Mobile Communications

MAINTENANCE MANUAL FOR GENERAL ELECTRIC 33-50 MHz Beacon™ Monitor Pager

Maintenance Manual

Printed in U.S.A.

LBI-31482

TABLE OF CONTENTS

TYPICAL SPECIFICATIONS

FCC Identification Number	AXA9ERER-145-A1, B1, C1, D1
GE Type Number	ER-145-A1: 41-45 MHz ER-145-B1: 37-41 MHz ER-145-C1: 33-37 MHz ER-145-D1: 45-50 MHz
Frequency Range	33-50 MHz
Type of Operation	Tone, Voice and Monitor
Signalling System	Two-Tone Sequential
Audio Power Output (4 Ohm Speaker)	
HI	150 Milliwatts
LO	20 Milliwatts

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TYPICAL SPECIFICATIONS (CONT.)

Current Drain (at 2.5 Volts)	
Standby	5.2 milliamperes
Receive	105 milliamperes
Battery Life	
Nicke1-Cadmium	25 hours
Mercury	115 hours
Modulation Acceptance	±8 kHz
Channel Spacing	20 kHz
Selectivity (EIA)	-65 dB
Paging Sensitivity	7 uV/meter
Usable Sensitivity (12 dB SINAD)	18 uV/meter
Spurious Response	-56 dB
Frequency Stability	±5 PPM
Audio Distortion	5%
Dimensions (H x W x D)	110 x 52 x 36 millimeters (with belt clip)
	(4.3 x 2 x 1.4 inches)
Weight	160 grams (5.66 ounces) with battery and belt clip

COMBINATION NOMENCLAURE

Digits 1 & 2	Digit 3	Digit 4	Digit 5	Digit 6	Digit 7	Digit 8
Product Code	**Tone Option**	**Control**	**Color**	**Channel Spacing**	**Frequency Range**	**Distribution**
P8 Pager	**L** T99/Quick Call	**M** Separator	**W** Black	**5** 20 kHz	**B** 33-37 MHz	**A** All Other
			R Red		**C** 37-41 MHz	**D** Dealer
					D 41-45 MHz	**B** Less Xtals & Reeds
					E 45-50 MHz	**E** Less Xtals & Reeds Dealer

LBI-31482

DESCRIPTION

The General Electric Beacon™ Monitor Pager is a highly reliable, extremely compact receiver for tone and voice paging and channel monitor applications.

The Pager is equipped with a built-in speaker, earphone jack and antenna, and is shipped with two nickel-cadmium rechargeable batteries and an external earphone.

The receiver is housed in a ruggedly-constructed case, with all operating controls conveniently mounted on the top and side of the case. An accessory jack on the bottom of the radio is provided for an external earphone.

Power for the Pager is normally supplied by two rechargeable nickel-cadmium batteries that fit in a separate battery compartment in the bottom section of the case. The batteries can be recharged either in or out of the receiver.

If desired, the Pager can also be operated by mercury, zinc-carbon, or alkaline batteries. However, these batteries are not rechargeable.

The spring clip on the Pager may be used to clip the radio to a pocket or belt.

OPERATION

Turn the receiver on by placing the Power/Volume switch to Volume HI position (See Figure 1). Several short bursts of tone should be heard. The receiver is now ready to receive messages.

Before a message is received, a short, interrupted burst of tone will be heard, followed by a voice message. As soon as the message is completed, press the Reset/Monitor button to reset the receiver.

NOTE

Failure to press the Reset button after receiving a message may shorten battery life. Do not press the Reset button while receiving a message or an alert tone. Doing so will prevent you from receiving the message.

The Pager operates in either the SELECTIVE or MONITOR mode.

In the SELECTIVE mode, the Pager operates as a tone and voice receiver, and allows only those calls that are tone

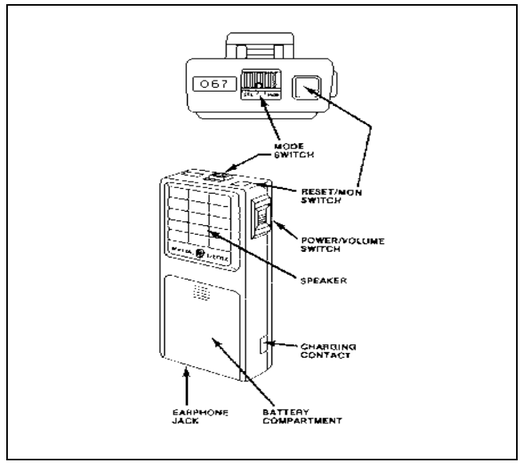


Figure 1 - Operating Controls

coded for the Pager to be heard. After the call has been received, the Pager switches automatically to the MONITOR mode. The Pager will remain in the MONITOR mode, receiving all calls on the channel until the RESET switch is pressed.

Placing the mode switch in the MONITOR position allows all calls on the channel to be heard whether they are tone coded or not. The Pager will squelch when no calls are being received.

An earphone is available for use in high-noise areas, or for receiving messages in private. Plugging the earphone into the earphone jack disables the Pager speaker so that messages can only be heard through the earphone.

After receiving the first message, it may be desirable to reduce the volume by placing the OFF-HI switch in the LO position.

CHARGERS

A single-unit desk-top charger and a multi-unit charger are available for recharging the nickel-cadmium batteries in the radio as well as spare nickel-cadmium batteries.

Temperature characteristics of nickel cadmium batteries prevent a full charge at temperature extremes. For maximum capacity, recharge the batteries at room temperatures between 65° to 85° Fahrenheit.

WARNING

Do not attempt to charge mercury, alkaline or zinc-carbon batteries. To do so may cause the batteries to explode.

To use the charger, connect the power cable to an appropriate power source. Place the Pager into the charger. The red light will turn on, indicating that the Pager is being charged. To charge spare nickel-cadmium batteries, place them into the battery insert. A second red light will come on to indicate that the batteries are being charged.

BATTERY INFORMATION

Two different types of batteries are normally used in the Pager. The type and battery life for each battery is shown in the following chart.

BATTERY TYPE	PART NUMBER	TYPICAL BATTERY LIFE
Nickel-Cadmium (Rechargeable)	19A703502P1	25 Hours
Mercury (Not Rechargeable)	19A701300P1 Mallory MP401, Eveready EP401E	115 Hours

NOTE

Nickel-cadmium batteries should be fully re-charged before using.

BATTERY REPLACEMENT

The Pager is shipped from the factory ready for immediate operation upon installation of two fully charged batteries.

To install or replace the batteries:

1. Slide the Pager OFF-HI switch to the OFF position.
2. Press in the battery cover on the ridges at the top of the cover and slide cover down as shown.
3. Replace batteries according to the (+) and (-) signs in the battery compartment.
4. Slide battery cover back into place.

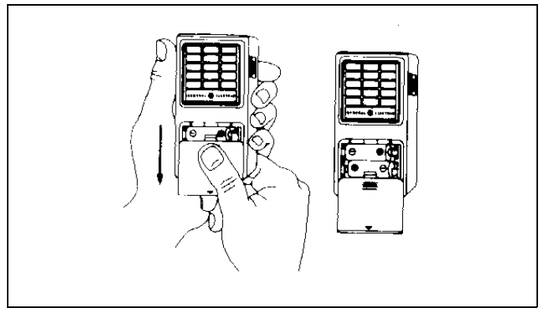


Figure 2 - Battery Replacement

WARNING

Do not dispose of either the rechargeable battery or the Mercury battery by burning. To do so may cause a battery to explode.

NOTE

There is no way to dispose of mercury batteries without possible polution except by returning them to the manufacturer for recycling.

Mallory Battery Company will buy all used mercury batteries at the current market price. Batteries are to be shipped prepaid, enclosing a packing slip indicating who is to receive payment for the batteries to:

Mallory Battery Company
Plant #2
Lexington, North Carolina 27292

CIRCUIT ANALYSIS

RECEIVER

Paging receiver Types ER-145-A1, -B1, -C1 and -D1 are double-conversion, superheterodyne receiver for tone and voice paging in the 33-50 MHz range. One circuit board con-

LBI-31482

tains both tone and voice circuits, and utilizes both discrete components and Thick Film Integrated Circuit Modules (IC's).

The receiver has intermediate frequencies of 10.7 MHz and 455 kHz. Adjacent channel selectivity is provided by using two, 2-pole ceramic filters. References to symbol numbers mentioned in the following text are found in the Outline Diagram, Schematic Diagram and Parts List (See Table of Contents). A block diagram of the receiver is shown in Figure 3.

Receiver Front End

An RF signal from the antenna is coupled through the antenna circuit to the base of RF amplifier Q1. The antenna circuit consists of L1, CV1 and C2. The circuit is tuned by CV1.

The output of Q1 is coupled through three tuned circuits that provide most of the front end selectivity. The tuned circuits are L2, L3, L4 and associated circuitry. The output of L4 is coupled through C10 to the base of the first mixer.

1st Oscillator

Q2, X1, L5 and associated circuitry make up a Colpitts oscillator. The frequency is controlled by a third mode crystal operated at one third of the required injection frequency. L5 is used to set the oscillator on frequency. R3 is in parallel with X1 to ensure operation on the third overtone of the crystal. The injection frequency is the operating frequency (-) 10.7 MHz, and is coupled through C16 to the first mixer. L6 is tuned to three times, the crystal frequency. The output to the 1st mixer is approximately 60-90 millivolts rms.

1st Mixer and IF Filter

RF from the Pager front end is applied to the base of first mixer Q3. Injection voltage from the first oscillator is also applied to the base of Q3. The 10.7 MHz first IF frequency is coupled through L7 to 10.7 MHz filter FL1. L7 is used to match the mixer output to the input of FL1.

The highly-selective filter provides the first portion of the receiver IF selectivity. The 10.7 MHz output of FL1 is applied to the second mixer IC (Al).

2nd Oscillator, Mixer and IF Filter

Al and associated circuitry make up the 2nd oscillator and mixer. The crystal for the oscillator is X2. The oscillator operates at 10.245 MHz for low side injection of the 2nd IF (standard), or 11.155 MHz for high side injection for those radios determined to be operating on a tweet frequency. This frequency is mixed with the 10.7 MHz input to provide the 455 kHz 2nd IF frequency.

The output of Al is coupled through ceramic filter FL2 which provides the 455 kHz selectivity. The filter output is applied to IF amplifier A2.

IF Amplifier and Detector

A2 and associated circuitry make up the IF amplifier. The amplifier IC also provides the 455 kHz limiting. The output of A2 is applied to the discriminator.

The discriminator demodulates the 455 kHz signal. This type of detector provides a high degree of AM rejection. The recovered audio, tone and noise is applied to audio amplifier IC A51.

Audio Stages

The discriminator output is applied to buffer/pre-amp A51. One output at A51-4 is coupled through high-pass filter A56 which filters out frequencies under 200 Hz to eliminate any Channel Guard (CTCSS) tone. The filter output is applied to squelch circuit A55, and to the decoder circuitry.

Applying the proper sequential tones to the receiver activates the decoder circuitry and audio stages, causing the second alert tone to be heard at the speaker.

After the alert tone is heard, the output of A51 is applied to the push-pull audio amplifiers Q51 and Q52, and then to the speaker.

