

# DEPARTMENT OF COMMERCE

# RADIO SERVICE BULLETIN

ISSUED MONTHLY BY BUREAU OF NAVIGATION

Washington, December 1, 1923—No. 80

## CONTENTS.

	Page.		Page.
Abbreviations.....	1	Miscellaneous—Continued.....	
New stations.....	2	Alaskan stations reopened.....	10
Alterations and corrections.....	5	Azores station reopened.....	10
Miscellaneous:		Lost commercial radio operators' licenses....	10
Radio stations installed on German light vessels.....	9	Application of statistical analysis to radio transmission problems.....	11
Wireless fog signal established at Cape Ray, Newfoundland.....	9	Announcement of standard frequency transmissions.....	11
Wireless fog signal established on Heath Point Light Vessel, Gulf of St. Lawrence, Canada.....	10	A study of radio signal fading.....	12
Alaskan station closed for the season.....	10	Standard frequency stations.....	13
		References to current radio periodical literature.....	14

## 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.
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. RC = Radio compass station. FS = Fog signal. P = Private. O = Government business exclusively.
Hours	= Hours of operation: N = Continuous service. X = No regular hours. m = a. m. (12 m = midday). s = p. m. (12 s = midnight).
Rates	= Ship or coast charges in cents: c. = cents. (The rates in the international list are given in francs and centimes.)
I. W. T. Co.	= Independent Wireless Telegraph Co.
R. C. A.	= Radio Corporation of America.
S. O. R. S.	= Ship Owners' Radio Service.
C. w.	= Continuous wave.
I. c. w.	= Interrupted continuous wave.
V. t.	= Vacuum tube.
FX	= Fixed station.
U. S. L.	= After operating company denotes that the change applies only to the List of Radio Stations of the United States.
Kc.	= Kilocycles.
Fy.	= Frequency.

## 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, 1923, and to the International List of Radiotelegraph Stations published by the Berne bureau.]

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by—
Benton Harbor, Mich. <sup>1</sup> ...	WIZ	300, 600, 706.....	P	X	Graham & Merton Transportation Co.
Birmingham, Ala.....	WPM	.....	P	X	Inland and Coastwise Waterways Service.
Los Angeles, Calif. (portable). <sup>2</sup>	KFV	146, 1666.....	FX	X	Los Angeles County, forestry department.
Los Angeles, Calif. <sup>2</sup>	KYY	146, 1666.....	FX	X	Do.
Manistique, Mich. <sup>3</sup> .....	WOJ	300, 600, 706, 1666.	P	X	Ann Arbor R. R. Co.
Memphis, Tenn.....	WPI	.....	P	X	Inland and Coastwise Waterways Service.
Mobile, Ala.....	WPP	.....	P	X	Do.
Tree Point Lighthouse Station, Alaska. <sup>4</sup>	KIJ	300, 650, 600.....	P	X	G. E. Maddox.

<sup>1</sup> Loc. 0.83° 28' 42", N. 42° 06' 50"; range, 200; system, R. C. A., 1000.

<sup>2</sup> Range, 50; system, composite v. t. telephone and telegraph.

<sup>3</sup> Range, 150; system, De Forest v. t. telephone and telegraph.

<sup>4</sup> Loc. 0.86° 15' 35", N. 46° 57' 48"; range, 300; system, composite spark, 1000.

<sup>5</sup> Loc. 0.133° 55' 57", N. 54° 48' 07"; range, 25; system, composite v. t. telegraph.

*Commercial ship stations, alphabetically by names of vessels.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923, and to the International List of Radiotelegraph Stations published by the Berne bureau.]

Name of vessel.	Call signal.	Rates.	Service.	Hours.	Owner of vessel.	Station controlled by—
Aisne.....	KDNC	8	PG	N	U. S. S. B.....	Owner of vessel.
Birmingham.....	KFME	.....	P	X	Inland and Coastwise Waterways Service.	
Cantigny.....	KDFO	8	PG	N	U. S. S. B.....	Do.
Cordeva.....	KFMF	.....	P	X	Inland and Coastwise Waterways Service.	
Demopolis.....	KFMG	.....	P	X	do.....	Do.
Douglas.....	KFMM	.....	.....	.....	Cary Davis Tug & Barge Co.	
Gulfport.....	KFMD	.....	P	X	Inland and Coastwise Waterways Service.	Do.
Illinois.....	KFMC	.....	P	X	do.....	
Iowa.....	KFLT	.....	P	X	do.....	Do.
John W. Boardman.....	KFMN	.....	PG	X	Huron Transportation Co.	
Marne.....	KDLV	8	PG	N	U. S. S. B.....	Owner of vessel.
New Orleans.....	KPLS	.....	P	X	Inland and Coastwise Waterways Service.	
Mobile.....	KFMI	.....	P	X	do.....	Do.
Montgomery.....	KFMH	.....	P	X	do.....	
Outcq.....	KDMF	8	PG	N	U. S. S. B.....	Do.
Pioneer <sup>1</sup> .....	KFMK	.....	PG	X	Cleveland Cliffs S. S. Co.	
Pontiac <sup>2</sup> .....	KFML	.....	PG	X	do.....	Do.
Shasta <sup>2</sup> .....	KFMO	8	PG	X	E. K. Wood Lumber Co.	
Tours.....	KDNB	8	PG	N	U. S. S. B.....	Do.
Tuscaloosa.....	KFMI	.....	P	X	Inland and Coastwise Waterways Service.	

<sup>1</sup> Range, 150; system, Navy-R. C. A., 1000; w. l., 300, 600, 706; rates, Great Lakes service, 2 cents per word.

<sup>2</sup> Range, 200; system, Gray & Danielson, 240; w. l., 300, 600.

NOTE.—The Inland and Coastwise Waterways Service, in addition to the above-named ship stations, operates the following-named ship stations: Baton Rouge (KDVB), Cairo (KDQW), Memphis (KDVB),

**RADIO SERVICE BULLETIN.**

*Commercial land and ship stations, alphabetically by call signals.*

[—ship station; —land station.]

Call signal.	Name.	Call signal.	Name.
KDFO	Cantigny.....b	KFMJ	Mobile.....b
KDLV	Marnes.....b	KFMK	Pioneer.....b
KDMF	Courcy.....b	KFML	Pontiac.....b
KDNB	Tours.....b	KFMM	Douglas.....b
KDNC	Aisne.....b	KFMN	John W. Boardman.....b
KFLS	New Orleans.....b	KFMO	Shasta.....b
KFLT	Iowa.....b	KFV	Los Angeles, Calif. (portable).....c
KFMC	Illinois.....b	KJJ	Tree Point Lighthouse Station, Alaska.....c
KFMD	Gulfport.....b	KYY	Los Angeles, Calif.....c
KFME	Birmingham.....b	WIZ	Benton Harbor, Mich.....c
KFMF	Cordova.....b	WOH	Manistique, Mich.....c
KFMG	Demopolis.....b	WPI	Memphis, Tenn.....c
KFMH	Montgomery.....b	WPM	Birmingham, Ala.....c
KFMI	Tuscaloosa.....b	WPP	Mobile, Ala.....c

*Broadcasting stations, alphabetically by names of cities.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923.]

City	Call signal.	City	Call signal.
Atlantic, Iowa.....	KFLZ	Kenosha, Wis.....	WOAR
Camden, N. J.....	WABU	Little Rock, Ark.....	KFMB
Do.....	WWAF	Missoula, Mont.....	KFLV
Dover, Ohio.....	WABP	Nashville, Tenn.....	WABV
Fargo, N. Dak.....	KFLY	Newark, N. J.....	WABS
Galesburg, Ill.....	WRAM	Rockford, Ill.....	KFLV
Galveston, Tex.....	KFLX	San Benito, Tex.....	KFLU
Haverford, Pa.....	WABQ	Toledo, Ohio.....	WARR
Houghton, Mich.....	WWAO	Washington, Pa.....	WABT
Joliet, Ill.....	WWAE		

*Stations broadcasting market or weather reports, music, concerts, lectures, etc., alphabetically by call letters.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923.]

