KANcomm Communications (Pty) Ltd.

KLT ALARM RADIO

MANUAL

December 1998

WARNING

The RF POWER DEVICES BLU30/12 and M56649HR CONTAIN BERYLIUM OXIDE WHICH IS TOXIC. DO NOT TRY TO BREAK THEM OPEN. The Devices are Entirely Safe Provided they are not Physically Damaged.

Table of contents

1.1 INTRODUCTION

The KLT radio, which is also referred to as FMR (Fleet Management Radio), is designed for alarm purposes, vehicle location (and tracking) and fleet management.

In contrast to “normal” mobile units KLT is not intended for speech processing. Data is transmitted by analogue tone FM modulation. Its compact size makes it ideal for the above applications.

The unit may be operated on either standard MPT1327 system or on a Kavicomm proprietary system.

1.2 SPECIFICATIONS

General

Power Supply Operating Voltage	:	10,8 to 15,6V DC.
Antenna Impedance	:	50Ω, unbalanced.
Frequency Range	:	450 – 470 MHz
Channel Spacing	:	12,5 MHz
Modulation	:	FM
Frequency Stability	:	± 2,5 ppm (-30°C to 60°C)
Dimensions	:	(142 L) x (115 W) x (27 H) mm
Weight	:	0,5 Kg
Max. Channel Separation (Tx or Rx)	:	14 MHz

Receiver

Sensitivity	:	-115 dm (typical), without de-emphasis fore 12db SINAD
Hum and Noise Ratio	:	34 dB
Spurious Response and Image	:	50 dB
Conducted Spurious Emissions	:	Less than –60 dBm

Transmitter

Nominal RF Output Power	:	15 watts
Spurious Emissions and Harmonics	:	-75 dBC
Adjacent Channel Power	:	-70 dBC
Frequency Deviation	:	fixed at 1,5 KHz ± 1 dB
Hum and Noise Ratio	:	34 dB

2. INSTALLATION

2.1 General

Radio placement in a vehicle is not critical to its performance. Because of its small size the radio could practically be installed almost anywhere. Do not install the unit where ambient temperatures could rise above +60°C. Choose a place where the main power cable will be as short as possible.

2.2 Power Source

The radio operates from a 13.6V DC (6 Amp) source such as a standard automotive "12v" negative Gnd electrical system. In case a vehicle uses "24V" system it is recommended to use a proper DC to DC converter preferably a linear type (if possible) in order to avoid radio interference.

The installer is advised to make sure that the vehicle's battery is "healthy" and that it is not lower than 10,8V DC. A low battery or defective regulator can severely impair the unit's operation.

A power cable is supplied with the radio. The red wire must always be connected to the (+) terminal of the battery and the black to the (-) terminal.

CAUTION

Do not ever apply more than 16V to the radio. Check the voltage source before connecting the power leads to it. Do not connect the power leads to the cigarette lighter socket or to any other points where high spike voltages might develop. Do not install the unit in a positive GND vehicle.

2.3 Antenna

The antenna and its coaxial cable are supplied by Kavicomm. The installer may install other antennae provided they are of equivalent quality or better. Bear in mind that the radio is designed to operate with a 50Ω antenna.

3. FEATURES AND OPERATING INSTRUCTIONS

3.1 Features

The unit is a multipurpose one. The main purpose is raising alarm signals once activated by input at the Micro-Controller connector. The alarm data is transmitted using FFSK signals, which are decoded at the central control room or other similar means.

In addition the unit could be used as a radio link repeating signals which are received by its receiver. Both of the above-described functions utilize either a standard MPT1327 network or Kavicomm's proprietary network.

The receiver is equipped with Relative Signal Strength Indication (RSSI) in order to facilitate locking on strongest (RF) signal available on the network.

3.2 Operating Instructions

Once the radio is installed as per installation instructions (see section 2) the radio is turned on (no switch for turning the radio on is available).

If a RF signal is available on the air to which the radio is programmed to receive, he unit locks on. The RSSI indication led will flash periodically.

The more times the led flashes the stronger signal is being received. 5 flashes in a row indicate that the signal strength is stronger than – 80dMm. No more than 5 flashes are available even if the signal is very strong. When the led flashes only once the signal strength is around – 110dBm. If no signal is available the led flashes at a very low rate.

As the unit has no other indications and/or knobs to operate the operation becomes very simplified.

4. THEORY OF OPERATION

4.1 Receiver

The receiver is double heterodyne type having the 1st I.F at 45MHz and 2nd I.F at 455KHz. The receiver outputs two signals: (a) A DC voltage level which is relative to received signal strength and (b) FFSK signal which is composed of two tones 1200 and 1800Hz.

Both of the above signals are fed to the Micro-controller circuitry for analysis and detection.

The received signal, which comes from the antenna connector and flows via the Tx L.P.F. (harmonic trap), is applied via C_{95}, C_{97}, C_{98}, C_{100}, C_{101} and C_{103} to the base of the RF Front End Amplifier Q_{25}. C_{96} and L_{25} form the first Front-End filter. So do the other components which follow with a similar arrangement. This amplifier provides some 15-dB gain and feeds the signal via C_{108} to base of the Mixer Transistor Q_{26}.

Q_{26} receives the L.O. drive via C_{105}, C_{112} and C_{111}. The two signals mix at the base-emitter function of the transistor to produce the difference frequency (I.F) at 45MHz. Q_{27} together with FLT_1 and FLT_2 form the 45MHz I.F. filters. L_{31} and L_{30} help tune the filter to exactly 45MHz and get the desired frequency response. The I.F signal is matched to the input of I.F chip U_{26} using C_{122}. R_{165} ensures stability of Mix In circuitry inside the IC.

The I.F IC U_{26} contains oscillator circuitry, mixer circuitry, I.F gain circuitry and RSSI circuitry. XL_5 is a X-tal resonator which makes the internal oscillator oscillate at 45,455MHz. The frequency difference between 45MHz and 45,455MHz which is 455KHz flows via C_{129} to U_{27} and then via the resistive network R_{178}, R_{179} and R_{180} to U_{28} and then back into the IC via C_{130}. The 455KHz signal is amplified and then fed to a quadrate discriminator using the tank circuit L_{33}, its own built in cap (150p) and R_{182}. The recovered signal comes out at pin 9 and goes via the internal OPAMP between pins 10 and 11. Pin 11 outputs the recovered audio (FFSK signal in our case) to be fed to U_{25}. U_{25} is a Tschbechef Low Pass Filter (L.P.F.). As the FFSK chip (FX829 in the Micro-controller) requires an accurate level at its input, the level may be adjusted to 220mV rms using the potentiometer R_{162}. The demodulated data is fed to the IC FX829 from across resistor R_{160}.

Pin 13 outputs the RSSI DC level. U_{25} amplifies it slightly (just over unity) and applies it to the A/D in the Micro-Controller. R_{171} is used to adjust the level exactly to the required one.

4.2 Transmitter Circuit Diagram

The transmitter line-up consists of transistor Q_{30}, RF Power Module type M67749HR and P.A Q_{33}. The level of the RF-in which comes from the Synthesiser is approx. +8dBm. It is coupled to base of Q_{30} via C_{145}. The output of Q_{30} is fed via C_{149} to the attenuator consisting of R_{195}, R_{196}, and R_{197}. The RF signals flows via C_{154} and current dependent attenuator D_{27}. U_{31} amplifies the incoming signal to output approx. 6W at pin 5. The signal is coupled via a 40Ω micro-strip to base of Q_{33}. C_{163}, C_{164}, the micro-strip line and C_{162} serve to match the relatively low input impedance of Q_{33} to the desired load impedance seen by U_{31} at pin 5. The RF collector of Q_{33} is matched to 50Ω using C_{172}, C_{173} the 40Ω line C_{171}, C_{169} and C_{170}. C_{174} couples the signal to the 50Ω line. D_{28} serves as the antenna RF switch. The O/P RF signal is fed to the m-derived harmonic trap and comes out at the antenna connector J_4. Coupled to the 50Ω micro-strip is an 80Ω strip, which samples the strength of the transmitted power. D_{29} serves as a RF rectifier. The DC taken from across R_{213} is fed via R_{212} to the inverting input of U_{32} at pin 2. The voltages at pins 2 and 3 are compared and pin 1 of the OPAMP supplies the current to D_{27} via R_{198}. On transmit D_{28} and D_{30} conduct and become very low impedance for RF. L_{45} and C_{181} form a parallel resonator in order not to affect the RF being transmitted at the antenna terminal. Also D_{31} conducts and shunts whatever remaining RF signal in order to protect the receiver's front-end transistor. On receive the received signal flows from J_4, via the harmonic trap L_{45}, L_{46} and C_{191} to the front end of receiver.

Q_{31} which acts as a switch, supplies 8V on Tx mode only to the various transmitter circuits which need that voltage. Q_{31} is turned on upon a Tx Enable high (5V) applied to R_{200} which switches on Q_{32} which in turn switches on Q_{31}.

4.3 Controller

The Micro-Computer section (also referred to as Controller) controls all radio activity which includes the setting of the Synthesiser's desired frequencies (Rx and Tx), enabling Tx and Rx , modes, activating the FFSK (Fast Frequency Shift Keying) modem U_{14} and performing all decoding activities of the received signals.

U_6 is the Micro-Computer device. Its associated circuitry is the memory of Flash type (U_{11}) and Ram device (U_{13}). U_{14}, which is the FFSK modem, generates the two-tone FFSK at 1200 BPS.

U_3, which is a relatively simple Micro-processor (Compared to U_6), performs certain software tasks ("talking" with U6) and also used as a Watch-Dog Timer. U2 is an 8-BIT A/D converter which enables the Micro-Computer U6 to read the Signal Strength of the received signal.