Squelch

Squelch control IC A55 monitors noise in the 30-40 kHz range on A55-1. When there is no carrier present, the noise is above a squelch threshold set by RV52. This condition makes A55-7 high, shutting off the audio amp at A51-9. When a carrier is present, the noise level drops below the threshold driving A55-7 and A51-9 low. This turns the audio amp on allowing transmissions on the channel to be monitored.

SEQUENTIAL TONE DECODER

The decoder is a two-reed, sequential tone decoder for operation with any two-tone sequential encoder in individual call applications.

The two reeds mount at the bottom of the circuit board, and are available for operation on tone frequencies in the 288.5 to 2000 Hz range.

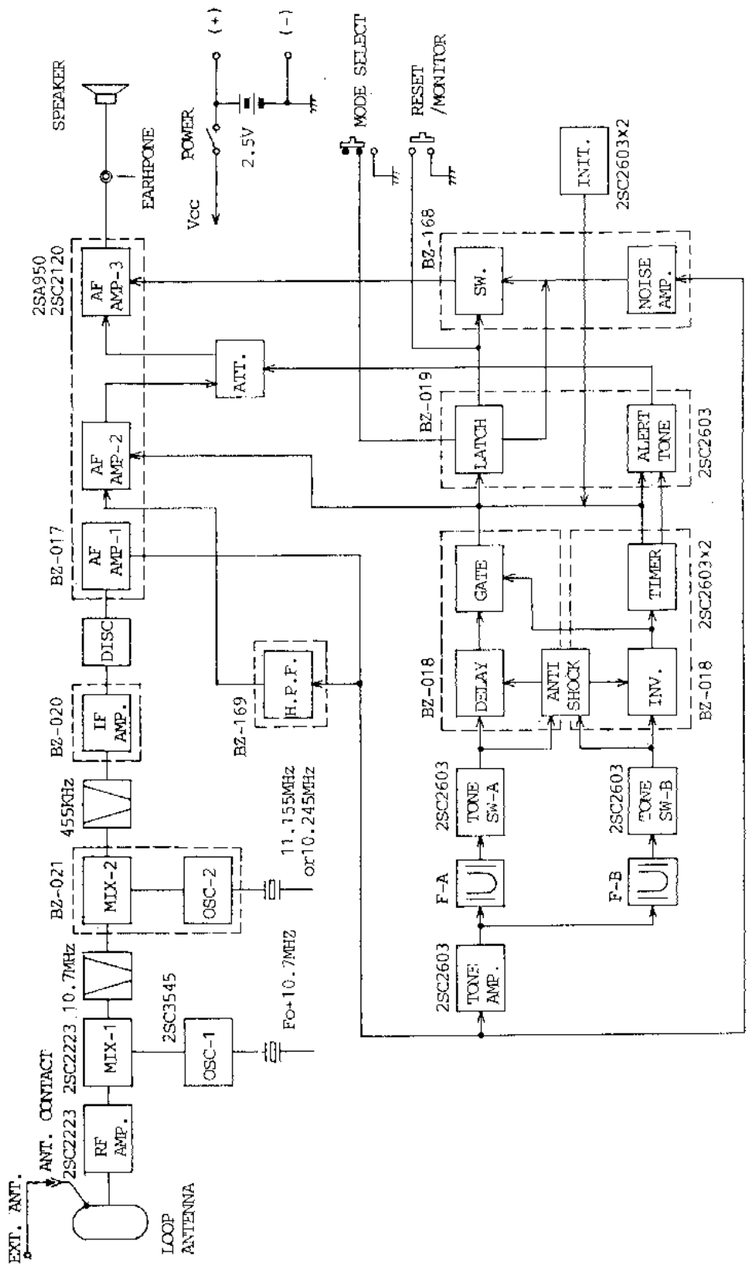


Figure 3 - Pager Block Diagram

LBI-31482

The pager is also compatible with Quik-Call II two-tone paging systems, and operates in both individual call and group call applications.

Timing waveforms for the decoder circuitry are shown in Figures 4-1, 4-2 and 5-1, 5-2. It is recommended that these waveforms be studied in conjunction with the circuit analysis for a better understanding of the decoder operation.

Tone Amplifiers & Reeds

When the proper tone sequence is applied to the Pager, the discriminator output is applied to buffer/amplifier A51-1.

Tone A

When an HE signal containing Tone A is applied to the Pager for approximately one second, the output at A51-2 is applied to limiter-amplifier Q53. The square wave output of Q53 drives reed FL51 into mechanical resonance. The reed output is applied to tone amplifier Q54 which provides a gain of approximately 20 dB. The amplifier output is rectified by D52, and the resulting low (-0.2 VDC) is applied to A52-1.

Tone B

After Tone A has been received, Tone B is applied to the receiver for approximately three seconds. The tone is amplified by Q53 and applied to reed FL52. The reed output is amplified by Q55 (approximately 20 dB gain) and rectified by D53. The low output (-0.2 VDC) is applied to A53-1.

Individual Call

The one-second low output from Q54 and D52 applied to A52-1 causes A52-6 to go low for approximately one second after a delay of 0.6 second (See Figures 4-1 and 4-2). A52-6 then returns to a high state controlled by delay timer C68 and R69. The high at A52-6 causes A52-8 to go low momentarily, and then go high.

After Tone A is received, Tone B causes a low to be applied to A53-1. The lows applied to A52-1 and A53-1 activate an “AND” gate in A52, causing the output at A52-11 to go low for approximately 2.5 seconds. The low at A52-11 is applied to A54-6, activating the alert tone oscillator.

The continuous tone output at A54-7 is shunted to ground for 50 milliseconds at 100 millisecond intervals by Q59 to provide the interrupted alert tone. The alert tone is then applied to A51-5.

The same time the tone alert oscillator starts, A55-5 and A55-7 go low. The low at A55-7 is applied to amplifier A51-9, turning the amplifier on so that messages can be heard.

GROUP CALL

In group call applications, only Tone B is applied to the receiver. The tone is applied for approximately 8 seconds. This applies a low to A53-1, causing A53-6 to go low after a 0.3 second delay caused by C72. After a 5-second delay by delay timer circuit R72, R73, and C73, A53-11 goes low and turns off Q56. This allows Q57 to turn on, applying a low to A54-6 and a high to A54-3. This causes a continuous, interrupted 3.5 second alert tone to be heard, followed by the voice message.

ANTI-SHOCK CIRCUIT

When the Pager is subjected to a mechanical shock, both reeds will vibrate and apply a low to pin 1 of A52 and A53. This causes a high at pin 2 of decoders A52 and A53 which disables the decoders to prevent falsing.

RESET/MONITOR CIRCUIT

Pressing momentary reset button S52 at any time applies a negative pulse to A54-9. This drives A54-12 and squelch control IC A55-13 low. A55-7 then applies a low to audio amp A51-9 and turns it on. While the reset button is depressed, noise or any transmission on the Pager frequency will be heard. Releasing the reset button causes A54-9, A54-12, A55-13, A55-7 and A51-9 to all go high shutting off the audio amp and resetting the Pager.

MODE SELECT

When mode select switch S53 is in the SEL (SELECT) position, A54-11 is high and the Pager operates in the tone and voice paging mode. Placing S53 in the MON (MONITOR) position applies a low to A54-11, causing A54-6 to go low and A54-12 to go high. This causes the Pager to switch to the monitor mode so that all transmissions on the Pager frequency can be monitored.

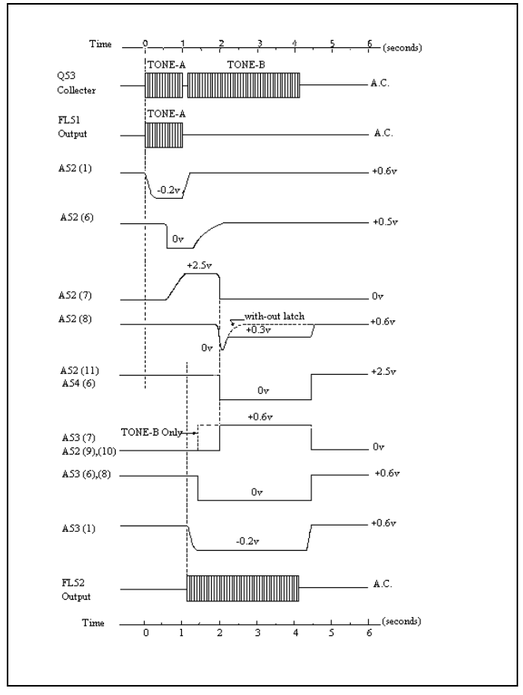


Figure 4-1 - Individual Call Timing Diagram

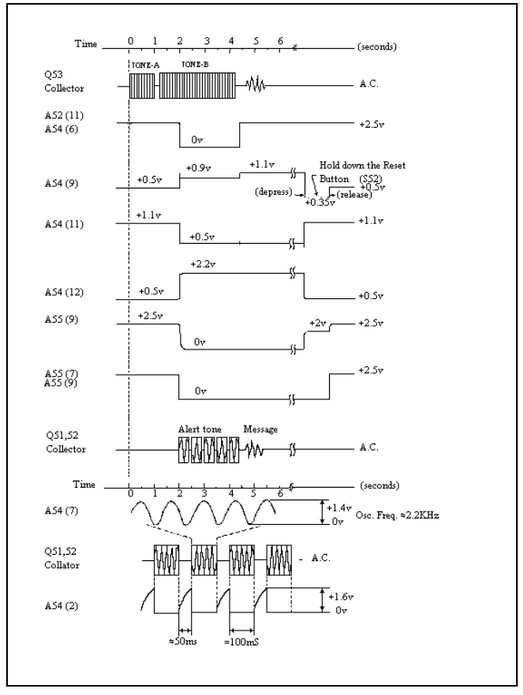


Figure 4-2 - Individual Call Timing Diagram

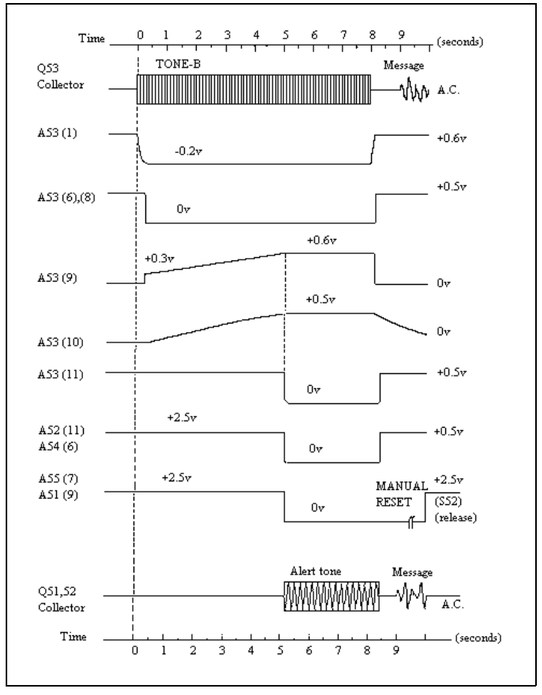


Figure 5-1 - Group Call Timing Diagram

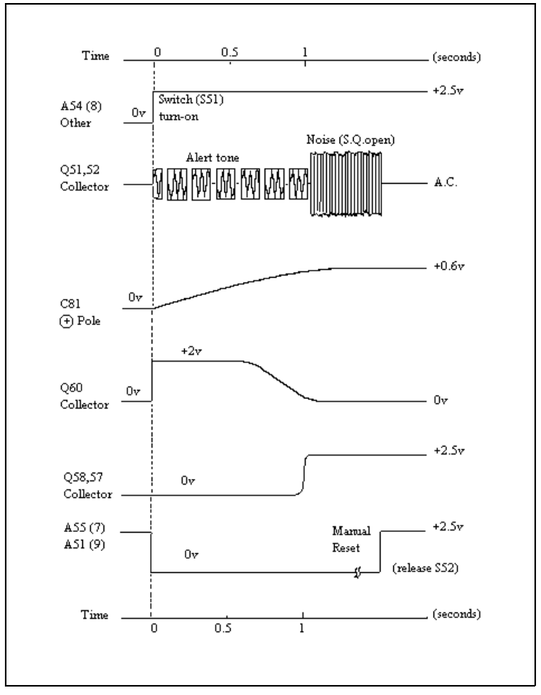


Figure 5-2 - Group Call Timing Diagram

LBI-31482

DETERMINATION OF TONE FREQUENCIES

The Pager can receive and decode two-tone sequential signals coded in the GE Type 99 format or the Motorola format.

