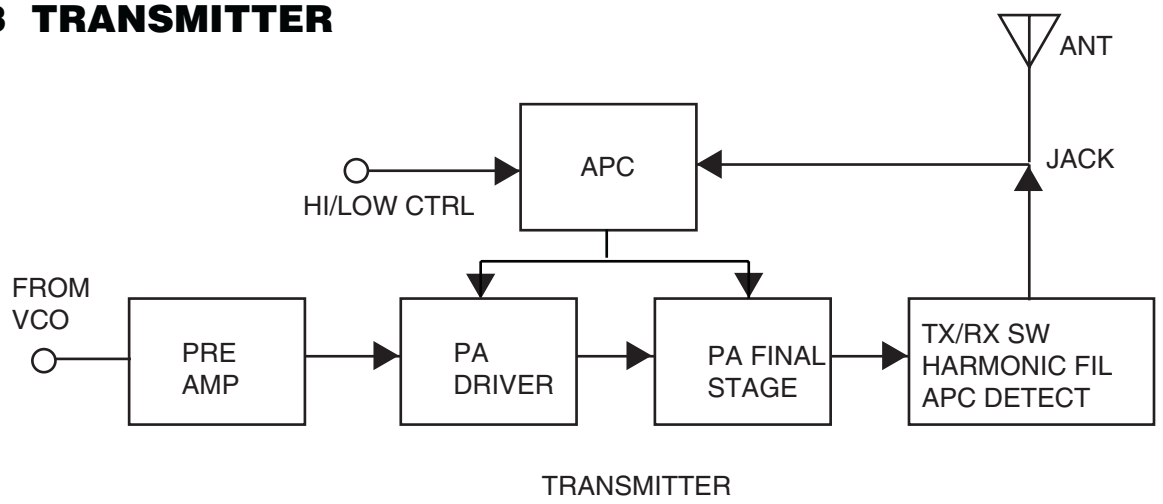
3 TRANSMITTER



TRANSMITTER

3.1 PRE-AMPLIFIER:

The Pre-Amplifier consists of Q807 & Q808. The VCO output signal is applied to Pre-Amplifier (Q807 & Q808), to obtain a level above 14dBm, while operating in the frequency range of 136MHz to 174MHz. The T5V supplies a 5V to Pre-Amplifier Q810 & Q809 are turned on by T5V . The TX5 supplies a 5V to Q807 & Q808.

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The output signal of Pre-Amplifier provided the drive stage Q801 (RD01MUS1) and power amplifier Q802 (2SK3476),to obtain RF Power above 6 Watts . Its current drain is less than 2000mA ,while operating in the frequency range of 136MHz to 174MHz.

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Antenna switch circuit consists of two PIN diode (D801, D802), transistor (Q803), and pi network (C810 L814 C832). In TX mode, TX5 supplies a High level to turn on Q803 & Q804 5V bias is applied to the switch circuit to bias two diodes on. The shunt diode (D802) shorts out the receiver port and a high impendence between L814 and harmonic filter. In receive mode, the diodes are both off so it will form a low attenuation path between antenna and receiver ports.

3.4 HARMONIC FILTER

Harmonic filter consists of C807, C806, L803, C805, L802, C804, C803, L801 & C801 to form three poles low pass filter to attenuate harmonic energy of the transmitter.

