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**EMC TESTS ON THE  
 TST AGENCIES JET AIR  
 SYSTEM ACCORDING TO:  
 2004/104 EC AND  
 2004/108 EC**

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**ACRONYMS AND ABBREVIATIONS**

AVE	Average
C	Circular
CSIR	Council for Scientific and Industrial Research
E-Fields	Electric Fields
EFT	Electrical Fast Transients
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
EUT	Equipment Under Test
H	Horizontal
HCP	Horizontal Coupling Plane
NIST	National Institute of Science and Technology
OATS	Open Area Test Site
PC	Personal Computer
QP	Quasi-Peak
RF	Radio Frequency
SANAS	South African National Accreditation System
V	Vertical
VCP	Vertical Coupling Plane

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## 1. INTRODUCTION

The TST Agencies JET AIR SYSTEM, henceforth referred to as Equipment Under Test (**EUT**), was tested for compliance on the 09/12/2009 at the premises of ITC-Services (Pty) Ltd to the following specifications:

- SABS CISPR22: 1997 'Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement'
- Vehicle Directive 2004/104/EEC
  - Annex VIII: Narrowband and Broadband Radiated Emissions from Electrical Sub Assemblies
  - Annex IX : RF immunity
- IEC 61000-4-2 (2001): *Testing and measurement techniques – Electrostatic discharge immunity test*
- IEC 61000-4-3 (2003) :*Testing and measurement techniques –Radiated, radio-frequency, electromagnetic field immunity test*
- IEC 61000-4-4 (2004):*Testing and measurement techniques – Electrical Fast Transient / Burst*
- IEC 61000-4-5 (2002): *Testing and measurement techniques – Surge immunity test*
- IEC 61000-4-6 (2005): *Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
- CISPR 25 (2008): *Vehicles Boats and Internal Combustion Engines-Radio Disturbance Characteristics- Limits and Methods of measurement for the protection of On board Receivers*

## 2. TEST RESULT SUMMARY

CISPR 22 Radiated Emissions	Pass Class A
2004/104/EC Radiated Emissions	Pass
2004/104/EC RF Immunity	Pass
2004/104/EC Conducted Emissions	Pass
CISPR 25 Conducted Emissions	Pass Class 1
IEC 61000-4-2 Electrostatic discharge immunity test	Pass Criteria A
IEC 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test	Pass Criteria A
IEC 61000-4-4: Electrical Fast Transient / Burst	Pass Criteria A
IEC 61000-4-5: Surge immunity test	Pass Criteria A
IEC 61000-4-6: Immunity to conducted disturbances, induced by radio-frequency fields	Pass Criteria A



Test Set-up : IEC 61000-4-2 and



CISPR 25 Conducted Emissions

## 2.1 EMISSION CLASSES AND IMMUNITY CRITERIA

### 2.1.1 Emissions

#### CISPR 22 Classifies ITE as either Class A or Class B.

**Class B ITE** is a category of apparatus which satisfies the class B ITE disturbance limits.

Class B ITE is intended primarily for use in the domestic environment and may include:

- Equipment with no fixed place of use; for example, portable equipment powered by built-in batteries;
- Telecommunication terminal equipment powered by a telecommunication network;
- Personal computers and auxiliary connected equipment.

NOTE The domestic environment is an environment where the use of broadcast radio and television receivers may be expected within a distance of 10 m of the apparatus concerned.

**Class A ITE** is a category of all other ITE which satisfies the class A ITE limits but not the class B ITE limits. Such equipment should not be restricted in its sale but the following warning shall be included in the instructions for use:

#### **Warning**

This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

### 2.1.2 Immunity

**The Criteria set-out above are defined as follows:**

**Criteria A:** normal performance within limits specified by the manufacturer, requestor or purchaser;

**Criteria B:** temporary loss of function or degradation of performance which ceases after the disturbance ceases, and from which the equipment under test recovers its normal performance, without operator intervention;

**Criteria C:** temporary loss of function or degradation of performance, the correction of which requires operator intervention;

**Criteria D:** loss of function or degradation of performance which is not recoverable, owing to damage to hardware or software, or loss of data.

