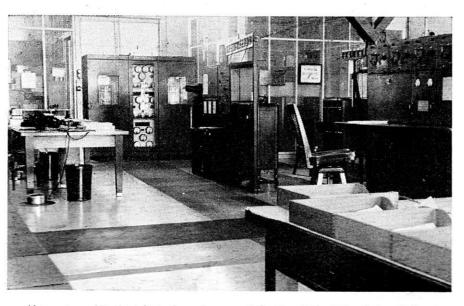


Situated on a plain, near the geographical center of the U.S. is the world's biggest monitoring station, maintained by our Government.

GRAND ISLAND -Where Pink Slips Are Born

by STANLEY JOHNSON, W9LBV Grand Island, Nebraska

Often have we wondered what sort of place the birthplace of the infamous "Pink Slip" was. The author describes this most interesting receiving station where DX is very commonplace.



Nary a transmitter in sight in the main room of the Grand Island Monitoring Station.

VERY good radio operator, whether he is a "ham," a broadcast engineer, or a seagoing "sparks," has heard of Grand Island, Nebraska. Most "bad" radio operators have heard from it, since the government monitoring station, which polices the radio lanes of the world, is located a few miles west of this midwestern city. The station houses radio's equivalent of the "G-men."

However, unlike the "G-men," radio inspectors seldom deal with cases which are clearly of a criminal nature. Most violations of radio regulations are the result of maladjustment of equipment or errors in operating technic. For this reason, the usual penalty is a simple statement of the nature of the offense and a notice to explain how it happened. The revocation of a license, which may, of course, spell financial ruin for a broadcasting station or deprive an operator of his means of earning a living, is regarded as a severe penalty. Fines and imprisonment are rare and their occasional imposition only serves to re-

mind those who have the urge to violate radio laws that the laws have teeth in them.

There are several monitoring stations in the United States but the largest in this country, or for that matter the world, is that located at Grand Island, Nebraska. The stations are maintained by the Federal Communications Commission.

Tourists from other states who visit the Grand Island station are first of all impressed with the plains country in which it is located. The land is extremely flat, with only occasional clumps of trees. The buildings for the station stand alone on a bare square mile of land, with but two farmhouses closer than half a mile. Airway warning lights, on top of the antenna masts of the station, are visible from the transcontinental Lincoln Highway (No. 30) three miles south. There are not even power lines to break the bareness of the scene, all of the wires being brought in underground.

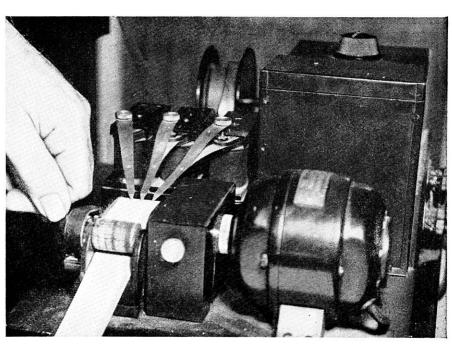
The "wide open" location of the station helps to make the spot a paradise for radio reception. Since the antennas are higher than any nearby objects and there are no hills to interfere, weak signals are picked up with a minimum of loss. Too, since the land is so flat, the station's directive antennas can extend in perfectly straight lines and are extremely effective—signals from all over the world pounding in with "local" strength. "Ham" visitors usually mutter something about "What a spot for rhombics—a couple of rhombics." The chief requirement for the popular rhombic antenna is a backyard the size of a farm.

The location of the station has some important geographical advantages, too. Grand Island is very near the exact center of the United States, less than seventy-five miles from the spot in northern Kansas to which map makers have given that distinc-Thus radio stations on either coast can be picked up with approximately the same signal strength and with a minimum of interference from each other. Another feature of the location is its freedom from mearby broadcasting stations which might block the signals from weak, distant trans-The nearest broadcasting station is KMMJ in Clay Center, Nebraska, a distance of approximately 30 miles, airline. The 20,000 watt KFAB, Lincoln, is the closest high power station and it is almost 100 miles away.

