Intertek ETL SEMKO

10/28/05

Mr. Dave Oswill
Millennial Net, Inc.
2 Fourth Avenue
Burlington, MA 01803

Mr. Dave Oswill:

Enclosed you will find our EMI Test Report covering testing on your MN-5424.

If there are any questions regarding this report, please contact the undersigned or your account representative.

Sincerely,

Nicholas Abbondante
Project Engineer

Jeff Goulet
Engineering Team Leader, EMC

Enclosure

Intertek ETL SEMKO

EMISSIONS TEST REPORT

Report Number: 3084942BOX.005
Project Number: 3084942

Testing performed on the
MeshNode
Model: MN-5424

to

FCC Part 15 Subpart C 15.247

For

Millennial Net, Inc.

Test Performed by:	Test Authorized by:
Intertek – ETL SEMKO	Millennial Net, Inc.
70 Codman Hill Road	2 Fourth Avenue
Boxborough, MA 01719	Burlington, MA 01803

Prepared by: _____ Date: 10/27/05
Nicholas Abbondante

Reviewed by: _____ Date: 10-28-2005
Roland W. Gubisch

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1.0 Job Description

1.1 Client Information

This EUT has been tested at the request of

Company:	Millennial Net, Inc. 2 Fourth Avenue Burlington, MA 01803
Contact:	Dave Oswill
Telephone:	781-222-1030
Fax:	781-222-1039

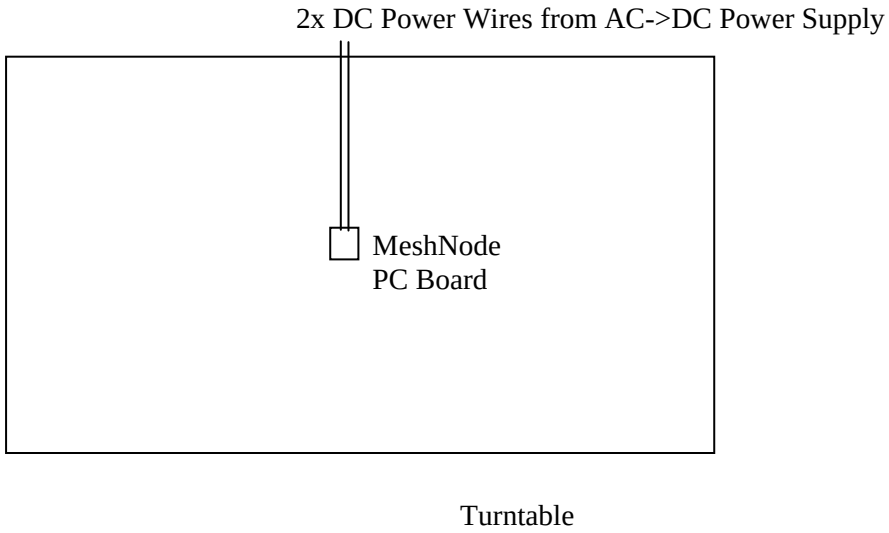
1.2 Equipment Under Test

Equipment Type:	MeshNode
Model Number(s):	MN-5424
Serial number(s):	405360044
Manufacturer:	Millennial Net, Inc.
EUT receive date:	10/11/2005
EUT received condition:	Good
Test start date:	10/11/2005
Test end date:	10/27/2005

1.3 Test Plan Reference: Tested according to the standards listed and ANSI C63.4:2003.

1.4 Test Configuration

1.4.1 Block Diagram



1.4.2 Cable List:

Cable	Shielding	Connector	Length (m)	Qty.
DC Power	None	Wire	2	1

1.4.3 Support Equipment:

Name: UNIFIVE AC-DC Power Supply
Model No.: UL305-3315
Serial No.: 408-0021815

1.5 Mode of Operation:

The EUT was operated as a module, with 3.0VDC power applied from a power supply running at 120V/60Hz AC power. The EUT was transmitting continuously throughout testing.

2.0 Test Summary

TEST STANDARD	RESULTS	
FCC Part 15 Subpart C 15.247		
SUB-TEST	**TEST PARAMETER**	**COMMENT**
Occupied Bandwidth FCC 15.247(a)(2)	The 6 dB bandwidth must be at least 500 kHz.	Pass
Maximum Peak Conducted Output Power and Human RF Exposure FCC 15.247(b)(3-5)	The output power must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm^2.	Pass
Antenna Port Conducted Spurious Emissions FCC 15.209, 15.247(d)	The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc.	Pass
Radiated Spurious Emissions FCC 15.205, 15.209, 15.247(d)	The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209.	Pass
Peak Power Spectral Density FCC 15.247(e)	The peak power spectral density must not exceed 8 dBm / 3 kHz.	Pass
Band Edge Compliance FCC 15.215	The fundamental frequency must stay within the assigned frequency band.	Pass
AC Line-Conducted Emissions FCC 15.207	The AC line-conducted emissions must not exceed the limits of 15.207.	Pass

Notes: The EUT was tested as a module.

The channels selected for test were channels 11, 18, and 26.

Channel 11: 2405 MHz
Channel 18: 2440 MHz
Channel 26: 2480 MHz

3.0 Sample Calculations

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows.

Assume a receiver reading of 52.0 dBμV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 52.0 dBμV
AF = 7.4 dB/m
CF = 1.6 dB
AG = 29.0 dB
FS = 32 dBμV/m

Level in μV/m = [10(32 dBμV/m)/20] = 39.8 μV/m

The following is how net line-conducted readings were determined:

NF = RF + LF + CF + AF

Where NF = Net Reading in dBμV
RF = Reading from receiver in dBμV
LF = LISN Correction Factor in dB
CF = Cable Correction Factor in dB
AF = Attenuator Loss Factor in dB

To convert from dBμV to μV or mV the following was used:

$UF = 10^{(NF / 20)}$ where UF = Net Reading in μV

Example:

NF = RF + LF + CF + AF = 28.5 + 0.2 + 0.4 + 20.0 = 49.1 dBμV
$UF = 10^{(48.1\ dB\mu V / 20)}$ = 254 μV/m

3.1 Measurement Uncertainty

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes.
The expanded uncertainty (k = 2) for radiated emissions from 30 to 1000 MHz has been determined to be:
±3.5 dB at 10m, ±3.8 dB at 3m

The expanded uncertainty (k = 2) for mains conducted emissions from 150 kHz to 30 MHz has been determined to be:
±2.6 dB

The expanded uncertainty (k = 2) for telecom port conducted emissions from 150 kHz to 30 MHz has been determined to be:
±3.2 for ISN and voltage probe measurements
±3.1 for current probe measurements

3.2 Site Description

Test Site(s): 2

Our OATS are 3m and 10m sheltered emissions measurement ranges located in a light commercial environment in Boxborough, Massachusetts. They meet the technical requirements of ANSI C63.4-2003 and CISPR 22:1993/EN 55022:1994 for radiated and conducted emission measurements. The shelter structure is entirely fiberglass and plastic, with outside dimensions of 33 ft x 57 ft. The structure resembles a quonset hut with a center ceiling height of 16.5 ft.

The testing floor is covered by a galvanized sheet metal groundplane that is earth-grounded via copper rods around the perimeter of the site. The joints between individual metal sheets are bridged with a 2 inch wide metal strips to provide low RF impedance contact throughout. The sheets are screwed in place with stainless steel, round-head screws every three inches. Site illumination and HVAC are provided from beneath the ground reference plane through flush entry ports, the port covers are electrically bonded to the ground plane.

A flush metal turntable with 12 ft. diameter and 5000 lb. load capacity (12,000 lb. in Site 3) is provided for floor-standing equipment. A wooden table 80 cm high is used for table-top equipment. The turntable is electrically connected to the ground plane with three copper straps. The straps are connected to the turntable at the center of it with ground braid. The copper strap is directly connected to the groundplane at the edges of the turntable. The turntable is located on the south end of the structure and the antennas are mounted 3 and 10 meters away to the north. The antenna mast is a non-conductive with remote control of antenna height and polarization. The antenna height is adjustable from 1 to 4 meters.

All final radiated emission measurements are performed with the testing personnel and measurement equipment located below the ground reference plane. The site has a full basement underneath the turntable where support equipment may be remotely located. Operation of the antenna, turntable and equipment under test is controlled by remote controls that manipulate the antenna height and polarization and with a turntable control. Test personnel are located below the ellipse when measurements are performed, however the site maintains the ability of having personnel manipulate cables while monitoring test equipment. Ambient radiated emissions are 6 dB or more below the relevant FCC emission limits.

AC mains power is brought to the equipment under test through a power line filter, to remove ambient conducted noise. 50 Hz (240 VAC single phase), 60 Hz power (120 VAC single phase, 208 VAC three phase), and 60 Hz (480 VAC three phase) are available. Conducted emission measurements are performed with a Line Impedance Stabilization Network (LISN) or Artificial Mains Network (AMN) bonded to the ground reference plane. A removable vertical groundplane (2 meter X 2 meter area) is used for line-conducted measurements for table top equipment. The vertical groundplane is electrically connected to the reference groundplane.

The EMC Lab has two Semi-anechoic Chambers and one Shielded Chamber. AC Mains Power is available at 120, 230, and 277 Single Phase; 208, 400, and 480 3-Phase. Large reference groundplanes are installed in the general lab area to facilitate EMC work not requiring a shielded environment.

Test Results: Pass

Test Standard: FCC 15.247(a)(2)

Test: Occupied Bandwidth

Performance Criterion: The 6 dB bandwidth must be at least 500 kHz.

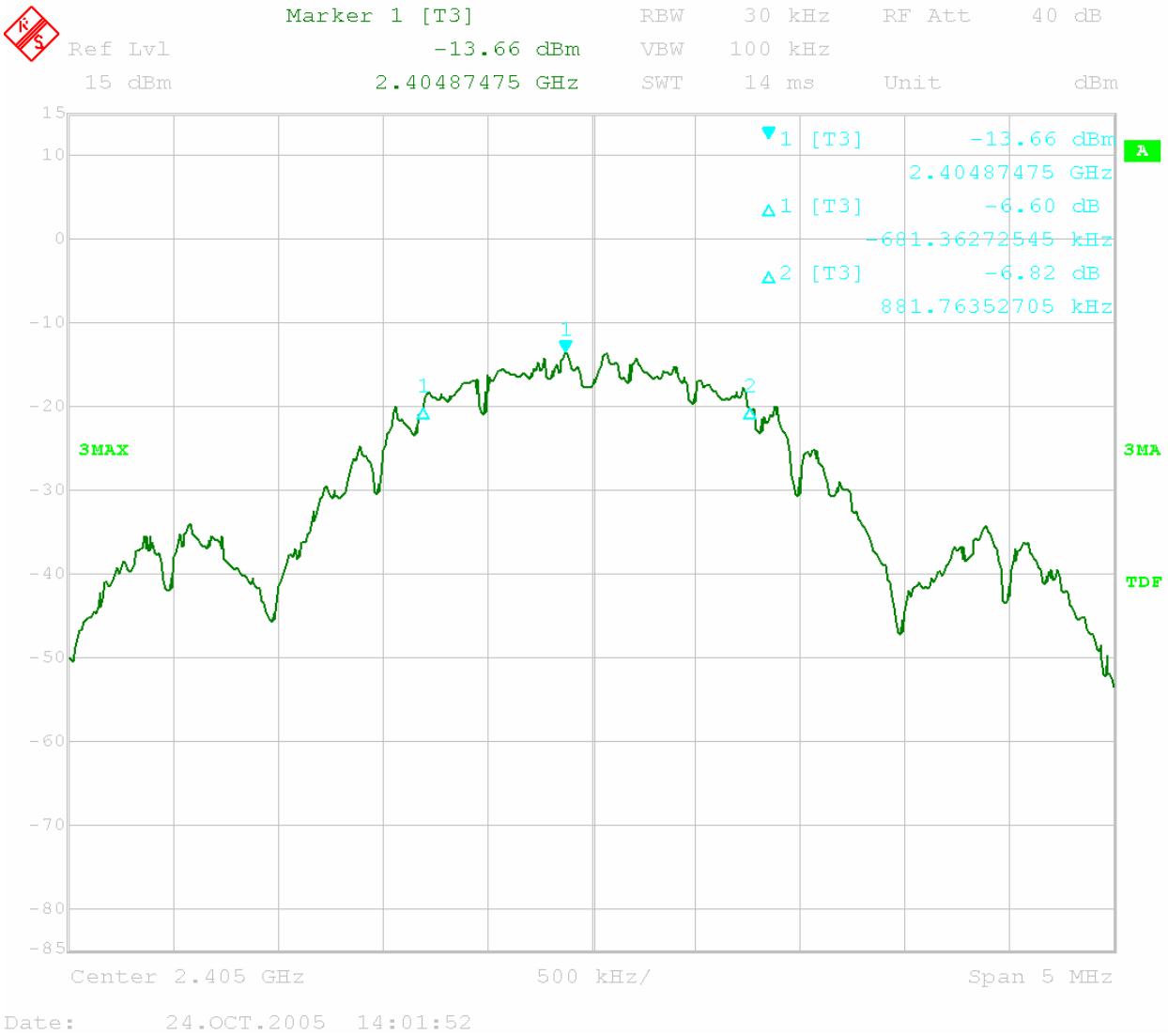
Test Date: 10/24/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWG **Date:** 10-28-2005

Test Equipment Used:

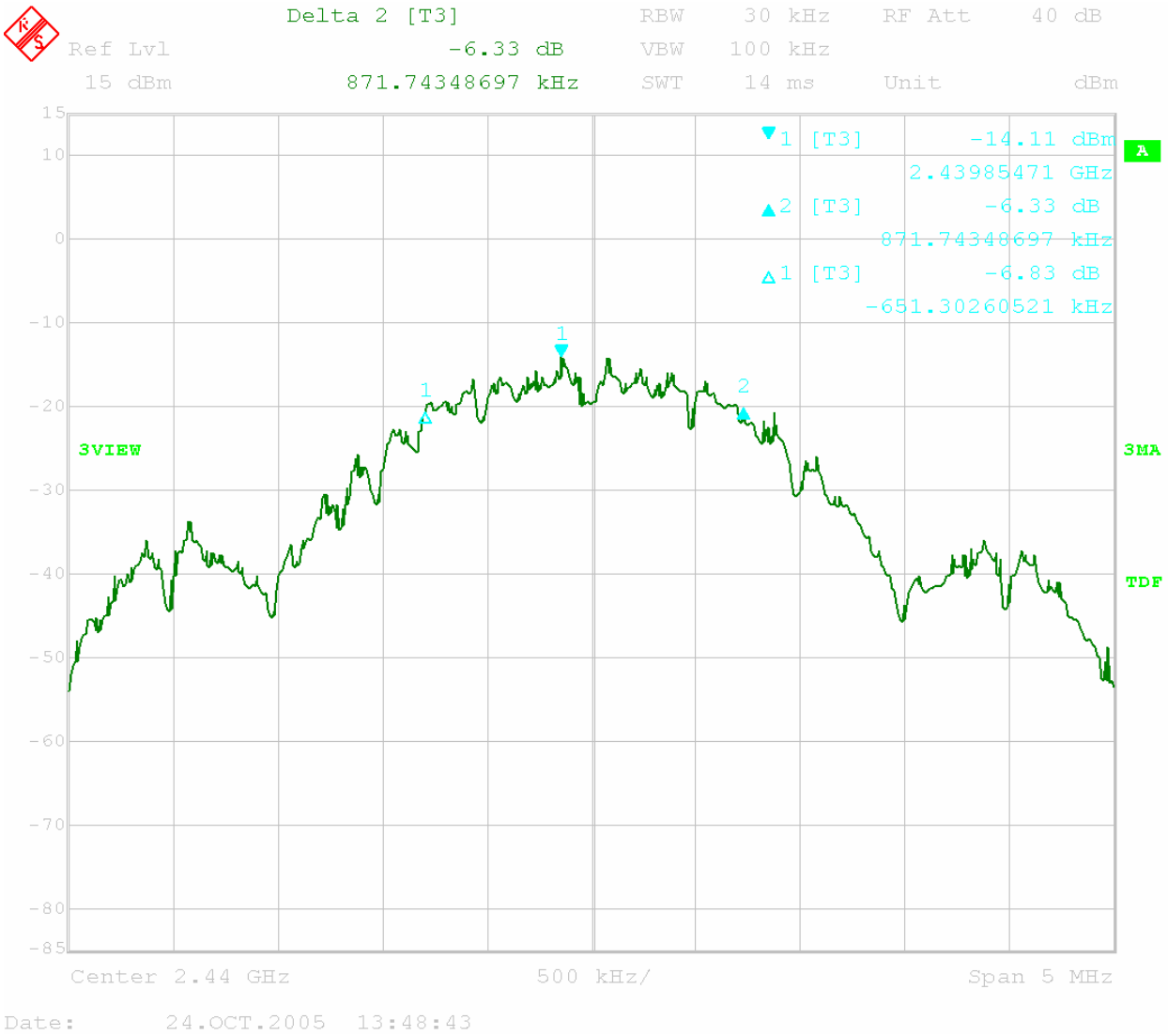
Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005

Test Details:

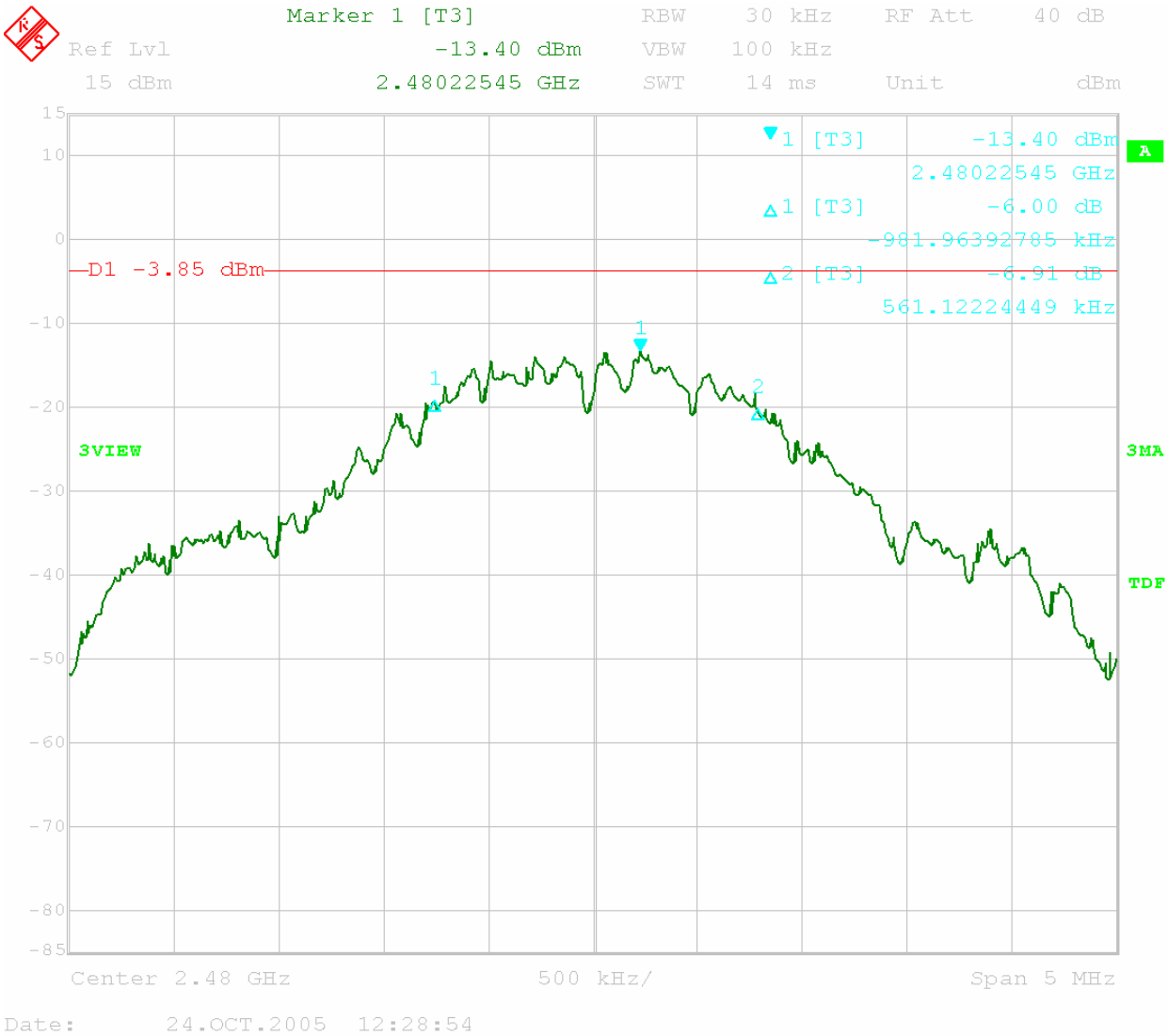
Channel	Frequency	6 dB Bandwidth
11	2405 MHz	1.563 MHz
18	2440 MHz	1.523 MHz
26	2480 MHz	1.543 MHz


Marker 1 [T3]
RBW 30 kHz
RF Att 40 dB
Ref Lvl
-13.66 dBm
VBW 100 kHz
15 dBm
2.40487475 GHz
SWT 14 ms
Unit dBm
1 [T3] -13.66 dBm
2.40487475 GHz
Δ1 [T3] -6.60 dB
-681.36272545 kHz
Δ2 [T3] -6.82 dB
881.76352705 kHz
A
3MAX
3MA
TDF
Center 2.405 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 14:01:52

Channel 11


Delta 2 [T3]
RBW 30 kHz
RF Att 40 dB
Ref Lvl
-6.33 dB
VBW 100 kHz
15 dBm
871.74348697 kHz
SWT 14 ms
Unit dBm
1 [T3] -14.11 dBm
2.43985471 GHz
2 [T3] -6.33 dB
871.74348697 kHz
Δ1 [T3] -6.83 dB
-651.30260521 kHz
A
3VIEW
3MA
TDF
Center 2.44 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 13:48:43

Channel 18


Marker 1 [T3]
RBW 30 kHz
RF Att 40 dB
Ref Lvl
-13.40 dBm
VBW 100 kHz
15 dBm
2.48022545 GHz
SWT 14 ms
Unit dBm
1 [T3] -13.40 dBm
2.48022545 GHz
Δ1 [T3] -6.00 dB
-981.96392785 kHz
D1 -3.85 dBm
Δ2 [T3] -6.91 dB
561.12224449 kHz
3VIEW
3MA
TDF
Center 2.48 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 12:28:54

Channel 26

Test Results: Pass

Test Standard: FCC 15.247(b)(3-5)

Test: Maximum Peak Conducted Output Power and Human RF Exposure

Performance Criterion: The output power must not exceed 1 Watt (30 dBm) and 36 dBm EIRP. The human RF Exposure limit is 1 mW/cm^2.

Test Date: 10/24/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWH. **Date:** 10-28-2005

Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005

Test Details:

Antenna	Type	Model	Connector	Gain
Centurion WCR ½ Wave Coaxial Dipole	Whip	WCR2400-SMRP	Reverse-SMA	2.0 dBi
Pacific Wireless Rubber Duck Omni	Whip	PAWIN24-5RD	Reverse-SMA	5.5 dBi

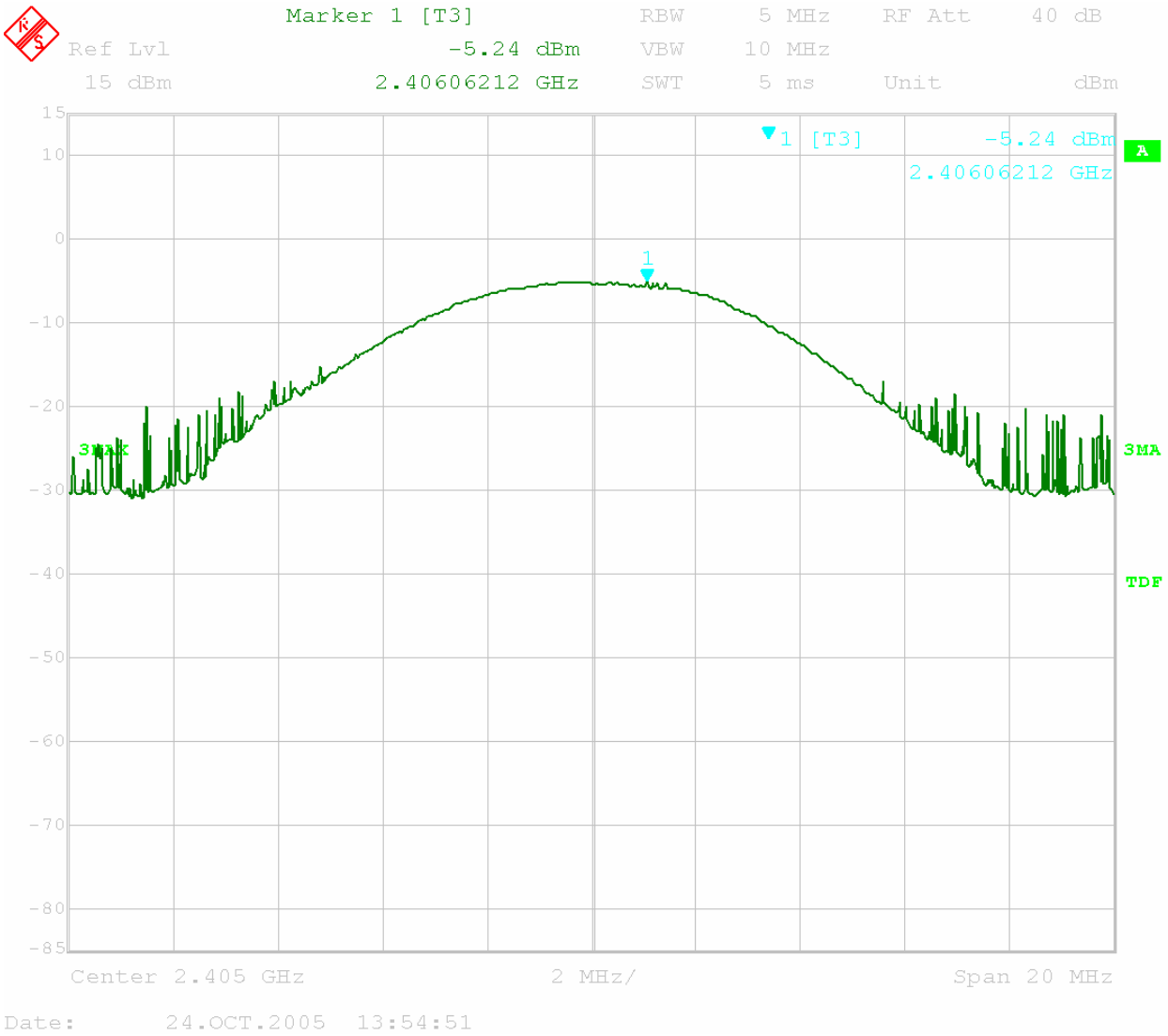
Channel	Frequency	Power	Limit	EIRP	EIRP Limit
11	2405 MHz	-5.24 dBm	30.0 dBm	0.26 dBm	36.0 dBm
18	2440 MHz	-5.62 dBm	30.0 dBm	-0.12 dBm	36.0 dBm
26	2480 MHz	-3.85 dBm	30.0 dBm	1.65 dBm	36.0 dBm

Notes: The cable loss was compensated for in the spectrum analyzer.

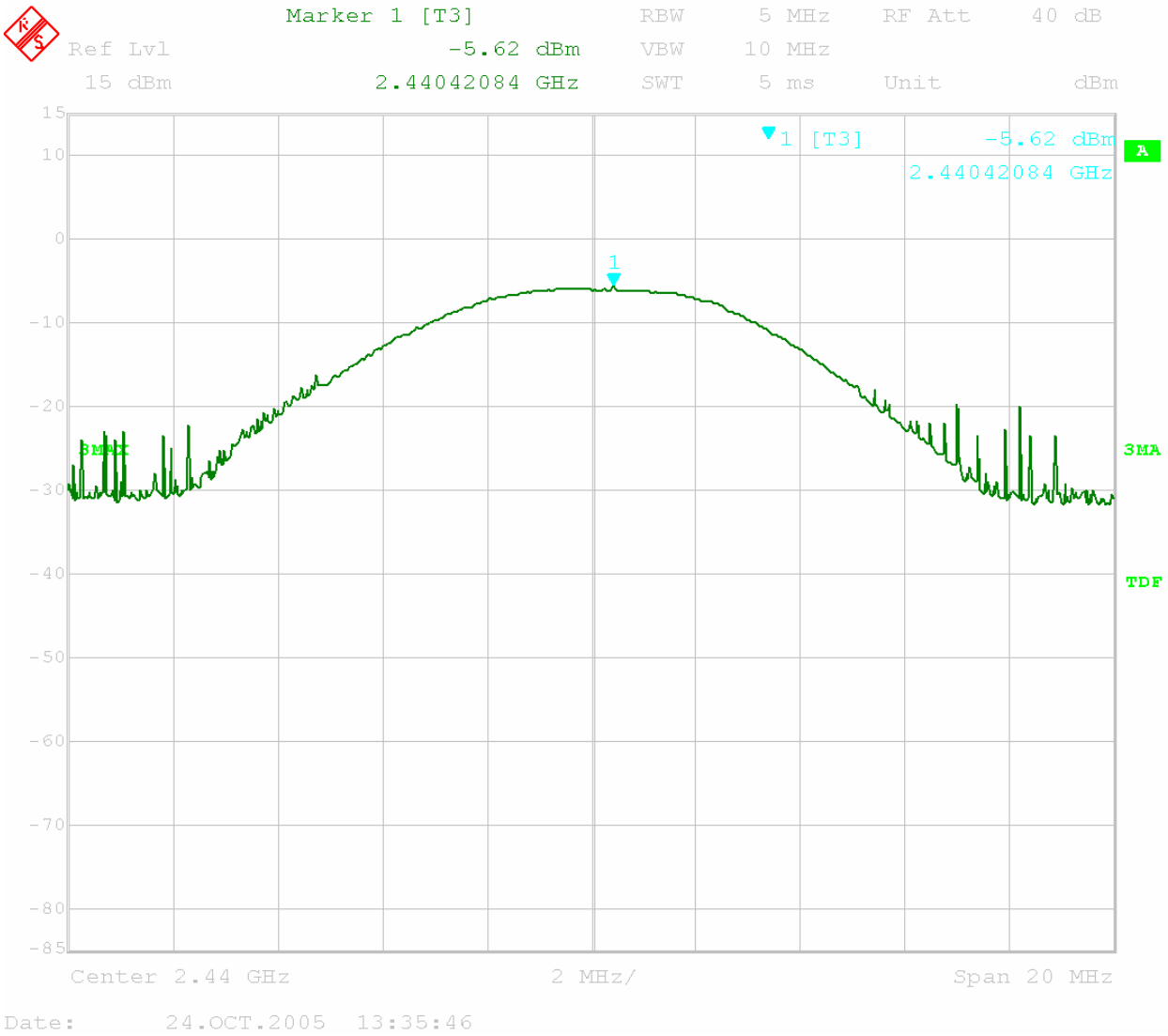
The human RF exposure limit is 1 mW/cm^2. The power density S generated by some value of EIRP at a given distance d is related by the equation:

$$S=EIRP / (4\pi d^2)$$

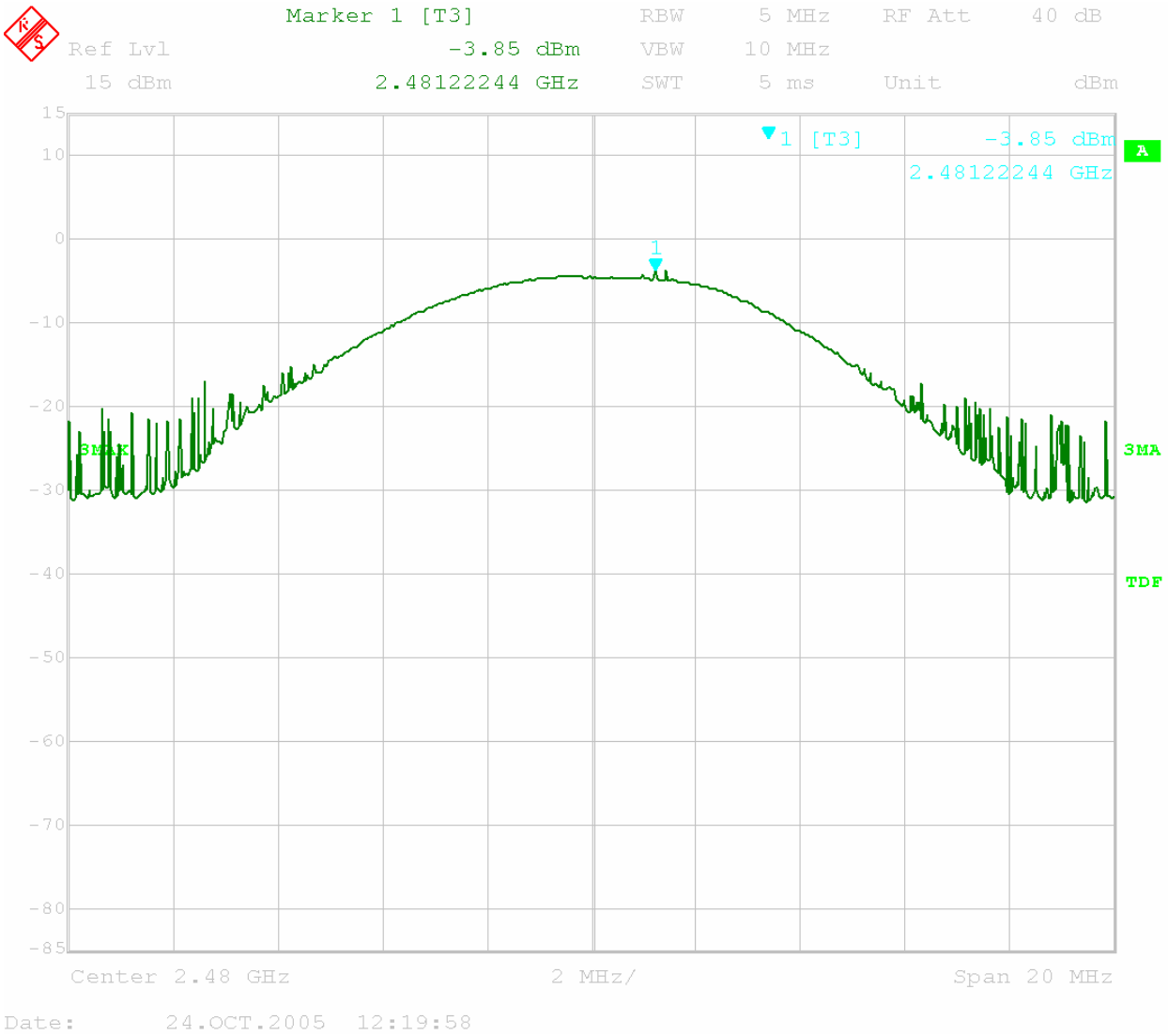
The distance, given a maximum EIRP of 1.65 dBm (1.46 mW) at which the radiated power density of the EUT is equal to the human RF exposure limit is 0.34 cm from the antenna.


Marker 1 [T3]
RBW 5 MHz
RF Att 40 dB
Ref Lvl
-5.24 dBm
VBW 10 MHz
15 dBm
2.40606212 GHz
SWT 5 ms
Unit dBm
1 [T3] -5.24 dBm
2.40606212 GHz
A
3MAX
3MA
TDF
Center 2.405 GHz
2 MHz/
Span 20 MHz
Date: 24.OCT.2005 13:54:51

Channel 11


Marker 1 [T3]
RBW 5 MHz
RF Att 40 dB
Ref Lvl
-5.62 dBm
VBW 10 MHz
15 dBm
2.44042084 GHz
SWT 5 ms
Unit dBm
1 [T3] -5.62 dBm
2.44042084 GHz
A
3MA
TDF
Center 2.44 GHz
2 MHz/
Span 20 MHz
Date: 24.OCT.2005 13:35:46

Channel 18


Marker 1 [T3]
RBW 5 MHz
RF Att 40 dB
Ref Lvl
-3.85 dBm
VBW 10 MHz
15 dBm
2.48122244 GHz
SWT 5 ms
Unit dBm
1 [T3] -3.85 dBm
2.48122244 GHz
A
3MA
TDF
Center 2.48 GHz
2 MHz/
Span 20 MHz
Date: 24.OCT.2005 12:19:58

Channel 26

Test Results: Pass

Test Standard: RSS-210 A8.5

Test: Antenna Port Conducted Spurious Emissions

Performance Criterion: The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc.

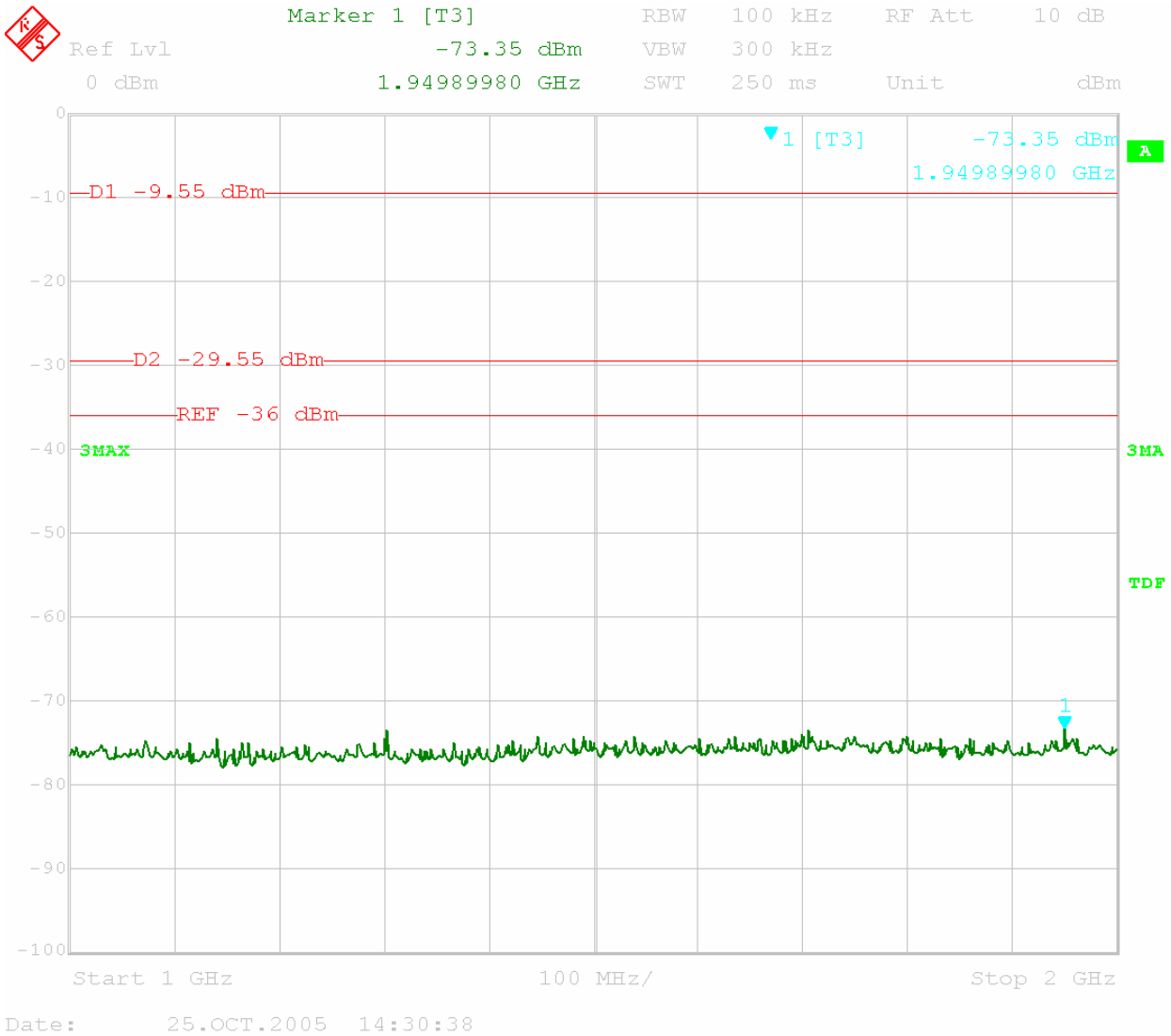
Test Date: 10/25/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWB. **Date:** 10-28-2005

Test Equipment Used:

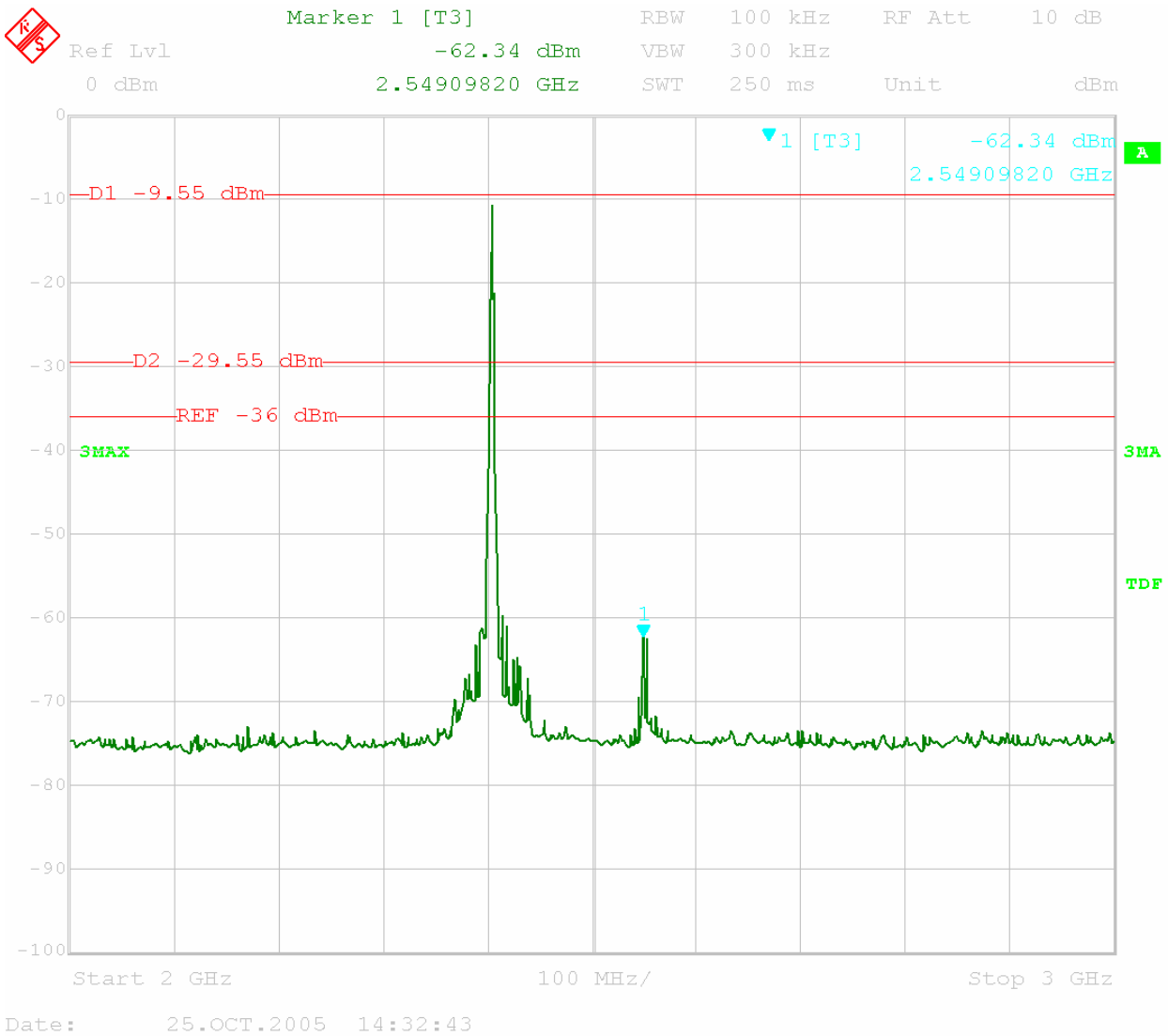
Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005

Test Details:

Notes: A display line was placed at the output power in a 100 kHz bandwidth of the channel under test, and a second display line was placed 20 dB below the first display line. The cable loss was compensated for in the spectrum analyzer.

