DATE 1-19-59 SH. 1 OF 1 COMPILED BY E. Miller	TMC SPECIFICATION NO. S 407	
APPROVED P.L.K. J&R	TITLE: MODIFICATION OF R-5007/FRR-502 SUB-ASSEMBLY TO IMPROVE OPERATION	JOB

Supersedes S-377

CHANGES INVOLVED:

1. Beat frequency oscillator injection voltage is increased.
2. Automatic volume control reference point is moved from the detector V103 to the plate of the 3rd I.F. Amplifier V102.
3. B.F.O. output jack J104 circuit is decreased in impedance to provide a more stable output.

PROCEDURE:

1. Disconnect C119 from pins 2 and 7 of X103.
2. Remove white shielded lead between pin 2 of X103 and C144.
3. Connect RG-58A lead between grid terminal (green) of T103 and unconnected end of C144. Connect shield of coaxial cable to adjacent ground lugs.
4. Remove 6.8K resistor R114 and substitute with a 33K 5% 1/2 watt resistor RC20GF333J, FSN 5905-171-1998.
5. Drill a hole, to take a #4-40 screw, midway between X103 and T103 one half inch from the end of the terminal board which holds R114. Mount an insulated terminal standoff (TMC TE-102-2) on the bottom side of the chassis.
6. Connect an insulated wire between the terminal standoff and the plate terminal (blue) of T103.
7. Connect a new 51 uuf ceramic capacitor, TMC CC21SL510J, FSN N5910-197-1625 between the terminal standoff and pin 2 of X103.
8. Disconnect C134 from the junction of C145 and L104. Reconnect to the other side of C145.
9. Realign the I.F. Transformers and readjust C100 for th required detector output.
10. See IN-1054.

DATE 5-13-60
SH. 1 OF 3
COMPILED BY L. G.

TMC SPECIFICATION NO. S-407

REV. C

TITLE: FFR-2 Modification Kit (R-5007/FRR-502)

JOB

APPROVED

KIT-151 (MILITARY)

NOTE: The Communications Receiver Model FFR-2 has the military nomenclature R-5007/FRR-502

EQUIPMENT AFFECTED

R-5007/FRR-502, Receiver Subassembly

PURPOSE

To improve receiver operation by increasing the beat frequency oscillator (BFO) injection voltage, relocating the automatic volume control (AVC) reference point from the second detector (V103) to the plate of the third intermediate frequency (IF) amplifier (V102), and decreasing the impedance of the BFO output jack (J104).

MATERIALS SUPPLIED IN KIT

Item No.	Nomenclature
1.	One each TMC No. CC-101-3 (Symbol C134) Capacitor, Fixed, Ceramic, 220 UUF.
2.	One each TMC No. RG-58A/U (CA-1) Coaxial Cable. 16" Long.
3.	One each TMC No. RC20GF333J (Symbol R114) (FSN5905-171-1998) Resistor, Fixed, Composition, 33K Ohms, 1/2 watt.
4.	One each 1/8 inch diameter drill bit.
5.	One each TMC No. TE0102-2, Terminal, Insulated.
6.	One each TMC No. SCBS0440BN4, Screw, Machine, 4-40 Threads X 1/4 inch long.
7.	One each TMC No. LWE04MRN, Lockwasher, External Tooth, No. 4.
8.	One each TMC No. LWC20(7)U96, Cable, Insulated, Stranded, White/Blue, Size 20, 6 in. long.
9.	One each TMC No. CC21SL510J (Symbol C119) (FSN5910-197-1625), Capacitor, Fixed, Ceramic, 51 UUF.
10.	One each TMC No. NP-337-2, Nameplate.
11.	One copy of TMC Modification Drawing No. IN-1054.

DATE 5-13-60 SH. 2 OF 3 COMPILED BY L.G.	TMC SPECIFICATION NO. S-407	REV. C
APPROVED	TITLE: FFR-2 Modification Kit (R-5007/FRR-502) KIT-151 (MILITARY)	JOB

TOOLS REQUIRED

To be provided by installing activity.

Pliers, 6 inch longnose.

Pliers, 6 inch Diagonal Cutting.

Screwdriver, 5 inch.

Soldering Iron, 35 watt (pencil type tip).

PROCEDURE

NOTE: See TMC Modification Drawing No. IN-1054

For unmodified FFR Bottom View of Chassis, see NAVSHIPS 92786A "Technical Manual for Radio Receiving Set AN/FFR-49 (V)" Figure 4-3.

