5.3 *Induced signal susceptibility*

(According to RTCA DO 160 C – Section 19 – Category Z)

5.3.1 Magnetic field induced into the equipment

The equipment powered and operating in its functional mode defined chapter 3 must not exhibit malfunction, degradation of performances or deviation beyond tolerances when subjected to an induced magnetic field.

The field which is generated by the current specified below, in a straight wire radiator, which is within 0.15 m of the periphery of the unit of equipment under test.

- Current frequency : 400 Hz
- Current level : 20 Arms

- Test set-up

The equipment is placed on a reference ground plane.

The interconnecting wire bundles are spaced 50 mm above the ground plane with wood shims.

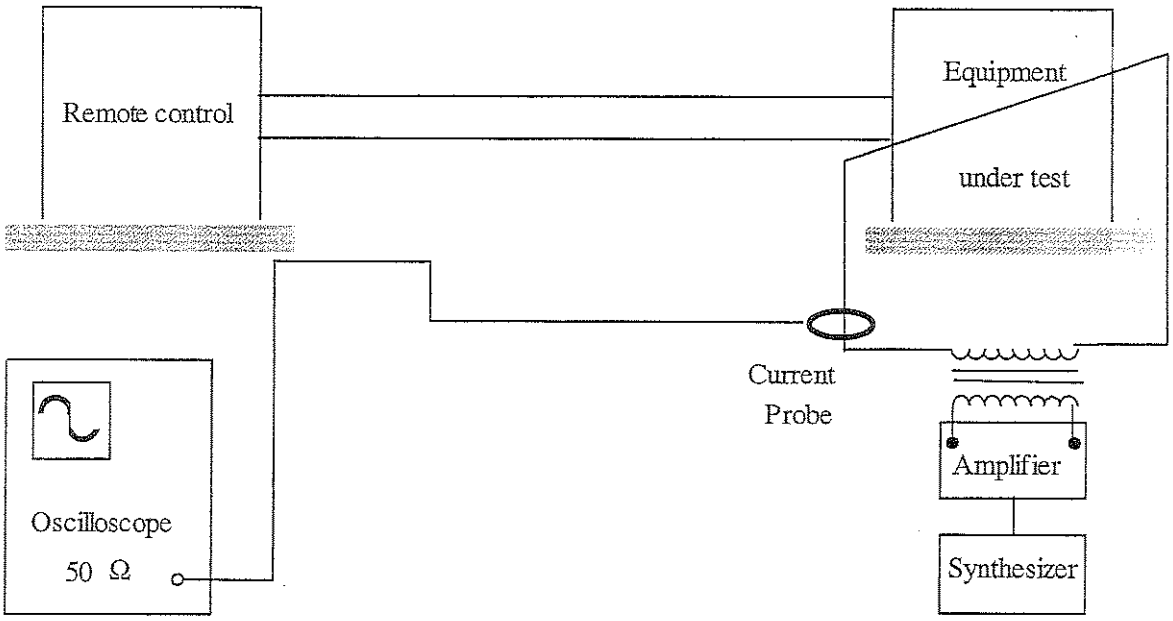
During this test, the radiator is oriented with respect to each external surface of each unit to cause maximum interference. The length of the radiator is extend a distance of at least 0.6 m (laterally) beyond each extremity of the unit under test. The leads applying current to the radiator is routed at least 0.6 m away from any part of the unit under test and from the radiator itself.

- Test results

The equipment is compliant.

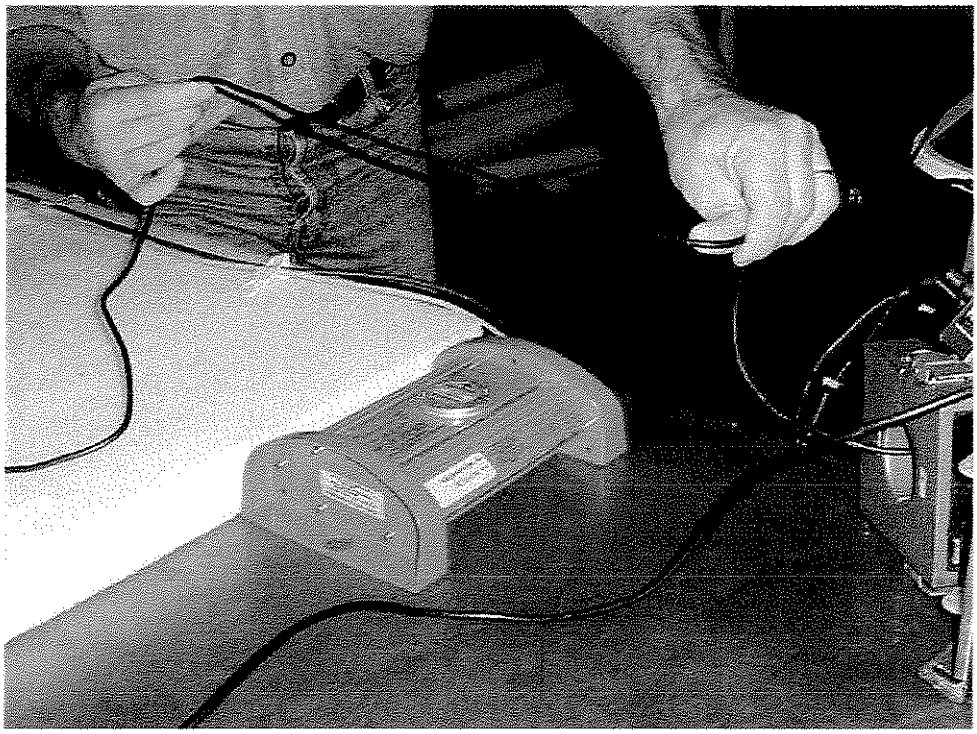
Figure 5.3.1.1

MAGNETIC FIELD INDUCED INTO THE EQUIPMENT



Picture 5.3.1.2

MAGNETIC FIELD INDUCED INTO THE EQUIPMENT



5.3.2 Magnetic field induced into interconnecting cables

The equipment powered and operating in its functional mode defined chapter 3 must not exhibit malfunction, degradation of performances or deviation beyond tolerances when the interconnecting wire bundles of the equipment are subjected to an audio frequency magnetic field.

