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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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Technical Supervisor

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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Telephone : +47 64 84 57 00
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Comlab is granted accreditation by Norwegian Accreditation under the registration number T031

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: 19.1⁰C – 22.7⁰C

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) |
| Error 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.

Environmental testing are performed according to IEC 60945, and "Environmental Test Overview" 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 "Environmental Test Overview" 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

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 ($\ll 1$ kHz from start, measured modulated) |
| Maximum of these times, | 0.572 |
| Measurement uncertainty | $\leq \pm 5 \%$ |

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 ($\ll 1$ kHz from start, measured modulated) |
| Maximum of these times, | |
| Measurement uncertainty | $\leq \pm 5 \%$ |

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 | $\leq \pm 5 \%$ |

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 | $\leq \pm 5 \%$ |

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 | $\leq \pm 0.5 \text{ dB}$ | |

Limit Clause 15.3.3

| | |
|--------------------------------------|------------|
| Variation between -7 dBm and -77 dBm | $\leq 1\%$ |
|--------------------------------------|------------|

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 | $\leq \pm 0.5 \text{ dB}$ | |

Limit Clause 15.3.3

| | |
|--------------------------------------|------------|
| Variation between -7 dBm and -77 dBm | $\leq 1\%$ |
|--------------------------------------|------------|

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 | $\leq \pm 1.0$ dB | | |
| Test criterium | PER \leq 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 | $\leq \pm 1.0$ dB | |
| Test criterium | PER $\leq 20\%$ | |

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} | $V_{nom}(24\text{ V})$ | 71.9, 19.7 % | 72.5, 14.7 % | 75, 11.1 % | 75.7, 9.9 % |
| Measurement uncertainty | | $\leq \pm 2.5\text{ dB}$ | | | |
| Test criterium | | PER $\leq 20\%$ | | | |

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 | $\leq \pm 2.5$ dB |
| Test criterium | PER \leq 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 | | $\leq \pm 2$ 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 | | $\leq \pm 2.0$ 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 | $\leq \pm 0.05$ 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 | | $\leq \pm 1.5$ 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 | $\leq - 107$ dBm |
| Extreme test conditions | $\leq - 101$ dBm |

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 | $\leq \pm 0.5$ 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 | $\leq \pm 2.5$ 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 | $\leq \pm 2.5$ 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 | $\leq \pm 2.0$ 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 | $\leq \pm 2.5$ dB |

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

Limits Clause 15.4.7

| | |
|--------------------|----------------|
| The blocking ratio | ≥ 84.0 dB |
| BER | $\leq 10^{-2}$ |

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

| Conducted | Frequency Range | Limits |
|------------------|------------------------|------------------|
| | 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 | | $\leq \pm 1.1$ dB |

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

Limits Clause 15.5.2

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

Test Equipment Used: 19, 208, 1079, 1337

IEC 60945 Clause 8.7

3.5.3 Vibration

| | | | | |
|-----|--|---|--|----------|
| 1.3 | IEC 60945 Clause 8.7 IEC 68-2-6 Test Fc | <u>Vibration Test, sinusoidal:</u> 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.

