Alignment method for SD-160 Series

1. Introduction

There are many alignment points in SD-160 and some of them need critical alignment. Especially, ACC-516 (PCB Extender) isn't useful for alignment in RF board is connected to BNC connector of bottom cover. So, we recommend the modification of ACC-516, flexible PCB extender, and use of RF cable which has BNC connector at the end, RF test cable, showed in Fig.2.1, 2.2. This document describes required preparation for alignment and its procedure.

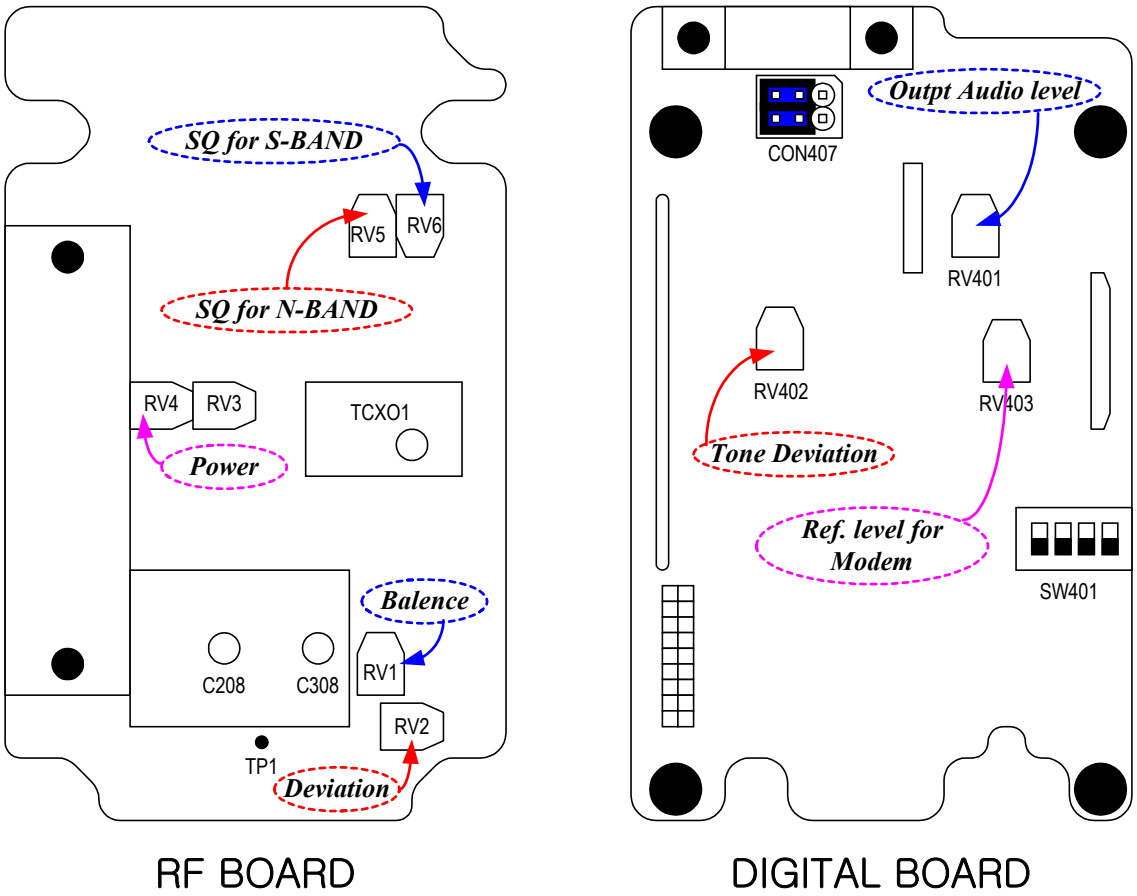

Figure 1.1. Alignment points of SD-164

2. Preparation

2.1. Required accessories for alignment

a. Flexible PCB Extender – It's modified from ACC-516.

Figure 1.1. Flexible PCB Extender

b. RF test cable – It consists of BNC connector and RG-178 RF cable.

