

## TY91 Commentary on Transmitter Parts Changes

Version 1.0, January 12, 2022

### Introduction

The changes to the transmitter for the Class II permissive change do not modify the architecture of the block functions, including frequency, modulation circuit, maximum power, or field strength. Specifically, the PCB layout and parts changes do not change the device's form or functional specification as previously granted/approved.

The modifications to the transmitter board were necessitated by impending exhaustion of stocks of the parts used in the transmitter. Other changes were made to improve the manufacturing yield and incorporate an off-board filter with an equivalent filter on the transmitter board.

The changes to the parts list are therefore limited to these non-substantive changes to the transmitter and are primarily concerned with the integration and matching of replacement parts into the design.

### Change Detail

The following table details the new parts list with reference to the previous transmitter parts list. As some component references have been changed (mostly without value changes), a reference is made to the previous component reference. In addition, a comment is made for every component that has had a value change in order to describe the non-substantive nature of the change.

Item	New Submission Data		Previous Grant data		Comment on any change (blank if unchanged)
	Reference	Value	Previous Reference	Previous Value	
1A	C1	100n 16V	C1	100n 16V	
1B	C2	100n 16V	C2	100n 16V	
2A	C3	22n 20%	C3	1n 100V	Minor improvement to modulated supply filter
2B	C4	22n 20%	C4	10n 200V	Minor design improvement to reduce component count
3A	C5	10n	C6	10n	
1C	C6	100n 16V	C103	100n 16V	
4A	C7	47p 200V 1%	C7	24p 150V	Minor change for drive transistor match.
5A	C8	DNF	N/A (New)	-	Space allocated but no component added
6A	C9	1n 100V	C8	1n 100V	
7A	C10	27p	C9	10p	Minor change to Antibroadcast filter
8A	C11	15p	C10	10p	Minor change to Antibroadcast filter
8B	C12	15p	C11	10p	Minor change to Antibroadcast filter
8C	C13	15p	C12	10p	Minor change to Antibroadcast filter
9A	C14	12p 100V	C13	10p	Minor change to Antibroadcast filter
10A	C15	110p	C15	39p	Minor change for PA transistor drive
4B	C16	47p 200V 1%	C18	24p 150V	Minor change for PA transistor match
11A	C17	22p 200V 1%	C14	68p 150V	Minor change for PA transistor match
12A	C18	82p 200V 2%	C17	82p 150V	Minor change for PA transistor drive
13A	C19	110p 250V 1%	C16	100p 150V	Minor change for PA transistor match
14A	C20	39p	C19	27p	Minor change for PA transistor match
15A	C21	DNF	C20	DNF	
15B	C22	DNF	C21	8p2	Minor change to Antibroadcast filter
16A	C23	22p	C22	4p7	Minor change to Antibroadcast filter

