Medium Wave DX-ing in the Western Hemisphere

by Thomas Sundstrom, USA

PREFACE

MEDIUM WAVE (MW) DX-ing in the 535-1605 kHz band is an interesting and fascinating hobby. In many ways it can be more exciting than DX-ing the international shortwave broadcast bands, whereas the latter frequencies are frequently subject to 'power plays' SW broadcasters nowadays seem to play the power game called 'up the kilowatts' or 'who's got the megawatt?' The MW band in the Western hemisphere is less subject to this sort of aggrevation and, in fact, a knowledge of the MW band can provide benefits other than just hearing DX.

For example, this writer is a hockey fan attending games of one of the teams in the National Hockey League, Western Division. The NHL covers the entire USA and Canada, and it is easily possible to listen to virtually any game played on any given night. Of the 18 teams in the NHL in 1974-75, this writer can hear the home-town broadcaster for 13 of them . . . and odds are that those five teams I cannot hear will play a team who I can listen to. In recent years, the division races in the NHL have been closely contested, and my wife and I can pick and choose the crucial games, as we please, to listen to. Similarly, DX-ers who follow other professional sports listen to games of their choice.

The MW band is taken for granted by many people. If the listener will look closely, however, there is a whole new and fascinating world of DX-ing. In one year's time, it is relatively easy to hear 400 or 500 stations in 40 or so states and provinces, and up to 30 different countries. Some older MW DX-ers have worked their way up to 2000 or 3000 verifications from more than 100 countries, but even some newcomers in the past threee years have logged and verified over 1000 stations.

Time, patience, and knowledge are essential ingredients to being a successful MW DX-er. The balance of this article will address itself to the last element specified.

RECEIVERS

What kind of receiver is necessary for MW DX-ing? Well, the small 8-transistor protables will inhale a lot of signals, and many younger MW DX-ers begin by using such receivers but, generally speaking, they cannot 'cut the mustard'.

It should be pointed out, emphatically, that some new DX-ers are easily discouraged at this point in time because they read, in club bulletins and magazines, of unusual and rare catches that they have no hope of hearing on their $20 'zip' special. Dear readers, everyone has to begin at some point and the hobbyist getting into MW DX-ing for the first time should not be downcast at the seemingly inability to log 'Nibi-Nibi' that experienced DX-ers are logging with apparent ease. Much of your good catches will be 'luck' – until you gain the expertise to recognise DX conditions and the best times for DX-ing.

For best results, a communications receiver is a necessity. Unfortunately there are not too many manufacturers marketing new equipment, and the number seems to be decreasing. Perhaps the best place to start inquiring about receivers is at a local amateur radio supply house or with advertisers in some of the general electronics magazines. The price range of new equipment nowadays is about $150 to $1000, with one at the astronomical level of $2500. There are several good receivers to choose from under $500, and two popular models under $160.

The alternative choice to new equipment is that which is used, and it is possible to locate good, clean, receivers from either commercial outlets that accept trades or from private citizens. This type of shopping, however, has to be highlighted as 'buyer beware'. A rapport with a local service technician is worthwhile; he can look over the receiver and determine what steps must be taken, if any, to put the equipment in tip-top shape. Obvious visual checks can be quickly made. Has the cabinet been knocked around? A fresh paint job will hide hard useage. How about the knobs? Are they worn, or newly replaced? Pull the chassis and look underneath. Any charred wiring indicating shorts or other component replacement? I should emphasise simple things such as a realignment job or a new set of tubes should not deter you from an otherwise 'clean' receiver. Modifications and changes in original wiring should normally be avoided, if such are extensive, unless appropriate notes are made on the accompanying service manual and schematic (which should be obtained on any purchase of used gear). It is impossible to give a 'rule of thumb' on prices to be paid, but your desires to own the receiver should be guided by how much needs to be done to the unit to make it functional. The writer, for instance, knocked off $10 off the bid for equipment recently purchased because it lacked the service manual and I was not sure of my costs and time involved to locate a replacement.

In choosing a receiver, whether new or used, the DX-er should look for the three 'S's': sensitivity, selectivity, and stability.

Time, patience, and knowledge are essential ingredients to being a successful MW DX-er.

Sensitivity is the measure of the receiver's ability to hear weak signals. It is usually quantified in terms of a number expressing dB in signal-to-noise ratio – the lower the number of microvolts, the better, A receiver sporting a sensitivity of 2 uv for a 10 dB s/n ratio is better than one offering 50 uv for the same 10 dB s/n ratio.

Good sensitivity in a receiver mandates the use of an r.f. (radio frequency) amplifying stage. This is the first section of the receiver the incoming signal encounters. The weak signal is amplified, i.e., made stronger, for further processing in the mixer and i.f. (intermediate frequency) stages.

A mixer circuit converts the incoming frequency, whether it be 610 kHz or 1540 kHz or whatever, after amplification, to one common frequency, called the intermediate frequency (i.f.).

The i.f. stages are all finely tuned to one common frequency, 455 kHz. It is impossible to have a receiver's circuits designed to process *all* frequencies incoming, hence the conversion to one. The more i.f. stages a receiver has, the more selective the receiver is. Two or three i.f. stages is a good measure of a selective receiver. Some of the more expensive receivers have two or three i.f. strips of different frequencies and are called dual and triple conversion, respectively. Typical i.f.'s used are 6000 kHz, 1650 kHz, 455 kHz and 262 kHz; a dual or triple conversion receiver may have any combinations of these, each strip having two or three stages.

As dual or triple conversions help to improve selectivity, so do crystal or mechanical filters and Q-multipliers. The idea is that the broadness of the receiver bandpass skirts is lessened. (See illustration 1.)

The mechanical filter is better than the crystal filter in that, at the peak of the i.f. curve, the top of the bandpass is squared off to pass more audio in the sidebands (wherein lies all the 'intelligence') than with the 'sharpness' of the crystal filter or Q-multiplier.

