SD-160 Series Data Radio

(include SD-170 Series)

Technical Manual

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1. INTRODUCTION

The SD-160 and SD-170 Series (hereinafter called "the radios") of RF wireless modems from MAXON utilize the latest technology in its design and manufacturing. Both the UHF and VHF models are Phase Lock Loop Synthesizer (PLL) / microprocessor controlled and offer two watts (SD-160 Series) or one to five watts (SD-170 Series) of power with 16-channel capability. Multiple functions including 1200 to 9600 baud rates, AC and/or DC audio coupling, GMSK, FFSK and FSK modulation are standard in these fully programmable wide bandwidth RF wireless modem units. Programmable sub-audio squelch system (CTCSS & DCS) and two-tone squelch system are newly added to the signal level detect squelch system (RSSI). GPS Data handling is provided to interface and control internal GPS receiver.

The radios are programmed using an IBM® Personal Computer, DOS® or WINDOWS® based software, an interface module and a programming cable. This allows the radio to be tailored to meet the requirements of the individual user and of the System(s) it is operating within.

2. TECHNICAL SPECIFICATIONS

GENERAL

	VHF		UHF	
Equipment Type :	Data radio (Wireless Modem)		Data radio (Wireless Modem)	
Model Series :	SD-161	SD-171	SD-164	SD-174
Performance Specifications :	TIA/EIA-603	ETS 300-113	TIA/EIA-603	ETS 300-113
Frequency Range :	148-174MHz	148-174MHz	450-490MHz	450-490MHz
RF Output :	2W Only	1-5W	2W Only	1-5W
Channel Spacing :	12.5KHz, 25KHz Programmable			
Modulation Type :	F3D, F3E			
Intermediate Frequency :	45.1MHz & 455KHz			
Number of Channels :	16			
Frequency Source :	Synthesizer			
Operation Rating :	Intermittent 90 : 5 : 5 (Standby : RX : TX)			
Power Supply :	Ext. Power Supply (12 VDC Nominal)			

Temperature Range :
  Storage
  Operating
	From -40°C to +80°C
	From -30°C to +60°C			

Current Consumption :
  Standby(Muted)
  Transmit 5Watts RF Power
  Transmit 2Watts RF Power
	< 65mA
	< 2.0 A
	< 1.0 A			

Lock Time :	< 10ms			
TX to RX attack time :	< 20ms (No Power Saving)			
RX to TX attack time :	< 20ms			
Dimensions :	(32mm)H X (58mm)W X (125mm)D			
Weight :	253 grams			

TRANSMITTER

	VHF		UHF	
Model Series :	SD-161	SD-171	SD-164	SD-174

Carrier Power : (Nom. Max. Min.)
 	
  Hi Power
  Low Power
	
	2W < 3W > 1.5W
	N/A
		
		5W < 6W > 4.5W
		1W<1.5W>0.8W
			
			2W < 3W > 1.5W
			N/A
				
				5W < 6W > 4.5W
				1W<1.5W>0.8W

Sustained Transmission :
  Time :   5   10   30Sec
  (Nominal Conditions)
	Power : >90% >85% >80%		Power : >90% >85% >80%	

Frequency Error :
  Nominal condition
  Extreme condition
	< 0.5 KHz
	±5.0 ppm
			< 0.75 KHz
			±5.0 ppm	

Frequency Deviation :
  25 KHz Channel Spacing
  12.5 KHz Channel Spacing
	Peak ±5.0, Min. ±3.8
	Peak ±2.5, Min. ±1.9			

Audio Frequency Response :	Within +1/-3dB of 6dB octave @ 300 Hz to 2.55 kHz for 12.5 kHz C.S. @ 300 Hz to 3.0 kHz for 25 kHz C.S.			

Adjacent Channel Power :
  25 KHz Channel Spacing
  12.5 KHz Channel Spacing
	< 70 dBc @ Nominal Condition , < 65 dBc @ Extreme Condition
	< 60 dBc @ Nominal Condition , < 55 dBc @ Extreme Condition			

Conducted Spurious Emission :	< -60 dBc	< -30 dBm	< -60 dBc	< -30 dBm
Modulation Sensitivity :	100mV RMS @ 60% Peak Dev.			

Hum & Noise :
  25 KHz Channel Spacing
  12.5 KHz Channel Spacing
	> 40 dB (without PSOPH)
	> 40 dB (with PSOPH)			

Modulation Symmetry :	< 10% Peak Dev @ 1KHz input for nominal dev. + 20dB			
Load Stability :	No osc at ≥ 10:1 VSWR all phase angles and suitable antenna No destroy at ≥ 20:1 all phase angle			

Peak Deviation Range Adjustment
@ 1 KHz, Nom Dev + 20dB :
  25 KHz Channel Spacing
  12.5 KHz Channel Spacing
	
	Min. 3.5, Max. 6.0
	Min. 1.5, Max. 4.0			

RECEIVER

	VHF		UHF	
Model Series :	SD-161	SD-171	SD-164	SD-174
Sensitivity (@ 12dB SINAD) :				
25 KHz Channel Spacing	< 0.28uV	< 0.28uV	< 0.28uV	< 0.28uV
12.5 KHz Channel Spacing	< 0.30uV	< 0.30uV	< 0.30uV	< 0.30uV
Sensitivity (1/100 Error Rate)				
With ACC-513	< -113dBm	< -113dBm	< -113dBm	< -113dBm
With ACC-514	< -110dBm	< -110dBm	< -110dBm	< -110dBm
Amplitude Characteristic :	> -3dB , < +3dB		> -3dB , < +3dB	
Adjacent Channel Selectivity :				
25 KHz Channel Spacing(Nom.)	> 65 dB	> 70 dB	> 65 dB	> 70 dB
(Extreme Condition)	> 55 dB	> 60 dB	> 55 dB	> 60 dB
12.5 KHz Channel Spacing(Nom.)	> 55 dB	> 60 dB	> 55 dB	> 60 dB
(Extreme Condition)	> 45 dB	> 50 dB	> 45 dB	> 50 dB
Spurious Rejection(100KHz ~ 4GHz)	> 60 dB	> 70 dB	> 60 dB	> 70 dB
Image / Half IF Rejection :	> 60 dB	> 70 dB	> 60 dB	> 70 dB
Intermodulation Response Rejection				
±25 kHz/ 50 kHz	> 60 dB	> 70 dB	> 60 dB	> 70 dB
±50 kHz/ 100 kHz	> 60 dB	> 70 dB	> 60 dB	> 70 dB
Conducted Spurious Emission :				
9 KHz - 1 GHz	< -57 dBm		< -57 dBm	
1 GHz – 4 GHz	< -47 dBm		< -47 dBm	
RX Spurious Emissions (Radiated) :				
9 KHz - 1 GHz	< -57 dBm		< -57 dBm	
1 GHz – 4 GHz	< -47 dBm		< -47 dBm	
AF Distortion :				
Nominal condition	< 5%	< 3%	< 5%	< 3%
Extreme condition	< 10%	< 10%	< 10%	< 10%
RX Hum & Noise (only audio) :				
25 KHz Channel Spacing	< 40 dB without PSOPH		< 40 dB without PSOPH	
12.5 KHz Channel Spacing	< 40 dB with PSOPH		< 40 dB with PSOPH	
Receiver Response Time :	< 16 ms		< 16 ms	
Squelch (factory pre-set)				
Open	-113dBm			
Close	-116dBm			
Squelch Attack Time :				
RF Level at Threshold	< 20 ms (RSSI), < 40 ms (Analog)			
RF Level at Threshold + 20dB	< 10 ms (RSSI), < 30 ms (Analog)			
Squelch Decay Time :	5 ms Min., 20ms Max.			
Antenna Socket Input Match	> 10 dB Return Loss			
Temperature Stability for L.O. Frequency :	1st < 5 ppm, 2nd < 15 ppm from -30° to + 60° C			
L.O. Frequency Aging Rate :	±2 ppm/ year			

REFERENCE CRYSTAL

	VHF		UHF	
Model Series :	SD-161	SD-171	SD-164	SD-174
Frequency :	12.8MHz			
Holder Type :	HC-18			
Temperature Characteristic :	±5.0 ppm from -30° C to +60° C			
Aging Rate :	< 2 ppm/ year in 1st year < 1 ppm/ year thereafter			

ENVIRONMENTAL (performance without degradation unless stated)

	VHF		UHF	
Model Series :	SD-161	SD-171	SD-164	SD-174

Temperature (deg C)
  Operating
  Storage
	-30° to +60° C Degradation Specified @ Extreme condition
	-40° to +80° C			

ESD	20 KV			
Vibration	MIL STD 810 C Procedures I, II, V and IEC68 26			

● **Due to continuing research and development the company reserves the right to alter these specifications without prior notice.**

3. FEATURES

16 Channels

The SD-160 Series(include SD-170 Series, hereinafter called "SD-160") radio can store up to 16 channels within the same band. These channels can be selected by inner DIP-S/W or serial command inputted from external control system.

Channel Spacing

The SD-160 is capable of programmable channel spacing, in both UHF and VHF bands. Each channel can be programmed via the PC programmer, ACC-916, having 12.5KHz or 25KHz channel spacing.

Output Power

In case of SD-160, 2-Watts output power is only available, but, in SD-170, it's programmable. Each channel can be programmed via the PC programmer to a high-power output, 5 Watts, and a low-power output, 1 Watt.

Channel Scan

For audio application, SD-160 supports channel scan enabled via serial commands. During programming of the radio, any channel can be selected as a scanned channel. When a scanned channel is selected, it becomes a part of the scan list. Once the scan list has been established, initiates scan by serial commands. If a conversation is detected on any of the channels in the scan list, the radio will stop on that channel and audio signal will be released through pin 9 of the DB-15 connector. At that moment, busy channel data is sent to external equipment or device through serial command. So, busy channel data can be identified as decoding received serial command from radio in the external equipment or device. Normally, if user tries to transmit during scanning, the transmission will be made on the channel that the call is received during the programmable scan delay time. (The scan delay time is the amount of time the radio will stay on that channel once working has ceased. Dealer programming of 4 ~ 7 seconds is typical). The radio will resume scanning once the scan delay time has passed, and will continue to scan until the serial command for scan stop is inputted by external equipment. After the scan has resumed, if a transmission is made, the radio will transmit on the selected priority channel. This feature is similar to priority scan TX except for selection of priority channel. You can assign a priority channel by inner dip switch only.

Scan Delete

To temporarily delete a channel from the scan list, simply input the serial command for scan deletion to the radio while scanning and stopped on the channel to be deleted. This will temporarily remove that channel from the scan list until the scan is closed or the radio's power is reset.

CTCSS / DCS Scanning

To help to block out unwanted calls to your radio, the SD-160 series can be programmed by your dealer to scan for tones.

Busy Channel Lockout

This feature, when enabled, disables the transmitter when the user would attempt to transmit during the receiving channel is busy. It will be dealer-programmable on/off and applicable to all channels.

Marked Idle

When used in conjunction with Busy Channel, lockouted transmitter is allowed to operate as long as valid RX tone is received. Dealers program this feature as ON or OFF. This feature will be dealer-programmable on/off and applicable to all channels.

TX Time-out

This feature, when enabled, limits the amount of time that the user can continuously transmit. This time can be set in increments by 10 seconds from 10 seconds to 990 seconds. If the user attempts to transmit longer than the TX Time-out period, five seconds prior to expiration, the radio will release Time-out alert signal through pin 9 of the DB-15 connector and will cease transmission.

Power Save

The function of Power Save is used when an external battery is used as the power source. When Power Save is enabled, the receiver ON and OFF time can be programmed and allows the operator to set the length of time the receiver gets asleep.

Tx Delay

The TX will remain active for 150 ms at the end of TX when using CTCSS tones. This eliminates squelch tail. Dealer programs this feature as ON or OFF.

Squelch Options

Compared to existing Maxon data radios, programmable sub-audio squelch system (CTCSS & DCS) and two-tone squelch system are newly added. Each channel will have these squelch option sets during dealer programming. More detail descriptions for all available squelch systems of SD-160 are the following.

Sub-audio squelch system

The SD-160 can operate singly or with optional modem boards. Even if user wants to use sub-audio SQ system, the radio will permit this SQ option according to some cases to avoid confliction between sub-audio and data.

Contrary to general-purpose two-way radio, the input of the radio is data or audio. In case of audio, its frequency spectra are limited to 300㎐ ∼ 3㎑ by internal BPF. So, the division of this and sub-audio is possible on the frequency spectra because sub-audio has under 300㎐ frequency. But, Data has wide frequency spectra compared with audio. Normally, that has 30㎐ ∼ 4.8㎑ frequency (except harmonic freq.) at 9600 baud rate. Accordingly, the conflict of sub-audio and data are inevitable and so broken data or SQ error is unavoidable. To solve this problem, the radios can use the FFSK modulation which converts data into two different continuous audio tone according to their logic levels. Therefore, available cases of sub-audio SQ system are Audio and FFSK signal. But, it's not permitted to FSK(FM direct modulation of data) and GMSK signal.

a. Single operation of SD-160

If the radio operates singly, only FM direct modulation/demodulation of audio and data are available. In this case, audio and data are inputted and released through different DB connector lines which pin 7, 9, 1 and 2 of DB-15 connector are used as audio input, audio output, data input and data output, respectively. Normally, Sub-audio Squelch(SQ) System can be applied to audio signal, but data doesn't use it to avoid frequency confliction. So, if user tries to transmit data in one channel which has sub-audio squelch option, radio will flash green LED two times as warning and then transmit it without sub-audio.

Note : SD-160 provides the connection of external modems to receive and transmit external modulated data which can be inputted and outputted through pin 1 and 2

of DB-15 connector, respectively. In this case, the external signals are referenced to ground and may be a.c. or d.c. coupled depending on the user requirement. Especially, if the type of external modem is AFSK or FFSK, Sub-audio Squelch(SQ) System can be applied by dealer programming. For reference, its related parameter is "Tx Tone Generation for Data Input" of "Tx option" group on the "System Option / GPS" tap window of ACC-916.

Brief block signal flow diagrams for each input are the following (See Figure 2.1. ~ 2.3.).

Audio signal flow in Transmitter   *Audio signal flow in Receiver*
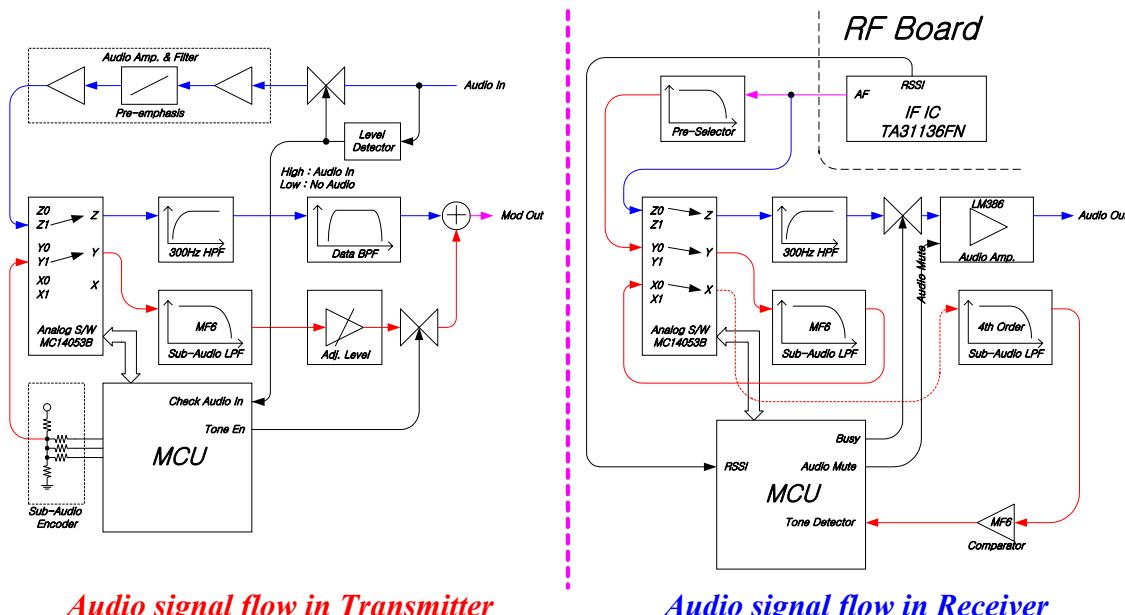
Figure 3.1. Audio signal flow diagram

Data signal flow in Transmitter   *Data signal flow in Receiver*
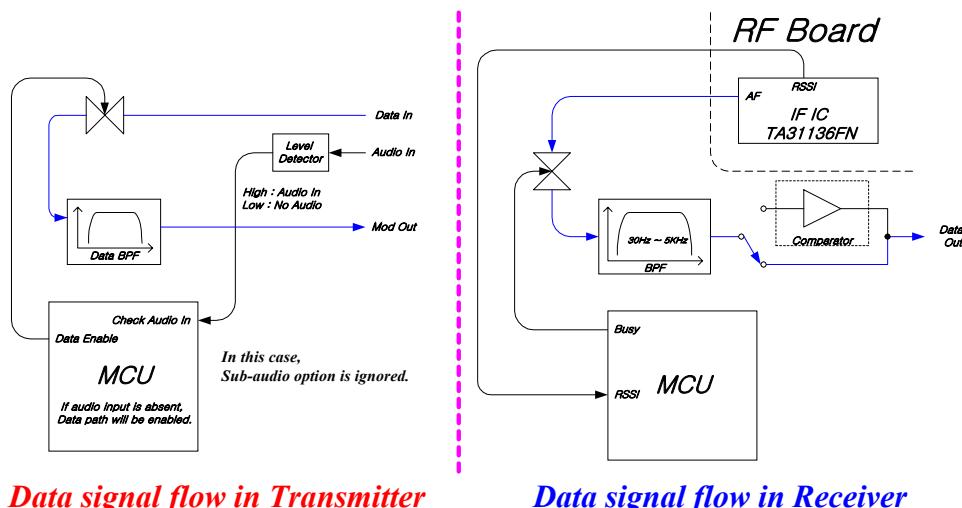
Figure 3.2. Data signal flow diagram

Ext. Mod. signal flow in Transmitter   *Ext. Mod. signal flow in Receiver*
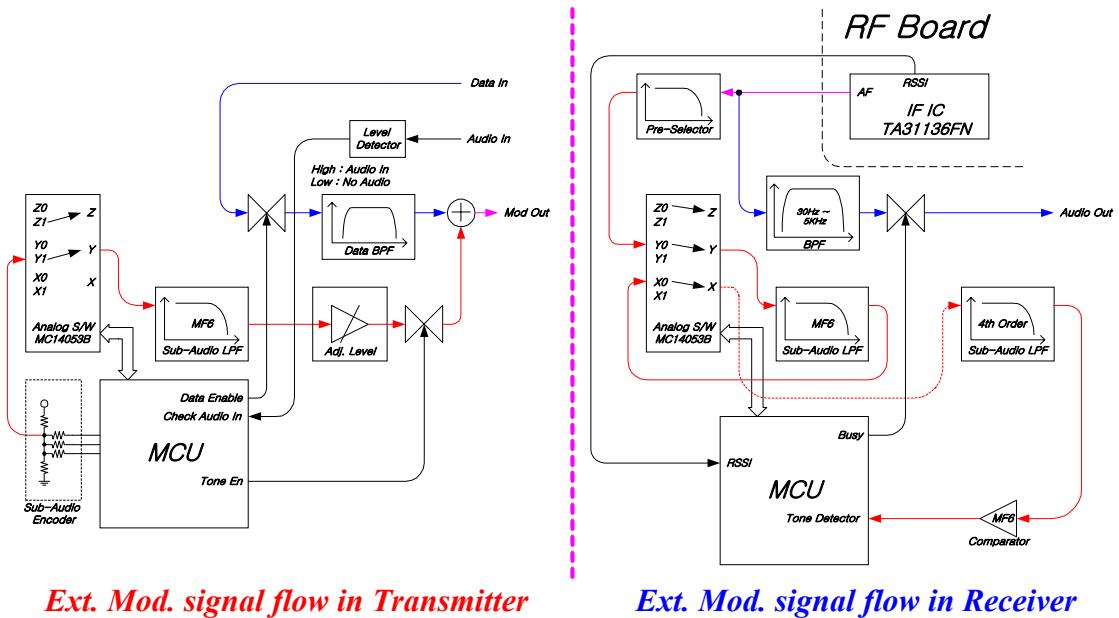
Figure 3.3. External modulated signal flow diagram

b. FFSK & GMSK

Maxon provides two optional modem boards, ACC-513, GMSK and ACC-514, FFSK for SD-160 to improve the efficiency for data transmission and offer maximum flexibility for user application. Selection of the required modulation option is made installing wanted modem to radio and programming several modem parameters through PC-programmer, ACC-916. Modem board provides the facility to connect a computerized controller via an RS-232 level serial data interface (i.e. Communication port COM1, COM2, etc. for PCs) to its Slave MCU. Received data from controller(DTE) will then drive the FFSK or GMSK modulator and allow transmission of serial data. It also provides FFSK or GMSK demodulator for the reception of FFSK or GMSK modulated data signals. These are converted to RS-232 level serial data stream for supply to a computerized controller.

In application of Sub-audio squelch, it can't apply to GMSK modulated signal because of their frequency confliction. But, FFSK modulated signal can be mixed with sub-audio because it consists of two different continuous tones which frequency spectra are on the audio frequency region.

Brief block signal flow diagrams for each optional modem board are the following (See Figure 2.4. and Figure 2.5.).
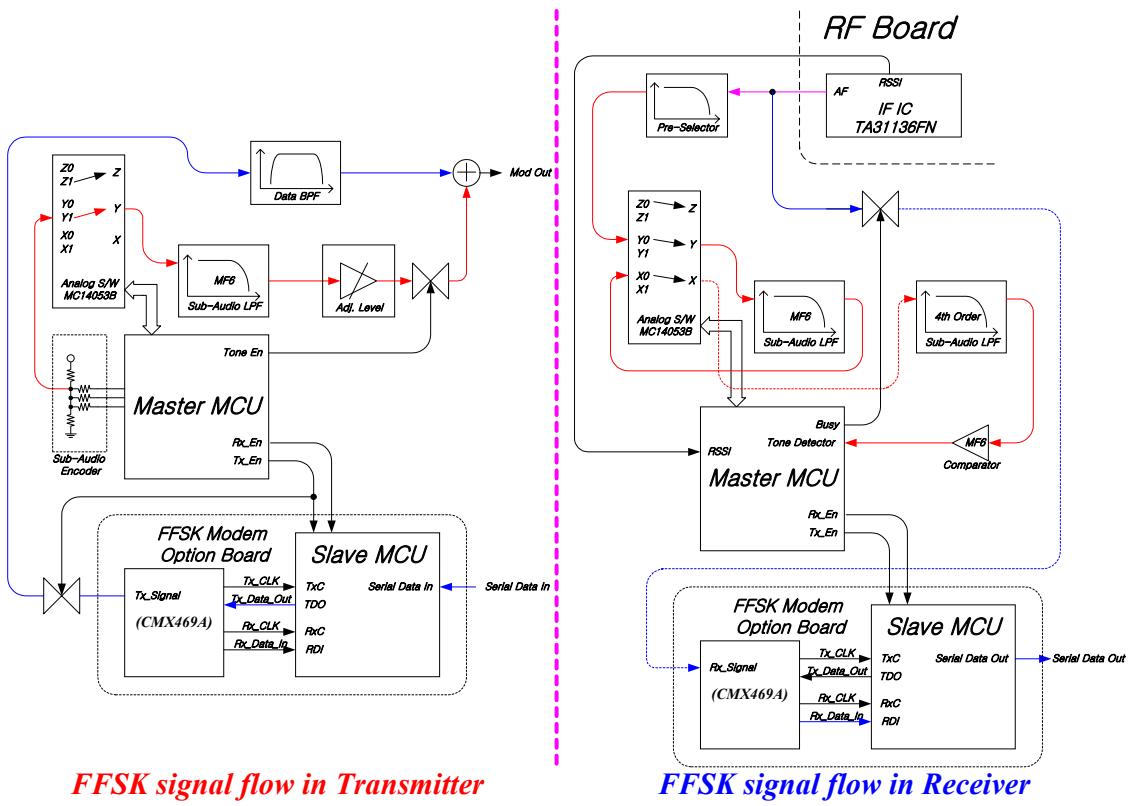
Figure 3.4. FFSK signal flow diagram
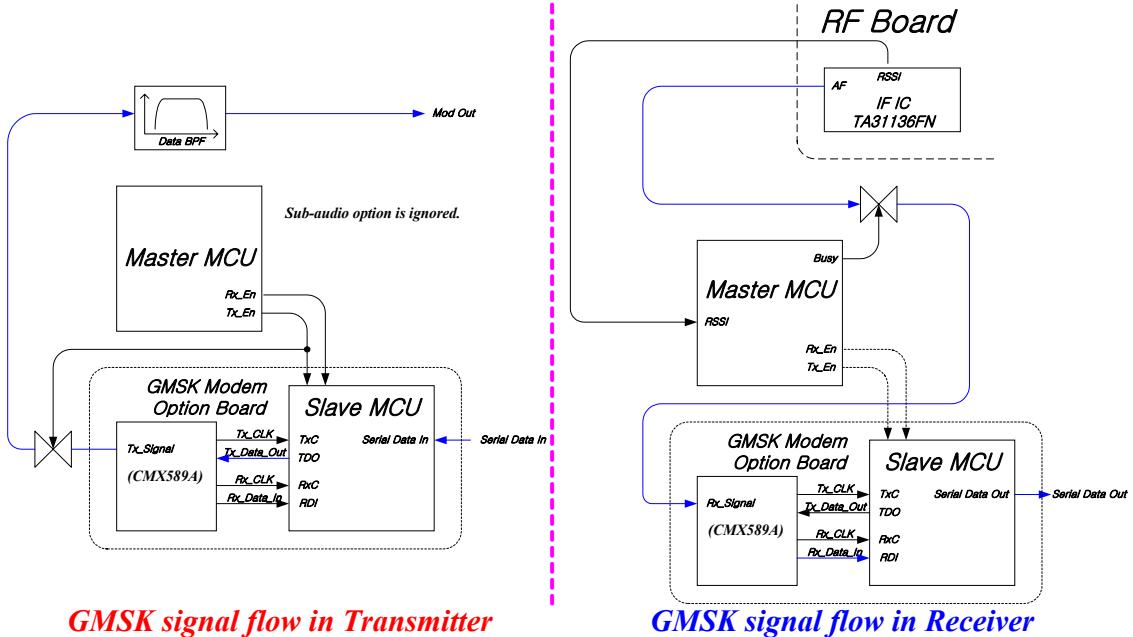
Figure 3.5. GMSK signal flow diagram

c. CTCSS signal information

Each channel supports the 38 TIA/EIA standard tone frequencies and 11 non-standard tones. All tones will be set up during dealer programming.

No.	Freq. (Hz)	No.	Freq. (Hz)	No.	Freq. (Hz)	No.	Freq. (Hz)	No.	Freq. (Hz)
01	67.0	11	97.4	21	136.5	31	192.8	41	171.3
02	71.9	12	100.0	22	141.3	32	203.5	42	177.3
03	74.4	13	103.5	23	146.2	33	210.7	43	183.5
04	77.0	14	107.2	24	151.4	34	218.1	44	189.9
05	79.7	15	110.9	25	156.7	35	225.7	45	196.6
06	82.5	16	114.8	26	162.2	36	233.6	46	199.5
07	85.4	17	118.8	27	167.9	37	241.8	47	206.5
08	88.5	18	123.0	28	173.8	38	250.3	48	229.1
09	91.5	19	127.3	29	179.9	39	69.3	49	254.1
10	94.8	20	131.8	30	186.2	40	159.8		

Table 3.1. CTCSS Frequency Chart

d. DCS signal information

The radio supports the encoding and decoding of 104 DCS data (include TIA/EIA code).

Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code	Octal Code
023	054	125	165	245	274	356	445	506	627	732
025	065	131	172	246	306	364	446	516	631	734
026	071	132	174	251	311	365	452	523	632	743
031	072	134	205	252	315	371	454	526	654	754
032	073	143	212	255	325	411	455	532	662	
036	074	145	223	261	331	412	462	546	664	
043	114	152	225	263	332	413	464	565	703	
047	115	155	226	265	343	423	465	606	712	
051	116	156	243	266	346	431	466	612	723	
053	122	162	244	271	351	432	503	624	731	

Table 3.2. DCS Code Chart

Two-Tone Squelch(SQ) System

The radios will support Motorola-Format, Two-Tone(Type 99) decoding. **_This is receive only, decode only feature._** It will allow a dispatcher to call individuals and groups. Each System/Group will be programmable to respond to any combination of the code, with a distinctive alert for each System/Group. The alert format consists of two tone sequences, first the ID of the radio being called, then the ID of the calling radio.

This feature is programmed by the dealer(per customer's request) and is not activated / deactivated by the user. The user interface consists of the radio emitting the tones being broadcast. At this point, the radio will enter Unmuted Rx mode and remain in this mode until the PTT signal is inputted.

Serial command

To give the simplest protocol for control of radio, Maxon has prepared for some serial commands which have an ease to encode and decode format. SD-160 can be used without serial commands, but user can use its various functions through application of those, for instance, setting-up the basic radio operation such as channel change, switch of RX/TX and channel scan, moreover, used for control of GPS and modem option board. All messages are in binary format, which reduces required data size to shorten response time of radio and follows below data format.

Serial RX/TX Data Format

(1) Asynchronous Serial Data Transfer

(2) Baud Rate : 4,800 bit/sec

(3) Data Bit : 8bit , Non Parity

(4) Stop Bit : 1bit

(5) MSB first transmission

Each serial command is consist of 3 bytes. 1_{st} byte is command and 2_{nd} is data required by command and 3_{rd} is check sum to decide validity of total contents.

Byte0

ST	1_{st} Byte (Command)	SP

Byte1

ST	2_{nd} Byte (Data)	SP

Byte2

ST	3rd Byte (Check Sum)	SP

Data Protocol

a. Protocol for input serial command
   Protocol of data transmission from external equipment or device (: PC) to radio :
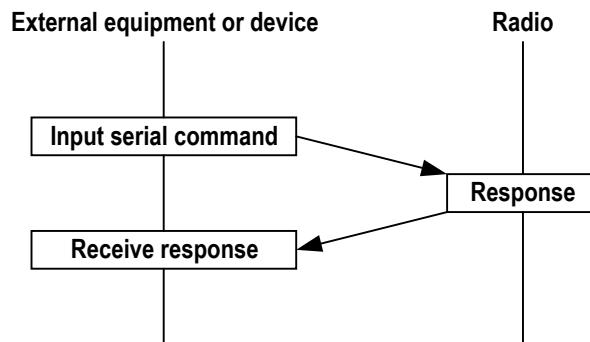
Figure 3.6. Protocol for input serial command

b. Protocol for output data
   Protocol of data transmission from radio to external equipment or device (: PC) :
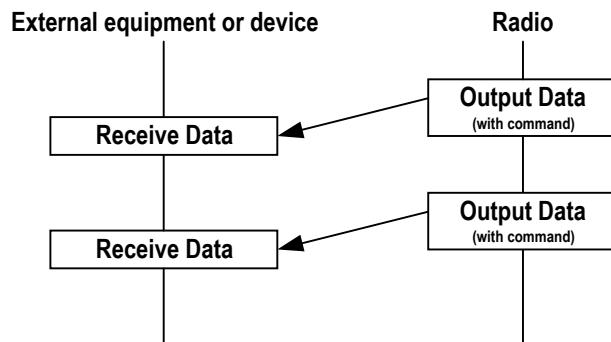
Figure 3.7. Protocol for output data

Detail information of Serial Commands

a. Transmitting Command & Data

	Mode	Command (BYTE0)	Data (BYTE1)	Check sum (BYTE2) : Command + Data

1.	Channel Change		0x64	0x?? :Current channel	(0x64 + Channel)
2.	RTX Mode Selection		0x61	R(0x72) : Rx mode T(0x74) : TX mode	(0x61+0x72) (0x61+ 0x74)
3.	Scan Mode	From PC To Radio	0x62	F(0x46) : Scan Stop S(0x73) : Scan Start O(0x4F) : Scan Delete	(0x62+ 0x46) (0x62+ 0x73) (0x62+ 0x4F)
		From Radio To Pc	0x66	0x00 : 1 Channel 0x01 : 2 Channel 0x02 : 3 Channel ⋮ 0x0f : 16 Channel	0x66 + 0x00 0x66 + 0x01 ⋮ *Only for Unmute Channel, Correct Call Channel
		Error Message	0x65	● It occurs when Scan Delete command comes except Busy/Correct Call ● It occurs when PTT key is pushed except Busy/Correct Call. ● It occurs when channel change command exists during Scanning.	
4.	GPS mode	Control of GPS Power	0x6a	0x00 : GPS Power Off 0x01 : GPS Power On	(0x6a + 0x00) (0x6a + 0x01)
		Control of GPS Data	0x63	0x00 : GPS Data Disable 0x01 : Release GPS Data to DB-15 0x02 : Release GPS Data to Modem	(0x63 + 0x00) (0x63 + 0x01) (0x63 + 0x02)
5.	Modem test mode		0x75	0x78 : Enable test data 0x79 : Disable test data	(0x75 + 0x78) (0x75 + 0x79)
6.	Modem alignment mode	GMSK	0x7a	0x00 : Disable 0x01 : Enable	(0x7a + 0x00) (0x7a + 0x01)
		FFSK	0x7c	0x00 : Disable 0x01 : Enable Mark data	(0x7c + 0x00) (0x7c + 0x01)
			0x7e	0x00 : Disable 0x01 : Enable Space data	(0x7e + 0x00) (0x7e + 0x01)

Table 3.3. Composition of input serial commands

Receiving Command & Data

	Mode	Command (BYTE0)	Data (BYTE1)	Check sum (BYTE2) : Command + Data
1	Process Complete	0xaa	ACK	N/A
	Commands	0x55	NACK	N/A

Table 3.4. Composition of response commands

Note)

This command is return signal for receiving command.

If Byte2 and sum of Byte0 and Byte1 among received data are same, Radio would send ACK data and execute command. If not, Radio sends Nack data.

User would go into next step if receives ACK data. If receiving Nack data, user should send command again.

example)   If user changes from 1st Channel to 2nd Channel,

user should send Channel Change Command (0x64,0x02 , (0x64 + 0x2)) to Radio.

If Byte2 and sum of Byte0 and Byte1 among received data are same, Radio sends ACK data to user and goes to 2nd channel. If not, radio would send Nack data.

