telefication bv
The Netherlands
Chamber of Commerce
09076358
www.telefication.com

telefication

Test report
20093484306

based on:
FCC Part 2 and Part 90 (10-1-09 Editions)

Fixed mounted maritime VHF with DSC
SAILOR
6216

Contents

This report comprises of three modules. The total number of pages is: 25

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication bv
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Ordering party:

Company name	:	Thrane & Thrane A/S
Address	:	Porsvej 2
Zipcode	:	9200
City/town	:	Aalborg
Country	:	Denmark
Date of order	:	11 June 2009

2 Product

A sample of the following product was submitted for testing:

Product name	:	Fixed mounted maritime VHF with DSC
Product category	:	Stations in the maritime services
Manufacturer	:	Thrane & Thrane A/S
Trade mark	:	SAILOR
Type designation	:	6216
FCC ID	:	ROJ6216
Hardware version	:	60-127368-D
Software version	:	0.00.00; 2.00.0422 (audio filter test in narrowband mode only)
Serial number	:	0000000002

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;

Tests were carried out between:

- 25 August and 3 September 2009

4 Product documentation

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

Description	Date	Identification
User & installation manual	January 8, 2010	Doc. No. TT98-128825-THR-C

The above mentioned documentation will be filed at Telefication B.V. Zevenaar for a period of 10 years following the issue of this report.

5 Observations and comments

The product is member of a family of maritime radios based on the same software, hardware and mechanical platform.

Members of this family are:

SAILOR 6210: VHF transceiver Non DSC;
SAILOR 6215: VHF transceiver DSC class D;
SAILOR 6216: VHF transceiver DSC class D, US version.

Test results in this report are obtained from measurements on the SAILOR 6216 with S/N 2 and with software version 0.00.00, except for the audio filter test in narrowband mode, which was performed on the same sample, however with software version 2.00.0422.

6 Summary

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

Radio transmitters and receivers for the maritime telecommunication service in the band 156 - 162.5 MHz, for ships and coast stations

The sample was tested according to the following specification:

FCC Part 2 and Part 90 (10-1-09 Editions)

7 Conclusions

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

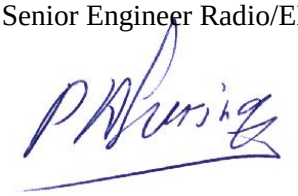
The results of the tests as stated in this report, are exclusively applicable to the product item as identified in this report. Telefication accepts no responsibility for any stated properties of product items in this test report, which are not supported by the tests as specified in section 6 "*Summary*".

All tests are performed by:

name : ing. P.A. Suringa

function : Senior Engineer Radio/EMC

signature :



Review of test methods and report by:

name : G.J. Gort

function : Senior Test Engineer

signature :

The above conclusions have been verified by the following signatory:

date : 16 February 2010

name : ing. P.A.J.M. Robben

function : Manager Laboratory

signature :

Test results module

1 Summary

According to FCC Part 2 and Part 90, the following tests have been performed:

Port	Reference	Phenomena	Result
Enclosure	§ 2.1053 (a), § 90.210 (b) (d)	Radiated emissions	P
Antenna	§ 2.1051, § 90.210 (b) (d)	Conducted emissions	P
Antenna	§ 2.1049, § 90.210 (b) (d)	Occupied bandwidth	P
Antenna	§ 2.1055 (a) (2), (b); § 90.213 (a)	Frequency stability	P
Antenna	§ 2.1047 (a)	Audio frequency response	P
Antenna	§ 2.1047 (a)	Frequency deviation	P
Antenna	§ 2.1047 (b)	Modulation limitation	P
Antenna	§ 2.1046 (a)	Transmitter power	P
Antenna	§ 90.214	Transient behaviour of the transmitter	P

Results:

P	=	pass	NA	=	not applicable
F	=	fail	NP	=	not performed

2 Emission tests

2.1 Radiated spurious (> 30 MHz), cabinet radiation

Compliance standard : FCC part 90, section 90.210 (b) (d)
FCC part 2, section 2.1053 (a)

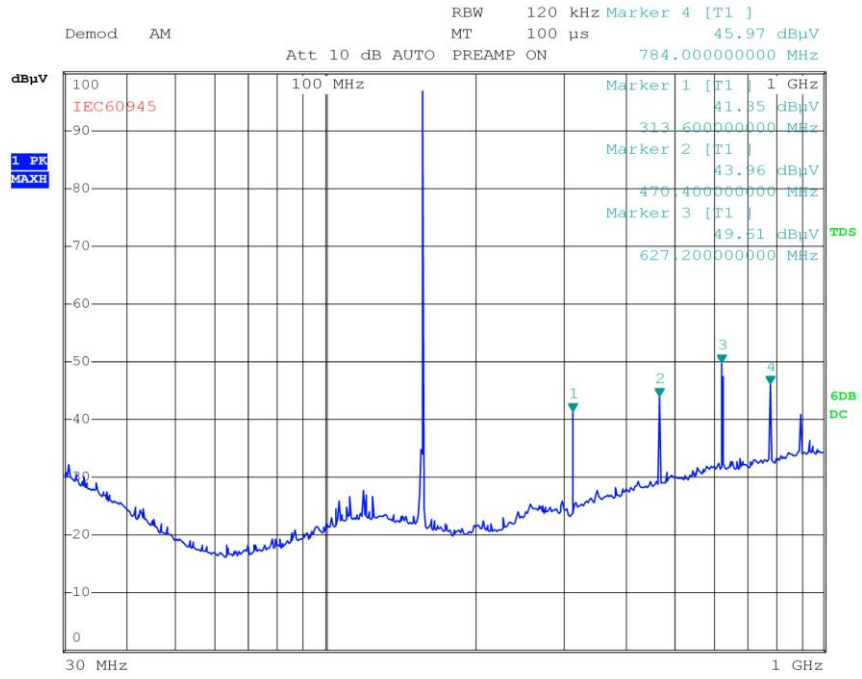
Compliance limit : *For 25 kHz channelization*:

