH.—Service, PG; rates, ship service, 3 c. per word.
- MANAGUA, NICARAGUA.—Loc. $0.86^{\circ} 37' 00''$, N. $12^{\circ} 17' 00''$.
- MANILA, P. I.—Call signal changed to WUAI.
- MANISTIQUE, MICH.—Loc. $0.86^{\circ} 15' 36''$, N. $45^{\circ} 57' 36''$; service, PG; rates, ship service, 6 c. per word.
- MARSHFIELD, OREG.—Loc. $0.124^{\circ} 13' 33''$, N. $43^{\circ} 20' 38''$; service, 0.
- MIAMI, FLA.—Loc. $0.80^{\circ} 07' 43''$, N. $25^{\circ} 47' 56''$.
- MOBILE, ALA.—Service, PG; rates, ship service, 6 c. per word.
- MOREHEAD CITY, N. C.—Loc. $0.76^{\circ} 44' 00''$, N. $34^{\circ} 43' 30''$; service, PG; rates, ship service, 6 c. per word.
- NAVAL ACADEMY, MD. (NAK).—See Annapolis, Md.
- NAVARRA ISLAND, WEST INDIES.—Loc. $0.74^{\circ} 01' 00''$, N. $18^{\circ} 24' 00''$; service, PG; rates, ship service, 6 c. per word.
- NEW ORLEANS, LA. (NAT).—Loc. $0.90^{\circ} 01' 54''$, N. $20^{\circ} 56' 51''$.
- NEWPORT, R. I.—Loc. $0.71^{\circ} 17' 00''$, N. $41^{\circ} 35' 20''$.
- NEW YORK, N. Y.—Loc. $0.73^{\circ} 58' 48''$, N. $40^{\circ} 41' 58''$.
- NORFOLK, VA.—Loc. $0.76^{\circ} 17' 43''$, N. $36^{\circ} 49' 36''$.
- NORTH HEAD, WASH.—Loc. $0.124^{\circ} 04' 31''$, N. $46^{\circ} 17' 56''$.
- OLONGAPO, P. I.—Loc. $0.120^{\circ} 10' 49''$ E., N. $14^{\circ} 49' 78''$; service, PG; rates, ship service, 6 c. per word.
- PARRIS ISLAND, S. C.—Loc. $0.80^{\circ} 46' 22''$, N. $32^{\circ} 21' 01''$.
- PEKING, CHINA.—Loc. $0.116^{\circ} 47' 00''$ E., N. $39^{\circ} 55' 00''$.
- PETERSBURG, ALASKA.—Strike out all particulars.
- PHILADELPHIA, PA.—Loc. $0.75^{\circ} 10' 50''$, N. $39^{\circ} 53' 20''$.
- PENSACOLA, FLA.—Loc. $0.87^{\circ} 16' 10''$, N. $30^{\circ} 20' 53''$.
- POINT ISABEL, TEX.—Loc. $0.97^{\circ} 12' 33''$, N. $26^{\circ} 04' 10''$.
- PORT AU PRINCE, HAITI.—Loc. $0.72^{\circ} 19' 52''$, N. $18^{\circ} 33' 18''$.
- PORTLAND, ME.—Loc. $0.70^{\circ} 12' 08''$, N. $43^{\circ} 33' 54''$; service, 0.
- PORTSMOUTH, N. H.—Service, 0.
- PUGET SOUND, WASH.—Loc. $0.122^{\circ} 37' 03''$, N. $47^{\circ} 41' 46''$.
- PUERTO OBALDIA, PANAMA.—Loc. $0.79^{\circ} 13' 00''$, N. $09^{\circ} 33' 00''$; service, PG; rates, ship service, 6 c. per word.

