

FCC/MELLON

DEC 02 1998

CETECOM

CETECOM ICT Services GmbH

Radio Satellite Communication

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RSC11

issue test report consist of 23 Pages

Page 1 (23)

Akkreditiertes Prüflaboratorium

DAR-Registriernummer:
TTI-P-G 066/94-70 vom 16.03.98

Test report no.: 2_0528-B/98
FCC Rule 90.217 and 90.238(e) / USA
TC 917

Table of Contents

1 General information

1.1 Notes

1.2 Testing laboratory

1.3 Details of applicant

1.4 Application details

1.5 Test item

1.6 Test standards

2 Technical test

2.1 Summary of test results

2.2 Test report

1 General information

1.1 Notes

The test results of this test report relate exclusively to the item tested as specified in 1.5.

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1.2 Testing laboratory

CETECOM ICT Services GmbH

66117 Saarbrücken

Untertürkheimer Straße 6 - 10

Deutschland

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Internet :

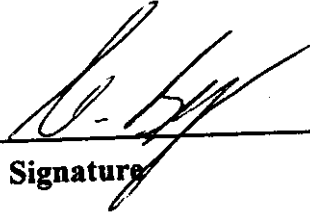
Accredited testing laboratory**DAR-registration number : TTI-P-G-066/94-70 vom 16.03.98****1.3 Details of applicant****Name** : Ceotronics AG**Street** : Adam-Opel-Str. 6**City** : D-63322 Rödermark**Country** : Germany**Telephone** : +49(0)6074 / 8751-0**Telefax** : +49(0)6074 / 8751-76**Contact** : Mr. Gerald Schwerer**Telephone** : +49(0)6074 / 8751-46**1.4 Application details****Date of receipt of application** : 01.09.98**Date of receipt of test item** : 01.09.98**Date of test** : 02.09.98**1.5 Test item****Type of equipment** : Low Power Device for short range communications**Type designation** : TC 917**Manufacturer** : applicant**Street** :**City** :**Country** :**Serial number** : -.-**Additional informations:** :**Frequency** : 450 - 470 MHz / 16K0G3E**Channel separation:** 25 kHz**Number of channels** : 16**Antenna** : BNC socket**Power supply** : 7.2V NC accu**Unmodulated carrier** : not possible**1.6 Test standards: FCC Rule Part 90.217 and 90.238**

2 Technical test**2.1 Summary of test results**

No deviations from the technical specification(s) were ascertained in the course of the tests performed.

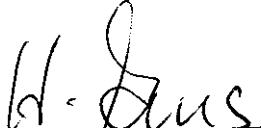
Technical responsibility for area of testing :

17.09.98	RSC 8411	Berg
Date	Section	Name


Signature

Technical responsibility for area of testing :

17.09.98	RSC8414	Ames
Date	Section	Name


Signature

2.2 Testreport

TEST REPORT

Testreport no. : 2_0528-B/98

TEST REPORT REFERENCE**LIST OF MEASUREMENTS**

Paragraph	PARAMETER TO BE MEASURED	PAGE
	Transmitter parameters	
§ 2.985	RF Power Output	7
§ 2.987(a)	Modulation Characteristics	8
§ 2.987(b)	Modulation Limiting	8
§ 2.989	Occupied Bandwidth	9
§ 2.991	Spurious Emissions at Antenna Terminals	10
§ 2.993	Field Strength of Spurious Emissions	11
§ 2.995	Frequency Stability	12
	Receiver parameters	
§ 15.111	Receiver Antenna Power Conduction	13
	Test equipment listing	14
	Photographs of the equipment	16

Equipment under test : TC 917
 Ambient temperature : 23°C
 Relative humidity : 54%

RF POWER OUTPUT**SUBCLAUSE § 2.985**

TEST CONDITIONS		POWER OUTPUT (mW)		
Frequency (MHz)		460.01		
$T_{\text{nom}}(23)^{\circ}\text{C}$	$V_{\text{nom}}(7.2)\text{V}$	73.8		
Maximum deviation from output power under extreme test conditions (dBc)		0.6		
Measurement uncertainty		$\pm 3\text{dB}$		

