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**BS EN 50090-2-2 TESTS  
 ON THE  
 THE FPC-C40 PROTOCARRIER  
 FPC-N40 PROTONODE UNIT**

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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 FPC-C40 ProtoCarrier / FPC-N40 ProtoNode unit, manufactured by Sierra Monitor Corporation, model number FPC-C40-xxx-yyy-zzzz / FPC-N40-xxx-yyy-zzzz, serial number 1220801914 / QuickServer model: FS-QS-1240-NNMM / ProSoft QuickServer model: PS-QS-1240-NNMM also with assembly A23114 (“Protocarrier”), serial number 488-002 and assembly A23107 (“FFP-RS485-D32”), serial number 4E61AF, henceforth referred to as Equipment Under Test (**EUT**), was tested for compliance on 18/02/2013 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 B
CISPR 22 Radiated Emissions: 1000-2500MHz	Pass Class B
CISPR 22 Conducted Emissions	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 61000-4-11: 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: 23 °C
- Relative Humidity: 42 %

## 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.

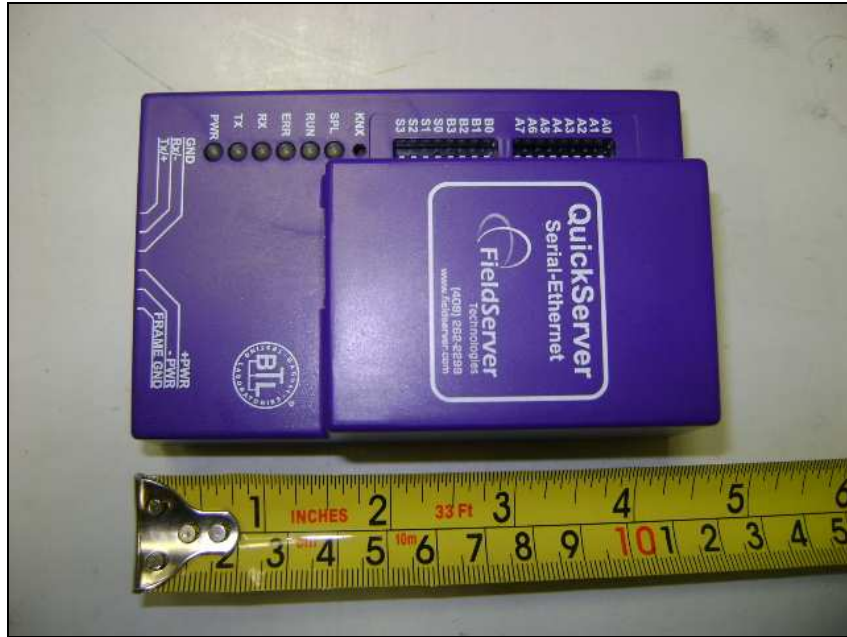
## 6. TEST SAMPLE DESCRIPTION AND TEST SETUP DETAILS

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<sub>dc</sub> 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-C40 ProtoCarrier / FPC-N40 ProtoNode: Top view