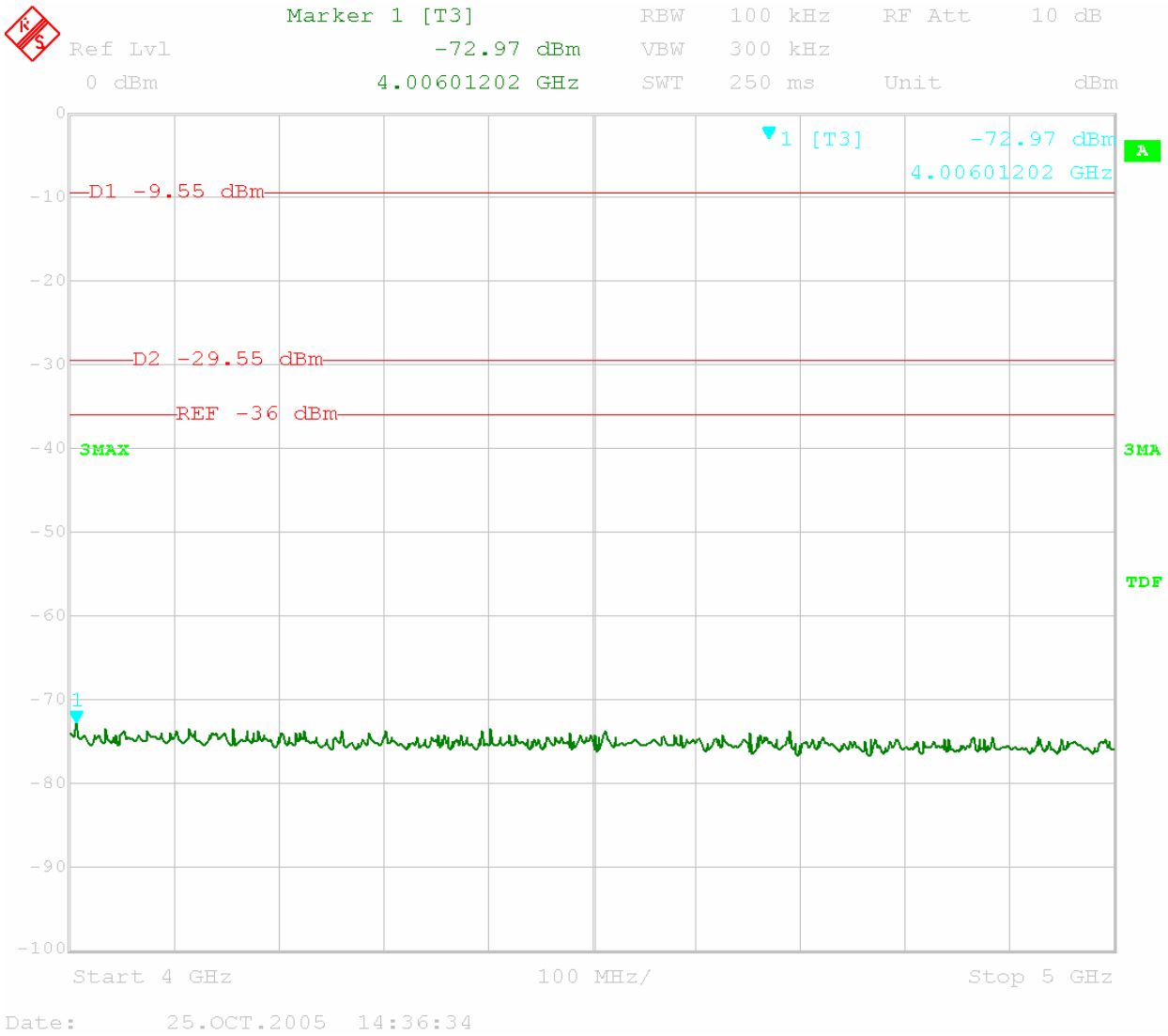


Channel 11 1-2 GHz

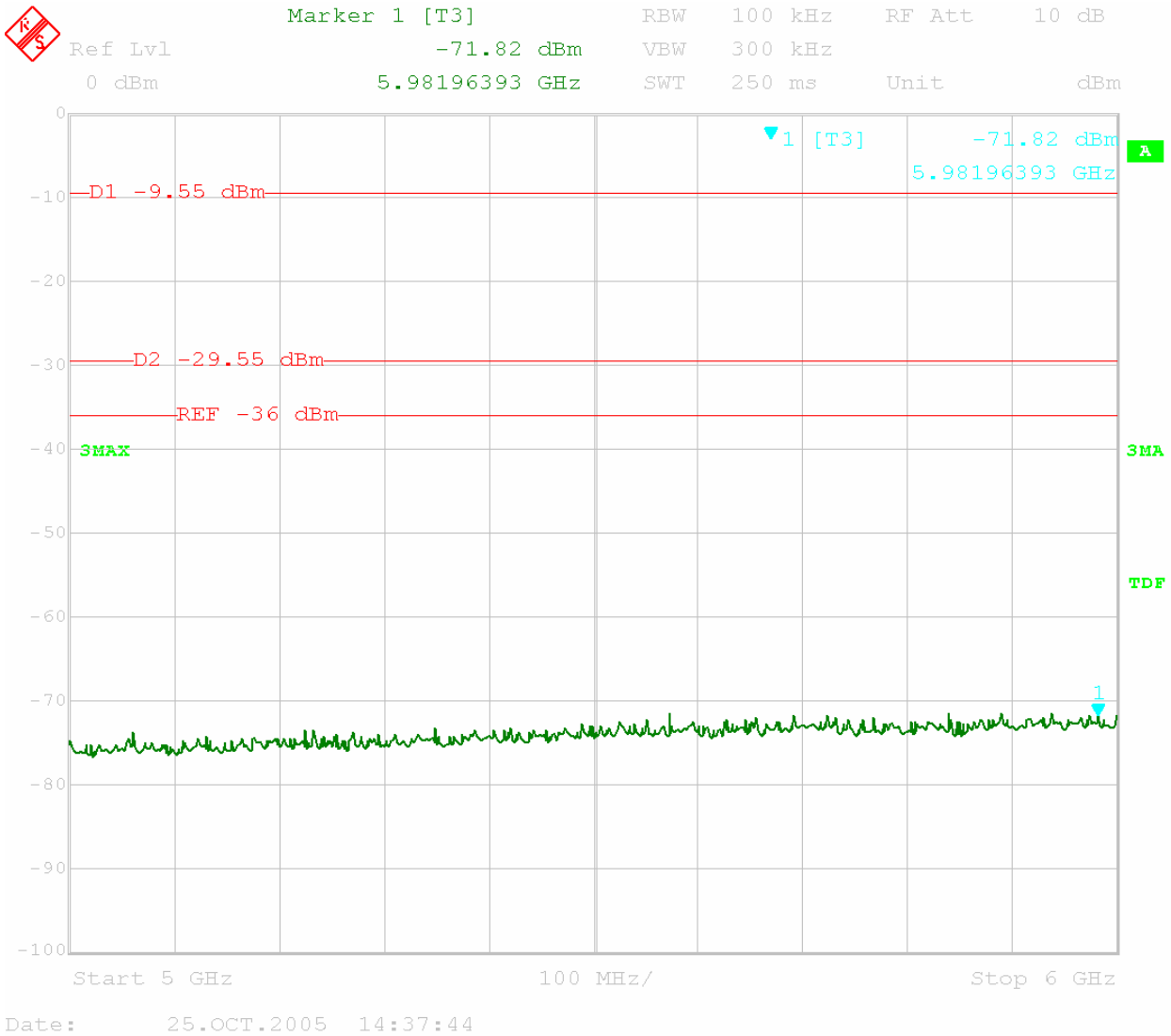


Channel 11 2-3 GHz

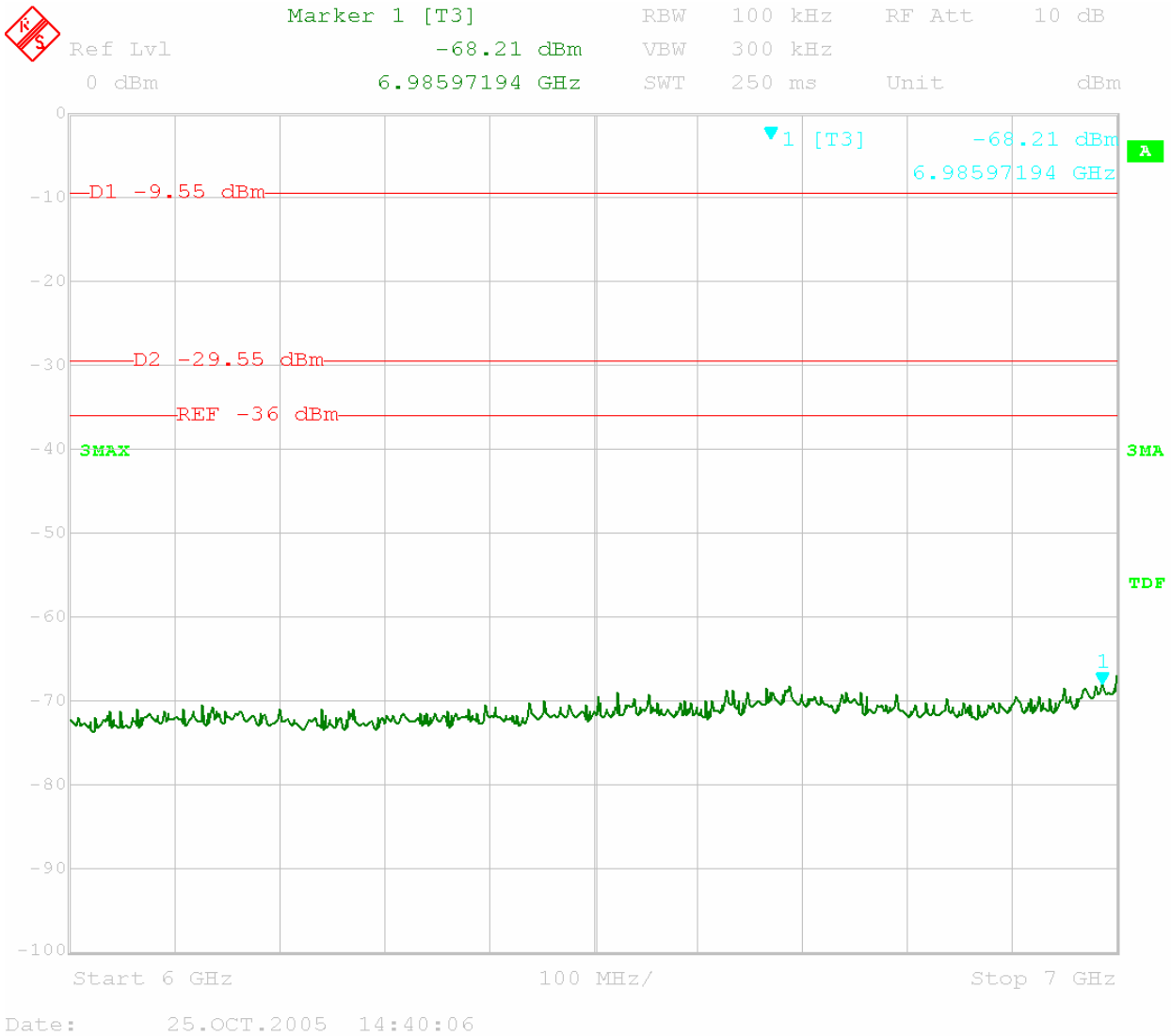
Channel 11 3-4 GHz



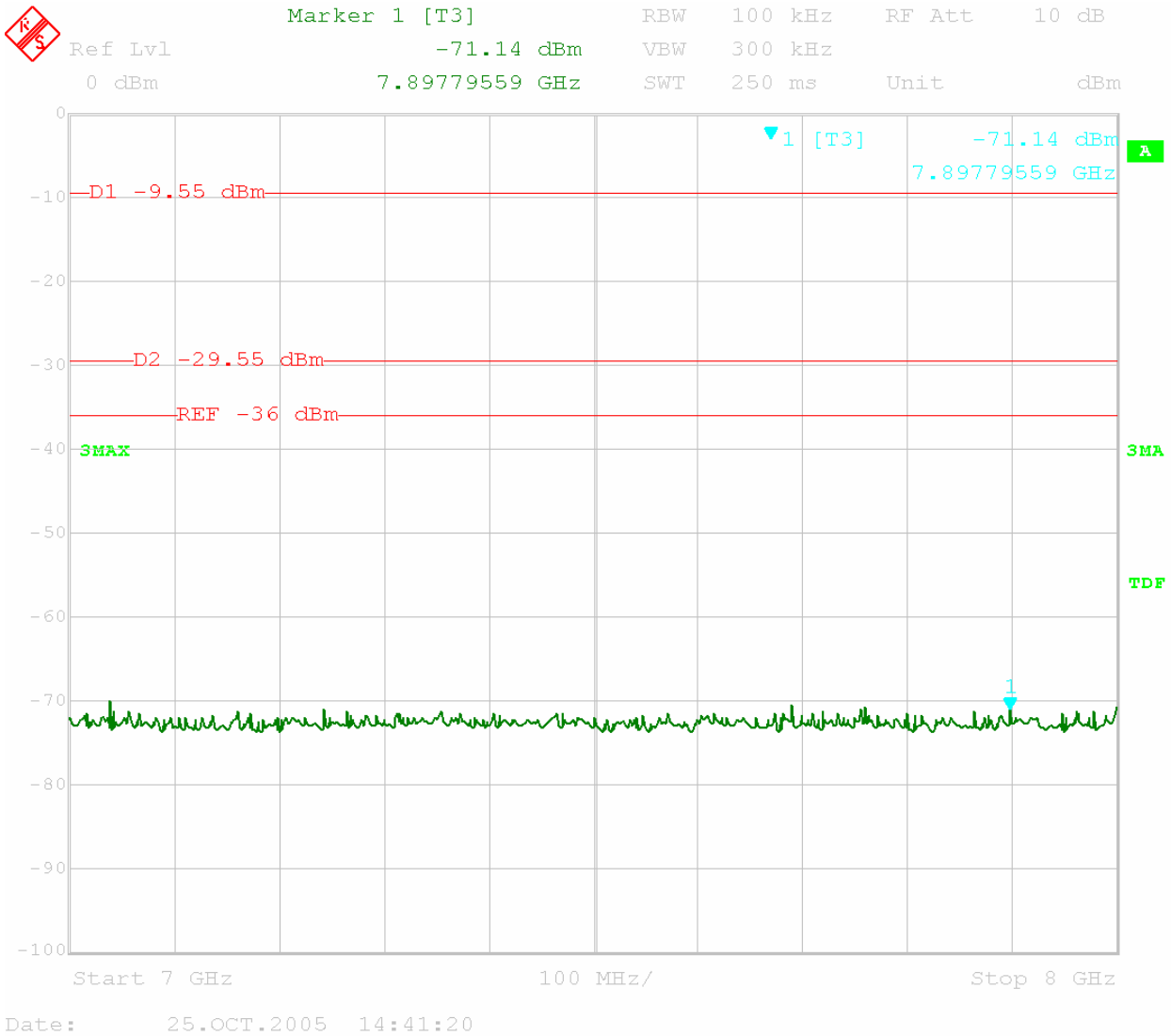
Channel 11 4-5 GHz



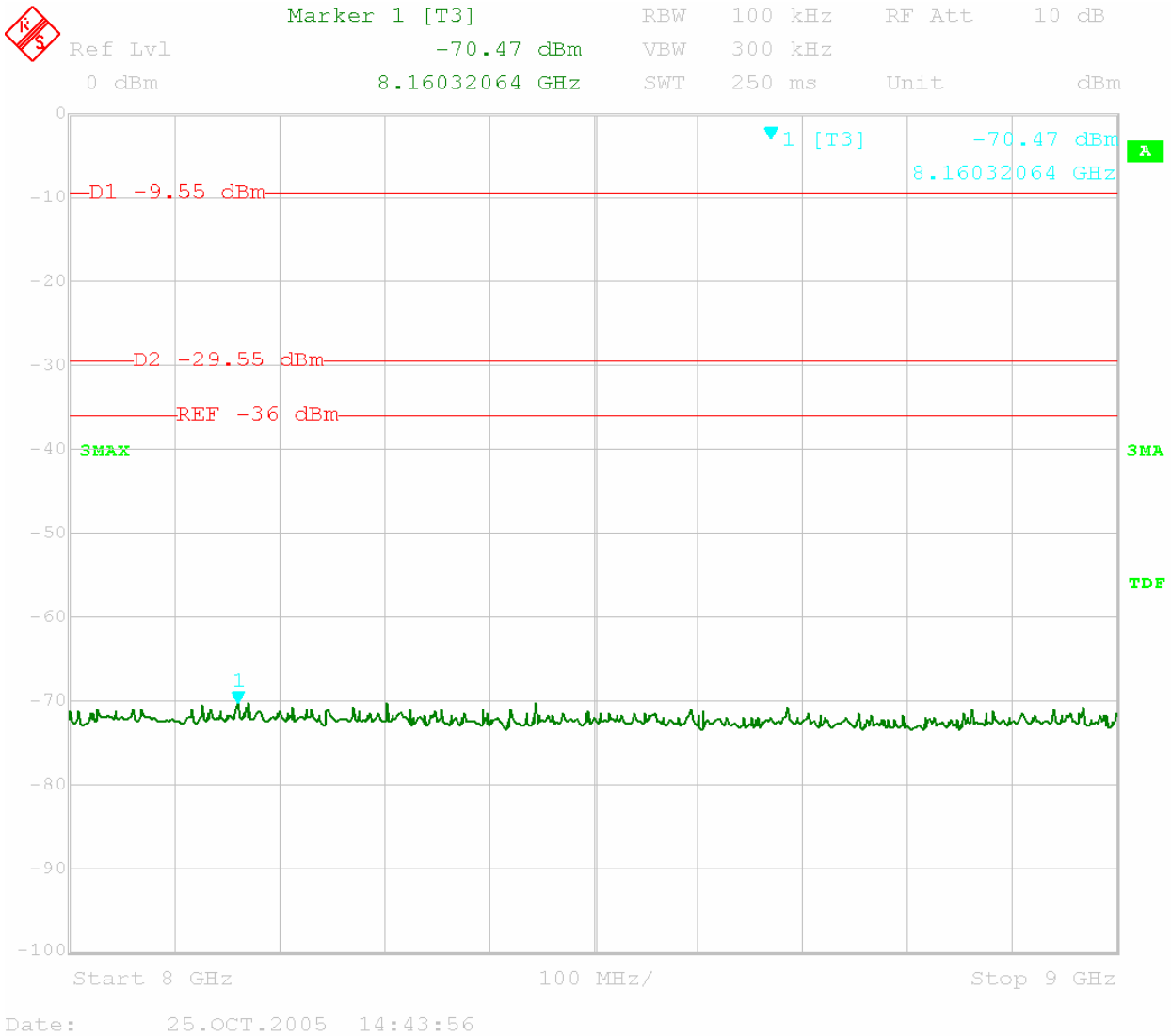
Channel 11 5-6 GHz



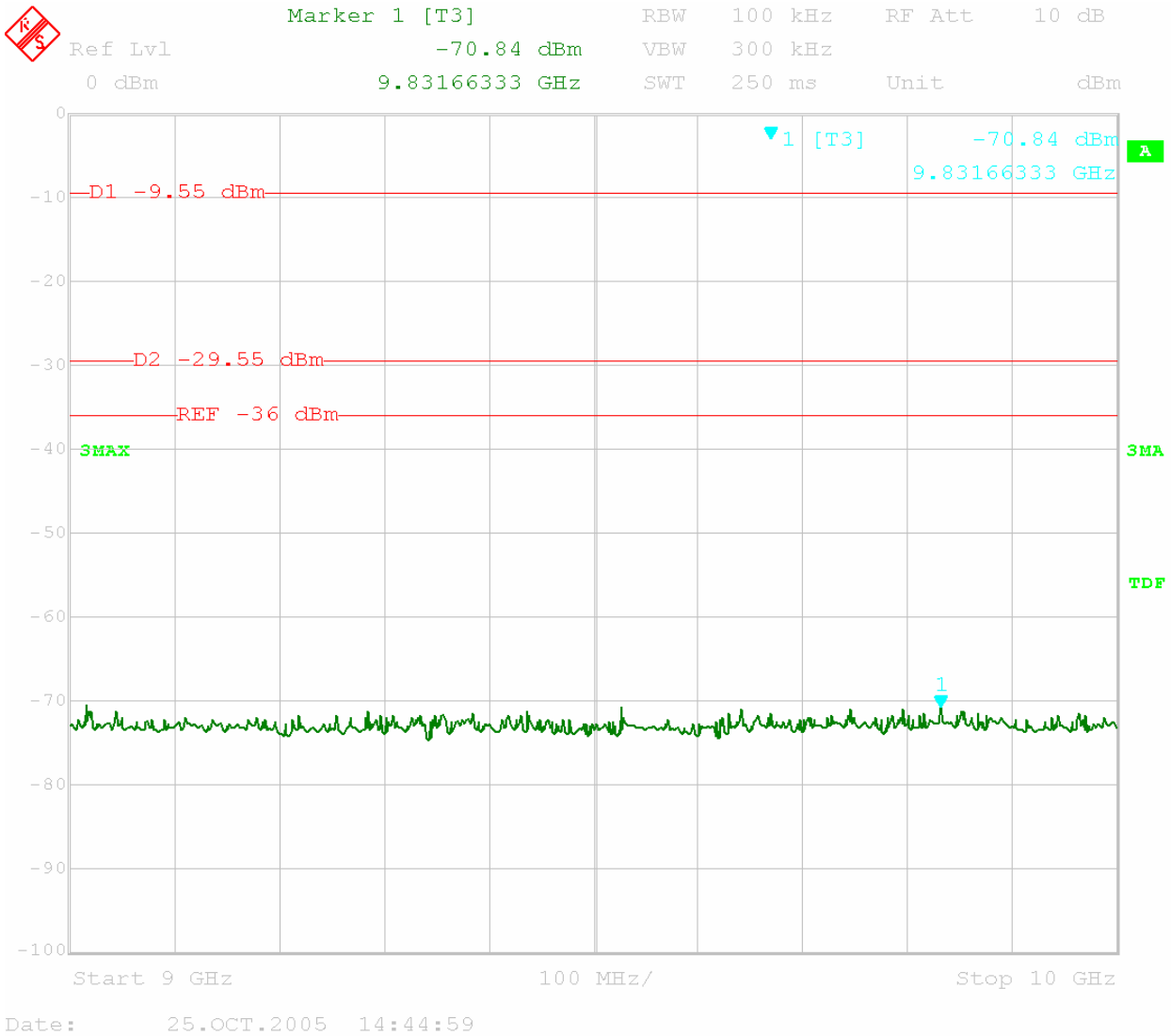
Channel 11 6-7 GHz



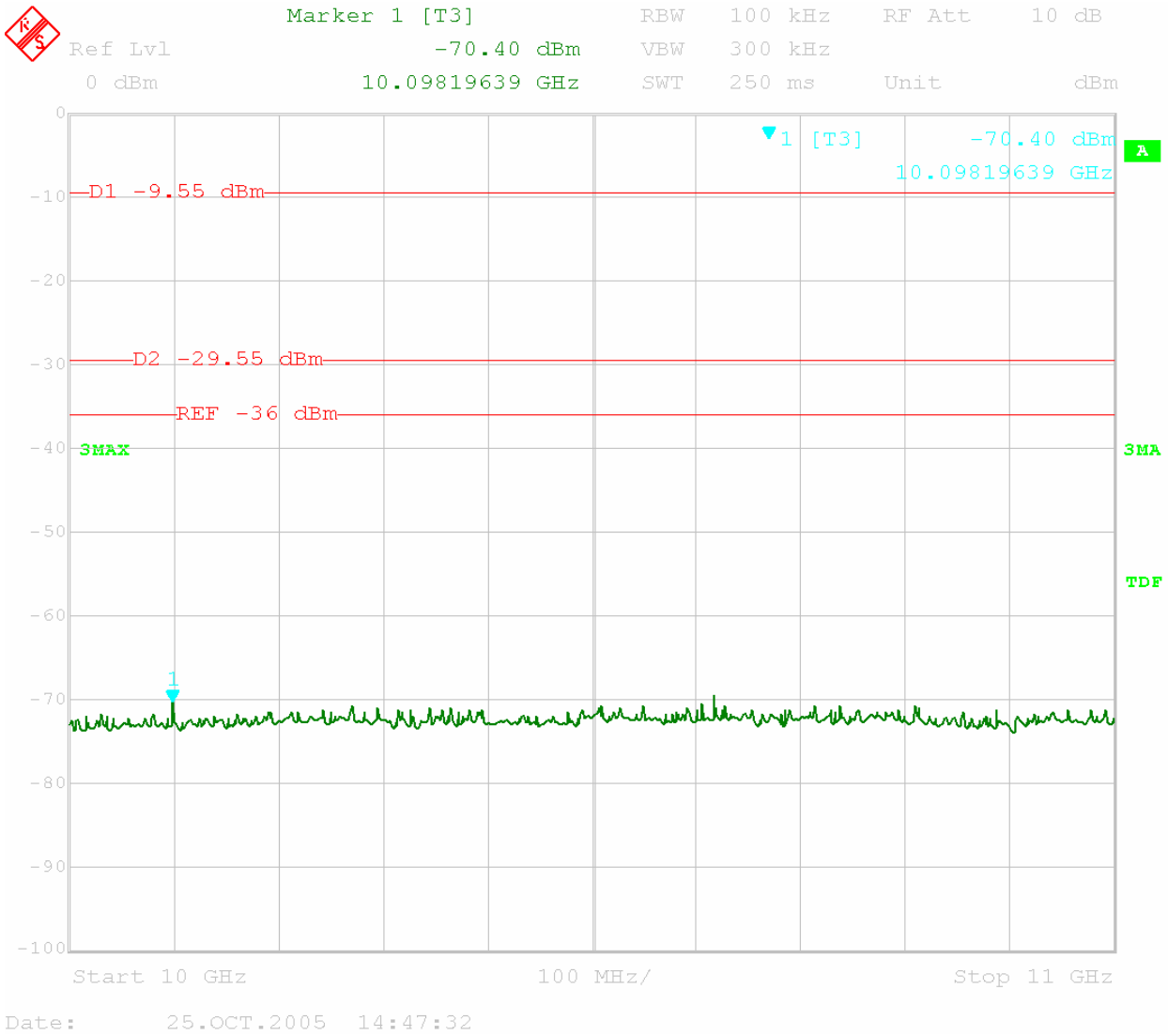
Channel 11 7-8 GHz



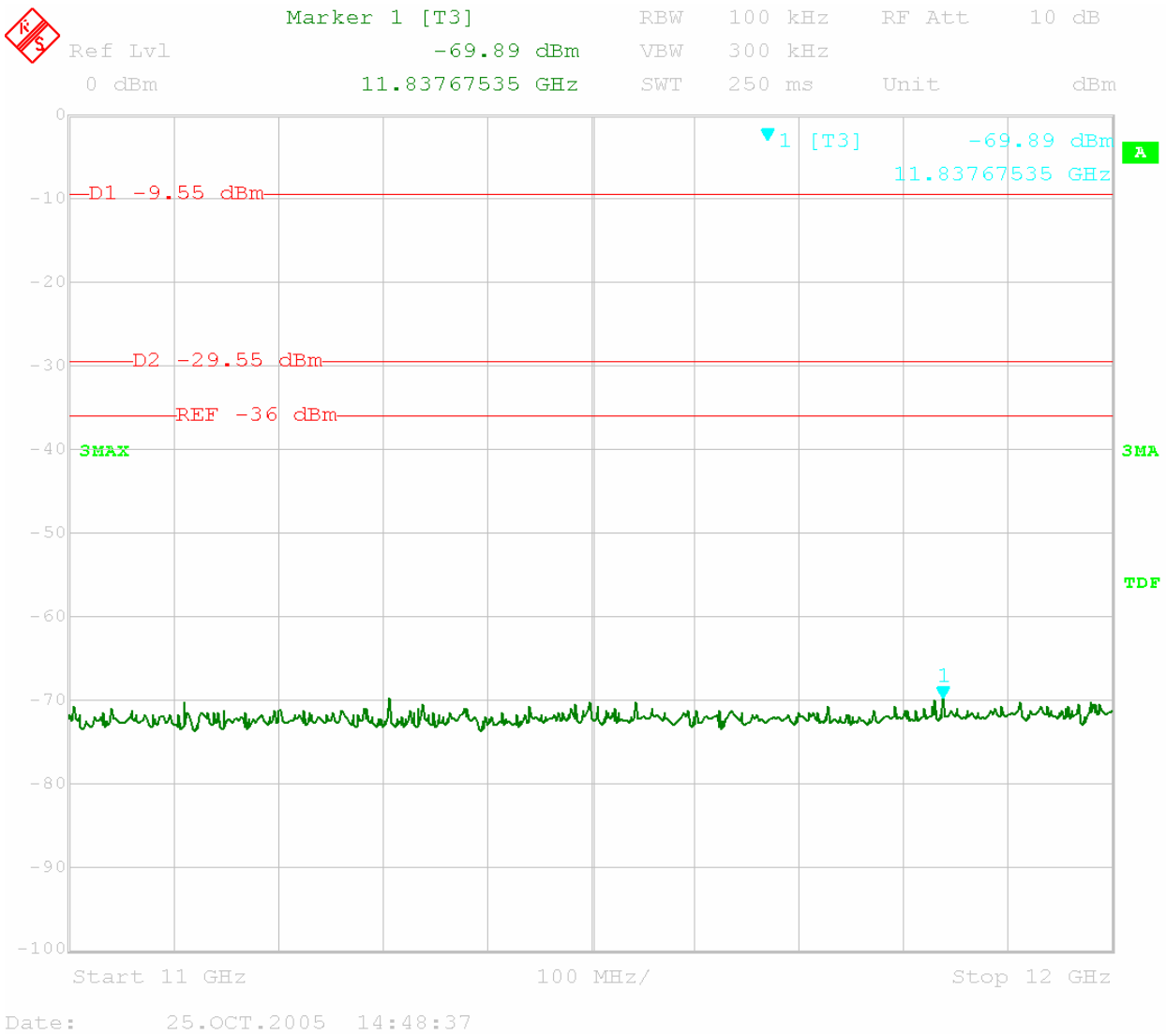
Channel 11 8-9 GHz



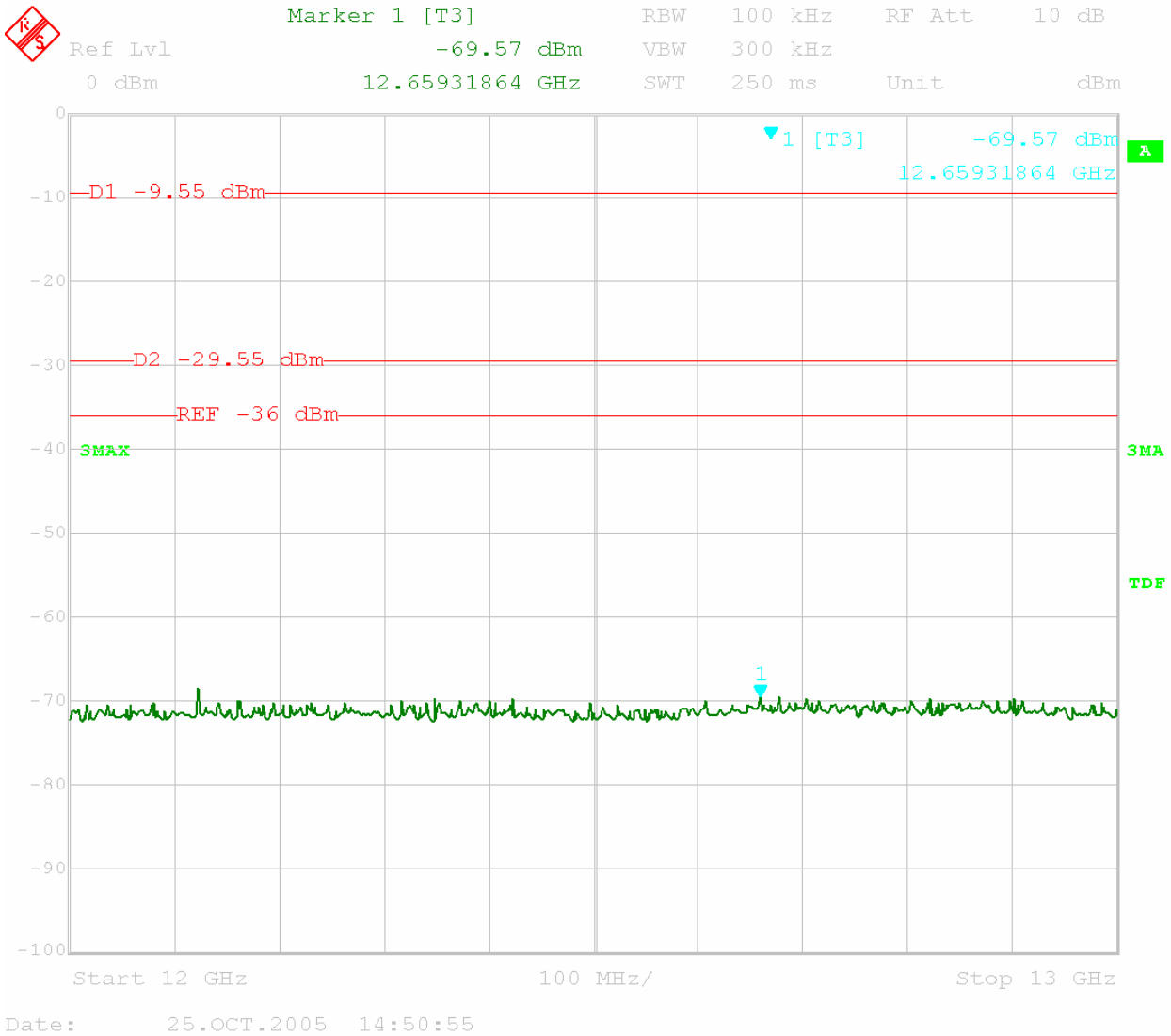
Channel 11 9-10 GHz



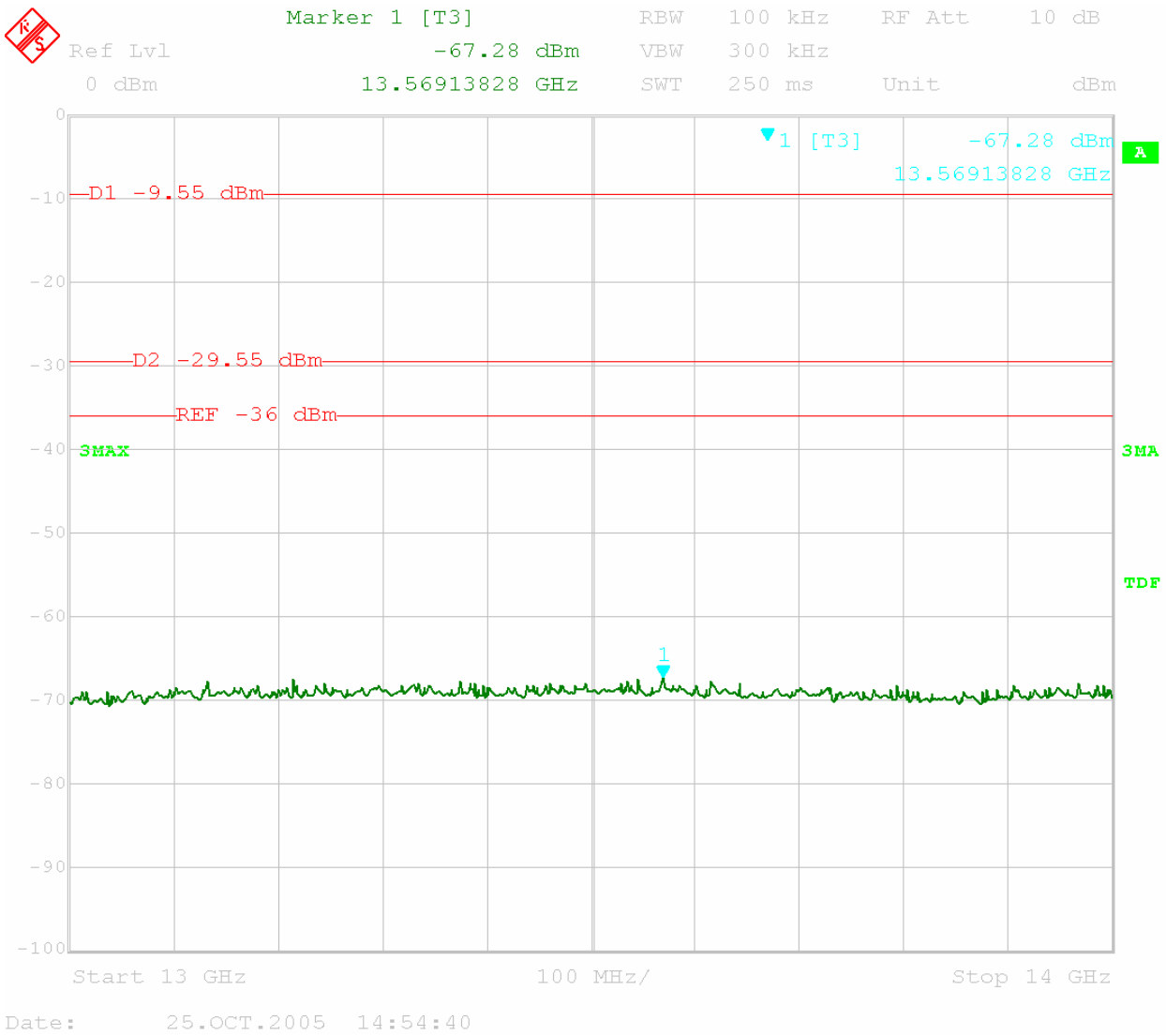
Channel 11 10-11 GHz



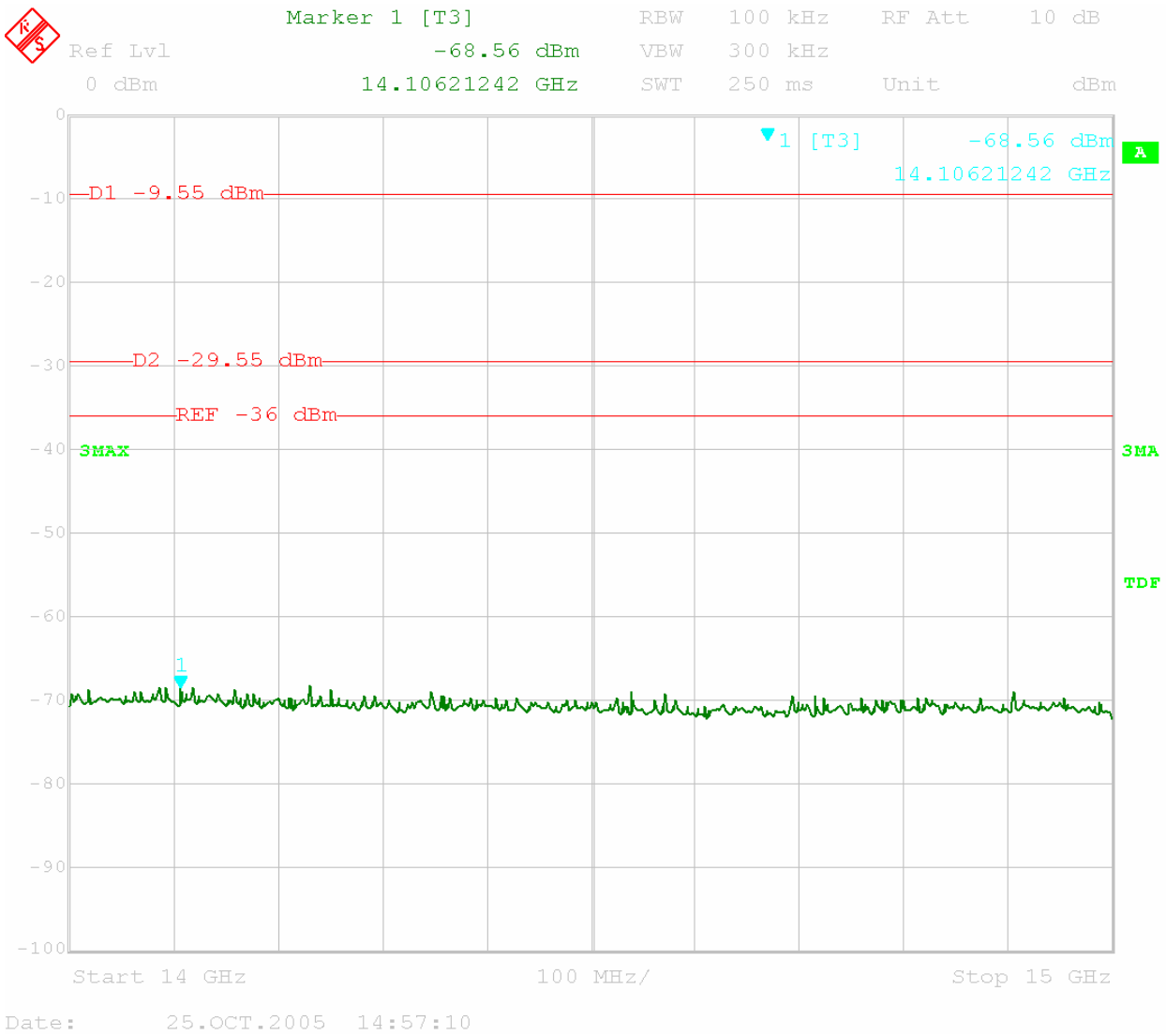
Channel 11 11-12 GHz



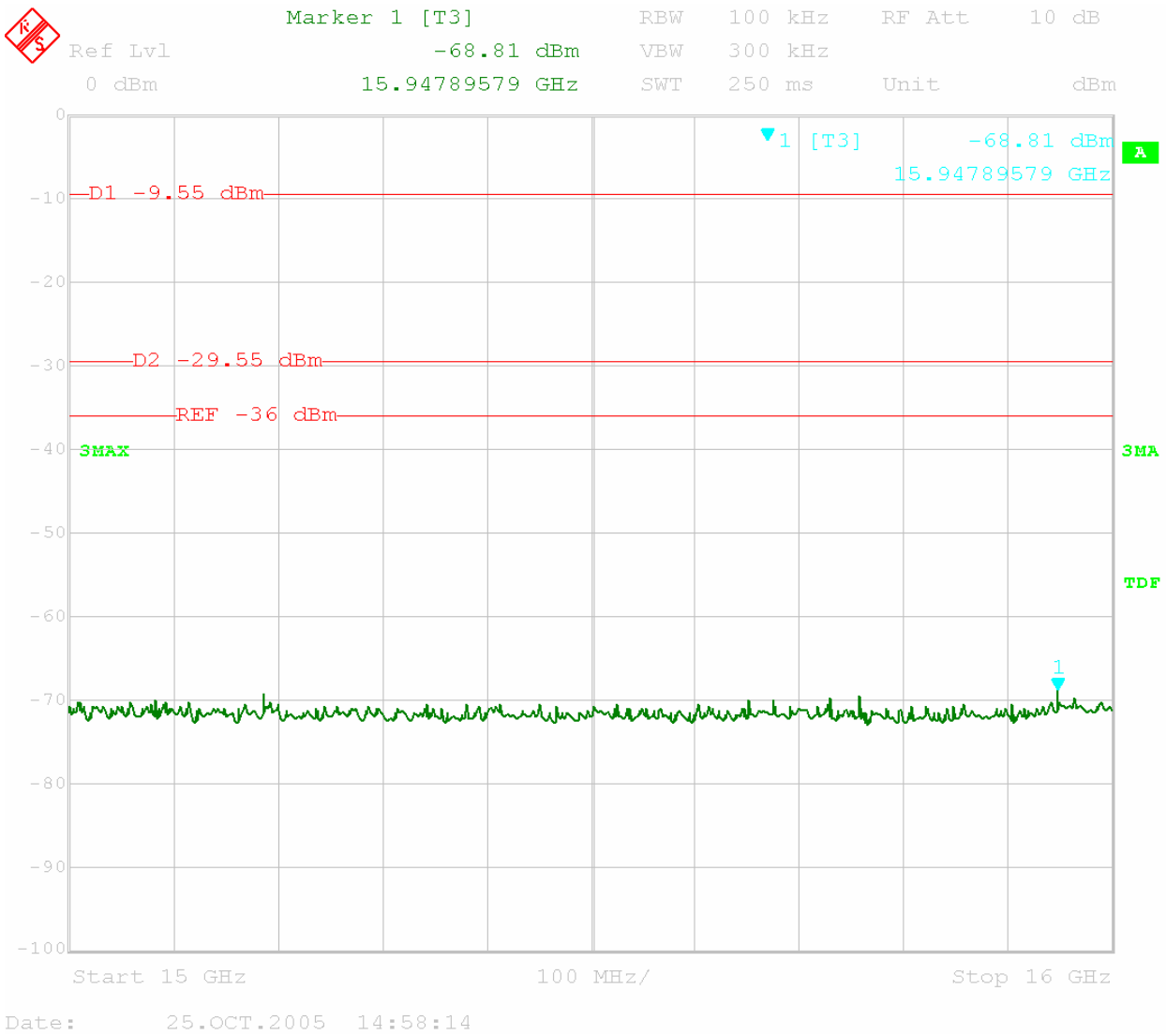
Channel 11 12-13 GHz



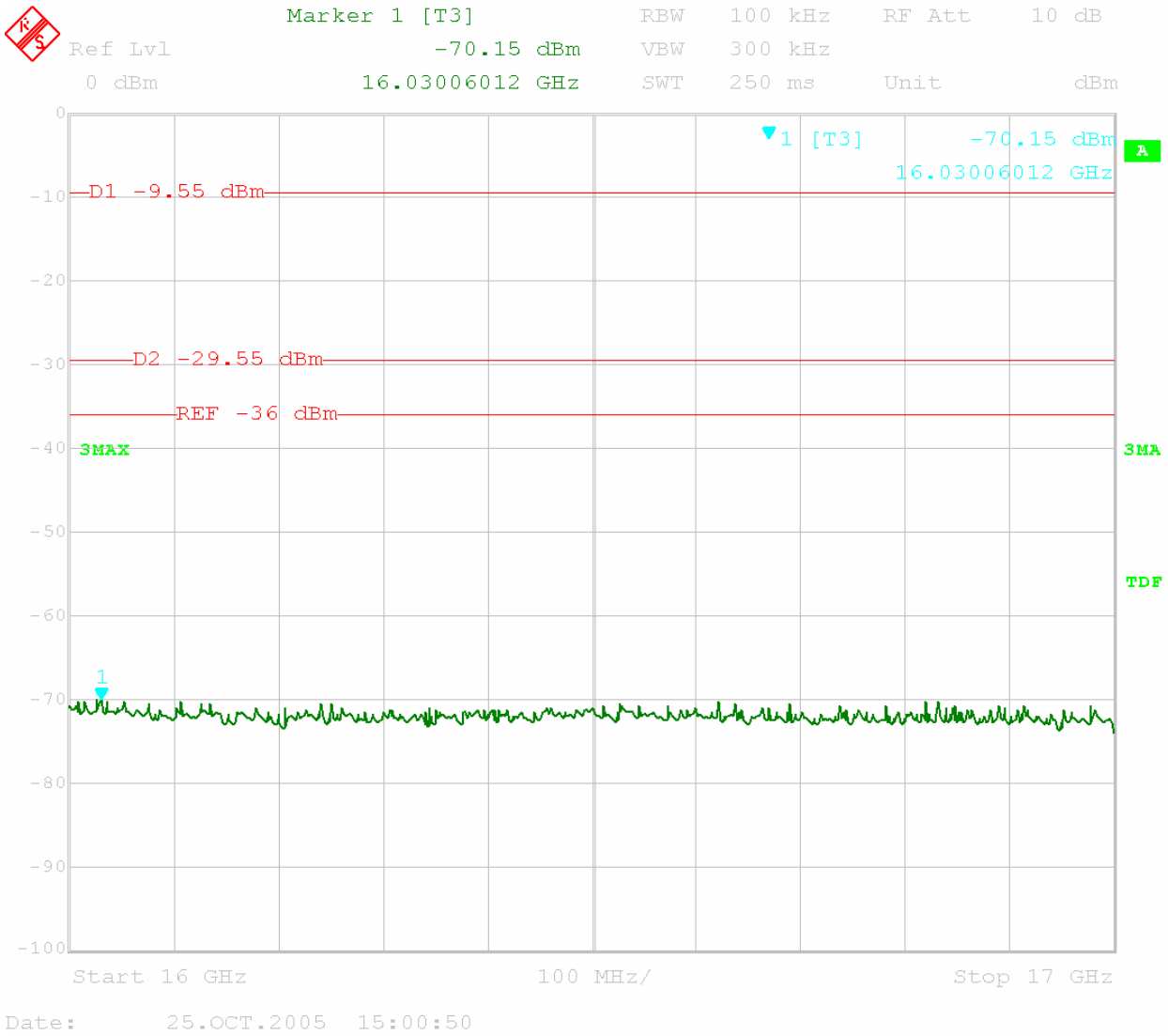
Channel 11 13-14 GHz



