

7.16770 MHz

B

A BAND C D E

ENTER

M.in

M/VFO

VFO

A=B

SPLIT

LOCAL

LOCK

AOR

DDS-2A

local generator

PRESECTOR

7.0 5 6 7 8 9 14 21 28 3.5 1 2 3

STBY OFF OPR CAL

COLLINS

REJECTION TUNING

75S-3C

MODE

USB CWT CWB AM

BFO

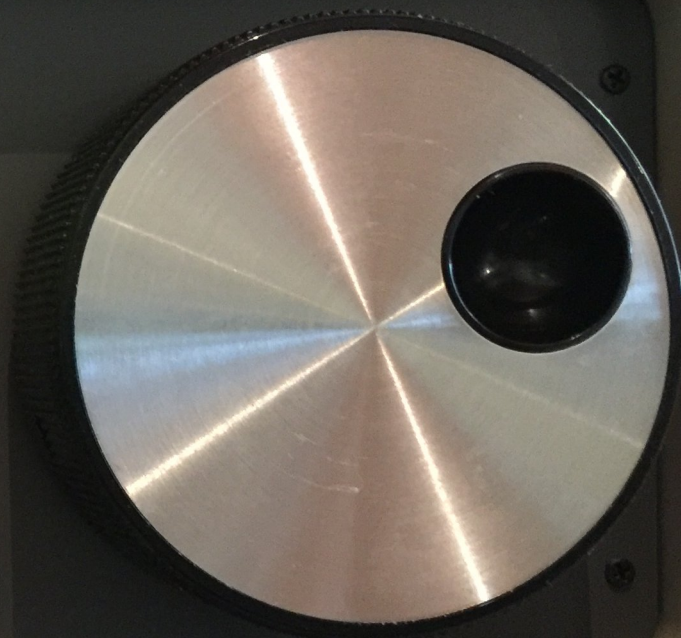
7.16770 MHz
B

B C D
A BAND E

ENTER M.in M/VFO ← →
VFO A=B SPLIT LOCAL LOCK



DDS-2A local generator





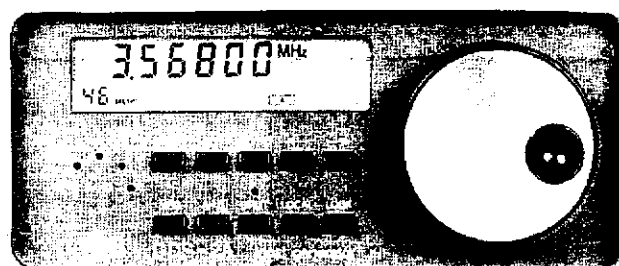
Instruction Manual

DDS-2A

TM

External VFO for Collins

KWM-2 (A), 75S- () and 32S- ()



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Japan

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1. GENERAL

1-1. General Description

The **DDS-2A** is a microprocessor controlled VFO for the Collins KWM-2 (A) and S-Line, including 75S-3B and 32S-3. The DDS-2A uses the latest DDS and PLL technology to produce accurate and clean local signals for the equipment. The unit utilizes an original BFO of 435.65 KHz (456.35 KHz) in the Collins equipment.

The DDS-2A replaces **PTO** and **HFO** in the equipment. You can expect 10 Hz frequency resolution and accuracy in the transmit and the receive.

Because of the clean local injection, you can expect performance improvement, including inter-modulation and cross-modulation characteristic.

1-2. Features

HFO

The DDS-2A provides an HFO (Heterodyne Frequency Oscillator) signal in the range of 6.550 MHz to 32.950 MHz (5 KHz off the original range) in 200 KHz increments.

The signal replaces the HFO oscillator of the equipment thereby general coverage is possible. You can operate your equipment in a new **WARC** bands, as well as to receive short-wave broadcast stations.

The HFO output is produced by the low-noise PLL with reference frequency of 50 KHz.

VFO & 100 Memory Channel

The DDS-2A provides VFO signal of 2.695 MHz to 2.495 MHz (5 KHz off the original range) that will replace the PTO of the equipment. The VFO output can be adjusted in 10 Hz increment.

The VFO uses an **NCO** (Numeric Controlled Oscillator) within a PLL loop that provides excellent C/N and accuracy over the range.

Total of 100 memory channels are provided for instant access to the important frequencies. **A=B** and split operation are also included for the VFO function.

BFO Shift compensation

The DDS-2A provides BFO shift compensation to obtain accurate frequency display. A 455 KHz of the reference frequency can be compensated up to 9.999 KHz in 1 Hz step for both the USB and the LSB. (Example; 1.350 KHz of the Collins original frequency)

Easy installation

The DDS-2A can be installed to the KWM-2 (A) without any modifications to the equipment. It can also be installed to the S-Line (75S- / 32S-) with the modification to the 75S- () receiver. The DDS-2A uses inch size optical encoder for the VFO dial, so you can replace the knob to an original Collins spinner knob.

2. SUPPLIED ACCESSORIES

Table 1 shows the accessories and parts that comes with the DDS-2A. Installation for the 32S - () requires additional parts that will be discussed in the chapter 4 of this manual.

Table 1 (Supplied Accessory List)

Parts	Qauntity	Length	Description
DC Cable	1	5 feet	DC cable that comes with a 5.5 mm diameter round type plug.
Interface Cable	1	2-4/5 feet	5 conductor cable with 8-pin DIN plug and 9-pin vacuum tube plug
6EA8 Coaxial Cable	1	2-4/5 feet	Coaxial cable with RCA plug and 9-pin vacuum tube adapter.
BPF Coaxial Cable	1	2 feet	Coaxial cable with RCA plugs. This cable includes a BPF.
Modification parts	1	N/A	Parts for the S-line modification. Resistors, wires, coaxial cable and 9-pin adapter socket are included.
Instruction Manual	1	N/A	Operating and installation manual. (This book)

3. INSTALLATION PRECAUTION

1. Before installs the DDS-2A to the radio equipment, you must make sure that the radio is operating satisfactory. Adjust and repair the radio equipment before installing the DDS-2A.
2. Use high quality 12 ~ 13.8 VDC power supply with minimum ripple contents. A minimum of 1 A output is required for the DDS-2A.
3. The DDS-2A has no power ON-OFF switch. You must use power ON-OFF switch of the DC power supply. When you turn your radio ON, the DDS-2A turns ON same time.
4. Do not install the DDS-2A under high temperature and vibrating locations. If you install the unit near the power supply, the unit may pick-up power noise.