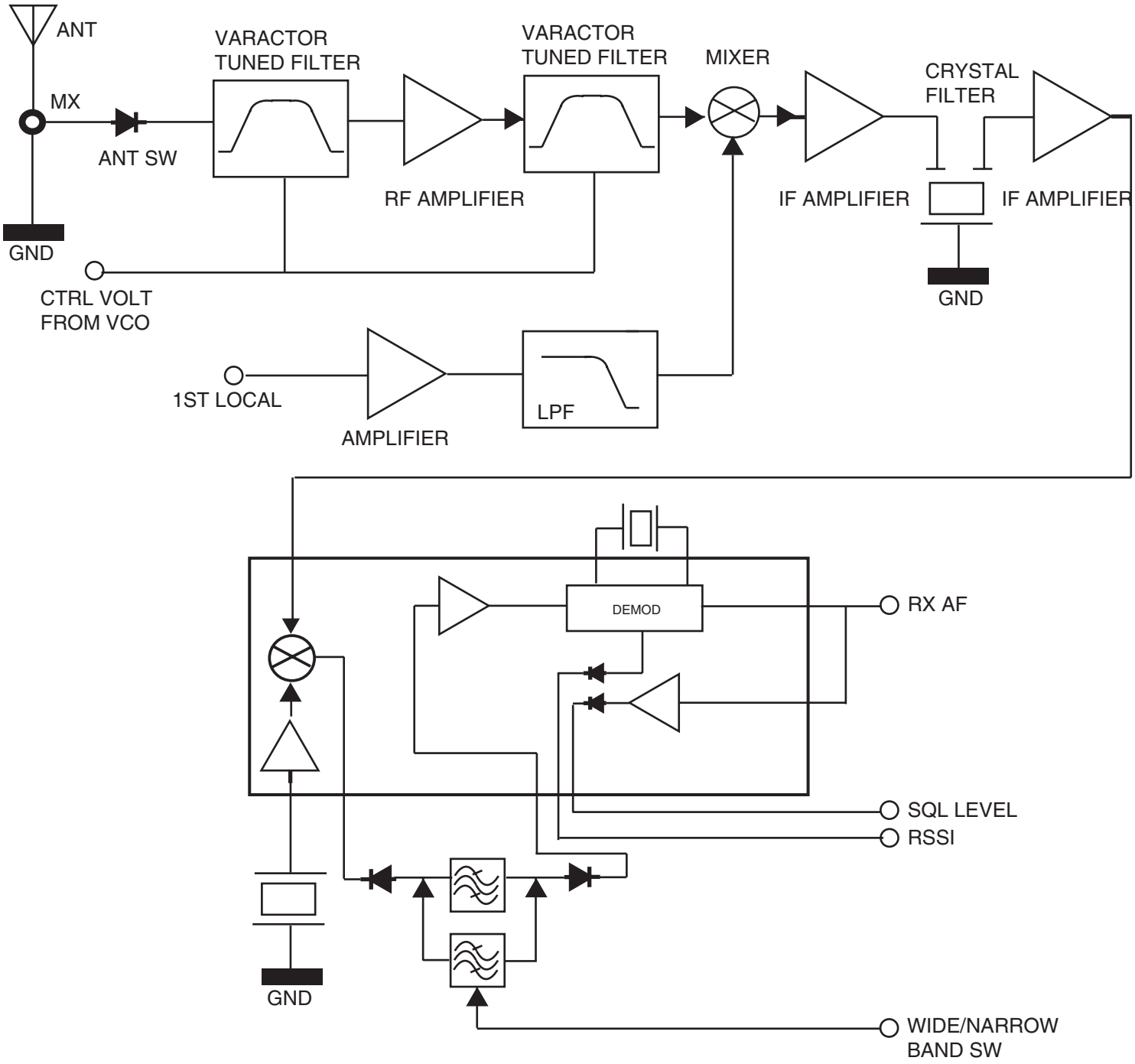
3.5 APC (Auto Power Control)

Transmitter with feedback voltage , which controls driver stage (Q802) and final stage (Q801) ,stabilize RF output power. The feedback voltage is formed by D803, to provide the U802 (2/2) amplifier and voltage reference (1/2). It controls two stages, Q801 & Q802, to get bias voltage and forms an auto level control to stabilize transmitter output power.

3.6 High / Low POWER CONTROL

In TX mode, it will turn off Q805 while H/L pin is low, adjusting VR801 to control U801 (1/2) comparator reference voltage to control high power output of transmitter.
Q805 will turn on when H/L pin is high,to adjust VR802 to control low power output.
Q806 is as a power enable (PE) control. When PE setting is low, Q806 is turned off and APC activates. When PE setting is high, the Q806 is turned on and APC is turned off,so that RF power is disabled.

