

SERVICE MANUAL

MJ-327

VHF FM TRANSCEIVERS

SPECIFICATIONS

GENERAL

Frequency Range	136--174MHz
Working Temperature	-20°C ~ +55°C
Operating Voltage	DC 7.2V
Current Consumption	≤ 1.6A(transmit 4W)
Sensitivity Adjust	220mV
Antenna impedance	50 Ω

TRANSMITTER

Frequency Stability	± 5ppm
Output Power	4W(High),2W(Low)
Maxx Frequency Deviation	≤ 5KHz
Audio Distortion	≤ 3%
Adjacent Channel Power	-65dB
Occupied Bandwidth	≤ 16KHz
RF Sensitivity :	≤ 2μV
Audio Output	≥ 0.5W
Audio Distortion	≤ 10%

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

CIRCUIT DESCRIPTION

1. Frequency configuration

The receiver utilizes double conversion. The first IF is 38.85MHz and the second IF is 450kHz. The first local oscillator signal is supplied from the PLL circuit. The PLL circuit in the transmitter generates the necessary frequencies. Fig. 1 shows the frequencies.

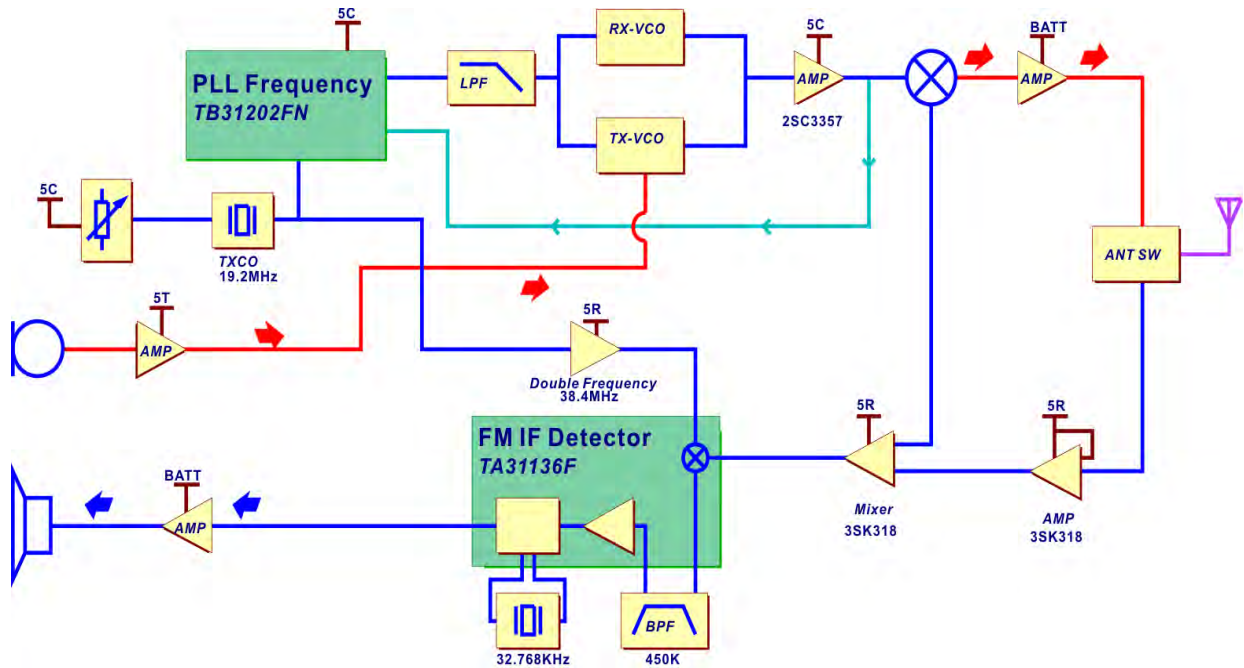


Fig.1

2. Receiver

The frequency configuration of the receiver is shown in Fig.2.

1) Front - end RF amplifier

An incoming signal from the antenna is applied to an RF amplifier (T226) after passing through a transmit/receive switch circuit (D154 ,D211,D212) and a 3-pole LC filter(L214,C215).After the signal is amplified (T226), the signal is filtered by a band pass filter (a 3-pole LC filter) (L230,C230,L235,L235) to eliminate unwanted signals before it is passed to the first mixer. The voltage of these diodes are controlled by to track the MPU(U811) center frequency of the band pass filter. (See Fig. 2)

