RADIO RESEARCH LABORATORIES
JAPAN
1963

電波

MINISTRY OF POSTS & TELECOMMUNICATIONS

CONTENTS

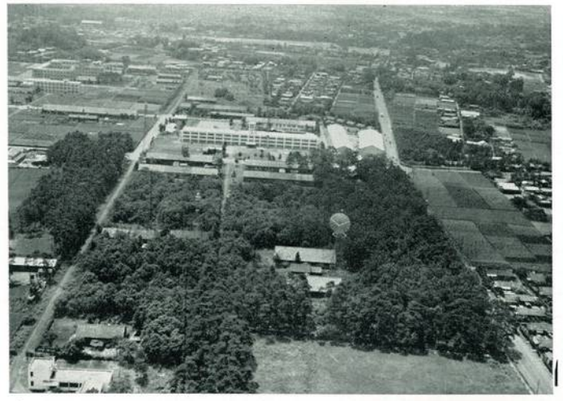
Outline of the Radio Research Laboratories

The Radio Research Laboratories came into existence on August 1, 1952, as a government research agency belonging to the Ministry of Posts and Telecommunications. It has a history of far longer years. It may be said that this Laboratories has its origin in the Research Committee of Radio Wave Propagation organized in 1922 within the National Scientific Research Council. Afterwards, through the Physical Institute for Radio Waves, Ministry of Education, the present Laboratories developed into an agency having for its object overall researches in radio matters.

This Laboratories has in Tokyo and vicinity, the headquarters at Kokubunji (139°29′E, 35°42′N) and three detached offices at Koganei, Ogikubo, and Kashima. Throughout the country, there are five branch radio wave observatories at Wakkanai (141°41′E, 45°24′N), Akita (140°08′E, 39°44′N), Hiraiso (140°38′E, 36°22′N), Inubo (140°51′E, 35°42′N), and Yamagawa (130°38′E, 31°13′N). The structure of the Laboratories is as shown in the attached table.

The Radio Research Laboratories is taking up various problems necessary for more effective and wider utilization of radio waves. In addition to the research work, this Laboratories is carrying on the following services related to not only radiocommunication but also general matters of scientific research or public utility:

Emission of the standard frequencies and broadcasting of the standard time signals;
Broadcasting of URSIgrams;
Radio propagation forecasts and radio forewarnings;
Governmental type approval of radio apparatus and devices;
Performance test and calibration of radio apparatus and devices;
Data center (C2) for the Ionosphere.



General View of the Radio Research Laboratories.

The Radio Research Laboratories Building.

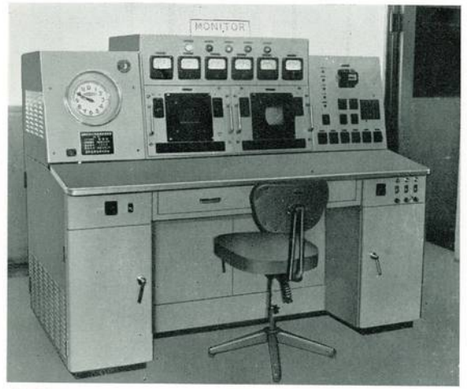
Brief History of Ionospheric Observations in Japan

The first step of study for ionospheric soundings in Japan was made in 1931 by the Navy Technical Institute at Meguro, Tokyo. The Institute achieved success in the measurement of height of the ionosphere in 1932, adopting the frequency modulation method of Appleton and Bernett. Furthermore, the Institute made the continuous observation of virtual height of the ionosphere, the so-called h'–t observation, by the use of the pulse method on 2 Mc and 4 Mc from 1932 to 1934. This marks the beginning of the routine ionospheric soundings in Japan. Finally, the first observation of the ionosphere in virtual height versus frequency, the so-called h'–f observation, was started in Japan in June, 1934.

On the other hand, the Hiraiso Branch of Electrotechnical Laboratory, Ministry of Communications, constructed the ionosonde of h'–t type in 1932, and started the h'–f observation in 1936.

In 1940, the Japanese Army began the routine ionospheric soundings of h'–f and other related observations at Tsitsihar, Manchuria. Thus, the ionospheric soundings accompanied by the study of the ionosphere were continued by the Army, the Navy and the Electrotechnical Laboratory. But when the Physical Society for Radio Wave was established in the Ministry of Education in March, 1941, all the responsibilities for research work on the ionosphere was transferred to this Society, which was reorganized into the Physical Institute for Radio Waves in April, 1942. This Society started, first of all, the h'–f observation by an automatic recorder of Berkner type at Hankow in China on the 21st of September, 1941, at the time of a solar eclipse. The reorganized Physical Institute for Radio Waves established the stations of routine ionospheric soundings in the Far Eastern region, totaling 21 in number. One of these stations has been at Kokubunji where the ionospheric soundings on a routine basis have continued even until now at the present site of the Radio Research Laboratories working as the successor of the Physical Institute for Radio Waves through several reorganizations after the end of World War II. Though this station of routine ionospheric soundings was temporarily moved to Kaminoge, Tokyo, during the war, the observation was resumed at Kokubunji after the war, keeping up the long traditions of the ionospheric observation in the Tokyo area since 1932. After that, three stations for the routine ionospheric soundings were established in every five degrees of latitude at Wakkanai, Akita and Yamagawa, in addition to the Kokubunji station that acts the part of the key station in Japan.

Automatic Recording Ionosonde (Type-6).



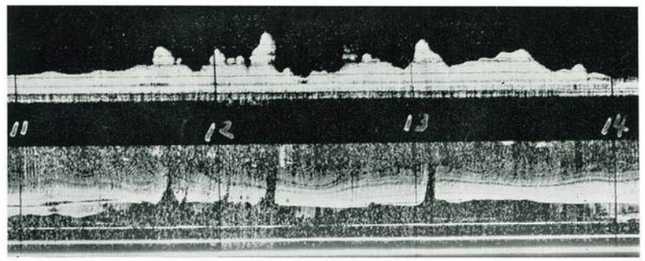
Monitor.