4 RECEIVER



4.1 FRONT-END

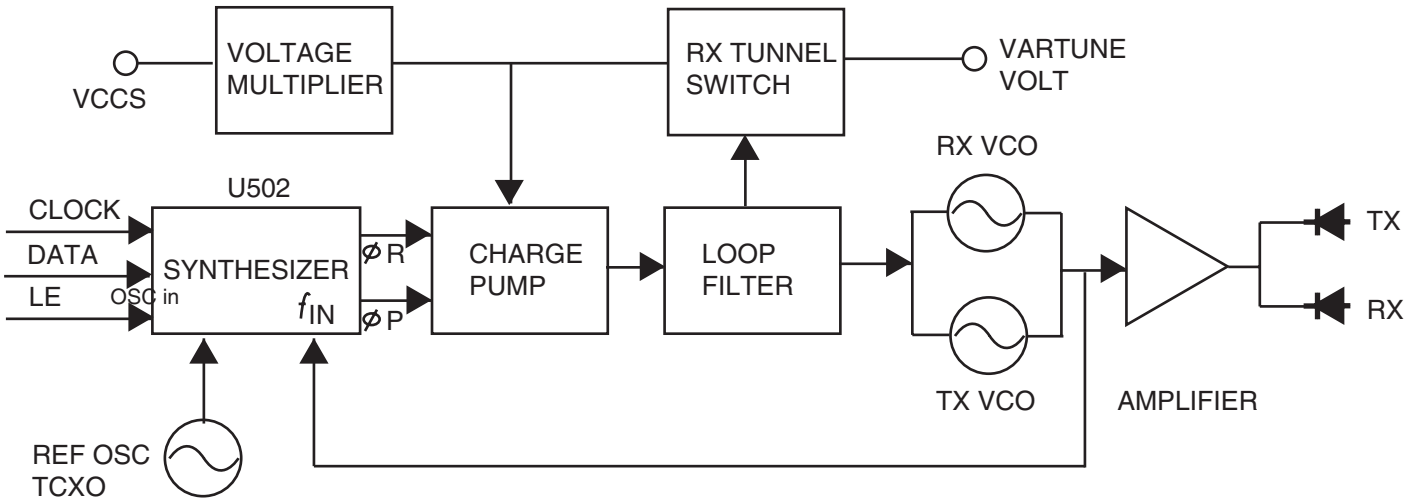
RF signal is fed through antenna into low pass filter, which is composed of C801,C802, L801, C803, C804, L802, C805, C806, L803, C807, then going into TX/RX antenna switch, which is composed of 2 PIN diode (D801, D802), transistor (Q803) and pi network (C810, L814, C832).
RF signal is coupling with C701 to varactor tuned band pass filter, which is composed of L701, L702, C702, C703, C704, & D701 D702. to change varactor diode (D701, D702) voltage to tune band pass filter shift band.
The control voltage of band pass filter is supplied from Q504 ,the voltage is controlled by VCO
The output signal of band pass filter is provided with RF amplifier transistor (Q701)
,the C710 coupling into second band pass filter, which is composed of L704, C711,C783,C712, L705, C713,C714,C715,C784,L706,C716, D704, & D705. The Q504 is controlled by VCO.
The voltage of Q504 controls the second varactor tuned band pass filter (D704, D705) band shift.

The signal of RF amplifier and band pass filter are fed through C717 coupling into double balance mixer. The signal comes from T701, matching with D706, D707, D708, & D709.
The first local signal comes from VCO output, then into local amplifier Q702 and low pass filter, the Low Pass Filter is composed of C730, L710, C731, L711, C732, the signal coupling with C733 into transformer (T702) matching with D706, D707, D708, D709, The VCO using a high side injection the RF signal is down-converted to 45MHz IF signal ,the signal output from T701
The IF signal output comes from mixer through L715, C734 & C735, coupling to RF signal attenuate and depress loop circuit, which is composed of L713, C738, R715, L714, C736, C737, and then, through IF amplifier (Q703) applied to crystal filter to provide necessary selectivity and intermodulation protection.

4.2 BACK-END

IF signal goes through IF amplifier Q704, C747, L716, & C748 and it matches with U701 pin 16 (IF). U701 pin 1 feeds second local frequency 44.545MHz ,there are two signals coming internal mixer(U701) ,becomes 2nd IF signal 455KHz.
The 2nd IF signal goes through diode (D710, D711) & ceramic filter CF701 (12.5KHz) CF702 (25KHz), which are narrow band & wide band channel spacing filter respectively.
The CHSP control wide & narrow bands switch. When CHSP is in High, IF signal pass through CF702 (25KHz); while CHSP is in Low, IF signal pass through CF701 (12.5KHz).
Thewide band ceramic filter at -6dB, bandwidth is 7.5KHz. while the narrow band ceramic filter at -6dB, bandwidth is 3.75KHz. 2nd IF signal goes through U701 internal amplifier. And applies to demodulator, which used a ceramic discriminator to detect audio signal. U701 pin 9 recovers audio output. U701 pin12 supplies a received signal-strength indicator (RSSI) to microprocessor (U102), RSSI supplied received signal strength level to showen on LCD indicator . U701 functions have a noise amplifier and a noise detector level for microprocessor to control the squelch . The noise signal comes fromdemodulator (U701 pin9) ,then pass through R738, C768, and then applied to pin 8 through internal noise amplifier. Noise detector supplies noise voltage for microprocessor (U102) to control squelch .