IEC 61000-4-2: Electro Static Discharge test set-up

## 8. EMISSIONS

### 8.1 SET-UP

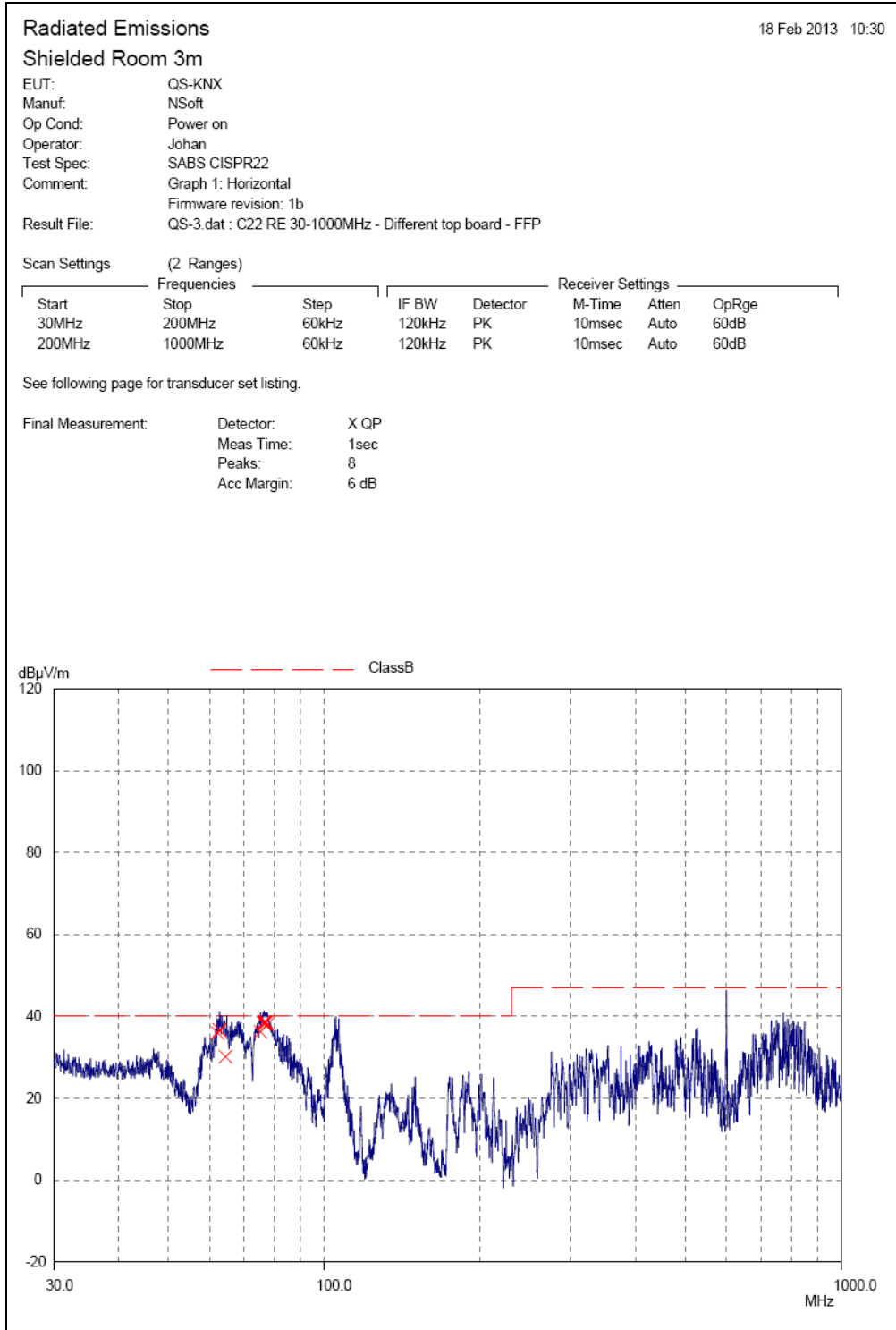
- The EUT was switched on and operated in accordance with the manufacturer instructions.
- Automated scans in the frequency band 30MHz to 2500MHz (radiated emissions) were done in order to determine compliance emission results for the EUT.

**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
EM 6961 Ridge horn antenna	Ser No: 6248
AFJ LS-16 LISN	Ser No: 90038