- Magnetic field characteristics

  Category Z : I x L = 30 A x m at 400 Hz
  Reducing to 0.8 A x m at 15 kHz

- Test set-up

  The test set-up is performed according to Figure 5.3.2.1.

  The equipment is bonded on the reference ground plane.

  The interconnecting wire bundles are spaced 50 mm above the ground plane with wood shims.

  The disturbance wire is coupled with the interconnecting bundle along 3 m length cable.

  The minimum distance separation at each end is maintained at 15 cm.

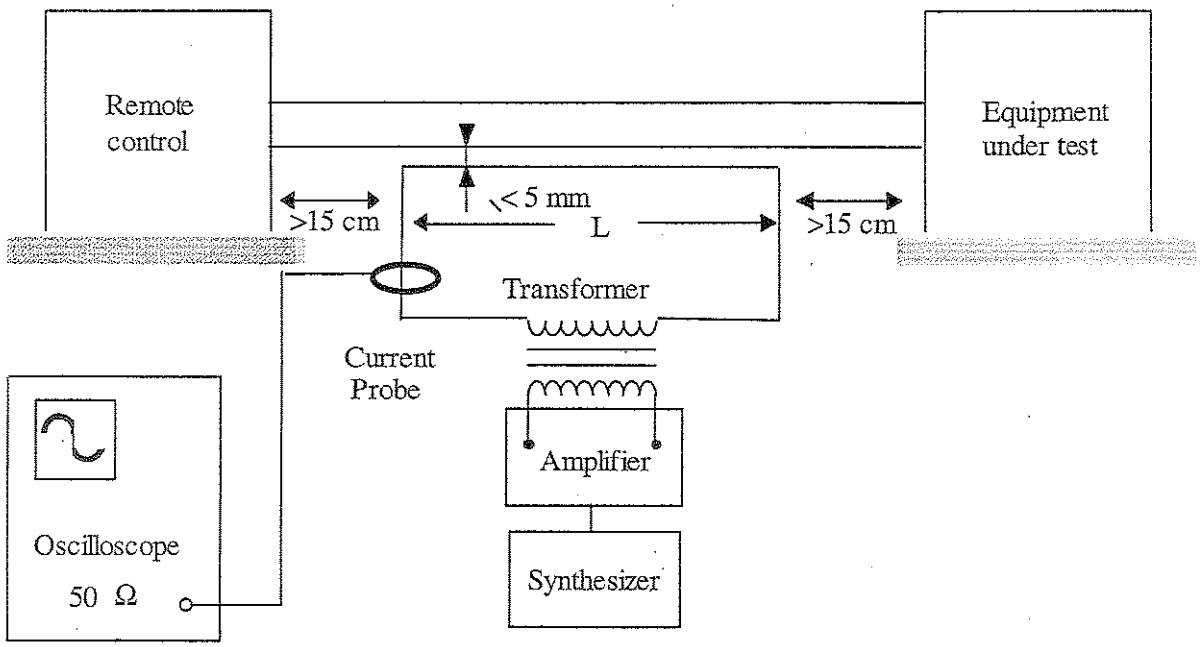
  A photography is given Picture 5.3.2.2.

- Test results

  The equipment is compliant.

