



Test report no. : 113141 - 4

Item tested : SP3560

Type of equipment : Handheld UHF Transceiver

FCC ID : ROJSP3560

Client : Thrane & Thrane A/S

FCC Parts 80 and 90

Licensed Non-Broadcast Transmitter held to face

RSS-119, Issue 9

Land Mobile and Fixed Radio Transmitters and Receivers
Operating in the Frequency Range 27.41-960 MHz

14 January 2008

Authorized by :

Frode Sveiensen
Technical Verificator



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1 GENERAL INFORMATION

1.1 Testhouse Info

Name : Nemko AS
Address : Nemko Comlab
Gåsevikveien 8, Box 96
N-2027 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
E-mail: comlab@nemko.com
FCC test firm
registration # : 994405
IC OATS registration # : 2140D-1
Total Number of Pages: 37

1.2 Client Information

Name : Thrane & Thrane A/S
Address : Porsvej 2, DK-9200 Aalborg SV, Denmark

Contact:

Name : Helge Hoff
Telephone : +45 9634 6311
E-mail : hof@thrane.com

1.3 Manufacturer (if other than client)

Name : /
Address : /

2 Test Information

2.1 Test Item

Name :	SAILOR
FCC ID :	ROJSP3560
Industry Canada ID :	6200B-SP3560
Model/version :	SP3560
Serial number :	0123456014
Hardware identity and/or version:	/
Software identity and/or version :	/
Frequency Range :	440.000 - 470.000 MHz
Tunable Bands :	1
Number of Channels :	3
Type of Modulation :	Phase Modulation
Emissions Designator :	11K0G3E (12.5 kHz channels) 16K0G3E (25 kHz channels)
User Frequency Adjustment :	None
Rated Output Power :	0.3 Watts 1.3 Watts (Part 80) 1.3 Watts (Part 90)
Type of Power Supply :	Secondary Battery: B3504, Lithium-Ion, 7.2V, 1800mAH
Antenna Connector :	50 Ohm SMA connector
Desktop Charger :	Type: CH3505, serial no.: 00000003

Theory of Operation

The EUT is a hand portable UHF transceiver for two way communication.

Exposure Evaluation

The EUT is a portable device and is designed to be worn in a belt clip and handheld (held to face) when used.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	20 - 25 °C
Relative humidity:	30 - 50 %
Normal test voltage:	7.2 V DC

The values are the limit registered in the laboratory during the test period. All tests except the Frequency Stability Test, were performed with a fully charged battery.

The Frequency stability test was performed with a regulated DC Power Supply.

2.3 Test Period

Item received date:	2008-11-05
Test period :	from 2008-11-05 to 2008-12-27

3 TEST REPORT SUMMARY

3.1 General

Manufacturer: Thrane & Thrane A/S
Model No.: See paragraph 2.1

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Parts 80 and 90 and Industry Canada RSS-119 Issue 9.

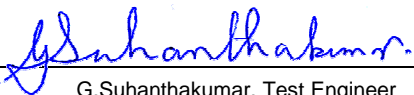
Radiated tests were conducted in accordance with ANSI C63.4-2003 and ANSI/TIA/EIA-603-B-2002. The radiated tests were made in a semi-anechoic chamber at measuring distances of 3 and 10metres.

- | | |
|---|---|
| <input checked="" type="checkbox"/> New Submission | <input checked="" type="checkbox"/> Production Unit |
| <input type="checkbox"/> Class II Permissive Change | <input type="checkbox"/> Pre-production Unit |
| TNF Equipment Code | <input type="checkbox"/> Family Listing |

THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.
Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".



TEST REPORT #: 113141-4

TESTED BY: 
G.Suhanthakumar, Test Engineer

DATE: 27 December 2008

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3.2 Test Summary

Name of test	FCC Parts 2 and 90 reference	RSS-119 Issue 9 reference	Result
RF Power Output	2.1046, 80.215, 90.205	5.4	Pass
Modulation Characteristics, - Audio Frequency Response - Audio Low Pass Filter - Modulation Limiting	2.1047	N/A	Pass
Occupied Bandwidth	2.1049, 80.205, 90.209	5.5	Pass
Spurious Emissions at antenna terminals	2.1051, 2.1057, 80.211, 90.210	5.8	Pass
Field Strength of Transmitter Spurious Radiations	2.1053, 2.1057, 80.211, 90.210	5.8	Pass
Frequency Stability	2.1055, 80.209 90.213	5.3	Pass
Transient Frequency Behavior	90.214	5.9	Pass
Suppression of Interference Aboard Ships	80.217	N/A	Pass
Exemption from technical standards	90.217(b)	5.10	Not Applicable
Receiver Spurious Emissions	N/A	5.11	Pass

¹ The tested equipment transmits analog voice.

² The tested equipment has a 50 ohm antenna connector only.

3.3 Description of modification for Modification Filing

Not applicable.

3.4 Comments

The can select the preprogrammed frequencies and can select full output power or the LOW setting for reduced output power. The pre-programmed frequencies and power levels can not be changed by the user.

3.5 Family List Rationale

Not Applicable.

4 TEST RESULTS

4.1 RF Output Power, Conducted

Para. No.: 2.1046, 80.215, 90.205

Test Performed By: G.Suhandhakumar	Date of Test: 27.12.2008
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Test Results: Complies

Measurement Data:

Frequency (MHz)	Measured RF Output Power (W)	
	Low Setting	Programmed 1,3 W FCC 80.215(e)(3) FCC 90.205(h) and RSS-219
440.000	0.30 / 12.5kHz 0.30 / 25kHz	1.27 / 12.5KHz 1.27 / 25kHz
457.525	0.31/ 12.5kHz 0.31 / 25kHz	1.29 / 12.5kHz 1.29 / 25kHz
470.000	0.33/ 12.5kHz 0.33 / 25kHz	1.41 / 12.5kHz 1.41 / 25kHz
Rated Power Level	0.3	1.3
Largest deviation from Rated Power	+0.41 dB	+0,35 dB

This measurement was performed with power meter and without modulation.

The test was performed conducted on the permanent 50 Ohm antenna connector.

Requirements:

FCC 80.215(e)(3):

The maximum conducted RF output power must not exceed 4 Watts.

FCC 90.205(h):

The maximum RF output power (ERP) must be between 2 and 500 Watts ERP.

RSS 119 section 5.4:

The maximum conducted RF output power must not exceed 30 Watts, and must be within ± 1 dB of the manufacturers rated output power.

4.2 Modulation Characteristics

4.2.1 Audio Frequency Response

Para. No.: 2.1047

Test Performed By: G.Suwanthakumar

Date of Test: 07-Nov-2008

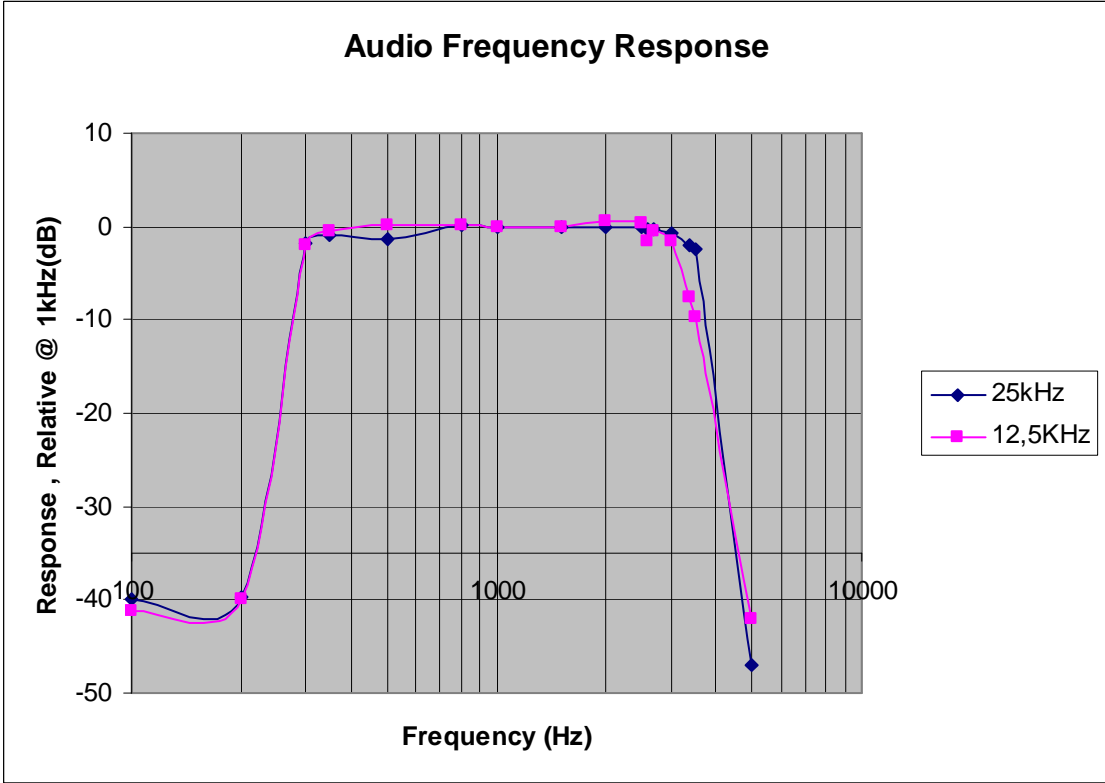
Test Results: Complies

Measurement Data:

See attached plots.

Requirements:

None.



Audio frequency response for 12.5kHz & 25kHz Channel separation

4.2.2 Audio Low Pass Filter

Para. No.: 2.1047

Test Performed By: G.Suhandhakumar

Date of Test: 07-Nov-2008

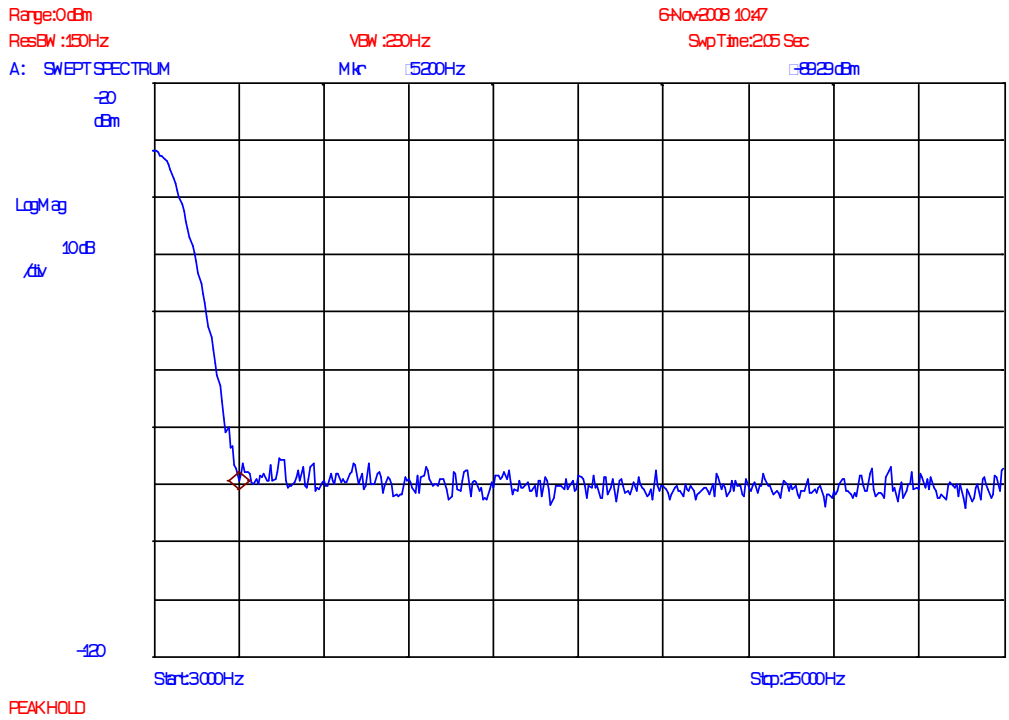
Test Results: Complies

Measurement Data:

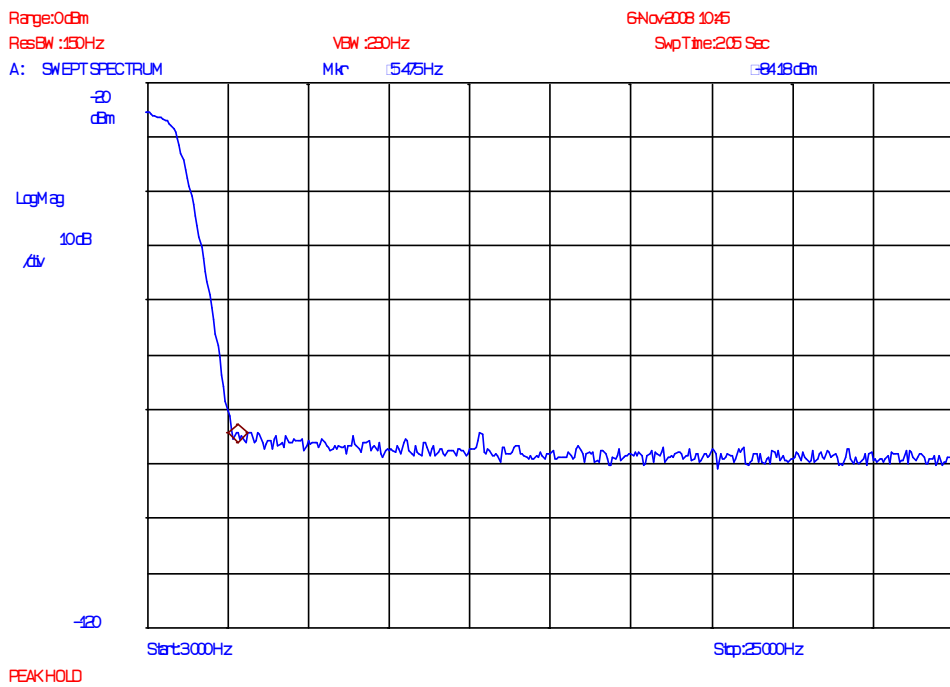
See attached plots.

Requirements:

None.



Audio Low pass filter, 12.5kHz



Audio Low pass filter, 25kHz

4.2.3 Modulation Limiting

Para. No.: 2.1047

Test Performed By: G.Suhandhakumar

Date of Test: 07 Nov-2008

Test Results: Complies

Measurement Data:

See attached plots.

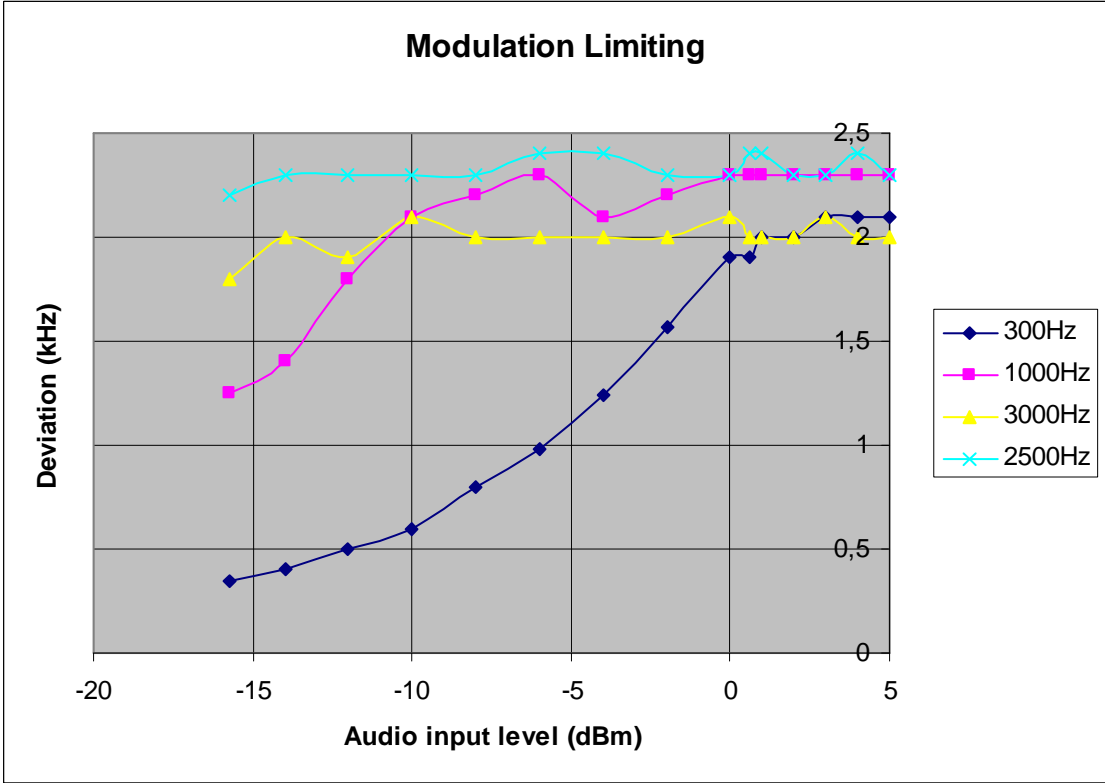
Requirements:

FCC 80.205(a) footnote 8:

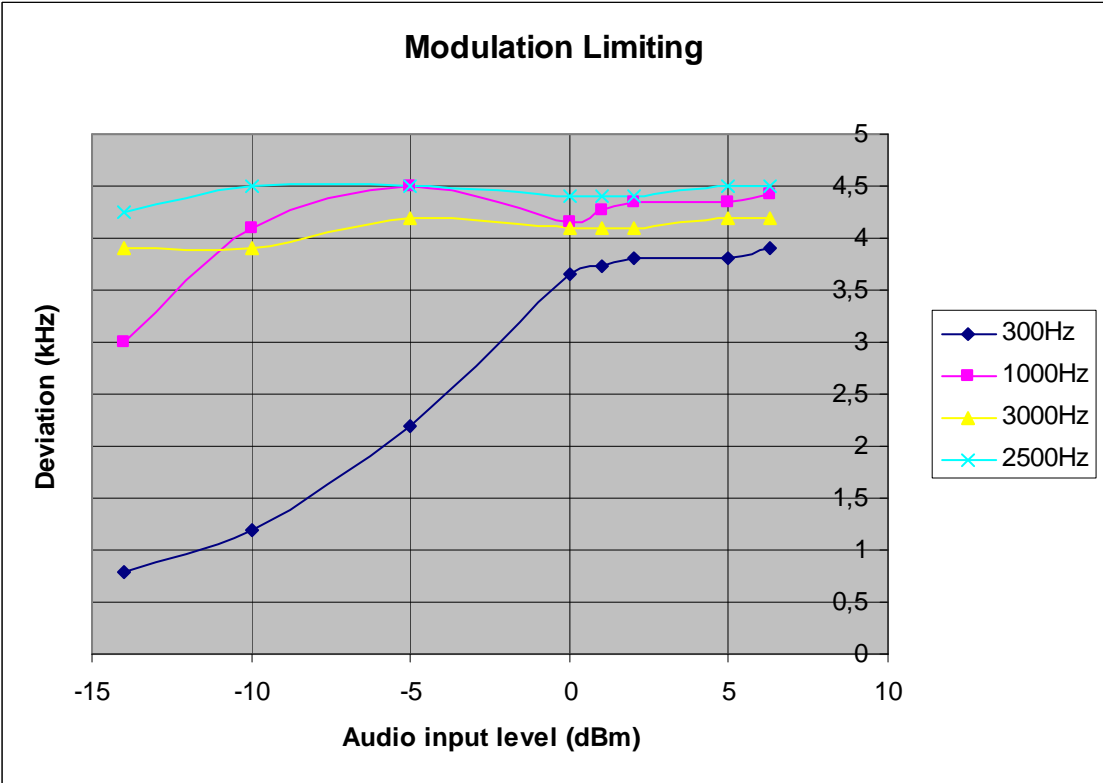
5 kHz Maximum Frequency Deviation

FCC 90:

None.



Modulation limiting, 12.5kHz



Modulation limiting, 25kHz

4.3 Occupied Bandwidth

Para. No.: 2.1049, 80.205, 90.209, 90.217

Test Performed By: G.Suhandhakumar	Date of Test: 27-Dec-2008
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Test Results: Complies

Measurement Data:

Carrier Frequency	99% Occupied Bandwidth	
	12.5 kHz Channels	25 kHz Channels
440.000 MHz	10,0	14,9
457.525 MHz	10,0	14,9
470.000 MHz	10,0	14,9

See attached plots.

For this test the EUT was made to transmit continuously with modulation activated.

Modulated at 2.5KHz with 16dB overdrive

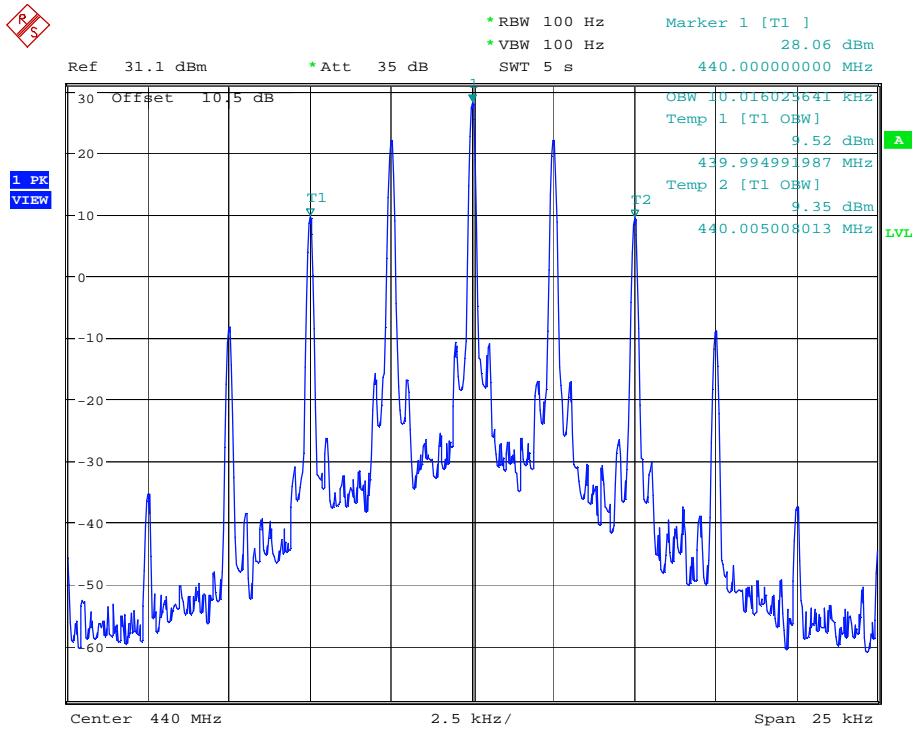
Requirements:

80.205(a):