5 FREQUENCY GENERATION CIRCUIT



The frequency generation circuit is composed of synthesizer chip (U502) and voltage control oscillator (VCO) and voltage multiplier.

5.1 SYNTHESIZER

The PLL frequency synthesizer U502 contains prescaler ,phase detector ,internal dividers ,reference counter ,there are controlled by microcontroller pin Clock,Data,LE ,an external VC-TCXO assures that the frequency remains stable across the temperature range (typically +/_ 2.5 ppm) .besides VC-TCXO offers a modulation port for the 2 port modulation system.
The reference frequency (VC-TCXO) goes through U502 internal programmer to 5KHz or 6.25KHz, and then goes through phase comparator to gain a ΦR signal to pin 16 (U502).
The VCO provides a feedback signal match to U502 (pin 8 F-in),the port including a pre-scale programmable counter, & swallow counter, to control VCO frequency divider to 5KHz or 6.25KHz. And then, goes through phase comparator to catch ΦP signal output from pin5 (U502).
ΦR & ΦP signals applied to charge pump Q503 Q502 controls the loop filter, whose circuit consists of R514 C511. Then charge pump voltage pass to low pass filter, The low pass filter consists of R512 C512 R513 C513, supply a necessary DC steering voltage for VCO to gain a stable local-oscillator frequency.

