

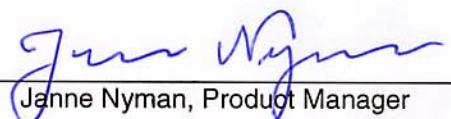
Date: ESPOO 28.02.2001Page: 1 (13)Appendices -Number:
No. 1 / 3**1010750****T017 (EN 45001)**Date of handing in: 06.02.2001

Tested by:



Timo Leismala, Test Engineer

Reviewed by:



Janne Nyman, Product Manager

SORT OF EQUIPMENT:

Radio modem

MARKETING NAME:

SATELLINE-3ASd Epic

TYPE:

SATELLINE-3ASd/125/10W/DIV

MANUFACTURER:

SATEL Oy, Finland

SERIAL NUMBER:

0102079 and 0103101

CLIENT:

SATEL Oy, Finland

ADDRESS:

Meriniitynkatu 17, FIN-24100 Salo

TELEPHONE:

+ 358 2 777 7891

TEST SPECIFICATION:

EN 300 279 (1999)**SUMMARY:**

In regard to the performed tests the EUT fulfils the requirements defined in the test specification EN 300 279 (1999), see page 2 for details.

The test results are valid for the tested unit only. Without a written permission of EMCEC Oy it is allowed to copy this report as a whole, but not partially.

Summary of performed tests and test results

Immunity tests according to the test specification EN 300 279 (1999)

| Immunity test | Test method | Conclusion |
|--|---------------------|--------------------|
| Radiated radio-frequency electromagnetic field | EN 61000-4-3 (1996) | Pass |
| Radiated radio-frequency electromagnetic field (GSM) | ENV 50204 (1995) | Pass ¹⁾ |
| Electrostatic discharge (ESD) | EN 61000-4-2 (1995) | Pass |
| Transients and surges in vehicular environment | ISO 7637-2 (1990) | Pass |

¹⁾ Additional test

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1. General

The equipment under test (EUT) was a Radio modem. The purpose of the performed tests was to see if in regard to these tests the EUT fulfils the EMC requirements defined in the EC Council Directive 89/336/EEC. The tests were performed according to the test specification EN 300 279 (1999) by using accredited test methods.

2. System Configuration

2.1 Test set-up

Equipment under test (EUT):

- Radio modem, type SATELLINE-3ASd/125/10W/DIV, S/N: 0102079. This unit is a transceiver and during the test it was used as a transmitter.
- Radio modem, type SATELLINE-3ASd/125/10W/DIV, S/N: 0103101. This unit is a transceiver and during the test it was used as a receiver.

Cables:

- DC power input cable of the 'transmitter unit', unshielded, 2.0 m in length ¹⁾
- DC power input cable of the 'receiver unit', unshielded, 2.0 m in length ¹⁾
- RS-232 serial cable, connected from a control computer to the radio modem ('transmitter unit'), unshielded, 2.0 m in length
- RS-232 serial cable, connected from the radio modem ('receiver unit') to a monitoring computer, unshielded, 2.0 m in length

¹⁾ The length was 0.5 m in the transients and surges in vehicular environment immunity test.

Peripheral devices:

- Two separate car batteries connected in series, used as a 24 V DC power supply, model Biltema
- Control computer, model Olivetti Pentium 100 MHz
- Monitoring computer, model Hewlett-Packard

Operating voltage of the EUT:

- 24 V DC

2.2 Operating conditions and monitoring of the EUT

For the duration of the tests the EUT was set to a continuous communications mode of operation. A control program 'Saterm' was used in the control computer. The radio modem ('transmitter unit') was set to send a test message continuously. The monitoring computer was monitoring the messages from the receiving radio modem. The TX power of the transmitter unit was set to its maximum value, i.e. 10W.

When testing the communications mode, the monitoring was performed visually by watching the display of the monitoring computer. When testing the standby mode of operation, the monitoring was performed visually by watching the display of a monitoring spectrum analyzer. The spectrum analyzer was set to maxhold mode in order to be able to see potential unintentional responses of the transmitter.