Call signal.	Station operated and controlled by—	Location of station.	Power (watts).	Wave length.	Frequency (kilo-cycles).
KFLU	Rio Grande Radio Supply House.....	San Benito, Tex.....	20	296	1,270
KFLV	A. T. Frykman.....	Rockford, Ill., 1503 Fourth Avenue.....	10	229	1,310
KFLW	Missoula Electric Supply Co.....	Missoula, Mont.....	10	234	1,280
KFLX	George R. Clough.....	Galveston, Tex.....	10	240	1,250
KFLY	Fargo Radio Supply Co.....	Fargo, N. Dak.....	30	231	1,300
KFLZ	Atlantic Automobile Co.....	Atlantic, Iowa.....	10	273	1,100
KFMB	Christian churches of Little Rock.....	Little Rock, Ark.....		264	1,180
WABP	Robert F. Weing.....	Dover, Ohio.....	100	266	1,180
WABQ	Haverford College Radio Club.....	Haverford, Pa.....	50	261	1,150
WARR	Scott High School.....	Toledo, Ohio.....	50	270	1,110
WABS	Essex Manufacturing Co.....	Newark, N. J.....	50	244	1,230
WABT	Holliday-Hall.....	Washington, Pa.....	100	252	1,190
WABU	Victor Talking Machine Co.....	Camden, N. J.....	100	226	1,290
WABV	John H. De Witt.....	Nashville, Tenn., 1812 Fifteenth Avenue South.....	20	263	1,140
WOAR	Henry P. Lundskow.....	Kenosha, Wis.....	50	229	1,310
WRAM	Lombard College.....	Galesburg, Ill.....	250	244	1,230
WWAE	Alamo Dance Hall (L. J. Crowley).....	Joliet, Ill.....	500	227	1,230
WWAF	Galvin Radio Supply Co.....	Camden, N. J., 521 Market.....	100	226	1,270

## RADIO SERVICE BULLETIN.

*Government land stations, alphabetically by names of stations.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923, and to the International List of Radiotelegraph Stations published by the Berns bureau.]

Station.	Call signal.	Wave lengths.	Service.	Hours.	Station controlled by—
Duluth Range Light Station, Minn.	WWAK	145	O	X	Lighthouse Service, Department of Commerce.
Marquette Light Station, Mich.	WWAH	1,111	O	X	Do.
Relief Light Vessel No. 72.	NAKP	.....	O	X	Do.
Relief Light Vessel No. 85.	NAJJ	.....	O	X	Do.
Stannard Rock Light Station, Mich.	WWAI	1,111	O	X	Do.
Superior Entry Light Station, Wis.	WWAL	145	O	X	Do.

*Government ship stations, alphabetically by names of stations.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923, and to the International List of Radiotelegraph Stations published by the Berns bureau.]

Station.	Call signal.	Wave length.	Service.	Hours.	Station controlled by—
Edgemoor.....	WXC	.....	O	N	War Department.

*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.
NAJJ	Relief Light Vessel No. 85.....c	WWAK	Duluth Range Light Station, Minn....c
NAKP	Relief Light Vessel No. 72.....c	WWAL	Superior Entry Light Station, Wis....c
WWAH	Marquette Light Station, Mich.....c	WXC	Edgemoor.....b
WWAI	Stannard Rock Light Station, Wis....c		

*Special land stations, alphabetically by names of stations.*

[Additions to the List of Radio Stations of the United States, edition of June 30, 1923.]

Station.	Call signal.	Station controlled by—
Aberdeen, Wash.....	7ZT	Walter A. Hemrich, 913 West Hume Street.
Alameda, Calif.....	6ZAW	Ralph E. Moore, 2612 Buens Vista Street.
Berkeley, Calif.....	6ZAZ	G. W. Lewis, 1915 University Avenue.
Buffalo, N. Y.....	8ZB	Charles S. Taylor, 508 Masten Street.
Bywood, Pa.....	3ZE	John S. Marsh, 7112 Sellers Avenue.
Cincinnati, Ohio.....	8ZAB	Carl P. Goetz, 1128 Atwood Avenue.
Claremont, Calif.....	6ZBG	James C. Flagg, 211 East Ninth Street.
Corvallis, Oreg.....	7ZE	G. S. Feikert, 402 North Seventeenth Street.
Dorchester, Mass.....	1ZH	James W. Carter, 24 Auckland Street.
East Pittsburgh, Pa. (portable)...	8XP	Westinghouse Electric & Mfg. Co.
El Paso, Tex.....	5XAS	C. C. McNeel, 813 Estrella Street.
Fullerton, Calif.....	8ZBF	Cecil Yates, R. D. No. 3, P. O. Box 104A.
Galesburg, Ill.....	9XS	Lombard College.
Helena, Mont.....	7ZJ	Fred C. Ashall.
Hilo, Hawaii.....	6ZAX	Raymond A. Tilford, Seaside Road, P. O. Box 835.
Houghton, Mich.....	9XAW	Michigan College of Mines.
Koko Head, Hawaii.....	6ZAC	Chifford J. Dow.
Lenox, Mass.....	1ZI	Harris Fahnestock, jr.
Los Angeles, Calif.....	6ZBB	Aloysius L. Blodgett, 630 West Forty-fifth Street.

## RADIO SERVICE BULLETIN.

5

*Special land stations, alphabetically by names of stations—Continued.*

Station.	Call signal.	Station controlled by—
Los Gatos, Calif.....	6ZAG	Robert J. Miller, Glen Una Drive.
Do.....	6ZAT	Lyndon Farwell, 55 Broadway.
Do.....	6ZAU	Karl W. Kent, 53 Hernandez Avenue.
Natick, Mass.....	1ZH	Walter J. Klein, Jr.
Oakland, Calif.....	6XG	General Electric Co., 5441 East Fourteenth Street.
Philadelphia, Pa.....	3ZB	Paul H. Singewald, 5156 Parkside Avenue.
Do.....	3ZC	Arthur W. Bjorth, 2020 South Croeskey Street.
Piedmont, Calif.....	6ZBD	Elmer C. Michelson, 122 Olive Avenue.
Pittsburgh, Pa.....	8XBG	Doubleday-Hill Electric Co., 719 Liberty Avenue.
Pontiac, Mich.....	8ZT	James H. Hampton, 28 Mechanic Street.
Potsdam, N. Y.....	8XBH	Clarkson College of Technology.
Redlands, Calif.....	6ZBE	Ralph E. Smith, 222 Buena Vista Street.
Sacramento, Calif.....	6ZAY	Joseph N. Baker, 515 U Street.
San Francisco, Calif.....	6ZAS	Examiner Printing Co.
San Jose, Calif.....	6ZAV	Gerard Wilson, 363 South Eleventh Street.
Santa Cruz, Calif.....	6ZBA	Herbert H. Coats, 45 Church Street.
Trenton, N. J.....	3ZI	Edward G. Raser, 931 Edgewood Avenue.
Tuckerton, N. J.....	2XD	Radio Corporation of America, 66 Broad Street, New York, N. Y.
Ukiah, Calif.....	6ZAI	James B. Mannon, 404 Dora Street.

*Special land stations, grouped by districts.*

Call signal.	District and station.	Call signal.	District and station.
1ZI	First district: Lenox, Mass.		
2XD	Second district: Tuckerton, N. J.		
	Third district:		
	Philadelphia, Pa.	6ZBB	Sixth district—Continued.
	Do.	6ZBC	Los Angeles, Calif.
3ZB		6ZBD	Do.
3ZC		6ZBE	Piedmont, Calif.
3ZE	Bywood, Pa.	6ZBF	Redlands, Calif.
3ZI	Trenton, N. J.	6ZBG	Fullerton, Calif.
4XAS	Fifth district: El Paso, Tex.	6ZU	Claremont, Calif.
	Sixth district:		Los Angeles, Calif.
6XG	Oakland, Calif.		Seventh district:
6ZAC	Koko Head, Hawaii.	7ZE	Corvallis, Oreg.
6ZAG	Los Gatos, Calif.	7ZJ	Helena, Mont.
6ZAI	Ukiah, Calif.	7ZT	Aberdeen, Wash.
6ZAS	San Francisco, Calif.		Eighth district:
6ZAT	Los Gatos, Calif.	8XBG	Pittsburgh, Pa.
6ZAU	Do.	8XBH	Potsdam, N. Y.
6ZAV	San Jose, Calif.	8XP	East Pittsburgh, Pa. (portable).
6ZAW	Alameda, Calif.	8ZAB	Cincinnati, Ohio.
6ZAX	Hilo, Hawaii.	8ZB	Buffalo, N. Y.
6ZAY	Sacramento, Calif.	8ZT	Pontiac, Mich.
6ZAZ	Berkeley, Calif.		Ninth district:
6ZBA	Santa Cruz, Calif.	9XAW	Houghton, Mich.
		9XS	Galesburg, Ill.

## ALTERATIONS AND CORRECTIONS.

## COMMERCIAL LAND STATIONS.

[Alterations and corrections to be made to the List of Radio Stations of the United States, edition of June 30, 1923, and to the International List of Radiotelegraph Stations, published by the Berne bureau.]

ABERDEEN, WASH.—W. l., 300, 550, 600, 1641; this station communicates with Seattle, Wash. (KPE), and Everett, Wash. (KFT), also certain vessels.