Status indicators and audible alert tones

SD-160 series data radio has a sophisticated microprocessor control which provides a range of LED displays. LED displays operation mode, current status of radio, warning, and etc. Moreover, if you connect the Speaker filtered OUT (Pin 9 of DB-15 connector) to an external speaker, you can hear audible tones under the following conditions:

• Attempt to transmit on a channel which is already in use when busy channel lockout option
   has been programmed
• Transmission time has exceeded time-out timer programmed length
• The other group or people has finished transmission using repeater

See the status indicators and audible alert tones chart (Table 2.5.) for full specification.

STATUS	DESCRIPTION	LED COLOR	AUDIBLE TONE
NORMAL	POWER ON	-	
	Busy Channel	Yellow	
	Correct Call	Green	
	Transmit	Yellow	
	Transmit Not Allowed		
SCANNING	Normal Scan Mode	Green LED Flash	
	Scan Delete	one time Red LED	
	Scan All Delete	Two times Red LED	
WARNING	Busy Channel lockout	two times Green LED	Single Beep Tone
	Time out Time	one time Green LED	
	Before 5S T-O-T	one time Green LED	Single Beep Tone
	EEPROM Error	one time Yellow LED	
	Unlock	Four times Yellow LED	
	Communication error with Modem MCU	Green LED flash	
	Transmit Hang on time	-	Single Beep Tone
	Under channel programmed sub-audio SQ, when transmission is tried by input of FSK or GMSK data.	Two times Green LED	
PROGRAM	Read Mode	Red LED flash	
	Write Mode	Green LED flash	
AUTO TEST		Yellow	
SQUELCH PROGRAM MODE	Open Squelch Mode	three times Green LED	
	Close Squelch Mode	Two times Green LED	
	Save Squelch Mode	One time Green LED	
	Init Data Load	one time Green LED	

Table 3.5. status indicators and audible alert tones

Modem Option for data communication

ACC-513 and ACC-514 are new kinds of internal option-modems, which are applied to SD-160 series to increase capability for data application. The goal of internal modem is to improve the efficiency for data transmission and provide maximum flexibility for user application. In former case, the most obvious method of increasing the efficiency is to maximize the data signaling speed in the limited channel bandwidth. But, FSK, called direct FM modulation, has very wide transmission bandwidth requirement. To solve this problem, Maxon supplies GMSK(Gaussian Filtered Minimum Shift Keying) internal option-board. In latter case, to improve quality of service, some of service provider (or user) want to apply new radio to their existing system without additional investment to establish new system even if it's audio system. But, data application can't be directly applied in audio system because of its spectra characteristic. Generally, spectra of data have wider bandwidth than audio. So, direct application of data is not matched with audio system and its application. For instance, if sub-audio(Tone) SQ system is applied to data application, its frequency spectra conflict with that of sub-audio. Moreover, if inputted data is filtered by audio filter circuit to avoid this problem, some of that will be broken. Therefore, to get over these problems and provide maximum flexibility, Maxon prepares FFSK(Fast Frequency Shift Keying) internal option-board.

Our internal modem option boards consist of Slave MCU, Modem IC, and extra circuitry. These option-boards directly communicate with DTE (Data Terminal Equipment) to send and receive the meaningful data through the DB-15 connector on digital board of SD-160. These are designed to accept RS232 serial data format and also capable of high speed wireless data-transmission between two or more devices. More detail information for modem option boards is given in technical manual for ACC-513/514. Moreover, dealer will help you define a TX On/Off Delay time, RX On Delay time, Baud Rate, Modem Enabled, Modem Baud Rate, Data flow control, and Test Mode.

Table for modem speed

Channel Space	DTE Baud Rate	Modem Baud Rate
Narrow (12.5KHz)	1200	1200
	2400	2400
Standard (25KHz)	1200	1200
	2400	2400
	4800	4800

Table 3.6. Available Baud rate for FFSK modem

Channel Space	DTE Baud Rate	Modem Baud Rate
Narrow (12.5KHz)	4800	4800
Standard (25KHz)	4800	4800
	9600	9600

Table 3.7. Available Baud rate for GMSK modem

GPS option board

As one of methods to satisfy various requests for user application, SD-160 basically supports GPS data handling. That may help your implementation for system related to GPS. Nevertheless, if it's not enough for each your application, received position data from GPS module placed in SD-160 can be reprocessed by your own application. ACC-515 is GPS module for SD-160, which releases some of 11 different output data according to NMEA-0183 format. Moreover, it can be also selected by user, but it should be processed by user's application. Received data from ACC-515 will be released via DB-15 connector of SD-160 or/and transmitted to other system through installed modem. More detailed information for GPS option board is given in technical manual for ACC-515.

4. THEORY OF OPERATION

4.1. INTRODUCTION

The VHF and UHF radios comprise of two PCBs (RF and digital PCB). These boards are connected by an 18 pin female and male connector. The digital board which controls the radio and data receiving and sending is interfaced with external data equipment through the 15 pin d-sub female (DB-15) connector.

4.2. DIGITAL CIRCUITS

The Digital circuit contains the CPU, the channel select switch, and associated digital circuits.

TX-SIGNAL CIRCUIT

There are two signal paths in the Tx-signal circuit. One is FSK data signal path and the other is the audio signal path. The FSK data signal from Pin 1 of DB-15 connector (CON401) goes through IC406-C. The signal is amplified by IC404-C and then its amplitude is limited by IC404-D. After that, this signal is filtered by an 8'th order low pass filter (IC405) in order to reduce the required transmission bandwidth. The first two stages of the 8'th order LPF consist of a Gaussian filter for the improvement of ramp function response and the last two stages use a Butterworth filter for attenuation. The output of the LPF is then fed to the RF board for TX modulation.

Audio signal, from Pin 7 of DB-15 connector is fed into the 300Hz High pass filter(IC408) through the IC406-B and IC409. The HPF removes sub-audible voice products for application of Sub-audio(Tone) squelch system (CTCSS, DCS) and then the output from IC408 is fed into IC404-A&B with associated parts to form a mic amplifier and pre-emphasis circuit. After that, the pre-emphasized Tx-audio signal is inputted to the RF board for Tx modulation through the FSK data signal path.

RX-SIGNAL CIRCUIT

The Rx-signal circuit also has two signal paths. One is the data signal path and the other is the audio signal path. The Rx signal comes from the RF board, which is connected with pin 10 of CON405. Data signals are switched in IC406-D by a Busy signal which is activated when the radio receives a valid RF signal, and is filtered by IC416-A and then its amplitude level is

adjusted (amplified) by IC416-B. The amplitude-adjusted signal goes to pin 2 of the DB-15 connector (CON401).

Audio signals are inputted to the 300Hz High pass filter (IC408) to eliminate sub-audible voice products through IC409. The output of the HPF is switched by IC406-A and de-emphasized by resister R471 and C452. After that, its level is adjusted by RV401 and then that is amplified by IC412 (LM386 : Audio amplifier). The amplified signal goes to pin 9 of CON401 (DB-15).

ANALOG SWITCH

IC409 (MC14053B) is a digitally controlled analog switch which internally consists of three single pole, double throw switches. By placing a high (5V) or low (0V) on the control lines which consists of A, B and C. A controls the X ports, B controls the Y ports and C controls the Z ports. Example: A high on control A would connect X to X1. A low on control A would connect X to X0.

HIGH PASS FILTER

The 300Hz high pass filter is an 8-pole 1dB Chebeyshev active filter that comprises of IC410 and associated components. Received audio is passed to IC408 from Pin 4 of IC409 where sub-audible tones below 300Hz are removed. Tx (Mic) audio is also fed into IC408 via IC 409 (Pin 4) where sub-audible voice products below 300Hz are also removed.

CTCSS/DCS DECODE CIRCUITS

Discriminated audio from Pin 9 of IC6 is fed into IC411-B and associated parts which are the first 2 poles are part of a 6th order 250 Hz Chebeyshev low pass filter. The output from pin 1 (IC411-B) is fed into IC409 (Pin 2) and outputs to pin 15 (IC409). The signal is then fed to Pin 8 (IC410) which is a 6th order low pass Butterworth switched capacitor filter. The output from the Butterworth filter (Pin 3 of IC410) is then fed to the remaining second 4 poles part of the 6th order Chebeyshev filter, which consist of IC411-D and one of the two internal operational amplifiers of IC410 (MSNBLPS) along with associated components. Both the Chebeyshev and the Butterworth combines for a 4dB ripple low pass filter when programmed for 250 Hz. The output of IC411-D (Pin 14) is fed into the remaining internal operational amplifier of IC410 (MSNBLPS) which forms the squaring circuit for the signal decode. The signal is out from Pin 2 of IC411 (MSNBLPS) and fed into IC401 (MCU) where it is compared whether that is matched with preprogrammed data or not. If matched,   valid data is decoded, shown by a green L.E.D. on the top panel of the radio, and audio is released through pin 9 of DB-15 Connector. If

unmatched, the busy L.E.D. (Yellow) would be shown.

CTCSS/DCS ENCODE CIRCUITS

During TX encode, the tone squelch digital signal is produced as a 3-bit parallel word at Pins 33, 34, and 35 of the micro controller (IC401). The 3-bit digital signal is converted to an analog signal by resistors R481, 482 and 483. The analog signal is fed into Pin 1of IC409 and out on Pin 15 (IC409) and then fed into Pin 8 of IC410 (6th order Butterworth clock tuned low pass filter). The filtered encode output from Pin 3 (IC410) is fed to IC411-A and RV402 (sub-audible gain control), the output of IC411-A is then fed to the audio mixer circuit of the RF board.

TWO TONE DECODE CIRCUITS

Two tone uses frequency with audio. Discriminated audio from the RF board is inputted to the comparator (two tone decoder : IC403-B) which forms the squaring circuit for the decode signal. The signal is output from Pin 7 of IC403-B and fed into IC401 (MCU) where it is compared whether it is matched with preprogrammed data or not. If matched valid data is decoded, which is shown by a green L.E.D. on the top panel of the radio and audio is released through pin 9 of the DB-15 Connector. If unmatched, the busy L.E.D. (Yellow) is shown.

RSSI DETECTOR

From the RF board, the RSSI (Received Signal Strength Indicator) signal flows to Pin 31 of IC401(MCU) through R513. Micro controller unit (IC401) detects received signal level using the inner 8-bit ADC(Analog to Digital Converter). The output of ADC is compared with the programmed RSSI level. If the MCU detects existence of a received signal through these comparison a yellow L.E.D. is shown on the top panel of the radio.

EEPROM

RX / TX channel and RSSI detection level as well as other data from the programmer are stored in the EEPROM. The stored data is retained without power supply. This is a non-volatile memory and re-programmable. IC402 is an EEPROM with 4096 (8 x 512) capacity and data is written and read serially.

CHANNEL SELECTOR

One of 16 channels may be selected using the Dip Switch (SW401) and serial commands. The hardware selector, SW401 encodes the channel number, selected into 4-bit binary code. The binary code plus one equals the channel number. The binary code is decoded by the CPU, which enables the appropriate RX or TX frequency and associated data to be selected from the EEPROM. External serial commands which come from Pin 8 of the DB-15 Connector (CON401) are fed into Pin 41 of IC401 (MCU). The micro controller uses UART (Universal asynchronous receiver transceiver) for serial communication and decodes serial commands in order to control the radio.

DC TO DC CONVERTER

The main DC power is supplied to the switched mode DC to DC converter . The DC to DC converter regulates the various input power supply voltage and outputs a constant voltage of 6.5 Volts (SD-161, SD-164) or 7.5 Volts (SD-171, SD-174). It is a source for all of the RF and digital circuits. The DC to DC converter is formed by IC801, Q801, Q802, L801, R804 and voltage divider(R805, R806, R802). IC801 is a PWM controller that controls pulse width of the switching pulse output. Various input voltage appears as various output voltage of voltage divider. IC801 detects the voltage difference between inner reference voltage and the voltage divider output controls the switching pulse width in proportion to its difference. Wanted output voltage is decided by product of input voltage and duty ratio of switching pulse. As the switching pulses, Q801and Q802 switch the input DC of various supply voltages and generate the constant DC of supply voltage. IC801 controls maximum current of DC to DC converter by current detection through voltage drop of R804.

4.3. RF CIRCUITS

4.3.1. PLL SYNTHESIZER

12.8 MHz TCXO

The TCXO contains the 3-stage thermistor network compensation and crystal oscillator and modulation ports. Its compensation is ±5 PPM or less from -30c to +60c.

PLL IC DUAL MODULE PRESCALER

Input frequency of 12.8 MHz to pin 1 of IC2 MB15A02 (or MB15E03SL) is divided into 6.25 kHz or 5 kHz by the reference counter and then supplied to the comparator. RF signal input from the VCO is divided to 1/64 at the 64/65 modulus prescaler in IC2, divided by A and N counter in IC2 to determine frequency steps, and then supplied to the comparator. PLL comparison frequency is 6.25/5 kHz, so its minimum programmable frequency step is 6.25/5 kHz. The A and N counter is programmed to obtain the desired frequency by serial data in the CPU. In the comparator, the phase difference between reference and VCO signal is compared. When the phase of the reference frequency is leading, ΦP is the output, but when the VCO frequency is leading, ΦR is the output. When ΦP= ΦR, phase detector out is a very small pulse.

EXTERNAL CHARGE PUMP

This is used to increase dynamic range of VCO. Voltage range is decided by the supply voltage of the charge pump and the DC to DC converter which supplies that voltage. 0-12v is necessary for controlling the VCO. In addition the radio adopts a current mode charge pump to take direct control of such parameters as charge pump voltage swing, current magnitude, TRI-STATE leakage, and temperature compensation. ΦP, ΦR logic signals are converted into current pulses to enable either charging or discharging of the loop filter components to control the output frequency of the PLL.

REFERENCE FREQUENCY LPF

The Loop Filter contains R9, C1 and C2. LPF settling time is 12mS with 1 kHz frequency. This also reduces the residual side-band noise for the best signal-to-noise ratio.

DC TO DC CONVERTER

The DC to DC converter converts 5v to 14-16v to supply the necessary voltage for wide range frequency in the VCO.

VCO

The radio adopts a two VCO system for RX and TX in order to maximize each performance. The TX and RX VCO generates RF carrier and local frequency and each VCO is switched by a TX/RX power source. It is configured as a Colpitts oscillator and connected to the buffer as a cascade, the bias circuit is a cascade configuration to save power. The varicap diode D201/D301are low-resistance elements and have different capacitance for reverse bias voltage. Using the change of reverse bias voltage (2 ~ 11V), the wanted frequency for each channel can be obtained. L203/L303 are resonant coils and C208/C308 are used to change the control voltage by the tuning core. D202 modulation diode modulates the audio signal. C204 compensates the non-linearity of the VCO due to the modulation diode and maintains a constant modulation regardless of frequency.

4.3.2. TRANSMITTER

The transmitter consists of:
1. Buffer
2. P.A. Module
3. Low Pass Filter
4. Antenna Switch
5. A.C.C. Circuits

BUFFER

VCO output level is -4dBm and amplified to +10dBm. The buffer consists of Q9 and Q10 for reverse isolation and gain.

P.A. BLOCK

The P.A. Block uses a three stage amplifier and contains Q501, Q502, and Q503. The SD-171, SD-174 have different amplifiers applied compared to the SD-161, SD-164 because different of a output power specification. Q501 amplifies the TX signal from +10 dBm to 100mW and Q502

amplifies to 0.5W and Q503 amplifies to 3W(SD-161, SD-164) or 6W(SD-171, SD-174) and then matched to 50 Ohms using the L.C. network or strip line, thereby reducing the harmonics by -30 dB.

LOW PASS FILTER

L7, L8, L9, C36, C37, C38 and C39 are the 7th order Chebyshev low pass filter. Unwanted harmonics are reduced by -70 dBc.

ANTENNA SWITCH

When transmitting, the diodes D3 and D5 are forward biased to enable to make an RF path to the antenna. D5 is shorted to ground to block the RF signal to the front-end. In receive, the diodes, D3 and D5, are reverse biased to pass the signal from the antenna through L10 and C61 to the front-end without signal loss.

AUTOMATIC CURRENT CONTROL (ACC) CIRCUITS

The ACC circuit consists of R63, variable resistor RV4, IC5(B) and transistors Q11 and Q12. The supplied current to the P.A. block is monitored by the voltage difference on R63 (0.1 Ohm). If the current varies by RF power output or other reasons, it produces a voltage difference on R63 and then IC5A outputs a bias voltage to Q19 in proportion to that difference. The adjusted value of Q15 output by RV4 is compared with the reference voltage in IC5B and then a differential voltage at the output of IC5B is passed to Q12 and Q11 which controls the bias voltage of the P.A. module to maintain a constant power output to the antenna. RV4 is used to adjust the RF power level.

4.3.3. RECEIVER

FRONT-END

The front-end block consist of two band pass filters and a low noise amplifier (LNA). The Band pass filter is used for elimination of image frequency and impedance matching and the LNA is used to amplify weak RF signals without any increase of noise. The received signal comes from the antenna, then is input into a band pass filter of the front-end block with C601through C610, L601 through L604 at UHF and C622 through C608, L607 through L604 at VHF, and is coupled

to the base of Q601 serving as an RF amplifier. Diode D601 serves as protection from static RF overload from nearby transmitters. The output of Q601 is then coupled to a second band pass filter consisting of C611 through C623 and L606 through L609 at UHF and C607 through C601, L603 through L601 at VHF. The output of the front-end block is then coupled to the double balanced diode mixer D6. The Front-end block is pre-tuned at factory and no more adjustment is required

FIRST MIXER

The Double balanced diode mixer consists of D9, T1 and T2 and generates the 45.1 MHz intermediate frequency output from RF and local frequency. The filtered frequency from the front-end module is coupled to T1and the local frequency from RX VCO is coupled to T2. The 45.1 MHz IF output is matched with the input of the 2-pole monolithic filter by L12, L13, C65 and C66. The crystal filter provides a bandwidth of ±7.5 kHz at the operating frequency for a high degree of spurious and inter-modulation protection. The IF filter provides additional attenuation for the image frequency of the second mixer. The output impedance of the filter is matched with the base of the post amplifier Q16 by C67 and C70.

SECOND OSCILLATOR MIXER LIMITER AND FM DETECTOR

The output of the post amplifier, Q16, is coupled via C71 to the input of IC6 (TA31136FN). IC6 is a monolithic single conversion FM transceiver, containing a mixer, the second local oscillator, limiter and quadrature detector. Crystal X1, 44.645 MHz, is used to provide resultant 455kHz signal from the output of the second mixer. The mixer output is then routed to CF1 (455F) or CF2(455HT). These ceramic filters provide the adjacent channel selectivity of 25 kHz or 12.5 kHz bandwidth. After that, filtered signal is fed to the limiter and then audio is derived from the limited signal at the quadrature detector.

RSSI (RECEIVER SIGNAL STRENGTH INDICATOR)

The RSSI signal is output from IC6 on pin 12. The output is an analog DC voltage and varied as much as the received signal strength. The signal which is filtered unwanted noise by the low pass filter (IC4-B) in the RSSI signal is used for squelch system. Also, this signal is compensated with a thermistor (TH3) at temperature.

4.4. ACC-513 (GMSK MODEM CIRCUITS)

MAXON GMSK option modem boards uses a CMX589A IC to generate and decode GMSK signals. The modem fully supports auto mode, dump mode (RTS mode) and extended dump mode operation. This section describes only the operation of circuit. A special characteristic of GMSK modems is that they can use a high data throughput in limited channel space.

TX-SIGNAL CIRCUIT

The transmit data (TXD) signal from Pin 1 of CON2 is level-shifted to TTL levels by Q1 and then applied to the Pin 45(UART port) of U1 (slave MCU). The slave micro controller stores received data in the memory buffer and releases stored data to U2 (CMX589A) by the transmit clock pulses of the CMX569A. Random timed asynchronous input from the external data terminal is synchronized by the MCU and then synchronous information is sent into U2 (CMX589A), which filters the data stream through a Gaussian filter in order to reduce transmission bandwidth. The cut-off frequency of the Gaussian filter is decided by a transmit bit ratio. Output signal of the GMSK modem is fed into a RC network formed by R12 and C10 that is positioned to reduce high-frequency noise. To adjust the cut-off frequency of the RC network, R22and U6, is used. The filtered signal is inputted to the gain amplifier and the 3rd order low pass filter (U5) through a buffer. The first stage of U5 is used as a buffer and the second stage is a gain amplifier to supply sufficient amplitude level for modulation and the third stage comprises of an additional 3rd order Butterworth LPF to guarantee maximum attenuation of high-frequency noise before modulation. The output of the LPF is then fed to the RF board for TX modulation.

RX-SIGNAL CIRCUIT

Discriminated signal from the RF board is amplified by IC416-C in the digital board to have a proper level for data detection. The amplified signal is fed into the GMSK modem option board and then inputted to Pin 11 of U2(CMX589A) through Pin 14 of CON1. The CMX589A detects synchronous data and recovers receive clock and then each data and clock is sent into U1 (slave MCU) for conversion back into asynchronous data. This information is then sent out to the data terminal through the U3 (MAX234).

LEVEL CONVERTER

The MAX234 level converter (U3) and peripheral circuitry with Q1, Q2 convert TTL input/output levels to the nominal +/- 10V, RS-232 input/output levels. If dump or extended dump mode is used an additional handshake   signal is required. The PTT, Carrier Detect and Busy signal are used as handshake signals. The PTT signal level is shifted from RS-232 to TTL level and Carrier Detect and Busy signal is shifted from TTL to RS-232 level.

4.5. ACC-514 (FFSK MODEM CIRCUITS)

MAXON FFSK option modem boards uses a CMX469 IC to generate and decode FFSK signals. The modem fully supports auto mode, dump mode (RTS mode) and extended dump mode operation. This section describes only the operation of the circuit. A special characteristic of FFSK modems is that they can apply the sub-audio (tone) squelch system (CTCSS, DCS) to data communication.

TX-SIGNAL CIRCUIT

The transmit data (TXD) signal comes from Pin 1 of CON2 that is level shifted to the TTL levels by Q1 and then it's applied to the Pin 45(UART port) of U1 (slave MCU). The slave micro controller unit stores received data in the memory buffer and releases stored data to U2 (CMX469A) by transmit clock pulses of the CMX469A. Random timed asynchronous input from the external data terminal is synchronized by the MCU and synchronous information is sent to U2 (CMX469A), which converts the logic 0 and 1 into a sine-wave signal with two different frequencies. At this moment, frequency is decided by a transmit bit ratio. The converted signal is fed into a gain amplifier and 5th order low pass filter (U5). The first stage of U5 is used as a gain amplifier to supply sufficient amplitude level for modulation and the next two stages comprise of a 5th order Butterworth LPF to guarantee maximum attenuation of high-frequency noise before the modulation. The output of the LPF is then fed to the RF board for TX modulation.

RX-SIGNAL CIRCUIT

Discriminated signal from the RF board is amplified by IC416-C in the digital board to have proper level for data detection. The amplified signal is fed into the FFSK modem option board and then inputted to Pin 16 of U2(CMX469A) through Pin 14 of CON1. The CMX469A detects synchronous data and recovers receive clock and then each data and clock is sent into U1 (slave MCU) for conversion back into asynchronous data. This information is then sent out to the data terminal through U3 (MAX234).

LEVEL CONVERTER

The MAX234 level converter (U3) and peripheral circuitry with Q1, Q2 convert TTL input/output levels to the nominal +/- 10V,RS-232 input/output levels. If dump or extended dump mode is used an additional handshake signal is required. PTT, Carrier Detect and Busy signal are used as handshake signals. The PTT signal level is shifted from RS-232 to TTL level and Carrier Detect and Busy signal are shifted from TTL to RS-232 level.

4.6. ACC-515 (GPS INTERFACE CIRCUITS)

The radio series outputs an industry standard NMEA GPS sentence on the DB-15 connector when the GPS option board is installed. The GPS module releases NMEA-0183 format data every 1sec. To prevent unnecessary data from the GPS engine, the GPS output is controlled by Pin 6 of J1 (GPS_OUT), and besides, power save mode can be executed by Pin 4 of J1 (PSAVE). Even if GPS engine enters power save mode, Back-up voltage should be supplied to Pin 3 of J3 (B+) in order to use warm start at wake-up. The GPS option board and GPS antenna require a different supply voltage level compared with the main supply voltage of the radio. The GPS interface circuit supplies a regulated 3.3V power to the GPS board.

5. MAINTENANCE AND REPAIR

GENERAL

Any repair or adjustment should only be made by or under the supervision of a qualified radio service technician. When removing or fitting, use the Exploded View and Parts List in conjunction with the following procedures:

Important: *Before disassembling and reassembling the radio, wear a conduction wrist strap to prevent any components on its main board from being damaged by electrostatic discharge.*

SEPARATING UPPER AND BOTTOM COVER

1. Unfasten the four mounting screws
   located on the bottom cover of
   the radio.
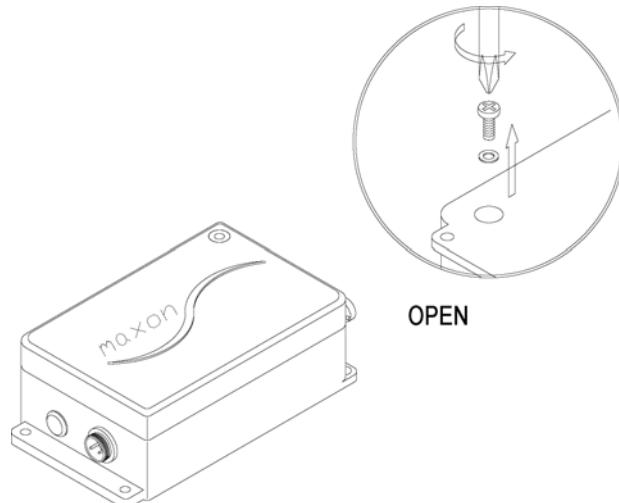
Figure 5.1. Loosing the four mounting screws

2. Open slowly the upper cover from the side of
   power connector.
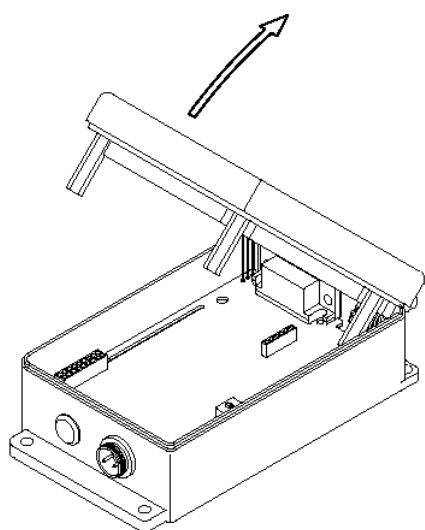
Fig 5.2. Opening the upper cover

3. Separate upper cover from bottom
   cover by removing RF cable of ANT.
   connector.

SOLDERING
IRON
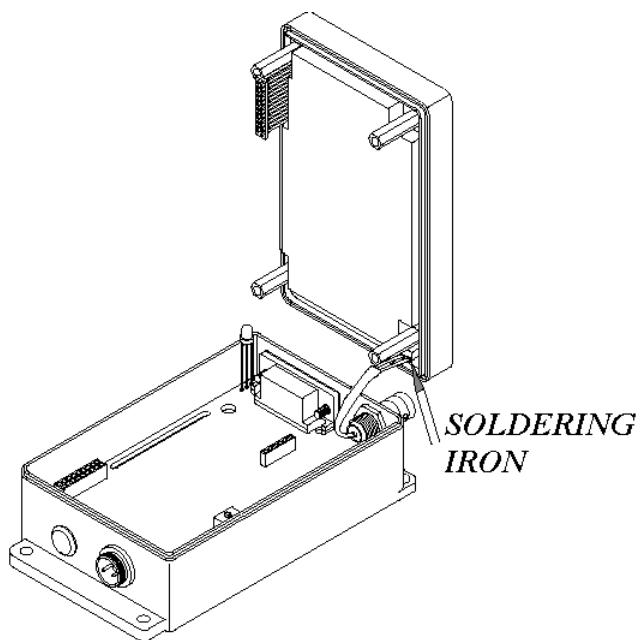
Fig 5.3. Separating upper and bottom cover

REMOVING & REPLACING THE RF BOARD
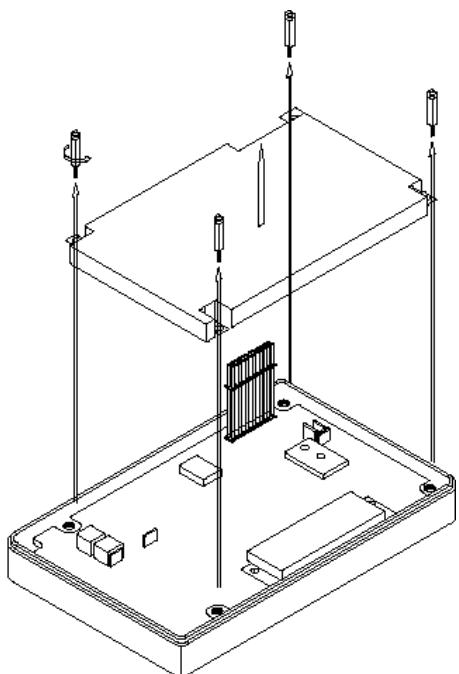
1. Unscrew the four upholding screws from
   the RF board.

2. Remove the shield plate.

Fig 5.4. Removing shield plate

3. Unscrew the two mounting screws located
   on shield can for PA module.

4. Replace the RF board assembly.
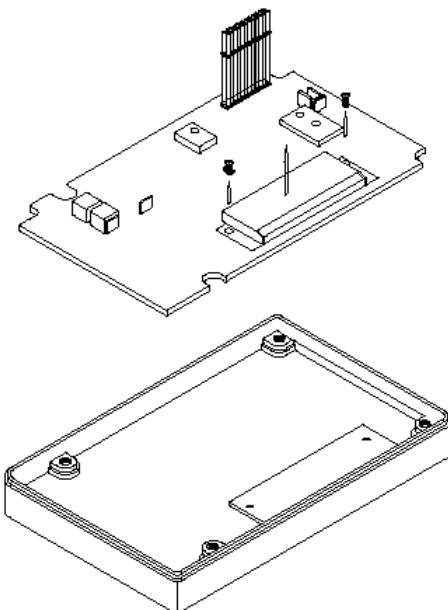
Fig 5.5. Replacing RF board assembly

REMOVING & REPLACING THE DIGITAL BOARD
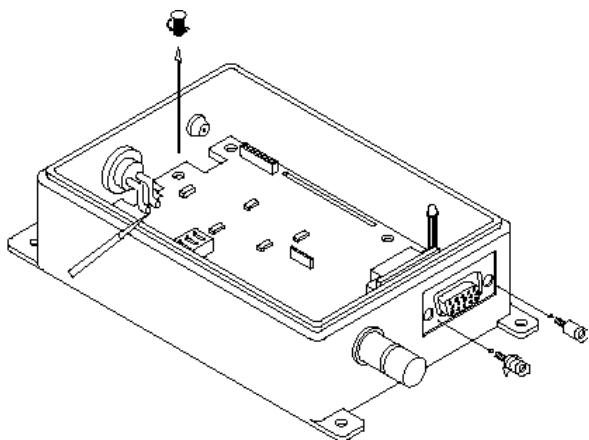
1. Unfasten the two hexagonal screws from
   DB-15 connector.

2. Loosen the mounting screw located on
   the left side of digital board

3. Remove two wires between power
   connector and digital board.

Fig 5.6. Removing screws and wires from digital B'D

4. Pull the digital board out of bottom cover.

5. Replace the digital board assembly.
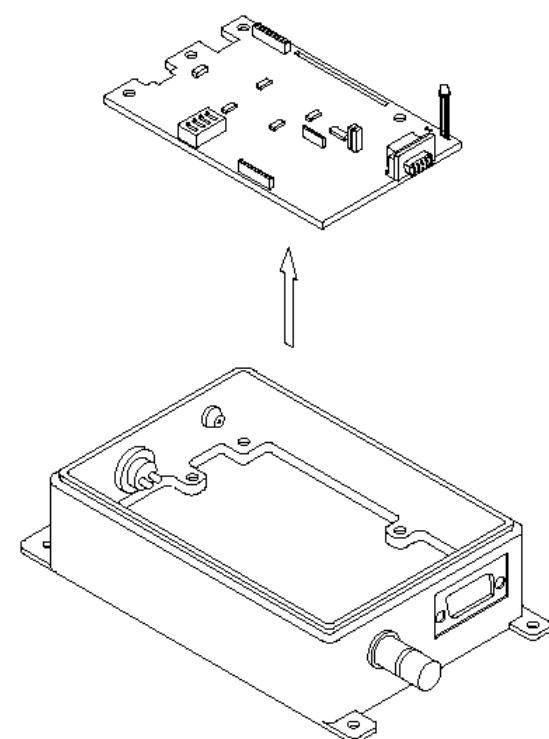
Fig 5.7. Replacing digital board assembly

6. COMPONENT REPLACEMENT

Surface Mount Components

Surface mount components should always be replaced using a temperature controlled soldering system. The soldering tools may be either a temperature controlled soldering iron or a temperature controlled hot-air soldering station. A hot-air system is recommended for the removal of components on these boards. With either soldering system, a temperature of 700° F (371° C) should be maintained. The following procedures outline the removal and replacement of surface mount components. If a hot-air soldering system is employed, see the manufacturer's operating instructions for detailed information on the use of your system.

- **CAUTION:** Avoid applying heat to the body of any surface mount component using standard soldering methods. Heat should be applied only to the metalized terminals of the components. Hot-air systems do not damage the components since the heat is quickly and evenly distributed to the external surface of the component.

- **CAUTION:** The CMOS Integrated Circuit devices used in this equipment can be destroyed by static discharges. Before handling one of these devices, service technicians should discharge themselves by touching the case of a bench test instrument that has a 3-prong power cord connected to an outlet with a known good earth ground. When soldering or desoldering a CMOS device, the soldering equipment should have a known good earth ground.

Surface Mount Removal

1. Grip the component with tweezers or small needle nose pliers.
2. Alternately heat the metalized terminal ends of the surface mount component with the soldering iron. If a hot-air system is used, direct the heat to the terminals of the component. Use extreme care with the soldering equipment to prevent damage to the printed circuit board (PCB) and the surrounding components.
3. When the solder on all terminals is liquefied, gently remove the component. Excessive force may cause the PCB pads to separate from the board if all solder is not completely liquefied.
4. It may be necessary to remove excess solder using a vacuum de-soldering tool or Solder wick. Again, use great care when de-soldering or soldering on the printed circuit boards. It may also be necessary to remove the epoxy adhesive that was under the surface mount component and any flux on the printed circuit board.