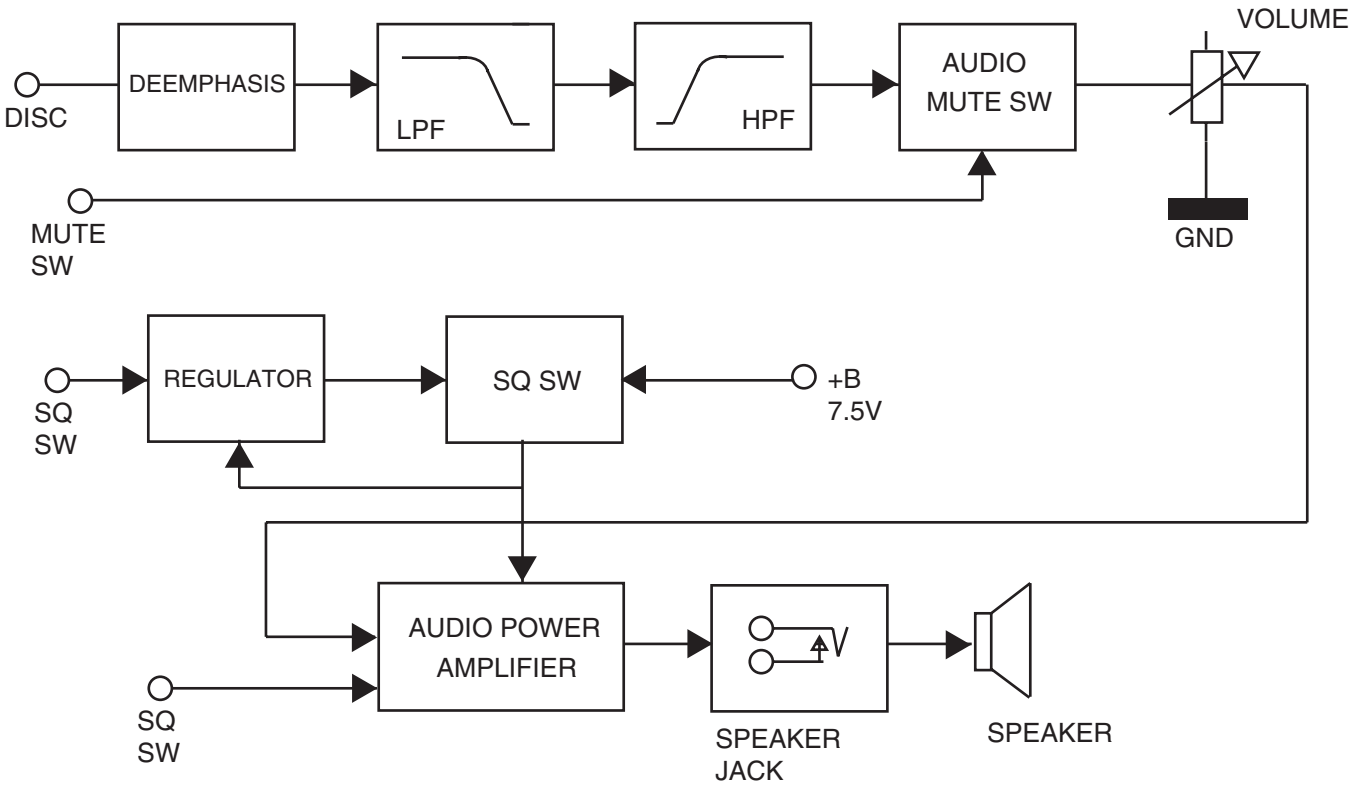
5.2 VCO

RX VCO The RX VCO includes transistor Q602 ,coil L604,C611,Varicap CT601 and two varactors D605 and D606 ,it is configured as a colpitts oscillator . its complexity comes from the balance between wide band and low noise needs . the resonant circuit produces a different frequency with a change in dc voltage controlled by the tuning voltage signal present at the cathode of D605 and D606 ,the local oscillator signal is applied to the amplifier Q601 .D601 is a dual diode,when 1 of 2 is reverse biased the other one is forward biased. Due to D601,the lo signal is applied to the mixer .
TX VCO The TX VCO comprises transistor Q603, Coil L607,Capacitor C621,Varicap CT602 and varactors D603 and D604,it is configured as a colpitts oscillator .the resonant circuit produces a different frequency with change in dc voltage controlled by the tuning voltage signal present at the cathode of D603 and D604.the AF signal from R613 to the cathode of D602 to produce FM modulation . the signal is applied to amplifier Q601.
RX and TX power line filters transistor Q606 is configured as a 5v power supply ripple filter the filter reduces the noise on the carrier and local oscillator signals.

5.3 VOLTAGE MULTIPLIER

Voltage multiplier circuit consists of IC (U501), diode (D501, D502), R501, R502, C502, & C503. Dc/Dc is set up to 10V. It goes through ripple filter (Q501) supply the charge pump (Q502, Q503) to control TX/RX VCO. VCO controls RX front-end band pass filter by Q504.

6 RECEIVER AUDIO CIRCUIT



6.1 AUDIO FILTER

The audio output signal of the demodulator provides to the De-Emphasis circuit.
The circuit is composed of C319, R317, C320, R318, R319, C321, & IC (U302), and then applied to low pass filter, which is composed of R320, C324, R321, C323, R322, C323, & IC (U301). The function of low pass filter is to attenuate 3KHz above audio signal. By R327 & C328, the audio signal of low pass filter is coupling with high pass filter, which is composed of IC (U303). The function of high pass filter is pass voice band filters with CTCSS/DCS rejection properties.

