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RADIO SCIENCE

Vol. 1—No. 2.

MARCH, 1948

- MINIMINOR 4 VALVE MANTEL RECEIVER
- U.H.F. TECHNIQUES (Part 1)
- RADAR AIDS TO NAVIGATION-D.M.E.
- RADIO SERVICEMEN-FOR YOUR NOTEBOOK
- COMPLETE SHORT WAVE NOTES

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e d i t o r i a l .

After some unavoidable delays and minor tribulations that usually beset a first issue, RADIO SCIENCE has now been successfully inaugurated—as your newest, latest and most up-to-date technical radio journal.

At this stage, we take the opportunity of thanking all who have contributed in making this possible. In these days of shortages, it is indeed a big move to produce a new journal. However, with the earnest co-operation of advertisers, readers, contributors and not forgetting our own staff, we intend to make this magazine a "must" for every technically-minded reader.

Although anticipating a large demand for the first issue, we must admit the response far exceeded our expectations—all distributed copies being sold within a few days of their appearance. To offset this, the circulation of this second issue has been greatly increased, but in view of current newsprint restrictions, we must stress that the only sure way of receiving every issue is by placing a definite order or taking out a subscription.

In This Issue

With the increasing importance of UHF techniques and application of radar aids to navigation, this issue includes the first of a series of articles dealing with both these subjects. Written by experts in the particular field, these articles are up-to-date and authoritative, and should appeal to all readers.

To cater for the needs of the home constructor, a rather comprehensive section has been included. Of particular importance is the description of the FM Receiver—the first of its kind in any Australian journal. With the FM transmissions still of an experimental nature, it did not appear logical at this stage, to design a completely new receiver. Because of this, an ex-disposals unit has been used and this should provide ample scope for ingenuity and experimenting until the transmission standards have been finally announced.

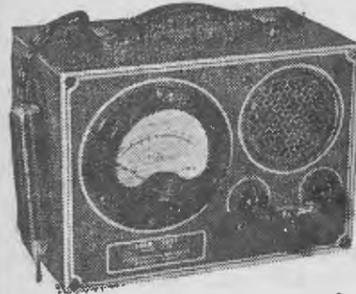
With the accent on "portability" nowadays, the new mantel receiver described should set new standards in this field. In addition to being an excellent performer, it is undoubtedly the smallest receiver of its type yet produced in this country.

Once again we thank all readers who have written in to us, because this is our only reliable guide as to just what is required. With your co-operation RADIO SCIENCE will be the FIRST in radio.

So readers, continue to send in your suggestions and ideas as to what you want included in YOUR magazine.

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RADIO SCIENCE

FOR THE ADVANCEMENT OF RADIO AND ELECTRONIC KNOWLEDGE.

Vol. 1.—No. 2.

