

- (13) One canvas tool roll containing:
- (a) Five double-ended wrenches ranging from $\frac{5}{16}$ " to $1\frac{9}{32}$ " by thirty-seconds of an inch.
 - (b) One double-ended adjustable end wrench, jaws similar to those on a 4" and 6" wrench.
 - (c) One flexible shaft screwdriver.
 - (d) One 6" medium screwdriver.
 - (e) One 4" medium screwdriver.
 - (f) One 2" medium screwdriver.
 - (g) One 8" insulated shaft screwdriver.
 - (h) One #1 Phillips head screwdriver.
 - (i) One #2 Phillips head screwdriver.
 - (j) One offset screwdriver.
 - (k) One pair diagonal cutting pliers, 6".
 - (l) One pair long needle nose pliers, 6".
 - (m) One pair long nose "duck bill" pliers, 6".
 - (n) One pair side cutting pliers, $6\frac{1}{2}$ ".
 - (o) One 6" steel rule with wire gauge scale.

The kits are being distributed through the various RMO pools, and activities desiring kits may secure them by making application to the nearest radio material pool.

SOURCE OF ENTERTAINMENT RECEIVERS FOR SHORE USE

The Radio Material Organization is often faced with requests for model RBO series or other types of radio receivers, particularly in advanced base areas, for entertainment purposes ashore. In general, the requested equipments were not procured for such purposes, nor are they particularly satisfactory because of the problem of obtaining an entirely satisfactory loudspeaker. A better solution to this need is described below.

The Bureau of Naval Personnel has procured through the Bureau of Ships a substantial quantity of models RCT and RCU radio and phonograph combinations, with spare parts, which are designed for satisfactory recreational and entertainment use ashore in tropical as well as continental locations. These combinations, as well as record kits, are described in the "Sports-Games-Music Catalog" and may be procured with welfare and recreational funds or ships' stores profits, as described in page three in the

catalog and in Bureau of Supplies & Accounts memorandum #494 of November 1943.

A revision of this catalog, to be distributed this month to all ships and stations, will indicate that officers' clubs and similar activities which do not have access to welfare funds or ships' stores profits, may obtain the radio sets through the welfare fund by making a cash contribution to it.

It should be clearly understood that the models RCT and RCU equipments are not approved for shipboard installations. These receivers do not meet the specified radiation limitations for shipboard equipment and, therefore, should not be installed aboard any vessel.

RECEIVER SECURITY

The U. S. Navy Radio and Sound Laboratory, San Diego, has invited the attention of the Bureau to the fact that in some cases the local-oscillator-radiation-reducing properties of the type CME-50063 preselector are being impaired by locating the preselector at a considerable distance from the receiver and connecting it to the receiver with a long unshielded wire.

Great care should be taken to locate the preselector close to the receiver and to connect the two units with a shielded conductor, the shield of which is grounded. A coaxial type conductor is to be preferred as its capacity from conductor to ground is low and it provides excellent shielding.

OSCILLATOR RADIATION—A SUMMARY OF SAFE AND UNSAFE RECEIVERS

The following information was compiled at the Naval Research Laboratory. It was gathered from the records of tests conducted at the laboratory. The receivers are grouped in two sections—those operating in the frequency range above, and those operating below 30 megacycles. Two columns are entered for all receivers. The first lists those frequencies which are "safe"—i.e., on which operation would present no hazard to security. The other column lists the "unsafe" frequencies—i.e., on which security would be endangered by oscillator radiation. In all cases the frequency listed is the oscillator frequency.

All receivers listed are rated in accordance with a safety limit of 400 micromicrowatts power appearing from antenna to ground at optimum load resistance.

