Test Report for FCC Equipment Authorization

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Table of Contents

Publication History **9**
List of Consultants 9
Decisiom Maker 9
Decision Ratifier 9
Revision History 10

Acronyms and Abbreviations **11**

1 Introduction **13**
1.1 Required Tests 13

2 Engineering Declaration **14**

3 Equipment Authorization Application Requirements **15**
3.1 Standard Test Conditions and Test Equipment 15
3.2 EUT Identification List 15
3.3 Test Equipment List 15

4 Transmitter Tests **17**
4.1 RF Power Output 17
4.1.1 RF Power Output Requirements 17
4.1.1 FCC Part 2.1046 Measurements required: RF power output 17
4.1.2 Test Method 17
4.1.3 Test Setup 17
4.1.4 Test Result 18
4.2 Certification Requirements 25
4.2.1 Application for certification 25
4.2.1 FCC Part 2.1033 Application for certification 25
4.2.2 Test Method 25
4.2.3 Test Setup 25
4.2.4 Test Results 25
4.3 Occupied Bandwidth 26
4.3.1 Occupied Bandwidth Requirements 26
4.3.1 FCC Part 2.1049 26
4.3.2 Test Method 26
4.3.3 Test Setup 26
4.3.4 Test Results 27
4.4 Spurious Emissions at Antenna Terminals 33
4.4.1 Spurious Emissions Requirements 33
4.4.1 FCC Part 2.1051 33
4.4.1 FCC Part 2.1057 - Frequency Spectrum to be investigated 33
4.4.1 FCC Part 22.917 Limit 33
4.4.2 Test Method 34
4.4.3 Test Requirements 35
4.4.4 Test Setup 35
4.4.5 Test Results 36

4.5 Transmitter Tests (CDMA Mode) 45
4.5 Unwanted Emissions....45
4.5 IC RSS-129 45
4.5.1 Test Method 46
4.5.2 Test Setup 47
4.5.3 Test Results....48
4.6 Frequency Stability 51
4.6.1 Frequency Stability Requirements....51
4.6.1 FCC Part 2.1055 51
4.6.2 Test Procedure 52
4.6.3 Frequency Results....52
References....55

List of Figures

Figure 1 : Test Setup for RF Power Output Measurement 18
Figure 2 : Test Setup for Occupied Bandwidth Measurement.....27
Figure 3 : Test Setup for Spurious Emissions Measurement.....36
Figure 4 : Test Setup for Spurious Emissions Measurement.....47
Figure 5 : Test configuration for Frequency Stability 52

List of Tables

Table 1 : Required Tests 13
Table 2 : EUT Identification List.....15
Table 3 : Test Equipment List.....16
Table 4 : RF Output Power 800 MHz MFRM2 1-Carrier IS95.....18
Table 5 : RF Output Power of 800 MHz MFRM2 1-Carrier IS856 16-QAM.....19
Table 6 : RF Output Power of 800 MHz MFRM2 1-Carrier IS856 8-PSK.....19
Table 7 : RF Output Power of 800 MHz MFRM21-Carrier IS856 QPSK 19
Table 8 : RF Output Power of 800 MHz MFRM21-Carrier IS2000 (1Channel 16 times).....20
Table 9 : RF Output Power of 800 MHz MFRM2 2-Carrier IS95 20
Table 10 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 16-QAM.....20
Table 11 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 8-PSK.....21
Table 12 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 QPSK 21
Table 13 : RF Output Power of 800 MHz MFRM2 2-Carrier IS2000 (1 Channel 16 times).....21
Table 14 : RF Output Power of 800 MHz MFRM2 3-Carrier IS95 21
Table 15 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 16-QAM.....22
Table 16 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 8-PSK.....23
Table 17 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 QPSK 23
Table 18 : RF Output Power of 800 MHz MFRM2 3-Carrier IS2000 (1 channel 16 times) 23
Table 19 : RF Output Power of 800 MHz MFRM2 2-Carrier IS95 1-Carrier IS856 16-QAM ...24
Table 21 : Average Current Values @ Pout = 48.45 dBm 25
Table 22 : Occupied Bandwidth (OB) Measurements 800 MHz MFRM2 1-Carrier IS95 27
Table 23 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 16-QAM 28
Table 24 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 8-PSK 28
Table 25 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 QPSK.....28
Table 26 : OB Measurements 800 MHz MFRM2 1-Carrier IS2000 (1 Channel 16 times) 29
Table 27 : OB Measurements 800 MHz MFRM2 2-Carrie IS-95.....29
Table 28 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 16-QAM 29
Table 29 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 8-PSK 29
Table 30 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 QPSK.....30
Table 31 : OB Measurements 800 MHz MFRM2 2-Carrier IS2000 (1 Channel 16 times) QPSK ..

30
Table 32 : OB Measurements 800 MHz MFRM2 3-Carrier IS95 30
Table 33 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 16-QAM 31
Table 34 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 8-PSK 31
Table 35 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 QPSK.....32
Table 36 : OB Measurements 800 MHz MFRM2 3-Carrier IS2000 (1 Channel 16 times) 32
Table 37 : OB Measurements 800 MHz MFRM2 2-Carrier IS95, 1-Carrier IS856 16-QAM 32
Table 39 : All other Emission Spectrum Analyze Settings 35
Table 41 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS95, IS2000.....36
Table 42 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS856 37
Table 43 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS95, IS2000 38
Table 44 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS856.....39
Table 45 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-95, IS2000 40
Table 46 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-856 41
Table 47 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port A-Band 2-Carrier IS-95 and 1 Carrier IS856 16-QAM 42
Table 48 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier B Band IS95, IS-2000 43
Table 49 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier B Band IS856.....44
Table 50 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port B Band 2-Carrier IS95 and I Carrier IS856 16-QAM 45
Table 52 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS856 1 Carrier 48
Table 53 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS95, IS-2000 1 Carrier 48
Table 54 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS95, IS-2000 3 Carrier 49
Table 55 : Test results for Frequency Stability versus Power supply Voltage 52
Table 56 : Test results for Frequency Stability versus Temperature at -48V operation 53
Table 57 : Test results for Frequency Stability versus Temperature at 24V operation 54

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Ratifier's Name	Signature	Date
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00/02	01/05/2003	Second issue of Report. Revised Tables 43,52,53,54,56,57	Lorne Thompson

Change bars will not be used in this document..

Acronyms and Abbreviations

ASIC	Application Specific Integrated Circuit
BBW	Breathing, Blossoming and Wilting
BPF	Bandpass Filter
BTS	Base Station Transceiver Subsystem
BW	Bandwidth
CDMA	Code Division Multiple Access
CR	Cost Reduced
dBFS	dB relative to Full Scale
DDS	Direct Digital Synthesizer
DPM	Duplexer Preselector Module
EEPROM	Electrically Erasable and Programmable ROM
EC	Engineering Change
ERLCE	Excess Reverse Link Capacity Estimate
HSSPC	High-Speed Serial Protocol Controller
HW	Hardware
IF	Intermediate Frequency
IIC	Inter-Integrated Circuit Bus
IS	Interim Standard
LO	Local Oscillator
LPF	Lowpass Filter
MFRM-2	Multi-Carrier Flexible Radio Module
MTRM	Multi-Carrier Transmitter Receiver Module
NF	Noise Figure
OCNS	Orthogonal Channel Noise Source
OH	OverHead
PA	Power Amplifier
PC	Personal Computer
PPR	Peak Power Reduction
PSA	Product Specification Agreement
RBW	Resolution BandWidth

RF	Radio Frequency
Rx	Receive
SA	Spectrum Analyzer
SFRM	Single Carrier Flexible Radio Module
SW	Software
TBD	To Be Determined
TM	Triplexer Module
TPTL	Transmit Power Tracking Loop
TRM	Transmitter Receiver Module
Tx	Transmit
uP	Microprocessor
XCVR	Transceiver

1 Introduction

This test report is submitted in accordance with the FCC Rules and Regulations, Part 2, Subpart J, Sections 2.1046 through 2.1057 for equipment authorization of Nortel Networks' CDMA 800 MHz Multi carrier Flexible Radio Module 2 (MFRM2).

The 800 MHz MFRM2 is intended for use in the Domestic Public Cellular Radio Telecommunications Service and is designed in accordance with the following standards:

- *CFR 47, Part 22, Subpart H, Cellular Radiotelephone Service [1]*
- *CFR 47, Part 2, Subpart J, Equipment Authorization Procedures - Equipment Authorization[2]*
- *IC RSS-129,Issue 2, 800 MHz Dual-Mode CDMA Cellular Telephones [3]*
- *TIA/EIA-97-D, Recommended Minimum Performance Standards for Base Stations Supporting Dual Mode Spread Spectrum Systems [4]*

1.1 Required Tests

Table 1 summarizes the required tests for the CDMA 800 MHz MFRM.

Table 1 : Required Tests

FCC Measurement Specification	FCC Limit Specification	Description	Test to be Performed?
2.1046	22.913	RF Power Output	Yes
2.1049	22.917	Occupied Bandwidth	Yes
2.1051, 2.1057	22.917	Spurious Emissions at Antenna Terminals	Yes
2.1053, 2.1057	22.917	Field Strength of Spurious Emissions	Yes[a]
2.1055		Frequency Stability	Yes

a. Field strength of spurious emissions testing will be performed by Sanmina-SCI Canada, Calgary.

2 Engineering Declaration

The CDMA 800MHz Multi carrier Flexible Radio Module2 has been tested in accordance with the requirements contained in the Federal Communications Commission Rules and Regulations Part 2 and 22.

To the best of my knowledge, these tests were performed in accordance with good engineering practices using measurement procedures consistent with industry or commission standards or previous Commission correspondence or guidance and demonstrate that this equipment complies with the appropriate standards. All tests were conducted on a representative sample of the equipment for which equipment authorization is sought.

Tested By:

Lorne Thompson
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Signature

Date April 30 /2003

Reviewed By:

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Date April 30, 2003

3 Equipment Authorization Application Requirements

3.1 Standard Test Conditions and Test Equipment

The MFRM2 will be tested under the following standard test conditions unless otherwise noted:

- Ambient Temperature: 20 to 35 degrees C
- Ambient Humidity: 20 to 40%
- DC Supply Voltage: -48 Vdc and +24 Vdc (nominal)
- Input modulation IS-95, IS-2000 and IS-856 (16 QAM, 8 PSK, QPSK)

3.2 EUT Identification List

Table 2 shows the identification of the components required for testing.

Table 2 : EUT Identification List

Equipment Description	Model / Part Number	Release Number	Serial Number
800 MHz Multi carrier Flexible Radio Module	NTGY30AA	X1	NNTM533GTDXU
800 DPM	NTGS89DB	12	CLWVPP20459L
800 FAM	NTGS5652	01	NNTM535889BC
DC Power Cable	NTGS8082	N/A	N/A
Fiber Cable	NTGY5520	N/A	N/A
DPM Power/Data Cable	NTGS8088	9	N/A
DPM to RX0 Cable	NTGS8069	9	N/A
DPM to RX1 Cable	NTGS8069	9	N/A

3.3 Test Equipment List

Table 3 shows the identification of the test equipment required.

Table 3 : Test Equipment List

Description	Manufacturer	Model	Serial Number	Cal. Due Date
9kHz to 40 GHz Spectrum Analyzer	Rohde&Schwarz	FSEK-30	849243/008	20 NOV 03
RF Power Meter	Agilent	E4419B	US38260722	11 FEB 04
RF Power Sensor Head	Agilent	E9300A	US39210469	23 APR 04
30dB Attenuator (>100W)	Weinschel	49-30-43	LK299	n/a
RF Cable 1 24”	Nortel	NTGS8017	n/a	n/a
RF Cable 2 8m Heliax	Nortel	ntmloocy-sf	n/a	n/a

4 Transmitter Tests

4.1 RF Power Output

4.1.1 RF Power Output Requirements

FCC Part 2.1046 Measurements required: RF power output

§(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

4.1.2 Test Method

Setup the DE via the BTS controller to enable the MFRM2 to transmit at maximum power for each of the carrier configurations one, two and three carrier in each of the Baseband modulation formats IS-95, IS-2000, and IS-856 (16 QAM, 8 PSK, QPSK). Measurements will be made on channels at the bottom and top of the duplexer bands with the MFRM-2 in both the -48Vdc and +24Vdc. The RF output power will be measured using the power meter.

4.1.3 Test Setup

The set-up required for the MFRM2 RF output power test is illustrated in Figure 1. RF output power measurements will be referenced to the antenna port of the DPM

4.1.4 DOM

The conducted spurious emissions of the MFRM-2, with IS-856 (1xEV DO) waveforms were tested at reduced power. The power was backed off by 1.5dB per carrier relative to the full rated output power of the radio. This back off was based on a Nortel Networks specified setting to ensure overall network performance. This 1.5dB per IS-856 carrier back off specification will be clearly stated in customer documentation at the time of 1xEV DO product introduction, and operation within this reduced power rating will be controlled via standardized system parameter datafill at that time.

4.1.5 Noise Floor

Table 4 lists the noise floor of the measurement system with no signal present. .

Table 4: Spectrum Analyzer Noise floor

Start MHz	stop MHz	dBm
0.01	400	-43.1
400	1000	-40.42
1000	2000	-38.96
2000	3000	-37.56
3000	4000	-37.05
4000	5000	-37.32
5000	6000	-34.61
6000	7000	-30.64
7000	8000	-32.76
8000	9000	-33.49
9000	10000	-33.6

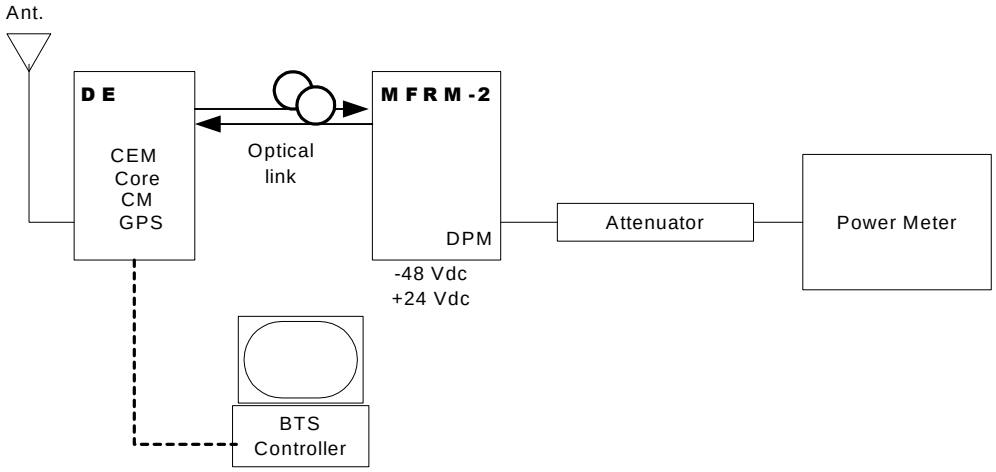

Figure 1 : Test Setup for RF Power Output Measurement

4.1.6 Test Result

Table 5 : RF Output Power 800 MHz MFRM2 1-Carrier IS95

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4[a] (A)	870.12	47.3	47.3
296 (A)	878.88	47.3	47.3
371(B)	881.13	47.3	47.3
629 (B)	888.87	47.3	47.3
754 (B’)	892.62	47.3	47.3
763 (B’)	892.89	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 6 : RF Output Power of 800 MHz MFRM2 1-Carrier IS856 16-QAM

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4[a] (A)	870.12	45.8	45.8
296 (A)	878.88	45.8	45.8
371(B)	881.13	45.9	45.8
629 (B)	888.87	45.8	45.8
754 (B’)	892.62	45.8	45.8
763 (B’)	892.89	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 7 : RF Output Power of 800 MHz MFRM2 1-Carrier IS856 8-PSK

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4[a] (A)	870.12	45.8	45.8
763 (B’)	892.89	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 8 : RF Output Power of 800 MHz MFRM21-Carrier IS856 QPSK

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4[a] (A)	870.12	45.8	45.8
763 (B’)	892.89	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 9 : RF Output Power of 800 MHz MFRM21-Carrier IS2000 (1Channel 16 times)

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4[a] (A)	870.12	47.3	47.3
763 (B’)	892.89	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 10 : RF Output Power of 800 MHz MFRM2 2-Carrier IS95

Channel Number (Band)	Frequencies (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45[a] (A)	870.12, 871.35	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 11 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 16-QAM

Channel Number (Band)	Frequencies (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45[a] (A)	870.12, 871.35	45.9	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 12 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 8-PSK

Channel Number (Band)	Frequencies (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4,45[a] (A)	870.12, 871.35	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 13 : RF Output Power of 800 MHz MFRM2 2-Carrier IS856 QPSK

Channel Number (Band)	Frequencies (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45[a] (A)	870.12, 871.35	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 14 : RF Output Power of 800 MHz MFRM2 2-Carrier IS2000 (1 Channel 16 times)

Channel Number (Band)	Frequencies (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45[a] (A)	870.12, 871.35	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 15 : RF Output Power of 800 MHz MFRM2 3-Carrier IS95

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45, 86[a] (A)	870.12, 871.35 872.58	47.3	47.3
214, 255, 296 (A)	876.42, 877.65, 878.88	47.3	47.3
371, 412, 453 (B)	881.13, 882.36, 883.59	47.3	47.3
547,588, 629 (B)	886.41, 887.64 888.87	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 16 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 16-QAM

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45, 86[a] (A)	870.12, 871.35 872.58	45.8	45.8
214, 255, 296 (A)	876.42, 877.65, 878.88	45.8	45.8
371, 412, 453 (B)	881.13, 882.36, 883.59	45.8	45.8
547,588, 629 (B)	886.41, 887.64 888.87	45.9	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 17 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 8-PSK

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45, 86[a] (A)	870.12, 871.35 872.58	45.8	45.8
547,588, 629 (B)	886.41, 887.64 888.87	45.8	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 18 : RF Output Power of 800 MHz MFRM2 3-Carrier IS856 QPSK

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45, 86[a] (A)	870.12, 871.35 872.58	45.8	45.8
547,588, 629 (B)	886.41, 887.64 888.87	45.9	45.8

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 19 : RF Output Power of 800 MHz MFRM2 3-Carrier IS2000 (1 channel 16 times)

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
4, 45, 86[a] (A)	870.12, 871.35 872.58	47.3	47.3
547,588, 629 (B)	886.41, 887.64 888.87	47.3	47.3

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 20 : RF Output Power of 800 MHz MFRM2 2-Carrier IS95 1-Carrier IS856 16-QAM

Channel Number (Band)	Frequency of middle channel (MHz)	Measured RF Output Power (dBm)	Maximum Rated Power (dBm)
214, 255, 296 (A)	876.42, 877.65, 878.88	46.8	46.8
371, 412, 453 (B)	881.13, 882.36, 883.59	46.8	46.8
547,588, 629 (B)	886.41, 887.64 888.87	46.8	46.8

4.2 Certification Requirements

4.2.1 Application for certification

FCC Part 2.1033 Application for certification.

(c) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

4.2.2 Test Method

This information required for this section is available from:

Title: CDMA BTS Development, MFRM-2 800 MHz Power Amplifier Assembly Beta Cycle Verification Report
Dataset Name: NTGY37AA
Document Status: Ratified
Stream: 02 Issue: 02
Issue Date: March 12, 2003
Document Prime: Neil Claxton, 2M23

4.2.3 Test Setup

See above document

4.2.4 Test Results

The final amplifying dc voltage is 27.02 Vdc. The final dc current is

Table 21 : Average Current Values @ Pout = 48.45 dBm

Average Current Values @ Pout = 48.5 dBm				
	22.5°C			
	Q4	Q5	Q6	Q7
Mean	3.63	4.03	3.82	3.92

4.3 Occupied Bandwidth

4.3.1 Occupied Bandwidth Requirements

FCC Part 2.1049

The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

(g) Transmitter in which the modulating baseband comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.

(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.

4.3.2 Test Method

Setup the DE via the BTS controller to enable the MFRM2 to transmit at maximum power for each of the carrier configurations one, two and three carrier in each of the Baseband modulation formats IS-95, IS-2000, and IS-856 (16 QAM, 8 PSK, QPSK). Measurements will be made on channels at the bottom and top of each of the duplexer bands.

A reference level is established by first using a resolution bandwidth that exceeds the signal bandwidth. RBW is then set to 1% of the estimated emission bandwidth and the video bandwidth is set to 3 times the resolution bandwidth. The markers are now moved to the -20 dB points (from the previously established reference level) on either side of centre frequency.

4.3.3 Test Setup

The set-up required for the MFRM2 Occupied bandwidth test is illustrated in Figure 2.

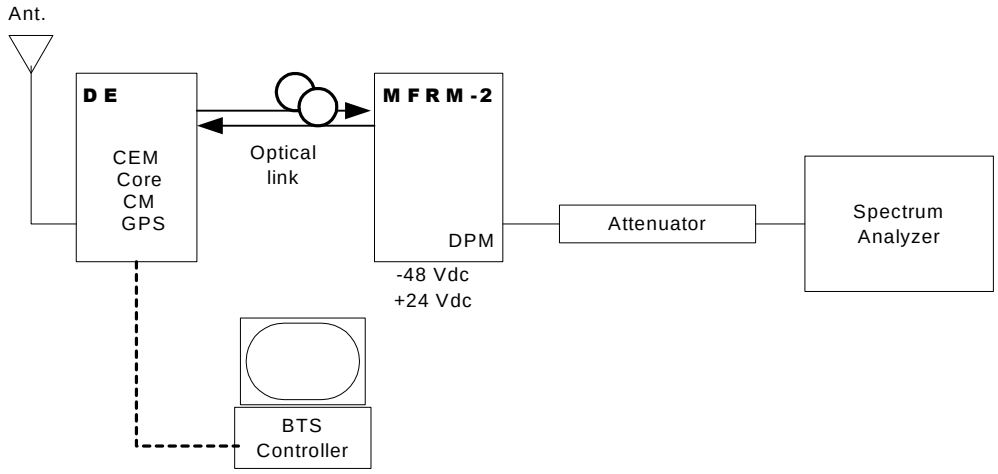

Figure 2 : Test Setup for Occupied Bandwidth Measurement

4.3.4 Test Results

.

Table 22 : Occupied Bandwidth (OB) Measurements 800 MHz MFRM2 1-Carrier IS95

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (MHz) (1-Carrier)
4[a] (A)	870.12	1.2745
296 (A)	878.88	1.2745
371(B)	881.13	1.2905
629 (B)	888.87	1.2985
754 (B’)	892.62	1.2585
763 (B’)	892.89	1.2905

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 23 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 16-QAM

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (MHz) (1-Carrier)
4[a] (A)	870.12	1.266533
296 (A)	878.88	1.250501
371(B)	881.13	1.258517
629 (B)	888.87	1.242485
754 (B’)	892.62	1.258517
763 (B’)	892.89	1.266533

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 24 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 8-PSK

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (MHz) (1-Carrier)
4[a] (A)	870.12	1.266533
763 (B’)	892.89	1.266533

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 25 : OB Measurements 800 MHz MFRM2 1-Carrier IS856 QPSK

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (MHz) (1-Carrier)
4[a] (A)	870.12	1.266533
763 (B’)	892.89	1.250501

a. Channel 4 is only a valid channel if the cellular provider has both A and A’’ bands

Table 26 : OB Measurements 800 MHz MFRM2 1-Carrier IS2000 (1 Channel 16 times)

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (MHz) (1-Carrier)
4[a] (A)	870.12	1.2665
763 (B')	892.89	1.2825

a. Channel 4 is only a valid channel if the cellular provider has both A and A'' bands

Table 27 : OB Measurements 800 MHz MFRM2 2-Carrier IS-95

Channel Number (Band)	Frequencies (MHz)	Measured Occupied Bandwidth (MHz) (2-Carrier)
4, 45[a] (A)	870.12, 871.35	2.4549

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 28 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 16-QAM

Channel Number (Band)	Frequencies (MHz)	Measured Occupied Bandwidth (MHz) (2-Carrier)
4, 45[a] (A)	870.12, 871.35	2.45491

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 29 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 8-PSK

Channel Number (Band)	Frequencies (MHz)	Measured Occupied Bandwidth (MHz) (2-Carrier)
4, 45[a] (A)	870.12, 871.35	2.44489

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 30 : OB Measurements 800 MHz MFRM2 2-Carrier IS856 QPSK

Channel Number (Band)	Frequencies (MHz)	Measured Occupied Bandwidth (MHz) (2-Carrier)
4, 45[a] (A)	870.12, 871.35	2.44489

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 31 : OB Measurements 800 MHz MFRM2 2-Carrier IS2000 (1 Channel 16 times) QPSK

Channel Number (Band)	Frequencies (MHz)	Measured Occupied Bandwidth (MHz) (2-Carrier)
4, 45[a] (A)	870.12, 871.35	2.48497

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 32 : OB Measurements 800 MHz MFRM2 3-Carrier IS95

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.679
214, 255, 296 (A)	876.42, 877.65, 878.88	3.667
371, 412, 453 (B)	881.13, 882.36, 883.59	3.679
547,588, 629 (B)	886.41, 887.64 888.87	3.679

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 33 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 16-QAM

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.679359
214, 255, 296 (A)	876.42, 877.65, 878.88	3.667335
371, 412, 453 (B)	881.13, 882.36, 883.59	3.67359
547,588, 629 (B)	886.41, 887.64 888.87	3.667335

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 34 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 8-PSK

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.655311
547,588, 629 (B)	886.41, 887.64 888.87	3.667335

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 35 : OB Measurements 800 MHz MFRM2 3-Carrier IS856 QPSK

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.667335
547,588, 629 (B)	886.41, 887.64 888.87	3.667335

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 36 : OB Measurements 800 MHz MFRM2 3-Carrier IS2000 (1 Channel 16 times)

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.679
547,588, 629 (B)	886.41, 887.64 888.87	3.679

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 37 : OB Measurements 800 MHz MFRM2 2-Carrier IS95, 1-Carrier IS856 16-QAM

Channel Number (Band)	Frequency of Middle Channel (MHz)	Measured Occupied Bandwidth (MHz) (3-Carrier)
4, 45, 86[a] (A)	870.12, 871.35 872.58	3.667335
547,588, 629 (B)	886.41, 887.64 888.87	3.643287

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

4.4 Spurious Emissions at Antenna Terminals

4.4.1 Spurious Emissions Requirements

FCC Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 2.1057 - Frequency Spectrum to be investigated

The spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency or to the highest frequency practicable in the present state of the art of measuring techniques, whichever is lower. Particular attention should be paid to harmonics and subharmonics of the carrier frequency. Radiation at the frequencies of multiplier stages should be checked. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC Part 22.917 Limit

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

Alternative out of band emission limit. Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas, in lieu of that set forth in this section, pursuant to a private contractual arrangement of all affected licensees and applicants. In this event, each party to such contract shall maintain a copy of the contract in their station files and disclose it to prospective assignees or transferees and, upon request, to the FCC.

Interference caused by out of band emissions. If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section

4.4.2 Test Method

Configure the BTS digital enclosure via the BTS controller to enable the MFRM2 to transmit at maximum power for each of the carrier configurations one, two and three carrier in each of the Baseband modulation formats IS-95, IS2000, and IS-856 (16 QAM, 8 PSK, QPSK), and a three carrier with two IS-95 carriers and one IS856 16-QAM carrier. Measurements will be made on channels at the bottom and top of the duplexer. The following spectrum analyzer settings are to be used for the measurement of the antenna port (DPM) spurious emissions:

Adjacent 1MHz to indicated cellular band (Upper and Lower)

Table 38: Adjacent 1MHZ Spectrum Analyze Settings

Setting	1 Carrier	2 Carrier	3 Carrier
Resolution Bandwidth[a]:	30 kHz	30 kHz	50 kHz
Video Bandwidth (3x RBW)[b]	100 kHz	100 kHz	200 kHz
Video Average	10 Averages	10 Averages	10 Averages
Span	Set accordingly	Set accordingly	Set accordingly
Detector	RMS	RMS	RMS
Attenuation[c]	30 dB	30 dB	30 dB
Ref. Level	35 dBm	35 dBm	35 dBm
Ref. Level Offset	31-34 dB	31-34 dB	31-34 dB

a. If the spectrum analyze cannot be set to the specified RBW the next highest RBW should be used and all measurements corrected to the specified RBW
b. If the spectrum analyze cannot be set to the specified Video Bandwidth the next highest Video Bandwidth should be used.
c. The lowest value of attenuator should be used to improve measurement accuracy, without overdriving the Spectrum Analyzer.

All spectrum analyzer settings were coupled as per the manufacturers recommendations to improve measurement time, without compromising data.

All other Spurious Emissions up to 10 GHz

Table 39 : All other Emission Spectrum Analyze Settings

Setting	1 Carrier	2 Carrier	3 Carrier
Resolution Bandwidth	100 kHz	100 kHz	100 kHz
Video Bandwidth (3x RBW)	300 kHz	300 kHz	300 kHz
Video Average	10 Averages	10 Averages	10 Averages
Span	Set accordingly	Set accordingly	Set accordingly
Detector	RMS	RMS	RMS
Attenuation[a]	30 dB	30 dB	30 dB
Ref. Level	35 dBm	35 dBm	35 dBm
Ref. Level Offset	31-34 dB	31-34 dB	31-34 dB

a. The lowest value of attenuator should be used to improve measurement accuracy, without overdriving the Spectrum Analyzer.

The emissions will be investigated up to 10 GHz (the 10th harmonic of the fundamental emission) for all carrier configurations (1, 2, 3) as per FCC Part 22.

4.4.3 Test Requirements

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Table 40: Spurious Emissions Requirements

Frequency Offset	1 Carrier	2 Carrier	3 Carrier
+/- 1.11 MHz	-13 dBm/30KHz	-13 dBm/30KHz	-13 dBm/37.5 KHz
+/- 2.11 MHz	-13dBm/100 KHz	-13dBm/100 KHz	-13dBm/100 KHz

4.4.4 Test Setup

The set-up required for the MFRM2 Antenna Port (DPM) Spurious Emission test is illustrated in Figure 3. An optional filter may be used to improve the accuracy of the measurements far away from the cellular band (greater than 100 MHz). If a filter is used it must be clearly stated in the test results, and the frequency response of the filter must also be recorded, and presented in the results data.

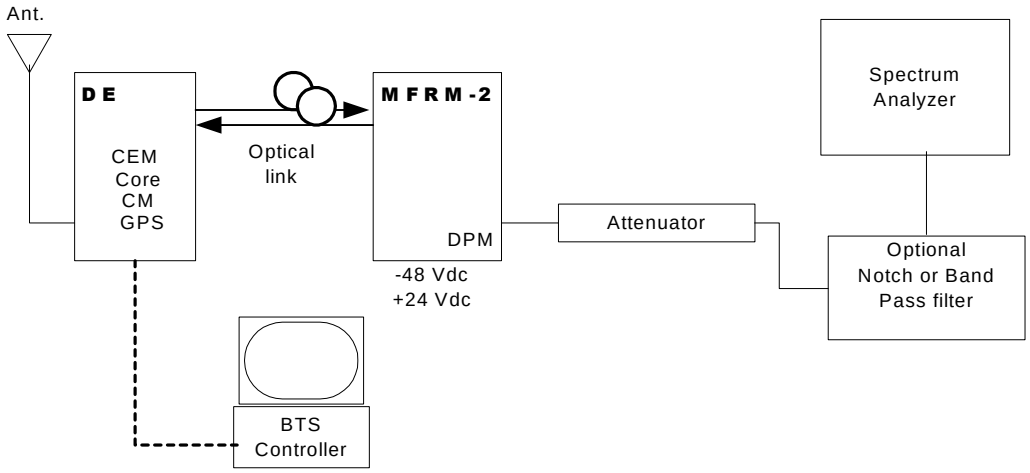


Figure 3 : Test Setup for Spurious Emissions Measurement

4.4.5 Test Results

Note: Refer to Table 4 for Spectrum Analyzer Noise floor

Table 41 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	1Carrier IS-95	1Carrier IS-2000 (16 times)	1Carrier
869 (lower edge of band A[a]) Ch4 RBW=30kHz	-20.06	-26.2	7.06
880 (upper edge of band A) Ch296 RBW=30kHz	-22.6	-26.1	9.6
880 (lower edge of band B) Ch 371 RBW=30kHz	-20.1	-23.8	7.1
890 (upper edge of band B) Ch 629 RBW=30kHz	-22.6	-28.1	9.6
891.51 (lower edge of band B') Ch 754 RBW=30kHz	-18.5	-22.9	5.5
894 (upper edge of band B') Ch 763 RBW=30kHz	-20.2	-22.9	7.2
0-1000 (RBW=100KHz)	-34.13	-33.94	20.9

Table 41 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	1Carrier IS-95	1Carrier IS-2000 (16 times)	1Carrier
1000-2000 (RBW=100KHz)	-33.06	-34.55	20.1
2000-3000 (RBW=100KHz)	-34.94	-34.99	20.9
3000-4000 (RBW=100KHz)	-34.54	-35.06	21.5
4000-5000 (RBW=100KHz)	-35.16	-35.52	22.2
5000-6000 (RBW=100KHz)	-32.37	-32.94	19.4
6000-7000 (RBW=100KHz)	-28.69	-28.93	15.7
7000-8000 (RBW=100KHz)	-30.34	-30.88	17.3
8000-9000 (RBW=100KHz)	-31.30	-30.89	17.9
9000-10000 (RBW=100KHz)	-30.93	-31.63	17.9

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 42 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	1Carrier 16 QAM	1Carrier 8 PSK	1Carrier QPSK	1Carrier
869 (lower edge of band A[a]) Ch4 RBW=30kHz	-25.3	n/a	n/a	12.3
880 (upper edge of band A) Ch296 RBW=30kHz	-25.0	n/a	n/a	12.0
880 (lower edge of band B) Ch 371 RBW=30kHz	-24.5	n/a	n/a	11.5
890 (upper edge of band B) Ch 629 RBW=30kHz	-27.7	n/a	n/a	14.7
891.51 (lower edge of band B’) Ch 754 RBW=30kHz	-24.7	n/a	n/a	11.7

Table 42 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port IS856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	1Carrier 16 QAM	1Carrier 8 PSK	1Carrier QPSK	1Carrier
894 (upper edge of band B') Ch 763 RBW=30kHz	-24.8	n/a	n/a	11.8
0-1000 (RBW=100KHz)	-37.99	-36.67	-36.40	23.4
1000-2000 (RBW=100KHz)	-37.46	-37.6	-37.73	24.5
2000-3000 (RBW=100KHz)	-36.34	-36.49	-36.12	23.12
3000-4000 (RBW=100KHz)	-35.68	-36.11	-36.22	22.7
4000-5000 (RBW=100KHz)	-35.6	-36.06	-35.33	22.3
5000-6000 (RBW=100KHz)	-33.77	-33.49	-33.95	20.5
6000-7000 (RBW=100KHz)	-29.55	-29.38	-30.26	16.4
7000-8000 (RBW=100KHz)	-31.8	-29.9	-31.91	16.9
8000-9000 (RBW=100KHz)	-32.0	-32.17	-31.98	19.0
9000-10000 (RBW=100KHz)	-32.15	-31.11	-32.18	18.1

a. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 43 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	2Carrier IS-95	2Carrier IS2000 (16 times)	2Carrier
869 (lower edge of band A[a]) Ch4, 45 RBW=30kHz	-25.73	-26.0	13.0
880 (upper edge of band A) Ch255, 296 RBW=30kHz	-35.1	-35.1	22.1

Table 43 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	2Carrier IS-95	2Carrier IS2000 (16 times)	2Carrier
0-1000 (RBW=100KHz)	-34.91	-33.9	20.9
1000-2000 (RBW=100KHz)	-33.87	-36.53	20.9
2000-3000 (RBW=100KHz)	-35.24	-36.46	22.2
3000-4000 (RBW=100KHz)	-34.81	-36.49	21.8
4000-5000 (RBW=100KHz)	-35.29	-36.70	22.3
5000-6000 (RBW=100KHz)	-32.51	-34.33	19.5
6000-7000 (RBW=100KHz)	-28.58	-30.27	15.6
7000-8000 (RBW=100KHz)	-30.41	-32.37	17.4
8000-9000 (RBW=100KHz)	-31.40	-33.17	18.4
9000-10000 (RBW=100KHz)	-31.18	-33.28	18.2

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 44 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	2Carrier 16 QAM	2Carrier 8 PSK	2Carrier QPSK	2Carrier
869 (lower edge of band A[a]) Ch4, 45 RBW=30kHz	-33.37	-36.7	-34.9	20.4
0-1000 (RBW=100KHz)	38.17	-37.88	-38.19	24.9
1000-2000 (RBW=100KHz)	-37.36	-37.76	-37.65	24.4
2000-3000 (RBW=100KHz)	-36.9	-37.04	-37.08	23.9

Table 44 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 2-Carrier IS856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	2Carrier 16 QAM	2Carrier 8 PSK	2Carrier QPSK	2Carrier
3000-4000 (RBW=100KHz)	-36.45	-36.45	-36.59	23.5
4000-5000 (RBW=100KHz)	-36.66	-36.76	-36.80	23.7
5000-6000 (RBW=100KHz)	-34.85	-34.3	-34.2	21.2
6000-7000 (RBW=100KHz)	-30.13	-30.14	-30.33	17.1
7000-8000 (RBW=100KHz)	-32.29	-32.33	-32.36	19.3
8000-9000 (RBW=100KHz)	-37.17	-33.16	-33.08	20.1
9000-10000 (RBW=100KHz)	-33.09	-33.11	-33.15	20.1

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 45 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	3Carrier IS-95	3Carrier IS2000 (16 times)	3Carrier
869 (lower edge of band A[a]) Ch4, 45,86 RBW=37.5kHz	-27.88	-28.47	14.9
880 (upper edge of band A) Ch214, 255, 296 RBW=37.5kHz	-30.84	-27.0	14.0
0-1000 (RBW=100KHz)	-35.03	-27.46	14.5
1000-2000 (RBW=100KHz)	-34.42	-37.37	21.4
2000-3000 (RBW=100KHz)	-35.26	-36.86	22.3
3000-4000 (RBW=100KHz)	-34.61	-36.54	21.6
4000-5000 (RBW=100KHz)	-34.97	-36.7	22.0

Table 45 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-95, IS2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	3Carrier IS-95	3Carrier IS2000 (16 times)	3Carrier
5000-6000 (RBW=100KHz)	-32.71	-34.22	19.7
6000-7000 (RBW=100KHz)	-28.8	-30.16	15.8
7000-8000 (RBW=100KHz)	-30.35	-32.37	17.4
8000-9000 (RBW=100KHz)	-31.26	-33.19	18.3
9000-10000 (RBW=100KHz)	-31.09	-33.23	18.1

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 46 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	3Carrier 16 QAM	3Carrier 8 PSK	3Carrier QPSK	3Carrier
869 (lower edge of band A[a]) Ch4, 45,86 RBW=37.5kHz	-33.37	-31.0	-31.7	29.2
880 (upper edge of band A) Ch214, 255, 296 RBW=37.5kHz	-42.2	n/a	-n/a	24.2
0-1000 (RBW=100KHz)	-38.04	-38.28	-37.16	24.2
1000-2000 (RBW=100KHz)	-37.76	-38.04	-37.73	24.7
2000-3000 (RBW=100KHz)	-37.02	-36.92	-37.05	23.9
3000-4000 (RBW=100KHz)	-36.45	-36.44	-36.39	23.4
4000-5000 (RBW=100KHz)	-36.81	-36.67	36.77	23.7
5000-6000 (RBW=100KHz)	-34.12	-34.27	-34.25	21.1
6000-7000 (RBW=100KHz)	-30.16	-30.22	-30.2	17.2

Table 46 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier A Band IS-856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	3Carrier 16 QAM	3Carrier 8 PSK	3Carrier QPSK	3Carrier
7000-8000 (RBW=100KHz)	-32.37	-32.28	-32.23	19.2
8000-9000 (RBW=100KHz)	-33.08	-33.15	-33.24	20.1
9000-10000 (RBW=100KHz)	-33.16	-33.15	-33.16	20.2

a. Channel 4 is only a valid channel if the cellular provider has both A and A” bands

Table 47 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port A-Band 2-Carrier IS-95 and 1 Carrier IS856 16-QAM[a]

Frequency (MHz)	Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
	3Carrier	3Carrier
869 (lower edge of band A[b]) Ch4, 45,86 RBW=37.5kHz	-35.12	22.12
880 (upper edge of band A) Ch214, 255, 296 RBW=37.5kHz	-34.8	21.8
0-1000 (RBW=100KHz)	-37.48	24.48
1000-2000 (RBW=100KHz)	-37.5	24.5
2000-3000 (RBW=100KHz)	-36.97	23.97
3000-4000 (RBW=100KHz)	-36.48	23.48
4000-5000 (RBW=100KHz)	-36.71	23.71
5000-6000 (RBW=100KHz)	-34.09	21.09
6000-7000 (RBW=100KHz)	-30.27	17.27
7000-8000 (RBW=100KHz)	-32.17	19.17
8000-9000 (RBW=100KHz)	-33.12	20.12

Table 47 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port A-Band 2-Carrier IS-95 and 1 Carrier IS856 16-QAM[a]

Frequency (MHz)	Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
	3Carrier	3Carrier
9000-10000 (RBW=100KHz)	-33.2	20.2

a. The two IS95 Carrier will be channels 10151015, and 34 the IS856 will be channel 75
b. Channel 4 is only a valid channel if the cellular provider has both A and A" bands

Table 48 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier B Band IS95, IS-2000

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to FCC Limit of -13 dBm (dB)
	3Carrier IS-95	3Carrier IS-2000 (16 times)	3Carrier
880 (lower edge of band B) Ch371, 412, 453 RBW=37.5kHz	-26.3	-23.4	10.4
890 (upper edge of band B) Ch547, 588, 629 RBW=37.5kHz	-32.2	-23.9	10.9
0-1000 (RBW=100KHz)	-26.74	-25.05	12.05
1000-2000 (RBW=100KHz)	-37.04	-37.41	24.04
2000-3000 (RBW=100KHz)	-36.98	-37.0	23.98
3000-4000 (RBW=100KHz)	-36.54	-36.53	23.53
4000-5000 (RBW=100KHz)	-36.7	-36.61	23.61
5000-6000 (RBW=100KHz)	-34.18	-34.28	21.18
6000-7000 (RBW=100KHz)	-30.19	-30.22	17.19
7000-8000 (RBW=100KHz)	-32.37	-32.33	19.33
8000-9000 (RBW=100KHz)	-33.15	-33.07	20.07
9000-10000 (RBW=100KHz)	-33.19	-33.02	20.02

IS

Table 49 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port 3-Carrier B Band IS856

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to FCC Limit of -13 dBm (dB)
	3Carrier 16 QAM	3Carrier 8 PSK	3Carrier QPSK	3Carrier
880 (lower edge of band B) Ch371, 412, 453 RBW=37.5kHz	-36.5	n/a	n/a	23.5
890 (upper edge of band B) Ch547, 588, 629 RBW=37.5kHz	-40.8	-40.3	-40.6	27.3
0-1000 (RBW=100KHz)	-38.45	-39.06	-38.61	25.45
1000-2000 (RBW=100KHz)	-38.24	-38.29	-38.26	25.24
2000-3000 (RBW=100KHz)	-36.96	-36.91	-37.02	23.91
3000-4000 (RBW=100KHz)	-36.36	-36.36	-36.42	23.36
4000-5000 (RBW=100KHz)	-36.65	-36.7	-36.7	23.7
5000-6000 (RBW=100KHz)	-34.14	-34.11	-34.09	21.09
6000-7000 (RBW=100KHz)	-30.25	-30.26	-30.27	17.26
7000-8000 (RBW=100KHz)	-32.36	-32.26	-36.29	19.26
8000-9000 (RBW=100KHz)	-33.04	-33.12	-33.23	20.12
9000-10000 (RBW=100KHz)	-33.08	-33.11	-33.00	20.00

Table 50 : Spurious Emissions at the 800 MHz MFRM2 Ant. Port B Band 2 Carrier IS95 and I Carrier IS856 16-QAM[a]

Frequency (MHz)	Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
	1Carrier	1Carrier
880 (lower edge of band B) Ch371, 412, 453 RBW=37.5kHz	-27.4	14.4
890 (upper edge of band B) Ch547, 588, 629 RBW=37.5kHz	-34.7	21.7
0-1000 (RBW=100KHz)	-36.81	23.81
1000-2000 (RBW=100KHz)	-37.55	24.55
2000-3000 (RBW=100KHz)	-36.83	23.83
3000-4000 (RBW=100KHz)	-36.57	23.57
4000-5000 (RBW=100KHz)	-36.79	23.79
5000-6000 (RBW=100KHz)	-34.18	21.18
6000-7000 (RBW=100KHz)	-30.05	17.05
7000-8000 (RBW=100KHz)	-32.41	19.41
8000-9000 (RBW=100KHz)	-33.12	20.12
9000-10000 (RBW=100KHz)	-32.95	19.95

a. The two IS95 Carrier will be channels 412, and 453 the IS856 will be channel 371

4.5 Transmitter Tests (CDMA Mode)

Unwanted Emissions

Unwanted emissions are emissions on a frequency or frequencies outside the necessary bandwidth which result from the modulation process, from spurious emissions and harmonics.

