

Test report no. : 74324-2

Item tested : Radius 1000

**Type of equipment : Direction and Distance
Monitoring Device**

FCC ID : Q8IKSXRADIUS

Client : Kongsberg Seatex AS

FCC Part 80

Licensed Non-Broadcast Station Transmitter

10 January 2007

Authorized by :



Frode Sveinsen
Technical Verificator

CONTENTS

1	GENERAL INFORMATION	3
1.1	Testhouse Info	3
1.2	Client Information	3
1.3	Manufacturer	3
2	Test Information	4
2.1	Test Item	4
2.2	Test Environment	5
2.2.1	Normal test condition	5
2.3	Test Period	5
3	TEST REPORT SUMMARY	6
3.1	General	6
3.2	Test Summary	7
3.3	Description of modification for Modification Filing	7
3.4	Comments	7
3.5	Family List Rational	7
4	TEST RESULTS	8
4.1	Bandwidths	8
4.2	Class of Emissions	10
4.3	Transmitter Frequency Tolerances	11
4.4	Emission Limitations	26
4.5	Modulation requirements	33
4.6	Transmitter Power	34
5	LIST OF TEST EQUIPMENT	36
6	BLOCK DIAGRAM	37
6.1	System set up	37
6.2	Test Site Radiated Emission	38

1 GENERAL INFORMATION

1.1 Testhouse Info

Name: Nemko Comlab
Address: Gåsevikveien 8, Box 96
N-2027 Kjeller, NORWAY
Telephone: +47 64 84 57 00
Fax: +47 64 84 57 05
E-mail: post@comlab.no
FCC test firm registration no: 994405
IC OATS registration no: 4443
Total Number of Pages: 38

1.2 Client Information

Name: Kongsberg Seatex AS
Address: Pirsenteret, 7462 Trondheim, Norway
Telephone: +47 73545504
Fax: -

Contact:

Name: Harald Rosshaug
E-mail: harald.rosshaug@kongberg.com

1.3 Manufacturer

Name: Kongsberg Seatex AS
Address: Pirsenteret, 7462 Trondheim, Norway
Telephone: +47 73545504

2 Test Information

2.1 Test Item

Name :	Radius 1000
FCC ID :	Q8IKSXRADIUS
Model/version :	Interrogator : Radius 1000, Transponder: Radius 500 & 600
Serial number :	RADius 1000: R10059 RADius 500: RT 5062 RADius 600: RT0110
Hardware identity and/or version:	RADius 1000: RAD-E-IU_00 RADius 600: RAD-E-HGT_00 RADius 500: RAD-E-LPT_00
Software identity and/or version :	RADius 1000: 1.3 CPU, 1.05 (TX-Cntrl), Processing unit: 1.05 RADius 500: 1.3 RADius 600: 4
Frequency Range :	5510 – 5610 MHz
Operating Modes :	TX (Sweep)
Type of Modulation :	FM-CW
User Frequency Adjustment :	None
Rated Output Power :	1 Watt
Type of Power Supply :	AC mains
Antenna Connector :	Integrated patch antenna
Switching range :	+/- 50MHz

Description of Test Item

The Radius 1000 comprises three main components, which are physically separated. These are:

6 U rack containing: The Processing unit, keyboard and power and connector shelf.

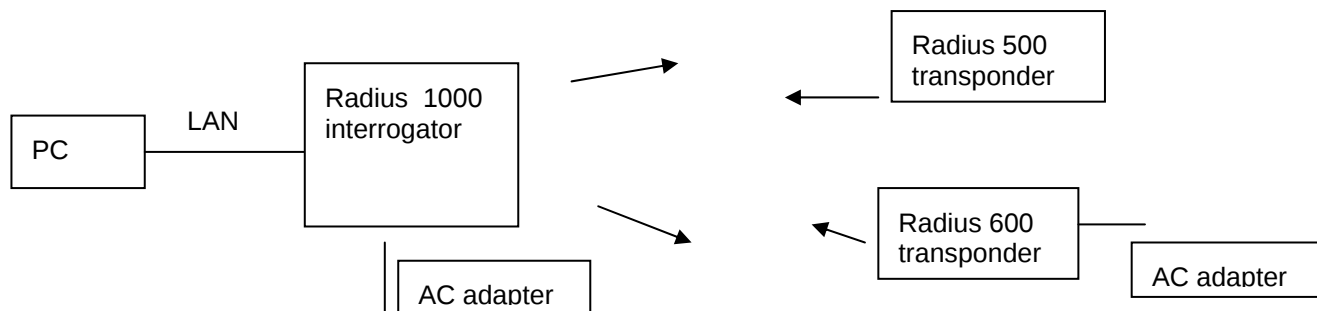
The Interrogator unit (Radius 1000): HP (Radius 600) and LP (Radius 500) transponders, User terminal application software.

Received items for testing:

- 1 pc. Of RADius 1000 Interrogator unit
- 1 pc. Of Radius 600 HP transponder
- 1 pc. Of RADius 500 LP transponder
- 1 pc. Of power shelf with 115 Vac filter, ac/dc adapter and LAN hub
- 1 pc. Of PC with GUI software.
- VDU monitor for table mounting.
- Power supply and power cable for transponder
- Power cables and cables between the Processing unit and the Interrogator unit.

Theory of Operation

The RADIUS 1000 interrogator is a direction and distance-monitoring device using radar technology. The transponder RADIUS 600 High Gain is an active transponder operated by 115 V AC and the RADIUS 500 Low power transponder is a retro reflective design without additional gain, operated by battery.



2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	115V AC

The values are the limit registered during the test period.

2.3 Test Period

Item received date:	2006-11-01
Test period :	from 2006-11-01 to 2006-11-29

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Kongsberg Seatex AS

Model No.: Radius 1000

Serial No.: R10059

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 80.

Radiated tests were conducted in accordance with ANSI C63.4-2003. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10 metres.

☒ New Submission

☐ Production Unit

☐ Class II Permissive Change

☒ Pre-production Unit

TNB Equipment Code

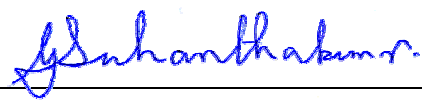
☐ Family Listing

THIS TEST REPORT RELATES ONLY TO THE ITEM (S) TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".



TEST REPORT #: 74324-2

TESTED BY: 
G.Suwanthakumar, Test engineer

DATE: 29 November 2006

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This test report applies only to the items and configurations tested.

3.2 Test Summary

Name of test	FCC Part 80 reference	Result
Frequency stability & Supply Voltage Variations	2.1055 (a)(d)	Complies
Bandwidth	80.205 (a)	Complies
Class of emissions	80.207 (d)	Complies
Transmitter frequency tolerance	80.209 (c)	Complies
Emissions Limitations	80.211 (f)	Complies
Modulation requirements	80.213(g)	N/A ¹
Transmitter power	80.215(n)(3)	Complies

¹Not applicable for equipment operating with only CW

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The measurements were done with the EUT powered by 115 V AC. It was checked that power variations between 85% and 115% did not have any influence on the measurements.

All ports were populated during spurious emission measurements.

3.5 Family List Rational

Not Applicable.

4 TEST RESULTS

4.1 Bandwidths

Para. No.: 80.205 (a)

Test Performed By: G.Suwanthakumar

Date of Test: 06.11.06

Test Results: **Complies**

Measurement Data: Bandwidth of the CW: Declared value 50 kHz

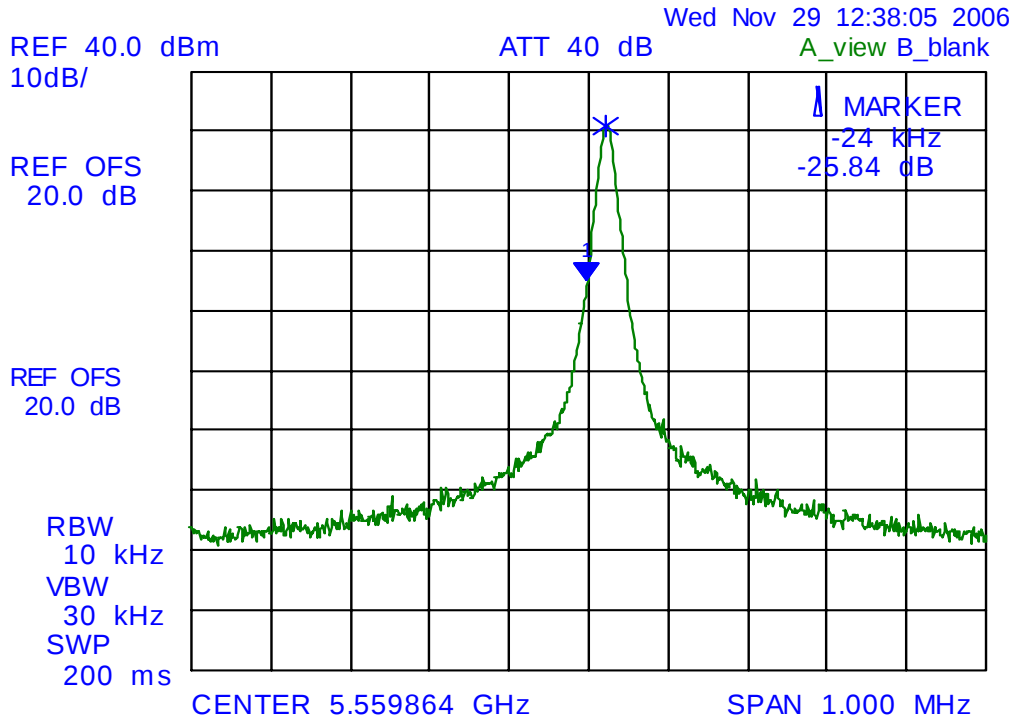
The scan bandwidth: 103.84 MHz.

See attached graph

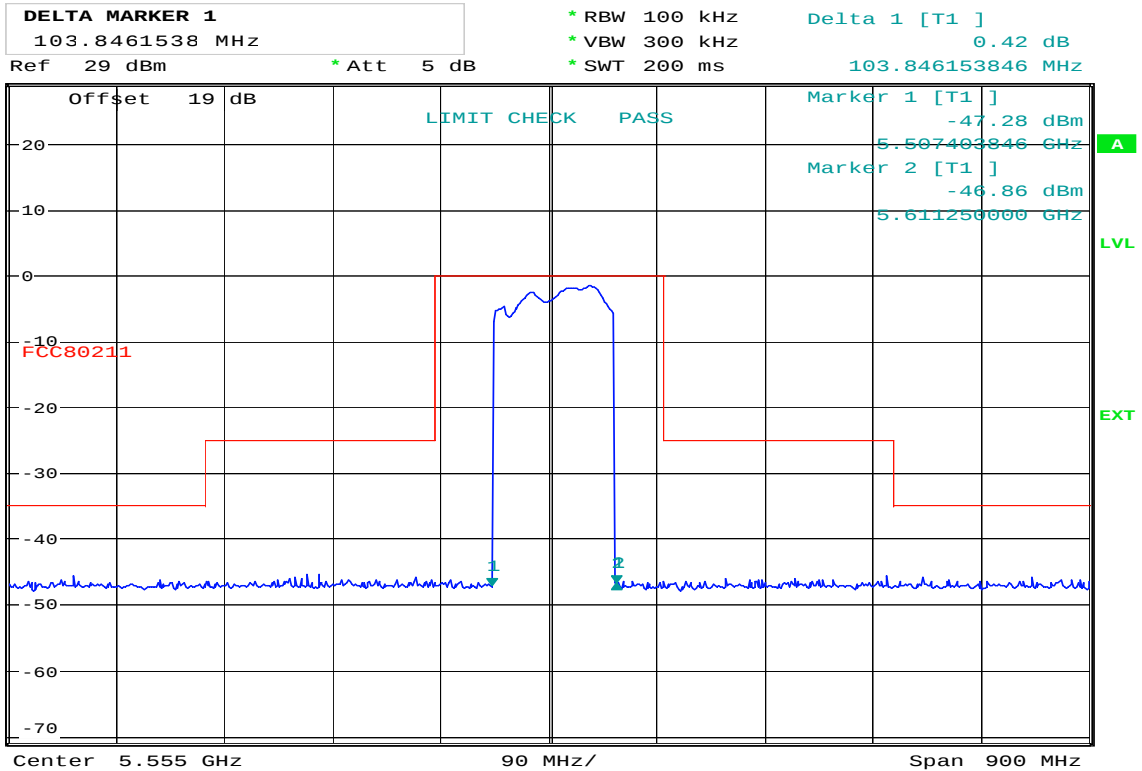
Requirement:

An emission designator shows the necessary bandwidth for each class of emission of a station except that in ship earth stations it shows the occupied or necessary bandwidth, whichever is greater.

No requirements for Radiodetermination systems operating in 5460MHz - 5650MHz range.



CW bandwidth - ± 25 kHz



Date: 3.NOV.2006 12:24:18

Scan band width - 103.84 MHz

4.2 Class of Emissions

Para. No.: 80.207 (d)

Test Performed By: G.Suwanthakumar

Date of Test: 08.11.06

Test Results: Complies

Measurement Data: /

Requirement:

Radiodetermination:

2.4-9.6 GHz P0N

4.3 Transmitter Frequency Tolerances

Para. No.: 80.209 (c)

Test Performed By: G.Suinthakumar	Date of Test: 06.11.06 – 29.11.06
-----------------------------------	-----------------------------------

Test Results: Complies

Measurement Data:

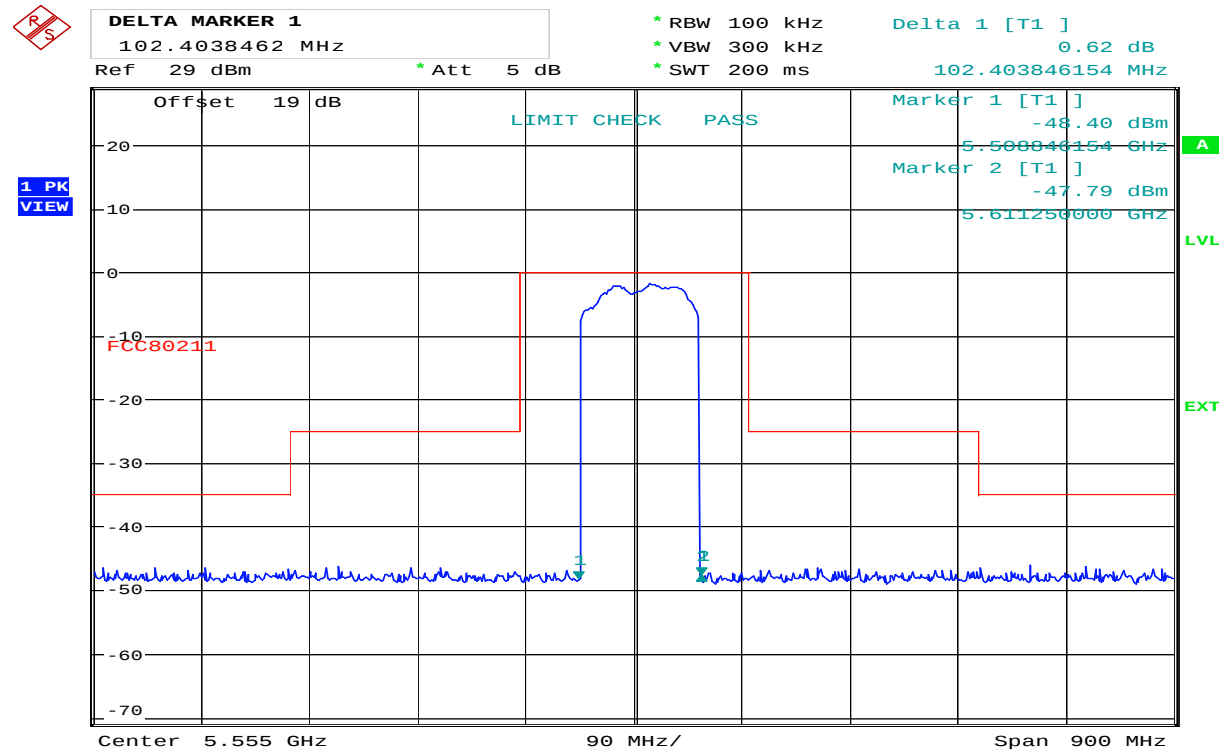
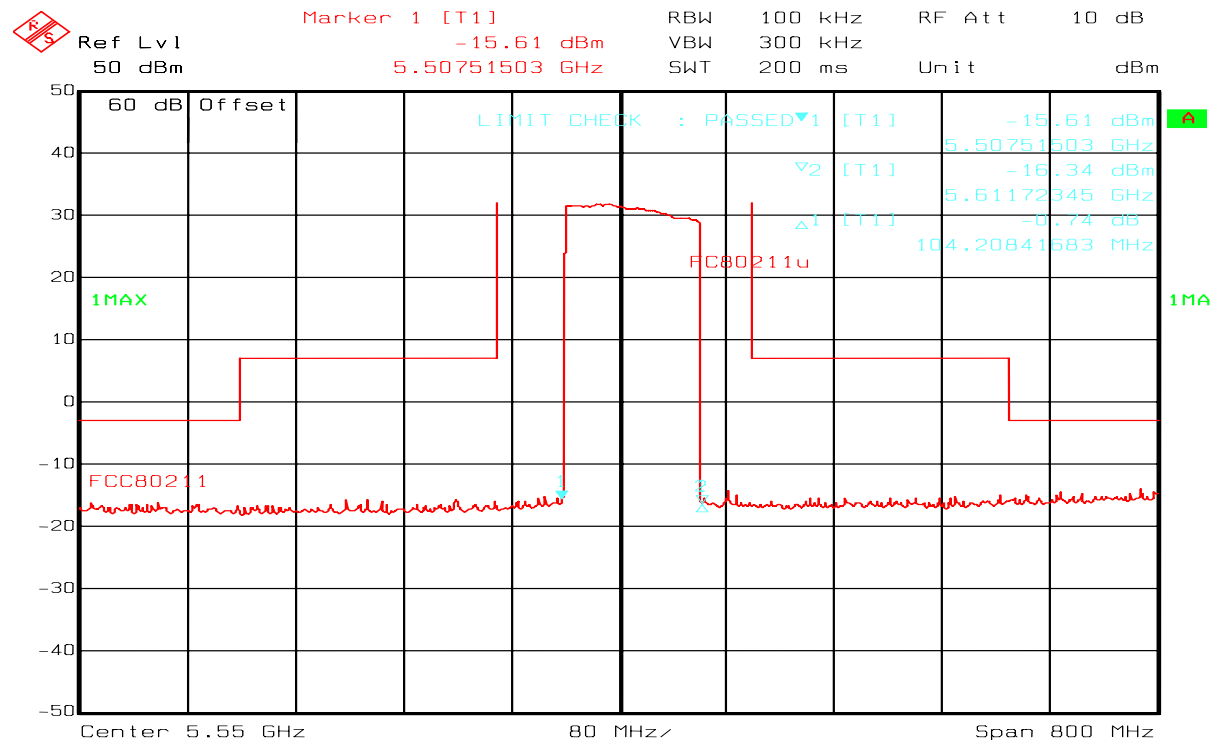
Test Conditions		Measured Frequency		
		GHz		
		F _L (5.51GHz)	F _H (5.61GHz)	BW (100MHz)
T _{nom} (20 °C)	V _{min} (97.75 Vac)	5.50751503	5.61172345	104.2
	V _{nom} (115 Vac)	5.50751503	5.61172345	104.2
	V _{max} (132.25 Vac)	5.50751503	5.61172345	104.2
T(+50 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{nom} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.507403846	5.61125000	103.8
T(+40 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{nom} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.508846154	5.61125000	102.4
T(+30 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{nom} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.508846154	5.61125000	102.4
T(+10 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{nom} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.507403846	5.61125000	103.8

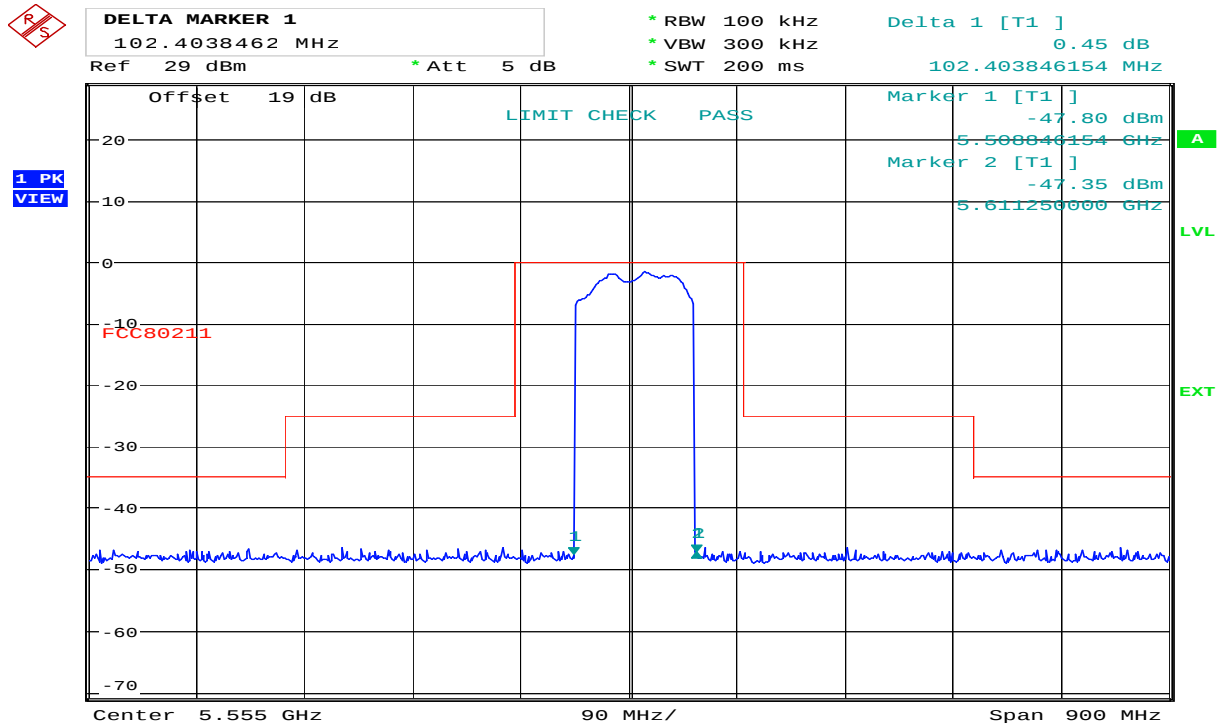
T(0 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{max} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.507403846	5.61125000	103.8
T(-10 °C)	V _{min} (97.75 Vac)	5.507403846	5.61125000	103.8
	V _{max} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.508846154	5.61125000	102.4
T(-20 °C)	V _{min} (97.75 Vac)	5.508846154	5.61125000	102.4
	V _{max} (115 Vac)	5.508846154	5.61125000	102.4
	V _{max} (132.25 Vac)	5.508846154	5.61125000	102.4
T(-30 °C)	V _{min} (97.75 Vac)	5,507600000	5.61170000	102.4
	V _{max} (115 Vac)	5.51010000	5.61170000	102.3
	V _{max} (132.25 Vac)	5.51010000	5.61170000	102.4

See attached graphs.

Requirements:

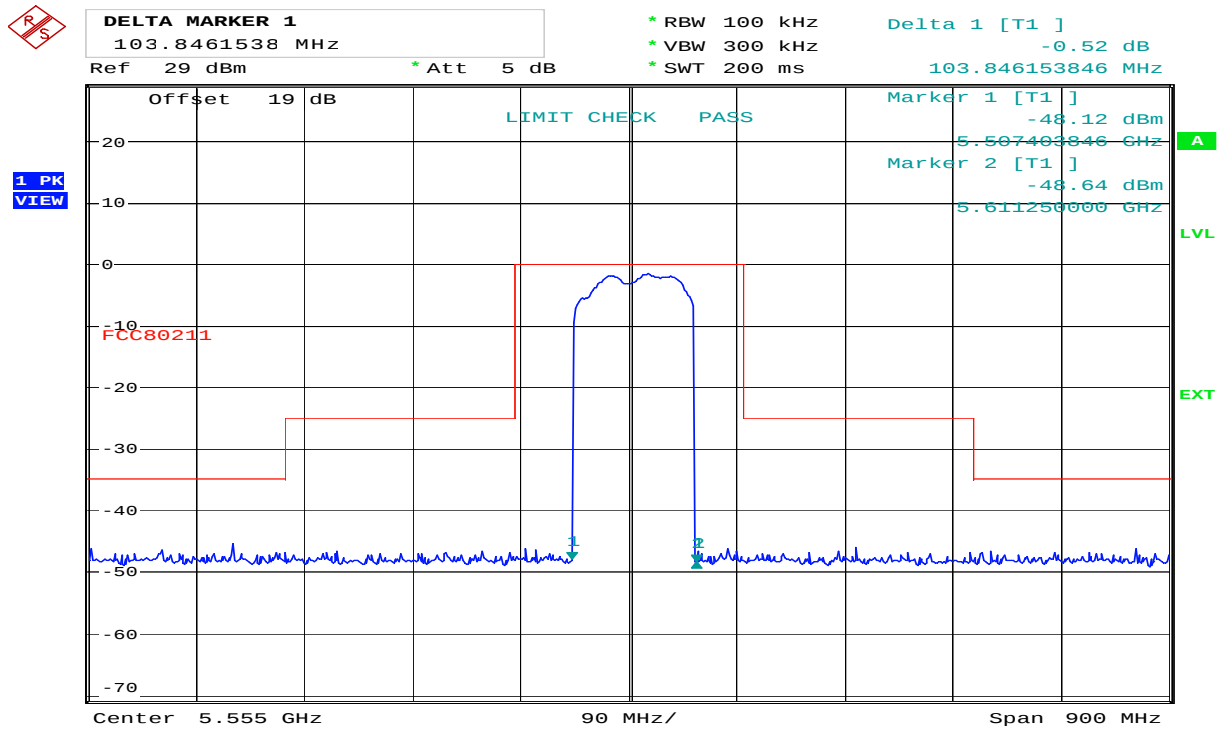
For stations in the maritime radiodetermination service, other than ship radar stations, the authorized frequency tolerance will be specified on the license when it is not specified in this part.