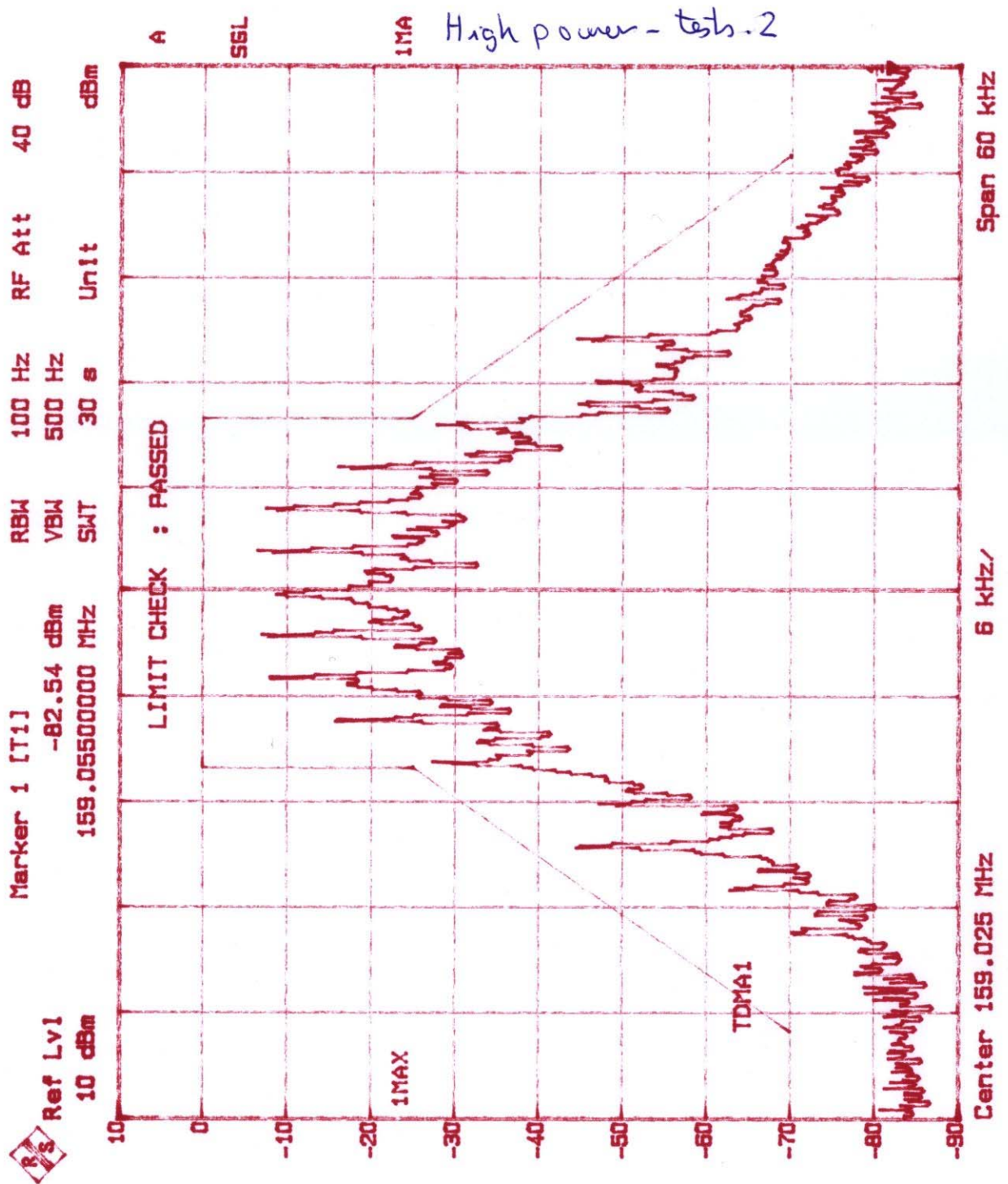
See annex 3 page 1.