IC RSS-129

(1) Suppression inside cellular band: For all base station transmit frequencies allocated to the same operator system, the total spurious emissions in any 30 kHz band shall be attenuated below the mean output power level in accordance with the following schedule:

(a) for all offset frequencies greater than 750 kHz from the CDMA centre frequency, at least 45 dB. 800 MHz Dual-Mode CDMA Cellular Telephones RSS-129.

(b) for all offset frequencies greater than 1.98 MHz from the CDMA centre frequency, at least 60 dB.

(c) for all offset frequencies not allocated to the same operator system, at least 60 dB or -13 dBm, whichever is less stringent.

(2) In any 30 kHz outside the cellular band, the attenuation shall be at least 43+10 Log10 (mean output power in watts) or 70, dB, whichever is the less stringent.

4.5.1 Test Method

Configure the BTS digital enclosure via the BTS controller to enable the MFRM2 to transmit at maximum power for each of the carrier configurations one, two and three carrier in each of the Baseband modulation formats IS-95, IS2000, and IS-856 (16 QAM, 8 PSK, QPSK), and a three carrier with two IS-95 carriers and one IS856 16-QAM carrier. Measurements will be made on channels at the bottom and top of the duplexer. The following spectrum analyzer settings are to be used for the measurement of the antenna port (DPM) spurious emissions:

Adjacent 1MHz to indicated cellular band (Upper and Lower)

Table 51: Adjacent 750 KHz and 1.98 MHZ Spectrum Analyze Settings

Setting	1 Carrier	2 Carrier	3 Carrier
Resolution Bandwidth[a]:	30 kHz	30 kHz	30 kHz
Video Bandwidth (3x RBW)	100 kHz	100 kHz	100 kHz
Video Average	10 Averages	10 Averages	10 Averages
Span	Set accordingly	Set accordingly	Set accordingly
Detector	RMS	RMS	RMS
Attenuation	30 dB	30 dB	30 dB
Ref. Level	35 dBm	35 dBm	35 dBm
Ref. Level Offset	31-34 dB	31-34 dB	31-34 dB

a. If the spectrum analyze can not be set to the specified RBW the next highest RBW should be used and all measurements corrected to the specified RBW

All spectrum analyzer settings were coupled as per the manufacturers recommendations to improve measurement time, without compromising data.

4.5.2 Test Setup

The set-up required for the MFRM2 Antenna Port (DPM) Spurious Emission test is illustrated in Figure 3. An optional filter may be used to improve the measurement set-up. If a filter is used it must be clearly stated in the test results, and the frequency response of the filter must also be recorded and presented in the results data.

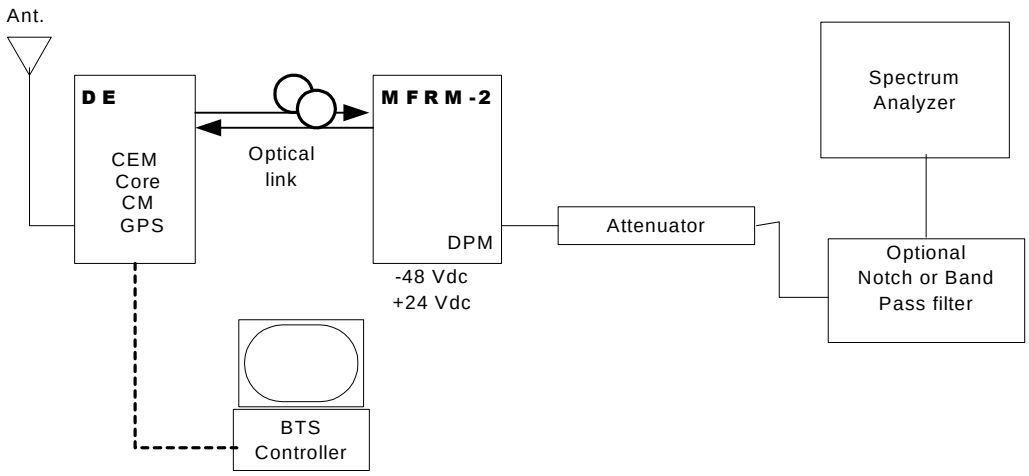


Figure 4 : Test Setup for Spurious Emissions Measurement

4.5.3 Test Results

Table 52 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS856 1 Carrier

Frequency (MHz)	Spurious Emissions Level (dBm)			Margin to IC Limit of 45 dBc/ 30KHz (dB)
	3Carrier 16 QAM	3Carrier 8 PSK	3Carrier QPSK	1Carrier
Ch4, 750KHz offset at lower band edge	-17.8	-18.2	-18.9	18.6
Ch4, 750KHz offset at upper band edge	-19.1	-18.7	-19	19.5
				Margin to IC Limit of 60 dBc/ 30KHz (dB)
Ch4, 1.98 MHz offset at lower band edge	-42	-41.1	-41.8	26.9
Ch4, 1.98 MHz offset at upper band edge	-42.5	-41.7	-43.8	27.5

Table 53 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS95, IS-2000 1 Carrier

Frequency (MHz)	Spurious Emissions Level (dBm)		Margin to IC Limit of 45 dBc/ 30KHz (dB)
	1Carrier IS-95	1Carrier IS2000 (16 times)	1Carrier
Ch4 750KHz offset at lower band edge	-15.2	-15.5	17.5
Ch4 750KHz offset at upper band edge	-15.5	-15.6	17.8

Table 53 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS95, IS-2000 1 Carrier

Frequency (MHz)	**Spurious Emissions Level (dBm)**		**Margin to IC Limit of 45 dBc/ 30KHz (dB)**
	1Carrier IS-95	1Carrier IS2000 (16 times)	1Carrier
			Margin to IC Limit of 60 dBc/ 30KHz (dB)
Ch4 1.98MHz offset at lower band edge	-42.2	-40.8	28.1
Ch4 1.98MHz offset at upper band edge	-42.7	-43.0	30

Table 54 : Industry Canada Suppression inside cellular band at the 800 MHz MFRM2 Antenna Port IS95, IS-2000 3 Carrier

Frequency (MHz)	**Spurious Emissions Level (dBm)**		**Margin to IC Limit of 45 dBc/ 30KHz (dB)**
	3Carrier IS-95	3Carrier IS2000 (16 times)	1Carrier
Ch547, 588, 629 750KHz offset at lower band edge	-20.58	-23.9	18.1
Ch547, 588, 629 750KHz offset at upper band edge	-20.97	-21.0	18.5
			Margin to IC Limit of 60 dBc/ 30KHz (dB)
Ch547, 588, 629 1.98MHz offset at lower band edge	-29.68	-27.5	10.0
Ch547, 588, 629 1.98MHz offset at upper band edge	-37.61	-36.5	19.0

4.6 Frequency Stability

4.6.1 Frequency Stability Requirements

FCC Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 to +50 centigrade for all equipment except that specified in subparagraphs (2) and (3) of this paragraph.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

FCC Part 22.355 Frequency Tolerance

The carrier frequency of each transmitter in the 821-896 MHz Frequency range, must be maintained within 1.5ppm tolerance, according to table C-1 of this section stability

4.6.2 Test Procedure

The test equipment was configured as shown in figure 5.

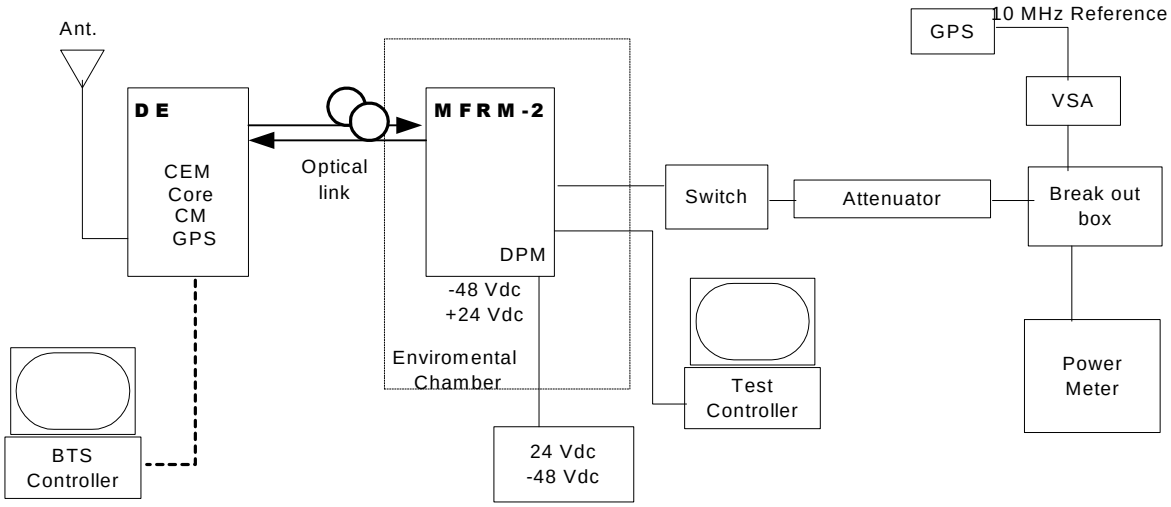


Figure 5 : Test configuration for Frequency Stability

4.6.3 Frequency Results

Table 55 : Test results for Frequency Stability versus Power supply Voltage

Voltage (Vdc)	Maximum Carrier Frequency Deviation (PPM)	Maximum Carrier Frequency Deviation (Hz)
40	0.0025	-2.2
48 nominal	0.0034	-3
56	0.0053	4.6
20	0.0029	2.5
24 nominal	0.0013	1.2

Table 55 : Test results for Frequency Stability versus Power supply Voltage

Voltage (Vdc)	Maximum Carrier Frequency Deviation (PPM)	Maximum Carrier Frequency Deviation (Hz)
28	0.0015	1.33

Table 56 : Test results for Frequency Stability versus Temperature at -48V operation

Temperature (ºC)	Maximum Carrier Frequency Deviation (PPM)	Maximum Carrier Frequency Deviation (Hz)
-30	0.0027	-2.31
-20	0.0038	3.27
-10	0.0044	-3.85
0	0.0065	-5.68
10	.0044	4.29
20	0.0049	3.11
30	0.0036	3.12
40	0.0036	5.06
50	0.0058	-1.41

Table 57 : Test results for Frequency Stability versus Temperature at 24V operation

Temperature (ºC)	Maximum Carrier Frequency Deviation (PPM)	Maximum Carrier Frequency Deviation (Hz)
-30	0.0063	-5.47
-20	0.0031	2.67
-10	0.0058	5.07
0	0.0044	3.86
10	0.0048	4.17
20	0.0007	-0.65
30	0.0036	-3.11
40	0.0023	-1.99
50	0.0049	-4.25

References

[1] FCC Part 22 Subpart H, “Public Mobile Services”, http://www.access.gpo.gov/nara/cfr/waisidx_01/47cfr22_01.html

[2] FCC Part 2 Subpart J, “Frequency allocations and radio treaty matters; general rules and regulations”, http://www.access.gpo.gov/nara/cfr/waisidx_01/47cfr2_01.html

[3] Industry Canada RSS-129, “800 MHz Dual-Mode CDMA Cellular Telephones”, http://strategis.ic.gc.ca/SSG/sf01324e.html

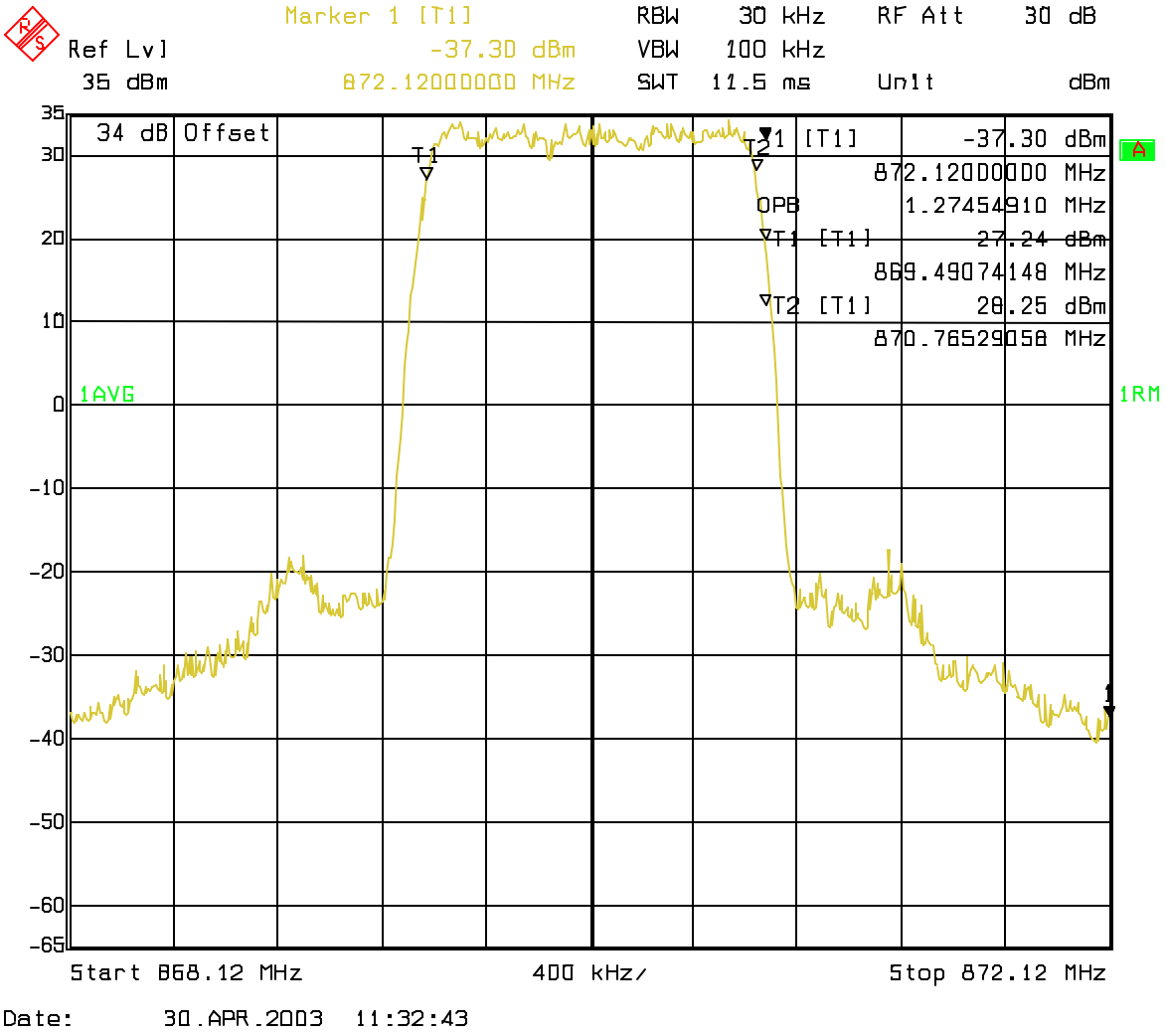
[4] TIA/EIA-97-D “Recommended Minimum Performance Standards for Base Stations Supporting Dual Mode Spread Spectrum Systems”, June 2001

[5] Industry Canada “Information on the 99% Bandwidth measurement” Author Brain Kasper. http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/vwapj/occupied-bandwidth.pdf/$FILE/occupied-bandwidth.pdf

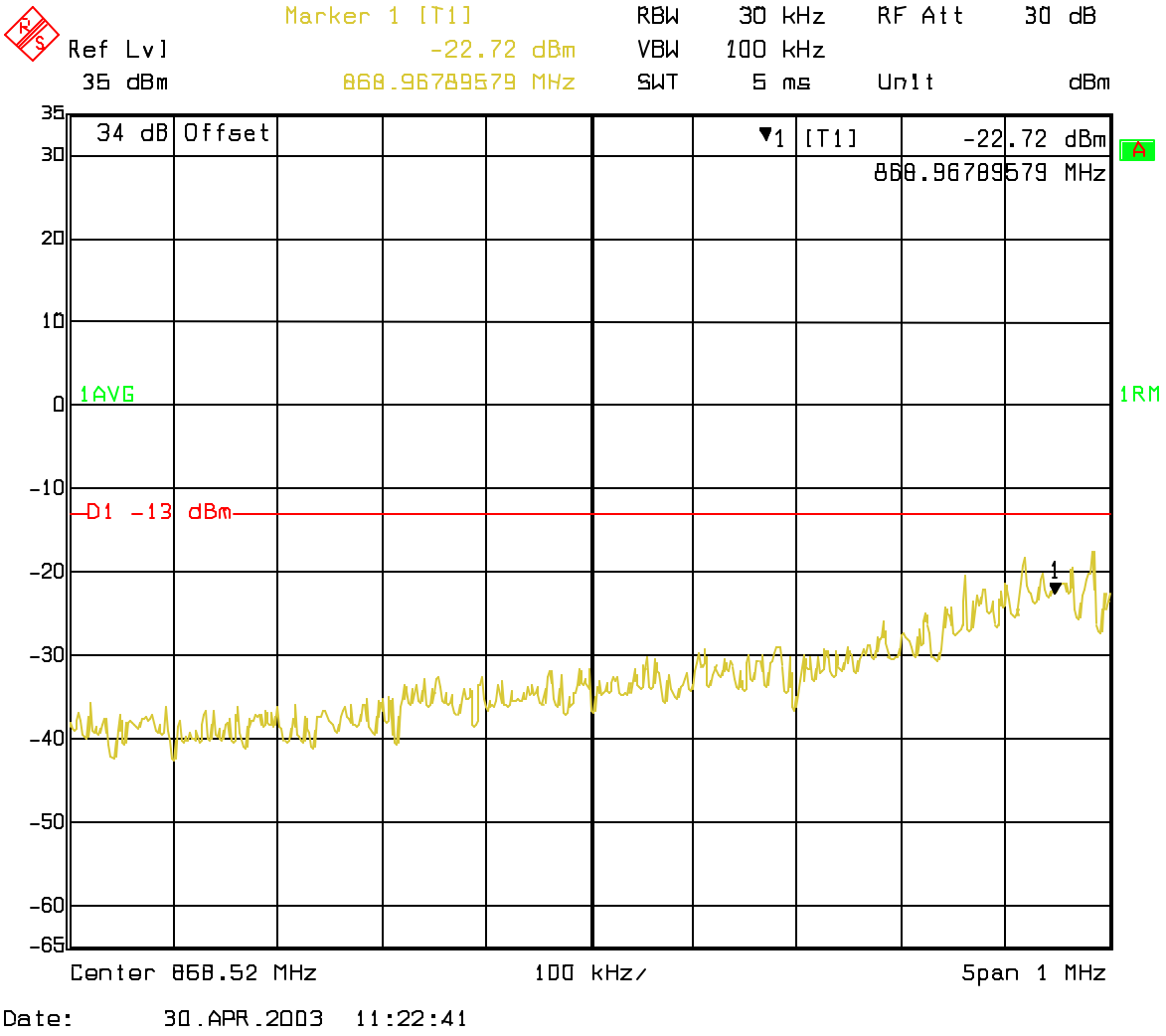
[6] CDMA BTS Developmen, MFRM-2 800 MHz Power Amplifier Assembly Beta Cycle Verification Report, Dataset Name: NTGY37AA, Document Status: Ratified, Stream: 02 Issue: 02, Issue Date: March 12, 2003, Document Prime: Neil Claxton, 2M23

APPENDIX PLOTS

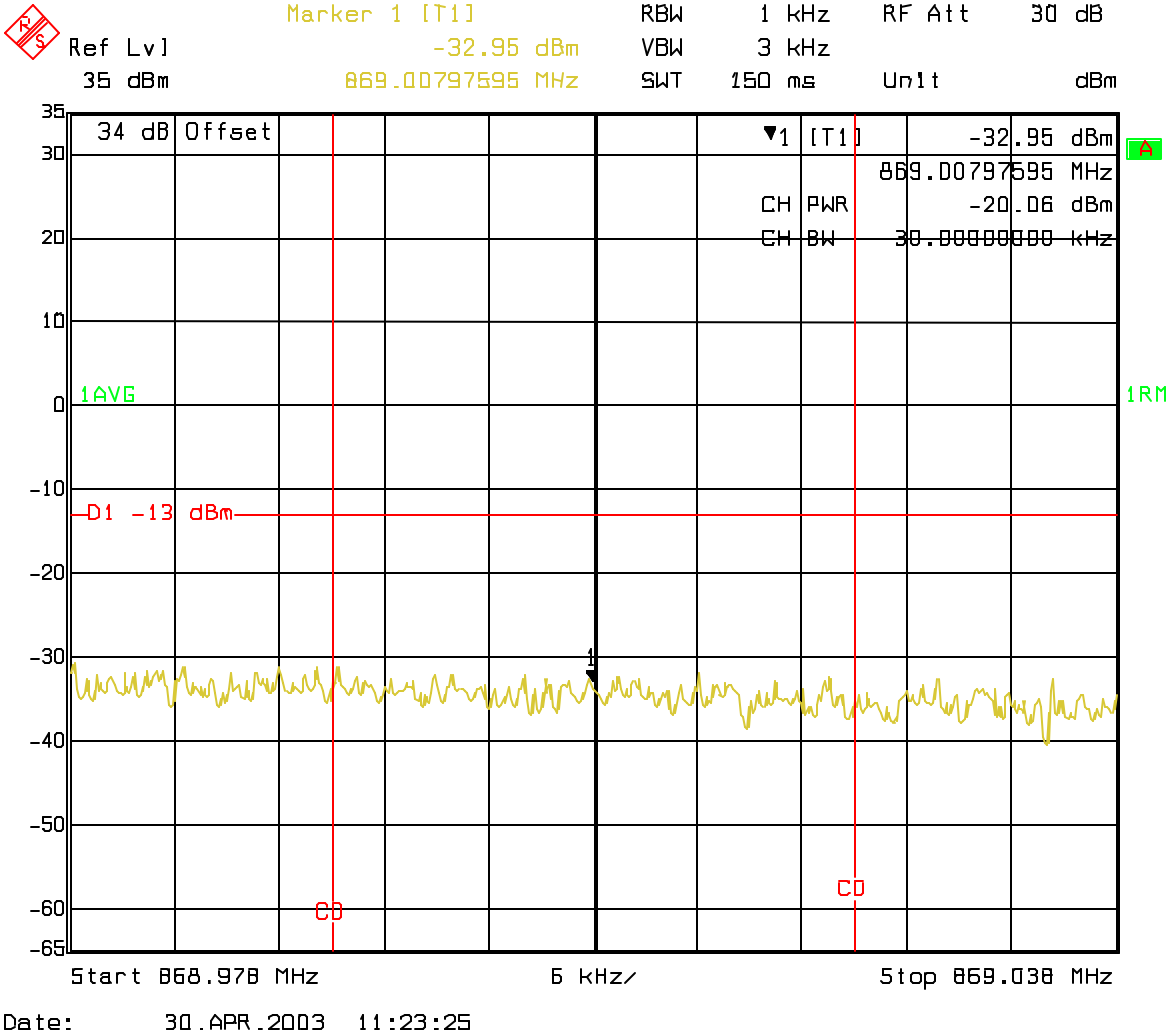
CH 4 Occupied BW



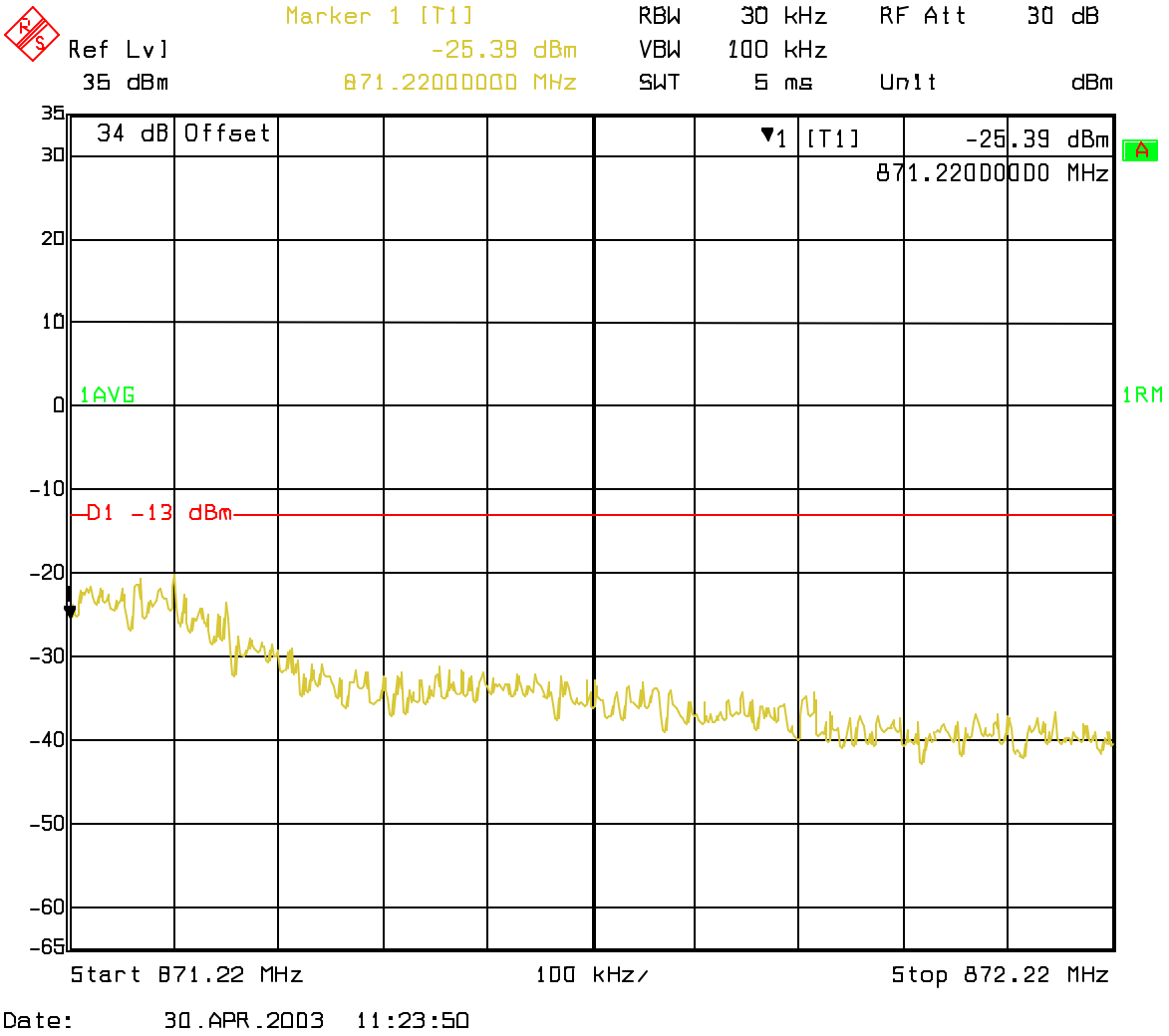
CH 4 1MHz Lower Adjacent Band Edge



CH 4 1MHz Lower Adjacent Band Edge 60kHz span



CH 4 1MHz Upper Adjacent Band Edge



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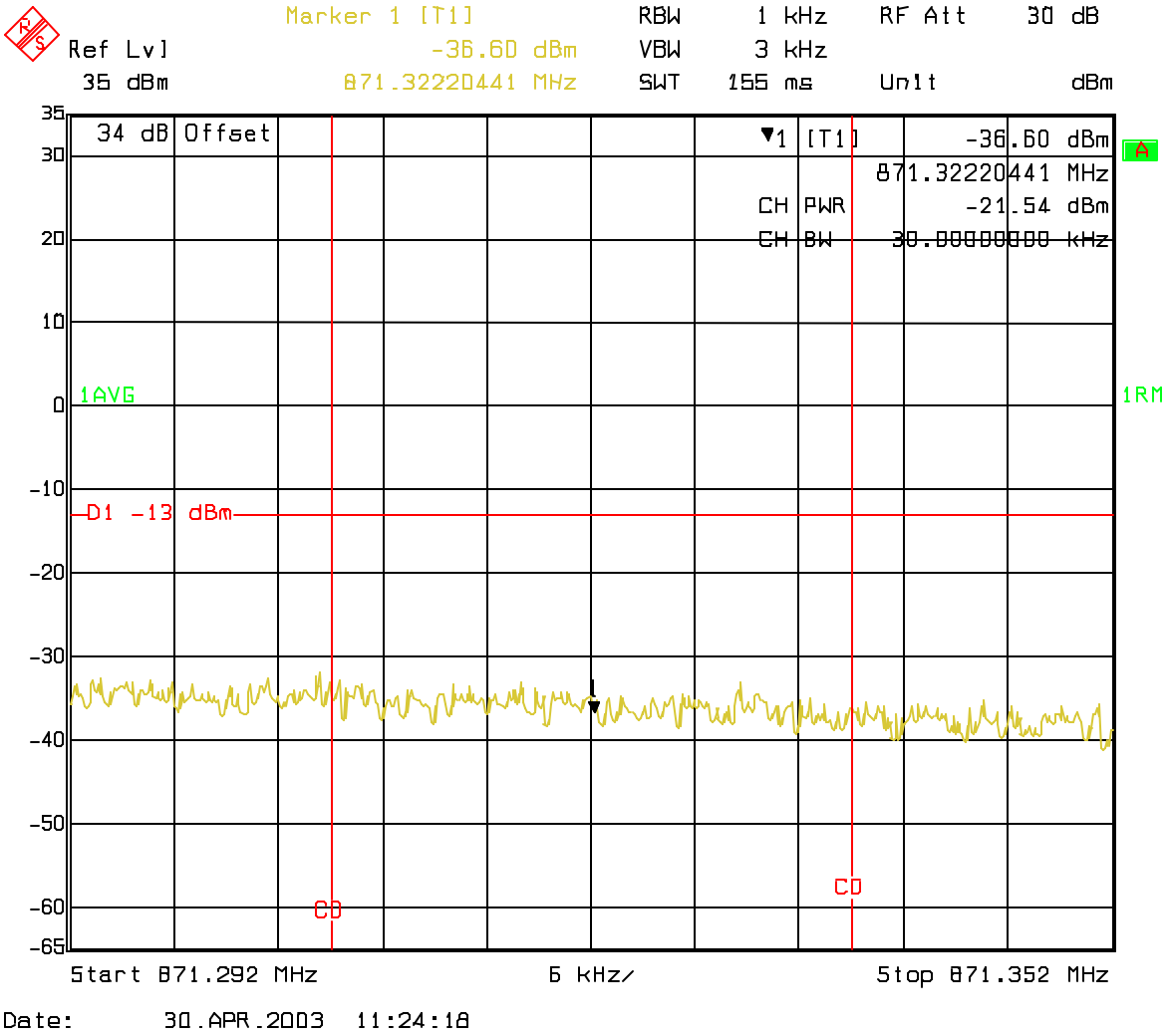
CH 4 1MHz Upper Adjacent Band Edge 60 kHz span



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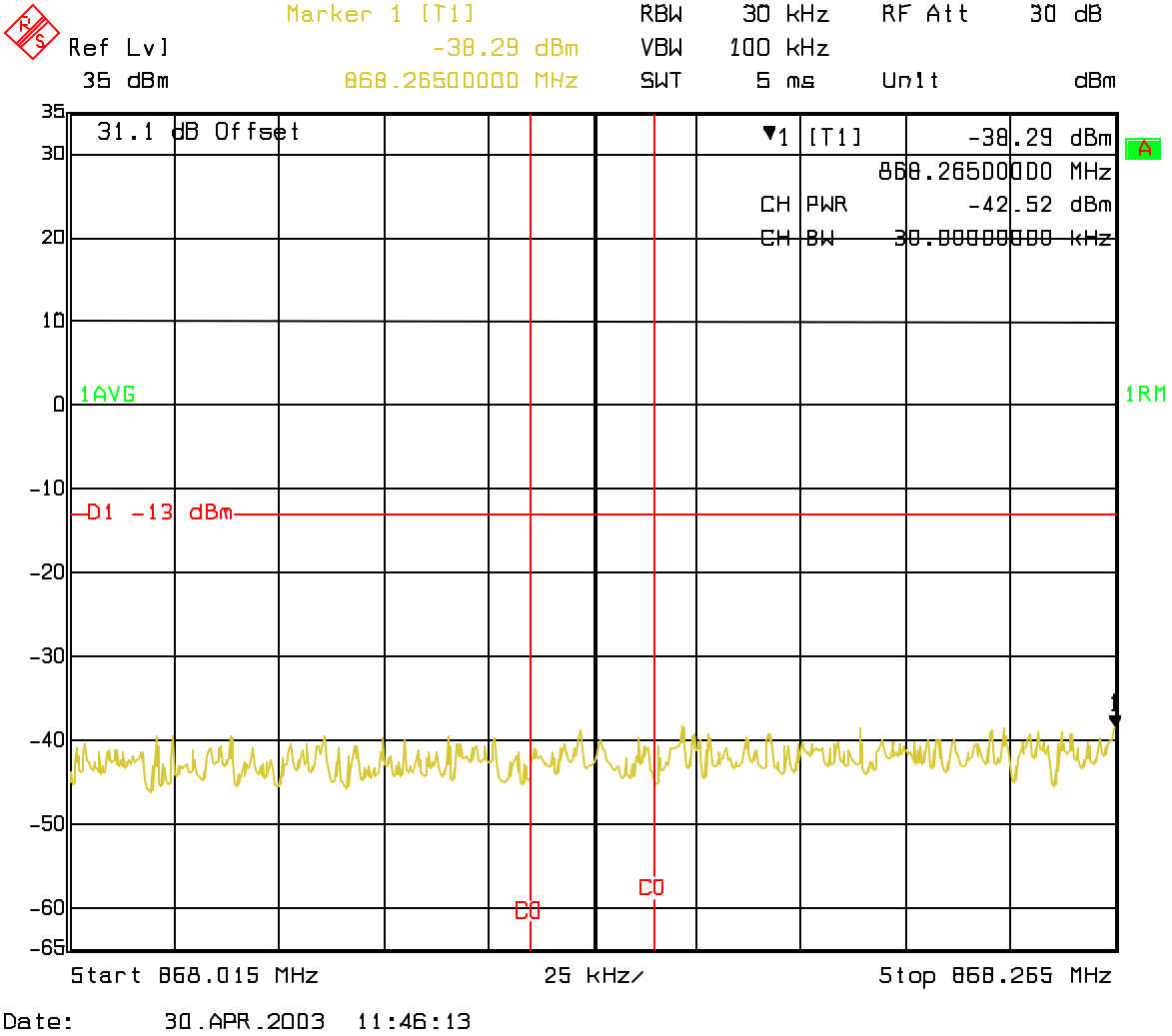
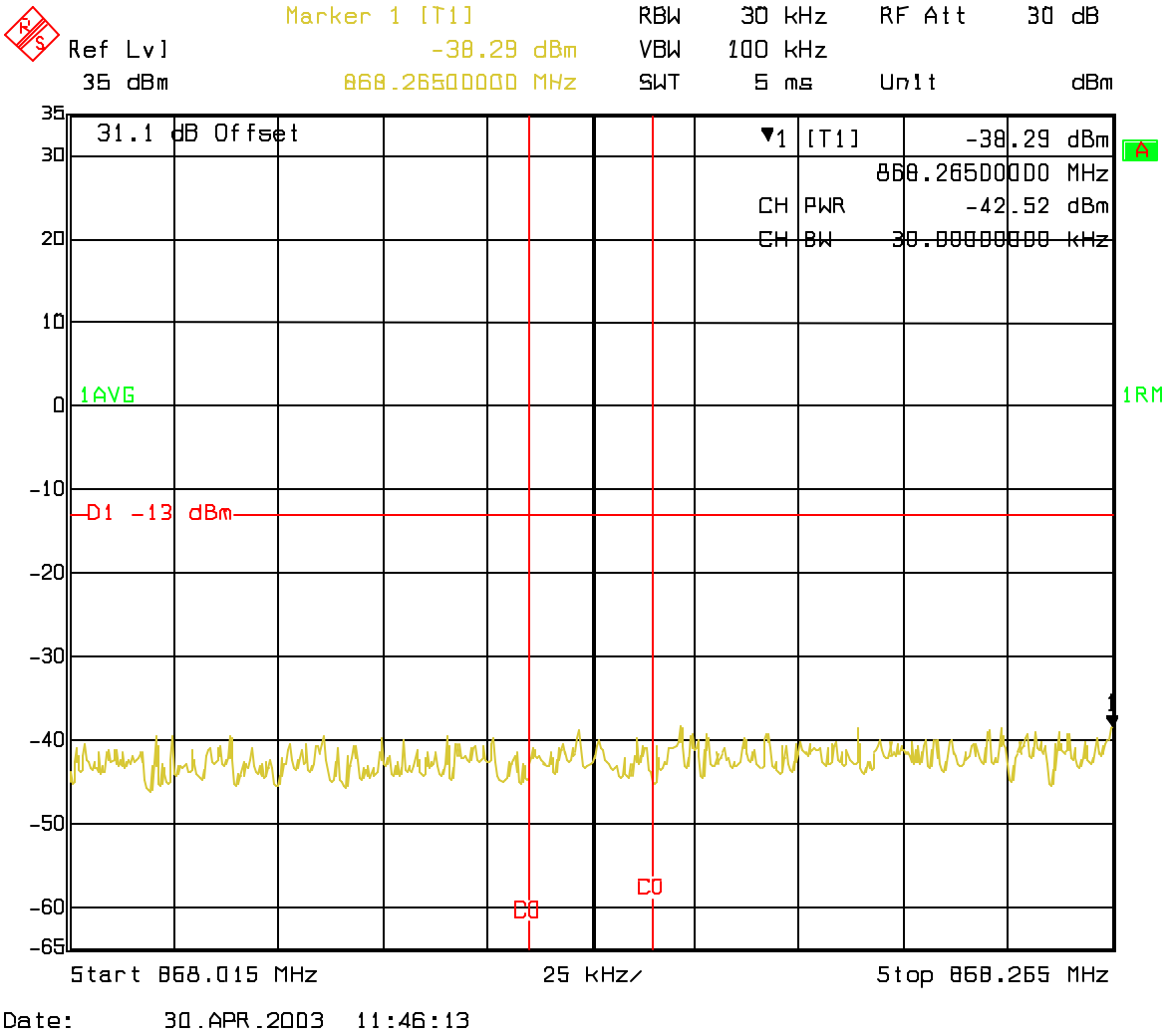
CH 4 Lower 1.98MHz Offset



CH 4 1.98 MHz offset upper



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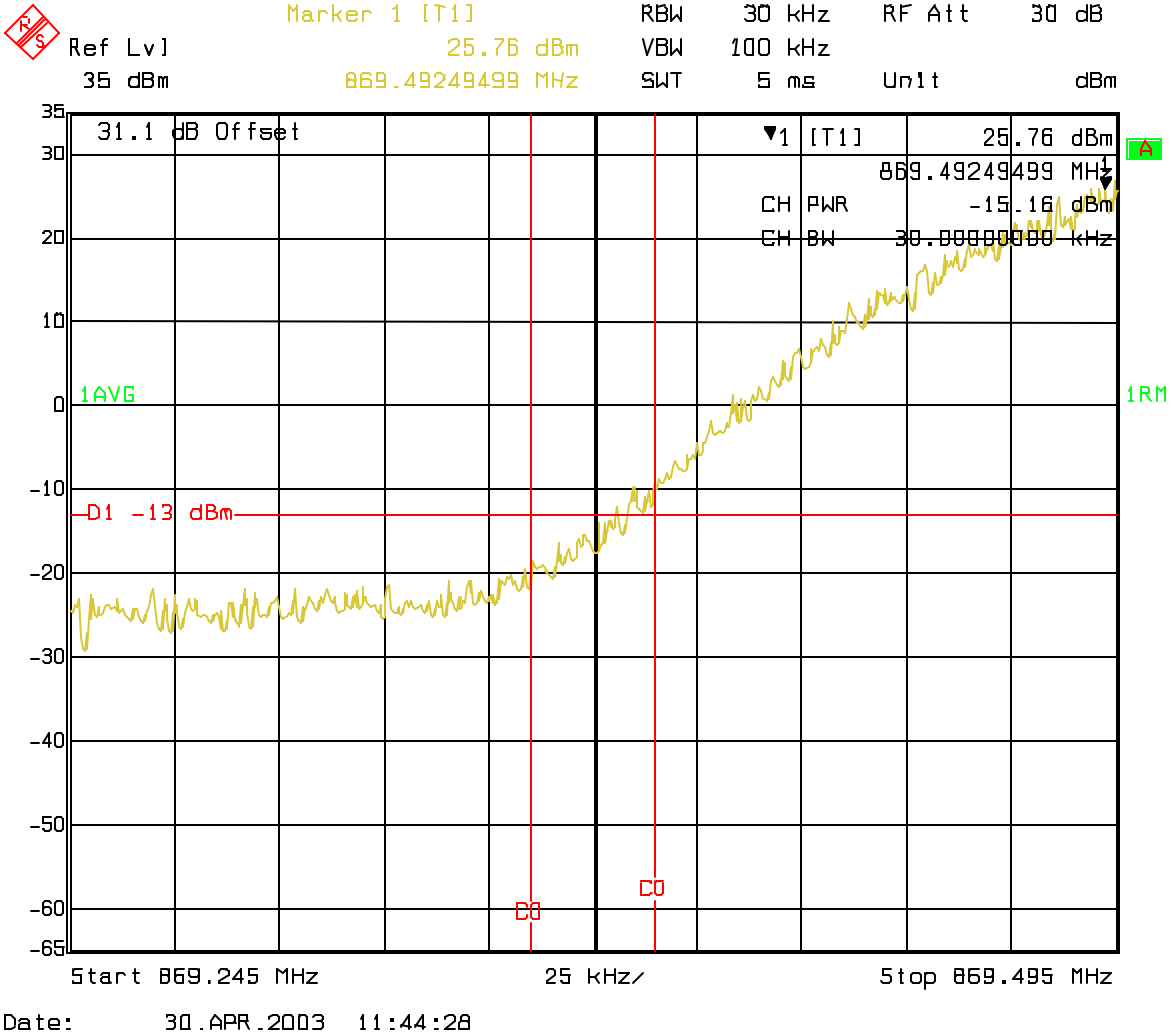
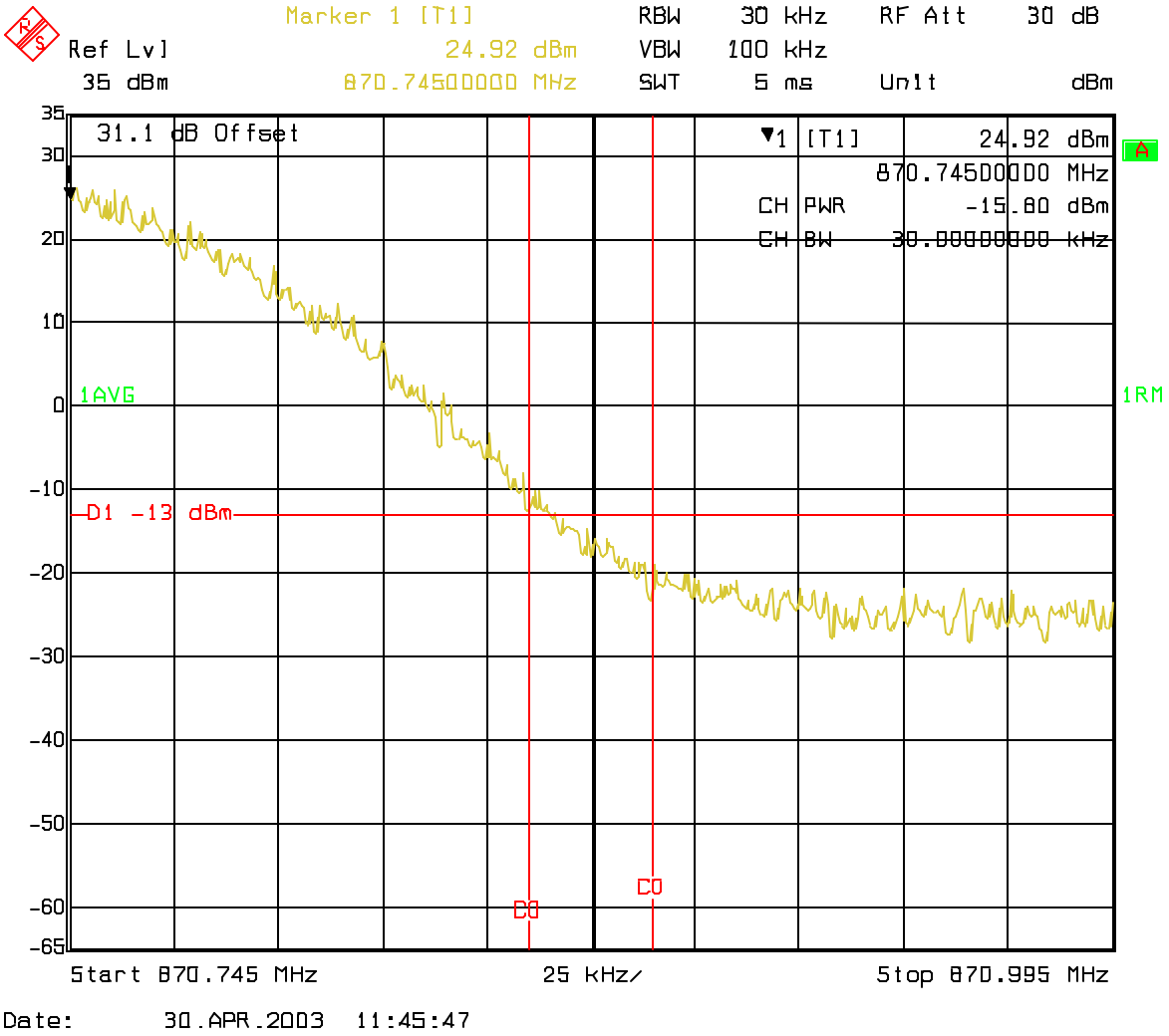
CH 4 750 kHz offset lower



