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TEST 031

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EMC, Radio and Telecommunications

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Test report : 03/502/5

Item tested : TR- 2500

Equipment type : AIS Transponder

Client : Jotron

Tested according to :

IEC 61993-2
IEC 60945

Date of issue : 2004. 02. 26

Authorised by :

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The results detailed in this test report are valid only for the particular sample(s) tested and with configuration(s) as implemented during testing.

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name :	Nemko Comlab AS
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1.2 Client Information

Name :	Jotron Electronics AS
Address :	PO Box 54, 3280 Tjodalyng
Telephone :	+ 47 33 13 97 00
Fax :	+ 47 33 12 67 80

Contact:

Name :	Eirik Storjordet
E-mail :	Eirik.storjordet@jotron.com

1.3 Manufacturer

Same as client

2 TEST INFORMATION

2.1 Test Item

Name : Ais Transponder

Model/version : TR - 2500

Software identity and version : DSP: 02.00.04, RF: 02.00.00

Remarks / Description of test item

The EUT was powered by a 24 VDC power supply.

2.2 Test Environment

2.2.1 Normal Test Conditions

The values are the limits registered during the test period

Temperature: 19.1^{0}C – 22.7 ^{0}C

Relative humidity: 21% - 34.1%

2.3 Test Period

Test item received date : 03.11.03

Test period : from 06.11.03 to 12.02.04

2.4 Standards and Regulations

IEC 61993-2 (2001-12)
IEC 60945 (2002-08)

2.5 Test Engineer

Knut Risting Hanssen

2.6 Additional Information

2.6.1 Selection Criteria

Selected tests have been performed on client's request

2.6.2 Test Equipment

List of used test equipment, see page no. 35.

TEST REPORT SUMMARY

2.7 Abbreviations

P Passed, the equipment fulfils the requirement

F Failed, the equipment does not fulfil the requirement

NA Not applicable, the requirement is not applicable for this type of the equipment

NT Not tested, the test is not performed even though the requirement is relevant

2.8 Test Summary

Frequency error	(P)
Carrier power H (conducted)	(P)
Carrier power L (conducted)	(P)
Modulation Spectrum 25 kHz mode	(P)
Modulation Spectrum 12.5 kHz mode	(P)
Transmitter Attack Time	(P)
Transmitter Release Time	(P)
DSC Transmissions	
Frequency error of the DSC Signal	(P)
Modulation Rate	(P)
TDMA Receivers	
Sensitivity – 25 kHz Operation	(P)
Sensitivity – 12.5 kHz Operation	(P)
Error Behaviour at High Input Levels	(P)
Co–Channel Rejection – 25 kHz Operation	(P)
Co–Channel Rejection – 12.5 kHz Operation	(P)
Adjacent Channel Selectivity – 25 kHz Operation	(P)
Adjacent Channel Selectivity – 12.5 kHz Operation	(P)
Spurious Response Rejection	(P)
Intermodulation Response Rejection and Blocking	(P)
Transmit to Receive Switching Time	(P)
DSC Receiver **(see comments on the next page)**	
Maximum Sensitivity	(P)
Errror Behaviour at High Input Levels	(P)
Co-Channel Rejection	(P)
Adjacent Channel Selectivity	(P)
Spurious Response Rejection	(P)
Intermodulation Response Rejection	(P)
Blocking or Desensitisation	(P)
Conducted Spurious Emissions Conveyed to the Antenna	
Spurious Emissions from the Receiver	(P)
Spurious Emissions from the Transmitter	(P)
Vibration	(P)
Enviromental test	(P)

2.9 Other Comments

DSC receiver:

The BER measurements are performed as PER.
See annex 3, pages 2 and 3.

Enviromental testing are performed according to IEC 60945,and Enviomental Test Overvew" from BSH. The performance check are performed with the EUT operating together with another AIS unit. They were connected to each other with a cable and a suitable attenuator.

See" Enviomental Test Overvew" from BSH in annex 3, page 1.

The TDMA receiver measurements are performed on "RX1". Test signal 2 are used. (Worst conditions)

The client supplied a modulation generator (PMG1) from Sine Qua Non Technology and a test -software installed in a PC.

The vibration measurements are performed at Nemko A/S

3 TEST RESULTS

3.1 Transmitter Measurements

IEC 61993-2, Cl.15.1.1

3.1.1 Frequency Error

Power level at which the measurement has been performed: 2 W,

Test Conditions		**Frequency Error kHz**			
		156.025 MHz	**157.4125 MHz**	**160.6375 MHz**	**162.025MHz**
T_{nom}	V_{nom}(24.0 V)	156.024999	157.412497	160.637500	162.025000
T_{min}(-15 °C)	V_{min}(21.6 V)	156.024995	157.412494	160.637495	162.024997
T_{max}(+55 °C)	V_{max}(31.2 V)	156.024998	157.412495	160.637497	162.024995
Maximum frequency error (kHz)		0.005	0.006	0.005	0.005
Measurement uncertainty		**≤ ± 50 Hz**			

Limits:

Normal Test Conditions	**Extreme Test Conditions**
± 0,5 kHz	± 1 kHz

Test Equipment Used: 19, 61, 208, 1337, 1435

IEC 61993-2, Cl.15.1.2

3.1.2 Carrier Power ref.

Rated output power level (maximum): 2 W, (33 dBm)

Test Conditions		**Transmitter Power dBm**		
		156.025 MHz	**159.025 MHz**	**162.025 MHz**
T_{nom}	V_{nom}(24.0 V)	32.96	32.80	33.19
T_{min}(-15 °C)	V_{min}(21.6 V)	33.47	33.21	33.22
T_{max}(+55 °C)	V_{max}(31.2 V)	33.29	33.40	32.92
Variation in output power under normal test conditions (dB)		0.04	0.20	0.19
Variation in output power under extreme test conditions (dB)		0.47	0.40	0.22
Measurement uncertainty		**≤ ± 0.7 dB**		

Limits:

Under normal test conditions	± 1.5 dB
Under extreme test conditions	+ 2.0 dB - 3.0 dB

Test Equipment Used: 19, 61, 142, 208, 1337, 1338, 1435

3.1.3 Carrier Power

Rated output power level (maximum): 12.5 W, (41 dBm)

Test Conditions		**Transmitter Power dBm**		
		156.025 MHz	**159.025 MHz**	**162.025 MHz**
T_{nom}	V_{nom}(24.0 V)	41.15	41.07	41.14
T_{min}(-15 °C)	V_{min}(21.6 V)	41.29	41.09	41.04
T_{max}(+55 °C)	V_{max}(31.2 V)	41.11	41.11	41.24
Variation in output power under normal test conditions (dB)		0.15	0.07	0.14
Variation in output power under extreme test conditions (dB)		0.29	0.11	0.24
Measurement uncertainty		**≤ ± 0.7 dB**		

Limits:

Under normal test conditions	± 1.5 dB
Under extreme test conditions	+ 2.0 dB - 3.0 dB

Test Equipment Used: 19, 61, 142, 208, 1337, 1338, 1435

IEC 61993-2, Cl.15.1.3

3.1.4 Modulation Spectrum 25kHz channel mode

See annex no.: **1 , pages 1 to 4 for TDMA, (H/L power with test signals 2 and 3)**
pages 9 to 10 for DSC, (H/L power with test signal 1)

Test Equipment Used: 19, 61, 208, 1337

IEC 61993-2, Cl.15.1.4

3.1.5 Modulation Spectrum 12.5kHz channel mode

See annex no.: **1, pages 5 to 8 for TDMA, (H/L power with test signals 2 and 3)**

Test Equipment Used: 19, 61, 208, 1337

IEC 61993-2, Cl.15.1.5

3.1.6 Transmitter Attack Time

Power level at which the measurement has been performed: 2 W

Time Characteristics	159.025 MHz
Time relative to the power rise (ms)	0.572
Time relative to the frequency behaviour (ms)	≈ 0 (<< 1 kHz from start, measured modulated)
Maximum of these times,	0.572
Measurement uncertainty	**≤ ± 5 %**

See annex no.: **2, pages 1 and 5**

Limits Clause 15.1.5

The transmitter attack time shall not exceed:	1 ms

Test Equipment Used: 19, 61, 208, 289, 1066, 1079, 1239, 1337, 1403

Power level at which the measurement has been performed: 12.5 W

Time Characteristics	159.025 MHz
Time relative to the power rise (ms)	0.711
Time relative to the frequency behaviour (ms)	≈ 0 (<< 1 kHz from start, measured modulated)
Maximum of these times,	
Measurement uncertainty	**≤ ± 5 %**