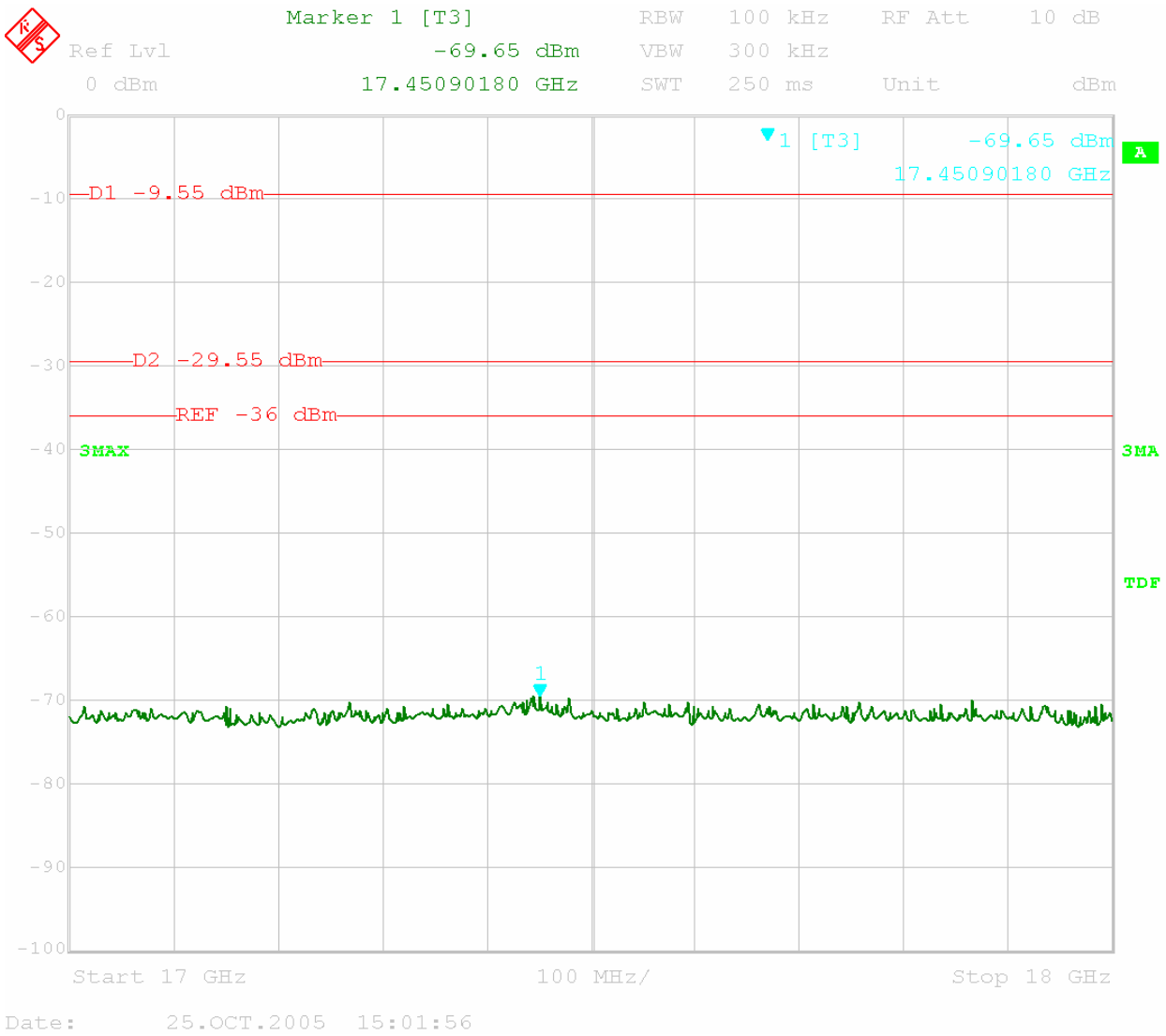
Channel 11 14-15 GHz



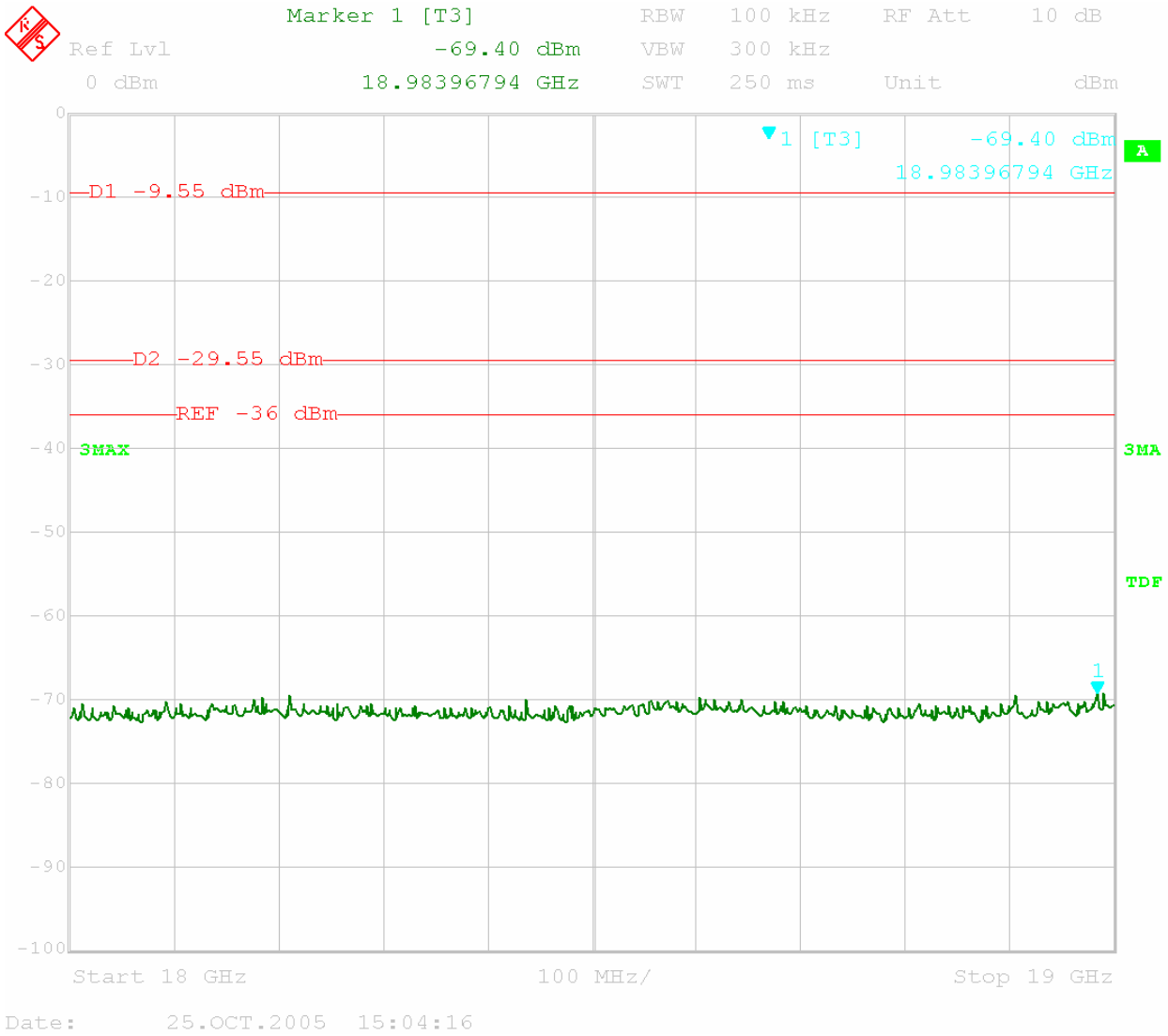
Channel 11 15-16 GHz



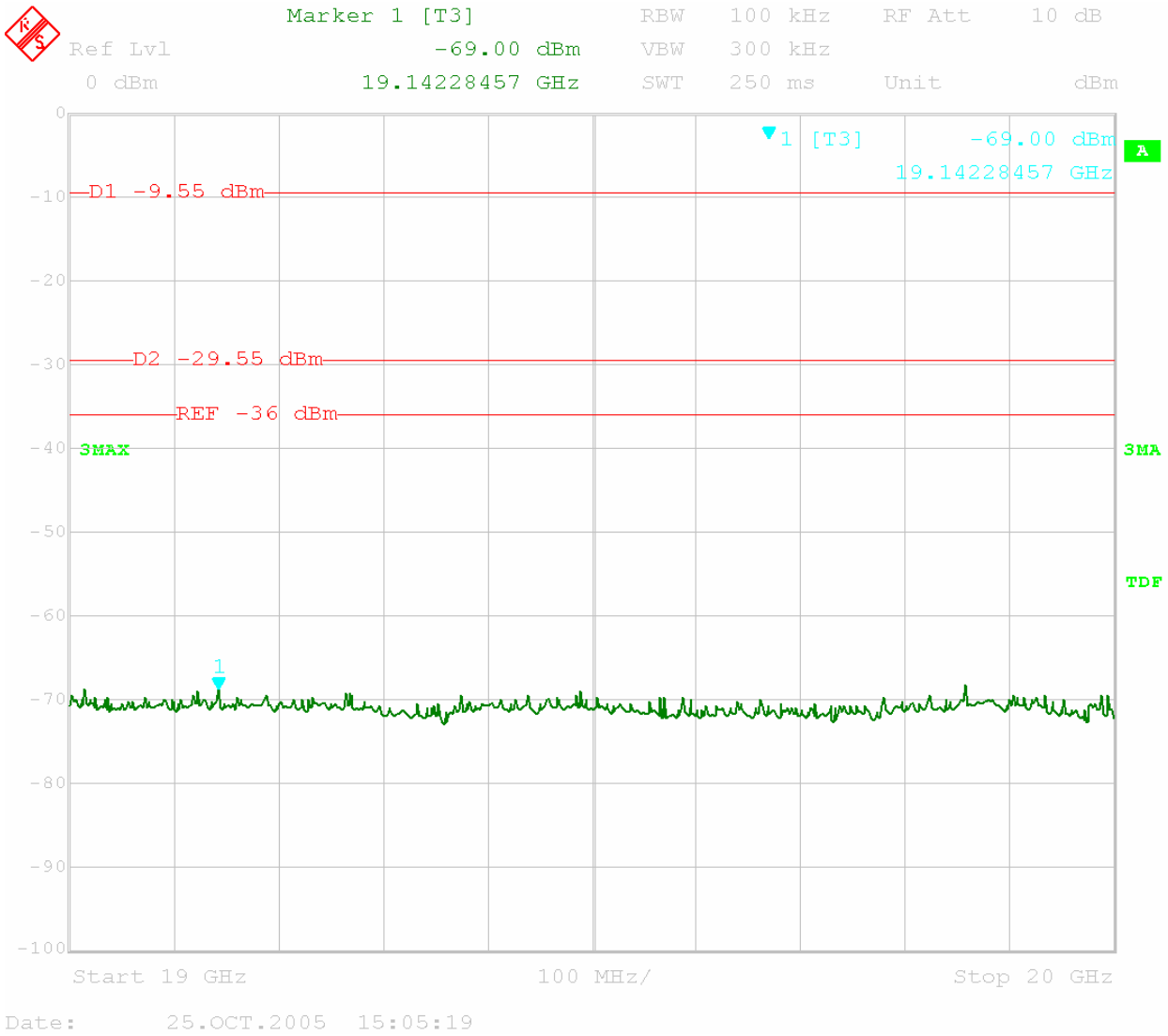
Channel 11 16-17 GHz



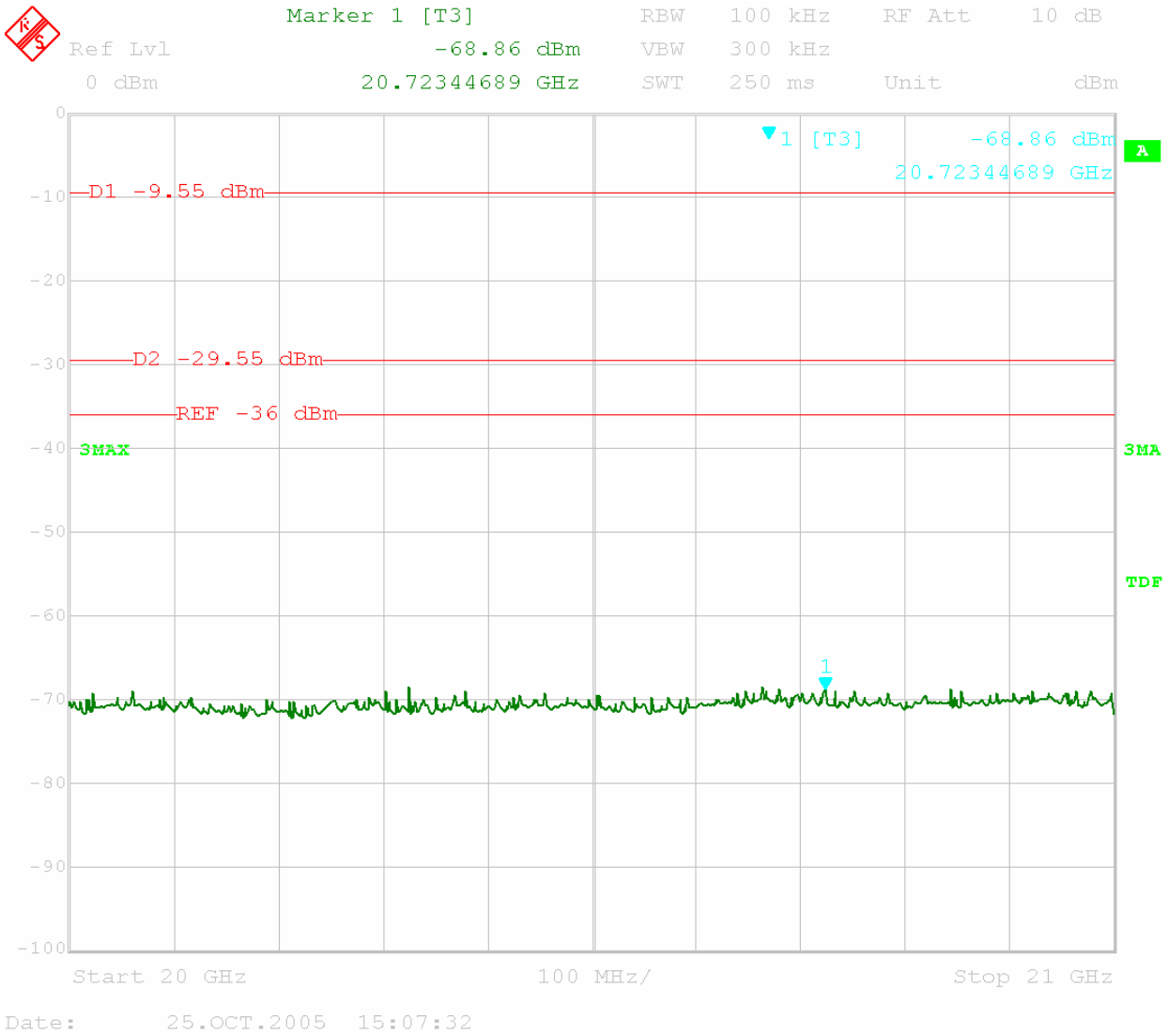
Channel 11 17-18 GHz



Channel 11 18-19 GHz

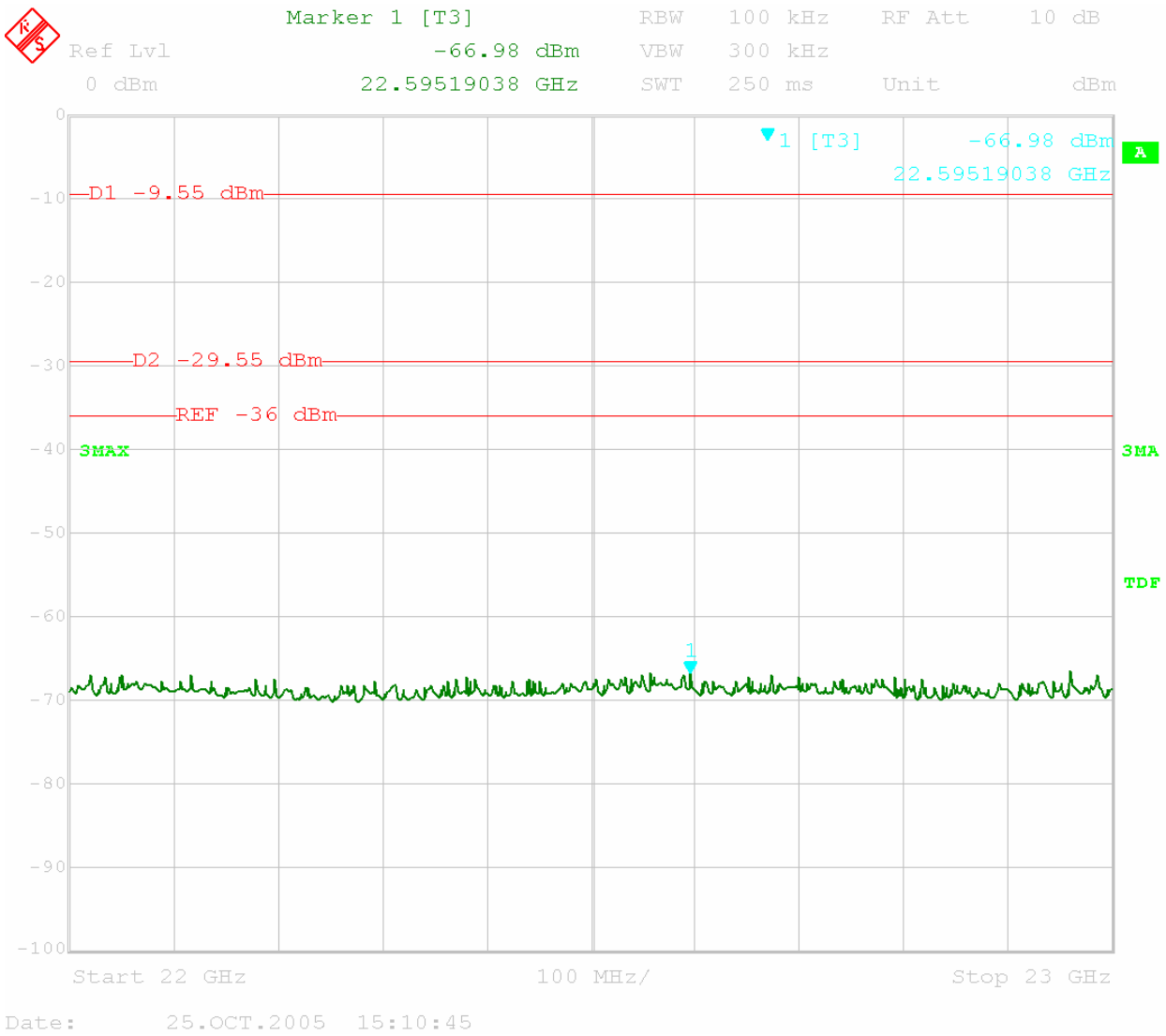


Channel 11 19-20 GHz

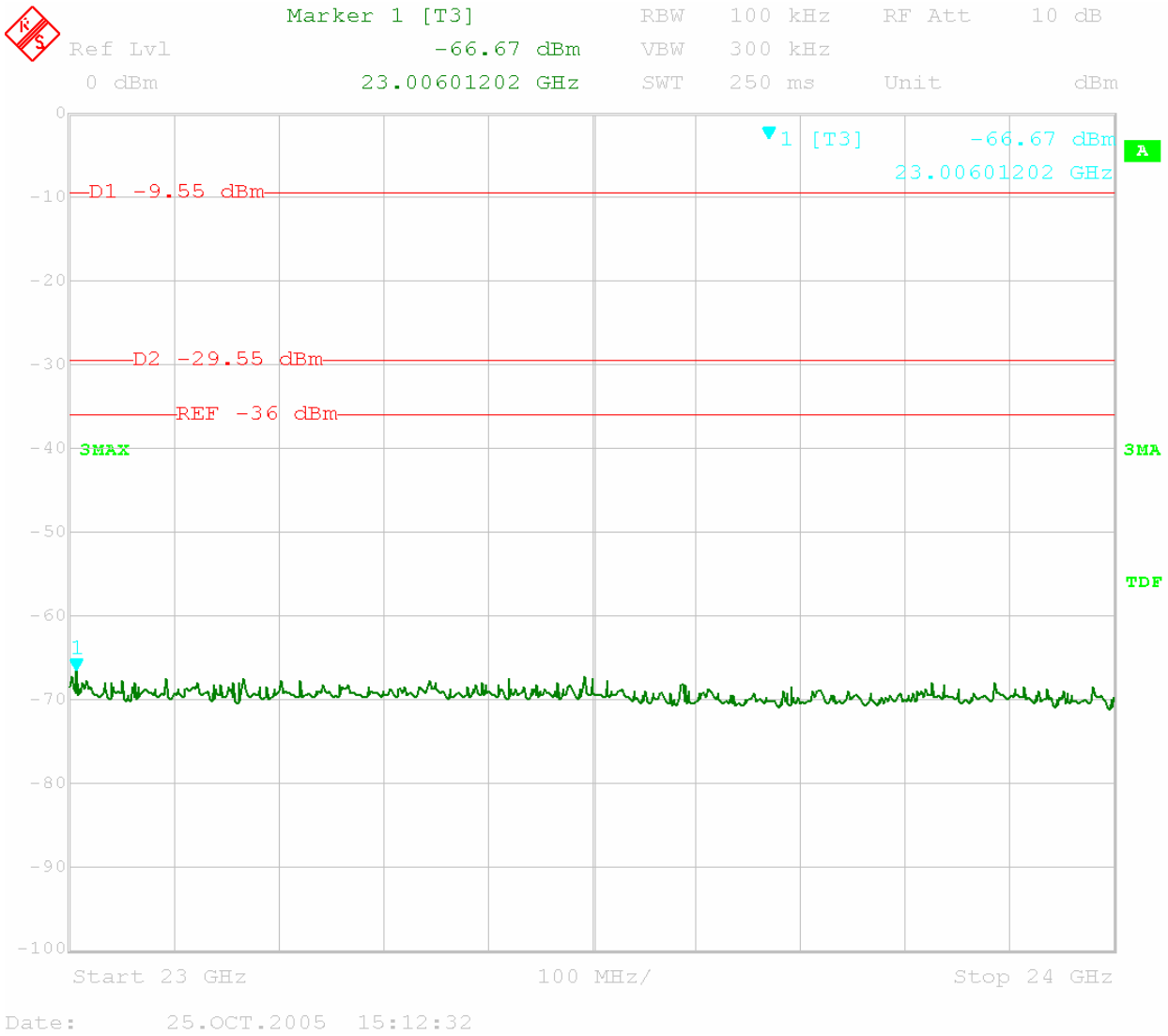


Channel 11 20-21 GHz

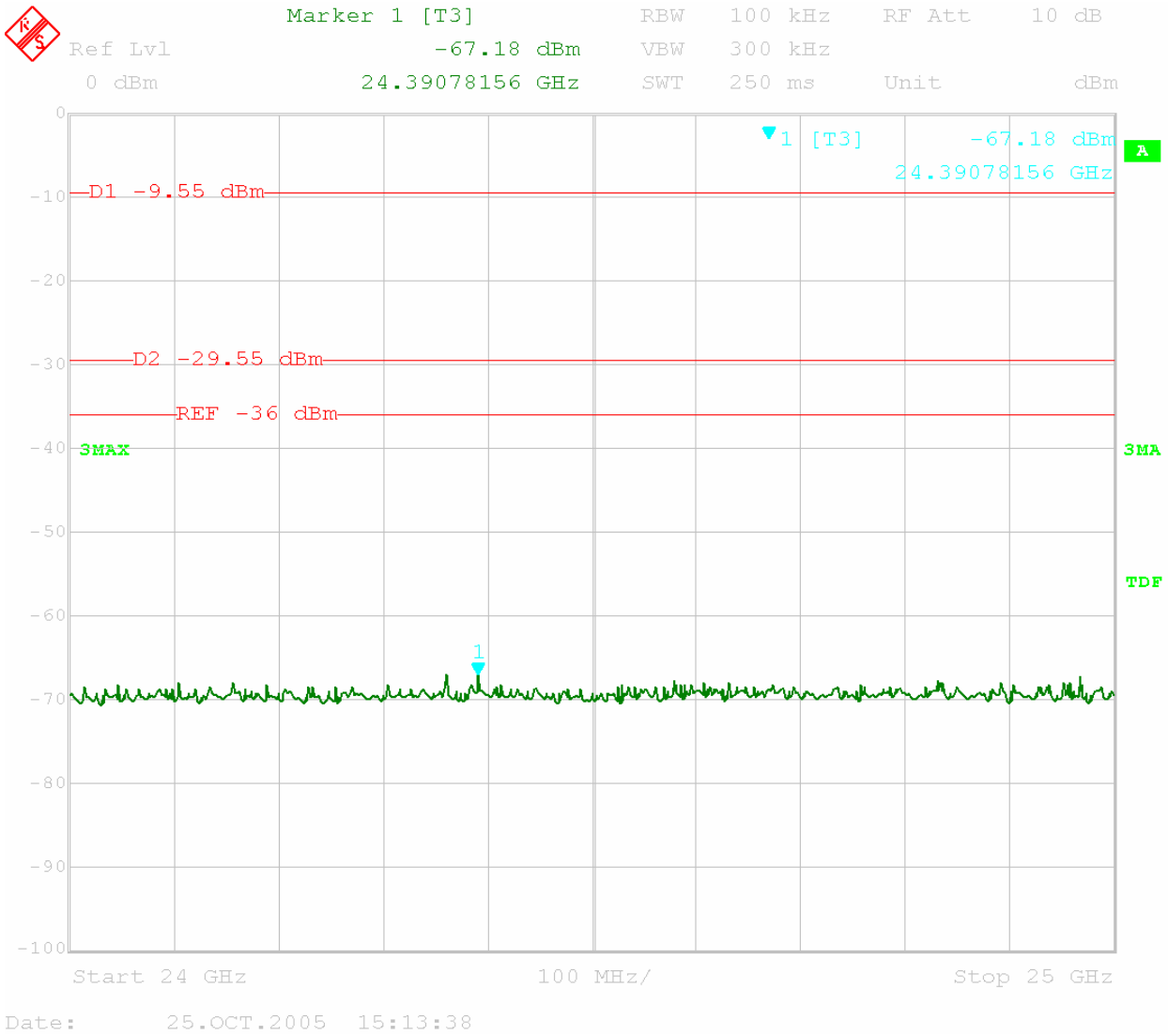
Channel 11 21-22 GHz



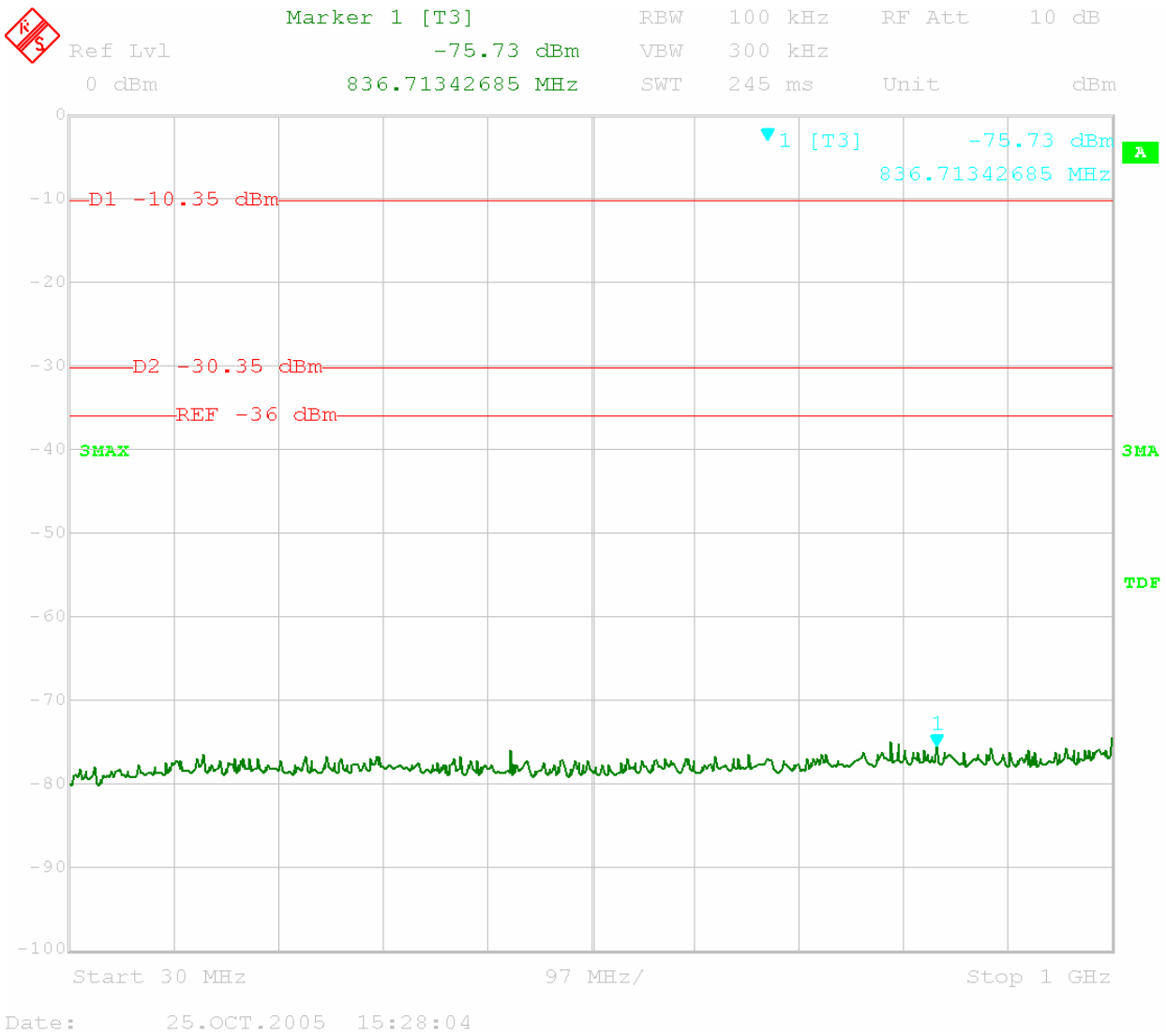
Channel 11 22-23 GHz



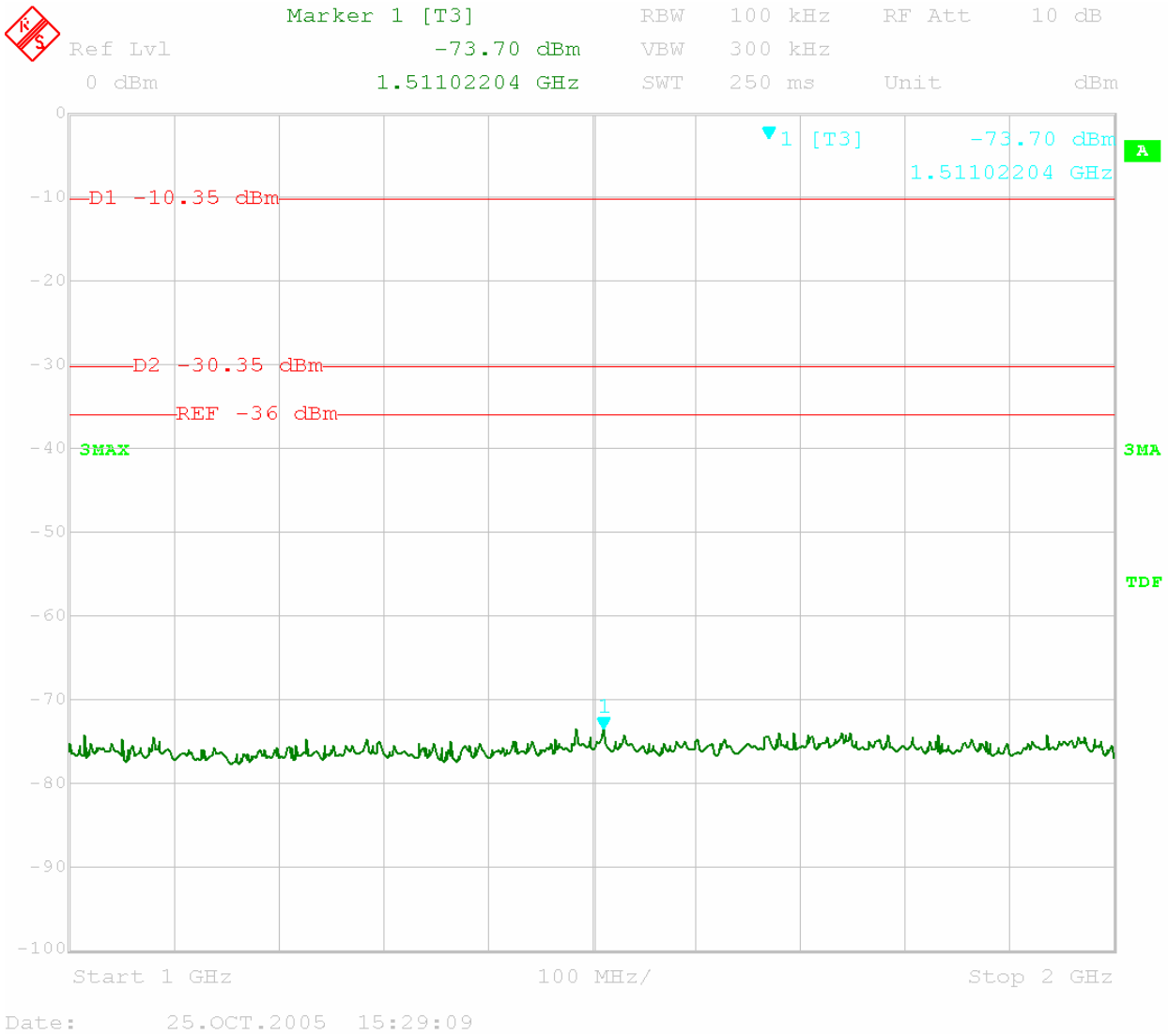
Channel 11 23-24 GHz



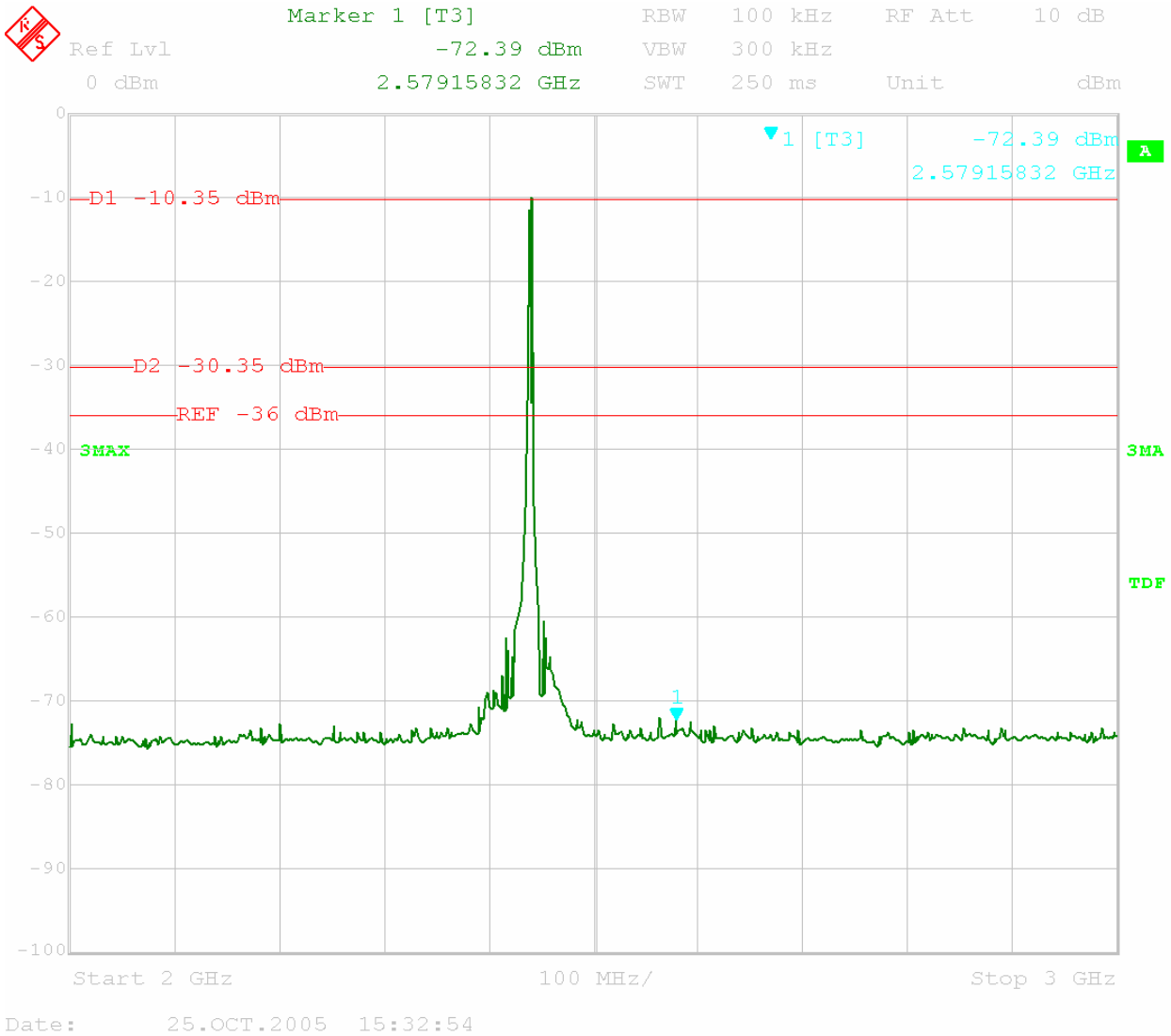
Channel 11 24-25 GHz



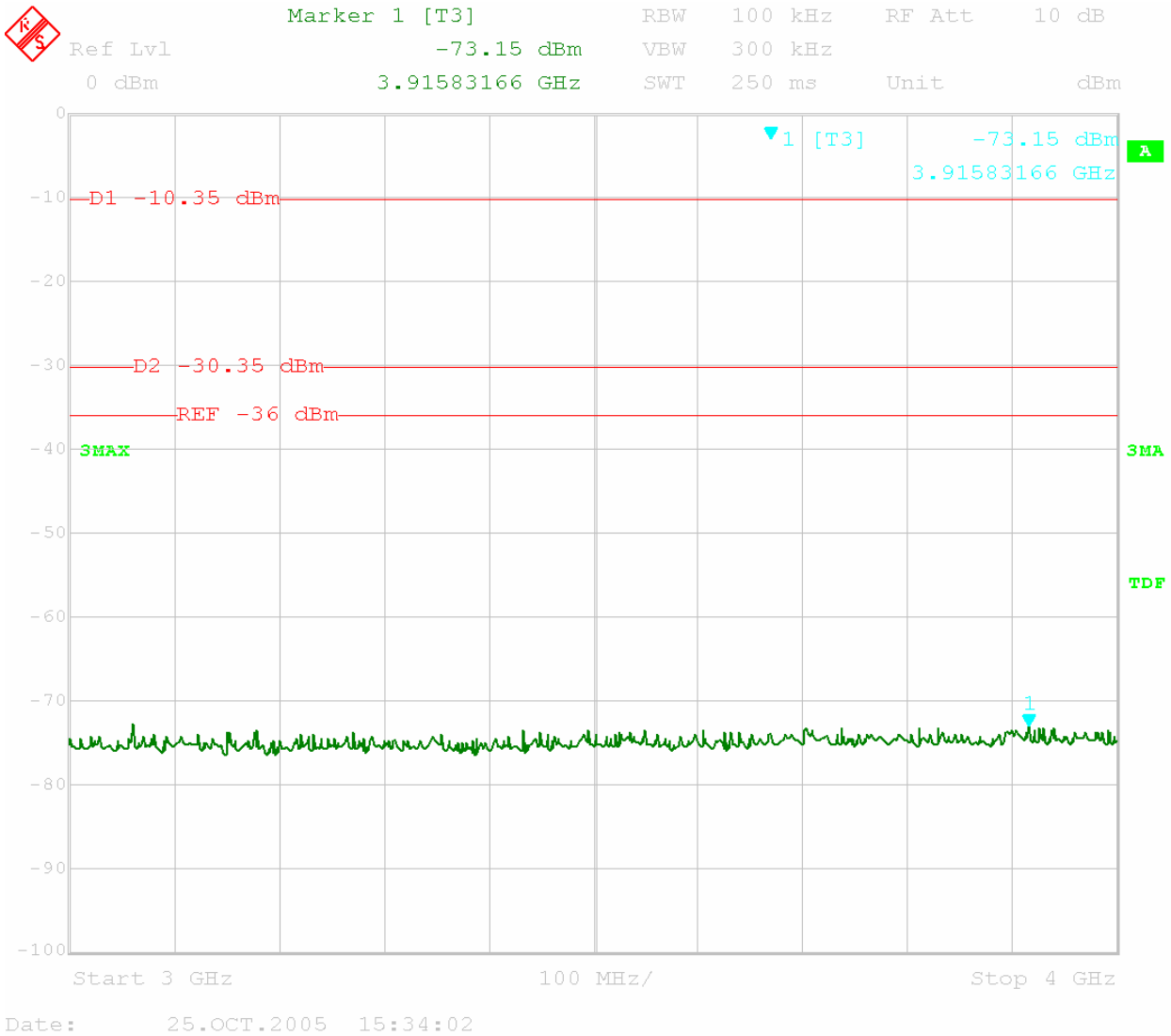
Channel 18 30 MHz -1 GHz



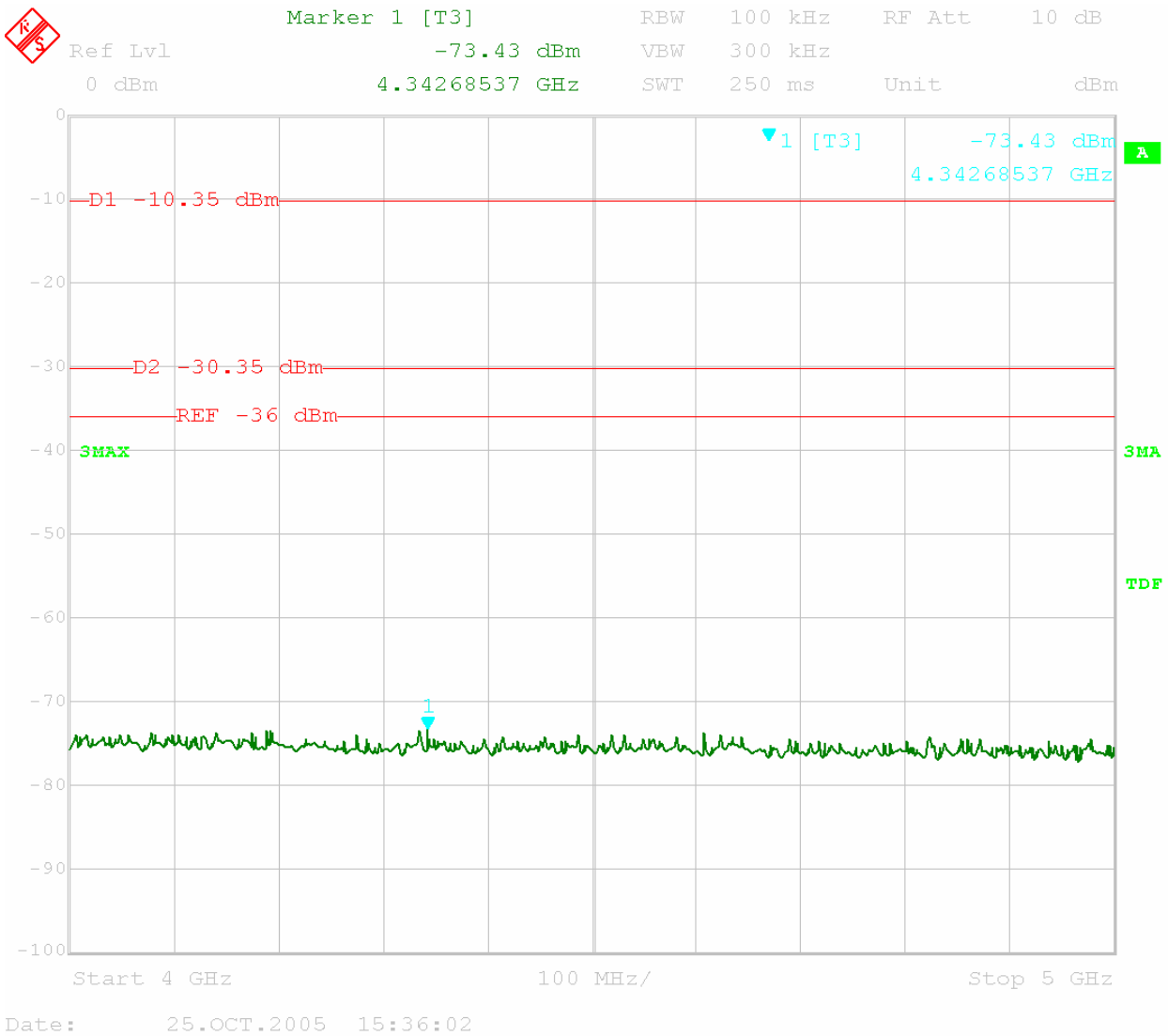
Channel 18 1-2 GHz