- QUANTICO, VA.—Loc. $0.77^{\circ} 17' 15''$, N. $38^{\circ} 31' 35''$.
 SAN DIEGO, CALIF.—Loc. $0.117^{\circ} 14' 49''$, N. $32^{\circ} 42' 26''$.
 SAN DOMINGO, P. R.—Loc. $0.69^{\circ} 53' 15''$, N. $19^{\circ} 27' 43''$; rates, ship service, 6 c. per word.
 SAN FRANCISCO, CALIF. (NPG).—Loc. $0.122^{\circ} 22' 52''$, N. $37^{\circ} 39' 18''$.
 SAN FRANCISCO, CALIF. (WYCH).—Call signal changed to WVY.
 SAN JUAN, P. R.—Loc. $0.66^{\circ} 05' 40''$, N. $18^{\circ} 28' 03''$.
 SAN PEDRO, CALIF.—Loc. $0.118^{\circ} 22' 35''$, N. $33^{\circ} 57' 49''$.
 SAVANNAH, GA.—Loc. $0.81^{\circ} 06' 15''$, N. $32^{\circ} 05' 15''$.
 SAYVILLE, N. Y.—Loc. $0.73^{\circ} 06' 12''$, N. $40^{\circ} 44' 38''$.
 SHANGHAI, CHINA (WZI).—Strike out all particulars.
 SITKA, ALASKA.—Loc. $0.135^{\circ} 21' 00''$, N. $57^{\circ} 02' 57''$.
 ST. AUGUSTINE, FLA.— $0.81^{\circ} 17' 18''$, N. $29^{\circ} 53' 10''$.
 ST. PETERSBURG, FLA.— $0.82^{\circ} 38' 00''$, N. $27^{\circ} 40' 15''$.
 TATOOSH, WASH. (regular station).—Loc. $0.124^{\circ} 44' 03''$, N. $48^{\circ} 23' 31''$.
 TONGSHAN, CHINA.—Strike out all particulars.
 VIRGINIA BEACH, VA. (regular station).—Strike out all particulars.
 VLADIVOSTOK, RUSSIA.—Loc. (approximately) $0.131^{\circ} 48' 00''$ E., N. $43^{\circ} 00' 00''$; w. l., 3950, variable; service, 6; hours, N.
 WASHINGTON, D. C. (Arlington, NAA).—Loc. $0.77^{\circ} 04' 47''$, N. $38^{\circ} 52' 05''$.
 WASHINGTON, D. C. (Navy Yard, NAL).—Loc. $0.76^{\circ} 59' 46''$, N. $38^{\circ} 52' 22''$.

GOVERNMENT SHIP STATIONS, ALPHABETICALLY BY NAMES OF VESSELS.

WEST LEWARK.—Name changed to Meigs.

GOVERNMENT LAND AND SHIP STATIONS, ALPHABETICALLY BY CALL SIGNALS.

NAK, read Annapolis, Md. (Naval Academy); NPM, read Honolulu, Hawaii (Heeia Point); WJD, strike out all particulars; WYI, strike out all particulars; WVP, read WUAL; WVR, read WUAK; WVU, read WUAJ; WXD, read Meigs; WYCA, read WVO; WYCB, strike out all particulars; WYCC, read WVQ; WYCD, read WVR; WYCE, read WVS; WYCF, strike out all particulars; WYCG, strike out all particulars; WYCH, read WYY; WYCI, read WVV; WYCI, read WVX; WYCK, read WVW; WZI, strike out all particulars.

SPECIAL LAND STATIONS, BY NAMES OF STATIONS.