Surface Mount Component Replacement

1. "Tin" one terminal end of the new component and the corresponding pad of the PCB. Use as little solder as possible.

2. Place the component on the PCB pads, observing proper polarity for capacitors, diodes, transistors, etc.

3. Simultaneously touch the "tinned" terminal end and the "tinned" pad with the soldering iron. Slightly press the component down on the board as the solder liquefies. Solder all terminals, allowing the component time to cool between each application of heat. Do not apply heat for an excessive length of time and do not use excessive solder. With a hot-air system, apply hot air until all "tinned" areas are melted and the component is seated in place. It may be necessary to slightly press the component down on the board. Touch up the soldered connections with a standard soldering iron if needed. Do not use excessive solder.

● **CAUTION:** Some chemicals may damage the internal and external plastic parts of the radio.

4. Allow the component and the board to cool and then remove all flux from the area using alcohol or another approved flux remover.

Surface Mounted Integrated Circuit Replacement

Soldering and de-soldering techniques of the surface mounted IC's are similar to the above outlined procedures for the surface mounted chip components. Use extreme care and observe static precautions when removing or replacing the defective (or suspect) IC's. This will prevent any damage to the printed circuit board or the surrounding circuitry.

● Note: The hot-air soldering system is the best method of replacing surface mount IC's. The IC's can easily be removed and installed using the hot-air system. See the manufacturer's instructions for complete details on tip selection and other operating instructions unique to your system. If a hot-air system is not available, the service technician may wish to clip the pins near the body of the defective IC and remove it. The pins can then be removed from the PCB with a standard soldering iron and tweezers, and the new IC installed following the Surface Mount Component Replacement procedures. It may not be necessary to "tin" all (or any) of the IC pins before the installation process.

7. ALIGNMENT PROCEDURE

The UHF/VHF Transceivers have broadband tuning range, UHF (450-490 MHz) and VHF (148-174 MHz) should require no special alignment, unless repairs are performed on the transceiver portion. Should repairs be necessary, use the "Test Equipment Diagram" and the "Alignment Points Diagram", in conjunction with the following procedures:

● Extender Board (ACC-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 Board Assembly.
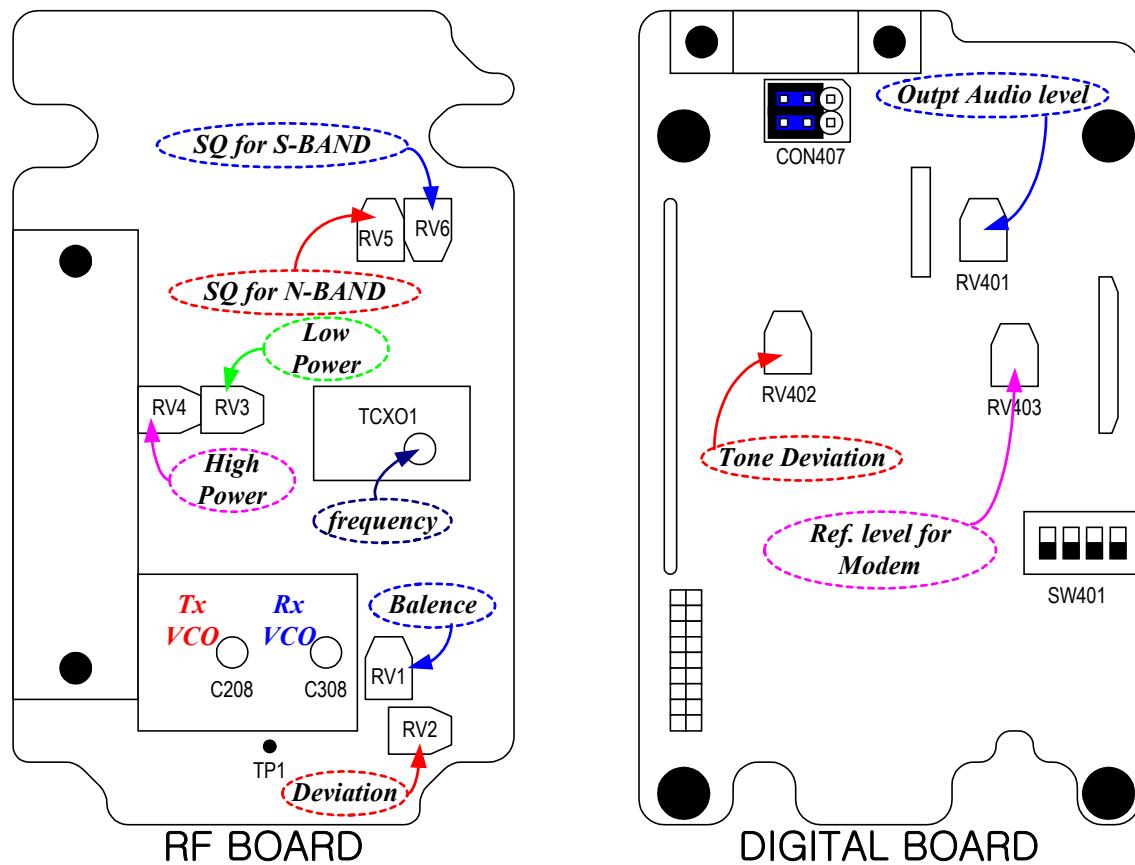
Figure 7.1. Alignment Points Diagram

7.1. RECEIVER

RX VCO

RX VCO is pre-tuned at the factory and adjustment should not be 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), 174MHz(VHF) and verify 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), 148(VHF) and verify that the VCO voltage is above **2.0 Volts**. Adjust C308 to **2.0 Volts**.

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

AUDIO OUTPUT LEVEL Adjustment

1. Select a receiver channel that is programmed for Standard band (25kHz) operation.

2. Prepare standard test signal as follows.

   a. Set the RF signal generator to the receiver frequency.

   b. And then set the AF modulation signal to 1 kHz at 3kH deviation.

   c. 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.

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. Verify 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).

7.2. TRANSMITTER

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

TCXO

Set the channel selector to the mid-range frequency 470 MHz, adjust TCXO1 for a reading of 470MHz ±200Hz (155 MHz VHF models).

TX VCO

TX VCO is pre-tuned at the 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), 174MHz(VHF) key the transmitter and verify 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), 148(VHF) key the transmitter and verify that the VCO voltage is above **1.8 Volts**. Adjust C208 to **1.8 Volts**.

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

CTCSS, DCS & TX Deviation and Balance Adjustment

1. a. Set the unit to a mid-frequency range and a CTCSS of 67Hz. Activate PTT and adjust RV402 for desired CTCSS tone deviation.

   b. Switch to a channel with the same frequency and CTCSS of 250.3Hz. Activate 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.

APC

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

In case alignment for SD-160 series:

1. Adjust RV4 and set the power at the point of **1.6W**.

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

※ Required alignment point for each radio and proper RF power output when radio is assembled

① Adjust RV4 for High Power (2W, SD-161, SD-164), (5W, SD-171, SD-174)

② Adjust RV3 for Low Power (1W) (SD-171, SD-174 only)

7.3. SQUELCH ADJUSTMENT

Before squelch adjustment a SQ type should be selected. Squelch level to open or close (un-mute or mute) is set up by not only software control but also hardware control and programmed by the system option of the ACC-916 programming software.

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 just 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 just 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.

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

Default setting of squelch level for all radios are 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 an RF signal generator. Radio communication test equipment is recommended.

1. Connect DB-9 and DB-15 connector of ACC-2016 to the PC and radio.

2. Hook up the power socket of the radio to the 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.

7.4. TEST EQUIPMENT SETUP
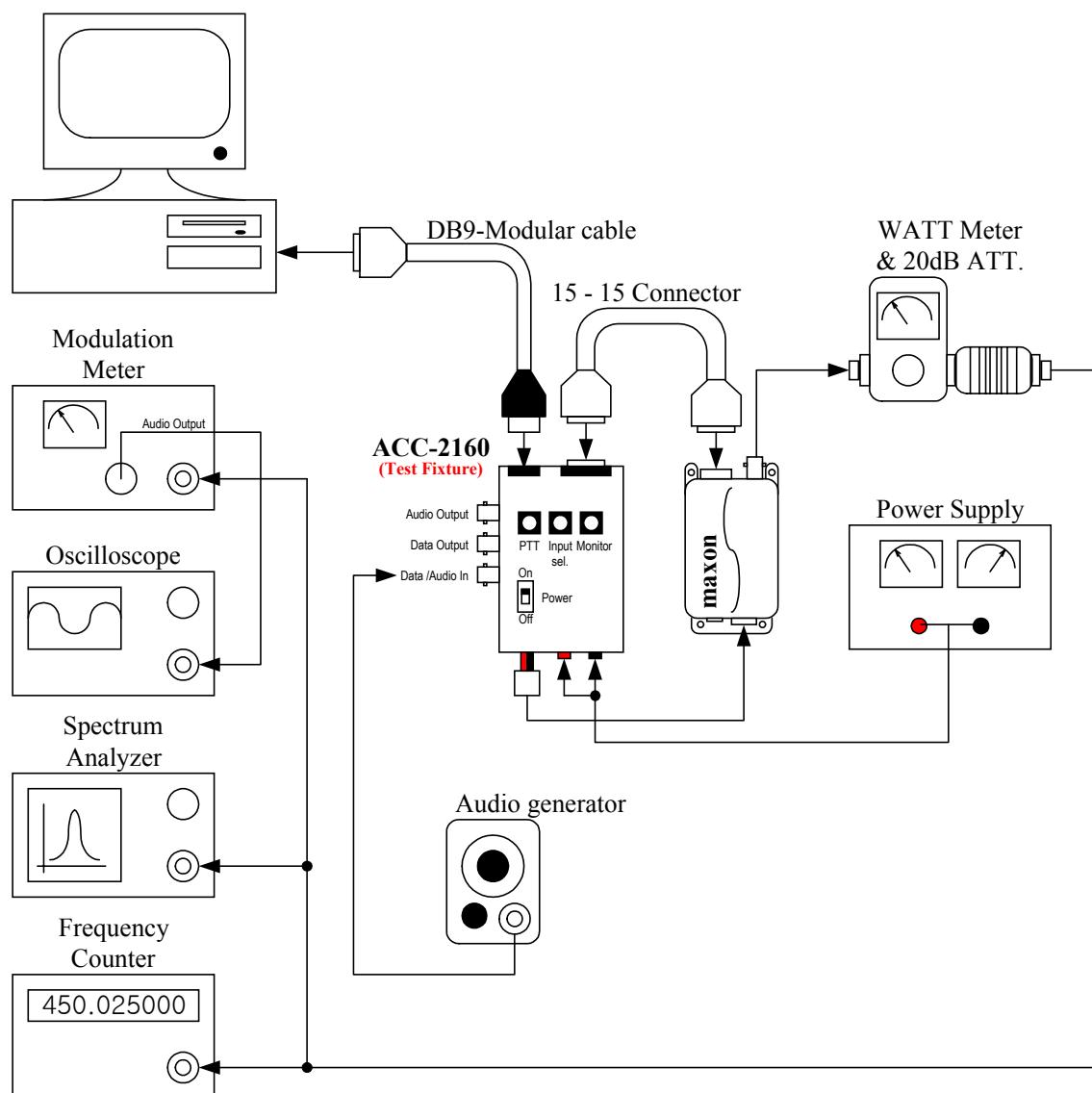
Figure 7.2. Test equipment setup for transmitter
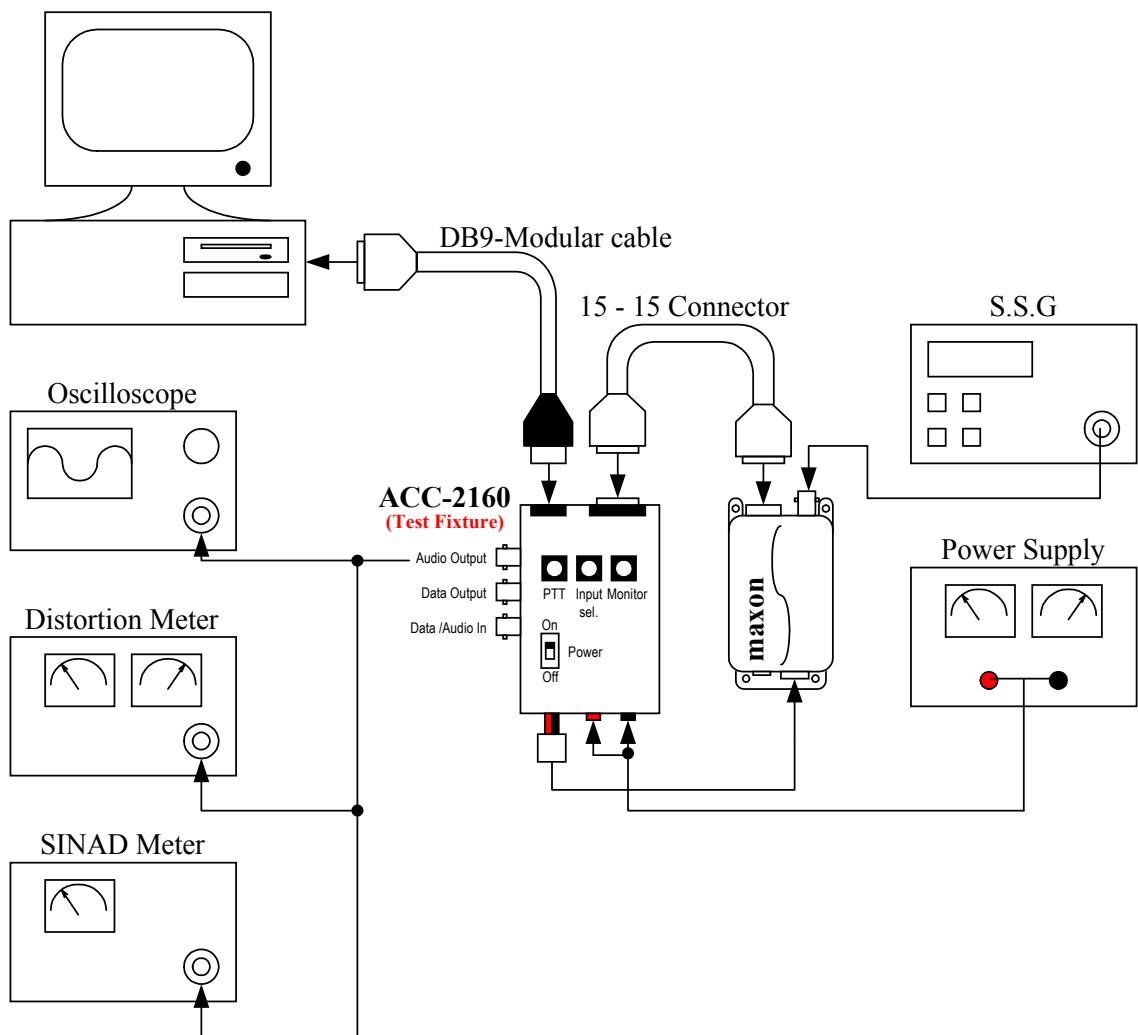
Figure 7.3. Test equipment setup for Receiver

Standard test conditions are following

⓪ Standard test voltage : 12Vdc

① Temperature for normal test : 25℃±10℃

② Standard audio frequency of S.S.G : 1KHz

③ Standard deviation : ±1.5KHz (N-Band), ±3KHz (S-Band)

④ Channel Spacing : 12.5KHz (N-Band), 25KHz (S-Band)

⑤ Standard signal input level : -47dBm

⑥ Antenna Impedance : 50 Ohm

⑦ Audio Output Load : 8 Ohm (Ext.)

8. INTERFACING

8.1. External connections

Connection is made to the SD-160 via an external 50 ohm BNC socket (RF signal) and a high density 15-way "D"-type socket (DB-15 connector; control and data signals) with 4-40 UNC threaded jack posts for more permanent connection. Besides, SCN-12 type circular connector is added to separate power line from data and analog signals of DB-15 connector.

8.2. DB-15 PIN descriptions with input/output level

D-Type Pin No.	Function	Description	Signal Type	Input/ Output
1	Data modulation IN (Tx Mod)	Signal is directly injected to MOD through data low pass filter without pre-emphasis.	Analog signal 1KHz audio at 60% peak system deviation input level = 100 to 120mVrms	I/P
2	Data unfiltered OUT (RX disc)	Discriminator audio from the SD-160. This is the unprocessed AF signal prior to tone filtering and de-emphasis.	Analog signal 1KHz audio at 60% peak system deviation produces 200 to 300mVrms	O/P
3	PTT In (Tx Key)	Signal from the 'external device' to key the SD-160 transmitter. This line has an internal pull up resistor to +5V. Pulling the line to 0V turns on the transmitter. **Note : If you installed option modem board, you can select RS-232 signal level by Jumper (CON407) on the digital board. See Figure 8.2.**	TTL level 0V = Tx o/c = Rx RS-232 level (option) +12V = Tx -12V = Rx	I/P
4	Ground	Ground connection to chassis of the radio.	0V (Chassis)	
5	Serial Data Out (TXD)	Serial data output for radio control or program. It uses asynchronous data format.	TTL level	O/P
6	Busy (CD)	Logic level output from SD-160 to indicate whether a carrier is present or not **Note : If you installed an option modem board, you can select RS-232 signal level by Jumper (CON407) on the digital board. See Figure 8.2.**	TTL level 0V = carrier 5V = no carrier RS-232 level (option) +12V = carrier -12V = no carrier	O/P
7	Microphone filtered audio IN	This signal is injected to the MOD at the point through audio-amplification, pre-emphasis and high pass filtering where sub-audio tone is mixed with audio.	Audio 1KHz audio at 60% peak system deviation input level = 6 to 8Vrms	I/P

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8	Serial data IN (RXD)	Serial command or data input for radio control or program. It uses asynchronous data format.	TTL level	I/P
9	Speaker filtered OUT	Audio output from the audio amplifier. It's filtered by tone-filter, de-emphasis circuit.	Audio 1KHz audio at 60% peak system deviation produces Nominal 1Vrms @ 8Ω	O/P
10	Serial data IN for option modem	The Serial data to be transmitted is input to this pin. It's only available when option modem board is installed. Inputted data are modulated by modem IC and then injected to MOD. It uses asynchronous data format.	RS-232 level	I/P
11	Serial data Out for option modem	The recovered asynchronous serial data output from the receiver. It's only available when option modem board is installed. It uses asynchronous data format.	RS-232 level	O/P
12	Serial data busy for option modem (reserved)	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	RS-232 level	O/P
13	GPS data input	Data input for initial setting of GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	I/P
14	DGPS data input	Data input for DGPS Correction of GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	I/P
15	GPS data output	Position data output from the GPS module. It follows NMEA 0183 format and uses asynchronous data format.	TTL level	O/P

Table 8.1. Pin description of DB-15 Connector

DB-15 CONNECTOR

BUSY	6	11	SERIAL DATA OUT (OPT)
DATA MOD IN	1		
MIC IN (AF)	7	12	SERIAL BUSY OUT (OPT)
Data OUT (AF)	2		
SERIAL IN (PROG.)	8	13	GPS DATA IN (OPT)
PTT IN	3		
SPK OUT	9	14	DGPS DATA IN (OPT)
GND	4		
SERIAL DATA IN (OPT)	10	15	GPS DATA OUT (OPT)
SERIAL OUT (PROG.)	5		
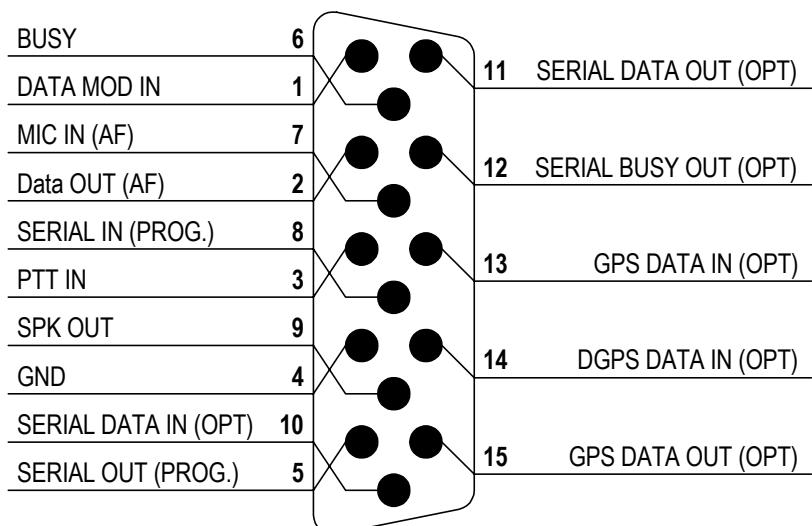
Figure 8.1. Pin-outs of DB-15 connector

8.3. Internal components
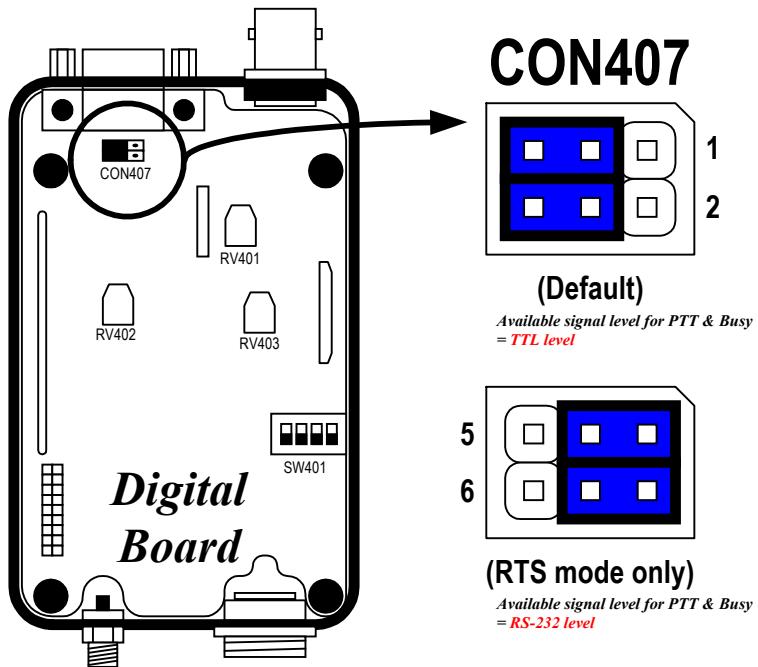
Figure 8.2. Signal level selector for PTT(RTS) & Busy
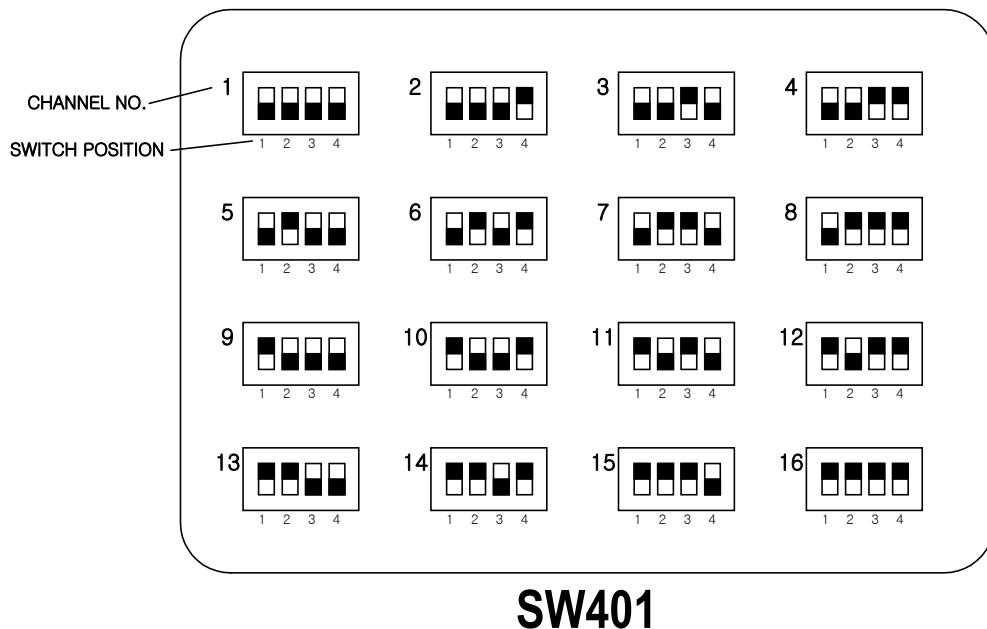
Figure 8.3. Setting of channel selector switch for each channel

8.4. Option board pin-out chart

8.4.1. ACC-513 (GMSK Modem Option board)

Connector No.	Pin No.	Function	Description	Input/Output
Connector 1	1	VCC	6V to 12V Power Input	I/P
	2	GND	Ground	
	3	PTT	Signal from the digital board to enable transmitter circuit of modem board.	I/P
	4	TXD_EN	It ensures that the radio has stabilized in transmission before the data is processed for modulation.	I/P
	5	TX_END	To finish transmission, it indicates memory buffer of Master MCU of digital board is empty.	O/P
	6	MUTE (Busy)	Logic level input from digital board to indicate whether a carrier is present or not	I/P
	7	MODEM_EN	Modem Enable input	I/P
	8	POWER_SAVE	Power save input for modem board.	I/P
	9	CMD_EN	It indicates that command for Modem programming is effective.	I/P
	10	CMD_IN/OUT	Data Input and Output for Modem programming.	I/P, O/P
	11	CMD_CLK	Clock Input for Modem programming.	I/P
	12	MODEM_SEL	It Indicates modem type to Master MCU for programming.	O/P
	13	RX_IN	The GMSK signal input for the receiver of modem IC.	I/P
	14	TX_OUT	The GMSK filtered Tx output signal.	O/P
Connector 2	1	Serial_IN	The Serial data to be transmitted is input to this pin.	I/P
	2	Serial_OUT	The recovered asynchronous serial data output from the receiver.	O/P
	3	Busy	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	O/P
	4	Carrier_Detect	Handshake signal for RTS control mode. It indicates whether Slave MCU of modem has decoded data or not.	O/P
	5	PTT_IN	Handshake signal for RTS control mode. It requests data transmission to Slave MCU of modem.	I/P
	6	PROGRAM	It's reserved input for firmware upgrade.	I/P

Table 8.2. Pin description of DB-15 Connector

8.4.2. ACC-514 (FFSK Modem Option board)

Connector No.	Pin No.	Function	Description	Input/Output
Connector 1	1	VCC	6V to 12V Power Input	I/P
	2	GND	Ground	
	3	PTT	Signal from the digital board to transmit data key the SD-160 transmitter	I/P
	4	TXD_EN	It ensures that the radio has stabilized in transmission before the data is processed for modulation.	I/P

	5	TX_END	To finish transmission, it indicates memory buffer of Master MCU of digital board is empty.	O/P
	6	MUTE (Busy)	Logic level input from digital board to indicate whether a carrier is present or not	I/P
	7	MODEM_EN	Modem Enable input	I/P
	8	POWER_SAVE	Power save input for modem board.	I/P
	9	CMD_EN	It indicates that command for Modem programming is effective.	I/P
	10	CMD_IN/OUT	Data Input and Output for Modem programming.	I/P, O/P
	11	CMD_CLK	Clock Input for Modem programming.	I/P
	12	MODEM_SEL	It Indicates modem type to Master MCU for programming.	O/P
	13	RX_IN	The FFSK/MSK signal input for the receiver of modem IC.	I/P
	14	TX_OUT	The FFSK/MSK signal output when the transmitter is enabled.	O/P
Connector 2	1	Serial_IN	The Serial data to be transmitted is input to this pin.	I/P
	2	Serial_OUT	The recovered asynchronous serial data output from the receiver.	O/P
	3	Busy	To eliminate data loss according to buffer overrun of slave MCU's memory, it indicates buffer status.	O/P
	4	Carrier_Detect	Handshake signal for RTS control mode. It indicates whether Slave MCU of modem has decoded data or not.	O/P
	5	PTT_IN	Handshake signal for RTS control mode. It requests data transmission to Slave MCU of modem.	I/P
	6	PROGRAM	It's reserved input for firmware upgrade.	I/P

Table 8.3. Pin description of DB-15 Connector

8.4.3. ACC-515 (GPS Option board)

Pin No.	Function	Description	Input/ Output
1	VCC	6V to 12V Power Input	I/P
2	VBAT	Backup Power Input (3.3V)	I/P
3	ENABLE	GPS Data Out Enable	I/P
4	PSAVE	GPS Power Enable (& Power save input for GPS)	I/P
5	GND	Ground	
6	GPS_OUT	Position Data Output	O/P
7	DGPS_IN	DGPS Correction Data Input	I/P
8	GPS_IN	Initial Setting Data Input	I/P
9	+5V	5V Power Input	I/P

Table 8.4. Pin description of DB-15 Connector

8.5. Wiring Diagram

CON401

PIN#	DESCRIPTION
1	DATA MOD IN
2	DATA OUT(AF)
3	PTT IN
4	GND
5	SERIAL OUT (PROG.)
6	BUSY
7	MIC IN(AF)
8	SERIAL IN (PROG.)
9	SPK OUT
10	SERIAL DATA IN (OPT)
11	SERIAL DATA OUT (OPT)
12	SERIAL BUSY OUT (OPT)
13	GPS DATA IN (OPT)
14	DGPS DATA IN (OPT)
15	GPS DATA OUT (OPT)

CON404

PIN#	DESCRIPTION
1	SERIAL_IN
2	SERIAL_OUT
3	BUSY
4	Carrier_Detect
5	PTT_IN
6	PROGRAM

CON403

PIN#	DESCRIPTION
1	VCC
2	GND
3	PTT
4	TXD_EN
5	TX_END
6	MUTE (BUSY)
7	MODEM_EN
8	POWER_SAVE
9	CMD_EN
10	CMD_IN/OUT
11	CMD_CLK
12	MODEM_SEL
13	RX_IN
14	TX_OUT

CON406

PIN#	DESCRIPTION
1	VCC
2	VBAT
3	ENABLE
4	PSAVE
5	GND
6	GPS_OUT
7	DGPS_IN
8	GPS_IN
9	+5V

CON405

PIN#	DESCRIPTION
1	VCC
2	GND
3	PLL_DATA
4	PLL_LOCK
5	PLL_EN
6	PLL_CLK
7	MOD_IN
8	CH_BW
9	PWR_SEL
10	AUDIO
11	TX_EN
12	PA_EN
13	RX_EN
14	RSSI
15	+5V
16	VCC
17	BUSY
18	GND

RF BOARD

DIGITAL BOARD

9. TROUBLE SHOOTING GUIDE

This chapter contains 6 troubleshooting tables for the following SD-160 components:

- Receiver
- Transmitter
- Synthesizer
- RX VCO (Voltage Controlled Oscillator)
- TX VCO (Voltage Controlled Oscillator)
- Control circuit

START

VERY LOW OR NO 12DB SINAD

NOISE AT SPKR WHEN RADIO IS UNSQ'D? — NO → NOISE AT PIN 9 OF IFIC IC6? — NO → CHECK IFIC IC6

NOISE AT SPKR WHEN RADIO IS UNSQ'D? — YES ↓

NOISE AT PIN 9 OF IFIC IC6? — YES → CHECK AFIC IC412

INJECT A 45.1MHz SIGNAL AT C71

IS 12DB SINAD NEAR -103DBM? — NO → IS 2ND LO ON FREQ? — NO → IS PIN 1 OF IFIC AT 4.4V DC? — NO → CHECK IFIC

IS 12DB SINAD NEAR -103DBM? — YES ↓

IS 2ND LO ON FREQ? — YES → CHECK VDC OF ALL PINS OF IFIC IC6

IS PIN 1 OF IFIC AT 4.4V DC? — YES → CHECK 2ND LO XTAL AND COMPONENTS

INJECT A 45.1MHz SIGNAL AT C70

CHECK IF AMP AND PERIPHERAL COMPONENTS

IS 12DB SINAD NEAR -115DBM? — NO → IS Q16 BIASED COREECTLY? — NO ↑ (CHECK IF AMP AND PERIPHERAL COMPONENTS)

IS 12DB SINAD NEAR -115DBM? — YES ↓

IS Q16 BIASED COREECTLY? — YES → CHECK XTAL FILTERS XF1 & XF2

ARE VOLTAGES ON PINS OK? — NO → CHECK EXTERNAL COMPONENTS CONNECTED TO IFIC. IF OK REPLACE IC6

ARE VOLTAGES ON PINS OK? — YES → CHECK EXTERNAL COMPONENTS CONNECTED TO IFIC

INJECT ON CH SIGNAL AT C62

IS 12DB SINAD NEAR -113DBM? — NO → IS 1ST LO AT PIN 4 OF T2 NEAR 3DBM? — NO → CHECK VCO SYNTH

IS 12DB SINAD NEAR -113DBM? — YES ↓

IS 1ST LO AT PIN 4 OF T2 NEAR 3DBM? — YES → BAD MIXER CIRCUITRY (D6, T1, T2)

INJECT ON CH SIGNAL AT C601

IS 12DB SINAD NEAR -119DBM? — NO → IS Q601 BIASED CORRECTLY? — NO → CHECK RX5V (Q2) AND BIAS COMPONENTS (R64, R601, R602, L605)

IS 12DB SINAD NEAR -119DBM? — YES → CHECK HARMONIC FILTER AND ANTENNA PATH

IS Q601 BIASED CORRECTLY? — YES → CHECK FRONT END FILTERS FOR OPENS OR SHORTS

Figure 9.1. Troubleshooting Flow Chart for Receiver

NO POWER OUTPUT AT ANTENNA

HIGH B+ CURRENT

(< 0.1A)
NO OR LOW B+ CURRENT

B+ CURRENT DRAW?

CHECK RF OUTPUT POWER AT C34

CHECK B+ ON FINAL STAGES

NO

OUTPUT POWER LEVEL GOOD?

YES

YES

B+ IS WITHIN +/- 0.5V OF DC-DC OUT?

NO

DC-DC OUTPUT

1) SD-161 : 5.5V
2) SD-164 : 6.5V
3) SD-171 : 7.5V
4) SD-174 : 7.5V

1) CHECK FOR INCORRECT OR DAMAGED PARTS IN FINAL STAGES.

2) VERIFY B+ FEED CIRCUIT INTEGRITY (I.E. CONDITIONAL SHORTS)

1) CHECK FOR INCORRECT OR DAMAGED PARTS IN FINAL STAGES.