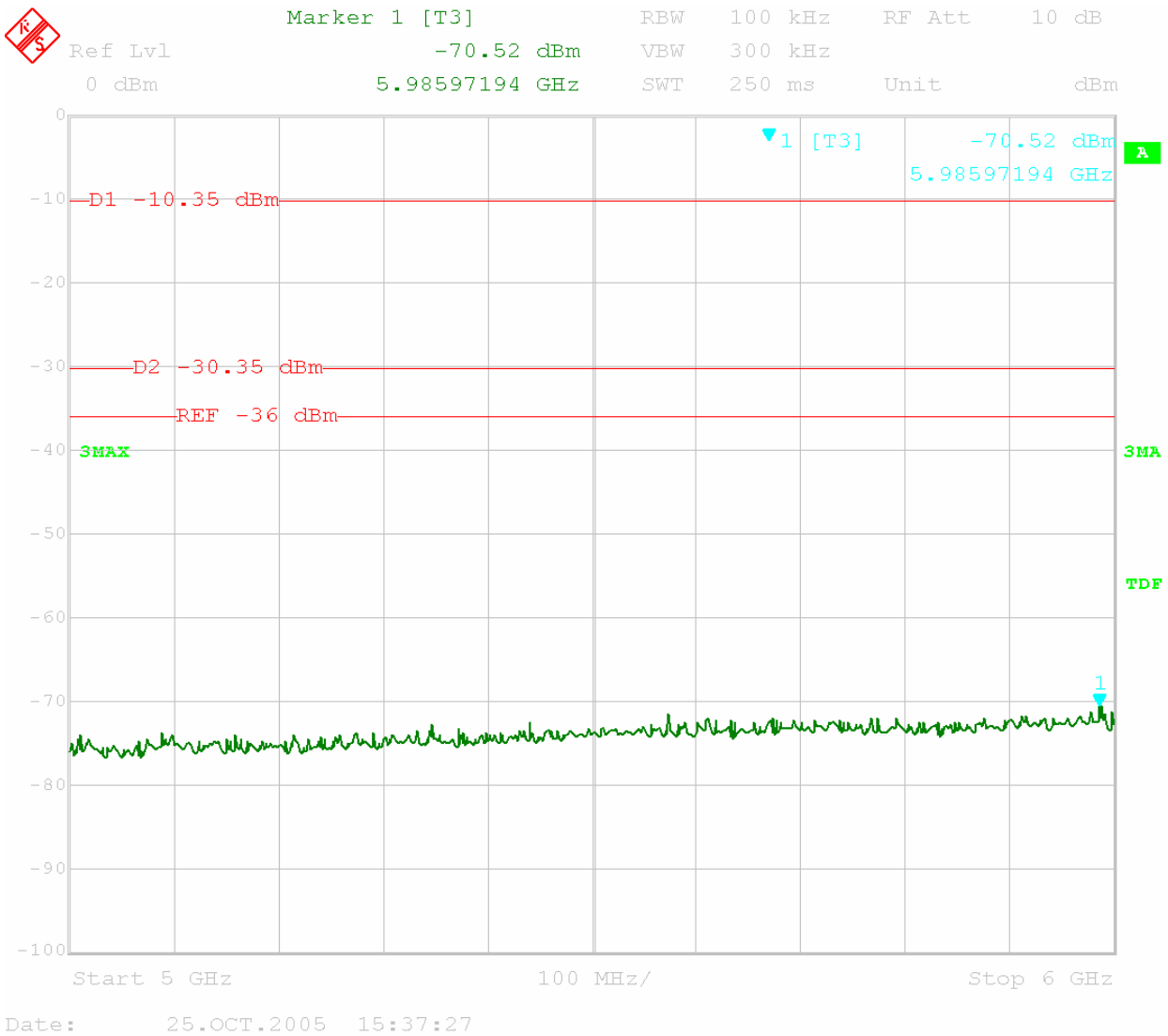
Channel 18 2-3 GHz



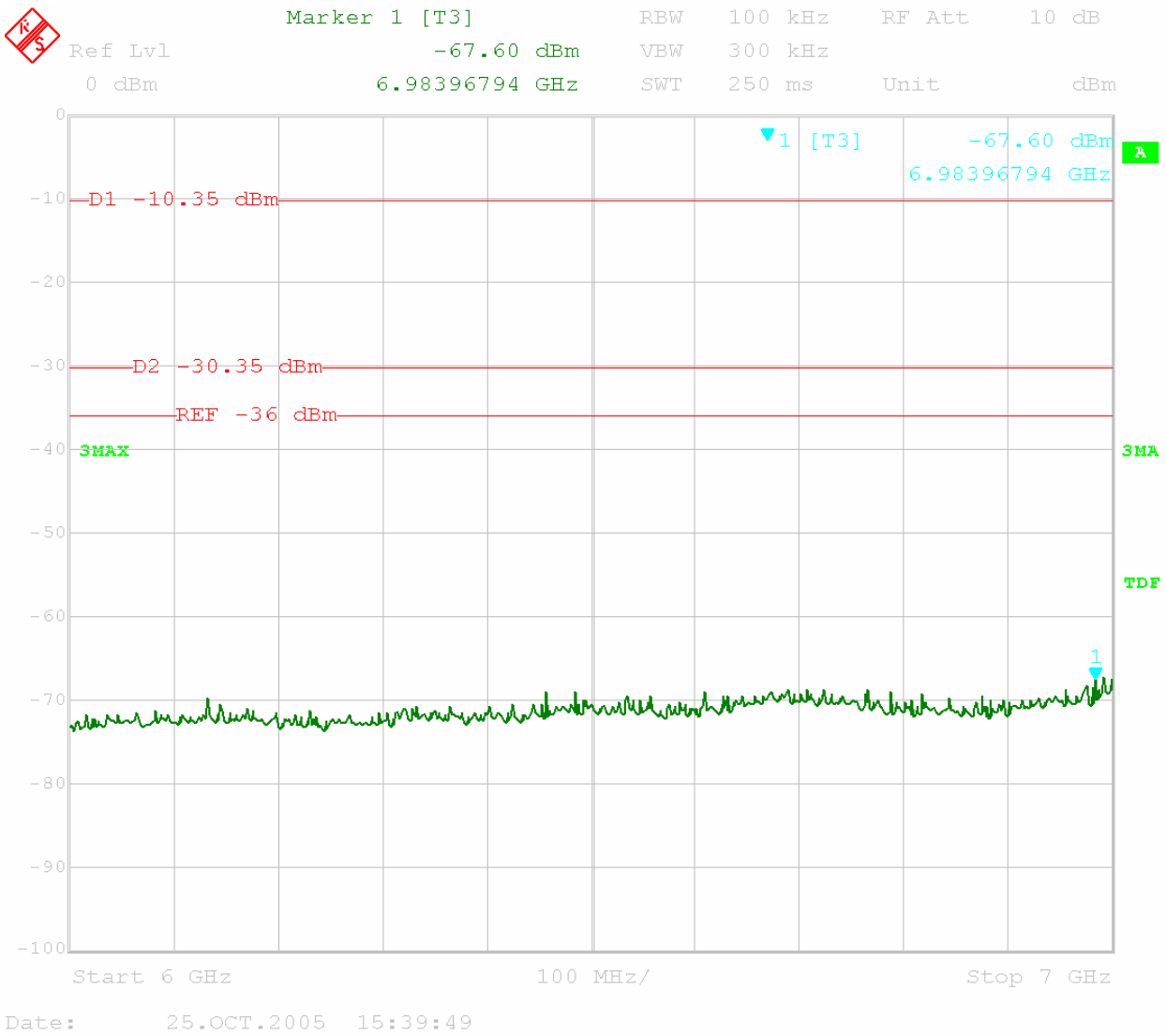
Channel 18 3-4 GHz



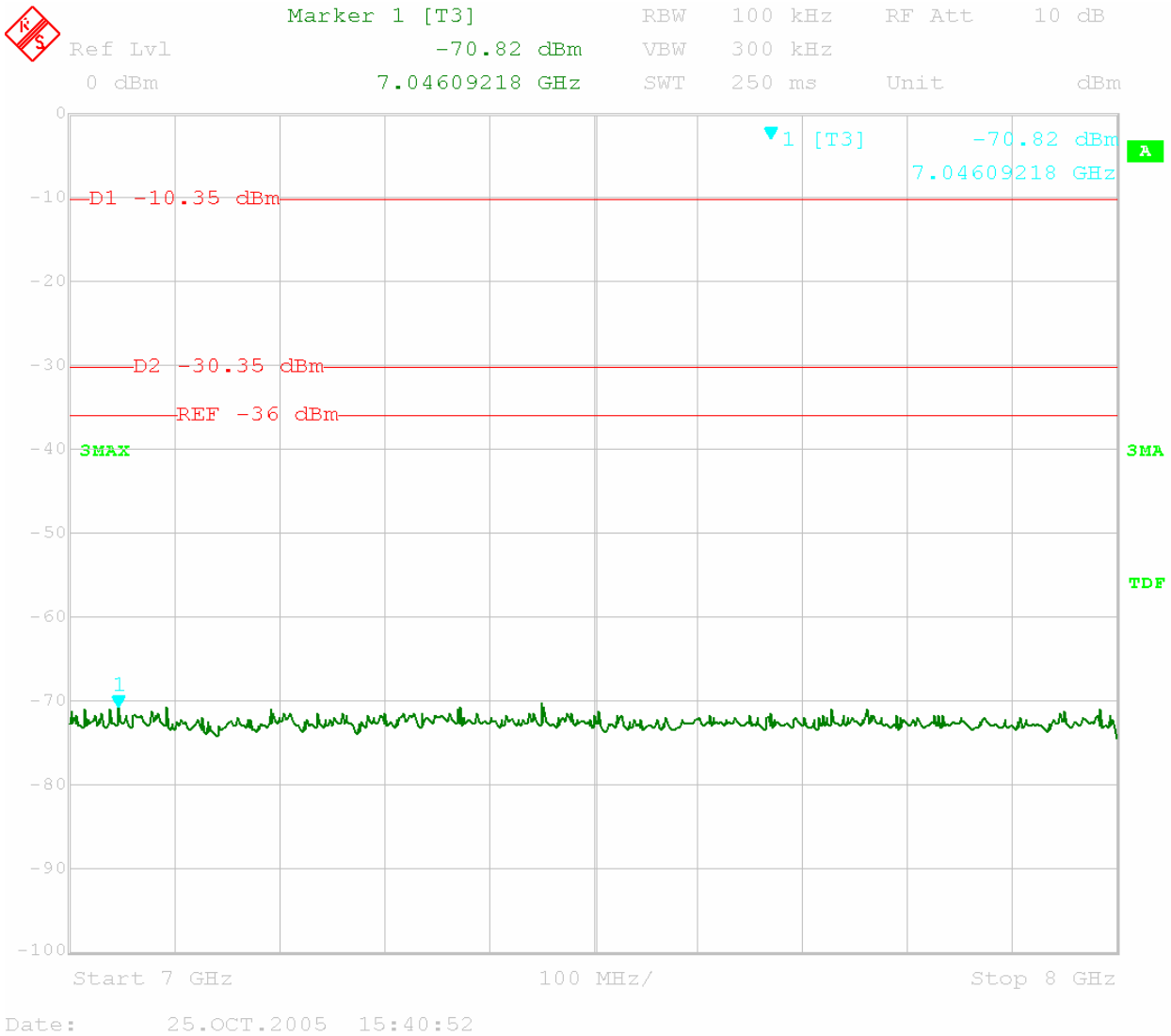
Channel 18 4-5 GHz



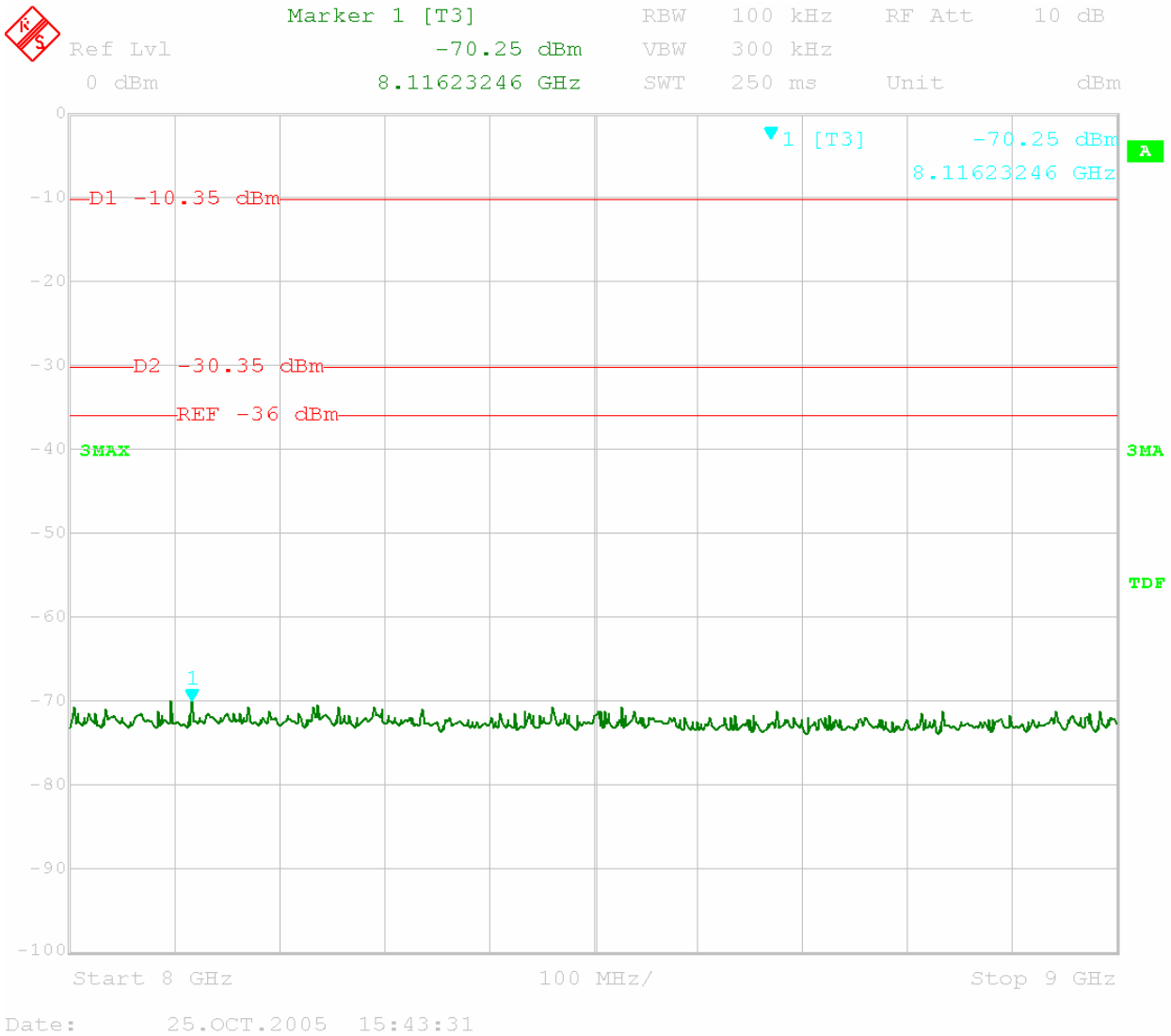
Channel 18 5-6 GHz



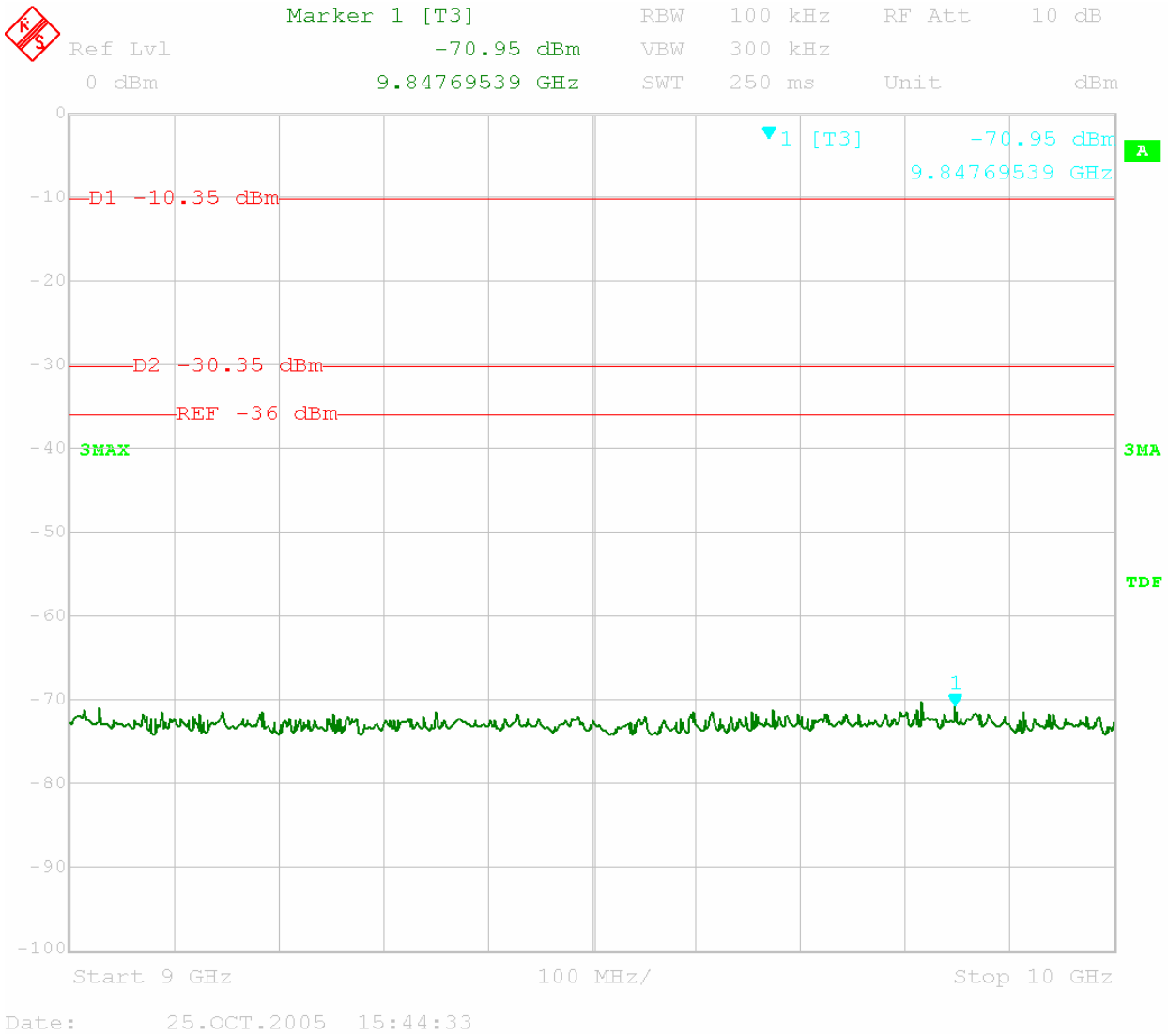
Channel 18 6-7 GHz



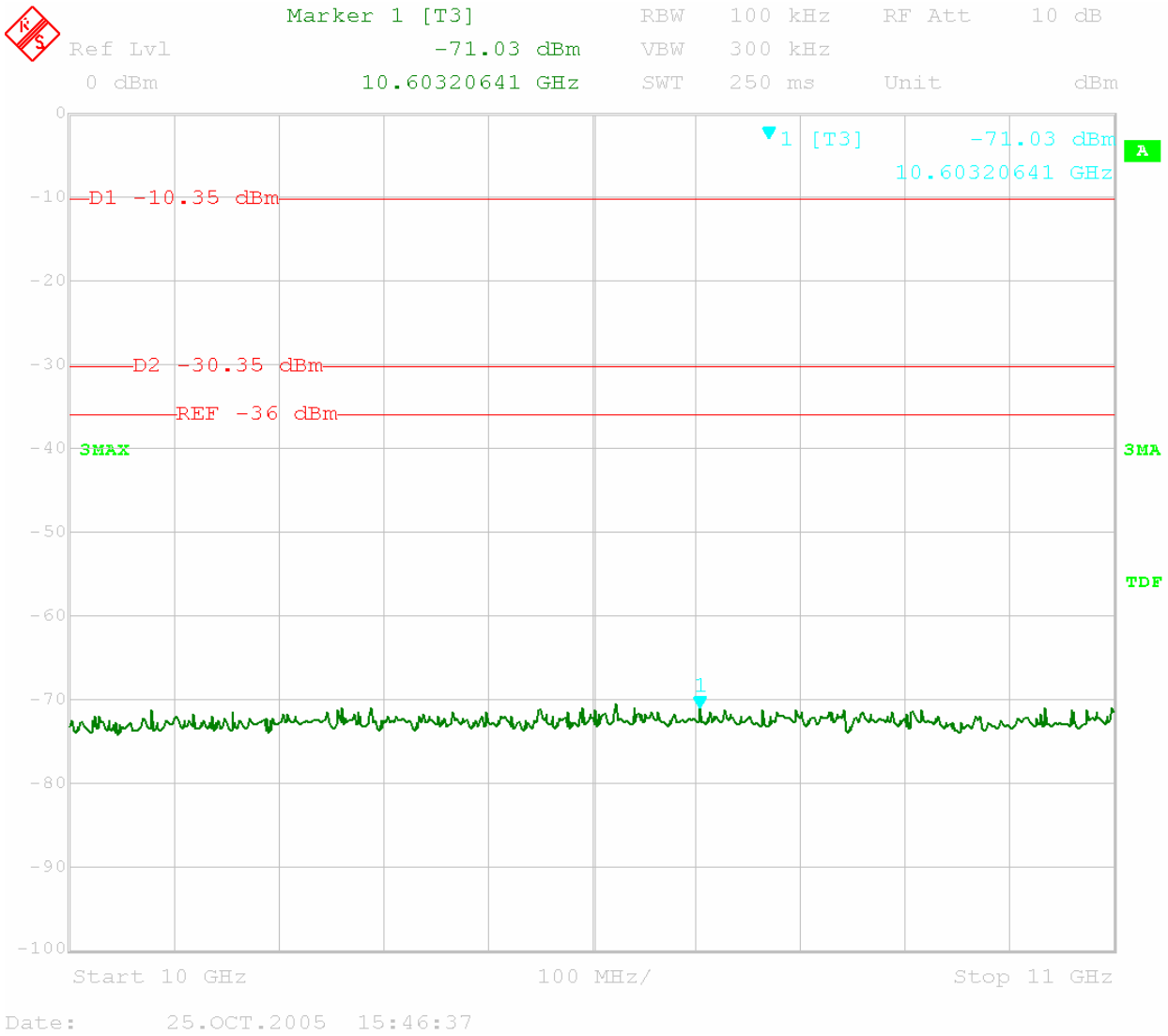
Channel 18 7-8 GHz



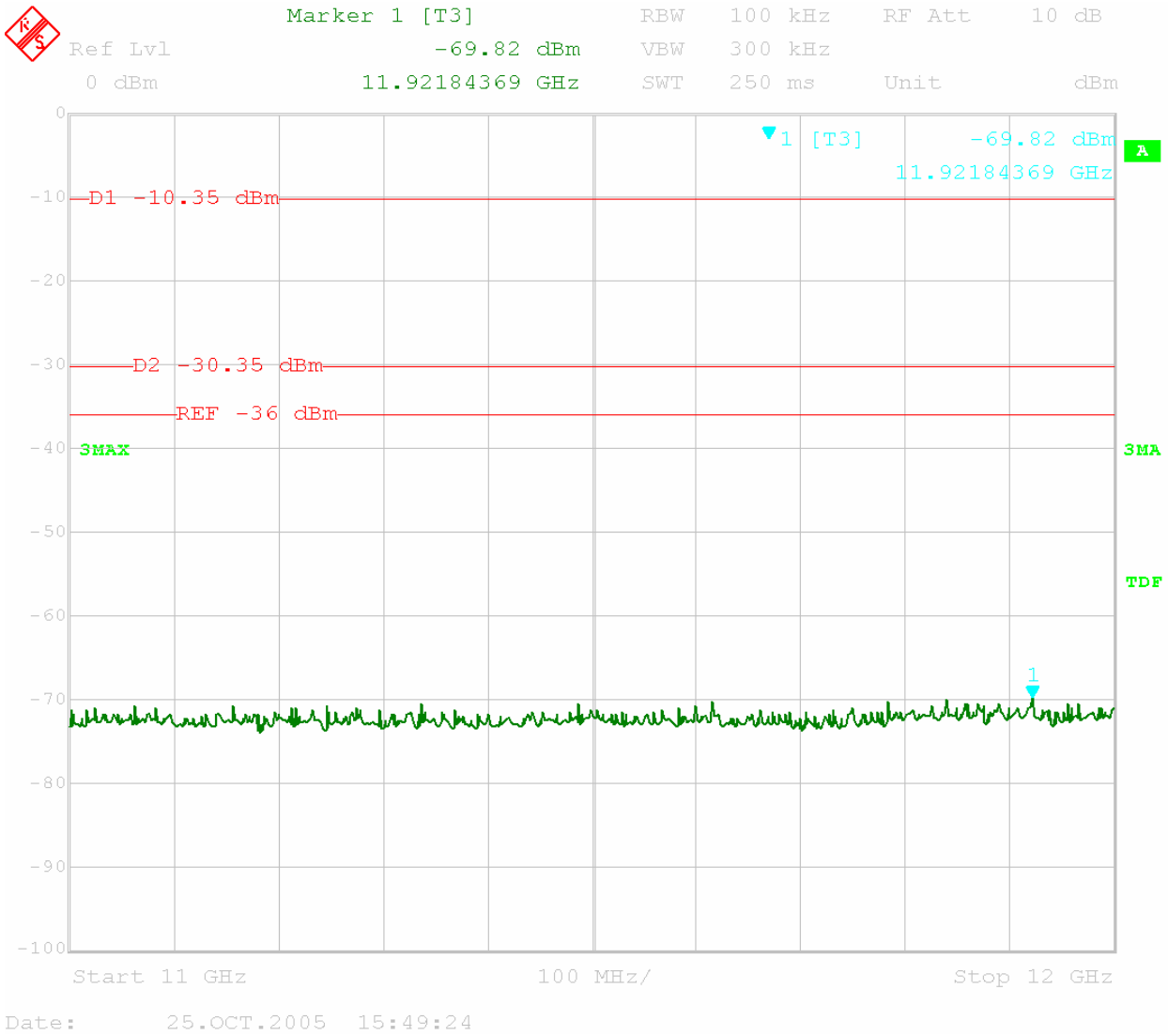
Channel 18 8-9 GHz



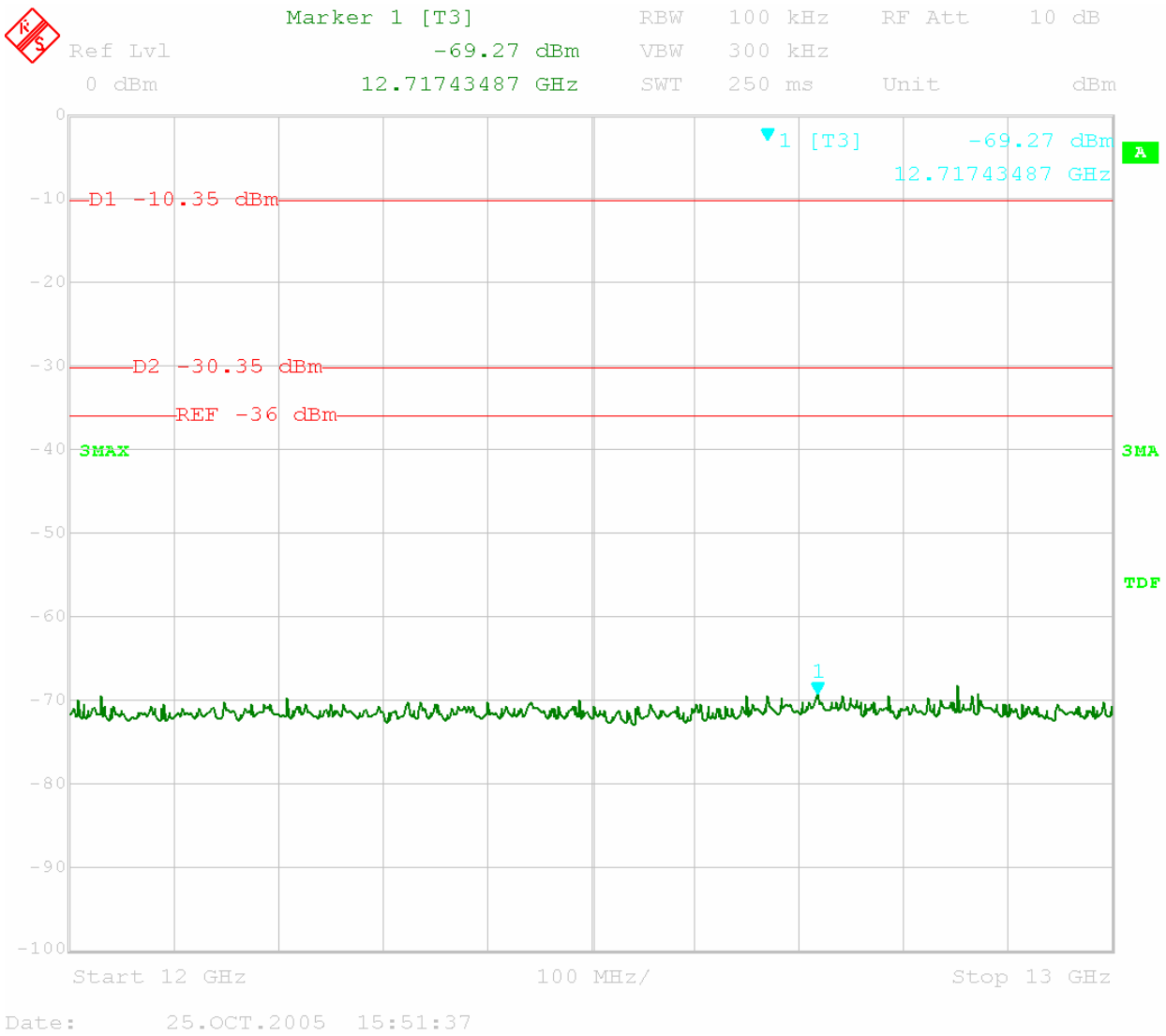
Channel 18 9-10 GHz



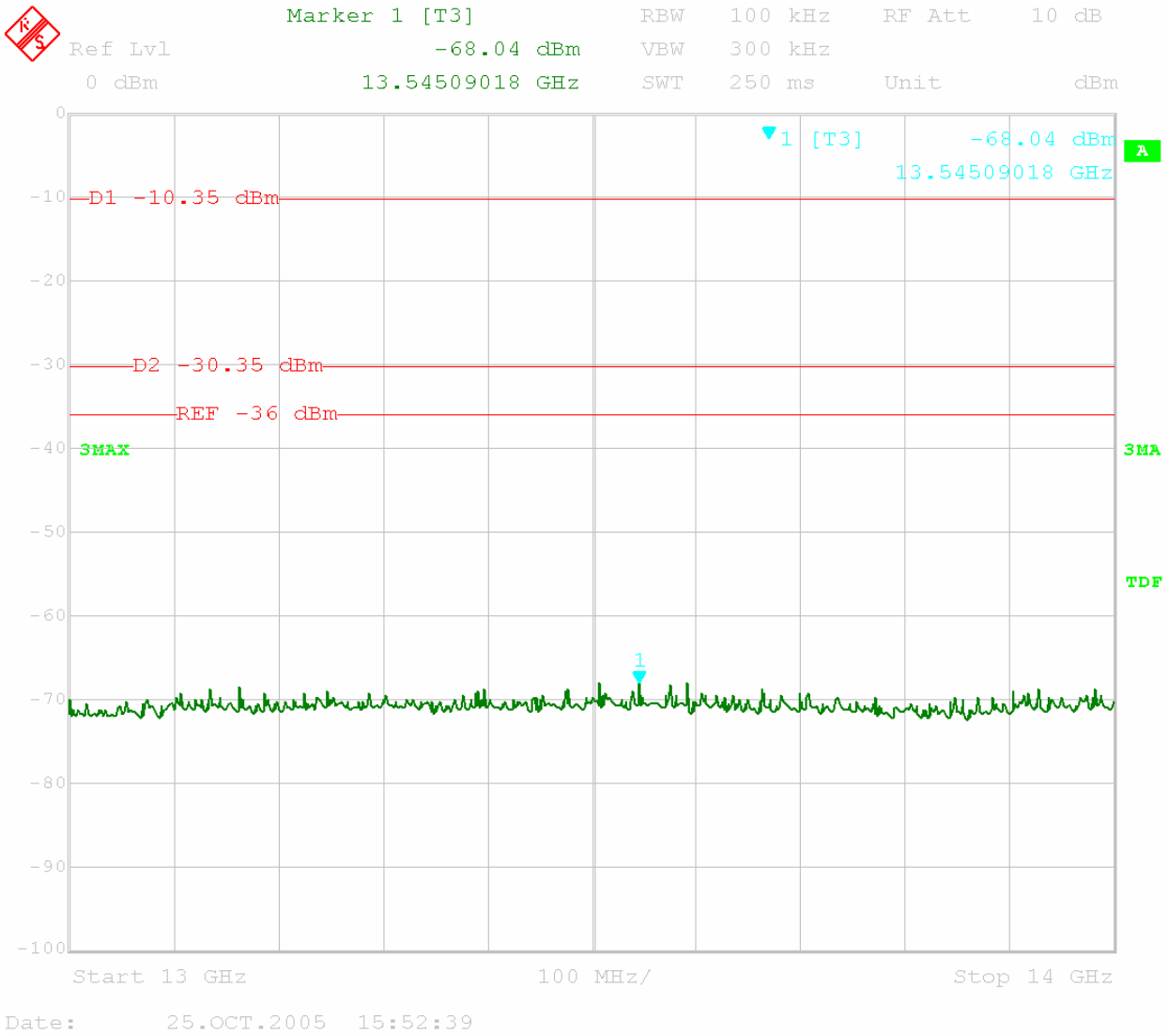
Channel 18 10-11 GHz



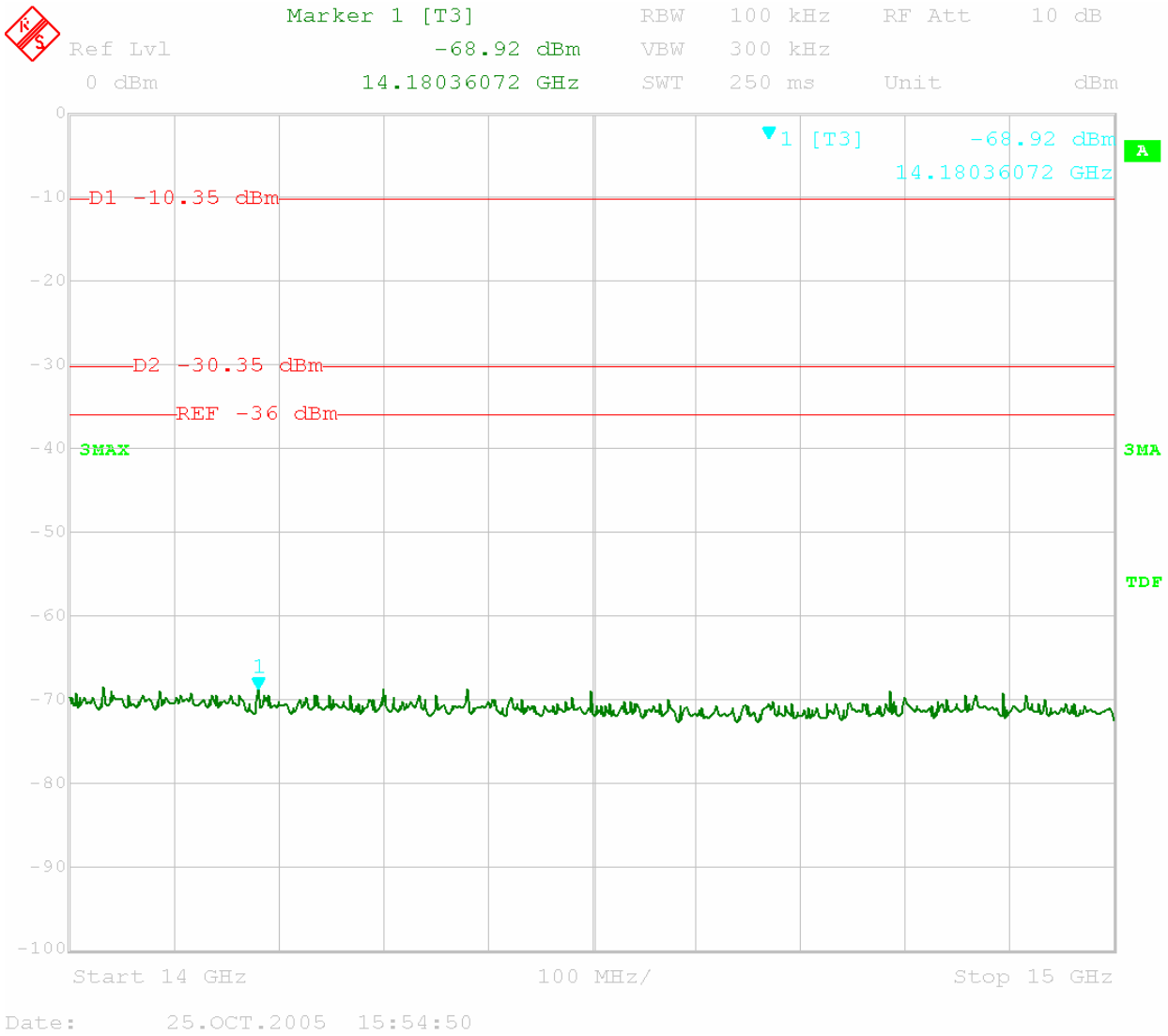
Channel 18 11-12 GHz



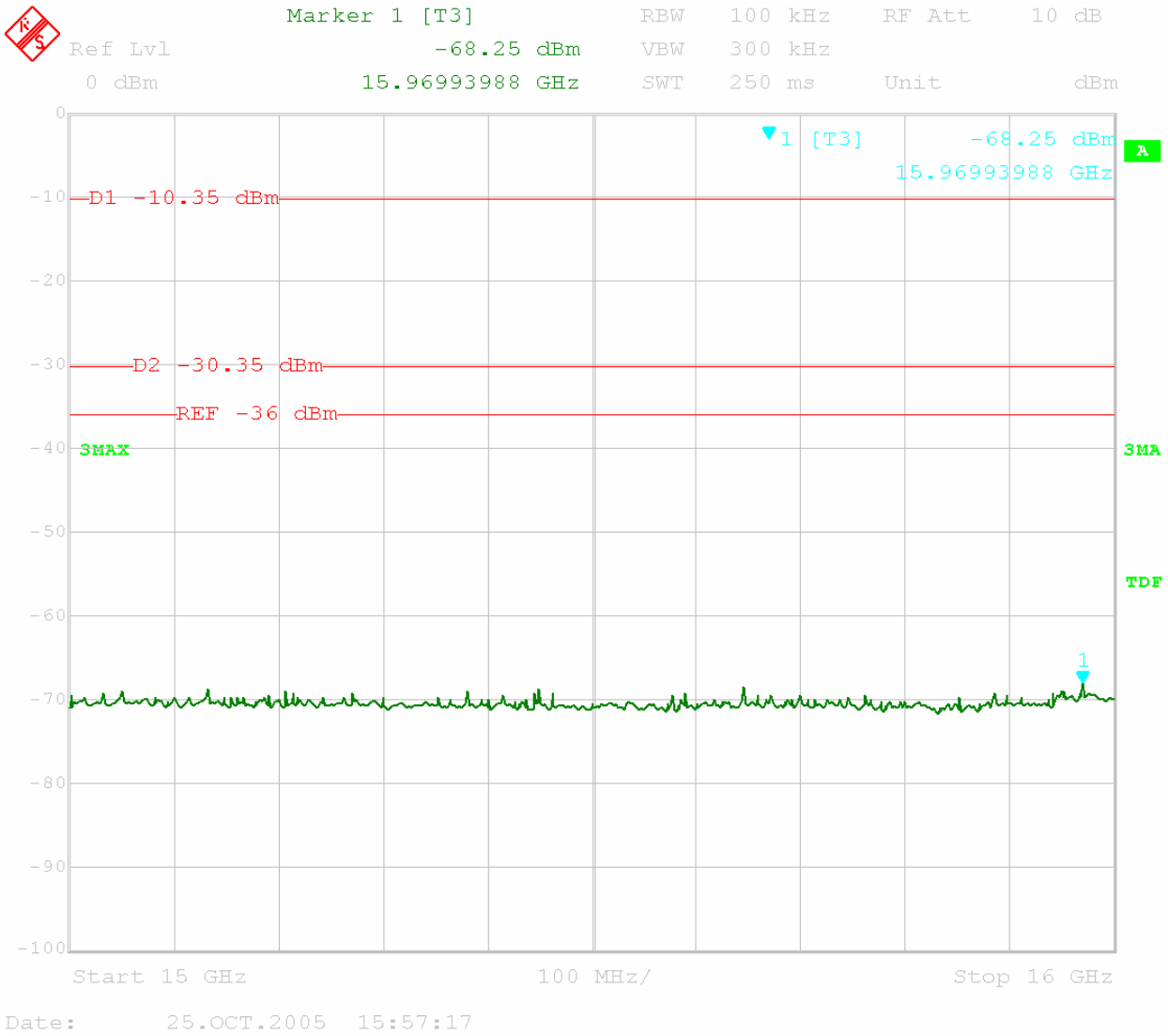
Channel 18 12-13 GHz



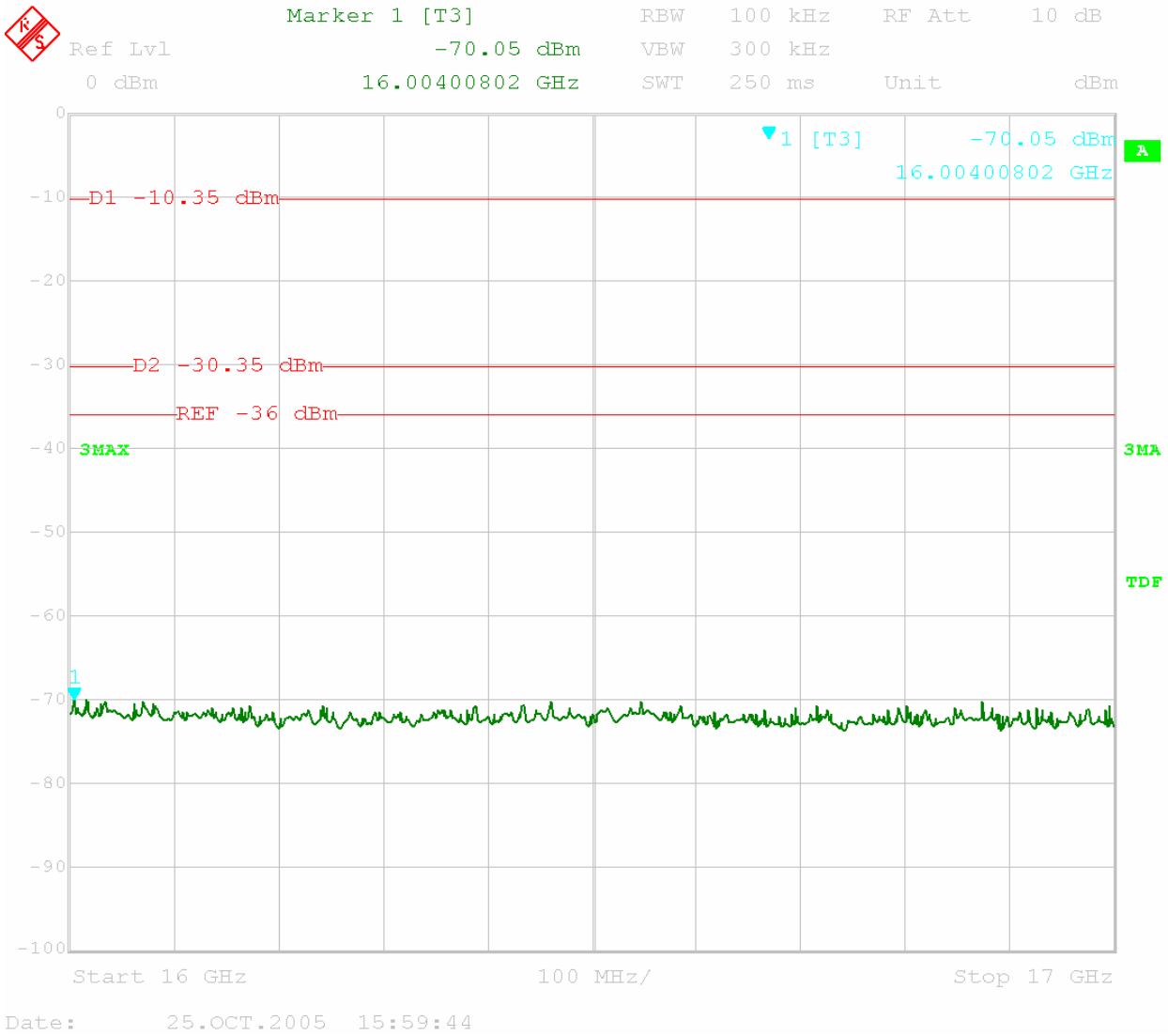
Channel 18 13-14 GHz



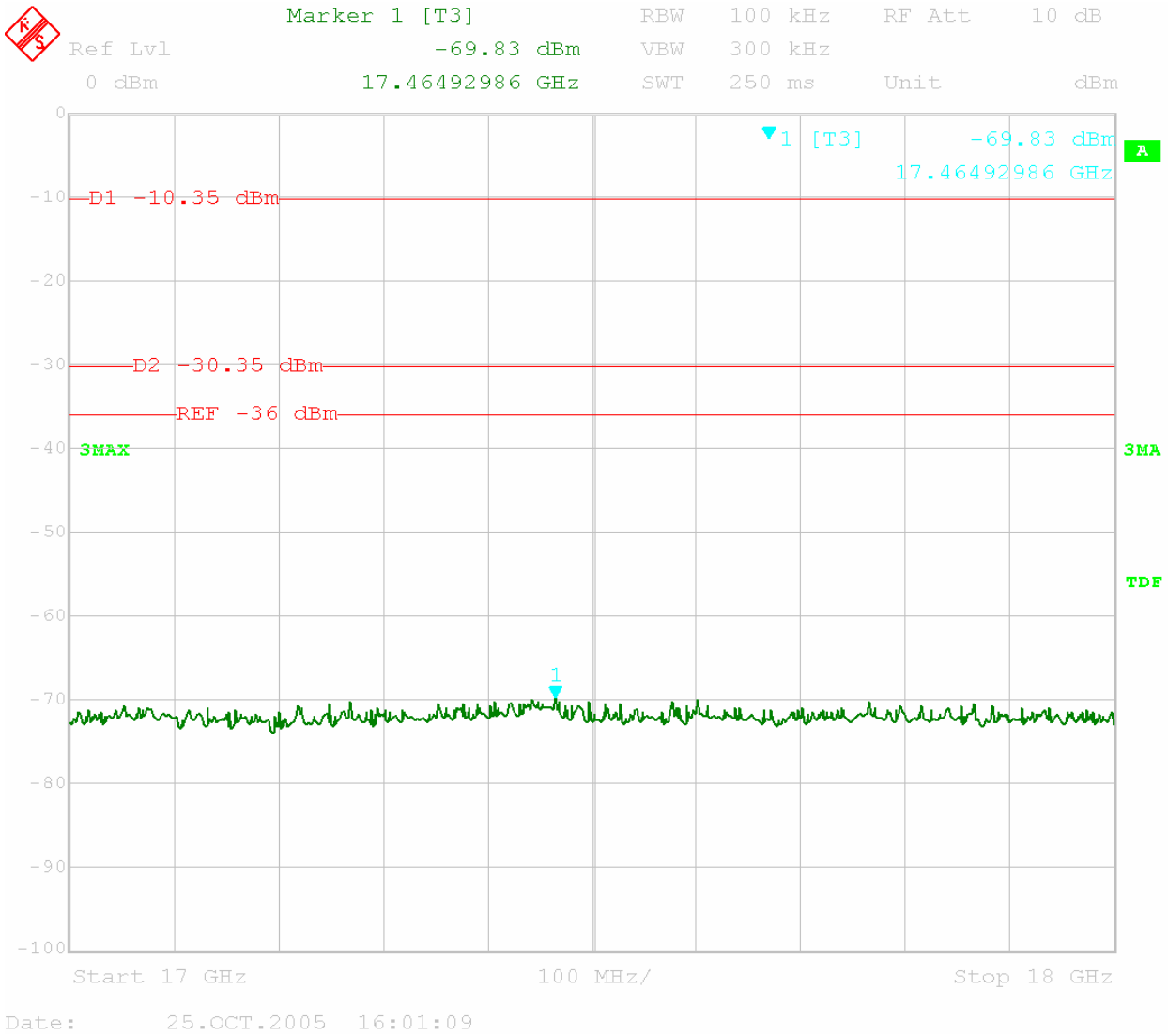
Channel 18 14-15 GHz



