



Interference Testing And Consultancy Services (Pty) Ltd

ITC SERVICES (PTY) LTD Reg 88/002032/07
 Plot 44 Kameeldrift East, Pretoria
 Private Bag X13 Lynn East 0039
 Republic of South Africa
 Tel (012) 808 1730 Int + 27 12 808 1730
 Fax (012) 808 1733

\\192.168.0.1\public\reports\EN 50270\5498 - Nsoft
 Development - 5100-05-IT Gas detector.doc

BS EN 50270 TESTS ON THE 5100-05-IT TOXIC GAS DETECTOR MODULE

REFERENCE NUMBER : R 5498/13
 REVISION : 1.0
 DATE : 01/07/2013
 COPY : Master

CONFIGURATION CONTROL

ORIGINAL ONLY
 IF THIS NOTE
 IS IN RED INK

PARTIES INVOLVED

AUTHORITY	NAME	SIGNATURE	DATE
NSOFT DEVELOPMENT Client:	F Giangregorio		
ITC SERVICES Approved By:	JJ Joubert		01/07/2013
ITC SERVICES Tested by:	CJ Deysel		01/07/2013



T0175



Armscor Accredited Company

5498/13

This Test Report may only be reproduced in full with the written approval of ITC-Services (Pty) Ltd.

DISTRIBUTION LIST		
COPY NO	NAME	ORGANISATION
MASTER	CONFIGURATION LIBRARY	NSOFT DEVELOPMENT
1	CONFIGURATION LIBRARY	ITC SERVICES

HISTORY SHEET				
REV	DATE	AUTHOR	PAGES AFFECTED	CHANGE PROPOSAL
1.0	01/07/2013	CJ Deysel	All	N/A

MAGNETIC ARCHIVE INFORMATION	
DIRECTORY	FILE NAME
\\192.168.0.1\public\reports\EN 50270\5498 - Nsoft Development - 5100-05-IT Gas detector.doc	5498 - Nsoft Development - 5100-05-IT Gas detector.doc

LIST OF EFFECTIVE PAGES								CONFIGURATION CONTROL
PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	
1	1.0	9	1.0	17	1.0			
2	1.0	10	1.0	18	1.0			
3	1.0	11	1.0					
4	1.0	12	1.0					
5	1.0	13	1.0					
6	1.0	14	1.0					
7	1.0	15	1.0					
8	1.0	16	1.0					

CLIENT INFORMATION	
DESCRIPTION	INFORMATION
Name	Nsoft Development
Address:	<i>PO Box 7090 Westgate 1734</i>
	Franco Giangregorio

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

TABLE OF CONTENTS

1. INTRODUCTION	6
2. TEST RESULT SUMMARY	6
2.1 EMISSION CLASSES AND IMMUNITY CRITERIA	7
2.1.1 Emissions	7
2.1.2 Immunity	7
3. TEST METHODOLOGY	7
3.1 ENVIRONMENTAL CONDITIONS DURING TEST:	7
4. CALIBRATION OF EQUIPMENT	7
5. MEASUREMENT OF UNCERTAINTY	8
5.1 CONDUCTED EMISSIONS	8
5.2 RADIATED EMISSIONS	8
6. TEST SAMPLE DESCRIPTION AND TEST SETUP DETAILS	8
7. IMAGES	9
8. EMISSIONS	10
8.1 SET-UP	10
8.1.1 Radiated Emission Results: 30 – 1000MHz	11
8.1.2 Conclusion	11
9. IMMUNITY	12
9.1 ELECTRICAL FAST TRANSIENTS	12
• AC Power Ports	12
• I/O Ports	12
9.1.1 Results	12
9.1.2 Conclusion	12
9.2 ELECTROSTATIC DISCHARGE	13
9.2.1 Set-up	13
9.2.2 Conclusion	13
9.3 SURGES	14
9.3.1 Set-up	14
• AC Power Port	14
• I/O Ports	14
9.3.2 Results	14
9.3.3 Conclusion	14
9.4 RADIATED IMMUNITY	15
9.4.1 Set-up	15
9.4.2 Results	15
9.4.3 Conclusion	15
9.5 CONDUCTED IMMUNITY	16
9.5.1 Set-up	16
9.5.2 Results	16
9.5.3 Conclusion	16
9.6 POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST	17
9.6.1 Set-up	17
9.6.2 Results	17
9.6.3 Conclusion	17
10. COMPLIANCE STATEMENT	17
11. CONCLUSION	18