2) VERIFY B+ FEED CIRCUIT INTEGRITY (I.E. CONDITIONAL OPENS.)

1) CHECK PIN DIODES(D3, D5) & TX_B2 VOLTAGE.

2) VERIFY CORRECT COMPONENTS IN HARMONIC FILTER.

IS Q703 BIASED PROPERLY?

NO

CHECK BIAS CIRCUITRY IF OK CHECK CONTORL VOLTAGE (COLLECTOR OF Q11)

YES

VERIFY INPUT OF P.A. STAGES (> +10DBM)

IS CONTROL VOLTAGE HIGH OR LOW?

HIGH

(COLLECTOR Q11 > 5.0V)

REPLACE Q703

P.A. STAGE(S) BAD:

1) VERIFY GAIN FROM INDIVIDUAL P.A. STAGES.

2) REPLACE LOW/NO GAIN DEVICE(S)

YES

INPUT OF P.A. STAGES GOOD?

LOW

TROUBLESHOOT POWER CONTROL CIRCUIT AND/ OR VERIFY POWER SET USING RV4.

NO

VERIFY VCO OUTPUT (> 0DBM)

VCO OUTPUT GOOD?

NO

TROUBLESHOOT VCO

YES

BUFFER & DRIVER STAGE BAD:

1) VERIFY GAIN FROM EACH BUFFER & DRIVER STAGE

2) REPLACE LOW/NO GAIN DEVICE(S)

Figure 9.2. Troubleshooting Flow Chart for Transmitter

```
                          ┌─────────┐
                          │  START  │
                          └────┬────┘
                               │
                          ╱──────────╲          ┌──────────────┐
                         ╱  VISUAL     ╲   NO   │   CORRECT    │
                        ╱  CHECK OF     ╲──────▶│   PROBLEM    │
                         ╲ THE BOARD    ╱        └──────────────┘
                          ╲   OK?      ╱
                           ╲─────────╱
                               │ YES
                               │
                          ╱──────────╲          ┌──────────────┐
                         ╱  +5V AT IC2 ╲   NO   │  CHECK 5V    │
                        ╱  PINS 3 & 4?  ╲──────▶│  REGULATOR   │
                         ╲             ╱        └──────────────┘
                          ╲──────────╱
                               │ YES
                               │
┌─────────────────┐      ╱──────────╲         ╱──────────╲
│ IF PIN1(MOD) AND │     ╱ IS 12.8MHZ ╲  NO   ╱ IS 12.8MHZ ╲   NO
│ PIN4(B+) OF TCXO1│◀NO─╱   SIGNAL AT   ╲◀───╱   SIGNAL AT   ╲─────
│ ARE 1.9VDC AND   │    ╲  TCXO1 PIN1?  ╱    ╲  IC2 PIN1?   ╱
│ 5.0VDC, RESPECT- │     ╲             ╱      ╲             ╱
│ IVELY THEN       │      ╲──────────╱        ╲──────────╱
│ REPLACE TCXO     │           │ YES               │ YES
└─────────────────┘           │                   │
                        ┌──────────────┐
                        │  CHECK R14 & │
                        │     C8       │
                        └──────────────┘

                          ╱──────────╲          ╱──────────╲         ┌──────────────┐
                         ╱   ARE       ╲   NO   ╱ DO PINS 9,10╲  NO   │   CHECK      │
                        ╱  SIGNALS AT   ╲──────╱ & 11 OF IC2   ╲─────▶│ PROGRAMMING  │
                         ╲ PINS 15 OR 16╱      ╲ TOGGLE WHEN   ╱      │ LINES BETWEEN│
                          ╲  OF IC2?   ╱        ╲ CHANNEL IS  ╱       │ IC401 AND IC2│
                           ╲─────────╱           ╲ CHANGED? ╱         │ PINS 9,10&11 │
                               │ YES                 │ YES           └──────────────┘
                               │                     │
        ╱──────────╲      ╱──────────╲          ╱──────────╲         ┌──────────────┐
       ╱    IS      ╲    ╱   ARE       ╲   NO   ╱ IS INFORM-  ╲  NO   │   CHECK uP   │
┌─────╲ THERE ANY   ╱◀──╱ WAVEFORMS     ╲◀─────╱ ATION FROM    ╲─────▶│    IC401     │
│IC2  ╲ SHORT BETW- ╱   ╲ AT PINS 15,16 ╱      ╲ uP IC401      ╱      └──────────────┘
│BAD  ╲ EEN AROUND ╱     ╲   SQUARE?   ╱        ╲  CORRECT?  ╱
└──────╲CIRCUITRY AND     ╲──────────╱           ╲─────────╱
        ╲PIN 15 & 16╱          │ YES                 │ YES
         ╲ OF IC2  ╱           │                     │
          ╲──────╱       ┌──────────────┐      ┌──────────────┐
             │ YES       │ OPEN R12 AND │      │   IC2 BAD    │
     ┌──────────────┐    │ THEN CHECK   │      └──────────────┘
     │   REMOVE     │    │ VOLTAGE AT   │
     │   SHORTS     │    │  D903 PIN1   │
     └──────────────┘    └──────┬───────┘
                                │
                          ╱──────────╲          ┌──────────────┐
                         ╱ IS D903 PIN1╲   NO   │ CHECK VOLTAGE│
                        ╱   >15.0VDC?   ╲──────▶│DOUBLER(TRIPLER)│
                         ╲             ╱        └──────────────┘
                          ╲──────────╱
                               │ YES        SD-161/171 : USE VOLTAGE TRIPLER
                               │            SD-164/174 : USE VOLTAGE DOUBLER
┌─────────────────┐      ╱──────────╲
│ IF R98 & C101   │     ╱  IS RF LEVEL╲   NO
│ AND R13 & C5 ARE│◀NO─╱  AT IC2 PIN 8 ╲
│ OK, THEN        │    ╲  BETWEEN -15  ╱
│ TROUBLESHOOT VCO│     ╲ & +5DBM?    ╱
└─────────────────┘      ╲──────────╱
                               │ YES
                               │
                          ╱──────────╲          ┌──────────────┐
                         ╱    ARE      ╲   NO   │ REPLACE OR   │
                        ╱  C1, C2, C3,  ╲──────▶│ RESOLDER     │
                         ╲ C4, C18, R9, ╱       │ NECESSARY    │
                          ╲ R10 & R11  ╱        │ COMPONENTS   │
                           ╲  OK?    ╱          └──────────────┘
                            ╲──────╱
                               │ YES
                               │
                          ╱──────────╲          ┌──────────────┐
                         ╱    ARE      ╲   NO   │ REPLACE OR   │
                        ╱ EXT. CHARGE   ╲──────▶│ RESOLDER     │
                         ╲ PUMP(Q3~Q6)  ╱       │ NECESSARY    │
                          ╲ CIRCUITRY  ╱        │ COMPONENTS   │
                           ╲  OK?    ╱          └──────────────┘
                            ╲──────╱
                               │ YES
                          ┌──────────────┐
                          │   IC2 BAD    │
                          └──────────────┘
```

Figure 9.3. Troubleshooting Flow Chart for Synthesizer

```
                    ┌─────────────────────┐
                    │  LOW OR NO POWER     │
                    │  AT PIN4 OF T2       │
                    └─────────────────────┘
                              │
                              ▼
                         ◇ VISUAL          NO     ┌──────────────┐
                           CHECK OF    ──────────▶│   CORRECT    │
                           THE BOARD              │   PROBLEM    │
                           OK? ◇                  └──────────────┘
                              │ YES
                              ▼
┌──────────────────┐     ◇ 4.2VDC AT
│ CHECK VOLTAGE    │ NO    EMITTER OF
│ REGULATOR        │◀────  Q20? ◇
│ CIRCUITRY FOR    │
│ RX VCO           │          │ YES
└──────────────────┘          ▼
                         ◇ ARE Q301 &     NO    ┌──────────────┐
                           Q302 BIASED  ───────▶│ CHECK R306,  │
                           CORRECTLY? ◇         │ R307, R308,  │
                                                │ R309 & L304  │
                              │ YES             └──────────────┘
                              ▼
┌──────────────────┐     ◇ IS THERE RF
│ CHECK            │ NO    OSCILLATION AT
│ RESONANT TANK    │◀────  COLLECTOR OF
│ (C307~9 & L303)  │       Q301? ◇
│ AND FEEDBACK     │          │ YES
│ (C312 & C315)    │          ▼
└──────────────────┘     ┌──────────────┐
                         │ SET LOWEST   │
                         │ FREQUENCY    │
                         └──────────────┘
                              │
                              ▼
                    ◇ IS CONTROL     NO    ◇ IS D301DC    NO    ┌───────────────────┐
                      VOLTAGE(TP1) ──────▶  BIASED? ◇   ──────▶│ IF R302 & L301    │
                      BETWEEN 1VDC                             │ ARE OK, MAKE SURE │
                      AND 3VDC? ◇                              │ SYNTHESIZER IS    │
                         │ YES           │ YES                 │ WORKING CORRECTLY │
                         │               ▼                     └───────────────────┘
                         │          ┌──────────────┐
                         │          │ CHECK        │
                         │          │ RESONANT TANK│
                         │          │ (C307~9 &    │
                         │          │ L303)        │
                         │          └──────────────┘
                         ▼
┌──────────────┐    ◇ IS KVCO
│ REPLACE C303 │ NO   BETWEEN 6MHZ/V
│              │◀──── AND 7MHZ/V? ◇
└──────────────┘        │ YES
                        ▼
                   ◇ IS RF LEVEL AT    NO   ┌──────────────────────┐
                     C318 BETWEEN -3 ─────▶│ IF L305, COUPLING     │
                     & 0DBM? ◇             │ CAP. (C311, 313,      │
                        │ YES              │ 318) AND FEEDBACK      │
                        │                  │ (C312 & C315, L304,    │
                        │                  │ R309) ARE OK, REPLACE  │
                        │                  │ LOW GAIN DEVICE(S)     │
                        │                  └──────────────────────┘
                        ▼
┌──────────────┐   ◇ ARE Q19     NO   ◇ IS RX BUFFER
│ CHECK RX_5V  │ NO  BIASED          STAGE WORKING
│ AND BUFFER   │◀── CORRECTLY?◇◀──── CORRECTLY? ◇
│ COMPONENTS   │       │ YES             │ YES
└──────────────┘       ▼                 ▼
              ┌──────────────┐   ┌────────────────────┐
              │ IF L14 AND   │   │ REPLACE OR RESOLDER │
              │ C100 ARE OK, │   │ NECESSARY COMPONENTS│
              │ REPLACE Q19  │   │ OF HARMONIC FILTER  │
              └──────────────┘   │ (C28 ~ 32, L4 ~ 5)  │
                                 └────────────────────┘
```

Figure 9.4. Troubleshooting Flow Chart for RX VCO

Left column flow

LOW OR NO POWER AT INPUT TO P.A.

↓

VISUAL CHECK OF THE BOARD OK? — NO → **CORRECT PROBLEM**

↓ YES

4.2VDC AT EMITTER OF Q8? — NO → **CHECK VOLTAGE REGULATOR CIRCUITRY FOR TX VCO**

↓ YES

ARE Q201 & Q202 BIASED CORRECTLY? — NO → **CHECK R206, R207, R208, R209 & L204**

↓ YES

IS THERE RF OSCILLATION AT COLLECTOR OF Q201? — NO → **CHECK RESONANT TANK (C207~9 & L203) AND FEEDBACK (C212 & C215)**

↓ YES

SET LOWEST FREQUENCY

↓

IS CONTROL VOLTAGE(TP1) BETWEEN 1VDC AND 3VDC? — NO → **IS D201DC BIASED?** — NO → **IF R202 & L201 ARE OK, MAKE SURE SYNTHESIZER IS WORKING CORRECTLY**

↓ YES   ↓ YES

                                        CHECK RESONANT TANK (C207~9 & L203)

IS KVCO BETWEEN 6MHZ/V AND 7MHZ/V? — NO → **REPLACE C203**

↓ YES

IS RF LEVEL AT C218 BETWEEN -3 & 0DBM? — NO → **IF L205, COUPLING CAP. (C211, 213, 218) AND FEEDBACK (C212 & C215, L204, R209) ARE OK, REPLACE LOW GAIN DEVICE(S)**

↓ YES

TX BUFFER(Q9) AND/OR DRIVER(Q10) STAGE(S) BAD:

1)VERIFY GAIN FROM EACH STAGE.

2)REPLACE LOW/NO GAIN DEVICE(S)

Right column flow

RF POWER IS OK BUT NO OR INCORRECT MODULATION

↓

IF NO MOD., IS 1.9VDC AT R201? — NO → **IS 1.9VDC AT R201 FOR NO MOD. IN?** — NO → **CHECK REF. VOLTAGE DRIVER (IC4A)**

↓ YES   ↓ YES

                                        IF R26, C19 ARE OK CHECK ALL PARTS AROUND IC3

IS THERE 200mVrms SIGNAL AT R201 UNDER STANDARD TEST CONDITION? — NO → **IF R26, C19 ARE OK CHECK ALL PARTS AROUND IC3**

↓ YES

IS THERE DIFFERENT FREQ. DEVIATION FOR EACH CH FREQ.? — NO → **REPLACE INCORRECT VALUE FOR C204, 205 AND L202**

↓ YES

TROUBLESHOOT DIGITAL BOARD FOR SIGNAL PATH

Figure 9.5. Troubleshooting Flow Chart for TX VCO

START

APPLY POWER TO RADIO

WAS POWER_ON INDICATION LIGHT EMITTED? —NO→ IS POWER SUPPLIED TO DC-DC CONVERTER? —NO→ CHECK CONTACT OF POWER CONNECTOR AND RUNNERS BETWEEN POWER CONNECTOR & DC-DC CONVERTER

YES (down from WAS POWER_ON)
YES (down from IS POWER SUPPLIED)

WAS NO WARNING LED INDICATION? —NO→ IS THERE CONTINUOUS LED FLASH?

IS CONTACT OF 18PIN INTERNAL CONNECTOR BETWEEN RF AND DIGITA B'D OK? —NO→ REASSEMBLE RF & DIGITAL B'D AND CHECK AGAIN. BUT, IF HAVE SAME PROBLEM REPLACE CONNECTOR (CON405)

GREEN LED FLASH → CHECK EEPROM DATA FOR MODEM OPTION & TYPE OF INSTALLED MODEM (ACC-513 OR ACC514 ?)

YELLOW LED FLASH

CHECK EEPROM DATA

YES (WAS NO WARNING LED) → DONE

IS VCC AT CON405 PINS 1 & 16 OK? —NO→ TROUBLESHOOT DC-DC CONVERTER

YES

IS EEPROM DATA NO PROBLEM? —NO→ REPROGRAM EEPROM & CHECK AGAIN BUT, IF HAVE SAME PROBLEM REPLACE EEPROM (IC402)

YES

TROUBLESHOOT FREQUENCY SYNTHESIZER CIRCUITRY (INCLUDES VCO & TCXO)

+5V AT CON405 PIN 15? —NO→ TROUBLESHOOT 5V REGULATOR CIRCUITRY OF RF B'D

YES

WITH POWER SUPPLIED TO RADIO CHECK THE FOLLOWING:

1) 5V AT THE PINS 39 & 40 OF IC401. IF NONE, CHECK L401, C465 & C477.

2) WITH HIGH IMPEDENCE PROBE CHECK FOR 8.0MHZ AT PINS 2 & 3 OF IC401. IF NO SIGNAL CHECK IC401 / X401 / R456 / C441 / C442.

3) CHECK DC AT PIN 4 OF IC401. IF < 4.5VDC, CHECK RESET CIRCUITRY (IC414 / R457 / R458 / C443)

4) CHECK FOR TYPICAL VOLTAGES OF IC401

IS CORRECT MODEM INSTALLED? —NO→ CHANGE MODEM

YES

IS CONTACT BETWEEN MODEM AND DIGITAL B'D OK? —NO→ REINSTALL MODEM TO DIGITAL B'D AND CHECK AGAIN. BUT, IF HAVE SAME PROBLEM REPLACE CONNECTOR (CON403)

YES

TROUBLESHOOT OR REPLACE MODEM

IS LED CONTROL SIGNAL PRESENT ON POWER UP AT IC401 PINS 23 & 24? —NO (loops back to checklist)

YES

CHECK LED401 AND ITS DRIVERS (Q401, Q411)

DONE

Figure 9.6. Troubleshooting Flow Chart for Control Circuit

10. VOLTAGE CHART

TRANSISTORS OF CONTROL BOARD							
REF#	Description	Receive state			Transmit state		
		E	B	C	E	B	C
Q401	KRA104S	5.0	4.6	0.0	5.0	4.6	0.0
Q402	KRA104S	1.9	4.9	1.8	1.9	4.9	1.9
Q403	KRC104S	0.0	4.9	0.0	0.0	0.0	5.0
Q406	KRC104S	0.0	4.9	0.0	0.0	0.0	5.0
Q407	KTA1504SY	6.5	6.4	3.3	6.5	5.9	6.5
Q408	KRC104S	0.0	0.0	5.9	0.0	5.0	0.0
Q410	KRC104S	2.1	4.9	5.2	0.0	0.0	6.5
Q411	KRC104S	1.9	4.9	5.1	1.9	5.0	5.1
Q413	KRA104S	5.0	4.6	0.1	5.0	0.6	4.9
Q417	KTA1504SY	0.0	4.9	0.0	0.0	5.0	0.0
Q418	KRC104S	0.0	0.0	4.8	0.0	5.0	0.0
Q419	KRC110S	0.0	0.0	0.0	0.0	0.0	0.0
Q424	KRA104S	6.5	6.5	0.0	6.5	6.5	0.0
Q425	KRC104S	0.0	0.0	6.5	0.0	0.0	6.5

TRANSISTORS OF RF BOARD							
REF#	Description	Receive state			Transmit state		
		E	B	C	E	B	C
Q1	KRA110S	5.0	4.8	0	5.0	0	4.8
Q2	KRA110S	5.0	0.0	4.8	5.0	4.8	0
Q3	KTC4075	2.4	2.0	15.0	2.4	2.0	15.0
Q4	KTC4075	0.0	0.0	1.8	0	0	2.0
Q5	KTA2014	0.0	2.4	0	0	2.4	0
Q6	KTA2014	15.0	15.0	1.8	15.0	15.0	2.0
Q7	KRA104S	5.0	4.8	0.4	5.0	4.8	0.4
Q8	KTC3875S	0.0	0.0	0	4.2	4.8	4.9
Q9	BFR92A	0.0	0.0	0	1.4	2.1	4.9
Q10	PBR951	0.0	0.0	0	0	0.7	3.5
Q11	KTA1663	6.5	6.5	0	6.5	5.8	3.7
Q12	KTC3875S	0.0	0.0	6.5	0.4	1.0	5.6
Q14	KRC104S	0.0	0.0	0	0	4.1	0
Q15	KTC3875S	0.2	0.9	6.5	1.0	1.6	6.4
Q16	BFR92A	0.0	0.7	4.1	0	0	0
Q17	KRC104S	0.0	4.9	0	0	4.9	0
Q18	KRC104S	0.0	4.9	0	0	4.9	0
Q19	BFR92A	1.4	2.1	4.9	0	0	0
Q20	KTC3875S	4.1	4.7	4.8	0	0	0
Q21	KRC104S	0.0	4.9	0	0	4.9	0
Q22	KRA104S	4.4	0.0	4.4	0	0	0
Q24	KRC104S	0.0	0.0	4.6	0	0	0

ICS OF RF BOARD					
RECEIVE MODE					
PIN #	IC1	IC2	IC3	IC4	IC5	IC6
	TK71750SCL	MB15A02PFV1	NJM12904V	NJM12904V	NJM12904V	TA31136FN
1	6.5	2.0 (OSC1)	1.9	1.9	0.9	4.3(OSC1)
2	0.0	2.0 (OSC2)	1.9	1.9	2.6	3.7(OSC2)
3	6.5	5.0	1.8	1.9	2.6	3.1
4	1.2	5.0	0.0	0.0	0.0	4.4
5	5.0	0.0	1.9	ANALOG	0.0	4.0
6	-	0.0	N/C	ANALOG	0.2	3.9
7	-	5.0	N/C	ANALOG	0.0	0.7
8	-	2.6 (RF)	5.0	5.0	5.0	0.7
9	-	0.0	-	-	-	1.0(AF)
10	-	0.0	-	-	-	4.4
11	-	0.0	-	-	-	3.5
12	-	4.8	-	-	-	ANALOG
13	-	0.0	-	-	-	0.0
14	-	0.0	-	-	-	0.0
15	-	2.1	-	-	-	0.0
16	-	0.0	-	-	-	1.0(IF)

ICS OF RF BOARD					
TRANSMIT MODE					
PIN #	IC1	IC2	IC3	IC4	IC5	IC6 (OFF)
	TK71750SCL	MB15A02PFV1	NJM12904V	NJM12904V	NJM12904V	TA31136FN
1	6.5	2.0 (OSC1)	1.9	1.9	1.7	-
2	0.0	2.0 (OSC2)	1.9	1.9	2.6	-
3	6.5	5.0	1.9	1.9	2.6	-
4	1.2	5.0	0.0	0.0	0.0	-
5	5.0	0.0	1.9	0	0.8	-
6	-	0.0	N/C	0	0.8	-
7	-	5.0	N/C	0	0.9	-
8	-	2.6 (RF)	5.0	5.0	5.0	-
9	-	0.0	-	-		-
10	-	0.0	-	-		-
11	-	0.0	-	-		-
12	-	4.8	-	-		-
13	-	0.0	-	-		-
14	-	0.0	-	-		-
15	-	2.1	-	-		-
16	-	0.0	-	-		-

ICS OF DIGITAL BOARD							
RECEIVE MODE							
PIN #	IC402 CSI24WC04	IC403 NJM12903V	IC404(off) KIA324F	IC405 KIA324F	IC406 MC14066B	IC407 MC14066B	IC408 KIA324F	IC409 MC14053B
1	0.0	0.2	0.0(Analog)	0.0(Analog)	1.9(Analog)	0.0(Analog)	1.9(Analog)	0.5
2	0.0	0.1	0.0(Analog)	0.0(Analog)	1.9(Analog)	1.8(Analog)	1.9(Analog)	2.7(Analog)
3	0.0	0.1	1.7(Analog)	1.7(Analog)	0.0(Analog)	1.8(Analog)	1.6(Analog)	0.0
4	0.0	0.0	0.0	0.0	0.0(Analog)	1.5(Analog)	4.9	1.1(Analog)
5	5.0	1.9	1.7(Analog)	0.0(Analog)	0.0(S/W2)	0.0(S/W2)	1.6(Analog)	1.1(Analog)
6	5.0	1.8(Analog)	0.0(Analog)	0.0(Analog)	0.0(S/W3)	0.0(S/W3)	1.9(Analog)	0.0
7	N/C	4.9Vp-p	0.0(Analog)	0.0(Analog)	0.0	0.0	1.9(Analog)	0.0
8	5.0	4.9	0.0(Analog)	0.0(Analog)	0.0(Analog)	1.9(Analog)	1.9(Analog)	0.0
9	-	-	0.0(Analog)	0.0(Analog)	0.0(Analog)	1.7(Analog)	1.9(Analog)	0.1
10	-	-	1.7(Analog)	0.0(Analog)	1.0(Analog)	1.8(Analog)	1.5(Analog)	0.1
11	-	-	0.0	0.0	1.0(Analog)	0.0(Analog)	0.0	5.0
12	-	-	1.7(Analog)	0.0(Analog)	4.9(S/W4)	0.0(S/W4)	1.4(Analog)	0.0
13	-	-	0.0(Analog)	0.0(Analog)	4.9(S/W1)	0.0(S/W1)	1.9(Analog)	1.8
14	-	-	0.0(Analog)	0.0(Analog)	5.0	5.0	1.9(Analog)	1.8
15	-	-	-	-	-	-	-	2.7(Analog)
16	-	-	-	-	-	-	-	5.0

ICS OF DIGITAL BOARD							
RECEIVE MODE							
PIN #	IC410 MSNBLPS	IC411 KIA324F	IC412 LM386	IC414 KIA7042F	IC416 KIA324F	IC417 KIA324F	IC418 TC7S66FU	
1	1.9	1.9(Analog)	1.3	5.0	1.9(Analog)	N/C	1.9(Analog)	
2	0.0	1.9(Analog)	0.0	0.0	1.9(Analog)	N/C	1.9(Analog)	
3	1.9	1.9(Analog)	0.0(Analog)	5.0	1.7(Analog)	N/C	0.0	
4	1.9	4.9	0.0	-	4.9	4.9	4.8	
5	1.9	1.9	Audio	-	1.7(Analog)	1.3(Analog)	5.0	
6	5.0	1.9(Analog)	6.5	-	1.9(Analog)	1.9(Analog)	-	
7	1.9	2.7(Analog)	3.3	-	1.9(Analog)	1.9(Analog)	-	
8	2.7(Analog)	1.9	1.3	-	2.5(Analog)	1.0(Analog)	-	
9	CLK	1.9	-	-	1.5(Analog)	1.0(Analog)	-	
10	0.0	1.9	-	-	1.5(Analog)	1.0(Analog)	-	
11	/CLK	0.0	-	-	0.0	0.0	-	
12	0.0	1.9	-	-	1.0(Analog)	N/C	-	
13	1.9	1.9(Analog)	-	-	1.0(Analog)	N/C	-	
14	1.9	1.9(Analog)	-	-	1.0(Analog)	N/C	-	
15	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	

ICS OF DIGITAL BOARD							
TRANSMIT MODE							
PIN #	IC402 CSI24WC04	IC403 NJM12903V	IC404 KIA324F	IC405 KIA324F	IC406 MC14066B	IC407 MC14066B	IC408 KIA324F	IC409 MC14053B
1	0.0	0.2	1.9(Analog)	1.9(Analog)	1.9(Analog)	1.9(Analog)	1.9(Analog)	0.4
2	0.0	0.1	1.9(Analog)	1.9(Analog)	0.0(Analog)	1.9(Analog)	1.9(Analog)	3.0(Analog)
3	0.0	0.1	1.7(Analog)	1.7(Analog)	0.0(Analog)	1.9(Analog)	1.6(Analog)	0.0
4	0.0	0.0	4.9	4.9	0.0(Analog)	1.7(Analog)	4.9	0.0(Analog)
5	5.0	1.9	1.7(Analog)	1.9(Analog)	5.0(S/W2)	0.0(S/W2)	1.5(Analog)	0.7(Analog)
6	5.0	1.7(Analog)	1.9(Analog)	1.9(Analog)	0.0(S/W3)	0.0(S/W3)	1.9(Analog)	0.0
7	N/C	0.0	1.9(Analog)	1.9(Analog)	0.0	0.0	1.9(Analog)	0.0
8	5.0	5.0	1.9(Analog)	1.9(Analog)	0.0(Analog)	1.9(Analog)	1.9(Analog)	0.0
9	-	-	1.9(Analog)	1.9(Analog)	1.9(Analog)	1.7(Analog)	1.9(Analog)	5.0
10	-	-	1.7(Analog)	1.9(Analog)	0.7(Analog)	1.9(Analog)	1.5(Analog)	5.0
11	-	-	0.0	0.0	0.0(Analog)	0.0(Analog)	0.0	0.0
12	-	-	1.7(Analog)	1.9(Analog)	0.0(S/W4)	0.0(S/W4)	1.4(Analog)	1.8
13	-	-	1.9(Analog)	1.9(Analog)	0.0(S/W1)	5.0(S/W1)	1.9(Analog)	2.1
14	-	-	1.9(Analog)	1.9(Analog)	5.0	5.0	1.9(Analog)	1.8
15	-	-	-	-	-	-	-	0.4(Analog)
16	-	-	-	-	-	-	-	5.0

ICS OF DIGITAL BOARD							
TRANSMIT MODE							
PIN #	IC410 MSNBLPS	IC411 KIA324F	IC412 LM386	IC414 KIA7042F	IC416 KIA324F	IC417 KIA324F	IC418 TC7S66FU	
1	1.9	1.9(Analog)	1.3	5.0	1.9(Analog)	N/C	1.9(Analog)	
2	0.0	1.9(Analog)	0.0	0.0	1.9(Analog)	N/C	1.9(Analog)	
3	2.2	1.9(Analog)	0.0(Analog)	5.0	1.7Analog)	N/C	0.0	
4	1.9	4.9	0.0	-	4.9	4.9	4.8	
5	1.9	1.9	1.3	-	1.7(Analog)	1.3(Analog)	5.0	
6	5.0	1.9(Analog)	6.5	-	1.9(Analog)	1.9(Analog)	-	
7	1.9	3.0(Analog)	6.5	-	1.9(Analog)	1.9(Analog)	-	
8	0.4(Analog)	1.9	1.3	-	0.6(Analog)	3.6(Analog)	-	
9	CLK	1.9	-	-	2.7(Analog)	3.6(Analog)	-	
10	0.0	1.9	-	-	1.5(Analog)	0.0(Analog)	-	
11	/CLK	0.0	-	-	0.0	0.0	-	
12	0.0	1.9	-	-	0.7(Analog)	N/C	-	
13	1.9	1.9(Analog)	-	-	0.7(Analog)	N/C	-	
14	1.9	1.9(Analog)	-	-	0.7(Analog)	N/C	-	
15	-	-	-	-	-	-	-	
16	-	-	-	-	-	-	-	

MCU (IC401)							
RECEIVE MODE							
PIN #	Voltage	PIN #	Voltage	PIN #	Voltage	PIN #	Voltage
1	0.0	21	0.0	41	4.7	61	4.9
2	1.7(XOUT)	22	5.0	42	4.7	62	0.0
3	1.7(XIN)	23	5.0	43	N/C	63	0.0
4	5.0	24	5.0	44	0.0	64	0.0
5	N/C	25	N/C	45	5.0	65	0.0
6	0.4	26	N/C	46	0.0	66	4.9
7	0.0	27	5.0	47	0.0	67	0.0
8	N/C	28	N/C	48	0.0	68	0.0
9	0.0	29	N/C	49	5.0	69	0.0
10	0.0	30	2.1(Analog)	50	N/C	70	4.9
11	5.0	31	RSSI(Analog)	51	N/C	71	3.4
12	5.0	32	N/C	52	N/C	72	0.0
13	4.7	33	0.0	53	4.7	73	N/C
14	0.0	34	0.0	54	N/C	74	N/C
15	0.0	35	0.0	55	N/C	75	N/C
16	N/C	36	5.0	56	0.0	76	0.0
17	N/C	37	0.0	57	4.8	77	0.0
18	4.9Vp-p	38	0.0	58	4.8	78	0.0
19	4.9Vp-p	39	5.0	59	4.8	79	4.9
20	N/C	40	5.0	60	4.8	80	N/C

MCU (IC401)							
TRANSMIT MODE							
PIN #	Voltage	PIN #	Voltage	PIN #	Voltage	PIN #	Voltage
1	0.0	21	0.0	41	4.8	61	4.9
2	1.7(XOUT)	22	5.0	42	4.8	62	0.0
3	1.7(XIN)	23	0.0	43	N/C	63	0.0
4	5.0	24	5.0	44	0.0	64	0.0
5	N/C	25	N/C	45	5.0	65	0.0
6	0.4	26	N/C	46	0.0	66	0.0
7	0.0	27	5.0	47	0.0	67	0.0
8	N/C	28	N/C	48	5.0	68	5.0
9	0.0	29	N/C	49	5.0	69	0.0
10	0.0	30	2.1(Analog)	50	N/C	70	5.0
11	5.0	31	0(Analog)	51	N/C	71	3.4
12	5.0	32	N/C	52	N/C	72	0.0
13	0.0	33	0.0	53	0.5	73	N/C
14	0.0	34	0.0	54	N/C	74	N/C
15	0.0	35	0.0	55	N/C	75	N/C
16	N/C	36	5.0	56	0.0	76	0.0
17	N/C	37	0.0	57	4.9	77	5.0
18	4.9Vp-p	38	0.0	58	4.9	78	4.2
19	0.0	39	5.0	59	4.9	79	0.0
20	N/C	40	5.0	60	4.9	80	N/C

11. ELECTRICAL PARTS LIST

11.1. PARTS LIST FOR SD-161

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION			REF
180-301-7Z	METAL POLY CAP	0.33UF	63V	C1	130-443-7	CHIP CERAMIC	0.47UF	GRM40 Y5V474Z 16V PT	C54
180-209-8	METAL POLY CAP	0.022UF	223K 63V BOX	C2	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C55
180-126-6Z	METAL POLY CAP	0.01UF	63V	C3	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C56
180-126-6Z	METAL POLY CAP	0.01UF	63V	C4	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C57
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C5	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C58
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C6	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C59
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C7	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C60
136-018-7Y	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C8	134-767-0Y	CHIP CERAMIC	4.7PF	GRM40 COG4R7C 50V PT	C61
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C9	132-034-1Y	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C62
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C10	138-245-6Y	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C64
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C11	131-851-7Y	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C66
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C12	131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C68
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C13	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C69
130-B36-3X	CHIP CERAMIC	0.1UF	CL05B104KPNC	C14	133-111-2Y	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C70
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C16	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C71
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C17	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C72
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C18	138-245-6Y	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C73
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C19	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C74
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C20	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C75
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C21	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C76
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C22	131-584-6Y	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C77
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C23	132-750-4Y	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C78
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C24	133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C79
131-256-4Y	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C25	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C80
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C26	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C81
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C27	144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C82
133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C28	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C83
131-312-7Y	CHIP CERAMIC	13PF	GRM36 COG130J 50V	C29	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C84
132-034-1Y	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C30	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C85
135-115-6Y	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C32	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C86
136-859-0Y	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C33	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C87
130-A17-6Y	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C34	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C88
136-833-6Y	CHIP CERAMIC	6.8PF	GRM40 COG6R8D 50V PT	C35	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C89
132-012-1Y	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C36	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C90
134-301-1Y	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C37	144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C91
134-301-1Y	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C38	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C92
132-012-1Y	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C39	130-447-1Y	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C93
130-A17-6Y	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C40	130-447-1Y	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C94
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C42	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C95
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C43	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C96
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C44	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C97
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C45	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C98
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C46	131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C99
141-072-3Y	CHIP TANTALUM	10UF	TSM1A106ASSR 10V	C47	132-034-1Y	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C100
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C48	132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C101
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C49	134-779-1Y	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C102
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C50	130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C103
140-405-6	CHIP TANTALUM	0.47UF	TCA10474MR 20V	C51	132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C104
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C52	132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C105
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C53	132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C106