Observations and Studies of the Ionosphere

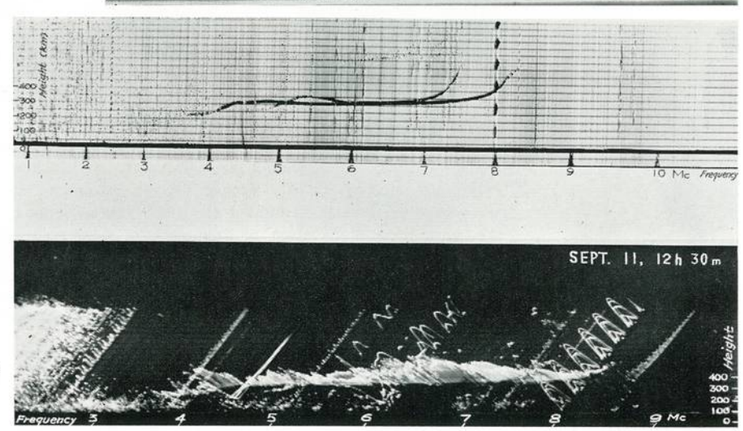
Observations of the Ionosphere at Vertical Incidence

The observations of the ionosphere at vertical incidence are made at four observatories at Wakkanai, Akita, Kokubunji and Yamagawa in order to utilize the observational results for forecasting radio propagational conditions and for investigating the physical characteristics of the ionosphere itself. The routine observation following after the IGY is being made every 15 minutes every day, and every 5 minutes during special observation periods. At each observatory, the panoramic recorder with the transmitter and receiver of non-tuning type is used for routine measurements. The values scaled from the films are published monthly in the "Ionospheric Data in Japan" obtained by observation.

At Kokubunji, additionally, the minimum heights and critical frequencies of the E and F layers are continuously recorded by means of the remodelled panoramic recorder on Special Observation Days. These records can reveal precise variations in the ionosphere related to the solar effect, e. g. in cases of Dellinger effect, magnetic storms, etc. This process succeeded in the observation of aurora in Tokyo and district during the IGY.



A Sample of the Serial Ionogram
(Upper) E_s Layer Critical Frequency.
(Lower) Apparent Height of E_s and F Layers.



h'–f and $h'\Gamma$–f Characteristic Records.

Other Observations of the Ionosphere

Besides, observations are carried out on the ionospheric absorption at Kokubunji and on the ionospheric drifts at Yamagawa, the former following the method of the local transmitter of pulse waves and the latter the fading method of closely spaced receivers, as described in the IGY Manual. Furthermore, other specific observations are made tentatively for the purpose of studying the ionosphere.

Radio observations of artificial satellites are going on, too, by measuring the shift of Doppler frequency and the fading by Faraday rotation in reception of the waves radiated from the satellites. At the same time, the telemetering signals from the satellites have been recorded on magnetic tapes, when possible. It is expected that the outer atmosphere will become more evident by means of space research.

Antenna for Observation of Satellite Radio Waves.

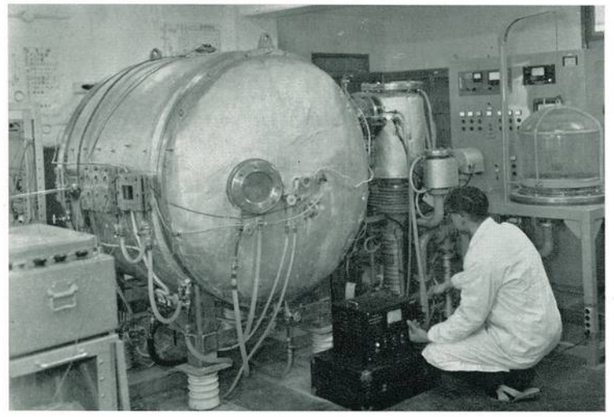
Observations of the Satellite Radio Waves.

Physical Study of the Ionosphere

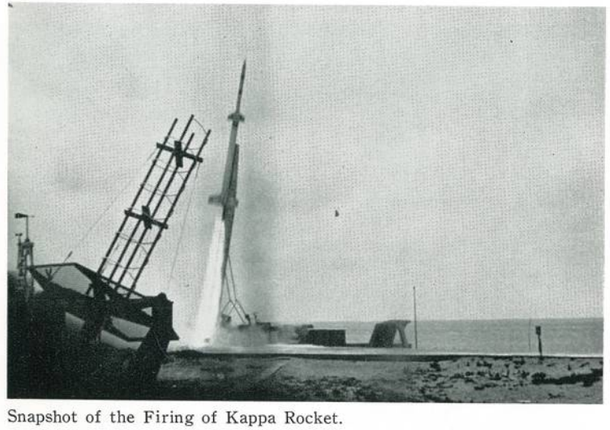
Theoretical research work as well as analysis of observational data on the ionosphere and exosphere have been carried on very actively for a number of years. The following may be mentioned on the subjects which brought about fruitful results: The theory of formation of the *F*2 layer, the nocturnal behaviour of the *F*2 layer, in particular, the temporal rate of electron disappearance, the theoretical electron density profiles in the ionosphere and exosphere, the diurnal, seasonal, non-seasonal, semi-annual, latitudinal and solar-cycle variations in electron density of the *E* and *F* layers, the world-wide distribution of frequency of occurrence of spread-*F* echoes, the semi-diurnal (and diurnal) lunar variations in electron density and height of the *F*2 layer, and the behaviour of the *F*2 layer during severe magnetic storms.

One of the most important quantities with regard to the physical conditions of the upper atmosphere is the distribution of electron density *versus* true height or $N(h)$ profile which can be obtained from the records of vertical ionospheric sounding or ionograms for heights below the peak of the *F*2 layer by an appropriate procedure. An improved method has been developed for the calculation of $N(h)$ profiles from virtual height of h'–f curves on ionograms and programmed for an electronic digital computer NEAC-2203.

Discharge Tubes for Low-Density Plasma Experiments.



Space Chamber.



Snapshot of the Firing of Kappa Rocket.

Research on Low Density Plasma and Its Application to Direct Ionospheric Sounding

The characteristics of low density plasma are studied by the use of many kinds of plasma tubes as well as a large space chamber. The space chamber has such dimensions of 1200 mm in diameter and 1000 mm in length that it is possible to study the plasma characteristic equivalent to that of the *D* and *E* layers.

The Laboratories developed the resonance probe which is one of the best instruments reliable and convenient of measuring the electron density and temperature of the ionosphere by a sounding rocket. The present study is given by means of the probe to the measurement of the electron energy distribution, number densities and temperatures of both ion and electron of the ionosphere, electric field in plasma, and ion mass-spectrometers.

These results have brought about decided improvements in the ionospheric direct sounding instruments for the past three years. Already, eleven instruments were flown on the Kappa rockets with successful results in cooperation with the Institute of Industrial Science, University of Tokyo, by firing the sounding rocket in the Uchinoura Rocket Range which had moved from Akita.

Furthermore, the joint experiments with the National Aeronautical and Space Administration by the use of these instruments developed by this Laboratories were conducted by Nike-Cajun three times with fruitful results.

Ionospheric Direct-Sounding Instrument.

