

Test report 99608331

based on:
FCC Part 80 (10-1-04 Edition)

Maritime shipborne VHF radio telephone with
integrated DSC class A controller and channel 70
watchkeeping receiver
SAILOR
RT5022

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This report comprises of three modules. The total number of pages is: 24

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication bv
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:1999. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie). The copyright of this test report is owned by Telefication bv and may not be reproduced except in full without the written approval of Telefication bv.

Ordering party:

Company name	:	Thrane & Thrane A/S
Address	:	Porsvej 2
Zipcode	:	9200
City/town	:	Aalborg
Country	:	Denmark
Date of order	:	22 December 2004

2 Product

A sample of the following product was submitted for testing:

Product name	: Maritime shipborne VHF radio telephone with integrated DSC class A controller and channel 70 watchkeeping receiver
Product category	: Stations in the maritime services
Manufacturer	: Thrane & Thrane A/S
Trade mark	: SAILOR
Type designation	: RT5022
FCC ID	: TCORT5022
Hardware version	: --
Software version	: Application (OS): 1.20 Boot Monitor (BM): 1.00 DSP: 1.10
Serial number	: --

3 Test schedule

Tests were carried out in accordance with the specification detailed in chapter 6 "Summary" of this report.

Tests were carried out at the following locations:

- Telefication, Zevenaar;
- TNO EPS, Niekirk
(FCC listed site nr. 90828)

Tests were carried out between:

- 2 March and 21 April 2005
-

4 Product documentation

For production of this report the following product documentation was used:

Description	Date	Identification
RT 5022 SAILOR Operation Manual (preliminary)	Issue 0505	B5022GB0

5 Observations and comments

None.

6 Summary

The product is intended for use in the following application area:

Maritime ship born communication equipment

The sample was tested according to the following specification:

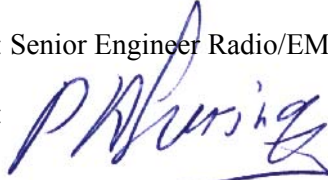
FCC Part 80 (10-1-04 Edition)

7 Conclusions

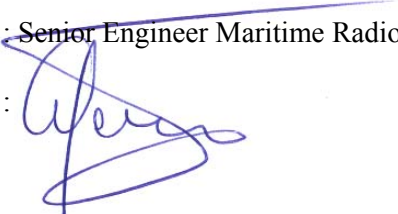
The sample of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 6 of this report.

The results of the tests as stated in this report, are exclusively applicable to the product item as identified in this report. Telefication does not accept any responsibility for the results stated in this report, with respect to the properties of product items not involved in these tests.

All tests are performed by:

name : ing. P.A. Suringa
function : Senior Engineer Radio/EMC
signature : 

Review of test methods and report by:

name : M.W. Jansen
function : Senior Engineer Maritime Radio
signature : 

The above conclusions have been verified by the following signatory:

date : 28 June 2005
name : J. P. van de Poll
function : Co-ordinator Test Group
signature : 

Test results module

1 Summary

According to FCC Part 80, the following tests have been performed:

Port	Reference	Phenomena	Result
Enclosure	§ 2.1053 (a)	Radiated emissions	P
Antenna	§ 80.211 (f) (3)	Conducted emissions	P
Antenna	§ 80.211 (f) (1), (2)	Occupied bandwidth	P
Antenna	§ 80.209 (a)	Frequency stability	P
Antenna	§ 80.213 (a) (2)	Frequency deviation	P
Antenna	§ 80.213 (b)	Modulation limitation	P
Antenna	§ 80.215 (g) (1)	Transmitter power	P

Results:

P = pass
F = fail

NA = not applicable
NP = not performed

2 Emission tests

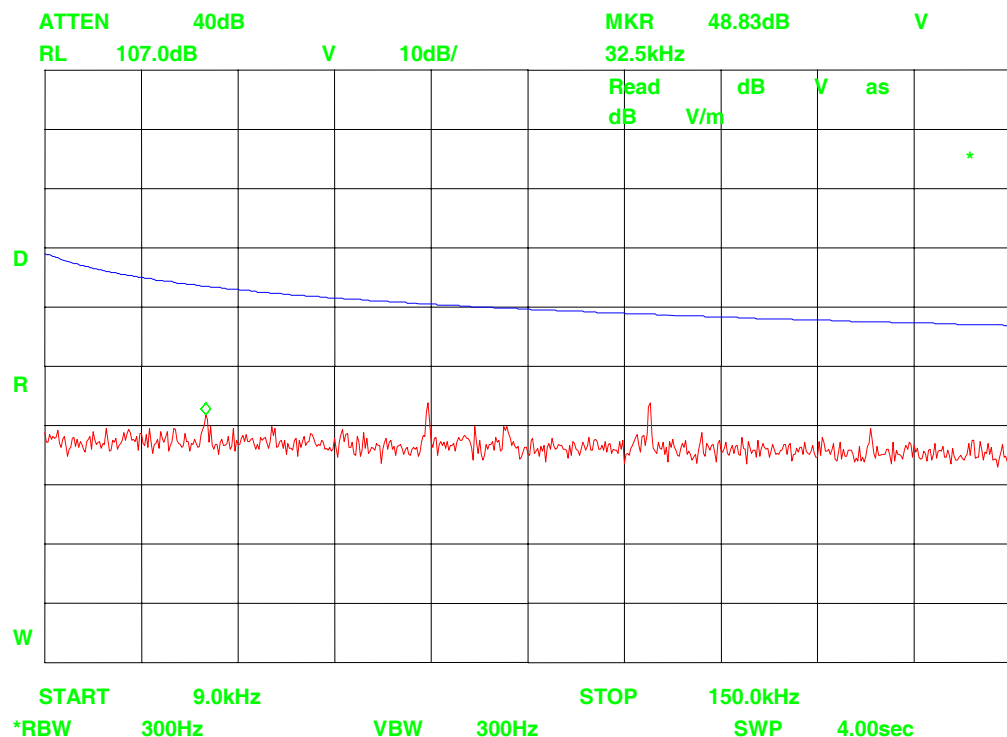
2.1 Radiated spurious (< 30 MHz), exploratory

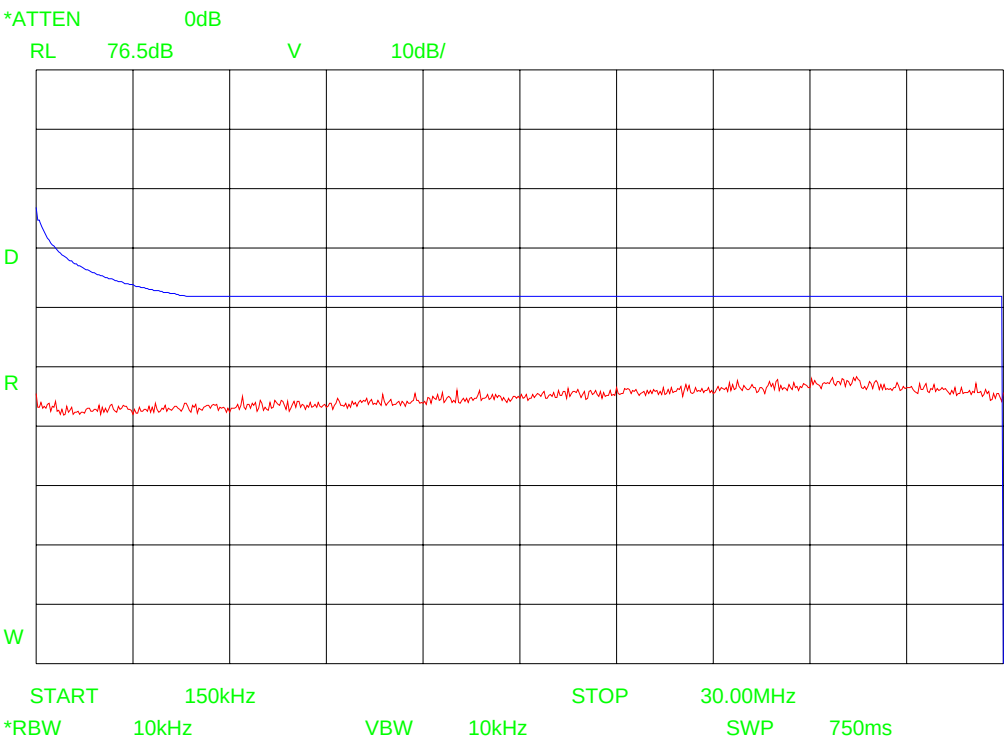
Compliance standard : FCC part 2, section 2.1053

Justification : Exploratory measurements in the range 0.01 – 30 MHz have been carried out in a large triple loop antenna.