MARCH, 1948

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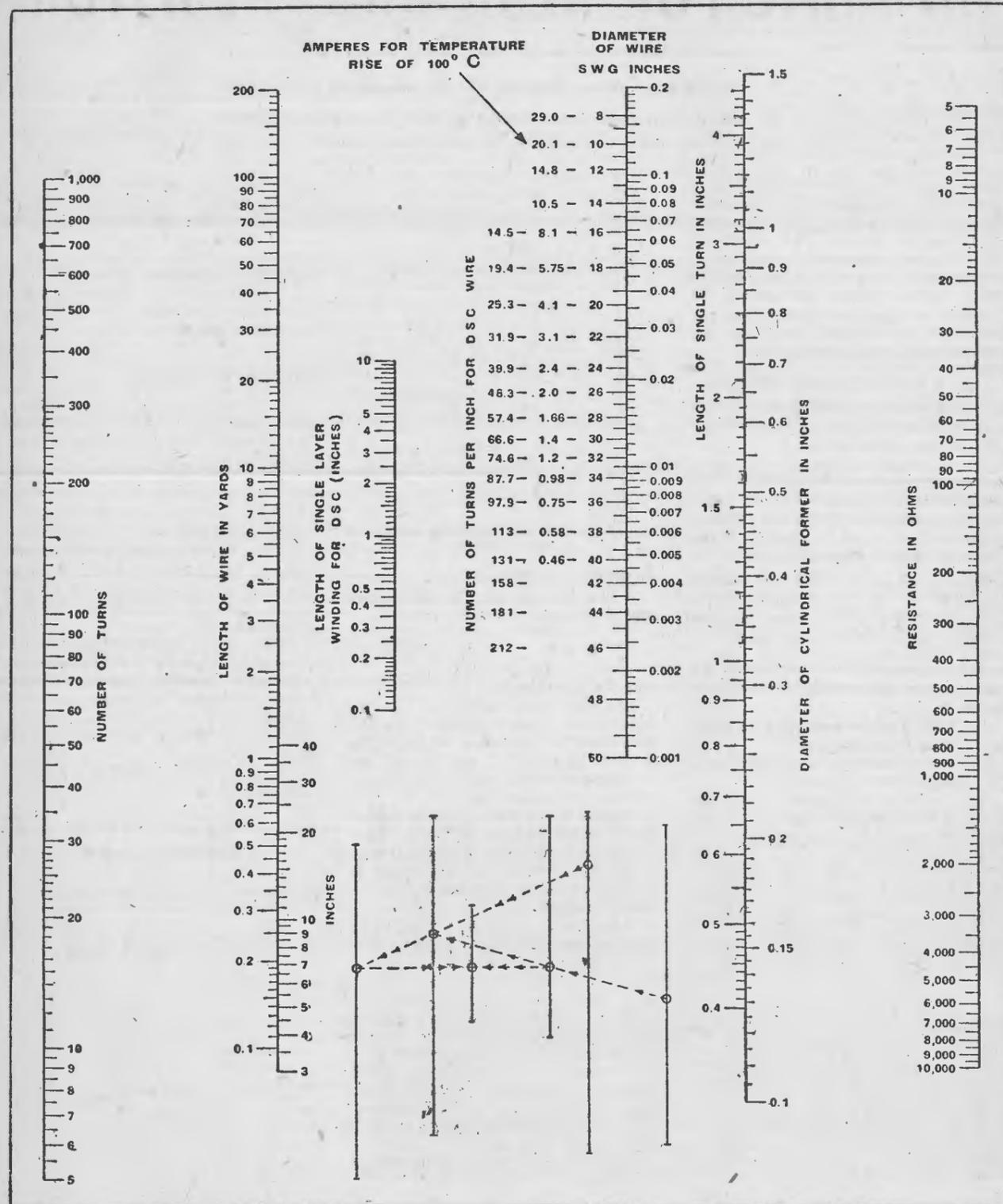
OUR COVER: This photograph taken at the Philips Hendon plant depicts the assembly of component parts in a radio receiving valve by means of an electric spot welding machine.

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"MIDNIGHT" AMERICANS

By the time this edition is read, the 1947-48 "Midnight American" season should be almost over. New Zealand DXers enjoy an advantage over the DXer on this side of the Tasman, as they can receive signals from North America at almost any time during the hours of darkness. Over here, however, Americans are heard from about September to March around midnight (E.A.S.T.) transmitting their breakfast sessions, including news services, farmers' services and recordings. A feature of American breakfast sessions seems to be live artist hillbilly shows, as these may be heard from quite a few stations.

Although few stations in the U.S.A. operate on clear channels at present—Crosley Radio's WLW Cincinnati, Ohio, 700 kc., and Chicago's WGN, 720 kc. operated by a well-known Ohio newspaper, the call initials standing for "World's Greatest Newspaper", are among those free from interference from other stations. These signals would be available possibly around 9 p.m. and, whilst a few DXers in this country have actually logged them, they are difficult to hear because of interference from Australian stations on the same channel.

Some midnight Americans likely to be heard during the next few weeks include—KMJ, Fresno, Calif., 580 kc.; KFRC, San Francisco, Calif., 610 kc.; KFI, Los Angeles, 640 kc.; KPO, San Francisco, or KABC, San Antonio, Texas, both on 680 kc. The latter, however, may be better a little before midnight; KECA, Los Angeles, 790

kc.; KOA, Denver, Calif., 850 kc.; KNX, Los Angeles, 1,070 kc. (try after 6WB closes, 12.30 a.m.); KSL, Salt Lake City, Utah, 1,160 kc.; KYA, San Francisco, 1,260 kc.; and others. Calls announced frequently.

Signals from America also reach Australia on the portion of the dial from 1,500 to 1,600kc., which, at the moment, has not been occupied by Australian stations, but may be tuned in on most receivers.

During our evenings it is possible to hear early morning sessions from such stations as—KXEL, Waterloo, Iowa, 1,540 kc.; KFBK, Sacramento, Calif., 1,530 kc.; or perhaps WCKY, Cincinnati, Ohio, also 1,530 kc., around 7 p.m.; WLAC, Nashville, Tenn., 1,510 kc.; XEBG, Tijuana, Mexico, 1,550 kc. Try for these and others from, say, about 8 p.m. till midnight, as they all provide interesting listening.

