INSTRUCTION MANUAL CPU-2500R

YAESU MUSEN CO, LTD.

TOKYO JAPAN.

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CPU-2500R 2 METER FM TRANSCEIVER WITH CENTRAL PROCESSING UNIT



The CPU-2500R is a revolutionary, ultimate performance transceiver for the most demanding 2 meter FM operator. Controlled by a central processing unit, the CPU-2500R features full PLL synthesis in 5 kHz steps, thus producing 800 channels between 144 and 148 MHz. An optical coupling frequency selection system utilizes photo-interrupters, eliminating ordinary rotary switches which can become oxidized and noisy.

The central processing unit allows never-beforepossible operating flexibility. As many as four memory channels may be programmed for simplex or repeater operation, and an additional channel may be programmed for split operation on any frequency. The CPU-2500R PLL scanner will sweep up or down the band, and will also scan only the four memory channels, per your instructions.

Two microphones are available for use with the CPU-2500R. The standard microphone features the normal PTT switch plus up/down scanning controls. A versatile keyboard microphone allows

remote input of memory or dial frequencies, up/ down scanning control, auxiliary repeater split selection of up to 4 MHz, and two-tone input for autopatch or control link purposes.

Among the other exciting features of the CPU-2500R are automatic or manual tone burst/tone call operation, selectable power output of 25W/3W, and a memory backup feature for holding memorized frequencies when the transceiver is turned off, A fully adjustable subaudible tone guarded squelch (TGS) is available as an option.

Famous Yaesu design features include automatic final protection for the output transistors, as well as reversed polarity protection for the supply input. The CPU-2500R is supplied complete with all mounting hardware, cables, and accessories required for mobile use, as well as a stand for base station use. The solid state devices used in the space-age CPU-2500R assure you of many years of trouble-free operation.

SPECIFICATIONS

Frequency range:

144-148 MHz*

144,000 - 147,995 MHz receive

144.010 - 147.995 MHz transmit

*Factory modified to 144-146 MHz,

if required by local regulations.

Synthesizer steps:

10 kHz, with 5 UP switch for intermediate

steps.

Emission type:

F3 variable reactance frequency modulation.

Deviation:

± 5 kHz factory preset, ± 16 kHz maximum

Power output:

25 watts (HI), 3 watts (LOW) @ 13.6 VDC

into 50 ohm load.

Spurious emissions:

Better than 60 dB down.

Antenna impedance:

50 ohms nominal.

Microphone impedance:

600 ohms

Tone burst frequency:

1800 Hz (USA model),

1750 Hz (Europe, etc.)

Receiver type:

Double conversion superheterodyne.

Receiver sensitivity:

0.3 µV for 20 dB OS

Selectivity:

±6 kHz at 6 dB down, ±12 kHz at 60 dB

down.

First IF:

10.7 MHz

Second IF:

455 kHz

Audio output:

1.5 watts @ 10% THD.

Audio output impedance:

8 ohms.

Voltage requirement:

13.6 volts ± 10%

Current consumption:

0.5 A receive

6.0 A transmit (HIGH), 2.5 A (LOW)

Case dimensions:

180 (W) x 72 (H) x 270 (D) mm.

Weight:

3.2 kg.

SEMICONDUCTOR COMPLEMENT

Integrated Circuits				Transistors	
MN9003 (CPU)	1	μPC14305	1	2SA496Y	I
MC14011B	5	μPD857C	1	2SA564Q	9
MC14042B	1	78L05	2	2SA719P	4
MC14069B	1	VP-20A	1	2SC373	1
MC14410	1			2SC496Y	2
MC14556B	1	Field-Effect Transistors		2SC535A	3
MSM5576	1	2SK19BL	1	2SC741	1
TA7060P	1	2SK19GR	3	2SC1000GR	1
TC5081P	1	2SK30AY	1	2SC1815Y	32
µPC575C2	1	3SK40M	3	2SD235-O	1
μPC577H	1	3SK51	3		

Photo-Interrupter		Varactor Diodes		LED Display	
ON1105	2	182209	5	5082-7740	7
		1SV50	1		
Germanium Diodes					
1S188FM	11	Varistor Diode			
		MV103	1		
Silicon Diodes					
181555	28	Zener Diode			
V05B	1	RD8.2EB	Ť		

Specifications subject to change without notice or obligation.

ACCESSORIES

MICROPHONE 1 ea.

The standard microphone comes with a flexible, coiled cord and 6 pin connector for insertion into the front panel microphone jack. The microphone includes a PTT switch and UP/DOWN scanner controls. The keyboard microphone includes a tone pad and remote programming controls.

2. MICROPHONE HANGER 1 ea.

The hanger may be installed wherever convenient for easy access to the microphone.

POWER CORD 1 ea.

The power cord comes equipped with a 10 ampere fuse in the DC line.

4. SPARE FUSES 1 ea.

These fuses are for replacement if the line fuse blows. When replacing fuses, be absolutely certain to use a replacement fuse of 10 amps rating.

WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.

MOBILE MOUNTING BRACKET 1 ea.

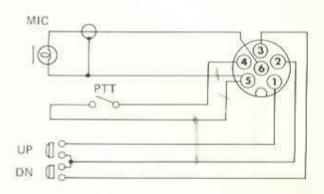
For mobile installations, a universal mounting bracket is supplied.

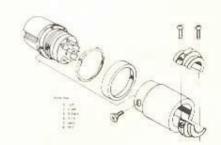
6. STAND 1 ea.

For easy viewing in base station use.

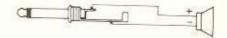
MINIATURE PHONE PLUG 1 ea.

For use of headphones or an external speaker.





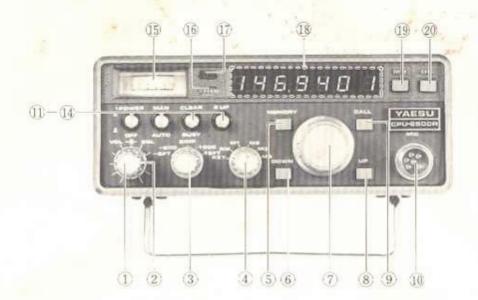
Standard Microphone Connector





Speaker Plug

FRONT PANEL CONTROLS AND SWITCHES



(1) VOL

This is the AF gain (volume) control for the transceiver, Clockwise rotation increases the audio output.

(2) SQL

This is the squelch threshold adjustment control. With no signal present, it should be adjusted to the point where receiver noise just disappears, to provide silent listening.

(3) TX OFFSET SELECTOR

SIMP — This position chooses simplex operation on the main dial frequency or memory frequencies M1-M4.

+600, -600 - These positions select the normal plus or minus 600 kHz repeater offset on the dial or M1-M4 frequencies.

+SFT, -SFT - When the keyboard microphone is used, these switch positions select remotely programmed auxiliary offset frequencies for transmit. In this way, unusual repeat splits may be accommodated.

(4) MEMORY CHANNEL SELECTOR

This six-position switch allows selection of the memorized frequencies as desired by the operator.

KEY – When the keyboard microphone is used, placing the switch in the KEY position allows programming and recall of memory frequencies from the keyboard. RM (RECEIVE MEMORY) — When this position is selected, split operation throughout the range of the transceiver is possible. Memory position M0 is used for reception, while transmission is on the dial frequency. Refer to the "Operation" section for details.

M1-M4 - These are the four main memory channels which may be programmed and recalled.

(5) MEMORY

This switch is used for programming a frequency into memory.

(6) DOWN

This button activates the CPU scanner for scanning lower in frequency. When the lower band edge is reached, the scanner's next step will be to 147.990 MHz (145.990 MHz on the European model), thus assuring in-band operation at all times.

(7) CHANNEL SELECTOR

This is the main tuning dial for the transceiver. It is activated when the DIL button is pushed. Each tuning step is 10 kHz, with the intermediate 5 kHz steps being provided via the 5 UP switch. When the transceiver is initially turned on, the display will indicate 147.000 MHz (145.000 on the European model), and the dial may be tuned from that point to the desired operating frequency. Tuning is via an optical coupling photo-interrupter circuit.

(8) UP

This button activates the CPU scanner for scanning higher in frequency. When the upper band edge is reached, the scanner's next step will be to 144,000 MHz.

(9) CALL

When pushed, this button activates the tone burst and PTT circuit for as long as it remains depressed. In this way, a number of differing repeater access requirements may be accommodated.

(10) MIC

This is the microphone receptacle for the standard microphone. Microphone impedance is 600 ohms.

(11) POWER

Pushing this switch supplies power to all transceiver circuits.

(12) SCAN STOP

When this switch is pressed (MANUAL scan mode), the scanning feature of the CPU-2500R will scan continuously until the microphone PTT switch or the front panel CALL switch is pressed.

When this switch is not pushed (AUTO mode), the scanner will hold on a busy or clear channel, according to the position of the SCAN STOP MODE switch.

(13) SCAN STOP MODE

When using the AUTO scanner, pressing this switch (CLEAR position) will cause the scanner to halt when a clear channel is found. This is very useful when searching for an unused frequency for simplex operation, etc.

In the BUSY position, (switch not pushed), the scanner will stop and hold on an occupied channel. This feature is useful for checking a number of channels for activity.

(14) 5 UP

This switch, when pressed, shifts the operating frequency 5 kHz up from the normal 10 kHz channel spacing.

(15) METER

On receive, signal strength is displayed, and on transmit, relative power output is displayed.

(16) BUSY

This lamp lights when the squelch is tripped by an incoming signal, thus indicating that the frequency is occupied.

(17) ON AIR

This lamp lights up during transmission.

(18) DISPLAY

Full frequency readout is provided by the digital display. As well, the memory channel selected is displayed at the right-hand side.

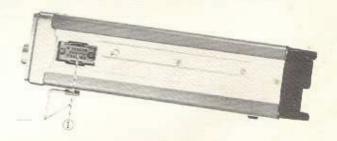
(19) MR (MEMORY RECALL)

This button transfers control from the main dial to the memory channels.

(20) DIL (DIAL)

This switch, when pressed, transfers control from the memory channels to the main tuning dial.

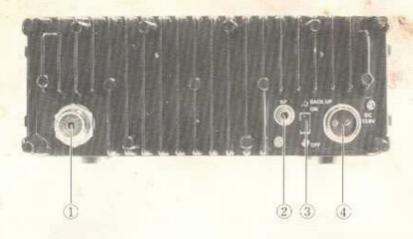
CABINET RIGHT SIDE



(1) KEYBOARD MIC JACK

When the keyboard microphone is used, its input is through this jack.

REAR APRON CONNECTIONS AND SWITCH



(1) ANT

This is the main antenna connector.

(2) EXT SP

This is a miniature phone jack for accommodation of an external speaker. Audio output impedance is 8 ohms, and the internal speaker will be cut off when an external speaker is used via this jack.

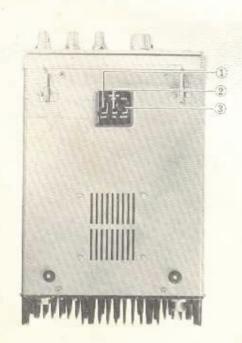
(3) BACKUP switch

When this switch is placed in the ON position, and DC power is still connected to the POWER connector, the memory circuits will still be held in operating condition. If DC power is removed, though, the memorized frequencies will be lost.

(4) POWER

This receptacle accommodates the power cord. A fuse is located in the power cord, rated at 10 amps. WHEN REPLACING FUSES, BE CERTAIN TO USE A FUSE OF 10 AMPS RATING. OUR WARRANTY DOES NOT COVER DAMAGE CAUSED BY IMPROPER FUSE REPLACEMENT.

UNDERSIDE CABINET SWITCHES



(1) LOW POWER SWITCH

In the LOW position, power output will be approximately 3 watts, and in the HIGH position, power output will be approximately 25 watts.

(2) TONE SQ

When the optional tone squelch unit is installed, placing this switch in the ON position will activate the subaudible encoder/decoder.

(3) BURST/CALL

When this switch is placed in the BURST position, a ½ second tone burst will be generated whenever the PTT switch is activated. In the CALL position, pressing the PTT switch will cause no tone to be sent. The front panel CALL button will send a tone and activate the PTT circuit for as long as the switch is pushed, regardless of the position of the BURST/CALL switch.

INSTALLATION

MOBILE INSTALLATION

For mobile service, the CPU-2500R should be installed where the digital display, controls, and microphone are easily accessible for operation. The transceiver may be installed in any position without loss of performance. A suitable location would be atop the transmission tunnel. A universal bracket is supplied with your transceiver for mobile installation. Refer to Fig. 1 for mounting details.

- Use the universal mounting bracket as a template for positioning the mounting holes.
 Use a 3/16" diameter bit for drilling these holes, allowing clearance for the transceiver, its cables and microphone, and its controls.
 Secure the mounting bracket with the screws, washers, and nuts supplied, as shown in the drawing.
- Ease the transceiver into the guide rail, and slide it into the desired position. Tighten the knobs on the outside of the universal bracket to secure the transceiver.
- The microphone hanger may be installed wherever convenient for access to the microphone.

