BENISON

FB-388

VHF FM TRANSCEIVERS

Service Manual

2006-1-28

SPECIFICATIONS

GENERAL

. Frequency coverage	: 144.0000-145.9875MHz
. Type of emission	: FM(FE3)
. Number of channels	: 99ch
. Power supply requirement	: 7.4 V DC (negative ground; supplied battery pack)
. Current drain (approx.)	: Transmit at High (4.0 W) 1.8 A, at Low (1.0 W) 700 mA
	: Receive rated audio 250 mA
	: stand-by 70 mA
. Frequency stability	: ± 0.001 %
. Usable temperature range	: -10°C～+60°C
. Dimensions (projections not included)	: 54(W) × 112(H) × 35(D) mm
. Weight (with ant., BP-512)	: 350 g

TRANSMITTER

. RF output power (at 7.4 V DC)	: 4 W / 1 W (High / Low)
. Modulation system	: Variable reactance frequency modulation
. Maximum frequency deviation	: ± 2.5 kHz
. Spurious emissions	: 70 dB typical
. Adjacent channel power	: 60 dB typical
. Transmitter audio distortion	: Less than 3% at 1 kHz, 40% deviation

RECEIVER

. Receive system	: Double conversion superheterodyne system
. Intermediate frequencies	: 1st 38.850 MHz / 2nd 450 kHz
. Sensitivity	: 0.18 μV at 12 dB SINAD (typical)
. Squelch sensitivity	: 0.25 μV at threshold (typical)
. Adjacent channel selectivity	: 65 dB (typical)
. Spurious response rejection	: 70 dB (typical)
. Intermodulation rejection ratio	: 70 dB (typical)
. Hum and noise	: 40 dB (typical)
. Audio output power (at 7.4 V DC)	: 500 mW typical at 5% distortion with an 8 ohm load

All stated specifications are subject to change without notice or obligation.

50 CTCSS TONES SQ. (Hz)

NO.	TONE	NO.	TONE	NO.	TONE	NO.	TONE	NO.	TONE
1	67.0	11	94.8	21	131.8	31	171.3	41	203.5
2	69.3	12	97.4	22	136.5	32	173.8	42	206.5
3	71.9	13	100.0	23	141.3	33	177.3	43	210.7
4	74.4	14	103.5	24	146.2	34	179.9	44	218.1
5	77.0	15	107.2	25	151.4	35	183.5	45	225.7
6	79.7	16	110.9	26	156.7	36	186.2	46	229.1
7	82.5	17	114.8	27	159.8	37	189.9	47	233.6
8	85.4	18	118.8	28	162.2	38	192.8	48	241.8
9	88.5	19	123.0	29	165.5	39	196.6	49	250.3
10	91.5	20	127.3	30	167.9	40	199.5	50	254.1

CONTROL AND CONNECTIONS

1. **CONTROL DIAL**
2. **VOLUME CONTROL /POWER SWITCH**
3. **PTT BUTTON**
4. **INTERNAL MICROPHONE**
5. **FUNCTION BUTTON**
6. **SQL BUTTON**
7. **KEY PAD**
8. **FUNCTION DISPLAY**
9. **MIC JACK**
10. **SP JACK**
11. **INTERNAL SPEAKER**
12. **ANTENNA**
13. **TX INDICATOR**

CIRCUIT DESCRIPTION

1) Receiver System

The receiver system is a double superheterodyne system with a 38.85MHz first IF and a 450kHz second IF.

1. Front End

The received signal at any frequency in the 144.0000MHz to 145.9875MHz range is passed through the low-pass filter (L39, L38, L37, C159,C158, C122,C157,C121,C156 and C154) and tuning circuit (L19 and C203), and amplified by the RF amplifier (Q29). The signal from Q29 is then passed through the tuning circuit (L28.L27.L26) and converted into 38.85MHz by the mixer (Q28). The local signal from the VCO is passed through the buffer (Q34), and supplied to the source of the mixer (Q28). The radio uses the lower side of the superheterodyne system.

2. IF Circuit

The mixer mixes the received signal with the local signal to obtain the sum of and difference between them. The crystal filter (FL3, FL2) selects 38.850MHz frequency from the results and eliminates the signals of the unwanted frequencies. The first IF amplifier (Q17) then amplifies the signal of the selected frequency.

3. Demodulator Circuit

After the signal is amplified by the first IF amplifier (Q36), it is input to pin 16 of the demodulator IC (IC14). The second local signal of 38.4MHz, which is oscillated by the internal oscillation circuit in IC14 and crystal (X6), Then these two signals are mixed by the internal mixer in IC14 and the result is converted into the second IF signal with a frequency of 450kHz. The second IF signal is output from pin 3 of IC14 to the ceramic filter (FL1), where the unwanted frequency band of that signal is eliminated, and the resulting signal is sent back to the IC14 through pins 5.The second IF signal input via pin 5 is demodulated by the internal limiter amplifier and quadrature detection circuit in IC14, and output as an audio signal through pin 9.

4. Audio Circuit

AF signals from the FM IF IC (IC14, pin 9) via the AF filter circuit (IC3, pins 12,13). The output signals from pin 14 are applied to the mute switch (Q16), are applied to the AF power amplifier (IC9, pin 4) after being passed through the [VOL] control (W2).The applied AF signals are amplified at the AF power amplifier circuit (IC1, pin 4) to obtain the specified audio level. The amplified AF signals, output from pin 10, are applied to the internal speaker (SP1) as the "SP" signal via the [SP-J] jack when no plug is connected to the jack.

5. Squelch Circuit

A squelch circuit cuts out AF signals when no RF signals are received. By detecting noise components in the AF signals,A portion of the AF signals from the FM IF IC (IC14, pin 9) are applied to the squelch switches (Q19.20.21.22),the active filter section (IC14, pin 8) where noise components are amplified and detected with an internal noise detector.The active filter section amplifies noise components. The filtered signals are rectified at the noise detector section and converted into "SQI" signals at the noise comparator section. The "SQI" signal is applied to the CPU(IC8, pin 22). The CPU detects the receiving signal , and outputs an "AFB" signal from pin 39. This signal controls the mute switch (Q16) to cut the AF signal line.