2.3 Performance criteria for immunity tests

Performance criteria for Continuous phenomena applied to Transmitters (CT):

The EUT shall continue to operate as intended during and after the test. No degradation of performance is allowed. No unintentional responses are allowed. If at least four error-free symbols out of five is received correctly, the performance is considered non-degraded. The communications link shall be maintained during the test.

Performance criteria for Transient phenomena applied to Transmitters (TT):

The EUT shall continue to operate as intended after the test. Moderate degradation of performance is allowed. No unintentional responses are allowed. The communications link shall be maintained during the test.

Performance criteria for Continuous phenomena applied to Receivers (CR):

The EUT shall continue to operate as intended during and after the test. No degradation of performance is allowed. No unintentional responses are allowed. If at least four error-free symbols out of five is received correctly, the performance is considered non-degraded. The communications link shall be maintained during the test.

Performance criteria for Transient phenomena applied to Receivers (TR):

The EUT shall continue to operate as intended after the test. Moderate degradation of performance is allowed. No unintentional responses are allowed. The communications link shall be maintained during the test.

2.4 Transmitter and receiver exclusion bands

Exclusion band of the transmitter:

- 424.975 MHz – 425.025 MHz

Exclusion band of the receiver:

- 403.75 MHz – 446.25 MHz

3. Test procedures

3.1 Immunity tests

3.1.1 Radiated radio-frequency electromagnetic field immunity test

The test was performed as a compliance test. The test parameters concerned were as follows:

| Parameter | Specification |
|-----------------------|--|
| Test method | EN 61000-4-3 (1996) |
| Frequency range | 80 - 1000 MHz |
| Modulation | AM 80% 400 Hz |
| Sweep | Step: 1 %, Time/step: 3 s |
| Test level | 3 V/m |
| Performance criterion | CT, CR |
| Site name | EMCEC Oy / Perkkaa |
| Date of testing | 26.02.2001 |
| Test equipment | 176, 184, 201, 291, 292, 293, 317, 340, 428, 431, 432, 433 |
| Test conditions | 22 °C, 30 % RH |

The test was carried out in an absorber-lined shielded room (see photographs 1 and 2). The EUT was placed on a non-conductive turntable 1 m above the floor absorbers. The distance between the transmitting bilog antenna and the EUT was 2.65 m measured from the tip of the antenna. The test was performed with the field generating antenna facing one of the four sides of the EUT. Both vertical and horizontal polarizations were tested. The field strength was checked with a calibrated field sensor. The uniformity of field has been calibrated.

3.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test

The test was performed as a compliance test. The test parameters concerned were as follows:

| Parameter | Specification |
|-----------------------|--|
| Test method | ENV 50204 (1995) |
| Frequency range | 900 ± 5 MHz |
| Modulation | Keyed carrier, repetition frequency 200 Hz, duty cycle 50% |
| Sweep | Step: 1 %, Time/step: 3 s |
| Test level | 3 V/m |
| Performance criterion | CT, CR |
| Site name | EMCEC Oy / Perkkaa |
| Date of testing | 26.02.2001 |
| Test equipment | 176, 184, 201, 291, 292, 293, 317, 340, 428, 431, 432, 433 |
| Test conditions | 22 °C, 30 % RH |

The test was carried out in an absorber-lined shielded room (see photographs 1 and 2). The EUT was placed on a non-conductive turntable 1 m above the floor absorbers. The distance between the transmitting bilog antenna and the EUT was 2.65 m measured from the tip of the antenna. The test was performed with the field generating antenna facing one of the four sides of the EUT. Both vertical and horizontal polarizations were tested. The field strength was checked with a calibrated field sensor. The uniformity of field has been calibrated.