Power connections should be made directly to the automobile battery. Routing through the cigarette lighter may cause the lighter fuse to blow if the fuse is not of sufficient rating. As well, connection directly to the battery allows the memory circuits to remain activated when the ignition is turned off, using the BACK UP switch.

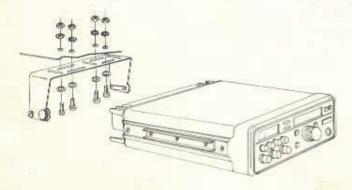


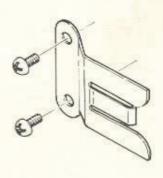
Figure 1

Connect the RED lead of the power cord to the POSITIVE (+) battery terminal, and connect the BLACK lead to the NEGATIVE (-) terminal. If it is necessary to extend the power cable, use #16 AWG insulated copper wire, and use the minimum length practicable to reduce voltage drop.

CAUTION

BEFORE CONNECTING THE POWER CABLE TO THE TRANSCEIVER, CHECK THE BAT-TERY VOLTAGE WITH THE ENGINE RUN-NING (BATTERY CHARGING), IF THE VOLT-AGE EXCEEDS 15 VOLTS DC. THE REGU-LATOR SHOULD BE READJUSTED SO THAT THE HIGHEST CHARGING RATE DOES NOT EXCEED 15 VOLTS. ALSO, BE ABSOLUTELY CERTAIN THAT THE CORRECT BATTERY POLARITY IS OBSERVED WHEN MAKING CONNECTIONS. REVERSED POLARITY WILL NOT DAMAGE THE CPU-2500R BECAUSE OF THE PROTECTIVE CIRCUITRY INCORPO-RATED IN DESIGN. HOWEVER, THE CPU-2500R WILL NOT OPERATE UNDER CON-DITIONS OF REVERSED SUPPLY POLARITY.

Connect the power cable to the POWER receptacle on the rear apron, connect the coaxial cable from the antenna to the rear apron ANT receptacle, and connect the microphone to the jack appropriate for the microphone in use. An external speaker may be connected to the rear apron SP jack, if desired. Use the speaker plug supplied with the transceiver. Insertion of a plug into this jack automatically cuts off the internal speaker.



BASE STATION INSTALLATION

A base station mounting stand is supplied with your transceiver, to provide easier viewing of the display and controls. A power supply capable of supplying 7 amps at 13.6 VDC is required for operation from AC mains. See your Yaesu dealer.

ANTENNA CONSIDERATIONS

The CPU-2500R is designed for operation using an antenna presenting a 50 ohm resistive load. The automatic final transistor protection circuitry will reduce the power output to protect the transistors when a high antenna SWR is encountered. The SWR on the antenna should, if possible, he kept below 1.5:1 at all times to secure full output from the transceiver.

In most cases; coverage is a function of antenna height. The antenna for base station operation should be located as high and in the clear as possible. Vertical polarization is standard for FM communications in most areas, so be sure that your antenna is oriented appropriately. Popular antennas for base station use include the 5/8 wavelength vertical or one of the many stacked dipole arrays. For accessing repeaters a long distance away, a Yagi or other high gain directional array may be required.

For mobile applications, the most popular antennas are the 1/4 wavelength vertical and the 5/8 wavelength vertical, which shows approximately 3 dB gain over the 1/4 wavelength vertical. See your Yaesu dealer for details of the Yaesu RSE-series of antennas for mobile use.

Do not economize on coaxial cable, as much power can be wasted in lossy transmission line. For mobile use, the RG-58A/U type of coax may be used. To minimize loss, use the shortest length that is possible. For base stations, use type RG8A/U coaxial cable. For very long runs, type RG17A/U, aluminum-jacketed "foamflex" coax, or air dielectric "heliax" cable may be used.



OPERATION

INITIAL CHECK

- Rotate the VOL and SQL controls fully counterclockwise. Push the POWER switch to turn the transceiver on. The digital display should read 147,000 MHz (145,000 if your unit is designed only for 144-146 MHz operation).
- 2. Advance the VOL control to the point where background noise is plainly heard. If the channel is clear, advance the SQL control clockwise until the receiver is just silenced, and the BUSY lamp turns off. Do not advance the SQL control past this threshold point, so as not to degrade the sensitivity of the receiver to weak signals. The TONE SQ switch should be OFF for this adjustment.
- Set the HI/LOW switch on the underside of the cabinet to the power level desired.

FREQUENCY SELECTION USING MAIN DIAL

When the transceiver is initially turned on, frequency control will be via the main tuning dial. After memory operation, pressing the DIL button will return control to the main dial. Rotate the dial to secure the operating frequency desired. As the synthesizer steps are 10 kHz increments, pressing of the 5 UP button is required for securing a frequency such as 147.955 MHz. When the upper or lower band edge is reached, the next synthesizer step will automatically be to the opposite band edge. Thus, after 147.990 MHz, the next step is to 144.000 MHz. When a repeater split frequency falls outside the amateur band, the transceiver will disable itself to prevent illegal operation.

Channel selection should not be made while the CPU-2500R is transmitting.

MEMORY OPERATION

In order to store a frequency selected per the preceeding section, proceed as follows: rotate the MEMORY CHANNEL SELECTOR switch to the M1 position and press the MEMORY button. The frequency is now stored. Another frequency can be stored by rotating the MEMORY CHANNEL SELECTOR switch to M2, dialing another frequency, and pressing the MEMORY button again.

In like fashion, memory positions M3 and M4 may be programmed at the discretion of the operator.

To recall a memorized frequency, press the MR button. Now frequency control is in the memory circuitry. Rotating the MEMORY CHANNEL SELECTOR to positions M1-M4 will select the desired frequency. To return frequency control to the main tuning dial, push DIL.

For holding memorized frequencies after the transceiver is turned off, activate the rear apron BACK UP switch (before the CPU-2500R is turned off). Remember that power must be applied to the rear apron power connector for this backup function to be performed. Current drain during backup operation is approximately 30 mA.

SCANNER OPERATION

Press the front panel DIL and MAN switches. Pressing the UP switch will now cause the CPU scanner to scan higher in frequency in 10 kHz steps. Pressing the microphone PTT switch or the front panel CALL button will halt the scan without transmitting a signal. A second press of the PTT or CALL switch will cause the transmitter to be activated.

In like fashion, pressing the DOWN button will cause the scanner to scan lower in frequency. Press the PTT or CALL buttons to halt the scan.

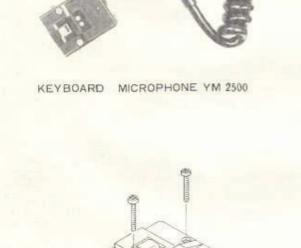
If frequencies are programmed in the memory slots, pressing MR and either the UP or DOWN button will cause the four memory channels to be scanned. The scan may be halted as described previously.

To secure automatic stopping of the scan at a desired frequency, set the SCAN STOP switch to AUTO. Now, when the SCAN STOP MODE switch is in the BUSY position, the scanner will hold on the first channel it finds which is occupied (containing a signal strong enough to trip the squelch). When the SCAN STOP MODE switch is in the CLEAR position, the scanner will stop when it finds a clear channel. Note that, when the SCAN STOP MODE switch is in the BUSY position, the squelch must be adjusted to mute the receiver under no-signal conditions; otherwise, if the SQL control is fully counter-clockwise, for example, the scanner will only advance one channel at a time, thinking that a busy channel has been found.

When using the optional tone squelch, the auto scan is controlled by the main squelch, not the tone squelch. Thus, the scan may be halted in the BUSY mode by a signal not breaking the tone squelch.

When using the standard microphone, pressing the UP or DOWN switches on the microphone will have the same effect as the UP and DOWN switches on the front panel of the CPU-2500R.





KEYBOARD MICROPHONE OPERATION

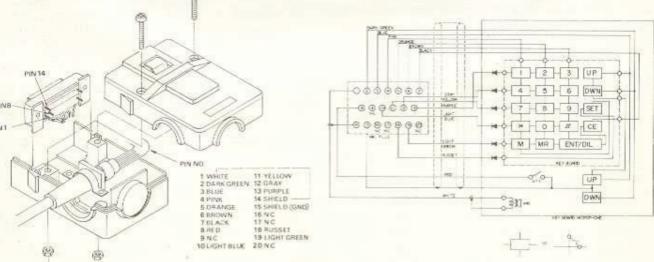
The keyboard microphone for the CPU 2500R allows remote programming of memory frequencies, dialing in of transceive frequencies, remote actuation of the scanner, and remote programming of auxiliary splits for repeaters.

PTT and scanning operation is identical to that of the standard microphone.

When the PTT switch is depressed for transmission, the keyboard becomes a tone pad for accessing autopatch facilities on repeaters, or for other control purposes. The two-tone audio frequencies are shown in Fig. 2. VR₉₀₁, located on the MONITOR UNIT (PB-1897), sets the level for the speaker monitor of the two-tone signal, VR₉₀₁ sets the two-tone audio output level to the transmitter.

			IGH TO	IA77Hz
	697Hz	1	2	3
LOW 770Hz TONE	Ī	4	5	6
	7	8	9	
	941Hz	*	0	#

Fig. 2



For dialing in an operating frequency, place the front panel MEMORY CHANNEL SELECTOR switch in the KEY position. To dial in 146.52 MHz, press "652" and DIL. 146.52 MHz will now be your operating frequency. Do not press "6520", as the final digit is already programmed. If four numbers are addressed, the display will, when you press DIL, indicate "14E.__" which means an error has been made. Press CE (Cl ear Entry) to erase the mistake and return to the original operating frequency.

If you should press "6520" but not DIL, simply press "652" again, then DIL. The digits will simply be shifted in the register, making error correction easy. When "14E.___" is displayed, the transmitter will not function, thus preventing out-of-band operation.

Press	Display	Comments
DIL	146.450	Original frequency.
6	14 . 60	Program 146.520 MHz.
5	14 .650	
2	146.520	
ENT/DIL	146.520	Correctly programmed.

To store 146,940 MHz in memory position M1, press "694" and DIL. Now press "1" and M on the key-board. 146,940 MHz will now be stored in M1. To store 146,520 MHz in M2, press "652" and DIL, then press "2" and M. To recall 146,940 MHz, press "1" and MR. To recall 146,520 MHz, press "2" and MR. The other memory channels may be treated in like fashion.

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Now program 146,940 MHz.
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly entered.
1	14 . 10	Enter 146.940 into memory position 1.
M	146.940	Correctly stored in M1.

The following examples will demonstrate typical input errors when using the keyboard microphone, as well as the remedial action required.

OVERFLOW ERROR CORRECTION

Press	Display	Comments
	146.520	Original frequency,
6	14 . 60	Now program 146.940 MHz.
9	14 .690	
4	146.940	
0	14 . 00	Overflow.
ENT/DIL	14E. 0	Error.
CE	146.520	Return to original frequency, try again.
6	14 . 60	
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly entered.

IMPROPER MEMORY CHANNEL PROGRAMMING

Press	Display	Comments
	146.520	Original frequency
6	14 . 60	Program 146.940 into memory.
9	14 .690	
4	146.940	A STATE OF THE STA
ENT/DIL	146.940	A CONTRACTOR OF THE PARTY OF TH
5	14 . 50	
M	14E. 0	No memory position 5, error detected.
CE	146.940	Clear, return to programmed frequency.
2	14 . 20	Try again.
M	146.940	146.940 correctly stored in memory position, 2

SCANNING WITHOUT FREQUENCY DISPLAYED

Press	Display	Comments
	146.520	Original frequency.
6	146. 60	Program 146.940 MHz.
DN or UP	14 . 0	Scanning, no display.
CE	14 . 0	Scanning, no display, CE will not clear.
PTT sw.	146.680	Scan halted normally, scan stop frequency displayed.

USE OF OVERFLOW FOR ERROR CORRECTION

Press	Display	Comments
	146,520	Original frequency.
6	14 . 60	Program 146,940 MHz.
9	14 .690	CV. MOVE SHIP SHIP SHIP SHIP SHIP SHIP SHIP SHIP
5	146.950	Pressed wrong button.
6	14 . 60	No need to clear, deliberately overflow.
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly programmed.

FAILURE TO PRESS ENT/DIL

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Program 146.940 MHz.
9	14 .690	
4	146.940	
PTT sw.	14E. 0	Transmit, did not press ENT/DIL,
PTT off	146.520	Returned to original frequency, no transmission occurred.
6	14 . 60	Try again.
9	14 .690	
4	146.940	
ENT/DIL	146.940	Correctly programmed.

