



8.10 T2000-A450X CTCSS & Scrambler Kit

The T2000-A450X CTCSS and scrambler PCB plugs into an options connector on the top side of the T2000 Series II logic PCB, and can be configured in two ways:

Product Code	Option	T201X	T2020	T203X	T2040	T2050
T2000-A4500	CTCSS	x	x	✓	✓	x
T2000-A4502	Scrambler	✓	✓	✓	✓	✓

The CTCSS option is used in trunked radios, and has 38 independent receive and transmit tones, set by solder links on the T2000-A450X PCB.

The scrambler option can be used in either trunked or conventional radios, and is enabled/disabled by the auxiliary () key (conventional models) or function () key (trunked models). The scrambler uses a simple frequency inversion algorithm that prevents casual eavesdropping by other radio users. After descrambling, the recovered speech suffers from some degradation in clarity.

Note: The T2000-A4500 CTCSS kit is only compatible with the following radio and PGM software versions:

Radio	Radio Software Version	PGM Software Version
T2030	3.24 or later	later than 1.44
T2035	3.28 or later	
T2040	5.36 or later	later than 2.57

The following topics are covered in this Section:

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8.10.1 Components Required

The T2000-A450X kits contain the following components:

Quantity	Description
1	T2000-A450X PCB assembly
12mm	PVC foam tape

8.10.2 Fitting

- 1 Refer to Figure 8.10.1.

Remove the top cover of the radio by unscrewing the four cover screws, unscrew the logic PCB and fold out.

- 2 Select the T2000-A450X link options, as described in Section 8.10.3, "T2000-A450X Link Options".

Position the T2000-A450X PCB as shown, and plug into the connector on the T2000 logic PCB:

Model	PCB IPN	Connector Circuit Reference
T2010 & T2015	220-01377-01 or later	P2
T2020, T203X, T2040 & T2050	220-01344-02 or later	#T3K45

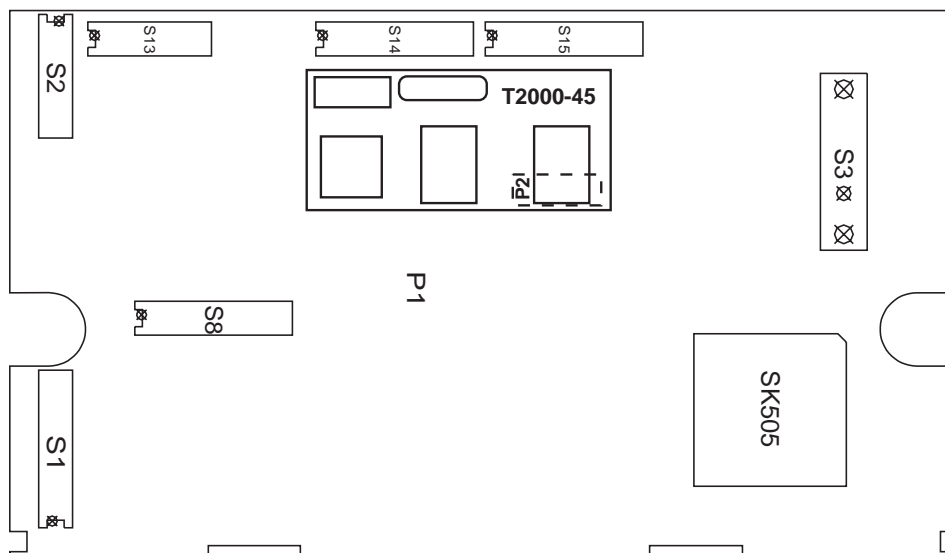


Figure 8.10.1 T2000-A450X PCB Mounting (T201X logic PCB shown)