BASCO, P. I.—Loc. E. 121° 58' 35", N. 20° 27' 35".

BAYTOWN, TEX.—System, Thordason & Grebe spark, 240 and composite c. w.

BEAUMONT, TEX.—Range, 200-300; system, Kilbourne & Clark, 1000; and Navy, 1000.

CANDLE, ALASKA.—Rates, station to station, 25 cents per word; station to station night letter, \$2.50 for 50 words, 25 cents for each additional 10 words.

CLEVELAND, OHIO (KDPM).—Loc. O. 81° 43' 37", N. 41° 29' 31".

EVERETT, WASH.—W. l., 300, 600, 1641.

JACKSON, OHIO.—W. l., 1934.

ROGERS, MICH.—System, Simon spark, 1000, and composite v. t. telegraph.

## 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, 1923, and to the International List of Radiotelegraph Stations, published by the Berne bureau.]

- AGWIMOOON.—W. l., add 450.  
 AGWISTAR.—System, R. C. A., 1000.  
 ALAMEDA (KOBN).—W. l., add 450.  
 AMERICAN PRESS.—W. l., add 706; station operated and controlled by S. O. R. S.  
 ANDREA F. LUCKENBACH.—W. l., add 706.  
 ATLANTIC.—System, R. C. A., 1000; w. l., add 706; station operated and controlled by R. C. A.  
 AVALON (WFH).—System, R. C. A., 1000; w. l., add 706; hours, N.  
 BEACONOIL.—W. l., add 450.  
 B. H. TAYLOR.—Range, 150; system, R. C. A., c. w., i. c. w., and spark, 1000, and R. C. A. v. t. telephone; w. l., 300, 600, 909, 1800; 909 meters is used for limited commercial telephone service with ship station Carl D. Bradley and Rogers City, Mich.  
 BYRON D. BENSON.—W. l., add 706.  
 CHICAGO.—Rates, 8 cents per word.  
 CITY OF ATLANTA.—W. l., 300, 600, 706.  
 CITY OF CHATTANOOGA.—Range, 300; system, R. C. A., 1000; w. l., 300, 450, 600, 706.  
 COLUMBIA.—Range, 150; system, R. C. A., 1000; w. l., 300, 450, 600; station operated and controlled by owner of vessel.  
 DEERFIELD.—Corporation Trust Co. of America, owner of vessel.  
 DIO.—Station operated and controlled by S. O. R. S.  
 DUNGANNON.—W. l., add 706.  
 ECLIPSE.—W. l., add 706.  
 EDGAR F. CONEY.—Range, 200; system, Navy-Simon, 1000; w. l., 300, 600.  
 ERLBECK.—Range, 300; system, Federal arc; w. l., 300, 600, 706, 1800.  
 EL ALBA.—System, R. C. A., 1000; w. l., 300, 450, 600, 706.  
 EL NORTE.—W. l., add 706.  
 EL SIGLO.—W. l., add 450.  
 ESSEX.—System, R. C. A., 1000; w. l., add 706.  
 ESTRADA PALMA.—W. l., add 450.  
 E. T. BEDFORD.—W. l., add 706.  
 EVELYN.—W. l., 300, 600, 706.  
 GENE CRAWLEY.—Sinclair Navigation Co., owner of vessel.  
 GEORGE WASHINGTON.—W. l., add 1800.  
 GUARDSMAN.—Rates, 8 cents per word; station operated and controlled by I. W. T. Co.  
 GULFSTREAM.—W. l., 300, 450, 600, 706.  
 HALBAKALA (KORL).—W. l., 300, 450, 600, 706.  
 HALO.—W. l., 300, 600, 706, 1800.  
 HARVESTER.—W. l., 300, 450, 600, 706.  
 HOLJESTEAD.—W. l., add 706.  
 I. J. MERRITT.—Rates, 8 cents per word; station operated and controlled by I. W. T. Co.  
 IOWAN.—Range, 200.  
 JAVA ARROW.—W. l., add 706.  
 JEFFERSON (WAJ).—W. l., 300, 600; rates, 8 cents per word.  
 JENNIE R. MORSE.—W. l., add 706.  
 J. N. PEW.—W. l., 300, 450, 600, 706.  
 JONANCY.—W. l., add 706.  
 JOSEPH SEEP.—W. l., add 706.  
 KENOWIS.—Station operated and controlled by S. O. R. S.  
 LIBERTY BELL.—W. l., add 706.  
 MEDINA.—System, R. C. A., 1000; w. l., add 706.  
 MEMPHIS CITY.—W. l., add 706.  
 MINNEQUA.—Station operated and controlled by S. O. R. S.  
 MINNESOTAN.—System, R. C. A., 1000.  
 MISKIANZA.—Station operated and controlled by I. W. T. Co. (U. S. L.).  
 MOUNT CLINTON.—Hours, X.  
 MUNAIRES.—Munaires Steamship Corporation, owner of vessel.  
 MUNDELTA.—W. l., add 706.  
 MUNSOMO.—Munsomo Steamship Corporation, owner of vessel.

## RADIO SERVICE BULLETIN.

7

- OPHIS.—Station operated and controlled by S. O. R. S.  
 ORIENT.—System, R. C. A., 1000.  
 O. T. WARING.—W. l., add 706.  
 PARAGUAY.—W. l., 300, 450, 600.  
 PEACOCK.—Station operated and controlled by I. W. T. Co.  
 PETER KERR.—W. l., add 706.  
 POINT LOMA.—Range, 200; system, Navy-Kilbourne & Clark, 1000; w. l., add 450.  
 PRESIDENT HARDING.—Station operated and controlled by I. W. T. Co.  
 PRESIDENT MCKINLEY.—Station operated and controlled by R. C. A.  
 QUISTCONCK.—Station operated and controlled by S. O. R. S.  
 RELIEF.—Station operated and controlled by I. W. T. Co.  
 RESOLUTE (KRM).—Merritt-Chapman & Scott Corporation, owner of vessel; rates, 8 cents per word; station operated and controlled by I. W. T. Co.  
 RIPPLE (KPKN).—Range, 300; system, R. C. A., 1000; w. l., 300, 450, 600, 706.  
 SABINE SUN.—W. l., add 706.  
 SACANDAGA.—Station operated and controlled by S. O. R. S.  
 SAN FRANCISCO.—W. l., add 706.  
 SANTORE.—System, R. C. A., 1000.  
 SEEKONK.—William Cramp & Sons Ship & Engine Building Co.  
 SHENANGO.—W. l., 300, 450, 600, 706.  
 SHICKSHINKY.—Station operated and controlled by S. O. R. S.  
 SIOUX FALLS.—Range, 200; system, Navy-R. C. A., 1000; w. l., 300, 450, 600.  
 STANDARD (KIC).—System, R. C. A., 1000; w. l., add 706.  
 STARR.—Range, 150; system, Wireless Specialty Apparatus Co., 1000; w. l., add 706.  
 SUDBURY.—Range, 150; station operated and controlled by I. W. T. Co.  
 SUN.—W. l., 300, 450, 600, 706.  
 SUNBEAM.—W. l., add 706.  
 SUNDANCE.—W. l., 300, 450, 600, 706.  
 SUPORTCO.—Range, 300; system, Navy-Lowenstein, 1000; w. l., 300, 600, 706.  
 SURAILCO.—Range, 300; system, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600, 706.  
 SUSHERICO.—Range, 300; system, Navy-Wireless Specialty Apparatus Co., 1000; w. l., 300, 450, 600, 706; rates, 8 cents per word; station operated and controlled by R. C. A.  
 SUSPEARCO.—Range, 300; system, Navy-Wireless Improvement Co., 1000; w. l., 300, 450, 600, 706; rates, 8 cents per word; station operated and controlled by R. C. A.  
 SUTORCO.—W. l., add 706.  
 SWIFT SCOUT.—Station operated and controlled by I. W. T. Co.  
 TENAFLY.—Range, 300; system, Federal arc; w. l., 300, 450, 600.  
 TERRE HAUTE.—Range, 300; system, Navy-R. C. A., 1000; w. l., 300, 450, 600.  
 UNION LIBERTY.—Range, 200; system, Navy-Simon, 1000; w. l., 300, 450, 600.  
 WARBLER.—Station operated and controlled by I. W. T. Co.  
 WASHINGTON.—Name changed to Great Canton; United States & China S. S. Co. owner of vessel.  
 WEST CALERA.—Station operated and controlled by S. O. R. S.  
 WEST CHETAC.—Range, 300; system, Navy, 1000; w. l., add 706.  
 WEST ELDARA.—System, Navy-R. C. A., 1000.  
 WEST HESSELTINE.—W. l., add 706.  
 WEST HIXTON.—Station operated and controlled by S. O. R. S.  
 WEST KASSON.—Station operated and controlled by S. O. R. S.  
 WEST MAHWAH.—Station operated and controlled by S. O. R. S.  
 WEST SAGINAW.—W. l., add 706.  
 W. H. LIBBY.—W. l., add 706.  
 WILLETT.—Station operated and controlled by I. W. T. Co.  
 WILLIAM PENN.—Range, 300; system, Federal arc; w. l., 300, 600, 1800.  
 WILLSOLO.—Corporation Trust Co. of America, owner of vessel.  
 WOONSOCKET.—Name changed to Makiki; Matson Navigation Co., owner of vessel.  
 YOUNGSTOWN.—System, Navy-R. C. A., 1000; w. l., 300, 600.  
 Strike out all particulars of the following-named vessels: Benowa, Edgemoor, Kennecott, Mary Winkleman, Minnesota (WMI), Mundale, Panuco (KMM),