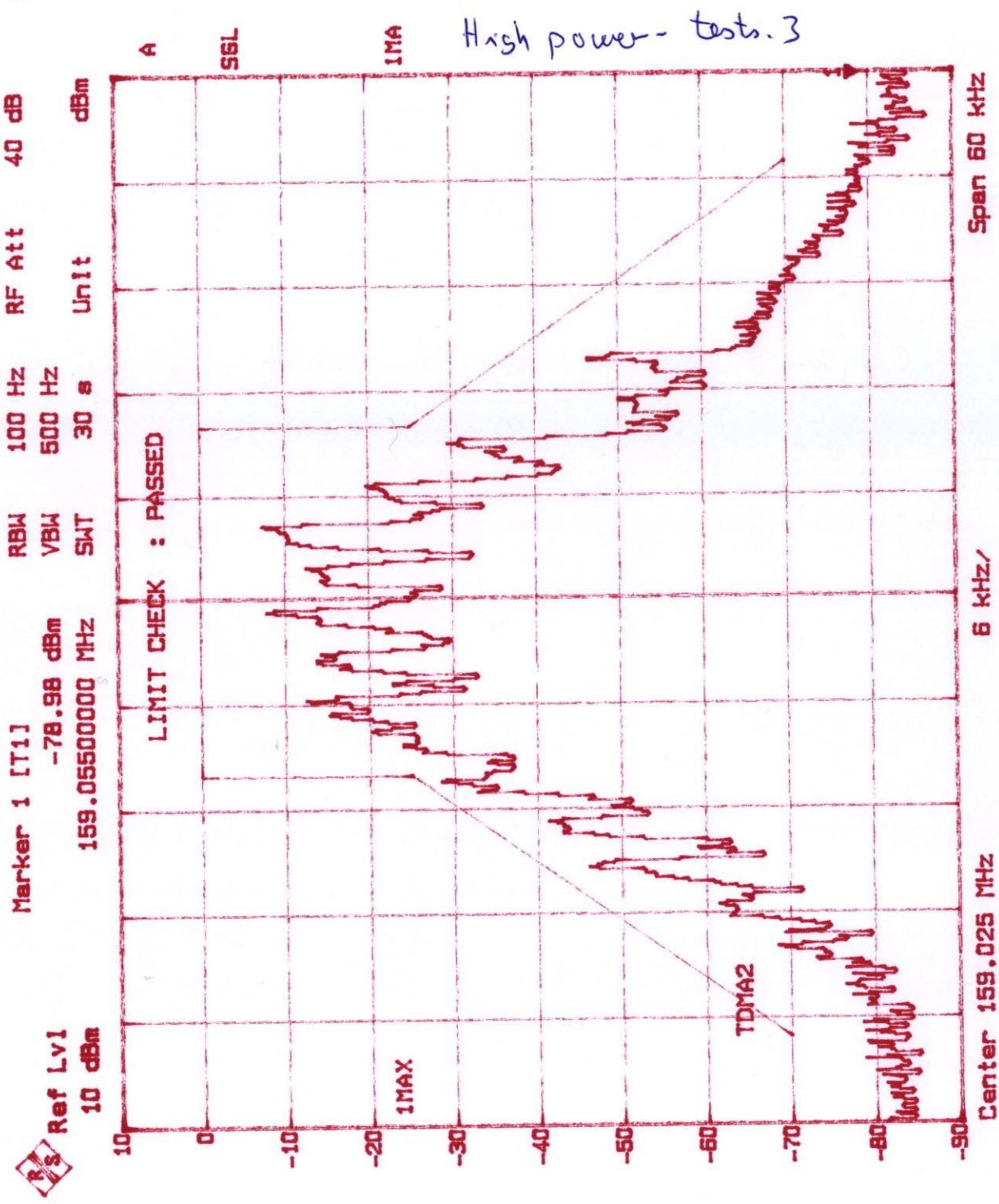
4 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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.

