

SD-160 / 170 SERIES DATA RADIOS

SERVICE MANUAL



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1. INTRODUCTION

The SD-160 and SD-170 Series 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 an 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 :	F2D, 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	From -40°C to +80°C			
Operating	From -30°C to +60°C			
Current Consumption :				
Standby(Muted)	< 65mA			
Transmit 5Watts RF Power	< 2.0 A			
Transmit 2Watts RF Power	< 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	2W < 3W > 1.5W	5W < 6W > 4.5W	2W < 3W > 1.5W	5W < 6W > 4.5W
Low Power	N/A	1W<1.5W>0.8W	N/A	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	< 0.5 KHz		< 0.75 KHz	
Extreme condition	±2.5 ppm		±2.5 ppm	
Frequency Deviation :				
25 KHz Channel Spacing	Peak ±5.0, Min. ±3.8			
12.5 KHz Channel Spacing	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 $\geq 10:1$ VSWR all phase angles and suitable antenna No destroy at $\geq 20:1$ 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 $+60^{\circ}$ 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 810F Procedures I, IV 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 (includes 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

The SD-160 is 2-Watts output power. The SD-170 power is 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, the 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, scan initiates 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 the 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 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 while the receiving channel is busy. It is dealer-programmable on/off and applicable to all channels.

Marked Idle

When used in conjunction with Busy Channel lockout the 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 a 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 goes asleep.

Tx Delay

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

Squelch Options

Compared to former Maxon data radios, a programmable sub-audio squelch system (CTCSS & DCS) and two-tone squelch system are added. Each channel will have these squelch option sets during dealer programming. Available squelch systems of SD-160 are the following.

Sub-audio squelch system

The SD-160 can operate with or without optional modem boards. Even if the user wishes to use a sub-audio SQ system, the radio will permit this SQ option to avoid conflict between sub-audio and data.

Contrary to a general-purpose two-way radio, the input of the radio is data or audio. In case of audio, its frequency spectra is limited to $300\text{Hz} \sim 3\text{kHz}$ by internal BPF. So, the division of this and sub-audio is possible on the frequency spectra because sub-audio has under 300Hz frequency. Data has wide frequency spectra compared with audio. Normally, data has $30\text{Hz} \sim 4.8\text{kHz}$ frequency (except harmonic freq.) at a 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 FFSK modulation that converts data into two different continuous audio tones 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 are pins 7, 9, 1 and 2 of the DB-15 connector and are used as audio input, audio output, data input and data output, respectively. Normally a Sub-audio Squelch (SQ) System can be applied to an audio signal, but data does not use Sub-audio to avoid frequency confliction. So, if the user tries to transmit data in one channel which has sub-audio squelch option, the radio will flash the green LED two times as a warning and then transmit without sub-audio.

Note : The 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 the 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.

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

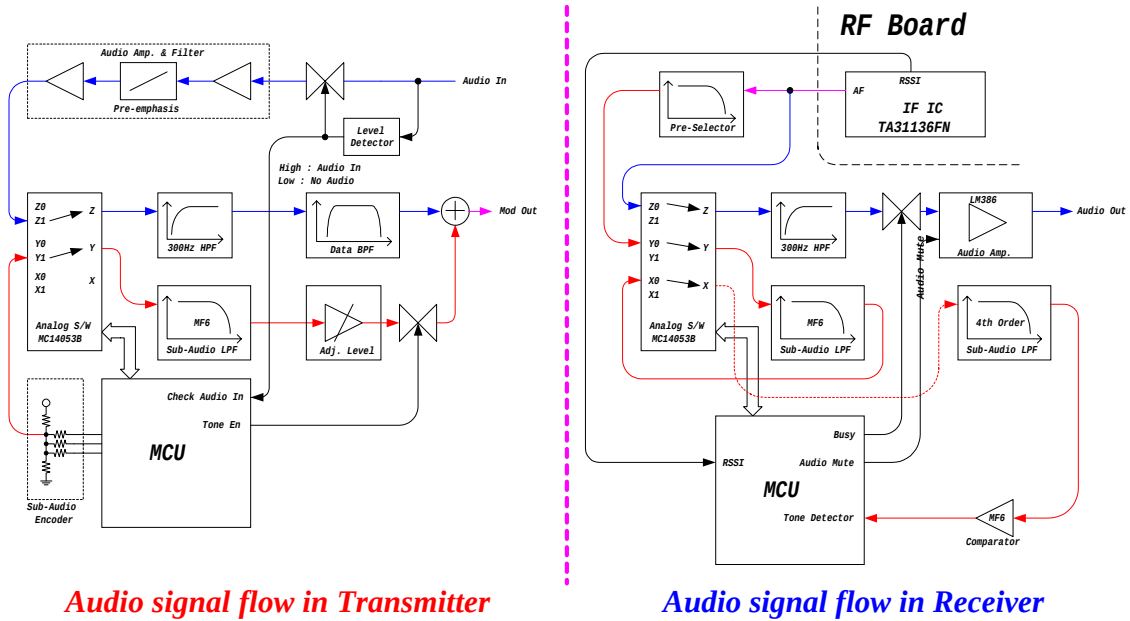


Figure 3.1. Audio signal flow diagram

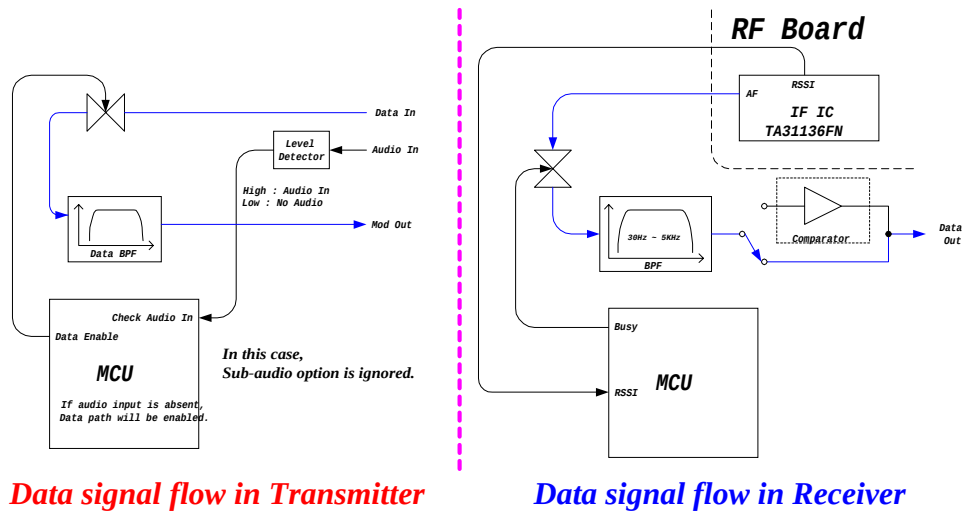


Figure 3.2. Data signal flow diagram

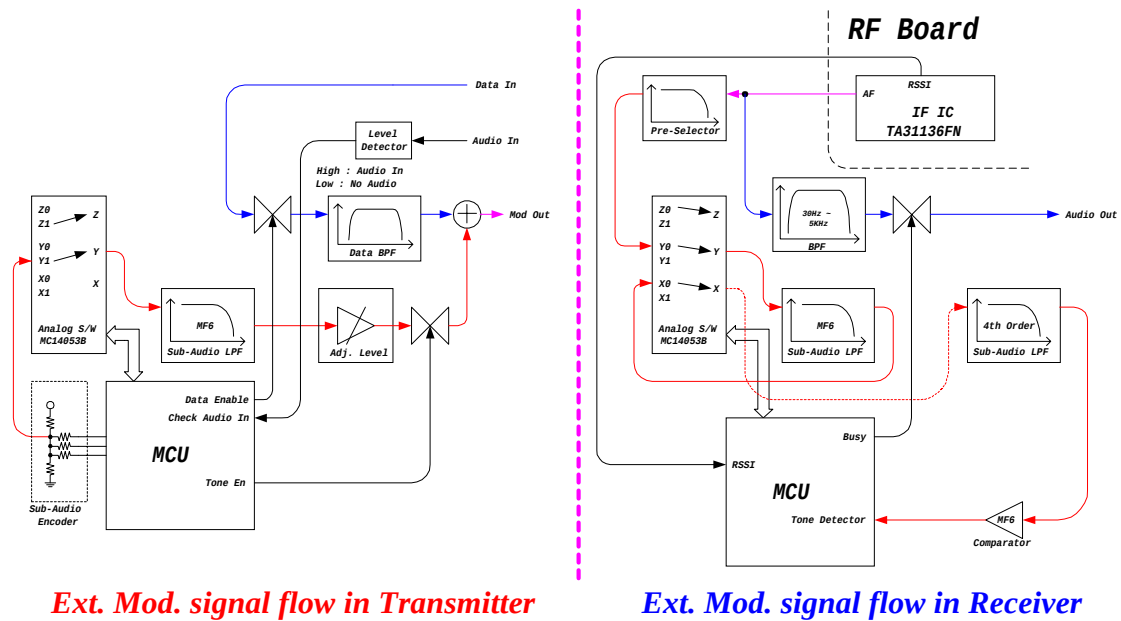


Figure 3.3. External modulated signal flow diagram

b. FFSK & GMSK

Maxon provides two optional modem boards, ACC-513, GMSK and ACC-514, FFSK for the SD-160 to improve the efficiency for data transmission and offer maximum flexibility for user applications. Selection of the required modulation option is made installing wanted modem to radio and programming several modem parameters through PC-programmer, ACC-916. Modem boards provide 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 an 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 conflict. FFSK modulated signals can be mixed with sub-audio because it consists of two different continuous tones which frequency spectra are in 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.).

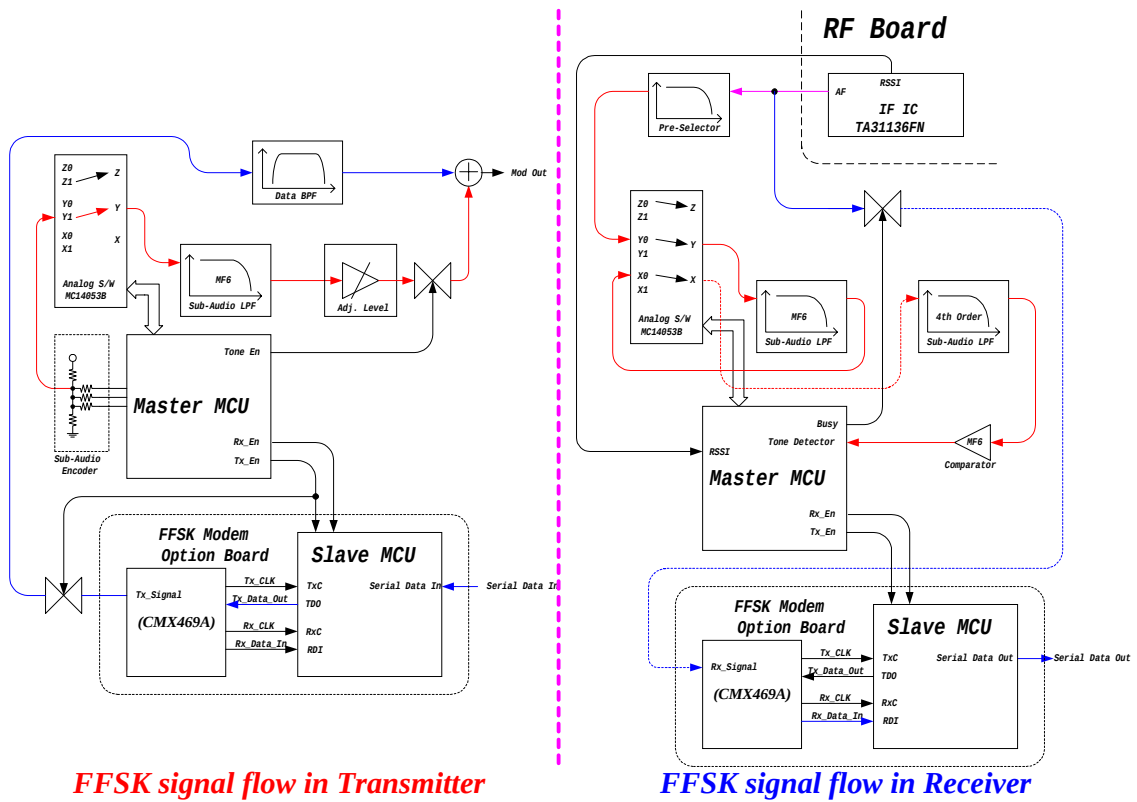


Figure 3.4. FFSK signal flow diagram

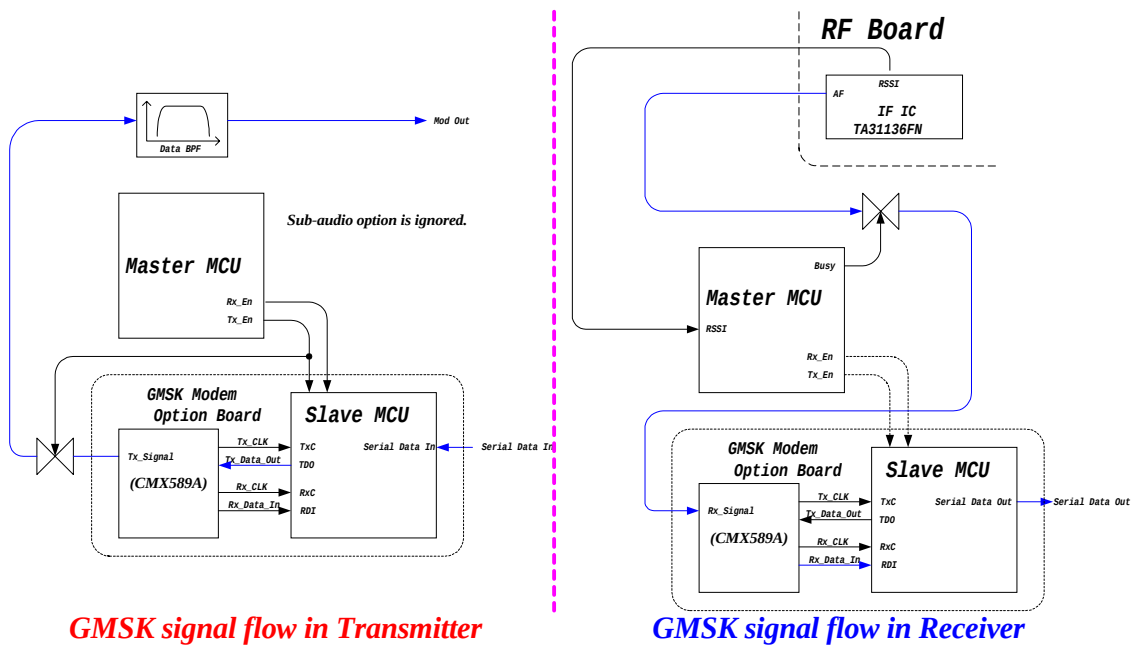


Figure 3.5. GMSK signal flow diagram

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 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 or supply voltage is removed and applied.

Serial command

To give the simplest protocol for control of the radio, Maxon has prepared for serial commands which have an easy to encode and decode format. The SD-160 can be used without serial commands, but a 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 the radio and follows the 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. 1st byte is command and 2nd is data required by command and 3rd 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	3 rd Byte (Check Sum)	SP
----	----------------------------------	----

Data Protocol

a. Protocol for input serial command

Protocol of data transmission from external equipment or device (: PC) to radio :

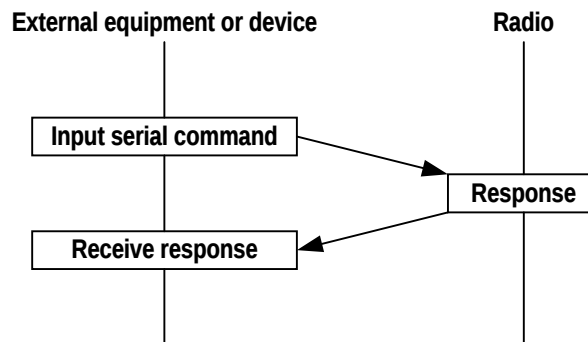


Figure 3.6. Protocol for input serial command

b. Protocol for output data

Protocol of data transmission from radio to external equipment or device (: PC) :

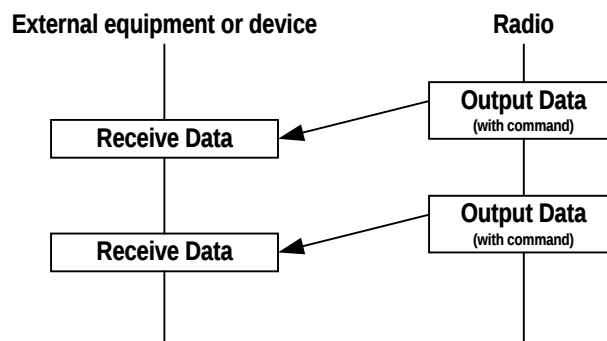


Figure 3.7. Protocol for output data

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 M 0x0f : 16 Channel	0x66 + 0x00 0x66 + 0x01 M *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 Commands	0xaa	ACK	N/A
		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 the same, The Radio will send ACK data and execute command. If not, Radio sends Nack data.

User will go into the next step Radio 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

The SD-160 series data radio has a sophisticated microprocessor control that provides a range of LED displays. The 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 will 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

The ACC-513 and ACC-514 are internal option-modems, which are applied to the SD-160 series to increase capability for data application. The goal of an internal modem is to improve the efficiency for data transmission and provide maximum flexibility for user applications. The most obvious method of increasing the data efficiency is to maximize the data signaling speed in the limited channel bandwidth. But, FSK, called direct FM modulation, has a very wide transmission bandwidth requirement. To solve this problem a GMSK (Gaussian Filtered Minimum Shift Keying) internal option-board can be used.

Generally data has a wider bandwidth than audio. So, direct application of data is not matched with an audio system and its application. For instance, if a sub-audio (Tone) SQ system is applied to a data application, its frequency conflicts with that of sub-audio. Moreover, the inputted data is filtered by the audio filter circuit resulting in broken data transmission. To overcome these problems and provide maximum flexibility, an FFSK (Fast Frequency Shift Keying) internal option-board modem can be used.

Our internal modem option boards consist of a Slave MCU, Modem IC, and extra circuitry. These option boards directly communicate with DTE (Data Terminal Equipment) to send and receive meaningful data through the DB-15 connector on the digital board of the SD-160. These modems are designed to accept RS232 serial data format and are also capable of high speed wireless data-transmission between two or more devices. More detailed information for the modem option boards is given in the technical manual for the ACC-513/514. You will need to 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

The SD-160 supports GPS data handling. That may help your implementation for a system related to GPS. If it's not enough for your application, received position data from the GPS module placed in an SD-160 can be reprocessed by your own application. The ACC-515 is a GPS module for the SD-160, which releases 11 different output data according to the NMEA-0183 format, which can be selected by the user, the available data should be processed by the user's application. Received data from the ACC-515 will be released via the DB-15 connector of the SD-160 and/or transmitted to another system through an installed modem. More detailed information for the GPS option board is given in the technical manual for the 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 the 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 the 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 microphone 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 resistor 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 Chebyshev 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 of a 6th order 250 Hz Chebyshev 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 Chebyshev filter, which consist of IC411-D and one of the two internal operational amplifiers of IC410 (MSNBLPS) along with associated components. Both the Chebyshev 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 1 of 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 the 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 $\Phi P = \Phi R$, phase detector out is a very small pulse.

EXTERNAL CHARGE PUMP

This is used to increase the dynamic range of the 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/D301 are 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 of a different 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 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 C601 through 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 the factory and no further 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 T1 and 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 use a CMX589A IC to generate and decode GMSK signals. The modem fully supports auto mode, dumb mode (RTS mode) and extended dumb 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, R22 and 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 dumb or extended dumb 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, dumb mode (RTS mode) and extended dumb 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 dumb or extended dumb 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 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), power save mode can be executed by Pin 4 of J1 (PSAVE). Even if the 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.

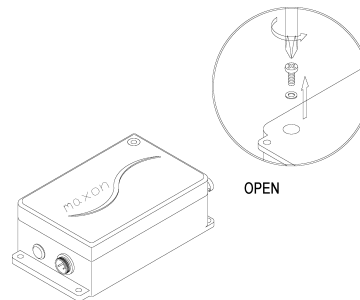
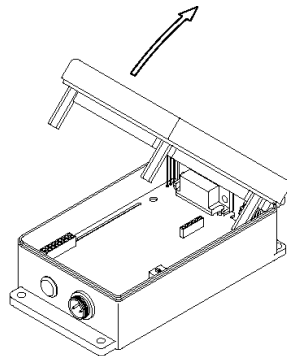


Figure 5.1. Loosing the four mounting screws



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.

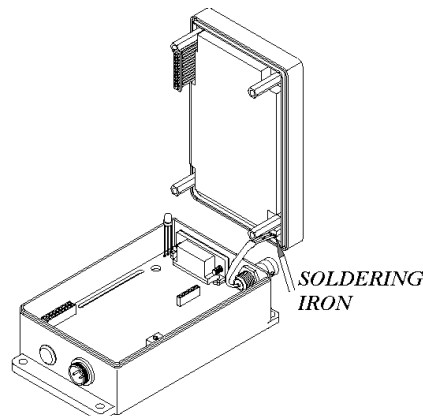
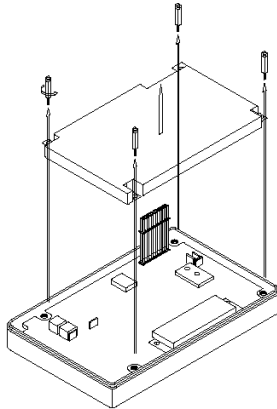


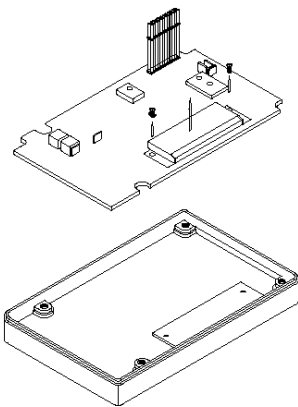
Fig 5.3. Separating upper and bottom cover

REMOVING & REPLACING THE RF BOARD



1. Unscrew the four upholding screws from the RF board.
2. Remove the shield plate.

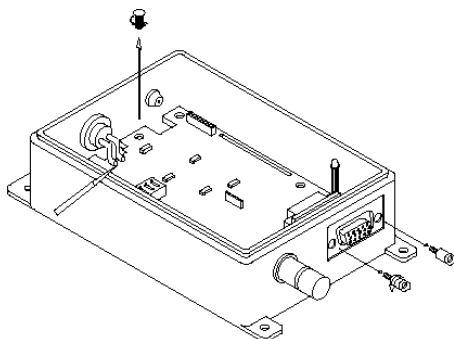
Fig 5.4. Removing shield plate



3. Unscrew the two mounting screws located on shield can for PA module.
4. Replace the RF board assembly.

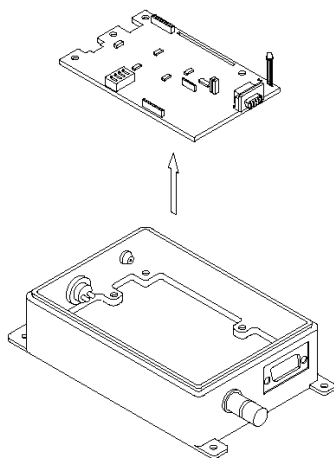
Fig 5.5. Replacing RF board assembly

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.