Authorized Bandwidth for G3E emission, maximum authorized bandwidth = 20 kHz

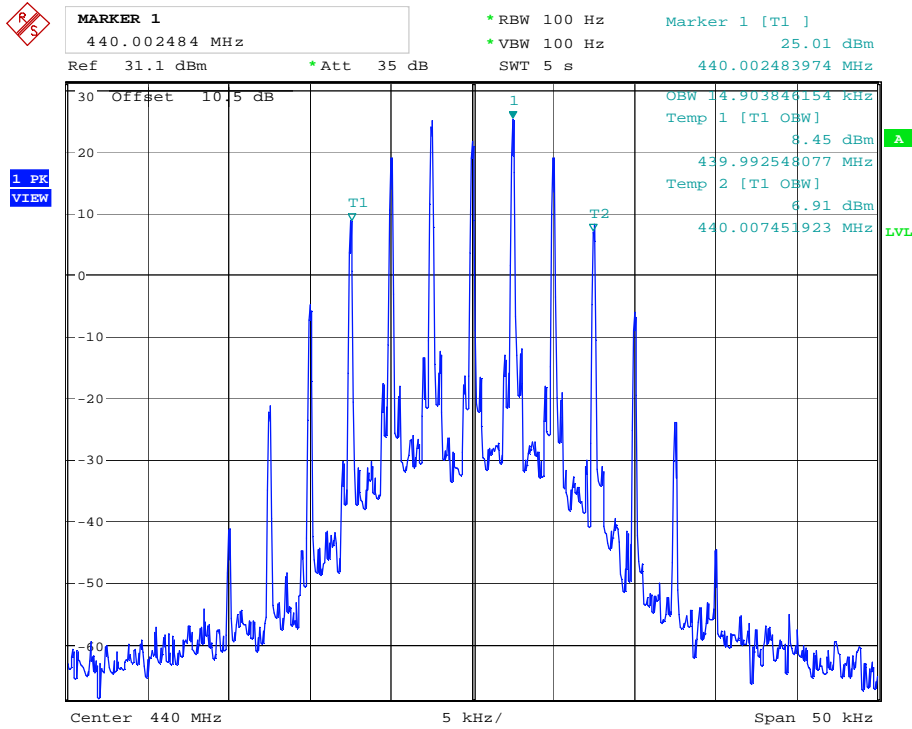
90.209(b)(5) and RSS 119, section 5.5:

Bandwidth Limitations: maximum authorized bandwidth = 20 kHz for 25 kHz channels and 11.25 kHz for 12.5 kHz channels.



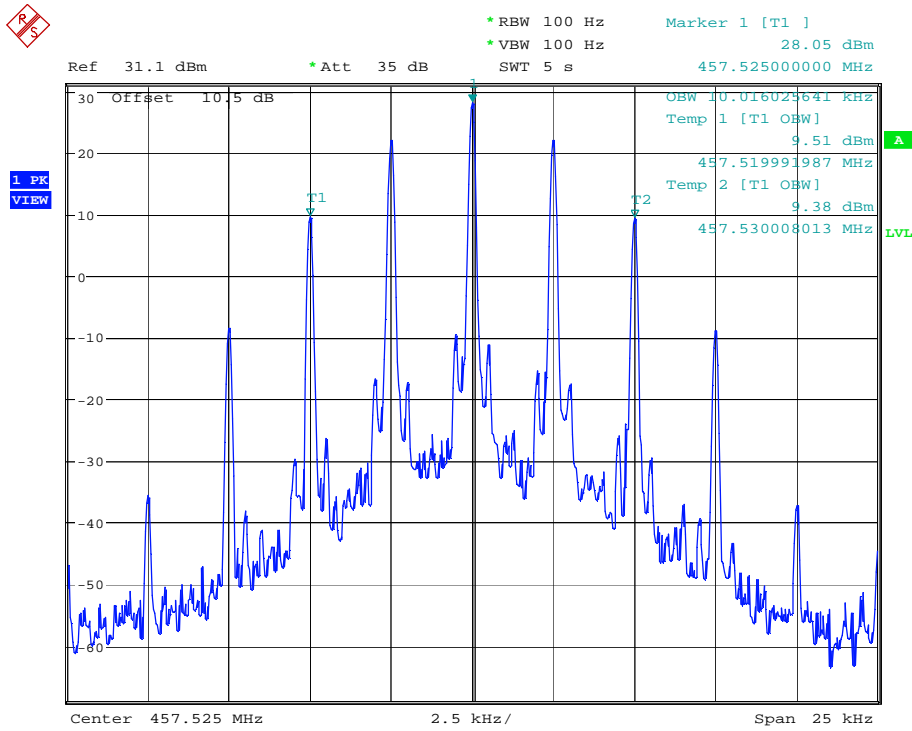
Date: 27.DEC.2008 11:15:47

99% Occupied Bandwidth, 12.5 kHz, Low Channel



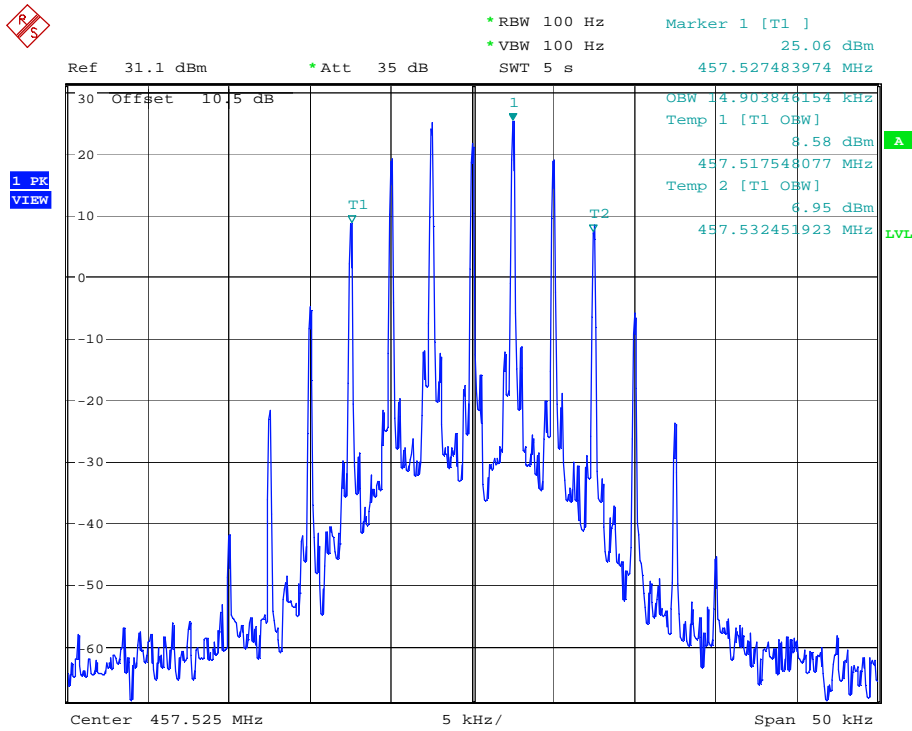
Date: 27.DEC.2008 11:14:54

99% Occupied Bandwidth, 25 kHz, Low Channel



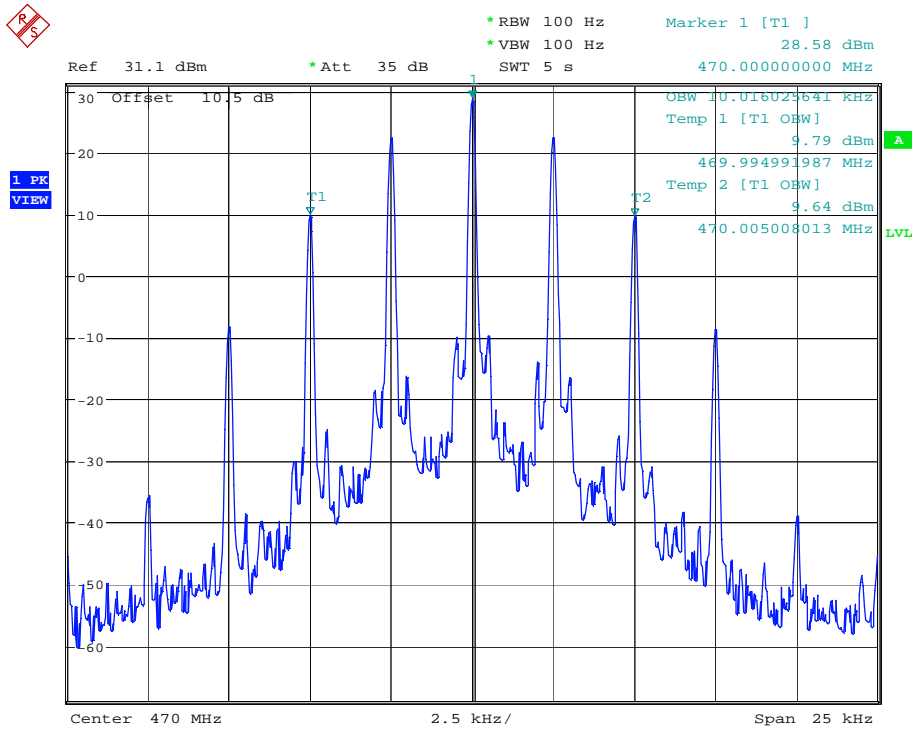
Date: 27.DEC.2008 11:17:29

99% Occupied Bandwidth, 12.5 kHz, Mid Channel



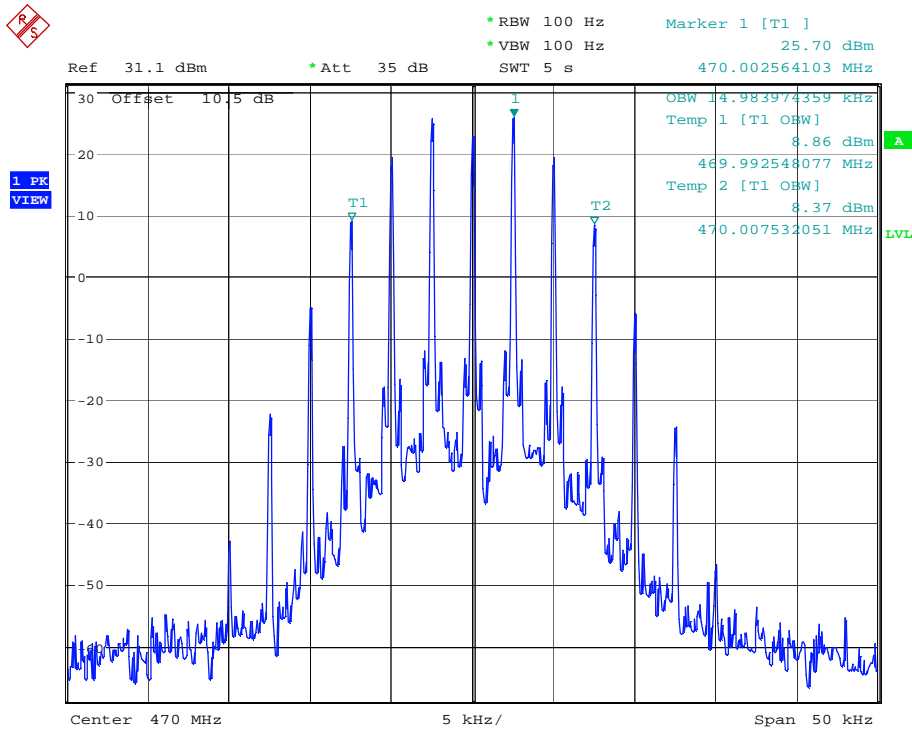
Date: 27.DEC.2008 11:18:22

99% Occupied Bandwidth, 25 kHz, Mid Channel



Date: 27.DEC.2008 11:16:37

99% Occupied Bandwidth, 12.5 kHz, High Channel



Date: 27.DEC.2008 11:12:11

99% Occupied Bandwidth, 25 kHz, High Channel

4.4 Spurious Emissions at the Antenna Terminal, Swept Frequency

Para. No.: 2.1053, 2.1057, 80.211, 90.210, 90.217

Test Performed By: G.Suhandhakumar	Date of Test: 10-Nov-2008
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Test Results: Complies

Measurement Data:

The maximum emission is -60 dBm at 942,3 MHz. This is -40dB below the specification limit. The spectrum was searched from 9kHz to 5000 MHz using a spectrum analyzer set to positive peak detector, 100kHz RBW/VBW below 1GHz and above 1 GHz , 1 MHz RBW/VBW. A band pass filter was used for each detected spurious to suppress the fundamental emission. Measurements were made using signal substitution method.