New Samoan Station

The National Broadcasting Service of New Zealand has undertaken the construction of a station for the Government of Samoa, to operate on 1,420 kc., from Apia, Western Samoa. Former manager of 2YH, Napier, Major E. Elliot Lloyd, will, according to an A.B.C. report, be in charge of the new station.

By
ROY HALLETT



A "Midnight American"—KNX, Los Angeles, 1070 kc. sends out this attractive QSL to confirm listeners' reports.

Q'd Regional Stations

A new regional relay station, 4QB, 560 kc., was recently put into operation by the A.B.C. The transmitter, an A.W.A. 2 kw. unit, has been installed in a cottage at Pialba, an attractive little spot on the Queensland coast, some 22 miles east of Maryborough, and will provide improved reception to listeners in the Maryborough-Bundaberg districts.

4QB will relay programmes from Brisbane's 4QG (transmitting the A.B.C. interstate programme), and 4QR (carrying the National type programme). No doubt local news bulletins will also be featured, as is the case with other A.B.C. Regionals.

4QL, Longreach, 690 kc., 200 w., took the air around the middle of last year, and, like 4QB, relays programmes in association with regionals 4AT, Atherton, 4RK, Rockhampton, 4QN, Townsville, and 4QS, Dalby, which have all been on the air for some time. Actually some 15 new units are planned by the A.B.C. to provide an important service in many parts of the Commonwealth, and stations at Broken Hill and Manilla, N.S.W., expected on the air soon.

Are you interested in Broadcast DXing? If so, you are invited to send in reports of your latest logging, equipment being used, as well as any suggestions regarding the information you would like included in this page. All letters should be posted direct to Mr. Roy Hallett, 36 Baker Street, Enfield, N.S.W.

B.C.O.F. News

Throughout the Pacific and European occupation areas transmitters have been erected for the entertainment of the troops in that area, and these provide interesting listening for the DXer at home.

Among the several stations on the air at the moment, providing entertainment for occupation troops in this case, is WLKS, operating from Kure, Japan, on behalf of B.C.O.F.

As the result of a report sent to them on hearing their short-wave unit, WLKS, forwarded their verification card, showing call sign in large red letters, with coat of arms in dark blue, together with details of their transmitters. The station which interests this page particularly is their 200 watt, 1,470 kc. outlet, and this is on the air daily till 11.30 p.m., A.E.S.T. WLKS is only one of several units operating in Japan, about which we hope to have a lot more to say as the winter months approach, when DXers in Australia are able to receive signals from Asia a little easier.

SHORT WAVE LISTENER

CONDUCTED BY TED WHITING

ON REPORTING STATIONS

Many of our readers will undoubtedly be beset with difficulties in reporting stations to us, a few remarks on this phase of the game may not be out of order.

We invite you all to write to us telling of your listening, and it will help a lot if these reports were arranged in columns instead of as is often found, in the form of a letter. This makes it far easier for us to pick out the rarer stations, and those on which we comment at more length, but we do emphasize that all loggings are of interest to us, and should include the announced frequency of the station heard, time of operation, direction of transmission if known and any other data given. We like to hear of your successes, will help you in your failures, and who does not have them?

Receiver Calibration

A very helpful suggestion is that you calibrate the dial of your receiver so that you can return to the frequency you desire at will. While we realise the average Dual-wave receiver dial is difficult to calibrate, it is possible to mark reference points of at least the stronger stations, which can be logged as received, the position on the dial being noted at the time.

For those with a dial marked in numerical divisions the job is easier, as for ourselves, we keep a book which is in effect a comprehensive station list by frequency, and all stations heard are logged in that book. It therefore becomes easy, after a reasonable number of reference points are noted to determine the frequency of a new station fairly accurately, and also to detect a station which is for some reason or another not operating on the assigned frequency.

Although reception conditions at present are very variable, it is possible on any night to receive large number of stations, which will provide much in the

way of light entertainment. Many of our readers are, we feel sure, availing themselves of this good fare, and we would like them to report their loggings to us.

This is your magazine, and these are your pages in which your prowess in Short Wave Listening will be recorded. We would emphasize that although you may receive a particular station consistently at excellent level, it may not be the fortune of others to hear it so well,

READERS' REPORTS

Readers desirous of submitting Short Wave reports for inclusion in these notes, should ensure they reach our Short Wave Correspondent not later than the 1st of each month. Address all letters to:—Mr. Ted Whiting, 16 Loudon Street, Five Dock, N.S.W.