## 3. TEST METHODOLOGY

### 3.1 ENVIRONMENTAL CONDITIONS DURING TEST:

- Temperature: 20°C
- Relative Humidity: 34 %

## 4. CALIBRATION OF EQUIPMENT

The computer controlled EMI Measuring system is checked for amplitude and frequency accuracy with a signal generator (calibrated by a SANAS accredited laboratory and is traceable to the national standards maintained by the CSIR) on a monthly basis. The calibration of the equipment is performed by Inala Technology. All equipment Calibration Certificates are available on request.

## 5. MEASUREMENT OF UNCERTAINTY

The uncertainty budget is calculated according to the guidelines of LAB34 and CISPR16-4

### 5.1 RADIATED EMISSIONS

- Compliance is deemed to occur if all measured disturbances are below the CISPR 22 limit.
- Non-compliance is deemed to occur if any measured disturbance exceeds the CISPR 22 limit.

## 6. TEST SAMPLE DESCRIPTION AND TEST SETUP DETAILS

The specific test methodology will be discussed under each relevant test if different to the general set-up guidelines below.

The **EUT** was subjected to all tests in the following way:

- The EUT was connected to a 24V battery.
- The EUT was switched on and operated in accordance with the manufacturer instructions.
- A Wurth 742712 22 Ferrite were clipped around the supply loom during all tests.
- Deviations from the above set-up will be noted in each specific case.

## 7. EMISSIONS

### 7.1 SET-UP

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- Automated scans in the frequency band 30MHz to 1000MHz (radiated emissions) were done in order to determine compliance emission results for the EUT.

**Table 7.1-1: Test equipment used for Conducted and Radiated Emission Measurements**

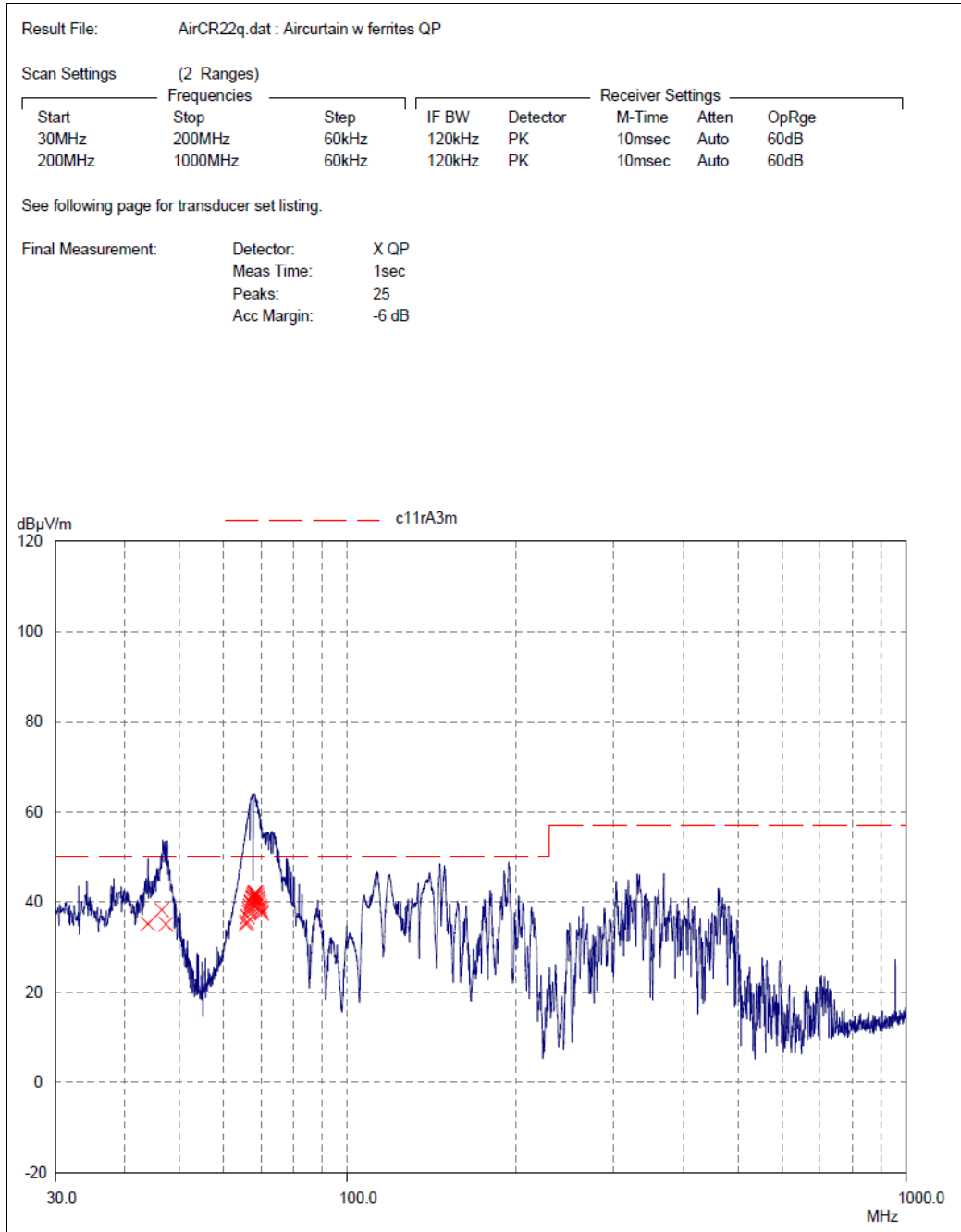
EQUIPMENT	SERIAL NO
IBM Compatible PC	Ser No : None
Rohde & Schwarz ESPC	Ser No: 845296/004
BIA 30 Biconical antenna	Ser No : 3568
EM 6950 Log-P Antenna	Ser No: ITC001
Solar 6338-50-5 PJ N LISN	Ser No: None



