EMC
TEST REPORT

CFR 47 FCC Part 2 and Part 27, Subpart C

Report No. : TS08030041-EME

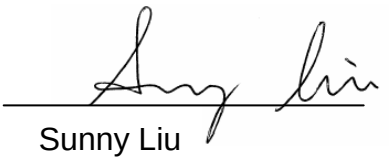
Model No. : MAX-206M2

Issued Date : Mar. 11, 2008

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

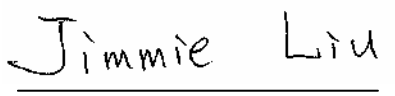
Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,
Shiang-Shan District, Hsinchu City, Taiwan

Report Engineer



Sunny Liu

Project Engineer



Jimmie Liu

Reviewed By

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 Simple CPE-2.5GHz
Model No.	: MAX-206M2
FCC ID.	: I88MAX206M2
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: 5M23G9W For 10MHz:10M14G9W
RF Power Output (EIRP)	: 32.96dBm
Rated Power	: 100-240Vac, 50/60Hz with adapter (Model No.: DSA-36W-12 3 24)
Power Cord	: 3C×18AWG×1.5meter unshielded cable
Sample Received	: Feb. 26, 2008
Test Date(s)	: Mar. 03, 2008 ~ Mar. 10, 2008

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.

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Description of EUT

The EUT is a WiMAX IEEE802.16e Indoor Simple 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

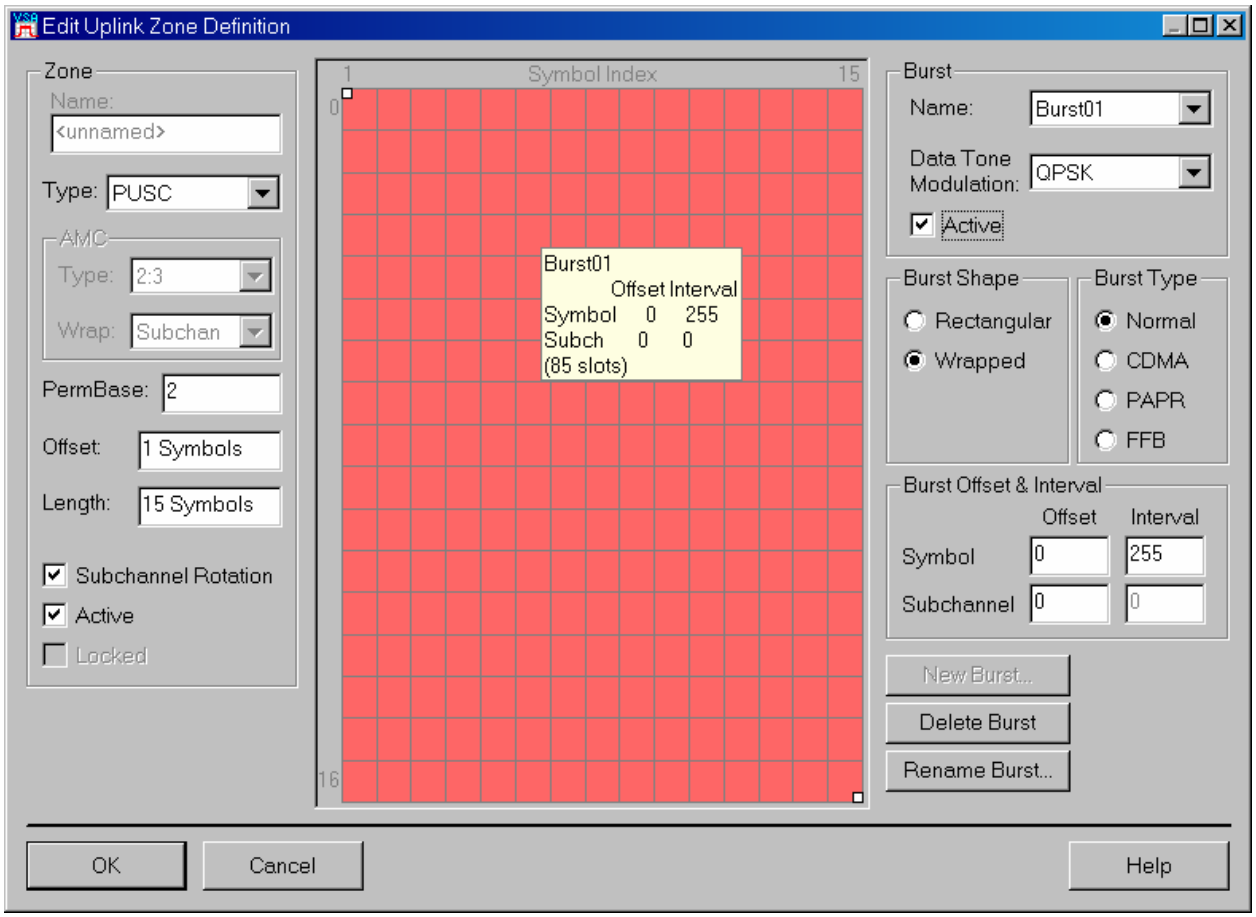
The EUT uses a permanently connected antenna.

Antenna Gain	: 6dBi max
Antenna Type	: PCB Printed antenna
Connector Type	: SMA

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
EC1303	EMI Test Receiver	Rohde & Schwarz	ESCS 30	04/27/2008
EC1353	Spectrum Analyzer	Rohde & Schwarz	FSP 30	08/06/2008
EC1365	Spectrum Analyzer	Rohde & Schwarz	FSEK 30	11/12/2008
EC1354	Signal Generator	Rohde & Schwarz	SMR27	11/01/2008
EC1371	Horn Antenna	SCHWARZBECK	BBHA 9120 D	03/04/2009
EC1351	Horn Antenna	SCHWARZBECK	BBHA 9170	08/08/2008
EC1347	Bilog Antenna	SCHWARZBECK	VULB 9168	08/16/2009
EC1373	Pre-Amplifier	MITEQ	919981	03/07/2009
EC1374	Pre-Amplifier	MITEQ	828825	01/15/2008
EP1346	Controller	HDGmbH	CM 100	N/A
EP1347	Antenna Tower	HDGmbH	MA 2400	N/A
EC1344	LISN	Rohde & Schwarz	ESH3-Z5	03/30/2008
EC1396	Wideband Peak Power Meter/ Sensor	Anritsu	ML2497A/ MA2491A	11/15/2008
EC1363	Temperature Humidity Test Chamber	Juror	TR-4010	09/18/2008
EC1404-1	PSA Series Spectrum Analyzer	Agilent	E4440A	04/26/2008
EP1391	WiMAX Tested	Agilent	N8990A P30	-
EC1404-4	P Series Power Meter	Agilent	N1911A	02/17/2009
EC1404-5	Wide band Power Sensor	Agilent	N1921A	02/17/2009
EC1404-3	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: Mar. 03, 2008
Input Power: 120Vac, 60Hz
Environmental Conditions: 25℃, 65%

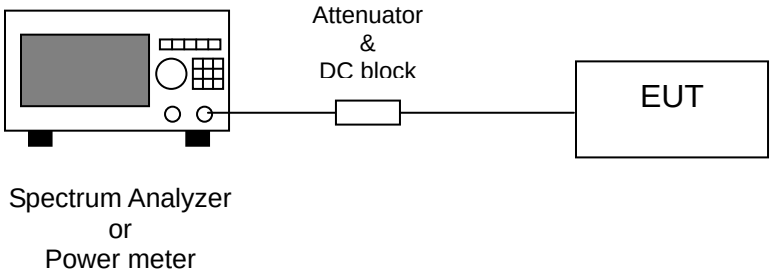
Test Equipment: EC1396

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	20℃, 65%	PCB antenna	QPSK	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	24.96	2	6	32.96	33	5
2590	24.87	2	6	32.87	33	5
2685	23.95	2	6	31.95	33	5
2505	24.92	2	6	32.92	33	10
2590	24.36	2	6	32.36	33	10
2685	23.86	2	6	31.86	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	20℃, 65%	PCB antenna	QPSK	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	24.91	2	6	32.91	33	5
2590	24.68	2	6	32.68	33	5
2685	23.88	2	6	31.88	33	5
2505	24.84	2	6	32.84	33	10
2590	24.29	2	6	32.29	33	10
2685	23.74	2	6	31.74	33	10

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

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	20℃, 65%	PCB antenna	16QAM	1/2

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	24.85	2	6	32.85	33	5
2590	24.52	2	6	32.52	33	5
2685	23.71	2	6	31.71	33	5
2505	24.53	2	6	32.53	33	10
2590	24.11	2	6	32.11	33	10
2685	23.58	2	6	31.58	33	10

Input Power	Environmental Conditions	Antenna Type	Modulation	Coding Rate
120Vac, 60Hz	20℃, 65%	PCB antenna	16QAM	3/4

Frequency (MHz)	Power Meter Reading (dBm)	Cable Loss (dB)	Ant. Gain (dBi)	EIRP (dBm)	Limit (dBm)	Band Width (MHz)
2500	24.77	2	6	32.77	33	5
2590	24.48	2	6	32.48	33	5
2685	23.65	2	6	31.65	33	5
2505	24.41	2	6	32.41	33	10
2590	24.08	2	6	32.08	33	10
2685	23.37	2	6	31.37	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: Mar. 10, 2008
Input Power: 120Vac, 60Hz
Environmental Conditions: 23℃, 65%

Test Equipment: EC1353

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 PCB antenna:

QPSK 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	31.87
Middle	2590	30.57
High	2685	28.26

QPSK 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	31.23
Middle	2590	30.22
High	2685	28.21

16QAM 1/2_5MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2500	30.66
Middle	2590	29.91
High	2685	27.75

16QAM 1/2_10MHz BW

Channel	Frequency (MHz)	EIRP (dBm)
Low	2505	30.37
Middle	2590	29.42
High	2685	27.39

6. Occupied Bandwidth

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

Tested By: Jimmie Liu
Test Date: Mar. 03, 2008
Input Power: 120Vac, 60Hz
Environmental Conditions: 23℃, 65%

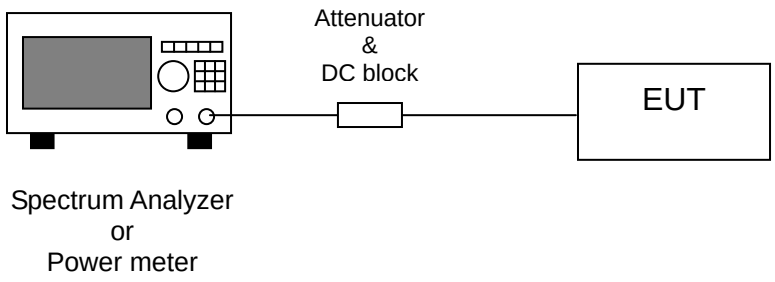
Test Equipment: EC1365

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.

Frequency (MHz)	Bandwidth (MHz)
2500	5.19
2590	5.15
2685	5.23
2505	9.98
2590	9.78
2685	10.14

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

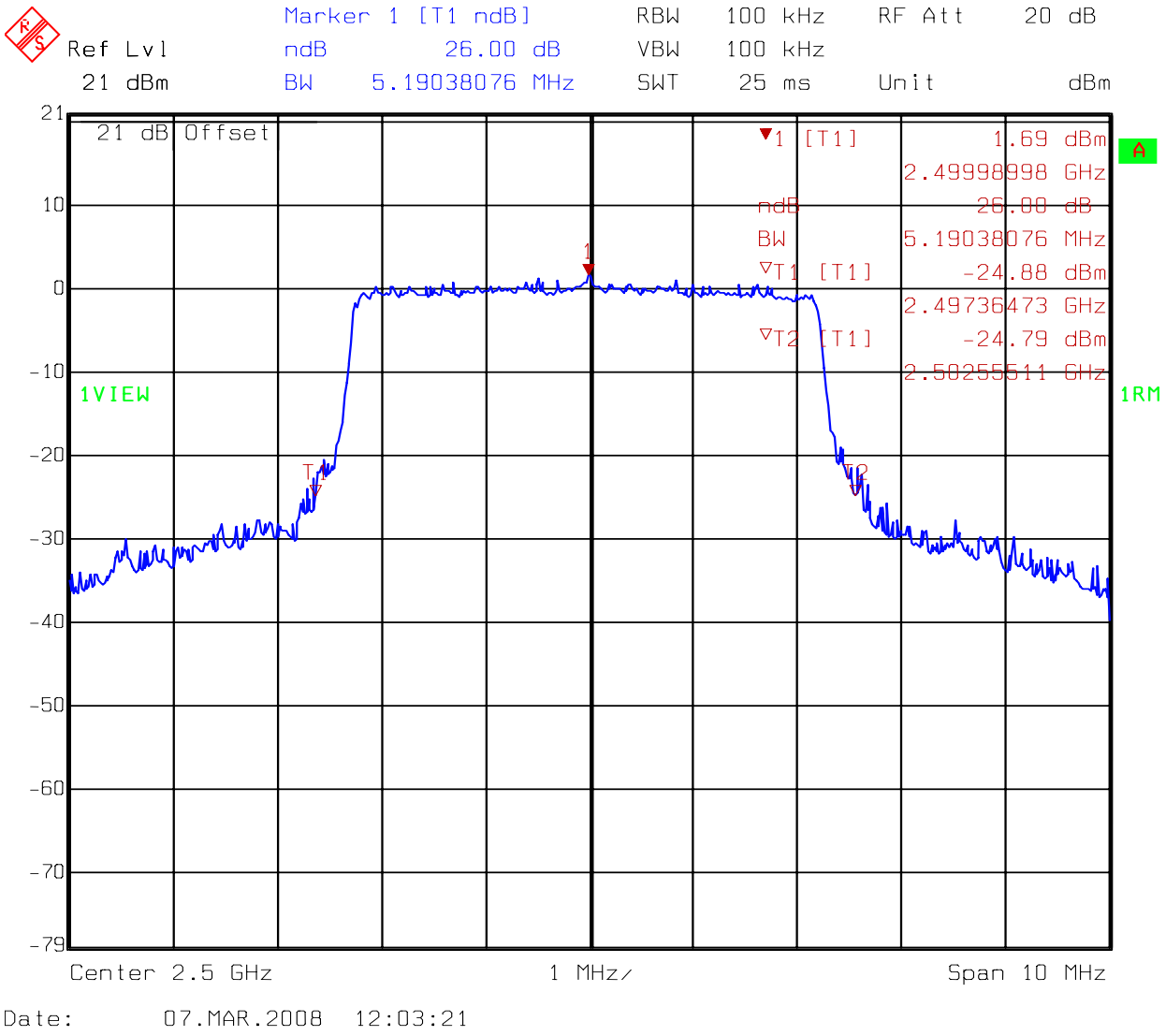


Figure 2. Occupied Bandwidth @ middle channel (5MHz)

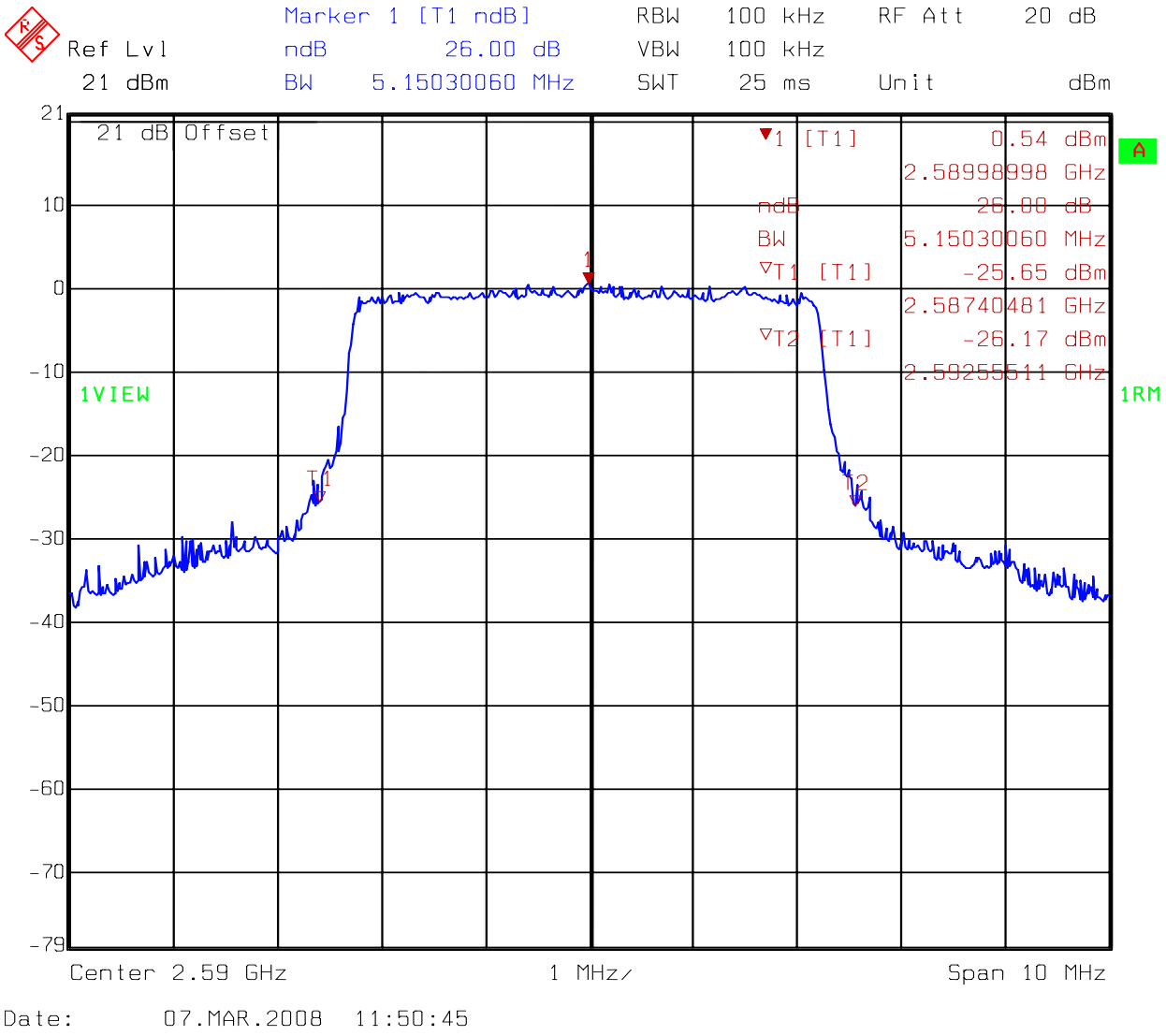


Figure 3. Occupied Bandwidth @ high channel (5MHz)

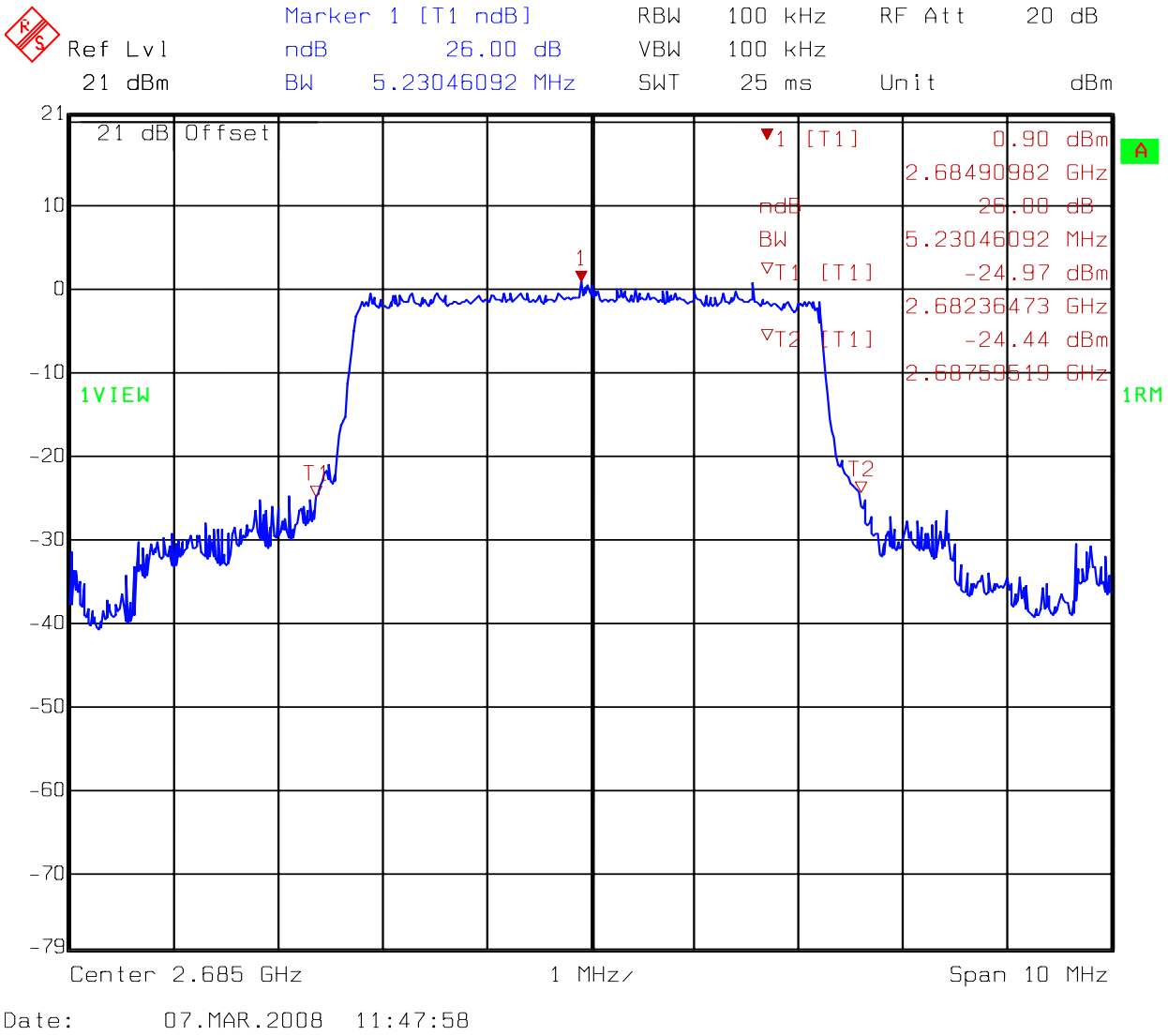


Figure 4. Occupied Bandwidth @ low channel (10MHz)

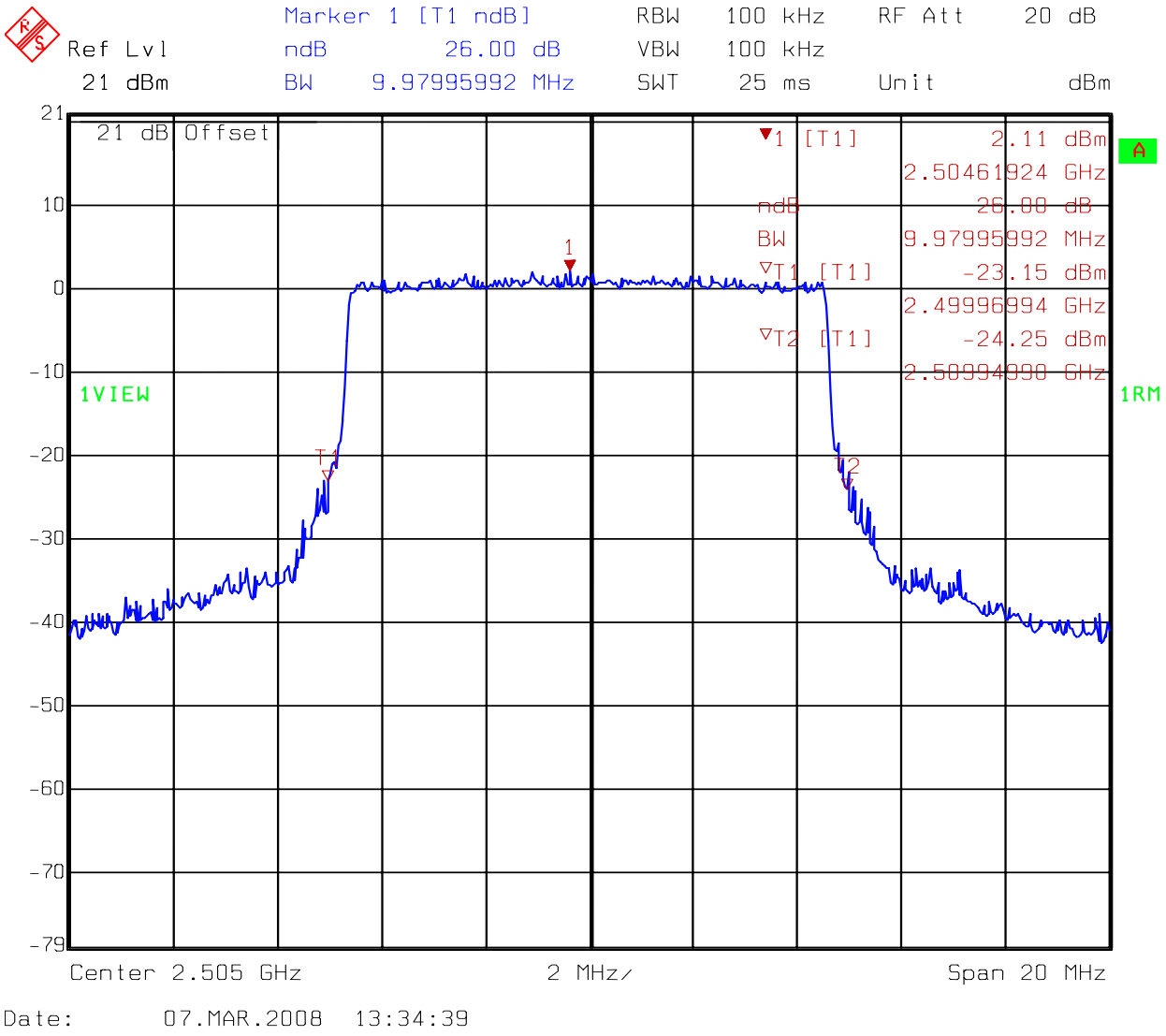


Figure 5. Occupied Bandwidth @ middle channel (10MHz)

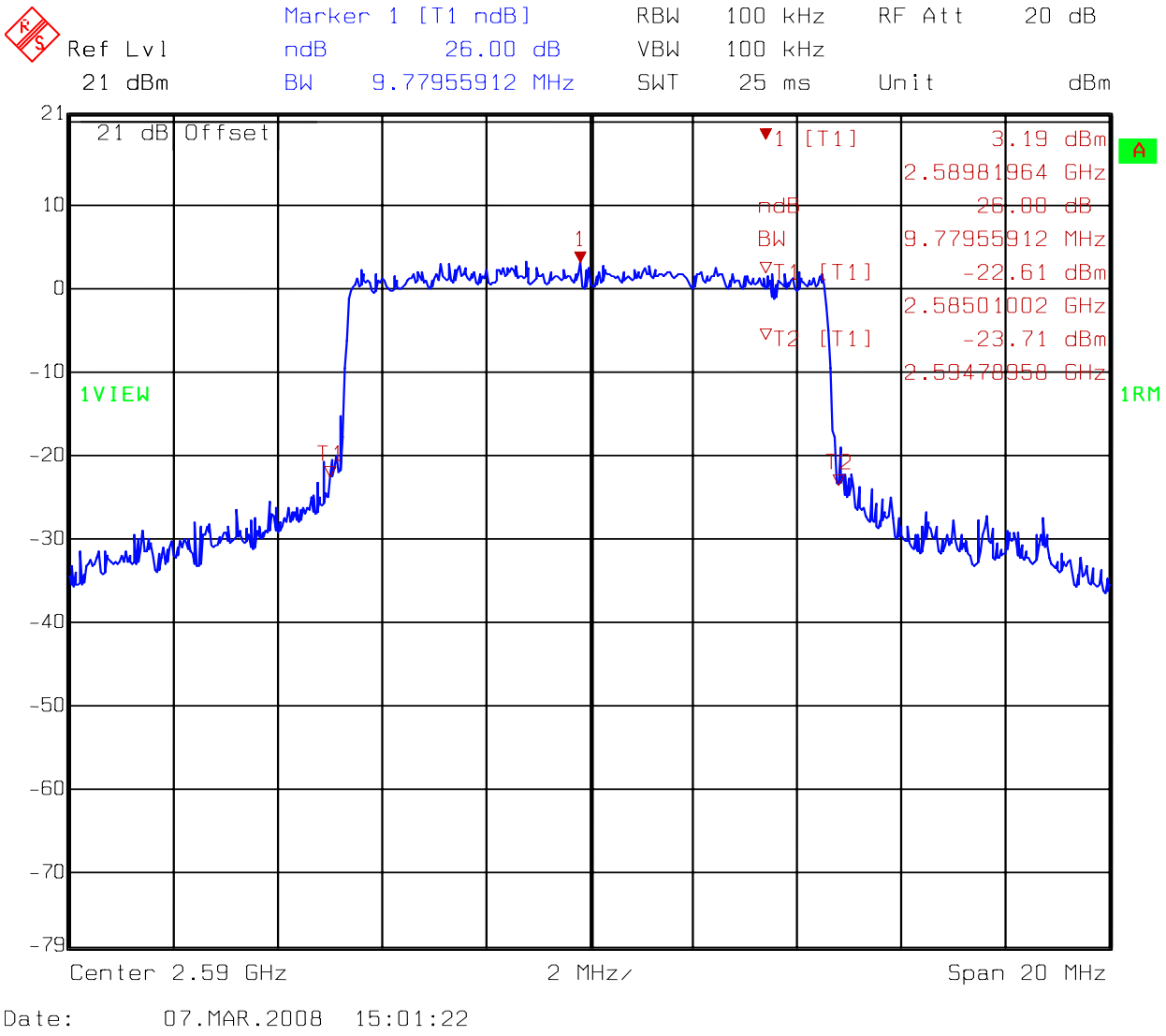
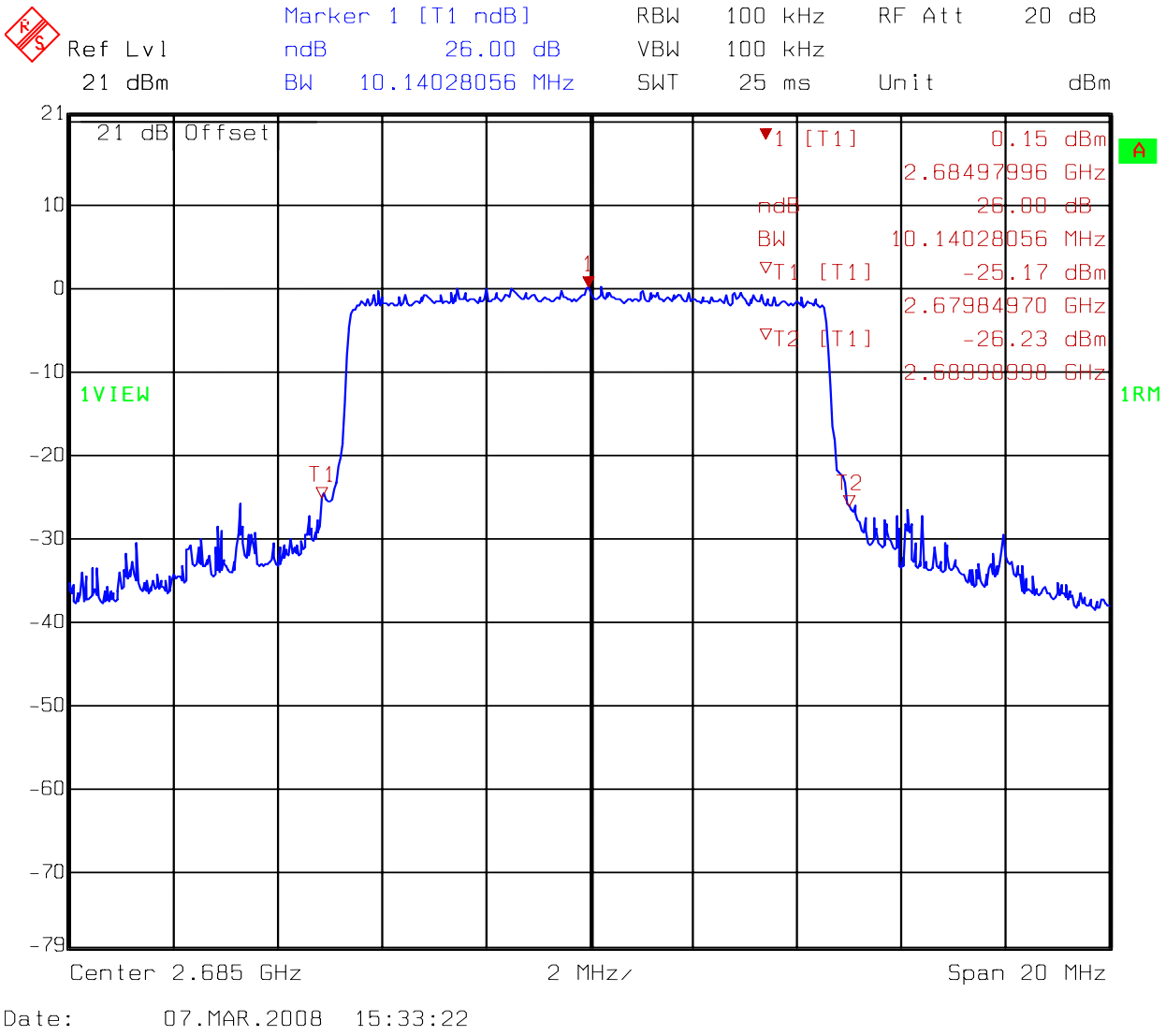


Figure 6. Occupied Bandwidth @ high channel (10MHz)



7. Spurious Emissions at Antenna Terminals

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

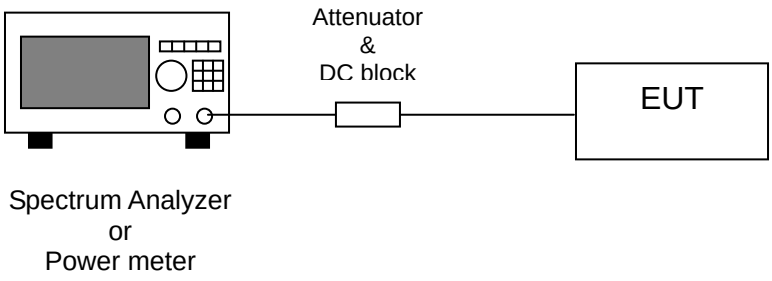
Tested By: Jimmie Liu
Test Date: Oct. 22, 2007
Input Power: 120Vac, 60Hz
Environmental Conditions: 26℃, 65%

Test Equipment: EC1365

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.