LIMIT**SUBCLAUSE § 90.217**

Frequency range	RF power output
Part 90 Subpart B and C	$\leq 120\text{ mW}$

Equipment under test : TC 917

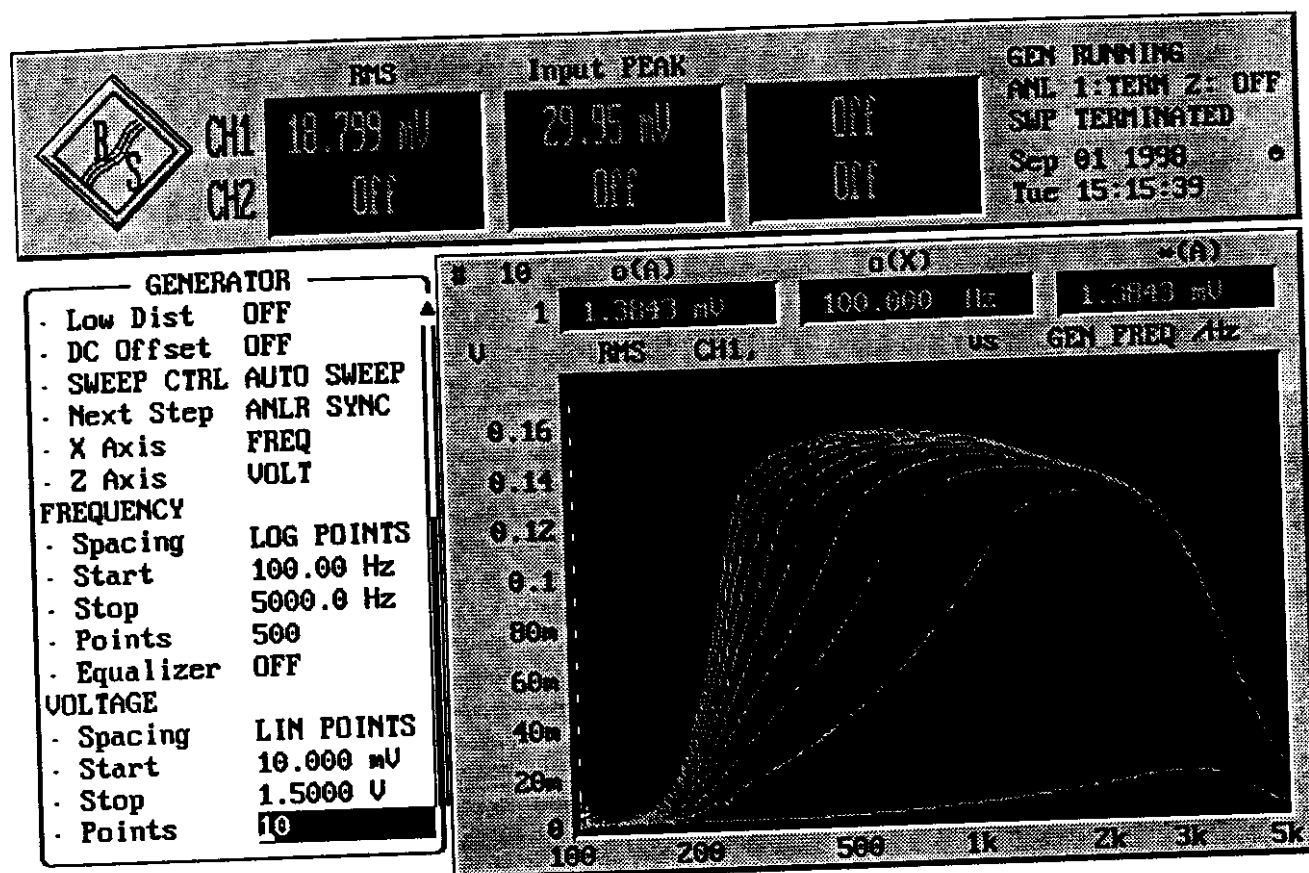
Ambient temperature : 23°C

Relative humidity : 54%

MODULATION CHARACTERISTICS

SUBCLAUSE § 2.987 (a)

Frequency Response



MODULATION LIMITING

SUBCLAUSE § 2.987(b)

TEST CONDITIONS		MAXIMUM DEVIATION (kHz)		
Frequency (MHz)		460.01		
$T_{nom}(23)^{\circ}C$	$V_{nom}(7.2)V$	4.8		
Limit		5 kHz		
Measurement uncertainty		$\pm 5 \%$		

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

04, 05, 51

Equipment under test : TC 917

Ambient temperature : 23°C

Relative humidity : 54%

OCCUPIED BANDWIDTH

SUBCLAUSE 2.989 (c) (1)

TEST CONDITIONS		OCCUPIED BANDWIDTH (kHz)		
Frequency (MHz)		460.01		
T _{nom} (23)°C	V _{nom} (7.2)V	11.14		
Measurement uncertainty		±3dB		

MODE OF OPERATION:

- AF : 2500 Hz
- Level : 312.6 mV (16 dB above 34 mV/50% Modulation)

LIMIT

Occupied bandwidth shall not exceed 25 kHz

Equipment under test : TC 917

Ambient temperature : 23°C

Relative humidity : 54%

SPURIOUS EMISSIONS AT ANTENNA TERMINALS SUBCLAUSE § 2.991

SPURIOUS EMISSIONS				
460.01 MHz				
f (MHz)	amplitude of emission (dBm)	limit max. allowed emmission power (P_m-31,54db)	actual attenuation below frquency of operation (dB)	results
460.01	+18.54	-13	0	Freq. of operation
920.02	-32.10	-13	50.64	complies
1380.03	-46.70	-13	62.24	complies
1840.05	-53.90	-13	72.44	complies
2300.22	-62.60	-13	81.14	complies
3220.07	-63.80	-13	82.34	complies
3680.08	-61.80	-13	80.34	complies
4140.09	-53.60	-13	72.14	complies
4600.10	-69.60	-13	88.14	complies
5060.11	-72.10	-13	90.64	complies
Measurement uncertainty		± 3dB		

Limits

FREQUENCY	LIMIT
$f_d > 5 \text{ kHz and } < 10 \text{ kHz}$	$83 \text{ Log}(f_d/5) \text{ dB}$
$f_d > 10 \text{ kHz and } < 50 \text{ kHz}$	the least of $116 \text{ Log}(f_d/6.1) \text{ dB}$ or $50 + 10 \text{ Log}(P)$ or 70 dB
$f_d > 50 \text{ kHz}$	the lesser of 80 dB or $43 + 10 \text{ Log}(P)$

