EMC
TEST REPORT

CFR 47 FCC Part 2 and Part 27, Subpart C

Report No. : EME-071149

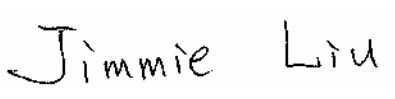
Model No. : MAX-200M1

Issued Date : Nov. 06, 2007

Applicant : ZyXEL Communications Corporation
6, Innovation Rd II, Science-Based Industrial Park,
Hsin-Chu, Taiwan

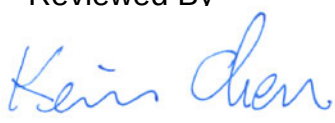
Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

Project Engineer



Jimmie Liu

Reviewed Bv



Kevin Chen

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1. Summary of Test Data

Test/Requirement Description	Applicable Rule	Result
RF Power Output	CFR 47, Part 2, Para 2.1046 CFR 47, Part 27, Para 27.50(h)	Pass
Modulation Characteristics	CFR 47, Part 2, Para 2.1047	Pass
Occupied Bandwidth	CFR 47, Part 2, Para 2.1049 CFR 47, Part 27, Para 27.53(m)	Pass
Spurious Emission at Antenna Terminals	CFR 47, Part 2, Para 2.1051 CFR 47, Part 27, Para 27.53(m)	Pass
Field Strength of Spurious Radiation	CFR 47, Part 2, Para 2.1053 CFR 47, Part 15.209 CFR 47, Part 27, Para 27.53(m)	Pass
Frequency Stability	CFR 47, Part 2, Para 2.1055 CFR 47, Part 27, Para 27.54	Pass
AC Power Line Conducted Emission	CFR 47, Part 15.207	Pass

2. General Information

Identification of the EUT

Applicant	: ZyXEL Communications Corporation
Product	: WiMAX IEEE802.16e Indoor Basic CPE-2.5GHz
Model No.	: MAX-200M1
FCC ID.	: I88MAX200M1
Frequency Range	: 2496MHz to 2690MHz
Channelization	: 2500MHz to 2685MHz for 5M BW 2505MHz to 2685MHz for 10M BW
Type(s) of Modulation	: QPSK, 16QAM
Emission Designator	: For 5MHz: 5M00G9W For 10MHz:10M0G9W
RF Power Output (EIRP)	: 32.85dBm
Rated Power	: 100-240Vac, 50/60Hz with adapter (Model No.: MU18-2180100-A1)
Power Cord	: N/A
Sample Received	: Jun. 23, 2007
Test Date(s)	: Sep. 22, 2007 ~ Oct. 22, 2007

EUT RF Profile of WiMax forum:

1. RF Profile:

Frequency Range (GHz)	Channel Frequency Step (kHz)	Channel Bandwidth(s)(MHz)	FFT size	Duplexing Mode
2.496 – 2.690	250	5	512	TDD
		10	1024	TDD

The RF profile of EUT is followed WiMax forum Document " WiMAX Forum™ Mobile System Profile Release 1.0 Approved Specification", The EUT is WiMAX device which used TDD mode. Following clause 4.1.1.2 table 6 of attachment 1, the EUT is compliant to not only frequency band (2496~2690MHz) of WiMAX Forum specification, but also lowest bandedge and highest bandedge of FCC Part 27 requirement.

2. PHY Parameter:

Parameter	Uplink	Uplink
System Bandwidth	5MHz	10MHz
FFT Size	512	1024
Null Sub-Carriers	104	184
Pilot Sub-Carriers	136	280
Data Sub-Carriers	272	560
Sub-Channels	17	35
Symbol Period, Ts	102.9 microseconds	
Frame Duration	5 millisecond	
OFDM Symbols/Frame	48	
Data OFDM Symbols	44	
Modulations	QPSK 1/2 CTC , QPSK 3/4 CTC 16QAM 1/2 CTC , 16QAM 3/4 CTC (The EUT is followed WiMAX forum document" WiMAX Forum™ Mobile System Profile Release 1.0 Approved Specification" as attachment 2, clause 7, and Table 131.)	

3. Voltage and current through final PA

According to 2.1033 (c) (8), the voltage is 157mV, and the current is 878mA

4. According to 2.1033 (c) (6), the range of operating power values are ±1dB, please also reference specification of manual.

Description of EUT

The EUT is a WiMAX IEEE802.16e Indoor Basic CPE-2.5GHz and was defined as temporary fixed station, it has two type of Bandwidth, one is 5MHz, the other is 10MHz and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

The EUT used Runcom’s chips for WiMAX solution.
All test have been done in accordance with the WiMAX standard IEEE 802.16e-2005. and with compliance to the MRCT requirements.
(Ref. Runcom Technologies Ltd MSS Test results)

Antenna description

Antenna 1

The EUT uses a permanently connected antenna.

Antenna Gain	: 6dBi max
Antenna Type	: Patch antenna
Connector Type	: U.FL-R-SMT

Antenna 2

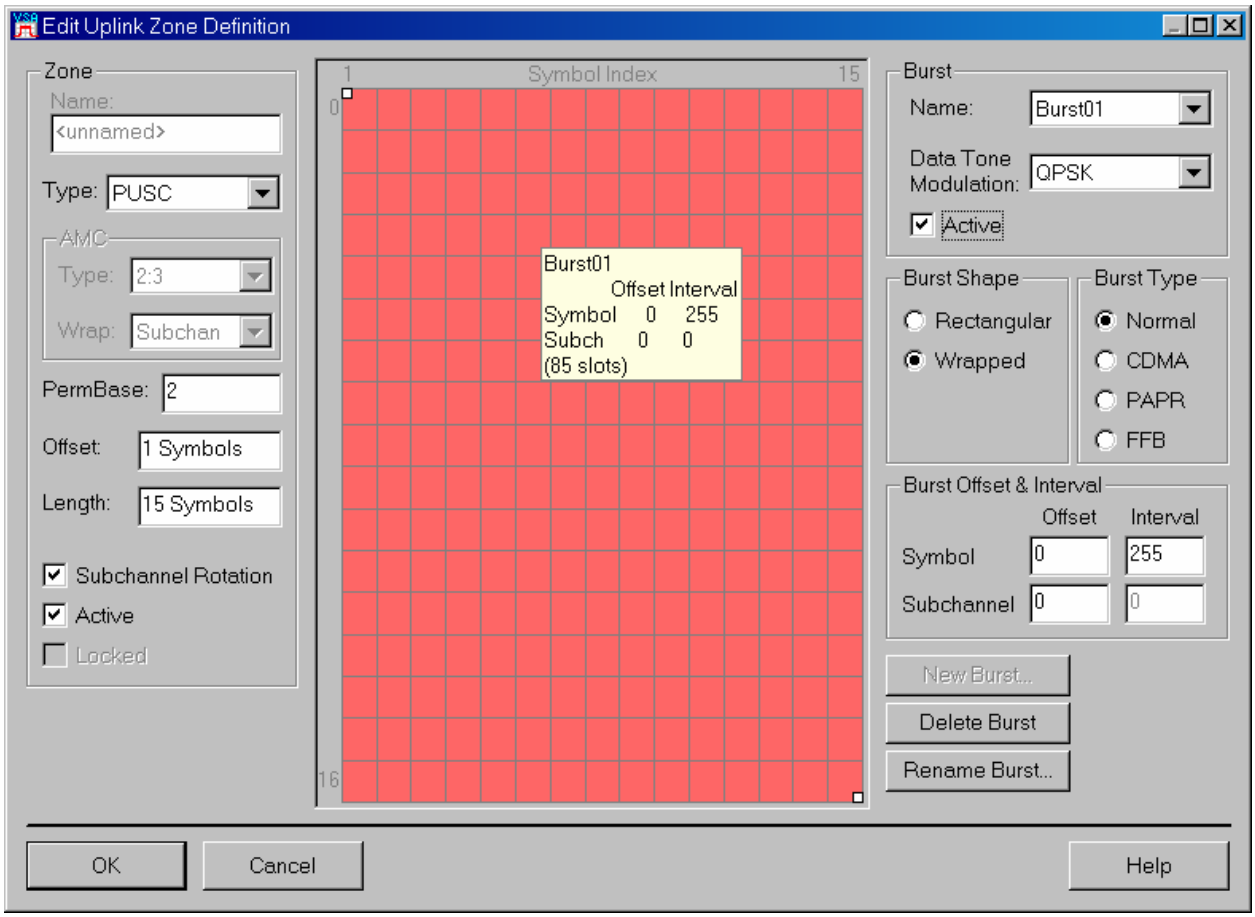
The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain	: 2dBi max
Antenna Type	: Dipole antenna
Connector Type	: SMA reverse

Test description

Since the EUT has 16QAM and QPSK modulation, after verifying both modulations, the maximum output power and the worst case were found at OFDMA QPSK 1/2 for 5 MHz Bandwidth and 10 MHz Bandwidth. The final tests has been executed under these conditions and recorded in this report individually.

The EUT was transmitted continuously during the test and subchannelizations as below (for 5MHz. &10MHz Bandwidth)



3: Test Equipment List

Intertek ID No.	Equipment	Brand	Model No.	Calculation Due
EC303	EMI Test Receiver	Rohde & Schwarz	ESCS 30	04/27/2008
EC353	Spectrum Analyzer	Rohde & Schwarz	FSP 30	08/06/2008
EC365	Spectrum Analyzer	Rohde & Schwarz	FSEK 30	11/12/2008
EC354	Signal Generator	Rohde & Schwarz	SMR27	11/01/2008
EC371	Horn Antenna	SCHWARZBECK	BBHA 9120 D	12/22/2007
EC351	Horn Antenna	SCHWARZBECK	BBHA 9170	03/04/2008
EC347	Bilog Antenna	SCHWARZBECK	VULB 9168	12/23/2007
EC373	Pre-Amplifier	MITEQ	919981	03/07/2009
EC374	Pre-Amplifier	MITEQ	828825	01/15/2008
EP346	Controller	HDGmbH	CM 100	N/A
EP347	Antenna Tower	HDGmbH	MA 2400	N/A
EC344	LISN	Rohde & Schwarz	ESH3-Z5	03/30/2008
EC396	Wideband Peak Power Meter/ Sensor	Anritsu	ML2497A/ MA2491A	11/15/2008
EC363	Temperature Humidity Test Chamber	Juror	TR-4010	09/18/2008
EC404-1	PSA Series Spectrum Analyzer	Agilent	E4440A	04/26/2008
EP391	WiMAX Tested	Agilent	N8990A P30	-
EC404-4	P Series Power Meter	Agilent	N1911A	02/08/2008
EC404-5	Wide band Power Sensor	Agilent	N1921A	01/20/2008
EC404-3	ESG VECTOR SIGNAL GENERATIOR	Agilent	E4438C	04/28/2008
N/A	INDUSRIAL COMPUTER	ADVANGTECH	610H	N/A

Note: 1. The above equipments are within the valid calibration period.

Measurement Uncertainty:

Measurement uncertainty was calculated in accordance with NAMAS NIS 81.

Parameter	Uncertainty
Radiated Emission	±4.98 dB
Conducted Emission	±2.6 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4. RF Power Output (EIRP Power)

Name of Test	RF Power Output
Base Standard	FCC 2.1046 & 27.50(h)

Tested By: Jimmie Liu
Test Date: Sep. 22, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 25℃, 65%

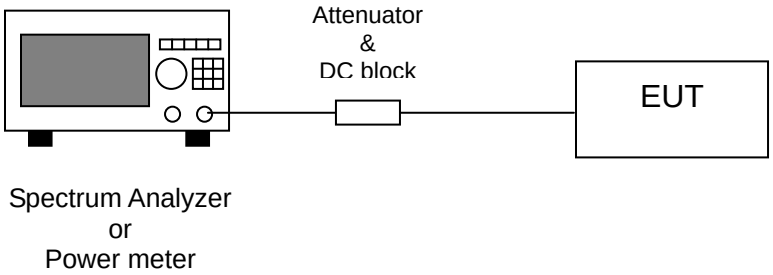
Test Equipment: EC396

Test Procedure and Setup:

A1. Method of Measurement:

The peak power at antenna terminals is measured using a Power Meter. Power output is measured with the maximum rated input level.

A2. Test Diagram:



Test Result: Complies

Measurement Data: See Table1.

Note: The EUT was tested while in a continuous transmit mode. The EUT was tuned to a low, middle and high channel.

Table1. EIRP

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Dipole antenna	QPSK	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	25.36	2	2	29.36	33	5
2590	25.38	2	2	29.38	33	5
2685	22.32	2	2	26.32	33	5
2505	25.38	2	2	29.38	33	10
2590	25.26	2	2	29.26	33	10
2685	22.03	2	2	26.03	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Dipole antenna	QPSK	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	25.30	2	2	29.30	33	5
2590	25.32	2	2	29.32	33	5
2685	22.26	2	2	26.26	33	5
2505	25.25	2	2	29.25	33	10
2590	25.21	2	2	29.21	33	10
2685	21.98	2	2	25.98	33	10

Remark: EIRP= Power Meter Reading + Cable Loss + Ant. Gain

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Dipole antenna	16QAM	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	25.24	2	2	29.24	33	5
2590	25.26	2	2	29.26	33	5
2685	22.14	2	2	26.14	33	5
2505	25.18	2	2	29.18	33	10
2590	25.12	2	2	29.12	33	10
2685	21.85	2	2	25.85	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Dipole antenna	16QAM	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	25.13	2	2	29.13	33	5
2590	25.19	2	2	29.19	33	5
2685	22.08	2	2	26.08	33	5
2505	25.07	2	2	29.07	33	10
2590	25.08	2	2	29.08	33	10
2685	21.28	2	2	25.28	33	10

Remark: EIRP= Power Meter Reading + Cable Loss + Ant. Gain

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Patch antenna	QPSK	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	23.06	2	6	31.06	33	5
2590	23.24	2	6	31.24	33	5
2685	21.94	2	6	29.94	33	5
2505	23.25	2	6	31.25	33	10
2590	23.06	2	6	31.06	33	10
2685	21.92	2	6	29.92	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Patch antenna	QPSK	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	22.95	2	6	30.95	33	5
2590	23.13	2	6	31.13	33	5
2685	21.86	2	6	29.86	33	5
2505	23.09	2	6	31.09	33	10
2590	22.96	2	6	30.96	33	10
2685	21.75	2	6	29.75	33	10

Remark: EIRP= Power Meter Reading + Cable Loss + Ant. Gain

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Patch antenna	16QAM	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	22.84	2	6	30.84	33	5
2590	22.32	2	6	30.32	33	5
2685	21.74	2	6	29.74	33	5
2505	22.72	2	6	30.72	33	10
2590	22.97	2	6	30.97	33	10
2685	21.71	2	6	29.71	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	26℃, 65%	Patch antenna	16QAM	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	22.56	2	6	30.56	33	5
2590	22.17	2	6	30.17	33	5
2685	21.65	2	6	29.65	33	5
2505	22.59	2	6	30.59	33	10
2590	22.77	2	6	30.77	33	10
2685	21.53	2	6	29.53	33	10

Remark: EIRP= Power Meter Reading + Cable Loss + Ant. Gain

5. Radiated Power Measurement

Name of Test	EIRP Power
Base Standard	FCC 2.1046 & 27.50(h)

Tested By: Jimmie Liu
Test Date: Sep. 23, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 25℃, 65%

Test Equipment: EC353

Test Procedure and Setup:

A1. Method of Measurement:

Tests were performed to identify the maximum equivalent isotropically radiated output power from the EUT.

The EIRP was measured with the EUT arranged on a non-conducting table on a fully-anechoic chamber,

The test procedure is consist of three parts:

1. Measured the highest peak readings in horizontal & vertical polarity in the three orthogonal axes.
2. Use the substitution method to perform final tests.
   I. The EUT was substituted with a half wave dipole.
   II. The substituted antenna was set to the same center location as the EUT in horizontal or vertical polarity.
   III. The substituted antenna was connected with a 6dB attenuator for impedance matching purpose between S/G and substituted antenna.
   IV. The S/G was tuned to the frequency according to the measurement results and used a broadband S/G to generate the signal.
   V. The level of S/G was adjusted until the maximum reading is the same as recorded EUT level. (A power amplifier maybe used to produce the wanted power)
3. The EIRP was calculated as:

   EIRP = S/G level – cable loss + antenna gain

   The maximum EIRP test results are recorded in the following table

A2. Measurement Results:

Radiated Power from Dipole antenna:

QPSK 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	31.23
Middle	2590	31.26
High	2685	28.18

QPSK 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	31.25
Middle	2590	31.22
High	2685	27.85

16QAM 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	30.83
Middle	2590	31.19
High	2685	27.93

16QAM 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	30.54
Middle	2590	30.41
High	2685	27.39

Radiated Power from Patch antenna:

QPSK 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	32.64
Middle	2590	32.85
High	2685	30.81

QPSK 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	32.69
Middle	2590	32.04
High	2685	31.66

16QAM 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	32.47
Middle	2590	31.99
High	2685	31.31

16QAM 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	32.51
Middle	2590	32.66
High	2685	31.62

5. Occupied Bandwidth

Name of Test	Occupied Bandwidth
Base Standard	FCC 2.1049 & 27.53(l)

Tested By: Jimmie Liu
Test Date: Oct. 22, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 26℃, 65%

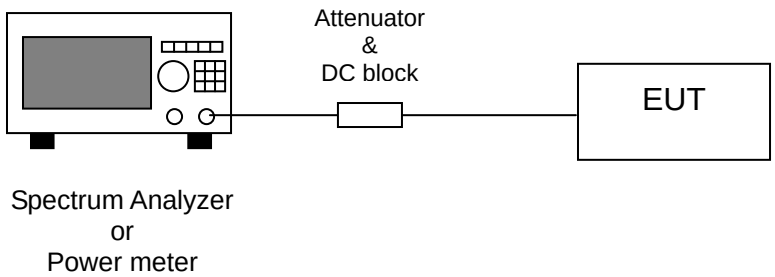
Test Equipment: EC365

Test Procedure and Setup:

B1. Method of Measurement:

A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of at least 1% of the bandwidth of the transmitted signal. The resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform. The appropriate bandwidth mask is applied to the output waveform to verify compliance.

B2. Test Diagram:



Test Result: Complies
Measurement Data: See attached plots

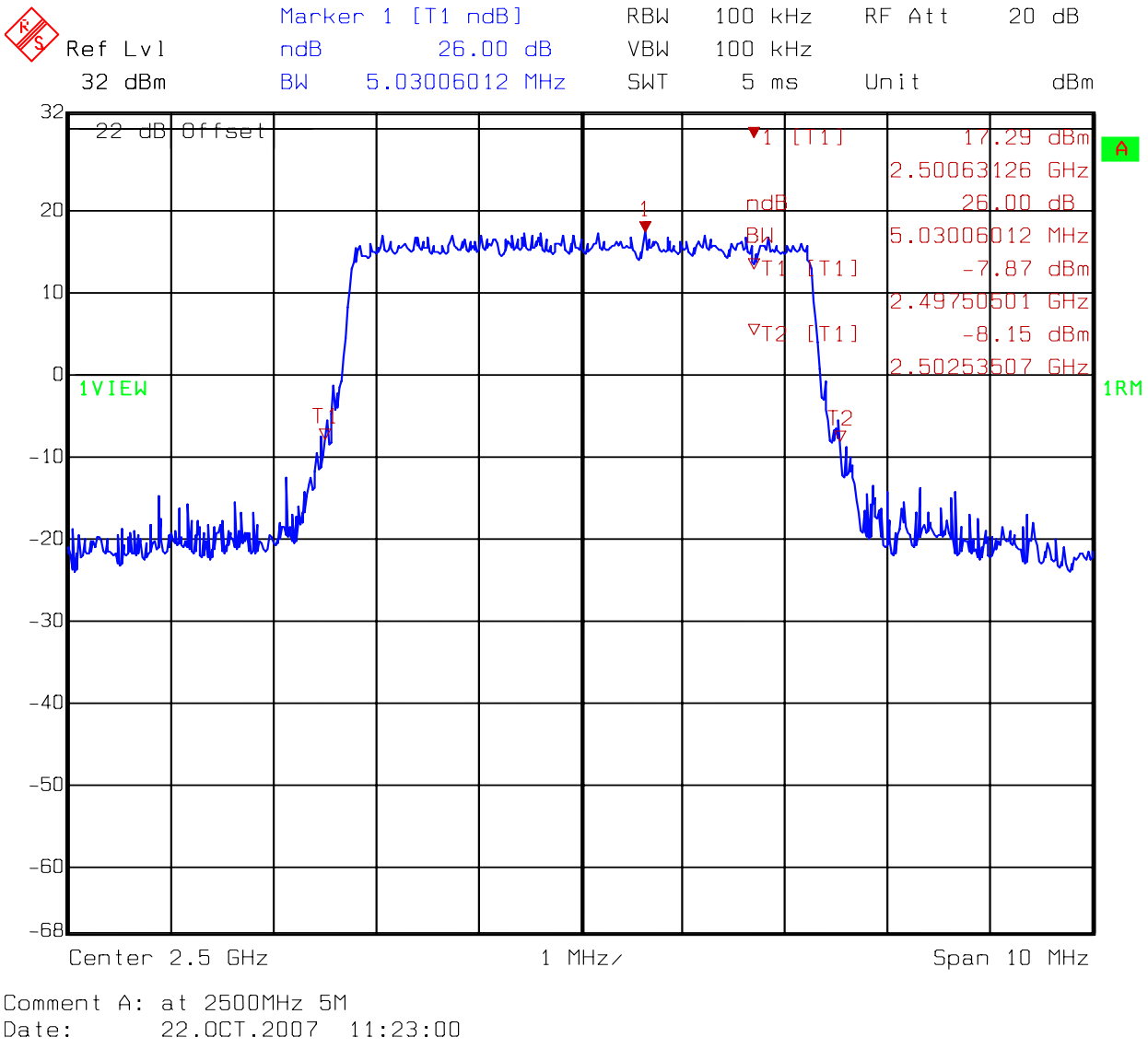
Note: The EUT was tested while in a continuous transmit mode.
The EUT was tuned to a low, middle and high channel.

Antenna Type	Frequency (MHz)	Bandwidth (MHz)
Dipole antenna	2500	5.03
Dipole antenna	2590	5.03
Dipole antenna	2685	4.99
Dipole antenna	2505	9.62
Dipole antenna	2590	9.62
Dipole antenna	2685	9.66

Antenna Type	Frequency (MHz)	Bandwidth (MHz)
Patch antenna	2500	4.95
Patch antenna	2590	4.95
Patch antenna	2685	4.89
Patch antenna	2505	9.62
Patch antenna	2590	9.62
Patch antenna	2685	9.70

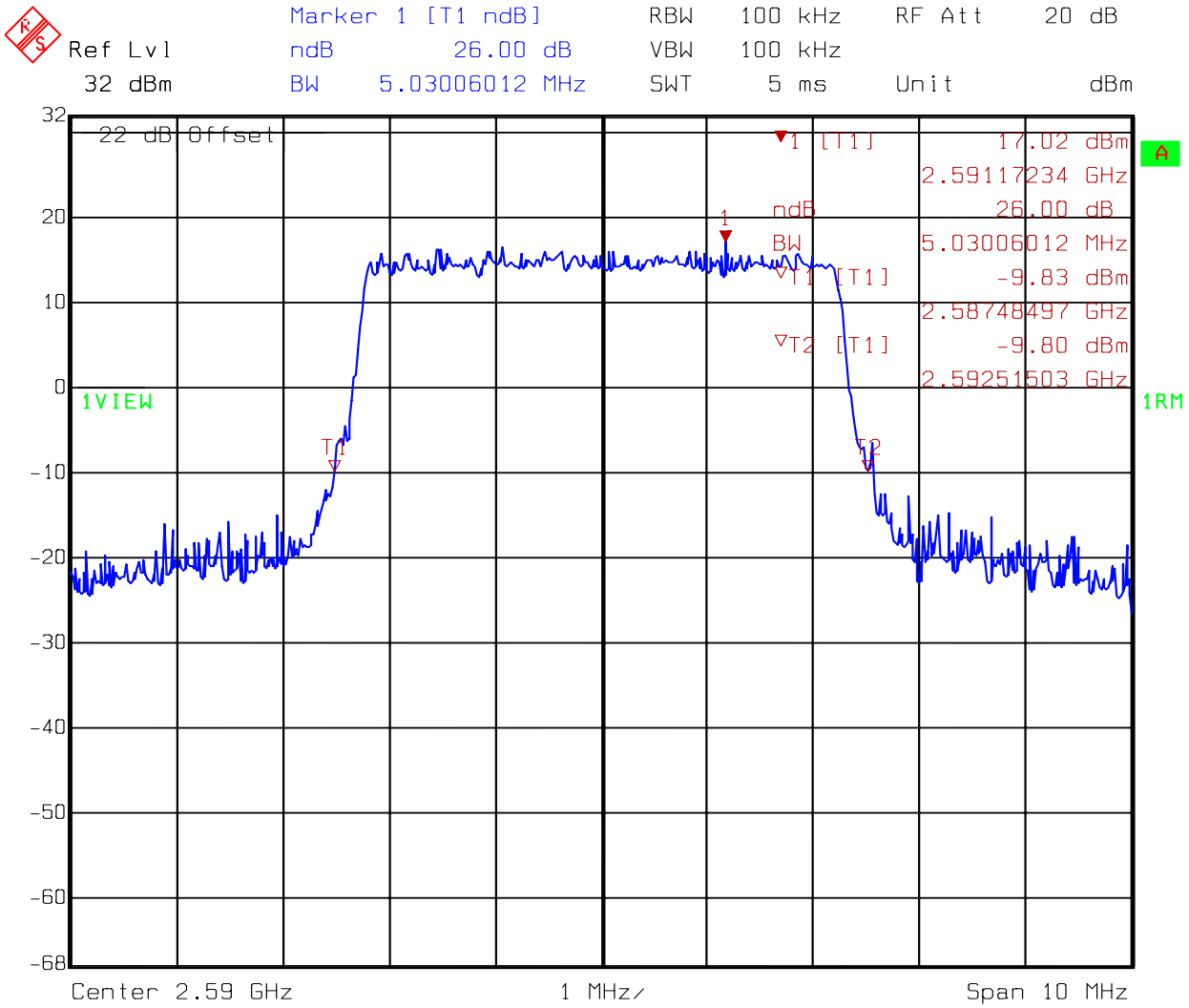
Antenna Type: Dipole antenna

Figure 1. Occupied Bandwidth @ low channel (5MHz)



Antenna Type: Dipole antenna

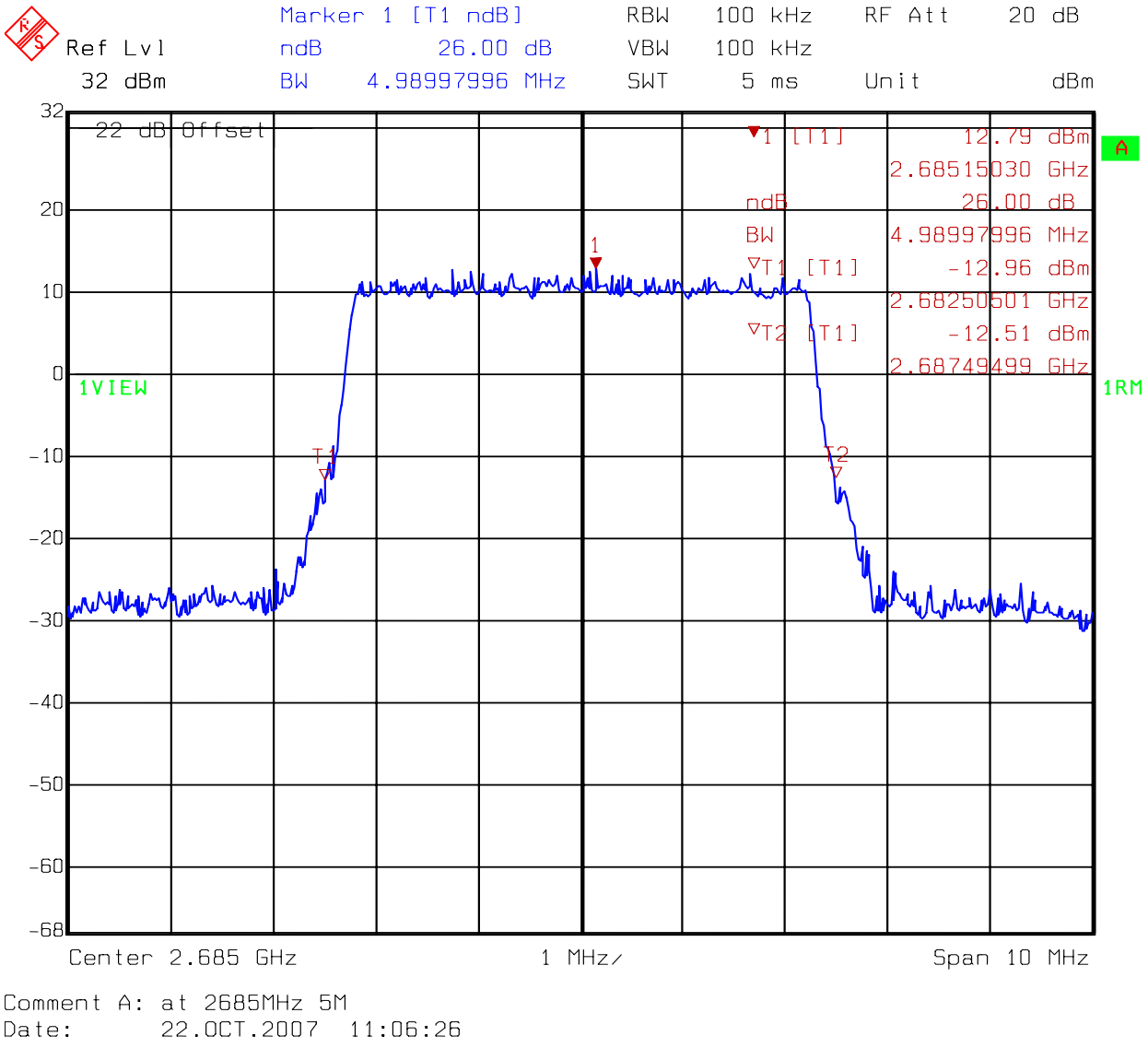
Figure 2. Occupied Bandwidth @ middle channel (5MHz)



Comment A: at 2590MHz 5M
Date: 22.OCT.2007 11:19:10

Antenna Type: Dipole antenna

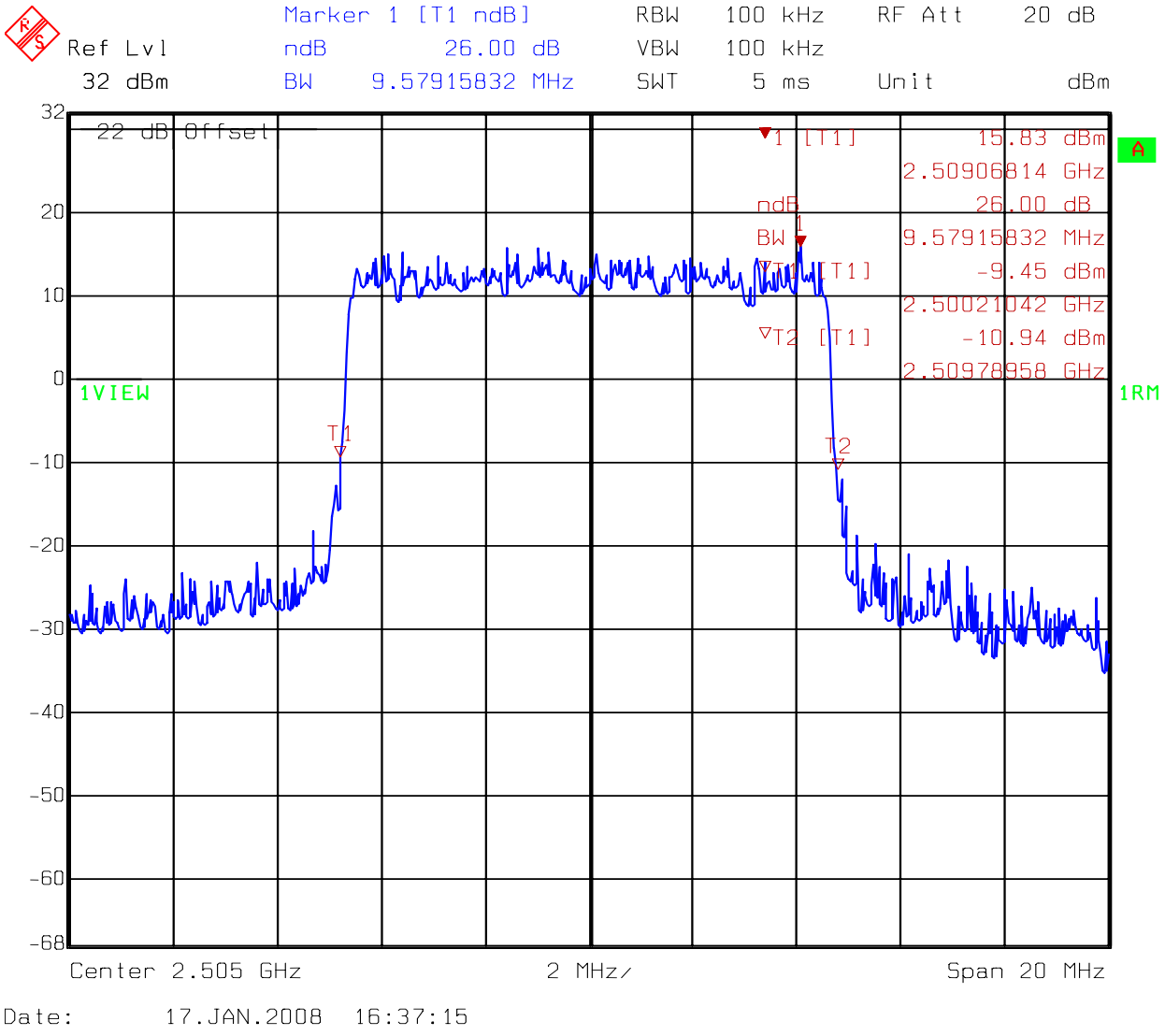
Figure 3. Occupied Bandwidth @ high channel (5MHz)



Comment A: at 2685MHz 5M
Date: 22.OCT.2007 11:06:26

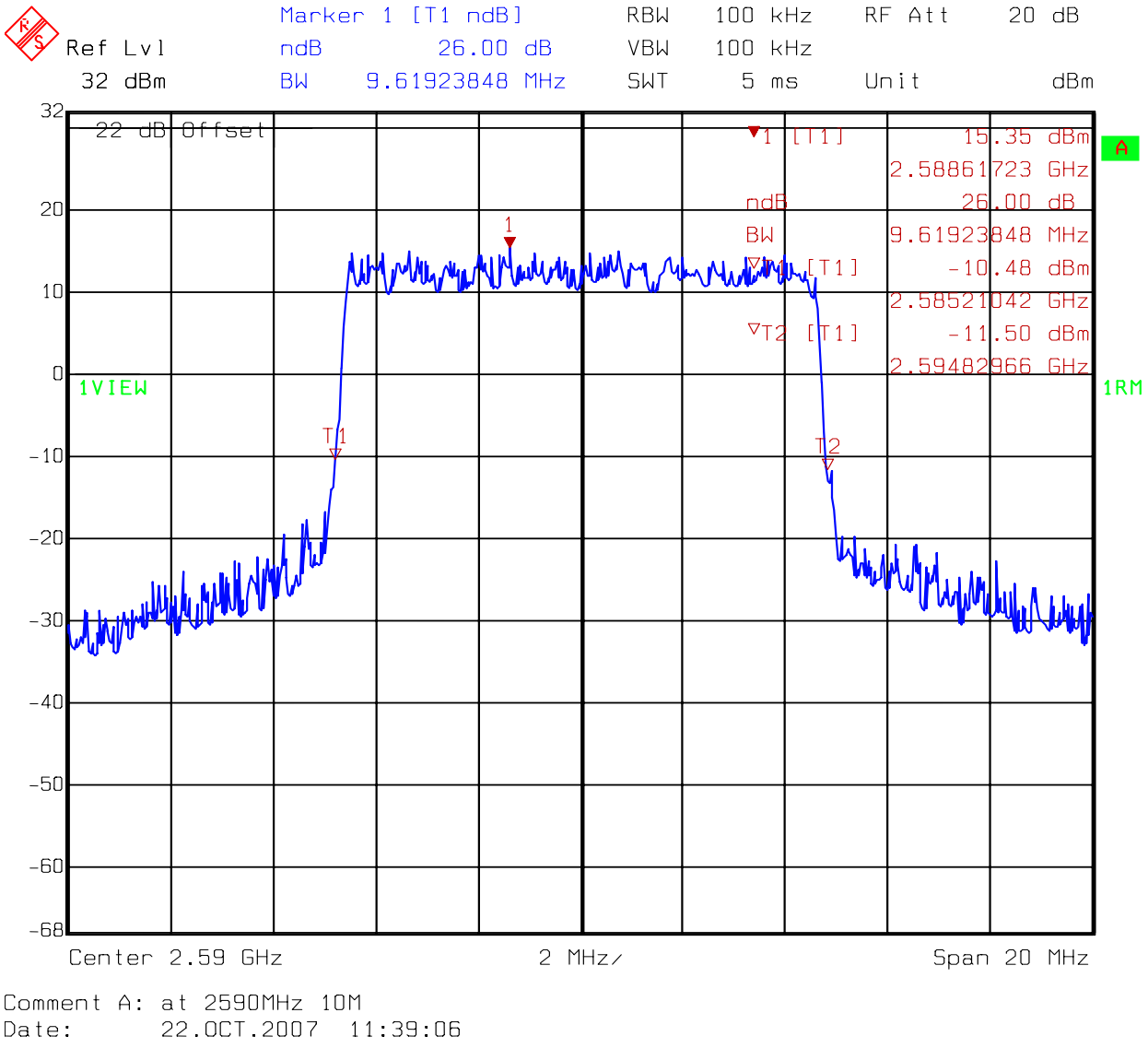
Antenna Type: Dipole antenna

Figure 4. Occupied Bandwidth @ low channel (10MHz)



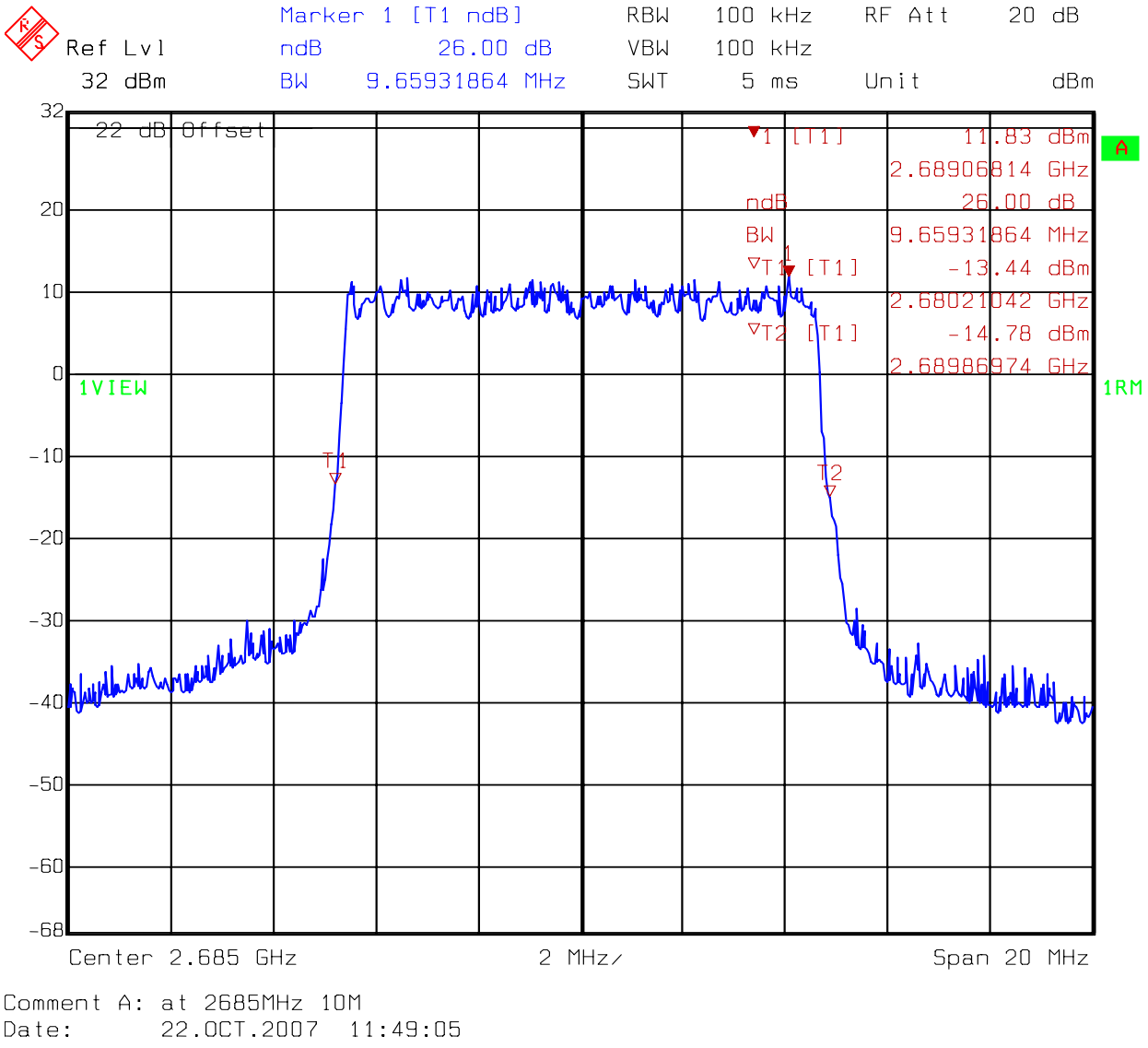
Antenna Type: Dipole antenna

Figure 5. Occupied Bandwidth @ middle channel (10MHz)



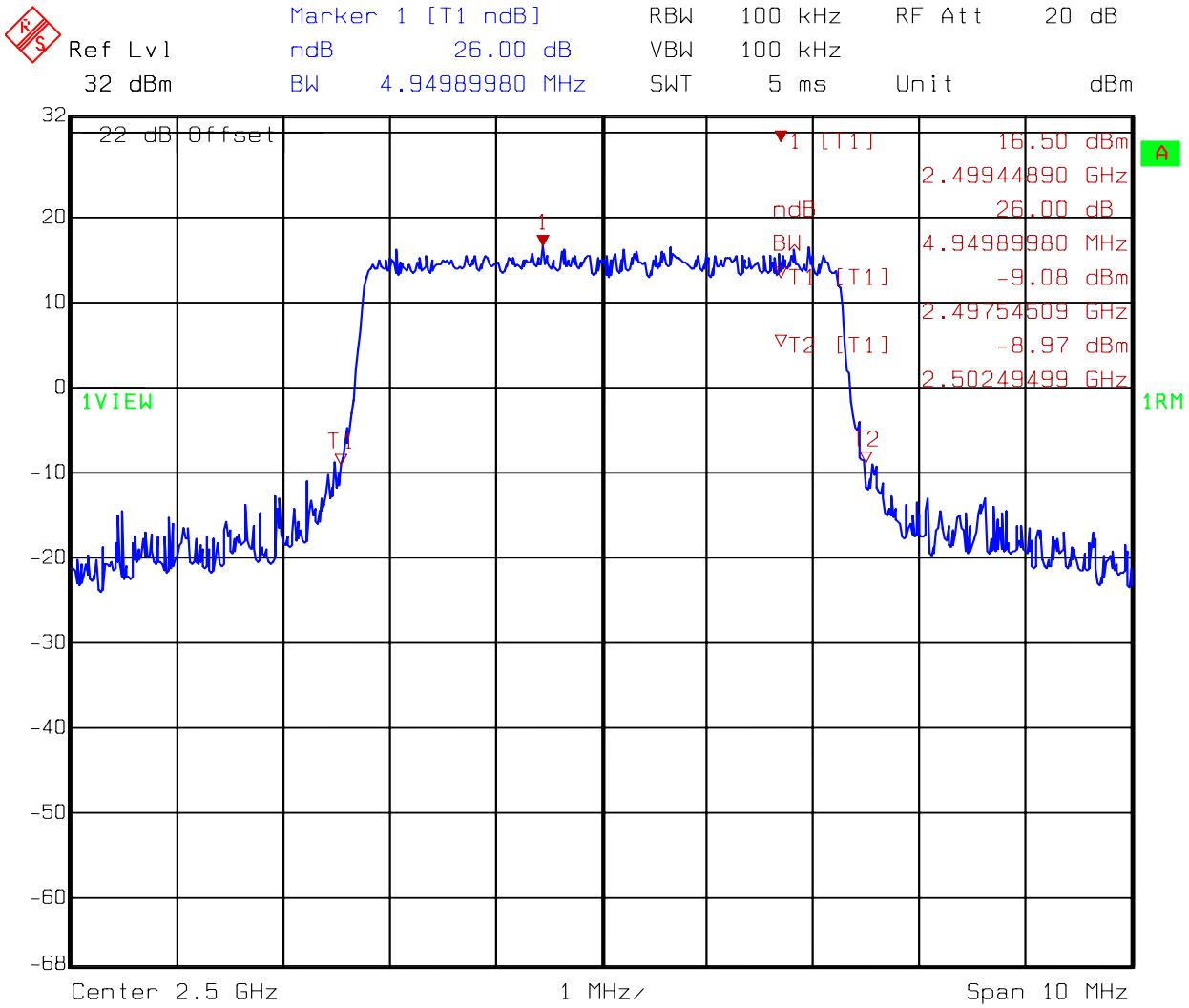
Antenna Type: Dipole antenna

Figure 6. Occupied Bandwidth @ high channel (10MHz)



Antenna Type: Patch antenna

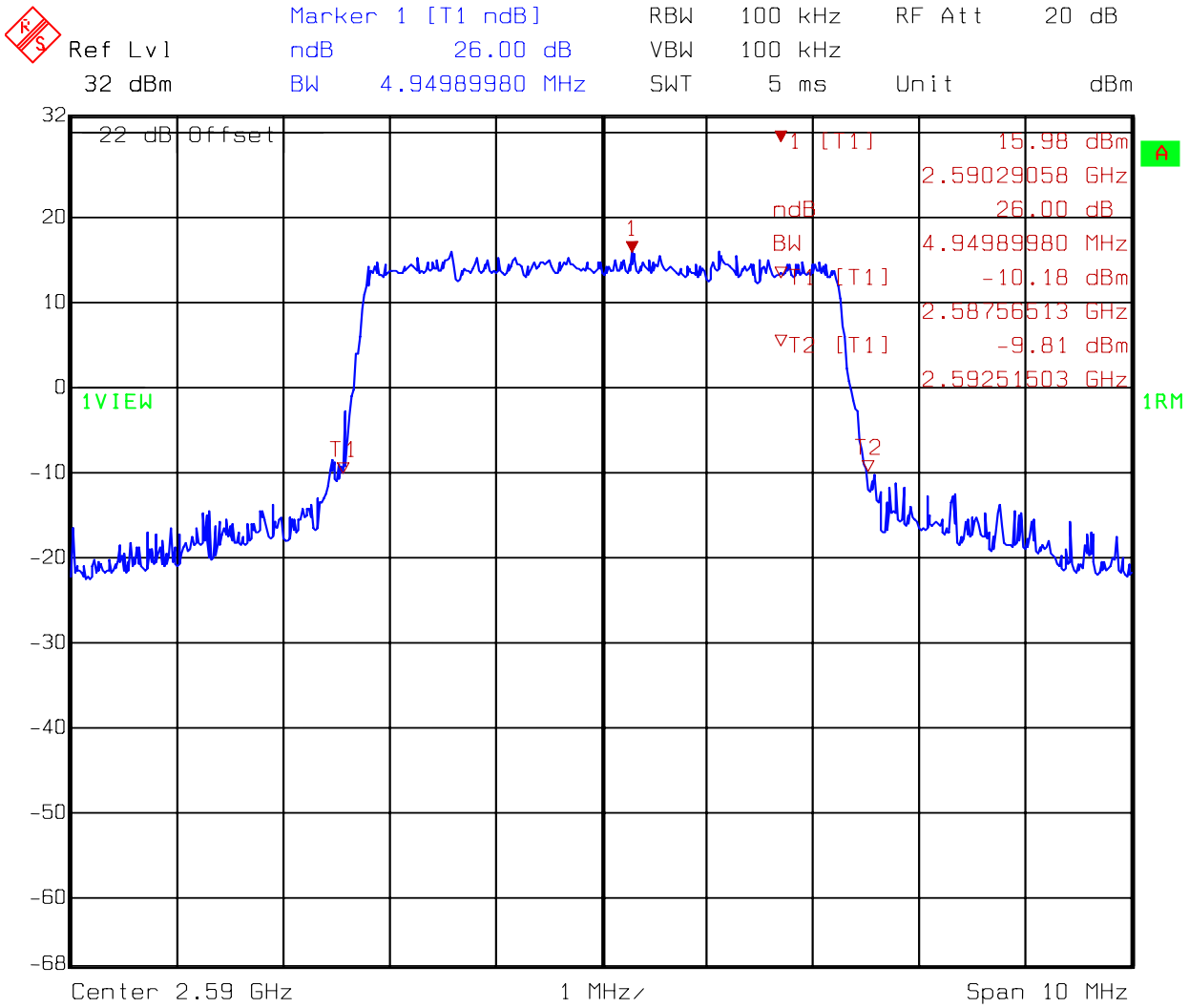
Figure 7. Occupied Bandwidth @ low channel (5MHz)



Comment A: at 2500MHz 5M
Date: 22.OCT.2007 11:25:26

Antenna Type: Patch antenna

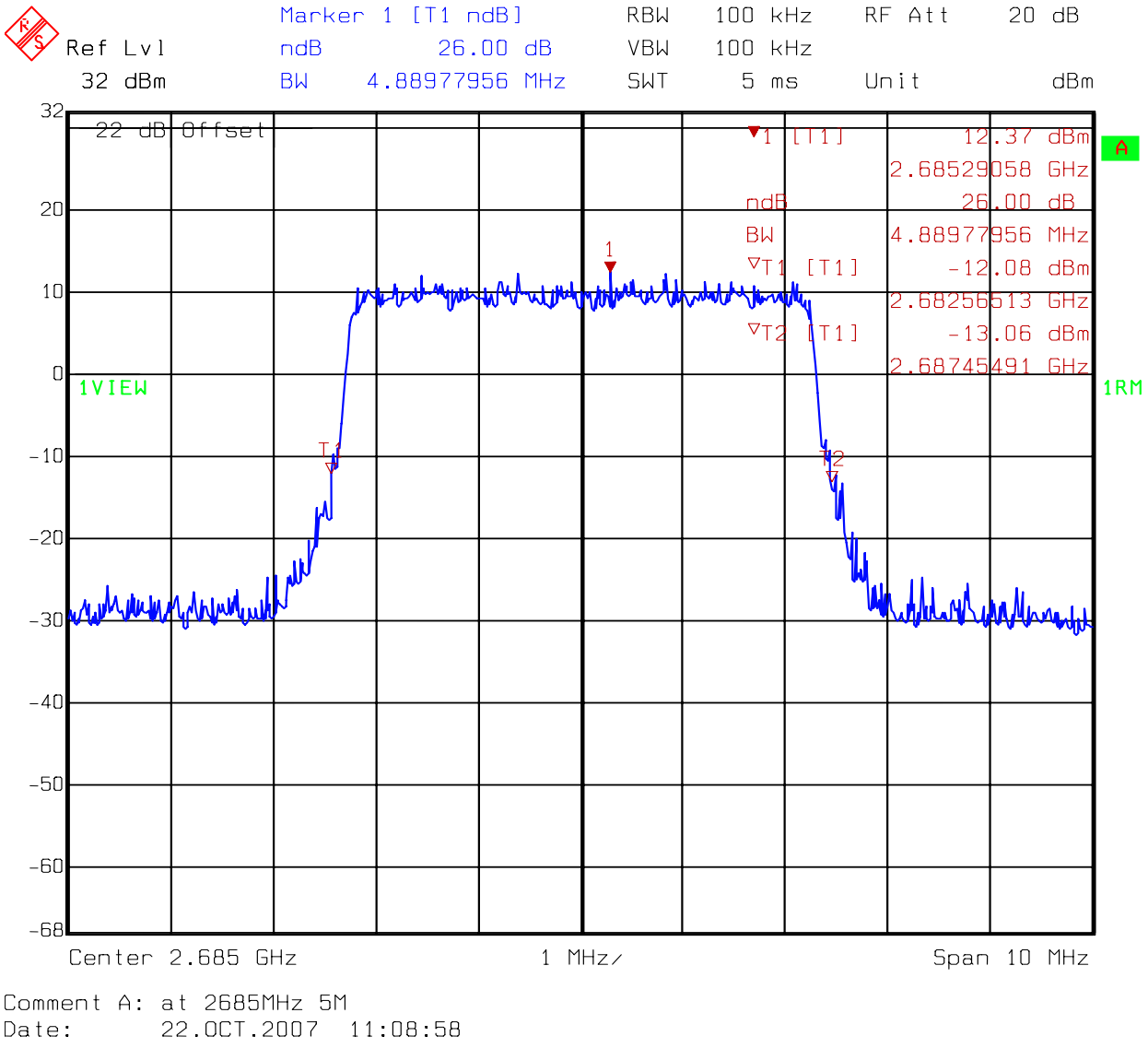
Figure 8. Occupied Bandwidth @ middle channel (5MHz)



Comment A: at 2590MHz 5M
Date: 22.OCT.2007 10:48:43

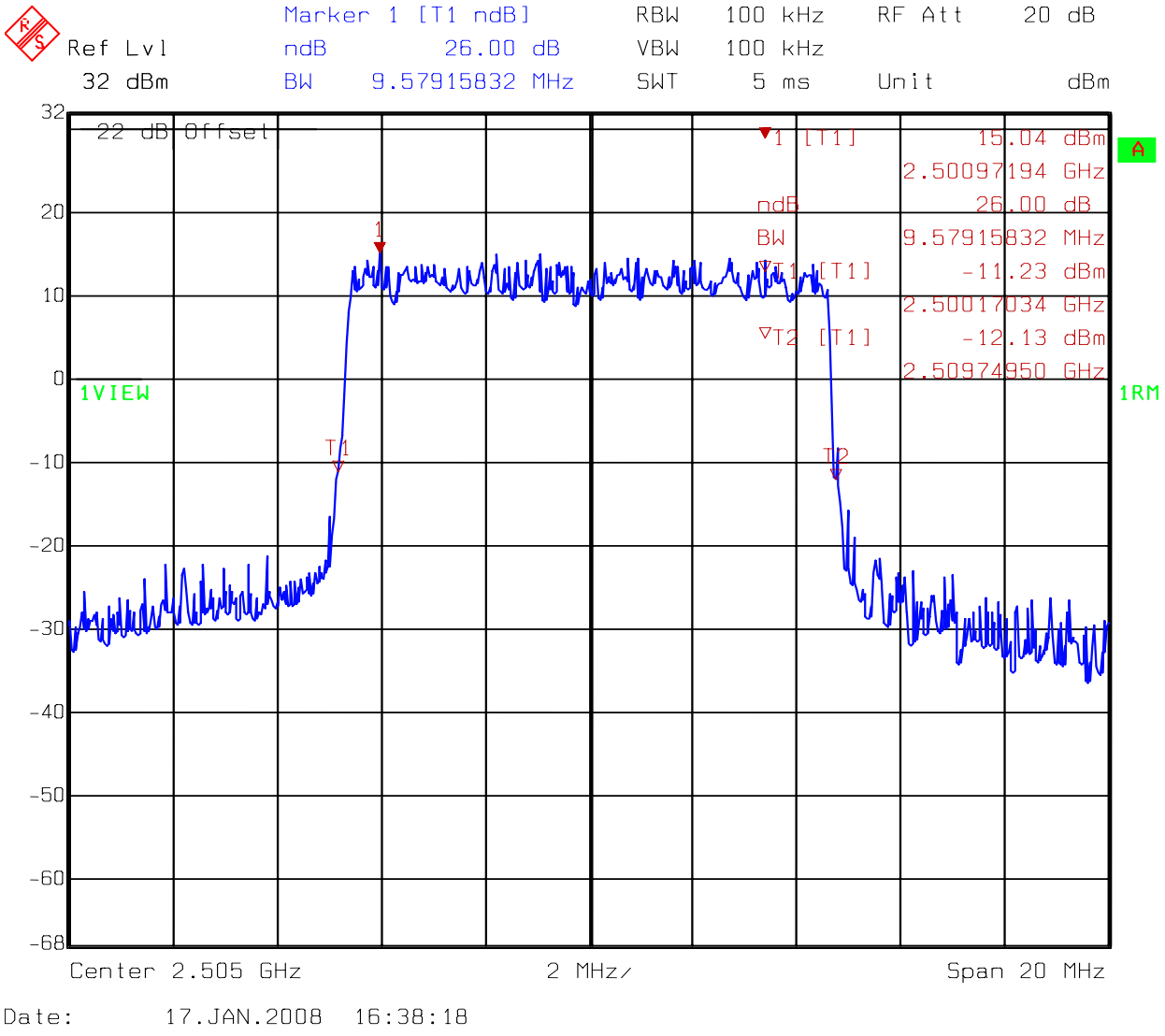
Antenna Type: Patch antenna

Figure 9. Occupied Bandwidth @ high channel (5MHz)



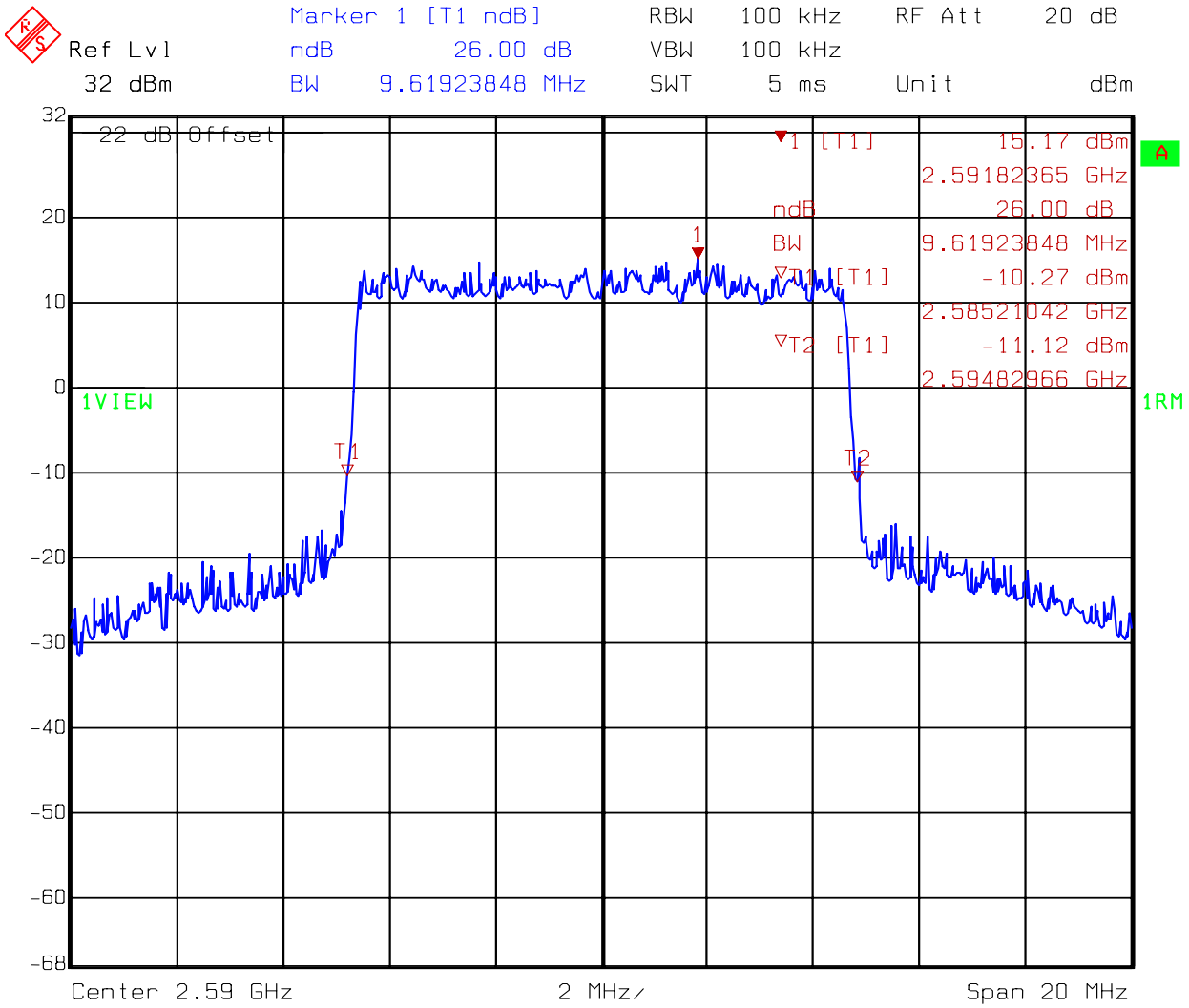
Antenna Type: Patch antenna

Figure 10. Occupied Bandwidth @ low channel (10MHz)



Antenna Type: Patch antenna

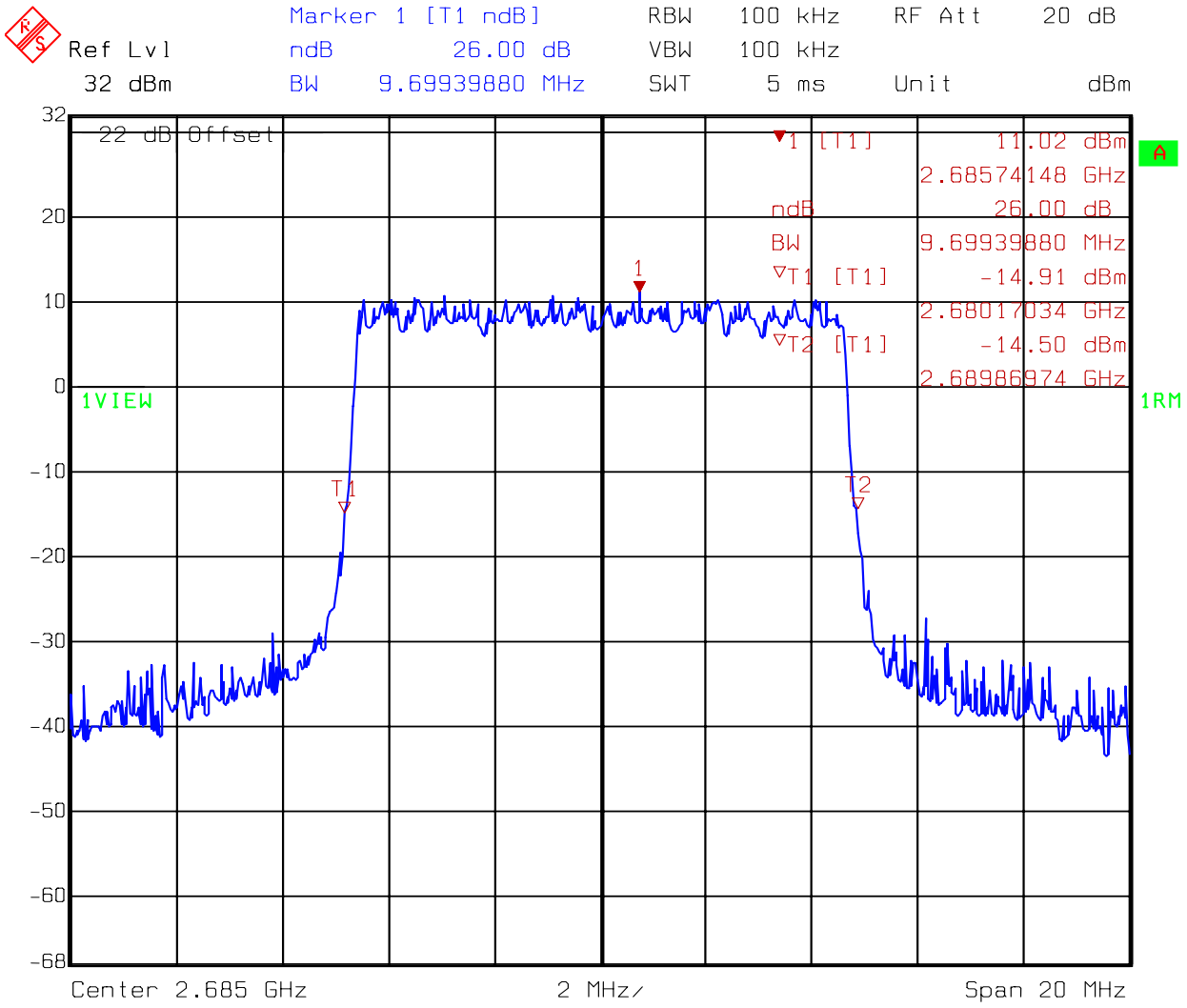
Figure 11. Occupied Bandwidth @ middle channel (10MHz)



Comment A: at 2590MHz 10M
Date: 22.OCT.2007 11:42:04

Antenna Type: Patch antenna

Figure 12. Occupied Bandwidth @ high channel (10MHz)



Comment A: at 2685MHz 10M
Date: 22.OCT.2007 11:46:01

6. Spurious Emissions at Antenna Terminals

Name of Test	Spurious Emission at Antenna Terminals
Base Standard	FCC 2.1051 & 27.53(l)

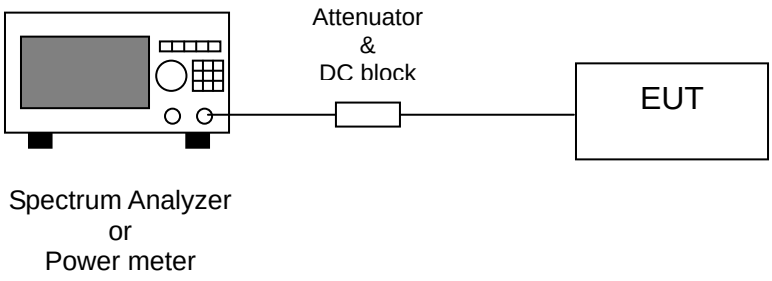
Tested By: Jimmie Liu
Test Date: Oct. 22, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 26℃, 65%

Test Equipment: EC365

Test Procedure and Setup:

C1. Method of Measurement:
A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of 1 MHz for emissions above 1 GHz. Below 1 GHz the resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform. The appropriate limit line is applied to the output waveform to verify compliance.