17A	C24	2p7	C23	DNF	Minor change to Antibroadcast filter
15C	C25	DNF	C24	8p2	Minor change to Antibroadcast filter
7B	C26	27p	C25	6p8	Minor change to Antibroadcast filter
15D	C27	DNF	C26	68p	Minor change for drive transistor match.
2C	C28	22n 20%	C28	10n 200V	Minor change for PA transistor match
2D	C29	22n 20%	C101	10n	Minor change to harmonic filter
10B	C30	110p	C89	10n	Minor change to interstage match
10C	C31	110p	C90	10n	Minor change to interstage match
10D	C32	110p	C29	1n 100V	Minor change to interstage match
18A	C33	1n	C58	1n	
5B	C34	DNF	C31	2p2 150V	Minor change for PA transistor match
11B	C35	22p 200V 1%	C30	12p 150V	Minor change for PA transistor match
5C	C36	DNF	C33	DNF	
18B	C37	1n	C37	1n	
19A	C38	27p 200V 1%	C34	27p 150V	
5D	C39	DNF	C35	DNF	
5E	C40	DNF	C36	6p8 150V	Minor change to harmonic filter
20A	C41	3p9 200V $\pm$ 0.1p	N/A (New)	-	Minor change to harmonic filter
21A	C42	1.2p 200V $\pm$ 0.1p	N/A (New)	-	Minor change to harmonic filter
18C	C43	1n	C65	1n	
22A	C44	150p 10%	C41	150p	
22B	C45	150p 10%	C42	150p	
23A	C46	5p6 200V $\pm$ 0.1p	N/A (New)	-	Minor change to harmonic filter
24A	C47	12p 200V 1%	C38	18p 150V	Minor change to harmonic filter
20B	C48	3p9 200V $\pm$ 0.1p	C39	DNF	Minor change to harmonic filter
25A	C49	470p	C45	470p	
1D	C50	100n 16V	C71	100n 16V	
19B	C51	27p 200V 1%	C43	DNF	Minor change to coupler
5F	C52	DNF	N/A (New)	-	Space allocated but no component added
26A	C53	1n 100V	N/A (New)	-	Minor change to include GNSS filter
27A	C54	100p	C44	DNF	Minor change to coupler
28A	C55	3p3 200V $\pm$ 0.1p	N/A (New)	-	Minor change to include GNSS filter
29A	C56	100n	C47	100n 50V	
1E	C57	100n 16V	C48	100n 16V	
30A	C58	10n	C49	10n	
1F	C59	100n 16V	C100	100n 16V	
1G	C60	100n 16V	C106	100n 16V	
31A	C61	220n	C55	220n 50V	
2E	C62	22n 20%	C91	10n	Minor change to driver transistor match
30B	C63	10n	C50	10n	
32A	C64	33p	C107	33p	
15E	C65	DNF	C108	DNF	
15F	C66	DNF	C53	DNF	
8D	C67	15p	C56	15p	
8E	C68	15p	C57	15p	
33A	C69	56p	C59	DNF	Minor change to driver transistor match

15G	C70	DNF	C60	DNF	
32B	C71	33p	C61	33p	
15H	C72	DNF	C63	DNF	
15I	C73	DNF	C67	DNF	
30C	C74	10n	C62	10n	
34A	C75	18p	C64	18p	
16B	C76	22p	C68	68p	Minor change to driver transistor match
30D	C77	10n	N/A (New)	-	Minor change to driver transistor match
35A	C78	47n 25V	C72	47n 25V	
29B	C79	100n	C70	100n 50V	
36A	C80	2u2 100V	C88	2u2 100V	
37A	C81	680p 10%	C73	680p	
38A	C82	100n 100V	C94	100n 100V	
36B	C83	2u2 100V	C105	2u2 100V	
1H	C84	100n 16V	C74	100n 16V	
1I	C85	100n 16V	C75	100n 16V	
1J	C86	100n 16V	C97	100n 16V	
38B	C87	100n 100V	C87	100n 100V	
36C	C88	2u2 100V	C86	2u2 100V	
36D	C89	2u2 100V	C98	2u2 100V	
37B	C90	680p 10%	C78	680p	
27B	C91	100p	C79	100p	
39A	C92	10n 200V	C80	10n 200V	
37C	C93	680p 10%	C96	680p	
36E	C94	2u2 100V	C76	2u2 100V	
36F	C95	2u2 100V	C99	2u2 100V	
1K	C96	100n 16V	C81	100n 16V	
30E	C97	10n	C82	10n	
27C	C98	100p	C104	100p	
40A	C99	390p 100V	C77	390p	
1L	C100	100n 16V	C83	100n 16V	
41A	C101	33n 100V	C93	33n 100V	
37D	C102	680p 10%	C95	680p	
30F	C103	10n	C84	10n	
42A	C104	22n	C85	22n	
43A	D1	UPP1002	D1	UPP1002	
43B	D2	UPP1002	N/A (New)	-	Minor improvement in T/R switch
43C	D3	UPP1002	D2	UPP1002	
44A	D4	BAS70-04	D6	HSMS 2802	
44B	D5	BAS70-04	D5	HSMS 2812	Minor improvement in T/R switch
45A	D6	BZX84C10	D7	BZX84C8V2	Minor improvement in diode choice
46A	D7	STPS3150	D13	STPS3150	
46B	D8	STPS3150	D14	STPS3150	
44C	D9	BAS70-04	D9	BAS70-05/SOT	
47A	J1	PAD	J1	PAD	
47B	J3	PAD	J2	PAD	