See annex no.: **2, pages 3 and 5**

Limits Clause 15.1.5

The transmitter attack time shall not exceed:	1 ms

Test Equipment Used: 19, 61, 208, 289, 1066, 1079, 1239, 1337, 1403

IEC 61993-2, Cl.15.1.6

3.1.7 Transmitter Release Time

Power level at which the measurement has been performed: 2 W

Time Characteristics	**159.025 MHz**
Time relative to the power decrease (ms)	0.304
Measurement uncertainty	**≤ ± 5 %**

See annex no.: **2, page 2**

Limits Clause 15.1.6

The transmitter release time shall not exceed:	1 ms

Test Equipment Used: 19, 61, 208, 1066, 1079, 1337

Power level at which the measurement has been performed: 12.5 W

Time Characteristics	**159.025 MHz**
Time relative to the power decrease (ms)	0.304
Measurement uncertainty	**≤ ± 5 %**

See annex no.: **2, page 4**

Limits Clause 15.1.6

The transmitter release time shall not exceed:	1 ms

Test Equipment Used: 19, 61, 208, 1066, 1079, 1337

3.2 DSC Transmissions

IEC 61993-2, Cl.15.2.1

3.2.1 Frequency error of the DSC Signal

Power level at which the measurement has been performed: 2 W

Test Conditions		**Frequency Error Hz**	
		B (2100Hz)	**Y (1300Hz)**
T_{nom}	V_{nom}(24.0 V)	2100.004	1300.003
T_{min}(-15 °C)	V_{min}(21.6 V)	2100.013	1300.008
T_{max}(+55 °C)	V_{max}(31.2 V)	2100.024	1300.015
Maximum frequency error (Hz)		0.024	0.015
Measurement uncertainty		**≤ ± 0.5 Hz**	

Limits:

Normal Test Conditions	**Extreme Test Conditions**
± 1.0%	± 1.0%

Test Equipment Used: 19, 61, 208, 1013, 1066

IEC 61993-2, Cl.15.2.2

3.2.2 Modulation Rate,

Measured Baud rate	**Limit**
1200 +1.7 ppm	1200 ± 30 ppm
Measurement uncertainty	**≤ ± 10 ppm**

Test Equipment Used: 19, 208, 1013

3.3 TDMA Receivers

IEC 61993-2, Cl.15.3.1

3.3.1 Sensitivity – 25kHz Operation

RX1, testsignal 2

Test Conditions		**Receiver Sensitivity dBm/PER**	
		156,025MHz	**162,025MHz**
T_{nom}	V_{nom}(24.0 V)	- 108.5, 11 %	- 108.5, 10.3 %
T_{min}(-15°C)	V_{min}(21.6 V)	- 110, 5.6 %	- 110, 12.4 %
T_{max}(+55 °C)	V_{max}(31.2 V)	- 108, 6.6 %	- 107, 13.5 %
Measurement uncertainty		**≤ ± 1.5 dB**	
Test criterium		PER ≤ 20%	

Limits Clause 15.3.1

Normal test conditions	-107 dBm
Extreme test conditions	-101 dBm

Test Equipment Used: 19, 208, 257, 1079, 1435, PMG1

IEC 61993-2, Cl.15.3.2

3.3.2 Sensitivity – 12.5kHz Operation

RX1, testsignal 2

Test Conditions		Receiver Sensitivity dBm/PER	
		157,4125MHz	**160,6375MHz**
T_{nom}	V_{nom}(24.0 V)	- 101, 11.7 %	-101, 8.5 %
T_{min}(-15 °C)	V_{min}(21.6 V)	- 102, 7.4 %	- 102, 11.7 %
T_{max}(+55 °C)	V_{max}(31.2 V)	-101, 12.4 %	- 101, 14.1 %
Measurement uncertainty		**≤ ± 1.5 dB**	
Test criterium		PER ≤ 20%	

Limits Clause 15.3.2

Normal test conditions	-98 dBm
Extreme test conditions	-92 dBm

Test Equipment Used: 19, 208, 257, 1079, 1435, PMG1

IEC 61993-2, Cl.15.3.3

3.3.3 Error Behaviour at High Input Levels

Test Signal 2 159.025 MHz

Input to receiver	**Number of Messages not Correctly Received at**	
	- 7dBm	**- 77dBm**
	0.2 %	0.1 %
Variation in %	0.1 %	
Measurement uncertainty	**≤ ± 0.5 dB**	

Limit Clause 15.3.3

Variation between –7 dBm and –77 dBm	≤ 1%

Test Equipment Used: 19, 208, 1079, PMG1

Test Signal 3 159.025 MHz

Input to receiver	**Number of Messages not Correctly Received at**	
	- 7dBm	**- 77dBm**
	0.6	0.2
Variation in %	0.4 %	
Measurement uncertainty	**≤ ± 0.5 dB**	

Limit Clause 15.3.3

Variation between –7 dBm and –77 dBm	≤ 1%

Test Equipment Used: 19, 208, 1079, PMG1

IEC 61993-2, Cl.15.3.4

3.3.4 Co-Channel Rejection - 25kHz Operation

Rx 1,testsignal 2

Frequency Of Unwanted Signal	**Co-Channel Rejection Ratio dB/PER**		
	156.025 MHz	**159.025 MHz**	**162.025 MHz**
f + 3000Hz	- 9.8, 14.5 %	-9.8, 13.1 %	- 9.8, 13.9 %
f	- 9.0, 15.1 %	- 9.0, 12.9 %	- 9.0, 13.7 %
f - 3000Hz	- 9.0, 12.6 %	- 9.0, 11.3 %	- 9.0, 11.1 %
Measurement uncertainty	**≤ ± 1.0 dB**		
Test criterium	PER ≤ 20%		

Limits Clause 15.3.4

Channel Separation: 25kHz	-10dB<Limit<0dB (and >0)

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.5

3.3.5 Co-Channel Rejection - 12.5kHz Operation

RX1, testsignal 2

Frequency Of Unwanted Signal	**Co-Channel Rejection Ratio dB/PER**	
	157.4125 MHz	**160.6375 MHz**
f + 1500Hz	- 14.3, 19.0 %	- 14.5, 18.7 %
f	- 10.5, 17.5 %	- 11.2, 11.4 %
f - 1500Hz	- 15.4, 17.7 %	- 14.8, 17.6 %
Measurement uncertainty	**≤ ± 1.0 dB**	
Test criterium	PER ≤ 20%	

Limits Clause 15.3.5

Channel Separation: 12.5kHz	-18dB<Limit<0dB (and >0)

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.6

3.3.6 Adjacent Channel Selectivity – 25kHz Operation

RX1, testsignal 2

Test Conditions		**Adjacent Channel Selectivity Ratio dB/PER**			
		156.025 MHz		**162.025 MHz**	
		+ 25 kHz	**- 25 kHz**	**+ 25 kHz**	**- 25 kHz**
T_{nom}	V_{nom}(24 V)	71.9, 19.7 %	72.5, 14.7 %	75, 11.1 %	75.7, 9.9 %
Measurement uncertainty		**≤ ± 2.5 dB**			
Test criterium		PER ≤ 20%			

Limits Clause 15.3.6

Channel Separation	**Normal Conditions**	**Extreme Conditions**
25,0 kHz	70,0 dB	60,0 dB

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.7

3.3.7 Adjacent Channel Selectivity – 12.5kHz Operation

RX1, testsignal 2

Test Conditions		Adjacent Channel Selectivity Ratio dB/PER			
		157.4125 MHz		160.6375 MHz	
		+ 12.5 kHz	- 12.5 kHz	+ 12.5 kHz	- 12.5 kHz
T_{nom}	V_{nom}(24 V)	56.8, 11.6 %	50.5, 13.2 %	57.5, 13.6 %	50.6, 14.8 %
Measurement uncertainty		**≤ ± 2.5 dB**			
Test criterium		PER ≤ 20%			

Limits Clause 15.3.7

Channel Separation	Normal Conditions	Extreme Conditions
12,5 kHz	50,0 dB	50,0 dB

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.8

3.3.8 Spurious Response Rejection

TDMA Receiver, RX1, testsignal 2

Spurious Response Rejection	
159.025 MHz	
Frequency MHz	**Ratio dB**
158.1257	74 (19%,PER)
Measurement uncertainty	**≤ ± 2.5 dB**
Test criterium	PER ≤ 20%

Limits Clause 15.3.8

Rejection ratio limit	70,0 dB

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.9

3.3.9 Intermodulation Response Rejection and Blocking

Test 1:

Measured value	Generator A	Generator B	Generator C	Generator D
2.2 %	156.025	156.525	157.025	161.750
3.0 %	156.025	155.525	155.025	150.300
Measurement uncertainty		**≤ ± 2 dB**		

Limits Clause 15.3.9

The packet error rate, with the outputs of signal generators B, C and D switched on, shall be 20% or less.