Ic's U_9, U_7, U_8, U_{10}, U_5 and U_{12} are used for various address decoding.

4.4 Synthesiser

The main parts of the frequency synthesiser are: the VCO, the Buffer/Driver (Q_9 and Q_7) the Synthesiser IC and its buffer (U_{20} and Q_{16}) and the loop filter and Charge pump circuitry.

The Synthesiser operates from two sources of voltage namely 5V and 9V; the voltage regulators for these are U_{22} and U_{23} respectively.

VCO Only one VCO operates at a time. The VCO's are switched using the switching circuitry associated with Q_{11}, Q_{12}, Q_{14} and Q_{15}. On transmit Q_{20} is on and on receive Q_{13} is on. The generated RF is coupled via C_{50} to base of buffer Q_{10}.

Synthesiser Circuitry

The output of Q_{10} splits two ways: to Q_{16} which is the Synthesiser IC buffer via C_{43} to base of Q_9. The output of Q_{16} is fed via the L.P.F. L_{20}, C_{75} and C_{77} to C_{81} which in turn couples it to pin 8 of U_{20}. U_{20} contains a reference frequency divider, a two-modulus divider plus another "main" divider and a charge pump feeder. Both dividers are programmable. The reference divider produces a 12,5KHz signal, which is compared to the output of main divider. The VCO locks only when the frequency of both dividers is identical. The above mentioned dividers are programmable by the data which comes from the Micro-controller at pin 10. The charge pump circuitry is fed from pins 15 and 16 of the IC. $R1_{34}$ and C_{86} form the loop filter components. The loop is closed via the loop L.P.F.

Exciter Circuitry

The RF signal coupled to Q_9 is amplified by it and fed via C_{41} to the gate (G1) of the dual gate MOSFET transistor Q_7. The output of Q_7 which is at least +7dBm is routed to one of the outputs either the one at TP_{22} or TP_{21}. When the RF ENABL is high (+5V) which is on transmit mode Q_5 is turned on allowing the drive to pass via C_{34}, D_{12}, C_{31}, and R_{64} to drive the transmitter. At the same time VCO Q_{20} is switched on allowing it to oscillate and generate the desired transmit frequencies. On receive RF ENABL is low (0V) turning Q_5 off and therefore Q_6 on which in turn routes the output of Q_7 via C_{37}, D_{13}, C_{33} and R_{63} to TP_{21}, as the L.O. signal to drive the 1^{st} mixer in the receiver.

5. MAINTENANCE

5.1 RF Circuitry main Test Points and Alignment Locations.

The RF circuitry contains many test points in order to facilitate troubleshooting and repair of circuitry when needed. The following Voltage Chart gives the main test points and the expected limits of levels. Also the conditions under which the measurements should take place are listed.

Voltage Chart for Main Test Points – RF Circuitry

Test Point	Mode/Remarks	Level
TP33	Tx and Rx depending on VCO setting*	3V - 7VDC
TP29	Tx	1,8V – 2,6VDC
TP28	Rx	1,8V – 2,6VDC
TP25	Tx	1,2V – 1,7V DC
TP22	Tx	+6dBm - +10dBm
TP20	Tx	4,5V – 5,1VDC
TP21	Rx	+2dBm - +5dBm
TP30	Tx and Rx	150mvrms – 270mvrms
TP45	Tx (Without drive at C145)	1,50V – 1,70V DC
TP46	Tx (Without drive at C145)	3,9V – 4,5VDC
TP48	Tx (Without drive at C145)	1,5V – 1,8VDC
TP47	Rx	5,6V – 6,2VDC
TP37	Rx	3,7V – 4,1VDC
TP41	Rx	4,8V – 5,2VDC
TP40	Rx (depends on signal strength received either at antenna terminal or at TP35)	1,5V – 5,0VDC

* VCO setting (voltage at TP33) depends on the band of frequencies that radio has to cover. The lower the frequency the lower the voltage. If only a few channels close in frequency are used adjust VCO coils for voltage to be approx. 5V.

5.2 Controller Circuitry Test Points

Various Test Points are provided in order to ensure the correct function of the Controller. The following chart lists them:

Test Point	Mode/Remarks	Level
TP16	Rx. Checks the demodulated received FFSK level for correct decoding under received signal (1,5KHz deviation)	650mV p-p
TP13	Rx. No RF present at antenna terminal	4,1V – 4,9V DC
TP15	Tx. FFSK output to modulate the VCO	2V – 2,5V p-p
TP7	Rx. Checks the sequence of "0" and "1" This sequence depends on the DC level received from the RSSI circuitry (U25 pin 1).	0 – 5V p-p
TP1	Rx. Checks the analogue DC voltage to the A/D converter (U2). This voltage depends on received signal strength.	1,5V – 5,0V DC

5.3 Alignment Procedures

5.3.1 Synthesiser Alignment Procedure

In the Synthesiser circuitry there are only 4 adjust / tuning points: R_{136}, U_{21}, L_{14} and L_{12}.

In order to align the Synthesiser, power the radio with its test jig and program the radio to the desired channels (frequencies).

a) Adjusting the Lock-Line voltage at TP_{32}.
The lowest limit for the Lock-Line voltage is 3,0VDC and the highest 7,0VDC. The lower the frequency the lower the voltage. If there are desired frequencies that are spread over a few MHz. choose first the lowest one and adjust L_{12} so that the voltage at TP_{32} is 3,0VDC. Switch to the other channels and make sure that the voltage does not exceed 7,0VDC.

Note: In case there is only one channel or a group of channels close in frequency adjust the voltage approx. 5,0VDC. Connect a 50Ω dummy load to antenna terminal and switch to Tx mode using the P.T.T. switch and repeat the above alignment procedure. This time adjust L_{14}.

b) Adjusting the RF Frequency Error.
Connect a 50Ω dummy load to the attenuator / antenna terminal. Connect the output of the attenuator to a calibrated frequency counter. Switch the radio to Tx mode and measure the frequency. Adjust the adjustment point on U_{21} to get the correct frequency i.e. zero error.

c) Adjust the Modulation (Frequency Deviation).
Repeat the connection procedure as in b) above but instead of measuring frequency measure FM modulation. Switch the test jig so that the radio produces modulation. Measure at the upper part of R_{135} that there is approximately 2V p-p of FFSK signal. Adjust R_{136} to get 1,5KHz deviation ± 0,5dB.

Repeat the modulation measurement at another desired RF channel (frequency) and make sure that it is again 1,5KHz ±0,5dB.

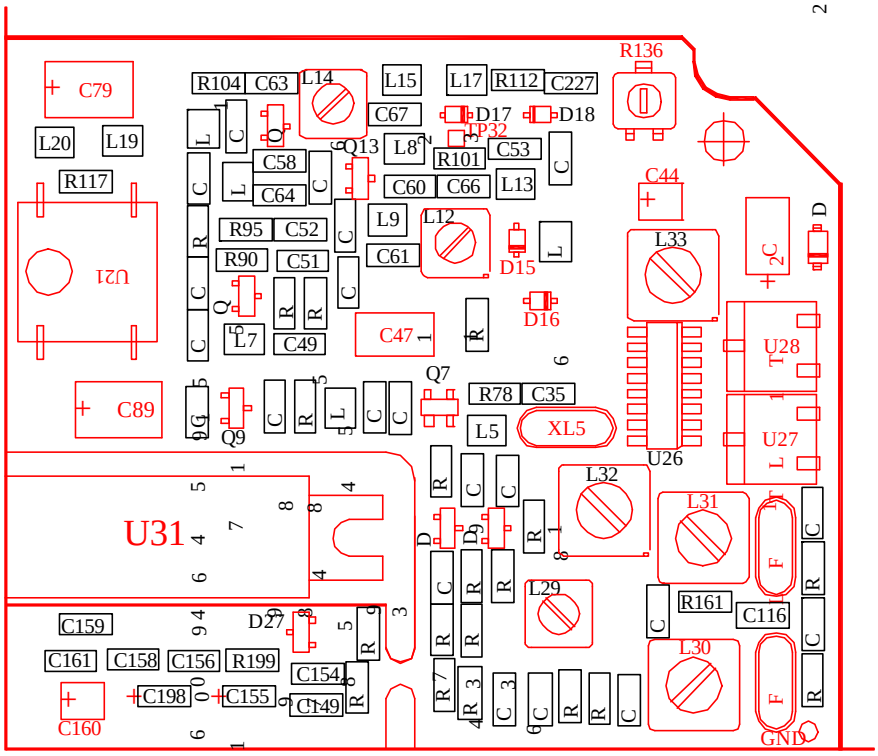
5.3.2 **Receiver Alignment Procedure**
Connect the radio as described in 5.2.1 above. With the radio on Rx mode monitor the SINAD at TP_{38} while injecting approx. –70dBm RF signal modulated by 1,0KHz tone, 1,5KHz deviation.
Adjust L_{30}, L_{31} and L_{33} for best SINAD. Reduce received signal gradually and keep monitoring the SINAD. Tune Front-End coils for maximum SINAD when signal is –110dBm. If necessary readjust coils L_{30}, L_{31} and L_{29}. Reduce further the incoming signal until the SINAD meter reads 12dB the incoming level should be between –113 and –116dBm.

Switch to another desired frequency and make sure that you get again 12dB SINAD or better for –113dBm of incoming RF signal.

Adjust potentiometer R_{162} to get approx. 70mV rms at TP_{138}.

Inject at antenna terminal –100dBm and adjust R_{171} to get 2,5VDC at TP_{40}.