**7.2 CISPR 22**

**7.2.1 Radiated Emission Results**

Graph AirCR22q: Represents (peak) radiated emissions measured from the EUT. Emissions exceeding the class A specification were re-measured with a quasi peak detector (represented by the red crosses). Note that the test distance was 3m. The limit line was adjusted accordingly.



**7.2.1.1 Conclusion**

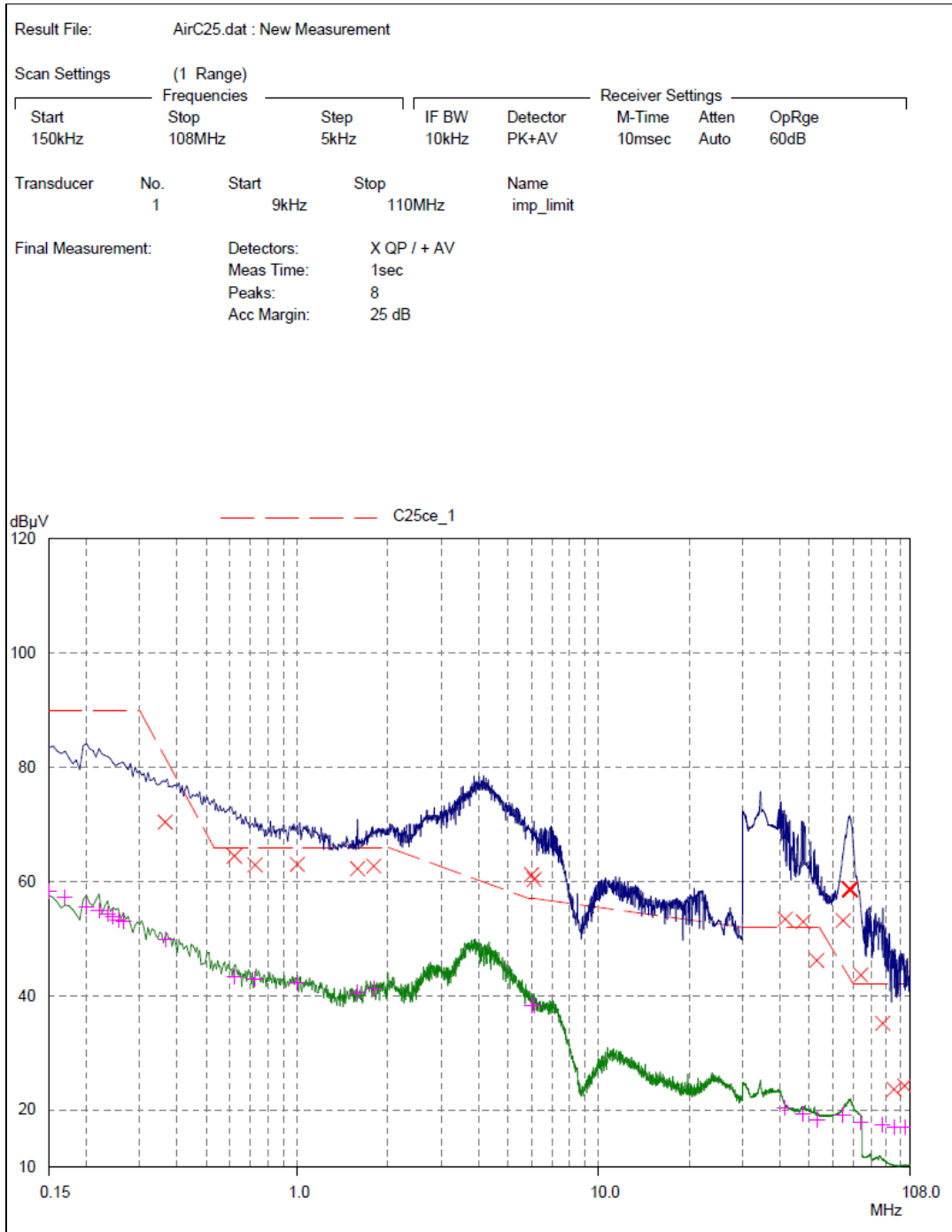
The EUT complies with the emissions requirements of SANS CISPR 22 Class B.