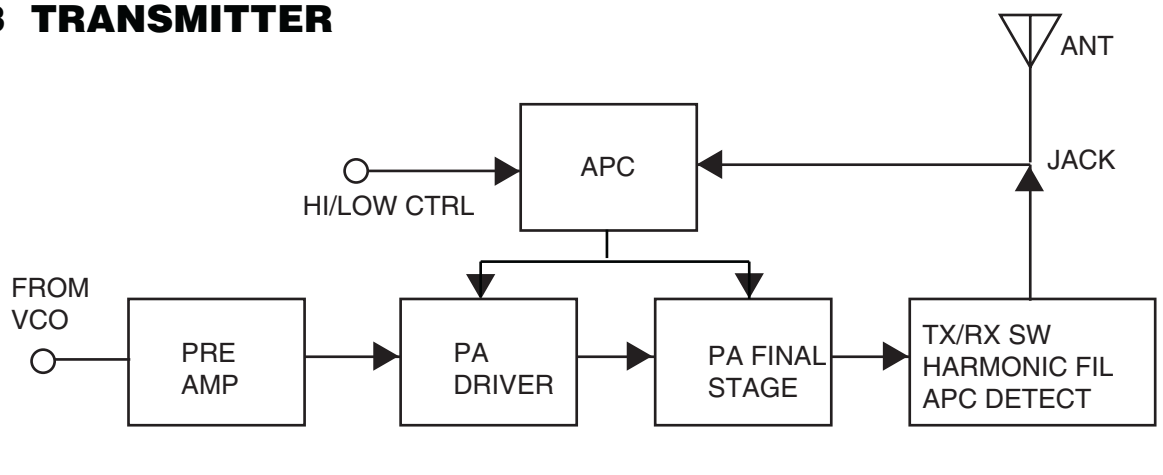
6.2 AUDIO AMPLIFIER

The audio signal is passed to band pass filter, which is composed of IC (U302, U303), applied to audio mute switch control ,then passed to volume control (VR301), applied to audio amplifier (U301), in the end, through C318 to activate the speaker (SP301) by speaker jack (J302). The audio output power is more than 0.5W at 10% distortion.

6.3 SQUELCH CONTROL CIRCUIT

The noise signal of the demodulator output goes through R738, C761,into a tank, which is composed of C760 ,L718, and then goes through U701 internal noise amplifier, the noise amplifier provide noise signal voltage from U701 pin13 is applied to MCU pin36 (A/D) sampling; in the end, by SQ SW (pin73) to turn on transistors(Q302, Q303) and to control audio power amplifier (U301). The mute control switch is achieved with MCU pin 68 to control transistor (Q301) to mute audio signal.

3 TRANSMITTER



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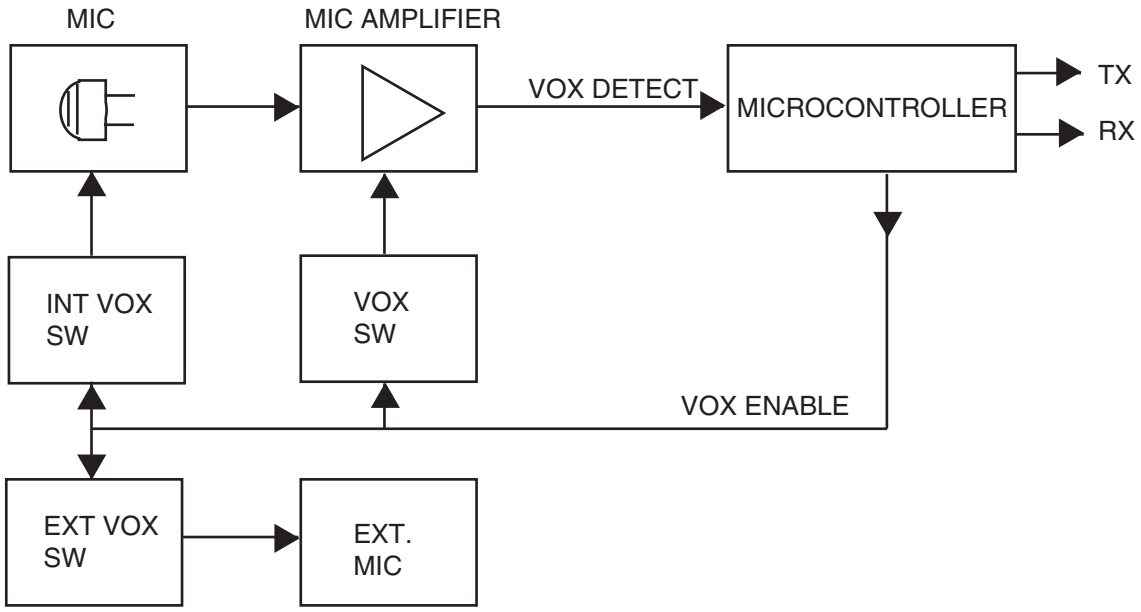
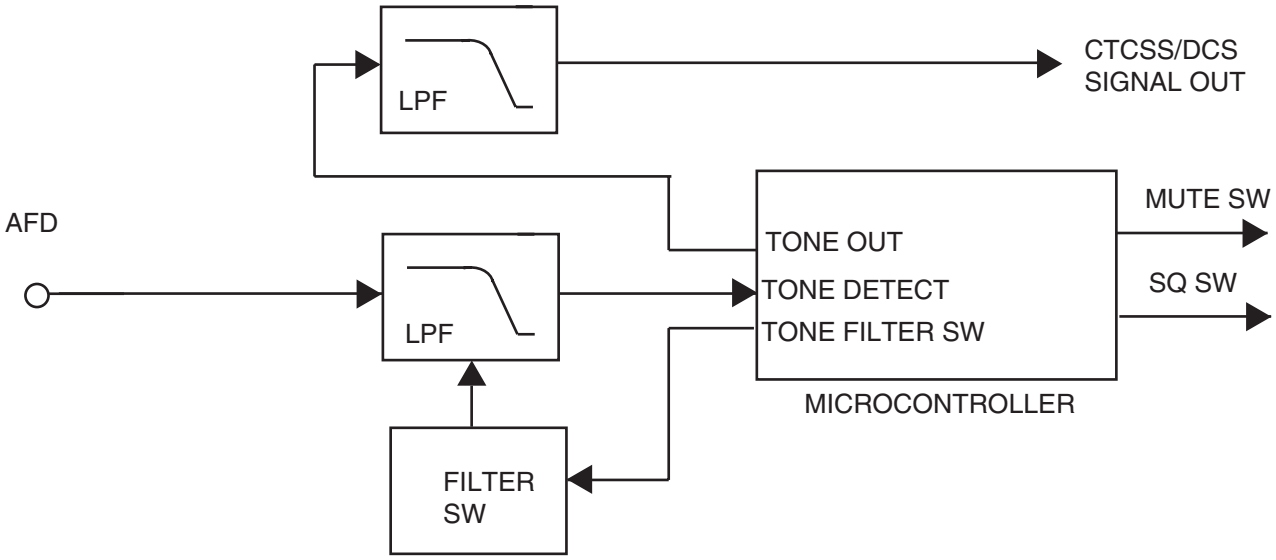
8 VOX CONTROL