Figure 7. Lower Band Edge (5MHz)

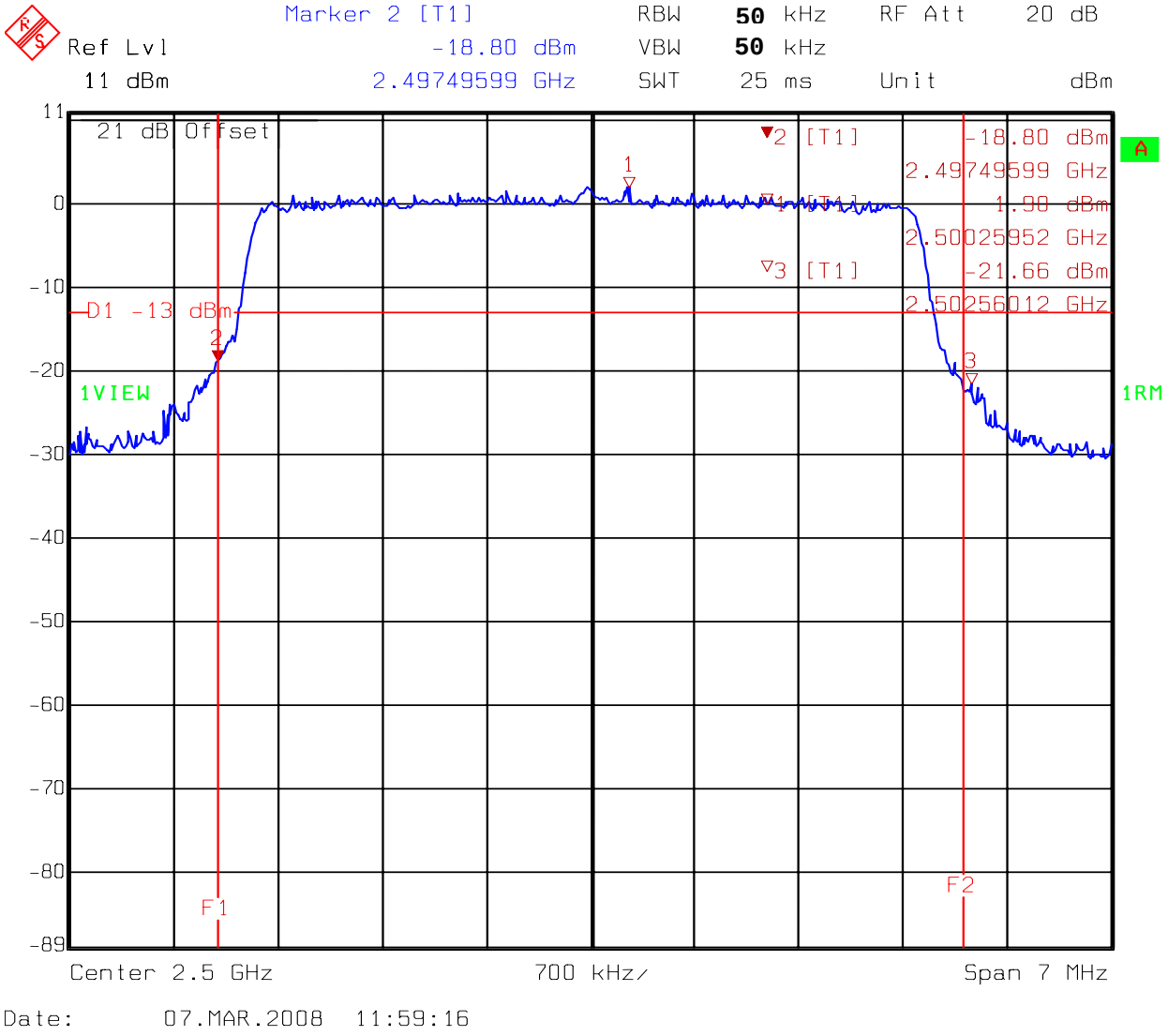


Figure 8. Upper Band Edge (5MHz)

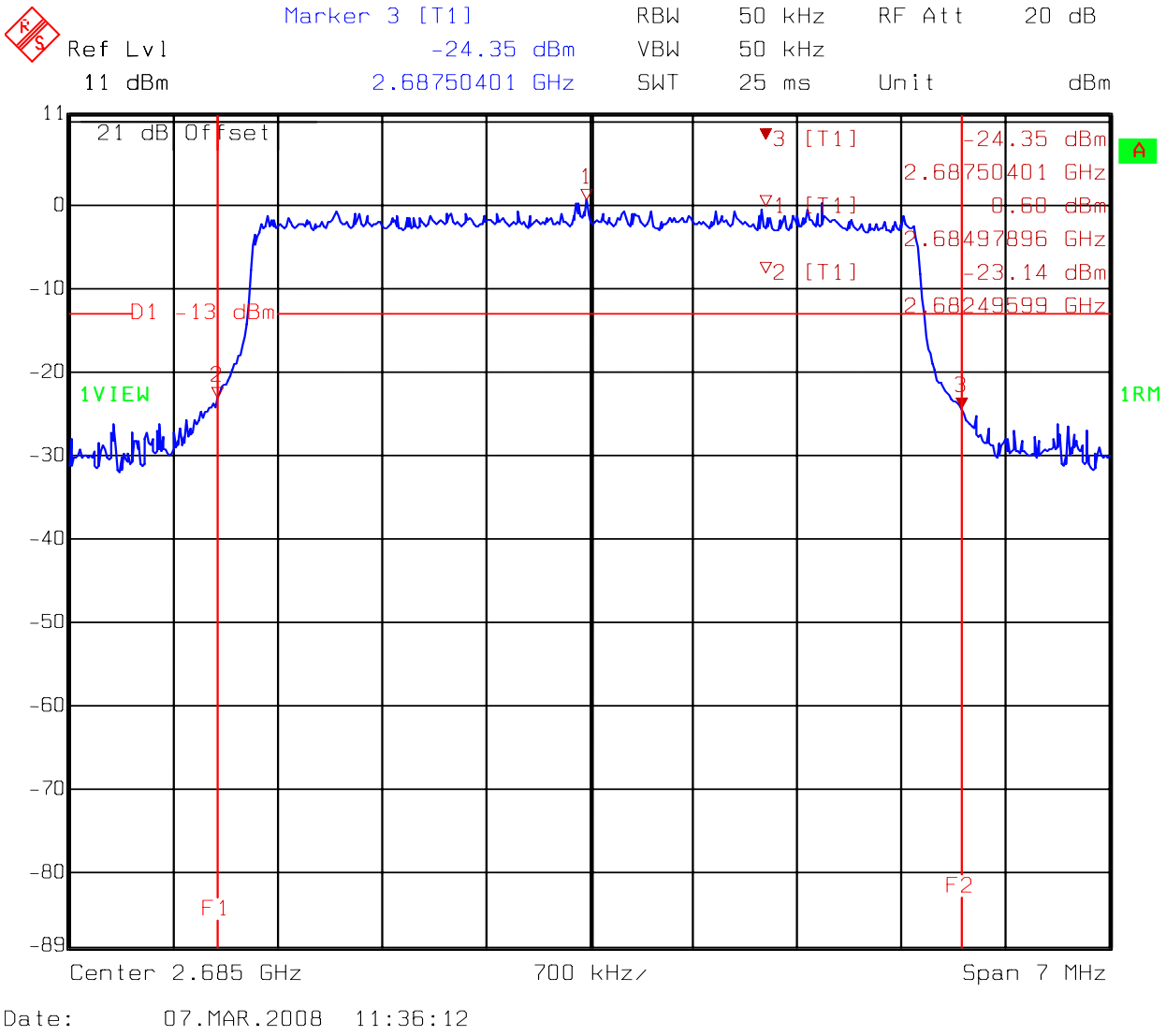


Figure 9. Lower Band Edge (10MHz)

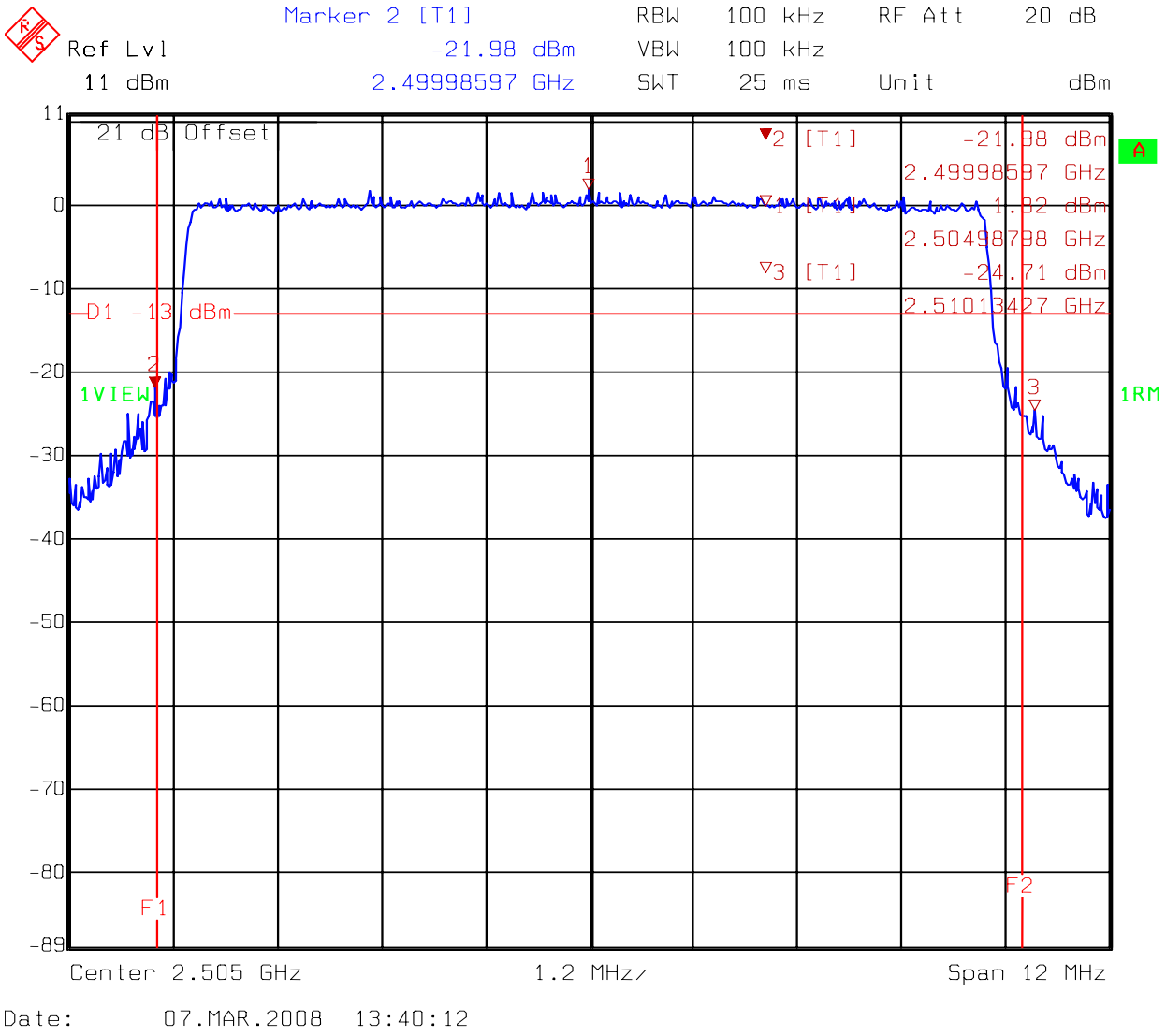


Figure 10. Upper Band Edge (10MHz)

