

- IX) Adjust VR2 until FM deviation = 30 +/- 0.2KHz
- X) Test Frequency response : 70Hz 1+/-3dB 20KHz 1+/-3dB

3. LED BOARD AND POWER SWITCH BOARD

The build in LEDs of the transmitter indicate the status of operation and charging of battery. The green LED lights when the battery is under trickle charging which is controlled by transistor Q1. The other LED indicates that the transmitter is under transmission mode when it is red.

- I) Connect and solder the LED Board and Power switch board.
- II) Power the unit.
- III) Toggle the SW21 and the power LED is red.
- IV) Connect a 100 ohm resistor at CH+ and CH- and the red LED is on.

Receiver Section:

1. RF BOARD

The RF signal picked up by the antenna will be amplified by two cascaded LNAs which are composed by transistor Q309 and Q310. The amplified RF signal will be filtered by SAW filter F303 for first image rejection. The first local VCO is phase locked to a reference crystal oscillator by U302 KB8825. The reference frequency is controlled by a 4MHz crystal X302 and the PLL IC. The first local oscillator signal will mix with the RF signal in the mixer which is constructed by Q311. After passing through the mixer, the IF signal is feeding to the base band PCB through the solder connect point.

Equipment: Spectrum analyzer, DVM, RF signal generator

1) LO measurement

- I) Connect a spectrum analyzer (Via a 0.1U CAP) to IF
- II) Spectrum analyzer settings Center frequency = 904.9MHz, span = 20kHz
- III) Adjust the inductance of L304, until the VCO voltage at TP2 is 2.1V +/-0.3V
- IV) If the frequency of LO is within 904.9MHz +/- 4KHz and the RF power is -17 +/- 3dBm, the LO testing pass.
- V) If the frequency of LO is lower than 904.9MHz - 4KHz, C344 should be removed
- VI) If it is still lower, change C367 value to 27P.
- VII) The testing procedure III) and IV) should be repeated.
- VIII) If the frequency is higher than 904.9MHz + 4KHz, change C367 value to 36P.
- IX) If it is still higher, change C344 value to 5P.
- X) The testing procedure III) and IV) should be repeated.

2) LNA Gain test

- I) Connect one RF signal generator to ANT, its setting : -60dbm, 911.4MHz.
- II) Change Spectrum analyzer setting to Center frequency = 6.5MHz, span = 1MHz, the amplitude is -47 +/-3dBm.
- III) Change the generator setting : 915.6MHz
- IV) Change Spectrum analyzer setting Center frequency to 10.7MHz, the amplitude is -47+/-3dBm.
- XI) Solder the shielding cases of VCO and LNA and re-check the VCO voltage at TP2 is : 0.8 – 1.8V .

2. Base band main board

The first intermediate frequency (IF) signal from RF board will input to the first IF amp Q209, and then pass through 10.7MHz Ceramic filter (F201, F202) for IF1 10.7MHz and pass through 6.5MHz Ceramic filter (F203, F204) for IF1 6.5MHz. The first IF signal (IF1, IF2) will then enter the FM-IF chip TA8187 for demodulation. The FM-IF chip use quadrature demodulation method to regenerate the audio signal. The amplitude of the demodulated base band signals are controlled by the Quad coil L201 and L202. The demodulated audio signals will be buffered by Q214 and Q215.

The operating voltage of the whole receiver board is 2.8V which is regulated from the battery. Regulator U203 is responsible for the DC regulation and stabilization. Before feeding the demodulated audio signal

to the amplifier for acoustic output, it will be enhanced by feeding the audio signal to the compander IC U204 TA31101 for further processing. The low battery checking and muting functions are detected by the op-amp U201. The MCU will monitor the detection signal to confirm the shut down of receiver by disabling the DC supply to the RF module. On the main board, the channel selector switch will help telling the MCU which channel the user is going to select. And the RF channel is commanded by the MCU through proper programming of PLL IC.

Equipment: A good TX unit, a test JIG created by a good RX RF Board, Audio analyzer, Audio signal generator

1) The low battery alarm voltage

Equipment: DVM

- I) Connect 3.6V power supply to the main board and then the red LED is on.
- II) The output voltage of TP205 should be 2.8V +/-0.2V
- III) Decrease the power supply output.
- IV) When it is 3.1V, the red LED is on. When 2.7V, the LED is Flashing.