LOW-FREQUENCY RECEIVERS (BELOW 30 MC.)

| Type rcvr. | Safe frequencies | Unsafe frequencies |
|-----------------------------------|---|---|
| REa | All, except with regen. max. | 72-130 kc. with max. regen. |
| RFa | All, except with regen. max. | Above 240 kc. with max. regen. |
| RAB-1 | Up to 23 mc. | 23-38 mc. |
| RAC-1 | All | |
| RAL-4 | All | |
| RAO | All | |
| RAO-2 | All | |
| RAO-3 | All | |
| RAS | Bands 1-5 | Part of band 6, Band 7. |
| RBA | All | |
| RBB | All | |
| RBC | All | |
| RBG | Band 2. Band 1 very close to limit just above at 540 and 1300 kc. | Bands 3, 4, 5. |
| RBH | All | |
| RBL | All | |
| RBI-3 | All | |
| RBM(hf) | Bands 1, 2, 3, Band 4 (14-19 mc). | Band 4 (13-14 and 19-22 mc). |
| RBM(mf) | All | |
| RBO | All | |
| DP-9 | All | |
| TBX-4 | | All. |
| TCS | | All. |
| TCS (with Majestic "wonder box"). | | |
| Hallicrafter SX-28 (now RCF) | | Definitely above 3 mc. |
| RMCA 8505 (now RCG) | | All. |
| Scott SLR-F (now RCH) | | All. |
| Bendix BC-348-Q | 2 lowest freq. bands | 3rd band 3.5-5 mc. 4th band 6-9 mc. 5th band 9.5-13 mc. 6th band 13.5-17 mc. |
| Emerson 413 | | All. |
| Farnsworth C-138 | 3 lowest freq. bands | 3 high bands. |
| Hallicrafter Ht-11. | | All. |

| Type rcvr. | Safe frequencies | Unsafe frequencies |
|------------------------------------|--------------------------|-----------------------|
| Magnavox CR-155 | | All. |
| National HRO (Bakelite ant. block) | Up to 26 mc. | Above 26 mc. |
| National HRO (Styrene ant. block) | 2 low-freq. bands | 2 high bands. |
| Philco 42-788T | | All. |
| Philips 512 | Up to 3 mc. | Above 3.5 mc. |
| Philips 513AN | Up to 18 mc. | 18-22.5 mc. |
| Philips 595AM | Broadcast band 1-2.1 mc. | Elsewhere: 2.1-23 mc. |
| RCA 8506B | All | |
| RCA AR88 | All | |
| RCA Q-33 | | All. |
| Scott SLR-C | Up to 21 mc. | Above 22 mc. |
| Sparton 842 SX | | All. |
| Zenith 8W 645At | | All. |

HIGH-FREQUENCY RECEIVERS (ABOVE 30 MC.)

| | | |
|---|---|---|
| RAQ | 70-153 mc. | 153-190 mc. |
| RBQ (with shielded crystal) ¹ | Harmonics up to 126 mc. | Above 126 mc (except 132 mc). |
| BL-2 | | All. |
| CXBG | | All. |
| TBS ¹ | All, if trimmers are not peaked by mistake to oscillator; then only on one frequency is unsafe. | |
| TBY-2 | | All. |
| Hallicrafter S-27 (now RBK) | | All. |
| Bendix BC-639-A Communications Co. model 132 ¹ | .23-67, 100-120. Above 146 mc. | Harmonics below. 23 mc., 90 mc., 135, 146 mc. |
| Hallicrafter NS-27-C | 108-113 mc. | 113-195 mc. |
| RCA (rcvr. freq.: 200-400 mc) | | All. |

UNAUTHORIZED RECEIVERS

From time to time the Bureau receives information—usually via the "scuttlebutt"—that commercial receivers are being installed aboard Navy ships for both entertainment and communications. A case in point is a certain destroyer having a Hallicrafter SX-28 receiver which was borrowed from or installed by the Army.

¹ Measured on crystal harmonics.