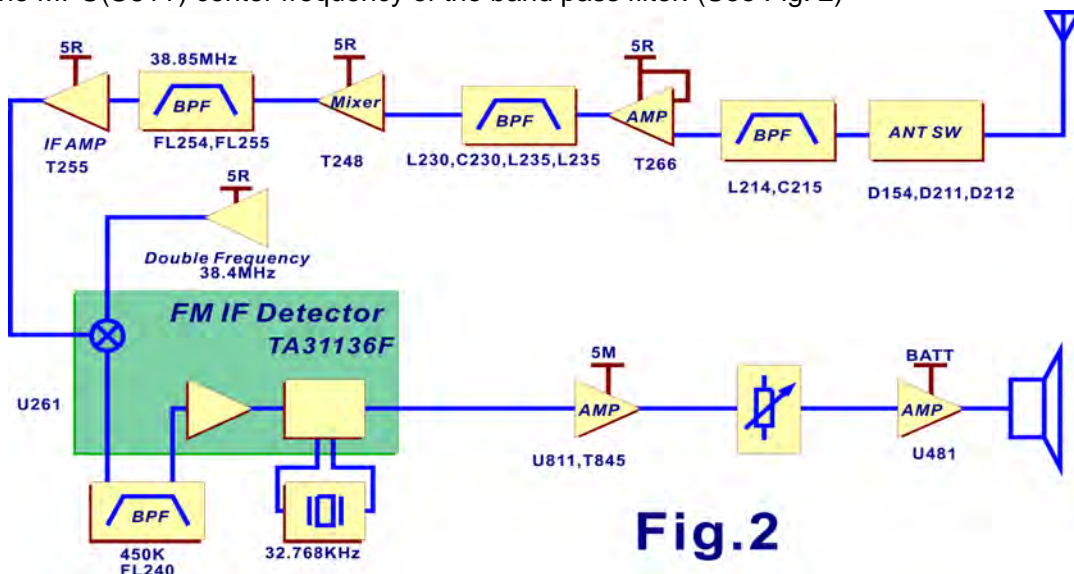


Fig.2

2) First Mixer

The signal from the RF amplifier is heterodyned with the first local oscillator signal from the PLL frequency synthesizer circuit at the first mixer (T248) to create a 38.85MHz first intermediate frequency (1st IF) signal. The first IF signal is then fed through crystal filters (FL254,FL255) to further remove spurious signals.

3) IF amplifier

The first IF signal is amplified by T255, and then enters U261 (FM processing IC). The signal is heterodyned again with a second local oscillator signal within U261 to create a 450kHz second IF signal. The second IF signal is then fed through a 450kHz ceramic filter (FL263) to further eliminate unwanted signals before it is amplified and FM detected in FL240.

4) AF amplifier

The recovered AF signal obtained from U261 goes to the microprocessor(U811). The processed AF signal passes through an AF volume control and is amplified to a sufficient level to drive a loud speaker by an AF power amplifier (U481).

5) Squelch

Part of the AF signal from the IC enters the FM IC again, and the noise component is amplified and rectified by a filter and an amplifier to produce a DC voltage corresponding to the noise level. The DC signal from the FM IC goes to the analog port of the microprocessor (U811). U811 determines whether to output sounds from the speaker by checking whether the input voltage is higher or lower than the preset value. To output sounds from the speaker, U811 sends a high signal to the AF Power lines and turns U481 on through T471, T472.

6) Receive signaling

QT/DQT

The output signal from FM IC (U261) enters the microprocessor(U811). U811 determines whether the QT or DQT matches the preset value, and controls the AF Power and the speaker output sounds according to the squelch results

3. PLL frequency synthesizer

The PLL circuit generates the first local oscillator signal for reception and the RF signal for transmission.

1) PLL

The frequency step of the PLL circuit is 5 and 6.25kHz and so on. A 19.2MHz reference oscillator signal is divided at U311 by a fixed counter to produce the 5 or 6.25kHz reference frequency. The voltage controlled oscillator (VCO) output signal is buffer amplified by T340, then divided in U311 by a programmable counter. The divided signal is compared in phase with the 5 or 6.25kHz reference signal in the phase comparator in U311. The output signal from the phase comparator is filtered through a low-pass filter and passed to the VCO to control the oscillator frequency.

2) VCO

The operating frequency is generated by T340 in transmit mode and T341 in receive mode. The oscillator frequency is controlled by applying the VCO control voltage, obtained from the phase comparator, to the varactor diodes (D330 and D331 in transmit mode and D340 and D341 in receive mode). The TC/RC pin is set low in receive mode causing T345 off, and turn T337 on. The TC/RC pin is set high in transmit mode causing T337 off, and T192, T191 on.