The crystal filter and the mechanical filter are fix-tuned to a particular i.f., whereas the Q-multiplier can be varied by a few kHz up and down to 'fine-tune' closely spaced stations. An advantage of the Q-multiplier is that it can not only be used to 'peak' a desired station but it can also 'null' an annoying heterodyne (whistle) caused by the interaction of the carriers of two closely-spaced stations.

The Q-multiplier's 'peak' control is variable and sharpens the i.f. bandpass, whereas the 'null' function inserts a 'notch' into the receiver bandpass and which is tunable across its full range. As such, the annoying heterodyne can be wiped out by tuning the 'notch' (depth of the notch is variable) to stop the interfering frequency in the i.f. bandpass.

Unfortunately, if a Q-multiplier is not included within the receiver, a circuit has to be built from scratch as there are no units commercially available in assembled or kit form. Amateur radio journals are probably the best source of such schematics: in the United States, look to the section entitled 'Improving Receiver Selectivity' in the *1973 ARRL The Radio Amateur's Handbook,* chapter 8, 'Receiving Systems', page 256-259.

How does one judge the adequacy of receiver selectivity? One needs two measurements of the i.f. bandpass to get a decent idea. Typically, 6 dB @ 6 kHz and 60 dB @ 10 kHz would be excellent. The first measurement is at the peak of the curve, and the second is at the bottom of the curve; the plotting of a curve is indicative of the i.f. response and the frequencies adjacent to it. The 'peakedness' of the curve is a graphical illustration of the receiver's selectivity. (See illustration 1.)

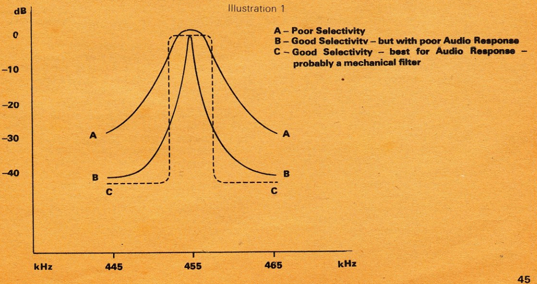
For example, receiver A has a curve of 6 dB @ 6 kHz and 30 dB at 18 kHz. Receiver B has a curve of 6dB @ 6kHz and 40 dB at 10 kHz. Which one has the better selectivity? Receiver B . . . despite both having identical responses of 6 dB @ 6 kHz at the peak of the i.f. curve, as B has a smaller bandpass further 'down' from the peak of the i.f. curve.

Dual or triple conversion i.f. receivers can also eliminate spurs and images. True images, if present, can be heard at a frequency twice the i.f. below the transmitting frequency of a station. For example, I have a local station on 1460 kHz and a single conversion receiver with a 455 kHz i.f. strip. If I could hear that station on 550 (1460–2x455 = 550) kHz, my receiver would have image rejection problems. A measurement of image rejection is expressed in dB – the higher the dB figure, the better.

Typically, image rejection on a multi-band receiver is better on the lower frequency bands than on the higher ones. This is inherent in the design of superheterodyne receivers, and is to be expected.

With multiple i.f. conversions, you can see what would happen with image responses. It is virtually removed, as the second i.f. times 2 falls outside the range of image frequency created by the first i.f. strip.

Illustration 1



Spurs, most often caused by two or more strong signals mixing their frequencies in various combinations either externally or internally of the receiver, will cause signals of the two stations to appear in strange places on the dial. Often it sounds like you're listening to two stations at once. Fortunately, an r.f. stage and multiple i.f. stages eliminate the problem for all but those who are unfortunate enough to live near concentration of high-powered transmitters, such as in the meadowlands of New Jersey just west of New York City.

An example of external mixing spurs, as experienced by the writer in southern New Jersey, is the sum and the difference generated by two Philadelphia stations, WCAU on 1210 kHz, and WFIL on 560 kHz. These generate an external mixing spur on 1770 kHz and on 650 kHz . . . which covers up KORL on 650 kHz in Honolulu, Hawaii. External mixing spurs will act as if they are an actual transmitter, and can be tuned as any other signal in that area of the band. While nothing can be done about external mixing spurs, usually an alignment job or better shielding will remove internal mixing spurs. Internal spurs will also appear in the receiver when the receiver is tuned to one frequency and an antenna preamplifier or antenna tuner is set to another frequency.

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There isn't much point in having selectivity unless the receiver has accurate dial calibration. The small radios tend to compact the dial and one virtually has to 'fish' for the desired station. Receivers with dial cords also cause problems with 'dial backlash'. Direct drive dials are best, and are to be found in communications receivers that cover SW bands too. Popular receivers are being, or have been, marketed by Hammarlund, Hallicrafters, Drake, National, and Galaxy. Others, because of price, are not true communications receivers but enjoy a wide following by the beginner DX-er as they are less than $160: the Realistic DX-160 series and the Lafayette HA-600 series.

Good dial calibration is important to the DX-er who winds up being interested in foreign BCB DX-ing. As you'll see later, not all stations operate on the even 10 kHz assignments used by North American stations. A minimum readout accuracy should be 10 kHz, but it might be preferable to be able to spot a frequency to the nearest 5 kHz. The newer transistorized receivers, such as the Drake SW-4 and SPR-4 and Galaxy R-530, that use a crystal controlled oscillator to tune 500 kHz segments have a readout to 1 kHz with interpolation to 200 Hz (1/5 of 1 kHz)!

To enjoy good dial calibration, you must have the third 'S': stability. If a tube-type receiver, it helps to have a VR (voltage regulator) tube in the power supply. Once the set warms up (heat causes a receiver to drift as components change, minimally, values), the VR will help to minimize further drifting, i.e., changing frequency without tuning, of the receiver. Transistorized receivers don't have a heat problem, but drift does occasionally occur with changes in a.c. line voltage. A variac transformer and a.c. line meter can be inserted into the line to stabilize line voltage changes' effects upon the receiver. With power shortages and 'brownouts' such equipment is likely to be very popular in the future.