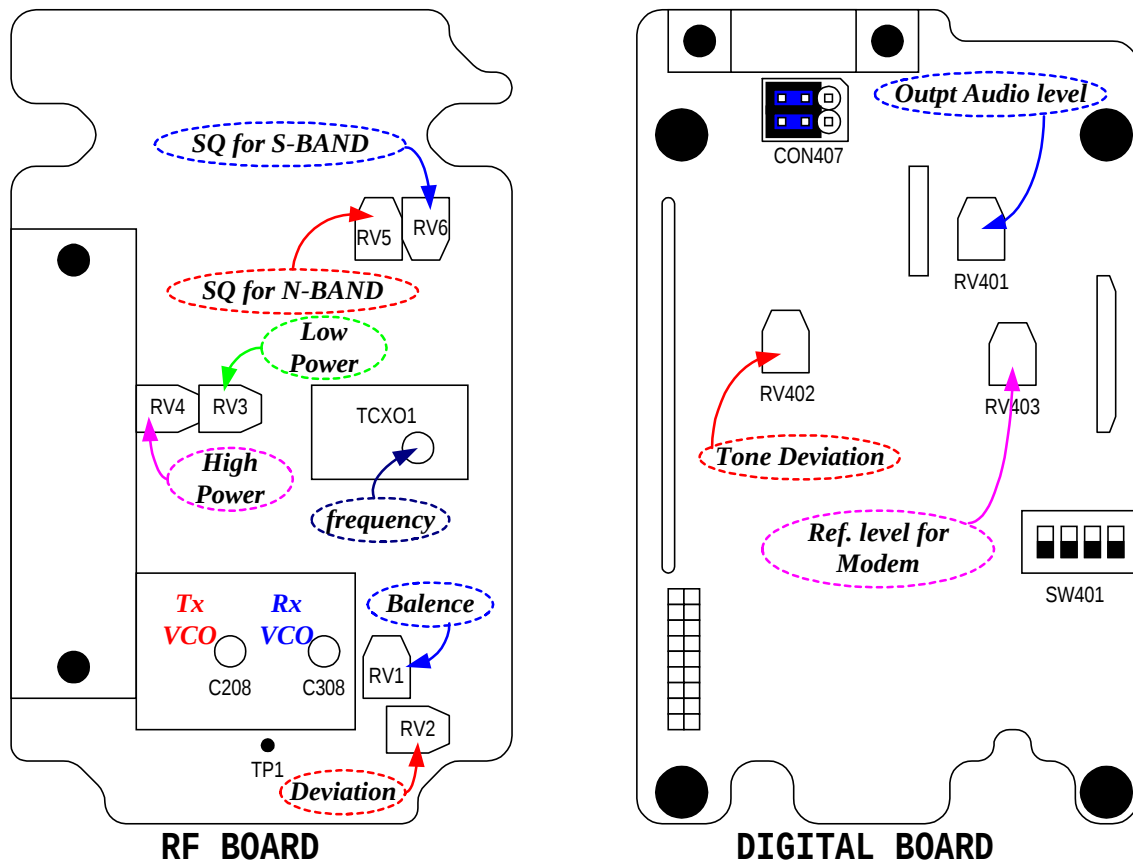


Figure 7.1. Alignment Points Diagram

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 3kHz 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 $\pm$ 200Hz (155 MHz VHF models).

TX VCO

TX VCO is pre-tuned at the factory and no further 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), 148MHz (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 the ACC-516 (PCB Extender Board) has a voltage drop in transmission mode and so power drop occurs. This is why the 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 again check if 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 1.5kHz 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 3kHz 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

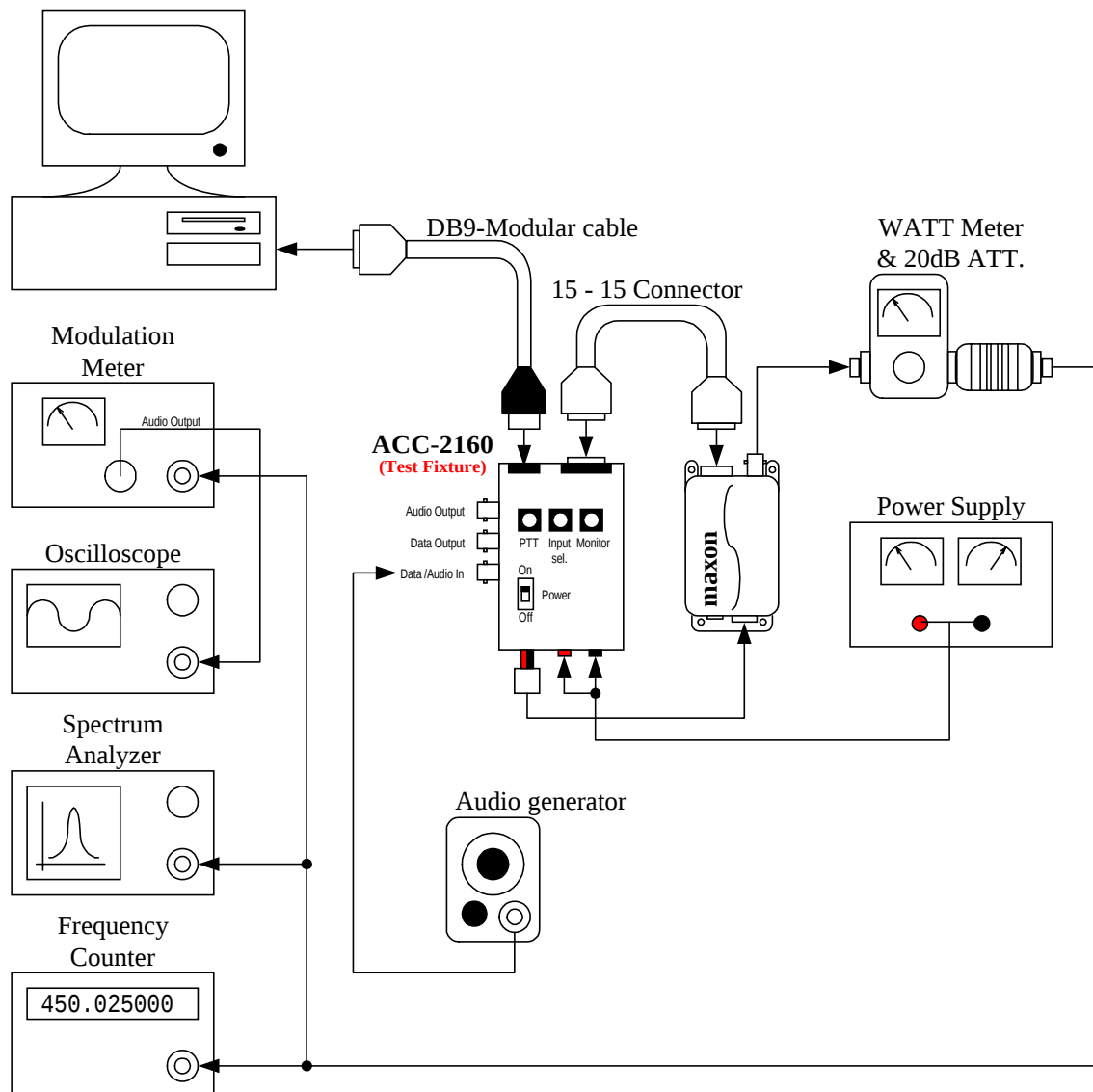


Figure 7.2. Test equipment setup for transmitter

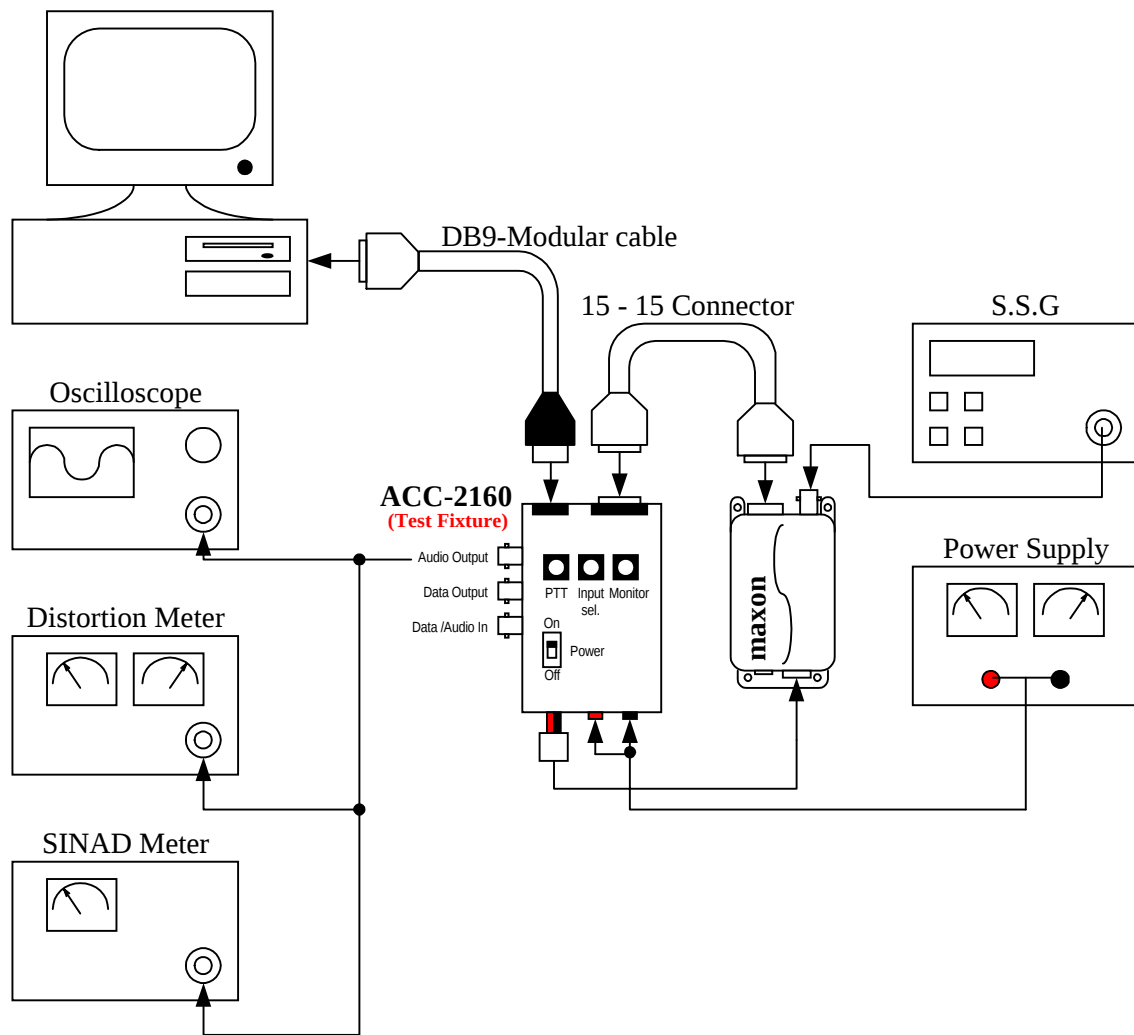


Figure 7.3. Test equipment setup for Receiver

Standard test conditions are following

- % Standard test voltage : 12Vdc
- || Temperature for normal test : $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$
- ¶ Standard audio frequency of S.S.G : 1KHz
- @ Standard deviation : $\pm 1.5\text{KHz}$ (N-Band), $\pm 3\text{KHz}$ (S-Band)
- % Channel Spacing : 12.5KHz (N-Band), 25KHz (S-Band)
- % Standard signal input level : -47dBm
- || Antenna Impedance : 50 Ohm
- © 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 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 = 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
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	O/P

			produces Nominal 1Vrms @ 8 Ω	
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

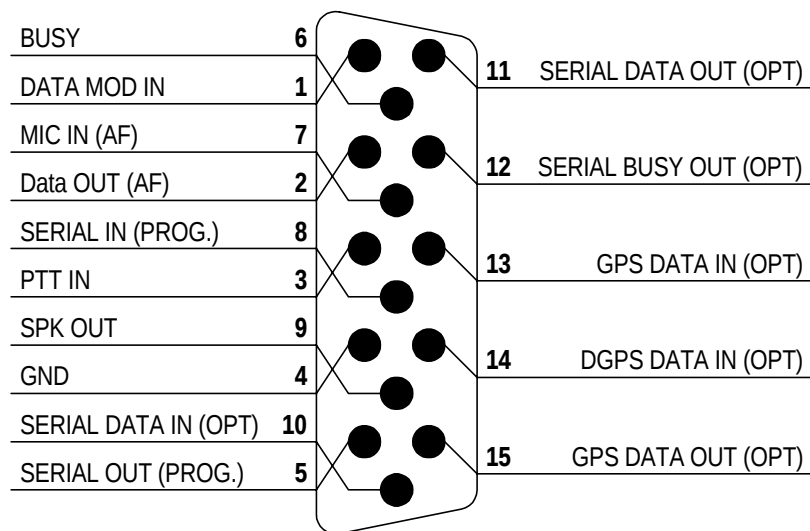


Figure 8.1. Pin-outs of DB-15 connector

8.3. Internal components

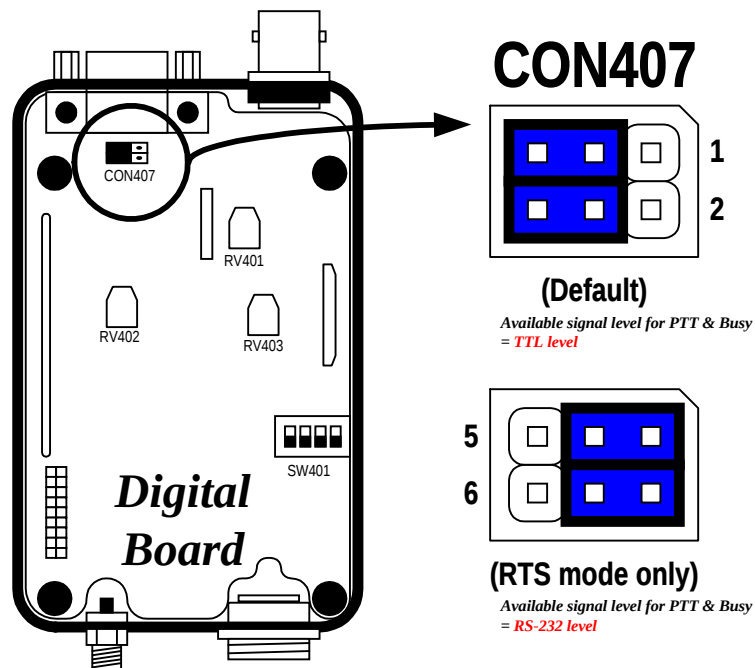


Figure 8.2. Signal level selector for PTT(RTS) & Busy

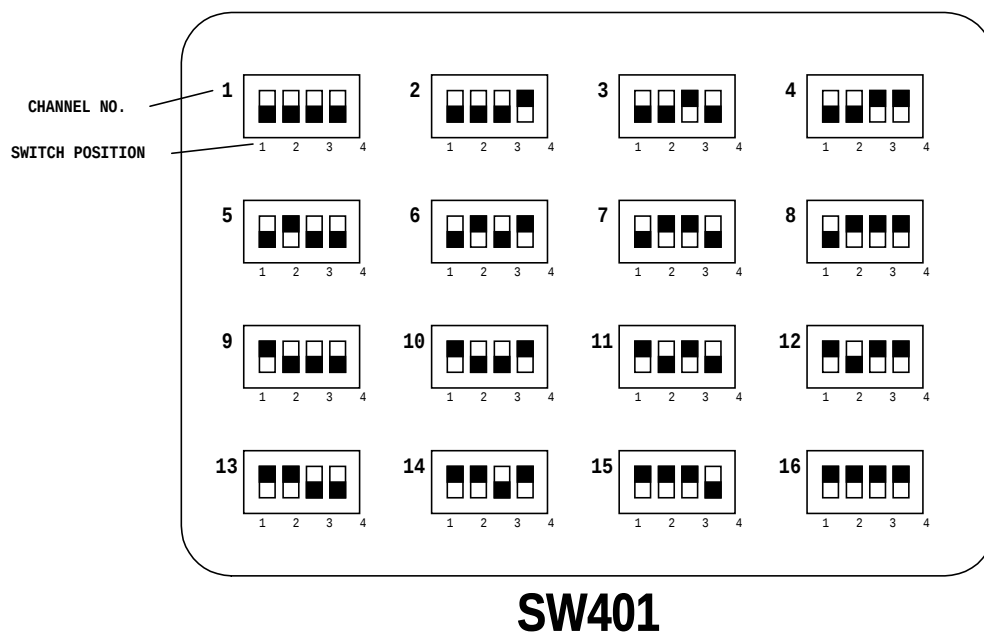


Figure 8.3. Setting of channel selector switch for each channel

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

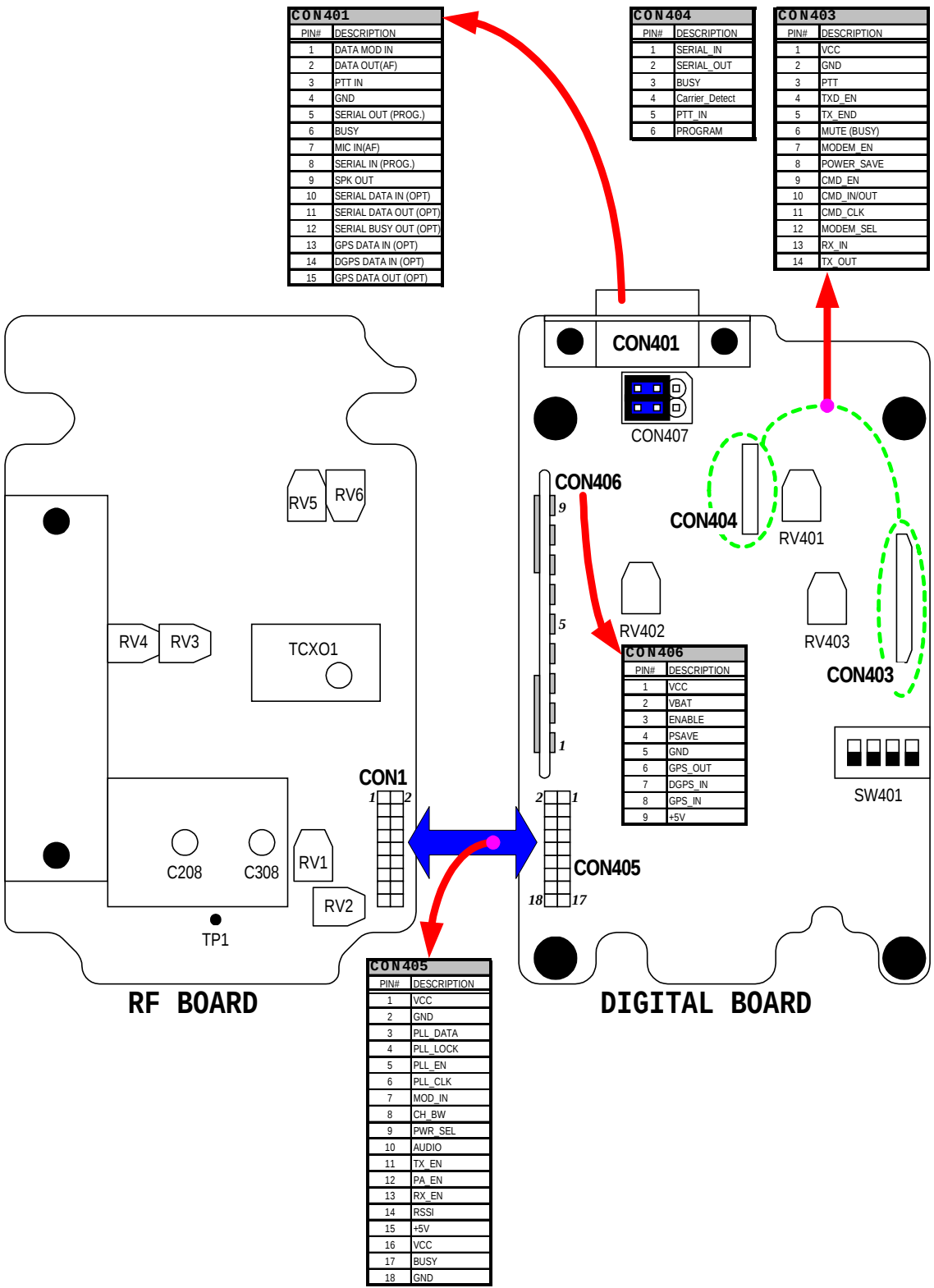
Table 8.3. Pin description of DB-15 Connector