3) UNLOCK DETECTOR

If a pulse signal appears at the LD pin of U311, an unlock condition occurs, and the DC voltage obtained from D309, and C311 causes the voltage applied to the PLL-LD pin of the microprocessor to go low. When the microprocessor detects this condition, the transmitter is disabled, ignoring the push-to-talk switch input signal. (See Fig.3)

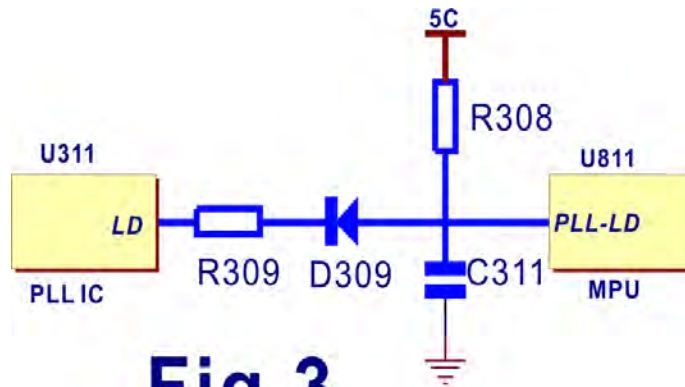


Fig.3

4. Transmitter

1)Microphone Amplifier

The signal from the microphone passes through U511. The signal passes through the Audio processor (U511) for the maximum deviation adjustment, and goes to the VCO modulation input.

2)Drive and Final Amplifier

The signal from the T/R switch (D154 and D155) is amplified by the pre-drive (T112, T120) and drive amplifier (T133) to 50mW. The output of the drive amplifier is amplified by the RF power amplifier (T145) to 3.0W (1W when the power is low). The RF power amplifier consists of two MOS FET stages. The output of the RF power amplifier is then passed through the harmonic filter (LPF) and antenna switch (D154, D155) and applied to the antenna terminal.

5. Power supply

There are four 5V power supplies for the microprocessor: 5M, 5C, 5R, and 5T. 5M for microprocessor is always output while the power is on. 5M for microprocessor is always output while the power is on. 5M is always output, but turns off when the power is turned off to prevent malfunction of the microprocessor.

5C is a common 5V and is output when SAVE is not set to OFF.

5R is 5V for reception and output during reception.

5T is 5V for transmission and output during transmission.

6. Control Circuit

The control circuit consists of a microprocessor (U811) and its peripheral circuits. It controls the TX-RX unit. U811 mainly performs the following:

- (1) Switching between transmission and reception by the PTT signal input.
- (2) Reading system, group, frequency, and program data from the memory circuit.
- (3) Sending frequency program data to the PLL.
- (4) Controlling squelch on/off by the DC voltage from the squelch circuit.
- (5) Controlling the audio mute circuit by the decode data input.
- (6) Transmitting tone and encode data.

1)Memory Circuit

Memory circuit consists of the CPU (U811) and an EEPROM(U831).An EEPROM has a capacity of 32K bits that contains the transceiver control program for the CPU and data such as Transceiver channels and operation features

2)Low Battery Warning

The battery voltage is checked using by the microprocessor.

(1) The red LED blinks when the battery voltage falls below 6.2V.

(2) A Warning tone generates when the red LED blinking. (See Fig.4)

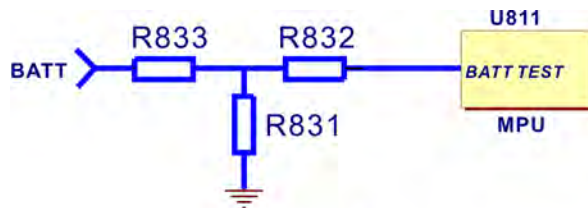


Fig.4

ADJUSTMENT

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 voltmeter

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

100P	0402	Capacitance	C192. C421. C423. C424. C425. C426. C427. C428. C429. C430. C432	11
102P	0402	Capacitance	C181. C304. C377. C389. C407. C731. C830. C902	8
103P	0402	Capacitance	C201. C261. C302. C414. C451. C549. C549. C654. C659. C668. C673. C827. C841. C842. C911. C913	16
104P	0402	Capacitance	C388. C402. C422. C441. C444. C535. C540. C542. C650. C656. C663	11
105P	0402	Capacitance	C375. C524	2
10P	0402	Capacitance	C434	1
120P	0402	Capacitance	C528. C539	2
150P	0402	Capacitance	C541	1
220P	0402	Capacitance	C612. C712. C858	3
223P	0402	Capacitance	C406. C431. C529	3
273P	0402	Capacitance	C371. C372	2
332P	0402	Capacitance	C442. C448. C862	3
33P	0402	Capacitance	C537	1
470P	0402	Capacitance	C185. C195. C374. C403. C411. C420. C438. C453. C532. C533. C665. C912	12
472P	0402	Capacitance	C671. C672. C674	3
473P	0402	Capacitance	C404. C445	2
47P	0402	Capacitance	C538	1
563P	0402	Capacitance	C526	1
680P	0402	Capacitance	C443	1
820P	0402	Capacitance	C447	1
9P	0402	Capacitance	C257	1
105P	0805	Capacitance	C857	1
0R	0402	Resistor	R532	1
100K	0402	Resistor	R403. R525. R540. R545. R661	5
100R	0402	Resistor	R283. R304. R438. R713. R843. R844	6
10K	0402	Resistor	R181. R376. R444. R449. R535. R648. R654. R658. R660. R827. R909. R910	12
10R	0402	Resistor	R450	1
120K	0402	Resistor	R374. R379	2
12K	0402	Resistor	R527	1
150KD	0402	Resistor	R192. R194. R195. R196. R197. R198	6
180K	0402	Resistor	R832	1
18K	0402	Resistor	R404	1
1K	0402	Resistor	R526. R652. R669. R712. R869. R900. R901	7
1K5	0402	Resistor	R432. R436	2
1K8	0402	Resistor	R867	1