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION			REF
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C107	130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C425
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C108	130-365-0	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C426
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C109	130-365-0	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C427
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C111	131-257-5Y	CHIP CERAMIC	120PF	GRM36 COG121J 50V	C428
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C112	130-808-4Y	CHIP CERAMIC	0.082UF	GRM40 X7R823K 50V PT	C429
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C116	130-624-4	CHIP CERAMIC	0.68UF	GRM40 Y5V684Z 16V PT	C430
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C121	130-359-5Y	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C431
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C122	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C432
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C201	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C433
131-851-7Y	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C203	130-294-9Y	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C434
131-583-5Y	CHIP CERAMIC	1.5PF	GRM36 COG1R5C 50V	C204	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C435
131-258-6Y	CHIP CERAMIC	1.2PF	GRM36 COG1R2C 50V	C205	130-294-9Y	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C436
131-853-9Y	CHIP CERAMIC	1.8PF	GRM36 COG1R8C 50V	C206	130-629-9Y	CHIP CERAMIC	0.0068UF	GRM36 X7R682K 25V	C437
131-126-6Y	CHIP CERAMIC	1PF	GRM36 COG010C 50V	C207	131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C438
176-016-7	CHIP TRIMMER	6PF	TZV02Z060A100	C208	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C439
132-286-9Y	CHIP CERAMIC	2.2PF	GRM36 COG2R2C 50V	C209	132-035-2Y	CHIP CERAMIC	200PF	GRM36 COG201J 50V	C440
135-651-3Y	CHIP CERAMIC	5.6PF	GRM36 COG5R6D 50V	C211	133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C441
131-312-7Y	CHIP CERAMIC	13PF	GRM36 COG130J 50V	C212	133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C442
134-778-0Y	CHIP CERAMIC	4.7PF	GRM36 COG4R	C213	130-B36-3X	CHIP CERAMIC	0.1UF	CL05B104KPNC	C443
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C214	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C444
133-111-2Y	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C215	130-359-5Y	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C445
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C216	130-287-0Y	CHIP CERAMIC	0.0027UF	GRM36 X7R272K 50V	C446
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C217	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C448
134-018-7Y	CHIP CERAMIC	4PF	GRM36 COG040C 50V	C218	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C449
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C301	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C450
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C303	130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C451
176-016-7	CHIP TRIMMER	6PF	TZV02Z060A100	C308	130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C452
131-853-9Y	CHIP CERAMIC	1.8PF	GRM36 COG1R8C 50V	C309	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C453
132-733-9Y	CHIP CERAMIC	2.7PF	GRM39 COG2R7C 50V PT	C311	130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C454
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C312	144-729-8Z	CHIP TANTALUM	47UF	293D476X0016E2T16V	C455
134-778-0Y	CHIP CERAMIC	4.7PF	GRM36 COG4R	C313	141-052-5Z	CHIP TANTALUM	100UF	293D107X0006E2T6V	C456
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C314	141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C457
131-608-5Y	CHIP CERAMIC	16PF	GRM36 COG160J 50V	C315	131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C458
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C316	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C459
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C317	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C460
132-034-1Y	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C318	141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C461
131-585-7Y	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C401	144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C462
131-585-7Y	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C402	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C463
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C403	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C464
131-135-4Y	CHIP CERAMIC	1UF	GRM39 Y5V105Z 10V	C404	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C465
130-286-9Y	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C405	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C467
130-B14-3Y	CHIP CERAMIC	0.0015UF	GRM36 X7R152K 50V	C406	130-A17-6Y	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C468
130-359-5Y	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C407	142-253-5	CHIP TANTAL	TSM1V226	DSSR	C469
130-359-5Y	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C408	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C470
130-447-1Y	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C409	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C472
130-286-9Y	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C410	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C473
130-A99-0Y	CHIP CERAMIC	0.012UF	GRM39 X7R123K 25V PT	C411	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C474
139-104-6	CHIP CERAMIC	910PF	GRM39 X7R911J 50V PT	C412	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C475
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C413	130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C476
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C414	141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C477
134-779-1Y	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C415	141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C478
130-294-9Y	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C416	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C481
134-779-1Y	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C417	141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C482
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C418	130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C487
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C419	130-365-0	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C488
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C420	130-365-0	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C489
141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C421	130-365-0	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C490
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C422	130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C491
133-112-3Y	CHIP CERAMIC	300PF	GRM36 X7R301K 50V	C423	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C492
130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C424	134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C493

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION			REF
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C494	243-052-6	DIODE SI CHIP	KDS193		D2
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C500	243-087-8	DIODE CHIP	UPP9401(T&R)50V	2.5W	D3
141-036-1	CHIP TANTALUM	1UF	293D105X0016A2T16V	C504	243-087-8	DIODE CHIP	UPP9401(T&R)50V	2.5W	D5
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C507	243-122-6	SCHOTTKY DIODE	HSMS-2817 #L31		D6
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C511	243-063-6	DIODE SWITCHING	KDS181S A3		D8
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C512	243-063-6	DIODE SWITCHING	KDS181S A3		D9
130-454-7	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C513	242-027-9	DIODE VARICAP CHIP	1SV217		D201
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C514	242-027-9	DIODE VARICAP CHIP	1SV217		D202
132-734-0Y	CHIP CERAMIC	27PF	GRM39 COG270J 50V PT	C601	242-027-9	DIODE VARICAP CHIP	1SV217		D301
131-306-2Y	CHIP CERAMIC	13PF	GRM39 COG130J 50V PT	C603	243-063-6	DIODE SWITCHING	KDS181S A3		D402
132-734-0Y	CHIP CERAMIC	27PF	GRM39 COG270J 50V PT	C606	241-179-8	DIODE ZENER CHIP	Z02W5.6Y	5.6V 0.2W (SOT-23)	D404
136-839-2Y	CHIP CERAMIC	68PF	GRM39 COG680J 50V PT	C608	241-179-8	DIODE ZENER CHIP	Z02W5.6Y	5.6V 0.2W (SOT-23)	D405
131-575-8Y	CHIP CERAMIC	150PF	GRM39 COG151J 50V PT	C609	241-179-8	DIODE ZENER CHIP	Z02W5.6Y	5.6V 0.2W (SOT-23)	D406
136-839-2Y	CHIP CERAMIC	68PF	GRM39 COG680J 50V PT	C610	241-179-8	DIODE ZENER CHIP	Z02W5.6Y	5.6V 0.2W (SOT-23)	D410
131-575-8Y	CHIP CERAMIC	150PF	GRM39 COG151J 50V PT	C611	243-049-4Z	DIODE CHIP	KDS226		D601
135-107-9Y	CHIP CERAMIC	51PF	GRM39 COG510J 50V PT	C612	243-104-0	DIODE	KDS160		D801
133-103-5Y	CHIP CERAMIC	30PF	GRM39 COG300J 50V PT	C615	243-127-1	DIODE SCHOTTKY	MBRS140T3	(403A-03)	D802
130-A75-8Y	CHIP CERAMIC	0.001UF	GRM39 X7R102K 50V PT	C616	243-049-4Z	DIODE CHIP	KDS226		D901
133-349-1Y	CHIP CERAMIC	33PF	GRM39 COG330J 50V PT	C618	243-049-4Z	DIODE CHIP	KDS226		D902
132-259-8Y	CHIP CERAMIC	22PF	GRM39 COG220J 50V PT	C619	243-049-4Z	DIODE CHIP	KDS226		D903
130-A75-8Y	CHIP CERAMIC	0.001UF	GRM39 X7R102K 50V PT	C620	221-344-6Z	I.C VOLT. REGULATOR	TK71750SCL		IC1
135-627-2Y	CHIP CERAMIC	5.6PF	GRM40 COG5R6C 50V PT	C701	221-555-8	I.C PLL	MB15A02PFV1	(FPT-16P-M05)	IC2
132-714-2Y	CHIP CERAMIC	27PF	GRM40 COG270J 50V PT	C702	221-762-8	I.C OPAMP	NJM12904V		IC3
130-172-2Y	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C703	221-762-8	I.C OPAMP	NJM12904V		IC4
131-816-6Y	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C704	221-762-8	I.C OPAMP	NJM12904V		IC5
133-611-7Y	CHIP CERAMIC	36PF	GRM40 COG360J 50V PT	C705	220-520-1	I.C IF DETECT	TA31136FN		IC6
130-172-2Y	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C706	221-773-8	I.C CPU	TMP87PS68DF		IC401
130-172-2Y	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C710	221-571-2	I.C EEPROM	CSI24WC04J-TE13		IC402
130-172-2Y	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C712	221-795-8	I.C OP AMP	NJM12903V		IC403
131-816-6Y	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C713	222-018-5A	I.C	KIA324F-EL		IC404
131-816-6Y	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C714	222-018-5A	I.C	KIA324F-EL		IC405
130-172-2Y	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C715	223-224-9	I.C	MC14066BDR2:SO14		IC406
136-008-8Y	CHIP CERAMIC	60PF	GRM40 COG600J 50V PT	C717	223-224-9	I.C	MC14066BDR2:SO14		IC407
134-301-1Y	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C718	222-018-5A	I.C	KIA324F-EL		IC408
135-115-6Y	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C801	223-261-2	I.C	MC14053BD		IC409
131-100-6Y	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C802	231-073-3Z	I.C	MSNBLPS		IC410
133-367-7Y	CHIP CERAMIC	330PF	GRM36 X7R331K 50V	C803	222-018-5A	I.C	KIA324F-EL		IC411
135-115-6Y	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C804	231-038-1	I.C	LM386MX-1 (SO-08)		IC412
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C805	222-023-9A	I.C DETECTOR	KIA7042F		IC414
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C806	222-018-5A	I.C	KIA324F-EL		IC416
142-253-5	CHIP TANTAL	TSM1V226 DSSR		C807	222-018-5A	I.C	KIA324F-EL		IC417
131-100-6Y	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C808	220-655-0	I.C CMOS SW	TC7S66FU	(SSOP5PA)(MAX-2000)	IC418
130-A73-6Y	CHIP CERAMIC	0.01UF	GRM39 X7R103K 25V	C810	221-114-3	I.C DC/DC CONVERTOR	LTC1435CS	(SO-16)	IC801
141-067-6Z	CHIP TANTALUM	100UF	NRD107M16R12	C811	310-659-2	COIL CHIP	10UH:LER015T100K		L1
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C812	312-197-1Z	COIL WIREWOUND CHIP	100NH	WCI1608TR10	L2
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C813	312-167-4	COIL INDUCTOR CHIP	150NH	SWI0805CTR15	L3
141-067-6Z	CHIP TANTALUM	100UF	NRD107M16R12	C815	310-861-7	COIL CHIP	47NH:LL2012-F47NM		L4
132-288-1Y	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C901	310-861-7	COIL CHIP	47NH:LL2012-F47NM		L5
132-288-1Y	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C902	312-132-2	COIL INDUCTOR CHIP	1UH	SWI0805FT1RO	L6
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C904	311-298-4Z	COIL SPRING	3X0.55X4T:L		L7
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C905	311-297-3	COIL SPRING	3X0.55X5T:L SMD		L8
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C906	311-297-3	COIL SPRING	3X0.55X5T:L SMD		L9
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C907	311-323-3	COIL SPRING	2.8X0.4X8T:L		L10
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C908	312-167-4	COIL INDUCTOR CHIP	150NH	SWI0805CTR15	L11
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C909	312-129-0	COIL INDUCTOR CHIP	0.56UH	SWI0805FTR56	L12
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C910	312-168-5	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L14
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C911	312-132-2	COIL INDUCTOR CHIP	1UH	SWI0805FT1RO	L15
270-343-3Y	FILTER CERAMIC	LTM455FW		CF1	312-137-7	COIL INDUCTOR CHIP	2.7UH	SWI0805FT2R7	L16
270-342-2Y	FILTER CERAMIC	LTM455HW		CF2	312-133-3	COIL INDUCTOR CHIP	1.2UH	SWI0805FT1R2	L201
243-063-6	DIODE SWITCHING	KDS181S A3		D1	311-801-8	COIL CHIP	56NH	LQN21A56N04	L203

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION			REF
312-136-6	COIL INDUCTOR CHIP	2.2UH	SWI0805FT2R2	L204	202-113-1	TRANSISTOR	KTC3875S(BL)		Q20
312-168-5	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L205	202-095-8Z	TRANSISTOR	KRC104SND		Q21
312-133-3	COIL INDUCTOR CHIP	1.2UH	SWI0805FT1R2	L301	218-057-7Z	TRANSISTOR	KRA104S		Q22
311-801-8	COIL CHIP	56NH	LQN21A56N04	L303	202-095-8Z	TRANSISTOR	KRC104SND		Q24
312-137-7	COIL INDUCTOR CHIP	2.7UH	SWI0805FT2R7	L304	200-277-6	TRANSISTOR	2SC5086		Q201
312-168-5	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L305	200-277-6	TRANSISTOR	2SC5086		Q202
310-659-2	COIL CHIP	10UH:LER015T100K		L401	200-277-6	TRANSISTOR	2SC5086		Q301
312-197-1Z	COIL WIREWOUND CHIP 100NH		WCI1608TR10	L601	200-277-6	TRANSISTOR	2SC5086		Q302
312-196-0Z	COIL WIREWOUND CHIP 82NH		WCI1608T82N	L602	218-057-7Z	TRANSISTOR	KRA104S		Q401
311-960-8	COIL SPRING	0.26X0.9X8T:L 26NH		L604	218-057-7Z	TRANSISTOR	KRA104S		Q402
311-960-8	COIL SPRING	0.26X0.9X8T:L 26NH		L605	202-095-8Z	TRANSISTOR	KRC104SND		Q403
311-960-8	COIL SPRING	0.26X0.9X8T:L 26NH		L607	202-095-8Z	TRANSISTOR	KRC104SND		Q406
311-960-8	COIL SPRING	0.26X0.9X8T:L 26NH		L608	202-106-5	TRANSISTOR	KTA1504SY		Q407
312-191-5Z	COIL WIREWOUND CHIP 39NH		WCI1608T39N	L701	202-095-8Z	TRANSISTOR	KRC104SND		Q408
312-191-5Z	COIL WIREWOUND CHIP 39NH		WCI1608T39N	L702	202-095-8Z	TRANSISTOR	KRC104SND		Q410
311-960-8	COIL SPRING	0.26X0.9X8T:L 26NH		L705	202-095-8Z	TRANSISTOR	KRC104SND		Q411
310-913-1	COIL SPRING	1.0X0.45X4T:R(SMD)		L706	218-057-7Z	TRANSISTOR	KRA104S		Q413
310-913-1	COIL SPRING	1.0X0.45X4T:R(SMD)		L707	202-106-5	TRANSISTOR	KTA1504SY		Q417
311-202-7	SPRING COIL	1.2X0.3X2T SMD (R)		L708	202-095-8Z	TRANSISTOR	KRC104SND		Q418
311-299-5	COIL SPRING	2X0.45X8T:L SMD		L709	202-096-9Z	TRANSISTOR	KRC110SNK		Q419
312-192-6Z	COIL WIREWOUND CHIP 47NH		WCI1608T47N	L710	218-057-7Z	TRANSISTOR	KRA104S		Q424
311-743-9	COIL INDUCTOR	12UH	A814AY-120M=P3	L801	202-095-8Z	TRANSISTOR	KRC104SND		Q425
311-759-4	COIL INDUCTOR CHIP	3.3UH	636CY-3R3M=P3	L802	200-067-3Z	TRANSISTOR	KTC5084(0)		Q601
251-286-4Z	LAMP LED	L-115 VEGW		LED401	203-181-7Z	TRANSISTOR	PBR951		Q701
059-000-0Z	CHIP RESISTOR	0	1/ 8W 5% T 3216	LK1	200-293-1	MOS FET(N-CHANNEL)	NE5510279A		Q703
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK3	200-190-0	FET MOS	SI4412DY		Q801
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK5	200-190-0	FET MOS	SI4412DY		Q802
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK7	200-113-1	TRANSISTOR	KTC4075		Q901
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK10	200-113-1	TRANSISTOR	KTC4075		Q902
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK13	200-113-1	TRANSISTOR	KTC4075		Q903
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	LK15	200-113-1	TRANSISTOR	KTC4075		Q904
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK404	200-114-2	TRANSISTOR	KTA2014		Q905
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK407	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R1
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK411	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R2
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK412	05D-122-2Z	CHIP RESISTOR	1.2K	1/16W 5% T 1005	R3
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK417	05D-122-2Z	CHIP RESISTOR	1.2K	1/16W 5% T 1005	R4
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK419	05D-152-9Z	CHIP RESISTOR	1.5K	1/16W 5% T 1005	R5
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK421	05D-152-9Z	CHIP RESISTOR	1.5K	1/16W 5% T 1005	R6
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK422	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R7
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK424	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R8
05B-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1608	LK427	05D-562-6Z	CHIP RESISTOR	5.6K	1/16W 5% T 1005	R9
059-000-0Z	CHIP RESISTOR	0	1/ 8W 5% T 3216	LK701	05D-272-4Z	CHIP RESISTOR	2.7K	1/16W 5% T 1005	R10
202-092-5	BRT	KRA110SPK		Q1	05D-272-4Z	CHIP RESISTOR	2.7K	1/16W 5% T 1005	R11
202-092-5	BRT	KRA110SPK		Q2	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R12
200-113-1	TRANSISTOR	KTC4075		Q3	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R13
200-113-1	TRANSISTOR	KTC4075		Q4	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R14
200-114-2	TRANSISTOR	KTA2014		Q5	05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R15
200-114-2	TRANSISTOR	KTA2014		Q6	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R16
218-057-7Z	TRANSISTOR	KRA104S		Q7	05D-470-6Z	CHIP RESISTOR	47	1/16W 5% T 1005	R17
202-113-1	TRANSISTOR	KTC3875S(BL)		Q8	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R18
200-003-5	TRANSISTOR	BFR92A REEL		Q9	05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R19
203-181-7Z	TRANSISTOR	PBR951		Q10	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R20
202-116-4	TRANSISTOR	KTA1663		Q11	05D-333-6Z	CHIP RESISTOR	33K	1/16W 5% T 1005	R21
202-113-1	TRANSISTOR	KTC3875S(BL)		Q12	05D-122-2Z	CHIP RESISTOR	1.2K	1/16W 5% T 1005	R22
202-095-8Z	TRANSISTOR	KRC104SND		Q14	05D-203-2Z	CHIP RESISTOR	20K	1/16W 5% T 1005	R23
202-113-1	TRANSISTOR	KTC3875S(BL)		Q15	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R26
200-003-5	TRANSISTOR	BFR92A REEL		Q16	05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	R27
202-095-8Z	TRANSISTOR	KRC104SND		Q17	05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R28
202-095-8Z	TRANSISTOR	KRC104SND		Q18	05D-562-6Z	CHIP RESISTOR	5.6K	1/16W 5% T 1005	R29
200-003-5	TRANSISTOR	BFR92A REEL		Q19	05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R30

PART NO.	NAME & DESCRIPTION		REF	PART NO.	NAME & DESCRIPTION		REF
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R31	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R95
05D-301-7Z	CHIP RESISTOR	300 1/16W 5% T 1005	R32	05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R96
05D-180-4Z	CHIP RESISTOR	18 1/16W 5% T 1005	R33	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R97
05D-301-7Z	CHIP RESISTOR	300 1/16W 5% T 1005	R34	05D-510-9Z	CHIP RESISTOR	51 1/16W 5% T 1005	R98
05D-123-3Z	CHIP RESISTOR	12K 1/16W 5% T 1005	R35	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R99
05D-682-1Z	CHIP RESISTOR	6.8K 1/16W 5% T 1005	R36	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R100
05D-154-1Z	CHIP RESISTOR	150K 1/16W 5% T 1005	R37	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R101
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R38	060-103-8Z	CHIP RESISTOR	10K 1/10W 5% T 2012	R105
05D-271-3Z	CHIP RESISTOR	270 1/16W 5% T 1005	R39	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R108
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R40	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R110
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R41	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R111
060-000-8Z	CHIP RESISTOR	0 1/10W 5% T 2012	R42	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R112
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R43	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R113
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R44	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R114
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R45	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R115
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R46	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R116
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R47	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R117
05D-152-9Z	CHIP RESISTOR	1.5K 1/16W 5% T 1005	R48	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R118
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R49	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R119
05D-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1005	R50	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R201
05D-105-7Z	CHIP RESISTOR	1M 1/16W 5% T 1005	R51	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R202
05D-123-3Z	CHIP RESISTOR	12K 1/16W 5% T 1005	R52	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R203
05D-100-2Z	CHIP RESISTOR	10 1/16W 5% T 1005	R53	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R206
05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R54	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R207
05D-331-4Z	CHIP RESISTOR	330 1/16W 5% T 1005	R56	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R208
05D-475-1Z	CHIP RESISTOR	4.7M 1/16W 5% T 1005	R57	05D-271-3Z	CHIP RESISTOR	270 1/16W 5% T 1005	R209
05G-683-2Z	CHIP RESISTOR	68K 1/16W 1% T 1005	R58	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R302
05G-104-6Z	CHIP RESISTOR	100K 1/16W 1% T 1005	R59	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R306
05G-683-2Z	CHIP RESISTOR	68K 1/16W 1% T 1005	R60	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R307
05G-104-6Z	CHIP RESISTOR	100K 1/16W 1% T 1005	R61	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R308
05D-390-7Z	CHIP RESISTOR	39 1/16W 5% T 1005	R62	05D-271-3Z	CHIP RESISTOR	270 1/16W 5% T 1005	R309
06F-108-3	CHIP RESISTOR	0.1 1W 1% 1218	R63	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R402
05D-220-7Z	CHIP RESISTOR	22 1/16W 5% T 1005	R64	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R403
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R65	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R404
05D-510-9Z	CHIP RESISTOR	51 1/16W 5% T 1005	R68	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R405
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R69	05D-563-7Z	CHIP RESISTOR	56K 1/16W 5% T 1005	R406
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R70	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R407
05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R71	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R408
05D-182-6Z	CHIP RESISTOR	1.8K 1/16W 5% T 1005	R72	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R409
05D-152-9Z	CHIP RESISTOR	1.5K 1/16W 5% T 1005	R73	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R410
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R74	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R411
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R75	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R412
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R76	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R413
05D-563-7Z	CHIP RESISTOR	56K 1/16W 5% T 1005	R77	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R414
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R78	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R415
05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R79	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R416
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R80	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R417
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R81	05D-184-8Z	CHIP RESISTOR	180K 1/16W 5% T 1005	R418
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R82	05D-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1005	R419
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R83	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R420
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R84	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R421
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R85	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R422
05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R86	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R423
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R87	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R425
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R88	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R426
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R90	05D-302-8Z	CHIP RESISTOR	3K 1/16W 5% T 1005	R427
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R91	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R428
05D-184-8Z	CHIP RESISTOR	180K 1/16W 5% T 1005	R92	05D-392-9Z	CHIP RESISTOR	3.9K 1/16W 5% T 1005	R429
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R93	05D-273-5Z	CHIP RESISTOR	27K 1/16W 5% T 1005	R430
05D-513-2Z	CHIP RESISTOR	51K 1/16W 5% T1005	R94	05D-124-4Z	CHIP RESISTOR	120K 1/16W 5% T 1005	R431

PART NO.	NAME & DESCRIPTION		REF	PART NO.	NAME & DESCRIPTION		REF
05D-124-4Z	CHIP RESISTOR	120K 1/16W 5% T 1005	R432	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R506
060-364-7	CHIP RESISTOR	360K 1/10W 5% T 2012	R433	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R507
060-433-6Z	CHIP RESISTOR	43K 1/10W 5% T 2012	R434	05D-121-1Z	CHIP RESISTOR	120 1/16W 5% T 1005	R510
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R435	05D-121-1Z	CHIP RESISTOR	120 1/16W 5% T 1005	R511
060-433-6Z	CHIP RESISTOR	43K 1/10W 5% T 2012	R436	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R512
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R437	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R513
05D-363-3Z	CHIP RESISTOR	36K 1/16W 5% T 1005	R438	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R515
05D-303-9Z	CHIP RESISTOR	30K 1/16W 5% T 1005	R439	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R516
05D-303-9Z	CHIP RESISTOR	30K 1/16W 5% T 1005	R440	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R517
05D-512-1Z	CHIP RESISTOR	5.1K 1/16W 5% T 1005	R441	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R518
05D-273-5Z	CHIP RESISTOR	27K 1/16W 5% T 1005	R442	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R519
05D-122-2Z	CHIP RESISTOR	1.2K 1/16W 5% T 1005	R443	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R520
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R444	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R521
05D-912-9Z	CHIP RESISTOR	9.1K 1/16W 5% T 1005	R445	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R522
05D-512-1Z	CHIP RESISTOR	5.1K 1/16W 5% T 1005	R446	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R523
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R453	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R524
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R455	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R525
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R456	05D-242-7Z	CHIP RESISTOR	2.4K 1/16W 5% T 1005	R526
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R457	05D-823-2Z	CHIP RESISTOR	82K 1/16W 5% T 1005	R527
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R458	05D-821-0Z	CHIP RESISTOR	820 1/16W 5% T 1005	R528
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R459	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R529
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R460	05D-333-6Z	CHIP RESISTOR	33K 1/16W 5% T 1005	R530
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R461	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R531
05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R462	05D-123-3Z	CHIP RESISTOR	12K 1/16W 5% T 1005	R532
05D-683-2Z	CHIP RESISTOR	68K 1/16W 5% T 1005	R463	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R533
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R465	05D-243-8Z	CHIP RESISTOR	24K 1/16W 5% T 1005	R534
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R466	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R535
05D-105-7Z	CHIP RESISTOR	1M 1/16W 5% T 1005	R467	05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R540
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R468	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R544
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R469	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R549
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R470	05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R550
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R471	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R551
05D-151-8Z	CHIP RESISTOR	150 1/16W 5% T 1005	R472	05D-113-4Z	CHIP RESISTOR	11K 1/16W 5% T 1005	R554
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R473	05D-203-2Z	CHIP RESISTOR	20K 1/16W 5% T 1005	R555
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R474	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R556
05D-100-2Z	CHIP RESISTOR	10 1/16W 5% T 1005	R475	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R557
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R476	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R561
05D-333-6Z	CHIP RESISTOR	33K 1/16W 5% T 1005	R477	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R562
05D-203-2Z	CHIP RESISTOR	20K 1/16W 5% T 1005	R478	05D-122-2Z	CHIP RESISTOR	1.2K 1/16W 5% T 1005	R563
05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R479	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R564
05D-393-0Z	CHIP RESISTOR	39K 1/16W 5% T 1005	R481	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R565
05D-203-2Z	CHIP RESISTOR	20K 1/16W 5% T 1005	R482	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R567
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R483	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R569
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R484	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R570
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R485	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R571
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R486	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R572
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R487	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R573
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R488	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R574
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R489	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R581
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R492	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R582
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R493	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R584
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R494	05B-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1608	R601
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R495	05B-181-5Z	CHIP RESISTOR	180 1/16W 5% T 1608	R602
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R496	05B-821-0Z	CHIP RESISTOR	820 1/16W 5% T 1608	R603
05D-684-3Z	CHIP RESISTOR	680K 1/16W 5% T 1005	R500	05B-229-6Z	CHIP RESISTOR	2.2 1/16W 5% T 1608	R604
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R501	05B-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1608	R605
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R502	060-272-7Z	CHIP RESISTOR	2.7K 1/10W 5% T 2012	R701
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R503	060-682-4Z	CHIP RESISTOR	6.8K 1/10W 5% T 2012	R702
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R504	060-473-2Z	CHIP RESISTOR	47K 1/10W 5% T 2012	R705
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R505	060-220-0Z	CHIP RESISTOR	22 1/10W 5% T 2012	R706

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION	REF
060-202-4Z	CHIP RESISTOR	2K	1/10W 5% T 2012	R710			
060-392-2Z	CHIP RESISTOR	3.9K	1/10W 5% T 2012	R711			
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R801			
05D-363-3Z	CHIP RESISTOR	36K	1/16W 5% T 1005	R802			
06B-018-9	CHIP RESISTOR	0.033	1/10W 1% T 2012	R804			
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R805			
05D-203-2Z	CHIP RESISTOR	20K	1/16W 5% T 1005	R806			
05D-273-5Z	CHIP RESISTOR	27K	1/16W 5% T 1005	R901			
05D-752-1Z	CHIP RESISTOR	7.5K	1/16W 5% T 1005	R902			
05D-273-5Z	CHIP RESISTOR	27K	1/16W 5% T 1005	R903			
05D-752-1Z	CHIP RESISTOR	7.5K	1/16W 5% T 1005	R904			
05D-222-9Z	CHIP RESISTOR	2.2K	1/16W 5% T 1005	R905			
05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R906			
05D-222-9Z	CHIP RESISTOR	2.2K	1/16W 5% T 1005	R907			
05D-470-6Z	CHIP RESISTOR	47	1/16W 5% T 1005	R908			
060-000-8Z	CHIP RESISTOR	0	1/10W 5% T 2012	R(C508)			
060-104-9Z	CHIP RESISTOR	100K	1/10W 5% T 2012	R(L202)			
098-473-0	THERMISTOR CHIP	ECTH201208473H4100H		RTH402			
075-473-0	RES.CHIP TRIMMER	47K RH03E1CS4X		RV1			
075-104-7	RES.CHIP TRIMMER	100K RH03E1C15X		RV2			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X		RV4			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X		RV5			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X		RV6			
075-223-1	RES.CHIP TRIMMER	22K RH03E1CJ4X		RV401			
075-473-0	RES.CHIP TRIMMER	47K RH03E1CS4X		RV402			
075-472-8	RES.CHIP TRIMMER	4.7K RH03E1CS3X		RV403			
300-223-8	TRANSFORMERS CHIP	617PT-1019		T1			
300-223-8	TRANSFORMERS CHIP	617PT-1019		T2			
269-042-3	VTCXO	VX-F7M-2.0FX		TCXO1			
263-418-0X	CRYSTAL	44.645M -30 15PM 32P	3RD	X1			
263-472-8	CRYSTAL RESONATOR	8.0M -20 30PPM 18PF		X401			
271-225-5	FILTER CRYSTAL	45N15B4 45.1MHZ		XF2			
270-358-7	DISCRIMINATOR CERAMIC	DBCB455KCAY24-R0		Y1			

11.2. PARTS LIST FOR SD-164

PART NO.	NAME & DESCRIPTION			REF
180-301-7Z	METAL POLY CAP	0.33UF	63V	C1
180-209-8	METAL POLY CAP	0.022UF	223K 63V BOX	C2
180-126-6Z	METAL POLY CAP	0.01UF	63V	C3
180-126-6Z	METAL POLY CAP	0.01UF	63V	C4
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C5
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C6
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C7
136-018-7Y	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C8
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C9
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C10
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C11
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C12
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C13
130-B36-3X	CHIP CERAMIC	0.1UF	CL05B104KPNC	C14
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C15
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C17
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C18
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C19
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C20
133-110-1Y	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C21
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C22
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C23
132-033-0Y	CHIP CERAMIC	2PF	GRM36 COG020C 50V	C24
131-256-4Y	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C25
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C26
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C27
136-859-0Y	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C28
137-017-1Y	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C29
131-584-6Y	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C30
136-018-7Y	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C31
132-750-4Y	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C32
133-941-8X	CHIP CERAMIC	3.9PF	CL05C3R9CBNC	C33
134-761-4Y	CHIP CERAMIC	470PF	GRM40 COG471J 50V PT	C34
130-504-9Y	CHIP CERAMIC	0.5PF	GRM40 COG0R5C 50V PT	C35
130-702-1Y	CHIP CERAMIC	0.75PF	GRM40 COG0R75C50V PT	C36
139-003-8Y	CHIP CERAMIC	9PF	GRM40 COG090D 50V PT	C37
131-404-7Y	CHIP CERAMIC	14PF	GRM40 COG140J 50V PT	C38
136-833-6Y	CHIP CERAMIC	6.8PF	GRM40 COG6R8D 50V PT	C39
134-761-4Y	CHIP CERAMIC	470PF	GRM40 COG471J 50V PT	C40
130-702-1Y	CHIP CERAMIC	0.75PF	GRM40 COG0R75C50V PT	C41
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C42
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C43
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C44
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C45
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C46
141-072-3Y	CHIP TANTALUM	10UF	TSM1A106ASSR 10V	C47
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C48
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C49
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C50
140-405-6	CHIP TANTALUM	0.47UF	TCA10474MR 20V	C51
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C53
130-443-7	CHIP CERAMIC	0.47UF	GRM40 Y5V474Z 16V PT	C54
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C55
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C56
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C57
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C58
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C59
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C60
131-039-1Y	CHIP CERAMIC	10PF	GRM40 COG100C 50V PT	C61
137-017-1Y	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C62
138-245-6Y	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C64
131-851-7Y	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C66
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C68
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C69
133-111-2Y	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C70
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C71
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C72
138-245-6Y	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C73
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C74
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C75
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C76
131-584-6Y	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C77
132-750-4Y	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C78
133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C79
130-B16-5X	CHIP CERAMIC	0.01UF	CL05B103KONC	C80
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C81
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C82
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C83
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C84
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C85
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C86
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C87
141-059-2	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C88
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C89
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C90
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C91
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C92
130-447-1Y	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C93
130-447-1Y	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C94
130-B36-3Y	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C95
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C96
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C97
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C98
131-089-7Y	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C99
135-023-6Y	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C100
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C101
134-779-1Y	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C102
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C103
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C104
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C105
132-289-2Y	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C106
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C107
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C108
130-B12-1Y	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C109
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C110
130-B19-8Y	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C111
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C112
130-B16-5X	CHIP CERAMIC	0.01UF	CL05B103KONC	C121
130-B16-5X	CHIP CERAMIC	0.01UF	CL05B103KONC	C122
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C201
139-009-4Y	CHIP CERAMIC	9PF	GRM36 COG090D 50V	C203
130-707-6Y	CHIP CERAMIC	0.75PF	GRM36 COG0R75C50V	C204