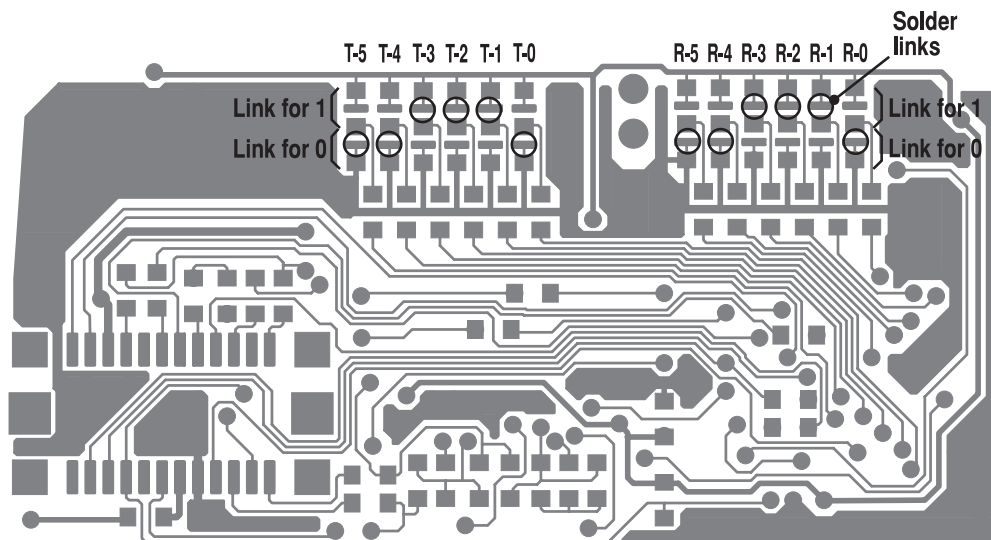
- 2 Position the foam tape provided on top of #IC5, on the T2000-A450X PCB.
- 3 Carefully fold the logic PCB back in position and secure using the three logic PCB retaining screws.
Refit the top cover.

8.10.3 T2000-A450X Link Options

There are 2 groups of links on the underside of the T2000-A4500 PCB, the receive (R) group and the transmit (T) group. Each group contains 6 bits that are pulled logic high or low, by either solder links or zero ohm resistors.

The receive settings are set by links R-0 to R-5 and the transmit settings by links T-0 to T-5. A short to the 5V line represents a '1', and a short to ground represents a '0'.

The following diagram shows the T2000-A450X PCB, with links indicated.



T2000-A450X PCB IPN 220-01335-04 (bottom side):
links for transmit & receive 110.9Hz CTCSS frequency shown.

T2000-A4500 CTCSS PCB Links

The following table gives the linking details for the 38 independent transmit and receive CTCSS frequencies.

Tone Number	R-5 T-5	R-4 T-4	R-3 T-3	R-2 T-2	R-1 T-1	R-0 T-0	CTCSS Frequency (Hz)
1	0	0	0	0	0	0	67
2	0	0	0	0	0	1	71.9
3	0	0	0	0	1	0	74.4
4	0	0	0	0	1	1	77
5	0	0	0	1	0	0	79.7
6	0	0	0	1	0	1	82.5
7	0	0	0	1	1	0	85.4
8	0	0	0	1	1	1	88.5
9	0	0	1	0	0	0	91.5
10	0	0	1	0	0	1	94.8
11	0	0	1	0	1	0	97.4
12	0	0	1	0	1	1	100
13	0	0	1	1	0	0	103.5
14	0	0	1	1	0	1	107.2
15	0	0	1	1	1	0	110.9

Tone Number	R-5 T-5	R-4 T-4	R-3 T-3	R-2 T-2	R-1 T-1	R-0 T-0	CTCSS Frequency (Hz)
16	0	0	1	1	1	1	114.8
17	0	1	0	0	0	0	118.8
18	0	1	0	0	0	1	123
19	0	1	0	0	1	0	127.3
20	0	1	0	0	1	1	131.8
21	0	1	0	1	0	0	136.5
22	0	1	0	1	0	1	141.3
23	0	1	0	1	1	0	146.2
24	0	1	0	1	1	1	151.4
25	0	1	1	0	0	0	156.7
26	0	1	1	0	0	1	162.2
27	0	1	1	0	1	0	167.9
28	0	1	1	0	1	1	173.8
29	0	1	1	1	0	0	179.9
30	0	1	1	1	0	1	186.2
31	0	1	1	1	1	0	192.8
32	0	1	1	1	1	1	203.5
33	1	0	0	0	0	0	210.7
34	1	0	0	0	0	1	218.1
35	1	0	0	0	1	0	225.7
36	1	0	0	0	1	1	233.6
37	1	0	0	1	0	0	241.8
38	1	0	0	1	0	1	250.3