4. INSTALLATION

4-1. KWM-2 (A) Installation

(1) Interface Cable

Connect **8-pin DIN** connector to the **CONTROL** jack of the DDS-2A. Remove 9-pin jumper plug from the **EXT-VFO** socket that is located inside center of the KWM-2 (A). The jumper plug should be left there. Connect **9-pin plug** to the **EXT VFO** socket through the large hole of the rear panel of the unit.

(2) 6EA8 Cable

Connect **RCA** plug to the **HFO** jack of the DDS-2A. Remove **6EA8 (V13)** from the KWM-2 (A). Connect the adapter to the **V13** socket through the large hole of the rear panel of the unit. Re-install the **6EA8 (V13)** to the **tube adapter**.

(3) BPF Cable

Connect **RCA** plug to the **VFO** jack of the DDS-2A. Connect **RCA** plug to the **EXT VFO** jack on the unit.

4-2. 75S - () Installation

(1) 32S - () Connection

Connect 32S - () to the 75S - () for transceiver operation. The DDS-2A connects to the 75S - () only.

(2) DDS-2A Modification

< (Remove the cover from the DDS-2A. Solder 15 K Ω / 5 W resistor parallel with the large power resistor that is mounted inside of the DDS-2A chassis. Close the cover. X

(3) 75S - () Modification

Locate the **lug plate** that is used to relay the coaxial cable from the **PTO** unit. Cut the center conductor of the coaxial cable from the **PTO** at the **lug plate**. Solder new coaxial cable supplied to the **lug plate**. Solder both the inner conductor and the braid to the **lug plate**.

Solder the other end of the coaxial cable to the **SPARE** jack (vacant jack) of the rear panel of the 75S - (). Solder both the inner conductor and braid to the jack. Remove **6AU8 (V301)** from the **PTO** unit.

Assemble **9-pin socket** by soldering wires provided. A pin layout of the socket is same as the vacuum tube.

Pin No.	Color	Connect to:
2	BLUE	Connect to MUTE (-30V at transmit)
3	RED	Connect to B+140V
5	YELLOW	LSB/USB switch
9	BLACK	Ground

Insert the wires through the same hole that is used for the **PTO** wires. Leave the wires approximately 2-1/2 inches from the hole.

Refer to the schematic and parts location of the 75S - () manual. Solder the other end of the wires as indicated above. **YELLOW** wire (LSB/USB switch) should be connected to the location where the -30 V is obtained at LSB and + 130 V for the other mode. (for **PTO** shift)

(4) Interface Cable

Connect **8-pin** DIN connector to the **CONTROL** jack of the DDS-2A. Connect **9-pin** plug to the **9-pin** socket (mounted in the above (3)) through the large hole of the 75S - () rear panel.

(5) 6EA8 Cable x

Connect RCA plug to the **HFO** jack of the DDS-2A. Remove **6EA8 (V3)** from the 75S - (). Connect tube adapter to the **V3** socket through the large hole of the rear panel. Re-install the **6EA8 (V3)** to the tube adapter.

(6) BPF Cable x

Connect RCA plug to the **VFO** jack of the DDS-2A. Connect RCA plug to the **SPARE** jack on the rear panel of the unit.

4-3. 32S - () Installation

(1) 75S - () Connection

Connect 75S - () to the 32S - () for independent operation. The DDS-2A connects to the 32S - () only. Prepare following additional parts. (Not included)

Coaxial Cable (approx. 2 - 4/5 feet) with RCA plugs.	x	1
51 Ω 1/4 W Resistor	x	1
470 Ω 1/2 W Resistor	x	1
0.01 μ F / 500 WV Ceramic Capacitor	x	1

(2) DDS-2A Modification

No modifications are needed for this application.

(3) 32S - () Modification - Add 9-pin socket

Assemble **9-pin socket** comes with the DDS-2A by soldering wires provided. A pin layout of the socket is same as the vacuum tube.

Pin No.	Color	Connect to:
3	RED	B+275 V (+275 V)
4	YELLOW	T+275 V (+275V at transmit)
5	BLUE	LSB/USB switch
9	BLACK	Ground

Insert the wires through the same hole that is used for the PTO wires. Leave the wires approximately 2-1/2 inches from the hole.

Refer to the schematic and parts location of the 32S - () manual. Solder the other end of the wires as indicated above. **YELLOW** wire (T275 V) should be connected to one end of the **R17** (5 K Ω) that is connected to the **0A2** regulator tube.

BLUE wire (LSB/USB switch) should be soldered to the point where the -30 V is obtained at the LSB mode and + 150 V for the other mode. (for PTO shift)

(4) 32S - () Modification - 6CB6 (V12)

Replace **100 K Ω** that is connected to **pin 1** (Grid) of the **6CB6 (V12)** by **51 Ω 1/4 W**. Cut the wire that is connecting to the crystal switch. Solder coaxial cable provided between **SPARE** jack on the rear panel and the **pin 1**. Braid of the coaxial cable should be soldered to ground.

Disconnect **82 pF** that is connected to **pin 6** (Screen). Cut the wire that is connecting to the crystals. Do not remove the **L23** (1 mH) from the **pin 6**. Solder **0.01 μ F** ceramic capacitor between **pin 6** and **ground**. Replace **R135** (**100 Ω**) by **470 Ω 1/2 W** resistor. The **R135** is connecting **L18** (220 μ H) that connects to **pin 2**.

Remove **6AU6 (V301)** from the PTO unit.

(5) Interface Cable

Connect **8-pin DIN** connector to the **CONTROL** jack of the DDS-2A. Connect **9-pin plug** to the **9-pin socket** (mounted in the above (3)) through the large hole of the 32S - () rear panel.

(6) BPF Cable

Connect **RCA** plug to the **VFO** jack of the DDS-2A. Connect **RCA** plug to the **J8 (VFO INPUT)** of the 32S - ().

(7) HFO Cable - Use cable you provided.

Connect **RCA** plug to the **HFO** jack of the DDS-2A. Connect **RCA** plug to the **SPARE** jack.

5. CONTROLS & CONNECTIONS

5-1. Front Panel

The illustration shows the front panel of the DDS-2A. Table 2 shows a list of front panel controls.