## COMMERCIAL LAND AND SHIP STATIONS, ALPHABETICALLY BY CALL SIGNALS.

**KDRI**, read Great Canton; **WCW**, read Makiki; strike out all particulars following the call signals, **KDFY**, **KDPP**, **KEVF**, **KFJO**, **KMM**, **KOTZ**, **KUJ**, **KVN**, **KVO**, and **WMI**.

## BROADCASTING STATIONS BY CALL SIGNALS.

[Alterations and corrections to be made to the List of Radio Stations of the United States, edition of June 30, 1923.]

- KDYM** (San Diego, Calif.).—Power, 100.  
**KDYQ** (Portland, Oreg.).—Power, 100.  
**KDZE** (Seattle, Wash.).—Power, 500.  
**KFCB** (Phoenix, Ariz.).—W. l., 278, frequency, kc. 1080.  
**KFFV** (Lamoni, Iowa).—Power, 10.  
**KFFX** (Omaha, Nebr.).—Power, 100.  
**KFIY** (Seattle, Wash.).—W. l., 231, frequency, kc. 1300.  
**KFJJ** (Carrollton, Mo.).—Power, 10; station operated and controlled by George F. Grossman.  
**KFJM** (Grand Forks, N. Dak.).—W. l., 280, frequency, kc. 1070.  
**KFJR** (Stevensville, Mont., near).—Power, 5.  
**KGU** (Honolulu, Hawaii).—Power, 500.  
**KTW** (Seattle, Wash.).—Power, 750.  
**WBZ** (Springfield, Mass.).—Power, 1000.  
**WCAU** (Philadelphia, Pa.).—Power, 100.  
**WEAJ** (Vermilion, S. Dak.).—W. l., 283; frequency, kc. 1060.  
**WGAQ** (Shreveport, La.).—Power, 150.  
**WFAB** (Syracuse, N. Y.).—Power, 100.  
**WHAM** (Rochester, N. Y.).—W. l., 283, frequency, kc. 1060.  
**WHK** (Cleveland, Ohio).—Power, 100; w. l., 283, frequency, kc. 1060.  
**WHN** (New York, N. Y.).—Address, 1540 Broadway.  
**WJAF** (Muncie, Ind.).—Station operated and controlled by Muncie Press & Smith Publishing Co.  
**WJAT** (Marshall, Mo.).—Station operated and controlled by Kelley-Vawter Jewelry Co.  
**WJD** (Granville, Ohio).—Station operated and controlled by Denison University.  
**WLAQ** (Kalamazoo, Mich.).—W. l., 283, frequency, kc. 1060.  
**WMAC** (Cazenovia, N. Y.).—Station operated and controlled by Clive B. Meredith.  
**WMU** (Washington, D. C.).—Power, 50.  
**WNAC** (Boston, Mass.).—W. l., 278, frequency, kc. 1080.  
**WOAD** (Sigourney, Iowa).—Power, 20.  
**WOAX** (Trenton, N. J.).—Power, 500.  
**WPAZ** (Charleston, W. Va.).—Power, 10.  
**WQAX** (Peoria, Ill.).—Power, 100.  
**WRAF** (Laporte, Ind.).—Power, 20.  
**WRAO** (St. Louis, Mo.).—Power, 10; station operated and controlled by St. Louis Radio Service Co.  
**WRAX** (Gloucester City, N. J.).—Station operated and controlled by Flexons Garage.  
**WSAG** (St. Petersburg, Fla.).—Station operated and controlled by Loren V. Davis and George Prestman, sr.  
**WSAH** (Chicago, Ill.).—Station operated and controlled by A. G. Leonard, jr.  
**WTAF** (New Orleans, La.).—W. l., 268, frequency, kc. 1120.  
**WTAJ** (Portland, Me.).—Power, 10.  
**WTAS** (Elgin, Ill., near).—W. l., 286, frequency, kc. 1050.  
**WWAC** (Waco, Tex.).—Power, 50.  
**WZAZ** (Pomeroy, Ohio).—Correct call signal is **WSAZ**.  
Strike out all particulars of the following-named stations: **KFCL**, San Antonio, Calif.; **KFDP**, Des Moines, Iowa; **KFFA**, San Diego, Calif.; **KFFP**, Moberly, Mo.; **KFGP**, Cheney, Kans.; **KNJ**, Roswell, N. Mex.; **WAAH**, St. Paul, Minn.; **WBBC**, Sterling, Ill.; **WBU**, Chicago, Ill.; **WCBB**, Greenville, Ohio; **WDAD**, Lindsborg, Kans.; **WDAI**, Syracuse, N. Y.; **WDBF**, Youngstown, Ohio; **WEAB**, Fort Dodge, Iowa; **WEAG**, Edgewood, R. I.; **WGAR**, Fort Smith, Ark.; **WGAU**, Wooster, Ohio; **WHAL**, Lansing, Mich.; **WHAQ**,



## RADIO SERVICE BULLETIN.

9

WKC, Baltimore, Md.; WLAC, Raleigh, N. C.; WOAK, Frankfort, Ky.; WOAZ, Stamford, Tex.; WQAB, Springfield, Mo.; WQAZ, Greensboro, N. C.; WRAP, Winter Park, Fla.; WRAU, Amarillo, Tex.; WSAK, Middleport, Ohio; WWAX, Laredo, Tex.; WWB, Canton, Ohio; and WWZ, New York, N. Y.

## GOVERNMENT LAND STATIONS, ALPHABETICALLY BY NAMES OF STATIONS.

(Alterations and corrections to be made to the List of Radio Stations of the United States, edition of June 30, 1923, and to the International List of Radiotelegraph Stations, published by the Berne bureau.)

RELIEF (NACD).—*Read Relief Light Vessel No. 76.*  
 RELIEF (NITR).—*Read Relief Light Vessel No. 78.*  
 RELIEF (NITS).—*Read Relief Light Vessel No. 90.*  
 RELIEF (NADB).—*Read Relief Light Vessel No. 92.*  
 RELIEF (NAJC).—*Read Relief Light Vessel No. 109.*

## GOVERNMENT LAND AND SHIP STATIONS, ALPHABETICALLY BY CALL SIGNALS.

NACD, *read Relief Light Vessel No. 76*; NADB, *read Relief Light Vessel No. 92*;  
 NAJC, *read Relief Light Vessel No. 109*; NITR, *read Relief Light Vessel No. 78*; NITS, *read Relief Light Vessel No. 90.*

## SPECIAL LAND STATIONS, BY NAMES OF STATIONS.

(Alterations and corrections to be made to the List of Radio Stations of the United States, edition of June 30, 1923.)

Strike out all particulars of the following-named stations: Altadena, Calif. (6XBF); Atlanta, Ga. (4XH); Bangor, Me. (1XG); Cambridge, Mass. (1XAB); Cleveland, Ohio (8YAJ); Delaware, Ohio (8YK); Denver, Colo. (9KAG); Emporia, Kans. (9YAA); Helena, Mont. (7ZQ); Monroe, Wis. (9XA); Philadelphia, Pa. (3YF); Rockford, Ill. (9XF); Superior, Wis. (9YAC); Washington, D. C. (3XO); Washington, D. C. (3YL); Washington, D. C. (3ZB); Washington, D. C. (3ZE); and Waterbury, Conn. (1XT).