Studies in Ionospheric Propagation

Sweep Frequency Pulse Transmission Tests at Oblique Incidence

With a view to investigating the ionospheric propagation by the observational data in comparison with the ionospheric vertical-incidence soundings at the apex of the propagation path, the transmission tests by pulse wave on sweep frequency at oblique incidence were conducted over a distance of 1,000 km between Hiraiso and Yamagawa in 1955. Further tests have been carried on since 1957 between Wakkanai and Yamagawa over a distance of 1,840 km by using a method of the round trip, which is initiated by a pilot signal. The frequencies of this equipment range is from 2 to 37 Mc/s.

Analysis of Ionospheric Scattering

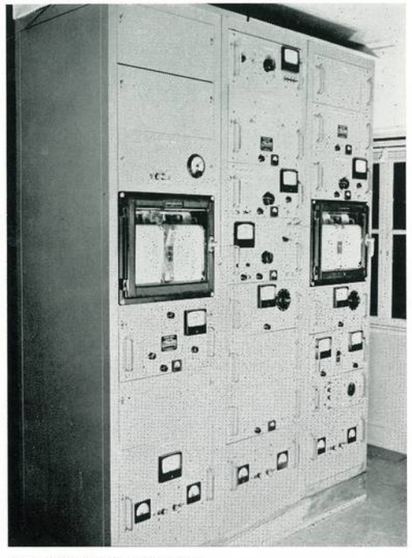
The long-distance communication making use of radio scatter phenomenon due to irregularity in electron density in the ionosphere has been in practical use in some countries of late years. But there still remains much to be studied into the propagational mechanism, distance characteristic, regional characteristic, etc. Until 1959, this Laboratories, in cooperation with the Central Radio Propagation Laboratory, U. S. A., was engaged in the investigation of ionospheric scattering and latitudinal distribution of the sporadic *E* layer, by receiving at several stations in Japan the 49.68 Mc/s signals transmitted from Okinawa.

After 1960, in order to investigate the scattering propagational mode unclarified, the propagational tests in the VHF band were carried out several times by the independent synchronized-pulse method on the path of 1000 km from Kokubunji to Yamagawa, and the vertical ionospheric soundings were made at a place near the apex of the propagational path.

The experimental results show the existence of a new propagational mode, which appears frequently in the nighttime and is thought to be the scattering height of 150-180 km. The average field-strength is about −35 db for the transmission of 1 kW at peak, and the appearance has close relations with the spread trace of the ionogram at the apex.

Studies in the Propagational Characteristics of Long and Medium Waves

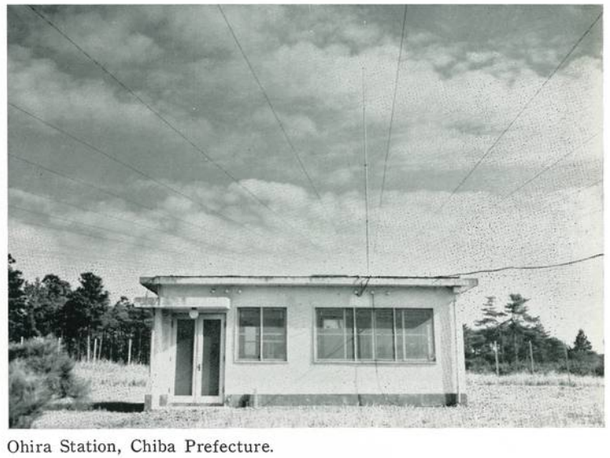
For the purpose of establishing the method of field strength calculation and of clarifying the construction of lower ionosphere, field intensity measurements are made in the frequency range below medium-high frequencies by means of transmission of pulse waves or transmission from broadcasting stations.



CRPL's Noise Recorder.

Measurement of Atmospheric Radio Noise in High Frequency Bands

The knowledge of geographical distribution of atmospheric radio noise in high frequency bands is essential for the designing of radio circuits. The C. C. I. R. has requested every country to cooperate in the preparation of charts showing the world-wide distribution of atmospheric radio noise. With a view to expressing statistically the characteristics of noises, the cumulative amplitude distribution and crossing rate distribution of atmospheric radio noise in high frequency bands are measured by means of the equipment designed originally by this Laboratories. Also, the Laboratories has participated in the 15-years' measurement program by the use of C. R. P. L.'s noise recorder borrowed in accordance with the resolution of the C. C. I. R. Observational results by both systems are under comparison at Ohira, in lat. 35°36′N. and long. 140°30′E.



Ohira Station, Chiba Prefecture.
(C. R. P. L. Type Atmospheric Noise Observatory).

Space Communication Systems

A large steerable antenna of 30 m in diameter was established at Kashima, Ibaragi Prefecture, in lat. 35°57′10.032″N. and long. 140°39′57.753″E. for the experimental tests of space communication via satellites, with a view to possible operational use at a later date.

The purpose is not only to obtain information on the performance of communication satellite systems, but also to study the geophysical and astronomical phenomena.

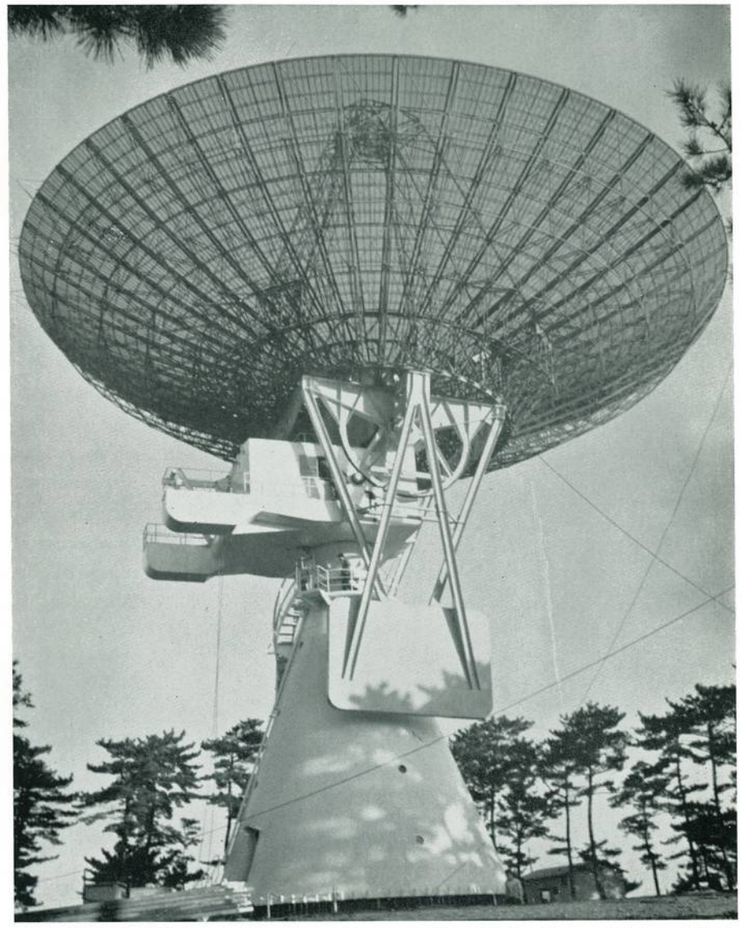
In order to acquire and track the signal from satellites, a computer, named NEAC 2206, will be set up at Kokubunji to be used for computation of the ephemeris at every second on the basis of information given by the NASA.

