

ENGINEERING STATEMENT

for type acceptance of

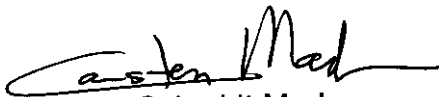
Trade Name: SAILOR

Model No: RT4801 with handset C4901

Measurements of performance for the DSC transceiver RT4801 have been carried out in the laboratory of EuroCom Industries in Aalborg, Denmark, as well as in the laboratory of the KTL in Arnhem, The Netherlands.

The measurements at EuroCom Industries have been carried out by the VHF Project Manager, Mr Carsten Schmidt Madsen.

The VHF Project Manager, Mr Carsten Schmidt Madsen, has been working with construction of VHF equipment for years. It is hereby certified that the measuring results are in accordance with the truth.



Carsten Schmidt Madsen
VHF Project Manager
EuroCom Industries

Aalborg 3rd of March 1999

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page

**Test report for the following
SAILOR equipment:
RT4801**

**Tests performed by development
Engineer: Luis Rasmussen.**

**Viewed by project manager:
Carsten S. Madsen.**



Carsten S. Madsen



Luis Rasmussen

	Doc. Type	Foreign approvals	Initials	LJR	Date	03/09/99		
	Concerning	Renewal of approvals	Doc. No.	1166		Rev.	A	Page

2.985 RF-power output.

The carrier power was measured as the power delivered into a 50 Ω load.
The power level was measured as a function of the power supply voltage level.
The carrier frequency was 156.300 MHz.

High Power:

V batt.	Power
10.8 V	21.6 W
12.0 V	22.8 W
15.6 V	22.9 W

Low Power:

V batt.	Power
10.8 V	0.912 W
12.0 V	0.912 W
15.6 V	0.916 W

Transceiver current consumption in High power mode at $V_{cc} = 12\text{ V} : 5.5\text{ A}$

Measurement instrument list :

- Modulation analyzer HP8901B.
- 30 dB attenuator HP8498A.
- Power supply EA-3021S.

2.987 Modulation Characteristics

The modulation characteristics of the transmitter has been verified by means of a modulation meter.

The measurement have been carried out with the transmitter output terminated in a 50 Ω load. The supply voltage has been 12.0 V and the nominal carrier frequency 156.300 MHz

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page 3

Modulation frequency response.

The frequency deviation as a function of the modulation frequency has been measured with an AF signal ranging from 100 Hz to 5 kHz.

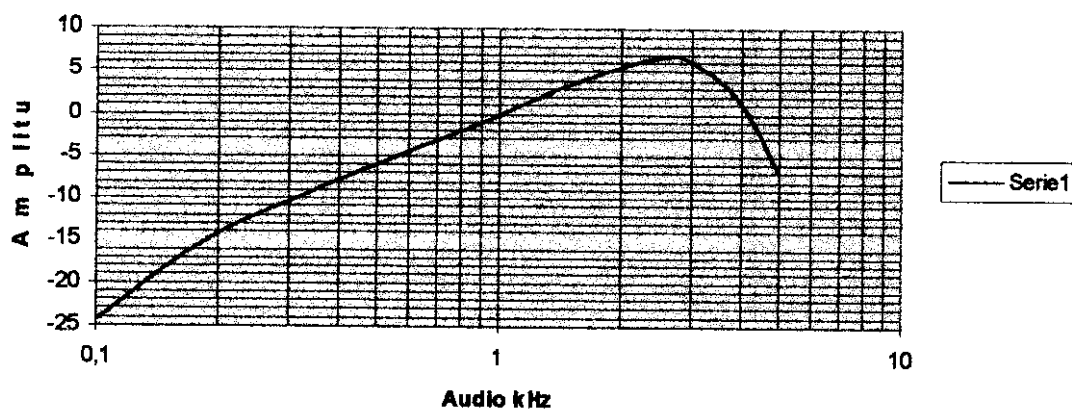
Modulation frequency	Freq. Dev. Relative to 1 kHz mod. Freq.
0.1 kHz	-24.3 dB
0.2 kHz	-14.3 dB
0.5 kHz	-5.9 dB
0.7 kHz	-3.1 dB
1.0 kHz	0 dB
1.5 kHz	3.4 dB
2.0 kHz	5.6 dB
2.5 kHz	6.7 dB
3.0 kHz	6.3 dB
4.0 kHz	1.4 dB
5.0kHz	-6.9 dB

The measured figures can be seen on the enclosed curve plot.

Measurement instrument list :

- Stabilock 4040.
- Power supply EA-3021S.
- Audio signal generator B&O TG7.