Figure 2.2. RF test cable

2.2. Preparation for alignment

a. Solder end of RF test cable to PCB land for antenna cable of RF board

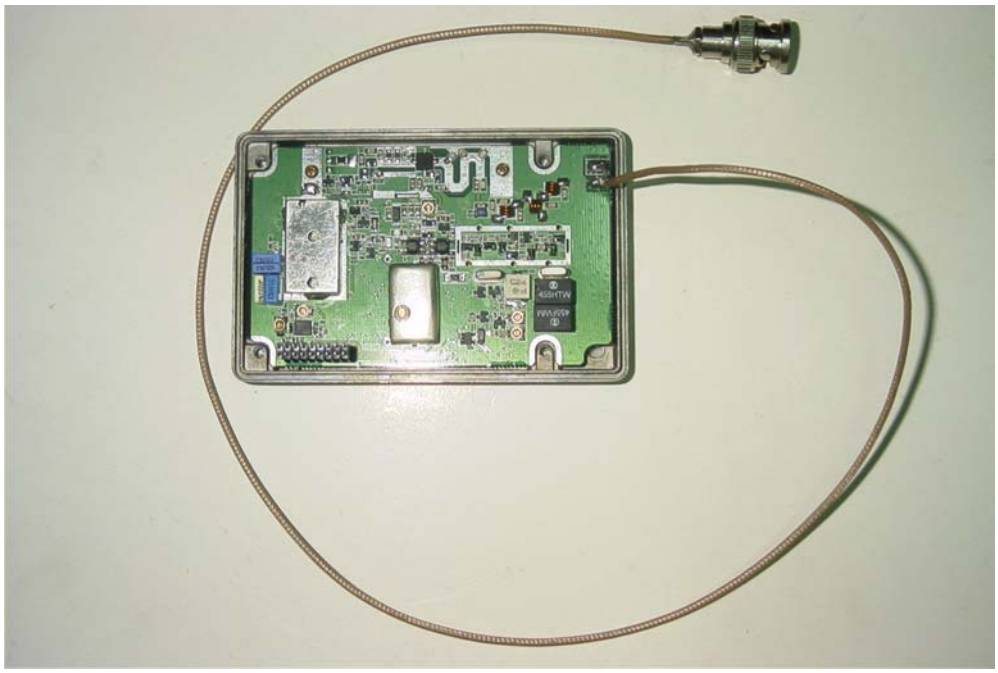

Figure 2.2. Soldering RF test cable to RF board

b. Connect RF board to Digital board with Flexible PCB extender.

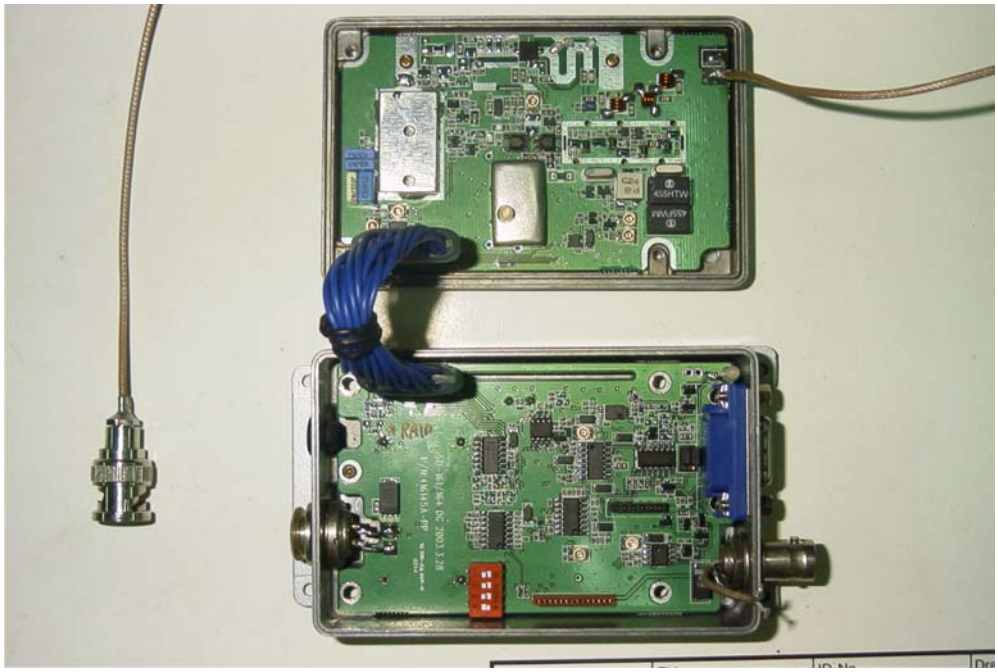

Figure 2.3. Connecting RF board to Digital board

3. Alignment procedure

The SD-160 should require no special alignment, unless repairs are performed on the transceiver portion. Should repairs be necessary, use the "Test Equipment Diagram (refer to technical manual for SD-160)" and the Alignment Points Diagram (refer to Fig. 1.1)", in conjunction with the following procedures:

☞ ***An Flexible PCB Extender, which is modified fromACC-516, is required in order to separate the Digital and RF PCB's to allow access to the alignment points. Installation instructions are provided with the Extender Assembly.***

3.1. RECEIVER

(1) RX VCO

RX VCO is pre-tuned at factory and no more adjustment is required.
To identify existence of defect of RX VCO, check the VCO Control voltage.

1. Set the unit to the highest receive frequency, 490MHz(UHF2) and check the VCO control voltage is under 10.0 Volts. If it's over 10.0 Volts, adjust C308 of RX VCO to 10.0 Volts
2. Set the unit to the lowest receive frequency 450MHz(UHF2) and check that the VCO voltage is above 2.0 Volts. Adjust C308 to 2.0 Volts

※ **Note: Use TP1 to measure the voltage.**

(2) AUDIO OUTPUT LEVEL Adjustment

1. Select a receiver channel that is programmed for Standard band (25kHz) operation.
2. Prepare standard test signal as follows.
   Set the RF signal generator to the receiver frequency.
   And then set the AF modulation signal to 1 kHz at 3kH deviation.
   Adjust the RF output level of the RF signal generator to -47dBm.
3. Apply a standard test signal to the receiver antenna terminals.
4. Adjust RV401 for the specific audio output level.

(3) LEVEL SHIFTER for Modem option Board (ACC-513, ACC-514)

1. Select a receiver channel which is programmed for Standard band (25kHz) operation.
2. After Preparing standard test signal for Standard band, apply that signal to the antenna terminals of receiver.
3. Adjust RV403 until the center voltage of demodulated signal (1KHz sine wave) of TP401 is 2.5 Volts.
4. Select a receiver channel which is programmed for Narrow band (12.5kHz) operation.
5. After Preparing standard test signal for Narrow band (only decrease deviation of AF modulation signal as 1.5K from standard test signal for Standard band), apply that signal to the antenna terminals of receiver.
6. Check the center voltage of demodulated signal of TP401 is 2.5 Volts.
   If different, Adjust RV403 until the center voltage is near 2.5 Volts for each band (25KHz / 12.5KHz).

3.2. TRANSMITTER

Connect the unit to a Service Monitor with the power meter set to the 10 W scale (or autorange)

(1) TCXO

Set the channel selector to the mid-range frequency 470 MHz, adjust TCXO1 for a reading of 470MHz ±200Hz.

(2) TX VCO

TX VCO is pre-tuned at factory and no more adjustment is required
To identify existence of defect of TX VCO, check the VCO Control voltage.

1. Set the unit to the highest transmit frequency, 490MHz(UHF2), key the transmitter and check the VCO control voltage is under 10.0 Volts. If it's over 10.0 Volts, adjust C208 of TX VCO to 10.0 Volts.
2. Set the unit to the lowest transmit frequency 450 MHz(UHF2), key the transmitter and check that the VCO voltage is above 1.8 Volts. Adjust C208 to 1.8 Volts

※Note: use TP1 to measure the voltage.

(3) CTCSS, DCS & TX Deviation and Balance Adjustment

1. a. Set the unit to a mid-frequency range and a CTCSS of 67Hz. Push PTT and adjust RV402 for desired CTCSS tone deviation.
   b. Switch to a channel with the same frequency and CTCSS of 250.3Hz. Push PTT and adjust RV1 to desired CTCSS tone deviation, same as above step.
   c. Switch between the 67Hz channel and the 250.3Hz channel and adjust RV1 until the deviation is the same on both channels. It may be necessary to readjust RV402 to get the desired deviation.
2. Set the unit to a mid-frequency and input the TX data with 400 Hz standard audio level.
3. Increase the signal level to 20 dB from standard level.
4. Monitor the demodulated signal from service monitor. Adjust RV1 to make the monitored signal to be a balanced square wave.
5. Reduce input signal to the standard level and adjust RV2 for the standard deviation.