C2. Test Diagram:



Test Result: Complies

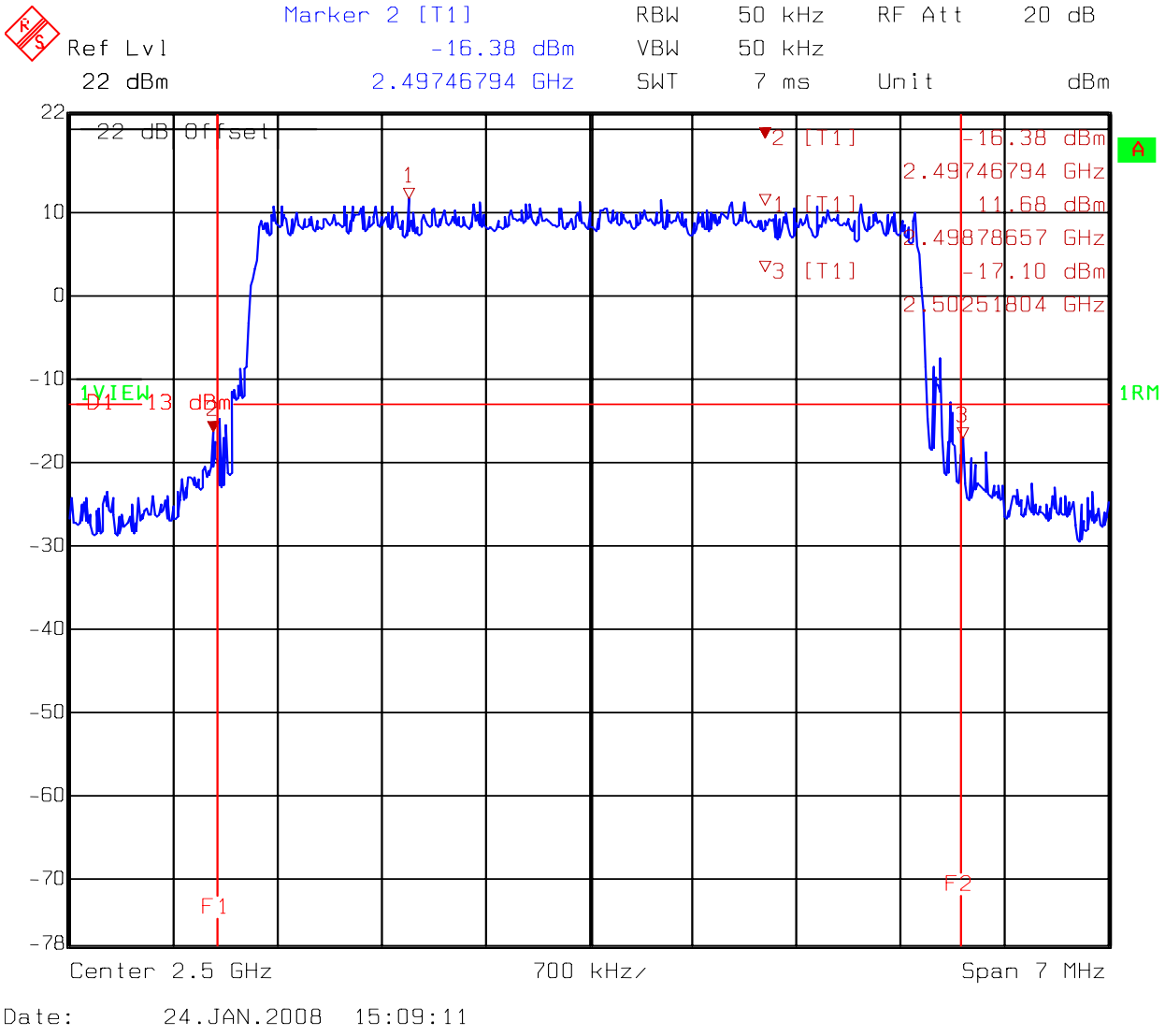
Measurement Data: See attached plots

Note: (1) The EUT was tested while in a continuous transmit mode. The EUT was tuned to a low, middle and high channel.

(2) The EUT operating at 2.5GHz band. Frequency Range scanned from 30MHz to 27GHz.

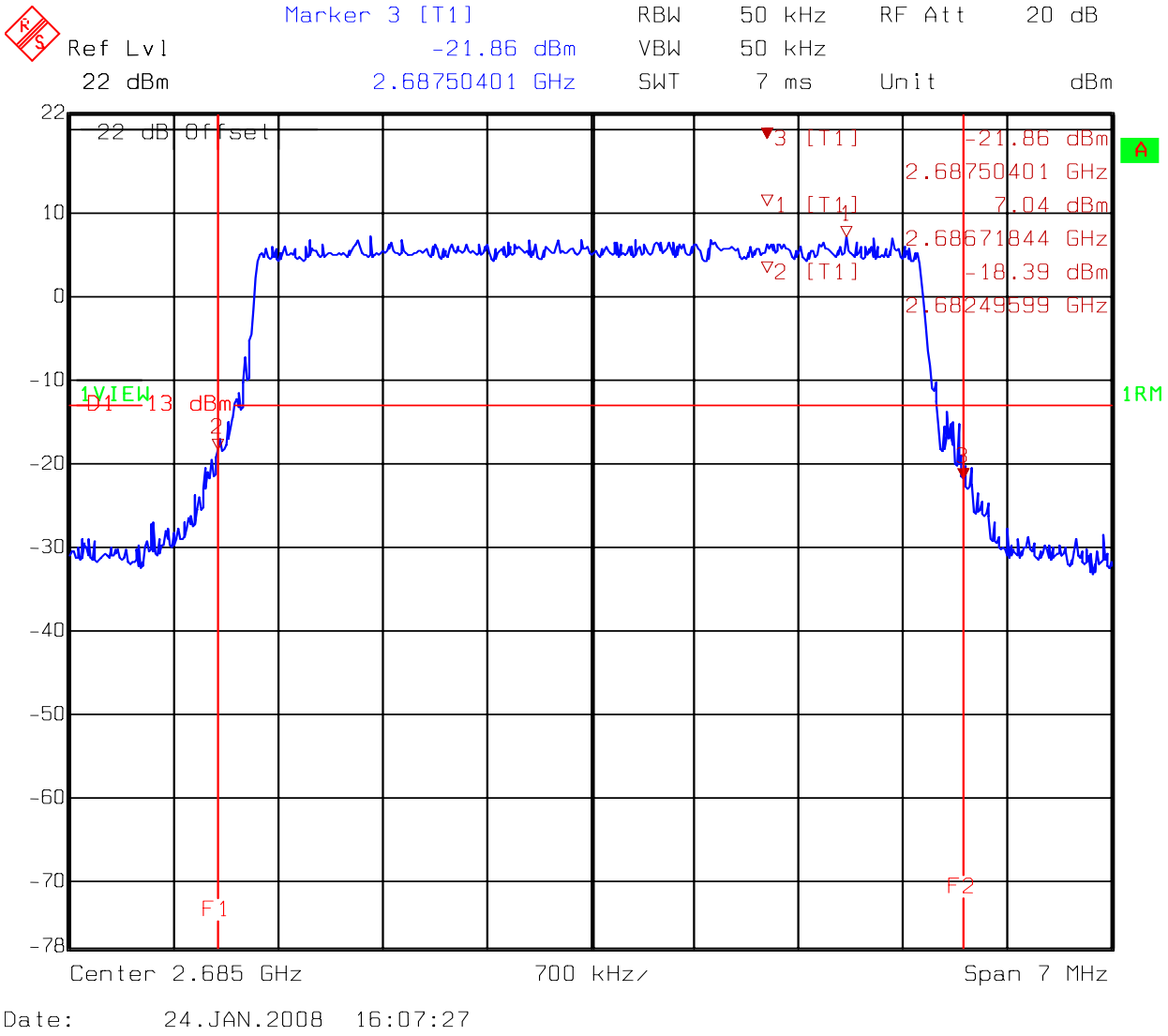
Antenna Type: Dipole antenna

Figure 13. Lower Band Edge (5MHz)



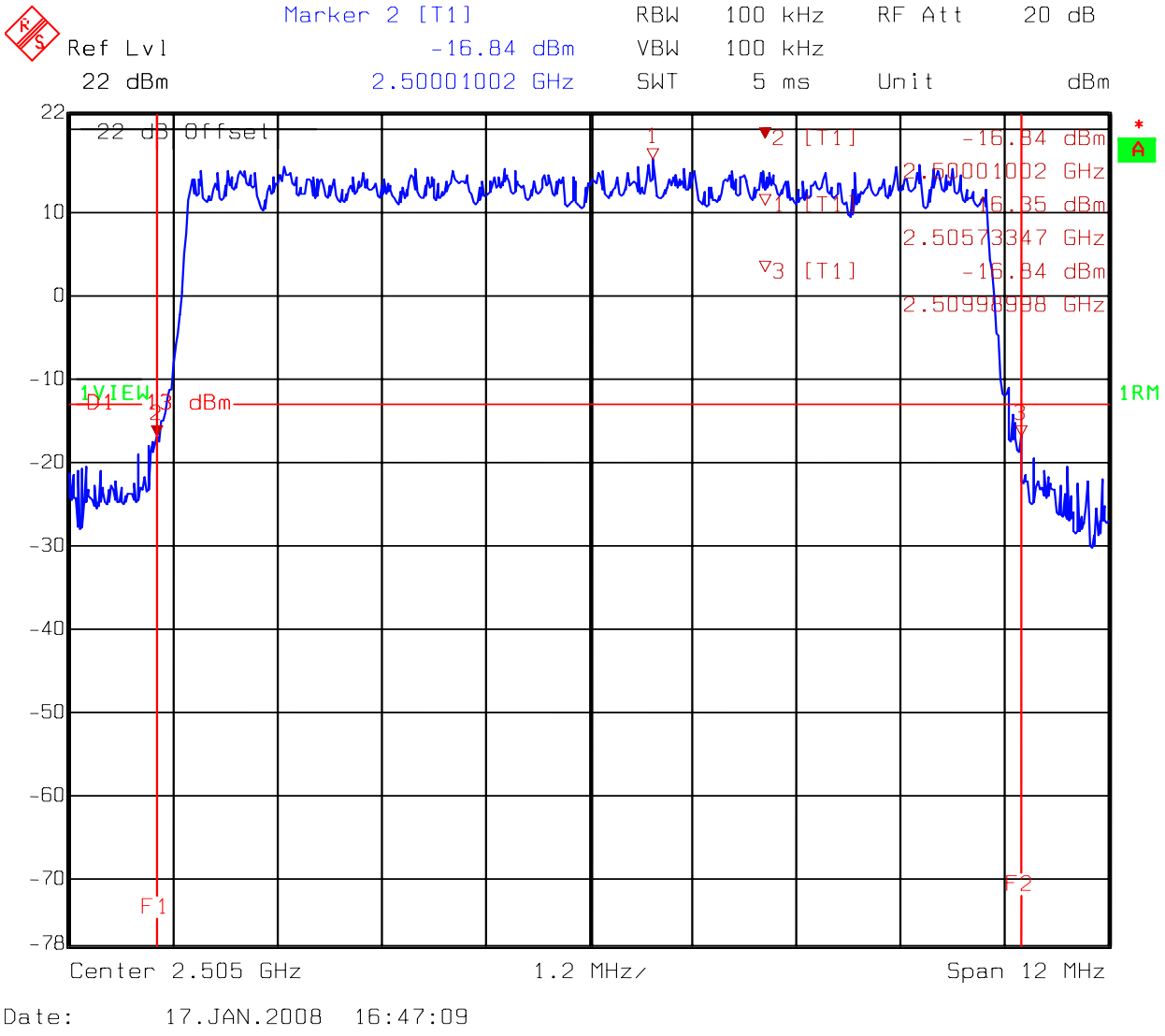
Antenna Type: Dipole antenna

Figure 14. Upper Band Edge (5MHz)



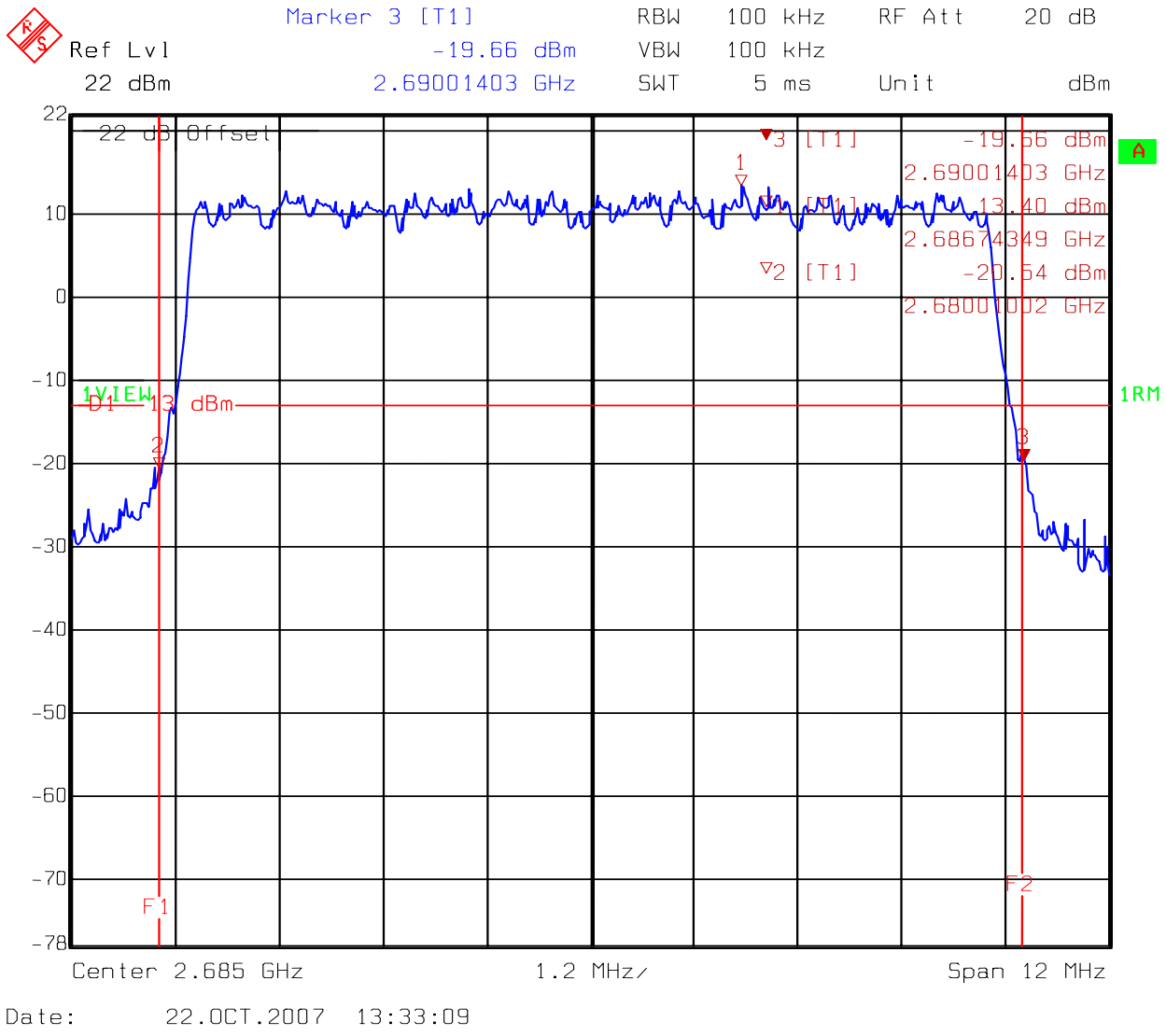
Antenna Type: Dipole antenna

Figure 15. Lower Band Edge (10MHz)



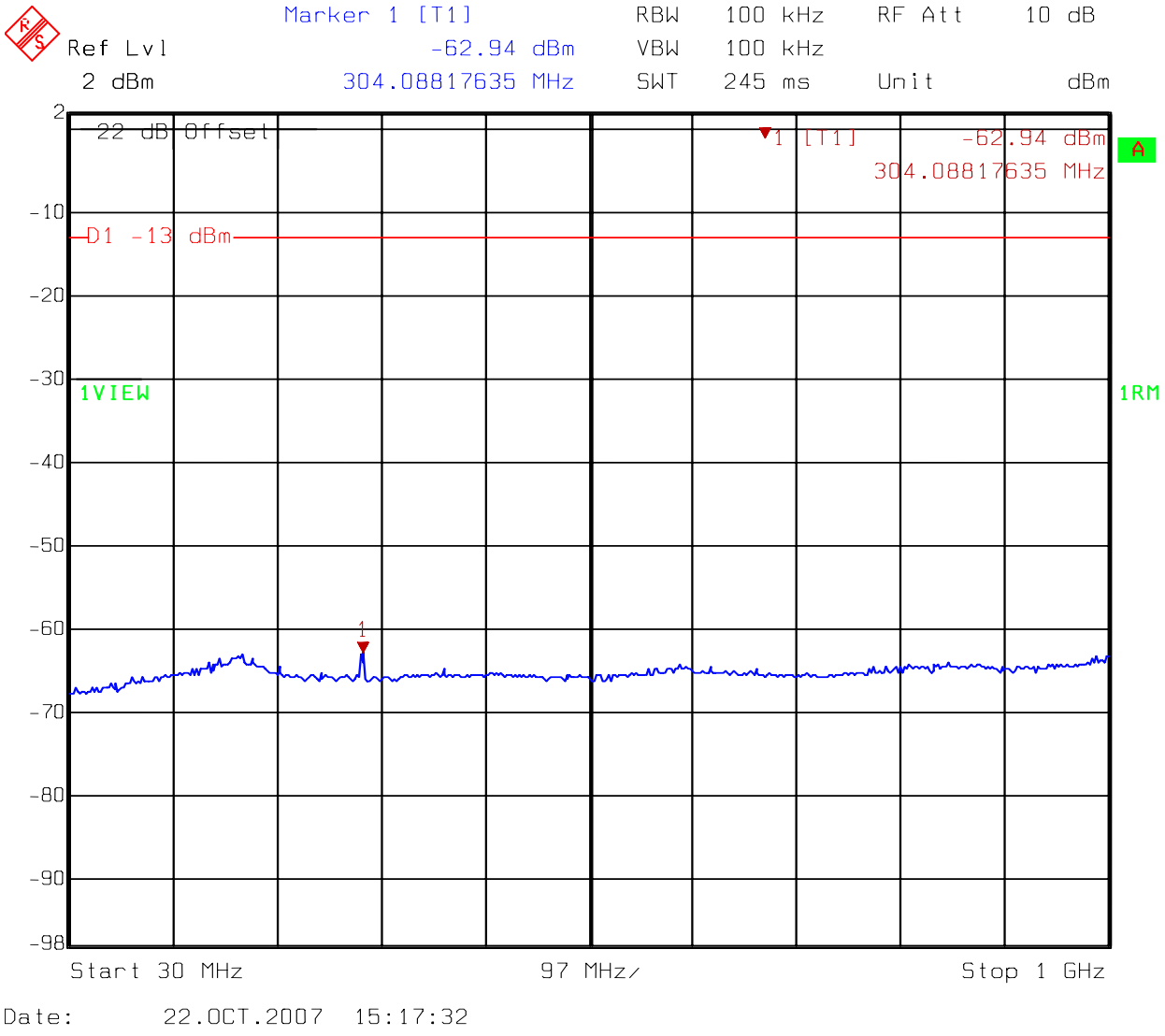
Antenna Type: Dipole antenna

Figure 16. Upper Band Edge (10MHz)



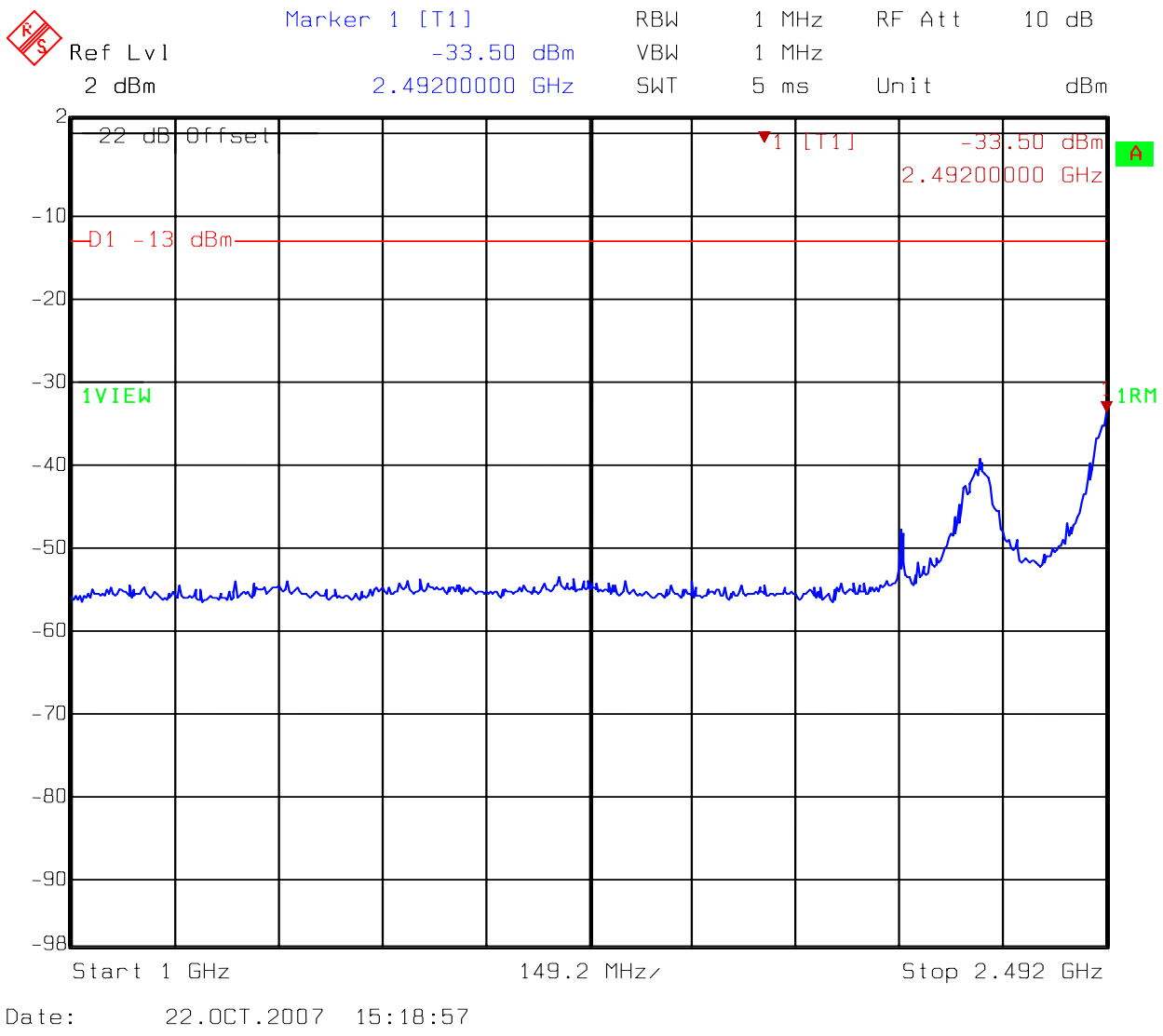
Antenna Type: Dipole antenna

Figure 17. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 1 of 8



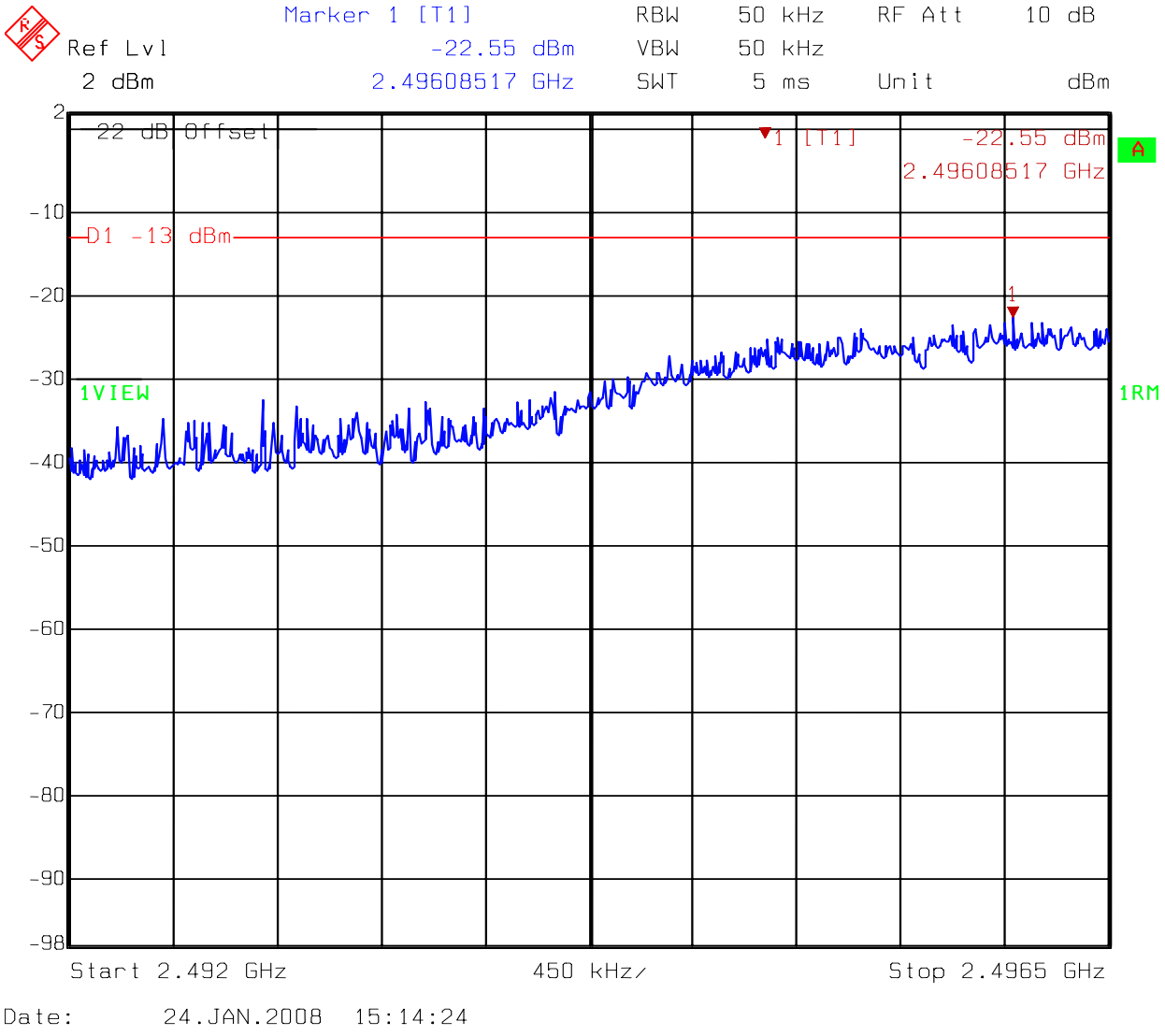
Antenna Type: Dipole antenna

Figure 18. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 2 of 8



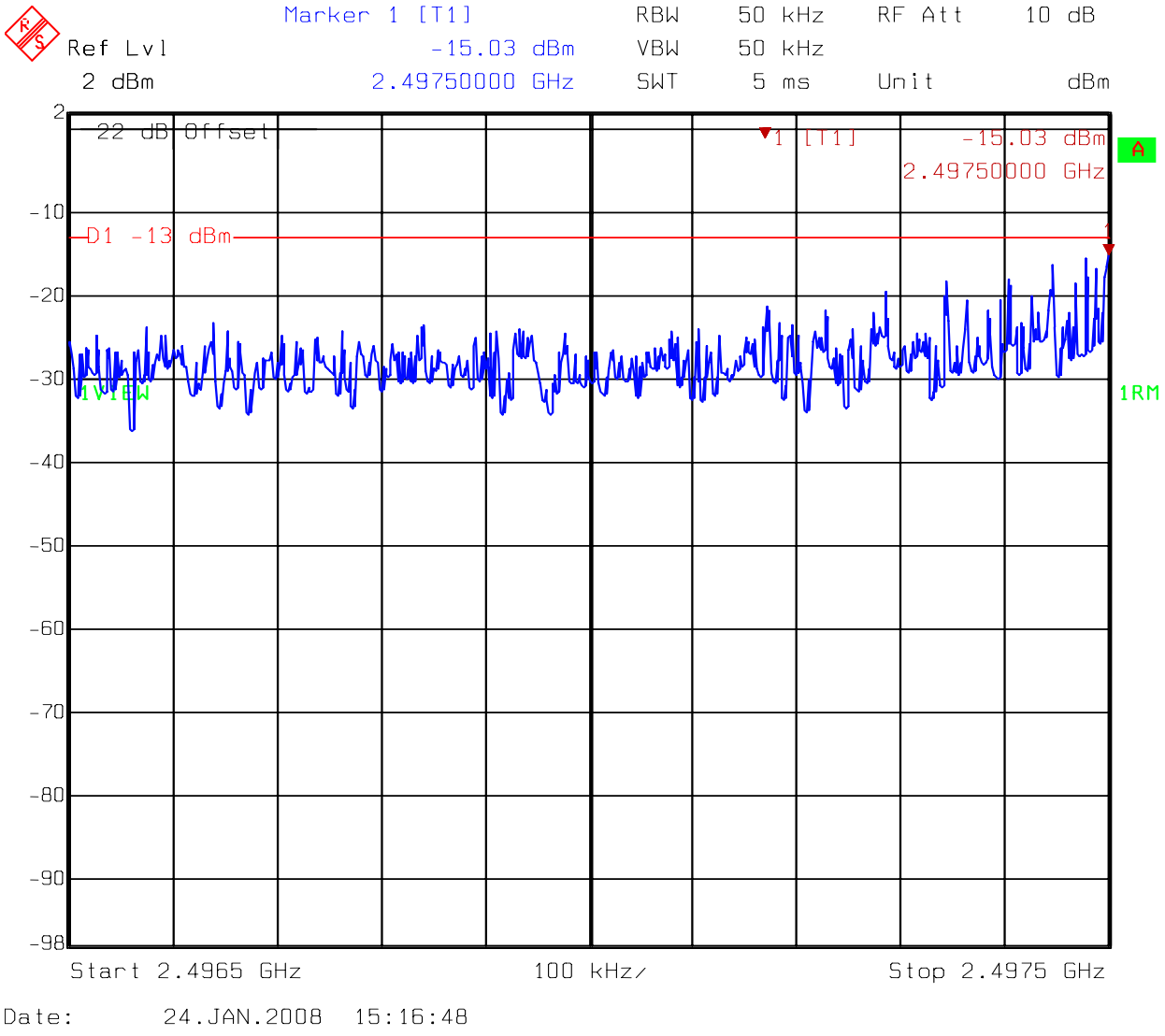
Antenna Type: Dipole antenna

Figure 19. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 3 of 8



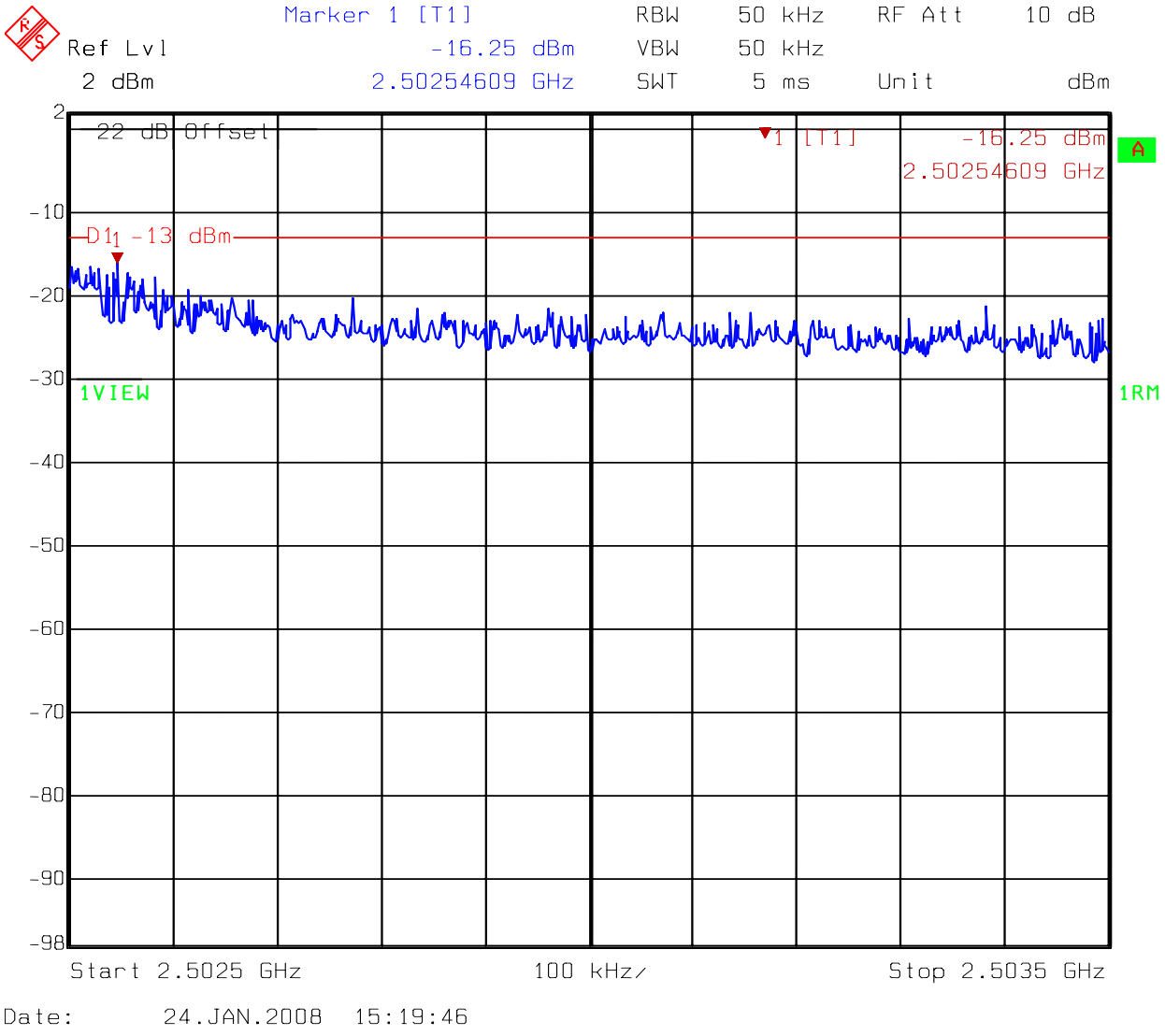
Antenna Type: Dipole antenna

Figure 20. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 4 of 8



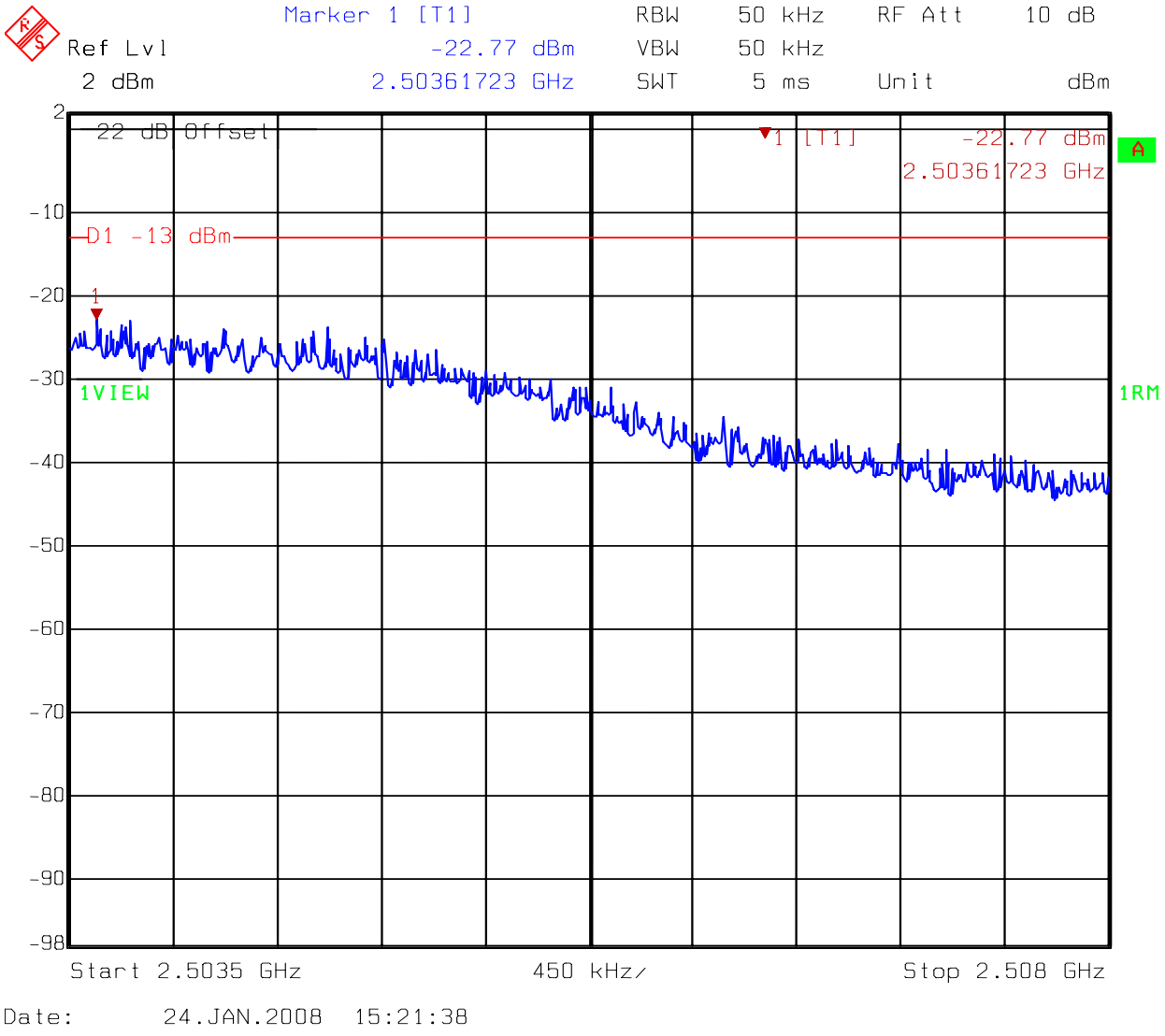
Antenna Type: Dipole antenna

Figure 21. Spurious Emission at Antenna Terminals @ low channel (5MHz) – 5 of 8



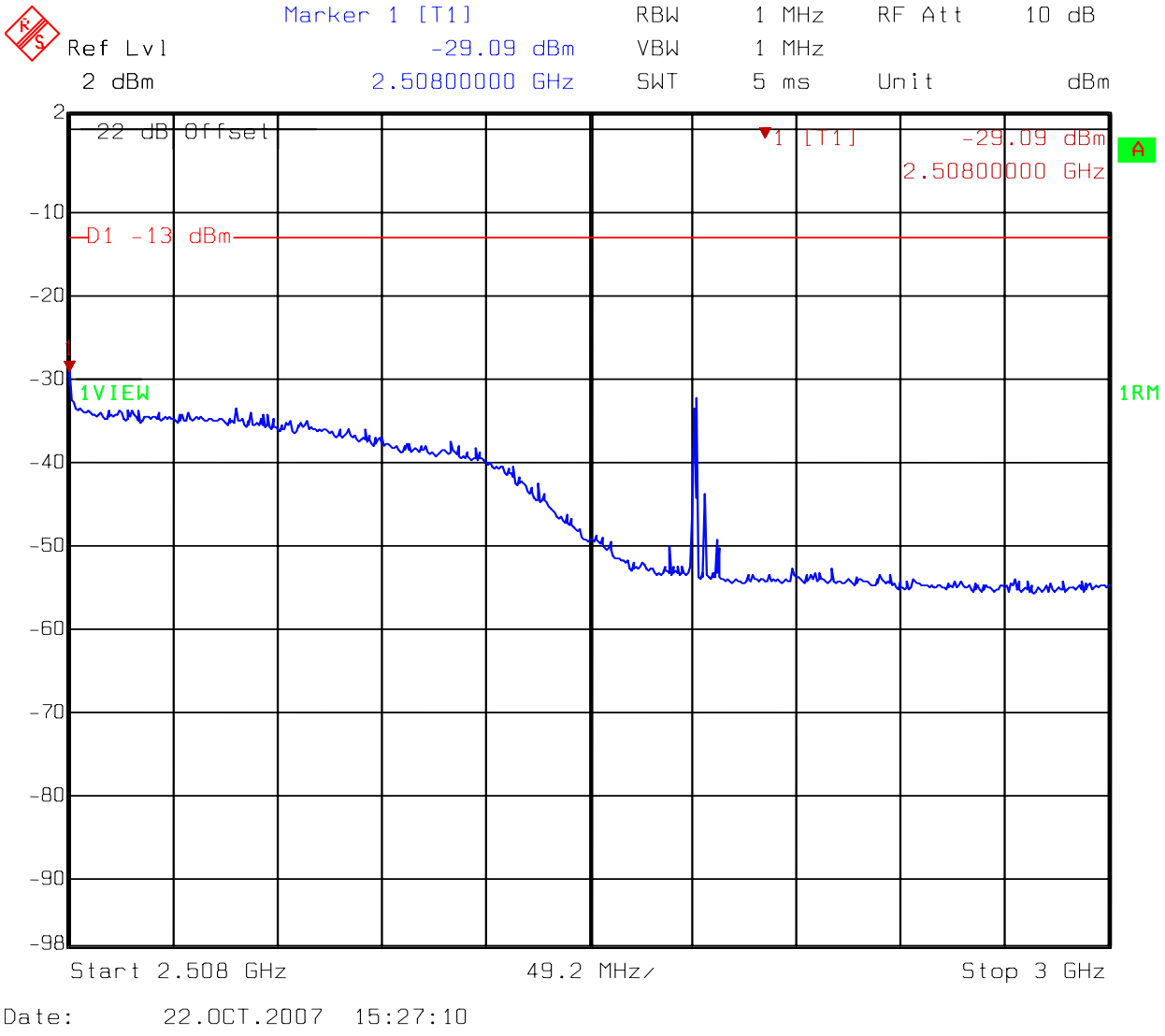
Antenna Type: Dipole antenna

Figure 22. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 6 of 8



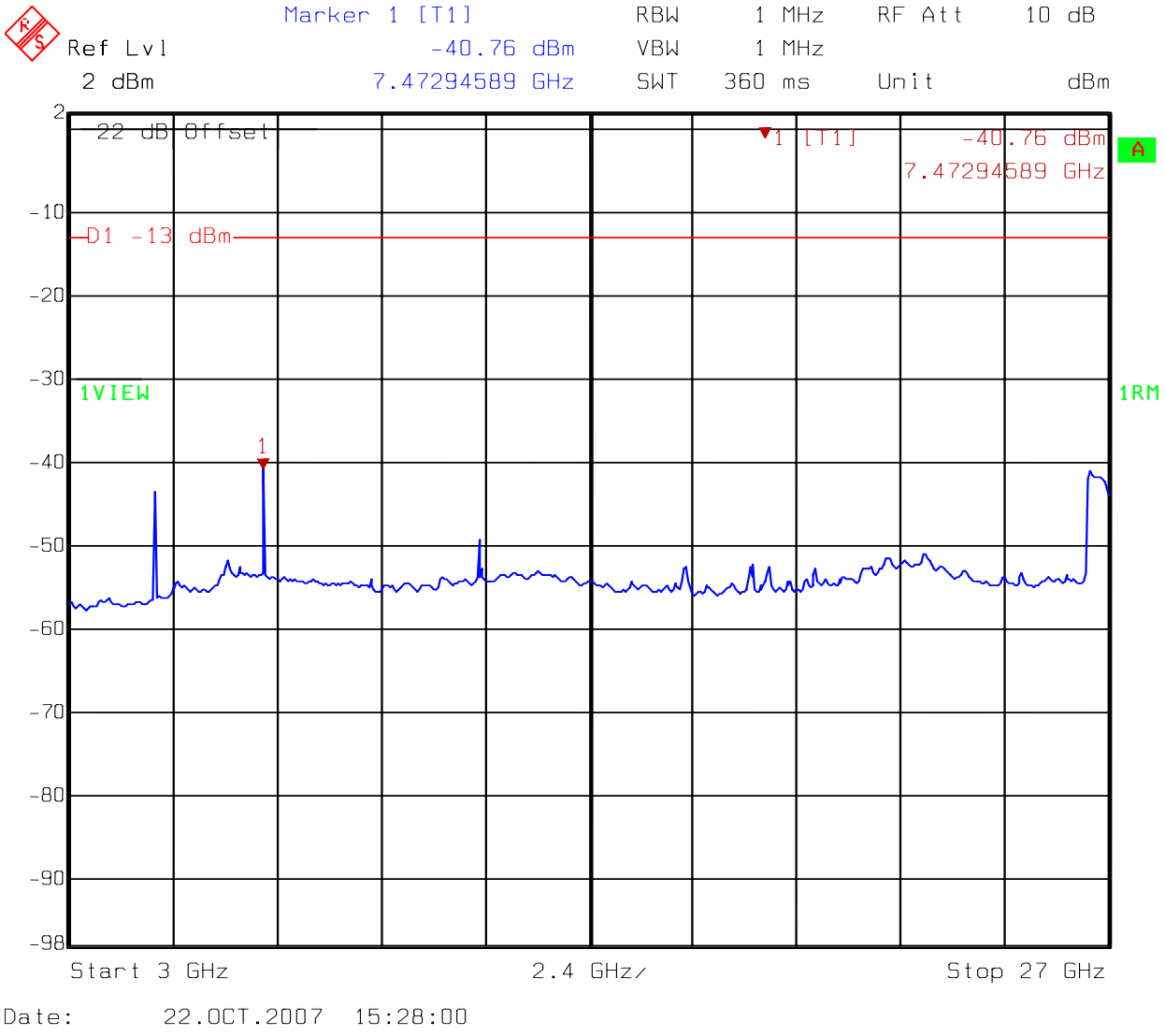
Antenna Type: Dipole antenna

Figure 23. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 7 of 8



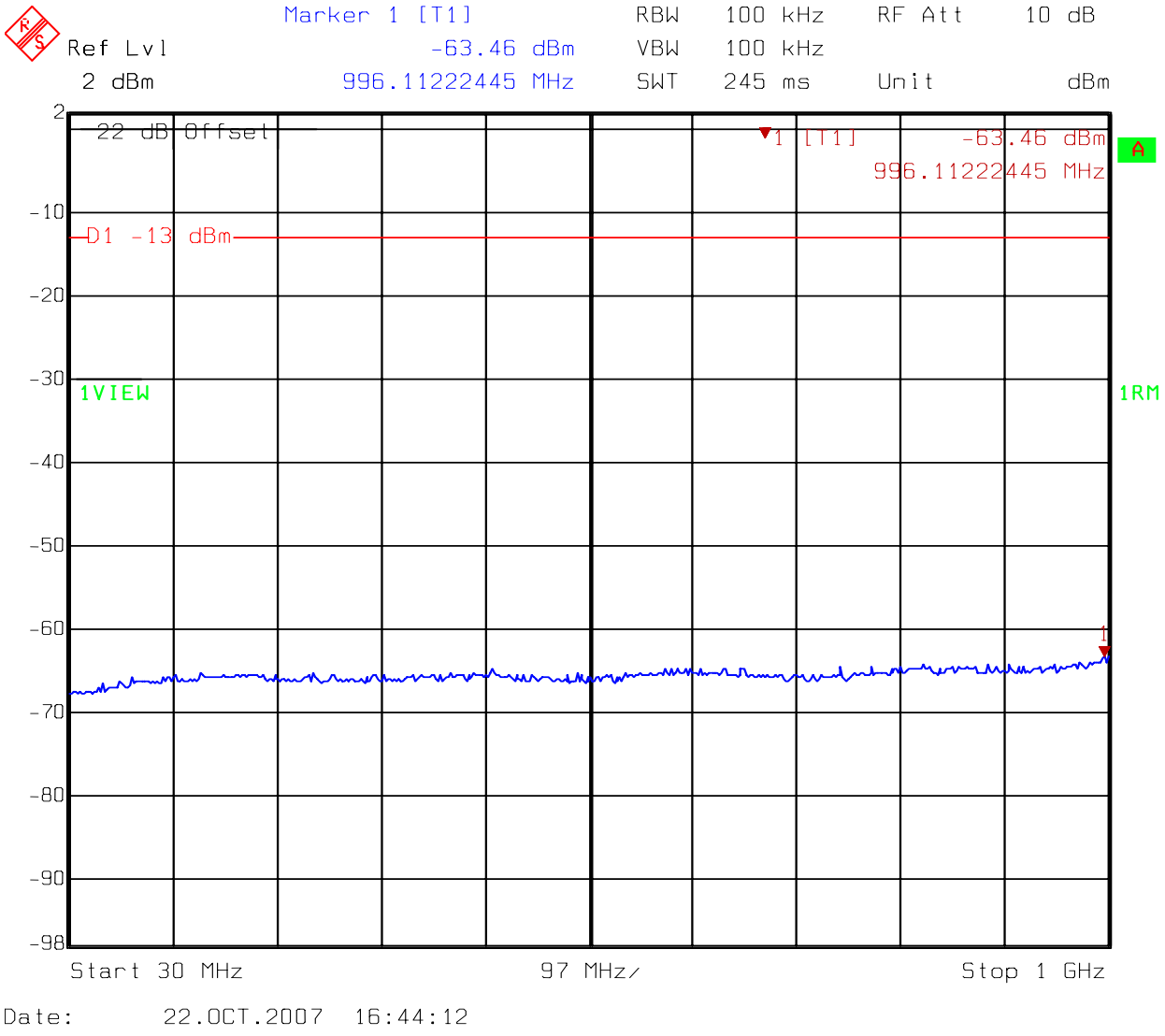
Antenna Type: Dipole antenna

Figure 24. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 8 of 8



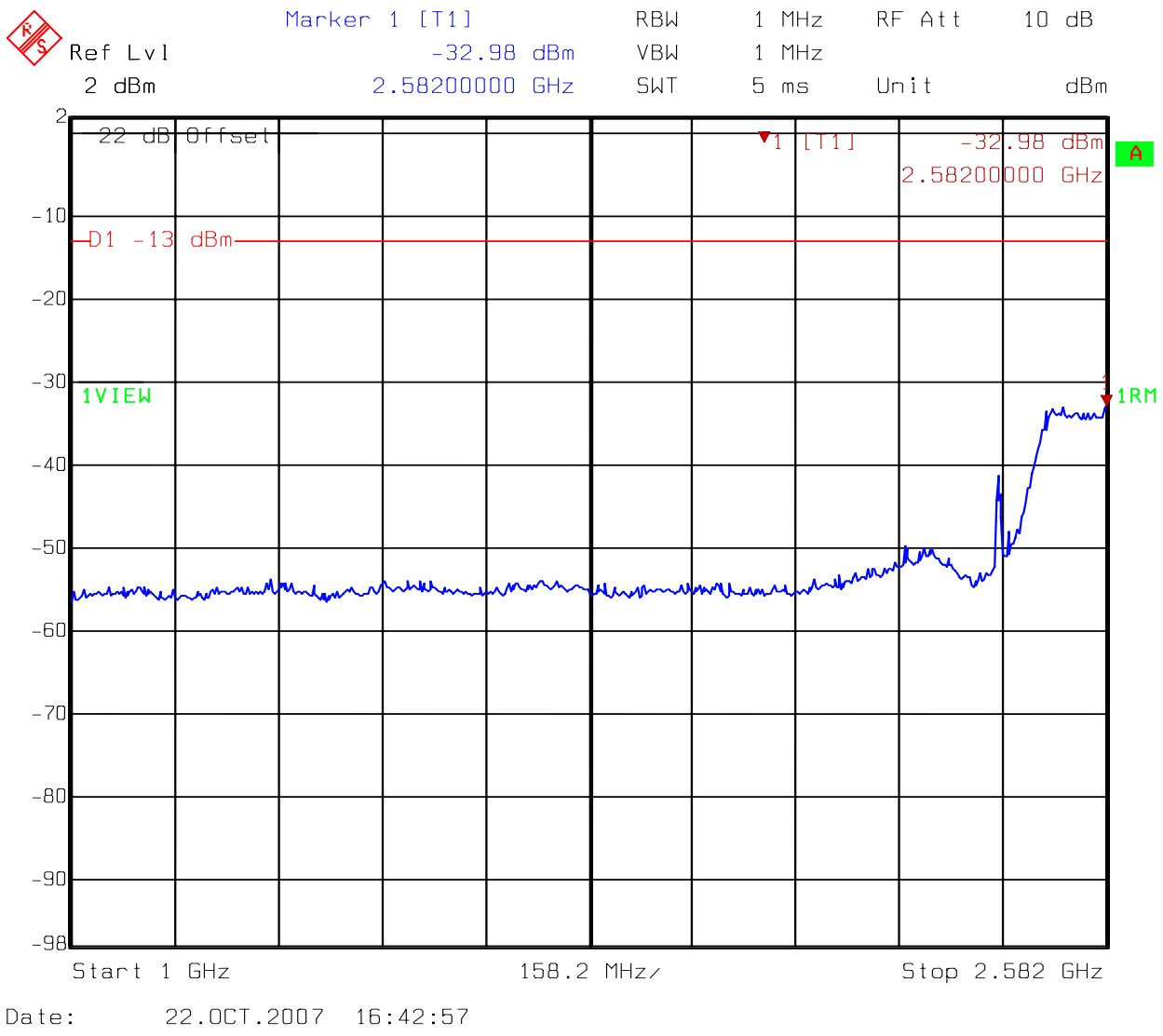
Antenna Type: Dipole antenna

Figure 25. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 1 of 8



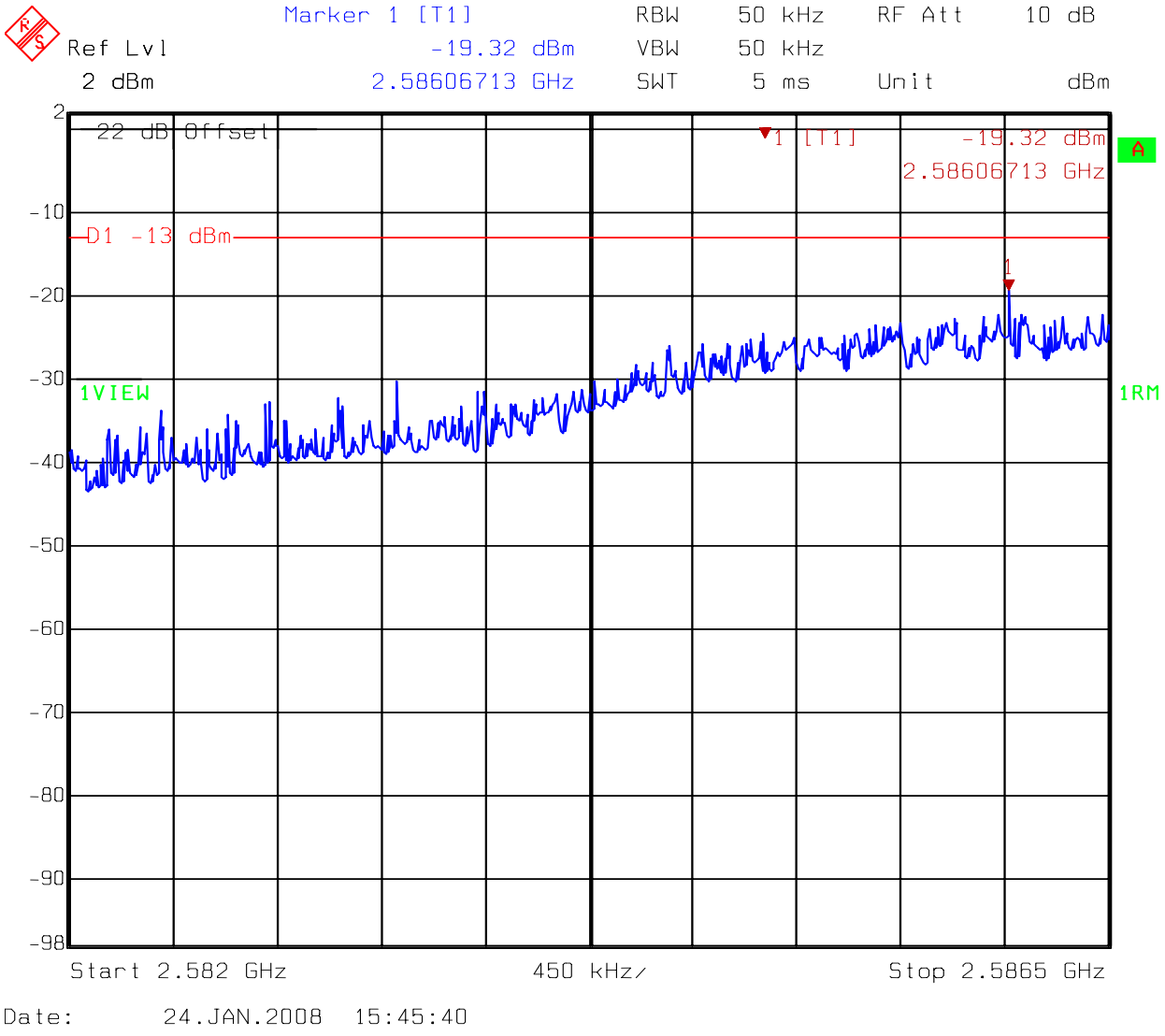
Antenna Type: Dipole antenna

Figure 26. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 2 of 8



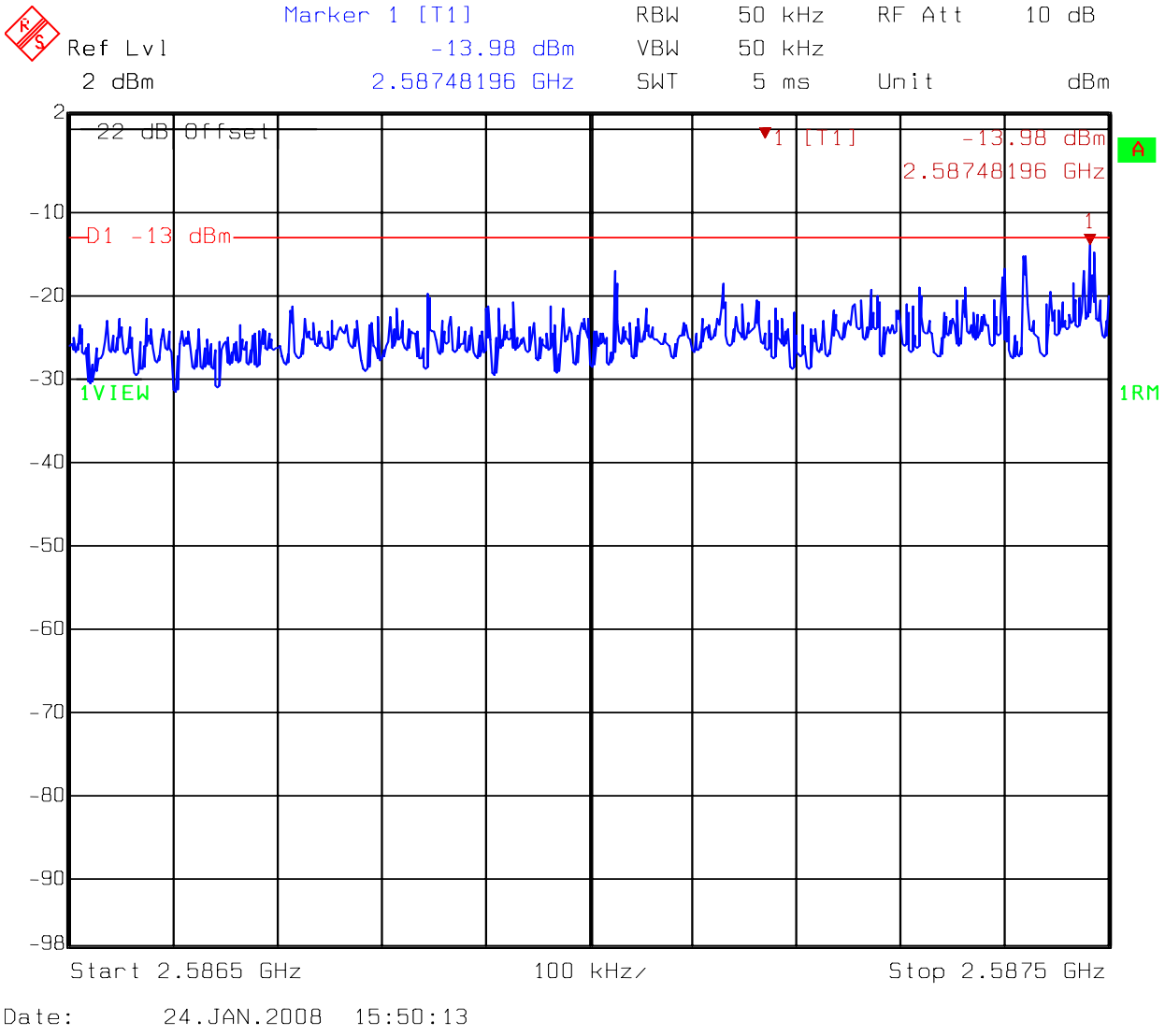
Antenna Type: Dipole antenna

Figure 27. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 3 of 8



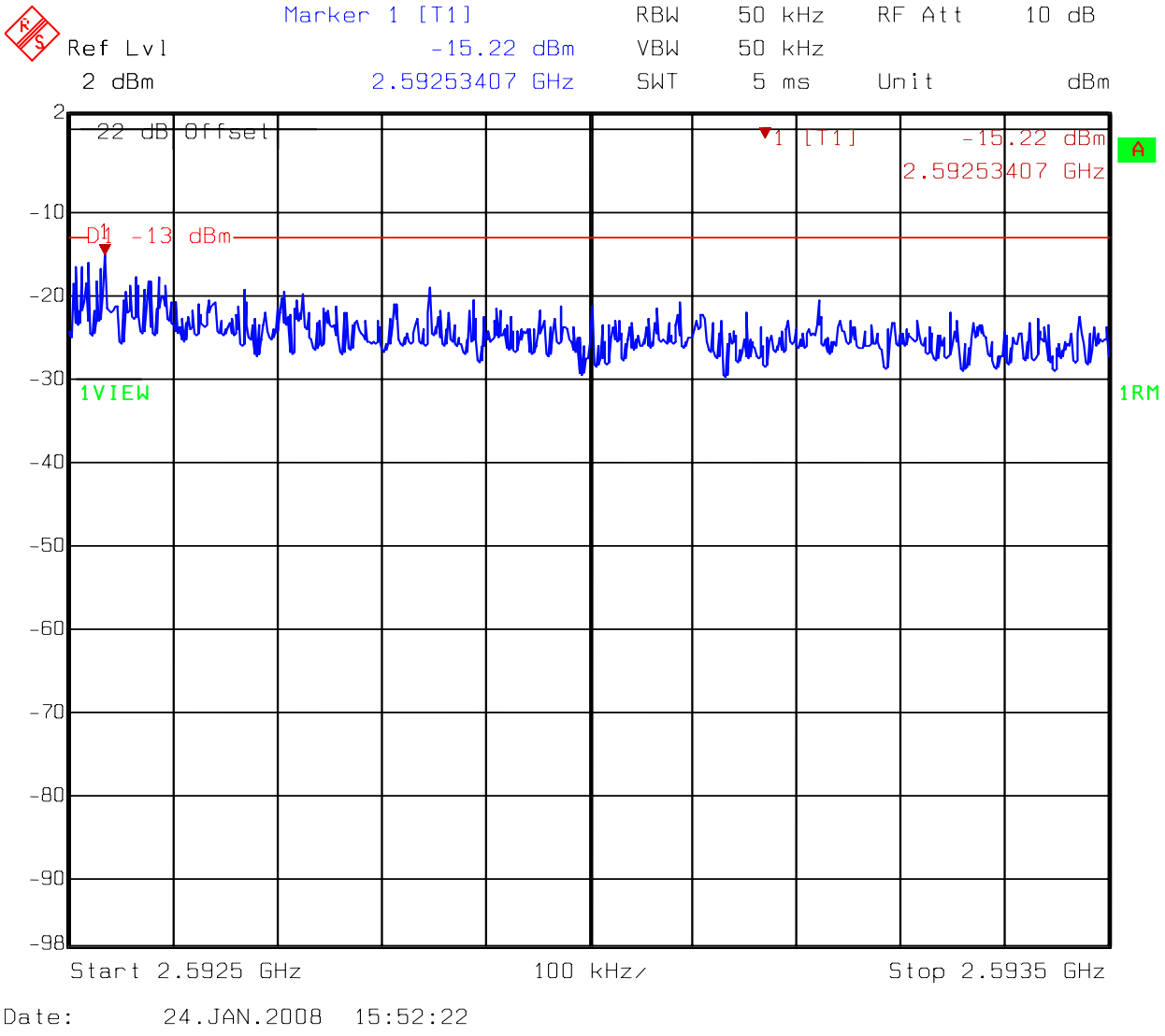
Antenna Type: Dipole antenna

Figure 28. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 4 of 8



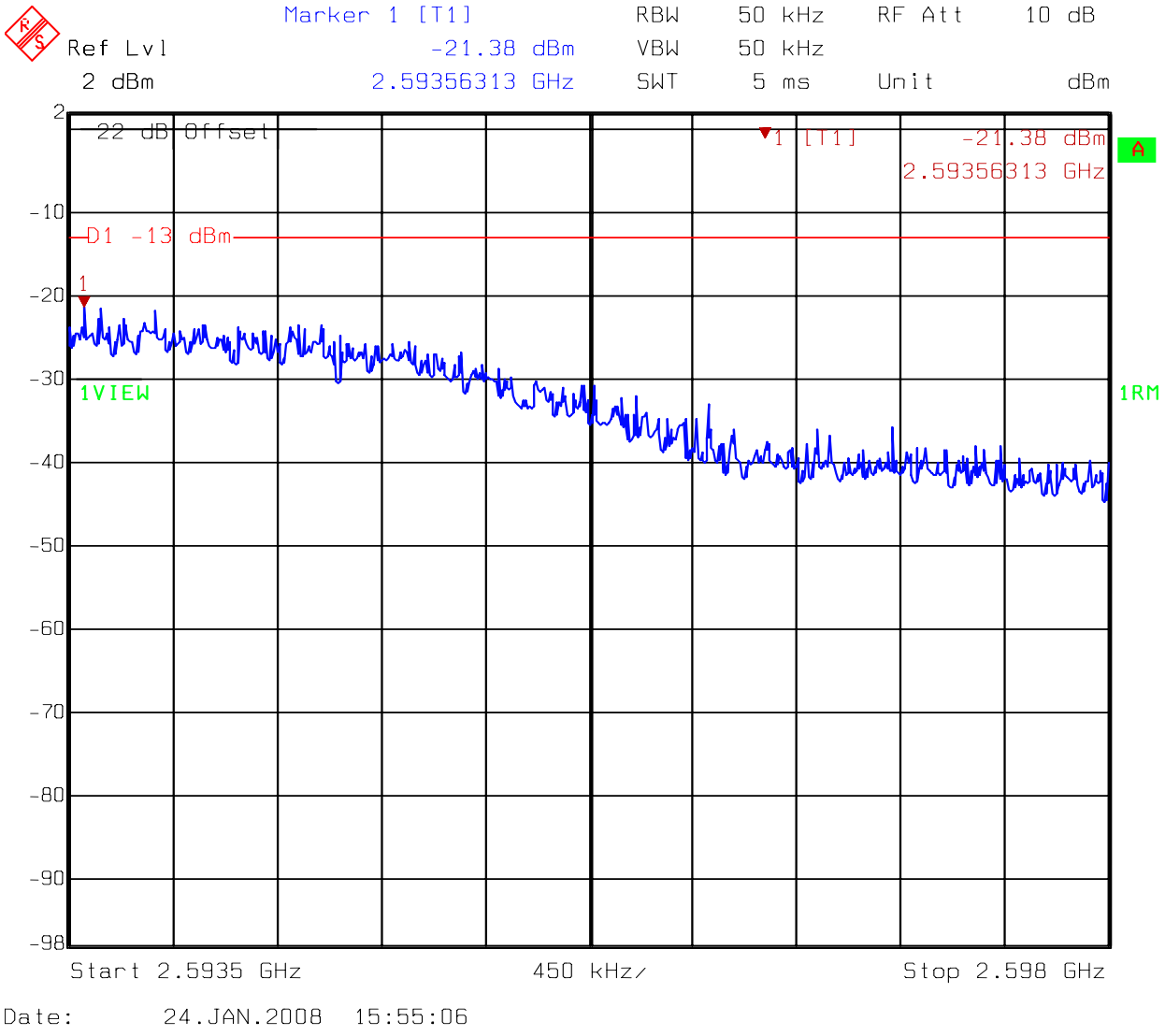
Antenna Type: Dipole antenna

Figure 29. Spurious Emission at Antenna Terminals @ middle channel (5MHz) – 5 of 8