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



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

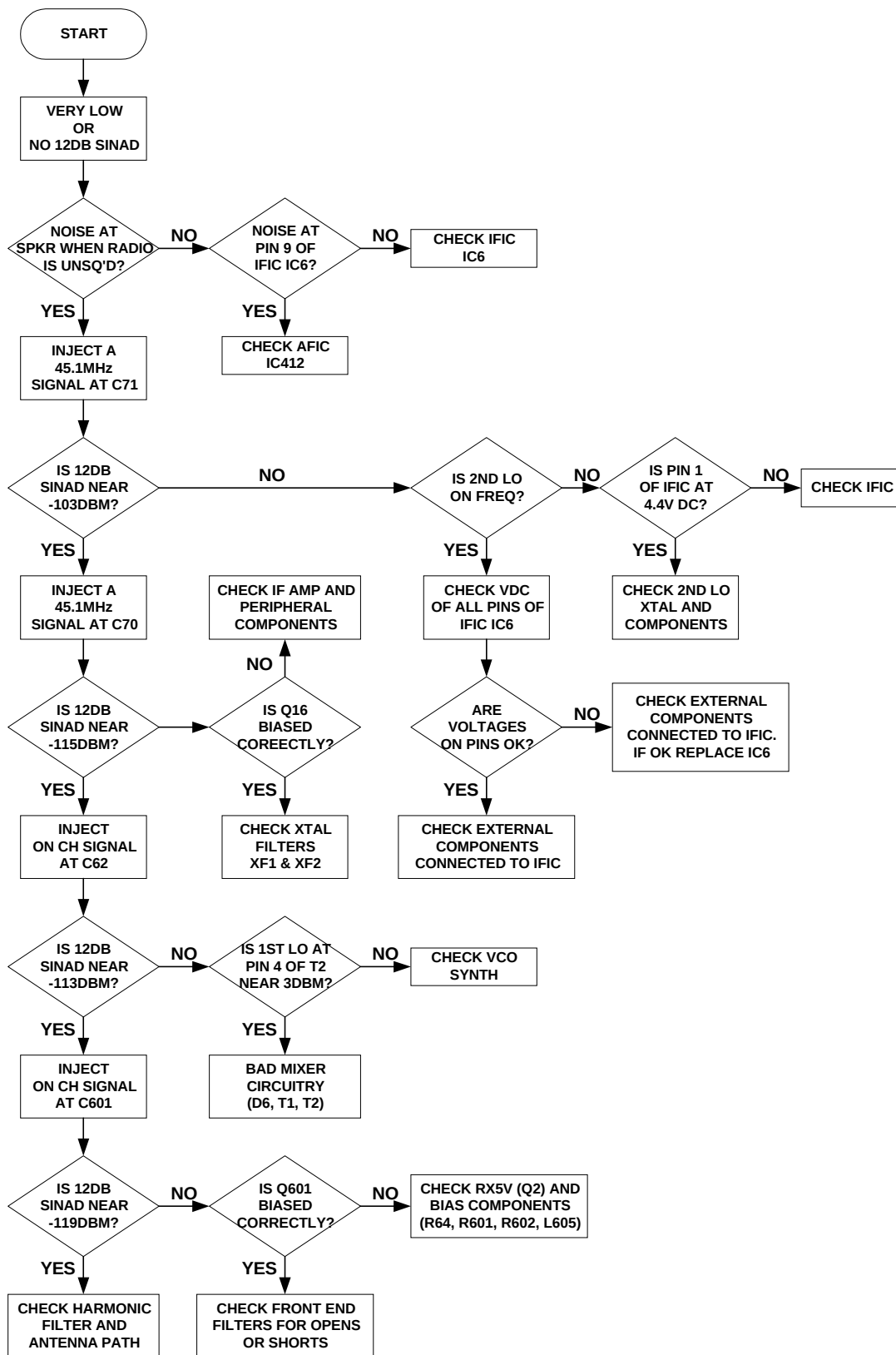


Figure 9.1. Troubleshooting Flow Chart for Receiver

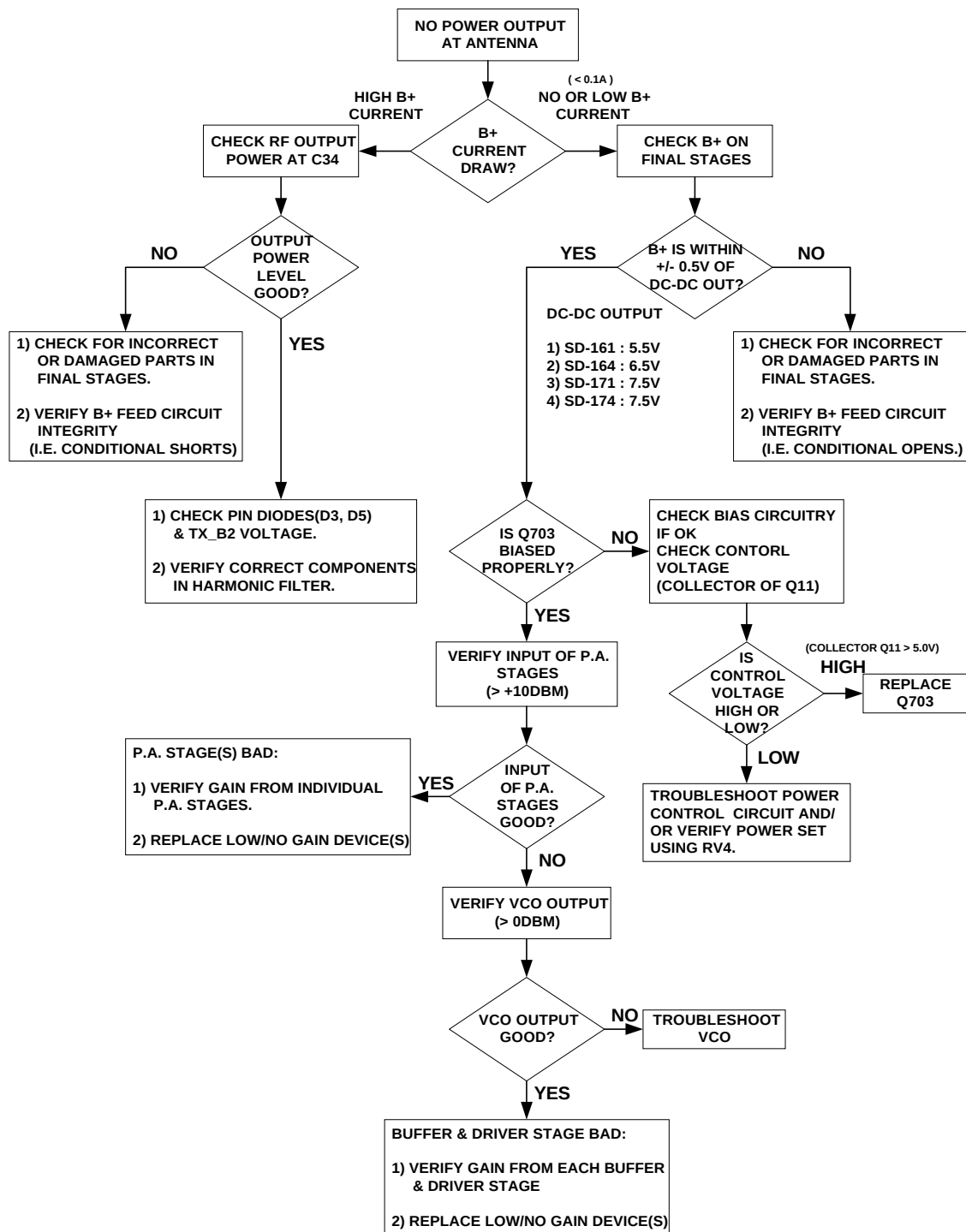


Figure 9.2. Troubleshooting Flow Chart for Transmitter

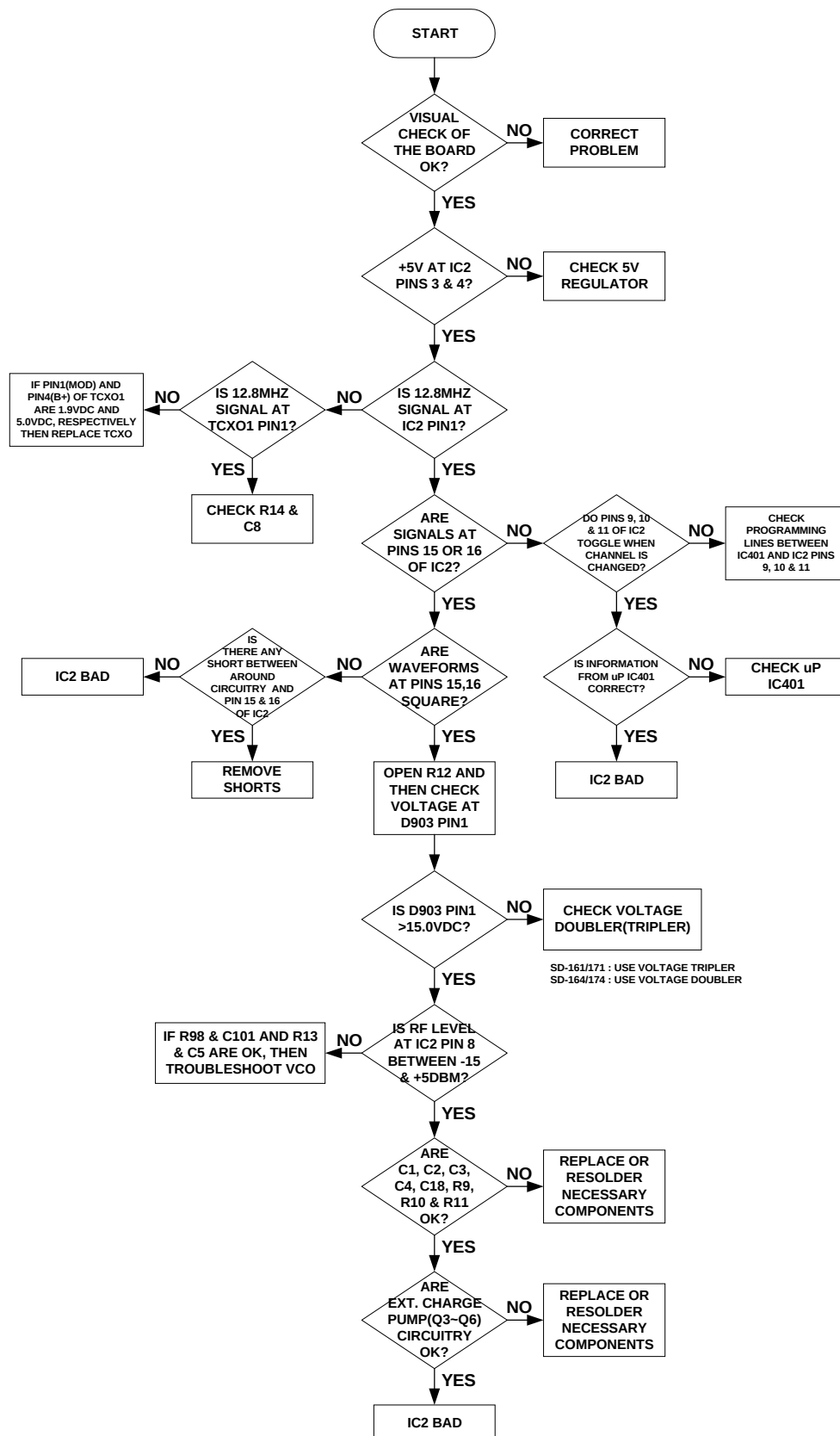


Figure 9.3. Troubleshooting Flow Chart for Synthesizer

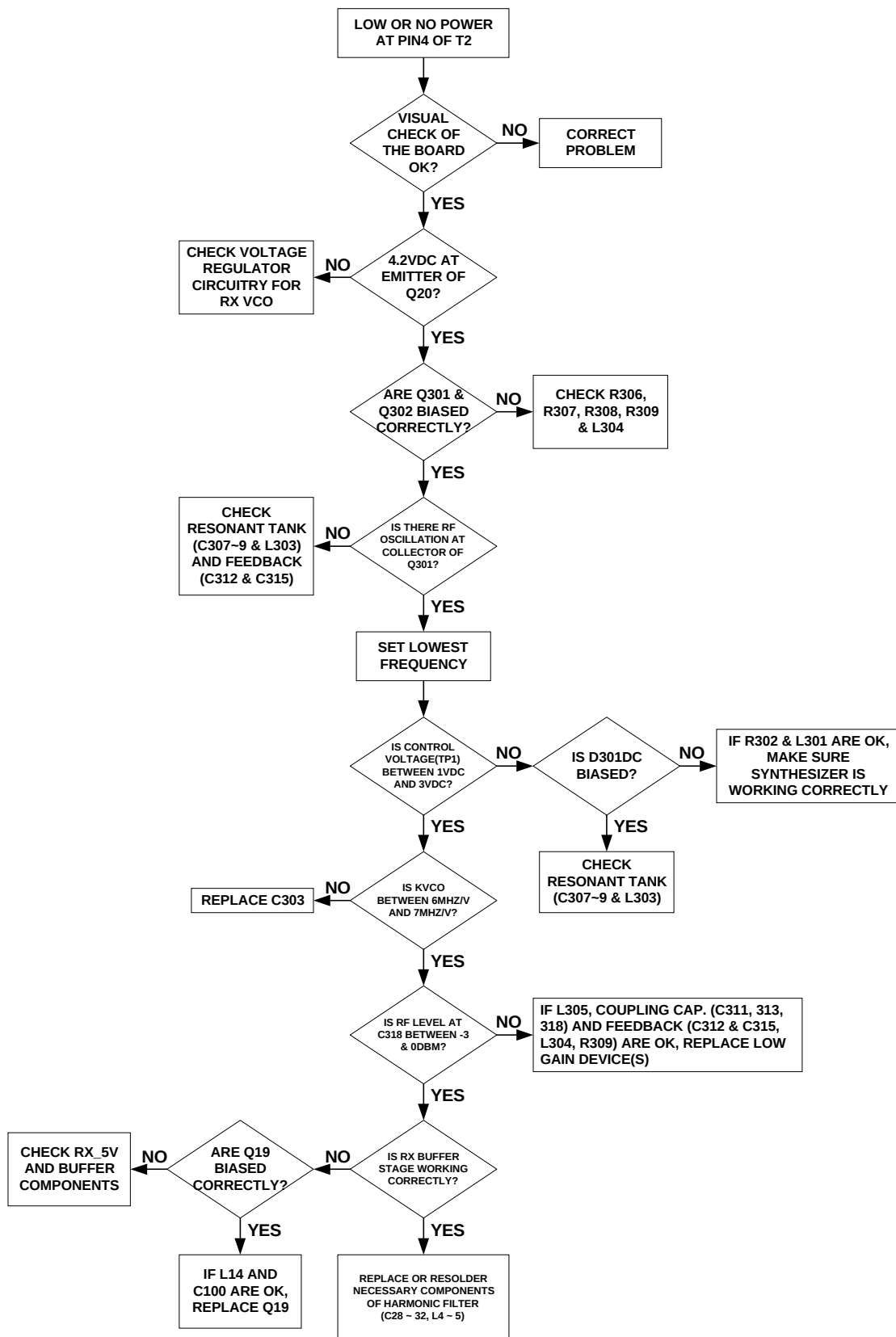


Figure 9.4. Troubleshooting Flow Chart for RX VCO

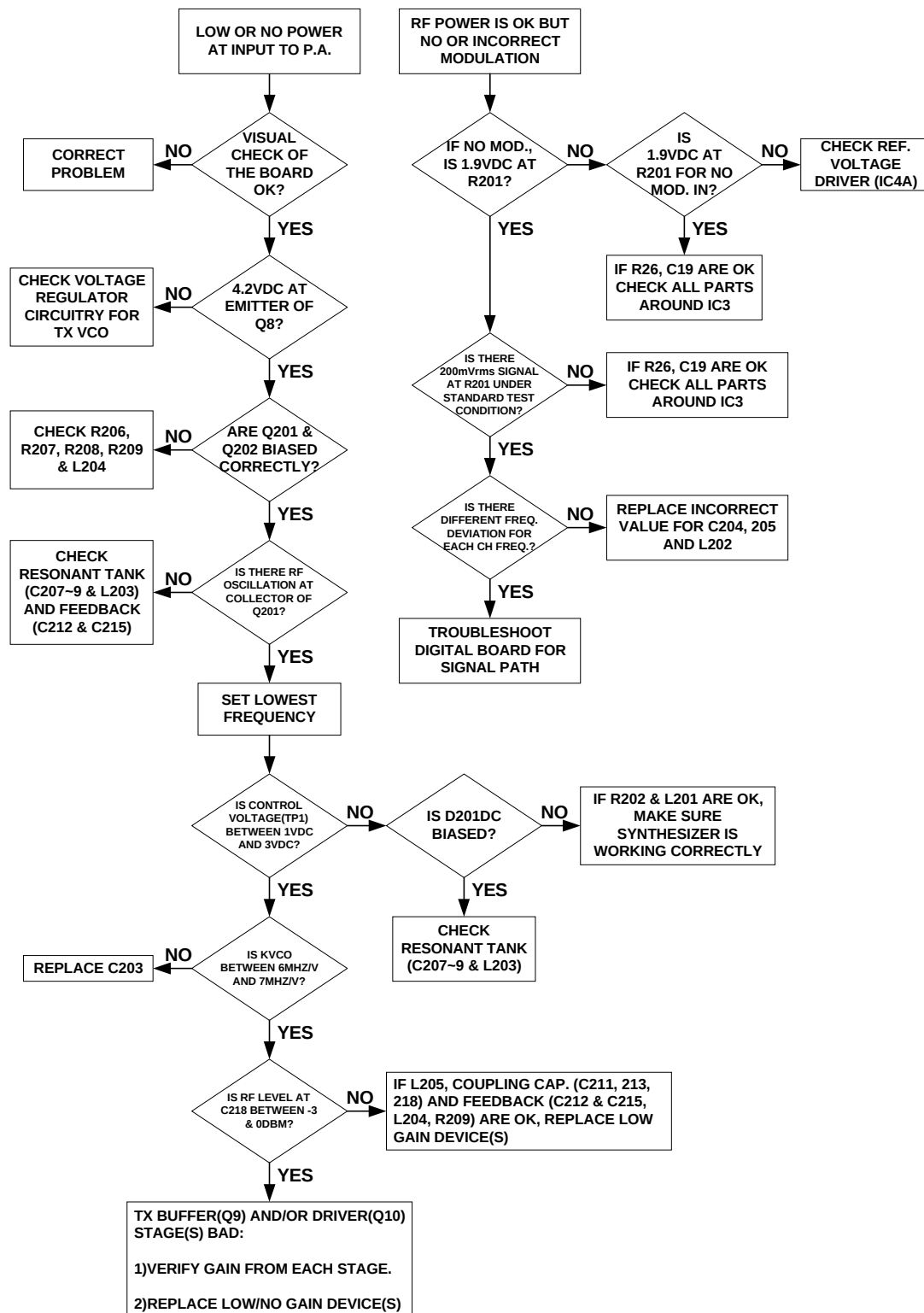


Figure 9.5. Troubleshooting Flow Chart for TX VCO

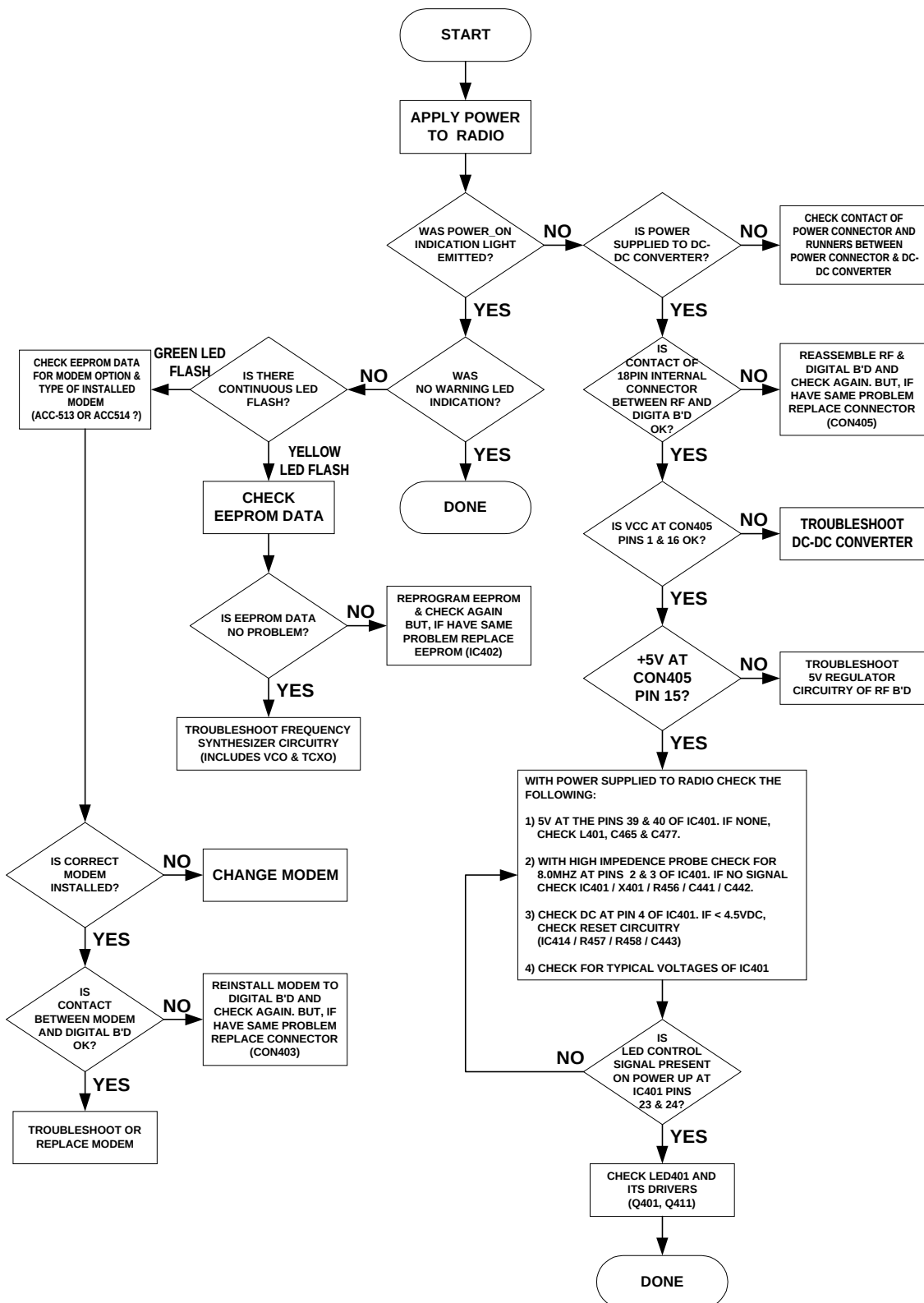


Figure 9.6. Troubleshooting Flow Chart for Control Circuit

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	IC403	IC404(off)	IC405	IC406	IC407	IC408	IC409
	CSI24WC04	NJM12903V	KIA324F	KIA324F	MC14066B	MC14066B	KIA324F	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	IC411	IC412	IC414	IC416	IC417	IC418	
	MSNBLPS	KIA324F	LM386	KIA7042F	KIA324F	KIA324F	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	1.7Analog)	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	IC403	IC404	IC405	IC406	IC407	IC408	IC409
	CSI24WC04	NJM12903V	KIA324F	KIA324F	MC14066B	MC14066B	KIA324F	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	IC411	IC412	IC414	IC416	IC417	IC418	
	MSNBLPS	KIA324F	LM386	KIA7042F	KIA324F	KIA324F	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	1.7(Analog)	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 #	Component	Value	Manufacturer description	Ref #
70-136222	METAL POLY CAP	0.33UF	63V	C1
70-136223	METAL POLY CAP	0.022UF	223K 63V BOX	C2
70-136224	METAL POLY CAP	0.01UF	63V	C3
70-136224	METAL POLY CAP	0.01UF	63V	C4
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C5
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C6
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C7
70-137219	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C8
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C9
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C10
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C11
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C12
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C13
70-137263	CHIP CERAMIC	0.1UF	CL05B104KPNC	C14
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C16
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C17
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C18
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C19
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C20
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C21
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C22
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C23
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C24
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C25
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C26
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C27
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C28
70-137227	CHIP CERAMIC	13PF	GRM36 COG130J 50V	C29
70-137231	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C30
70-137237	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C32
70-137220	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C33
70-137168	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C34
70-137185	CHIP CERAMIC	6.8PF	GRM40 COG6R8D 50V PT	C35
70-137186	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C36
70-137164	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C37
70-137164	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C38
70-137186	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C39
70-137168	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C40
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C42
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C43
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C44
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C45
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C46
70-135433	CHIP TANTALUM	10UF	TSM1A106ASSR 10V	C47
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C48
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C49
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C50
70-135434	CHIP TANTALUM	0.47UF	TCA10474MR 20V	C51

70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C52
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C53
70-138963	CHIP CERAMIC	0.47UF	GRM40 Y5V474Z 16V PT	C54
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C55
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C56
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C57
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C58
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C59
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C60
70-137187	CHIP CERAMIC	4.7PF	GRM40 COG4R7C 50V PT	C61
70-137231	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C62
70-137238	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C64
70-137230	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C66
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C68
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C69
70-137234	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C70
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C71
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C72
70-137238	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C73
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C74
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C75
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C76
70-137228	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C77
70-137233	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C78
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C79
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C80
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C81
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C82
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C83
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C84
Part #	Component	Value	Manufacturer description	Ref #

70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C85
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C86
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C87
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C88
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C89
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C90
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C91
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C92
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C93
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C94
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C95
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C96
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C97
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C98
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C99
70-137231	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C100
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C101
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C102
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C103
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C104
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C105
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C106

70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C107
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C108
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C109
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C111
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C112
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C116
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C121
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C122
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C201
70-137230	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C203
70-137206	CHIP CERAMIC	1.5PF	GRM36 COG1R5C 50V	C204
70-137205	CHIP CERAMIC	1.2PF	GRM36 COG1R2C 50V	C205
70-137209	CHIP CERAMIC	1.8PF	GRM36 COG1R8C 50V	C206
70-137204	CHIP CERAMIC	1PF	GRM36 COG010C 50V	C207
70-123113	CHIP TRIMMER	6PF	TZV02Z060A100	C208
70-137211	CHIP CERAMIC	2.2PF	GRM36 COG2R2C 50V	C209
70-137218	CHIP CERAMIC	5.6PF	GRM36 COG5R6D 50V	C211
70-137227	CHIP CERAMIC	13PF	GRM36 COG130J 50V	C212
70-137216	CHIP CERAMIC	4.7PF	GRM36 COG4R7C50V	C213
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C214
70-137234	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C215
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C216
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C217
70-137215	CHIP CERAMIC	4PF	GRM36 COG040C 50V	C218
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C301
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C303
70-123113	CHIP TRIMMER	6PF	TZV02Z060A100	C308
70-137209	CHIP CERAMIC	1.8PF	GRM36 COG1R8C 50V	C309
70-137188	CHIP CERAMIC	2.7PF	GRM39 COG2R7C 50V PT	C311
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C312
70-137216	CHIP CERAMIC	4.7PF	GRM36 COG4R7C50V	C313
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C314
70-137229	CHIP CERAMIC	16PF	GRM36 COG160J 50V	C315
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C316
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C317
70-137231	CHIP CERAMIC	20PF	GRM36 COG200J 50V	C318
70-137241	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C401
70-137241	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C402
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C403
70-138785	CHIP CERAMIC	1UF	GRM39 Y5V105Z 10V	C404
70-137247	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C405
70-137246	CHIP CERAMIC	0.0015UF	GRM36 X7R152K 50V	C406
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C407
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C408
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C409
70-137247	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C410
70-137189	CHIP CERAMIC	0.012UF	GRM39 X7R123K 25V PT	C411
70-137190	CHIP CERAMIC	910PF	GRM39 X7R911J 50V PT	C412
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C413
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C414
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C415
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C416
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C417
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C418