CH 4 750 kHz offset upper



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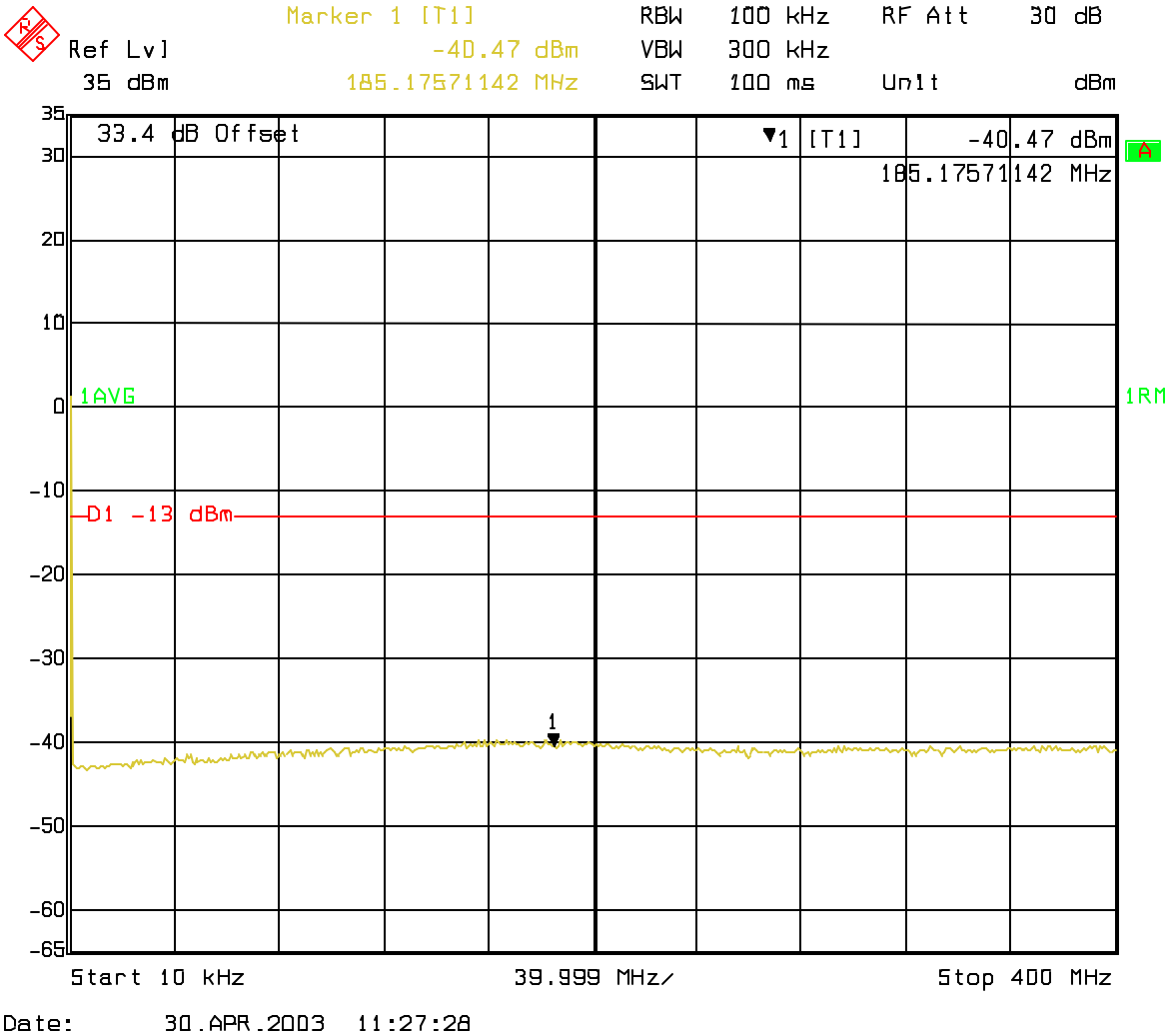
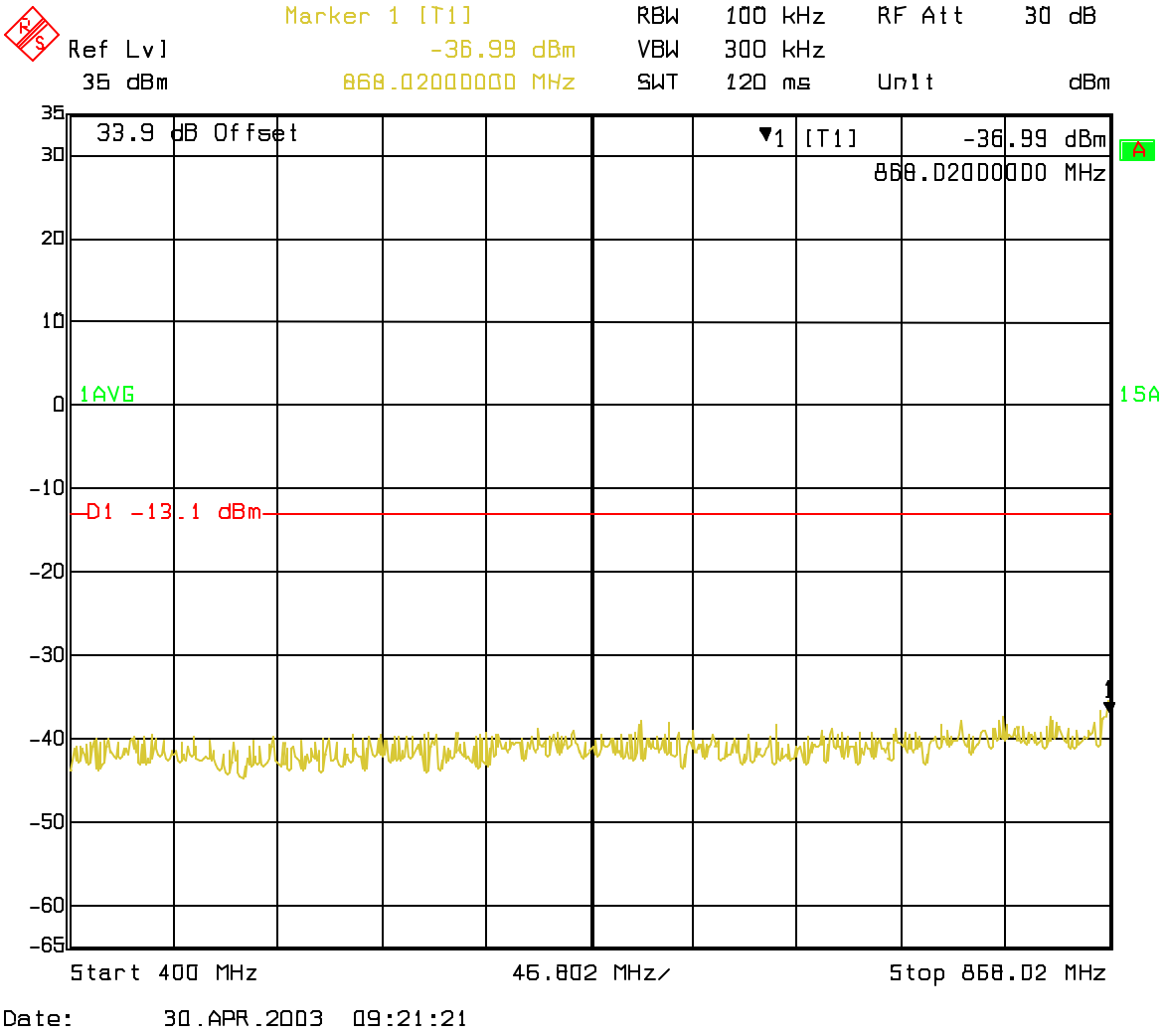
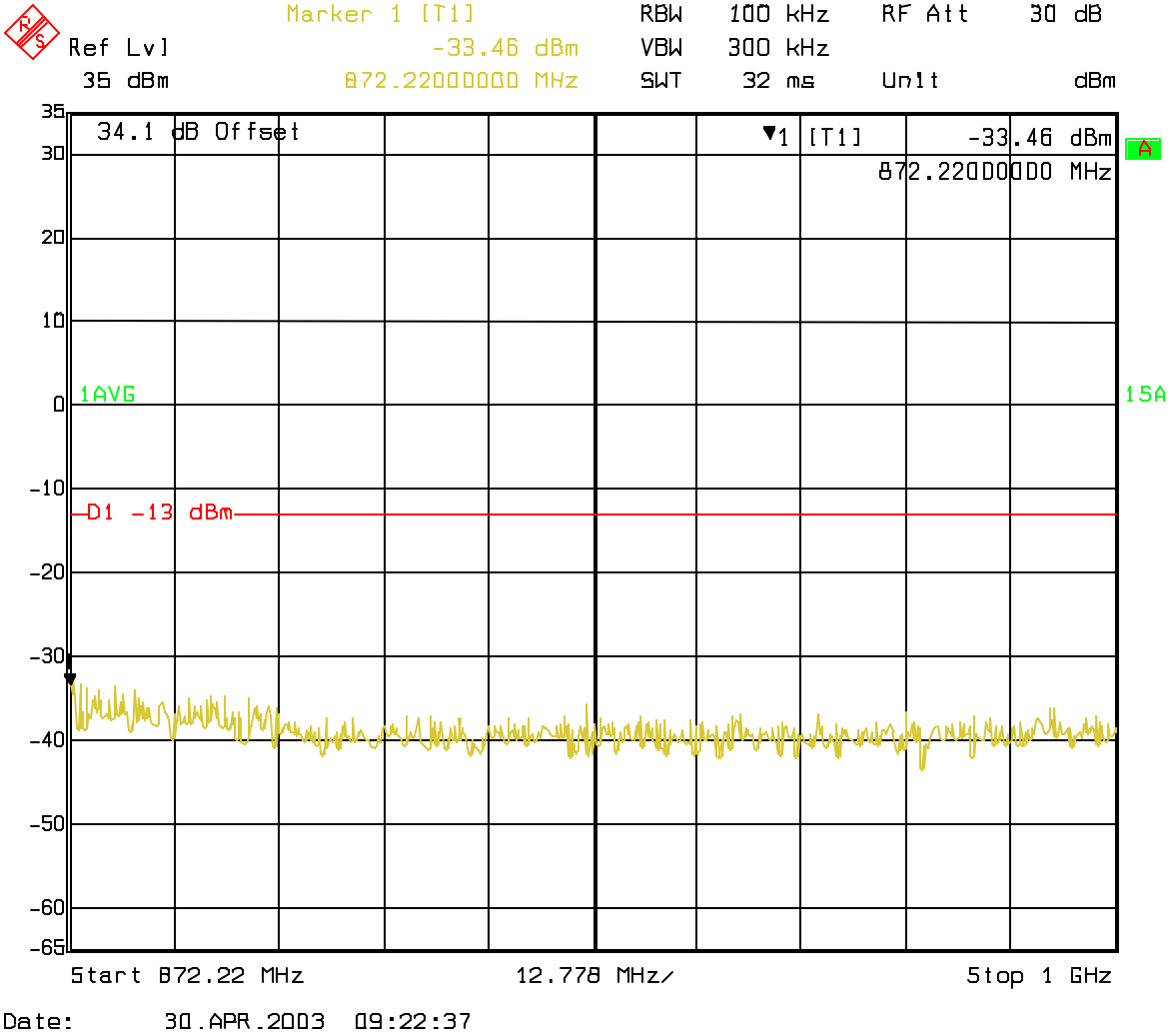
CH 4 Spurious 10kHz to 400MHz