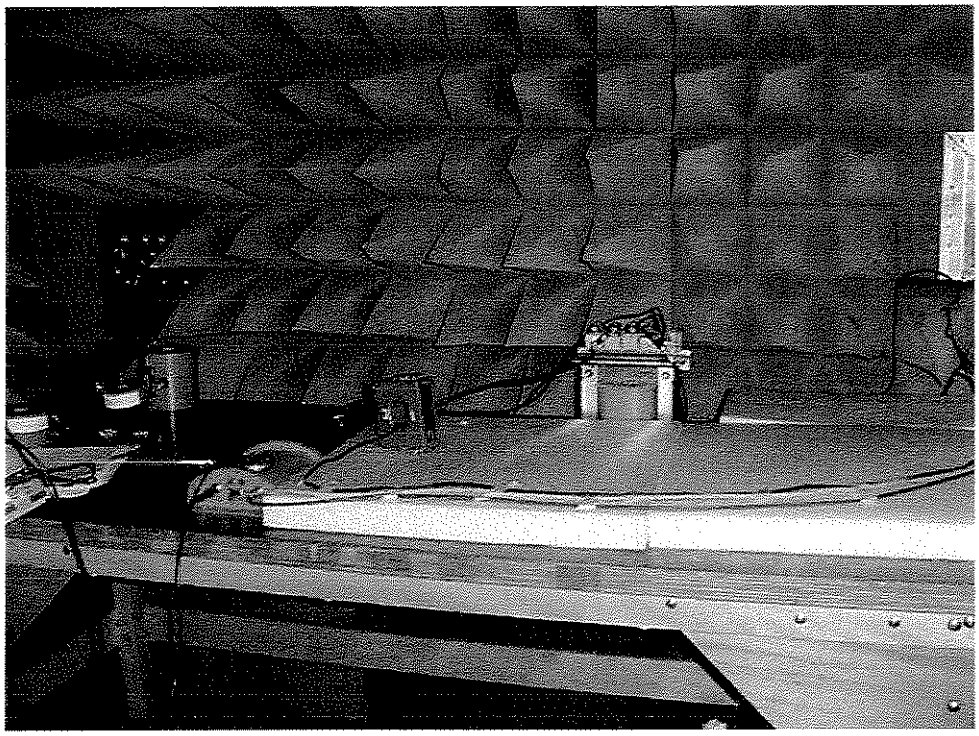
Figure 5.3.2.1

MAGNETIC FIELD INDUCED INTO INTERCONNECTING CABLES



Picture 5.3.2.2

MAGNETIC FIELD INDUCED INTO INTERCONNECTING CABLES



5.3.3 Electric field induced into interconnecting cables

The equipment powered and operating in its functional mode defined chapter 3 must not exhibit malfunction, degradation of performances or deviation beyond tolerances when the interconnecting wire bundles of the equipment are subjected to an audio frequency magnetic field.

- Electric field characteristics

  Category Z : V x L = 1800 V x m at 380 Hz to 420 Hz.

- Test set-up

  The test set-up is performed according to Figure 5.3.3.1.

  The equipment is bonded on the reference ground plane.

  The interconnecting wire bundles are spaced 50 mm above the ground plane with wood shims.

  The disturbance wire is coupled with the interconnecting bundle according to 3 spirals per meter along 3 m length cable.

  The minimum distance separation at each end is maintained at 15 cm.

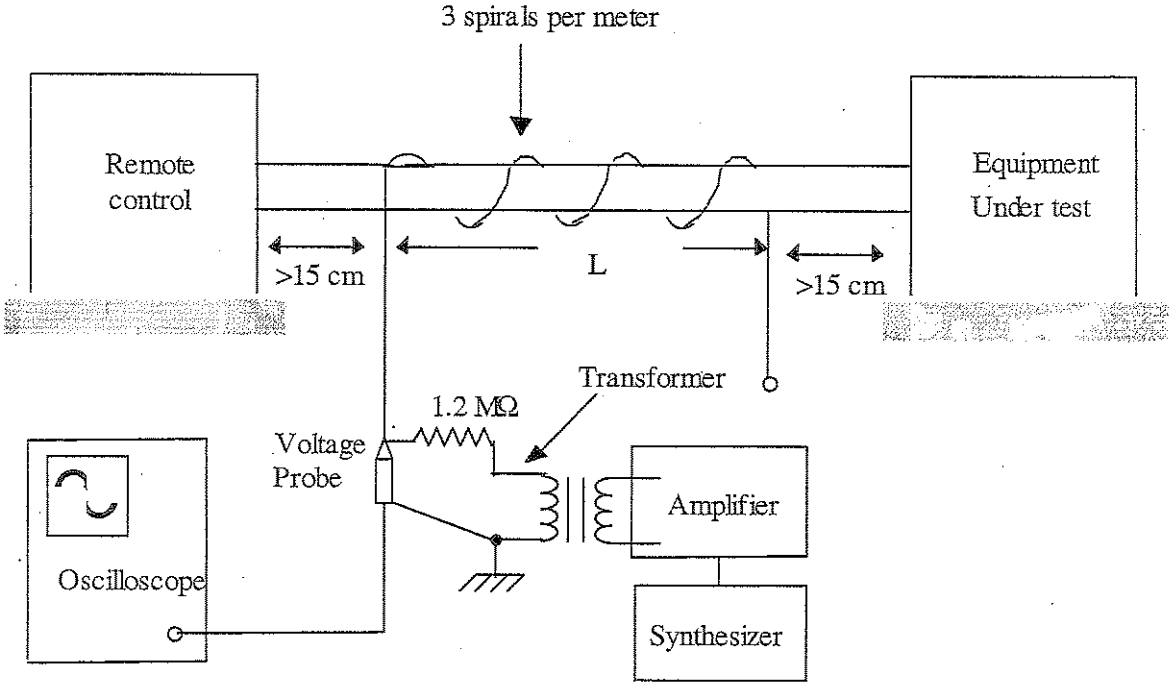
  A photography is given Picture 5.3.3.2.

- Test results

  The equipment is compliant.