Transmitting power is 25 W, antenna gain 0 dBd (assumed).
Limit = transmitting power minus attenuation as required per section 90.210 (b).
44 dBm – (43 dB + 14 dB) = -13 dBm
Conversion to the dBµV/m limit for a 3 m semi anechoic chamber yields: -13 dBm + 103.4 dB = 90.4 dBµV/m

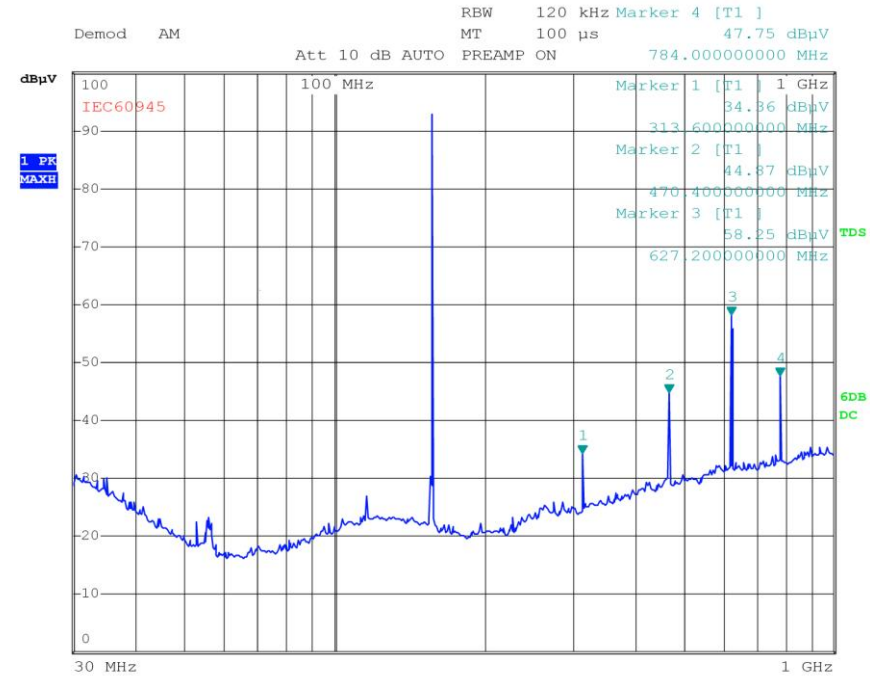
For 12.5 kHz channelization

Transmitting power is 25 W, antenna gain 0 dBd (assumed).
Limit = transmitting power minus attenuation as required per section 90.210 (d).
44 dBm – (50 dB + 14 dB) = -20 dBm
Conversion to the dBµV/m limit for a 3 m semi anechoic chamber yields: -20 dBm + 103.4 dB = 83.4 dBµV/m

Results :
(Hor. pol., dBµV/m)



(Vert. pol., dBµV/m)



Measurement uncertainty	Horizontal polarization	
	30 – 200 MHz	4.5 dB
	200 – 1000 MHz	3.6 dB
	Vertical polarization	
	30 – 200 MHz	5.4 dB
	200 – 1000 MHz	4.6 dB

Test equipment used: 15, 17, 38, 45, 46, 47

2.2 Conducted spurious (> 30 MHz)

Compliance standards : FCC part 90, section 90.210 (b) (d)
FCC part 2, section 2.1051