T2000-A4502 Scrambler PCB Links

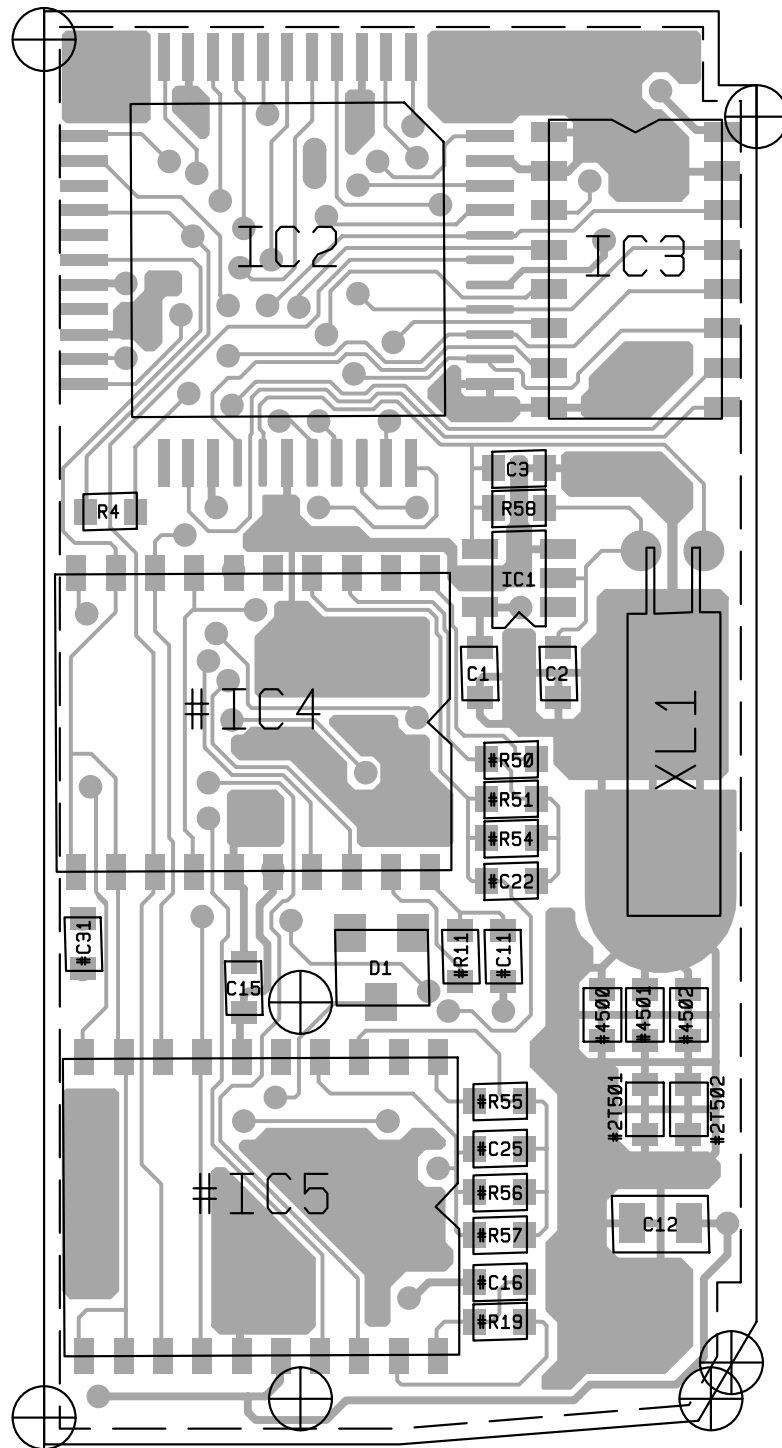
The T2000-A4502 has the following R settings linked during manufacture. The T settings have no effect.