VOX control signal comes from MCU (U102) pin 75 (VOX enable). When VOX is activated, VOX enable (pin 75) is low, it will turn on VOX switch (Q102, Q103) to make microphone (MK101) and MIC amplifier (U104) in stand-by mode.When VOX signal is sent from MIC amplifier through R114 applied to MCU VOX detect (pin 38), for sampling reference level to change TV (TX control Voltage) or RV (RX control voltage) state.

9 TONE CIRCUIT



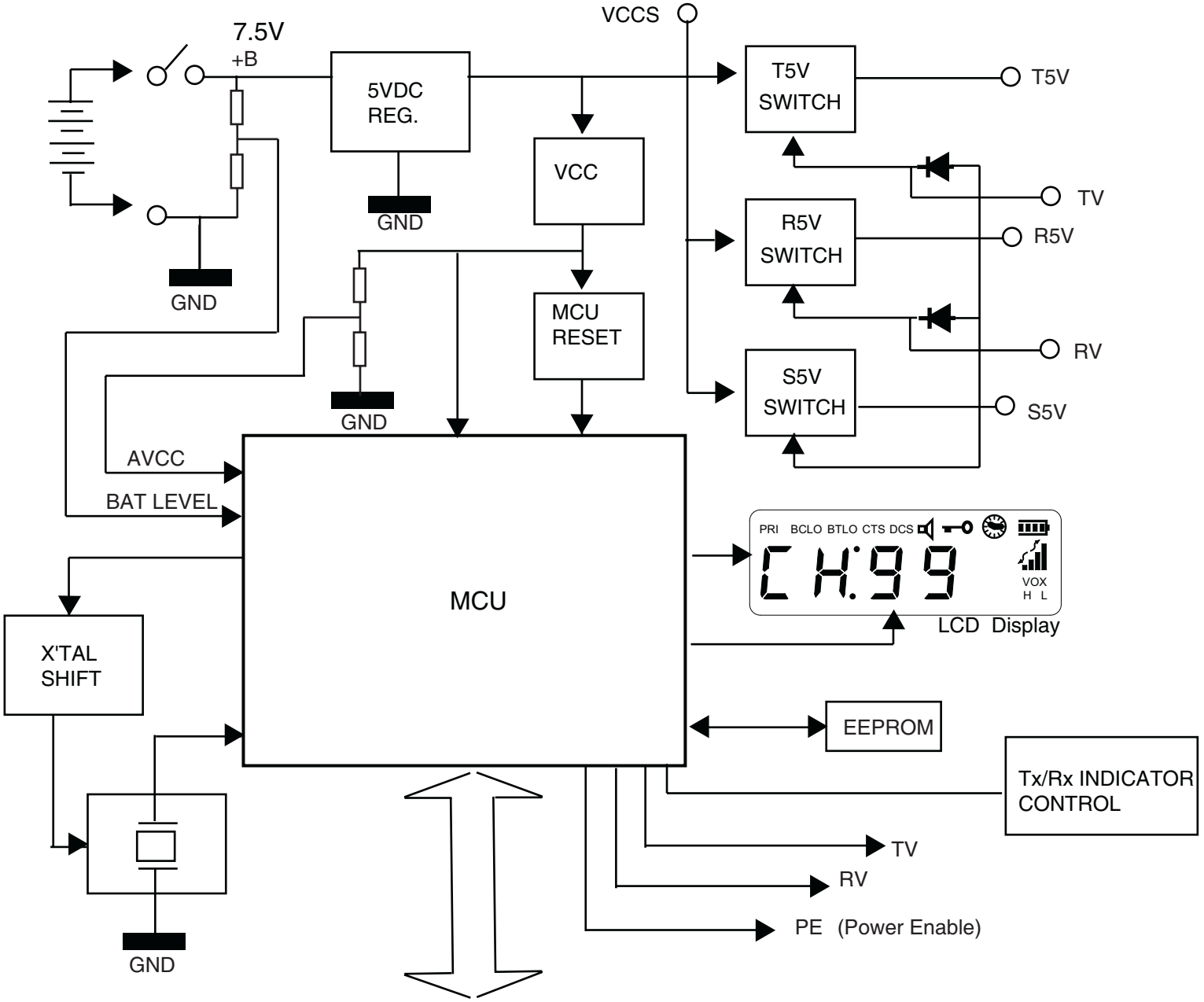
9.1 CTCSS/DCS ENCODE

CTCSS/DCS signal is sent from MCU (U102) tone out (pin 71) A/D converter, through R183, & R184 passing low pass filter, which is consisting of R139, R140, C145, C146, IC (U105 1/4), R141, R142, C147, C148, & IC (U105 2/4), to get a smooth tone signal out.

9.2 CTCSS / DCS DECODE

The tone code comes from connector (CN101) AFD IN goes through a low pass filter, which is composed of U105 (3/4), R158, R149, C158, & C157, and then coupling with C158 applied to another low pass filter, which is composed of IC (U105 4/4), R148, R144, C155, C153, & R145. The tone code comes from U105 (pin 14) output to MCU (U102 pin37) A/D converter to check the code. If the code is correct, MUTE SW (U102 pin68) is low, and SQ SW (pin73) is high to open audio path. Transistor (Q105) is the tone filter switch. It will be turned on when CTCSS code below 131.8Hz or DCS code.

10 POWER SUPPLY & DIGITAL CONTROL



.PRO in-out
.Unlock Det.
.KeyPad in/out
.Squelch Control
.RSSI Level
.VOX Enable
.Serial Data

.CHSP Control Out
.Tone Filter Control Out
.Hi/Low Power Control Out
.Mute Switch Control Out
.SQ Level
.VOX Det.
.Tone Code in-out

10.1 DIGITAL CONTROL

MCU (U102) is an 8-bit microprocessor with 48KB ROM & 2KB RAM memory.
Microprocessor functions as following:

. LCD driver
. EPROM programming read/write
. CTCSS / DCS encode/decode
. TX / RX mode control

. VOX enable / disable
. Keypad I/O control
. PTT (Push To Talk) control
. 12.5KHz / 25KHz Channel spacing control
. RSSI Indicator of radio signal-strength
. Squelch control
. MCU clock shift control
. Series clock and data control
. Hi / Lo power & power enable control
. Indicator of battery capacity

10.2 POWER SUPPLY CIRCUIT

The DC Power source is supplied by 7.5VDC NI-MH battery
7.5VDC supplies audio power amplifier & transmitter RF power amplifier.
7.5VDC supplies DC regulator (U201) to convert 5VDC (VCCS) Supply for digital, Q201 (T5V), Q202 (R5V), Q203 (S5V) and TX5.

10.3 ROM READ/WRITE CIRCUIT

ROM Read/Write data is from programming kit (ROM writer) through J301, R342, to MCU (U102) pin 82. By pin 78 (clock) & pin 79 (data), pin 83 (data I/O) program IC (U103) EEPROM, which provide a 16K bit for MCU to read or write channel data.