



Test report no. : 158780/5

Item tested: Sailor 6222 VHF DSC

Type of equipment: VHF Transceiver

Client: Thrane &Thrane A/S

www.nemko.com

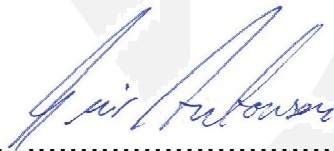


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**FCC Part 80
IRC RSS-182, Issue 4**

2011-06-20

Authorized by:



Geir Antonsen
Technical Verificator



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1 GENERAL INFORMATION

1.1 Tested by

Name : Nemko A/S
Address : Nemko Kjeller
Instituttveien 6, Box 96
N-2027 Kjeller, NORWAY
Telephone : +47 64 84 57 00
Fax : +47 64 84 57 05
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Number of Pages: 43

1.2 Client Information

Name : Thrane & Thrane A/S
Address : Porsvej 2
DK-9200 Aalborg SV
Telephone : +45 96 34 63 44
Fax : -

Contact:

Name : Henrik Kalstrup
E-mail: HEK@thrane.com

1.3 Manufacturer (if other than client)

Name : -
Address : -

2 Test Information

2.1 Tested Item

Name :	Thrane & Thrane
Model/version :	TT-6222A
Serial number :	0000000005
Hardware identity and/or version:	626222A
Software identity and/or version :	1.01.0002 Build date Nov 19 2010
Frequency Range :	156.025 MHz – 157.425 MHz
Tuneable Bands :	/
Number of Channels :	57
Channel spacing:	12.5 and 25 kHz
Test frequencies	156.050 MHz, 156.525 MHz, 157.425 MHz
Operating Modes :	Tx, Rx
Type of Modulation :	Frequency modulated
User Frequency Adjustment :	Not applicable
RF Output Power (Conducted) :	23.9 W
Power Supply :	24V DC and EUT connected to DC voltage stabiliser
Antenna Connector :	UHF sockets
Antenna Diversity Supported :	-
Desktop Charger :	Not applicable

Description of Tested Device(s)

The Equipment Under Test (EUT) is a 25W Marine VHF Radio telephone with DSC.

2.2 Test Environment

2.2.1 Normal test condition

Temperature:	22 – 25 °C
Relative humidity:	22 – 46 %
Normal test voltage:	24 V DC

The values are the limits registered during the test period.

2.3 Test Period

Item received date:	2010-09-16
Test period :	from 2010-09-23 to 2011-06-20

2.4 Test Engineers

Jan G Eriksen / Frode Sveinsen

2.5 Test Equipment

See list of test equipment in clause 4

2.6 Comments

All results are within the limits in the referenced standard.

3 TEST REPORT SUMMARY

3.1 General

The tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with:

**FCC PART 80: STATIONS IN THE MARITIME SERVICES
IRC RSS-182, ISSUE 4: MARITIME RADIO TRANSMITTERS AND RECEIVERS IN THE BAND
156-162.5 MHZ**

The test methods have been in accordance with Comlab 1003, FCC Part 80, IRC RSS-182, Issue 4 and other standards which are referred to in those mentioned above, where applicable.

- Production Unit
 Pre-production Unit


THIS TEST REPORT RELATES 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 NO.: 158780/5

TESTED BY :


Jan G Eriksen, test engineer

DATE: 2011-05-25

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3.2 Test Summary

Tested items of EUT

Test	FCC Rules		IRC RSS-182	
		P/F	Clause	P/F
RF Output Power	2.1046	P	6.2	P
Automatic TX timer	80.215	P	3.7	P
Audio Frequency Response	2.1047	p	3.4	p
Modulation Limiting	2.1047	P	3.4 (b)	P
Occupied Bandwidth	2.1049	P	3.4 (d)	P
Spurious Emissions at Antenna Terminals (Swept Frequency 0,009 – 2000 MHz)	2.1051	P	6.3	P
Spurious Emissions at Antenna Terminals (Emissions mask)	2.1051	P	6.3	P
Field strength of spurious radiation	2.1053	P	N/A	-
Radiated emission limits	15.109	P	6.7	P
Frequency Stability	2.1055	P	6.1	P
Suppression of Interference aboard ships	80.217	P	N/A	-

4 Test Results

4.1 RF Output Power

FCC 2.1046
 RSS-182 Section 6.2

The output power levels have been measured with a power meter and adjusted for attenuator and cable losses (measured with Vector Network Analyser).

RF Output Power					
12,5 kHz channel spacing					
Frequency [MHz]	Rated Power [W]	Measured power [W]	Measured power [dBm]	Difference from rated [dB]	Verdict
156,050	1	0,93	29,7	-0,3	Pass
156,775	1	0,93	29,7	-0,3	Pass
156,875	1	0,93	29,7	-0,3	Pass
157,425	1	1,00	30,0	0,0	Pass
156,050	25	23,9	43,8	-0,2	Pass
157,425	25	25,4	44,0	0,0	Pass
25 kHz channel spacing					
156,050	1	0,93	29,7	-0,3	Pass
156,775	1	0,93	29,7	-0,3	Pass
156,875	1	0,93	29,7	-0,3	Pass
157,425	1	1,00	30,0	0,0	Pass
156,050	25	23,9	43,8	-0,2	Pass
157,425	25	25,2	44,0	0,0	Pass

4.2 RF Output Power – TX timer

FCC 80.215
 RSS-182, section 3.7

The EuT has a timer which set the EuT in receive mode after an uninterrupted transmit period of 5 minutes ± 2 seconds

Verdict: PASS

4.3 Suppression of interference aboard ships

FCC 80.217
 RSS-182, section 3.7

The power from the receiver into the artificial antenna is below 1 microwatt at all investigated frequencies.
 See plot in section 6.7.

Requirement:

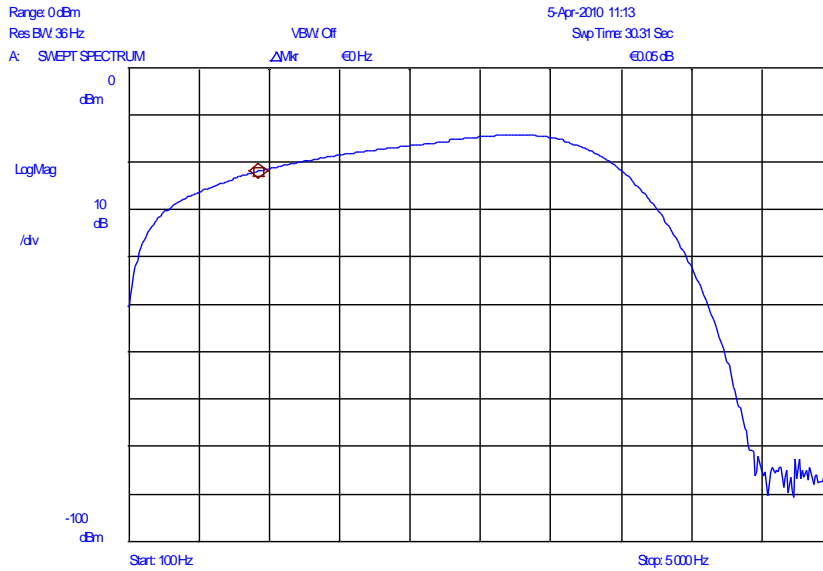
A voluntarily equipped ship station receiver must not deliver not more than the following amounts of power, to an artificial antenna having electrical characteristics equivalent to those of the average receiving antenna(s) use on shipboard:

Frequency of interfering emissions	Power to artificial antenna in microwatts	Power to artificial antenna in dBm
Below 30 MHz	400	-4.0
30 to 100 MHz	4,000	6.0
100 to 300 MHz	40,000	16.0
Over 300 MHz	400,000	26.0

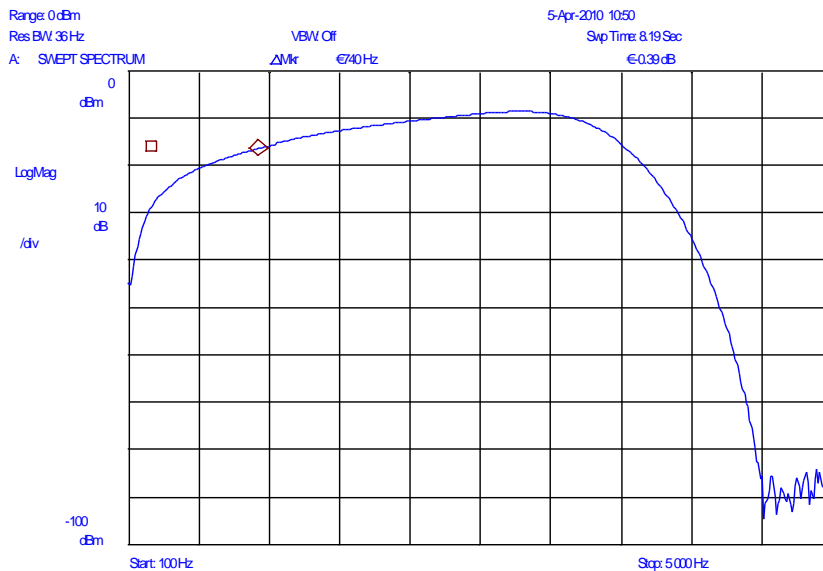
Verdict: PASS

4.4 Modulation characteristics

FCC 2.1047 (audio frequency response)
 RSS-182 Section 3.4(c)



Audio frequency response at 12,5 kHz channel spacing

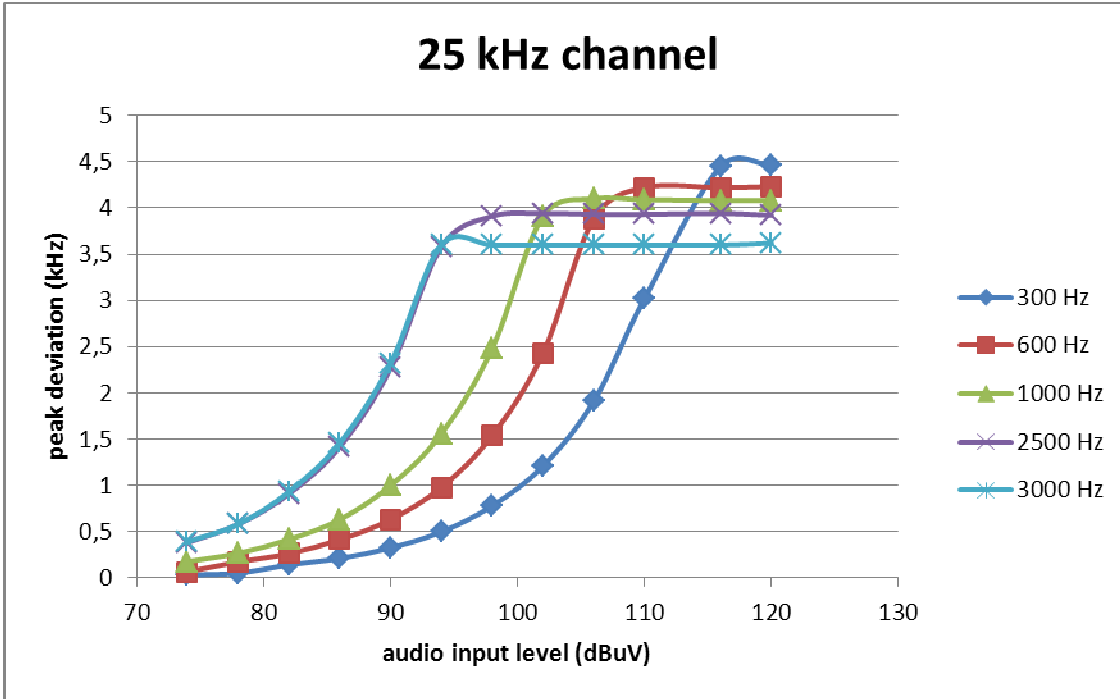


Audio frequency response at 25 kHz channel spacing

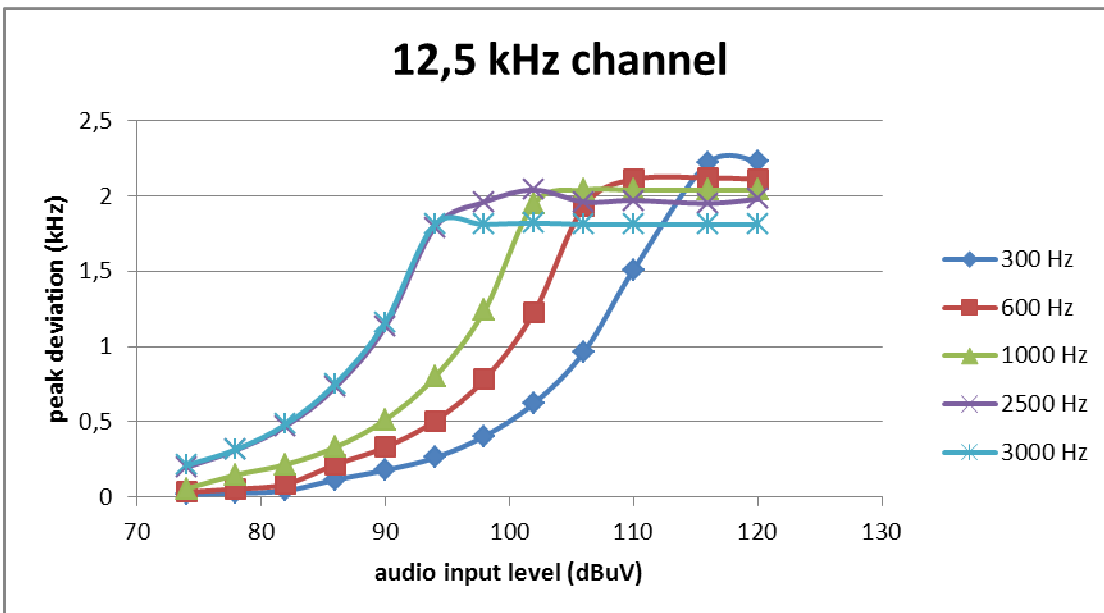
Verdict: Pass

4.5 Modulation characteristics

FCC 2.1047 (modulation limiting)
 RSS-182 Section 3.4 (b)



Modulation limiting for 25 kHz channel separation



Modulation limiting for 12,5 kHz channel separation

4.6 Modulation characteristics

FCC 2.1049 (Occupied Bandwidth)
 RSS-182 Section 3.4 (d)

See plots in Annex 5.1

Carrier frequency [MHz]	Occupied Bandwidth [kHz]	
	25 kHz channel	12.5 kHz channel
156.050	14.93	9.91
156.525	12.02	7.94
157.425	15.22	10.14

4.7 Spurious Emissions in frequency band 9 kHz – 2 GHz

FCC 2.1051: Spurious emissions at antenna terminals
 RSS-182 Section 6.3 Transmitter unwanted emissions

See plots in Annex 5.2.

Because results for all three carrier frequencies are very similar only plots for 156,050000 MHz low power and high power at 12,5 and 25 kHz channel distance are included in the Annex.

Carrier frequency [MHz]	Conducted Spurious emissions in band 0,009 – 2000 MHz			
	Low power		High power	
	25 kHz channel	12,5 kHz channel	25 kHz channel	12,5 kHz channel
156,050	None above -13 dBm limit	None above -20 dBm limit	None above -13 dBm limit	None above -20 dBm limit
156,525	None above -13 dBm limit	NA	None above -13 dBm limit	NA
157,425	None above -13 dBm limit	None above -20 dBm limit	None above -13 dBm limit	None above -20 dBm limit

4.8 Spurious Emissions close to carrier

FCC §2.1051, §80.211(f): Spurious Emissions at antenna terminals
 RSS-182 Section 6.3 Transmitter unwanted emissions

This measurement was performed with 25 and 12.5 kHz channel spacing modes – with high and low power. The reference level at high power is 44.3 dBm and the reference level at low power is 30.3 dBm (both measured with spectrum analyser).

An audio signal of 2500 Hz with a level giving 16 dB above 50% of nominal deviation was applied to the audio inputs. At the DSC channel a DCS signal was applied.

See plots in Annex 5.3 (FCC emission masks) and 5.4 (RSS-182 emission masks).