R-5	R-4	R-3	R-2	R-1	R-0
1	1	1	1	1	1

8.10.4 PCB Information

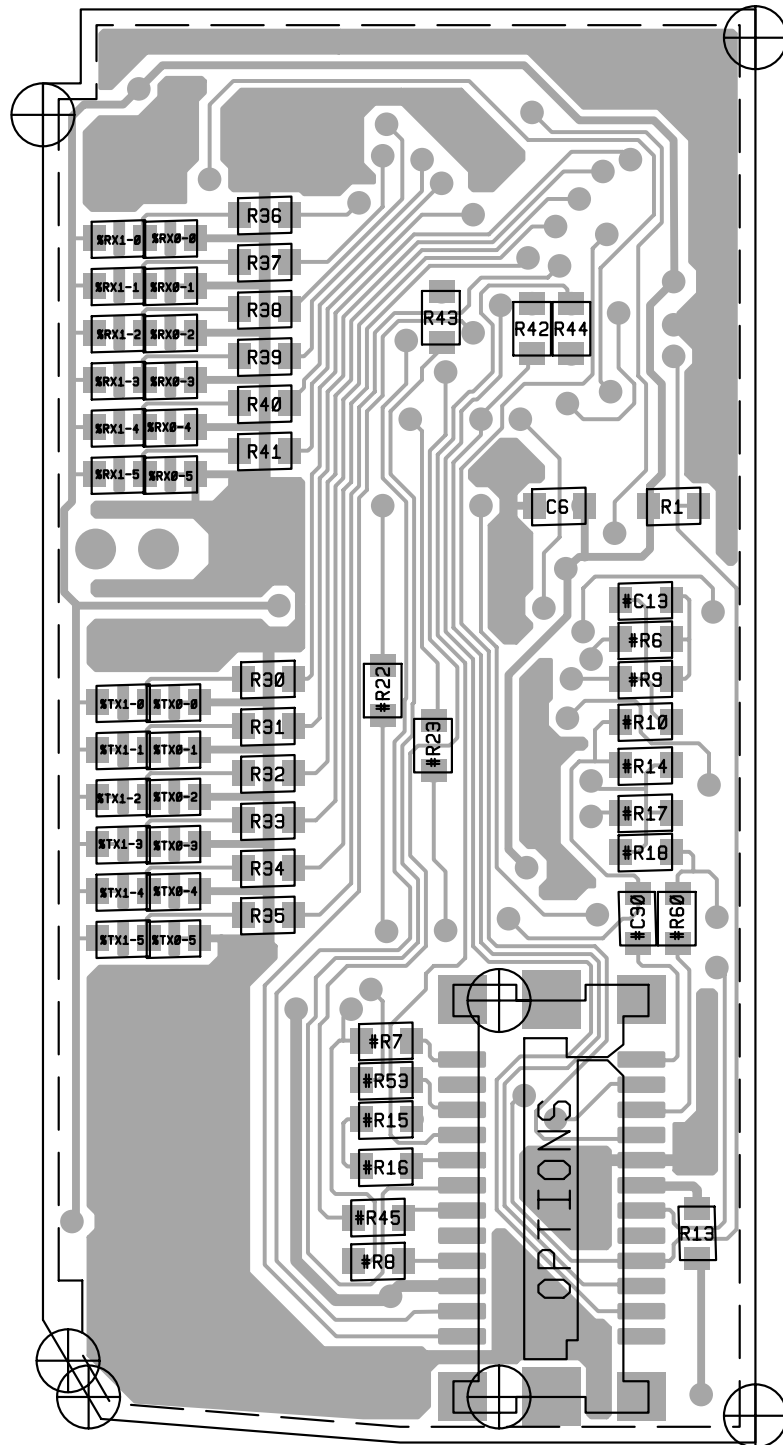
T2000-A450X Parts List (IPN 220-01335-04)