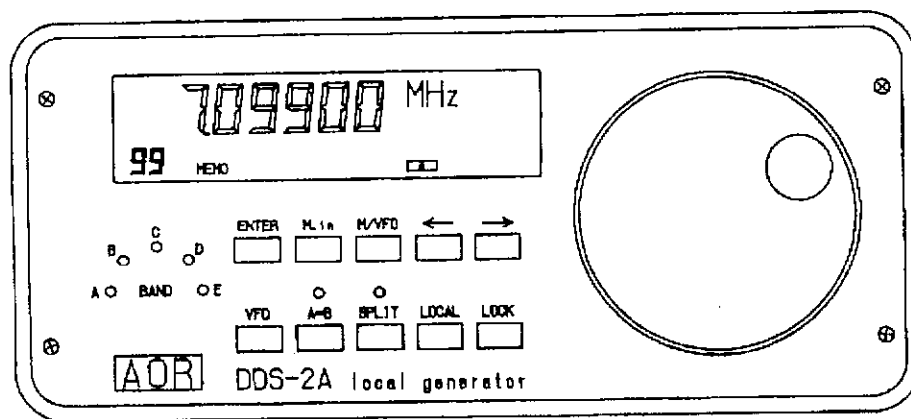
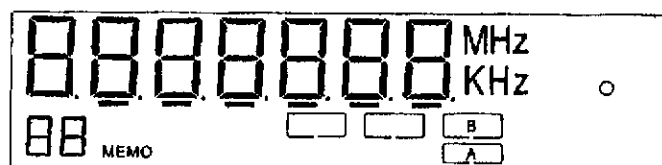


Table 2 (DDS-2A Front Panel)

CONTROLS	FUNCTION
BAND	Display the band depending on the frequency tuned.
ENTER	Use to store the frequency into the memory channel. Toggles between the odd and the even number start frequency.
M. In	When this key is pressed, channel number start blinks indicating that the DDS-2A is ready for the memory input. Push the ENTER key to store the frequency into the memory channel.
M.VFO	Switch between VFO and memory channel. In the memory mode, the channel number can be changed by the main dial.
← →	Change the frequency decimal point. It is also used to change the memory channel.
VFO	Switch between the A (1st) VFO and the B (2nd) VFO.
A = B	Frequency transfer switch. Push this switch transfers the second VFO (A or B) frequency into the first VFO (A or B).
SPLIT	Push this switch for split operation. You may receive by the A VFO and transmit by the B VFO.
LOCAL	Not Used
LOCK	Keybod Lock (Unlock).
Main Knob	Use to tune the frequency. It also selects the memory channel in the memory mode.




5-2. LCD Panel

The illustration shows the LCD panel of the DDS-2A. Table 3 shows a list of symbols of the LCD.



5-2. LCD Panel

Table 3 (DDS-2A LCD Panel)

DISPLAY	MEANING
Number (large)	The frequency can be displayed to 10 Hz order.
[A] [B]	Indicates the type of VFO selected.
○	Indicates when inputting BFO shift frequency.
Number (small)	Indicates number of the memory channel.
	Indicates that the DDS-2A accepts the frequency for memory storage.
 	Rectangular indicator next to B VFO indicator shows that the DDS-2A starts from an odd frequency. (Example: 3.5, 3.7, 3.9 MHz etc.)

5-3. Rear Panel

The illustration shows the rear panel of the DDS-2A. Table 4 shows a list of symbols of the rear panel.

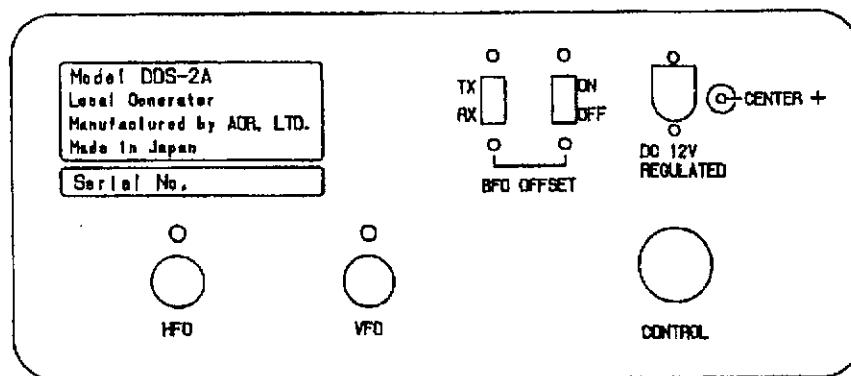


Table 4 (DDS-2A Rear Panel)

LABEL	PURPOSE
DC 12V	Provided for DC supply. Use the DC cable comes with the unit.
BFO OFFSET	Turn this switch ON to compensate the BFO frequency. When the switch is ON, LCD shows shift frequency in KHz. Turn the switch to OFF after compensation is done. The LCD returns to normal display.
HFO	6.550 MHz ~ 32.950 MHz output. (Heterodyne Frequency Oscillator)
VFO	2.695 MHz ~ 2.495 MHz VFO output for PTO.
CONTROL	For 8-Pin DIN connector. Connect between the radio and the DDS-2A.

6. OPERATION

6-1. Basic control

(1) Power Supply

Connect high quality DC 12 ~ 13.8 V power supply using the power cable supplied with the unit. The DDS-2A has no power ON-OFF switch, but it will turn ON when the power is applied to the radio equipment.

(2) MEMO/VFO Switch

This switch is used to change between the VFO mode and the Memory mode. In the VFO Mode, the "MEMO" icon and the Channel number will be disappeared from the LCD.

(3) Main Dial knob

This knob is used to tune the frequency in the VFO mode. The tuning steps can be changed by the ← → key. In the Memory mode, channel number can be changed by the knob.

(4) VFO select

Push the VFO key to select the A or B VFO. When the DDS-2A is in the Memory mode, this key resumes to the VFO mode. When the VFO mode is selected, the LCD shows either the [A] or [B] icon depending on the type of the VFO selected.

(5) Key lock

Push the [LOCK] key to lock the controls. Push the [LOCK] key again to unlock the controls.

(6) Memory write

Tune the frequency by the main knob. To store the frequency, push the [M.in] key. The display shows the lowest vacant channel number. Push the [ENTER] key to store frequency into memory.

(7) Odd or Even number start

When you move the frequency in some bands (example 3.800 MHz to 3.799 MHz), you will hear switching noise from the receiver. To prevent the switching noise, you may consider using an odd (even) number frequency start feature.

To activate this feature, push the [ENTER] key. Once the DDS-2A is an odd start setup, a rectangular indicator next to the "B VFO" icon should lit. The [ENTER] key toggles the ODD and EVEN start. No display will be changed when this feature is activated.

6-2. Collins equipment control

Once frequency is tuned by the DDS-2A, the **BAND LED** lit showing an appropriate and for the main radio equipment. Set the radio's band switch to the same position. Tune radio equipment according to the operating procedure as described in the manual.

