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BS EN 50090-2-2 TESTS
ON THE
RS-485 FFP2 "THE BRAIN"
REVISION C

REFERENCE NUMBER		**R 5708-2/13**
REVISION	:	**2.0**
DATE	:	**02/10/2013**
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CLIENT INFORMATION	
DESCRIPTION	**INFORMATION**
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	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

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1. INTRODUCTION

The FPC-N3X ProtoNode RER unit, manufactured by Sierra Monitor Corporation, model number FPC-N34-xxx-yyy-zzzz, serial number 1220801921 / QuickServer model: FS-QS-1X10-NNMM / ProSoft QuickServer model: PS-QS-1X10-NNMM also with assembly A23110 ("Protocarrier"), serial number IAER30883 and assembly A23121 ("FFP485-The Brain"), serial number IAEZH0050, henceforth referred to as Equipment Under Test (EUT), was tested for compliance on 11/11/2013, and re-tested on 19/11/2013, 04/12/2013 and 26/09/2014 at the premises of ITC Services (Pty) Ltd to the following specifications:

- BS EN 50090-2-2: (1996) +A2: 2007: *Home and building electronic systems (HBES) – System overview – General technical requirements.*
- 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 61000-4-11 (2005) / IEC 61000-4-11(2004): *Testing and measurement techniques – Voltage Dips, Short Interruptions and voltage variations immunity test.*
  - SANS 61000-3-3 (2009) / IEC 61000-3-3 (2008) *: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤16 A per phase*

2. TEST RESULT SUMMARY

CISPR 22 Radiated Emissions: 30-1000MHz	Pass Class A
CISPR 22 Radiated Emissions: 1000-6000MHz	Pass Class B
CISPR 22 Conducted Emissions	Pass Class B
IEC 61000-4-2 Electrostatic discharge immunity test	Pass Criterion B
IEC 61000-4-3: Radiated, radio-frequency, electromagnetic field immunity test	Pass Criterion A
IEC 61000-4-4: Electrical Fast Transient / Burst	Pass Criterion B
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 61000-4-11: Voltage dips	Pass Criterion A
IEC 61000-3-3: voltage changes, voltage fluctuations and flicker	Pass

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: 21 - 22 °C
- Relative Humidity: 45 - 55 %

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.

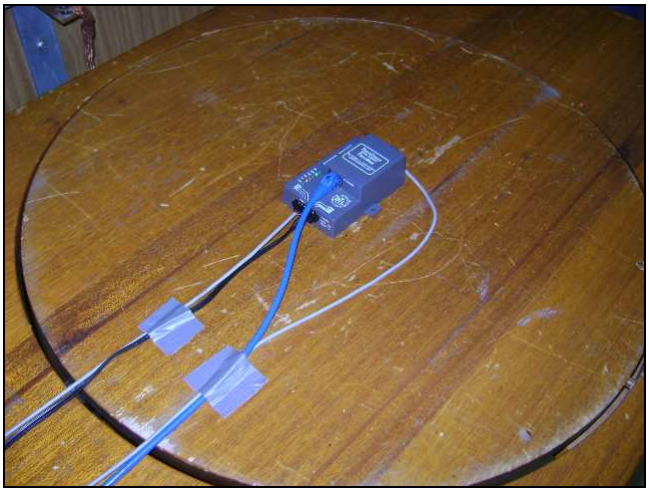
The **EUT** was subjected to all tests in the following way:

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- Tests were performed while the unit was fully operational.
- Continues operation was monitored on a laptop computer via a LAN cable.
- The unit was supplied with a 15 V_{dc} Condor power supply, part number: SA-152A0IV, Model number: HK-H5-A15.
- Deviations from the above set-up will be noted in each specific case.