The GE tone frequencies range from 517.5 Hz to 967.5 Hz. Motorola tone frequencies range from 288.5 Hz to 1433.4 Hz. The Pager is capable of both Individual and Group Call. However, the Group Call will operate only with the Quik-Call II signaling format.

GE FORMAT

INDIVIDUAL CALL

Tables 1 and 2 enable the technician to determine the tone frequencies without opening the radio to examine the reed networks.

For example, assume the paging number to be 123. The first digit of the paging number is a 1. Look in Table 1, and read down the column labeled “100’s Digit” to a 1. Read horizontally across to the column labeled “10’s Digit”. The tone group is B. The second digit of the paging number is a 2. The tone number is B2. Look in Table 2 and down the column labeled “Tone Designator” to find B2. Read horizontally across to the column labeled “Tone Frequency”. The first tone frequency is 787.5 Hz.

To determine the second tone frequency look in Table 1 and as before, find the first digit of the paging number 1. Read horizontally across to the column labeled “1’s Digit”.

The second tone group is A. The third digit of the paging number is a 3 and the Tone Designator is A3. In Table 2 read down the column labeled “Tone Designator” and find A3. Read horizontally across the column labeled “Tone Frequency”. The second tone frequency is 802.5 Hz.

For different paging numbers, locate the first digit in the “100’s Digit” column and determine the tone frequencies as described in the example. For a complete description of tone applications see DATAFILE BULLETIN DF-5000-3A.

Table 1 - Tone Groups

100’S DIGIT	10’S DIGIT	1’S DIGIT
	For 1st Tone	For 2nd Tone
0	A	A
1	B	A
2	B	B
3	A	B
4	C	C
5	C	A
6	C	B
7	A	C
8	B	C
9	Not Used	

Table 2 - Tone Generator

TONE GROUP	TONE DESIGNATOR	TONE FREQUENCY
	A0	682.5 Hz
	Al	592.5 Hz
	A2	757.5 Hz
	A3	802.5 Hz
	A4	847.5 Hz
	A5	892.5 Hz
	A6	937.5 Hz
	A7	547.5 Hz
	A8	727.5 Hz
	A9	637.5 Hz
	B0	652.5 Hz
	B1	607.5 Hz
	B2	787.5 Hz
	B3	832.5 Hz
	B4	877.5 Hz
	B5	922.5 Hz
	B6	967.5 Hz
	B7	517.5 Hz
	B8	562.5 Hz
	B9	697.5 Hz
	C0	667.5 Hz
	C1	712.5 Hz
	C2	772.5 Hz
	C3	817.5 Hz
	C4	862.5 Hz
	C5	907.5 Hz
	C6	952.5 Hz
	C7	532.5 Hz
	C8	577.5 Hz
	C9	622.5 Hz
Diagonal Tone		742.5 Hz

QUIK-CALL II FORMAT

INDIVIDUAL CALL

Tables 3 and 4 are used to determine the Quik-Call II tone frequencies.

The first digit of the code determines the tone groups used in the code (See Table 3). Then Table 4 is used to determine the actual tone frequencies.

Table 3 - Quik-Call II Code Numbers

FIRST DIGIT OF CODE	GROUP FROM WHICH TONE A IS SELECTED	GROUP FROM WHICH TONE B IS SELECTED
1	1	1
2	2	2
3	1	2
4	4	4
5	5	5
6	2	1
7	4	5
8	5	4
9	2	4
0	4	2
A	3	3

For a code of 124, the tone groups used are shown in Table 3. (Tone A and Tone B are both located in Tone Group 1.) Tone A is tone number 2 in Tone Group 1, and Tone B is tone number 4. Refer to the following examples for additional information.

EXAMPLE 1 - Code 098:

The digit “0” in Table 3 (First Digit of Code) shows that Tone A is in Tone Group 4, and Tone B is in Tone Group 2 as shown in Table 4.

Tone number 9 in Tone Group 4 is 524.6 Hz.

Tone number 8 in Tone Group 2 is 879.0 Hz.

EXAMPLE 2 - Code 265:

The digit “2” in Table 3 shows that both Tone A and Tone B are both in Tone Group 2.

Tone number 6 is 788.5 Hz.

Tone number 5 is 746.8 Hz.

GROUP CALL

In Group Call application, the Tone Group is determined by Table 5, while the frequency is determined by Table 4. Refer to the following examples.

NOTE

Group Call code numbers range from 00 to 99. However, there are several Group Calls with the same Tone B frequency. This limits the total number of Group Calls to 40.

Table 4 - Quik-Call II Tone Frequencies and Groups

TONE NO.	TONE GROUP 1	TONE GROUP 2	TONE GROUP 3	TONE GROUP 4	TONE GROUP 5	TONE GROUP 6
1	349.0 Hz	600.9 Hz	288.5 Hz	339.6 Hz	584.8 Hz	1153.4 Hz
2	368.5 Hz	634.5 Hz	296.5 Hz	358.6 Hz	617.4 Hz	1185.2 Hz
3	389.0 Hz	669.9 Hz	304.7 Hz	378.6 Hz	651.9 Hz	1217.8 Hz
4	410.8 Hz	707.3 Hz	313.0 Hz	399.8 Hz	688.3 Hz	1251.4 Hz
5	433.7 Hz	746.8 Hz	953.7 Hz	422.1 Hz	726.8 Hz	1285.8 Hz
6	457.9 Hz	788.5 Hz	979.9 Hz	445.7 Hz	767.4 Hz	1321.2 Hz
7	483.5 Hz	832.5 Hz	1006.9 Hz	470.5 Hz	810.2 Hz	1357.6 Hz
8	510.5 Hz	879.0 Hz	1034.7 Hz	496.8 Hz	855.5 Hz	1395.0 Hz
9	539.0 Hz	928.1 Hz	1063.2 Hz	524.6 Hz	903.2 Hz	1433.4 Hz
0	330.5 Hz	569.1 Hz	1092.4 Hz	321.7 Hz	553.9 Hz	1122.5 Hz

EXAMPLE 1 - Group Call Code 07 (also code 27 and 37):

The digit “0” in Table 5 shows that Tone B is in Tone Group 2 along with 20 to 29 and 30 to 39. Tone number 7 in Tone Group 2 is 832.5 Hz (See Table 4).

EXAMPLE 2 - Group Call Code 98 (also code 48 and 88):

The digit “9” in Table 5 shows that Tone B is in Tone Group 4 along with 40 to 49 and 80 to 89. Tone number 8 in Tone Group 4 is 496.8 Hz.

Table 5 - Group Call Tone Groups (TG)

GROUP CALL CODE NUMBER	TONE GROUP (Tone B)
00 - 09	TG2
10 - 19	TG1
20 - 29	TG2
30 - 39	TG2
40 - 49	G4
50 - 59	TG5
60 - 69	TG1
70 - 79	TG5
80 - 89	TG4
90 - 99	TG4

DISASSEMBLY

To gain access to the receiver board for servicing:

1. Loosen the two screws in the back cover and while applying pressure to the lower portion of the front cover, lift off cover.

2. With the speaker facing down, carefully loosen the board in the front cover, starting with the bottom of the printed board first.

3. Carefully turn the Pager over in the palm of the hand (speaker facing up) and lift off the front cover.

When replacing the board in the case, hold the case with the speaker grill facing down and insert the Mode Select switch, Reset switch and the Power/Volume switch into their appropriate positions in the top of the case first. Make sure the speaker is properly located. Then gently press the board up into the case. Snap the back cover back into place and tighten the two securing screws.

ALIGNMENT PROCEDURES (33-50 MHz)

EQUIPMENT REQUIRED:

1. Multimeter.

2. SINAD Meter or Distortion Analyzer (with floating instrument circuit ground).

3. RF Signal Generator (two required).

4. 2-Tone Generator.

NOTE

Use short, direct cabling and wiring to keep RF interference to a minimum.

STEP	PROCEDURE
1.	Construct a 50 ohm coaxial cable (RG58-type) with a BNC connector on one end and clip leads on the other end.
2.	Remove printed hoard assembly from case and insert fully charged batteries.
3.	Connect the shield clip lead of the coaxial cable to the negative battery terminal. (This terminal connects directly to chassis ground.)
4.	Place the center conductor lead of the coaxial cable beneath the pager and lay pager flat on work bench. (cable lead should be insulated from radio circuitry.)
5.	Connect BNC end of cable to the RF Signal Generator.
6.	Turn of the Pager and adjust squelch control RV52 until the pager is fully un-squelched.
7.	Set unmodulated RF signal generator to desired pager operating frequency. Keeping the RF generator exactly on frequency. Slowly turn up the RF output of the generator until the pager starts to quiet.
8.	Set another unmodulated RF generator to 10.7 MHz. Loosely couple this 10.7 MHz signal into coil form of L7.
9.	Adjust L5 for desired frequency by tuning until a zero beat between the two signals is heard in the speaker.
10.	Remove the 10.7 MHz signal. Connect an RF millivolt meter to TP1 and adjust L6 for maximum output on the meter.
11.	Modulate the RF generator with 1 kHz tone at 3 kHz deviation. Set the generator’s output so that an audible level of approximately 12 dB SINAD is heard at the speaker.
12.	Adjust L2, L3 and CV1 for best quieting. Reduce the generator output while tuning to maintain an audible level of approximately 12 dB SINAD.
13.	Adjust L7 to mid-range.
13.1	Connect the probe of the RF millivolt meter to TP1. Note thereading on the meter. Next, increase the radiated, un-modulated RF input to the pager by turning up the generator output until a significant increase in meter reading is obtained. Then adjust L4 for maximum reading on the meter. (If two peaks are observed, tune to the one nearest the top of the coil form.)