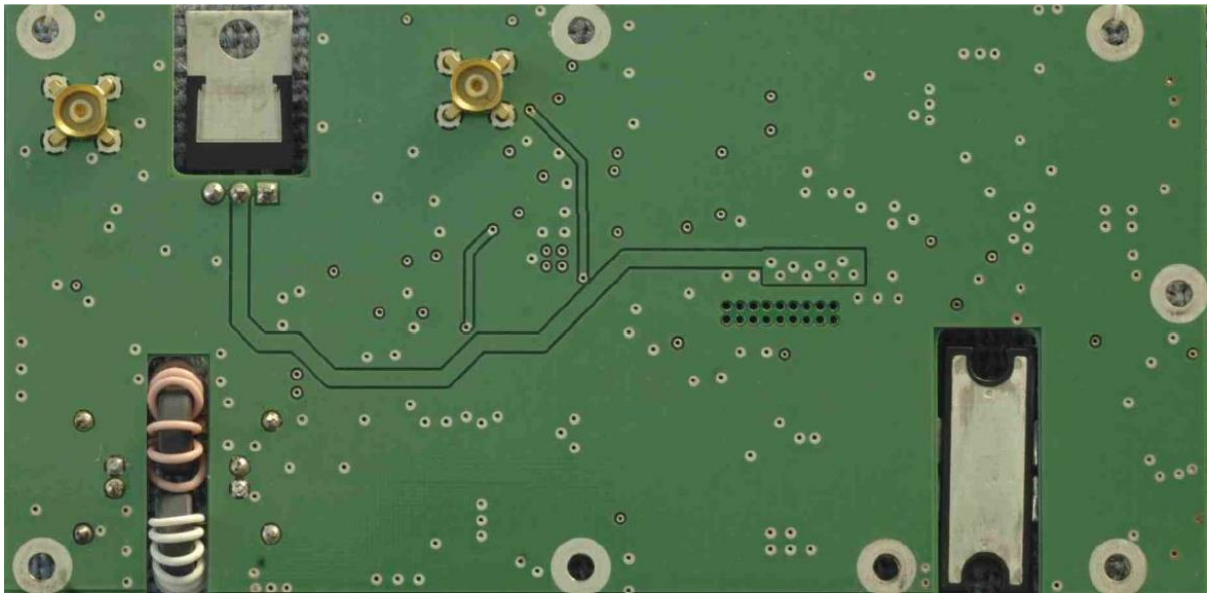
48A	J4	CON18A	J3	CON18A	
49A	L1	BEAD 3A	L1	BEAD	
50A	L2	BEAD 12A	L2	BEAD 6A	Minor improved filter on Modulated supply.
51A	L3	56nH	L4	82nH	Change to standard inductor packaging from custom wound.
52A	L4	27nH	L3	47nH	Change to standard inductor packaging from custom wound.
53A	L5	33nH	L5	68nH	Minor improvement to anti-broadcast filter.
53B	L6	33nH	L6	68nH	Minor improvement to anti-broadcast filter.
53C	L7	33nH	L7	68nH	Minor improvement to anti-broadcast filter.
54A	L8	8nH	L8	21mm of 1.2mm wire U	Change to standard inductor packaging from custom wound.
55A	L9	47nH	L9	82nH	Minor change to PA bias and change to standard inductor packaging from custom wound.
56A	L10	33nH	N/A (New)	-	Minor improvement to PA bias.
57A	L11	12n1H	L10	5nH	Minor improvement to PA bias.
58A	L12	68nH	L11	110nH	Minor improvement to harmonic filter and change to standard inductor packaging from custom wound.
58B	L13	68nH	L12	50nH	Minor improvement to harmonic filter and change to standard inductor packaging from custom wound.
58C	L14	68nH	L13	56nH	Minor improvement to harmonic filter and change to standard inductor packaging from custom wound.
59A	L15	BK1608HS102-T	L16	1uH	Minor improvement for manufacturability through use of standard inductor packaging.
49B	L16	BEAD 3A	N/A (New)	-	Minor improvement to supply filter
59B	L17	BK1608HS102-T	L17	1uH	Minor improvement for manufacturability through use of standard inductor packaging.
60A	L18	12n5H	N/A (New)	-	Minor addition of GNSS band filter
61A	L19	1u3H	N/A (New)	-	Minor addition of GNSS band filter
62A	L20	15uH	L18	15uH	
62B	L21	15uH	L19	15uH	
53D	L22	33nH	L20	33nH	
63A	L23	820nH	L23	12n5H	Minor change for drive transistor match.
53E	L24	33nH	L24	33nH	
64A	L25	56nH	N/A (New)	-	Drive transistor matching.
65A	L26	68nH	N/A (New)	-	Drive transistor matching.
66A	L27	680nH	L25	680nH	Minor change to package.
67A	Q1	Si2308	Q1	Si2308	
68A	Q2	MRFE6VP5150GNR1	Q2	MRF6V2150	Replacement part for obsolete PA transistor
67B	Q3	Si2308	Q8	Si2308	
69A	Q4	MMBT3906	Q3	MMBT3906/SOT	
69B	Q5	MMBT3906	Q4	MMBT3906/SOT	
67C	Q6	Si2308	Q5	Si2308	
70A	Q7	AFT05MS004NT1	Q6	MRF1513NT1	Replacement part for obsolete driver transistor
71A	Q8	BFU590GX	Q7	BFG35	Replacement part for obsolete transistor
72A	Q9	MMBT3904	Q14	MMBT3904/SOT	
73A	Q10	PBSS304	Q11	PBSS304	
74A	Q11	BC846B	Q13	BC846B	
75A	Q12	D44H11G	Q12	D44H11G	
76A	R1	10k	R1	10k	
77A	R2	100k	R3	100k	
78A	R3	82R 0.4W	R4	82R 0.4W	