7. IMAGES

FPC-N3X ProtoNode RER: Top view

SANS / IEC 61000-4-2: ESD immunity test set-up



SANS 222 / CISPR 22: Conducted emissions test set-up

8. EMISSIONS

8.1 SET-UP

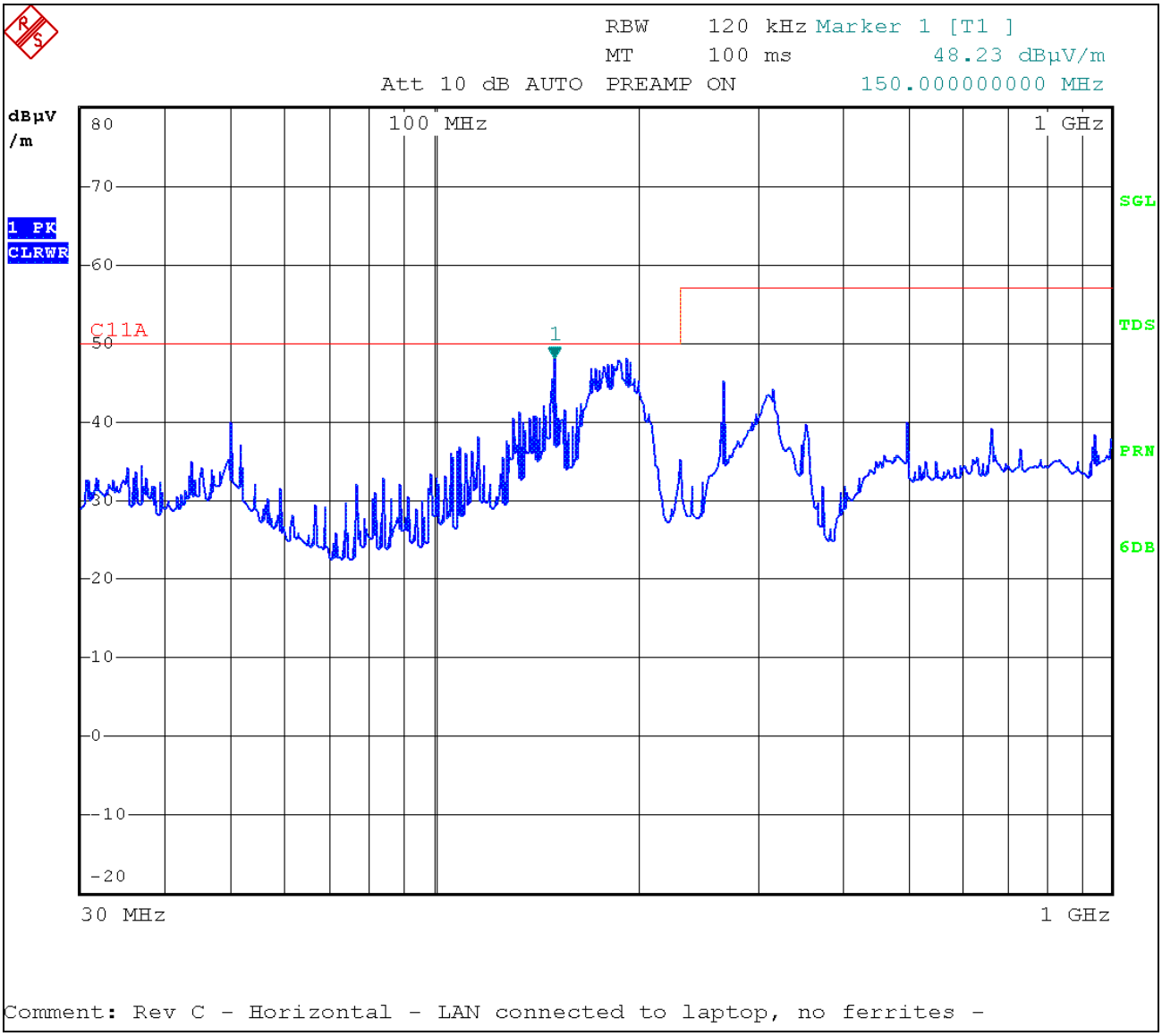
- The EUT was switched on and operated in accordance with the manufacturer instructions.
- Automated scans in the frequency band 30MHz to 6000MHz (radiated emissions) were done in order to determine compliance emission results for the EUT.