Tests by the Federal Communications Commission and the Naval Research Laboratory have shown repeatedly that all commercial Halli-crafter receivers have local oscillator radiations far in excess of the safe limit. It should be remembered that the Army does not have the receiver security problem that the Navy does and that it is useless and foolish to put safe receivers aboard a ship only to have the ship's security violated by a commercial receiver.

Commercial *broadcast* receivers can *not* be made safe merely by the use of preselectors due to their usual "spread-out" construction and wooden or plastic cabinets, which provide excellent opportunities for radiation. See the following article for a list of authorized commercial receivers.

COMMERCIAL RADIO RECEIVING EQUIP- MENT ABOARD U.S. VESSELS

A number of commercial shipbuilding yards have continued to follow an old peacetime practice of presenting broadcast entertainment receivers to the crews of vessels that were built in their yards. For a number of reasons, this practice should be discouraged and Navy shipbuilding representatives at the various yards involved should take steps to insure that unauthorized receivers are not placed aboard new construction vessels.

The presence of "crew" or "individually" owned receivers on board certain vessels has recently been the subject of an unusual amount of official correspondence which should not have been necessary. In view of this correspondence, certain decisions have been necessitated which were not entirely satisfactory to all parties concerned. Therefore, the cause of such situations should be eliminated at the source.

Practically all available stocks of commercial non-radiating broadcast receivers have been exhausted and replacements are not being manufactured. Therefore, the majority of receivers being presented to vessels at the present time are of the unapproved radiating types which cannot be used while the vessels are at sea. Certain of the various methods used to secure these receivers, while at sea, are somewhat uncertain and, therefore, unsatisfactory from an overall standpoint.

In view of the approved type of broadcast entertainment equipment being supplied by the Bureau as a part of each vessel's allowance, it is considered that any additional broadcast receivers are unnecessary and that the practice of placing them aboard Naval vessels should be terminated.

The following types of radio receiving equipment have been approved by the Federal Communications Commission as capable of being used and operated on board ships of the United States in accordance with the limitation regarding the radiation of energy imposed by the rules of the commission, i.e., that the electromagnetic field created does not exceed 0.1 microvolt per meter at one nautical mile from the receiver:

AUTHORIZED COMMUNICATION RECEIVERS

| <i>Manufacturer</i> | <i>Freq. range (kilocycles)</i> | <i>Type or model number</i> |
|------------------------------------|---------------------------------------|--|
| Arnessen Electric Company | .841LW | 80-550 |
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. 117-C | 16-40 100-200 300-530 |
| | 128-A | 16-650 |
| | 128-AX | 15-650 |
| | 130-A | 300-500 |
| | 138-A | 80-560 |
| | | 1900-25000 |
| Globe Wireless or Heintz & Kaufman |936 | 70-210 350-515 |
| Hallierafters, Inc. |SX-28A ¹ | 540-40000 |
| National Company |D. C. SW-3RM | 100-600 |
| Radiation Products Corporation |R-96-SR | 140-500 1500-12000 |
| Radio Corporation of America |AR-88 AR-67-X CR-91 | 535-32000 75-1500 75-550 1500-30000 |
| Radiomarine Corporation of America |AR-8503 AR-8506-A | 15-600 210-550 1900-25000 |
| Radiomarine Corporation of America |AR-8506-B AR-8507 AR-8510 | 90-550 1900-25000 70-515 15-650 |
| E. M. Sargent |AH-10X | 34-550 |

¹ When used with Radiation Suppressor Unit No. 1X381.

| Manufacturer | Freq. range (kilocycles) | Type or model number |
|---------------------------------|---|----------------------|
| E. H. Scott Radio Labs. | SLR-C | 80-520 3600-24000 |
| | SLR-D | 500-24000 |
| | SLR-F | 80-550 1900-24000 |
| | SLR-H | 530-15600 |
| Technical Radio Company | LRR-4 | 1500-18000 |
| Western Electric Company | Standard receivers incorporated in radiotelephone equipment types | |
| | 224-A | 2100-2800 |
| | 224-B ² | 2100-2800 |
| | 226-A | 2100-2800 |
| | 226-B | 2100-2800 |
| | 226-C | 2100-2800 |
| | 226-D | 2100-2800 |