The measurements are done on 440MHz, 457,525MHz & 470MHz and in High & low power. The measured spurious emissions are well below 40 dB from the limit.

Modulated 2.5KHz with 16dB overdrive

Frequency of Emission (MHz)	Channel	Measured Emission Level (dBm)	Limit (dBm) 80.211(f)(3) 90.210(b)(3)	Limit (dBm) 90.210(d)(3)	Margin (dB) -13/-20 dBm
879,8	Lower	-63	-13	-20	> 20dB
916,66	Middle	-62	-13	-20	> 20 dB
942,3	upper	-60	-13	-20	> 20dB
1320	Lower	-72	-13	-20	> 20 dB
1371,7	Middle	-71	-13	-20	> 20dB
1410	upper	-70	-13	-20	> 20 dB

See attached plots. The plots are identical for 12.5 kHz and 25 kHz channels.

Requirements:

FCC 80.211(f)(3): Below -13 dBm

FCC 90.210(b)(3): 25 kHz channels with ALPF: Below -13 dBm

FCC 90.210(d)(3): 12.5 kHz channels: Below -20 dBm

4.5 Spurious Emissions at the Antenna Terminal, Emission Masks

Para. No.: 2.1053, 2.1057, 80.211, 90.210, 90.217

Test Performed By: G.Suhandhakumar

Date of Test: 27-Dec-2008

Test Results: Complies

Measurement Data:

See attached plots.

Modulated 2.5KHz with 16dB overdrive

Requirements:

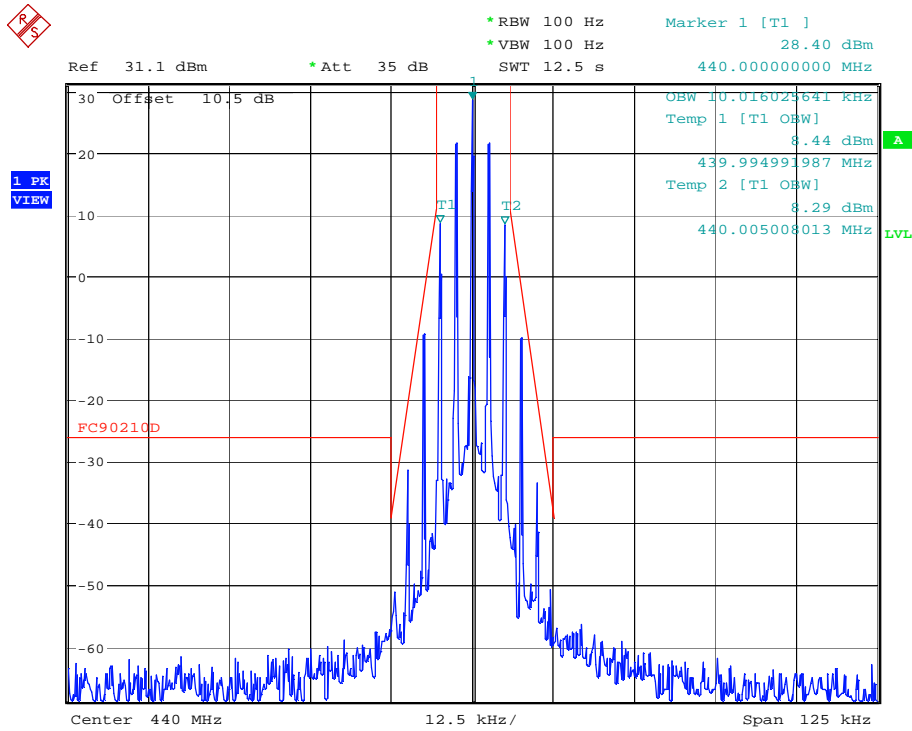
FCC 80.211(f) for 25 kHz channels, 20 kHz authorized bandwidth

FCC 90.210(b) for 25 kHz channels with ALPF, 20 kHz authorized bandwidth

FCC 90.210(d) for 12.5 kHz channels, 11.25 kHz authorized bandwidth

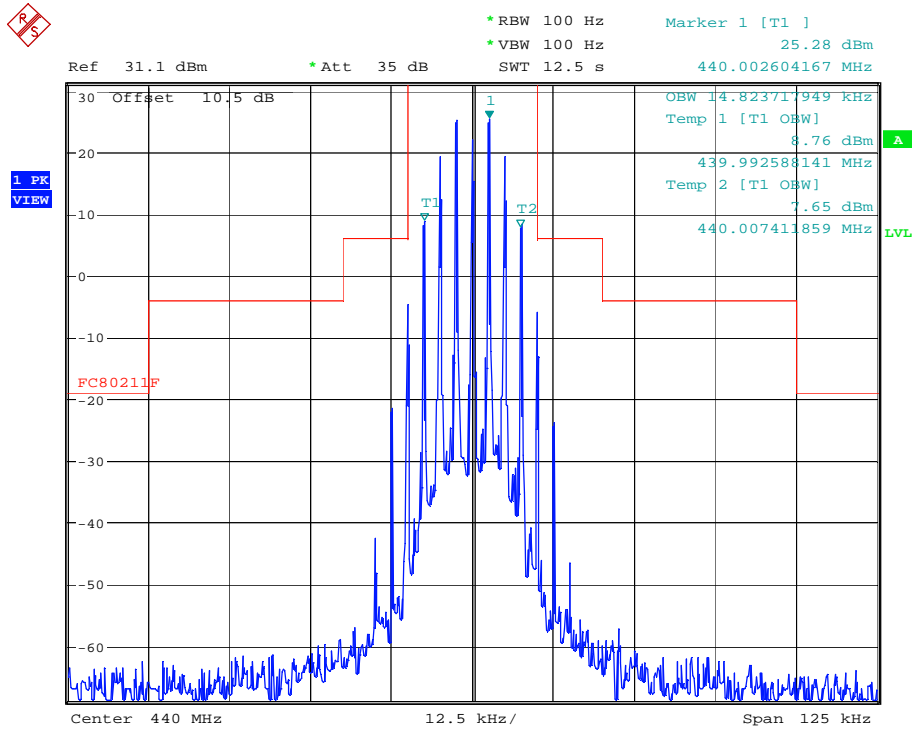
RSS-119 section 5.8.1 for 25 kHz channels with ALPF, 20 kHz authorized bandwidth

RSS-119 section 5.8.3 for 12.5 kHz channels, 11.25 kHz authorized bandwidth



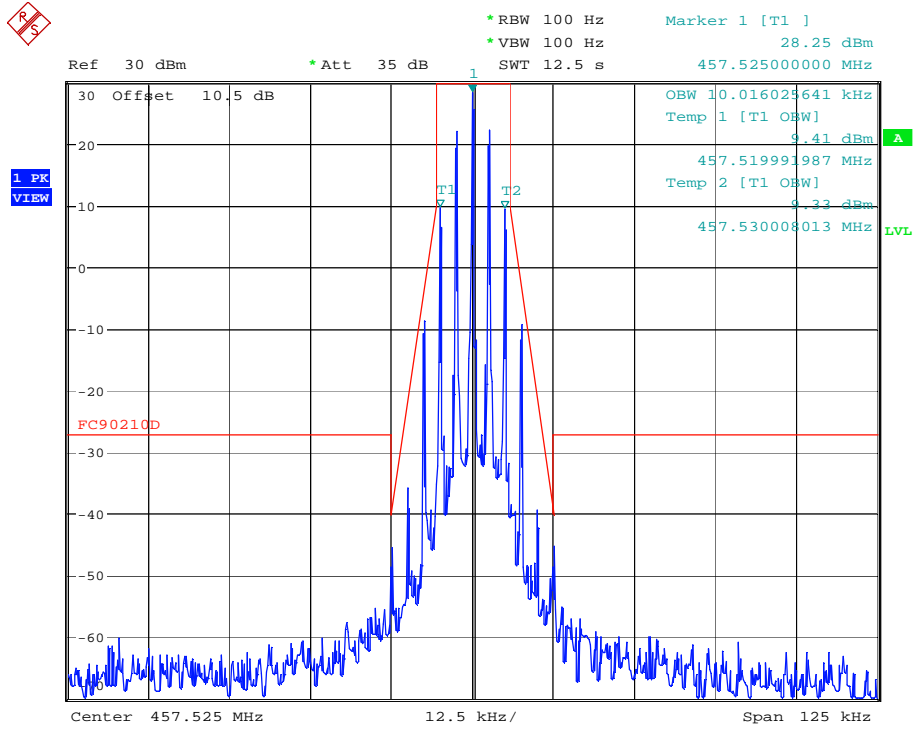
Date: 27.DEC.2008 11:06:37

Emission Mask, FCC 90.210(d), RSS 119 mask D, Lower Channel (12,5kHz) – high power



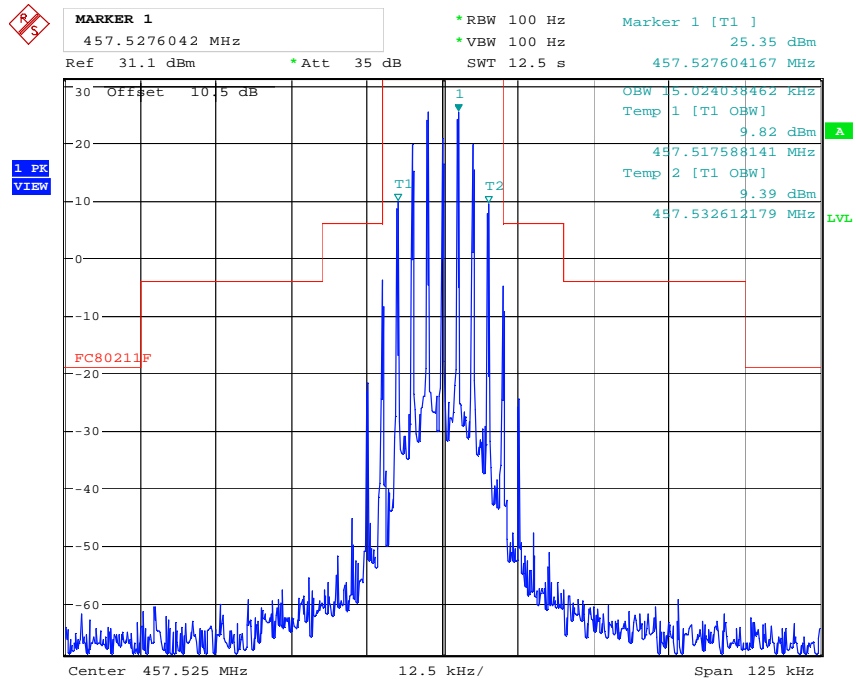
Date: 27.DEC.2008 11:04:50

Emission Mask, FCC 80.211(f), 90.210(b), RSS 119 mask B, Lower Channel, (25kHz) , High power