In this case : $43 + 10 \text{ Log}(P) = 43 + 10 \text{ Log}(0,071) = 43 - 11.46 = 31.54$

Equipment under test : TC 917

Ambient temperature : 23°C

Relative humidity : 54%

FIELD STRENGTH OF SPURIOUS EMISSIONS SUBCLAUSE § 2.993(a)

SPURIOUS EMISSIONS					
460.01 MHz					
f (MHz)	polarization	amplitude of emission (dBm)	limit max. allowed emission power (P_{no})	actual attenuation below frequency of operation (dB)	results
460.01	vertical	+12.7			Freq. of operation
920.02	vertical	-41.8	-31.54	-54.5	complies
1380.03	vertical	-54.4	-31.54	-67.1	complies
1840.05	vertical	-48.1	-31.54	-60.8	complies
2300.22	vertical	-55.9	-31.54	-68.6	complies
2760.06	vertical	-51.6	-31.54	-64.3	complies
3220.07	vertical	-51.5	-31.54	-64,2	complies
460.01	horizontal	+8.2			Freq. of operation
920.02	horizontal	-49.5	-31.54	-62.2	complies
1380.03	horizontal	-57.1	-31.54	-69.8	complies
2300.22	horizontal	-44.7	-31.54	-57.4	complies
2760.06	horizontal	-52.1	-31.54	-64,8	complies
3220.07	horizontal	-43.5	-31.54	-56.2	complies
Measurement uncertainty		± 3dB			

Limits

FREQUENCY	LIMIT
$f_d > 5 \text{ kHz and } < 10 \text{ kHz}$	$83 \text{ Log}(f_d/5) \text{ dB}$
$f_d > 10 \text{ kHz and } < 50 \text{ kHz}$	the least of $116 \text{ Log}(f_d/6.1) \text{ dB}$ or $50 + 10 \text{ Log}(P)$ or 70 dB
$f_d > 50 \text{ kHz}$	the lesser of 80 dB or $43 + 10 \text{ Log}(P)$

In this case : $43 + 10 \text{ Log}(P) = 43 + 10 \text{ Log}(0,071) = 43 - 11.46 = 31.54$

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

Equipment under test : TC 917

Ambient temperature : 23°C

Relative humidity : 54%

TRANSMITTER FREQUENCY STABILITY vs. TEMPERATURE AND BATTERY VOLTAGE
SUBCLAUSE § 2.995

Power level at which the measurement has been performed: 71.5 mW

TEST CONDITIONS		FREQUENCY ERROR (kHz)	
Frequency (MHz)		460.01 MHz	
Temperature (°C)	Voltage (V)	Frequency error (kHz)	Limit (kHz)
-30	6.48	-2.17	± 2.30
-30	7.20	-1.11	± 2.30
-20	6.48	-0.82	± 2.30
-20	7.20	+0.31	± 2.30
-10	6.48	-0.39	± 2.30
-10	7.20	+0.77	± 2.30
0	6.48	-0.64	± 2.30
0	7.20	+0.63	± 2.30
+10	6.48	-1.45	± 2.30
+10	7.20	+0.01	± 2.30
+20	6.48	-0.62	± 2.30
+20	7.20	+0.07	± 2.30
+30	6.48	-1.81	± 2.30
+30	7.20	-0.42	± 2.30
+40	6.48	-1.86	± 2.30
+40	7.20	-0.43	± 2.30
+50	6.48	-1.88	± 2.30
+50	7.20	-0.50	± 2.30
Maximum freq. error (kHz)		-2.17	
Measurement uncertainty		±1x10 ⁻⁷	

SUBCLAUSE § 2.995

Limit

Frequency tolerance of ± 0.0005 %

REFERENCE NUMBER(S) OF TEST EQUIPMENT USED
(for reference numbers see test equipment listing)

01, 02, 05

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
01	Spectrum Analyzer	8566 A	Hewlett-Packard	1925A00257
02	Analyzer Display	8566 A	Hewlett-Packard	1925A00860
03	Oscilloscope	7633	Tektronix	230054
04	Radio Analyzer	CMTA 54	Rohde & Schwarz	894 043/010
05	System Power Supply	6038 A	Hewlett-Packard	2848A07027
06	Signal Generator	8111 A	Hewlett-Packard	2215G00867
07	Signal Generator	8662 A	Hewlett-Packard	2224A01012
08	Funktionsgenerator	AFGU	Rohde & Schwarz	862 480/032
09	Regeltrenntrafo	MPL	Erft	91350
10	Netznachbildung	NNLA 8120	Schwarzbeck	8120331
11	Relais-Matrix	PSU	Rohde & Schwarz	893 285/020
12	Power-Meter	436 A	Hewlett-Packard	2101A12378
13	Power-Sensor	8484 A	Hewlett-Packard	2237A10156
14	Power-Sensor	8482 A	Hewlett-Packard	2237A00616
15	Modulationsmeter	9008	Racal-Dana	2647
16	Frequenzzähler	5340 A	Hewlett-Packard	1532A03899
17	Absorber Schirmkabine	---	MWB	87400/002
18	Spectrum Analyzer	85660 B	Hewlett-Packard	2747A05306
19	Analyzer Display	85662 A	Hewlett-Packard	2816A16541
20	Quasi Peak Adapter	85650 A	Hewlett-Packard	2811A01131
21	RF-Preselector	85685 A	Hewlett-Packard	2833A00768
22	Biconical Antenne	3104	Emco	3758
23	Log. Per. Antenne	3146	Emco	2130
24	Double Ridge Horn	3115	Emco	3088
25	EMI-Testreceiver	ESAI	Rohde & Schwarz	863 180/013
26	EMI-Analyzer-Display	ESAI-D	Rohde & Schwarz	862 771/008
27	Biconical Antenne	HK 116	Rohde & Schwarz	888 945/013
28	Log. Per. Antenne	HL 223	Rohde & Schwarz	825 584/002
29	Relais-Switch-Unit	RSU	Rohde & Schwarz	375 339/002
30	Highpass	HM985955	FSY Microwave	001
31	Amplifier	P42-GA29	Tron-Tech	B 23602
32	Absorber Schirmkabine		Frankonia	
33	Steuerrechner	PSM 7	Rohde & Schwarz	834 621/004
34	EMI Test Receiver	ESMI	Rohde & Schwarz	827 063/010
35	EMI Test Receiver	Display	Rohde & Schwarz	829 808/010

TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

No	Instrument/Ancillary	Type	Manufacturer	Serial No.
36	Controler	HD 100	Deisel	100/322/93
37	Relais Matrix	PSN	Rohde & Schwarz	829 065/003
38	Control Unit	GB 016 A2	Rohde & Schwarz	344 122/008
39	Relais Switch Unit	RSU	Rohde & Schwarz	316 790/001
40	Power Supply	6032A	Hewlett Packard	2846A04063
41	Spektrum Monitor	EZM	Rohde & Schwarz	883 720/006
42	Meßempfänger	ESH 3	Rohde & Schwarz	890 174/002
43	Meßempfänger	ESVP	Rohde & Schwarz	891 752/005
44	Biconi Ant. 20-300MHz	HK 116	Rohde & Schwarz	833 162/011
45	Logper Ant. 0.3-1 GHz	HL 223	Rohde & Schwarz	832 914/010
46	Amplifier 0.1-4 GHz	AFS4	Miteq Inc.	206461
47	Logper Ant. 1-18 GHz	HL 024 A2	Rohde & Schwarz	342 662/002
48	Polarisationsnetzwerk	HL 024 Z1	Rohde & Schwarz	341 570/002
49	Double Ridge G Horn Antenne 1-26.5 GHz	3115	EMCO	9107-3696
50	Microw. Sys. Amplifier 0.5- 26.5 GHz	8317A	Hewlett Packard	3123A00105
51	Audio Analyzer	UPD	Rohde & Schwarz	1030.7500.04
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TC 917

Transmitter/Receiver

for wireless communication over short distances

Technical Specification for TC 917 Frequency Range 450.00...470.00 MHz

Overview

- Part 1 TC 917 Variants and Construction • Technical Data
- Part 2 Operating Instruction
- Part 3 Functional Description
- Part 4 Block Diagram, Circuit Diagrams, PCB Layouts, Parts Lists
TC 917 Frequency Range 450.00...470.00 MHz
- Part 5 Photos

TC 917

Transmitter/Receiver

for wireless communication over short distances

Technical Specification

**Part 1 TC 917 Variants and Construction
Technical Data**

TC 917 Variants and Construction

(1) General

The TC 917 is a transmitter/receiver for wireless (simplex or semiduplex) communication over short distances. The transmitter can be keyed manually by means of the the PTT button (PTT = Push-to-Talk) or automatically by means of voice control (VOX). For radio communication the TC 917 is equipped with up to 16 channels.

(2) TC 917 Variants and Construction

The TC 917 can be delivered for the frequency ranges:

Version A = 433.05...434.79 MHz

Version B = 450.00...470.00 MHz

The electronics of the TC 917 is always integrated into a shielded modul housing. The construction of the TC 917 transmitter/ receiver sets is almost the same. There are only differences made for the frequency-determining components, such as the filters for the transmitter and receiver and some components for matching purposes used in the transmitter and receiver stage.

The TC 917 (standard version) normally consists of:

- TC 917 transmitter/receiver modul
 - Modul housing
 - RF pcb
 - AF pcb
- Control elements
 - Channel selector switch
 - On/off switch and volume control
 - VOX/PTT selector switch
 - VOX sensitivity control
- Loudspeaker(s)
- Microphone
- Antenna

The TC 917 transmitter/receiver modul and the control elements are always integrated into ear muff capsules or other housings which accomlishe the protection class IP 20 or higher.

This TC 917 test model e.g. is integrated into two ear muff capsules. The ear muff capsules are completely made of synthetic resin and do not have any shielding effect.

Instead of the synthetic ear muff capsules, used for the TC 917 test model, other synthetic or metal housings may be used with a protection class IP 20 or higher.

In every case cables and wirings must not exceed the lenght of 1 m (39 in).