AUTHORIZED BROADCAST RECEIVERS

| | | |
|--|--------------------|------------------------|
| Herbach and Rademan Company | AR-93 | 540-1600 |
| | AR-93-A | 540-1600 |
| Maritime Radio Corporation | MA-1 | 540-1600 |
| | MA1-A ³ | 540-1600 |
| | MA1-B ³ | 540-1600 |
| Radio Corporation of America | ER-88 | 535-32000 |
| | SLR-12-A | 540-1600 5550-15600 |
| E. H. Scott Radio Labs. | SLR-12-B | 540-1600 5550-15600 |

AUTHORIZED DIRECTION FINDERS

| | | |
|-------------------------|-------------------|---------|
| Bludworth, Inc. | Standard Binnacle | |
| | DF-1009 | 280-520 |
| | DF-1011 | 280-520 |
| | DF-1012 | 280-520 |
| | DF-1013 | 280-520 |
| | DF-1014 | 280-520 |
| | DF-1015 | 280-520 |
| | DF-1016 | 280-520 |
| | DF-1017 | 280-520 |
| | DF-1018 | 280-520 |
| | DF-1019 | 280-520 |
| | DF-1020 | 280-520 |
| | DF-1022 | 280-520 |
| | DF-1023 | 280-520 |
| | DF-1024 | 280-520 |

| | | |
|---|------------------------------|---------|
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. | |
| | 102-A & B | 250-540 |
| | 103-A & B | 250-540 |
| | 104-A & B | 250-540 |

² When modified in accordance with manufacturer's instructions and such modification is designated by the addition of the letter "M" to the serial number of the modified receiver.
³ Models MA1-A and MA1-B are identical in electrical design to the model MA-1.

| Manufacturer | (kilocycles) | Type or model number |
|--|--------------|----------------------|
| Radiomarine Corporation of America | 105-A & B | 250-540 |
| | 106-A & B | 250-540 |
| | 102-BD | 250-540 |
| | 103-BD | 250-540 |
| | 104-BD | 250-540 |
| | 105-BD | 250-540 |
| | 106-BD | 250-540 |
| | AM-4490-DM | 250-540 |
| | AM-4490-EM | 250-540 |
| | AM-4490-F | 250-540 |
| | AR-8700-S | 270-520 |
| | AR-8701 | 270-520 |
| | AR-8702 | 270-520 |
| AR-8702-A | 270-520 | |
| AR-8703 | 270-520 | |
| AR-8704 | 270-520 | |
| AR-8709 | 270-520 | |
| AR-8700-ASX | 270-520 | |
| AR-8701-AX | 270-520 | |
| AR-8703-AX | 270-520 | |
| AR-8703-BX | 270-520 | |
| AR-8073-BX1 | 270-520 | |
| AR-8707-X | 270-520 | |
| AR-8707-X1 | 270-520 | |
| ER-1445-A | 200-525 | |
| ER-1445-B | 200-525 | |
| ER-1445-R | 200-525 | |

AUTHORIZED AUTO ALARMS

| | | |
|--|------------------------------|-----|
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. | |
| | 101-B | 500 |
| Radiomarine Corporation of America | AR-8600-X | 500 |
| | AR-8601 | 500 |

This approval was given upon the condition that normal circumstances of operation, including applied voltages and electron tubes, will be maintained whenever the equipment is in use or operation.