Carrier frequency [MHz]	Spurious emission masks			
	Low power		High power	
	25 kHz channel	12.5 kHz channel	25 kHz channel	12.5 kHz channel
156.050	PASS	PASS	PASS	PASS
156.525	PASS	NA	PASS	NA
157.425	PASS	PASS	PASS	PASS

4.9 Field strength of spurious radiations

FCC 2.1053: Field strength of spurious radiation
 RSS-182 NA

This test was performed with a 50 ohm termination on the TX-output and the spurious emission level was measured in the frequency range 0.009 – 2000 MHz. The test was performed with EuT in low power mode and high power mode.

The measurement range is pre-calibrated using substitution measurements. In the range from 0,009 to 30 MHz the Quasi-Peak field strength was measured using a loop antenna, here pre-calibrated correction factors are automatically added to the measurement result. In the range from 30 to 1000 MHz pre-calibrated correction factors have been added manually. In the range 1000 – 2000 MHz pre-calibrated correction factors are automatically added to the measurement results.

As can be seen from the results below the measured spurious levels are very low and therefore no substitution was performed during the test.

For the range 30-2000 MHz the red curves in plots are vertical polarisation, and the blue curves are horizontal polarisation. During the pre-scans the antenna height was 100 cm at vertical polarisation and 400 cm at horizontal polarisation, and the EuT was turned 0-360 degrees.

During final measurement at spurious frequencies antenna height and turntable azimuth was altered.

Measurement distance was 10 meters in the range 0.009-1000 MHz, and 3 meters in the range 1000-2000 MHz.

See measurement plots in annex 5.5

Measured frequency [MHz]	Measured spurious level [dBm] (dBuV/m QP in the frequency range 0.009-30 MHz)
	Carrier frequency 156.050 MHz, low power mode
0.009-2000	No values close to limit level
	Carrier frequency 156.050 MHz, high power mode
0.009-2000	No values close to limit level
	Carrier frequency 157.425 MHz, low power mode
0.009-2000	No values close to limit level
	Carrier frequency 157.425 MHz, high power mode
0.009-2000	No values close to limit level

4.10 Radiated emission limits

FCC 15.109: Radiated emission limits
 RSS-182 Section 6.7 Receiver spurious emissions

This test was performed in RX-mode. The antenna connectors were terminated with 50 ohm.

For this measurement EMC32 software by Rohde & Schwarz was used. Pre-measured calibration factors are used.

Field strength was measured in the range 30 – 2000 MHz. Measurement distance was 3 meters

See measurement plots in annex 5.6

Result for 156.050 MHz setting

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
49.546439	34.4	120.000	100.0	V	287.0	-13.7	5.6	40.0	PASS
232.694664	34.0	120.000	135.0	H	22.0	-10.9	12.0	46.0	PASS
264.534164	42.3	120.000	121.0	H	94.0	-9.0	3.7	46.0	PASS
631.875359	44.3	120.000	135.0	H	121.0	-1.1	1.7	46.0	PASS

Result for 157.425 MHz setting

Frequency (MHz)	QuasiPeak (dBµV/m)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
199.492324	32.5	120.000	174.0	H	283.0	-9.3	11.0	43.5	PASS
221.591526	27.9	120.000	100.0	H	89.0	-11.3	18.1	46.0	PASS
265.996836	42.1	120.000	136.0	H	61.0	-8.9	3.9	46.0	PASS
310.440799	35.0	120.000	100.0	H	203.0	-7.8	11.0	46.0	PASS
332.510560	37.7	120.000	116.0	H	191.0	-7.4	8.3	46.0	PASS

4.11 Frequency stability

FCC 2.1055 Frequency Stability
 RSS-182 Section 6.1 Frequency Stability

The frequency stability was measured at every 10 degrees from -30 °C to +55 °C. At nominal temperature (+20 °C), the temperature was also measured at ±15 % of standard mains voltage (24 V DC).

The frequency stability was measured at 156.525 MHz and the two DSC tones of 1300 and 2100 Hz was also measured.

Temperature [°C]	RF frequency [MHz]	Error [ppm]	Limit [ppm]	1300 Hz DSC tone	2100 Hz DSC tone	Limit DSC tones	Verdict
55 @ 24 V DC	156.524914	0.5	± 5.0	1300.002	2100.003	± 10 Hz	PASS
50 @ 24 V DC	156.524891	0.7	± 5.0	1300.003	2100.004	± 10 Hz	PASS
40 @ 24 V DC	156.524912	0.6	± 5.0	1300.002	2100.004	± 10 Hz	PASS
30 @ 24 V DC	156.524945	0.4	± 5.0	1300.002	2100.004	± 10 Hz	PASS
20 @ 24 V DC	156.524960	0.3	± 5.0	1300.003	2100.004	± 10 Hz	PASS
10 @ 24 V DC	156.524928	0.5	± 5.0	1300.003	2100.004	± 10 Hz	PASS
0 @ 24 V DC	156.524894	0.7	± 5.0	1300.003	2100.004	± 10 Hz	PASS
-10 @ 24 V DC	156.524887	0.7	± 5.0	1300.003	2100.004	± 10 Hz	PASS
-20 @ 24 V DC	156.524884	0.7	± 5.0	1300.003	2100.004	± 10 Hz	PASS
-30 @ 24 V DC	156.524886	0.7	± 5.0	1300.002	2100.004	± 10 Hz	PASS
20 @ 20.4 V DC	156.524954	0.3	± 5.0	1300.002	2100.004	± 10 Hz	PASS
20 @ 27.6 V DC	156.524949	0.3	± 5.0	1300.003	2100.004	± 10 Hz	PASS

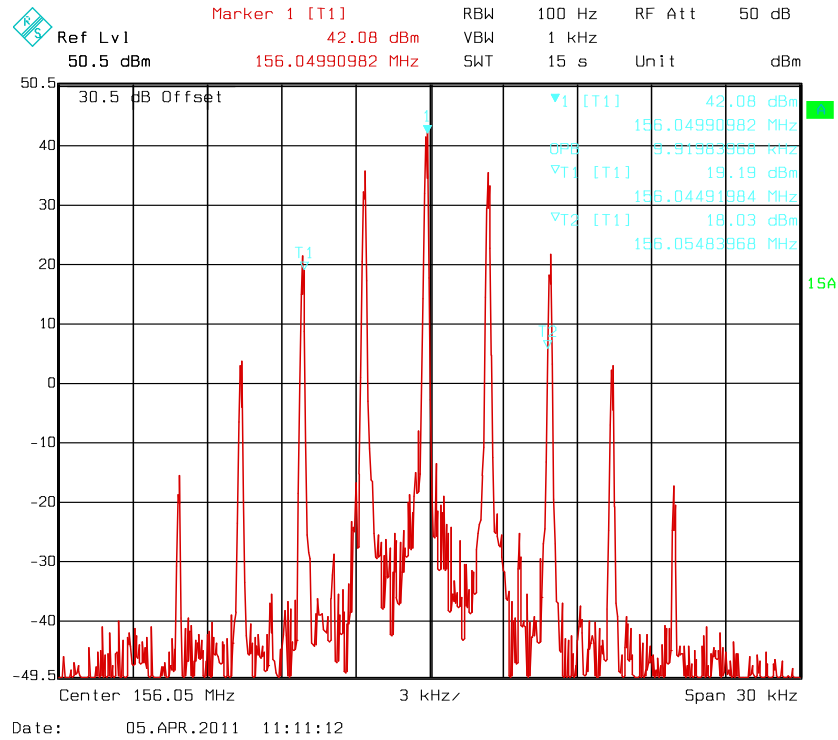
5 Test Equipment Used

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 testhouse.

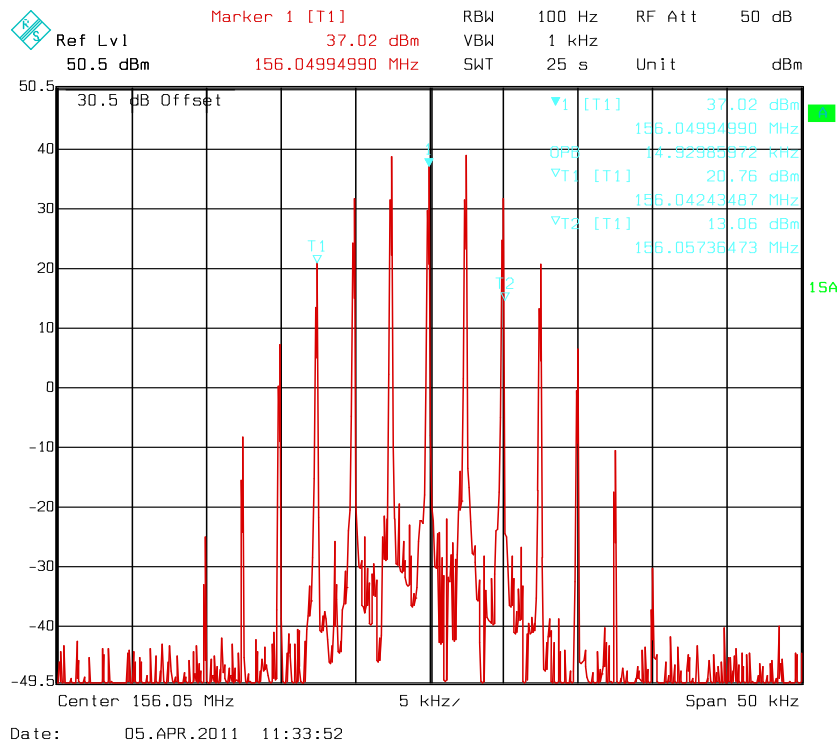
No	Instrument/Ancillary	Type	Manufacturer	Ref. No.
1				
2	Radiocom. Analyser	CMTA	R&S	LR 1047
3	Spectrum Analyser	FSU26	R&S	LR 1113
4	Spectrum Analyser	FSEK30	R&S	LR 1337
5	Power Meter	436A	HP	LR 181
6	Vector Network Analyser	8720D	HP	LR 1344
7	Power Meter	U2000A	Agilent	LR 1523
8				
9				