All of the above sounds very complicated, and I don't want to scare the reader. What you have here is some verbage to assist you in understanding the terminology of the literature put forth – don't forget the true test of the receiver is trying it yourself, and see how it 'fits'. Do some comparison shopping and you'll quickly see what we've been talking about here. A good receiver, whether new or used, will be readily apparent to you after a foray or two into the marketplace before the initial purchase is made.

ANTENNAS

The communications receiver that you use is only as good as the antenna inhaling the signals. There are, basically, two types of antennas used by DX-er: the long-wire (LW) and the loop.

The LW is simply a length of wire put up as high and long as possible, between two insulators with a down-lead to the receiver. Typically, it would be best installed broadside to the area of the world from which reception is desired. I found a N-S orientation on the East coast to be a good compromise for Europe-Africa and Asia which also minimizes the pickup of the normally dominant Latin Americans. A minimum run of 50 feet is desirable. Several mail order electronics houses sell ready-made LW antenna kits with all parts included, if the junkbox in your cellar is lacking.

An interesting variation of the LW is the 'beverage' antenna, currently used by some BCB DX-ers who are fortunate to have the room required for a *long* length of copper wire run out in a straight line and hung on supports a few feet above ground. The 'beverage' is best at a wavelength or two. A wavelength in feet can be determined by the formula: length (ft) = 984/MHz. Thus a wavelength at 540 kHz would be 984/.54 or 1825 feet, and at 1600 kHz about 615 feet. A 1000 foot beverage antenna would drop you right in the middle of the band (near 1000 kHz), giving you a half-wave at the bottom end and about 1½ wavelengths on the top. The longer the antenna is in wavelengths, the more directional it becomes. (See illustration 2.) Thus a 1000 foot 'beverage' will exhibit more of a directional effect as you tune toward 1600 kHz, and less of a directional effect as you approach 540 kHz. In any case, the 'beverage' antenna must be installed in a straight line for the entire distance; the co-ax feedline to the receiver may be bent to enter the house. The antenna is receptive to stations off either end of the wire, not to stations broadside to it, at these lengths. Thus, the wire should be erected in such a manner that it 'points' (on the 'great circle' path) to the area of the world you want to receive. In Florida a few DX seasons ago, a DX-er ran a 'beverage' due west from his receiver for about 1200 feet or so – he enjoyed nightly reception of low-powered daytime stations in California prior to sunset in California. Medium-powered stations in Hawaii were common place, and an amazing tape was made of 50 kW 4QD on 1550 kHz in Emerald, Australia, while 50 kW CBE Windsor, Ontario, was on the air.

The 'beverage' is bi-modal, i.e., will receive signals off both ends of the antenna but, very simply, can be made uni-directional by grounding the far end of the antenna. The antenna is grounded to a copper grounding rod through a 300 to 1000 ohm (experiment to determine best value) resistor. It involves considerable antenna theory, but briefly the grounding of the far end eliminates signal pickup of stations from the back-side. For example, that DX-er in Florida had his receiver on the East end of that wire, ran the wire West, and grounded the West end. In doing so, he eliminated signal pickup from the many low-powered Cuban stations that otherwise tend to dominate the dial in southern Florida, along with any other signals coming from the East.

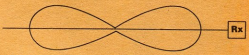
Incidentally, if you are fortunate enough to be able to erect a 'beverage' and perhaps install multiple 'beverage' antennas or a single 'beverage' and some other kind of antenna, you should take care to ground *any* antenna not in use. An adjacent antenna left underground will influence the directional aspects of the 'beverage', and vice versa. Use one antenna at a time, and ground the ones not in use through the use of 'shorting' switches. Needless to say, the appropriate precautions against lightning damage should also be taken.

Unfortunately, those living in urban or suburban communities don't have the acreage required to install a 'beverage'. An excellent antenna that takes up little space and which requires no outdoor installation is the loop antenna.

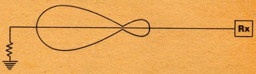
There are several variations in design, but the standard design is the box loop: 11 turns spaced $\frac{1}{2}$ inch apart on four spacers on the ends of the cross-arms, giving 4 feet on a side, are tuned by variable capacitors. A 365 uufd variable will cover almost the whole band, but it may be necessary to switch

Illustration 2

A beverage ungrounded at the far end is bi-modal.



Grounding the far end makes the beverage sensitive to signals from only one direction.



As the wavelength increases, the lobes decrease in width. A true beverage must be at least one wavelength long. See the text for details.

in additional fixed or variable capacitors in parallel to extend coverage to the bottom of the band. A single turn placed between the fifth and sixth turns feeds the receiver. (See illustration 3.)

This is the easiest loop to build and use; it is unamplified, but still can inhale the weak signals. The sophisticated version of this box loop is an amplified version having a small tuneable preamp and the ability to tilt the loop in two planes.

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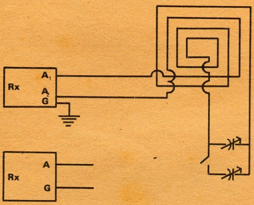
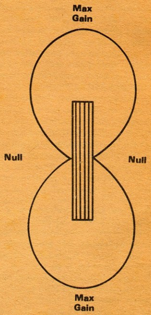
Illustration 3



The multiple turns are tuned by the variable capacitors. The single turn feeds the receiver inputs.



Top View

In either version, loops are directional and exhibit sharp nulls perpendicular to the plane of the loop. As such it is possible to peak either the desired signal or null an offending one. On the crowded frequencies it is often possible to dig out two or three stations that are normally under the dominant local. Loops are also good for direction finding, and it is possible to determine the approximate area of the world the signal is coming from.

Plans for various loops are available through the National Radio Club, Box 127, Boonton, NJ 07005, USA, or the International Radio Club of America, 12536 Arabian Way, Poway, CA 92064, USA. Costs are nominal; write to check on availability first.

A relatively new antenna has come upon the MW DX-ing market. Developed by Joseph Worcester, he calls it the 'Space Magnet'. Several variations are available. Basically, it consists of a 12 inch ferrite rod wrapped with litz wire and with a tuneable preamplifier, all of which can be rotated in one or two planes (depending upon the model selected). It's popularity stems from the fact that it equals or surpasses a bulky non-amplified air-core loop (as described above) in much less space, and it is an assembled product. Being compact, it is also a wife-pleaser. Write: Joseph A. Worcester Electronics Laboratory, RD illustration 1, Frankfort, NY 13340, USA, for a fact sheet and price list.