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**7.3 CISPR 25**

**7.3.1 Conducted Emission Results**

Graph AirC25: Peak, Quasi Peak and Average Conducted emissions measured on the live lead of the EUT was below the Class 1 limit. (Class 3 peak limit shown)



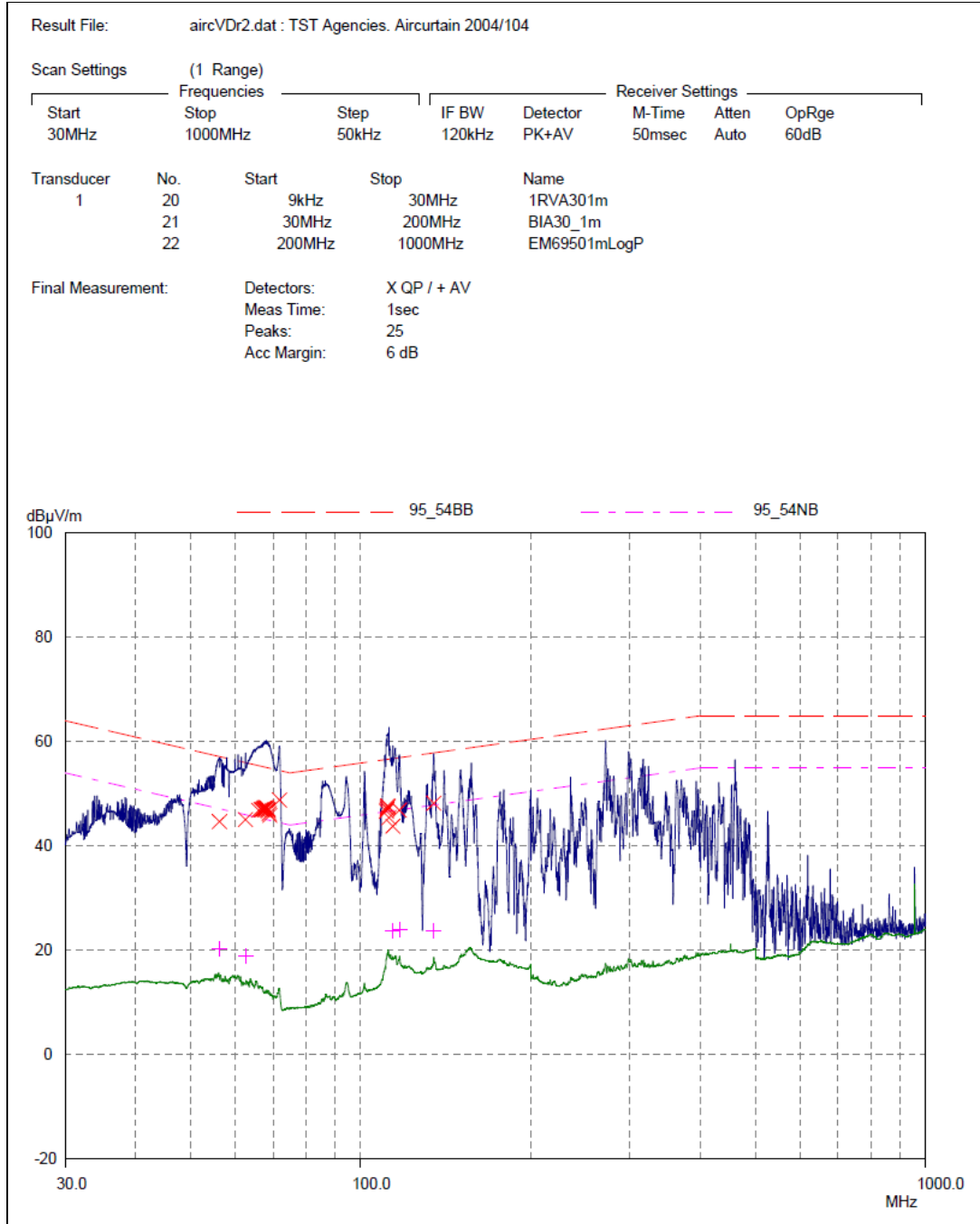
**7.3.1.1 Conclusion**

The EUT complies with the conducted emissions requirements of CISPR 25 Class 1.

**7.4 VEHICLE DIRECTIVE 2004/104 EC**

**7.4.1 Radiated Emission Results**

Graph aIRcVDr2: Represents peak, Quasi Peak (Represented by the red crosses) and average radiated emissions measured from the EUT. Quasi Peak and Average emissions are below the relevant specifications, as required by 2004/104/EC



**7.4.1.1 Conclusion**

The EUT complies with the radiated emissions requirements of 2004/104/EC.

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**7.4.2 Conducted Emission Results**

Time domain switching spikes from the EUT did not exceed 150V or -450V when switched on or off.

**7.4.2.1 Conclusion**

The EUT complies with the conducted emissions requirements of 2004/104/EC.

## 8. IMMUNITY

### 8.1 ELECTRICAL FAST TRANSIENTS

- The EUT was supplied with the required voltage and subjected to a direct injected 5 kHz repetition rate 5/50nS wave interference signal.
  - The EUT was tested as table top equipment.
  - The interference signal was applied in the following sequence:
- **DC Power Ports**
    - a. Positive to Negative: Tests were executed with +0.5kV and -0.5kV interference signal amplitudes for a 60 second period for each polarity.