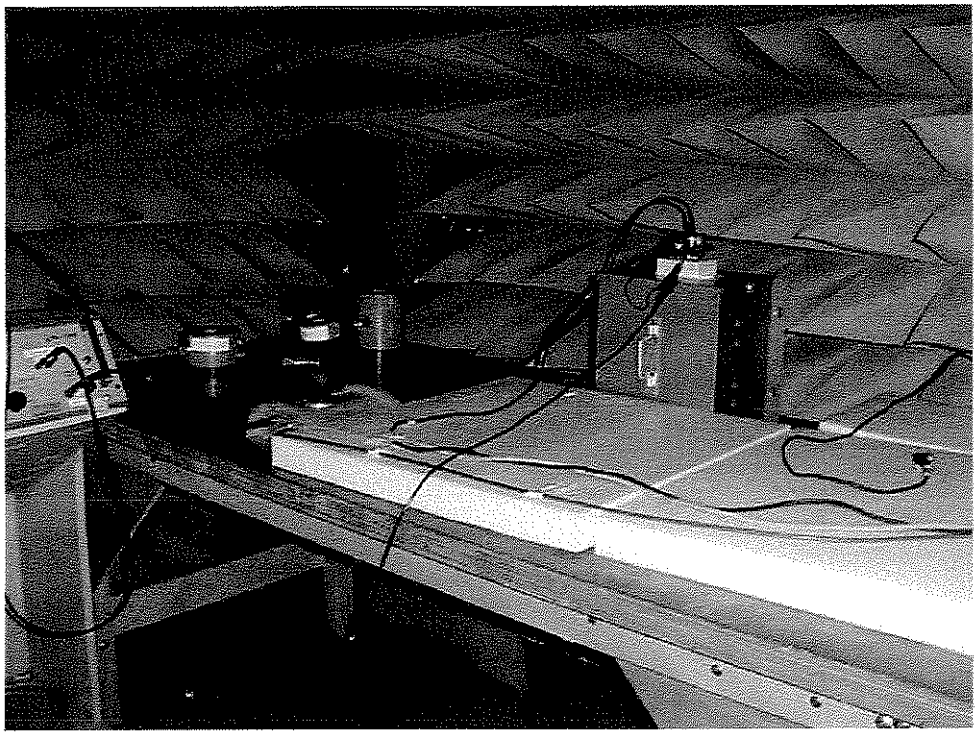
Figure 5.3.3.1

ELECTRIC FIELD INDUCED INTO INTERCONNECTING CABLES



Picture 5.3.3.2

ELECTRIC FIELD INDUCED INTO INTERCONNECTING CABLES



5.3.4 Spikes induced into interconnecting cables

The equipment powered and operating in its functional mode defined chapter 3 must not exhibit malfunction, degradation of performances or deviation beyond tolerances when the interconnecting wire bundles of the equipment are exposed to both positive and negative transient fields.

- Electric field characteristics

  - Amplitude ≈ 600 Vpp.
  - Transient waveform : Figure 5.3.4.3.
  - Repetition rate : ten pulses per second.
  - Test time duration : minimum 2 min for each polarity.

- Test set-up

  The test set-up is performed according to Figure 5.3.4.1.

  The equipment is bonded on the reference ground plane.

  The interconnecting wire bundles are spaced 50 mm above the ground plane with wood shims.

  The disturbance wire is coupled with the interconnecting bundle according to 3 spirals per meter along 3 m length cable.

  The minimum distance separation at each end is maintained at 15 cm.

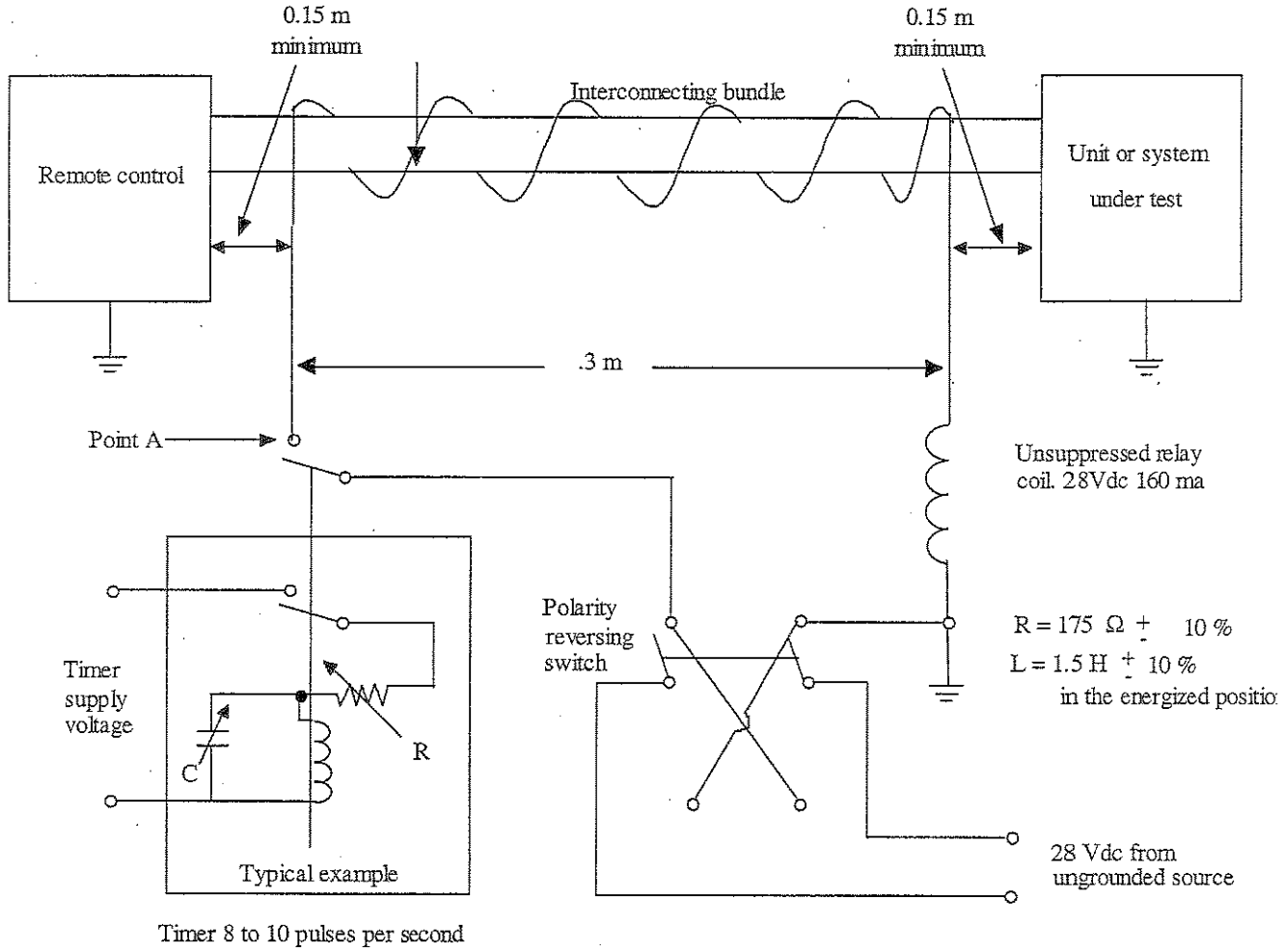
  A photography is given Picture 5.3.4.2.