Example: Tune **EXCITOR TUNE, TUNE (KWM-2 (A)), PRE-SELECTOR (75S- ())** etc.

7. ADJUSTMENT

7-1. BFO Compensation - KWM-2 (A)

(1) Shift frequency offset - General

The BFO compensation is provided to display accurate operating frequency. The DDS-2A set it BFO offset frequency to 1.350 KHz when shipped from the factory. You may fine tune the BFO shift frequency according to your preference.

(2) BFO compensation at RECEIVE mode

The following procedure applies to the KWM-2 (A). You can use the same technique for the 75S - () and the 32S - ().

On the **LSB** mode, tune the KWM-2 (A) to 15.000 MHz. (or other frequency to receive standard signal.) Slide the **BFO offset** switches to **RX** and **ON** position respectively. The LCD shows a factory default value of 1.350 KHz. The " O " icon in the LCD blinks. Tune the main knob of the DDS-2A to obtain the "ZERO BEAT".

Once the "ZERO BEAT" is obtained, slide the **BFO offset** switch to **OFF** position.

NOTE: If the display shows other than 1.350 KHz at ZERO BEAT, (example 1.330 KHz) the frequency of the BFO crystal inside of the KWM-2 (A) should be : 453.670 KHz
(455.000 - 1.330 = 453.670)

Change the mode switch to the **USB** mode, tune the KWM-2 (A) to 15.000 MHz. (or other frequency to receive standard signal.) Slide the **BFO offset** switches to **RX** and **ON** position respectively. The LCD shows a factory default value of 1.350 KHz. The " O " icon in the LCD blinks. Tune the main knob of the DDS-2A to obtain the "ZERO BEAT".

Once the "ZERO BEAT" is obtained, slide the **BFO offset** switch to **OFF** position.

NOTE: If the display shows other than 1.350 KHz at ZERO BEAT, (example 1.375 KHz) the frequency of the USB BFO crystal inside of the KWM-2 (A) should be : 456.375 KHz
(455.000 + 1.375 = 456.375)

(3) BFO compensation at TRANSMIT mode

KWM-2 (A) uses the same filter and BFO oscillator for both transmit and receive.

On the **LSB** mode, slide the **BFO offset** switches to **TX** and **ON** position respectively. Tune the main knob of the DDS-2A to obtain the same offset value. (1.330 KHz in the above example.) Slide the **BFO offset** switches to **OFF** and **RX** position respectively.

For the **USB** mode, proceed the same to compensate the TX offset..

7-2. BFO Compensation - S-LINE

(1) Preparation

To perform the BFO compensation, you must connect your 32S - () to a dummy load and a monitor receiver with at least 10 Hz accuracy. Set 32S - () to any amateur frequency (Example 7.08700 MHz etc.) You must tune the equipment to transmit properly at the frequency in the **LSB** mode. You must also set the monitor receiver to the same frequency to monitor the sound.

(2) BFO Compensation

Slide the **BFO offset** switches to **ON** and **RX** respectively. The LCD shows a factory default of 1.350 KHz. Transmit the S-Line and monitor your signal. The DDS-2A shows 1.350 KHz.

Adjust the main knob until comfortable sound is obtained from the monitor receiver. Slide the **BFO offset** switch to **OFF** position.

NOTE: If the display shows other than 1.350 KHz at ZERO BEAT, (example 1.323 KHz) the frequency of the LSB crystal should be: $453.677 \text{ KHz} (455.000 - 1.323 = 453.677)$

Change the **mode switch** to the **USB mode** and proceed the same compensation. Slide the **BFO offset** switch to **OFF** position.

NOTE: If the display shows other than 1.350 KHz at ZERO BEAT, (example 1.385 KHz) the frequency of the USB crystal should be: $456.385 \text{ KHz} (455.000 + 1.385 = 456.385)$

7-3. BFO Compensation - 32S - ()

If you use the DDS-2A for the 32S - (), no RX compensation is needed. However, you can compensate TX offset using same technique as described in this manual.

7-4. Reset and initialization

You may reset the DDS-2A by the following two methods.

RESET (No memory contents will be erased.)

Push the reset switch firmly using a pointing object such as tooth pick through the pin hole that is located underneath of the front trim of the DDS-2A.

INITIALIZE (Memory contents will be erased.)

Turn **OFF** the radio equipment while holding the **[ENTER]** key. Wait approximately five (5) seconds until all memory contents are erased. The DDS-2A returns to the factory default.

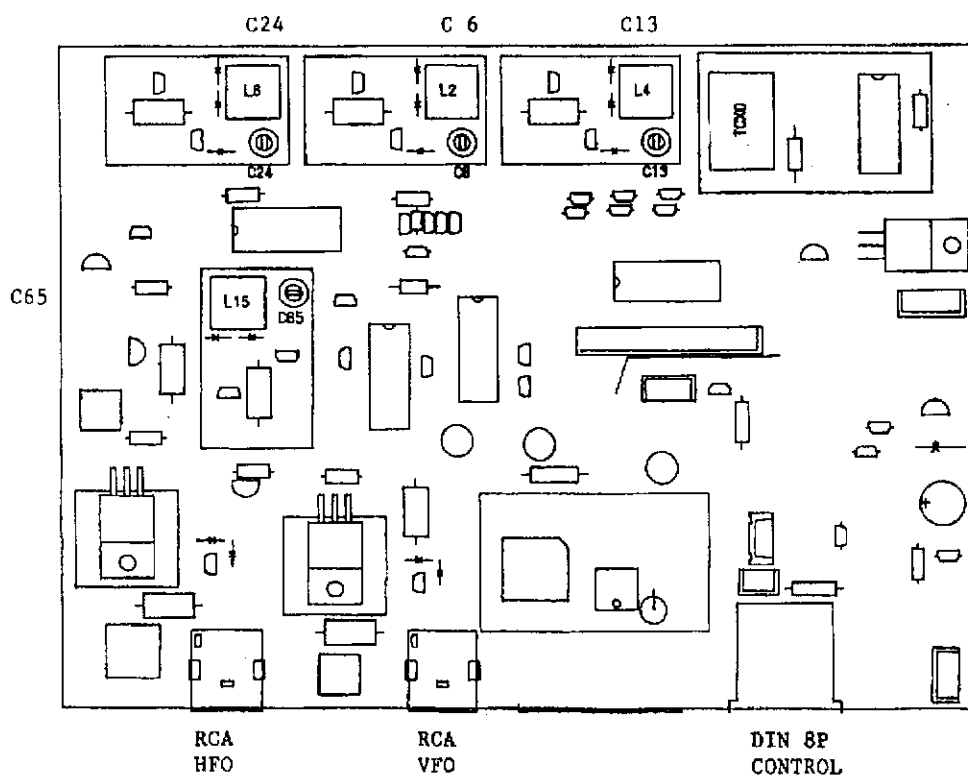
BFO SHIFT OFFSET : 1.350 KHz
VFO A/B : 10.000 MHz

7-5. Output level adjustment

Factory default is sufficient for an ordinary users. When the fine adjustment is required, refer to the following diagram for the location of the tuning.