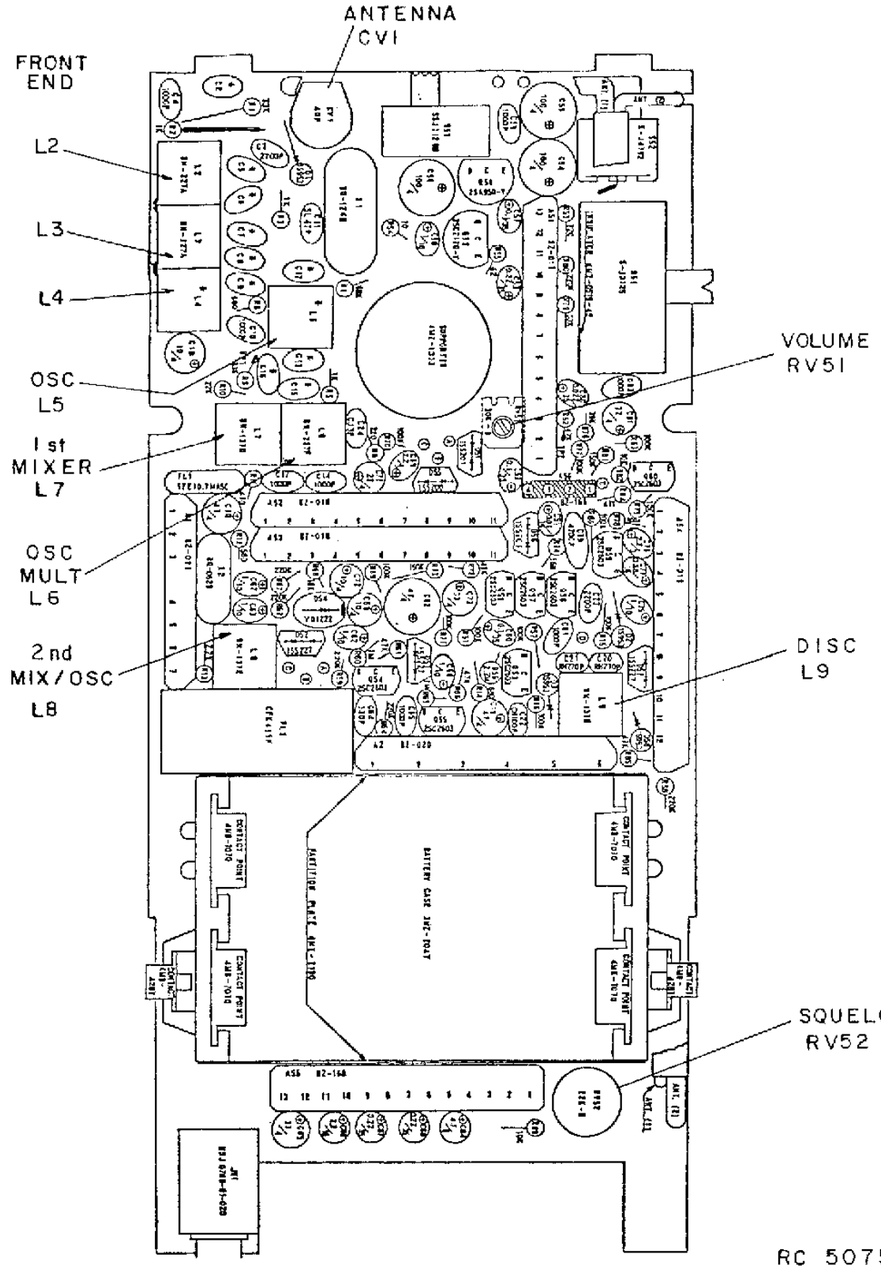
LBI-31482

STEP	PROCEDURE
14.	Peform steps 14 and 15 Only if deemed necessary. Discriminator: Apply a strong RF signal (approximately 1 mV Carrier with 1 kHz modulation at 3 kHz deviation) and adjust the discriminator coil (L9) for maximum audio output level measured across the 4 ohm speaker. Service Note: If there are two output peaks, set the coil to the higher peak.
15.	Audio Output Level: Apply a strong RF signal (approximately 1 millivolt carrier with 1 kHz modulation, but now at 2 kHz deviation). Set the power/volume switch to HI, and adjust the audio gain potentiometer (RV51) for rated audio output (150 milliwatts or 0.775 volts RMS across the 4-ohm speaker). Set the Power/Volume switch to LO. The audio output level should drop 10 dB +2 dH.
16.	Set up as in Step 11 above. Adjust squelch control (RV52) for an audible level of approximately 12 dB SINAD squelch opening.
17.	Slide S53 to SEL position and push S52 to reset pager.
18.	Modulate the RF generator with the proper tone sequence from the 2-tone generator. Verify the alignment and performance by successfully decoding several pages.

ALIGNMENT PROCEDURES WITH TQ0602 TEST FIXTURE)

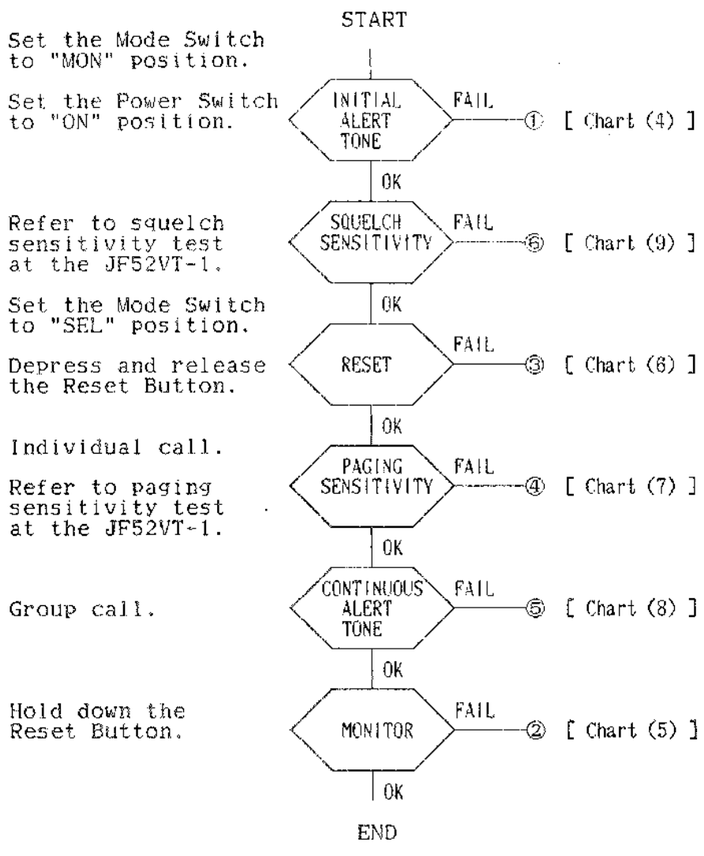
ALTERNATE TUNING PROCEDURE

1. Remove Printed Board Assembly from Case and insert fully charged batteries.
2. Place back cover of pager in fixture.
3. Place the pager on the cover.
4. Connect RF generator to RF input jack on fixture.
5. Go to step 6 of the main alignment procedure and continue through that procedure to complete the alignment.

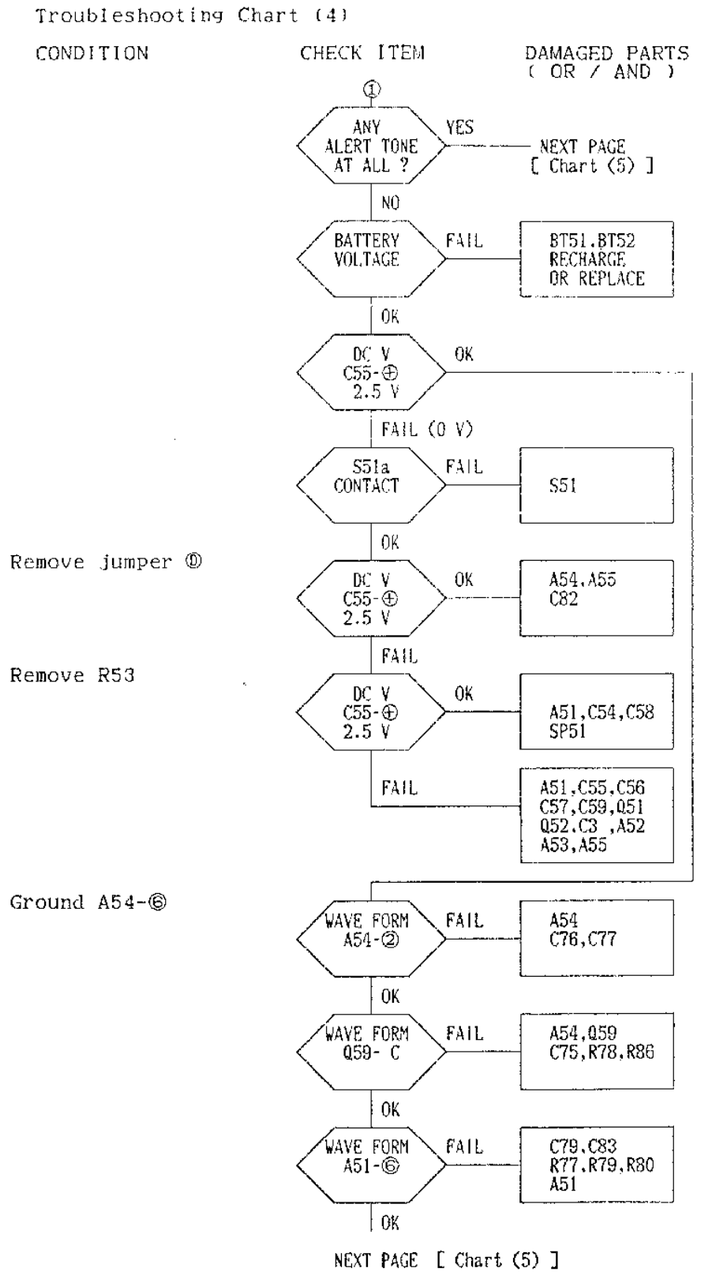


RECEIVER ER-145-A1, B1, C1, D1
ISSUE 1

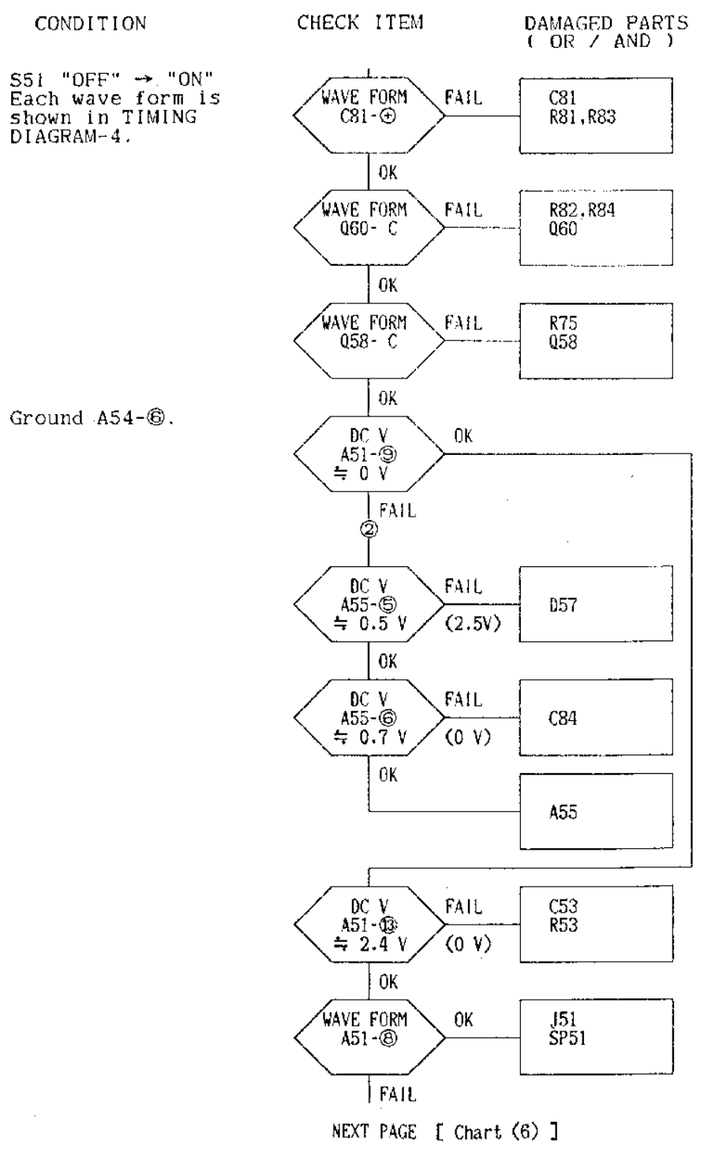
OPERATION FUNCTION CHECK



Troubleshooting Chart (4)