1M	0402	Resistor	R182. R537. R662	3
1M8	0402	Resistor	R443. R447	2
200K	0402	Resistor	R831	1
220K	0402	Resistor	R539	1
22K	0402	Resistor	R405. R674	2
27K	0402	Resistor	R866	1
2K	0402	Resistor	R542	1
2K2	0402	Resistor	R715. R716	2
30K	0402	Resistor	R185. R431. R529. R861	4
33K	0402	Resistor	R378. R434. R441. R442. R446. R448	6
36K	0402	Resistor	R183. R857	2
390K	0402	Resistor	R546	1
39K	0402	Resistor	R377. R387	2
3K3	0402	Resistor	R437. R451. R657	3
3K9	0402	Resistor	R653	1
470R	0402	Resistor	R262	1
47K	0402	Resistor	R301. R549. R833. R841. R842	5
4K7	0402	Resistor	R302. R371. R372. R655. R656. R671. R673	7
51K	0402	Resistor	R388	1
560R	0402	Resistor	R813. R814	2
5K6	0402	Resistor	R541	1
680K	0402	Resistor	R406	1
6K8	0402	Resistor	R433	1
820R	0402	Resistor	R421. R548	2
82K	0402	Resistor	R528	1
0R39	1206	Resistor	R171. R172. R173	3
3K3	1206	Resistor	L164	1
1UF	0805	Pol-Cap	E854	1
2U2F	0805	Pol-Cap	E421	1
4U7F	0805	Pol-Cap	E181. E377. E431. C379	4
10UF	A	Pol-Cap	E283. E913	2
10UF	B	Pol-Cap	E911	1
101T	0402	Ind	L402. L711	2
GREEN	0603	G-LED	D813	1
RED	0603	R-LED	D814	1
1SS372	USM	Diode	D422	1
DAN222	USM	Diode	D421	1
2SK1824	ESM	Transistor	T431. T526	2
DTA114EE	ESM	Transistor	T201	1
DTC114EE	ESM	Transistor	T181	1
MRF497	USM	Transistor	T421	1
2SB624	TSM	Transistor	T301	1
24C32	SO8	IC	U821	1
CHORD	SO8	IC	U511	1
LM358	SO8	IC	U661	1

LM4558	SO8	IC	U411	1
LM2904V	SSOP8	IC	U161	1
FX128	SSOP16	IC	U512	1
5A	SOT89	IC	U911	1
3M58HZ	FX-CS20	Oscillator	CR537	1
50K		Var-Res	RV351. RV378	2
MONI		Button	SW711	1
PTT		Button	SW712	1
SCR		Button	SW713	1
JP18		Connectors	JP811	1