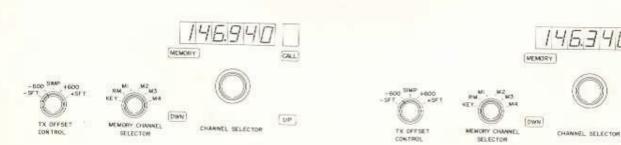
ATTEMPTS TO PROGRAM OUTSIDE BAND

Press	Display	Comments
16 10 10	146.520	Original frequency,
8	14 . 80	Program 148.880 MHz.
- 8	14 .880	
8	148.880	
ENT/DIL	14E. 0	Error, frequency outside band.
CE	146.520	Return to original frequency.
	146.520	Original frequency.
8	14 . 80	Mistake, intended to press 7.
CE	14 . 0	Clear register.
7	14 . 70	Program 147.390 MHz.
3	14 .730	110gram 147.390 MHz.
9	147.390	
ENT/DIL	147.390	Correctly programmed.
	146.520	Original frequency,
8	14 . 80	Program 148.880 MHz.
8	14 .880	
8	148.880	
ENT/DIL	14E. 0	Error, frequency outside.
DN or UP	14E. 0	Pressed scan switch with no frequency programmed.
CE	14E. 0	CE does not clear here.
PTT sw.	14E. 0	
CE	146.520	Return to original frequency.

REPEATER OPERATION

Repeater operation is easily accomplished with the CPU-2500R. Placing the front panel TX OFFSET SELECTOR switch in the +600 or -600 position will provide transmit frequency offset of +600 kHz or -600 kHz, respectively. In the United States, -600 kHz shift is generally used between 144 and 147 MHz, while +600 kHz is used above 147 MHz.

STANDARD ± 600 kHz REPEATER SHIFT OPERATION



Choose receive frequency on dial. TX OFFSET to -600.

Press PTT switch; TX frequency displayed.

0#



Choose receive frequency on dial. TX OFFSET to +600.

Press PTT switch; TX frequency displayed.

To program an auxiliary split when using the standard type microphone, set the CPU-2500R dial to the desired receive frequency (repeater output frequency). Rotate the MEMORY CHANNEL SELECTOR switch to the RM (Receive Memory) position. Press the MEMORY switch to store the receive frequency in memory. Now, rotate the main tuning dial to the desired transmitting frequency. Press the MR switch, and you will be receiving on the memorized frequency (stored in the M0 position), while transmitting on the dialed frequency. If you wish to change the transmit frequency, press DIL again, dial in a new TX frequency, press MR again, and the new combination will be programmed.



Choose receive frequency and press MEMORY switch.
MEMORY CHANNEL SELECTOR to RM.



Choose transmit frequency.

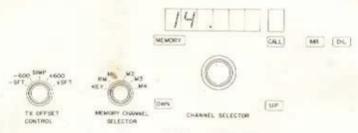


Press MR switch to recall receive frequency.



Press PTT switch; TX on dial frequency.

When the keyboard microphone is used, the above operation is accomplished thus: dial in the desired receive frequency on the keyboard. Press DIL, "0" (zero), and M. Now dial in the desired transmit frequency on the keyboard, and press MR. The auxiliary split is now programmed. To program another TX frequency, press DIL, dial in the new frequency, press DIL, then press "0" M and MR to program the new split.



Set to KEY position.

Press	Display	Comments
	146.520	Original frequency.
6	14 . 60	Program 146.940 into Receive Memory (M0).
9	14 .690	
4	146.940	
ENT/DIL	146.940	Frequency now entered.
0	14 . 00	Store frequency in M0.
M	146.940	Frequency now stored correctly.
6	14 . 60	Program 146.240 as transmit frequency,
2	14 .620	The factors of the control of the factors of the control of the co
4	146.240	
ENT/DIL	146.240	Transmit frequency entered.
MR	146.940	SELECT sw. to RM. RX on 146,940.
PTT sw.	146.240	On the air, TX on 146.240.

If a particular frequency shift is frequently used, the shift may be programmed from the keyboard microphone. For example, to program a +700 kHz shift, dial in "70" on the keyboard, push SET, then place the TX OFFSET SELECTOR to the +SFT (+SHIFT) position.

Press	Display	Comments
	146.940	Original frequency.
7	14 . 70	Set automatic shift of 700 kHz.
0	14 .700	TX OFFSET SELECTOR TO -SFT.
SET	146.940	Shift of -700 kHz now programmed.
PTT sw.	146.240	On the air, TX on 146.240.

Place TX OFFSET SELECTOR to +SFT for +700 kHz shift.



T SEFT REM

Set to +SFT.

± 600 kHz shift.

MEMORY CHANNEL



No shift,

This may be extended to any frequency within the operating range of the transceiver. For example, it is possible to program a shift of 2.2 MHz down as follows: dial in "220" on the keyboard, press SET, and then set the TX OFFSET SELECTOR to + or — SFT, as desired. If the shift is outside the amateur band, the display will indicate that an error has been made when the PTT switch is activated, thus preventing illegal operation.

Be careful when using alternative splits not to interfere with the operation of other users. For example, the inadvertant transmission of FM near 144,100 MHz might cause interference to weak-signal DXers or other operators using SSB or CW. THINK BEFORE YOU SHIFT!

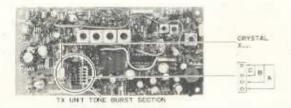
Tone-actuated repeaters can be accessed by means of the built-in tone burst generator, which is activated by placing the BURST/CALL switch (cabinet bottom) in the BURST position. In this mode, pushing the microphone PTT switch will cause insertion of the burst signal at the beginning of each transmission. In the CALL position, pushing the front panel CALL button will activate the tone and the PTT for as long as the button is depressed.

The audio frequency of the tone burst signal may be programmed for any frequency between 671 and 2900 Hz, by use of a crystal and by positioning the selector plug on the tone burst unit. The US model normally is set up for 1800 Hz operation, and the European model for 1750 Hz operation. The charts will show the relation between the position of the selector plug, the crystal frequency, and the tone frequency. Moving the selector plug will change the tone frequency by a factor of two or four, as shown in the charts.

Tone Frequency	Multiplier	Plug Position	Crystal Frequency
671 - 1342	4096	A	2750 - 5500
1343 - 2685	2048	В	2750 - 5500
2686 - 2900	1024	C	2750 - 2970

Crystal frequency = Tone frequency × Multiplier.

Table 1



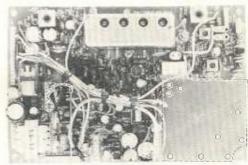
OPTIONAL TONE SQUELCH OPERATION

The optional tone squelch circuit consists of a subaudible encoder and decoder which can provide selective communication on otherwise busy channels. The tone frequency is preset to 77 Hz at the factory.

When the TONE SQ switch on the bottom of the cabinet is placed in the ON position, the receiver will be quieted until a signal containing an identical audio tone is received, at which time the tone squelch will activate the receiver.

If other stations are present on the channel, without the tone squelch signal, the front panel BUSY lamp will light up, indicating that the channel is in use.

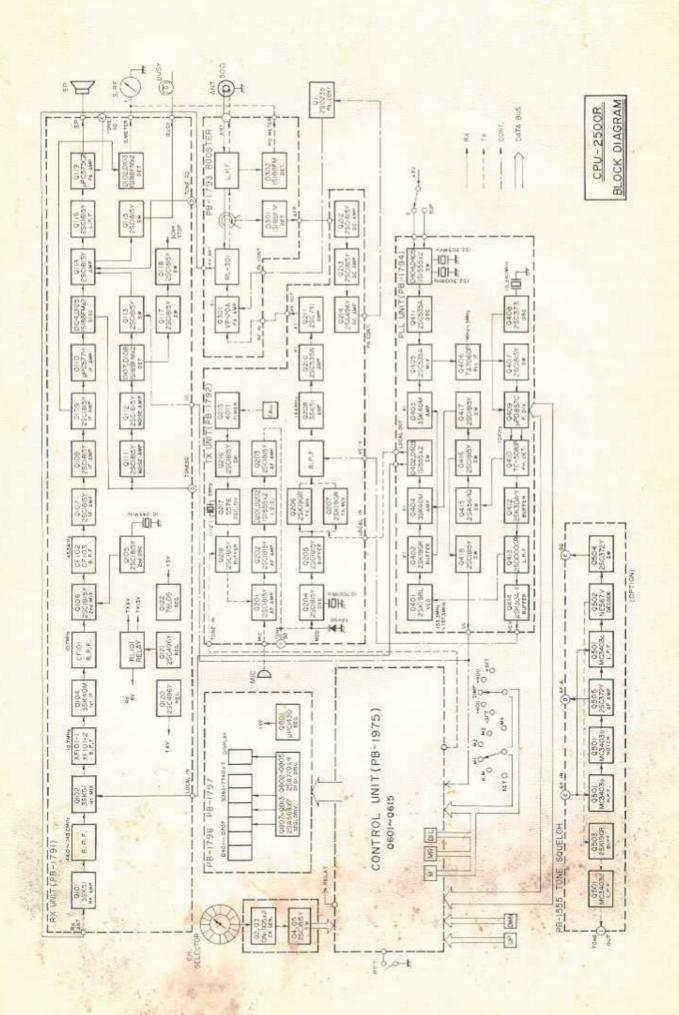
Before transmitting on a channel, make sure that the BUSY lamp is not lighted, to avoid interference to other users. The purpose of the tone squelch system is to provide silent listening on a channel where there are many stations calling. It is not designed to allow two stations equipped with tone squelch to have priority use of a channel.



RED WIRE MUST BE CUT WHEN TONE SQUELCH UNIT INSTALLED.



TONE SQUELCH INSTALLATION (OPTION)



CIRCUIT THEORY

The block diagram and circuit description to follow will provide you with a better understanding of this transceiver. Refer to the schematic diagram for specific component details.

The CPU-2500R consists of a transmitter and a double-conversion superheterodyne receiver. A phase lock loop synthesizer provides channel selection over the entire 144–148 MHz band, in conjunction with the optical coupling system. The frequency range may be limited at the factory to 144–146 MHz or 144–148 MHz, to conform to local regulations. Solid state circuitry is employed throughout the CPU-2500R, which is designed for operation from a 13.6 VDC ± 10% negative ground power source.

TRANSMITTER

The transmitter produces a frequency modulated signal. The audio signal from the microphone is set to a proper level by VR₂₀₁, and is amplified by Q₂₀₁, Q₂₀₂, and Q₂₀₃ (2SC1815Y). The audio output from Q₂₀₂ is coupled to the instantaneous deviation control (IDC), where both positive and negative peaks are clipped by diodes D₁₀₁ and D₁₀₂ (1S1555). The output from Q₂₀₃ is fed through a low-pass filter consisting of C₂₁₃, L₂₀₁, and C₂₁₄, thus eliminating harmonics above the speech range caused by clipping. The deviation level is set by VR₂₀₂, and it is adjusted at the factory for a nominal deviation of ± 5 kHz.

The speech signal is then applied to a phase modulator varactor diode D203 (1SV50), which varies the frequency of the 10.7 MHz crystal controlled oscillator Q204 (2SC1815Y). The frequency modulated 10.7 MHz signal is then amplified by buffer amplifier Q205 (2SC1815Y) and fed to a balanced mixer consisting of Q206 and Q207 (2SK19GR). Here the signal is converted up to 144-148 MHz by mixing with the 133.3-137.3 MHz signal supplied from the VCO (voltage controlled oscillator) on the PLL UNIT. The output from the balanced mixer is fed through a bandpass filter consisting of T203-T206 to amplifiers Q208 (3SK51), Q₂₀₁ (2SC535A), and Q₂₁₁ (2SC741). providing 200 mW of drive to the RF POWER UNIT. T203-T206 are tuned to the transmitting frequency by varactor diodes D205-D208 (1S2209). PA amplifier module Q301 (VP-20A) provides 25 watts of RF energy through a diode switch and low-pass filter into a 50 ohm load.

A small portion of the RF output is rectified by diode D₃₀₂ (1S188FM); the resulting DC voltage is fed to the front panel meter for an indication of the relative power output from the transmitter. VR₃₀₃ allows setting of the relative power output meter deflection range. The DC output from D₃₀₂ is also fed to the control unit for activation of the ON AIR lamp while transmitting.

If the transmitter is activated without an antenna being connected, or if a high VSWR is present at the antenna receptacle, the reflected power is detected through T₃₀₁ and D₃₀₁ (IS188FM), producing a DC voltage. Q212 (2SC1815Y) conducts with the application of DC voltage through VR302, causing a decrease in the collector current of O213 (2SC1815Y). As a result, the collector voltage of Q214 (2SA496Y) drops, causing Q212 to decrease current and supply voltage to the PA transistor, thus protecting that component. The threshold level is set by VR302. This circuit is also used to switch the power output down to 3 watts when the HIGH/LOW switch is placed in the LOW position. The amount of power reduction is set by VR204.