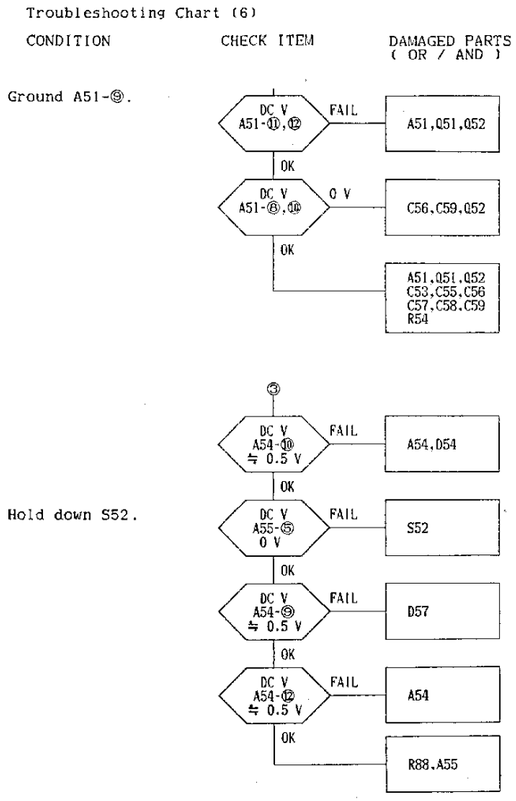


Troubleshooting Chart (5)

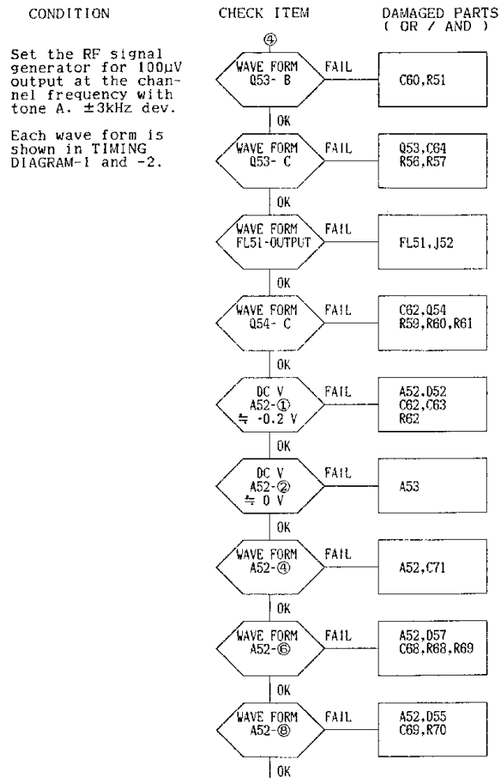


RECEIVER ER-145-A1, B1, C1, D1

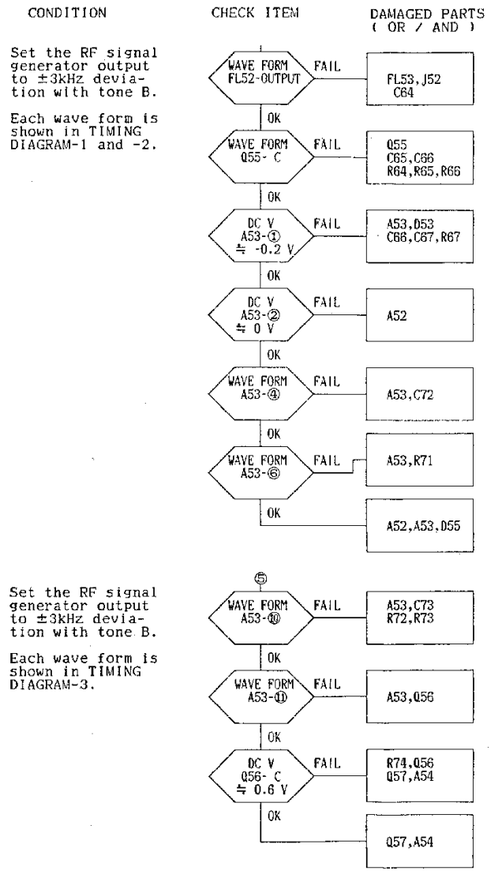
Troubleshooting Chart (6)



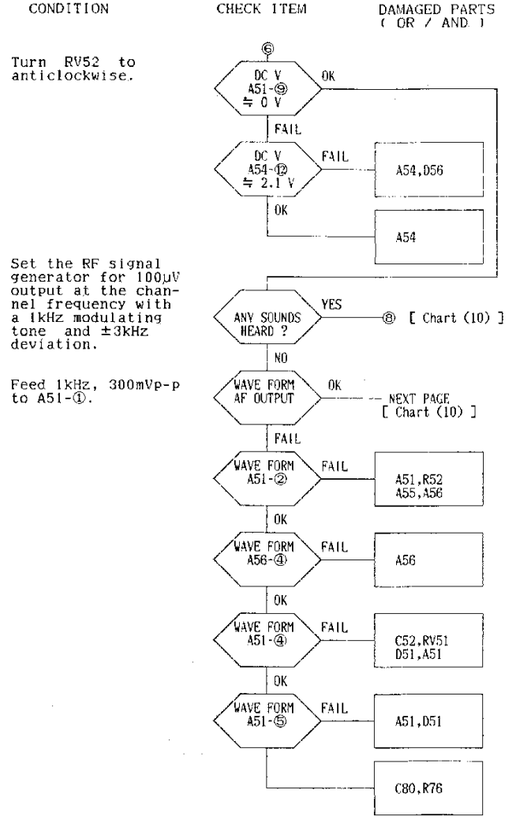
Troubleshooting Chart (7)



Troubleshooting Chart (8)

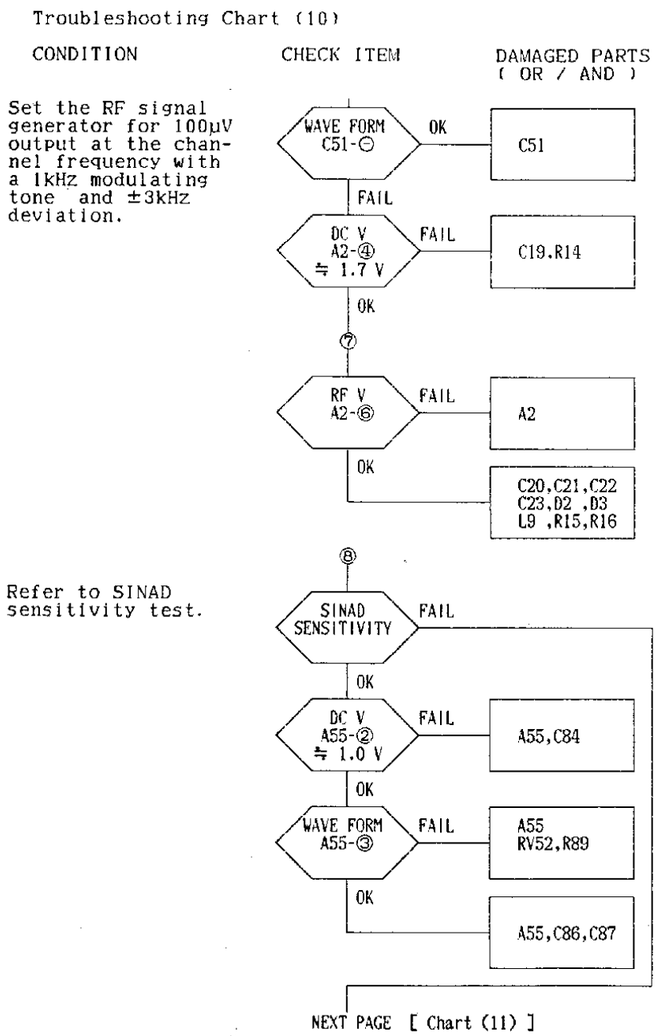


Troubleshooting Chart (9)

