



LCIE

---

## EMC Test report for the introduction of the GSM 850 MHz on GSM 18000 Outdoor BTS (FCC)

---

**Reference:** 60053379-554566-C-TR-18o-FCC

**Version:** A

**Status:** Approved

**Date:** 27/Feb/2007

---

**Customer:** NORTEL NETWORKS  
Parc d'Activités de Magny-Châteaufort  
78928 Yvelines Cedex 09

**Product:** GSM 18000 Outdoor BTS 850 MHz

---

**Author:** Marc CANCOUËT

**Technical Manager:** Didier PRADON

05/ March / 2007

---

*This document shall not be reproduced, except in full, without the written approval of the LCIE.  
This document contains results related only to the items tested. It does not imply the conformity of the whole production to the items tested.*



## PUBLICATION HISTORY

VERSION	DATE	AUTHOR	MODIFICATION
A	27-Feb-07	M.CANCOUËT	Creation of document



# CONTENTS

1.	INTRODUCTION .....	4
2.	RELATED DOCUMENTS .....	5
2.1.	APPLICABLE STANDARDS .....	5
2.2.	REFERENCE DOCUMENTS .....	5
3.	IDENTIFICATION OF EQUIPMENT UNDER TEST .....	6
4.	TESTS RESULTS .....	9
4.1.	EMISSIONS TESTS .....	9
4.1.1	Test configuration .....	9
4.1.2	Matrix Results .....	11
5.	CONCLUSION .....	11
6.	ABBREVIATIONS AND DEFINITIONS .....	12
6.1.	ABBREVIATIONS .....	12
6.2.	DEFINITIONS .....	13



# 1. INTRODUCTION

This document presents the FCC EMC tests report for the introduction of GSM 850 MHz & Dual GSM 850 MHz / PCS 1900 MHz and New Digital Board RICAM, Rectifier 1.4kW Artesyn CR as described in the document referenced [R1] on GSM 18000 Outdoor BTS.

For North America, applicable standard for EMC Base stations are the FCC part 15/ICES 003 Class B, the FCC Part 22 /RS132 and the FCC Part 24/RS133.

The tests were performed at LCIE Ecuelles (FCC registration number: 93402 – Industry Canada number: IC6231)

The following table gives some information of the EUT :

Product Name	GSM 18000 Outdoor BTS
Manufacturer	NORTEL
Serial Number	-
Alimentation of the EUT	AC



## 2. RELATED DOCUMENTS

### 2.1. APPLICABLE STANDARDS

[A1]	CFR 47 Part 2	Code of Federal Regulations - Part 2 - Frequency Allocations and Radio Treaty Matters. General Rules and Regulations. Date : June 1996.
[A2]	47 CFR Part 15 08/20/02	FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations – Radio frequency devices – dated 08/20/02
[A3]	CFR 47 Part 22	Code of Federal Regulations - Part 22 - Public Mobiles Services.
[A4]	CFR 47 Part 24	Code of Federal Regulations - Part 24 - Personal Communications Services.
[A5]	IC ES 003 (NMB 003)	Industry Canada - Digital apparatus
[A6]	RSS 132	Industry Canada - 800 MHz Cellular Telephones Employing New Technologies.
[A7]	RSS 133	Industry Canada – 2 GHz Personal Communications Services.

### 2.2. REFERENCE DOCUMENTS

[R1]	PE/BTS/DPL/020739	GSM 18000 BTS Project Qualification Plan for GSM850 MHz introduction
[R2]	60052684-553669-TP-18-FCC	EMC Test plan for the introduction of GSM 850 MHz (FCC)
[R3]	PE/BTS/DJD/021761 01.01 / EN	GSM850/1900 Outdoor BTS 18000 hardware delivery notice
[R4]	60053379-554566-B-T-NORTEL	ELECTROMAGNETIC COMPATIBILITY TESTS ACCORDING TO THE PUBLICATIONS 47 CFR PART 15 CLASS B of 2005 AND ICES003 CLASS B of 2004 & 47 CFR PART 22 of 2004 and RSS132 of 2005 on GSM 18000 Outdoor BTS 850 MHz



### 3. IDENTIFICATION OF EQUIPMENT UNDER TEST

This document applies to:

*Product:* GSM 18000 Outdoor BTS  
*Manufacturer:* NORTEL  
*Frequencies:* 850 MHz  
*Configuration:* R18OB 19 S333 85 S333 H2 E1  
*Option:* ALPRO2

<b>AVLM</b> Recipient: LCIE	Date of delivery: 09/FEB/2007
Product: GSM/UMTS 18000 Outdoor BTS	
Article delivered: GSM 18000 Outdoor BTS R18OB 19 S333 85 S333 H2 E1	Article code: NTT915AF 01
Section transmitting: 8U00	Designer name: CHENET S. / JEULAND P.
Cabinet Serial Number: NNTMC3002GCK / N°446117	
<b>Documents related to the Hardware Design Specifications</b>	
<b>Documents dealing with specifications:</b> – PE/BTS/DD/5282 V05.01/EN BTS 18000 system design specification	
<b>Issues fixed on the cabinet:</b> <ul style="list-style-type: none"><li>- DBP2</li><li>- RICAM to replace 1IFM1+2ICM+1ABM</li><li>- RMPSU CR on 3 RM</li><li>- Rectifier 1.4KW CR Artesyn</li><li>- DDM850 with VSWR</li><li>- HPRM850 60/45W</li></ul>	
<b>Missing Equipment:</b> - None	