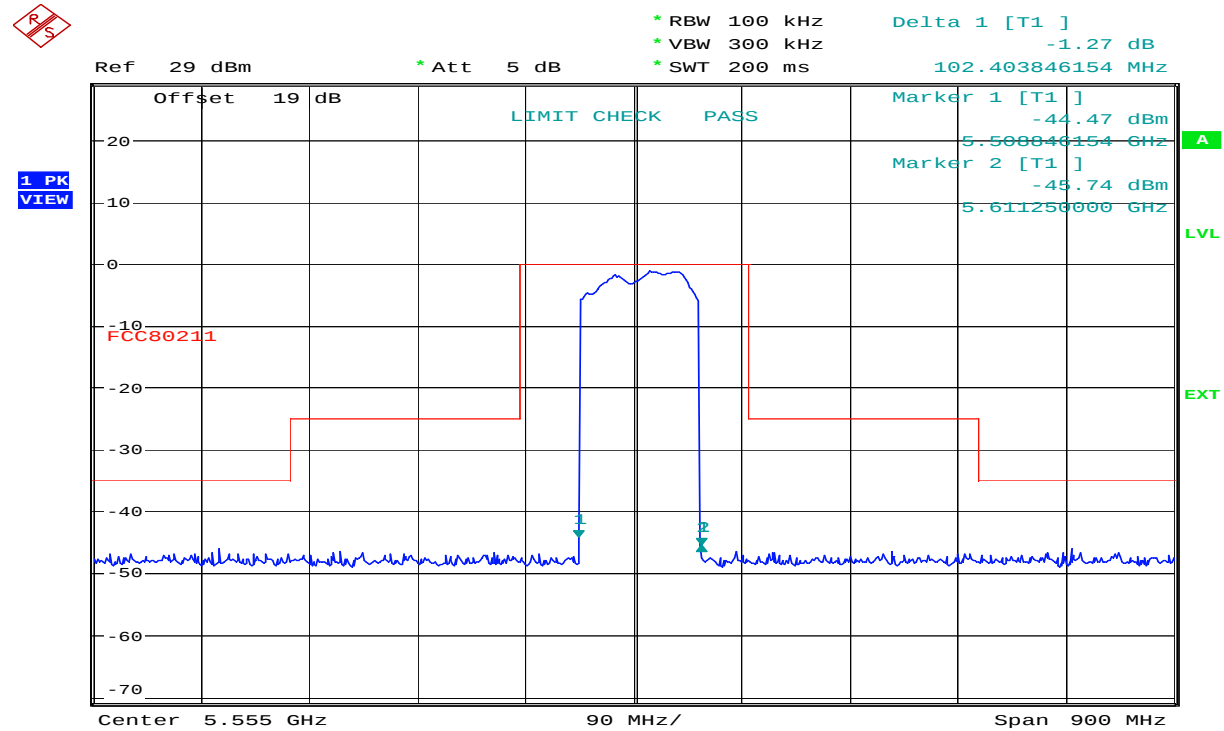
Date: 3.NOV.2006 15:30:33

Temperature: +50 °C , Voltage : 115V AC



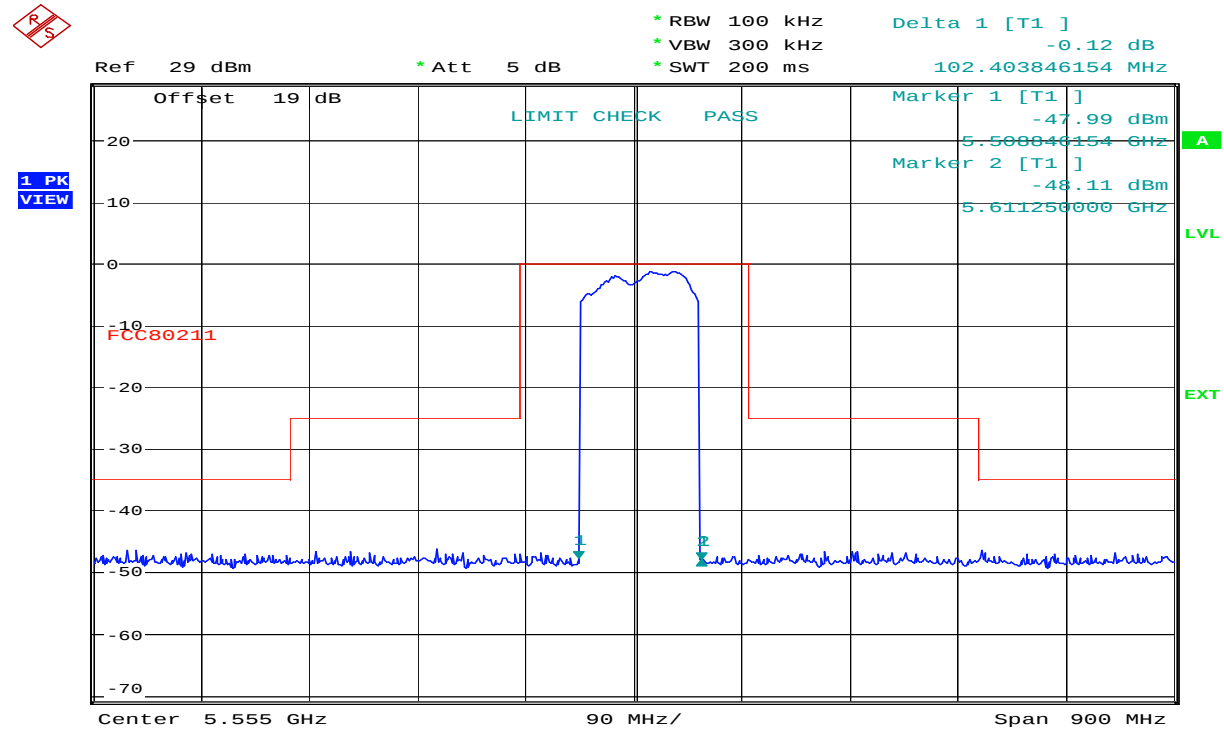
Date: 3.NOV.2006 15:27:53

Temperature: +50 °C , Voltage : 132.25V AC



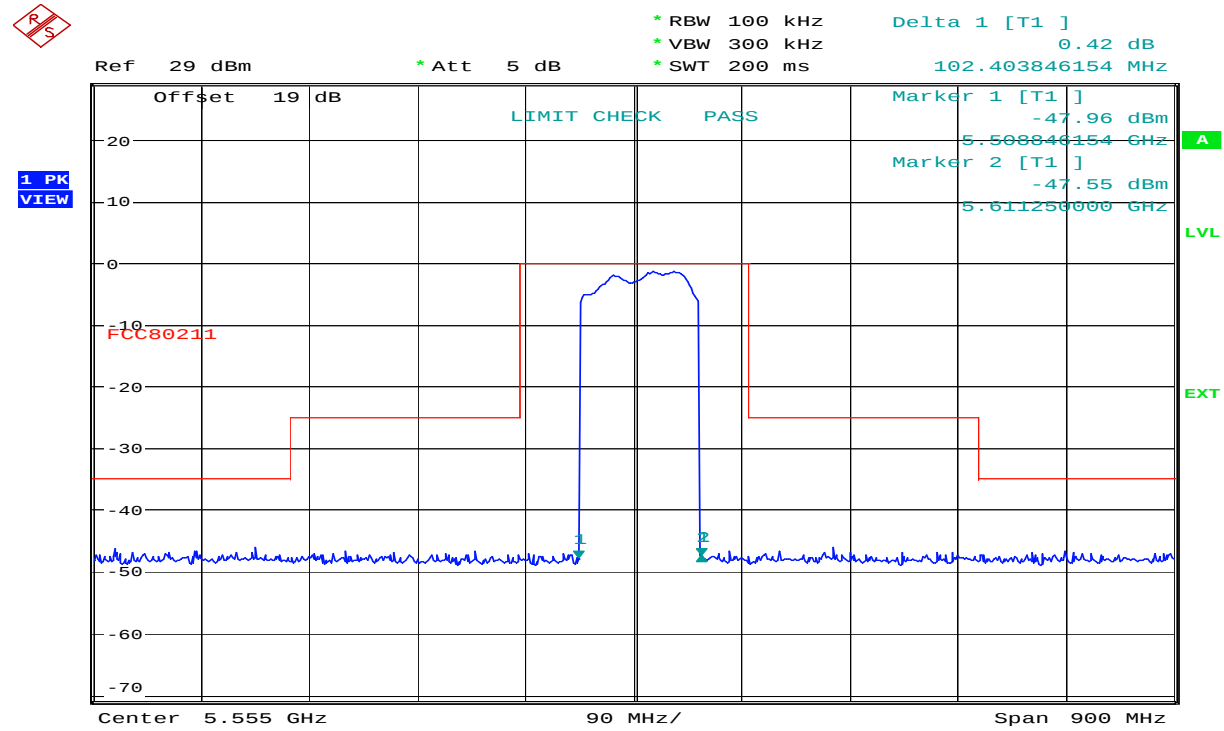
Date: 3.NOV.2006 14:40:56

Temperature: +40 °C, Voltage: 97.75V AC



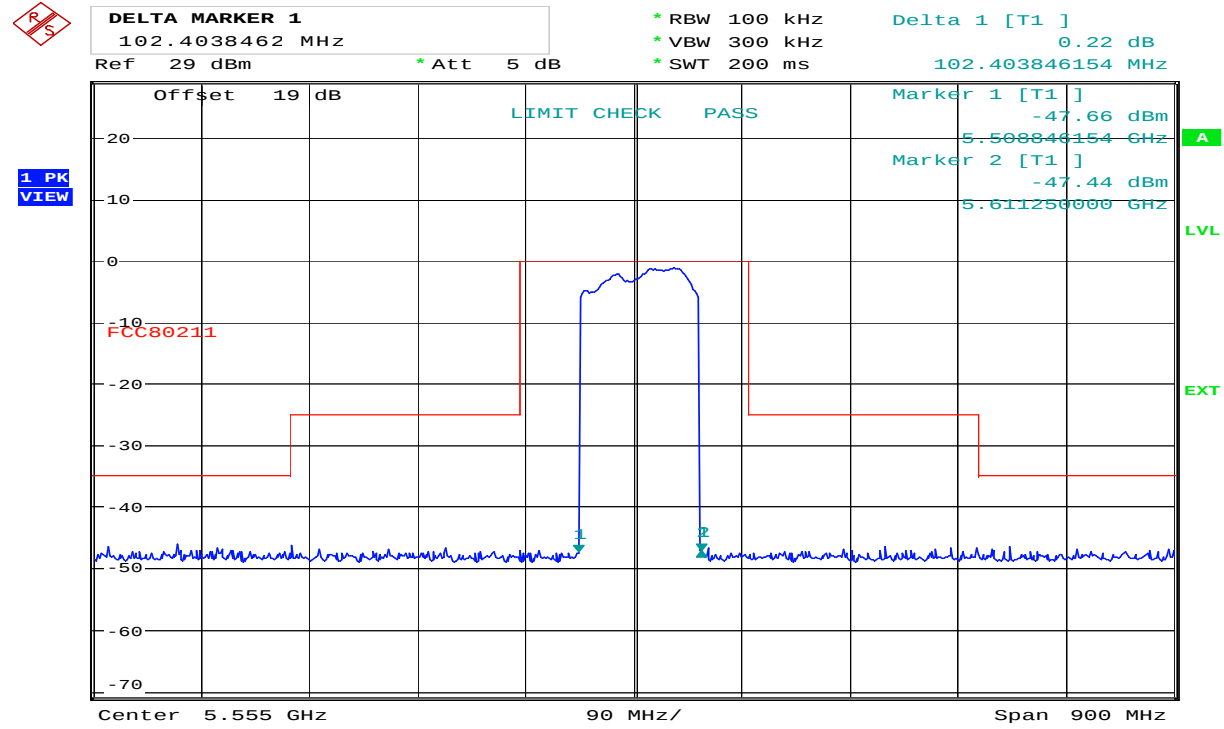
Date: 3.NOV.2006 14:42:45

Temperature: +40 °C, Voltage: 115V AC



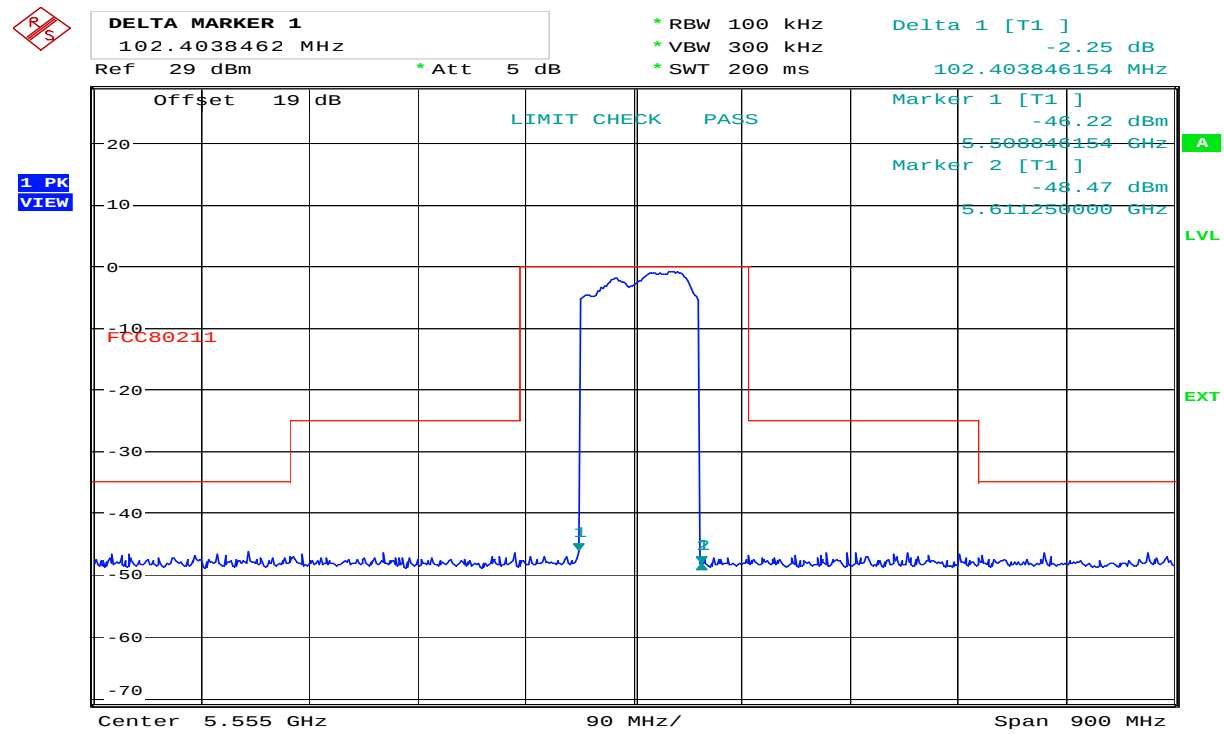
Date: 3.NOV.2006 14:45:12

Temperature: +40 °C, Voltage: 132.25V AC



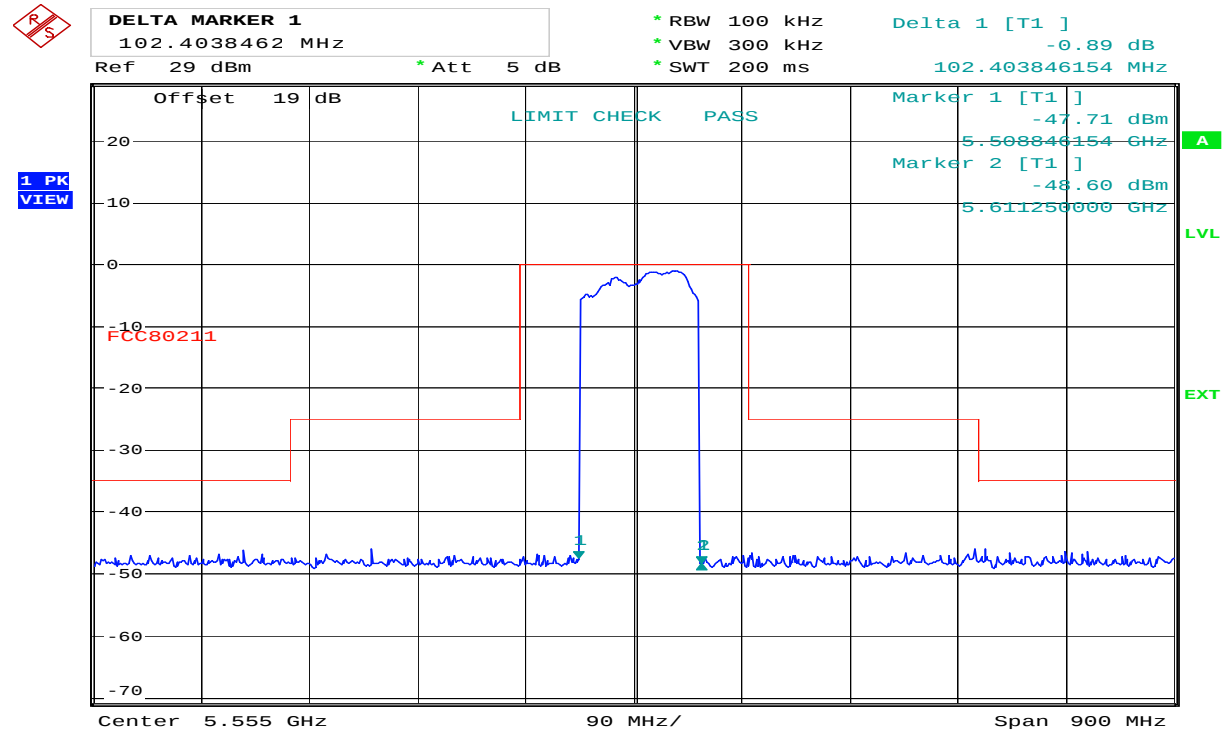
Date: 3.NOV.2006 14:02:59

Temperature: +30 °C, Voltage: 97.75V AC



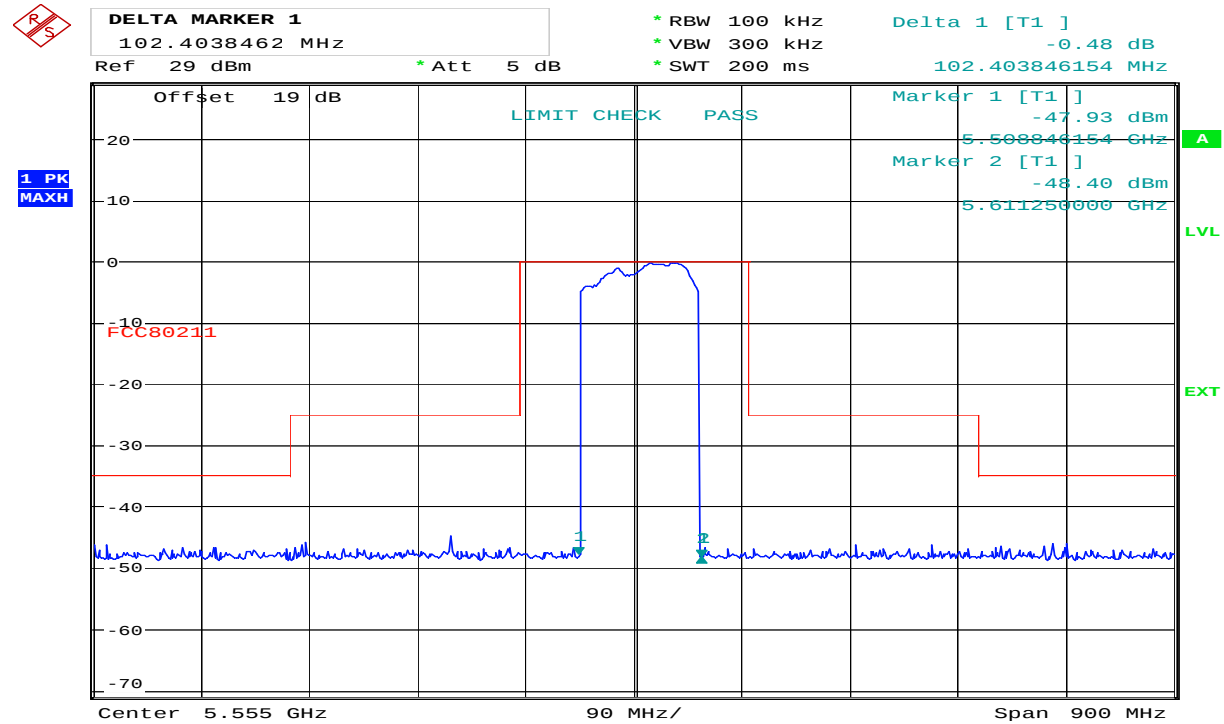
Date: 3.NOV.2006 13:52:20

Temperature: +30 °C, Voltage: 115V AC



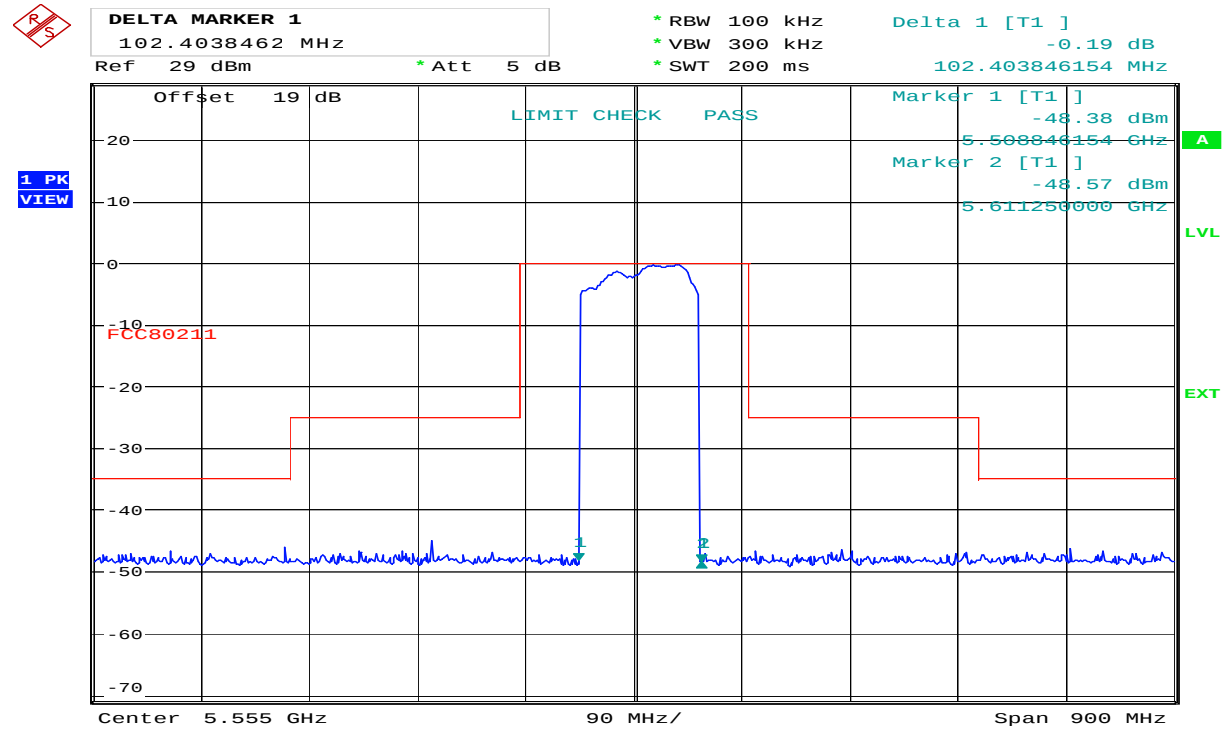
Date: 3.NOV.2006 13:59:05

Temperature: +30 °C, Voltage: 132.25V AC



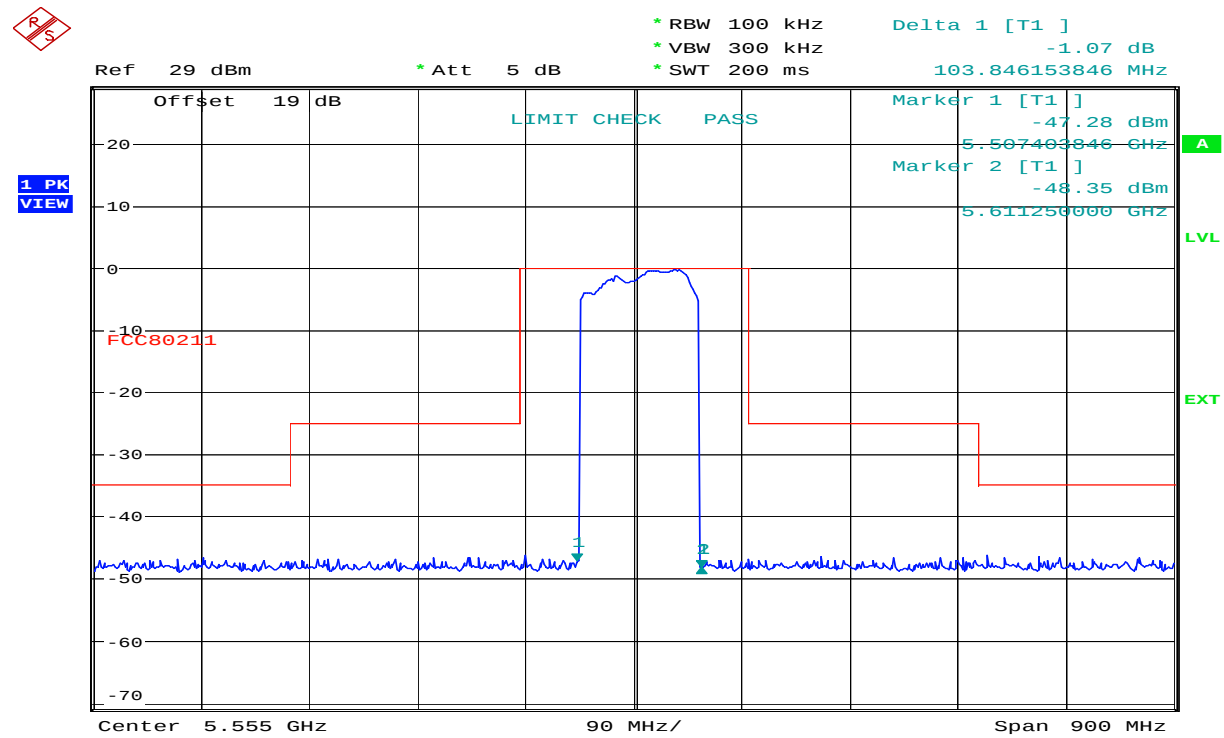