78B	R4	82R 0.4W	R5	82R 0.4W	
76B	R5	10k	R67	10k	
76C	R6	10k	R66	10k	
77B	R7	100k	R35	100k	
79A	R8	47k Thermistor	R7	47k Thermistor	
80A	R9	0R22 0.25W	R8	0R22 0.25W	
81A	R10	220k	R56	220k	
82A	R11	1k0	R9	1k0	
83A	R12	4k7	N/A (New)	-	Minor addition for manufacturing test point
84A	R13	47R	N/A (New)	-	Minor addition for manufacturing test point
77C	R14	100k	R6	100k	
85A	R15	3K3	R11	3K3	
86A	R16	1k8	R12	2k2	Minor value change for match adjustment
87A	R17	2k2 0.125W	R75	2k2 0.125W	
88A	R18	56R	R13	56R	
76D	R19	10k	R31	5k6	Minor improvement in supply filter
89A	R20	DNF	R37	DNF	
89B	R21	DNF	N/A (New)	-	
90A	R22	10k Trim	R65	10k Trim	
91A	R23	1k 0.125W	R17	100R 0.25W	Minor value change for match adjustment
92A	R24	2R2 0.125W	R71	2R2 0.125W	
93A	R25	82R	R18	82R	
94A	R26	4R7 0.25W	R19	4R7 0.25W	
77D	R27	100k	R20	100k	
95A	R28	1k2	R21	1k2	
96A	R29	10R 0.125W	R74	10R 0.125W	
89C	R30	DNF	R23	DNF	
82B	R31	1k0	R24	1k0	
89D	R32	DNF	R25	DNF	
89E	R33	DNF	R26	DNF	
96B	R34	10R 0.125W	R27	10R 0.125W	
97A	R35	22R	R29	22R	
98A	R36	0R	R28	0R	
94B	R37	4R7 0.25W	R32	4R7 0.25W	
94C	R38	4R7 0.25W	R33	4R7 0.25W	
82C	R39	1k0	R30	1k0	
84B	R40	47R	R55	47R	
99A	R41	8k2	R36	10k	Minor manufacturing improvement
100A	R42	220R	R70	220R	
101A	R43	2k2	R73	12k	
101B	R44	2k2	R72	2k2	
102A	R45	18k	R34	18k	
95B	R46	1k2	R38	1k5	Minor manufacturing improvement
76E	R47	10k	R39	10k	
103A	R48	10R 0.25W	R48	10R 0.25W	
103B	R49	10R 0.25W	R41	10R 0.25W	