Table 8.1-1: Test equipment used for Conducted and Radiated Emission Measurements

EQUIPMENT	SERIAL NO
IBM Compatible PC	Ser No : None
Rohde & Schwarz ESPI	Ser No: 100186
BIA 30 Biconical antenna	Ser No : 3568
EM 6950 Log-P Antenna	Ser No: ITC001
EM 6961 Ridge horn antenna	Ser No: 6248
AFJ LS-16 LISN	Ser No: 90038

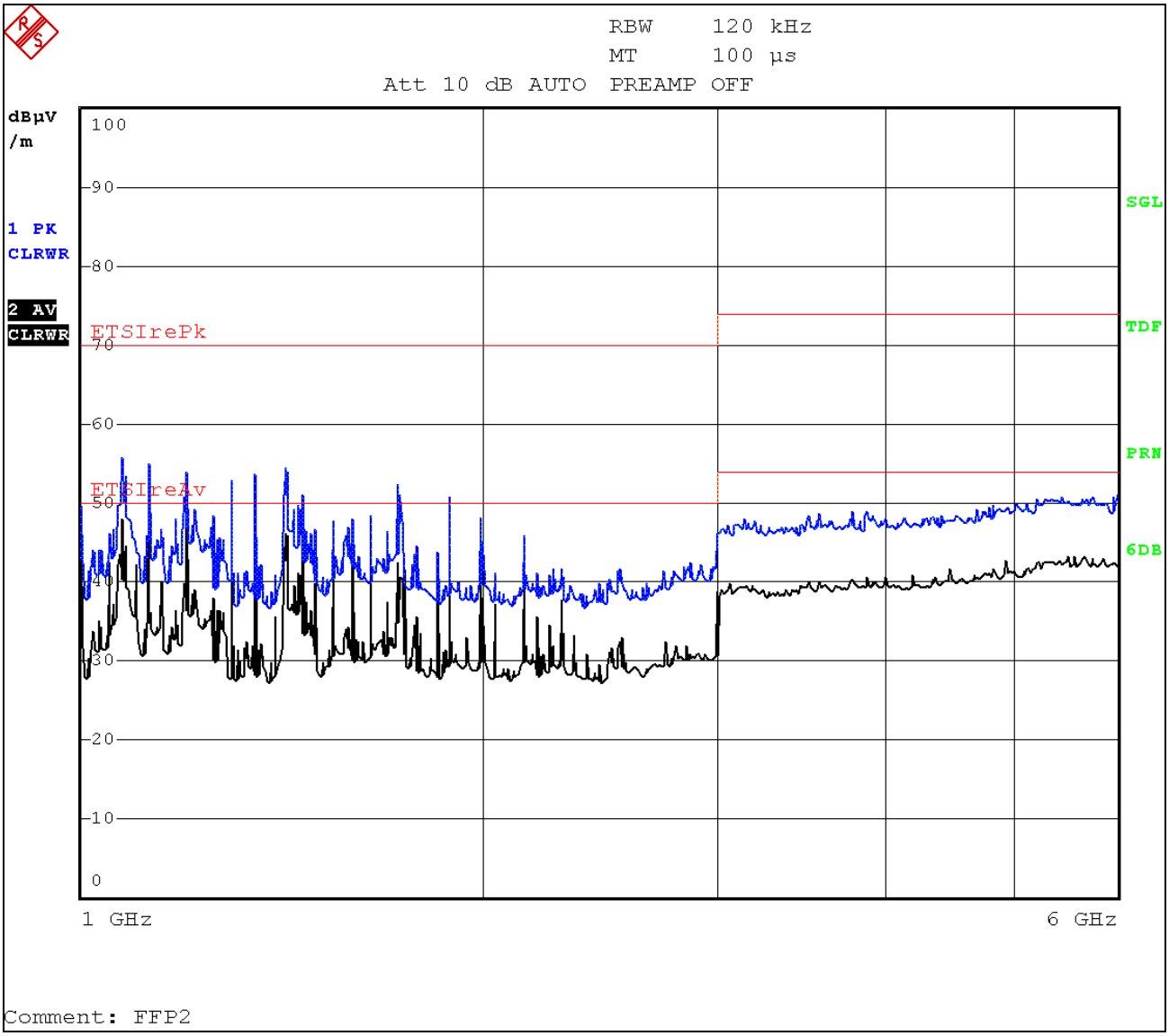
8.1.1 Radiated Emission Results: 30 – 1000MHz