Date: 3.NOV.2006 16:14:38

Temperature: +10 °C, Voltage: 97.75V AC



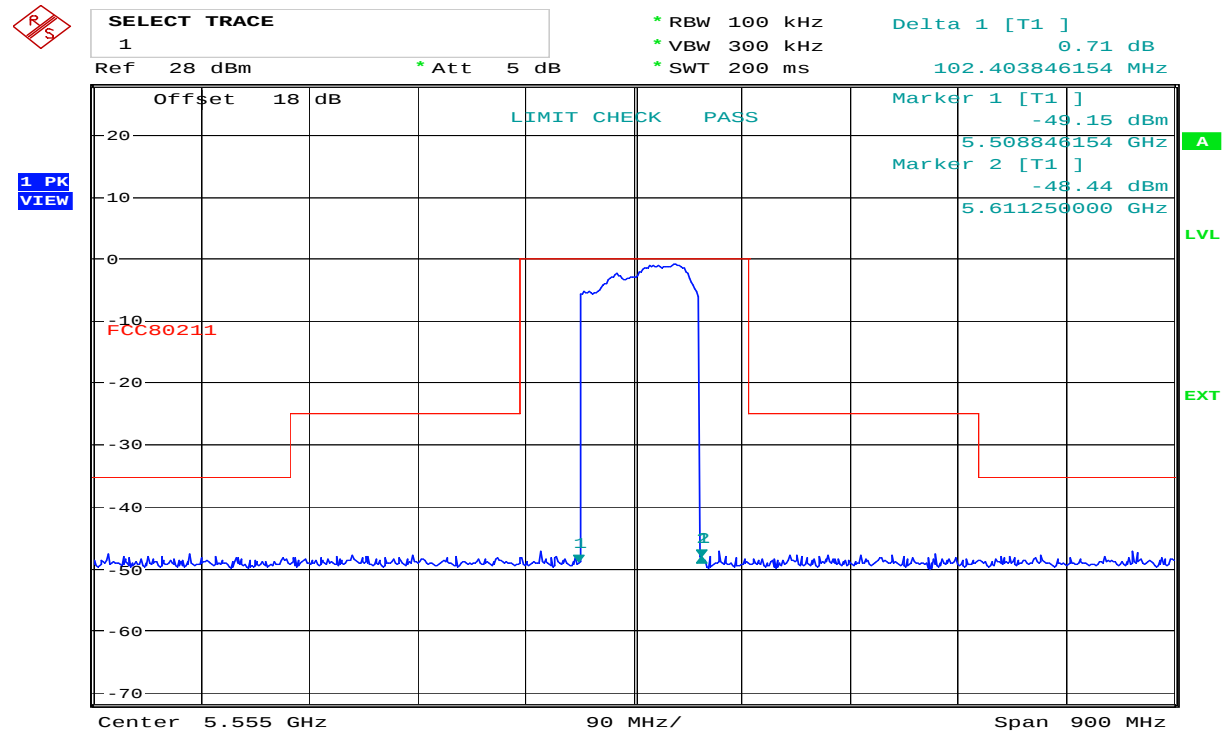
Date: 3.NOV.2006 16:17:34

Temperature: +10 °C, Voltage: 115V AC



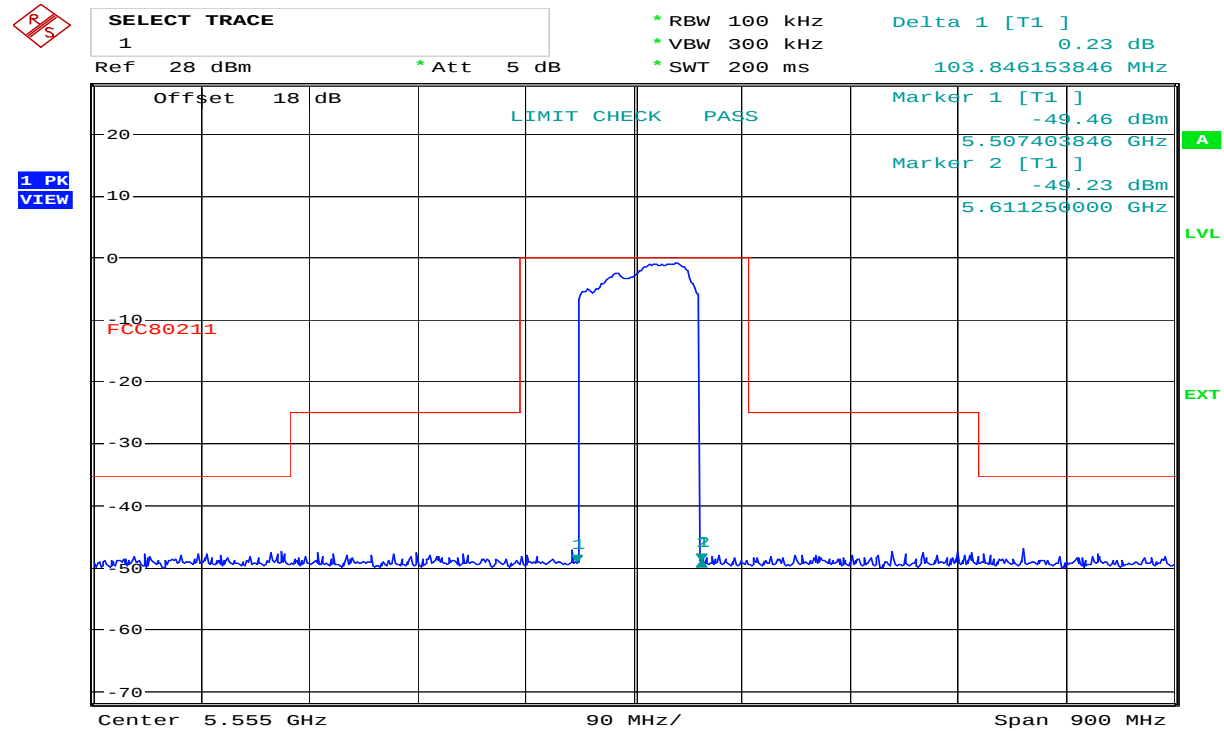
Date: 3.NOV.2006 16:19:52

Temperature: +10 °C, Voltage: 132.25V AC



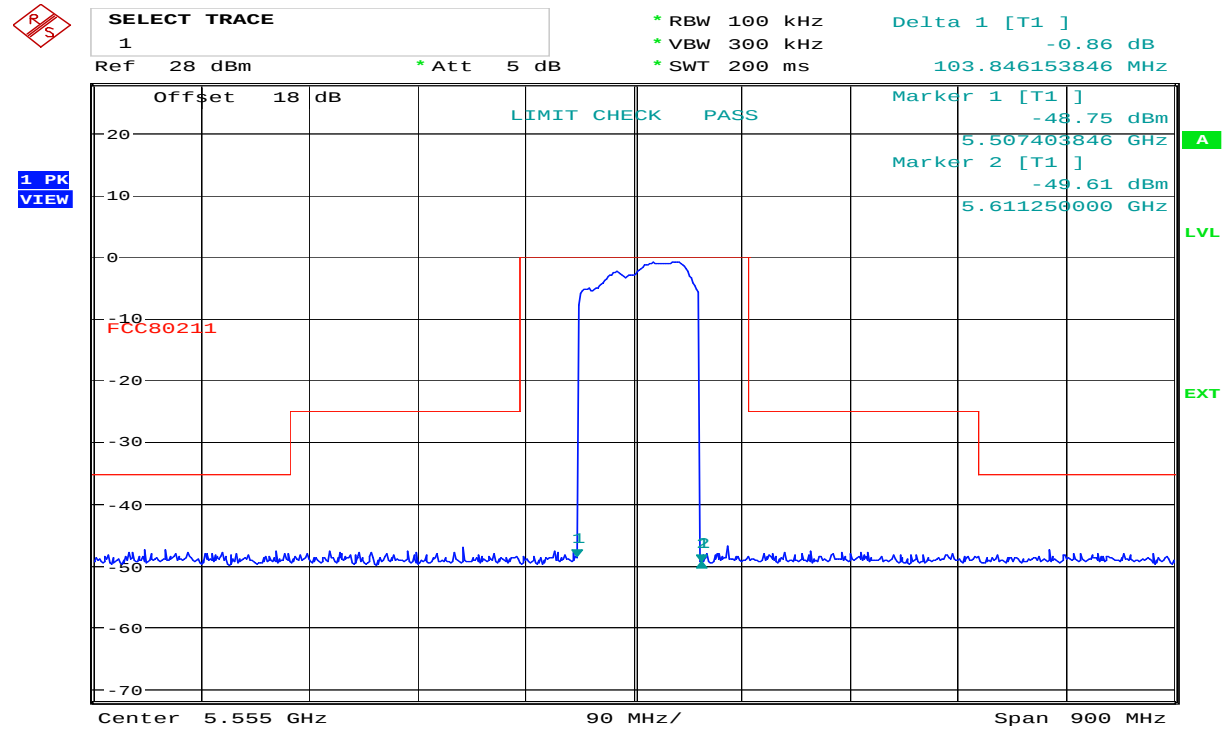
Date: 3.NOV.2006 17:17:01

Temperature: 0 °C, Voltage: 97.75V AC



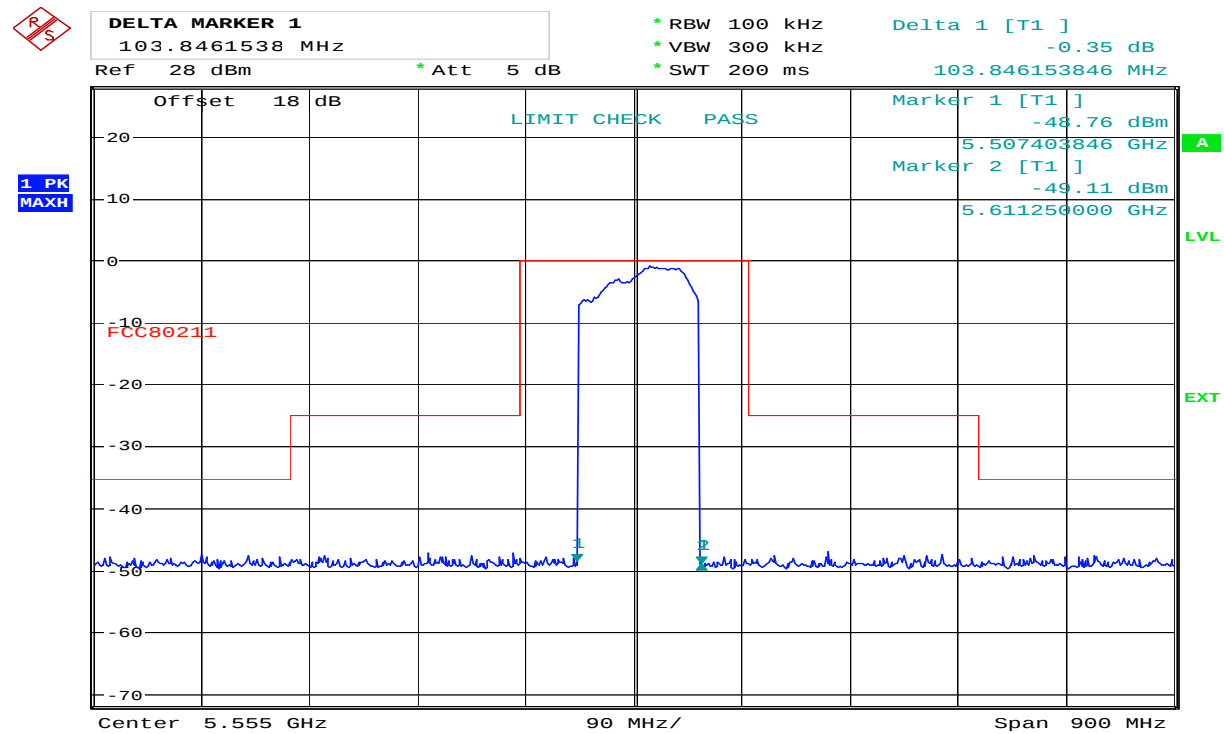
Date: 3.NOV.2006 17:14:31

Temperature: 0 °C, Voltage: 115V AC



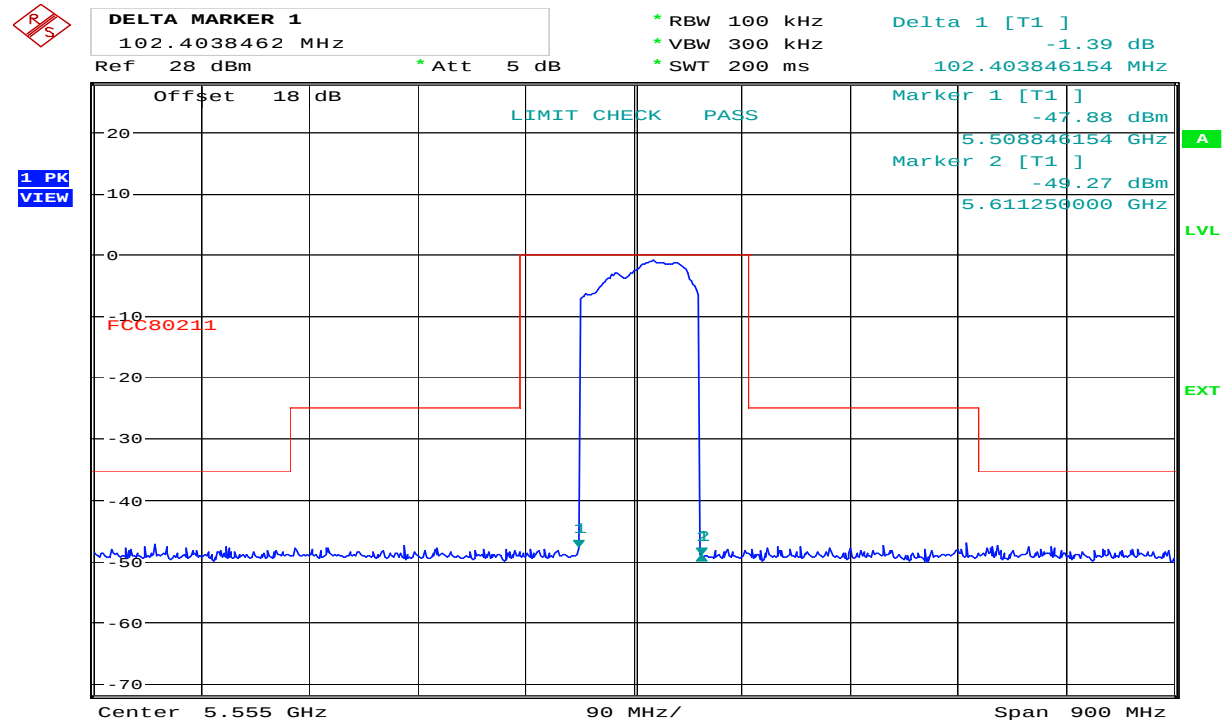
Date: 3.NOV.2006 17:11:27

Temperature: 0 °C, Voltage: 132.25V AC



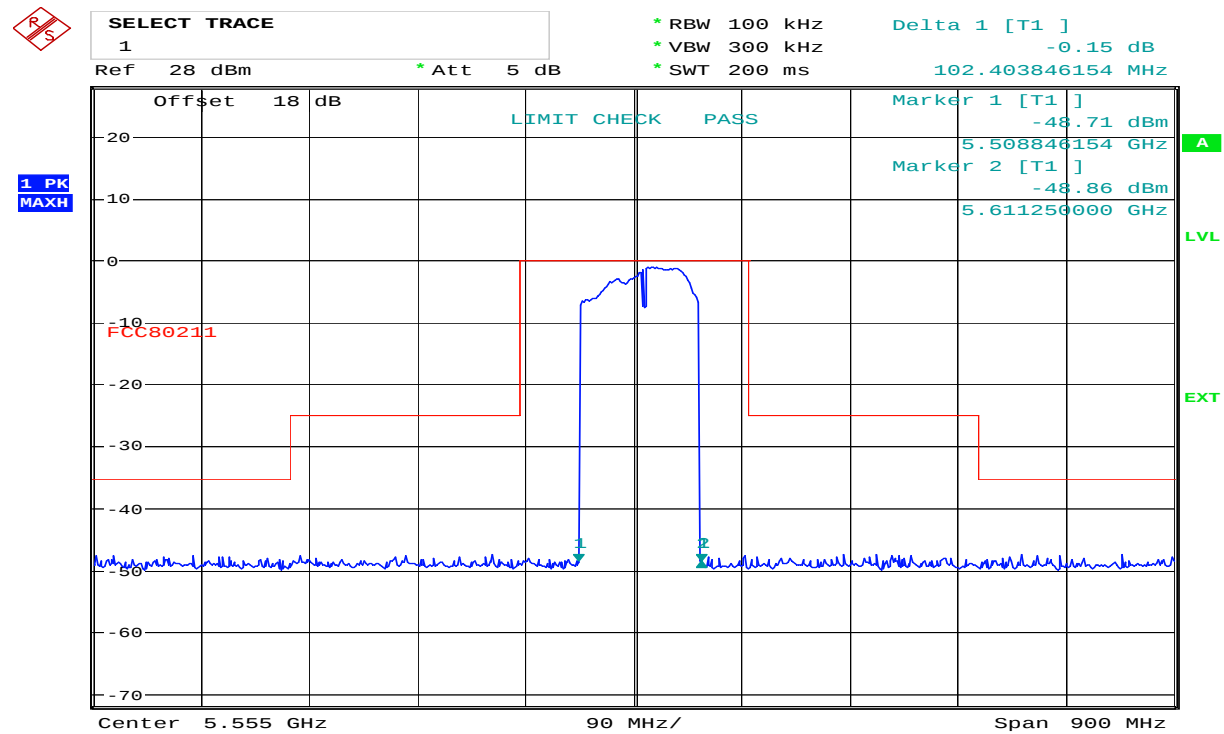
Date: 3.NOV.2006 20:05:17

Temperature: -10 °C, Voltage: 97.75V AC



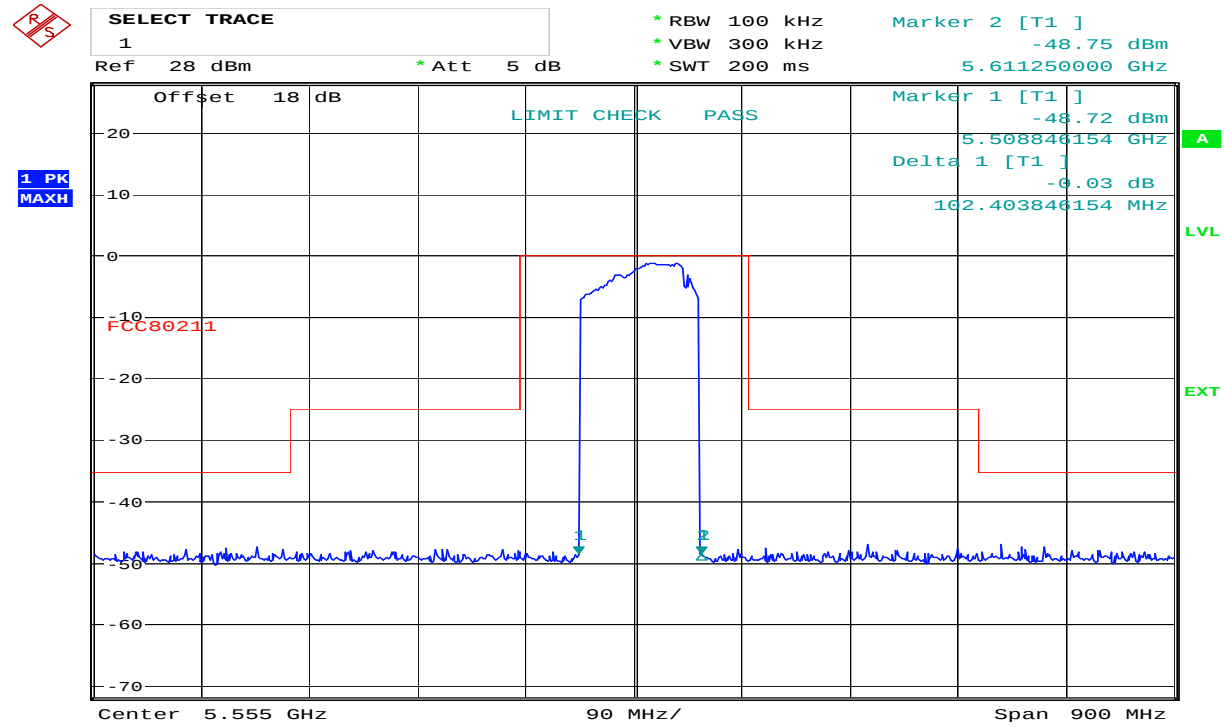
Date: 3.NOV.2006 20:02:58

Temperature: -10 °C, Voltage: 115V AC



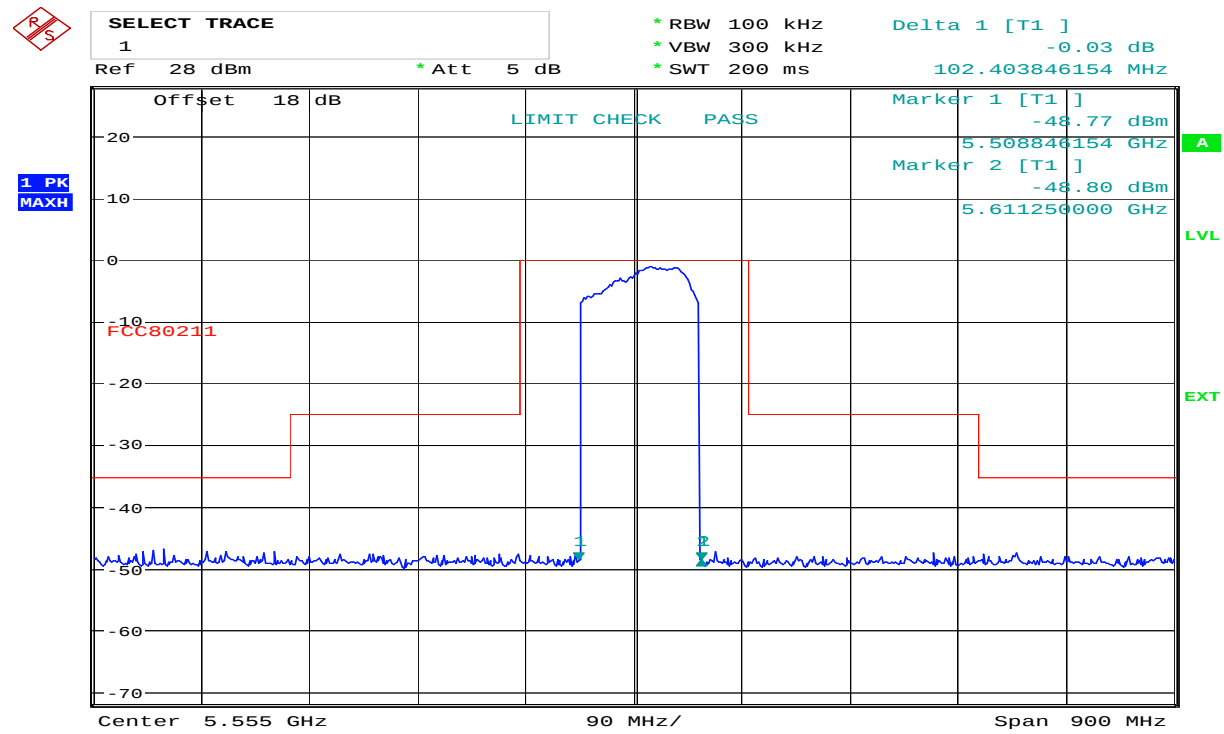
Date: 3.NOV.2006 20:07:39

Temperature: -10 °C, Voltage: 132.25V AC