- ANTHONY, KANS. (9ZAC).—Station controlled by T. & H. Radio Co.
 BELFAST, ME. (1XR).—Strike out all particulars.
 BOISE, IDAHO (7YA).—Address, Boise High School.
 BOZEMAN, MONT. (TXB).—W. l., variable from 200 to 375.
 BURLEY, IDAHO (7YF).—Strike out all particulars.
 BUFFALO, N. Y. (8XAD).—Station controlled by Federal Telephone & Telegraph Co., 1738 Elmwood Avenue.
 DEFIANCE, OHIO (8ZY).—Address, 1060 Wilhelm Street.
 EL PASO, TEX. (5ZAD).—Address, 811 North Oregon Street.
 FRANKLINTON, LA. (5ZK).—W. l., 200, 375.
 FRESNO, CALIF. (6ZU).—Address, 100 Olive Avenue.
 HAMPTON, N. H. (1XY).—Strike out all particulars.
 HIGHLAND PARK, MICH. (8XAF).—Address, 896 Monterey Avenue.
 HOUSTON, TEX. (5ZAA).—Address, R. F. D. No. 3, Box 29-B, Bellaire Boulevard.
 HOUSTON, TEX. (5ZX).—Address, 2504 Bagby Street.
 KNOXVILLE, TENN. (5XK).—W. l., variable from 200 to 375.
 MEDFORD, MASS. (1XE).—Read Medford Hillside, Mass.
 MEDIA, PA. (3ZM).—W. l., 200, 375.

MINNEAPOLIS, MINN. (9ZT).—W. L., 150, 200, 375; address, 402 Courthouse Building.
 MOUNT CLEMENS, MICH. (8XAE).—W. L., 200, 375.
 MULGA, ALA. (5ZY).—Strike out all particulars.
 NEW HAVEN, CONN. (1ZC).—Strike out all particulars.
 PHILADELPHIA, PA. (3ZG).—Address, 3936 Locust Street.
 PITTSBURGH, PA. (8XK).—Address, 7712 Pennsylvania Avenue.
 POLYTECHNIC, MONT. (7XD).—Strike out all particulars.
 PORTLAND, OREG. (7XA).—Strike out all particulars.
 RICHFIELD, UTAH. (6ZH).—Strike out all particulars.
 RICHMOND, VA. (3ZP).—Address, 2112 East Clay Street.
 SAN DIEGO, CALIF. (6XZ).—Strike out all particulars.
 SAN FRANCISCO, CALIF. (6XT).—Read Vernon, Calif.; address, 604 Mission Street, San Francisco, Calif.
 SANFORD, FLA. (5ZH).—Strike out all particulars.
 SCHENECTADY, N. Y. (2XQ).—W. L., 200, 375, variable.
 SOUTH MANCHESTER, CONN. (1XT).—Strike out all particulars.
 SOUTH SAN ANTONIO, TEX. (5XI).—Station controlled by Max E. Schneider, Kelly Field, Tex.
 TUCSON, ARIZ. (5YP).—Call signal changed to 6YB.
 WASHINGTON, D. C. (3ZW).—W. L., 100, 150, 200, 250.

MISCELLANEOUS.

LOCALIZED RADIO LANDING SIGNALS FOR AIRPLANES.

Radio direction finders and other radio devices have been in use for some time to assist airplanes to land during the night, during fog, or at other time of poor visibility. The most usual method of using radio for this purpose is to transmit from an ordinary elevated antenna at the landing field radio signals which are received on a direction finder located on the airplane. On small planes the direction finder may be simply a coil of wire wound on the fuselage; in larger planes a small rotatable coil may be mounted vertically aft in the plane. This method gives the direction of the landing field, but does not give accurate information as to its distance when the plane is near the landing field.

Several years ago the Bureau of Standards was called upon to develop a method to assist airplanes to accurately locate the landing field when the airplane was quite near. It was desired to develop a method which would give a good signal which would be easily audible over a comparatively large area when the airplane was at comparatively high altitudes, but would be localized within a small area when the airplane was near the ground. The accurate location of the landing field is very important when near the ground.

A method of induction signaling was first tried, using 500-cycle alternating current. This current flowed through a large horizontal single-turn coil, 600 by 800 feet, at the landing field. The coil was tuned to 500 cycles, so that a large current flowed. For the induction signaling the reception on the airplane was made using horizontal coils wound on the lower wings of the airplane. It was found that this method gave a signal which was audible over a wide area when the airplane was near the ground, but was confined to a small area when the airplane was at an elevation of about a mile. This was not satisfactory.