2) Transmitter System

1. MICROPHONE AMPLIFIER CIRCUIT

The microphone amplifier circuit amplifies audio signals with +6 dB/octave pre-emphasis characteristics from the microphone to a level needed for the modulation circuit. The AF signals from the microphone are applied to the microphone amplifier circuit (IC2C, pin 2). The amplified AF signals are passed through the low-pass filter circuit (IC1B, pins 5, 6). The filtered AF signals are applied to the modulator circuit after being passed through the modulation circuit.

2. MODULATION CIRCUIT

The modulation circuit modulates the VCO oscillating signal (RF signal) using the microphone audio signal.

The audio signals change the reactance of a diode (D29) to modulate an oscillated signal at the VCO circuit (Q30).The oscillated signal is amplified at the buffer-amplifiers (Q31,Q32,Q33,Q35),.

3. DRIVE/POWER AMPLIFIER CIRCUITS

The signal from the VCO circuit passes through the buffer (Q31,Q32,Q33,Q35),drive (Q27)and power amplifier (Q26)to obtain 4W of RF power (at 7.4V DC). The amplified signal passes through the antenna switching circuit (D11), and low-pass filter and is then applied to the antenna connector. The bias current of the drive (IC6) and the power amplifier (Q26) is controlled by the APC circuit.

4. APC CIRCUIT

The APC circuit (IC6) protects the drive and the power amplifiers from excessive current drive, and selects HIGH or LOW output power. The signal output from the power detector circuit (L32,R177,RR95,RR144) is applied to the differential amplifier (IC6, pin 2.3), and the "PWC" signal from the expander (IC6, pin5), controlled by the CPU (IC8), is applied to the other input for reference. When the driving current is increased, input voltage of the differential amplifier (pin 2) will be increased. In such cases the differential amplifier output voltage (pin 7) is decreased to reduce the driving current.

3) PLL Synthesizer Circuit

1. PLL

The dividing ratio is obtained by sending data from the CPU (IC8) to pin 14 and sending clock pulses to pin 15 of the PLL IC (IC13). The oscillated signal from the VCO is amplified by the buffer (Q31,Q34) and input to pin6 or pin11 of IC13. Each programmable divider in IC13 divides the frequency of the input signal by N according to the frequency data, to generate a comparison frequency.

2. PLL Loop Filter Circuit

If a phase difference is found in the phase comparison between the reference frequency and VCO output frequency, the charge pump output (pin8,pin9) of IC13 generates a pulse signal, which is converted to DC voltage by the PLL loop filter and input to the varicap of the VCO unit for oscillation frequency control.

3. VCO Circuit

A PLL circuit provides stable oscillation of the transmit frequency and receive 1st frequency. The PLL output compares the phase of the divided VCO frequency to the reference frequency. The PLL output frequency is controlled by the divided ratio (N-data) of a programmable divider.The PLL circuit contains the VCO circuit (Q25, Q30). The oscillated signal is amplified at the buffer-amplifiers (Q34, Q31) and then applied to the PLL IC (IC13). The PLL IC contains a prescaler, programmable counter, programmable divider and phase detector, etc. The entered signal is divided at the prescaler and programmable counter section by the N-data ratio from the CPU. The divided signal is detected on phase at the phase detector using the reference frequency. If the oscillated signal drifts, its phase changes from that of the reference frequency, causing a lock voltage change to compensate for the drift in the oscillated frequency. A portion of the VCO signal is amplified at the buffer-amplifier (Q34, Q31) and is then applied to the receive 1st mixer (Q28) or transmit buffer-amplifier circuit (Q32).

4) CPU and Peripheral Circuits

1. LCD Display Circuit

The IC10 turns ON the LCD via segment and common terminals with 1/4 the duty and 1/3 the bias, at the frame frequency is 100Hz.

2. Display Lamp Circuit

When the key is pressed, "H" is output form pin 24 of CPU (IC8) to the bases of Q2. Q2 then turn ON and the LED (D1.2.4.5.7.8) light.

3. DTMF Encoder

The CPU (IC8) is equipped with an internal DTMF encoder. The DTMF signalis output from pin 8, through

C60, and through the microphone amplifier (IC2), and is sent to the varicap of the VCO for modulation. At the same time, the monitoring tone passes through the AF circuit and is output form the speaker.

4. CTCSS Encoder

The IC3 is equipped with an internal tone encoder, The tone signal (67.0 to 254.3Hz) is output from pin 18 of the IC3 to the varicap (D29) of the VCO for modulation.

5. CTCSS Decoder

The voice band of the AF output signal from pin 9 of IC14 is cut by sharp active filter IC3 and amplified. The input signal is compared with the programmed tone frequency code in the CPU. The squelch will open when they match.

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ADJUSTMENT PROCEDURES

Note:

It is assumed that the unit is supplied with a regulated 8.0 volts during the adjustment procedure. Do not use a metal screw driver to adjust the ferrite cores as it causes variations in the inductance whilst adjustments are being performed. Use of the wrong size trimming tools can cause damage to the cores. A plastic or ceramic trimming tool is recommended.

ADJUSTMENT

1) Required Test Equipment

The following items are required to adjust radio parameters:

1. Regulated power supply
Supply voltage: 5~14V DC
Current: 3A or more

2. Digital multimeter
Voltage range: FS = Approx. 20V
Current: 10A or more
Input resistance: High impedance

3. Oscilloscope
Measurable frequency: Audio frequency

4. Audio dummy load
Impedance: 8 ohm
Dissipation: 1W or more
Jack: 3.5mm

5. SSG
Output frequency: 200MHz or more
Output level: -20dBu/0.1uV ~120dBu/1V
Modulation: FM

6. Spectrum Analyzer
Measuring range: Up to 2GHz or more

7. Power meter
Measurable frequency: Up to 200MHz
Impedance: 50, unbalanced
Measuring range: 0.1W ~10W

8. Audio volmeter
Measurable frequency: Up to 100kHz
Sensitivity: 1mV to 10V

9. Audio generator
Output frequency: 67Hz to 10kHz
Output impedance: 600, unbalanced

10.Distortion meter/SINAD meter
Measurable frequency: 1kHz
Input level: Up to 40dB
Distortion: 1% ~100%

