Explanation of the Operation for FX-2458 (IC-F21)

1. Mic Amp

The audio signal from the mic is given +6 dB/oct pre-emphasis characteristics from R138 and C185 while being amplified in IC5C.

2. Mute/Switchover Circuit

The audio signal amplified in IC5C, during transmission, is sent to the next stage splatter filter (IC5D), and during receive, is muted by the switch circuit IC6. Also, IC6 changes the receive HPF (IC5B) output to the next stage LPF (IC5D) during receive. IC5D is used as the splatter filter during transmit, and as the receive LPF during receive. The output from IC5D is again by way of the switch circuit IC6 sent to the VCO modulation circuit during transmit, and to the AF amp circuit during receive.

3. Splatter Filter

IC5D has two functions as the splatter filter and the receive LPF, and when working as the splatter filter, operates also as a summing amp for the different types of audio signal signaling (CTCSS/DTCS/5/2 Tone and DTMF) from the mic amp.

4. Signaling (Encode)

The 5 tone/2 tone/DTMF encode output is wave adjusted in the 4-bit D/A (made up of R215~R219), then passes through the IC16 LPF and is sent to the splatter filter and AF amp. The CTCSS/DTCS encode output is wave matched in the 3-bit D/A (made up of R176~R179), then passes through the Q29 LPF and is sent to the splatter filter.

5. Signaling (Decode)

5 tone/2 tone passes through the IC5A LPF and amp, and is input to the CPU's pin 58, where it is decoded. CTCSS/DTCS passes through the IC12 LPF and amp, and is input to the CPU's pin 57 (CDEC) where it is decoded. In IC12, during DTCS the amp gain is increased for wave adjustment, and during CTCSS the gain resistor is switched ON and OFF at IC13 and Q30, to lower the gain so as not to distort the wave shape.

6. D/A Converter

The surrounding temperature is detected in the R151 thermistor and the CPU calculates the PLL lock voltage, frequency etc., and maintains the optimal control of the PLL standard oscillation, RF/BPF, modulation and transmission output via IC9 (D/A).

7. Power Circuit

In IC10 the stabilized 5V becomes the CPU power, and furthermore as the standard, T5V is made in Q27, R5V in Q26 and S5V in Q24.

8. VCO

At transmission, the oscillating frequency is decided in D7, L16 and C63~C66, and oscillation is carried out by Q11. D6 is a varactor diode for carrying out FM modulation. At reception, the frequency is decided in D5, L13 and C50~C53, and oscillation is carried out by Q10.

The transmit/receive circuit switchover is carried out by grounding the Q10 and Q11 emitter resistor, and applying bias current. The oscillation output after amplification passes through Q6 to the PLL circuit, and is also sent from Q5 to the transmit YGR circuit and receive mixer circuit.

9. YGR/PA

During transmission, Q5 output is linked to the YGR circuit while D3 is ON. After amplification in Q4 and Q3, it goes to the final FET Q1 after passing the driver FET Q2, where it is amplified to the necessary power.

10. APC Circuit

The LPF L4 high frequency voltage is detected in D2 and is compared with the D/A output (T4) in IC2 to adjust this voltage and the RF power. By making the IC2 output voltage as the Q1 and Q2 gate voltage, RF power is controlled.

11. ANT SW/LPF

The RF output passes through the transmit/receive switchover circuit (made up of D1, D9 and D10) and is directed to the ANT after passing through the LPF.

12. RF BPF

The signal received in the antenna passes the LPF and is directed to the 1st stage receive BPF. The BPF (made up of L21, C105, D12 and C104), the same as the 2nd stage BPF, is adjusted to the optimal BPF according to the frequency of the D/A output tracking voltage, and is given ample attenuation in regard to the image frequency. Q15 is a low noise RF amp, and here the signal is amplified and passes through the next stage BPF circuit, where it is input to the mixer circuit (Q16) by the FET. An AGC circuit is employed for the Q15 gate-2 voltage adjusted at Q33 according to the signal input strength.

13. MIX

The output from the VCO, during receive passes through D4 and is input to the Q16 mixer circuit as the 1st Lo signal after going through the R79/R80/R81 attenuator, and C126 and L25 filter. And the receive signal that has passed through the receive BPF is mixed with the 1st Lo, and changed to the 1st IF frequency.

14. IF Amp

The changed signal in the 1st IF passes through the crystal filter FI1, and after amplification in Q17, is input to the FM detection IC, IC3.

15. IF DET

In the FM detection IC (IC3), the standard oscillation output from IC1 is amplified in Q18 and the 3rd order higher harmonics are used as the 2nd Lo. The signal changed to the 1st IF frequency and the signal mixed in the 2nd Lo, is output from pin 3. This signal has the unwanted band components eliminated in the ceramic filter FI2, and is re-input to pin 5 as the 450 kHz 2nd IF signal. Inside IC3 it is sent to the detection circuit after this. The detection circuit uses X2 as the Phase Delay by the Quadrature detection method. The detection output is output as an AF signal from pin 9.

16. SQL

The signal from IC3 pin 9 is made into noise components only in the noise amp (made up of IC3 pin7, 8, R98~R100, C154 and C155), and is detected inside IC3. The detection signal from IC3 pin 13 is input to CPU pin 53 (NOIS) and is controlled by the respective mute signals (RMUT, AFON) in the CPU.

17. AF

The audio signal from the IC3 pin 9 is directed to the SW-A or SW-B VOL after passing through the IC5B HPF and the IC5D LPF. After the level is controlled by the VOL, it is amplified in the IC4 AF amp and comes out of the speaker.

18. PLL

The signal from the VCO is input to IC1 pin 8 after passing through Q6. This signal is divided into the N-data sent from the CPU and compared with the standard oscillation from X1 and Q31, with the result output from IC1 pin 5. This signal is directed to the VCO D5 and D7 after passing through the LPF (made up of R40~R42 and C75~C77), and is oscillated as the intended frequency.