The use of radio-frequency waves was therefore undertaken. Two horizontal coils were placed one above the other. The coils were identical in construction, and placed so that their axes coincided. The current in one coil flowed in a direction opposite to the current in the other coil. A fairly high radio frequency, suitable for direction-finding work, such as 300 kilocycles, was used.

A calculation was made which indicated that the signals radiated from the two coils would be strongest for an airplane flying in a given horizontal plane, whenever the plane was inside a comparatively small ring-shaped area located above the landing field. After the coils had been constructed a careful experimental investigation was made under actual flying conditions, and the results of this calculation were verified. Signals were received on the airplane only when it was nearly above and in the immediate vicinity of the landing field. A Curtiss Type R plane was used for the experimental work for both the induction signaling and the radio signaling.

The Bureau of Standards has just published a paper giving the theory of the radiation from an antenna consisting of two horizontal coils, as used in this work. It is found that if a vertical coil antenna is used for reception on the airplane and if the airplane flies horizontally, the maximum signal is received when the line joining the airplane to the transmitting coils makes an angle of 30° with the vertical, assuming that the effect of the earth is negligible. The region of space within which the signal can be detected by receiving instruments of given sensibility has nearly the form of the space between two inverted coaxial vertical circular cones of finite length having their common apex at the transmitting station. The upper limit of the region within which the signal is audible depends on the sensitivity of the receiving apparatus and is not as clearly defined as the bounding conical surfaces. The signal vanishes when the airplane is directly over the transmitting station, and vanishes rather soon after the airplane passes over the region of maximum signal and flies away from the transmitting station.

The effect on the transmission of having a perfectly conducting earth directly under the transmitting coils has also been investigated, and it has been found that in this case a maximum signal is obtained when the line joining the airplane to the transmitting station makes an angle of $26^\circ 34'$ with the vertical. It is expected that these theoretical studies will be very useful in the design of radio transmitting stations for sending localized landing signals to airplanes.

The results of these investigations are given in Bureau of Standards Scientific Paper No. 431, "The Field Radiated from Two Horizontal Coils," by Gregory Breit. A copy may be purchased for 5 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.—Submitted by Bureau of Standards.

A RADIO RELAY RECORDER.

Recording devices have been used for many years in wire and cable telegraphy, but it has only been within the last few years that their use has been extended to radiotelegraphy. The very small amount of energy in a received radio signal, usually only a few microwatts, has made it difficult to construct recorders which would operate from radio signals.

In the last few years several devices have been developed for recording radio signals. One type is photographic and is expensive in operation. Another type uses a sensitive air jet. A third is an electron tube device which operates at the critical point of the characteristic curve of the tube, where the tube is just on the verge of oscillation. These are all very sensitive devices and are designed to operate on currents of a milliamperes or less. Their mechanical systems are therefore delicate and require careful adjustment. In some types very sensitive relays are used.

There has recently been developed at the Bureau of Standards a type of recorder which differs from those heretofore available, in that larger currents of the order of 5 milliamperes or more are used, and the whole apparatus is therefore more rugged. Currents of this strength are obtained by amplifying the feeble received signals by the use of the electron tube amplifier. Electrical tuning to the audio frequency which is being received is employed. This relay has been made possible by the development of the electron tube amplifier as a reliable radio instrument suitable for use in engineering practice and not simply as a laboratory instrument. With a cur-

rent of 5 milliamperes or more available, it is possible to use an ordinary telegraph relay, which possesses rugged construction and does not require careful and repeated adjustment for operation. With 5 milliamperes a strong and positive action is obtained.