Technical Data

(1) General

Frequency ranges for TC 917 variants:

Version A = 433.05...434.79 MHz

Version B = 450.00...470.00 MHz

Number of channels:

up to 16

Operating mode:

Simplex or semiduplex

(2) Transmitter

TC 917 version A: 433.05...434.79 MHz

Tx power output:

max. 10 mW erp

Nom. frequency deviation:

2.4 kHz at $V_{\text{microphone}} = 150 \text{ mV}$

Max. frequency deviation:

4 kHz

Mod. distortion:

< 10 %

S/N ratio:

> 40 dB (weighted)

Harmonics and spurious emissions:

$\leq -36 \text{ dBm}$

Adjacent channel power:

$\leq -37 \text{ dBm}$

TC 917 version B: 450.00...470.00 MHz

Tx power output:

approx. 50 mW

Nom. frequency deviation:

3.0 kHz at $V_{\text{microphone}} = 150 \text{ mV}$

Max. frequency deviation:

5 kHz

(3) Receiver

Sensitivity:

$\leq 113 \text{ dBm}$ (20 dB SINAD weighted)

Distortion:

< 10 %

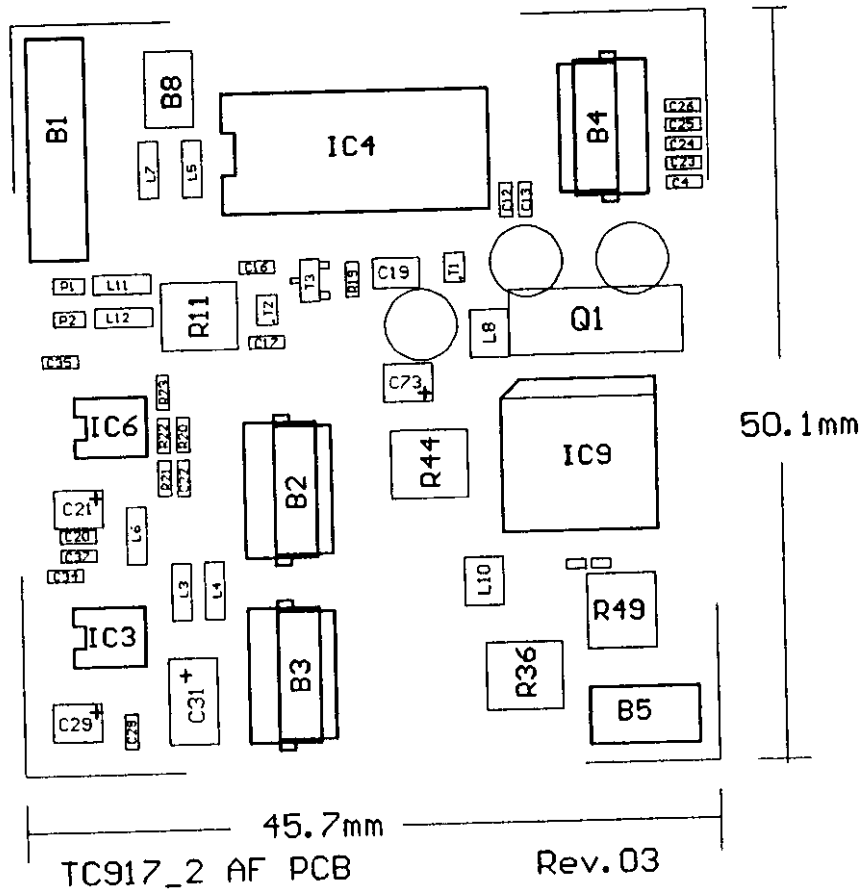
S/N ratio:

> 40 dB (weighted)

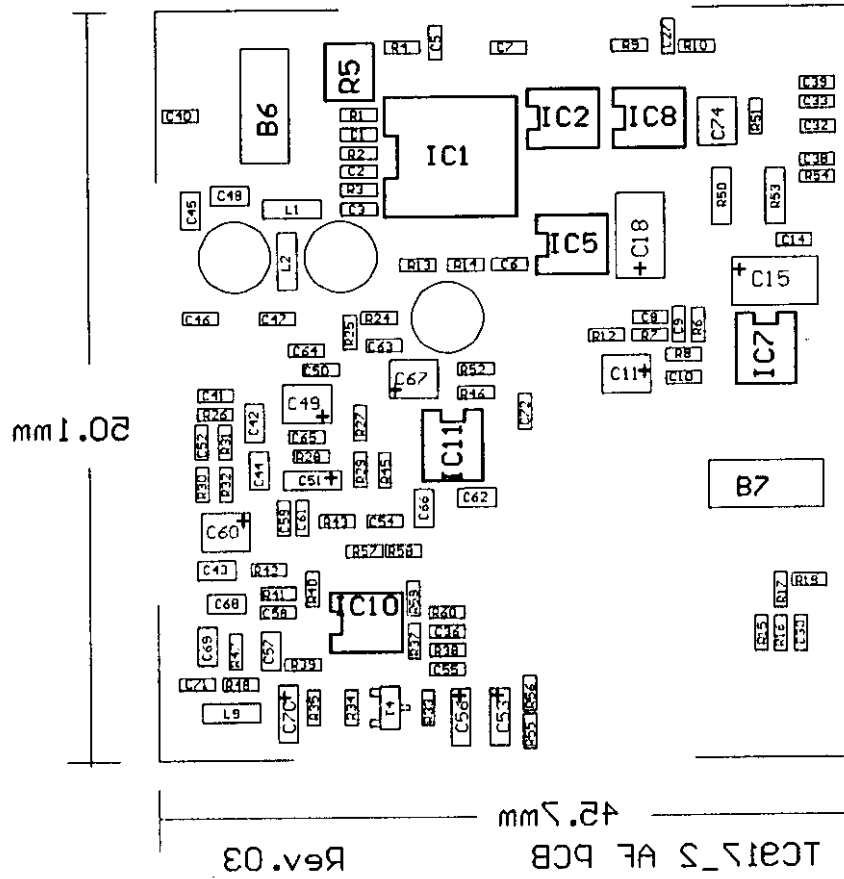
Spurious radiation:

$\leq -57 \text{ dBm}$

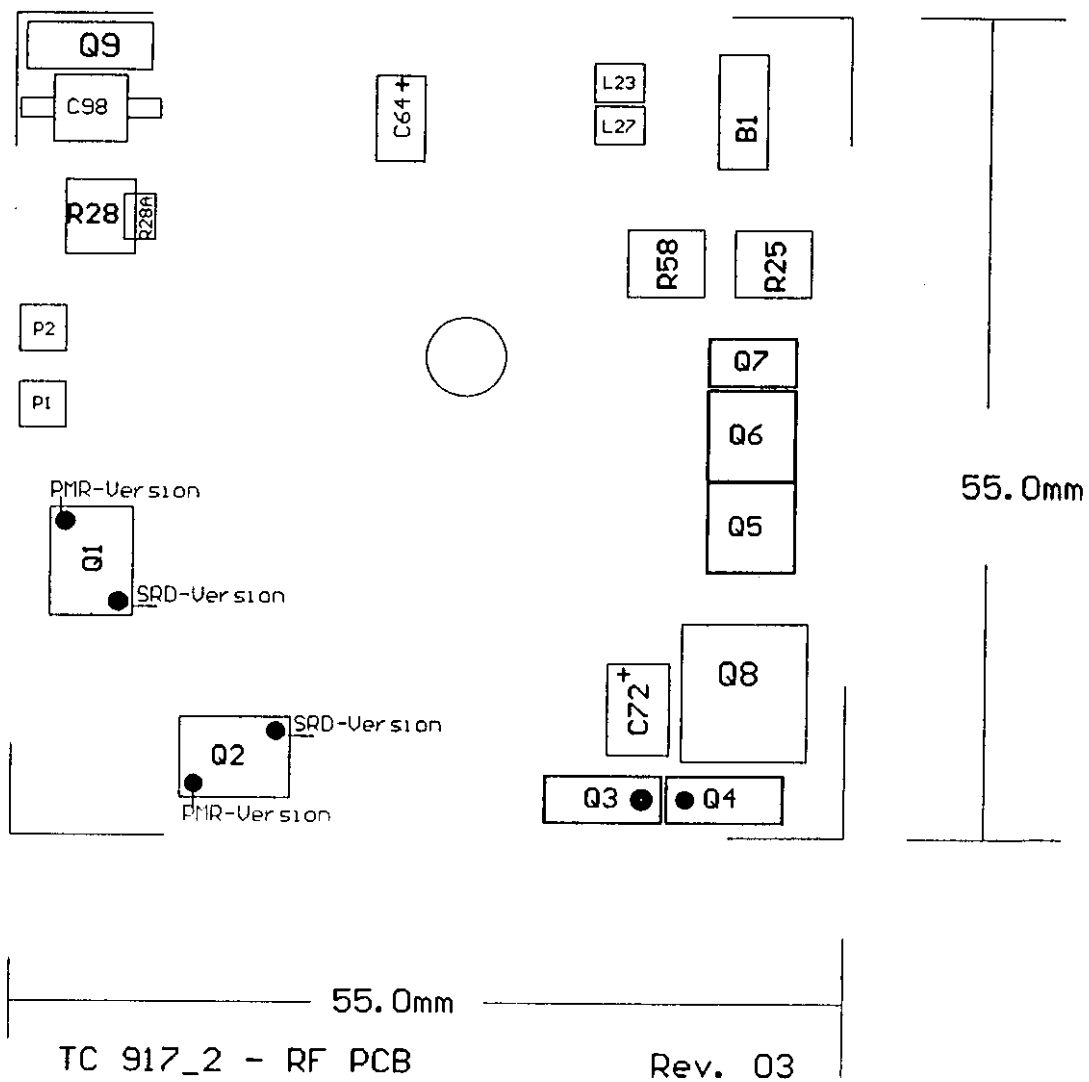
TC 917-2 - Pcb layout AF pcb - top side



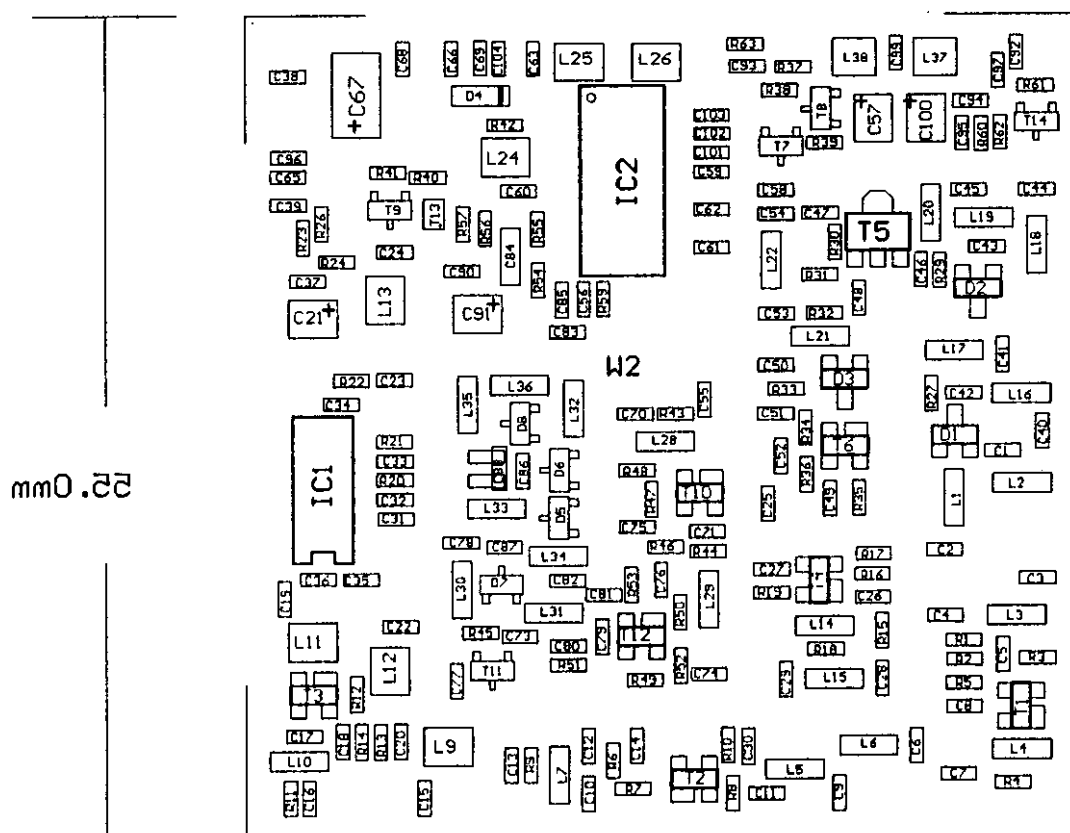
TC 917-2 - Pcb layout AF pcb - bottom side



TC 917-2 - Pcb layout RF pcb - top side



TC 917-2 - Pcb layout RF pcb - bottom side



Rev. 03

TC 217_5 - RF PCB

0.22mm

CeoTronics - Partlist

for PC-Board : TC 917-2 AUDIO

Date: 17. 08. 1998

Revision : 02

Name : schw

Pos.:	Value:	Part-description:	Size:	Tol.:	Manuf.:
B1		Connector male : B8B-ZR-SM3-TF	8 pol.		J.S.T.
B2		Flexboard connector : 05 FFS-SP-TF	5 pol.		ADAPT
B3		Flexboard connector : 05 FFS-SP-TF	5 pol.		ADAPT
B4		Flexboard connector : 05 FFS-SP-TF	5 pol.		ADAPT
B5		Connector male : B3B-ZR-SM3-TF	3 pol.		J.S.T.
B6		Connector male: FTS-106-01-F-DV	12 pol.		Samtec
B7		Connector female: CLP-106-02-F-D	12 pol.		Samtec
B8		Connector female: CLP-104-02-F-D	8 pol.		Samtec

C1	---				
C2	---				
C3	---				
C4	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C5	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0603	+80/-20%	all
C6	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0603	+80/-20%	all
C7	1nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C8	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0603	+80/-20%	all
C9	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0603	+80/-20%	all
C10	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C11	4.7µF	SMD-Tantal-Chip-Capacitor / 16V	B	20%	all
C12	1nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C13	1nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C14	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C15	10µF	SMD-Tantal-Chip-Capacitor / 16V	C	20%	all
C16	56pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	5%	all
C17	56pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	5%	all
C18	10µF	SMD-Tantal-Chip-Capacitor / 16 V	C	20%	all
C19	1µF	SMD-Ceramic-Chip-Capacitor/10V,Y5V	0805	+80/-20%	all
C20	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C21	10µF	SMD-Tantal-Chip-Capacitor / 10 V	B	20%	all
C22	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C23	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C24	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C25	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C26	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C27	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0603	+80/-20%	all
C28	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C29	10µF	SMD-Tantal-Chip-Capacitor / 10 V	B	20%	all