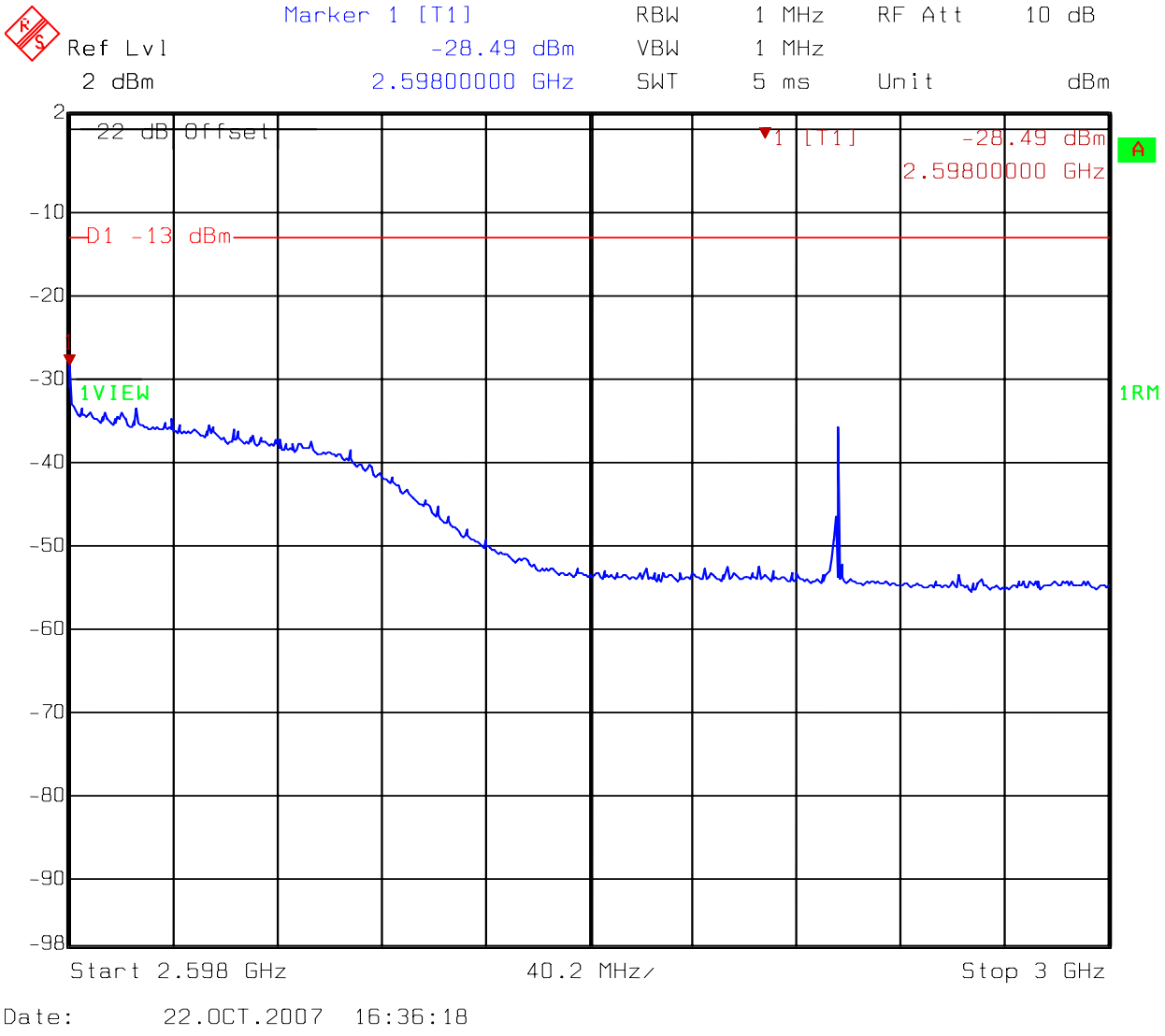
Antenna Type: Dipole antenna

Figure 30. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 6 of 8



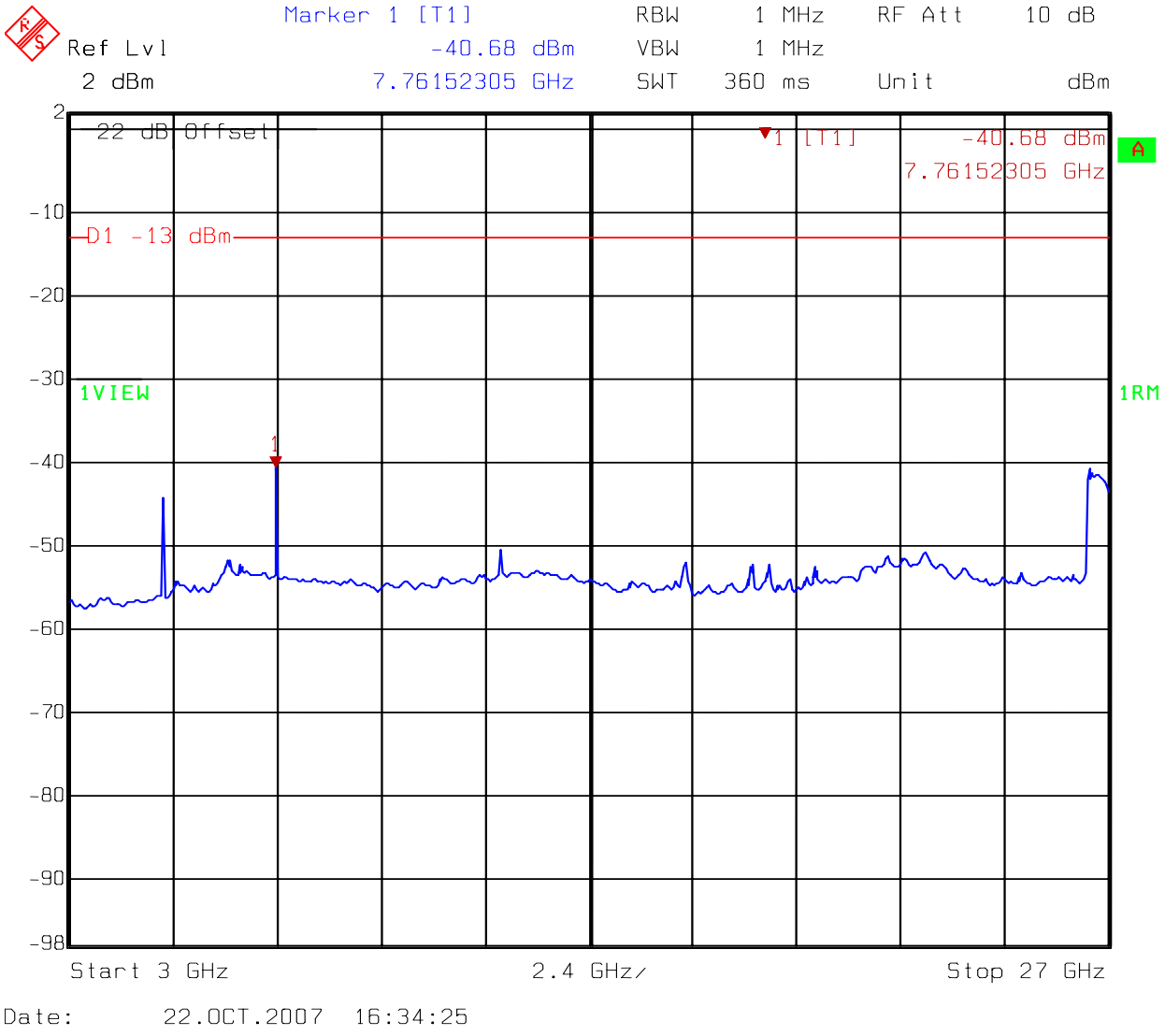
Antenna Type: Dipole antenna

Figure 31. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 7 of 8



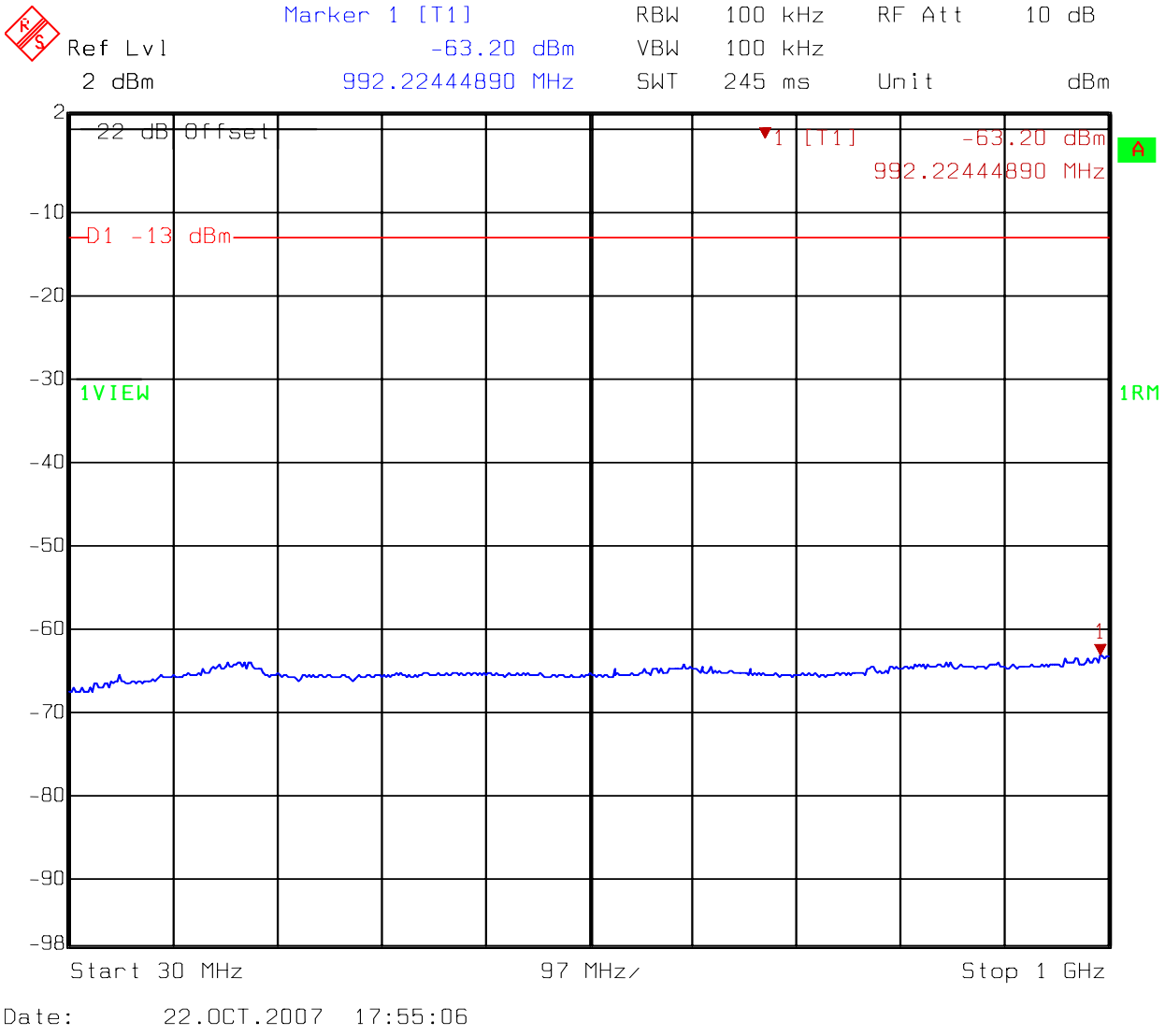
Antenna Type: Dipole antenna

Figure 32. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 8 of 8



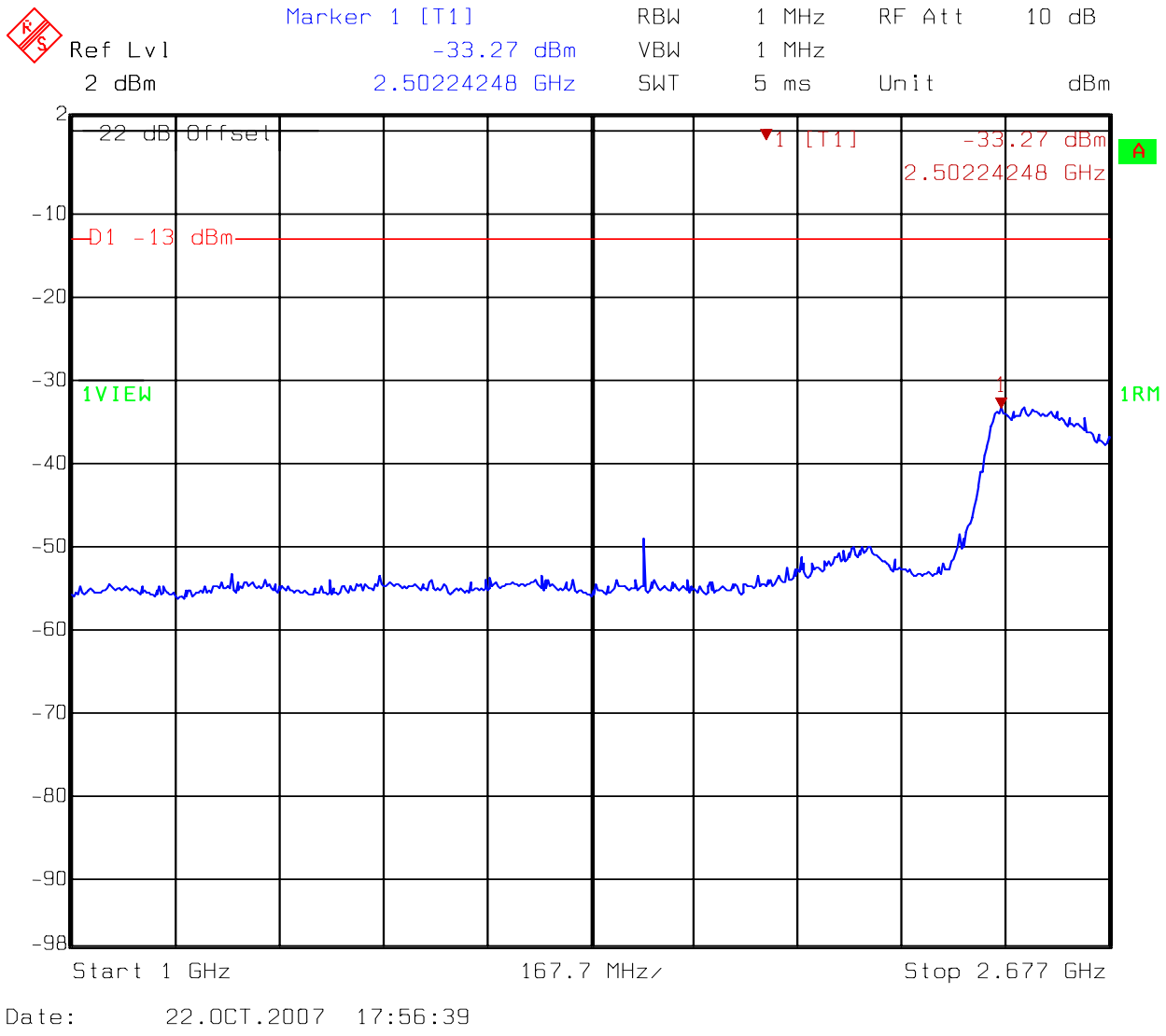
Antenna Type: Dipole antenna

Figure 33. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 1 of 8



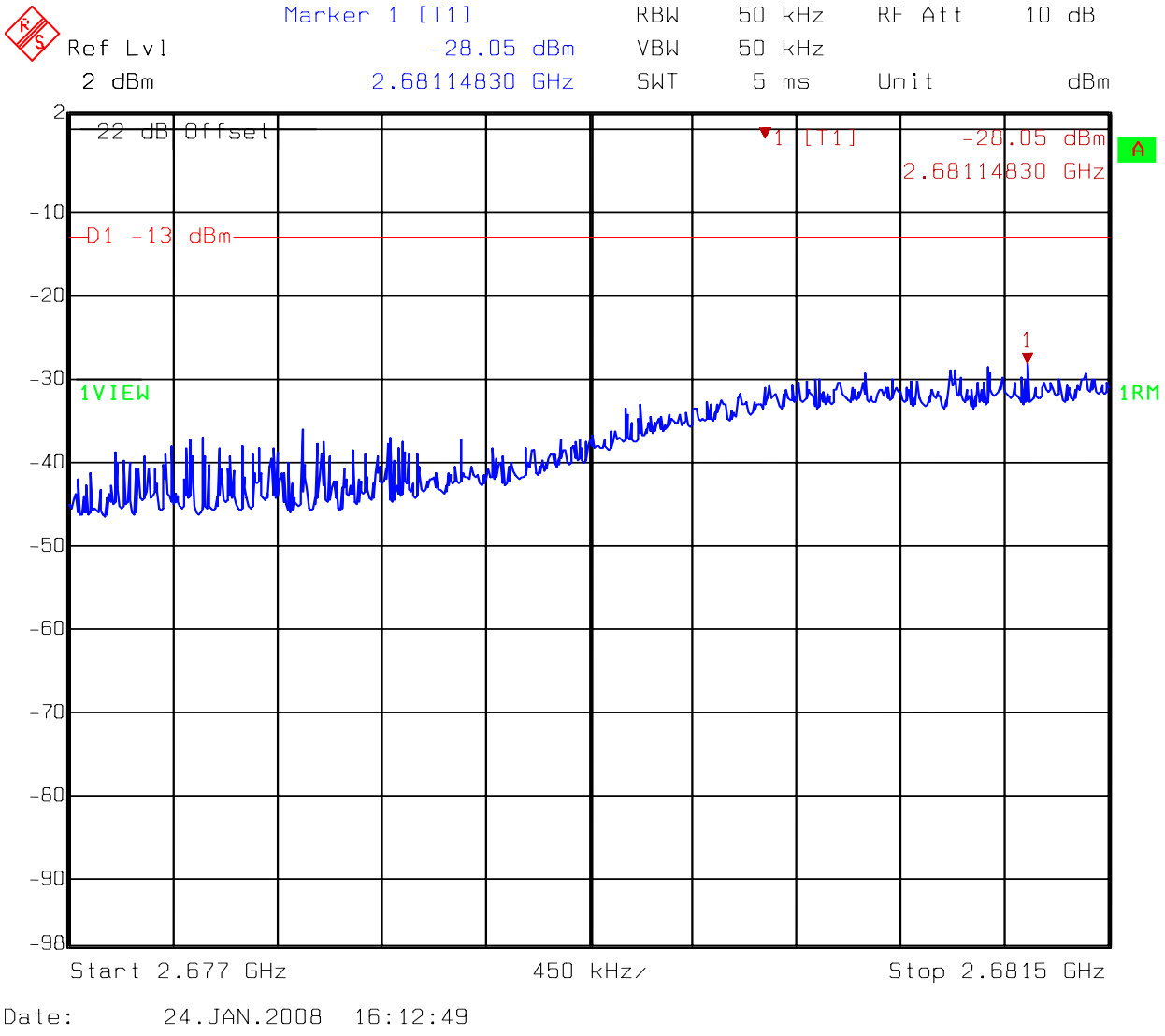
Antenna Type: Dipole antenna

Figure 34. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 2 of 8



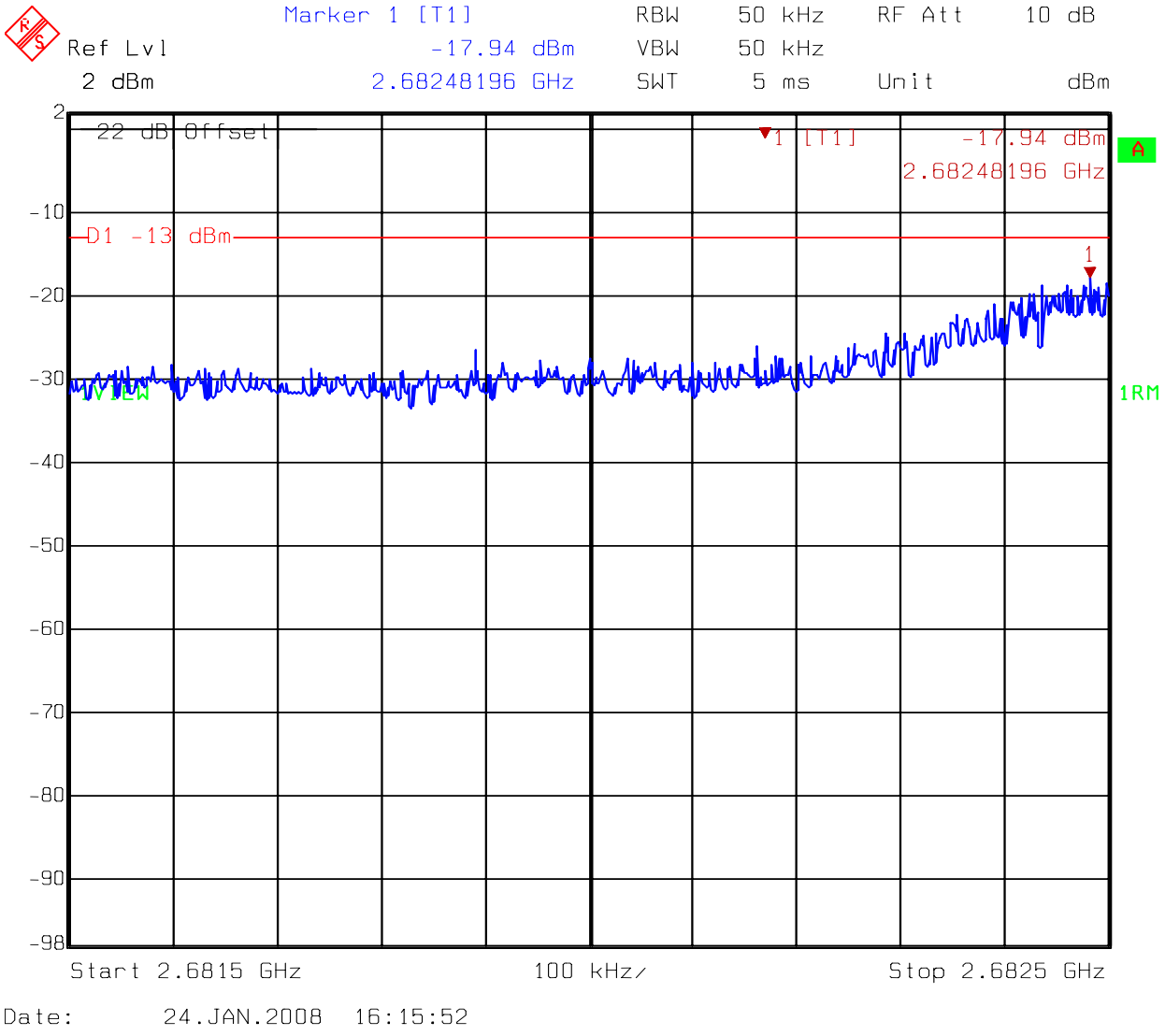
Antenna Type: Dipole antenna

Figure 35. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 3 of 8



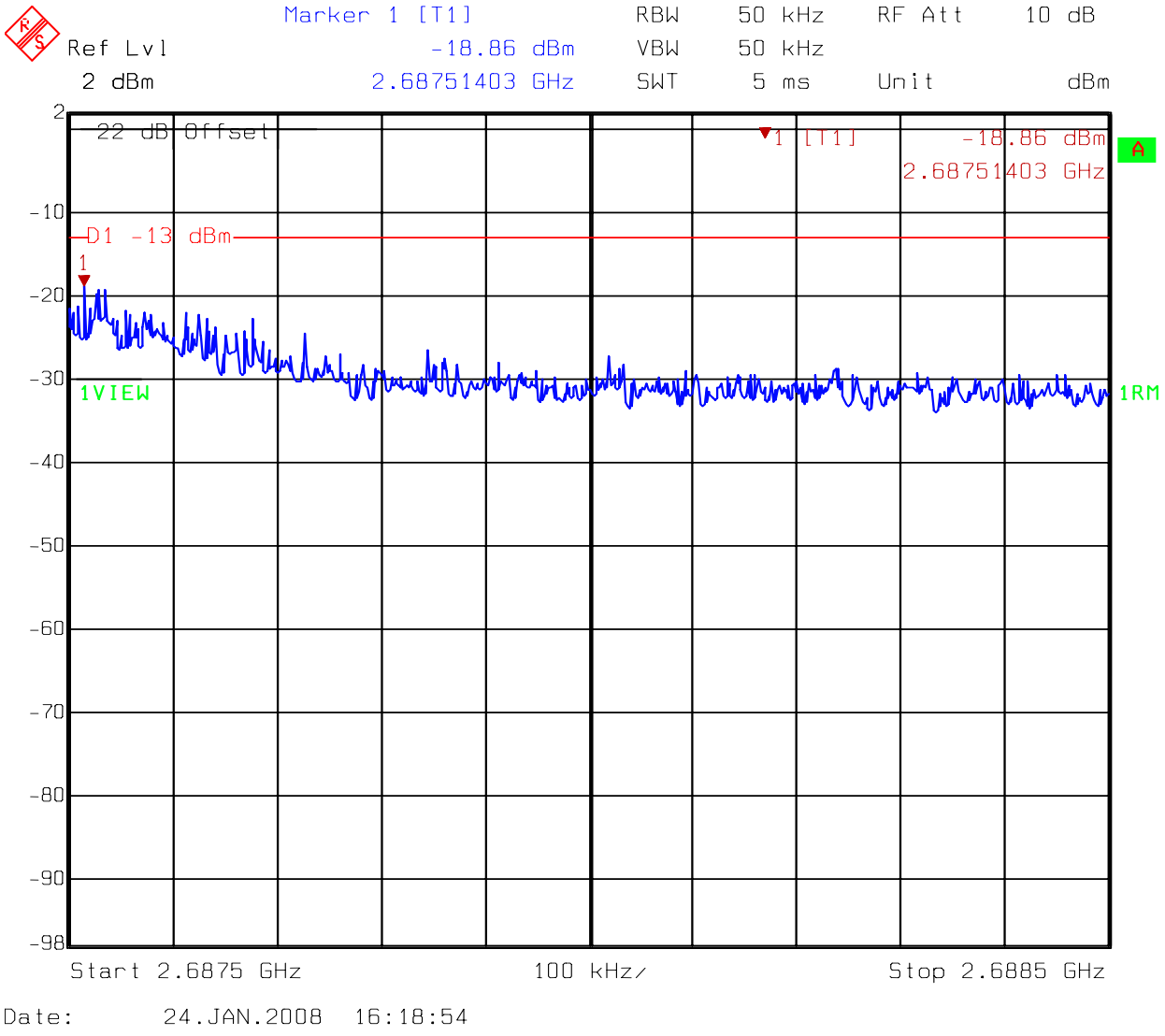
Antenna Type: Dipole antenna

Figure 36. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 4 of 8



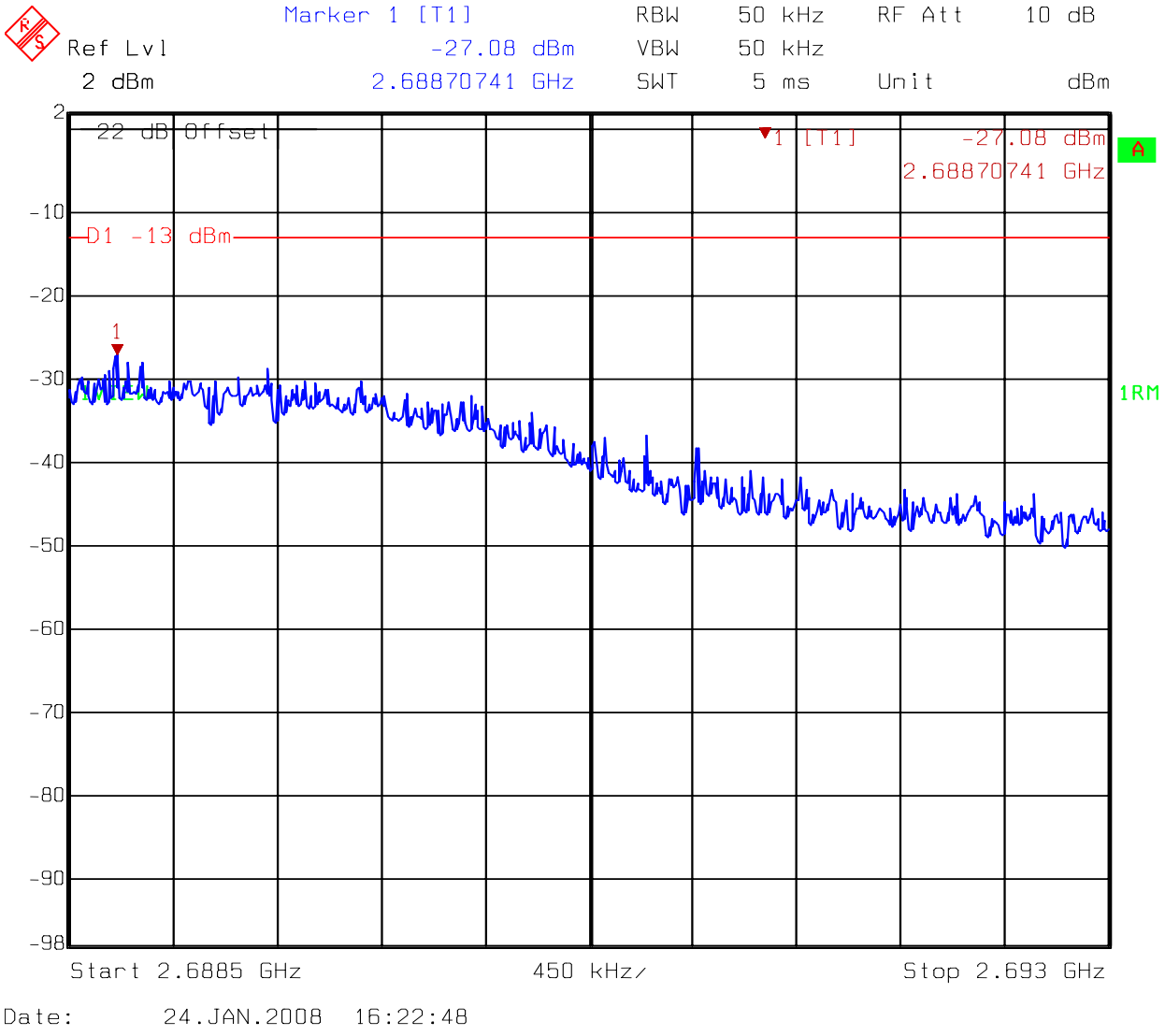
Antenna Type: Dipole antenna

Figure 37. Spurious Emission at Antenna Terminals @ high channel (5MHz) – 5 of 8



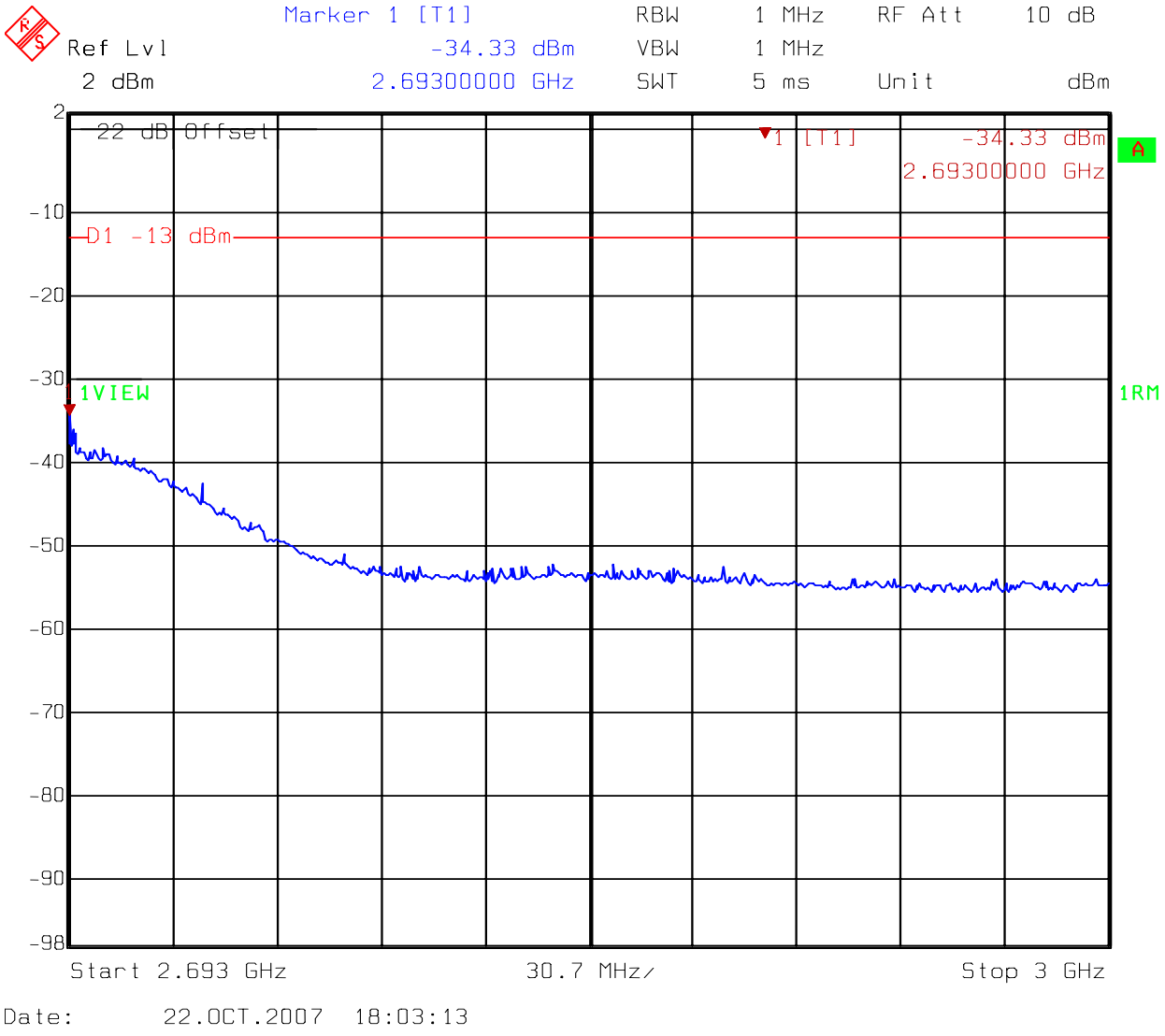
Antenna Type: Dipole antenna

Figure 38. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 6 of 8



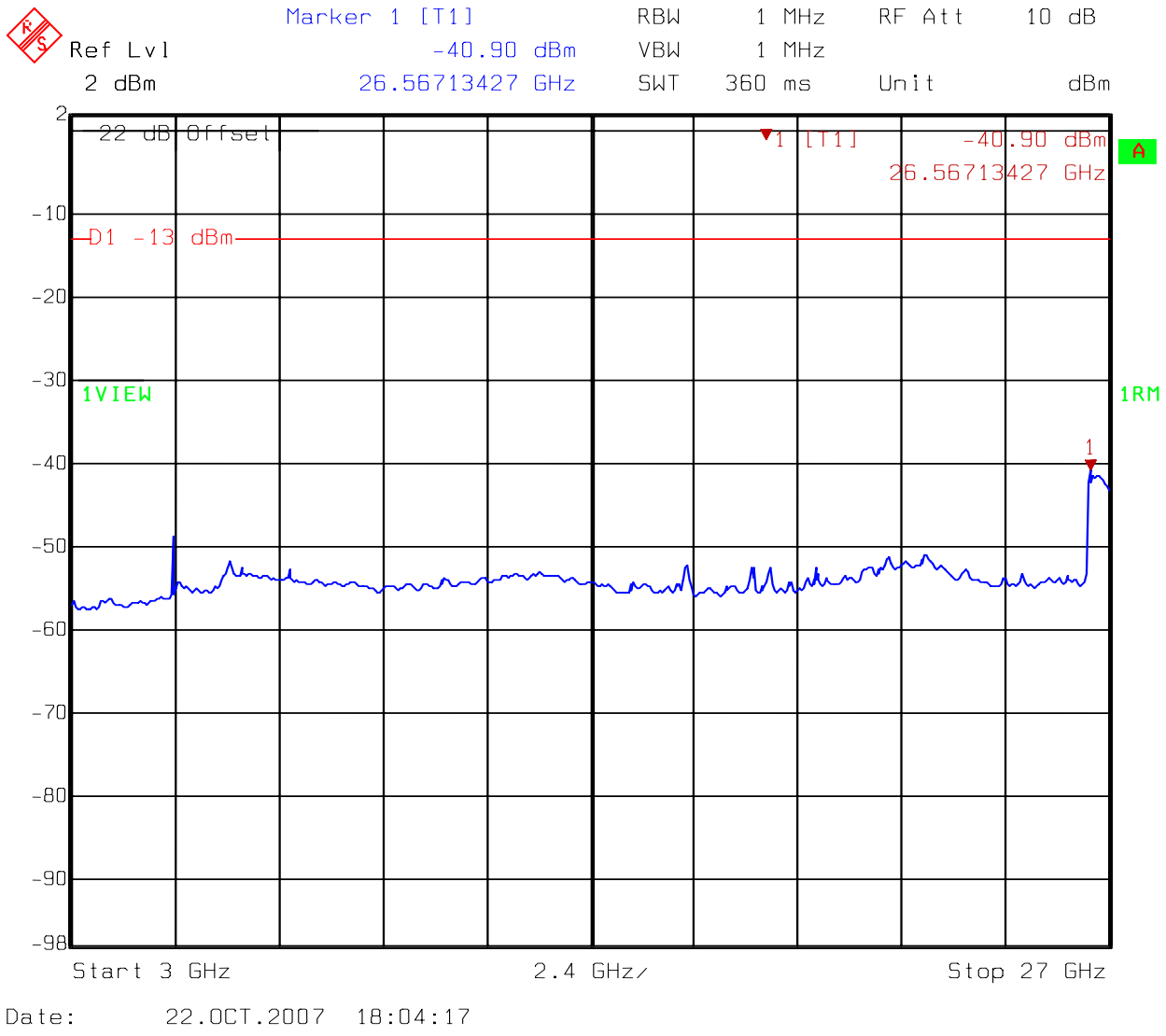
Antenna Type: Dipole antenna

Figure 39. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 7 of 8



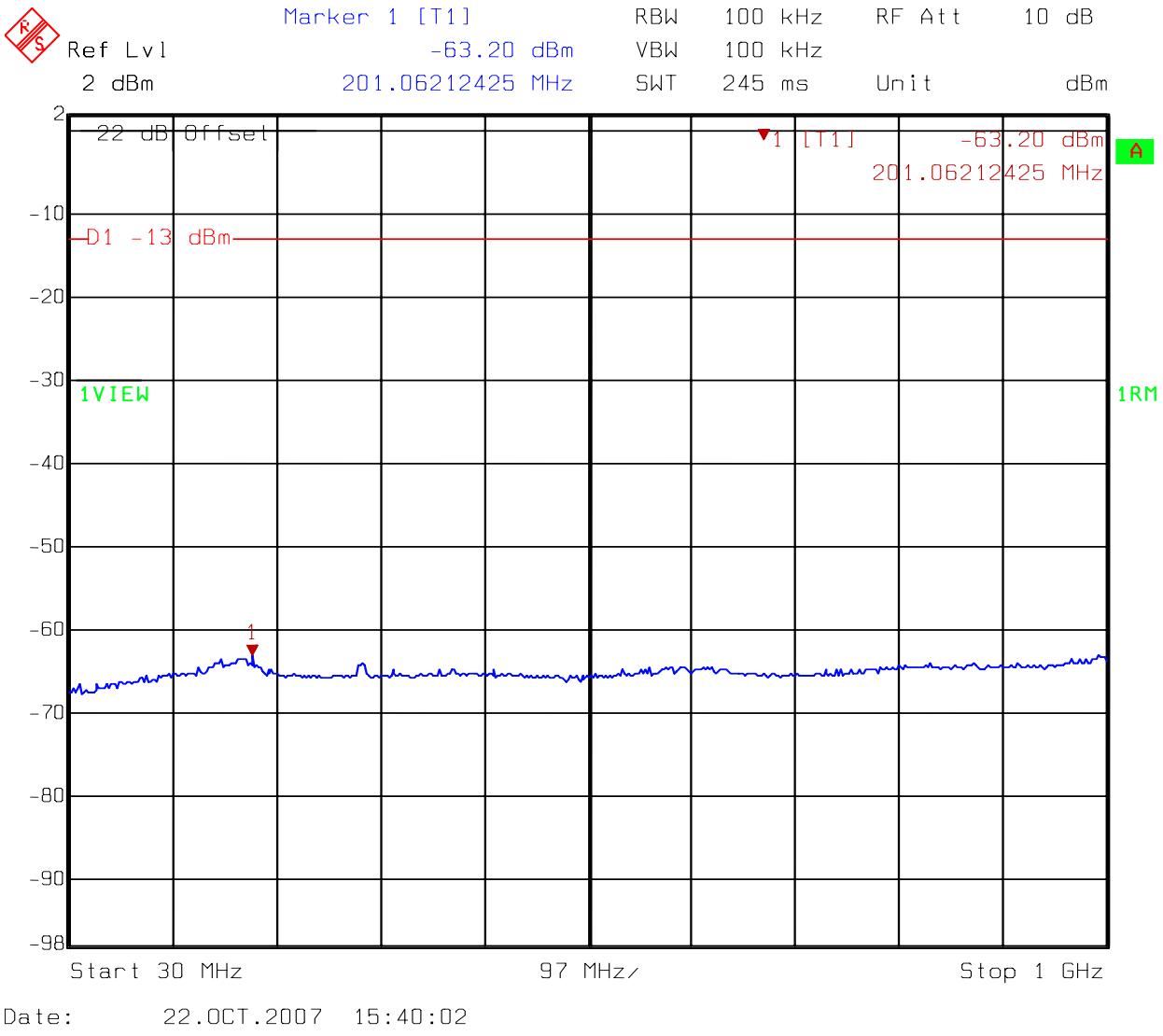
Antenna Type: Dipole antenna

Figure 40. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 8 of 8



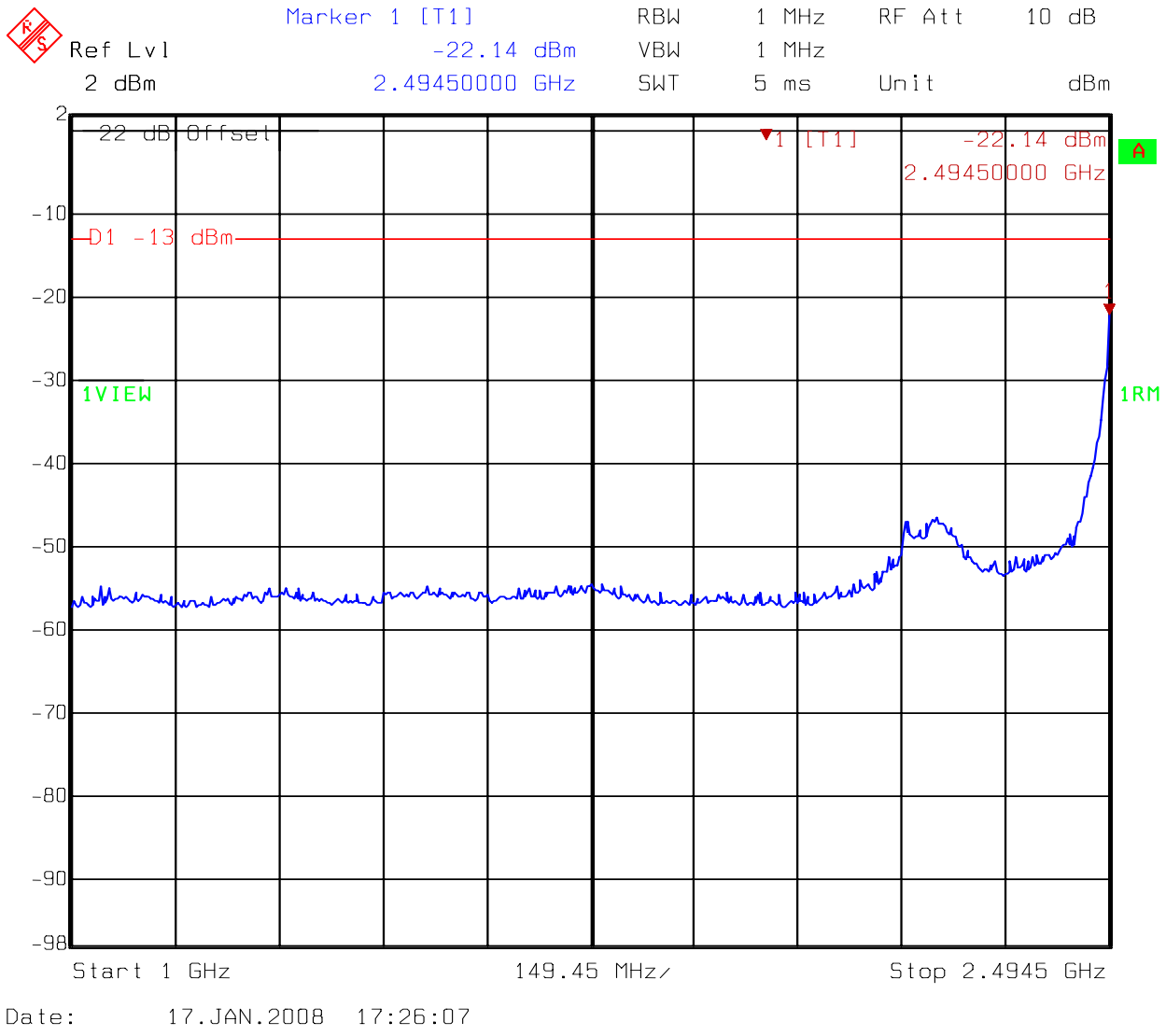
Antenna Type: Dipole antenna

Figure 41. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 1 of 8



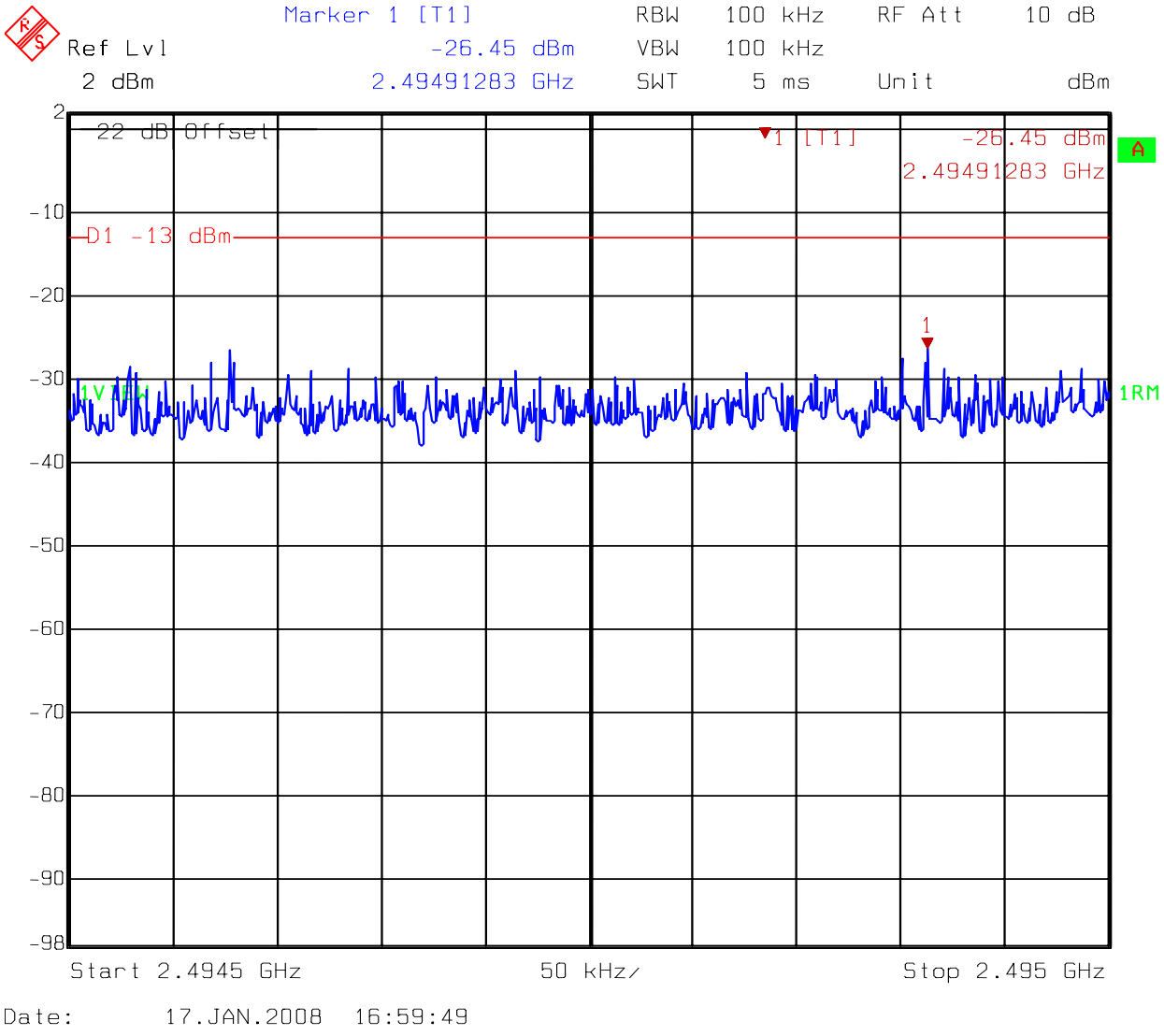
Antenna Type: Dipole antenna

Figure 42. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 2 of 8



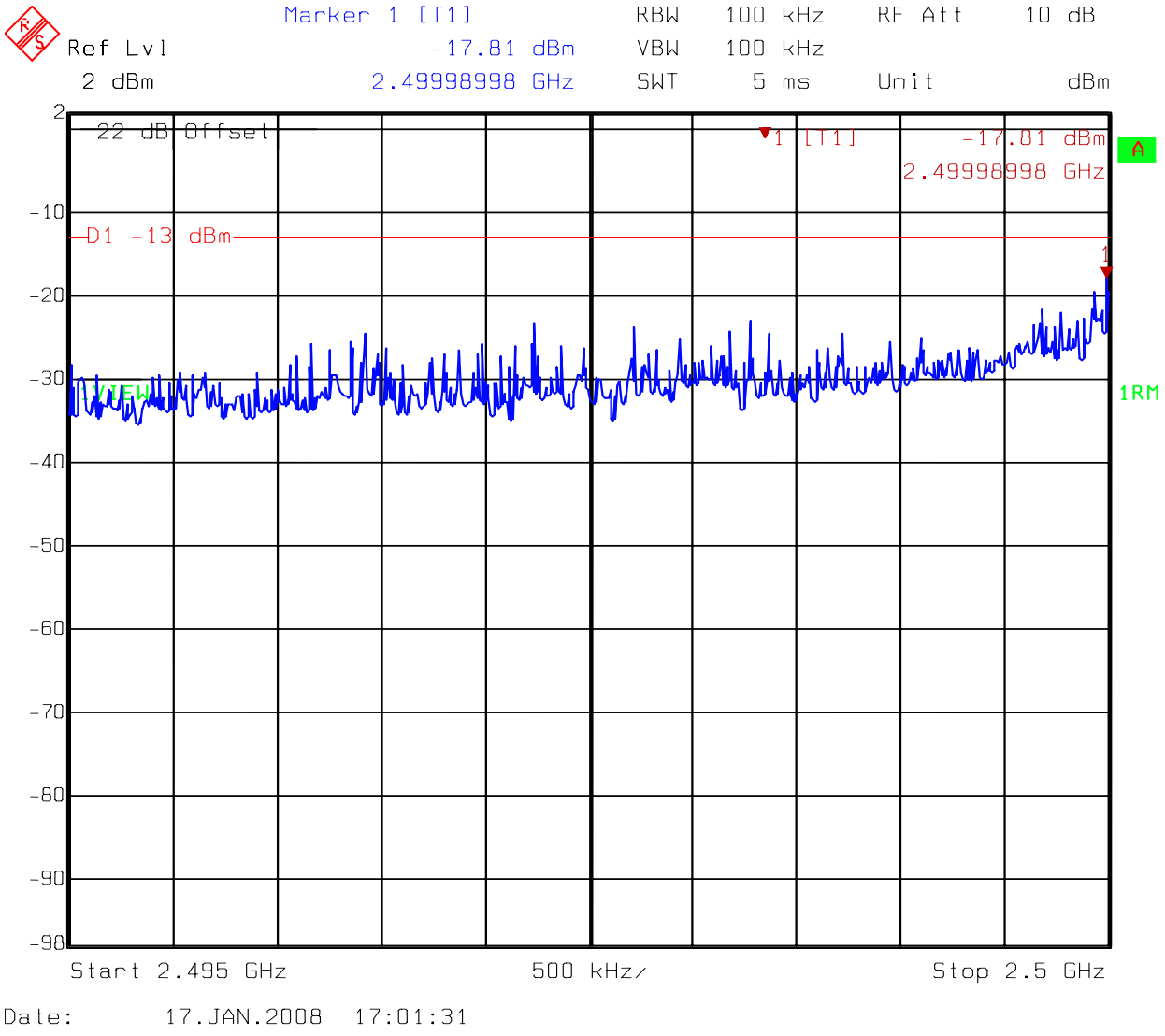
Antenna Type: Dipole antenna

Figure 43. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 3 of 8



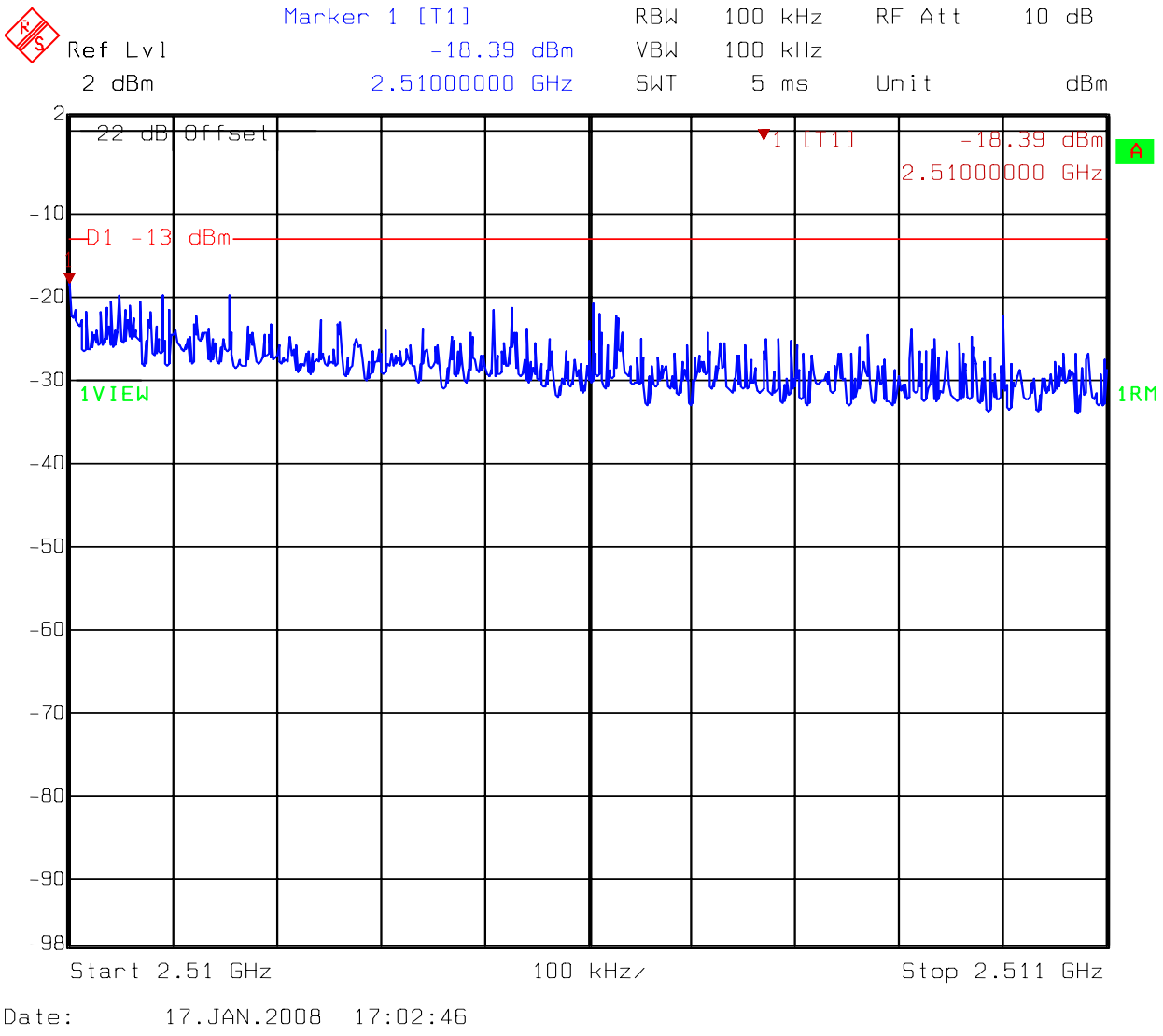
Antenna Type: Dipole antenna

Figure 44. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 4 of 8



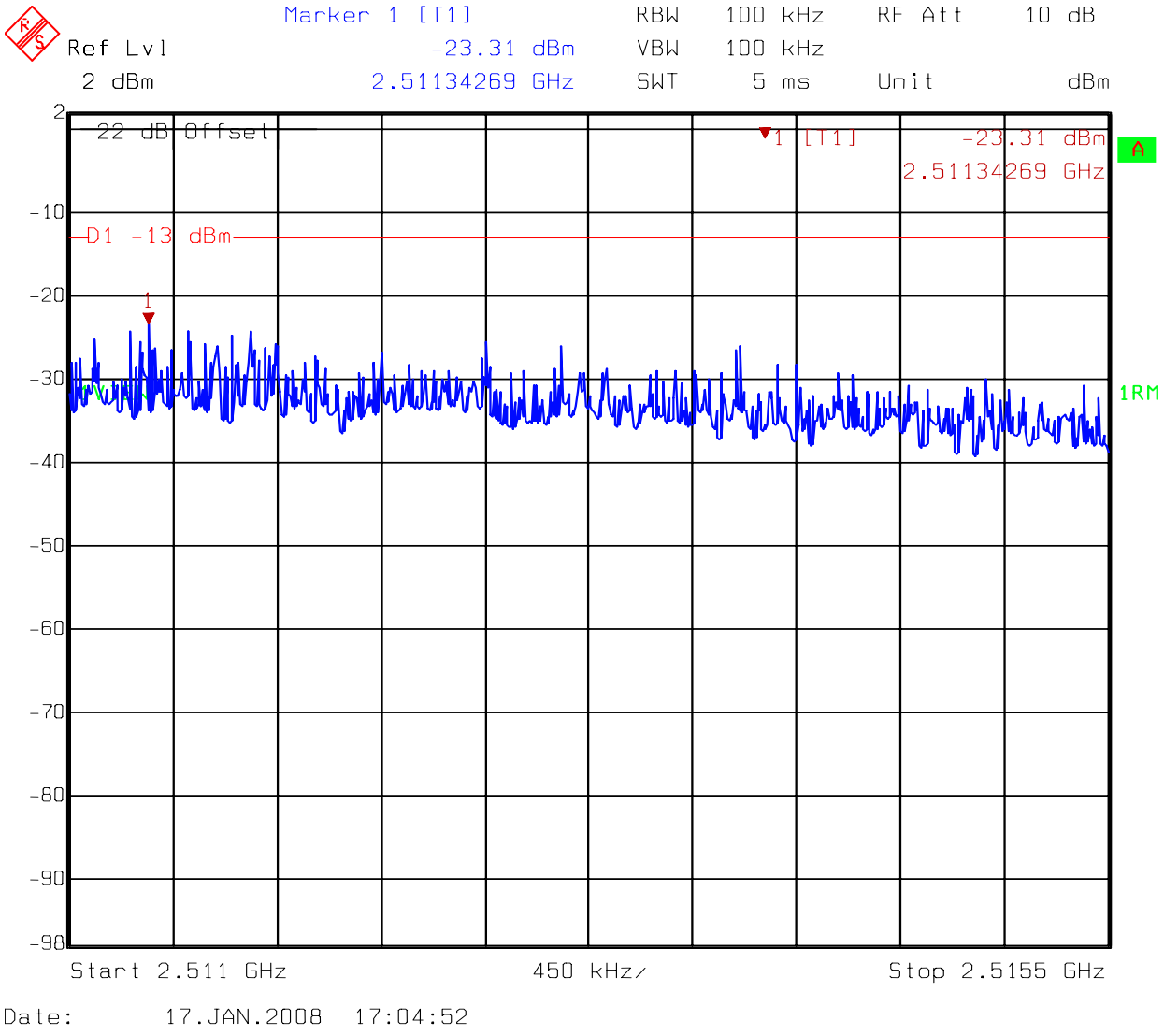
Antenna Type: Dipole antenna

Figure 45. Spurious Emission at Antenna Terminals @ low channel (10MHz) – 5 of 8