PART NO.	NAME & DESCRIPTION	REF	PART NO.	NAME & DESCRIPTION	REF
131-583-5Y	CHIP CERAMIC 1.5PF GRM36 COG1R5C 50V	C205	130-294-9Y	CHIP CERAMIC 0.022UF GRM36 X7R223K 16V	C436
130-525-8Y	CHIP CERAMIC 0.5PF GRM36 COG0R5C 50V	C206	130-629-9Y	CHIP CERAMIC 0.0068UF GRM36 X7R682K 25V	C437
131-853-9Y	CHIP CERAMIC 1.8PF GRM36 COG1R8C 50V	C207	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V PT	C438
176-016-7	CHIP TRIMMER 6PF TZV02Z060A100	C208	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C439
132-286-9Y	CHIP CERAMIC 2.2PF GRM36 COG2R2C 50V	C209	132-035-2Y	CHIP CERAMIC 200PF GRM36 COG201J 50V	C440
134-018-7Y	CHIP CERAMIC 4PF GRM36 COG040C 50V	C211	133-366-6Y	CHIP CERAMIC 33PF GRM36 COG330J 50V	C441
131-256-4Y	CHIP CERAMIC 12PF GRM36 COG120J 50V	C212	133-366-6Y	CHIP CERAMIC 33PF GRM36 COG330J 50V	C442
133-110-1Y	CHIP CERAMIC 3PF GRM36 COG030C 50V	C213	130-B36-3X	CHIP CERAMIC 0.1UF CL05B104KPNC	C443
130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C214	130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C444
135-023-6Y	CHIP CERAMIC 5PF GRM36 COG050C 50V	C215	130-359-5Y	CHIP CERAMIC 0.0033UF GRM36 X7R332K 50V	C445
132-288-1Y	CHIP CERAMIC 220PF GRM36 X7R221J 50V	C216	130-287-0Y	CHIP CERAMIC 0.0027UF GRM36 X7R272K 50V	C446
132-288-1Y	CHIP CERAMIC 220PF GRM36 X7R221J 50V	C217	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	C448
134-018-7Y	CHIP CERAMIC 4PF GRM36 COG040C 50V	C218	130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C449
132-288-1Y	CHIP CERAMIC 220PF GRM36 X7R221J 50V	C301	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C450
131-256-4Y	CHIP CERAMIC 12PF GRM36 COG120J 50V	C303	130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C451
135-023-6Y	CHIP CERAMIC 5PF GRM36 COG050C 50V	C307	130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C452
176-016-7	CHIP TRIMMER 6PF TZV02Z060A100	C308	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	C453
132-749-4Y	CHIP CERAMIC 2.7PF GRM36 COG2R7C 50V	C309	130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C454
134-018-7Y	CHIP CERAMIC 4PF GRM36 COG040C 50V	C311	144-729-8Z	CHIP TANTALUM 47UF 293D476X0016E2T16V	C455
131-128-8Y	CHIP CERAMIC 11PF GRM36 COG110J 50V	C312	141-052-5Z	CHIP TANTALUM 100UF 293D107X0006E2T6V	C456
133-110-1Y	CHIP CERAMIC 3PF GRM36 COG030C 50V	C313	141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C457
131-127-7Y	CHIP CERAMIC 10PF GRM36 COG100D 50V	C315	131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V PT	C458
132-288-1Y	CHIP CERAMIC 220PF GRM36 X7R221J 50V	C316	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	C459
132-288-1Y	CHIP CERAMIC 220PF GRM36 X7R221J 50V	C317	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C460
134-018-7Y	CHIP CERAMIC 4PF GRM36 COG040C 50V	C318	141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C461
131-585-7Y	CHIP CERAMIC 150PF GRM36 COG151J 50V	C401	144-722-2	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	C462
131-585-7Y	CHIP CERAMIC 150PF GRM36 COG151J 50V	C402	130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C463
130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C403	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C464
131-135-4Y	CHIP CERAMIC 1UF GRM39 Y5V105Z 10V	C404	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C465
130-286-9Y	CHIP CERAMIC 0.0022UF GRM36 X7R222K 50V	C405	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C467
130-B14-3Y	CHIP CERAMIC 0.0015UF GRM36 X7R152K 50V	C406	130-A17-6Y	CHIP CERAMIC 0.001UF GRM40 X7R102K 50V PT	C468
130-359-5Y	CHIP CERAMIC 0.0033UF GRM36 X7R332K 50V	C407	142-253-5	CHIP TANTAL TSM1V226 DSSR	C469
130-359-5Y	CHIP CERAMIC 0.0033UF GRM36 X7R332K 50V	C408	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C470
130-447-1Y	CHIP CERAMIC 0.0047UF GRM36 X7R472K 25V	C409	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C472
130-286-9Y	CHIP CERAMIC 0.0022UF GRM36 X7R222K 50V	C410	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C473
130-A99-0Y	CHIP CERAMIC 0.012UF GRM39 X7R123K 25V PT	C411	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C474
139-104-6	CHIP CERAMIC 910PF GRM39 X7R911J 50V PT	C412	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C475
130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C413	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	C475
144-722-2	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	C414	130-B12-1Y	CHIP CERAMIC 0.001UF GRM36 X7R102K 50V	C476
134-779-1Y	CHIP CERAMIC 47PF GRM36 COG470J 50V	C415	141-059-2	CHIP TANTALUM 10UF 293D106X06R3A2T6.3V	C477
130-294-9Y	CHIP CERAMIC 0.022UF GRM36 X7R223K 16V	C416	141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C478
134-779-1Y	CHIP CERAMIC 47PF GRM36 COG470J 50V	C417	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C481
130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C418	141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C482
144-722-2	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	C419	130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C487
130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C420	130-365-0	CHIP CERAMIC 0.033UF GRM36 X7R333K 10V	C488
141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C421	130-365-0	CHIP CERAMIC 0.033UF GRM36 X7R333K 10V	C489
131-089-7Y	CHIP CERAMIC 1UF GRM40 Y5V105Z 16V PT	C422	130-365-0	CHIP CERAMIC 0.033UF GRM36 X7R333K 10V	C490
133-112-3Y	CHIP CERAMIC 300PF GRM36 X7R301K 50V	C423	130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C491
130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C424	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C492
130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C425	134-780-1Y	CHIP CERAMIC 470PF GRM36 X7R471K 50V	C493
130-365-0	CHIP CERAMIC 0.033UF GRM36 X7R333K 10V	C426	144-722-2	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	C494
130-365-0	CHIP CERAMIC 0.033UF GRM36 X7R333K 10V	C427	130-B16-5Y	CHIP CERAMIC 0.01UF GRM36 X7R103K 16V	C500
131-257-5Y	CHIP CERAMIC 120PF GRM36 COG121J 50V	C428	144-722-2	CHIP TANTALUM 4.7UF 293D475X0010A2T10V	C502
130-808-4Y	CHIP CERAMIC 0.082UF GRM40 X7R823K 50V PT	C429	141-036-1	CHIP TANTALUM 1UF 293D105X0016A2T16V	C504
130-624-4	CHIP CERAMIC 0.68UF GRM40 Y5V684Z 16V PT	C430	130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C511
130-359-5Y	CHIP CERAMIC 0.0033UF GRM36 X7R332K 50V	C431	130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C512
130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C432	130-454-7	CHIP CERAMIC 0.047UF GRM36 X7R473K 10V	C513
130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C433	130-B19-8Y	CHIP CERAMIC 0.1UF GRM36 Y5V104Z 16V	C514
130-294-9Y	CHIP CERAMIC 0.022UF GRM36 X7R223K 16V	C434	135-651-3Y	CHIP CERAMIC 5.6PF GRM36 COG5R6D 50V	C601
130-B36-3Y	CHIP CERAMIC 0.1UF GRM36 X5R104K 10V	C435	132-033-0Y	CHIP CERAMIC 2PF GRM36 COG020C 50V	C602

PART NO.	NAME & DESCRIPTION			REF
131-128-8Y	CHIP CERAMIC	11PF	GRM36 COG110J 50V	C603
137-017-1Y	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C604
133-366-6Y	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C605
131-256-4Y	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C608
134-779-1Y	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C609
134-780-1Y	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C611
138-014-3Y	CHIP CERAMIC	8PF	GRM36 COG080D 50V	C612
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C613
136-859-0Y	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C614
134-778-0Y	CHIP CERAMIC	4.7PF	GRM36 COG4R	C615
131-256-4Y	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C616
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C617
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C618
131-256-4Y	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C619
137-017-1Y	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C620
135-023-6Y	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C621
133-365-5Y	CHIP CERAMIC	3.3PF	GRM36 COG3R3C 50V	C622
135-023-6Y	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C623
132-287-0Y	CHIP CERAMIC	22PF	GRM36 COG220J 50V	C701
131-127-7Y	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C702
132-288-1Y	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C703
133-110-1Y	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C704
138-004-4Y	CHIP CERAMIC	8PF	GRM40 COG080D 50V PT	C705
135-010-4Y	CHIP CERAMIC	5PF	GRM40 COG050C 50V PT	C707
132-407-5Y	CHIP CERAMIC	24PF	GRM40 COG240J 50V PT	C708
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C709
130-A17-6Y	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C711
132-220-2Y	CHIP CERAMIC	220PF	GRM40 COG221J 50V PT	C712
137-007-1Y	CHIP CERAMIC	7PF	GRM40 COG070D 50V PT	C713
136-005-5Y	CHIP CERAMIC	6PF	GRM40 COG060D 50V PT	C714
133-321-5Y	CHIP CERAMIC	3.3PF	GRM40 COG3R3C 50V PT	C715
131-816-6Y	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C716
130-286-9Y	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C720
133-321-5Y	CHIP CERAMIC	3.3PF	GRM40 COG3R3C 50V PT	C721
135-627-2Y	CHIP CERAMIC	5.6PF	GRM40 COG5R6C 50V PT	C722
135-115-6Y	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C801
131-100-6Y	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C802
133-367-7Y	CHIP CERAMIC	330PF	GRM36 X7R331K 50V	C803
135-115-6Y	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C804
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C805
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C806
142-253-5	CHIP TANTAL	TSM1V226 DSSR		C807
131-100-6Y	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C808
130-A73-6Y	CHIP CERAMIC	0.01UF	GRM39 X7R103K 25V	C810
141-067-6Z	CHIP TANTALUM	100UF	NRD107M16R12	C811
131-129-9Y	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C812
144-722-2	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C813
141-067-6Z	CHIP TANTALUM	100UF	NRD107M16R12	C815
132-288-1Y	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C901
132-288-1Y	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C902
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C904
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C905
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C908
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C909
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C910
130-B16-5Y	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C911
132-012-1Y	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C(L603)
270-343-3Y	FILTER CERAMIC	LTM455FW		CF1
270-342-2Y	FILTER CERAMIC	LTM455HW		CF2
243-063-6	DIODE SWITCHING	KDS181S A3		D1

PART NO.	NAME & DESCRIPTION			REF
243-052-6	DIODE SI CHIP	KDS193		D2
243-087-8	DIODE CHIP	UPP9401(T&R)50V	2.5W	D3
243-087-8	DIODE CHIP	UPP9401(T&R)50V	2.5W	D5
243-122-6	SCHOTTKY DIODE	HSMS-2817 #L31		D6
243-063-6	DIODE SWITCHING	KDS181S A3		D8
243-063-6	DIODE SWITCHING	KDS181S A3		D9
242-022-4	DIODE VARICAP CHIP 1SV229			D201
242-022-4	DIODE VARICAP CHIP 1SV229			D202
242-022-4	DIODE VARICAP CHIP	1SV229		D301
243-063-6	DIODE SWITCHING	KDS181S A3		D402
241-179-8	DIODE ZENER CHIP	Z02W5.6Y 5.6V	0.2W (SOT-23)	D404
241-179-8	DIODE ZENER CHIP	Z02W5.6Y 5.6V	0.2W (SOT-23)	D405
241-179-8	DIODE ZENER CHIP	Z02W5.6Y 5.6V	0.2W (SOT-23)	D406
241-179-8	DIODE ZENER CHIP	Z02W5.6Y 5.6V	0.2W (SOT-23)	D410
243-049-4Z	DIODE CHIP	KDS226		D601
243-104-0	DIODE	KDS160		D801
243-127-1	DIODE SCHOTTKY	MBRS140T3	(403A-03)	D802
243-049-4Z	DIODE CHIP	KDS226		D901
243-049-4Z	DIODE CHIP	KDS226		D902
060-000-8Z	CHIP RESISTOR	0	1/10W 5% T 2012	D903
221-344-6Z	I.C VOLT. REGULATOR TK71750SCL			IC1
221-555-8	I.C PLL	MB15A02PFV1 (FPT-16P-M05)		IC2
221-762-8	I.C OPAMP	NJM12904V		IC3
221-762-8	I.C OPAMP	NJM12904V		IC3
221-762-8	I.C OPAMP	NJM12904V		IC5
220-520-1	I.C IF DETECT	TA31136FN		IC6
221-773-8	I.C CPU	TMP87PS68DF		IC401
221-571-2	I.C EEPROM	CSI24WC04J-TE13		IC402
221-795-8	I.C OP AMP	NJM12903V		IC403
222-018-5A	I.C	KIA324F-EL		IC404
222-018-5A	I.C	KIA324F-EL		IC405
223-224-9	I.C	MC14066BDR2:SO14		IC406
223-224-9	I.C	MC14066BDR2:SO14		IC407
222-018-5A	I.C	KIA324F-EL		IC408
223-261-2	I.C	MC14053BD		IC409
231-073-3Z	I.C	MSNBLPS		IC410
222-018-5A	I.C	KIA324F-EL		IC411
231-038-1	I.C	LM386MX-1 (SO-08)		IC412
222-023-9A	I.C DETECTOR	KIA7042F		IC414
222-018-5A	I.C	KIA324F-EL		IC416
222-018-5A	I.C	KIA324F-EL		IC417
220-655-0	I.C CMOS SW	TC7S66FU	(SSOP5PA)(MAX-2000)	IC418
221-114-3	I.C DC/DC CONVERTOR LTC1435CS	(SO-16)		IC801
312-219-8	COIL INDUCTOR CHIP	15NH 1608GC2T15NJ00		L(R705)
310-659-2	COIL CHIP	10UH:LER015T100K		L1
311-167-9	COIL WIREWOUND CHIP 18NH	WCI1608T18N		L2
312-199-3Z	COIL WIREWOUND CHIP 18NH	WCI1608T18N		L3
312-129-0	COIL CHIP	18NH:LL2012-F18NM		L4
312-187-2Z	COIL CHIP	18NH:LL2012-F18NM		L5
312-132-2	COIL INDUCTOR CHIP	0.82UH	SWI0805FTR82	L6
312-137-7	COIL SPRING	2X0.75X3T:L SMD		L7
312-187-2Z	COIL SPRING	2X0.75X3T:L SMD		L8
312-197-1Z	COIL SPRING	2X0.75X3T:L SMD		L9
312-128-9	COIL SPRING	1X0.35X7T:R		L10
310-913-1	COIL WIREWOUND CHIP 150NH	WCI1608TR15		L11
312-131-1	COIL INDUCTOR CHIP	0.56UH	SWI0805FTR56	L12
312-188-3Z	COIL WIREWOUND CHIP 18NH	WCI1608T18N		L14
312-187-2Z	COIL INDUCTOR CHIP	1UH	SWI0805FT1RO	L15
312-197-1Z	COIL INDUCTOR CHIP	2.7UH	SWI0805FT2R7	L16
310-913-1	COIL WIREWOUND CHIP 100NH	WCI1608TR10		L201

| PART NO.	NAME & DESCRIPTION		REF	PART NO.	NAME & DESCRIPTION		REF
312-131-1	COIL INDUCTOR CHIP	0.47UH SWI0805FTR47	L202	218-057-7Z	TRANSISTOR	KRA104S	Q22
312-190-4Z	COIL SPRING	1.0X0.45X4T:R(SMD)	L203	200-277-6	TRANSISTOR	2SC5086	Q201
310-859-6	COIL INDUCTOR CHIP	0.82UH SWI0805FTR82	L204	200-277-6	TRANSISTOR	2SC5086	Q202
310-659-2	COIL WIREWOUND CHIP 22NH	WCI1608T22N	L205	200-277-6	TRANSISTOR	2SC5086	Q301
310-859-6	COIL WIREWOUND CHIP 100NH	WCI1608TR10	L301	200-277-6	TRANSISTOR	2SC5086	Q302
312-131-1	COIL SPRING	1.0X0.45X4T:R(SMD)	L303	218-057-7Z	TRANSISTOR	KRA104S	Q401
311-982-8	COIL INDUCTOR CHIP	0.82UH SWI0805FTR82	L304	218-057-7Z	TRANSISTOR	KRA104S	Q402
311-982-8	COIL WIREWOUND CHIP 33NH	WCI1608T33N	L305	202-095-8Z	TRANSISTOR	KRC104SND	Q403
311-943-3	COIL CHIP	10UH:LER015T100K	L401	202-095-8Z	TRANSISTOR	KRC104SND	Q406
311-982-8	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L601	202-106-5	TRANSISTOR	KTA1504SY	Q407
311-982-8	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L602	202-095-8Z	TRANSISTOR	KRC104SND	Q408
311-943-3	COIL SPRING	14NH 03095TL	L604	202-095-8Z	TRANSISTOR	KRC104SND	Q410
311-943-3	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L605	202-095-8Z	TRANSISTOR	KRC104SND	Q411
311-982-8	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L606	218-057-7Z	TRANSISTOR	KRA104S	Q413
311-301-3	COIL SPRING	14NH 03095TL	L607	202-106-5	TRANSISTOR	KTA1504SY	Q417
311-982-8	COIL SPRING	14NH 03095TL	L608	202-095-8Z	TRANSISTOR	KRC104SND	Q418
312-180-5Z	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L609	202-096-9Z	TRANSISTOR	KRC110SNK	Q419
311-167-9	SPRING COIL(SMD)	0.30X0.90$X4T(R)	L701	200-307-0	TRANSISTER NPN	AT-41532	Q601
311-301-3	COIL WIREWOUND CHIP 3.9NH	WCI1608T3N9	L704	203-181-7Z	TRANSISTOR	PBR951	Q701
311-743-9Z	COIL SPRING	1X0.35X7T:R	L705	200-302-5	FET RF POWER	2SK3079A	Q703
311-759-4Z	COIL INDUCTOR CHIP	12UH DA104-120M	L801	200-190-0	FET MOS	SI4412DY	Q801
311-301-3	COIL INDUCTOR CHIP	3.3UH SD73-3R3M	L802	200-190-0	FET MOS	SI4412DY	Q802
251-286-4Z	LAMP LED	L-115 VEGW	LED401	200-113-1	TRANSISTOR	KTC4075	Q901
059-000-0Z	CHIP RESISTOR	0 1/ 8W 5% T 3216	LK1	200-113-1	TRANSISTOR	KTC4075	Q902
05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	LK3	200-113-1	TRANSISTOR	KTC4075	Q903
05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	LK5	200-113-1	TRANSISTOR	KTC4075	Q904
05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	LK7	200-114-2	TRANSISTOR	KTA2014	Q905
05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	LK10	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R1
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK404	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R2
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK407	05B-911-8Z	CHIP RESISTOR	910 1/16W 5% 1608	R3
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK411	05B-911-8Z	CHIP RESISTOR	910 1/16W 5% 1608	R4
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK412	05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R5
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK417	05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R6
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK419	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R7
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK421	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R8
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK422	05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R9
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK424	05D-272-4Z	CHIP RESISTOR	2.7K 1/16W 5% T 1005	R10
05B-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1608	LK427	05D-272-4Z	CHIP RESISTOR	2.7K 1/16W 5% T 1005	R11
059-000-0Z	CHIP RESISTOR	0 1/ 8W 5% T 3216	LK701	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R12
202-092-5	BRT	KRA110SPK	Q1	05D-180-4Z	CHIP RESISTOR	18 1/16W 5% T 1005	R13
202-092-5	BRT	KRA110SPK	Q2	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R14
200-113-1	TRANSISTOR	KTC4075	Q3	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R15
200-113-1	TRANSISTOR	KTC4075	Q4	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R16
200-114-2	TRANSISTOR	KTA2014	Q5	05D-470-6Z	CHIP RESISTOR	47 1/16W 5% T 1005	R17
200-114-2	TRANSISTOR	KTA2014	Q6	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R20
218-057-7Z	TRANSISTOR	KRA104S	Q7	05D-333-6Z	CHIP RESISTOR	33K 1/16W 5% T 1005	R21
202-113-1	TRANSISTOR	KTC3875S(BL)	Q8	05D-122-2Z	CHIP RESISTOR	1.2K 1/16W 5% T 1005	R22
200-003-5	TRANSISTOR	BFR92A REEL	Q9	05D-203-2Z	CHIP RESISTOR	20K 1/16W 5% T 1005	R23
203-181-7Z	TRANSISTOR	PBR951	Q10	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R24
202-116-4	TRANSISTOR	KTA1663	Q11	05D-684-3Z	CHIP RESISTOR	680K 1/16W 5% T 1005	R25
202-113-1	TRANSISTOR	KTC3875S(BL)	Q12	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R26
202-095-8Z	TRANSISTOR	KRC104SND	Q14	05D-122-2Z	CHIP RESISTOR	1.2K 1/16W 5% T 1005	R28
202-113-1	TRANSISTOR	KTC3875S(BL)	Q15	05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R29
200-003-5	TRANSISTOR	BFR92A REEL	Q16	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R30
202-095-8Z	TRANSISTOR	KRC104SND	Q17	05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R31
202-095-8Z	TRANSISTOR	KRC104SND	Q18	05D-301-7Z	CHIP RESISTOR	300 1/16W 5% T 1005	R32
200-003-5	TRANSISTOR	BFR92A REEL	Q19	05D-180-4Z	CHIP RESISTOR	18 1/16W 5% T 1005	R33
202-113-1	TRANSISTOR	KTC3875S(BL)	Q20	05D-301-7Z	CHIP RESISTOR	300 1/16W 5% T 1005	R34
202-095-8Z	TRANSISTOR	KRC104SND	Q21	05D-123-3Z	CHIP RESISTOR	12K 1/16W 5% T 1005	R35
202-095-8Z	TRANSISTOR	KRC104SND	Q22	05D-682-1Z	CHIP RESISTOR	6.8K 1/16W 5% T 1005	R36

| PART NO.	NAME & DESCRIPTION		REF	PART NO.	NAME & DESCRIPTION		REF
05D-154-1Z	CHIP RESISTOR	150K 1/16W 5% T 1005	R37	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R101
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R38	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R104
05D-121-1Z	CHIP RESISTOR	120 1/16W 5% T 1005	R39	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R105
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R40	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R109
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R41	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R110
060-000-8Z	CHIP RESISTOR	0 1/10W 5% T 2012	R42	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R111
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R43	05D-823-2Z	CHIP RESISTOR	82K 1/16W 5% T 1005	R113
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R44	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R114
060-229-9Z	CHIP RESISTOR	2.2 1/10W 5% T 2012	R45	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R115
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R46	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R116
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R47	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R117
05D-152-9Z	CHIP RESISTOR	1.5K 1/16W 5% T 1005	R48	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R118
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R49	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R119
05D-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1005	R50	05D-000-5Z	CHIP RESISTOR	0 1/16W 5% T 1005	R201
05D-105-7Z	CHIP RESISTOR	1M 1/16W 5% T 1005	R51	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R202
05D-123-3Z	CHIP RESISTOR	12K 1/16W 5% T 1005	R52	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R203
05D-100-2Z	CHIP RESISTOR	10 1/16W 5% T 1005	R53	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R206
05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R54	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R207
05D-221-8Z	CHIP RESISTOR	220 1/16W 5% T 1005	R56	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R208
05D-475-1Z	CHIP RESISTOR	4.7M 1/16W 5% T 1005	R57	05D-271-3Z	CHIP RESISTOR	270 1/16W 5% T 1005	R209
05C-683-2Z	CHIP RESISTOR	68K 1/16W 1% T 1608	R58	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R302
05C-104-6Z	CHIP RESISTOR	100K 1/16W 1% T 1608	R59	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R306
05C-683-2Z	CHIP RESISTOR	68K 1/16W 1% T 1608	R60	05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R307
05C-104-6Z	CHIP RESISTOR	100K 1/16W 1% T 1608	R61	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R308
05D-390-7Z	CHIP RESISTOR	39 1/16W 5% T 1005	R62	05D-271-3Z	CHIP RESISTOR	270 1/16W 5% T 1005	R309
06F-108-3	CHIP RESISTOR	0.1 1W 1% 1218	R63	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R402
05D-470-6Z	CHIP RESISTOR	47 1/16W 5% T 1005	R64	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R403
060-474-3Z	CHIP RESISTOR	470K 1/10W 5% T 2012	R65	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R404
05D-510-9Z	CHIP RESISTOR	51 1/16W 5% T 1005	R68	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R405
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R69	05D-563-7Z	CHIP RESISTOR	56K 1/16W 5% T 1005	R406
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R70	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R407
05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R71	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R408
05D-222-9Z	CHIP RESISTOR	2.2K 1/16W 5% T 1005	R72	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R409
05D-182-6Z	CHIP RESISTOR	1.8K 1/16W 5% T 1005	R73	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R410
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R74	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R411
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R75	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R412
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R76	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R413
05D-563-7Z	CHIP RESISTOR	56K 1/16W 5% T 1005	R77	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R414
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R78	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R415
05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R79	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R416
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R80	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R417
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R81	05D-184-8Z	CHIP RESISTOR	180K 1/16W 5% T 1005	R418
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R83	05D-332-5Z	CHIP RESISTOR	3.3K 1/16W 5% T 1005	R419
05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R84	05D-224-1Z	CHIP RESISTOR	220K 1/16W 5% T 1005	R420
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R85	05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R421
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R85	05D-223-0Z	CHIP RESISTOR	22K 1/16W 5% T 1005	R422
05D-474-0Z	CHIP RESISTOR	470K 1/16W 5% T 1005	R86	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R423
05D-102-4Z	CHIP RESISTOR	1K 1/16W 5% T 1005	R87	05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R425
05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R88	05D-101-3Z	CHIP RESISTOR	100 1/16W 5% T 1005	R426
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R90	05D-302-8Z	CHIP RESISTOR	3K 1/16W 5% T 1005	R427
05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R91	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R428
05D-184-8Z	CHIP RESISTOR	180K 1/16W 5% T 1005	R92	05D-392-9Z	CHIP RESISTOR	3.9K 1/16W 5% T 1005	R429
05D-104-6Z	CHIP RESISTOR	100K 1/16W 5% T 1005	R93	05D-273-5Z	CHIP RESISTOR	27K 1/16W 5% T 1005	R430
05D-513-2Z	CHIP RESISTOR	51K 1/16W 5% T1005	R94	05D-124-4Z	CHIP RESISTOR	120K 1/16W 5% T 1005	R431
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R95	05D-124-4Z	CHIP RESISTOR	120K 1/16W 5% T 1005	R432
05D-562-6Z	CHIP RESISTOR	5.6K 1/16W 5% T 1005	R96	060-364-7	CHIP RESISTOR	360K 1/10W 5% T 2012	R433
05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R97	060-433-6Z	CHIP RESISTOR	43K 1/10W 5% T 2012	R434
05D-330-3Z	CHIP RESISTOR	33 1/16W 5% T 1005	R98	05D-473-9Z	CHIP RESISTOR	47K 1/16W 5% T 1005	R435
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R99	060-433-6Z	CHIP RESISTOR	43K 1/10W 5% T 2012	R436
05D-103-5Z	CHIP RESISTOR	10K 1/16W 5% T 1005	R100	05D-472-8Z	CHIP RESISTOR	4.7K 1/16W 5% T 1005	R437

PART NO.	NAME & DESCRIPTION			REF	PART NO.	NAME & DESCRIPTION			REF
05D-363-3Z	CHIP RESISTOR	36K	1/16W 5% T 1005	R438	05D-224-1Z	CHIP RESISTOR	220K	1/16W 5% T 1005	R513
05D-303-9Z	CHIP RESISTOR	30K	1/16W 5% T 1005	R439	05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R515
05D-303-9Z	CHIP RESISTOR	30K	1/16W 5% T 1005	R440	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R516
05D-512-1Z	CHIP RESISTOR	5.1K	1/16W 5% T 1005	R441	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R517
05D-273-5Z	CHIP RESISTOR	27K	1/16W 5% T 1005	R442	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R518
05D-122-2Z	CHIP RESISTOR	1.2K	1/16W 5% T 1005	R443	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R519
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R444	05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R520
05D-912-9Z	CHIP RESISTOR	9.1K	1/16W 5% T 1005	R445	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R521
05D-512-1Z	CHIP RESISTOR	5.1K	1/16W 5% T 1005	R446	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R522
05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R453	05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	R523
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R455	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R524
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R455	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R525
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R456	05D-242-7Z	CHIP RESISTOR	2.4K	1/16W 5% T 1005	R526
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R457	05D-823-2Z	CHIP RESISTOR	82K	1/16W 5% T 1005	R527
05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R458	05D-821-0Z	CHIP RESISTOR	820	1/16W 5% T 1005	R528
05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R459	05D-224-1Z	CHIP RESISTOR	220K	1/16W 5% T 1005	R529
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R460	05D-333-6Z	CHIP RESISTOR	33K	1/16W 5% T 1005	R530
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R461	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R531
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	R462	05D-123-3Z	CHIP RESISTOR	12K	1/16W 5% T 1005	R532
05D-683-2Z	CHIP RESISTOR	68K	1/16W 5% T 1005	R463	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R533
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R465	05D-243-8Z	CHIP RESISTOR	24K	1/16W 5% T 1005	R534
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R466	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R535
05D-105-7Z	CHIP RESISTOR	1M	1/16W 5% T 1005	R467	05D-474-0Z	CHIP RESISTOR	470K	1/16W 5% T 1005	R540
05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R468	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R544
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R469	05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R549
05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R470	05D-474-0Z	CHIP RESISTOR	470K	1/16W 5% T 1005	R550
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R471	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R551
05D-151-8Z	CHIP RESISTOR	150	1/16W 5% T 1005	R472	05D-113-4Z	CHIP RESISTOR	11K	1/16W 5% T 1005	R554
05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R473	05D-183-7Z	CHIP RESISTOR	18K	1/16W 5% T 1005	R555
05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R474	05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R556
05D-100-2Z	CHIP RESISTOR	10	1/16W 5% T 1005	R475	05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	R557
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R476	05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005	R561
05D-333-6Z	CHIP RESISTOR	33K	1/16W 5% T 1005	R477	05D-224-1Z	CHIP RESISTOR	220K	1/16W 5% T 1005	R562
05D-203-2Z	CHIP RESISTOR	20K	1/16W 5% T 1005	R478	05D-122-2Z	CHIP RESISTOR	1.2K	1/16W 5% T 1005	R563
05D-224-1Z	CHIP RESISTOR	220K	1/16W 5% T 1005	R479	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R564
05D-393-0Z	CHIP RESISTOR	39K	1/16W 5% T 1005	R481	05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R565
05D-203-2Z	CHIP RESISTOR	20K	1/16W 5% T 1005	R482	05D-224-1Z	CHIP RESISTOR	220K	1/16W 5% T 1005	R567
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R483	05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R569
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R484	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R570
05D-223-0Z	CHIP RESISTOR	22K	1/16W 5% T 1005	R485	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R571
05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R486	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R572
05D-221-8Z	CHIP RESISTOR	220	1/16W 5% T 1005	R487	05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R573
05D-221-8Z	CHIP RESISTOR	220	1/16W 5% T 1005	R488	05D-104-6Z	CHIP RESISTOR	100K	1/16W 5% T 1005	R574
05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R489	05D-303-9Z	CHIP RESISTOR	30K	1/16W 5% T 1005	R601
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R492	05D-470-6Z	CHIP RESISTOR	47	1/16W 5% T 1005	R602
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R493	05D-272-4Z	CHIP RESISTOR	2.7K	1/16W 5% T 1005	R701
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R494	05D-682-1Z	CHIP RESISTOR	6.8K	1/16W 5% T 1005	R702
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R495	05D-689-8Z	CHIP RESISTOR	6.8	1/16W 5% T 1005	R703
05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R496	05D-220-7Z	CHIP RESISTOR	22	1/16W 5% T 1005	R707
05D-684-3Z	CHIP RESISTOR	680K	1/16W 5% T 1005	R500	05D-820-9Z	CHIP RESISTOR	82	1/16W 5% T 1005	R709
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R501	05D-339-2Z	CHIP RESISTOR	3.3	1/16W 5% T 1005	R710
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R502	05D-103-5Z	CHIP RESISTOR	10K	1/16W 5% T 1005	R801
05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R503	05D-333-6Z	CHIP RESISTOR	33K	1/16W 5% T 1005	R802
05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005	R504	06B-018-9	CHIP RESISTOR	0.033	1/10W 1% T 2012	R804
05D-101-3Z	CHIP RESISTOR	100	1/16W 5% T 1005	R505	05D-563-7Z	CHIP RESISTOR	56K	1/16W 5% T 1005	R805
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R506	05D-203-2Z	CHIP RESISTOR	20K	1/16W 5% T 1005	R806
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R506	05D-273-5Z	CHIP RESISTOR	27K	1/16W 5% T 1005	R901
05D-121-1Z	CHIP RESISTOR	120	1/16W 5% T 1005	R510	05D-752-1Z	CHIP RESISTOR	7.5K	1/16W 5% T 1005	R902
05D-121-1Z	CHIP RESISTOR	120	1/16W 5% T 1005	R511	05D-273-5Z	CHIP RESISTOR	27K	1/16W 5% T 1005	R903
05D-473-9Z	CHIP RESISTOR	47K	1/16W 5% T 1005	R512	05D-752-1Z	CHIP RESISTOR	7.5K	1/16W 5% T 1005	R904

PART NO.	NAME & DESCRIPTION				REF	PART NO.	NAME & DESCRIPTION	REF
05D-222-9Z	CHIP RESISTOR	2.2K	1/16W 5% T 1005		R905			
05D-472-8Z	CHIP RESISTOR	4.7K	1/16W 5% T 1005		R906			
05D-222-9Z	CHIP RESISTOR	2.2K	1/16W 5% T 1005		R907			
05D-470-6Z	CHIP RESISTOR	47	1/16W 5% T 1005		R908			
060-000-8Z	CHIP RESISTOR	0	1/10W 5% T 2012		R(C16)			
060-000-8Z	CHIP RESISTOR	0	1/10W 5% T 2012		R(C508)			
05D-000-5Z	CHIP RESISTOR	0	1/16W 5% T 1005		R(C607)			
098-473-0	THERMISTOR CHIP	ECTH201208473H4100H			RTH402			
075-473-0	RES.CHIP TRIMMER	47K RH03E1CS4X			RV1			
075-104-7	RES.CHIP TRIMMER	100K	RH03E1C15X		RV2			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X			RV4			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X			RV5			
075-103-6	RES.CHIP TRIMMER	10K RH03E1C14X			RV6			
075-223-1	RES.CHIP TRIMMER	22K RH03E1CJ4X			RV401			
075-473-0	RES.CHIP TRIMMER	47K RH03E1CS4X			RV402			
075-472-8	RES.CHIP TRIMMER	4.7K RH03E1CS3X			RV403			
594-180	LMR TCXO OF "B" CLASSGMRS-21X				TCXO			
300-223-8	TRANSFORMERS CHIP	617PT-1019			T1			
300-223-8	TRANSFORMERS CHIP	617PT-1019			T2			
263-418-0X	CRYSTAL	44.645M	-30 15PM 32P	3RD	X1			
263-472-8	CRYSTAL RESONATOR	8.0M	-20 30PPM 18PF		X401			
271-225-5	FILTER CRYSTAL	45N15B4 45.1MHZ			XF2			
270-358-7	DISCRIMINATOR CERAMICDBCB455KCAY24-R0				Y1			