One of the aerial masts of the short wave station near Rio de Janeiro. Courtesy—Phil. Tech. Rev.

we would like to hear about it and we know our other readers would be equally interested.

Radio Nacional, Brazil

The Radio Nacional short wave station, in Rio de Janeiro, Brazil, made its inaugural transmission on 31/12/42, and since that date has been correctly reported in most countries of the world. This station, one of the most powerful in the world, and the most powerful in South America uses a power of 50 Kilowatts, is equipped with a series of directional and omni-directional beams, enabling the best signal to be placed in the desired area.

The transmitter is one manufactured by and installed by RCA Victor and operates under the following calls and frequencies. PRL7 9520kc, PRL8 11720-weekdays from 4.30 p.m.-5.30 p.m., 9.30

Transmitter Location

The location of the station is some 12 miles from the city of Rio de Janeiro at Parada Lucas, the antennas being suspended from the six towers which may be seen from the surrounding countryside. Modern buildings house the transmitter and associated studios and offices, and besides the domestic programmes emanating from these stations, many outside broadcasts are made from spots in the city from whence all kinds of entertainment are relayed.

The Cultural and Propaganda aspects are well catered for and among other talks and similar sessions, broadcasts of news are undertaken in English, Spanish and Portuguese. Broadcasts are taken from the Latin American Service of the BBC and from similar services of the American stations.

Radio Nacional is pleased at all times to receive reports of reception of their transmissions, especially from Australia, and interesting booklets are sent to those interested as well as their colourful card.

Reports should be addressed to Division of Foreign Relations, Radio Nacional of Brazil, Rio de Janeiro, Brazil.

NEWS OF THE AMATEUR BANDS

There is much activity on the amateur bands at present, although night reception on "40" is difficult owing to the vast number of stations operating.

Always present is the careless VFO operator, the chap who must show his form by swishing from one end of the band to the other, and many of those who never seem to listen on their own frequency before calling. We have heard many QSO's ruined by such careless operating, which can only have one result, that of severe steps being taken by the authorities.

What sounds like intentional interference has been noted on the transmissions of several well-known stations, this appears to be of local origin, the strength of the signal at this location is sufficient to put the pin on the "S" meter hard over on nights when local conditions

have been poor. This is another of the actions which is detrimental to the amateur, although no amateur would be guilty of such practice. No doubt the offender will be caught eventually, and it will go very hard for him and quite rightly so.

UHF

Much DX has been worked on "40" of late, good CW signals being heard from W, KH6, KL7, and even G and F have been contacted. Two stations heard in contact with DX on this band have been VK2DO and VK2NS who have both done quite well.

For interesting information on the WIA and general matters of interest to Amateurs listen to VK2WI (VK2HZ on the mike) at 11 a.m. Sunday on 7156kc. An enlarged version of this transmission

is given from VK2WI by 2NP or 2NO at 8 p.m. Sunday on 50.3 or 51 M/c.

There is also quite a fair amount of activity on the 50 M/c band, and reports are that quite a few country amateurs intend working on "Six," should provide interesting contacts and keep things going on this band despite the lull in DX.

DX Plus Noise

This typifies the 14 M/c band, as when the band is open it is just about one solid hetrodyne. However good signals are being heard and worked at times, VK2AGU and VK2IQ among others seem to have little difficulty in getting over to England in the early evening.

Early morning signals have deteriorated greatly of late while reception at night is limited at present to a few Americans with short skip predominating. The 28 M/c band has also failed lately to show anything exceptional in the way of signals, a few Americans in the forenoon period, while at night G's are heard but by no means are they as prolific as a few months ago.

READERS' REPORTS

An excellent report has been received from Miss Sanderson of Malvern, Vic. In this list of loggings are many stations of which are heard at very fine strength. The receiver in use at Miss Sanderson's listening post is an ex-disposals type made by the Philips organisation and it certainly gives a very fine account of itself. Any receiver will, if in good order, give similar results, and by dint of careful tuning Miss Sanderson compiles some very fine lists of stations.

To quote a few, HEK3 7380kc at 6 a.m., news in French and Music; HE15 11710kc, HER5 11860kc both at 5 p.m., the location being Switzerland. OrL2A 6010kc at 6.15 a.m. from Prague. Ponta Delaga, Azores Is., 4840kc at 6.45 a.m. is an excellent catch for this time of the year. Paris is heard on 9560kc, 11880kc and 15240kc in afternoon on the two first frequencies and on the latter at 9.15 p.m. with a very fine signal. This one is easily identified. SBT, Stockholm, Sweden at 6.30 p.m. on 15150kc, TAP, Ankara, Turkey on 9465kc at 7.30 a.m. At this time reports are answered over the air, report to the station and listen for your call.