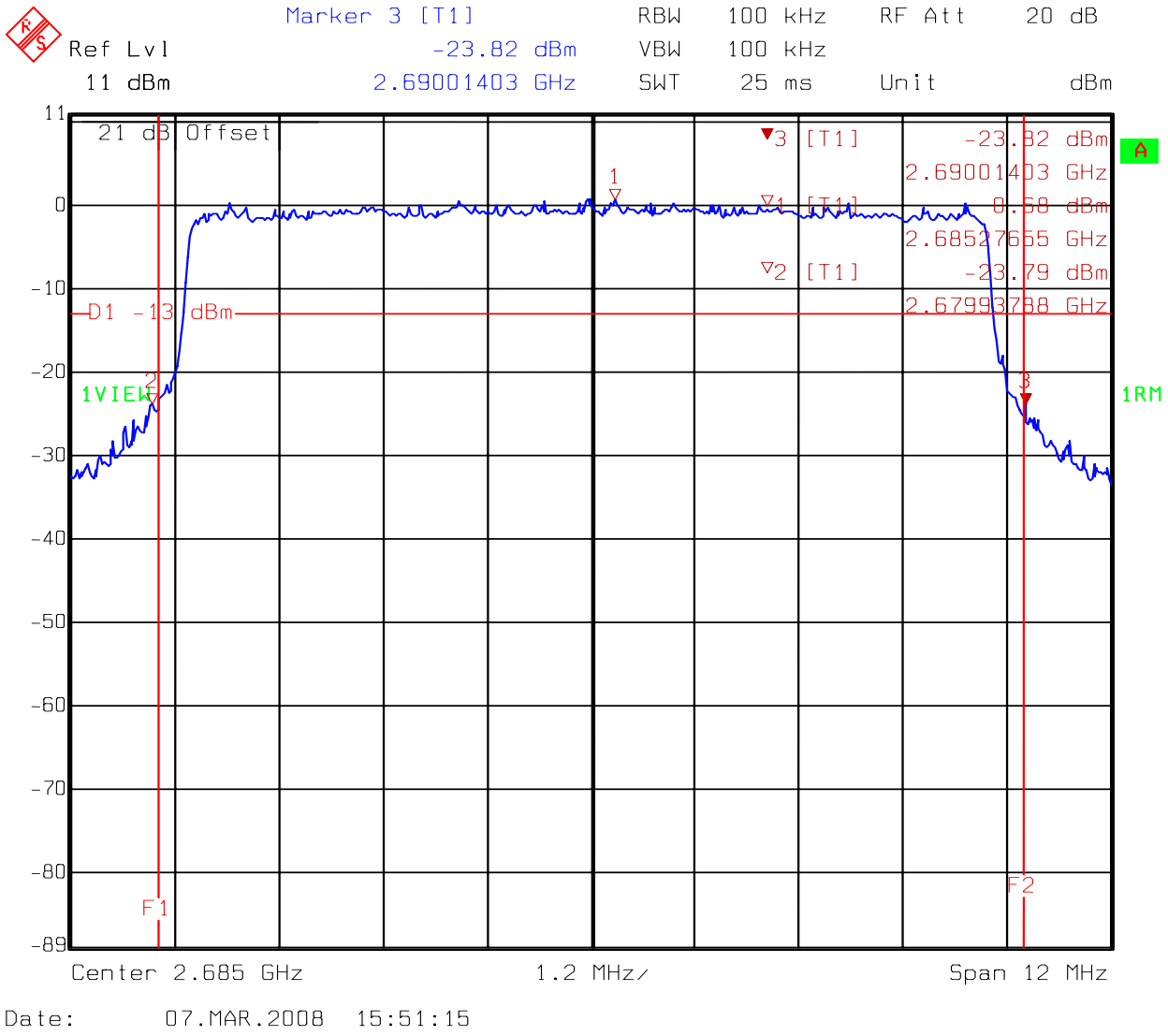


Figure 11. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 1 of 8

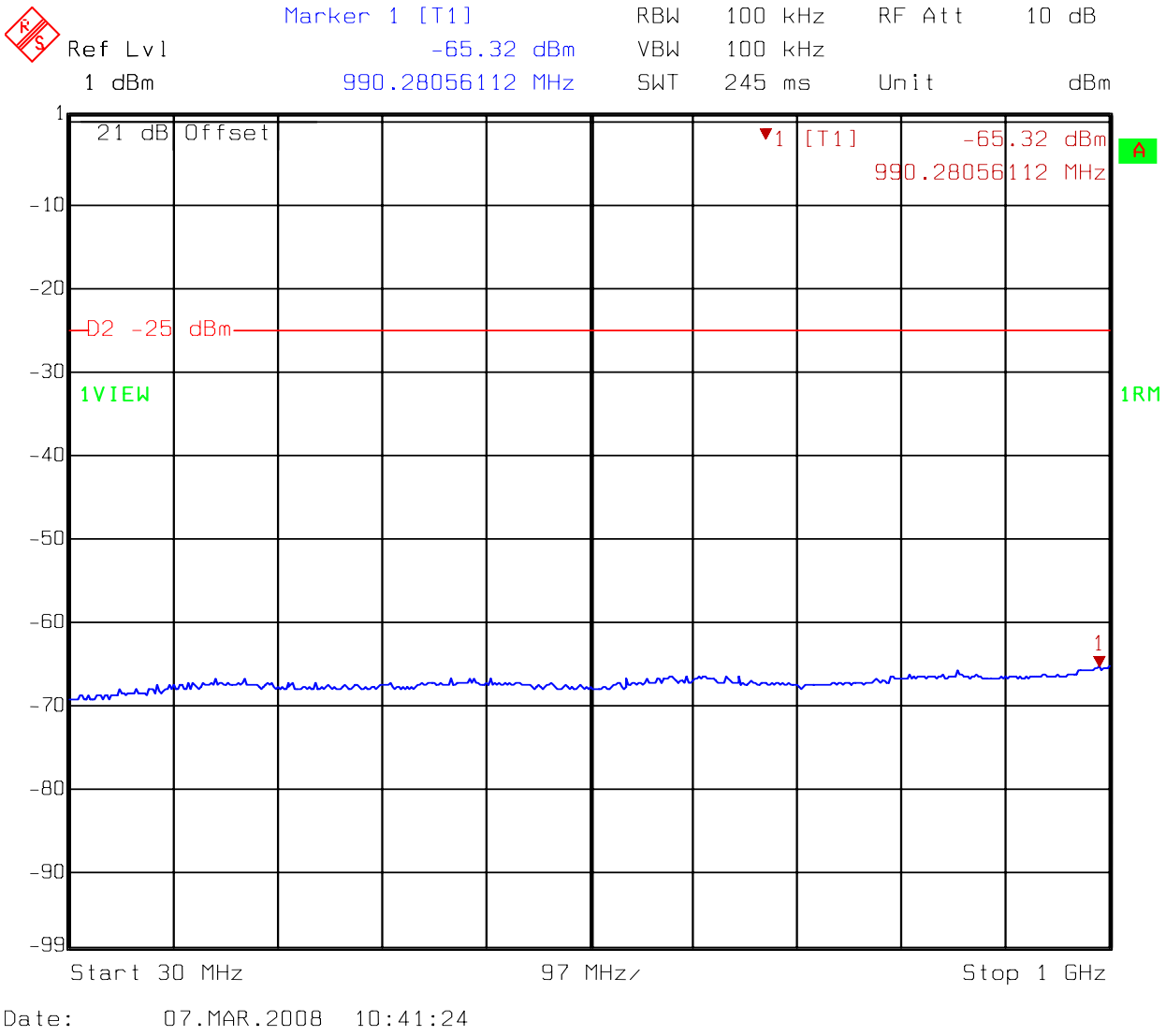


Figure 12. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 2 of 8

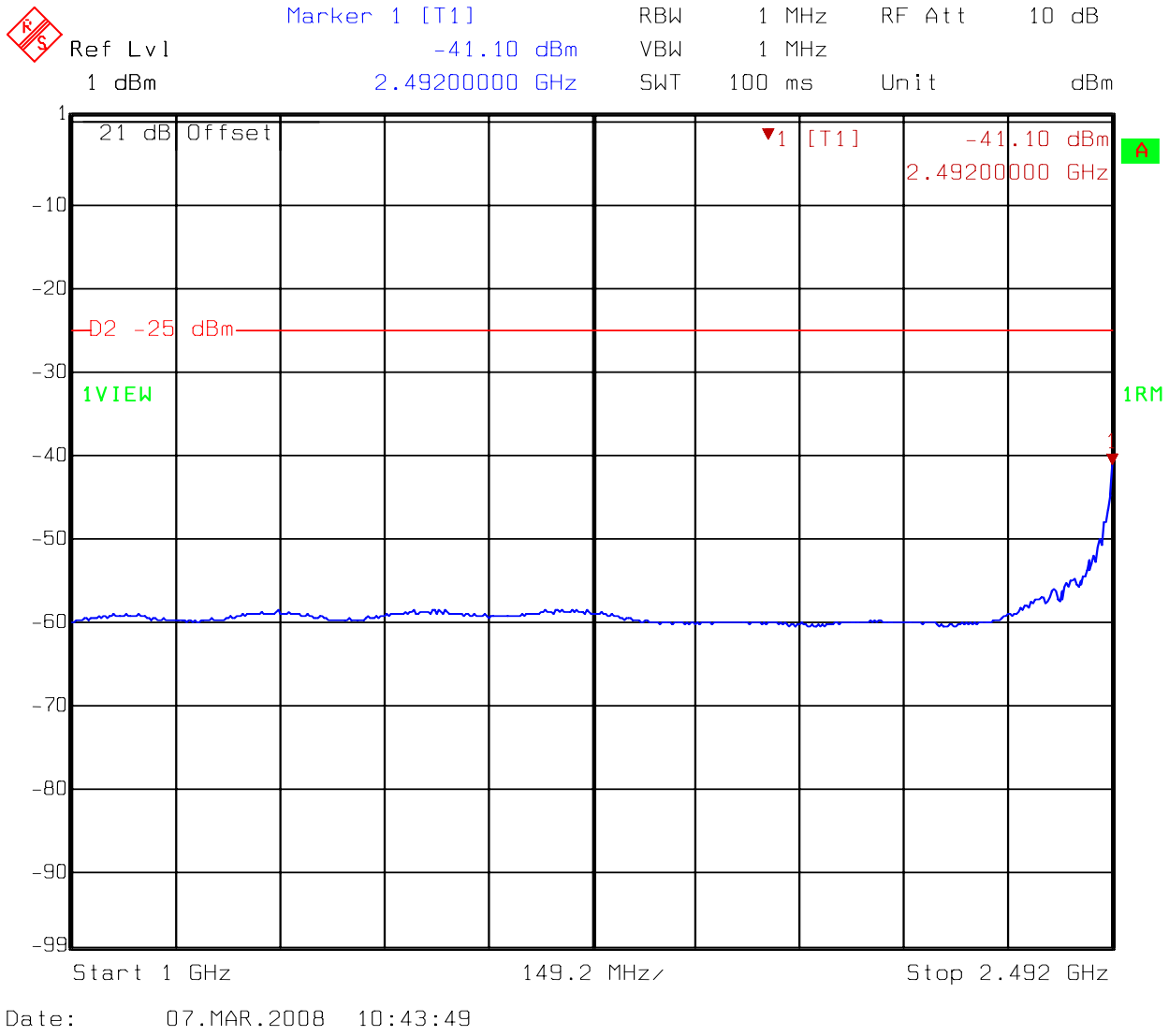


Figure 13. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 3 of 8

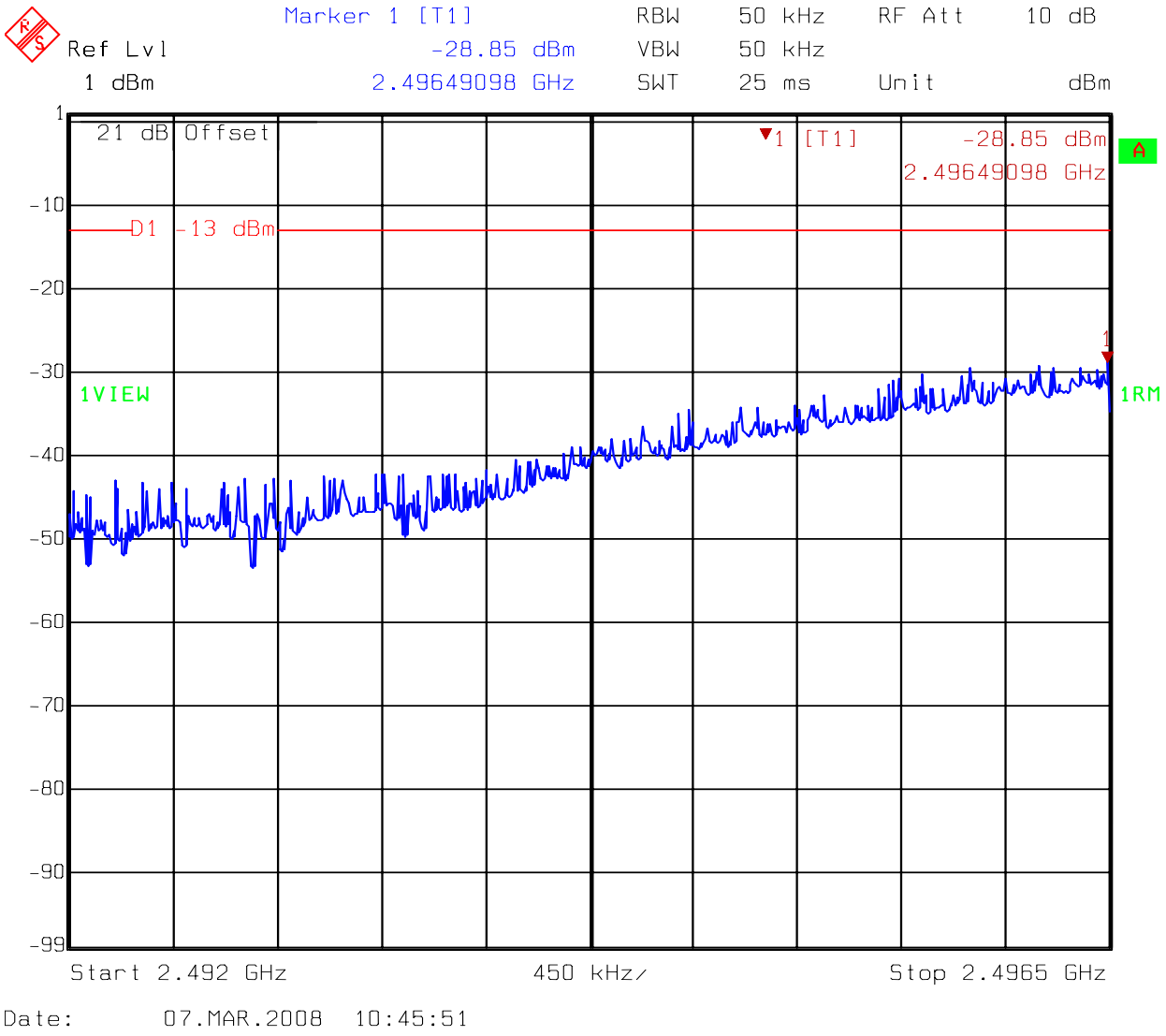


Figure14. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 4 of 8

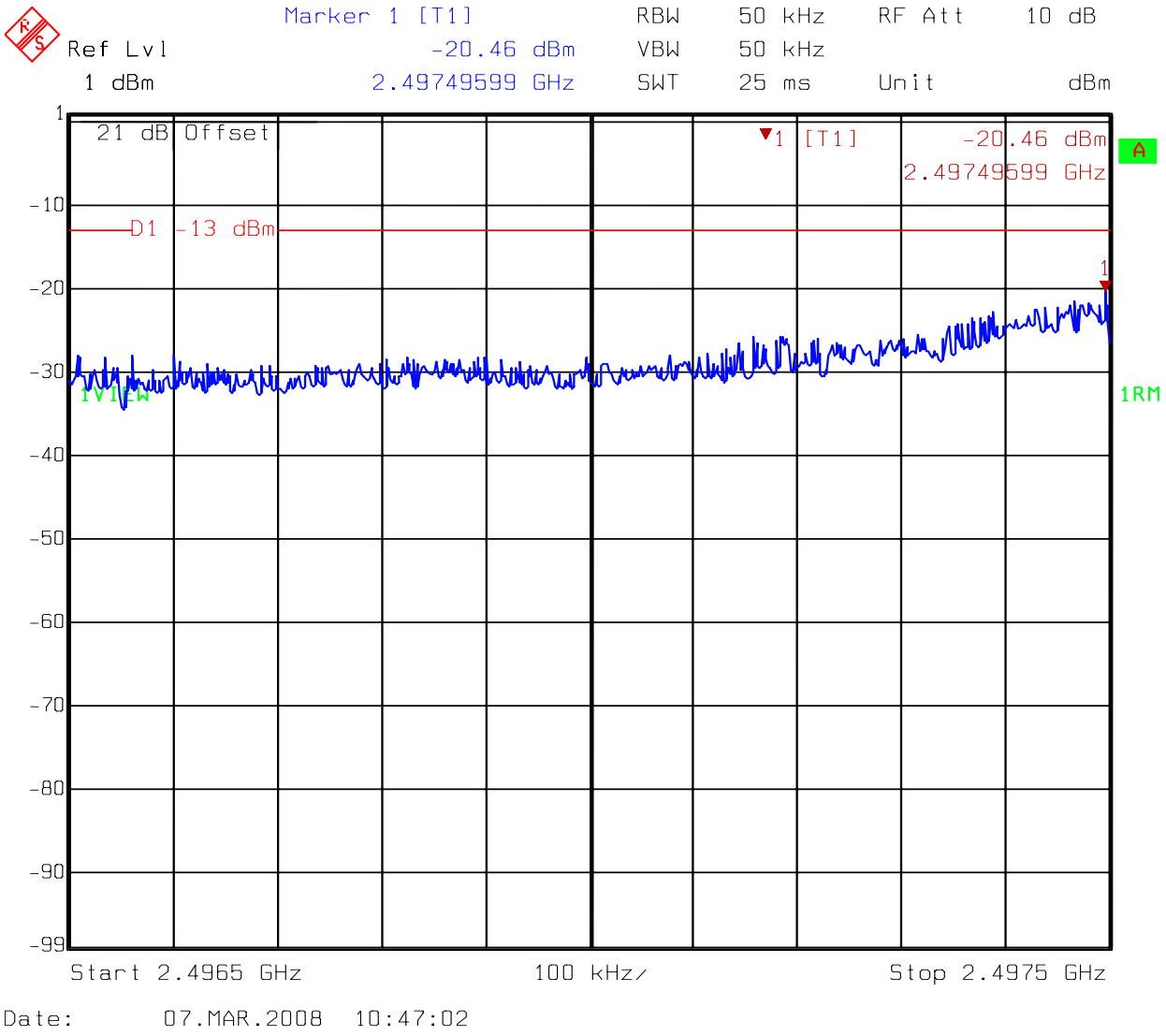


Figure 15. Spurious Emission at Antenna Terminals @ low channel (5MHz) – 5 of 8

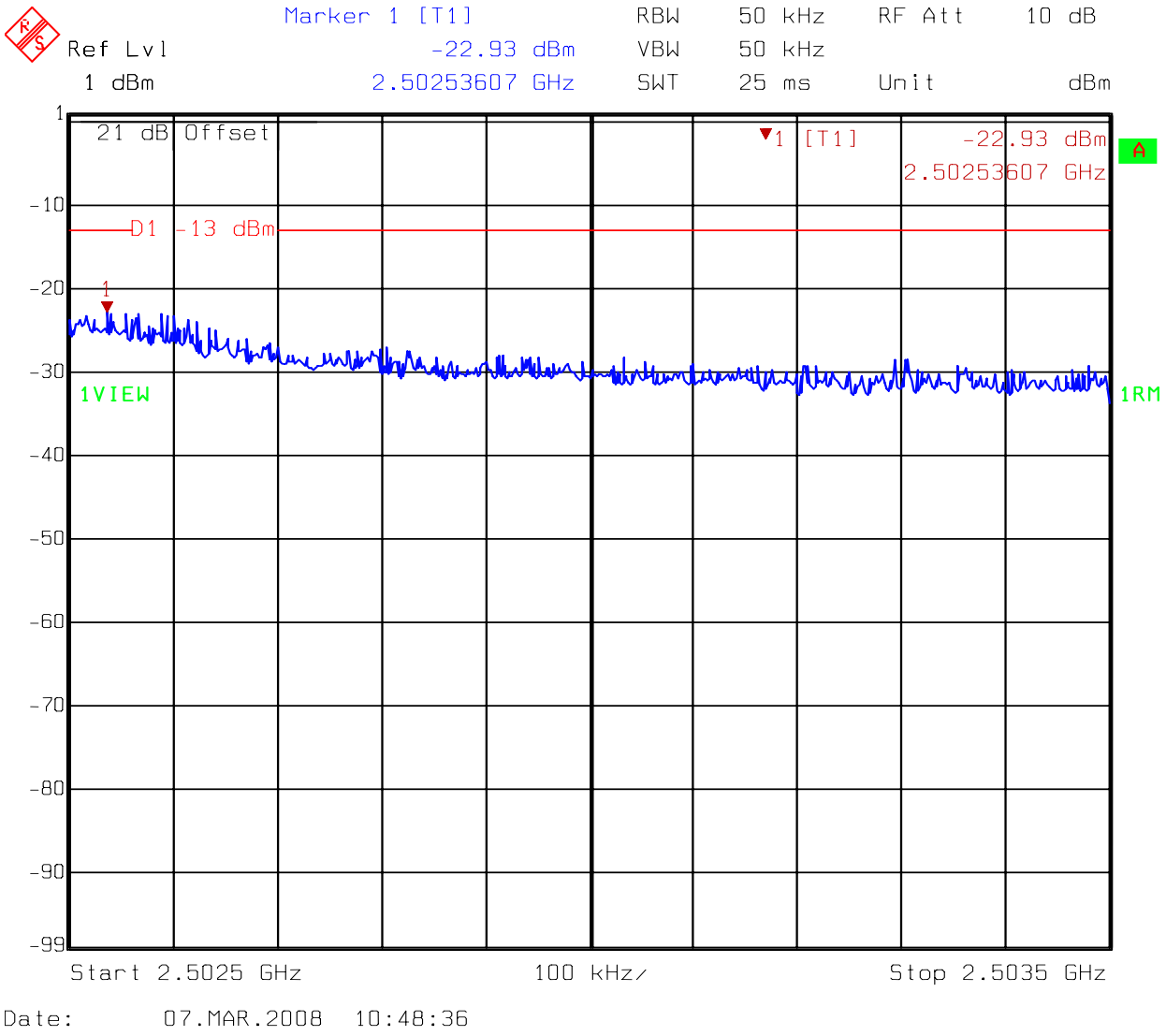


Figure 16. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 6 of 8

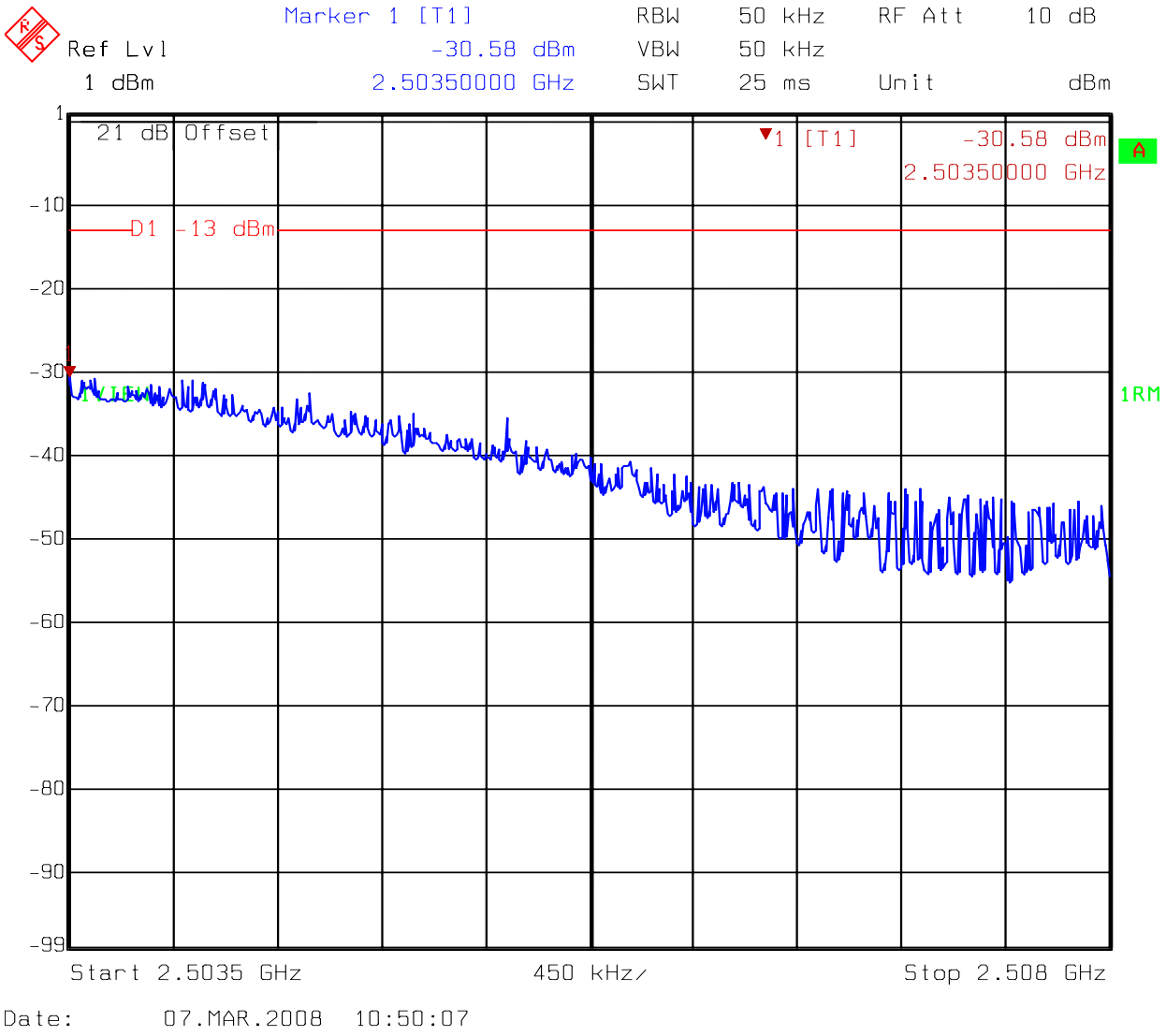


Figure 17. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 7 of 8

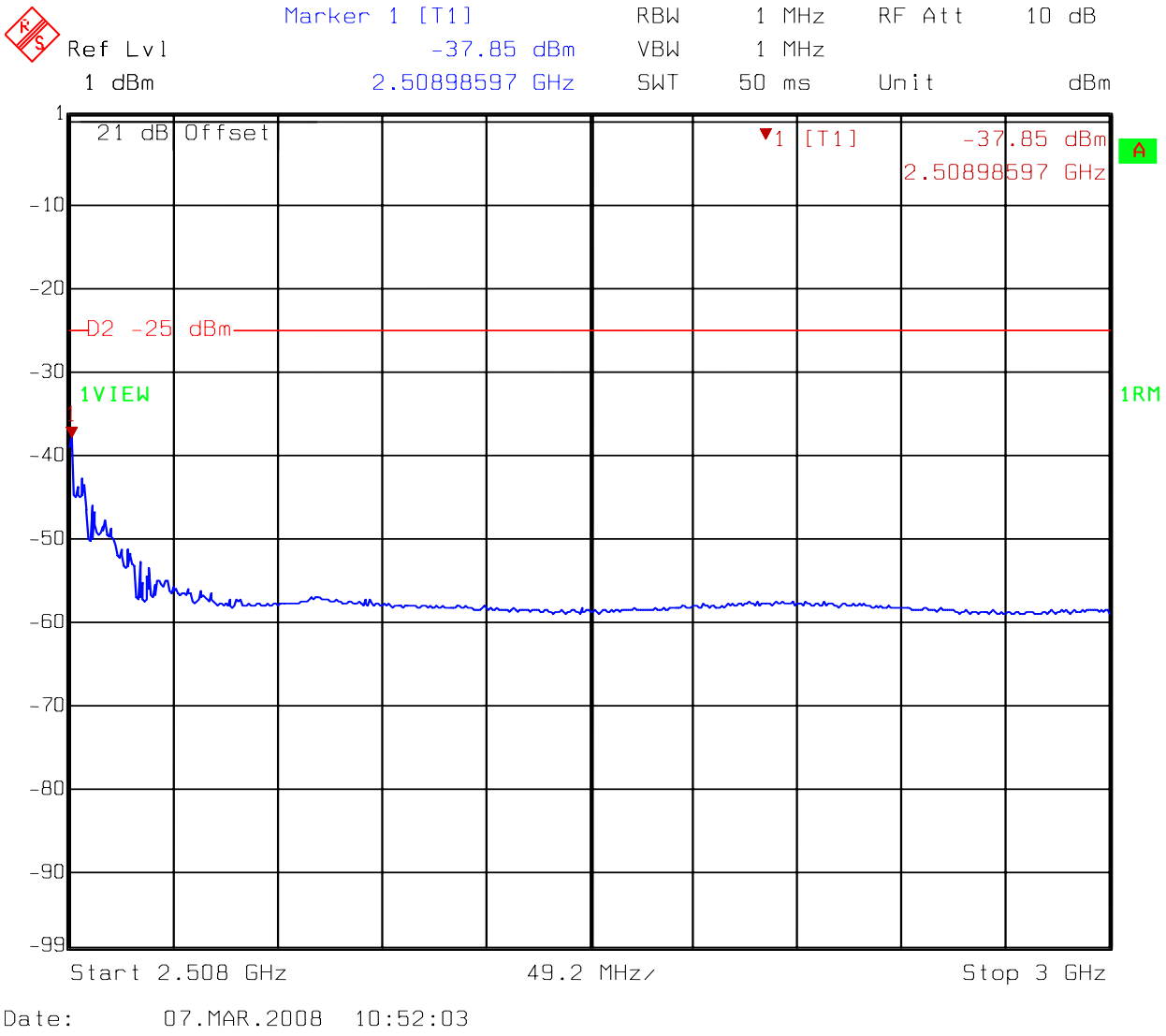


Figure 18. Spurious Emission at Antenna Terminals @ low channel (5MHz) - 8 of 8

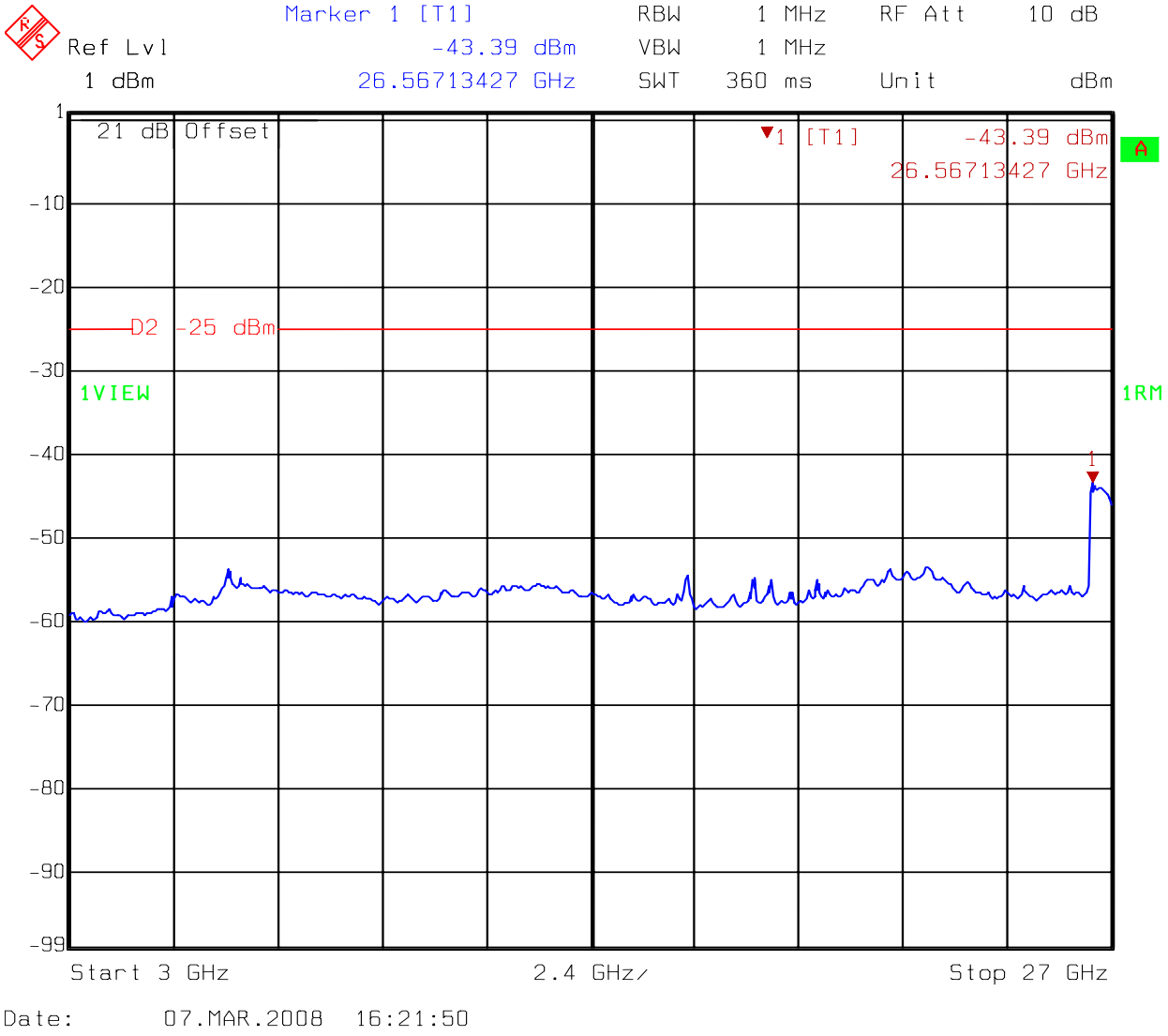


Figure 19. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 1 of 8

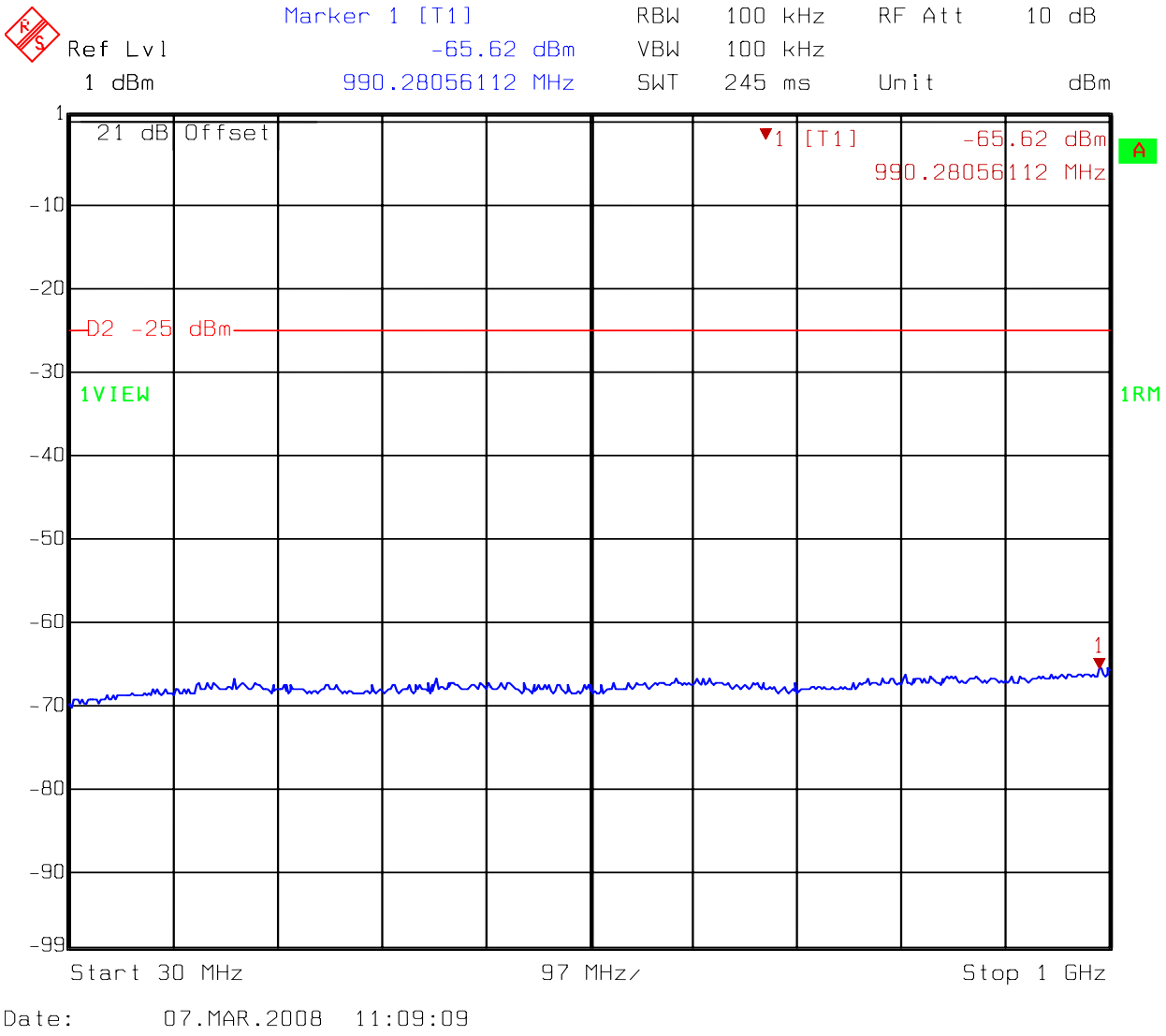


Figure 20. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 2 of 8

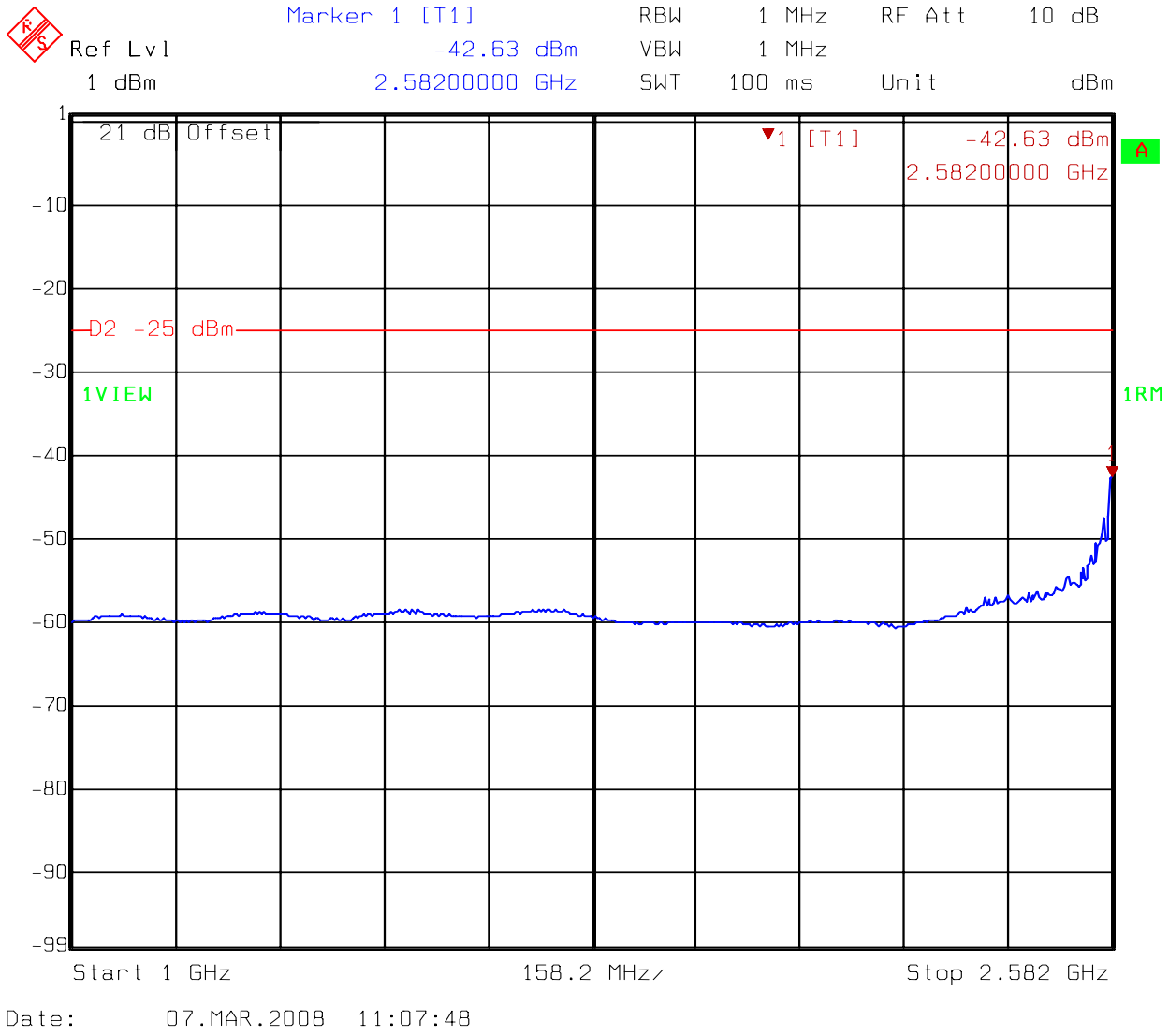


Figure 21. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 3 of 8

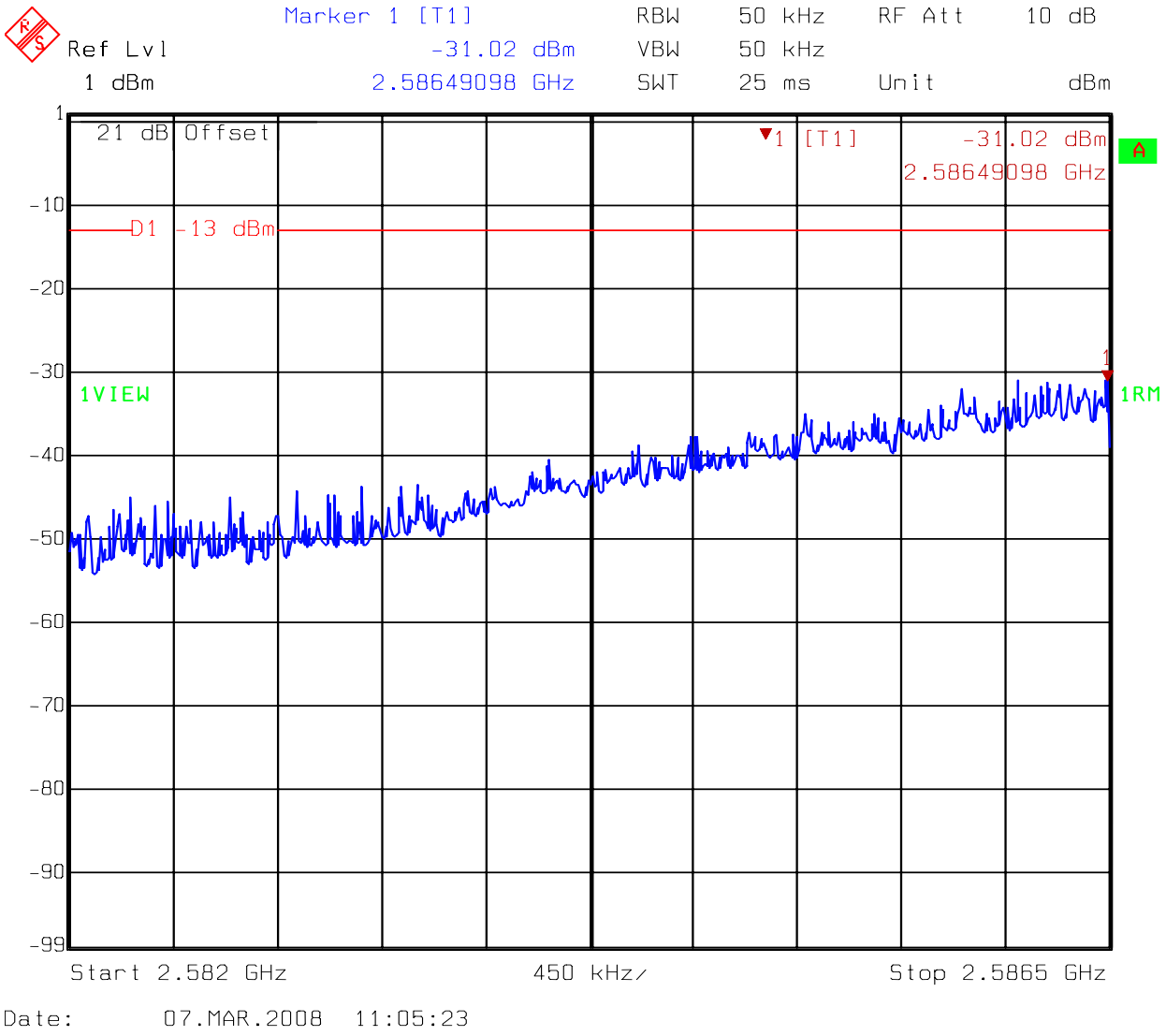


Figure 22. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 4 of 8

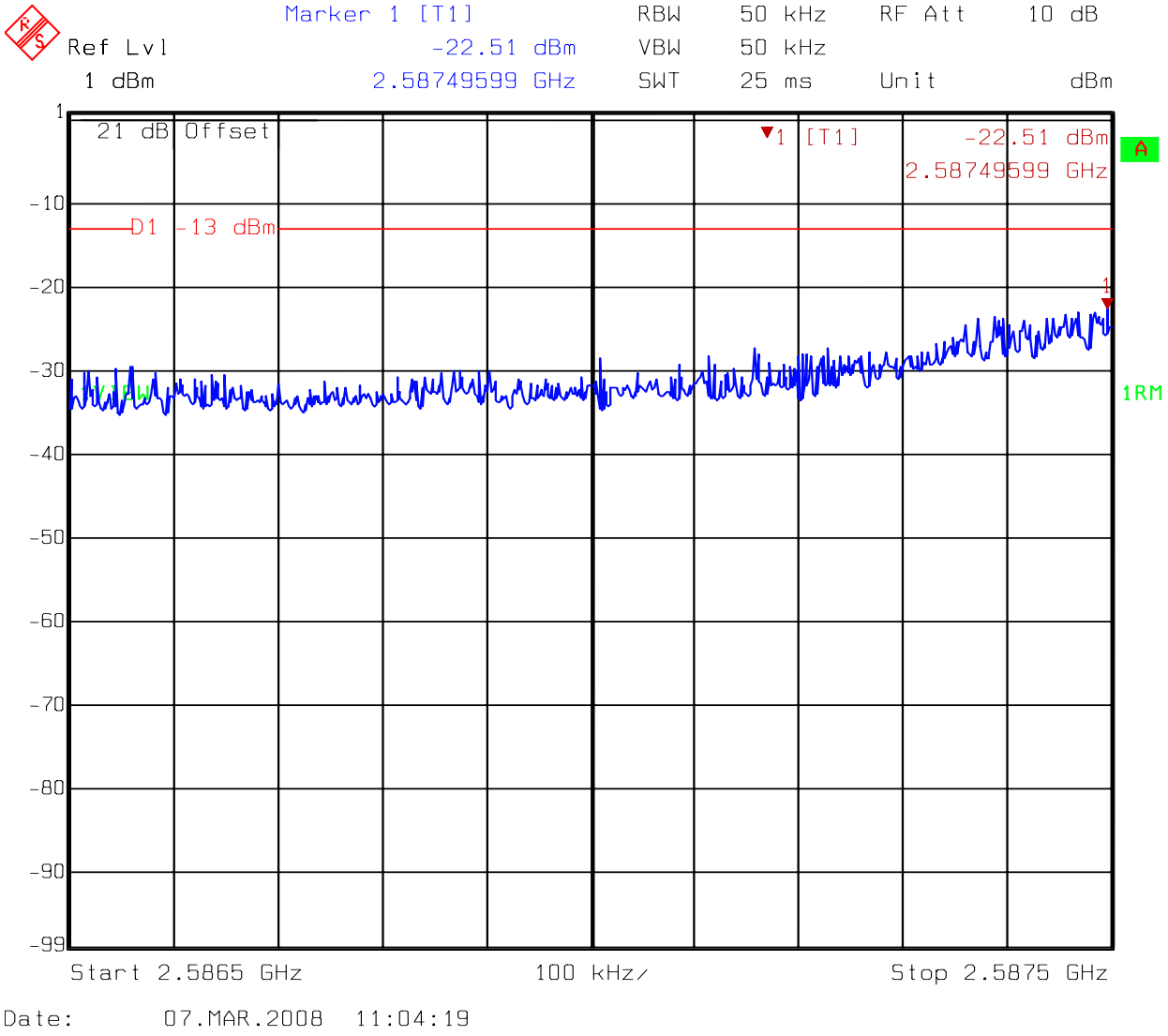


Figure 23. Spurious Emission at Antenna Terminals @ middle channel (5MHz) – 5 of 8