Test Equipment Used: 19, 208, 289, 1002, 1066, 1079, 1240, PMG1

Test 2:

Measured value	Generator A	Generator B	Generator C	Generator D
3.2 %	162.025	162.525	163.025	167.750
7.7 %	162.025	161.525	161.025	156.300
Measurement uncertainty		**≤ ± 2.0 dB**		

Limits Clause 15.3.9

The packet error rate, with the outputs of signal generators B, C and D switched on, shall be 20% or less.

Test Equipment Used: 19, 208, 289, 1002, 1066, 1079, 1240, PMG1

IEC 61993-2, Cl.15.3.10

3.3.10 Transmit to Receive Switching Time

MHz	Measurement results	Required results
156.025	0.73 ms	0.83 ms
162.025	0.73 ms	0.83 ms
Measurement uncertainty	**≤ ± 0.05 ms**	

Limit 0.83 ms

See annex 4 and annex 3 page 2.

Test Equipment Used: 19, 208, 1079, 1239

3.4 DSC Receiver

IEC 61993-2, Cl.15.4.1

3.4.1 Maximum Sensitivity

Test Conditions		Receiver Sensivity dBm/PER		
		156.525 MHz	156.525 MHz + 1.5 kHz	156.525 MHz - 1.5 kHz
T_{nom}	V_{nom} (24.0 V)	- 108, 7%	- 108, 2%	- 108, 12%
T_{min} (-15 °C)	V_{min} (21.6 V)	- 110, 4%	- 110, 5%	- 111, 5%
T_{max} (+55 °C)	V_{max} (31.2 V)	- 108, 5%	- 108, 4%	- 107, 10%
Measurement uncertainty		**≤ ± 1.5 dB**		
Test criterium		BER =10^{-2}		

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.1

Normal test conditions	≤ - 107dBm
Extreme test conditions	≤ - 101dBm

Test Equipment Used: 19, 208, 257, 1079, 1435, PMG1

IEC 61993-2, Cl.15.4.2

3.4.2 Error Behaviour at High Input Levels

Test Signal 1

Measured value	0%,PER (up to –5 dBm)
Measurement uncertainty	**≤ ± 0.5 dB**

PER measurements are performed instead of BER. See comments on page 8.

Limit Clause 15.4.2

BER	$\leq 10^{-2}$

Test Equipment Used: 19, 208, 1079, PMG1

IEC 61993-2, Cl.15.4.3

3.4.3 Co-Channel Rejection

Frequency Of Unwanted Signal	Co-Channel Rejection Ratio dB/PER
f + 3000Hz	- 9.0, 2%
f	- 9.5 9%
f - 3000Hz	- 9.0, 7%
Measurement uncertainty	**≤ ± 2.5 dB**

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.3

Channel Separation: 25kHz	-10dB <Limit< 0dB (and >0)
BER	$\leq 10^{-2}$

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.4.4

3.4.4 Adjacent Channel Selectivity

Test Conditions		Adjacent Channel Selectivity Ratio dB/PER	
		156.525 MHz	
		+ 25 kHz	- 25 kHz
T_{nom}	V_{nom}(24.0 V)	75, 2%	75, 4%
Measurement uncertainty		**≤ ± 2.5 dB**	
Test criterium		BER ≤ 10^{-2}	

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.4

Channel Separation	Normal Conditions	Extreme Conditions
25,0 kHz	70,0 dB	60,0 dB

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.4.5

3.4.5 Spurious Response Rejection

DSC Receiver

Spurious Response Rejection	
156.525 MHz	
Frequency MHz	**Ratio dB**
163.704	> 75 (<20%, PER)
Measurement uncertainty	**≤ ± 2.5 dB**

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.5

Rejection ratio limit	70,0 dB
BER	$\leq 10^{-2}$

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.4.6

3.4.6 Intermodulation Response Rejection

Frequency Increments Of Unwanted Signals	**Intermodulation Response Rejection Ratio dB/PER**
	156.525 MHz
-50 / -100 kHz	68, 8%
+50 / +100 kHz	68, 4%
Measurement uncertainty	**≤ ± 2.0 dB**

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.6.

The intermodulation response rejection ratio	> 65.0dB
BER	$\leq 10^{-2}$

Test Equipment Used: 19, 208, 289, 1079, 1240, PMG1

IEC 61993-2, Cl.15.4.7

3.4.7 Blocking or Desensitisation

Frequency Of Wanted Signal	Blocking Or Desensitisation Ratio dB/PER
	156.525 MHz
f - 1 MHz	86, 2%
f - 2 MHz	86, 3%
f - 5 MHz	86, 5%
f - 10 MHz	86, 3%
f + 1 MHz	86, 3%
f + 2 MHz	86, 2%
f + 5 MHz	86, 1%
f + 10 MHz	86, 1%
Measurement uncertainty	**≤ ± 2.5 dB**

PER measurements are performed instead of BER. See comments on page 8.

Limits Clause 15.4.7

The blocking ratio	≥ 84.0dB
BER	≤ 10^{-2}

Test Equipment Used: 19, 208, 1079, 1240, PMG1

IEC 61993-2, Cl.15.5.1

3.5 Conducted Spurious Emissions Conveyed to the Antenna

3.5.1 Spurious Emissions from the Receiver

Spurious Emissions		
159.025 MHz		
Frequency MHz	Bandwidth kHz	Level dBm
111.5	10	- 63.2
228.051	10	-58.0
342.076	10	-65.5
Others 0.15 – 2000	-	< limit –10 dB
Measurement uncertainty		**≤ ± 1.1 dB**

Bandwidth (kHz) refers to the bandwidth of the measuring spectrum analyzer.

Limits Clause 15.5.1

	Frequency Range	**Limits**
Conducted	150 KHz to 1 GHz	2 nW (-57,0 dBm)
	1 GHz to 2 GHz	20nW (-47,0 dBm)

Test Equipment Used: 19, 208, 1079, 1337

IEC 61993-2, Cl.15.5.2

3.5.2 Spurious Emissions from the Transmitter

Spurious Emissions		
159.025 MHz (H/L power)		
Frequency MHz	Bandwidth kHz	Level dBm
ca: 51	-	≤ -40
158.516	10	-40.2
158.525	10	-39.5
159.510	10	-39.5
Others 0.15 – 2000	-	< limit –10 dB
Measurement uncertainty		**≤ ± 1.1 dB**

Bandwidth (kHz) refers to the bandwidth of the spectrum analyzer.

Limits Clause 15.5.2

	Frequency Range	Limits
Conducted	150 kHz to 1 GHz	0,25 µW (-36,0 dBm)
	1 GHz to 2 GHz	1 µW (-30,0 dBm)

Test Equipment Used: 19, 208, 1079, 1337

3.5.3 Vibration

1.3	IEC 60945 Clause 8.7 IEC 68-2-6 Test Fc	Vibration Test, sinusoidal: 3 -13.2 Hz: 1.0 mm (peak) displ. 13.2-100 Hz: 0.7 G 3 axes (X, Y, Z)	The EUT was fastened to the shaker with a mounting device. No resonance was found, so the endurance test was carried out at 30 Hz, for 120 minutes at all three axes. The EUT was operating during the test, and its functionality was OK under and after the test. Both the radio and the junction box was tested in all axis.	**P**

3.5.4 Enviromental testing

Performed according to IEC 60945, clause 7.1, table 2.

The EUT passed the test.