12. COMPONENT PINOUT

BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SYMBOL
	2SC5086	Q201.202 Q301.302	
	AT-41532	Q601	
	KTC4075	Q3.4 Q901.902.903.904	
	KTA2014	Q5.6 Q905	
	PBR951	Q10 Q701	
	BFR92A	Q9.16.19	
	KTC3875S	Q8.12.15.20	
	KTA1504S	Q407.417	
	KRC104S (ND)	Q14.17.18.21.24 Q403.406.408.410 Q411.418.425	
	KRA104S (PD)	Q7.22 Q401.402.413.424	
	KRC110S (NK)	Q419	
	KRA110S (PK)	Q1.2	
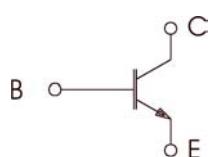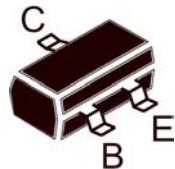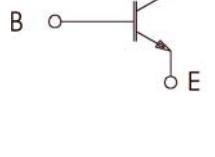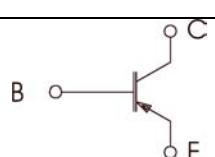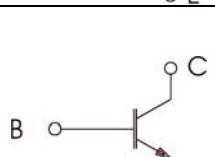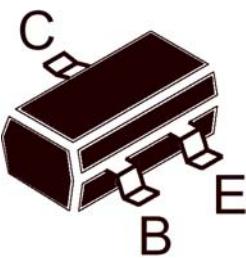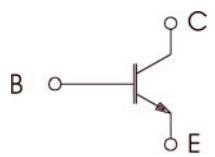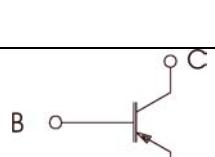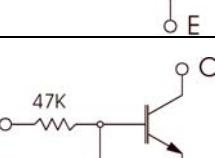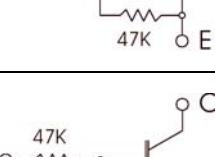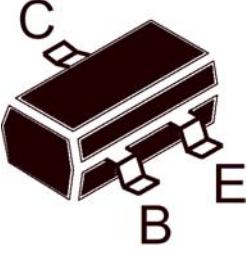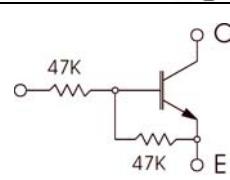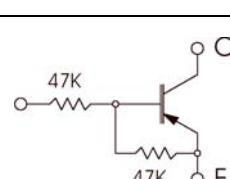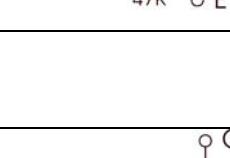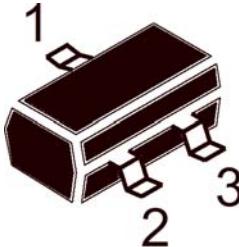
BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SYMBOL
	KDS181 (A3)	D1.8.9 D402	
	KDS193 (F3)	D2	
	KDS226 (C3)	D601 D901.902	
	ZENER (5.6V)	D404.405.406.410	
	HSMS-2817	D6	
	1SV229 1SV217	D201.202.301	
	KDS160	D801	
	MBRS140T3	D802	
	UPP9401	D3.5	
1.BASE 2.COLLECTOR 3.EMITTER	KTA1663	Q11	
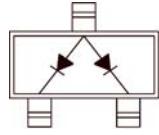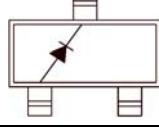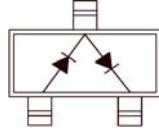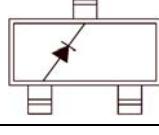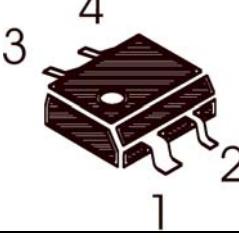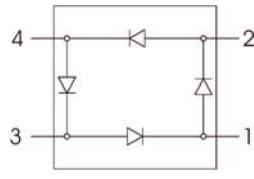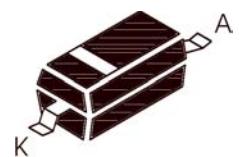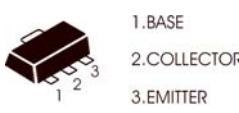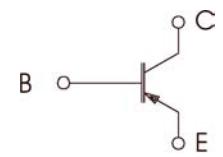
80
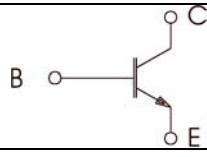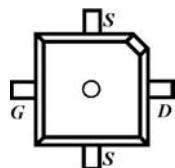
BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SYMBOL
4 1.EMITTER 2.BASE 3.EMITTER 4.COLLECTOR 1 2 3	BFG35 BLT50	Q702	C B E
S G D S	NE5510279A 2SK3079A 2SK3476	Q703	D G S
5 8 4 1	SI4412DY	Q801.802	D G S
41 40 60 21 61 20 80 1	TMP87PS68DF	IC401	MCU
4 1:VCC 2:GND 3:OUTPUT 4:GND 1 2 3	KIA7042F	IC414	Voltage Detector IC
9 16 8 1	MB15A02PFV1	IC2	PLL IC
	TA31136FN	IC6	IF IC
5 8 4 1	NJM12903V	IC403	Comparator
	NJM12904V	IC3.4.5	OP AMP
9 16 8 1	MC14053BD	IC409	MUX./DEMUX.
	LTC1435CS	IC801	DC/DC Converter
8 14 7 1	MC14066BD	IC406.407	Analog S/W IC
	KIA324F	IC404.405.408.411 IC416.417	OP AMP
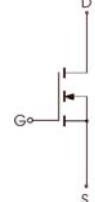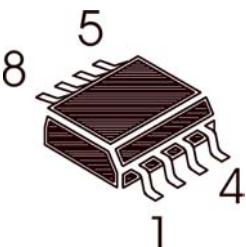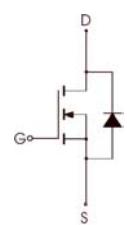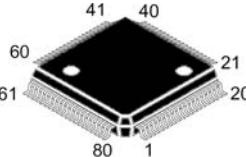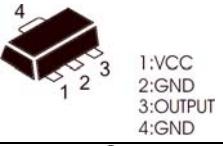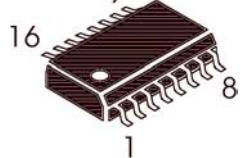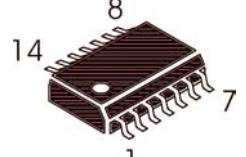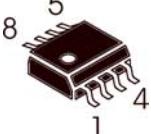
| BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SYMBOL
	CSI24WC04J	IC402	EEPROM
	LM386M	IC412	AUDIO AMP
	MSNBLPS	IC410	6TH SWITCHED CAPACITOR LPF IC
	TK71750SCL	IC1	VOLTAGE REGULATOR IC
	TC7S66FU	IC418	Analog S/W IC
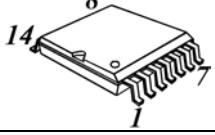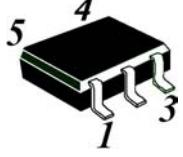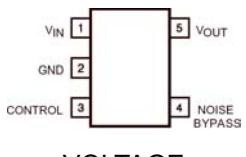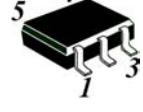
13. SCHEMATIC DIAGRAMS

This chapter contains 9 schematic diagrams as the following:

- Block Diagram for SD-160 Series
- Digital B'D Schematic for SD-160/SD-170 Series
- RF B'D Schematic for SD-161
- RF B'D Schematic for SD-164
- RF B'D Schematic for SD-171
- RF B'D Schematic for SD-174
- Schematic Diagram for ACC-513 (GMSK Modem)
- Schematic Diagram for ACC-514 (FFSK Modem)
- Schematic Diagram for ACC-515 (GPS Module)

TCXO 12.8MHz
TCXO1
MOD
Ref freq.

Charge Pump
*R
*V
Q3, 6
Q5, 4
Fin
(From MCU)
Clk
Data
Enable

Loop Filter
LPF

DC to DC Converter
(Voltage Tripler)

Q201/Q202 TX VCO
MOD

Q301/Q302 RX VCO

Q9
TX Buffer

Q10
TX Driver

P.A. BLOCK
Q701
Q702
Q703

LPF

TX B+
ANT_SW
D3

ANT

D5

Q11

Current Sensor
Vcc
R63

IC5-A
Current Detector

IC5-B

Low Power Enable Signal (SD-160 Only)
Power Ref

Q19
RX Buffer

Local LPF

T1/T2/D6
1st Mixer

FRONT-END BLOCK
BPF
Low Noise Amp.
Q601
BPF
RX 5V

Buffer IC3A

BALANCE RV1

TXD_EN
IC407D
MODEM DATA

IC407A
Analog_En

6th order
IC405 (B,C,D)
Butterworth LPF

2nd order
IC405A
Gaussian LPF

MOD LEVEL RV2

IC407B

Tone_En

IC411A
RV402
Adjust Sub-audio level

IC409-X

6th order
Switched Capacitor
Butterworth LPF

CTCSS, DCS Encoder
(R481, 482, 483)

IC409-Y

(SW401)
CHANNEL SELECTOR

X401 8.0 MHz

EEPROM (IC402)

4th order
IC410 IC411D
Chebyshev LPF

Comparator
IC410

2nd order
IC411B (300Hz)
Chebyshev LPF

L/D
CLK
DATA
ENABLE
(To PLL)
LED Data

Channel Data

SDA SDA

IC401
TMP87CS68DF

CALL Detector
Sub Audio Generator
RSSI level Detector
Two-tone Detector

BW : 25KHz
CF1
455KHz 2nd IF Filter

CF2
455KHz 2nd IF Filter
BW : 12.5KHz

X1
2nd LOCAL
44.645MHz

Y1
Discriminator
455KHz

RX +5V

XF1
45.1MHz
1st IF Filter

Q16

Mixer Input

IC6
TA31136FN

RSSI
AF

GREEN RED
Q410 Q411

LK408
IC403A
Comparator
LK405
LK407

IC416B

IC416A
4KHz LPF

IC403A
Comparator

4KHz HPF

DB-15
CON401

Audio Amp
IC412

Adjust Audio level
RV401

Demphasis

Audio_En1

Limiter
IC404D

TO MODEM BOARD

IC416C
LEVEL ADJUSTER

455KHz LPF

Audio_in
IC409-Z

IC408
300Hz HPF

C404A

Premphasis

IC404B

IC404C

VCC

IC1
TK71750S

IC801

CON402
7.5V ~ 20V

5V

DC-DC CONVERTER

Data_En

DC-DC Converter

Audio Filter With Pre-emphasis

Data Filter

Data Decoder

Adjust Sub-Audio Level

300Hz HPF

Level Shifter

Audio Amp.

Sub-Audio LPF

Voltage Divider

EEPROM

Two Tone

Sub-Audio Encoder

Difference values for each model

	R802	R805	R554	R555
SD-161	36K	47K	11K	24K
SD-164	33K	56K	11K	18K
SD-171	36K	68K	11K	24K
SD-174	36K	68K	11K	18K

Jul./18/03
DIGITAL SCHEMATIC DIAGRAM FOR SD-160/170
MAXON TELECOM CO., LTD

P.A MODULE

FRONT-END

VCO   TCXO

Jun./17/03
RF SCHEMATIC DIAGRAM FOR SD-164
(450MHz ~ 490MHz)
MAXON TELECOM CO., LTD

RF B'D Schematic for SD-171 (Reserved)

RF B'D Schematic for SD-174 (Reserved)

PTT : Low active
MUTE : Low active

Jun./01/2003
SCHEMATIC DIAGRAM FOR ACC-513 (GMSK MODEM)
MAXON TELECOM. CO., LTD

PTT : Low active
MUTE : Low active

Jun./26/2003
SCHEMATIC DIAGRAM FOR ACC-514 (FFSK MODEM)
MAXON TELECOM. CO., LTD
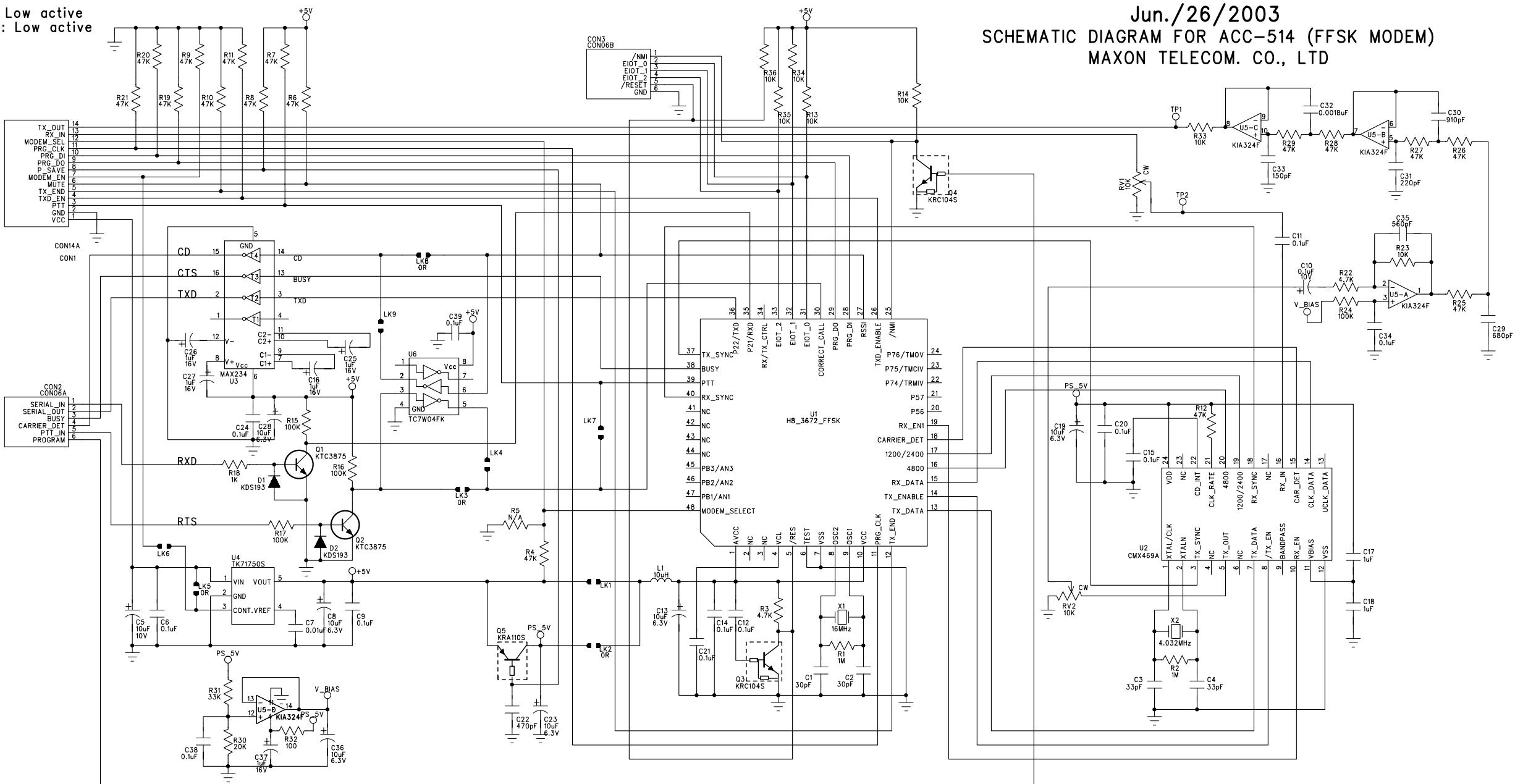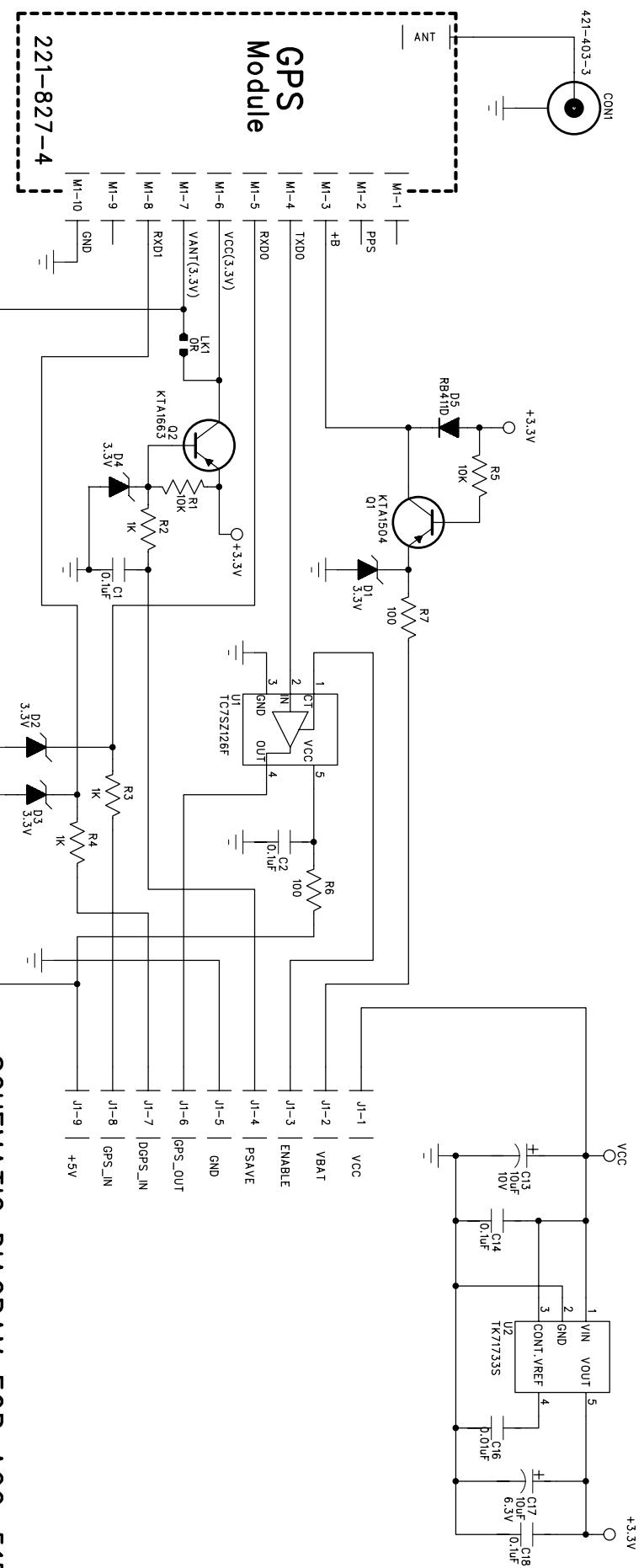
SCHEMATIC DIAGRAM FOR ACC-515
(GPS Module for SD-160)
MAXON TELECOM CO., LTD

14. CIRCUIT B'D DETAILS

This chapter contains 7 circuit B'D details as the following:

- Digital PCB details for SD-160/SD-170 Series
- RF PCB details for SD-161/171
- RF PCB details for SD-164
- RF PCB details for SD-174
- PCB details for ACC-513 (GMSK Modem)
- PCB details for ACC-514 (FFSK Modem)
- PCB details for ACC-515 (GPS Module)
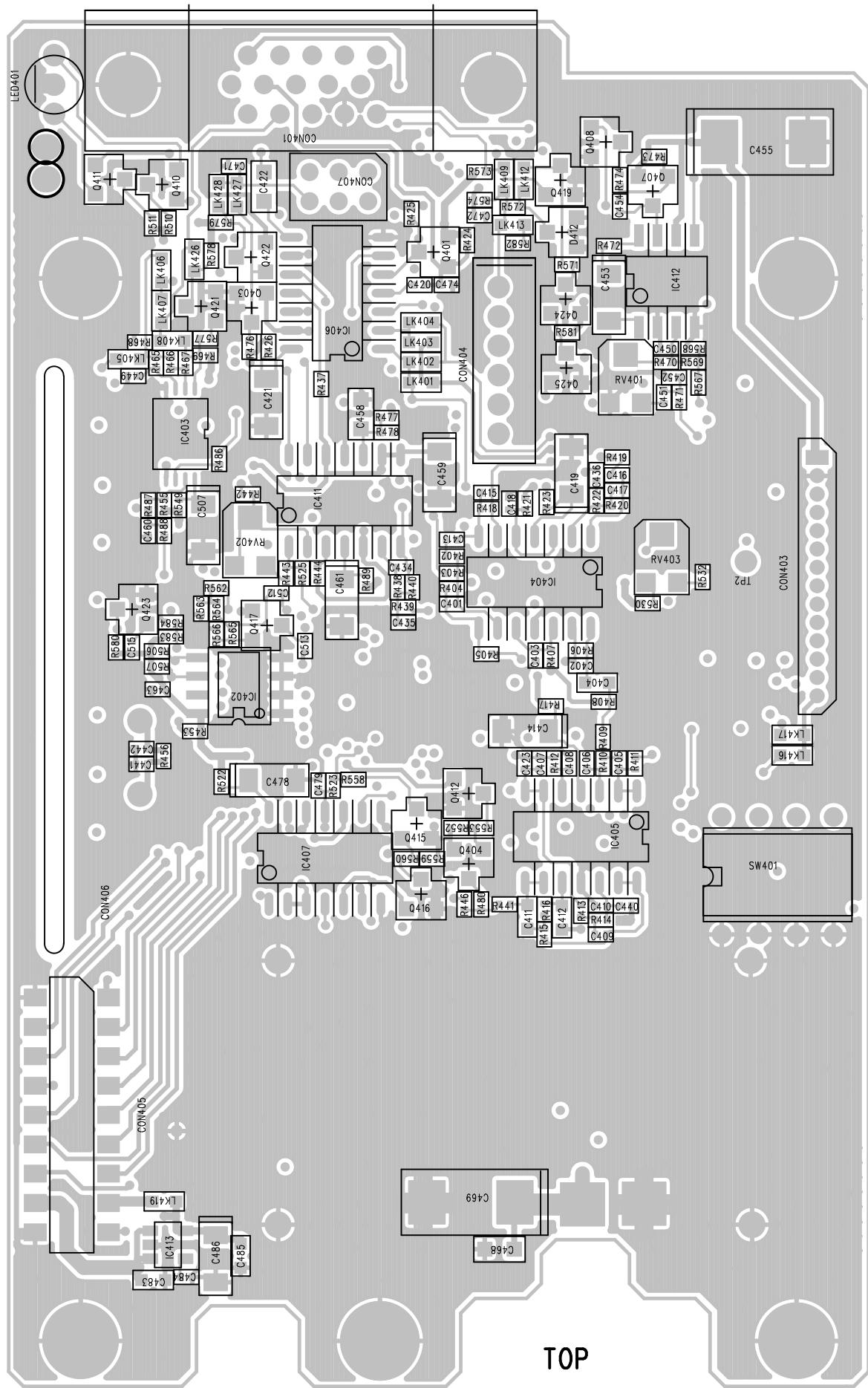
Digital Board Assembly 416145B

TOP

BOTTOM

Digital Board Assembly 416145B

416145B-final(map).pcb - Mon Aug 11 17:38:33 2003
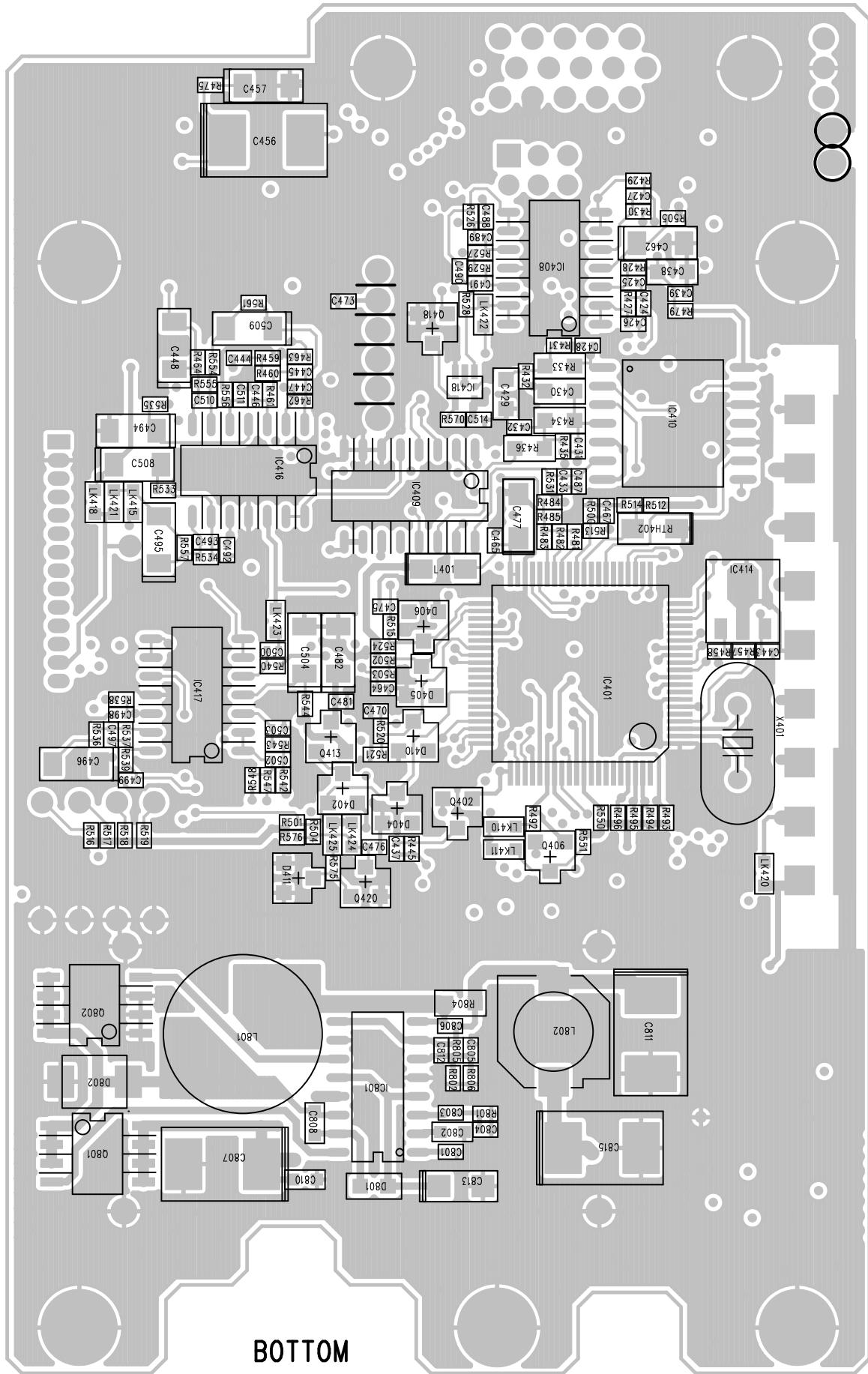
416148B
RF B'D
2003.05.15
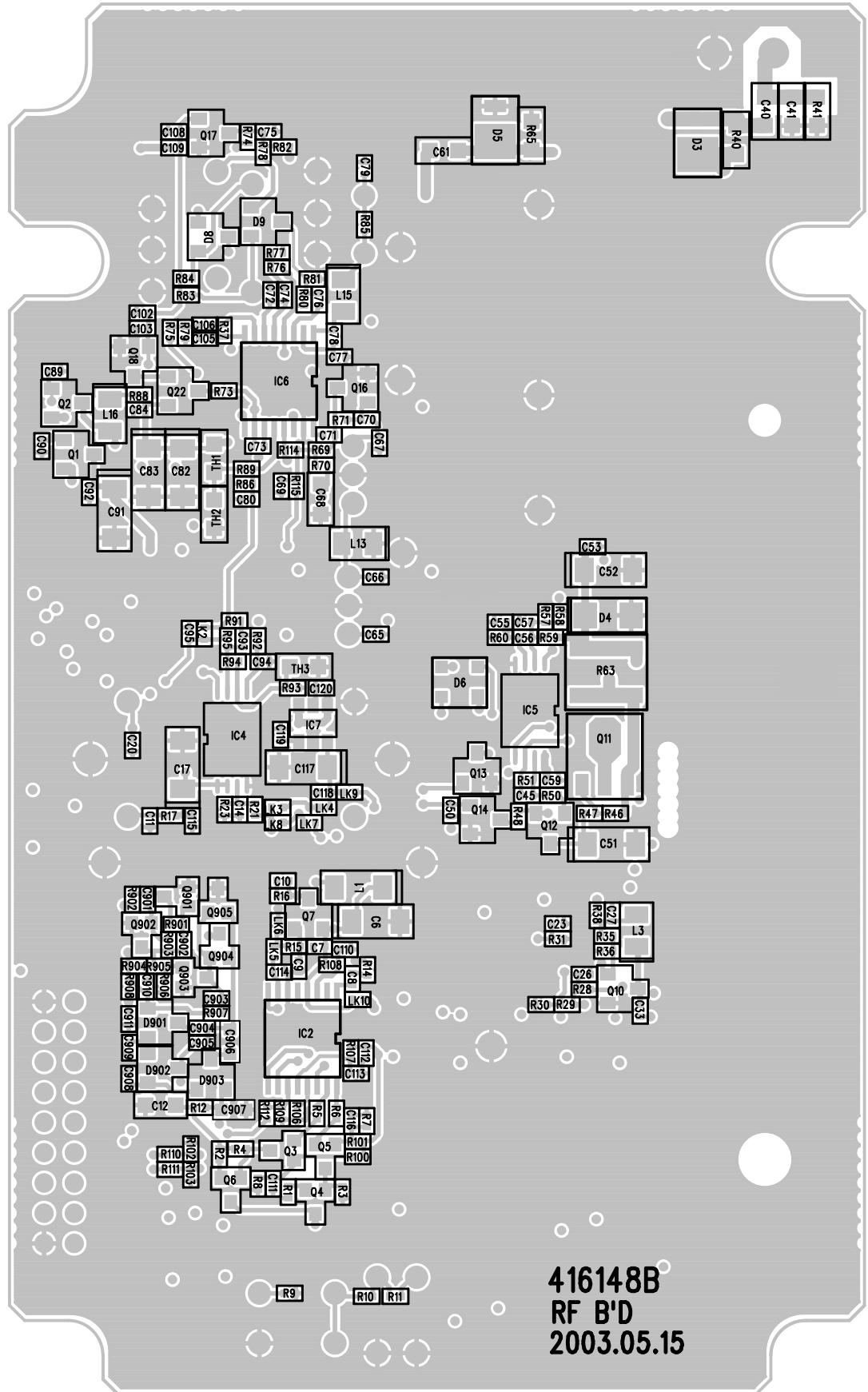
Top View of RF Assembly
416148B