3.1.3 Electrostatic discharge (ESD) immunity test

The test was performed as a compliance test. The test parameters concerned were as follows:

| Parameter | Specification |
|-----------------------|---|
| Test method | EN 61000-4-2 (1995) |
| Test level | <i>Contact discharge:</i> ± 2 and ± 4 kVp <i>Air discharge:</i> ± 2, ± 4 and ± 8 kVp |
| Performance criterion | TT, TR |
| Site name | EMCEC Oy / Perkkaa |
| Date of testing | 21.02.2001 |
| Test equipment | 184, 348, 405, 406, 409 |
| Test conditions | 21 °C, 31 % RH |

The test was carried out inside a shielded room. A non-conductive table was placed on the reference ground plane (RGP). A horizontal coupling plane (HCP) was placed on the non-conductive table 0.8 m high. The EUT was placed on the table. PVC sheets were used to prevent the conductive parts of the EUT touch the HCP. Indirect contact discharges were applied on the EUT by discharging to a vertical coupling plane (VCP, see photographs 3 and 4) and HCP (see photographs 5 and 6). Air discharges were applied on the non-conductive parts of the EUT. At least 10 discharges of both polarities were applied on each test point at each test level.

3.1.4 Transients and surges in vehicular environment immunity test

The test was performed as a compliance test. The test parameters concerned were as follows:

| Parameter | Specification |
|-----------------------|---|
| Test method | ISO 7637-2 (1990) |
| Test pulse | 1a: 10 pulses, cycle time 2.5 s 1b: 10 pulses, cycle time 2.5 s 2: 10 pulses, cycle time 2.5 s 3a: duration 5 min, cycle time 100ms 3b: duration 5 min, cycle time 100ms 4: 25 ms (t_{g}) / 5 s (t_{g}), five pulses |
| Test level | Pulse 1a: -100 V (level 2) Pulse 1b: -550 V (level 2) Pulse 2: +50 V (level 2) Pulse 3a: -70 V (level 2) Pulse 3b: +70 V (level 2) Pulse 4: -10 V / -5 V (EN 300 279 specified test level) |
| Performance criterion | B |
| Site name | EMCEC Oy / Perkkaa |
| Date of testing | 1.3.2001 |
| Test equipment | 184, 347, 348 |
| Test conditions | 22 °C, 30 % RH |

The test was carried out inside a shielded room. The EUT was placed on a non-conductive support 0.8 m above the RGP. The untwisted cable between the test generator and the EUT was 0.5 m in length (see photographs 7 and 8).

4. Test results

4.1 Immunity tests

4.1.1 Radiated radio-frequency electromagnetic field immunity test

| Polarisation | Frequency MHz | Test level V/m | Remarks | Conclusion Pass/Fail |
|--------------|------------------|-------------------|---------|-------------------------|
| Vertical | 80 – 1000 | 3 | – | Pass |
| Horizontal | 80 – 1000 | 3 | – | Pass |

4.1.2 Radiated radio-frequency electromagnetic field (GSM) immunity test

| Polarisation | Frequency MHz | Test level V/m | Remarks | Conclusion Pass/Fail |
|--------------|------------------|-------------------|---------|-------------------------|
| Vertical | 890 – 960 | 3 | – | Pass |
| Horizontal | 890 – 960 | 3 | – | Pass |

4.1.3 Electrostatic discharge (ESD) immunity test

| Discharge mode | Test points | Test level kVp | Remarks | Conclusion Pass/Fail |
|------------------|------------------------------------|-------------------|---------|-------------------------|
| Indirect contact | VCP and HCP | ±2 and ±4 | – | Pass |
| Direct contact | VCP and HCP | ±2 and ±4 | – | Pass |
| Air | Non-conductive parts of the EUT | ±2, ±4 and ±8 | – | Pass |