6 Measurement plots

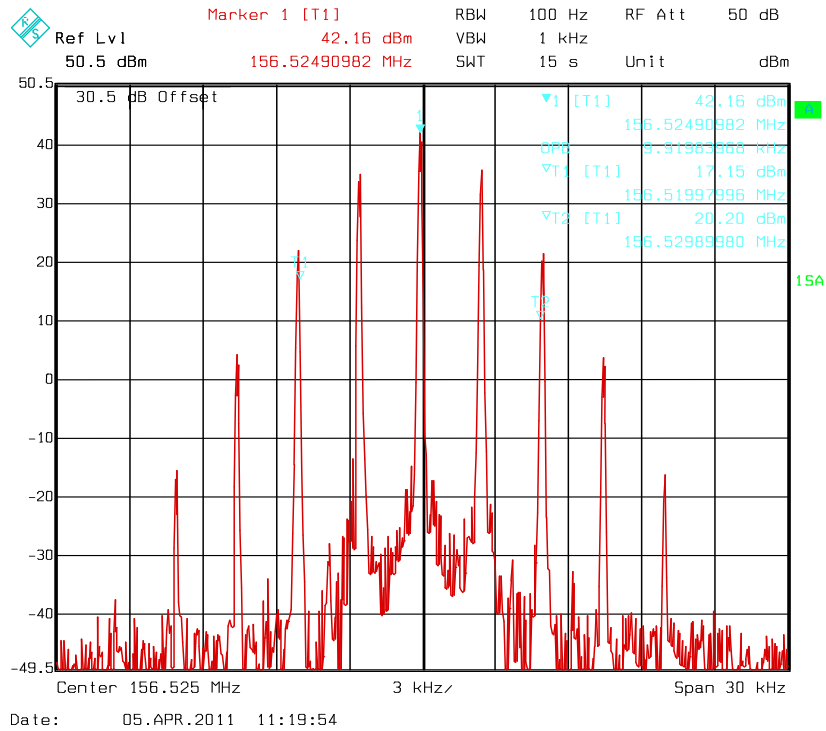
6.1 Occupied Bandwidth



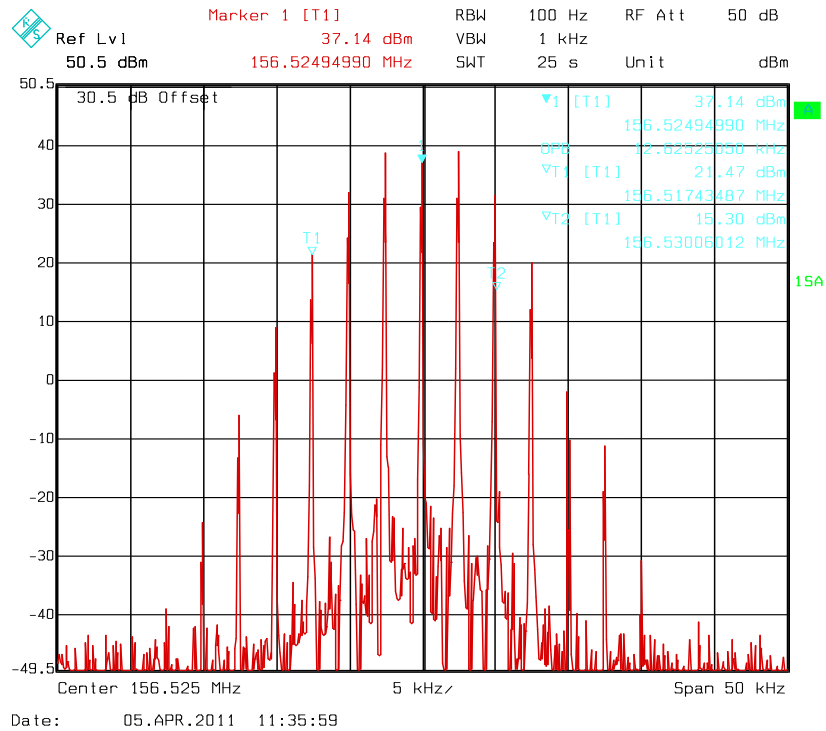
156,050 MHz, 12,5 kHz



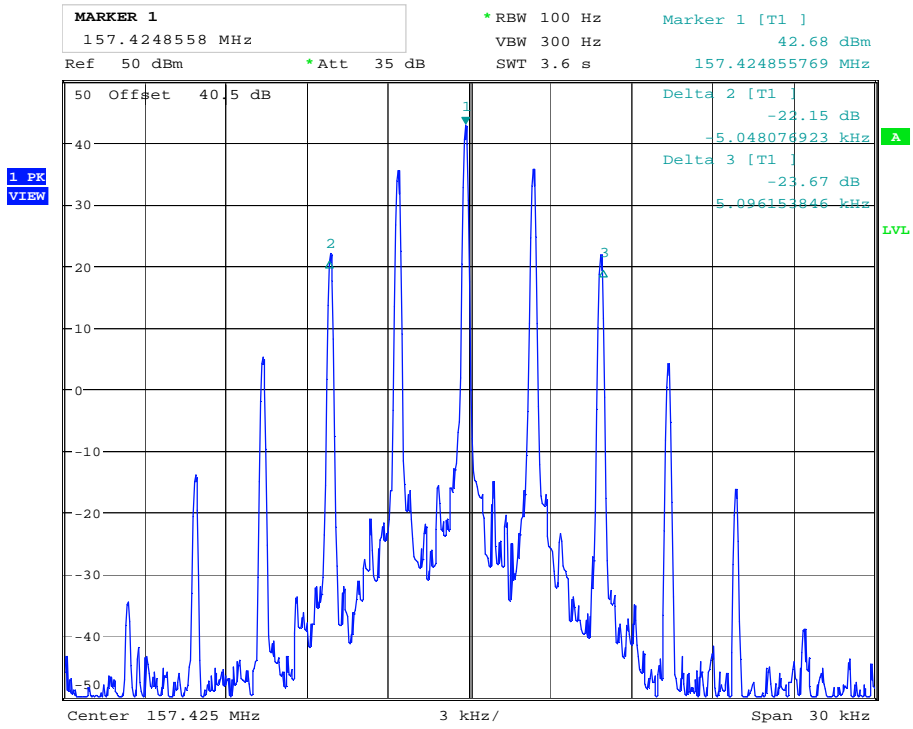
156,050 MHz, 25 kHz



156,525 MHz, 12,5 kHz

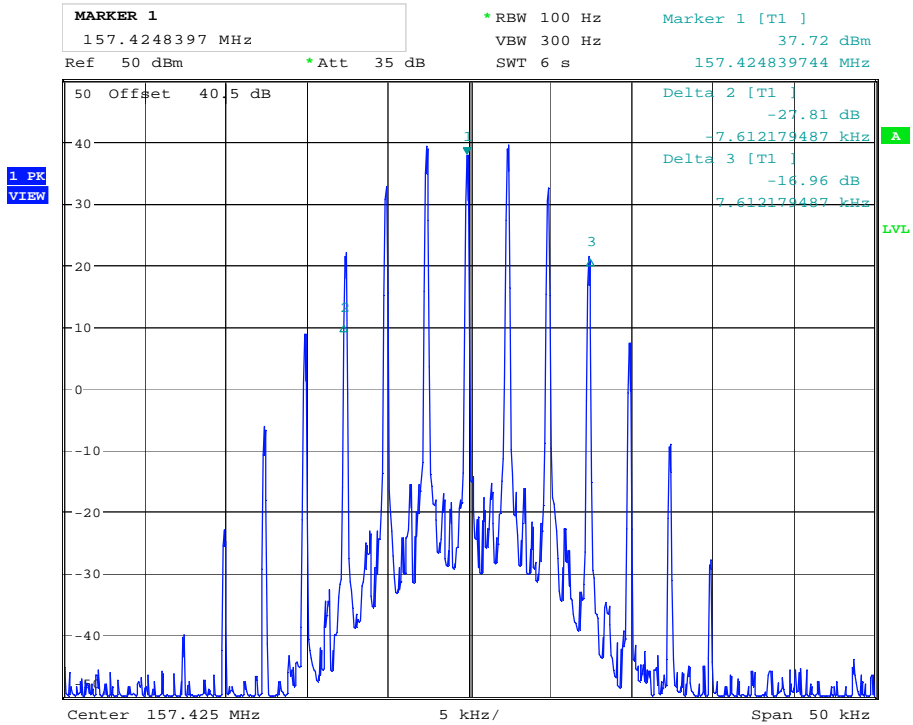


156,525 MHz, 25 kHz



Date: 20.JUN.2011 12:15:52

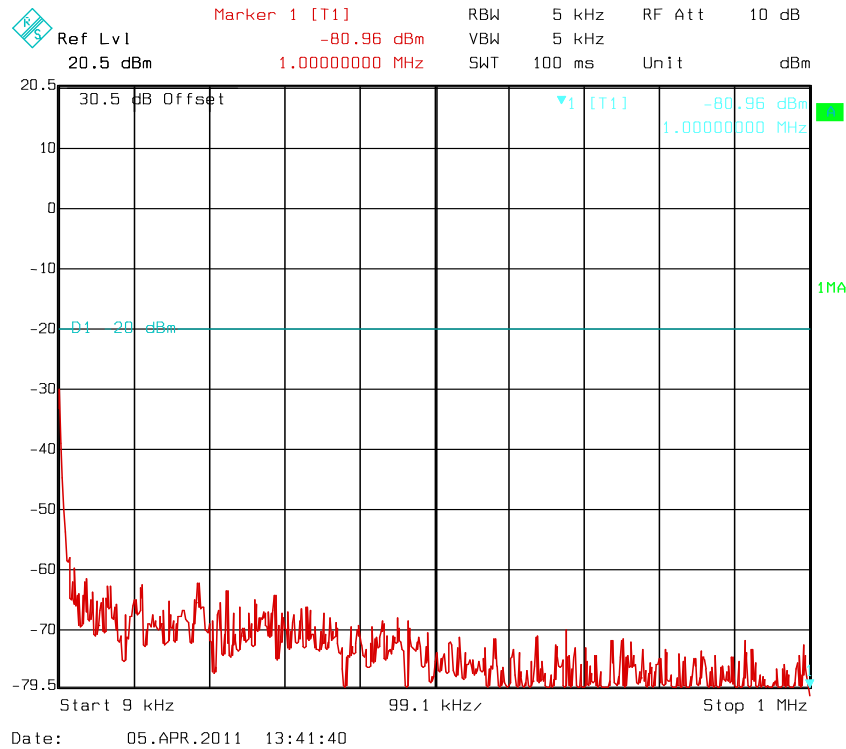
157,425 MHz, 12,5 kHz



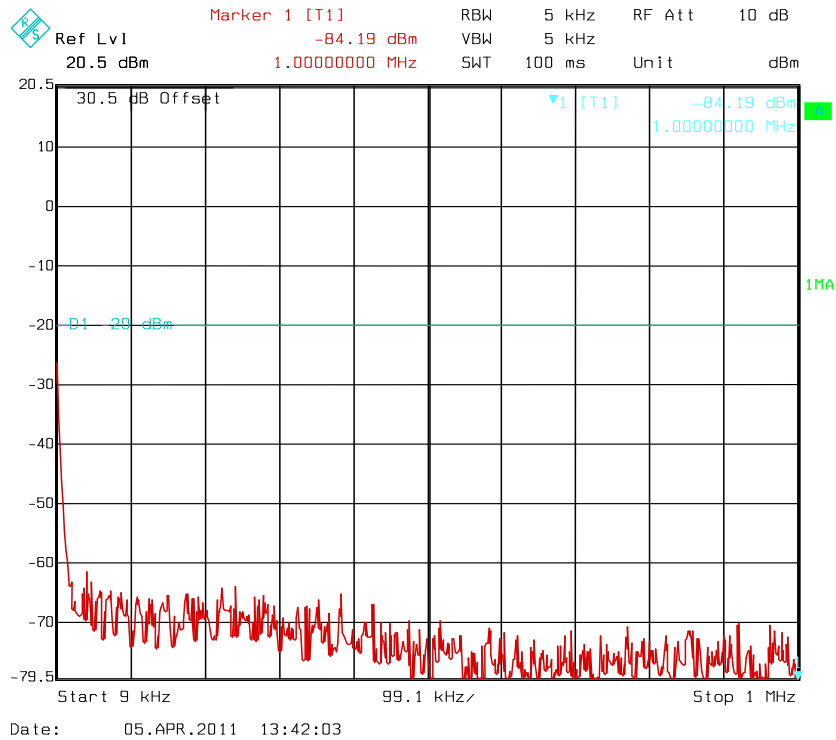
Date: 20.JUN.2011 12:23:45

157,425 MHz, 25 kHz

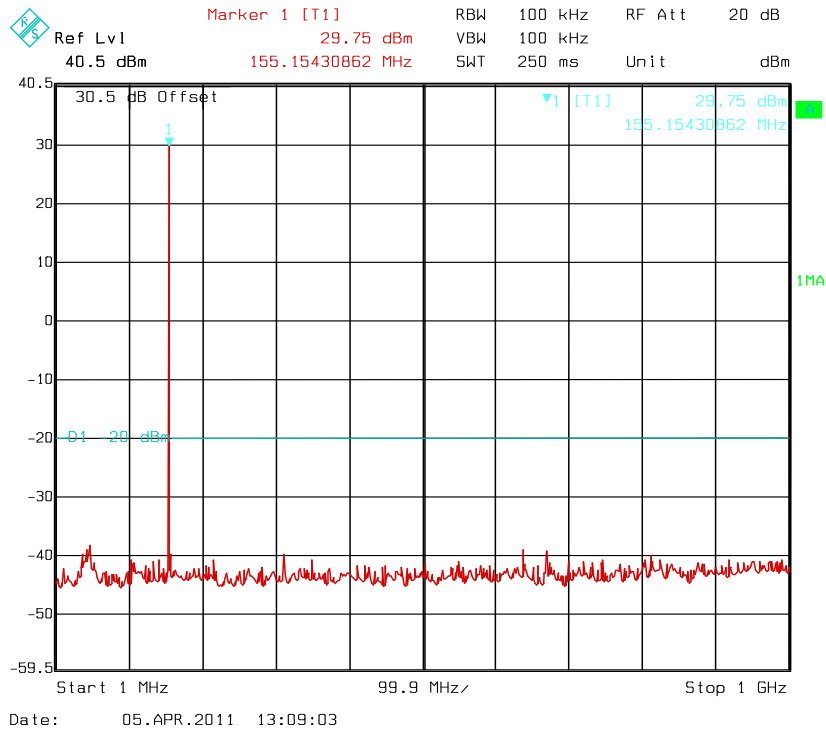
6.2 Conducted Spurious Emissions – carrier at 156,525 MHz