## MISCELLANEOUS.

## RADIO STATIONS INSTALLED ON GERMAN LIGHT VESSELS.

Radio stations, regarding which detailed information is given below, have been installed on Kiel, Kalkgrund, and Fehmarn Belt Light Vessels:

Light vessels.	Approximate position.	Call signals.	Wave lengths.	Range (miles).	
				Day.	Night.
Kiel.....	54° 29' N., 10° 16' E....	KBI.....	300, 450, and 600...	40	70
Kalkgrund.....	54° 50' N., 9° 53' E....	KBD.....	300, 450, and 600...	90	160
Fehmarn Belt.....	54° 36' N., 11° 02' E....	KBC.....	300, 450, and 600...	100	180

The above-named stations are open to public service during the first 10 minutes of each hour between 8 a. m. and 8 p. m., but communications are strictly limited to urgent messages on navigational matters.—*From Hydrographic Bulletin No. 1785.*

## WIRELESS FOG SIGNAL ESTABLISHED AT CAPE RAY, NEWFOUNDLAND.

At a distance of one cable, 215°, from Cape Ray Lighthouse, in approximately lat. 47° 37' N., long. 59° 18' W., a wireless fog-signal station has been established. The signals, which are automatically transmitted continuously during thick or foggy weather, consist of a series of triple dashes for a period of one minute followed by a silent period of four minutes. The approximate range of the station is 50 miles. There will also be two routine transmissions daily for

(civil). Masters of vessels equipped with direction-finding apparatus are requested to listen-in when within range of the station and report the results to the Director of Radio, Department of Marine and Fisheries, Ottawa, Canada.—*From Admiralty Notice to Mariners, No. 1583, 1923.*

WIRELESS FOG SIGNAL ESTABLISHED ON HEATH POINT LIGHT VESSEL, GULF OF ST. LAWRENCE, CANADA.

Wireless fog-signals are automatically transmitted by Heath Point Light Vessel. The characteristic of the signals will be a series of groups of four dashes transmitted for one minute (elapsed time from the beginning of one group to the beginning of the next being four seconds), followed by a silent interval of four minutes. In foggy weather the automatic transmitter will be in operation on 1000 meters continuously, except when the operator is on watch. The operator will maintain watch on 600 meters during the following periods, Eastern Standard Time (meridian of 75 W. long.):

0700-0730	1100-1130	1500-1530	1900-1930
0900-0930	1300-1330	1700-1730	2200-2230

If during the period the operator is on watch a ship should require the transmission of signals for direction-finding purposes, the request for such signals should be made on 600 meters. The light vessel will then acknowledge the request on that wave length, after which she will immediately transmit the automatic signal on 1000 meters, as mentioned above. This station is located in approximately lat. 49° 03' N., long. 61° 30' W., and the call signal is VCI. No charge is made for this service.—*From Admiralty Notice to Mariners, No. 1755, 1923.*

ALASKAN STATION CLOSED FOR THE SEASON.

The Kukak Bay Station, call letters KDN, closed for the season on October 15.

ALASKA STATIONS REOPENED.

The Saltchuck station, call letters KWQ, reopened November 1, and the station at Candle, call letters KGF, reopened November 15.

AZORES STATION REOPENED.

The coast station at Terceira has been reopened, according to information received from the Berne bureau.

LOST COMMERCIAL RADIO OPERATORS' LICENSES.

Printed below is a list of radio operator's licenses which have been reported to this bureau as having been lost. Should any of them be found, they should be returned to the bureau for cancellation. Inspectors and others concerned should see that lost licenses are not-being used by unauthorized persons.

Name.	Class.	Number.	Date issued.	Port issued.
Amy, George D.	First	758	Aug. 30, 1921	New York.
Ashford, M. J., jr.	Second	2637	Sept. 1, 1923	New Orleans.
Baldwin, John M.	do.	2614	Jan. 25, 1923	Do.
Birchfield, Elmer T.	First	4428	July 23, 1923	Do.
Brady, Raymond	Second	396	Mar. 5, 1922	New York.
Breth, Alexander Martin	First	715	Aug. 17, 1921	Do.
Brown, Kenneth L.	Second	1328	June 22, 1923	Detroit.
Charte, Vincent J.	do.	148	June 19, 1923	Boston.
Cusack, John George	First	4120	Dec. 27, 1922	New York.
Entwistle, Guy R.	do.	24291	May 31, 1921	Boston.
Fefel, William B.	do.	5040	Dec. 21, 1922	Baltimore.
Gillis, L. W.	do.	4577	Feb. 14, 1923	Seattle.
Halstead, Canute	do.	1913	Sept. 12, 1921	San Francisco.
Hartogensis, Alwyn M.	Second	450	July 17, 1922	New York.
Hill, Alfred L.	do.	891	Sept. 22, 1922	New Orleans.
Holt, Nelson Edwin	First	4397	May 4, 1923	Do.
Israel, John J.	do.	3138	Jan. 29, 1922	New York.
Jacobsen, Elliott	do.	2653	Sept. 8, 1922	Detroit.
Jacobsen, Carl	Second	2322	Oct. 3, 1923	Seattle.

## RADIO SERVICE BULLETIN.

11

Name.	Class.	Number.	Date issued.	Port issued.
Kathan, Warren W.	Second.	1215	Sept. 17, 1921	Detroit.
Leach, John Gilbert	do.	4291	Oct. 10, 1922	New Orleans.
Leads, Lawrence	First.	4101	Dec. 8, 1922	New York.
Lewis, Garrett W.	do.	4325	Oct. 26, 1922	Seattle.
Lufkin, Willard E.	Extra first.	351	June 27, 1921	San Francisco.
Do.	do.	44	July 13, 1923	Do.
Magill, Posey J.	First.	1277	Oct. 21, 1922	Do.
Martin, Jonathan S.	do.	21135	June 23, 1921	New York.
Methiot, Jacob E.	Second.	2905	Nov. 19, 1922	Baltimore.
Metsalfo, Thomas M.	First.	3829	May 29, 1922	New York.
McNaughton, Andrew H.	do.	5449	Aug. 10, 1922	Baltimore.
Miller, Lester John.	do.	3749	Apr. 7, 1922	New York.
Mitchell, Harvey H.	Second.	545	Feb. 23, 1922	Baltimore.
Munster, Wilfred	First.	7097	May 12, 1923	San Francisco.
Muench, Franz.	do.	23252	June 6, 1921	Baltimore.
Nelson, Paul Eberle.	do.	3884	June 1, 1922	New York.
O'Herin, John Maurice.	do.	742	Aug. 24, 1921	Do.
Quinlan, James Alexander.	do.	21673	May 26, 1921	Do.
Richards, F. A.	do.	205	July 7, 1921	Boston.
Rudd, H. R.	do.	24591	June 16, 1921	Seattle.
Sargent, Edward M.	do.	3270	Jan. 30, 1922	San Francisco.
Stoff, Karl A.	do.	1736	Mar. 9, 1922	New Orleans.
Sweeney, John L.	do.	3258	Jan. 19, 1922	San Francisco.
Tessdall, S. W.	do.	1041	Sept. 25, 1922	Baltimore.
Thomas, Henry P.	do.	447	June 8, 1923	Boston.
Tinus, William C.	do.	4278	Sept. 15, 1922	New Orleans.
Walters, Leslie.	do.	24430	Apr. 30, 1921	Do.
Watts, Victor W.	do.	4527	Nov. 7, 1922	Seattle.
White, Henry F.	do.	2191	May 2, 1922	San Francisco.
Wilder, John M.	Second.	848	May 26, 1922	New Orleans.
Willot, Clarence E.	do.	5001	July 12, 1923	Baltimore.
Worrell, Richard A.	First.	4183	Feb. 10, 1923	New York.
Yager, Barton.	Second.	1222	Dec. 9, 1921	Detroit.

## APPLICATION OF STATISTICAL ANALYSIS TO RADIO TRANSMISSION PROBLEMS.

The radio laboratory of the Bureau of Standards has in a number of cases had the problem of analyzing a large amount of complex data obtained as a result of tests conducted for the purpose of investigating radio transmission phenomena. The wide distribution of observers and the large number of variables contained in the data require the use of rapid methods of analysis. Using the tabulating machines of the Bureau of the Census, it has been possible to make a comprehensive statistical analysis of such data with a minimum expenditure of time.

Several types of electric tabulating machines are in use, all of which are designed to compile, classify, and analyze statistical information. The original data are transferred to cards by means of punched holes, which permit the machine electrically and automatically to classify and aggregate the various items recorded.

Three machines are used in this work—a key punch, a sorting machine, and a tabulating or counting machine. The key punch is manually operated and is used to transfer the data to the tabulating machine cards. The sorting machine is used in sorting the information contained by the cards into any desired groups or classes, and the tabulating machine counts the cards and at the same time obtains any total or subtotal of the information desired.

The first radio problem in which such an analysis was made by the bureau was the investigation of signal fading conducted during 1920 and 1921 in cooperation with the American Radio Relay League. Another investigation which has been in progress since 1922 is the distance-range tests on radio-transmitting stations.