Bottom

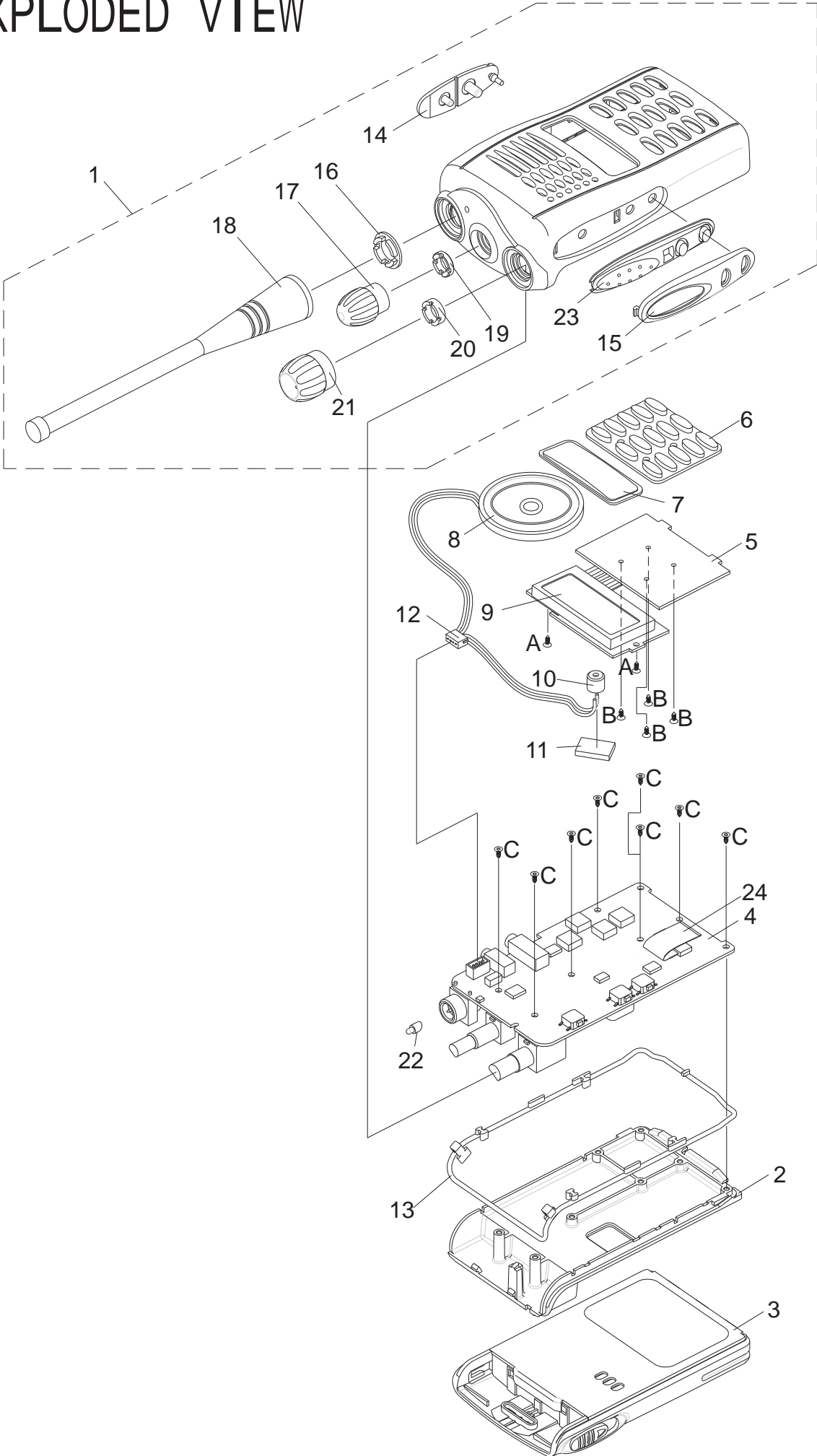
Comment	Footprint	Name	Designators	Quantity
0P5	0402	Capacitance	C247. C336. C352	3
100P	0402	Capacitance	C275. C313. C314. C315. C317. C343. C384. C643	8
102P	0402	Capacitance	C128. C137. C191. C205. C232. C248. C256. C281. C312. C316. C318. C328. C418	13
103P	0402	Capacitance	C113. C143. C146. C186. C219. C231. C250. C251. C254. C258. C280. C321. C354. C382. C383. C391. C413. C645. C854. C885	20
104P	0402	Capacitance	C103. C145. C188. C264. C273. C274. C278. C282. C283. C284. C319. C326. C395. C416. C417. C602. C604. C642. C850. C851. C855. R644	22
105P	0402	Capacitance	C138	1
10P	0402	Capacitance	C333. C351. C355. C359. R357. VC241	6
12P	0402	Capacitance	C154. C155. C161. C214. C240. C335. C358	7
15P	0402	Capacitance	C115. C166. C811. C882	4
18P	0402	Capacitance	C211	1
1P	0402	Capacitance	C332. C349	2
1P5	0402	Capacitance	C334. VC220	2
20P	0402	Capacitance	C123. C125	2
220P	0402	Capacitance	C286. C387. C853	3
222P	0402	Capacitance	C871	1
223P	0402	Capacitance	C345	1
22P	0402	Capacitance	C167. C168. C393	3
25P	0402	Capacitance	C212	1
27P	0402	Capacitance	C276. C287	2
330P	0402	Capacitance	C381. C385	2
33P	0402	Capacitance	C133. C272. C346	3
3P	0402	Capacitance	C238. C246. C255	3