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

Compliance limit : *For 25 kHz channelization*

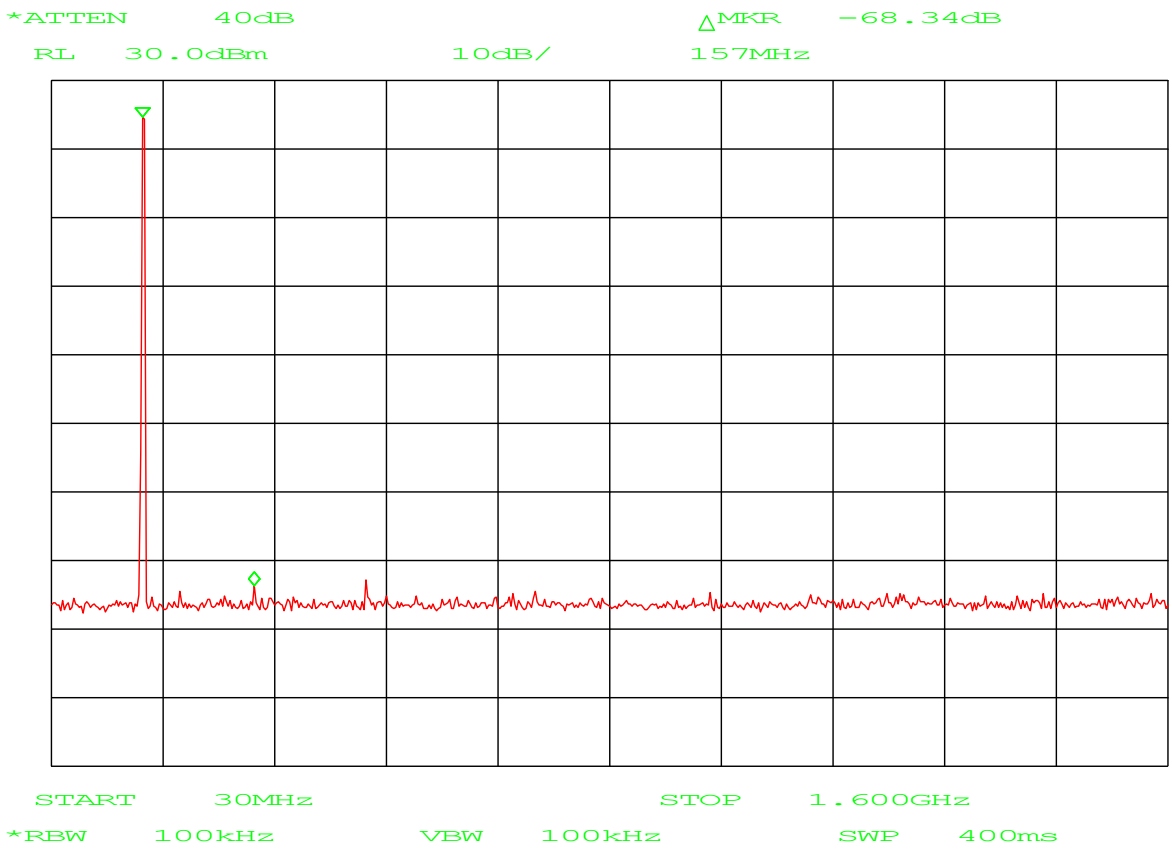
attenuation > 43 dB + 10 log P = 43 + 14 = 57 dBc;

For 12.5 kHz channelization

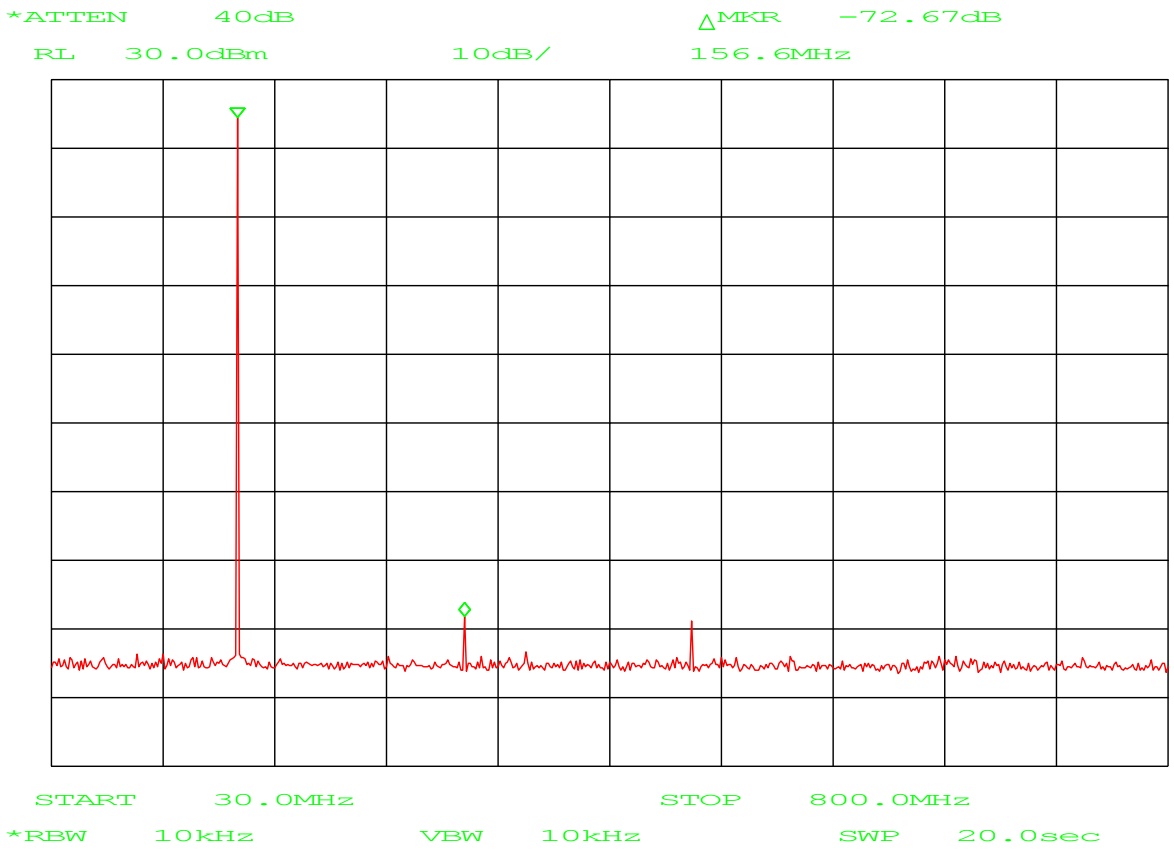
attenuation > 50 dB + 10 log P = 50 + 14 = 64 dBc