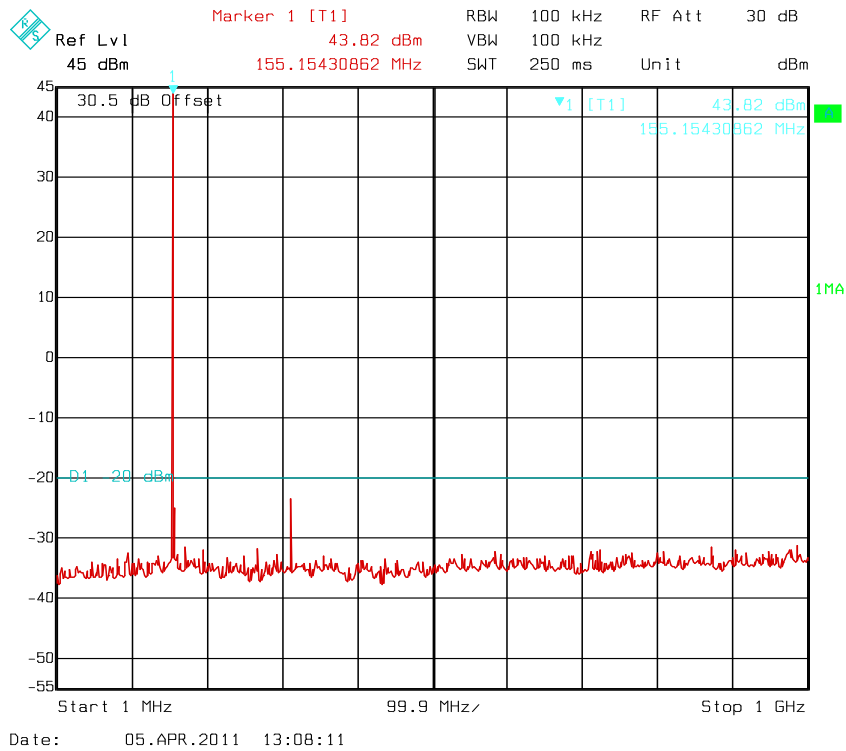
12,5 kHz, low power



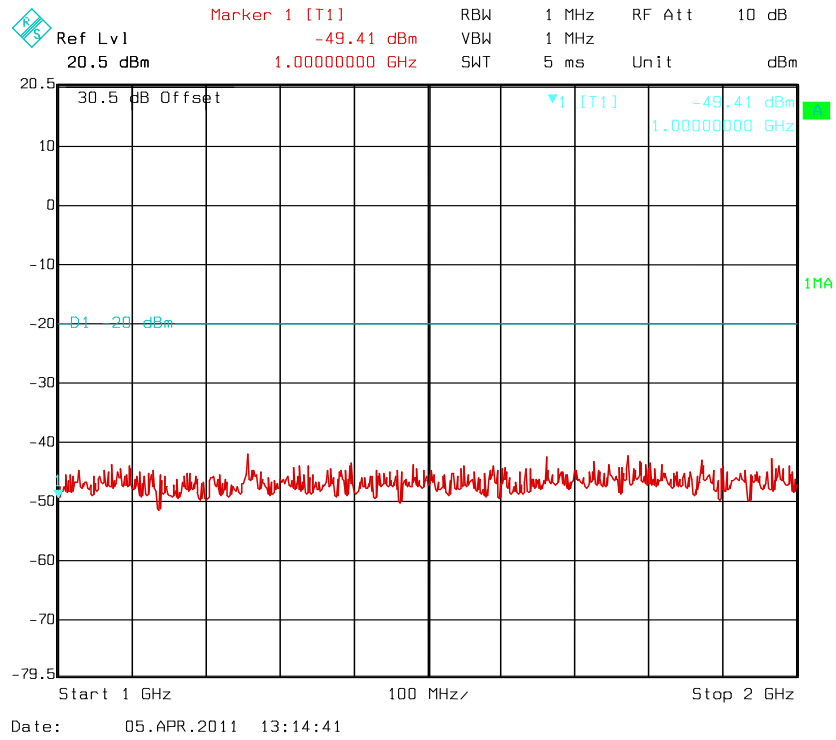
12,5 kHz, high power



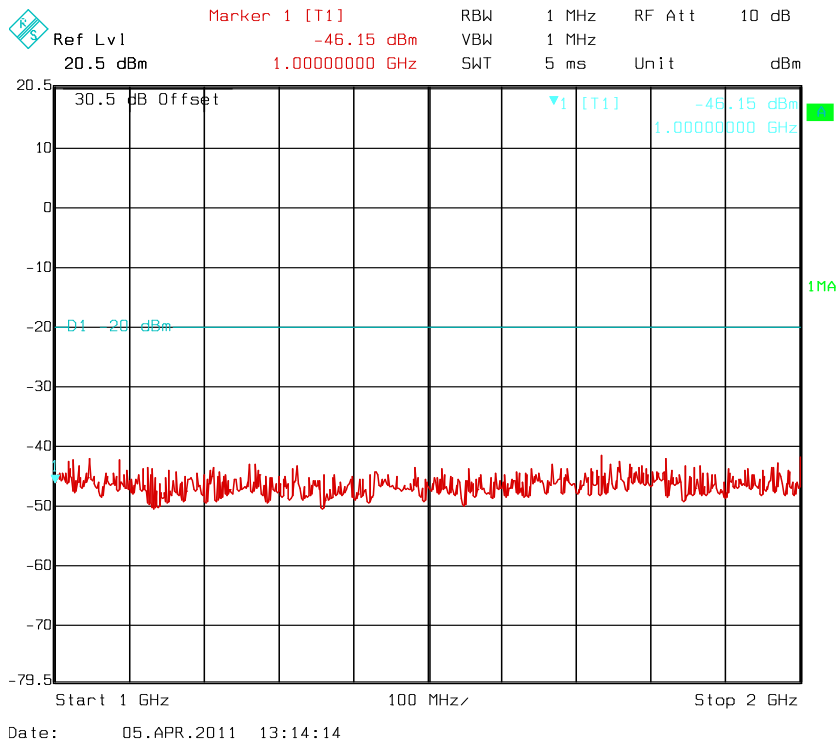
12,5 kHz, low power



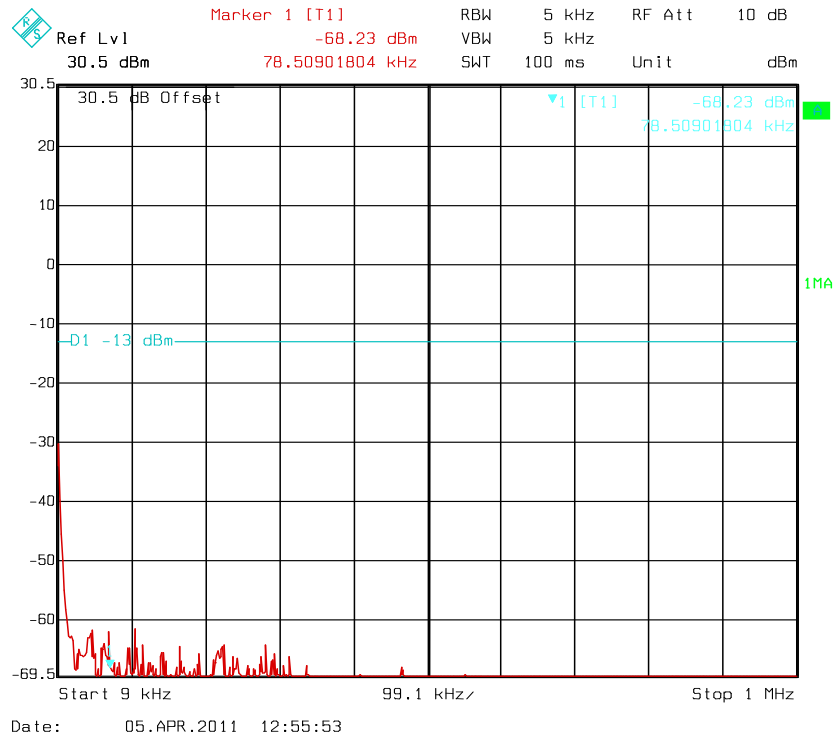
12,5 kHz, high power



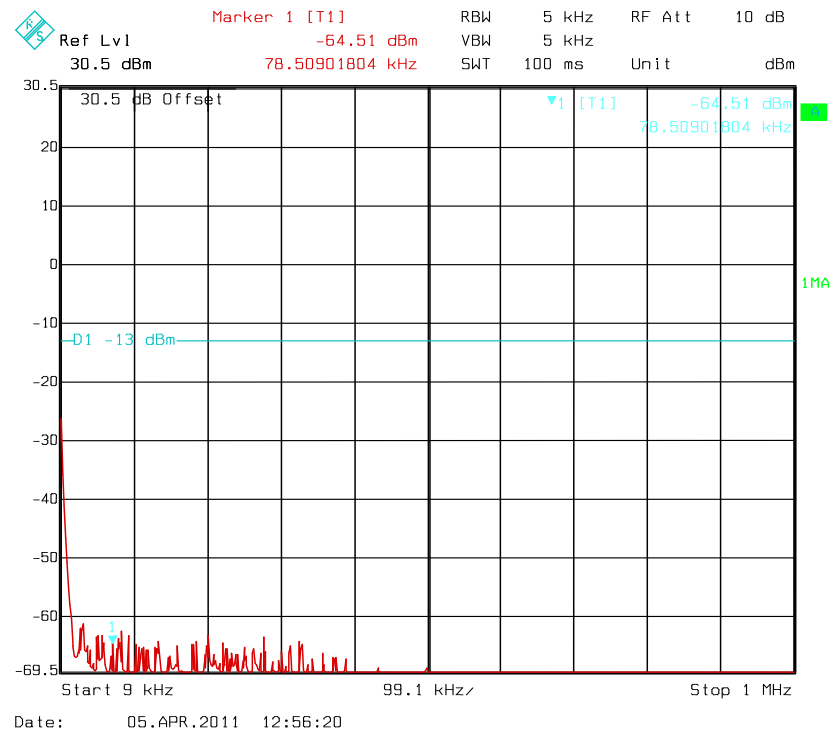
12,5 kHz, low power



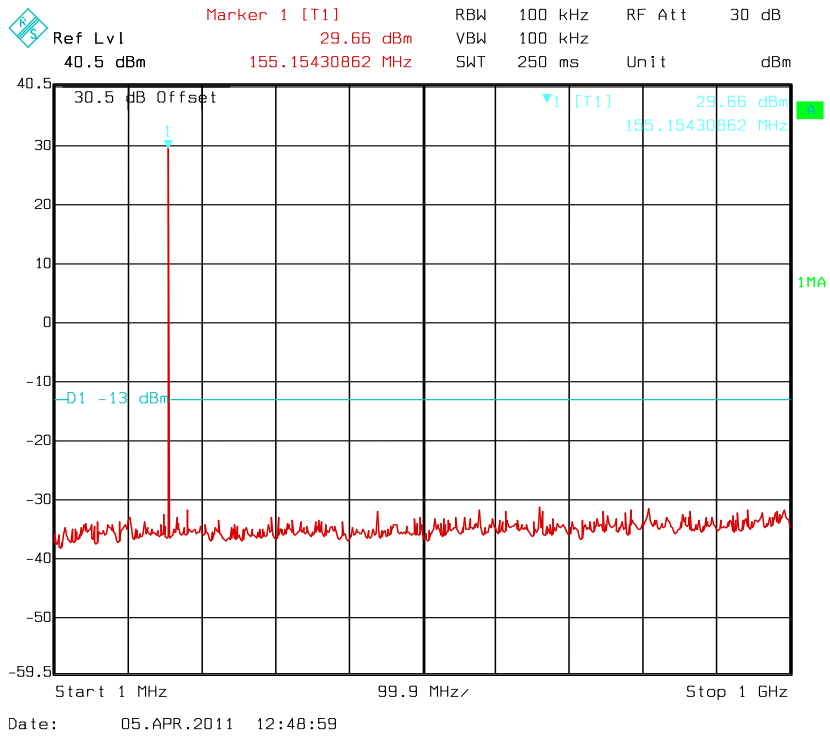
12,5 kHz, high power



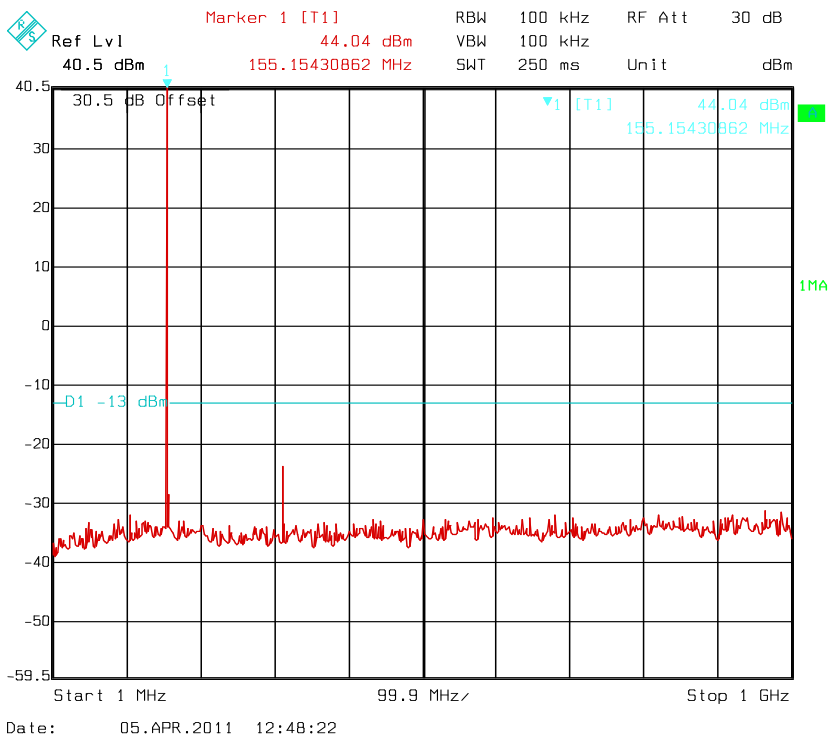
25 kHz, low power



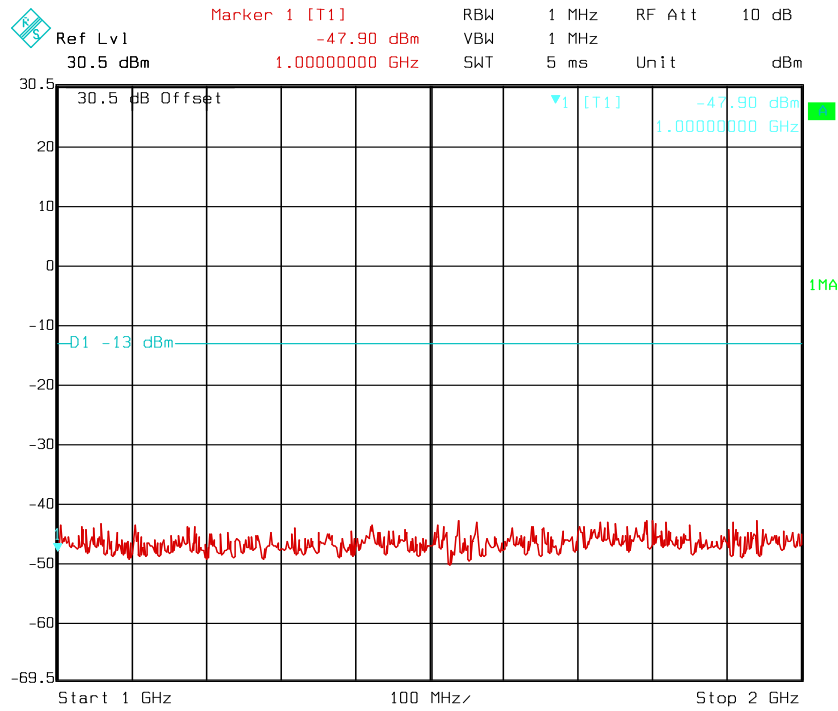
25 kHz, high power



25 kHz, low power

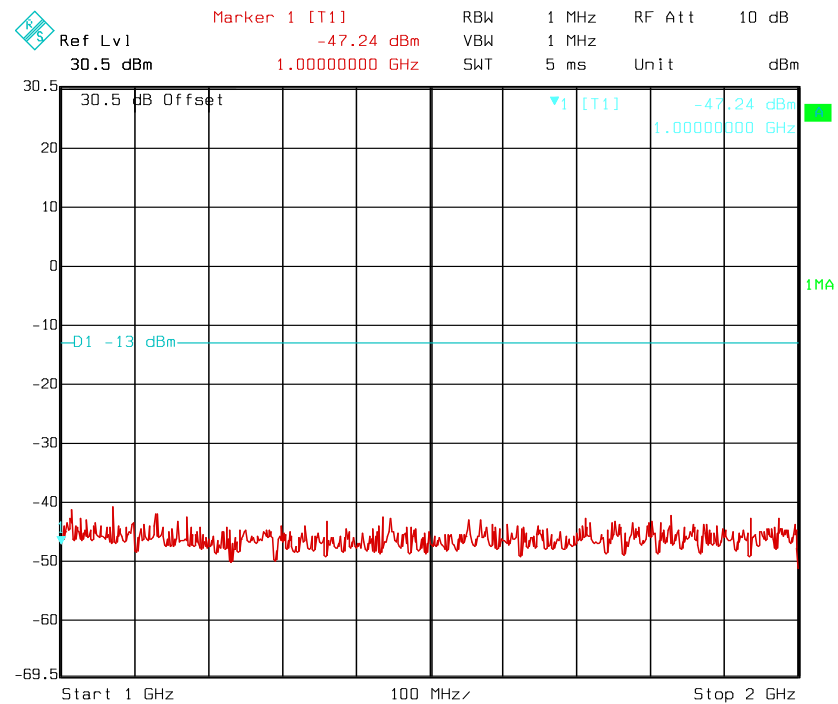


25 kHz, high power



Date: 05.APR.2011 12:59:22

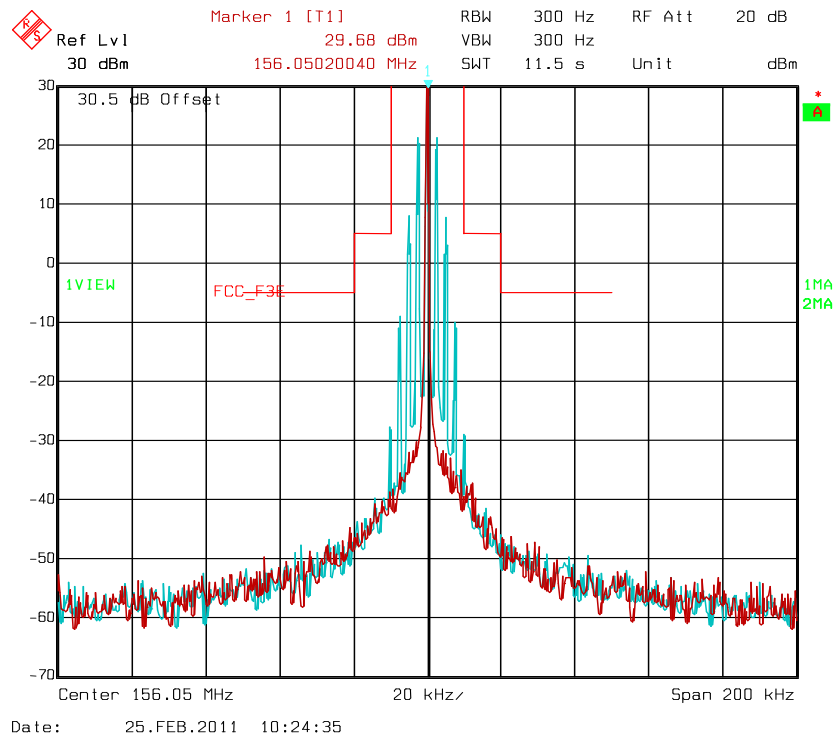
25 kHz, low power



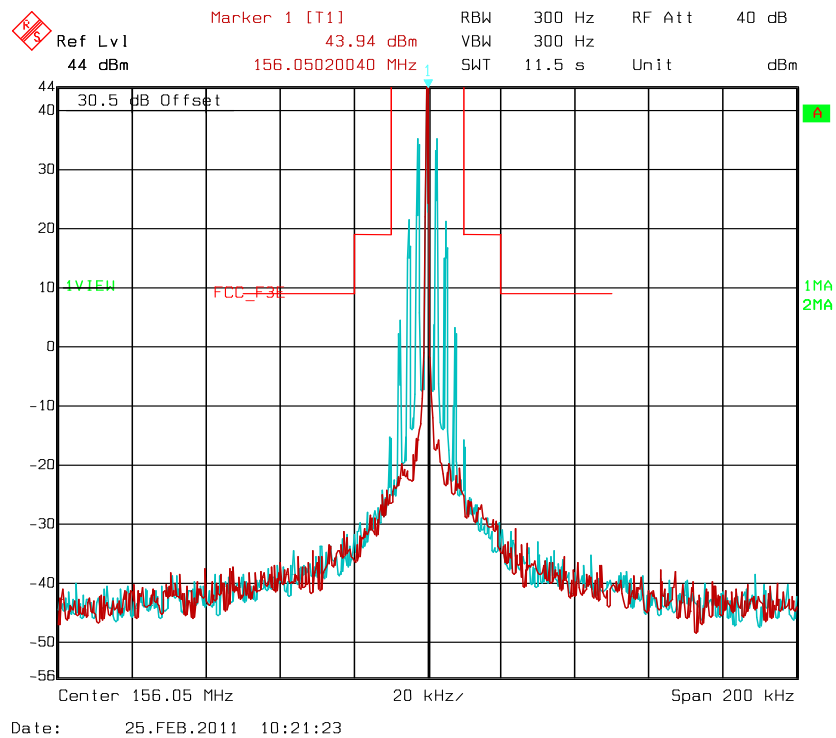
Date: 05.APR.2011 12:59:43

25 kHz, high power