470P	0402	Capacitance	C104. C111. C112. C114. C121. C122. C127. C131. C134. C157. C206. C218. C233. C285. C288. C320. C323. C324. C325. C327. C342. C394. C396. C398. C419. C452. C601. C886. C904	29
472P	0402	Capacitance	C872	1
474P	0402	Capacitance	C646	1
47P	0402	Capacitance	C329. C380. C852	3
56P	0402	Capacitance	C386	1
5P	0402	Capacitance	C348. C397	2
683P	0402	Capacitance	C640	1
6P	0402	Capacitance	C135. C136. C169. C392	4
8P	0402	Capacitance	C217	1
9P	0402	Capacitance	VC243	1
104P	0603	Capacitance	L333	1
105P	0603	Capacitance	C883. C901	2
10P	0603	Capacitance	C163. C164	2
13P	0603	Capacitance	C165	1
470P	0603	Capacitance	C162. L133	2
47P	0603	Capacitance	C156	1
6P	0603	Capacitance	C151	1
104P	0805	Capacitance	C817	1
47P	0805	Capacitance	C152	1
6P	0805	Capacitance	C331	1
4P	1008	Capacitance	C347	1
0R	0402	Resistor	R363. R364. R400. R886	4
100K	0402	Resistor	R226. R229. R240. R258. R322. R342. R355. R883. R885	9
100R	0402	Resistor	R321. R326. R391. R397. R714	5
10K	0402	Resistor	R189. R256. R278. R361. R380. R382. R416. R601. R718. R907. R908	11
10R	0402	Resistor	R124. R393. C644	3
120K	0402	Resistor	R113. R187. R261. R392	4
150K	0402	Resistor	R128. R186	2
150R	0402	Resistor	R362. R642	2
15K	0402	Resistor	R111. R328	2
180K	0402	Resistor	R257. R286	2
1K	0402	Resistor	R242. R264. R341. R365. R902. R903. R904. R905. R906	9
1K2	0402	Resistor	R276	1
1K5	0402	Resistor	R115	1
1K8	0402	Resistor	R402	1
1M	0402	Resistor	R417. R856	2
200K	0402	Resistor	R227. R230	2