Results :

25 kHz channelization



12.5 kHz channelization



Measurement uncertainty	0-2 GHz: +1.7/-1.9 dB

Test equipment used: 23, 36, 37

2.3 Occupied bandwidth

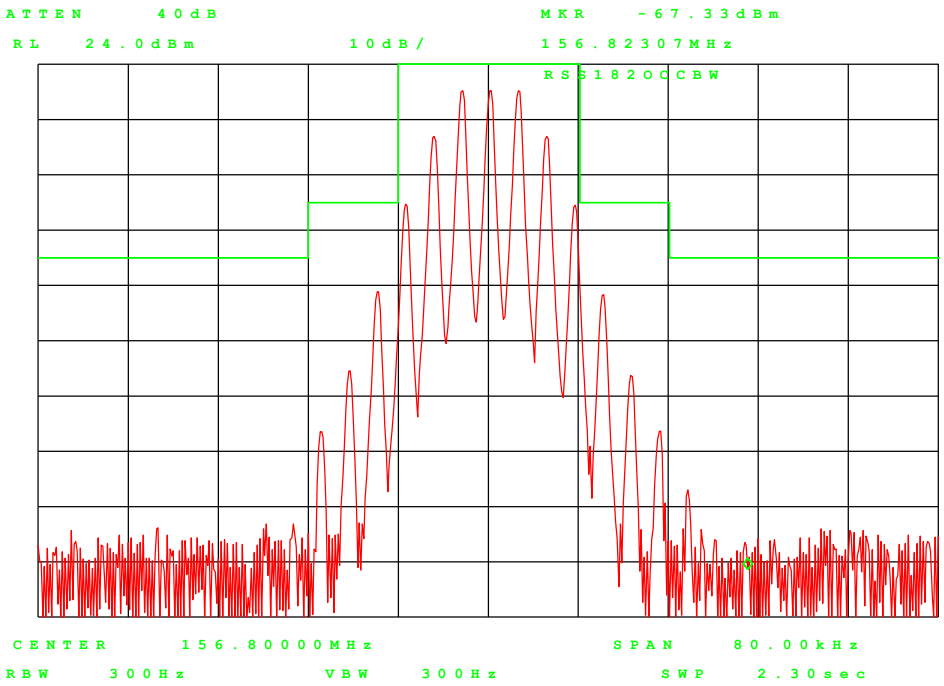
Compliance standard : FCC part 90, section 90.210 (b) (d)
FCC part 2, section 2.1049

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

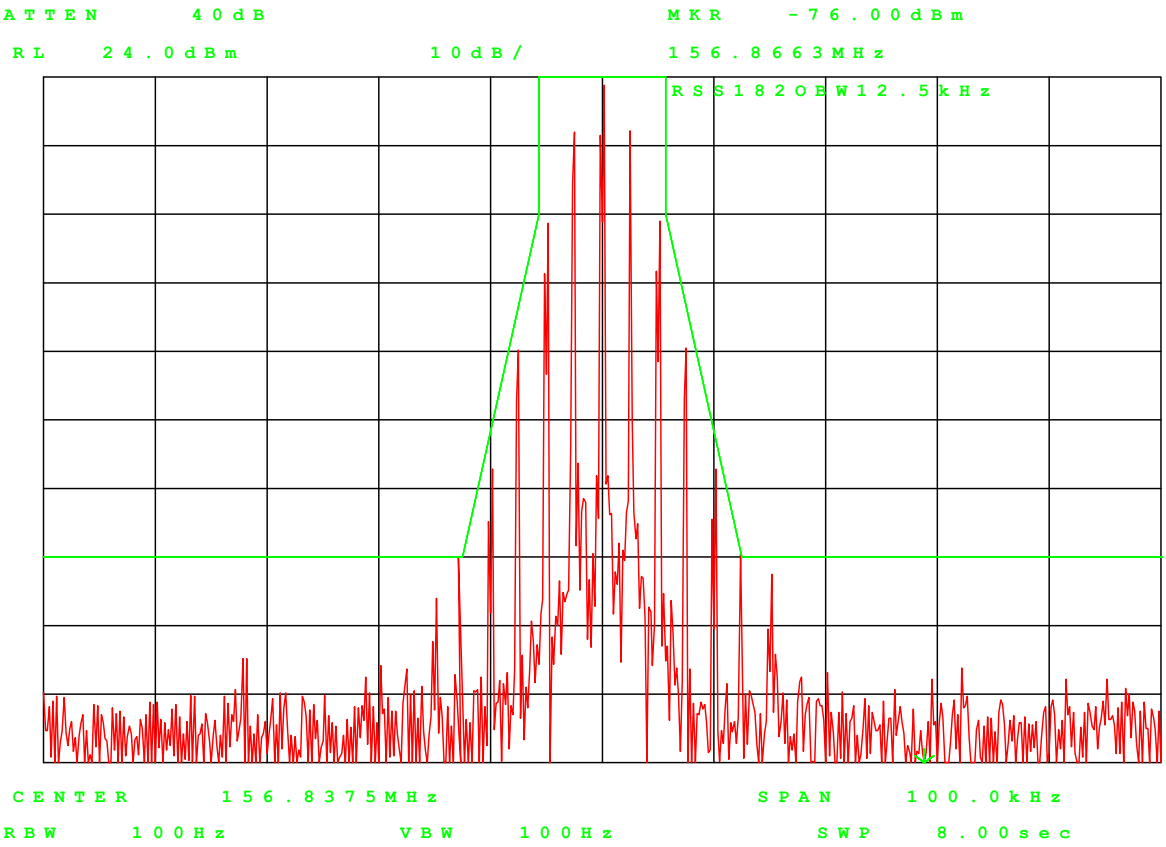
Compliance limit : See spectrum masks in plots.