LIST OF TABLES

Table 8.1-1: Test equipment used for Conducted and Radiated Emission Measurements	10
Table 9.1-1 Test equipment used for Electrical Fast Transients	12
Table 9.2-1 Test equipment used for ESD	13
Table 9.2-2 Results of ESD (Contact discharge).....	13
Table 9.2-3 Results of ESD (Air discharge).....	13
Table 9.3-1 Test equipment used for Surges	14
Table 9.4-1 Test equipment used for Radiated Immunity.....	15
Table 9.5-1 Test equipment used for Conducted Immunity.....	16
Table 9.6-1 Test equipment used for Power Frequency Magnetic Field Immunity.	17

1. INTRODUCTION

The 5100-05-IT Toxic Gas Detector Module manufactured by Sierra Monitor Corporation, serial number: 1123054, model number: 5100-05-IT, henceforth referred to as Equipment Under Test (**EUT**), was tested for compliance between 28/06/2013 and 01/07/2013 at the premises of ITC Services (Pty) Ltd to the following specifications:

- BS EN 50270: (2006) *Electromagnetic compatibility. Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen*
- SANS 222 (2009) / CISPR 22 (2008): *'Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement'*
 - SANS 61000-4-2 (2009) / IEC 61000-4-2 (2008): *Testing and measurement techniques – Electrostatic discharge immunity test*
 - SANS 61000-4-3 (2008) / IEC 61000-4-3 (2010): *Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
 - SANS 61000-4-4 (2011) / IEC 61000-4-4 (2011): *Testing and measurement techniques – Electrical Fast Transient / Burst*
 - SANS 61000-4-5 (2006) / IEC 61000-4-5 (2005): *Testing and measurement techniques – Surge immunity test*
 - SANS 61000-4-6 (2009) / IEC 61000-4-6 (2008): *Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
 - SANS 61000-4-8 (2009) / IEC 61000-4-8 (2009): *Testing and measurement techniques- Power Frequency Electric Field Immunity Test*

2. TEST RESULT SUMMARY

CISPR 22 Radiated Emissions: 30-1000MHz	Pass Class B
IEC 61000-4-2 Electrostatic discharge immunity test	Pass Criterion A
IEC 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test	Pass Criterion A
IEC 61000-4-4: Electrical Fast Transient / Burst	Pass Criterion A
IEC 61000-4-5: Surge immunity test	Pass Criterion A
IEC 61000-4-6: Immunity to conducted disturbances, induced by radio-frequency fields	Pass Criterion A
IEC 61000-4-8: Power Frequency Magnetic Field Immunity Test	Pass Criterion A

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;

3. TEST METHODOLOGY

3.1 ENVIRONMENTAL CONDITIONS DURING TEST:

- Temperature: 18 - 19 °C
- Relative Humidity: 30 - 35 %

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 CONDUCTED EMISSIONS

- Compliance is deemed to occur if all measured disturbances are 0.83dB below the CISPR 22 limit.
- Non-compliance is deemed to occur if any measured disturbance is less than 0.83dB below the CISPR 22 limit.

5.2 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.