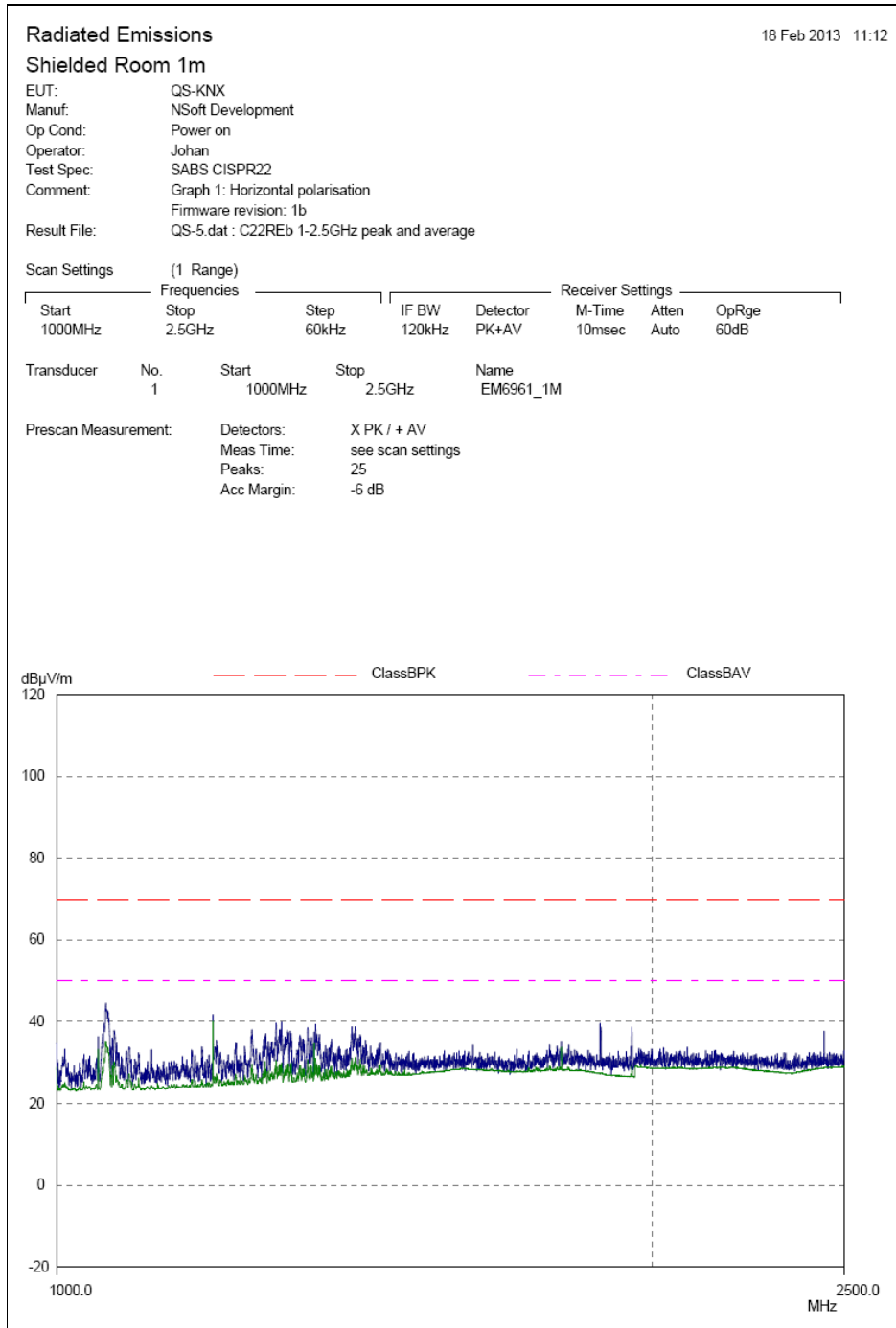
**8.1.1 Radiated Emission Results: 30 – 1000MHz**

Graph 1: Represents quasi peak radiated emissions (represented by the red crosses) measured from the EUT. Emission levels were below the Class 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 Radiated Emission Results: 1000 – 2500MHz**

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.