11.Frequency counter

Measurable frequency: Up to 200MHz

Measurable stability: Approx. ±0.1ppm

12.Linear detector

Measurable frequency: Up to 200MHz

Characteristics: Flat

CN: 60dB or more

Note

Standard modulation: 1kHz ±2.5kHz/DEV

Reference sensitivity: 12dB SINAD

Specified audio output level: 200mW at 8

Adjustment Mode

High power adjustment mode

1. At same time push **[3]** key and **[9]** key. Rotate **[VOL]** to the power ON.
2. Then press **[7]** key,
3. Press the **[6]** or **[9]** key set the output power to the value closest to 4 W .
4. When the **PTT** key is released, the output power at that time will be stored as the high power setting.
5. Press the **SQL** key to return.

Low power adjustment mode

1. At same time push **[3]** key and **[9]** key. Rotate **[VOL]** to the power ON.
2. Then press **[8]** key,
3. Press the **[6]** or **[9]** key set the output power to the value closest to 1 W .
4. When the **PTT** key is released, the output power at that time will be stored as the low power setting.
5. Press the **SQL** key to return.

Modulation Adjustment

STEP	CONDITIONS	ADJUST	READINGS
1	Connect the antenna output via a suitable RF attenuator to a modulation analyzer	—	—
2	Apply 1000Hz at a level of 5.0mV to the microphone jack	—	—
3	Press the PTT switch	W1	Modulation analyzer reading 1.5kHz (+/-0.2KHz)
4	Increase the modulation signal level to 50mV	W1	Modulation analyzer reading 2.5kHz (+/-0.1KHz)

Frequency Adjustment

STEP	CONDITIONS	ADJUST	READINGS
1	Connect the antenna output via a suitable RF attenuator to a Frequency counter	—	—
2	Press the PTT switch	W3	Frequency counter: +/-0.2KHz

SERVICING AND REPAIR

RF RECEIVE CIRCUITS

1. Ensure that the transceiver has not been switched to the battery saving mode.
2. Carefully check that all connectors are in a good condition. Check that the power supply voltage(IC5) of the receiver circuit is approximately 4.5-5.0V.
3. If the correct gain is measured then check that the bias of Q25 or Q30 is Vs=1V and Vd=4.2V. Check the signal level at the collector of Q31 or Q34 the local oscillator output, the signal level should be around -10dBm and the spectrum purity should be good.

TRANSMIT CIRCUIT

1. Carefully check that all connectors are in good condition and check that the power supply voltage is correct.
2. Using the frequency counter to check that the operating frequency is correct. If not, check whether the PLL is locked. If the PLL is unlocked, check the local oscillator circuit. If the PLL is locked, check that the RF output is correct. If not, check from Q31 Q32 Q33 Q35 Q27 Q26 stage by stage to assure that the signal levels are correct. First check the bias voltage of each stage and then try to find any voltages which are out of tolerance.

VOLTAGE REGULATION CIRCUIT

Apply 8.0 volts to the power input jack, Measure the collector voltage of IC5. The normal value should be approximately 5.0 volts. The voltage at the collector of IC5 should hold are approximately 5.0 volts.

AUDIO OUTPUT

1. Connect a signal generator set to the required frequency at an output level of 1mV, deviated with a 1kHz tone and 1.5kHz deviation to the antenna socket. Connect a probe to pin 9 (the output pin) of IC14. If the transceiver is operating correctly a 1kHz sine wave should be present.
2. If not, then use the oscilloscope to check the second local oscillator to assure that it is operating correctly. A probe connected to the case of X3 or pin 16 of IC13 should detect the presence of a

38.4MHz sine wave. If not, then X6 may have failed.

3. If a 1kHz signal is measured at pin 9 of IC14 then decrease the output level of the signal generator to 0.35uV. If the 1kHz audio signal disappears when the RF level is decreased to this level, then IC14 may be faulty.
4. If IC14 appears okay, then check IC1 are correct. Check for the presence of a 1kHz audio signal at the collector of the pin10.
5. Check pin 14 of IC3 to see if there is a 1kHz audio signal present. Check pin 10 of IC1 for a presence of a large 1kHz audio signal. If the audio output signal is too small or not present then IC1 may be faulty.

CONTROL PROBLEM

If the LCD display becomes faulty then check the drive IC10.

PARTS LIST

Part Type	Designator Footprint
C1	1000P
C2	1000P
C3	1000P
C4	1000P
C5	1000P
C6	1000P
C7	1000P
C8	1000P
C9	1000P
C10	1000P
C11	1000P
C12	1000P
C13	1000P
C14	1000P
C15	1000P
C16	1000P
C17	1000P
C18	1000P
C19	1000P
C20	1000P
C22	1000P
C23	1000P
C24	1000P
C25	1000P
C26	1000P
C27	1000P
C28	1000P
C29	1000P
C30	1000P
C31	1000P
C32	1000P
C33	1000P
C34	1000P
C35	1000P
C36	1000P
C37	1000P
C38	1000P
C39	1000P
C40	1000P
C41	1000P
C42	1000P
C43	1000P
C44	1000P

C45	1000P
C46	1000P
C47	1000P
C48	1000P
C49	1000P
C50	1000P
C51	1000P
C52	1000P
C53	1000P
C54	1000P
C55	1000P
C56	1000P
C57	1000P
C58	0.01
C59	0.01
C60	0.01
C61	0.01
C62	0.01
C63	0.01
C64	0.01
C65	0.01
C66	0.01
C67	0.01
C69	100P
C70	1000P
C71	0.1
C72	1000P
C73	15P
C74	10U
C75	10U
C76	10U
C77	10U
C78	10U
C79	10U
C80	10U
C81	10U
C82	10U
C83	10U
C84	10U
C85	100P
C86	100P
C87	100P
C88	100P
C89	100P
C90	100P
C91	100P