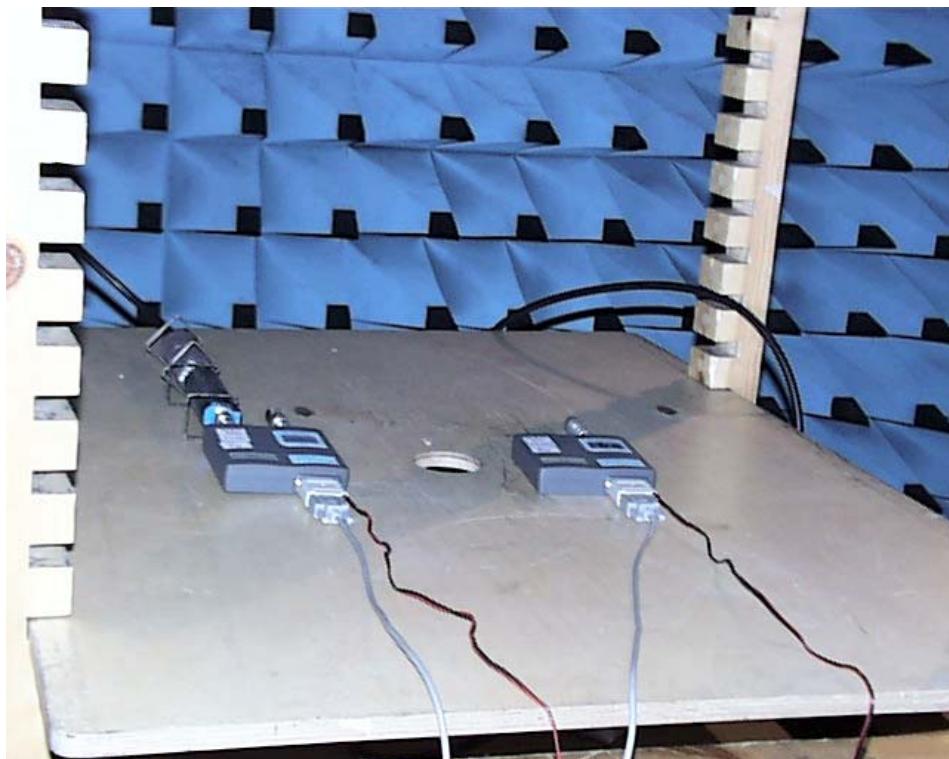
4.1.4 Transients and surges in vehicular environment immunity test

| Port | Pulse | Remarks | Conclusion Pass/Fail |
|----------------|-------|---------|-------------------------|
| DC power input | 1a | – | Pass |
| | 1b | – | Pass |
| | 2 | – | Pass |
| | 3a | – | Pass |
| | 3b | – | Pass |
| | 4 | – | Pass |