Results :

25 kHz channelization



12.5 kHz channelization



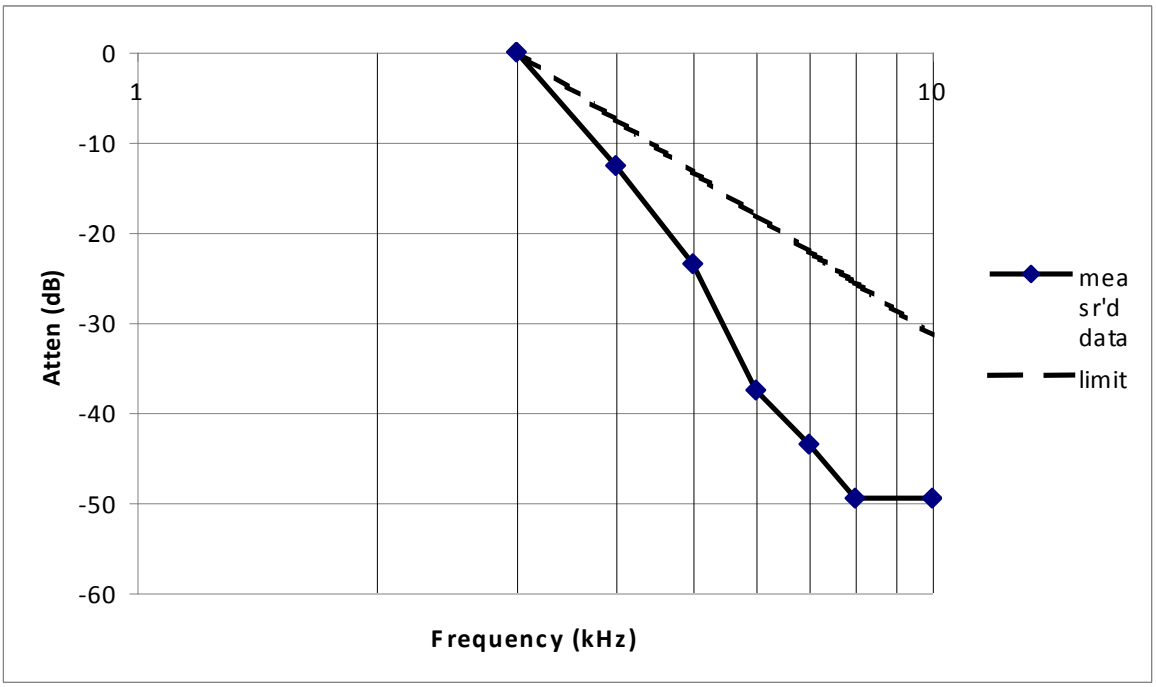
Measurement uncertainty	0-2 GHz: +1.7/-1.9 dB

