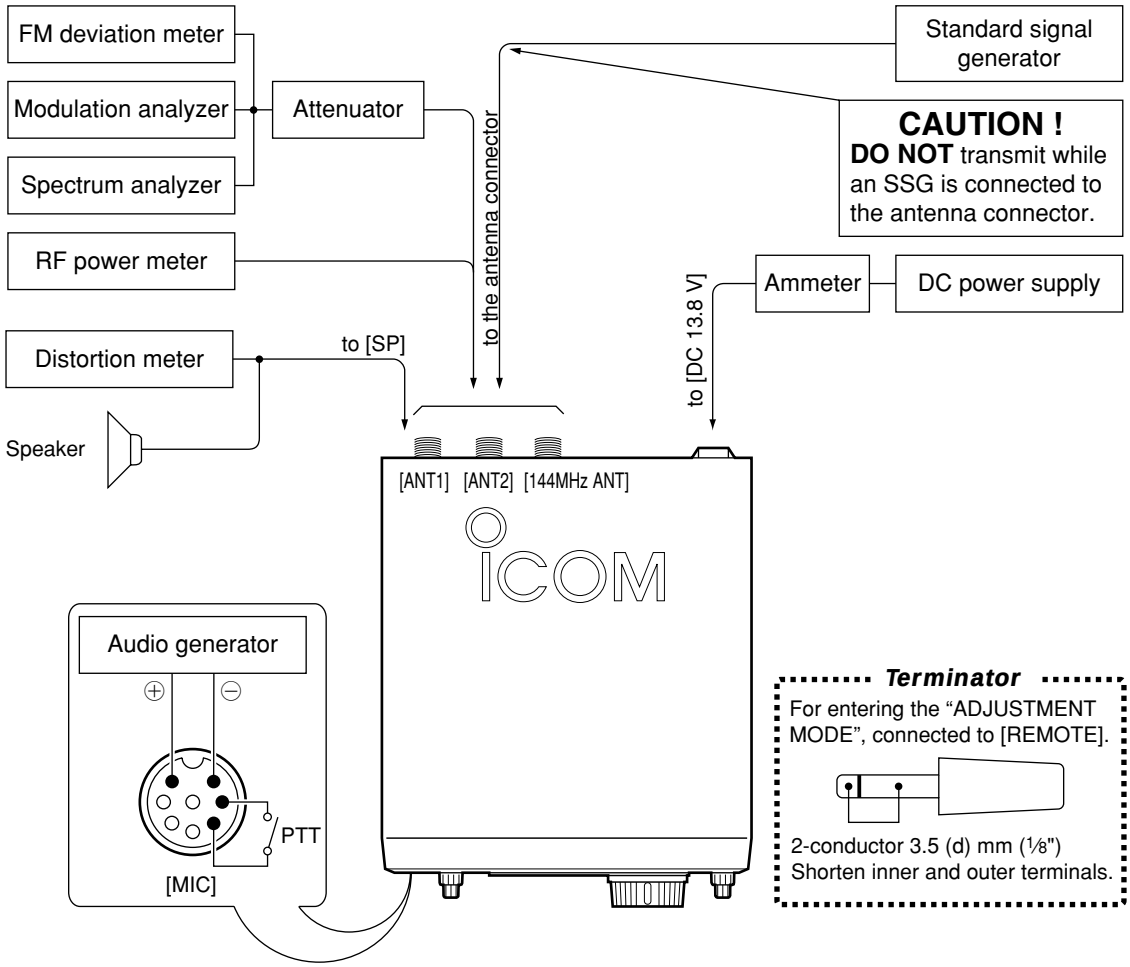
5. ADJUSTMENT PROCEDURES

5-1 PREPARATION BEFORE SARVICING

■ REQUIRED TEST EQUIPMENT

EQUIPMENT	GREDE AND RANGE	EQUIPMENT	GREDE AND RENGE
DC power supply	Output voltage : 13.8 V DC Current capacity : 30 A or more	Audio generator	Frequency range : 300–3000 Hz Measuring range : 1–500 mV
RF power meter (terminated type)	Measuring range : 10–200 W Frequency range : 1.8–200 MHz Impedance : 50 Ω SWR : Less than 1.2 : 1	Standard signal generator (SSG)	Frequency range : 0.1–200 MHz Output level : 0.1 µV to 32 mV (–127 to –17 dBm)
Frequency counter	Frequency range : 0.1–200 MHz Frequency accuracy : ±1 ppm or better Sensitivity : 100 mV or better	Digital multimeter	Imput impeadance : 10 MΩ/DC or beter
RF voltmeter	Frequency range : 0.1–200 MHz Measuring range : 0.01–10 V	AC millivoltmeter	Measuring range : 10 mV–10 V
FM deviation meter	Frequency range : DC–200 MHz Measuring range : 0 to ±5 kHz	DC voltmeter	Input impedance : 50 kΩ/V DC or better
Modulation analyzer	Frequency range : At least 200 MHz Measuring range : 0–100 %	DC ammeter	Measurement capability: 1 A/30 A
Distortion meter	Frequency range : 1 kHz ±10 % Measuring range : 1–100 %	Spectrum analyzer	Frequency range : At least 90 MHz Spectraum bandwidth : 100 kHz or more
Oscilloscope	Frequency range : DC–20 MHz Measuring range : 0.01–20 V	Attenuator	Power attenuation : 50 or 60 dB Capacity : 150 W or more
		External speaker	Input impedance : 8 Ω Capacity : 5 W or more
		Terminator	Resistance : 50 Ω, 25 or 100 Ω Capacity : 150 W or more

■ CONNECTIONS