The received signal after amplification is delivered through a tuned audio-frequency transformer to the plate circuit of an electron tube in which is connected the windings of a high-resistance telegraph relay. A condenser having a capacity of about 1 microfarad is shunted across the relay windings. The movement of the armature of the relay may be made to operate any desired mechanism, such as the usual ink-tape register or other apparatus. The relay may therefore be used for remote control of boats or other vehicles.

The selectivity of the apparatus is greatly increased by the use of audio-frequency tuning of the secondary circuit of the input transformer. This makes duplex operation possible. By the use of two such relays operated in series from the output of the same amplifier, simultaneous records have been made of two messages sent at the same time on slightly different wave lengths. On a double-pen register, with one antenna, simultaneous records have been made of the marking wave and the spacing wave of Annapolis by proper audio-frequency tuning.

This relay has been so constructed that all of the power required for operating the electron tube circuits may be obtained from lighting mains carrying 110-volt, 60-cycle, alternating current. If such alternating current power is not available, the relay is also constructed so as to operate from batteries connected to the proper terminals provided for this purpose.

This device has many applications:

1. Code messages may be received on tape, and the necessity for an experienced operator therefore eliminated. News, market, and weather reports and other material broadcasted by radiotelegraph at fairly high speeds may be received on tape and read by an operator of comparatively little experience.

2. A call system may be used, thus avoiding the necessity of a constant watch being kept by an operator.

3. In line-radio telegraphy a sounder may be operated from the signal transmitted by radio-frequency currents, thus making it unnecessary for the Morse operator to read signals received on a telephone receiver.

4. Any form of mechanism may be operated by radio for the remote control of a moving body. Thus this relay can be used for controlling an automobile, a boat, or an airplane.

5. By means of two recorders of this type connected in series simultaneous reception may be made of two messages on the same antenna.

6. Interference from strays is somewhat reduced by the audio-frequency tuning.

A complete description of this recorder may be found in a paper by F. W. Dunmore, "A relay recorder for remote control by radio," published in the April (1922) issue of the *Journal of the American Institute of Electrical Engineers*.—*Submitted by Bureau of Standards.*

ELEMENTARY RADIO PUBLICATIONS.

The Signal Corps has published two pamphlets which will be found of interest by any person who desires an elementary discussion of electricity and radio.

Signal Corps Radio Communication Pamphlet No. 1, "Elementary Principles of Radio Telegraphy and Telephony," is a pamphlet of 79 pages which presents in simple language the fundamental principles of radio communication and discusses the operation of the more important methods and apparatus for transmitting and receiving, including spark gaps, arcs, electron tubes, crystal detectors, regenerative reception, and radio telephony. The use of the electron tube as a generator, detector, and amplifier, and in beat reception, is discussed. No mathematics is used. The pamphlet contains 56 explanatory figures, many of which are circuit diagrams. A

copy of this pamphlet may be purchased for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Signal Corps Training Pamphlet No. 1, "Elementary Electricity," is a pamphlet of 52 pages which presents the fundamental facts of electricity and magnetism. It includes discussions of the flow of the electric current, the action of electric charges, the magnetic field, electromagnetism, batteries, and the action of dynamos. There are 37 explanatory figures and a number of illustrative problems. A copy may be purchased for 15 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.—*Submitted by Bureau of Standards.*

A METHOD OF MEASURING COIL CAPACITIES AND STANDARDIZING WAVE METERS.

In any laboratory in which accurate radio measurements are made it is important to have available exact methods of measuring and comparing frequencies. A method of accomplishing this result has been developed at the Bureau of Standards.

This paper describes a method of adjusting the frequencies of two alternating currents accurately to a ratio which is known. It may be used for the measurement of capacities of inductance coils and for standardizing wave meters, because in both of these an accurate knowledge of frequencies is required.