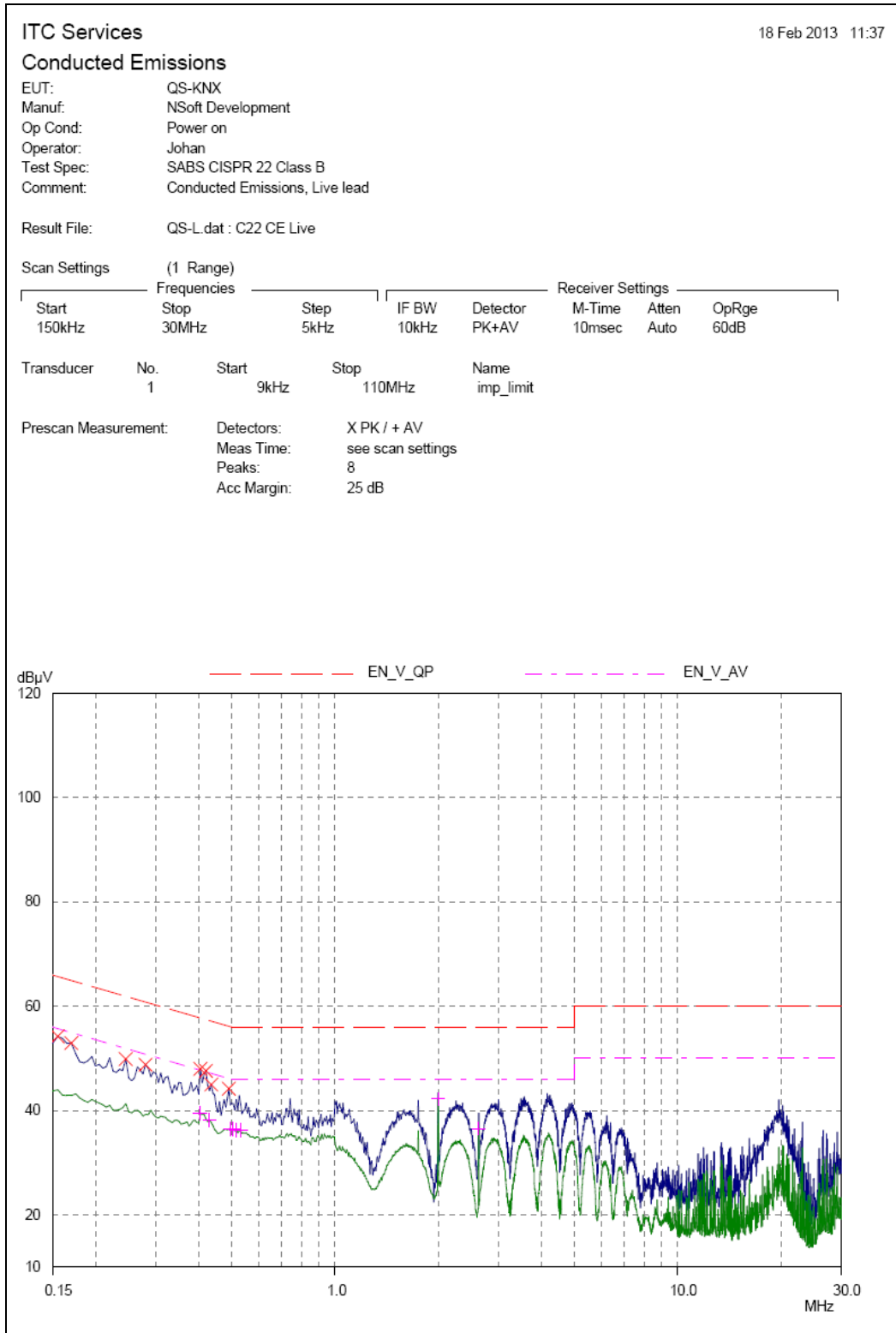


**8.1.3 Conclusion**

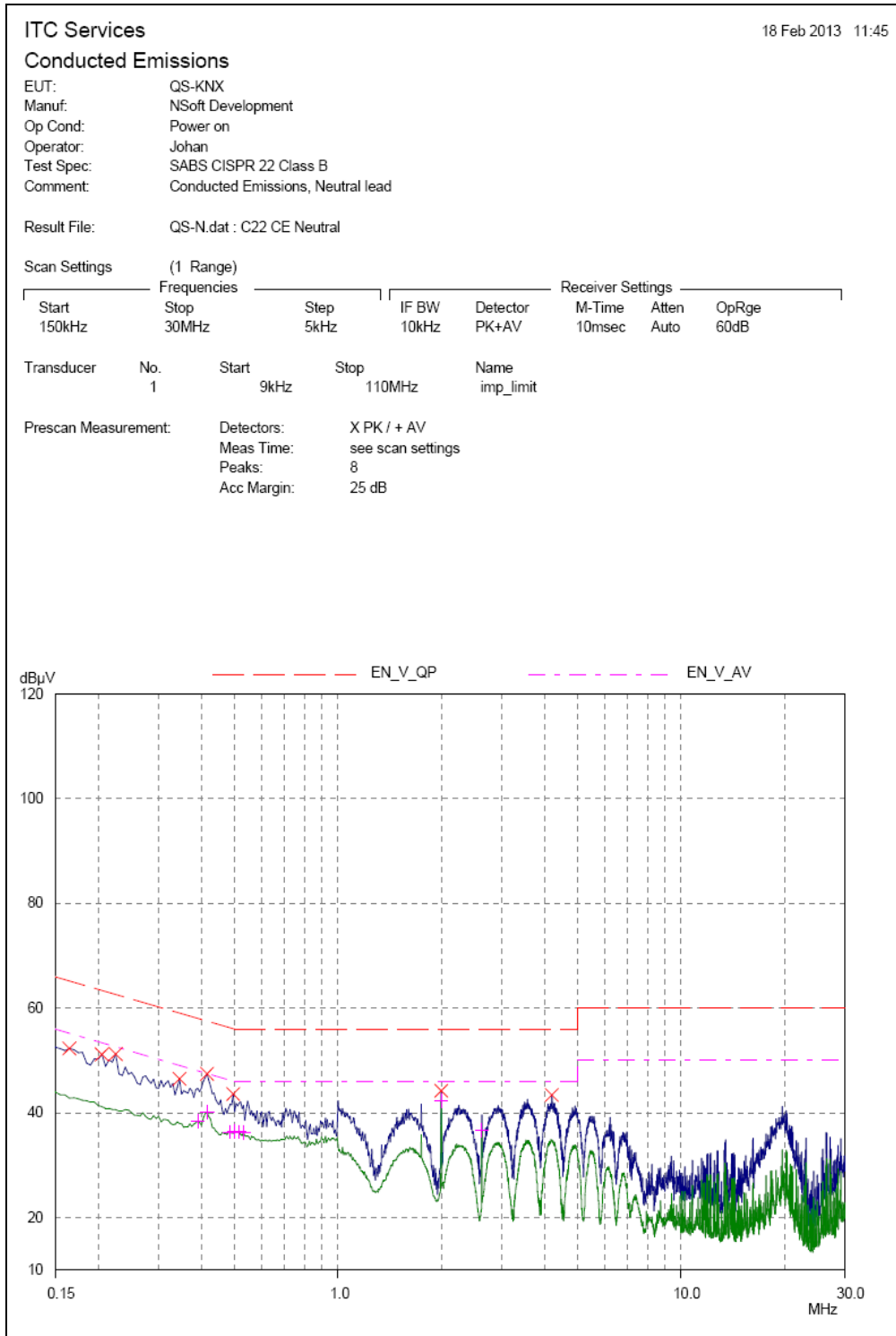
The EUT complies with the radiated emissions requirements of SANS 222 / CISPR 22 Class B.

**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 KNX bus loom.
  - b) Capacitive coupled + 0.5 kV and - 0.5 kV interference signal applied to the LAN 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 KNX bus, LAN and RS-485 looms individually.
- The EUT functioned normally during and after the test.

**9.1.2 Conclusion**

The EUT comply 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.
- 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 resilient to the ESD pulses.
- The EUT functioned normally during and after the test.

**9.2.2 Conclusion**

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

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

**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 a shielded enclosure 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, KNX bus, LAN and RS-485 looms 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 KNX bus loom.
- 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.

**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. The  $d_{max}$  value recorded was 0.1%

**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 The FPC-C40 ProtoCarrier / FPC-N40 ProtoNode devices (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  $\leq 16$  A per phase*