5-2 PLL ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
REFERENCE FREQUENCY	1	• Displayed freq. : Any • Preset R1032 (RF unit) to the center position. • Preset L1902 (RF unit) approximate 1.5 mm downside from top of the coil's case. • Receiving	RF	Connect an RF voltmeter to the check point P1901.	Maximum level (0 dB or more)	RF	L1903, L1904
	2	• Receiving		Connect a frequency counter to the check point P1901.	64.000000 MHz		L1901 (L1902, R1032 for critical adjustment)
LPL LOCK VOLTAGE	1	• Displayed freq. : 0.030000 MHz • Mode : USB • Receiving	RF	Connect a digital multimeter or oscilloscope to the check point CP1101 (LV1).	1.0 V	RF	C1303
VCO LOCK VOLTAGE	1	• Displayed freq. : 7.999999 MHz • Mode : USB • Receiving	RF	Connect a digital multimeter or oscilloscope to the check point CP1802 (LV2).	4.0 V	RF	C1208
	2	• Displayed freq. : 21.999999 MHz • Mode : USB • Receiving					C1228
	3	• Displayed freq. : 39.999999 MHz • Mode : USB • Receiving					C1248
	4	• Displayed freq. : 60.000000 MHz • Mode : USB • Receiving					C1268
1LO OUTPUT LEVEL	1	• Displayed freq. : 0.500000 MHz, 7.999999 MHz 8.000000 MHz, 21.999999 MHz 22.000000 MHz, 39.999999 MHz 40.000000 MHz, 50.000000 MHz 54.000000 MHz, 144.000000 MHz, 148.000000 MHz • Receiving	RF	Connect an RF voltmeter to the check point CP1500.	–7 dBm or more		Verify
3LO OUTPUT LEVEL	1	• Displayed freq. : Any • Mode : USB • Receiving	RF	Connect an RF voltmeter to the check point CP1601.	–25 dBm or more		Verify
MARKER OUTPUT LEVEL	1	• Displayed freq. : 14.100000 MHz • Mode : CW • Marker : ON • Receiving	FRONT	Display	S3 or more (S-meter level)		Verify