The ephemeris will be sent to Kashima Site over a domestic microwave data transmission line, being punched out there on paper tape to be fed into a program tracking equipment of which the output values are supplied to servo devices in analogue form.

On the other hand, actually-measured doppler shift frequencies and values of the angle of both azimuth and elevation axes at Kashima Site are sent back to Kokubunji in order to improve the accuracy in the next orbital calculation.

This antenna is used in common for both transmission and reception. A 10 kW transmitter and a low-noise receiver are accommodated in separate cabinets on the antenna which rotates in the azimuth plane, being controlled remotely from the control building at the foot of the antenna tower.

To connect the TV and multi-channel telephone to the inland trunk network, a microwave route will be available.

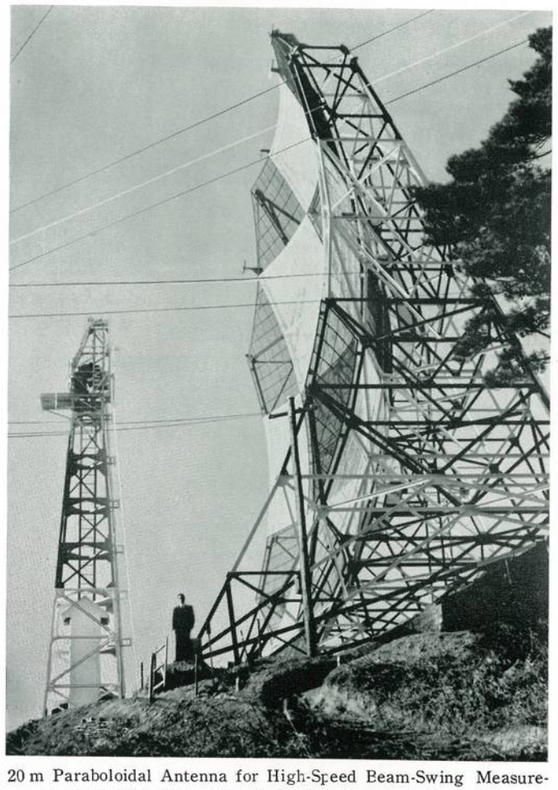


30 m Paraboloidal Antenna for Space Communications (Radio Research Laboratories' Kashima Station).

10 m Paraboloidal Antenna for Transmission on 600 Mc and 2120 Mc at Kokubunji Station, Tokyo.

Studies of Tropospheric Scatter Propagation of Very Short Waves

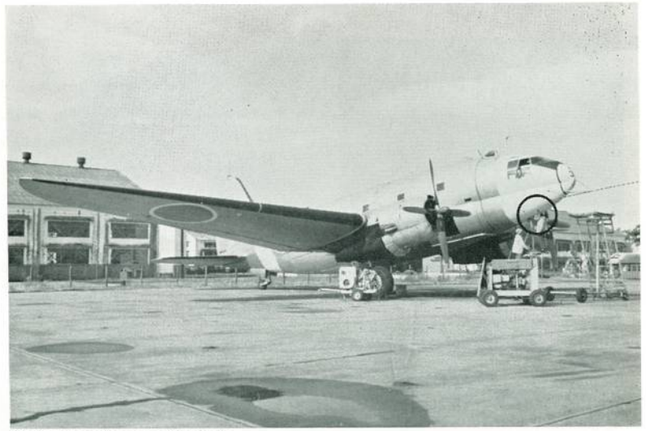
Communication links over a long range of several hundred kilometers, which utilize the tropospheric scatter propagation on VHF and UHF, have been realized successively between countries or islands all over the world. Recently, from the viewpoint of efficiency and economy, desired are extensions of the range, capability and reliability in the communication service, and further advanced knowledge is required of the propagational mechanism and the propagational characteristics far beyond the radio horizon. Thus, both experimental and theoretical researches are in progress along this line. The pictures show the transmitting and receiving antennas employed in a series of experiments concerned.



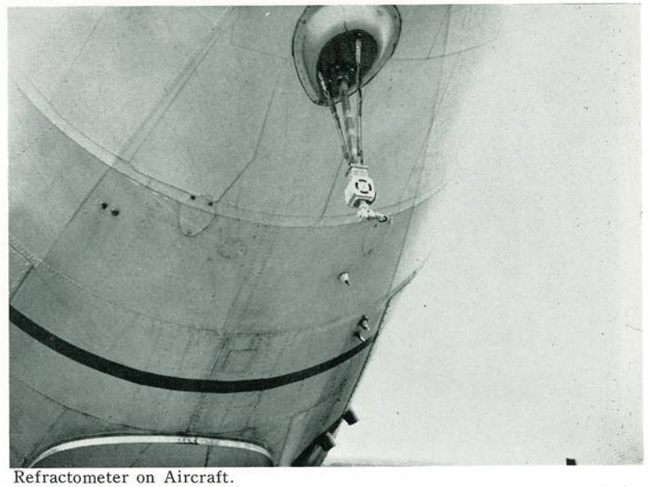
20 m Paraboloidal Antenna for High-Speed Beam-Swing Measurement of 2120 Mc Tropospheric Scatter Waves at Sendai Station, Sendai.