(4) APC

Adjust RV4 for RF transmission power. (2W, SD-161, SD-164)

This is the most critical point of the transmitter alignment procedures. If you use ACC-516 (PCB Extender Board) or Flexible PCB Extender, that has a voltage drop in transmission mode and so power drop occurs. That's the reason that radio outputs higher power than assigned after assembly. To prevent over power output, follow below procedure.

‼ In case that ACC-516 (PCB Extender Board) is used for alignment :

① Set the power at the point of 1.25W.

② Assemble the radio and then check again RF transmission power is near 2.0W.

‼ In case that Flexible PCB Extender is used for alignment :

① Set the power at the point of 1.6W.

② Assemble the radio and then check again RF transmission power is near 2.0W.

3.3. SQUELCH ADJUSTMENT

Before squelch adjustment, user should select SQ type. With new SD-160 series, squelch level to open or close (un-mute or mute) is set up by not only software control but also hardware control. It's programmed by system option of ACC-916.

(1) SQUELCH Adjustment (Noise SQ only)

1. Select a receiver channel which is programmed for narrow band (12.5kHz) operation.
2. Set the RF signal generator to the receiver frequency.
   Set the AF modulation signal to 1 kHz at 1.5kH deviation.
3. Adjust the RF output level of the RF signal generator until the 1kHz signal is heard.
4. Adjust the RF signal to the desired level for squelch sensitivity as you monitor SINAD.
   This is usually 8 to 12 dB sinad.
5. On the RF board, adjust RV5 until the squelch is justly un-muted (open).
6. Switch off the RF generator (squelch should be closed).
7. Switch on the RF generator, Squelch should be opened at the SINAD point where RV5 was adjusted.
8. Select a receiver channel that is programmed for wide band operation (25kHz).
9. Set the RF signal generator to the receiver frequency.
   Set the AF modulation signal to 1 kHz at 3kH deviation.
10. Adjust the RF output level of the RF signal generator until the 1kHz signal is heard.
11. Adjust the RF signal to the desired level for squelch sensitivity as you monitor SINAD. This is usually 8 to 12 dB SINAD.
12. On the RF board, adjust RV6 until the squelch is justly un-muted (open).
13. Switch off the RF generator (squelch should be closed).
14. Switch on the RF generator, Squelch should be opened at the SINAD point where RV6 was adjusted.
15. Disconnect the test equipment.

(2) SQUELCH Adjustment (RSSI SQ only) using ACC-2016 & ACC-916

Default setting of squelch level for all the SD-160 series from our manufacture and workshop is approximately set at:

1. Squelch open (un-mute) at -114 to -113dBm (0.45 - 0.5mV of the RX signal

strength)

2. Squelch close (mute) at -117 to -116dBm (0.3 - 0.35mV of the RX signal strength)

Changing the default squelch settings requires use of the programming cable and software. Those are designed for use not only as part of the programming kit but also as a tool of squelch level setting.

The minimum equipment required for squelch level setting is a RF signal generator. Radio communication test equipment is recommended.

1. Connect DB-9 and DB-15 connector of ACC-2016 to the PC and SD-160 respectively.
2. Hook up the power socket of SD-160 unit to power connector of the programming cable, and its antenna connector to the RF input port of the RF signal generator.
3. Execute ACC-916 and then select calibration mode.
4. Power up the ACC-2016 by plugging Power plug to the Power supply.
   (use the DC supply of 9 - 12 Volts 200mA).
5. Select "Custom Define" menu of Squelch program menu of ACC-916.
6. Adjust the RF signal generator for the desired signal strength to OPEN squelch
   (e.g. default setting is -113dBm, that is equivalent to 0.5mV)
6. Press "Set(OPEN)" button, LED indicator will flash 3 times then it will be ON.
7. Adjust the RF signal generator for the desired signal strength to CLOSE squelch
   (e.g. default setting is -116dBm, that is equivalent to 0.35mV)
8. Press "Set(CLOSE)" button, LED indicator will flash 2 times then it will be OFF.
9. Press "SAVE" button, LED indicator will flash once.
10. Squelch level is now set. Test for the desired level by increasing or decreasing the RF signal to levels set for open and close squelch (mute LED will be OFF & un-mute LED will be ON).

· NOTE: The difference of RF signal strength between the un-mute and mute levels must be greater than or at least equal to 0.15mV (i.e. at least -123.5dBm) for the squelch setting to work properly. If they are too close, RSSI through the A/D conversion can not differentiate between the mute and un-mute level properly. As a result, it would cause the CD (Carrier Detect) to act intermittently.