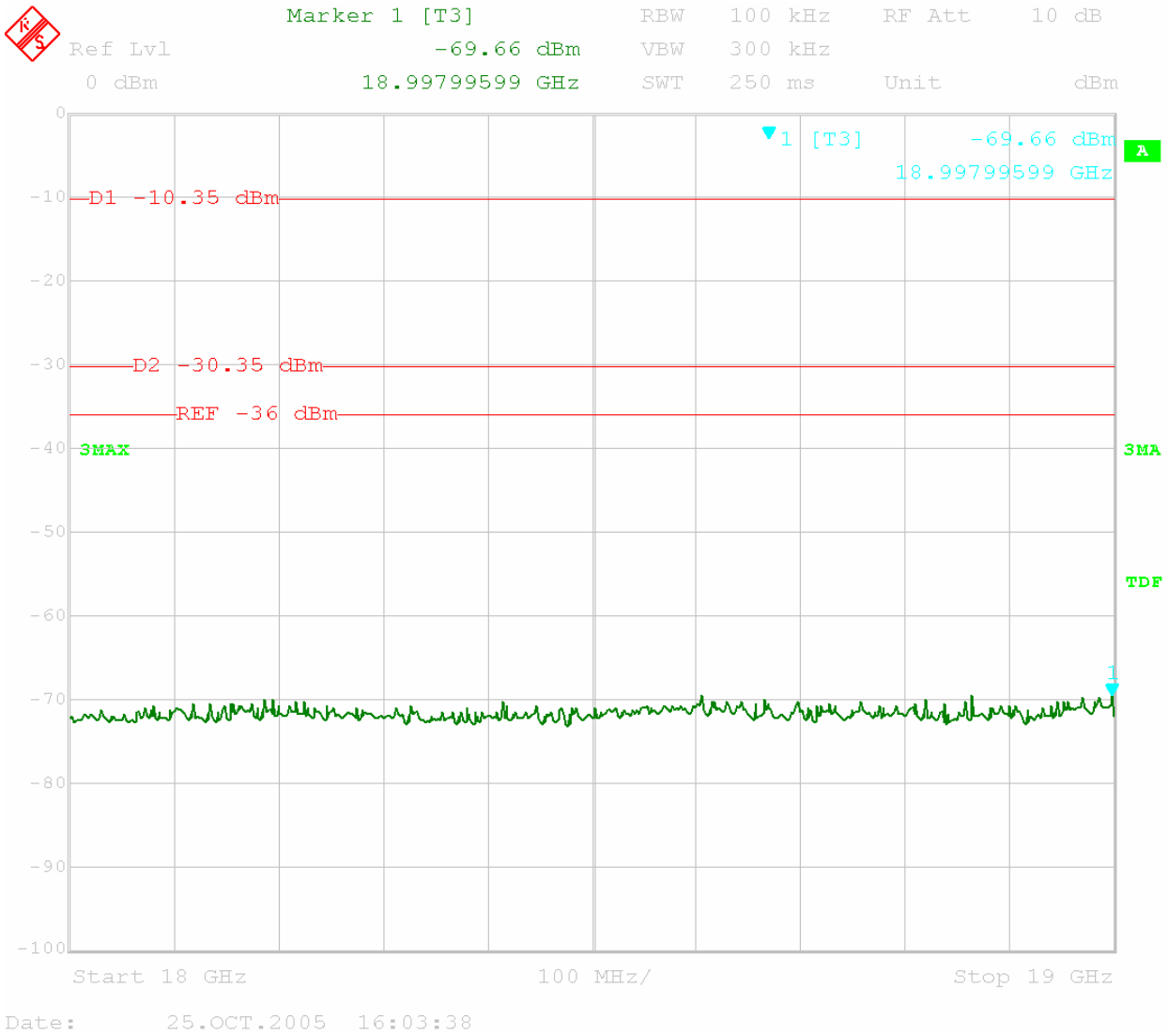
Channel 18 15-16 GHz



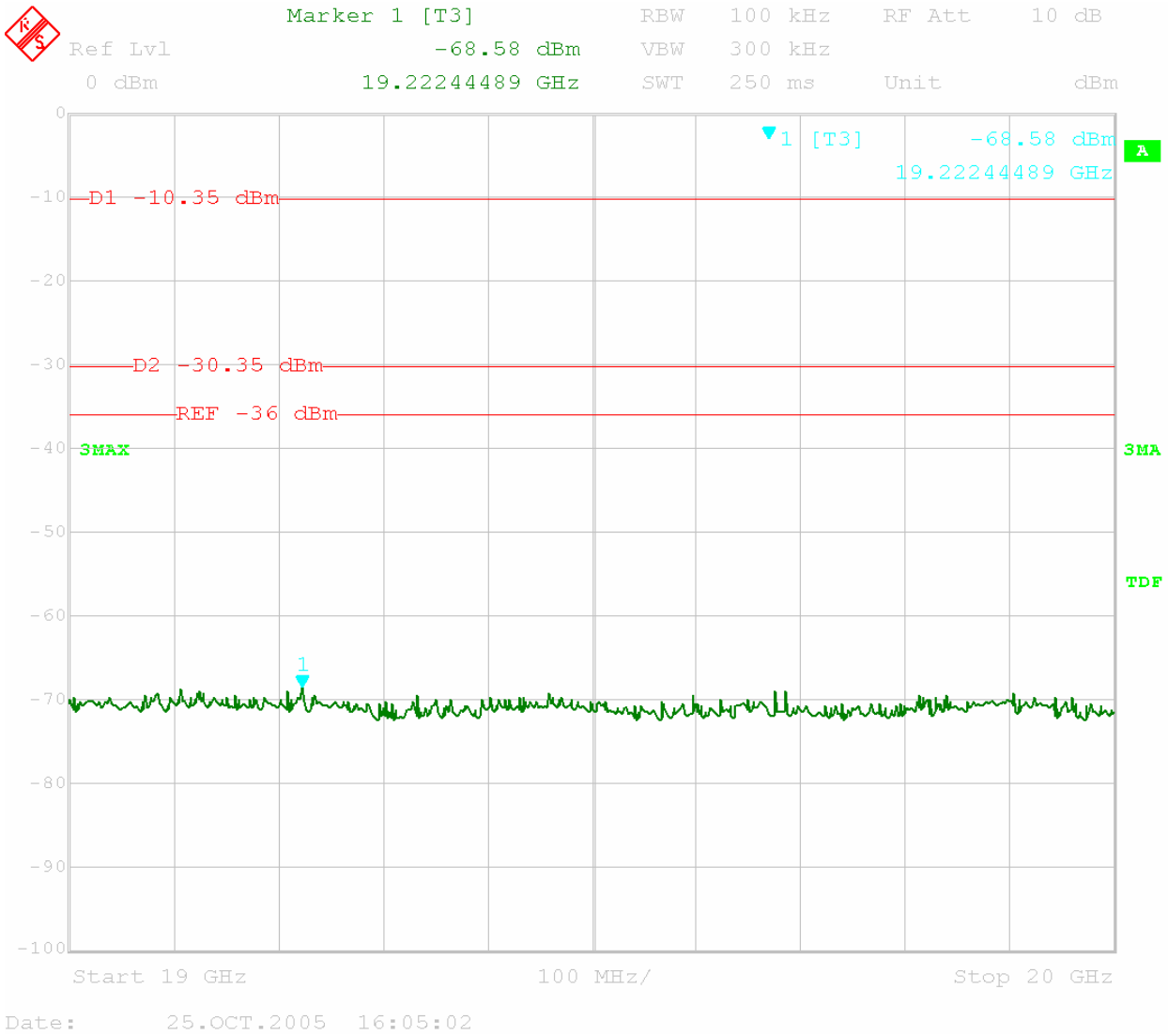
Channel 18 16-17 GHz



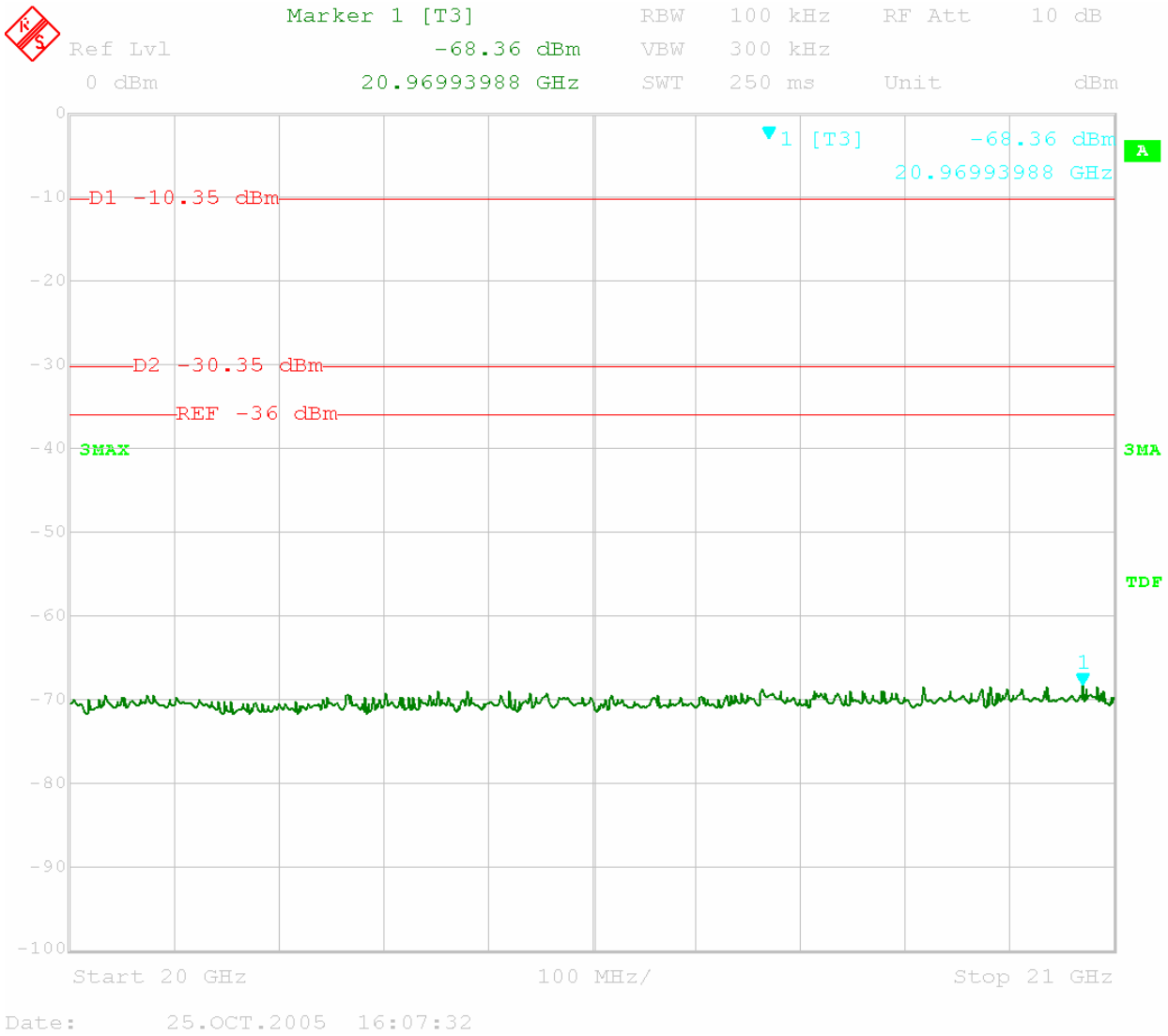
Channel 18 17-18 GHz



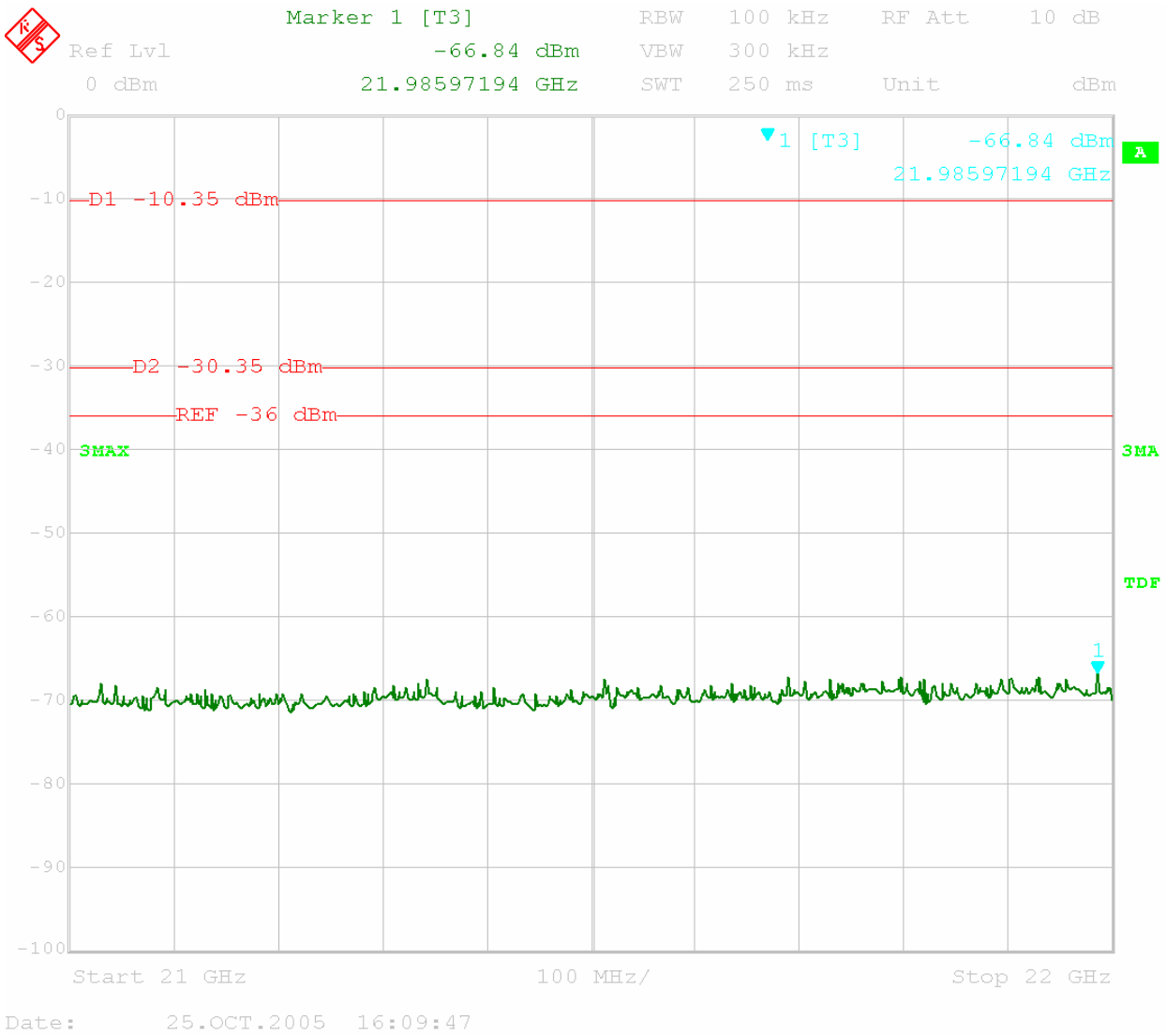
Channel 18 18-19 GHz



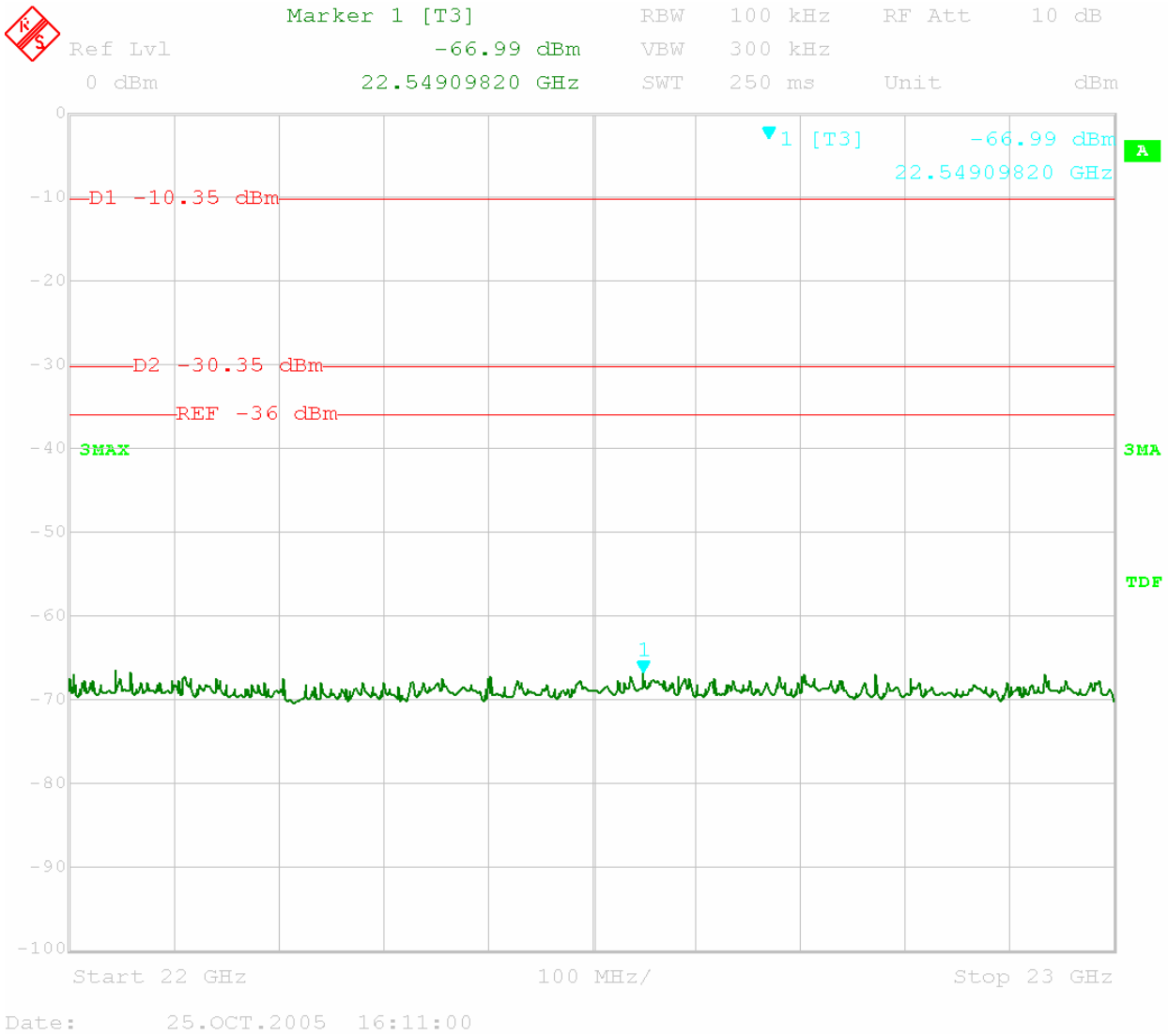
Channel 18 19-20 GHz



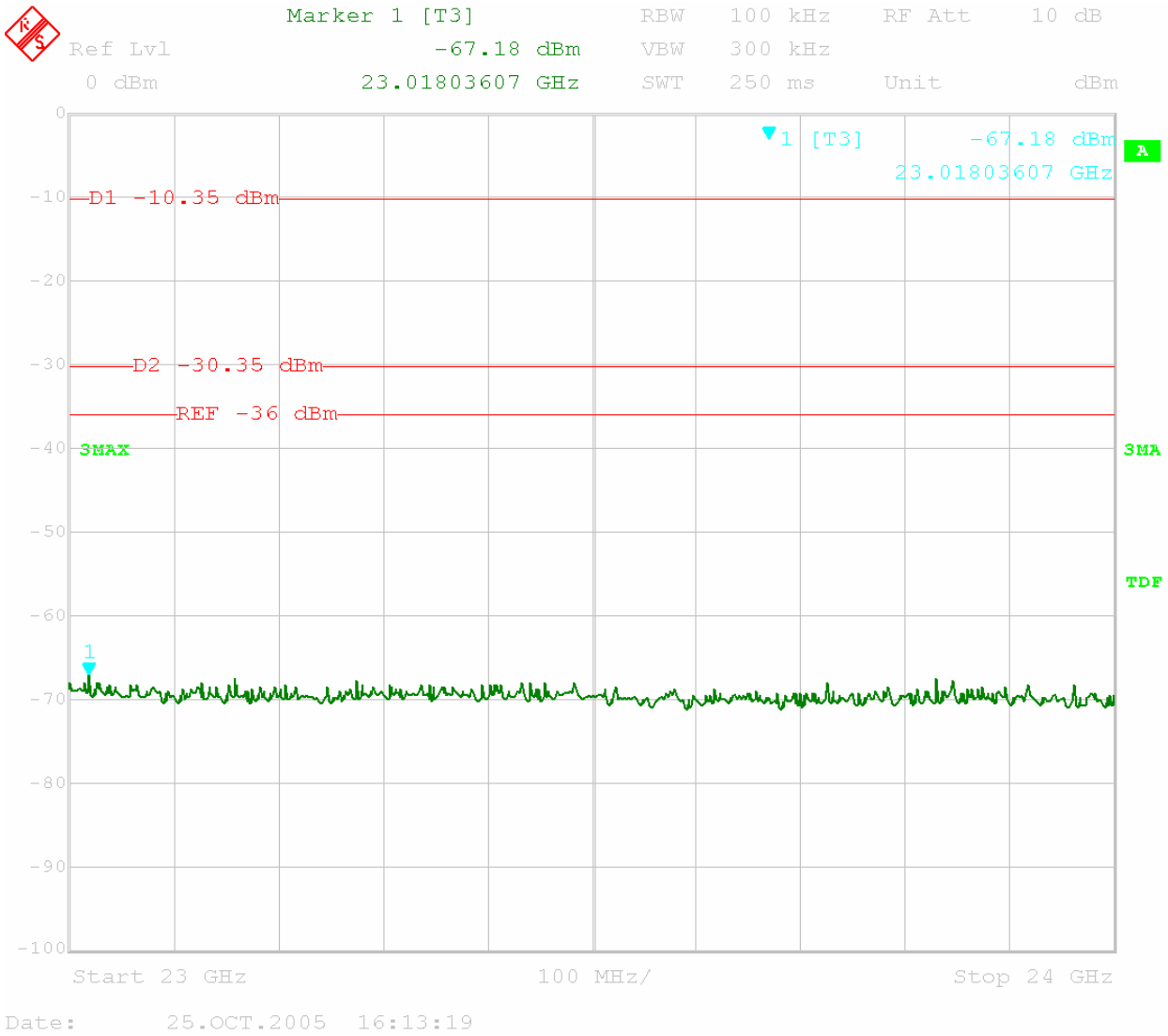
Channel 18 20-21 GHz



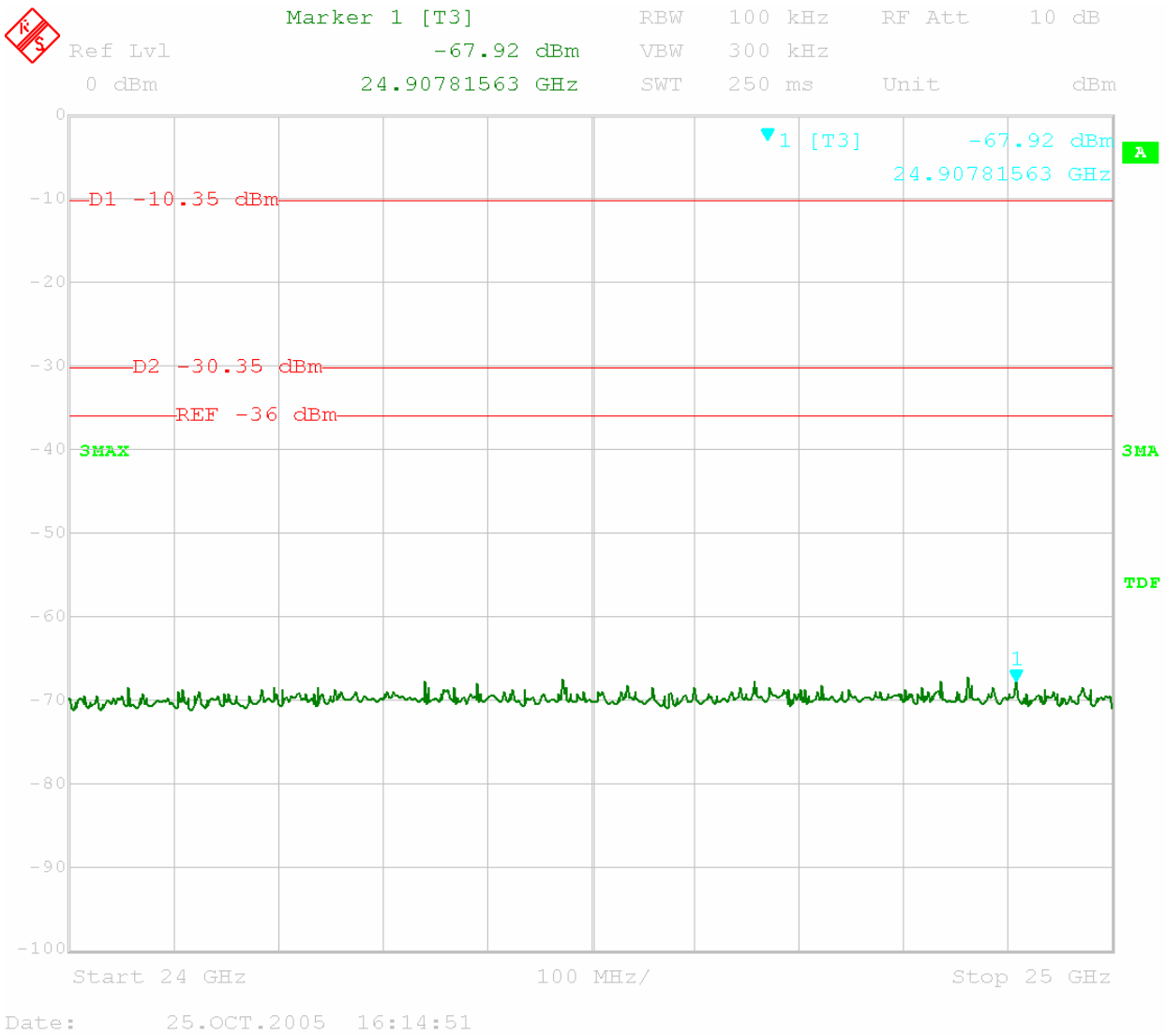
Channel 18 21-22 GHz



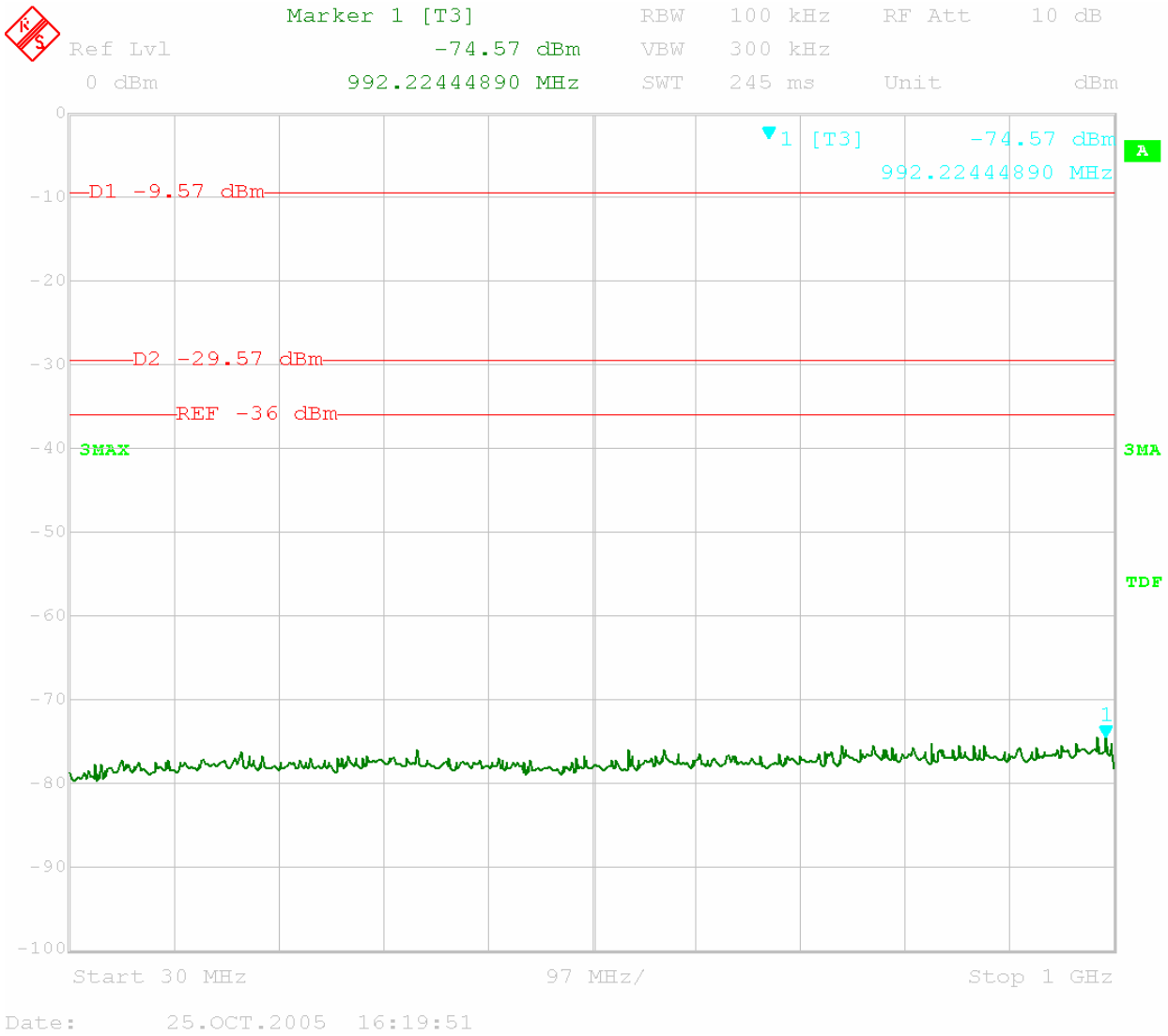
Channel 18 22-23 GHz



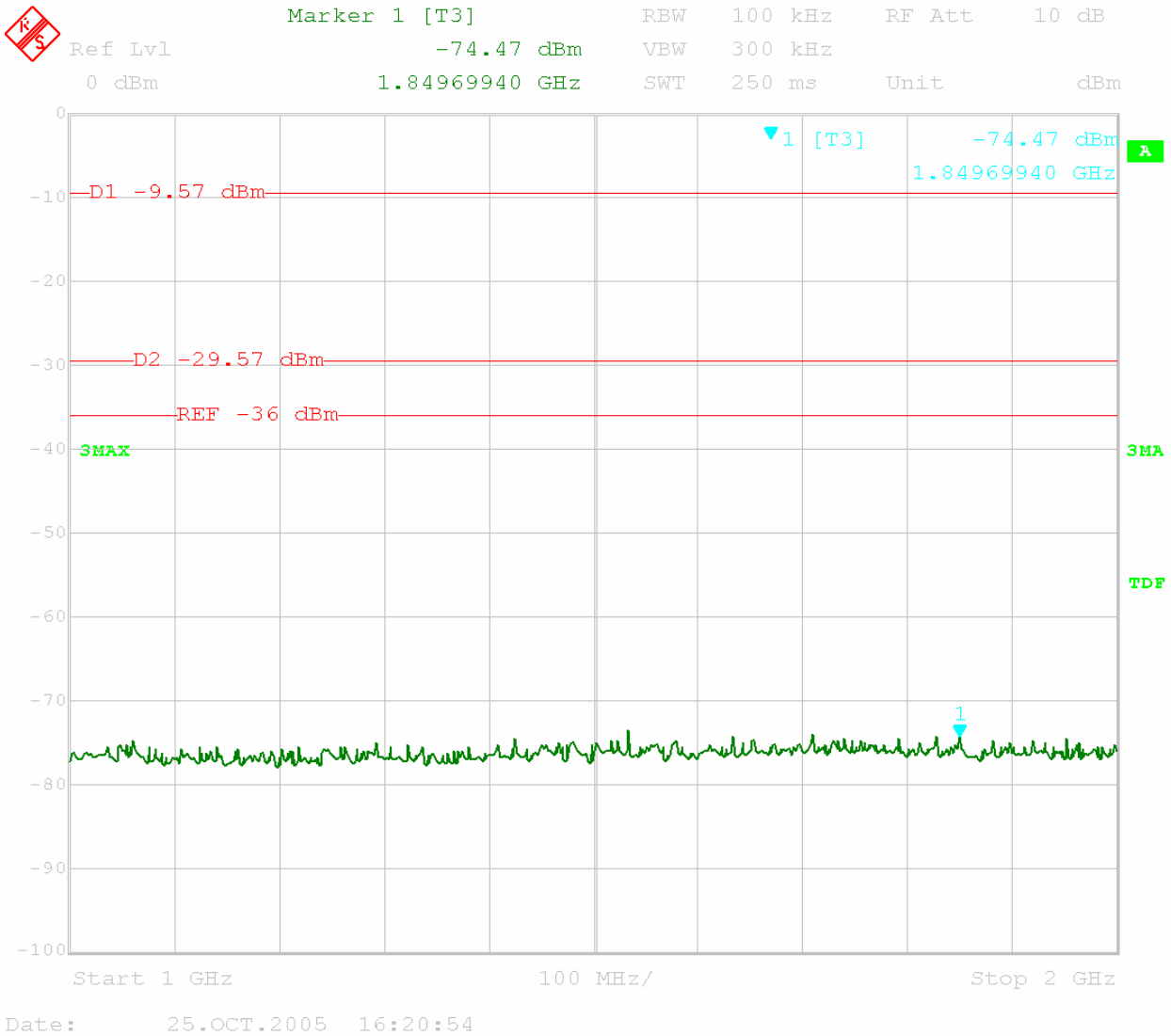
Channel 18 23-24 GHz



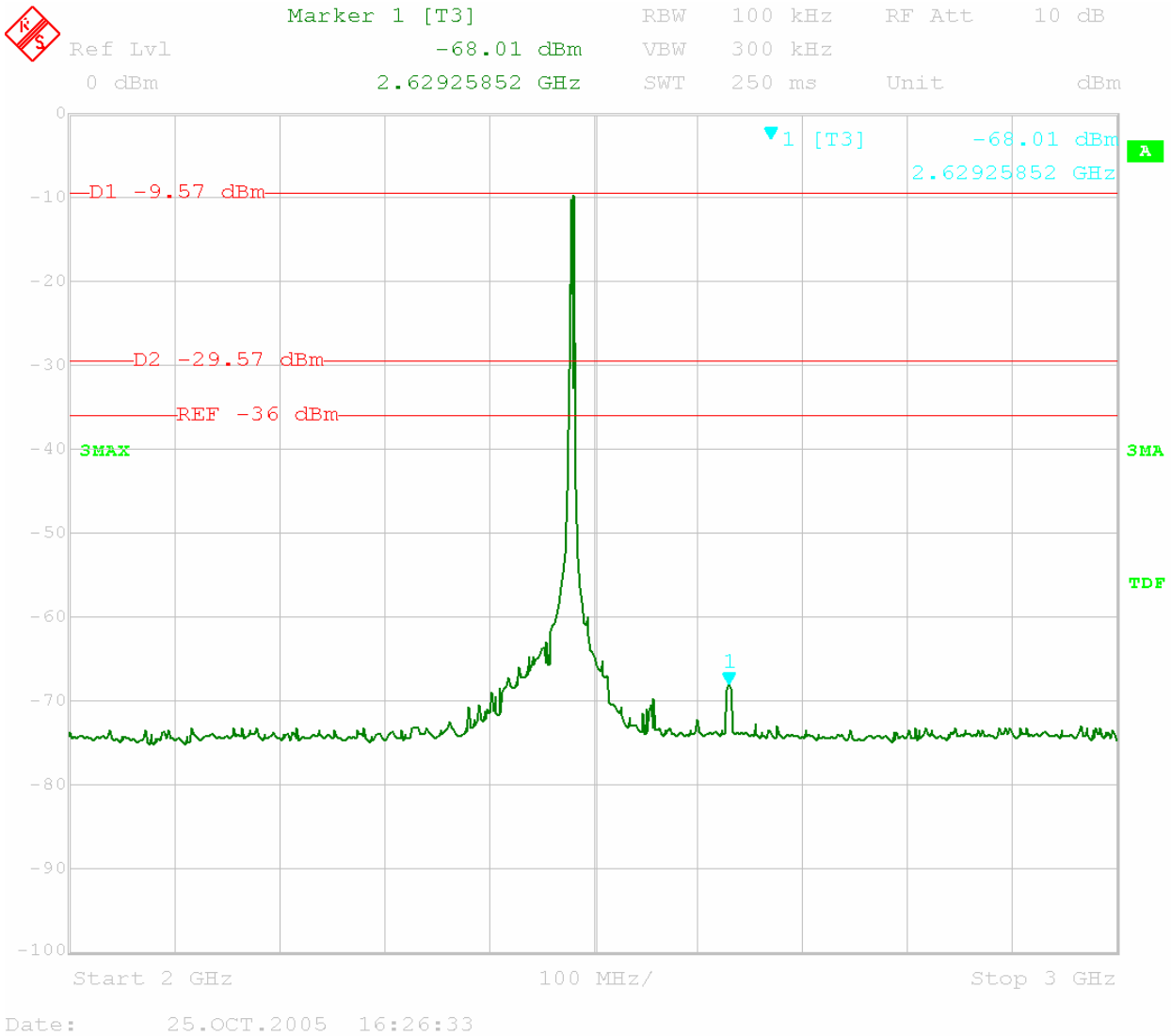
Channel 18 24-25 GHz



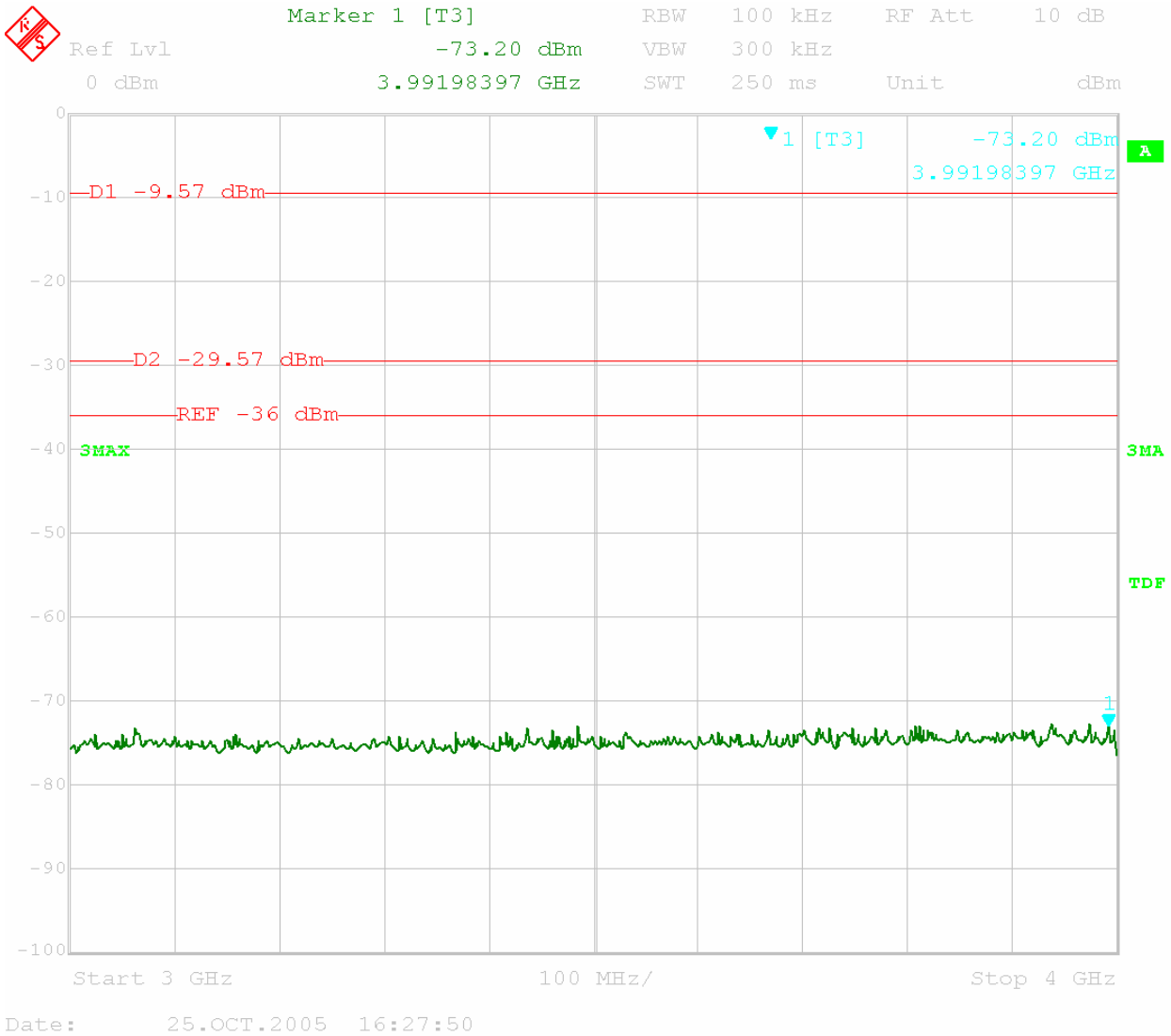
Channel 26 30 MHz -1 GHz



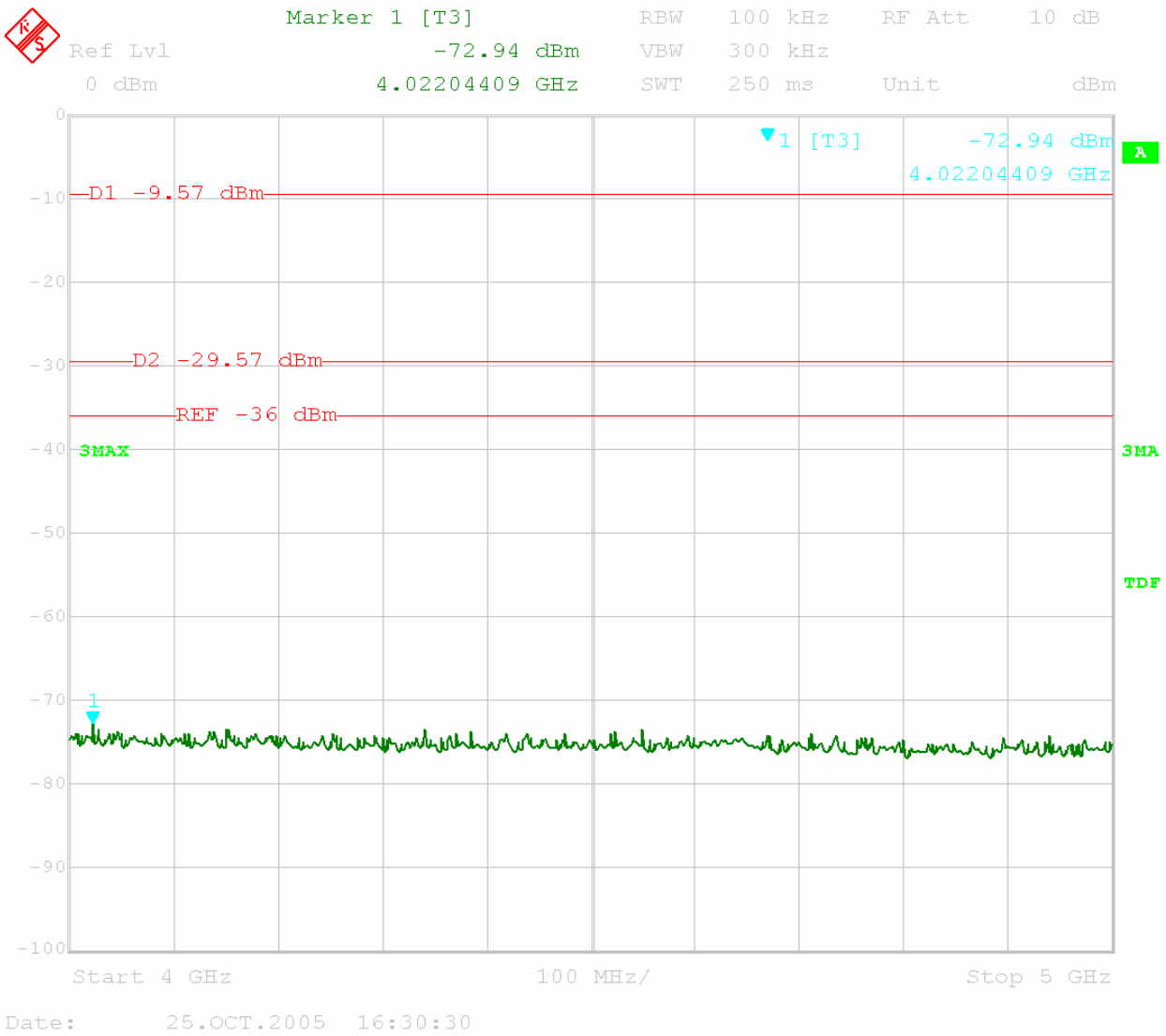
Channel 26 1-2 GHz



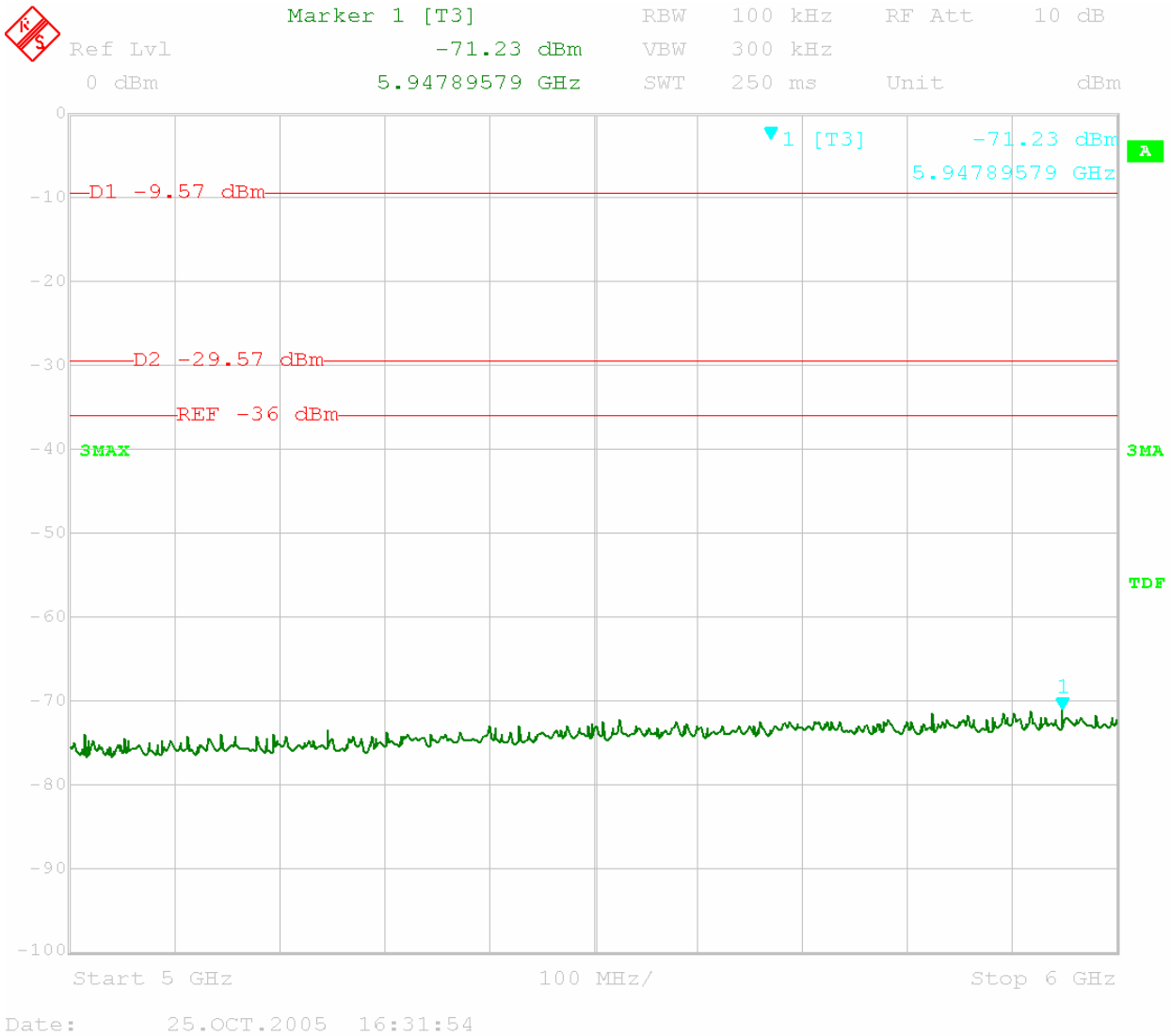