The tone burst circuit consists of a timing generator and a gated multivibrator, With the BURST/CALL switch in the BURST position, a DC voltage is applied to trigger Q₂₁₅ (4011), which generates a pulse of 0.5–1 second duration. The pulse switches Q₂₁₆ (2SC1815Y) to supply DC voltage to Q₂₁₇ (MSM5576), where the clock signal is divided by 1024, 2048, or 4096, producing an accurate tone burst signal. The burst signal is fed to the base of microphone amplifier Q₂₀₁. The front panel CALL button provides a manual switch for actuation of the audio tone, as well as the transceiver PTT. The tone level is set by VR₂₀₆, while the burst length is set by VR₂₀₅. RECEIVER

The input signal from the antenna is fed through a low-pass filter consisting of L₁, L₃₀₁, C₂, C₃₀₁ – 303, and C₃₁₃, and T/R relay RL₃₀₁, to RF amplifier Q₁₀₁ (3SK51), a dual-gate FET. The amplified signal is then fed through a four-stage high-Q co-axial resonator to the first mixer, Q₁₀₂, (3SK51). This front end configuration provides high immunity from cross modulation and other spurious responses, while providing a low system noise figure.

- 18 -

The 144—148 MHz signal is heterodyned with the first local oscillator, producing a 10.7 MHz first IF signal. The first local oscillator signal is delivered from the PLL VCO circuit. The first IF signal is fed through crystal filter XF-101, which has a passband of ±15 kHz, and amplified by IF amplifier Q₁₀₄ (3SK51). The amplified IF signal is fed through CF-101, and then delivered to the second mixer, Q₁₀₆ (2SC1815Y), where the heterodyne signal of 10.245 MHz from Q₁₀₅ (2SC1815Y) is injected; the result is a 455 kHz second IF signal. CF-101, with a bandwidth of ±200 kHz, prevents image responses (produced by mixing) from degrading receiver performance.

Cascaded ceramic filters CF₁₀₂ and CF₁₀₃ provide a ±7.5 kHz bandwidth for the receiver. IF amplifiers Q₁₀₇—Q₁₀₉ (2SC1815Y) deliver the 455 kHz IF signal to Q₁₁₀ (µPC577H), where any amplitude variation is eliminated. The signal is then delivered to ceramic descriminator CD₁₀₁ and diodes D₁₀₄ and D₁₀₅ (1S188FM).

The discriminator produces an audio output in response to a corresponding frequency shift in the IF, signal. The audio output signal is amplified by Q₁₁₄ and Q₁₁₆ (2SC1815Y) for application across the VOLUME control VR_{1a} to the input of Q₁₁₉ (μPC575C2), which delivers 1.5 watts of audio to the loudspeaker. The audio response is shaped by the low pass filter at Q₁₁₆.

A portion of the 455 kHz IF signal is rectified by D₁₀₂ and D₁₀₃ (1S188FM) for S-meter indication. VR₁₀₁ provides calibration of the S-meter deflection level.

When no carrier is present in the 455 kHz IF, the high frequency noise at the discriminator output is amplified by Q₁₁₁ and Q₁₁₂ (2SC1815Y) and detected by D₁₀₇ and D₁₀₈ (1S188FM), producing a DC voltage. This voltage activates switch Q₁₁₃ (2SC1815Y). As Q₁₁₃ conducts, the base of Q₁₁₄ is grounded, thus disabling the audio amplifier. When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator output; the audio amplifier then returns to normal operation.

When the squelch circuit opens (Q₁₁₄ conducting), lamp driver Q₁₁₅ (2SC1815Y) draws current, causing the BUSY lamp to light up. The squelch is preset by VR₁₀₂, and VR_{1b} is the front panel SQL control.

HETERODYNE OSCILLATOR

The heterodyne signal is generated by the PLL (phase lock loop) circuit consisting of a voltage controlled oscillator (VCO), a reference crystal oscillator, a programmable divider, and a phase comparator.

VCO oscillator Q₄₀₁ (2SK19GR) generates a 133.3-137.3 MHz signal. The oscillator frequency is controlled by varactor diode D₄₀₁ (1S2209), which varies the capacitance of a tuned circuit consisting of L₄₀₁, TC₄₀₁, and C₄₀₄, C₄₀₆ in accordance with a DC voltage supplied from phase comparator Q₄₀₁ (TC5081).

The output signal from Q₄₀₁ is amplified by buffer amplifiers Q₄₀₂ (2SK19GR) and Q₄₀₄ (3SK40M) and fed through diode switch D₄₀₂/D₄₀₃ (1S1555) to the receiver or transmitter mixers.

A portion of the output from Q₄₀₄ is fed through buffer amplifier Q₄₀₃ (3SK40M) to a PLL mixer Q₄₀₅ (2SC535A), producing a 1-5 MHz PLL IF signal through mixing with the PLL heterodyne signal.

The PLL heterodyne signal is generated by an overtone-crystal-controlled oscillator Q411 (2SC535A).

Diode switches D₄₀₄ and D₄₀₅ (1S1555) select the appropriate crystal in accordance with the TX OFFSET SELECTOR switch and the 5 UP switch. The output from Q₄₁₁ is fed to the PLL mixer Q₄₀₅.

Crystal oscillator Q₃₁₂ (2SC373) generates a 10.24 MHz signal, and its output is fed to scaler/divider Q₄₀₉ (µPD857C), where a 10 kHz reference signal is produced.

Digital phase comparator Q₄₀₁ (TC5081P) compares the phase of the PLL IF signal with that of the reference signal, and any phase difference is converted into an error correcting voltage. This error correcting voltage is fed through buffer Q₄₁₂ (2SK30AY) and amplifier Q₄₁₃ (2SC1000-GR) to varactor diode D₄₀₁, which changes the output signal phase to lock with that of the reference signal.

When the VCO is locked, the constant voltage at pin 4 of Q₄₁₀ is applied to Q₄₁₅ (2SA564Q), causing it to conduct; in turn, Q₄₁₆ (2SC1815Y) cuts off. The "H" voltage at the collector of Q₄₁₆ turns Q₄₁₇ (2SC1815Y) ON, supplying DC voltage to the earlier exciter stages Q₄₀₂ and Q₄₀₄. When the VCO is unlocked, the DC voltage at the emitter of Q₄₁₇ drops, preventing normal operation of Q₄₀₂ and Q₄₀₄.

The output voltage from Q_{416} is reversed in polarity by Q_{417} (2SC1815Y) and applied to Q_{418} (2SC1815Y), keeping the collector of Q_{418} "H" in order to drive the digital display. The voltage is also applied to Q_{113} (2SC1815Y), which supplies DC voltage to audio amplifier Q_{114} .

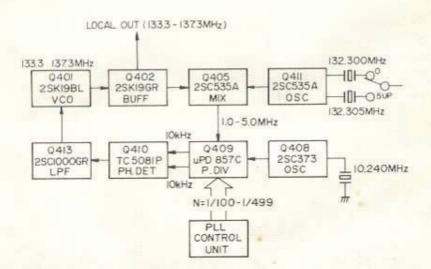
When the VCO is unlocked, the collector DC voltage drops, causing the LED's to turn off; simultaneously, audio amplifier Q₁₁₄ is muted, silencing the receiver. The receiver remains muted until VCO lock is achieved.

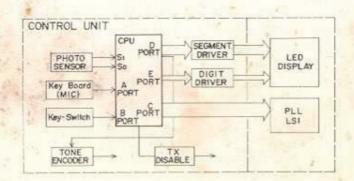
PLL CONTROL

Control of the PLL circuitry is by means of a 4-bit central processing unit (CPU). The CPU controls frequency selection by means of the main tuning dial, the scanners, the memory, and the keyboard microphone. The necessary memory storage capability is provided for in a read-only memory, located within the CPU.

DISPLAY

The digital display consists of 7 seven-segment light emitting diode display digits, D₇₀₁ –D₇₀₇ (5082–7740). Drivers Q₈₀₂–Q₈₀₅(2SA719) and segment drivers Q₈₀₇–Q₈₁₃ (2SA564) provide the necessary input to drive the display correctly.





POWER SUPPLY

A DC 13.6 VDC is required for operation of the transceiver, DC 13.6 VDC is used for audio PA Q₁₁₉, relay RL₃₀₁, and the lamps. The supply voltage to the driver and transmitter PA is fed through voltage regulator Q₁ (2SD235), which is controlled by the HIGH/LOW switch and the automatic final protection circuit.

Voltage regulator Q₈₀₁ (μPC14305) regulates the supply voltage at 5 VDC to supply the memory backup circuit, thus holding the memorized frequencies when the transceiver is turned off. Q₁₂₀ (2SC496Y) provides a regulated 8 VDC for the control circuitry, Q₁₂₁ (2SC496Y) provides 8 volts for the receiver strip and the transmitter low level circuits, Q₁₂₂ provides 5 VDC for the logic circuits.

OPTIONAL TONE SQUELCH CIRCUIT

The tone squelch circuitry permits selective calling and listening on otherwise busy channels. The encoder transmits a subaudible low-frequency tone, and the decoder mutes the receiver until a similar subaudible tone is received on an incoming signal. The tone signal can be set to any frequency within the range of 70–250 Hz.

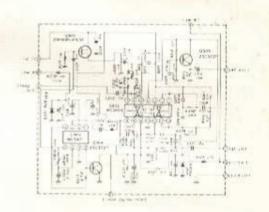
The tone signal is generated by Q₅₀₂ (NE567); its frequency is set by R₅₁₆, VR₅₀₂, and C₅₁₆. The level of the tone signal is set by VR₅₀₄ and fed through buffer amplifier Q₅₀₃ (2SK19GR) to a low-pass filter consisting of the "d" unit of operational amplifier Q₅₀₁ (MC3403). The tone signal is then superimposed on the speech signal. The constants for setting the frequency are obtained from Table 2.

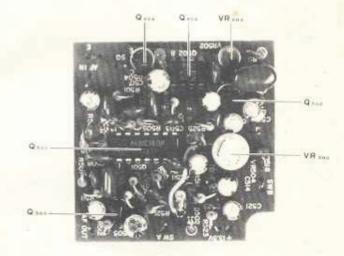
The audio output from the receiver discriminator is fed to unit "a" of Q_{501} . Unit "a" forms a high-pass filter, while unit "b" forms a T-notch filter. Both filters remove the tone signal from the audio signal which subsequently is fed through audio amplifier Q_{505} (2SC372Y) to the receiver audio amplifier Q_{114} .

The tone signal passes through a low-pass filter at unit "c" of Q_{501} , and is fed to Q_{502} . When the tone frequency on the incoming signal matches that of the transmitted signal from the CPU-2500R, the voltage at pin 8 of Q_{502} becomes low, causing Q_{504} (2SC372Y) to switch off. In turn, proper bias is applied to Q_{119} for normal operation.

Without a proper tone signal, Q_{504} conducts, removing bias from Q_{119} , and hence disabling the audio circuit.

As the conventional squelch circuit is operative when the tone squelch is switched in, the BUSY lamp will light up when the channel is occupied, indicating that no transmission should be made out of courtesy to the other operators.





	CS18	it 516 ⁵⁰	R 513 *	R 514	R 524
JOHn † 160Hn	4.15#F	39KO	15KΩ	€78KΩ	ыка
160Hz 250Hz	9.1#F	3980	8.2KΩ	270KG	8.2XD

Table 2

TONE SQUELCH UNIT (OPTION)

MAINTENANCE & ALIGNMENT

GENERAL

The CPU-2500R has been carefully aligned and tested at the factory prior to shipment. The reliability of the solid-state devices used in the CPU-2500R should provide years of trouble-free service if the transceiver is not abused, and if normal, routine maintenance is carried out.

THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED IN ORDER TO PREVENT DAMAGE TO THE TRANSCEIVER:

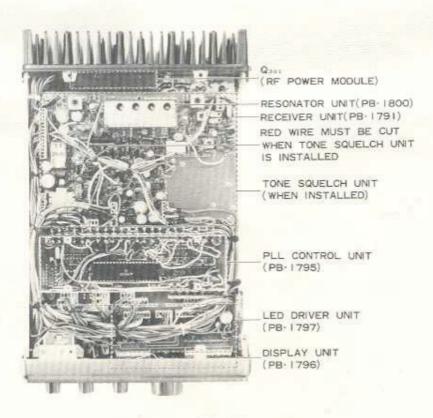
- (1) Do not exceed 15 volts DC at the power receptacle. When operating mobile, check the battery voltage under load (transmitter keyed) with the engine running fast enough that the ammeter shows a charge. As well, do not operate the CPU-2500R if the battery voltage is below 12 VDC.
- (2) Avoid prolonged exposure to direct sunshine, and do not expose the transceiver directly to water.

ROUTINE MAINTENANCE

Routine maintenance should be limited to keeping the transceiver clean, and making periodic checks of the transmitter power output and the receiver sensitivity.

Cleaning:

When the transceiver has been used in a dusty or sandy area, the interior may require periodic cleaning. A vacuum cleaner may be used for loose dirt, while caked or otherwise accumulated dirt may be removed with a soft brush. Check the interior to make sure that it is completely dry before replacing the case and operating the transceiver. The exterior may be wiped with a damp cloth as often as needed.