South and Central American stations heard by Miss Sanderson include COBC 9370kc, COKG 8950kc and COHI 6450kc all from Cuba and good ones after 9 p.m.

From Venezuela YV1RL 4810kc, YV5RN 4920kc give the typical Spanish type of programme.

XEWX, Mexico City, 9500kc, is another good station at 3 p.m. daily, heard

at the right time of the year opening at 11 p.m. also. This one is slow in verifying.

XERQ 9615kc also from Mexico is heard well in the afternoon at the same time but with a different programme.

Any reader requiring the addresses of these stations, or any others heard may have them on receipt of a stamped addressed envelope. We will be pleased to receive your letters and are prepared to answer all your questions.

Mr. G. J. Minnis, Kensington, N.S.W., writes to tell of his reception of some American stations. KCBA and KCBF were heard, at good level on the 49 meter band. Keep up the listening and the addresses you require should be in your hands by this time.

Report from Dr. K. B. Gaden to hand proves that Killarney, Q., is not such a bad spot for reception. Here are a few of his best heard recently:—

14M/c — MI6ZJ, (ex I6ZJ), MI6AB, UD6AC, U18AE, HE1AB, EP1AL, ZM6AF, MX2A, ST2CH, HC2CC, HE1CE, ET1IR, HC1JB, HZ1AB, MD7RJ (ex XU1RJ), ZB1AB, ZK1AA, ZK1AE, ZD3B, ZC6JL, HC6KI, ZC6JV, ZB1BD, MB9AG, OX3BD, ZE2JD, ZE1JX, VR6AA, VR4AA, VR3A, VR5PL, VR5IP, VQ2HC, SM5RF.

28 M/c — ZB1AB, YI2GX, EP1AL, ET1IR, MD5KW, KZ5AK, SM5AP, UH8AA, 16ZJ, OH3NB, HZ1AB, VP5AL, TG9JW, VU7JU, ZB1AC, ZS6GO, YNIHB, CX1DB, CE1AH, LU5DQ, OA4BC, XE1A, YIHEN marine mobile at Curacao, F8TU, VR6AA.

RADIO CLUBS.

We would be pleased to hear from Officers of all radio clubs, and amateurs in general. Many people are interested in your activities, and we can help you and them by including in these pages matter which will be of interest to you all. Let us have your ideas and suggestions and make this page for the amateur.

Station Addresses

TAP, Ankara. Turkish Press Department,
Radio Branch,
Ankara, Turkey.
FXE, Beirut. Lebanese Broadcasting Station,
Beirut, Lebanon.
Warsaw. Chief Foreign Liaison,
Dyrekcja Ogolno-Organizacyjna,
Polskie Radio,
Noakowskiego 20, Warsaw, Poland.
HH3W, Haiti. P.O. Box A-117,
Port-au-Prince, Haiti.
YV5RM. C/o Estacion de Onda, Larga YV5RB,
"Radiodifusora Venezuela,"
Cipreses a Miracielos No. 1-1,
Caracas, Venezuela.
SBT, SBP, SDB2, SBU, SBO,
Aktiebolaget Radiojansst,
Kungsgatan 8,
Stockholm 7, Sweden.
SEAC. Radio SEAC,
G.P.O. Colombo, Ceylon.

LISTEN FOR THESE STATIONS

Norway's Voice

Recent information to hand is that the Norwegian authorities are once again organised in the field of Short Wave Broadcasting. Pre-war many listeners heard the old LKJ on the 31-meter band at around 4 p.m. and frequently logged LKQ operating on the 25 meter band. This latter station was, we believe, destroyed by the allies as a result of one of the sporadic raids made on Fredrikstad.

Stations in operation at the time of writing are as follows:—

LLM—15175kc, 19.77m, Tromsø.
LKQ—11735kc, 25.56m, Fredrikstad.
LLG—9610kc, 31.22m, Oslo.
LKJ—9540kc, 31.45m, Oslo.

LLG uses a power of 100 watts and operates for an hour in the forenoon closing at noon, will therefore be one to remember for the winter.

All other outlets are on the air on p.m.-11 p.m. and 2 a.m.-7 a.m., and on Sunday an additional transmission is made at 5.25 p.m.-10.30 p.m.