C65, C24, C13, and C6 Locations

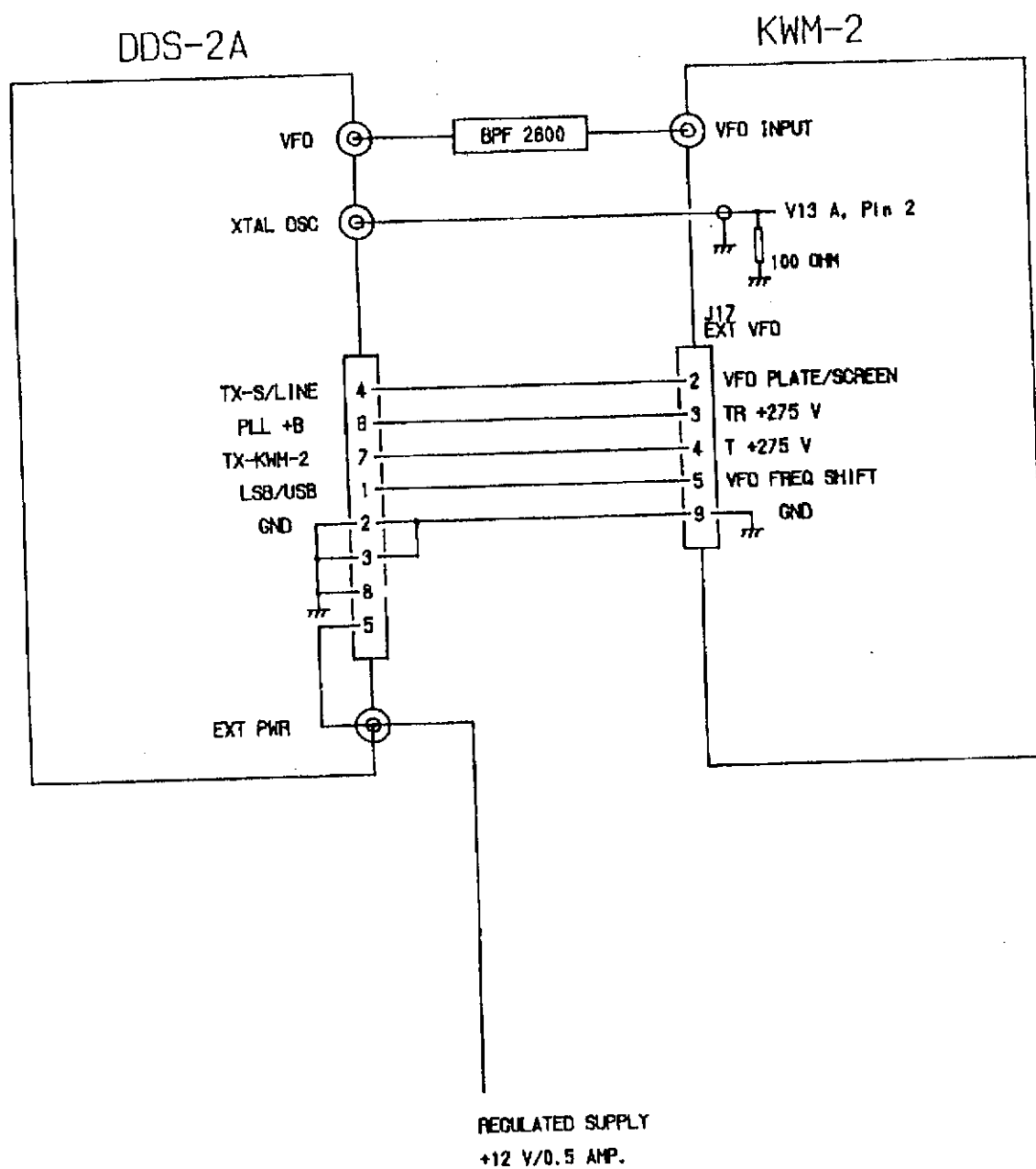
C65 :	VFO Output	
C24 :	HFO Output	3.4 ~ 7.8 MHz band
C6 :	HFO Output	8.0 ~ 15.8 MHz band
C13 :	HFO Output	16.0 ~ 29.8 MHz band