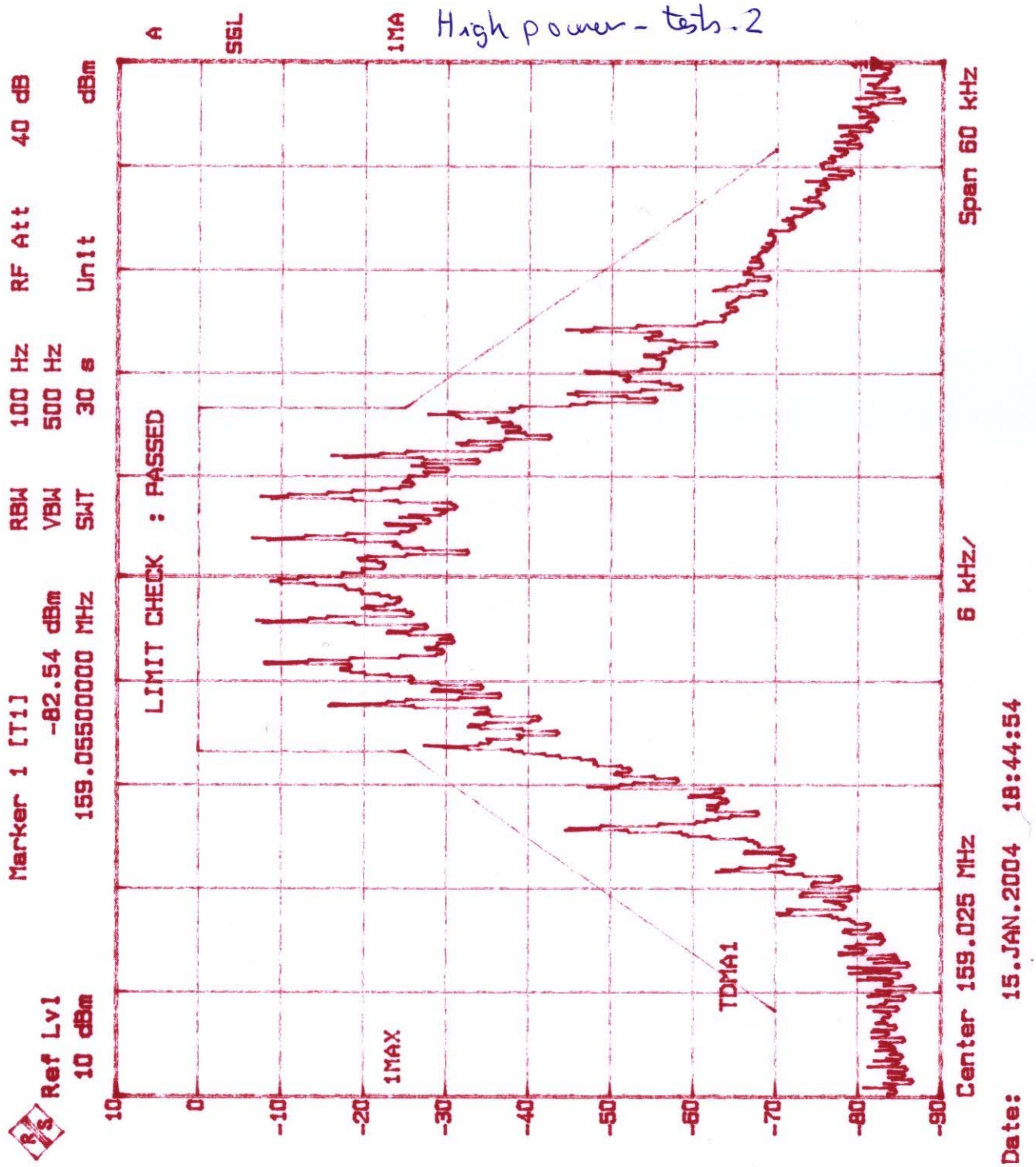
See annex 3 page 1.

4 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

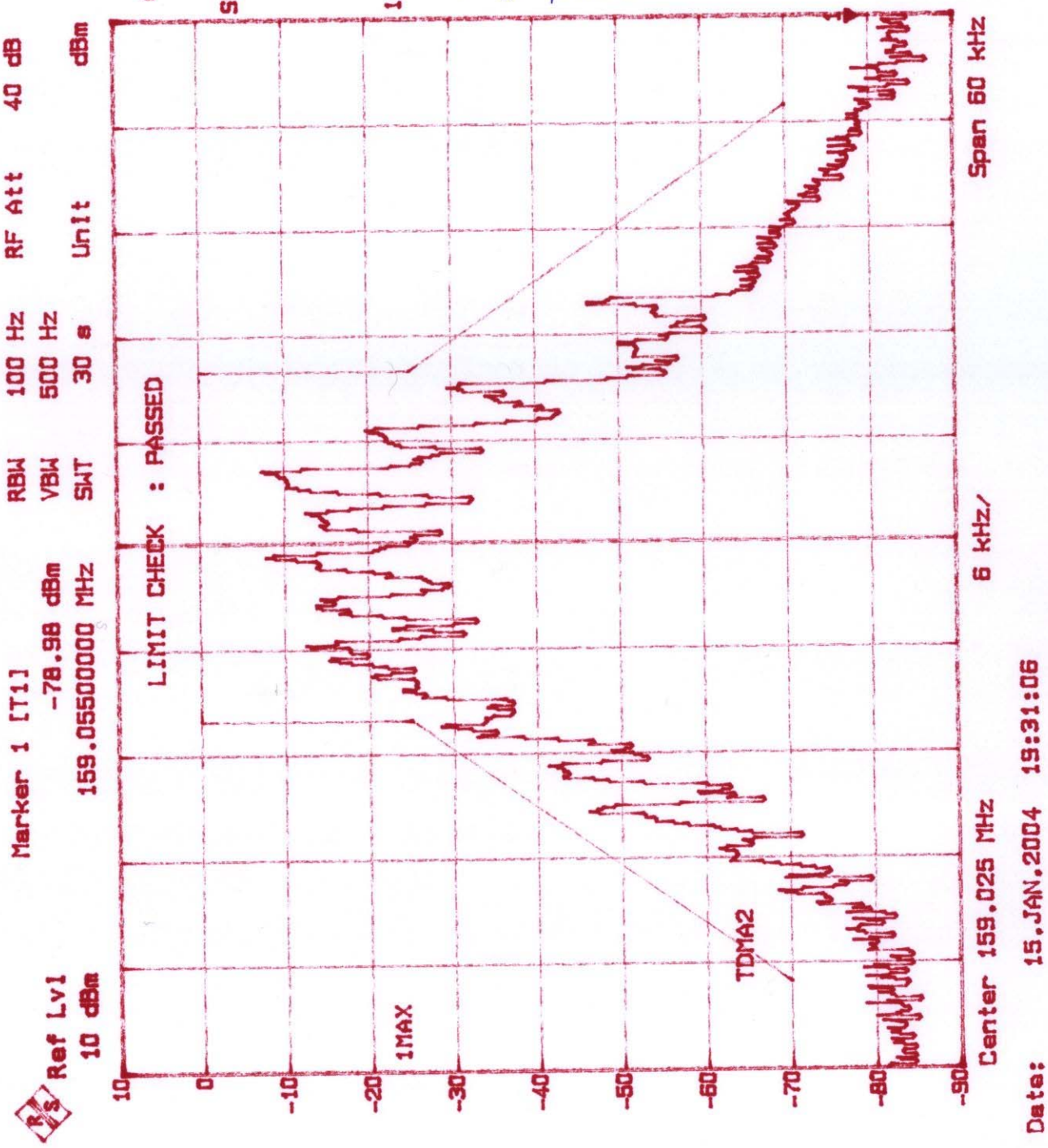
To simplify identification of the test equipment and ancillaries used, all item used are identified by the testhouse on each page of the test report. All numbers are referenced to the list given below.