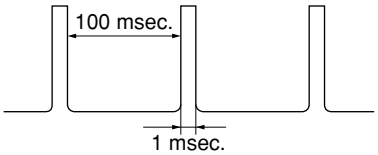
5-3 TRANSMITTER ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
IDLING CURRENT (for driver)	1	• Displayed freq. : 14.100000 MHz • Mode : USB • [MIC GAIN] : Max.CCW • [RF POWER] : Max. CW • [TUNER] : OFF • Preset R11, R18, R224 (PA unit) to max. counter clockwise. • Turn C202 (PA unit) to 90˚ clockwise. • Transmitting	PA	Connect an ammeter between the power supply and the IC-746PRO/7400.	+2.5 A	PA	R11
(for HF/50 M band final amplifier)	2	• Transmitting			+300 mA		R18
(for 144 M band final amplifier)	3	• Displayed freq. : 144.00000 MHz • Mode : USB • Transmitting			+1 A		R204
		After adjustment, disconnect the ammeter between the power supply and the IC-746PRO/7400.					
144 M PEAK	1	• Displayed freq. : 146.00000 MHz [USA] 144.00000 MHz [except USA] • Mode : RTTY • Transmitting	Rear panel	Connect an RF power meter to the [ANT 144MHz] connector.	Maximum output power	PA	C202
TX PEAK	1	• Displayed freq. : 145.00000 MHz • Mode : USB • Set following controls as: [RF POWER] : Max. CW [MIC GAIN] : Center [KEY SPEED] : Center [PITCH] : Center • Disconnect P1 (PA unit) from J151 (RF unit). • Connect an audio generator to [MIC] connector and set as: Frequency : 1.5 kHz Level : 1 mVrms • Transmitting	RF	Connect a digital multimeter or oscilloscope to the check point J151.	Maximum output Level	RF	Adjust in sequence L253, L252, L251, L272 several times.
		After adjustment, re-connect P1 (PA unit) to J151 (RF unit).					
	2	• Displayed freq. : 14.100000 MHz • Mode : USB • Connect an audio generator as: Frequency : 1.5 kHz Level : 1 mVrms • Transmitting	Rear panel	Connect an RF power meter to the [ANT1] connector.	50 W	Front panel	[MIC GAIN] control
	3	• Transmitting			Maximum output power	MAIN	L330
TRANSMITTER TOTAL GAIN	1	• Displayed freq. : 14.100000 MHz • Mode : USB • [MIC GAIN] : Center • Connect an audio generator to [MIC] connector and set as: Frequency : 1.5 kHz Level : 1 mVrms • Transmitting	Rear panel	Connect an RF power meter to [ANT1] connector.	50 W	MAIN	R331
Ic APC	1	• Mode : RTTY • Connect CP300 to GND. • Transmitting on the maximum TX current band.	Rear panel	Connect an ammeter between power supply and the IC-746PRO/7400.	23 A	MAIN	R555

TRANSMITTER ADJUSTMENTS—continued

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
HF BANDS OUTPUT POWER	1	• Displayed freq. : 14.10000 MHz • Mode : RTTY • [RF POWER] : Max. CW • [TUNER] : OFF • Transmitting	Rear panel	Connect an RF power meter to [ANT1] connector.	100 W	MAIN	R306
50 M BAND OUTPUT POWER	1	• Displayed freq. : 51.00000 MHz • Mode : RTTY • [RF POWER] : Max. CW • [TUNER] : OFF • Transmitting	Rear panel	Connect an RF power meter to [ANT1] connector.	100 W	MAIN	R311
144 M BAND OUTPUT POWER	1	• Displayed freq. : 145.00000 MHz • Mode : RTTY • [RF POWER] : Max. CW • [TUNER] : OFF • Transmitting	Rear panel	Connect an RF power meter to [ANT 144MHz] connector.	100 W	MAIN	R317
AM CARRIER	1	• Displayed freq. : 14.10000 MHz • Mode : AM • [RF POWER] : Max. CW • [MIC GAIN] : Center • Apply no audio signals to [MIC] connector. • Transmitting	Rear panel	Connect an RF power meter to [ANT 144MHz] connector.	40 W	MAIN	R320
AM MODULATION	1	• Displayed freq. : 14.10000 MHz • Mode : AM • [MIC GAIN] : Center • [RF POWER] : Max. CCW • Connect an audio generator to [MIC] connector and set as: Frequency : 1 kHz Level : 10 mVrms • Transmitting	Rear panel	Connect a modulation analyzer to [ANT1] connector through an attenuator.	100% or less		Verify
FM DEVIATION	1	• Displayed freq. : 28.50000 MHz • Mode : FM • Tone : OFF • [RF POWER] : Max. CW • [MIC GAIN] : Center • Connect an audio generator to [MIC] connector and set as: Frequency : 1 kHz Level : 10 mVrms • Transmitting	Rear panel	Connect an FM deviation meter to [ANT1] connector through an attenuator.	4.5 kHz ±0.3 kHz		Verify
RESIDUAL AM	1	• Displayed freq. : 145.00000 MHz • Mode : FM • Tone : OFF • [RF POWER] : Max. CW • [MIC GAIN] : Center • Connect an audio generator to [MIC] connector and set as: Frequency : 1 kHz Level : 4.5 kHz deviation at the connected deviation meter. • Transmitting	Rear panel	Connect an FM deviation meter to [ANT 144MHz] connector through an attenuator.	Minimum RESIDUAL AM level	RF	L252, L251
SWR DETECTOR		• Displayed freq. : 29.70000 MHz • Mode : FM • [RF POWER] : Max. CW • [TUNER] : OFF (Through) • Connect CP7 (SETI) on the CTRL unit to GND. • Connect a 50 Ω dummy load or an RF power meter to [ANT1] connector. • Transmitting	CTRL	Connect a digital multimeter or oscilloscope to the check point CP1.	Minimum voltage	CTRL	C3
		After adjustment, disconnect CP7 (CTRL unit) from GND.					