Graph 1: Represents quasi peak radiated emissions (represented by the red crosses) measured from the EUT. Emission levels were below the Class A 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 Radiated Emission Results: 1000 – 6000MHz

Graph 2: Peak radiated and average emissions measured from the EUT were below the Class B quasi peak and average limits. Note that the test distance was 1m. The test was performed with the antennas in the Horizontal polarization.

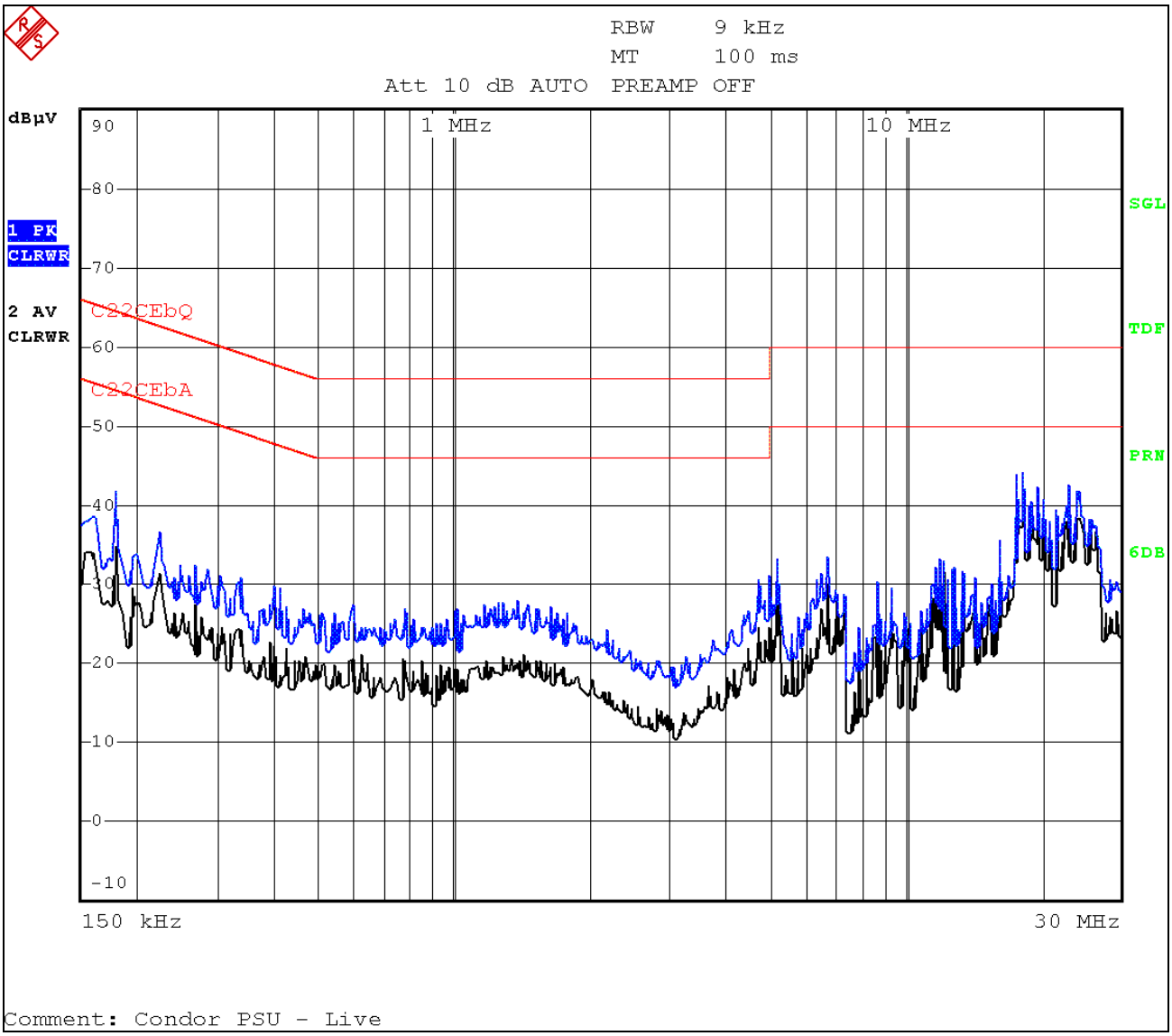


8.1.3 Conclusion

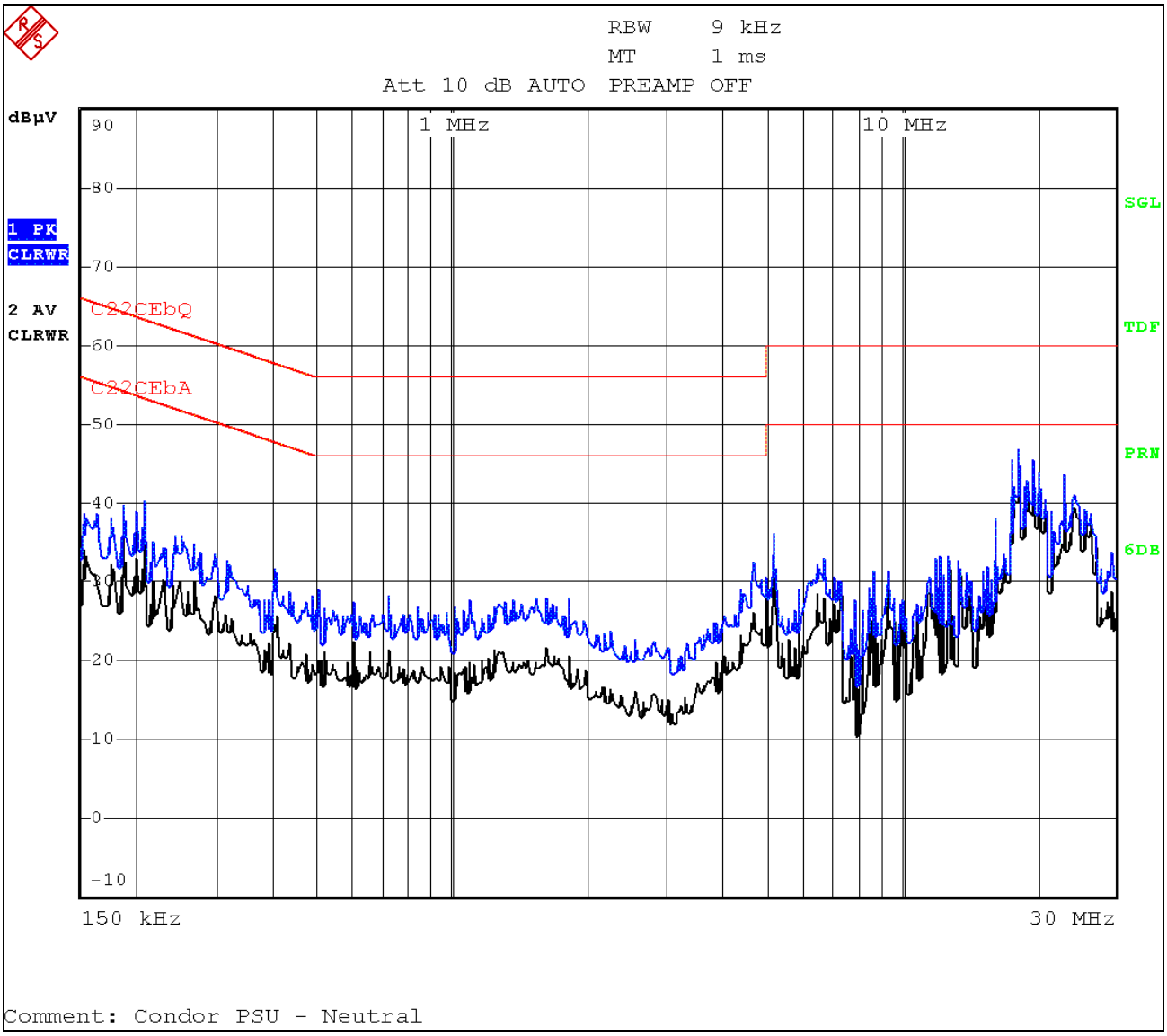
The EUT complies with the radiated emissions requirements of SANS 222 / CISPR 22 Class B.