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page

Preemphasis**2.987 Modulation Characteristics cont.****Audio low pass filter response.**

The frequency response of the audio low pass filter has been measured in the range from 200 Hz to 8 kHz.

The output level is measured in dB relative to the level at 1.8 kHz.

Modulation Frequency (Hz)	Level
200	-0.25 dB
400	-0.12 dB
600	-0.1 dB
800	0.05 dB
1200	0.03 dB
1500	0.03 dB
1800	0 dB
2000	-0.1 dB
2200	-0.2 dB
2500	-0.54 dB
2800	-1.1 dB
3000	-1.6 dB
3200	-2.15 dB
3500	-3.26 dB
4000	-5.6 dB
4500	-8.4 dB
5000	-11.4 dB
6000	-17.9 dB

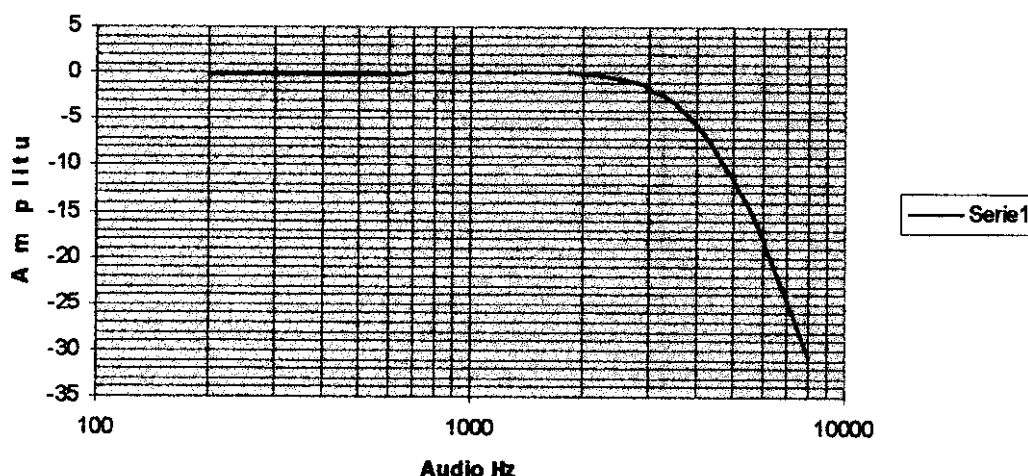
	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page 5

The measured figures can be seen on the enclosed curve plot.

Measurement instrument list :

- Stabilock 4040.
- Power supply EA-3021S.
- Audio signal generator B&O TG7.

Low pass filter



2.987 Modulation Characteristics cont.

Audio limiter characteristics.

The performance of the AF limiting circuit has been verified at three different frequencies: 500 Hz, 1500 Hz and 2500 Hz.

The AF input voltage, from 600 Ω generator, to the microphone input terminals is measured, the levels are stated as the equivalent power levels dissipated in a 600 Ω load, referenced to 1 mW.

AF Mod. Freq. 500 Hz		AF Mod. Freq. 1500 Hz		AF Mod. Freq. 2500 Hz	
Input level (mV RMS)	Freq. Dev. (kHz)	Input level (mV RMS)	Freq. Dev. (kHz)	Input level (mV RMS)	Freq. Dev. (kHz)
10	0.16	10	0.46	10	0.64
25	0.42	25	1.21	25	1.74