STEP 1. Unsolder & remove capacitor (symbol C119) from pins 2 and 7 of the Second Detector & AVC tube socket, XV103. Discard capacitor.

2. Unsolder & remove the white shielded lead connecting XV103, pin 2 and capacitor C144 on the BFO terminal board.

3. Unsolder & remove capacitor (symbol C134) from the BFO terminal board. Discard capacitor.

4. Add new capacitor (item 1) in place of C134 from C145 to ground terminal lug on the BFO terminal board.

5. Connect new coaxial cable (item 2) from green terminal of T103 to capacitor, C144, on BFO terminal board. Solder the shield of item 2 to any convenient ground lug on both ends of cable.

6. Unsolder and remove existing 6800 ohm resistor (symbol R114) from detector terminal board and replace with new resistor (item 3).

7. Drill a 1/8 dia. hole midway between socket, XV103, and transformer, T103, approximately 1/2 inch from edge of detector terminal board. Use drill bit, item 4.

8. Mount the insulated terminal (item 5) with the screw & washer (item 6 & 7) on the bottom side of the chassis.

DATE 5-13-60 SH. 3 OF 3 COMPILED BY L.G.	TMC SPECIFICATION NO. S-407	REV. C
APPROVED	TITLE: FFR-2 Modification Kit (R-5007/FRR-502) KIT-151 (MILITARY)	JOB

9. Connect the new wire (item 8) from the new insulated terminal to the blue terminal of T103 (plate terminal).

10. Connect the new capacitor (item 9) from pin 2 of XV103 to the insulated terminal. This capacitor replaces C119 (removed in step 1).

11. Re-Align the IF transformers and re-adjust C100 as per P4-2A and page **4-2A** of T.M. Navships 92786A.

12. Affix foil-cal nameplate (item 10) immediately below existing nameplate.

REVISION SHEET

THE TECHNICAL MATERIEL CORP.
MAMARONECK NEW YORK

S-407

MODEL FFR-2 PROJECT NO SPEC.

DATE	REV.	PAGE	EMN#	DESCRIPTION	CHK.	APP.
8-1-61	A	1	5383	On "MATERIALS SUPPLIED IN KIT", Item 8, add "6 in. Lg".		
1/16/64	B	1	10760	Revised Sheet 1 per EMN.		
5/5/69	C	1,2,3	19411	Revised as per EMN 19411		

IMC FORM 104 ◇

IRIDITE #8P BLUBRITE

For Zinc and Cadmium Plate, Zinc Die Castings, and Hot Dipped Galvanize.

FILE: ZINC & CADMIUM

INTRODUCTION

Iridite #8P BluBrite is a concentrated powder, which when mixed with water at various concentrations, produces a variety of chromate conversion coatings on zinc plated parts, ranging from a bright (chrome like) finish to yellow, iridescent coatings. The yellow coatings can also be produced on cadmium plate, zinc die castings, and galvanized steel.

When used as a yellow, protective finish (Mix B), Iridite #8P will meet government specifications for supplementary chromate coatings on any of the metal surfaces listed above; and when desired, for paint base applications.

When used to produce bright finishes on zinc plated parts, a choice of concentrations is suggested; the higher (Mix A-1) producing maximum chemical polishing and brightness; the alternate (Mix A-2) provides a more economical finish of satisfactory brightness for many applications. Final finish appearance with either Mix A-1 or Mix A-2 may be varied by selection of bleach dips as outlined later.

QUICK GLANCE FLOW CHARTS

I. Recommended for either manual or automatic operation on zinc or cadmium plate.

1. Zinc or Cadmium Plate
2. Warm or Cold Running Rinse
3. Warm or Cold Running Rinse
4. Iridite #8P BluBrite
5. Warm or Cold Running Rinse
6. Bleach Optional with Zinc Plate
7. Rinse Optional
8. Hot Water Rinse
9. Dry

Note: A single spray rinse may be used to replace rinse tanks #2, #3, #5, #6, and #8.

II. Recommended for zinc die castings or hot dipped galvanize.

1. ARP #140 Zinc Die Cast Cleaner or equal
1a. Cleaner for Galvanize
2. Warm or Cold Running Rinse
3. Die Castings 1-2% Sulfuric or Phosphoric Acid
4. Cold Running Rinse
5. Iridite #8P BluBrite
6. Warm or Cold Running Rinse
7. Hot Water Rinse
8. Dry

Note: A single spray rinse may be used to replace rinse tanks #2, #4, #6, and #7.