ACCESSORIES

There are all kinds of interesting gadgets which can be added to your listening post. Probably the most fundamental piece is a crystal calibrator of something better than the standard 100 kHz unit. One that emits markers every 10 kHz, or even every 5 kHz, would be ideal and, fortunately, with the advances in transistor and IC technology today several compact units are available in North America for less than $40.

If your receiver does not have any selectivity controls built in, a Q-multiplier circuit ought to be put together and wired into your receiver, as we discussed earlier. An alternative choice is to acquire mechanical filters and install one or two within the IF strip of your set. The latter option is more expensive, however, and one has to weigh the expense of mechanical filters versus upgrading the communications receiver.

If you operate with a random length wire as an antenna, an antenna tuner is a must. It matches the impedence of the antenna to the input of your receiver, and a good match can easily add two or three (or more) s-units in signal strength. There are numerous circuits around, including ones published within the '73 edition of HOW TO LISTEN TO THE WORLD. A good antenna tuner can help in reducing images and internal mixing spurs too.

Another useful addition is a piece of surplus equipment called a 'Q-5er'. It is a US Signal Corps BC-453 which tunes, within its range, 455 kHz. 455 kHz is a popular i.f. for many receivers and the BC-453 'inhales' (through inductive coupling – no direct connection – to the last i.f. stage) the 455 kHz signal and continues processing the signal through its own 85 kHz i.f., which, in effect, gives another conversion stage. As I indicated before, dual conversion is better than single, and triple better than dual, but I know of no generally available communications receiver having triple conversion on the MW band, and only a few have dual conversion. The Q-5er is an inexpensive way to help a less-expensive receiver perform a bit better.

Relatively new to the SWL market is the spectrum analyzer. Surplus dealers occasionally come up with a bulky vintage panadaptor, but operative ones are few and far between. Heath Company of Benton Harbour, MI 49022, USA, now markets its SB-620 'Spectrum Analyzer' as part of its amateur radio line, and the SB-620 can be wired into almost any receiver i.f. found in today's receivers. It's fascination lies in the fact that it displays as little as a 10 kHz spread or as much as a 500 kHz spread centred on the receiver's i.f. One can resolve stations as little as one-half kHz apart if the signals are of more-or-less equal strength, or one-to-three kHz if one is much stronger than the other. Openings can be 'seen' with signals displayed on the CRT before they are normally audible with the receiver bandpass being wide-open.

The super-sophisticated listening post, with unlimited budgets, may also contain a frequency counter, a signal generator, and an oscilloscope. It is most useful for Latin American DX-ing wherein many LA stations have transmitters that drift in frequency, but this gear allows measurement of any frequency desired . . . to the nearest Hz. In simplest terms, a warmed-up, thus stabilized, signal generator is inductively coupled into the front end, or antenna circuit, of the receiver. The signal generator output is set to zero-beat (i.e., minimize the oscillations on the s-meter or with an oscilloscope's vertical input tied into the receiver AVC line with the horizontal sweep adjusted to 4 Hz) with the incoming signal. Once zero-beat, the frequency of the signal generator is read on the frequency counter to an unbelievable accuracy of 1 or 2 Hz.

And finally, another useful acquisition is the tape recorder. Many DX-ers consider a tape recorder to be an absolute must . . . but this is a whole seperate story; please refer to the companion article elsewhere in this edition.

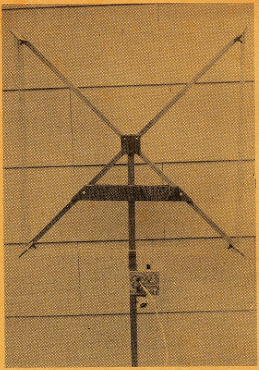
LOGS

Most DX-ers like to keep track of what stations have been heard, and this activity is called 'keeping a log'. Depending upon your particular desires to pursue DX awards and keep track a variable number of 'DX statistics', your answers to these questions will dictate the kind of log and the number of cross-references you'll want to generate.

Most MW DX-ers in NA will keep a tally on the following: stations, states, Canadian provinces, and countries, each category in number 'heard' and number 'verified'.

For award purposes, a basic log might include the following data elements:

1) date.
2) time (either Eastern local time or GMT; see the following discussion).
3) call (or slogan, or both).
4) frequency.
5) power.
6) location.
7) program notes.
8) date reception report sent and date verification received.



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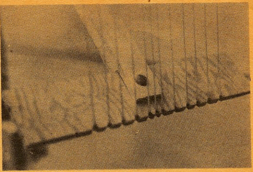

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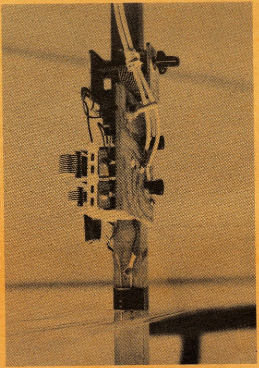

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Let me insert my own bias at this time and suggest one method of log keeping which can satisfy the above demands and yet does not entail much drudgery . . . I'd rather DX than make laborious log notes.

A basic log is maintained on 3x5 index cards, one per frequency (540, 550 . . . 1590, 1600). The 3x5 card lists the data elements 1, 3, 5, and 6 above. A 'V' is also added to each single-line entry if the station is later verified. As a particular frequency card is filled, a new card is added to the file. For example, 3 index cards summarize a total of 30 stations logged over a 13-year period on 1580 kHz. The card file log, arranged by frequency, is in the format most useful in answering the question 'have I heard this station before on this frequency?'

The cards are easy to manipulate and one can quickly tabulate the heard and verified counts referred to earlier. The detail to support the card-file log is found within two other documents: a steno pad and a spiral bound notebook.