Compliance limit : Transmitting power is 25 W, antenna gain 2.14 dBi (assumed).
Limit = transmitting power minus attenuation as required per section 80.211 (f) (3).
44 dBm – (43 dB + 14 dB) = -13 dBm
Conversion to the dB μ V/m limit for a 3 m OATS
yields: -13 dBm + 103.4 dB = 90.4 dB μ V/m

Results :
(dB μ V/m, exploratory)





Remark: As no other emissions than ambient-related are shown in the graphs above, measurements on the Open Area Test Site were deemed not necessary.

2.2 Radiated spurious (> 30 MHz), cabinet radiation

Compliance standard : FCC part 80, section 80.211 (f) (3), FCC part 2, section 2.1053 (a)

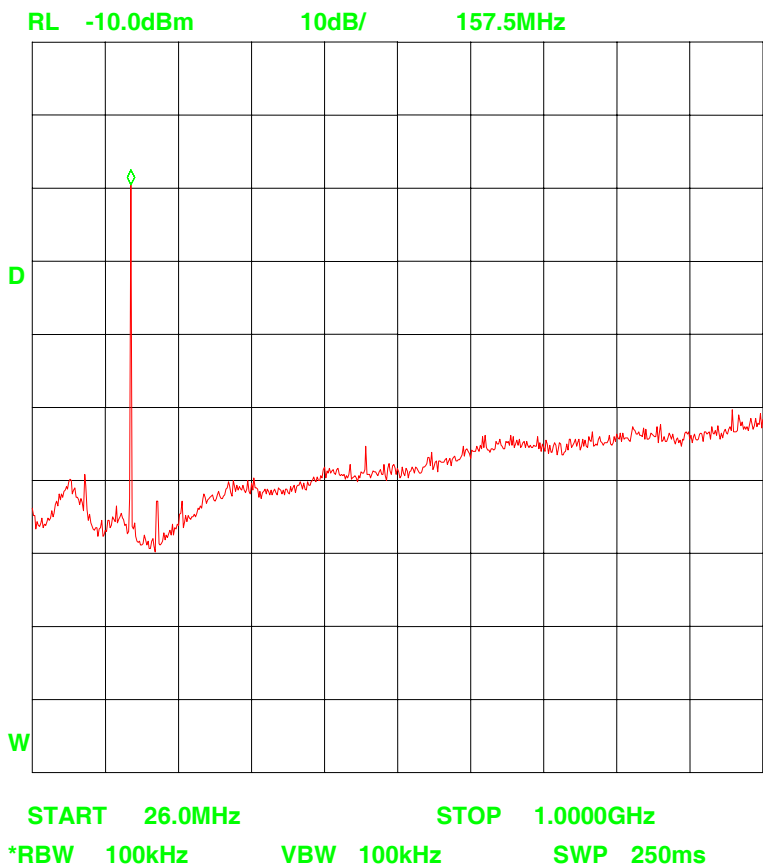
Justification : Exploratory measurements in the range 0.03 – 1 GHz have been performed in a 3 m compact fully anechoic room (CFAC).
Compliance measurements in the range 1 – 4 GHz have been performed in a 3 m compact fully anechoic room (CFAC).
The CFAC has been calibrated for e.(i).r.p. measurements.
Compliance measurements in the range 0.03 – 1 GHz have been carried out on a 3 m Open Area Test Site (OATS) at TNO EPS, Nieuwerkerk.