**Table 8.1-1 Test equipment used for Electrical Fast Transients**

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Schaffner Best EMC	Ser No: 199826-025SC

#### 8.1.1 Results

DC power port:

- The EUT was resilient to the interference signal.
- The EUT functioned normally during and after the test.

##### 8.1.1.1 Conclusion

The EUT comply with criteria A of SANS IEC 61000-4-4.

## 8.2 RADIATED SUSCEPTIBILITY

This test does not form part of our SANAS accreditation schedule.

### 8.2.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The test was performed in a shielded enclosure in the frequency band 80 MHz to 1000 MHz with 80 % AM 1kHz, at a level of 30 V/m according to IEC 61000-4-3 Clause 8 (Frequency step and dwell method) with the following deviations:
  - IEC61000-4-3 calls for the use of an anechoic lined enclosure. ITC-Services used a shielded enclosure. The effect of reflections in the chamber was taken into account.
  - The antenna distance specified in IEC61000-4-3 is 3m and ITC-Services radiated the EUT from a distance of 2.5 m.

**Table 8.2-1 Test equipment used for Radiated Susceptibility.**

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Olivetti Personal Computer Model PCS 286	Ser No : 00074333
RF Signal Generator HP Model 8657A	Ser No: 2819UO4767
Log Periodic Antenna 200 MHz to 1000 MHz Model EM6950	Ser No : 1001
Biconical Antenna 30 MHz to 200 MHz Model BIA-30	Ser No : 3568
RF Amplifier EM Model 4248-1	Ser No : None
Field Strength Meter AR Model FM2000	Ser No: 14021

### 8.2.2 Results

- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 30 V/m (20 MHz – 1 GHz).