C30	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C31	10µF	SMD-Tantal-Chip-Capacitor / 16 V	C	20%	all
C32	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C33	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C34	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C35	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C36	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C37	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C38	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all

C39	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C40	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C41	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C42	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C43	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C44	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C45	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C46	33pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	10%	all
C47	33pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	10%	all
C48	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C49	10µF	SMD-Tantal-Chip-Capacitor / 10 V	B	20%	all
C50	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C51	1µF	SMD-Tantal-Chip-Capacitor / 16 V	A	20%	all
C52	22pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	10%	all
C53	1µF	SMD-Tantal-Chip-Capacitor / 16 V	A	20%	all
C54	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C55	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C56	2.2µF	SMD-Tantal-Chip-Capacitor / 10 V	A	20%	all
C57	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C58	22pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	10%	all
C59	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C60	1µF	SMD-Tantal-Chip-Capacitor / 16 V	A	20%	all
C61	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C62	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C63	---				
C64	---				
C65	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C66	1µF	SMD-Ceramic-Chip-Capacitor/10V,Y5V	0805	+80/-20%	all
C67	4.7µF	SMD-Tantal-Chip-Capacitor / 16 V	B	20%	all
C68	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C69	100nF	SMD-Ceramic-Chip-Capacitor/16V,Y5V	0805	+80/-20%	all
C70	2.2µF	SMD-Tantal-Chip-Capacitor / 10 V	A	20%	all
C71	100pF	SMD-Ceramic-Chip-Capacitor/50V,NP0	0603	10%	all
C72	10nF	SMD-Ceramic-Chip-Capacitor/50V,X7R	0603	10%	all
C73	10µF	SMD-Tantal-Chip-Capacitor / 10 V	B	20%	all
C74	---				