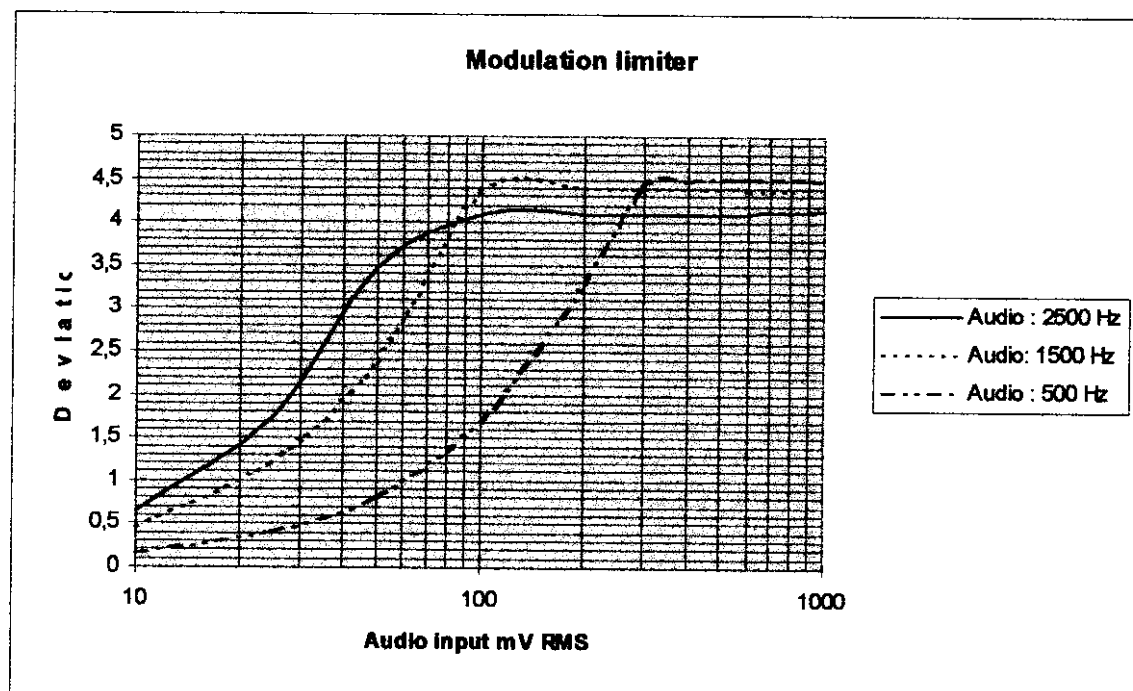
	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99		
	Concerning	Renewal of approvals	Doc. No.	1166		Rev.	A	Page

100	1.70	100	4.37	100	4.10
200	3.29	200	4.39	200	4.10
300	4.44	300	4.39	300	4.10
400	4.50	400	4.39	400	4.10
500	4.52	500	4.39	500	4.10
600	4.52	600	4.38	600	4.10
700	4.51	700	4.38	700	4.11
800	4.51	800	4.38	800	4.12
900	4.51	900	4.40	900	4.13
1000	4.50	1000	4.40	1000	4.14

The measured figures can be seen on the enclosed curve plot.

Measurement instrument list :

- Stabilock 4040.
- Power supply EA-3021S.
- Audio signal generator B&O TG7.



	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page 7

The occupied bandwidth has been measured by means of a spectrum analyzer.

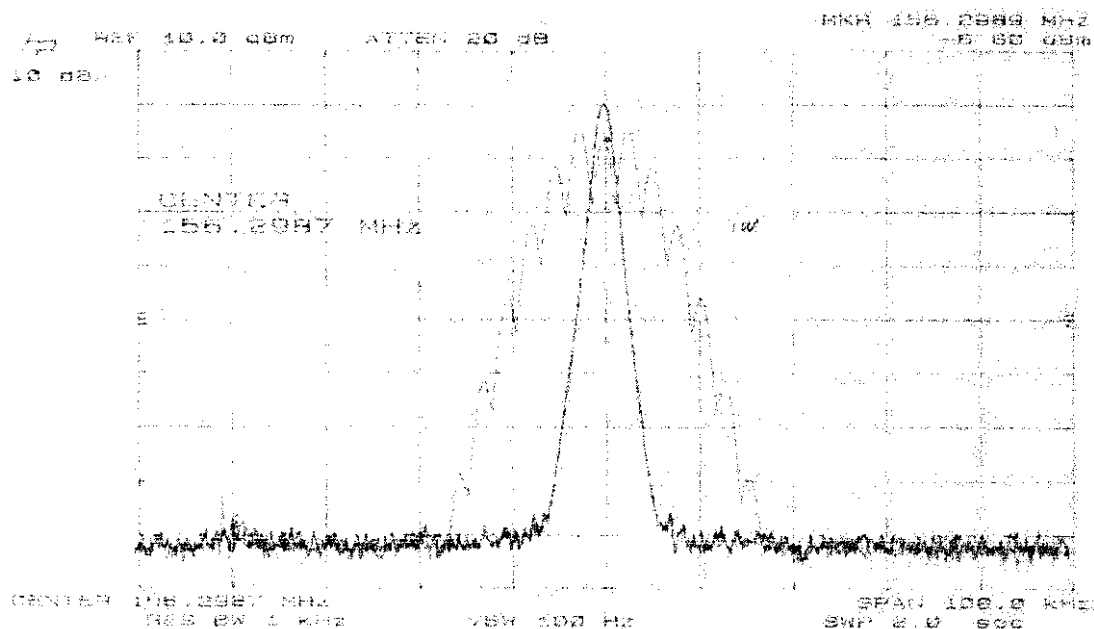
The input level to the microphone input terminals was 16 dB above the level needed to produce 50 % modulation of the transmitter.