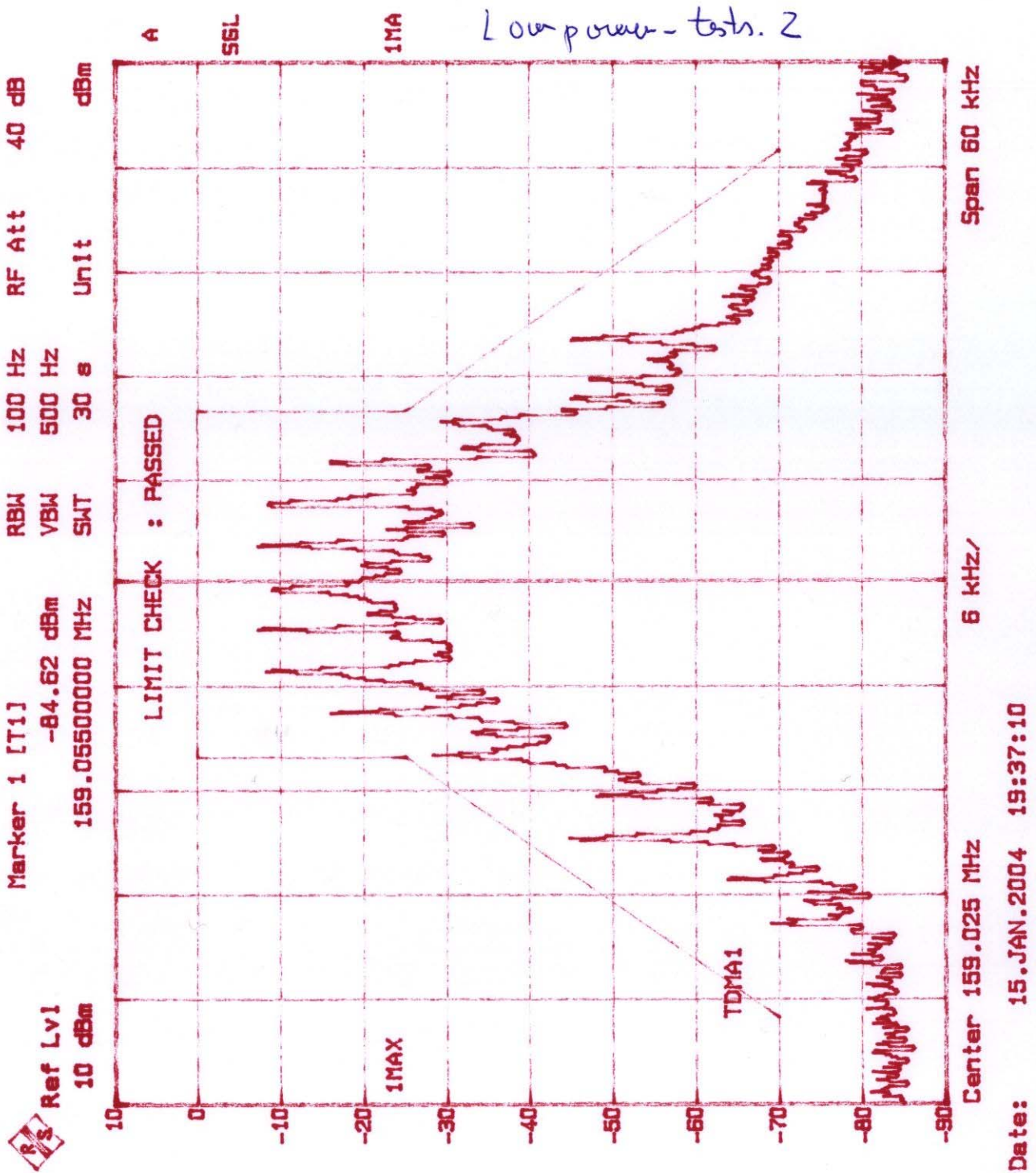
| C | No | Instrument/Ancillary | Manufacturer | Type |
|----------|-----------|-----------------------------|----------------------------|-----------------------------|
| LR | 61 | Attenuator | Bird | 8135 |
| LR | 1134 | Attenuator | Suhner | 6820.17.A |
| LR | 130 | Attenuator Adjustable | R&S | DPU |
| 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 |