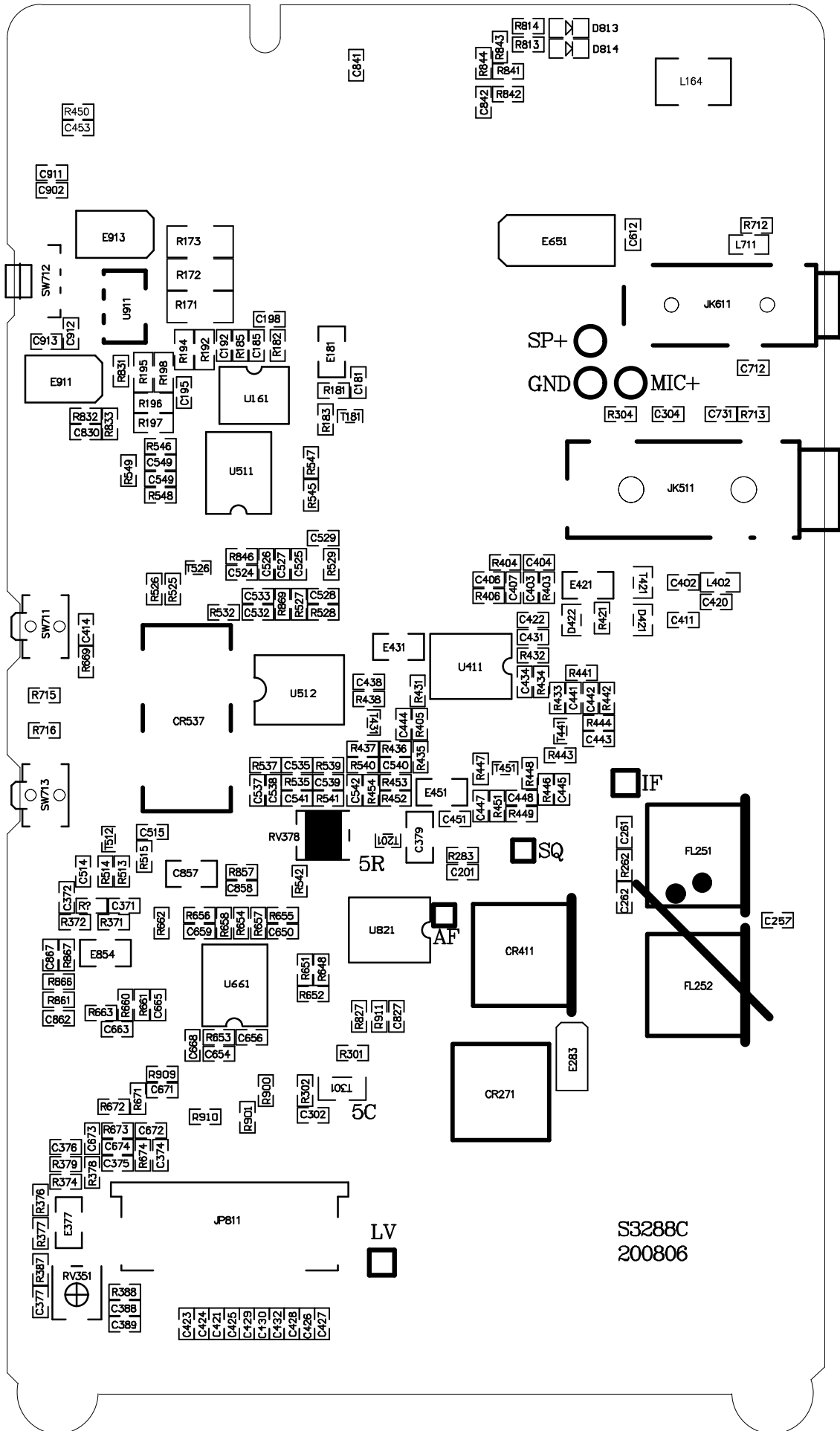
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220R	0402	Resistor	R228. R239. R335. R351. R389	5
22K	0402	Resistor	R333	1
22R	0402	Resistor	R114. R121. R136. R343	4
270K	0402	Resistor	R285	1
270R	0402	Resistor	R157. R158	2
2K2	0402	Resistor	R366. R367. R613. C641	4
330K	0402	Resistor	R852	1
330R	0402	Resistor	R122. C124	2
33K	0402	Resistor	R854. R871	2
33R	0402	Resistor	R231	1
39K	0402	Resistor	R137	1
3K3	0402	Resistor	R123. R277. R288. R394. R396. R398. R399. R873	8
3K9	0402	Resistor	R287	1
470K	0402	Resistor	R646. R853	2
470R	0402	Resistor	R254. R356. R401. C132	4
47K	0402	Resistor	R102. R127. R138. R188. R323	5
47R	0402	Resistor	R126. R252. R312	3
4K7	0402	Resistor	R101. R324. R815. R818	4
560R	0402	Resistor	R368	1
56K	0402	Resistor	R238	1
5K6	0402	Resistor	R395. R872	2
680K	0402	Resistor	R381	1
0R	0603	Resistor	L335. R645	2
47R	0603	Resistor	R125	1
4K7	0603	Resistor	L329. L346	2
0R	0805	Resistor	R135. R153. L253	3
0U1F	0805	Pol-Cap	E364. E367	2
1UF	0805	Pol-Cap	E319. E646	2
2U2F	0805	Pol-Cap	E363	1
4U7F	0805	Pol-Cap	E312. E325. E401	3
1UF	A	Pol-Cap	E871	1
10UF	A	Pol-Cap	E642	1
100NH	0603	Ind	L112. L122. L312. L320. L324. L386	6
220NH	0603	Ind	L231. L351. L355. L391. L392	5
390NH	0603	Ind	L123	1
470NH	0603	Ind	L381. L383	2
560NH	0603	Ind	L382	1
220NHD	0805	Ind	L157	1
6U8H	0603	Ind	L328. L345	2
101T	0603	Ind	L851. L886	2
101T	0805	Ind	L132. L142. L901	3
68NH	0805	Ind	L212. L213. L224. L227. L288	5
R10	0805	Ind	L344. L347	2
R12	0805	Ind	L216. L326. L331	3

2R2	0805	Ind	L252	1
3T	0.4*1.5mm	Coil-Ind	L165	1
4T	0.31*1.3mm	Coil-Ind	L131	1
5T	0.4*1.5mm	Coil-Ind	L161. L163	2
6T	0.31*1.5mm	Coil-Ind	L211	1
6T	0.4*1.5mm	Coil-Ind	L162	1
8T	0.4*1.5mm	Coil-Ind	L143	1
HSC277	ESC	Diode	D111. D211. D212. D213	4
MA2S111	ESC	Diode	D324. D325	2
1SS314	USC	Diode	D156	1
1SV220	USC	Diode	D332	1
B9	USC	Diode	D328. D329. D345. D346	4
MA742	USM	Diode	D411	1
2SC4617	ESM	Transistor	T321	1
2SJ243	ESM	Transistor	T326	1
DTA114EE	ESM	Transistor	T275. T401. T815	3
DTC114EE	ESM	Transistor	T102. T191. T611. T646. T813. T814	6
2SC4226	USM	Transistor	T111. T355	2
2SC5108(Y)	USM	Transistor	T391	1
KTC4082	USM	Transistor	T261. T381	2
R25	USM	Transistor	T392	1
UMC4	USV	Transistor	T327	1
2SB624	TSM	Transistor	T103. T602	2
2SK508NV	TSM	Transistor	T333. T341	2
R3111N451	TSV	Transistor	T881	1
2SC4988	SOT89	Transistor	T121	1
2SK1588	SOT89	Transistor	T645	1
2SK3078	SOT89	Transistor	T131	1
3SK1212	SOT343	Transistor	T231. T251	2
3SK4037	HWSON-2	Transistor	T141	1
MCU	QFP44	IC	U811	1
TA7368F	SSOP10	IC	U641	1
TA31136F	SSOP16	IC	U261	1
LMX2332	SSOP20	IC	U311	1
14M4HZ		Oscillator	CR311	1
32K768		Oscillator	CR881	1
450K		Filters	FL261	1
BAT		Battery	BAT111	1