Test equipment used: 23, 36, 37

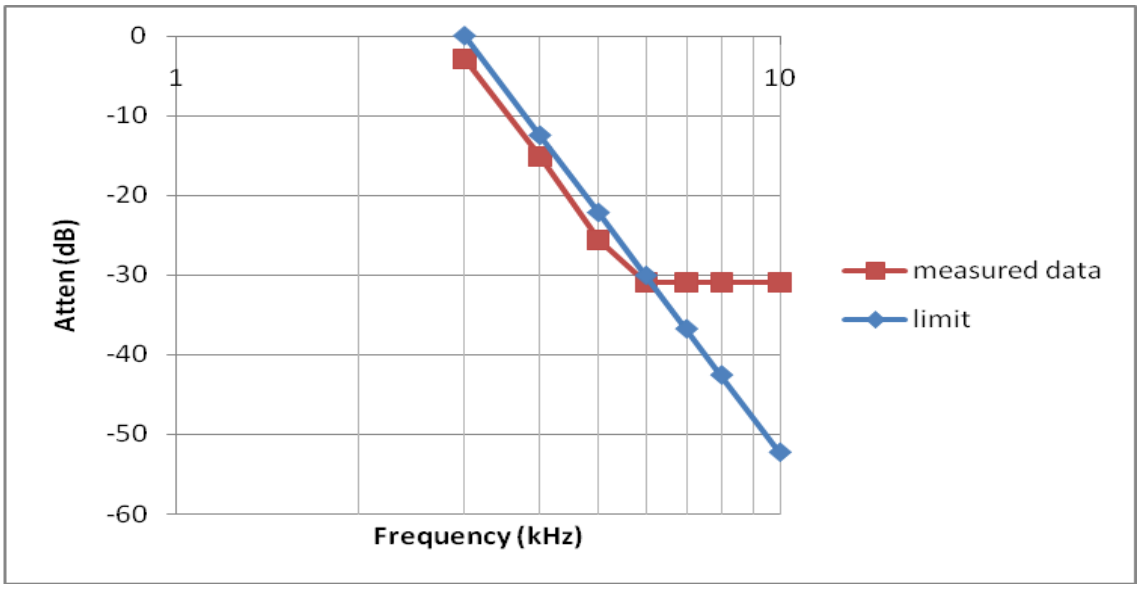
2.4 Post limiter filter frequency response

Compliance standard : FCC part 2, section 2.1047 (a)

25 kHz channelization



12.5 kHz channelization



Note: measurements with frequencies higher than 6 kHz are not possible due to limitations of the measuring equipment.

Measurement uncertainty	0.37 dB

Test equipment used: 40

2.5 Audio frequency response

Compliance standard : FCC part 2, section 2.1047 (a)

25 kHz channelization

Modulation frequency (Hz)	Reference line (dB relative to Δf = 1 kHz)	Audio-frequency response (dB)
300	-10.46	-9.37
500	-6.02	-5.51
600	-4.44	-4.15
700	-3.10	-2.97
800	-1.94	-1.83
900	-0.92	-0.72
1000	0.00	0
1500	3.52	3.91
2000	6.02	6.64
2500	7.96	8.62
2700	8.63	9.30
3000	9.54	9.90
Measurement uncertainty		0.41 dB

Limit:

Audio frequency response	Within –3 dB and +1 dB of a +6 dB/oct. reference line passing through the reference point: fmod = 1 kHz and Δf = 1 kHz.

12.5 kHz channelization

Modulation frequency (Hz)	Reference line (dB relative to Δf = 0.5 kHz)	Audio-frequency response (dB)
300	-10.46	-9.4
500	-6.02	-5.0
600	-4.44	-4.4
700	-3.10	-2.6
800	-1.94	-1.94
900	-0.92	0
1000	0.00	0
1500	3.52	3.5
2000	6.02	6.0
2500	7.96	8.3
2550	8.63	8.3
Measurement uncertainty		0.41 dB

Limit:

Audio frequency response	Within –3 dB and +1 dB of a +6 dB/oct line passing through the reference point: fmod = 1 kHz and Δf = 0.5 kHz.

Test equipment used: 22, 23, 26, 40

2.6 Modulation limitation

Compliance standard : FCC part 2, section 2.1047 (b)

25 kHz channelization

LF (kHz)	Input level (dBµV)	Deviation (kHz)	Limit (kHz)
0.3	102	0.85	≤ 5
1	102	3	≤ 5
3	102	3	≤ 5
0.3	122	4.1	≤ 5
1	122	4.2	≤ 5
3	122	3	≤ 5

12.5 kHz channelization

LF (kHz)	Input level (dBµV)	Deviation (kHz)	Limit (kHz)
0.3	100.8	0.40	≤ 2.5
1	100.8	1.50	≤ 2.5
3	100.8	1.70	≤ 2.5
0.3	120.8	2.1	≤ 2.5
1	120.8	2.35	≤ 2.5
3	120.8	1.7	≤ 2.5

Measurement uncertainty	100 Hz – 3000 Hz : 0.98 dB – 0.37 dB

Test equipment used: 40

2.7 Transmitter power

Compliance standard : FCC part 2, section 2.1046 (a)

CHANNEL	Test condition	Temperature	Power source voltage (Vdc)	HIGH POWER	LOW POWER
				Carrier power (W)	Carrier power (W)
1	Normal	26ºC	12.0	*23.2*	*0.88*
16	Normal	26ºC	12.0	*23.6*	*0.85*
88	Normal	26ºC	12.0	*23.9*	*0.85*
Measurement uncertainty		*0.61 dB*			

Test equipment used: 22, 23, 26, 30 ,40

2.8 Frequency stability

Compliance standard : FCC part 2, section 2.1055 (a) (2), (b)
FCC part 90, section 90.213 (a)