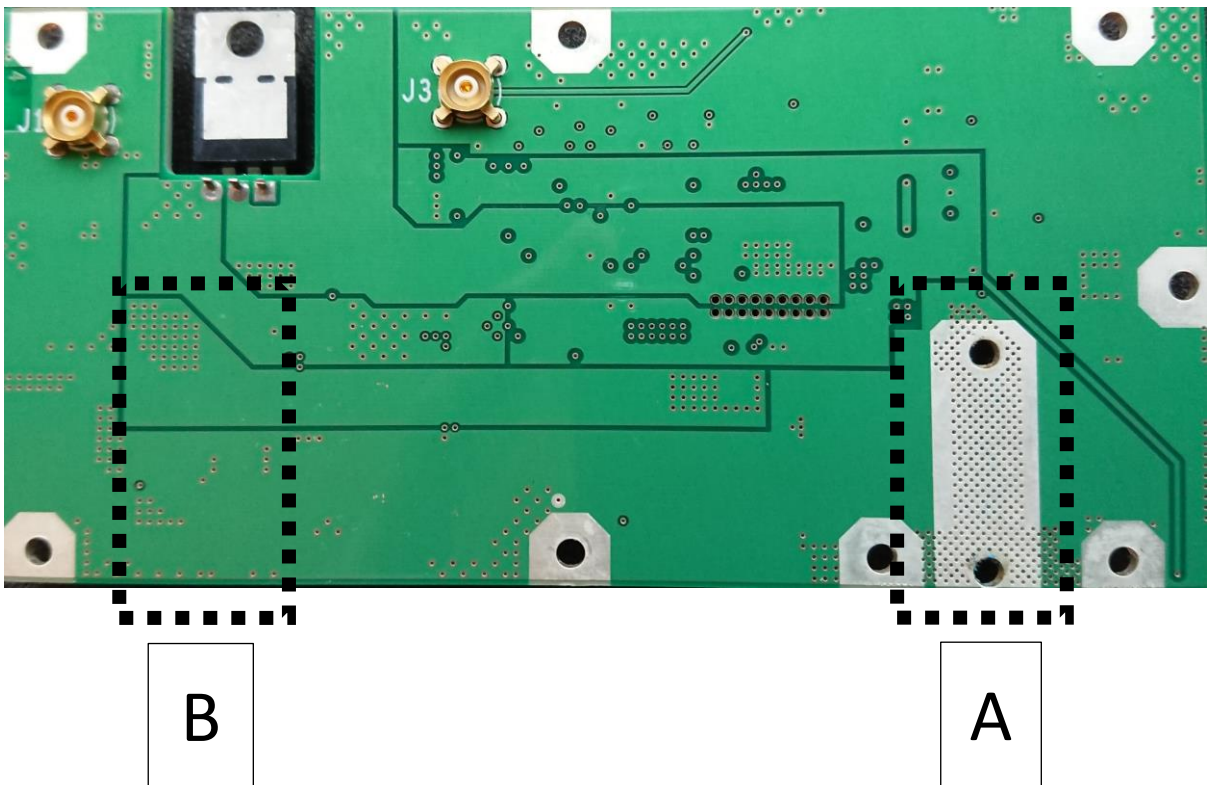
97B	R50	22R	R42	22R	
103C	R51	10R 0.25W	R64	10R 0.25W	
76F	R52	10k	R43	10k	
104A	R53	470R 0.4W	R47	470R 0.4W	
83B	R54	4k7	R44	4k7	
105A	R55	12k	R53	12k	
104B	R56	470R 0.4W	R46	470R 0.4W	
82D	R57	1k0	R49	1k0	
106A	R58	680R	R58	680R	
107A	R59	100R	R52	100R	
76G	R60	10k	R59	10k	
84C	R61	47R	R57	47R	
94D	R62	4R7 0.25W	R45	4R7 0.25W	
108A	R63	2k7 0.25W	R60	2k7 0.25W	
83C	R64	4k7	R63	4k7	
94E	R65	4R7 0.25W	R40	4R7 0.25W	
109A	R66	6k8	R50	6k8	
110A	R67	470R 0.125W	R61	470R 0.125W	
111A	R68	3k9 0.25W	R68	DNF 0.25W	Minor manufacturing improvement
112A	R69	2k7	R51	2k7	
105B	R70	12k	R62	12k	
110B	R71	470R 0.125W	R69	470R 0.125W	
113A	U1	LTC6246IS6	U1	LTC6246IS6	
113B	U2	LTC6246IS6	U2	LTC6246IS6	
113C	U3	LTC6246IS6	U3	LTC6246IS6	