C92	100P
C93	100P
C94	100P
C95	100P
C96	100P
C97	0.1
C98	0.1
C99	0.1
C100	0.1
C101	0.1
C102	0.1
C103	0.1
C104	0.1
C105	0.1
C106	0.1
C107	0.1
C108	0.1
C109	0.1
C110	0.1
C111	0.1
C112	0.1
C113	0.047
C114	0.047
C115	0.047
C116	22P
C117	22P
C118	22P
C119	22P
C120	22P
C121	22P
C122	22P
C123	5600P
C124	5600P
C125	0.022
C126	220P
C127	220P
C128	220P
C129	220P
C130	1U
C131	1U
C132	1U
C133	1U
C134	1U
C135	180P
C136	200P
C137	10U

C138	1U
C140	0.22
C141	0.22
C142	0.22
C143	0.22
C144	0.22
C145	0.22
C146	100U
C147	100U
C148	22U
C149	1U
C150	1U
C151	8200P
C152	10P
C153	10P
C154	10P
C155	10P
C156	10P
C157	10P
C158	10P
C159	10P
C160	470P
C161	470P
C162	470P
C163	470P
C164	470P
C165	470P
C166	470P
C167	470P
C168	470P
C169	10U
C170	10U
C171	0.1U
C172	0.1U
C173	102P
C174	47P
C175	47P
C176	4.7U
C177	4.7U
C178	17P
C179	1P
C180	1P
C181	1P
C182	15P
C183	12P
C184	12P

C185	12P
C186	12P
C187	12P
C188	12P
C189	12P
C190	12P
C191	0.5P
C192	0.5P
C193	82P
C194	8P
C195	18P
C196	18P
C197	18P
C198	18P
C199	5P
C200	4P
C201	4P
C202	7P
C203	20P
C204	20P
C205	33P
C206	9P
C207	1000P
C208	1000P
C209	1000P
C210	1000P
C211	0.01
C212	100P
C213	100P
C214	100P
C215	100P
C216	0.1
C217	0.01
C218	0.01
C219	22U
C220	1000P
C221	1000P
C222	1000P
C223	1000P
C224	1000P
C225	1000P
C226	1000P
C227	1000P
C228	1000P
C229	1000P
C230	100P

Part Type	Designator Footprint
D1	LED_Y
D2	LED_Y
D3	1SS372
D4	LED_Y
D5	LED_Y
D6	A111
D7	LED_Y
D8	LED_Y
D9	A111
D10	A111
D11	1SS356
D12	HS277
D13	1SS356
D14	A111
D15	A111
D16	A111
D17	A111
D18	A111
D19	A111
D20	A111
D21	LED_G
D22	LED_R
D23	N
D24	3V
D25	HVC375
D26	HVC375
D27	HVC375
D28	HVC375
D29	BB149

Part Type	Designator Footprint
FL1	LTC450E
FL2	38.85M
FL3	38.85M

Part Type	Designator Footprint
IC1	TA7368F
IC2	NJM2902V
IC3	CMX808
IC4	24WC08
IC5	XC6202P502
IC6	NJM2904
IC8	EM78P567
IC10	HT1621B

IC13	M64082
IC14	TA31136

Part Type	Designator Footprint
J1	JACK (MIC)
J2	SMD14P
J3	ANT JACK
J4	SMD14P
J5	SP-J

Part Type	Designator Footprint
K1	FUNC
K2	MONI
K3	PTT
K4	RTW
K5	POWER SW

Part Type	Designator Footprint
L1	102T
L2	102T
L3	102T
L5	102T
L6	102T
L7	102T
L8	102T
L9	10UH
L11	150N
L12	180N
L13	2.2UH
L14	2.2UH
L15	2.2UH
L16	2.2UH
L17	100N
L18	100N
L19	100N
L20	100N
L21	68N
L22	470N
L23	470N
L24	102T
L25	102T
L26	7T
L27	7T
L28	7T
L29	7T
L30	7T

L31	1UH
L32	301T
L33	9T
L34	3T
L35	2T
L36	2.2UH
L37	4T
L38	5T
L39	5T
L40	6T

Part Type	**Designator Footprint**
Q1	5B1
Q2	2SC2712
Q3	2SC2712
Q5	DTA114
Q6	DTA114
Q7	DTA114
Q8	DTA114
Q9	DTA114
Q10	DTA114
Q11	DTA114
Q12	DTA114
Q13	5B1
Q14	5B1
Q15	2SK1588
Q16	DTA114
Q17	DTA114
Q18	DTA114
Q19	DTA114
Q20	DTA114
Q21	DTA114
Q22	DTA114
Q23	2SC4617
Q24	2SC4617
Q25	K52
Q26	R007
Q27	2SK2973
Q28	DUR
Q29	DUR
Q30	K52
Q31	R24
Q32	R24
Q33	R24
Q36	2SC5195

Part Type	**Designator Footprint**

R1	47K
R2	47K
R3	47K
R4	47K
R5	47K
R6	47K
R7	47K
R8	47K
R9	47K
R10	47K
R11	47K
R12	47K
R13	47K
R14	220
R15	220
R16	330
R17	330
R18	330
R19	330
R20	330
R21	330
R22	330
R23	10K
R24	10K
R25	10K
R26	10K
R27	10K
R28	10K
R29	10K
R30	10K
R31	10K
R32	10K
R33	10K
R34	10K
R35	10K
R36	10K
R37	4K7
R38	4K7
R39	4K7
R40	4K7
R41	560
R42	560
R43	560
R44	560
R45	100
R46	100

R47	100
R48	100
R49	100
R50	100
R51	100
R52	100
R53	100
R54	100
R55	100
R56	100
R57	100
R58	100
R59	470
R60	470
R61	470
R62	470
R63	2K
R64	2K
R65	T10K
R66	15K
R67	15K
R68	3K3
R69	3K3
R70	3K3
R71	3K3
R72	3K3
R73	3K3
R74	3K3
R75	0
R76	0
R77	0
R78	0
R79	0
R80	0
R81	0
R82	0
R83	0
R84	0
R85	2K7
R86	2K7
R87	100K
R88	100K
R89	100K
R90	100K
R91	100K
R92	100K