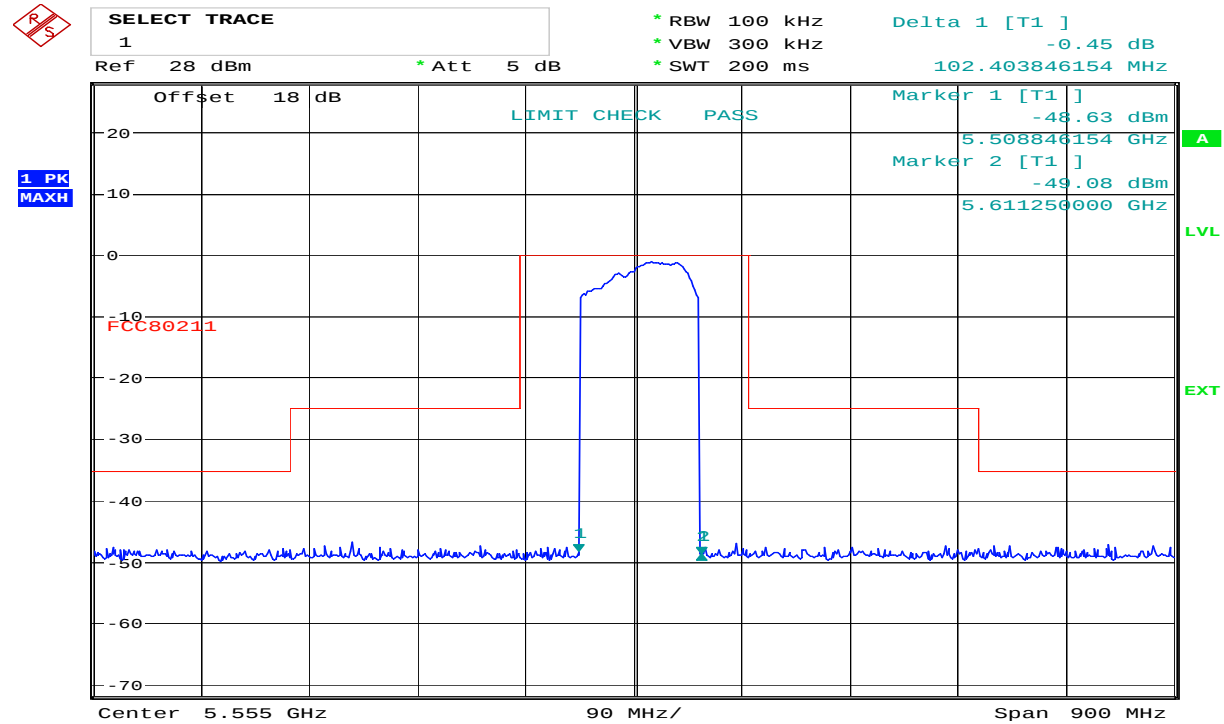
Date: 3.NOV.2006 21:03:51

Temperature: -20 °C, Voltage: 97.75V AC



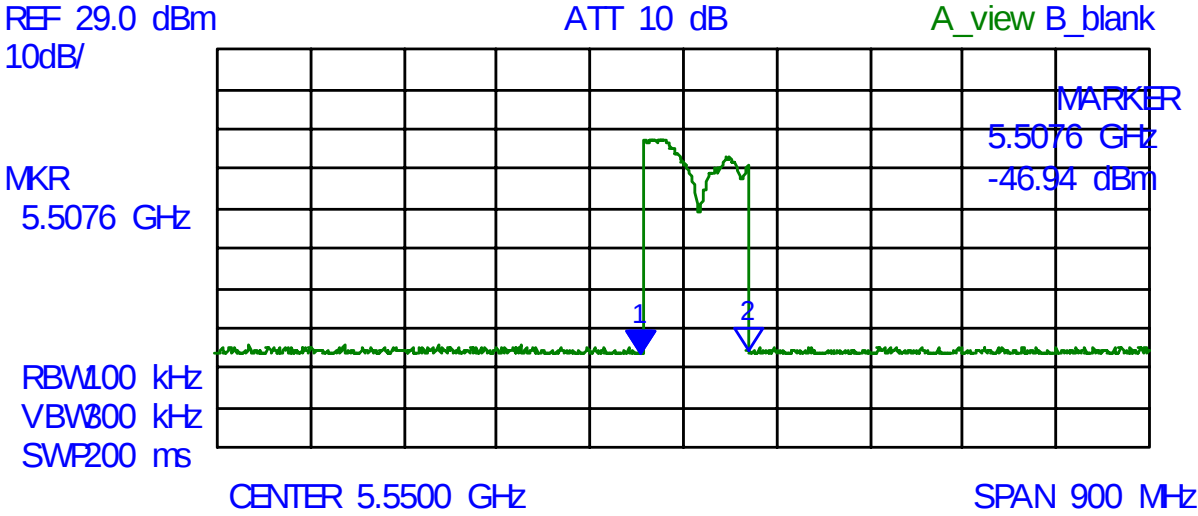
Date: 3.NOV.2006 21:02:15

Temperature: -20 °C, Voltage: 115V AC



Date: 3.NOV.2006 20:59:50

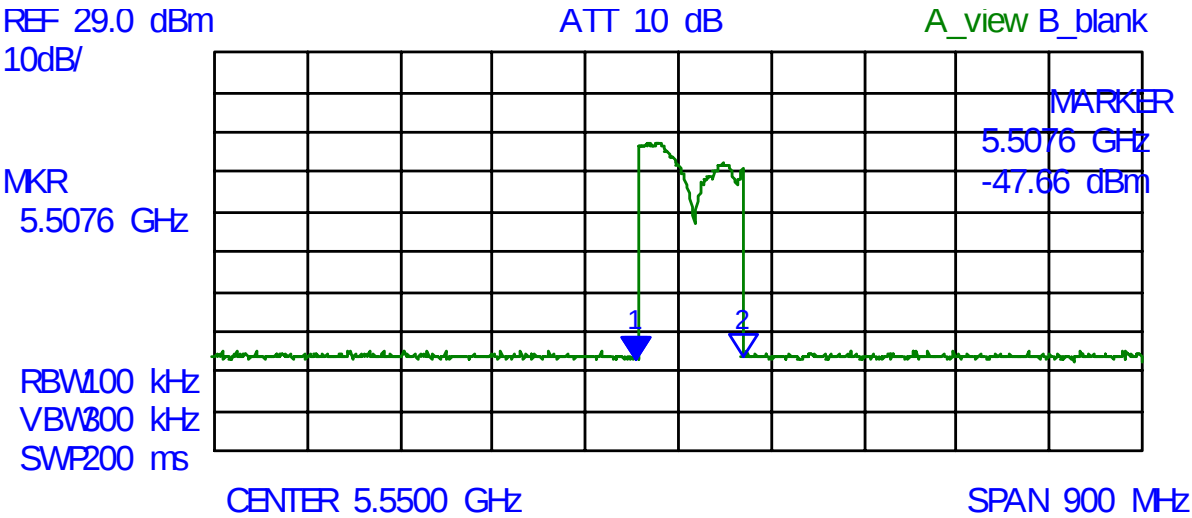
Temperature: -20 °C, Voltage: 132.25V AC



*** Multi Marker List ***

No.1:	5.5076 GHz	-46.94 dBm	A
No.2:	5.6117 GHz	-46.28 dBm	A
No.3:			

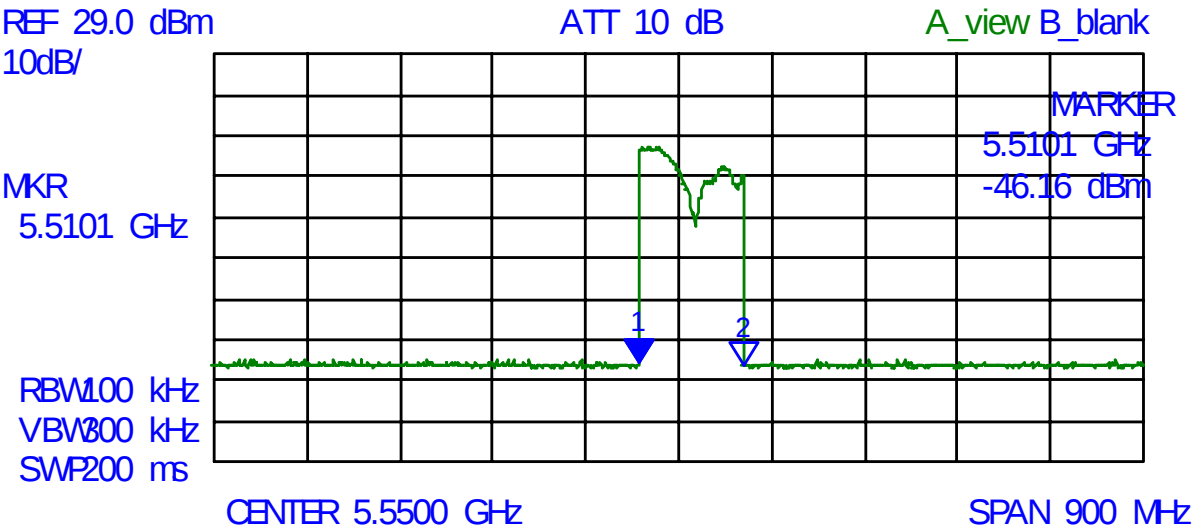
Temperature: -30 °C, Voltage: 115V AC



*** Multi Marker List ***

No.1:	5.5076 GHz	-47.66 dBm	A
No.2:	5.6117 GHz	-47.50 dBm	A

Temperature: -30 °C, Voltage: 97.7V AC



*** Multi Marker List ***

No.1:	5.5101 GHz	-46.16 dBm	A
No.2:	5.6117 GHz	-47.44 dBm	A

Temperature: -30 °C, Voltage: 132V AC

4.4 Emission Limitations

Para. No.: 80.211 (f)

Test Performed By: G.Suwanthakumar

Date of Test: 06.11.06

Test Results: Complies

Measurement Data:

Frequency (MHz)	Bandwidth (kHz)	Spurious level (dBm)
32	100	-50
47	100	-54
69.85	100	-46
90	100	-59
170	100	-49
180	100	-64
190	100	-58
250	100	-58
260	100	-53
300	100	-51
340	100	-48
420	100	-50
11100	100	-15.6
16000	100	-17
20GHz – 40GHz		None detected*

Substitution method is used to determine the spurious levels. Under 1GHz erp and over 1 GHz eirp.

The spectrum was searched from 30 MHz up to 40 GHz. And all emissions within 20 dB below the limit were measured and reported.

*But all emissions above 20GHz and up to 40 GHz none detected

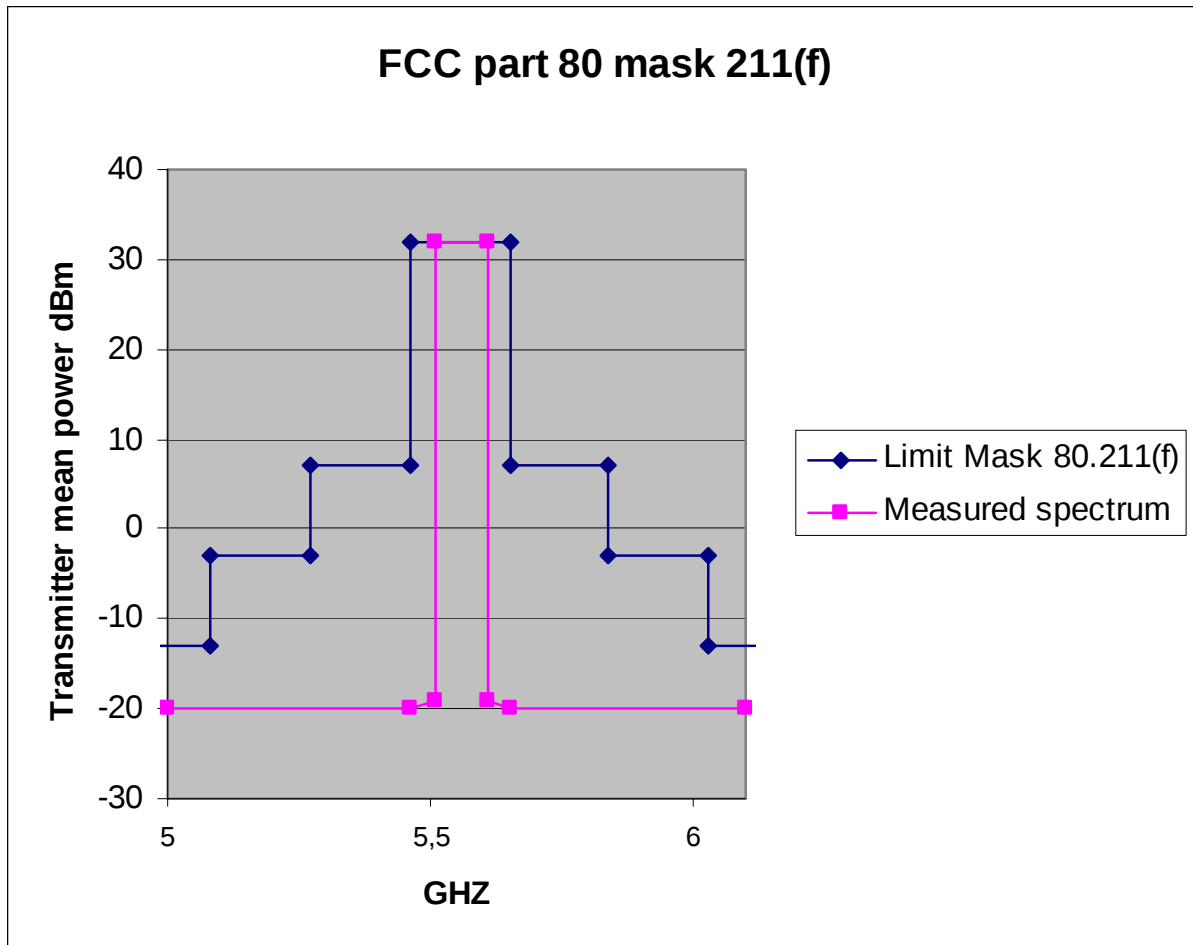
The RADIUS 1000 uses a permanently attached patch antenna enclosed in a plastic enclosure and does not lend itself to direct connection to a spectrum analyser. Therefore it is not possible to measure spurious emissions at the antenna terminal (conducted). Radiated emissions were measured transmitting the full power into the permanently attached antenna.