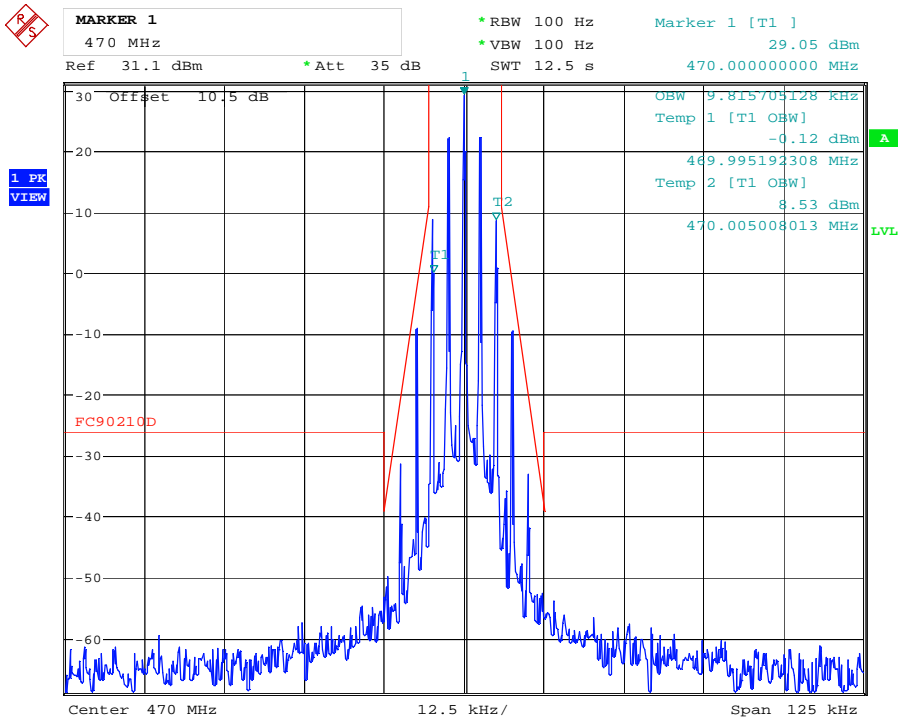
Date: 27.DEC.2008 10:59:34

Emission Mask, FCC 90.210(d), RSS 119 mask D, Middle Channel, (12,5kHz), High power



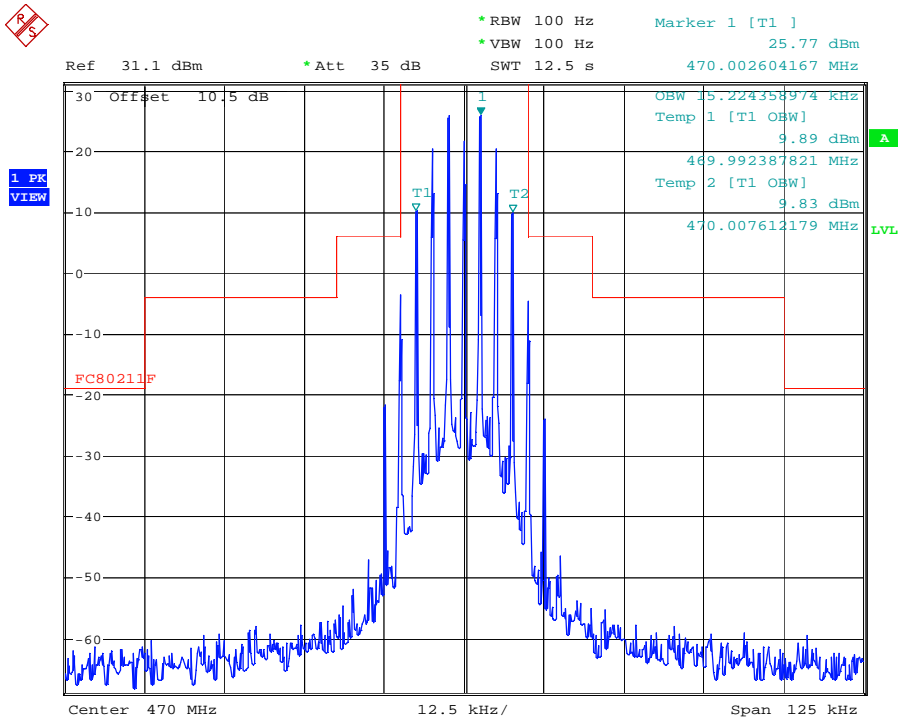
Date: 27.DEC.2008 11:02:45

Emission Mask, FCC 80.211(f), 90.210(b), RSS 119 mask B, Middle Channel, (25kHz), High power



Date: 27.DEC.2008 11:08:03

Emission Mask, FCC 90.210(d), RSS 119 mask D, Upper Channel, (12,5kHz) High power



Date: 27.DEC.2008 11:09:46

Emission Mask, FCC 80.211(f), 90.210(b), RSS 119 mask B, Upper Channel, (25kHz), High Power

4.6 Field Strength of Spurious Radiations

Para. No.: 2.1053, 2.1057, 80.211, 90.210, 90.217

Test Performed By: G.Suhandhakumar	Date of Test: 06-Nov-2008
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Test Results: Complies

Measurement Data:

Middle channel with high power– 50ohm load , Modulated 2.5KHz with 16dB overdrive

Spurious Frequency MHz	Polarity	Measured Value dBm	Limit dBm	Margin dB -13/-20
915.15	VP	-47.6	-13/-20	-34.6/-27.6
1371.7	VP	-42.9	-13/-20	-29.9/-22.9
1826.9	VP	-49.3	-13/-20	-36.3/-29.3
2288.4	VP	-47.4	-13/-20	-34.4/-27.4
4583.3	VP	-35.3	-13/-20	-22.3/-15.3

The frequency band below 1 GHz is measured with 100 kHz and Peak Detector; the frequencies from 1 to 5 GHz were measured with 1 MHz RBW and Peak Detector.

The measurement was performed at 10m below 1 GHz and at 3m above 1 GHz, both measurements with transducer factor programmed in the spectrum analyzer.

The emissions on highest and lowest channel did not differ significantly from the values at the middle frequency.

EUT was transmitting continuously without modulation. The EUT was rotated in 3 planes for this test.

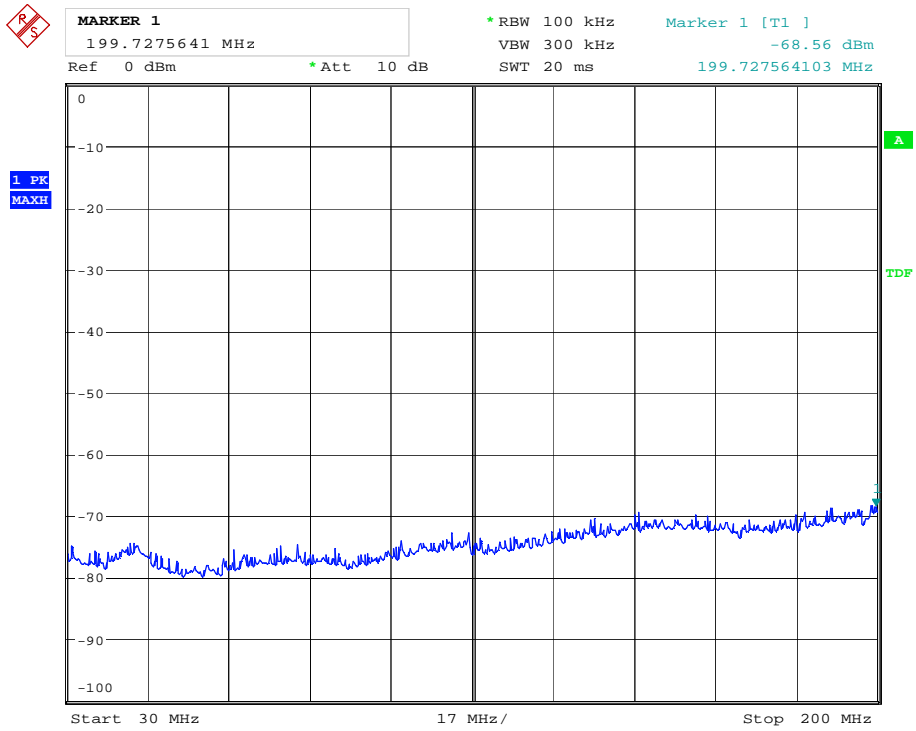
The measured values are ERP below 1 GHz and EIRP above 1 GHz.

Requirements:

FCC 80.211(f)(3): Less than -13 dBm

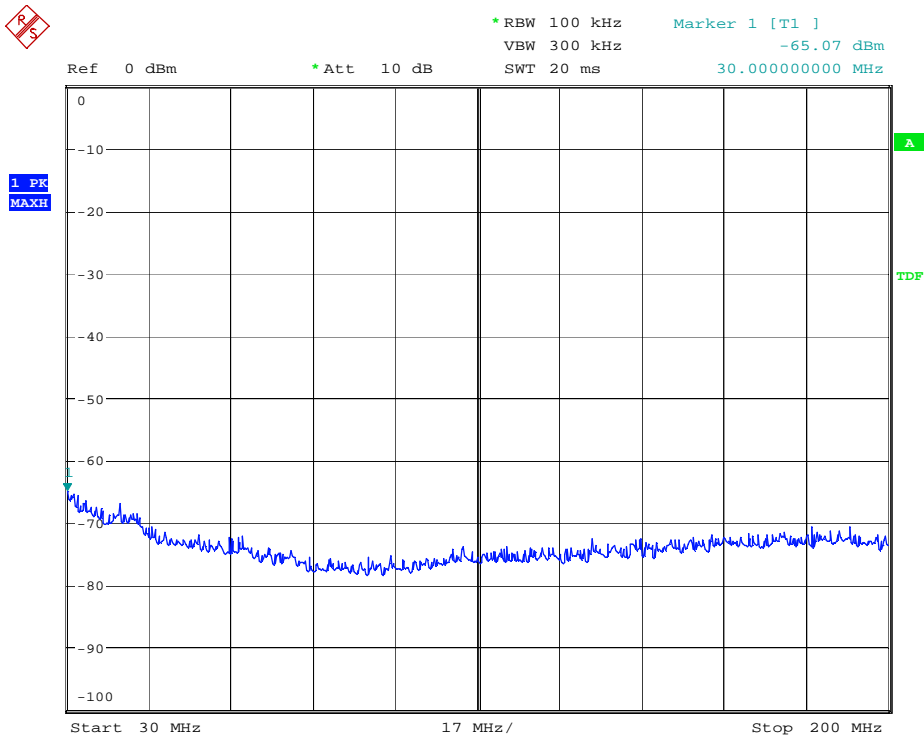
FCC 90.210(b)(3): 25 kHz channels: Less than -13 dBm