	Attenuation in dBc	
	Measured	Required
10-20 kHz	38	25
20-50 kHz	80	35
over 50 kHz	80	57

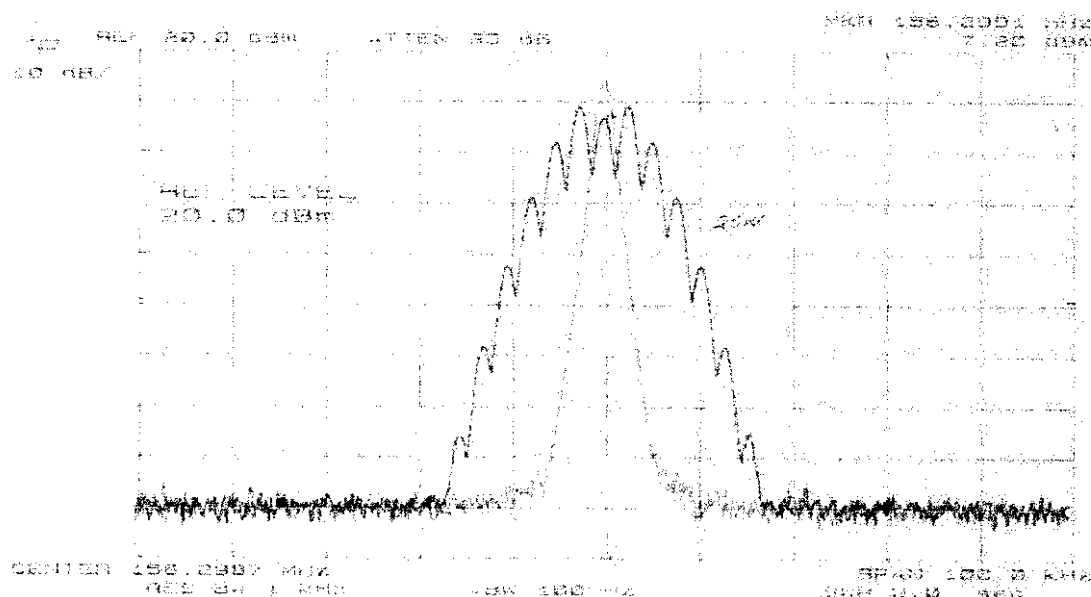
The measured values can be seen on the enclosed curve plot.

Measurement instrument list :

- Spectrum analyzer HP8568B.
- 30 dB attenuator HP8498A.
- Power supply EA-3021S.



	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page



2.991 Spurious emissions at antenna terminals.

The spurious emission at the antenna has been measured by means of a spectrum analyzer, with the antenna terminated in a 50 Ω load.

Transmitter spurious emission.

The reference is 0 dBm at 50 ohm.

Transmitter carrier frequency : 156.300 MHz		
Spurious frequency (MHz)	Low power	High power
312.6	-45.0 dBm	-38.0 dBm
468.9	-46.6 dBm	-40.1 dBm
625.2	-62.0 dBm	-42.5 dBm
781.5	<-65 dBm	<-65 dBm
937.8	-57.0 dBm	-47.6 dBm
1094.1	<-65 dBm	<-65 dBm
1250.4	-56.0 dBm	<-65 dBm
1406.7	<-65 dBm	<-65 dBm
1563.0	<-65 dBm	<-65 dBm

Limit: -36 dBm

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page

Receiver spurious emission.

There has not been measured any spurious components with a level above - 69 dBm.

Measurement instrument list :

- Spectrum analyzer HP8568B.
- 30 dB attenuator HP8498A.
- Power supply EA-3021S.

2.993 Field strength of spurious radiation.

The field strength of spurious from the transceiver has been measured by the accredited test laboratory - "KTL-Arnhem" situated in the Netherlands. The values stated below are the measured emissions determined at a distance of 3 meters with the transmitter switched to its high power mode.

Spurious emissions power level in nW								
Carrier freq. : 150.8 MHz			Carrier freq. : 156.8 MHz			Carrier freq. : 163.6 MHz		
Spur. Freq. MHz	Antenna Position	Power nW	Spur. Freq. MHz	Antenna Position	Power nW	Spur. Freq. MHz	Antenna Position	Power nW
452.4	P1	26.8	470.4	P1	30.2	490.8	P1	-
	P2	23.8		P2	35.3		P2	-
603.2	P1	239.2	627.2	P1	70.6	654.4	P1	-
	P2	21.2		P2	18.8		P2	-
754.0	P1	67.1	784.0	P1	157.9	818.0	P1	-
	P2	50.1		P2	68.4		P2	-
904.8	P1	78.1	940.8	P1	194.4	981.6	P1	233.6
	P2	36.1		P2	64.5		P2	109.8
1055.6	P1	13.4	1097.6	P1	24.4	1145.2	P1	-
	P2	99.7		P2	74.4		P2	-
1206.4	P1	108.6	1254.4	P1	158.9	1308.0	P1	149.5
	P2	182.0		P2	110.3		P2	172.1

Limit: 250 nW

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166	Rev.	A	Page 10

2 GHz are measured.

Antenna position:

P1: Angle of rotation of the measuring antenna at which the field strength is maximum.