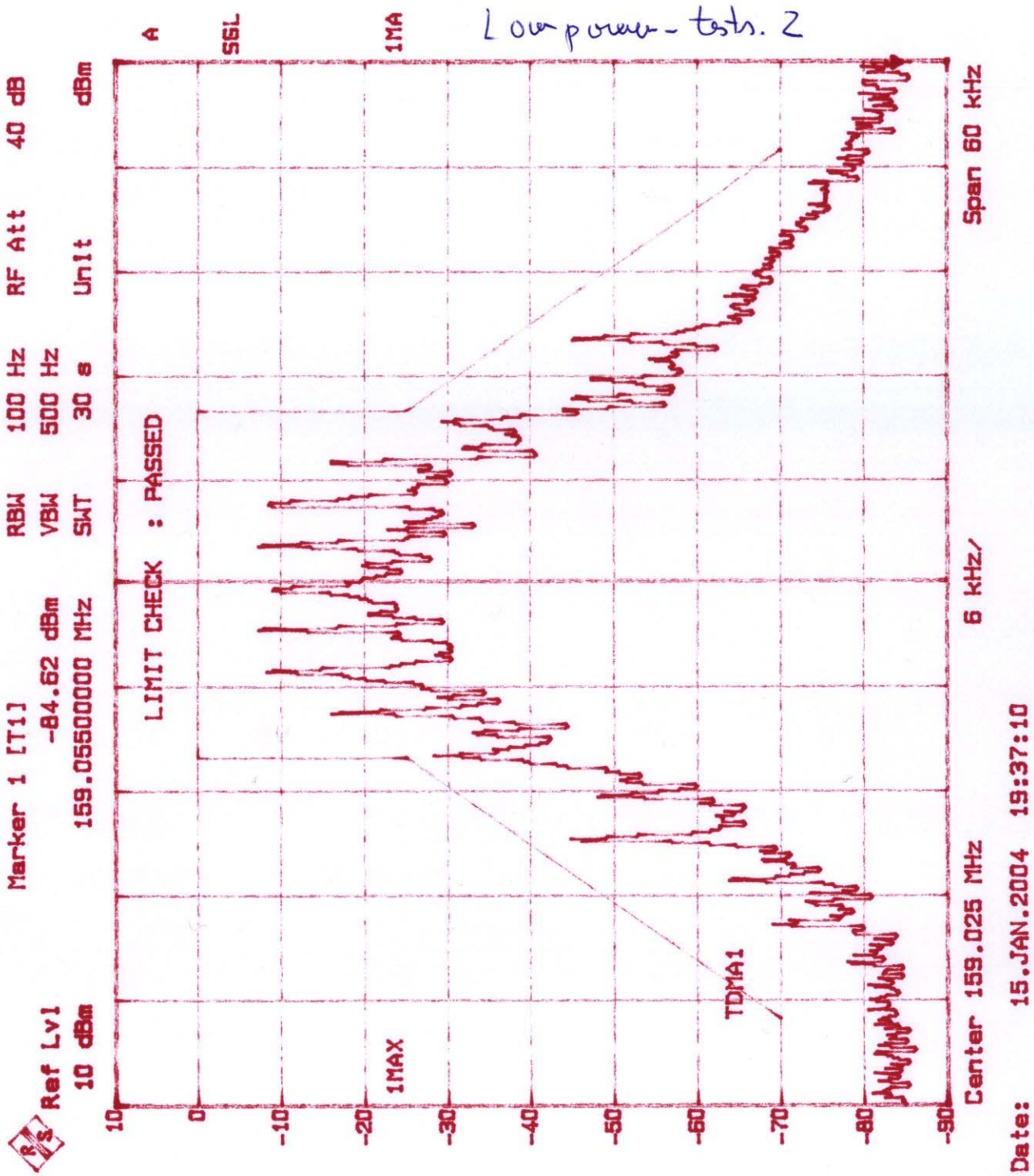
C	No	Instrument/Ancillary	Manufacturer	Type
LR	61	Attenuator	Bird	8135
LR	1134	Attenuator	Suhner	6820.17.A
LR	130	Attenuator Adjustable	R&S	DPU
LR	1435	Climate Chamber	Vötsch	VC 4060
LR	1013	Counter Freq	HP	HP5385A
LR	1169	Filter Band Pass	Trilithic	5VF250/500
LR	1170	Filter Band Pass	Trilithic	5VF500/1000
LR	1079	Generator, AF/../UHF	R&S	SMHU56
LR	1002	Generator, AF/../UHF	R&S	SMPC
LR	1240	Generator, AF/../UHF	R&S	SMHU
LR	257	Hybrid	Anzaz	H-9
LR	289	Hybrid	Anzaz	DS-4-4
LR	208	Multimeter, Digital	Fluke	77
LR	1239	Oscilloscope	Fluke	PM3392A
LR	16	Power Supply	Oltronix	B32-10R
LR	19	Power Supply	Oltronix	B32-10R
LR	1338	Probe, RF	HP	HP8481H
LR	1066	Radiocomm Analyzer	R&S	CMTA 54
LR	1337	Spectrum Analyzer	R&S	FSEK 1088,3494,30
LR	142	Wattmeter, RF, Wideband	HP	HP435B
LR	1403	Crystal detector	Agilent	423P
*	PMG1	Mod. generator	Sine Qua Non Technology	PMG1 Serial: 010101-0020

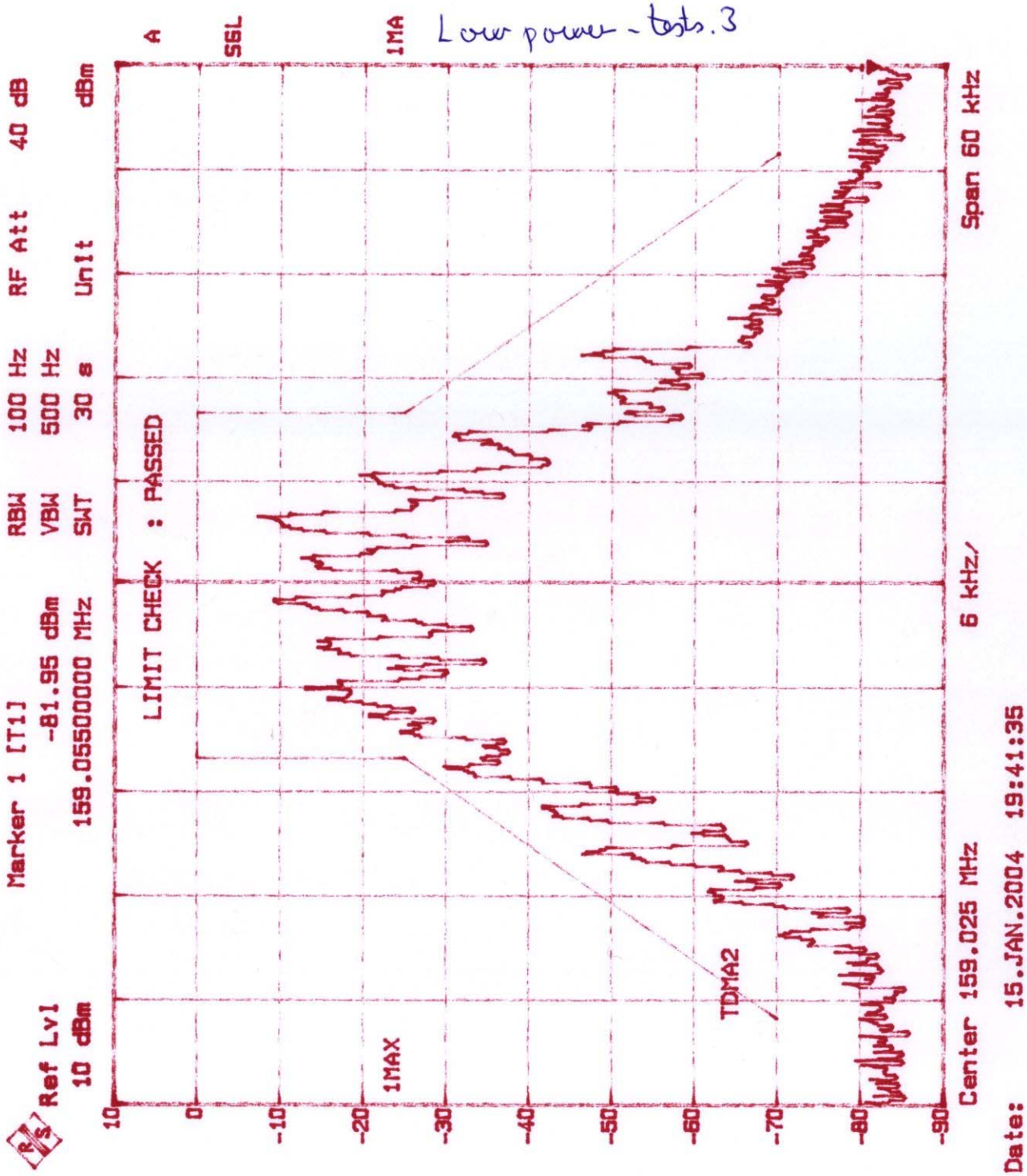
* Supplied by the client.