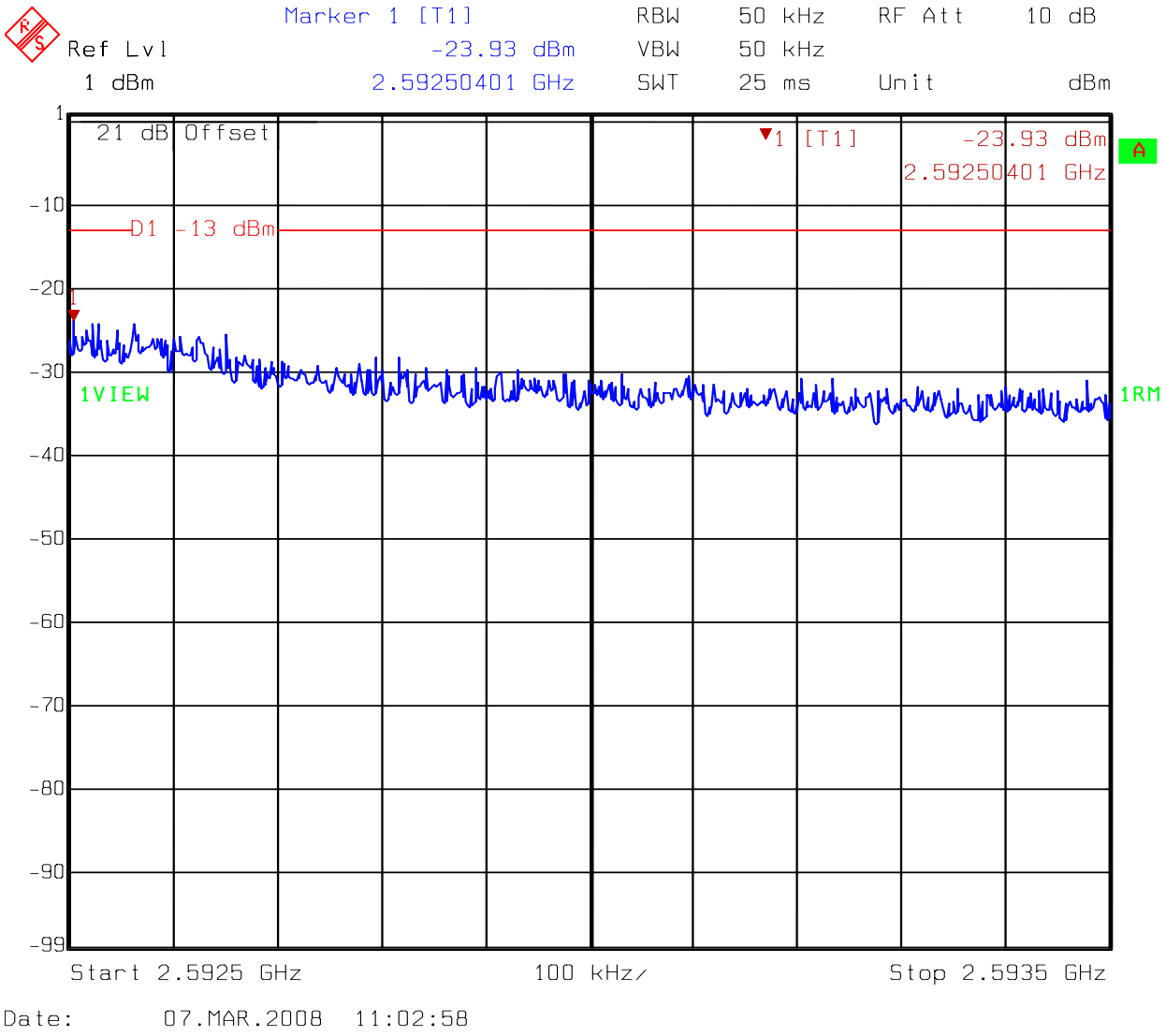


Figure 24. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 6 of 8

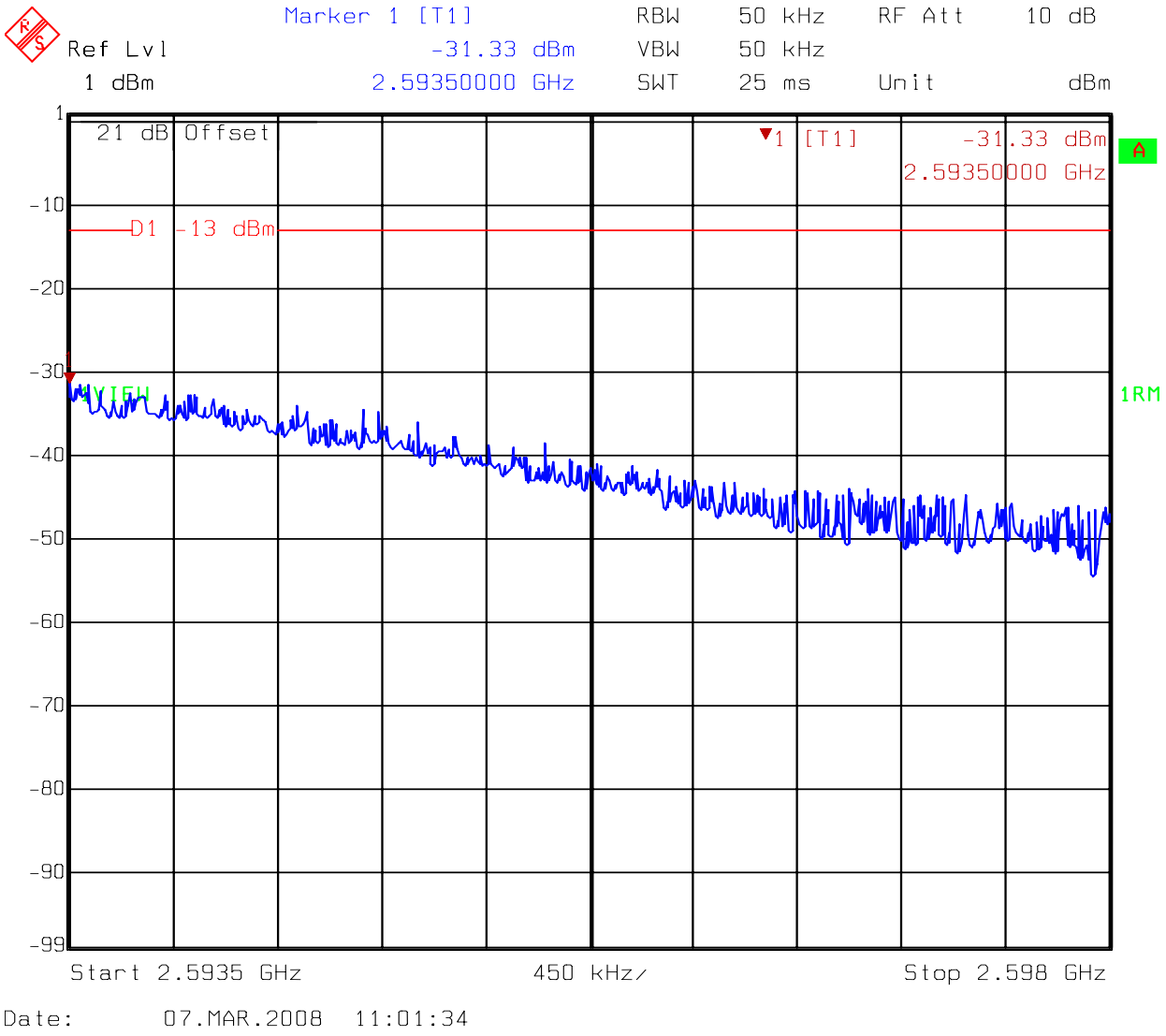


Figure 25. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 7 of 8

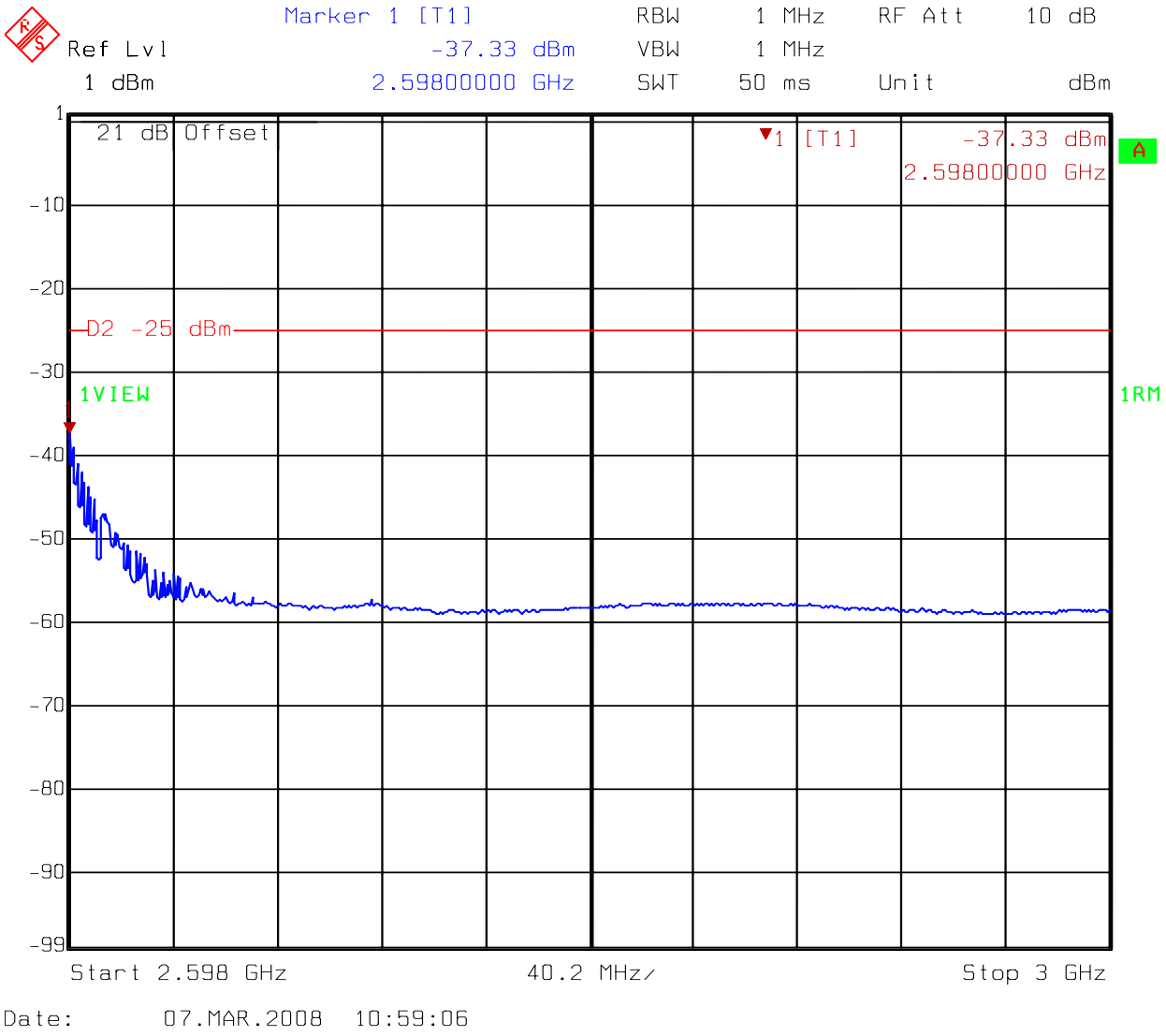


Figure 26. Spurious Emission at Antenna Terminals @ middle channel (5MHz) - 8 of 8