The steno pad is used for rough note taking when DX-ing. It is the *only* writing pad used, and it contains the data for reception reports, tape recorder index readings (so I can recheck the tape in case of an unidentified station) marking the point in time of an ID to be checked, and other notes and comments. This is, by design, in chronological order and, as a steno pad fills up and is completed, it goes into my files and a new one is started. The purpose of this method? I don't have miscellaneous notes on scraps of paper scattered around the 'shack' which can be lost or otherwise disposed of.

A spiral bound notebook is kept, also in chronological order, wherein resides my 'finished' reports in the format used to report loggings to SWL club bulletins. The 'edited' reports in the spiral bound

1) A common box loop antenna without any preamplification.

2) The spacer at the end of one of the box loop's arms; note the pickup turn in between turns 5 and 6 of the 11 turns at $\frac{1}{4}$-inch spacing.

3) On the box loop's upright support, both the ends of the 11 turns and the ends of the single pickup turn are pulled through drilled holes and secured (with tape). The 11 turns are tuned by two capacitors in parallel, and the single turn feeds the coax to the receiver input.

notebook are usually sufficient for any necessary research – such as time of day – and the steno pad's notes serve as backup. The 'finished' reports are entered in the spiral bound notebook during free time; completed notebooks are also filed as they are filled.

Whatever system you develop to keep track of the stations you hear, the 'measuring stick' of a 'good' system is how well it works for you. If someone asks you a question about a logging that you've reported, can you satisfactorily find the answer in a time frame suitable to you? If you are a 'bug' on statistics, is the information easily compilable? I can't answer those questions but, with experience, you can. The methodology suggested above is just one way of 'doing it' . . . but may not be the best way for you.

Let's go back and talk about the time logging for a moment. Convention has it that domestic logs, i.e., US and Canadian stations, are kept in Eastern local time. Two of the largest clubs use ELT to commonly define schedules for sign-on and sign-off times and for frequency checks (which we'll discuss later). Operating schedules and frequency check schedules do not normally change in clock terms from 'Standard' to 'Daylight' and back. A station that operates from 6 a.m. to 12 midnight daily will continue to do so whether it be on EST or EDT. To define schedules in EST or, possibly in Greenwich Mean Time (GMT), only would cause a horrendous conversion problem twice a year.

Foreign loggings are noted in GMT. All the warnings and procedures for the SW DX-er are equally applicable to the MW DX-er when reporting foreign stations in GMT. The switch from 'Standard' to 'Daylight' is not particularly bothersome here, and the MW DX-er has the advantage of having operating schedules in the *World Radio/TV Handbook* expressed in GMT. Accordingly, errors in time conversion are minimized. Research in DX literature is also simplified, with only the end product needing adjustment to one's local time.

Of course, readers outside the North American continent are going to have a different problem on their hands. Never having had the opportunity to DX from outside this area of the world, I would suspect that maintenance of logs in GMT for *all* catches would be the simplest way to go. A conversion chart for the several US time zones would probably be quite useful for those fortunate enough to be able to DX the NA continent.

PUBLICATIONS

Essential ingredients to the 'complete' listening post are certain commercial and DX-club publications that provide up-to-date information on stations. Quite often only a partial identification is heard, or the pronunciation of the town's name is difficult to understand. A replay of the tape may not clear it up. How does one complete the missing information?

The *World Radio-TV Handbook* does not have to have too much said about its format or contents, but I can only emphasize this one is a 'must' for the foreign DX-er.

The WRTH foreign listings are excellent, but have some shortcomings on domestic stations in that it doesn't list the lower-powered stations. North America-based DX-ers need something with more detail. There are several sources available.

'White's Radio Log' is now owned by Davis Publications, Inc., 229 Park Avenue South, New York, NY 10008, USA. The 'Log' appears in Davis' *Communications World,* a magazine published twice a year. It is a 3-way listing (frequency, call and location) of moderate accuracy. News-stand price in 1975 was $1.35 US, but the magazine can also be bought through the mails.

Howard W. Sams Publications of Indianapolis, Indiana, publishes the 'Vane A. Jones Log' on an irregular basis. This too is a 3-way listing, and sells for about $5. Virtually any electronics supplies house who sells Sams publications can get this one for you.

Perhaps the best MW log around is the *National Radio Club Domestic Log*. By frequency, it includes addresses, operating schedules, network affiliations, and other data not found in those items mentioned above. Publication frequency and availability is not predictable (all volunteer work); write the National Radio Club, Box 127, Boonton, NJ 07005, USA, to check on price and availability. The last edition was issued in 1975 for a price of $8 US.

For the foreign DX-er, the International Radio Club of America publishes its 'Foreign Log', a compilation of all DX reported in the prior DX season to the IRCA bulletin. It is arranged by frequency and sorted out into Europe-Africa, Latin America, and Asia-Oceania groupings. Again, write for price and availability, to IRCA, 12536 Arabian Way, Poway, CA 92064, USA. The WRTH is a necessary companion piece to this effort which gives the reader an excellent idea of what has been heard where at what times with certain kinds of programming.

THE ART OF DX-ING

What to listen to? To DX the BCB it is best to know something of its organization.

Domestic stations are divided into four major classes. Class I stations operate on 'clear' channels with 10 to 50 kW, with only one (I-A) or two (I-B) stations on the frequency at night in North America (a treaty makes this possible). This permits sky-wave service without interference into remote areas at night.

Class II are secondary stations on clear channels, with powers of 0.25 kW to 50 kW, serving a population centre and an adjacent suburban area. Schedules and antenna patterns are arranged so as not to interfere with Class I stations – which usually means daytime operations.

Class III stations are similar to class II stations in service, but utilize 'regional' frequencies and powers of 0.5 to 5 kW, both daytime and unlimited operations. There are 41 regional channels and more than 2000 Class III stations.

Class IV stations operate on 'local' channels with maximum powers of 1 kW day and 0.25 kW night. There are more than 150 stations on each of the six local channels.