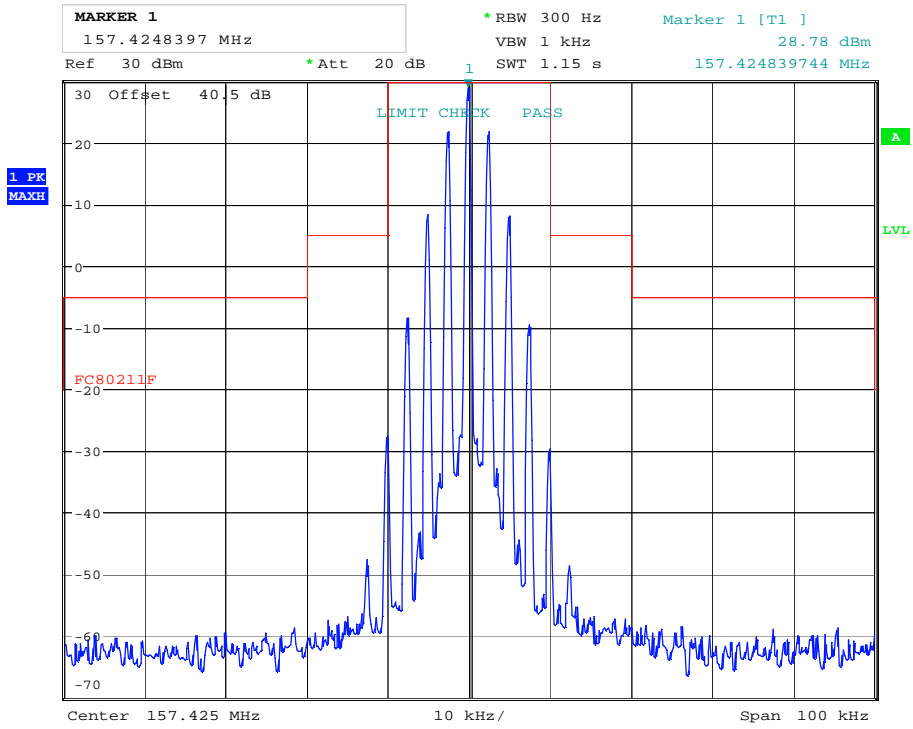
6.3 FCC Spectrum emission masks



156,050 MHz: 12,5 kHz, low power

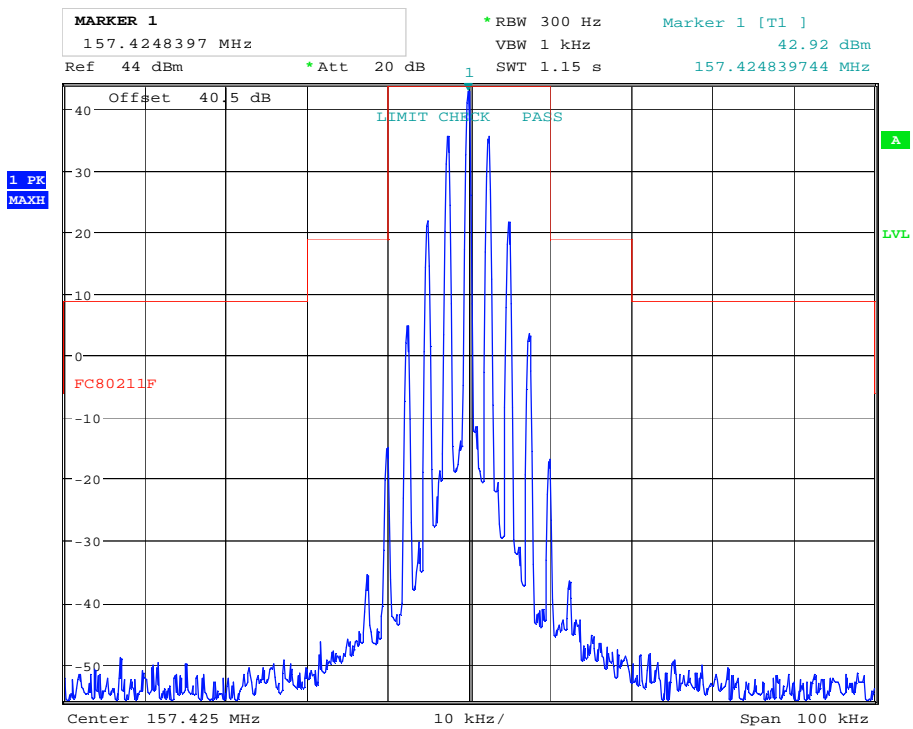


156,050 MHz: 12,5 kHz, high power



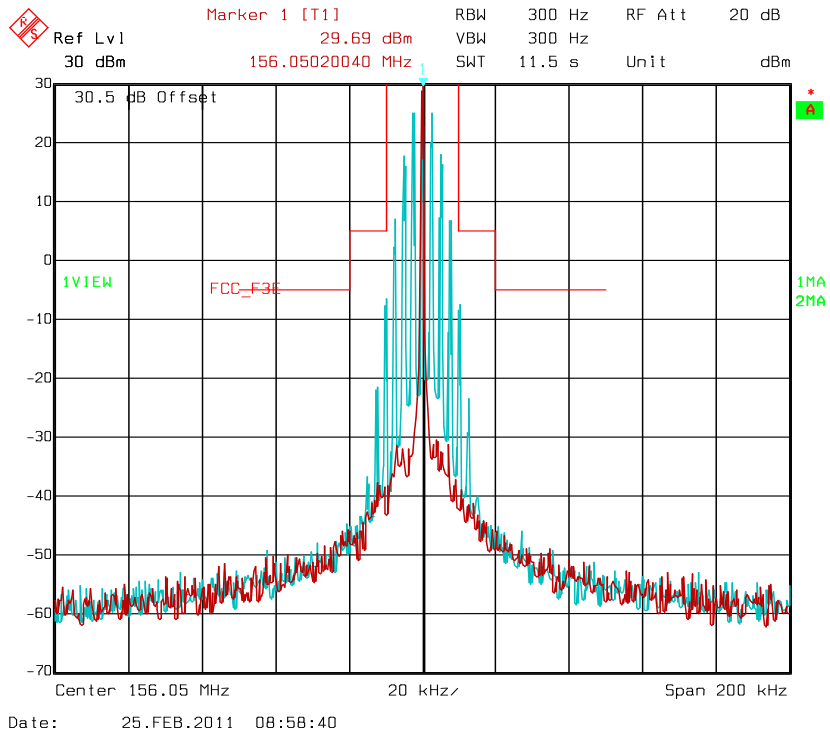
Date: 20.JUN.2011 13:19:40

157,425 MHz: 12,5 kHz, low power

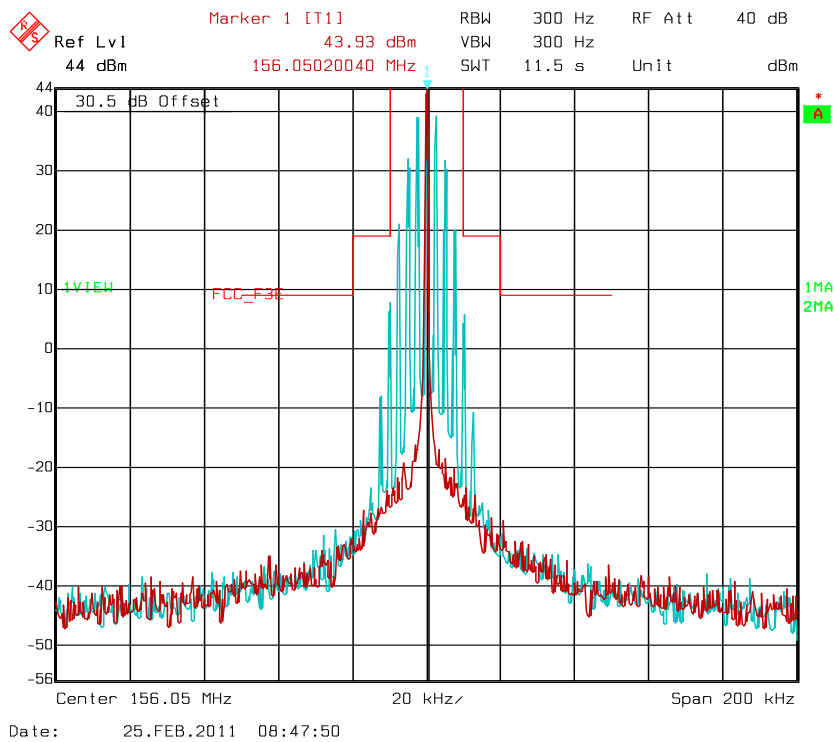


Date: 20.JUN.2011 13:20:13

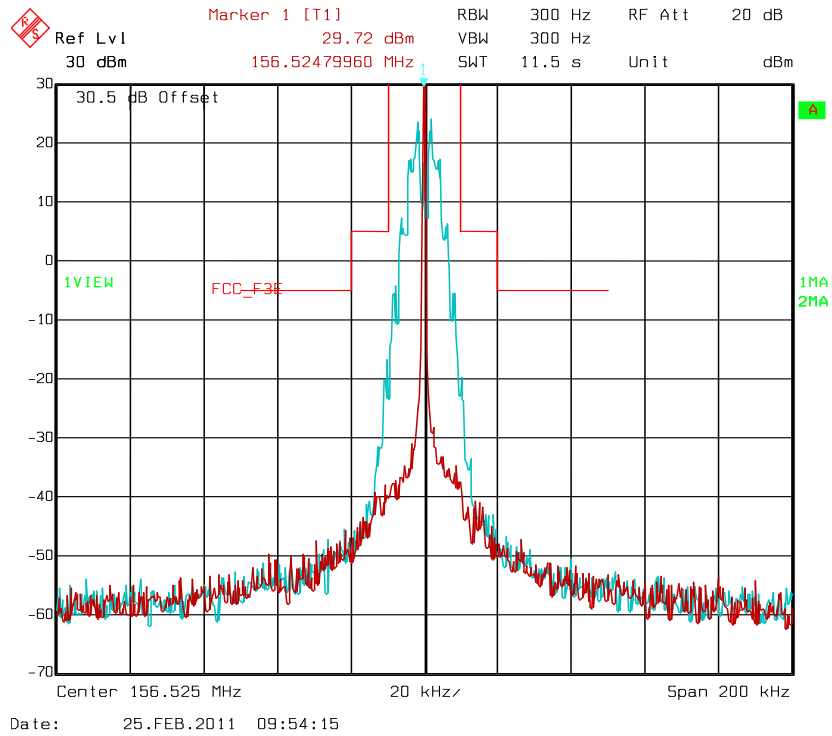
157,425 MHz: 12,5 kHz, high power



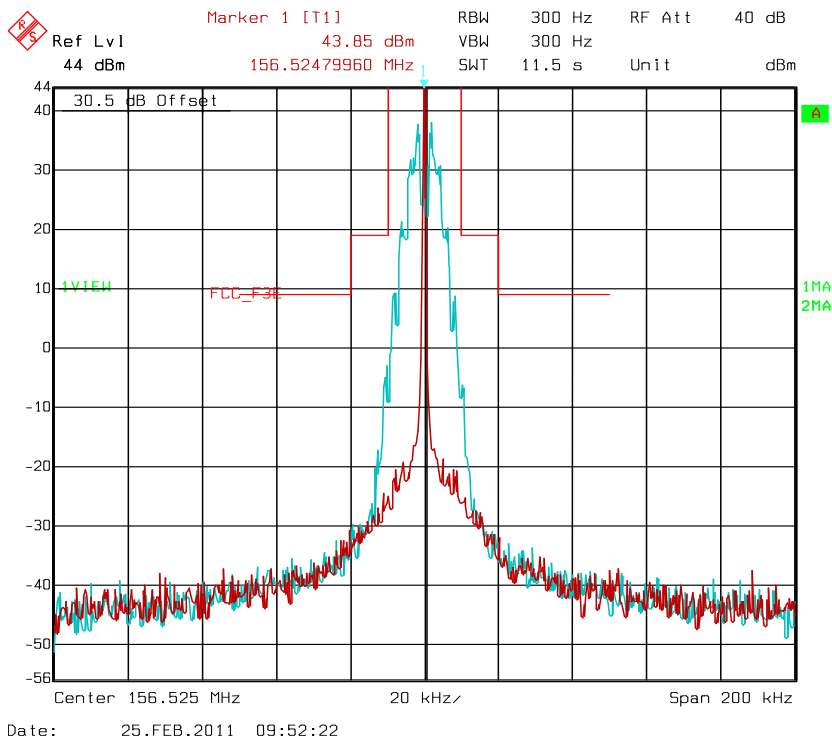
156,050 MHz: 25 kHz, low power



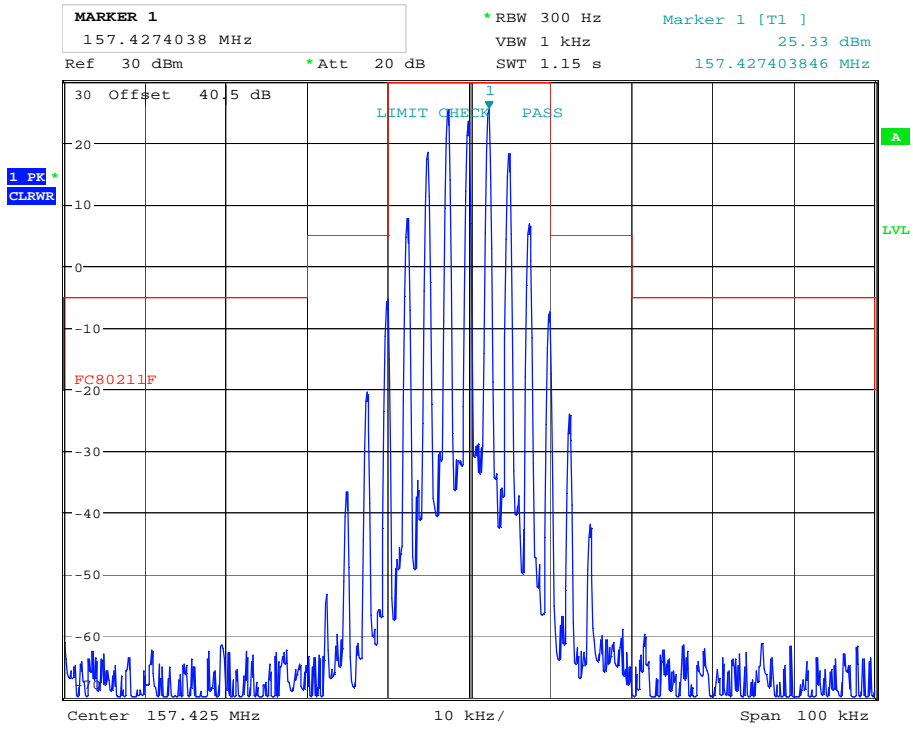
156,050 MHz: 25 kHz, high power



156,525 MHz: 25 kHz, low power, DSC modulation

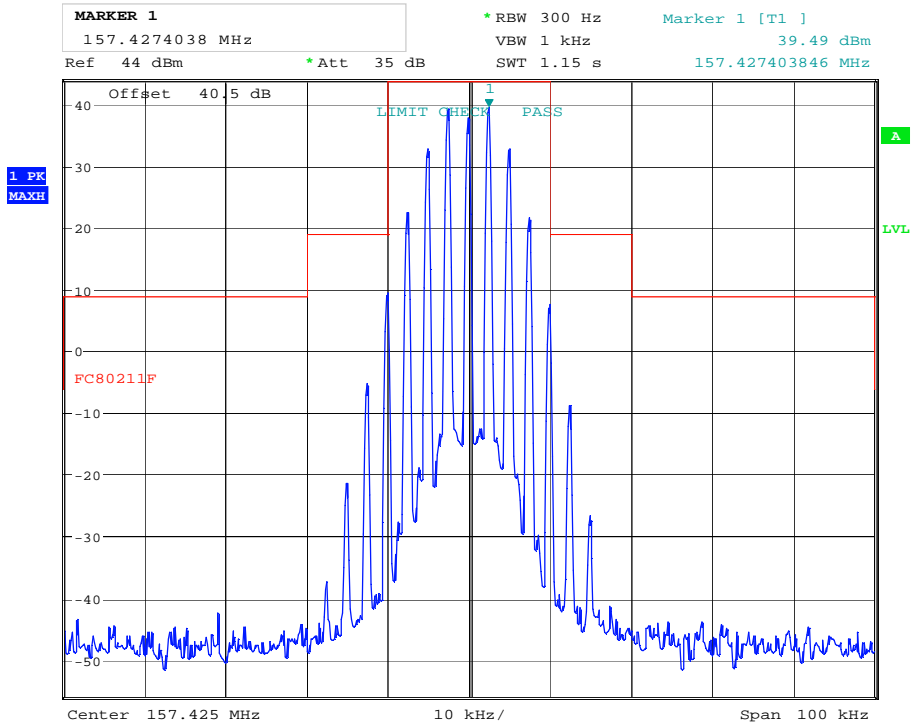


156,525 MHz: 25 kHz, high power, DSC modulation



Date: 20.JUN.2011 13:18:30