FCC 90.210(d)(3): 12.5 kHz channels: Less than -20 dBm



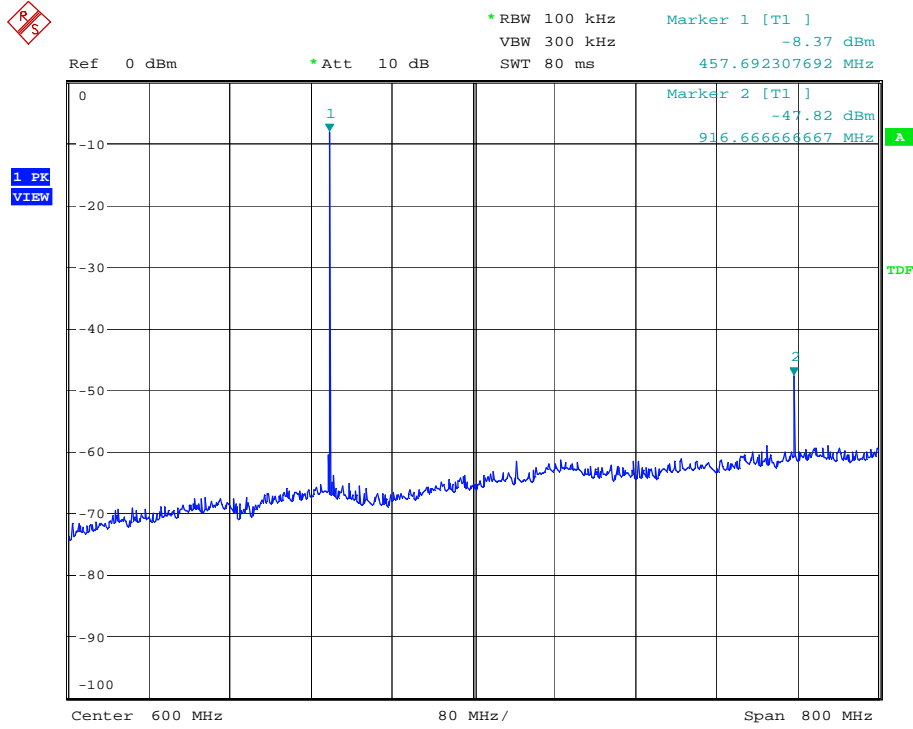
Date: 5.NOV.2008 16:15:09

30 - 200MHz VP, TX on , 50ohm load



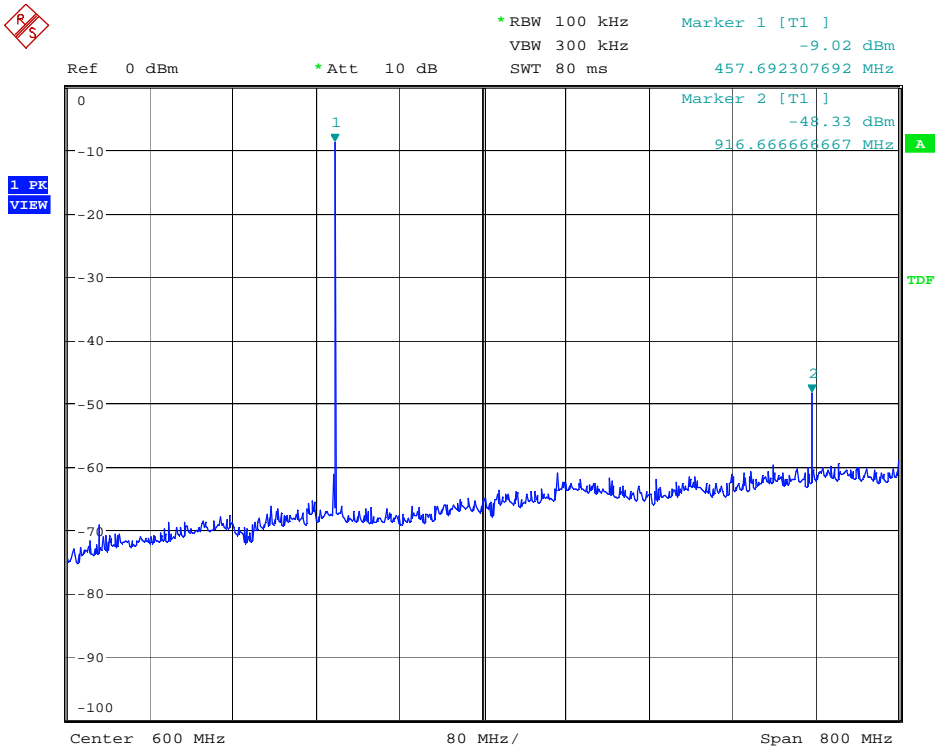
Date: 5.NOV.2008 16:13:49

30 - 200MHz HP, TX on , 50ohm load



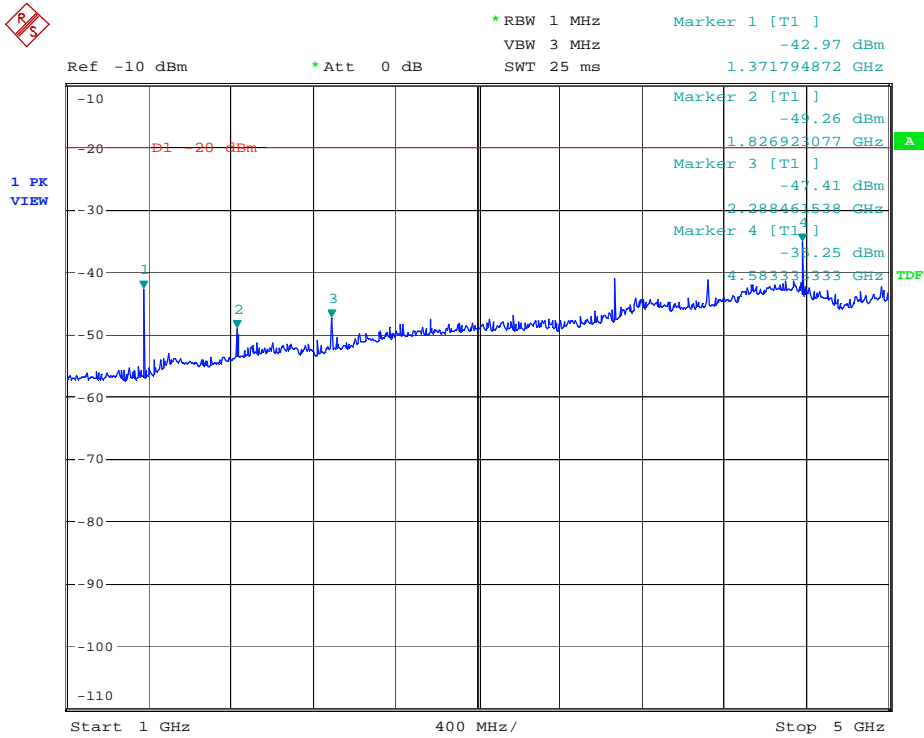
Date: 5.NOV.2008 16:03:21

200 - 1000MHz VP, TX on, 50ohm load



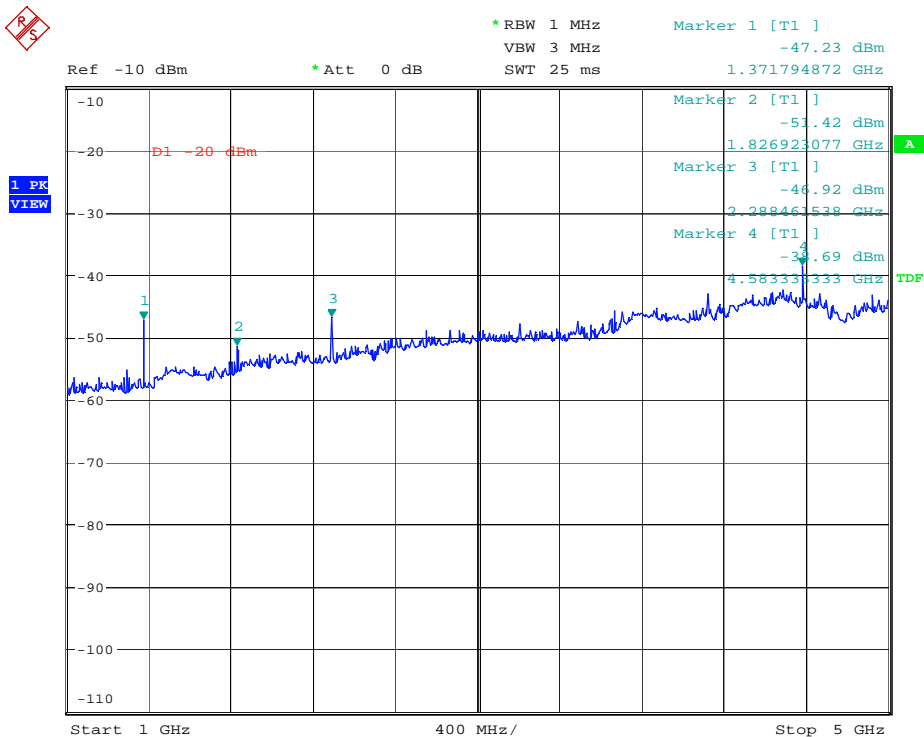
Date: 5.NOV.2008 16:02:22

200 - 1000MHz HP, TX on, 50ohm load



Date: 5.NOV.2008 13:27:59

1 - 5GHz VP, TX on, 50ohm load



Date: 5.NOV.2008 13:29:59

1 - 5GHz HP, TX on, 50ohm load

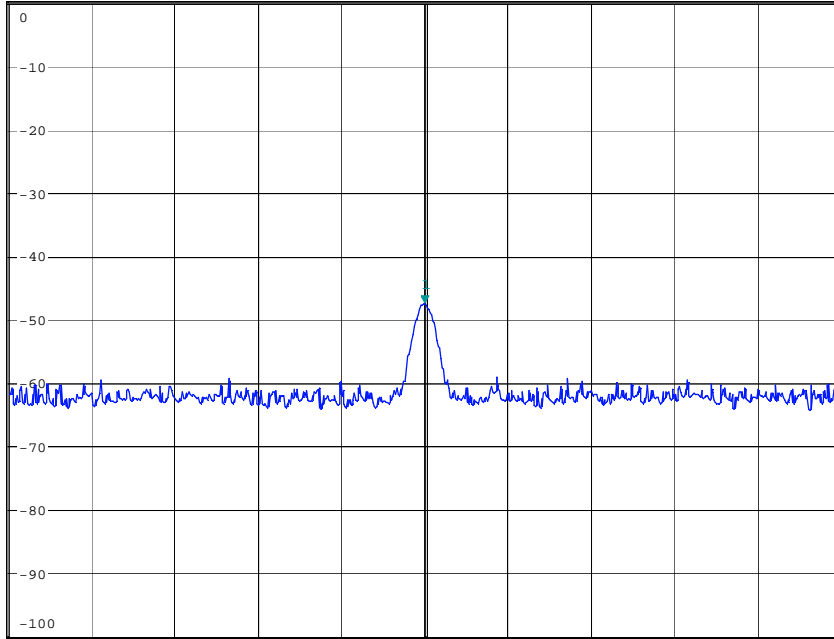


*RBW 100 kHz Marker 1 [T1]
VBW 300 kHz -47.60 dBm
SWT 2.5 ms 915.151576923 MHz

Ref 0 dBm

*Att 10 dB

1 PK
VIEW



Date: 5.NOV.2008 16:07:42

2nd harmonic, 50 ohm load

4.7 Frequency Stability

Para. No.: 2.1055, 80.209, 90.213, 90.217(b)

Test Performed By: G.Suhandhakumar	Date of Test: 11.11.08
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Test Results: Complies

Measurement Data:

Assigned frequency 457.525MHz (Middle)

Temperature	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
+50 degrees C	457.52507	+0.070	0.15299
+40 degrees C	457.52511	+0.110	0,24042
+30 degrees C	457.52519	+0.190	0.41527
+20 degrees C	457.52520	+0.200	0.43713
+10 degrees C	457.52511	+0.110	0,24042
0 degrees C	457.52520	+0.200	0.43713
-10 degrees C	457.52502	+0.020	0.04371
-20 degrees C	457.52502	+0.020	0.04371
-30 degrees C	457.52505	+0.050	0.10928

Voltage	Measured Frequency (MHz)	Deviation (kHz)	Deviation (ppm)
8.4 Volts(Maximum)	457.52519	+0.190	0.41527
7.2 Volts (Nominal)	457.52520	+0.200	0.43713
6.5 Volts (Minimum)	457.52519	+0.190	0.41527

Comment: /

Requirements:

FCC 80.209(a): Band 400- 466 MHz (ii) On-board stations: 5 ppm

FCC 90.213(a) note 8: Mobile stations using 12.5 kHz channels: 2.5 ppm

RSS 119 section 5.3: Mobile station on 12.5 channels: 2.5 ppm

4.8 Transient Frequency Behaviour

Para. No.: 2.1055, 80.209, 90.213, 90.217(b)

Test Performed By: G.Suhandhakumar

Date of Test: 10-Nov-2008

Test Results: Complies

Measurement Data:

See attached plots.