Compliance limit : 5 ppm (25 kHz channelization)
2.5 ppm (12.5 kHz channelization)

Results :

As a function of ambient temperature

Temperature °C	Supply voltage Vdc	Frequency error (kHz)	Limit (kHz)
-20	12	-0.1	0.392
-10	12	-0.1	0.392
0	12	-0.1	0.392
10	12	-0.025	0.392
20	12	+0.013	0.392
30	12	+0.009	0.392
40	12	-0.035	0.392
50	12	-0.1	0.392

As a function of primary voltage variation

Supply voltage Vdc	Frequency error (kHz)	Limit (kHz)
10.2	0.063	0.392
12.0	0.038	0.392
13.8	0.042	0.392

Measurement uncertainty	9 Hz

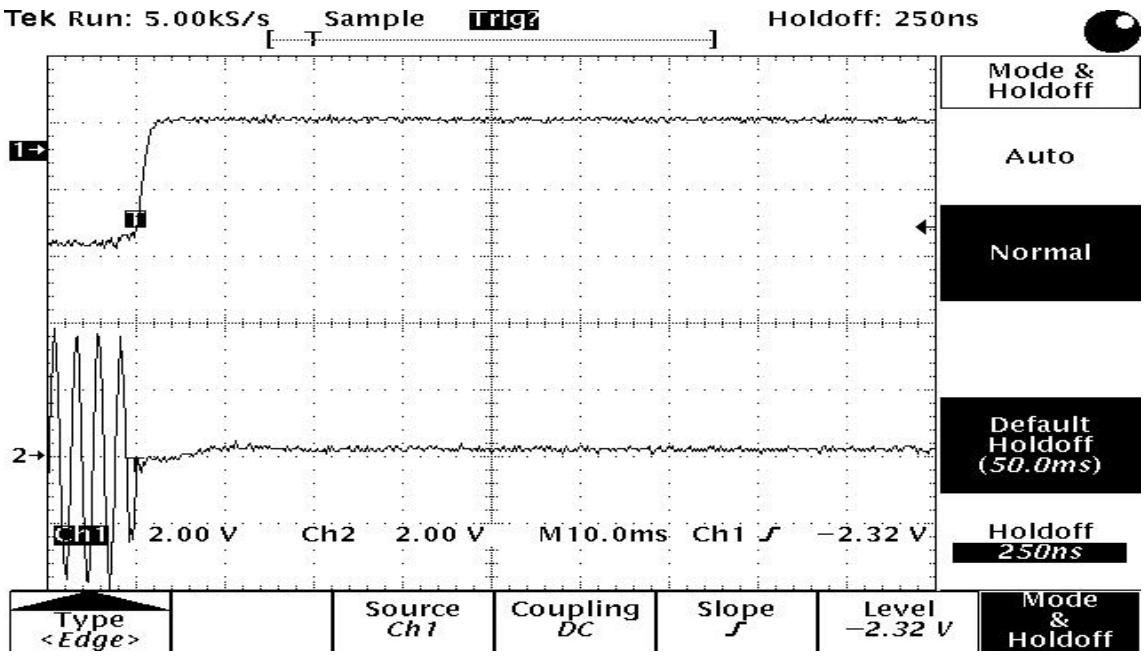
Test equipment used: 22, 26, 48

2.9 Transient frequency behaviour of the transmitter

Compliance standard : FCC part 90, section 90.214

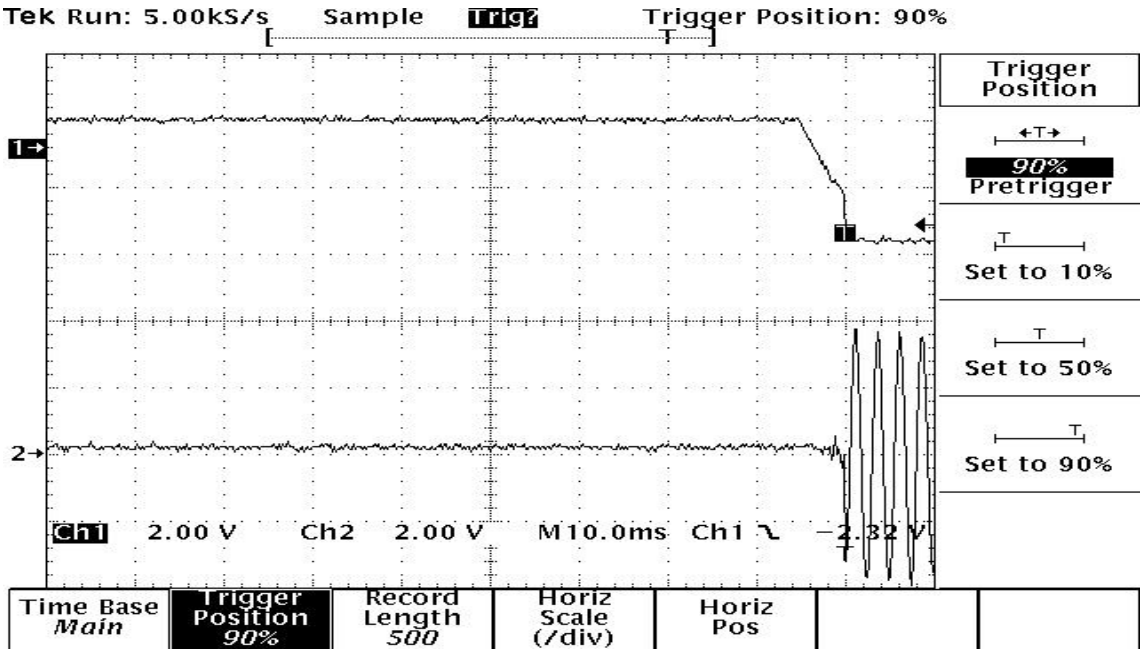
Test conditions : Normal test conditions
Channel : 16