8.1.4 Conducted Emission Results

Graph CE1: Peak and Average Conducted emissions measured on the live lead of the EUT was below the Class B quasi peak and Average limit.



Graph CE2: Peak and Average Conducted emissions measured on the Neutral lead of the EUT was below the Class B quasi peak and Average limit.



8.1.5 Conclusion

The EUT complies with the conducted 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 5kHz repetition rate 5/50nS wave interference signal.
- The EUT was tested as table top equipment.
- The interference signal was applied in the following sequence:

- **AC Power Ports**

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

b. Live and Neutral 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 LAN loom.
b) Capacitive coupled + 0.5 kV and - 0.5 kV interference signal applied to the RS-485 Socket port loom.
c) Capacitive coupled + 0.5 kV and - 0.5 kV interference signal applied to the RS-485 Field port 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 LAN and RS-485 Field port looms individually.

- The EUT was susceptible to the capacitive coupled + 0.5 kV and -0.5 kV interference signal when applied to the RS-485 Socket port loom. The EUT lost communications, but managed to self recover and continue normal operation.

9.1.2 Conclusion

The EUT comply with criterion B of SANS / IEC 61000-4-4.

(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)

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.
- 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)
LAN connector	± 4kV	10	Susceptible	Comply (B)

Table 9.2-3 Results of ESD (Air discharge)

POSITION ON EUT	VOLTAGE	NUMBER OF DISCHARGES	RESULT	VERDICT
Enclosure	± 8kV	10	Susceptible	Comply (B)

- The EUT was susceptible to the ± 4kV contact discharge ESD pulses when applied directly to the LAN connector. The EUT reset but resumed normal operation after application of the ESD pulses.

- The EUT was susceptible to the ± 8kV air discharge ESD pulses when applied to the enclosure of the EUT. The interfering pulses arced over to the power connector and as a result caused the EUT to reset. Normal operation was resumed after application of the ESD pulses.

9.2.2 Conclusion

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

(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)

9.3 SURGES

9.3.1 Set-up

- The EUT was supplied with the required voltage.
- Five positive and five negative 1.2/50µs pulses were directly injected into the supply at 60 second intervals between surges at 0°, 90°, 180° and 270° angles. The pulses were applied in the following sequence:

- **AC Power Port**

a. Live to Neutral ±1kV.