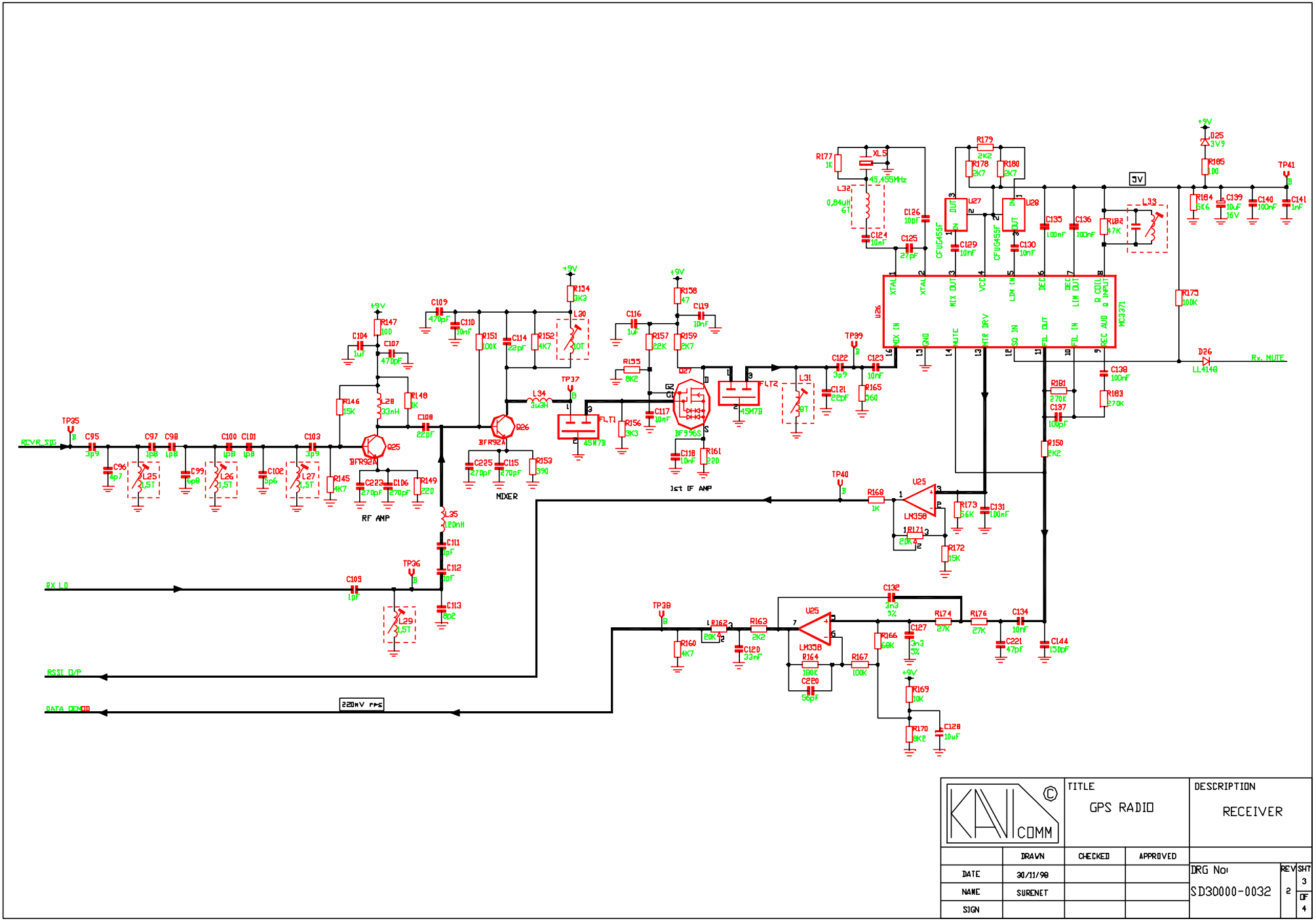
5.3.3. Transmitter Alignment Procedure
The transmitter is a wideband type; as such it does not have any tuning trimmer components. The RF output power is determined by potentiometer R_{215}. In order to set the output power, switch the radio into Tx mode and turn R_{215} until the power meter connected to the antenna terminal displays the desired power at the frequency of interest.