- FCC listed nr. 90828
- IC listed nr. IC3501

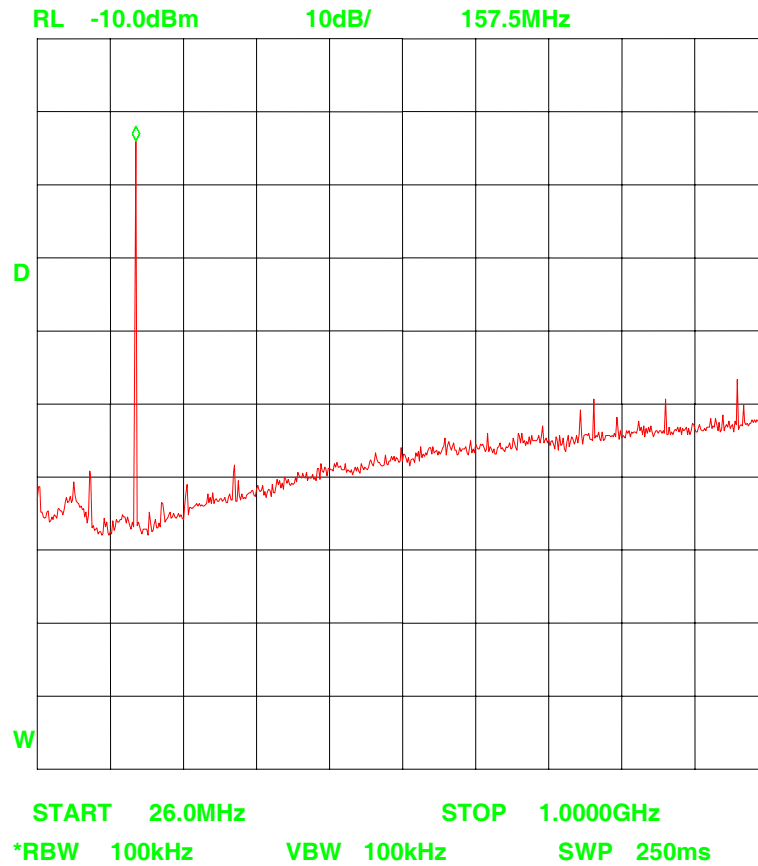
Compliance limit : Transmitting power is 25 W, antenna gain 2.14 dBi (assumed).
Limit = transmitting power minus attenuation as required per section 80.211 (f) (3).
 $44 \text{ dBm} - (43 \text{ dB} + 14 \text{ dB}) = -13 \text{ dBm}$
Conversion to the dB μ V/m limit for a 3 m OATS
yields: $-13 \text{ dBm} + 103.4 \text{ dB} = 90.4 \text{ dB}\mu\text{V/m}$

CFAC results (< 1GHz) :
(dBm e.r.p. , exploratory)

Horizontal polarization



Vertical polarization

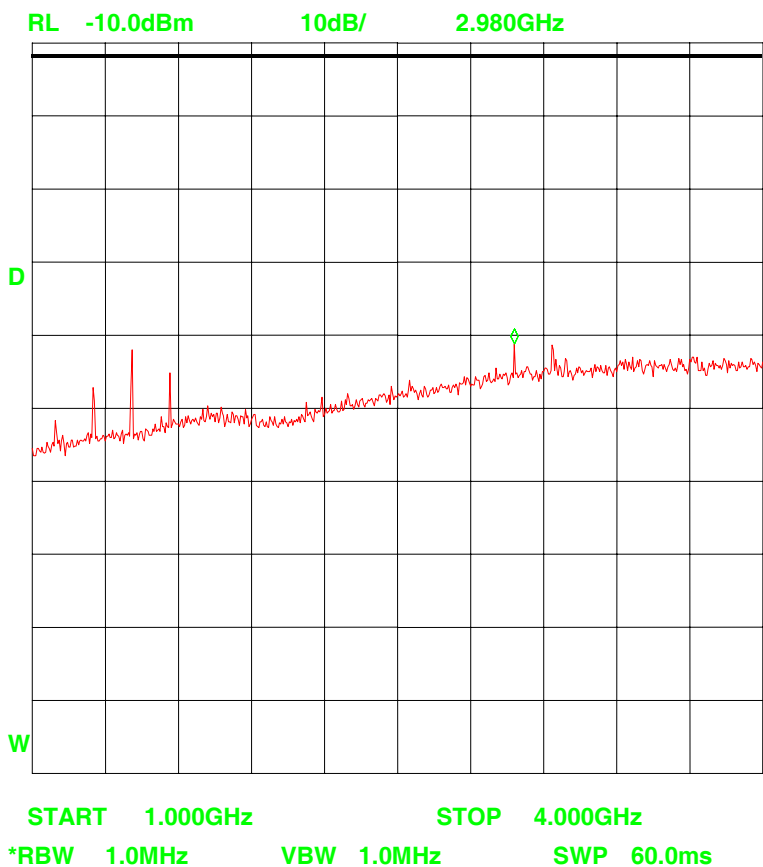


OATS results (< 1 GHz):
(dB μ V/m, compliance)