Channel 26 2-3 GHz



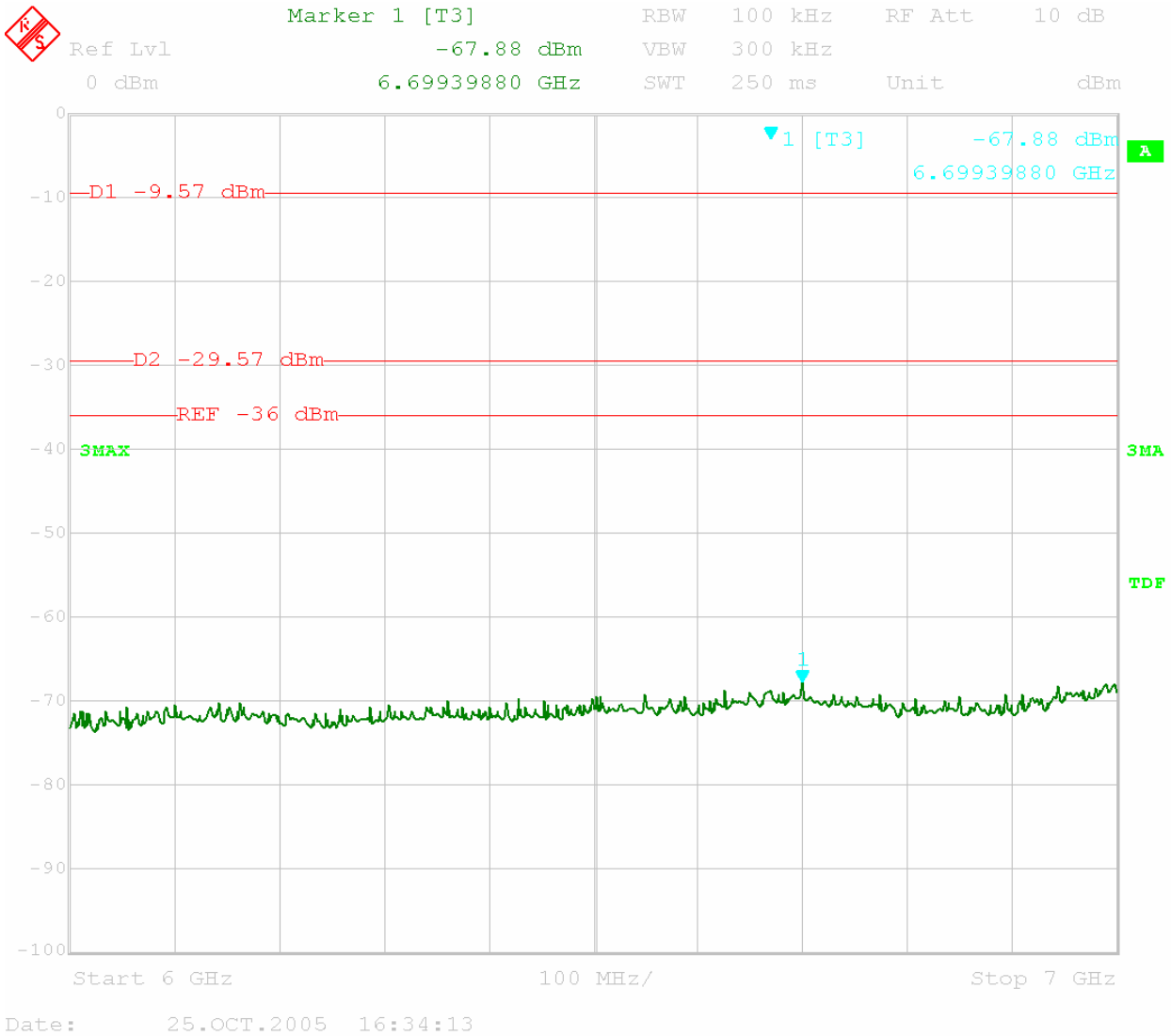
Channel 26 3-4 GHz



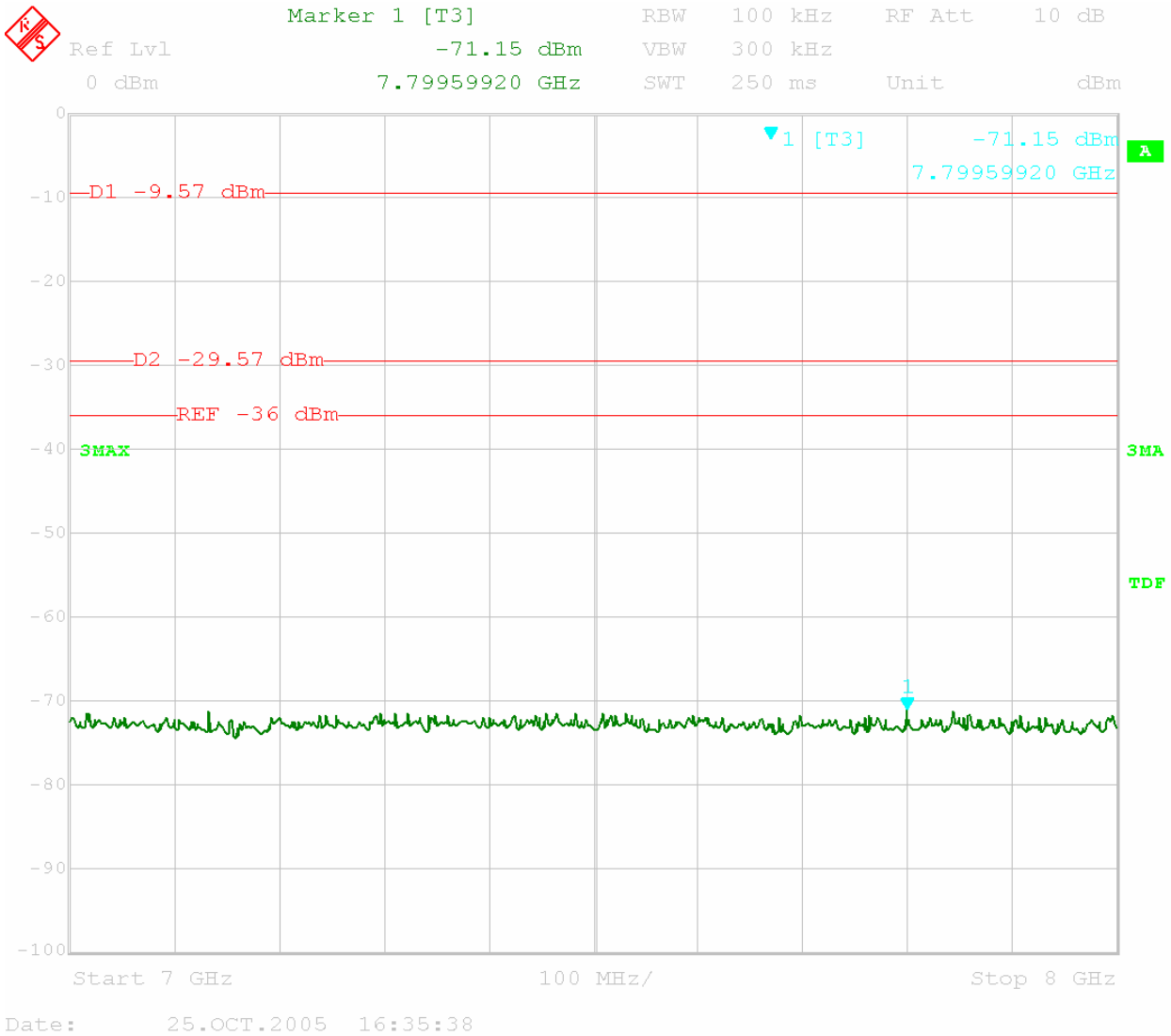
Channel 26 4-5 GHz



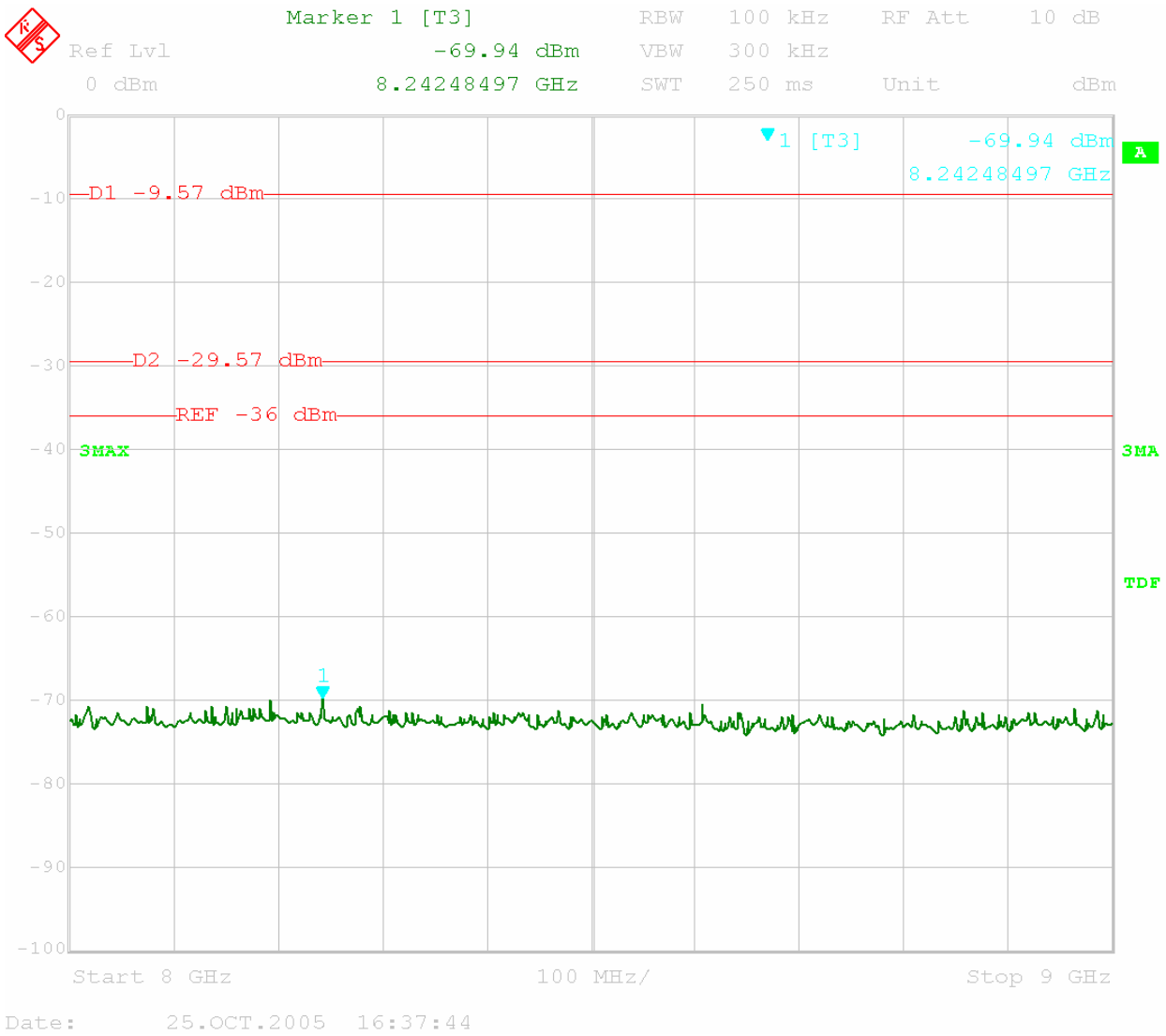
Channel 26 5-6 GHz



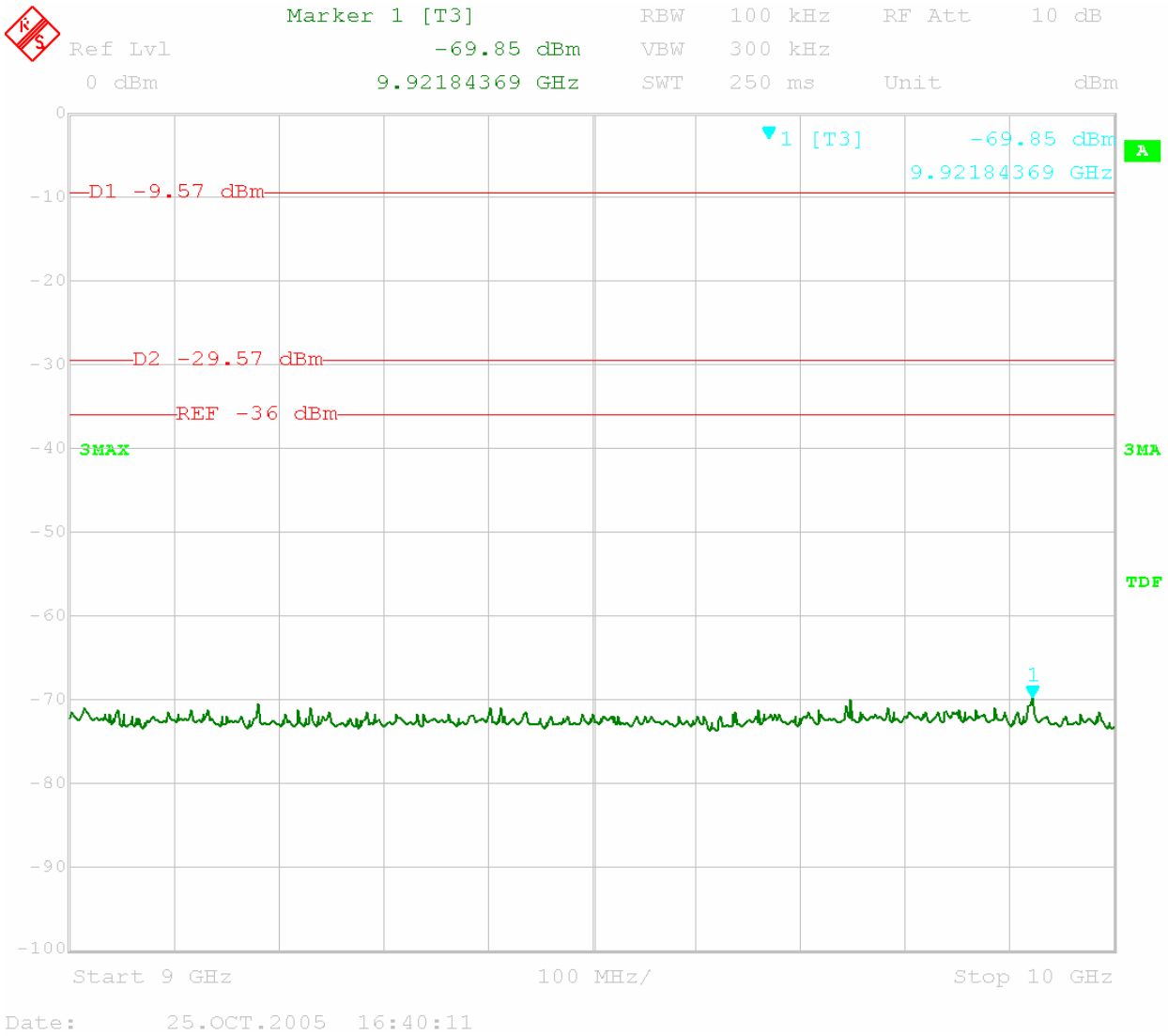
Channel 26 6-7 GHz



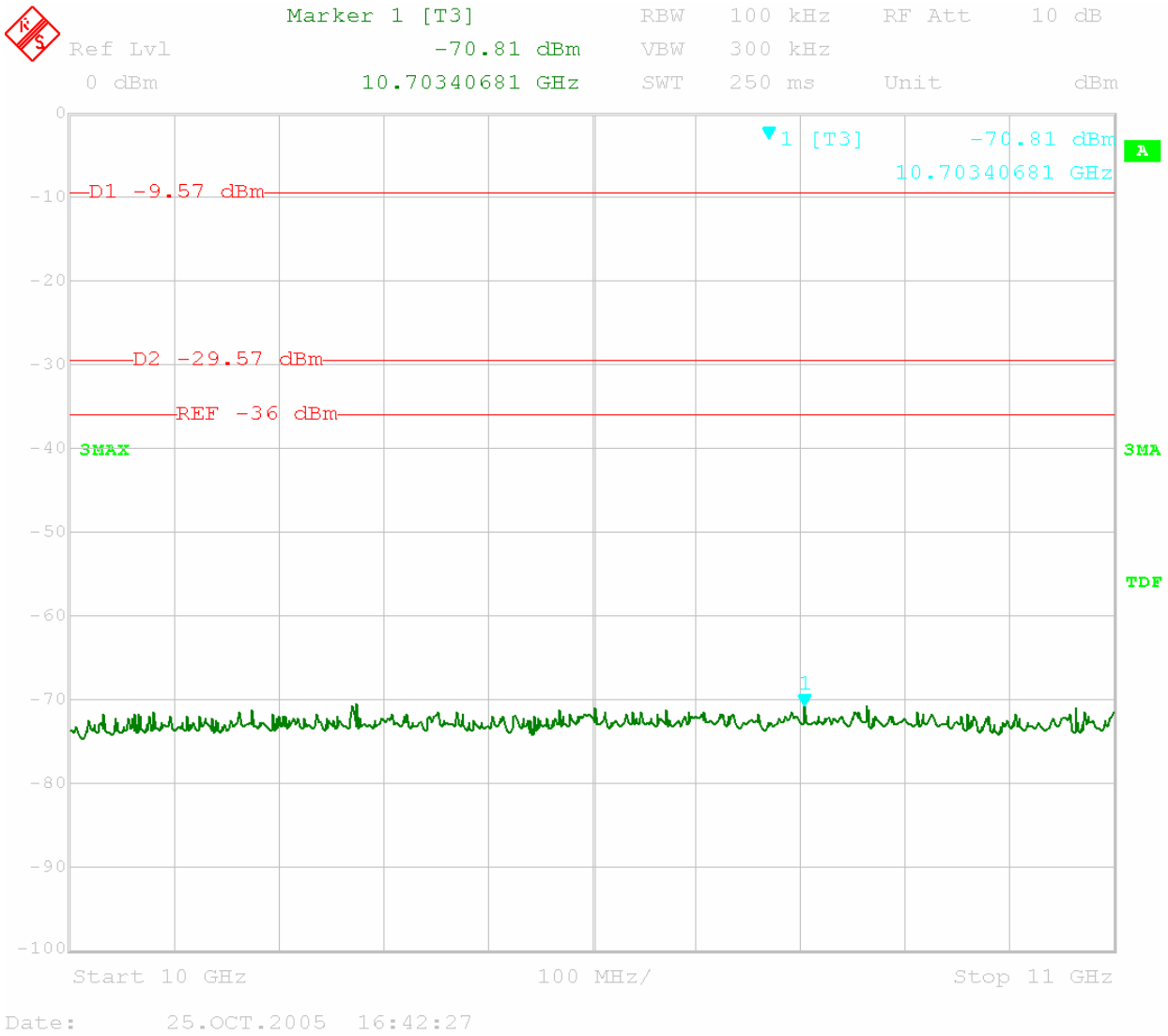
Channel 26 7-8 GHz



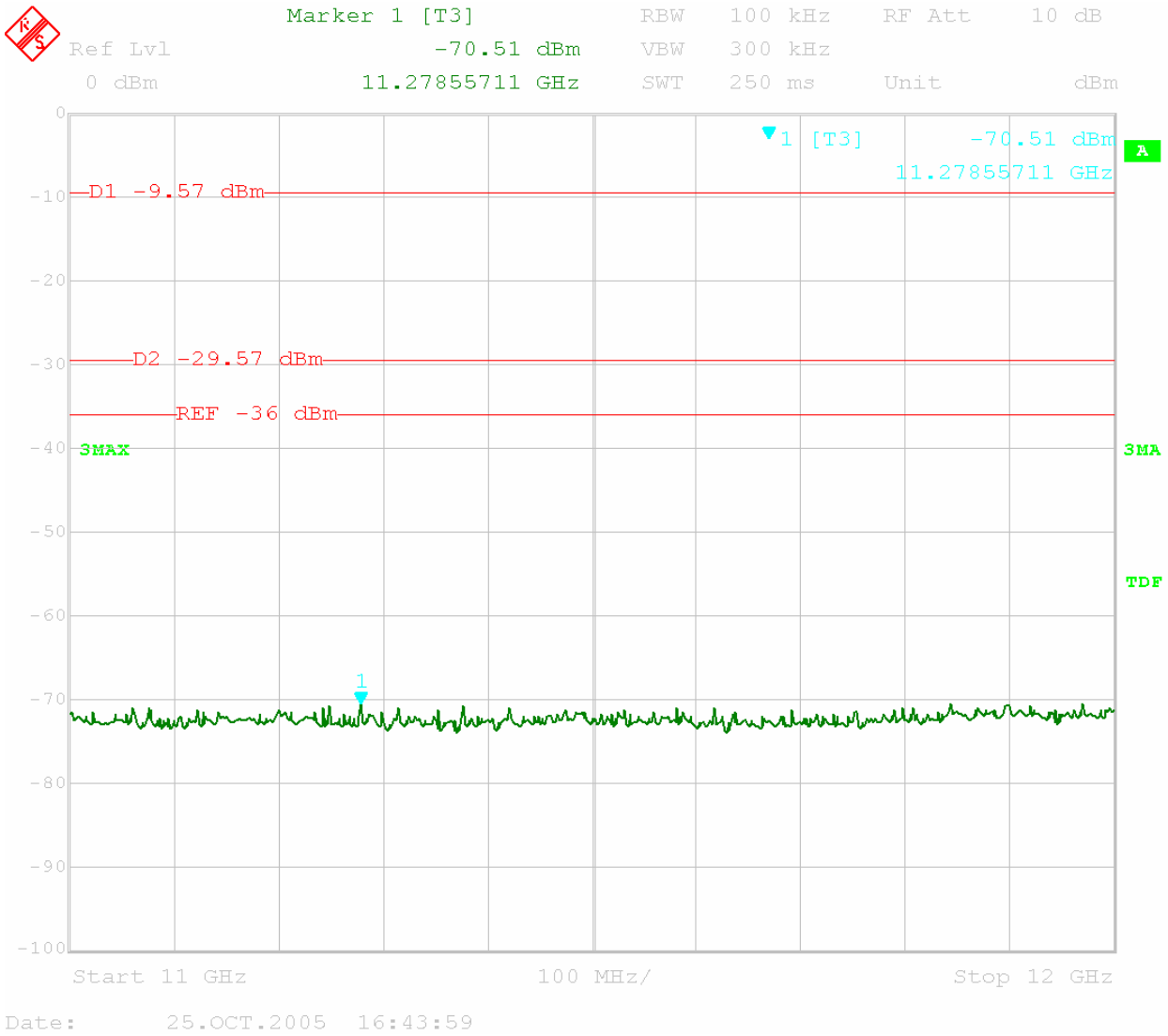
Channel 26 8-9 GHz



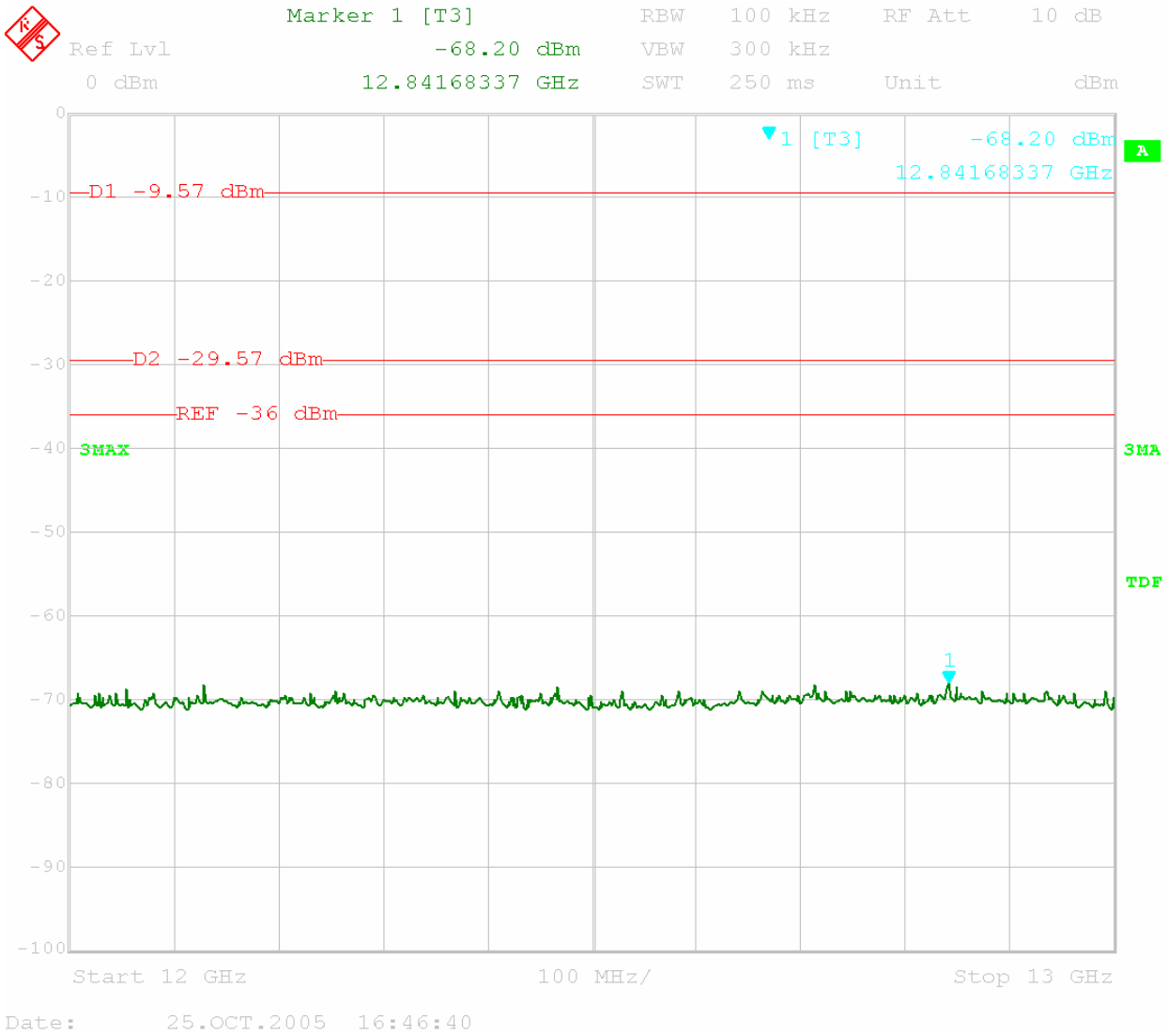
Channel 26 9-10 GHz



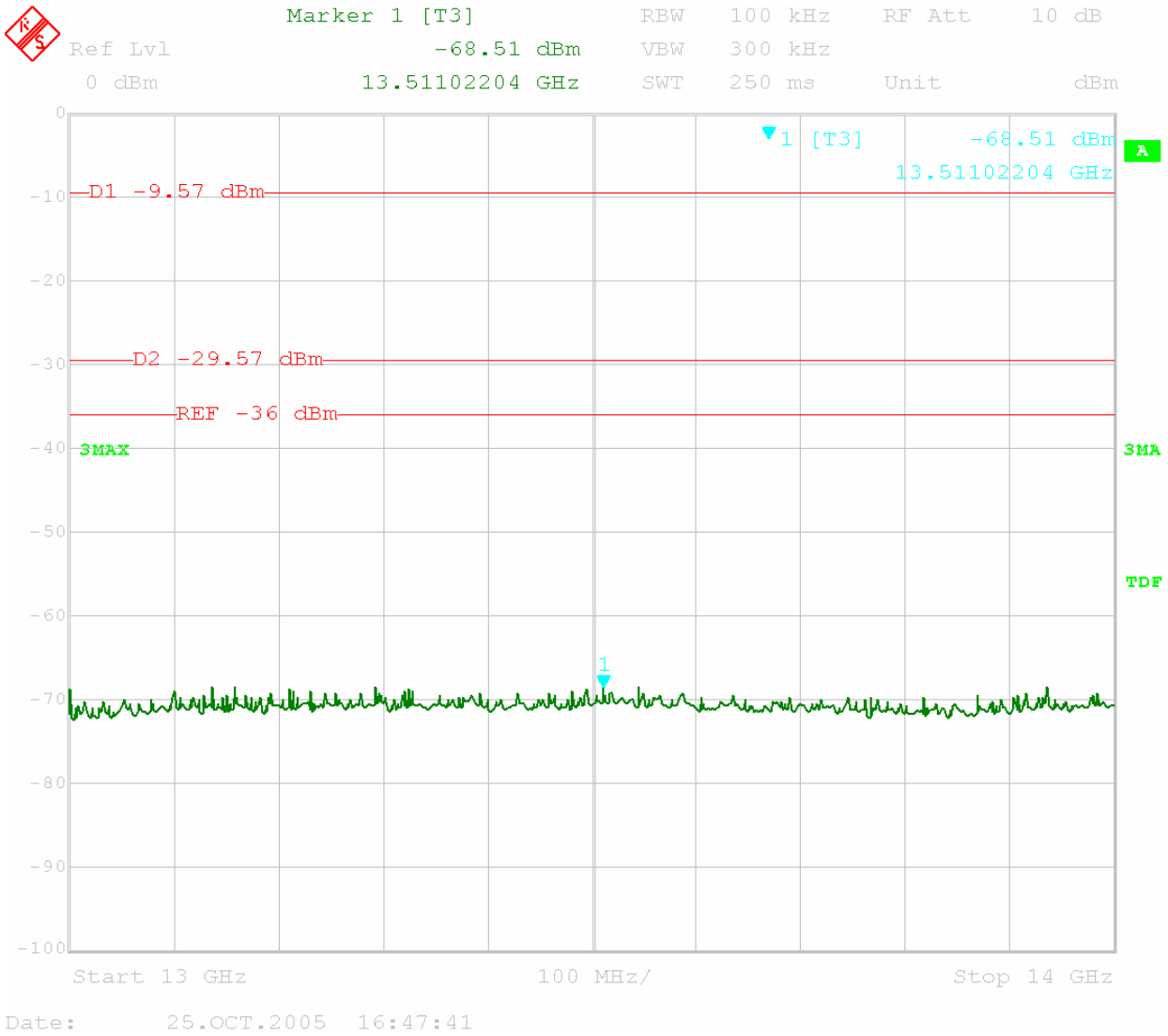
Channel 26 10-11 GHz



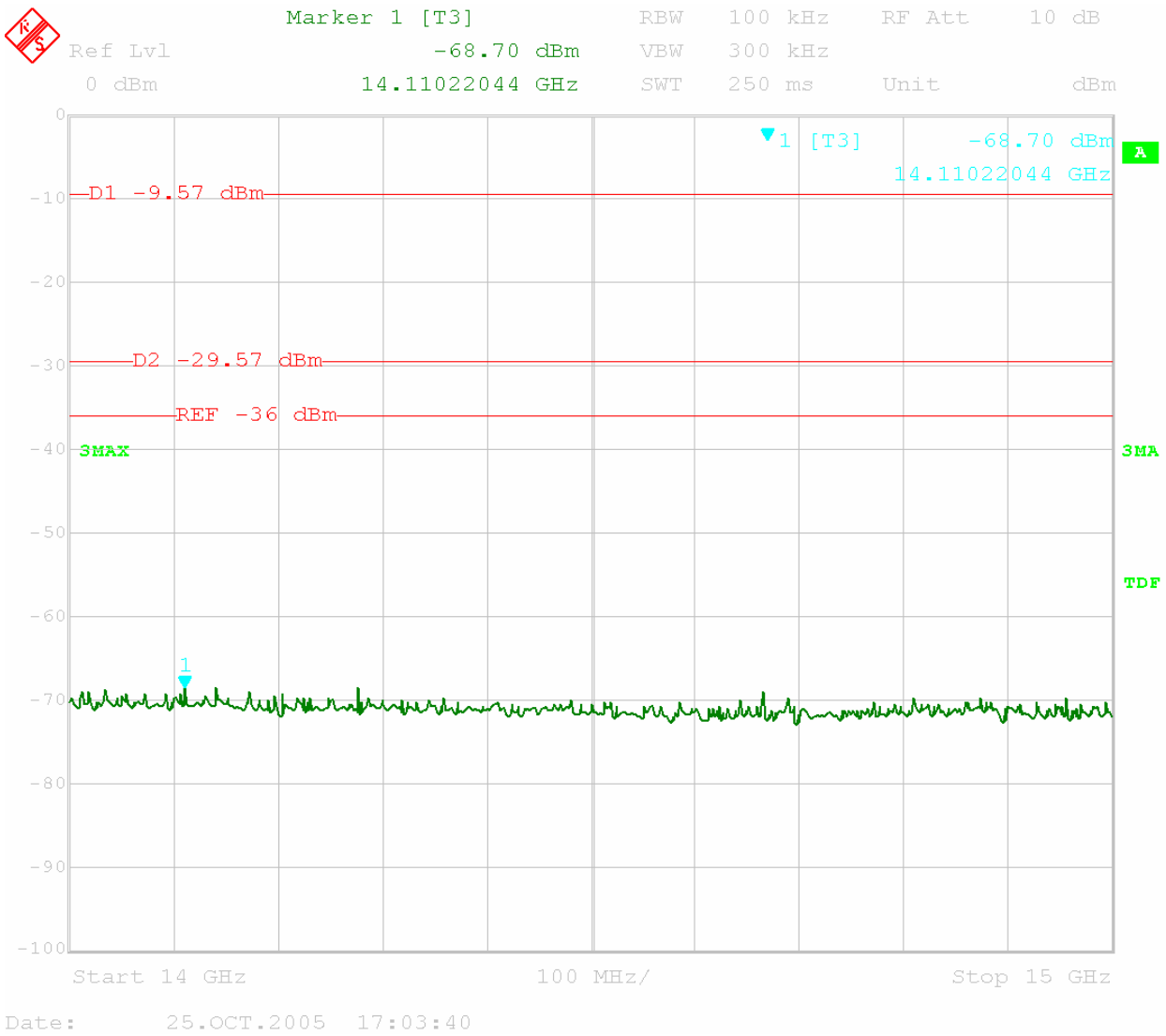
Channel 26 11-12 GHz



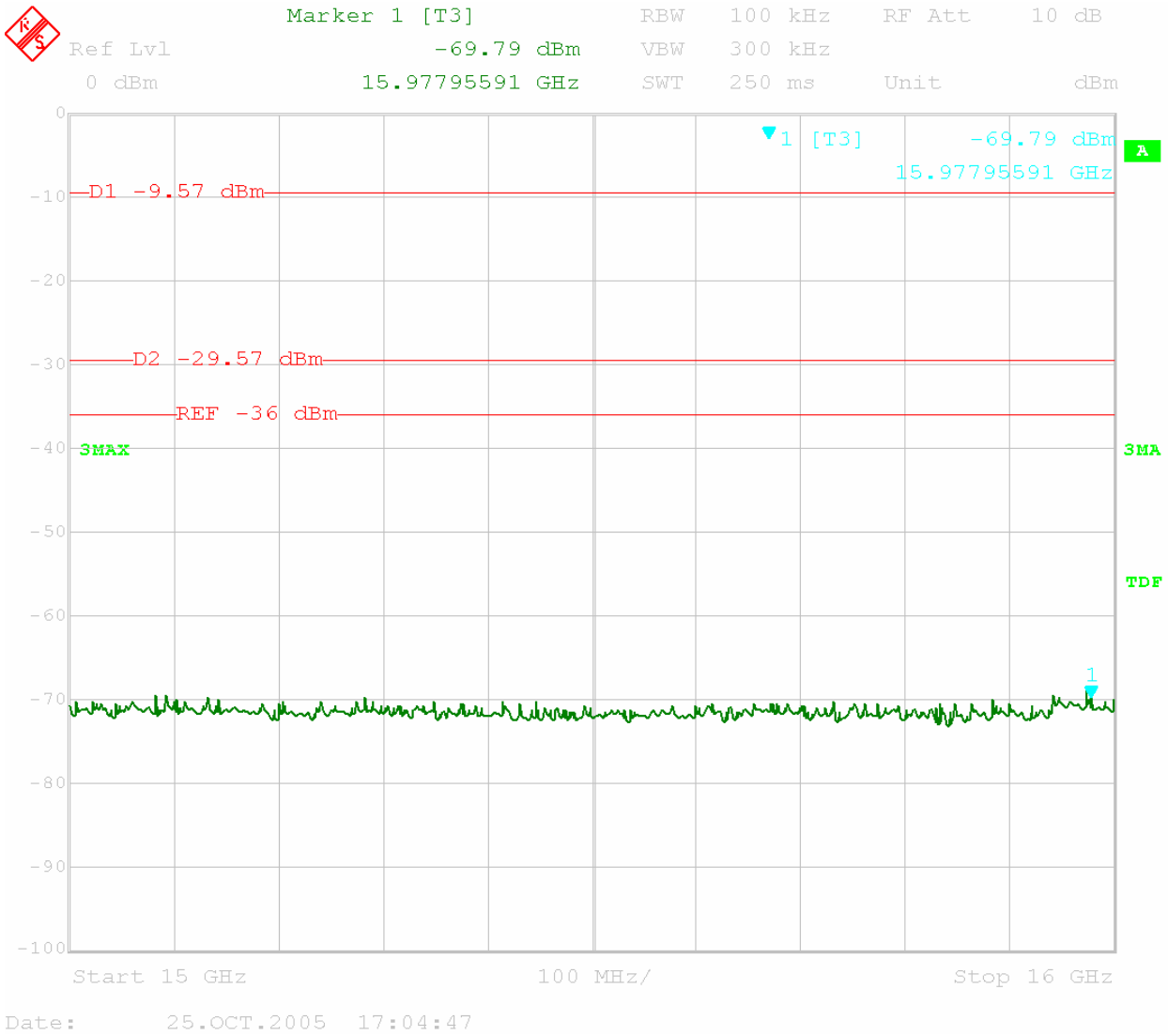
Channel 26 12-13 GHz



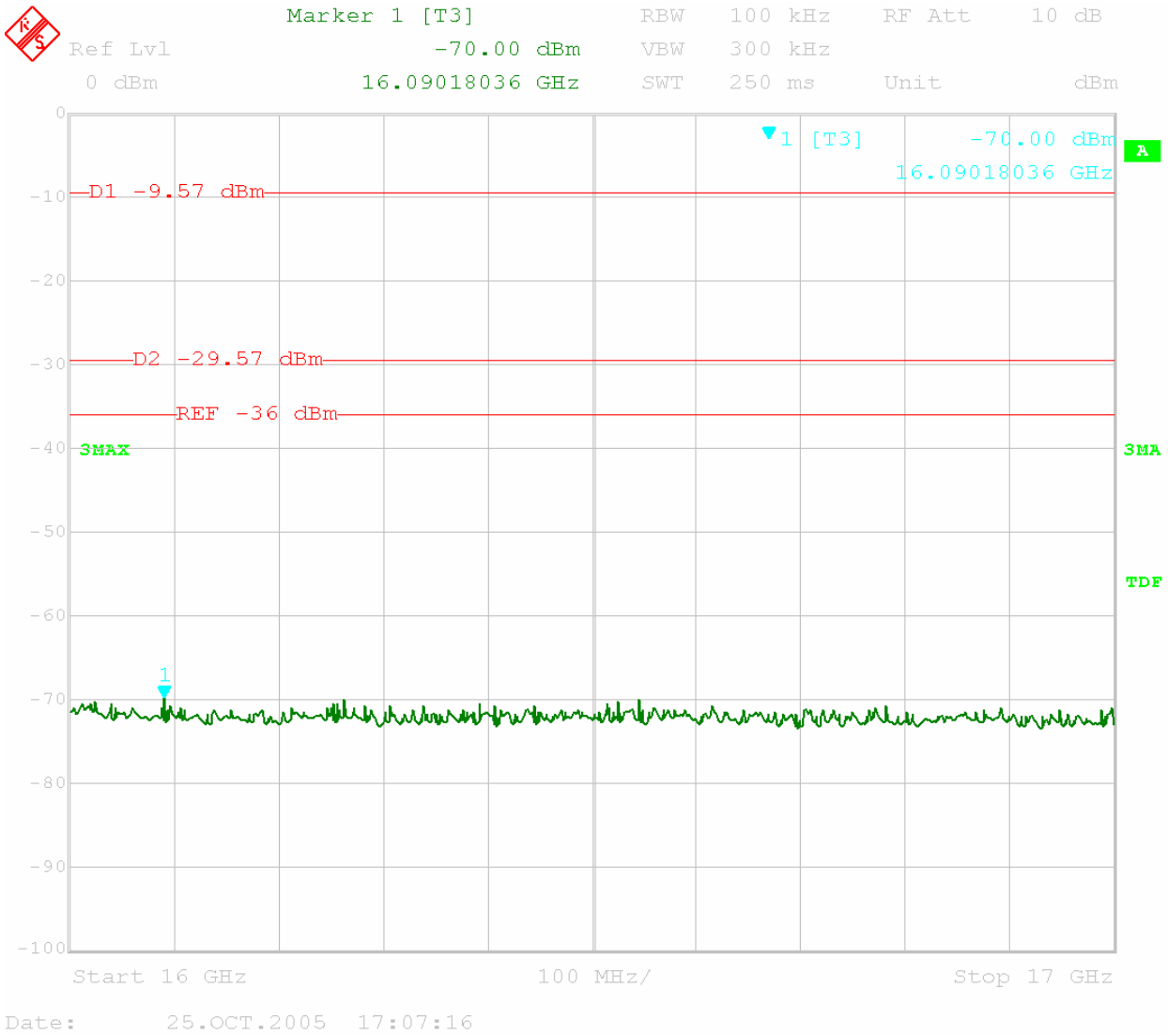
Channel 26 13-14 GHz



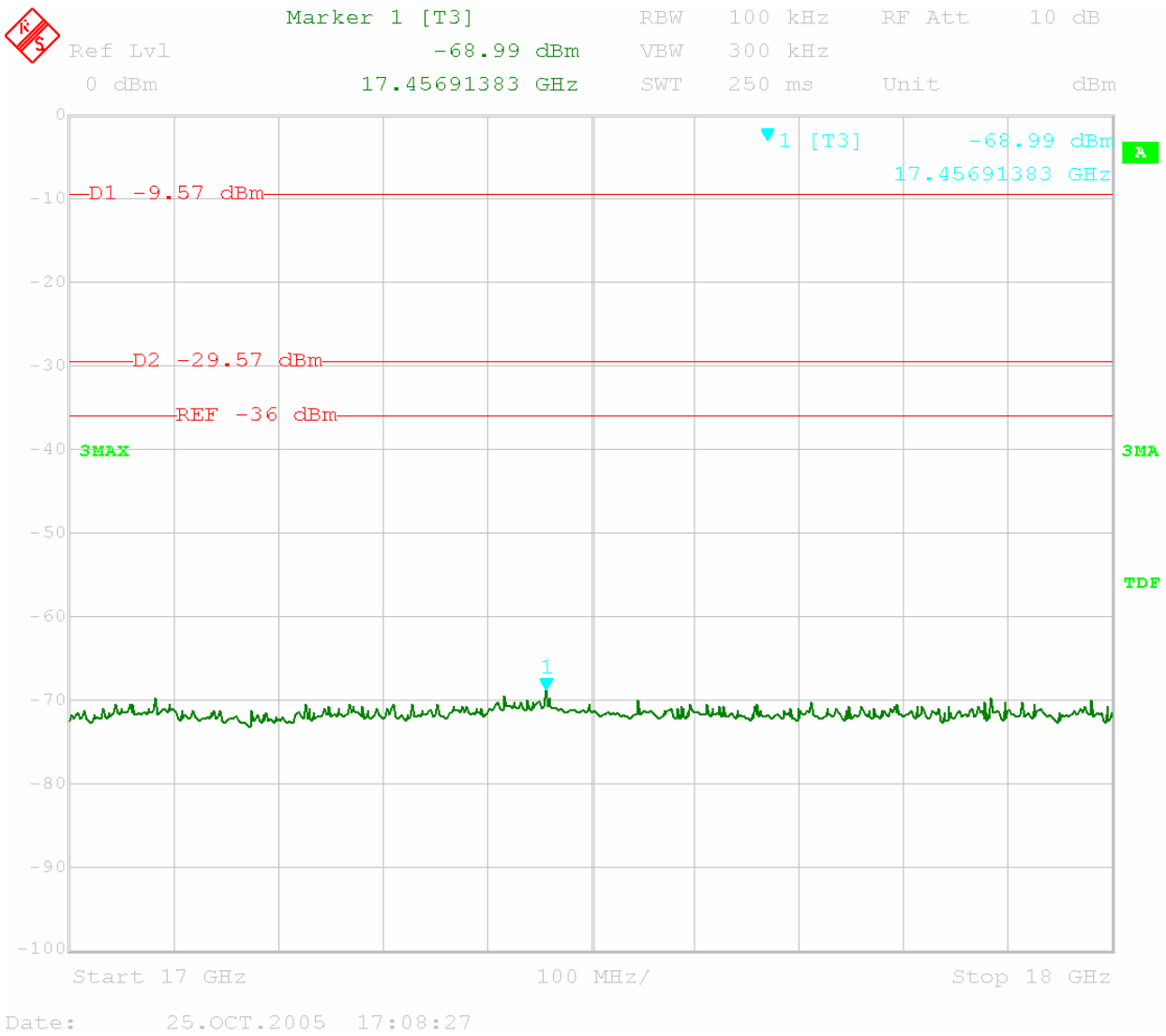
Channel 26 14-15 GHz