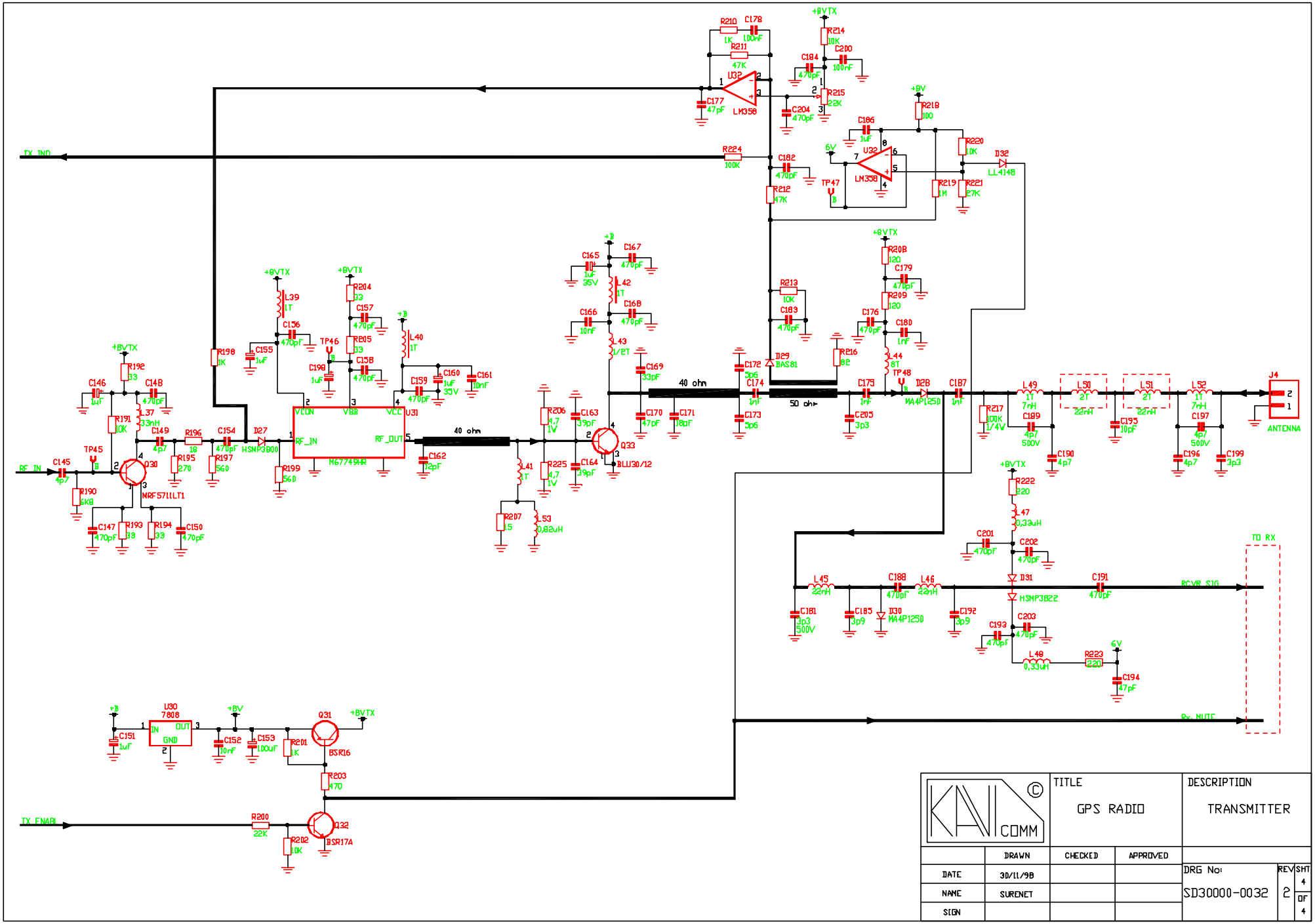


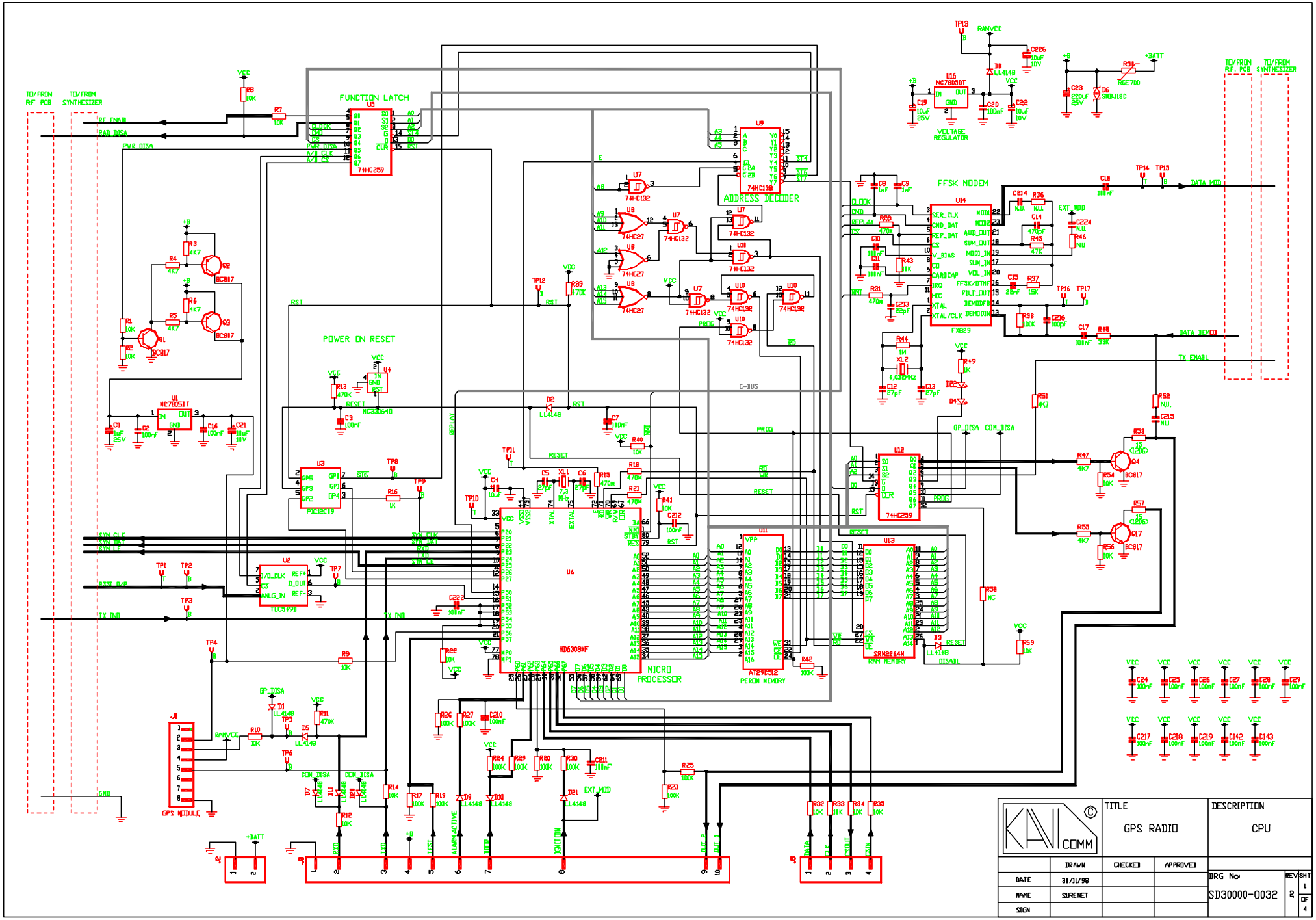
SHOWING VCO. TUNING COILS:

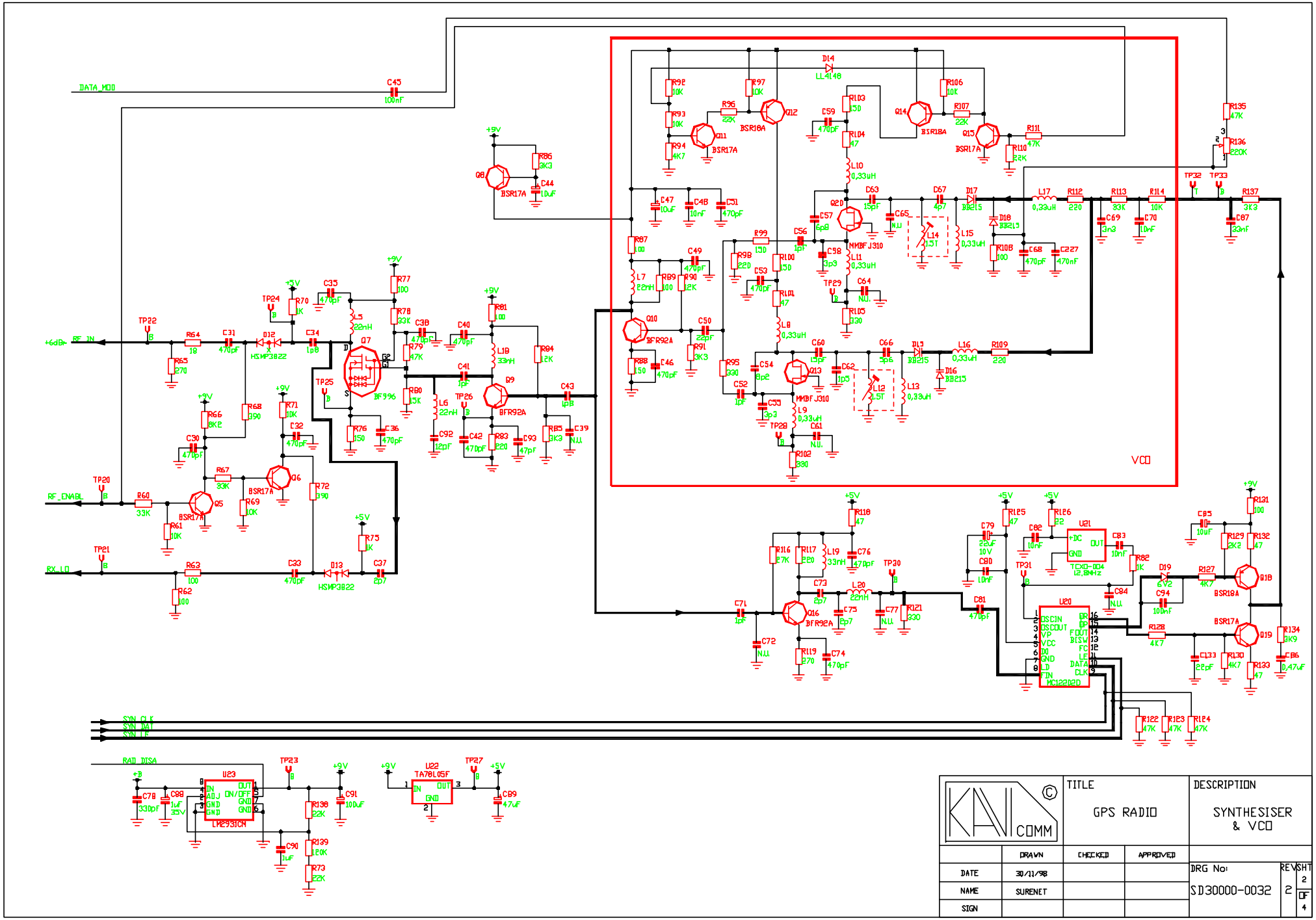
L12 for Rx
L14 for Tx

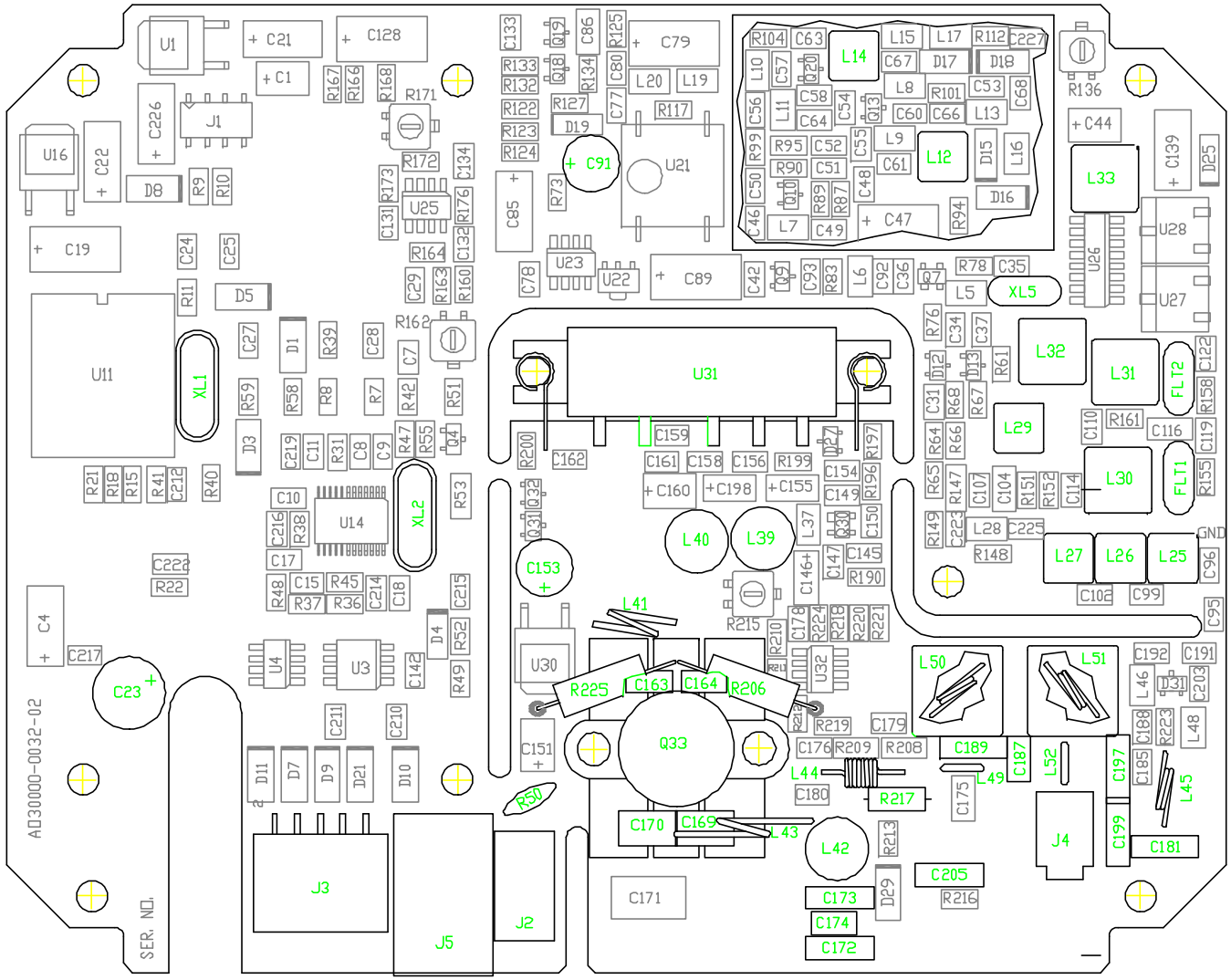
6. SCHEMATIC AND COMPONENT LOCATION DIAGRAMS (ASSEMBLY)