Syria

An excellent marker station is now operating on 12000kc 25.0m, located in Damascus, Syria. This station has been heard in Australia at several locations but conditions on this frequency at this post are too severe for definite identification. We believe that the transmission closes at 6 a.m., and would appreciate reports on this one.

Reports, which will be welcomed by the station, should be addressed to Director-Generale des Postes, Telegraphes et Telephones, Damascus, Syria. Another station in a neighbouring locality is Beruit, FXE operating on 8020kc from Midnight to 6 a.m., heard at fair level at times, and with announcements in French and English.

Cebu

The Philippines Broadcasting Corporation has placed in service a new station KZBU, located at Cebu City, operating on 6100kc and 1250kc. KZBU has an announced power of 250 watts on the higher frequency and may be heard till sign off at 2.5 a.m. Although the transmission commences at 5 p.m., KZBU cannot be heard at this location until 11 p.m. from which time the transmission builds up to a good level.

KZRH, that great old timer from Manila, "The Voice of the Philippines"

is now heard mornings at 7.30 a.m. and also in the evenings when the usual American type programmes are heard. The frequency in use 9640kc, and reports should be despatched to Manila Broadcasting Coy., Manila, Philippine Is.

Costa Rica

Stations operative in Costa Rica are heard frequently, these are the frequencies together with the distinguishing slogans used in announcements.

TIGPH 5875kc, San Jose, "Alma Tica."
TIRH 6150kc, San Jose, "Radio el Mundo."
TILS 6165kc, San Pedro, "Para Ti."
TIRCC 6180kc San Jose "Accion Catolica."
TIEP 6700kc, San Jose, "La Voz del Tropico."
TIPG 9615kc, San Jose, "La Voz de la Victor."
TINRH 9692kc, San Jose, "La Voz de Costa Rica."

It is interesting to mention at this point that the latter station is the one owned by one Amando Cespedes Marin, heard here for many years, and one which is ranked as among the oldest of the short wave stations. Signor Marin has done some very fine work in this field of Short Wave Radio, as a result of which transmissions are now maintained so splendidly.

Antarctica

Expeditions frequently provide some thrills for the short wave listener, but owing to the intervention of the war, very few signals of this type have been available to the listener.

We refer to the base stations recently established on Heard and Macquarie Islands, the frequencies allotted together with call signs are:—

HEARD ISLAND—VJH 9940kc, VJH2 12255kc, VJH3 15845kc, VJH4 19255kc.
MACQUARIE ISLAND—VJM, VJM2, VJM3, VJM4, the same frequencies being used.

Among the personnel at these bases are three amateurs from Victoria, these will operate in the amateur bands under their own VK3 calls with a portable suffix.

ABC National Service

Schedule of transmissions of the National Short Wave stations are:
VLH4 11880kc, 6 a.m.-9 a.m. week days, 6.45 a.m.-9 a.m. Sunday.

VLH5 15230kc, 9.15 a.m.-6.15 p.m. week days, 8.15 a.m.-6.15 p.m. Sunday.

VLH3 9580kc, 6.28 p.m.-Midnight, throughout the week.

VLR2 6150kc 6 a.m.-8.15 a.m. week days, 6.45 a.m.-8.15 a.m. Sunday, 6.45 p.m.-Midnight week days, 5.30 p.m.-Midnight Sunday.

VLR 9540kc, 8.30 a.m.-6.30 p.m. week days, 8.30 a.m.-5.15 p.m. Sunday.

VLG7 15160kc, 6 a.m.-8 a.m. daily.

Trujillo

Throughout the Latin American countries are several cities of this name—one we refer to is that located in Dominican Republic, and one from which we were wont to hear some very fine transmissions. "La Voz del Yuna" is being heard with fair regularity at various locations on 11900kc and 7275kc using a power of 7.5 kilowatts. The call is HI2T and the best time is 7.30 a.m. Frequently stations from this area are heard till 2 p.m. on Sunday afternoon, especially in the winter time here, these are well worth looking for on account of their very colourful verification cards. It is wise to include International Reply Coupons to all stations in this area. The stations are interested in reports from Australia as the service they provide is only intended for local reception.

Radio Luxembourg

The signals from Radio Luxembourg are among those we rate as first class, the radiations taking place on 15350kc at 9 p.m.-11 p.m. and 6090kc at 2.30 a.m.-9 a.m. As regards the latter, we think that at 6 a.m. there is little better in the way of signals.