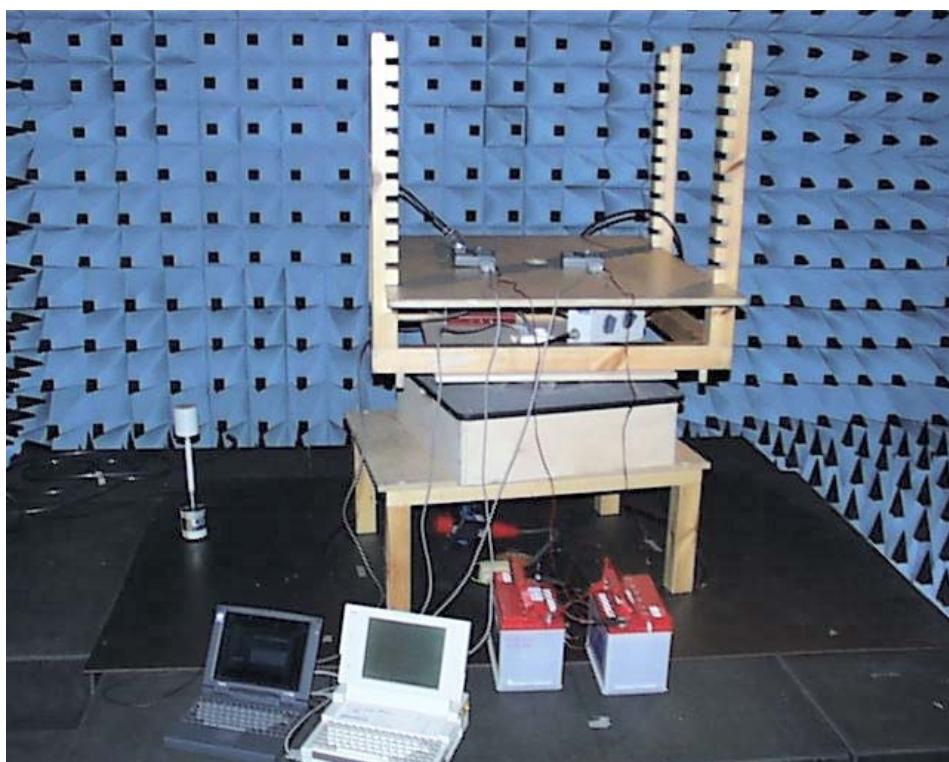
5. List of test equipment

| No. | Equipment | Type | Manufacturer | Serial Number |
|-----|-----------------------------|---------------|--------------------|---------------|
| 3 | Test receiver | ESH-2 | Rohde & Schwarz | 871544/061 |
| 5 | Test receiver | ESH-3 | Rohde & Schwarz | 894718/015 |
| 6 | Test receiver | ESVP | Rohde & Schwarz | 861743/022 |
| 165 | Spectrum monitor | EZM | Rohde & Schwarz | 862065/011 |
| 338 | Test receiver | ESS | Rohde & Schwarz | 847151/009 |
| 9 | Modulation analyzer | 8901B | Hewlett Packard | 2718A01220 |
| 45 | Spectrum analyzer | FSBS | Rohde & Schwarz | 862563/010 |
| 38 | RF generator | SMG | Rohde & Schwarz | 883590/035 |
| 201 | RF generator | 2042 | Marconi | 119571/062 |
| 317 | RF generator | 2052 | Marconi | 119754/058 |
| 351 | RF generator | SMT 06 | Rohde & Schwarz | 845715/001 |
| 199 | RF amplifier | ZHL-1042J | Mini-Circuits | 012288-10 |
| 205 | RF amplifier | ZHL-1042J | Mini-Circuits | 012288-11 |
| 61 | Audio amplifier | PRL 737 | Self made | |
| 340 | RF-power amplifier | 7100LC-CE | Kalmus | 7583B1 |
| 354 | RF power amplifier | AR 500W1000M7 | Amplifier Research | 20487 |
| 355 | RF power amplifier | LA100V - CE | Kalmus | 7809-1 |
| 366 | RF-amplifier | AR15A25 | Amplifier Research | 10783 |
| 397 | RF-amplifier | ZFL-2000 | Mini-Circuits | - |
| 89 | Antenna, logperiodic | 3147 | EMCO | 9202-1078 |
| 90 | Antenna, biconical | 3109 | EMCO | 9109-2582 |
| 188 | Antenna, bilog | CBL 6111 | Chase | 1028 |
| 319 | Antenna | CBL6112 | Chase | 2018 |
| 352 | Antenna | 3142 | EMCO | 9701-1122 |
| 417 | Antenna, bilog | CBL 6141 | Chase | 4028 |
| 167 | Artificial mains network | NSLK 8126 | Schwartzbeck | 8126101 |
| 168 | Artificial mains network | NSLK 8127 | Schwartzbeck | 8127162 |
| 184 | Temp. & humidity meter | HMI 32 | Vaisala | 63837 |
| 291 | Field sensor | BA05 | | |
| 292 | Optical repeater | ORO1 | | |
| 293 | Isotropic field meter | PMM 8051 | | |
| 308 | Internet advisor | J2300A | Hewlett Packard | 3530A00685 |
| 10 | Oscilloscope | 9400A | LeCroy | 8878 |
| 102 | Hybrid | H 9 | Anzac | |
| 413 | Decoupling clamp | FGZ 40X15 C | Lüthi | 4562 |
| 193 | ESD generator | NSG435 | Schaffner | 316 |
| 405 | Horizontal coupling plane | HCP1 | Self made | - |
| 406 | Vertical coupling plate | VCP1 | Self made | - |
| 409 | ESD generator | NSG435 | Schaffner | 2288 |
| 362 | Power supply | B32-20R | Oltronix | 653 |
| 327 | Power attenuator | 765-20 | Narda | - |
| 392 | RF attenuator PAD | 1A (6dB) | Weinschel | |
| 395 | RF attenuator PAD | 757 C - 10 dB | Narda | |
| 347 | Automotive test system | NSG5000 | Shaffner | EK3396-021 |
| 294 | DCN-network | 801-M2/M3 | Lüthi GmbH | |
| 299 | RF injection clamp | EM 100 | Lüthi GmbH | - |
| 326 | Power attenuator | 765-6 | Narda | - |
| 428 | Directional coupler | RK 100 | MEB | 13703 |
| 431 | Power meter | NRVD | Rohde & Schwarz | 826224/047 |
| 432 | Voltage probe | URV5-Z2 | Rohde & Schwarz | 826853/030 |
| 433 | Voltage probe | UVR5-Z2 | Rohde & Schwarz | 826853/029 |
| 176 | Anechoic chamber | RFD-60 | Euroshield Oy | 509 |
| 348 | Shielded room | RFSD-100 | Euroshield Oy | 1320 |
| 349 | Shielded room | RFSD-100 | Euroshield Oy | 1319 |
| 350 | Semi-anechoic shielded room | RFD-F-100 | Euroshield Oy | 1327 |