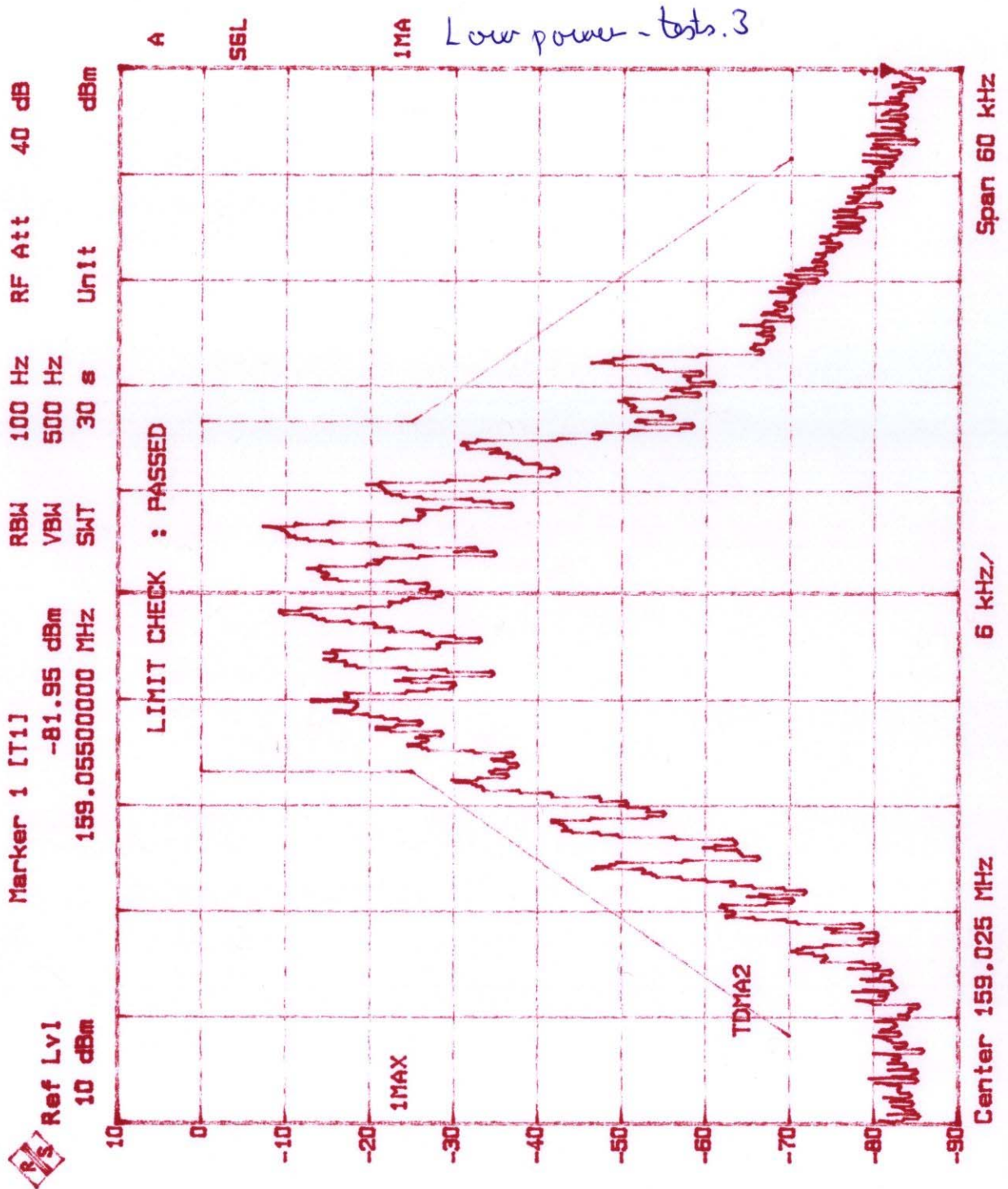
* Supplied by the client.