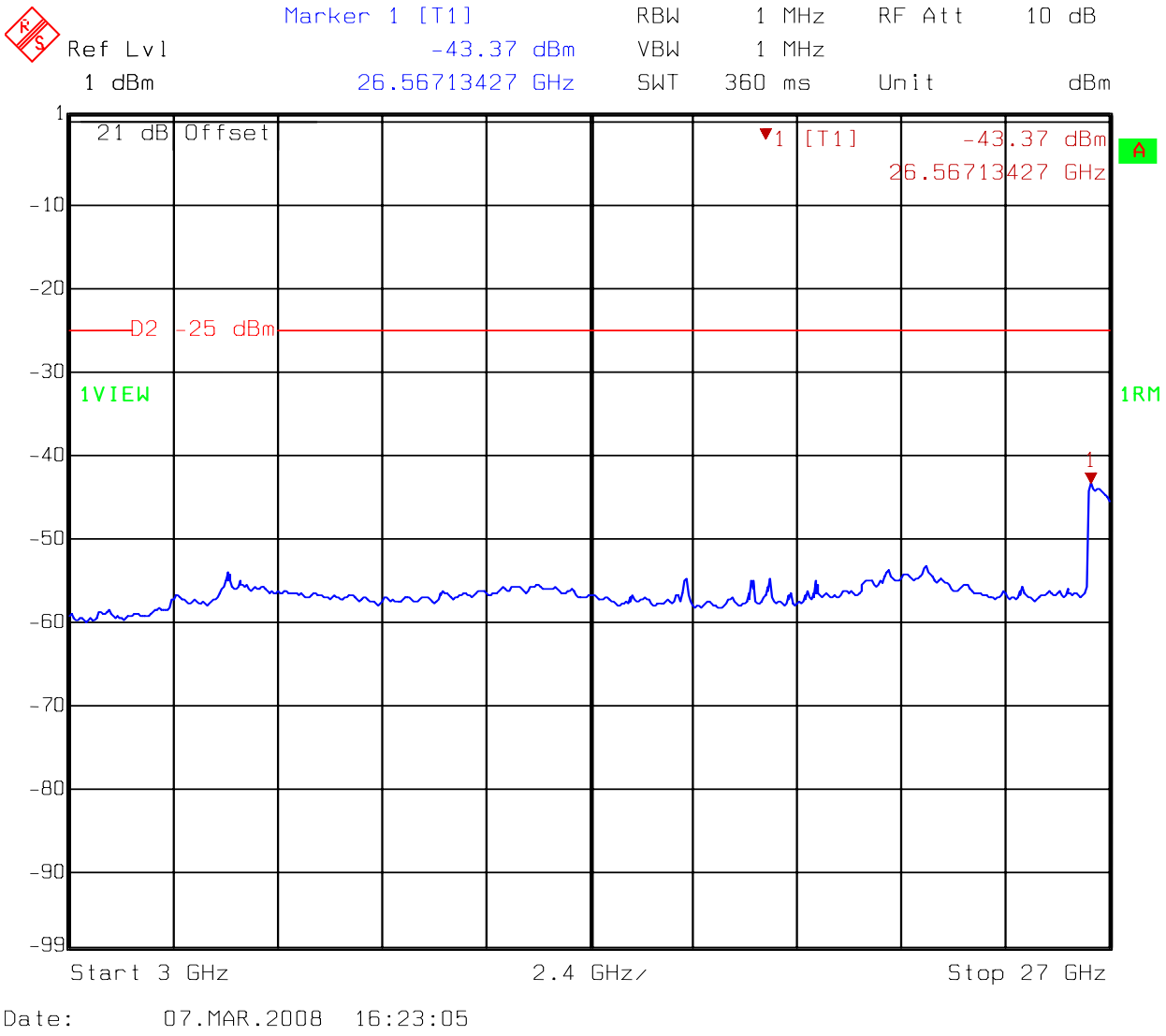


Figure 27. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 1 of 8

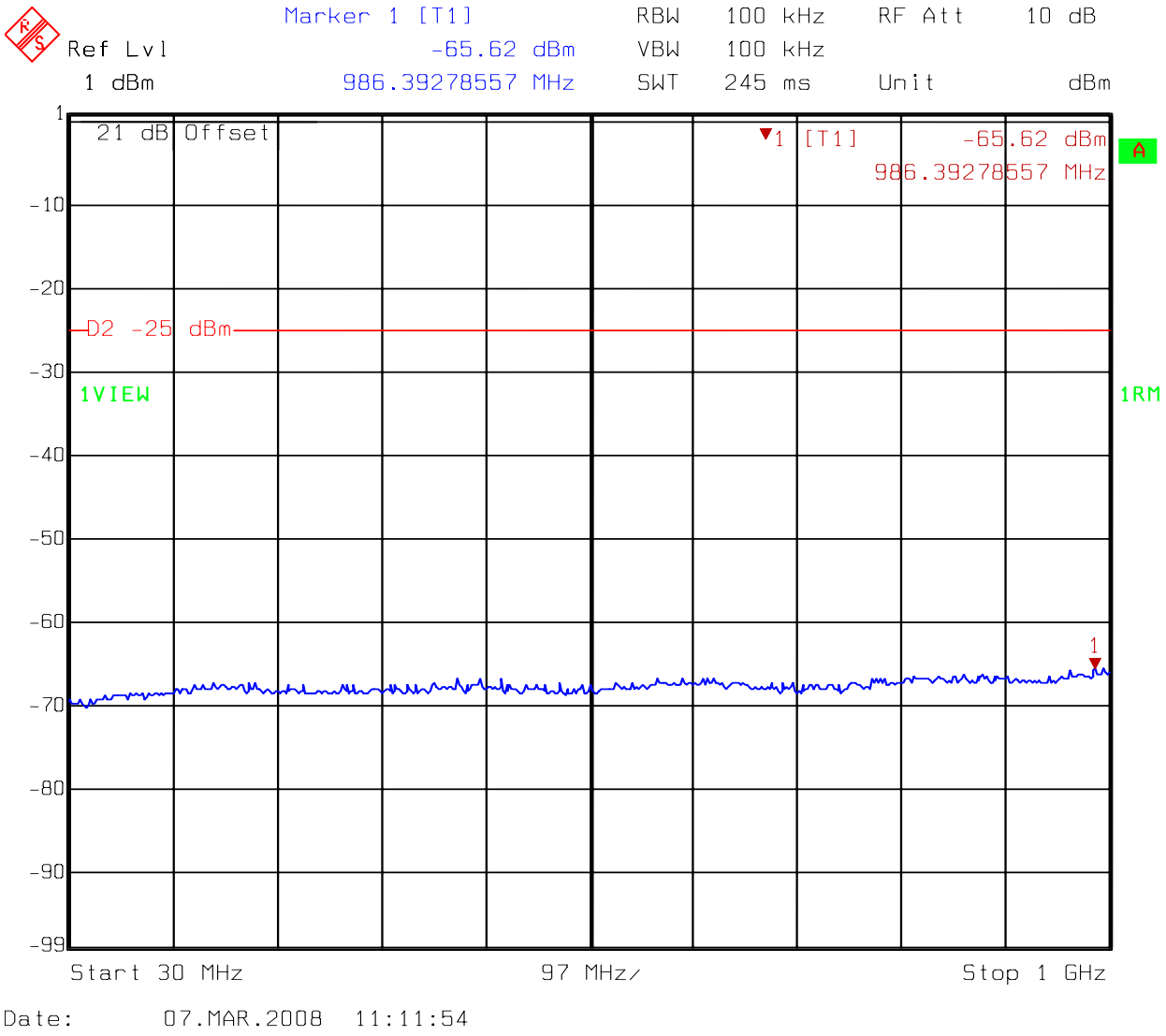


Figure 28. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 2 of 8

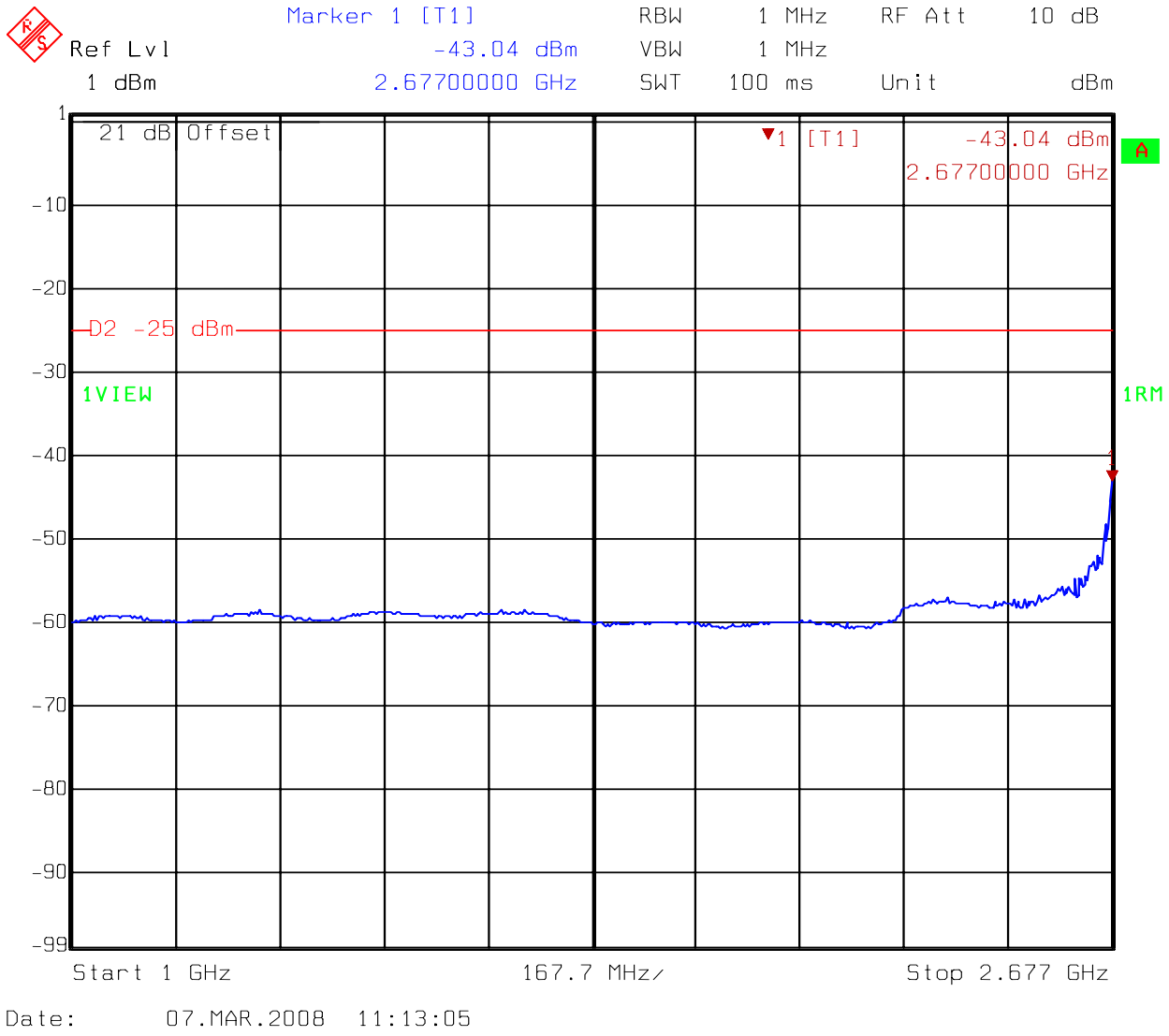


Figure 29. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 3 of 8

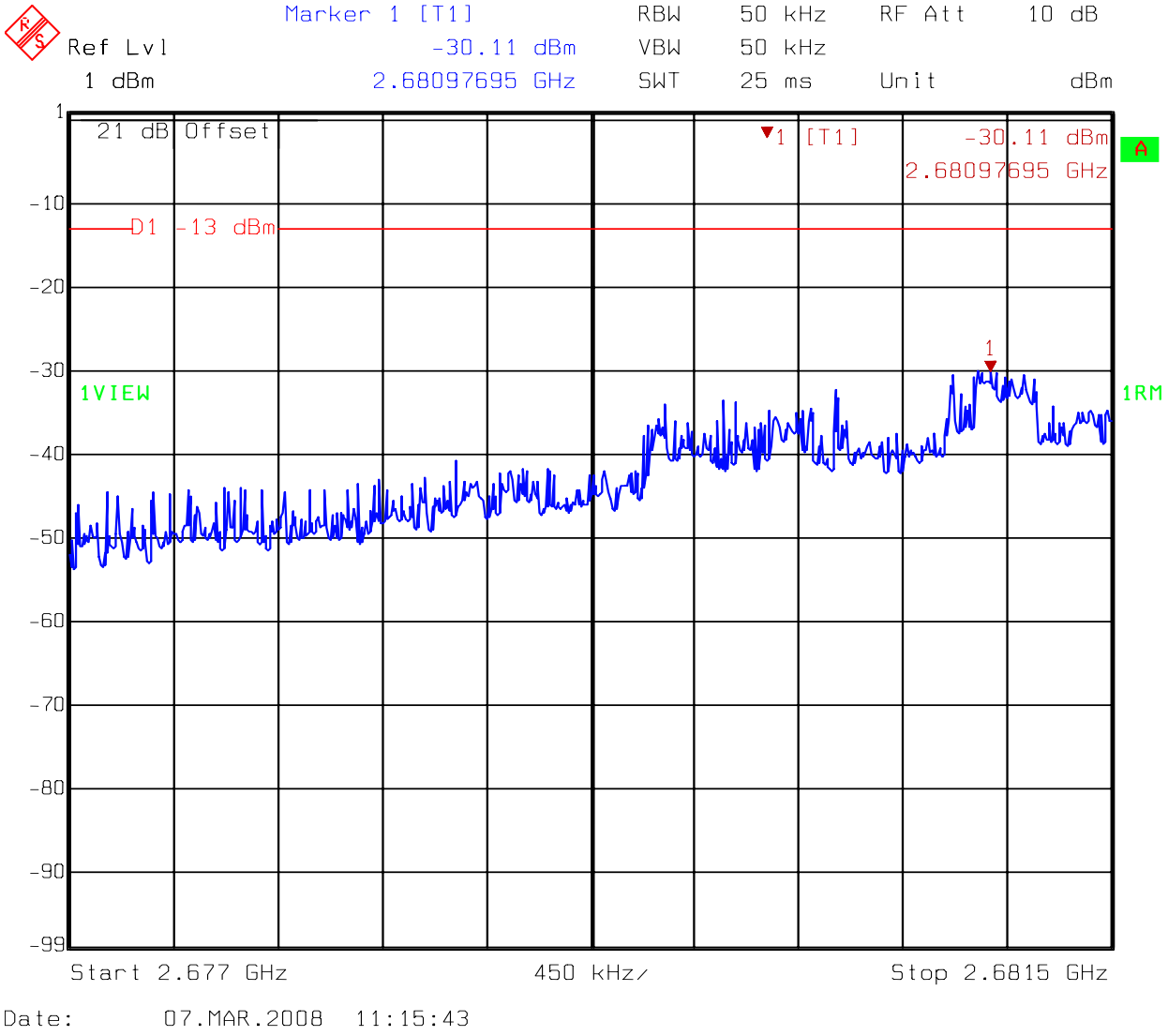


Figure 30. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 4 of 8

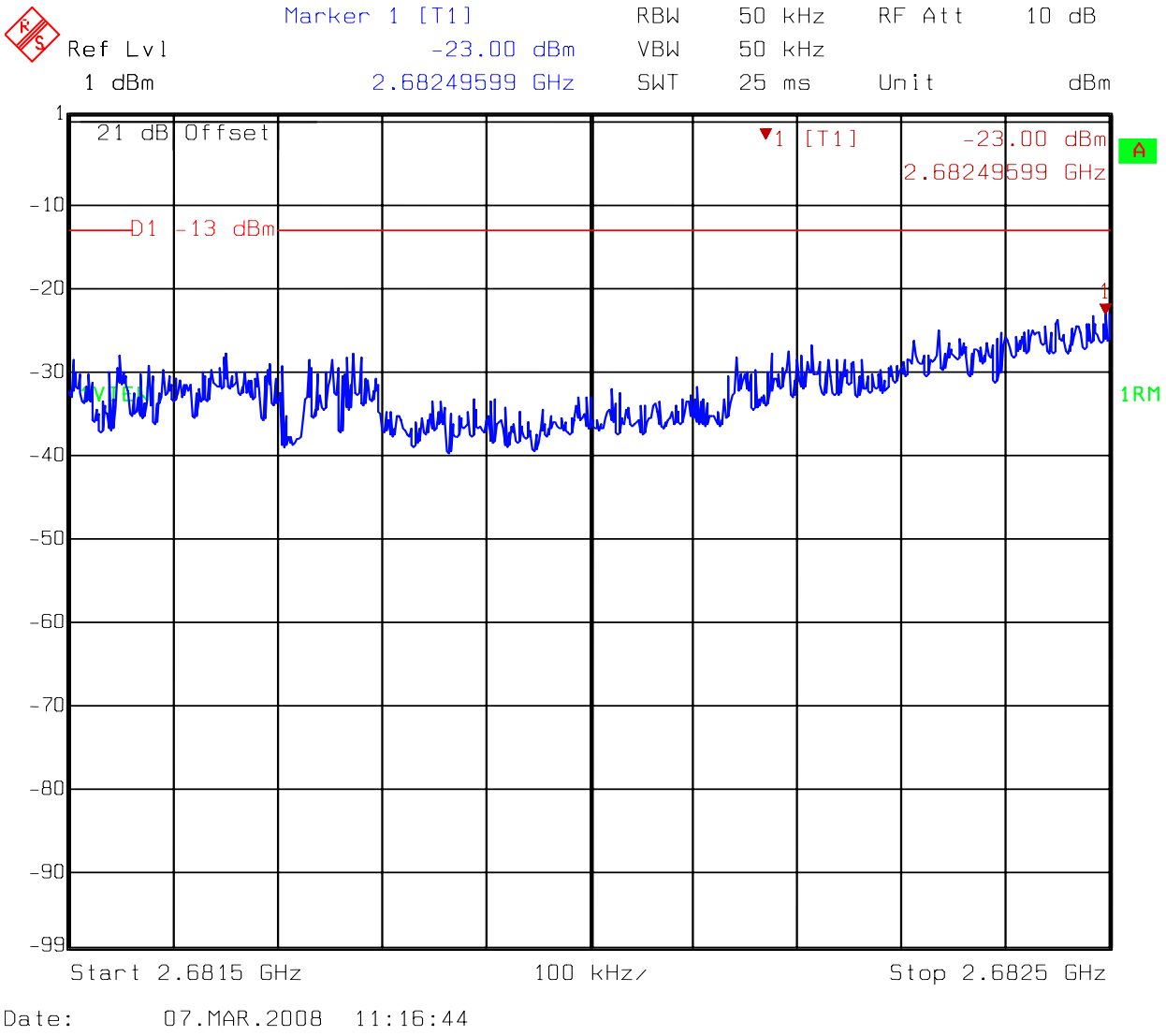


Figure 31. Spurious Emission at Antenna Terminals @ high channel (5MHz) – 5 of 8

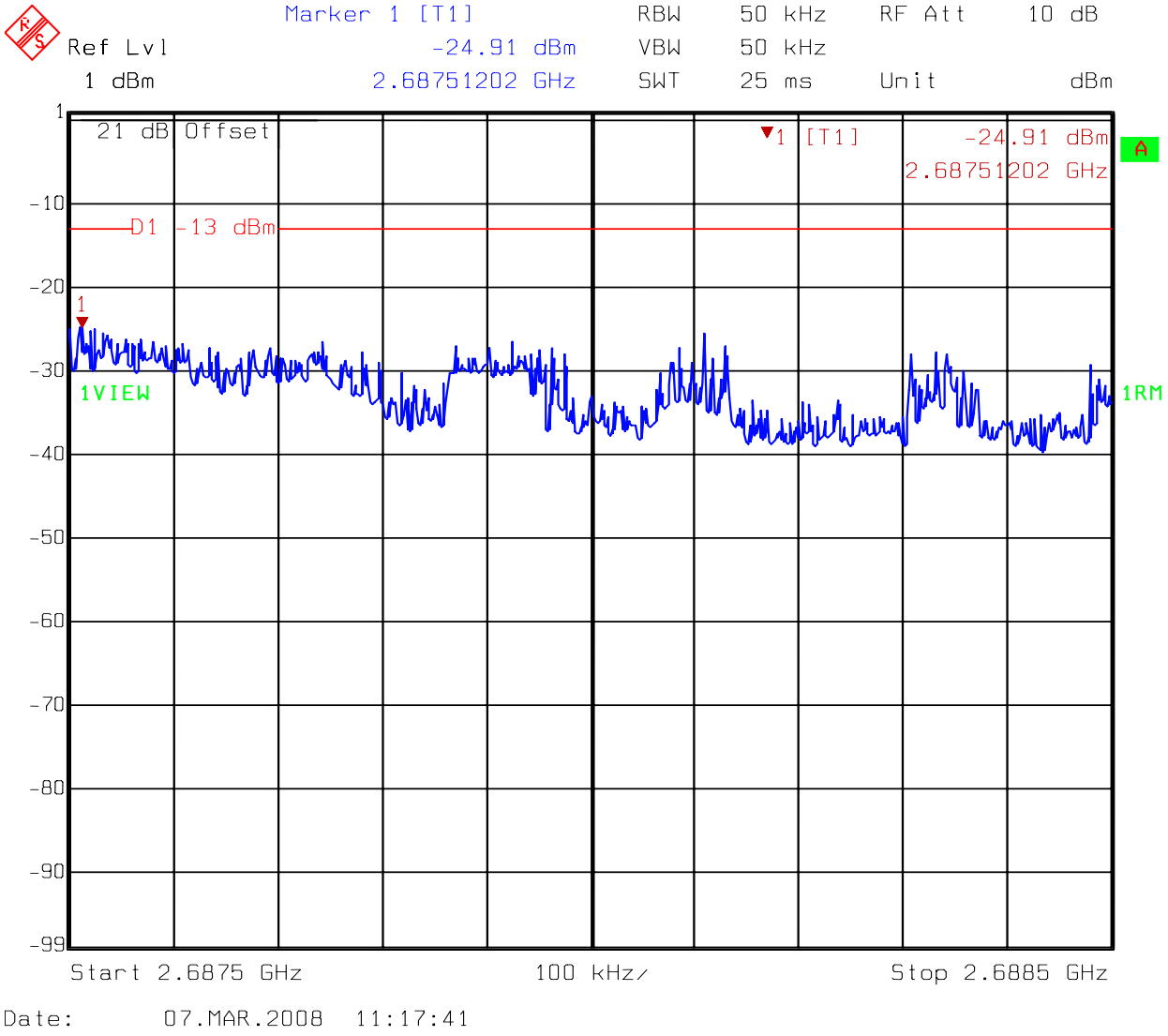


Figure 32. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 6 of 8

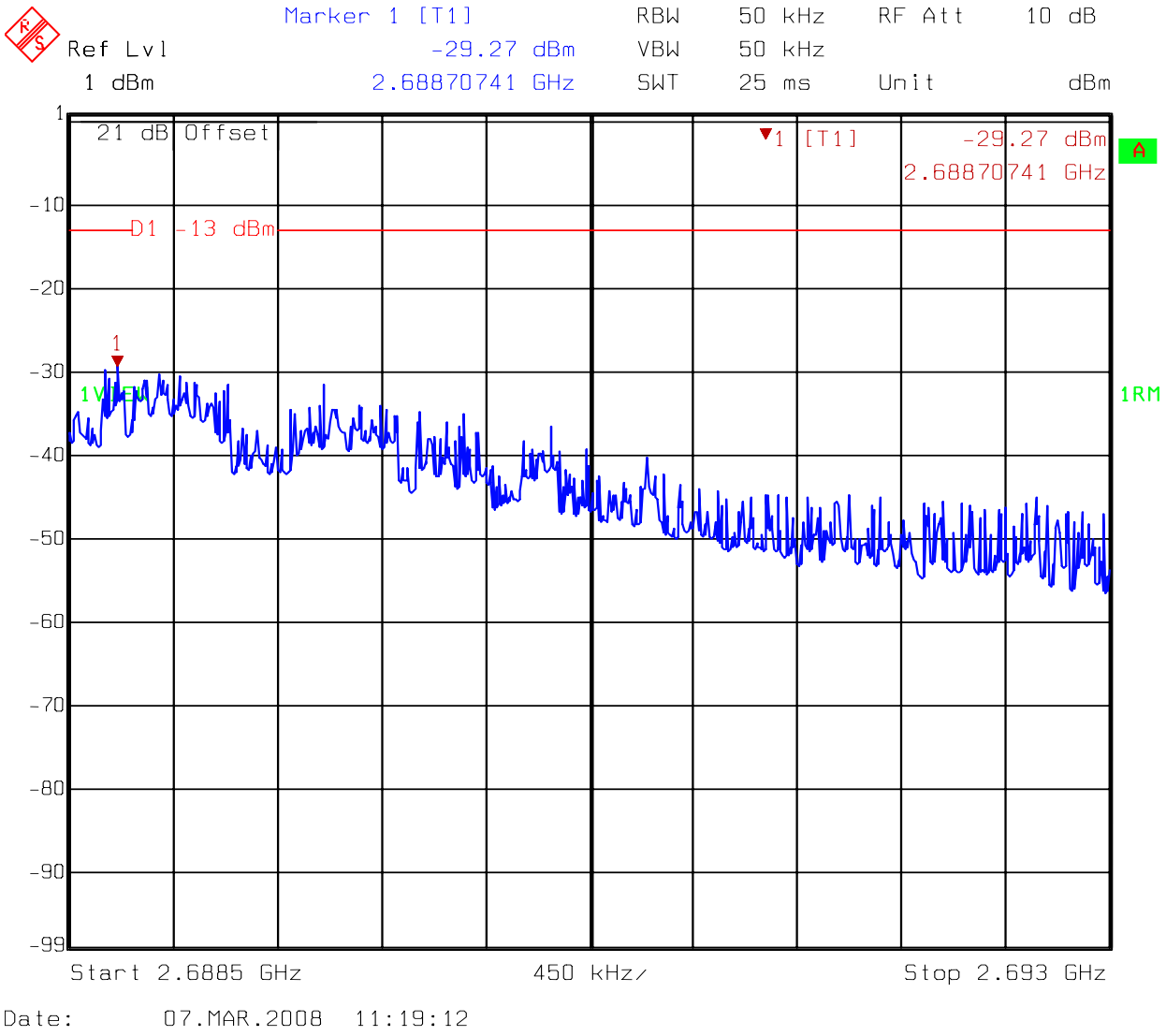


Figure 32. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 7 of 8

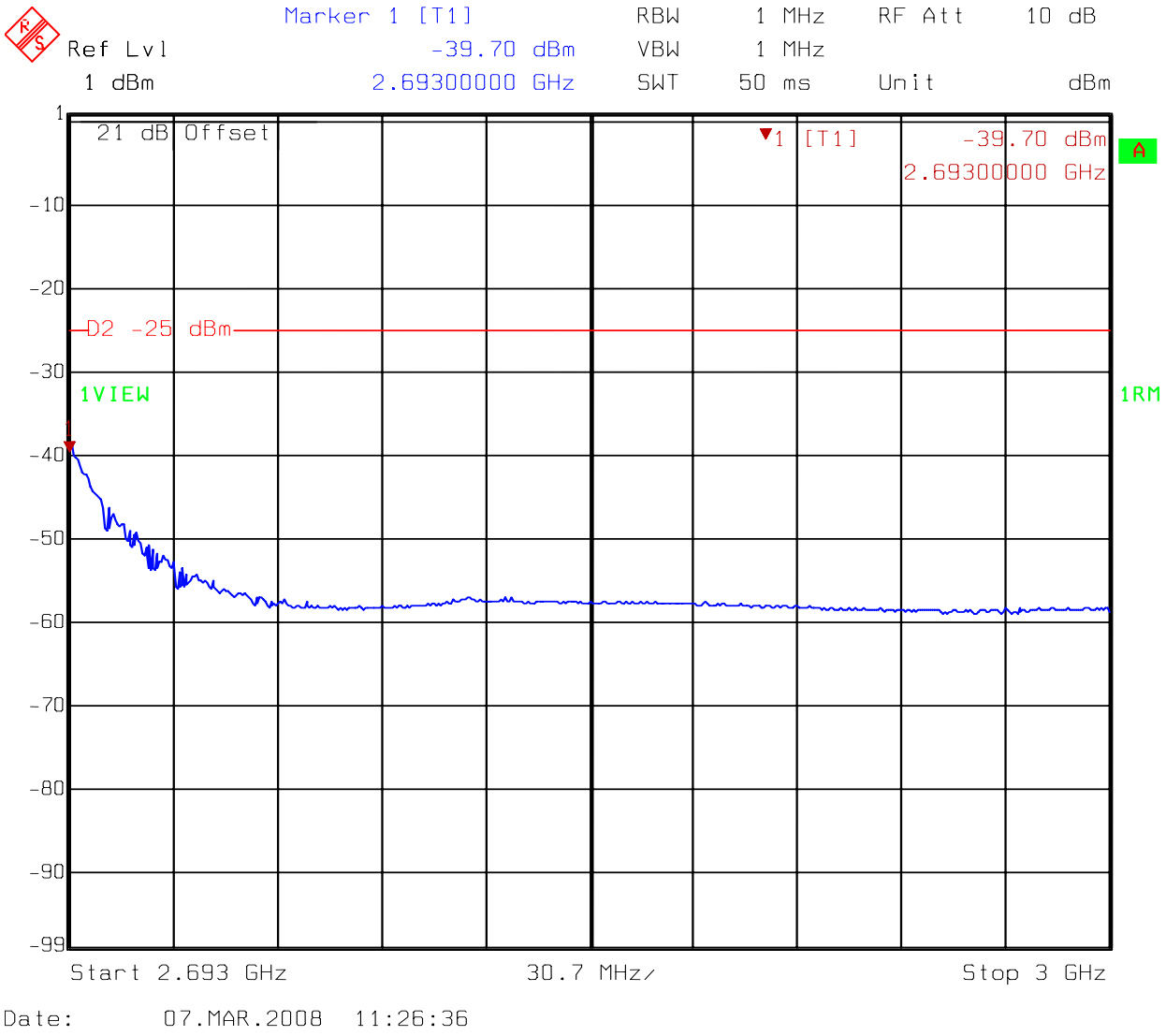


Figure 33. Spurious Emission at Antenna Terminals @ high channel (5MHz) - 8 of 8

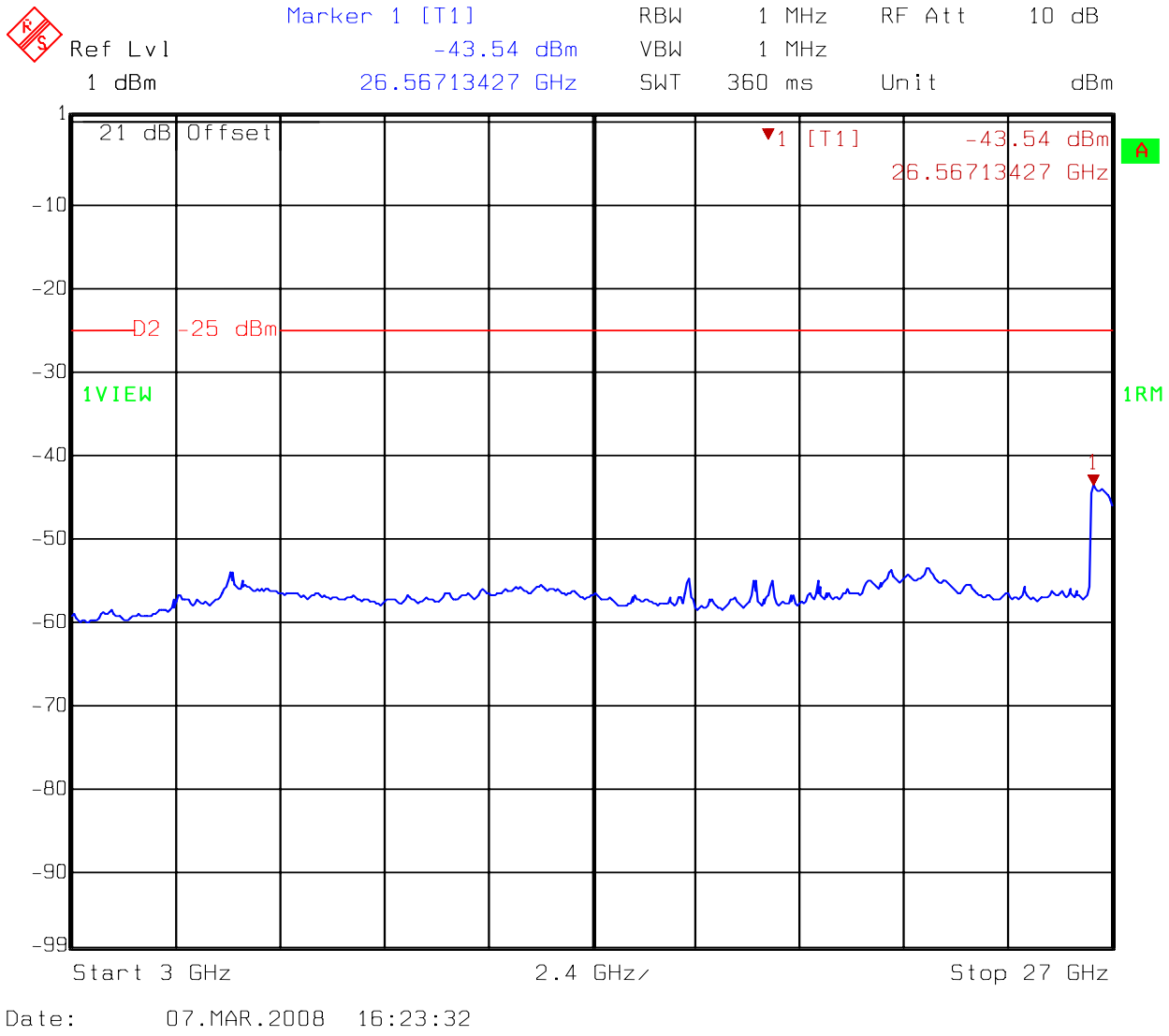


Figure 34. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 1 of 8

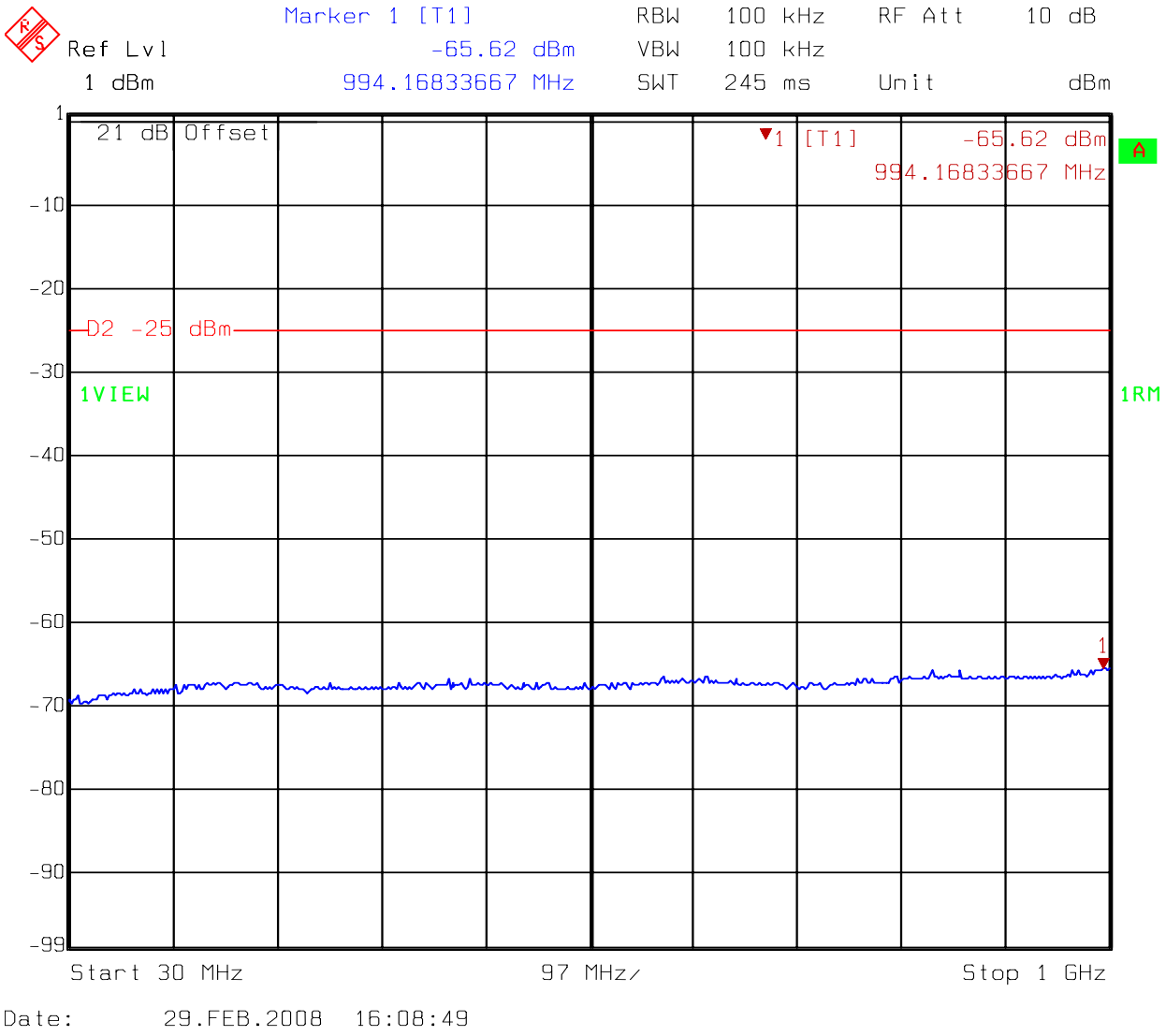


Figure 35. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 2 of 8

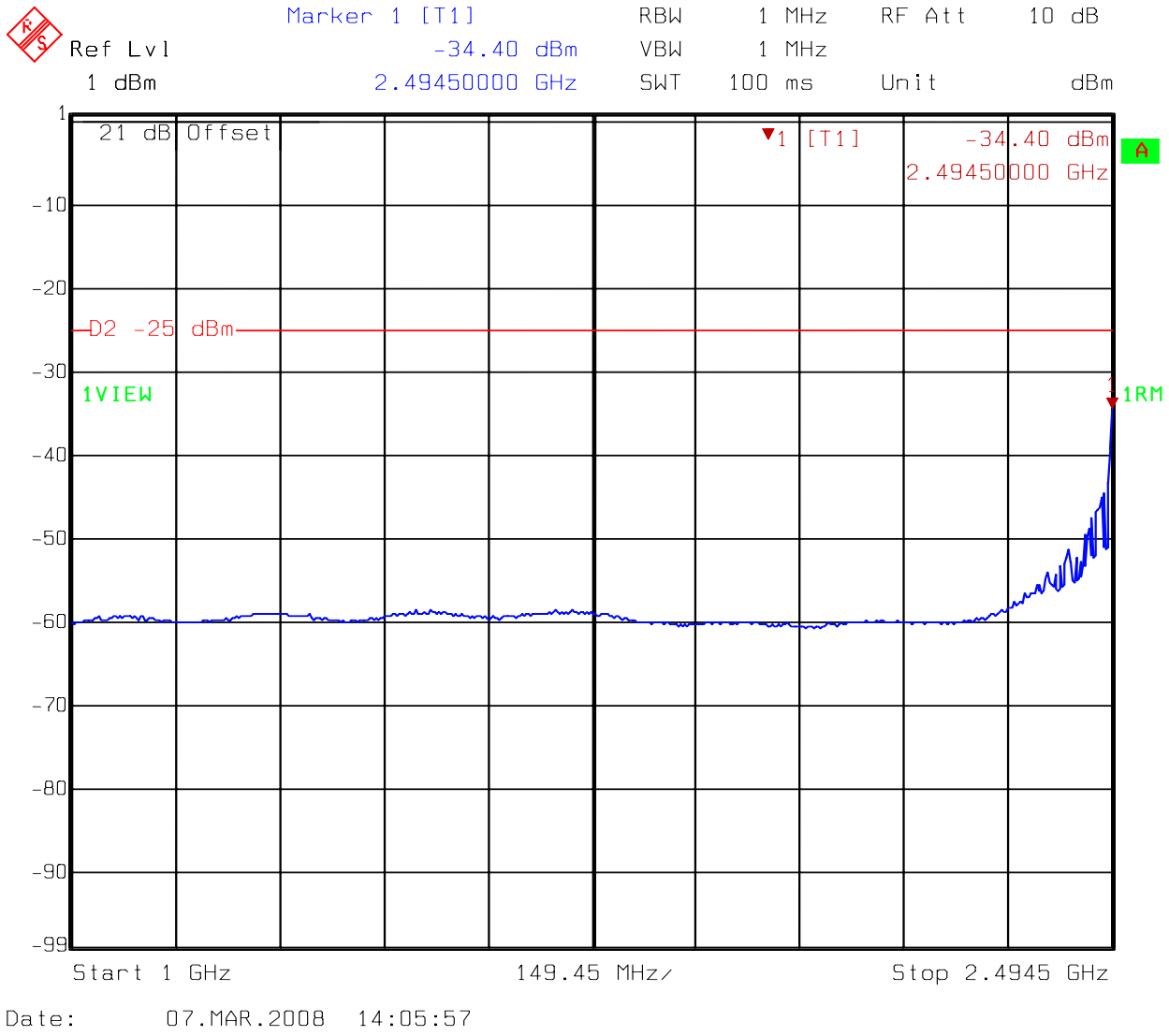


Figure 36. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 3 of 8

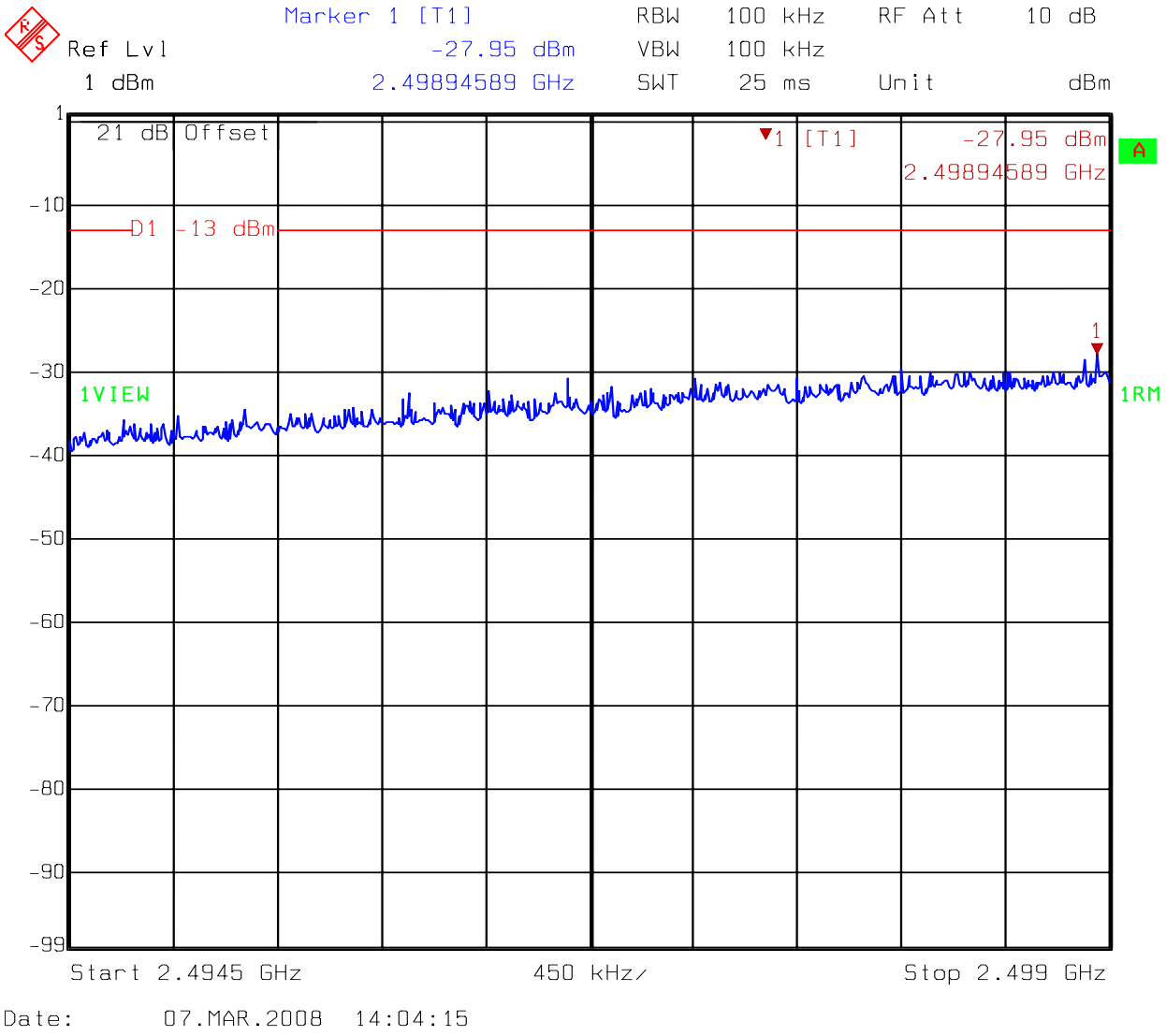


Figure 37. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 4 of 8