Ref	Var	IPN	Description	Ref	Var	IPN	Description
#4500	CTCSS	038-10000-00	RES 0603 CHIP ZERO OHM 1/16W +	R58		038-17100-00	RES 0603 CHIP 1M 1/16W +-5%
#2T502	SCRAM	038-10000-00	RES 0603 CHIP ZERO OHM 1/16W +	#R60	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%
C1		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V	XL1		274-01063-00	(L) XTAL 3.579545MHZ MINITURE CYLINDRICA
C2		018-12330-10	CAP 0603 CHIP 33P 50V NPO +-1%			220-01298-01	(L) PCB FLEXI T3000 OPTIONS LOOM
C3		018-12150-10	CAP 0603 CHIP 15P 50V NPO +-1%			220-01335-04	PCB T3000-4500 CTCSS OPTION BOARD
C6		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V			365-00011-38	LABEL STATIC WARNING YELLOW A4A315
#C11	CTCSS	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V			365-00011-54	LABEL WHITE RW1556/2 90*24MM SPECIAL AD
#C11	SCRAM	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			369-00020-49	TAPE SA TESAMOLL 9*3 (25 M ROLLS)
C12		015-27100-10	CAP CER 0805 CHIP 1M +80-20% Y5V 16V			369-00020-50	TAPE SA TESAMOLL 6*3MM (25 M ROLLS)
#C13	CTCSS	018-15100-00	CAP 0603 CHIP 10N 50V X7R +-10%			399-00010-86	BAG STATIC SHIELDING 127X203MM
C15		018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			410-01064-01	PKG HEADER CARD (NEW TAIT LOGO)
#C16	SCRAM	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V			418-24500-00	FITTING INS T2000-45 SCRAMBLER KIT
#C22	CTCSS	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%	Variants: CTCSS = CTCSS option SCRAM = Scrambler option			
#C22	SCRAM	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%				
#C25	SCRAM	018-13150-00	CAP 0603 CHIP 150P 50V NPO +-5%				
#C30	CTCSS	018-16100-01	CAP 0603 CHIP 100N +80-20% Y5V 16V				
D1		001-10000-70	(S) DIODE SMD BAV70 DUAL SWITCH SOT-23				
IC1		002-74900-40	(LSH) IC SMD TC7S04F SINGLE INV GATE SO-				
IC2		002-18937-10	LSH) IC SMD Z89371-16FSC OTP DSP 44PIN Q				
IC3		002-74917-30	LSH) IC SMD 74HC173D 4BIT DTYPE REGISTE				
#IC4	CTCSS	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
#IC4	SCRAM	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
#IC5	SCRAM	002-11454-80	LSH) IC SMD MC145480DW PCM CODEC F				
OPTION		240-10000-09	CONN SMD 24WAY (SKT/CAP WITH MTG LUGS				
R1		038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
R4		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R6	CTCSS	038-15470-00	RES 0603 CHIP 47K 1/16W +-5%				
#R6	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R7	CTCSS	038-14330-00	RES 0603 CHIP 3K3 1/16W +-5%				
#R8	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R9	CTCSS	038-16470-00	RES 0603 CHIP 470K 1/16W +-5%				
#R9	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R10	CTCSS	038-14470-00	RES 0603 CHIP 4K7 1/16W +-5%				
#R10	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R11	CTCSS	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R11	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R13		038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R15	SCRAM	038-11470-00	RES 0603 CHIP 4E7 1/16W +-5%				
#R17	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R18	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R19	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R22	CTCSS	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
#R22	SCRAM	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
#R23	SCRAM	038-15150-00	RES 0603 CHIP 15K 1/16W +-5%				
R30		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R31		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R32		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R33		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R34		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R35		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R36		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R37		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R38		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R39		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R40		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R41		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R42		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R43		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
R44		038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R50	CTCSS	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R50	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R51	CTCSS	038-16470-00	RES 0603 CHIP 470K 1/16W +-5%				
#R51	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R53	SCRAM	038-15100-00	RES 0603 CHIP 10K 1/16W +-5%				
#R54	CTCSS	038-16220-00	RES 0603 CHIP 220K 1/16W +-5%				
#R55	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				
#R56	SCRAM	038-16100-00	RES 0603 CHIP 100K 1/16W +-5%				