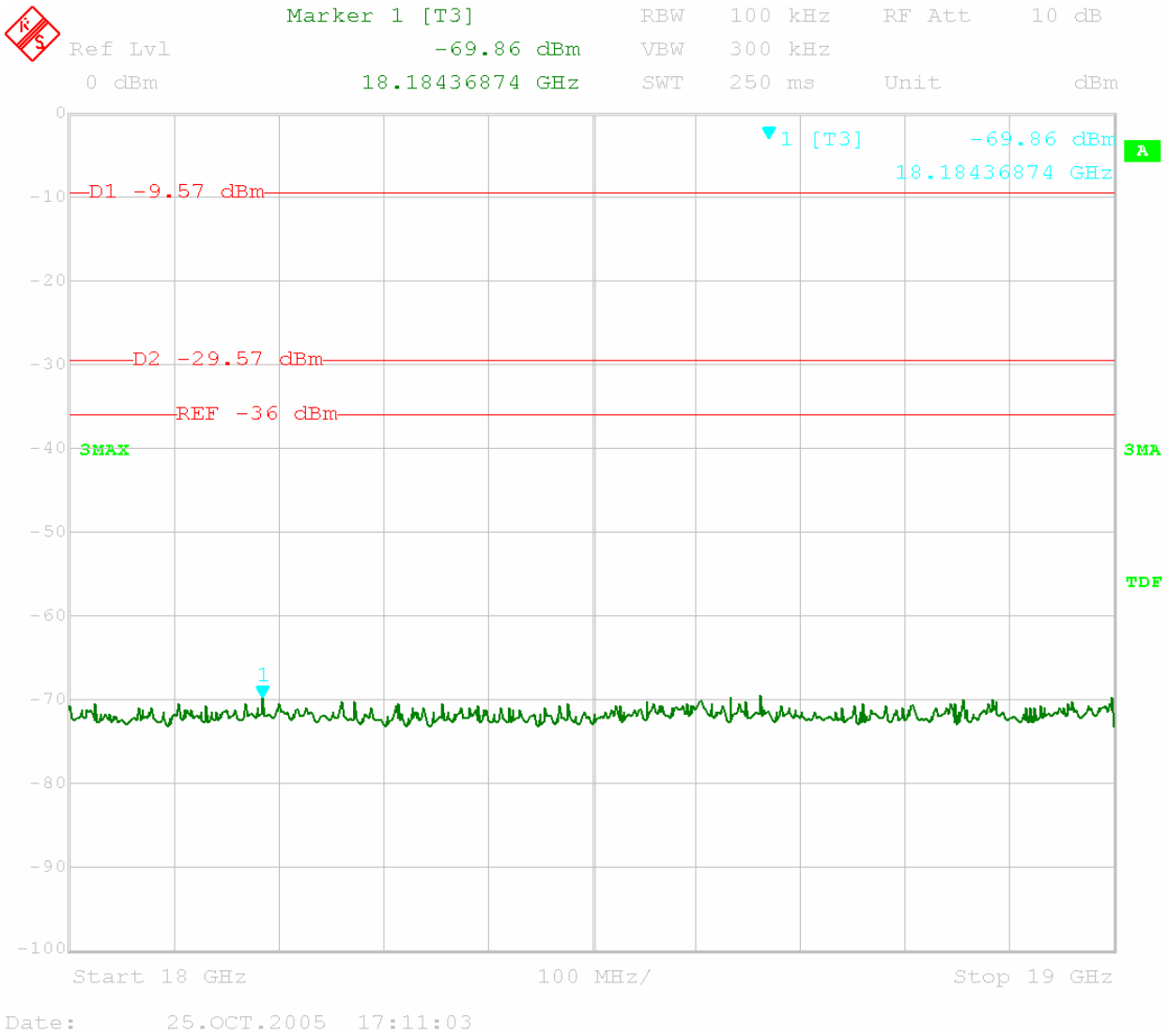
Channel 26 15-16 GHz



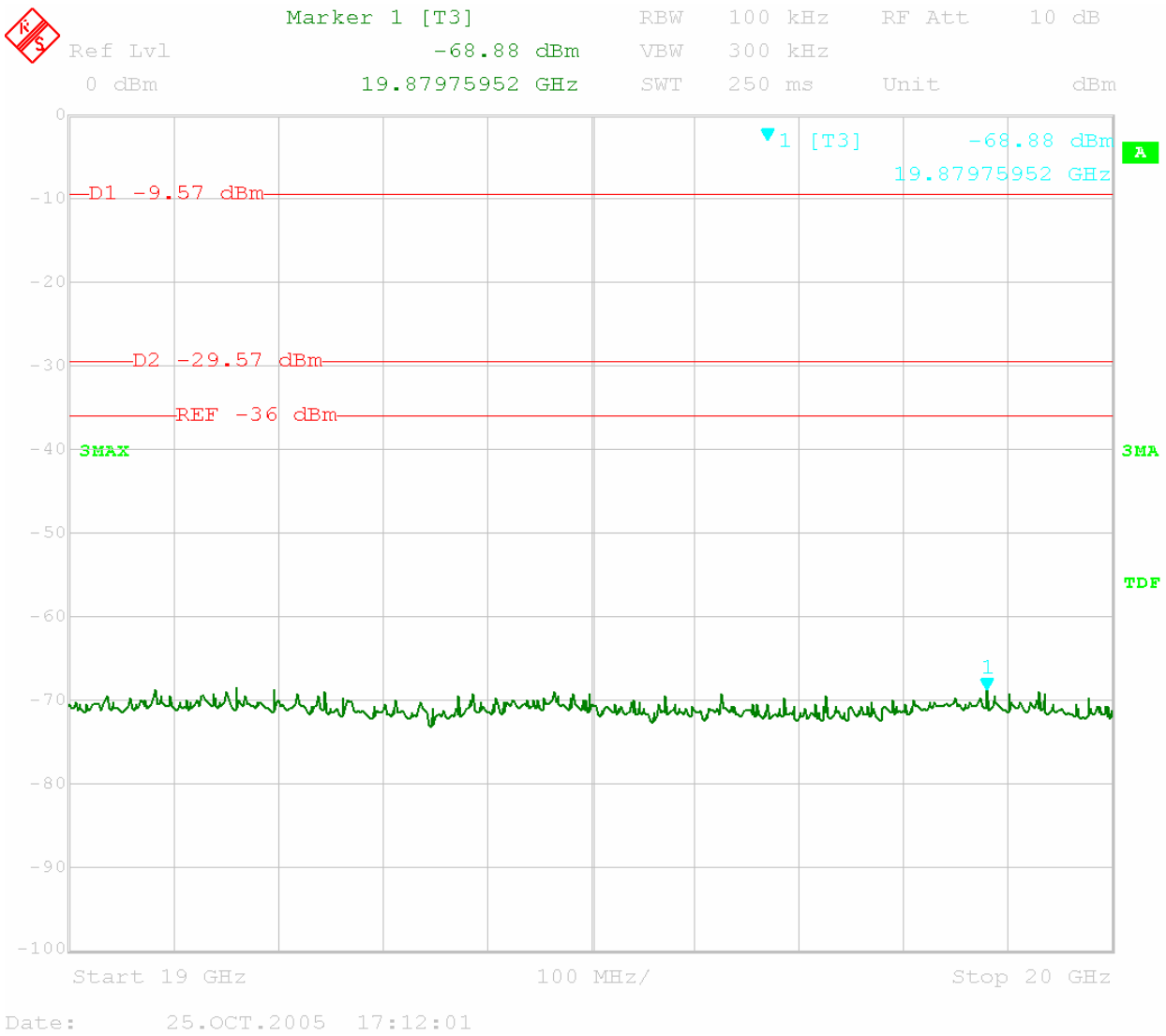
Channel 26 16-17 GHz



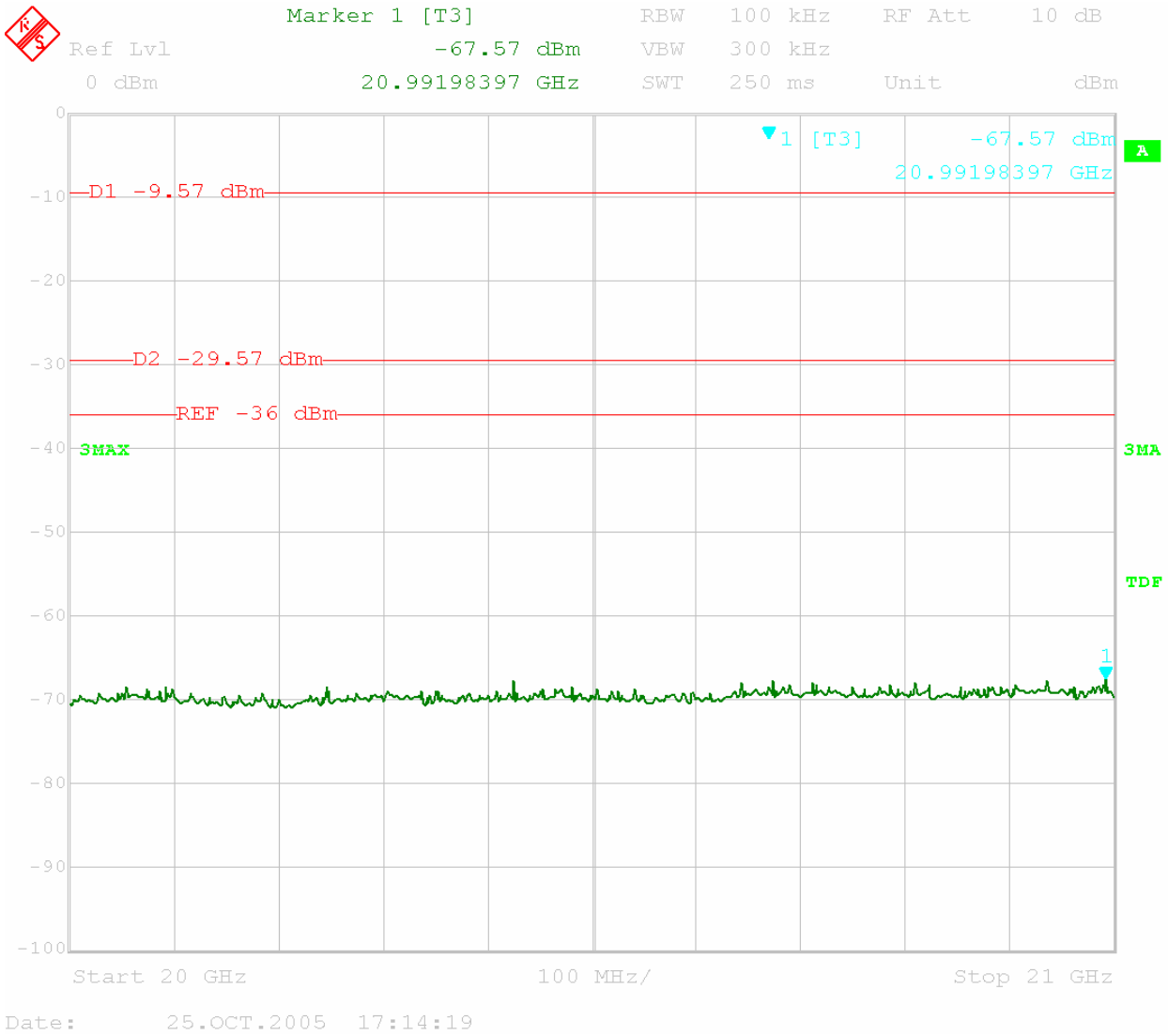
Channel 26 17-18 GHz



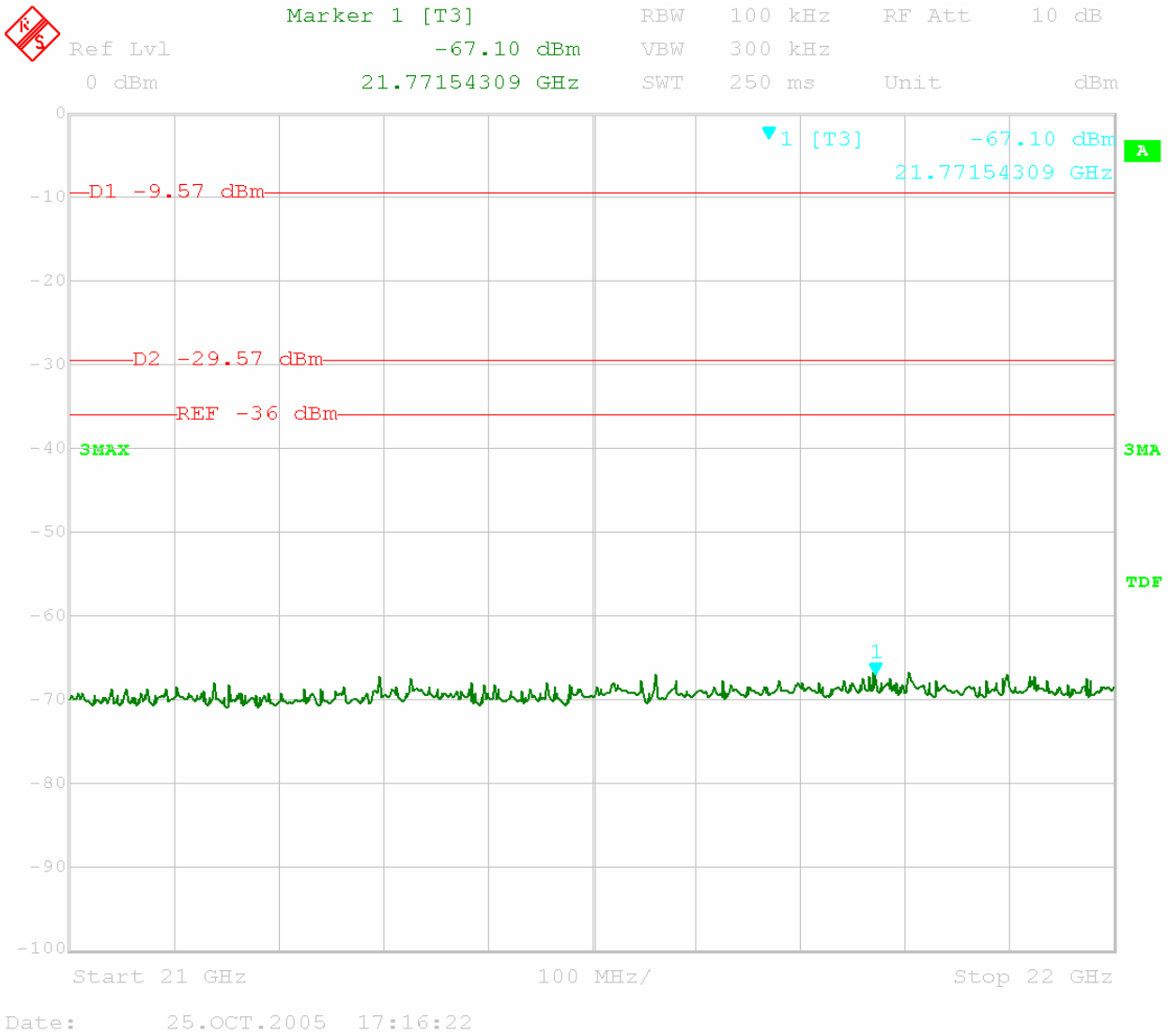
Channel 26 18-19 GHz



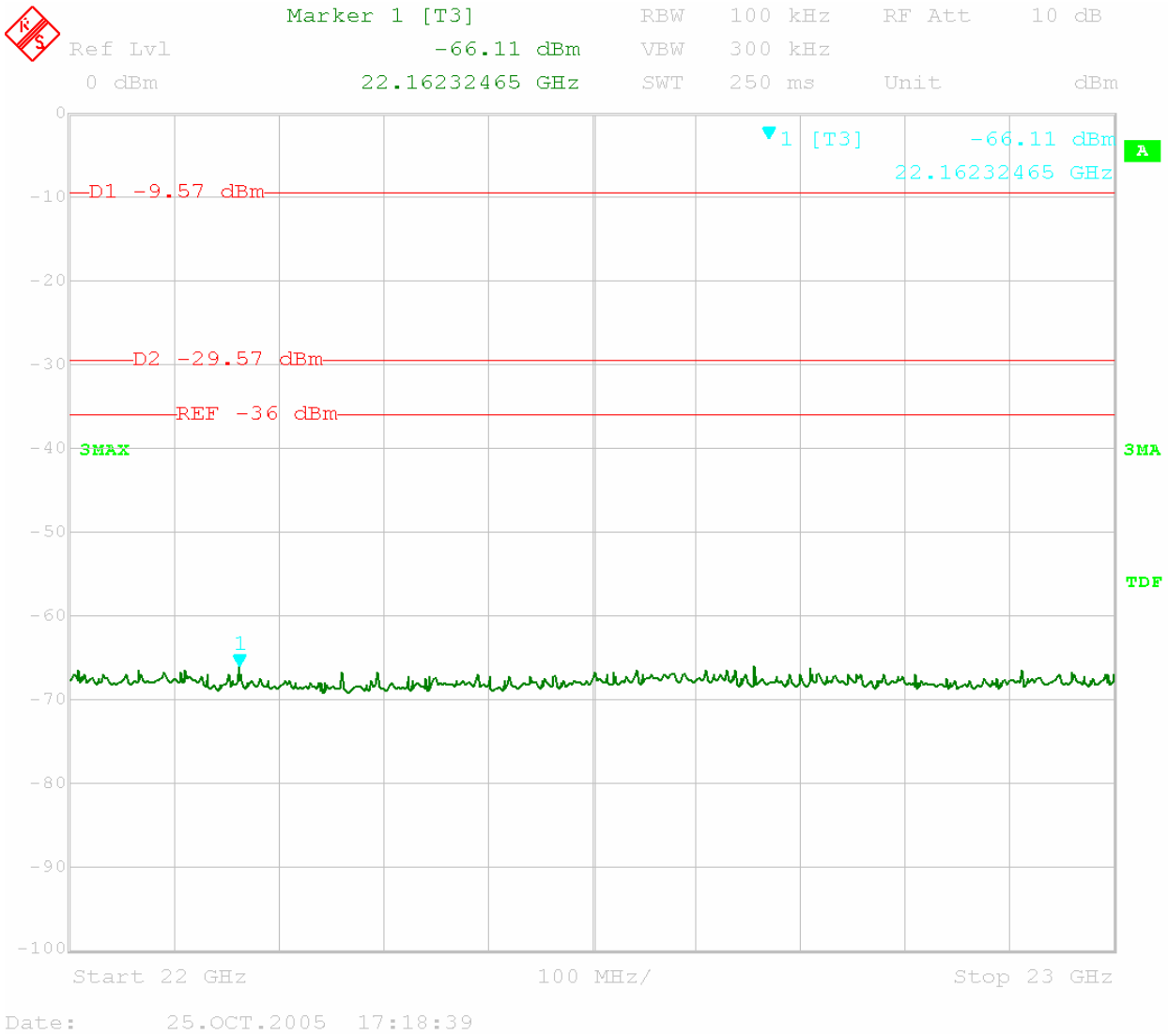
Channel 26 19-20 GHz



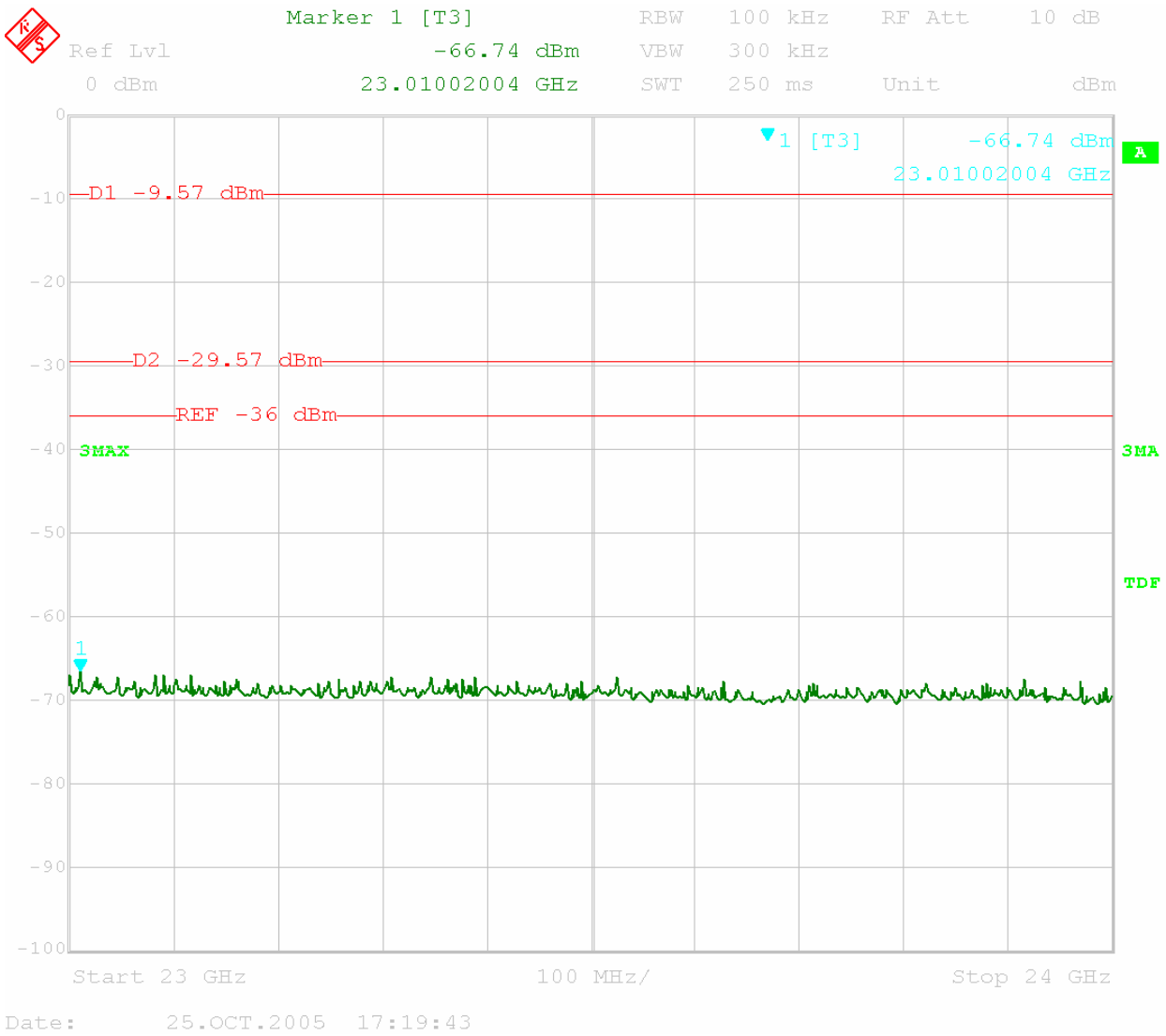
Channel 26 20-21 GHz



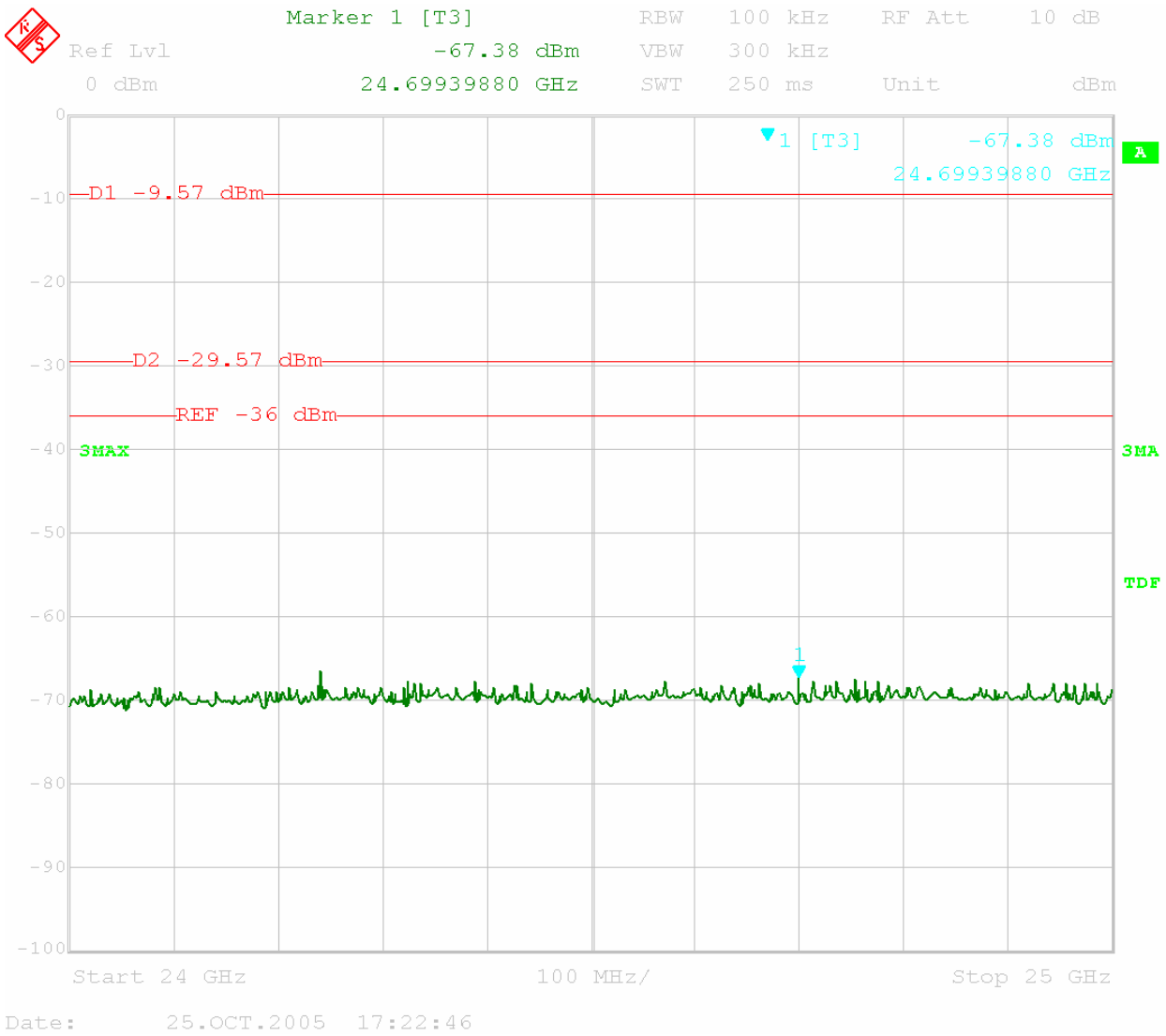
Channel 26 21-22 GHz



Channel 26 22-23 GHz



Channel 26 23-24 GHz



Channel 26 24-25 GHz

Test Results: Pass

Test Standard: FCC 15.205, 15.209, 15.247(d)

Test: Radiated Spurious Emissions

Performance Criterion: The spurious emissions must be attenuated below the level of the fundamental by at least 20 dBc. Emissions which fall in the restricted bands must meet the general limits of 15.209.