R93	100K
R94	100K
R95	100K
R96	100K
R97	100K
R98	100K
R99	1K
R100	1K
R101	1K
R102	1K
R103	1K
R104	1K
R105	1K
R106	1K
R107	1K
R108	1K
R109	1K
R110	1K
R111	1K
R112	1K
R113	1K
R114	1K
R115	1K
R116	1K
R117	1K
R118	1K
R119	1K
R120	220K
R121	220K
R122	220K
R123	220K
R124	330K
R125	330K
R126	10
R127	47
R128	33K
R129	0
R130	2K
R131	120K
R132	33K
R133	10
R134	10
R135	22K
R136	22K
R137	470K
R138	1M

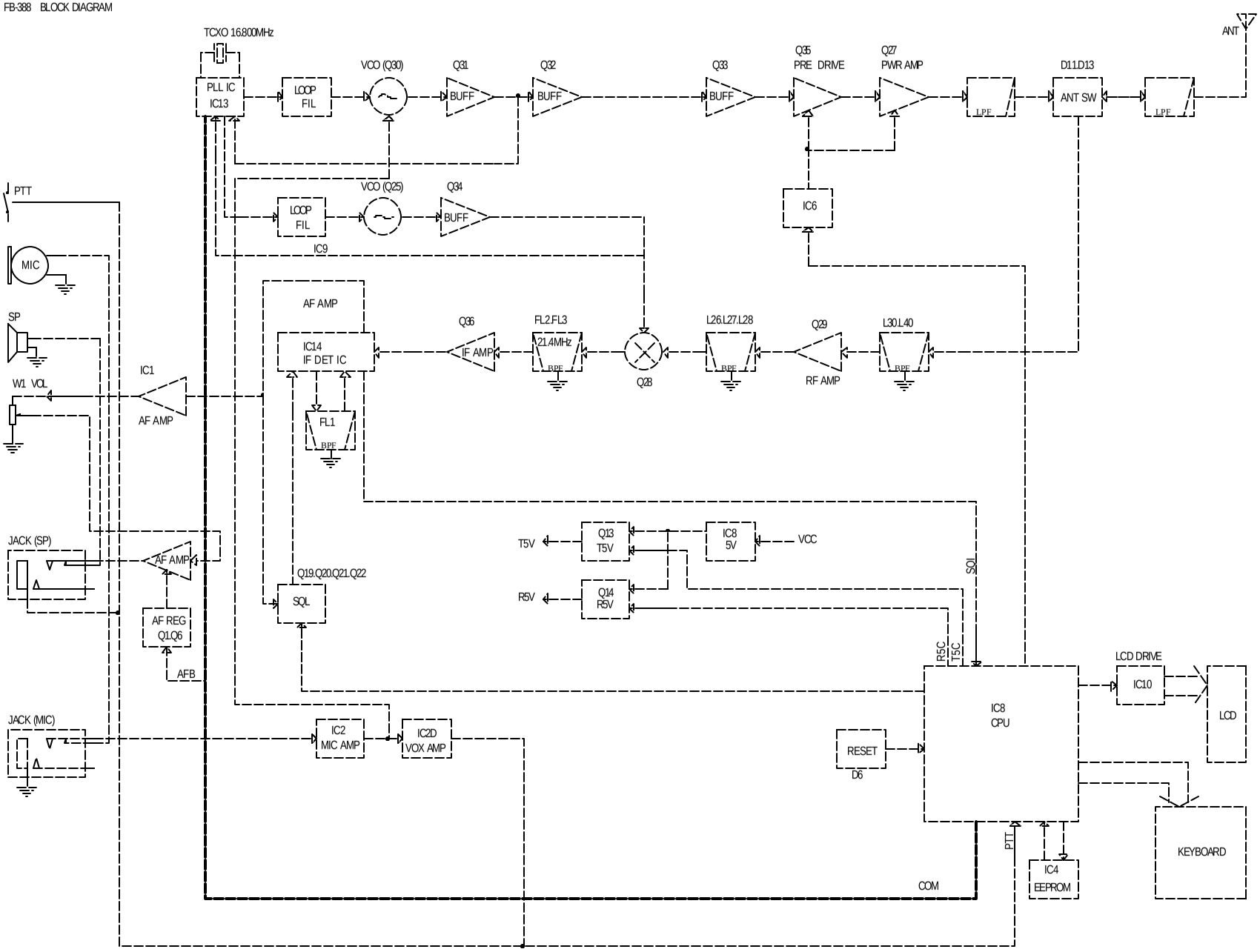
R139	1M
R140	1M
R141	1M
R142	68K
R143	180K
R144	180K
R145	180K
R146	180K
R147	3K9
R148	3K9
R149	3K9
R150	1K5
R151	1K5
R152	1K8
R153	47
R154	47
R155	6K8
R156	2K2
R157	2K2
R158	2K2
R159	22
R160	22
R161	20K
R162	33K
R163	33K
R164	10K
R165	10K
R166	10K
R167	47K
R168	47K
R169	100
R170	3K3
R171	680
R172	680
R173	2K2
R174	47
R175	47
R176	150K
R177	82K
R178	220
R179	220
R180	56K
R181	330K
R182	82K
R183	180K
R184	180K