P2: Angle of P1 + 90°

2.995 Frequency stability.

A measurement of the frequency stability against temperature was made in the temperature range from -20° to +50° centigrade. At each temperature the unit was thermally stabilized before the carrier frequency was measured.

The test temperature was sequenced in the order shown in the table below, starting at -20° centigrade.

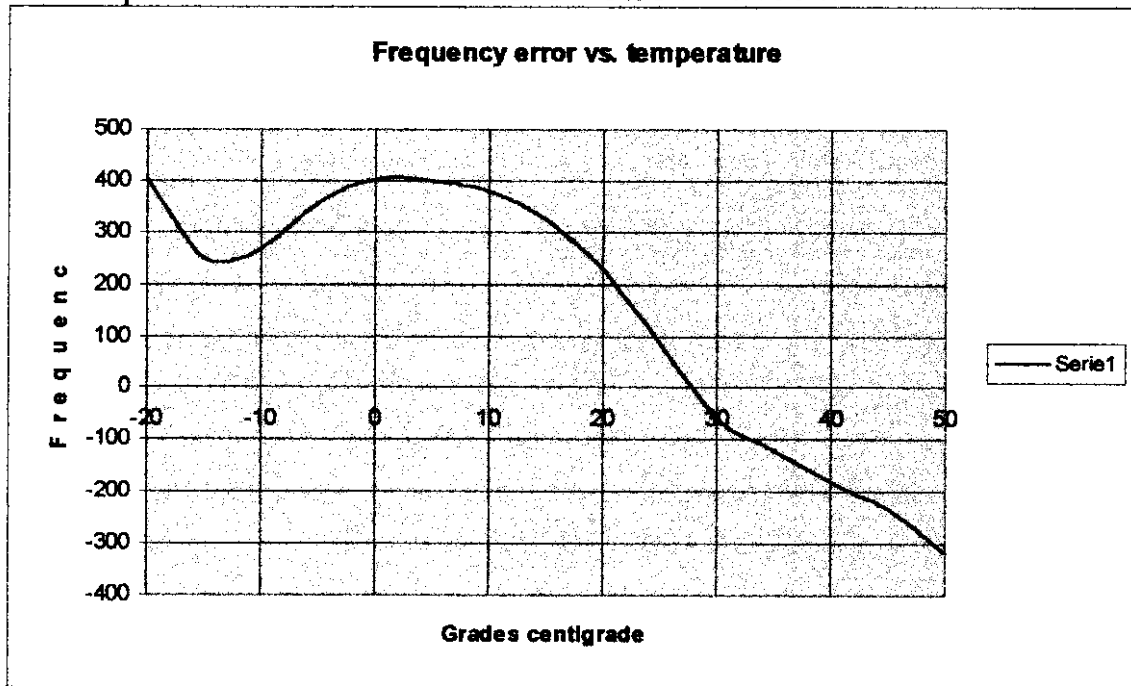
The transceiver was supplied with 12 VDC, as the nominal input voltage.

Nominal carrier frequency : 156.750 MHz	
T amb. °C	Δf (Hz)
-20	405
-15	249
-10	267
-5	356
0	402
5	401
10	382
15	323
20	228
25	81
30	-58
35	-120
40	-180
45	-233
50	-320

The measured figures can be seen on the enclosed curve plot.

	Doc. Type	Foreign approvals	Initials	LIR	Date	03/09/99	
	Concerning	Renewal of approvals	Doc. No.	1166		Rev.	A Page 11

- Stabilock 4040.
- Power supply EA-3021S.
- Temperature chamber Heraeus Vötsch HT4004.



Frequency stability versus input voltage.

Power supply voltage (V)	Frequency error (Hz)
10.8	20
12.0	20
13.2	10
14.4	10
15.6	10

Time out timer.

The transceiver has a timer function, that can be enabled. The time out can be set in 10 seconds steps from 20 to 2550 seconds, before the transmitter is disabled. Further more another timer can be set to block the transmitter before keying again in interval 2 to 255 seconds.