70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C419
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C420
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C421
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C422
70-137259	CHIP CERAMIC	300PF	GRM36 X7R301K 50V	C423
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C424
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C425
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C426
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C427
Part #	Component	Value	Manufacturer description	Ref #
70-137240	CHIP CERAMIC	120PF	GRM36 COG121J 50V	C428
70-137191	CHIP CERAMIC	0.082UF	GRM40 X7R823K 50V PT	C429
70-137192	CHIP CERAMIC	0.68UF	GRM40 Y5V684Z 16V PT	C430
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C431
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C432
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C433
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C434
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C435
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C436
70-137251	CHIP CERAMIC	0.0068UF	GRM36 X7R682K 25V	C437
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C438
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C439
70-137242	CHIP CERAMIC	200PF	GRM36 COG201J 50V	C440
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C441
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C442
70-137263	CHIP CERAMIC	0.1UF	CL05B104KPNC	C443
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C444
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C445
70-137248	CHIP CERAMIC	0.0027UF	GRM36 X7R272K 50V	C446
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C448
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C449
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C450
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C451
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C452
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C453
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C454
70-135416	CHIP TANTALUM	47UF	293D476X0016E2T16V	C455
70-135432	CHIP TANTALUM	100UF	293D107X0006E2T6V	C456
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C457
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C458
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C459
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C460
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C461
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C462
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C463
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C464
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C465
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C467
70-137168	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C468
70-135422	CHIP TANTAL		TSM1V226 DSSR	C469
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C470
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C472
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C473

70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C474
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C475
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C476
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C477
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C478
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C481
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C482
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C487
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C488
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C489
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C490
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C491
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C492
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C493
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C494
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C500
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C504
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C507
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C511
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C512
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C513
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C514
70-138920	CHIP CERAMIC	27PF	GRM39 COG270J 50V PT	C601
70-138967	CHIP CERAMIC	13PF	GRM39 COG130J 50V PT	C603
70-138920	CHIP CERAMIC	27PF	GRM39 COG270J 50V PT	C606
70-138974	CHIP CERAMIC	68PF	GRM39 COG680J 50V PT	C608
70-138881	CHIP CERAMIC	150PF	GRM39 COG151J 50V PT	C609
70-138974	CHIP CERAMIC	68PF	GRM39 COG680J 50V PT	C610
70-138881	CHIP CERAMIC	150PF	GRM39 COG151J 50V PT	C611
70-137165	CHIP CERAMIC	51PF	GRM39 COG510J 50V PT	C612
70-138703	CHIP CERAMIC	30PF	GRM39 COG300J 50V PT	C615
70-138956	CHIP CERAMIC	0.001UF	GRM39 X7R102K 50V PT	C616
70-138972	CHIP CERAMIC	33PF	GRM39 COG330J 50V PT	C618
70-138969	CHIP CERAMIC	22PF	GRM39 COG220J 50V PT	C619
70-138956	CHIP CERAMIC	0.001UF	GRM39 X7R102K 50V PT	C620
70-137193	CHIP CERAMIC	5.6PF	GRM40 COG5R6C 50V PT	C701
70-137162	CHIP CERAMIC	27PF	GRM40 COG270J 50V PT	C702
70-137194	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C703
70-137195	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C704
70-137196	CHIP CERAMIC	36PF	GRM40 COG360J 50V PT	C705
70-137194	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C706
70-137194	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C710
Part #	Component	Value	Manufacturer description	Ref #
70-137194	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C712
70-137195	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C713
70-137195	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C714
70-137194	CHIP CERAMIC	0.01UF	GRM40 X7R103K 50V PT	C715
70-137197	CHIP CERAMIC	60PF	GRM40 COG600J 50V PT	C717
70-137164	CHIP CERAMIC	43PF	GRM40 COG430J 50V PT	C718
70-137237	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C801
70-137198	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C802
70-137260	CHIP CERAMIC	330PF	GRM36 X7R331K 50V	C803
70-137237	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C804

70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C805
70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C806
70-135422	CHIP TANTAL		TSM1V226 DSSR	C807
70-137198	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C808
70-138955	CHIP CERAMIC	0.01UF	GRM39 X7R103K 25V	C810
70-135435	CHIP TANTALUM	100UF	NRD107M16R12	C811
70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C812
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C813
70-135435	CHIP TANTALUM	100UF	NRD107M16R12	C815
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C901
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C902
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C904
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C905
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C906
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C907
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C908
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C909
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C910
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C911
70-179185	FILTER CERAMIC		LTM455FW	CF1
70-179164	FILTER CERAMIC		LTM455HW	CF2
70-085582	DIODE SWITCHING		KDS181S A3	D1
70-085582	DIODE SWITCHING		KDS181S A3	D1
70-085532	DIODE CHIP		UPP9401(T&R)50V 2.5W	D3
70-085532	DIODE CHIP		UPP9401(T&R)50V 2.5W	D5
70-085573	SCHOTTKY DIODE		HSMS-2817 #L31	D6
70-085582	DIODE SWITCHING		KDS181S A3	D8
70-085582	DIODE SWITCHING		KDS181S A3	D9
70-085592	DIODE VARICAP CHIP		1SV217	D202
70-085592	DIODE VARICAP CHIP		1SV217	D301
70-085582	DIODE SWITCHING		KDS181S A3	D402
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D404
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D405
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D406
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D410
70-085494	DIODE CHIP		KDS226	D601
70-085579	DIODE		KDS160	D801
70-085580	DIODE SCHOTTKY		MBRS140T3 (403A-03)	D802
70-085494	DIODE CHIP		KDS226	D901
70-085494	DIODE CHIP		KDS226	D902
70-085494	DIODE CHIP		KDS226	D903
70-077005	I.C VOLT. REGULATOR		TK71750SCL	IC1
70-076969	I.C PLL		MB15A02PFV1 (FPT-16P-M05)	IC2
70-077006	I.C OPAMP		NJM12904V	IC3
70-077006	I.C OPAMP		NJM12904V	IC4
70-077006	I.C OPAMP		NJM12904V	IC5
70-076962	I.C IF DETECT		TA31136FN	IC6

70-077007	I.C CPU		TMP87PS68DF	IC401
70-077008	I.C EEPROM		CSI24WC04J-TE13	IC402
70-077009	I.C OP AMP		NJM12903V	IC403
70-076978	I.C		KIA324F-EL	IC404
70-076978	I.C		KIA324F-EL	IC405
70-076977	I.C		MC14066BDR2:SO14	IC406
70-076977	I.C		MC14066BDR2:SO14	IC407
70-076978	I.C		KIA324F-EL	IC408
70-077010	I.C		MC14053BD	IC409
70-077011	I.C		MSNBLPS	IC410
70-076978	I.C		KIA324F-EL	IC411
70-076979	I.C		LM386MX-1 (SO-08)	IC412
70-076980	I.C DETECTOR		KIA7042F	IC414
70-076978	I.C		KIA324F-EL	IC416
70-076978	I.C		KIA324F-EL	IC417
70-077012	I.C CMOS SW		TC7S66FU (SSOP5PA)(MAX-2000)	IC418
70-076981	I.C DC/DC CONVERTOR		LTC1435CS (SO-16)	IC801
70-090908	COIL CHIP	10UH:	LER015T100K	L1
70-090941	COIL WIREWOUND CHIP	100NH	WCI1608TR10	L2
70-090942	COIL INDUCTOR CHIP	150NH	SWI0805CTR15	L3
70-090901	COIL CHIP	47NH:	LL2012-F47NM	L4
70-090901	COIL CHIP	47NH	LL2012-F47NM	L5
70-090945	COIL INDUCTOR CHIP	1UH	SWI0805FT1RO	L6
70-090912	COIL SPRING		3X0.55X4T:L	L7
Part #	Component	Value	Manufacturer description	Ref #

70-090951	COIL SPRING		3X0.55X5T:L SMD	L8
70-090951	COIL SPRING		3X0.55X5T:L SMD	L9
70-090911	COIL SPRING		2.8X0.4X8T:L	L10
70-090942	COIL INDUCTOR CHIP	150NH	SWI0805CTR15	L11
70-090943	COIL INDUCTOR CHIP	0.56UH	SWI0805FTR56	L12
70-090944	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L14
70-090945	COIL INDUCTOR CHIP	1UH	SWI0805FT1RO	L15
70-090946	COIL INDUCTOR CHIP	2.7UH	SWI0805FT2R7	L16
70-090947	COIL INDUCTOR CHIP	1.2UH	SWI0805FT1R2	L201
70-090952	COIL CHIP	56NH	LQN21A56N04	L203
70-090948	COIL INDUCTOR CHIP	2.2UH	SWI0805FT2R2	L204
70-090944	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L205
70-090947	COIL INDUCTOR CHIP	1.2UH	SWI0805FT1R2	L301
70-090952	COIL CHIP	56NH	LQN21A56N04	L303
70-090946	COIL INDUCTOR	2.7UH	SWI0805FT2R7	L304

	CHIP			
70-090944	COIL INDUCTOR CHIP	180NH	SWI0805CTR18	L305
70-090908	COIL CHIP	10UH:	LER015T100K	L401
70-090941	COIL WIREWOUND CHIP	100NH	WCI1608TR10	L601
70-090953	COIL WIREWOUND CHIP	82NH	WCI1608T82N	L602
70-090954	COIL SPRING	26NH	0.26X0.9X8T:L 26NH	L604
70-090954	COIL SPRING	26NH	0.26X0.9X8T:L 26NH	L605
70-090954	COIL SPRING	26NH	0.26X0.9X8T:L 26NH	L607
70-090954	COIL SPRING	26NH	0.26X0.9X8T:L 26NH	L608
70-090955	COIL WIREWOUND CHIP	39NH	WCI1608T39N	L701
70-090955	COIL WIREWOUND CHIP	39NH	WCI1608T39N	L702
70-090954	COIL SPRING	26NH	0.26X0.9X8T:L 26NH	L705
70-090963	COIL SPRING		1.0X0.45X4T:R(SMD)	L706
70-090963	COIL SPRING		1.0X0.45X4T:R(SMD)	L707
70-090964	SPRING COIL		1.2X0.3X2T SMD (R)	L708
70-090965	COIL SPRING		2X0.45X8T:L SMD	L709
70-090956	COIL WIREWOUND CHIP	47NH	WCI1608T47N	L710
70-090898	COIL INDUCTOR	12uH	12UH A814AY-120M=P3	L801
70-090899	COIL INDUCTOR CHIP	3.3UH	636CY-3R3M=P3	L802
70-085599	LAMP LED		L-115 VEGW	LED 401
70-144850	CHIP RESISTOR	0 1/ 8W 5%	T 3216	LK1
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK3
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK5
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK7
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK10
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK13
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK15
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK404
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK407
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK411
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK412
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK417
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK419
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK421
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK422
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK424
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK427
70-144850	CHIP RESISTOR	0 1/ 8W 5%	T 3216	LK701
70-080621	BRT		KRA110SPK	Q1
70-080621	BRT		KRA110SPK	Q2
70-080593	TRANSISTOR		KTC4075	Q3
70-080593	TRANSISTOR		KTC4075	Q4
70-080591	TRANSISTOR		KTA2014	Q5
70-080591	TRANSISTOR		KTA2014	Q6
70-080617	TRANSISTOR		KRA104S	Q7
70-080622	TRANSISTOR		KTC3875S(BL)	Q8
70-080623	TRANSISTOR		BFR92A REEL	Q9
70-080637	TRANSISTOR		PBR951	Q10

70-080625	TRANSISTOR		KTA1663	Q11
70-080622	TRANSISTOR		KTC3875S(BL)	Q12
70-080618	TRANSISTOR		KRC104SND	Q14
70-080622	TRANSISTOR		KTC3875S(BL)	Q15
70-080623	TRANSISTOR		BFR92A REEL	Q16
70-080618	TRANSISTOR		KRC104SND	Q17
70-080618	TRANSISTOR		KRC104SND	Q18
70-080623	TRANSISTOR		BFR92A REEL	Q19
70-080622	TRANSISTOR		KTC3875S(BL)	Q20
70-080618	TRANSISTOR		KRC104SND	Q21
70-080617	TRANSISTOR		KRA104S	Q22
70-080618	TRANSISTOR		KRC104SND	Q24
70-080638	TRANSISTOR		2SC5086	Q201
70-080638	TRANSISTOR		2SC5086	Q202
70-080638	TRANSISTOR		2SC5086	Q301
70-080638	TRANSISTOR		2SC5086	Q302
70-080617	TRANSISTOR		KRA104S	Q401
70-080617	TRANSISTOR		KRA104S	Q402
70-080618	TRANSISTOR		KRC104SND	Q403
70-080618	TRANSISTOR		KRC104SND	Q406
Part #	Component	Value	Manufacturer description	Ref #

70-080619	TRANSISTOR		KTA1504SY	Q407
70-080618	TRANSISTOR		KRC104SND	Q408
70-080618	TRANSISTOR		KRC104SND	Q410
70-080618	TRANSISTOR		KRC104SND	Q411
70-080617	TRANSISTOR		KRA104S	Q413
70-080619	TRANSISTOR		KTA1504SY	Q417
70-080618	TRANSISTOR		KRC104SND	Q418
70-080639	TRANSISTOR		KRC110SNK	Q419
70-080617	TRANSISTOR		KRA104S	Q424
70-080618	TRANSISTOR		KRC104SND	Q425
70-080640	TRANSISTOR		KTC5084(0)	Q601
70-080637	TRANSISTOR		PBR951	Q701
70-080641	MOSFET(N-CHANNEL)		NE5510279A	Q703
70-080642	FET MOS		SI4412DY	Q801
70-080642	FET MOS		SI4412DY	Q802
70-080593	TRANSISTOR		KTC4075	Q901
70-080593	TRANSISTOR		KTC4075	Q902
70-080593	TRANSISTOR		KTC4075	Q903
70-080593	TRANSISTOR		KTC4075	Q904
70-080591	TRANSISTOR		KTA2014	Q905
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R1
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R2
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R3
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R4
70-144809	CHIP RESISTOR	1.5K 1/16W 5%	T 1005	R5
70-144809	CHIP RESISTOR	1.5K 1/16W 5%	T 1005	R6
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R7
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R8
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R9
70-144813	CHIP RESISTOR	2.7K 1/16W 5%	T 1005	R10
70-144813	CHIP RESISTOR	2.7K 1/16W 5%	T 1005	R11
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R12

70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R13
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R14
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R15
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R16
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R17
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R18
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R19
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R20
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R21
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R22
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R23
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R26
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R27
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R28
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R29
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R30.
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R31
70-144804	CHIP RESISTOR	300 1/16W 5%	T 1005	R32
70-144792	CHIP RESISTOR	18 1/16W 5%	T 1005	R33
70-144804	CHIP RESISTOR	300 1/16W 5%	T 1005	R34
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R35
70-144820	CHIP RESISTOR	6.8K 1/16W 5%	T 1005	R36
70-144842	CHIP RESISTOR	150K 1/16W 5%	T 1005	R37
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R38
70-144803	CHIP RESISTOR	270 1/16W 5%	T 1005	R39
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R40
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R41
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	R42
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R43
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R44
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R45
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R46
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R47
70-144809	CHIP RESISTOR	1.5K 1/16W 5%	T 1005	R48
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R49
70-144815	CHIP RESISTOR	3.3K 1/16W 5%	T 1005	R50
70-144847	CHIP RESISTOR	1M 1/16W 5%	T 1005	R51
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R52
70-144791	CHIP RESISTOR	10 1/16W 5%	T 1005	R53
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R54
70-144805	CHIP RESISTOR	330 1/16W 5%	T 1005	R56
70-144848	CHIP RESISTOR	4.7M 1/16W 5%	T 1005	R57
70-144838	CHIP RESISTOR	68K 1/16W 1%	T 1005	R58
70-144840	CHIP RESISTOR	100K 1/16W 1%	T 1005	R59
70-144838	CHIP RESISTOR	68K 1/16W 1%	T 1005	R60
70-144840	CHIP RESISTOR	100K 1/16W 1%	T 1005	R61
70-144795	CHIP RESISTOR	39 1/16W 5%	T 1005	R62
70-144764	CHIP RESISTOR	0.1 1W 1%	1218	R63
70-144793	CHIP RESISTOR	22 1/16W 5%	T 1005	R64
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R65
70-144797	CHIP RESISTOR	51 1/16W 5%	T 1005	R68
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R69
Part #	Component	Value	Manufacturer description	Ref #

70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R70
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R71
70-144810	CHIP RESISTOR	1.8K 1/16W 5%	T 1005	R72
70-144809	CHIP RESISTOR	1.5K 1/16W 5%	T 1005	R73
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R74
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R75
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R76
70-144837	CHIP RESISTOR	56K 1/16W 5%	T 1005	R77
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R78
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R79
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R80
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R81
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R82
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R83
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R84
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R85
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R86
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R87
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R88
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R90
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R91
70-144843	CHIP RESISTOR	180K 1/16W 5%	T 1005	R92
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R93
70-144836	CHIP RESISTOR	51K 1/16W 5%	T1005	R94
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R99
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R100
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R101
70-144865	CHIP RESISTOR	10K 1/10W 5%	T 2012	R105
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R108
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R110
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R111
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R112
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R113
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R114
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R115
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R116
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R117
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R118
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R119
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R201
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R202
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R203
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R206
70-144849	CHIP RESISTOR	2K 1/16W 5%	T 1005	R207
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R208
70-144803	CHIP RESISTOR	270 1/16W 5%	T 1005	R209
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R302
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R306
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R307
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R308
70-144803	CHIP RESISTOR	270 1/16W 5%	T 1005	R309
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R402
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R403
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R404

70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R405
70-144837	CHIP RESISTOR	56K 1/16W 5%	T 1005	R406
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R407
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R408
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R409
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R410
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R411
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R412
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R413
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R414
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R415
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R416
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R417
70-144843	CHIP RESISTOR	180K 1/16W 5%	T 1005	R418
70-144815	CHIP RESISTOR	3.3K 1/16W 5%	T 1005	R419
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R420
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R421
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R422
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R423
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R425
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R426
70-144814	CHIP RESISTOR	3K 1/16W 5%	T 1005	R427
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R428
70-144816	CHIP RESISTOR	3.9K 1/16W 5%	T 1005	R429
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R430
70-144841	CHIP RESISTOR	120K 1/16W 5%	T 1005	R431.
70-144841	CHIP RESISTOR	120K 1/16W 5%	T 1005	R432
70-144869	CHIP RESISTOR	360K 1/10W 5%	T 2012	R433
70-144866	CHIP RESISTOR	43K 1/10W 5%	T 2012	R434
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R435
70-144866	CHIP RESISTOR	43K 1/10W 5%	T 2012	R436
Part #	Component	Value	Manufacturer description	Ref #

70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R437
70-144833	CHIP RESISTOR	36K 1/16W 5%	T 1005	R438
70-144831	CHIP RESISTOR	30K 1/16W 5%	T 1005	R439
70-144831	CHIP RESISTOR	30K 1/16W 5%	T 1005	R440
70-144818	CHIP RESISTOR	5.1K 1/16W 5%	T 1005	R441
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R442
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R443
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R444
70-144822	CHIP RESISTOR	9.1K 1/16W 5%	T 1005	R445
70-144818	CHIP RESISTOR	5.1K 1/16W 5%	T 1005	R446
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R453
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R455
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R456
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R457
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R458
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R459
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R460
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R461
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R462
70-144838	CHIP RESISTOR	68K 1/16W 5%	T 1005	R463
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R465

70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R466
70-144847	CHIP RESISTOR	1M 1/16W 5%	T 1005	R467
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R468
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R469
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R470
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R471
70-144801	CHIP RESISTOR	150 1/16W 5%	T 1005	R472
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R473
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R474
70-144791	CHIP RESISTOR	10 1/16W 5%	T 1005	R475
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R476
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R477
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R478
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R479
70-144834	CHIP RESISTOR	39K 1/16W 5%	T 1005	R481
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R482
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R483
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R484
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R485
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R486
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R487
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R488
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R489
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R492
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R493
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R494
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R495
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R496
70-144846	CHIP RESISTOR	680K 1/16W 5%	T 1005	R500
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R501
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R502
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R503
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R504
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R505
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R506
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R507
70-144800	CHIP RESISTOR	120 1/16W 5%	T 1005	R510
70-44800-	CHIP RESISTOR	120 1/16W 5%	T 1005	R511
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R512
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R513
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R515
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R516
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R517
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R518
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R519
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R520
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R521
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R522
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R523
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R524
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R525
70-144812	CHIP RESISTOR	2.4K 1/16W 5%	T 1005	R526
70-144839	CHIP RESISTOR	82K 1/16W 5%	T 1005	R527
70-144806	CHIP RESISTOR	820 1/16W 5%	T 1005	R528

70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R529
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R530
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R531
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R532
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R533
70-144829	CHIP RESISTOR	24K 1/16W 5%	T 1005	R534
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R535
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R540
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R544
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R549
Part #	Component	Value	Manufacturer description	Ref #

70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R550
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R551
70-144824	CHIP RESISTOR	11K 1/16W 5%	T 1005	R554
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R555
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R556
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R557
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R561
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R562
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R563
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R564
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R565
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R567
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R569
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R570
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R571
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R572
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R573
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R574
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R581
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R582
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R584
70-144856	CHIP RESISTOR	3.3K 1/16W 5%	T 1608	R601
70-144853	CHIP RESISTOR	180 1/16W 5%	T 1608	R602
70-144854	CHIP RESISTOR	820 1/16W 5%	T 1608	R603
70-144852	CHIP RESISTOR	2.2 1/16W 5%	T 1608	R604
70-144856	CHIP RESISTOR	3.3K 1/16W 5%	T 1608	R605
70-144862	CHIP RESISTOR	2.7K 1/10W 5%	T 2012	R701
70-144864	CHIP RESISTOR	6.8K 1/10W 5%	T 2012	R702
70-144867	CHIP RESISTOR	47K 1/10W 5%	T 2012	R705
70-144860	CHIP RESISTOR	22 1/10W 5%	T 2012	R706
70-144861	CHIP RESISTOR	2K 1/10W 5%	T 2012	R710
70-144863	CHIP RESISTOR	3.9K 1/10W 5%	T 2012	R711
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R801
70-144833	CHIP RESISTOR	36K 1/16W 5%	T 1005	R802
70-144858	CHIP RESISTOR	0.033 1/10W 1%	T 2012	R804
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R805
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R806
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R901
70-144821	CHIP RESISTOR	7.5K 1/16W 5%	T 1005	R902
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R903
70-144821	CHIP RESISTOR	7.5K 1/16W 5%	T 1005	R904
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R905

70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R906
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R907
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R908
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	R(C508)
70-144868	CHIP RESISTOR	100K 1/10W 5%	T 2012	R(L202)
70-086095	THERMISTOR CHIP	ECTH201208473H4 100H		RTH402
70-164194	RES.CHIP TRIMMER	47K	RH03E1CS4X	RV1
70-164195	RES.CHIP TRIMMER	100K	RH03E1C15X	RV2
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV4
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV5
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV6
70-164193	RES.CHIP TRIMMER	22K	RH03E1CJ4X	RV401
70-164194	RES.CHIP TRIMMER	47K	RH03E1CS4X	RV402
70-164197	RES.CHIP TRIMMER	4.7K	RH03E1CS3X	RV403
70-098059	TRANSFORMERS CHIP	617PT-1019		T1
70-098059	TRANSFORMERS CHIP	617PT-1019		T2
70-179193	VTCXO	VX-F7M-2.0FX		TCXO1
70-179182	CRYSTAL	44.645M	-30 15PM 32P 3RD	X1
70-179195	CRYSTAL RESONATOR	8.0M	-20 30PPM 18PF	X401
70-179196	FILTER CRYSTAL	45N15B4	45.1MHZ	XF2
70-179197	ISCRIMINATOR CERAMIC	DBC B455KCAY24- R0		Y1.