5-4 RECEIVER ADJUSTMENTS

ADJUSTMENT		ADJUSTMENT CONDITION	MEASUREMENT		VALUE	ADJUSTMENT POINT	
			UNIT	LOCATION		UNIT	ADJUST
RX PEAK	1	• Displayed freq. : 14.100000 MHz • Mode : USB • Set following selections, controls and functions as: [RF/SQL] : Center [PITCH] : Center [AGC] : OFF , [ATT] : OFF [NB] : OFF , [RIT] : OFF PBT1 : Center, PBT2 : Center [P.AMP] : P.AMP1 IF Filter : 2.4 kHz [NR] switch : OFF [NOTCH] switch: OFF • Preset L215 (RF unit) to 2 rotation downside from top of the coil's case. • Connect an SSG to [ANT1] connector and set as: Frequency : 14.101500 MHz Level : 10 µV* (–87 dBm) Modulation : 1 kHz/±3.5 kHz dev. • Receiving	Rear panel	Connect an AC millivolt meter to [EXT SP] connector with an 8 Ω load.	Maximum audio output level	RF	L252, L251
	2	• Mode : FM • Filter : 15 kHz • Set an SSG as : Frequency : 14.100000 MHz Level : 1 mV* (–47 dBm) Modulation : 1 kHz/±5.0 kHz Dev. • Receiving		Connect an distortion meter to [EXT SP] connector with an 8 Ω load.	Minimum distortion level		L242, L241
	3	• Displayed freq. : 0.03000 MHz • Set an SSG as : Level : OFF • Receiving		Connect an AC millivolt meter to [EXT SP] connector with an 8 Ω load.	Minimum noise output level		R218
RECEIVER TOTAL GAIN	1	• Displayed freq. : 14.100000 MHz • Mode : USB • Filter : 2.4 kHz • [P.AMP] : OFF • Set an SSG as : Frequency : 14.101500 MHz Level : 160 mV* (–3 dBm) Modulation : 1 kHz/±5.0 kHz dev. • Receiving	MAIN	Connect an oscilloscope to the check point CP1460.	4.0 Vp-p	MAIN	R1469
NOISE BLANKER	1	• Displayed freq. : 14.100000 MHz • Mode : USB • [P.AMP] : P.AMP1 • [NB] : OFF • [NB LEVEL] : 50% • Set an SSG as : Frequency : 14.101500 MHz Level : 18 µV* (–82 dBm) Modulation : OFF and apply following signal to [ANT1] connector.  • Preset R200 (MAIN unit) to the 12 o'clock position. • Receiving	MAIN	Connect an oscilloscope to the check point CP200.	Maximum noise level	MAIN	L201, L202, L203
	2	• [NB] : ON • Receiving			At the point where the voltage just reduces.		R200

*This output level of a standard signal generator (SSG) is indicated as SSG's open circuit.