EXPLODED VIEW

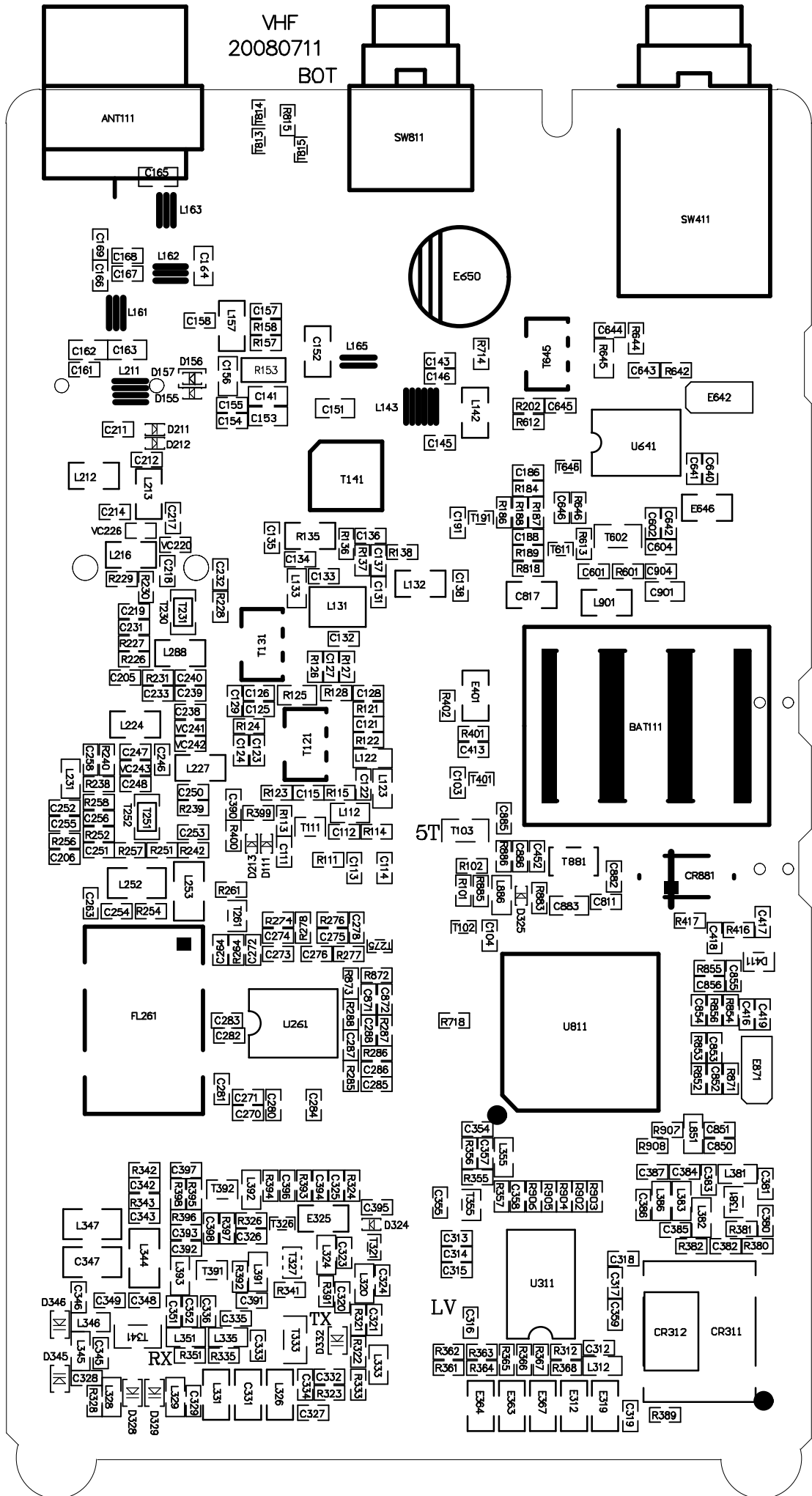


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