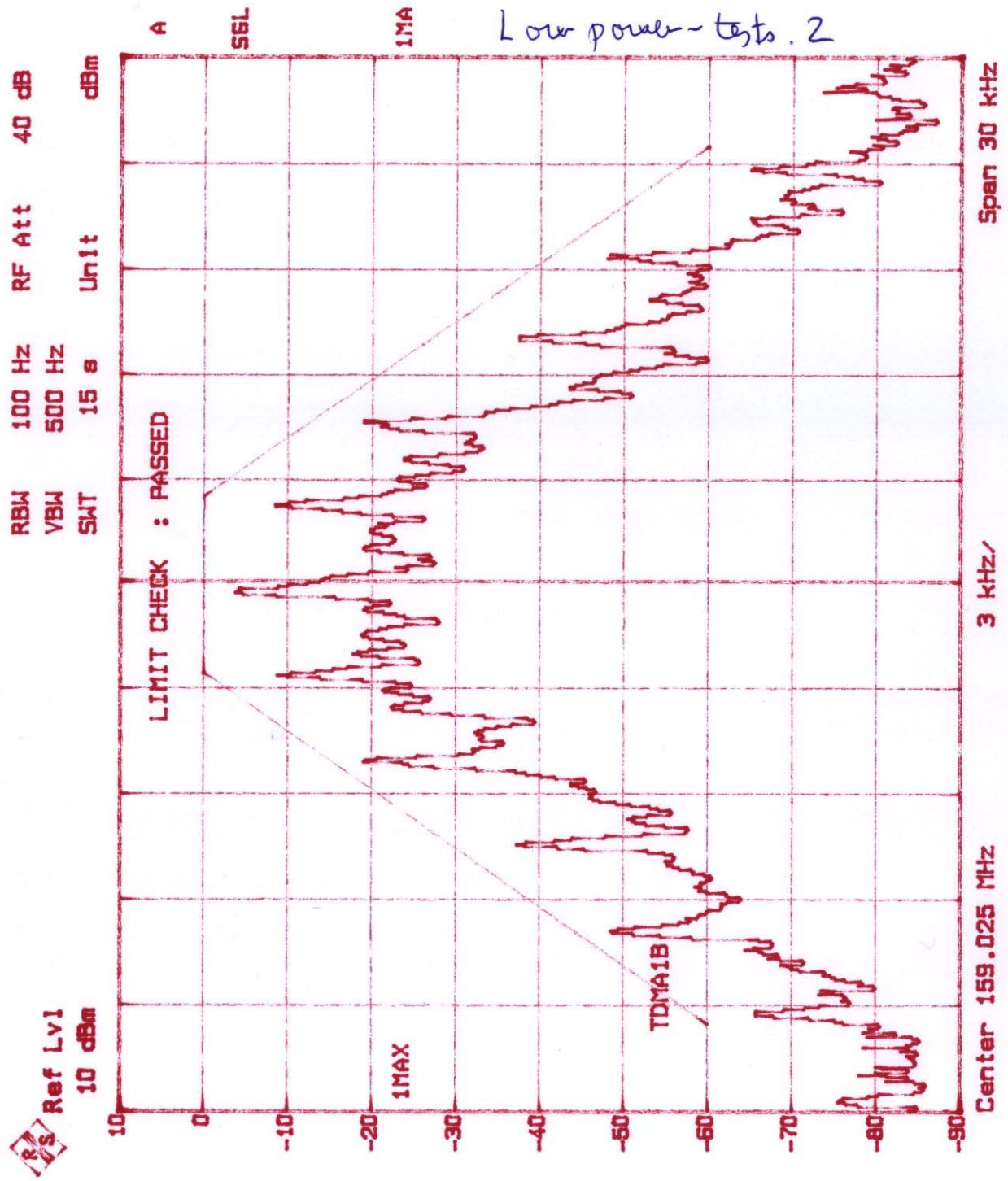


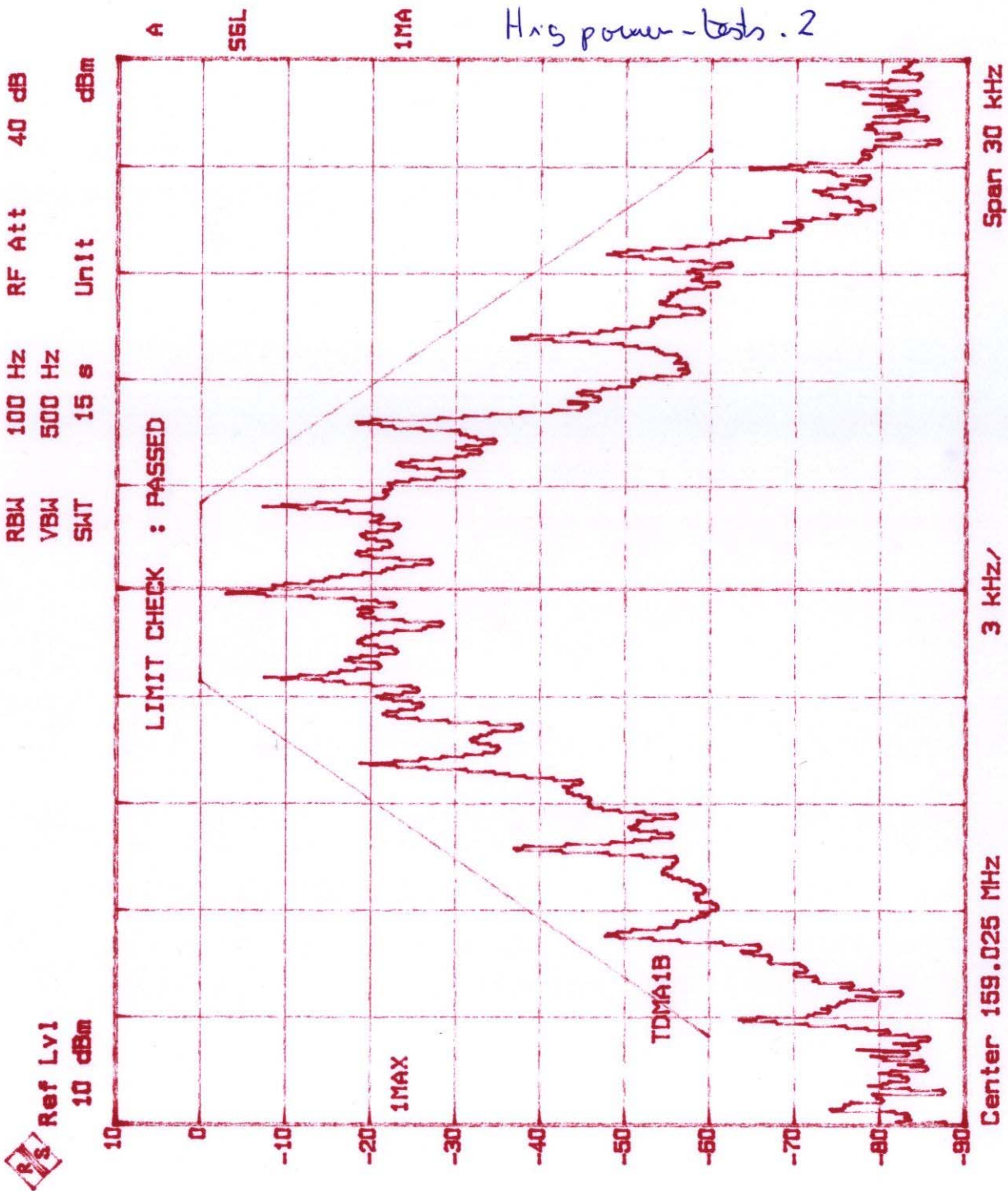