Software:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Date: 10/26-27/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWH. **Date:** 10-28-2005

Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
BAR2	Mannix	0ABA116	BAR2	08/02/2006
LOG2	EMCO	3142	9711-1223	12/13/2005
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
HORN2	EMCO	3115	9602-4675	09/13/2006
EMC04	EMCO	3116	2090	11/30/2005
CBL028	Megaphase	TM40 K1K1 197	CBL028	12/01/2005
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005
PRE8	Miteq	NSP4000-NF	507145	11/16/2005
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006
S2 10M FLR	ITS	RG214B/U	S2 10M FLR	09/02/2006

Test Details:

Radiated Emissions / Interference

Company: Millennial Net, Inc. Model #: MN-5424
Engineer: Nicholas Abbondante Barometer: BAR2 Serial #: 405360044
Project #: 3084942 Pressure: 990 mB Receiver: HP 8542E (REC2/RECFL2)
Date: 10/26/05 Temp: 18c Antenna: LOG2 12-13-05 V10.txt LOG2 12-13-05 H10.txt
Standard: FCC 15.209 Humidity: 57% PreAmp: NONE.
Class: - Group: - Cable(s): S2 10M FLR 9-2-2006.cbl NONE.
Limit Distance: 3 meters Test Distance: 10 meters Location: Site 2
Voltage/Frequency: 120V/60Hz Frequency Range: 30 - 1000 MHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
QP	V	40.510	15.0	11.3	1.5	0.0	-10.5	38.3	40.0	-1.7	120/300 kHz
QP	V	48.280	12.3	9.0	1.5	0.0	-10.5	33.3	40.0	-6.7	120/300 kHz
QP	V	64.230	14.7	6.9	1.6	0.0	-10.5	33.6	40.0	-6.4	120/300 kHz
QP	V	73.100	16.6	6.6	1.6	0.0	-10.5	35.2	40.0	-4.8	120/300 kHz
QP	V	84.980	10.0	7.3	1.5	0.0	-10.5	29.3	40.0	-10.7	120/300 kHz
QP	V	131.000	2.8	6.8	2.0	0.0	-10.5	22.0	43.5	-21.5	120/300 kHz
QP	V	155.900	4.3	9.1	2.2	0.0	-10.5	26.1	43.5	-17.4	120/300 kHz
QP	V	171.600	4.2	9.4	2.5	0.0	-10.5	26.5	43.5	-17.0	120/300 kHz

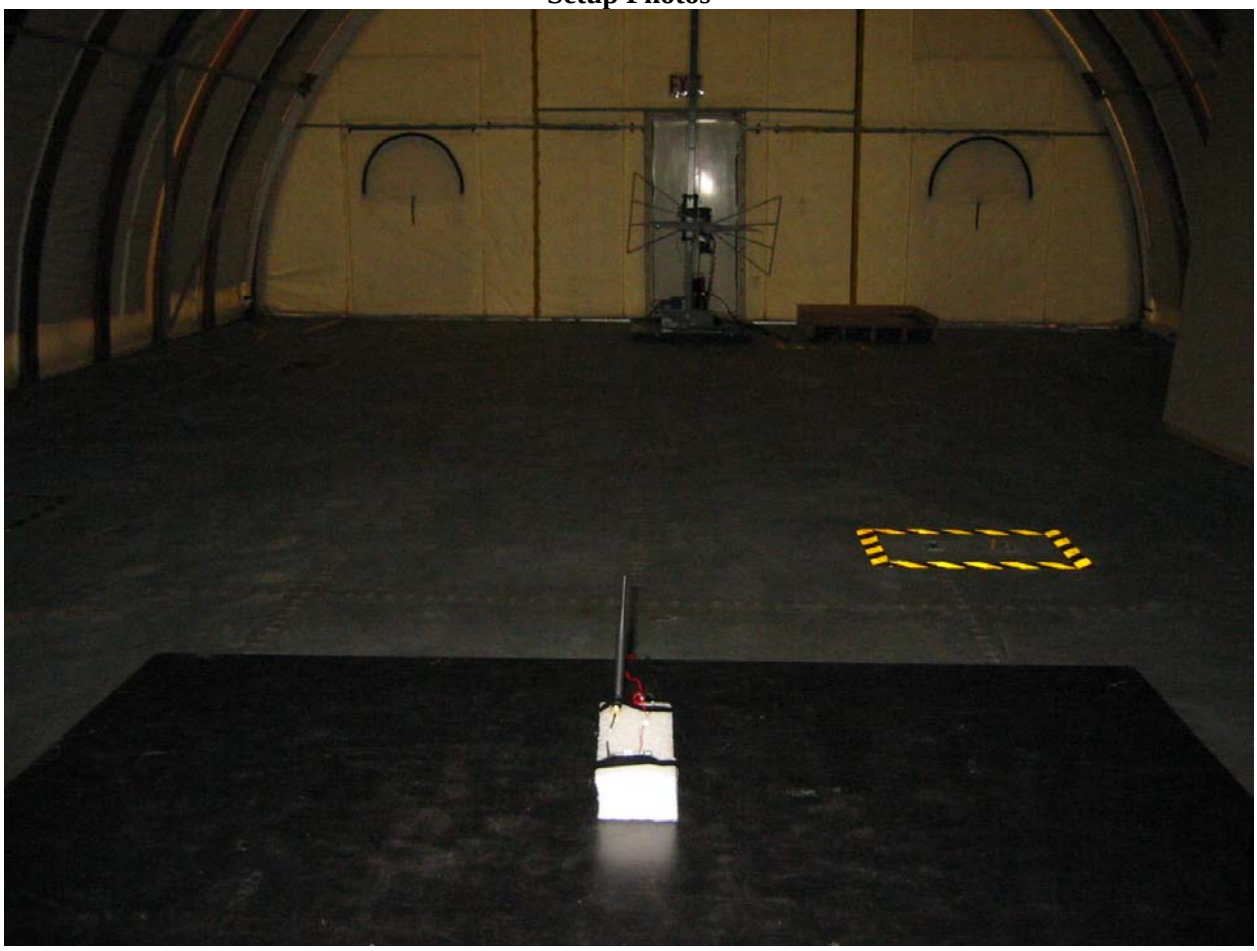
Radiated Emissions / Interference

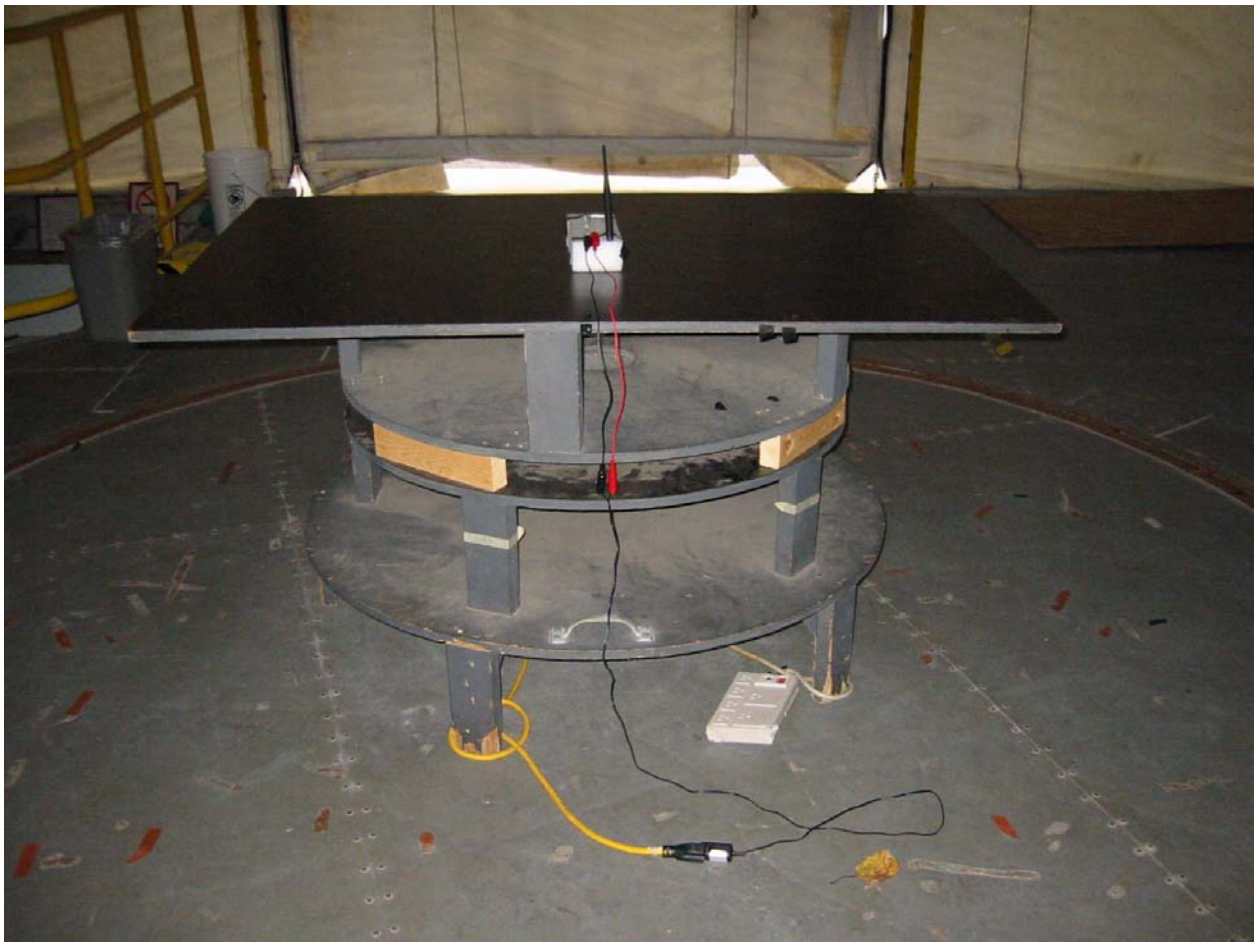
Company: Millennial Net, Inc. Model #: MN-5424
Engineer: Nicholas Abbondante Barometer: BAR2 Serial #: 405360044
Project #: 3084942 Pressure: 990 mB Receiver: R&S FSEK-30 (ROS001)
Date: 10/26/05 10/27/05 Temp: 18c Antenna: HORN2 9-13-06 V1m.txt HORN2 9-13-06 H1m.txt
Standard: FCC 15.209, 15.247 Humidity: 57% PreAmp: PRE8 11-16-05.amp
Class: - Group: - Cable(s): CBL028 12-1-2005.cbl CBL030 12-1-2005.cbl
Limit Distance: 3 meters Test Distance: 3 meters Location: Site 2
Voltage/Frequency: 120V/60Hz Frequency Range: 1 - 25 GHz
Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Ant. Pol. (V/H)	Frequency MHz	Reading dB(uV)	Antenna Factor dB(1/m)	Cable Loss dB	Pre-amp Factor dB	Distance Factor dB	Net dB(uV/m)	Limit dB(uV/m)	Margin dB	Bandwidth
PK	V	2405.000	75.5	28.6	4.2	20.0	0.0	88.3	-	-	100/300 kHz
PK	V	2440.000	72.9	28.6	4.2	20.0	0.0	85.7	-	-	100/300 kHz
PK	V	2480.000	74.3	28.7	4.3	20.0	0.0	87.2	-	-	100/300 kHz
PK	V	4810.000	26.5	33.4	6.4	21.4	0.0	44.9	74.0	-29.1	1/3 MHz
AVG	V	4810.000	18.5	33.4	6.4	21.4	0.0	36.9	54.0	-17.1	1/3 MHz
PK	V	4880.000	26.1	33.6	6.4	21.4	0.0	44.7	74.0	-29.3	1/3 MHz
AVG	V	4880.000	19.5	33.6	6.4	21.4	0.0	38.0	54.0	-16.0	1/3 MHz
PK	V	4960.000	29.3	33.8	6.5	21.5	0.0	48.0	74.0	-26.0	1/3 MHz
AVG	V	4960.000	18.5	33.8	6.5	21.5	0.0	37.3	54.0	-16.7	1/3 MHz
PK	V	7215.000	19.9	36.5	8.2	20.3	0.0	44.3	68.3	-24.0	100/300 kHz
PK	V	7320.000	25.3	36.8	8.3	20.3	0.0	50.0	74.0	-24.0	1/3 MHz
AVG	V	7320.000	19.5	36.8	8.3	20.3	0.0	44.2	54.0	-9.8	1/3 MHz
PK	V	7440.000	28.7	37.1	8.3	20.2	0.0	53.9	74.0	-20.1	1/3 MHz
AVG	V	7440.000	19.9	37.1	8.3	20.2	0.0	45.0	54.0	-9.0	1/3 MHz
PK	V	9620.000	20.3	38.0	9.9	18.2	0.0	50.0	68.3	-18.3	100/300 kHz
PK	V	9760.000	21.0	38.2	10.0	18.1	0.0	51.1	65.7	-14.6	100/300 kHz
PK	V	9920.000	21.4	38.4	10.1	18.1	0.0	51.9	67.2	-15.4	100/300 kHz
PK	V	12025.000	27.7	39.2	11.5	18.3	0.0	60.1	74.0	-13.9	1/3 MHz
AVG	V	12025.000	18.5	39.2	11.5	18.3	0.0	50.9	54.0	-3.1	1/3 MHz
PK	V	12200.000	27.9	39.1	11.6	18.4	0.0	60.2	74.0	-13.8	1/3 MHz
AVG	V	12200.000	19.9	39.1	11.6	18.4	0.0	52.2	54.0	-1.8	1/3 MHz
PK	V	12400.000	29.4	39.0	11.7	18.6	0.0	61.6	74.0	-12.4	1/3 MHz
AVG	V	12400.000	19.9	39.0	11.7	18.6	0.0	52.1	54.0	-1.9	1/3 MHz
PK	V	14430.000	20.7	40.8	13.3	20.1	0.0	54.7	68.3	-13.6	100/300 kHz
PK	V	14640.000	20.7	40.1	13.4	20.3	0.0	53.9	65.7	-11.8	100/300 kHz
PK	V	14880.000	23.0	39.2	13.6	20.5	0.0	55.2	67.2	-12.0	100/300 kHz
PK	V	16835.000	20.3	40.4	14.8	23.0	0.0	52.5	68.3	-15.8	100/300 kHz
PK	V	17080.000	21.4	41.5	15.1	23.3	0.0	54.7	65.7	-11.0	100/300 kHz
PK	V	17360.000	21.4	43.7	15.8	23.4	0.0	57.5	67.2	-9.7	100/300 kHz

Note: No emissions were detected above 1 GHz other than the fundamental. All emissions measured other than the fundamental were measurements of the measuring instrumentation noise floor. Emissions from 18-25 GHz were scanned using the horn antenna EMC04.

Setup Photos





Test Results: Pass

Test Standard: FCC 15.247(e)

Test: Peak Power Spectral Density

Performance Criterion: The peak power spectral density must not exceed 8 dBm / 3 kHz.

Test Date: 10/24/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** DWH. **Date:** 10-28-2005

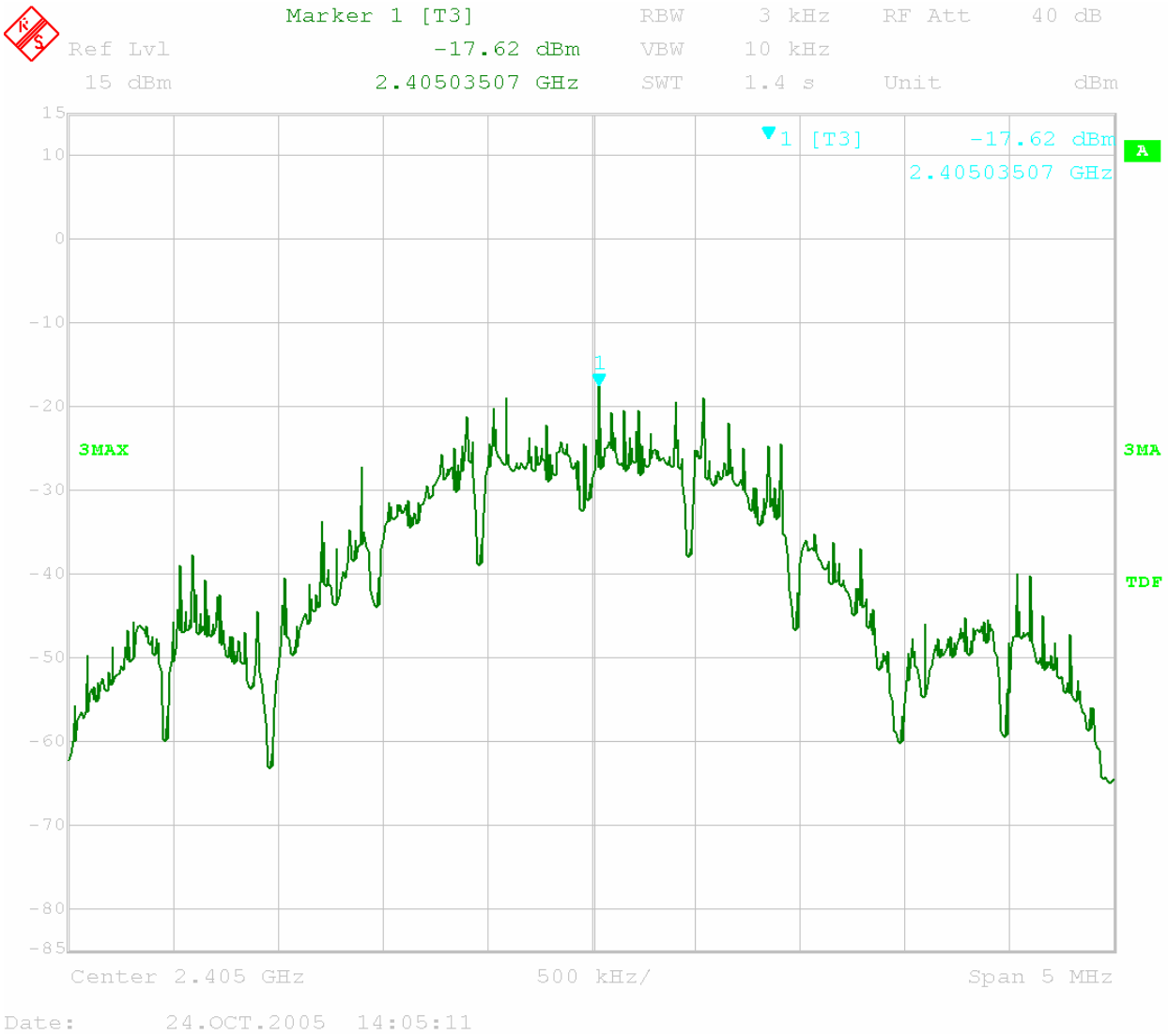
Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005

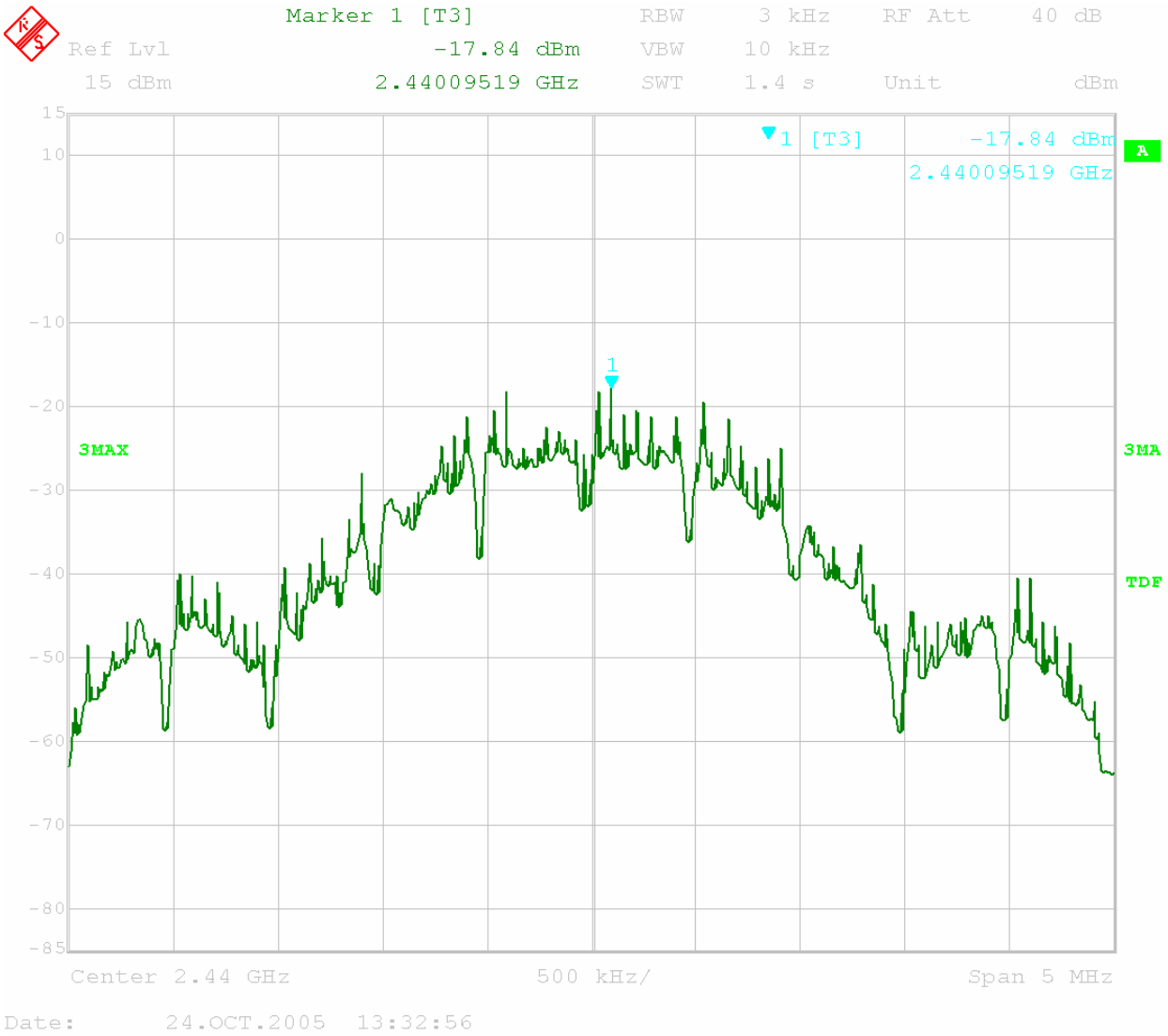
Test Details:

Notes: The cable loss was compensated for in the spectrum analyzer.

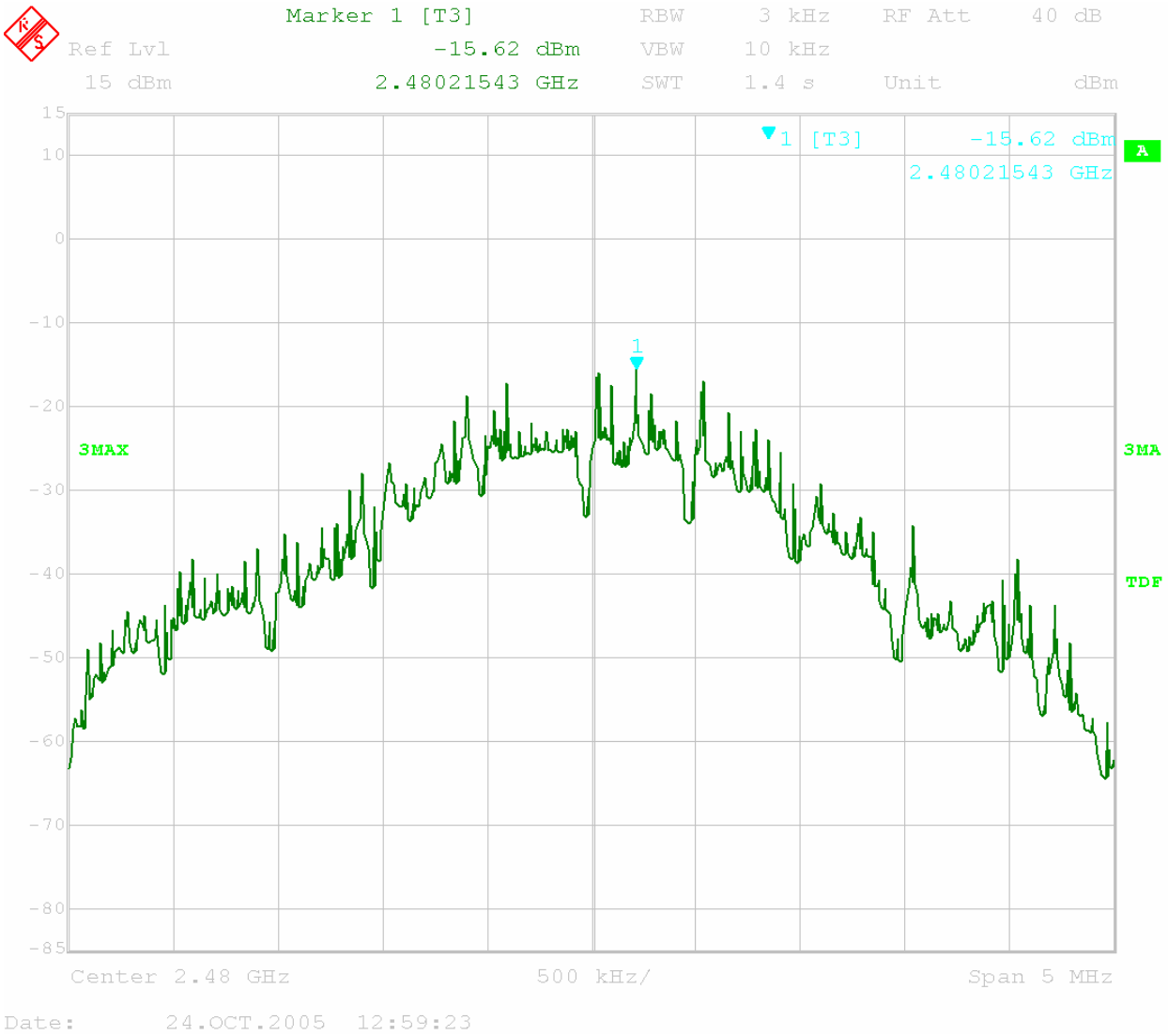
Channel	Frequency	Spectral Density	Spectral Density Limit
11	2405 MHz	-17.62 dBm	8 dBm
18	2440 MHz	-17.84 dBm	8 dBm
26	2480 MHz	-15.62 dBm	8 dBm


Marker 1 [T3]
RBW 3 kHz
RF Att 40 dB
Ref Lvl
-17.62 dBm
VBW 10 kHz
15 dBm
2.40503507 GHz
SWT 1.4 s
Unit dBm
1 [T3] -17.62 dBm
2.40503507 GHz
A
3MAX
3MA
TDF
Center 2.405 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 14:05:11

Channel 11


Marker 1 [T3]
RBW 3 kHz
RF Att 40 dB
Ref Lvl
-17.84 dBm
VBW 10 kHz
15 dBm
2.44009519 GHz
SWT 1.4 s
Unit dBm
1 [T3] -17.84 dBm
2.44009519 GHz
A
3MAX
3MA
TDF
Center 2.44 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 13:32:56

Channel 18


Marker 1 [T3]
RBW 3 kHz
RF Att 40 dB
Ref Lvl
-15.62 dBm
VBW 10 kHz
15 dBm
2.48021543 GHz
SWT 1.4 s
Unit dBm
1 [T3] -15.62 dBm
2.48021543 GHz
A
3MAX
3MA
TDF
Center 2.48 GHz
500 kHz/
Span 5 MHz
Date: 24.OCT.2005 12:59:23

Channel 26

Test Results: Pass

Test Standard: FCC 15.215

Test: Band Edge Compliance

Performance Criterion: The fundamental frequency must stay within the assigned frequency band.

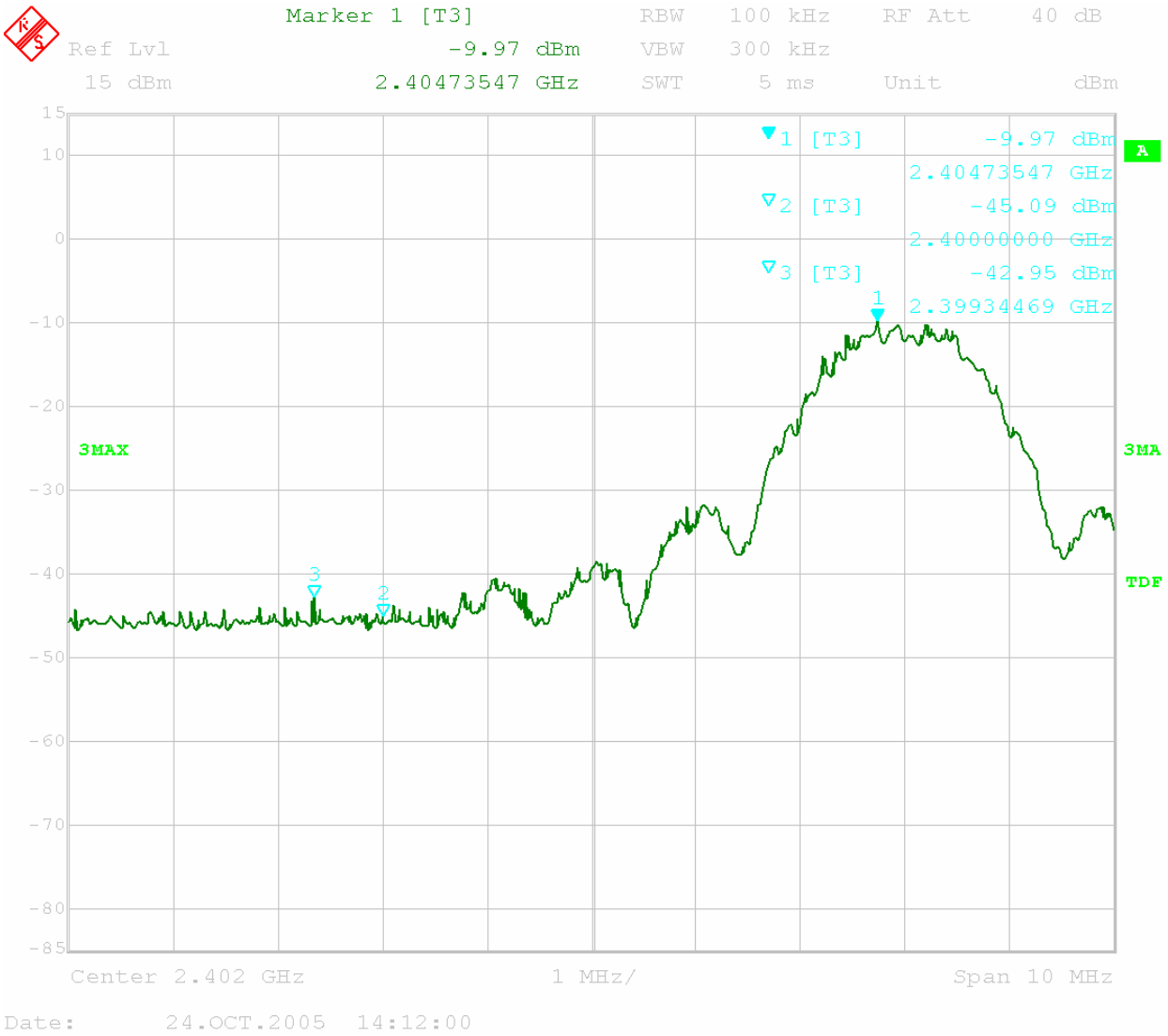
Test Date: 10/18-19/2005 **Engineer Initials:** NNA **Date:** 10/27/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** [illegible] **Date:** 10-28-2005

Test Equipment Used:

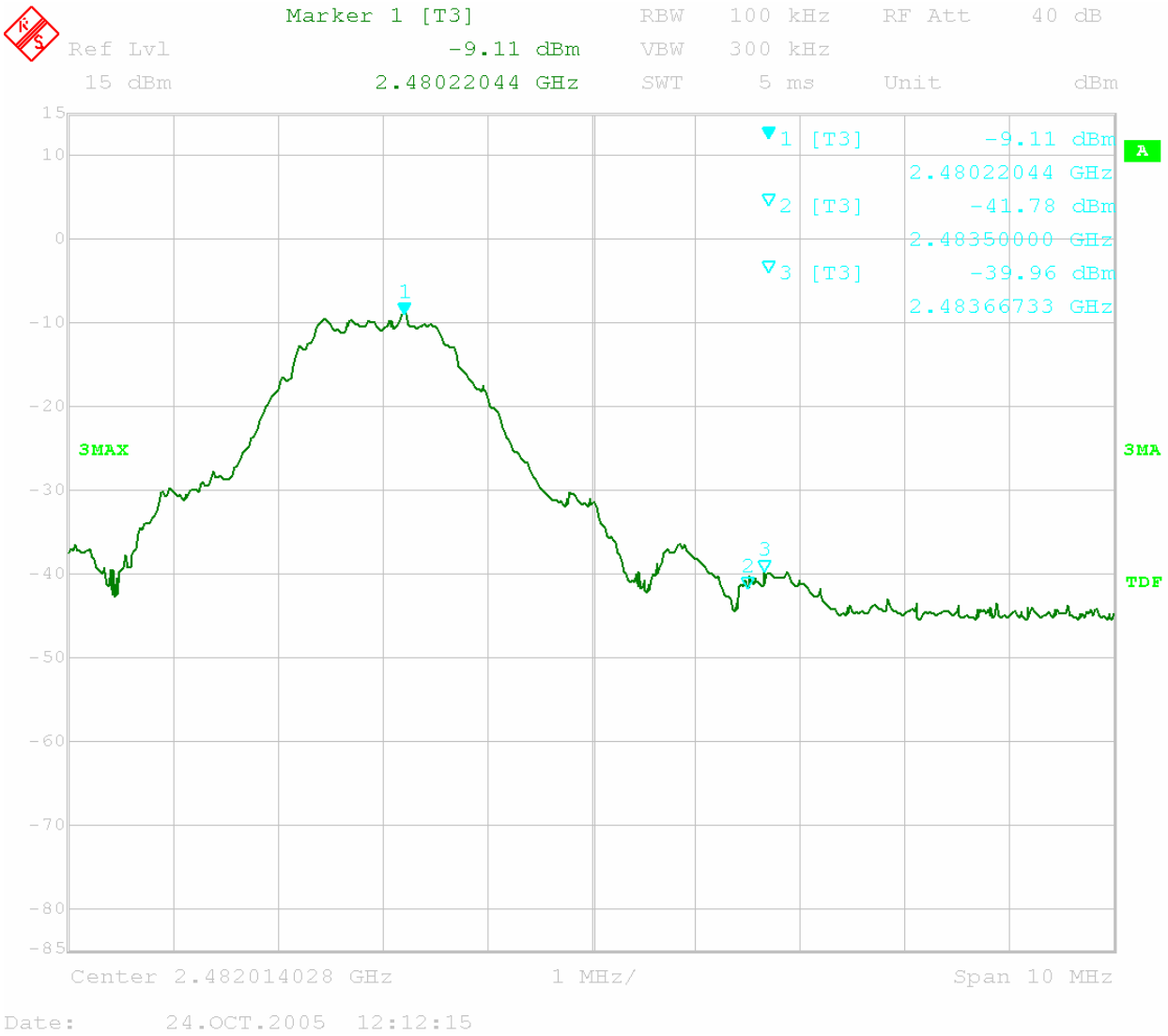
Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
ROS001	Rohde & Schwarz	FSEK-30	100225	07/26/2006
CBL030	Megaphase	TM40 K1K1 80	CBL030	12/01/2005

Test Details:

Notes: The upper and lower channels (channels 11 and 26) were observed using a 100 kHz bandwidth. A marker was placed at the peak of the fundamental. Another marker was placed at the band edges, 2400 MHz and 2483.5 MHz and at the highest signal level above and below the band edge. It can be seen that the highest signal level below the 2400 MHz band edge is 33.0 dB below the peak signal level of the 2405 MHz fundamental, and the highest signal level above the 2483.5 MHz band edge is 30.9 dB below the peak signal level of the 2480 MHz fundamental. The cable loss was compensated for in the spectrum analyzer.



Channel 11 – 2405 MHz



Channel 26 – 2480 MHz

Test Results: Pass

Test Standard: FCC 15.207

Test: AC Line-Conducted Spurious Emissions

Performance Criterion: Emissions must meet the general limits of 15.207.

Software:

Name	Manufacturer	Version
EXCEL 2000	Microsoft Corporation	9.0.6926 SP-3
EMI BOXBOROUGH	Intertek	2/07/05 Revision

Test Date: 10/27/2005 **Engineer Initials:** NNA **Date:** 10/21/05
Test Engineer: Nicholas Abbondante **Reviewer Initials:** RWH **Date:** 10-28-2005

Test Equipment Used:

Intertek ID	Manufacturer	Model	Serial Number	Cal. Due
BAR2	Mannix	0ABA116	BAR2	08/02/2006
DS22A	Mini Circuits	20dB, 50 Ohm	DS22A	11/17/2005
LISN11	Solar Electronics	9252-50-R-24-BNC	941713	07/05/2006
CBL022	Belden	RG-58/U	CBL022	11/17/2005
REC2	Hewlett Packard	8542E	3520A00125	02/08/2006
RECFL2	Hewlett Packard	85420E	3427A00126	02/08/2006

Test Details:

Conducted Emissions / Interference

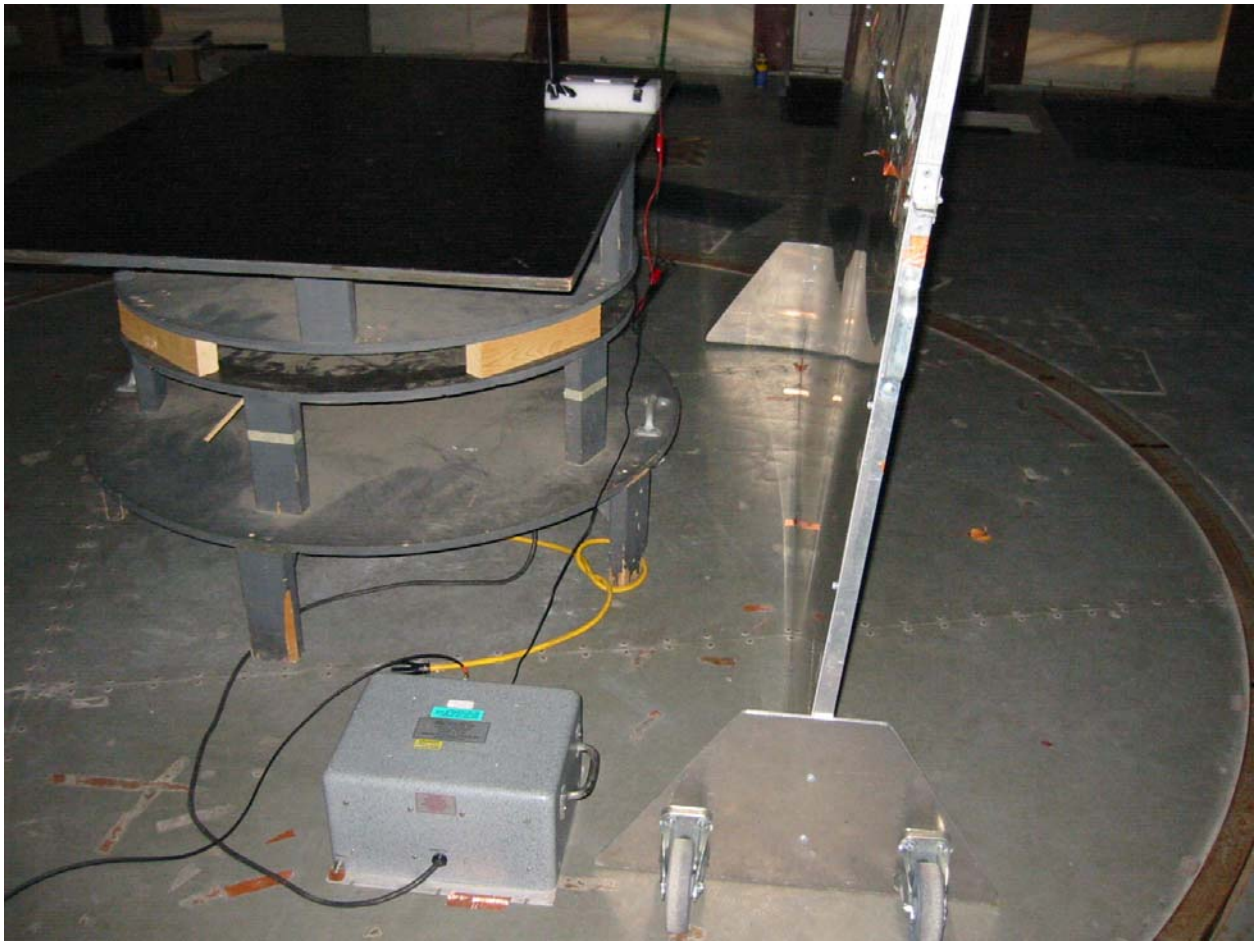
Company:	Millennial Net, Inc.			Model #:	MN-5424
Engineer:	Nicholas Abbondante	Barometer:	BAR2	Serial #:	405360044
Project #:	3084942	Pressure:	1008 mB	Receiver:	HP 8542E (REC2/RECFL2)
Date:	10/27/05	Temp:	18c	Cable:	CBL022 11-17-2005.cbl
Standard:	FCC 15.207	Humidity:	48%	LISN 1, 2:	LISN11 [1] 7-05-06.lsn LISN11 [2] 7-05-06.lsn
Class:	-	Group:	-	LISN 3, N:	NONE. NONE.
				Attenuator:	DS22A 11-17-2005.att Location: Site 2

Voltage/Frequency: See Notes Frequency Range: 150 kHz - 30 MHz

Net is the sum of worst-case lisn, cable, & attenuator losses, preamp gain, and initial reading

Peak: PK Quasi-Peak: QP Average: AVG RMS: RMS; Bandwidth denoted as RBW/VBW

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Net dB(uV)	QP Limit dB(uV)	Margin dB	Bandwidth
Note: 120V/60Hz									
QP	0.177	24.1	22.7			44.3	64.6	-20.3	9/30 kHz
QP	0.389	28.8	29.3			49.5	58.1	-8.6	9/30 kHz
QP	0.518	25.2	27.1			47.3	56.0	-8.7	9/30 kHz
QP	3.104	5.5	9.4			29.8	56.0	-26.2	9/30 kHz
QP	14.010	2.6	2.2			23.3	60.0	-36.7	9/30 kHz
QP	23.520	-4.6	-3.4			17.7	60.0	-42.3	9/30 kHz

Detector Type	Frequency MHz	Reading Line 1 dB(uV)	Reading Line 2 dB(uV)	Reading Line 3 dB(uV)	Reading Neutral dB(uV)	Net dB(uV)	Average Limit dB(uV)	Margin dB	Bandwidth
Note: 120V/60Hz									
AVG	0.177	7.8	4.9			28.0	54.6	-26.6	9/30 kHz
AVG	0.389	15.7	17.8			38.0	48.1	-10.1	9/30 kHz
AVG	0.518	20.5	23.6			43.8	46.0	-2.2	9/30 kHz
AVG	3.104	1.4	7.7			28.1	46.0	-17.9	9/30 kHz
AVG	14.010	-0.2	-0.3			20.5	50.0	-29.5	9/30 kHz
AVG	23.520	-10.2	-8.7			12.4	50.0	-37.6	9/30 kHz

Setup Photos