RECVR_SIG
RF AMP
MIXER
1st IF AMP
RX LO
RSSI O/P
DATA DEMOD
220mV rms
Rx. MUTE
3V
+9V
45.455MHz
45M7B
BFR92A
BF996S
MC3371
LM358
CFUG455F
TITLE
GPS RADIO
DESCRIPTION
RECEIVER
KAI COMM
DRAWN
CHECKED
APPROVED
DATE
30/11/98
NAME
SURENET
SIGN
DRG No:
SD30000-0032
REV
2
SHT
3
OF
4


TX_IND
+8VTX
+8V
+6V
+B
+BV
U32
LM358
U33
LM358
U31
M67749HR
U30
7808
IN
OUT
GND
Q30
NRF571LLT1
Q31
BSR16
Q32
BSR17A
Q33
BLU30/12
D27
HSMP3B00
D29
BAS81
D28
MA4P125D
D31
HSMP3822
D30
MA4P125D
D32
LL4148
RF_IN
RF_OUT
VCON
VBB
VCC
40 ohm
50 ohm
ANTENNA
J4
TP45
TP46
TP47
TP48
TX_ENABL
TO RX
RCVR SIG
Rx_MUTE
C145
C146
C147
C148
C149
C150
C151
C152
C153
C154
C155
C156
C157
C158
C159
C160
C161
C162
C163
C164
C165
C166
C167
C168
C169
C170
C171
C172
C173
C174
C175
C176
C177
C178
C179
C180
C181
C182
C183
C184
C185
C186
C187
C188
C189
C190
C191
C192
C193
C194
C195
C196
C197
C198
C199
C200
C201
C202
C203
C204
L37
L39
L40
L41
L42
L43
L44
L45
L46
L47
L48
L49
L50
L51
L52
L53
R190
R191
R192
R193
R194
R195
R196
R197
R198
R199
R200
R201
R202
R203
R204
R205
R206
R207
R209
R210
R211
R212
R213
R214
R215
R216
R217
R218
R219
R220
R221
R222
R223
R224
R225
TITLE
GPS RADIO
DESCRIPTION
TRANSMITTER
DRAWN
CHECKED
APPROVED
DATE
30/11/98
NAME
SURENET
SIGN
DRG No:
SD30000-0032
REV
2
SHT
4
OF
4


FUNCTION LATCH
ADDRESS DECODER
POWER ON RESET
MICRO PROCESSOR
FFSK MODEM
VOLTAGE REGULATOR
TO/FROM RF PCB
TO/FROM SYNTHESIZER
GPS MODULE
TITLE
GPS RADIO
DESCRIPTION
CPU
KAI COMM
DRAWN
CHECKED
APPROVED
DATE
31/1/98
NAME
SURENET
SIGN
DRG No:
SD30000-0032
REV
2
SHT
1
OF
4

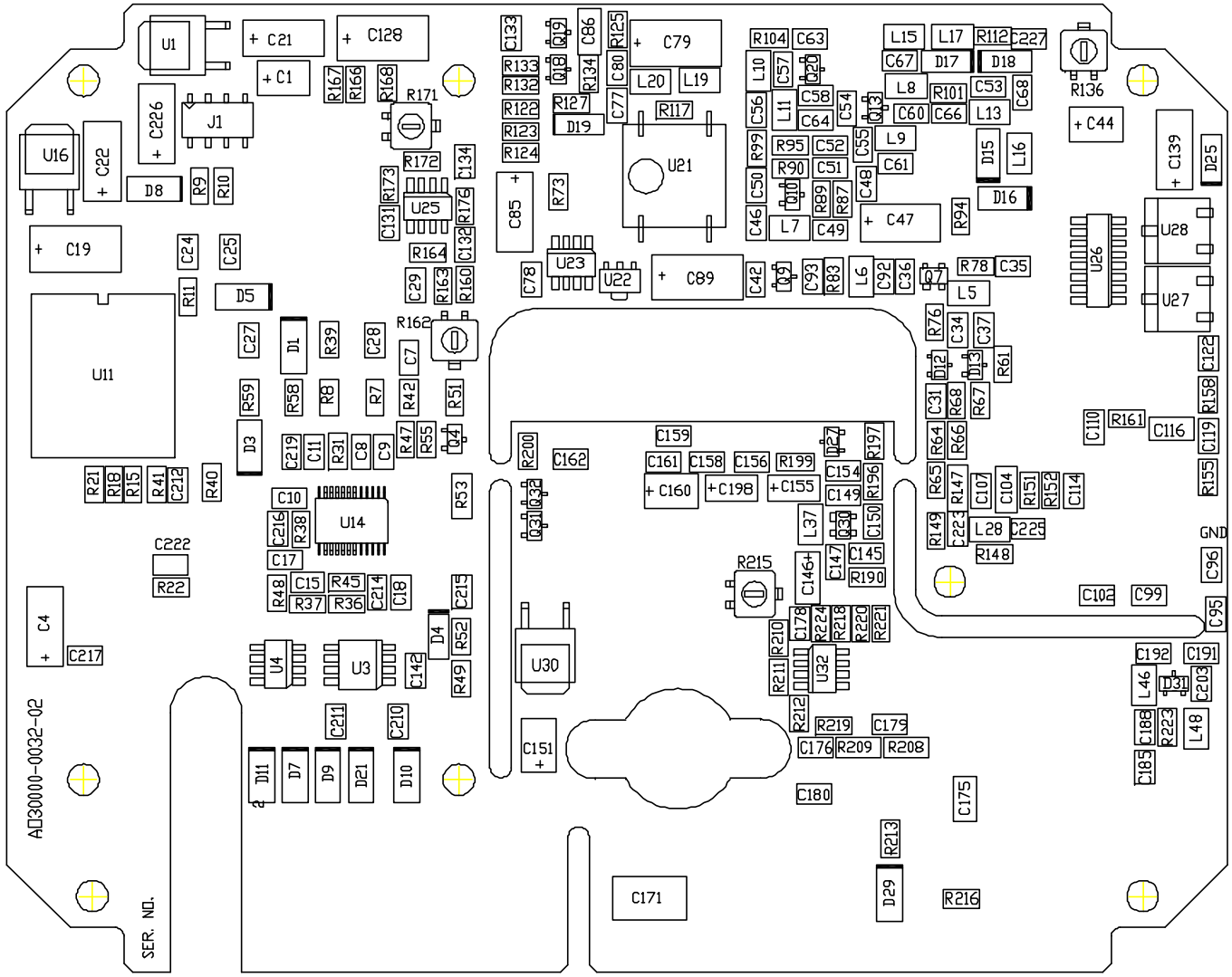

DATA_MOD
C45
100nF
+9V
R86
3K3
Q8
BSR17A
C44
10uF
D14
LL4148
R92
10K
R97
10K
R106
10K
R93
10K
R96
22K
Q12
BSR18A
Q14
BSR18A
R107
22K
Q11
BSR17A
R94
4K7
C59
470pF
Q15
BSR17A
R111
47K
R110
22K
R103
150
R104
47
L10
0,33uH
R135
47K
R136
220K
TP32
TP33
R137
3K3
C87
33nF
C47
10uF
C48
10nF
C51
470pF
Q20
C57
6p8
C63
15pF
C65
N.U.
L14
1.5T
D17
BB215
L17
0,33uH
R112
220
R113
33K
R114
10K
C69
3n3
C70
10nF
D18
BB215
R108
100
C68
470pF
C227
470nF
R87
100
C49
470pF
R99
150
C56
1pF
C58
3p3
MMBFJ310
L11
0,33uH
C64
N.U.
TP29
R105
330
R98
220
R100
150
R101
47
L8
0,33uH
L7
82nH
R89
100
R90
12K
C53
470pF
Q10
BFR92A
C50
22pF
R91
3K3
R88
150
C46
470pF
R95
330
C54
8p2
Q13
MMBFJ310
C52
1pF
C55
3p3
TP28
L9
0,33uH
C61
N.U.
R102
330
C60
15pF
C66
3p6
D15
BB215
L16
0,33uH
R109
220
C62
1p5
L12
1.5T
L13
0,33uH
D16
BB215
VCO
+6dBm
RF_IN
TP22
R64
18
C31
470pF
D12
HSMP3822
C34
1p8
+5V
TP24
R70
1K
C35
470pF
R77
100
R78
33K
C38
470pF
C40
470pF
+9V
R81
100
L5
22nH
Q7
BF996
R79
47K
L1B
33nH
Q9
BFR92A
R84
12K
C41
1pF
C43
1p3
R80
15K
L6
22nH
TP26
C92
12pF
C42
470pF
R83
220
C93
47pF
R85
3K3
C39
N.U.
R76
150
C36
470pF
TP25
R65
270
R68
390
+9V
R66
8K2
C30
470pF
R71
10K
C32
470pF
R67
33K
Q6
BSR17A
R72
390
TP20
RF_ENABL
R60
33K
Q5
BSR17A
R69
10K
R61
10K
+5V
R75
1K
TP21
RX_LO
R63
100
C33
470pF
D13
HSMP3822
C37
2p7
R62
100
+5V
R118
47
R116
27K
R117
220
L19
33nH
C76
470pF
TP30
C73
2p7
L20
22nH
C75
2p7
C71
1pF
Q16
BFR92A
C77
N.U.
R121
330
C72
N.U.
R119
270
C74
470pF
+5V
R125
47
R126
22
C79
22uF
10V
C80
10nF
C90
10nF
U21
TCXO-004
12.8MHz
C83
10nF
TP31
C81
470pF
U20
MC12202D
C84
N.U.
R82
1K
D19
6V2
C94
10nF
R128
4K7
+9V
R131
100
C85
10uF
R129
2K2
R132
47
R127
4K7
Q18
BSR18A
Q19
BSR17A
R134
3K9
C133
22pF
R130
4K7
R133
47
C86
0,47uF
R122
47K
R123
47K
R124
47K
SYN_CLK
SYN_DAT
SYN_LE
RAD_DISA
U23
LM2931CM
TP23
C78
330pF
C88
1uF
35V
C91
10uF
R138
22K
C90
1uF
R139
120K
R73
22K
+9V
U22
TA78L05F
TP27
+5V
C89
47uF
TITLE
GPS RADIO
DESCRIPTION
SYNTHESISER
& VCO
KAN COMM
DRAWN
CHECKED
APPROVED
DATE
30/11/98
NAME
SURENET
SIGN
DRG No:
SD30000-0032
REV
2
SHT
2
OF
4