- Test results

  The equipment is compliant.

Figure 5.3.4.1

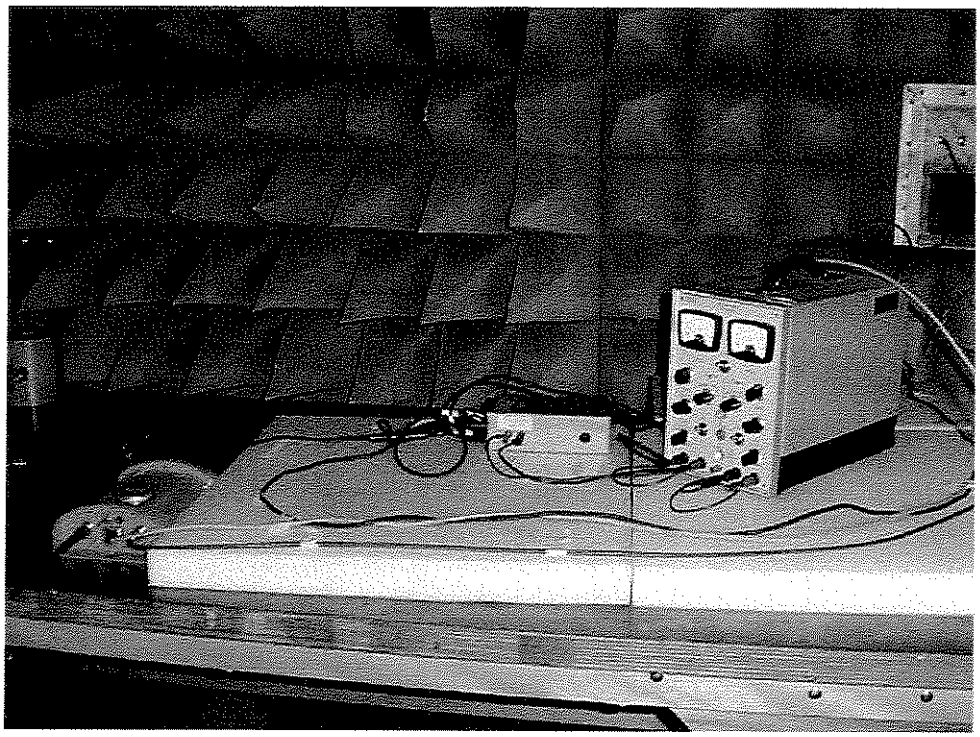
SPIKES INDUCED INTERCONNECTING CABLES – TEST SET-UP



Timer 8 to 10 pulses per second

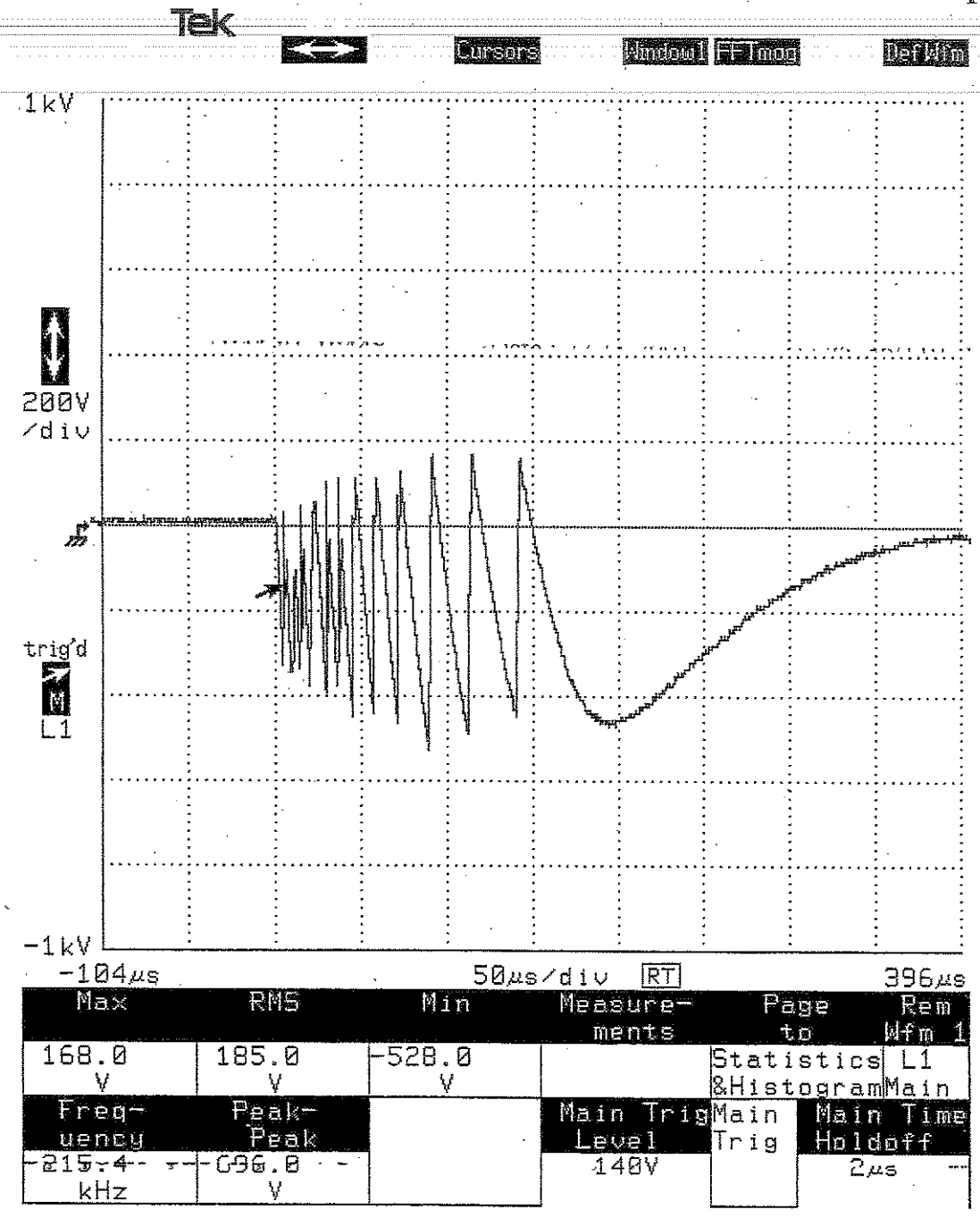
Picture 5.3.4.2

SPIKES INDUCED INTERCONNECTING CABLES – TEST SET-UP



DSA 602 DIGITIZING SIGNAL ANALYZER
date: 25-OCT-01 time: 10:06:37

Figure 5.3.4.3



Max	RMS	Min	Measure-ments	Page to	Rem Wfm 1
168.0 V	185.0 V	-528.0 V		Statistics &Histogram	L1 Main
Freq-uency	**Peak-Peak**		**Main Trig Level**	**Main Trig**	**Main Time Holdoff**
215.4 kHz	696.0 V		140V		2µs

5.3.5 Apparatus list

NoEmitech	Category	Marque	Type
1/05/12/012	Oscilloscope	Tektronix	DSA 602
1/05/12/014	Oscilloscope module	Tektronix	11A32
3/24/12/228	Current probe	Pearson Electonics	3525
4/01/00/010	Amplifier	Elgar	501 A
4/04/00/006	Generator	Wavetek	130
5/24/00/082	Transient box	Emitech	Boite sub transitoire
5/25/00/010	Transformer	Legrand	42757