It is often observed that if a detector is placed in the neighborhood of two radio-frequency electron tube generating sets a musical note is heard in a pair of telephone receivers connected in the detector output even if the frequencies of the two generating sets are not near equality. A measurement of the frequencies of both generating sets reveals the fact that if the note is heard the ratio of the frequencies is very nearly that of two small whole numbers. The reason which makes the musical note appear when the two frequencies are nearly in this ratio is the distortion in the current of the detector circuit caused by the rectifying properties of the detector and at times the distortion of the wave form of the oscillator itself—that is, the action of the detector is to introduce various harmonics. The method used depends on this fact.

The harmonics produced by a circuit of adjustable frequency are made to give beats with the fundamental of a circuit of fixed frequency. The beats are rectified and amplified and are heard as a musical note. When the beat frequency is zero, the ratio of the frequencies is exactly a whole number. This whole number may be made very large, as, for example, 100.

The paper describes the method in detail, and gives applications to frequency standardization and the measurement of coil capacities.—*Submitted by Bureau of Standards.*

VIOLATION OF REGULATIONS.

A number of complaints of violation of article 2 of the International Convention Service Regulations by radio operators on board American vessels have been recently received from Canadian direction-finding stations. This article prohibits the use of 800 meters for commercial traffic; 800 meters should be used only for obtaining radio compass bearings.

The attention of all ship radio operators is invited also to article 35 of the International Convention Service Regulations, which requires shipboard stations to transmit their messages to the nearest coast station. Several foreign land stations have reported American ship stations for violation of this regulation.

Any operator violating these regulations may have his license suspended or revoked.

ALASKAN STATIONS OPENED.

The following-named stations in Alaska opened for the season as follows:

- Ikaton (KXW), March 14, 1922.
- False Pass (KJL), March 13, 1922.
- Yakutat (KKA), March 16, 1922.
- Port Walter, Alaska (KEQ), April 2, 1922.
- Port Althorp, Alaska (KJW), April 3, 1922.

DAILY POSITION OF VESSELS BY RADIO.

The following information was furnished by the assistant traffic manager of the Radio Corporation of America:

"Mariners are advised that their daily ship position reports may be forwarded without charge if addressed to one of the radio stations given below:

Station.	Call signal.	Station.	Call signal.
Chatham, Mass. (Cape Cod).....	WCC	New York, N. Y.....	WNY
Natick, Mass.....	WPC	Cape May, N. J.....	WCY
New London, Conn.....	WLC	San Francisco, Calif.....	KPH

"Such reports are now being printed on the marine pages of several of the daily newspapers on the Atlantic and Pacific coasts."—From *Hydrographic Bulletin*, March 22, 1922.

DATE ON WHICH AN OBSTRUCTION IS SIGHTED.

The attention of shipmasters is invited to the fact that it is very desirable to know the date when ice and other obstructions reported by radio from ship to ship were sighted. Many reports of this kind come to the Hydrographic Office bearing only the date of the radiogram and lacking the date when the obstruction was seen. Cooperation in supplying this additional fact will assist the work of this office and will be thankfully appreciated.—From *Hydrographic Bulletin*, March 22, 1922.

CHANGE IN RATES FOR NAVAL STATIONS.

The notice regarding "Change in rates for naval stations," published in the Radio Service Bulletin for September, 1921, is canceled and the following should be substituted.

Effective November 1, 1921, the delivery rates for traffic destined to points in Panama via naval radio stations in the Canal Zone will be as follows: For the first 10 words (or fraction thereof), 20 cents. For each additional word in excess of 10, 1 cent per word. The foregoing are the land-line delivery rates and are in addition to the published rates for radio reception by the various naval radio stations in the Canal Zone.

RADIO WEATHER REPORT BY KARLSBORGS, SWEDEN, STATION.