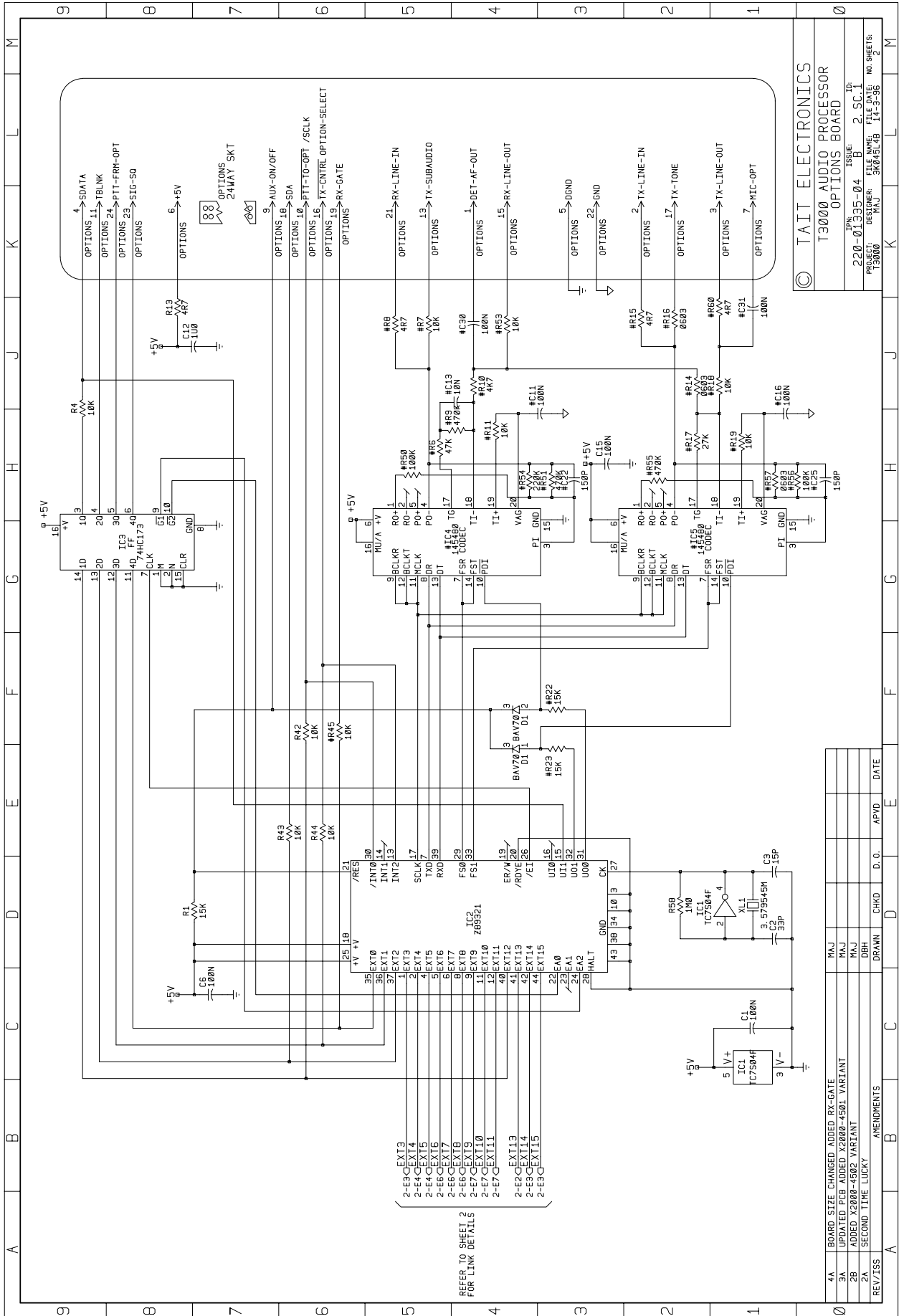
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T2000-A450X PCB (IPN 220-01335-04) - Top Side