A mimeographed pamphlet which describes the methods used and gives examples of the method of analyzing the fading-test data and the distance-range test data has been prepared. This is Letter Circular No. 105 of the Bureau of Standards. A limited number of copies are available for distribution to those who can show that they have actual use for this. Requests should be addressed to the Bureau of Standards, Washington, D. C.

## ANNOUNCEMENT OF STANDARD FREQUENCY TRANSMISSIONS.

The Bureau of Standards is transmitting special signals of standard frequency

below. The signals can be heard and utilized, in general, east of the Mississippi River.

These special signals of standard frequency are of use to testing laboratories, transmitting station operators, and others in checking wave meters and adjusting transmitting and receiving apparatus. Their accuracy is better than three-tenths of 1 per cent. Information on how to use the signals was given in the February (1923) issue of the Radio Service Bulletin. More detailed information is given in Bureau of Standards Letter Circular No. 92, which may be obtained on application from the Bureau of Standards, Washington, D. C.

All transmissions are by unmodulated continuous-wave telegraphy. A complete frequency transmission includes a "general call," a "standard frequency signal," and "announcements." The "general call" is given at the beginning of the eight-minute period and continues for about two minutes. This includes a statement of the frequency. The "standard frequency signal" is a series of very long dashes with the call letters WWV intervening. This signal continues for about four minutes. The "announcements" are on the same frequency as the "standard frequency signal" just transmitted and contain a statement of the measured frequency. An announcement of the next frequency to be transmitted is then given. There is then a four-minute interval while the transmitting set is adjusted for the next frequency.

The schedule of standard frequency signals is as follows:

*Schedule of frequencies in kilocycles.*

[Approximate wave lengths in meters in parentheses.]

Eastern standard time.	Dec. 5.	Jan. 7.	Jan. 21.	Feb. 5.	Feb. 20.
11 to 11.08 p. m. ....	500 (600)	150 (2000)	500 (600)	1300 (231)	150 (2000)
11.12 to 11.20 p. m. ....	700 (428)	205 (1483)	600 (500)	1400 (214)	205 (1483)
11.24 to 11.32 p. m. ....	900 (333)	290 (1153)	700 (428)	1500 (200)	290 (1153)
11.36 to 11.44 p. m. ....	1100 (273)	315 (952)	833 (360)	1600 (187)	315 (952)
11.48 to 11.56 p. m. ....	1300 (231)	370 (810)	900 (333)	1700 (178)	370 (810)
12 to 12.08 a. m. ....	1500 (200)	435 (680)	1000 (300)	1800 (167)	435 (680)
12.12 to 12.20 a. m. ....	1600 (187)	500 (600)	1200 (250)	1900 (158)	500 (600)
12.24 to 12.32 a. m. ....	1700 (176)	570 (520)	1400 (214)	2000 (150)	570 (520)

A STUDY OF RADIO SIGNAL FADING.

When radio first began to be used for long-distance communication it was noticed that signals were not transmitted as far during the day as during the nighttime. It has also been observed that at night radio signals received from distant stations operating on the higher radio frequencies (shorter wave lengths) vary greatly in intensity from minute to minute. Persons who receive broadcast concerts from distant stations have occasion to notice this variation in intensity of received signals, since loud signals may be received from a given distant station at one moment only to disappear entirely for a few minutes and then recover their original intensity.

This and related phenomena have been recorded from time to time, and various hypothesis have been brought forward in an attempt to explain them. The phenomena are dependent upon a large number of variable quantities, such as weather conditions, the nature of the country over which transmission occurs, the surroundings of the transmitting and receiving stations, and the method of handling the receiving apparatus. Only by a statistical study in which the results obtained simultaneously at a large number of receiving stations are collected and tabulated may reliable averages be obtained.

In an attempt to secure some worth-while statistics of this kind, a cooperative study of radio signal fading was made by the Bureau of Standards and the American Radio Relay League during 1920 and 1921. In these tests from 5 to 10 radio stations transmitted signals in succession on certain nights, according

100 receiving stations whose operators were provided with forms for recording the variation in the intensity of the signals as received.

The paper gives summary tables pointing out possible relationships between weather conditions and the fading and intensity of radio signals and the prevalence of strays or atmospheric disturbances.

The results of these tests indicate that the sources or causes of fading are intimately associated with the conditions at the Heaviside surface, which is a conducting surface about 60 miles above the earth. Daytime transmission is largely carried on by means of waves moving along the ground, while night transmission, especially for great distances and at high frequencies, is by means of waves transmitted along the Heaviside surface. Waves at night are thus free from the absorption encountered in the daytime but are subject to great variations caused by irregularities of the ionized air at or near the Heaviside surface. These variations probably account for fading.

This paper is entitled "A study of radio signal fading," by J. H. Dellinger, L. E. Whittemore, and S. Kruse. A copy of this paper may be obtained for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C.

#### STANDARD FREQUENCY STATIONS.

Measurements of radio station frequencies by the Bureau of Standards show that there are some transmitting stations which maintain a sufficiently constant frequency to serve as frequency standards. If every radio transmitting station maintained exactly the wave frequency assigned to it there would be available a standard frequency wave every time any station was in operation. That is, the frequency of the waves from such stations could be depended upon and used to standardize wave meters and other apparatus. Unless special precautions are taken in a transmitting station, however, the frequency is not likely to remain highly constant. The mere use of the proper taps or settings on the tuning and coupling elements of the transmitting set is not sufficient. The effects of temperature, supply voltage, antenna conditions, and many other factors introduce variations into the frequency produced. A station which incorporates the best mechanical features in its antenna system and which strictly observes a policy of allowing no tampering with the transmitting circuit may maintain a fairly constant frequency. It is, however, very desirable that some form of frequency indicator be used. Without this device the frequency may shift and the operator will not be aware of the change. If a frequency indicator is employed, any change in the transmitting circuit will at once be made evident by a variation in deflection of the indicating instrument. The adjustment should be repeated or verified at intervals during a transmission.

As a result of the bureau's measurements (made by the methods described in Bureau of Standards Letter Circular No. 92), data are given in each month's RADIO SERVICE BULLETIN on stations which have been found to maintain a sufficient accuracy to be useful as frequency standards. The six broadcasting stations listed below have attained the goal of varying not more than 2 kilocycles from the assigned frequency as recommended by the Second National Radio Conference (reported in April (1923) RADIO SERVICE BULLETIN). There may be many other stations maintaining their frequency just as constant as these, but these are the only ones which reached the degree of constancy shown among the stations upon whose transmitted waves measurements were made in the bureau's laboratory. There is, of course, no guaranty that the stations named below will maintain the same constancy. As a means of maintaining constant frequency the high-power low-frequency alternator stations listed below have speed regulators. Most of the broadcasting stations listed use frequency indicators (one-point wave meters) and maintain a maximum deflection of the instrument on the frequency indicator throughout the transmission.

The transmitted frequencies from these stations can be utilized for standardizing wave meters and other apparatus by the procedure given in Bureau of Standards Letter Circular No. 92, "Radio Signals of Standard Frequency and Their Utilization." A copy of this letter circular can be obtained by a person having actual use for it upon application to the Bureau of Standards, Wash-

Station.	Owner.	Location.	Assigned frequency (kc.).	Period covered by measurements.	Number of times measured.	Greatest deviation from assigned frequency.	Average deviation from assigned frequency.
WII....	B. C. A.....	New Brunswick, N. J.	17.04	Oct. 1-Nov. 24...	35	<i>Per ct.</i> 0.6	<i>Per ct.</i> 0.3
NSS....	U. S. N.....	Annapolis, Md....	17.48	Aug. 24-Nov. 15..	48	.5	.2
WQK..	R. C. A.....	Rocky Point, Long Island, N. Y.	18.21	.....do.....	26	.4	.3
WGG..	.....do.....	Tuckerton, No. 1, N. J.	18.85	.....do.....	62	.4	.2
WSO..	.....do.....	Marion, Mass.....	25.80	.....do.....	57	.7	.3
WWJ..	Detroit News.....	Detroit, Mich.....	580	Aug. 27-Nov. 24..	19	.2	.1
WCAP..	Chesapeake & Potomac Telephone Co.	Washington, D. C.	640	Sept. 11-Nov. 24..	23	.3	.1
WOS..	Marketing Bureau.....	Jefferson City, Mo.	680	Sept. 10-Nov. 24..	5	.2	.0
WSB..	The Atlanta Journal.....	Atlanta, Ga.....	700	Sept. 14-Nov. 24..	21	.3	.2
WGY..	G. E. Co.....	Schenectady, N. Y.	790	Oct. 5-Nov. 24...	16	.3	.1
KDKA..	Westinghouse Electric & Manufacturing Co.	Pittsburgh, Pa....	920	Nov. 5-Nov. 24...	13	.2	.1

R. C. A. = Radio Corporation of America.

U. S. N. = United States Navy.

G. E. Co. = General Electric Co.

**NOTE.**—Over the last two columns of the table similar to this one in the November RADIO SERVICE BULLETIN the words "per cent" were omitted.