PERFORMANCE CHECKS

Make all performance checks at 13.5 VDC under load,

Check the transmitter output as follows:

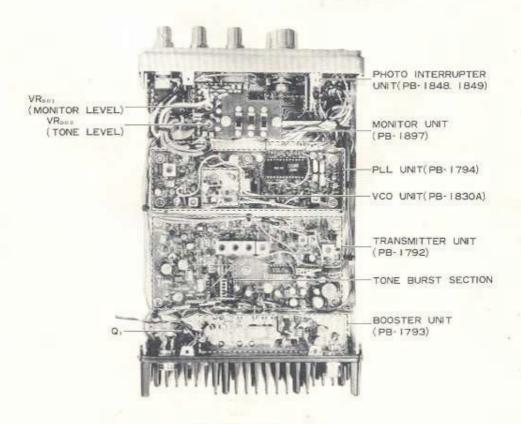
- (a) Connect a suitable dummy load/RF wattmeter to the ANT receptacle.
- (b) Set the channel selector to any channel and key the transmitter. Observe the RF power output, which should be approximately 25 watts (HIGH). The S-meter should indicate between 6 and 8 on the relative output scale at full power.

Check the receiver sensitivity as follows:

- (a) Connect an AC voltmeter to the SP receptacle, and set the SQUELCH control fully counterclockwise.
- (b) Connect the RF output of a precision VHF signal generator to the ANT receptacle. Note the VTVM reading with no signal generator input. Adjust the VOLUME control and the

- VTVM range, as required, to obtain approximately a full scale reading on the VTVM. Do NOT change the VOLUME control setting after this adjustment is made.
- (c) Set the signal generator to the receiving frequency of the transceiver, and adjust the output amplitude of the signal generator until the VTVM reads 1/100th (20 dB decrease) of the reading in step (b). The signal generator output voltage at this point is the 20 dB quieting sensitivity, and the level should be approximately 0.3 μV.

If the above performance checks indicate the need for realignment, it is recommended that the unit be returned to your dealer for servicing. The sophisticated CPU and control circuitry, in particular, are so critical that they should not be touched by other than an experienced technician. Attempts to realign the transceiver tuned circuits without the proper test equipment may result in degraded transceiver performance.



BOTTOM VIEW

ALIGNMENT

SOME OF THE FOLLOWING ALIGNMENT PROCEDURES REQUIRE SPECIALIZED TEST EQUIPMENT AND TECHNIQUES, AND SHOULD ONLY BE PERFORMED BY AN EXPERIENCED TECHNICIAN.

RECEIVER -

(1) RF Amplifier

- Connect a calibrated VHF signal generator to the antenna receptacle, and set the channel selector to 147,000 MHz.
- b) Tune the signal generator to the receive frequency, and peak L₁₀₁, L₁₀₄, TC₁₀₁ -TC₁₀₄, T₁₀₁, and T₁₀₂ for a maximum S-meter reading.

(2) First IF Amplifier

- Connect a sweep generator to the second gate of Q₁₀₂. Connect an oscilloscope through a detector to the drain of Q₁₀₃.
- b) Set the frequency of the sweep generator to 10.7 MHz, and apply output from the generator. Adjust T₁₀₁ until the scope pattern illustrated in Figure 3 is obtained.

10.7

Fig. 3

 c) Disconnect the sweep generator and scope, Measure the RF injection voltage to the second gate of Q₁₀₅. A nominal value is 1 volt RMS.

(3) S-Meter Sensitivity

- a) Apply the output from the signal generator to the antenna receptacle. Peak T₁₀₃ for a maximum S-meter reading on the generator signal.
- Set the output level of the signal generator to 20 dB, and adjust VR₁₀₁ for a full-scale deflection of the S-meter.

(4) Noise Squelch Threshold

- a) Apply a 0 dB signal from the signal generator at 147,000 MHz.
- b) Set the front panel SQL switch to the fully clockwise position. Adjust VR₁₀₂ until the squelch just opens. Do not advance VR₁₀₂ past the threshold point.

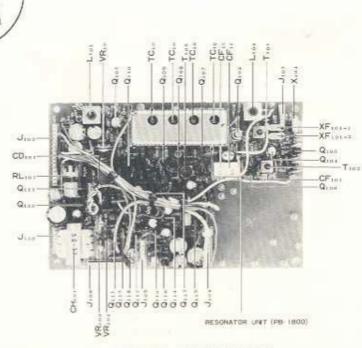
Counter clockwise Clockwise Clockwise Clockwise



Front View



Rear View



RECEIVER UNIT(PB-1791)

- Place the TONE SQ switch in the ON position. Set the signal generator output to -10 dB.
- d) Adjust VR₁₀₃ until the squelch threshold is found. Do not vary VR₁₀₃ away from the threshold point:
- e) Turn off the signal generator,
- f) Rotate the front panel SQL control until the squelch threshold is found. Back off on the SQL control very slightly so that the receiver is just muted. Now apply output from the signal generator. A signal of approximately -12 dB should be required to trip the squelch.

TRANSMITTER ALIGNMENT (Align at 146,000 MHz)

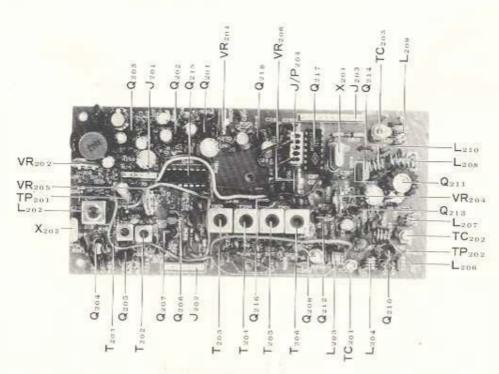
Note: When making the automatic final protection (AFP) circuit adjustment, be certain to follow the instructions regarding connection of the dummy load explicitly. If no load is connected when the AFP is out of alignment, the final transistor may be damaged.

(1) 10.7 MHz TX Alignment

- a) Connect the RF probe of a VTVM to TP₂₀₁.
 - Adjust T₂₀₁ for a maximum indication on the VTVM. A nominal value is 550 mV RMS.
 - Connect a frequency counter to TP₂₀₁, and adjust L₂₀₂ for a reading of 10,700 MHz ± 100 Hz on the counter.

(2) Mixer/Interstage Alignment

- Connect a dummy load/wattmeter to the antenna jack.
- b) Connect the RF probe of a VTVM to gate 1 of Q₂₀₈.
- c) Close the microphone PTT switch, and adjust T₂₀₁-T₂₀₆ for a maximum VTVM indication. A nominal reading is 100 mV RMS.
- d) Connect a DC voltmeter to TP₂₀₂, and adjust T₂₀₁ -T₂₀₆ and TC₂₀₁ for a maximum reading on the DC voltmeter.
- e) Remove the DC voltmeter, and adjust T₂₀₁-T₂₀₆ and TC₂₀₁-TC₂₀₃ for maximum power output as indicated on the wattmeter.



TRANSMITTER UNIT(PB-1792)

(3) Modulator Alignment

- Set up the test equipment as specified in Figure 4.
- b) As shown in Figure 4, set VR₂₀₁ and VR₂₀₂ to the center of their ranges. Apply a signal of 1 kHz at 25 mV from an audio oscillator connected to the microphone jack.
- c) Short the PTT connection at pin 4 of the mic jack to ground. Adjust VR₂₀₂ for an indication of ± 4.5 kHz on the deviation meter.
- d) Set the audio generator for an output of 2.5 mV. Adjust VR₂₀₁ for a deviation of ± 3.5 kHz as indicated on the deviation meter.

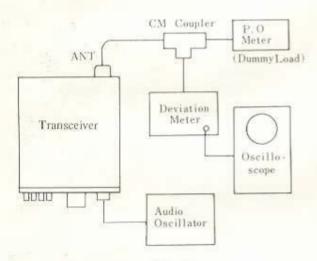


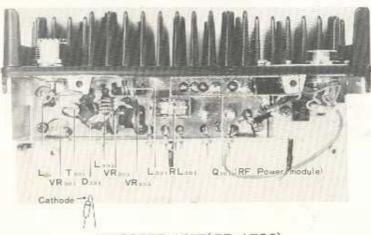
Fig. 4

(4) Tone Burst

- a) Push the front panel CALL switch.
- b) Connect an oscilloscope to the center pin of VR₂₀₂, and confirm that oscillation of the circuit is taking place.
- c) Connect a frequency counter to the center pin of VR₂₀₆, and confirm that the burst signal is of the proper frequency (1800 Hz for the USA model, etc.). Release the CALL switch.
- d) Return to step a) of section 3, "Modulator Alignment". Adjust VR₂₀₆ while pressing the CALL switch to establish that the FM deviation is ± 3.5 kHz with application of the burst signal. Release the CALL button after this alignment.
- e) While listening on a monitor receiver, place the BURST/CALL switch in the BURST position, and close the microphone PTT switch. Confirm that the burst signal is of the desired duration (factory set at 0.5 second). VR₂₀₅ provides adjustment of the burst length.

(5) AFP Circuit, PO Meter, and Local Output

- Connect a dummy load/wattmeter to the antenna receptacle.
- b) Connect a DC voltmeter (+) lead to the cathode of D₃₀₁, and the (-) lead to ground. Adjust VR₃₀₁ for minimum cathode voltage.



BOOSTER UNIT(PB-1793)

- Remove the dummy load/wattmeter from the antenna receptacle.
- d) Connect a DC ammeter with a 10 ampere full scale capability to the (+) lead of the power cord.
- e) While transmitting, adjust VR₃₀₂ for a reading of 2 amps on the DC ammeter.
- f) Reconnect the dummy load/wattmeter to the antenna receptacle. Adjust VR₃₀₃ for a reading of 8 on the front panel meter. This calibrates the relative output meter.
- g) To set the low power mode output power, set the power switch to the LOW position, Adjust VR₂₀₄ while transmitting for a reading of 3 watts output on the wattmeter.

PLL ALIGNMENT

(1) 10.240 MHz Oscillator Alignment

- a) Connect the RF probe of a VTVM to the emitter of Q₄₀₈. Confirm that oscillation is taking place at a level of approximately 1,1 V RMS.
- b) Connect a frequency counter to TP₁, located on the PLL Unit. Adjust TC₄₀₂ for a reading of exactly 5.1200 MHz.

(2) PLL Local, Multiplier Stages

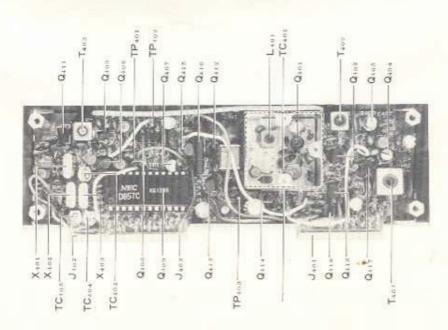
- a) In the receive mode, connect the RF probe of a VTVM to the emitter of Q₁₁₁.
 Confirm that the stage is oscillating at a level of approximately 180 mV RMS.
- b) Connect a DC voltmeter using a 10 volt scale to TP3. Adjust TC₄₀₁ to secure a voltage of 3.3 volts.
- c) Connect an oscilloscope to TP₂, and adjust T₄₀₂ and T₄₀₃ for a maximum deflection on the scope.
- d) Connect the RF probe of a VTVM to the cathodes of D₄₀₂/D₄₀₃. Adjust T₄₀₁ for a maximum reading on the VTVM. A nominal reading is 540 mV RMS.

(3) PLL Local Frequency

- a) Connect a frequency counter to the cathodes of D₄₀₂/D₄₀₃.
- Adjust TC₄₀₃ for a reading of 135,300 MHz ± 100 Hz on the counter.
- c) Press the front panel 5 UP button, and adjust TC₄₀₄ for a reading of 135.305 MHz ± 100 Hz on the counter.

(4) UNLOCK Circuit

 Short TP2 to ground. Digits 3, 4, and 5 of the display should be blanked to indicate PLL unlock.