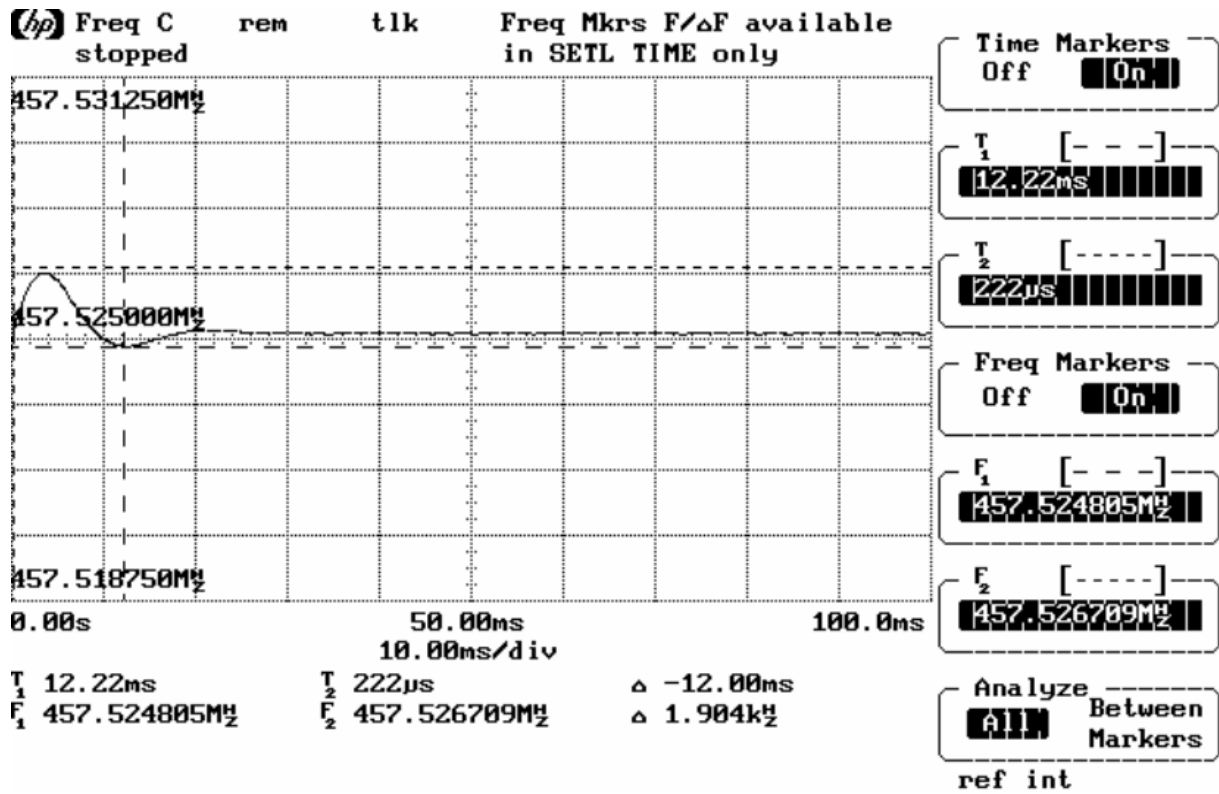
Measurement method according to ANSI/TIA/EIA-603-B-2002 with Frequency Domain Analyzer.

Comment: /

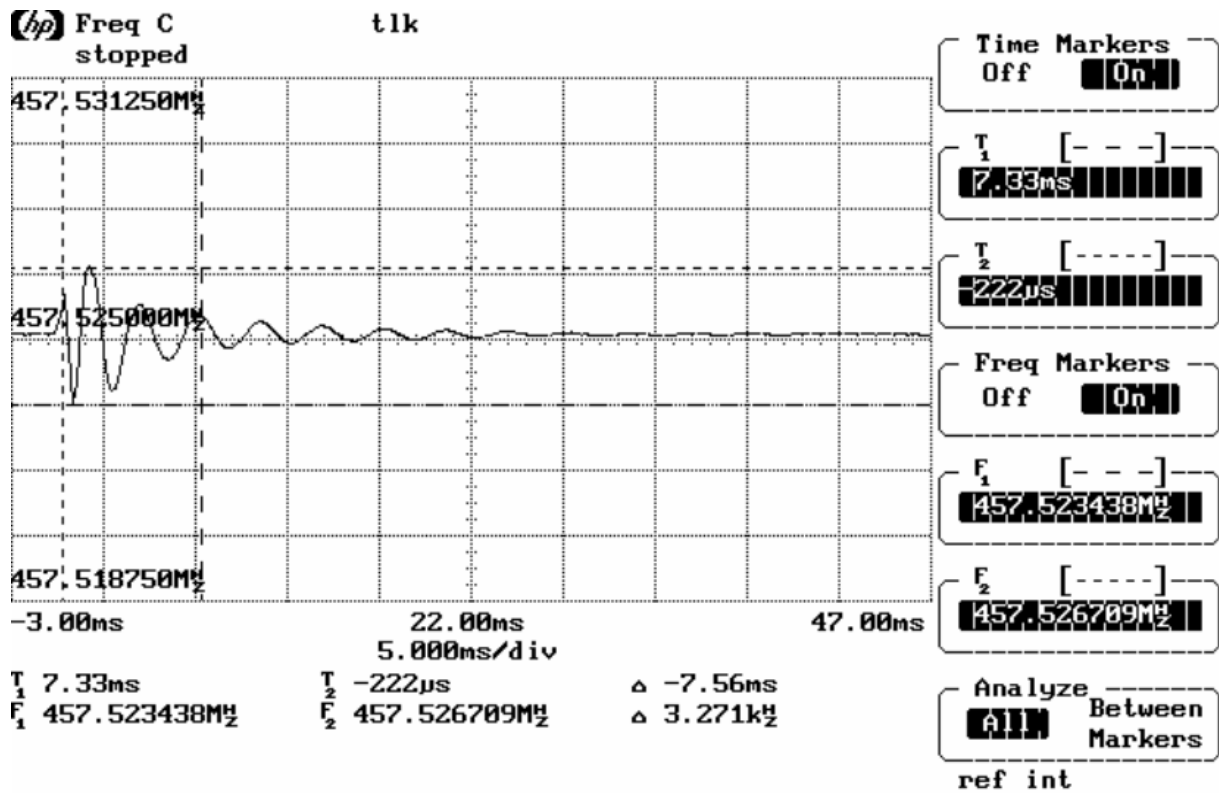
Requirements:

FCC 90.214

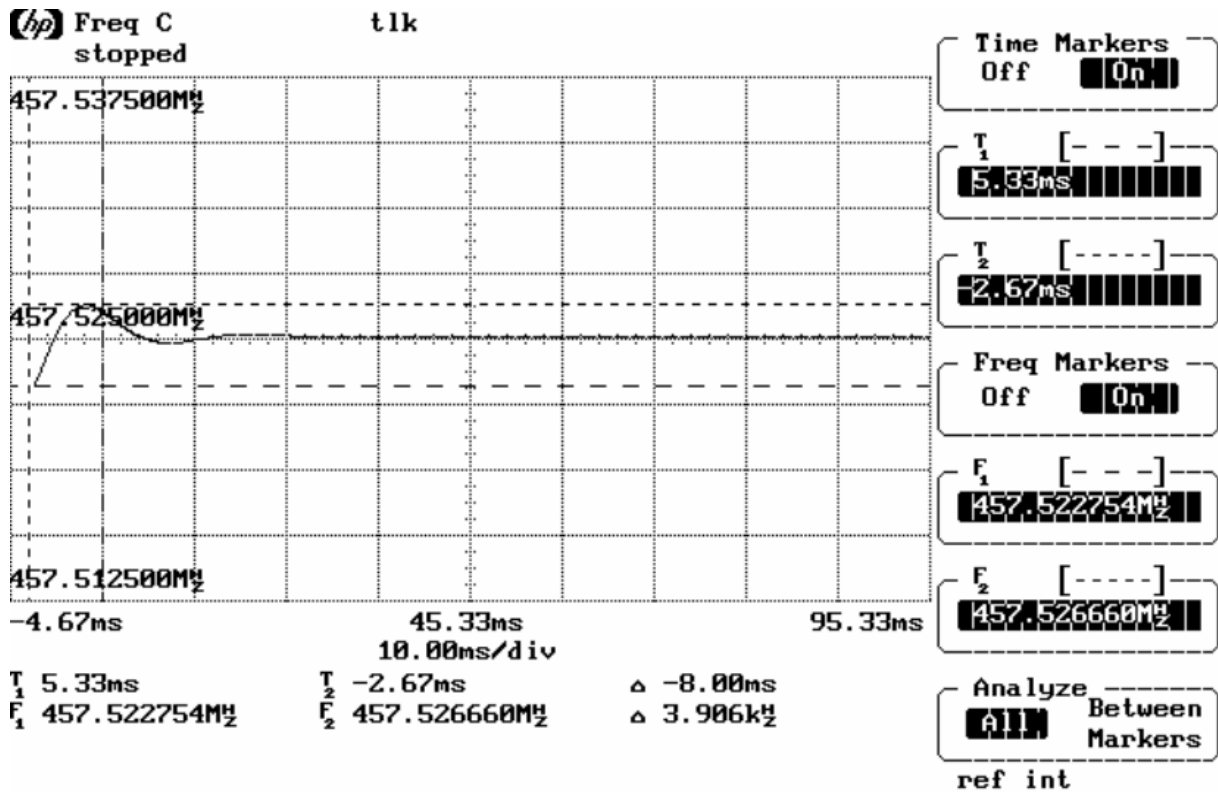
RSS 119 Section 5.9



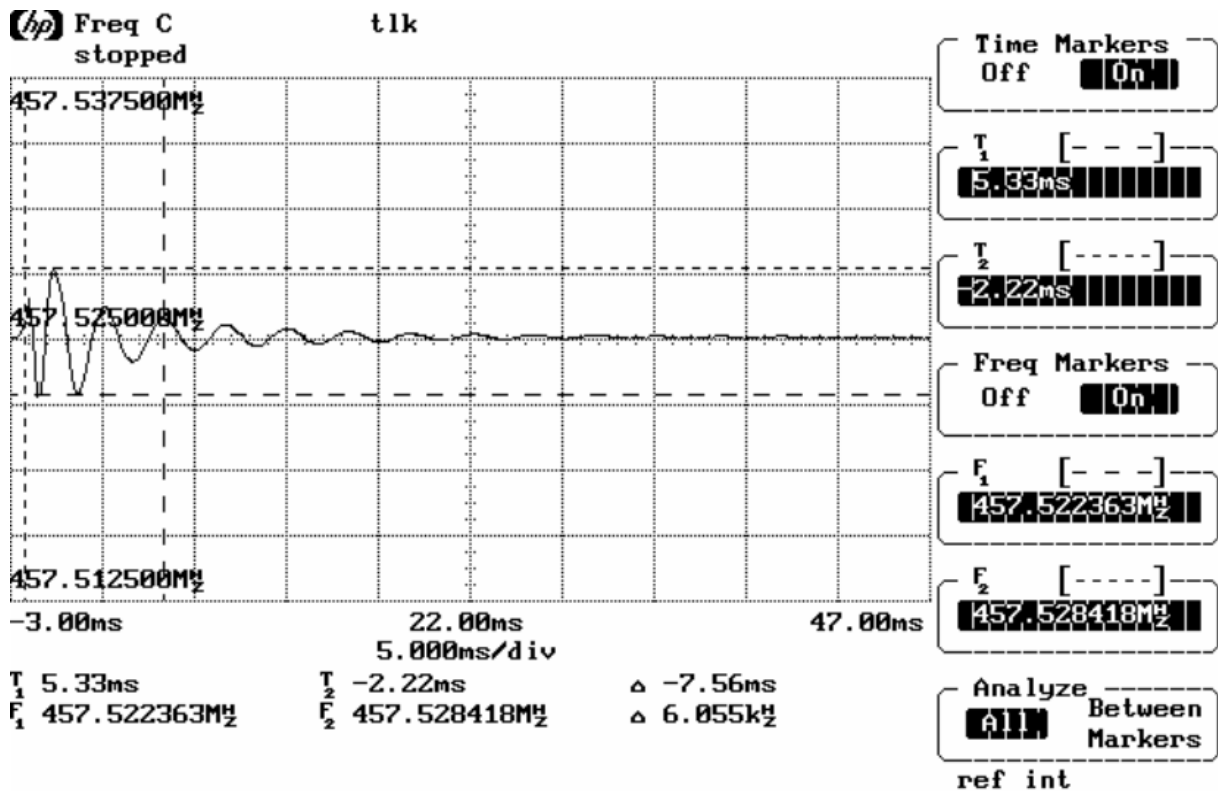
Transient Frequency, 12.5 kHz Channels, Tx ON