The domestic channels are on 10 kHz spacing, from 540 to 1600 kHz inclusive. Excepting Europe, the Near East, and Africa, the remainder of the world utilizes 10 kHz spacing as well. European, Near Eastern and African stations utilize 9 kHz spacing one they hit 539 kHz . . . 520, 529, 539, 548, 557, 566 kHz, etc. As you can see, many of these assignments fall inbetween the 10 kHz spacing of the domestics, and it is possible to tune the trans-Atlantic (TA) signals nightly. Monday mornings, US time, is a good time to DX foreign stations if one has only a moderately selective receiver. For instance, Droitwich, England, on 1088 kHz is easy after WBAL-1090 Baltimore goes off the air at 1 a.m. on Mondays. Otherwise, DX the TA stations beginning at sunset here through dawn in Europe. During the winter months, the best time for TA DX-ing, stations in eastern Europe will begin disappearing around Midnight EST and the western European stations will go out by 2 a.m. or so. Excepting the 24-hour TAs, you'll hear sign-offs at sunset here, and sign-ons in the wee hours of the morning. (See table II.)

The only other group of stations you'll find that are not on even 10 kHz assignments are a few Latin Americans and a small handful of trans-Pacific (TP) stations. In the case of the LA stations, some purposely place their carrier frequency in between the 10 kHz assignments, and others appear by accident or lack of knowledge pertaining to transmitter maintenance. In any case, these are called 'splits' because they 'split' the even-10 kHz assignments in the Western hemisphere. (See tables III and IV.)

Perhaps the most widely-heard 'split' is 4VEF, 10 kW on 1035 kHz, in Cap Haitien, Haiti, with English and French religious programmes. 4VEF is part of a 2 medium-wave, 5 shortwave transmitter array for Radio 4VEH. (See table IV.)

The Cuban stations are notorious for drifting off frequency by 100 or 200 kHz. The Czech-built transmitters are apparently difficult to maintain, and you can hear such examples of drift by heterodynes on 720, 1020, 1060, 1210 and 1270 kHz. A loop is ideal for nulling the Cuban interference.

The beginner DX-er is liable to say, 'Who, me? Hear those TA and TP stations? Never!' Let's look at some domestic DX tips:

1) Monday mornings will find many of the high-powered clear channel stations off the air for varying lengths of time, usually servicing equipment. For example, WSM-650 Nashville is off, leaving the frequency open for KORL-650 in Honolulu. Many class II and III stations do their equipment testing on Monday mornings and provide good DX-ing opportunities. A class II station on a clear channel might make it from coast to coast while testing, if the class I is off. Tones and continuous lengths of music without announcements typify a station testing; identifications are usually infrequent, so be patient. You may turn up a rare catch.

2) The fall, winter, and early spring months are usually the best times for listening. Atmospheric static is a limiting factor in the summer, though it is possible to find a handful of days when conditions are quiet and some excellent domestic and foreign DX can be heard. Too, propagation conditions are better during the winter months – with the longer nights – and a useful clue to solar conditions is broadcast by WWV at 18 minutes past the hour and WWVH at 45 minutes past. These standard time-frequency stations transmit on 2.5, 5.0, 10.0, 15.0, 20.0 and 25.0 MHz; at the time specified a propagation report and forecast is given. The auroral index (A-index) is the second item announced; the count can range from zero to forty or more. Typically, the count ranges from six to fifteen but several days of low (0 to 4) A-indices were a clue to excellent TP conditions in the fall of 1971 (10 kW VSZ-1 Tarawa in the Gilbert & Ellice Islands made it into New Jersey and New York during that time), as well as good conditions into

> Many class II and III stations do their equipment testing on Monday mornings and provide good DX-ing opportunities.

Europe and Africa. It 'appears' that the Latin American signals get stronger whereas they are actually just less subject to skywave signals that normally arrive from the East and West. The combination of low atmospheric noise and low A-indices for a period of several days to a week or two should mean good DX-ing conditions to points that are trans-continental or trans-oceanic.

3) A good time to DX the domestics is at sunrise and sunset. On the regional and local channels there are many stations, operating on daytime only, signing on at local sunrise and signing off at local sunset. Stations to the east of the listener can most easily be heard at sunrise, and stations to the west are best heard at sunset.

On the East coast, for example, most stations are to the West. Following 1580 here, for example, local stations in Pennsylvania and Maryland first go off the air, and then every 15 minutes more signoffs are heard from stations in Ohio, Kentucky, Tennessee until an hour or so later when the last are heard from Illinois and Iowa – by this time the Canadian usually dominates the frequency.

Sunrise DX-ing even for East coast listeners can be profitable too, if the right frequency is chosen. For example, WQXR-1560 New York does not sign on until 7 a.m. local time on Sunday mornings. In the space of one hour, from 6 a.m. to 7 a.m., one morning in April 1972, the writer taped signons from no less than seven stations in six states, one each from Kentucky, North Carolina, Ohio, Tennessee, and West Virginia and two from Indiana.

West coast DX-ers can use signons to best advantage. In the wee hours of the morning West coast time, the channels are open to the East. As the sun rises on the East coast stations will begin to sign on. Every fifteen minutes a new group can be heard, and then will fade out as sunlight hits the transmitter sites . . . continuing to open the frequency as dawn moves across the country. On certain clear channels having class I stations located in the East, the class I stations will fade with sunrise at their locations, opening the clear for easy pickings of any class II stations that are located to the West of the class I and signing on when dawn comes to their location. Clear channel 1050kHz, with WHN in New York and CHUM Toronto would be a good example; there are over 50 daytime stations to pick over on this frequency.

Incidentally, it is extremely helpful to have a tape recorder running while DX-ing either sunrise or sunset skip. Quite frequently you will have as many as six signing on or off at the same time; a replay of the tape and careful examination of what might normally be written off as an impossible jumble of interference may yield several good identifications. Replaying of the tape through audio filters, cutting highs and lows to pass a narrow band of audio frequencies, often does wonders in improving intelligibility. Don't have an audio filter? Play it back through your hi-fi or stereo system; adjusting controls accordingly, and use earphones to listen to the tape to cut extraneous noise.