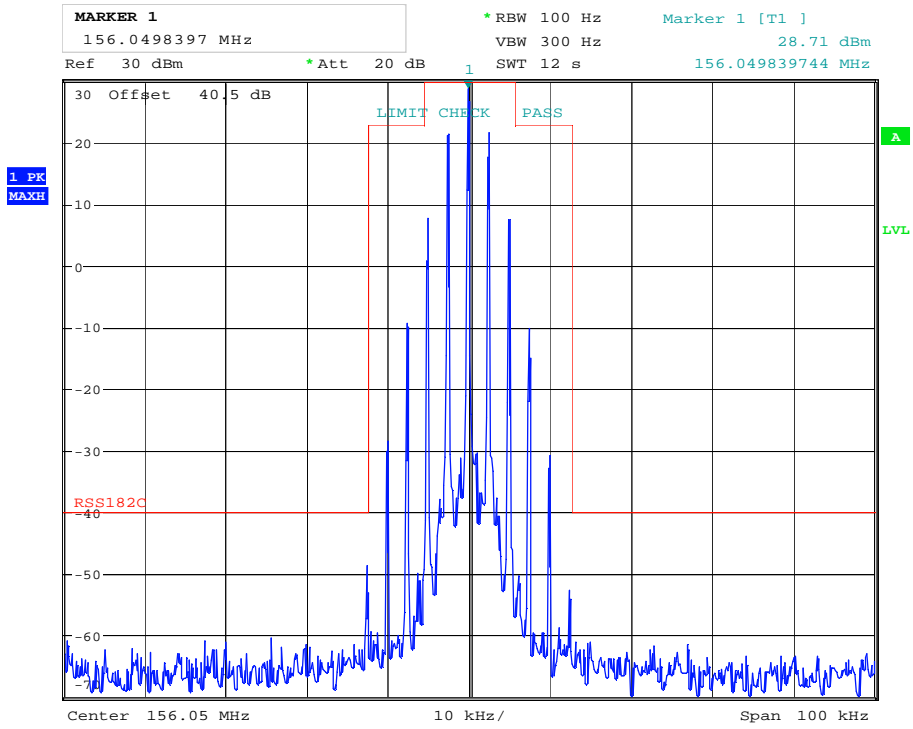
157,425 MHz: 25 kHz, low power



Date: 20.JUN.2011 13:16:00

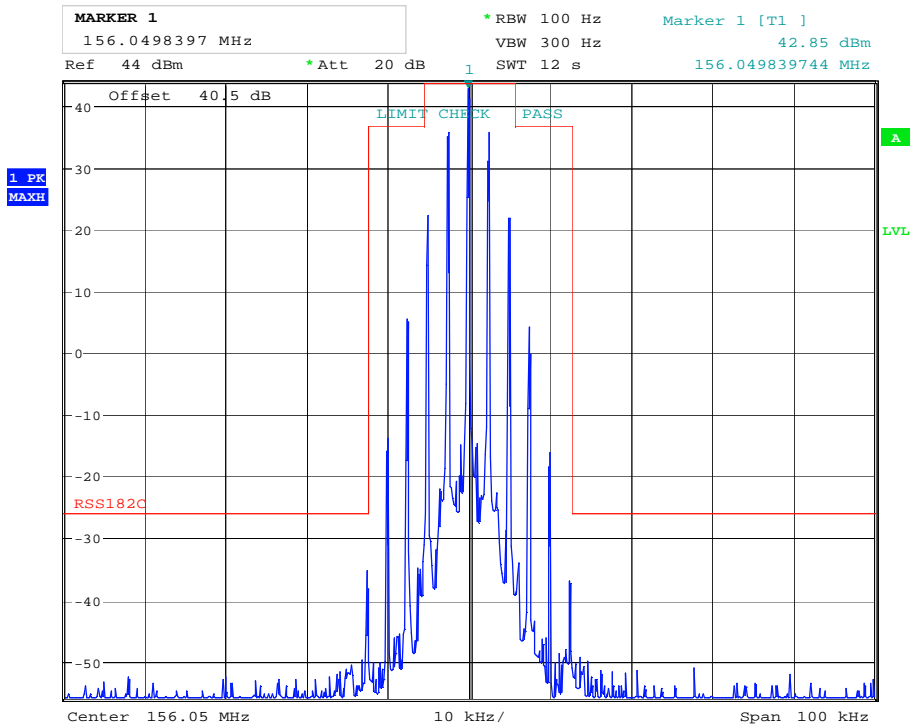
157,425 MHz: 25 kHz, high power

6.4 RSS-182 Spectrum emission masks



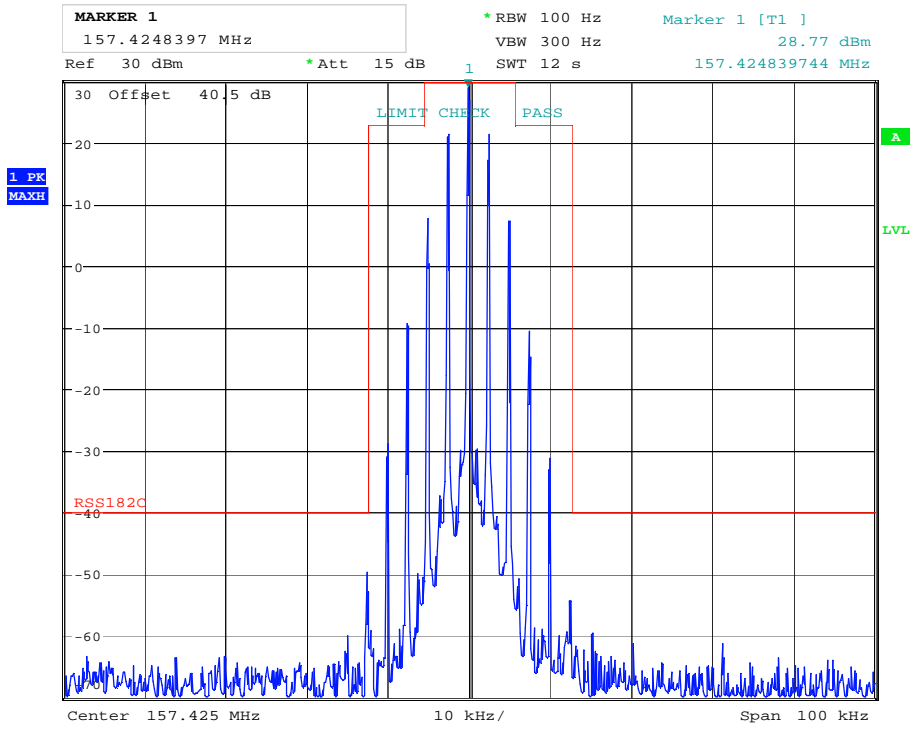
Date: 20.JUN.2011 13:41:51

156,050 MHz: 12,5 kHz, low power



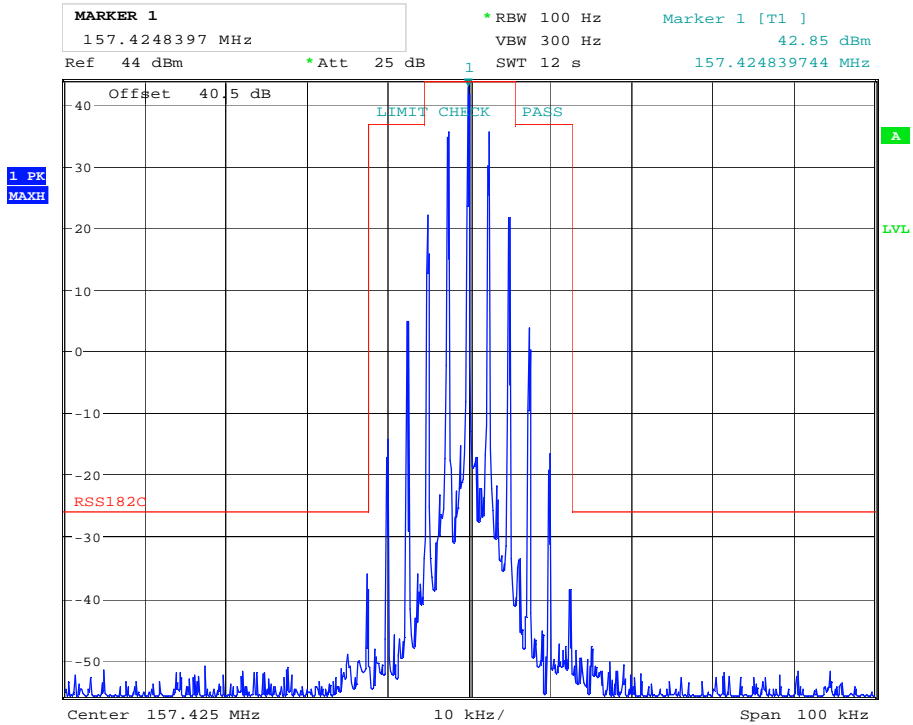
Date: 20.JUN.2011 13:40:42

156,050 MHz: 12,5 kHz, high power



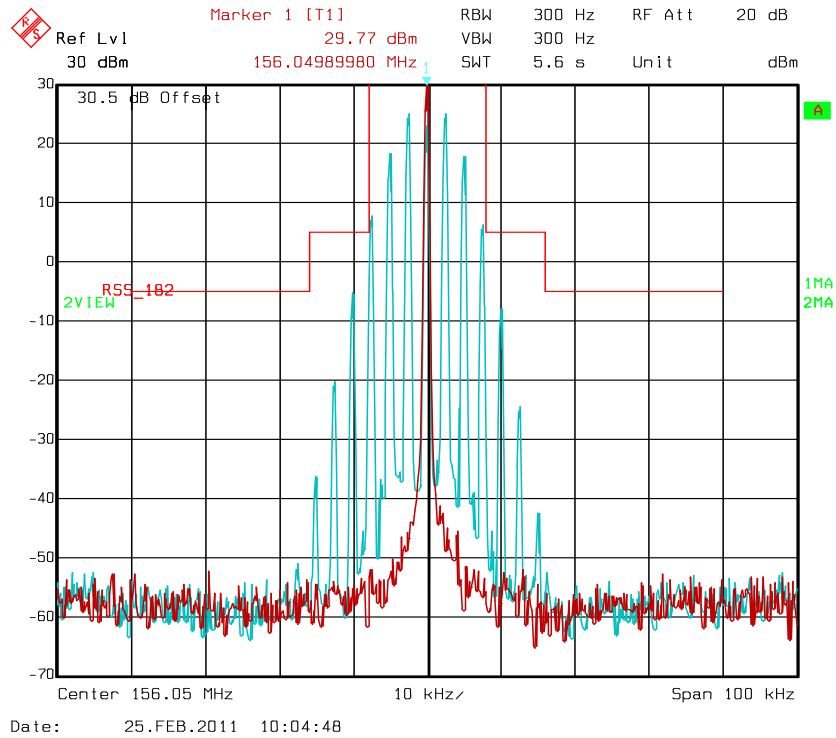
Date: 20.JUN.2011 13:36:43

157,425 MHz: 12,5 kHz, low power

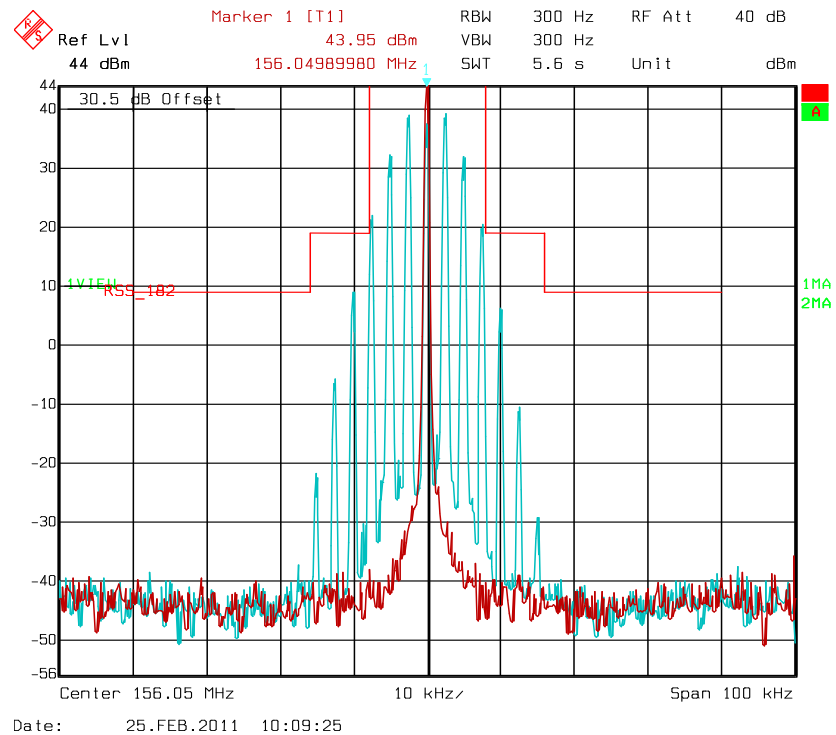


Date: 20.JUN.2011 13:35:08

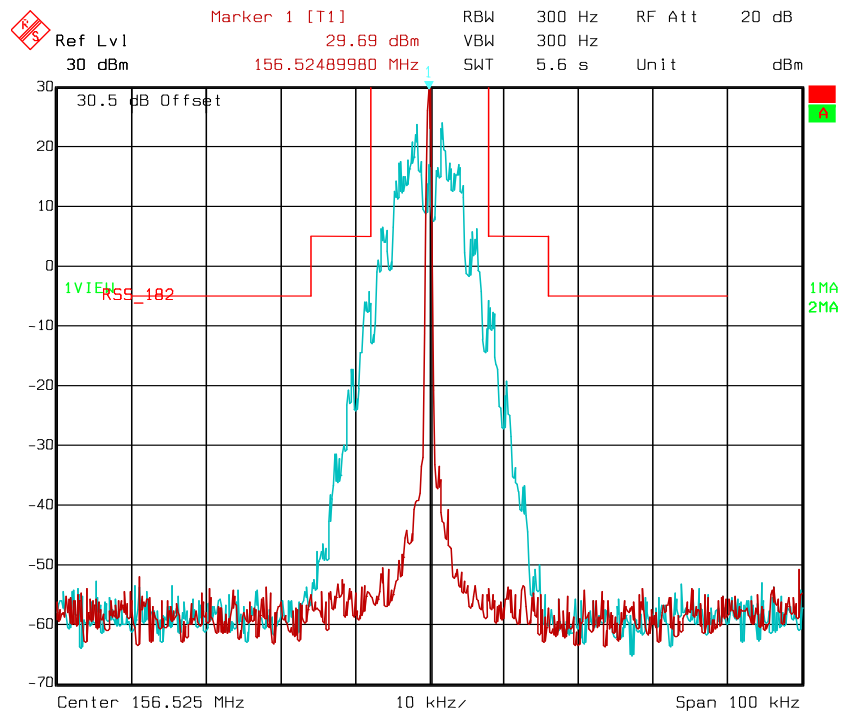
157,425 MHz: 12,5 kHz, high power



156,050 MHz: 25 kHz, low power

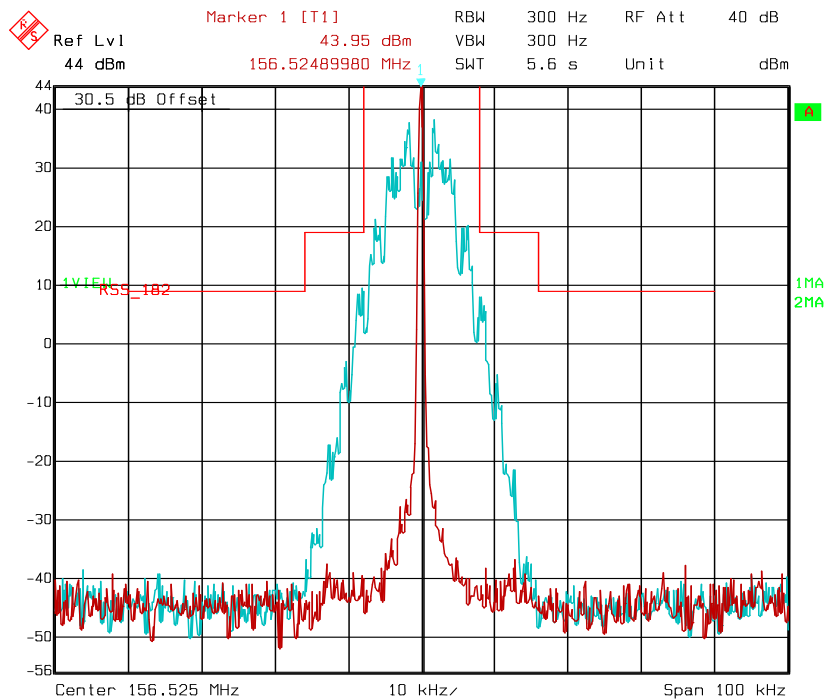


156,050 MHz: 25 kHz, high power