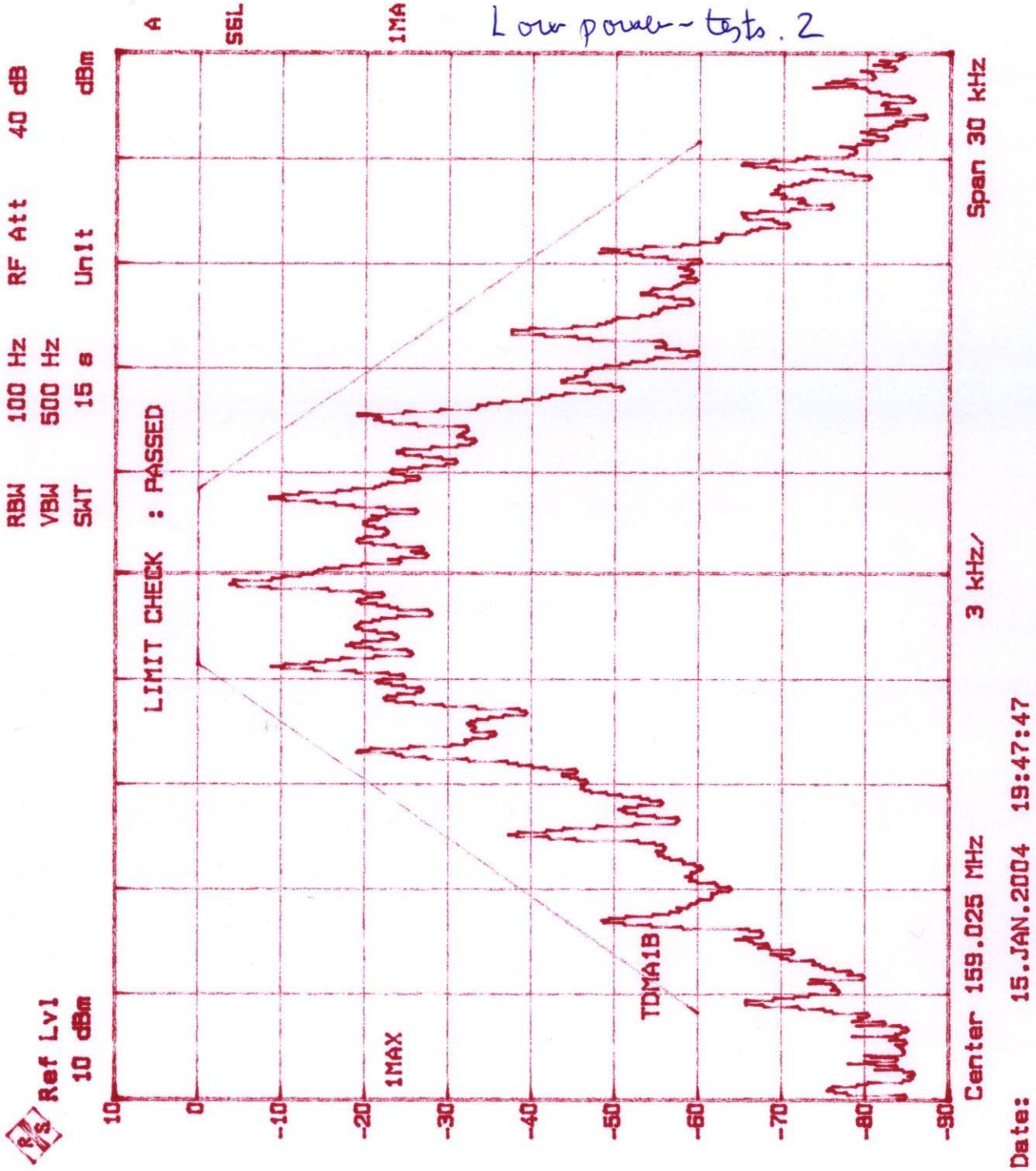

High power - tests.2
Ref Lvl
10 dBm
Marker 1 [T1]
-82.54 dBm
159.05500000 MHz
RBW 100 Hz
VBW 500 Hz
SWT 30 s
RF Att 40 dB
Unit dBm
A
SGL
1MA
LIMIT CHECK : PASSED
1MAX
TDMA1
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 159.025 MHz
6 kHz/
Span 60 kHz
Date: 15.JAN.2004 18:44:54