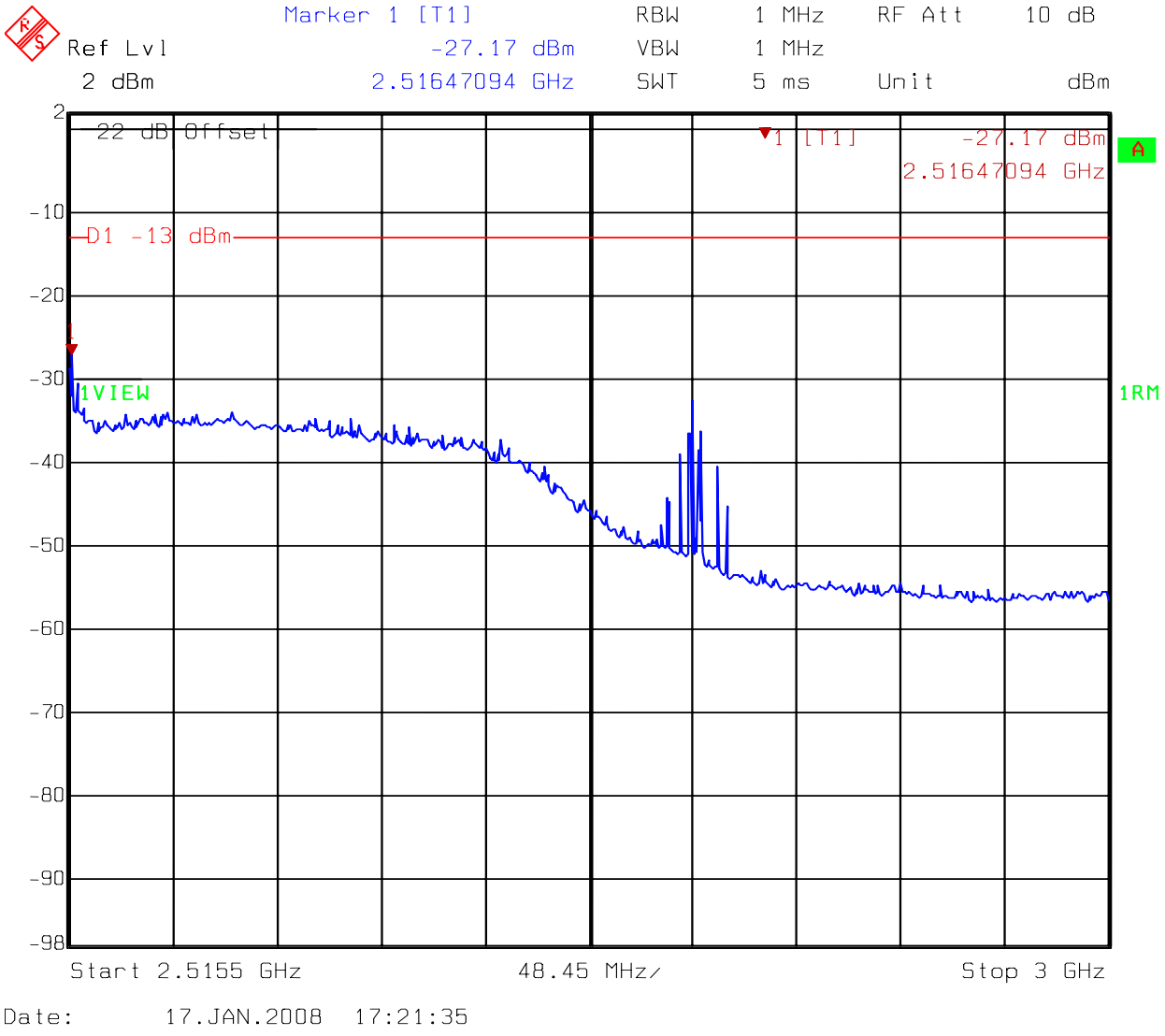
Antenna Type: Dipole antenna

Figure 46. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 6 of 8



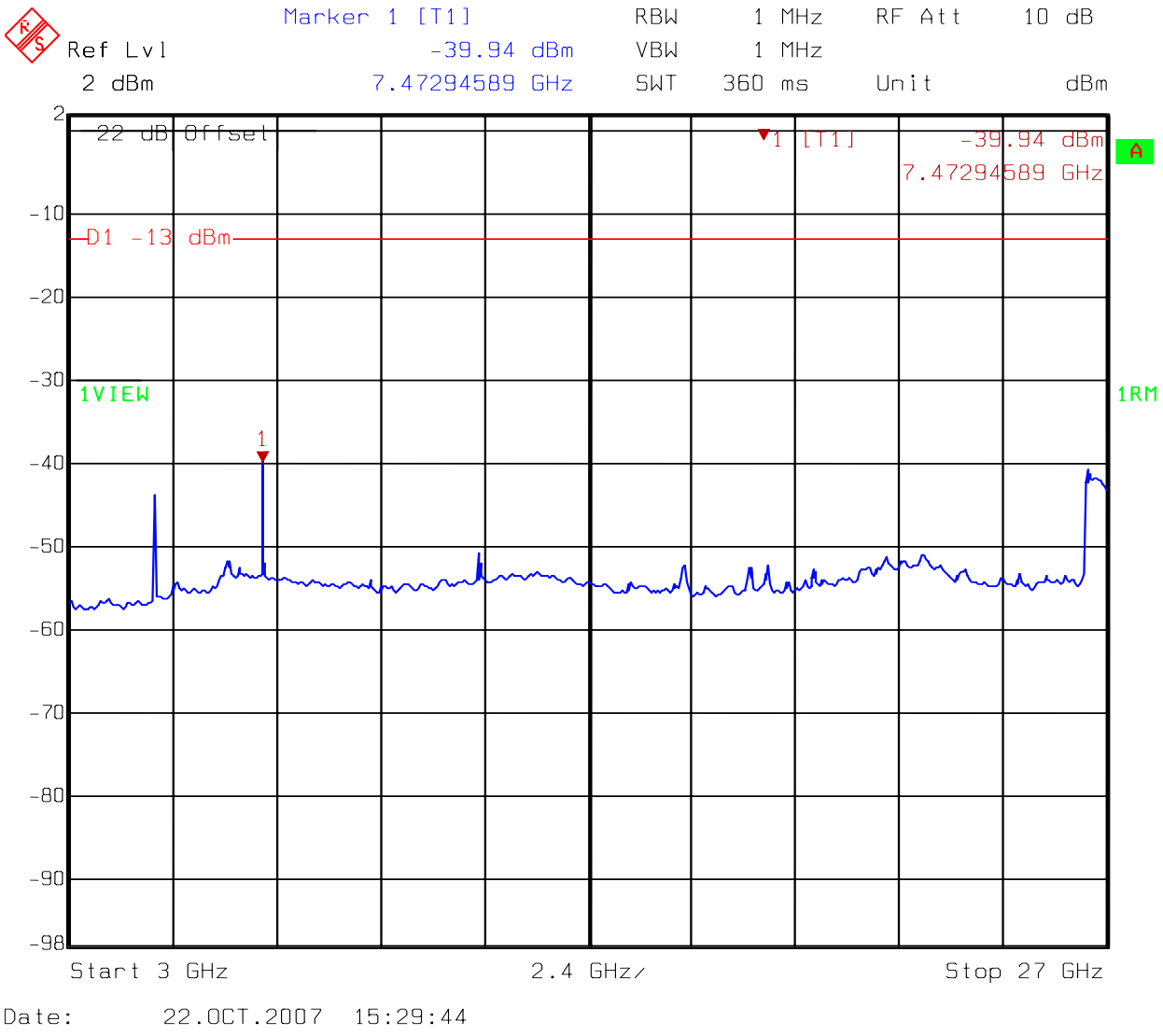
Antenna Type: Dipole antenna

Figure 47. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 7 of 8



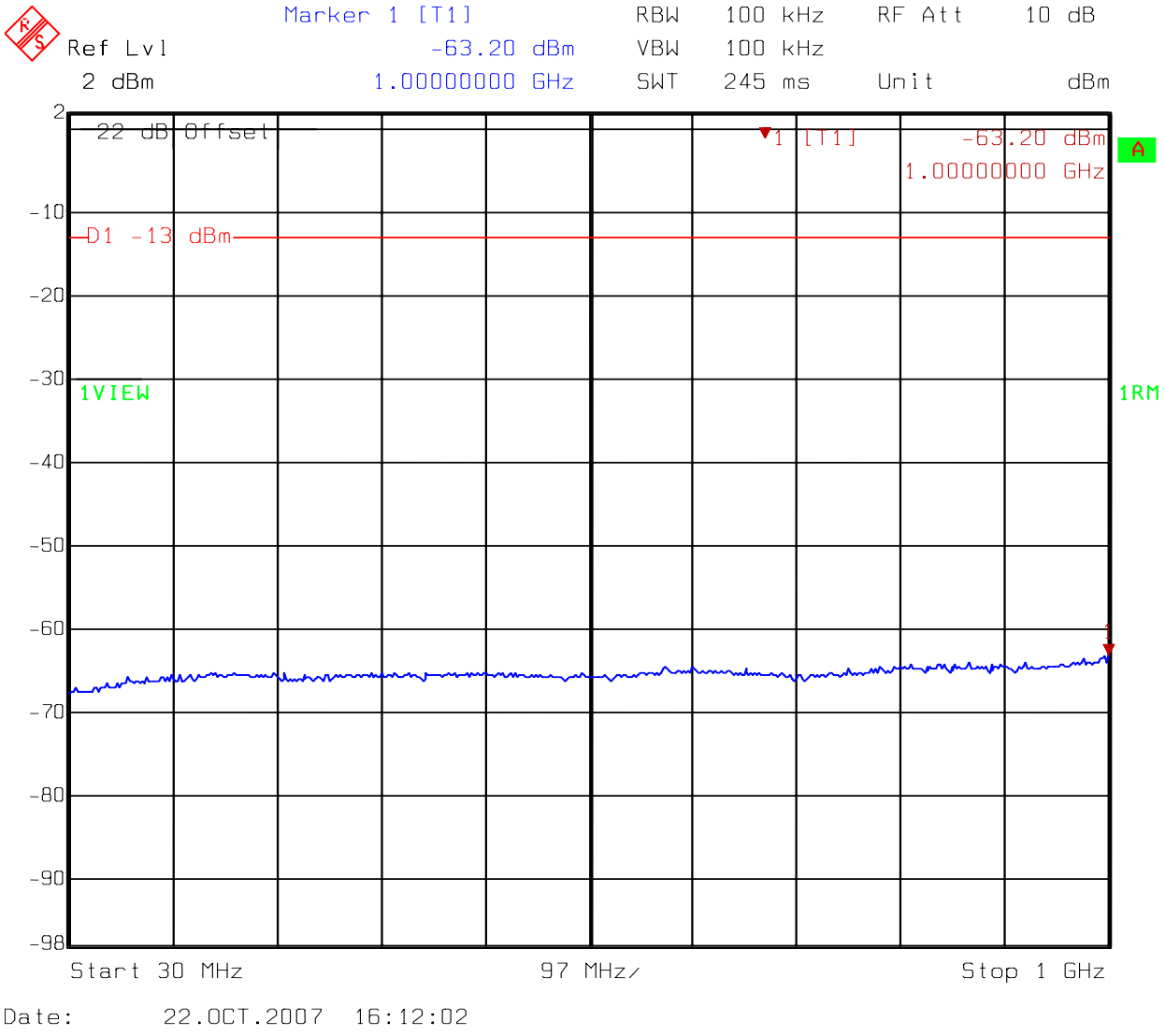
Antenna Type: Dipole antenna

Figure 48. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 8 of 8



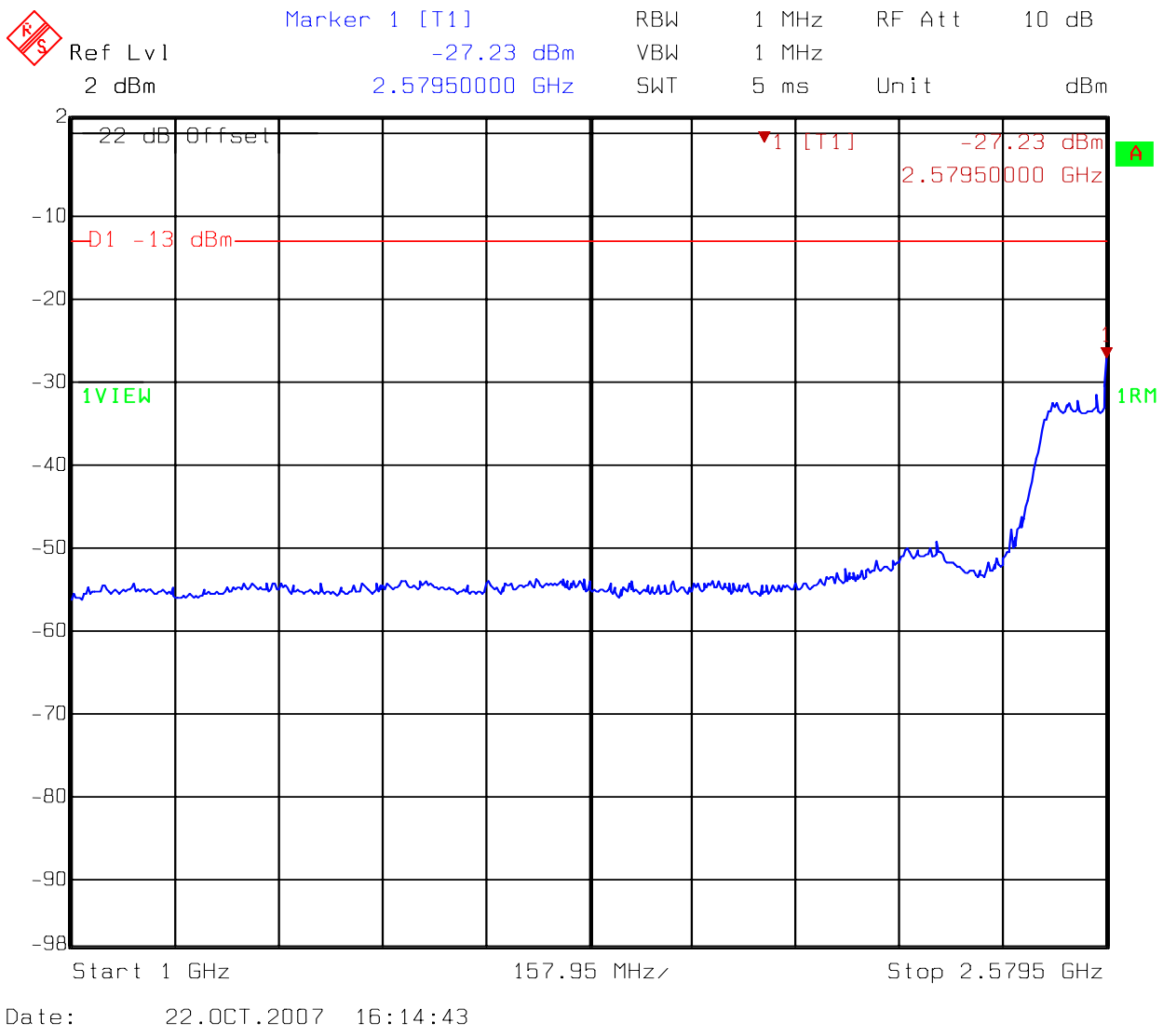
Antenna Type: Dipole antenna

Figure 49. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 1 of 8



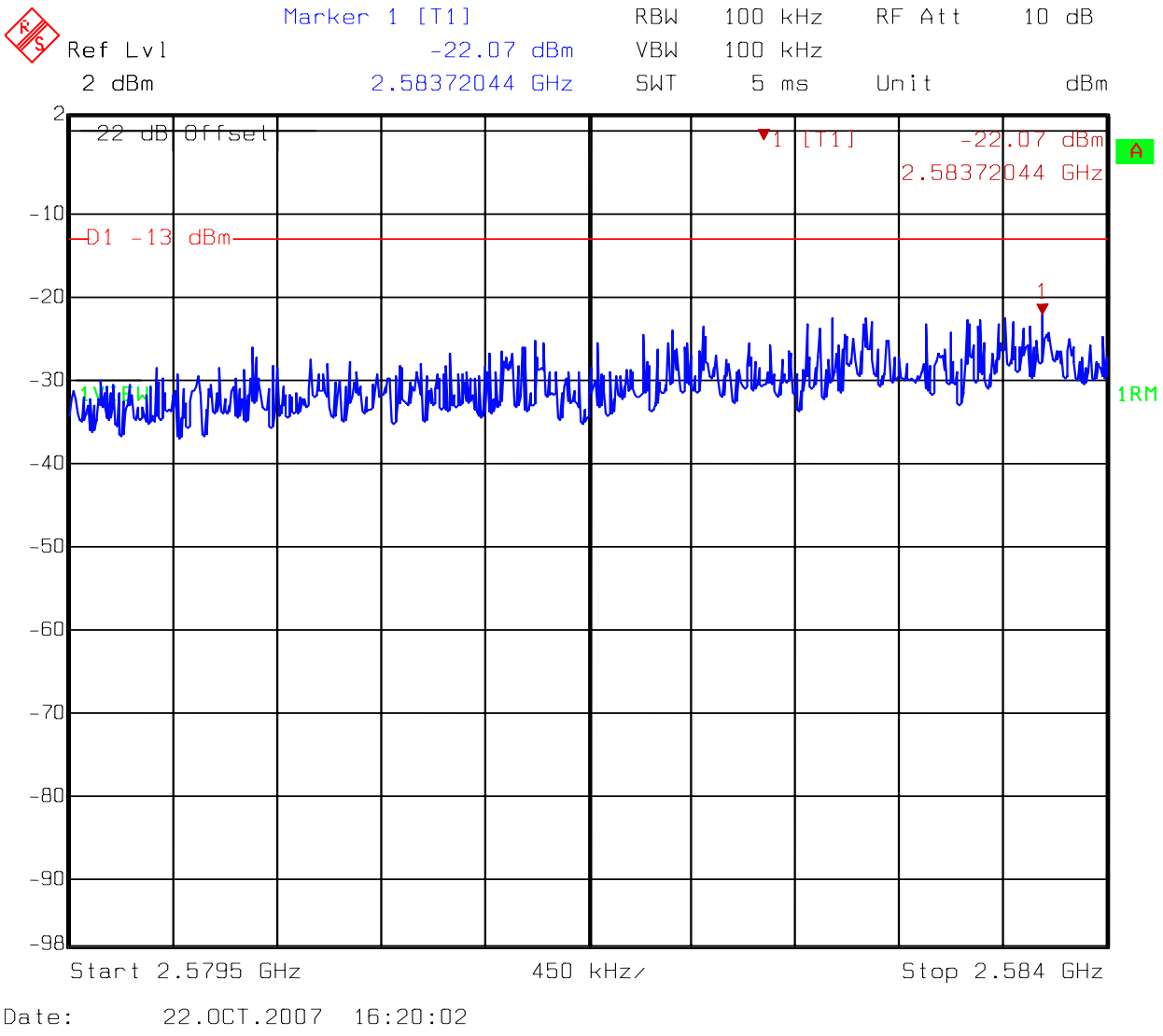
Antenna Type: Dipole antenna

Figure 50. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 2 of 8



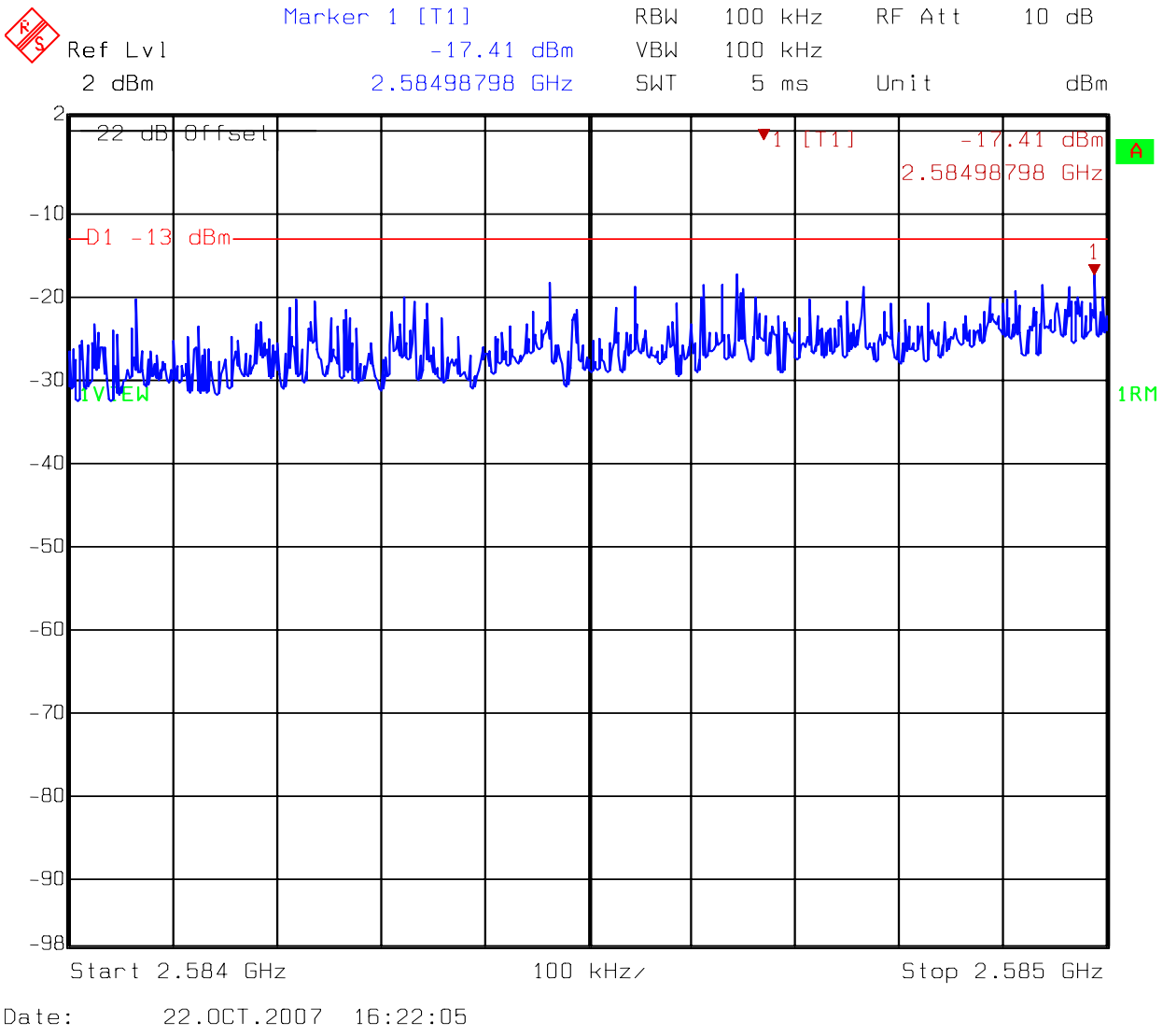
Antenna Type: Dipole antenna

Figure 51. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 3 of 8



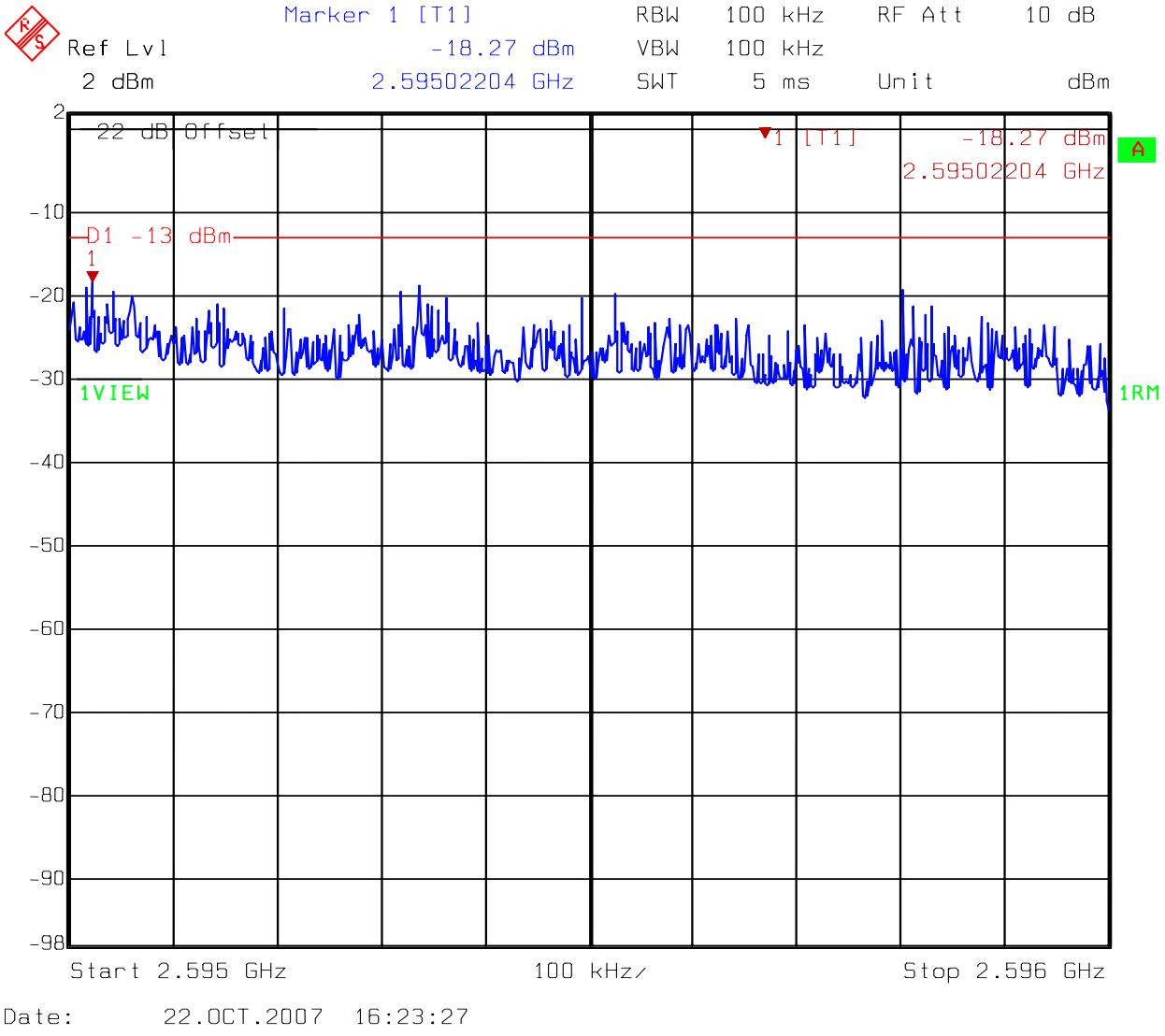
Antenna Type: Dipole antenna

Figure 52. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 4 of 8



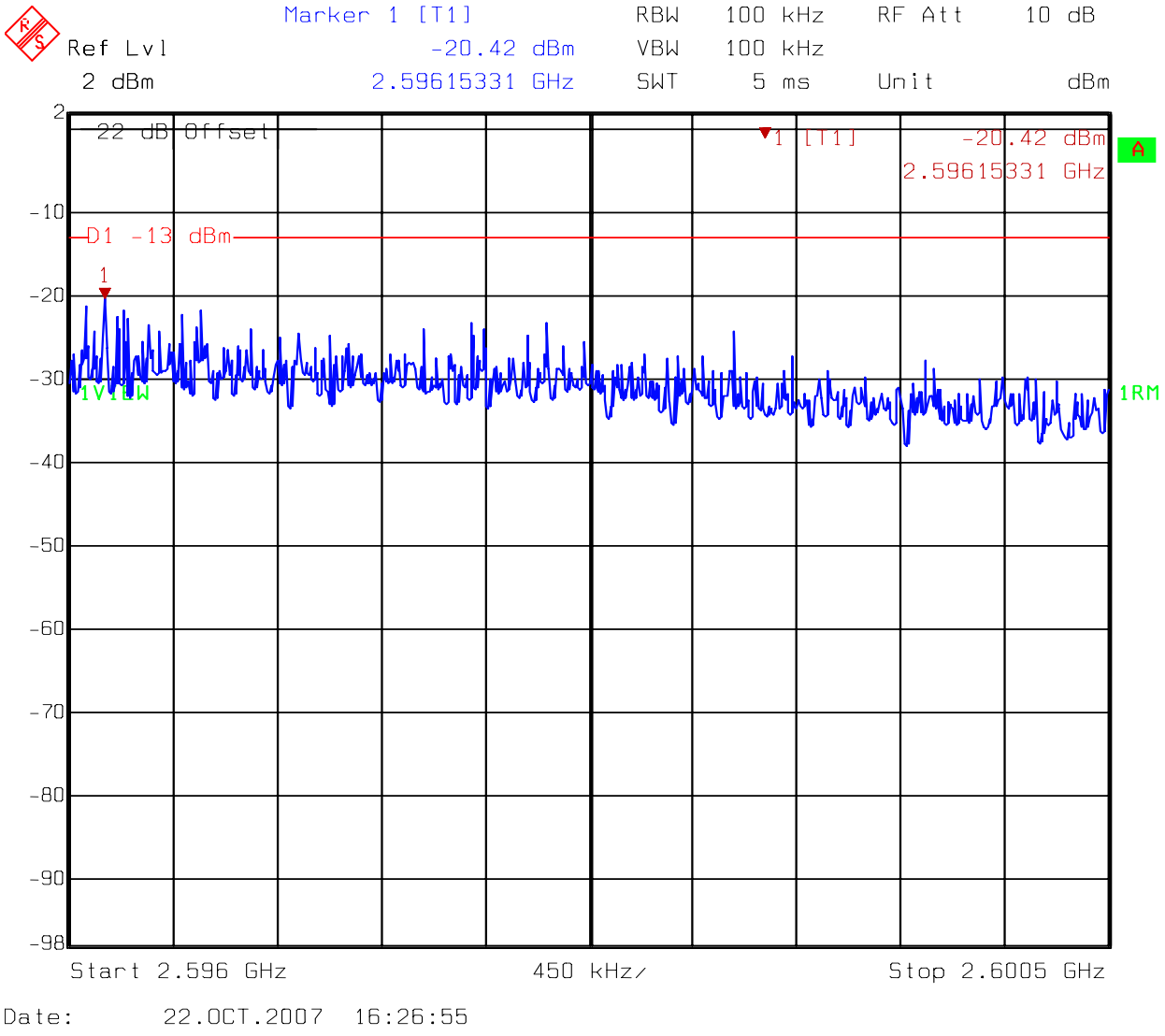
Antenna Type: Dipole antenna

Figure 53. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 5 of 8



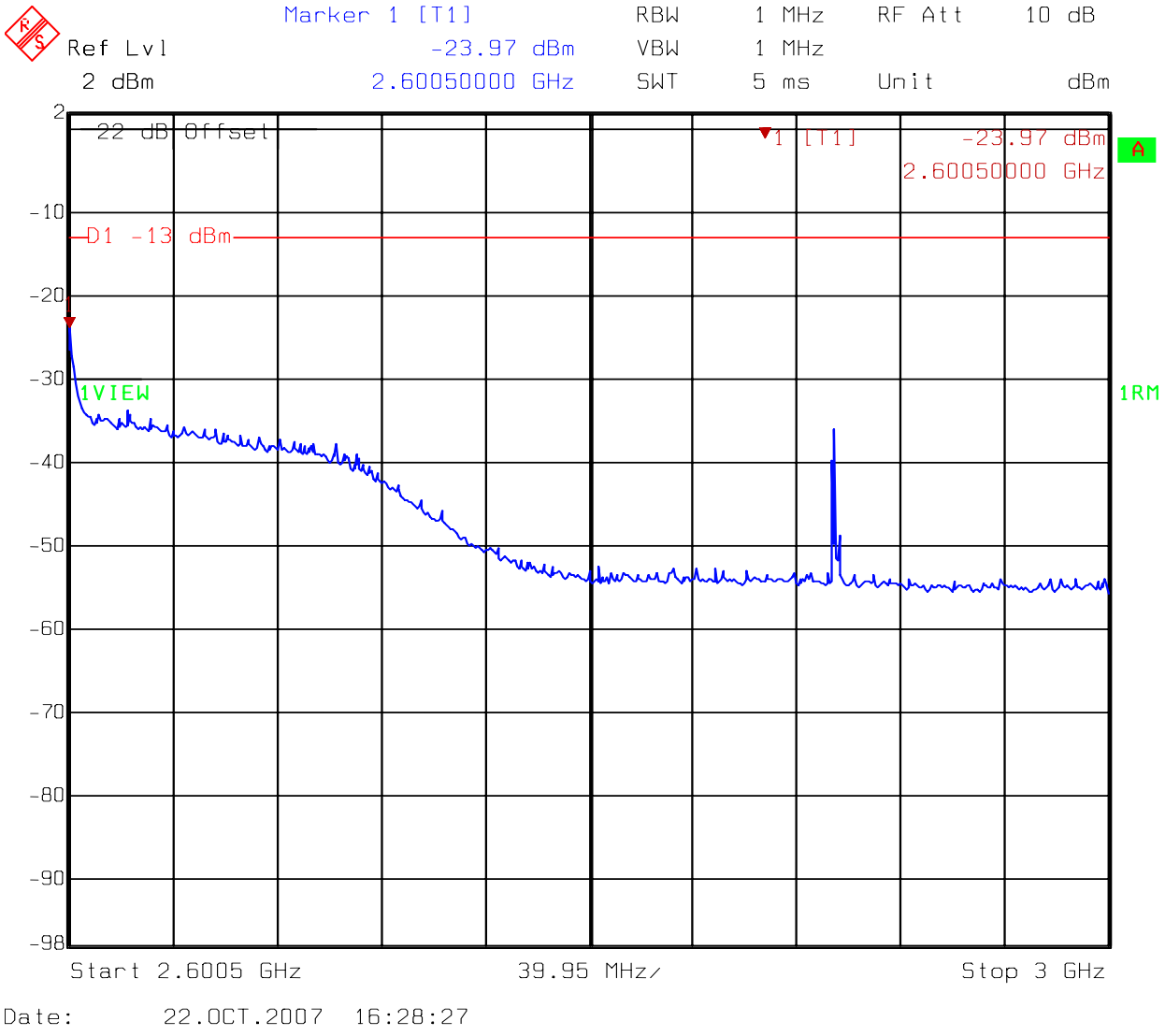
Antenna Type: Dipole antenna

Figure 54. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 6 of 8



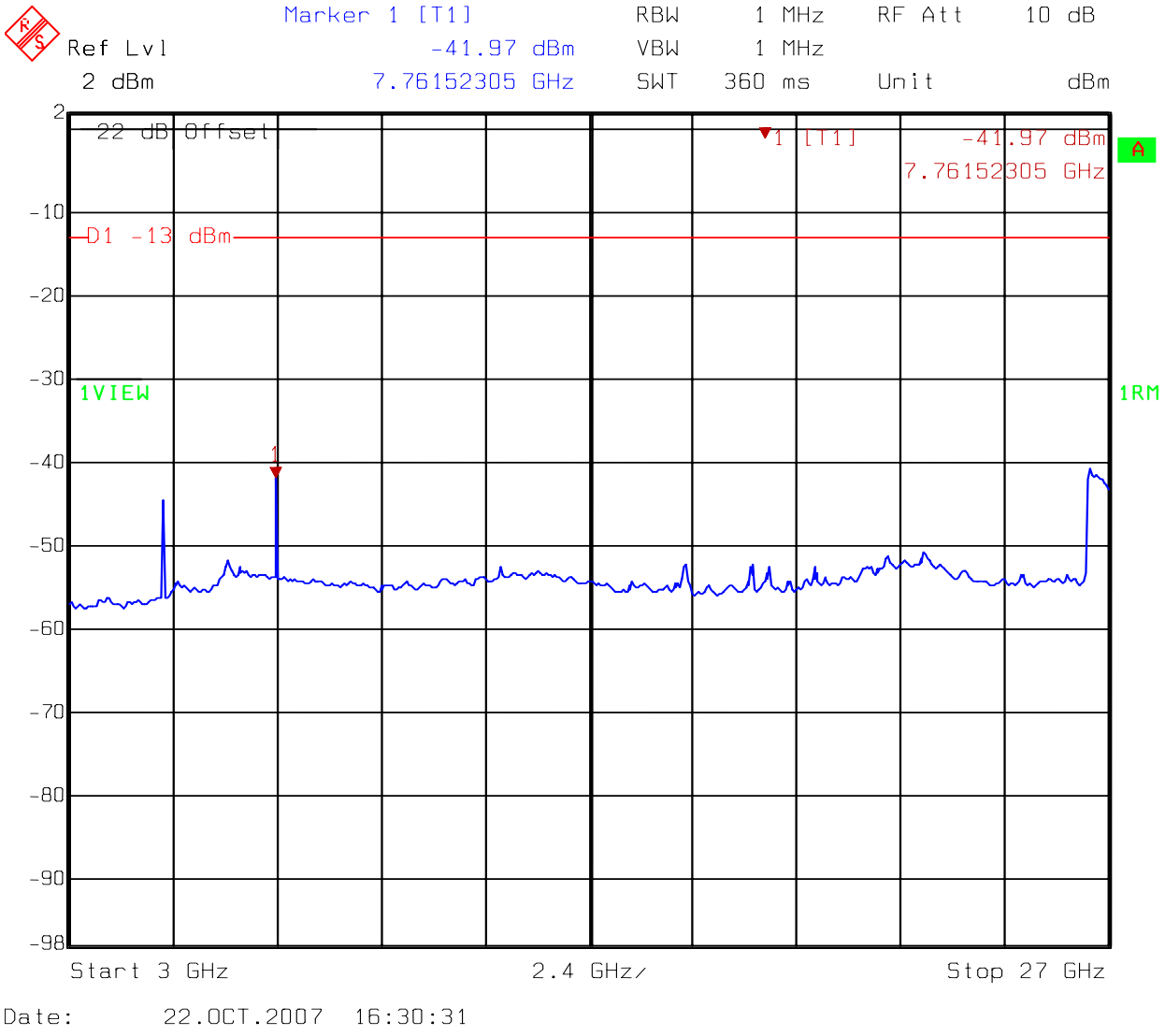
Antenna Type: Dipole antenna

Figure 55. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 7 of 8



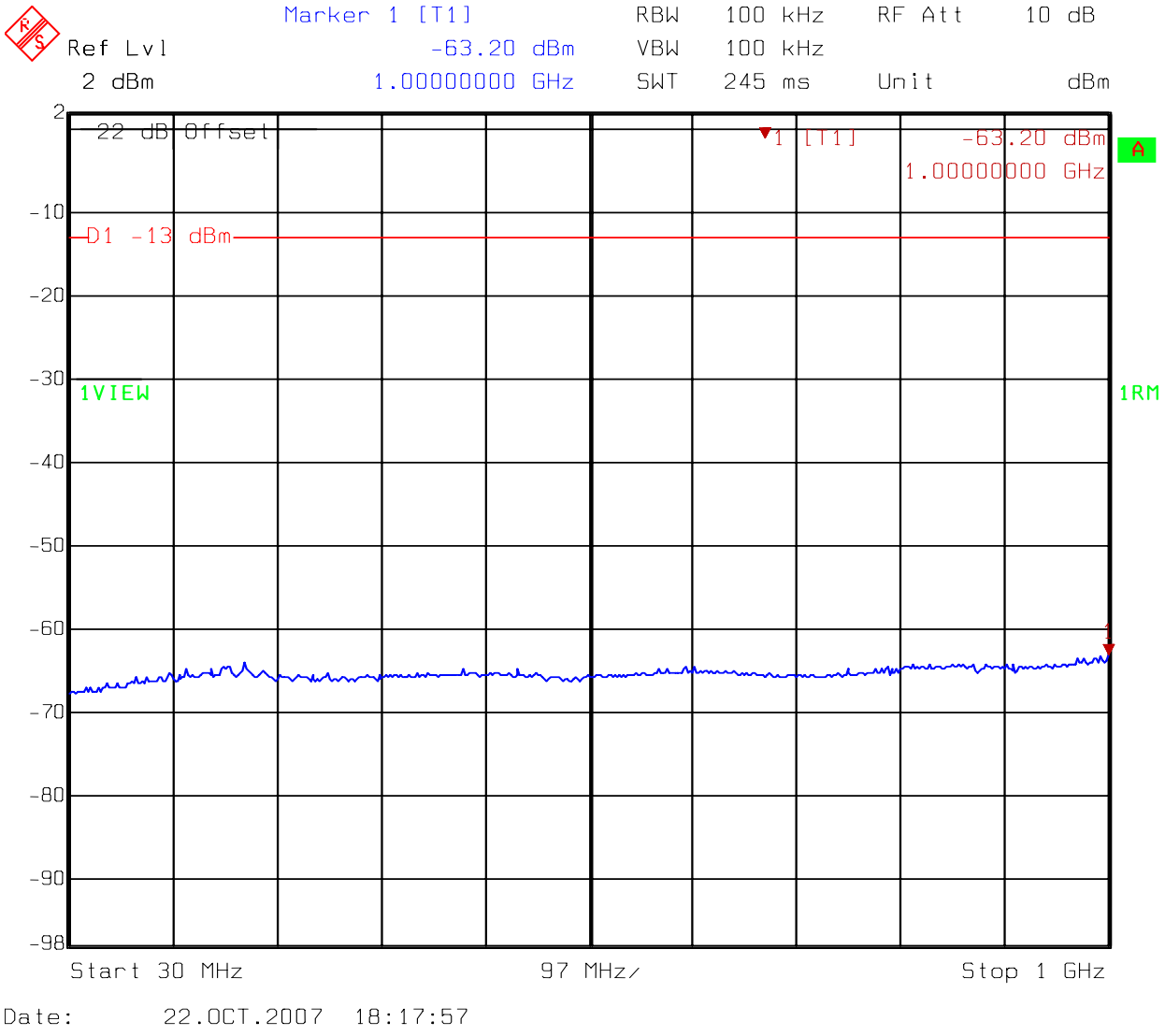
Antenna Type: Dipole antenna

Figure 56. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 8 of 8



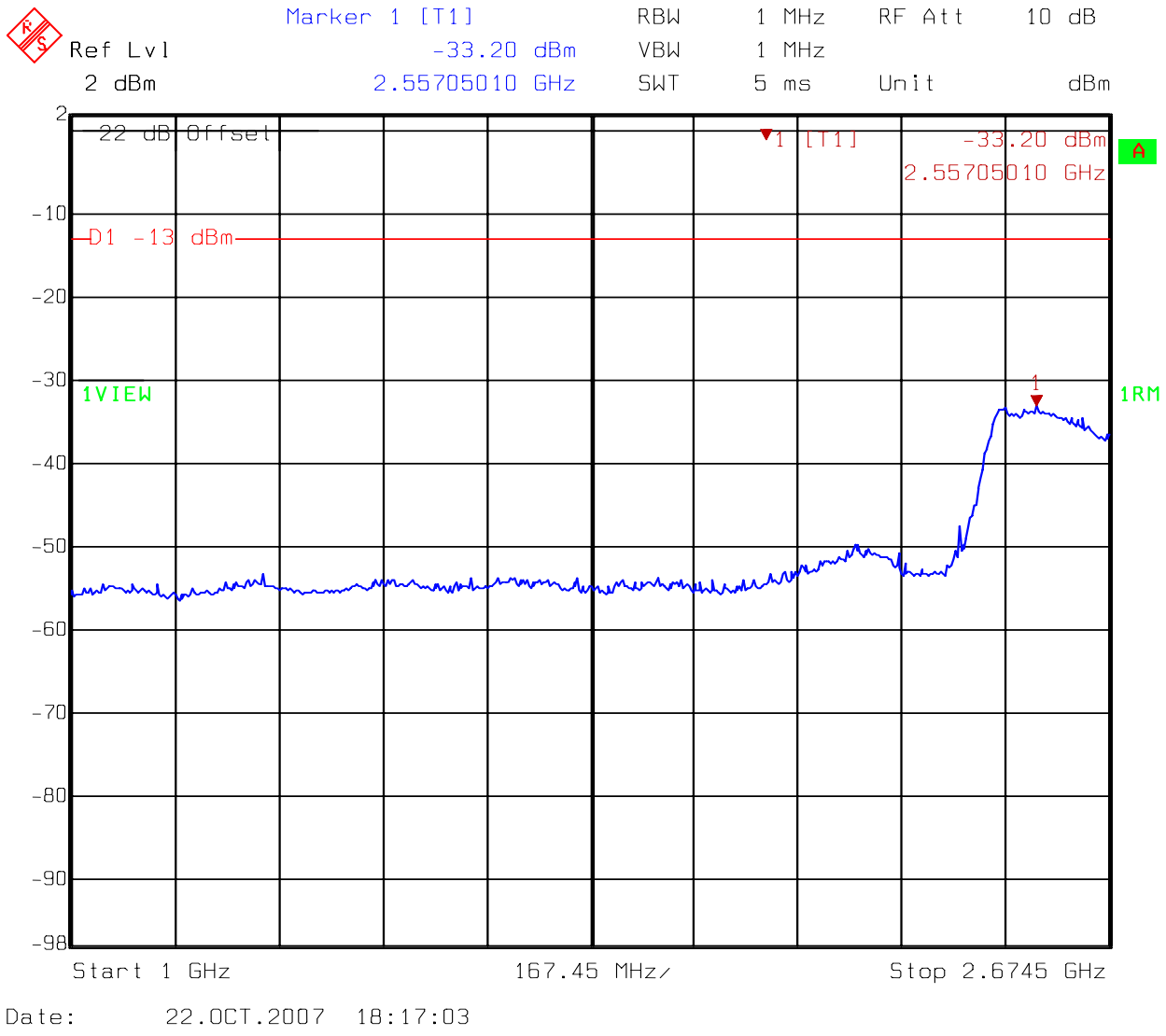
Antenna Type: Dipole antenna

Figure 57. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 1 of 8



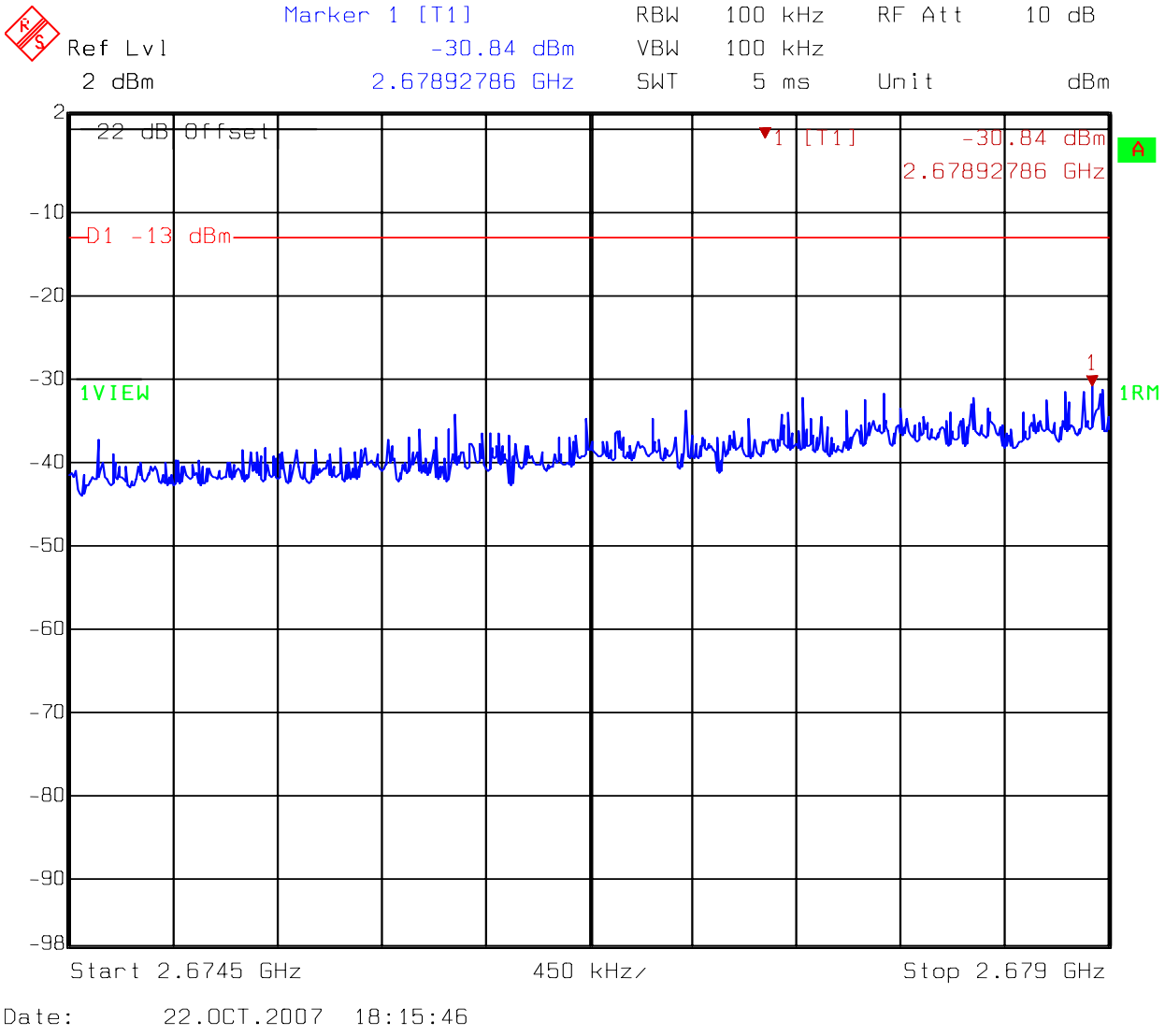
Antenna Type: Dipole antenna

Figure 58. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 2 of 8



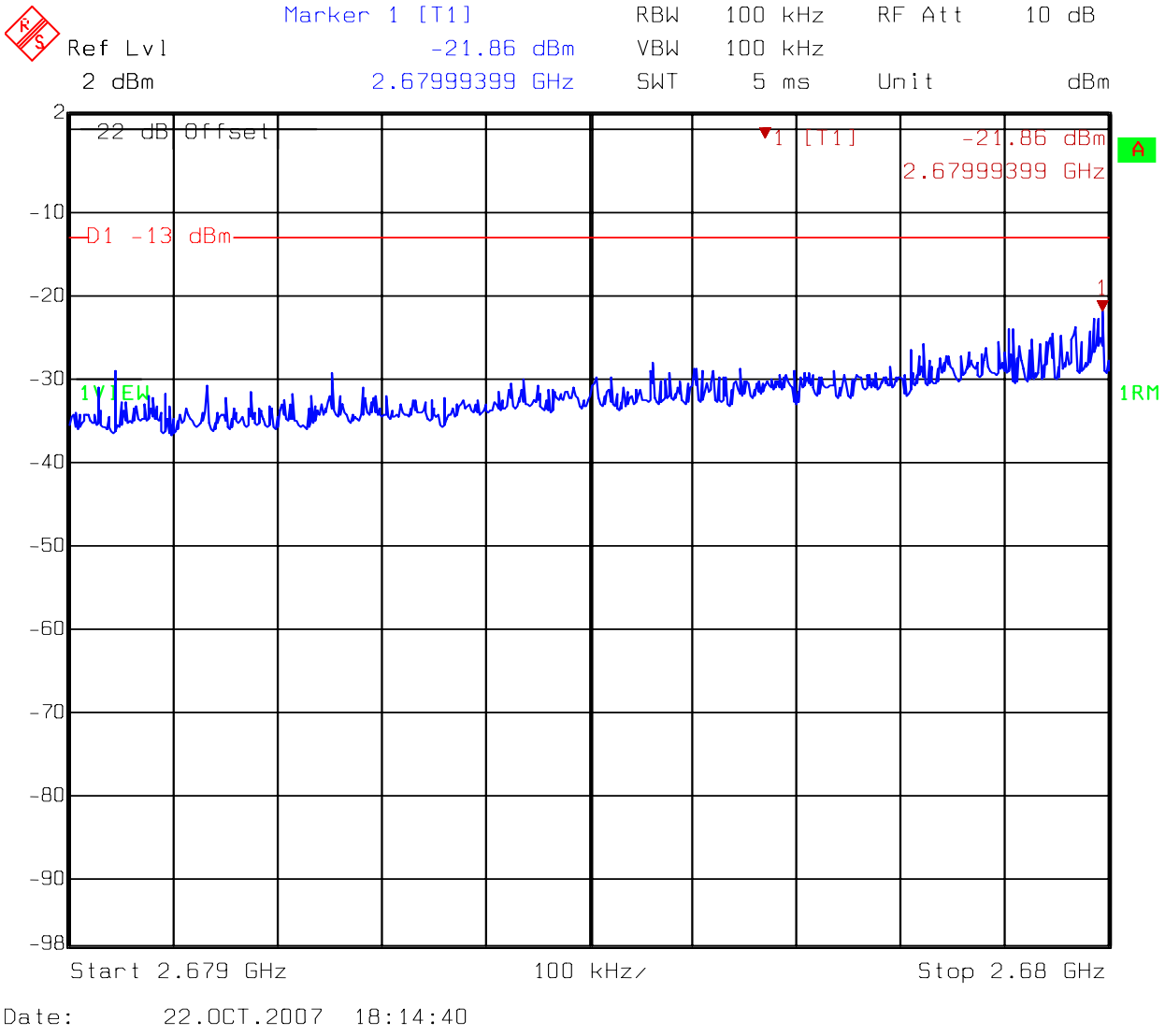
Antenna Type: Dipole antenna

Figure 59. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 3 of 8



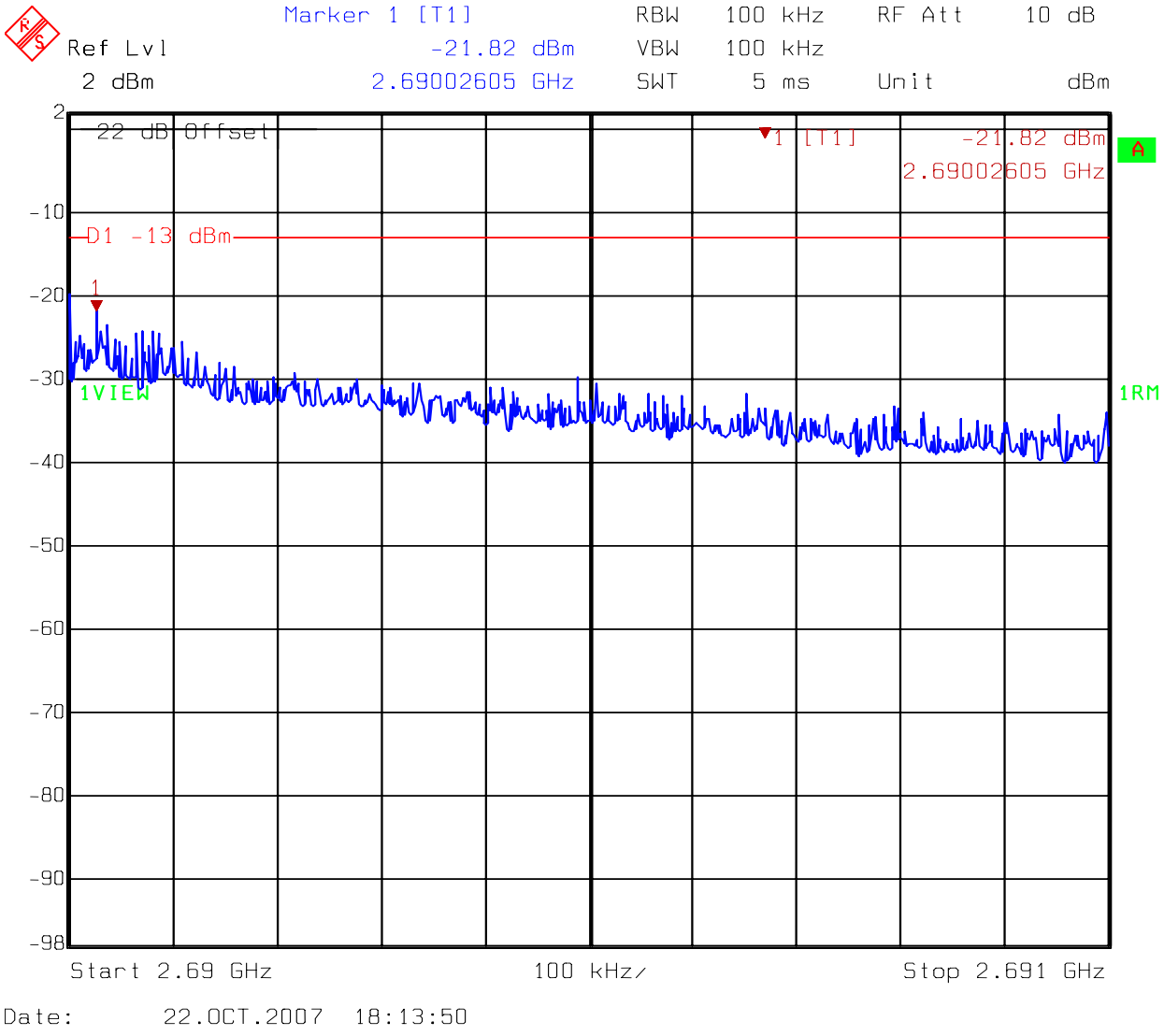
Antenna Type: Dipole antenna

Figure 60. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 4 of 8



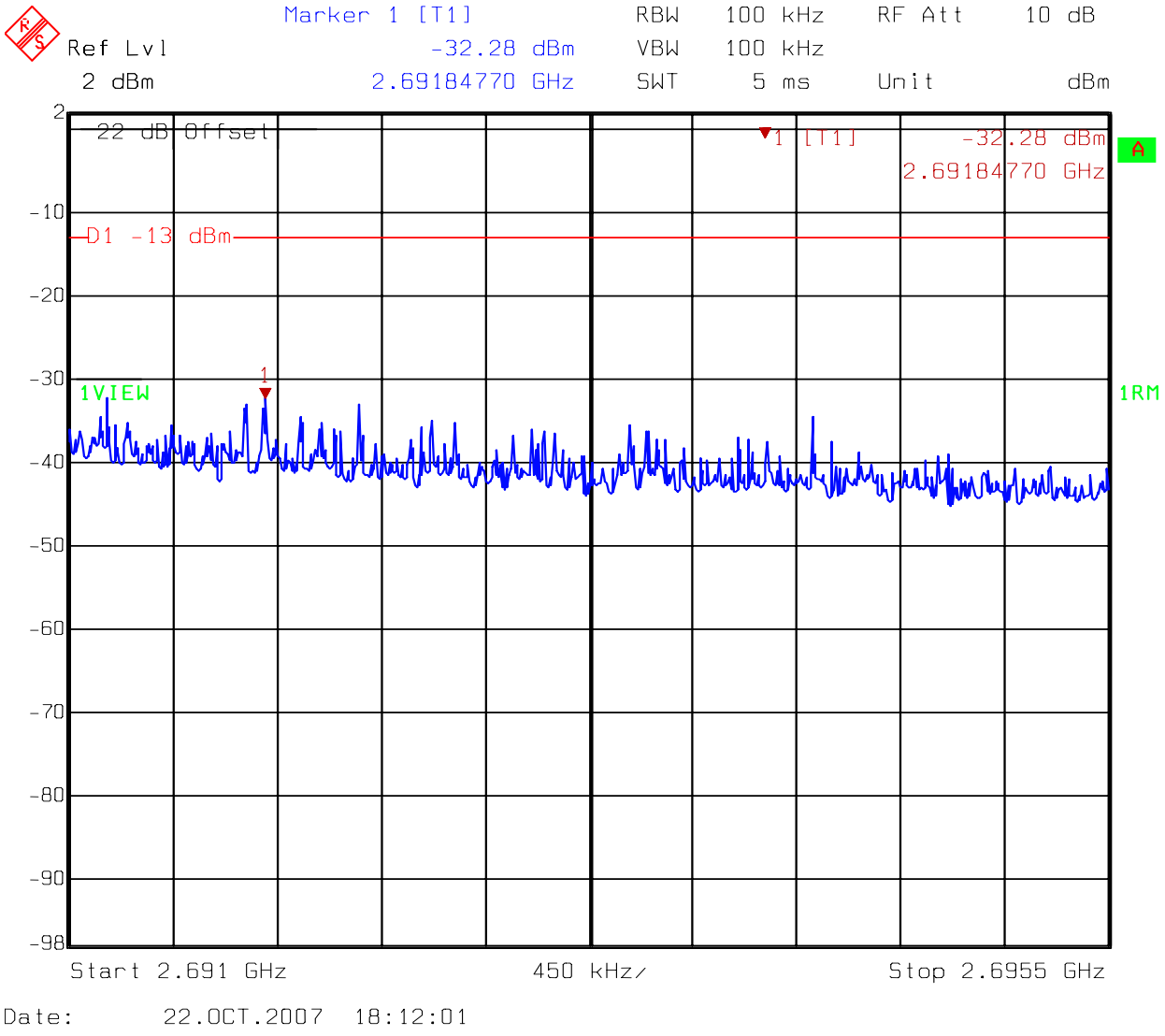
Antenna Type: Dipole antenna

Figure 61. Spurious Emission at Antenna Terminals @ high channel (10MHz) – 5 of 8