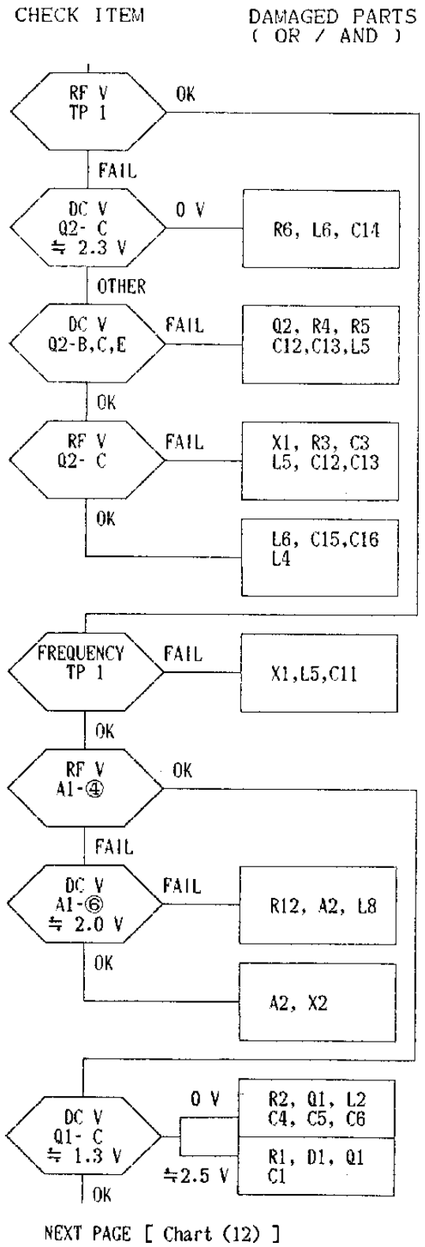


LBI-31482

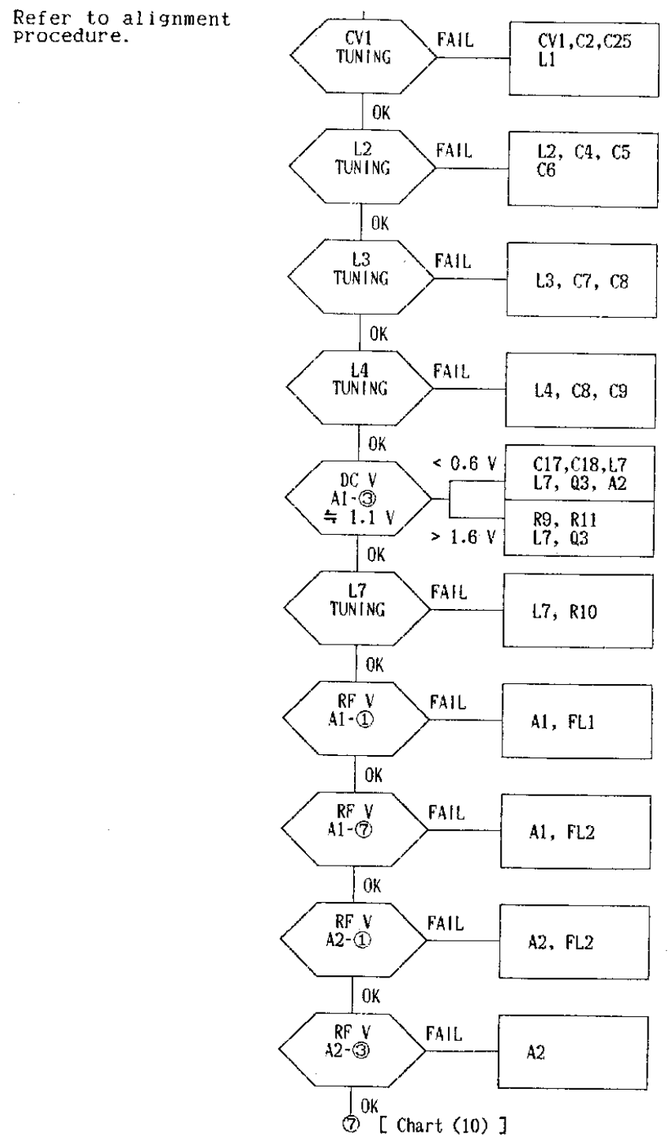
Troubleshooting Chart (10)



Troubleshooting Chart (11)



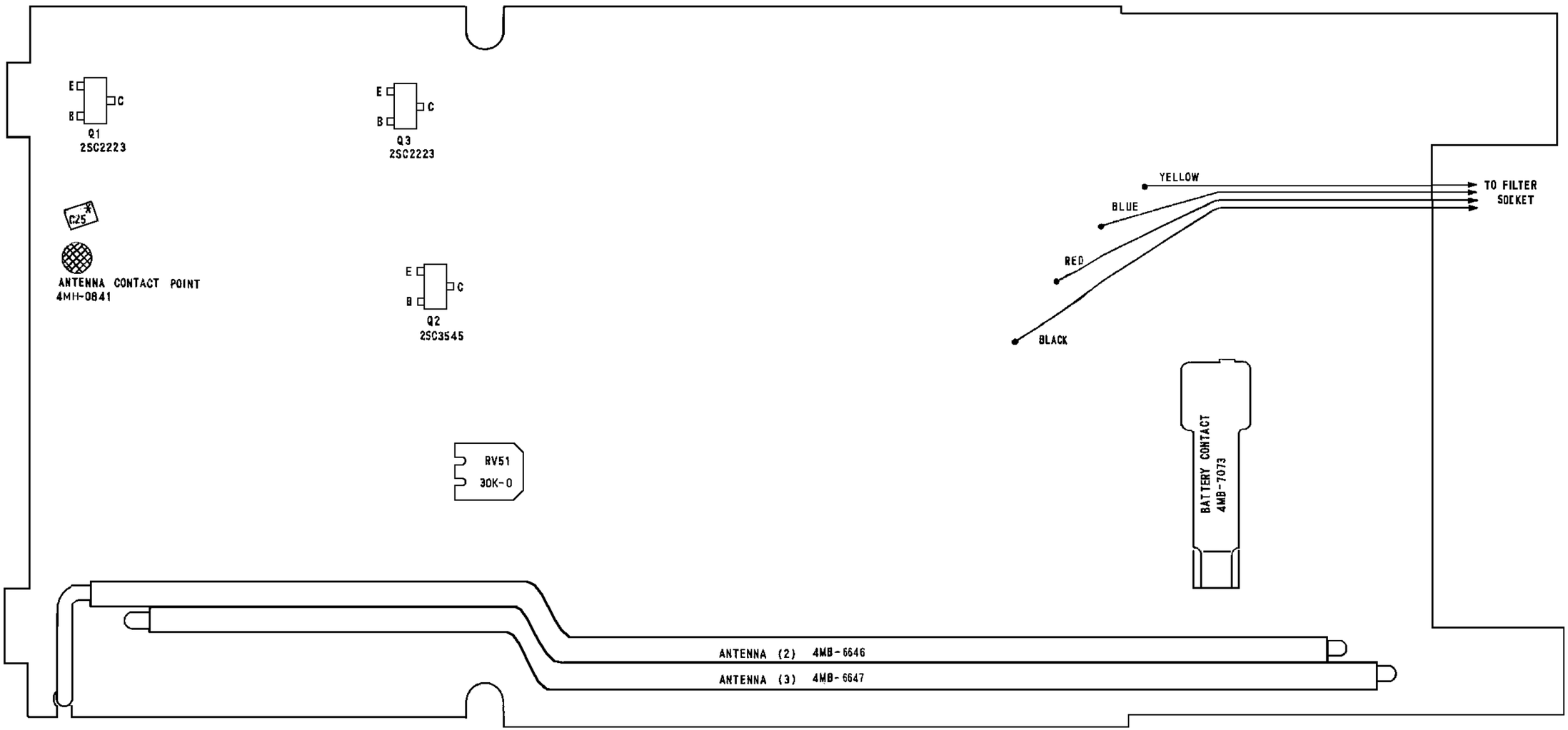
Troubleshooting Chart (12)