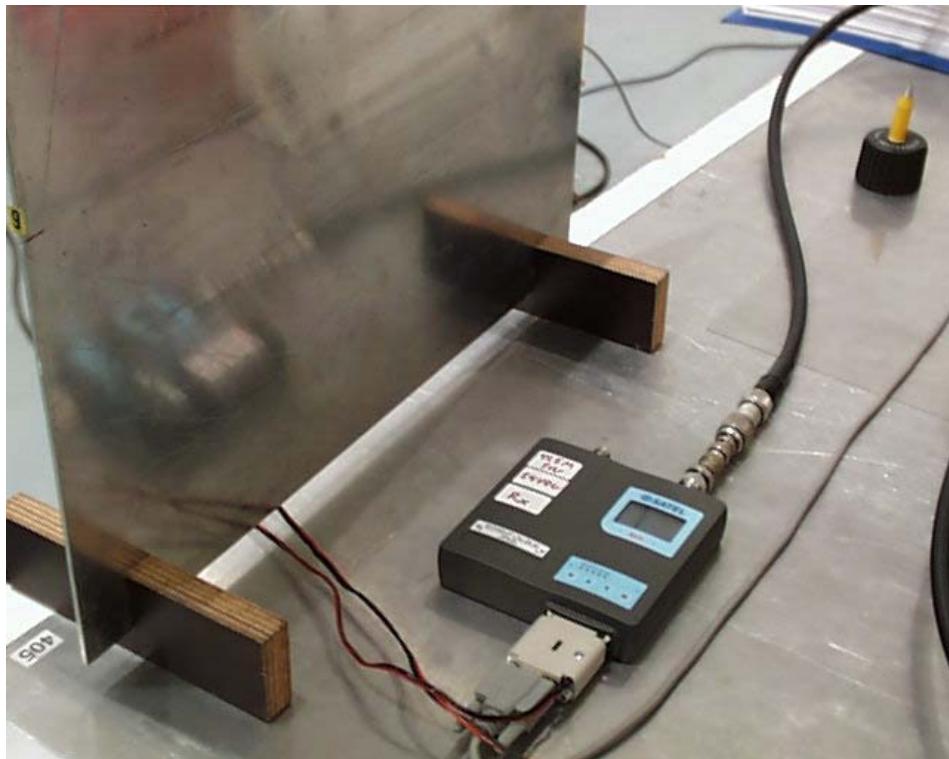
6. Photographs



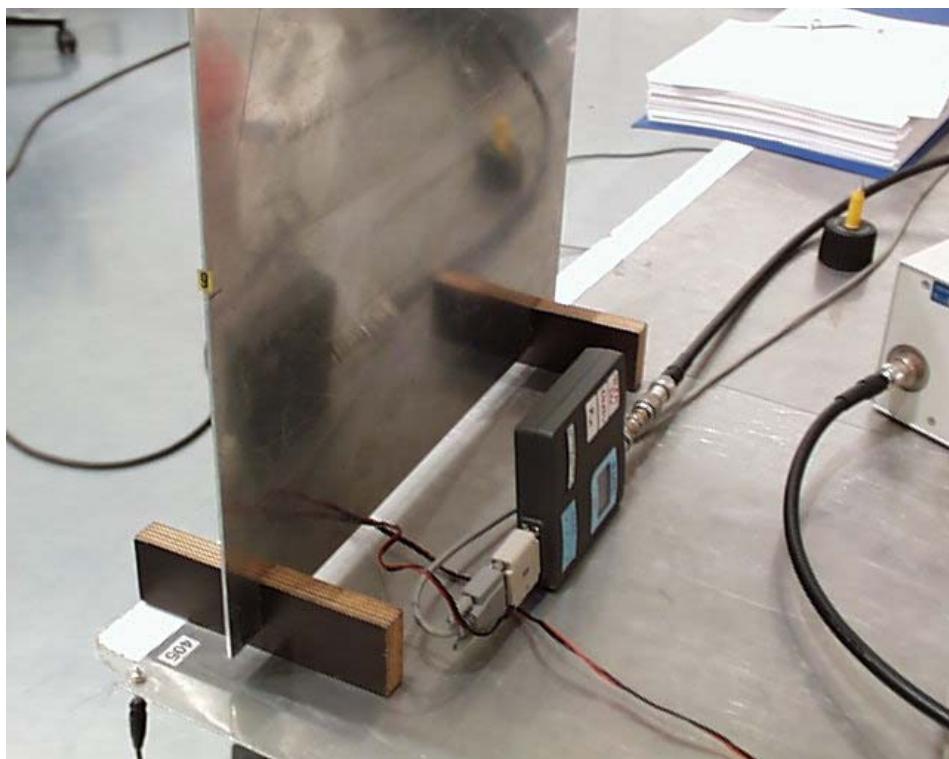
Photograph 1. Radiated radio-frequency electromagnetic field (also GSM) immunity test.



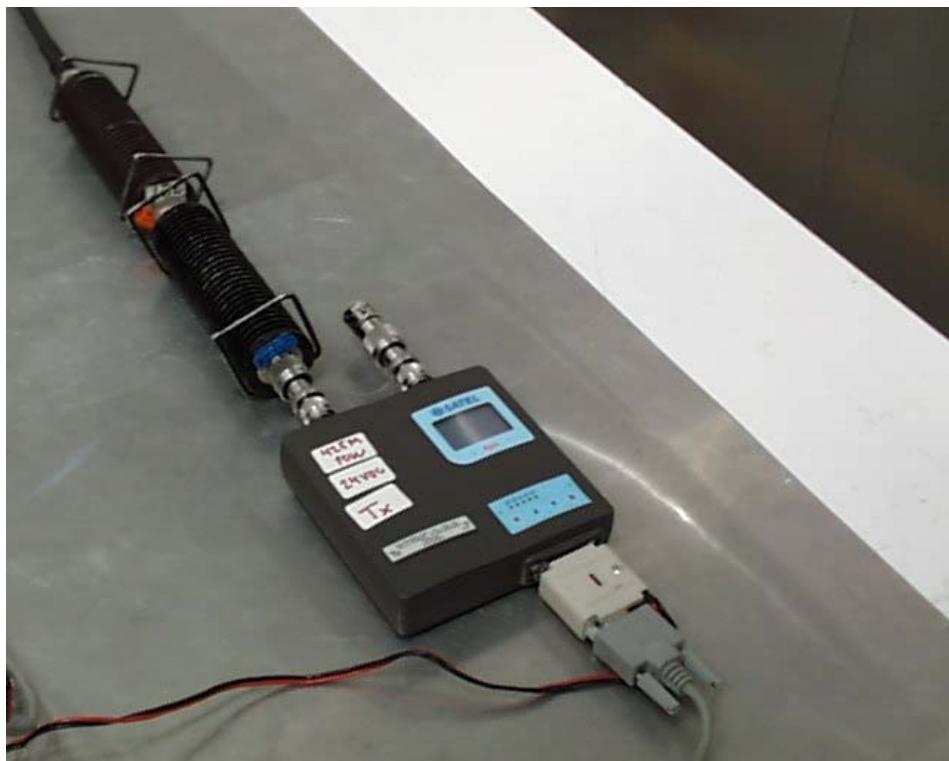
Photograph 2. Radiated radio-frequency electromagnetic field (also GSM) immunity test.