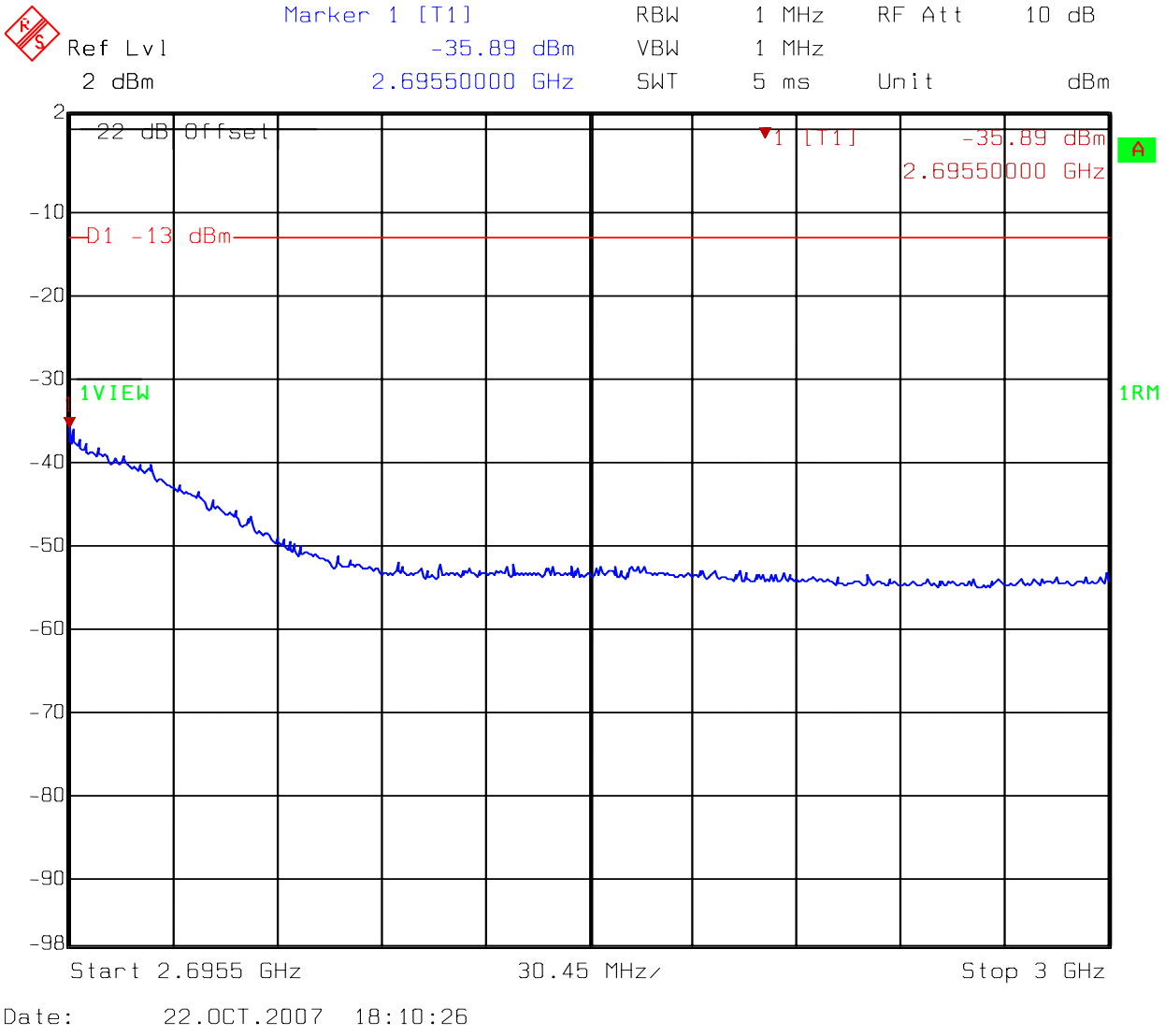
Antenna Type: Dipole antenna

Figure 62. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 6 of 8



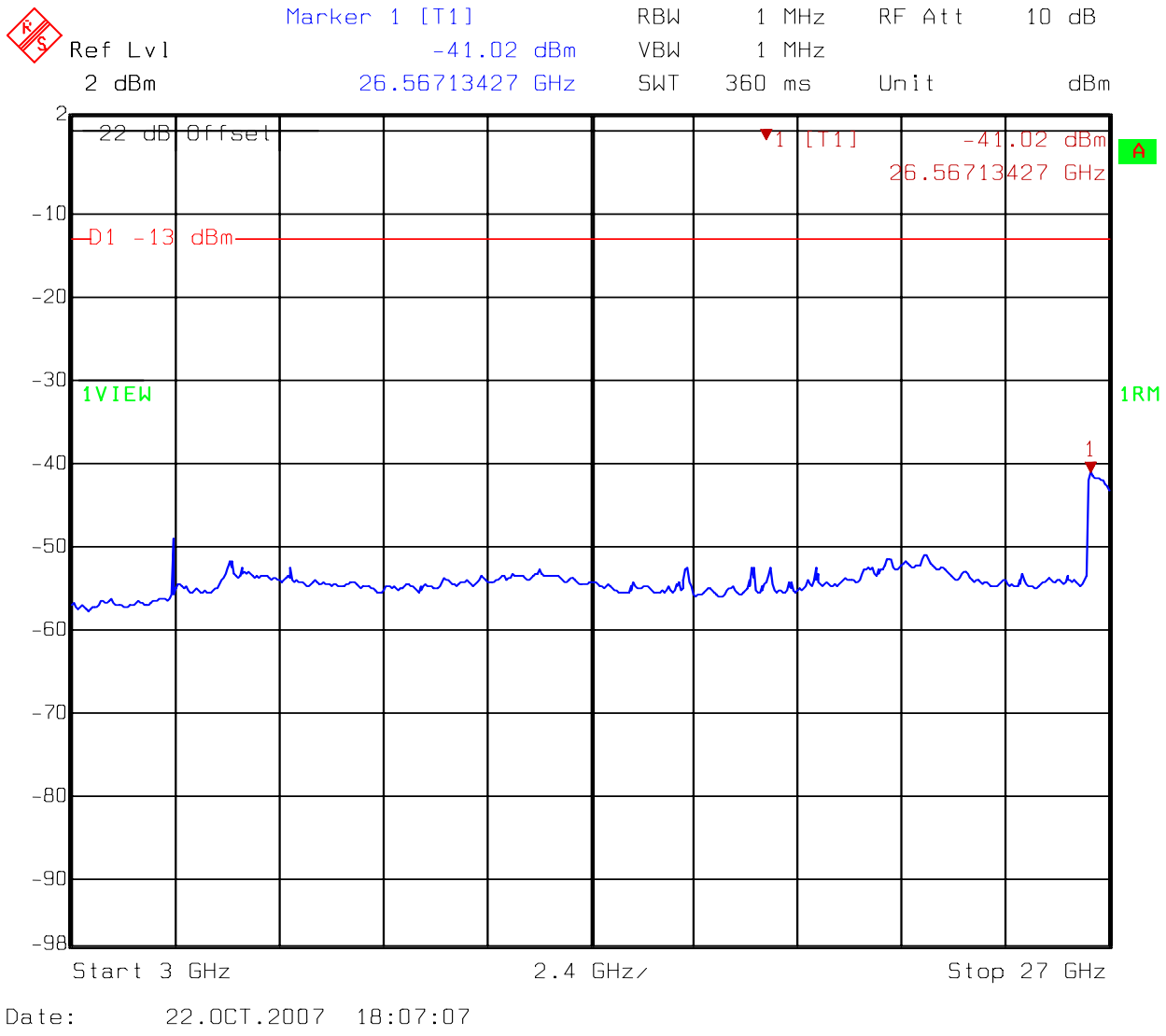
Antenna Type: Dipole antenna

Figure 63. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 7 of 8



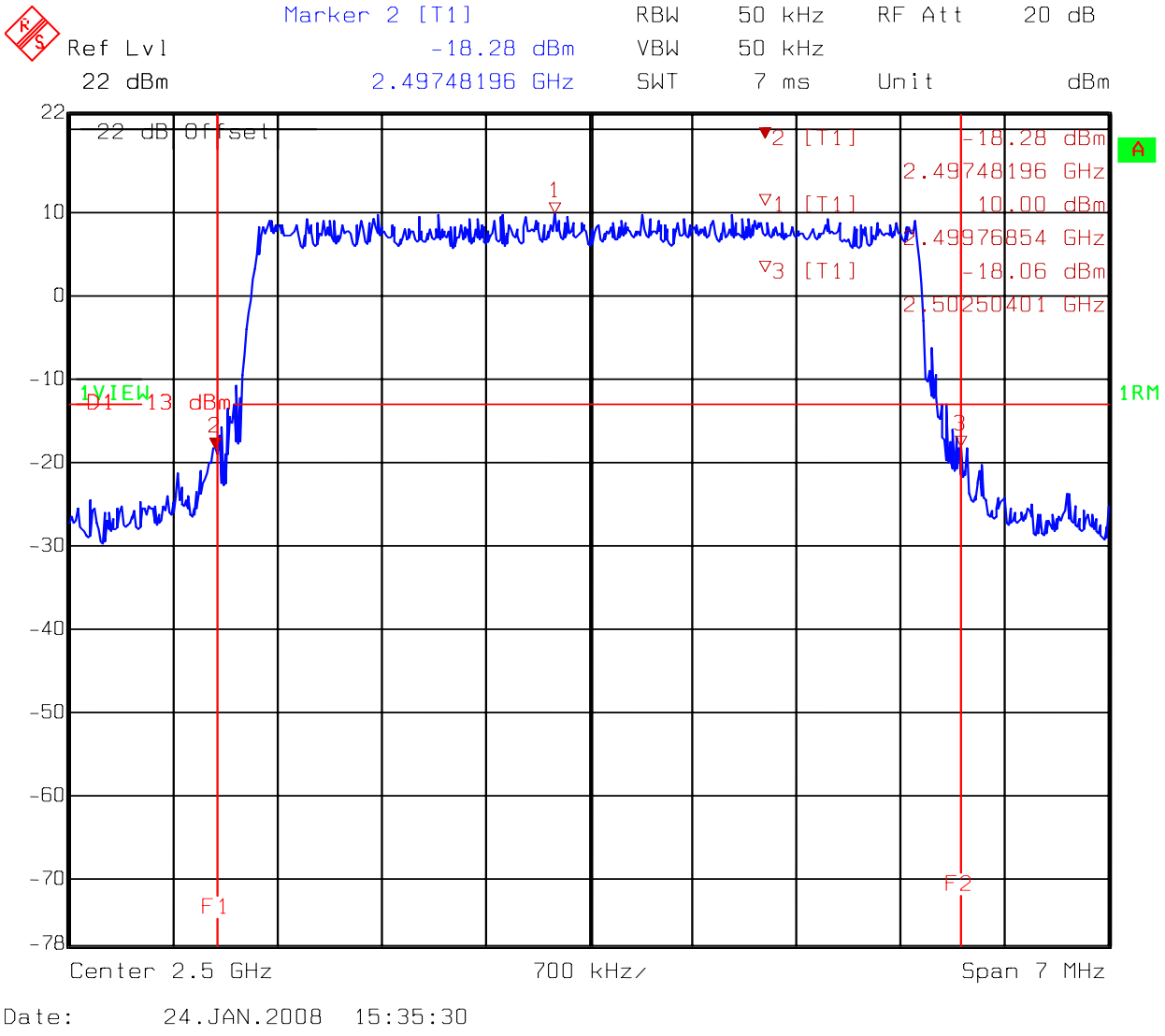
Antenna Type: Dipole antenna

Figure 64. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 8 of 8



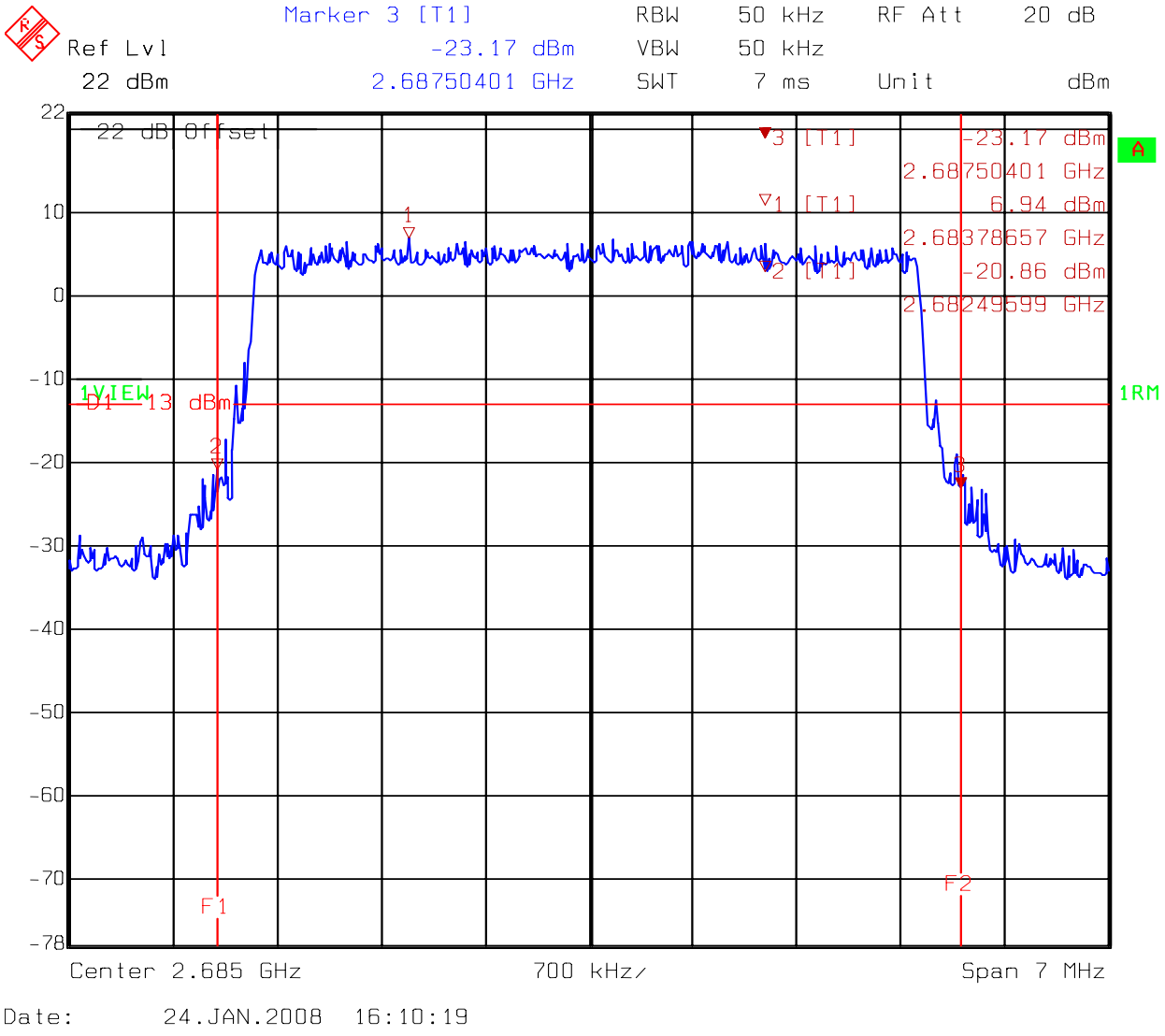
Antenna Type: Patch antenna

Figure 65. Lower Band Edge (5MHz)



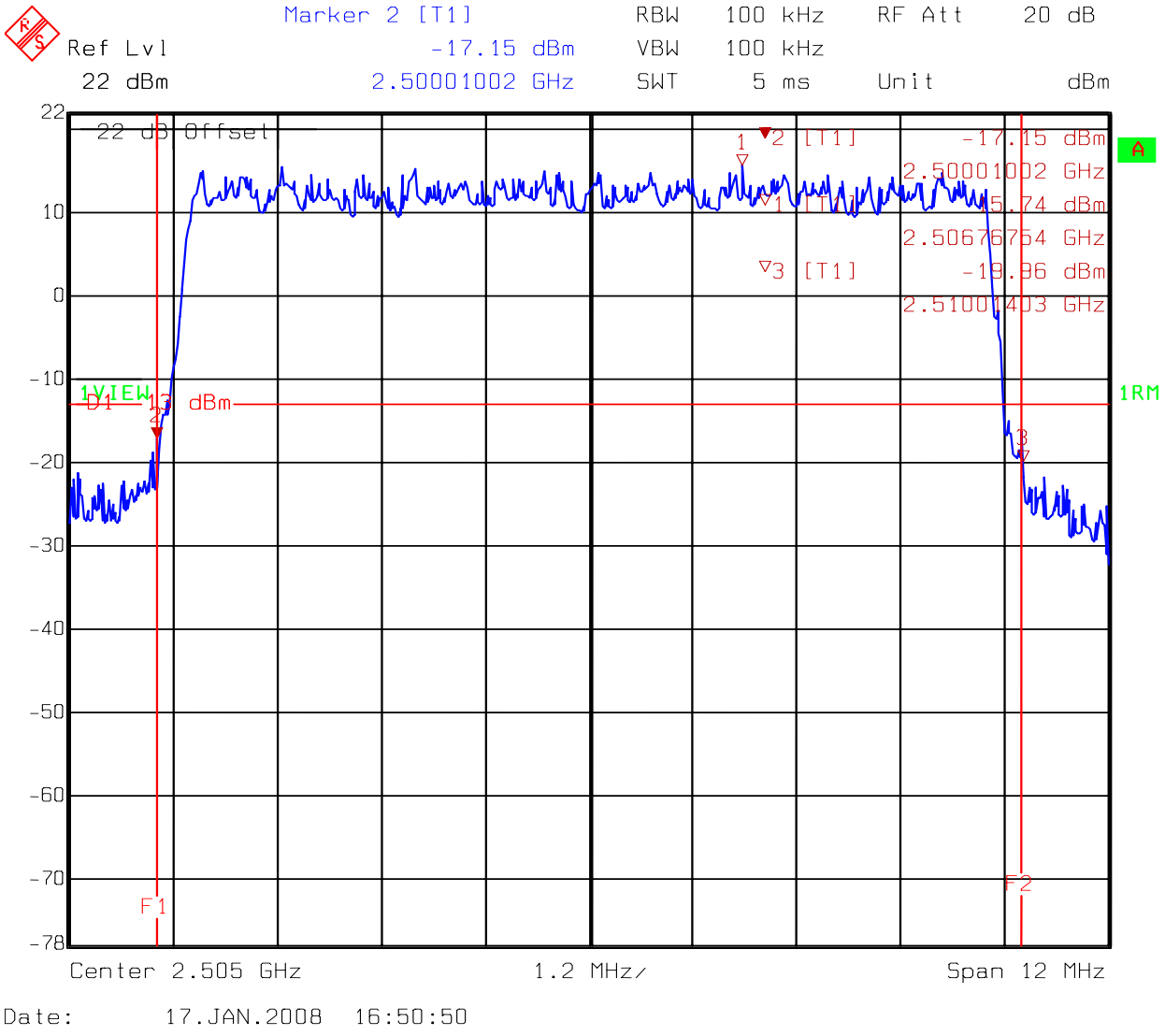
Antenna Type: Patch antenna

Figure 66. Upper Band Edge (5MHz)



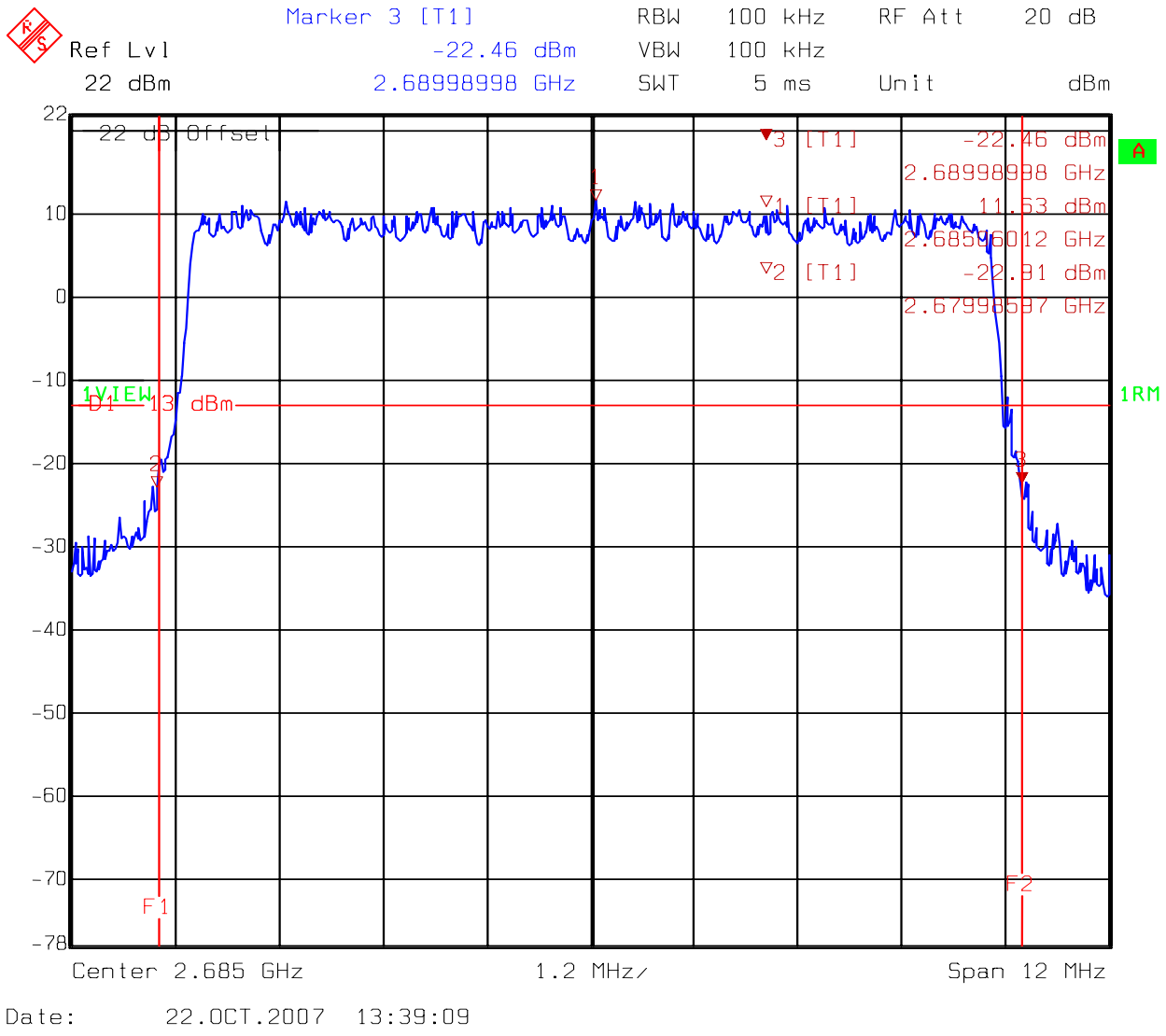
Antenna Type: Patch antenna

Figure 67. Lower Band Edge (10MHz)



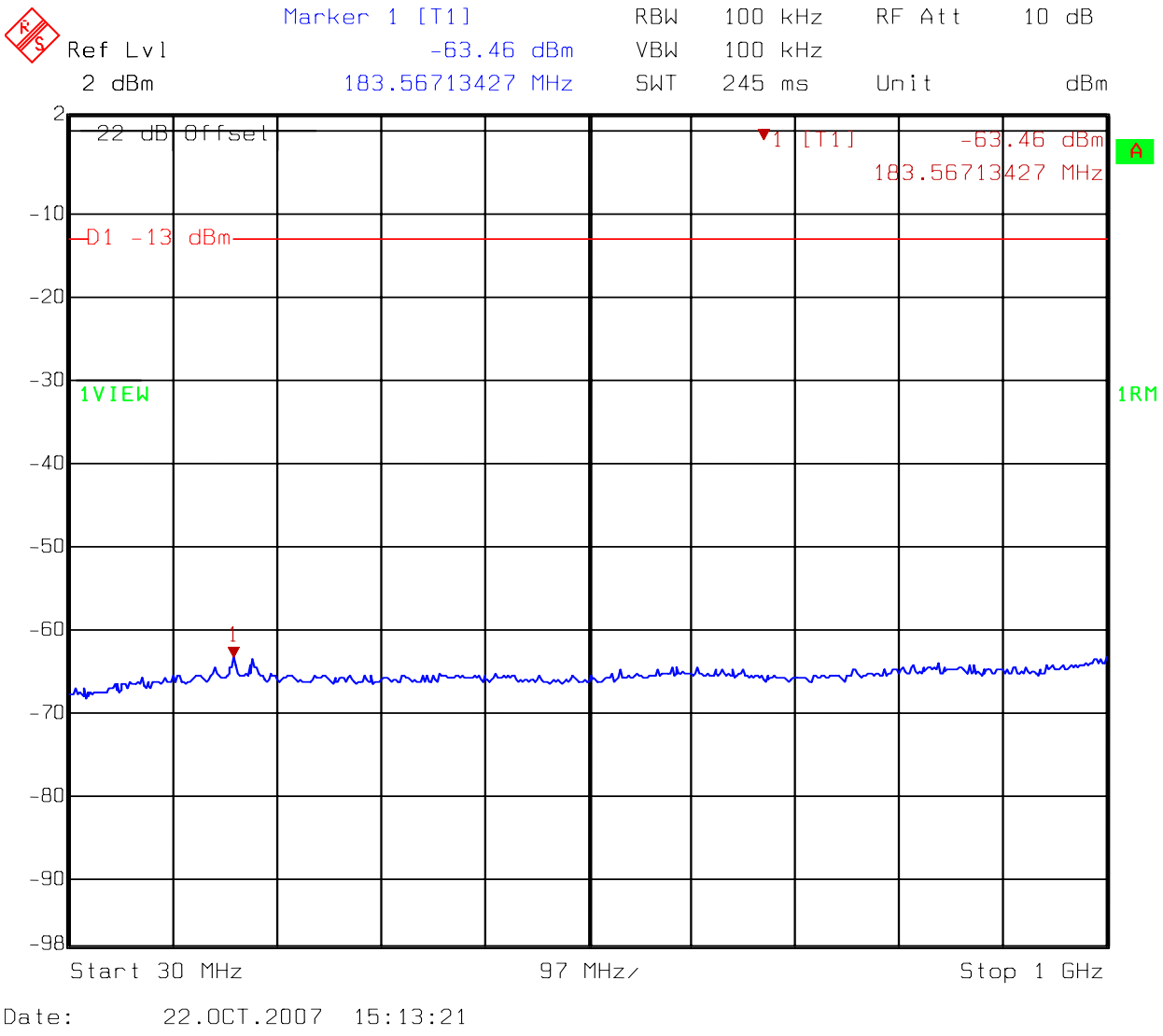
Antenna Type: Patch antenna

Figure 68. Upper Band Edge (10MHz)