See attached graphs for scan

Requirements:

The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

- (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;
- (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB; and
- (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: at least 43 plus $10 \log_{10}$ (mean power in watts) dB. The absolute limit : -13 dBm



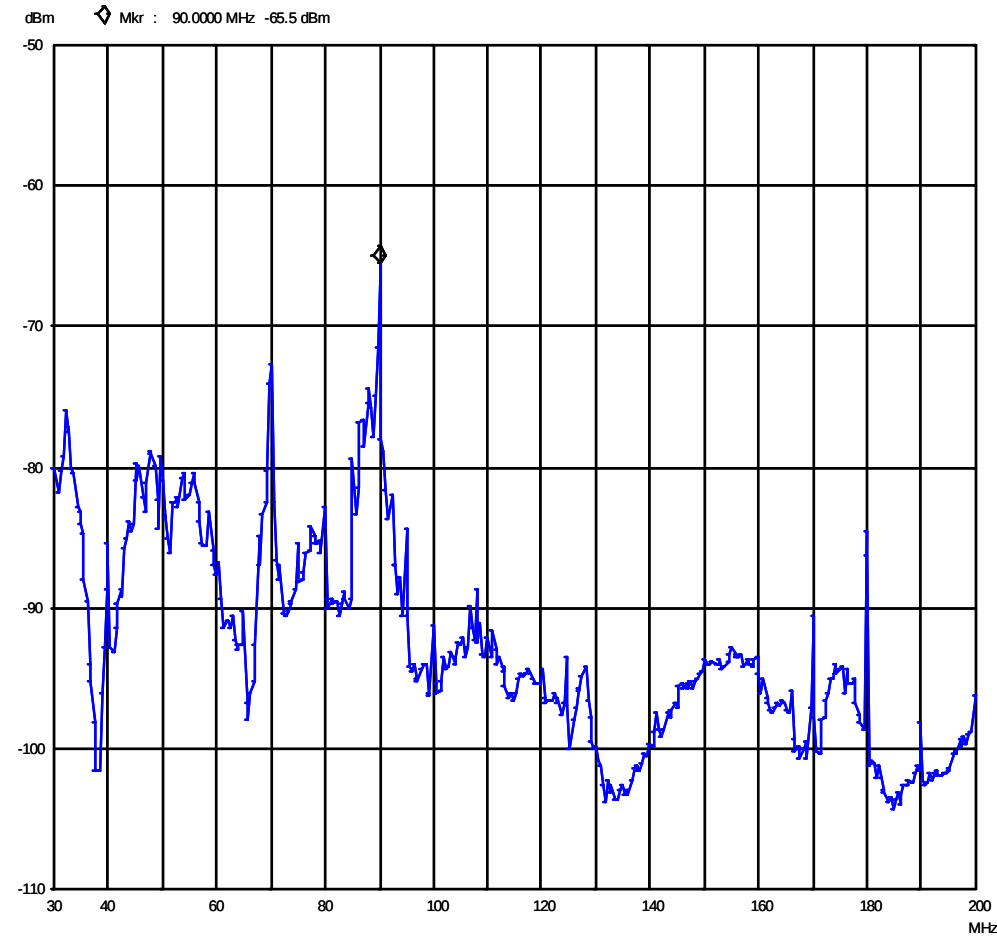
Nemko Comlab

06. Nov 06 09:49

Peak

EUT: Radius 1000
Manuf: Kongsberg seatex AS
Op Cond: 1m vp
Operator: gns
Test Spec: FCC 80 211

Scan Settings (1 Range)
----- Frequencies -----|----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
30M 200M 50k 120k PK 50ms AUTO LN ON 60dB



Nemko Comlab

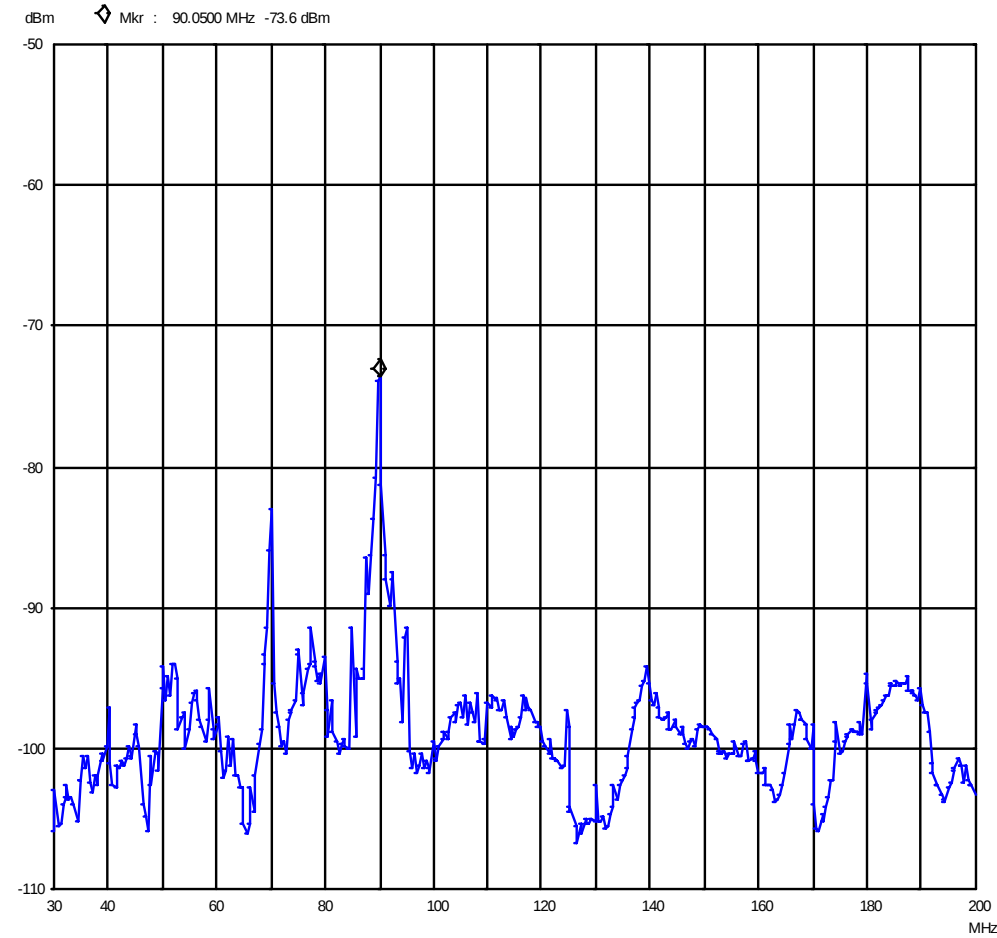
06. Nov 06 09:55

Peak

EUT: Radius 1000
Manuf: Kongsberg seatex AS
Op Cond: 4m hp
Operator: gns
Test Spec: FCC 80 211

Scan Settings (1 Range)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp OpRge
30M	200M	50k	120k	PK	50ms	AUTO	LN ON 60dB



HP, 30 – 200MHz, Interrogator

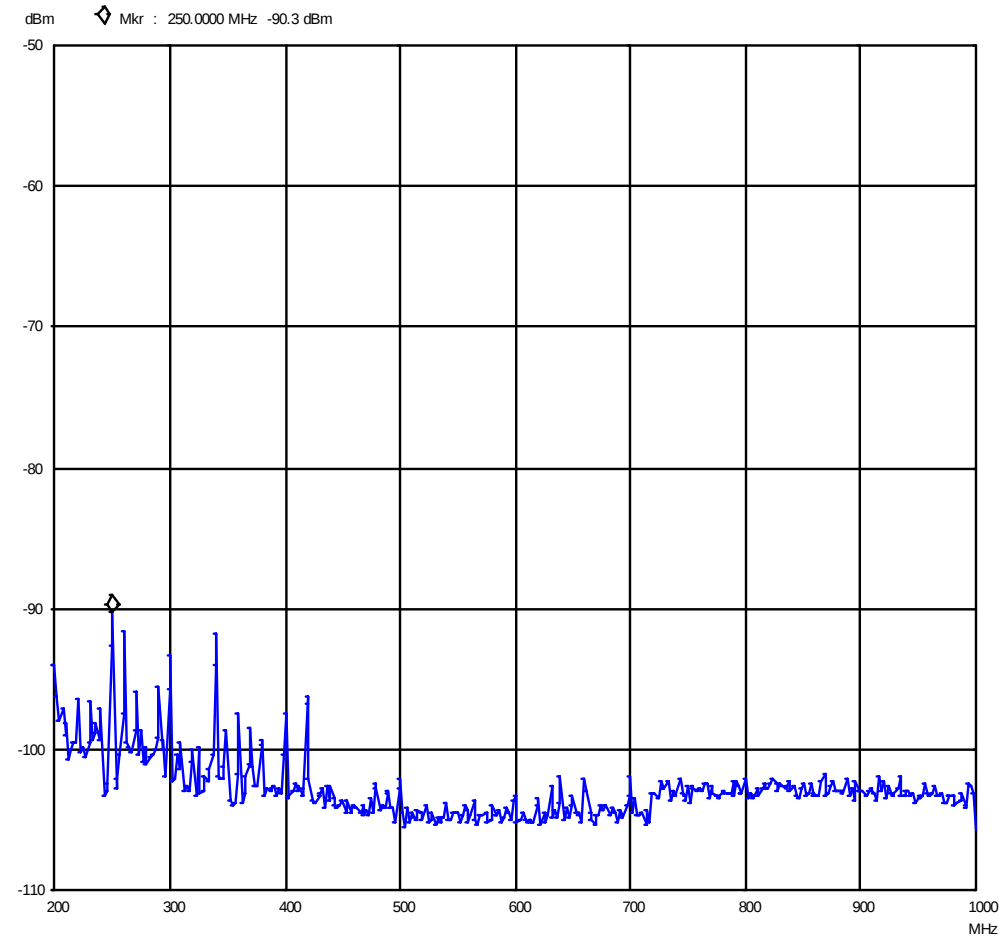
Nemko Comlab

06. Nov 06 10:02

Peak

EUT: Radius 1000
Manuf: Kongsberg seatex AS
Op Cond: 1m vp
Operator: gns
Test Spec: FCC 80 211

Scan Settings (1 Range)
|----- Frequencies -----| |----- Receiver Settings -----|
Start Stop Step IF BW Detector M-Time Atten Preamp OpRge
200M 1000M 50k 120k PK 50ms AUTO LN ON 60dB



VP, 200 – 1000MHz, Interrogator

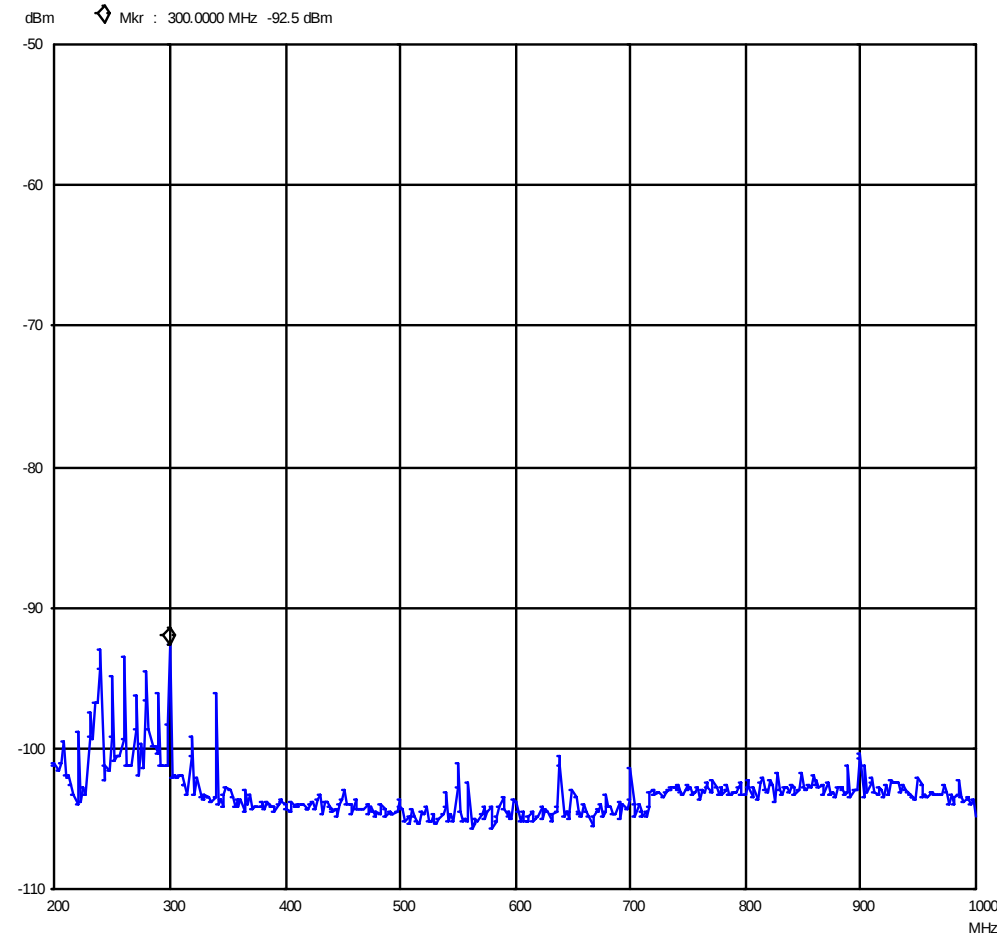
Nemko Comlab
Peak

06. Nov 06 10:32

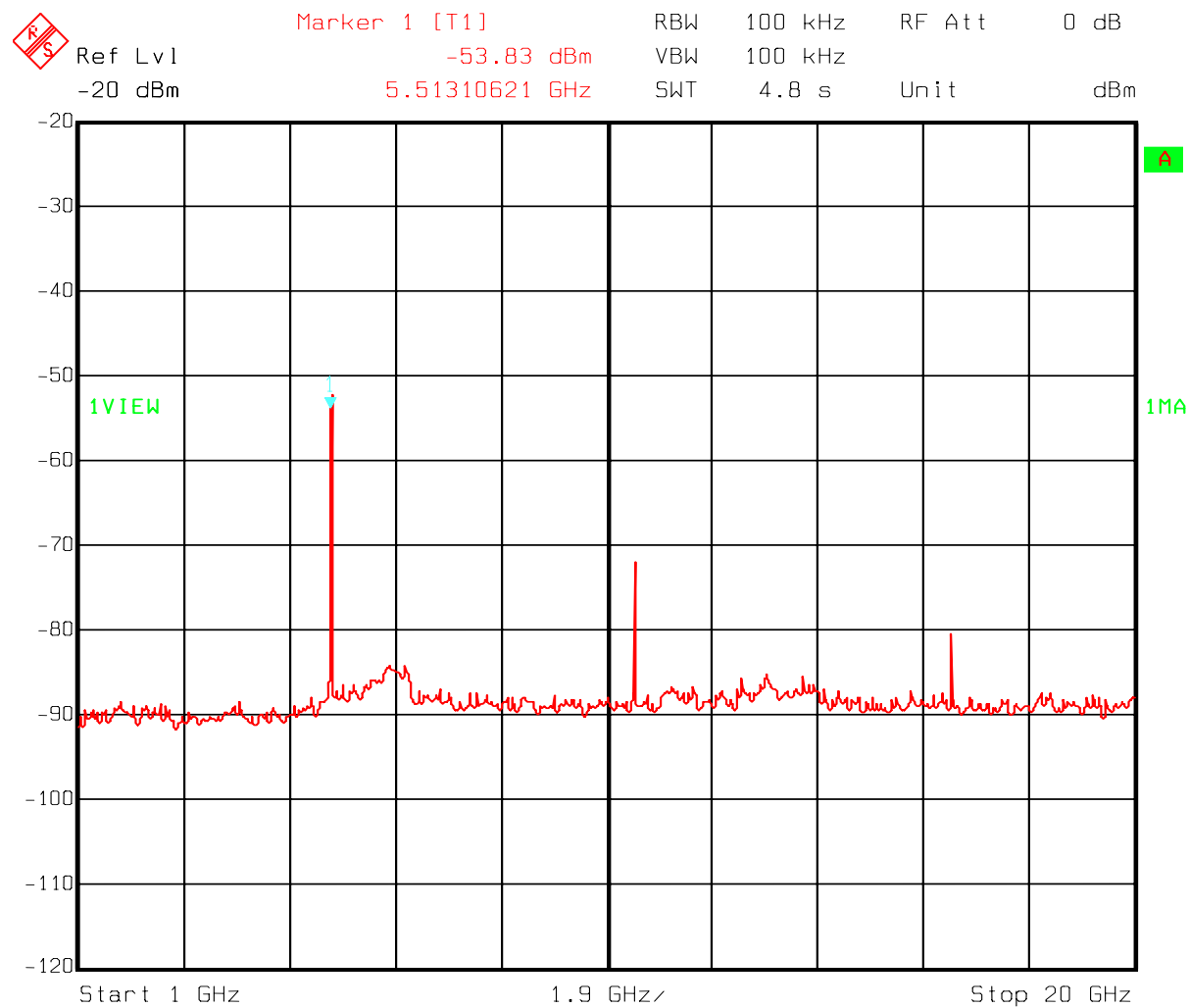
EUT: Radius 1000
Manuf: Kongsberg seatex AS
Op Cond: 4m hp
Operator: gns
Test Spec: FCC 80 211