UNAUTHORIZED COMMUNICATION RECEIVERS

The following equipments *do not* comply with FCC limitations and their use aboard U.S. vessels is *not authorized*:

| Manufacturer | Freq. range (kilocycles) | Type or model number |
|---------------------------|--------------------------|----------------------|
| Arnessen Electric Company | IP-501 | 37.5-1200 |
| | IP-501-A | 37.5-1200 |
| | SE-143 | 92-970 |
| | SE-1220 | 45-600 |
| | SE-1420 | |
| | 841 | 80-31000 |
| Ecophone Radio Company | EC-2 | 550-30000 |

| <i>Manufacturer</i> | <i>Freq. range (kilocycles)</i> | <i>Type or model number</i> |
|------------------------------------|--|---------------------------------|
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. | |
| | 104-B | 500-23000 |
| | 105-A | 16-1500 |
| | 117-A | 16-35 |
| | | 100-200 |
| | | 300-550 |
| | | 5200-19500 |
| | 117-B | 16-40 |
| | | 100-200 |
| | | 300-550 |
| | | 5200-19500 |
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. | |
| | 122-A & B | 300-500 |
| | 129-A | 540-30000 |
| Hallicrafters, Inc. | S-22R | 110-1530 |
| | | 1715-11500 |
| | SX-24 | 545-43500 |
| | SX-25 | 540-42000 |
| Hammarlund Manufacturing Company | SXR-200 | 535-20000 |
| National Company | NC-44 | 550-30000 |
| | NC-45 | 550-30000 |
| Philips | 614VN | 550-5550 |
| Radio Holland | UO | 15-21000 |
| Radio Corporation of America | AR-67 | 75-1500 |
| Radiomarine Corporation of America | AR-8501 | 5000-18000 |
| | AR-8504 | 300-900 |
| | AR-8505 | 540-30000 |
| E. M. Sargent | AH-10 | 34-14000 |
| | 12-D | 34-14000 |
| | 12-UD | 34-14000 |
| | 12-F | 34-14000 |
| | 12-UF | 34-14000 |
| | 11-51-TR | 80-31000 |
| Western Electric Company | Standard receivers incorporated in radiotelephone equipment type | |
| | 227-A | 2100-2800 |

UNAUTHORIZED DIRECTION FINDERS

| | | |
|------------------------------------|------------------------------|---------|
| Federal Telephone & Radio Corp. | Mackay Radio & Telegraph Co. | |
| | AM-3800 | 300-500 |
| | AM-4490-A | 250-540 |
| | AM-4490-D | 250-540 |
| | AM-4490-E | 250-540 |
| Radiomarine Corporation of America | AR-8700-AS | 270-520 |
| | AR-8701-A | 270-520 |
| | AR-8703-A | 270-520 |
| | AR-8703-B | 270-520 |
| | AR-8707 | 270-520 |

UNAUTHORIZED AUTO ALARMS

| <i>Manufacturer</i> | <i>Freq. range (kilocycles)</i> | <i>Type or model number</i> |
|------------------------------------|-------------------------------------|---------------------------------|
| Radiomarine Corporation of America | AR-8600 | 500 |

SPURIOUS RADIATIONS WHILE TUNING TRANSMITTERS

There is a possibility of spurious radiations being emitted, unintentionally, during transmitter tuning processes. Such radiations would have two main sources:

(1) If the transmitter oscillator is operating, then judgment must be exercised to ascertain that there is no form of coupling between this oscillator and the antenna.

(2) If a signal generator is connected to a receiver antenna trunk for the purpose of checking the receiver frequency, or for any other purpose, then radiation from the signal generator will occur.

Elimination of these radiations may be accomplished as follows:

(1) It is feasible to tune the transmitter completely without radiating. A suitable method is described in the article "Tuning Transmitters Under Conditions of Radio Silence," page ANT:5.

(2) Elimination of radiation from signal generators is simply a matter of refraining from coupling the antenna to a signal generator during radio silence. To insure that coupling does not exist, it may be useful to seal off the receiver antenna, and to use a direct connection to the receiver instead of a radiating connection because of the possibility of pickup of this radiation by other antennas.