Bottom View of RF Assembly
416148B
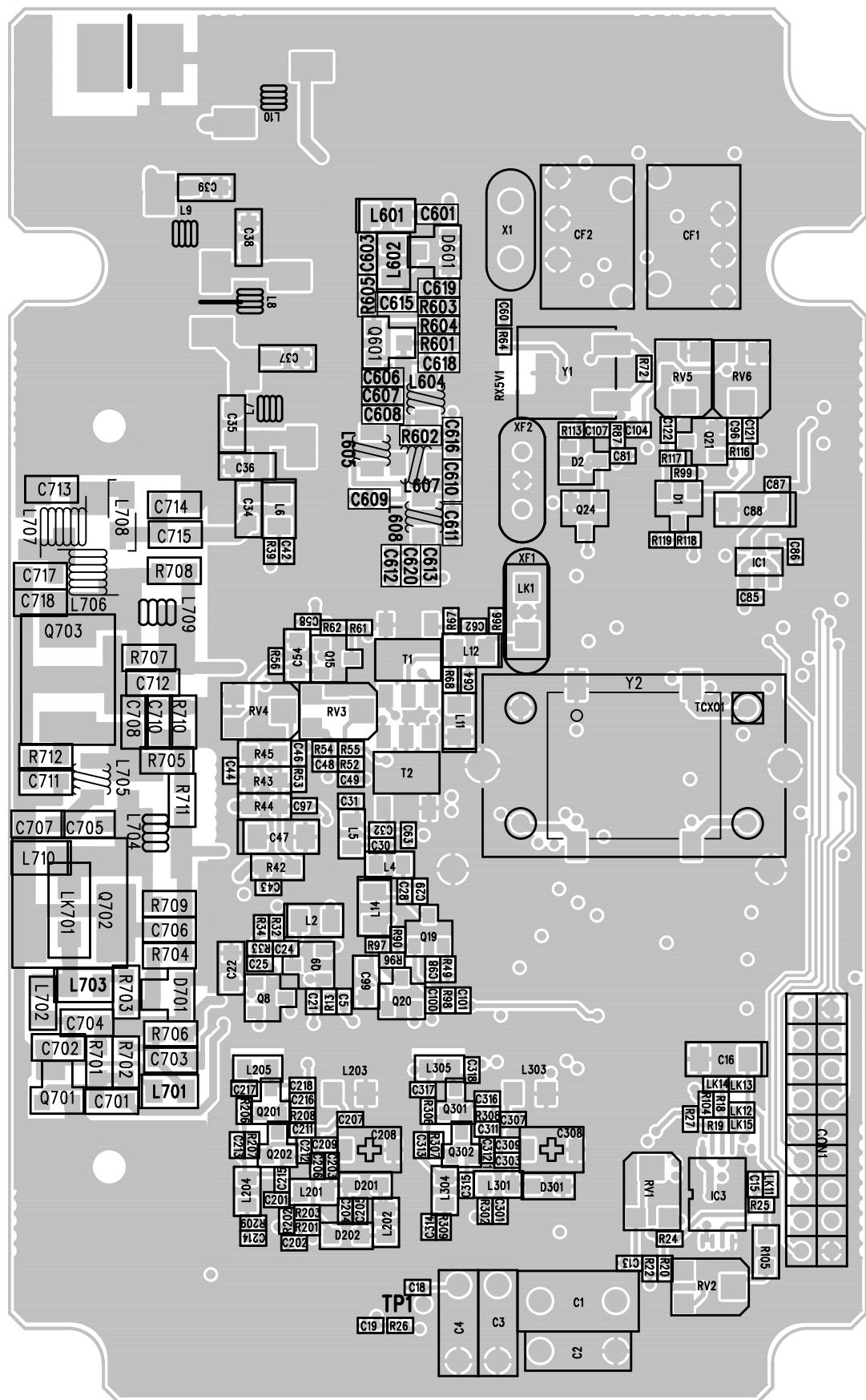
416146A(2W)
RF B'D
2003.03.31
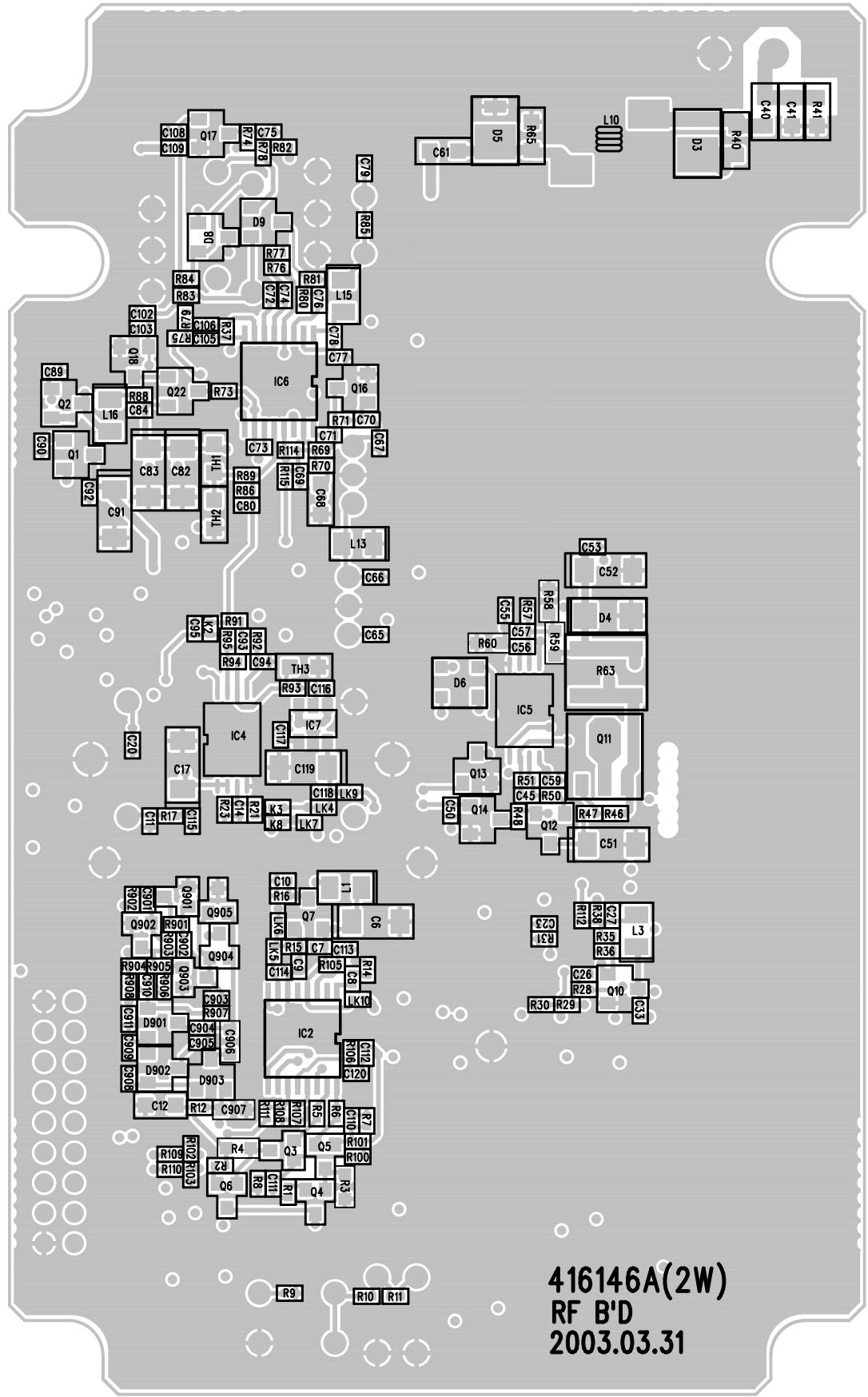
Top View of RF Assembly
416146A

Bottom View of RF Assembly
416146A
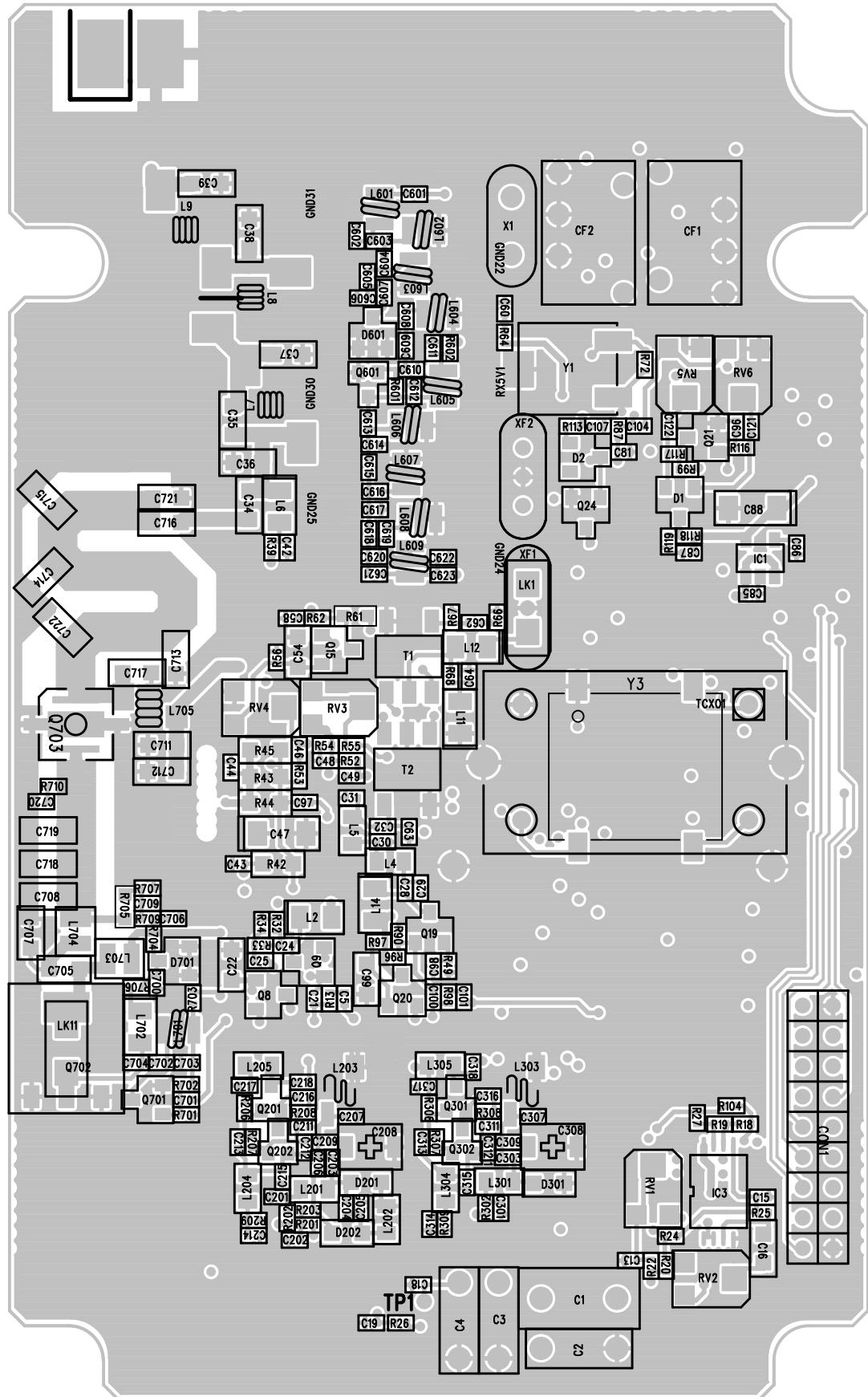
406872A(5W)
RF B'D
2003.03.31
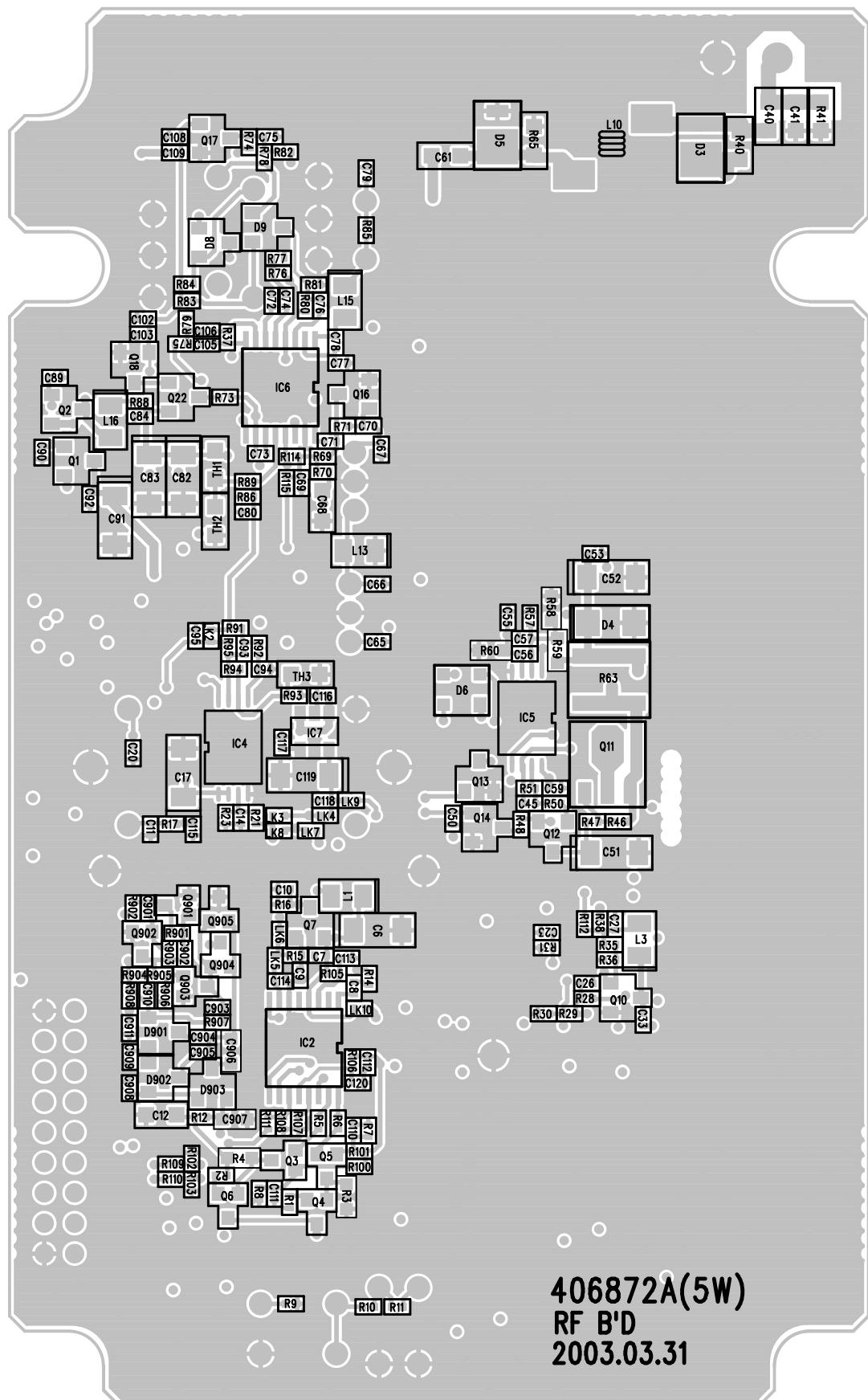
Top View of RF Assembly
406872A

Bottom View of RF Assembly
406872A

CON3

R34
C9
C8
C33
R27
R26
R24
C31
C32
R25
RV1
RV2

TP1
C6
U4
C7
C35
R28
C34
R35
U5
C3
C4
R2

C5

R21
R20
C40
C41
R29
C36
R30
C38

R8
Q8
C1
R1
C2

R6

R19
R33
R36
R37
U1

C21
R3
C14

ACC-513
406850B

C13

R5
R7
R4
LK1
L1
LK2
R17

D10
R15
R16
R18
Q2
D2

D1
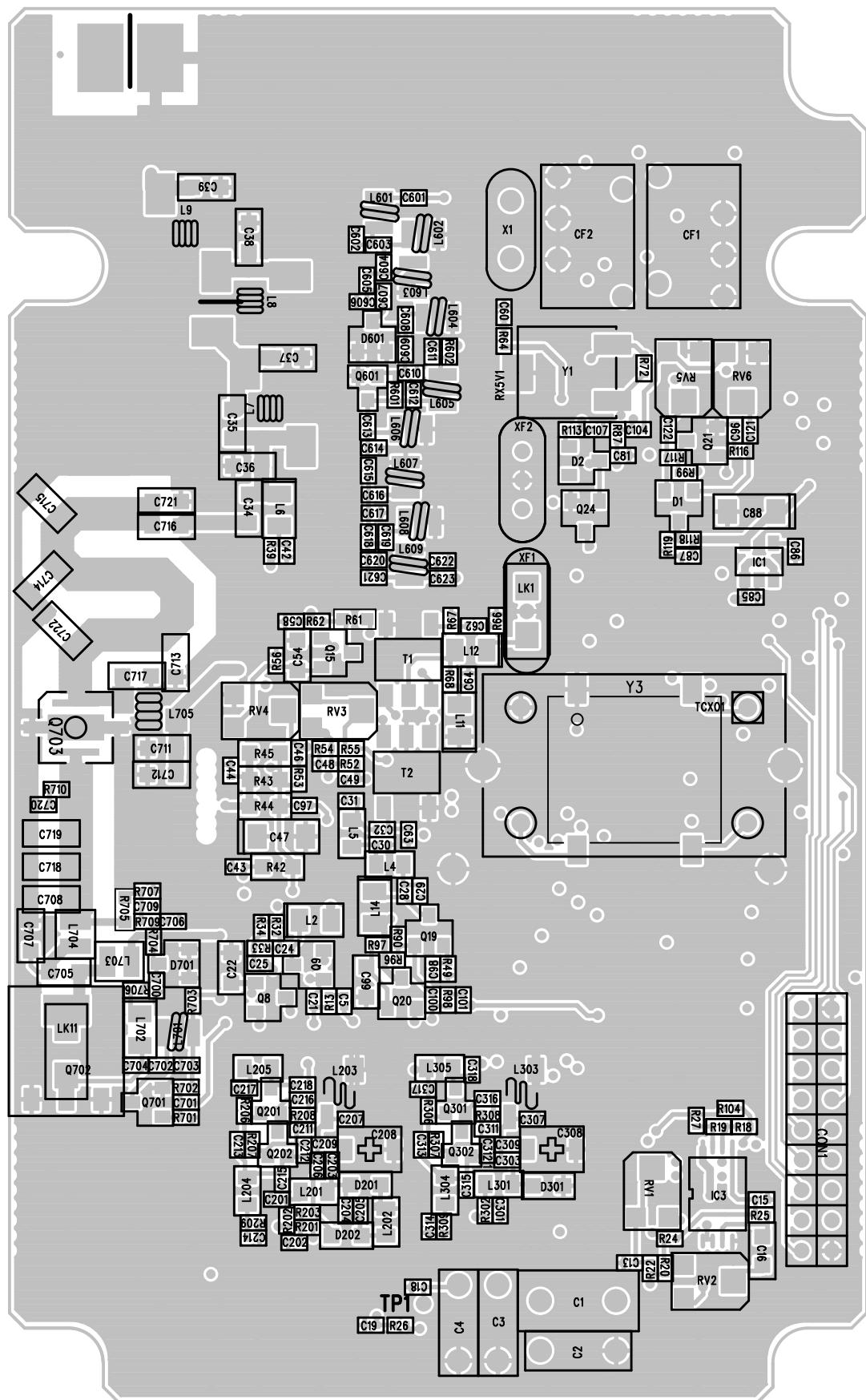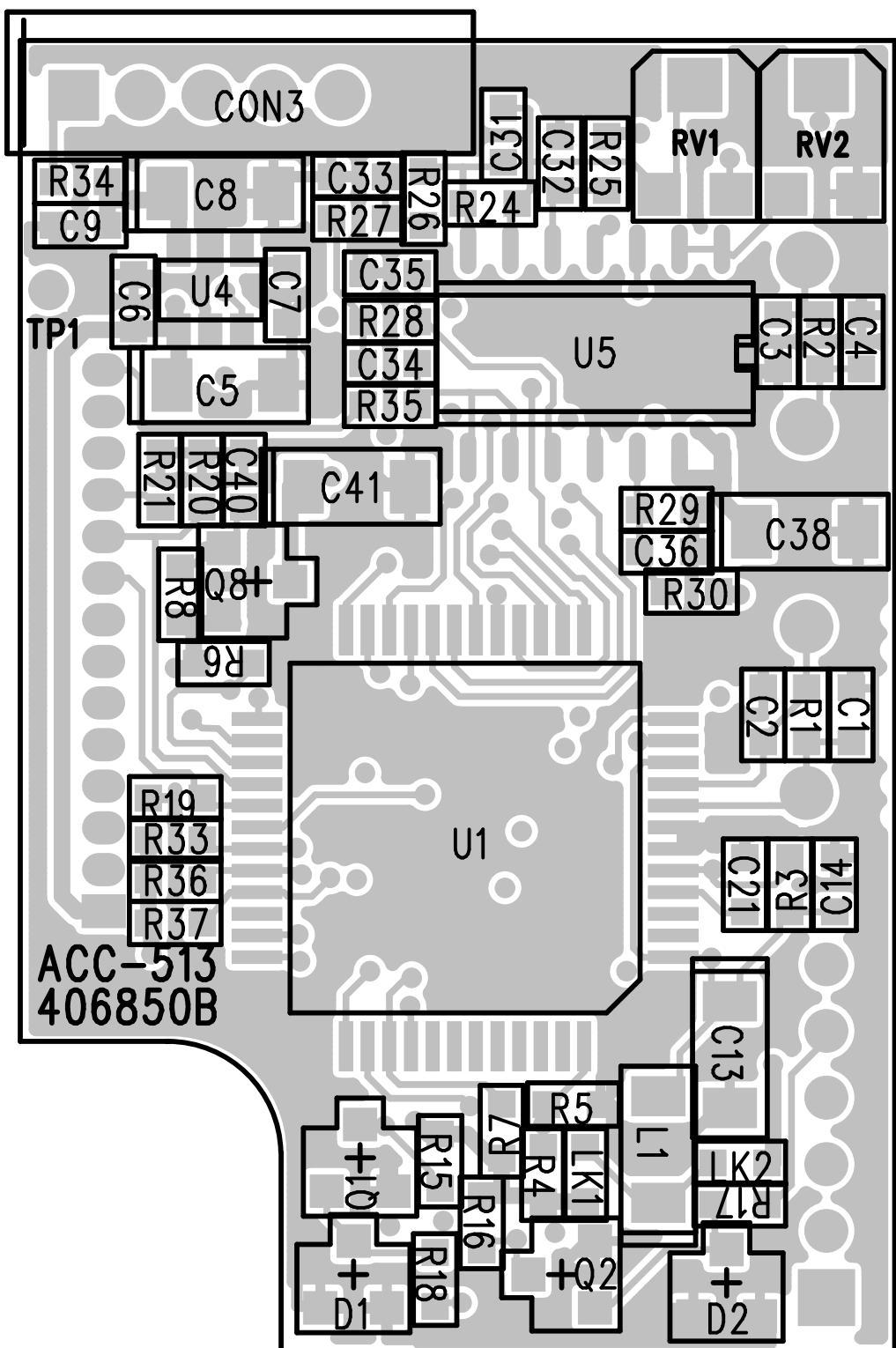
Top View of ACC-513
406850B
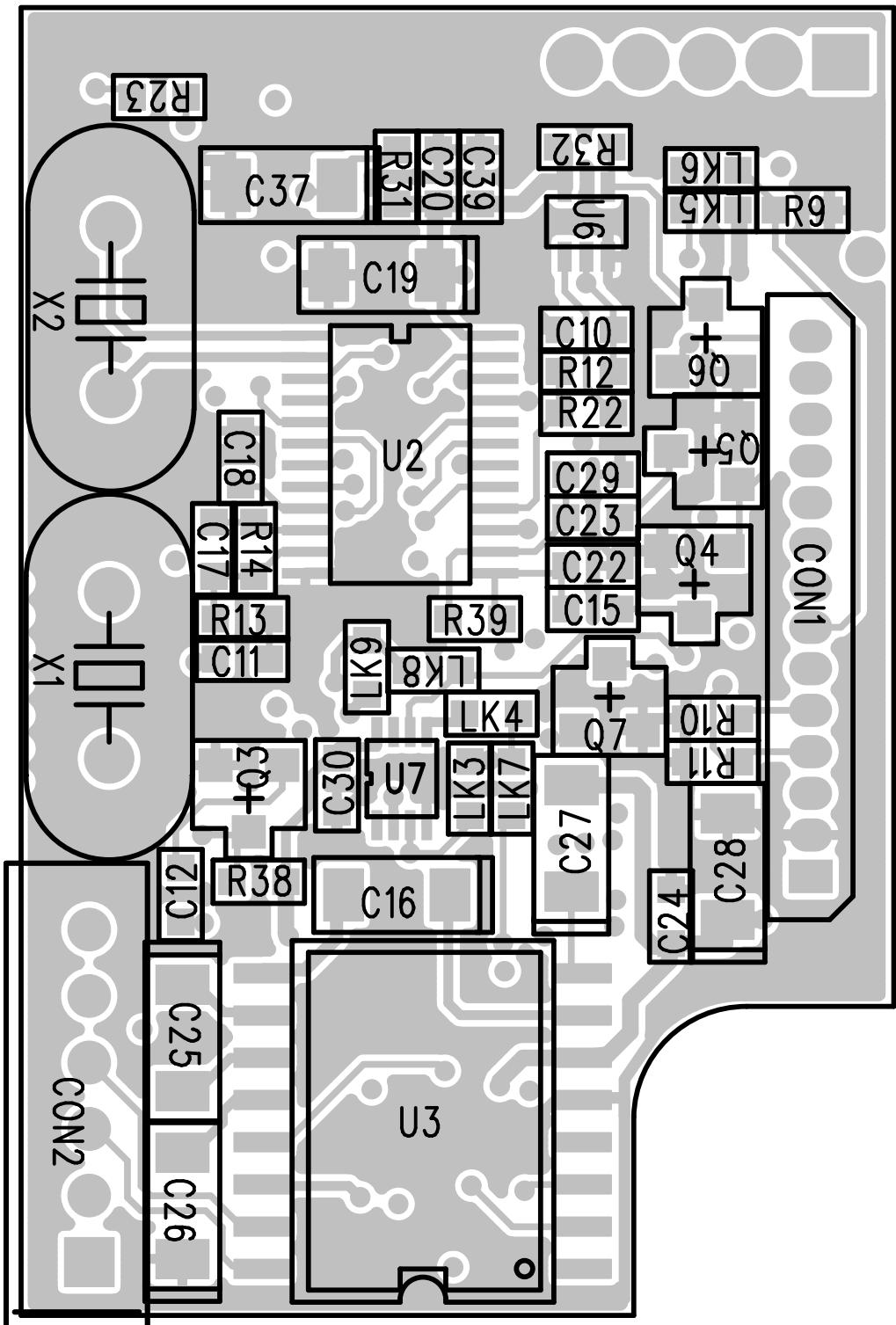
Bottom View of ACC-513
406850B
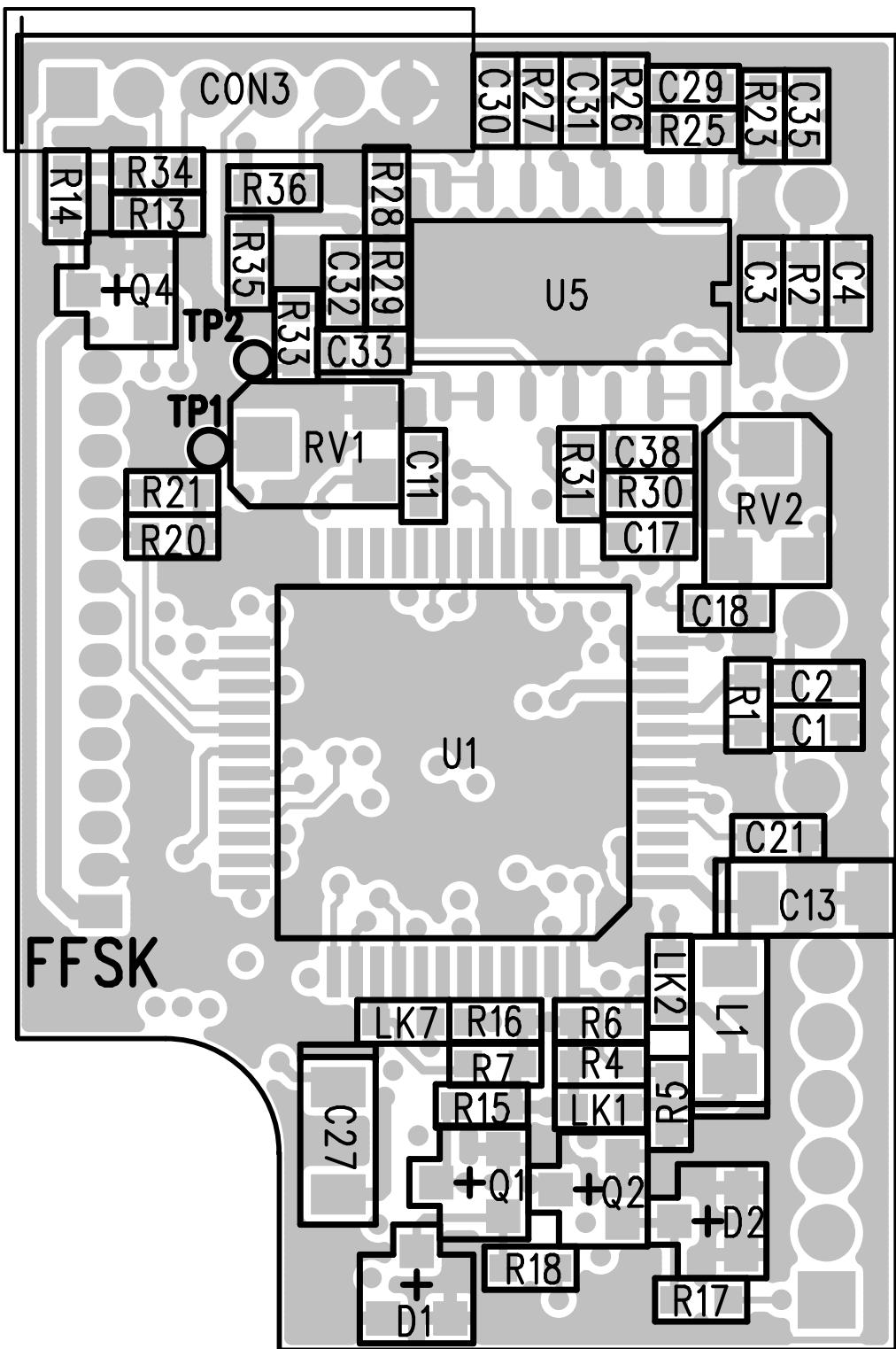
Top View of ACC-514
406851B
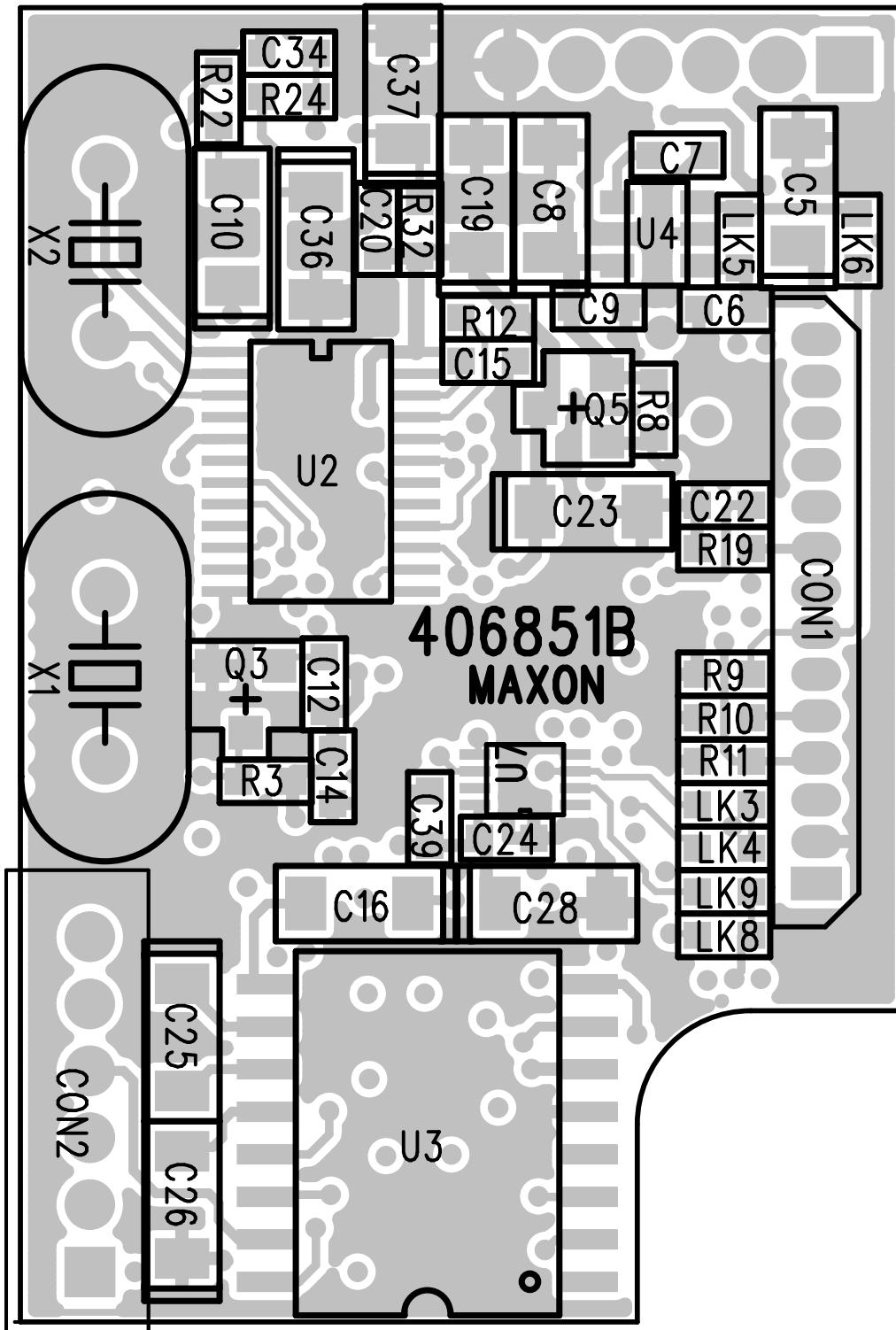
Bottom View of ACC-514
406851B

PCB details for ACC-515 (GPS Module)   - Reserved
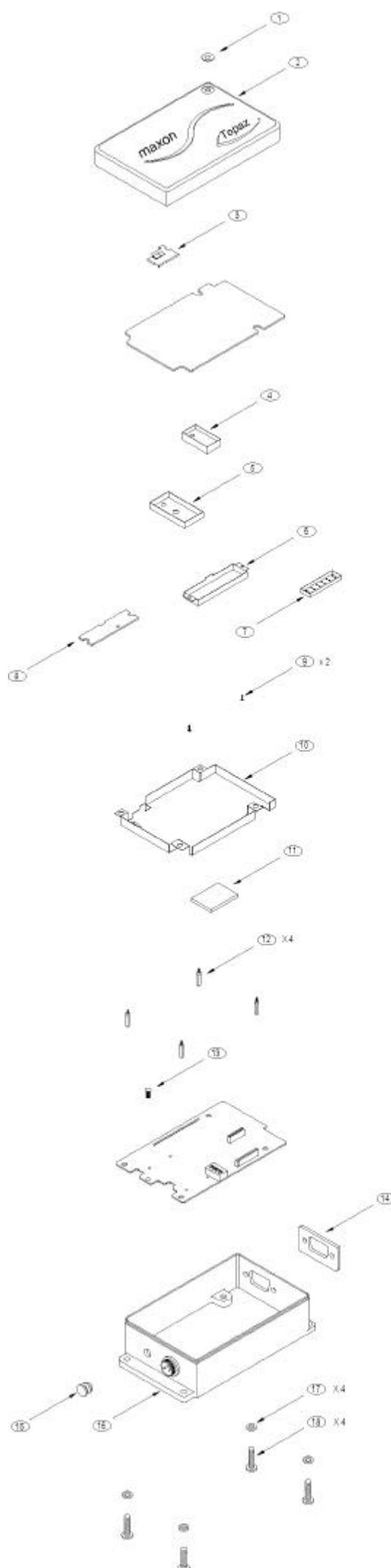
NO.	PART NAME	PART NO.
①	LED OVERLAY	795-942
②	UPPER COVER	71A-061
③	SHIELD CAN	772-363
④	SHIELD CAN(TCXO)	772-429
⑤	SHIELD CAN(VCO)	772-598
⑥	SHIELD CAN(PWR)	772-295
⑦	SHIELD CAN(FRONT-END)	772-427
⑧	HEAT SINK	761-783
⑨	SCREW	612-027
⑩	SHIELD PLATE	772-597
⑪	RUBBER SPONGE	894-527-A
⑫	POST	853-255
⑬	SCREW	612-081
⑭	GASKET	895-157
⑮	RUBBER CAP	896-007
⑯	BOTTOM COVER	71A-062
⑰	RUBBER WASHER	895-075
⑱	SCREW	613-323