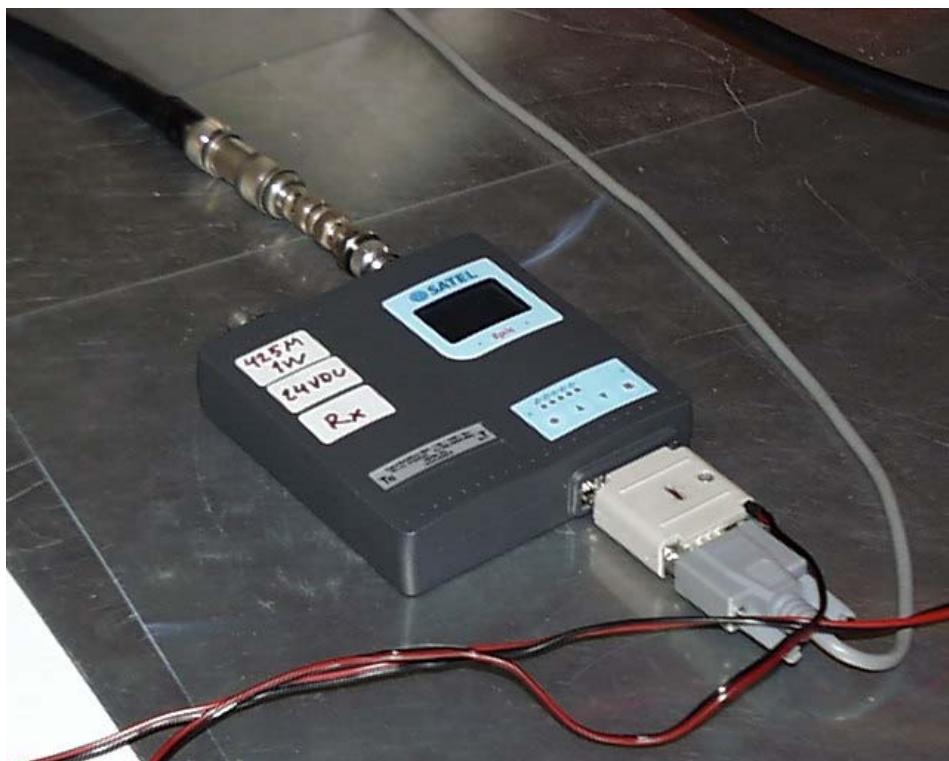
Photograph 3. Electrostatic discharge immunity test.



Photograph 4. Electrostatic discharge immunity test.



Photograph 5. Electrostatic discharge immunity test.



Photograph 6. Electrostatic discharge immunity test.



Photograph 7. Transients and surges in vehicular environment immunity test.



Photograph 8. Transients and surges in vehicular environment immunity test.