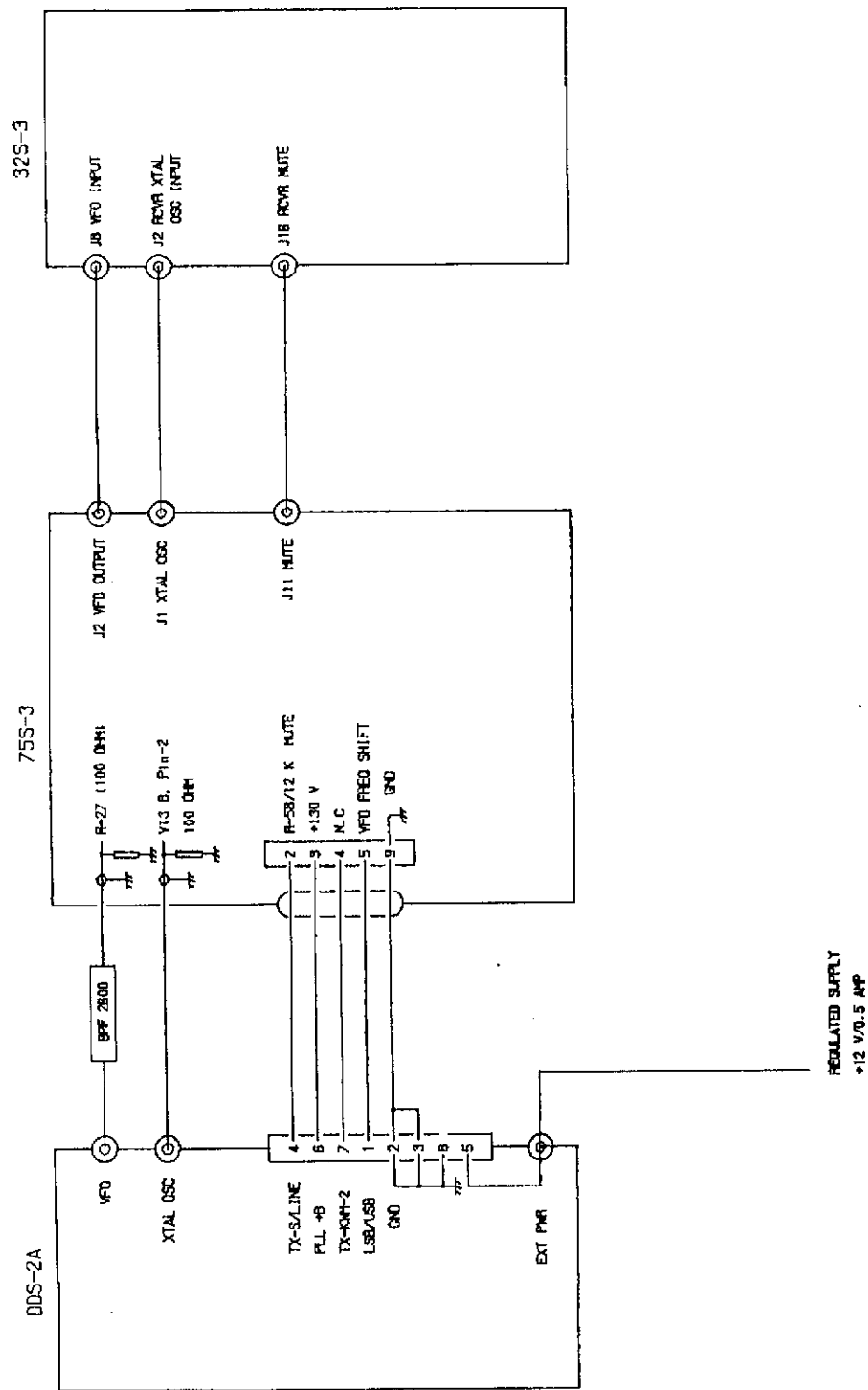
8. SPECIFICATIONS

As a part of our policy of continuous improvement, AOR reserves the right to make design and specification changes for product improvement without prior notice. The performance specification figures indicated are nominal values of production unit. There may be some deviation from these values in individual units.

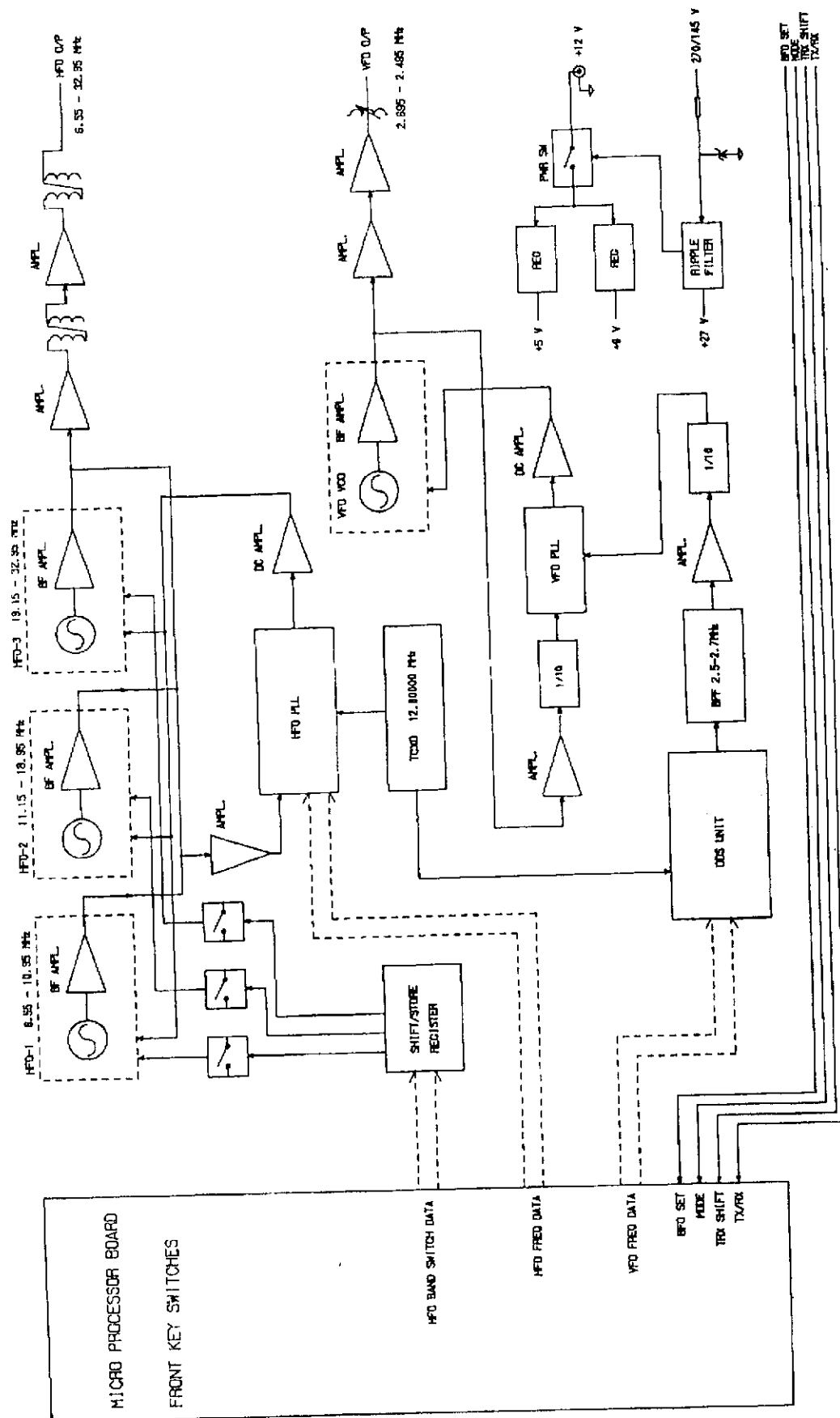
Model	DDS-2A External VFO
Frequency range	HFO 6.550 MHz ~ 32.950 MHz VFO 2.695 MHz ~ 2.495 MHz
Stability	Less than 5 PPM. (0.005%)
Output level	HFO 2.0 ~ 2.3 V RMS @50 Ω VFO 2.0 ~ 2.3 V RMS @100 Ω 1.5 ~ 1.7 V RMS through BPF
Spurious & Noise attenuation	HFO > 70 dBc @1 KHz ~ 25 KHz from the carrier frequency > 75 dBc @26 KHz ~ 1 MHz from carrier frequency VFO > 80 dBc @1 KHz ~ 25 KHz from carrier frequency > 90 dBc @25 KHz ~ 250 KHz from carrier frequency
Phase noise attenuation	> 130 dBc/Hz @25 KHz (VFO) from the carrier frequency
External power source	12.0 ~ 13.8 V DC @ 0.6 A Less than 5 mV ripple contents
Dimensions and weight	80 (H) x 180 (W) x 181 (D) (in mm) / 1.9 Kg (unit only) 3.15 (H) x 7.1 (W) x 7.1 (D) (inches) / 4.2 LBS (unit only)