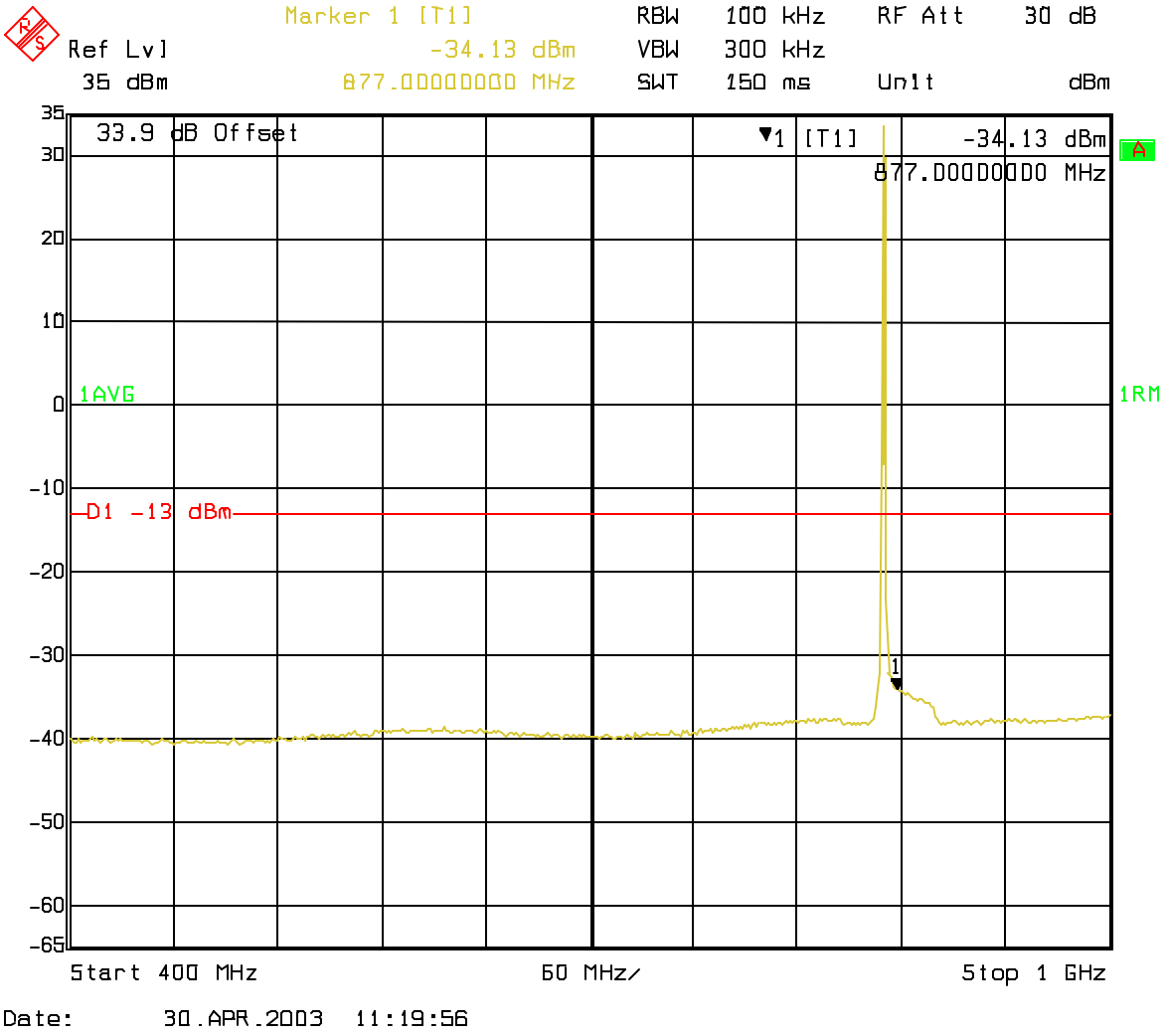
CH 4 Spurious 400MHz to 868MHz



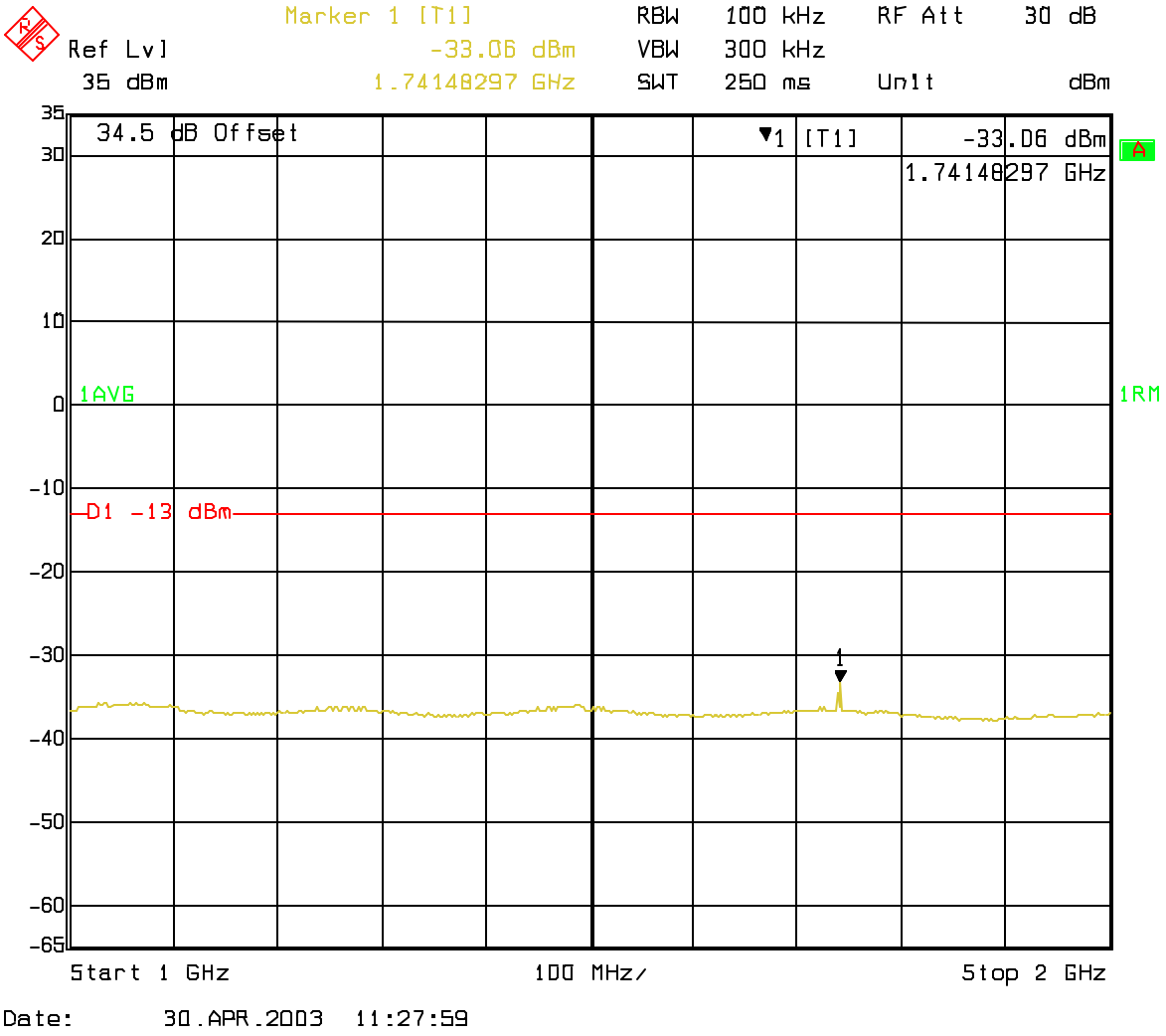
CH 4 Spurious 872MHz to 1GHz



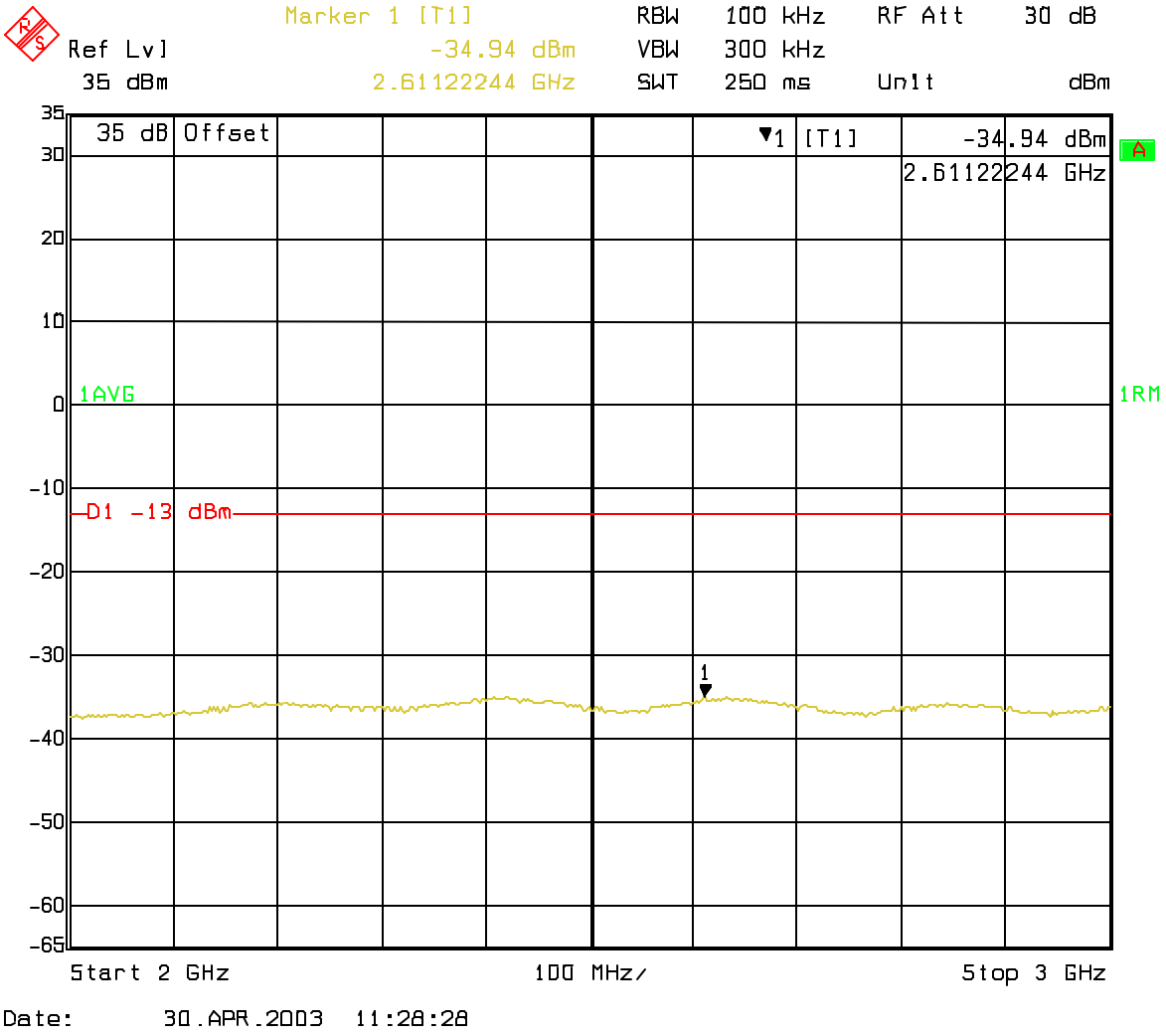
CH 4 Spurious 400MHz to 1GHz



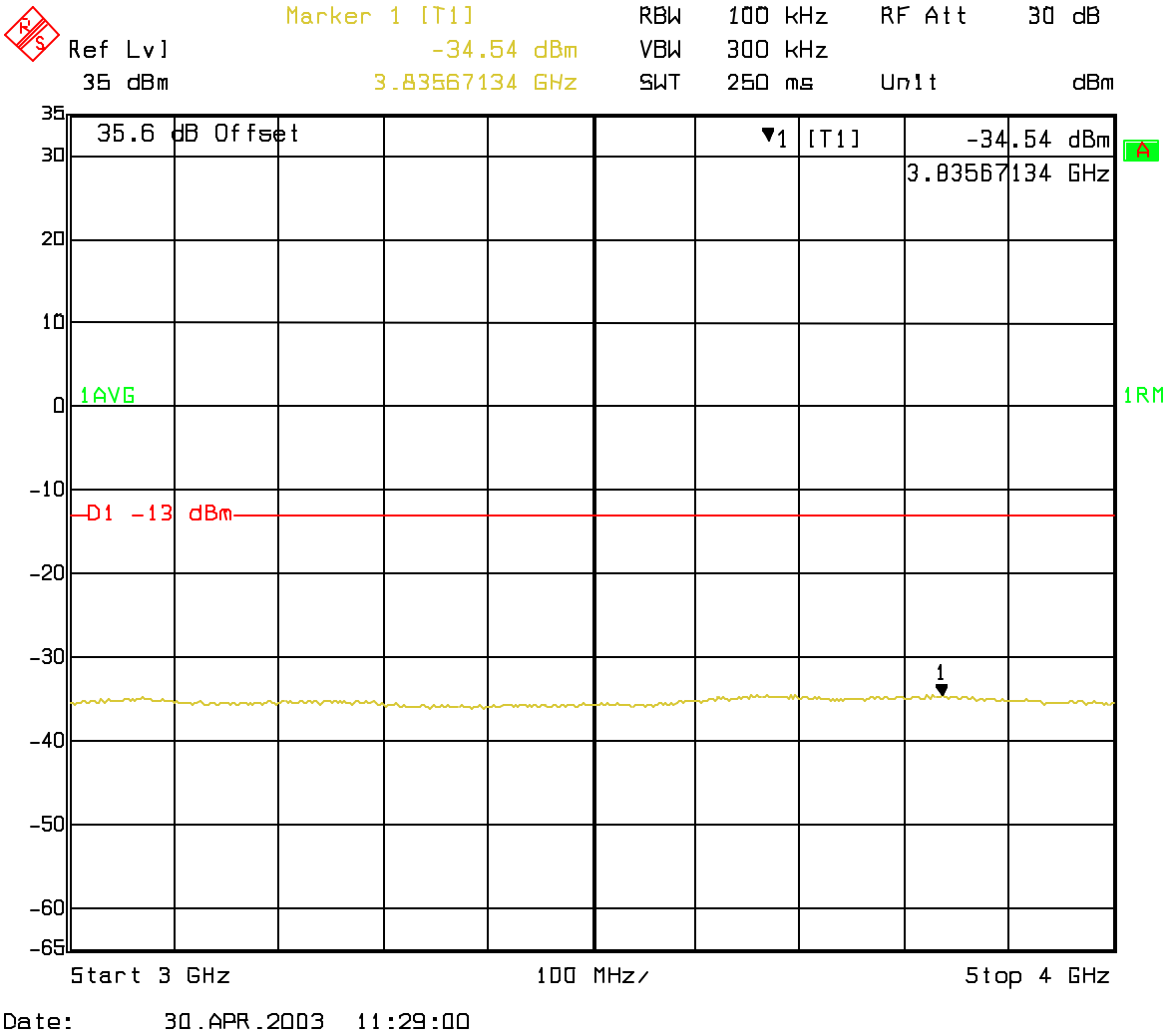
CH 4 Spurious 1 to 2 GHz



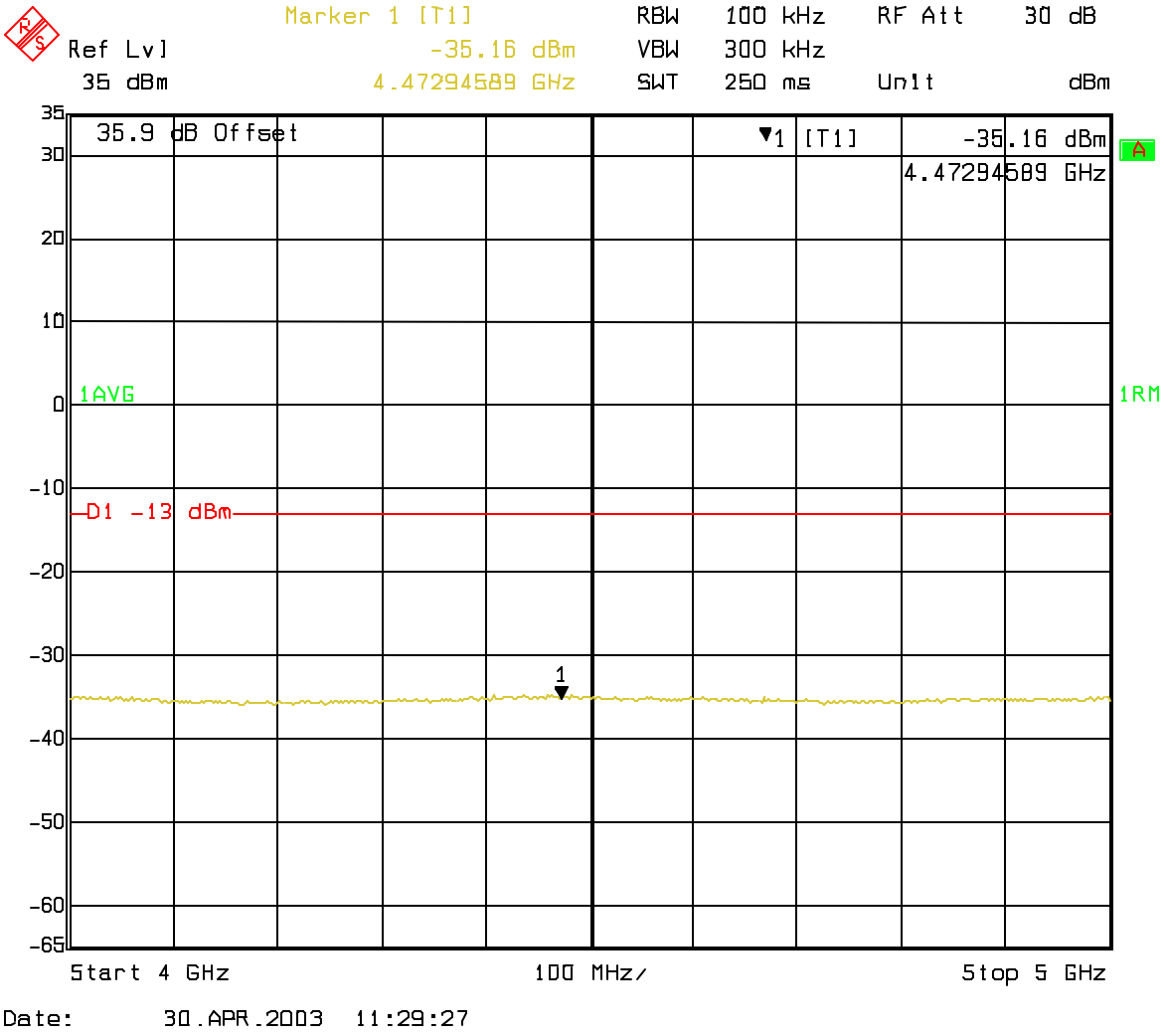
CH 4 Spurious 2-3GHz



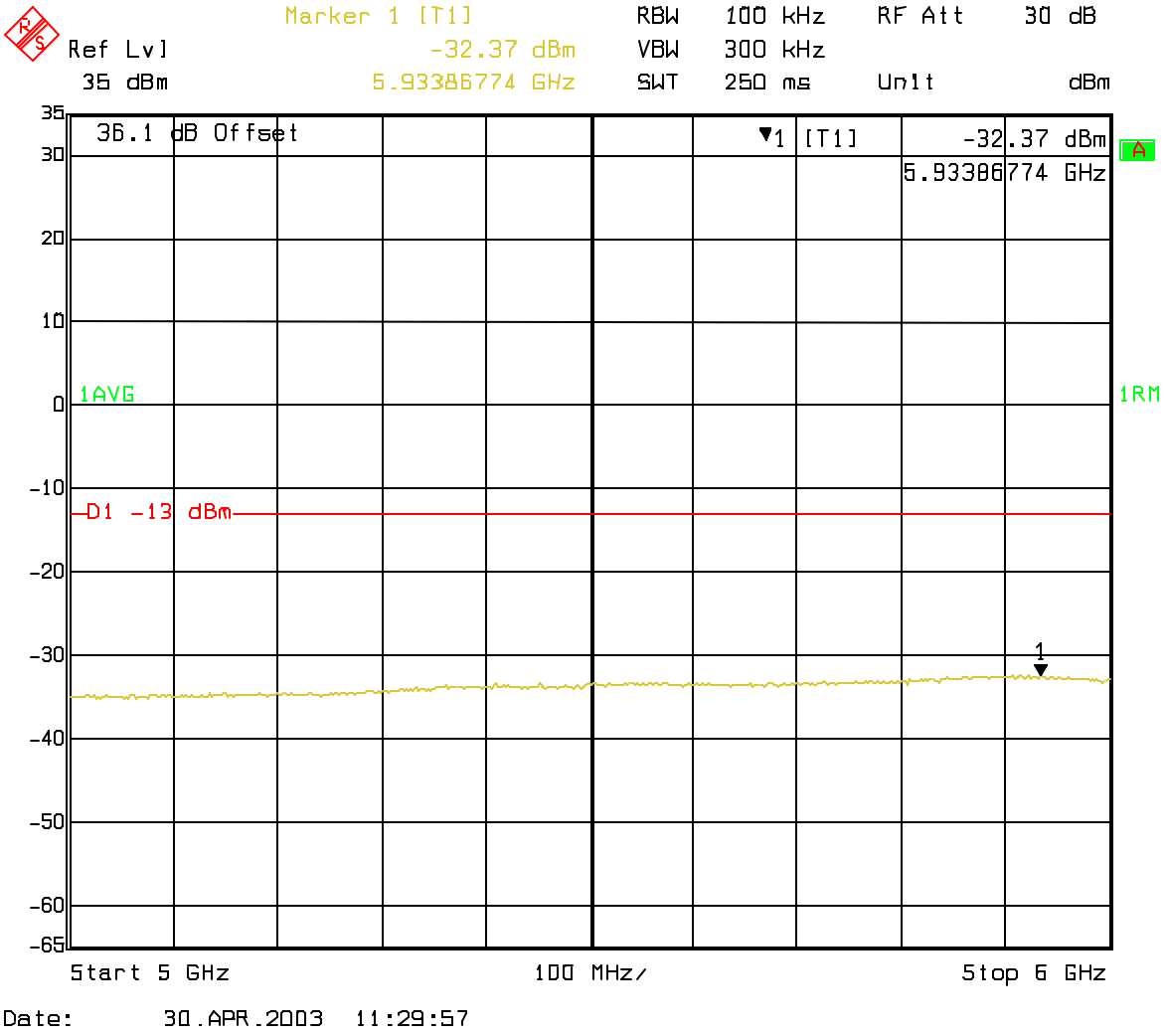
CH 4 Spurious 3-4GHz



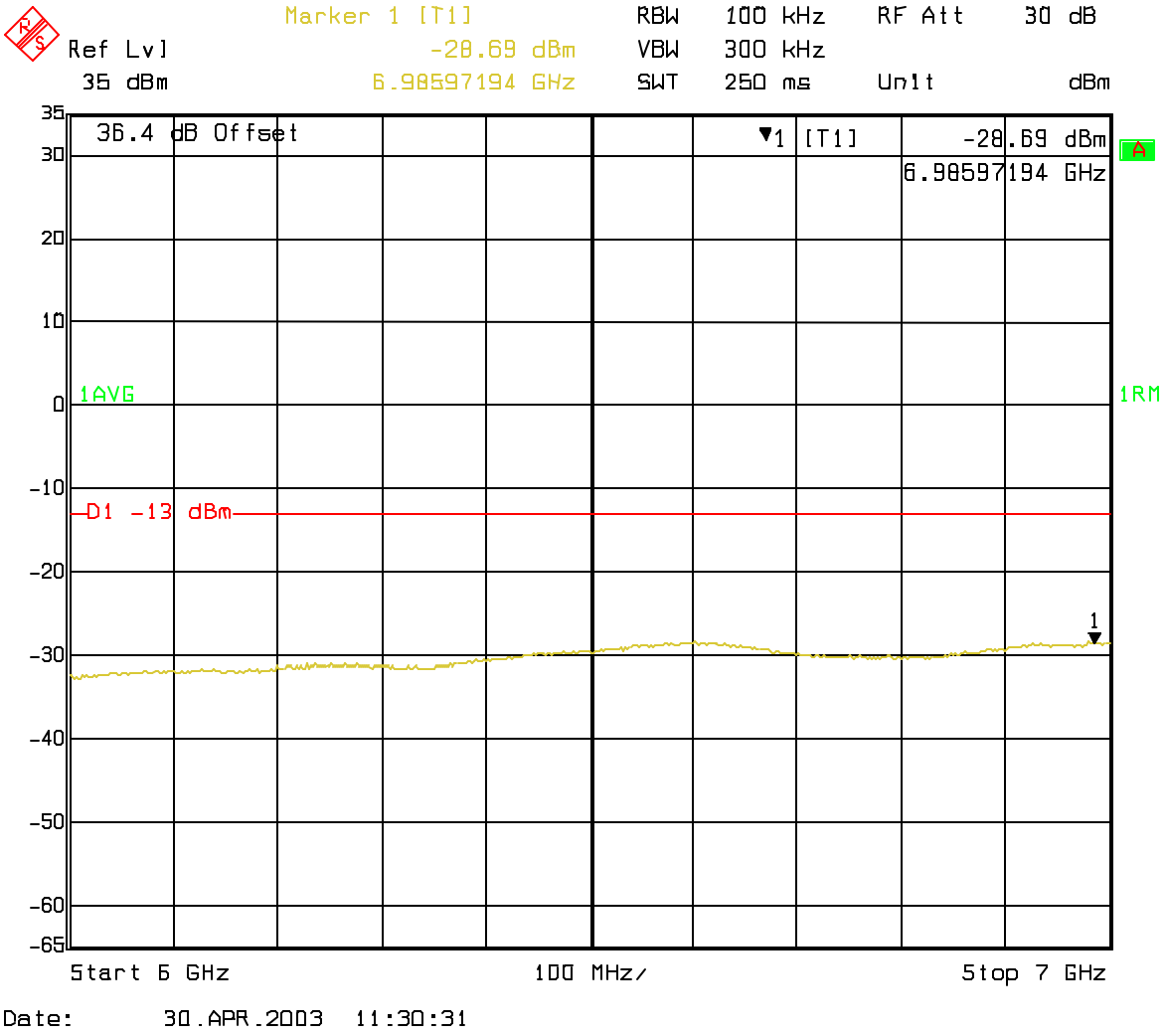
CH 4 Spurious 4-5GHz



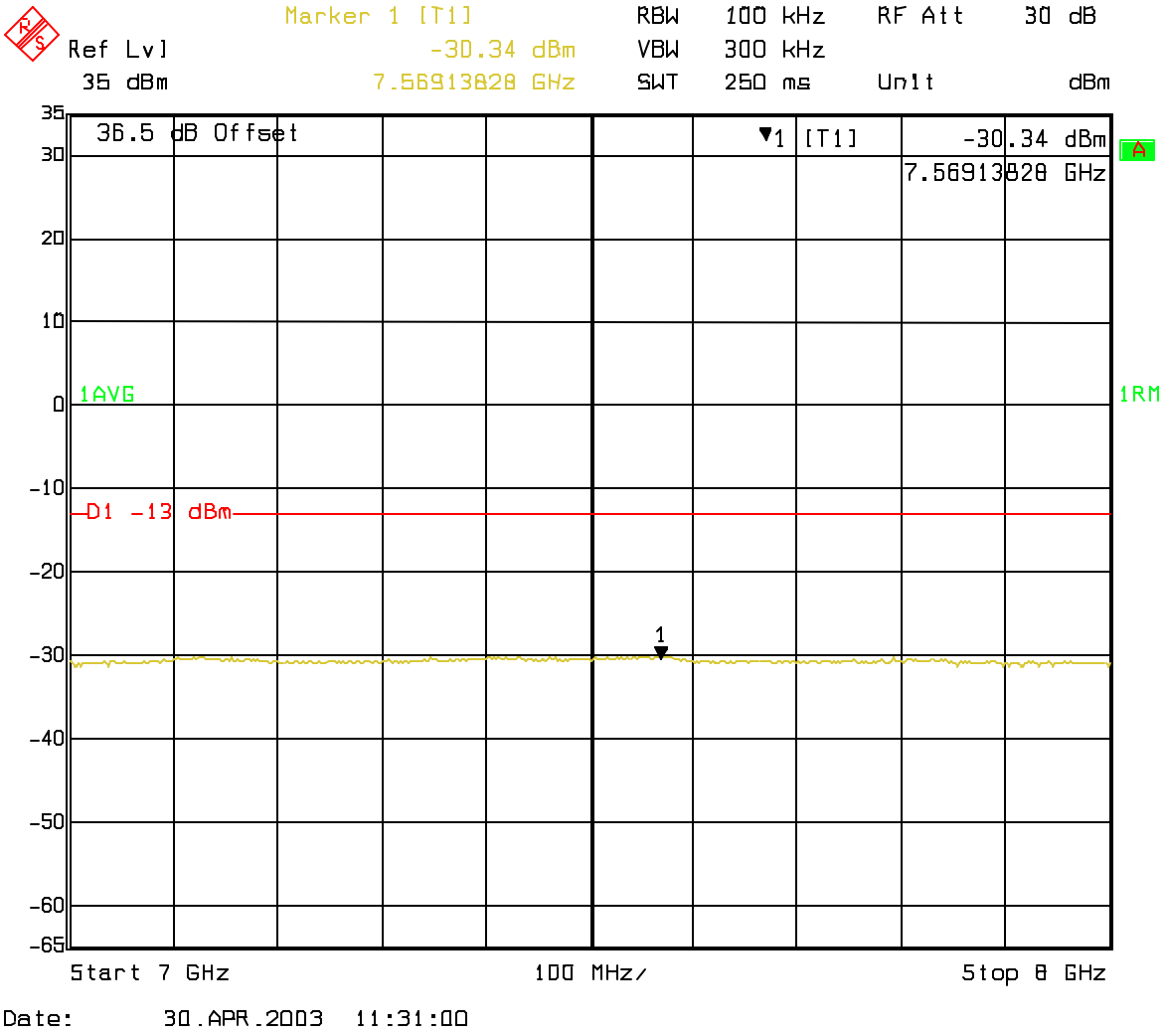
CH 4 Spurious 5-6GHz



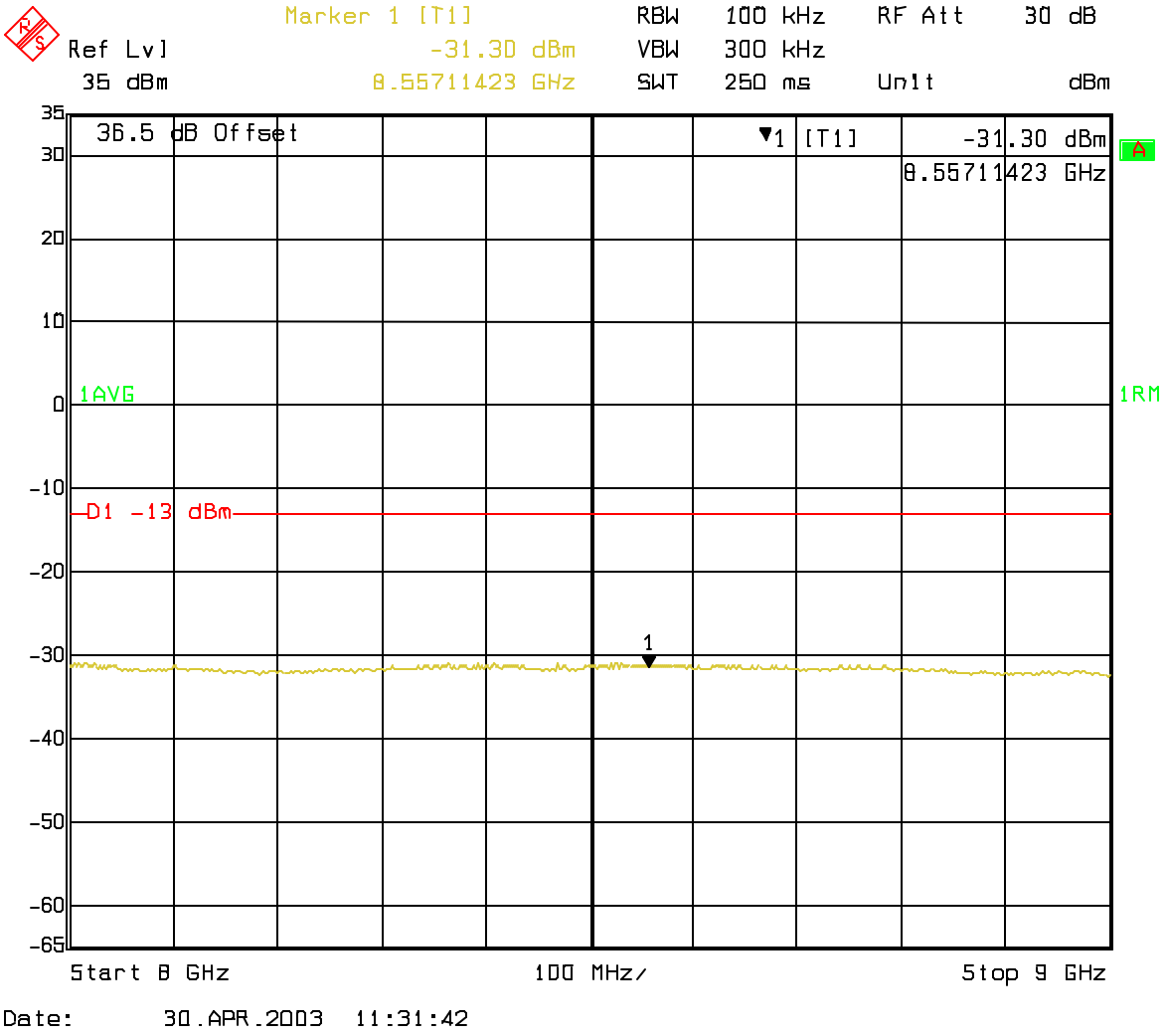
CH 4 Spurious 6-7GHz



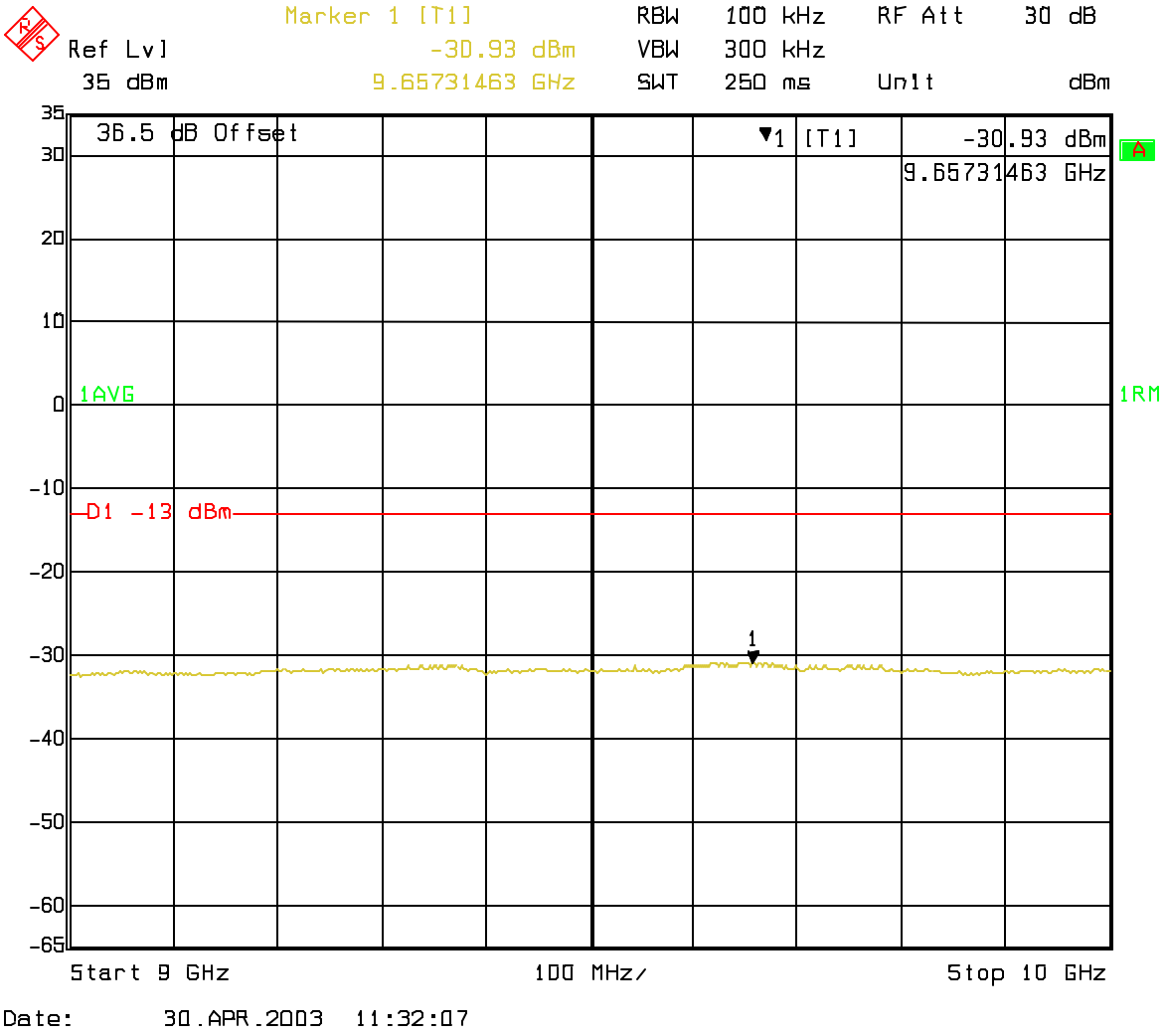
CH 4 Spurious 7-8GHz



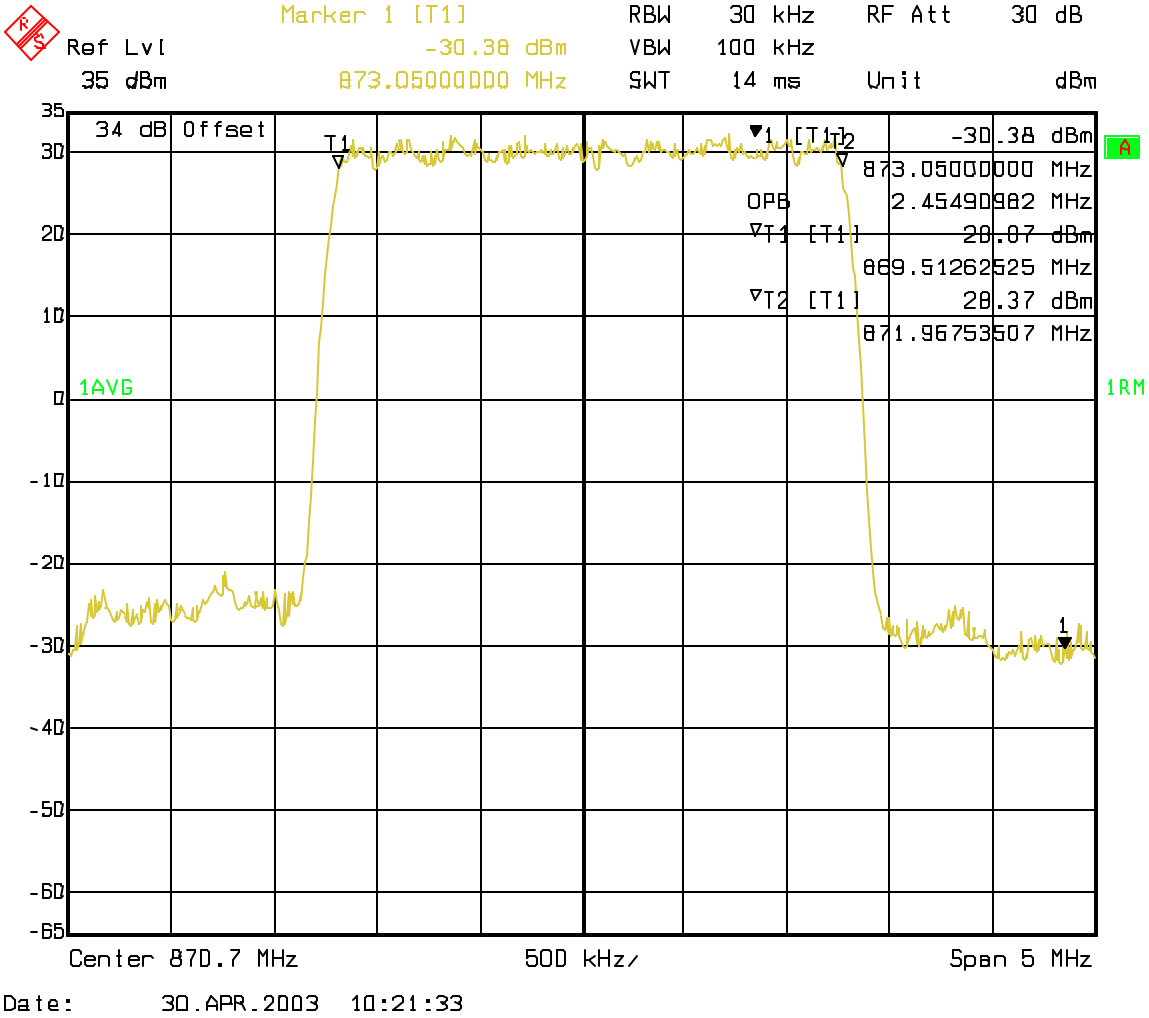
CH 4 Spurious 8-9GHz



CH 4 Spurious 9-10GHz



Chan 4_45 OBW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VBW 100 kHz
SWT 14 ms
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1RM
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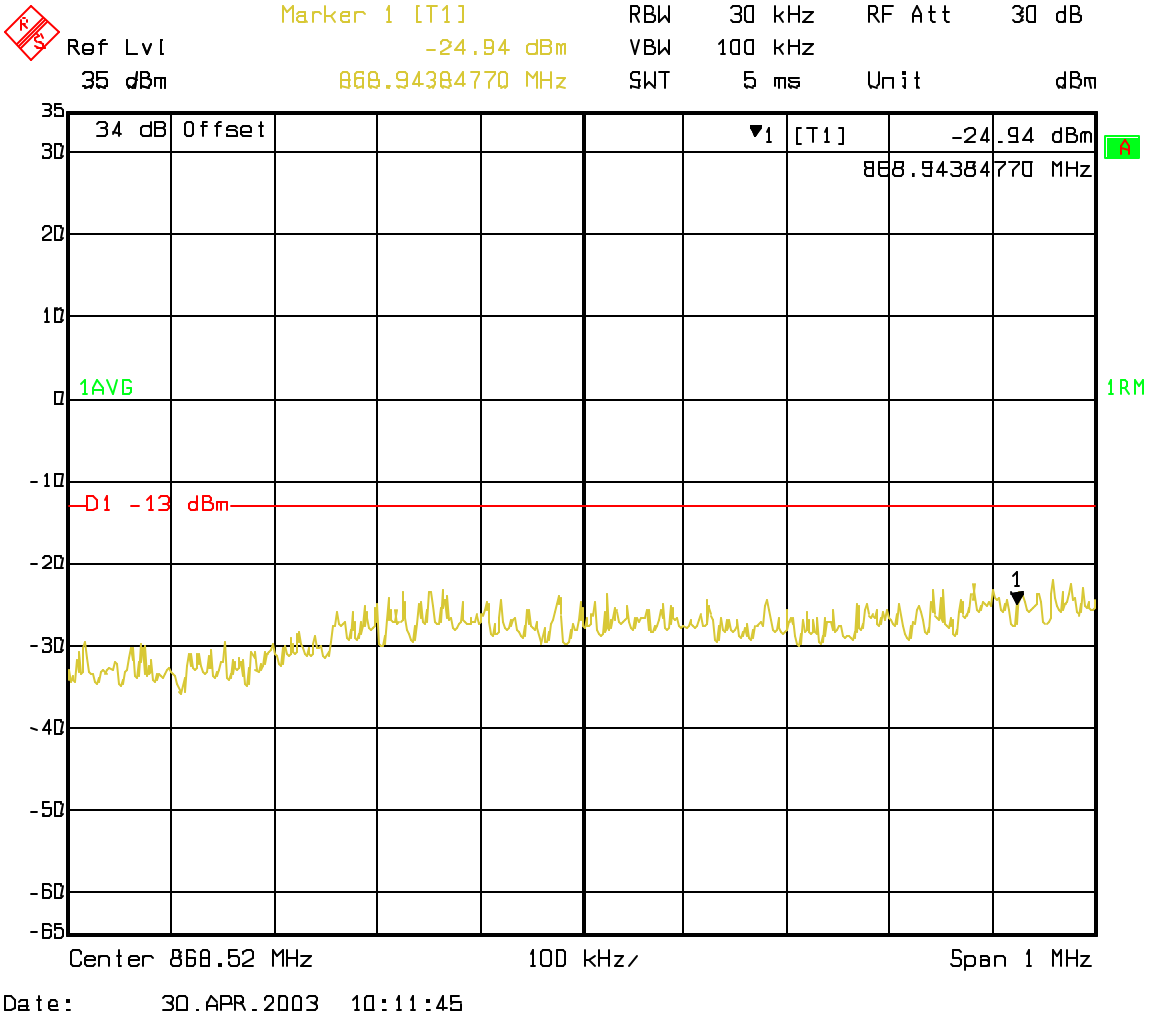