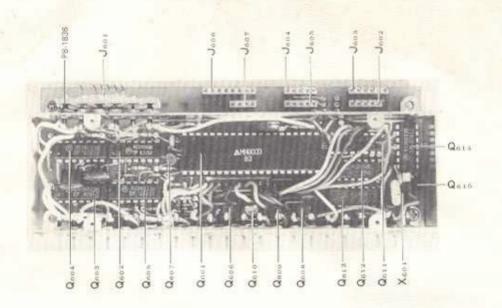


PLL UNIT(PB-1794)

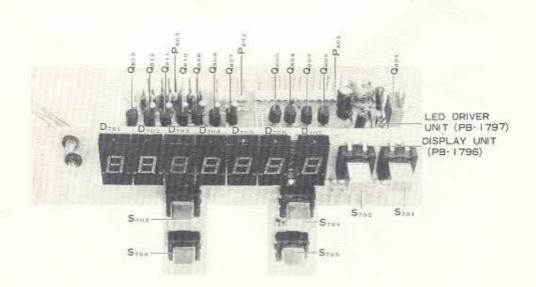
VCO UNIT (PB-1830A)

PLL CONTROL, DISPLAY UNITS

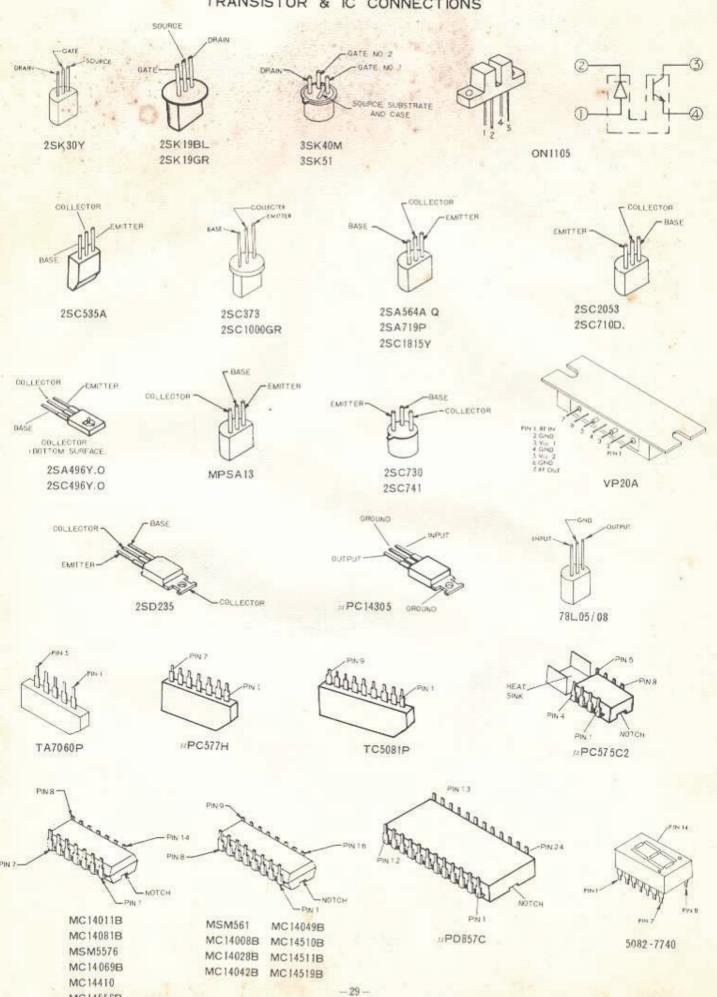
The CMOS circuitry used in these units is extremely critical in its adjustment. Under no circumstances should this circuitry be touched for alignment purposes.



PLL CONTROL UNIT(PB- 1795)



TRANSISTOR & IC CONNECTIONS



MC14556B

Q409 (µPD857C) PROGRAMMABLE DIVIDER CODE

	NUMBER -	1	2	3	4	5	- 6	7	8	9	10	11
P/J403		1	2	3	4	5	6	7	8	9	10	11
DIAL	PROGRAMMABLE		0.3		1					9		-
DISPLAY	DIVIDER RATIO		100		artes.		-	4940	6.	100	100	20
1	1	Pr	P.z.	Pa	P	Pa	P.	P ₂	P.e.	Pop	P 10	P
144.000	1/100	0	0	0.	0.	0	0.	0	0	1	0	0
4.010	1/101	1	0	0	0	0	0	0	0	1	0	0
4.020	1/102	0	1	0	0	0	0	0	0	1	0	0
4.030	1/103	1	1	0	0	0	0	0	0	1	0	0
4.040	1/104	0	0	1	0	0	0	0	0	1	0	0
4,050	1/105	1	0	1	0	0	0	0	0	1	0	.0
4.060	1/106	0	1	1	0	.0	-0	0	0	1	0	0
4.070	1/107	1	1	1	0	0	0	0	0	1	0	0
4.080	1/108	0	0	0	1	0	0	0	0	1	0	0
4.090	1/109	1	0	0	1	0	0	0	0	1	0	0
144,100	1/110	0	0	0	0	1	0	0	0	1	0	0
4.110	1/111	1	0	0	0	1	0	0	0	1	0	0
4.120	1/112	0	1	0	0	1	0	0	0	1	0	0
4.130	1/113	1	1	0	0	1	0	0	0	1	0	0
4.140	1/114	0	0	1	0	1	0	0	0	1	0	0
4.150	1/115	1	0	1	0	1	0	0	0	1	0.	0
4.160	1/116	0	1	1	0	1	0	0	0	1	0	0
4.170	1/117	1	1	1	0	1	0	0	0	1	0	0
4:180	1/118	0	0	0	1	1	0	0	0	1	0	0
4.190	1/119	1	0	0	1	1	0	0	0	1	0	0
144.200	1/120	0	0	0	0	.0	1	0	0	1	0	0
4.300	1/130	0	0	0	0	1	1	0	0	1	0	0
4-400	1/140	0	0	0	0	0	0	1	0	1	0	0
4.500	1/150	0	0	0	0	1	0	1	0	1	0	0
4.600	1/160	0	0	0	0	0	1	1	0	1	0	0
4.700	1/170	0	0	0	0	1	1	1	0	1	0	0
4.800	1/180	0	0	0	0	0	0	0	1	1	0	0
4.900	1/190	0	0	0	0	1	0	0	1	1	0	0
145.000	1/200	0	0	0	0	0	0	0	0	0	1	0
5.010	1/201	1	0	0	0	0	0	0	0	0	1	0
5.020	1/202	0	1	0	0	0	0	0	0	0	1	0
5.030	1/203	1	1	0	0	0	0	0	0	0	1	0
5.040	1/204	0	0	1	0	0	0	0	0	0	1	0
5.050	1/205	1	0	1	0	0	0	0	0	0	1	0
5.060	1/206	0	1	1	0	0	0	0	0	0	1	0
5.070	1/207	1	1	1	0	0	0	0	0	0	1	0
5.080	1/208	0	0	0	1	0	.0	0	0	0	1	0
5.090	1/209	1	0	0	1	0	0	0	0	0	1	0
145.100	1/210	0	0	0	0	1	0	0	0	0	1	0
5.200	1/220	0	0	0	0	0	1	0	0	0	1	0
5.300	1/230	0	0	0	0	1	1	0	0	0	1	0
5.400	1/240	0	0	0	0	0	0	1	0	0	1	0
5.500	1/250	0	0	0	0	1	0	1	0	0	1	0
5.600	1/260	0	0	.0	0.	0	1	1	0	0	1	0
5.700	1/270	0	0	0	0	1	1	1	0	0	1	0
5.800	1/280	0	0	0	0	0	0	0	1	0	1	0
5.900	1/290	0	0	0	0	1	0	0	1	0	1	0
146.000	1/300	0	0	0	0	0	0	0	0	1	1	0
147.000	1/400	0	0	0	0	0	0	0	0	0	0	1
147.990	1/499	1	0	0	1	1	0	0	1	0	0	1

*1 HIGH LEVEL (5V) *0 LOW LEVEL (0V)

		HASSIS			KNOB
Symbol Number	Parts Number	Description	Section 11 LC	94000037	FT-30T Charmel Selector
	E	TRANSISTOR	The second second	94000041	FT-16P(Volume)
Q1	22402353	Silicon Transister 2SD235		94000042	FT+16PA: Tx Offset, Measory
				94000040	FT-16PD Squetch:
	4		A PERSON		
			(19)		
		DIODE			
DI	21090130	Silicon Diode 1205B	I SEAL MARKET		TERMINAL BOARD
D.2,3,4	21015550	151555	TBI	90020003	11.4P 2-0-2
	1.3		TB2	90030003	11.5P 3-0-2
		RESISTOR			
R6	40124100	Carbon Composition SW GK100			
107	40124101	Ω0001 1000Ω			
1(2,3	40124181	9 1800		RX I	UNIT
114.5	41143221	Carbon Film WW TJ 2200	Symbol Number	Parts Number	Description
17.140	200000000000000000000000000000000000000	ARTHUR STORY OF THE STORY OF TH	5540	017912A7.	HN UNIT and RESONATOR UNI
			PB-1791	60417910	Printed Circuit Board
					THOUSAND COMMISSION OF THE PROPERTY OF THE PRO
		POTENTIOMETER			
VRI	49800108	DM 10 A637.A 10 KΩ B1/10 KΩ A			IC. FET & TRANSISTOR
0.000	43000100	TOTAL TOTAL	0122	25000132	IC 781.05
			Q121	25000132	781.08
,			(1119	25000119	- μ PCS75C2
		CAPACITOR		25000119	- uPC577H
C2	71.000150	A section of the sect	Q110 Q104	23800401	FET 3SK40M
C4.5	31829150				
	30820102		Q101,102	23800510	g-mor
C1	34220226	Electrolytic 16WVR 22µF	Q120	22104964	Transister 2SC496Y
C3.	34220476	* R 47µF	Q105-109,111-118	22318154	• 2SC1815V
					DIODE
		INDUCTOR	1)102-105,107,108	21001880	Germanium Biodel S188FM
1.1	55009397	Lownass Coil F220132	D106,109-111	21015550	Silicon Diode 151555
			D112	21090139	Zener Diode RDS_2EB
100		METER			
Milwith PL3	74000310	Λ13-120 200μ.Α			CRYSTAL
			X101	71800076	HC-18/U, 10.245MHz #210036
		SPEAKER			MONOLITHIC FILTER
SPI	76000013	SM-77K-Y 80 TW	XF101	71000031	10M2B2
		SWITCH			CERAMIC FILTER
52,5,6,10	63000002	SSF-22-08	CF101	71200010	10.7MF~BR
53	61000531	SRN1026N	CF102,103	71200016	LFB-15
54	61000532	SRN1025N			
19.55	J. W.				
					CERAMIC DISCRIMINATOR
		CONNECTOR	CD101	70900001	SFD45554
11	68020006	FM-142S			303,230007
,12	68040003	FM-146S			
.13	68020012	SG-8050			
14	68000011	M-BR-061)			RESISTOR
The state of the s	The state of the state of		D176	42124220	Carbon Composition ½W GK 220
.15	68020023	S-1620A	R178		
			R103,106,109,117	40143560	Carbon Film ¼W VI 56Ω
		mulmer 1 state	R118,127,133,138,144	40143101	- 100Ω
Maria da	14.41.22	PILOT LAMP	166,168,169	100.00	
PL1,2	14000030	BQ034-22526A	R160	40143121	- 120Ω
			R123,176	40143221	- 220Q
			R177	40143331	330Ω