COMPUTER FILE NAME: C:\ACAD\30000\AO\00321020		FROM	TO	DRAWN BY: H.A.W	DATE 22/2/99	KAVcomm Communications
		SERIAL No.		CHECKED	DATE	
THIS DRAWING IS THE PROPERTY OF KAVI-COMM. COMMUNICATIONS AND MAY NOT BE COPIED OR USED FOR ANY PURPOSE OTHER THAN WHICH IT IS SUPPLIED WITHOUT PREMISSION IN WRITING FROM THE OWNERS.				APPROVED	DATE	TITLE. FULL ASSEMBLY
				MANF. MAN.	DATE	TRANSCEIVER 460MHz

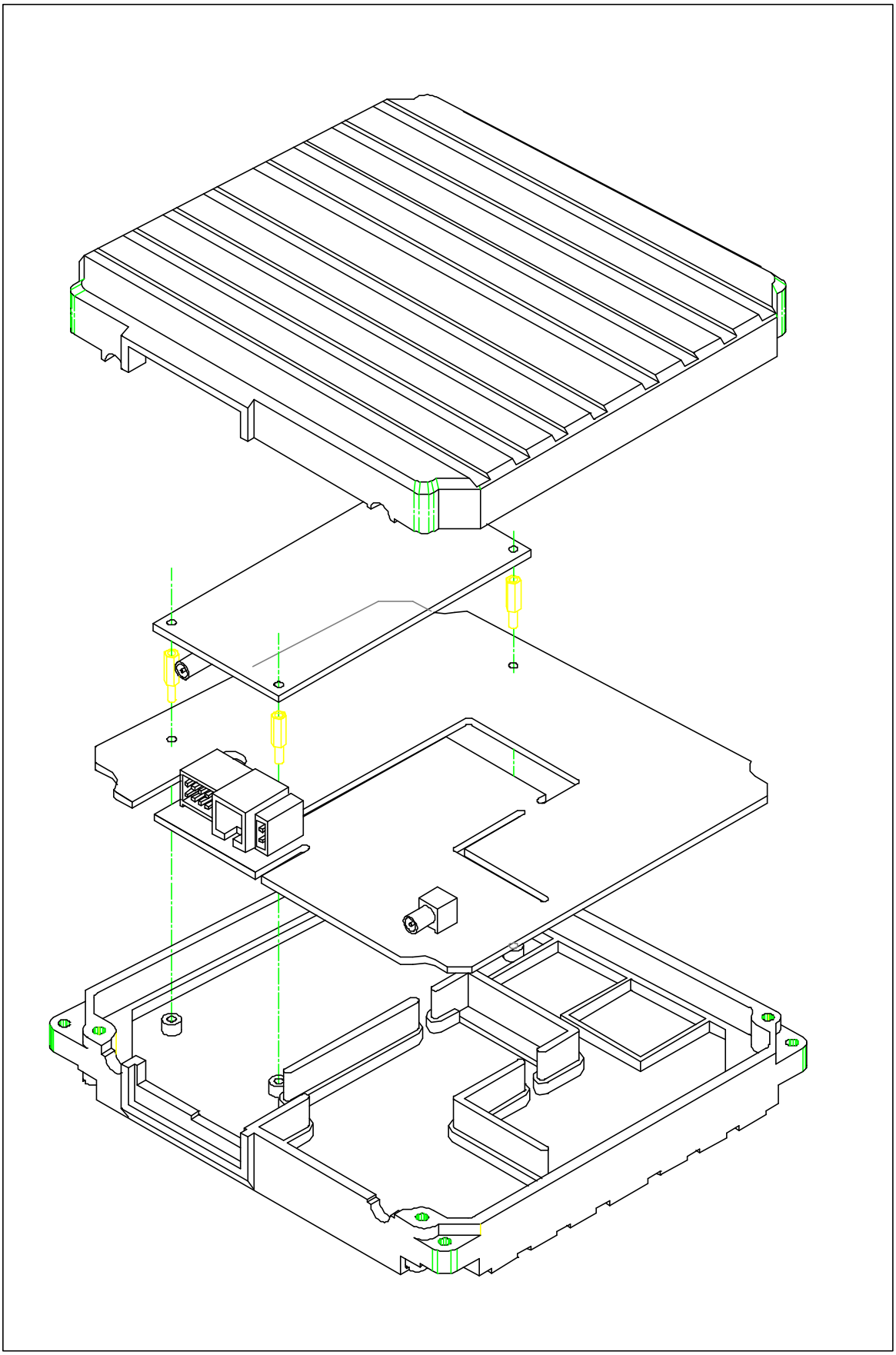
REV.	ECO No.	RN No.	CHECKED	APPROVED	DATE
010	00/00/00	00/00/00	00/00/00	00/00/00	00/00/00

SHEET:	SCALE:	
1 OF 1	2:1	A3
DRAWING No. AS30000-0032		REV. 020



COMPUTER FILE NAME: C:\ACAD\30000\AS\00321020			FROM	TO	DRAWN BY: H.A.W	DATE 22/2/99	KAVcomm Communications		
			SERIAL No.		CHECKED	DATE			
THIS DRAWING IS THE PROPERTY OF KAVI-COMM. COMMUNICATIONS AND MAY NOT BE COPIED OR USED FOR ANY PURPOSE OTHER THAN WHICH IT IS SUPPLIED WITHOUT PREMISSION IN WRITING FROM THE OWNERS.					APPROVED	DATE	TITLE. SMD ASSEMBLY TOP TRANSCEIVER 460MHz	SHEET: 1 OF 2	SCALE: 2:1	A3
					MANF. MAN.	DATE		DRAWING No. AS30000-0032		REV. 020
REV.	ECO No.	RN No.	CHECKED	APPROVED	DATE					

7. MECHANICAL ASSEMBLY



EXPLODED VIEW OF FMR UNIT

8. PARTS LIST

Item	Part No.	Qty	Description	Circuit Ref.
1			**COMPONENTS ON TOP OF PCBOARD**	
2	CS1021330VJE	2	CAP 1nF 100V 5% NPO 0805 VITRAMON	C15, C180
3	CS103114000E	5	CAP 10nF 50V NPO 0805	C48,80,110,119,161
4	CS104113000E	4	CAP 0,1uF 50V 5% NPO 0805	C17,18,134,178
5	CS105201611T	3	CAP 1uF 16V 10% TAN. CASE A	C146, C155, C198
6	CS10522ZMU2C	2	CAP 1uF 25V +80/-20% GRM42 1206	C104, C116
7	CS105303521T	2	CAP 1uF 35V 20% TAN. CASE B	C151, C160
8	CS106401621T	5	CAP 10uF 16V 20% TAN. CASE C	C4,22,47,85,139
9	CS106503511T	2	CAP 10uF 35V 10% TAN. CASE D	C19, C128
10	CS106301621T	1	CAP 10uF 16V 20% TAN. CASE B	C44
11	CS109113000E	2	CAP 1pF 50V 5% 0805	C52, C56
12	CS120113000E	1	CAP 12pF 50V 5% NPO 0805	C162
13	CS1501330VJE	2	CAP 15pF 100V 5% 0805	C60, C63
14	CS189113000E	2	CAP 1p8 50V 5% NPO 0805	C34, C37
15	CS220113000E	1	CAP 22pF 50V 5% NPO 0805	C114
16	CS226502021T	1	CAP 22uF 20V 10% TAN. CASE D	C79
17	CS279113000E	2	CAP 2p7 50V 5% NPO 0805	C77, C95
18	CS339234000E	1	CAP 3p3 63V 10% NPO 0805	C55
19	CS399234000E	3	CAP 3p9 63V 10% NPO 0805	C122, C185, C192
20	CS471134000E	24	CAP 470pF 100V 10% NPO 0805	C14,31,36,42,46,49,50,51, 53,61,64,68,107,147,150, 154,156,158,159,176,179, 188,191,203
21	CS476502011T	1	CAP 47uF 20V 10% TAN. CASE D	C89
22	CS479113000E	4	CAP 4p7 50V 5% NPO 0805	C58, C67, C145, C149
23	CS569143000E	3	CAP 5p6 200V 5% NPO 0805	C66, C96, C102
24	CS689143000E	1	CAP 6p8 200V 5% NPO 0805	C99
25	CS829113000E	2	CAP 8p2 50V 5% NPO 0805	C54, C57
26				
27	DL0HSMHC650R	1	LED HSMH-C650 RED 1206 HP.	D4
28	DS062000000S	1	DIODE, ZENER 6V2 5% SOD-123	D19
29	DS215000000B	4	DIODE, TUNER BB215 SOD-80 PHIL.	D15, D16, D17, D18
30	DS382200000H	3	DIODE, HSMP3822 HEWLETT PAC.	D12, D13, D31
31	DS390000000S	1	DIODE, ZENER 3V9 SOD-123	D25
32	DS414800000S	3	DIODE RLS4148	D2, D3, D8
33	DS81000SOD80	1	DIODE, BAS81 SOD-80 PHILIPS	D29
34	DSMMSZ18T100	1	DIODE, 18V MMSZ18T1 SOD123	D5
35	DSMBRS130LT3	1	DIODE, MBRS130LT3 1A 30V	D1
36	DS380000000H	1	DIODE, HSMP3800	D27
37	FS455000000F	2	FILTER, CER. CFUCG455F MURATA	U27, U28
38	FSTCXO-00400	1	TCXO-004 12.8MHz	U21

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 09/06/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm Communications Inc.