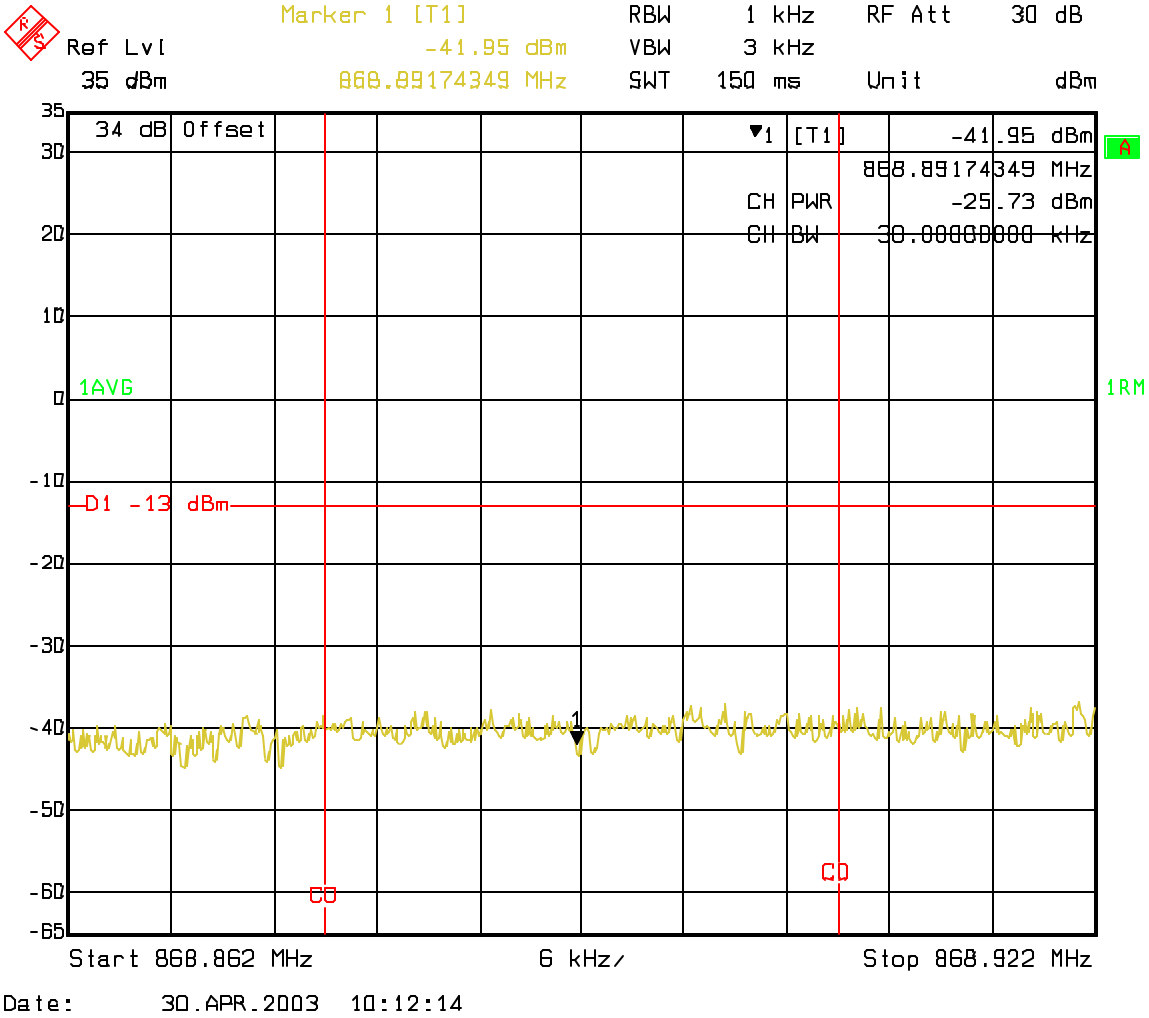
Date: 30.APR.2003 10:21:33

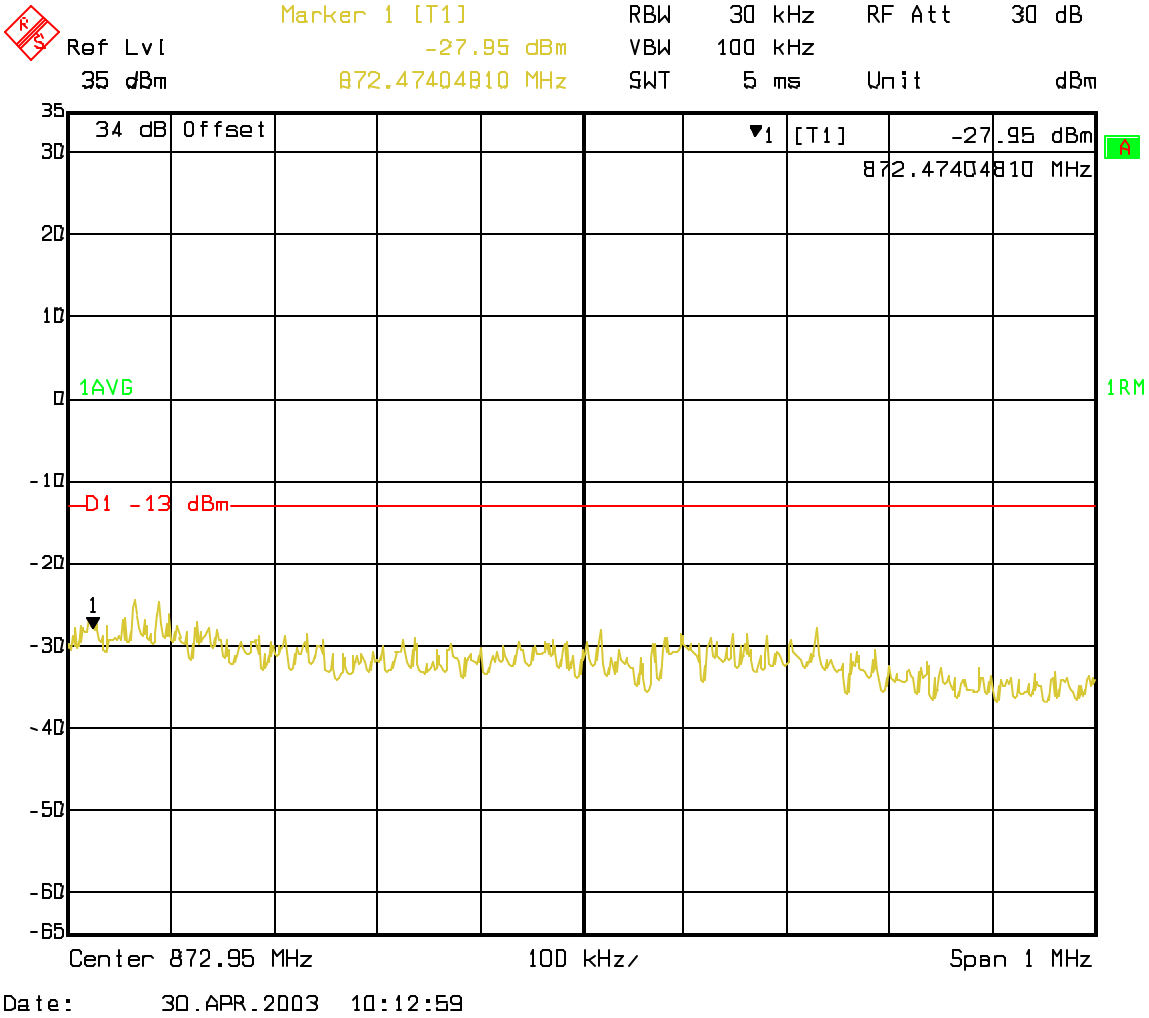
Chan 4_45 Adjacent 1MHz lower



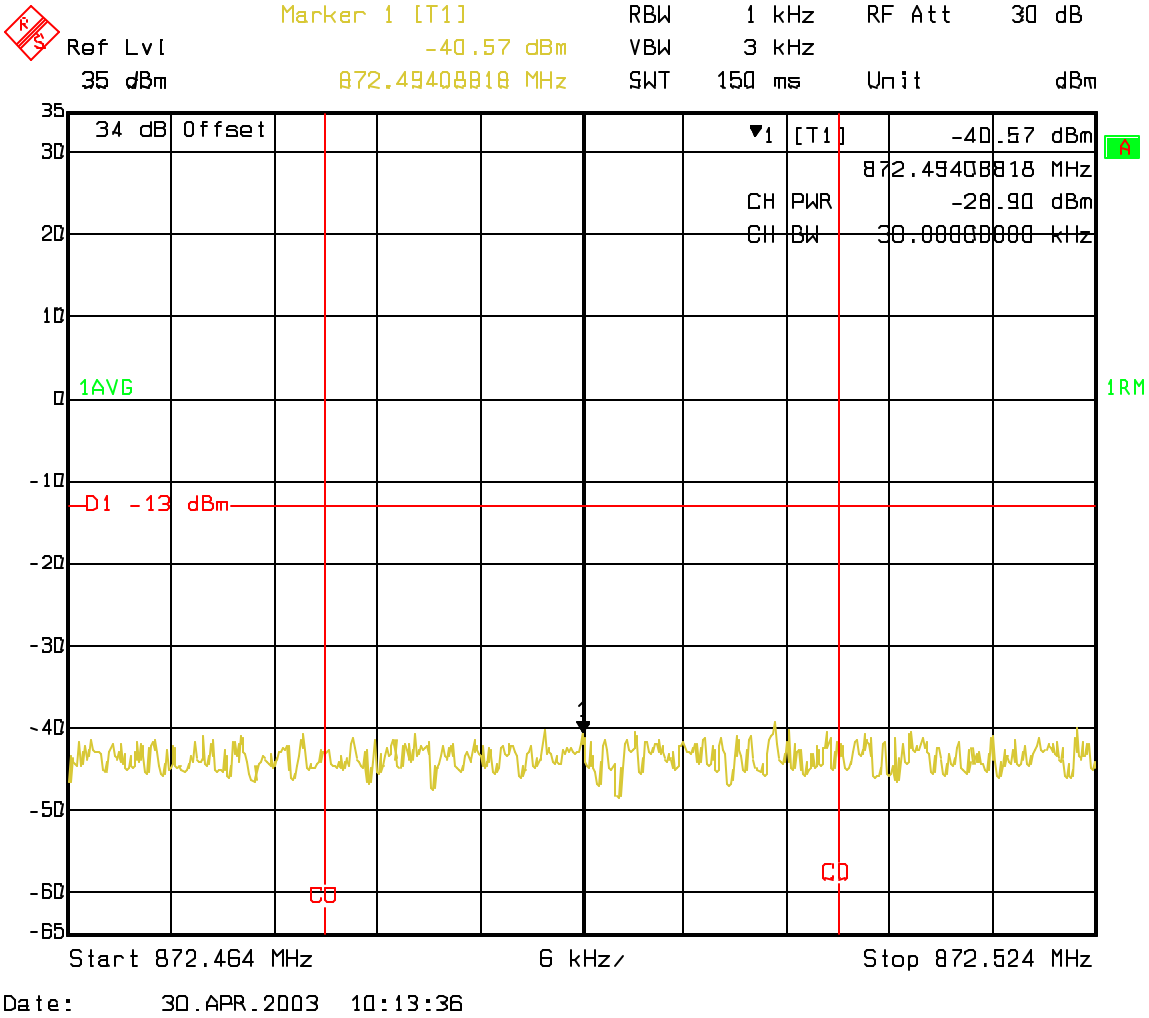
Chan 4_45 Adjacent 1MHz lower 60kHz BW



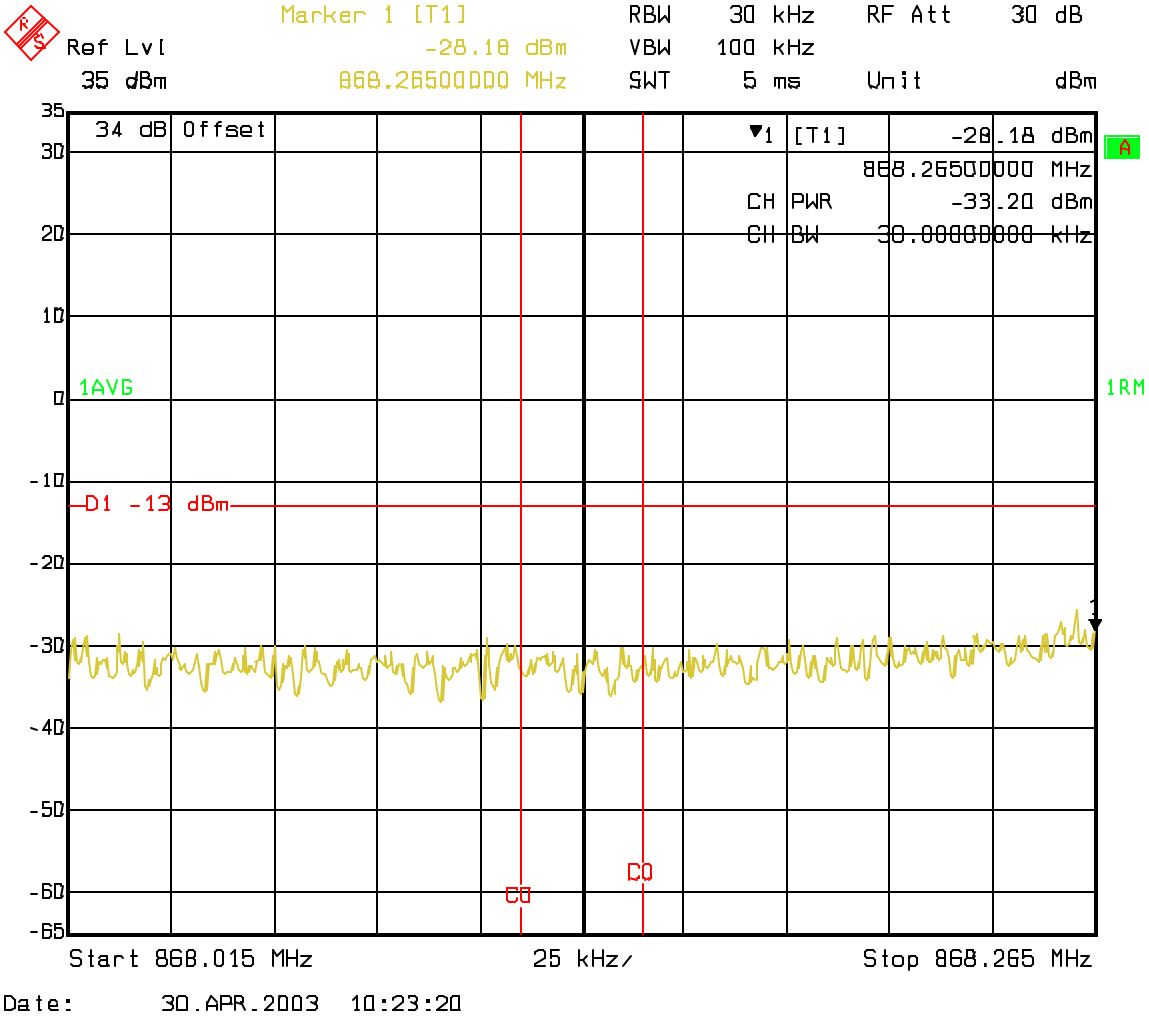
Chan 4_45 Adjacent 1MHz upper



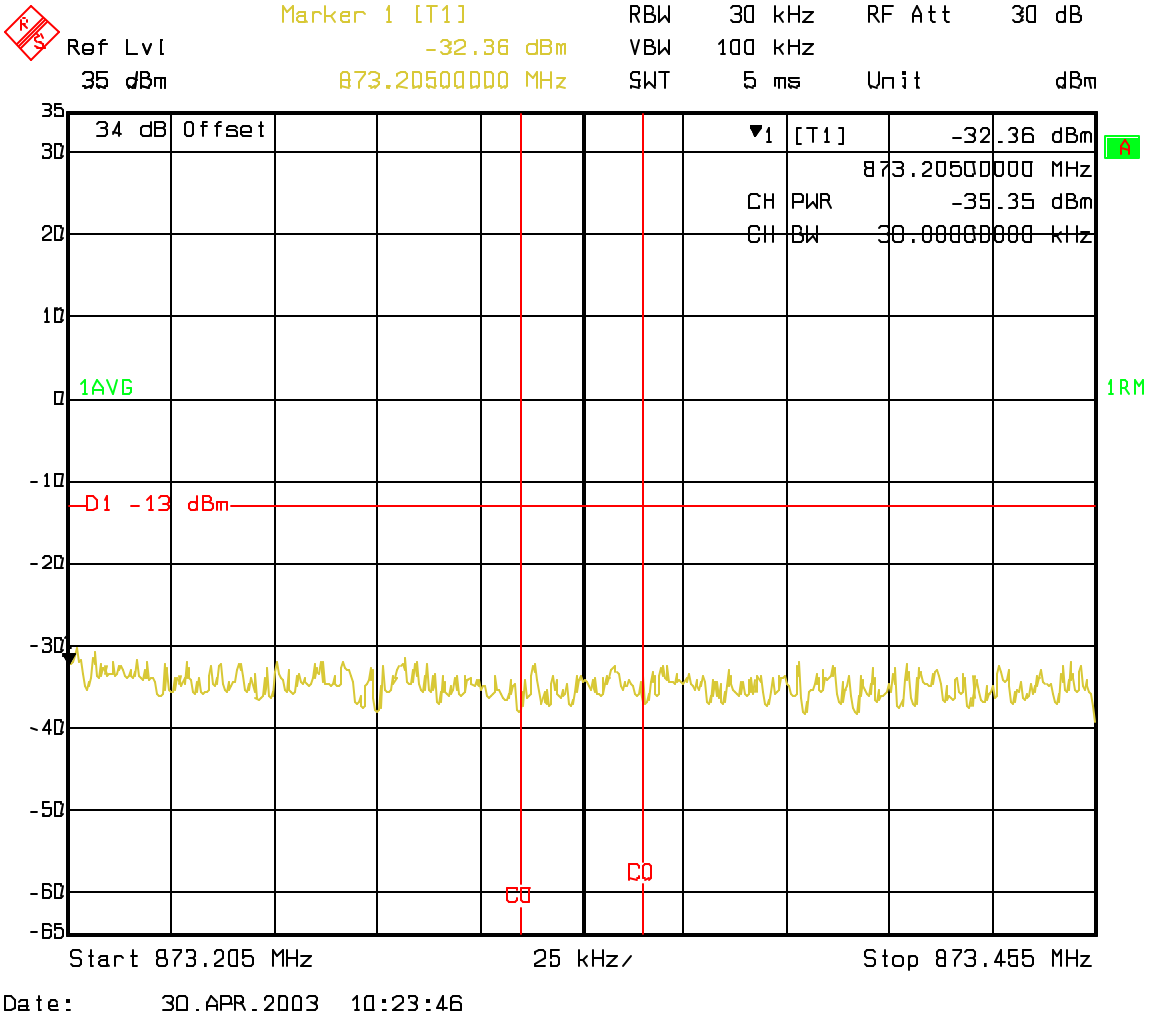
Chan 4_45 Adjacent 1MHz upper 60kHz BW



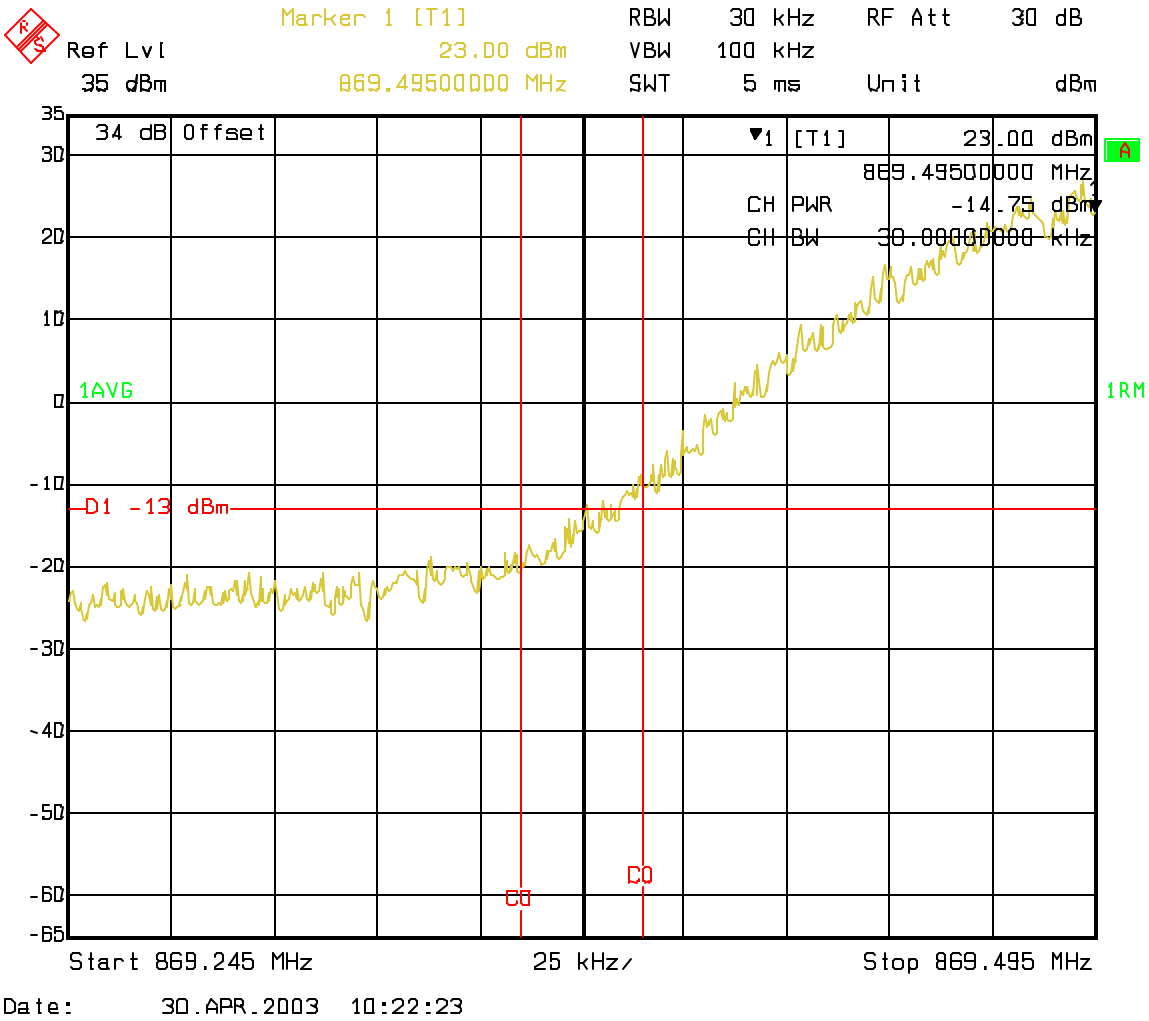
Chan 4_45 1.98MHz offset lower



Chan 4_45 1.98MHz offset upper



Chan 4_45 750kHz offset lower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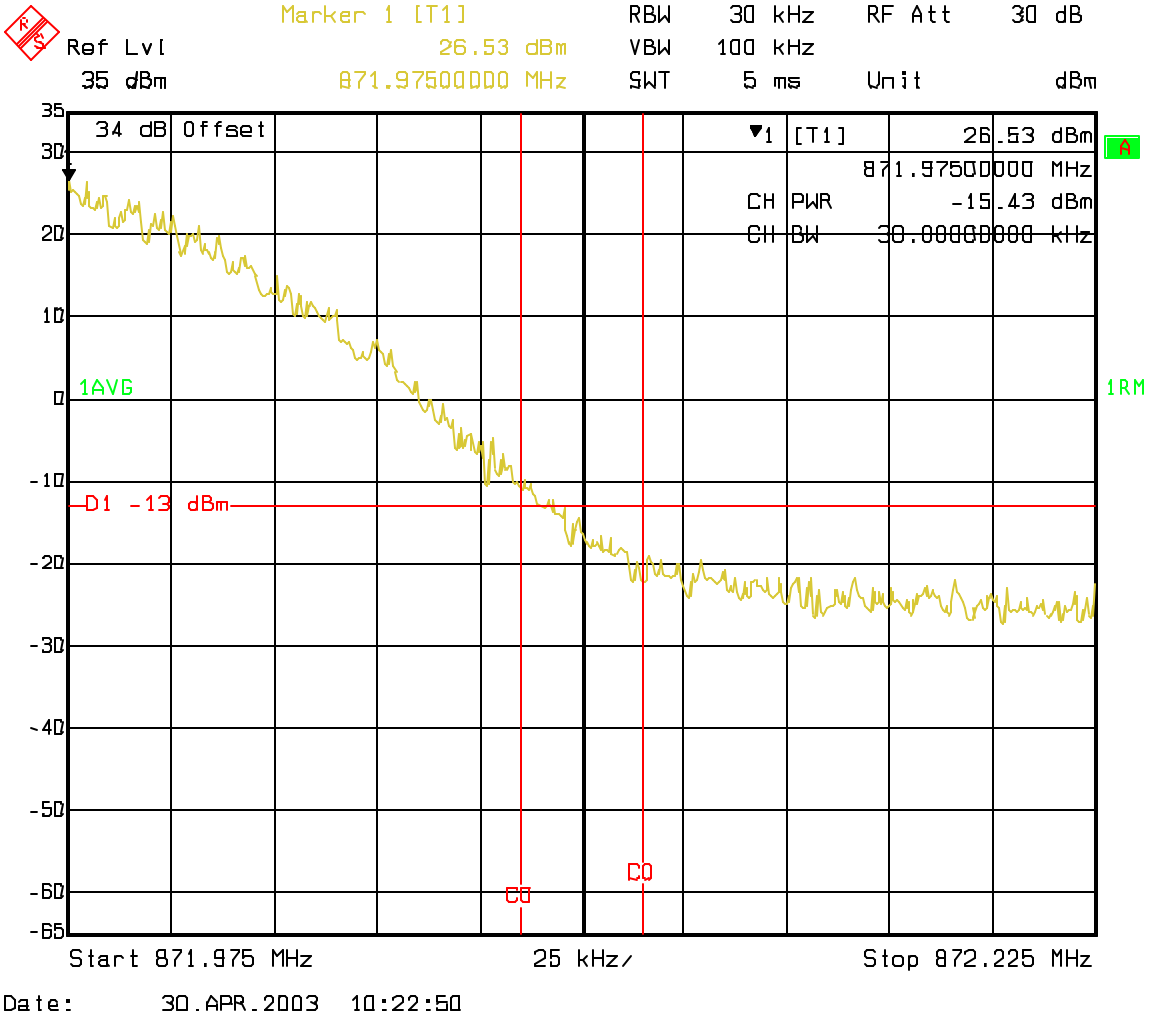
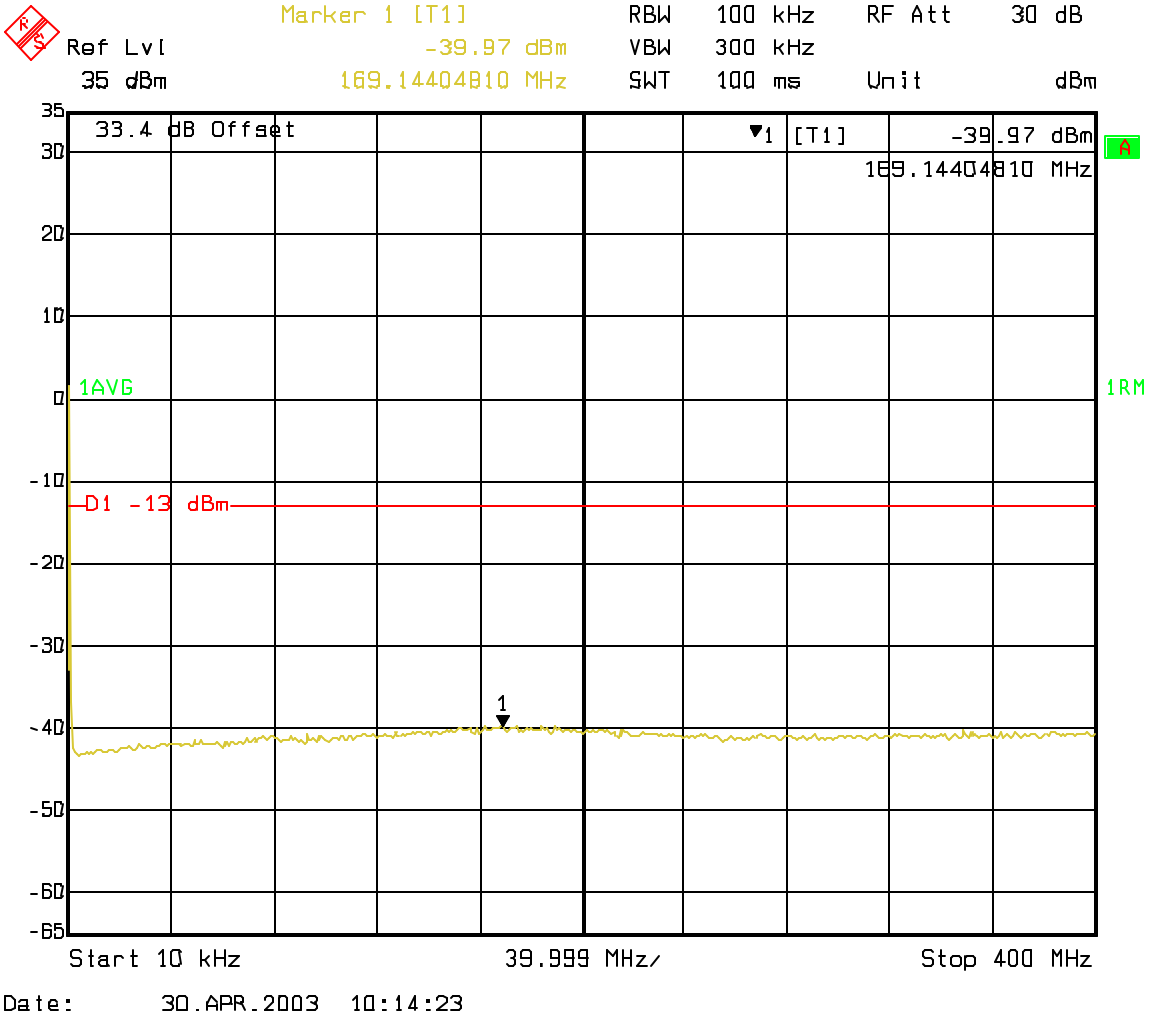
869.49500000 MHz
Ref Lvl
35 dBm
RBW 30 kHz
VBW 100 kHz
SWT 5 ms
RF Att 30 dB
Unit dBm
34 dB Offset
▼1 [T1] 23.00 dBm
869.49500000 MHz
CH PWR -14.75 dBm
CH BW 30.00000000 kHz
1AVG
1RM
D1 -13 dBm
C0
C0
Start 869.245 MHz
25 kHz/
Stop 869.495 MHz
Date: 30.APR.2003 10:22:23