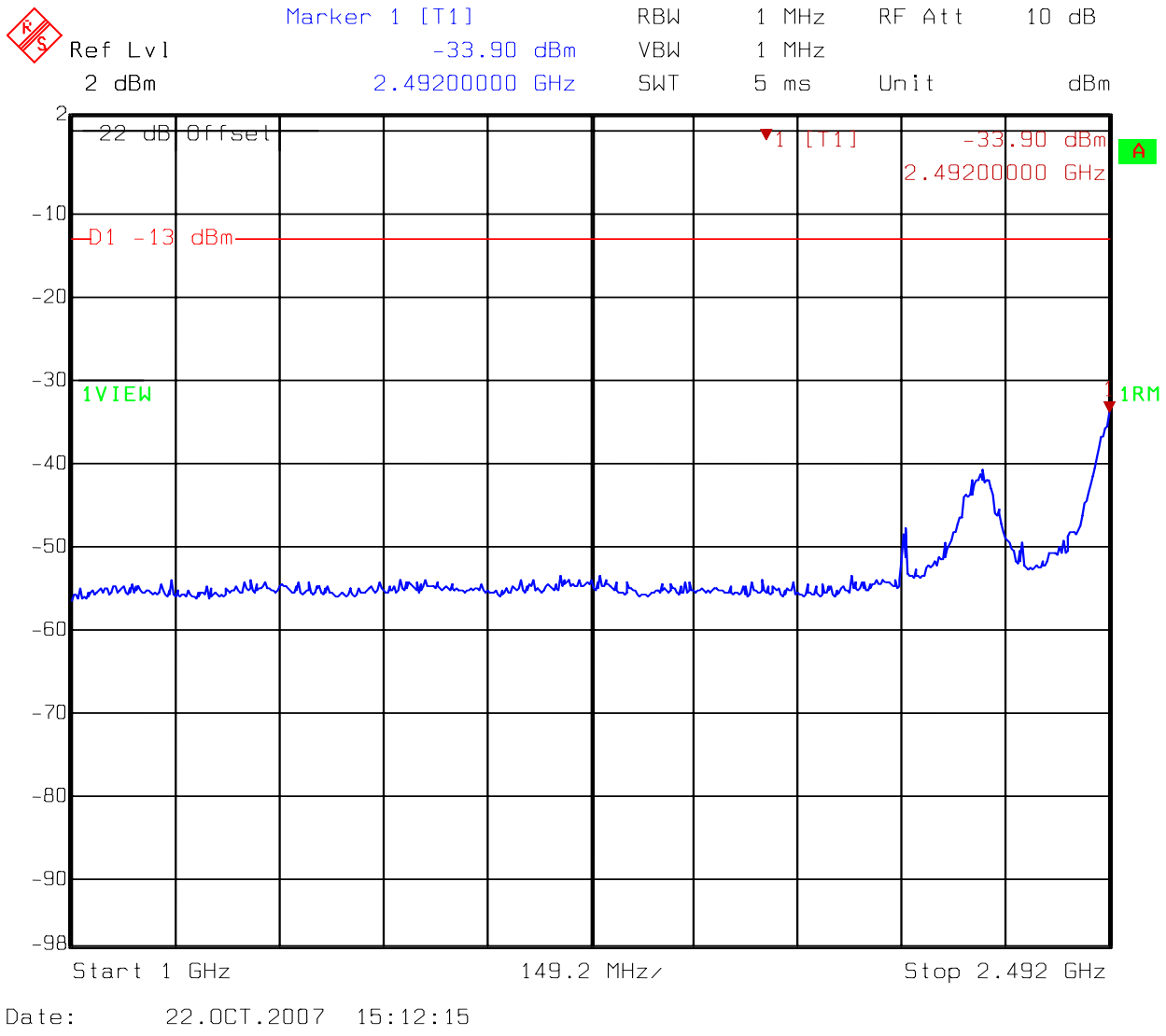
Antenna Type: Patch antenna

Figure 69. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 1 of 8



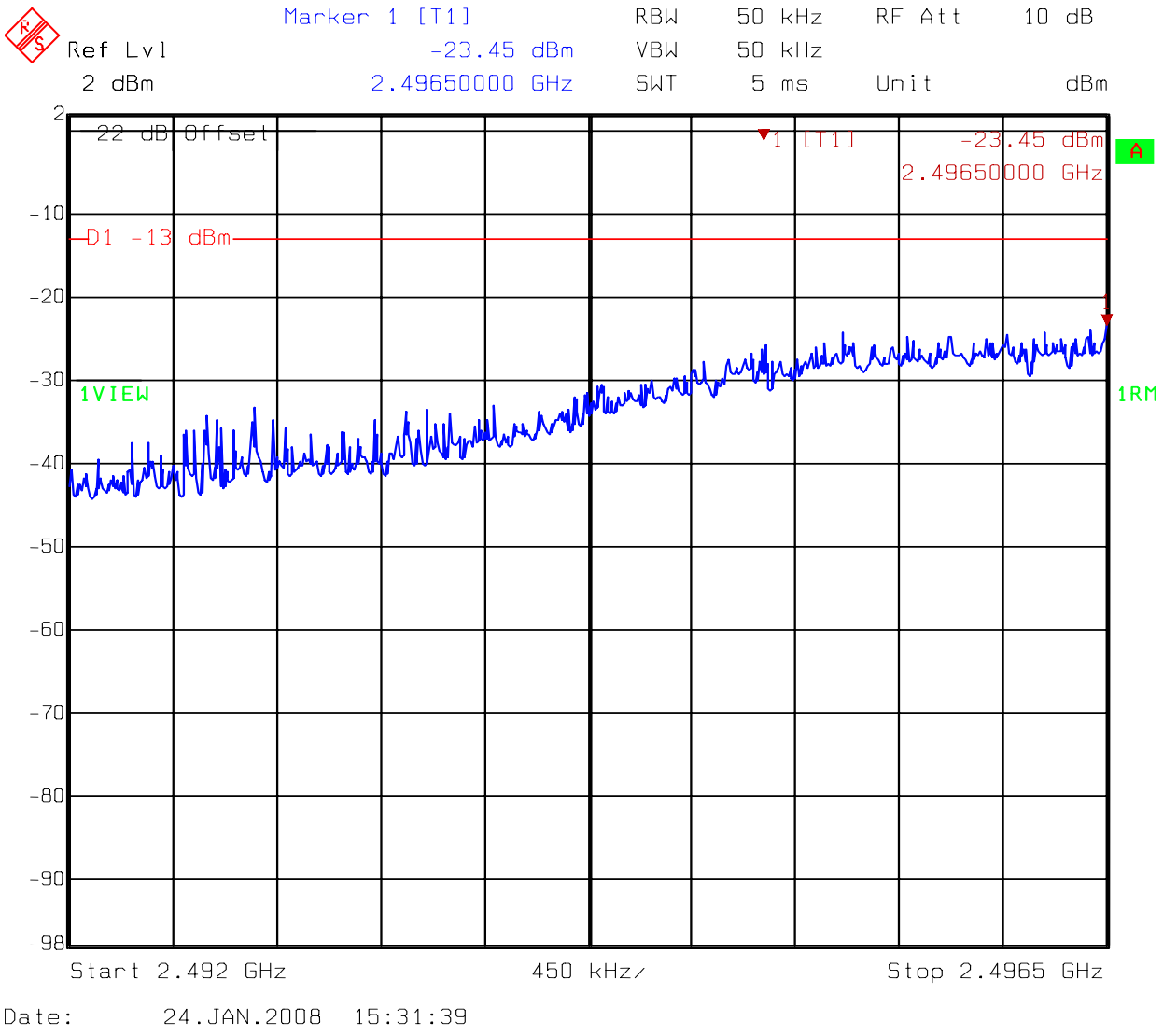
Antenna Type: Patch antenna

Figure 70. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 2 of 8



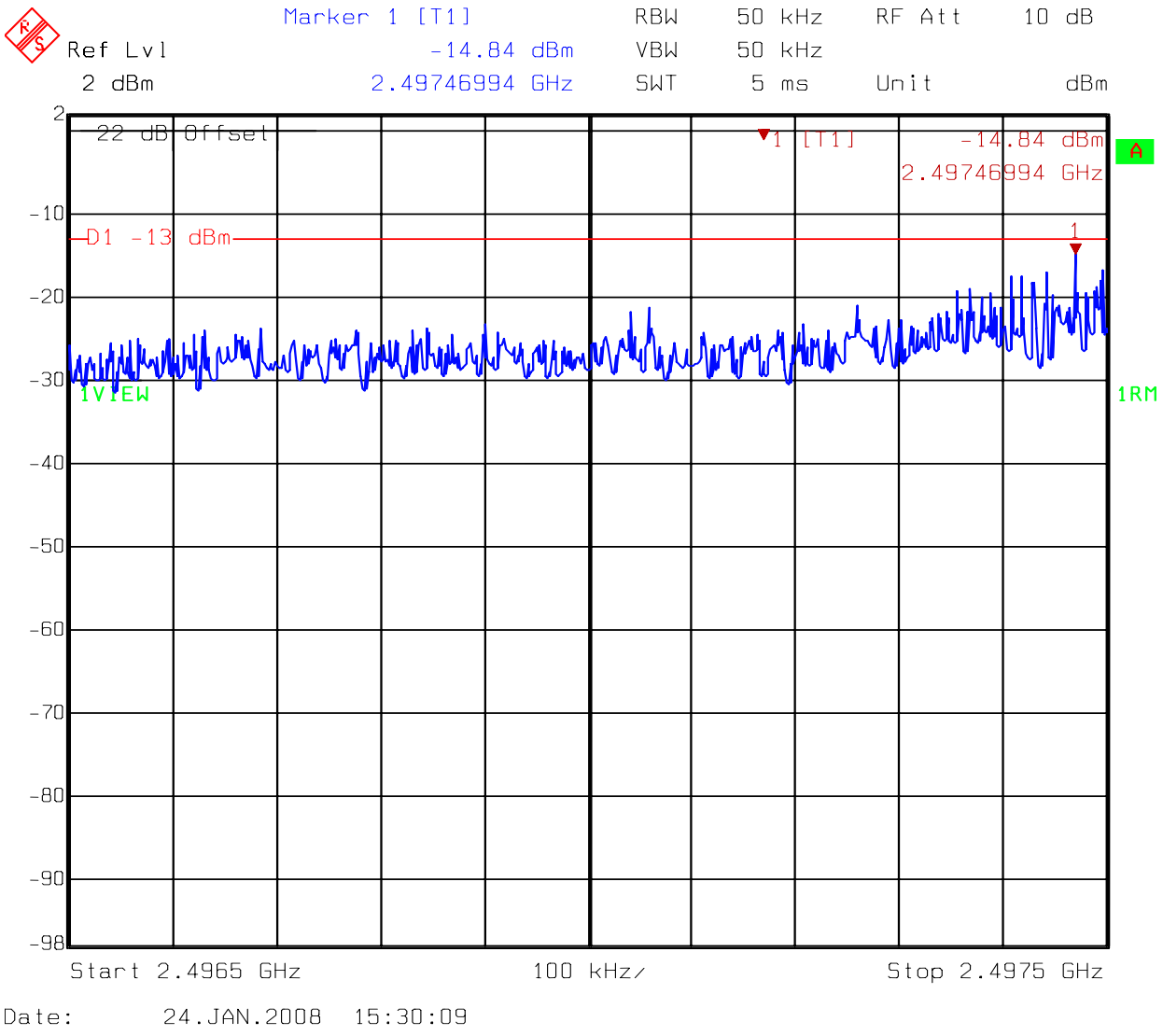
Antenna Type: Patch antenna

Figure 71. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 3 of 8



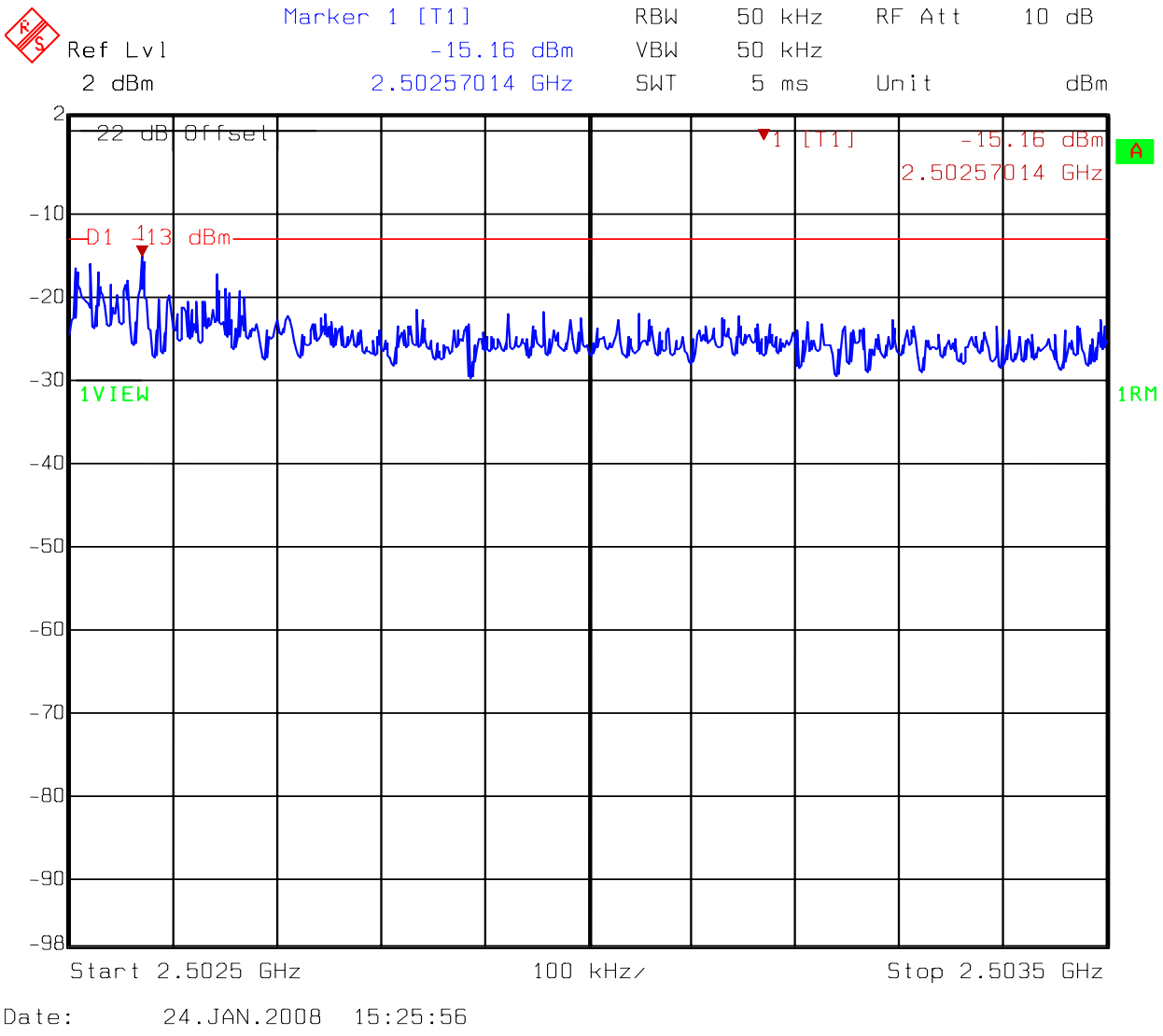
Antenna Type: Patch antenna

Figure 72. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 4 of 8



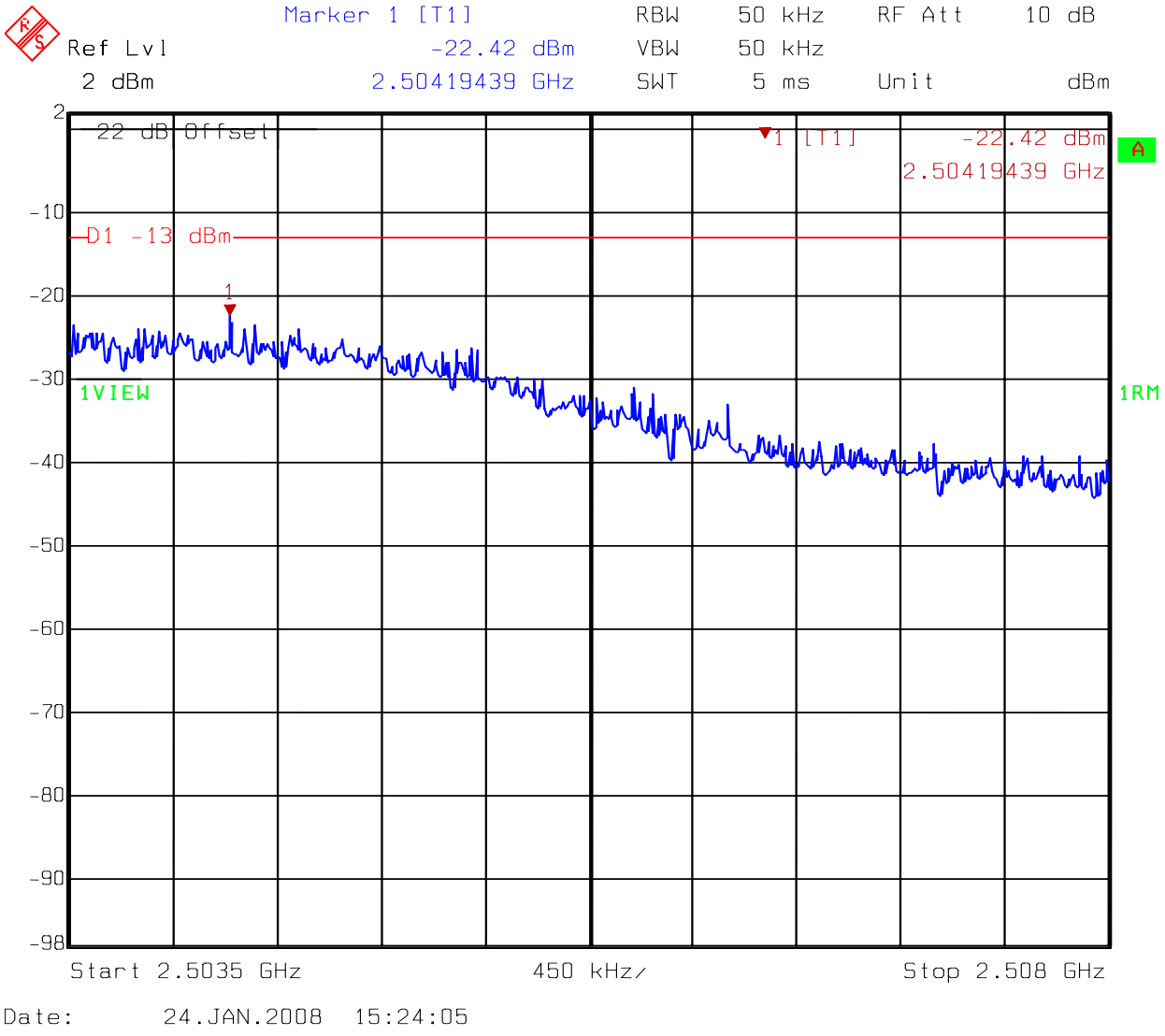
Antenna Type: Patch antenna

Figure 73. Spurious Emission at Antenna Terminals @ low channel (5MHz) – 5 of 8



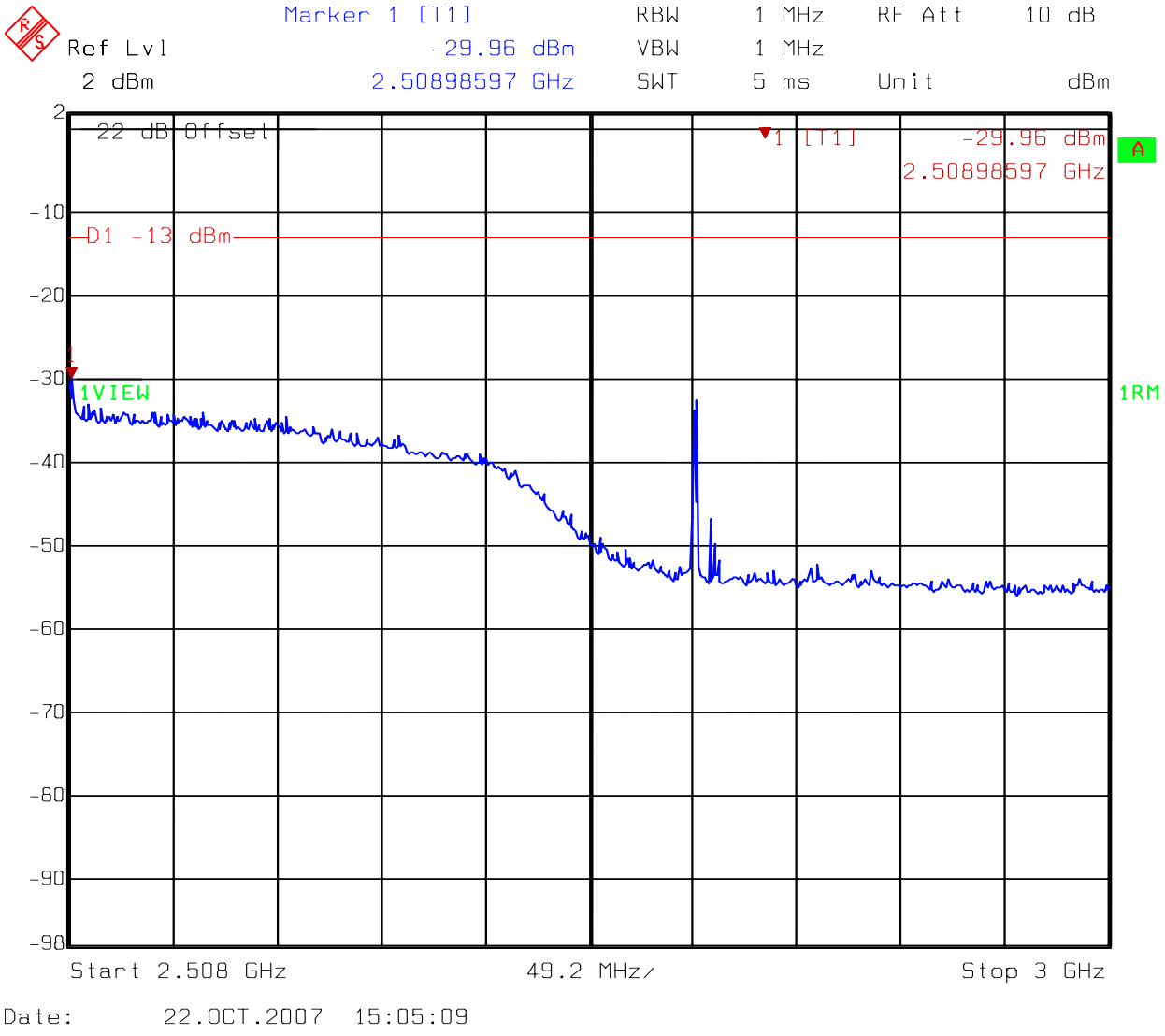
Antenna Type: Patch antenna

Figure 74. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 6 of 8



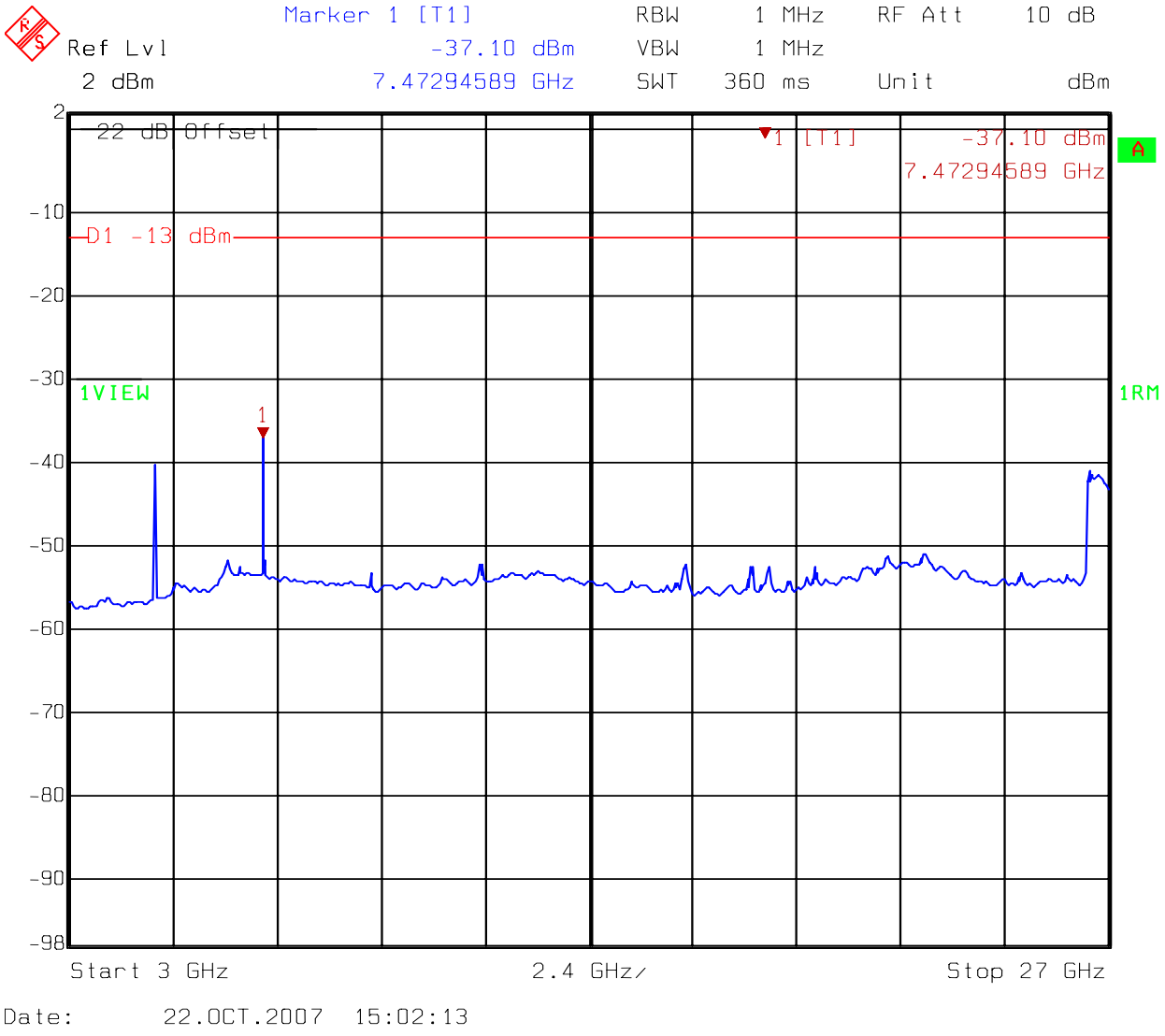
Antenna Type: Patch antenna

Figure 75. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 7 of 8



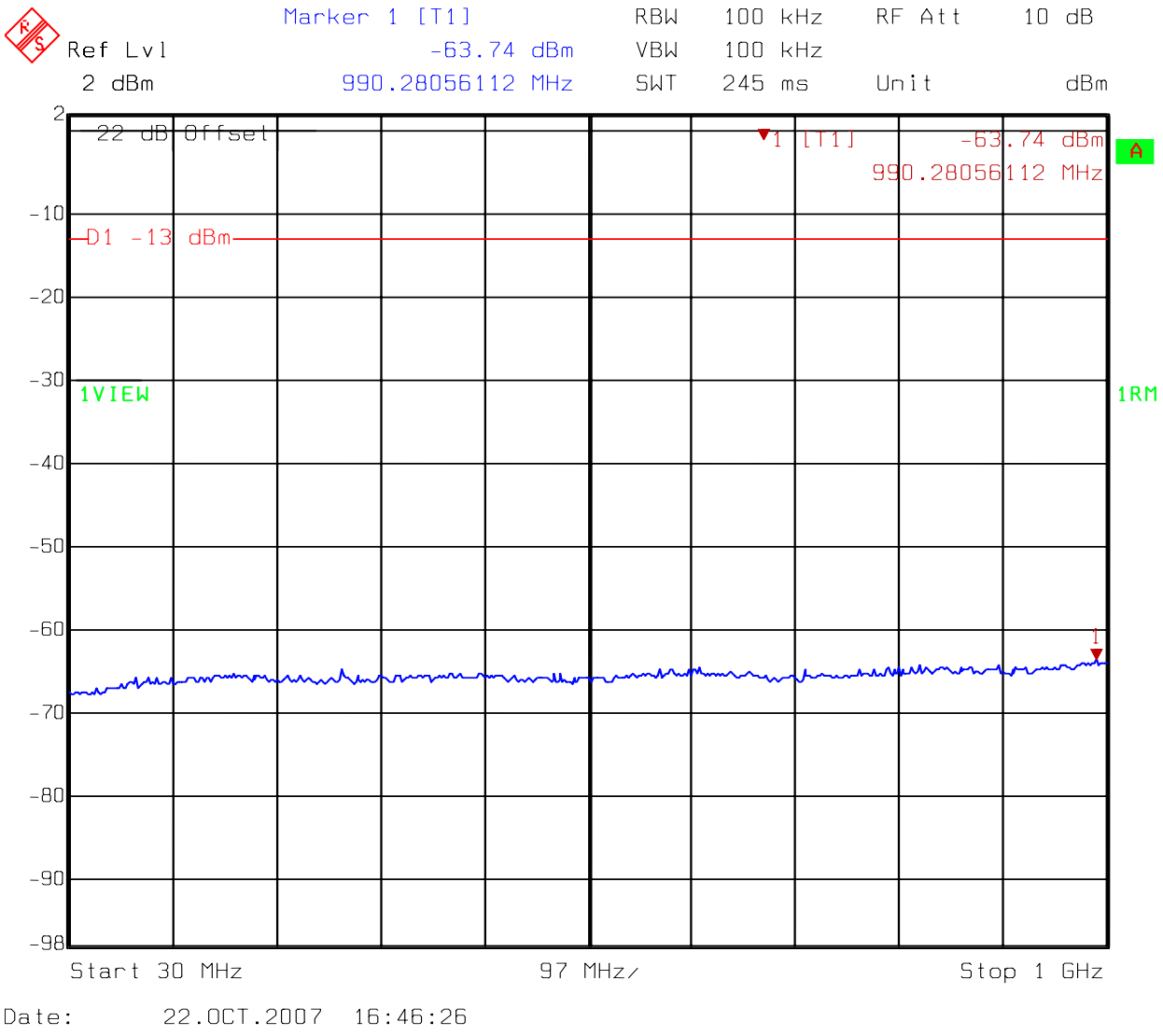
Antenna Type: Patch antenna

Figure 76. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 8 of 8



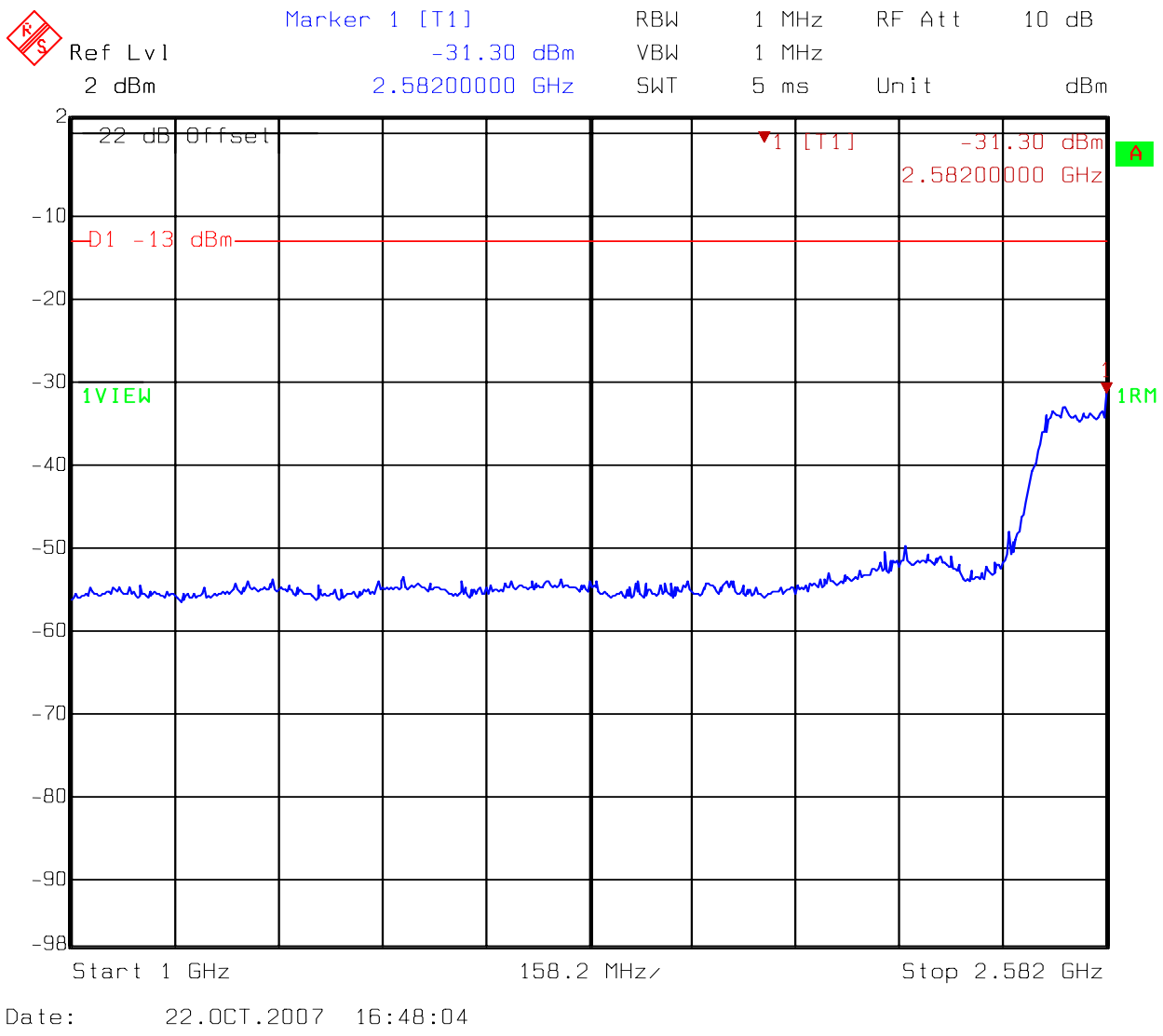
Antenna Type: Patch antenna

Figure 77. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 1 of 8



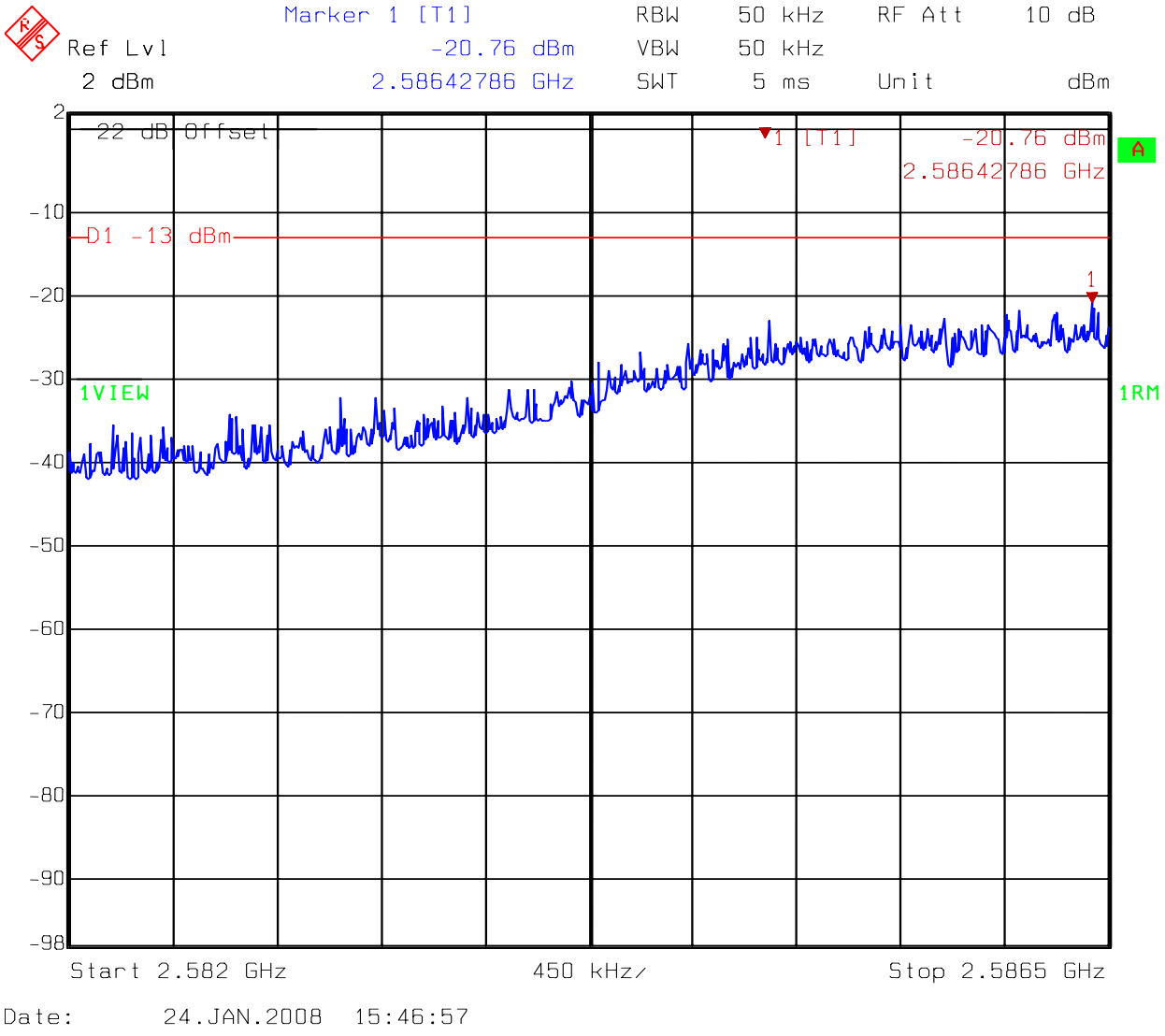
Antenna Type: Patch antenna

Figure 78. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 2 of 8



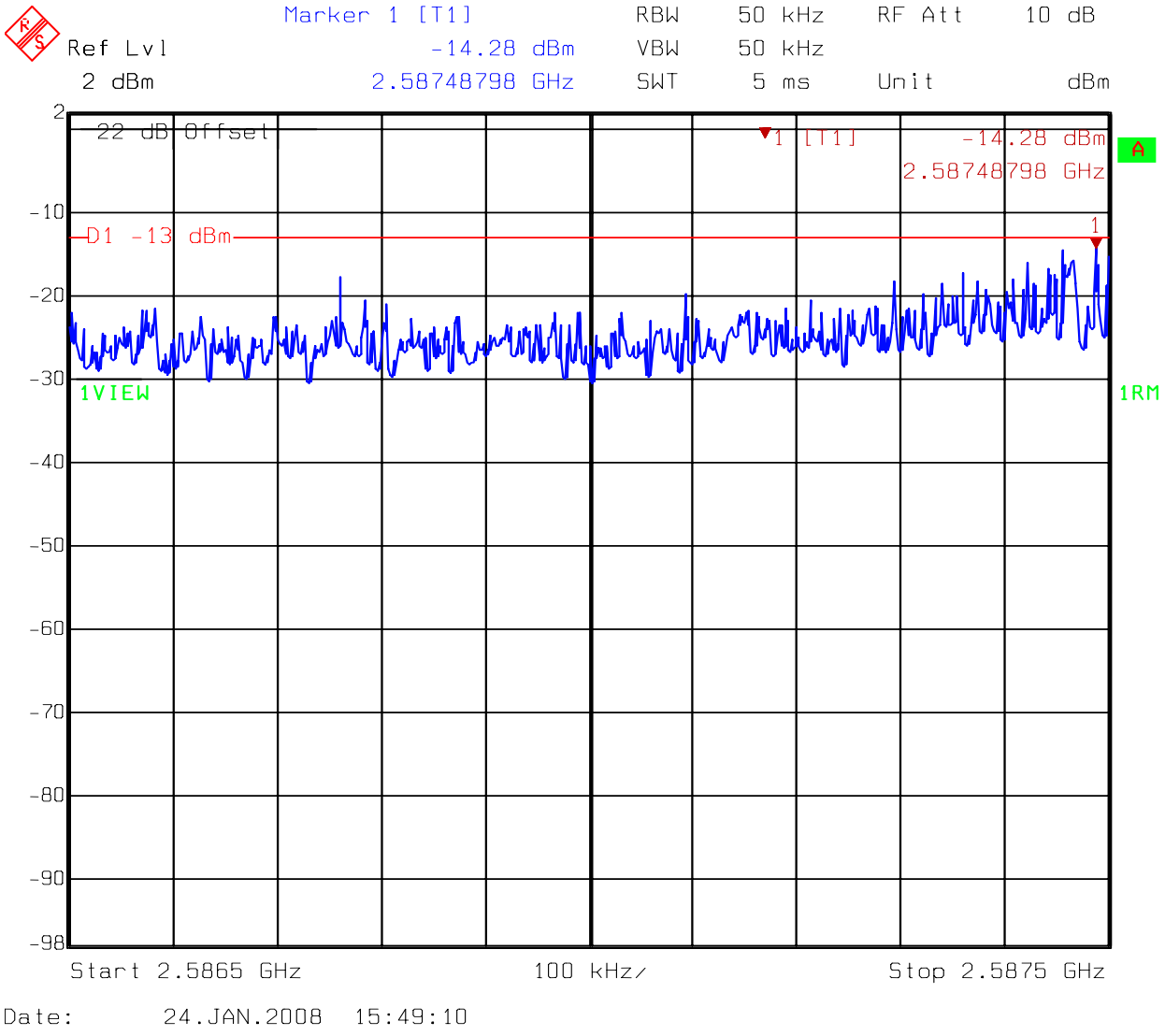
Antenna Type: Patch antenna

Figure 79. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 3 of 8



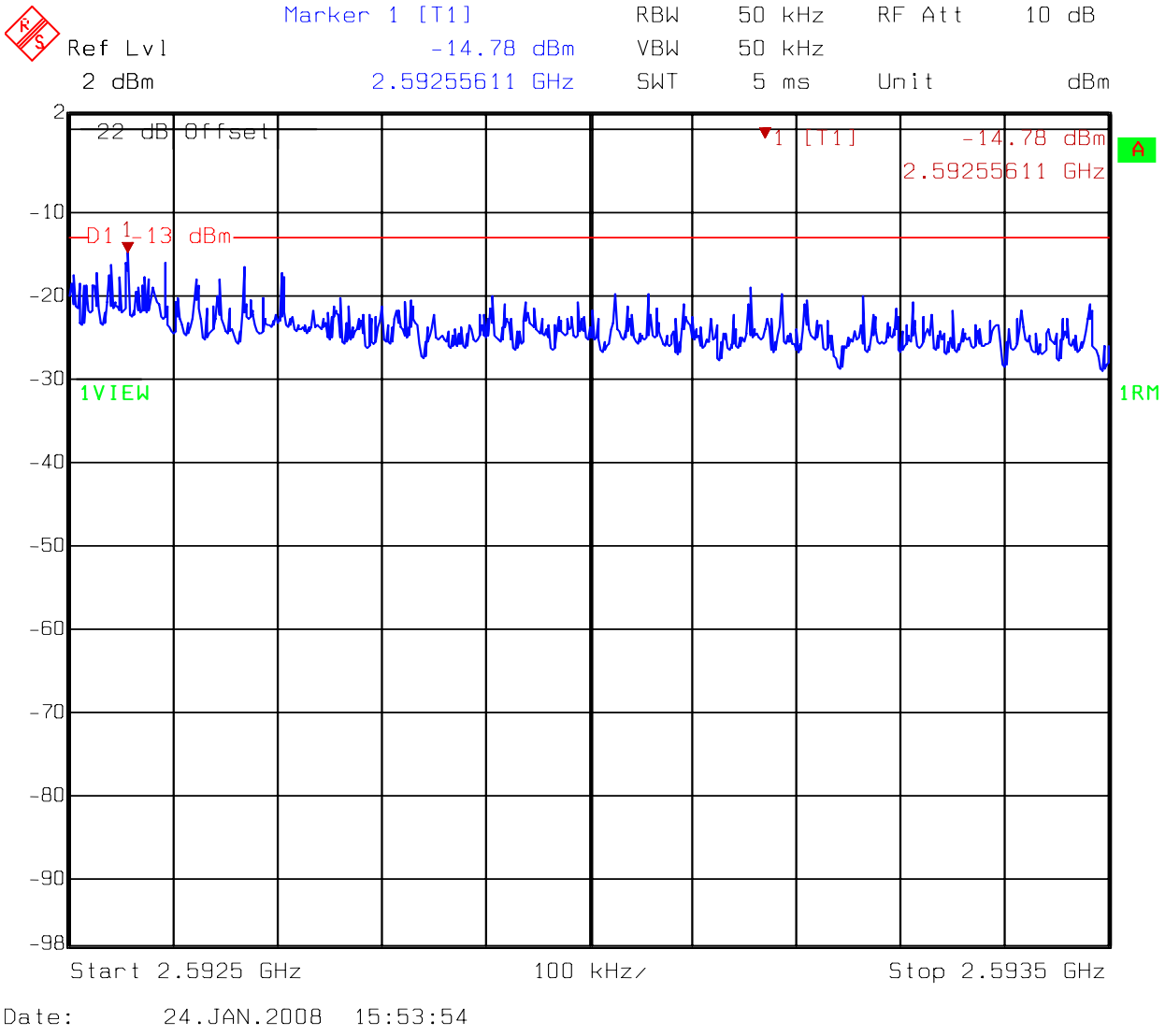
Antenna Type: Patch antenna

Figure 80. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 4 of 8



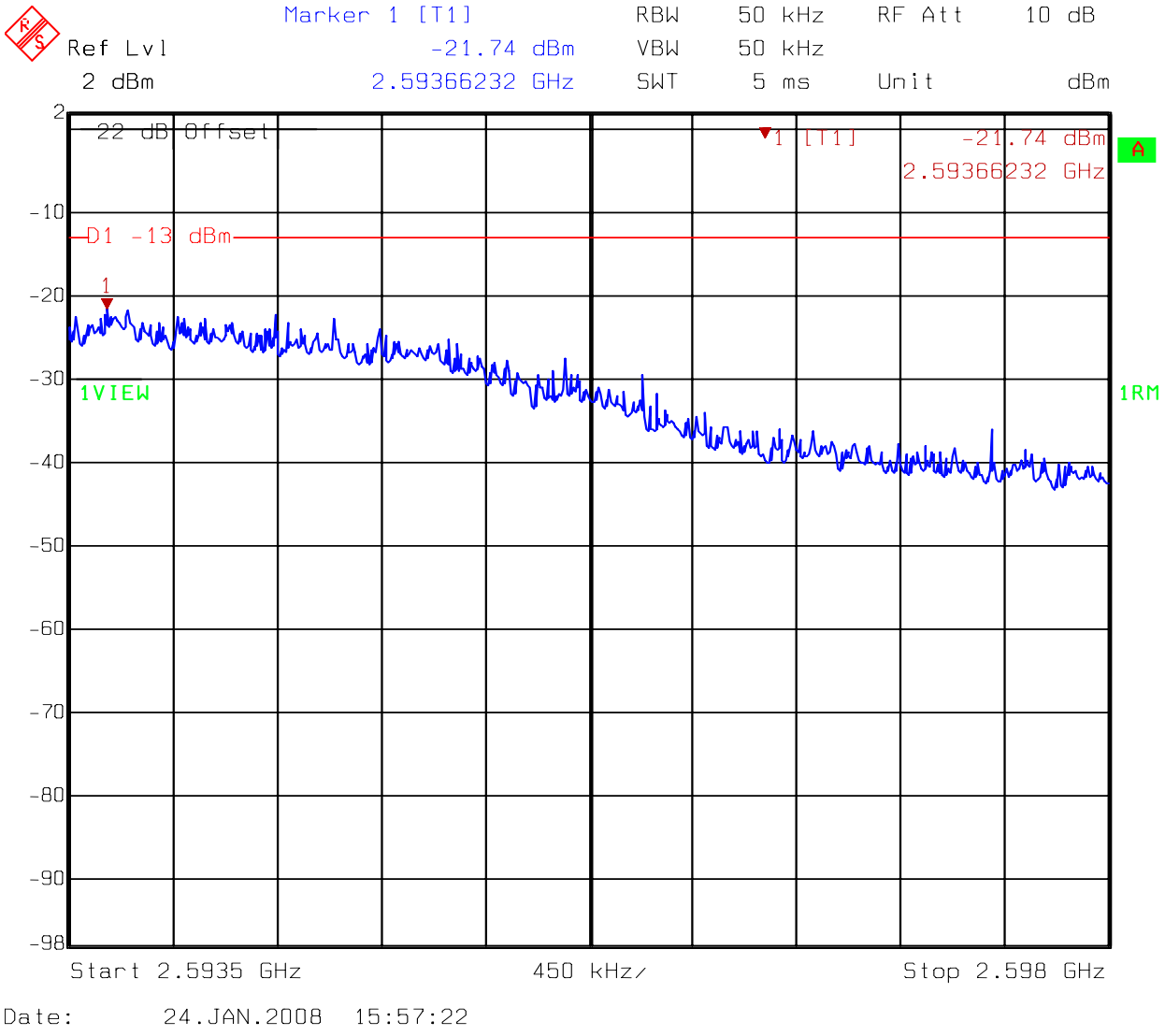
Antenna Type: Patch antenna

Figure 81. Spurious Emission at Antenna Terminals @ middle channel (5MHz) – 5 of 8