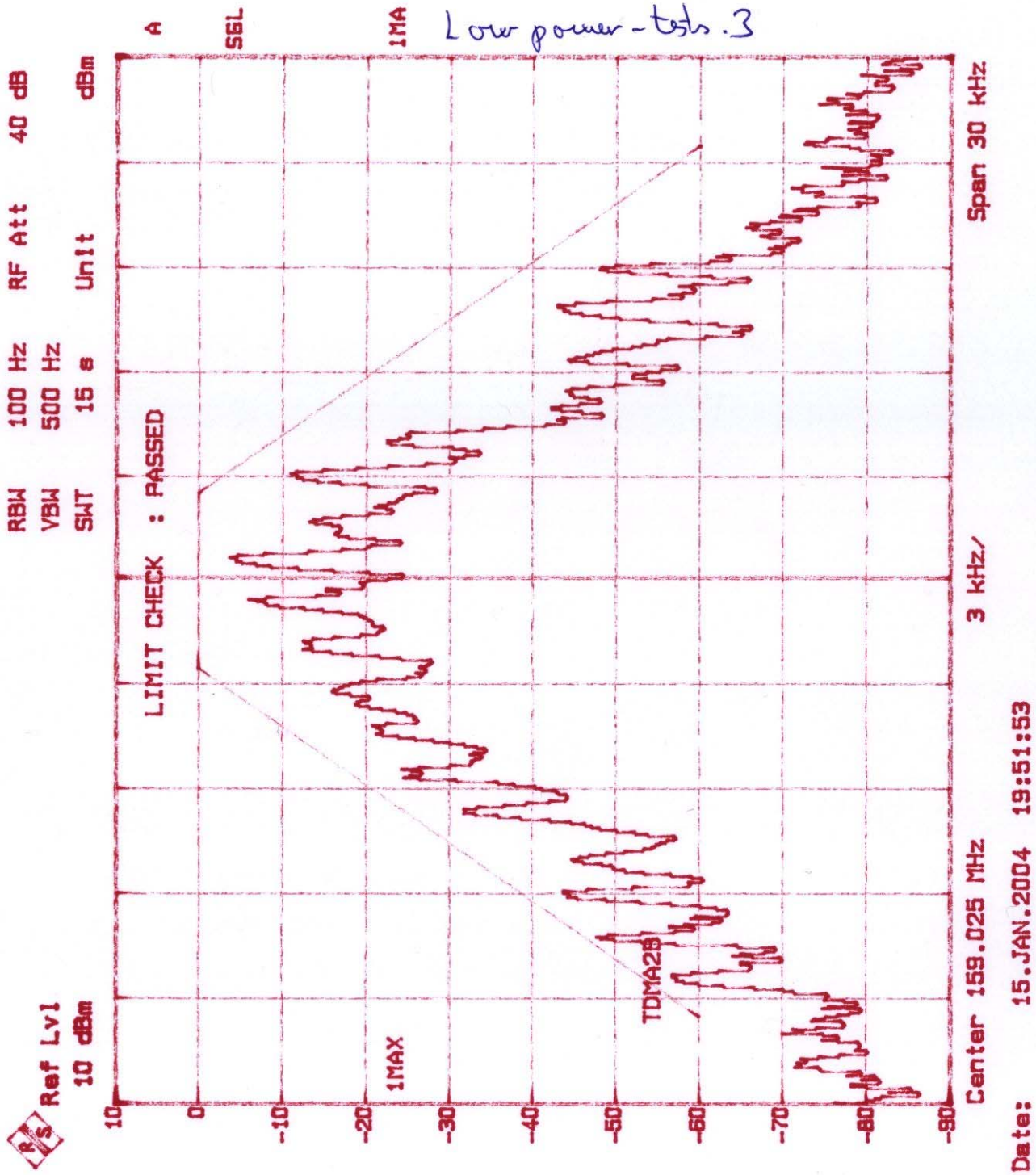
High power - tests. 3

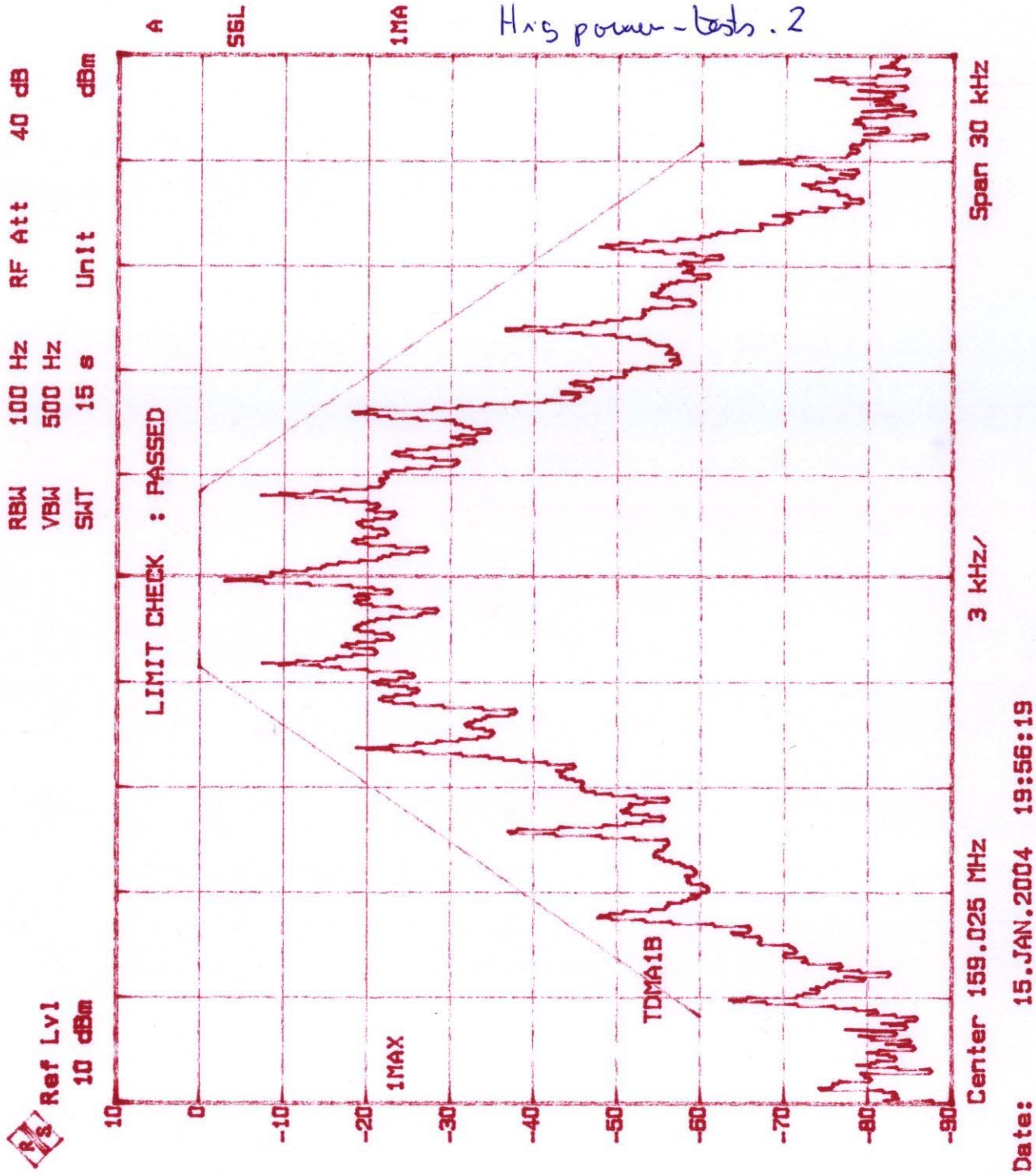



Low power - tests. 2
Ref Lvl
10 dBm
Marker 1 [T1]
-84.62 dBm
159.05500000 MHz
RBW 100 Hz
VBW 500 Hz
SWT 30 s
RF Att 40 dB
Unit dBm
LIMIT CHECK : PASSED
A
SGL
1MA
1MAX
TDMA1
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 159.025 MHz
6 kHz/
Span 60 kHz
Date: 15.JAN.2004 19:37:10

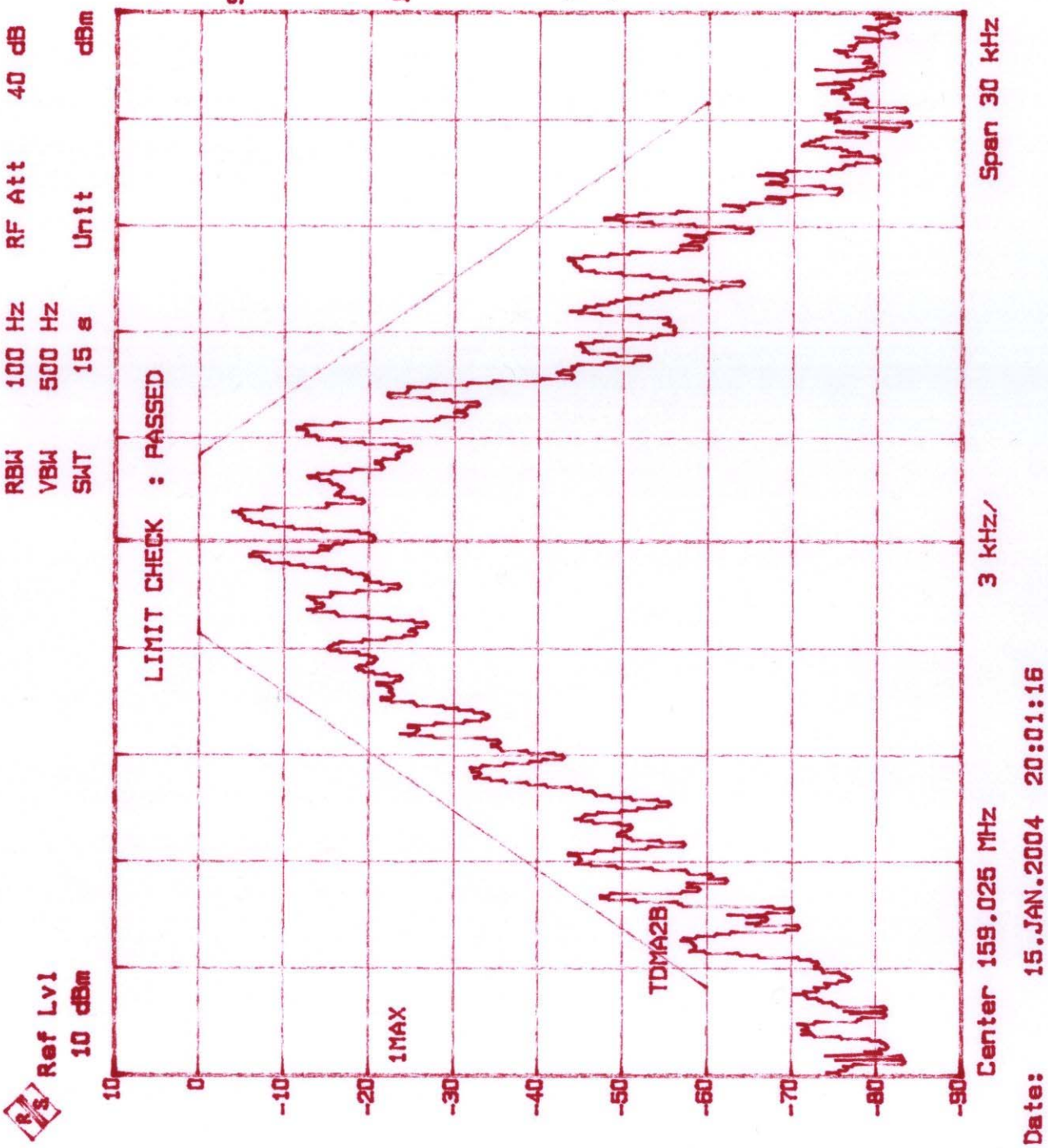

Low power - tests.3
Ref Lvl
10 dBm
Marker 1 [T1]
-81.95 dBm
159.05500000 MHz
RBW 100 Hz
VBW 500 Hz
SWT 30 s
RF Att 40 dB
Unit dBm
LIMIT CHECK : PASSED
A
SGL
1MA
1MAX
TDMA2
Center 159.025 MHz
6 kHz/
Span 60 kHz
Date: 15.JAN.2004 19:41:35