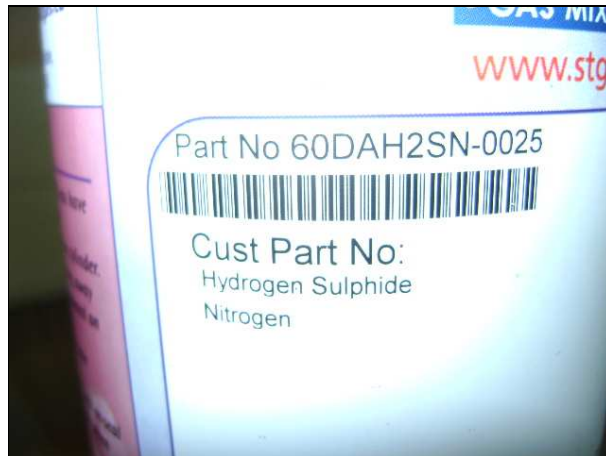
6. TEST SAMPLE DESCRIPTION AND TEST SETUP DETAILS

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 switched on and operated in accordance with the manufacturer instructions.
- Tests were performed while the unit was fully operational.
- The EUT was supplied with 25ppm Hydrogen Sulphide / balance Nitrogen gas to monitor performance during immunity testing.
- The gas tolerance is $\pm 5\%$, batch S33240-2, expiry date 31 October 2013
- The EUT was supplied with 24VDC batteries.
- Deviations from the above set-up will be noted in each specific case.

7. IMAGES



Hydrogen Sulphide / balance Nitrogen Gas: Used to monitor performance during immunity testing



SANS / IEC 61000-4-3: Radiated immunity test set-up



SANS / IEC 61000-4-8: Power frequency magnetic immunity test set-up

8. EMISSIONS

8.1 SET-UP

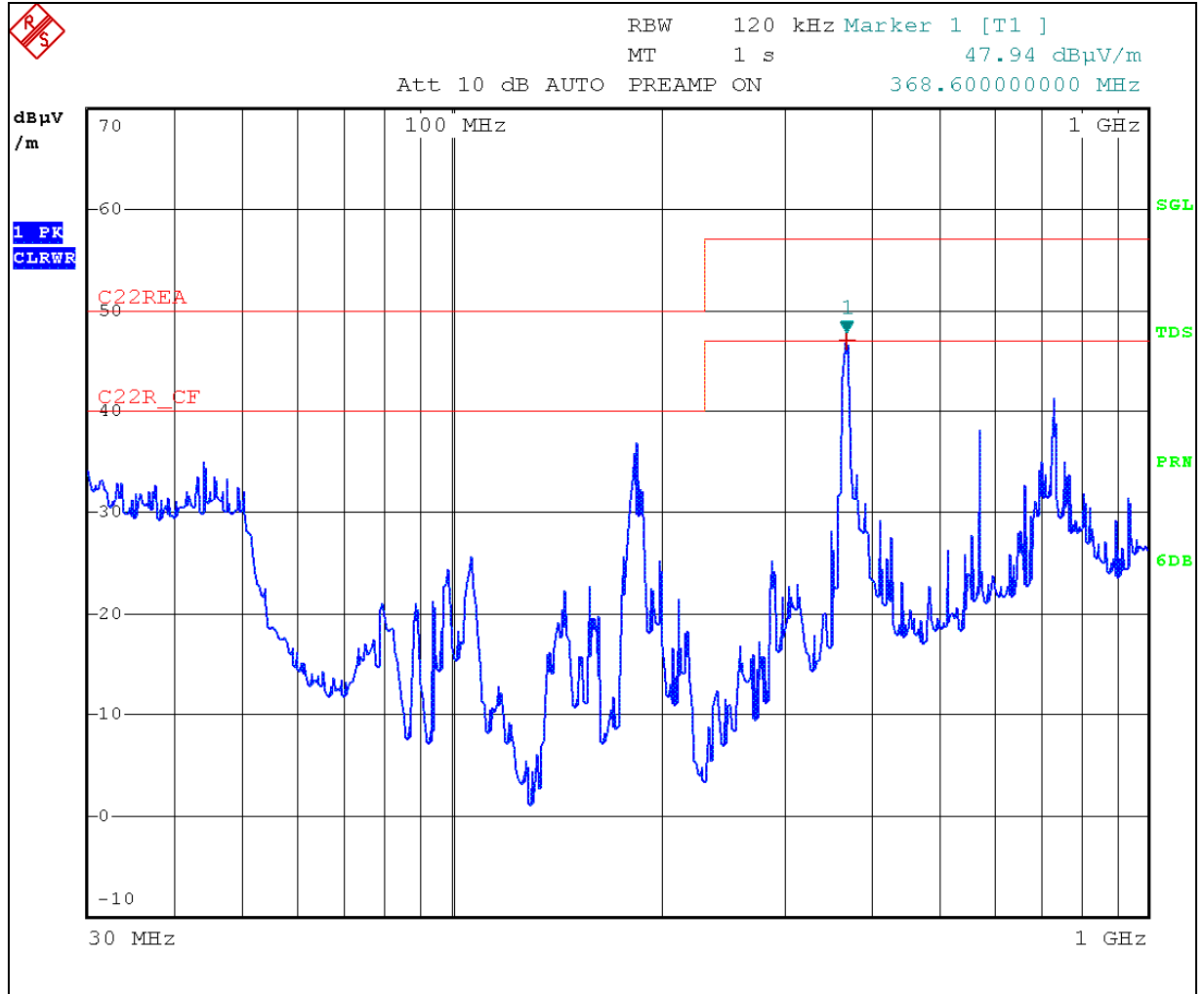
- The EUT was switched on and operated in accordance with the manufacturer instructions.
- Automated scans in the frequency band 30MHz to 1000MHz (radiated emissions) were done in order to determine compliance emission results for the EUT.