OPERATING DATA

Tank linings to hold working solution

Stoneware crock
18-8 stainless steel
Koroseal or equal
Polyethylene

Heating Coils

18-8 stainless steel

Iridite #8P is received as a balanced powder; a 100 pound non-returnable can equaling 1 unit. The powdered concentrate is mixed with water, to which concentrated Nitric Acid is added to make a normal working solution.

Solution Make-up Chart and Operating Controls

Mix A-1

Equal to a 1-5 liquid mix, it is recommended for zinc plate to simulate chrome plate. Provides maximum corrosion protection when bleached in sodium carbonate and given a clear organic finish.

Working Solution	#8P Compound	Conc. Nitric Acid
1 gallon	.2 lbs.	4 fluid oz. (120 ml.)
5 gallons	2.5 lbs.	1-1/4 pints
10 gallons	5.0 lbs.	1-1/4 quarts
20 gallons	10.0 lbs.	2-1/2 quarts
50 gallons	25.0 lbs.	1-1/2 gallons
75 gallons	32.5 lbs.	2-1/4 gallons
100 gallons	40.0 lbs.	3 gallons

Immersion time	5 to 15 seconds
Solution temperature	80 to 110°F.
pH operating range	0.1 to 0.7
Hexavalent chromium operating range	25 to 35 g/l
Acid Number range	65 to 110

Mix A-2

Equal to a 1-10 liquid mix, it is recommended for zinc and cadmium plate and hot dipped galvanize to produce a bright iridescent yellow corrosion protective finish and a clear blue bright finish on zinc.

Working Solution	#8P Compound	Conc. Nitric Acid
1 gallon	.2 lbs.	2.2 fl. oz. (66 ml.)
5 gallons	2.0 lbs.	11.0 fl. oz. (330 ml.)
10 gallons	4.0 lbs.	1.4 pts. (660 ml.)
20 gallons	8.0 lbs.	1.4 qts. (1320 ml.)
50 gallons	20.0 lbs.	3.5 qts. (3300 ml.)
75 gallons	30.0 lbs.	1.3 gals. (5150 ml.)
100 gallons	40.0 lbs.	1.7 gals. (6600 ml.)

Immersion time	5 to 30 secs.
Solution temperature	75 to 110°F.
pH operating range	0.2 to 0.7
Hexavalent chromium operating range	15 to 25 g/l
Acid Number range	35 to 65

Mix B

Equal to 1-50 liquid mix, it is used on zinc and cadmium plate, zinc die castings, and galvanize to produce a darker iridescent yellow protective finish. Make up as follows:

Working Solution	#8P Compound	Conc. Nitric Acid
1 gallon	1 oz.	12 ml.
5 gallons	5.0 oz.	2 fl. oz. (60 ml.)
10 gallons	10.0 oz.	4 fl. oz. (120 ml.)
20 gallons	1.4 lbs.	8 fl. oz. (240 ml.)
50 gallons	3.5 lbs.	20 fl. oz. (1.25 pts.)
75 gallons	5.3 lbs.	30 fl. oz. (2 pts.)
100 gallons	7.0 lbs.	40 fl. oz. (2.5 pts.)

Immersion time	5 to 30 secs.
Solution temperature	60 to 110°F.
pH operating range	0.8 to 1.5
Hexavalent chromium operating range	2 to 4 g/l
Acid Number range	7 to 12

Maintenance

Replenishment additions to be made in the same proportion of Iridite powder to Nitric Acid as in original mix, or use Concentrated Maintenance Mix. This should be done to maintain pH and hexavalent chromium in the range specified; or if appearance is the controlling factor, to appearance desired. ARP #1 Daily Doctor wetting agent may be used in the Iridite #8P working solution in the amount of 1 ml. per gallon.

Concentrated Maintenance Mix

This is an easy method to make up a regular Iridite concentrated solution of Iridite 8P powder and Nitric Acid in the customer's shop.

The concentrate facilitates the use of Iridite 8P by eliminating separate measurements of Iridite and Nitric Acid and thereby decreasing the possibility of making additions out of chemical balance. The concentrated mix can be used in the same concentrations as those recommended, that is 1- 5, 1- 10 or 1- 50.

The concentrated mixture should be made up and kept in a glazed ceramic crock or a glass container.

Make-up as follows for 10 gallons of Concentrated Mix:

1. Fill container about one-half full of water.
2. Add 42 lbs. of Iridite #8P compound.
3. Add 1.8 gallons of Concentrated Nitric Acid.
4. Fill up to 10 gallon mark

Mix thoroughly before using

New Iridite solutions made up from this mix should have a ratio of 1 part Iridite mixture to 5 or 10 parts of water to correspond to regular A-1 and A-2 mix of instruction sheet; or 1 part of Iridite mixture to 50 parts of water to correspond to B Mix.