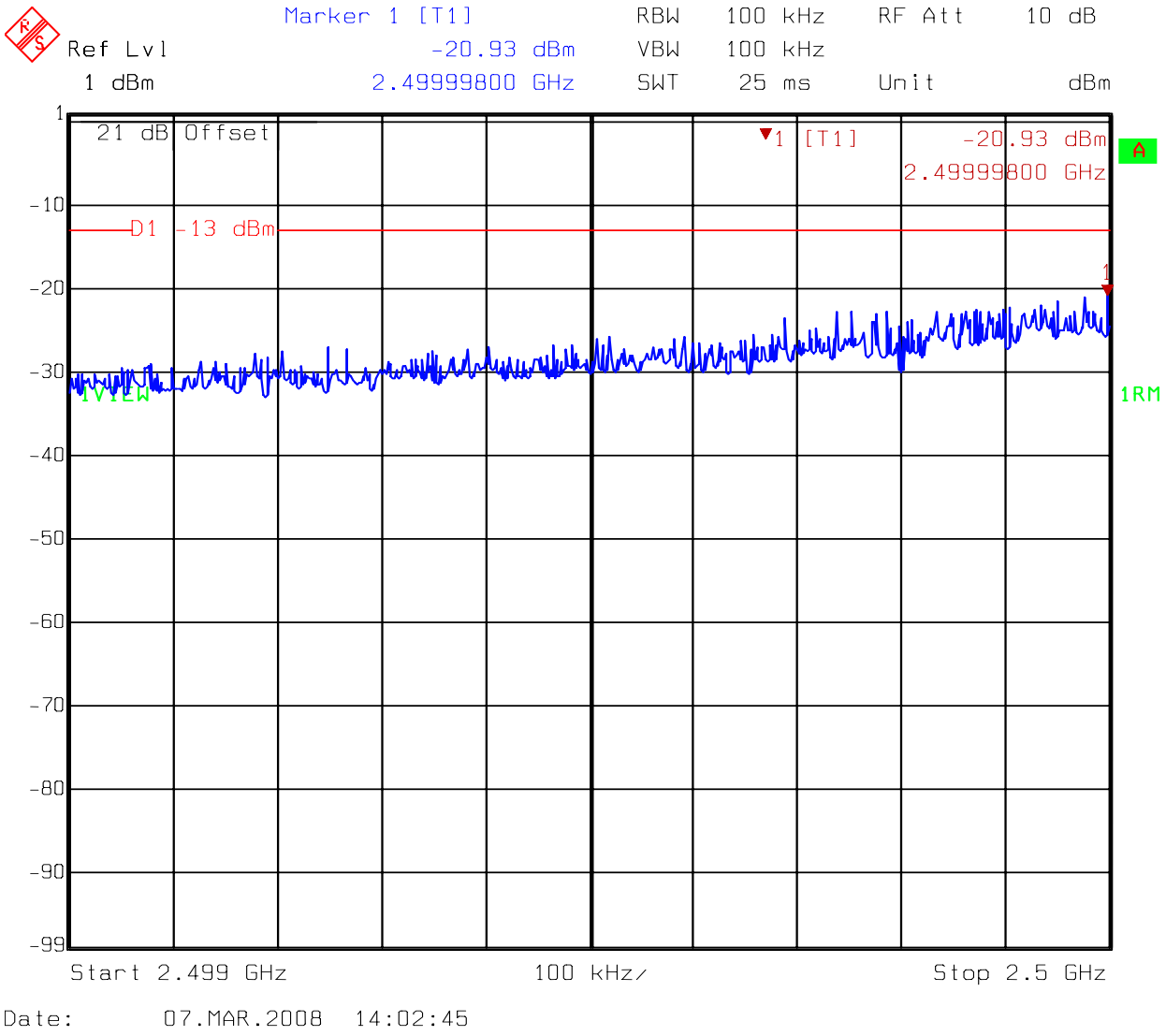


Figure 38. Spurious Emission at Antenna Terminals @ low channel (10MHz) – 5 of 8

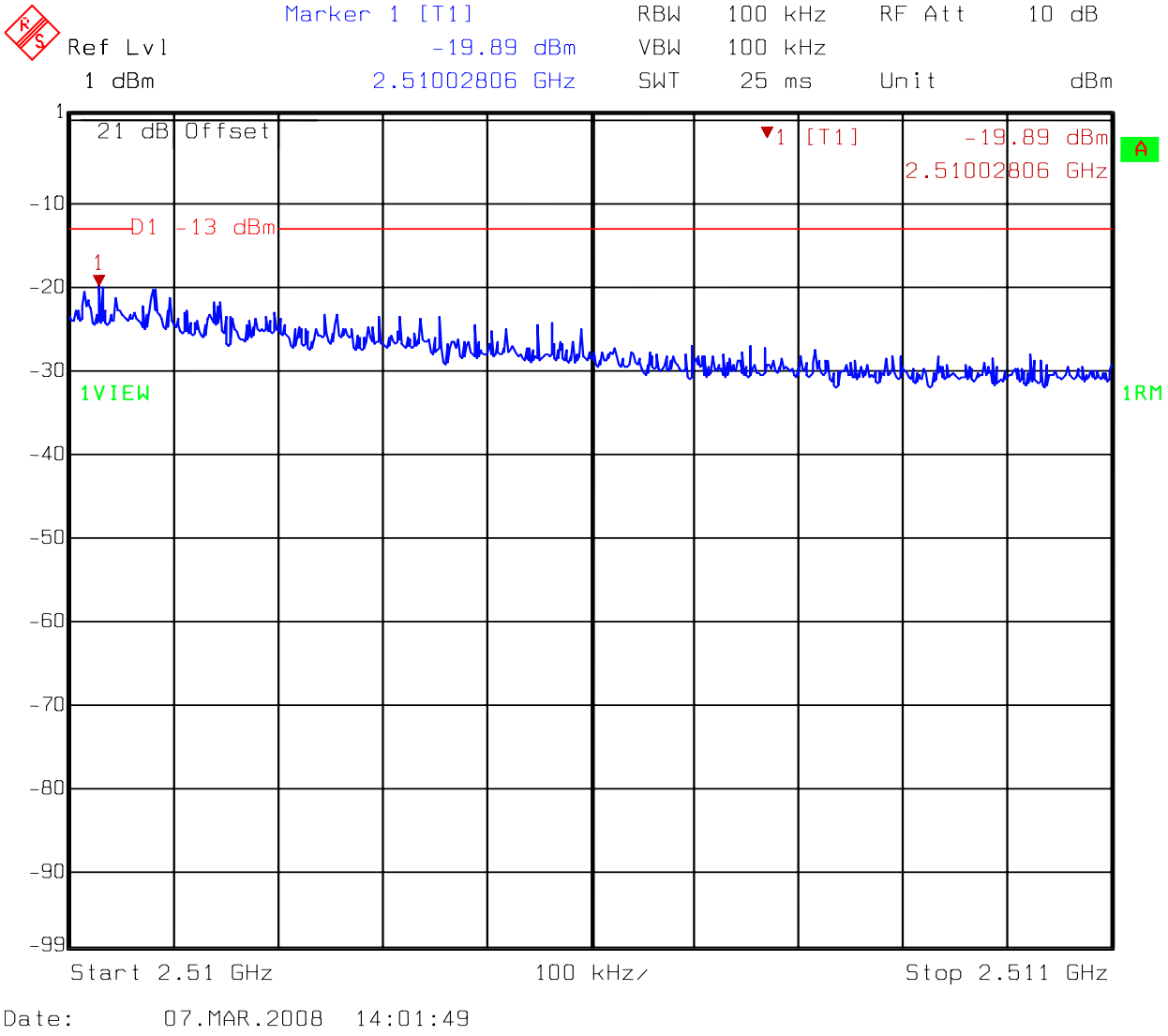


Figure 39. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 6 of 8

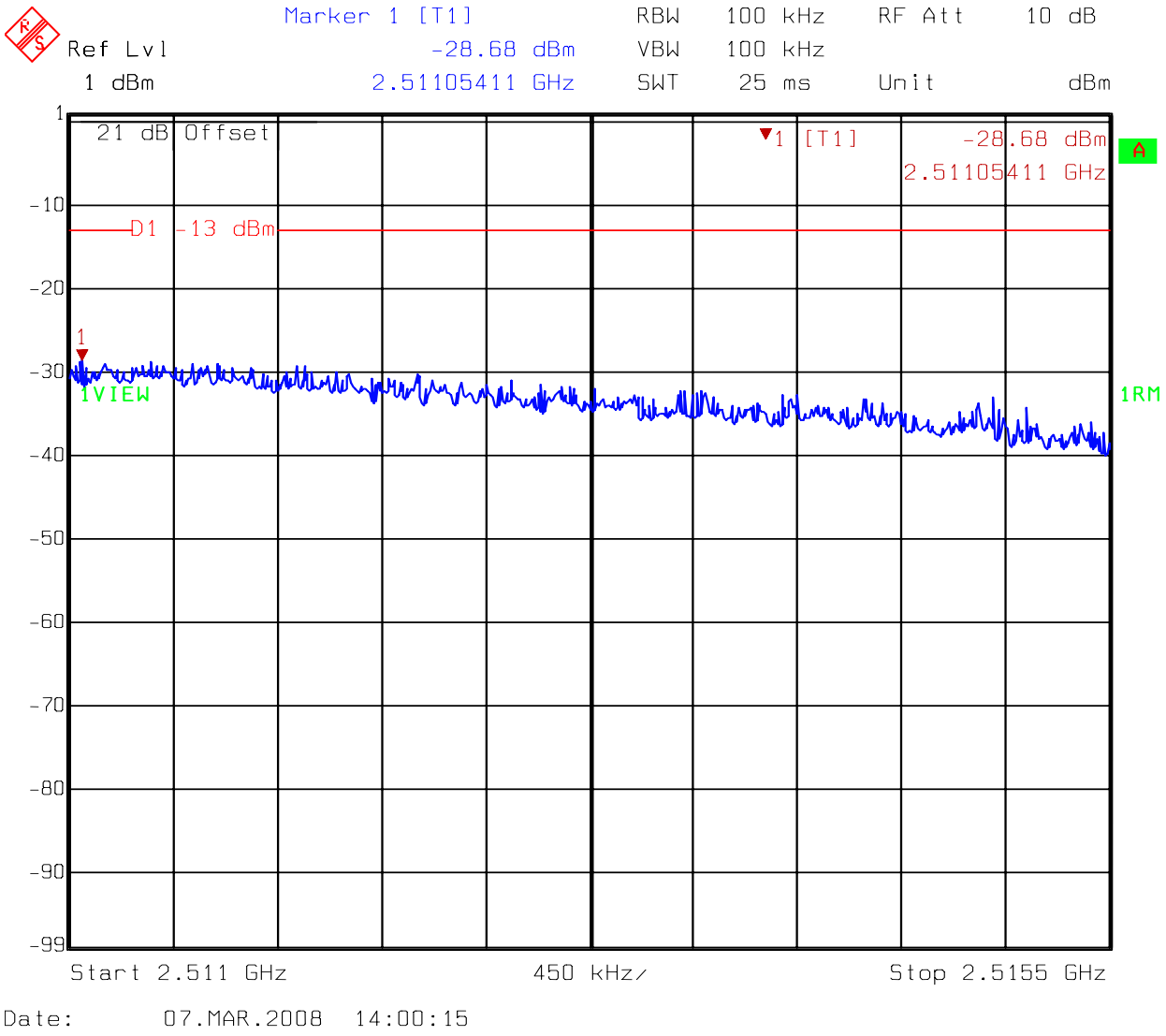


Figure 40. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 7 of 8

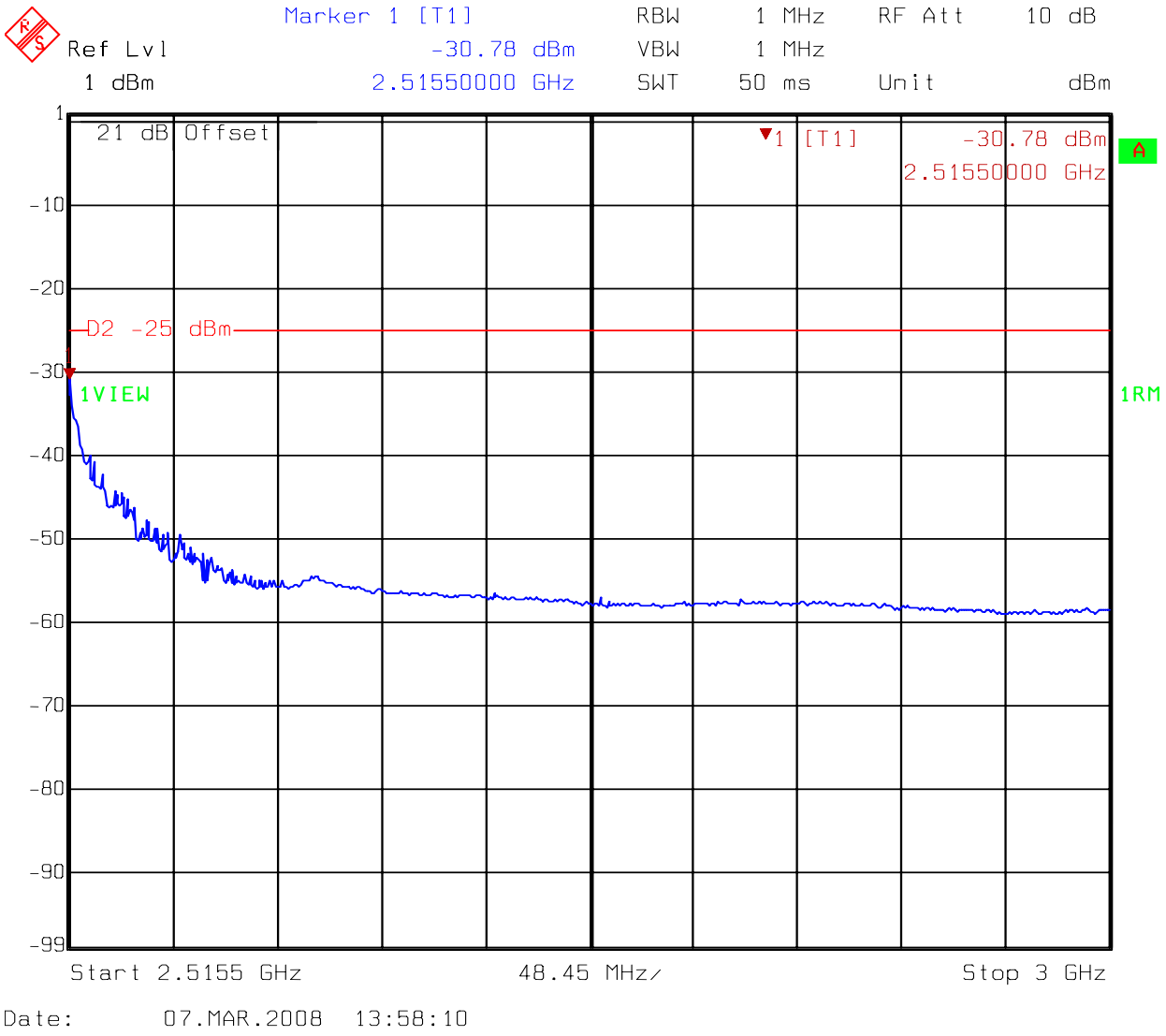


Figure 41. Spurious Emission at Antenna Terminals @ low channel (10MHz) - 8 of 8

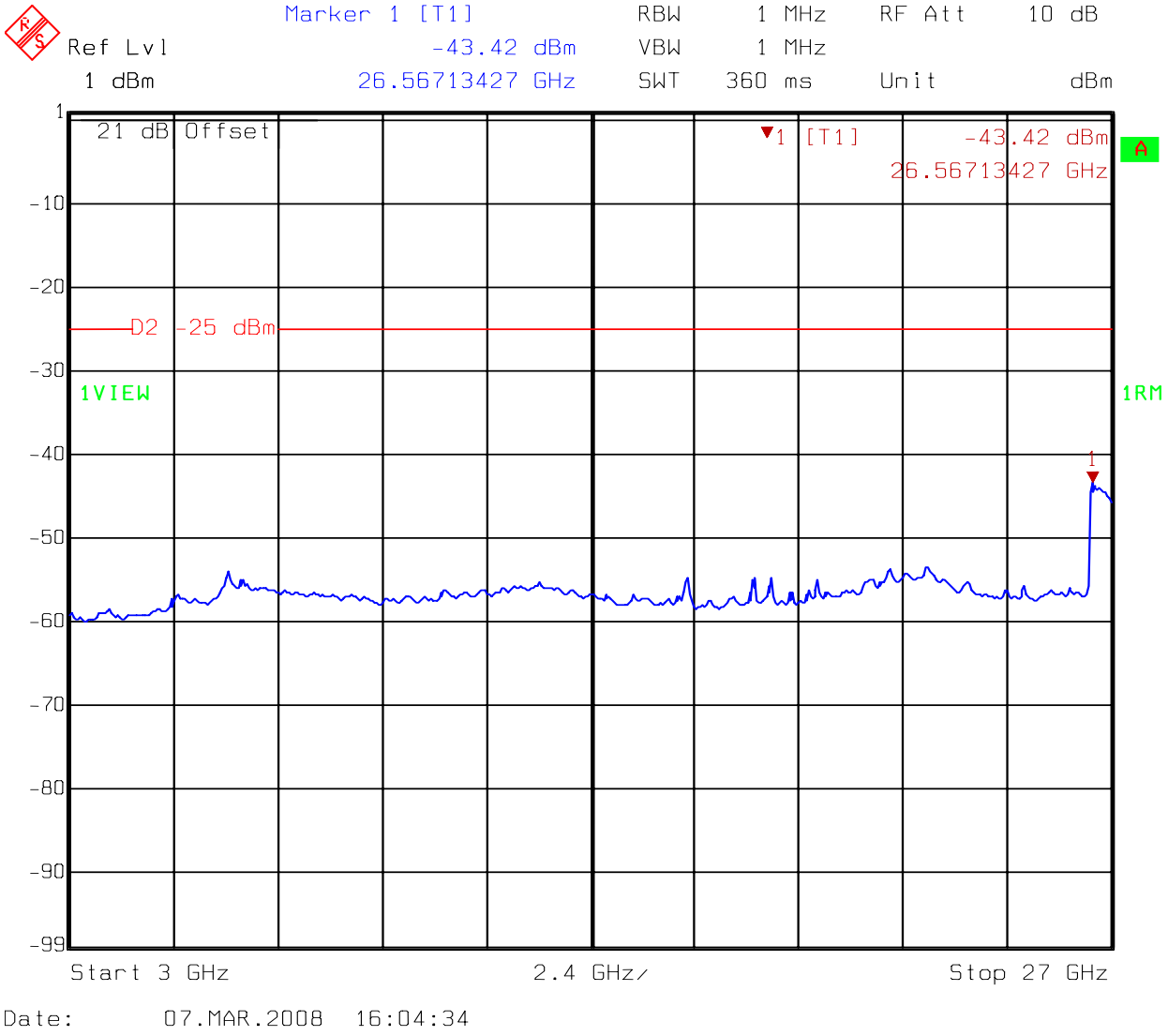


Figure 42. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 1 of 8

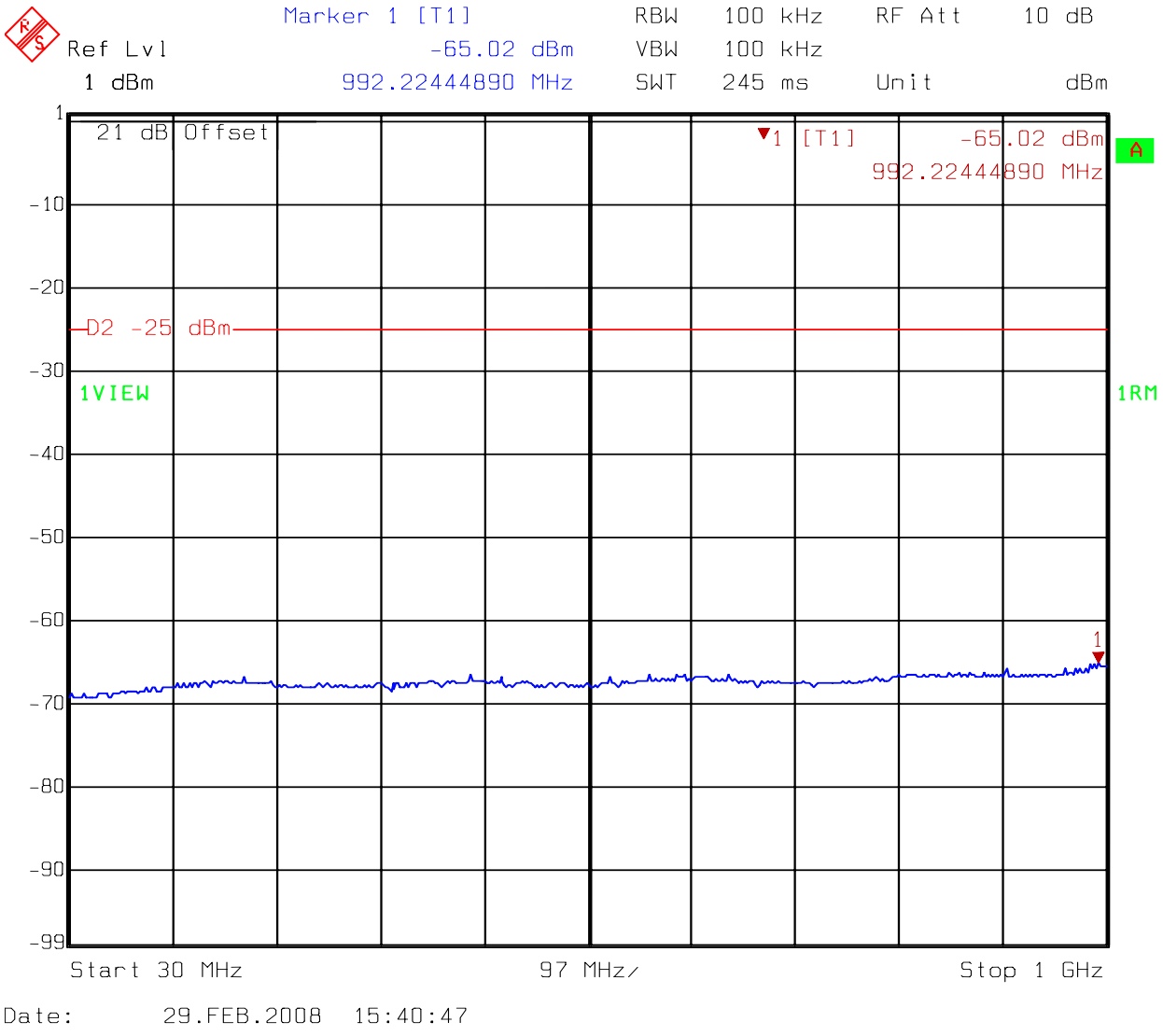


Figure 43. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 2 of 8

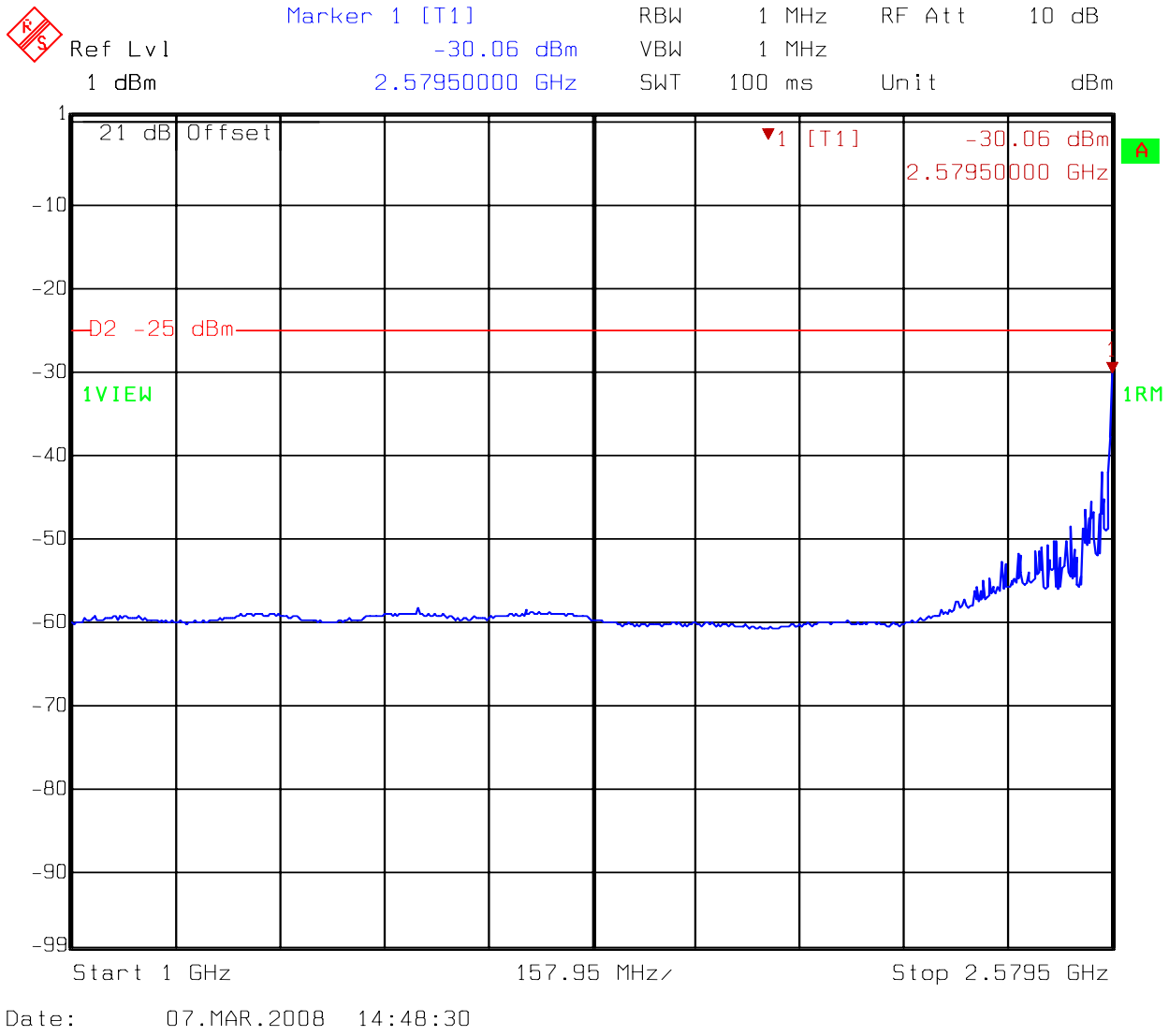


Figure 44. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 3 of 8

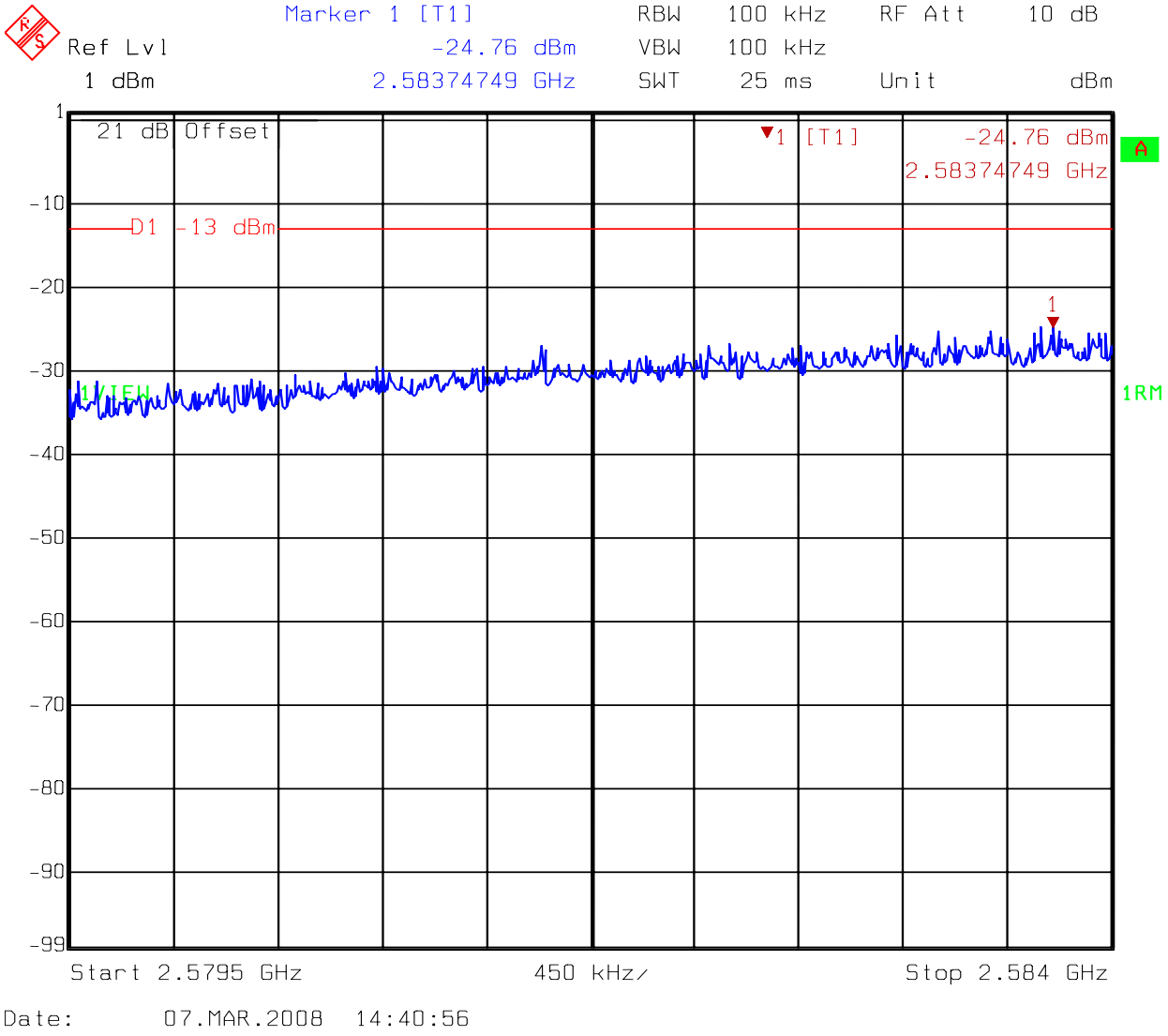


Figure 45. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 4 of 8

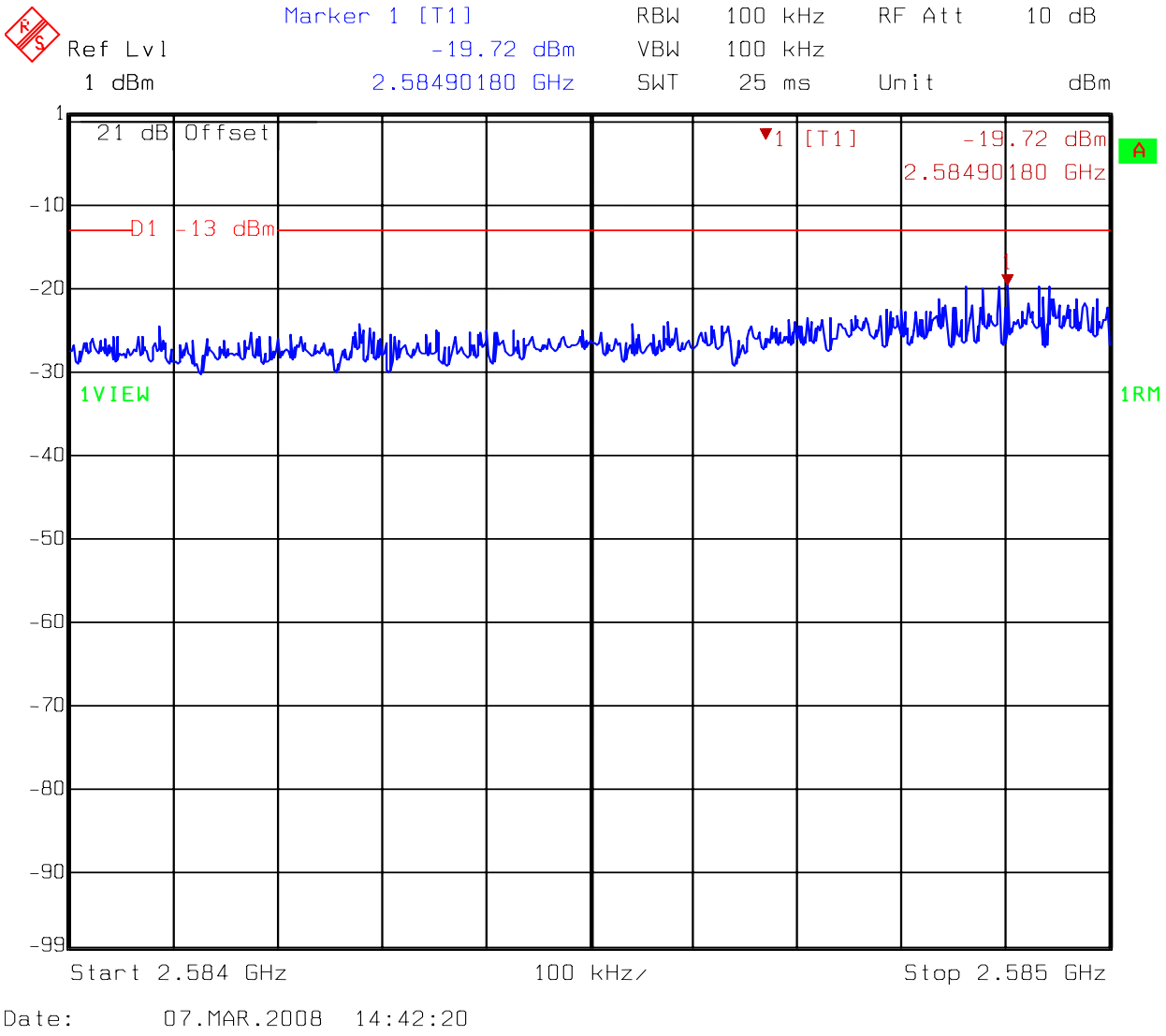


Figure 46. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 5 of 8

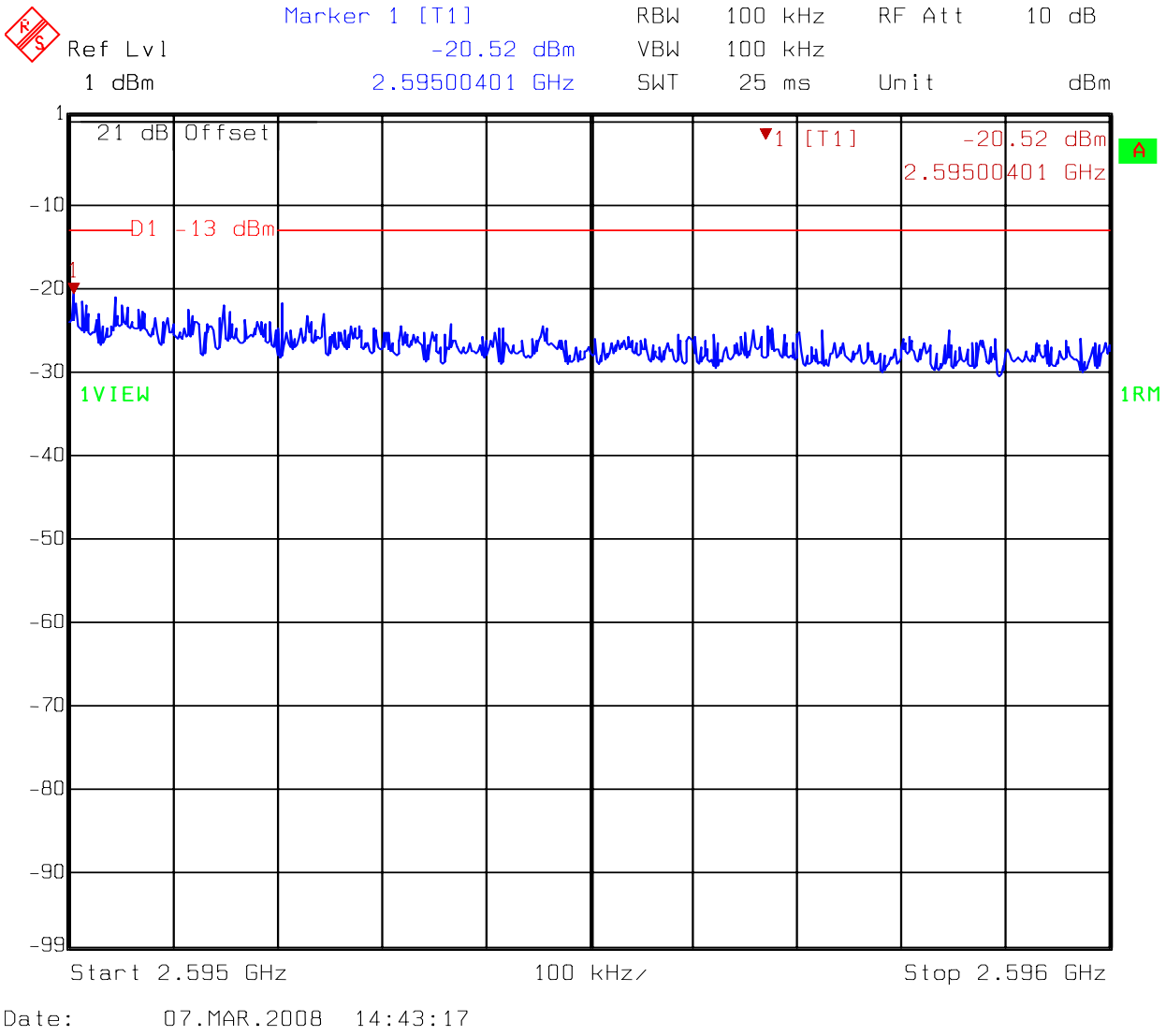


Figure 47. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 6 of 8

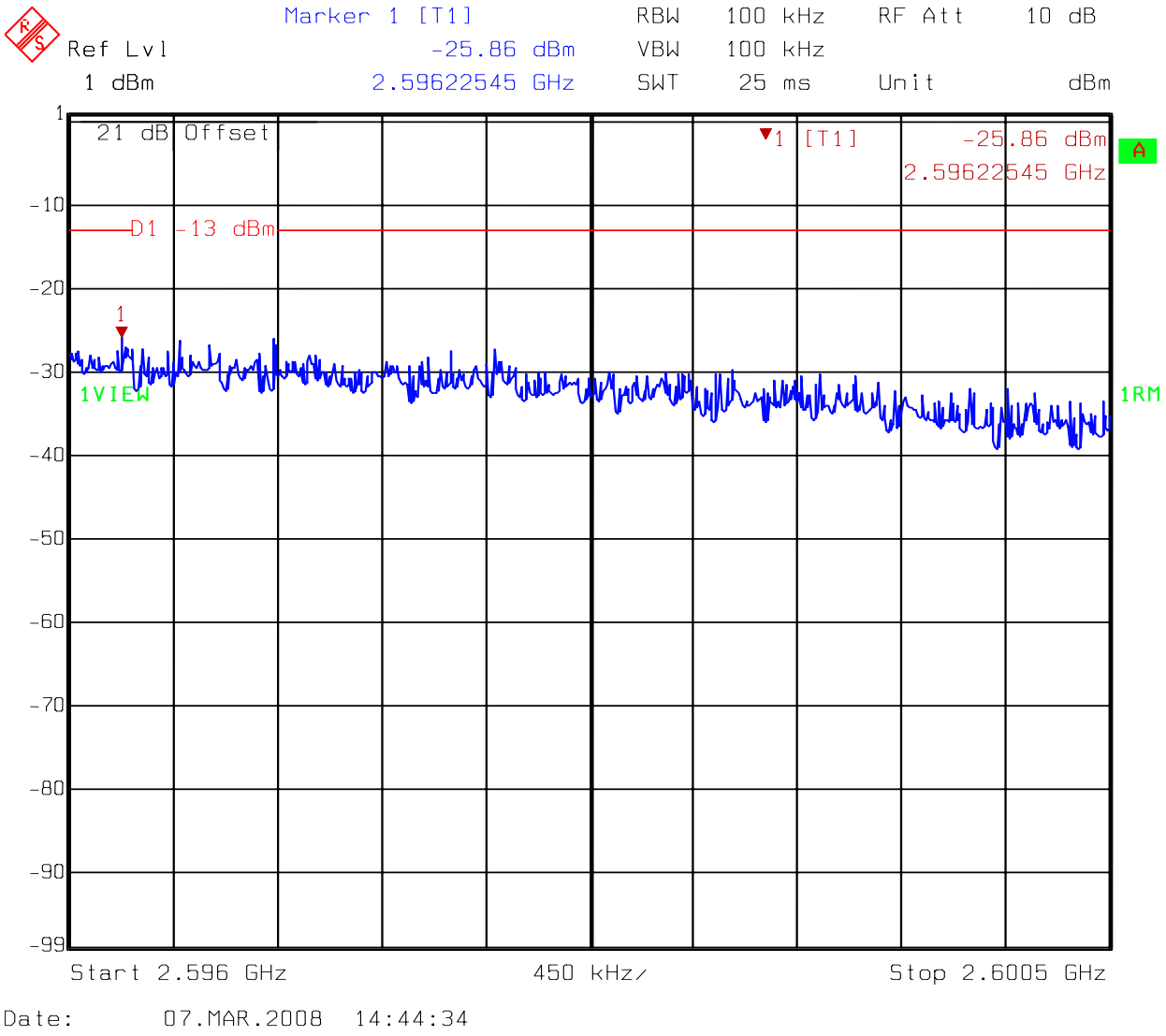


Figure 48. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 7 of 8

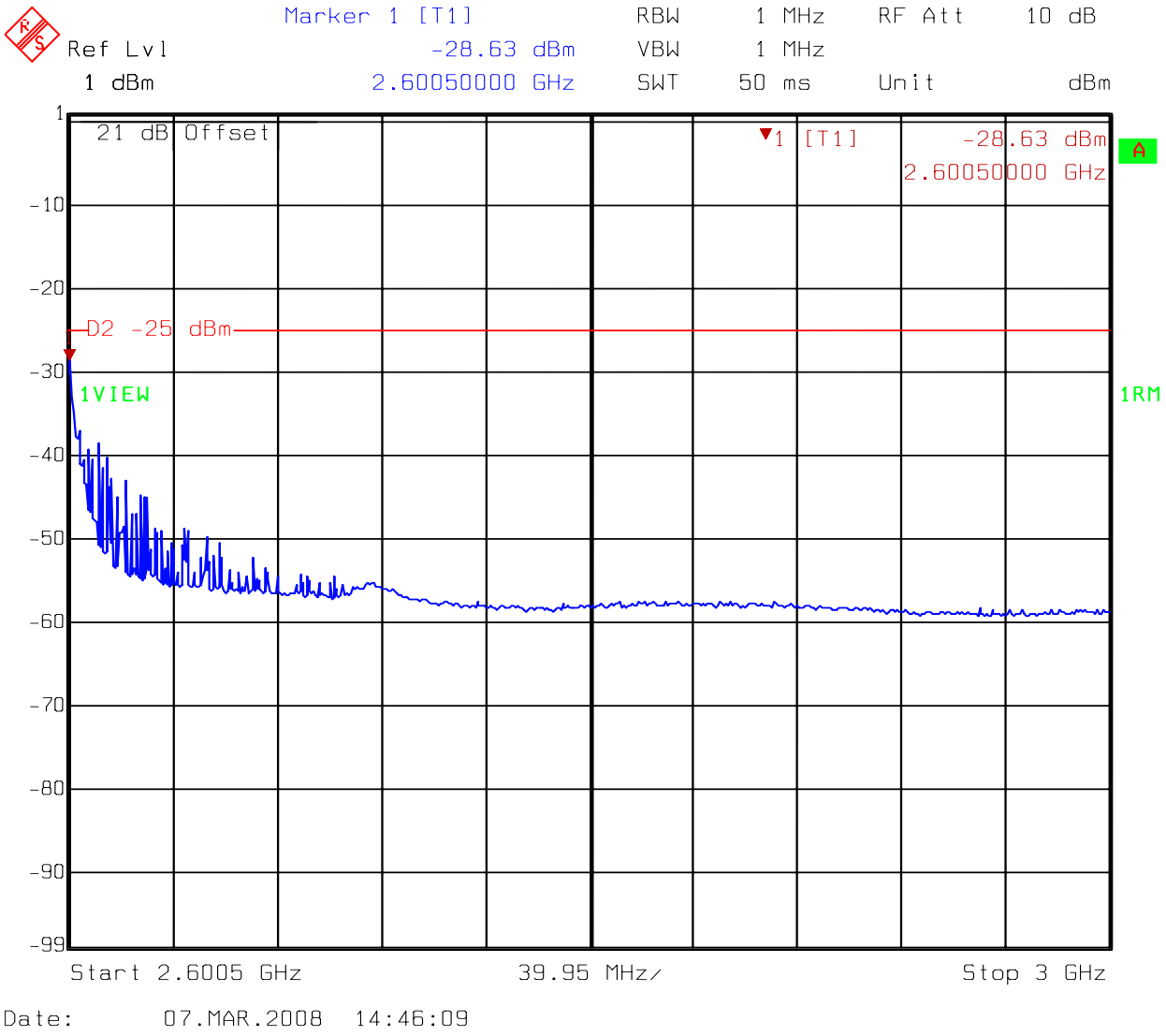


Figure 49. Spurious Emission at Antenna Terminals @ middle channel (10MHz) - 8 of 8