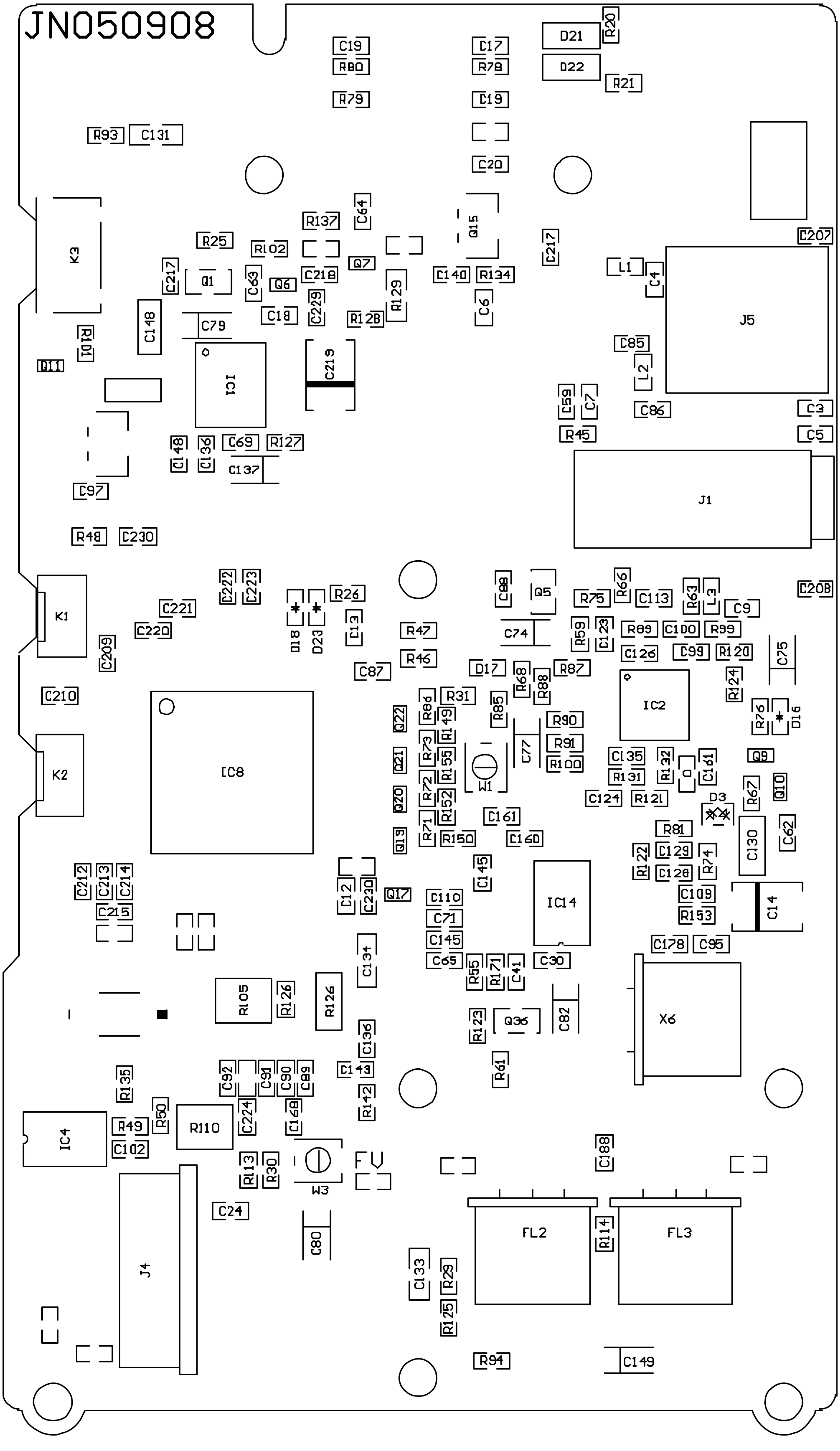
R185	180K

Part Type	**Designator Footprint**
MC1	MIC(-58dB)
SP1	8ohm
W1	W50K
W2	10K
W3	50K
X1	4M
X2	32.768K
X3	16.8M
X5	C24
X6	38.4M