Operating controls remain the same as for regular 8P operation. Maintenance additions of concentrate should be made to keep within operating ranges given or finish desired.

Caution: Iridite powdered mix or solution on the skin should be washed off immediately with a good quantity of water. It should be kept from contact with wood and other organic materials since it is oxidizing in nature. Iridite #8P solution is an acid solution and should be handled with the same care as other acid mixes.

Caution: Iridite #8P should never be mixed with water in a steel container.

Be sure to replace lid tightly on #8P container

Bleach Dips-Optional for use with zinc plate, and Iridite 8P

Clear Blue Bright A-1 and A-2 Mix

Where a clear, blue bright finish is desired, the Iridite part should be immersed in a solution consisting of:

Caustic Soda	3 oz/gallon of water
Temperature	Room
Immersion time	1-5 seconds

Plain steel tank can be used to hold bleach solution.

Faint Yellow Bright A-1 Mix

A bright finish with a slight yellow tint can be obtained by immersing the part in a solution consisting of:

Phosphoric Acid	3.8 ml/gallon of water
Temperature	Room
Immersion time	5 to 30 seconds

Tanks for solution should be made of wood, rubber, ceramic material or substance not attacked by phosphoric acid.

HueBrite Finish A-1 Mix

A multi-hued finish from which the yellow constituent has been removed can be obtained by immersion in the following solution:

Soda Ash (Sodium Carbonate)	2- 3 oz/gallon of water
Temperature	120 to 130°F.
Immersion time	15 to 60 seconds

Tanks and heating coils can be made of steel.

The resultant multi-hued finish can be obscured by coating with a clear lacquer or wax, resulting in a clear bright final finish of excellent corrosion resistance and paint base qualities.

Note: Bleach dips should be dumped two or three times a week, or as found necessary. Parts should not be immersed in bleach dips longer than is necessary to remove the visible film since prolonged immersion measurably lowers the corrosion resistance of the finish.

CONTROL METHODS

For precise control, use Electrometric pH for determining the acidity and Hexavalent Chromium analysis for controlling available chromium. Solution should be kept within operating ranges given, or as close as possible to original make-up.

For determining acidity without Electrometric pH, a simple titration for Acid Number is used. Acid Number control is not as accurate as pH because as bath becomes depleted, zinc hydroxide will build up during the titration.

Where appearance alone is the controlling factor, actual operation will determine the necessity and frequency of additions.

Maintenance additions of Iridite #8P compound and Nitric Acid should be in the same proportion as when making up original solution or use Concentrated Maintenance Mix. When using control pH control, if hexavalent chromium is within the proper operating range and the pH is still high, pH can be adjusted by adding additional Nitric Acid.

Acid Number Titration Control

Equipment:	Pipette	5 ml.
	Burette	50 ml.
	Beaker	250 ml.
	Cylinder	100 ml. graduated tall form
Solutions:	Sodium Hydroxide (NaOH) solution - 1 Normal	
	Phenolphthalein indicator	

Method:
1. Pipette a 5 ml. sample of Iridite working solution into a 250 ml. beaker.
2. Dilute with 75 ml. of distilled water.
3. Titrate with 1 normal solution of sodium hydroxide using 10 drops of phenolphthalein indicator. Titrate until a red color persists at least one minute.

Calculations: Multiply the mls. of NaOH used by 8. This will give the Acid Number of the solution.

Example: 14 ml. (amount of NaOH used) x 8 = 112 (Acid No.)

Determination of Reduced Metals

1. Transfer the solution from step 3 to a 100 ml. graduate, dilute to 100 ml. and stir.
2. Allow the solution to settle for 24 hours.
3. When the quantity of precipitated material approaches 55 ml., the solution has almost reached the limit of its effectiveness and should be renewed.

Note: To make a 1 normal solution of NaOH

Dissolve 40 gms. of C.P. NaOH in 400 ml. of distilled water. Dilute to exactly 1 liter.