5/25/00/012	Transformer	Emitech	T HT220v/..

5.4 Magnetic effect test

(According to RTCA DO 160 D – Section 15)

- Purpose of the test

This test determines the magnetic effect to the equipment.

With the equipment operating in its functional mode defined chapter 3 and oriented to produce the maximum magnet deflection, measure the distance between the magnet pivot and the nearest part of the equipment at which a deflection of 1 degree exists.

- Test set-up

Calibration

The compass is placed on a wood table distant of magnetic source. The table is oriented according to East / West axis of the magnet pivot.

Test

The equipment powered is placed on the table and correctly oriented. Moving the equipment, on East / West axis, first toward and then away from the compass.

The test set-up is performed according to Figure 5.4.1 and photography Picture 5.4.2.

- Apparatus list

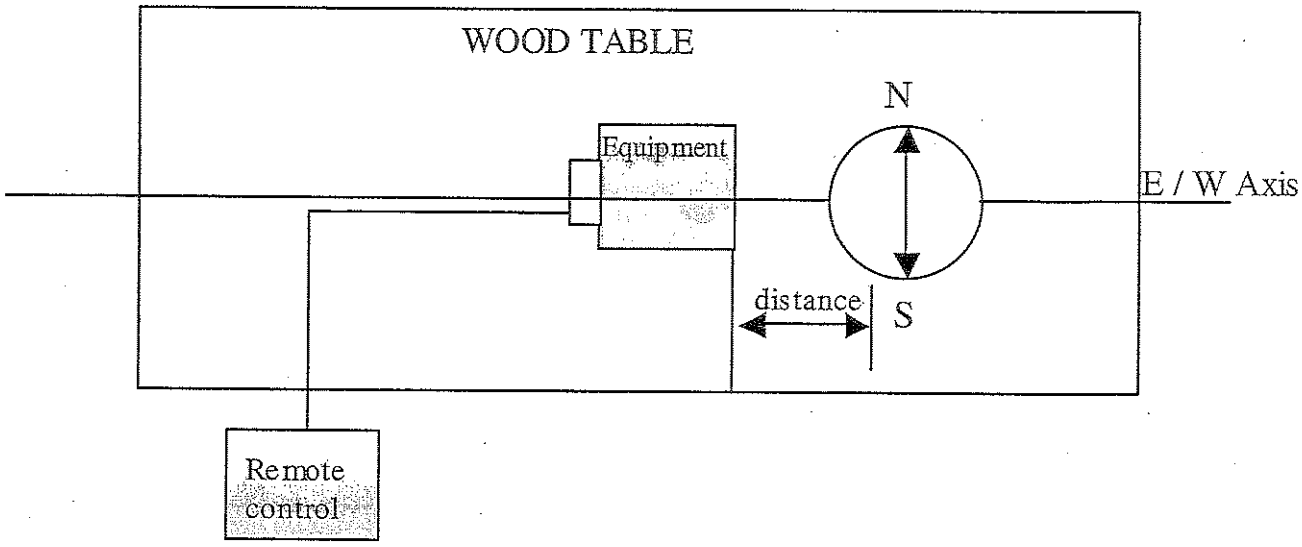
NoEmitech	Category	Marque	Type
5/24/00/039	Compass	Wilkie	-