#### REFERENCES TO CURRENT RADIO PERIODICAL LITERATURE.

This is a monthly list of references prepared by the radio laboratory of the Bureau of Standards, and is intended to cover the more important papers of interest to the professional radio engineer which have recently appeared in technical periodicals. The number at the left of each reference classifies the reference by subject, in accordance with the scheme presented in "A Decimal Classification of Radio Subjects—An Extension of the Dewey System," Circular No. 138, a copy of which may be obtained for 10 cents from the Superintendent of Documents, Government Printing Office, Washington, D. C. Further information about these lists, availabilities of previous lists and of the serial periodicals, is contained in the extended statement preceding the early lists as published in the RADIO SERVICE BULLETIN prior to April, 1923, and also in May and September, 1923.

##### R000.—Radio communication.

- R007.1 Radio bill to come up again in next Congress. *Electrical World*, 82, pp. 983-984, November 10, 1923.
- R020 Elwell, C. F. The Poulsen arc generator (book). E. Benn (Ltd.), London, 1923. Price, 18 shillings net. Noted in *Electrician*, October 12, 1923.
- R020 Redpath, E., and Kendall, G. P. 500 wireless questions answered (book). Radio Press (Ltd.), London, 1923. Price, 2 shillings 8 pence. Noted in *Modern Wireless*, November, 1923.
- R020 Thomas, J. L. Fundamentals of radio (book). Obtainable for \$1.50 from the Telegraph and Telephone Age, 253 Broadway, New York City. Noted in *Telegraph and Telephone Age*, October 16, 1923.
- R090 The march of radio: Did radio fail at Point Arguello? *Radio Broadcast*, 4, pp. 91-106, December, 1923.

##### R100.—Radio principles.

- R113 Ilin, B. Zur Frage nach den Ursachen der Schwankungen in der Empfangsintensität. *Jahrbuch der drahtlosen Telegraphie*, 22, pp. 123-127, September, 1923.
- R113 Knight, W. A. Observations at the receiving end of the radiophone. *Radio News*, 5, pp. 712-713, December, 1923.
- R113.1 Dellinger, J. H.; Whittemore, L. W.; Kruse, S. A study of radio signal fading. Bureau of Standards Scientific Paper No. 476. Obtainable for 10 cents a copy from the Superintendent of Documents, Government Printing Office, Washington, D. C.
- R113.4 Ilin, B. Messungen der Empfangsintensität der atmosphärischen Ionisation und anderer meteorologischen Elemente während der Sonnenfinsternis am 8 April, 1921. *Jahrbuch der drahtlosen Telegraphie*, 22, pp. 128-132, September, 1923.
- R114 Austin, L. W. Etat actuel des formules sur la propagation des ondes. *L'Onde Electrique*, 2 pp. 504-507, September, 1923.
- R125.1 Radio-telegraphic direction finding by reception. *Engineering (London)*, 116, pp. 305-307, September 7, 1923.
- R125.6 McCullough, F. S. Radiotelegraphy. U. S. Patent No. 1471406, issued October 23, 1923.
- R127 Miller, S. C. Some notes on receiving antenna resistance. *Wireless Age*, 11, pp. 47-48, November, 1923.
- R131 Miller, J. H. Vacuum-tube characteristics. *QST*, 7, pp. 31-32, November, 1923.
- R134.75 deWilly, F., and Lacault, R. E. Construction of superbeterodyne receivers. *Radio News*, 5, pp. 583-593, December, 1923.

## RADIO SERVICE BULLETIN.

15

- R134.75 Cocksday, L. M. How to build the new regenerative superheterodyne receiver. *Popular Radio*, 4, pp. 496-503, December, 1923.
- R145.3 Niwa, V. Calculation of self-inductance of coils wound on square forms. *Researches of the Electro-technical Laboratories*, No. 126, Tokyo, Japan. *Electrical World*, 82, p. 823, October 20, 1923.
- R148.1 McGown, D. B. Design of distortionless amplifiers. *Radio (San Francisco)*, 5, pp. 31-32, November, 1923.
- R162 Hogan, J. V. L. How to increase the selectivity of your receiver. *Popular Radio*, 4, pp. 504-511, December, 1923.

## R200.—Radio measurements and standardization.

- R200 Measurements of radio signals (rewritten from *Radio Transmission Measurements*, by R. Bown). *QST*, 7, pp. 29-31, November, 1923.
- R201.2 Blattner, D. G. Testing circuits. U. S. Patent No. 1472455, issued October 30, 1923.
- R201.3 Hull, A. W. The measurement of magnetic fields of medium strength by means of a magnetron. *Physical Review*, 22, pp. 279-292, September, 1923.
- R201.3 duFrel, G. Über Verstärkung von photoelektrischen und Ionisationsströmen mittels der Elektronenröhre. *Annalen der Physik*, 375, pp. 199-224, 1923.
- R220 Jelliffe, C. B. A study of polarization capacity and resistance at radio frequencies. *Physical Review*, 22, pp. 293-302, September, 1923.
- R281 Beck, Dr. Vorschläge für amerikanische Normallen für Isolatorprüfungen. *Elektrotechnik und Maschinenbau*, 41, pp. 615-616, October 21, 1923.
- R281.11 Place, S. W. Laminated phenolic condensation panel material. *Radio Bug (Canada)*, 1, p. 18, October, 1923.
- R281.31 Bucksath, W. Elektrische Stossprüfung von Porzellan-Isolatoren. *Elektrotechnische Zeitschrift*, 44, pp. 943-947, October 18, 1923.

## R300.—Radio apparatus and equipment.

- R330 Hogan, J. V. L. A new and ultrasensitive detector, the Sodian. *Radio News*, 4, pp. 686-687, December, 1923.
- R330.4 King, R. W. Electron-discharge device. U. S. Patent No. 1473477, issued October 30, 1923.
- R330.4 Reynolds, F. Thermionic valve. U. S. Patent No. 1474293, issued November 13, 1923.
- R333 Lafour, M. and Chireix, H. The efficiency of three electrode tubes for the production of continuous waves in radio telegraphy; that is, for the conversion of direct current into alternating current. *Proceedings Institute Radio Engrs.*, 11, pp. 551-558, October, 1923.
- R342.2 Haynes, F. H. Building the three-valve resistance coupled amplifier. *Wireless World and Radio Review*, 18, pp. 74-78, October 17, 1923.
- R342.6 Bishop, L. W. Tuned radio frequency amplification. *Wireless Age*, 11, pp. 49-50, November, 1923.
- R342.6 Harris, P. W. The "Transatlantic" receiver (two stages tuned high frequency). *Modern Wireless (London)*, 2, pp. 66-71, November, 1923.
- R343 Tuska, C. D. The superdyne receiver. *QST*, 7, pp. 7-12, November, 1923.
- R343 Boetern, F. G. Radio-receiving apparatus. U. S. Patent No. 1473417, issued November 5, 1923.
- R343 Van Dyke, A. The hyperregenerative receiver. *Wireless Age*, 11, pp. 45-46, November, 1923.
- R343 Rey, J. Lemelleur recepteur pour toutes longueurs d'onde (180 to 25,000 meters). *Radio-électricité*, 4, pp. 489-494, October 15, 1923.
- R343 100 best hookups. *Popular Radio*, 4, pp. 463-467, December, 1923.
- R343 Jaquet, Lloyd. The Abelé receptor: A French receiver. *Radio (San Francisco)*, 5, pp. 11-12, November, 1923.
- R344 Hartley, R. V. L. Method of and means for producing alternating currents. U. S. Patent No. 1472470, issued October 30, 1923.
- R344.3 Semm, A. Über Parallelschaltung von Röhrensensendern. *Jahrbuch der drahtlosen Telegraphie*, 22, pp. 117-122, September, 1923.
- R344.3 Felder, L. R. Continuous wave and radiophone transmitter (part 3). *Radio News*, 5, p. 705, December, 1923.
- R348 Jammer, J. S. Repeater circuits (electron tube repeaters). U. S. Patent No. 1470982, issued October 15, 1923.
- R348 Bendoragel, W. H. Telephone transmission system. U. S. Patent No. 1472237, issued October 30, 1923.
- R352.2 Woodhull, S. T. Gap (quenched spark gap). U. S. Patent No. 1473070, issued November 6, 1923.
- R352 Beal, R. R. Radiotelegraphy. U. S. Patent No. 1473719, issued November 13, 1923.
- R354 Bethenod, J. High-frequency signaling system. U. S. Patent No. 1473921, issued November 13, 1923.
- R356 Schmidt, K. Ein neuer Hochfrequenzmaschinensender für drahtlose Telegraphie. *Elektrotechnische Zeitschrift*, 44, pp. 910-914, October 4, 1923.
- R370 Lynch, A. H. What kind of receiver shall I buy? *Radio Broadcast*, 4, pp. 117-123, December, 1923.
- R370 Taylor, S. G. How to select your radio parts. *Popular Radio*, 4, pp. 456-458, December, 1923.
- R374 Strock, M. S. How to build an efficient crystal receiver. *Popular Radio*, 4, pp. 486-495, December, 1923.
- R374 Million, J. W., jr. Crystal detectors and their possibilities as amplifiers and oscillators. *Radio News*, 5, pp. 714-716, December, 1923.
- R374 Bade, E. Minerals that are used as crystal detectors (gives summary of various crystals, such as galena, carborundum, etc.). *Wireless Age*, 11, pp. 52-53, November, 1923.
- R376.3 Nynman, A. The fundamentals of loud-speaker construction. *Radio Broadcast*, 4, pp. 151-159, December, 1923.
- R376.3 Hanna, C. R. The function of the horn on a loud speaker. *Electric Journal*, 26, pp. 396-397, November, 1923.
- R377 Engstrom, O. D. Outline of the problem of radio control. *Radio News*, 5, pp. 716-719, December, 1923.
- R377 Batten, E. R. The automatic reception of wireless signals. *Wireless World and Radio Review*, 18, pp. 114-117, October 24, 1923.
- R377 Affel, H. A. Calling arrangement for radio systems. U. S. Patent No. 1472822, issued November 6, 1923.
- R377 Culver, C. A. Acoustic receiving apparatus. U. S. Patent No. 1474242, issued November 13, 1923.
- R377 Gebhart, A. Untersuchungen eines Elektronenrelais auf Grund elektrostatischer Ablenkung des