Research on Radio Meteorology

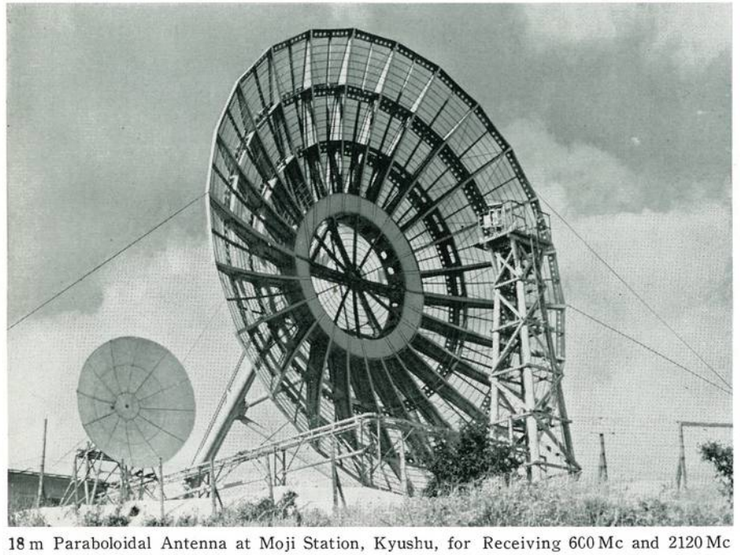
Radiometeorological investigations are directed to studies in spatial distribution characteristics of atmospheric refractive index; atmospheric refractivity profiles, elevated inversion layer characteristics, and turbulence spectra are measured by the use of a helicopter, an aircraft or a kytoon to find out the relation between the atmospheric conditions and the tropospheric scatter propagation on VHF and UHF. The pictures show an aircraft used for observation and the sampling cavity of a refractometer installed at the head of the aircraft.



Refractometer on Aircraft.



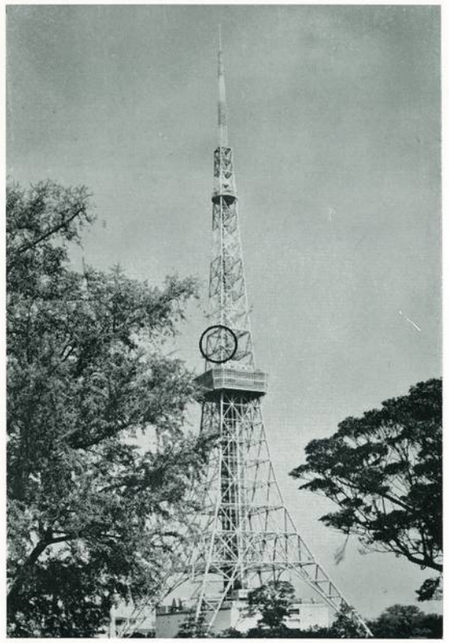
Refractometer on Aircraft.



18 m Paraboloidal Antenna at Moji Station, Kyushu, for Receiving 600 Mc and 2120 Mc Waves propagated over 802 km Distance from Tokyo.

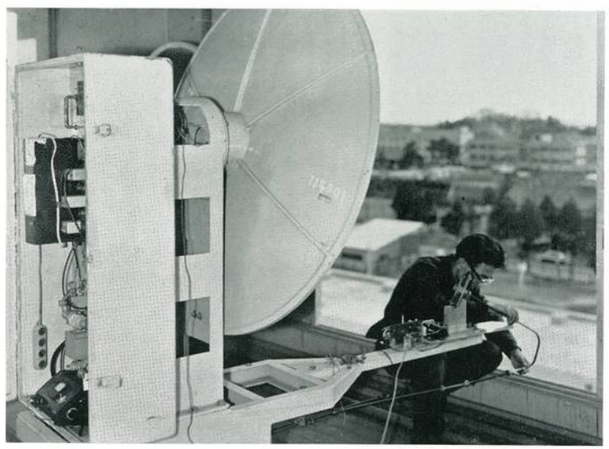
Studies of Millimetric Waves

Study is being given propagational problems in the millimetric wave communication and the development of possible utilization of millimetric waves. The investigations of rainfall attenuation, fluctuation of the angle of arrival, etc. are now in progress. Besides, the possibility of transmission of television signals is being examined.

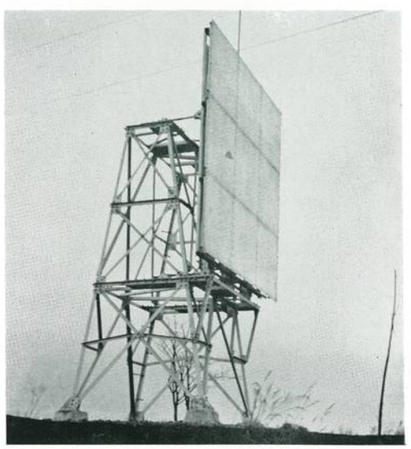


Tokyo Tower.

Terminal Station on the Tokyo Tower, Experiments of Propagational Characters of 8.6 mm Wave on the 24 km Path.



Off-set Paraboloidal Antenna for Transmitting 35 Gc Waves at Kokubunji over 8.5 km Distance to the Tama-Hill.



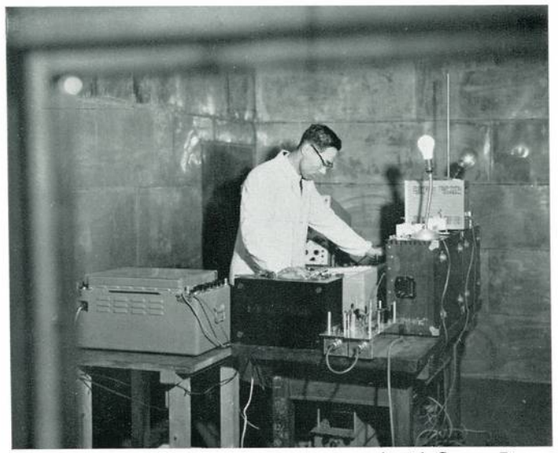
Reflector at the Tama-Hill.

Studies of Communication Systems

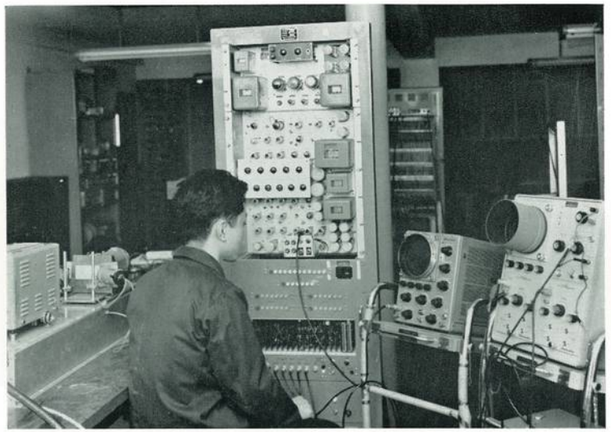
The study and development of communication systems immune from fading and noise, and the study of bandwidth compression for television are in progress.

Test Room belonging to Research Section of Communication System.

Assessment Room where Qualities of Television or Audio Signals are evaluated. It is a Room Darkenable, Sound-Proof, and Air-conditioned.