- Test results

Mod	Deviation	Distance between the axis of the compass and the EUT
Armed	1°	17 cm
	2°	10.5 cm
Activated	1°	10.5 cm

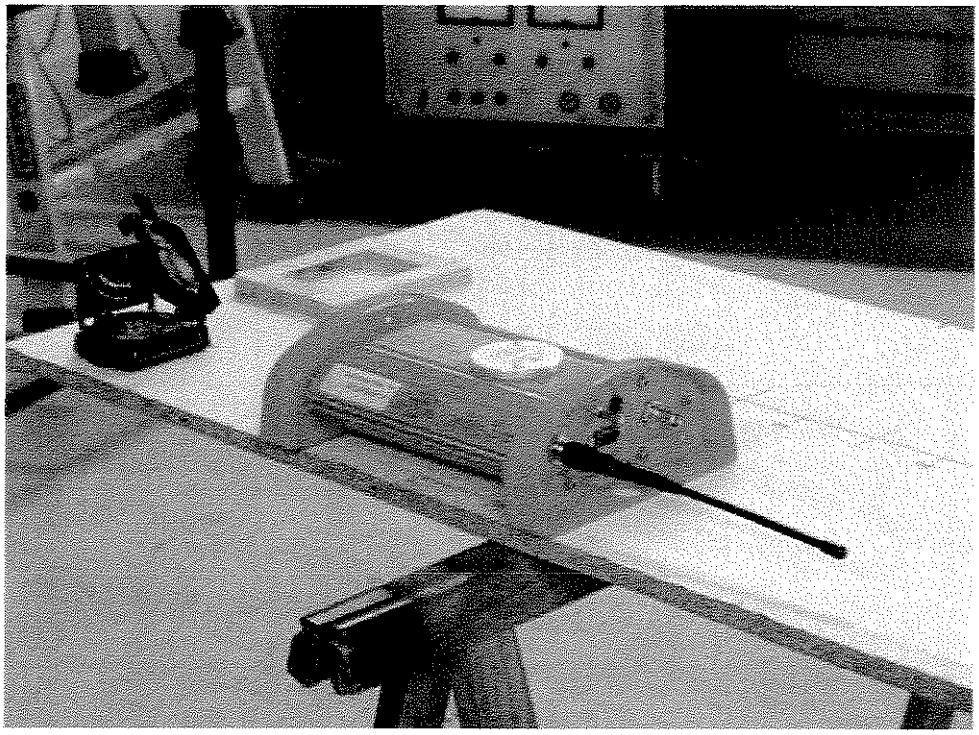
Figure 5.4.1

MAGNETIC EFFECT TEST SET-UP



Picture 5.4.2

MAGNETIC EFFECT TEST SET-UP



5.5 Radio frequency conducted susceptibility

(According to DO 160 D specification – Section 20 – Issue 1997 – Category W)

Bulk Current Injection

- Purpose of the test

This test determines whether equipment will operate within performance specifications when its interconnecting wiring is exposed to a RF conducted level.

The equipment powered and operating in its functional mode defined chapter 3 must not exhibit malfunction, degradation of performances or deviation beyond tolerances when the power lines and interconnecting cables are submitted to induced RF modulated signals.

- Frequency range

This test is performed from 10 kHz to 400 MHz frequency range.

- Test category : W

The category designates the RF test levels and establishes the equipment minimum RF susceptibility level.

The current level for the selected category is calibrated, before the injection, on a 50 Ω line.

The calibration determines, at each frequency, the necessary power to establish the specified current level on 50 Ω.

The power levels are after applied, through the injection probe onto the interconnecting wiring.

When necessary, adjust and control the forward power to limit induced current on the bundles to a maximum of 500 mA.

The current is controlled with a monitor probe clipped on the tested cable or wire.

The curve of specified calibrated current is given Figure 5.5.3.

The curve of associated power levels is given Figure 5.5.4 and Tables 5.5.5 (1 to 2).

- Modulation characteristics

  1) CW signal.
  2) Amplitude modulation with a squarewave of 91 % depth and 1 kHz frequency.

- Frequency range

  The test frequencies are logarithmically spaced according to 100 frequencies per decade.

  At each step, the specified level is established during 2 seconds and an equipment functional check is carried out.

- Test installation description

a) Calibration

The test set-up is given Figure 5.5.1.

The calibration fixture is bonded on the ground plane inside the shielded enclosure.

The injection probe is installed and centered on the 50 Ω loaded fixture.

b) Test installation

The test set-up is given Figure 5.5.2.

Test apparatus is installed outside the shielded enclosure.

The equipment is bonded on the ground plane according the EUT design and installation instructions.

All interconnecting cables and wires are spaced 5 cm above the ground plane with wood shims and run at a distance of 10 cm in parallel of the leading edge of the ground plane.

The LISN measurement outputs terminated with 50 ohms loads.

The induced current monitor probe is clipped on the tested wiring five centimeters four from the EUT. The injection probe is installed five centimeters four from the side of the monitor probe.