Table 8.1-1: 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

8.1.1 Radiated Emission Results: 30 – 1000MHz

Graph 1: Represents peak radiated emissions measured from the EUT. Emission levels were below the Class B limit. Note that the test distance was 3m. The limit line was adjusted accordingly. The test was performed with the antennas in the Horizontal polarization.



8.1.2 Conclusion

The EUT complies with the radiated emissions requirements of SANS 222 / CISPR 22 Class B.

9. IMMUNITY

9.1 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 EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas during testing.
 - The interference signal was applied in the following sequence:
- **AC Power Ports**
 - a. Positive to Negative: Tests were executed with +1kV and -1kV interference signal amplitudes for a 60 second period for each polarity.
 - b. Positive to Negative to Ground Reference: Tests were executed with +1kV and -1kV interference signal amplitudes for a 60 second period for each polarity.
 - **I/O Ports**
 - a) Capacitive coupled + 0.5 kV and - 0.5 kV interference signal applied to the RS 485 loom.
 - b) Capacitive coupled + 0.5 kV and - 0.5 kV interference signal applied to the 4-20mA loom.

Table 9.1-1 Test equipment used for Electrical Fast Transients

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
TESEQ NSG 3040	Ser No: 1856

9.1.1 Results

AC power port:

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

I/O ports:

- The EUT was resilient to the capacitive coupled + 0.5 kV and -0.5 kV interference signal applied to the RS-485 and 4-20mA looms individually.
- The EUT functioned normally during and after the test.

9.1.2 Conclusion

The EUT complies with criterion A of SANS / IEC 61000-4-4.

9.2 ELECTROSTATIC DISCHARGE

9.2.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The EUT was tested as tabletop equipment.
- The EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas during testing.
- 10 positive and 10 negative contact discharges were applied to the VCP and HCP respectively.
- 10 discharge attempts were made to the enclosure of the device.

Table 9.2-1 Test equipment used for ESD

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
TESEQ NSG 3040	Ser No: 1856
TESEQ NSG 435 ESD gun	Ser No: 6555
Air discharge tip	None
Contact discharge tip	None
Vertical Coupling Plane	None

Table 9.2-2 Results of ESD (Contact discharge)

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

Table 9.2-3 Results of ESD (Air discharge)

POSITION ON EUT	VOLTAGE	NUMBER OF DISCHARGES	RESULT	VERDICT
Enclosure	± 8kV	10	Not susceptible	Comply (A)

- The EUT was resilient to the applied ESD pulses and functioned normally during and after application thereof.

9.2.2 Conclusion

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

9.3 SURGES

9.3.1 Set-up

- The EUT was supplied with the required voltage.
- The EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas testing.
- Five positive and five negative 1.2/50 μ s pulses were directly injected into the supply at 60 second intervals. The pulses were applied in the following sequence:

- **AC Power Port**

- a. Positive to Negative ± 1 kV.
- b. Positive to GND reference ± 1 kV.
- c. Negative to GND reference ± 1 kV.