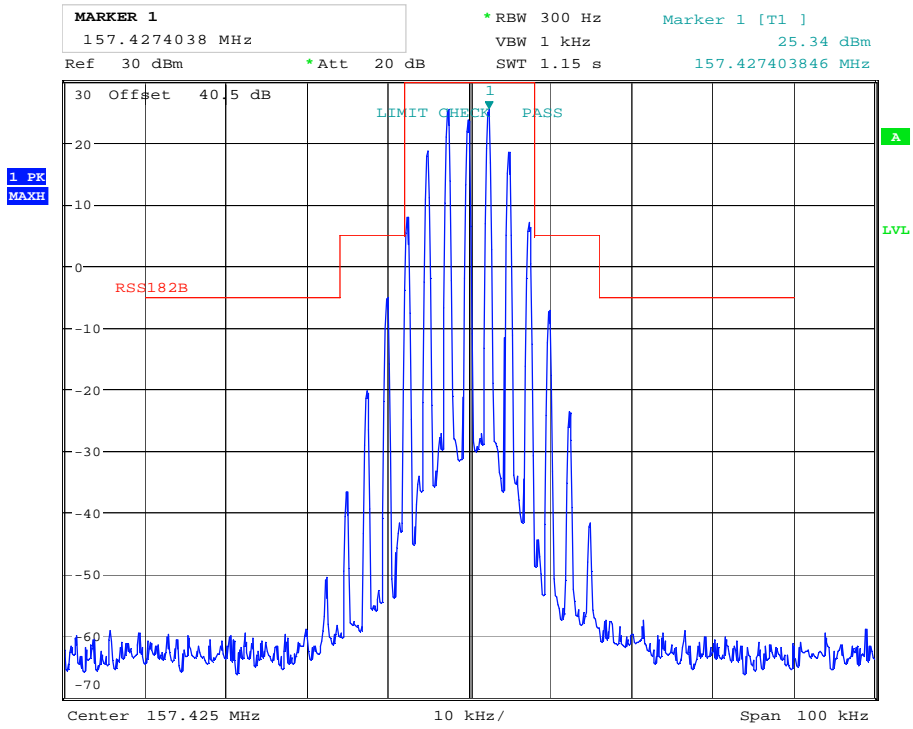
Date: 25.FEB.2011 10:13:06

156,525 MHz: 25 kHz, low power, DSC modulation



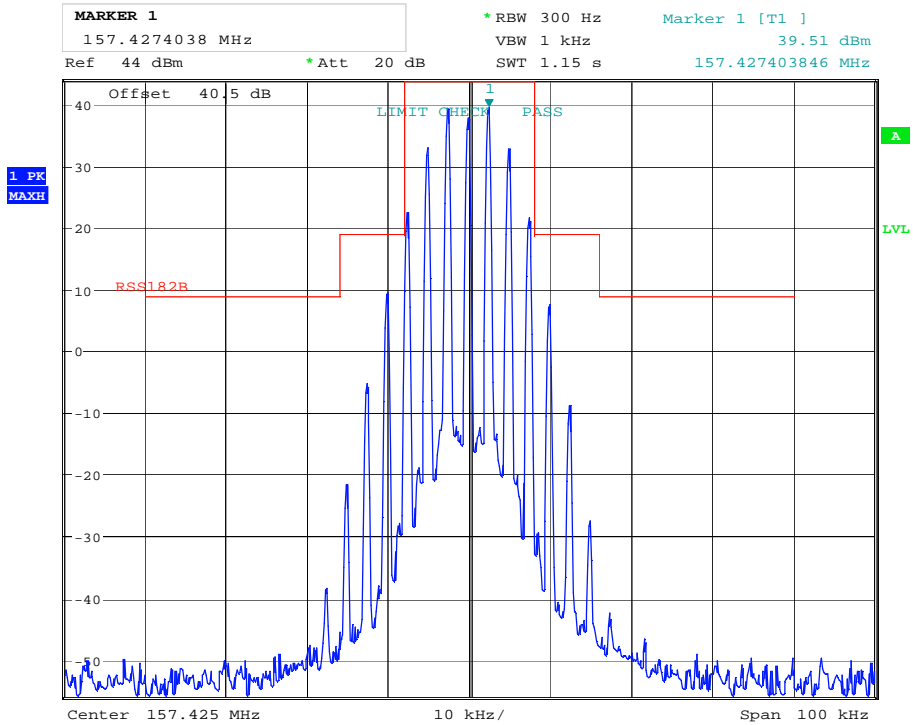
Date: 25.FEB.2011 10:14:42

156,525 MHz: 25 kHz, high power, DSC modulation



Date: 20.JUN.2011 13:54:13

157,425 MHz: 25 kHz, low power

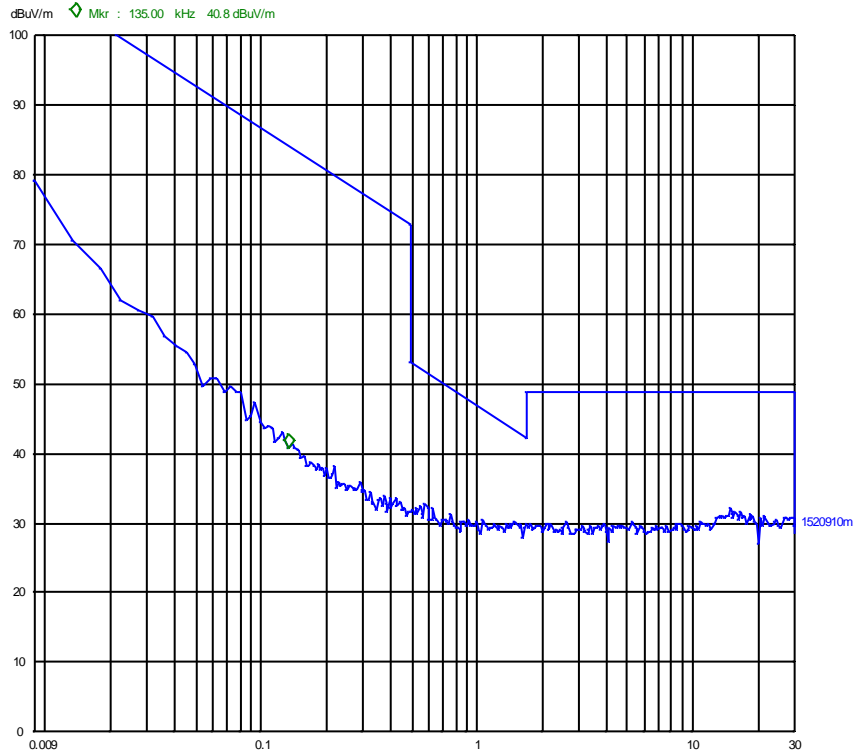


Date: 20.JUN.2011 13:55:23

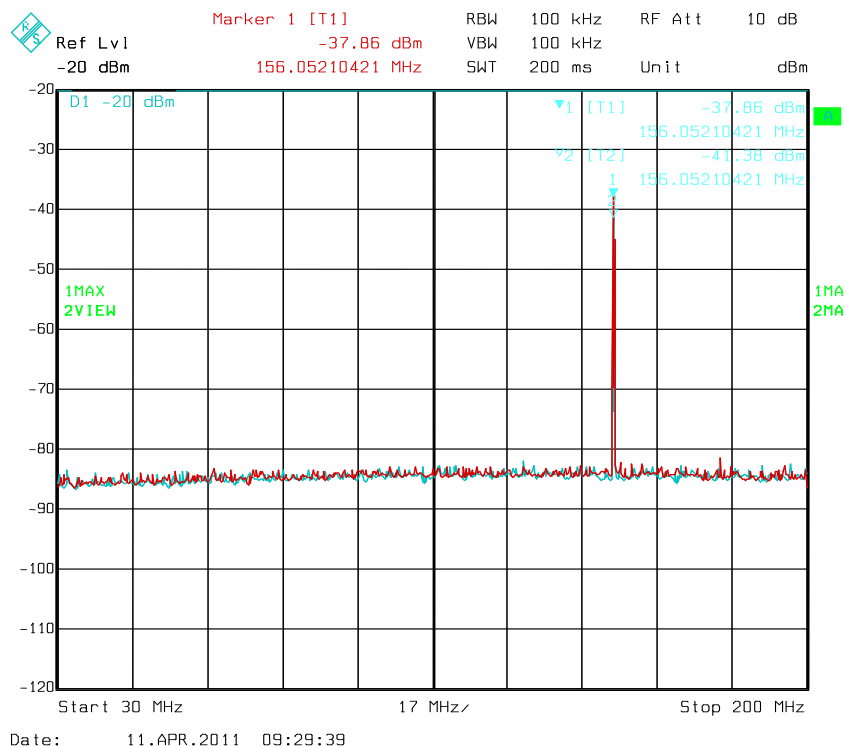
157,425 MHz: 25 kHz, high power

6.5 Field strength of spurious radiation

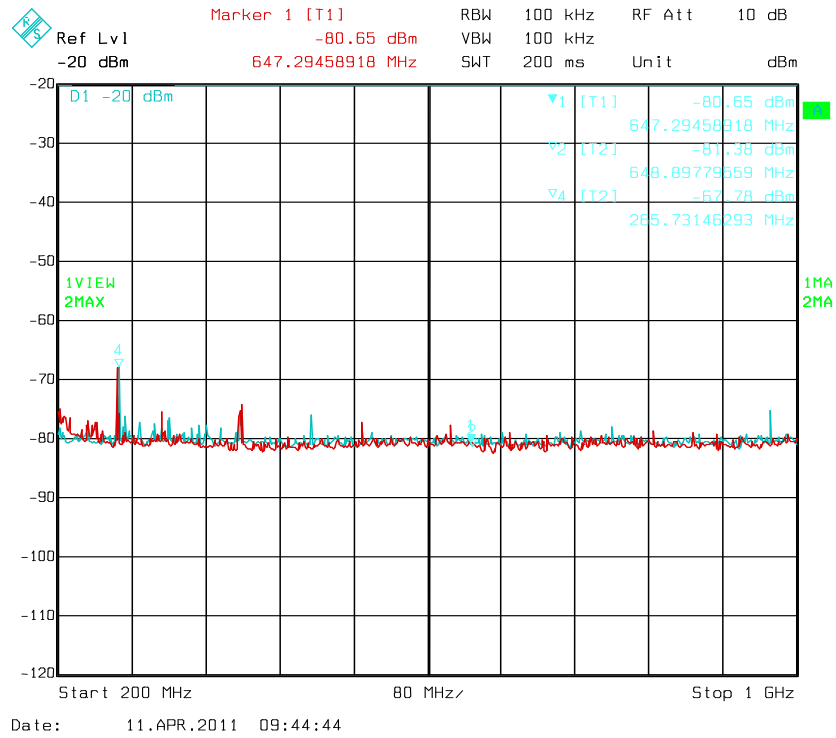
The spurious level for the range 0,009 – 30 MHz does not change for various frequency and power setting. Therefore only one plot is provided.



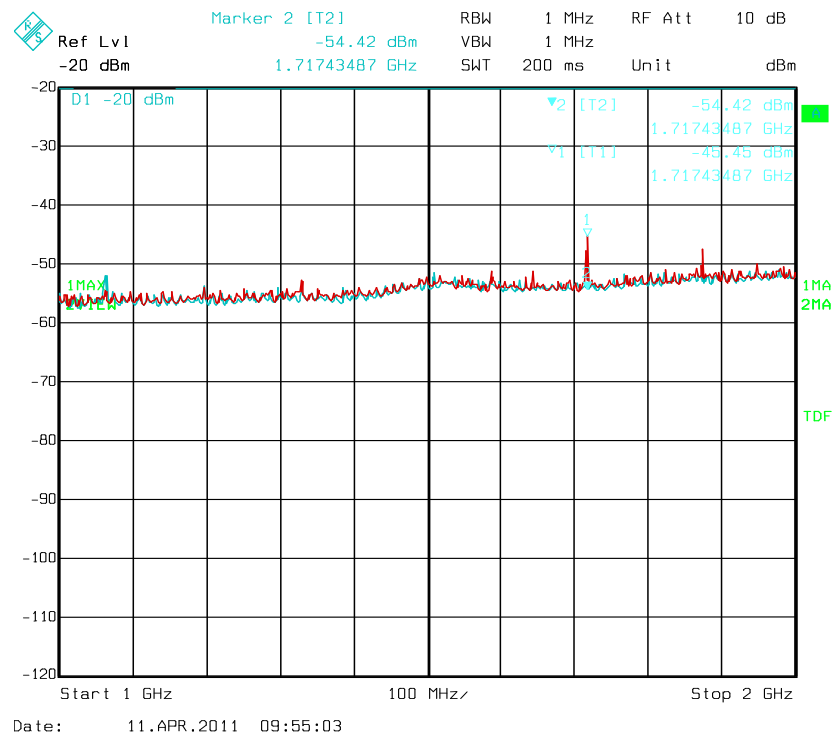
156.050 & 157.425 MHz. High- and low power