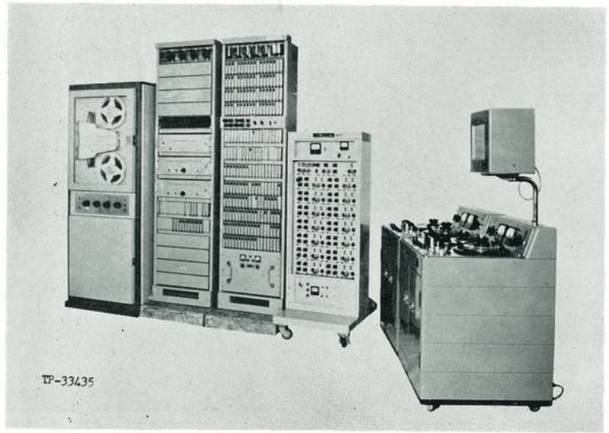
Shielded Room of Two-Fold Structure covered with Copper Plates. The Inner Room is Air-conditioned.



Character Sampling Device.

Studies of Information Processing

Studies are in progress mainly with regard to the visual and aural information processing, especially the recognition of various patterns such as hand-written, printed letters and speech sounds, by the aid of an electronic computer and peripheral equipments.



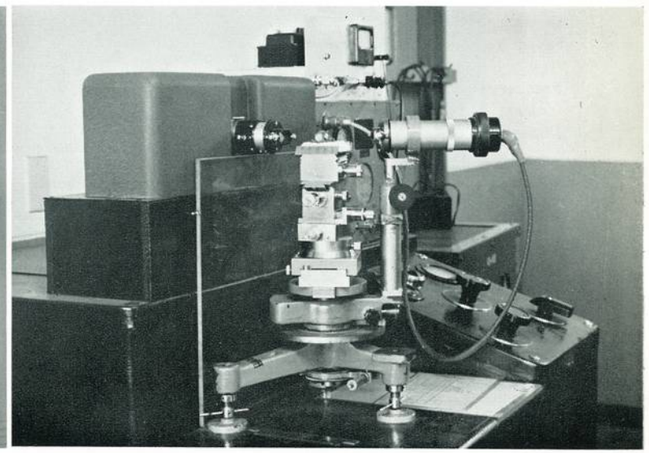
Speech Data Translator.

Electronic Computer (Type NEAC-2203).

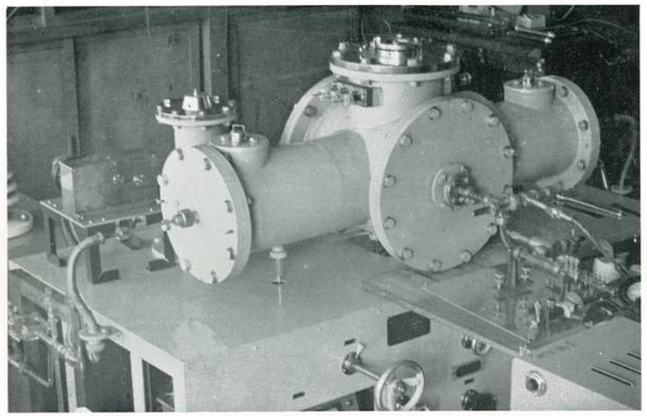
Research of Solid State Maser

With a view to development of receivers of less internal noise and wide band-width, fundamental studies are being made theoretically and experimentally of a solid-state maser making use of electron spin resonance of paramagnetic crystals.

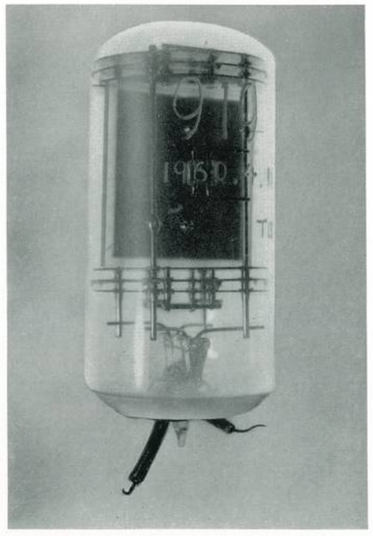
Apparatus of Solid-state Maser Experiment.



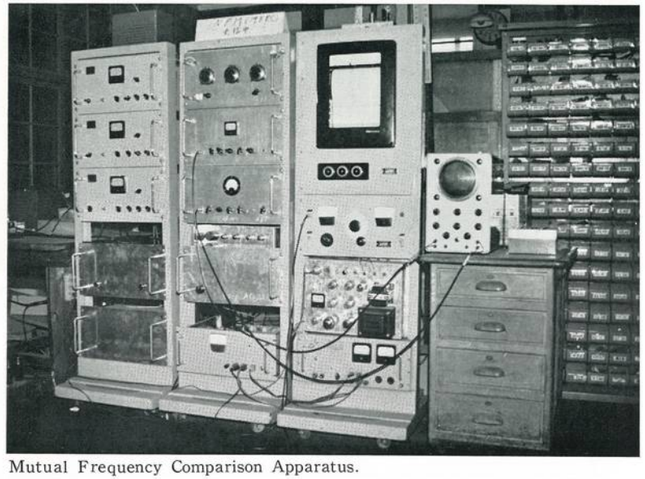
X-ray Apparatus for Finding out the Orientation of Maser Materials.



Ammonium Maser (Double-Beam Type).



Crystal Resonators (900 Type)
Resonant Frequency: 100 kc/s GT cut
Q-value: 3.5×10^{6}
Series Resonant Resistance: 11.0 Ω
Frequency-temperature Coefficient: less than 1×10^{-7}
Dimension: 39 mm × 85 mm



Mutual Frequency Comparison Apparatus.

Studies of Standards of Frequency

Atomic and Molecular Frequency Standards

Studies of atomic and molecular frequency standards have been made since 1951. The characteristics of a double-beam maser of $N^{14}H_3$ 3-2 line were investigated and the resetability is $\pm3\times10^{-11}$.

Standard Quartz Oscillators

To improve the stability of the quartz oscillator, studies are made of quartz unit, oscillator circuits and precision thermostats. GT-cut quartz unit has Q factor of 3.5×10^{6} and the frequency stability of a bridged oscillator is better than 1×10^{-10}.

Frequency Measurements

In order to investigate the frequency characteristics of standard oscillators, mutual frequency comparison is made by various methods. The phase variation and noise in the quartz oscillator and the frequency multiplier are studied to improve the precision of frequency comparison.

For the intercontinental frequency comparison, the measurement of phase variation of VLF standard waves from other standard frequency stations is carried out against the JJY frequency standard.