MEMO

FB-388 BLOCK DIAGRAM





JN050908
C19
R80
R79
C17
R78
C19
C20
D21
D22
R20
R21
R93
C131
K3
R25
R102
R137
C64
Q7
Q15
C217
Q1
C63
Q6
C218
C229
C18
R128
R129
C140
R134
C6
C217
L1
C4
C207
J5
C148
C79
R101
D11
IC1
C219
C85
L2
C59
C7
C86
C3
C5
R45
C148
C136
C69
R127
C137
C97
J1
R48
C230
C222
C223
R26
D18
D23
C13
C88
Q5
R66
R75
C113
R63
L3
C9
C208
K1
C221
C220
R47
C74
R59
C123
R89
C100
R99
C209
R46
C126
C99
R120
C75
C87
D17
R68
R88
R87
IC2
R124
C210
IC8
Q22
R86
R31
R149
R85
R90
R76
D16
K2
Q21
R73
R155
C77
R91
R100
C135
R32
C161
Q9
R131
R121
C124
Q20
R72
R152
W1
D3
R67
Q10
C161
C160
R71
R150
Q19
R81
C62
C130
R122
C129
R74
C128
C212
C213
C214
C145
IC14
C215
C12
C230
Q17
C110
C71
C109
R153
C14
C145
C178
C95
C65
C30
C134
R55
R171
C41
R105
R126
R126
X6
Q36
C82
R123
C136
R61
C143
C92
C91
C90
C89
R135
R142
R50
C224
C168
IC4
R49
R110
C102
R13
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W3
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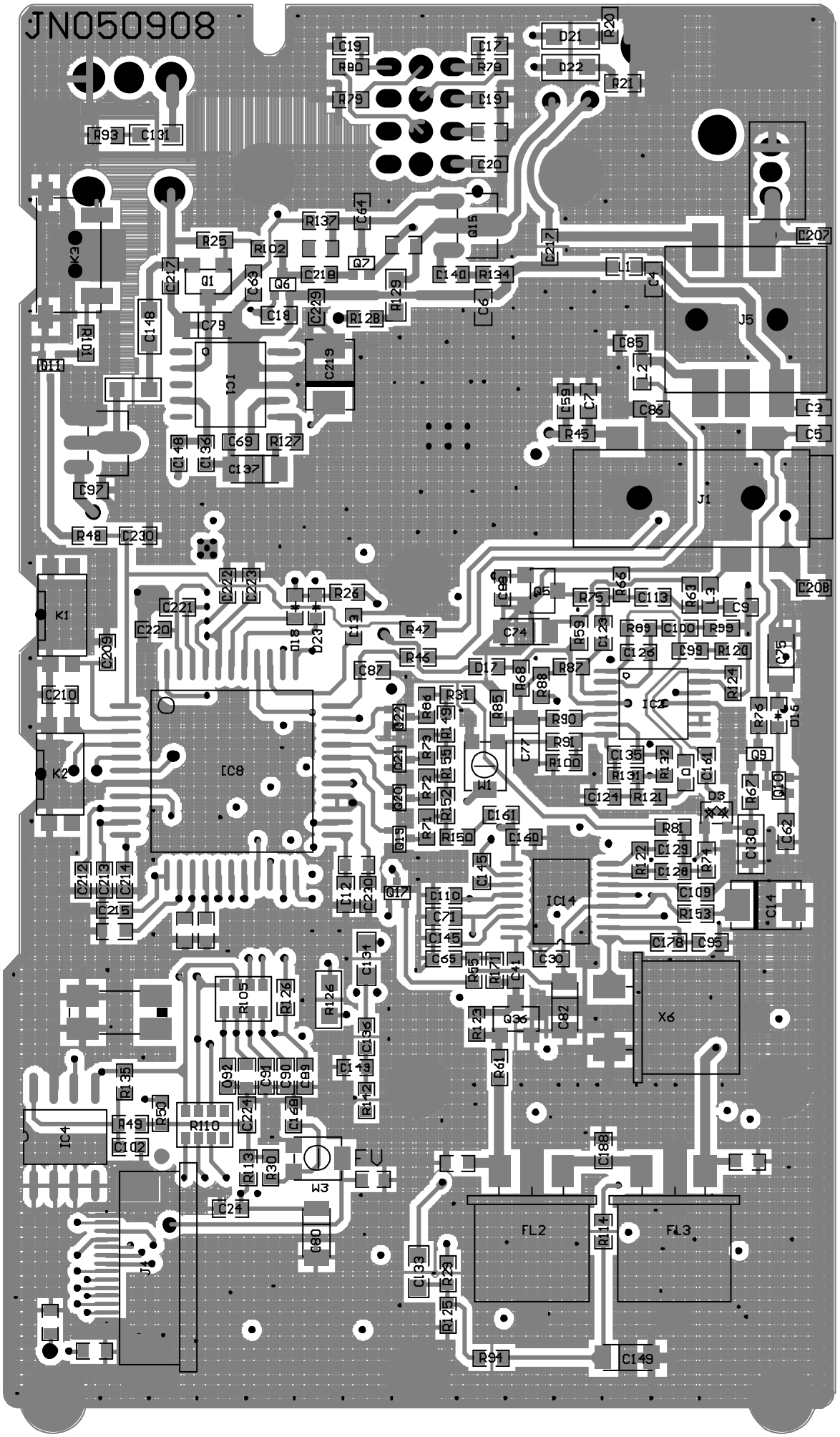
FL2
FL3
R114
J4
C133
R29
R125
R94
C149