R131,140,142,143	40143471	Carbon Film	EWA	J 4200			INDUCTOR	
R102	40143102	Com tool I true		- 1KD -	L101,104	54140910	R12-4091	#220105
R155,161	40143152			1.5KD	1.102	53020004		rFL-4H 2R2M 2.2µ
R132,145,175	40143222			2.2KΩ	L105	53010004		220,4
R119,120,134,137,151				3.3KD	1.106-108	53020009		FL-5H 102K 1mH
153								The state of the s
K128, 130, 167	40143472	200	9.	4.7KB				
KI16, 136, 146, 147, 154	40143562		7	5.6KA			AF CHOKE	
R164,165,180	40143862		-0.3	8.2KΩ	CH101	52000063		≠50-13
R125,126,148,157	40143103					-		
R124	40143153			1580				
R104,105,129,135,149	40143223			22KD			TRANSFORMER	
170					T101,102	55800185	3005	# 220187
R101,107,108,121,122	40143473	4 14	+	47KO	T103	55003084	7MC-312162NG	# 220188
139,141,159,172,179								
R156	40143563		. 4	56K/1				
R150,152,158,162,163	40143104			100KII			RELAY	
17,1					R1.101	70000036	AW6221-DC12	V.
R174	40143124	+ +	+	120KB				
R173	40143154	+ +	-	150KA				
3.0							MINI CONNECTO	R
					F101	67040007	5048-04A	
					P102.104	67050005	5048-05A	
		THERMISTOR			1705	67060004	5048-06A	
T11101	29090001	SDT-250			P106	67080006	5048-08A	
					P103	67140001	5048-14A	
		POTENTIOMETER						
VR102	49902502	TR-11 B300		5KOB				
VR101,103	49902103			10KDB	J101	68040009	5047-04 with	wire #240105
					J102	68050006	5047-05	# 240101
					J104	68050007	5047-05	
		CAPACITOR			J105	68060015	5047-06	# 240100
C120,125	31820030	Ceramic disc	50W V	CH 3PF	J106	68080008	5047-08	# 240099
C101,102	31820100	0.		CH 10PF	J103	68140008	5047-14	≠240105
C133	31829100	*	*	SL 10PF				
C160	31829200	*	25.0	SL 20PF				
C129	31820470		2.0	CH 47PF				
C141	31829101			SL 100PF				Total Mark William
C130,131	31829151	2	-	SL 150PF		56000024	Ferrite Beads 4A	RI 3×3-1
C116,118,123,144,177	30820102			0.001µF		91100008	Wrapping Termina	I C
180,186							0 == 1	
C103~106,108,117	30820103			0.01#F				
122,124,126,127,135								
139,188								
C128,132,134,140,187	30820473	***	- 1	0.047µF				
C136,138,150,153,158	36825102	Mylar Film	-	0.001µF	PERSONAL PROPERTY.	TX	CONTRACTOR OF THE PARTY OF THE	E as passed
C172	36825472		-	0.0047µF	Symbol Number	Parts Number	550,000,000	ription
C142,145,151,157,159	36825103		2	0.01µF	DEL ARGO	017922AZ	TX UNIT wa	
162,171	aganzone			0.000	PH-1792	60417920	Printed Circu	it Board
C154-156,174,176	36825223		-	0.022µF				
C137,143,146-149	36825473			0.047µF				ANALI DIO
152,161,164,175,195	pagement	20 1720		0.1015	Cone	OFFICE AT A	IC. FET & TRAN	A STATE OF THE PARTY OF THE PAR
C183	36825104	PROCESSES	- weatens	0.1µF	Q215	25000114	IC.	MC14011B
C194	36526104	Tantalum	35W V	0.47µF	Q217	25000155	10000	MSM5576
C167,170	34820105	Electrolytic		R IµF	Q206,207	22800195	FET	2SK19GR
C163,166,169,178	34320475			R 4.7#F	Q208	23800510	279.000.0187.220.010	3SK51
C165,173,191,192	34220106	*		R 10#F	Q214	22104964	Transistor	ZSA496Y
	34120476			R 47#F	Q210	22305351		2SC2053
				100# F	Q211	22307410		2SC741
C168,185,190	34120107				CORNE CAR ALLICA	AND THE RESERVE AND THE PARTY OF THE PARTY O		in charles in your bir
C168,185,190 C181,184,193	34220107	- 0°L *		R 100#F	Q201-205,212,213	22318154		2SC1815Y
C179,182 C168,185,190 C181,184,193 C189		4		R 100#F R 1000#F	9201-205,212,213 216,218	22318154	*	2SC1815Y
C168,185,190 C181,184,193	34220107					22318154	*	2SC181SY

		DIODE		C222	31829470	Cerumic disc	50WVSL 47PF
D201,202,209, -212	21015550	Silicon Diode	1S1555	C219,220	31820101		* CH 100PF
D204	29090004	Varistor *	MV-103	C217	31827101		+ UJ 100PF
D203	21090108	Varactor	1SV50	C201,204,216,242,248	30820102		+ 0.001/
D205-20 8	21022090		1S2209	257-259,263,266,267			
				272,273,286,287			
		CRYSTAL		C221,223,224,228,229	30820103	1	÷ 0.01μ
X201	71500174		La Tiene #210060-1	233-235,246,247,249			
11001	71500188		Tone = 210061-2	250,253,256,260,265			
	110001100	- 3.584 - option		269			
Vana	and the second	HC-18/U 10.7		C288	30820473	-	0.047/
X202	71800113	OPC 165% 1954)	ALISE - T 6310/92	C284,285	30825103	Ceramic Chip	25WV 0.01#
		pecieron		C280,281	36825472	Mylar - Film	50W V 0.0047M
10000	44.0.40.400	RESISTOR	LOW DET 1975	C270,277-279	36825103	State Fills	0.01µ
R250 >	41143470	Carbon Film	SW TJ 470		and a few strains and a section of the		0.022
R243,244,248	40143560		- VJ 56Ω	C202	36825223		0.047/
R236	41143101		- 13 100G	C213,214	36825473		
R201,208,225,256,270	40143101		- VJ 100Ω	1274	36526104	Tantalum	35WV 0.1,aF
R221	41143221		4 TJ 2200	C271	36526474	10.	0.47µ
R215,231 -233	40143221		 VJ 2200 	C205	36226106	. 6.	16W V 100 F
11254	40143471		- 470D	C206,208,215,264,282	34820105	Electrolytic	50WV-R 1/1F
R209	40143561	4 9	+ + 5600	C209,212,268,283	34220106	4	16WVB 10xE
R206,216,224,228,263	40143102		* * 1Kf1	C207	34120476		10WVR 47µF
269				C261	34220476		165VVR 47MF
R203	40143182	1 141	+ + 1.8KD	C203,210	34120107		10WVR 100mF
R246,255	40143222	1 .	2.2KN	C211	34120227		10W V R 220µ J
R210	40143272		- 2.7KΩ				
1204	40143332		3.3KO				
residence of the second	40143332		4.7KΩ				
R249,251-253,257	40140412		30.17975			TRIMMER CAPAC	UTOR
264,268	2001 315 616		- 5.6KΩ	TC201,202	39000010	ECV-IZW	10×53 10PF
R202,219	40143562				39000005	ECV-1ZW	50×32 50PF
R205,212,213,226,229 230,247,258,261	40143103	7 1		TC202	3300000	100.1 - 10.01	Sur- Sur- Hert 17
R217,223,227,241,242	40143223		22KO				18
267	4					INDUCTOR	
R218	40143333		- 33KΩ	1.207,209	55003298		≠ 220193
R222	40143473	3. 59	4780	1.203	55003299		# 220195
R220,234,237-240	40143104		- 100KI	1.204,206,210	55003300		#220197
362,265,266,271				1.202	55003301		#220319
17235	41143104		- TJ 160KN	1.208	55003294		#220380
13211,234	40143154		► V3 150KΩ	1.201	53030008	Miero Inductor	L10-104-l 100ml
13207	40143274		270KII	1,205	53020018	* * F	L-5H 100M 10#H
R259,260	40143105	5 8	• • 1MO	1.211	53020022	» * F	L-4H 4R7M4.7#1
						20112000000000	
I to the Control of t		POTENTIOMETER	1000000		24222	TRANSFORMER	77 57 57 57 5
VR202,206	49902102	TR-11R300	IKΩB	T201,202	55003083	3605	≠ 220187
VR204	49902202		2ΚΩΒ	7203-206	54141020	R12-4102	± 220111
VR201	49902502		5KΩH				
VR205	49902205	-	2MΩB				
						CRYSTAL SOCKE	ET
				XS201	69010012	SI>-0105	
		CAPACITOR					
C239,243	31629059	Ceramic disc	501/ V 0_5PF				
C230,238,241	31820010		· CH 1PF				
C218	31827040	- 14	* UJ 4PF			MINI CONNECTO	R
C254	31829040		* SL 4PF	P204	67040007	5048-04 A	
C236	31820050		• CH 5PF	P201	67050005	5048:05A	
C244	31827080		GI 8PF	P302	67060004	5048-06A	
C231,232,237,240	31827090		+ + 9PF	P283	67100007	5048-10A	
C255	31829150		* SL 15PF				
			- CH 20PF	-			
C226,227	31820200						
C2251245,252	31829270		• SL 27PF				
C262	31829330		* * 33PF				
C275,276	31820470		- CH 47PF				

J204	68040010	5047-04 with wire # 240102			UNIT	1000	
J201	68050007	5047-05 . + #240104	Symbol Number	Parts Number		iption	
J202	68060016	5047-06 + \$240105		017942AZ	PLL UNIT an with component	d VCO	BOARD
1203	68100013	5047-10 + F240098	PH-1794	60417940	Printed Gircui		
						-	
	91100008	Wrapping Terminal C			IC. FET & TRANS	SISTOR	
	95000012	Heat Sink TO-5	Q409	25000086	IC	gr P108	57C
	56000024	Ferrite Beads 4A-Rt 3×3-1	Q410	25000087		TC-50	1180
			Q406	25000105		TA-70	960Tr
			G402	22800195	FET	28KH	GR
			Q412,414	22800304		2.5K30	A-Y
			Q403_404	23800401		3SK40	
			Q415	22105640	Transistor	25A56	
	BOOSTE	R UNIT	()468	22303730		2SC37	
Symbol Number	Parts Number	Description	Q405,411	22305351	4	2.SC52	
	017932AZ	SMANSTER USIT	C#13	22310005		2SCH	
PB- 1793	60417930	Printed Circuit Board	0407,416-418	22318154		2SC18	
		RF POWER MODULE			DIODE		
0201	7000000		Dang and	21015550		18100	6
Q301	78000001	VP-20A	D402-406	21015350	Silicon Diode	LS155	0.
		Total Contract					
	20000000000	DIODE	The second secon		CRYSTAL	200000	Typercon
12301,302	21001880	Germanium Diode 1S188FM	X401	71800114	HC-18/U 10.24		#210035
			X402	71800115		OMHz	#21008¢
		10000000000000000000000000000000000000	X463	71800116	44.10	166MHz	#21008
	2000/02/10/10/02	POTENTIOMETER					
VR301	49905221	SR19R 220ΩH					
VR302	49902103	TR-11R300 10KAB			RESISTOR		
VR303	49902204	TH-11R300 200ΚΩΒ	R411	40143220	Carbon Film	P.M.	VJ 220
			R412	40143560	- 4		- 56Ω
		CARLOTTON	R407,419,428,456,464	40143101	-		 100Ω
(Inicia)	WATER BOOK OF THE PARTY OF THE	CAPACITOR	471	202 20 202			
C304	31829059	Ceramic disc 50WV 0.5PF	R425	40143471			* 470Ω
C307	31829030	- SI, 3PF	R466	42124471	Carhon Compos	210000000	
C301~303,305,313	31829150	- SI, ISPF	R424,448,465	40143561	Carbon Film	-	VJ 560Ω
C306,310	31829102	* 1000PF	R422,423	40143681			× 680Ω
C308,309,314316	32821102	Feed Thru	R406,421,431,434,435	40143102		-	" 1KΩ
C311,312	34220106	Electrolytic 16WVR 10pF	436~444_459,467				
			R427	40143122			* 1,2Ki
	-	SEL IV	R446,447	40143152			* 1.5K3
W. and		RELAY	R413-415,449,454	40143222		6	2:2K3
RL301	70000035	BR221D012	468.469				
			R445	40143272	*	-5	≈ 2.7Ki
			R453	40143473	6.		* 4.7K
		INDUCTOR	R430,432,433,458,460	40143103		6.	* 10КΩ
1.301,302	55003302	LPF Coil = 220430	461 - 463				
			R418	41143223	1.00		F.J. 22KΩ
			R409,410,417,429,455	40143223		0	51 22KΩ
resource.		TRANSFORMER	10404,405,408,416,450	40143473	1.80		 47ΚΩ
T301	52000064	CM Coupler #220335	R452,437	40143104	1.45		* 100K
			R426	40143154	1.0	.00	* 150K
			R428	40143334			- 330K
	91100008	Wrapping Terminal C	R451	40143105		200	- 1MΩ
	91001102	Seal Terminal A102					
			TO A STATE OF THE		CAPACITOR	-	ulitero vina
			C428,430	31820020	Ceramic disc	50W V	CH 3PF
			C425	31829020		4 5	31. 2PF
			C463,464	31820040		* 6	H 4PF

				W MOSSILLO	0 101			
C417,459	31820050	Ceramic disc		CHSPF		80044711	PLL Case	±004471
C412	31829050	1		SL5PF		80044721	- Cover A	#004472
C483	31820090			CH9PF.	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	88044731	+ Cover B	#004473
C414	31829100	*		SLIOPF		80044741	Hex Spacer	±004474
C484	31829120			SL 12PF		91100008	Wrapping Terminal	С
C433,434	31829180			SL18PF	1 30 F 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			
C424,440,461,462	31820330			CH33PF	71 4			
C443	31829470		*	SL47PF	1.00	2011		
C423,438,445,446-450	30820102			0.001µF		1		
453-457, 465, 466, 468								
469					VCO		(P/O PLL UNIT	1
C413,415,416,418,419	30820103			0,01#E	Symbol Number	Parts Number	Descri	ption
422,426,427,431,432						018301AZ	VCO Board wit	b components
435,444,451,458,460	4				PB-1830A	60418301	Printed Circuit	Board
476,480,485								
C420,436,477-479	30820473		-	0.047pF				
481,482							FET	
C470	36825103	Mylar Film	50WV	0.01µF	Q401	22800195		28K19BL
C471,473	36825473			0.047µF				+
C475	34320475	Electrolytic	25W V	R 4.7µF				
C421,437	34220106			R 10µF			DIODE	
C452	34120476			R 47µF	11401	21022090	Varactor Diode	1 S2209
C472	34120107			+ 100µ F				
C474	36526104	Tantalum	35W V					
C441	36824101	Styrel	50W V	1001°F			RESISTOR	
C442	36824221		-	220PF	R402,403	40143101	Carbon Film	%W VJ 100Ω
C467	36133105	Polyester Film	1001/1		R401	40143563	-	56KΩ
							CAPACITOR	
		TRIMMER CAPAC	TOR		G409	31820030	Ceramic disc	50WV CH 3PF
TC402-404	39000011	ECV-1ZW 20>	53	20PF	C405,406	31827040		* UJ 4PF
					C404,407	31820070		* CH 7PF
					C402	31820100		* CH 10PF
		INDUCTOR			C408	31820120		* CH 12PF
1.408	55003150	OSC COIL		#220205	C401,411	30820102		0.0018
L407	55003120	REC		#220206	C410	34220106	Electrolytic	16WVR 10MF
L406	53020033	Miero Inductor		10#H				
L405	53020020			15µH				
L409	53020007			22/4H			TRIMMER CAPAC	TOR
1.404	53020021			220#H	TC401	39000080	T'Z01Y010A	7PF
22/85		TRANSFORMER					INDUCTOR	the state of
T401	54141020	R12-4102		≠220111	1.401	55003289	S6-B	¥220359
T402,403	55003303			≠220312	1.403	53020031	Micro Inductor	0.68µ
					1.402	53920010	*	10µ H
		MINI CONNECTOR				80041041	VCO Case	≠004104
P402	67040006	5048-04A				80041051	VCO Cover	#004105
P403	67110004	5048-11A				91100008	Wrapping Terminal	C
P401	67120010	5048-12A						
J402	68040011	5047-4 with with	e	#240097				-
J403	68110009	5047-11 ~		≠240096				
1401	68120008	5047-12 >		≠240105				
		IC SOCKET					<u></u>	
QS401	68240001	116-24-30-114						
<u> </u>				7).				
				-47				