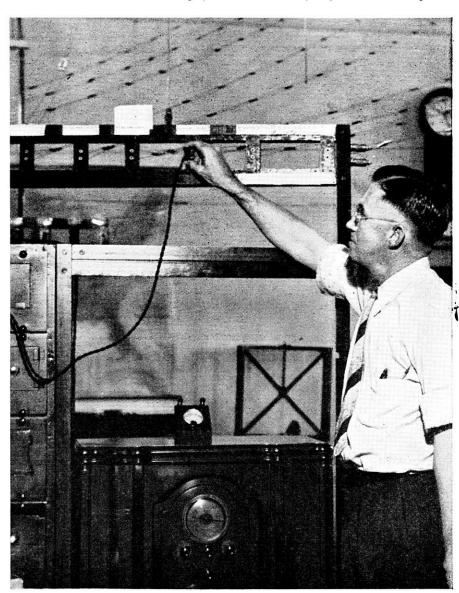
Grand Island, a city of twenty thousand, stands in the heart of a rich farm trading area—making it an ideal spot for a broadasting station—but when the monitoring station was proposed, city officials promised that no commercial transmitters would be rected in the city. So far, this promise has been kept. The only stations on the air in the Grand Island area are half a dozen mateur "rigs," an eight meter police transmiter, and a low power airway beam station located a few miles north of the city.

The monitoring station has no transmiting equipment. All of the necessary apartus is housed in two brick buildings and no grounds landscaped with thick and low bushes—but no trees of any Receiving equipment is in the larger two buildings.

On one side of the entrance hallway is the office of Benjamin Wolf, inspector in the station. Two secretaries as-



An intricate time clock recording system is used for frequency standard checking.



Antennae run in all directions. Clips are used to select the correct receiving pair.

Poem Y. C. C. 79	FEDERAL C	COMMUNICATIONS COMMISS	Station Call
Monitoring		FREQUENCY MEASUREMENT	
			Date
TIME (E. 8. T.)	FREQUENCY (ke) Amigned Measured	DEVIATION (cycles) High Low	REMARKS
SA II	To:		
of this no	tice, a reply to the Fe thereof to the above	deral Communications Com office. This rule sup and Regulations. • See rever	within three days of receipt mission, Washington, D. C., ersedes Rules 24-26 of the sc side for additional instructions.
H-5011			spector Making Measurement.
	3.00		
To	DIS	COMMUNICATIONS COMMISS SCREPANCY REPORT	Date mailed
Odenstering the To	DIS	(Class of station)	Date mailed
Sir: An i the above lations of erning coupt to D. C	nepection and/or observed date indicates that the Commission have no are directed to comply from the complete and Procedure, a reply file notice, a reply and a copy thereof to the Andio Commission's Rull	vation of the transmission of law, to the compiled with in the compiled with the	Date mailed
Members to Te Sir: An i the above lations o	nepection and/or observed date indicates that the Commission have no are directed to compilarity the Commission have no are directed to compilarity that the notice, a reply and a copy thereof to the Addio Commission's Rul	vation of the transmissise requirements of law, to the been complied with in	Date mailed. Date mailed. One of your station made or resty, or the rules and regular the following particulars: e rules of the Commission go subscitcemantage or s

Above, the green frequency measurement slip sometimes sent to hams. Below, the famous "pink slip" which hams usually receive.

sist him with administrative details, which include issuing "pink slips." Across the hall is a well equipped kitchen, the scene of many a "snack" during the long watches. The kitchen also enables the operators to double in brass as cooks and live at the station when blizzards block the roads. Living quarters are provided on the second floor of the building.

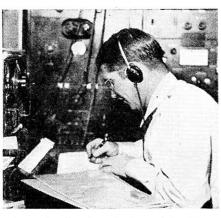
The hallway leads to a large room in which all of the monitoring is done. Here the visitor is faced with a maze of receiving and frequency measuring equipment which only the dyed-in-the-wool radio fan can fully appreciate. Arranged in rows of racks, sitting on the floor with aisles between them, are almost every conceivable type of receiver. There is a small detector for picking up signals as high in frequency as 300 megacycles; there are large long wave receivers with direction loops, communications type short wave receivers, chattering receivers inking field strength charts, frequency meters in long racks, and overhead, dozens of transposed antenna leadins terminating in jacks above the receiver panels. At the north end of the room are two large booths, completely enclosed by copper screen shield. In one of these is the multi-range multivibrator, in the other the complex radio clocks which measure radio frequencies by comparing them with time signals. Between the two booths stands the rack of the primary frequency standard.