### 8.2.3 Conclusion

The EUT complies with criteria A of SANS IEC 61000-4-3 and Annex IX of 2004/104

### 8.3 CONDUCTED IMMUNITY

#### 8.3.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The test was performed in a shielded enclosure in the frequency band 150kHz to 80 MHz with 80 % AM 1kHz, at a level of 3 V (unmodulated) on the power loom according to IEC61000-4-6.

**Table 8.3-1 Test equipment used for Conducted Immunity.**

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
RF Signal Generator HP Model 8657A	Ser No: 2819UO4767
BCI Probe FCC Model F-120-3	Ser No : 52
RF Amplifier EM Model 4248-1	Ser No : None

#### 8.3.2 Results

The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 3V on the power loom of the EUT.

#### 8.3.3 Conclusion

The EUT complies with criteria A of the relevant section of SANS IEC 61000-4-6.

**(Criteria A:** normal performance within limits specified by the manufacturer, requestor or purchaser)

## 8.4 ELECTROSTATIC DISCHARGE

### 8.4.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The EUT was tested while operating with external 24V battery.
- The EUT was tested as tabletop equipment.
- 10 positive and 10 negative contact discharges were applied to the VCP and HCP respectively.
- 10 positive and 10 negative air discharge attempts were made to the enclosure. No discharge path was available

**Table 8.4-1 Test equipment used for ESD**

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Schaffner Best EMC	Ser No: 199826-025SC
Contact discharge tip	None
Vertical Coupling Plane	None
Air discharge tip	None

**Table 8.4-2 Results of ESD (Contact discharge)**

POSITION ON EUT	VOLTAGE	NUMBER OF DISCHARGES	RESULT	VERDICT
VCP (Vertical)	± 4kV	10	Not susceptible	Comply
HCP (Horizontal)	± 4kV	10	Not susceptible	Comply
Enclosure screws	± 4kV	10	Not susceptible	Comply

**Table 8.4-3 Results of ESD (Air discharge)**

POSITION ON EUT	VOLTAGE	NUMBER OF DISCHARGES	RESULT	VERDICT
Power Switch	± 8kV	10	No discharge path	Comply

- The EUT was resilient to the ESD pulses applied.

### 8.4.2 Conclusion

The EUT complies with criteria A of SANS IEC 61000-4-2.

**(Criteria A:** normal performance within limits specified by the manufacturer, requestor or purchaser)



## 8.5 SURGES

### 8.5.1 Set-up

- The EUT was supplied with the required voltage.
- Five positive and five negative 1.2/50 $\mu$ s pulses were directly injected into the supply
- The pulses were applied in the following sequence:

- **DC Power Port**

- a. Positive to Negative: Tests were executed with +1kV and -1kV interference signal amplitudes for a 60 second period for each polarity.

**Table 8.5-1 Test equipment used for Surges**

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Schaffner Best EMC	Ser No: 199826-025SC

### 8.5.2 Results

The EUT was resilient to the surges applied. The EUT continued normal operation during and after application of the surge.

### 8.5.3 Conclusion

The EUT complies with the requirements of the relevant section of SABS IEC 61000-4-5.

## 9. COMPLIANCE STATEMENT

The EUT complies with the requirements of the specifications listed in 10 below.

## 10. CONCLUSION

The TST Agencies Jet Air (In the configuration tested) meets the requirements of the following specifications called for in 2004/104 EC and 2004/108/EC:

- SABS CISPR22: 1997 '*Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement*'; Radiated Emissions
- Vehicle Directive 2004/104/EEC
  - Annex VIII: Narrowband and Broadband Radiated Emissions from Electrical Sub Assemblies
  - Annex IX: Immunity of Electrical / Electronic sub-assemblies
- IEC 61000-4-2: *Testing and measurement techniques – Electrostatic discharge immunity test*
- IEC 61000-4-3: *Testing and measurement techniques –Radiated, radio-frequency, electromagnetic field immunity test*
- IEC 61000-4-4 (2004): *Testing and measurement techniques – Electrical Fast Transient / Burst*
- IEC 61000-4-5 (2002): *Testing and measurement techniques – Surge immunity test*
- IEC 61000-4-6: *Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields.*
- CISPR 25 (2008): *Vehicles Boats and Internal Combustion Engines-Radio Disturbance Characteristics- Limits and Methods of measurement for the protection of On board Receivers: Conducted Emissions Class 1*