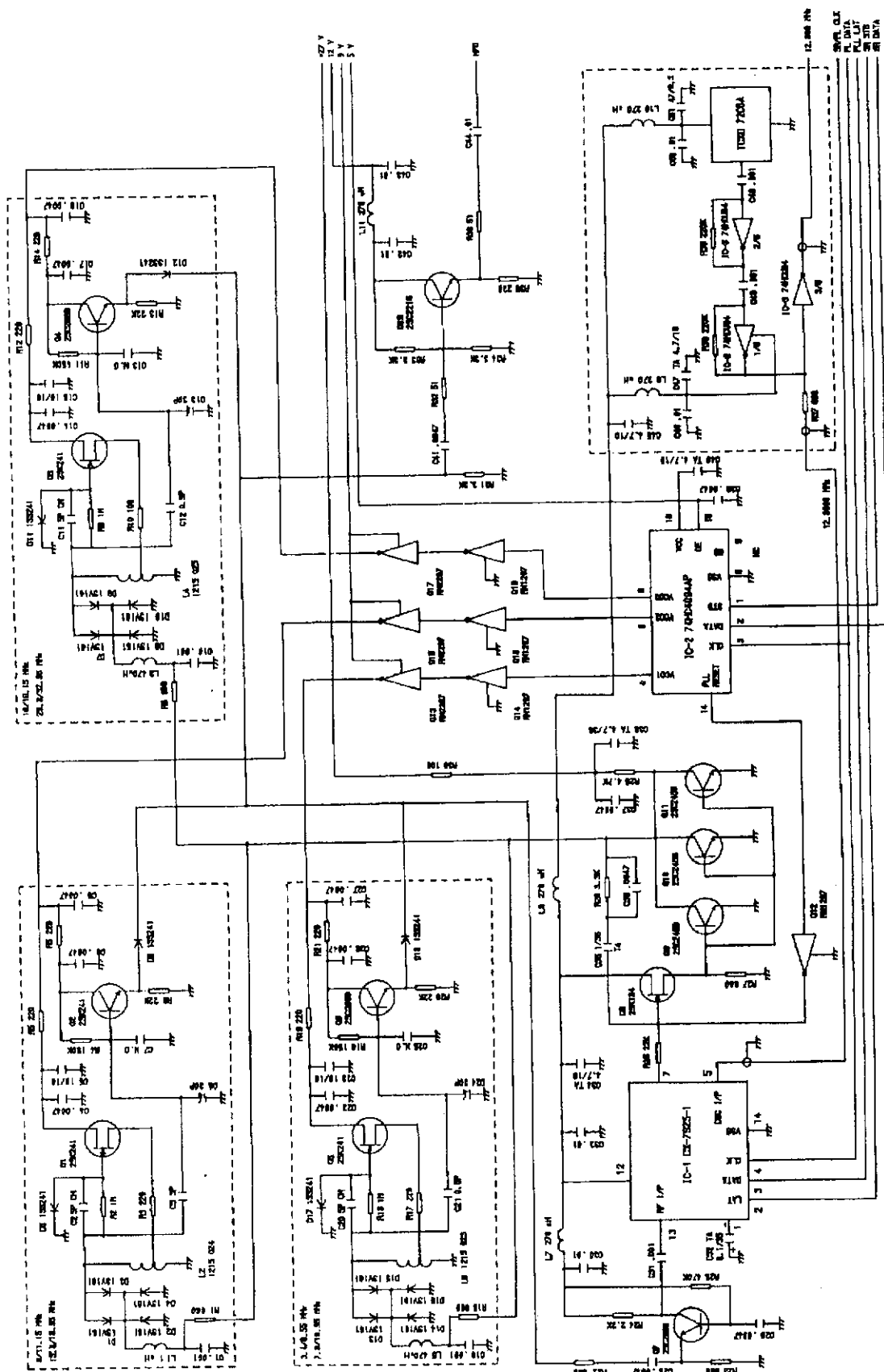
Interconnections. DDS-2A with KWM-2
Figure 1 (Sheet 1/1)