Standard Frequencies and Time Signal Transmissions

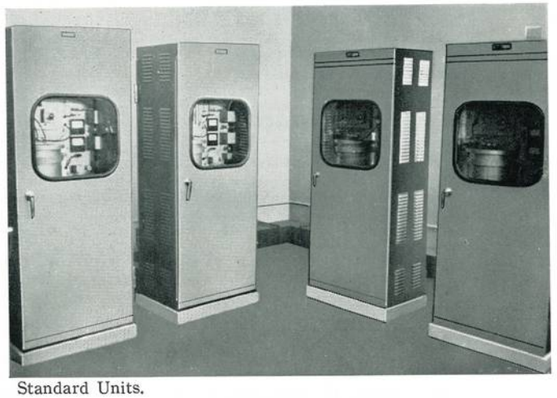
The standard frequencies and time signals JJY are broadcast at Koganei as shown in the table below. The accuracy of frequencies is $\pm5\times10^{-10}$.

The time signals are synchronized within ±1 ms with the standard time in other countries and maintained within 100 ms of the universal time U. T. 2. At the same time as the transmission of time signals are broadcast radio forewarnings.

To maintain the accuracy, a double-beam type ammonia maser is used as the primary standard.

JJY Station.

JJY Transmitter Room.



Standard Units.

Call Sign	Carrier Freq. (Mc/s)	Modulation Freq. (kc/s)	Emission Power (kW)	Hours of Emission
JJY	2.5	1	2	24
	5.0	1	2	24
	10.0	1	2	24
	15.0	none	2	24

Experimental: JG2AE (8 Mc/s), JG2AR (20 kc/s) and JG2AQ (16.2 kc/s)

Radio Forecasts and Forewarnings

The prediction of radio propagational conditions is most important to the assignment of frequencies, as is the radio forewarning of ionospheric disturbance to the operation of radio circuits.

Radio Forecasts

On the basis of the ionospheric data collected at home and abroad, radio forecasts are being issued three months in advance on behalf of the radiocommunication services having radio circuits national or international. They are published in the form of monthly pamphlets for distribution among those agencies concerned. In addition, at any time is satisfied any special request for prediction of the propagational conditions, for example, predictions for the 1964-Olympics, the Asian Olympics, communications with the Antarctic Research Expedition Party, etc.

As a guide for everyone who wishes to foresee the conditions of radiocommunication at an optional time and place, "the world-wide distribution charts of *F*2 critical frequencies and 4,000 km MUF" obtained publication. These charts are composed of 256 maps showing the distribution of f_0F2 and 4,000 km MUF with sunspot numbers 10 and 100, in 8 seasons of the year (every 1.5 months), and for every three hours in UT throughout day and night.

Radio Forewarnings

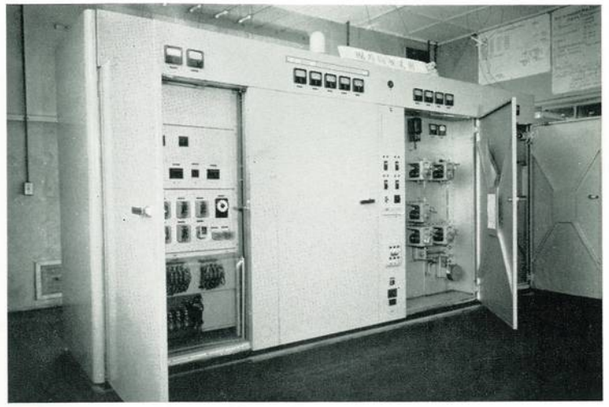
Radio forewarnings aim at cautioning the operators of radio circuits against the occurrence of Dellinger effects, geomagnetic storms, or ionospheric disturbances anticipated within 12 hours. This service is carried on at Hiraiso Radio Wave Observatory, where all the necessary data are scrutinized several times a day to find the possibility and degree of disturbances to occur, and the result is broadcast on the standard frequencies JJY. Advices of ionospheric storms are given by ursigram to the regions concerned, particularly to the Western Pacific Region. Besides the warnings mentioned above, the disturbance forecasts for the period of one week and of one month are prepared and distributed to all quarters concerned.

In addition to these services, continuous studies are carried on for improvement of the hitting rate of radio forecasts and forewarnings. In consequence of these studies, remarkable progress has been made.

Broadcasting of URSIGRAMS

This service was resumed at the Radio Research Laboratories on December 25, 1951, on the request of the IXth Plenary Assembly of the International Scientific Radio Union. Its object is to report promptly radio disturbances and to rapidly interchange between the radio organizations concerned the data concerning various phenomena of the sun, terrestrial magnetism, cosmic ray, ionosphere, etc. The Radio Research Laboratories has taken the role of the Western Pacific Regional Center since 1955.

All the information concerned is exchanged by radio to and from the three other Regional Centers (Nederhorst den Berg, Netherlands; Ft. Belvoir, U. S. A.; and Moscow, U. S. S. R.) and is broadcast further on as scheduled in the tables below.



URSIGRAM Broadcasting Transmitter.

BEAMED AT SOUTH

Call Sign	Time (U. T.)	Frequency (kc/s)		Nature of message
JJD	0430	A1	23,665	the same information on Adalert, current data summaries and satellite messages.
	0530	A1	18,180	
	0800	A1	18,785	the same information on Adalert, current data summaries and satellite messages.
	0900	A1	12,295	
	2030	A1	12,000	the same information on Geoalert and satellite messages.
	2130	A1	15,950	
	2300	A1	12,000	

BEAMED AT NORTHWEST

Call Sign	Time (U. T.)	Frequency (kc/s)		Nature of message
JJD	0500	A1	18,785	the same information as at 0430.
	0830	A1	18,180	the same information as at 0800.
	1000	A1	10,415	
	2000	A1	12,000	the same information as at 2030.
	2100	A1	12,295	

BEAMED NON-DIRECTIONAL

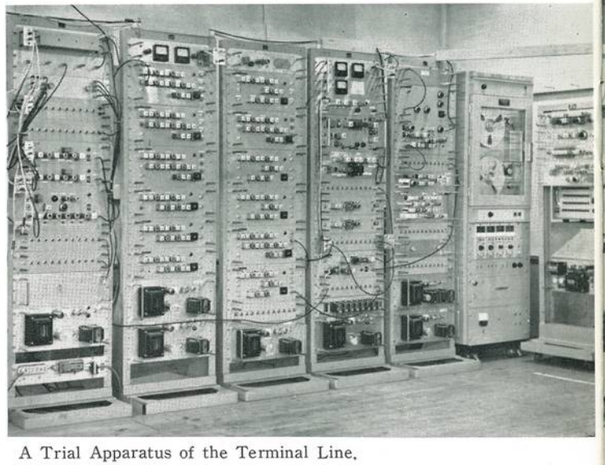
Call Sign	Time (U. T.)	Frequency (kc/s)		Nature of message
JJD	1200	A1	8,000	the same information as at 0430 and 0800, except Adalert and satellite messages.
	1500	A1	8,000	
	1700	A1	8,000	
	1900	A1	8,000	

Service for and Research on Radio Apparatus and Devices

Governmental Type Approval, Calibration Service and Performance Test

This Laboratories carries on, as a government enterprise, the service of type approval of radio direction-finders and automatic alarm receivers for ship's use, radiocommunication apparatus for survival craft, radio transmitters and receivers for aircraft, radio frequency meters, and others.