11.2. PARTS LIST FOR SD-164

Part #	Component	Value	Manufacturer	description	Ref #
70-136222	METAL POLY CAP	0.33UF	63V		C1
70-136223	METAL POLY CAP	0.022UF	223K 63V BOX		C2

70-136224	METAL POLY CAP	0.01UF	63V	C3
70-136224	METAL POLY CAP	0.01UF	63V	C4
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C5
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C6
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C7
70-137219	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C8
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C9
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C10
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C11
Part #	Component	Value	Manufacturer description	Ref #
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C12
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C13
70-137263	CHIP CERAMIC	0.1UF	CL05B104KPNC	C14
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C15
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C17
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C18
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C19
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C20
70-137213	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C21
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C22
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C23
70-137210	CHIP CERAMIC	2PF	GRM36 COG020C 50V	C24
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C25
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C26
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C27
70-137220	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C28
70-137221	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C29
70-137228	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C30
70-137219	CHIP CERAMIC	6PF	GRM36 COG060D 50V	C31
70-137233	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C32
70-137264	CHIP CERAMIC	3.9PF	CL05C3R9CBNC	C33
70-137199	CHIP CERAMIC	470PF	GRM40 COG471J 50V PT	C34
70-137200	CHIP CERAMIC	0.5PF	GRM40 COG0R5C 50V PT	C35
70-137201	CHIP CERAMIC	0.75PF	GRM40 COG0R75C50V PT	C36
70-137202	CHIP CERAMIC	9PF	GRM40 COG090D 50V PT	C37
70-137159	CHIP CERAMIC	14PF	GRM40 COG140J 50V PT	C38
70-137199	CHIP CERAMIC	470PF	GRM40 COG471J 50V PT	C40
70-137201	CHIP CERAMIC	0.75PF	GRM40 COG0R75C50V PT	C41
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C42
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C43
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C44
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C45
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C46
70-135433	CHIP TANTALUM	10UF	TSM1A106ASSR 10V	C47
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C48
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C49
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C50
70-135434	CHIP TANTALUM	0.47UF	TCA10474MR 20V	C51
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C53
70-138963	CHIP CERAMIC	0.47UF	GRM40 Y5V474Z 16V PT	C54
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C55
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C56
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C57

70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C58
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C59
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C60
70-137158	CHIP CERAMIC	10PF	GRM40 COG100C 50V PT	C61
70-137221	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C62
70-137238	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C64
70-137230	CHIP CERAMIC	18PF	GRM36 COG180J 50V	C66
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C68
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C69
70-137234	CHIP CERAMIC	30PF	GRM36 COG300J 50V	C70
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C71
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C72
70-137238	CHIP CERAMIC	82PF	GRM36 COG820J 50V	C73
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C74
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C75
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C76
70-137228	CHIP CERAMIC	15PF	GRM36 COG150J 50V	C77
70-137233	CHIP CERAMIC	27PF	GRM36 COG270J 50V	C78
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C79
70-137265	CHIP CERAMIC	0.01UF	CL05B103KONC	C80
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C81
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C82
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C83
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C84
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C85
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C86
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C87
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C88
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C89
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C90
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C91
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C92
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C93
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C94
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C95
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C96
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C97
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C98
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C99
70-137217	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C100
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C101
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C102
Part #	Component	Value	Manufacturer description	Ref #
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C103
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C104
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C105
70-137262	CHIP CERAMIC	220PF	GRM36 COH221J 25V	C106
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C107
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C108
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C109
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C110
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C111
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C112

70-137265	CHIP CERAMIC	0.01UF	CL05B103KONC	C121
70-137265	CHIP CERAMIC	0.01UF	CL05B103KONC	C122
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C201
70-137223	CHIP CERAMIC	9PF	GRM36 COG090D 50V	C203
70-137208	CHIP CERAMIC	0.75PF	GRM36 COG0R75C50V	C204
70-137206	CHIP CERAMIC	1.5PF	GRM36 COG1R5C 50V	C205
70-137207	CHIP CERAMIC	0.5PF	GRM36 COG0R5C 50V	C206
70-137209	CHIP CERAMIC	1.8PF	GRM36 COG1R8C 50V	C207
70-123113	CHIP TRIMMER	6PF	TZV02Z060A100	C208
70-137211	CHIP CERAMIC	2.2PF	GRM36 COG2R2C 50V	C209
70-137215	CHIP CERAMIC	4PF	GRM36 COG040C	C211
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C212
70-137213	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C213
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C214
70-137217	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C215
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C216
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C217
70-137215	CHIP CERAMIC	4PF	GRM36 COG040C 50V	C218
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C301
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C303
70-137217	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C307
70-123113	CHIP TRIMMER	6PF	TZV02Z060A100	C308
70-137212	CHIP CERAMIC	2.7PF	GRM36 COG2R7C 50V	C309
70-137215	CHIP CERAMIC	4PF	GRM36 COG040C 50V	C311
70-137225	CHIP CERAMIC	11PF	GRM36 COG110J 50V	C312
70-137213	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C313
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C315
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C316
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C317
70-137215	CHIP CERAMIC	4PF	GRM36 COG040C 50V	C318
70-137241	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C401
70-137241	CHIP CERAMIC	150PF	GRM36 COG151J 50V	C402
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C403
70-138785	CHIP CERAMIC	1UF	GRM39 Y5V105Z 10V	C404
70-137247	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C405
70-137246	CHIP CERAMIC	0.0015UF	GRM36 X7R152K 50V	C406
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C407
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C408
70-137250	CHIP CERAMIC	0.0047UF	GRM36 X7R472K 25V	C409
70-137247	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C410
70-137189	CHIP CERAMIC	0.012UF	GRM39 X7R123K 25V PT	C411
70-137190	CHIP CERAMIC	910PF	GRM39 X7R911J 50V PT	C412
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C413
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C414
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C415
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C416
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C417
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C418
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C419
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C420
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C421
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C422
70-137259	CHIP CERAMIC	300PF	GRM36 X7R301K 50V	C423
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C424

70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C425
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C426
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C427
70-137240	CHIP CERAMIC	120PF	GRM36 COG121J 50V	C428
70-137191	CHIP CERAMIC	0.082UF	GRM40 X7R823K 50V PT	C429
70-137192	CHIP CERAMIC	0.68UF	GRM40 Y5V684Z 16V PT	C430
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C431
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C432
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C433
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C434
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C435
70-137253	CHIP CERAMIC	0.022UF	GRM36 X7R223K 16V	C436
70-137251	CHIP CERAMIC	0.0068UF	GRM36 X7R682K 25V	C437
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C438
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C439
70-137242	CHIP CERAMIC	200PF	GRM36 COG201J 50V	C440
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C441
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C442
70-137263	CHIP CERAMIC	0.1UF	CL05B104KPNC	C443
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C444
70-137249	CHIP CERAMIC	0.0033UF	GRM36 X7R332K 50V	C445
Part #	Component	Value	Manufacturer description	Ref #

70-137248	CHIP CERAMIC	0.0027UF	GRM36 X7R272K 50V	C446
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C448
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C449
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C450
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C451
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C452
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C453
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C454
70-135416	CHIP TANTALUM	47UF	293D476X0016E2T16V	C455
70-135432	CHIP TANTALUM	100UF	293D107X0006E2T6V	C456
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C457
70-138998	CHIP CERAMIC	1UF	GRM40 Y5V105Z 16V PT	C458
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C459
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C460
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C461
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C462
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C463
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C464
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C465
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C467
70-137168	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C468
70-135422	CHIP TANTAL		TSM1V226 DSSR	C469
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C470
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C472
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C473
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C474
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C475
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C475
70-137245	CHIP CERAMIC	0.001UF	GRM36 X7R102K 50V	C476
70-135417	CHIP TANTALUM	10UF	293D106X06R3A2T6.3V	C477
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C478

70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C481
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C482
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C487
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C488
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C489
70-137254	CHIP CERAMIC	0.033UF	GRM36 X7R333K 10V	C490
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C491
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C492
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C493
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C494
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C500
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C502
70-138977	CHIP TANTALUM	1UF	293D105X0016A2T16V	C504
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C511
70-137257	CHIP CERAMIC	0.1UF	GRM36 X5R104K 10V	C512
70-137255	CHIP CERAMIC	0.047UF	GRM36 X7R473K 10V	C513
70-137256	CHIP CERAMIC	0.1UF	GRM36 Y5V104Z 16V	C514
70-137218	CHIP CERAMIC	5.6PF	GRM36 COG5R6D 50V	C601
70-137210	CHIP CERAMIC	2PF	GRM36 COG020C 50V	C602
70-137225	CHIP CERAMIC	11PF	GRM36 COG110J 50V	C603
70-137221	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C604
70-137235	CHIP CERAMIC	33PF	GRM36 COG330J 50V	C605
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C608
70-137236	CHIP CERAMIC	47PF	GRM36 COG470J 50V	C609
70-137261	CHIP CERAMIC	470PF	GRM36 X7R471K 50V	C611
70-137222	CHIP CERAMIC	8PF	GRM36 COG080D 50V	C612
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C613
70-137220	CHIP CERAMIC	6.8PF	GRM36 COG6R8D 50V	C614
70-137216	CHIP CERAMIC	4.7PF	GRM36 COG4R7C50V	C615
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C616
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C617
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C618
70-137226	CHIP CERAMIC	12PF	GRM36 COG120J 50V	C619
70-137221	CHIP CERAMIC	7PF	GRM36 COG070D 50V	C620
70-137217	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C621
70-137214	CHIP CERAMIC	3.3PF	GRM36 COG3R3C 50V	C622
70-137217	CHIP CERAMIC	5PF	GRM36 COG050C 50V	C623
70-137232	CHIP CERAMIC	22PF	GRM36 COG220J 50V	C701
70-137224	CHIP CERAMIC	10PF	GRM36 COG100D 50V	C702
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C703
70-137213	CHIP CERAMIC	3PF	GRM36 COG030C 50V	C704
70-137243	CHIP CERAMIC	8PF	GRM40 COG080D 50V PT	C705
70-137244	CHIP CERAMIC	5PF	GRM40 COG050C 50V PT	C707
70-137161	CHIP CERAMIC	24PF	GRM40 COG240J 50V PT	C708
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C709
70-137168	CHIP CERAMIC	0.001UF	GRM40 X7R102K 50V PT	C711
70-137203	CHIP CERAMIC	220PF	GRM40 COG221J 50V PT	C712
70-137157	CHIP CERAMIC	7PF	GRM40 COG070D 50V PT	C713
70-138991	CHIP CERAMIC	6PF	GRM40 COG060D 50V PT	C714
70-137153	CHIP CERAMIC	3.3PF	GRM40 COG3R3C 50V PT	C715
70-137195	CHIP CERAMIC	18PF	GRM40 COG180J 50V PT	C716
70-137247	CHIP CERAMIC	0.0022UF	GRM36 X7R222K 50V	C720
70-137153	CHIP CERAMIC	3.3PF	GRM40 COG3R3C 50V PT	C721
70-137193	CHIP CERAMIC	5.6PF	GRM40 COG5R6C 50V PT	C722

Part #	Component	Value	Manufacturer description	Ref #
70-137237	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C801
70-137198	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C802
70-137260	CHIP CERAMIC	330PF	GRM36 X7R331K 50V	C803
70-137237	CHIP CERAMIC	51PF	GRM36 COG510J 50V	C804
70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C805
70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C806
70-135422	CHIP TANTAL		TSM1V226 DSSR	C807
70-137198	CHIP CERAMIC	0.1UF	GRM39 X7R104K 50V PT	C808
70-138955	CHIP CERAMIC	0.01UF	GRM39 X7R103K 25V	C810
70-135435	CHIP TANTALUM	100UF	NRD107M16R12	C811
70-137239	CHIP CERAMIC	100PF	GRM36 COG101J 50V	C812
70-138979	CHIP TANTALUM	4.7UF	293D475X0010A2T10V	C813
70-135435	CHIP TANTALUM	100UF	NRD107M16R12	C815
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C901
70-137258	CHIP CERAMIC	220PF	GRM36 X7R221J 50V	C902
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C904
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C905
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C908
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C909
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C910
70-137252	CHIP CERAMIC	0.01UF	GRM36 X7R103K 16V	C911
70-137186	CHIP CERAMIC	20PF	GRM40 COG200J 50V PT	C(L603)
70-179185	FILTER CERAMIC		LTM455FW	CF1
70-179164	FILTER CERAMIC		LTM455HW	CF2
70-085582	DIODE SWITCHING		KDS181S A3	D1
70-085521	DIODE SI CHIP		KDS193	D2
70-085532	DIODE CHIP		UPP9401(T&R)50V 2.5W	D3
70-085532	DIODE CHIP		UPP9401(T&R)50V 2.5W	D5
70-085573	SCHOTTKY DIODE		HSMS-2817 #L31	D6
70-085582	DIODE SWITCHING		KDS181S A3	D8
70-085582	DIODE SWITCHING		KDS181S A3	D9
70-085547	DIODE VARICAP CHIP		1SV229	D201
70-085547	DIODE VARICAP CHIP		1SV229	D202
70-085547	DIODE VARICAP CHIP		1SV229	D301
70-085582	DIODE SWITCHING		KDS181S A3	D402
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D404
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D405
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D406
70-085492	DIODE ZENER CHIP		Z02W5.6Y 5.6V 0.2W (SOT-23)	D410
70-085494	DIODE CHIP		KDS226	D601
70-085579	DIODE		KDS160	D801
70-085580	DIODE SCHOTTKY		MBRS140T3 (403A-03)	D802
70-085494	DIODE CHIP		KDS226	D901
70-085494	DIODE CHIP		KDS226	D902
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	D903
70-077005	I.C VOLT.		TK71750SCL	IC1

	REGULATOR			
70-076969	I.C PLL		MB15A02PFV1 (FPT-16P-M05)	IC2
70-077006	I.C OPAMP		NJM12904V	IC3
70-077006	I.C OPAMP		NJM12904V	IC3
70-077006	I.C OPAMP		NJM12904V	IC5
70-076962	I.C IF DETECT		TA31136FN	IC6
70-077007	I.C CPU		TMP87PS68DF	IC401
70-077008	I.C EEPROM		CSI24WC04J-TE13	IC402
70-077009	I.C OP AMP		NJM12903V	IC403
70-076978	I.C		KIA324F-EL	IC404
70-076978	I.C		KIA324F-EL	IC405
70-076977	I.C		MC14066BDR2:SO14	IC406
70-076977	I.C		MC14066BDR2:SO14	IC407
70-076978	I.C		KIA324F-EL	IC408
70-077010	I.C		MC14053BD	IC409
70-077011	I.C		MSNBLPS	IC410
70-076978	I.C		KIA324F-EL	IC411
70-076979	I.C		LM386MX-1 (SO-08)	IC412
70-076980	I.C DETECTOR		KIA7042F	IC414
70-076978	I.C		KIA324F-EL	IC416
70-076978	I.C		KIA324F-EL	IC417
70-077012	I.C CMOS SW		TC7S66FU (SSOP5PA)(MAX-2000)	IC418
70-076981	I.C DC/DC CONVERTOR		LTC1435CS (SO-16)	IC801
70-090974	COIL INDUCTOR CHIP	15NH	1608GC2T15NJ00	L(R705)
70-090908	COIL CHIP	10UH:	LER015T100K	L1
70-090957	COIL WIREWOUND CHIP	18NH	WCI1608T18N	L2
70-090957	COIL WIREWOUND CHIP	18NH	WCI1608T18N	L3
70-090900	COIL CHIP	18NH:	LL2012-F18NM	L4
70-090900	COIL CHIP	18NH:	LL2012-F18NM	L5
70-090949	COIL INDUCTOR CHIP	0.82UH	SWI0805FTR82	L6
70-090966	COIL SPRING		2X0.75X3T:L SMD	L7
70-090967	COIL SPRING		2X0.75X3T:L SMD	L8
70-090968	COIL SPRING		2X0.75X3T:L SMD	L9
70-090969	COIL SPRING		1X0.35X7T:R	L10
70-090958	COIL WIREWOUND CHIP	150NH	WCI1608TR15	L11
70-090943	COIL INDUCTOR CHIP	0.56UH	SWI0805FTR56	L12
Part #	Component	Value	Manufacturer description	Ref #
70-090957	COILWIREWOUND CHIP	18NH	WCI1608T1	L14
70-090945	COIL CHIP	1	SWI0805F	L15
70-090946	COIL CHIP	2.7	SWI0805	L16
70-090941	COILWIREWOUND CHIP	100NH	WCI1608TR	L201
70-090950	COIL CHIP	0.47UF	SWI0805	L202
70-090962	COIL SPRING		1.0X0.45X4T:R	L203

70-090949	COIL CHIP	0.82UH	SWI0805FTR	L204
70-090959	COIL WIREWOUND CHIP	22N	WCI1608T	L205
70-090941	COIL WIREWOUND CHIP	100N	WCI1608T	L301
70-090962	COIL SPRING		1.0X0.45X4T:R(SMD)	L303
70-090949	COIL CHIP	0.82UH	SWI0805FTR82	L304
70-090960	COIL WIREWOUND CHIP	33NH	WCI1608T33N	L305
70-090908	COIL CHIP	10UH:	LER015T100K	L401
70-090970	SPRING COIL(SMD)		0.30X0.90\$X4T(R)	L601
70-090970	PRING COIL(SMD)		0.30X0.90\$X4T(R)	L602
70-090971	COIL SPRING	14NH	03095TL	L604
70-090970	SPRING COIL(SMD)		0.30X0.90\$X4T(R)	L605
70-090970	SPRING COIL(SMD)		0.30X0.90\$X4T(R)	L606
70-090971	COIL SPRING	14NH	03095TL	L607
70-090971	COIL SPRING	14NH	03095TL	L608
70-090970	SPRING COIL(SMD)		0.30X0.90\$X4T(R)	L609
70-090970	SPRING COIL(SMD)		0.30X0.90\$X4T(R)	L701
70-090961	COIL WIREWOUND CHIP	3.9NH	WCI1608T3N9	L704
70-090969	COIL SPRING		1X0.35X7T:R	L705
70-090972	COIL CHIP	12UH	DA104-120M	L801
70-090973	COIL CHIP	3.3UH	SD73-3R3M	L802
70-085599	LAMP LED		L-115 VEGW	LED401
70-144850	CHIP RESISTOR	0 1/8W 5%	T 3216	LK1
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK3
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK5
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK7
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	LK10
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK404
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK407
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK411
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK412
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK417
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK419
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK421
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK422
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK424
70-144851	CHIP RESISTOR	0 1/16W 5%	T 1608	LK427
70-144850	CHIP RESISTOR	0 1/8W 5%	T 3216	LK701
70-080621	BRT		KRA110SPK	Q1
70-080621	BRT		KRA110SPK	Q2
70-080593	TRANSISTOR		KTC4075	Q3
70-080593	TRANSISTOR		KTC4075	Q4
70-080591	TRANSISTOR		KTA2014	Q5
70-080591	TRANSISTOR		KTA2014	Q6
70-080617	TRANSISTOR		KRA104S	Q7
70-080622	TRANSISTOR		KTC3875S(BL)	Q8
70-080623	TRANSISTOR		BFR92A REEL	Q9
70-080637	TRANSISTOR		PBR951	Q10
70-080625	TRANSISTOR		KTA1663	Q11
70-080622	TRANSISTOR		KTC3875S(BL)	Q12
70-080618	TRANSISTOR		KRC104SND	Q14
70-080622	TRANSISTOR		KTC3875S(BL)	Q15
70-080623	TRANSISTOR		BFR92A REEL	Q16
70-080618	TRANSISTOR		KRC104SND	Q17
70-080618	TRANSISTOR		KRC104SND	Q18
70-080623	TRANSISTOR		BFR92A REEL	Q19
70-080622	TRANSISTOR		KTC3875S(BL)	Q20

70-080618	TRANSISTOR		KRC104SND	Q21
70-080618	TRANSISTOR		KRC104SND	Q22
70-080617	TRANSISTOR		KRA104S	Q22
70-080638	TRANSISTOR		2SC5086	Q201
70-080638	TRANSISTOR		2SC5086	Q202
70-080638	TRANSISTOR		2SC5086	Q301
70-080638	TRANSISTOR		2SC5086	Q302
70-080617	TRANSISTOR		KRA104S	Q401
70-080617	TRANSISTOR		KRA104S	Q402
70-080618	TRANSISTOR		KRC104SND	Q403
70-080618	TRANSISTOR		KRC104SND	Q406
70-080619	TRANSISTOR		KTA1504SY	Q407
70-080618	TRANSISTOR		KRC104SND	Q408
70-080618	TRANSISTOR		KRC104SND	Q410
70-080618	TRANSISTOR		KRC104SND	Q411
70-080617	TRANSISTOR		KRA104S	Q413
70-080619	TRANSISTOR		KTA1504SY	Q417
70-080618	TRANSISTOR		KRC104SND	Q418
70-080639	TRANSISTOR		KRC110SNK	Q419
70-080643	TRANSISTOR		NPN AT-41532	Q601
Part #	Component	Value	Manufacturer description	Ref #

70-080637	TRANSISTOR		PBR951	Q701
70-080644	FET RF POWER		2SK3079A	Q703
70-080642	FET MOS		SI4412DY	Q801
70-080642	FET MOS		SI4412DY	Q802
70-080593	TRANSISTOR		KTC4075	Q901
70-080593	TRANSISTOR		KTC4075	Q902
70-080593	TRANSISTOR		KTC4075	Q903
70-080593	TRANSISTOR		KTC4075	Q904
70-080591	TRANSISTOR		KTA2014	Q905
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R1
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R2
70-144855	CHIP RESISTOR	910 1/16W 5%	T 1608	R3
70-144855	CHIP RESISTOR	910 1/16W 5%	T 1608	R4
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R5
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R6
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R7
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R8
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R9
70-144813	CHIP RESISTOR	2.7K 1/16W 5%	T 1005	R10
70-144813	CHIP RESISTOR	2.7K 1/16W 5%	T 1005	R11
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R12
70-144792	CHIP RESISTOR	18 1/16W 5%	T 1005	R13
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R14
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R15
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R16
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R17
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R20
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R21
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R22
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R23
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R24
70-144846	CHIP RESISTOR	680K 1/16W 5%	T 1005	R25
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R26
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R28
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R29