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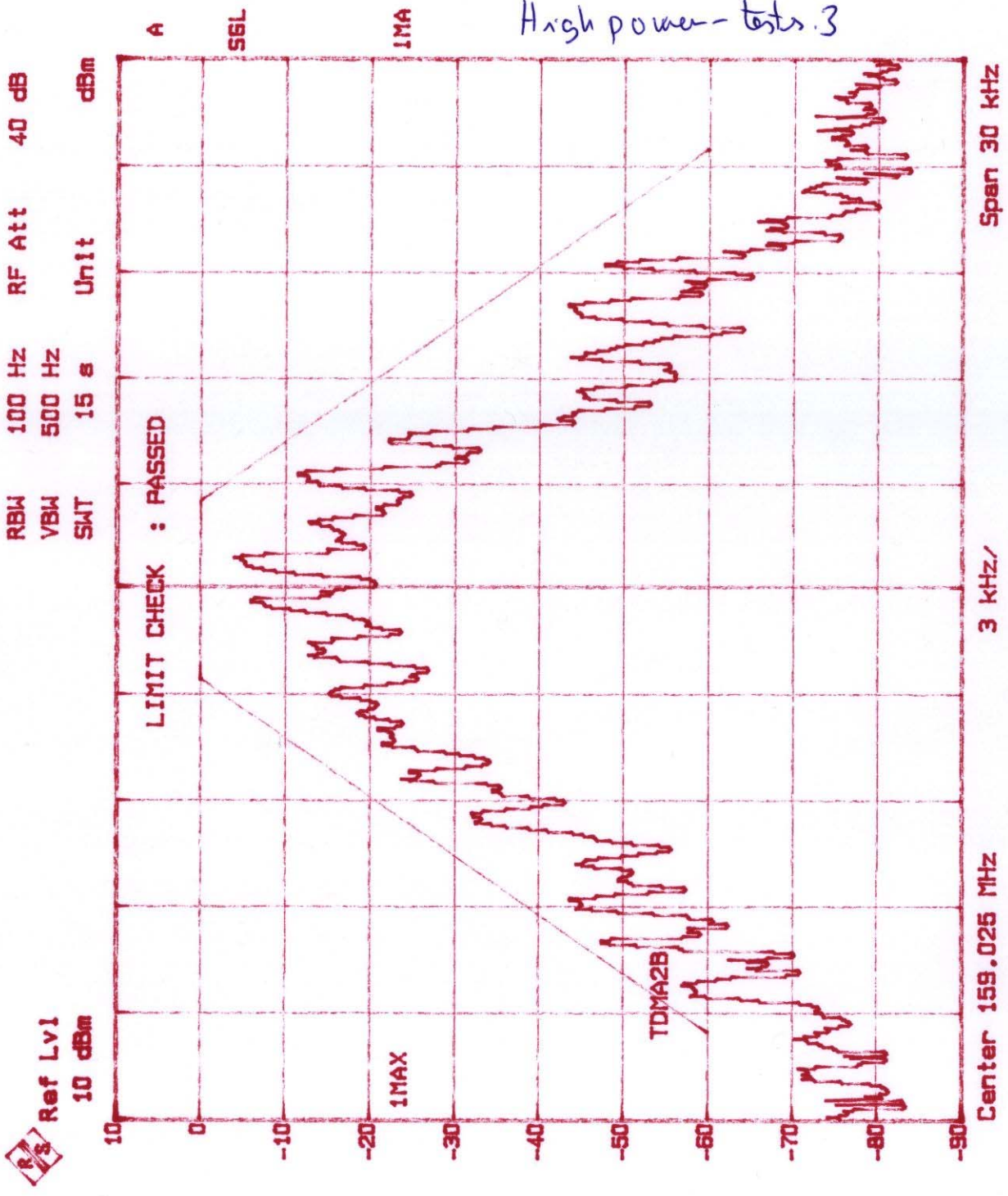
Date: 15.JAN.2004 19:41:35





Date: 15.JAN.2004 19:56:19

High power - tests.3



Date: 15.JAN.2004 20:01:16