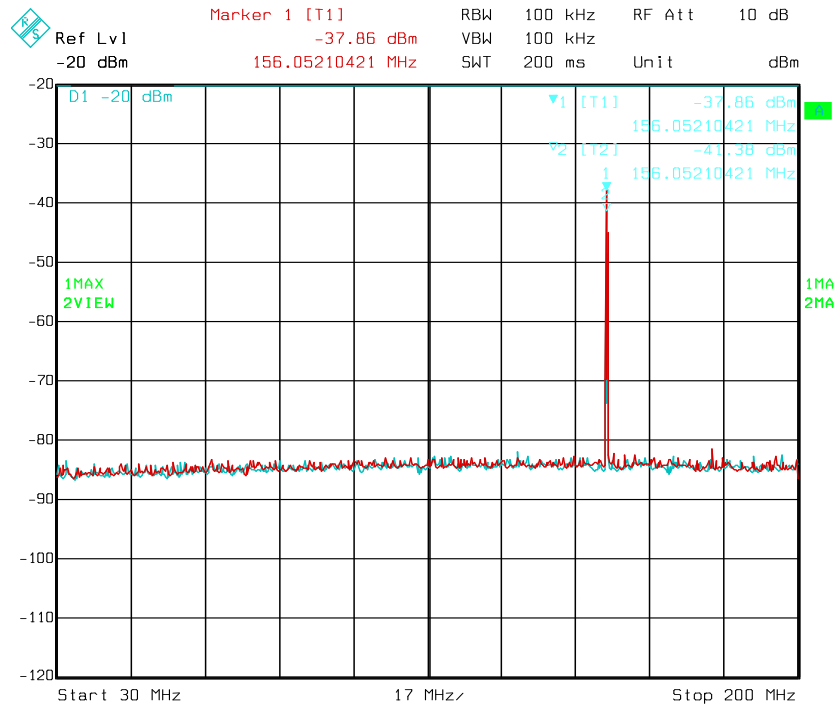
156,050 MHz, low power



156,050 MHz, low power

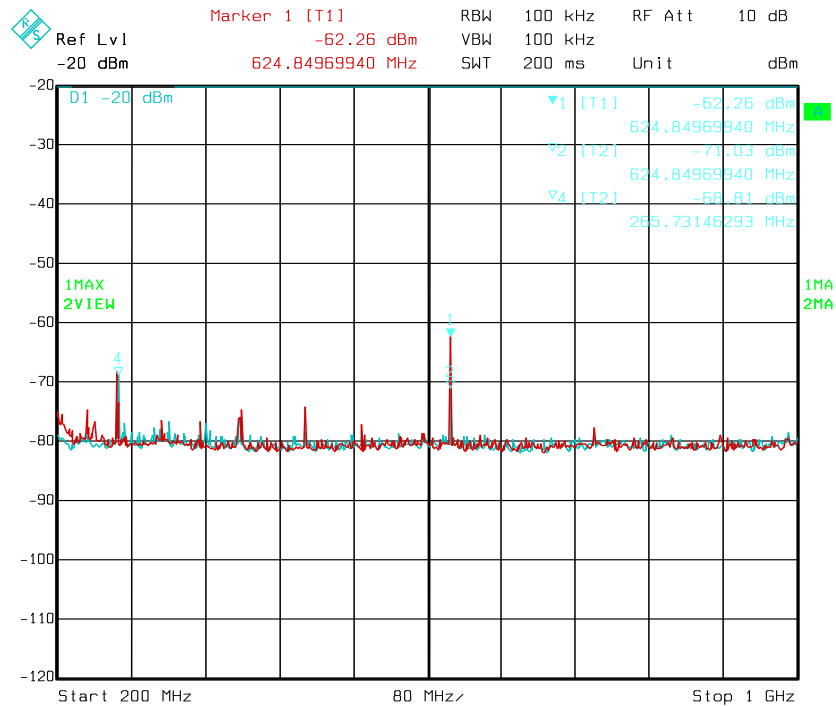


156,050 MHz, low power



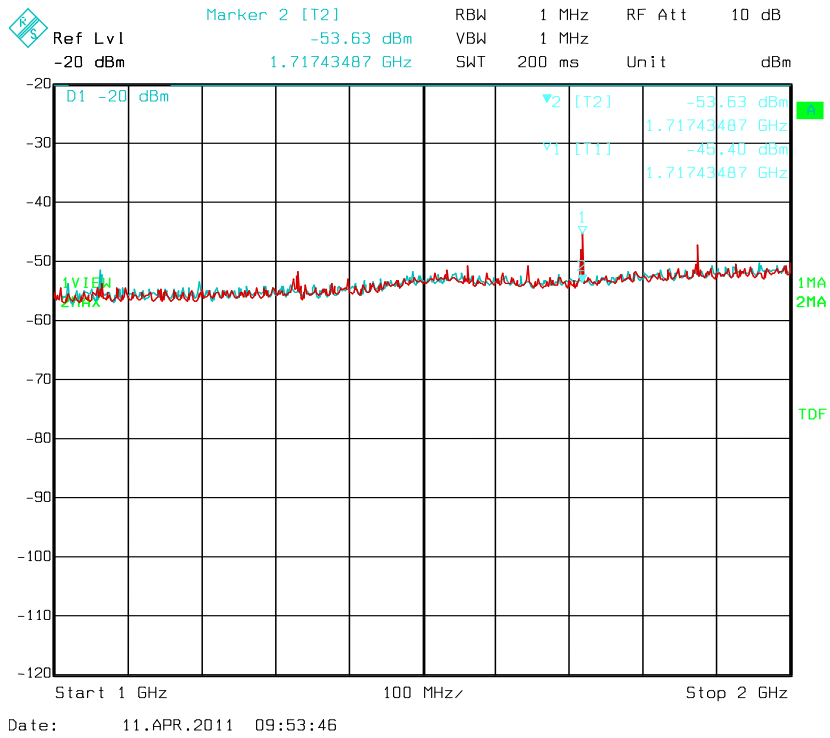
Date: 11.APR.2011 09:29:39

156,050 MHz, high power

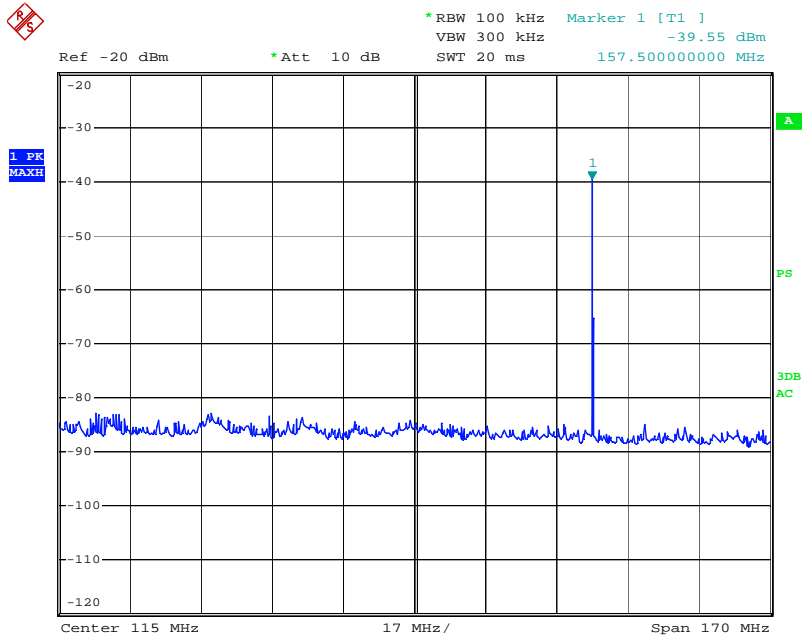


Date: 11.APR.2011 09:46:19

156,050 MHz, high power

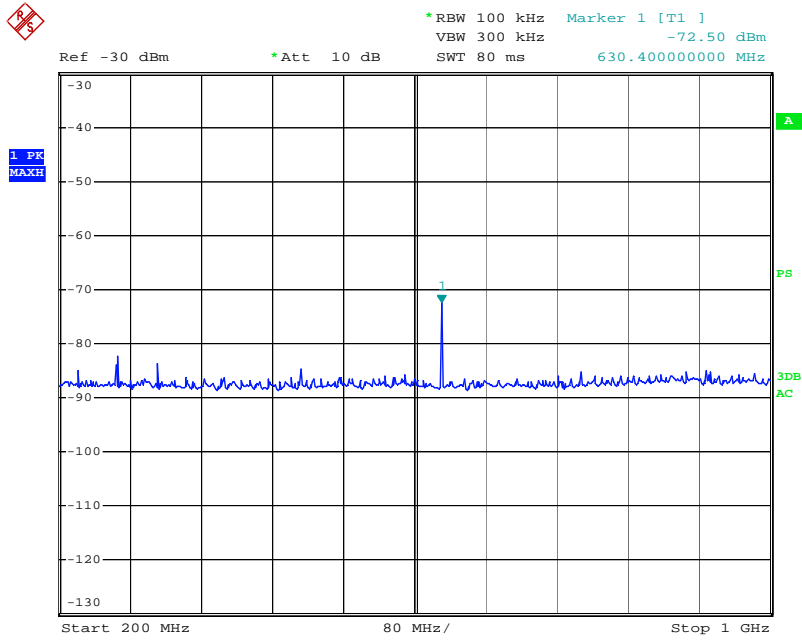


156,050 MHz, high power



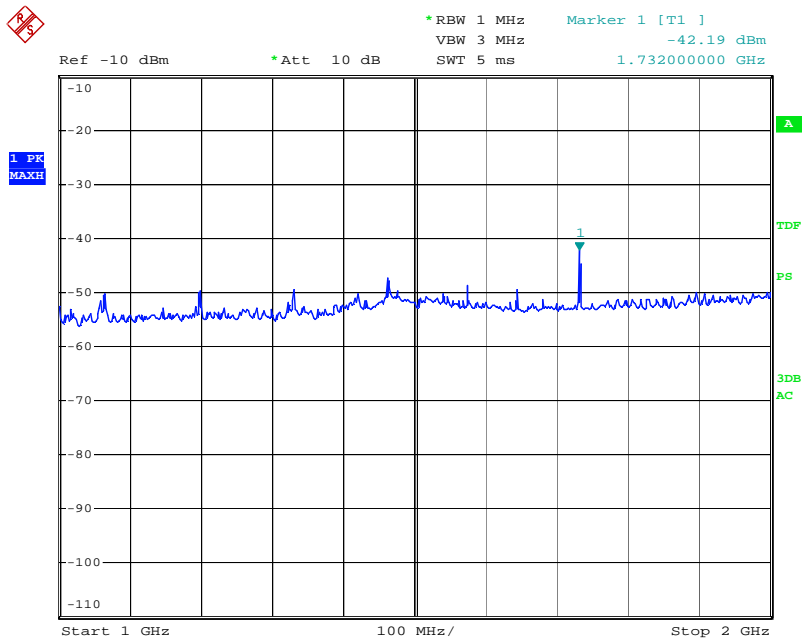
Date: 20.JUN.2011 15:39:25

157,425 MHz, high power



Date: 20.JUN.2011 16:00:56

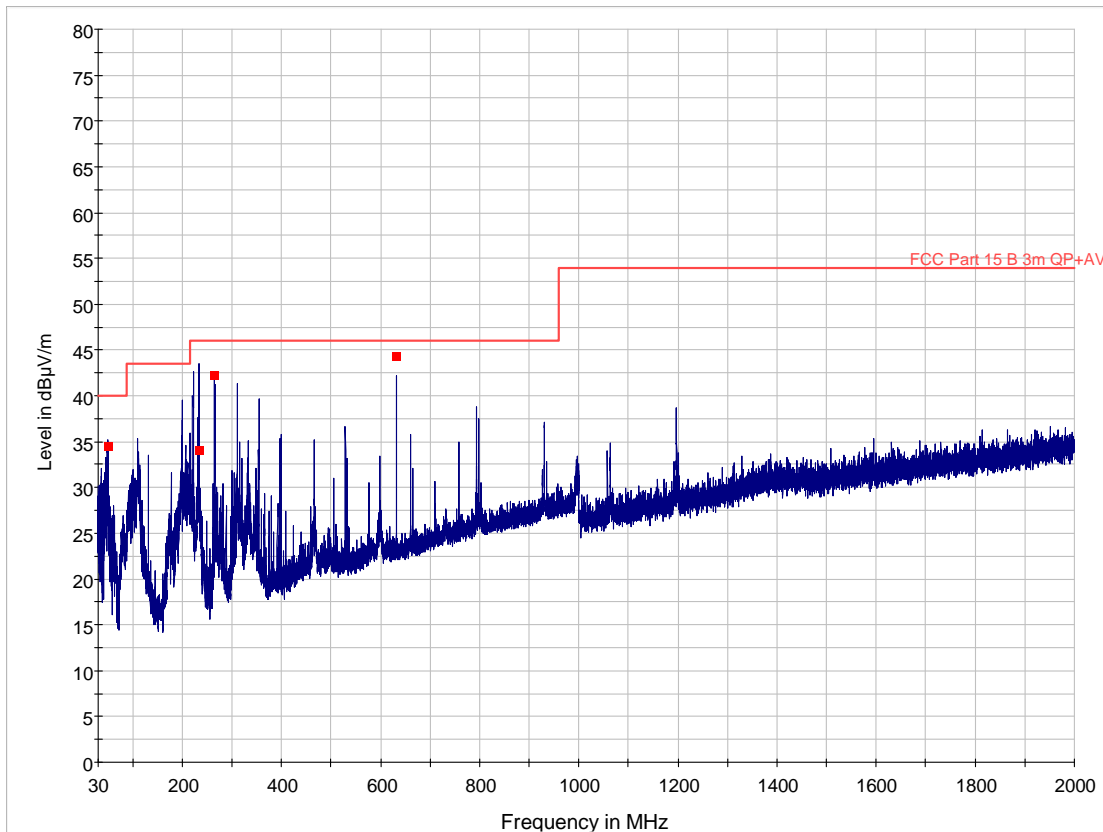
157,425 MHz, high power



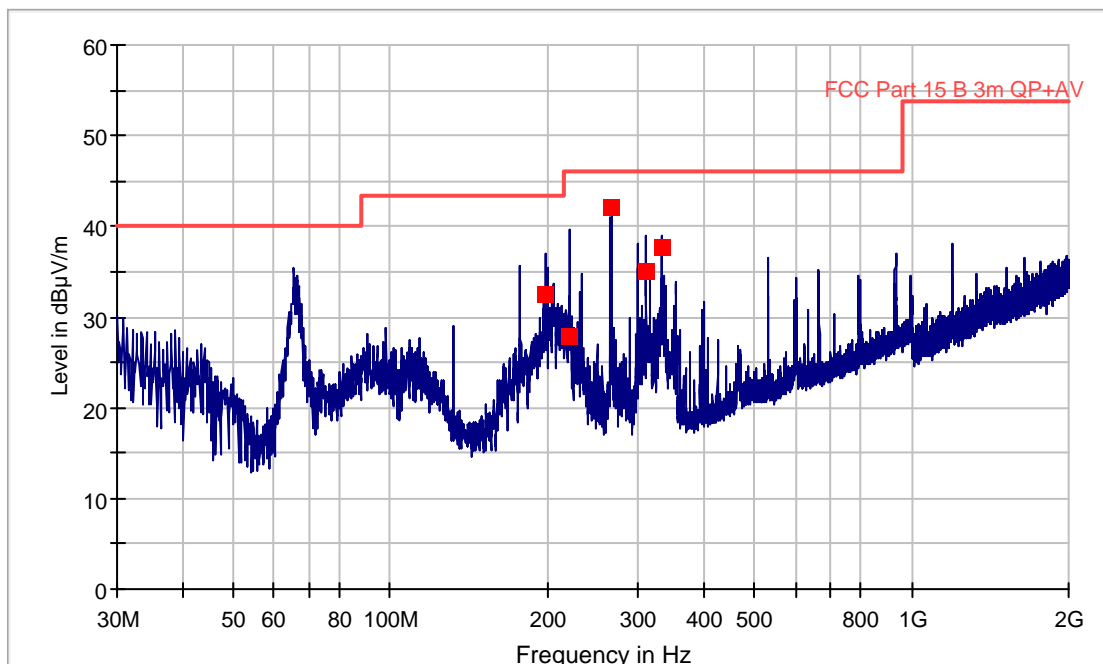
Date: 20.JUN.2011 16:06:34

157,425 MHz, high power

6.6 Radiated emission limits

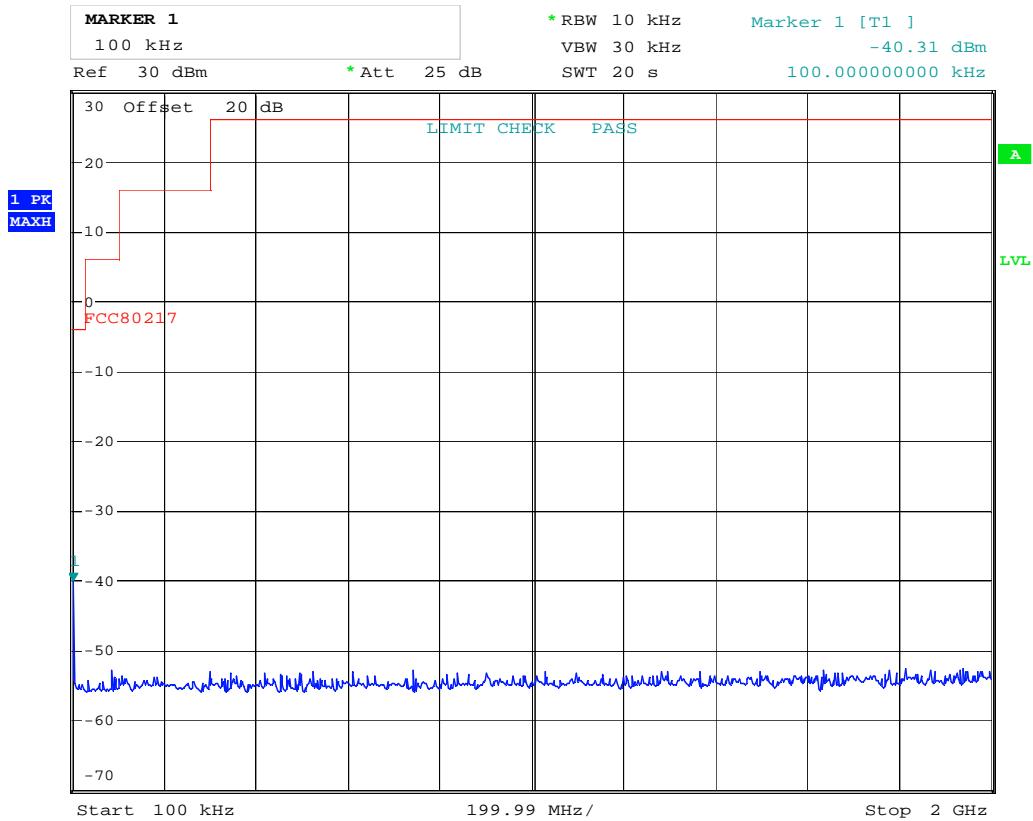


RX-mode at 156,050 MHz setting



RX-mode at 156,425 MHz setting

6.7 Suppression of interference aboard ships



Date: 21.JUN.2011 10:30:21

Emissions from receiver into artificial antenna, 156.850 MHz