220-01335-04 A

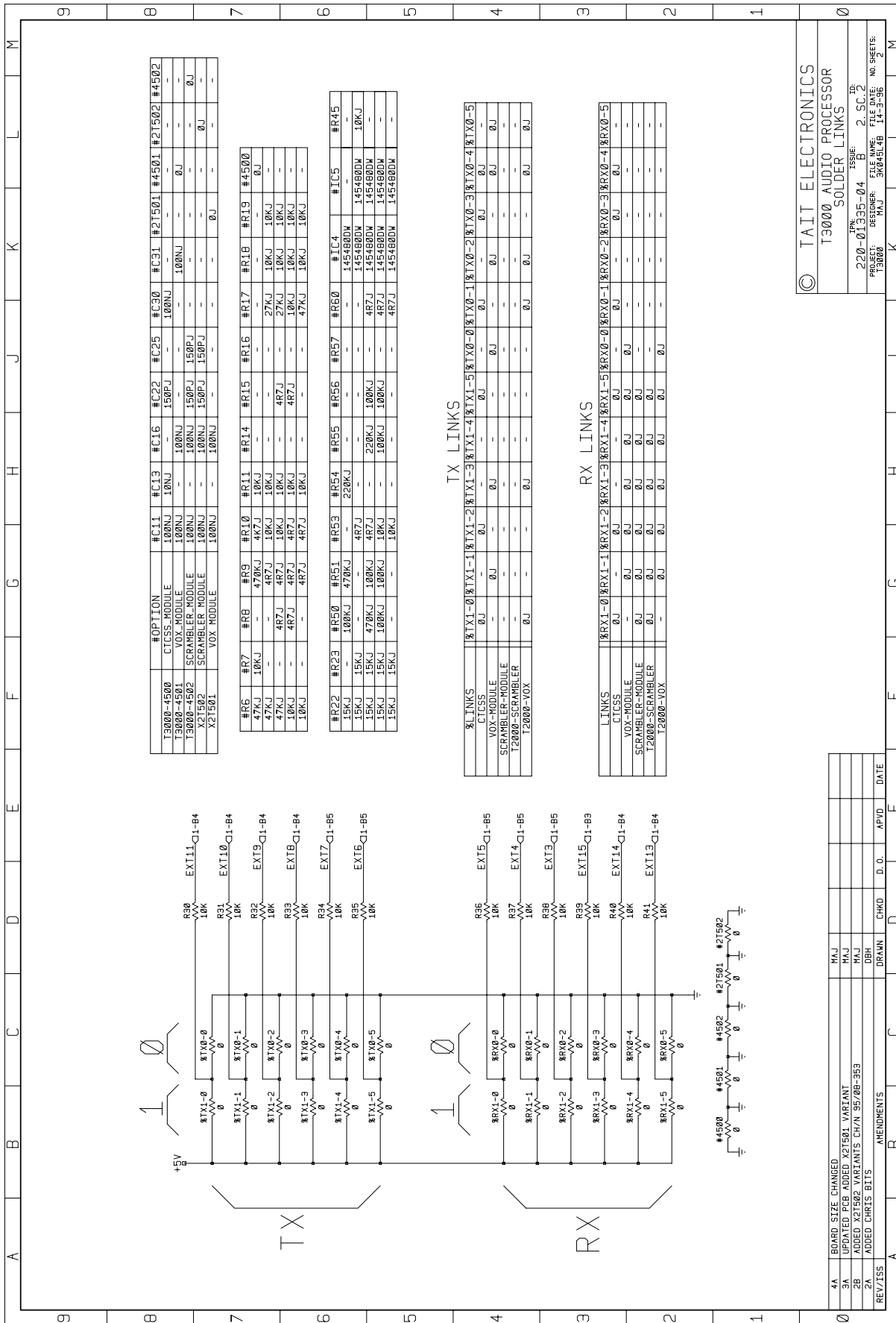
T2000-A450X PCB (IPN 220-01335-04) - Bottom Side



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 T3000 AUDIO PROCESSOR
 OPTIONS BOARD

LPN: 220-01335-04 ISSUE: 2, SC.1
 FILE NAME: SK045L4B
 PROJECT: T3000 DESIGNER: MAJ NO. SHEETS: 2

REV/ISS	AMENDMENTS	DATE	APVD	DATE
4A	BOARD SIZE CHANGED ADDED RX-GATE		MAJ	
3A	UPDATED PCB ADDED X2000-4501-VARIANT		MAJ	
2A	ADDED X2000-4502-VARIANT		DBH	
1A	SECOND TIME LOCK		MAJ	