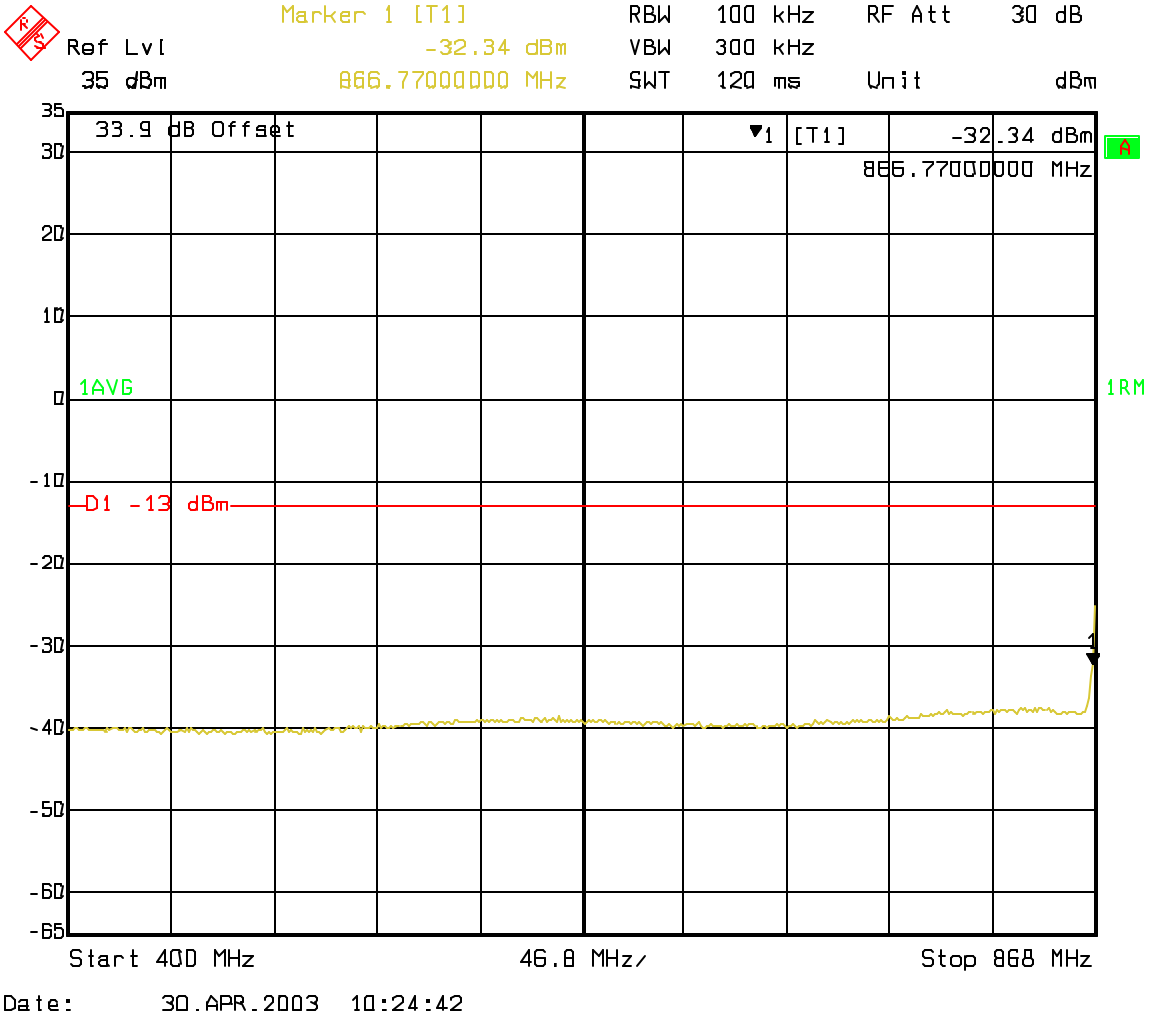
Chan 4_45 750kHz offset upper



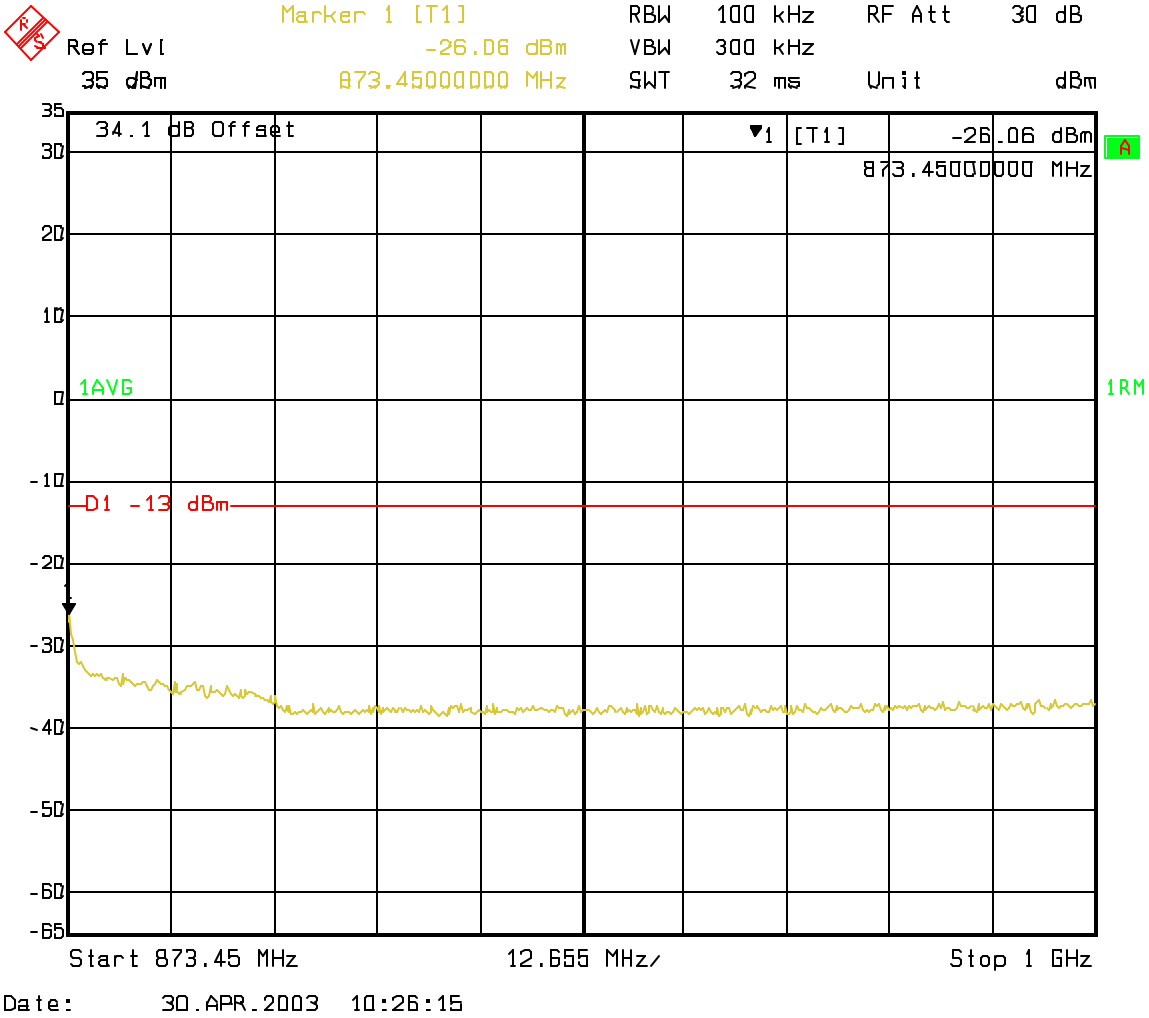
Chan 4_45 Spurious 10kHz – 400MHz



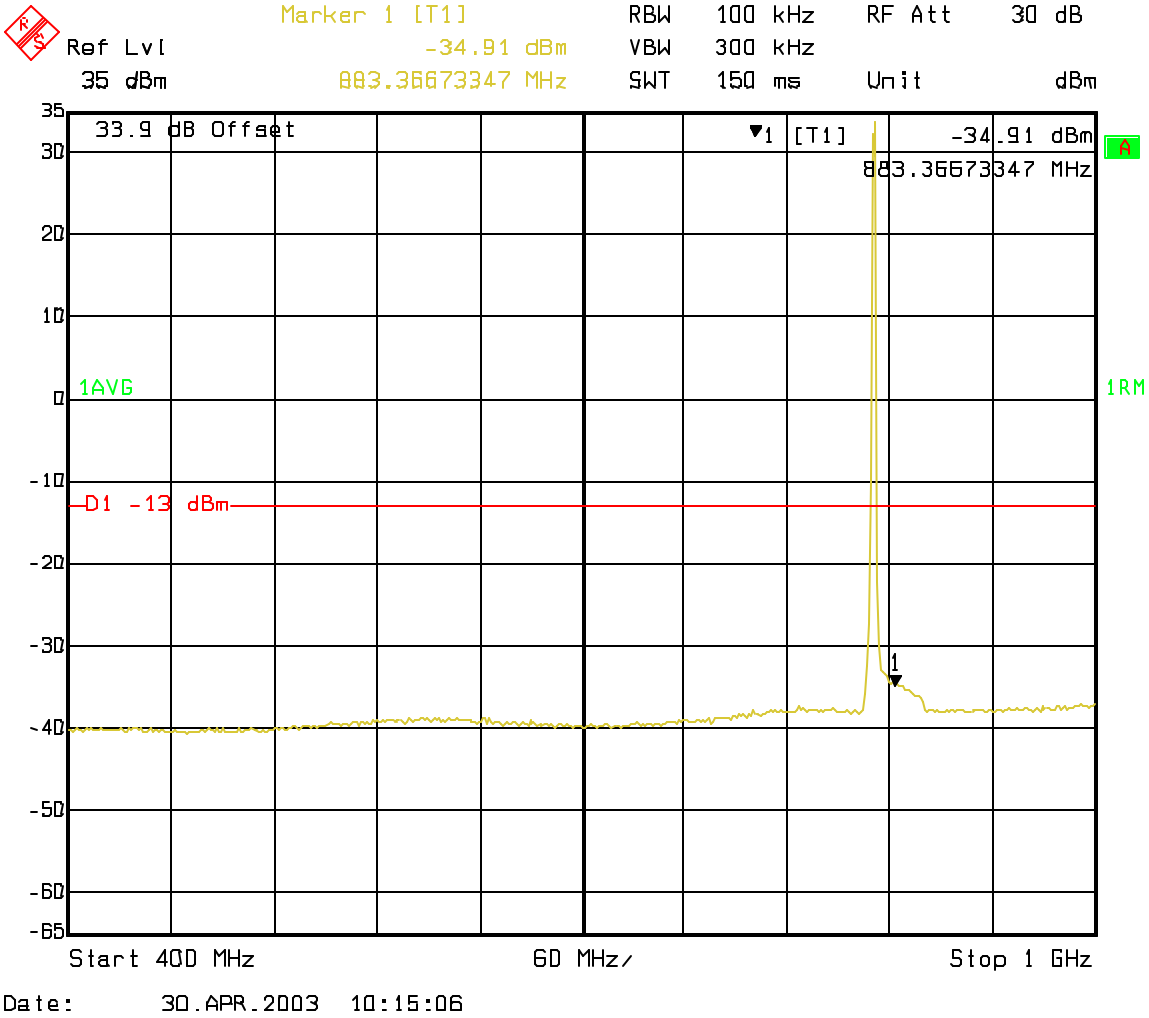
Chan 4_45 Spurious 400-868MHz



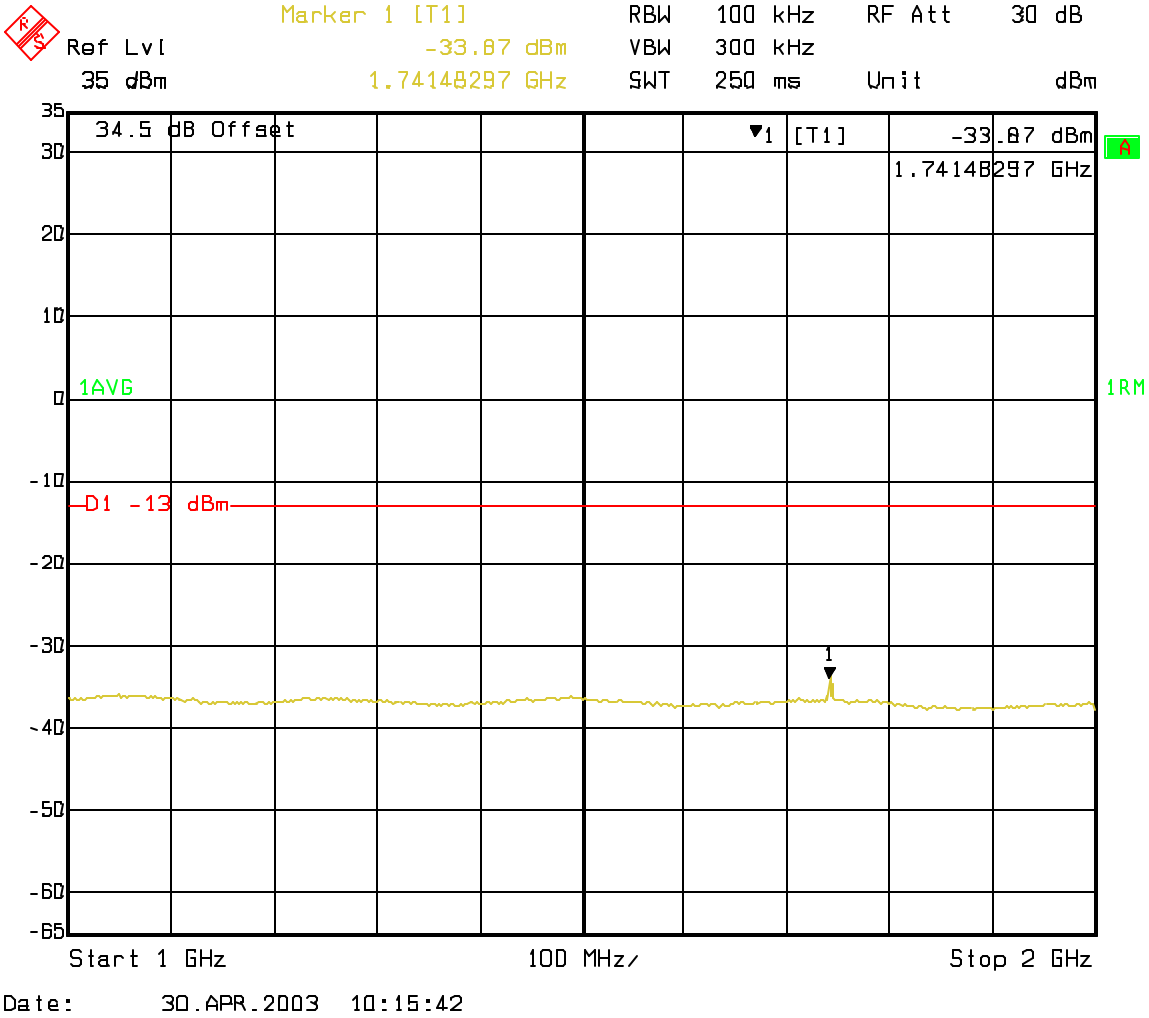
Chan 4_45 Spurious 873MHz-1GHz



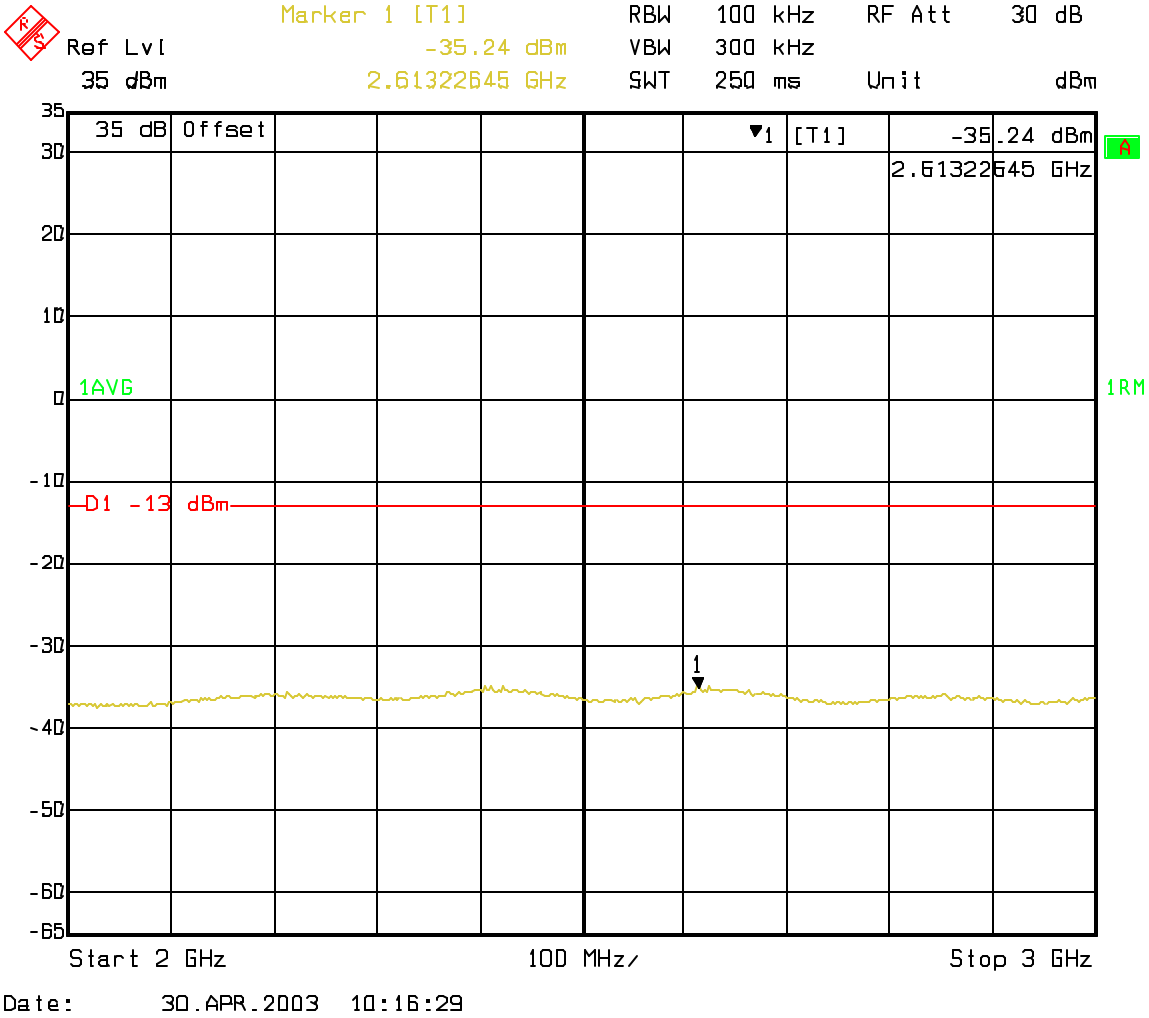
Chan 4_45 Spurious 400-1GHz



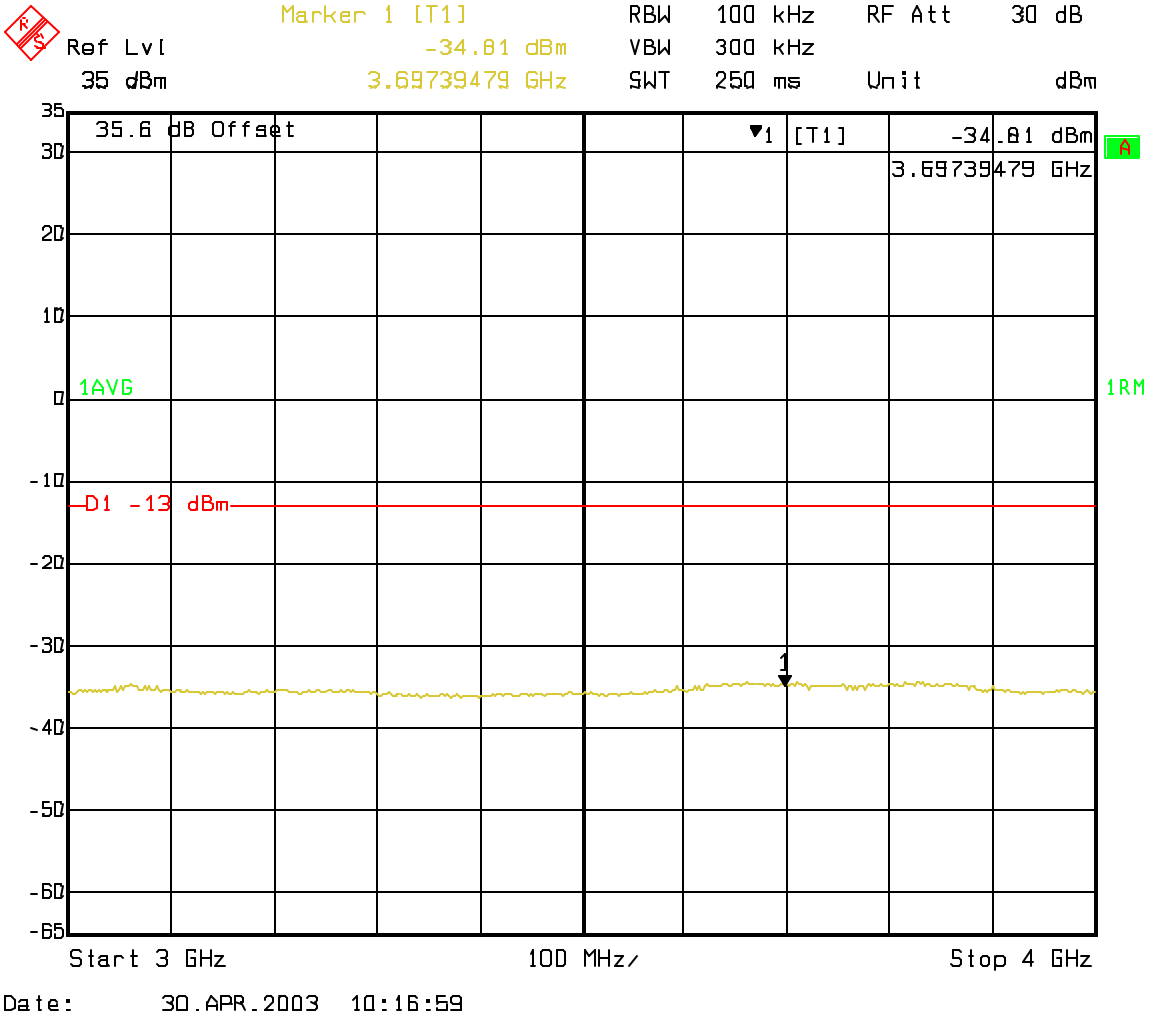
Chan 4_45 Spurious 1-2GHz



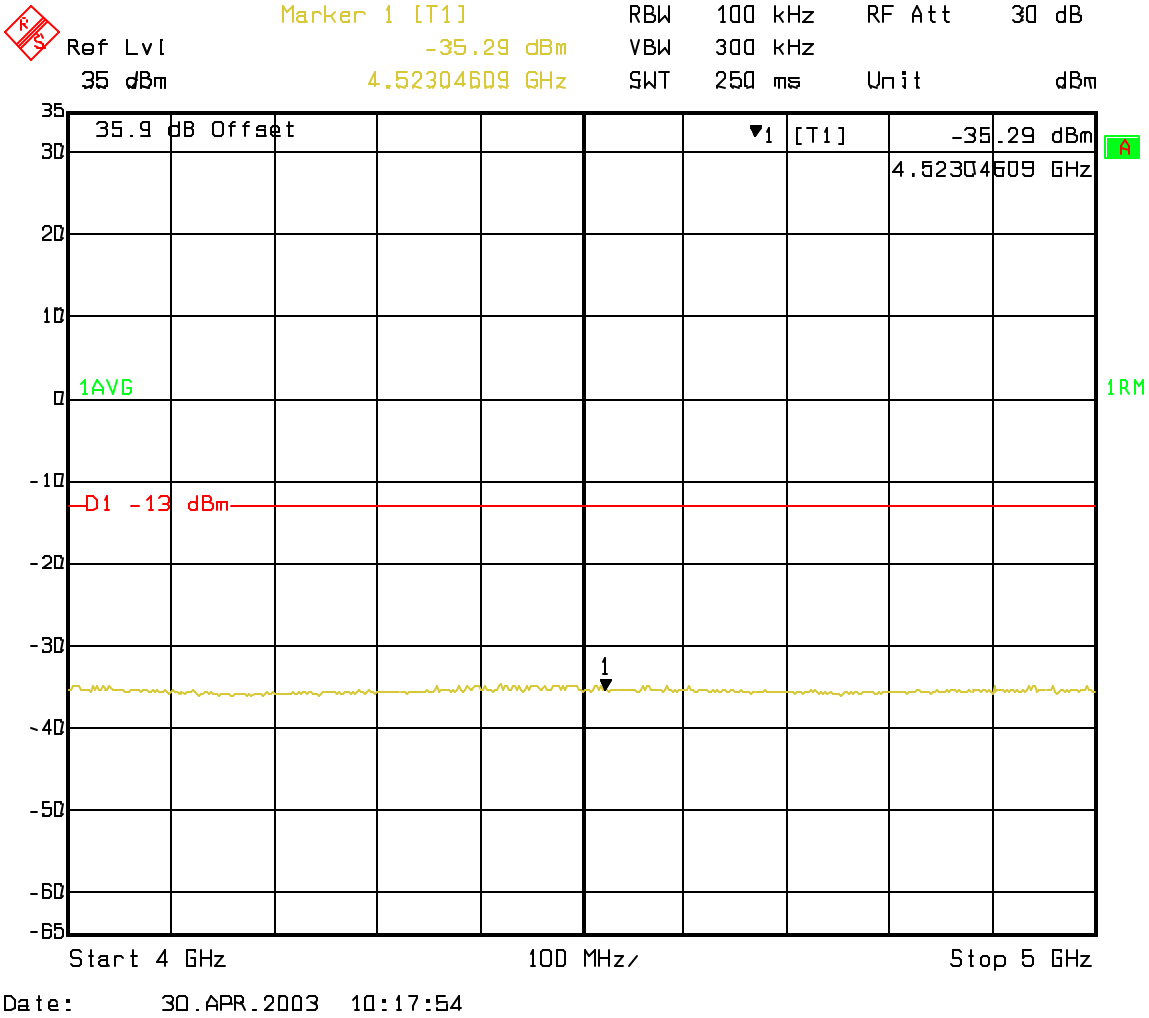
Chan 4_45 Spurious 2-3GHz



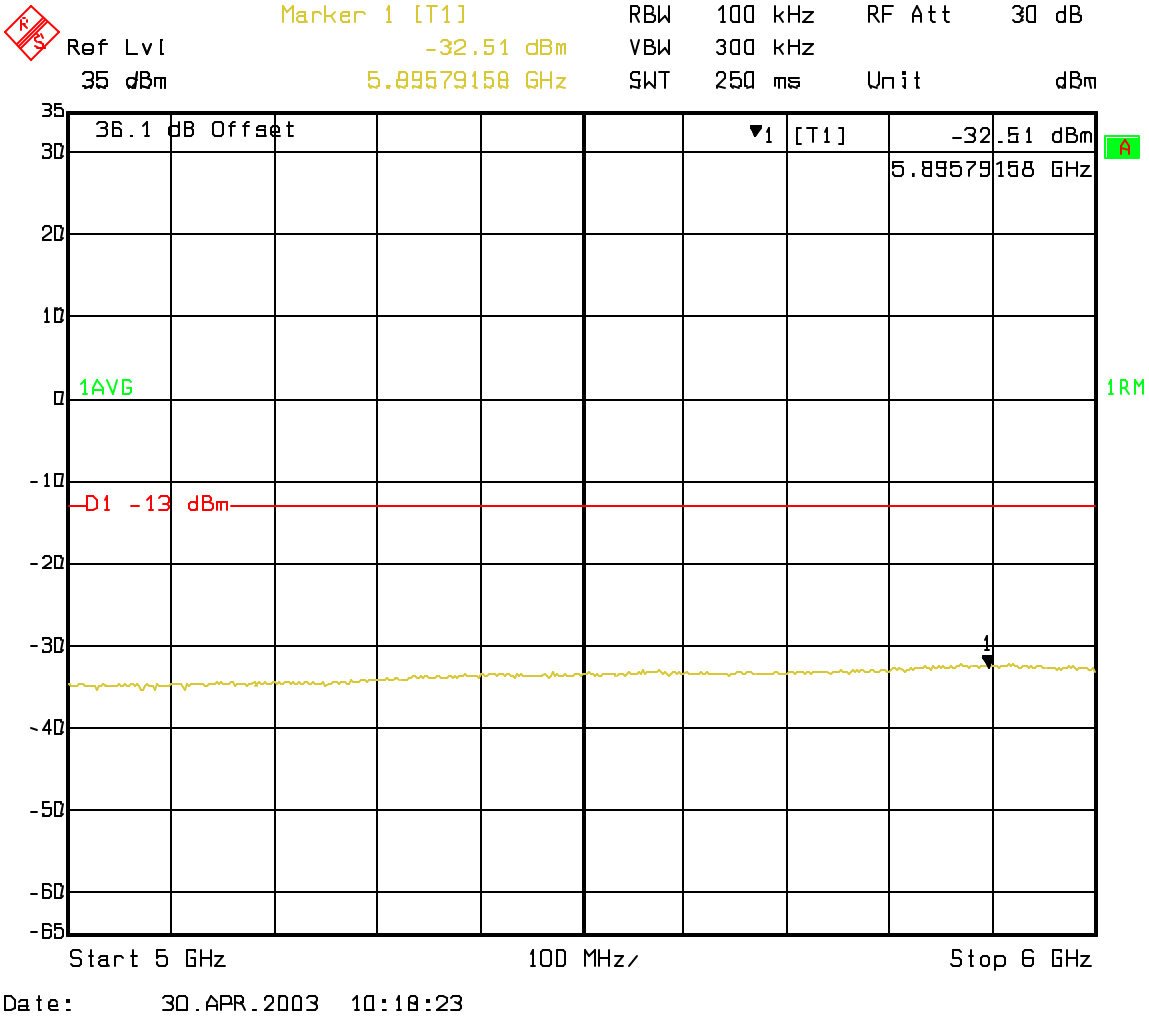
Chan 4_45 Spurious 3-4GHz



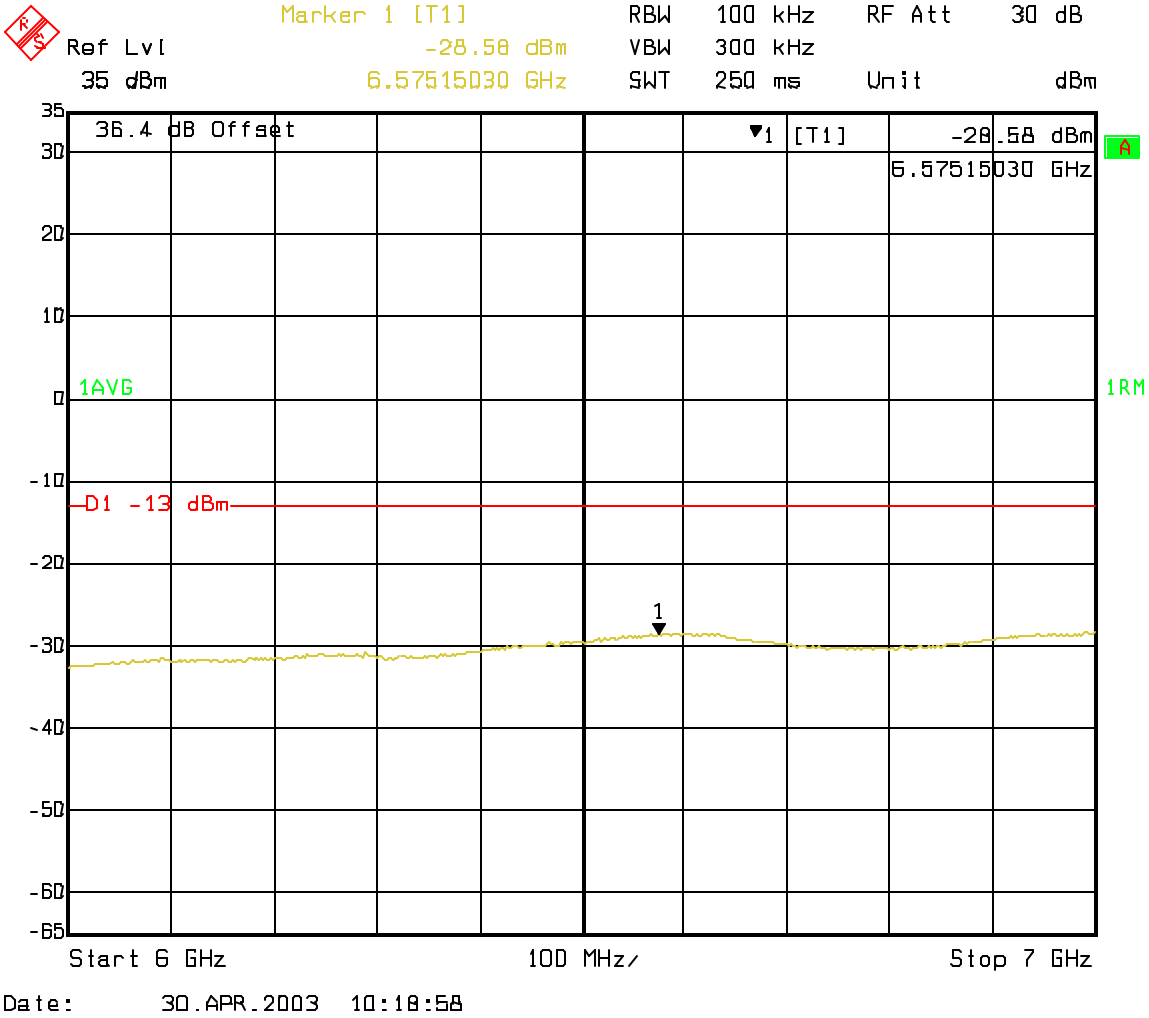
Chan 4_45 Spurious 4-5GHz



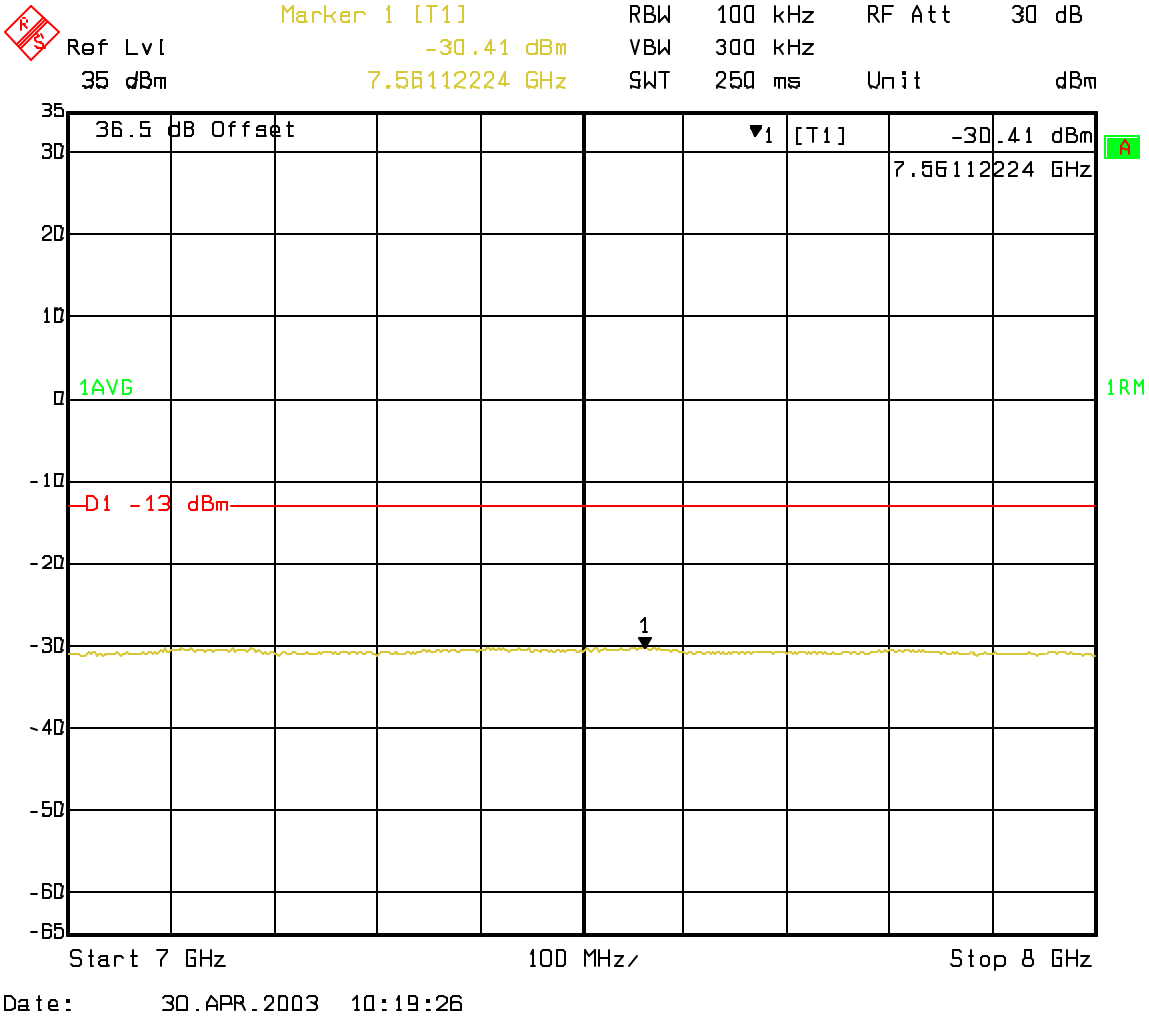
Chan 4_45 Spurious 5-6GHz



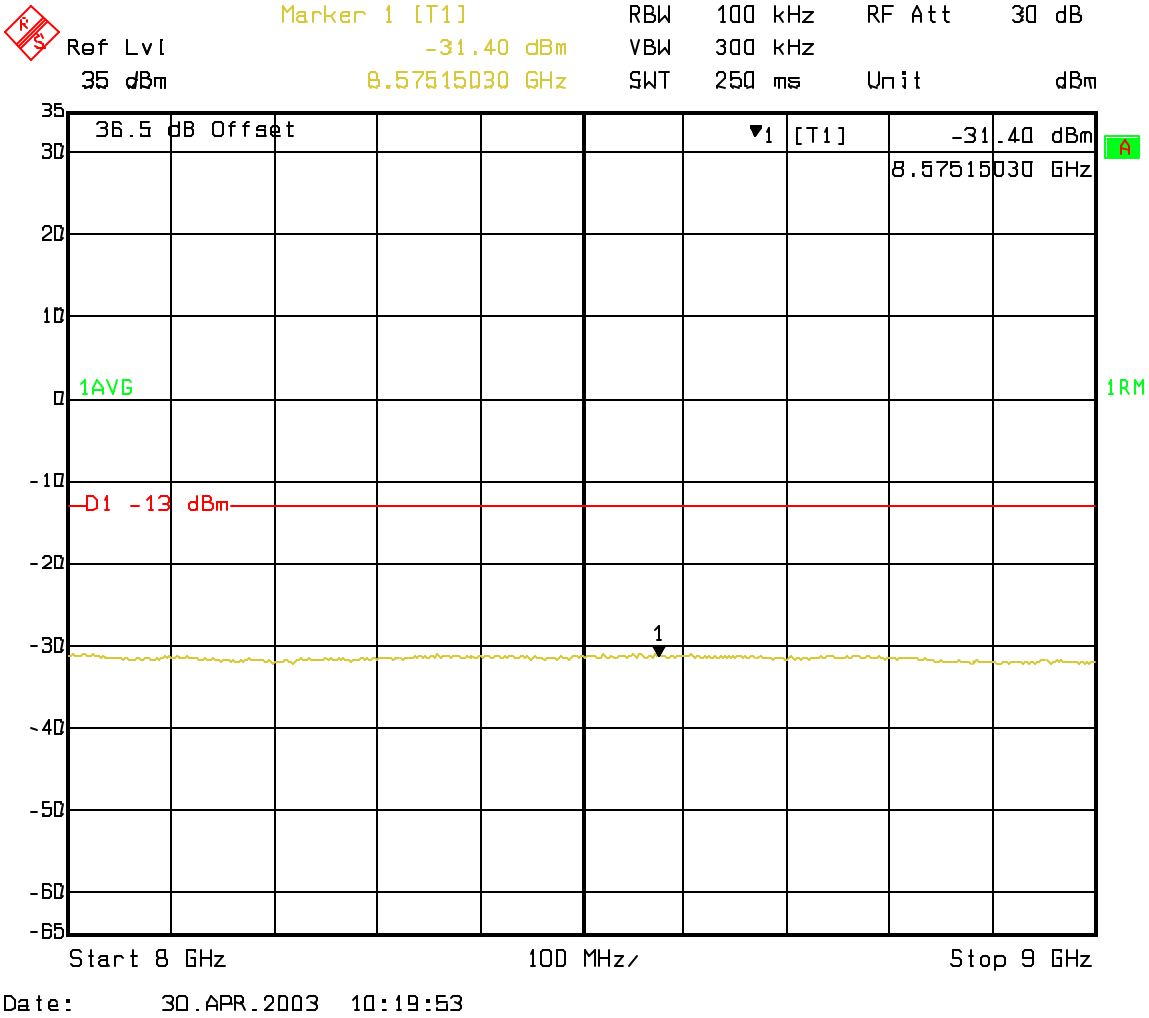
Chan 4_45 Spurious 6-7GHz



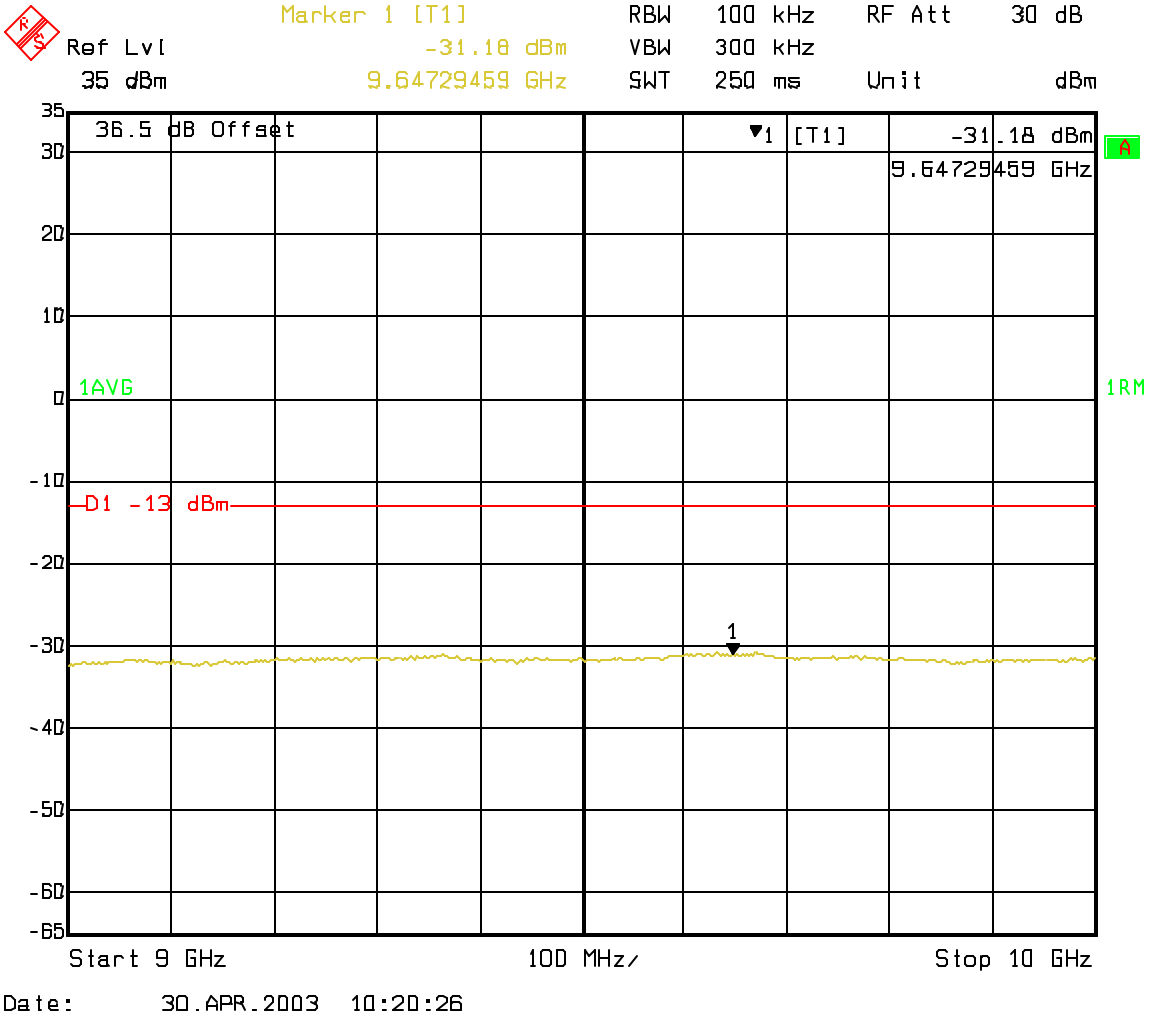
Chan 4_45 Spurious 7-8GHz



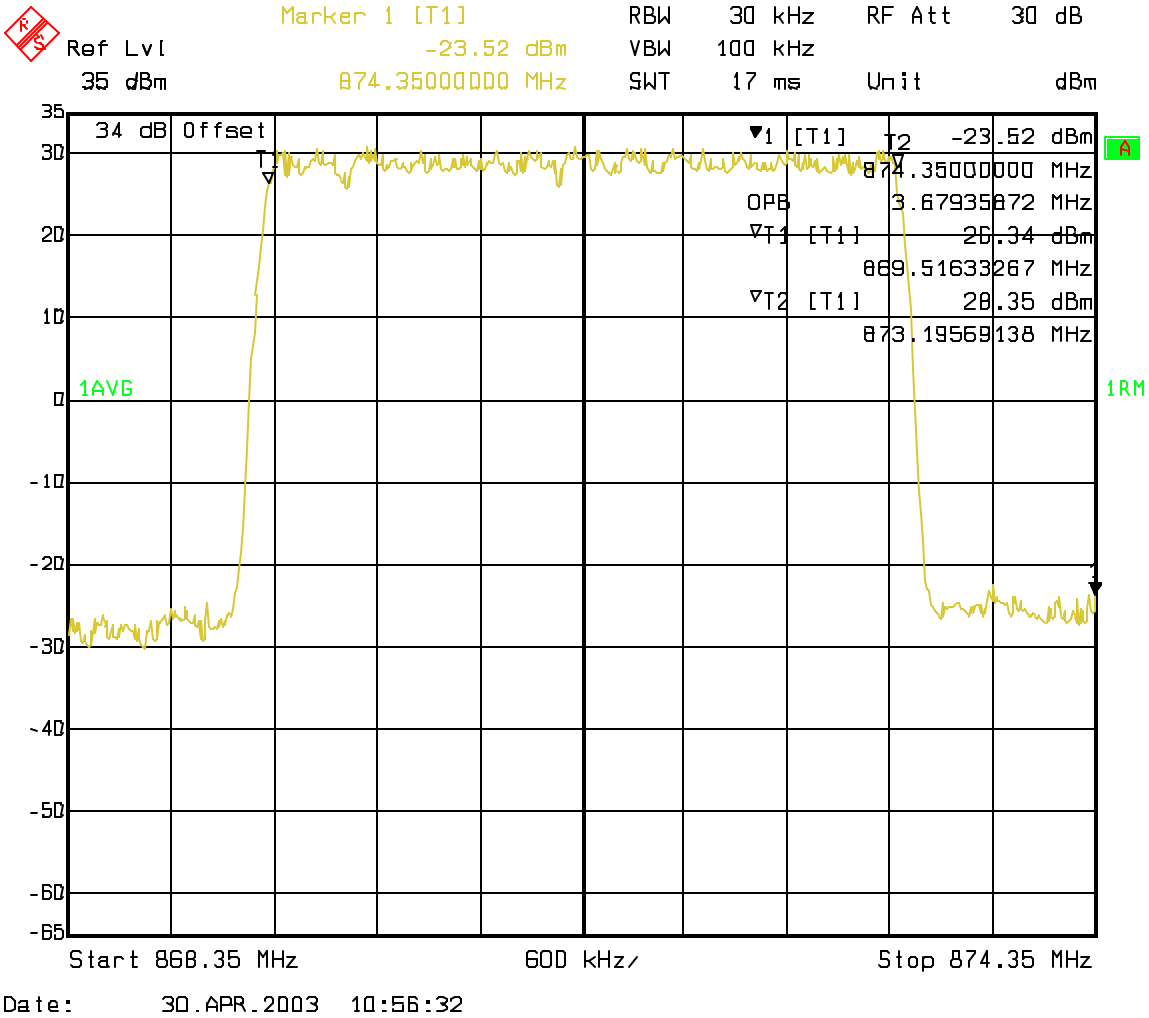
Chan 4_45 Spurious 8-9GHz



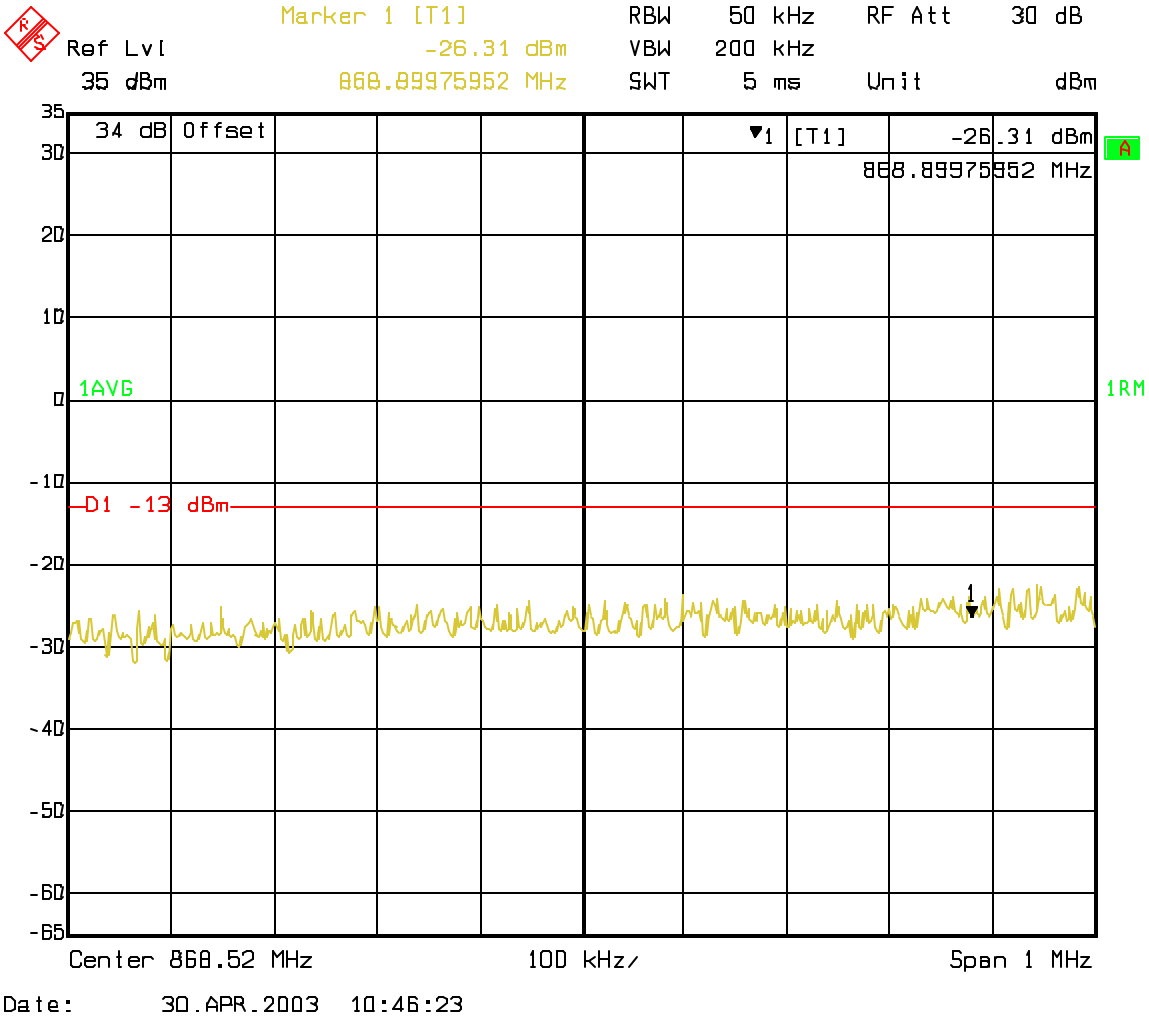
Chan 4_45 Spurious 9-10GHz



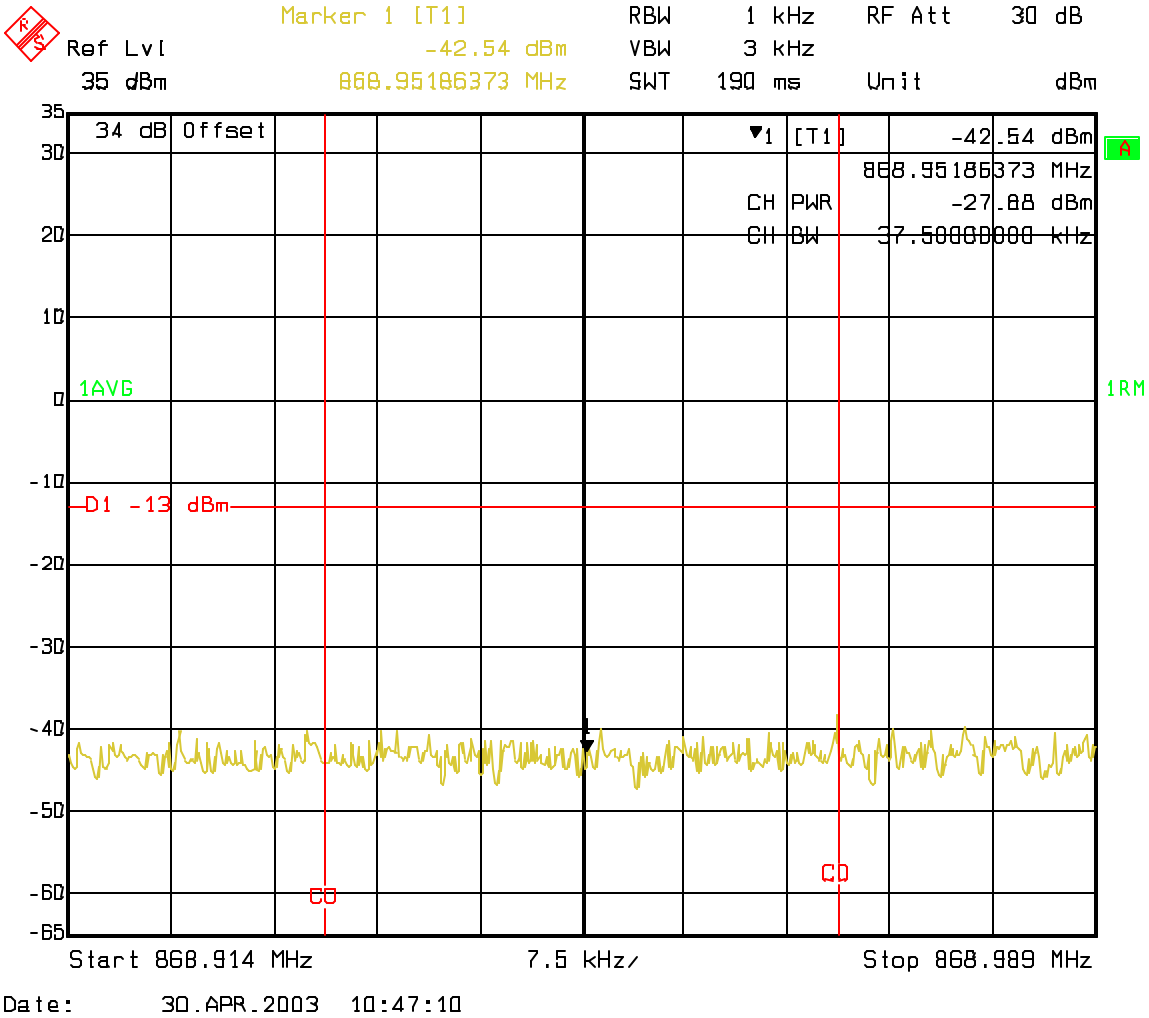
CH 4_45_86 Occupied BW



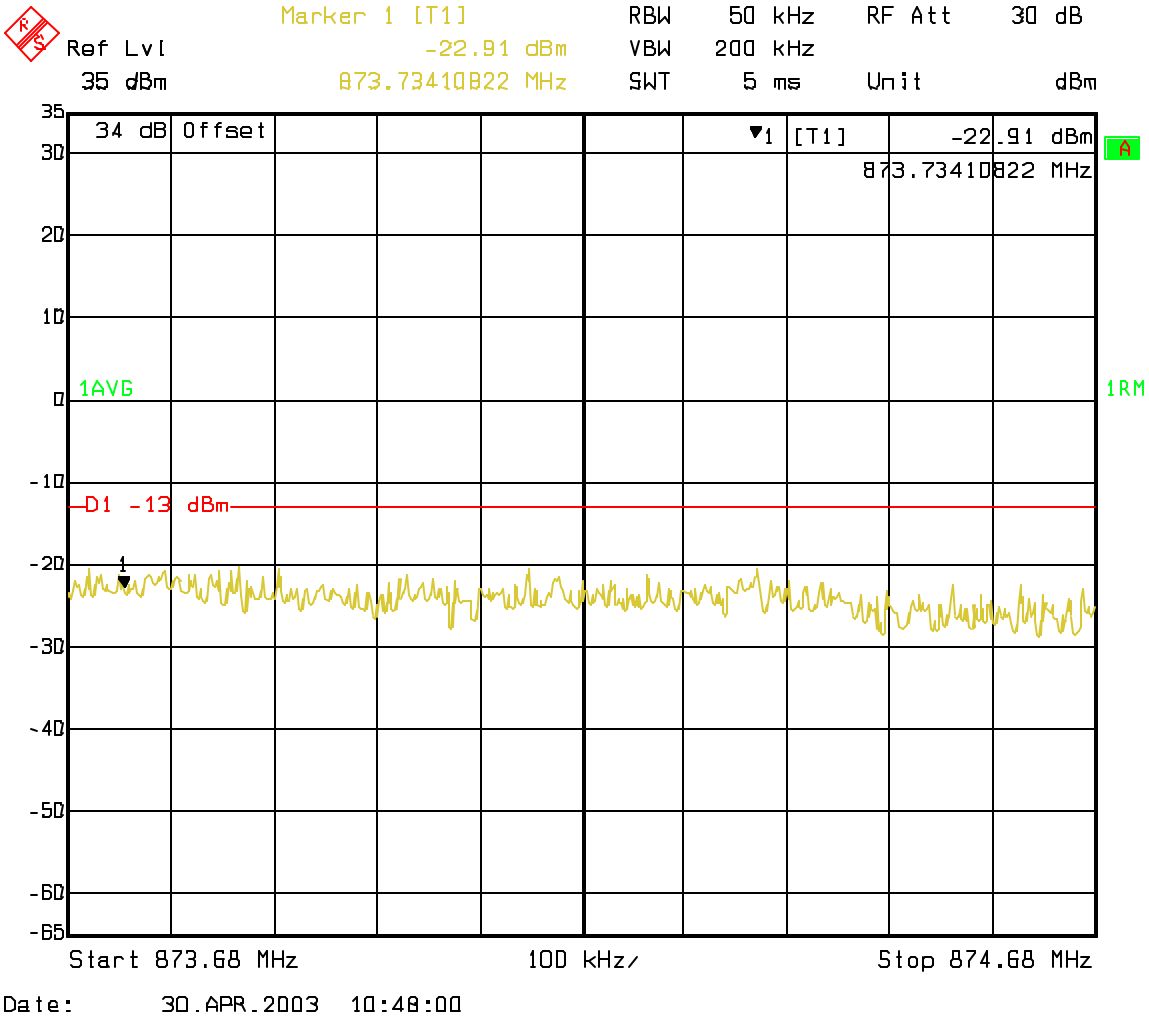
CH 4_45_86 1MHz Lower Adjacent Band Edge



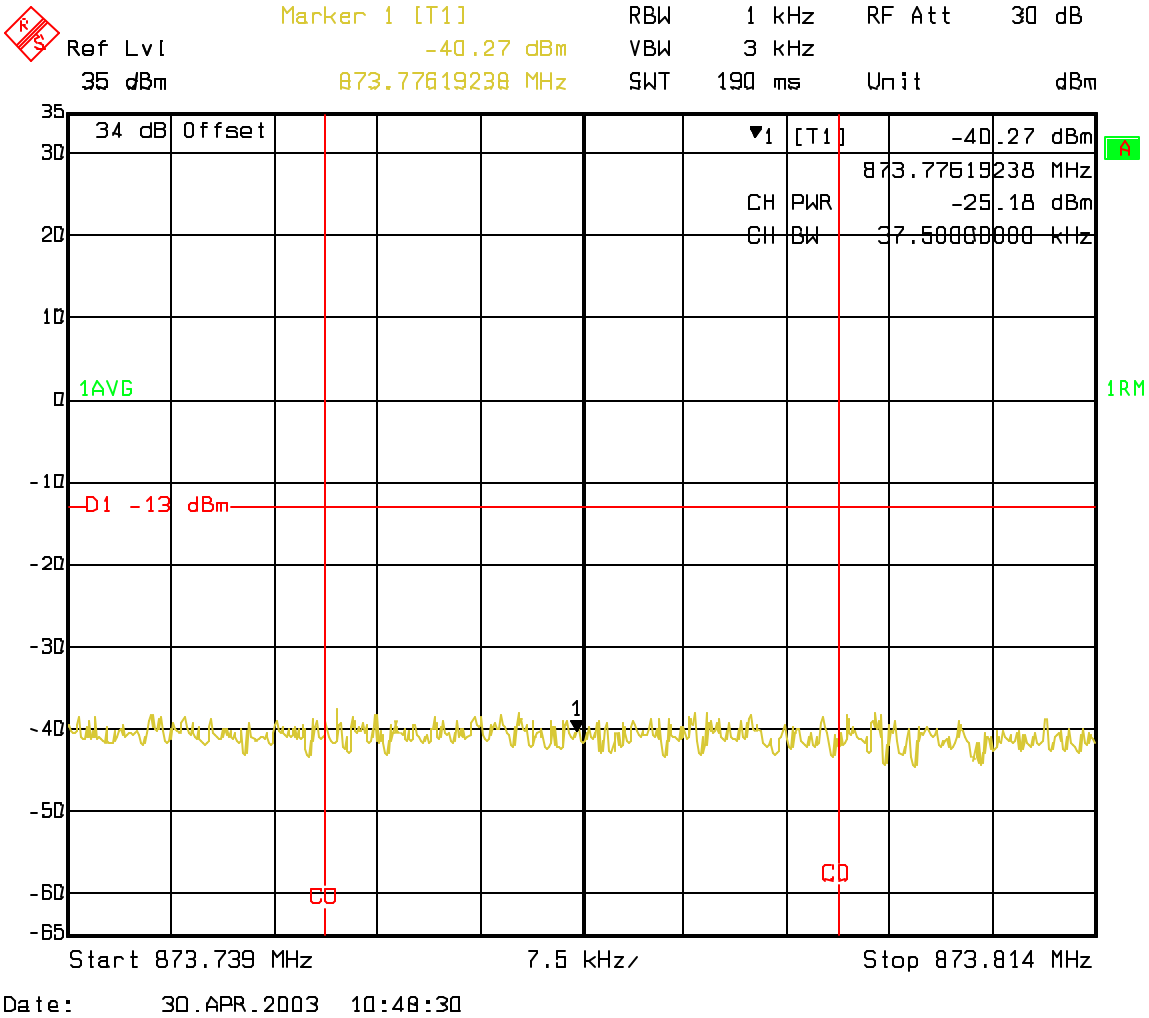
CH 4_45_86 1MHz Lower Adjacent Band Edge 60kHz span



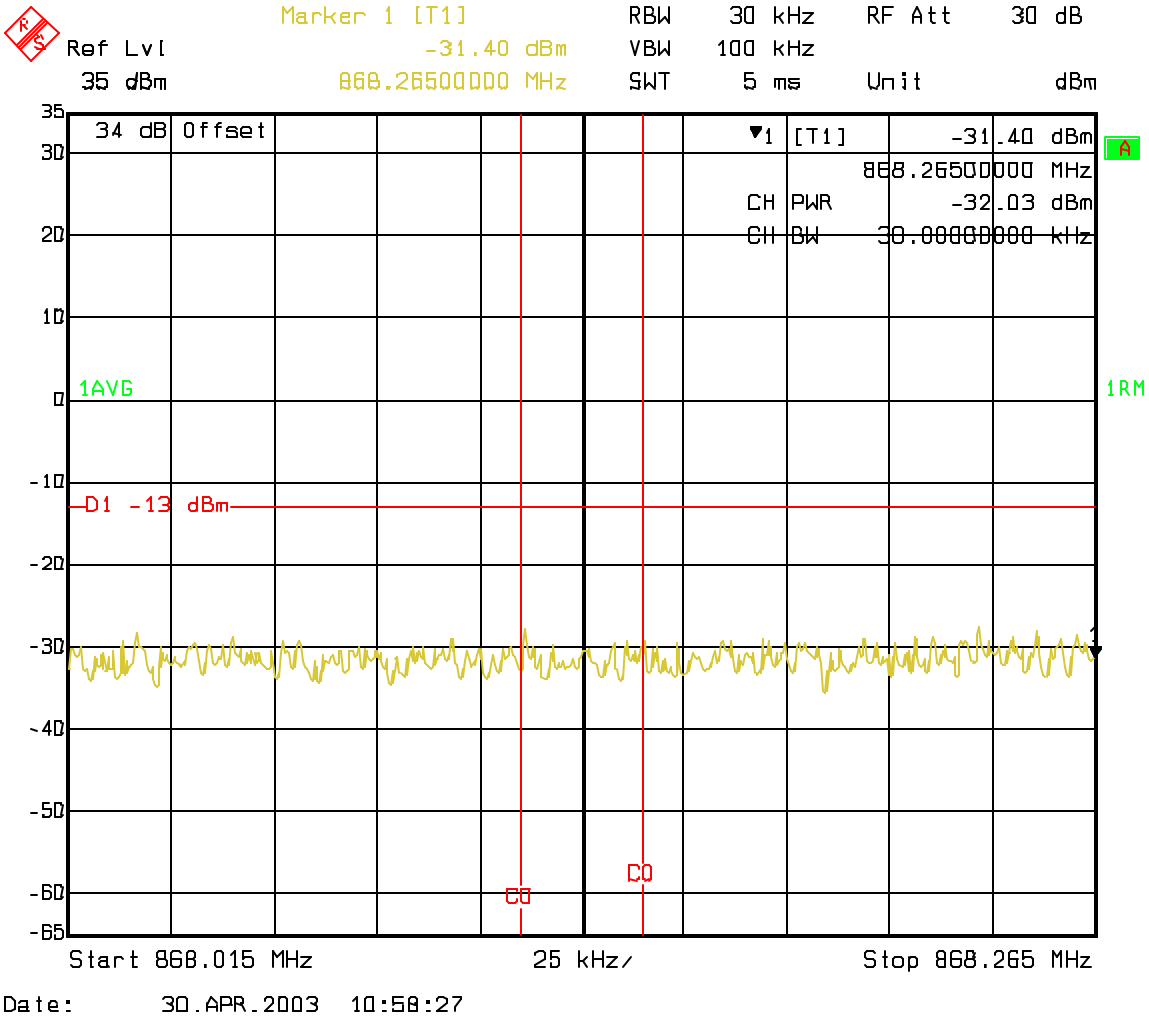
CH 4_45_86 1MHz Upper Adjacent Band Edge



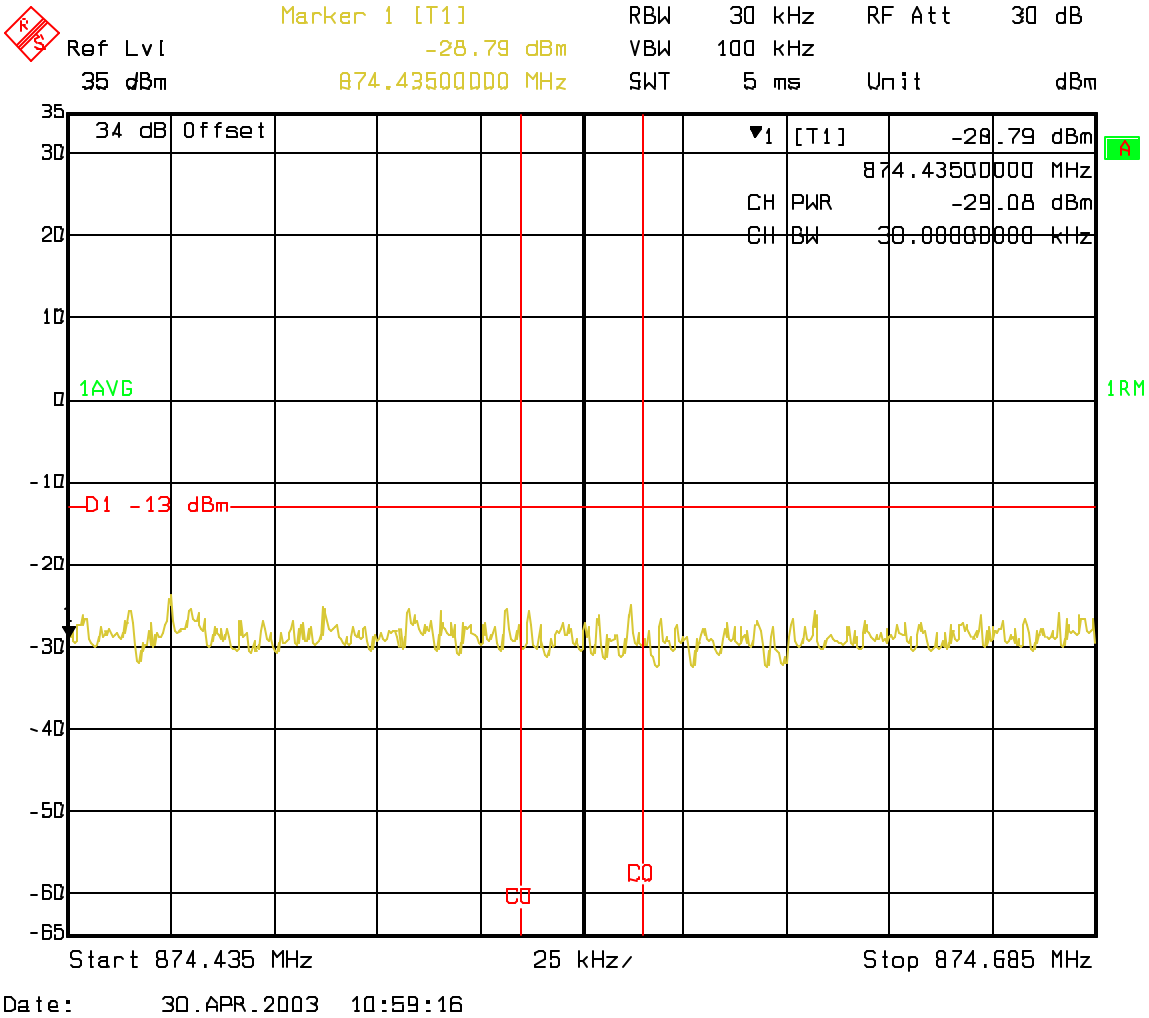
CH 4_45_86 1MHz Upper Adjacent Band Edge 60 kHz span