		NT UNIT	200		1604	68040012	5047-04 with wi	1000
Symbol Number	Parts Number	Descri			1605	68040013	5047-04	±240093
H-1795	60517950	Printed Circuit	Board		1603	68050008	5047-05	# 240092 # 24000E
	017950AZ	P.C.B with con	spotents		1601	68060017	5047-06	# 240095
		4	, ,		160 0	68070030	5047-07	# 240090
13-1836	60518360	Connector Boar	4.					
ON THE STATE OF TH	E GM							
1 3 4	1					45		
	100						IC SOCKET	
		IC. FET & TRANS	SISTOR		QS601	68280002	SE-OC8340-02	
9601	25000194	CPC	MN-900	3				
603-605-614	25000114	10	MC-140	118				
611	25000090		MC-140	1000		91001102	Seal Terminal A10	2
1602	25000178		MC-140			111111111111111111111111111111111111111		
	25000179		MC-144					
N613	25000179		MC-145					
2612			781.05	1001/				1 2
2615	25000132		2SA5640	1741				P. 17
2607	22105641	Teansastor				DISBI	AY UNIT	F (4 1 / 1 / 2
2606,608 610	22318154		2SC181	11)	Combal Market	Parts Number	Descr	ntion.
				-	Symbol Number		Printed Circuit	
		- Control of the Cont			PB-1796	60517960	P.C.B with con	
		DIODE	1720-2			017960AZ	F-24-19-WOLD 000	refrancista.
×601,-605,609,610,61	1 21015550	Silicon Diode	151555				DIRRE	
D606 - 608	21001880	Germanium Die	nln 151881	FM			DIODE	
					D701-707	21090135		7740
					D708	21015550	Silicon Diode	181555
		CRYSTAL						
X601	71750001	HC-43/U 1N	tHe :	210071				
Short	11100001	0255172055	71.1				RESISTOR	
					R707	42144101	Carbon Composi	tion IN GK 1000
	+	RESISTOR			R701-706,708-714	41183471	Carbon Film	%W TJ 470Ω
20000000	433,003,00	Carbon Film	36W. T.	1.380	THE PARTY OF THE P			
R623,624	41183102	Carbon Firm	0 0					
R605,610	41183103						PUSH SWITCH	
R616	41183183				E-901 205	65000042	The second fraction	AKC-8N
R620	41183223		9. 1		S701-706	OCHANIAL.		14400 007
R601,603,618,619	41183333	+		33KΩ		-		
R613,614	41183473	þ.,	b. 7				MINI CONNECTOR	
R602,604,606,607 - 60	9 41183104	-		100KΩ	41/2/201	100000000000000000000000000000000000000	The Market of the State of the	
611,612,615,617	10.7.20.00				P702	67110006	3022-11A	
R621	41183275	Carbon Conpos	fix aniti	GK2,730	P701	67150010	3022-15A	
		BLOCK RESISTO	R					
RB601	47000008	7×100KΩ	BA-7R					
KINOUL	21000000		The state of the					
	-				1 S. S. 1 2 S.	DRIVE	R UNIT	
	-	CAPACITOR			Symbol Number	Parts Number		ription
-	0.000701	ANNE SERVICE CHIPSES	E037/15	CH100PF	PB-1797	60517970	Printed Circui	t Board
C603	31820101	Ceramic	-200	The second second	10.1(3)	017970AZ	Name and the second second	
C604,606-608	30820104	Ceramic RPE				0119(0:0)	L POLD WITH E	- Indiana
C601,602,605	36825104	Mylar Film	20 <i>H</i> . A.			-	IC & TRANSISTO	0
C609	36226685	Tantalism	20WV	6.8# F		and the same of th		и PC-14305
C611-635	32821102	Feedthra	50W V	1000PF	Q801	25000109	1C	
	7				Q807-813	22105641	Transistor	2SA564Q
-					()802 ~805	23900011	*	2SA719-P
		MINI CONNECTO	OR.					
P607	67030005	5048-03A	20.00				DIODE	
P602,604,605	67040007	5048-04A			D801	21015550		1S1555
All Property and Control of the Cont			-					
P603	67050005							
P601	67060004						RESISTOR	
P606	67070006	5048-07.A			Denz.	42124229	CONTRACTOR CONTRACTOR	sition ½W GK 2.
					R802		sour sour sourpe	- 22Ω
					R801	42124220	Carles Will	1/W VJ 220
		Married Arts 1 1 4 1		ALC: A COUNTY	R810 - 816	40143220	Carbon Film	LAY Y SEVA
1607	68030007	5047-03 with	wire:	#240091 #240094	R803 809	40143472	4	- 4.7KS

	2_1	CAPACITOR	THE PROPERTY AND PERSONS ASSESSED.		RD PO RX UNIT
1802	36526474	Tantalum 35WV 0.47gF	Symbol Number	Parts Number	Printed Circuit Board
803	34220226	Electrolytic 16WVR 22#F	PB-1800	60318000	
801	34220107	► 100# F		018000AZ	RESONATOR BOARD
					with components
		MINI CONNECTOR			CAPACITOR
2200	67040007	5048-04A	C109,110,112,114	31820050	Ceramic 50WV CH5PF
2802	-0.000000	5048-07.A	C107,115	31820150	5PF
803	67070006	5048-12A	C111,113	31820180	18PF
'801	67120010	5045-12-5	SILITIN .		
					CERAMIC TRIMMER
		44 0 74 74	TC101-104	39000010	ECV-1ZW 10×53 10PF
802	68040012	5047-04 with wire #240103	10101-104	23000010	ASSET ASSET SVC1990. (777)
803	68070029	5047-07 = 240089			INDUSTRIAL
805	67110005	3024-11/A			INDUCTOR # 220409
801	68120010	5047-12 with wire #240092	1.103	55003293	F 220409
804	67150009	3024-15A			2001001
500	-			80044941	Resonator Case # 004494
				91100008	Wrapping Terminal C
	-				
	_				
	-		State of the last	MONIT	OR UNIT
	100	Allowed to the second s	Symbol Number	Parts Number	Description
The second second		UNIT	PB-1897A	60318971	Printed Circuit Board
Symbol Number	Parts Number	Description	1.0.10010	018971AZ	P.C.H with components
215-1798	60317980	Printed Circuit Board		010011786	1,000
	017980AZ	P.C.B with components			RESISTOR
				771777700	Carbon Composition 34W GK 10KO
		PUSH SWITCH	11901,903	42144103	Carton Composition Sq N Cik 10KG
St	65000040	MP0001AA2060	R902	42144153	- IDRAS
\$7,8,9	65000041	StPJ2-22-A01			
- Control - Cont					POTENTIOMETER
	-		VR901,902	49901203	EVL-S3AA 00B24 20KΩB
	_		1.53.51.51.5.5		
					CAPACITOR
	_		C901	36825224	Mylar Film 50WV 0.022g1
	-				
and the same of th		O A BOARD			
Symbol Number	Parts Number	Description	-	ACCE	SSORIES
PB-1848	60418460	Printed Circuit Board		Parts	Description
			Symbol Number	Number	
				77000016	Microphone Assembly YE-17
		PHOTO INTERRUPTER			with Microphone Hanger, Screws
Q3	29090014	ON-1105		67060001	Microphone Plug FM-146P
77616	1				112001020
		TRANSISTOR	5.	96000020	Power Cord Assembly #240067
0.00	20010154	2SC18153		67020006	Power Plug FM-142P
05	22318154	250.040		690000002	Fuse Holder 5N-1102
				73000005	Fuse 10A
William .		RESISTOR		- Factoriosis	
R13	40143103	Carbon Film 3¢W VJ 10KΩ		73000005	Fuse 10A
				(3000000	Fuse
				67020003	External Speaker Plug P-2240
Constitution of the last	PHOT	O B BOARD		80038631	Stand
	Parts Number	Description			
Sumbal Number	Number	ALCOHOLD BUILD COME STREET COME		8003866	Mobile Bracket Assembly
Symbol Number		a company to the contract of			with Set Screws
Symbol Number PB-1849	60418490				The state of the s
193-1849	60418490	PHOTO INTERRUPTER			
		PHOTO INTERRUPTER			PROADD MICROPHONE
1713-1849	60418490	PHOTO INTERRUPTER		AL KEY	BOARD MICROPHONE
1713-1849	60418490	PHOTO INTERRUPTER	OPTION Symbol Number	Parts Number	Description
1713-1849	60418490	PHOTO INTERRUPTER ON-1105 TRANSISTOR		Parts Number 7700001	Description Microphone Assembly YE-16
P8-1849 Q2	60418490 29090014	PHOTO INTERRUPTER ON-1105 TRANSISTOR		Parts Number	Description Microphone Assembly YE-16 with Microphone Hanger, Screws
P8-1849	60418490 29090014	PHOTO INTERRUPTER ON-1105 TRANSISTOR		Parts Number	Description Microphone Assembly YE-16 with Microphone Hanger, Screws
P8-1849 Q2	60418490 29090014	PHOTO INTERRUPTER ON-1105 TRANSISTOR 2SC1815Y RESISTOR	Symbol Number	7700001	Description Microphone Assembly YE-16 with Microphone Hanger, Screws

	ONE SO	UELCH UNIT	100	
Symbol Number	-Parts Number		ription	_
PB-1555A	60315551	Printed Green		
3 3 3 5	100			
to The T				
	100			
1 Av.		IC, FET & TRAN	SISTOR	
Q502	25000126	10	NE567	V
Q501	25000125	7	M C346	13
Q503	22800195	FET	25K19	GR
Q804,505	22303724	Silicon Trams	istor 25	C372Y
7 6				
1 10				
		DIODE		
D501,502	21090131	Zener Diode	RD8.2	EB
		Security and an experiences		
urva	112000000000000000000000000000000000000	RESISTOR	THE PERSON	an commence
H518	42124151	Carbon Comoos		
R523	40143271	Carbon Film		/J 2700
R517 R513++, R524++	40143472			- 4.7KΩ
R512	40143822 40143103	-		8.2KΩ - 10KΩ
R504	40143103			
R510,511,525	40143123			
R510,511,525	40143223			
R502,508	40143333	-	-	
R501,505,521,522	40143393	-		47KD
R506,507	40143823		4	
R509	40143154			
R514	40143274	-		
R503	40143474			
R515,519	40143105			
ACTOR BYOKE	CARLES CAR.			
		POTENTIOMETER		
VR502	49800084	TM062P		100КΩ/в:
VR504	49905102	SR-19R		1KO B
		CAPACITOR		
C503	36825102	Mylar Film	50W V	0.001µF
C511	36825222	-		0.0022#F
C512	36825472		-	0.0047µF
C506,507,520	36825103	4	-	0.01pF
C502,504,505,508	36825223	-	-	0.022µF
C509	36825473			0.047µF
C516 **	36825104	P		0.1µF
C523	36226154	Tantalum	35W V	0.15#F
C518	36226475		.0.	4.7µF
C514,522	34226105	Electrolytic	16#7.	I#F
C501,510,513,521,524	34226106		+	10µ F
C515,517,519	34226226	+		22#F
		47		
		THE COURSE OF STREET, SHOWING STREET,	10	
	91100008	Wrapping Termina	11. 60	
	91100008	Wrapping Termina		
	91100008	Wrapping Termina		
	91100008	Wrapping Termina		
	91100008	Wrapping Termina		
	91100008	Wrapping Termina		