70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R30
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R31
70-144804	CHIP RESISTOR	300 1/16W 5%	T 1005	R32
70-144792	CHIP RESISTOR	18 1/16W 5%	T 1005	R33
70-144804	CHIP RESISTOR	300 1/16W 5%	T 1005	R34
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R35
70-144820	CHIP RESISTOR	6.8K 1/16W 5%	T 1005	R36
70-144842	CHIP RESISTOR	150K 1/16W 5%	T 1005	R37
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R38
70-144800	CHIP RESISTOR	120 1/16W 5%	T 1005	R39
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R40
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R41
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	R42
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R43
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R44
70-144859	CHIP RESISTOR	2.2 1/10W 5%	T 2012	R45
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R46
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R47
70-144809	CHIP RESISTOR	1.5K 1/16W 5%	T 1005	R48
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R49
70-144815	CHIP RESISTOR	3.3K 1/16W 5%	T 1005	R50
70-144847	CHIP RESISTOR	1M 1/16W 5%	T 1005	R51
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R52
70-144791	CHIP RESISTOR	10 1/16W 5%	T 1005	R53
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R54
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R56
70-144848	CHIP RESISTOR	4.7M 1/16W 5%	T 1005	R57
70-144838	CHIP RESISTOR	68K 1/16W 1%	T 1608	R58
70-144840	CHIP RESISTOR	100K 1/16W 1%	T 1608	R59
70-144838	CHIP RESISTOR	68K 1/16W 1%	T 1608	R60
70-144840	CHIP RESISTOR	100K 1/16W 1%	T 1608	R61
70-144795	CHIP RESISTOR	39 1/16W 5%	T 1005	R62
70-144764	CHIP RESISTOR	0.1 1W 1%	1218	R63
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R64
70-144870	CHIP RESISTOR	470K 1/10W 5%	T 2012	R65
70-144797	CHIP RESISTOR	51 1/16W 5%	T 1005	R68
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R69
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R70
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R71
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R72
70-144810	CHIP RESISTOR	1.8K 1/16W 5%	T 1005	R73
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R74
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R75
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R76
70-144837	CHIP RESISTOR	56K 1/16W 5%	T 1005	R77
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R78
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R79
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R80
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R81
Part #	Component	Value	Manufacturer description	Ref #
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R83
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R84
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R85

70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R85
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R86
70-144807	CHIP RESISTOR	1K 1/16W 5%	T 1005	R87
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R88
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R90
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R91
70-144843	CHIP RESISTOR	180K 1/16W 5%	T 1005	R92
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R93
70-144836	CHIP RESISTOR	51K 1/16W 5%	T1005	R94
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R95
70-144819	CHIP RESISTOR	5.6K 1/16W 5%	T 1005	R96
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R97
70-144794	CHIP RESISTOR	33 1/16W 5%	T 1005	R98
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R99
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R100
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R101
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R104
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R105
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R109
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R110
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R111
70-144839	CHIP RESISTOR	82K 1/16W 5%	T 1005	R113
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R114
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R115
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R116
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R117
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R118
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R119
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R201
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R202
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R203
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R206
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R207
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R208
70-144803	CHIP RESISTOR	270 1/16W 5%	T 1005	R209
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R302
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R306
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R307
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R308
70-144803	CHIP RESISTOR	270 1/16W 5%	T 1005	R309
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R402
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R403
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R404
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R405
70-144837	CHIP RESISTOR	56K 1/16W 5%	T 1005	R406
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R407
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R408
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R409
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R410
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R411
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R412
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R413
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R414
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R415

70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R416
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R417
70-144843	CHIP RESISTOR	180K 1/16W 5%	T 1005	R418
70-144815	CHIP RESISTOR	3.3K 1/16W 5%	T 1005	R419
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R420
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R421
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R422
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R423
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R425
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R426
70-144814	CHIP RESISTOR	3K 1/16W 5%	T 1005	R427
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R428
70-144816	CHIP RESISTOR	3.9K 1/16W 5%	T 1005	R429
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R430
70-144841	CHIP RESISTOR	120K 1/16W 5%	T 1005	R431
70-144841	CHIP RESISTOR	120K 1/16W 5%	T 1005	R432
70-144869	CHIP RESISTOR	360K 1/10W 5%	T 2012	R433
70-144866	CHIP RESISTOR	43K 1/10W 5%	T 2012	R434
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R435
70-144866	CHIP RESISTOR	43K 1/10W 5%	T 2012	R436
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R437
70-144833	CHIP RESISTOR	36K 1/16W 5%	T 1005	R438
70-144831	CHIP RESISTOR	30K 1/16W 5%	T 1005	R439
70-144831	CHIP RESISTOR	30K 1/16W 5%	T 1005	R440
70-144818	CHIP RESISTOR	5.1K 1/16W 5%	T 1005	R441
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R442
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R443
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R444
Part #	Component	Value	Manufacturer description	Ref #

70-144822	CHIP RESISTOR	9.1K 1/16W 5%	T 1005	R445
70-144818	CHIP RESISTOR	5.1K 1/16W 5%	T 1005	R446
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R453
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R455
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R455
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R456
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R457
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R458
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R459
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R460
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R461
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R462
70-144838	CHIP RESISTOR	68K 1/16W 5%	T 1005	R463
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R465
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R466
70-144847	CHIP RESISTOR	1M 1/16W 5%	T 1005	R467
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R468
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R469
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R470
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R471
70-144801	CHIP RESISTOR	150 1/16W 5%	T 1005	R472
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R473
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R474
70-144791	CHIP RESISTOR	10 1/16W 5%	T 1005	R475

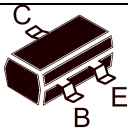
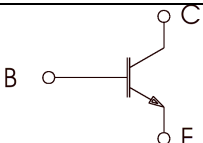
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R476
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R477
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R478
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R479
70-144834	CHIP RESISTOR	39K 1/16W 5%	T 1005	R481
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R482
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R483
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R484
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R485
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R486
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R487
70-144802	CHIP RESISTOR	220 1/16W 5%	T 1005	R488
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R489
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R492
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R493
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R494
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R495
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R496
70-144846	CHIP RESISTOR	680K 1/16W 5%	T 1005	R500
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R501
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R502
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R503
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R504
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R505
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R506
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R506
70-144800	CHIP RESISTOR	120 1/16W 5%	T 1005	R510
70-144800	CHIP RESISTOR	120 1/16W 5%	T 1005	R511
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R512
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R513
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R515
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R516
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R517
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R518
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R519
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R520
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R521
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R522
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R523
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R524
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R525
70-144812	CHIP RESISTOR	2.4K 1/16W 5%	T 1005	R526
70-144839	CHIP RESISTOR	82K 1/16W 5%	T 1005	R527
70-144806	CHIP RESISTOR	820 1/16W 5%	T 1005	R528
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R529
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R530
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R531
70-144825	CHIP RESISTOR	12K 1/16W 5%	T 1005	R532
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R533
70-144829	CHIP RESISTOR	24K 1/16W 5%	T 1005	R534
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R535
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R540
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R544
70-144799	CHIP RESISTOR	100 1/16W 5%	T 1005	R549

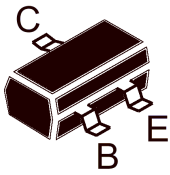
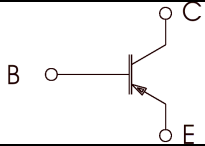
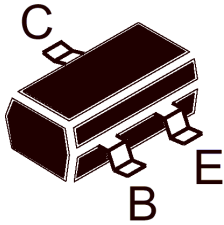
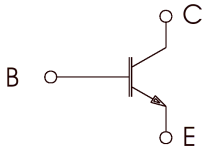
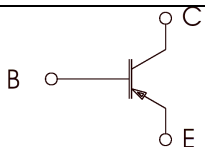
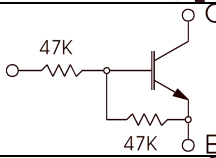
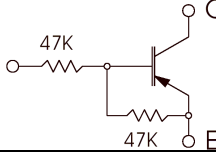
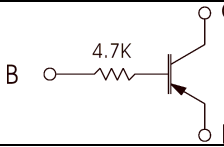
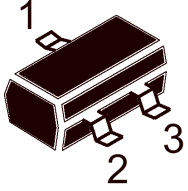
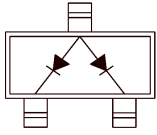
70-144845	CHIP RESISTOR	470K 1/16W 5%	T 1005	R550
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R551
70-144824	CHIP RESISTOR	11K 1/16W 5%	T 1005	R554
70-144826	CHIP RESISTOR	18K 1/16W 5%	T 1005	R555
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R556
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R557
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R561
Part #	Component	Value	Manufacturer description	Ref #

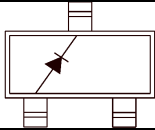
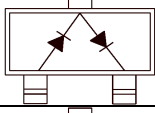
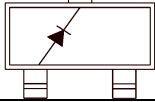
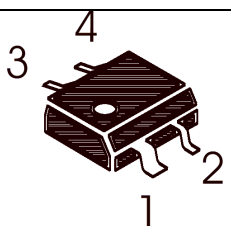
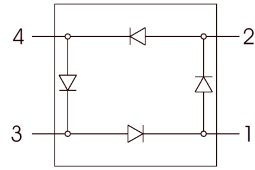
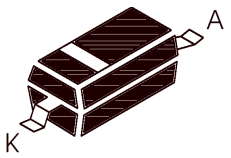
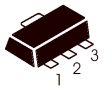
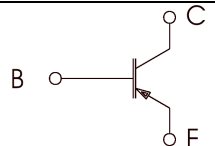
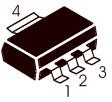
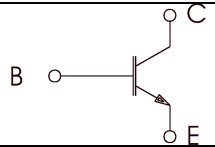
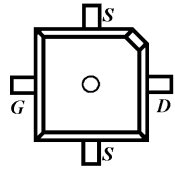
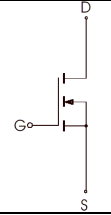
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R562
70-144808	CHIP RESISTOR	1.2K 1/16W 5%	T 1005	R563
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R564
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R565
70-144844	CHIP RESISTOR	220K 1/16W 5%	T 1005	R567
70-144828	CHIP RESISTOR	22K 1/16W 5%	T 1005	R569
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R570
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R571
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R572
70-144835	CHIP RESISTOR	47K 1/16W 5%	T 1005	R573
70-144840	CHIP RESISTOR	100K 1/16W 5%	T 1005	R574
70-144831	CHIP RESISTOR	30K 1/16W 5%	T 1005	R601
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R602
70-144813	CHIP RESISTOR	2.7K 1/16W 5%	T 1005	R701
70-144820	CHIP RESISTOR	6.8K 1/16W 5%	T 1005	R702
70-144790	CHIP RESISTOR	6.8 1/16W 5%	T 1005	R703
70-144793	CHIP RESISTOR	22 1/16W 5%	T 1005	R707
70-144798	CHIP RESISTOR	82 1/16W 5%	T 1005	R709
70-144789	CHIP RESISTOR	3.3 1/16W 5%	T 1005	R710
70-144823	CHIP RESISTOR	10K 1/16W 5%	T 1005	R801
70-144832	CHIP RESISTOR	33K 1/16W 5%	T 1005	R802
70-144858	CHIP RESISTOR	0.033 1/10W 1%	T 2012	R804
70-144837	CHIP RESISTOR	56K 1/16W 5%	T 1005	R805
70-144827	CHIP RESISTOR	20K 1/16W 5%	T 1005	R806
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R901
70-144821	CHIP RESISTOR	7.5K 1/16W 5%	T 1005	R902
70-144830	CHIP RESISTOR	27K 1/16W 5%	T 1005	R903
70-144821	CHIP RESISTOR	7.5K 1/16W 5%	T 1005	R904
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R905
70-144817	CHIP RESISTOR	4.7K 1/16W 5%	T 1005	R906
70-144811	CHIP RESISTOR	2.2K 1/16W 5%	T 1005	R907
70-144796	CHIP RESISTOR	47 1/16W 5%	T 1005	R908
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	R(C16)
70-144857	CHIP RESISTOR	0 1/10W 5%	T 2012	R(C508)
70-144788	CHIP RESISTOR	0 1/16W 5%	T 1005	R(C607)
70-086095	THERMISTOR CHIP		ECTH201208473H4100H	RTH402
70-164194	RES.CHIP TRIMMER	47K	RH03E1CS4X	RV1
70-164195	RES.CHIP TRIMMER	100K	RH03E1C15X	RV2
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV4
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV5
70-164192	RES.CHIP TRIMMER	10K	RH03E1C14X	RV6

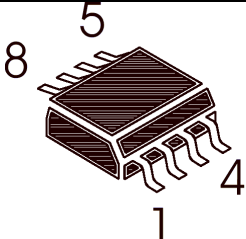
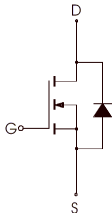
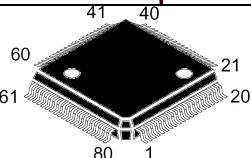
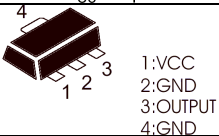
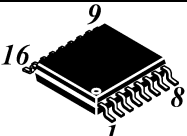
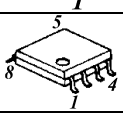
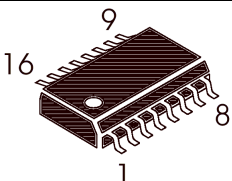
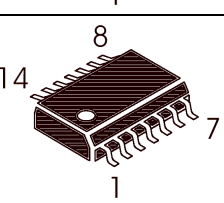
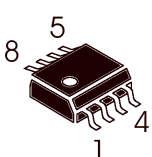
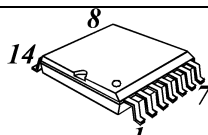
70-164193	RES.CHIP TRIMMER	22K	RH03E1CJ4X	RV401
70-164194	RES.CHIP TRIMMER	47K	RH03E1CS4X	RV402
70-164197	RES.CHIP TRIMMER	4.7K	RH03E1CS3X	RV403
70-179194	LMR TCXO OF "B" CLASS		GMRS-21X	TCXO
70-098059	TRANSFORMERS CHIP		617PT-1019	T1
70-098059	TRANSFORMERS CHIP		617PT-1019	T2
70-179182	X CRYSTAL		44.645M -30 15PM 32P 3RD	X1
70-179195	CRYSTAL RESONATOR	8.0M	-20 30PPM 18PF	X401
70-179196	FILTER CRYSTAL		45N15B4 45.1MHZ	XF2
70-179197	DISCRIMINATOR CERAMIC		DBC455KCAY24-R0	Y1

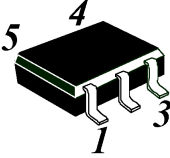
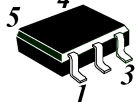
12. COMPONENT PINOUT

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	
BASE DIAGRAM	MANUFACTURER'S PART NUMBER	REFERENCE NO.	SYMBOL
 1.EMITTER 2.BASE 3.EMITTER 4.COLLECTOR	BFG35 BLT50	Q702	
	NE5510279A 2SK3079A 2SK3476	Q703	

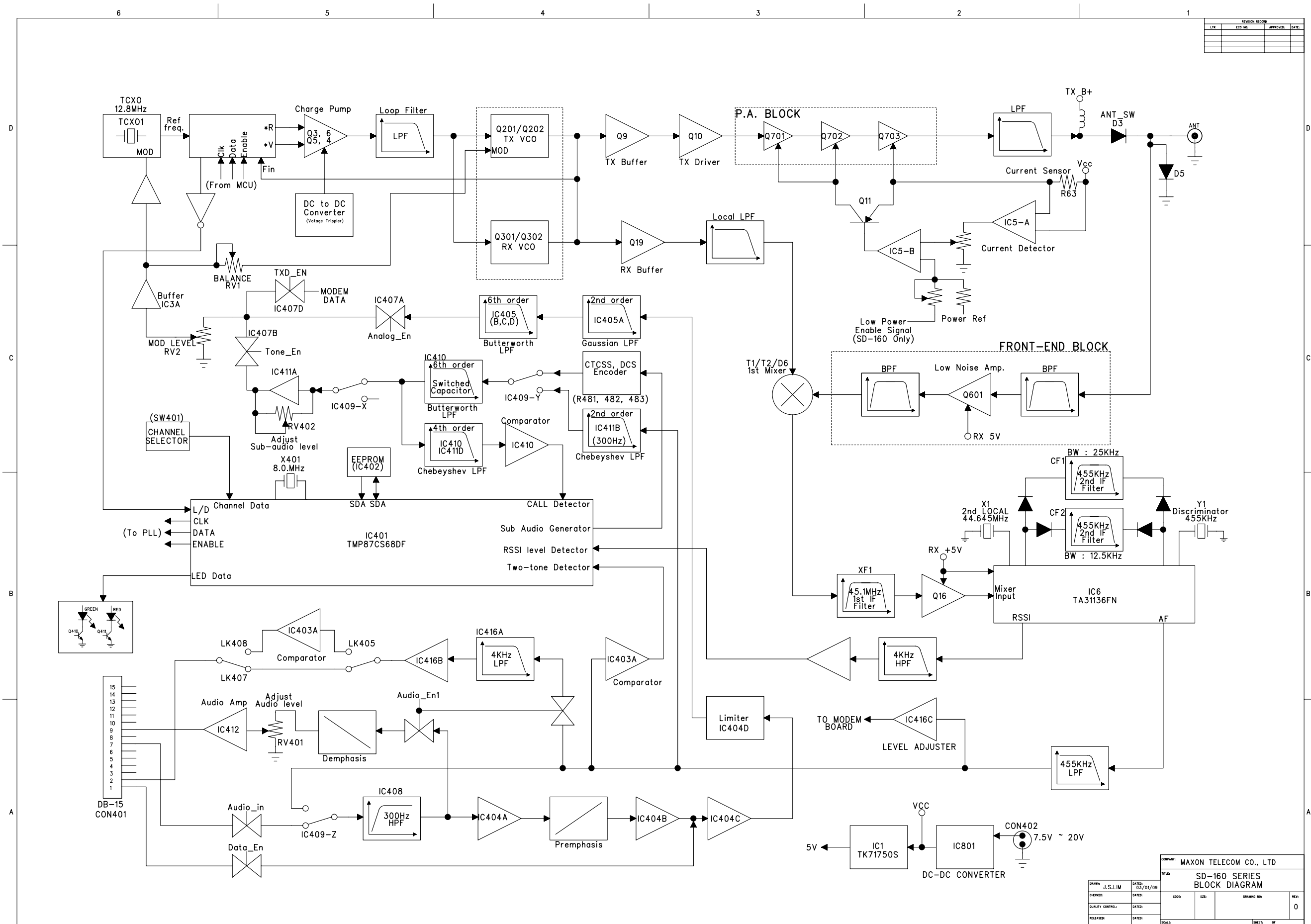
	SI4412DY	Q801.802	
	TMP87PS68DF	IC401	MCU
 1:VCC 2:GND 3:OUTPUT 4:GND	KIA7042F	IC414	Voltage Detector IC
	MB15A02PFV1	IC2	PLL IC
	TA31136FN	IC6	IF IC
	NJM12903V	IC403	Comparator
	NJM12904V	IC3.4.5	OP AMP
	MC14053BD	IC409	MUX./DEMUX.
	LTC1435CS	IC801	DC/DC Converter
	MC14066BD	IC406.407	Analog S/W IC
	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

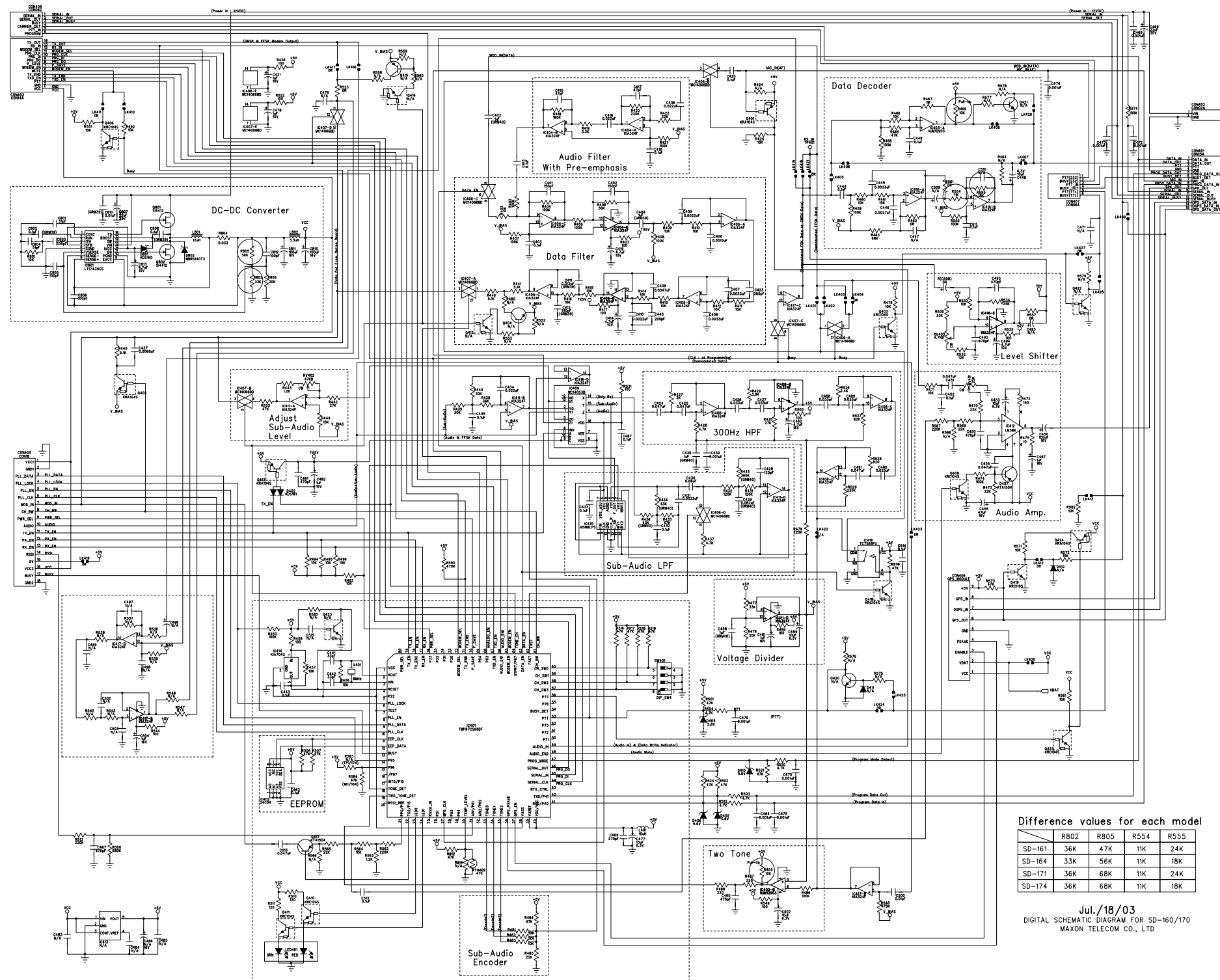
	TK71750SCL	IC1	 VOLTAGE REGULATOR IC
	TC7S66FU	IC418	Analog S/W IC

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)