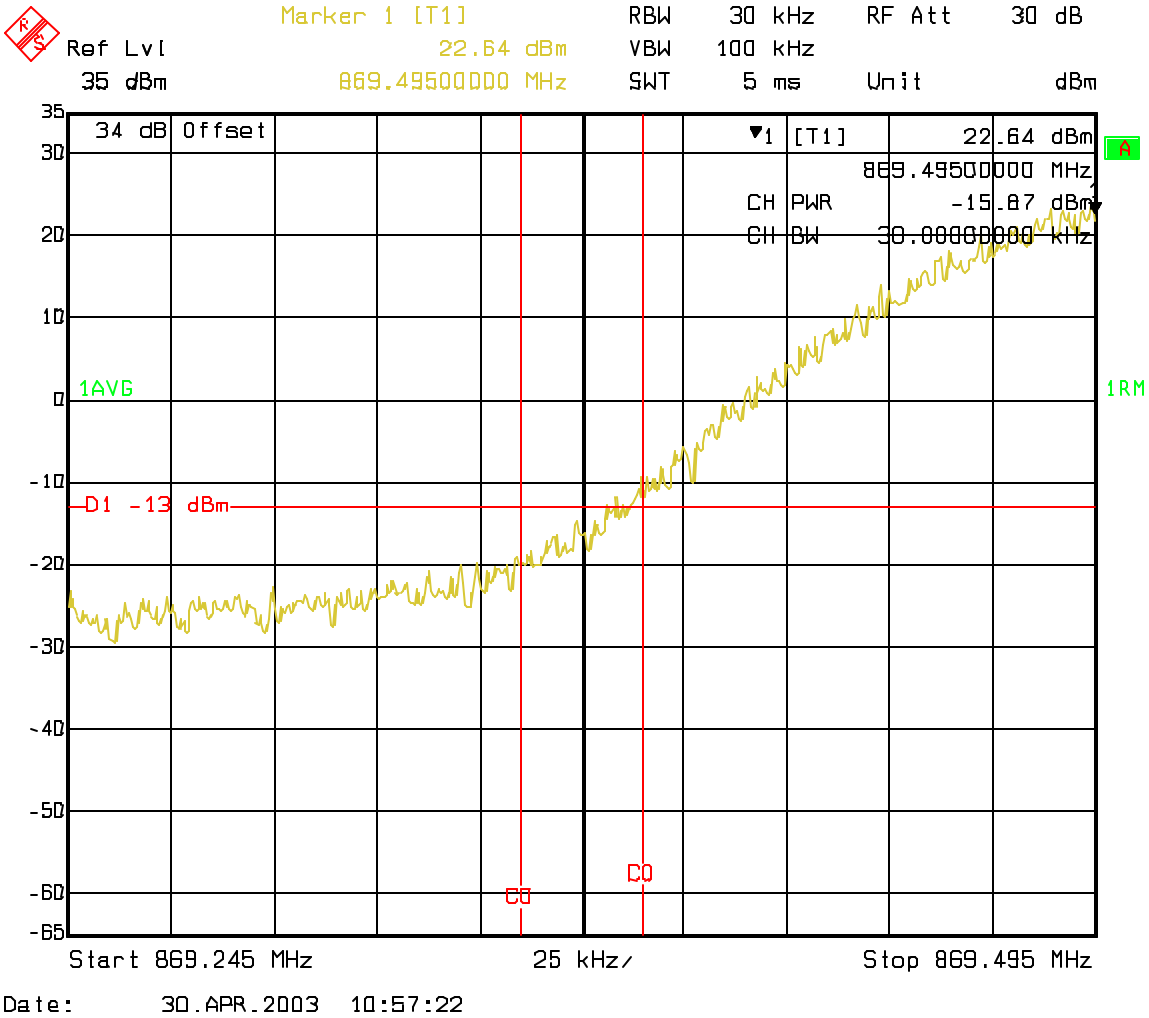
CH 4_45_86 1.98MHz Offset Lower



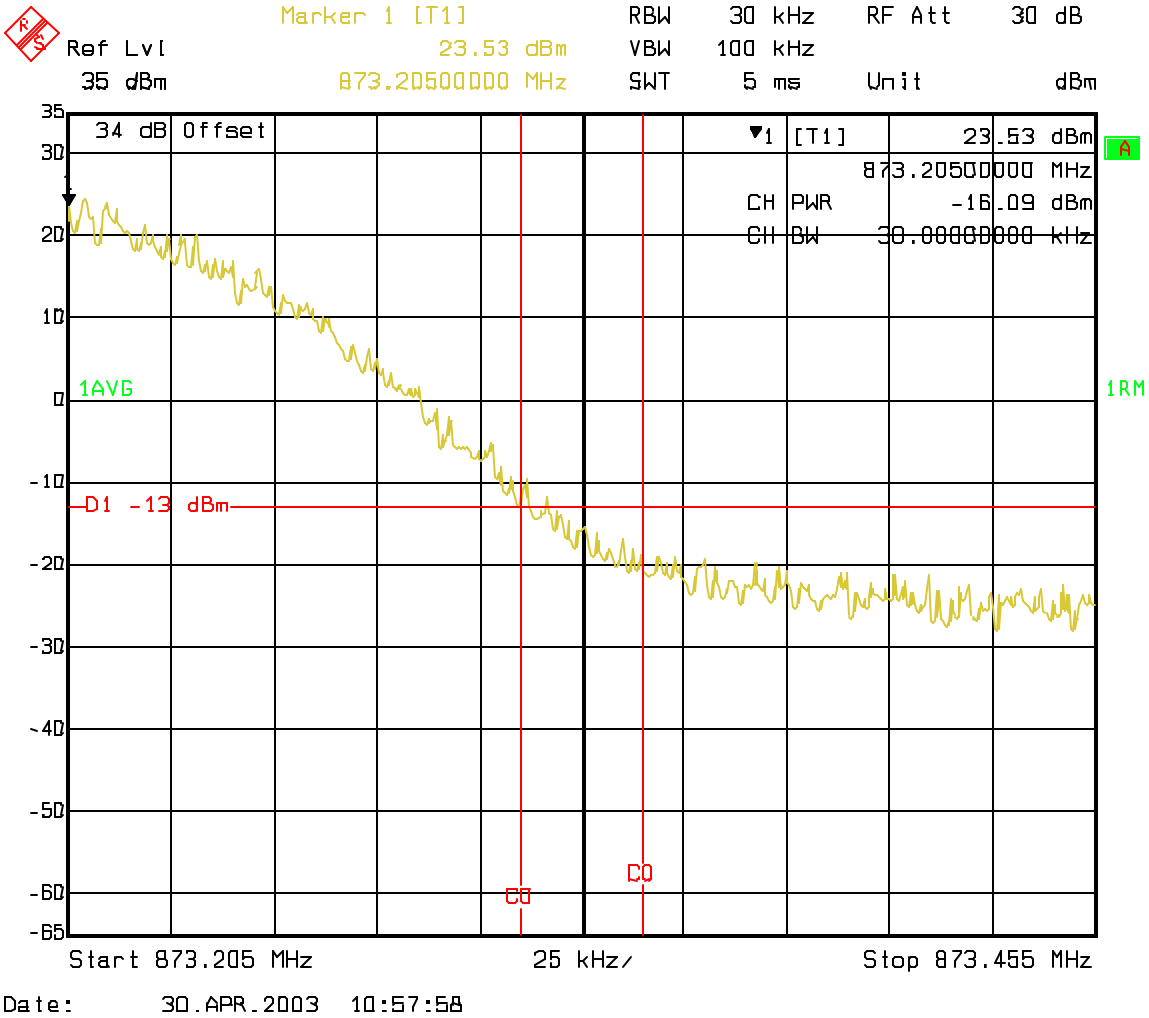
CH 4_45_86 1.98 MHz offset upper



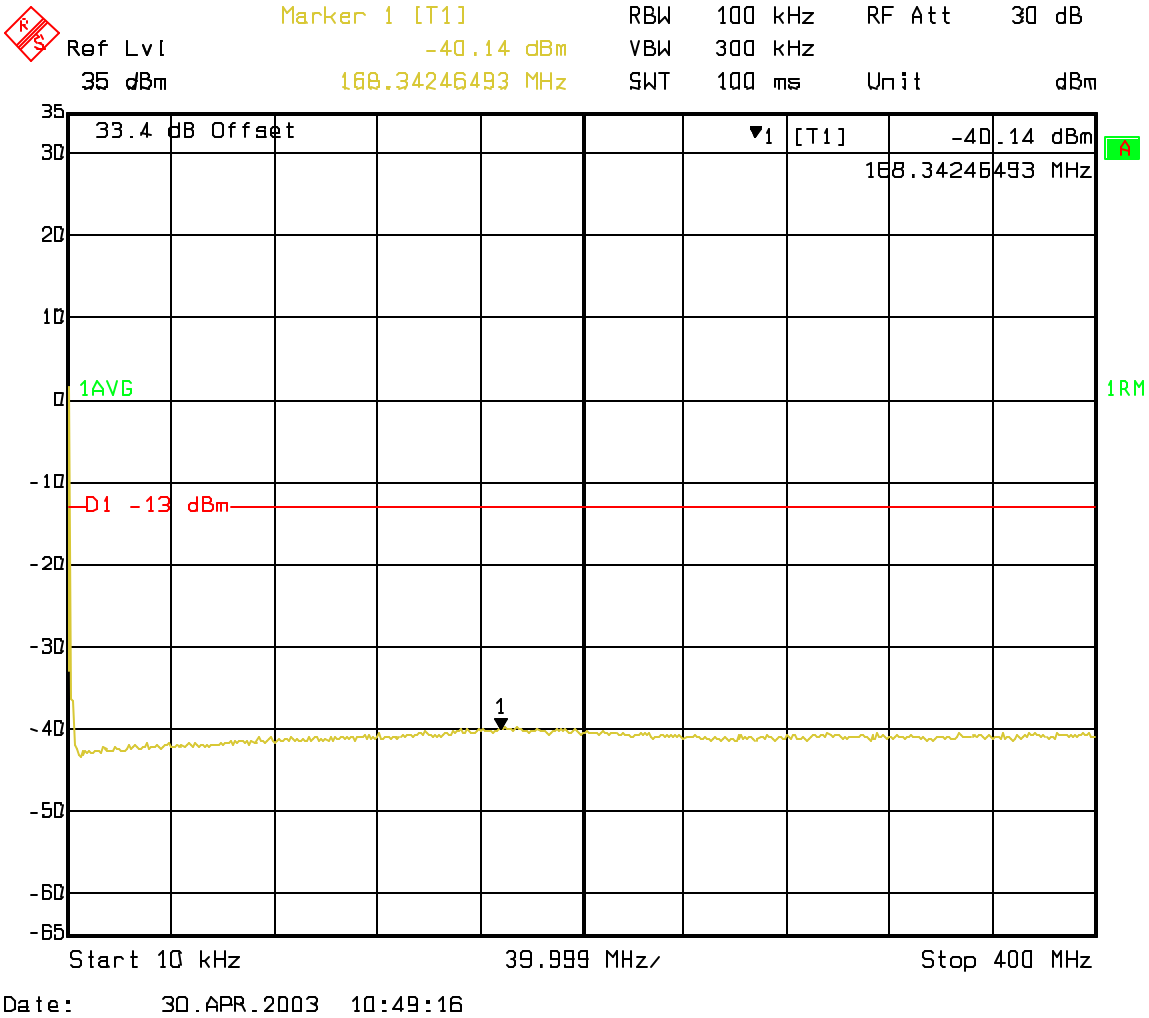
CH 4_45_86 750 kHz offset lower



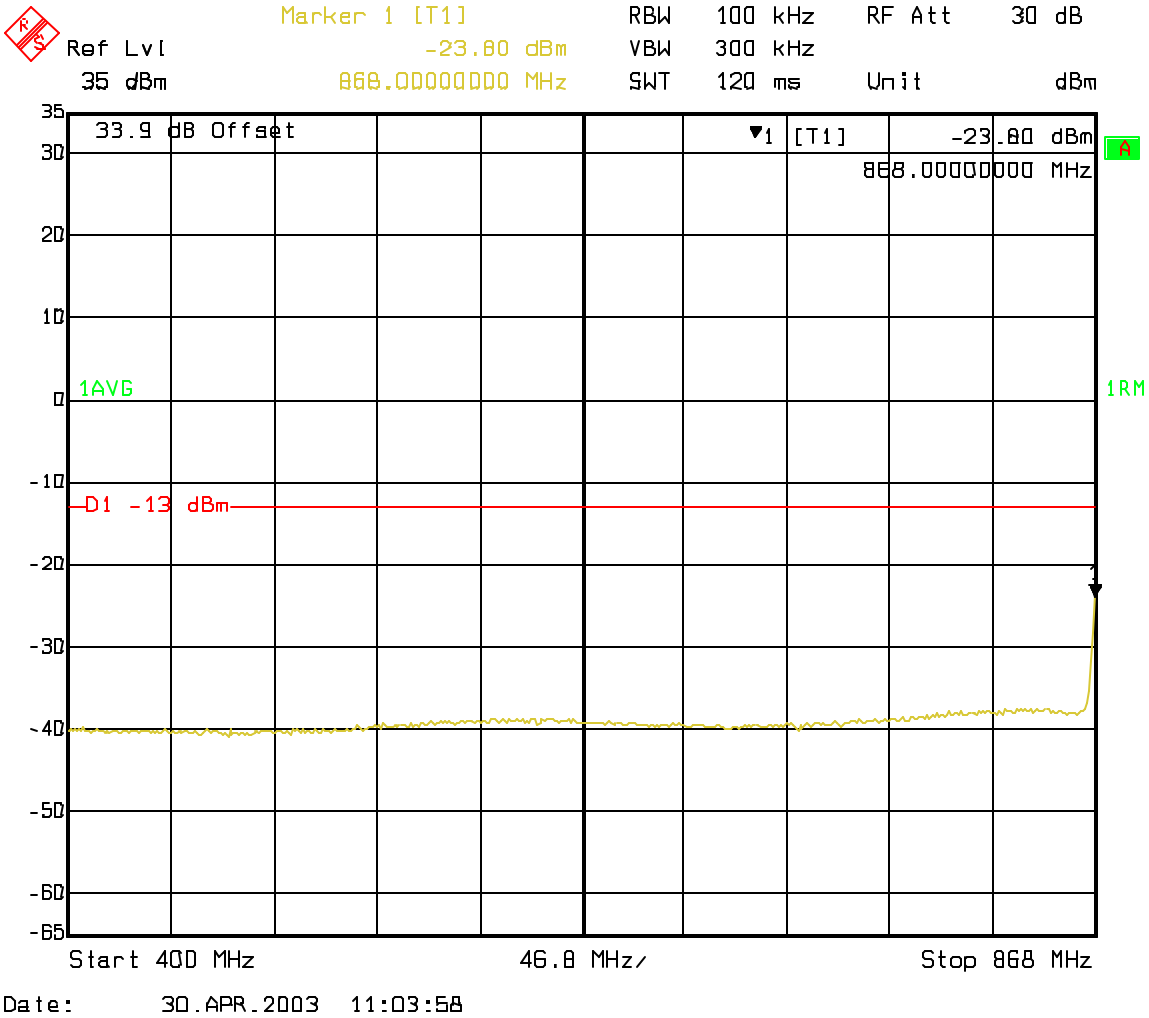
CH 4_45_86 750 kHz offset upper



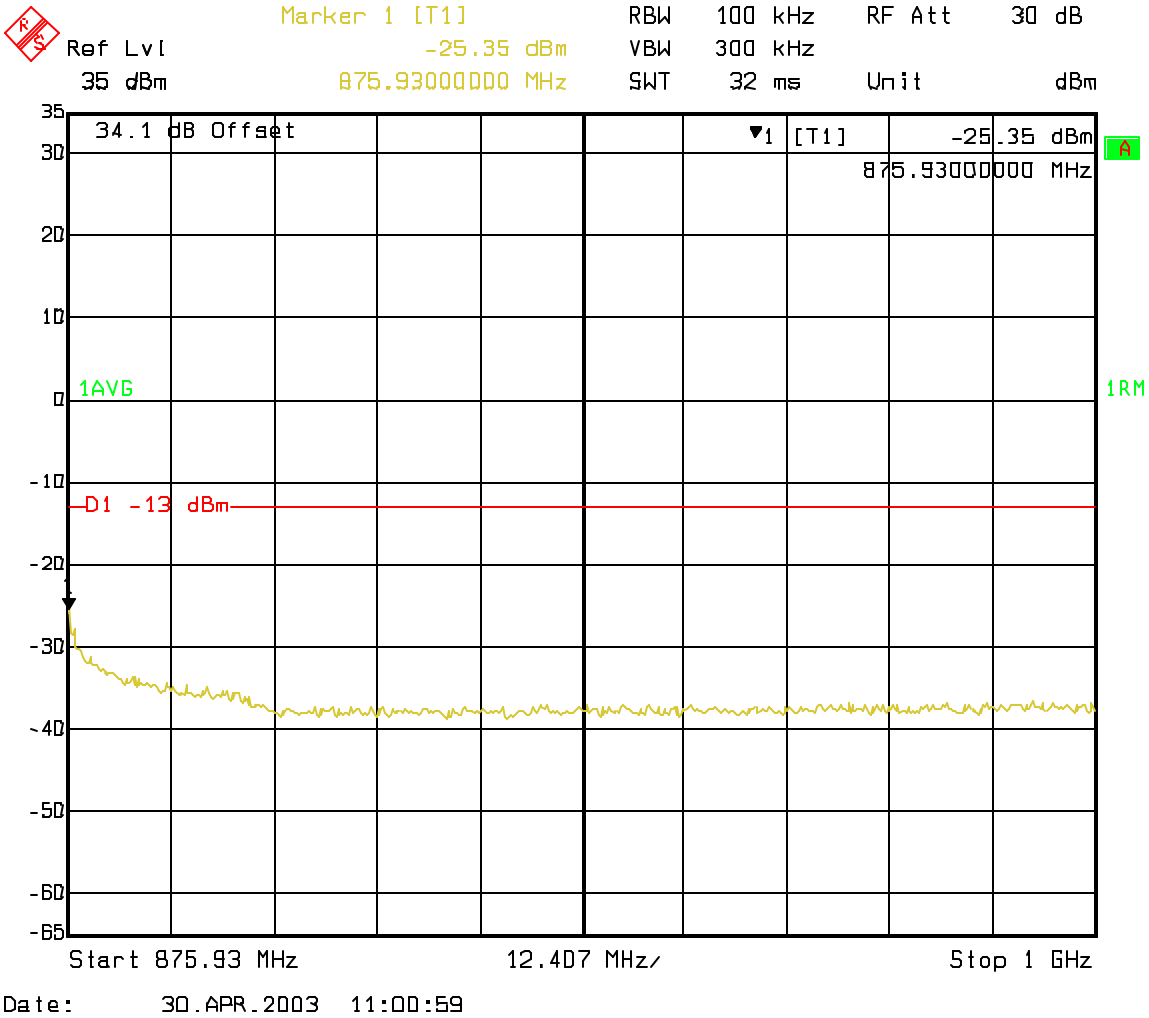
CH 4_45_86 Spurious 10kHz to 400MHz



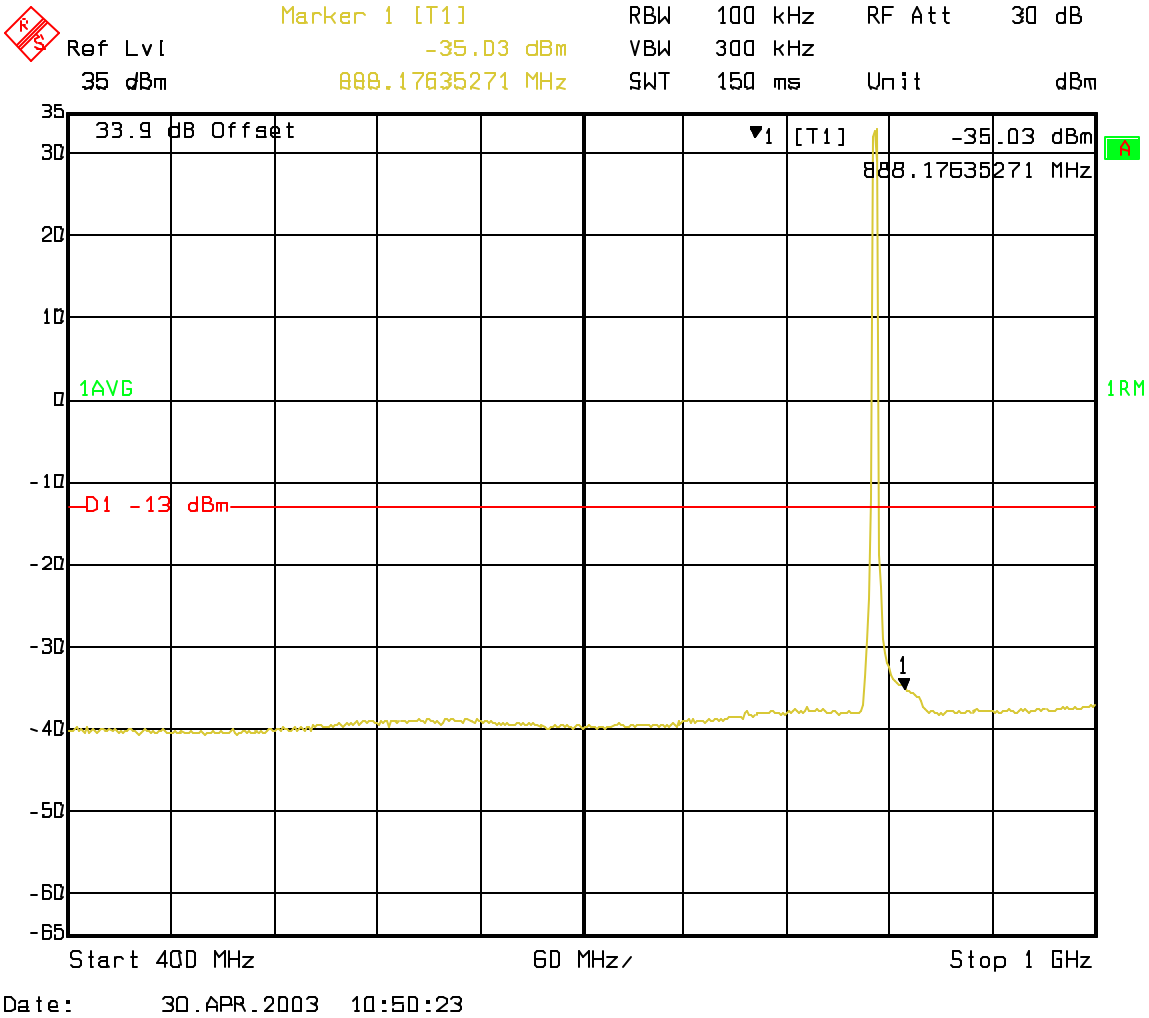
CH 4_45_86 Spurious 400MHz to 868MHz



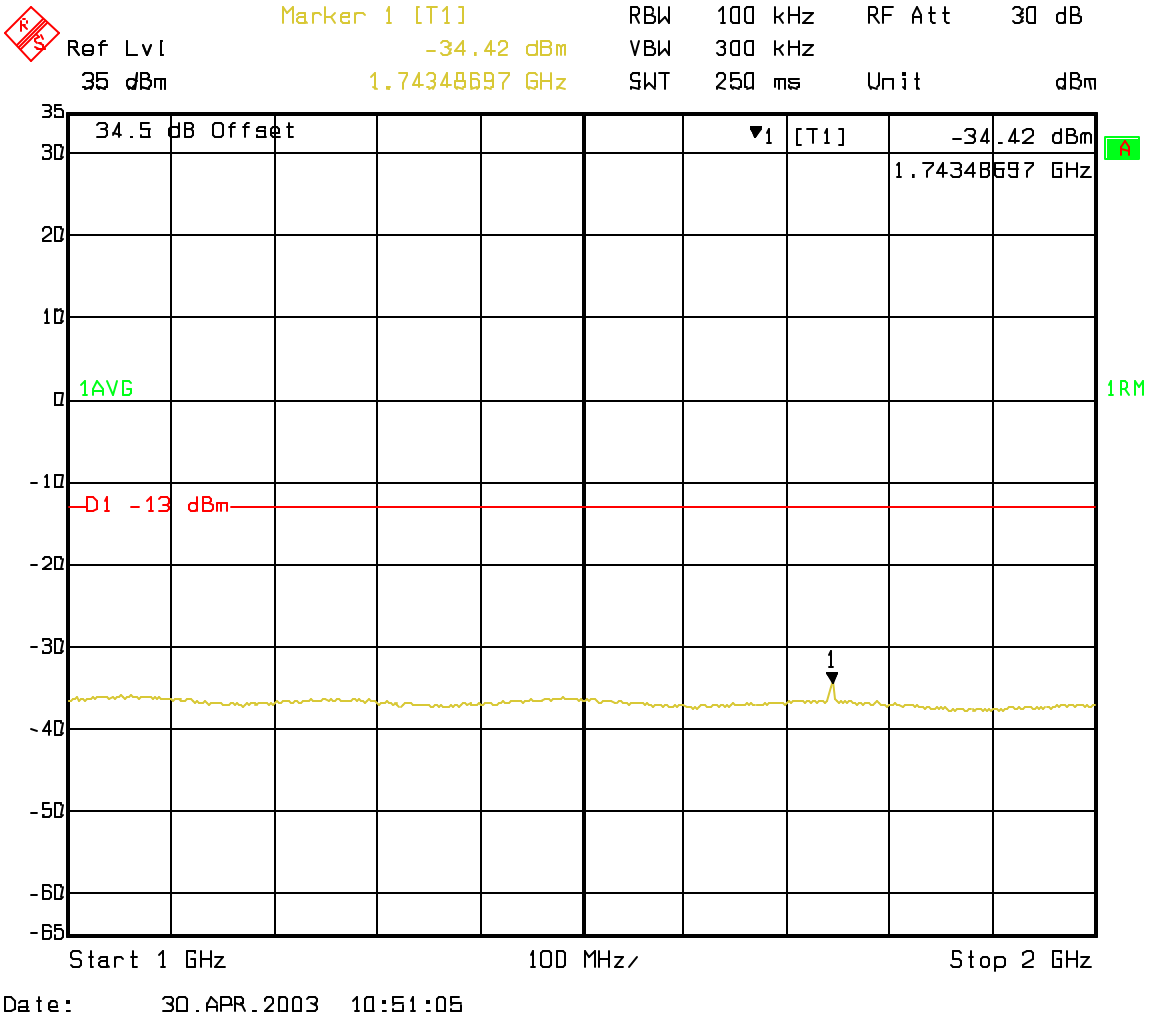
CH 4_45_86 Spurious 875MHz to 1GHz



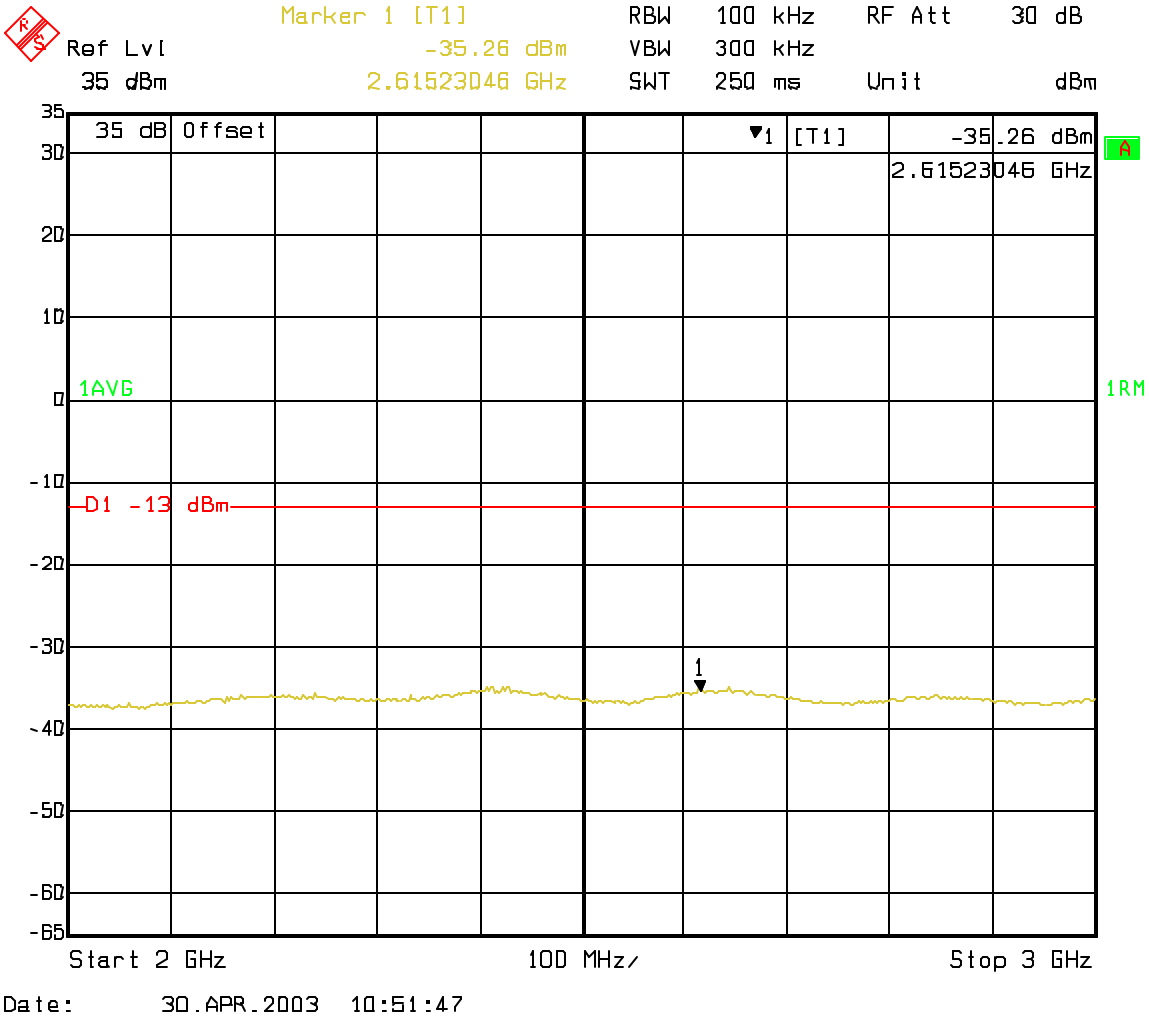
CH 4_45_86 Spurious 400MHz to 1GHz



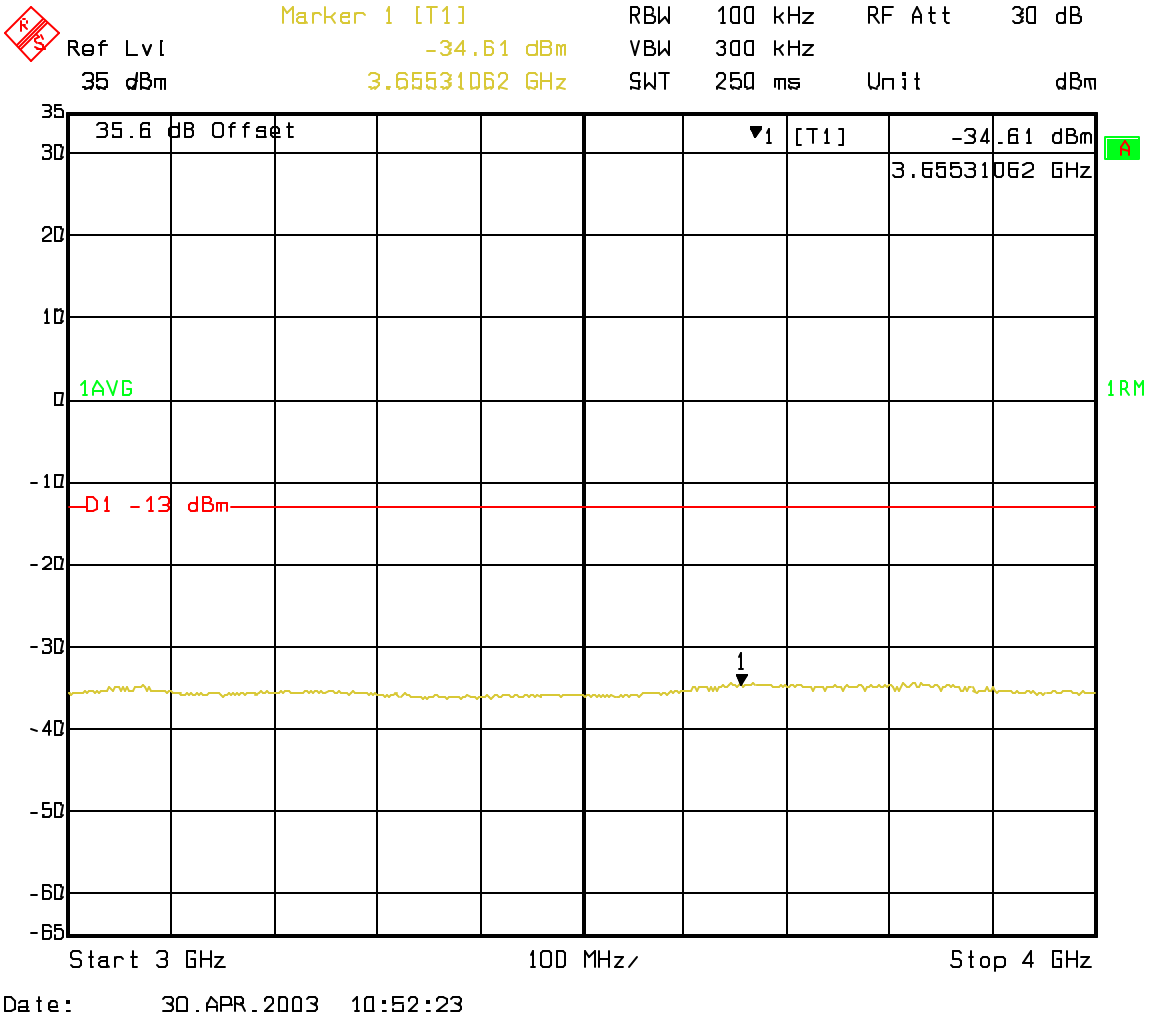
CH 4_45_86 Spurious 1 to 2 GHz



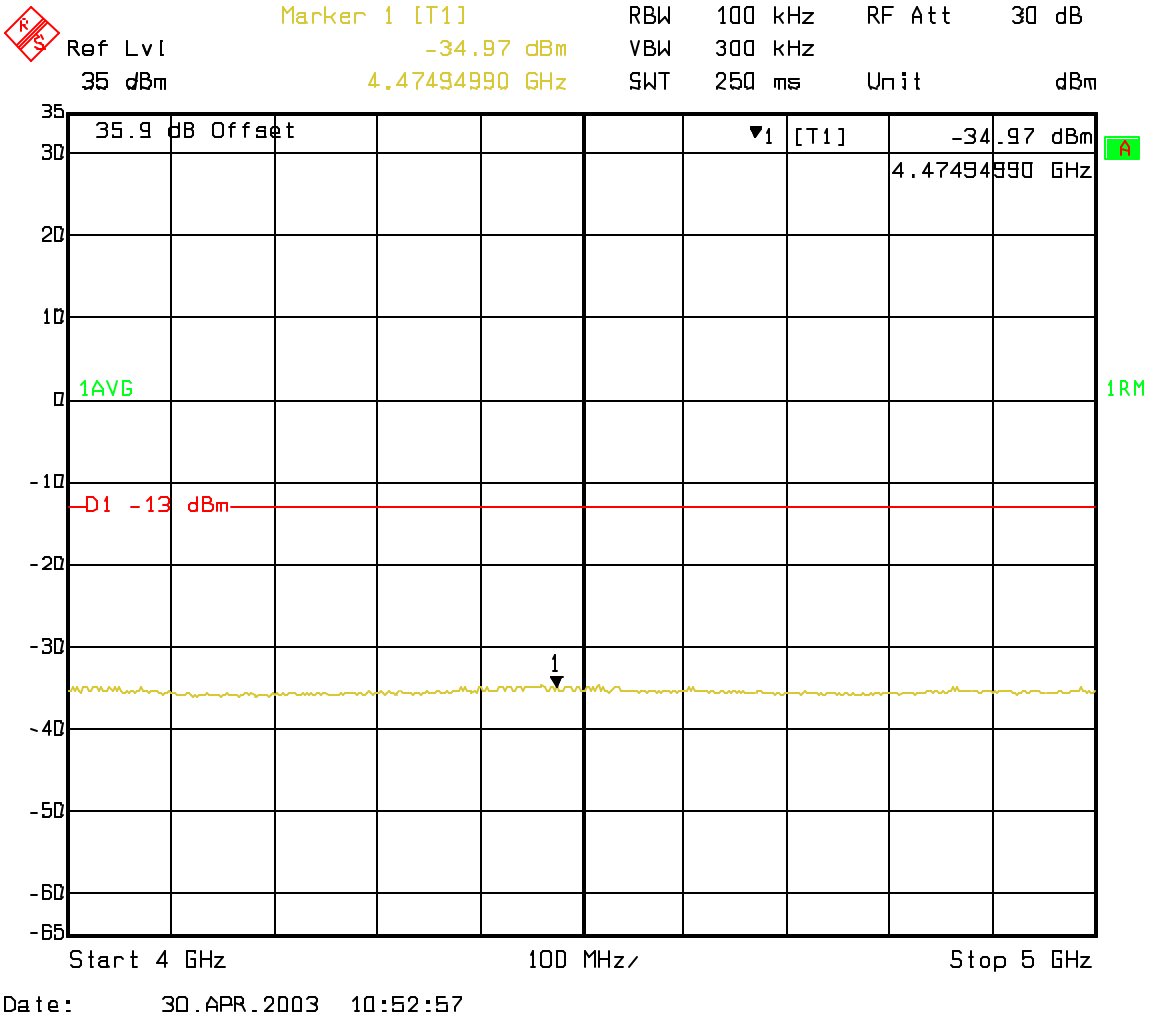
CH 4_45_86 Spurious 2-3GHz



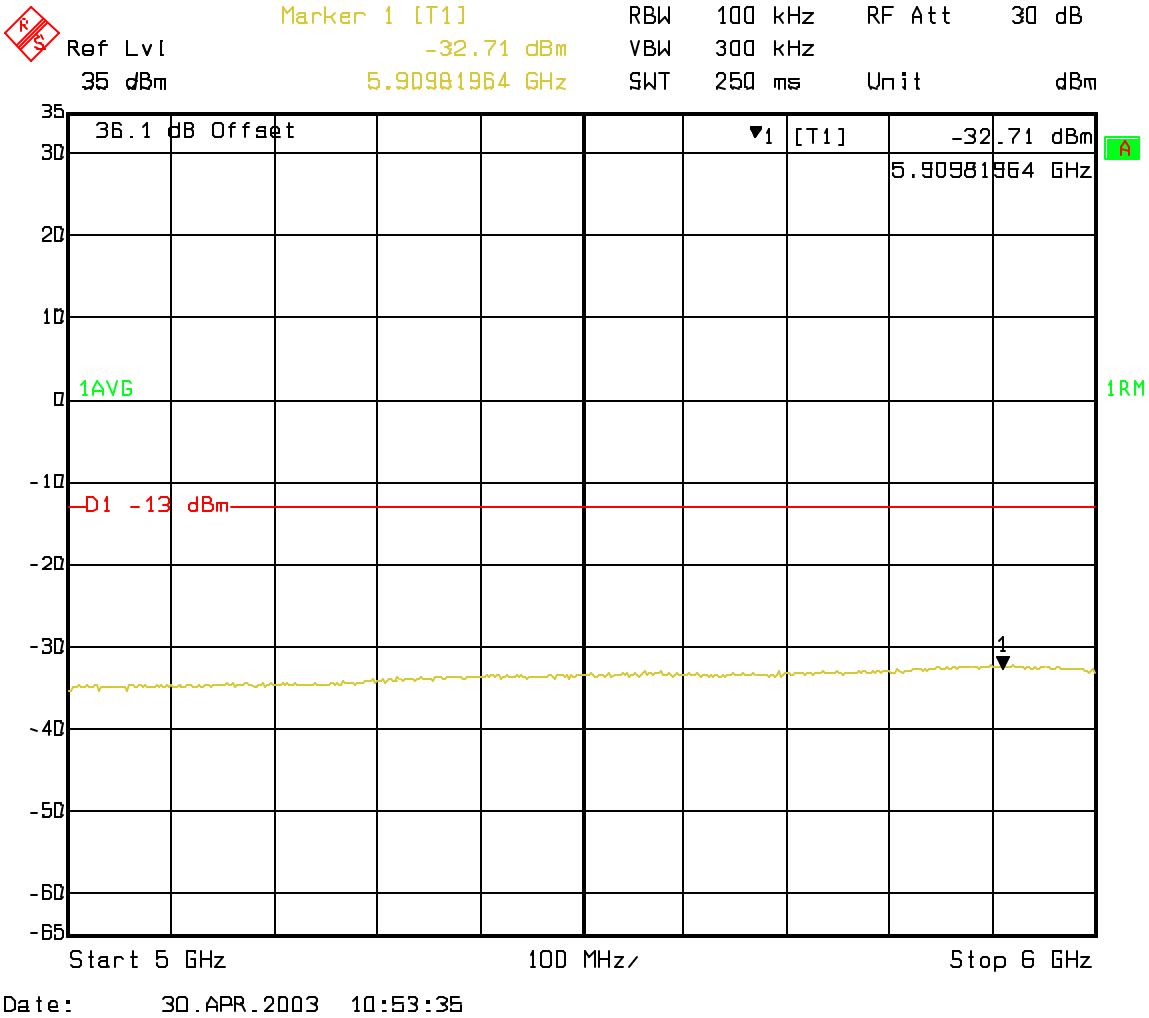
CH 4_45_86 Spurious 3-4GHz



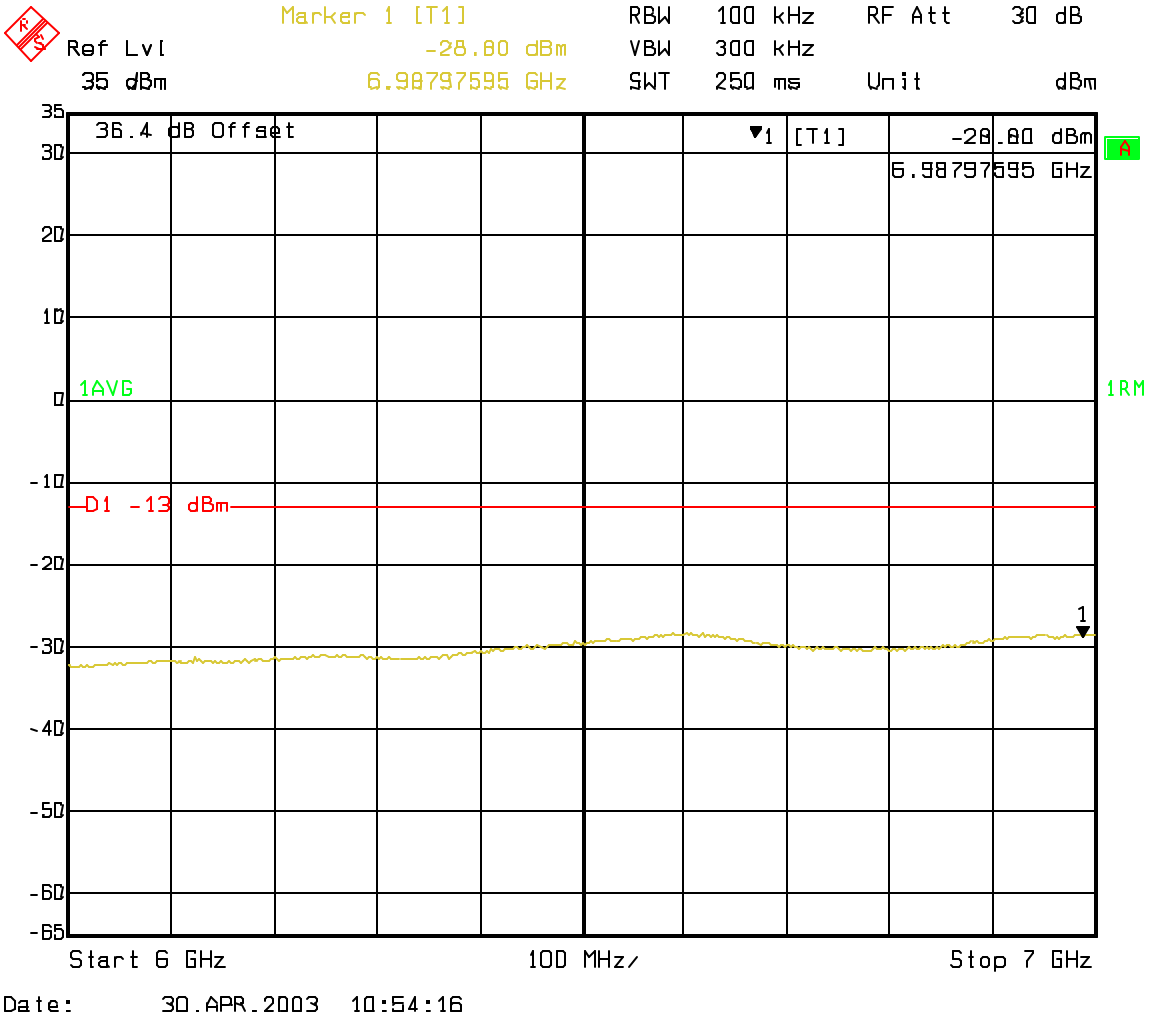
CH 4_45_86 Spurious 4-5GHz



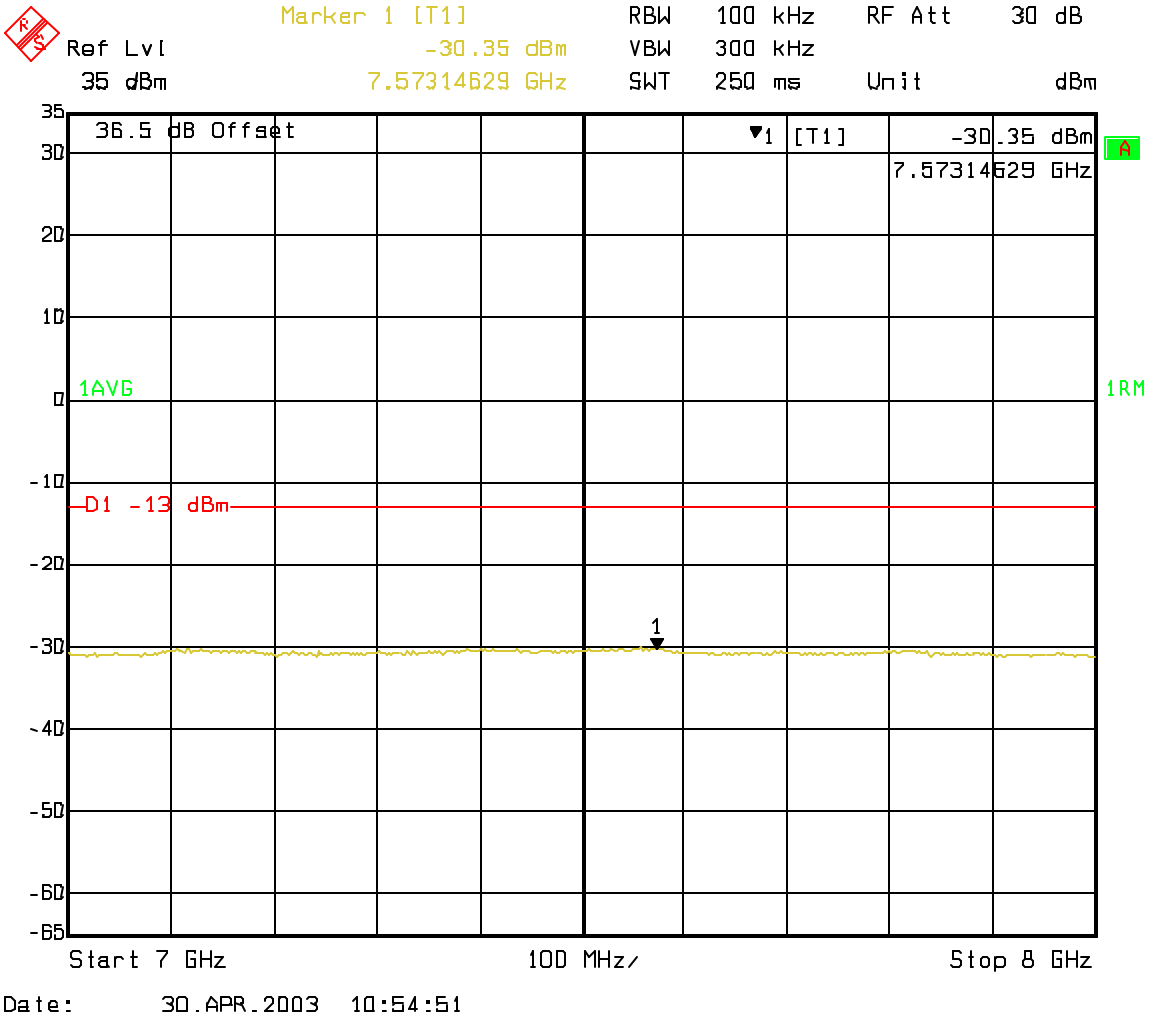
CH 4_45_86 Spurious 5-6GHz



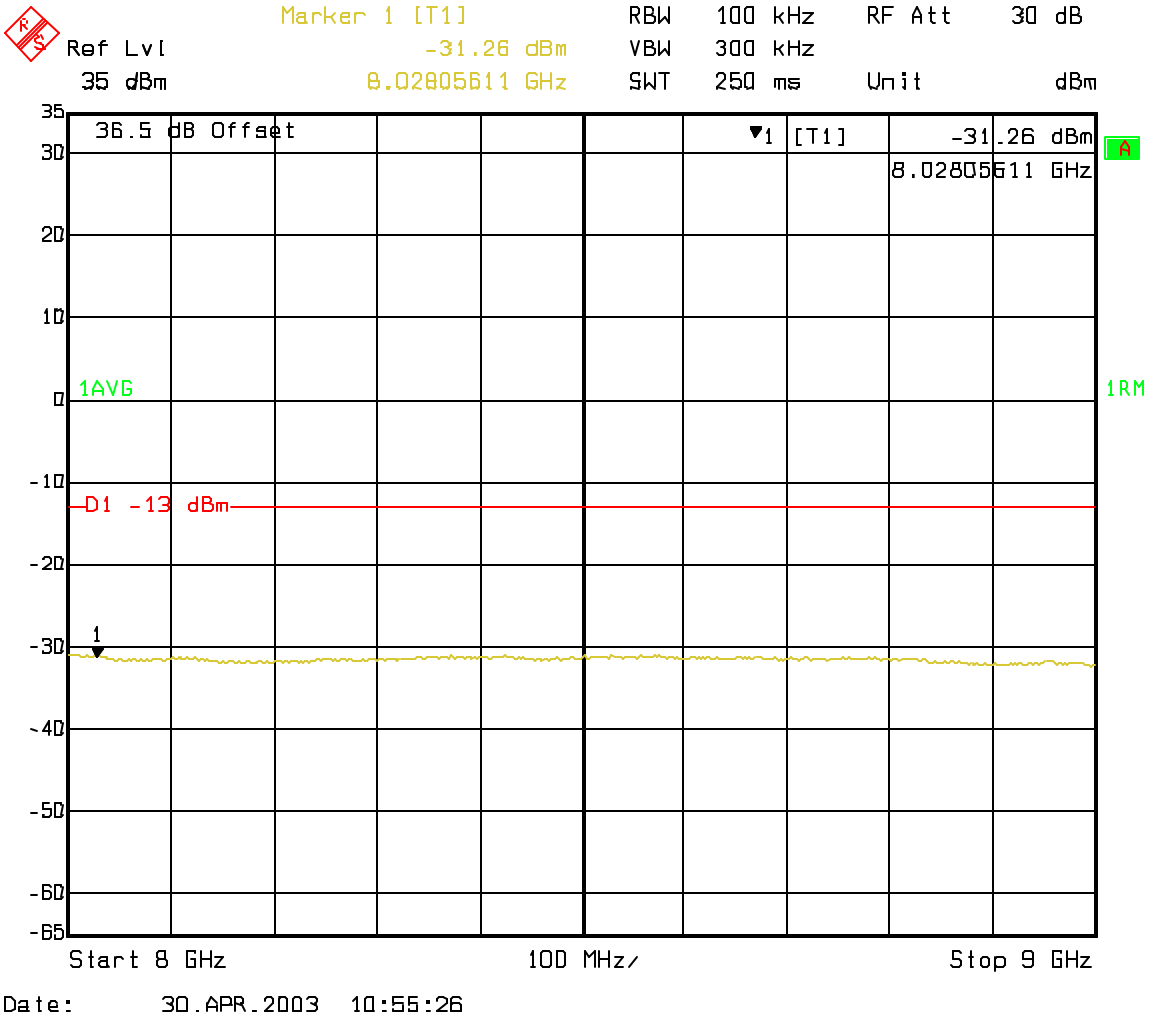
CH 4_45_86 Spurious 6-7GHz



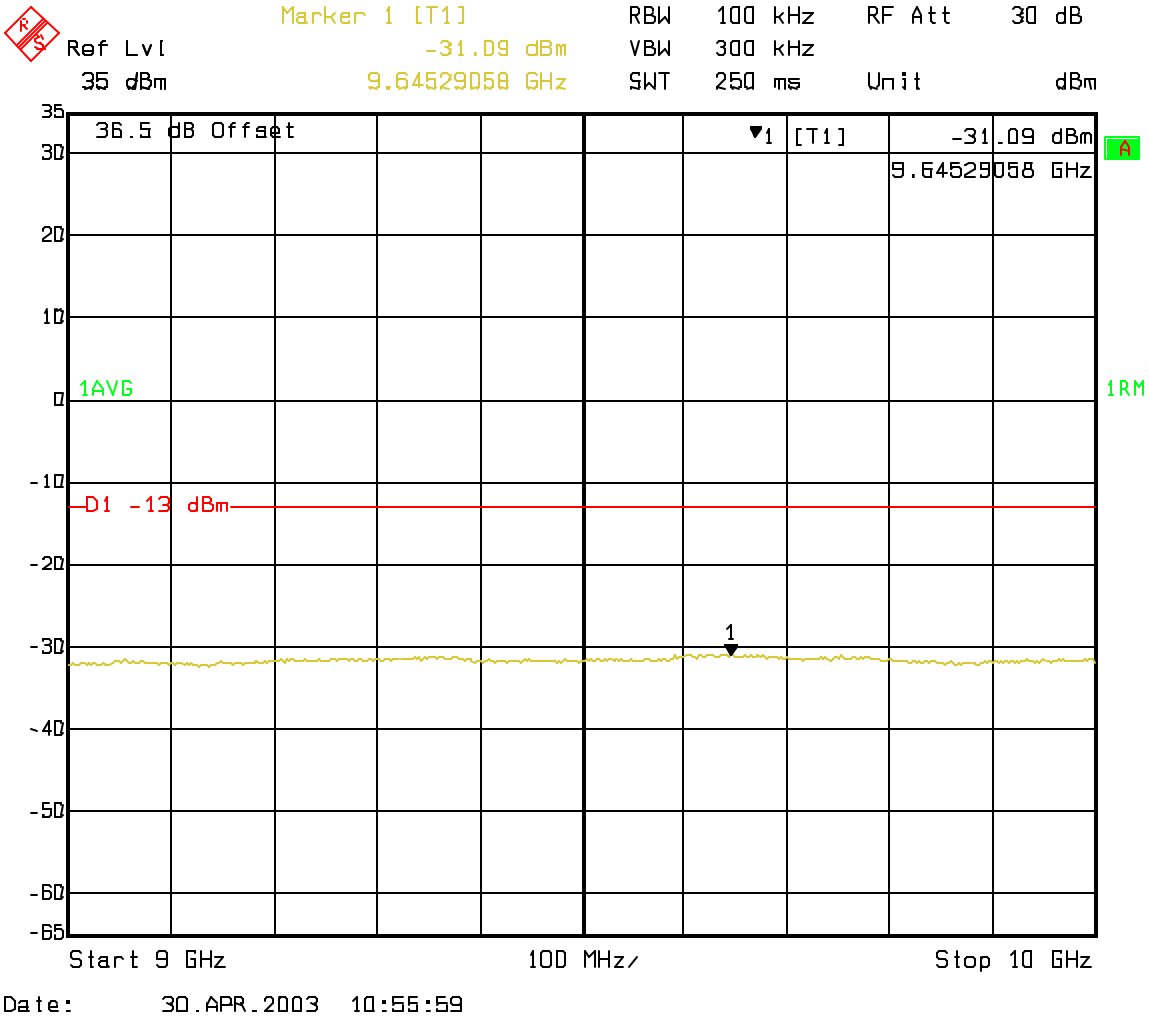
CH 4_45_86 Spurious 7-8GHz