PARTS LIST
TRANSCEIVER PCBOARD
SMD ASSY. FMR

Sheet 1 of 5	**Scale**	A4
Drawing No. PS30000-0032		**Rev.** 010

Item	Part No.	Qty	Description	Circuit Ref.
39	LS003300000N	8	COIL, 0,56uH LQH3NR56MO4	L8,9,10,11,13,15,16,17

40	LS008200000N	1	COIL, 0,82uH LQH3NR82MO4	L48
41	LS022000000N	3	COIL, 22nH LQN2A22NMO4	L7, L20, L46
42	LS033000000N	4	COIL, 33nH LQN2A33NMO4	L5, L19, L28, L37
43			ADD L1	
44				
45	MS29512000AT	1	IC. AT29C512-12JC FLASH	U11
46	MS330640000D	1	IC. MC33064D-5 UNDER VOLT	U4
47	MS3371D000MC	1	IC. MC3371D MOTOROLA	U26
48	MS358000000L	2	IC. LM358D DUAL OP. AMP.	U25, U32
49	MS741380000H	1	IC. 74HC138D	U9
50	MS742590000H	2	IC. 74HC259D	U5, U12
51	MS742700000H	1	IC. 74HC27 TRIPLE 3-IN	U8
52	MS780500000N	1	IC. TA78L05F +5V REG. 1A	U22
53	MS7805DT0000	1	IC. MC7805DT	U16
54	MS780800000F	1	IC. TA7808F +8V REG 1A	U30
55	MSULN2003000	1	IC. ULN2003 DARLINGTON	U15
56	MSMC34063AD0	1	IC. MC34063AD DC TO DC CONVERTER	U1
57	MSTLC549D000	1	IC. TLC549D	U2
58	MS74HC132AFN	2	IC. TC74HC132AFN SCHMITT NAND	U7, U10
59	MS12C509-04P	1	IC. PIC12C509-04 MCU CMOS 1K	U3
60	MSLM29321CM00	1	IC. LM2931CM	U23
61	MSFX829-D500	1	IC. FX829-D5	U14
62	MSSRM2264M00	1	IC. SRM2264M	U13
63	MS630300000F	1	IC. HD6303XF	U6
64				
65	PB30000-0032	1	PCBOARD BLANK	
66				
67	P0000000008S	1	CONN A3A-8DA-25V HIROSE	J1
68				
69	RS018012551C	2	RES. 18ς 1/8W 5% C/F 0805	R64, R196
70	RS001212550C	3	RES. 1,2ς 1/8W 5% C/F 1206	R6, R7, R8
71	RS047012551C	4	RES. 47ς 1/8W 5% C/F 0805	R101,104,125,158
72	RS082012551C	1	RES. 82ς 1/8W 5% C/F 0805	R216
73	RS100012551C	4	RES. 100ς 1/8W 5% C/F 0805	R87, R89, R147, R218
74	RS100112551C	4	RES. 1K 1/8W 5% C/F 0805	R5, R148, R168, R210
75	RS100212551C	5	RES. 10K 1/8W 5% C/F 0805	R1,3,61,213,220
76	RS100312551C	5	RES. 100K 1/8W 5% C/F 0805	R45,46,151,167,224
77	RS100412551C	1	RES. 1M 1/8W 5% C/F 0805	R219
78	RS120012550C	2	RES. 120ς 1/8W 5% C/F 1206	R208, R209
79	RS120212551C	1	RES. 12K 1/8W 5% C/F 0805	R90

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 09/06/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm **Communications**

PARTS LIST
TRANSCEIVER PCBOARD
SMD ASSY. FMR

Sheet 2 of 5	**Scale**
Drawing No. PS30000-0032	**Rev.** 031

A4

Item	Part No.	Qty	Description	Circuit Ref.
80	RS150012551C	1	RES. 150ς 1/8W 5% C/F 0805	R76
81	RS150212551C	1	RES. 15K 1/8W 5% C/F 0805	R47

82	RS180312551C	1	RES. 180K 1/8W 5% C/F 0805	R164
83	RS220012551C	8	RES. 220ç 1/8W 5% C/F 0805	R83,95,99,112,117,149, 161,223
84	RS220112551C	1	RES. 2K2 1/8W 5% C/F 0805	R163
85	RS220212551C	3	RES. 22K 1/8W 5% C/F 0805	R9,R10,R200
86	RS270006350C	1	RES. 270ç 1/8W 5% C/F 0805	R65
87	RS270212551C	1	RES. 27K 1/8W 5% C/F 0805	R221
88	RS330212551C	5	RES. 33K 1/8W 5% C/F 0805	R48,R67,R78,R174,R176
89	RS390012551C	1	RES. 390ç 1/8W 5% C/F 0805	R68
90	RS470112551C	2	RES. 4K7 1/8W 5% C/F 0805	R94, R152
91	RS470212551C	2	RES. 47K 1/8W 5% C/F 0805	R211, R212
92	RS560012551C	2	RES. 560ç 1/8W 5% C/F 0805	R197, R199
93	RS560212551C	2	RES. 56K 1/8W 5% C/F 0805	R172, R173
94	RS680112551C	1	RES. 6K8 1/8W 5% C/F 0805	R190
95	RS680212551C	1	RES. 68K 1/8W 5% C/F 0805	R166
96	RS820112551C	2	RES. 8K2 1/8W 5% C/F 0805	R66, R155
97				
98	TS160000000A	1	TRANS. BSR16 PNP SOT-23 PHIL.	Q31
99	TS170000000A	3	TRANS. BSR17A NPN SOT-23 PHIL.	Q1, Q2, Q32
100				
101	TS310000000J	2	TRANS. MMBF J310LT1 MOTOROLA	Q13, Q20
102	TS571100000A	1	TRANS. MRF5711LT1	Q30
103	TS920000000A	2	TRANS BFR92A NPN SOT-23 PHILIPS	Q9, Q10
104	TS996000000N	1	TRANS. BF996S	Q7
105				
106	VS200200000S	3	TRIM 20K SQR. C/F	R162, R171, R215
107	VS500300000S	1	TRIM 500K SQR. C/F	R136
108				
109			**COMPONENTS ON BOTTOM OF PCB.**	
110	CS100113000E	2	CAP 10pF 50V 5% NPO 0805	C113, C126
111	CS101134000E	2	CAP 100pF 100V 10% NPO 0805	C16, C137
112	CS1021330VJE	3	CAP 1nF 100V 5% NPO 0805 VITRAMON	C8, C9, C141
113	CS103114000E	11	CAP 10nF 50V NPO 0805	C70,82,83,117,118,123, 124,129,130,152,166
114	CS104113000E	25	CAP 0,1uF 50V 5% NPO 0805	C3,7,10,11,20,21,24,25,26 27,28,29,45,92,93,94,131, 135,136,138,140,142,143, 199,200
115	CS10522ZMU2C	2	CAP 1uF 25V +80/-20% GRM42 1206	C90, C186
116	CS105303521T	2	CAP 1uF 35V 20% TAN. CASE B	C88, C165

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 09/06/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm **Communications**

Title:
PARTS LIST
TRANSCEIVER PCBOARD
SMD ASSY. FMR

Sheet 3 of 5	**Scale**	**A4**
Drawing No. PS30000-0032		**Rev.** **0A0**

Item	Part No.	Qty	Description	Circuit Ref.
117	CS109113000E	8	CAP 1pF 50V 5% NPO 0805	C71,97,98,100,101,105, 111,112