- R382 James, W. Variometers. *Wireless World and Radio Review*, 18, pp. 81-84, October 17, 1923.  
 R382 Fortescue, C. L. Design of inductances for high-frequency circuits. *Electrician (London)*, 91, pp. 267-268, September 14, 1923.  
 R382 Marsten, J. The design and function of inductance coils—variable inductances (concluded from October issue). *Radio (San Francisco)*, 5, pp. 23-25, November, 1923.  
 R384.1 Douglas, A. L. M. The construction of a heterodyne wave meter (300-4,500 meters). *Modern Wireless (London)*, 2, pp. 91-94, November, 1923.  
 R384.1 Canada's new standard wave meter. *Radio (Toronto)*, 6, pp. 19-22, October, 1923.  
 R388 Low-voltage cathode-ray oscillograph (description of Western Electric 300-volt oscillograph). *Revue Générale de l'Electricité*, 14, pp. 323-330, September 8, 1923.

## R400.—Radio communication systems.

- R401 Elliott, H. F. Radiotelegraphy signaling system. U. S. Patent No. 1473220, issued November 6, 1923.  
 R401 Brockwell, H. E. Radio and commercial telephony (radio accessory to telephone for short distances). *Telephony*, 85, pp. 12-14, November 3, 1923.  
 R413 Joss, G., and Zenneck, J. Der Umfang von Hochfrequenzschwingungen mit Niederfrequenzmodulation. *Jahrbuch der drahtlosen Telegraphie*, 22, pp. 93-106, September, 1923.  
 R413 Heising, R. A. System for producing modulated wave. U. S. Patent No. 15722, reissued November 13, 1923.  
 R430 Emmett, W. How "can" the humming bee (how to make a wave trap). *Radio (San Francisco)*, 5, p. 19, November, 1923.  
 R431 Fassenden, R. A. Method for eliminating undesired impulses. U. S. Patent No. 1478179, issued November 6, 1923.  
 R431 Round, H. J. Receiver for wireless telegraphy. U. S. Patent No. 1473092, issued October 30, 1923.  
 R435 Hammond, J. H., jr. Transmission and receiving systems. U. S. Patent No. 1472218, issued October 30, 1923.  
 R450 Bown, R., and Nelson, E. L. Radio wire-connecting circuits. U. S. Patent No. 1472289, issued October 30, 1923.  
 R460 Mathes, R. C. Transmission circuits. U. S. Patent No. 1472610, issued October 30, 1923.  
 R460 Whiting, D. F. Telephone system. U. S. Patent No. 1471638, issued October 23, 1923.  
 R470 Carrier-current telephone systems (experience with two installations, one of 200 miles length cited). *Electrical World*, 82, pp. 904-906, October 20, 1923.  
 R470 Boddie, C. A. Application of high-frequency telephony to central station service (method now entirely automatic and provides for duplex communication—high voltage direct current from rectifier). *Electrical News (Toronto)*, 32, pp. 60-62, November 1, 1923.  
 R470 Murphy, P. B. Signaling system. U. S. Patent No. 1472987, issued November 6, 1923.  
 R470 Kishpaugh, A. W. Carrier wave transmission system. U. S. Patent No. 1473433, issued November 6, 1923.  
 R470 Espenschied, Lloyd. Means for and method of modulation. U. S. Patent No. 1473874, issued November 13, 1923.  
 R470 Osborne, H. S. Repeater apparatus for carrier systems. U. S. Patent No. 1473682, issued November 13, 1923.

## R500.—Applications of radio

- R513 Radio signals for coast protection (radio fog signal on Nantucket Shoals Light Vessel). *Electrical World*, 82, p. 814, October 20, 1923.  
 R531.4 Jellie, H. Practical hints on learning the code. *Radio News of Canada*, 2, pp. 18-19, November, 1923.  
 R531.4 Sweeney, K. M. Learning the code while asleep. *Popular Radio*, 4, pp. 459-462, December, 1923.  
 R545 Barnsley, J. Canadian station 9BP reaches arctic. *Radio News*, 5, p. 707, December, 1923.  
 R550 Complete list of broadcasting stations (corrected to September 25, 1923). *Radio News*, 5, p. 728, December, 1923.  
 R551 Winters, S. B. Time signals tell where you are (automatic recorder developed by Dr. Eckhardt Karcher). *Wireless Age*, 11, p. 31, November, 1923.  
 R551 Whittemore, L. E. Radio and time keeping. *National Jeweler*, 19, p. 82, November, 1923.  
 R570 Percheron, M. The radio-controlled aeroplane. *Radio News*, 5, pp. 684-685, December, 1923.  
 R580 The otophone—an aid to the deaf. *Wireless World and Radio Review*, 16, p. 147, October 31, 1923.  
 R580 Slec, J. A. Recent developments in the application of wireless telegraphy to shipping. *Electrician*, 91, pp. 392-393, October 12, 1923.  
 R581 Bouthillan, L. Anticipations sur la transmission de l'énergie à distance. *Radioélectricité*, 4, pp. 397-400, October 1, 1923.  
 R582 Davis, W. The new radio movies (C. F. Jenkins apparatus). *Popular Radio*, 4, pp. 437-444, December, 1923.  
 R590 Behnere, R. La T. S. F. en Yougoslavie (organisation des communications de royaume des Serbes-Croates-Slovenes). *Radioélectricité*, 4, pp. 429-432, October 15, 1923.

## R800.—Nonradio subjects.

- 347.7 An important decision (suit brought by Radio Corporation of America against I. W. T. Co. for infringement of vacuum tube patent: Action handed down against Radio Corporation of America). *Telegraph and Telephone Age*, 41, p. 517, November 1, 1923.  
 537.65 Cady, W. G. Method of maintaining electric currents of constant frequency. U. S. Patent No. 1472583, issued October 30, 1923.  
 621.317.3 Electrical change-over apparatus. U. S. Patent No. 1471863, issued October 23, 1923.  
 621.355 Schulte, W. B. Wave signaling system. U. S. Patent No. 1471755, issued October 23, 1923.  
 621.382.8 Chilowsky, C., and Langevin, P. Production of submarine signals and the location of submarine objects. U. S. Patent No. 1471547, issued October 23, 1923.  
 621.385 Pohlmann, B. Telephone repeaters. *Telegraph und Fernsprechtechnik*, 12, pp. 21-28, May, and pp. 29-32, June, 1923; *Sci. Abs. B*, No. 1504, October, 1923.  
 621.385 Johnson, E. D. Signaling system and method of operating the same. U. S. Patent No. 1471335, issued October 23, 1923.  
 21.385 Johnson, E. D. Telephone-repeater circuits. U. S. Patent No. 1474038, issued November 13, 1923.



[Return to Radio Service Bulletins Index](#)