	#OPTION	#C11	#C13	#C16	#C22	#C25	#C30	#C31	#21501	#4501	#21502	#4502
T3000-4500	CTCSS-MODULE	100NJ	10NJ	-	150PJ	-	100NJ	-	100NJ	-	0J	-
T3000-4501	VOX-MODULE	100NJ	-	100NJ	-	-	-	-	-	-	-	-
T3000-4502	SCRAMBLER-MODULE	100NJ	-	100NJ	150PJ	150PJ	-	-	-	-	-	0J
X21502	SCRAMBLER-MODULE	100NJ	-	100NJ	150PJ	150PJ	-	-	-	-	-	0J
X21501	VOX-MODULE	100NJ	-	100NJ	-	-	-	-	0J	-	-	-

#R6	#R7	#R8	#R9	#R10	#R11	#R14	#R15	#R16	#R17	#R18	#R19	#4500
47KJ	10KJ	-	470KJ	47J	10KJ	-	-	-	-	10KJ	10KJ	-
47KJ	-	-	47J	10KJ	10KJ	-	47J	27KJ	10KJ	10KJ	10KJ	-
47KJ	-	47J	47J	10KJ	10KJ	-	47J	27KJ	10KJ	10KJ	10KJ	-
10KJ	-	47J	47J	10KJ	10KJ	-	47J	27KJ	10KJ	10KJ	10KJ	-

#R22	#R23	#R50	#R51	#R53	#R54	#R55	#R56	#R57	#R60	#IC4	#IC5	#R45
15KJ	15KJ	100KJ	470KJ	-	220KJ	-	-	-	1454800N	-	-	10KJ
15KJ	15KJ	470KJ	47J	-	-	-	-	-	1454800N	1454800N	1454800N	10KJ
15KJ	15KJ	100KJ	100KJ	10KJ	10KJ	100KJ	100KJ	47J	1454800N	1454800N	1454800N	-
15KJ	15KJ	100KJ	100KJ	10KJ	10KJ	100KJ	100KJ	47J	1454800N	1454800N	1454800N	-

TX LINKS

#LINKS	#TX1-0	#TX1-1	#TX1-2	#TX1-3	#TX1-4	#TX1-5	#TX0-0	#TX0-1	#TX0-2	#TX0-3	#TX0-4	#TX0-5
CTCSS	0J	-	0J	-	0J	-	0J	-	0J	-	0J	-
VOX-MODULE	-	0J	-	0J	-	0J	-	0J	-	0J	-	0J
SCRAMBLER-MODULE	-	0J	-	0J	-	0J	-	0J	-	0J	-	0J
T2000-SCRAMBLER	-	0J	-	0J	-	0J	-	0J	-	0J	-	0J
T2000-VOX	0J	-	0J	-	0J	-	0J	-	0J	-	0J	-

RX LINKS

#LINKS	#RX1-0	#RX1-1	#RX1-2	#RX1-3	#RX1-4	#RX1-5	#RX0-0	#RX0-1	#RX0-2	#RX0-3	#RX0-4	#RX0-5
CTCSS	0J	-	0J	-	0J	-	0J	-	0J	-	0J	-
VOX-MODULE	-	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J
SCRAMBLER-MODULE	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J
T2000-SCRAMBLER	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J
T2000-VOX	-	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J	0J

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 T3000 AUDIO PROCESSOR
 SOLDER LINKS
 I.P.N. ISSUE: 2. SC.2
 PROJECT: 220-01395-04 B
 FILE NAME: 36065103
 FILE DATE: 14-3-98
 TAU NO. SHEETS: 2

REV/ISS	AMENDMENTS	DRAWN	CHKD	D.O.	APVD	DATE
1A	BOARD SIZE CHANGED	MJJ				
1B	ADDED CTCSB	MJJ				
2B	ADDED X21502 PARTS CHN 55/08-953	MJJ				
2C	ADDED X21501 PARTS CHN 55/08-953	DRH				