118	CS189113000E	1	CAP 1p8 50V 5% NPO 0805	C41
119	CS220113000E	2	CAP 22pF 50V 5% NPO 0805	C108, C121
120	CS229113000E	1	CAP 2p2 50V 5% NPO 0805	C62
121	CS270113000E	5	CAP 27pF 50V 5% NPO 0805	C5, C6, C12, C13, C125
122	CS279113000E	2	CAP 2p7 50V 5% NPO 0805	C73, C75
123	CS332114000E	3	CAP 3300pF 50V 5% NPO 0805	C69, C127, C132
124	CS333114000E	2	CAP 33nF 50V 10% 0805	C87, C120
125	CS339234000E	2	CAP 3p3 63V 10% NPO 0805	C39, C43
126	CS399234000E	1	CAP 3p9 63V 10% NPO 0805	C103
127	CS470134000E	2	CAP 47pF 100V 10% NPO 0805	C177, C194
128	CS471134000E	23	CAP 470pF 100V 10% NPO 0805	C30,32,33,35,38,40,59,74, 76,81,106,109,115,148, 157,167,168,182,183,184, 193,201,202
129	CS474274MU2C	1	CAP 470nF 16V ±10% GRM42 1206 MURATA	C86
130	CS479113000E	1	CAP 4p7 50V 5% NPO 0805	C72
131	CS479663MU1C	2	CAP 4p7 500V 5% GRH111 MURATA	C190, C196
132	CS689663MU1C	1	CAP 6p8 500V 5% GRH111 MURATA	C195
133				
134	DS412500000E	2	DIODE, PIN MA4P1250 MACOM	D28, D30
135	DS414800000S	5	DIODE, RLS4148	D9, D10, D11, D14, D32
136	DS5MBJ18C00	2	DIODE, SMBJ18C	D6, D7
137				
138	LS008200000N	2	COIL, 0,82uH LQH3NR82MO4	L47, L53
139	LS330100000N	1	COIL, 3,3uH LQH3N3R3M 20%	L34
140	LS033000000N	1	COIL, 33nH LQN2A33NMO4 20%	L18
141				
142	MSMC12202D00	1	IC. MC12202D	U20
143				
144	RS015012550C	1	RES 15ς 1/8W 5% C/F 1206	R207
145	RS018012551C	1	RES 18ς 1/8W 5% C/F 0805	R63
146	RS022012551C	1	RES 22ς 1/8W 5% C/F 0805	R126
147	RS033012551C	2	RES 33ς 1/8W 5% C/F 0805	R193, R194
148	RS033012550C	3	RES 33ς 1/8W 5% C/F 1206	R192, R204, R205
149	RS047012551C	3	RES 47ς 1/8W 5% C/F 0805	R118, R132, R133
150	RS100012551C	5	RES 100ς 1/8W 5% C/F 0805	R77,81,108,131,185
151	RS100112441C	9	RES 1K 1/8W 5% C/F 0805	R16,49,70,75,82,177,198, 201,203
152				

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 09/06/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm **Communications**

Title:
PARTS LIST
TRANSCEIVER PCBOARD
SMD ASSY. FMR

Sheet 4 of 5	**Scale**	**A4**
Drawing No. PS30000-0032		**Rev.** **031**

Item	Part No.	Qty	Description	Circuit Ref.
153	RS100212551C	15	RES 10K 1/8W 5% C/F 0805	R2,40,41,43,69,71,92,93, 97,106,114,169,191,202,

				214
154	RS100312551C	22	RES 100K 1/8W 5% C/F 0805	R17,18,19,20,21,22,24,25, 26,27,28,29,30,31,32,33, 34,35,36,37,38,42
155	RS100412551C	1	RES 1M 1/8W 5% C/F 0805	R44
156	RS120212551C	1	RES 12K 1/8W 5% C/F 0805	R84
157	RS150012551C	2	RES 150ç 1/8W 5% C/F 0805	R100, R103
158	RS150212551C	2	RES 15K 1/8W 5% C/F 0805	R80, R146
159	RS150312551C	1	RES 150K 1/8W 5% C/F 0805	R139
160	RS220012551C	3	RES 220ç 1/8W 5% C/F 0805	R98, R109, R222
161	RS220112551C	2	RES 2K2 1/8W 5% C/F 0805	R129, R179
162	RS220212551C	6	RES 22K 1/16W 5% C/F 0805	R12,96,107,110,138,157
163	RS220306350C	1	RES 220K 1/16W 5% C/F 0805	R135
164	RS270006350C	4	RES 270ç 1/8W 5% C/F 0805	R62,R88,119, R195
165	RS270112551C	3	RES 2K7 1/8W 5% C/F 0805	R159, R178, R180
166	RS270212551C	1	RES 27K 1/8W 5% C/F 0805	R116
167	RS270312551C	1	RES 270K 1/8W 5% C/F 0805	R183
168	RS330012551C	4	RES 330ç 1/8W 5% C/F 0805	R102, R105, R121, R150
169	RS330112551C	6	RES 3K3 1/8W 5% C/F 0805	R85,86,91,137,154,156
170	RS330212551C	2	RES 33K 1/8W 5% C/F 0805	R60, R113
171	RS330312551C	2	RES 330K 1/8W 5% C/F 0805	R13, R39
172	RS390112551C	1	RES 3K9 1/8W 5% C/F 0805	R4
173	RS390012551C	2	RES 390ç 1/8W 5% C/F 0805	R72, R153
174	RS470112551C	5	RES 4K7 1/8W 5% C/F 0805	R127,128,130,145,160
175	RS470212551C	6	RES 47K 1/8W 5% C/F 0805	R79,111,122,123,124,182
176	RS560012551C	1	RES 560ç 1/8W 5% C/F 0805	R165
177	RS560112551C	2	RES 5K6 1/8W 5% C/F 0805	R134, R184
178	RS560312551C	1	RES 560K 1/8W 5% C/F 0805	R181
179	RS820112551C	1	RES 8K2 1/8W 5% C/F 0805	R170
180				
181	TS817000000A	6	TRANS. BSR17A NPN SOT-23 PHILIPS	Q5,6,8,11,15,19
182	TS180000000A	3	TRANS. BSR18A PNP SOT-23 PHILIPS	Q12, Q14, Q18
183	TS920000000A	3	TRANS. BFR92A NPN SOT-23 PHILIPS	Q16, Q25, Q26
184	TS996000000N	1	TRANS. BF996S SIEMENS	Q27
185				
186				
187				
188				
189				
190				

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 09/06/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm **Communications**

Title:
PARTS LIST
TRANSCEIVER PCBOARD
SMD ASSY. FMR

Sheet 5 of 5	**Scale**	**A4**
Drawing No. PS30000-0032		**Rev.** 031

Item	Part No.	Qty	Description	Circuit Ref.
1	**SD30000-0032**	REF	CIRCUIT DIAGRAM	
2				

3	AS30000-0032	1	PCBOARD ASSEMBLY SMD.	
4				
5	ATRFP2503APO	1	ATT. RFP-25-03AP 25W	ATT1
6				
7	CO102110011C	3	CAP 1nF 100V 10% CER.	C174, C175, C187
8	CO107101621E	2	CAP 100uF 16V 20% ELEC.	C91, C153
9	CO107153521E	1	CAP 100uF 35V 20% ELEC.	C1
10	CO227152521E	1	CAP 220uF 25V 20% ELEC.	C23
11	CS330663MU1C	4	CAP 33p 5% 500V GRH111	C163,C164,C169,C170
12	CT569245150N	2	CAP 5p6 500V N150	C172, C173
13	CT689245150N	1	CAP 6p8 500V N150	C181
14				
15	FL45B7B00000	2	FILTER, CRYSTAL MCF 45M 7B STC	FLT1, FLT2
16				
17	LO100000001N	3	COIL, KAVI 1t ON BEAD	L39, L40, L42
18	LO103850000K	1	COIL, KAVI 1t	L41
19	LO455150000N	1	COIL, KAVI LLC-4828 455KHz TOKO	L33
20	LO526100106M	2	CAN, METAL 10.2x10.2	FOR L50 & L51
21	LO545100081N	6	COIL, NE545BNAS-100081 1.5t	L12,14,25,26,27,29
22	LO70000-0036	2	COIL, KAVI 8nH 1t	L49, L52
23	LO70000-0054	1	COIL, KAVI 5x2t 7KL ON A ∅3,2 MANDRELL	L30
24	LO70000-0055	1	COIL, KAVI 4x2t 7KL	L31
25	LO70000-0056	1	COIL, KAVI 3x2t 7KL	L32
26	LO70000-0057	1	COIL, KAVI 8t	L44
27	LO70000-0058	1	COIL, KAVI 1t	L43
28	LO70000-0059	3	COIL, KAVI 27nH 2t	L45, L50, L51
29				
30	MC67749HR00	1	IC. M67749HR RF. POWER MODULE	U31
31				
32	MP40000-0077	1	VCO METAL CAN	
33				
34	PO901303208M	1	CONN. 90130-3208 MOLEX	J2
35	PO901303214M	1	CONN. 90130-3214 MOLEX	J3
36	PO901362202M	1	CONN. 90136-2202 MOLEX	J4
37				
38	RO047010050C	1	RES 47Ω 1W 5% C/F	R206
39	RO100325050C	1	RES 100K ¼W 5% C/F	R217
40				
41				

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by H.A.W.	**Date** 27/05/98
Checked	**Date**
Approved	**Date**
Manf. Man.	**Date**

KAVIcomm **Communications**

Title:

PARTS LIST
TRANSCEIVER PCBOARD
FMR

Sheet 1 of 2	**Scale**	**A4**
Drawing No. PL30000-0032		**Rev.** **0A0**

Item	Part No.	Qty	Description	Circuit Ref.
42	**TP202136000J**	3	HOOK, TERMINAL VERO 202136J	TP1, TP2, GND
43				

44	**TR301200000J**	1	TRANS. BLU30/12 PHILIPS	Q33
45				
46	XT403200000X	1	CRYSTAL, 4.032MHz PARALLEL	XL2
47	XT454550000X	1	CRYSTAL, 45.455MHz PARALLEL	XL5
48	XT737280000X	1	CRYSTAL, 7.3728MHz	XL1
49				
50				
51				
52				
53				
54				
55				
56				
57				
58				
59				
60				
61				
62				
63				
64				
65				
66				
67				
68				
69				
70				
71				
72				
73				
74				
75				
76				
77				
78				
79				
80				
81				
82				
83				
84				

Rev.	ECO.No	RN No.	Checked	Approved	Date

Drawn by **H.A.W.**	**Date** **26/06/98**	KAVIcomm Communications			
Checked	**Date**				
Approved	**Date**	**Title:** **PARTS LIST TRANSCEIVER PCBOARD FMR**	**Sheet** 2 of 2	**Scale**	**A4**
Manf. Man.	**Date**		**Drawing No.** PL30000-0032		**Rev.** **0A0**