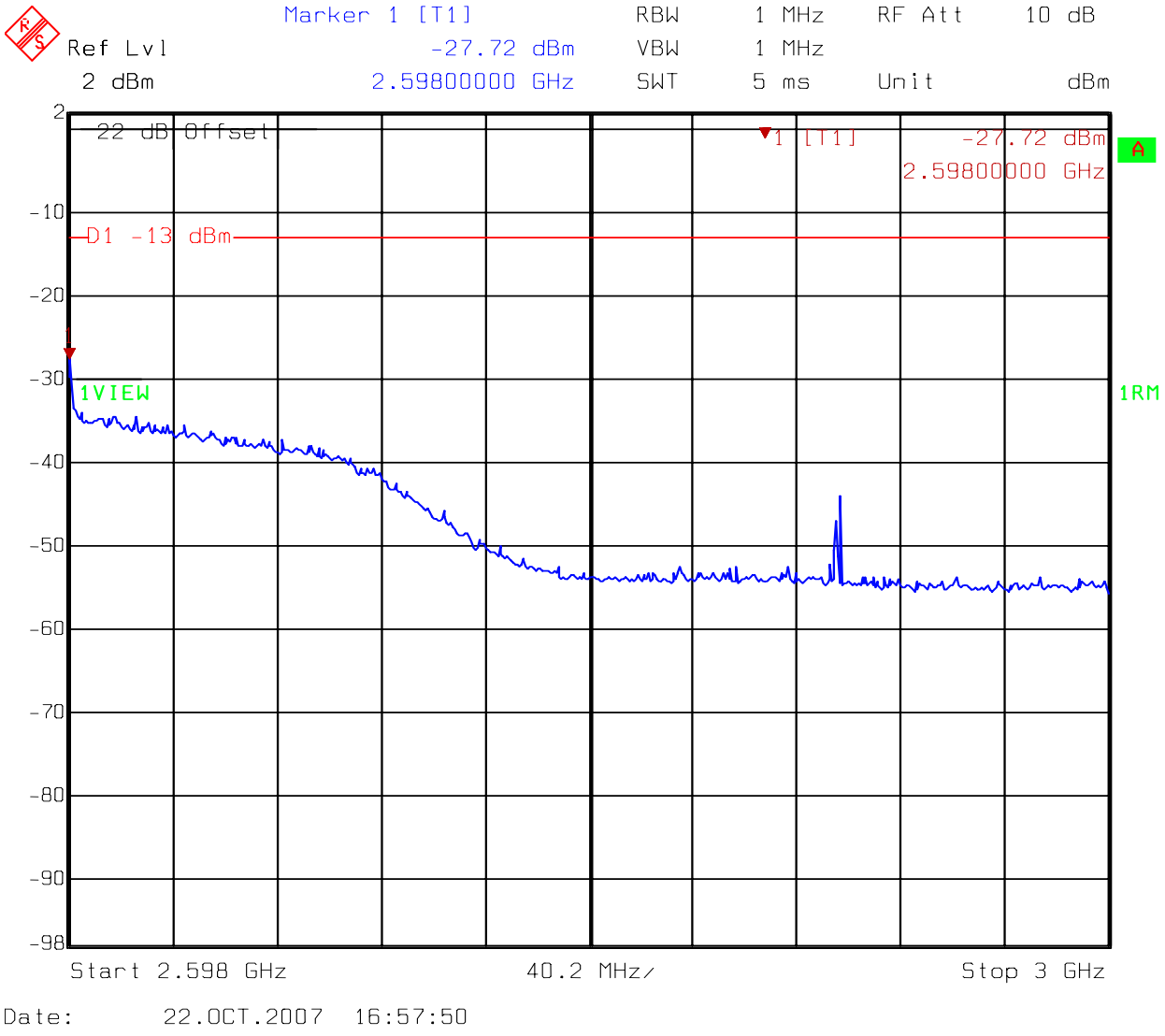
Antenna Type: Patch antenna

Figure 82. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 6 of 8



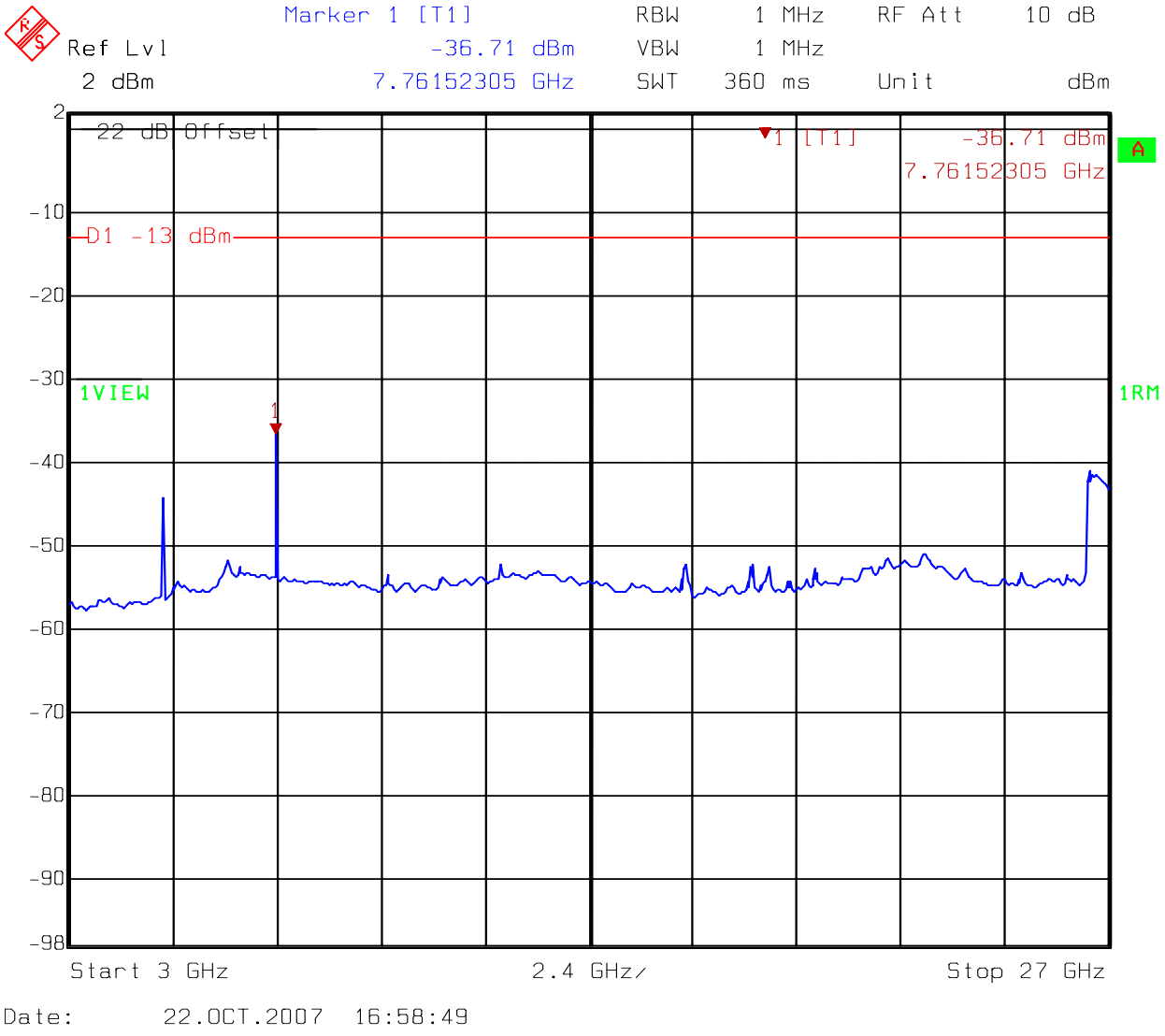
Antenna Type: Patch antenna

Figure 83. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 7 of 8



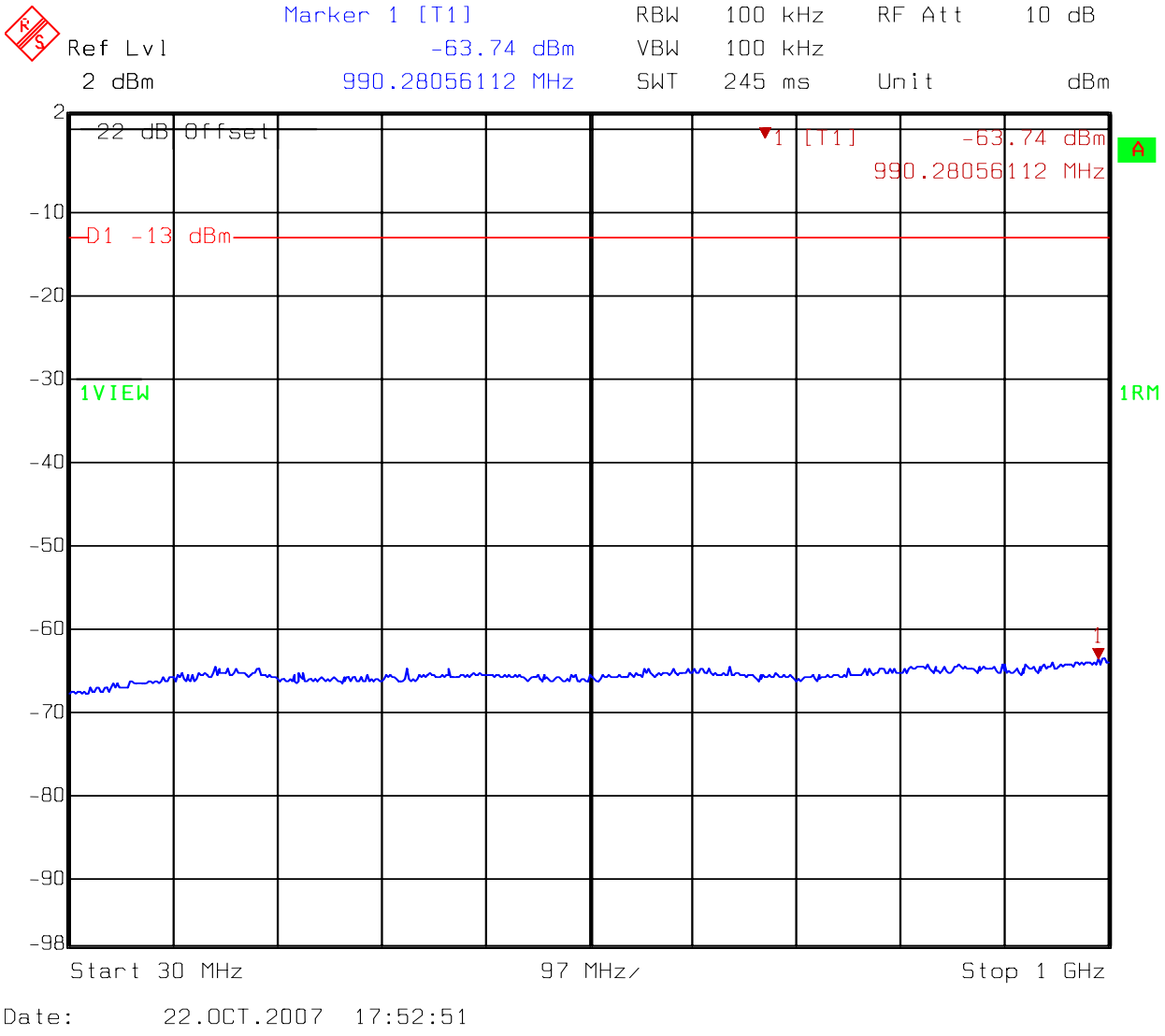
Antenna Type: Patch antenna

Figure 84. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 8 of 8



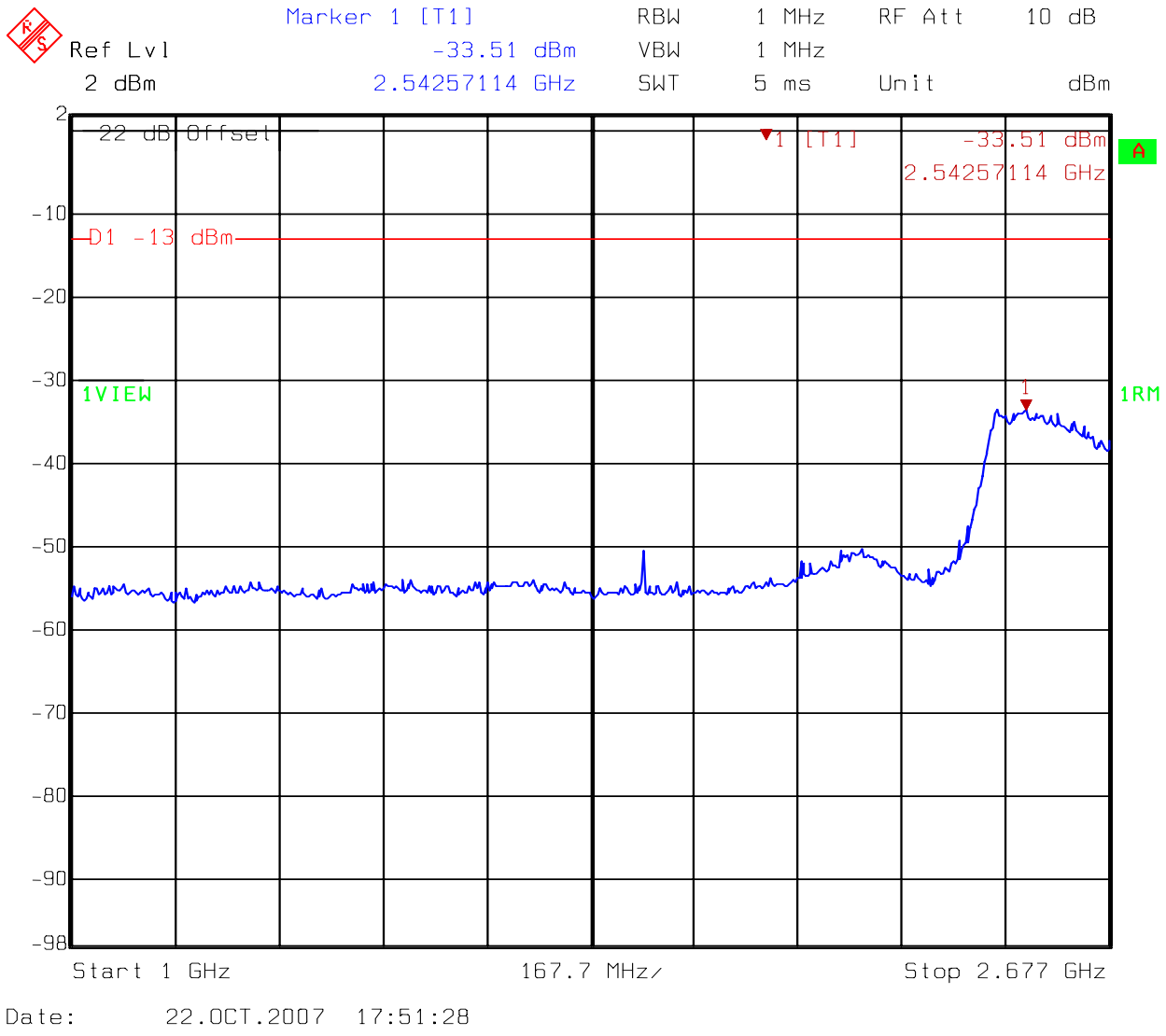
Antenna Type: Patch antenna

Figure 85. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 1 of 8



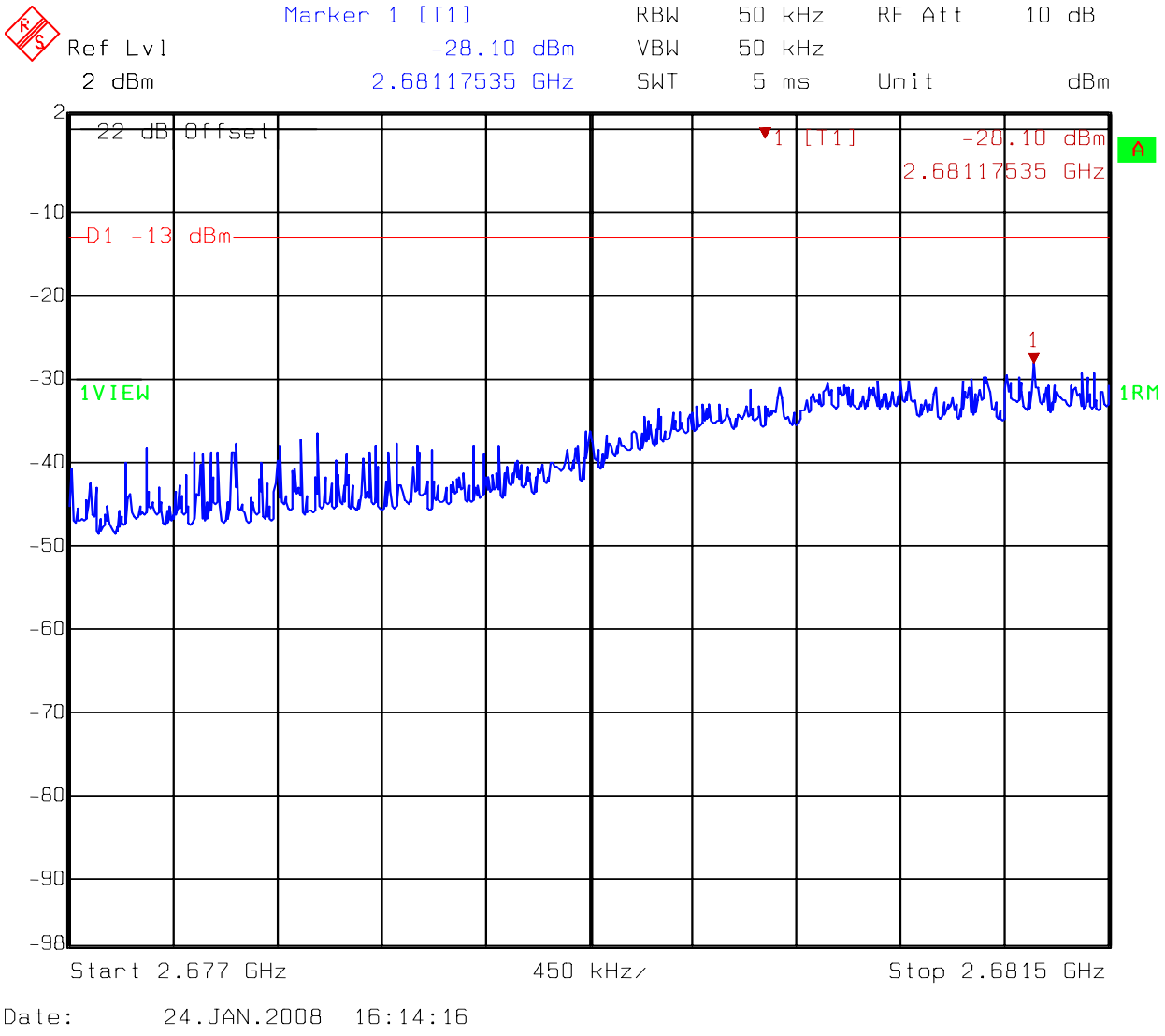
Antenna Type: Patch antenna

Figure 86. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 2 of 8



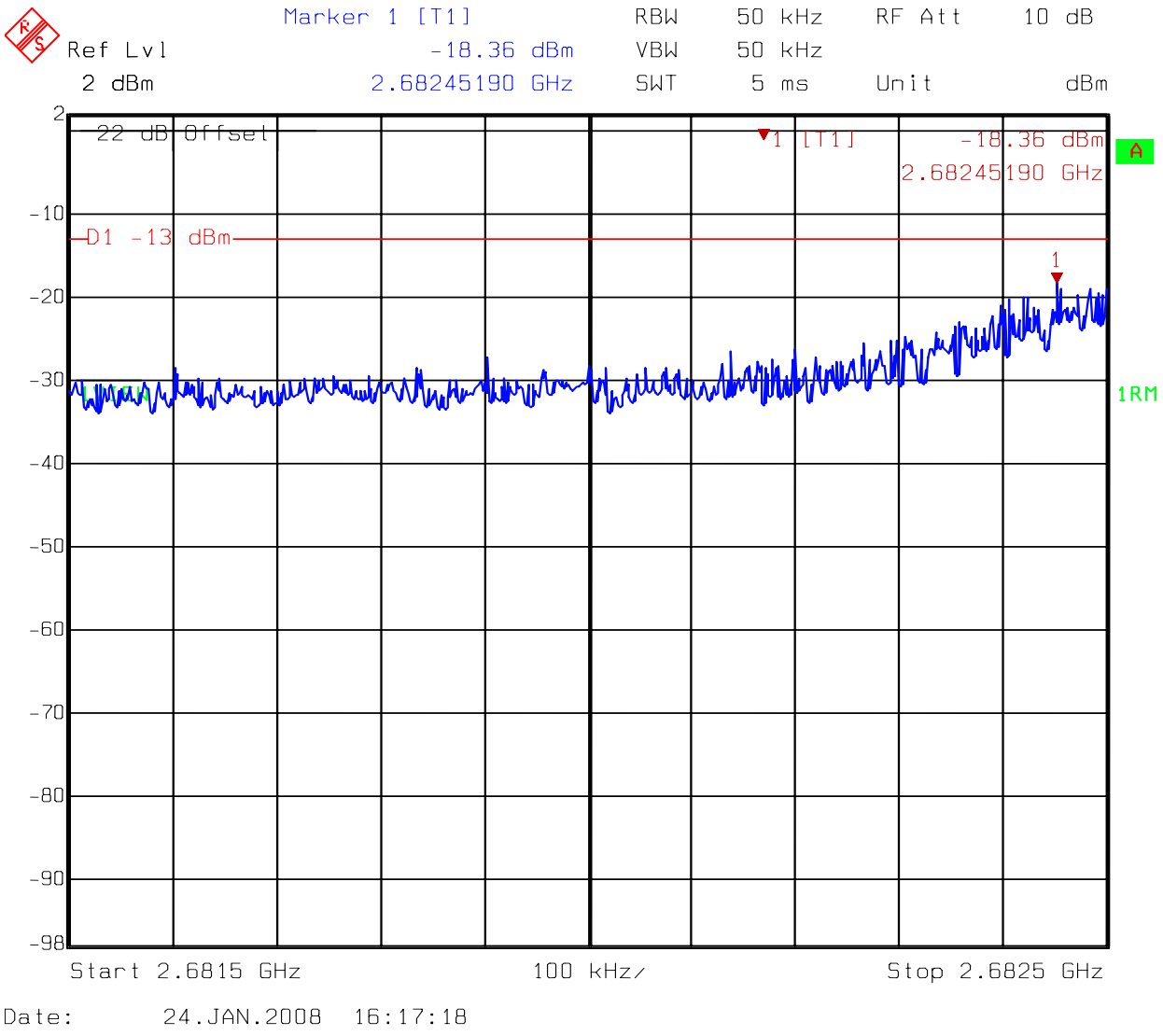
Antenna Type: Patch antenna

Figure 87. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 3 of 8



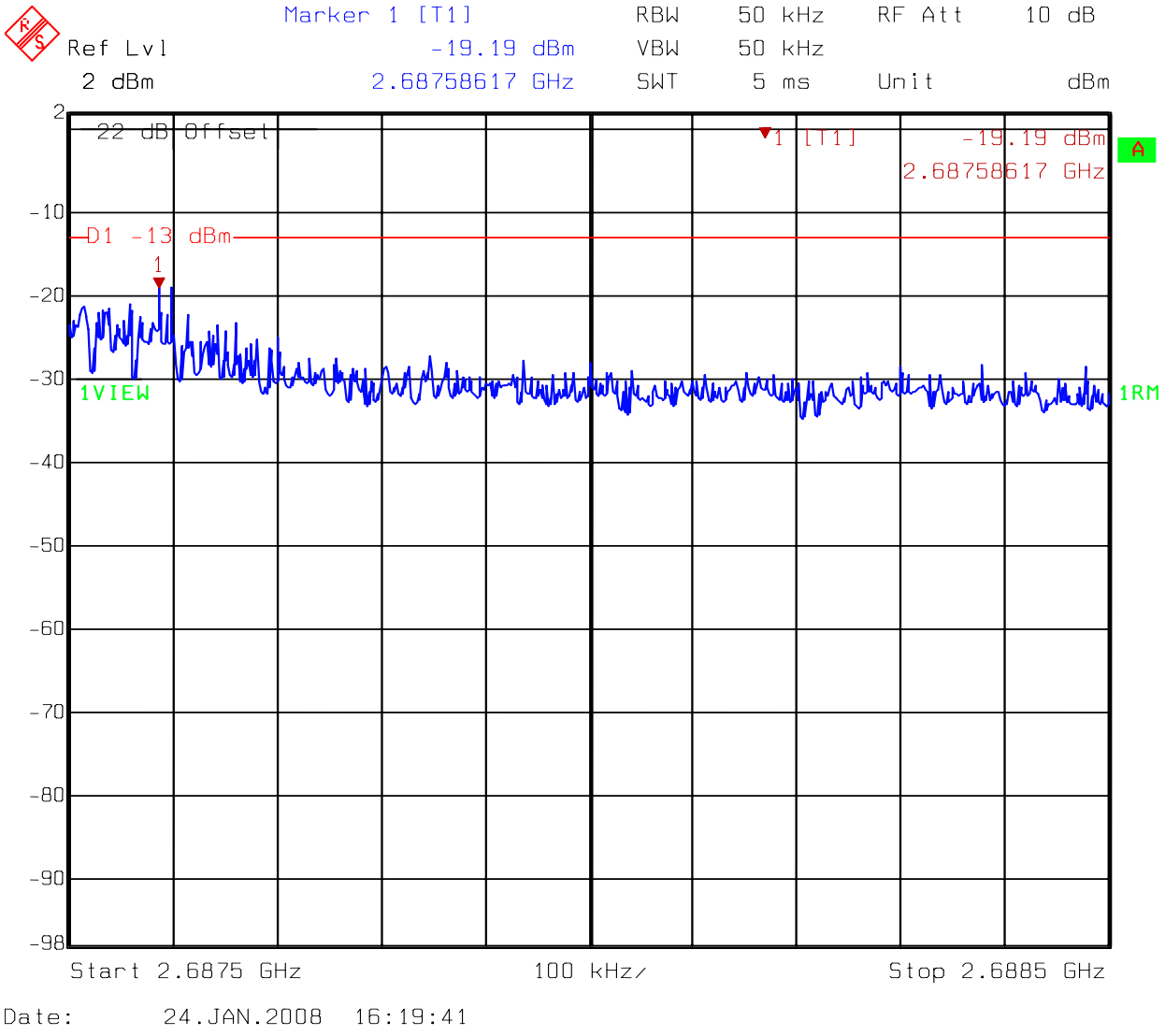
Antenna Type: Patch antenna

Figure 88. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 4 of 8



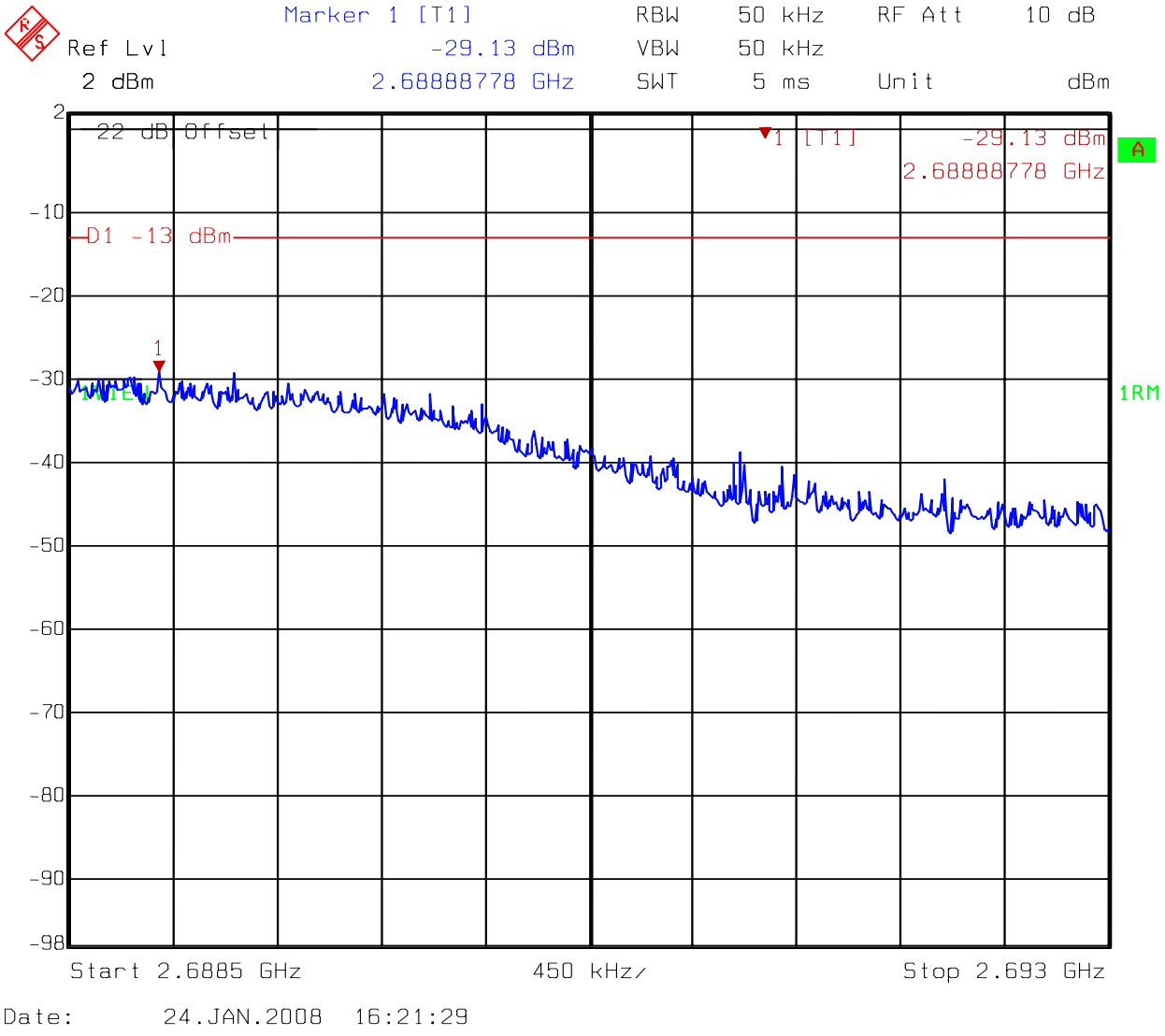
Antenna Type: Patch antenna

Figure 89. Spurious Emission at Antenna Terminals @ high channel (5MHz) – 5 of 8



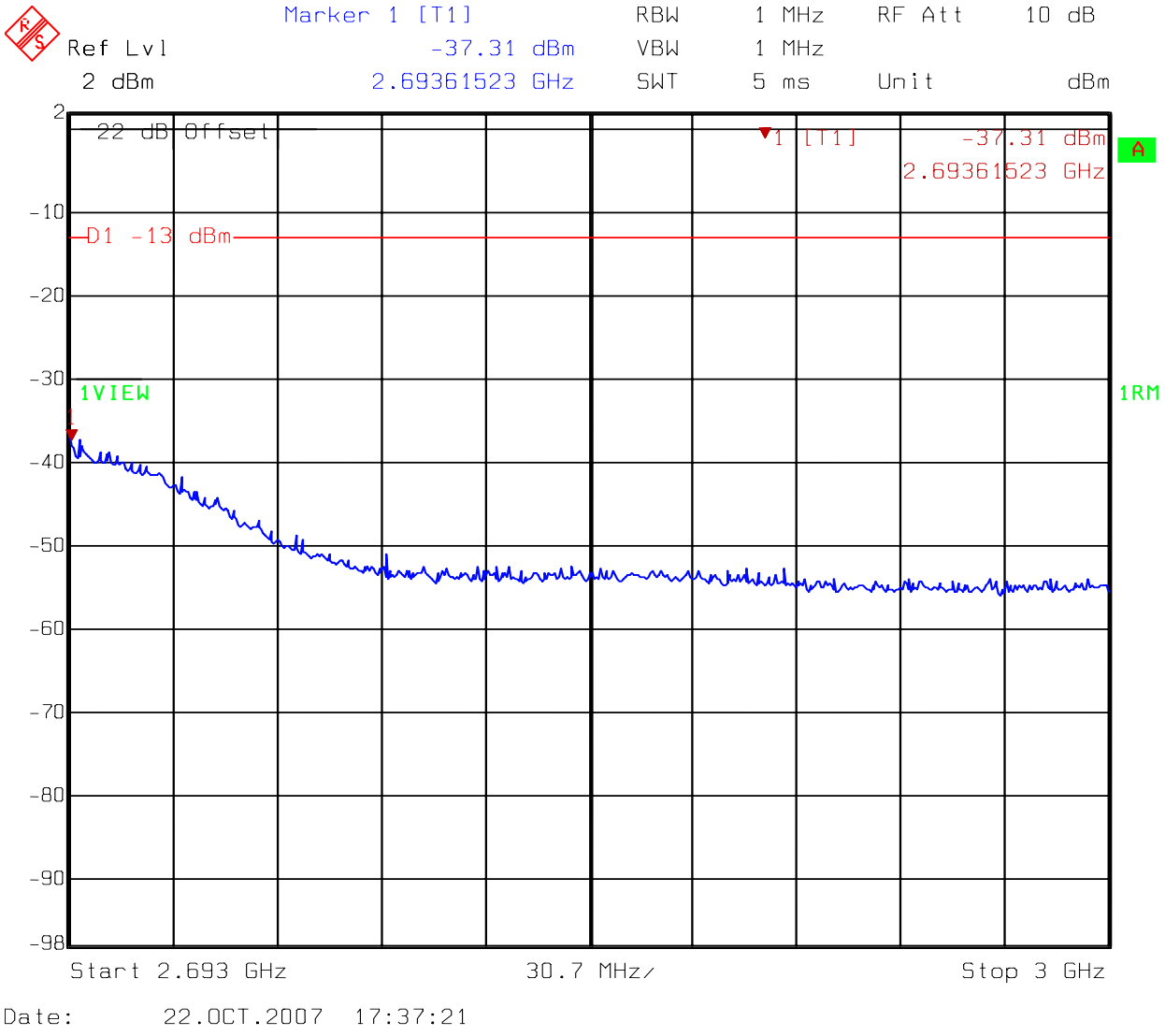
Antenna Type: Patch antenna

Figure 90. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 6 of 8



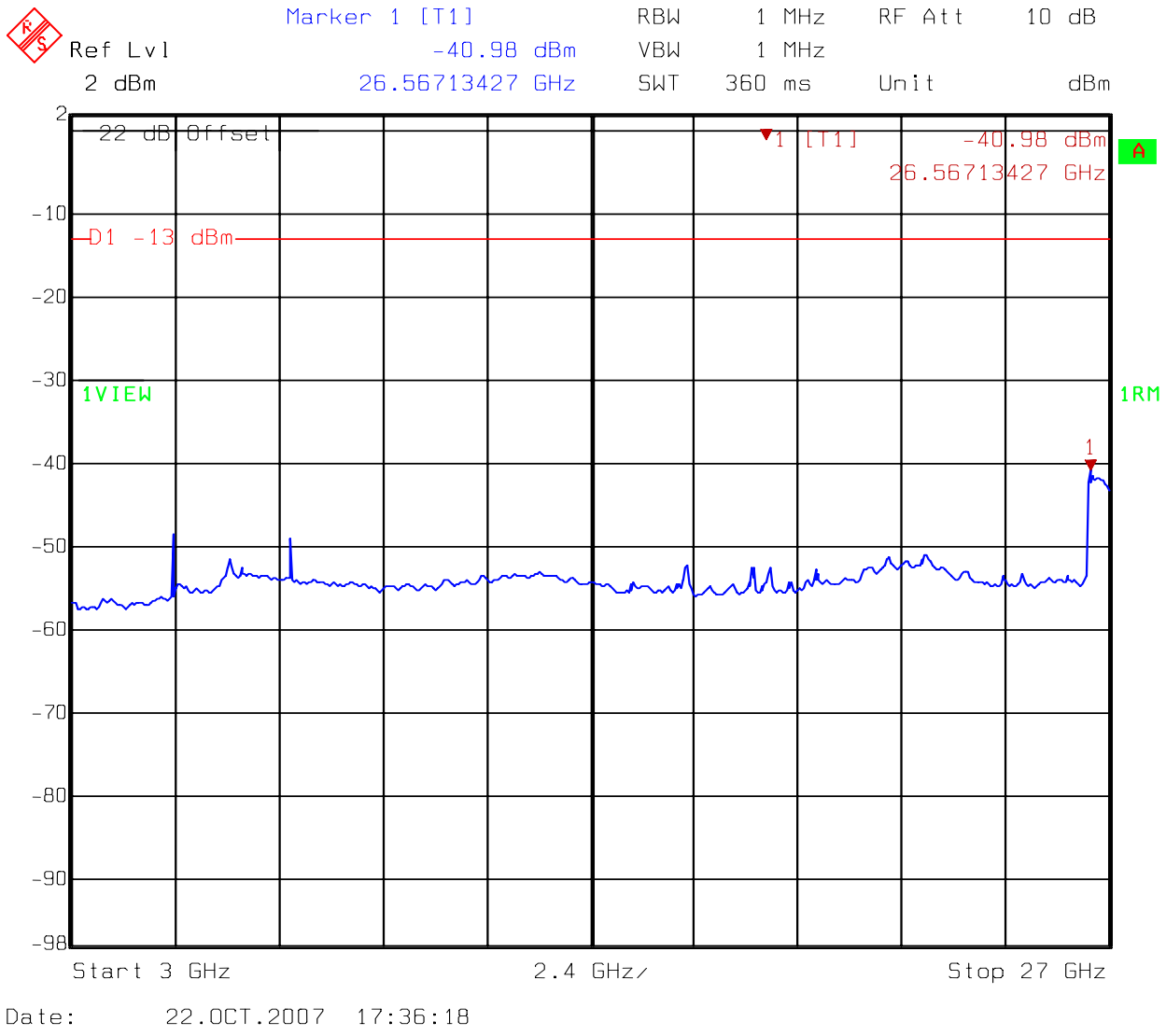
Antenna Type: Patch antenna

Figure 91. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 7 of 8



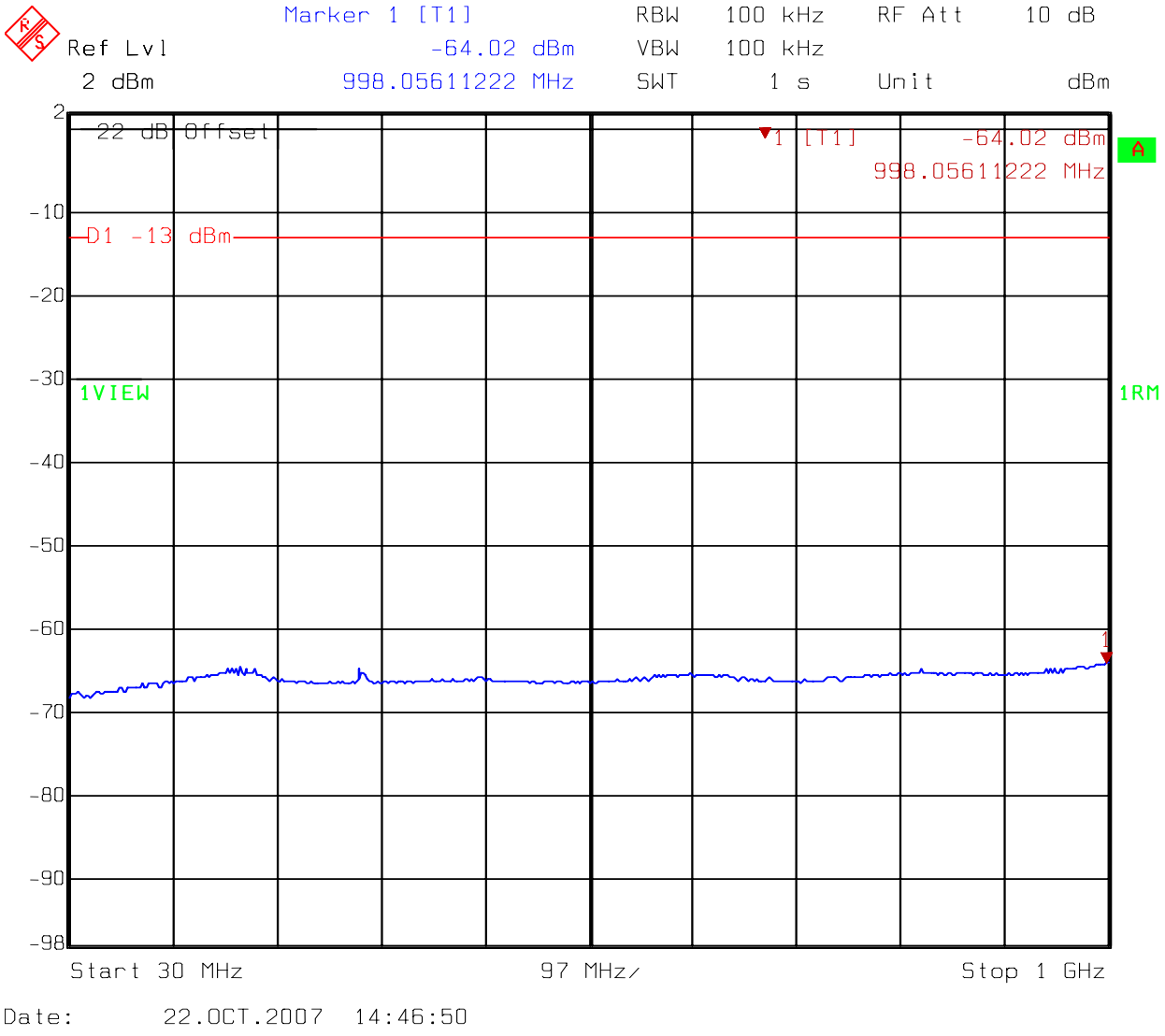
Antenna Type: Patch antenna

Figure 92. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 8 of 8



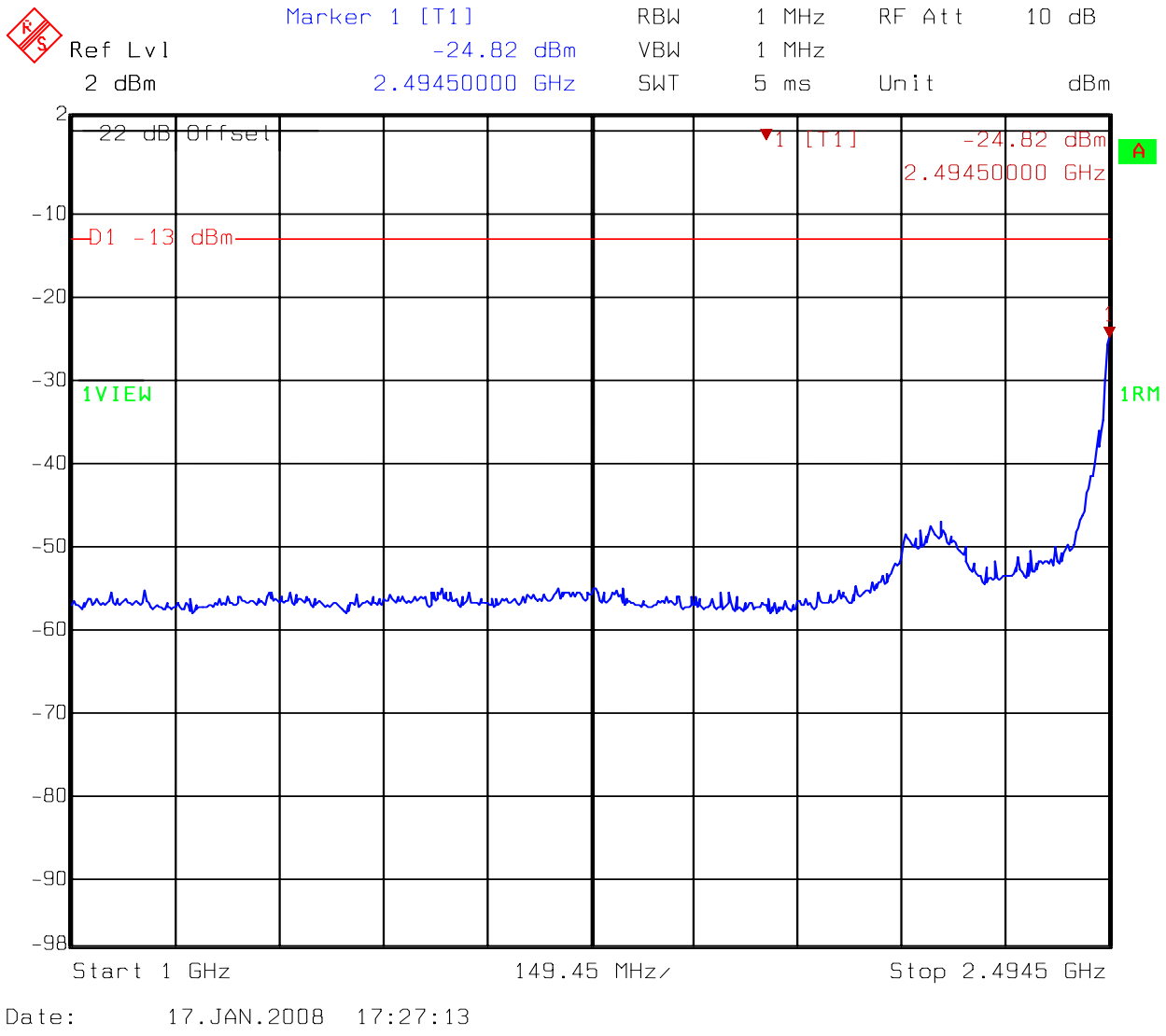
Antenna Type: Patch antenna

Figure 93. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 1 of 8



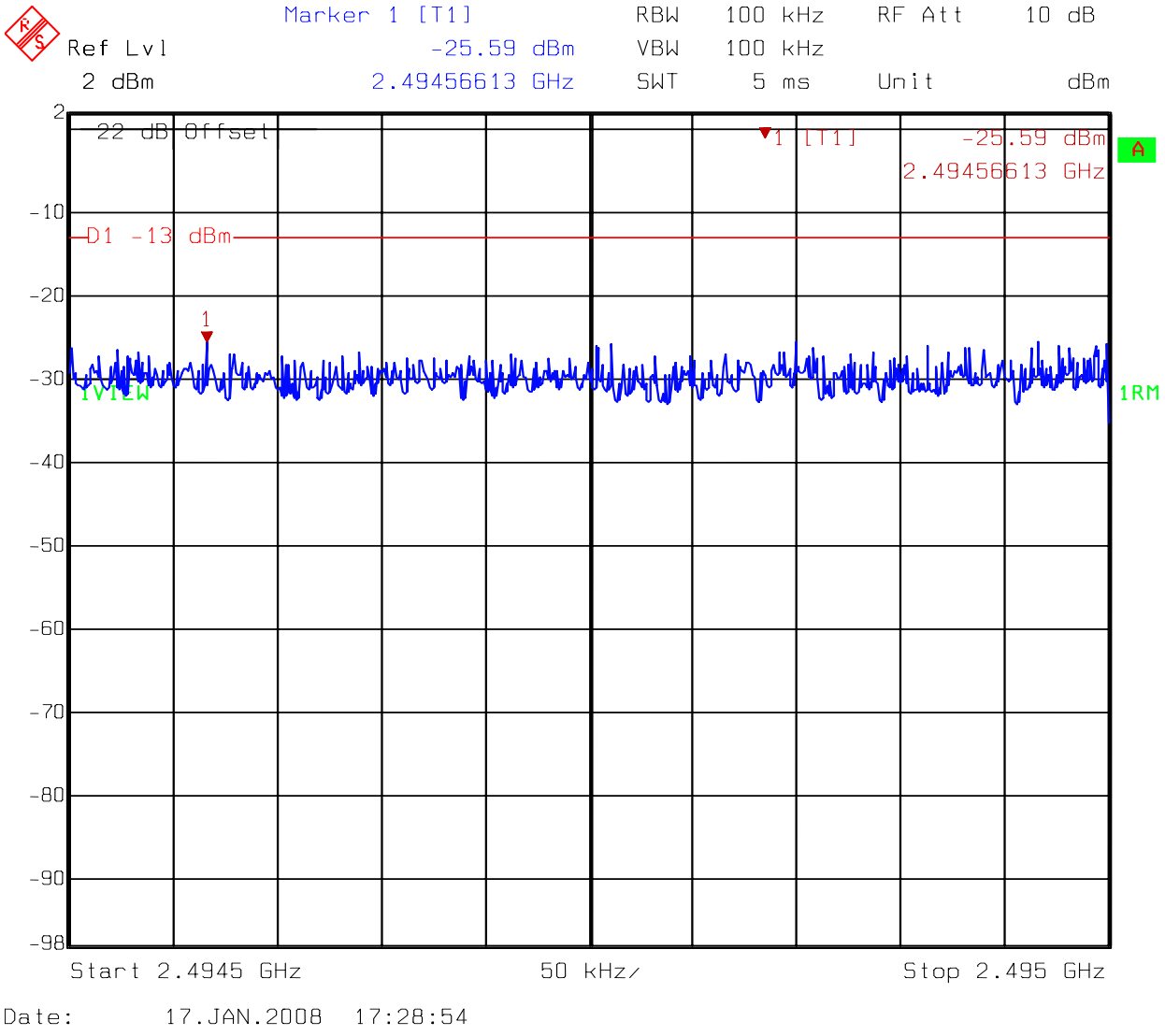
Antenna Type: Patch antenna

Figure 94. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 2 of 8



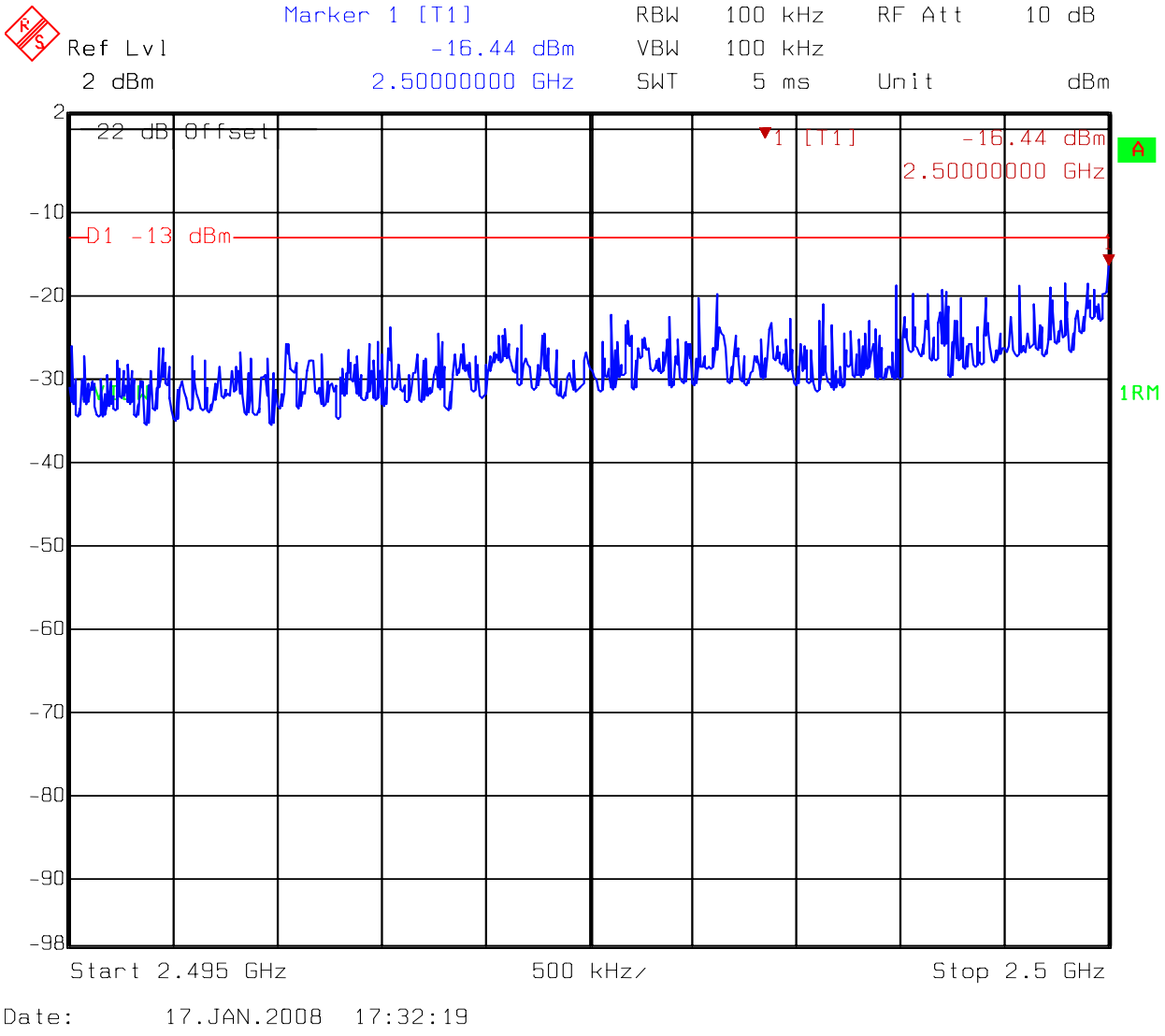
Antenna Type: Patch antenna

Figure 95. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 3 of 8



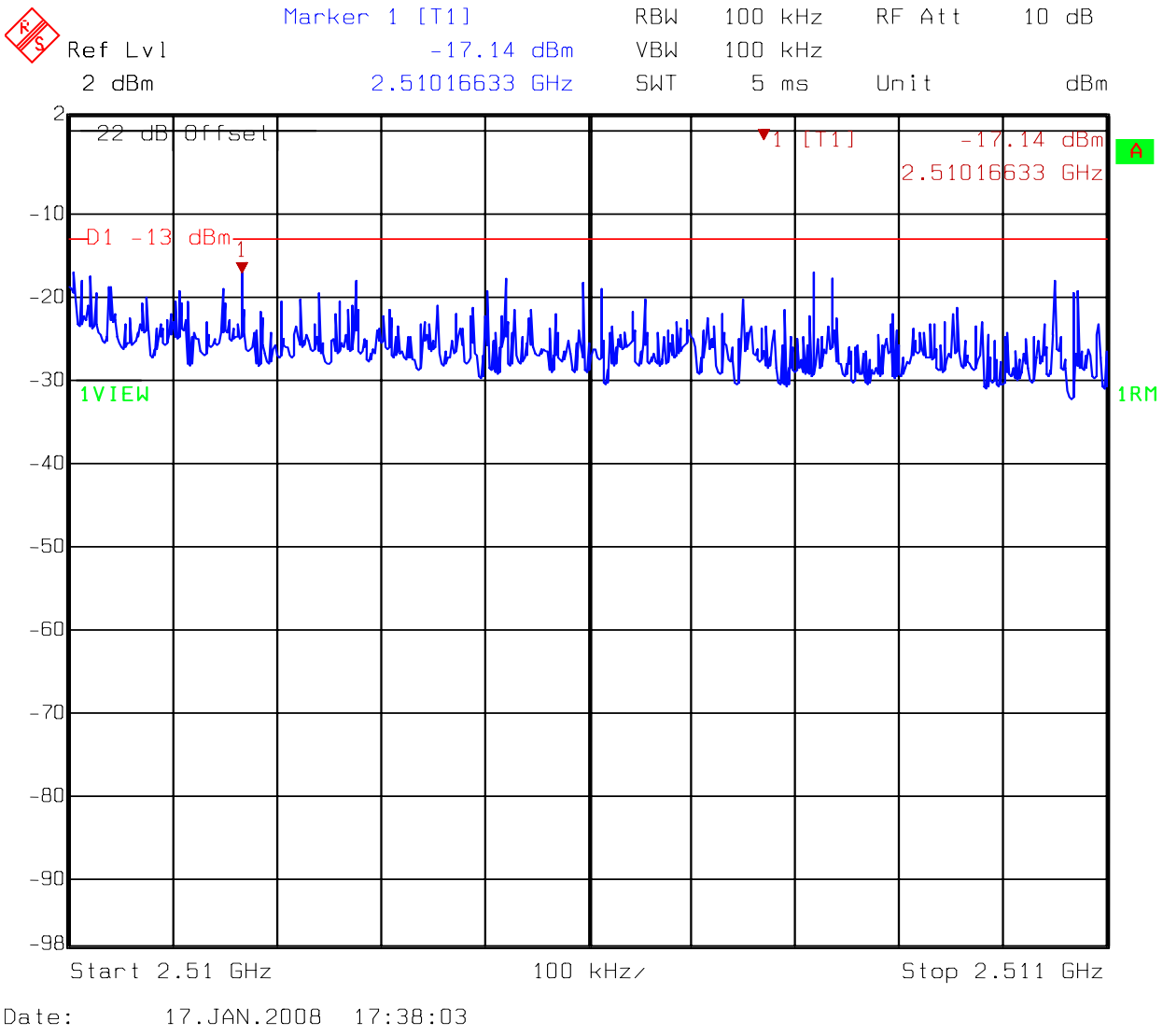
Antenna Type: Patch antenna

Figure 96. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 4 of 8



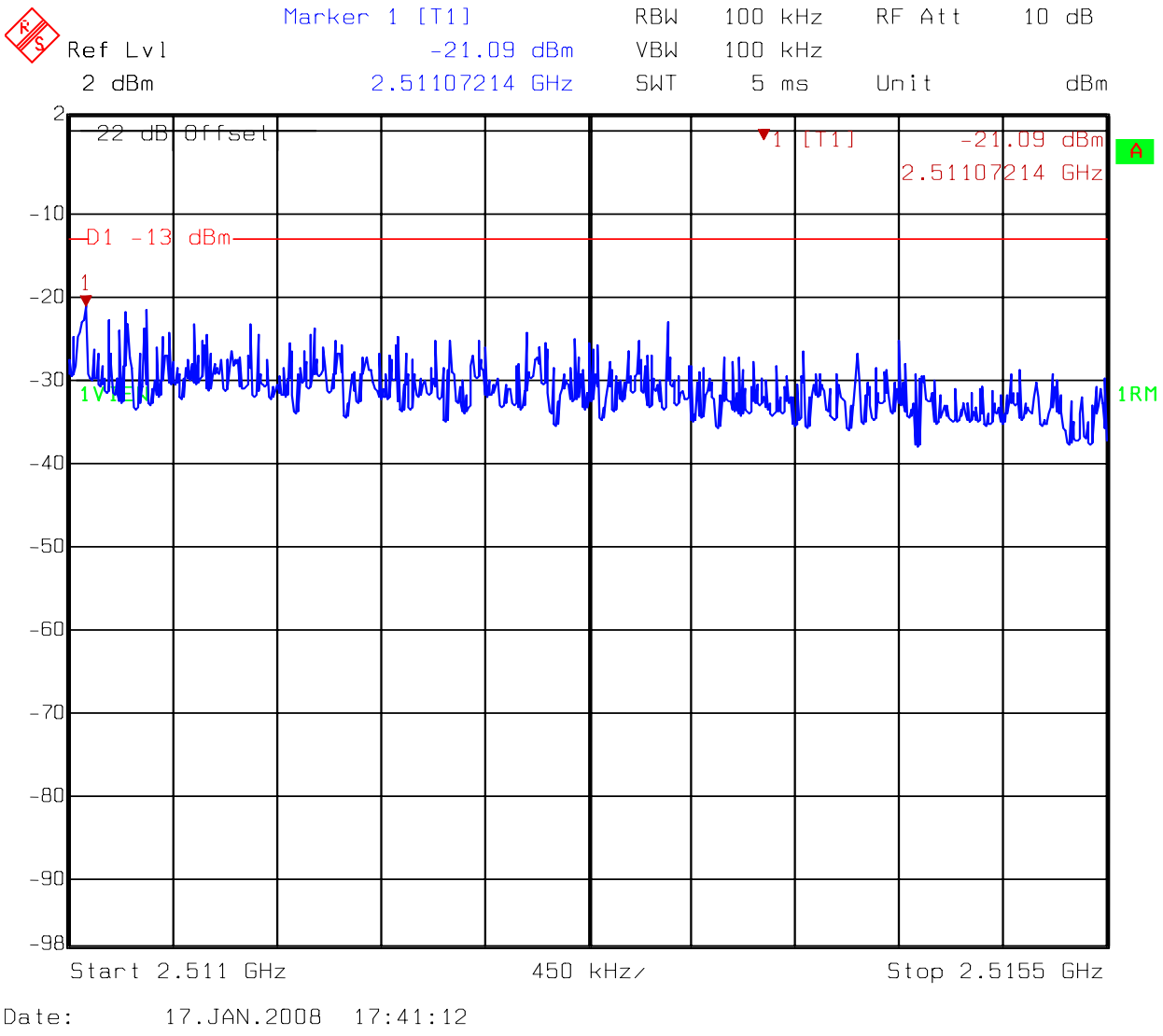
Antenna Type: Patch antenna

Figure 97. Spurious Emission at Antenna Terminals @ low channel (10MHz) – 5 of 8



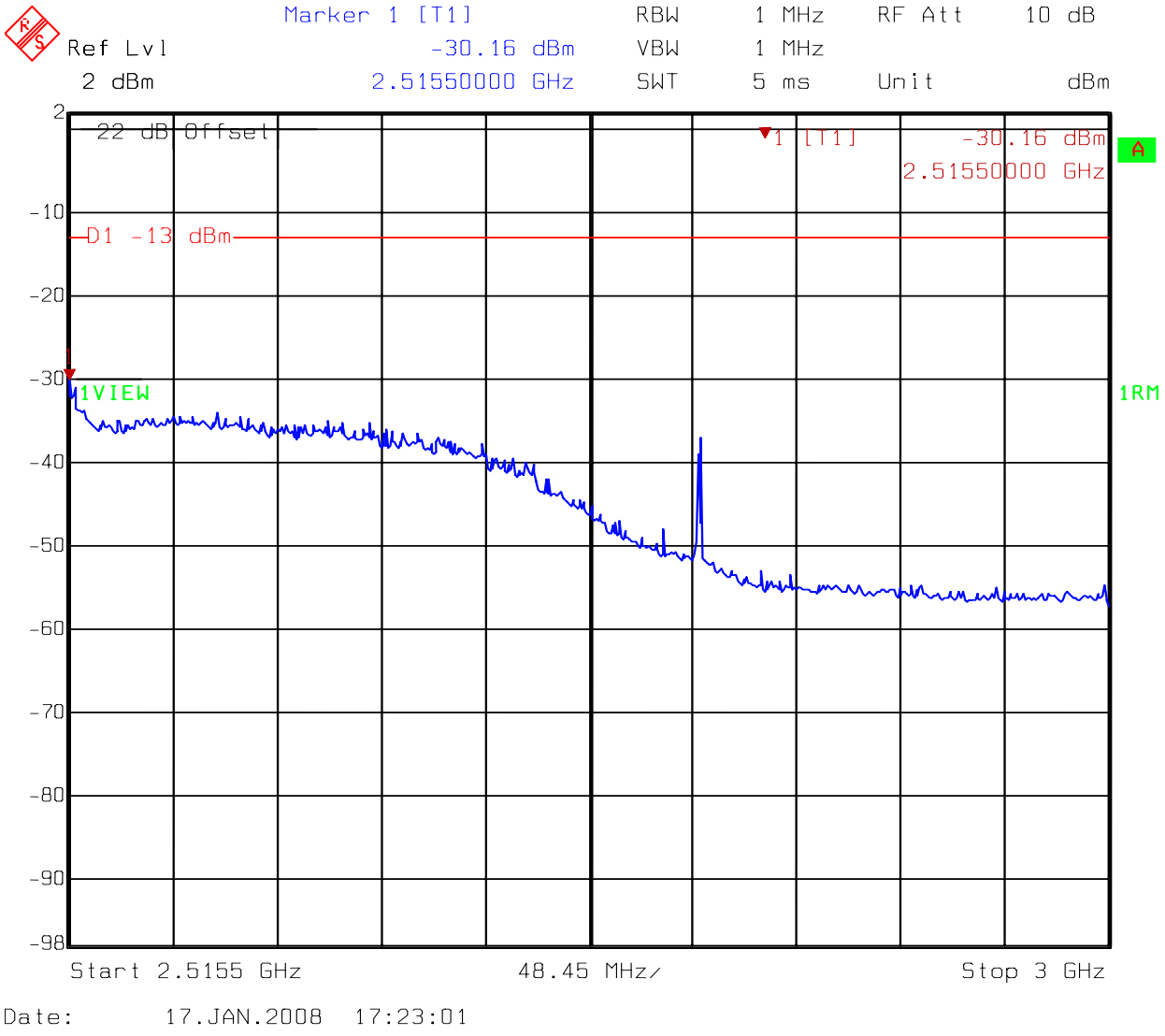
Antenna Type: Patch antenna

Figure 98. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 6 of 8



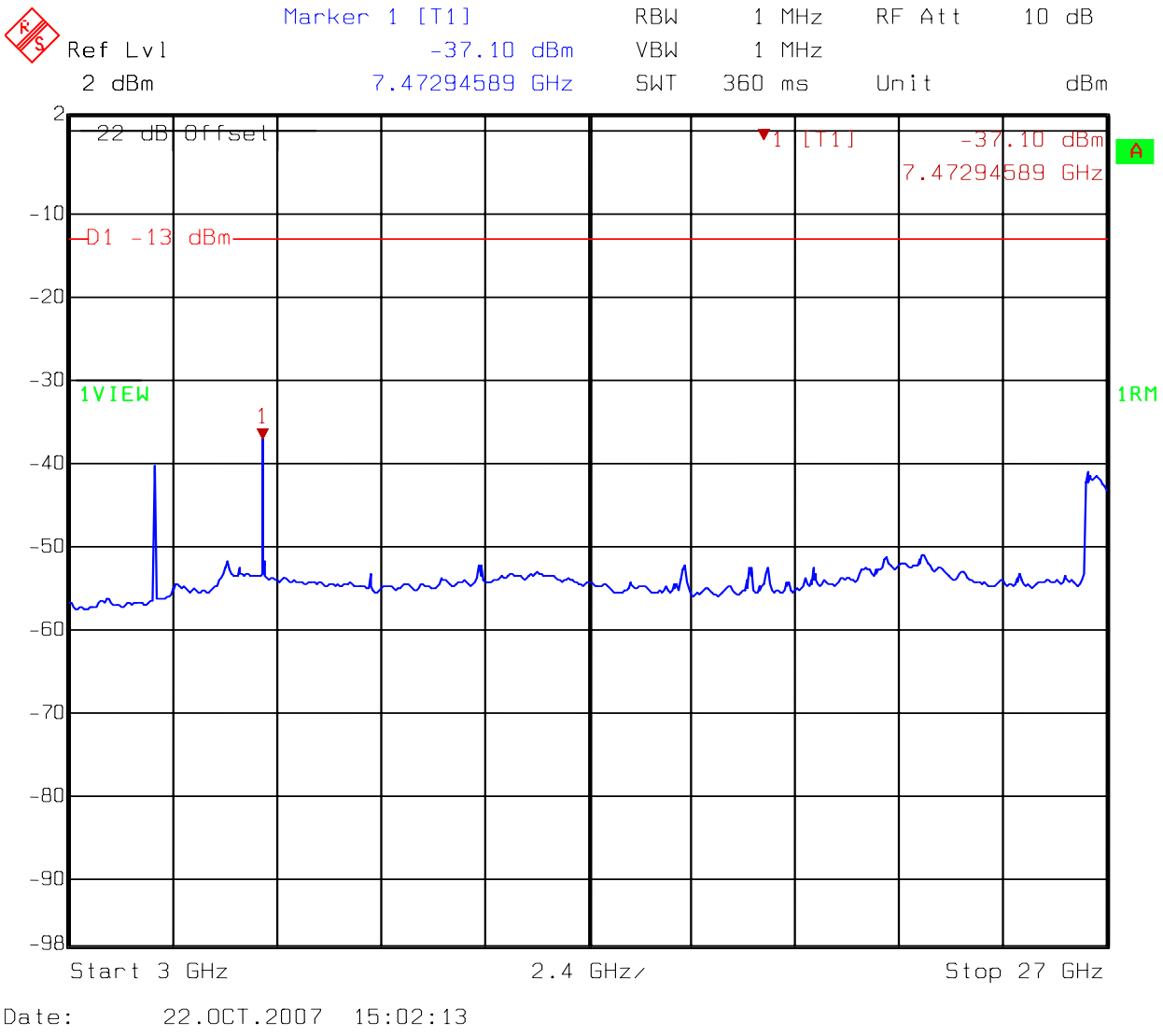
Antenna Type: Patch antenna

Figure 99. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 7 of 8



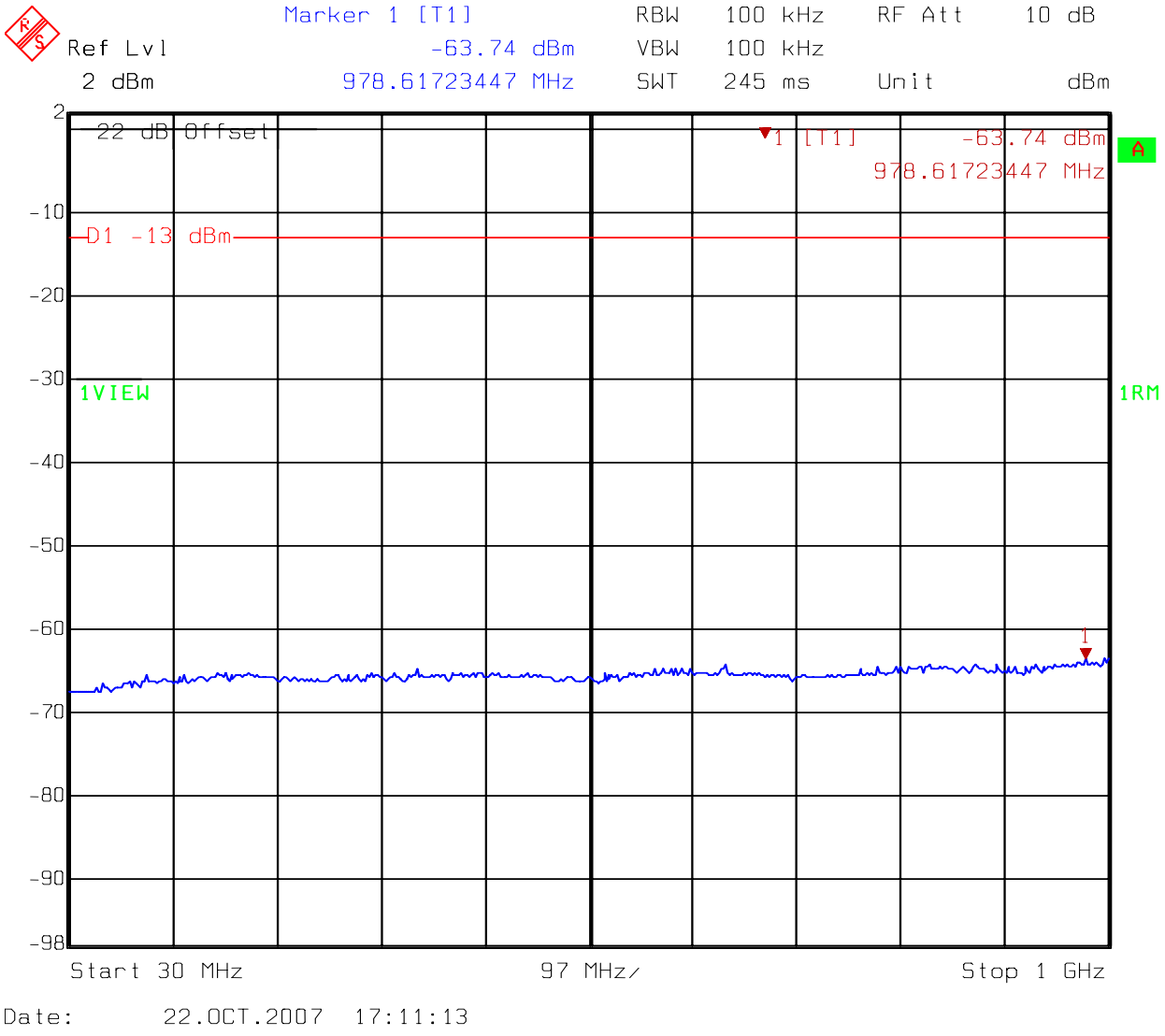
Antenna Type: Patch antenna

Figure 100. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 8 of 8



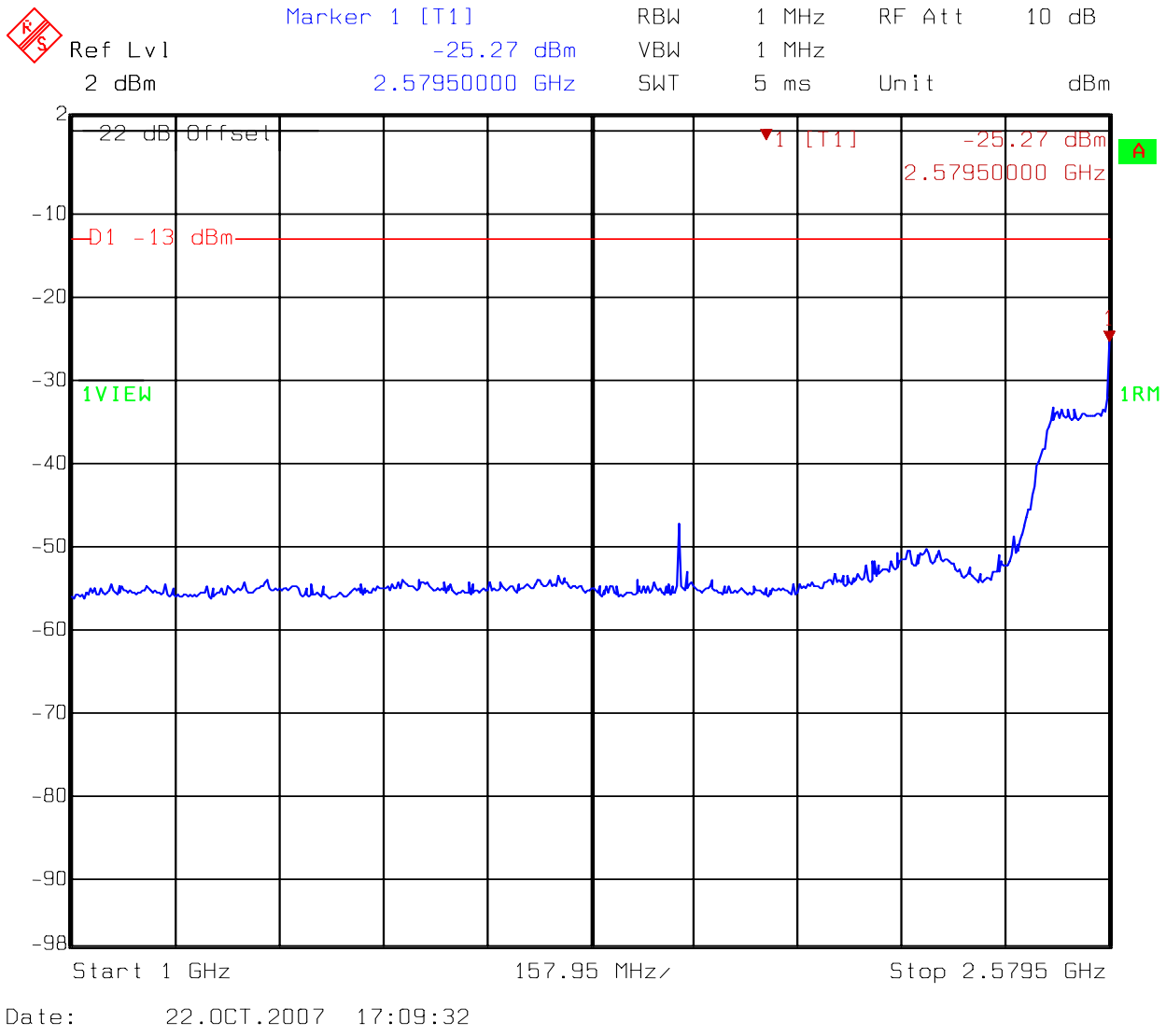
Antenna Type: Patch antenna

Figure 101. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 1 of 8



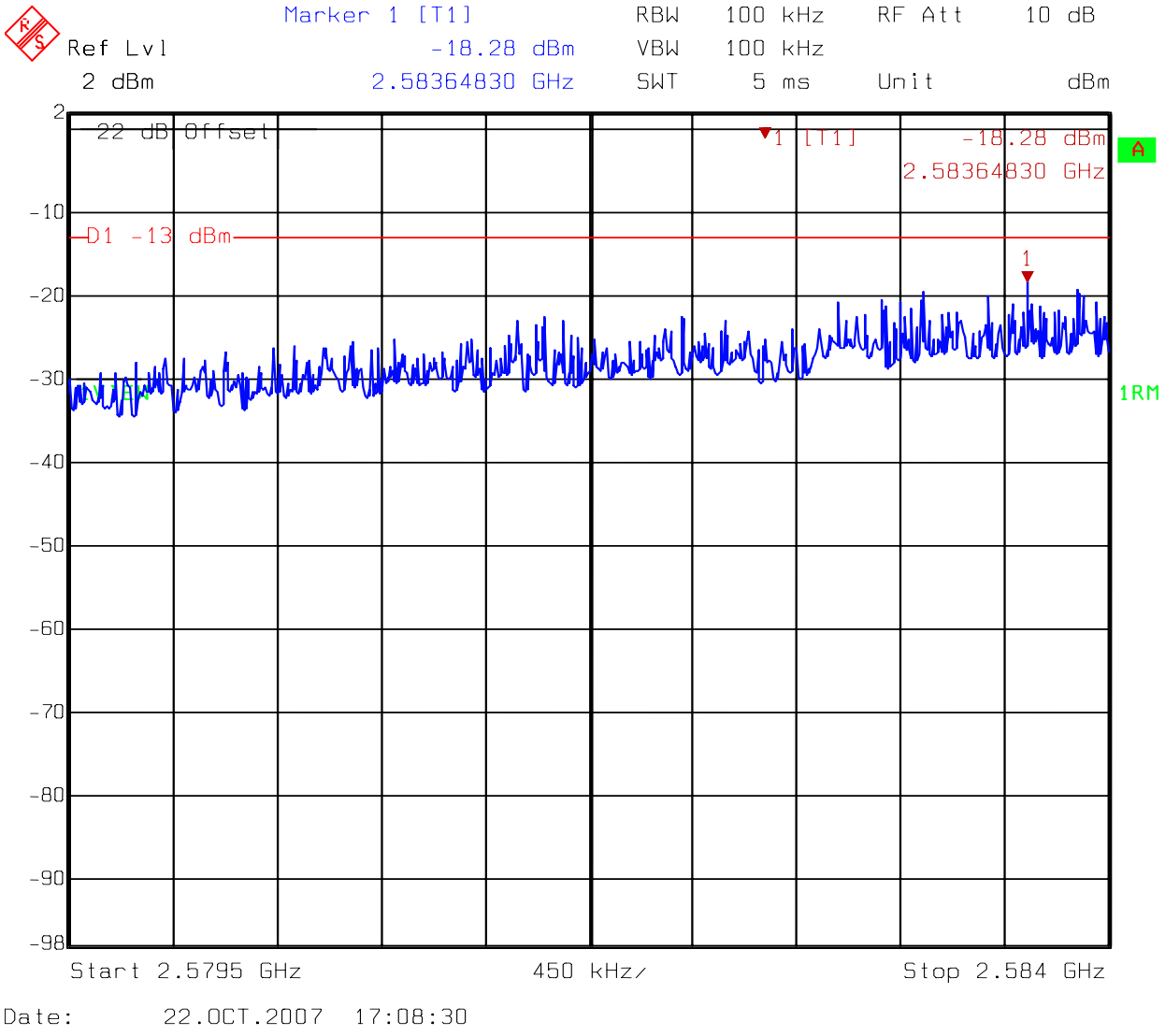
Antenna Type: Patch antenna

Figure 102. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 2 of 8



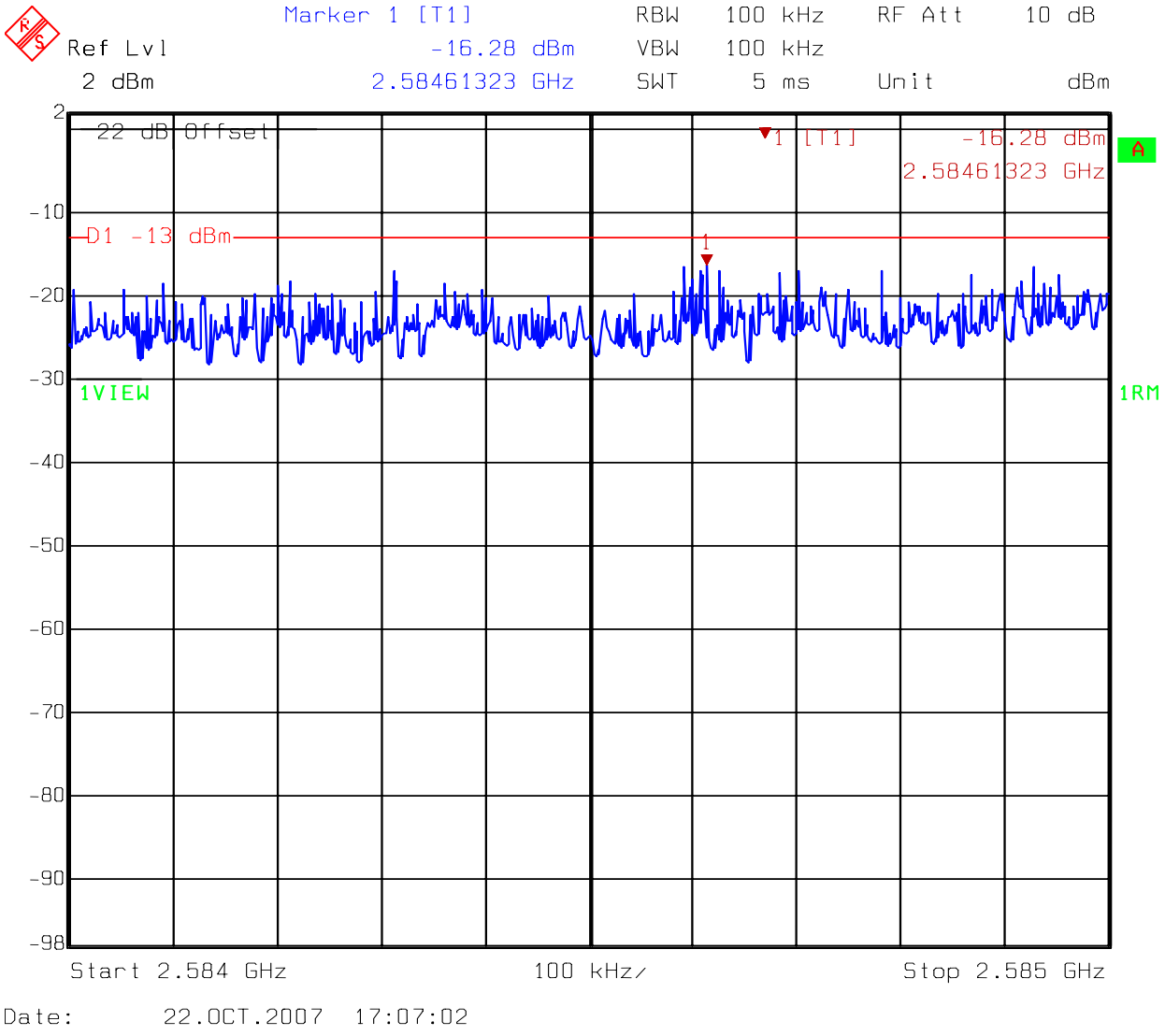
Antenna Type: Patch antenna

Figure 103. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 3 of 8



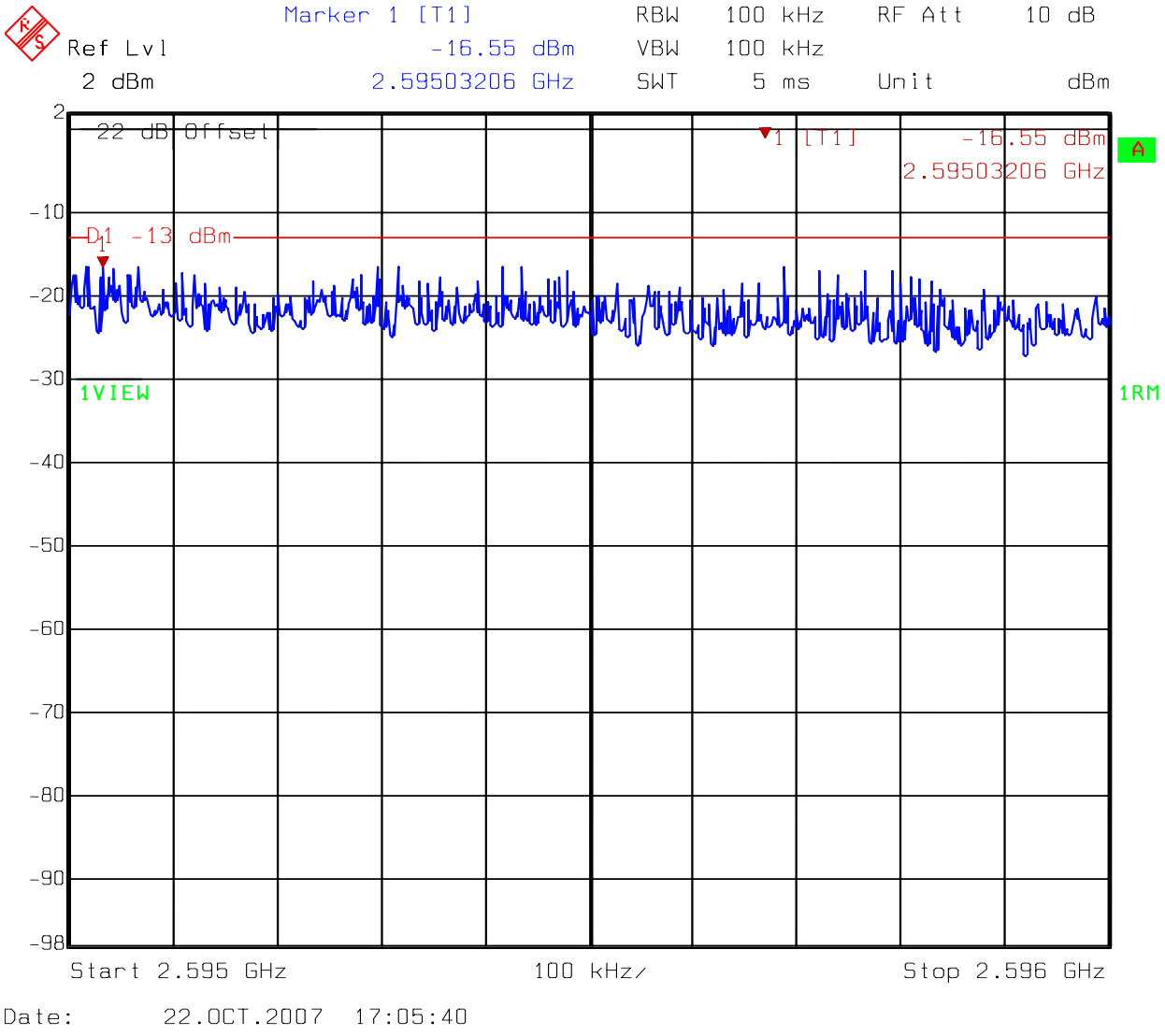
Antenna Type: Patch antenna

Figure 104. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 4 of 8



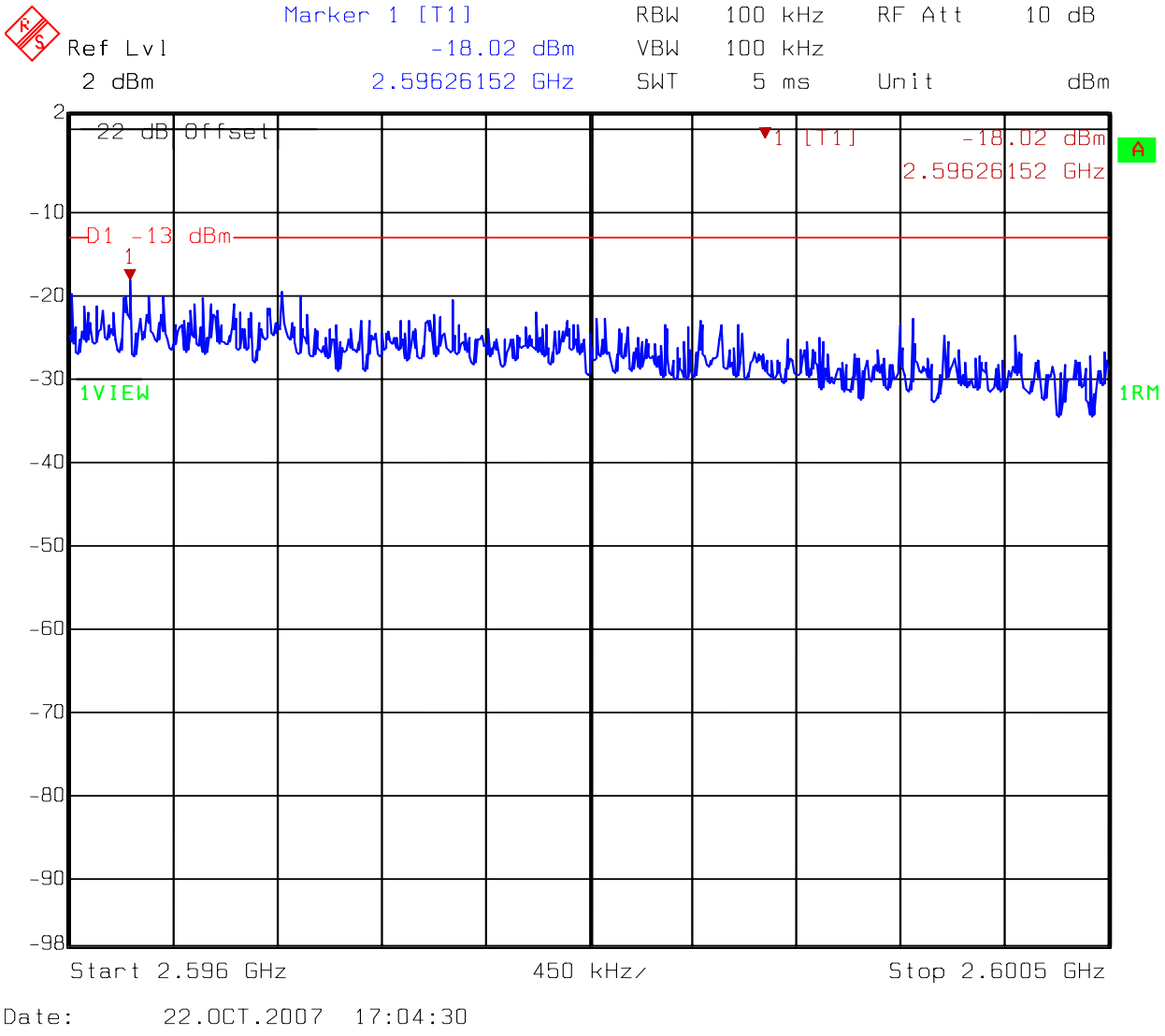
Antenna Type: Patch antenna

Figure 105. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 5 of 8



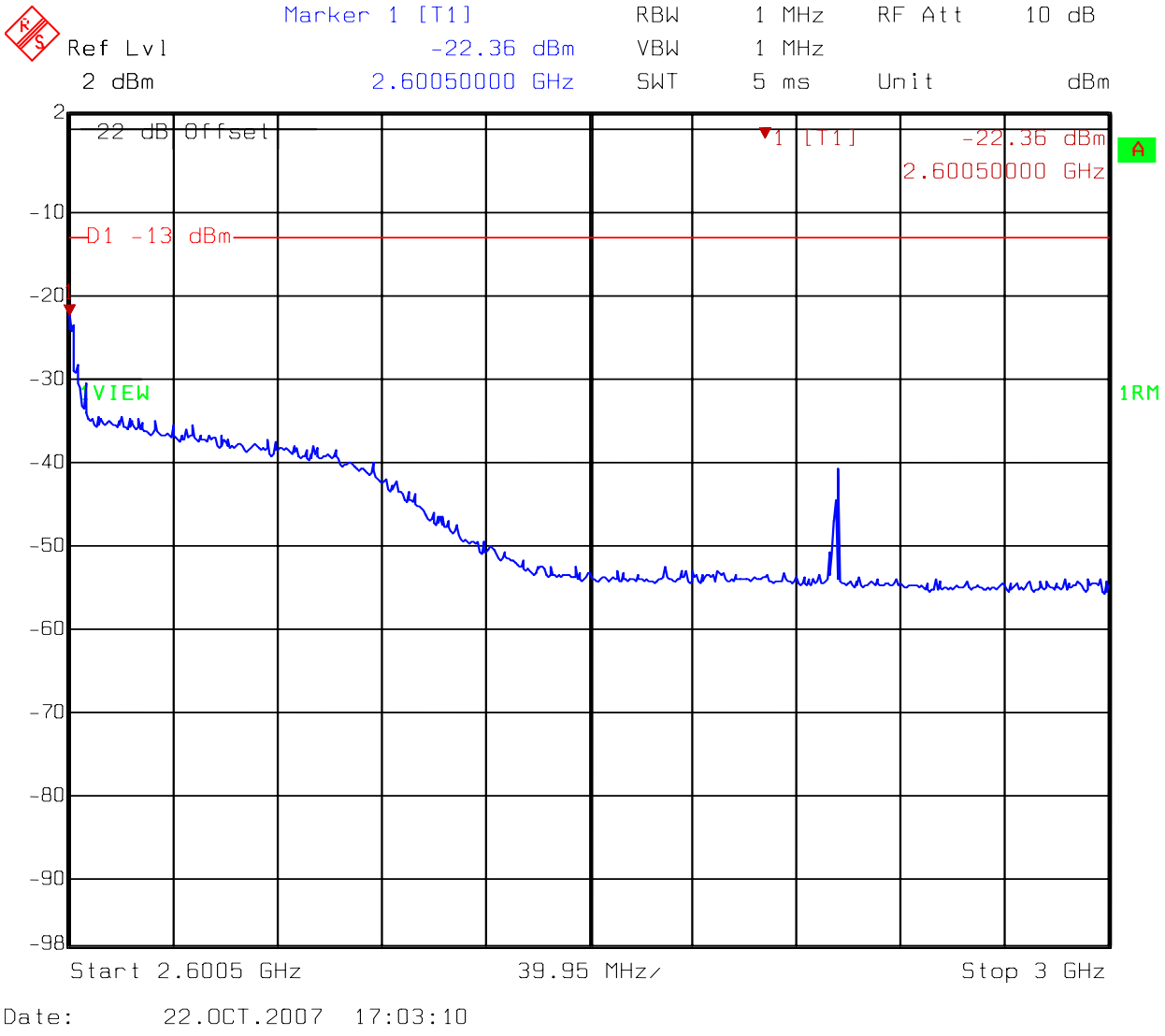
Antenna Type: Patch antenna

Figure 106. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 6 of 8



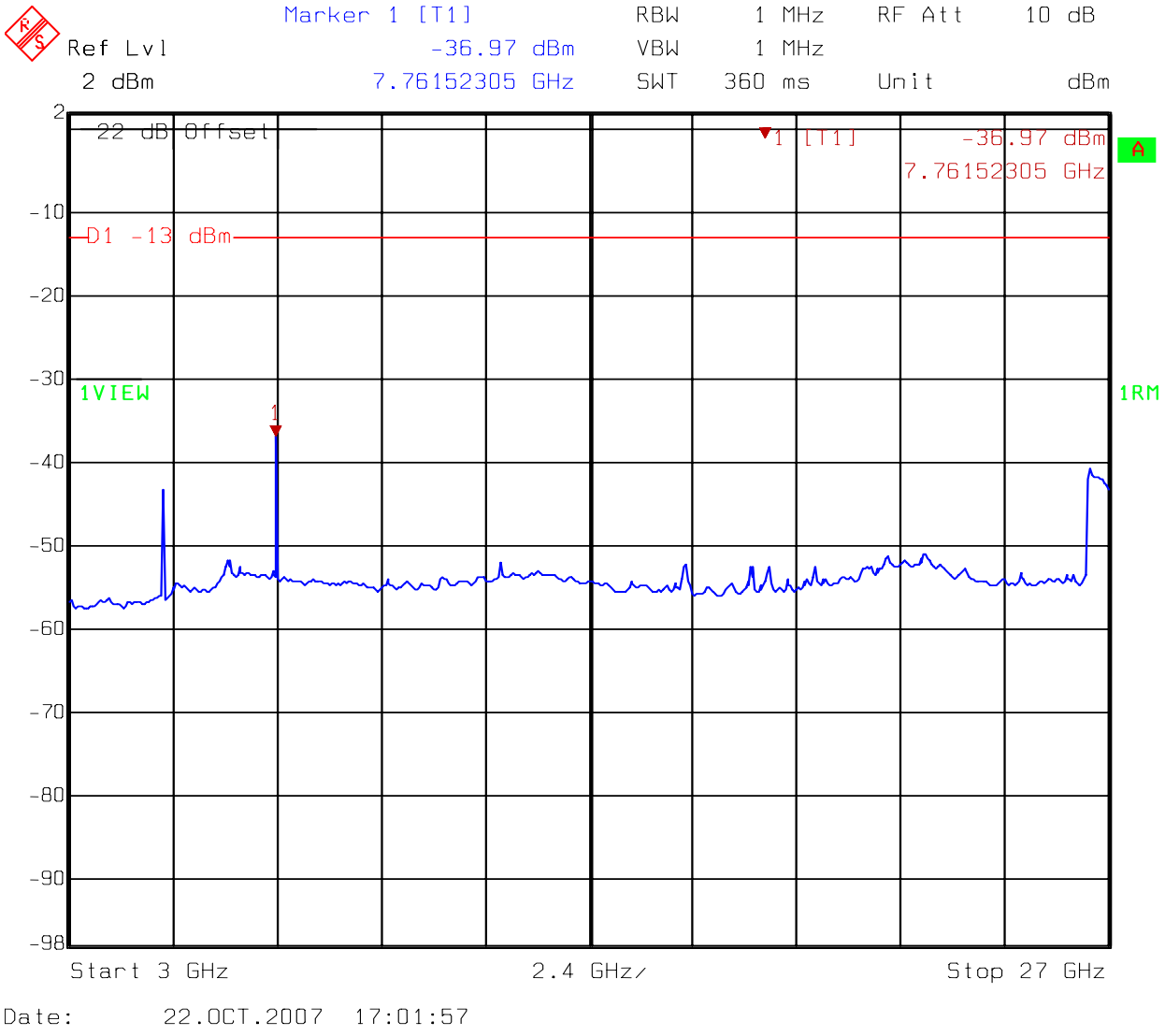
Antenna Type: Patch antenna

Figure 107. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 7 of 8



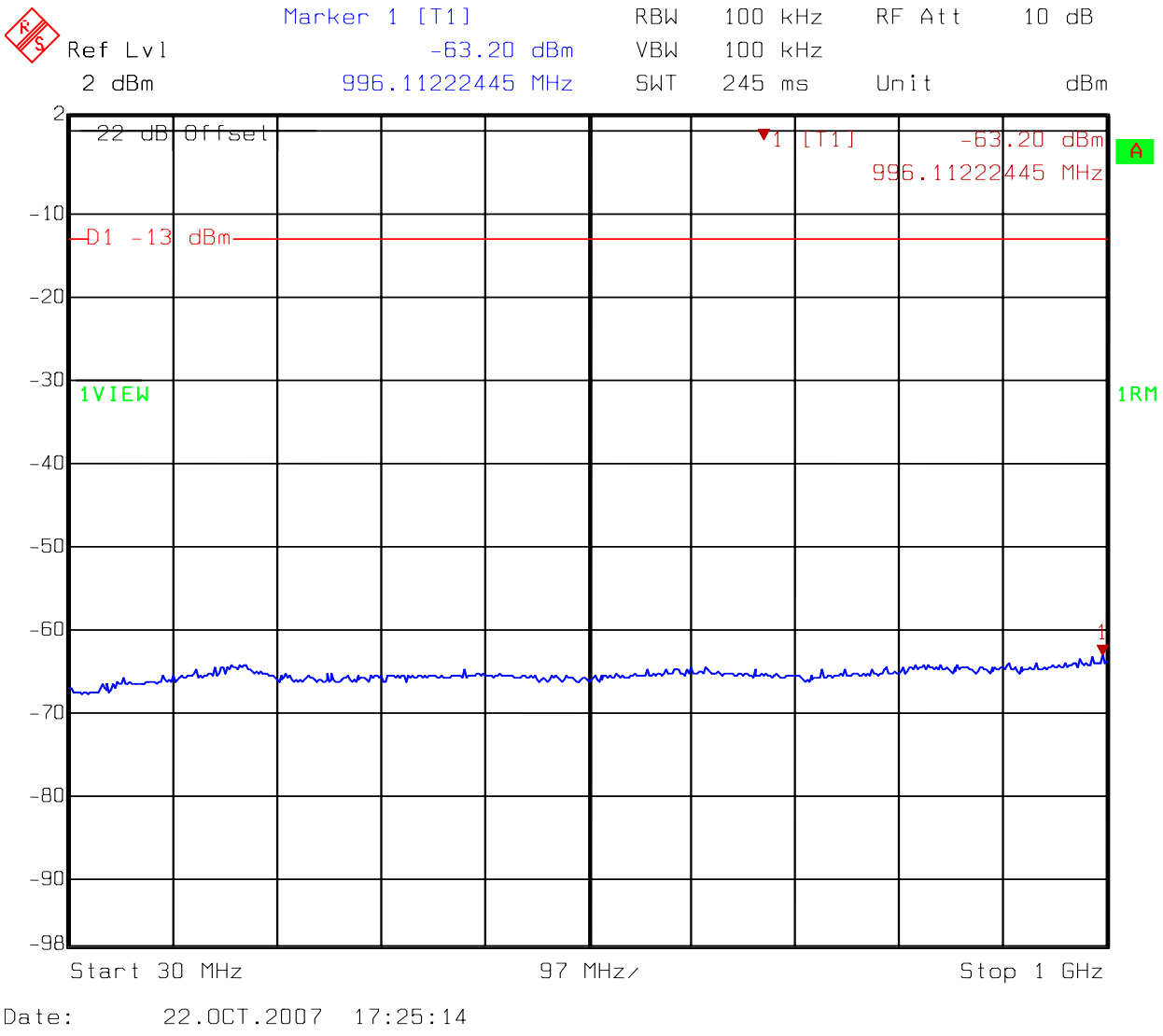
Antenna Type: Patch antenna

Figure 108. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 8 of 8



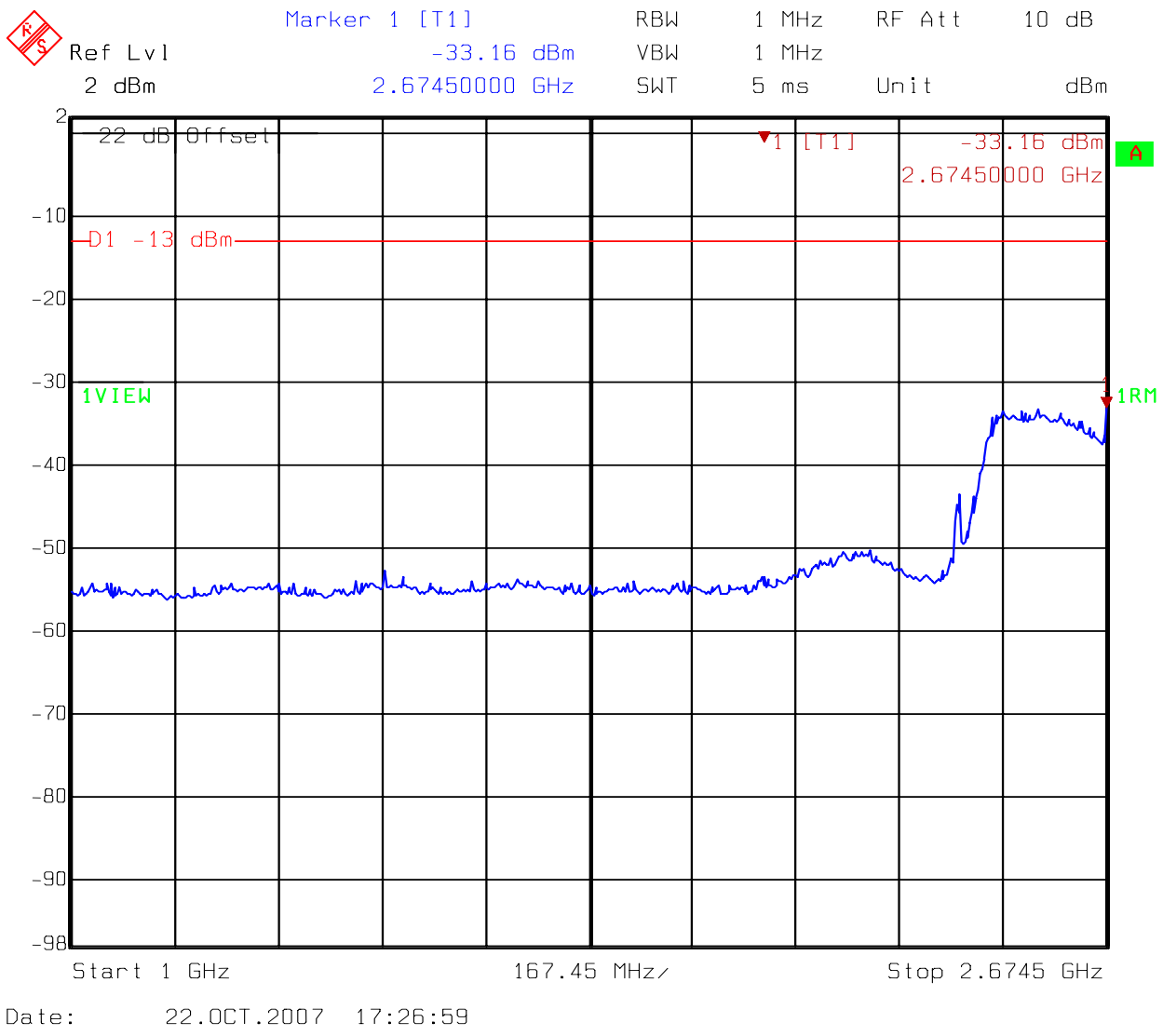
Antenna Type: Patch antenna

Figure 109. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 1 of 8



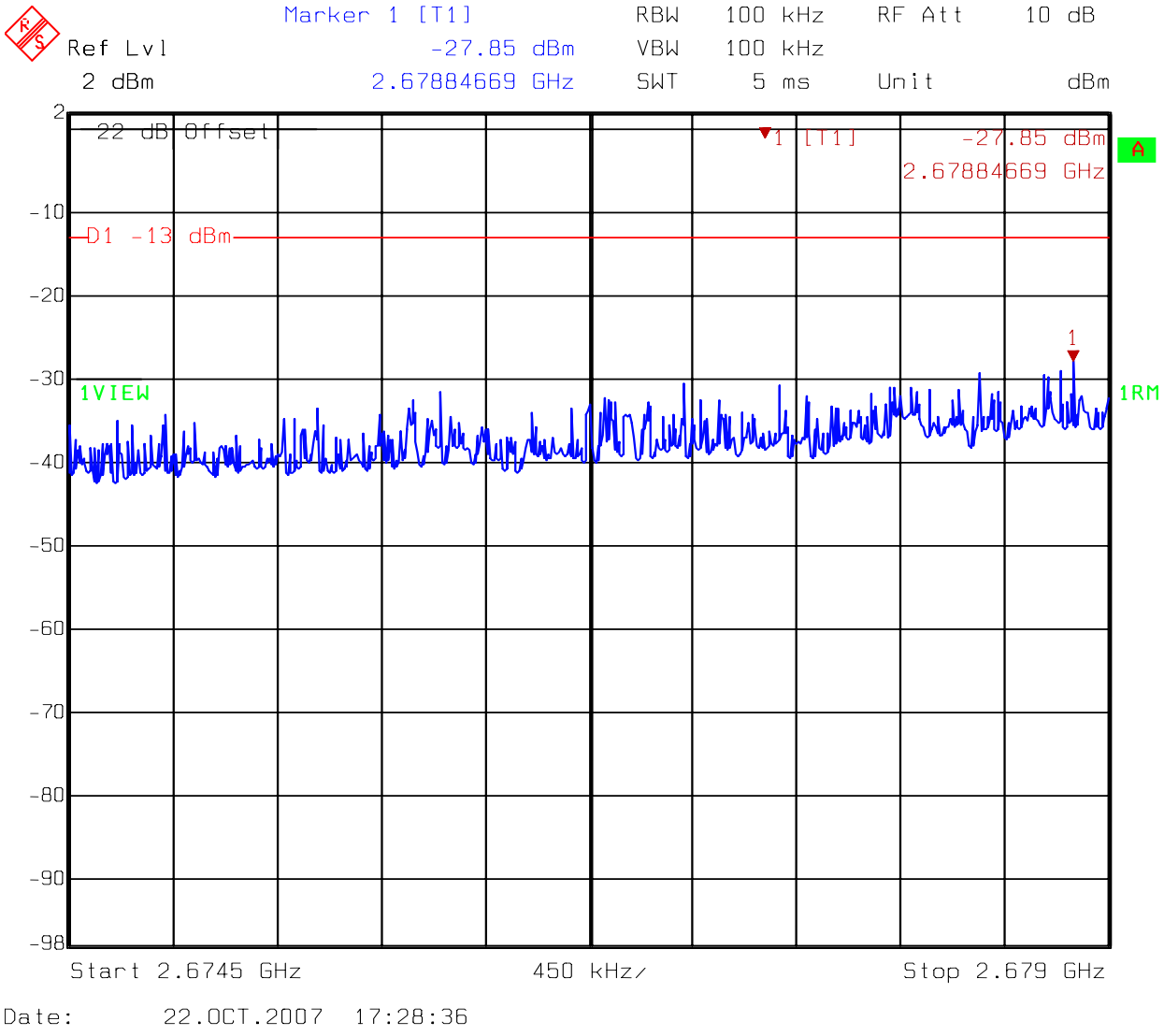
Antenna Type: Patch antenna

Figure 110. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 2 of 8



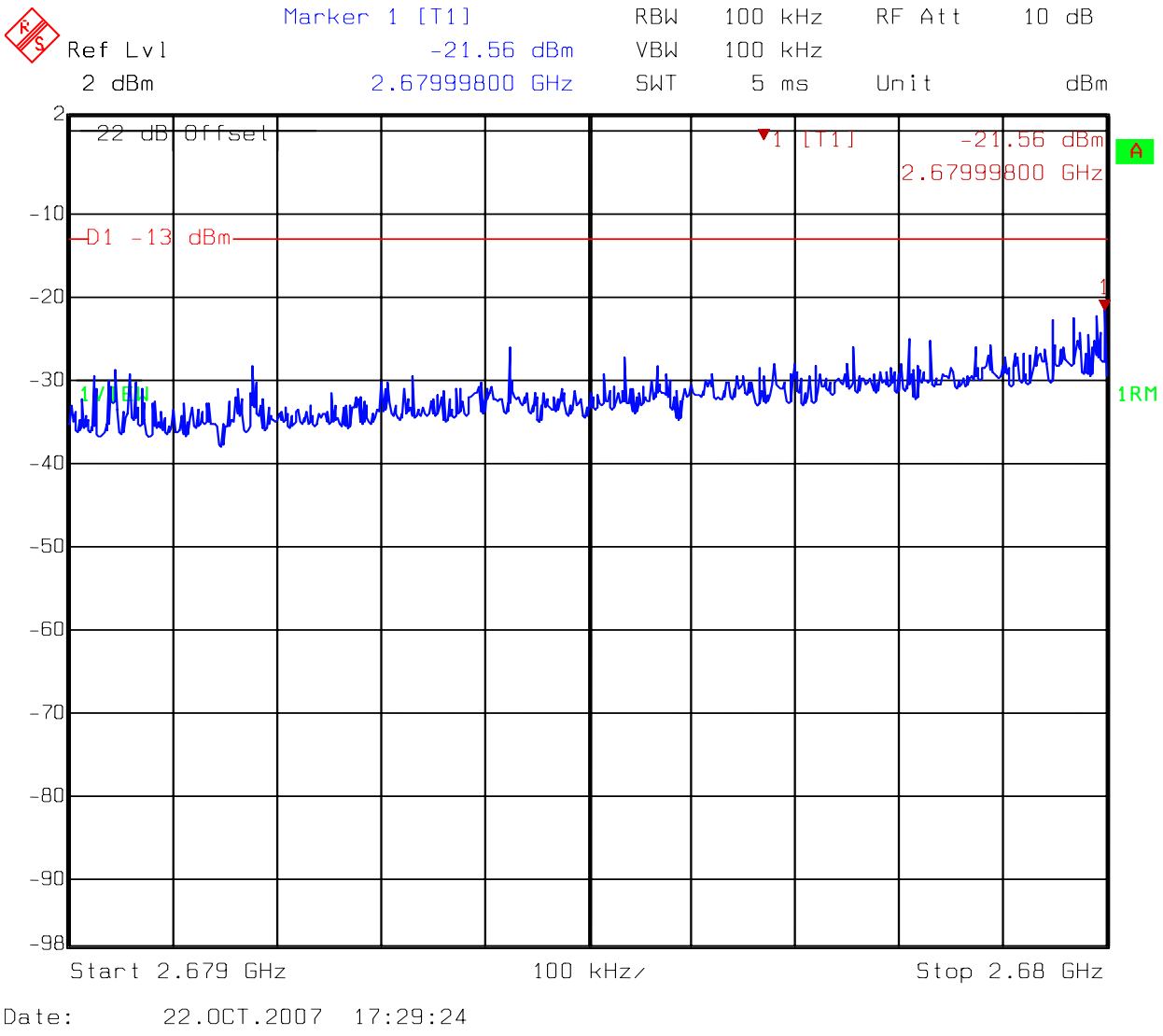
Antenna Type: Patch antenna

Figure 111. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 3 of 8



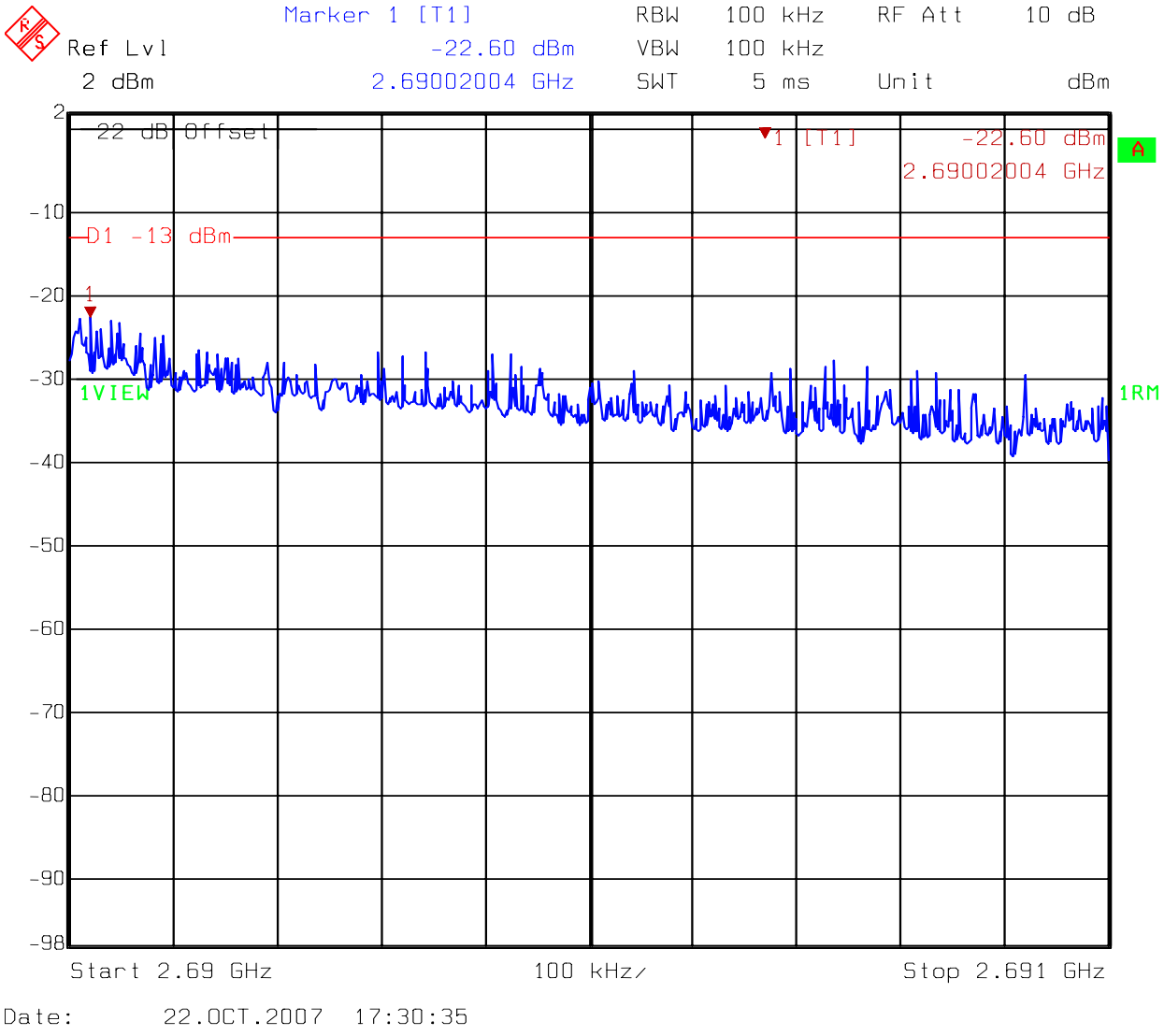
Antenna Type: Patch antenna

Figure 112. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 4 of 8



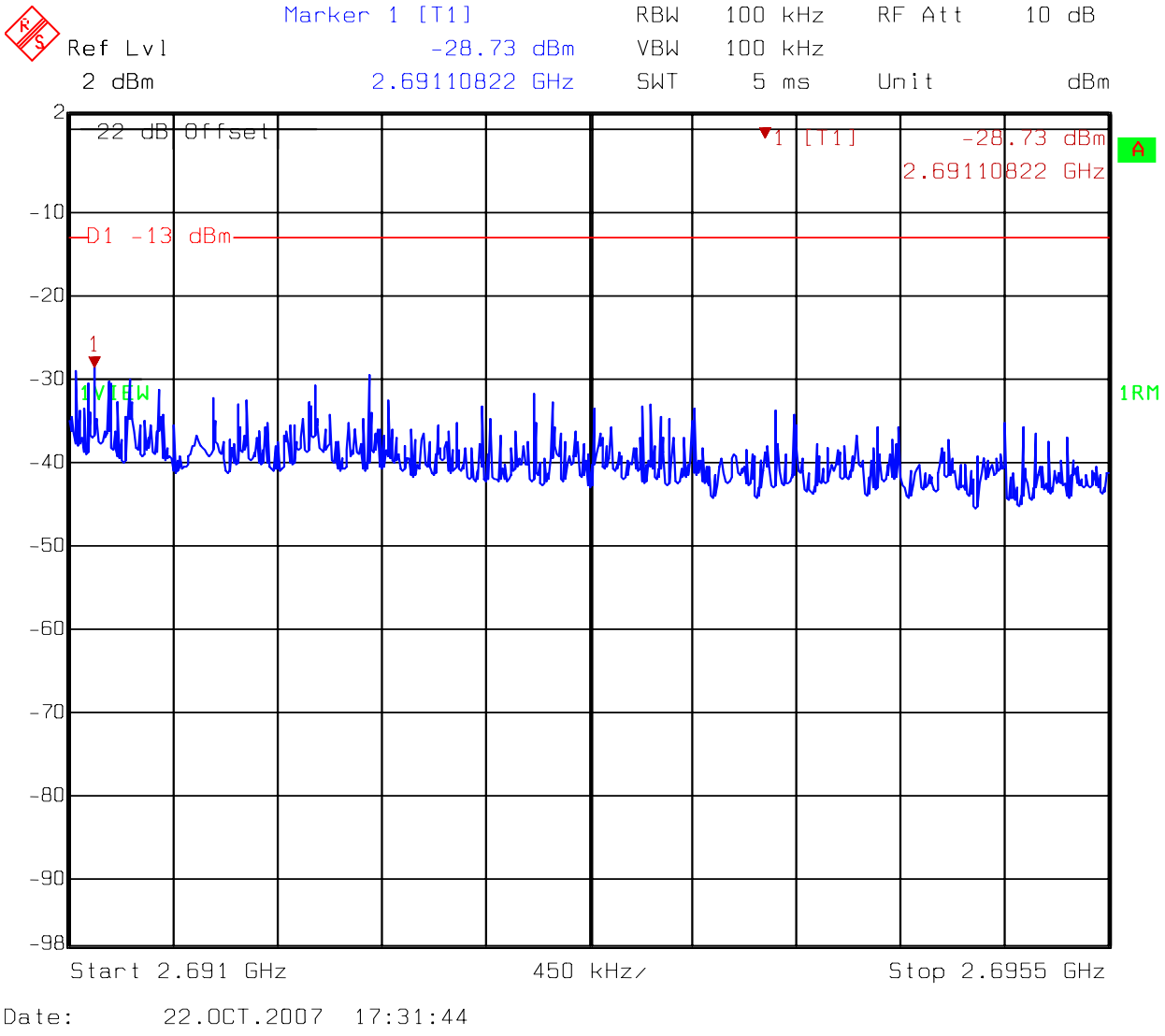
Antenna Type: Patch antenna

Figure 113. Spurious Emission at Antenna Terminals @ high channel (10MHz) – 5 of 8



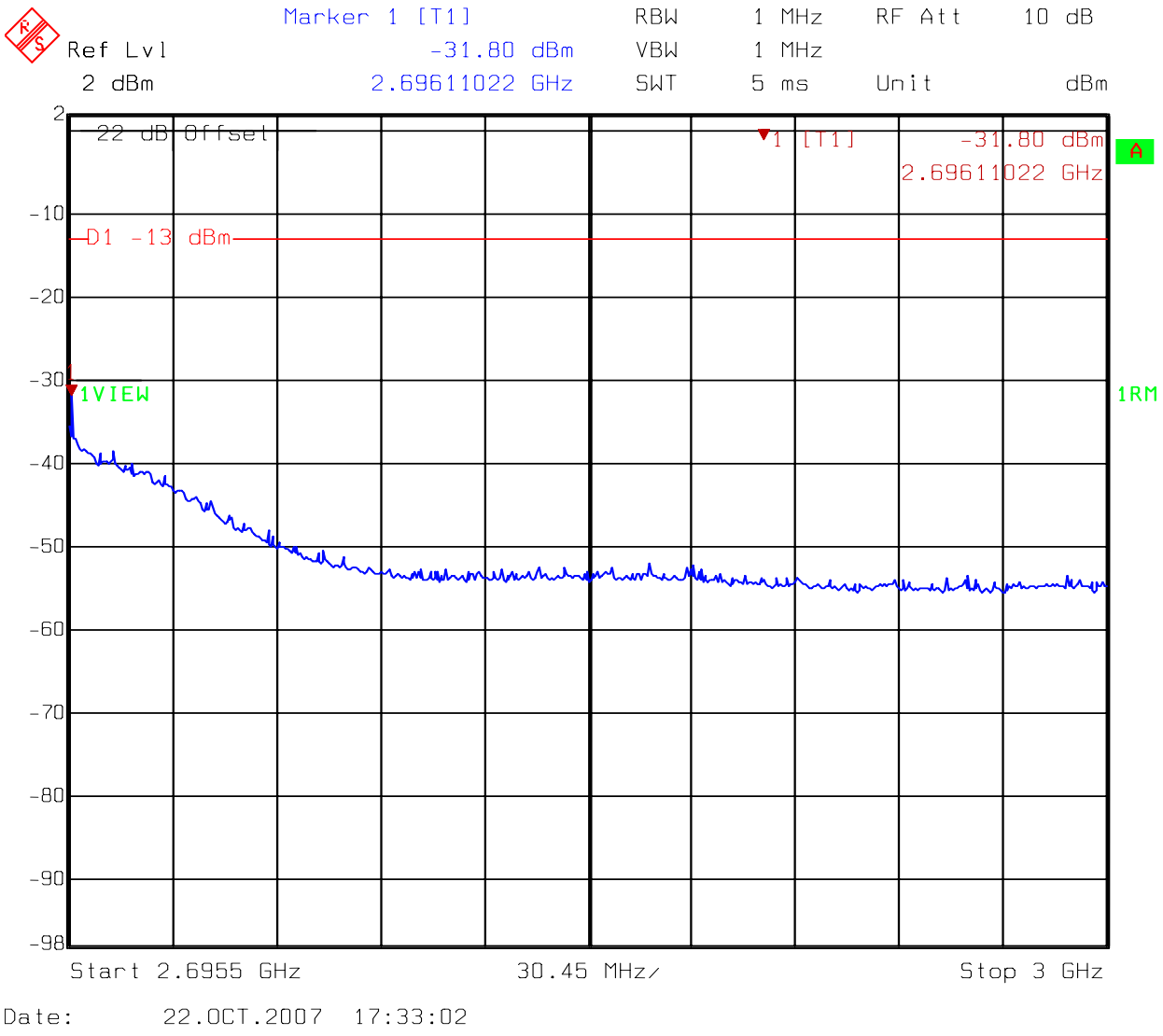
Antenna Type: Patch antenna

Figure 114. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 6 of 8



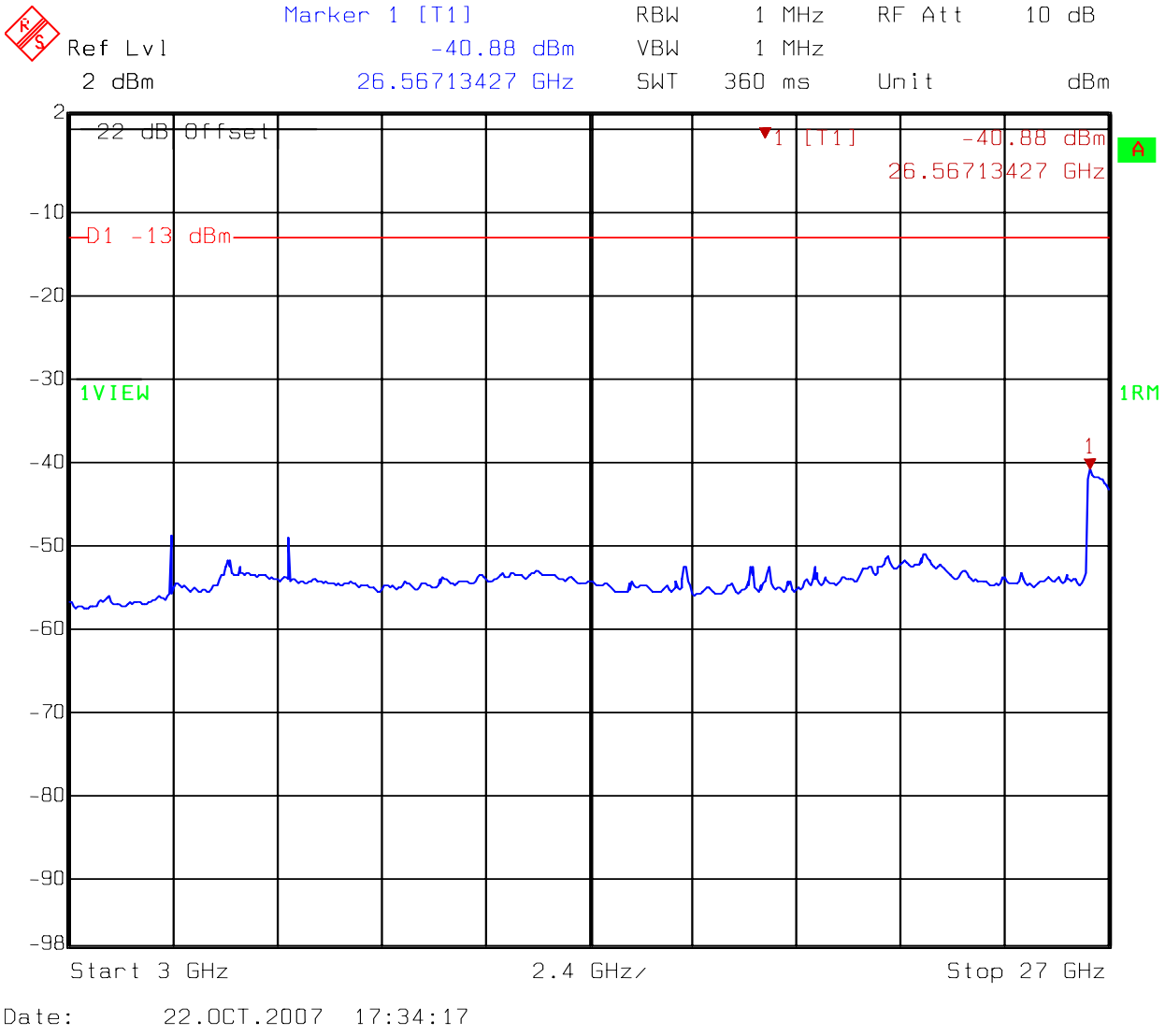
Antenna Type: Patch antenna

Figure 115. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 7 of 8



Antenna Type: Patch antenna

Figure 116. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 8 of 8



7. Field Strength & Spurious Radiated Emission

Name of Test	Field Strength of Spurious Radiation
Base Standard	FCC 2.1053 & 27.53(l) and 15.209

Tested By: Jimmie Liu
Test Date: Oct. 17, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 26℃, 65%

Test Equipment: EC351, EC353, EC354, EC365, EC371, EC373, EC374, EP364, EP347

Test Procedure and Setup:

If the antenna is detachable from the transmitter, it is removed and replaced with a 50 ohm load. Emissions are measured up to the 10th harmonic of the highest transmit frequency that the transmitter is capable of producing. If the antenna is not detachable from the transmitter, emissions are measured radiated only at a distance of 3 meters.

D1. Method of Measurement:

D1.1 Spurious **Radiated** Emission
The frequency range from 30MHz to 1000MHz using Bilog Antenna.
The frequency range over 1GHz using Horn Antenna.

The maximum field strength of the spurious emission is measured at a distance of 3 meters. The device under test is then replaced with a substitution antenna of known gain with respect to a Horn antenna. A calibrated signal source is used to feed the substitution antenna. The RF level to the substitution antenna is adjusted to repeat the previously measured field strength. The RF input level to the substitution antenna is the effective radiated power of the spurious emission after any correction for substitution antenna gain against a Horn antenna.

D1.2 Radiated Field Strength

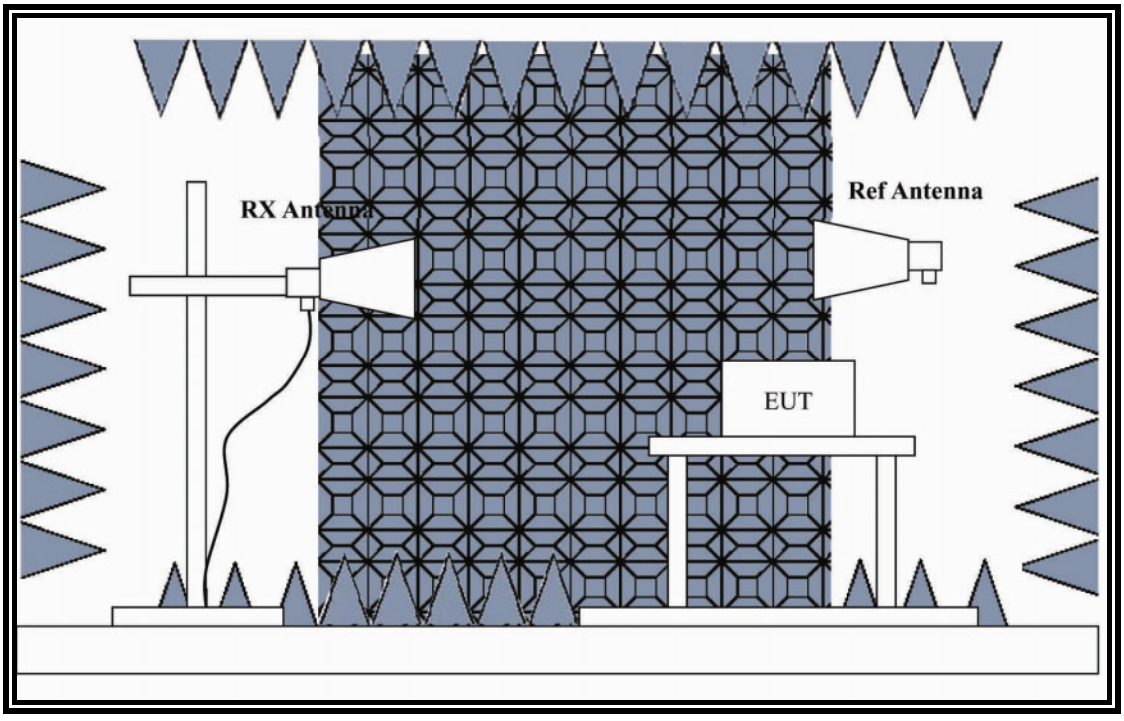
Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading

The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

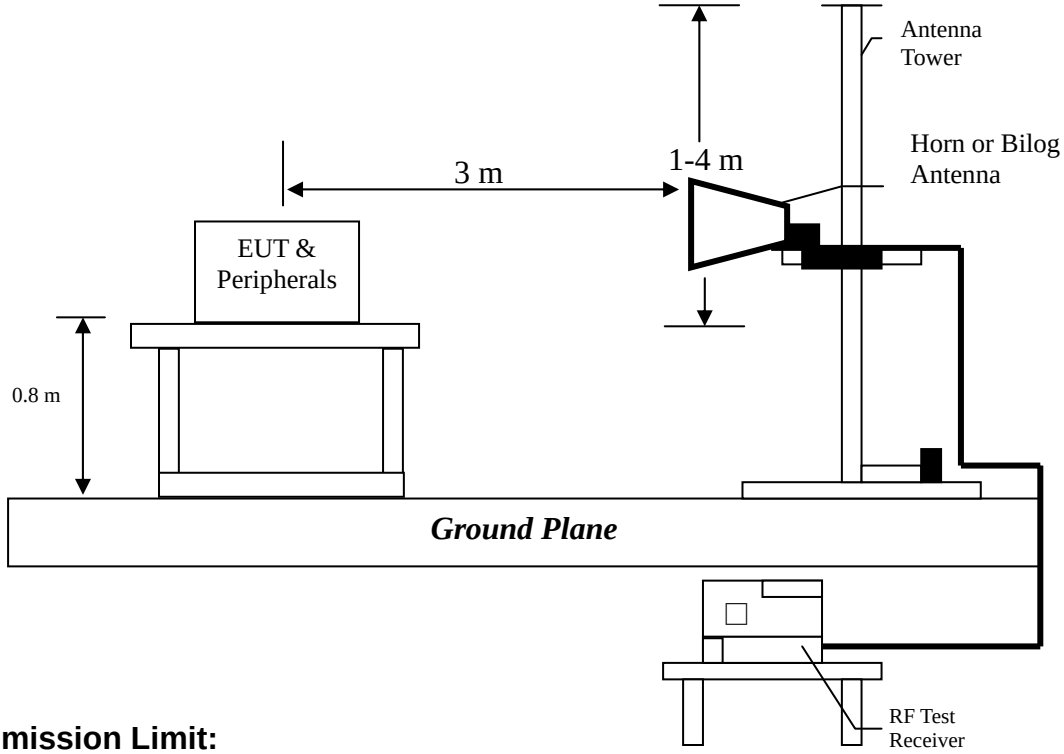
The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

D2. Test Diagram:

D2.1 Spurious **Radiated** Emission



D2.2 Radiated Field Strength



D3. Emission Limit:

D3.1 Spurious **Radiated** Emission

According to FCC 27.53(m) requirement, the spurious emission shall be attenuated at least 43 + 10 log(P) dB from the fundamental.

Sample Calculation:
Assume the EUT Pout= 2W = 33dBm
43 + 10 log(P)
43 + 10 log(2)
43 + 10 × 0.3
43 + 3 = 46 dB
33 dBm – 46 dB = -13 dBm

D3.2 Radiated Field Strength

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Limits (dBµV/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Test Result: Complies
Measurement Data: For FCC 15.209 see the Table2
For FCC 2.1053 & 27.53(m) see the Table3

Note: (1) The EUT was tested while in a continuous transmit mode. The EUT was tuned to a low, middle and high channel.
(2) The EUT operating at 2.5GHz band. Frequency Range scanned from 30MHz to 27GHz.

Table2. Field Strength of Spurious

Test Mode: Normal operating mode

Polarity (V/H)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
V	49.40000	QP	12.84	26.18	39.02	40.00	-0.98
V	132.82000	QP	11.39	22.52	33.91	43.50	-9.59
V	633.34000	QP	21.53	15.73	37.26	46.00	-8.74
V	666.34000	QP	21.50	14.23	35.73	46.00	-10.27
V	699.30000	QP	22.33	15.54	37.87	46.00	-8.14
V	933.07000	QP	25.13	14.06	39.19	46.00	-6.82

Test Mode: Normal operating mode

Polarity (V/H)	Frequency (MHz)	Detector	Corr. Factor (dB/m)	Reading (dBuV)	Calculated dBuV/m	Limit (dBuV/m)	Margin (dB)
H	132.82000	QP	12.32	25.95	38.27	43.50	-5.23
H	302.57000	QP	14.32	23.05	37.37	46.00	-8.64
H	399.57000	QP	16.74	20.55	37.29	46.00	-8.71
H	666.32000	QP	21.52	15.24	36.76	46.00	-9.25
H	699.30000	QP	22.48	16.32	38.80	46.00	-7.20
H	933.07000	QP	25.33	15.52	40.85	46.00	-5.15

Table3. Spurious Radiated Emission

Antenna Type	Frequency (MHz)
Dipole antenna	**2500**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	235.64000	-64.25	0.4	2.27	-62.38	-13	-49.38	5
V	334.58000	-66.9	0.3	6.61	-60.59	-13	-47.59	5
V	633.34000	-69.58	0.7	6.96	-63.32	-13	-50.32	5
V	934.04000	-62.14	0.7	7.44	-55.40	-13	-42.40	5
H	233.70000	-63.96	0.4	2.27	-62.09	-13	-49.09	5
H	400.54000	-66.17	0.4	6.39	-60.18	-13	-47.18	5
H	499.48000	-66.94	0.5	6.86	-60.58	-13	-47.58	5
H	967.02000	-62.45	0.7	7.44	-55.71	-13	-42.71	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5000	-23.1	0.5	9.6	-14	-13	-1	5
H	5000	-28.88	0.5	9.6	-19.78	-13	-6.78	5
V	7500	-31.83	0.74	10.1	-22.47	-13	-9.47	5
H	7500	-26.24	0.74	10.1	-16.88	-13	-3.88	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Dipole antenna	**2590**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	266.68000	-61.42	0.4	2.27	-59.55	-13	-46.55	5
V	334.58000	-66.45	0.3	6.61	-60.14	-13	-47.14	5
V	480.08000	-70.63	0.4	6.69	-64.34	-13	-51.34	5
V	934.04000	-63.18	0.7	7.44	-56.44	-13	-43.44	5
H	235.64000	-65.37	0.4	2.27	-63.50	-13	-50.50	5
H	400.54000	-67.12	0.4	6.39	-61.13	-13	-48.13	5
H	499.48000	-65.37	0.4	6.86	-58.91	-13	-45.91	5
H	534.40000	-68.36	0.5	6.93	-61.93	-13	-48.93	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5180	-26.55	0.5	9.6	-17.45	-13	-4.45	5
H	5180	-27.23	0.5	9.6	-18.13	-13	-5.13	5
V	7770	-37.26	1	10.9	-27.36	-13	-14.36	5
H	7770	-29.55	1	10.9	-19.65	-13	-6.65	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Dipole antenna	**2685**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	334.58000	-66.65	0.3	6.61	-60.34	-13	-47.34	5
V	701.24000	-66.8	0.7	7.06	-60.44	-13	-47.44	5
V	895.24000	-63.9	0.7	7.31	-57.29	-13	-44.29	5
V	934.04000	-62.25	0.7	7.44	-55.51	-13	-42.51	5
H	499.48000	-64.97	0.4	6.86	-58.51	-13	-45.51	5
H	668.26000	-66.07	0.7	7.01	-59.76	-13	-46.76	5
H	881.66000	-64.53	0.7	7.31	-57.92	-13	-44.92	5
H	967.02000	-63.05	0.7	7.45	-56.30	-13	-43.30	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5370	-25.8	0.5	9.6	-16.7	-13	-3.7	5
H	5370	-30.07	0.5	9.6	-20.97	-13	-7.97	5
V	8055	-30.94	1.72	10.9	-21.76	-13	-8.76	5
H	8055	-43.92	1.72	10.9	-34.74	-13	-21.74	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Dipole antenna	**2505**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	237.58000	-64.39	0.4	2.27	-62.52	-13	-49.52	10
V	334.58000	-67.02	0.3	6.61	-60.71	-13	-47.71	10
V	480.08000	-71.4	0.4	6.69	-65.11	-13	-52.11	10
V	934.04000	-62.14	0.7	7.44	-55.40	-13	-42.40	10
H	237.58000	-64.88	0.4	2.27	-63.01	-13	-50.01	10
H	400.54000	-66.2	0.4	6.39	-60.21	-13	-47.21	10
H	499.48000	-65.24	0.4	6.86	-58.78	-13	-45.78	10
H	668.26000	-67.8	0.7	7.01	-61.49	-13	-48.49	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5000	-26.12	0.5	9.6	-17.02	-13	-4.02	10
H	5000	-27.3	0.5	9.6	-18.2	-13	-5.2	10
V	7500	-34.75	0.74	10.1	-25.39	-13	-12.39	10
H	7500	-28.1	0.74	10.1	-18.74	-13	-5.74	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Dipole antenna	**2590**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	266.68000	-61.61	0.4	2.27	-59.74	-13	-46.74	10
V	334.58000	-67.18	0.3	6.61	-60.87	-13	-47.87	10
V	633.34000	-68.29	0.7	6.96	-62.03	-13	-49.03	10
V	934.04000	-63.17	0.7	7.44	-56.43	-13	-43.43	10
H	266.68000	-64.56	0.4	2.27	-62.69	-13	-49.69	10
H	400.54000	-66.85	0.4	6.39	-60.86	-13	-47.86	10
H	499.48000	-67.11	0.4	6.86	-60.65	-13	-47.65	10
H	633.34000	-68.61	0.7	6.96	-62.35	-13	-49.35	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5180	-28.6	0.5	9.6	-19.5	-13	-6.5	10
H	5180	-30.4	0.5	9.6	-21.3	-13	-8.3	10