IC1	ADC 08034 CIWM	4 Channel AD Converter	SO14		National
IC2	NM 93CS56	EEPROM 128 x 16	SO8		National
IC3	LP 2951 CM	Low Drop Voltage Regulator		SO8	National
IC4	COP 8 SAB 7 28 M8	OTP Micro Controller	SO28		National
IC5	ICL 7660 CSA	Voltage Converter	SO8		MAXIM
IC6	LP 2951 CM	Low Drop Voltage Regulator		SO8	National
IC7	TL 072CD	SMD- OPAMP	SO8		all
IC8	MAX 515 CSA	1 Channel DA Converter	SO8		MAXIM
IC9	FX 806 ALS	Audio Processor	PLCC24		CML
IC10	TL062CD	SMD- Operational Amplifier	SO8		all
IC11	MC 34119	Amplifier	SO8		Motorola

L1	390nH	SMD-Induktivity	1206	5%	Coilcraft
L2	390nH	SMD-Induktivity	1206	5%	Coilcraft
L3	390nH	SMD-Induktivity	1206	5%	Coilcraft
L4	390nH	SMD-Induktivity	1206	5%	Coilcraft
L5	390nH	SMD-Induktivity	1206	5%	Coilcraft
L6	390nH	SMD-Induktivity	1206	5%	Coilcraft
L7	390nH	SMD-Induktivity	1206	5%	Coilcraft

L8	22µH	SMD-Induktivität	SIMID02 15%	Siemens
L9	390nH	SMD-Induktivität	1206 5%	Coilcraft
L10	22µH	SMD-Induktivität	SIMID02 15%	Siemens
L11	390nH	SMD-Induktivität	1206 5%	Coilcraft
L12	390nH	SMD-Induktivität	1206 5%	Coilcraft

Q1	4.000MHz	X-tal	HC-49/S	Telefilter
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R1	0R	SMD-Chip-Resistor	0603	5%	all
R2	0R	SMD-Chip-Resistor	0603	5%	all
R3	0R	SMD-Chip-Resistor	0603	5%	all
R4	---				
R5	---				
R6	47k	SMD-Chip-Resistor 0.1W	0603	5%	all
R7	47k	SMD-Chip-Resistor 0.1W	0603	5%	all
R8	1k	SMD-Chip-Resistor 0.1W	0603	5%	all
R9	47k	SMD-Chip-Resistor 0.1W	0603	5%	all
R10	15k	SMD-Chip-Resistor 0.1W	0603	5%	all
R11	20k	SMD-Potentiometer	ST-4B	Roederstein, Bourns	
R12	22k	SMD-Chip-Resistor 0.1W	0603	5%	all
R13	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R14	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R15	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R16	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R17	22k	SMD-Chip-Resistor 0.1W	0603	5%	all
R18	3.3k	SMD-Chip-Resistor 0.1W	0603	5%	all
R19	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R20	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R21	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R22	27k	SMD-Chip-Resistor 0.1W	0603	5%	all
R23	3.9k	SMD-Chip-Resistor 0.1W	0603	5%	all
R24	47k	SMD-Chip-Resistor 0.1W	0603	5%	all
R25	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R26	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R27	1M	SMD-Chip-Resistor 0.1W	0603	5%	all
R28	1M	SMD-Chip-Resistor 0.1W	0603	5%	all
R29	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R30	82k	SMD-Chip-Resistor 0.1W	0603	5%	all
R31	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R32	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R33	1k	SMD-Chip-Resistor 0.1W	0603	5%	all
R34	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R35	15k	SMD-Chip-Resistor 0.1W	0603	5%	all
R36	---				
R37	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R38	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R39	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R40	10k	SMD-Chip-Resistor 0.1W	0603	5%	all
R41	330k	SMD-Chip-Resistor 0.1W	0603	5%	all
R42	2.2k	SMD-Chip-Resistor 0.1W	0603	5%	all
R43	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R44	---				
R45	2.2k	SMD-Chip-Resistor 0.1W	0603	5%	all
R46	18k	SMD-Chip-Resistor 0.1W	0603	5%	all
R47	4.7k	SMD-Chip-Resistor 0.1W	0603	5%	all
R48	4.7k	SMD-Chip-Resistor 0.1W	0603	5%	all
R49	20k	SMD-Potentiometer	ST-4B	Roederstein, Bourns	

R50	0R	SMD-Chip-Resistor	1206	5%	all
R51	0R	SMD-Chip-Resistor	0603	5%	all
R52	---				
R53	0R	SMD-Chip-Resistor	1206	5%	all
R54	---				
R55	---				
R56	0R	SMD-Chip-Resistor	0603	5%	all
R57	330k	SMD-Chip-Resistor 0.1W	0603	5%	all
R58	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R59	100k	SMD-Chip-Resistor 0.1W	0603	5%	all
R60	220k	SMD-Chip-Resistor 0.1W	0603	5%	all

T1	BC847 BS	Dual-SMD-NPN-Transistor	SOT363	Philips
T2	BC847 BS	Dual-SMD-NPN-Transistor	SOT363	Philips
T3	BC847	SMD-NPN-Transistor	SOT23	all
T4	BC847	SMD-NPN-Transistor	SOT23	all