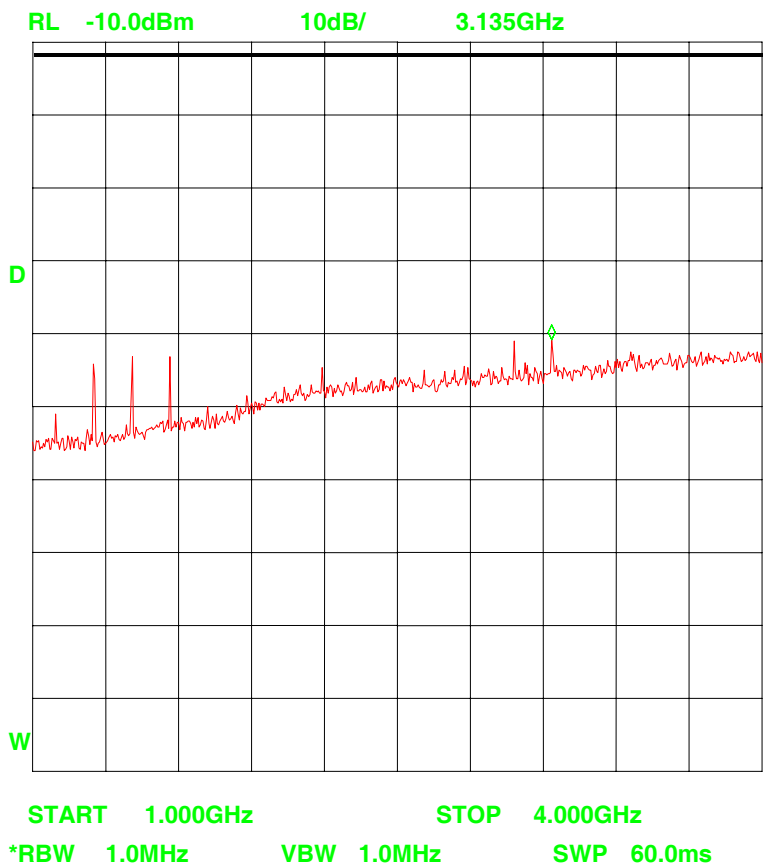
Frequency (MHz)	Polarization H/V	Level (dB μ V/m) (QP)	Limit (dB μ V/m) @ 3m distance
259.96	H & V	< 17	90.4
269.96	H & V	< 17	90.4
279.96	H & V	< 17	90.4
289.96	H & V	< 17	90.4
313.59	V	26.8	90.4
313.59	H	27.4	90.4
470.4	V	22.4	90.4
470.4	H	23.8	90.4
748	H & V	< 31	90.4
765	H & V	< 31	90.4
862	H & V	< 33	90.4
959	H & V	< 33	90.4

CFAC results (>1 GHz) :
(dBm e.i.r.p., compliance)