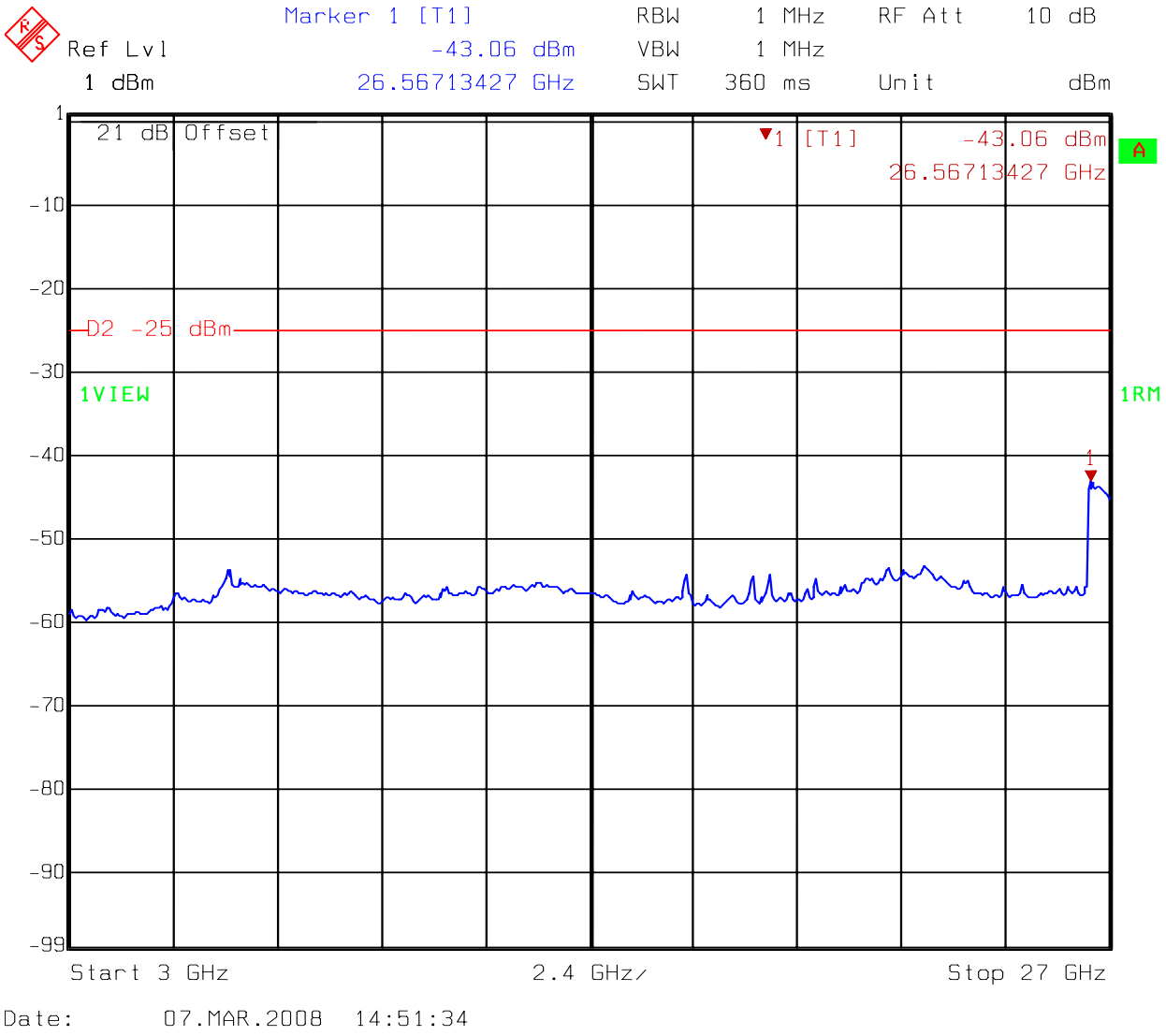


Figure 50. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 1 of 8

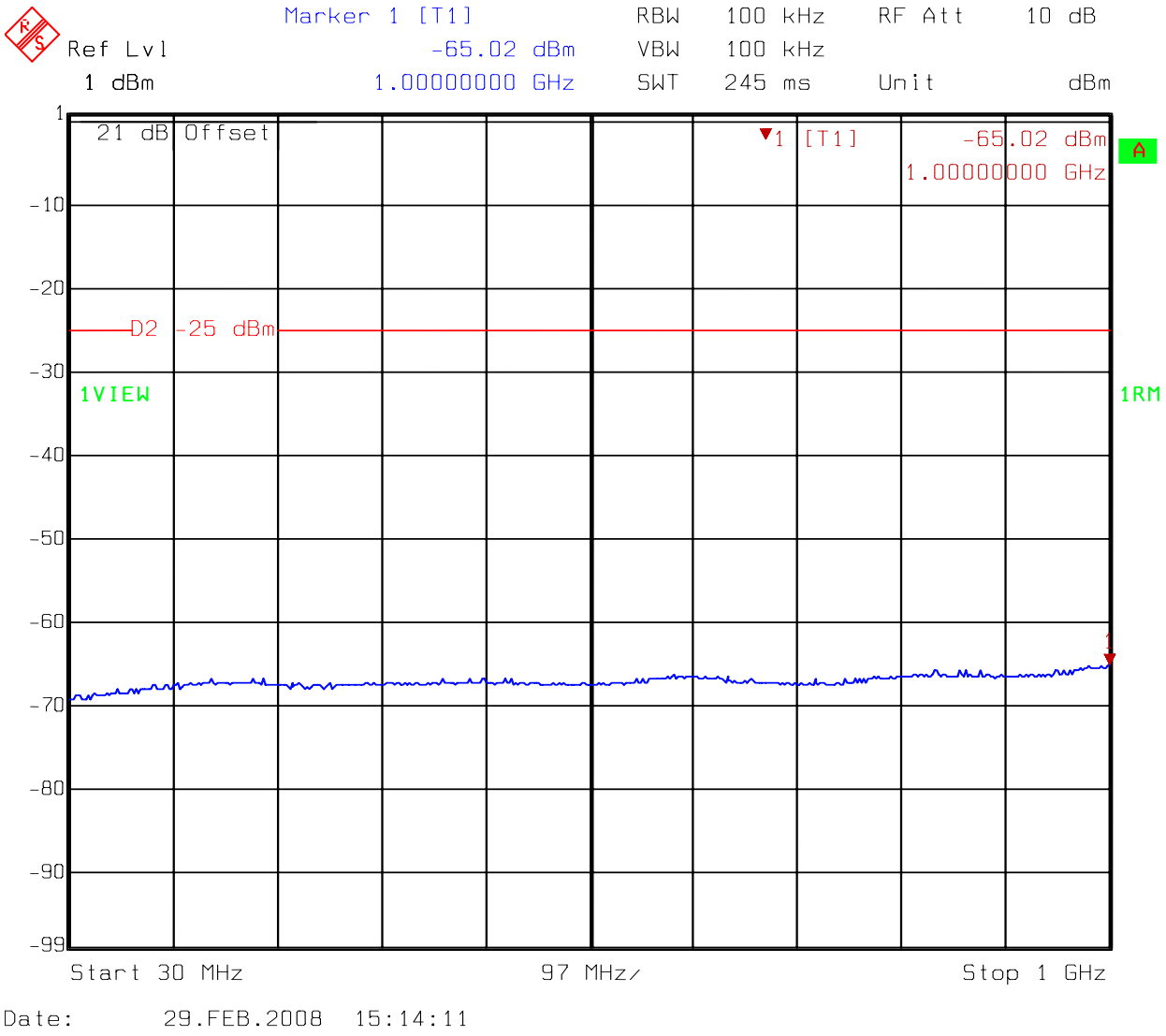


Figure 51. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 2 of 8

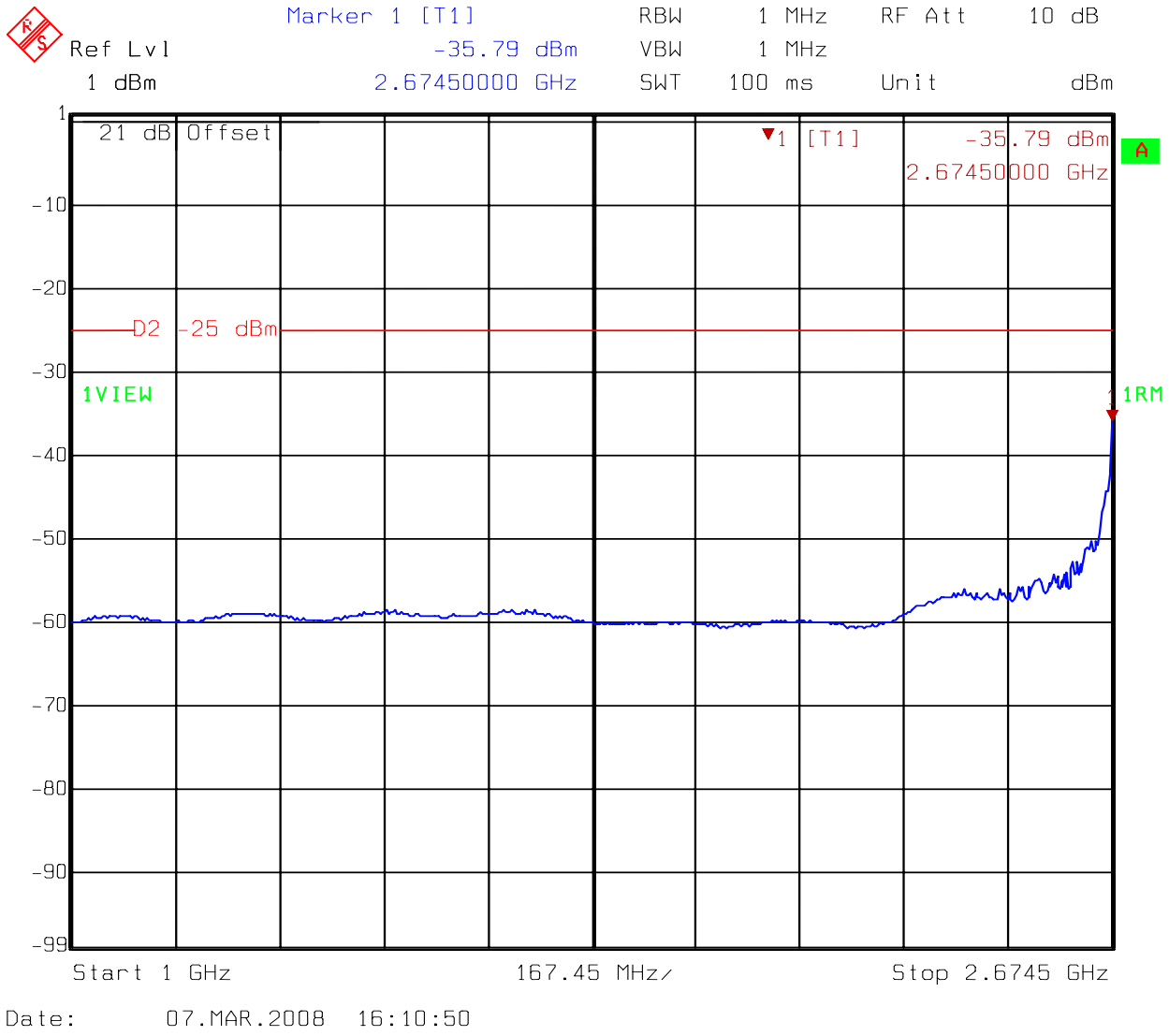


Figure 52. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 3 of 8

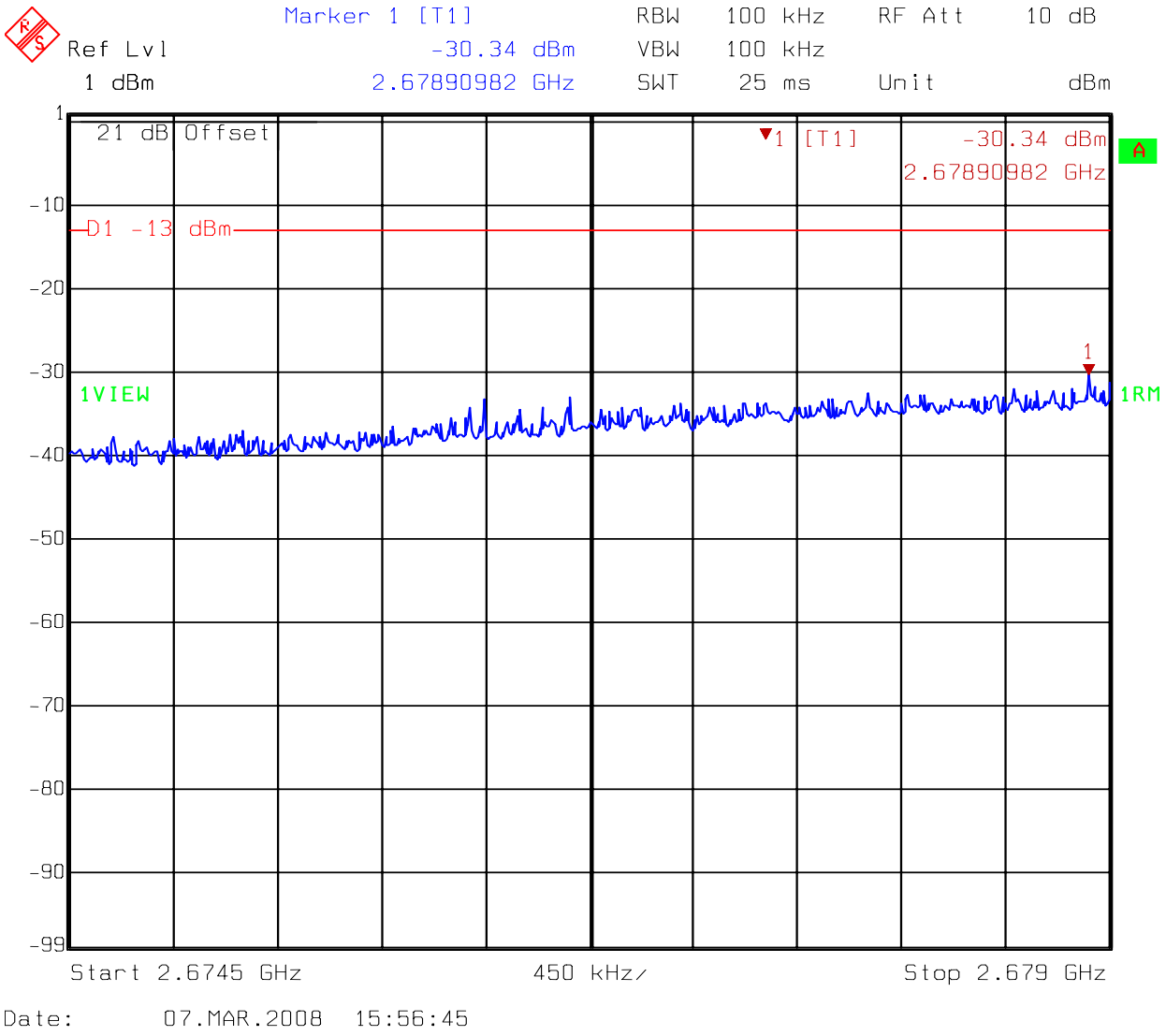


Figure 53. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 4 of 8

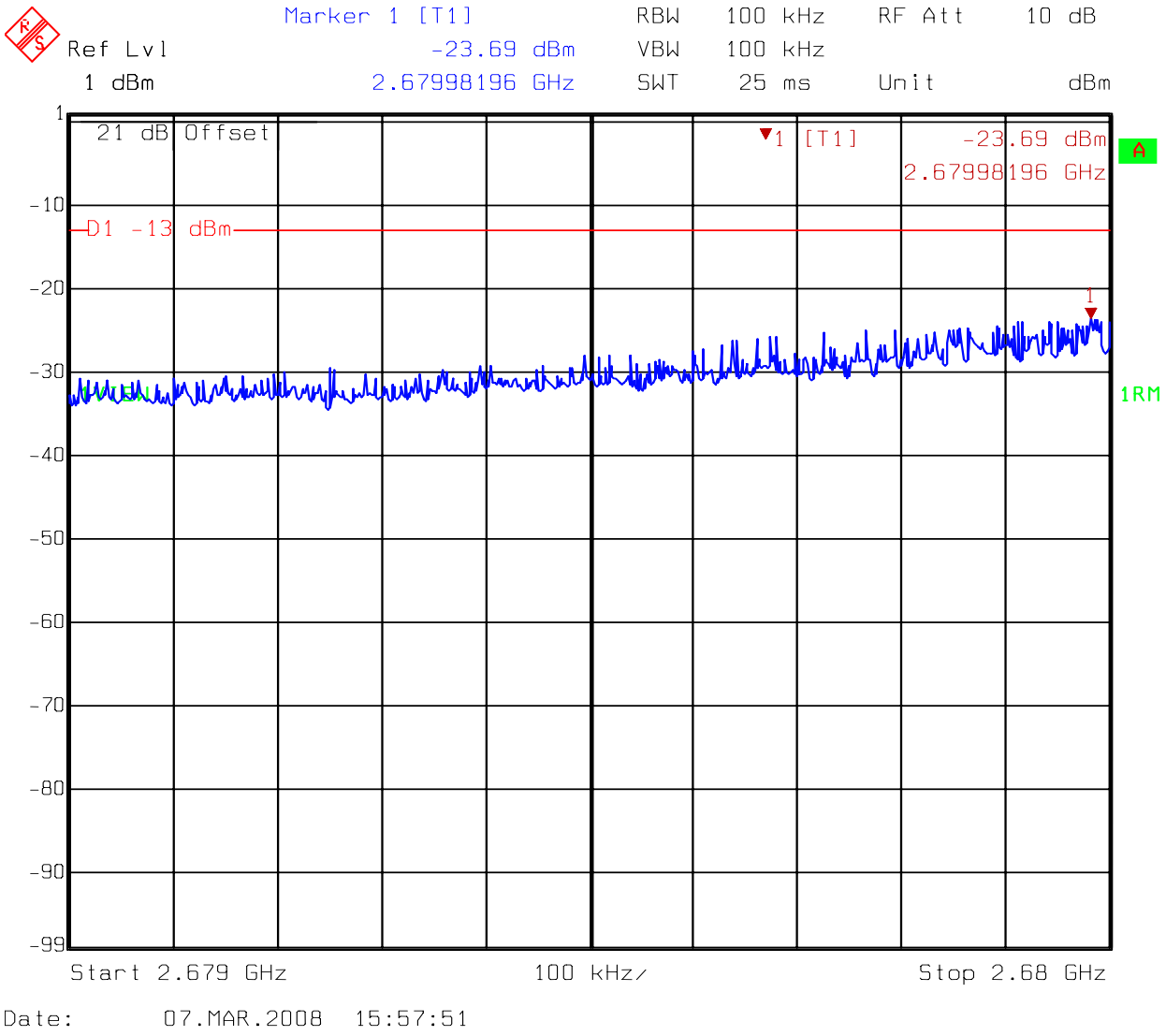


Figure 54. Spurious Emission at Antenna Terminals @ high channel (10MHz) – 5 of 8