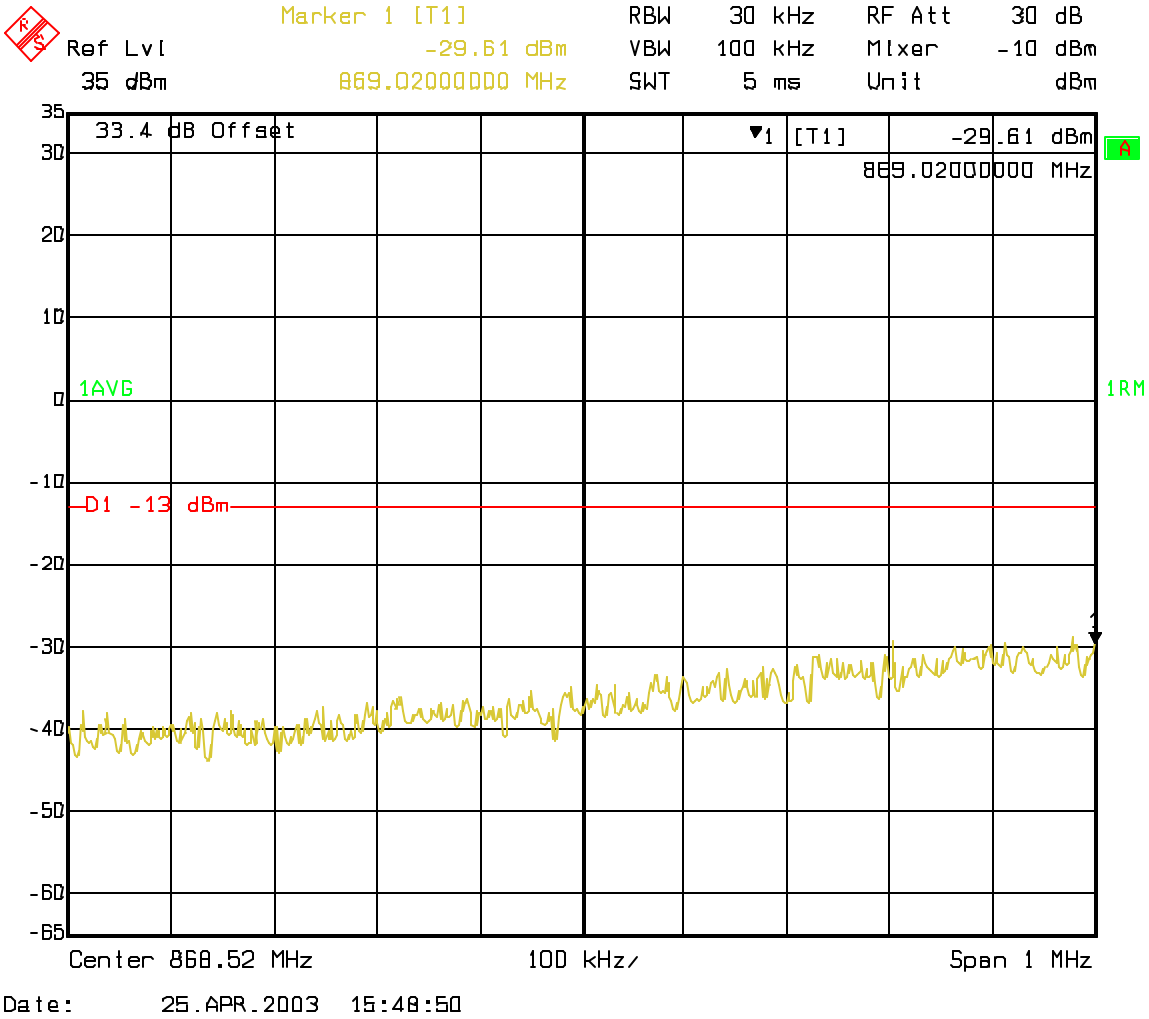
CH 4_45_86 Spurious 8-9GHz



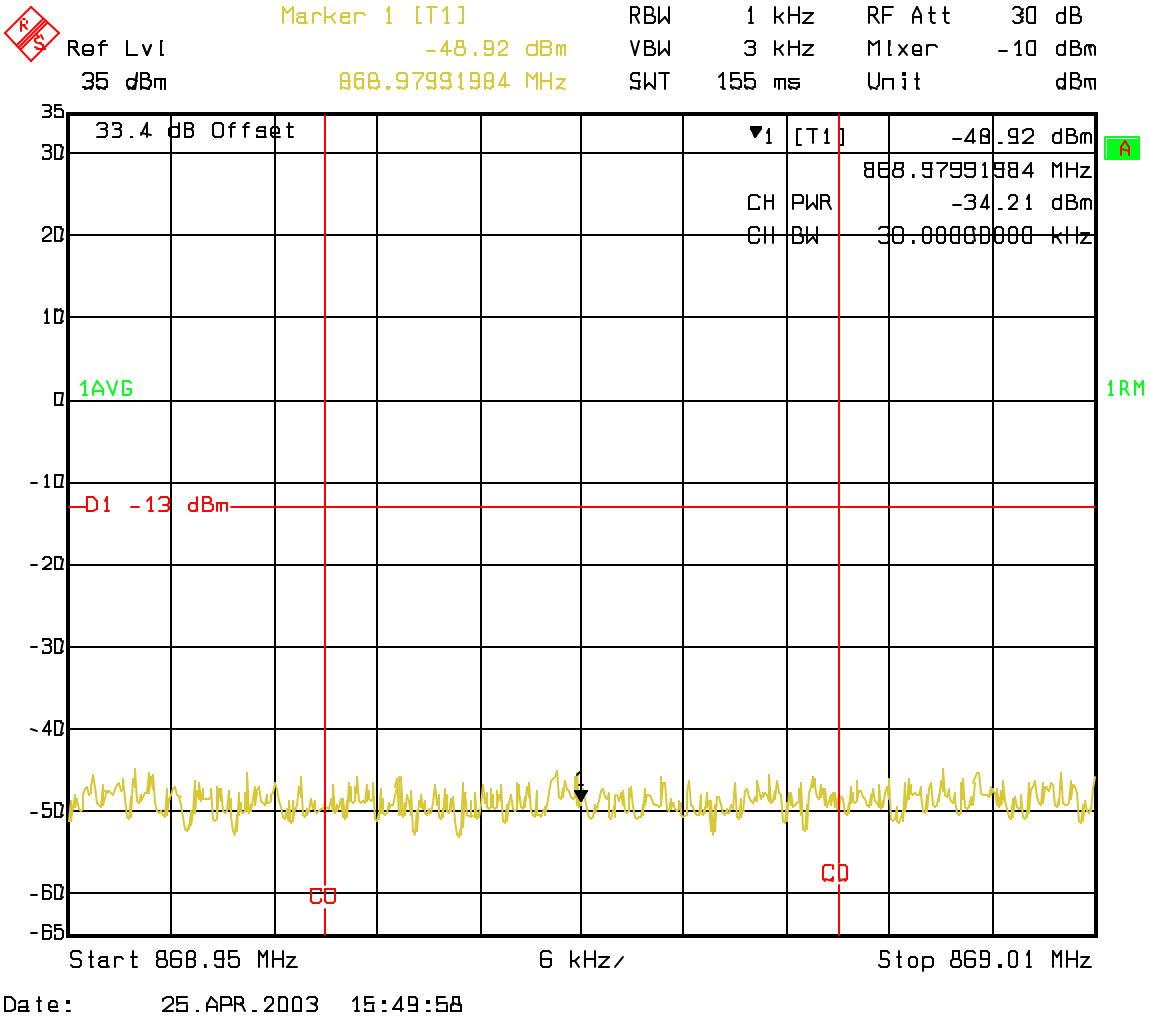
CH 4_45_86 Spurious 9-10GHz



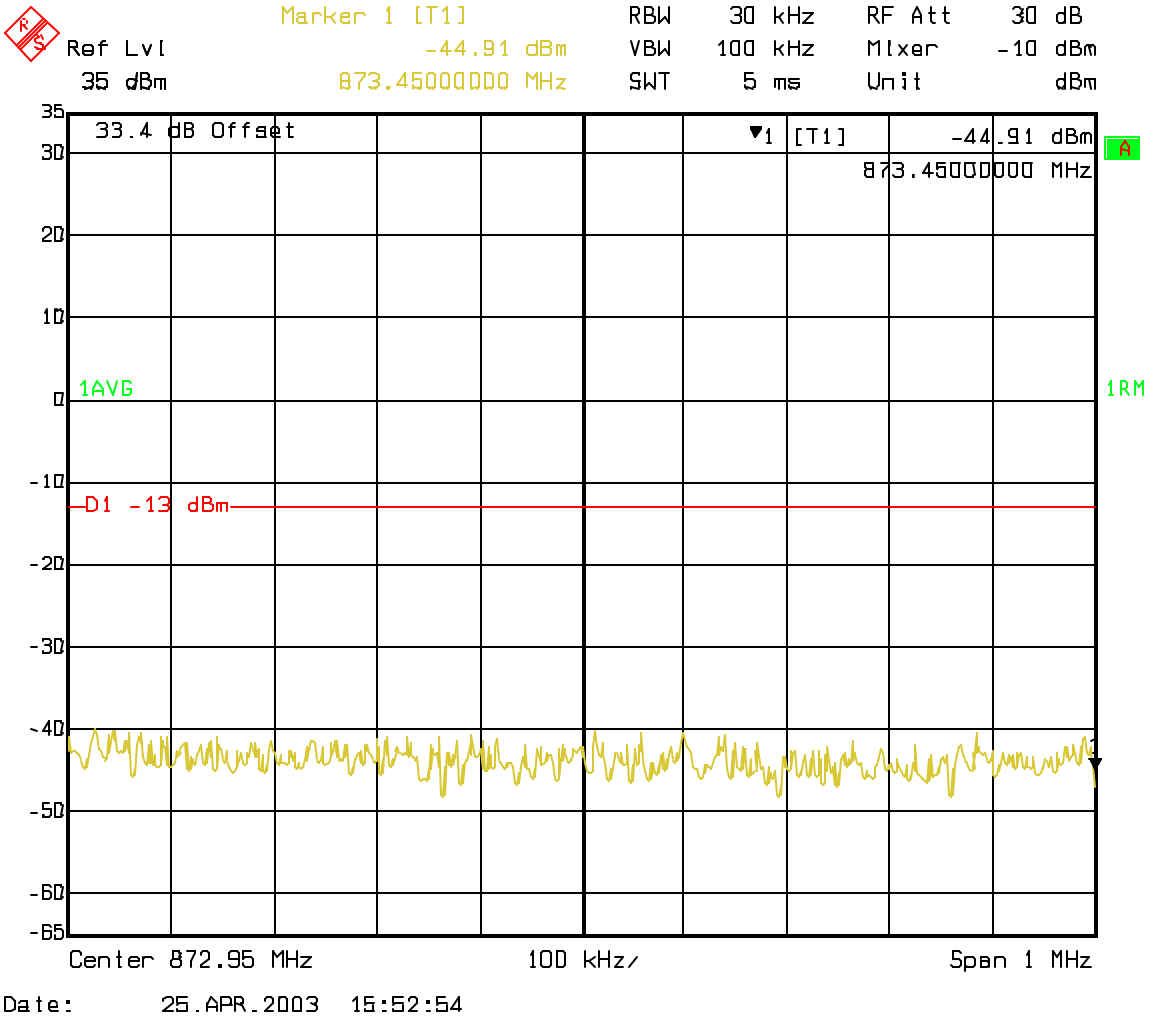
1 Carrier 4 DOM Lower 1MHz Adjacent



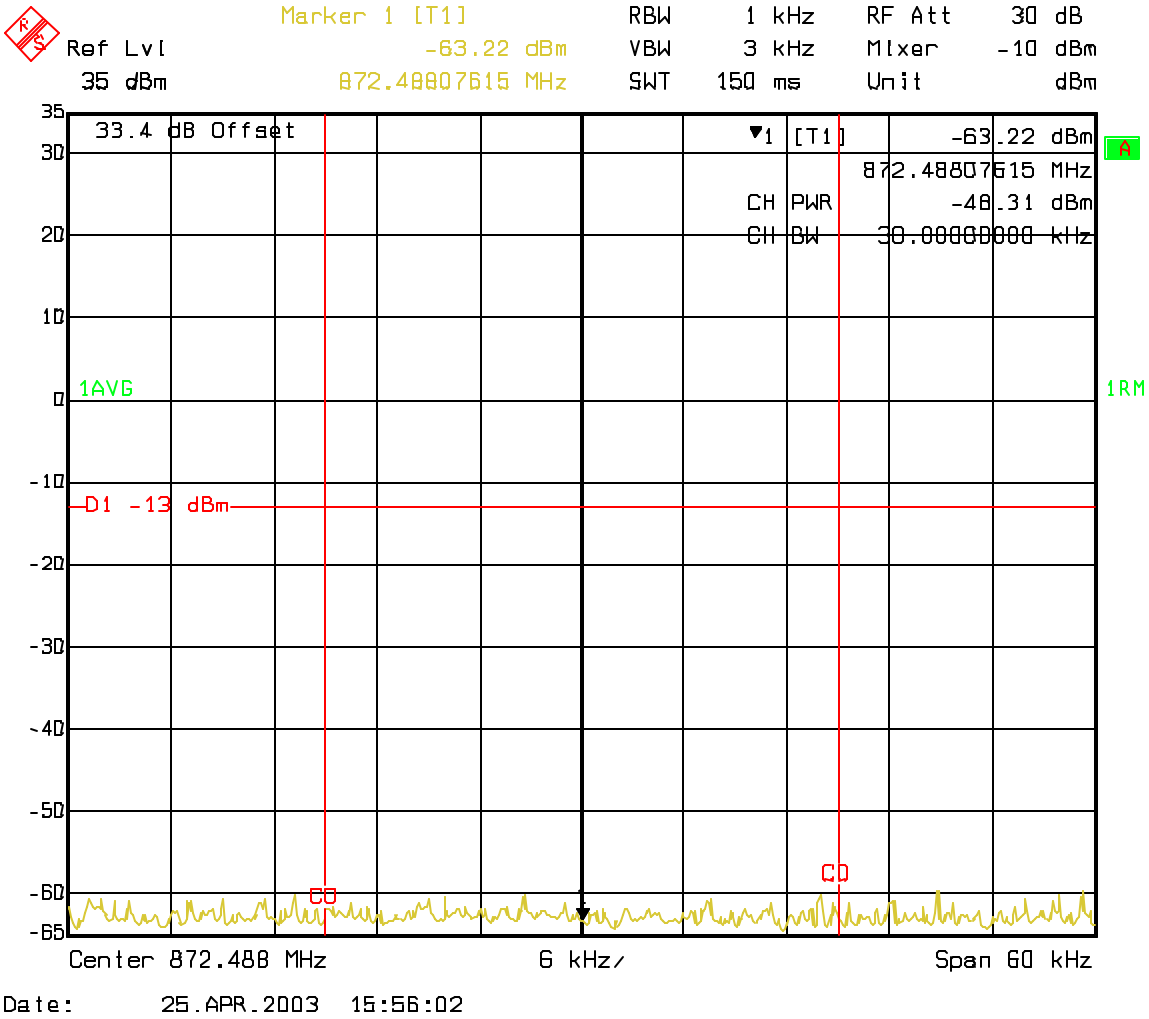
1 Carrier 4 DOM Lower 1MHz Adjacent 30kHz ChPwr



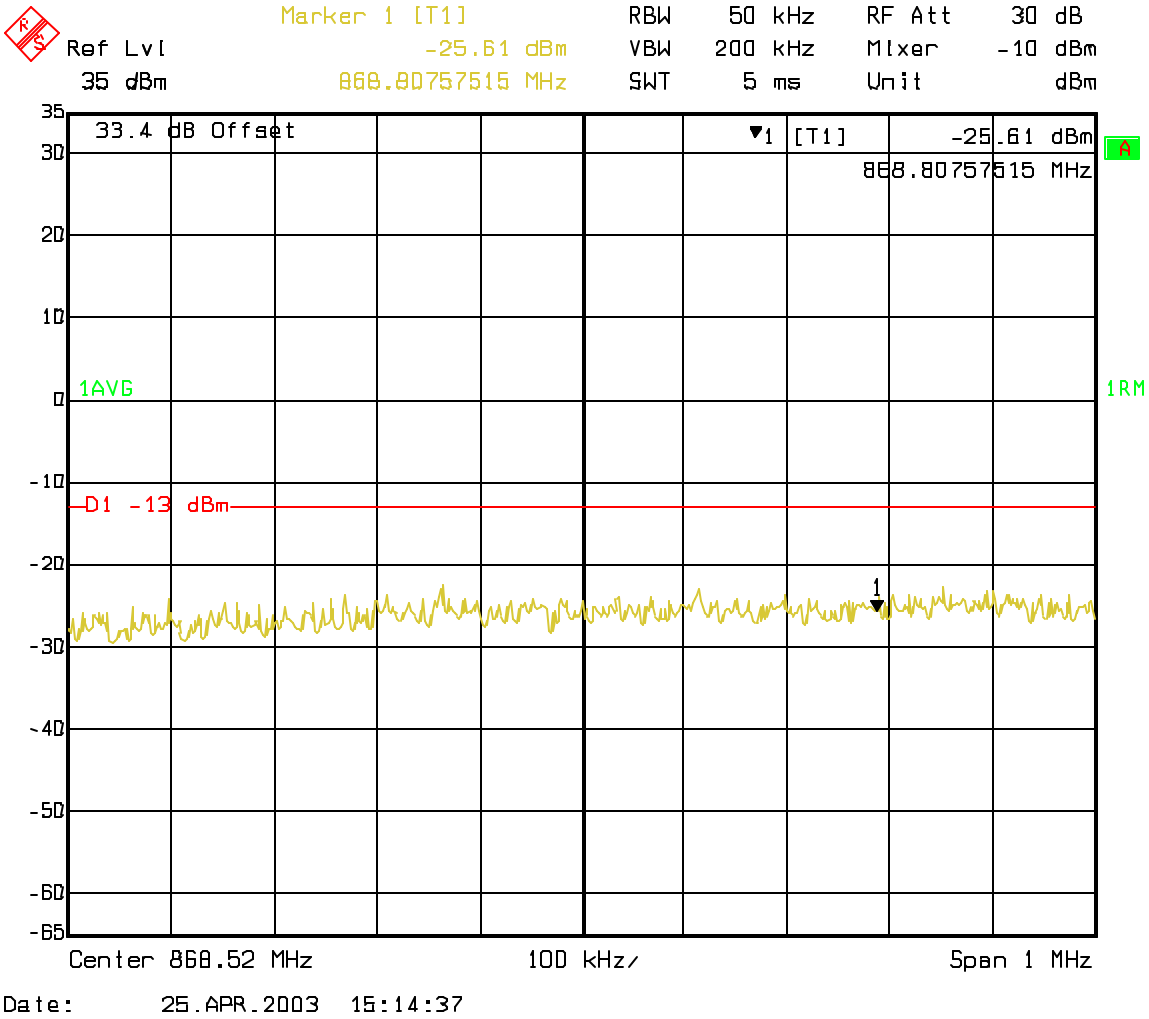
1 Carrier 4 DOM Upper 1MHz Adjacent



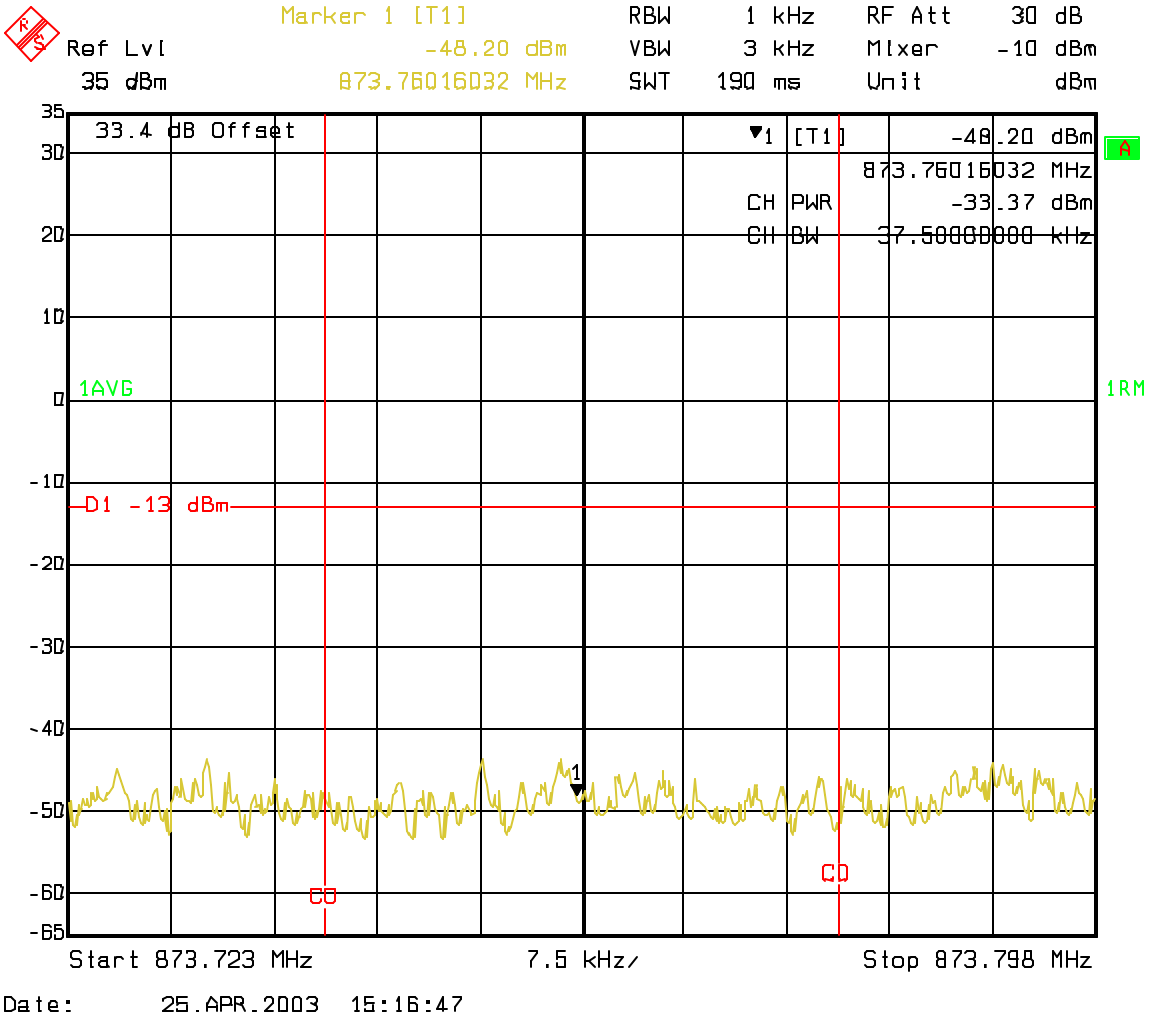
1 Carrier 4 DOM Upper 1MHz Adjacent 30kHz ChPwr



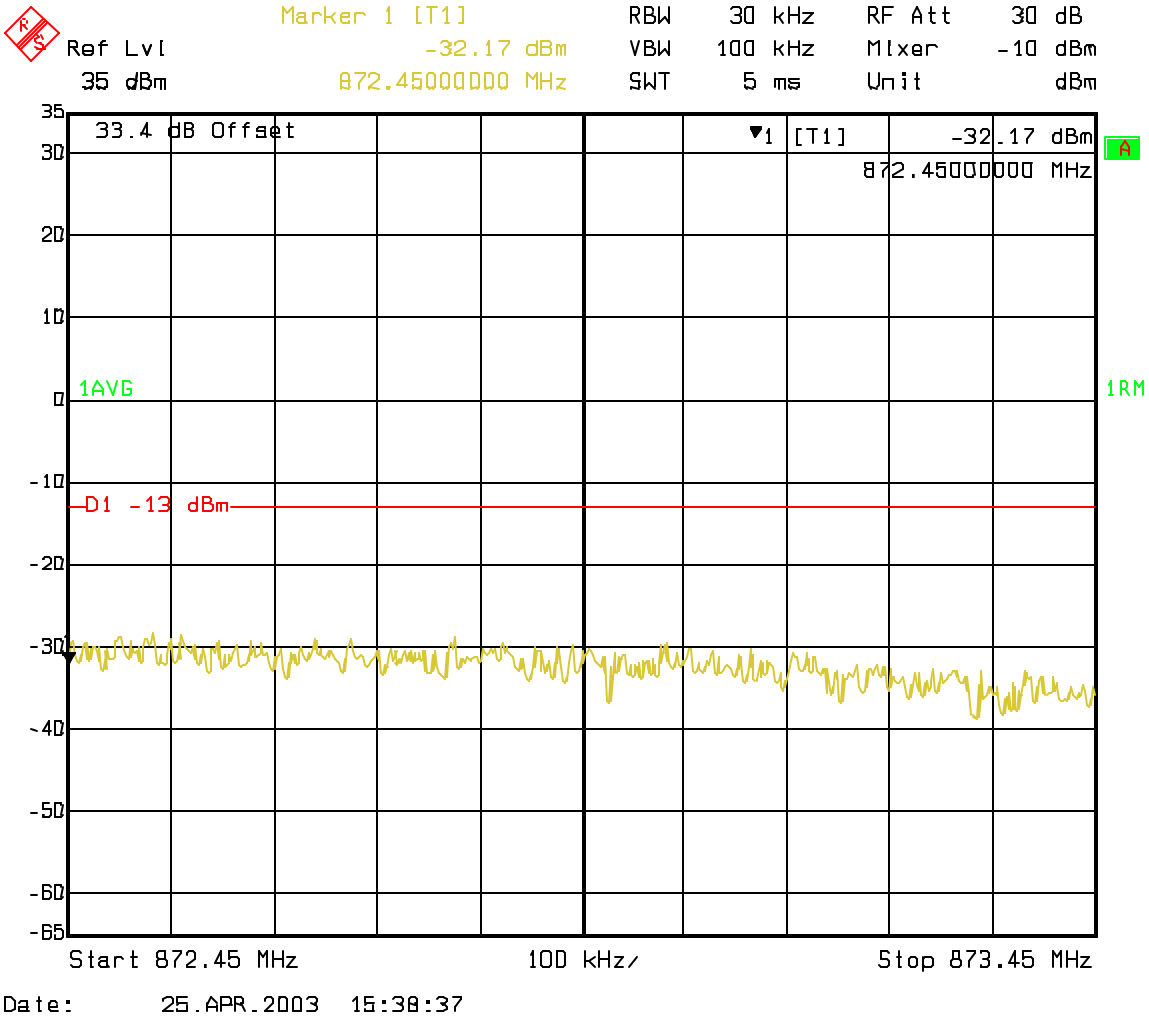
2 Carrier 4_45 DOM Lower 1MHz Adjacent



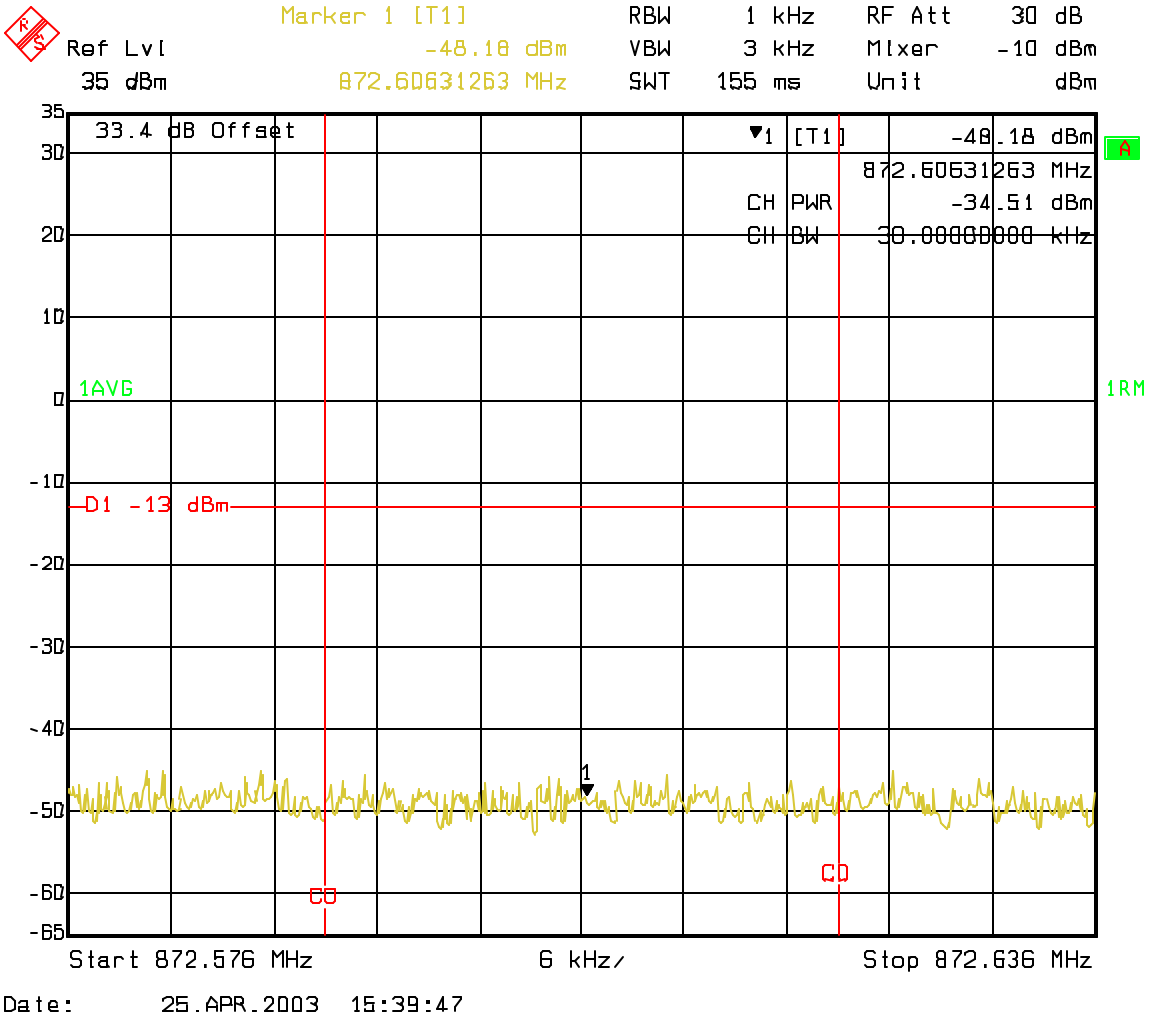
2 Carrier 4_45 DOM Lower 1MHz Adjacent 37.5 kHz ChPwr



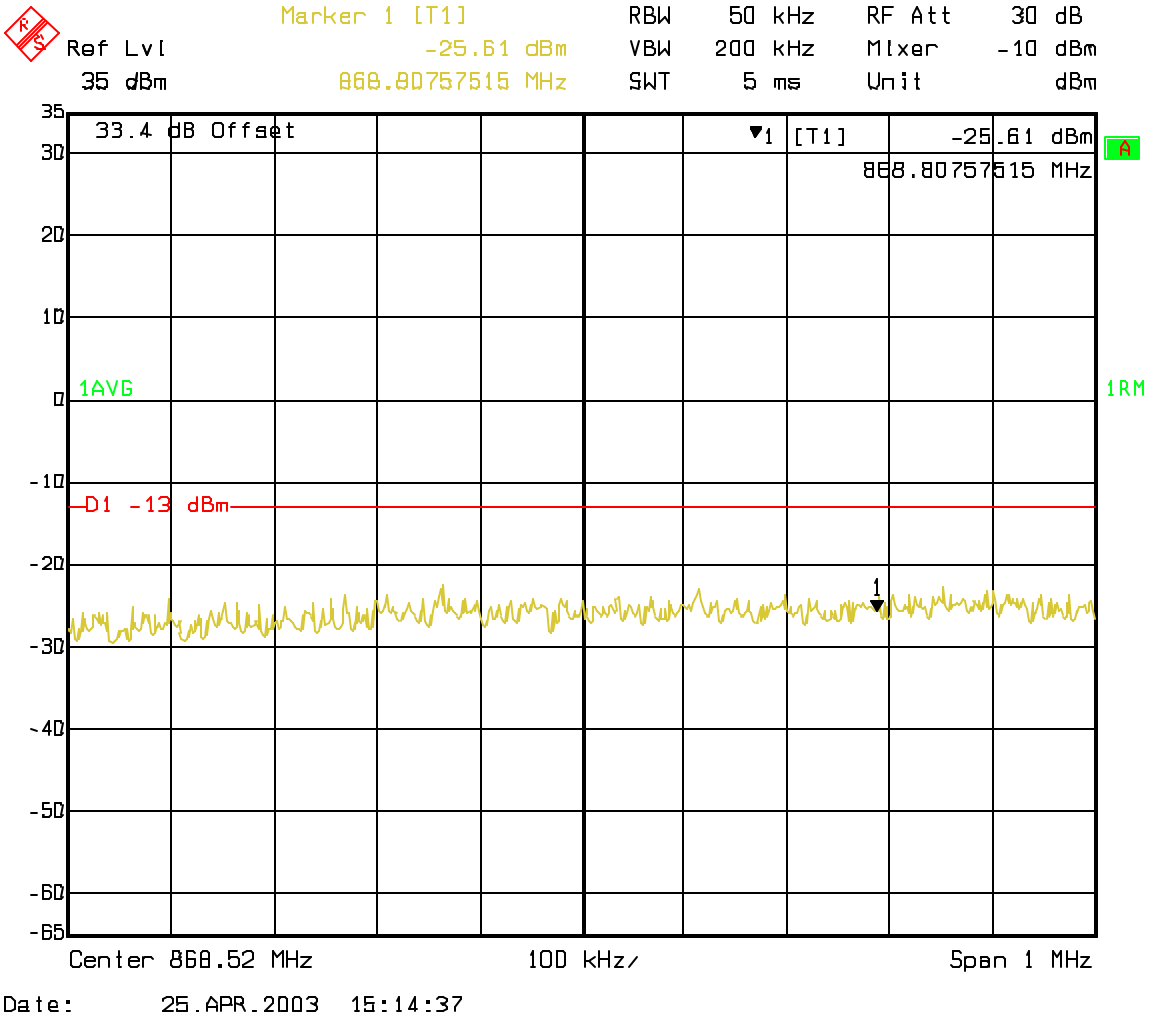
2 Carrier 4_45 DOM Upper 1MHz Adjacent



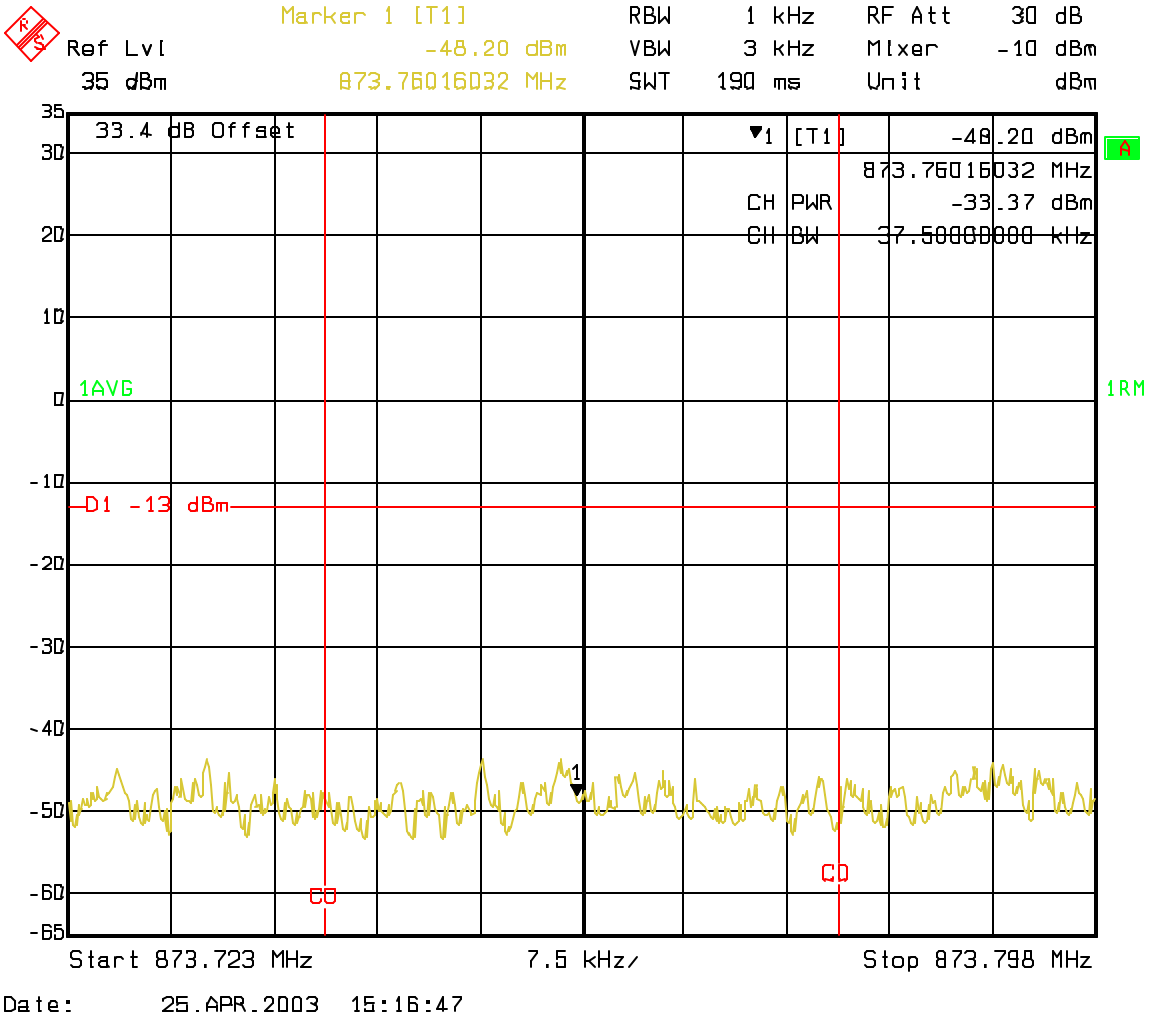
2 Carrier 4_45 DOM Upper 1MHz Adjacent 30 kHz ChPwr



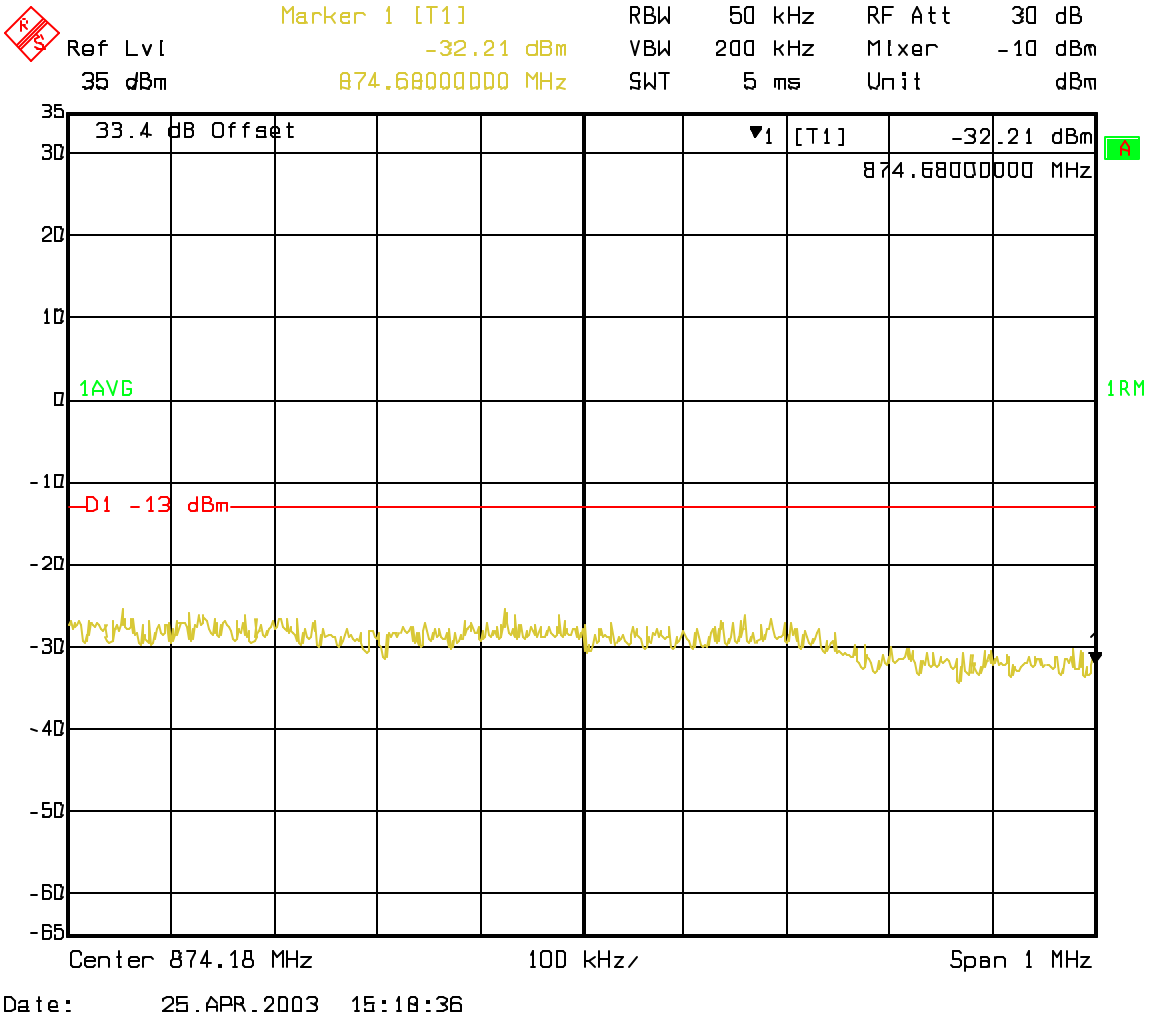
3 Carrier 4_45_86 DOM Lower 1MHz Adjacent



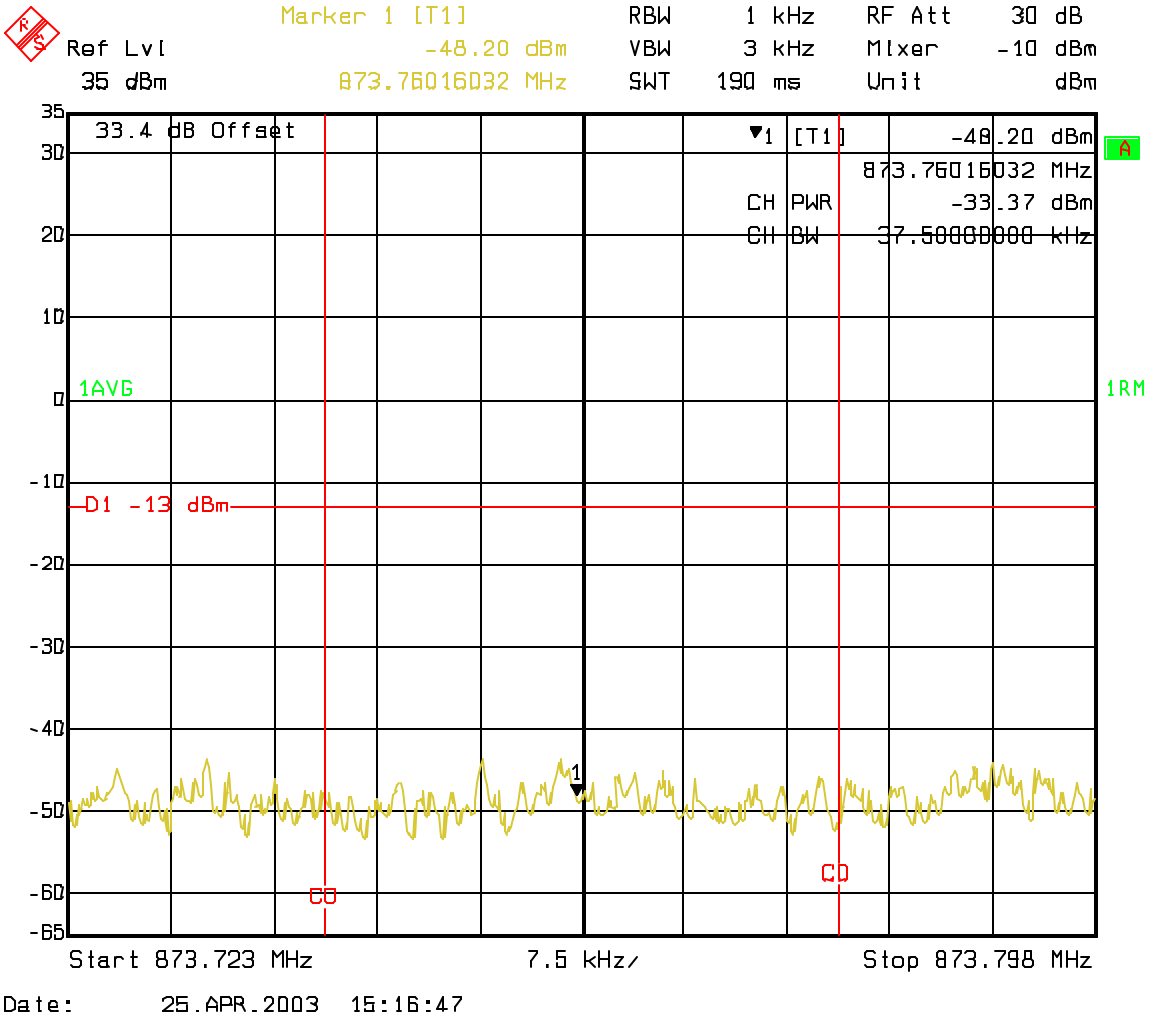
3 Carrier 4_45_86 DOM Lower 1MHz Adjacent 37.5kHz ChPwr



3 Carrier 4_45_86 DOM Upper 1MHz Adjacent



3 Carrier 4_45_86 DOM Upper 1MHz Adjacent 37.5 kHz ChPwr



7