- Apparatus list

NoEmitech	Category	Marque	Type
1/02/18/019	Spectrum analyzer	Hewlett Packard	8566 A
2/04/24/025	Synthesizer	Fluke	6060 B
2/11/12/020	Milliwattmeter	Rohde & Schwarz	NRV
2/11/12/021	Power probe	Rohde & Schwarz	URV5-Z2
3/01/12/082	Amplifier	Prâna	AP32026
3/12/12/155	Attenuator	Narda	765-20
3/17/12/061	Coupler	Euro MC	1400-40-600
3/18/12/016	Attenuator	Delta Ohm	20 dB 100W
3/24/12/286	Current probe	FCC	F-51
4/04/00/022	Generator	Beckman	FG 3 A
4/24/00/133	Injection probe	FCC	F-130-1A
4/24/00/134	Injection probe	FCC	F-120-8A
4/34/00/061	Software	Emitech	BCIC4H1
4/34/00/062	Software	Emitech	BCIP4H1
5/18/00/100	50 Ohms load	Ferisol	S815A
5/24/00/038	Calibration fixture	FCC	BCICF-1
5/24/00/225	Calibration fixture	Emitech	Jig BF

- Test results

The injections are carried out in "Armed" mode.

Figure n°	Listings table n°	Modulation		Remark
		CW	AM	
5.5.6 5.5.7 5.5.8	5.5.9 (1 to 12)	✓		No susceptibility is detected
5.5.10 5.5.11 5.5.12	5.5.13 (1 to 12)		✓	No susceptibility is detected

Figure 5.5.1

CALIBRATION TEST SET-UP

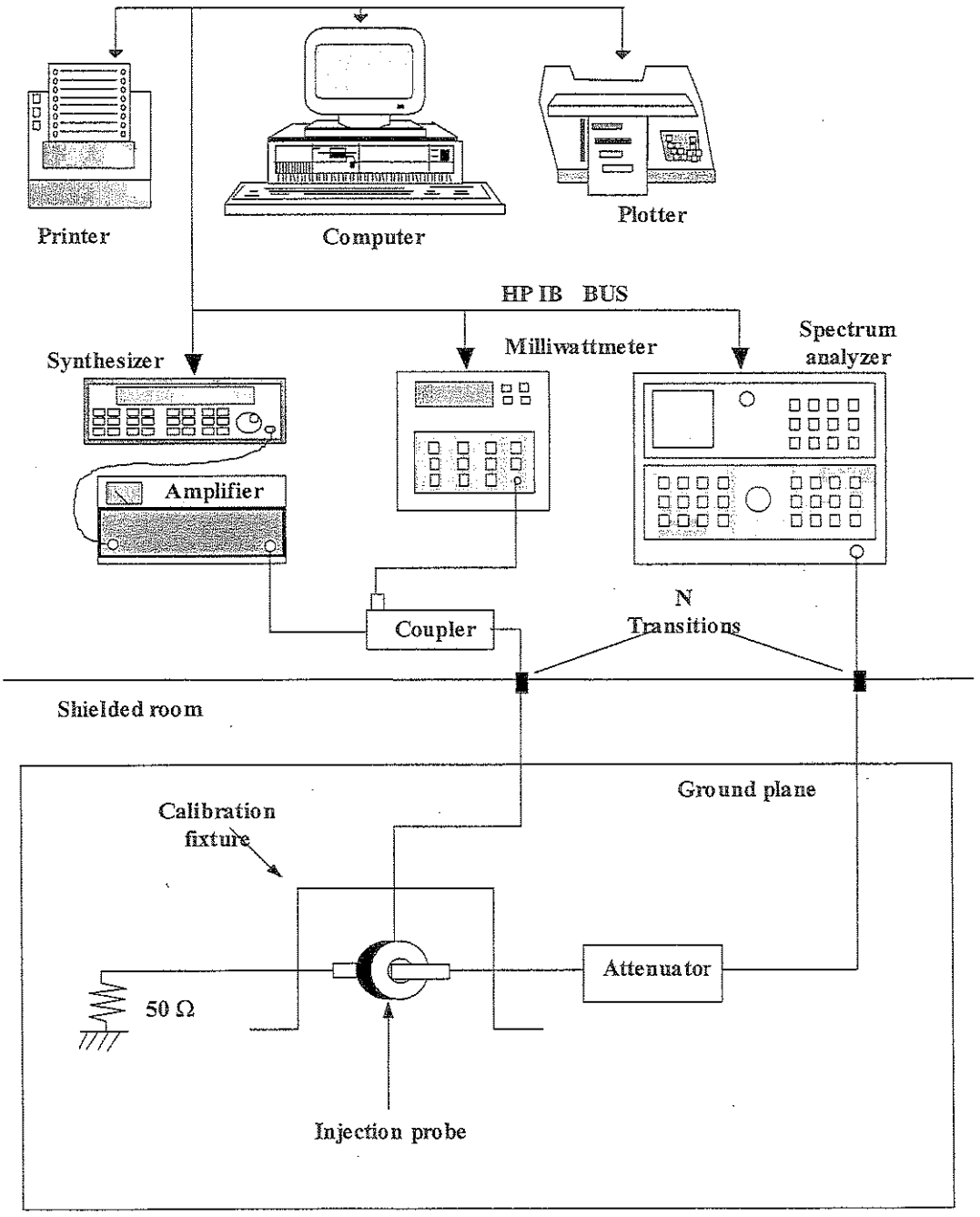


Figure 5.5.2

BULK CURRENT INJECTION TEST SET-UP