TROUBLESHOOTING PROCEDURE

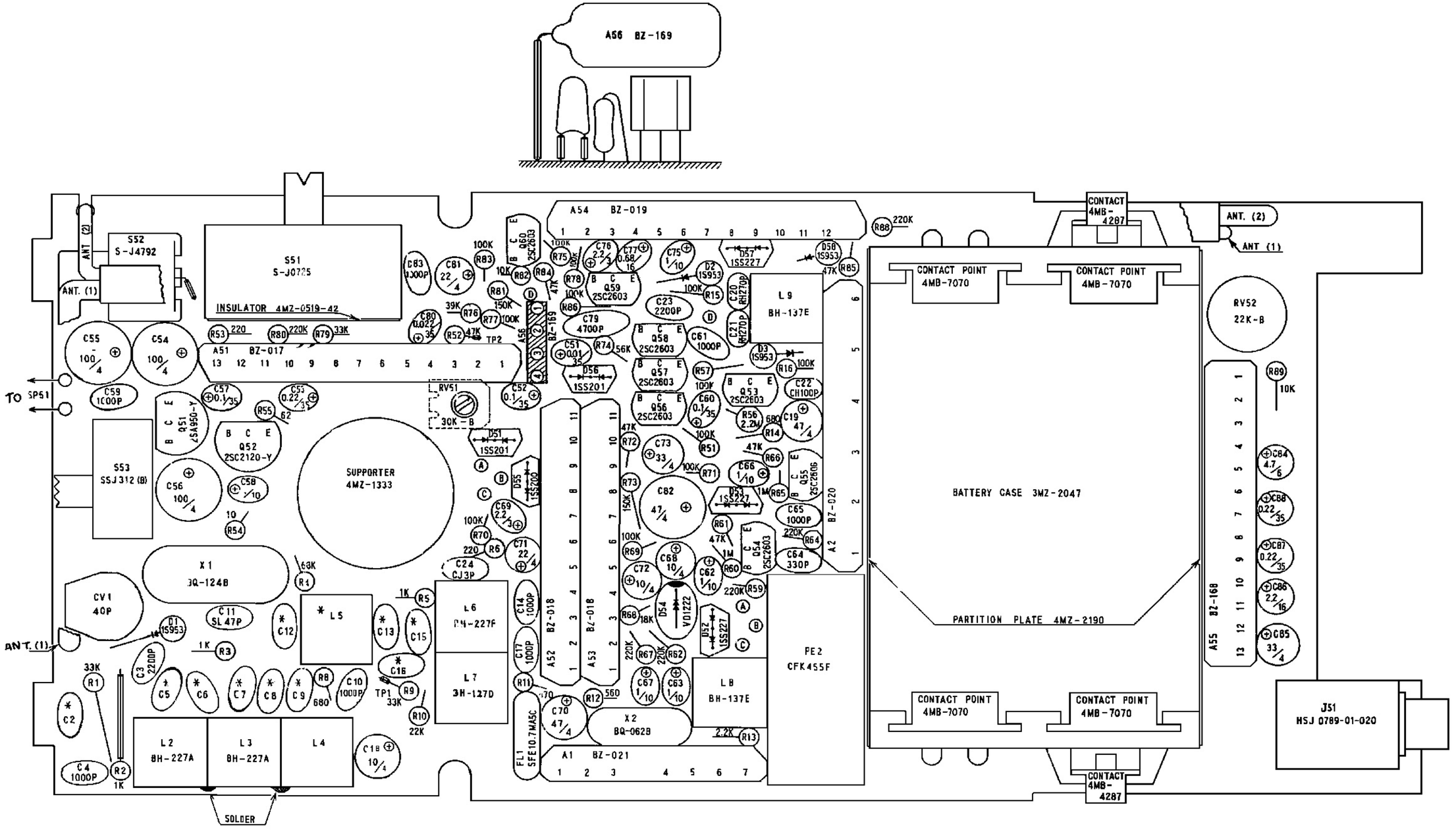
RECEIVER ER-145-A1, B1, C1, D1

RECEIVER ER-145-A1, B1, C1, D1

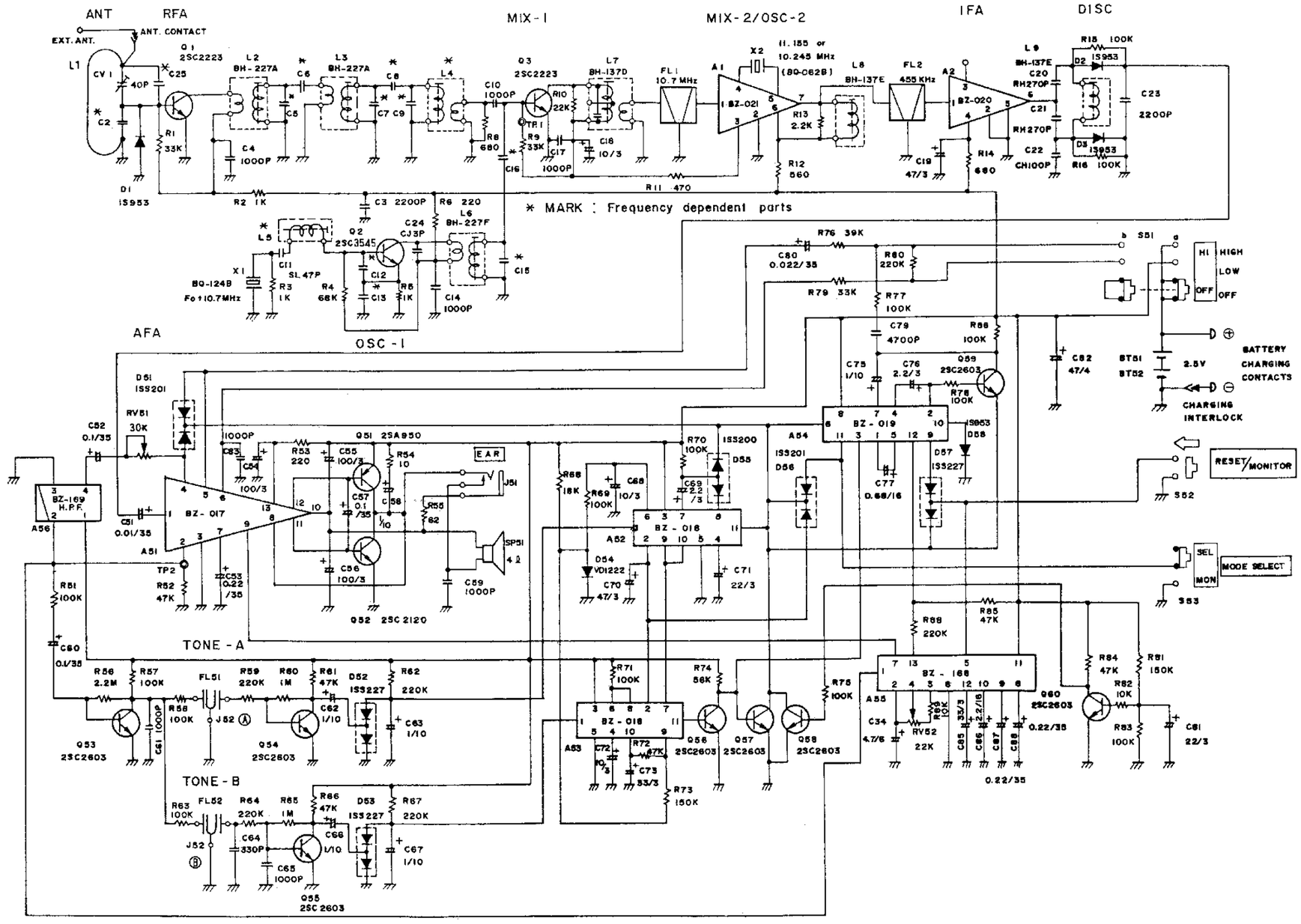


SOLDER SIDE

ISSUE 1



COMPONENT SIDE

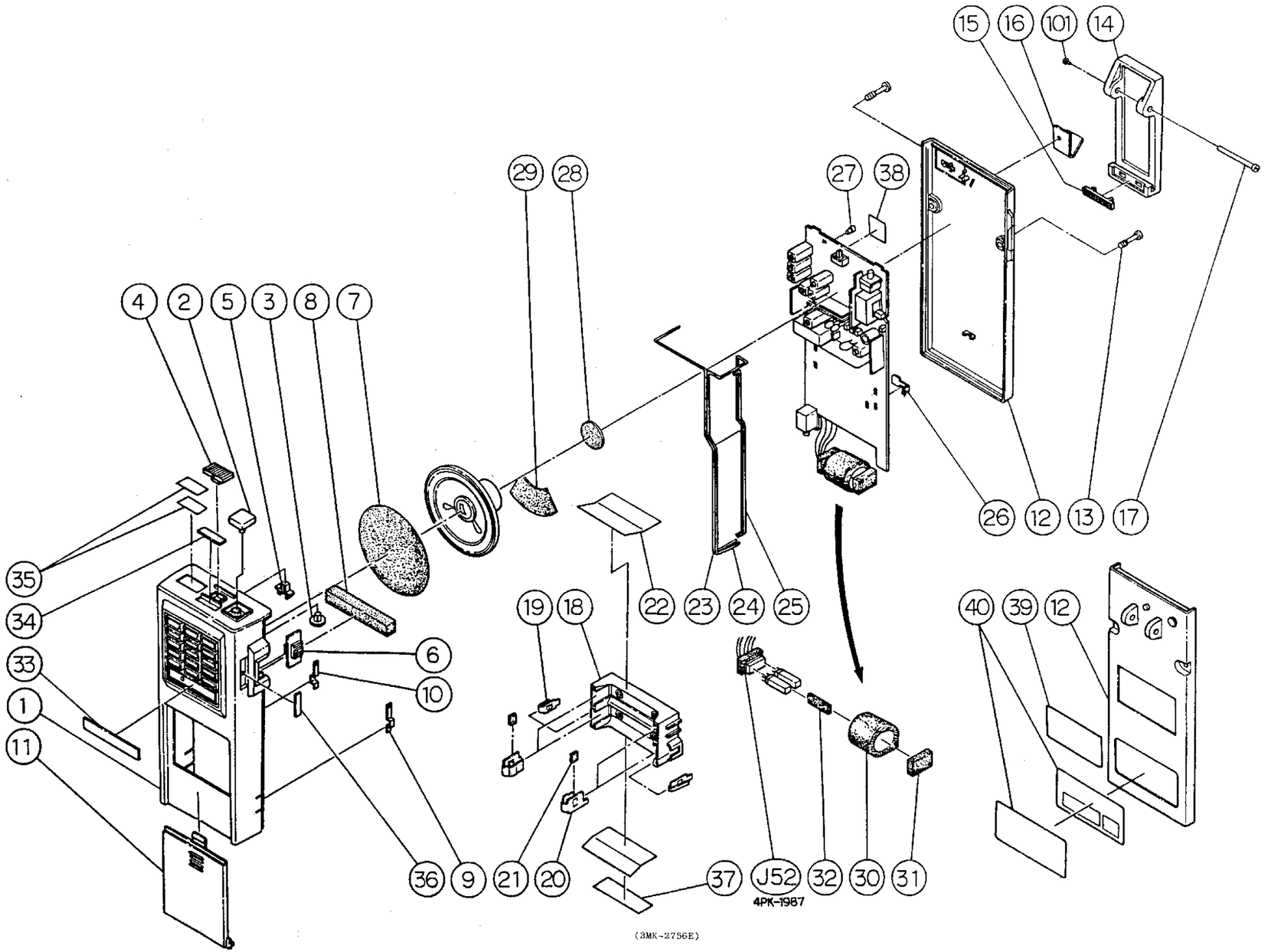


(3DC-6077E)