Horizontal polarization



Vertical polarization



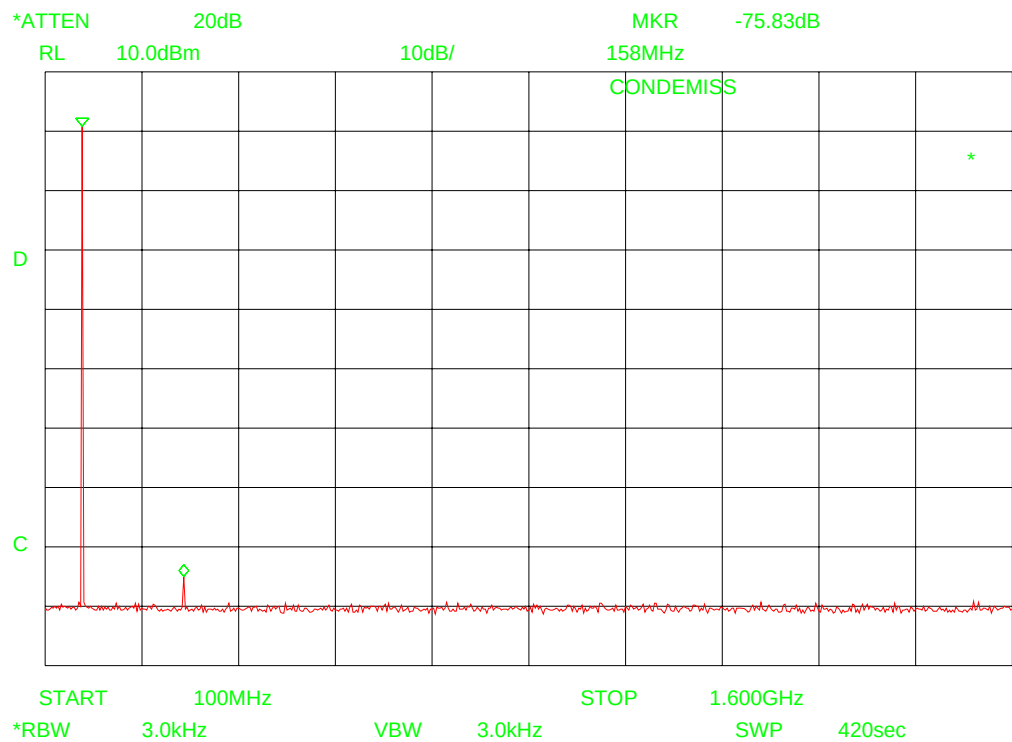
2.3 Conducted spurious (> 30 MHz)

Compliance standards : FCC part 80, section 80.211 (f) (3)

Justification : Compliance measurements have been carried out on the antenna connector.

Compliance limit : $\text{attenuation} > 43 \text{ dB} + 10 \log P = 43 + 14 = 57 \text{ dBc}$

Result :



2.4 Occupied bandwidth

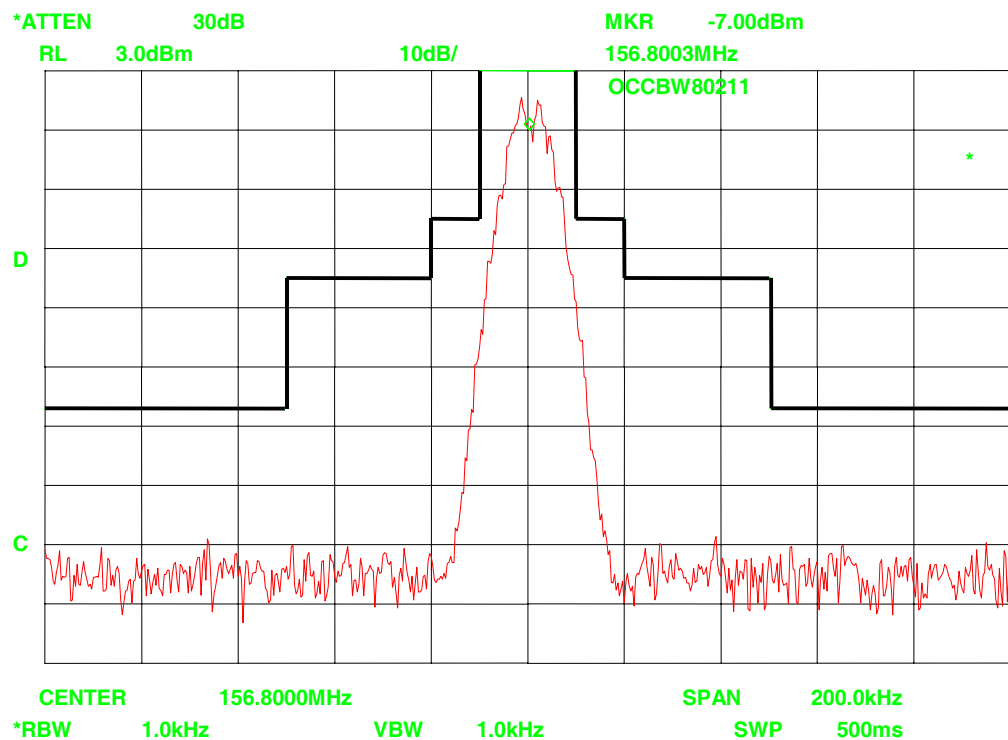
Compliance standard : FCC part 80, sections 80.211(f) (1); 80.211(f) (2)

Justification : Compliance measurements have been carried out on the antenna connector.