During switch on



Channel 1 : Relative output power level versus time.
Channel 2 : Transmitter frequency displacement 12.5 kHz/div versus time.

During switch off



Channel 1 : Relative output power level versus time.
Channel 2 : Transmitter frequency displacement 12.5 kHz/div versus time.

Limits:

25 kHz channelization

During	Timing limit (msec)	Frequency deviation limit Δ fd
t1	5	Δfd ≤ 25 kHz
t2	20	Δfd ≤ 12.5 kHz
t3	5	Δfd ≤ 25 kHz
See for definitions of t1, t2 and t3 the table in section 90.214 of Part 90		

12.5 kHz channelization

During	Timing limit (msec)	Frequency deviation limit Δ fd
t1	5	Δfd ≤ 12.5 kHz
t2	20	Δfd ≤ 6.25 kHz
t3	5	Δfd ≤ 12.5 kHz
See for definitions of t1, t2 and t3 the table in section 90.214 of Part 90		

Test equipment used: 01, 02, 12, 16, 20, 22, 23, 25, 26, 37.

Used test equipment module

No.	Instrument/Ancillary	Type	Manufacturer	ID No.
01	Spectrum analyzer	8562 E	HP	TE00099
02	Signal generator	2042	Marconi	TE00030
03	Signal generator	SMG	R&S	TE00213
04	Signal generator	8657B	HP	TE00335
05	Signal generator	2042	Marconi	TE00353
06	Measuring receiver	MR4100	Radio Holland	TE00896
07	FSK-decoder	JOZ-2	HM	KML 002
08	Frequency counter	5350B	HP	TE00252
09	DSC de/encoder	3817	Debeg	910932
10	Audio analyzer	8903A	HP	TE00373
11	Oscilloscope	2430A	Tektronix	TE00211
12	Oscilloscope	TDS 680B	Tektronix	TE00204
13	RF Wattmeter	URV-Z4	R&S	TE00132
14	Reference receiver	Ksr-ref	HM	KSR325
15	Adjacent channel power meter	NKS	R&S	TE00339
16	Transient detector	JOZ-1	HM	TE00887
17	EMI test receiver	ESCI	R&S	TE 11128
18	Splitter	ZFSC-2	MCL	KSR500
19	Splitter	ZSC 2-1	MCL	KSR357
20	Attenuator	8494B/8496B	HP	KSR699/700
21	Sound level meter	2230	B&K	TE00393
22	Digital multimeter	87	Fluke	TE00257
23	Coaxial power attenuator	8343-100	Termaline	TE00068
24	Band reject filter	FF 227	KL	KSR624
25	Mixer	10514A	HP	30397
26	Power supply	D050-10	Delta	TE00584
27	Amplifier	5171A	Philips	4980S29
28	Active loop antenna	HFH2-Z2	R&S	TE00746
29	Vibration table	894	LDS	440
30	Climate chamber	CTS	CTS	TE00741
31	Logper/bowtie antenna	3143	Emco	TE00700
32	Double ridged guide antenna	3115	Emco	TE00532
33	Anechoic chamber	RFD-F-100	Euroshield	TE01064
34	Pre-amplifier	ESV-Z3	R&S	TE00098
35	Pre-amplifier	8449B	HP	TE00092
36	Spectrum analyzer	8563 E	HP	TE00481
37	Coaxial power attenuator	8343-200	Termaline	TE00072
38	Coaxial resistive load	8080	Termaline	TE00126
39	Signal generator	2042	Marconi	TE00353
40	Communication analyzer	CMT	R&S	TE00217
41	Junction box	DVU-4	R&S	TE00031
42	Signal generator	8642B	HP	TE00424
43	Splitter	1506A	Weinschel	TE01121
44	DSC controller	RM2042	SAILOR	RM2042

45	Biconilog antenna	CBL6112A	Chase	TE00967
46	Antenna tower	MA4000	Inn-Co	--
47	Semi Anechoic Room		Comtest	TE00861
48	Radio Communications Monitor	CMS54	R & S	TE11129
49	Temp./Hum. logger	--	MicroLog	TE01123
50	Mouth simulator	4227	B & K	TE00368
51	Audio amplifier	6552-1A	Solar Electr. Co.	TE00517