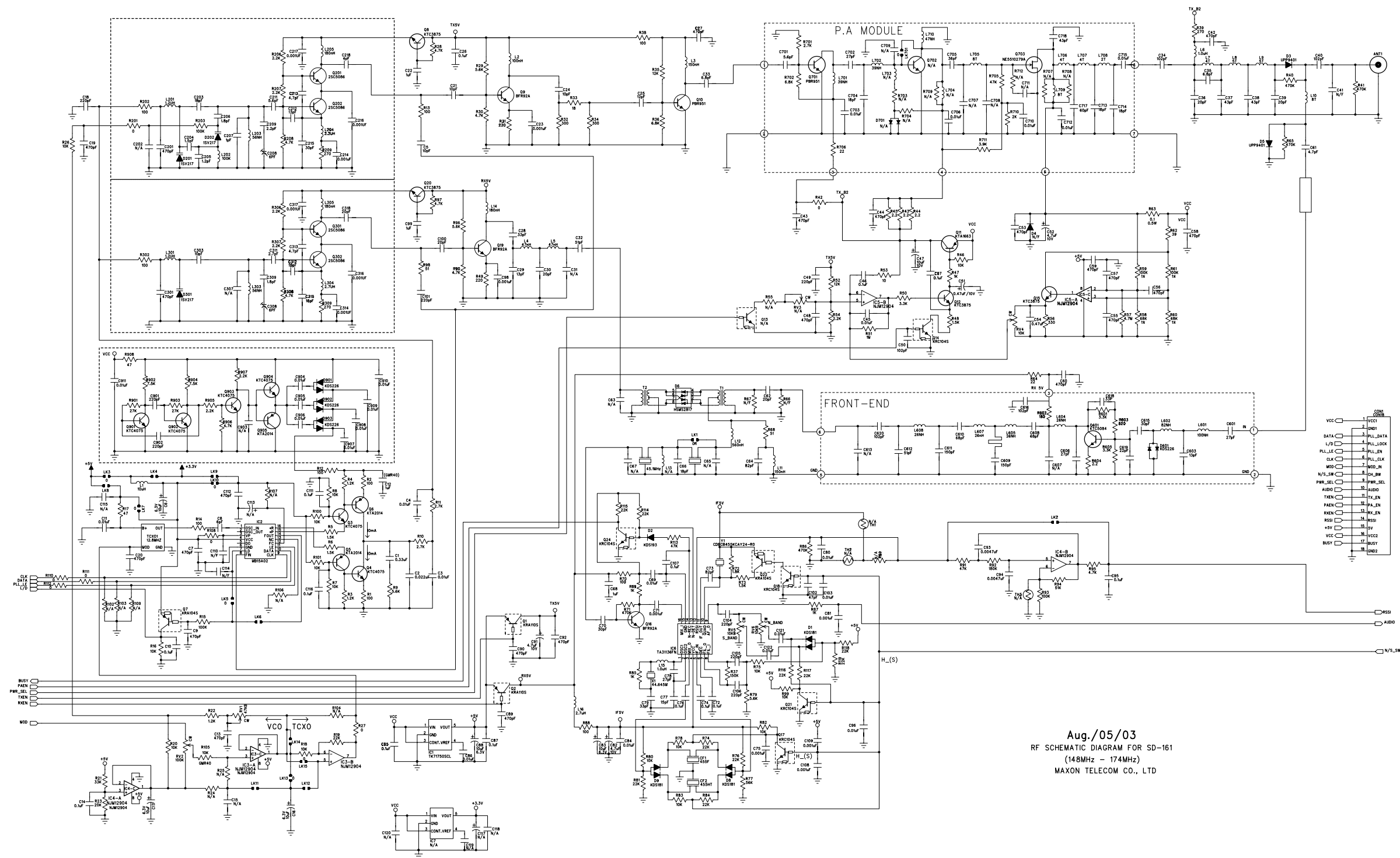


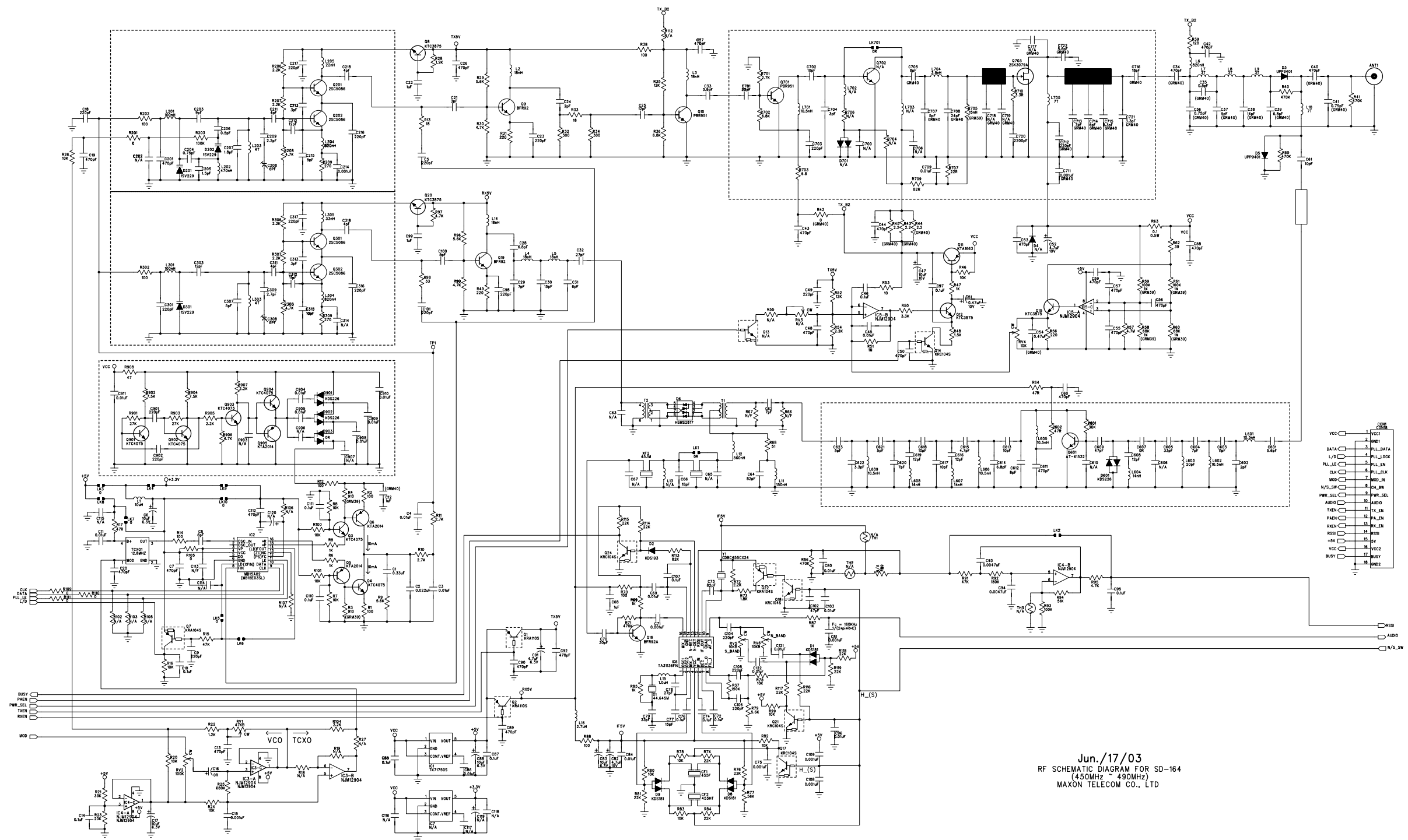


Difference values for each model

	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





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

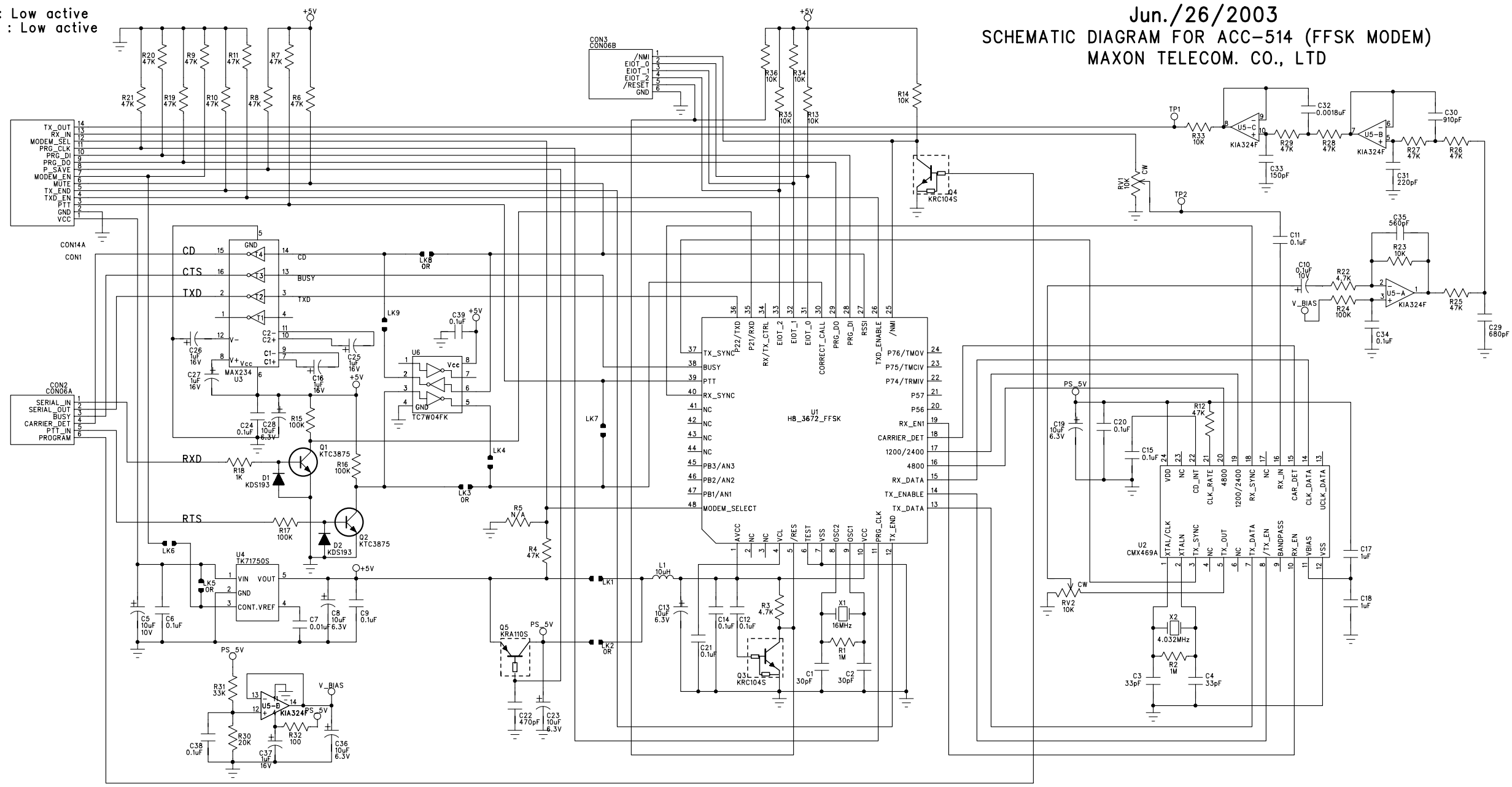
The schematic diagram illustrates the internal circuitry of the ACC-513 (GMSK MODEM). The central component is the H8_3672_GMSK IC, which is connected to various external components and control signals. The diagram includes the following components and connections:

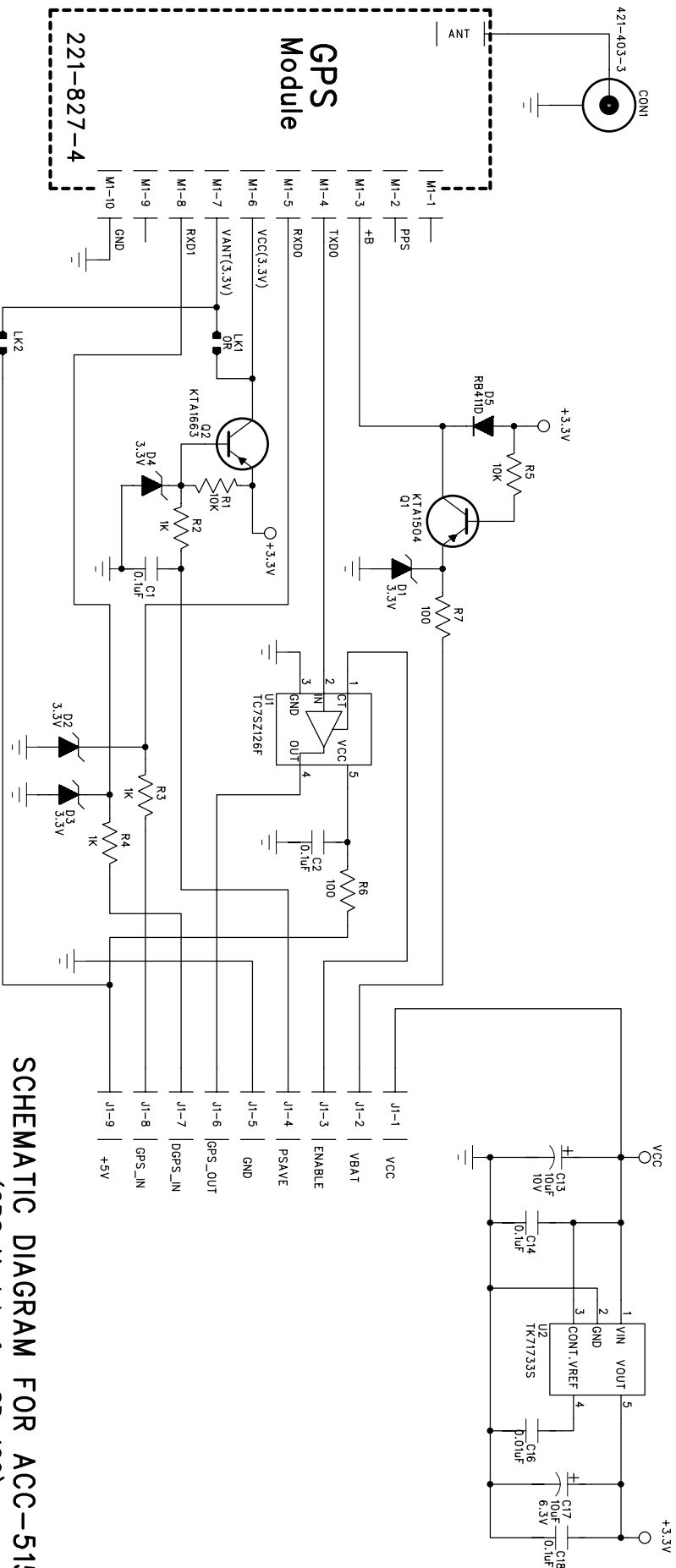
- Control Signals:** PTT (Low active), MUTE (Low active), and a +5V supply.
- ICs:** H8_3672_GMSK (Main IC), U1 (H8_3672_GMSK), U2 (CMX589A), U3 (MAX234), U4 (TK71750S), U5-A (KIA324F), U5-B (KIA324F), U6 (TC7566FU), U7 (TC7W04F), U8 (KRA110S), U9 (KRC104S), U10 (KRC104S), U11 (KRC104S).
- Passive Components:** Resistors (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72, R73, R74, R75, R76, R77, R78, R79, R80, R81, R82, R83, R84, R85, R86, R87, R88, R89, R90, R91, R92, R93, R94, R95, R96, R97, R98, R99, R100), capacitors (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100), and inductors (L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12, L13, L14, L15, L16, L17, L18, L19, L20, L21, L22, L23, L24, L25, L26, L27, L28, L29, L30, L31, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L42, L43, L44, L45, L46, L47, L48, L49, L50, L51, L52, L53, L54, L55, L56, L57, L58, L59, L60, L61, L62, L63, L64, L65, L66, L67, L68, L69, L70, L71, L72, L73, L74, L75, L76, L77, L78, L79, L80, L81, L82, L83, L84, L85, L86, L87, L88, L89, L90, L91, L92, L93, L94, L95, L96, L97, L98, L99, L100).
- Connectors:** CON1, CON2, CON3, CON14A.
- Other Components:** J1, J2, J3, J4, J5, J6, J7, J8, J9, J10, J11, J12, J13, J14, J15, J16, J17, J18, J19, J20, J21, J22, J23, J24, J25, J26, J27, J28, J29, J30, J31, J32, J33, J34, J35, J36, J37, J38, J39, J40, J41, J42, J43, J44, J45, J46, J47, J48, J49, J50, J51, J52, J53, J54, J55, J56, J57, J58, J59, J60, J61, J62, J63, J64, J65, J66, J67, J68, J69, J70, J71, J72, J73, J74, J75, J76, J77, J78, J79, J80, J81, J82, J83, J84, J85, J86, J87, J88, J89, J90, J91, J92, J93, J94, J95, J96, J97, J98, J99, J100).

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



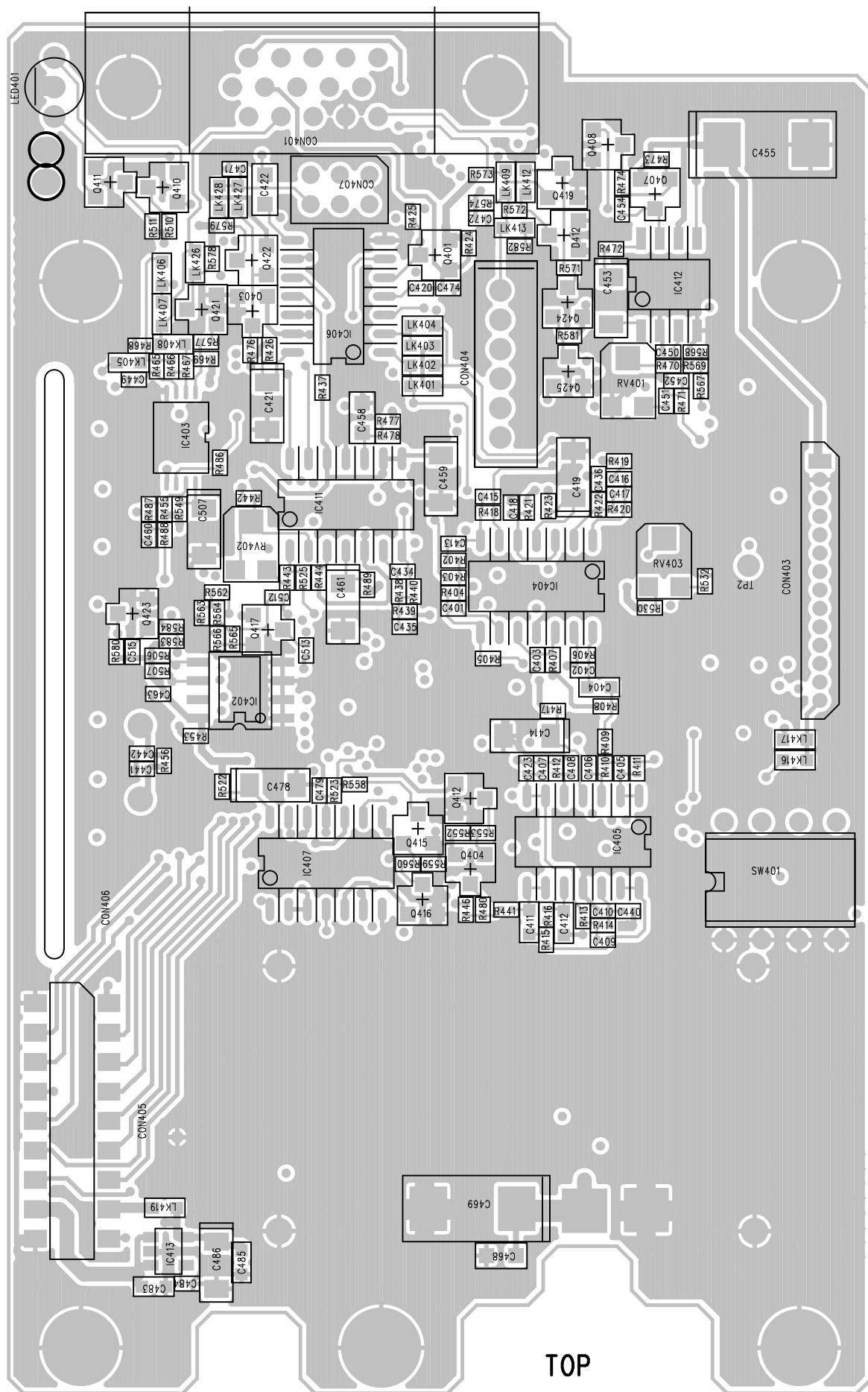


SCHEMATIC DIAGRAM FOR ACC-515
(GPS Module for SD-160)
MAXON TELECOM CO., LTD

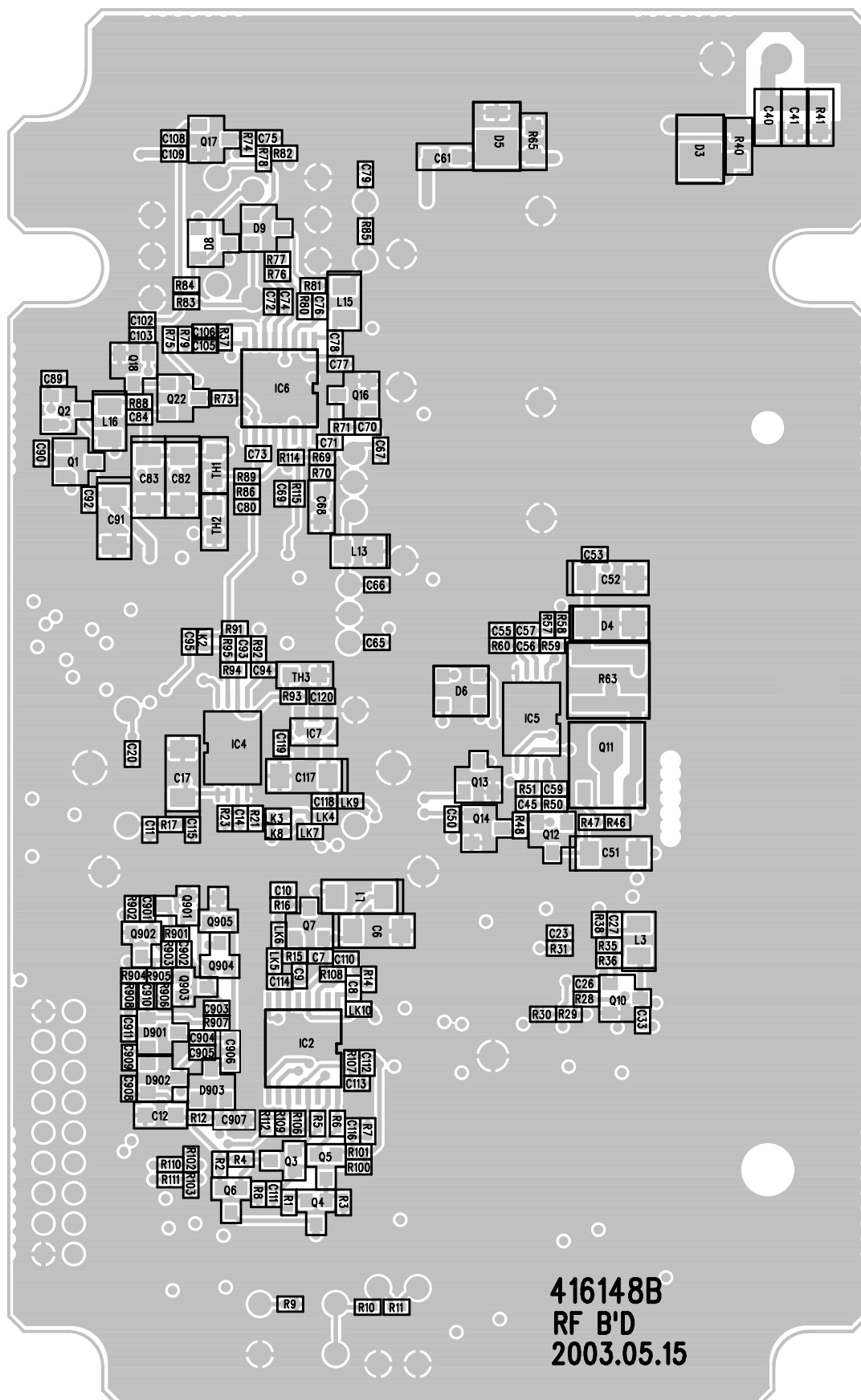
14. CIRCUIT B'D DETAILS

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

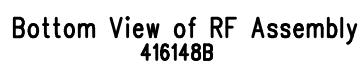
- Digital PCB details for SD-160/SD-170 Series
- RF PCB details for SD-161/171
- RF PCB details for SD-164
- RF PCB details for SD-174
- PCB details for ACC-513 (GMSK Modem)
- PCB details for ACC-514 (FFSK Modem)