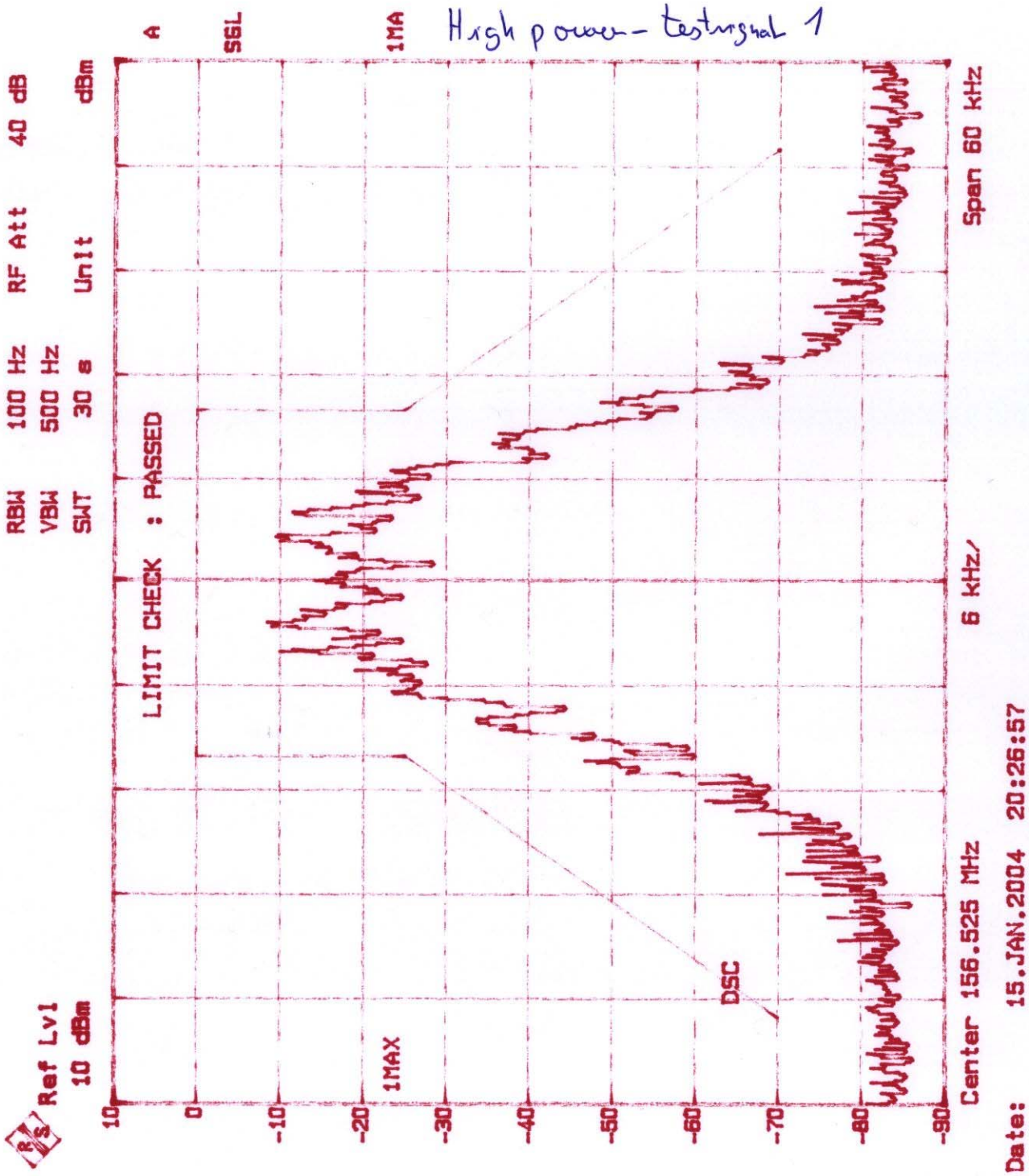
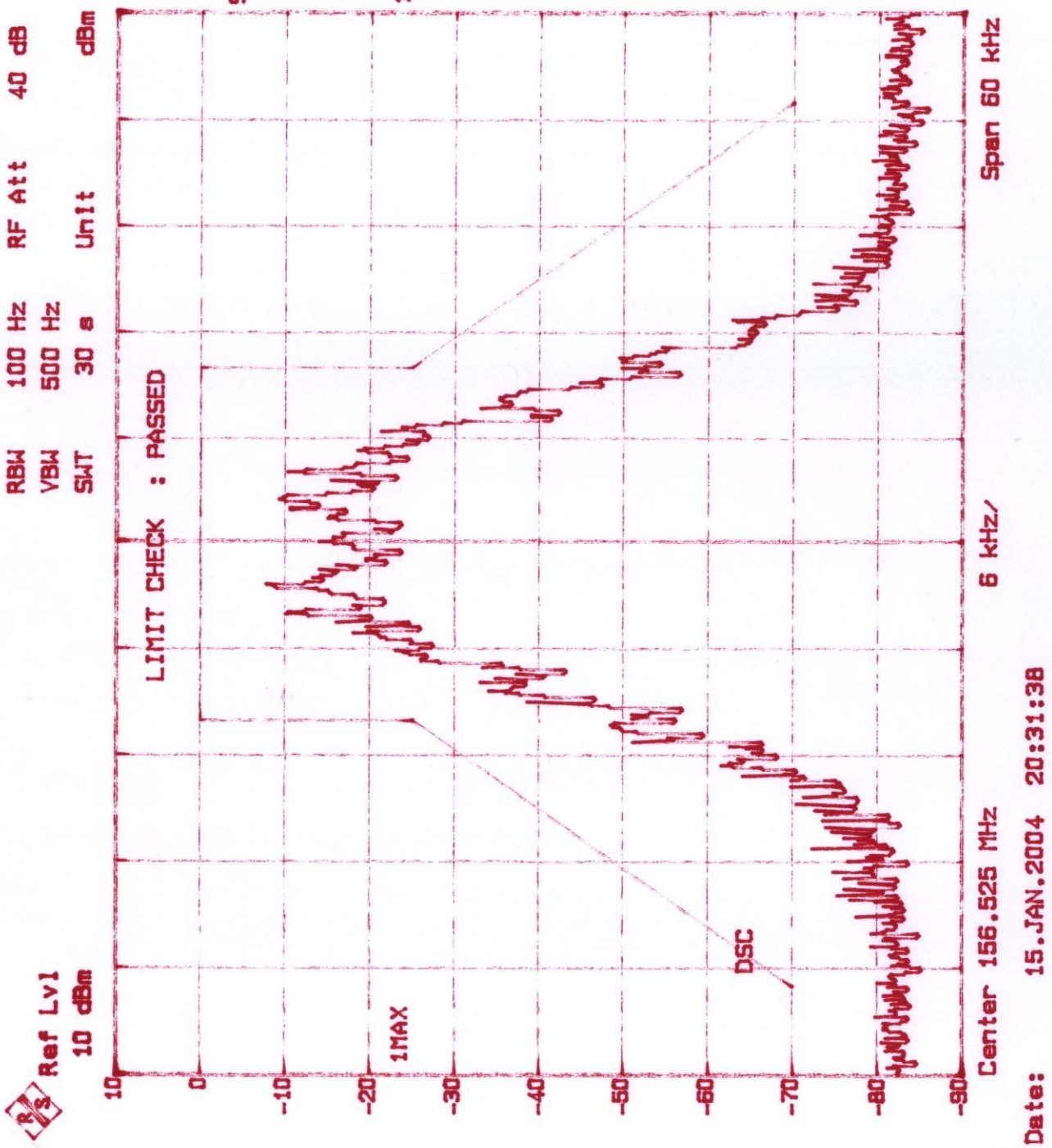

Low power - tests. 2
Ref Lvl
10 dBm
RBW 100 Hz
VBW 500 Hz
SWT 15 s
RF Att 40 dB
Unit dBm
A
SGL
1MA
LIMIT CHECK : PASSED
1MAX
TDMA1B
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 159.025 MHz
3 kHz/
Span 30 kHz
Date: 15.JAN.2004 19:47:47


Low power - tests.3
A
SGL
1MA
Ref Lvl
10 dBm
RBW 100 Hz
VBW 500 Hz
SWT 15 s
RF Att 40 dB
Unit dBm
LIMIT CHECK : PASSED
1MAX
TDMA2B
Span 30 kHz
3 kHz/
Center 159.025 MHz
Date: 15.JAN.2004 19:51:53


Hig power-tests. 2
RBW 100 Hz
VBW 500 Hz
SWT 15 s
RF Att 40 dB
Unit dBm
A
SGL
1MA
LIMIT CHECK : PASSED
1MAX
TDMA1B
Ref Lvl
10 dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Center 159.025 MHz
3 kHz/
Span 30 kHz
Date: 15.JAN.2004 19:56:19

High power - tests. 3




High power - testsignal 1
Ref Lvl
10 dBm
RBW 100 Hz
VBW 500 Hz
SWT 30 s
RF Att 40 dB
Unit dBm
A
SGL
1MA
LIMIT CHECK : PASSED
1MAX
DSC
Center 156.525 MHz
6 kHz/
Span 60 kHz
Date: 15.JAN.2004 20:26:57

Low power - testsignal 1