- **I/O Ports**

- c) ± 1 kV surge applied between the RS 485 loom and GND reference.
- d) ± 1 kV surge applied between the 4-20mA loom and GND reference.

Table 9.3-1 Test equipment used for Surges

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
TESEQ NSG 3040	Ser No: 1856

9.3.2 Results

AC power port:

- The EUT was resilient to the surges applied.

I/O ports:

- The EUT functioned normally during and after application of the surges between signal and GND reference.

9.3.3 Conclusion

The EUT complies with criterion A of the relevant section of SANS / IEC 61000-4-5.
--

9.4 RADIATED IMMUNITY

9.4.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The test was performed in a RF shielded chamber in the frequency band 80 MHz to 1000 MHz with 80 % AM 1kHz, at a level of 10 V/m according to SANS / IEC 61000-4-3 Clause 8 (Frequency step and dwell method).
- The EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas during testing.

Table 9.4-1 Test equipment used for Radiated Immunity.

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 Model EM6950	Ser No : 1001
RF Amplifier EM Model 4248-1	Ser No : None
Field Strength Meter AR Model FM2000	Ser No: 14021

9.4.2 Results

- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 10 V/m.

9.4.3 Conclusion

The EUT complies with criterion A of SANS / IEC 61000-4-3.

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

9.5 CONDUCTED IMMUNITY

9.5.1 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 10 V (unmodulated) on the power leads, 4-20mA and RS-485 looms according to SANS / IEC 61000-4-6.
- The EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas during testing.

Table 9.5-1 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

9.5.2 Results

- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 10V on the power leads.
- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 10V on the 4-20mA loom.
- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 10V on the RS-485 (field port) loom.

9.5.3 Conclusion

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

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

9.6 POWER FREQUENCY MAGNETIC FIELD IMMUNITY TEST

9.6.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The test was performed with a single Helmholtz Coil, at a level of 30 A/m according to SANS / IEC 61000-4-8.
- The EUT was supplied with Hydrogen Sulphide / balance Nitrogen gas during testing.

Table 9.6-1 Test equipment used for Power Frequency Magnetic Field Immunity.

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Variac Yokoyama Electric Works	Ser No: 3772
Magnetic Shield Division AC Magnetic Field Evaluator	None
Fluke 77 III Multimeter	72081177
Toptronic T60757 AC/DC Clamp Meter	None
AC Helmholtz Coil	ITC001

9.6.2 Results

The EUT was resilient to the 50 Hz signal applied at a level of 30 A/m.

9.6.3 Conclusion

The EUT complies with criterion A of the relevant section of SANS / IEC 61000-4-8.

10. COMPLIANCE STATEMENT

The EUT complies with the requirements of the specifications listed in 11 below.

11. CONCLUSION

The Sierra Monitor Corporation 5100-05-IT Toxic Gas Detector module (In the configuration tested) meets the requirements of the following specifications called for in BS EN 50270:2006

- BS EN 50270: (2006) *Electromagnetic compatibility. Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen*
- SANS 222 (2009) / CISPR 22 (2008): *'Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement'*
 - SANS 61000-4-2 (2009) / IEC 61000-4-2 (2008): *Testing and measurement techniques – Electrostatic discharge immunity test*
 - SANS 61000-4-3 (2008) / IEC 61000-4-3 (2010): *Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*
 - SANS 61000-4-4 (2011) / IEC 61000-4-4 (2011): *Testing and measurement techniques – Electrical Fast Transient / Burst*
 - SANS 61000-4-5 (2006) / IEC 61000-4-5 (2005): *Testing and measurement techniques – Surge immunity test*
 - SANS 61000-4-6 (2009) / IEC 61000-4-6 (2008): *Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*
 - SANS 61000-4-8 (2009) / IEC 61000-4-8 (2009): *Testing and measurement techniques- Power Frequency Electric Field Immunity Test*