2) Quad coil L201,L204 adjustment

- I) The TX unit is on and L, R are input with 1KHz , 500mV(RMS) signal (make sure its deviation is 30 +/-1KHz) .
- II) Connect the Audio analyzer to the R_SPK(loading 32ohm) and the Volume VR201 is at middle position.
- III) Adjust the quad coil L201 until the distortion of Audio output is the best.
- IV) Adjust the volume to max. position and test the audio power must be >10mW and <30mW.
- I) If the power > 0.95V(RMS), that is 28mw at 32ohm SPK, change the value of R245 to 4.3K and repeat the above steps. If the power < 0.6V(RMS), that is 11mw at 32ohm SPK, change the value of R245 to 5.1K.
- V) Test Frequency response : 70Hz >-6dB, 20KHz >-6dB
- VI) Connect the Audio analyzer to the L_SPK and the volume is at middle position.
- VII) Adjust the quad coil L202 until the distortion of Audio output is the best.
- VIII) Test Frequency response : 70Hz >-6dB, 20KHz >-6dB

3. Adjustment when combining the RF Board with the Base Band Main Board

1) Fine turning L201 and L202

The threshold of the two expanders used in the receiver board U204 has some variations. In order to minimize the channel unbalancing effect. Fine tuning of quad coil L201 and L202 on base band main board is inevitable.

Equipment: CRO, Two RF generators, SINAD Meter, RF combiner, Audio analyzer

- II) Connect the combined RF generators signal to the antenna feed point at the Base Band Main Board with the same FM modulation setting
- III) Modulation source = 1kHz, FM deviation = 30kHz, Amplitude = -60dBm
- IV) Turn On FM modulation of generator A with output frequency = 915.6MHz and generator B with output frequency = 911.4MHz
- V) Connect a CRO to the corresponding speaker terminal on the main board and check if the RSK+ and LSL+ have a 1KHz audio output or the Base Band Main Board must be repaired.
- VI) Adjust the volume control VR 201 until it is about 180mV(RMS)
- VII) Turn On FM modulation of generator A and turn off FM modulation of generator B.
- VIII) Connect a SINAD meter (filter range 300Hz – 3KHz) to the R_SPK speaker terminal on the Base Band Main board
- IX) Adjust Quad coil L201 slightly until the SINAD reading is MAX.
- X) Adjust the volume to max. position and test the audio power.

- XI) If the power > 0.95V(RMS), that is 28mw at 32ohm SPK, change the value of R245 to 4.3K and repeat the above steps. If the power > 0.6V(RMS), that is 11mw at 32ohm SPK, change the value of R245 to 5.1K and repeat the above steps.
 - XII) Adjust the volume control VR201 until it is 180mV (RMS) at CRO.
 - XIII) Turn On FM modulation of generator B and turn off FM modulation of generator A.
 - XIV) Connect a CRO and a SINAD meter to the L_SPK speaker terminal on the main board
 - XV) Adjust Quad coil L202 slightly until the SINAD reading is MAX and then adjust VR204 until the signal amplitude at CRO is 180mv (RMS) (same as that of R_SPK).
- 2) Sensitivity measurement:
- I) Use the same setting as above and calibrate the insertion loss of the combiner at 911.4 and 915.6MHz
 - II) Turn On the modulation of generator A and turn Off the modulation of generator B
 - III) Connect the combined RF signal to the receiver board.
 - IV) Connect the audio output of the RF board to the SINAD meter (filter range 300 – 3KHz)
 - V) Decrease the signal output amplitude of both generators to the same level until the SINAD drop to 20dB. Record the level of the signal generator
 - VI) Check the signal generator output is lower than -105dBm (with calibration factor).
 - VII) Repeat the procedures again (Off A and On B) to check the other end RF sensitivity with the same 20dB SINAD requirement.
- 3) RF input level adjustment at Mute
- The FM-IF chip TA8187A can provide the mute_audio signal to mute the audio and the audio-amp IC LA4533M has mute function. The mute control circuit is created by Q202, Q205, Q206 and the level is controlled by the VR203.
- I) With the same setting as above, RF generators A modulation is on and B is off .
 - II) The CRO and SINAD meter (with 300Hz – 3KHz filter) are connected to R_SPK+ and solder the connect points M4, M5.
 - III) Adjust VR203 until the resistor value of center pin to GND is below 2Kohm.
 - IV) Down the amplitude of A, B until the SINAD reading is 33db.
 - V) Adjust VR203 to make the audio signal should just be turned off.
 - VI) Adjust the A amplitude up 1-2db, the audio signal must be turned on and the SINAD reading is 34 +/- 2dB .

Note : The adjustment temperature must be 25C.