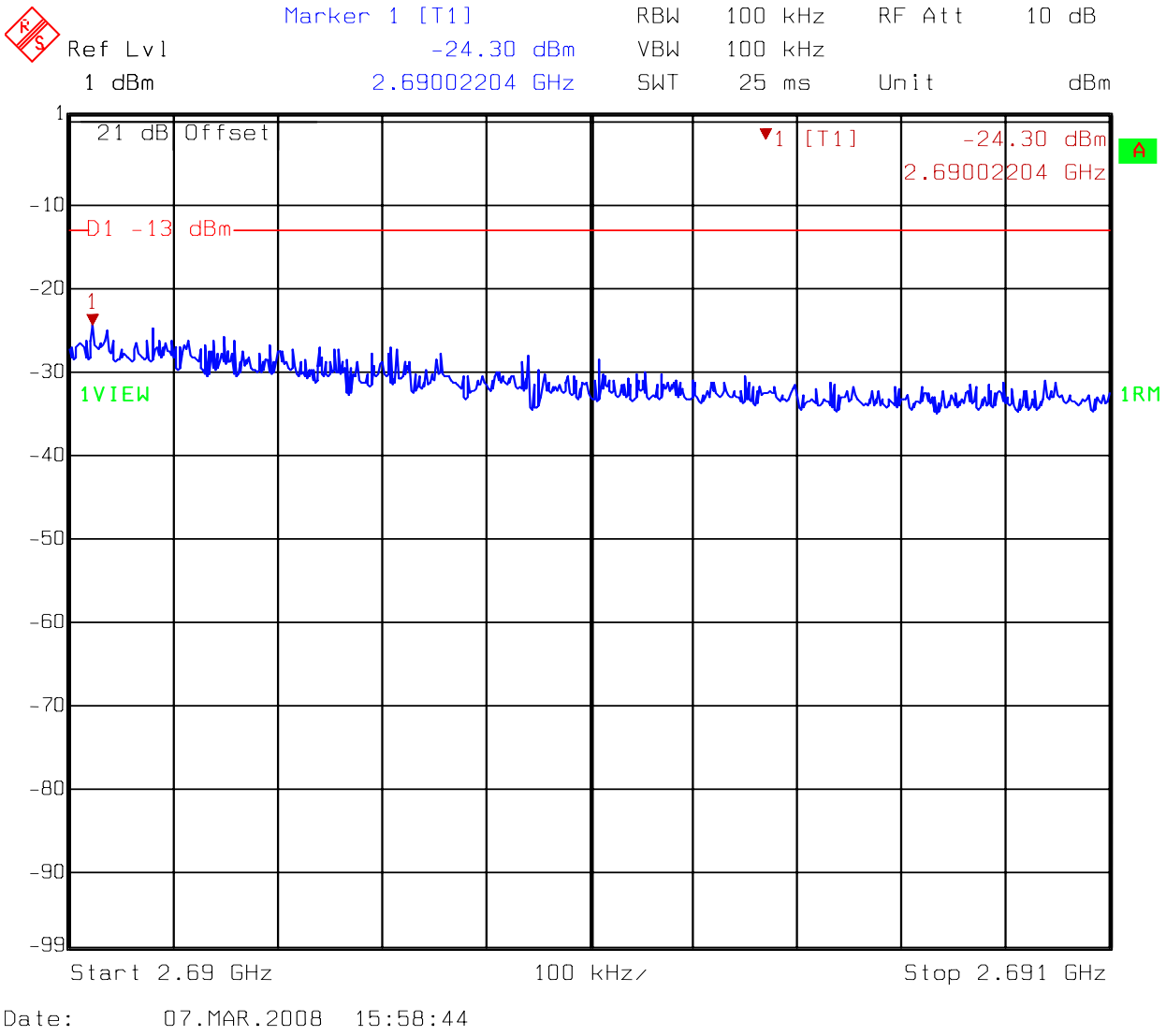


Figure 55. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 6 of 8

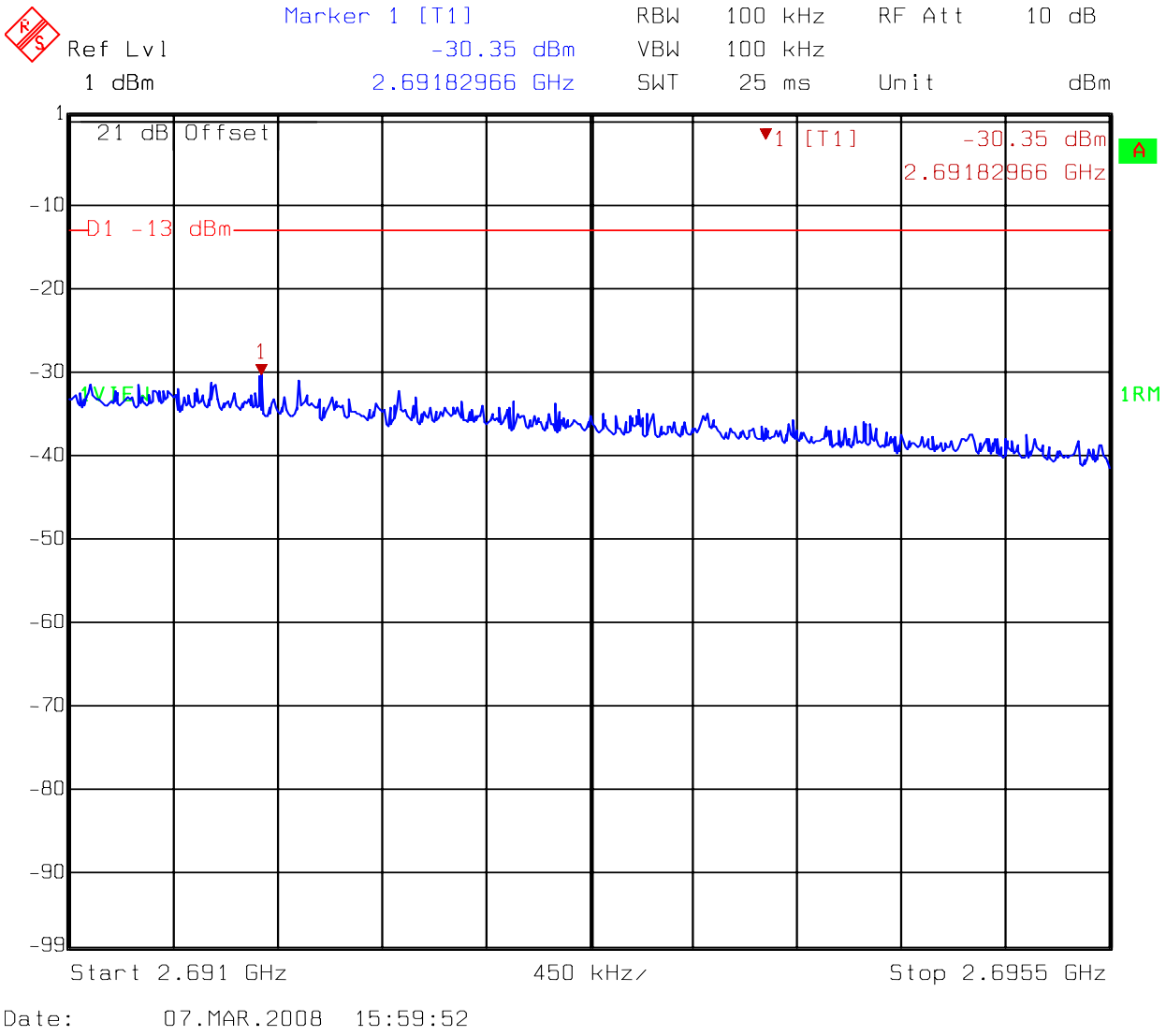


Figure 56. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 7 of 8

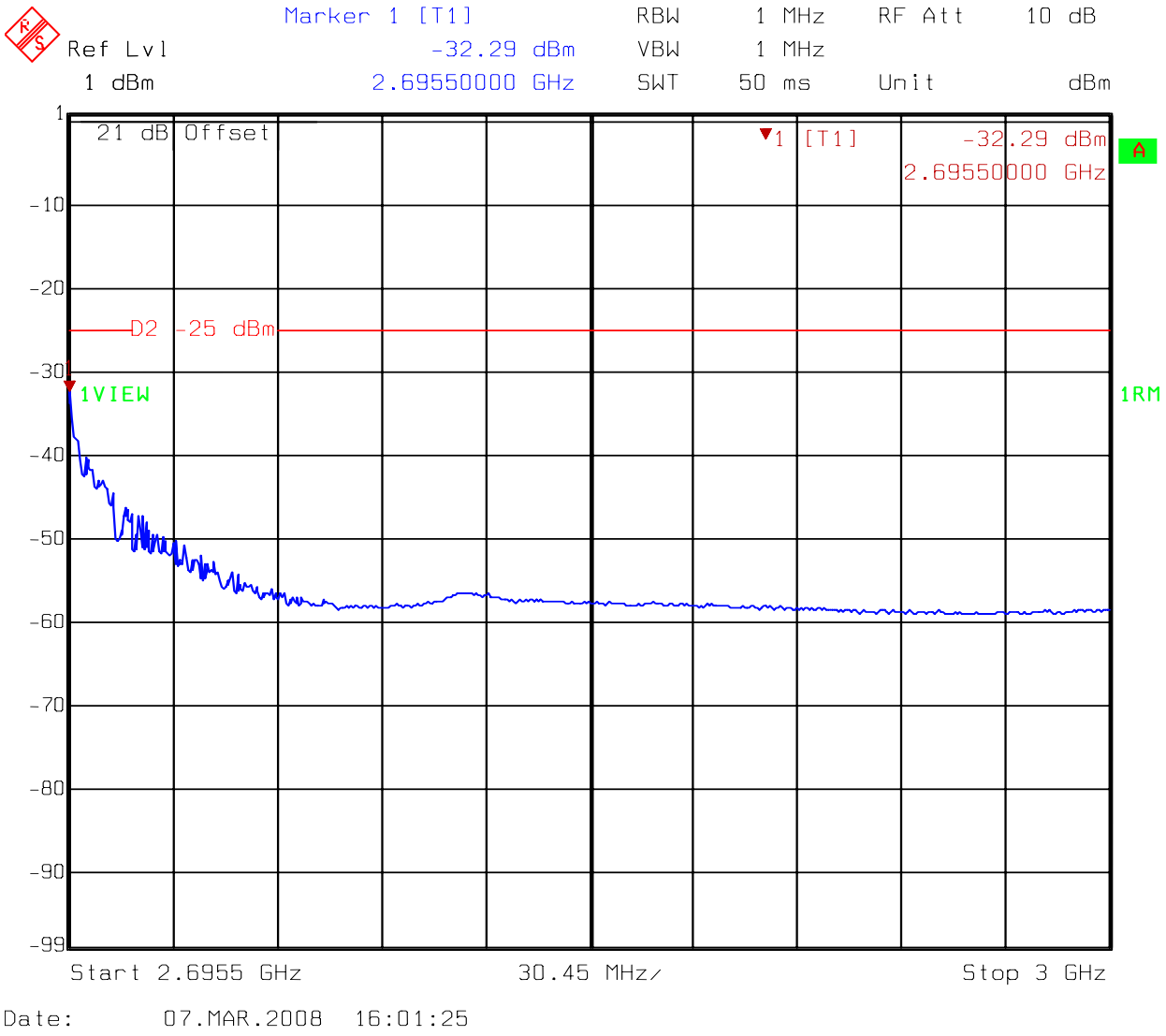
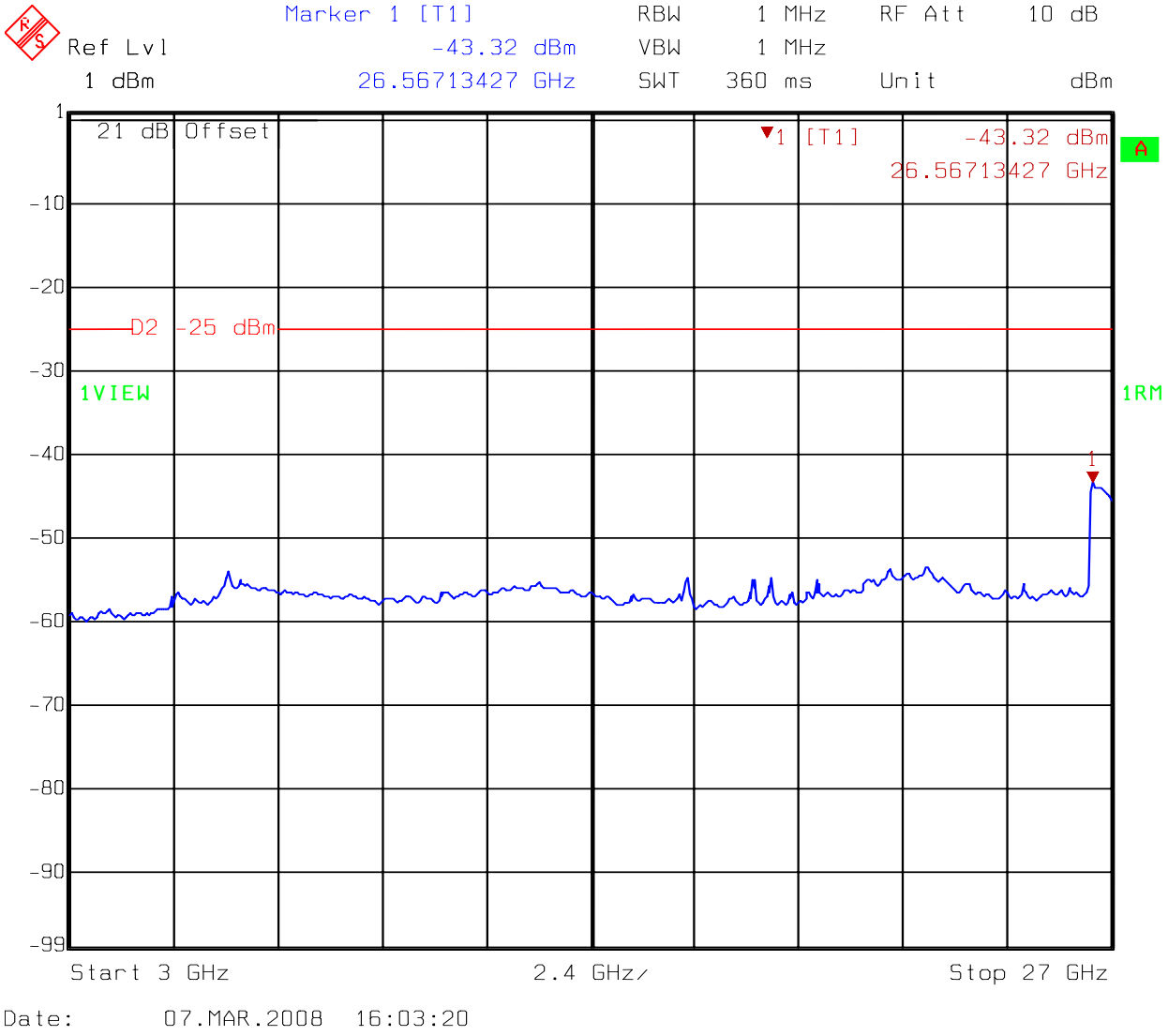


Figure 57. Spurious Emission at Antenna Terminals @ high channel (10MHz) - 8 of 8



8. 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: Mar. 10, 2008
Input Power: 120Vac, 60Hz
Environmental Conditions: 23℃, 53%

Test Equipment: EC1351, EC1353, EC1354, EC1365, EC1371, EC1373, EC1374, EP1364, EP1347

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

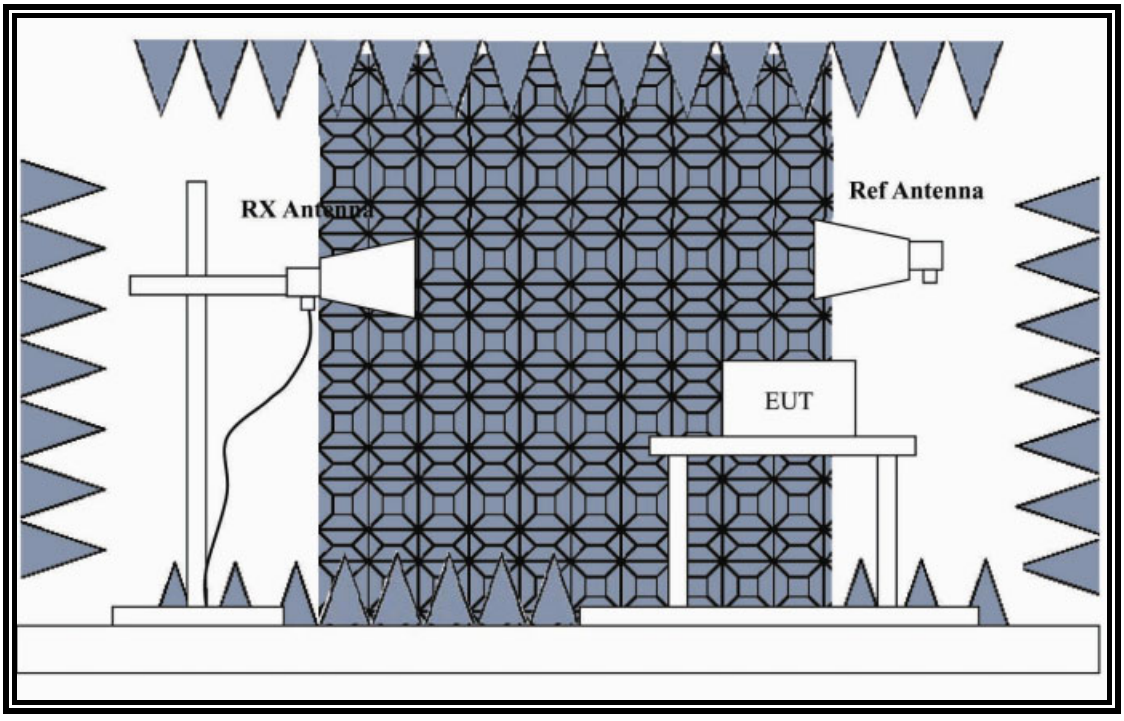
Radiated emissions were invested cover the frequency range from 30MHz to 1000MHz using a receiver RBW of 120kHz record QP reading

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.

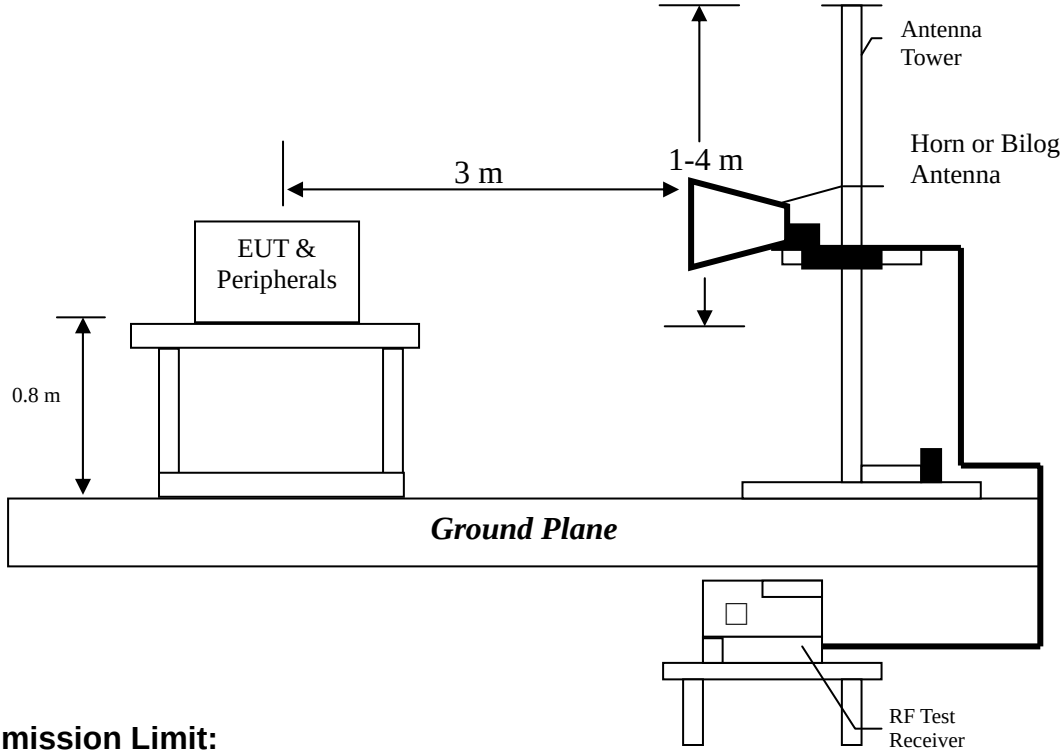
The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated 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	374.350	QP	15.06	24.93	39.99	46.00	-6.01
V	499.480	QP	18.43	19.95	38.38	46.00	-7.63
V	532.460	QP	19.46	19.06	38.52	46.00	-7.48
V	666.320	QP	21.50	15.77	37.27	46.00	-8.73
V	749.740	QP	22.74	15.27	38.01	46.00	-7.99
V	933.070	QP	25.13	16.74	41.87	46.00	-4.14

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	249.220	QP	12.36	24.09	36.45	46.00	-9.55
H	374.350	QP	15.48	24.86	40.34	46.00	-5.67
H	492.690	QP	18.64	22.30	40.94	46.00	-5.06
H	532.460	QP	19.65	21.02	40.67	46.00	-5.33
H	749.740	QP	22.95	17.33	40.28	46.00	-5.72
H	933.070	QP	25.33	19.51	44.84	46.00	-1.16

Table3. Spurious Radiated Emission

Frequency (MHz)
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	266.680	-64.49	0.2	2.27	-62.42	-25	-37.42	5
V	534.400	-68.81	0.3	6.61	-62.50	-25	-37.50	5
V	668.260	-65.93	0.4	7.01	-59.32	-25	-34.32	5
V	906.880	-56.74	0.7	7.39	-50.05	-25	-25.05	5
H	249.220	-68.04	0.2	2.27	-65.97	-25	-40.97	5
H	266.680	-67.97	0.2	2.27	-65.90	-25	-40.90	5
H	307.420	-70.26	0.2	3.56	-66.90	-25	-41.90	5
H	534.400	-69.51	0.3	6.61	-63.20	-25	-38.20	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	2397.2	-43.97	0.3	9.1	-35.17	-25	-10.17	5
H	2388.8	-55.38	0.3	9.1	-46.58	-25	-21.58	5
V	5000	-36.64	0.5	9.6	-27.54	-25	-2.54	5
H	5000	-42.07	0.5	9.6	-32.97	-25	-7.97	5
V	7500	-45.54	0.74	10.1	-36.18	-25	-11.18	5
H	7500	-48.7	0.74	10.1	-39.34	-25	-14.34	5

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

Frequency (MHz)
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	212.360	-71.98	0.2	2.27	-69.91	-25	-44.91	5
V	266.680	-65.33	0.2	2.27	-63.26	-25	-38.26	5
V	532.460	-69.05	0.3	6.61	-62.74	-25	-37.74	5
V	668.260	-66.14	0.4	7.01	-59.53	-25	-34.53	5
H	249.220	-67.62	0.2	2.27	-65.55	-25	-40.55	5
H	266.680	-67.28	0.2	2.27	-65.21	-25	-40.21	5
H	400.540	-70.63	0.2	4.25	-66.58	-25	-41.58	5
H	534.400	-69.59	0.3	6.61	-63.28	-25	-38.28	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	2369.2	-50.29	0.3	9.1	-41.49	-25	-16.49	5
H	2388.8	-50.27	0.3	9.1	-41.47	-25	-16.47	5
V	5180	-40.02	0.5	9.6	-30.92	-25	-5.92	5
H	5180	-45.22	0.5	9.6	-36.12	-25	-11.12	5
V	7770	-49.18	0.74	10.1	-39.82	-25	-14.82	5
H	7770	-52.01	0.74	10.1	-42.65	-25	-17.65	5

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

Frequency (MHz)
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	266.680	-65.38	0.2	2.27	-63.31	-25	-38.31	5
V	534.400	-69.65	0.3	6.61	-63.34	-25	-38.34	5
V	668.260	-65.96	0.4	7.01	-59.35	-25	-34.35	5
V	802.120	-64.66	0.6	7.53	-57.73	-25	-32.73	5
H	249.220	-65.87	0.2	2.27	-63.80	-25	-38.80	5
H	266.680	-67.56	0.2	2.27	-65.49	-25	-40.49	5
H	400.540	-69.43	0.2	4.25	-65.38	-25	-40.38	5
H	534.400	-68.87	0.3	6.61	-62.56	-25	-37.56	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	2386	-49.32	0.3	9.1	-40.52	-25	-15.52	5
H	2388.8	-54.4	0.3	9.1	-45.6	-25	-20.6	5
V	5370	-41.49	0.5	9.6	-32.39	-25	-7.39	5
H	5370	-47.38	0.5	9.6	-38.28	-25	-13.28	5
V	8055	-56.39	0.74	10.1	-47.03	-25	-22.03	5
H	8055	-58.51	0.74	10.1	-49.15	-25	-24.15	5

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

Frequency (MHz)
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	266.680	-64.86	0.2	2.27	-62.79	-25	-37.79	10
V	400.540	-67.84	0.2	4.25	-63.79	-25	-38.79	10
V	534.400	-69.19	0.3	6.61	-62.88	-25	-37.88	10
V	668.260	-66.52	0.4	7.01	-59.91	-25	-34.91	10
H	249.220	-67.98	0.2	2.27	-65.91	-25	-40.91	10
H	266.680	-67.64	0.2	2.27	-65.57	-25	-40.57	10
H	400.540	-70.68	0.2	4.25	-66.63	-25	-41.63	10
H	534.400	-69.8	0.3	6.61	-63.49	-25	-38.49	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	2397.2	-42.86	0.3	9.1	-34.06	-25	-9.06	10
H	2352.4	-54.37	0.3	9.1	-45.57	-25	-20.57	10
V	5010	-38.90	0.5	9.6	-29.80	-25	-4.80	10
H	5010	-41.96	0.5	9.6	-32.86	-25	-7.86	10
V	7515	-52.31	0.74	10.1	-42.95	-25	-17.95	10
H	7515	-53.44	0.74	10.1	-44.08	-25	-19.08	10

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

Frequency (MHz)
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	266.680	-65.06	0.2	2.27	-62.99	-25	-37.99	10
V	400.540	-69.29	0.2	4.25	-65.24	-25	-40.24	10
V	534.400	-68.4	0.3	6.61	-62.09	-25	-37.09	10
V	668.260	-65.55	0.4	7.01	-58.94	-25	-33.94	10
H	249.220	-66.39	0.2	2.27	-64.32	-25	-39.32	10
H	266.680	-67.98	0.2	2.27	-65.91	-25	-40.91	10
H	307.420	-70.73	0.2	3.56	-67.37	-25	-42.37	10
H	885.540	-64.02	0.6	8.01	-56.61	-25	-31.61	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	2397.2	-47.54	0.3	9.1	-38.74	-25	-13.74	10
H	2352.4	-54.41	0.3	9.1	-45.61	-25	-20.61	10
V	5180	-39.82	0.5	9.6	-30.72	-25	-5.72	10
H	5180	-44.82	0.5	9.6	-35.72	-25	-10.72	10
V	7770	-53.73	0.74	10.1	-44.37	-25	-19.37	10
H	7770	-50.98	0.74	10.1	-41.62	-25	-16.62	10

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

Frequency (MHz)
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	266.680	-65.04	0.2	2.27	-62.97	-25	-37.97	10
V	400.540	-69	0.2	4.25	-64.95	-25	-39.95	10
V	668.260	-66.07	0.4	7.01	-59.46	-25	-34.46	10
V	761.380	-64.57	0.5	7.25	-57.82	-25	-32.82	10
H	249.220	-66.53	0.2	2.27	-64.46	-25	-39.46	10
H	266.680	-67.93	0.2	2.27	-65.86	-25	-40.86	10
H	532.460	-70.92	0.3	6.61	-64.61	-25	-39.61	10
H	802.120	-64.71	0.6	7.53	-57.78	-25	-32.78	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	2397.2	-46.61	0.3	9.1	-37.81	-25	-12.81	10
H	2352.4	-53.69	0.3	9.1	-44.89	-25	-19.89	10
V	5370	-44.52	0.5	9.6	-35.42	-25	-10.42	10
H	5370	-50.99	0.5	9.6	-41.89	-25	-16.89	10
V	8055	-58.62	0.74	10.1	-49.26	-25	-24.26	10
H	8055	-59.43	0.74	10.1	-50.07	-25	-25.07	10

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

Figure 58. Photos - Radiated Emissions

9. AC power line conducted emission

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

Tested By: Jimmie Liu
Test Date: Mar. 07,2008
Input Power: 120Vac, 60Hz
Environmental Conditions: 23℃, 53%

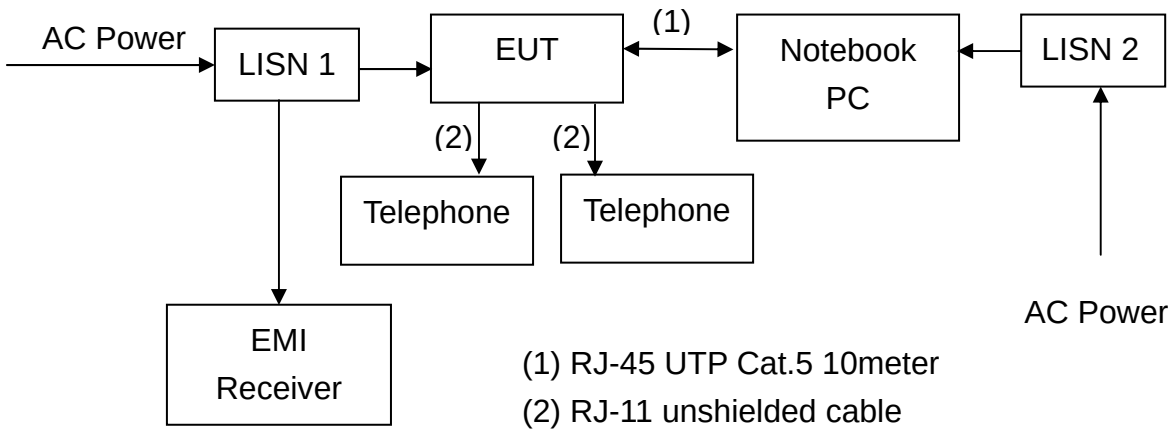
Test Equipment: EC1303

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:



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

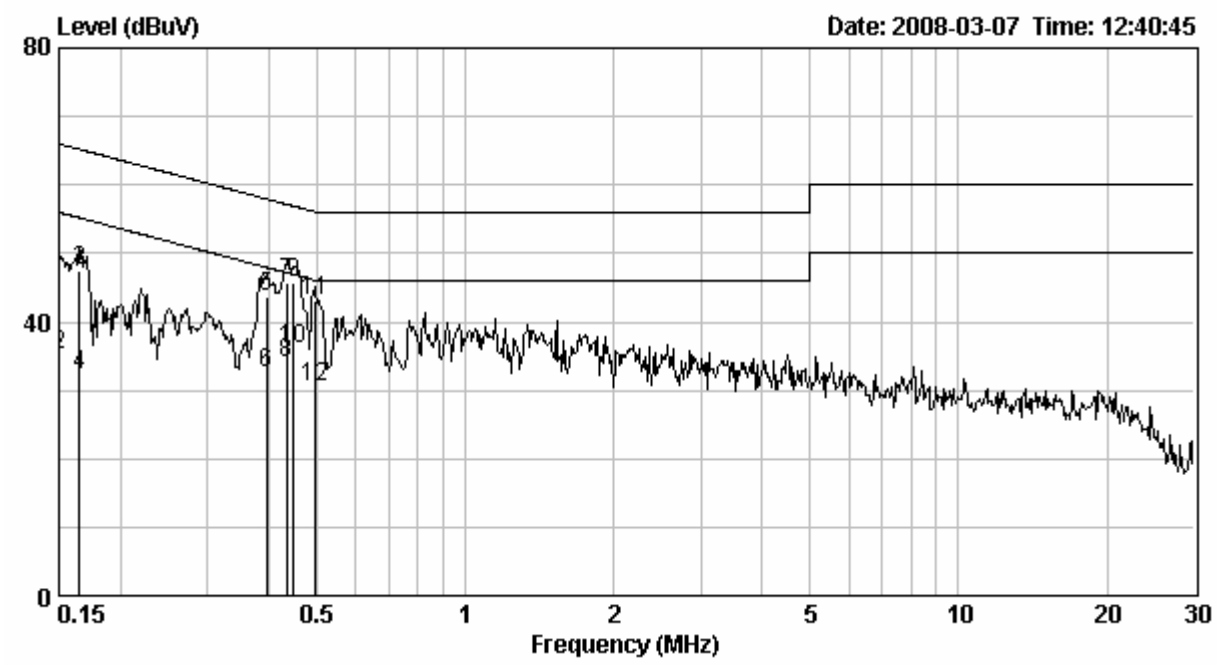
Measurement Data: See Tables & plots below

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

Phase : Line
EUT : MAX-206M2
Test Condition : Normal operating mode
Antenna type : PCB antenna

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.80	46.79	66.00	35.28	56.00	-19.21	-20.72
0.165	0.80	47.57	65.21	32.09	55.21	-17.64	-23.12
0.396	0.12	43.76	57.95	32.61	47.95	-14.19	-15.34
0.435	0.10	45.60	57.15	34.09	47.15	-11.55	-13.06
0.449	0.10	45.73	56.89	36.07	46.89	-11.16	-10.82
0.494	0.10	43.05	56.10	30.51	46.10	-13.05	-15.59

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



Phase : Neutral
EUT : MAX-206M2
Test Condition : Normal operating mode
Antenna type : PCB antenna

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.10	49.53	66.00	35.32	56.00	-16.47	-20.68
0.163	0.10	48.28	65.30	31.33	55.30	-17.02	-23.97
0.383	0.10	44.51	58.21	32.60	48.21	-13.70	-15.61
0.440	0.10	45.11	57.07	34.94	47.07	-11.96	-12.13
0.454	0.10	46.18	56.80	38.41	46.80	-10.62	-8.39
0.494	0.10	42.34	56.10	30.30	46.10	-13.76	-15.80

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

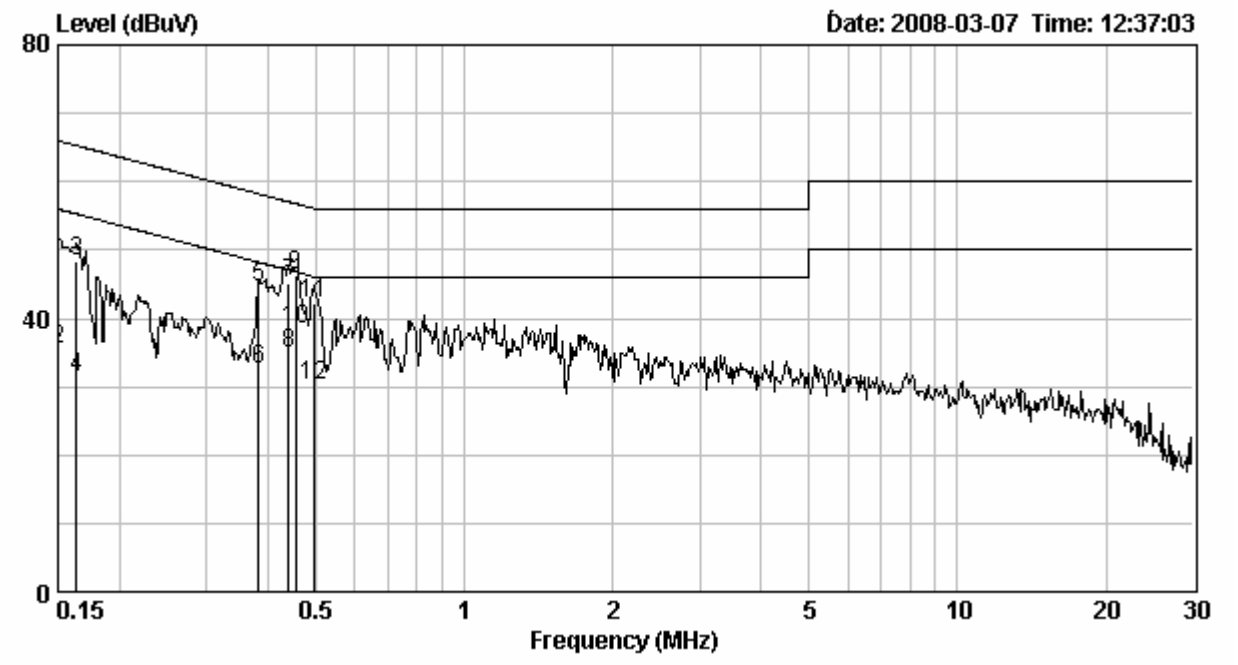
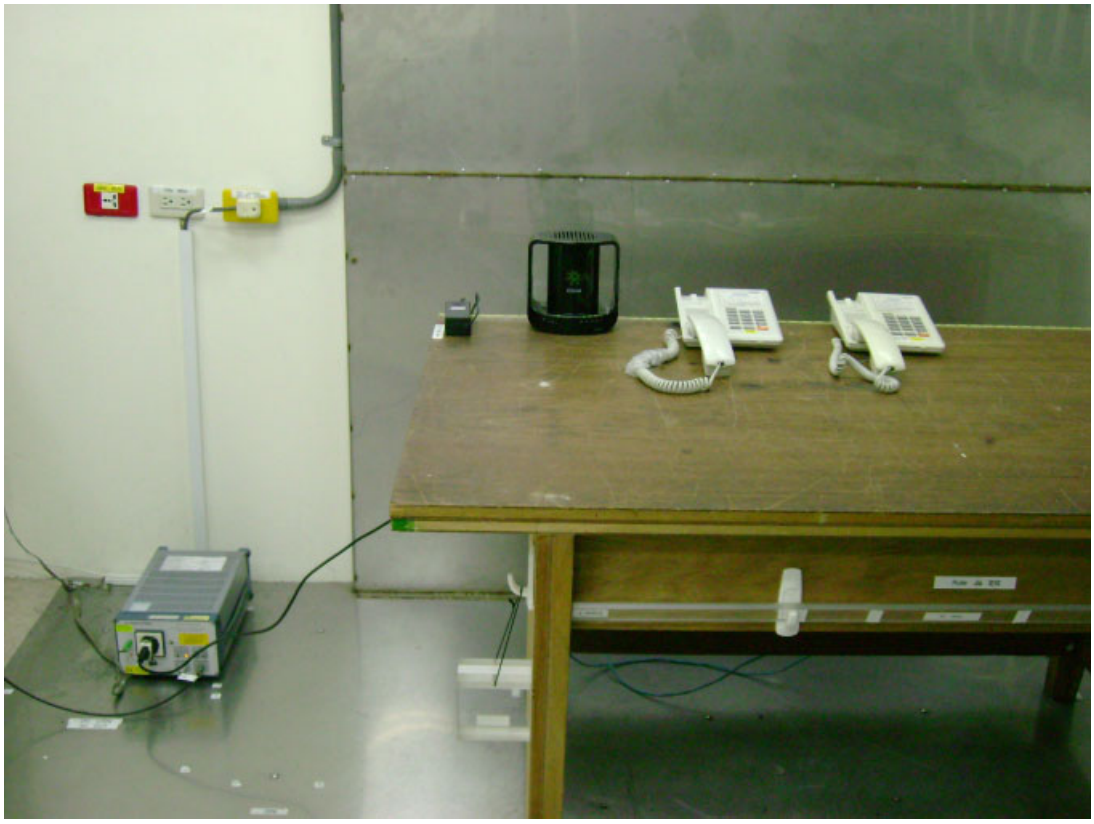


Figure 59. Photos - Conducted Emissions



10. Frequency Stability

Name of Test	Frequency Stability
Base Standard	FCC 2.1055 & 27.54

Tested By: Jimmie Liu
Test Date: Mar. 10, 2008

Test Equipment: EC1365

Test Result: Complies
Test Procedure and Setup: N/A
Measurement Data: See below table

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 10ppm.

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

Frequency	Temperature (℃)	Test Results (ppm)
Low	50	7.13
	22	2.54
	-30	-6.98
Middle	50	8.56
	22	1.65
	-30	3.25
High	50	5.34
	22	5.65
	-30	-7.23

For 10MHz BW

Frequency	Temperature (℃)	Test Results (ppm)
Low	50	4.95
	22	-3.56
	-30	6.87
Middle	50	1.56
	22	7.89
	-30	4.89
High	50	-7.87
	22	-4.96
	-30	1.56

Normal temperature_22℃:

For 5MHz BW

Frequency	Mains Voltage (Vac)	Test Results (ppm)
Low	102	-5.54
	120	7.45
	138	4.98
Middle	102	5.89
	120	-8.45
	138	1.25
High	102	-1.89
	120	7.23
	138	5.61

For 10MHz BW

Frequency	Mains Voltage (Vac)	Test Results (ppm)
Low	102	8.64
	120	1.56
	138	8.65
Middle	102	0.78
	120	-5.31
	138	4.25
High	102	8.53
	120	9.12
	138	-4.82

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

WiMAX Forum™ Mobile System Profile
Release 1.0 Approved Specification

(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