4) Frequency checks are an excellent way to add many low-powered, rare, stations to the log. A frequency check is a regularly scheduled test broadcast during the experimental period of Midnight to 6 a.m. local time. Most tests are run for 15 minutes and consist of test tone, usually 1000 Hz, with one or two IDs. Recent changes in the FCC rules and regulations will mandate monthly checks on the accuracy of the transmitter frequency. Various companies have the appropriate measuring equipment to spot the transmitter frequency to the nearest Hertz. The International Radio Club of America and the National Radio Club publish, annually, a list of the frequency checks run during the experimental period; several monitoring companies cooperate with the clubs, and IRCA and NRC members also report frequency checks heard. Most checks are run on a particular day of the month. Examples of some regular frequency checks which enable the MW DX-er to hear some rare states are, on the first Monday of each month, ones from KUPK-1050 (5 kW) Garden City, Kansas, at 0215-0230 ELT and, a few minutes later, KGHL-790 (5 kW) Billings, Montana, at 0245-0300 ELT. Both run test tone (TT). Frequency checks on 'graveyard' frequencies can also enjoy wide coverage. One such regular is WFOY-1240 (1 kW) St. Augustine, Florida, on the third Friday of each month at 0010-0025 ELT, also with TT.

A good time to DX the domestics is at sunrise and sunset.

Frequency checks are different from equipment tests, as the former are usually on a regular, repeating schedule from month to month. Although some run music, most frequency checks run a constant tone. Equipment tests (ETs) are usually longer than 15 minutes, run a variety of tones (from 20 Hz to 10,000 Hz) and music. Announcements can be very frequent, and sometimes an ET can almost sound like 'regular schedule' less commercials.

CLUBS

Half the fun of DX-ing is sharing your catches and information with other DX-ers. To that end, there are several large listeners' clubs in North America that deal with MW-DX-ing. The medium of information exchange is a bulletin distributed among the membership, and each club below also has an annual picnic or convention.

The *International Radio Club of America,* 12536 Arabian Way, Poway, CA 92064, USA, publishes an offset bulletin of $8\frac{1}{2}$x11 inches some 34 times a year, and weekly during the DX season. There are columns on domestic DX catches, members' comments, and international DX loggings, as well as a few technical articles.

The *National Radio Club,* Box 127, Boonton, NJ 07005, USA, publishes a bulletin 34 times a year and also weekly during the DX season excepting skips around Thanksgiving and Christmas. This bulletin is also offset which accommodates a multitude of technical articles. The domestic DX column, a members' 'musings' column, and an international DX column are also present. The oldest MW-only club going, it was founded in 1933 and now has some 600 members.

Some DX-ers believe IRCA and NRC coverage are duplicatory, but this is not so. It is confirmed to by some 400 individuals who belong to both clubs.

A third club is the all-band-coverage *Newark News Radio Club,* Box 539, Newark, NJ 07001, USA. This is the oldest club in existence, having started as a MW club in 1927, but now it is an all-band effort of monthly bulletins of some 60 pages each. Additional coverage is provided for SW broadcast, utility, amateur, FM, TV, card and tape swapping.

Postage costs and publishing materials and supplies dictate membership fees, as all clubs are strictly volunteer efforts. Write for information on membership rates.

All clubs enjoy a membership of over 500 apiece, and all three have Courtesy Programme Committees (CPCs). These CPCs arrange 'DX tests' from hard-to-log stations all over NA. In the case of day-timers, the cooperating station usually modifies his equipment test or extends his frequency check to include additional identifications as the day-timer is not allowed to operate at night for purposes of a dedicated programme to a club or other audience. The stations allowed to operate 'unlimited' hours will occasionally go all-out in putting on a special programme with fancy identifications, special music, and on-the-air phone calls. Both will, occasionally, include code identifications which penetrate interference very well . . . and is the only item heard. In many tests now, a phone number is made known (either on the air or through the bulletins) and the DX-ers are invited to call the station (not collect!) and the station gets an instant feedback of its coverage. The CPCs usually arrange such programmes or tests during the winter months, when conditions are quiet, and for Monday mornings if at all possible. They are usually scheduled well in advance of the broadcast date so that the clubs can notify their respective memberships that such a test or programme is forthcoming. The CPCs have arranged between 50 and 100 tests for each of the past three DX seasons.

GENERAL

There are a few items that have not been discussed heretofore, and let's talk about them briefly.

One of the most useful pieces of equipment in a MW DX-er's shack is a tape recorder. Missed IDs can be replayed, and 'de-bugging' of multiple signals containing sign-on or sign-off announcements can be repeated as many times as is necessary to decipher the contents thereof. Furthermore, it is often enjoyable to build up a tape file containing all or part of your DX catches. The writer just keeps a tape of the better loggings, and to me I enjoy those tapes just as much as a written verification.

Speaking of written verifications all the rules that SW DX-ers follow in assembling a complete report still hold true for MW DX-reports. Two points, however: first, attempt to put the report's time into that of the station's local time zone if reporting to a domestic station (otherwise use GMT), and second, be sure to enclose return postage. The stations don't have the large budgets of the international shortwave broadcasters. Request, don't demand, the verification; after all, it is a courtesy on the part of the chief engineer, the usual respondent, in taking his time and a secretary's time to write or otherwise prepare a verification in reply.

MW DX-ing is, indeed, a fascinating hobby. In many ways it can be more interesting than DX-ing the SW bands and I have noticed, in the years I've been listening, that quite a few of the newer SW

DX-ers convert to the lower MW band. Unfortunately, the congestion on the MW band often discourages beginners who attempt to use less-than-quality equipment. This article has attempted to discuss some of the problems in MW DX-ing, and hopefully the reader shall be able to bypass the usual pitfalls. Now, it's your turn . . .

Table I
Frequency Allocation in North America

'Clear' channels: 540, 640-780, 800-900, 940, 990-1140, 1160-1220, and 1500-1580 kHz.
'Regional' channels: 550-630, 790, 910-930, 950-980, 1150, 1250-1330, 1350-1390, 1410-1440, 1460-1480, 1590, and 1600 kHz.
'Local' channels: 1230, 1240, 1340, 1400, 1450, and 1490 kHz.