This station was one of the first taken from the Nazis at the close of the war, due to the resource of its operators and engineers, the American Army was able to place this station back in service in a matter of days, on reduced power, but at least on the air and disseminating the truth from Europe. Radio Luxembourg was later handed back to its original ownership and is once again doing a great job on both the Broadcast and the S.W. band.

A test transmission was recently made on 9527kc, but this frequency has not as yet been placed in regular service. An occasional glance at this frequency will in time pave the way for yet another verification.

RADIO SCIENCE, March, 1948

Technical BOOK REVIEW

THEORY AND APPLICATION OF MICROWAVES

By Arthur B. Bromwell, M.S., M.B.A., and Robert E. Bean, Ph.D. Published by the McGraw Hill Book Co. Stiff cover, 470 pages. Price approx. 42/-, plus postage.

This book is a recent addition to the "Radio Communication Series"—a series intended to cover the most important aspects of the radio engineering field. The text is a comprehensive study of microwave techniques and applications, stressing the engineering as well as the analytical point of view.

The book contains 21 chapters, the first five of which are in the main devoted to basic principles, such as vector manipulation, electrical laws, motion of charges in electric fields, all so necessary for the understanding of the remainder of the book. Chapters five to eight deal with most forms of oscillators—negative grid, klystron, resonator, travelling wave tube and magnetrons all receiving mention.

The theory of transmission line equations and networks are discussed in Chapters 8, 9, and 10, while typical microwaves systems are dealt with in Chapters 11 and 12. Chapters 16 to 18 give a very full discourse on wave guide theory, as well as covering applications of such equipment.

Although most of the analytical portions of this text require a sound knowledge of radio theory and mathematics through to calculus, making it essentially a text for the student or practising radio engineer, the diligent reader will also find much useful information in this book.

A TEXTBOOK OF RADAR

By the Staff of the Radiophysics Laboratory, Council for Scientific and Industrial Research, Australia. Published by Angus and Robertson Ltd. Price, 50/-, plus postage.

Although many texts on radar and radar systems engineering have been published since the end of the war, this latest addition to the field will form a valuable adjunct to any radio engineer's library.

The primary purpose of this new text

RADIO SCIENCE, March, 1948

JUST PUBLISHED A TEXTBOOK OF RADAR

A Collective Work by the Staff of the Radiophysics Laboratory, Council for Scientific and Industrial Research, Australia.

The Radiophysics Laboratory of the Council for Scientific and Industrial Research was established in 1939 as a result of consultations between the United Kingdom and Australian Governments. It was set up as a centre of radar research and development for the Allied Forces in the Pacific Area.

During the war the subject matter of radar grew to large proportions as a result of the activities of many research laboratories in Great Britain, the United States, Canada, and Australia, and a field of scientific knowledge came into being which is unknown outside the group of scientists and engineers who were directly involved. The relaxation of military secrecy now makes it possible to publish this material.

CONTENTS

Introduction; Fundamentals; The Magnetron; Triode Power Oscillators; Modulators; Microwave Transmission and Cavity Resonator Theory; Transmission Line and Resonator Techniques; Aerials; Aerial Duplexing; Receivers; Local Oscillators; Frequency Converters; Amplifiers; Display Circuits; Automatic Ranging Circuits; Radar Systems; Ground Radar; Shipboard Radar; Airborne Radar; Radar Navigation.

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AN ABAC FOR RESISTOR DESIGN

(Continued from page 41.)

it will be seen that as N decreases by a factor of 10, T increases by the same factor,

therefore $\log T = \log K_2 - \log N$ and therefore:-

$$T = K_2/N \dots \dots (4)$$

Combining (3) and (4) and re-arranging,

$$N = \frac{KL}{T}$$

which is the formula (B) required.

As the coil former is usually cylindrical, the length of a single turn T is given by $T = \pi C$, where C is the diameter of the former. Thus a scale of diameters can be added to the T scale.

Length of Winding

The length of a single layer close wound winding W is given by:-

$$W = KND \dots \dots (C)$$

where K is a constant.

The distance between the N and W scales is $1\frac{1}{2}$ times that between the W and D scales, and the W scale unit length being $\frac{3}{5}$ and the N scale $1\frac{1}{2}$ times that of the D scale. (Figure 3).

As before it will be seen that:-

$$(a) \log D = \log K_1 + \log W \text{ and}$$

$$(b) \log N = \log K_2 + \log W$$

$$\text{Therefore } D = K_1 W \dots \dots (5)$$

$$\text{and } N = K_2 W \dots \dots (6)$$

Re-arranging (5) and (6), $W = KND$ which is formula (C).