Transient Frequency, 12.5 kHz Channels, Tx OFF



Transient Frequency, 25 kHz Channels, Tx ON



Transient Frequency, 25 kHz Channels, Tx OFF

4.9 Suppression of Interference Aboard Ships/ Receiver Spurious Emissions

Measurement Procedure:

FCC 80.217

IC RSS-119 clause 5.11, RSS-GEN clauses 4.8 and 6.

Test results:

See plot. None detected from the Receiver.

Requirements, FCC 80.217(b)

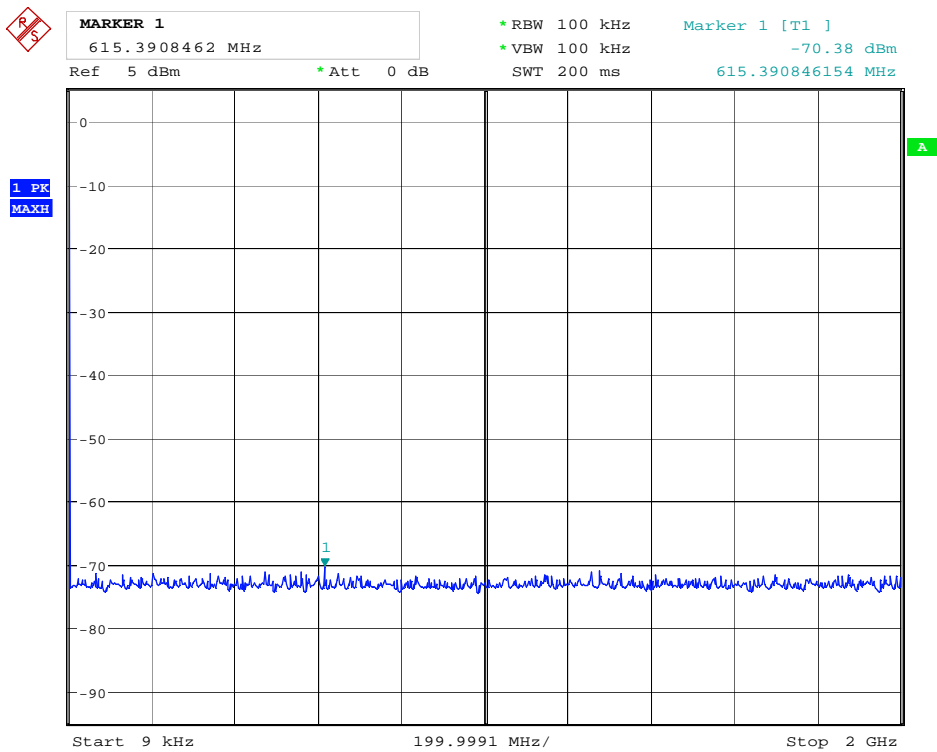
Frequency of Interfering Emissions	Power to Artificial Antenna in microwatts
Below 30 MHz	400 (-4.0 dBm)
30 to 100 MHz	4.000 (6.0 dBm)
100 to 300 MHz	40.000 (16.0 dBm)
Over 300 MHz	400.000 (26.0 dBm)

Requirements, RSS-GEN Issue 2, clause 6

The measurement can be performed either radiated or conducted.

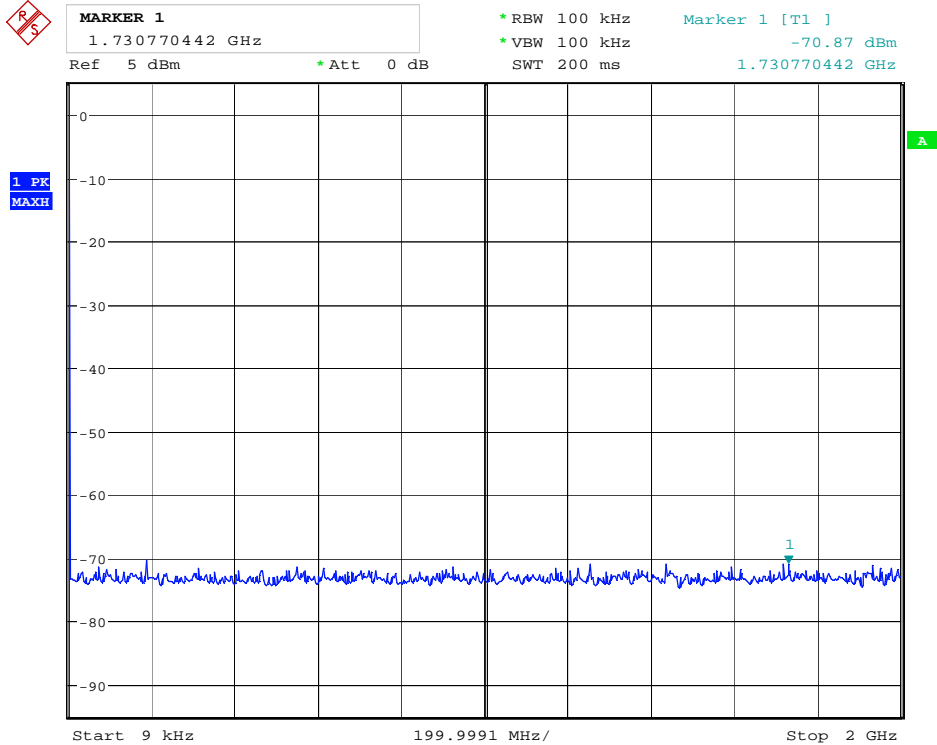
When measured Conducted: no spurious signals appearing at the antenna terminals shall exceed 2 nW per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nW above 1 GHz.

When measured Radiated: See Table 1 in RSS-GEN Issue 2, clause 6.



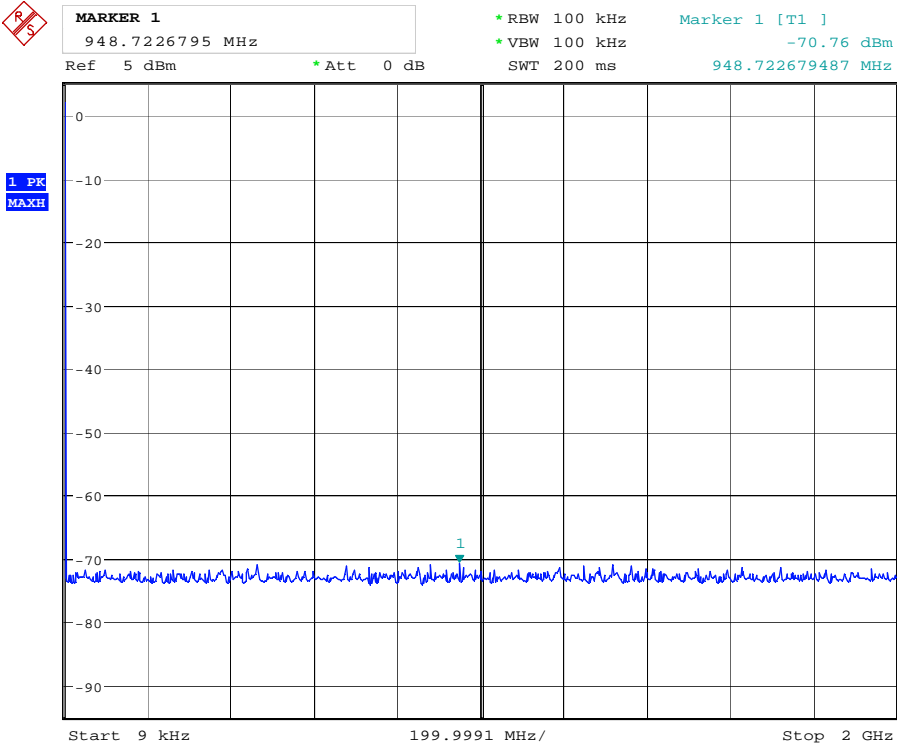
Date: 10.NOV.2008 10:13:01

Receiver Spurious Emissions, 9 kHz – 2 GHz, Lower Channel



Date: 10.NOV.2008 10:12:21

Receiver Spurious Emissions, 9 kHz – 2 GHz, Mid Channel



Date: 10.NOV.2008 10:14:22

Receiver Spurious Emissions, 9 kHz – 2 GHz, Upper Channel

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	CMTA	Radiocom. Analyzer	Rohde & Schwarz	LR 1087
2	SMHU	Signal generator	Rohde & Schwarz	LR 1079
3	SMPD	Signal generator	Rohde & Schwarz	LR 002
4	6232B	Power Supply	Hewlett Packard	LR 1088
5	77	Multimeter	Fluke	LR 302
6	FSU26	Spectrum Analyzer	Rohde & Schwarz	LR 1504
7	FSEK30	Spectrum Analyzer	Rohde & Schwarz	LR 1337
8	765-10	Attenuator	Narda	LR 1005
9	6810.17B	Attenuator	Suhner	LR 1184
10	6810.17B	Attenuator	Narda	LR 1212
11	H-9	Hybrid	Anzac	LR 1091
12	H-9	Hybrid	Anzac	LR 1095
13	8470B	Crystal Detector	Hewlett Packard	LR 1207
14	PM 3392	Oscilloscope	Philips	LR 1125
15	8561B	Spectrum Analyzer	Hewlett Packard	LR 1085
16	53310	Modulation Domain Analyzer	Hewlett Packard	LR 1483
17	ESVS30	Measuring Receiver	Rohde & Schwarz	LR 1101
18	ESN	Measuring Receiver	Rohde & Schwarz	LR 1237
19	8449B	Preamplifier	Hewlett Packard	LR 1322
20	3115	Horn Antenna	EMCO	LR 1226
21	HL223	Biconical Antenna	Rohde & Schwarz	LR 1261
22	HK116	Logperiod Antenna	Rohde & Schwarz	LR 1260
23	HFH2-Z2	Loop Antenna	Rohde & Schwarz	LR 285
24	HZ-12	Substitution Dipoles	Rohde & Schwarz	LR 1332
25	HZ-13	Substitution Dipoles	Rohde & Schwarz	LR 1334

6 TEST SETUP

6.1 Test Site Radiated Emissions