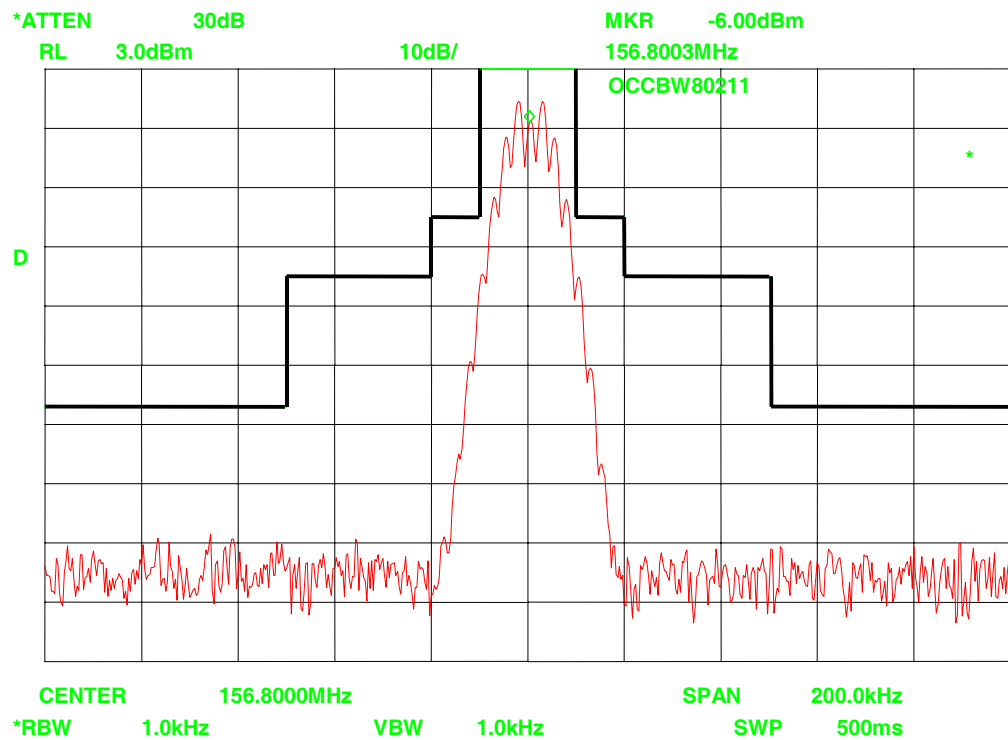
Compliance limit : See spectrum mask in plot.

Results :

Spectrum with DSC modulation



Spectrum with 2500 Hz modulation (at a level of 16 dB greater than that necessary to produce 50% modulation)



2.5 Frequency deviation

2.5.1 Maximum frequency deviation at modulation frequencies below 3 kHz

CHANNEL	FMOD (Hz)	FREQUENCY DEVIATION Df			
		High Power		Low Power	
		Df (kHz)		Df (kHz)	
		+	-	+	-
16	100	0.5	0.5	0.5	0.5
	300	4.4	4.4	4.4	4.4
	500	4.7	4.7	4.7	4.7
	1000	4.4	4.4	4.5	4.4
	1500	4.3	4.3	4.3	4.3
	2000	4.3	4.3	4.5	4.3
	2500	4.7	4.7	4.9	4.5
	3000	4.1	4.1	4.6	4.2
Measurement Uncertainty	100 Hz - 3000 Hz: 0.98 dB - 0.37 dB.				
Limits	Df < 5 kHz The transmitter was modulated with an audio tone at a level 20 dB above that required to produce normal test modulation (Fmod = 1 kHz → Df = 3 kHz).				