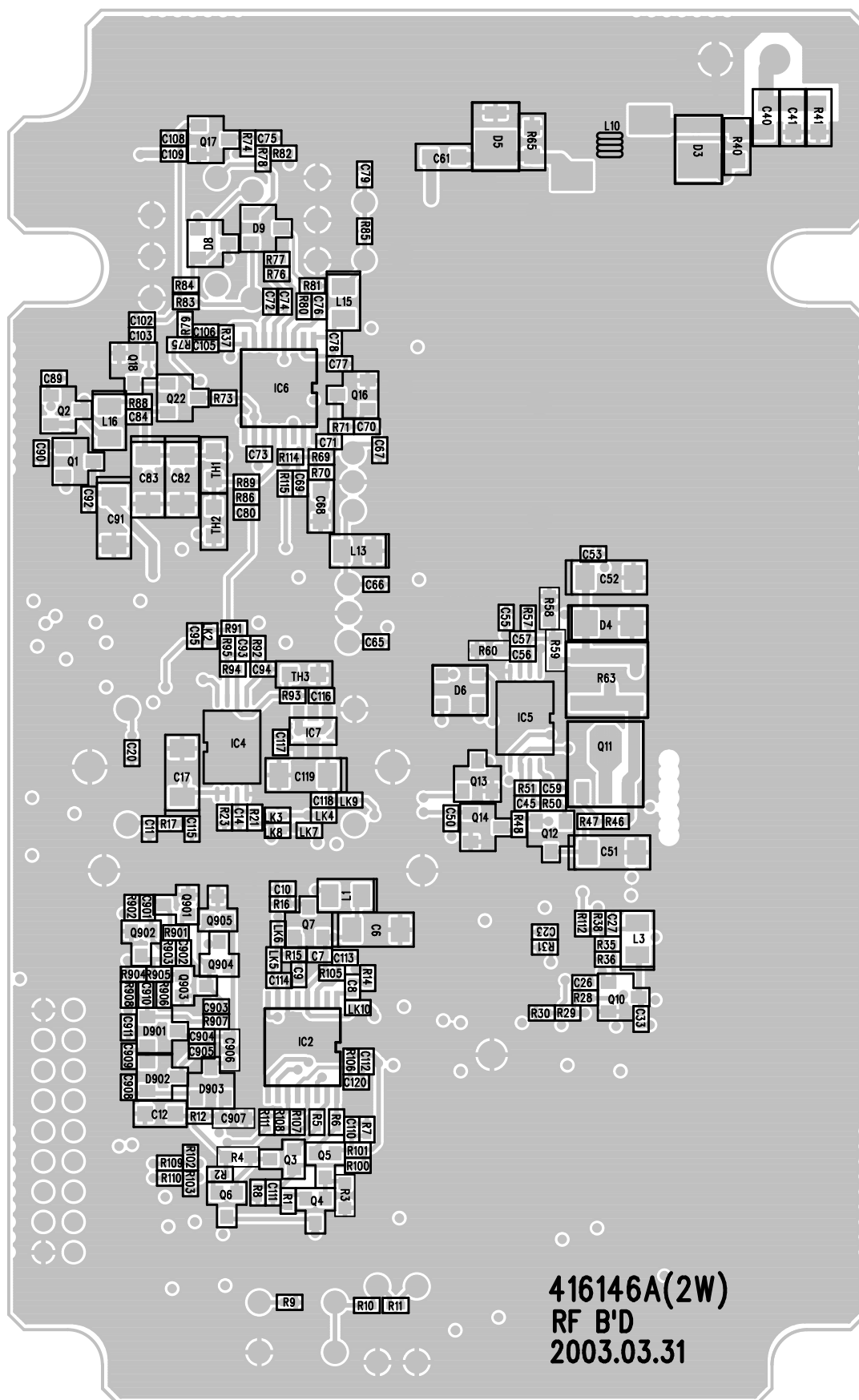


Digital Board Assembly 416145B

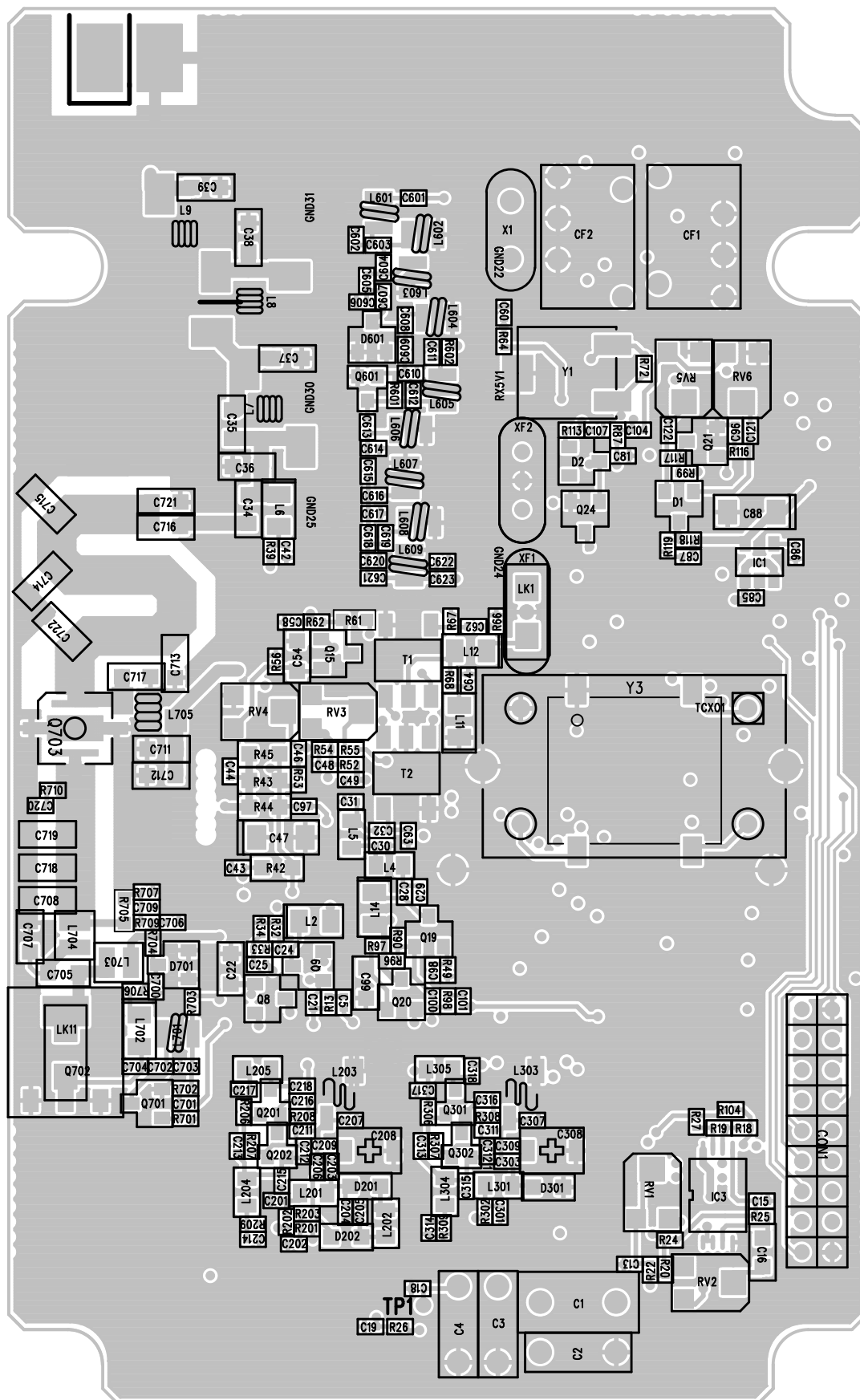


Top View of RF Assembly
416148B





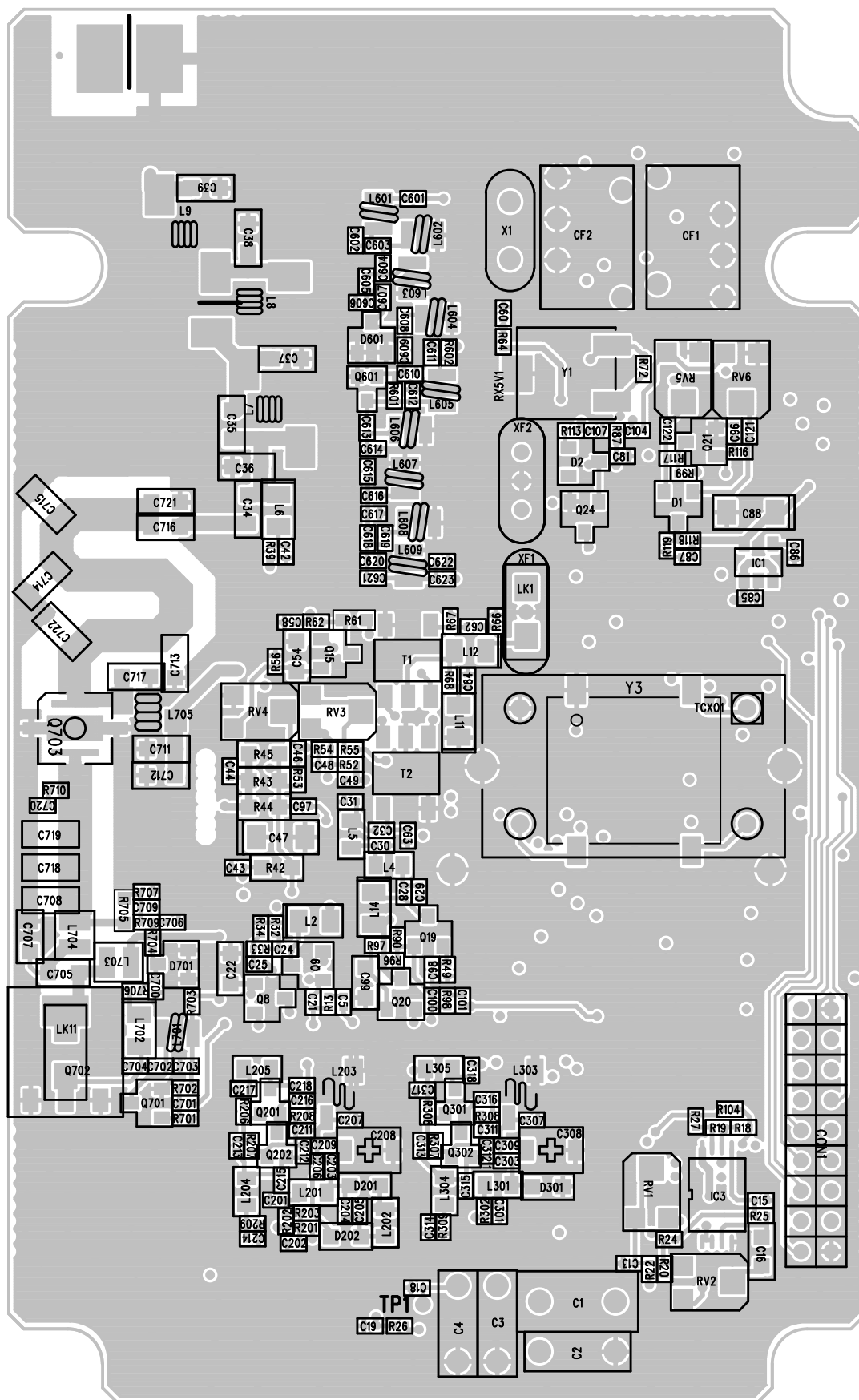
Top View of RF Assembly
416146A



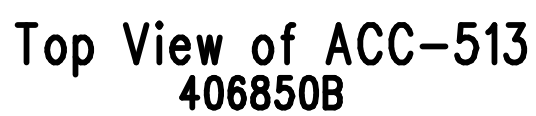
Bottom View of RF Assembly
416146A



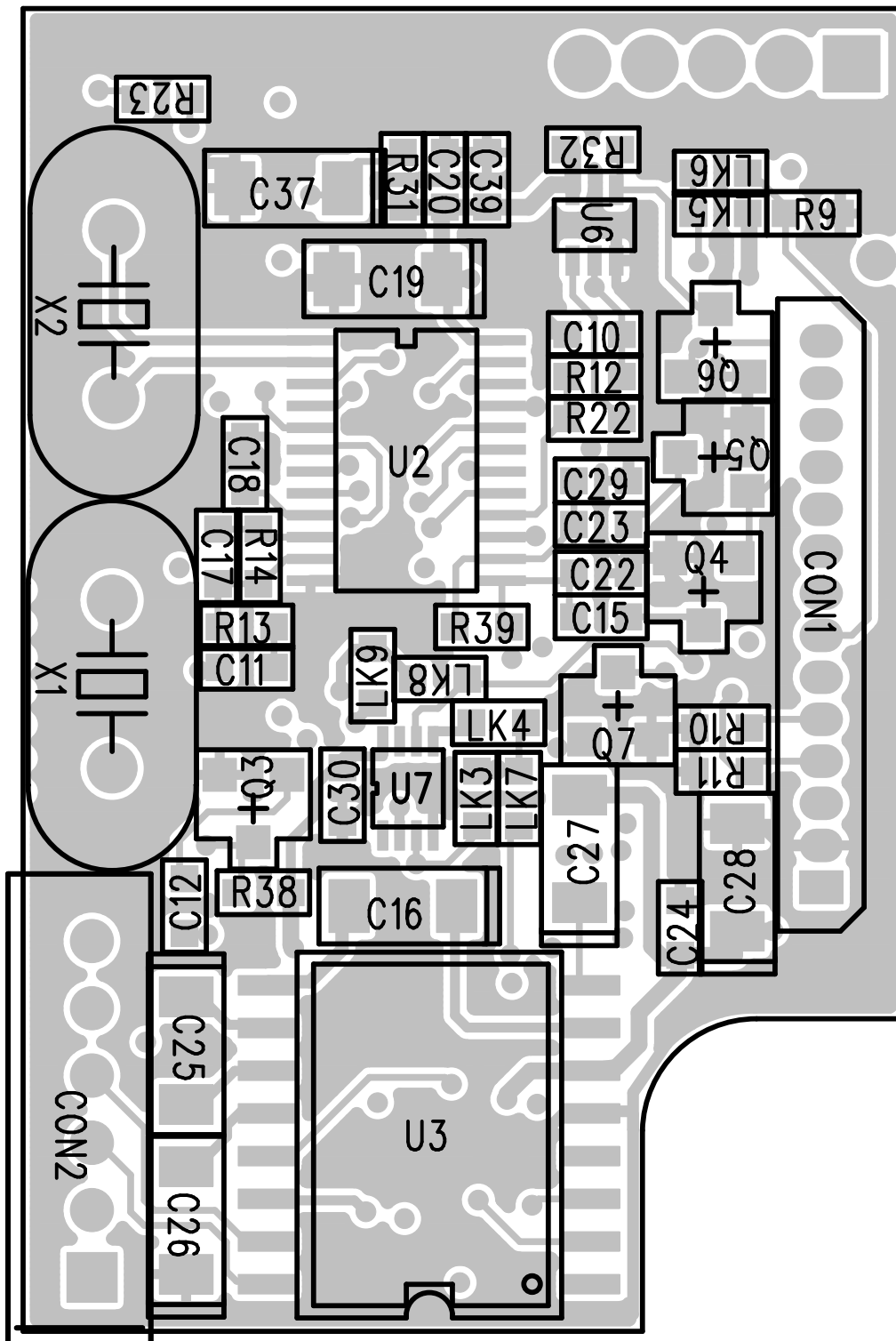
Top View of RF Assembly
406872A



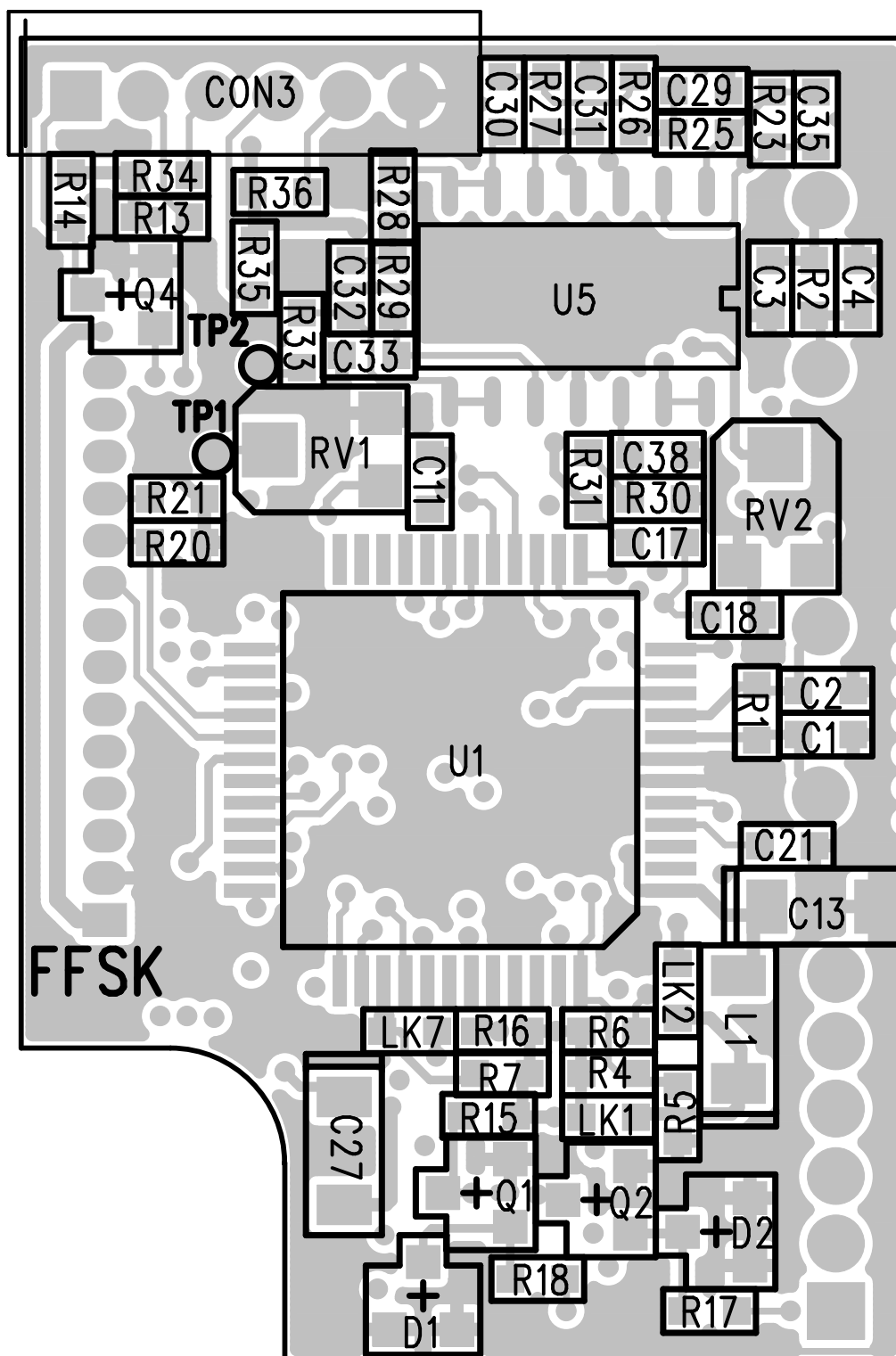
Bottom View of RF Assembly
406872A



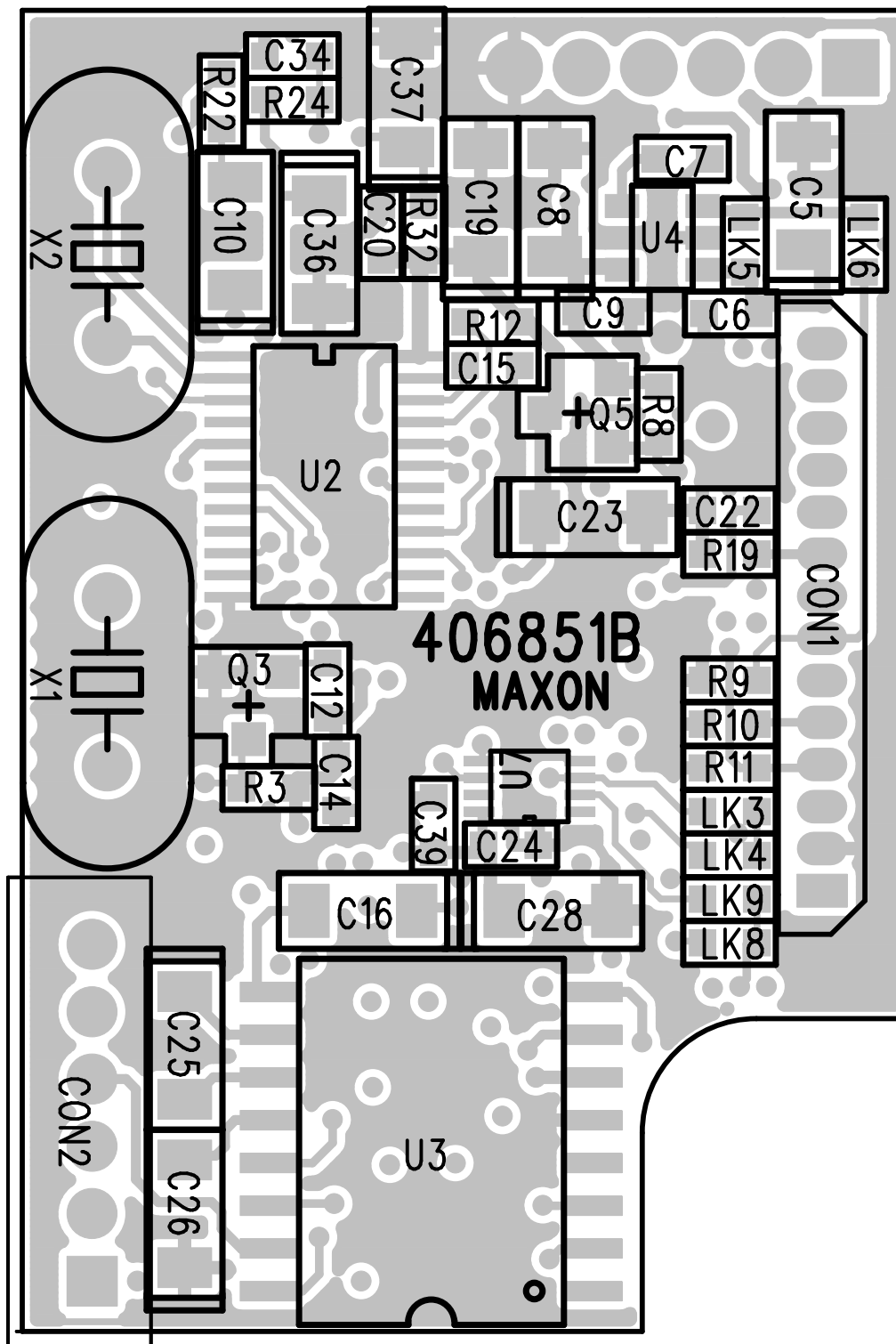
**Top View of ACC-513
406850B**



Bottom View of ACC-513
406850B



Top View of ACC-514
406851B



Bottom View of ACC-514
406851B