JN050908
C19
C17
D21
R20
R80
R78
D22
R21
R79
C18
C20
R93
C131
C64
R137
Q15
R25
R102
Q7
C217
C207
K3
C217
Q1
C63
Q6
C210
C140
R134
L1
C4
C229
R129
C6
J5
C148
C78
C18
R128
R101
C219
D85
D11
IC1
L2
C59
C7
C86
C3
R45
C5
C48
C32
C69
R127
C137
J1
C97
R48
C230
C222
C223
R26
C8
Q5
R75
R66
C113
R61
L3
C9
K1
C221
C220
D18
D23
C13
R47
C74
R59
C23
R69
C100
R99
C207
C209
R46
C87
D17
R68
R88
R87
C126
C99
R120
C25
C210
IC2
R124
R76
D16
R64
R31
R85
R90
C77
C135
Q9
K2
IC8
Q22
R49
C91
R91
D11
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C164
R131
Q21
R73
R35
C124
R121
D3
R67
Q10
Q20
R72
R152
R81
C130
C62
C212
C213
C214
C215
Q13
R71
R150
C129
R122
R71
C12
C230
Q17
C110
C45
IC14
C107
C109
R153
C14
C145
C178
C95
C65
R65
R107
C41
C30
C104
R105
R126
R125
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Q36
X6
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R6
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C90
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C88
R49
R50
C224
C148
R110
IC4
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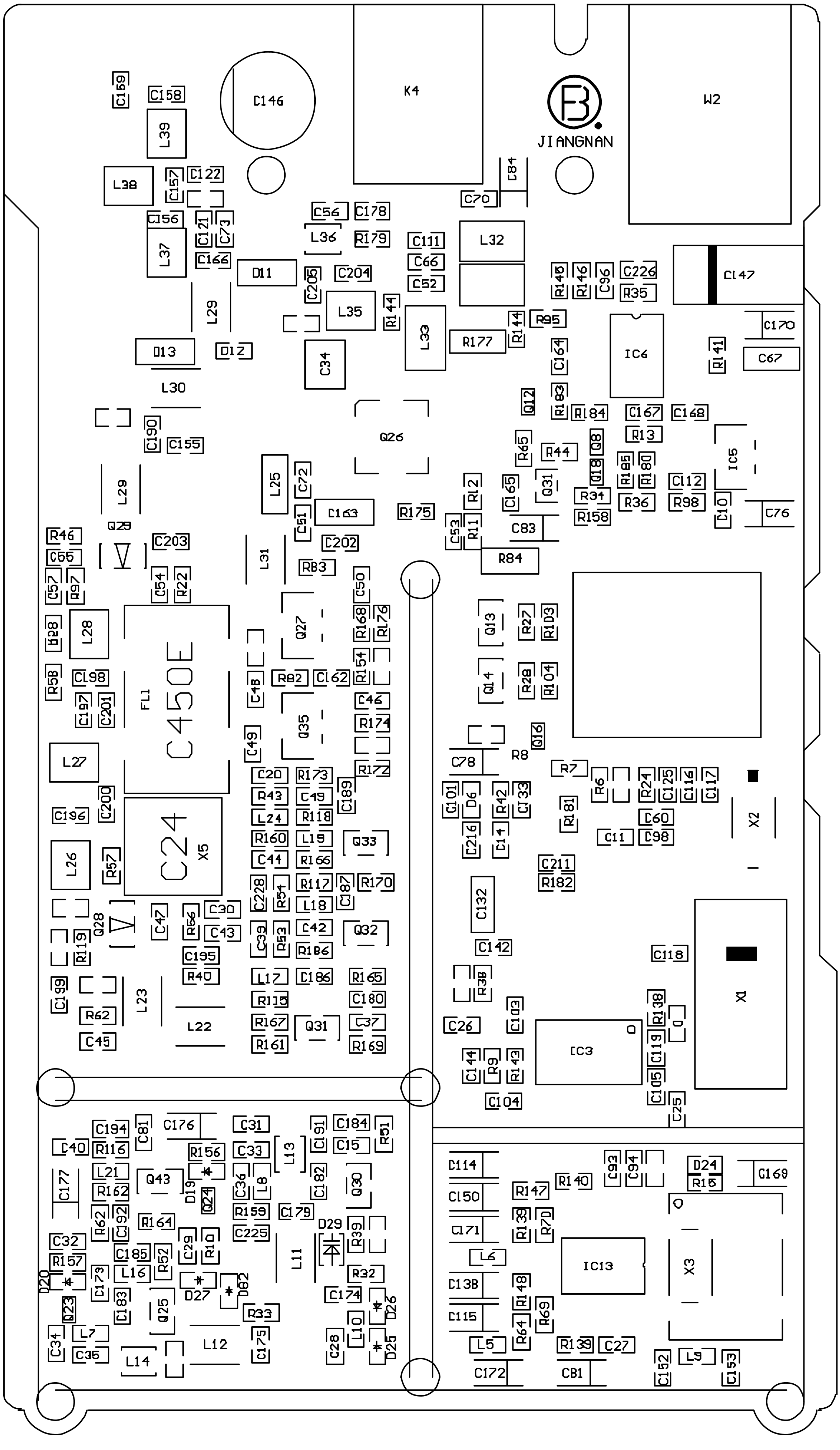
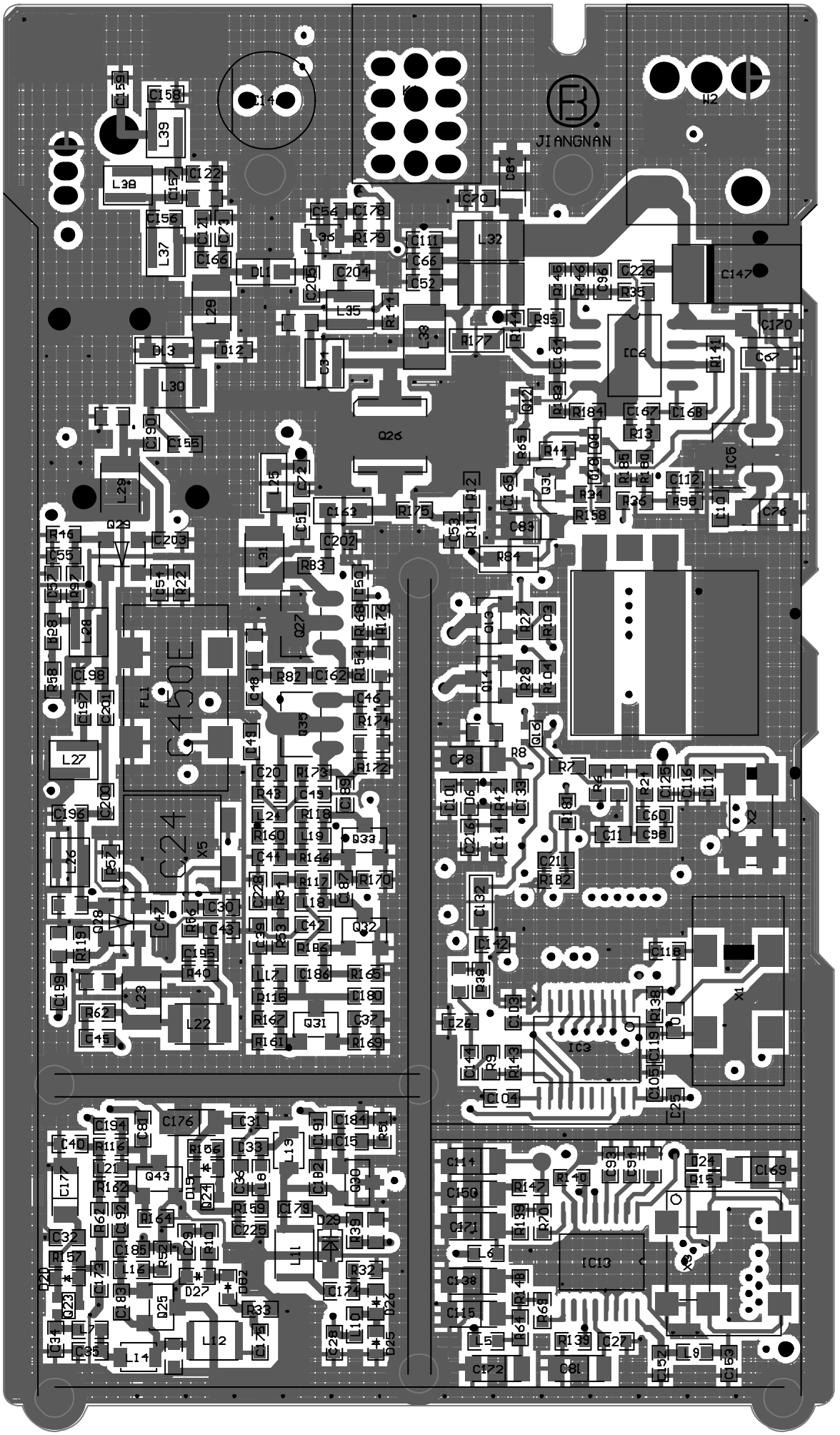


JIANGNAN
K4
W2
C146
C147
FL1
C450E
X5
C24
IC6
IC5
IC3
IC13
X1
X2
X3
Q26


JIANGNAN
G450F
C1.C24