The Complete Abac

It will be seen that the first and second abacs can be constructed with a common L scale, the second and third with a common N scale and the third and first with a common D scale, provided that the relative distances between the vertical scales are not altered.

A scale of SWG has been added to the D scale and refers to wire with no covering. As this scale is also used to find the length of winding for DSC wire, the result cannot be very accurate as in the case of the thicker gauges the covering will be negligible with respect to the wire, but in the case of thinner gauges the reverse will be true. The position of the scale was fixed for 24 SWG and may be taken to be sufficiently correct up to about 30 SWG. For gauges above 30, the scale reading should be doubled.

The method of use is explained by the small *key diagram* within the abac and consists entirely in performing the operations of the three separate abacs.

As an example suppose a resistance of 100 ohms is required to be wound on a former of diameter 1 inch, the wire to be 30 SWG DSC.

Connecting 100 ohms to 30 SWG gives 18 yards, connecting 18 yds. to 1 inch former gives 207 turns, connecting 207 turns to 30 SWG gives 3.0 in.

Radio Wave Velocity

The round figure of 300,000,000 or 3×10^8 metres per second, has been long accepted as the velocity of all electromagnetic waves. One frequently reads in radio textbooks that this velocity is fixed and unvarying, no matter what the conditions may be.

Some years ago A. A. Michelson determined the precise velocity of light waves as 2.99774×10^8 metres per second, with a possible maximum error of plus or minus 11,000 metres per second.

The coming of radar and the call for minute precision in the measurement of travel times led to fresh investigations and to the discovery that there might be slight variations in the velocity of electromagnetic waves, depending on the wave length and the medium traversed.

After some years of laboratory work a new determination of the velocity in a vacuum of centimetre waves has been made at the British National Physical Laboratory. This works out at 2.99793×10^8 metres per second, with a possible error of not more than 9,000 metres per second.

ANSWERS TO QUIZ

- A.1. (c) The face of the AT-cut crystals is cut at an angle with respect to the Z axis. In addition to increased power handling ability, the main characteristic is that they have a temperature coefficient approaching zero, thus enabling them to maintain the set frequency.
- A.2 (a) and (c). In general, the line filter consists of AF chokes bypassed to earth, at each end by suitable fixed condensers.
- A.3 (c). A.4 (b). A.5. (c).
- A.6. (b). The usual oscillatory circuit consists of a condenser-coil combination, which has the effect of storing energy and maintaining continuous oscillation under correct operating conditions — hence the term "tank" circuit.
- A.7. (a) Microvolts per metre.
(b) Plate supply voltage.
(c) Pulsating direct current or Pure direct current.
(d) "j" — an operator symbol used in complex algebra.
(e) Screen supply voltage.
(f) Automatic gain control.
(g) Standard wire gauge.
(h) Mutual conductance.
- A.8. (c). The trade name of a special type of loop aerial.
- A.9. (b). An electron which has been removed from an atom becomes a "free" electron. If this attaches itself to a neutral atom, the charge of that atom will become negative in character, and is then known as a "negative ion."
- A.10. (b) and (e). The iconoscope is fitted in the television pickup camera, whilst the kinescope is the cathode ray tube in the receiver.
- A.11. (c).
- A.12. (b) or (d). It is possible to operate the oscillator so that it is higher or lower in frequency than the incoming signal by a fixed amount — equal to the I.F. frequency. In both cases the net result will be the same, since the frequency difference still gives the required intermediate frequency.
- A.13. (b). A.14. (b).
- A.15. (a) D. (b) B.
(c) A. (d) C.

Signal Storage

Signal Storage device used during the war by the Germans enabled them to transmit a dozen or more messages in a fraction of a second. The signals were received, amplified and projected on the screen of a cathode ray tube of such persistence that the signals could be stored for long periods if necessary.

The cathode ray tube beam in this equipment scans a plate covered with a layer of microscopic quartz particles embedded in a photoelectric base. The particles of quartz hold a charge which varies with the intensity of the scanning beam. To transcribe the stored record an infra-red or ultra-violet beam (to avoid visible interference) is directed at the photoelectric plate, each point of which emits electrons in proportion to the charge at that point.

An electromagnetic lens focuses the streams of electrons on a fluorescent screen. The screen produces a visible image which will last for 15 minutes provided the plate continues to receive ultra-violet or infra-red light. However, the image can be wiped off the screen at any time by turning the light off and scanning the plate with an electron beam of uniform intensity.