A examination of the WRTH or any other BCB listing for the USA, Canada, and Mexico will disclose the dominant station on each 'clear' allocation.

Table I-A
Best Bets for the Fifty States

Note: Use a WRTH or an NRC log for specific station information. In the list below, the abbreviations used are:
FC = frequency check
MM = Monday morning
Times are in Eastern local time.

Alabama:	WAAY-1550
Alaska:	KFQD-750/KFAR-660
Arizona:	KTUF-1580
Arkansas:	KAAY-1050
California:	KFI-640
Colorado:	KOA-850
Connecticut:	WTIC-1080
Delaware:	WDOV-1410/WDEL-1150
Georgia:	WSB-750
Hawaii:	KORL-650
Idaho:	KGEM-1140/KBOI-670
Illinois:	WLS-890
Indiana:	WOWO-1190
Iowa:	WHO-1040
Kansas:	KUPK-1050 (FC 1st MM 0215-0230)
Kentucky:	WHAS-840
Louisiana:	WWL-870
Maine:	WABI-910/WCSH-970
Maryland:	WBAL-1090
Massachusetts:	WBZ-1030
Michigan:	WJR-760
Minnesota:	WCCO-830
Mississippi:	WOKJ-1550
Missouri:	KMOX-1120
Montana:	KGHL-790 (FC 1st MM 0245-0300)
Nebraska:	KFAB-1110/KRVN-880
Nevada:	KLUC-1140 (FC 3rd MM 0315-0330)/KCRL-780
New Hampshire:	WFEA-1370
New Jersey:	WPTA-930
New Mexico:	KOB-770
New York:	WABC-770
North Carolina:	WBT-1110
North Dakota:	KFYR-550
Ohio:	WLW-700
Oklahoma:	KOMA-1520
Oregon:	KEX-1190/KPNW-1120
Pennsylvania:	KDKA-1020
Rhode Island:	WPRO-630
South Carolina:	WBSC-1550
South Dakota:	WNAX-570
Tennessee:	WSM-650
Texas:	WOAI-1200
Utah:	KSL-1160
Vermont:	WHWB-1000
Virginia:	WRVA-1140
Washington:	KGA-1510/KING-1090
West Virginia:	WWVA-1170
Wisconsin:	WKOW-1070
Wyoming:	KNIE-1530
District of Columbia:	WTOP-1500

Table II
Trans-Atlantic Stations Easily Heard

This represents some of the more common TAs heard in North America. It is *not* an all-inclusive list.

Freq	*Call*	*kW*	*Location*
*665		135	Lisbon, Portugal
683	RNE	250	Sevilla, Spain
737	RNE	125/250	Barcelona, Spain
		1200	Tel Aviv, Israel
755		135	Lisbon, Portugal
*746		200	Dakar, Senegal
782	CSB9	100	Miramar, Portugal
818		900	La Vieja, Andorra
		450	Batra, Egypt
836	ORTF	150	Nancy, France
*845	RAI	540	Rome, Italy
863	ORTF	300	Paris, France
*1034	CSB2	120	Lisbon, Portugal
1088	BBC	500	Crowborough, England
1196	VOA	300	Munich, West Germany
*1205	ORTF	300	Bordeaux, France
*1214	BBC	60	Washford, England
1295	BBC	600	Crowborough, England
1385	ECS11	20	Madrid, Spain
1394		500	Shkodra, Albania
1457		500	Durres, Albania (R. Peking relay)
1466	3AM2	400	Monte Carlo, Monaco
1538	DLF	700	Mainflingen, West Germany
1554	ORTF	300	Nice, France
1578	CSB5	10	Porto, Portugal
1586	WDR	800	Langenberg, West Germany
1602	BR	370	Munich, West Germany

*best bets for reception on the West coast of North America.

Table III
Trans-Pacific Stations Easily Heard

The great circle path through the auroral zone from Asia to most of North America, especially the Eastern half, and the fact that most assignments are on the even 10-kHz spots, limits the possibilities of TP reception. The following is *not* an all-inclusive list.

Freq	*Call*	*kW*	*Location*
*650	KORL	10	Honolulu, Hawaii
655			Pyongyang, North Korea
725			Kimchaek, North Korea
770	JOUB		Akita, Japan
830	JOBB	300	Osaka, Japan
835			Nanchang, China
*844	VSZ1	10	Tarawa, Gilbert & Ellice Islands
877			Wonsan, North Korea
1040		1500	Shanghai, China
1178	VOA	1000	Okinawa
1529			Asiatic RSFSR (location unknown)

*best bets for reception on the East coast of North America.

Table IV

Latin American 'Splits' Frequently Heard

Although there are many LAs operating inbetween the even-10 kHz assignments that are drifting in frequency due to engineering difficulties, below is a partial list of ones that seem to be more-or-less permanent and consistently heard on the frequency specified.

Freq	*Call*	*Power (kW)*	*Location*	*Slogan*
555	ZIZ	5	Basseterre, St. Kitts	
575	TIWA	5	San Jose, Costa Rica	Cadena Musical
655	YSS	10	San Salvador, El Salvador	R. Nacional de El Salvador
675	YNDS	10	Managua, Nicaragua	R. Nueva Union
725	PZX26	50	Paramaribo, Surinam	
	TILX	3	San Jose, Costa Rica	R. Colombia
834	BHBS	20	Belize	R. Belize
855	PJC2	5	Curacao, Notherlands Antilles	R. Curom
965	YNLU	20	Managua, Nicaragua	R. Managua
1015	YSC	10	San Salvador, El Salvador	R. International
1035	4VEF	10	Cap Haitien, Haiti	
1115	YNP	10	Leon, Nicaragua	R. Circuito
1155	YSCF	1	San Miquel, El Salvador	Ondas Orientales
1265		50	Basseterre, St. Kitts	R. Paradise
1435	PJA5	1	Oranjestad, Aruba	R. Kelkboom