2.5.2 Maximum frequency deviation at modulation frequencies above 3 kHz

fmod (kHz)	Frequency deviation Df (kHz)			
	Channel 16			
	High Power		Low Power	
	+	-	+	-
3	4.1	4.1	4.1	4.1
3.5	3.5	3.5	3.5	3.5
4	2.6	2.6	2.6	2.6
4.5	1.5	1.5	1.5	1.5
5	0.7	0.7	0.7	0.7
6	<0.03	<0.03	<0.03	<0.03
7	<0.03	<0.03	<0.03	<0.03
8	<0.03	<0.03	<0.03	<0.03
9	<0.03	<0.03	<0.03	<0.03
10	<0.03	<0.03	<0.03	<0.03
12	<0.03	<0.03	<0.03	<0.03
14	<0.03	<0.03	<0.03	<0.03
16	<0.03	<0.03	<0.03	<0.03
18	<0.03	<0.03	<0.03	<0.03
20	<0.03	<0.03	<0.03	<0.03
22	<0.03	<0.03	<0.03	<0.03
25	<0.03	<0.03	<0.03	<0.03
Measurement uncertainty		0.37 dB		
Limits		Df < 5 kHz		

2.6 Modulation limitation

TEST CONDITIONS		FREQUENCY DEVIATION (kHz)					
		Channel 180		Channel 16		Channel 179	
Temperature	Voltage	H.P.	L.P.	H.P.	L.P.	H.P.	L.P.
T_{nom} (15-35 °C)	V_{nom} (24.0 V)	4.4	4.4	4.4	4.4	4.4	4.4
T_{min} (-15 °C)	V_{min} (21.6 V)	4.4	4.4	4.4	4.4	4.3	4.3
	V_{max} (31.2 V)	4.4	4.4	4.4	4.4	4.3	4.3
T_{max} (+55 °C)	V_{min} (21.6 V)	4.3	4.2	4.3	4.3	4.2	4.2
	V_{max} (31.2 V)	4.2	4.2	4.3	4.3	4.2	4.2
Measurement uncertainty		0.37 dB					
Limits		Df < 5 kHz					

Remark: a modulation signal at a frequency of 1 kHz was applied at a level which produced a frequency deviation of ± 1 kHz .The level was then increased by 20 dB and the resulting frequency deviation was measured.

H.P. = Output power switch set at its maximum

L.P. = Output power switch set at its minimum

N.A. = Not applicable.

2.7 Transmitter power

CHANNEL	Test condition	Temperature	Power source voltage (Vdc)	HIGH POWER	LOW POWER
				Carrier power (W)	Carrier power (W)
CH16 156.800MHz	Normal	+15~+35	24.0	21.9	0.68
	Extreme	-15	10.8	22.8	0.68
			31.2	22.8	0.70
		+55	10.8	24.3	0.70
			31.2	24.3	0.70
Measurement uncertainty		0.61 dB			
Limit		25 W			

2.8 Frequency stability

Compliance standard : FCC part 80, section 80.209

Compliance limit : 10 ppm (1.57 kHz)

Results :

<i>Frequency error (Hz)</i>			
Temperature °C	Supply voltage V _{dc}	Tx power high	Tx power low
+15~+35	24.0	-198	-198
-20	21.6	-83	-83
	31.2	-83	-83
-15	21.6	-118	-118
	31.2	-118	-118
+55	21.6	-188	-188
	31.2	-188	-188

Used test equipment module

This module contains the list of test equipment used.

Ref	Description	Telefication ident.	Manufacturer	Model
1	Spectrum analyzer	TE 00481	HP	8563E
2	Pre-amplifier	TE 00344	R & S	ESV-Z3
3	Pre-amplifier	TE 00092	HP	8449B
4	Logper/bow-tie antenna	TE 00700	EMCO	3143
5	Horn antenna	TE 00531	EMCO	3115
6	Compact Full Anechoic Chamber (CFAC)	TE 01064	Euroshield	RFD-F-100
7	Audio analyzer	TE 00373	HP	8903A
8	Modulation meter	TE 00360	Marconi	TF 2300B
9	RF attenuator	TE 00380	Bird	8325
10	RF attenuator	TE 00127	Tenuline	8343-200
11	RF power meter	TE 00377	Bird	Analyst 4381
12	Triple loop antenna	TE 01066	Telefication	--

The following measurement equipment is used at TNO EPS Niekkerk:

7	Test receiver	S/n 15667	Rohde & Schwarz	ESCS 30
8	Open Area Test Site	13886	Comtest	TNO EPS
9	Biconilog antenna	S/n 15633	Chase	CBL6111B