NEED FOR CAUTION WHEN USING REPAIR SHOP ANTENNAS

Users of repair shop antennas should exercise caution to insure the absence of receiver radiation when testing and aligning receivers while the ship is in restricted areas.

ELECTRIC RAZORS AS A HAZARD TO SECURITY

The Commander Service Force, U. S. Atlantic Fleet, and the San Diego Radio and Sound Laboratory recently conducted a series of tests to

determine the hazard to the security of a ship caused by the radiation of radio-frequency noise from electric razors. Tests were conducted using razors having vibrator motors and razors having commutator motors, and measurements were made over the frequency range of the model OF noise locator and the models RAK/RAL-5 receivers.

The results of the tests may be summarized as follows:

(1) A field strength of less than one microvolt per meter is produced outside a ship's compartment at a distance of ten feet from the vessel by an electric razor used inside the compartment.

(2) Electric razors when used inside metal enclosed compartments on a ship do not radiate enough energy into the ship's antennas to be detected, provided that no antenna extends out of the compartment in which the razor is operated.

(3) The signal radiated by an electric razor operated outside the compartment of a ship is of such strength that it cannot be detected by a sensitive receiving system at any frequency at a distance of 1000 feet.

As a result of the tests, it may be concluded that the operation of electric razors inside compartments creates no radio hazard to security.

It should be noted that local noise may be produced aboard ship by electric razors. This noise is usually conductively coupled to receivers through power wiring as distinguished from radiation. If this noise is bothersome it may be eliminated by connecting a 400-volt 0.01- to 0.05-mfd. condenser across the power line feeding the shaver. A number of commercial filters, such as the Solar type AE or its equivalent, are on the market which are excellent filters and do not require cutting the shaver attachment cord.

TREATMENT OF RIGGING ON SHIPS EQUIPPED WITH DIRECTION-FINDING EQUIPMENTS

When a direction finder is installed in a ship it is necessary to treat the rigging to reduce deviation. Wires not used as electrical conductors should have their conductivity interrupted at 5- to 8-foot intervals by the insertion of strain insulators. This practice will reduce the reradiation of energy at or near the frequencies to which the direction finder will be tuned and should be

applied to whistle cords, signal halyards, triatics, standing rigging, etc. Compression type strain insulators should be used as failure of this type of insulator will not cause the line to part.

In cases where wires cannot be properly insulated, permanent bonds should be attached so that the object is grounded. Large objects such as derrick booms which may not have a constant low-resistance ground connection should also be bonded to ground.

The use of copper for external bonding is unsatisfactory due to its chemical and electrolytic reaction with the steel of the ship. 7/18 or 7/32 steel wire should be used for bonds and corrector loops and should be welded or brazed to the stay and deck. The resistance of the bonds is, and should be, low and any small change in the resistance of the end contacts will produce serious changes in deviation. Bolts, lugs and clamps cannot be depended upon to give a constant low resistance connection.

It is important that a periodic inspection be made of these bonds, employing a check list if necessary to insure that none are overlooked. The breaking or corroding of these bonds will, in most cases, cause an error in calibration which may be either constant or variable. For maximum accuracy in direction-finding work, all rigging must be in the same condition as when the instrument was calibrated.

Care should be taken to see that no closed loops of appreciable size (larger than about one foot in diameter) are constructed near the direction finder, and that none already existing there are removed without a recalibration of the direction finder. The usual closed loop aboard ship is formed by stanchions, rails, decks, stays and by the post, boom and topping lift of cranes. The continuity of these loops may often be broken by insulating material, and this should be done wherever possible. A sheet of conducting material acts as a closed loop, but one that cannot be broken to prevent the flow of circulating currents. It is generally impossible to break up all closed loops aboard ship. The greatest attention should be paid to those of considerable size and those adjacent to the direction finder. In general, when a loop is more distant from the direction finder than twice its largest dimension, it will have little effect on deviation.

It should be emphasized that insulating mate-