Scan Settings (1 Range)

Frequencies				Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
200M	1000M	50k	120k	PK	50ms	AUTO	LN ON	60dB



HP, 200 - 1000MHz, Interrogator



Date: 1.NOV.2006 13:44:54

Scan 1 - 20GHz, Interrogator

4.5 Modulation requirements

Para. No.: 80.213(g)

Test Performed By: G.Suhanthakumar

Date of Test: 06.11.06

Test Results: N/A, see §80.209(b)

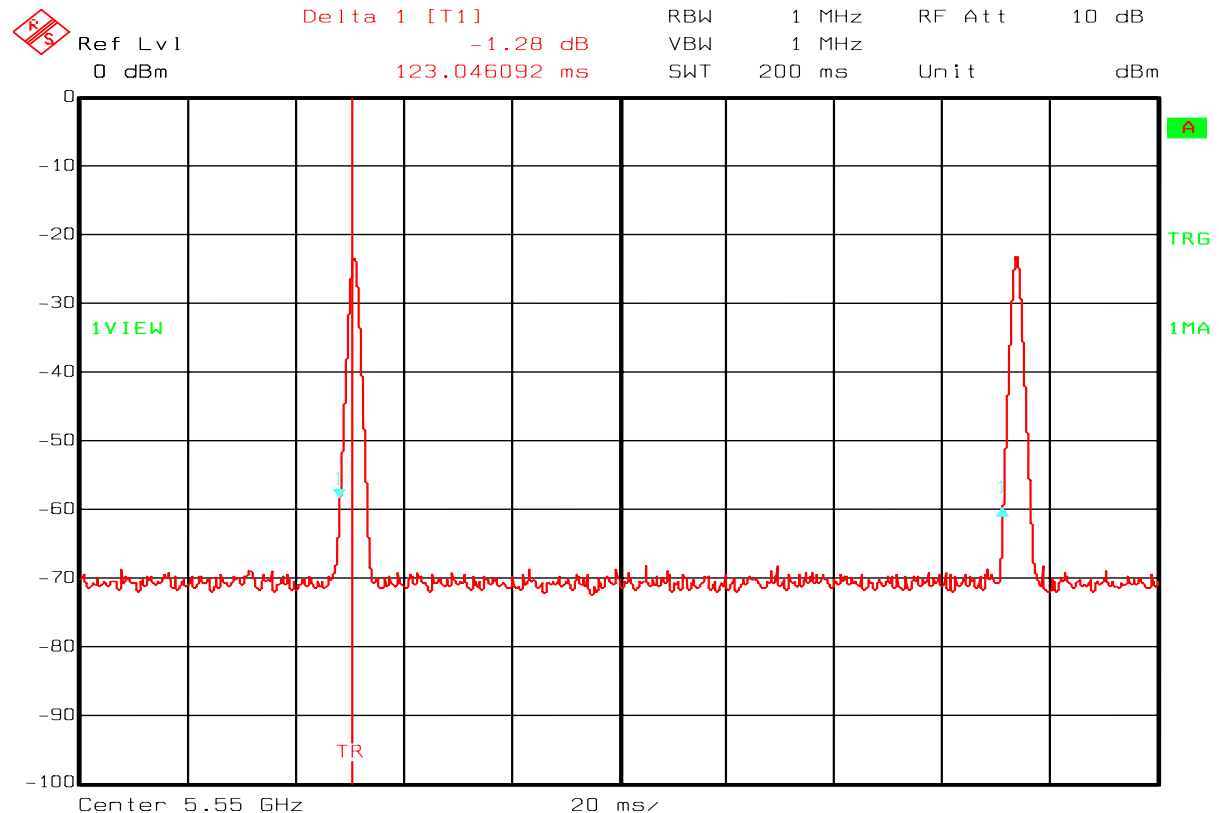
Measurement Data: No modulation Just a CW.

Measured value: 123ms

See attached graph for sweep period (The correct wording is sweep period. The time between the CW during the sweep scan of the frequency).

Requirements:

Radar stations operating in the bands above 2.4 GHz may use any type of modulation consistent with the bandwidth requirements in §80.209(b)



Date: 6.NOV.2006 11:57:08

Sweep period

4.6 Transmitter Power

Para. No.: 80.215(n)(3)

Test Performed By: G.Suhandhakumar

Date of Test: 06.11.06

Test Results: Complies

Measurement Data:

Frequency range GHz	Peak Power (e.i.r.p.) W	Mean power W
5.51 – 5.61	1.432	1.052

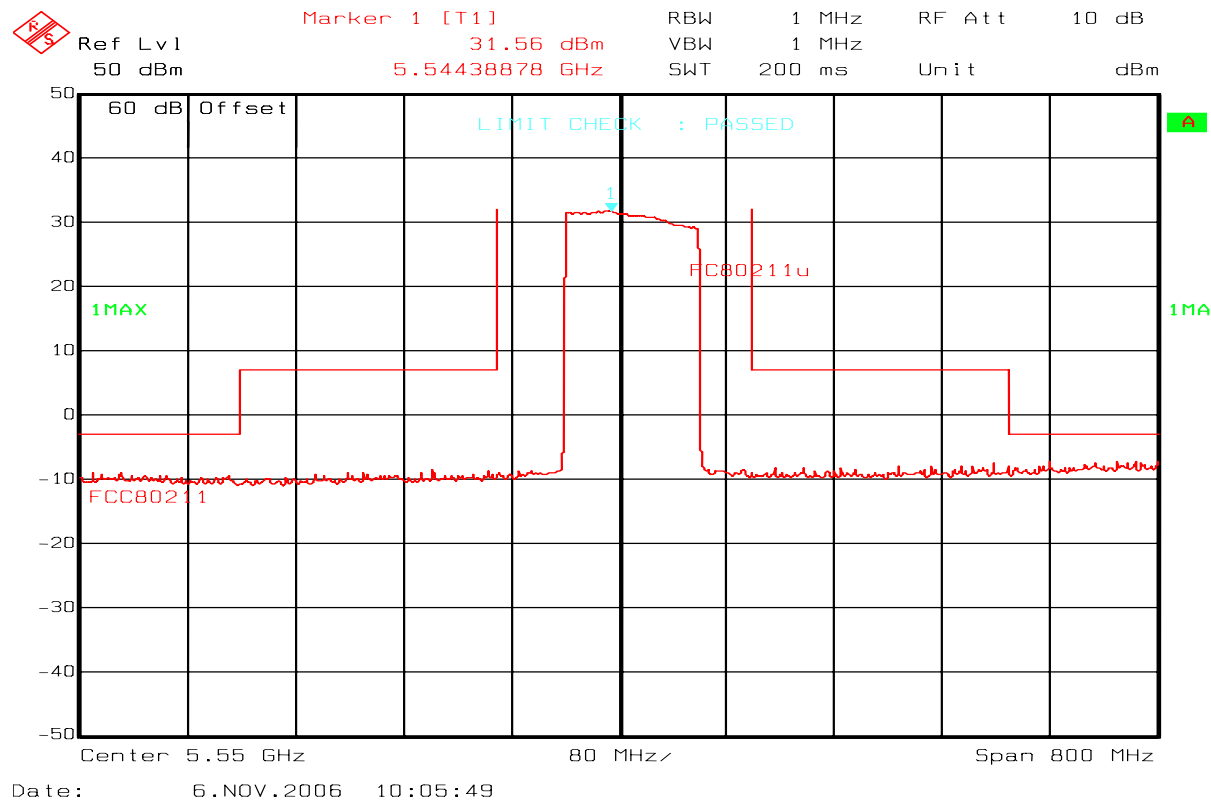
The value above is radiated power.

Only the radiated transmit power is measured, it is not possible to measure conducted power on this EUT.

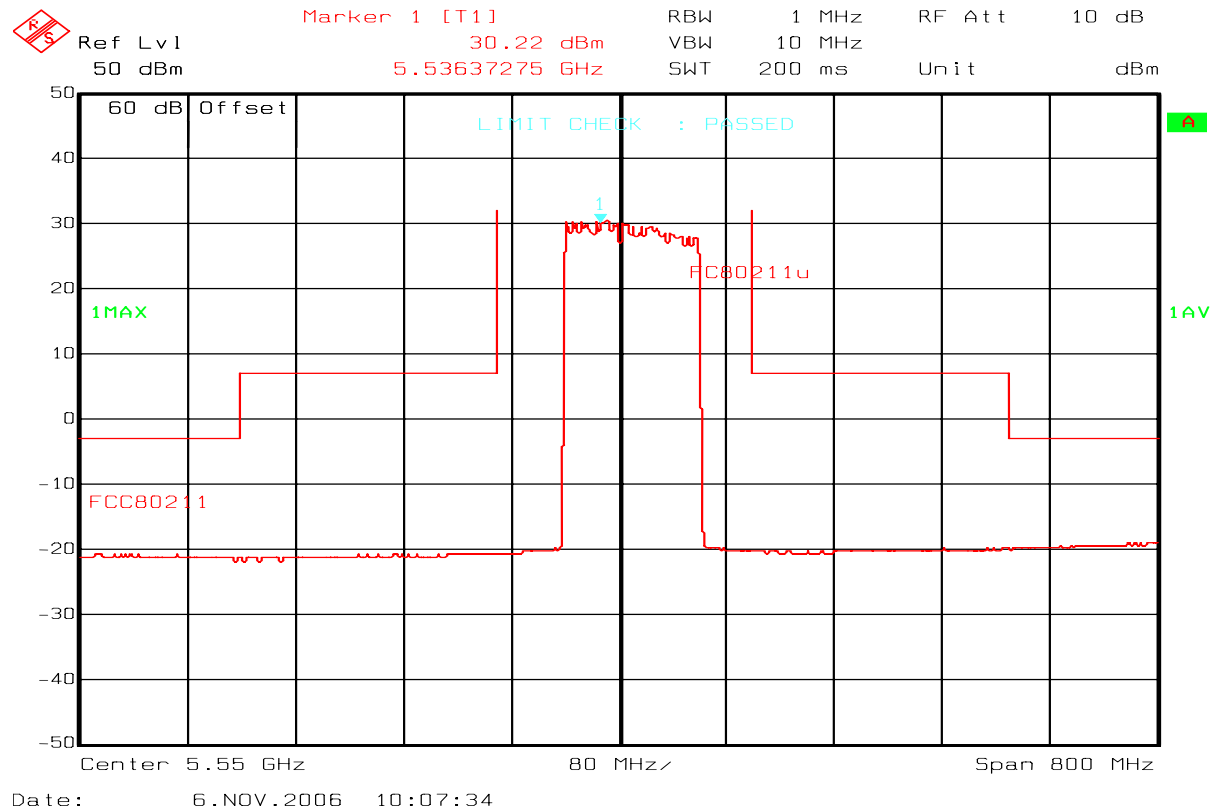
Power supply variation within 85 % to 115% of nominal value has no influence on measured value.

Requirements:

For all other transponder stations the output power must not exceed 20 watts peak e.i.r.p. Licensees of nonselectable transponder coast stations operating in the 2920-3100 MHz and 9320-9500 MHz bands must notify in writing the USCG District Commander of any incremental increase of their station's output power above 5 watts peak e.i.r.p.



Radiated Peak power



Radiated Mean power

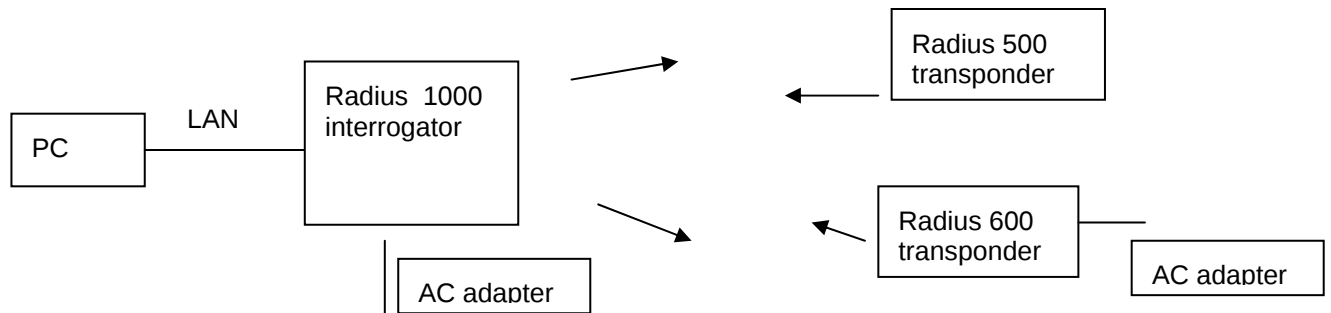
5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

No.	Instrument/ancillary	Type of instrument/ancillary	Manufacturer	Ref. no.
1	FSEK	Spectrum Analyzer	Rohde & Schwarz	LR 1337
2	ESAI	Spectrum Analyzer	Rohde & Schwarz	LR 1090
3	3115	Antenna horn	EMCO	LR 1330
4	643	Antenna horn	Narda	LR 093
5	642	Antenna horn	Narda	LR 220
6	PM7320X	Antenna horn	Siverts lab	LR 103
7	DBF-520-20	Antenna horn	Systron Donner	LR 101
8	638	Antenna horn	Narda	LR 098
9	5VF1000/2000	BP filter	Trilithic	LR 1174
10	5VF2000/4000	BP filter	Texscan	LR 42
11	ESH3-Z3	LISN	Rohde & Schwarz	LR 1076
12	8449B	Amplifier	Hewlett Packard	LR 1322
13	959C	Printer	Hewlett Packard	LR 1414
14	HFH2-Z2	Antenna loop	Rohde and Schwarz	LR 285
15	10855A	Amplifier	Hewlett Packard	LR 1445
16	HL223	Antenna log.per	Rohde & Schwarz	LR 1261
17	HK116	Antenna biconic	Rohde & Schwarz	LR 1260
18	ESVS 30	Test Receiver	Rohde & Schwarz	LR 1101
19	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504

6 BLOCK DIAGRAM

6.1 System set up



6.2 Test Site Radiated Emission