5-5 ADJUSTMENT MODE

ADJUSTMENT		ADJUSTMENT CONDITION	DISPLAY	OPERATION
ENTERING ADJUSTMENT MODE	1	• Enter the adjustment mode: ① Turn power OFF. ② Terminate the [REMOTE] jack with a 3.5(d) mm mini-plug. ③ While pushing [MENU] and [SSB], turn power ON.	ADJ D163E 0.70-0 TX RX 1.40-0	Push [F-1 (TX)] or [F-2 (RX)] to select each adjustment mode. Once enterring adjustment mode, use [F-2 (▼)] to skip items, or [F-1 (▲)] to return the opening display.
		CAUTION: **NEVER** select ajustment items [F-1 (TX)] while transceiver is connected to an SSG. Because transceiver automatically transmits when most transmit items in the [F-1 (TX)] is selected.		
TX ADJUSTMENT	1	• Push [F-1 (TX)] to enter the TX adjustment. • Connect an RF power meter to [ANT1] connector and to [ANT 144M] connector. • Connect a 100 Ω dummy load to [ANT2] connector. • Connect an audio generator to [MIC] connector and set as: Frequency : 1.5 kHz Level : 10 mVrms	TX POWER HF/50M 0% ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	2		TX POWER HF Tuner ▲ ▼ chk SET	Set the output power to 10 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER HF Tuner" meter into memory, and to step next.
	3		TX POWER HF 20% ▲ ▼ chk SET	Set the output power to 20 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER HF 20%" meter into memory, and to step next.
	4		TX POWER HF 50% ▲ ▼ chk SET	Set the output power to 50 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER HF 50%" meter into memory, and to step next.
	5		TX POWER HF 100% ▲ ▼ chk SET	Set the output power to 90 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER HF 100%" meter into memory, and to step next.
	6		TX POWER 50M Tuner ▲ ▼ chk SET	Set the output power to 10 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER 50M Tuner" meter into memory, and to step next.
	7		TX POWER 144M 0% ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	8		TX POWER 144M 20% ▲ ▼ chk SET	Set the output power to 20 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER 144M 20%" meter into memory, and to step next.
	9		TX POWER 144M 50% ▲ ▼ chk SET	Set the output power to 50 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER 144M 50%" meter into memory, and to step next.
	10		TX POWER 144M 100% ▲ ▼ chk SET	Set the output power to 90 W using [MAIN DIAL]. Then push [F-5 (SET)] to store the "POWER 144M 100%" meter into memory, and to step next.
	11		TX ALC ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	12		TX DRIVE HF/50M ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	13		TX DRIVE 144M ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	14		TX SWR HF/50M ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	15		TX SWR 144M-1 ▲ ▼ chk SET	Push [F-5 (SET)] to set, and to step next.
	16	• Connect 100 Ω or 25 Ω dummy load to [ANT 144MHz] connector.	TX SWR 144M-2 ▲ ▼ chk SET	Push [F-5 (SET)] to set, then push [F-2] to the opening display.

ADJUSTMENT MODE—continued

ADJUSTMENT		ADJUSTMENT CONDITION	DISPLAY	OPERATION
RX ADJUSTMENT	1	• Push [F-2 (RX)] to enter the RX adjustment. • Connect an SSG to [ANT1] connector and set as: Frequency : 14.151500 MHz Level : 50 µV (–73 dBm) and OFF Modulation : OFF • Connect an AC millivolt meter to [EXT SP] connector with an 8 Ω load. • Receiving	RX Total Gain ▲ ▼ chk SET	Set the RX total gain to 30 dB level difference between SSG ON and OFF using [MAIN DIAL]. Then push [F-5 (SET)] to store into memory, and to step next.
	2	• Set an SSG as : Level : OFF • Receiving	RX S0 Level ▲ ▼ chk SET	Push [F-5 (SET)] to store the “S0” level into memory, and to step next. **NOTE**: While RX METER adjustment, **NEVER** change the connected SSG’s level until transceiver emits “Pi Pi” and changes indication.
	3	• Set an SSG as : Level : 50 µV (–73 dBm) Modulation : OFF • Receiving	RX S9 Level ▲ ▼ chk SET	Push [F-5 (SET)] to store the “S9” level into memory, and to step next.
	4	• Set an SSG as : Level : 32 mV (–17 dBm) Modulation : OFF • Receiving	RX S9+60 Level ▲ ▼ chk SET	Push [F-5 (SET)] to store the “S9+60” level into memory, and to step next.
	5	• Set an SSG as : Frequency : 108.021500 MHz Level : 3.2 µV (–97 dBm) Modulation : OFF	RX Tuned BPF-1 ▲ ▼ chk SET	Push [[F-5 (SET)] to tune the “BPF-1”, and to step next.
	6	• Receiving • Set an SSG as : Frequency : 143.981500 MHz Level : 3.2 µV (–97 dBm)	RX Tuned BPF-2 ▲ ▼ chk SET	Push [[F-5 (SET)] to tune the “BPF-2”, and to step next.
	7	Modulation : OFF • Receiving • Set an SSG as : Frequency : 144.021500 MHz Level : 3.2 µV (–97 dBm)	RX Tuned BPF-3 ▲ ▼ chk SET	Push [[F-5 (SET)] to tune the “BPF-3”, and to step next.
	8	Modulation : OFF • Receiving • Set an SSG as : Frequency : 173.981500 MHz Level : 3.2 µV (–97 dBm) Modulation : OFF • Receiving	RX Tuned BPF-4 ▲ ▼ chk SET	Push [[F-5 (SET)] to tune the “BPF-4”, and return to the opening display.

*This output level of a standard signal generator (SSG) is indicated as SSG’s open circuit.