1 Normal NaOH can be purchased from most chemical supply houses or prepared by a druggist.

Hexavalent Chromium Determination

Equipment:

Pipette	1 ml.
Burette	50 ml.
Beaker	400 ml.
Graduate	10 ml.
Stirring rod	

Solutions:
1. Sodium thiosulfate $Na_2S_2O_3$, 0.1 N (24.82 gms/liter), standardized against $K_2Cr_2O_7$
2. Potassium Iodide KI 10%
3. Starch indicator 1 gram dissolved in 100 ml. water

Method:
1. Pipette 1 ml. of solution into beaker and dilute to 250 ml. with distilled water.
2. Add 10 ml. of potassium iodide and 5 ml. of conc. sulfuric acid. Stir.
3. Titrate with sodium thiosulfate solution to a light yellow color.
4. Add 1 to 2 ml. starch solution.
5. Continue titration adding thiosulfate solution dropwise with constant stirring until the dark blue color produced by the starch fades to a clear solution.
6. Record the reading, A mls.

Calculations: Grams per liter of hexavalent chromium = A x N x 17.34

2 pounds of Iridite 8P compound will raise the hexavalent chromium approximately 1 gram per liter in 100 gallons of working solution.

Note: As the Iridite solution becomes old, best results are obtained by increasing the hexavalent chromium concentration by as much as 1/2 of the original value.

Example: If the original hexavalent chromium content was 30 grams per liter, the top economical limit of the old solution will be about 45 grams per liter.

PRE-CLEANING AND PLATING PROCEDURES

Zinc or Cadmium Plate

The final appearance of the Iridite film is dependent upon the smoothness of the base metal and the quality of the plate deposited. A minimum of 0.0002" to 0.0003" will produce satisfactory results although heavier deposits will increase the protective value of the finish system. Use of plating bath brighteners containing molybdenum or mercury are not recommended since they affect the appearance of the Iridite coating and its corrosion protection.

Cadmium brighteners containing oils may affect Iridite film coverage and result in a tacky finish.

Plating bath impurirites should be kept to the allowable percentage of contamination. A properly operating plating solution produces a good plate which will give the most satisfactory appearance and corrosion resistance. Daily use of ARP 12 Zinc Purifier will keep plating bath impurities at a minimum.

Where parts are not processed immediately after plating adhering grease and oil should be removed by a degreaser or alkaline cleaner. Where an oxide film has formed, an acid dip of 1/2% Nitric Acid will be satisfactory.

Zinc Die Castings

Proper cleaning of zinc die castings is a must to obtain proper appearance and coverage from the Iridite solution.

ARP 140 Zinc Die Casting Cleaner has been especially formulated to prepare zinc die castings for Iriditing and may be used either for soak cleaning or for anodic electrocleaning. Satisfactory cleaning has been accomplished by the use of heavy duty cleaners for steel used at 4 to 6 oz. per gallon.

Neutralizing Dip of Die Cast Parts

A dip of 1 to 2% Sulphuric or Phosphoric Acid operated at room temperature for 5 to 10 seconds will neutralize any alkali carried over from the alkaline cleaner and also by activation, help prepare the zinc surface for the Iridite coating. An immersion time of 15 to 30 seconds at room temperature will be sufficient.

RINSING AND DRYING PROCEDURES

Good flowing rinses are recommended throughout the Iridite operation, and are a must for optimum results. A warm rinse is preferable when practical. Parts should be agitated if possible.

Rinses After Alkaline Solutions- such as the plating bath or alkaline bleach dips should have a good flow of water and be kept clean. The drag-in of alkali into the Iridite solution will have a tendency to neutralize the bath and shorten its life. Drag-out of alkali if carried over into the last rinse will adversely affect the corrosion protection of the Iridite finish.

Rinse after Iridite should be thorough so that soluble chromate solution is flushed off the part. Failure to rinse thoroughly can cause streaking of the finished surface.

Drag-in of excess chromate into bleach dips will shorten their period of use.

Last Hot Rinses when used with 1- 5 mix solutions can be run as high as 160 to 180°F. while with 1- 50 mix solutions, a temperature of 140°F. should not be exceeded or dulling will result.

The last hot rinse should be a clean rinse; the immersion time being no longer than necessary to give a final rinse to the surface.

Drying- Iridited parts can be dried by air blast or centrifuge, or by other practical methods.

Where hot circulating air is used, temperatures in excess of about 150°F. are not recommended since they may cause a slight degree of dulling of the finish as well as lowering the corrosion resistance, particularly when used with the 1- 50 mix solutions.

WARRANTY

All formulas referred to in these instructions are guaranteed as to formulated quality upon shipment from our plant. If the above recommended procedures and instructions are followed, desired results will be obtained. However, as actual use of our product by others is beyond our control, no guarantee, expressed or implied, is made as to the effects of such use, or the results to be obtained.

NOTE: All gallon measurements are U. S. Gallons.

September 14, 1956