This primary frequency standard is perhaps the most unusual technical feature of the station. It is, in brief, an oscillator maintaining a definite and known frequency which is used as a standard for frequency measurement. There are two of these primary oscillators, both on the same frequency which can be used alone, in case of

breakdown. Extraordinary precautions are taken to hold them on one frequency. The oscillators use low drift crystals mounted in temperature ovens to keep the temperature constant. To avoid vibration, they are suspended from long springs. Then, as a final precaution, each oscillator is mounted in a glass bell jar from which the air is exhausted by an electric pump which starts automatically when the air pressure changes.

Checking the frequency of these oscillators is quite a problem for the simple reason that there are few standards in the world of equal, let alone greater accuracy. For this reason, the oscillators are checked by a complicated process involving time signals. A string of frequency dividers splits up the 100 kilocycle fundamental into fifty cycles. This fifty

Even barbwire is insulated against QRM.



Inspector Scanlon checks a frequency.

cycle current is used to run a synchronous clock in somewhat the same fashion as the sixty cycle current from 110 volt lines turns electric clocks in our homes.

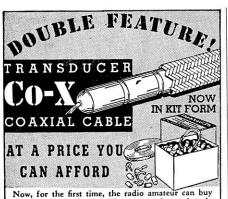
The time signals from each of the two clocks-each of the primary frequency oscillators has its own clock-are fed to a stylus arm of a tape recorder. The operator tunes in the time signals from NAA (time signals are often broadcast over radio stations as "tone beats" to indicate time) and feeds it to the center of the three stylus arms, the signals from the oscillators' clocks actuating the stylus arms on either side. The three arms make impressions on the tape and record seconds as visible changes in the lines, a "hump" in a line showing a second. By measuring with a centimeter rule the length of the seconds made on the tape by the oscillator clocks and comparing this with the seconds made on the tape by the NAA time signals (which are of extreme accuracy), the operator can, with a simple mathematical formula, determine the error, if any, in the frequency of the primary standard.

The primary standard serves as a basis for most frequency measurement at the station. First of all, however, the signal must be picked up. One feature of the monitoring station which is often a surprise to radio minded visitors, who expect "super" receivers, is that the short wave sets are standard communication types of the sort available from any large radio dealer. The ability of the station to pick up DX results more from the antenna system than from the sensitivity of the receivers. The operator can select an antenna for any given direction which will greatly increase the strength of the signal to be received and will usually reduce interference from other stations. For example, if it is desired to monitor a station in Oregon which is on the same frequency as a station in Oklahoma, by selecting an antenna which is directional toward Oregon the desired signal can be built up and the interfering signal almost eliminated.

Most of the frequency measurements are made in the primary measuring rack, which like the clocks is inclosed in a booth shielded with screen. The rack contains several different types of oscillators, including four multivibrators, the latter furnishing a useful signal every ten kilocycles to as high a frequency as 30 megacycles. The multivibrators are controlled by the primary standard so the ten kilocycle harmonics are very accurate, giving the operator "marker" signals to shoot at.

To describe "how" a signal is measured for frequency, it is best to consider first the procedure by which amateur stations are measured because the process is not quite so involved as that used for checking broadcast band stations. The initial step is tuning in the signal on one of the receivers. Then the heterodyne frequency meter in the measuring rack is set to zero beat with the received signal and the dial setting noted. The multivibrator is switched on and the operator notices the frequency meter dial readings for the ten kilocycle multivibrator harmonics above and below the signal to be measured. The frequency of each of these multivibrator harmonics is known and can quickly be ascertained by

(Monitor further on page 66)



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Grand Island-Where Pink Slips Are Born

(Continued from page 12)

consulting calibration charts. Thus the operator knows that the signal has a frequency within a given ten kilocycles, for example, 14200 and 14210. Given the three dial readings on the frequency meter—the two multivibrator harmonics and the one for the signal—the operator, by a simple mathematical process, "interpolates" and determines the frequency. A long slide rule bolted to the desk makes the calculation easy.