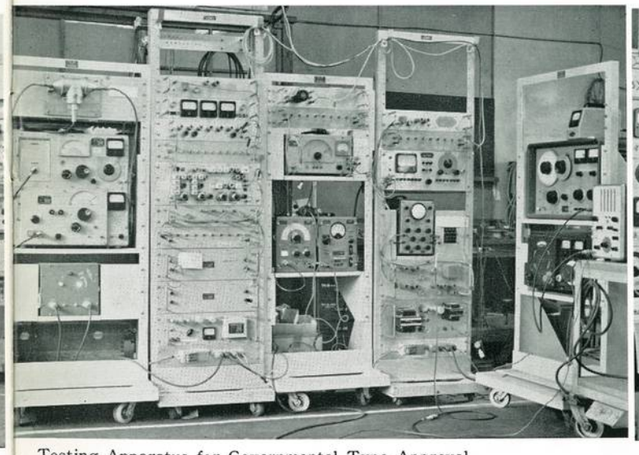
In order that various radio measuring equipments used for radio regulatory purposes may keep the high accuracy required, this Laboratories has held the practical standards for high frequencies and endeavored to develop various devices for calibrating efficiently measuring meters up to these standards. Remarkable improvement has been made in the practical standards or calibration devices for radio frequency voltage, current, impedance, field strength, frequencies, power, etc.



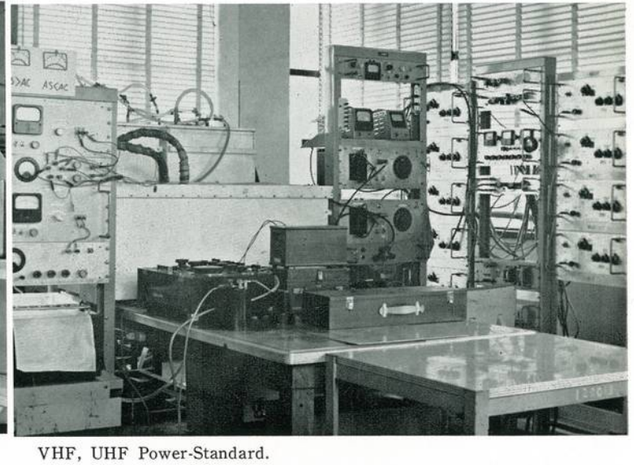
A Trial Apparatus of the Terminal Line.

Improvement of Radio Measuring Apparatus

Improvements in radio measuring apparatus for radio regulatory purposes and for radio research studies carried out at this Laboratories have largely contributed to the rise in level of radio measuring instruments used in Japan. At present, much effort is being given to the extention of frequency range of measuring apparatus and to the development of automatic method of measurement. Various automatic devices for measurement such as automatic reading machines of recorded curves have been brought to completion.



Testing Apparatus for Governmental Type Approval.



VHF, UHF Power-Standard.

Publications and Periodicals

The publications and periodicals issued from the Radio Research Laboratories up to date are as follows:

Ionospheric Data in Japan	In English	Monthly
Propagation Forecasts	In Japanese	Monthly
Monthly Forecast and Actual Disturbance in Radiocommunication	In Ehglish	Monthly
Journal of the Radio Research Laboratories	In English	Bimonthly
Review of the Radio Research Laboratories	In Japanese	Bimonthly
Catalogue of Data in WDC C2 Center for the Ionosphere	In English	June, December
Atlas of Radio Wave Propagation Curves for Frequencies between 30 Mc/s and 10,000 Mc/s	In English	Jan. 1957
World Maps of *F*2 Critical Frequencies and Maximum Usable Frequencies for 4,000 km	In English	Aug. 1958

World Data Center C2 for the Ionosphere

In the IGY program, World Data Center C2 in the fields of geomagnetism, ionosphere, cosmic rays and air glow were established in Japan. This Laboratories was designated as the C2 Center for the ionosphere and is playing an active part in cooperation with the three other Centers of "A" (C. R. P. L. in U. S. A.), "B" (Izmiran in U. S. S. R.), and "C1" (R. R. S. in Britain).

From Australia, India, Japan, New Zealand and Pakistan are forwarded to this Center the observational data concerning vertical incidence, absorption, drift, atmospherics, whistlers, meteors, etc., observed at 40 stations. Copies of these reports are sent by this Center to the three other Centers. Also, the copies of observational data obtained at other Centers are being sent to this Center. Accordingly, the ionospheric observational data are gathering here from 464 stations all over the world.

It was recommended at the Rome meeting of CIG-IQSY in March, 1963, that the existing World Data Centers A, B, C1 and C2 would continue in operation during the IQSY.

World Data Center C2 for the Ionosphere.

Structure of the Radio Research Laboratories

Director, Radio Research Laboratories	Vice-Directors	Planning Section	
		First Radio Wave Section (Ionospheric Propagation)	Kokubunji, Tokyo
		Second Radio Wave Section (Tropospheric Propagation)	
		Standard Frequency Section	Koganei, Tokyo
		Apparatus Section	Ogikubo, Tokyo
		Research Section of Radiophysics	Kokubunji, Tokyo
		Research Section of Ionosphere	
		Research Section of Tropospheric Propagation	
		Research Section of Plasma Physics in Ionosphere	
		Research Section of Millimetric Wave	
		Research Section of Crystal Oscillation	
		Research Section of Atomic Frequency Utilization	
		Research Section of Communication System	
		Research Section of Information Processing	
		Research Section of Space Communication	Kashima, Ibaragi Prefecture
	Chief, Administrative Division	General Affairs Section	Kokubunji, Tokyo
		Accounts Section	
		Wakkanai Radio Wave Observatory	Wakkanai-shi, Hokkaido
		Akita Radio Wave Observatory	Akita-shi, Akita Prefecture
		Hiraiso Radio Wave Observatory	Nakaminato-shi, Ibaragi Prefecture
		Inubo Radio Wave Observatory	Choshi-shi, Chiba Prefecture
		Yamagawa Radio Wave Observatory	Yamagawa-machi, Kagoshima Prefecture