V	7770	-36.09	1	10.9	-26.19	-13	-13.19	10
H	7770	-36.16	1	10.9	-26.26	-13	-13.26	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Dipole antenna	**2685**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	235.64000	-65.32	0.4	2.27	-63.45	-13	-50.45	10
V	334.58000	-66.58	0.3	6.61	-60.27	-13	-47.27	10
V	633.34000	-69.07	0.7	6.96	-62.81	-13	-49.81	10
V	934.04000	-62.13	0.7	7.44	-55.39	-13	-42.39	10
H	239.52000	-65.57	0.4	2.27	-63.70	-13	-50.70	10
H	400.54000	-67.14	0.4	6.39	-61.15	-13	-48.15	10
H	499.48000	-65.73	0.5	6.86	-59.37	-13	-46.37	10
H	967.02000	-62.82	0.7	7.45	-56.07	-13	-43.07	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5370	-30.36	0.5	9.6	-21.26	-13	-8.26	10
H	5370	-28.52	0.5	9.6	-19.42	-13	-6.42	10
V	8055	-37.46	1.72	10.9	-28.28	-13	-15.28	10
H	8055	-48.43	1.72	10.9	-39.25	-13	-26.25	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Patch antenna	**2500**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	233.70000	-63.76	0.4	2.27	-61.89	-13	-48.89	5
V	334.58000	-66.88	0.3	6.61	-60.57	-13	-47.57	5
V	493.66000	-71.27	0.4	6.86	-64.81	-13	-51.81	5
V	895.24000	-63.91	0.7	7.39	-57.22	-13	-44.22	5
H	237.58000	-63.96	0.4	2.27	-62.09	-13	-49.09	5
H	400.54000	-66.17	0.4	6.39	-60.18	-13	-47.18	5
H	499.48000	-66.94	0.5	6.86	-60.58	-13	-47.58	5
H	668.26000	-62.02	0.7	7.01	-55.71	-13	-42.71	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5000	-24.87	0.5	9.6	-15.77	-13	-2.77	5
H	5000	-28.75	0.5	9.6	-19.65	-13	-6.65	5
V	7500	-37.07	0.74	10.1	-27.71	-13	-14.71	5
H	7500	-30.01	0.74	10.1	-20.65	-13	-7.65	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Patch antenna	**2590**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	266.68000	-61.74	0.4	2.27	-59.87	-13	-46.87	5
V	334.58000	-66.8	0.3	6.61	-60.49	-13	-47.49	5
V	633.34000	-68.1	0.7	6.96	-61.84	-13	-48.84	5
V	934.04000	-63.64	0.7	7.44	-56.90	-13	-43.90	5
H	266.68000	-64.89	0.4	2.27	-63.02	-13	-50.02	5
H	400.54000	-67.14	0.4	6.39	-61.15	-13	-48.15	5
H	499.48000	-65.06	0.4	6.86	-58.60	-13	-45.60	5
H	534.40000	-68.16	0.5	6.93	-61.73	-13	-48.73	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5180	-26.27	0.5	9.6	-17.17	-13	-4.17	5
H	5180	-29.18	0.5	9.6	-20.08	-13	-7.08	5
V	7770	-28	1	10.9	-18.1	-13	-5.1	5
H	7770	-32.15	1	10.9	-22.25	-13	-9.25	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Patch antenna	**2685**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	233.70000	-62.48	0.4	2.27	-60.61	-13	-47.61	5
V	334.58000	-66.69	0.3	6.61	-60.38	-13	-47.38	5
V	633.34000	-68.18	0.7	6.96	-61.92	-13	-48.92	5
V	934.04000	-60.96	0.7	7.44	-54.22	-13	-41.22	5
H	400.54000	-66.42	0.4	6.39	-60.43	-13	-47.43	5
H	499.48000	-64.99	0.5	6.86	-58.63	-13	-45.63	5
H	668.26000	-67.96	0.7	7.01	-61.65	-13	-48.65	5
H	701.24000	-66.42	0.7	7.06	-60.06	-13	-47.06	5

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5370	-25.75	0.5	9.6	-16.65	-13	-3.65	5
H	5370	-34.14	0.5	9.6	-25.04	-13	-12.04	5
V	8055	-30	1.72	10.9	-20.82	-13	-7.82	5
H	8055	-35.58	1.72	10.9	-26.4	-13	-13.4	5

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Patch antenna	**2505**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	266.68000	-61.33	0.4	2.27	-59.46	-13	-46.46	10
V	334.58000	-66.5	0.3	6.61	-60.19	-13	-47.19	10
V	480.08000	-69.8	0.4	6.69	-63.51	-13	-50.51	10
V	934.04000	-63.8	0.7	7.44	-57.06	-13	-44.06	10
H	233.70000	-63.55	0.4	2.27	-61.68	-13	-48.68	10
H	334.58000	-66.94	0.3	6.61	-60.63	-13	-47.63	10
H	534.40000	-70.76	0.5	6.91	-64.35	-13	-51.35	10
H	934.04000	-62.2	0.7	7.44	-55.46	-13	-42.46	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5000	-27.98	0.5	9.6	-18.88	-13	-5.88	10
H	5000	-31.53	0.5	9.6	-22.43	-13	-9.43	10
V	7500	-28.78	0.74	10.1	-19.42	-13	-6.42	10
H	7500	-38.88	0.74	10.1	-29.52	-13	-16.52	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Antenna Type	Frequency (MHz)
Patch antenna	**2590**

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	237.58000	-65.86	0.4	2.27	-63.99	-13	-50.99	10
V	400.54000	-66.62	0.4	6.39	-60.63	-13	-47.63	10
V	499.48000	-65.39	0.5	6.86	-59.03	-13	-46.03	10
V	668.26000	-67.08	0.7	7.01	-60.77	-13	-47.77	10
H	400.54000	-67.04	0.4	6.39	-61.05	-13	-48.05	10
H	480.08000	-68.76	0.4	6.69	-62.47	-13	-49.47	10
H	499.48000	-65.38	0.5	6.86	-59.02	-13	-46.02	10
H	534.40000	-67.55	0.5	6.93	-61.12	-13	-48.12	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5180	-28.75	0.5	9.6	-19.65	-13	-6.65	10
H	5180	-33.23	0.5	9.6	-24.13	-13	-11.13	10
V	7770	-30.9	1	10.9	-21	-13	-8	10
H	7770	-34.98	1	10.9	-25.08	-13	-12.08	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

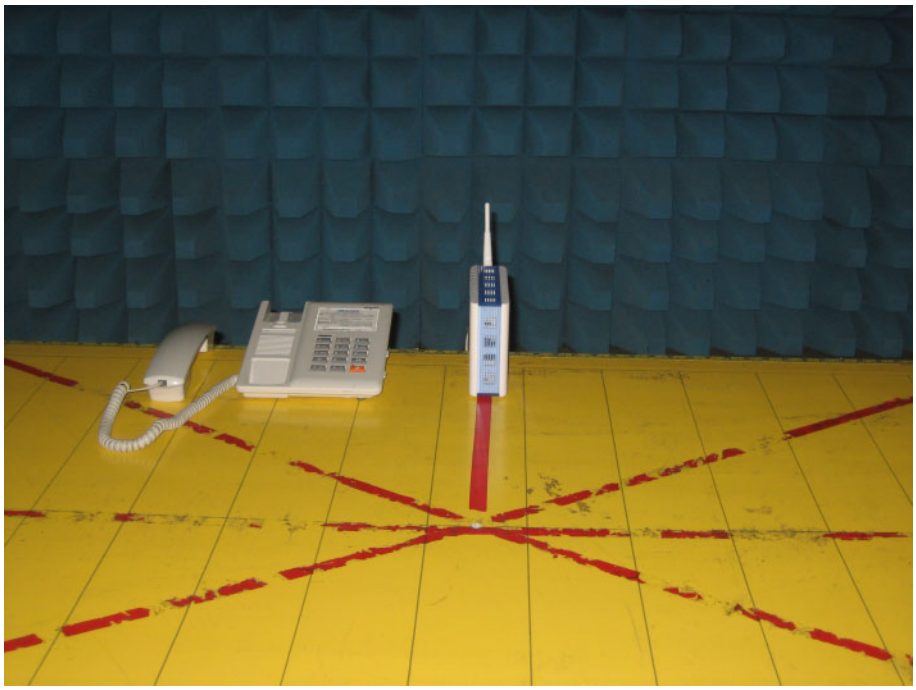
Antenna Type	Frequency (MHz)
Patch antenna	**2685**

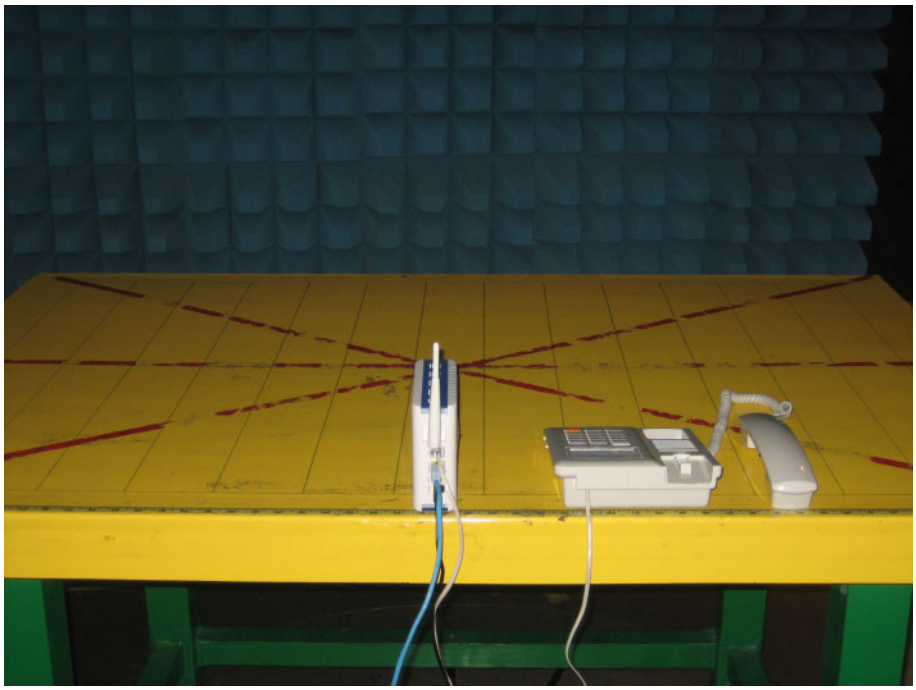
Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	233.70000	-62.94	0.4	2.27	-61.07	-13	-48.07	10
V	334.58000	-66.59	0.3	6.61	-60.28	-13	-47.28	10
V	534.40000	-70.12	0.5	6.93	-63.69	-13	-50.69	10
V	934.04000	-60.75	0.7	7.44	-54.01	-13	-41.01	10
H	233.70000	-64.73	0.4	2.27	-62.86	-13	-49.86	10
H	400.54000	-66.76	0.4	6.39	-60.77	-13	-47.77	10
H	499.48000	-65.44	0.5	6.86	-59.08	-13	-46.08	10
H	967.02000	-62.67	0.7	7.45	-55.92	-13	-42.92	10

Polarity (V/H)	Frequency (MHz)	SG Level (dBm)	Cable Loss (dB)	Substitution Ant. Gain (dB)	Net (dBm)	Limit (dBm)	Margin (dB)	Band Width (MHz)
V	5370	-29.25	0.5	9.6	-20.15	-13	-7.15	10
H	5370	-29.6	0.5	9.6	-20.5	-13	-7.5	10
V	8055	-49.56	1.72	10.9	-40.38	-13	-27.38	10
H	8055	-48.39	1.72	10.9	-39.21	-13	-26.21	10

Remark: Net = SG Level - Cable Loss + Substitution Ant. Gain

Figure 117. Photos - Radiated Emissions





8. AC power line conducted emission

Name of Test	AC power line conducted emission
Base Standard	FCC 15.207

Tested By: Jimmie Liu
Test Date: Oct. 29, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 26℃, 65%

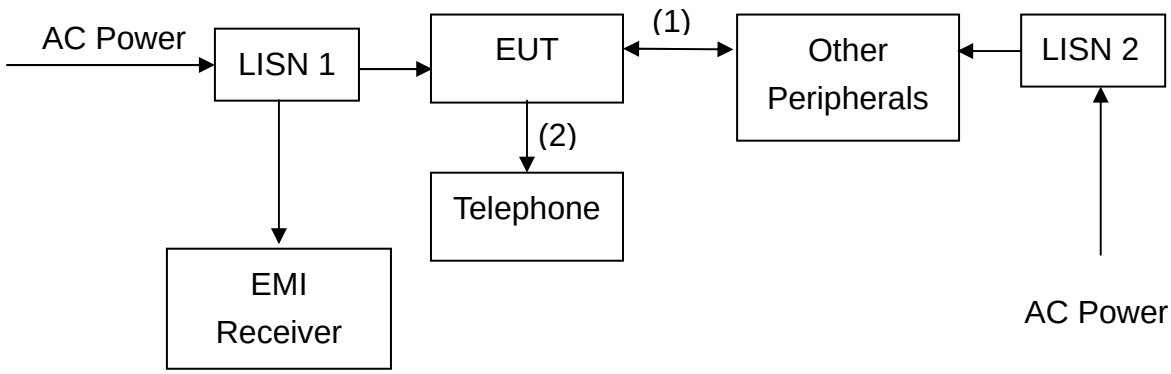
Test Equipment: EC303

Test Procedure and Setup: See Appendix E

E1. Method of Measurement:

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

E2. Test Diagram:



(1) RJ-45 UTP Cat.5 10meter
(2) RJ-11 unshielded cable 3meter

E2. Emission Limit:

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

*Decreases with the logarithm of the frequency.

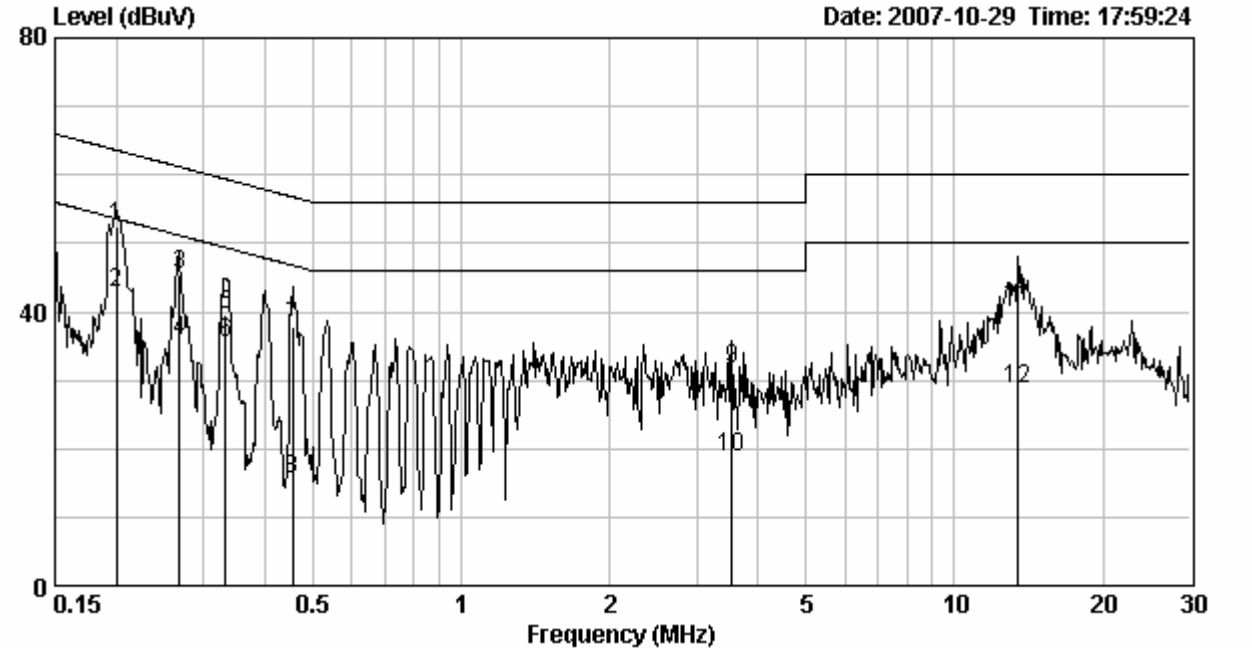
Test Result: Complies
Measurement Data: See Tables & plots below

Note: The EUT was tested while in normal communication mode.

Phase : Line
EUT : MAX-200M1
Test Condition : Normal operating mode
Antenna type : Dipole antenna

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.200	0.80	52.51	63.62	42.79	53.62	-11.11	-10.83
0.269	0.50	45.38	61.16	35.89	51.16	-15.78	-15.27
0.332	0.29	39.51	59.40	35.47	49.40	-19.89	-13.93
0.454	0.10	37.86	56.80	15.57	46.80	-18.94	-31.23
3.547	0.26	31.67	56.00	18.67	46.00	-24.33	-27.33
13.479	0.72	40.77	60.00	28.76	50.00	-19.23	-21.24

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Neutral
EUT : MAX-200M1
Test Condition : Normal operating mode
Antenna type : Dipole antenna

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.200	0.10	51.21	63.62	41.84	53.62	-12.41	-11.78
0.266	0.10	43.80	61.25	35.49	51.25	-17.45	-15.76
0.332	0.10	38.86	59.40	33.90	49.40	-20.54	-15.50
3.140	0.24	29.63	56.00	15.86	46.00	-26.37	-30.14
4.292	0.30	34.28	56.00	20.32	46.00	-21.72	-25.68
13.479	0.47	39.22	60.00	27.28	50.00	-20.78	-22.72

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)

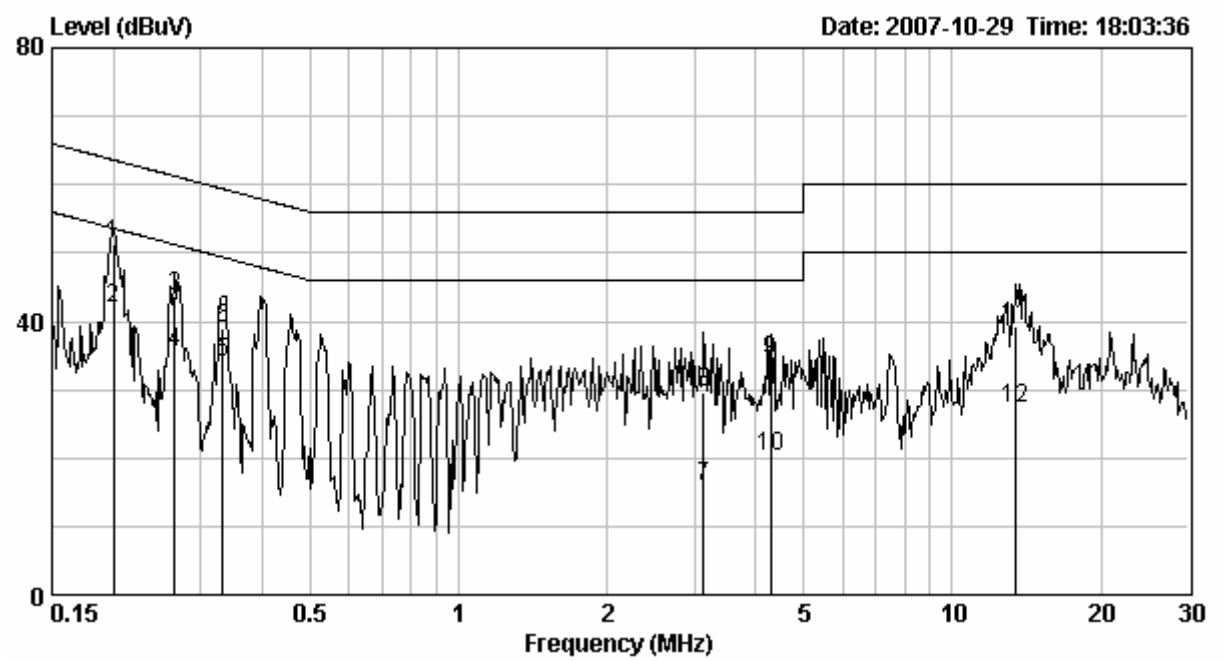
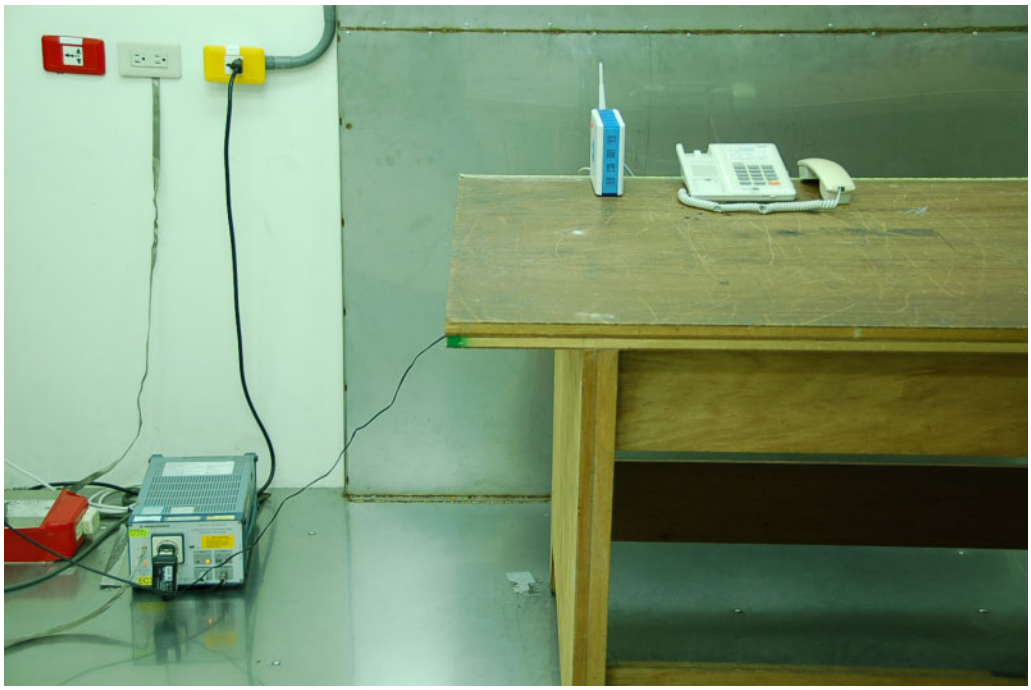
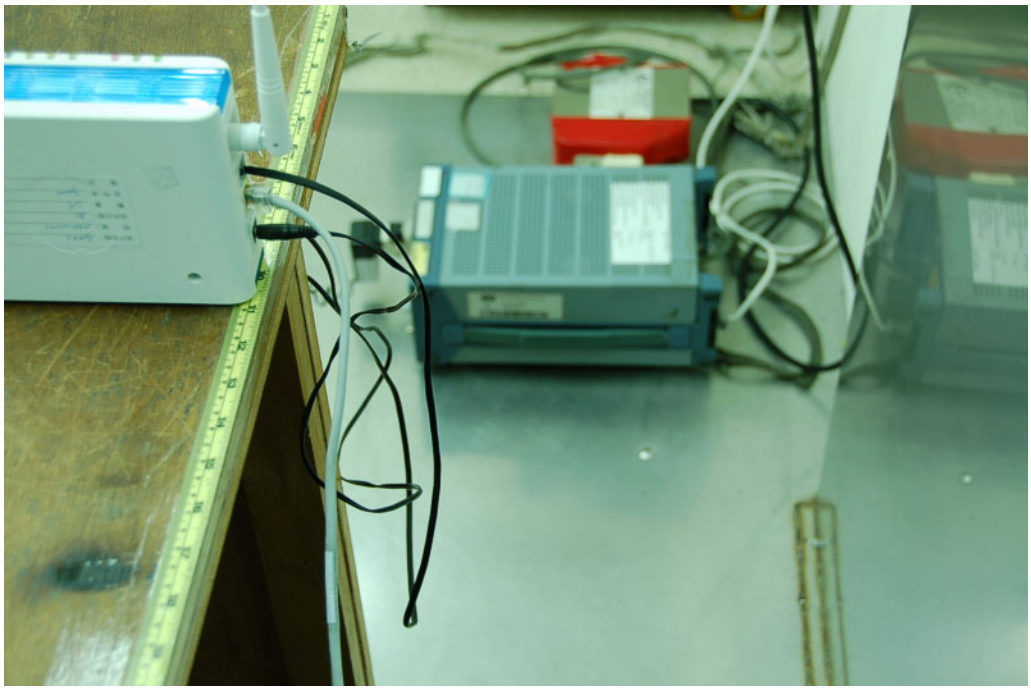


Figure 118. Photos - Conducted Emissions





9. Frequency Stability

Name of Test	Frequency Stability
Base Standard	FCC 2.1055 & 27.54

Tested By: Jimmie Liu
Test Date: N/A

Test Equipment: EC365

Test Result: N/A
Test Procedure and Setup: N/A
Measurement Data: N/A

Note: The EUT has been verified frequency stability of 5MHz and 10MHz Bandwidth, the temperature range from -30℃ ~ +50℃ in normal supplied voltage and the supplied voltage range from 85 to 115 percent of the nominal value in normal temperature. the shift deviation is less than 15ppm.

Normal supply voltage_120V/ 60Hz AC/ DC adapter:
For 5MHz BW

Frequency	Temperature (℃)	Test Results (ppm)
Low	50	1.56
	22	3.65
	-30	-3.79
Middle	50	3.36
	22	-8.88
	-30	4.04
High	50	3.34
	22	5.49
	-30	-0.64

For 10MHz BW

Frequency	Temperature (℃)	Test Results (ppm)
Low	50	1.22
	22	4.95
	-30	2.99
Middle	50	-9.84
	22	10.23
	-30	3.95
High	50	13.94
	22	0.92
	-30	-0.35

Normal temperature_22℃:

For 5MHz BW

Frequency	Mains Voltage (Vac)	Test Results (ppm)
Low	102	-0.34
	120	7.87
	138	4.22
Middle	102	3.95
	120	-9.86
	138	2.19
High	102	0.54
	120	1.33
	138	9.11

For 10MHz BW

Frequency	Mains Voltage (Vac)	Test Results (ppm)
Low	102	-2.22
	120	2.98
	138	3.01
Middle	102	-0.99
	120	-8.74
	138	5.98
High	102	10.53
	120	9.55
	138	6.83

WiMAX Forum™ Mobile System Profile
Release 1.0 Approved Specification

Attachment 1: PHY Profile

4. PHY Profile

4.1 *Profiles of BS and MS*

4.1.1 System Parameters

4.1.1.1 *PHY Mode*

Table 5. PHY Mode

Item	Description	Reference	Status	BS Required	MS Required	Comment
1	OFDMA	8.4	m	Y	Y	OFDMA is the sole PHY mode within the scope of this document.

4.1.1.2 Band Class Index

System profile requirements of this document are applied to the following band class indices. Each index shall specify one frequency range and one or more combinations of channel bandwidth, FFT size, channel raster and duplexing mode.

BS support for a particular band class requires support of a frequency range that is a subset of the complete frequency range defined by the band-class. The BS vendor shall provide a declaration of the supported frequency range. The supported frequency range shall be a minimum of three (3) times the largest supported channel bandwidth. MS must support the entire range of frequency defined by a band class (or sub-bands) while the BS is required to support only sub-range of the band class declared by vendor.

Table 6. Band Class Index

Band Class Index	Frequency Range (GHz)	Channel Frequency Step (kHz)	Channel Bandwidth(s) (MHz)	FFT Size	Duplexing Mode	Comments
1	2.3-2.4	250	5	512	TDD	Both bandwidths must be supported by the MS
			10	1024	TDD	
			8.75	1024	TDD	
2	2.305-2.320, 2.345-2.360	250	3.5	512	TDD	
			5	512	TDD	
			10	1024	TDD	
3	2.496-2.69	250 (200 KHz step size is also	5	512	TDD	Both bandwidths must be supported
			10	1024	TDD	

		recommended for band class 3 in Europe)				to by the MS
4	3.3-3.4	250	5	512	TDD	
			7	1024	TDD	
			10	1024	TDD	
5	3.4-3.8	250	5	512	TDD	
			7	1024	TDD	
			10	1024	TDD	
	3.4-3.6	250	5	512	TDD	
			7	1024	TDD	
			10	1024	TDD	
	3.6-3.8	250	5	512	TDD	
			7	1024	TDD	
			10	1024	TDD	

4.1.1.3 *Sampling Factor*

Table 7. Sampling Factor

Item	Description	Reference	Status	BS Required	MS Required	Comment
1	If channel bandwidth is a multiple of 1.75MHz then n=8/7 else if channel bandwidth is a multiple of any of 1.25, 1.5, 2 or 2.75 MHz then n=28/25 else if not otherwise specified then n=8/7.	8.4.2.3	m	Y	Y	

4.1.1.4 *Cyclic Prefix*

Table 8. Cyclic Prefix

Item	Description	Reference	Status	BS Required	MS Required	Comment
1	1/4	8.4.2.3	oi	N	N	
2	1/8	8.4.2.3	oi	Y	Y	
3	1/16	8.4.2.3	oi	N	N	
4	1/32	8.4.2.3	oi	N	N	

4.1.1.5 *Frame Length*

Table 9. Frame Length

Item	Description	Reference	Status	BS Required	MS Required	Comment
1	20 ms	8.4.5.2	oi	N	N	
2	12.5	8.4.5.2	oi	N	N	
3	10	8.4.5.2	oi	N	N	

Attachment 2: Power Class Profile

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(Revision 1.4.0: 2007-04-12)

7. Power Class Profile

The Power Classes listed in following table is developed to cover the complete target range of power levels while different interpretation of applicable modulation levels is addressed through a dual range requirement for QPSK and 16-QAM per Power Class.

Table 131. Power Classes

Class Identifier	Transmit Power (dBm) for 16-QAM	Transmit Power (dBm) for QPSK	MS Required
Power Class 1	18 <= PTx,max < 21	20 <= PTx,max < 23	oi
Power Class 2	21 <= PTx,max < 25	23 <= PTx,max < 27	oi
Power Class 3	25 <= PTx,max < 30	27 <= PTx,max < 30	oi
Power Class 4	30 <= PTx,max	30 <= PTx,max	oi