This method of frequency measurement is accurate to one part in fifty thousand, more than enough for checking amateur stations and most other short wave stations. However, for even greater accuracy in the case of signals which fall on harmonics of ten kilocycles, as do stations in the broadcast band, a beat note is obtained between the signal and a harmonic of the multivibrator. Then, with an audio oscillator, the operator counts the frequency of the beat note and adds or subtracts this from that of the multivibrator harmonic, the frequency of which is known.

Frequency measurement by this method has an accuracy of one part in a million. If a civil engineer could lay out a highway with equal accuracy, the error in a road long enough to reach around the world at the equator would be less than half of a small city block.

Once the frequency of a station is determined, the signal which it broadcasts, particularly if a radiophone, undergoes an examination by the cathode ray oscillograph, the X-ray of radio. Most radio fans are familiar with the oscillograph, which changes a radio signal into a visible pattern which glows on the flat end surface or "screen" of the cathode ray tube. The modulation of amateur phone stations is checked by comparing the image on the oscillograph with a chart made up of photographs showing the type of image for each ten degrees of modulation. For example, if a signal produces an image which looks the most like that for ninety per cent modulation, the station is rated at that percentage.

If the station which has been monitored is guilty of off frequency transmissions or of some other violation, perhaps overmodulation, the radio inspector who does the monitoring fills out two "pink slips," one of them going to the violator and the other to the F.C.C. offices in Washington. The wording of these slips is enough to make anyone sit up and take notice. The sixth in a list of instructions for radio amateur reads, "The importance and necessity of operating your transmitter in strict compliance with the rules and regulations cannot be too strongly emphasized. You are directed, therefore, to state why the Commission should not take action to suspend your operator's license and revoke your station license."

The Grand Island monitoring station spends approximately ten per cent of its operating hours in checking amateur stations. This percentage does not hold true for individual days, however. As one of

the radio inspectors described it to the writer, "The ham catches it when there isn't anything else to do." The inspector said this with considerable good humor, having once been an amateur himself and knowing something of the trials of ham radio. When there are special transmissions from broadcast band and commercial stations to be monitored, the amateur bands receive little attention. At the present time, more amateurs run afoul the regulations concerning the type of signals than are guilty of off frequency operation, the more common complaint a few years ago.

One question which radio amateurs frequently ask the "hams" who are on the air in Grand Island is, "You live so close to the monitoring station, do you ever have any trouble?" The answer is that the amateurs in the city have always been careful in using their equipment, frequently checking each other. To the writer's knowledge, there has been only one case of a member of the "G.I. gang" tangling with the regulations and that was under circumstances which made it something of a joke on both the monitoring station and the offending "ham."

The case in question would not happen now, since the routine of sending "pink slips" has been changed. At that time, four or five years ago, the monitoring station simply recorded the call letters of the station in error, not determining its location, and mailed a notice of the violation to the Washington offices, which issued the discrepancy report.

The amateur who was the victim of circumstances lived in the country, a little more than a mile from the monitoring station—in fact, the buildings can be seen from his home. He went on the air with a low power transmitter, monitoring it frequently to keep it in the band. Nevertheless, one day he opened the mail box to find it fairly stuffed with heavy brown envelopes postmarked "Washington."

The blanks showed that while the fundamental frequency of his transmitter was in the band, he had been picked up on *six* harmonics not falling in amateur bands and to make matters worse one of the harmonics, the third, was reported as being an illegal type A-2 transmission!

Of course, the matter was straightened out eventually—since the amateur transmitter was so close, reception at the monitoring station on a number of harmonics was unavoidable. But the amateur operator spent several days filling out affidavit after affidavit explaining why it really was not his fault at all!

So that's Grand Island. If any of the ham readers should ever get a "pink slip" they will have some idea of what means were used to check their frequency and discrepancies. Above all, however, the inspectors are more than fair in all their dealings with the radioists, and they have one thing—understanding of the problems involved.

-30-