From March 15, 1922, Karlsborgs Radio Station (call letters SAJ) will transmit daily at 12.15, G. M. T., on a 2,500-meter wave length, a weather report compiled by the Meteorologic-Hydrographic Office in Stockholm. The report is divided into four parts:

Part I.—Meteorological observations at 7, G. M. T., same day, from the following seven stations:

Station.	Code letter.	Position.
Boel.....	B	Lat., 67° 36' N.; long., 12° 04' E.
Kinn.....	K	Lat., 61° 54' N.; long., 4° 47' E.
.....	Lat., 59° 18' N.; long., 4° 53' E.
Hansthelm.....	Hm	Lat., 57° 07' N.; long., 8° 36' E.
Vinga.....	V	Lat., 57° 38' N.; long., 11° 36' E.
Hastingsham (Hornholm).....	Hs	Lat., 55° 19' N.; long., 14° 47' E.
Gotska Sandön.....	G	Lat., 58° 23' N.; long., 19° 11' E.
Bromö.....	B	Lat., 62° 52' N.; long., 17° 44' E.

The observations, which are preceded by the word "Weatherreport," are transmitted in two groups of five symbols each for every station, thus: BBDD FVTT.

"BBB" signifies the barometer reading given in millimeters and tenths of millimeters.

"DD" signifies the direction of the wind, in points, reckoned from the north, as:

- | | |
|-------------------|-------------------|
| 02—Wind from NNE. | 18—Wind from SSW. |
| 04—Wind from NE. | 20—Wind from SW. |
| 06—Wind from ENE. | 22—Wind from WSW. |
| 08—Wind from E. | 24—Wind from W. |
| 10—Wind from ESE. | 26—Wind from WNW. |
| 12—Wind from SE. | 28—Wind from NW. |
| 14—Wind from SSE. | 30—Wind from NNW. |
| 16—Wind from S. | 32—Wind from N. |
| 00—Calm. | |

"F" signifies the force of the wind according to the Beaufort scale, given in one symbol. When the force is over 9, the figure 9 is given and the real force is given at the end of the information for the station concerned, preceded by the word "storm"; for example, "Force 11, storm 11."

"V" signifies the weather at the time of observation, as:

- | | |
|--------------------|------------|
| 0—Clear sky. | 5—Rain. |
| 1—Almost clear. | 6—Snow. |
| 2—Half clear. | 7—Haze. |
| 3—Almost overcast. | 8—Fog. |
| 4—Overcast. | 9—Thunder. |

"TT" signifies the air temperature in whole degrees. The temperature under 0° is given by increasing the number indicating the temperature by 50. For example, 01 signifies +1°; 51 signifies -1°, etc.

"a" signifies the state of the sea according to the following scale:

- | | |
|---------------------------------|------------------------------|
| 0—No swell, smooth sea. | 5—Heavy swell, moderate sea. |
| 1—Moderate swell, smooth sea. | 6—Rather high sea. |
| 2—Heavy swell, smooth sea. | 7—High sea. |
| 3—No swell, moderate sea. | 8—Very high sea. |
| 4—Moderate swell, moderate sea. | 9—Extraordinary high sea. |

The letter "x" will replace a symbol to indicate missing data.

Example of Part I:

"Weatherreport R 67020 60515

"K 65808 50573 U 65520 10582

"Hm 62404 4461x V 62004 3166x

"Hs 56232 2661x G 59204 8364x" means:

"The following observations were made to-day at 7 a. m., G. M. T.

Point of observation.	Barometer.	Wind.		Weather.	Temperature.	State of the sea.
		Direction.	Force.			
Roset.....	767.0	SW.	5	Clear.....	- 1°	Heavy swell, moderate sea.
Finnh.....	765.8	E.	5	Clear.....	- 7°	No swell, moderate sea.
Cladre.....	766.5	SW.	1	Clear.....	- 8°	Heavy swell, smooth sea.
Hansholm.....	762.4	NR.	4	Overcast.....	-11°	
Vinga.....	763.0	NR.	3	Almost clear.....	-18°	
Hannestads.....	758.2	N.	2	Snow.....	-11°	
Grosska Sanden.....	759.2	NR.	8	Almost overcast.....	-14°	
Brend.....	(No reports.)					