Table 9.3-1 Test equipment used for Surges

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

9.3.2 Results

The EUT was resilient to the surges applied.

9.3.3 Conclusion

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

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

9.4 RADIATED SUSCEPTIBILITY

9.4.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The test was performed in an anechoic chamber in the frequency band 80 MHz to 1000 MHz with 80 % AM 1kHz, at a level of 3 V/m according to SANS / IEC 61000-4-3 Clause 8 (Frequency step and dwell method) with the following deviations:

Table 9.4-1 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 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 3 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 3 V (unmodulated) on the power leads, LAN, RS-485 Field port and RS-485 Socket port looms individually according to SANS / IEC 61000-4-6.

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
Lüthi Coupling decoupling network	Ser No : 2555

9.5.2 Results

- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 3V on the supply leads.
- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 3V on the LAN loom.
- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 3V on the RS-485 Field port loom.
- The EUT was resilient to the 80% AM 1 kHz signal applied at a level of 3V on the RS-485 Socket 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 VOLTAGE DIPS AND INTERRUPTIONS

9.6.1 Set-up

- The EUT was switched on and operated in accordance with the manufacturer instructions.
- The EUT was subjected to the following voltage dips and interruptions applied to the AC power port of the EUT:
-

a) 100 % reduction in supply voltage for 100ms :**Comply criterion A**
b) 30 % reduction in supply voltage for 300ms :**Comply criterion A**

Table 9.6-1 Test equipment used for Voltage Dips and Interruptions

EQUIPMENT	SERIAL NO/ REFERENCE NUMBER
Pacific AC Power source Model 140-AMX	0362
TESEQ NSG 3040	Ser No: 1856

9.6.2 Results

- The EUT was unaffected by the voltage dips and interruptions and continued normal operation during and after application thereof.

9.6.3 Conclusion

The EUT complies with criterion A of the relevant sections of SANS / IEC 61000-4-11

9.7 VOLTAGE FLUCTUATIONS & FLICKERS

9.7.1 Setup

- The EUT was switched on and operated in accordance with the manufacturer instructions.

```
HA-PC Link Plus. Software v2.02. Firmware v2.81
Report Number        : 9
Tested On            : 04 December 2013 14:03 for 300 Seconds.
Equipment Under Test :
Serial Number        :
Tested by            : Johan

Supply Voltage : 230.5 to 230.8 Vrms  326.3 Vpk   Frequency : 50.00 to 50.05 Hz
Load Current   : 1.4 to 7.8 Arms    1.5 to 7.9 Apk Crest Factor: 1.088

Test Method: EN61000-3-3:2008

Voltage Variations :
             Highest Level:  +1.24%
              Lowest Level:  -1.24%
                    d(max):   2.47%            PASS

     Highest d(t) of 500ms:   1.22%            PASS
   Present d(t) over 3.33%:   0.00 Seconds
   Longest d(t) over 3.33%:   0.02 Seconds
      Highest Steady State:  -0.00%
       Lowest Steady State:   0.00%
 Max d(c) Between Adjacent:   0.00%            PASS
      Max d(c) Between Any:   0.00%
```

9.7.2 Conclusion

The EUT complies with the voltage fluctuations and flicker requirements of SANS / IEC 61000-3-3.

10. COMPLIANCE STATEMENT

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

11. CONCLUSION

The FPC-N3X ProtoNode RER / QuickServer / ProSoft Quickserver Revision C (In the configuration tested) meet the requirements of the following specifications called for in BS EN 50090-2-2:

- BS EN 50090-2-2: (1996) +A2: 2007: *Home and building electronic systems (HBES) – System overview – General technical requirements.*
- 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 61000-4-11 (2005) / IEC 61000-4-11(2004): *Testing and measurement techniques – Voltage Dips, Short Interruptions and voltage variations immunity test.*
    - SANS 61000-3-3 (2009) / IEC 61000-3-3 (2008) *: Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤16 A per phase*