RECEIVER ER-145-A1, B1, C1, D1

PARTS LIST
33-50 MHz
BEACON MONITOR PAGER
4DT-2049E

SYMBOL	DESCRIPTION		PART NO.
A1	Integrated Circuit		0800210000
A2	Integrated Circuit		0800200000
A51	Integrated Circuit		0800170000
A52	Integrated Circuit		0800180000
A53	Integrated Circuit		0800180000
A54	Integrated Circuit		0800190000
A55	Integrated Circuit		0801680000
A56	Integrated Circuit		0801690000
BT51	Nickel-Cadmium Battery 1.2V/150 mAh		5300170818
BT52	Nickel-Cadmium Battery 1.2V/150 mAh		5300170818
C1	— — — — —		
C2	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, RH200 pF	2004438321
	33 MHz - 37 MHz	50V, RH160 pF	2004436321
	37 MHz - 41 MHz	50V, RH100 pF	2004431321
	41 MHz - 45 MHz	50V, RH75 pF	2004428321
	45 MHz - 50 MHz	50V, RH51 pF	2004424321
C3	Ceramic Capacitor	50V, 2200 pF	2001901321
C4	Ceramic Capacitor	50V, 1000 pF	2001400321
C5	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, RH43 pF	2004422321
	33 MHz - 37 MHz	50V, RH36 pF	2004420321
	37 MHz - 41 MHz	50V, SH27 pF	2001019321
	41 MHz - 45 MHz	50V, SH24 pF	2001018321
	45 MHz - 50 MHz	50V, SH20 pF	2001016321
C6	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, CH4 pF	2001105321
	33 MHz - 37 MHz	50V, CH4 pF	2001105321
	37 MHz - 41 MHz	50V, CJ3 pF	2001104321
	41 MHz - 45 MHz	50V, CJ3 pF	2001104321
	45 MHz - 50 MHz	50V, CJ3 pF	2001104321
C7	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, RH47 pF	2004423321
	33 MHz - 37 MHz	50V, RH39 pF	2004421321
	37 MHz - 41 MHz	50V, RH30 pF	2004418321
	41 MHz - 45 MHz	50V, SH24 pF	2001018321
	45 MHz - 50 MHz	50V, SH20 pF	2001016321
C8	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, CJ3 pF	2001104321
	33 MHz - 37 MHz	50V, CJ3 PF	2001104321
	37 MHz - 41 MHz	50V, CK2 pF	2001103321
	41 MHz - 45 MHz	50V, CK2 pF	2001103321
	45 MHz - 50 MHz	50V, CK2 pF	2001103321
C9	Ceramic Capacitor		
	30 MHz - 33 MHz	50V, RH36 pF	2004420321
	33 MHz - 37 MHz	50V, RH30 pF	2004418321
	37 MHz - 41 MHz	50V, RH33 pF	2004419321
	41 MHz - 45 MHz	50V, SH27 pF	2001019321
	45 MHz - 50 MHz	50V, SH22 pF	2001017321
C10	Ceramic Capacitor	50V, 1000 pF	2001400321
C11	Ceramic Capacitor		
	33 MHz - 37 MHz	50V, SL47 pF	2001326321
	37 MHz - 41 MHz	50V, SL47 pF	2001326321
	41 MHz - 45 MHz	50V, SL47 pF	2001326321
	45 MHz - 50 MHz	50V, SL47 pF	2001326321
C12	Ceramic Capacitor		
	33 MHz - 37 MHz	50V, SH33 pF	2001021321
	37 MHz - 41 MHz	50V, SH33 pF	2001021321
	41 MHz - 45 MHz	50V, SH22 pF	2001017321
	45 MHz - 50 MHz	50V, SH22 pF	2001017321
C13	Ceramic Capacitor		
	33 MHz - 37 MHz	50V, SH33 pF	2001021321
	37 MHz - 41 MHz	50V, SH33 pF	2001021321
	41 MHz - 45 MHz	50V, SH22 pF	2001017321
	45 MHz - 50 MHz	50V, SH22 pF	2001017321
C14	Ceramic Capacitor	50V, 1000 pF	2001400321
C15	Ceramic Capacitor		
	33 MHz - 37 MHz	50V, SH15 pF	2001013321
	37 MHz - 41 MHz	50V, SH13 pF	2001012321
	41 MHz - 45 MHz	50V, SH12 pF	2001011321
	45 MHz - 50 MHz	50V, SH10 pF	2001009321
C16	Ceramic Capacitor		
	33 MHz - 37 MHz	50V, CH7 pF	2001108321
	37 MHz - 41 MHz	50V, CH7 pF	2001108321
	41 MHz - 45 MHz	50V, CH5 pF	2001106321
	45 MHz - 50 MHz	50V, CH5 pF	2001106321
C17	Ceramic Capacitor	50V, 1000 pF	2001400321
C18	Tantalum Capacitor	4V, 10 uF	2013040501
C19	Tantalum Capacitor	4V, 10 uF	2013041501
C20	Ceramic Capacitor	50V, RH270 pF	2004441321
C21	Ceramic Capacitor	50V, RH270 pF	2004441321
C22	Ceramic Capacitor	50V, CH100 pF	2004135321
C23	Ceramic Capacitor	50V, 2200 pF	2001901321
C24	Ceramic Capacitor	50V, CJ3 pF	2001104321
C25	Chip Capacitor		
	33 MHz - 37 MHz	50V, CH39 pF	2004908061
	37 MHz - 41 MHz	50V, CH33 pF	2004909061
	41 MHz - 45 MHz	50V, CH22 pF	2004910061
	45 MHz - 50 MHz	50V, CH15 pF	2004911061
C51	Tantalum Capacitor	35V, 0.01 uF	2014001501
C52	Tantalum Capacitor	35V, 0.1 uF	2014002501
C53	Tantalum Capacitor	35V, 0.22 uF	2014003501
C54	Tantalum Capacitor	4V, 100 uF	2013042501
C55	Tantalum Capacitor	4V, 100 uF	2013042501
C56	Tantalum Capacitor	4V, 100 uF	2013042501
C57	Tantalum Capacitor	35V, 0.1 uF	2013004501
C58	Tantalum Capacitor	10V, 1 uF	2014004501
C59	Ceramic Capacitor	50V, 1000 pF	2001400321
C60	Tantalum Capacitor	35V, 0.1 uF	2014002501
C61	Ceramic Capacitor	50V, 1000 pF	2001400321
C62	Tantalum Capacitor	10V, 1 uF	2014004501
C63	Tantalum Capacitor	10V, 1 uF	2014004501
C64	Ceramic Capacitor	50V, 330 pF	2001402321
C65	Ceramic Capacitor	50V, 1000 pF	2001400321
C66	Tantalum Capacitor	10V, 1 uF	2014004501
C67	Tantalum Capacitor	10V, 1 uF	2014004501
C68	Tantalum Capacitor	4V, 10 uF	2013040501
C69	Tantalum Capacitor	3V, 2.2 uF	2014005501
C70	Tantalum Capacitor	4V, 47 uF	2013041501
C71	Tantalum Capacitor	4V, 22 uF	2013043501
C72	Tantalum Capacitor	4V, 10 uF	2013040501
C73	Tantalum Capacitor	4V, 33 uF	2013044501
C74	— — — — —		
C75	Tantalum Capacitor	10V, 1 uF	2014004501
C76	Tantalum Capacitor	3V, 2.2 uF	2014005501
C77	Tantalum Capacitor	16V, 0.68 uF	2014006501
C78	— — — — —		
C79	Ceramic Capacitor	25V, 4700 pF	2001902321
C80	Tantalum Capacitor	35V, 0.022 uF	2014007501
C81	Tantalum Capacitor	4V, 22 uF	2013043501
C82	Aluminum Capacitor	4V, 47 uF	2029501803
C83	Ceramic Capacitor	50V, 1000 pF	2001400321
C84	Tantalum Capacitor	6.3V, 4.7 uF	2013032501
C85	Tantalum Capacitor	4V, 33 uF	2013044501
C86	Tantalum Capacitor	16V, 2.2 uF	2013023501
C87	Tantalum Capacitor	35V, 0.22 uF	2013005501
C88	Tantalum Capacitor	35V, 0.22 uF	2013005501
CV1	Variable Capacitor	250V, 40 pF	2090012803
D1	Diode		0500017501
D2	Diode		0500017501
D3	Diode		0500017501
D51	Diode		0500050324
D52	Diode		0500051324
D53	Diode		0500051324
D54	Diode, Varistor		0500028501
D55	Diode		0500052324
D56	Diode		0500050324
D57	Diode		0500051324
D58	Diode		0500017501
FL1	Ceramic Filter 10.7 MHz		5010011321
FL2	Ceramic Filter 455 kHz		501000532l
FL51	Reed Filter		5010002803
FL52	Reed Filter		5010002803
J51	Earphone Jack 2.5 ø		3700110718
J52	Filter Socket		3700130901
L1	Antenna Coil		See Antenna (1)-(3)
L2	RF Coil		3002270101
L3	RF Coil		3002270101
L4	RF Coil		
	33 MHz - 37 MHz		3002270301
	37 MHz - 41 MHz		3002270201
	41 MHz - 45 MHz		3002270201
	45 MHz - 50 MHz		3002270201
L5	RF Coil		
	33 MHz - 37 MHz		3002270501
	37 MHz - 41 MHz		3002270401
	41 MHz - 45 MHz		3002270401
	45 MHz - 50 MHz		3002270401
L6	RF Coil		3002270601
L7	IF Coil		3001370401
L8	IF Coil		3001370501
L9	IF Coil		3001370501
Q1	Transistor (NPN)		0222232501
Q2	Transistor (NPN)		0235451501
Q3	Transistor (NPN)		0222232501
Q51	Transistor (PNP)		0009502324
Q52	Transistor (NPN)		0221202324
Q53	Transistor (NPN)		0226033806
Q54	Transistor (NPN)		0226033806
Q55	Transistor (NPN)		0226033806
Q56	Transistor (NPN)		0226033806
Q57	Transistor (NPN)		0226033806
Q58	Transistor (NPN)		0226033806
Q59	Transistor (NPN)		0226033806
Q60	Transistor (NPN)		0226033806
R1	Carbon Film Resistor 1/8 W, 33KΩ		1001105803
R2	Carbon Film Resistor 1/8 W, 1KΩ		1000070803
R3	Carbon Film Resistor 1/8 W, 1KΩ		1001070803
R4	Carbon Film Resistor 1/8 W, 68KΩ		1001112803
R5	Carbon Film Resistor 1/8 W, 1KΩ		1001070803
R6	Carbon Film Resistor 1/8 W, 220Ω		1001055803
R7	— — — — —		— — — — —
R8	Carbon Film Resistor 1/8 W, 680Ω		1001066803
R9	Carbon Film Resistor 1/8 W, 33KΩ		1000105803
R10	Carbon Film Resistor 1/8 W, 22KΩ		1001101803
R11	Carbon Film Resistor 1/8 W, 470Ω		1001062803
R12	Carbon Film Resistor 1/8 W, 560Ω		1001064803
R13	Carbon Film Resistor 1/8 W, 2.2KΩ		1001078803
R14	Carbon Film Resistor 1/8 W, 680Ω		1001066803
R15	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R16	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R51	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R52	Carbon Film Resistor 1/8 W, 47KΩ		1000108803
R53	Carbon Film Resistor 1/8 W, 220Ω		1001055803
R54	Carbon Film Resistor 1/8 W, 10Ω		1001024803
R55	DA Jumper		— — — — —
R56	Carbon Film Resistor 1/8 W, 2.2MΩ		1000346803
R57	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R58	Chip Resistor 1/16 W, 100KΩ		2004904061
R59	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R60	Carbon Film Resistor 1/8 W, 1MΩ		1001139803
R61	Carbon Film Resistor 1/8 W, 47KΩ		1001108803
R62	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R63	Chip Resistor 1/16 W, 100KΩ		2004904061
R64	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R65	Carbon Film Resistor 1/8 W, 1 MΩ		1001139803
R66	Carbon Film Resistor 1/8 W, 47KΩ		1001108803
R67	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R68	Carbon Film Resistor 1/8 W, 18KΩ		1001099803
R69	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R70	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R71	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R72	Carbon Film Resistor 1/8 W, 47KΩ		1001108803
R73	Carbon Film Resistor 1/8 W, 150KΩ		1001120803
R74	Carbon Film Resistor 1/8 W, 56KΩ		1001110803
R75	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R76	Carbon Film Resistor 1/8 W, 39KΩ		1001144803
R77	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R78	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R79	Carbon Film Resistor 1/8 W, 33KΩ		1001105803
R80	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R81	Carbon Film Resistor 1/8 W, 150KΩ		1001120803
R82	Carbon Film Resistor 1/8 W, 10KΩ		1001093803
R83	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R84	Carbon Film Resistor 1/8 W, 47KΩ		1001108803
R85	Carbon Film Resistor 1/8 W, 47KΩ		1001108803
R86	Carbon Film Resistor 1/8 W, 100KΩ		1001116803
R87	— — — — —		— — — — —
R88	Carbon Film Resistor 1/8 W, 220KΩ		1001124803
R89	Carbon Film Resistor 1/8 W, 10KΩ		1001093803
RV51	Variable Resistor B-30KΩ		1049022803
RV52	Variable Resistor B-22KΩ		1049002004
S51	Slide Switch		4200001224
S52	Push Switch		4100001224
S53	Slide Switch		4200029004
SP51	Speaker 40ø 4Ω/0.1W		5210001370
X1	Crystal		4512403321
X2	Crystal 11.155 MHz		4506210221
	or 10.245 MHz		4506209221



SYMBOL NO.	DESCRIPTION	GE STOCK NUMBER
1	FRONT CASE (BLACK)	2Mz-2111-1
	FRONT CASE (RED)	2MZ-2111-2
2	PUSH BUTTON (1)	4MZ-1760-3
3	PUSH BUTTON (2)	4MZ-1761-3
4	SWITCH PARTS (1)	4MZ-2128-1
5	SWITCH PARTS (2)	4MZ-2129-1
6	SWITCH PLATE	4MZ-2114-1
7	SPEAKER NET	4MZ-1277
8	CUSHION	4MZ-0489-57
9	CHARGE CONTACT	4MB-7098-1
10	CHARGE CONTACT	4MB-7098-2
11	BATTERY COVER (BLACK)	3MZ-2113-1
	BATTERY COVER (RED)	3MZ-2113-2
12	REAR COVER ASSEMBLY (BLACK)	2MZ-2112-1
	REAR COVER ASSEMBLY (RED)	2MZ-2112-2
13	ANTI REMOVABLE SCREW	4MH-0634
14	ANTENNA CONTACT	4MB-6644
15	CLIP	3MZ-1894
16	NON. SLIDING PARTS	4MZ-1258
17	ANTENNA PLATE	4MB-6643
18	SPRING	4MB-5960
19	CLIP PIN	4MH-0829
20	BATTERY CASE	3MZ-2047
21	CONTACT	4MB-4287J
22	CONTACT POINT	4MB-7070
23	CUSHION	4MZ-2085
24	PARTITION PLATE	4MZ-2190
25	BATTERY CONTACT	4MB-7073
26	INSULATOR	4MZ-1936
27	ANTENNA CONTACT POINT	4MH-0841
28	TUNER CASE ASSEMBLY	4MB-5783
29	SUPPORT	4MZ-1333
30	INSULATOR	4MZ-2201
31	CUSHION	4MZ-19 71-1
32	CUSHION	4MZ-1971-2
33	CUSHION	4MZ-1971-3
34	NAMEPLATE	4MN-1770
35	SWITCH NAMEPLATE	4MN-2132
36	CALL SEAL	4MN-1771
37	SWITCH NAMEPLATE	4MN-1741
38	NUMBER SEAL	4MN-1883
39	DEALER LABEL	4MN-2088
40	FACTORY MUTUAL LABEL	4MN-2130
41	MAIN NAMEPLATE	3MN-1772
101	CYLINDER SCREW	MI.7X5

RECEIVER ER-145-A1, B1, C1, D1
Issue 1