## PCB Change Overview

Previous Transmitter Bottom

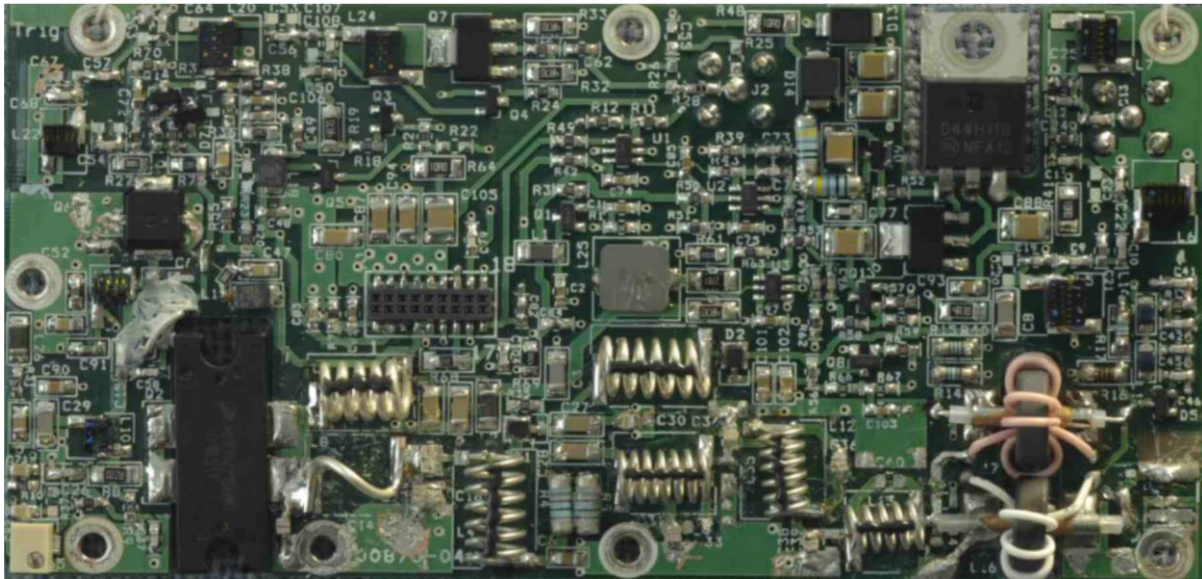


New Transmitter Bottom

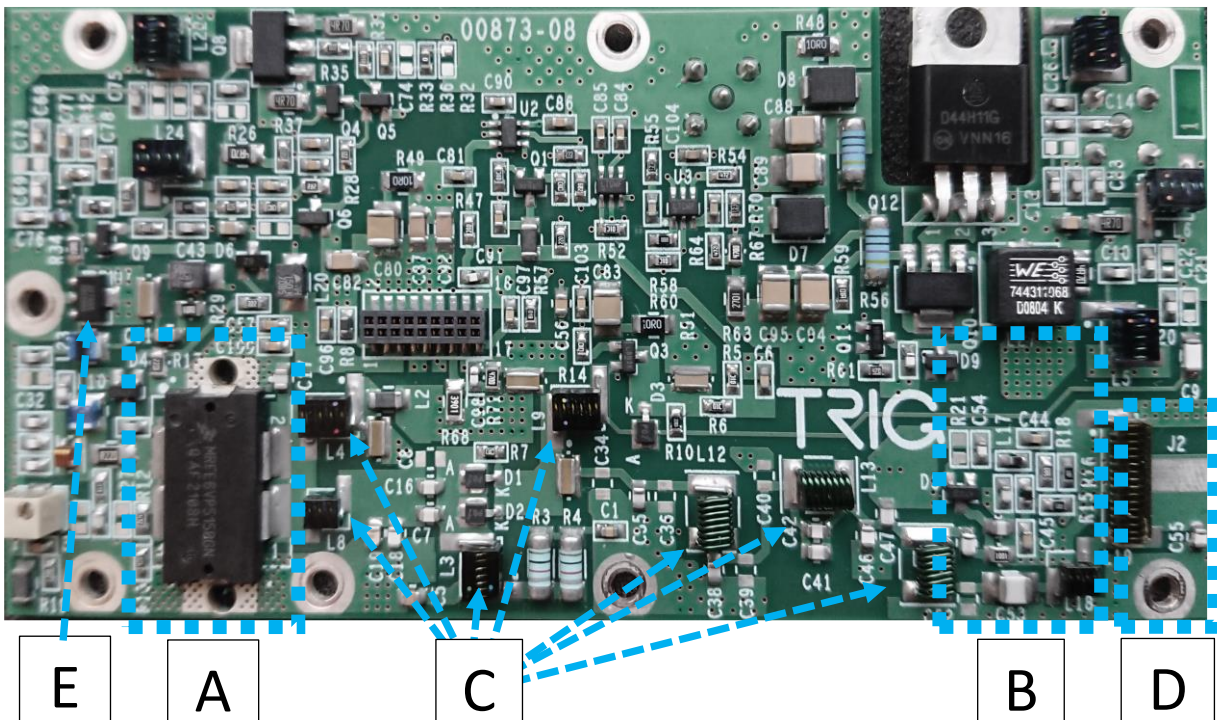


Item	Description
A	Replaced obsolete through board PA (Q2: MRF6V2150) with surface mount PA (Q2: MRFE6VP5150GNR1).
B	Replaced 2 X through board custom ferrites (L16 and L17, Hybrid Transformers) with standard surface mount devices (L15 and L17).

Previous Transmitter Top



New Transmitter Top



Item	Description
A	Replaced obsolete through board PA Q2 (MRF6V2150) with surface mount Q2 (MRFE6VP5150GNR1).
B	Replaced 2 X through board custom ferrites (L16 and L17, Hybrid Transformers) with standard surface mount devices (L15 and L17).
C	Replaced custom wound inductors (L3, L4, L8, L9, L11, L12, L13) with standard inductor packages (L3, L4, L8, L9, L12, L13, L14).
D	Addition of GNSS band filter.
E	Replaced obsolete driver transistor Q6 (MRF1513NT1) with Q7 (AFT05MS004NT1).