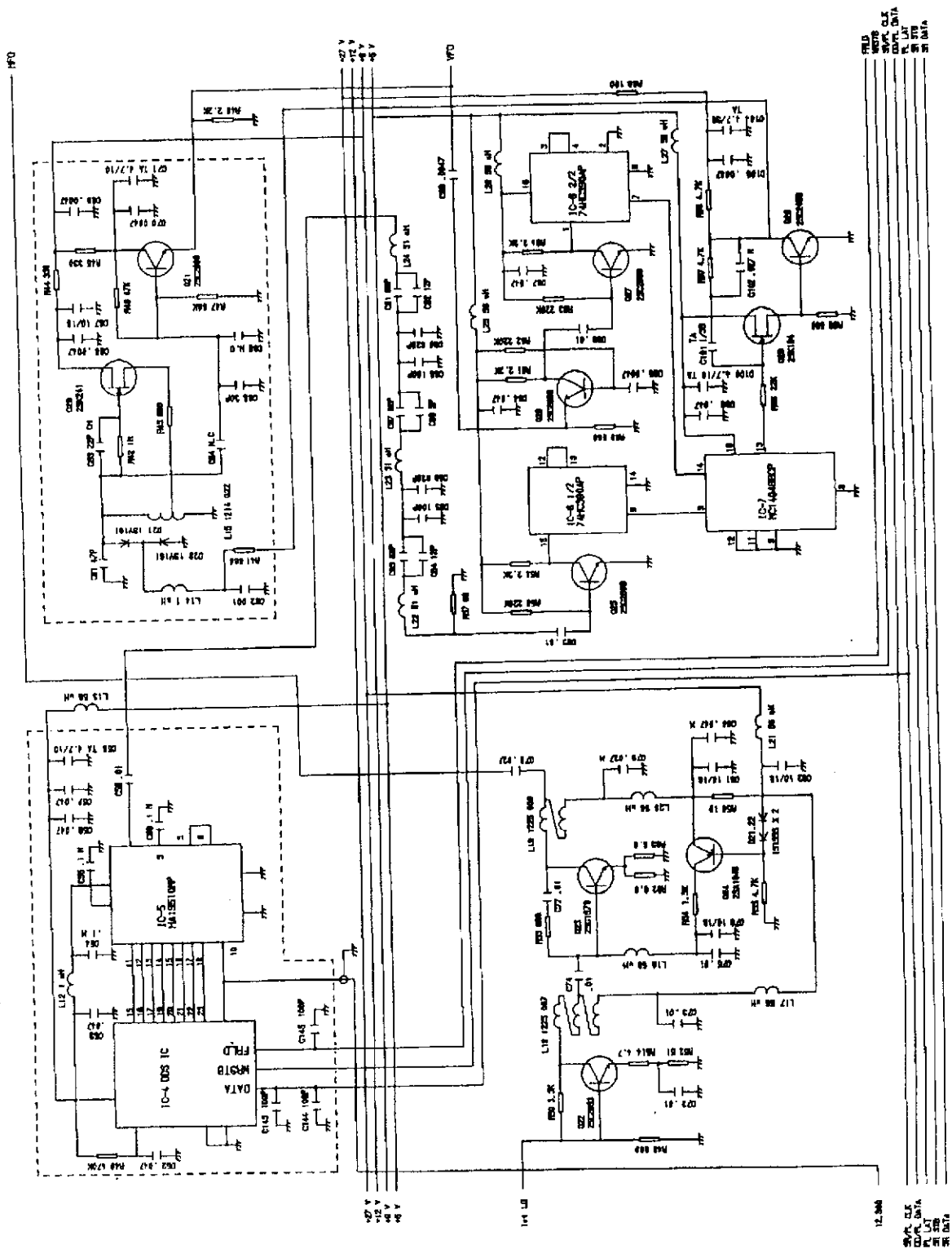
Interconnections. DDS-2A with S-LINE
Figure 2 (Sheet 1/1)



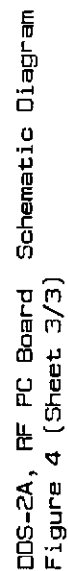
DDS-2A Local Generator, Functional Block Diagram.
Figure 3 (Sheet 1/1)

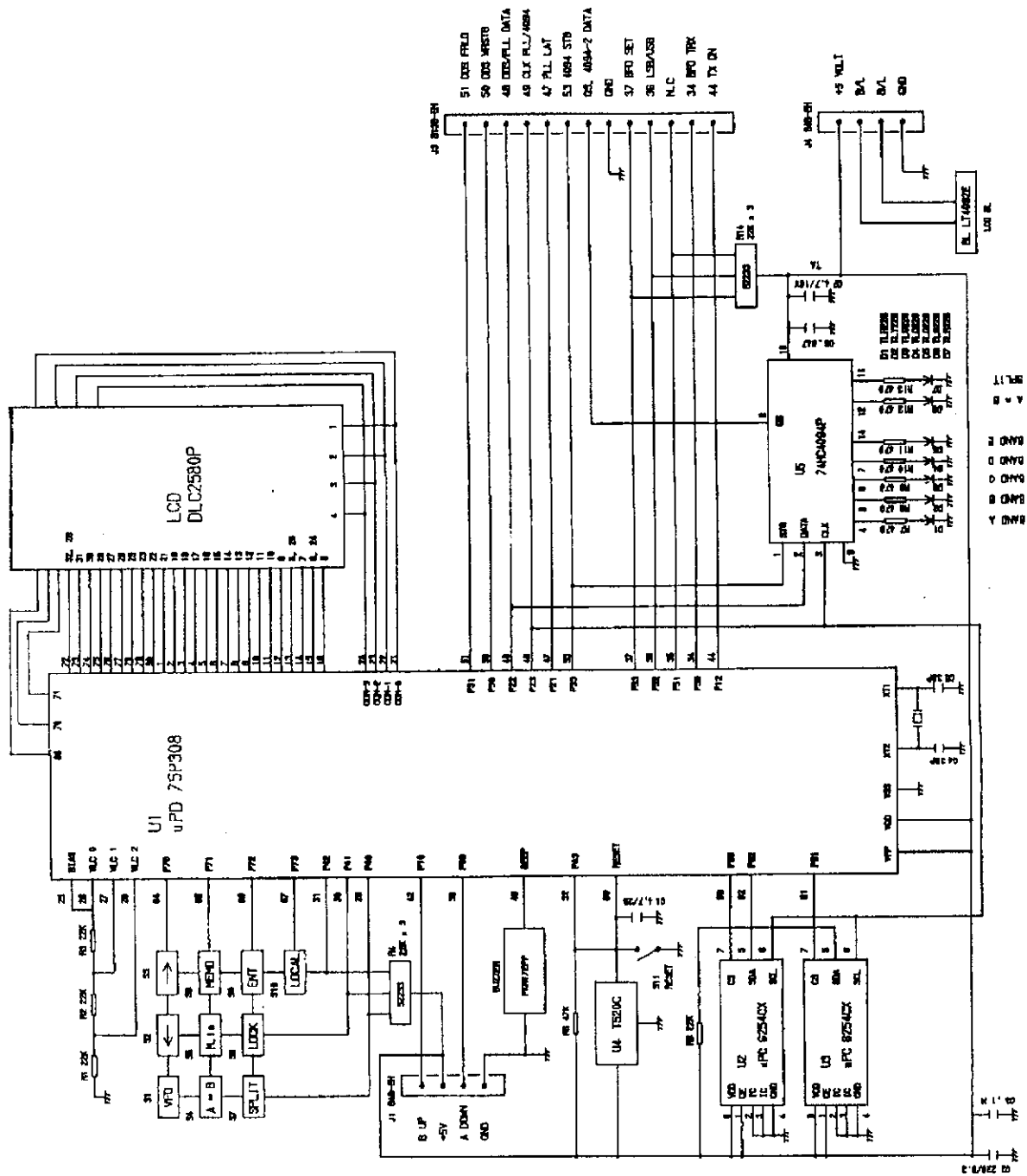


DDS-2A, RF P.C. Board Schematic Diagram.



DDS-2A, AF PC Board Schematic Diagram
Figure 4 (Sheet 2/3)





DOS-2A CPU PC Board Schematic Diagram
Figure 5 (Sheet 1/1)

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