**Software compatibility:**

Modules software version :

- Load BTS : v15f1e01 / CDI117235
  - ICM/ABM/RICAM : v15f101 / CDI117166
  - RM : v15e403 / CDI117006

PI software tools :

- WINTMI: v03d306
- TIL COAM: v15e402
- TIL Alarm: v15e401
- WINTOOL: v04b4e10



**The delivery includes :**

ARTICLE	PEC code	Release	Serial number	Comment
CAB: PRECA W BAT/60 S180 ROHS	NTT915AF	01	NNTMC3002GCK	
BARE CABINET & ECU	NTT91550	01	NNTMC3002GCK	
UCPS Rectifier 1.4KW	NTN070BF	04	ATSNZH152588	Rectifier 1.4KW CR ARTESYN
UCPS Rectifier 1.4KW	NTN070BF	04	ATSNZH152589	Rectifier 1.4KW CR ARTESYN
UCPS Rectifier 1.4KW	NTN070BF	04	ATSNZH152586	Rectifier 1.4KW CR ARTESYN
UCPS Rectifier 1.4KW	NTN070BF	04	ATSNZH152587	Rectifier 1.4KW CR ARTESYN
UCPS Rectifier 1.4KW	NTN070BF	04	ATSNZH152432	Rectifier 1.4KW CR ARTESYN
UCPS CCU UMTS/GSM	NTUM44AF	01	ATSNZH106461	
Rectifier Shelf UCPS W DDU	NTN066AA	01	ATSNZH127977	
ADU	NTT970AF	01	ATSNCR222358	
MOD: User ICO V2	NTT970BF	01	NNTMGT0052OI	
Kit Heater option :ECU	NTT991VF	01	NNTMGT0050F2	
Maintenance Plug Europe	NTN091HF	01	NNTMGT004XDK	
DBP2	NTN030AM	N1	18	New DBP without BUS bar
ECU W HEATER OPTION	NNT971CQ	01	NNTM7504YD2Y	
ECU ASSY	NTT971CF	01	NNTMC3002GDV	
RICAM	NTN024AA	D2 MIR2.5	FANTASTIX	ICM0 IP : 136.147.42.151 ICM1 IP : 136.147.42.152 ABM IP : 136.147.42.153
ABM	NTN029AF	01	NNTMGWC5036L	
RM PCS1900	NTN050PM	D3	CDN200639006	00 17 D1 9F 2F 58 IP : 136.147.42.85
RM PCS1900	NTN050PM	D5	CDN200640003	00 0E 62 FD 94 DF IP:136.147.42.88 with new PSU CR NTN058AM 04 / ATSNZH155434
RM PCS1900	NTN050PM	D4	CDN200640005	00 17 D1 9F 30 19 IP : 136.147.42.86
HPRM 850 for Radio Test	NTN050JA	D1	CDN200651003	00 19 69 FE C1 69 IP:136.147.42.128 with new PSU CR NTN058AM 04 / ATSNZH155432
HPRM 850	NTN050JA	D1	CDN200651009	00 19 69 FE C1 67 IP : 136.147.42.127
HPRM 850	NTN050JA	D1	CDN200651001	00 19 69 FE C1 6C IP : 136.147.42.120 with new PSU CR NTN058AM 04 / ATSNZH155429
DDM H2 1900 W/VSWR	NTN063AA	04	FICT03000MPC	
DDM H2 1900 W/VSWR	NTN063AA	04	FICT030016F3	
DDM H2 1900 W/VSWR	NTN063AA	04	FICT03000PEX	
DDM H2 850 W/VSWR	NTN063HA	D2	FICT03002119	FILTRONICS 850 full band
DDM H2 850 W/VSWR	NTN063HA	D2	FICT0300212D	FILTRONICS 850 full band
DDM H2 850 W/VSWR	NTN063HA	D1	FICT0200204F	FILTRONICS 850 full band
ALPRO 2	NTT971AF	01	NNTMGT004U9L	
ALPRO 2	NTT971AF	01	NNTMGT004U9N	



## 4. TESTS RESULTS

### 4.1. EMISSIONS TESTS

#### 4.1.1 TEST CONFIGURATION

The BTS is configured as close to normal intended use. The GSM 18000 Outdoor BTS 850 MHz is configured to transmit on all RF channels at Pmax on all the frequency band.

**Configuration GSM 18000 Outdoor dualband 850/1900 MHz**

			RM0 1900	RM1 1900 PSU CR	RM2 1900	RICAM				HPRM 850 PSU CR	HPRM 850	HPRM 850 PSU CR	ABM	
DPB2														
DDM 1900 FILTRO	DDM 1900 FILTRO	DDM 1900 FILTRO	DDM 850 FILTRO	DDM 850 FILTRO	DDM 850 FILTRO									
			1,4KW CR Artesyn	1,4KW CR Artesyn	1,4KW CR Artesyn	1,4KW CR Artesyn	1,4KW CR Artesyn	1,4KW CR Artesyn	CCU	DDU				

Frequencies configurations:

On GSM 18000 Indoor Dual band GSM 850 MHz/PCS 1900 MHz channel (128 190, 251) & (512, 661, 810).

ALPRO2 is present during this EMC campaign.

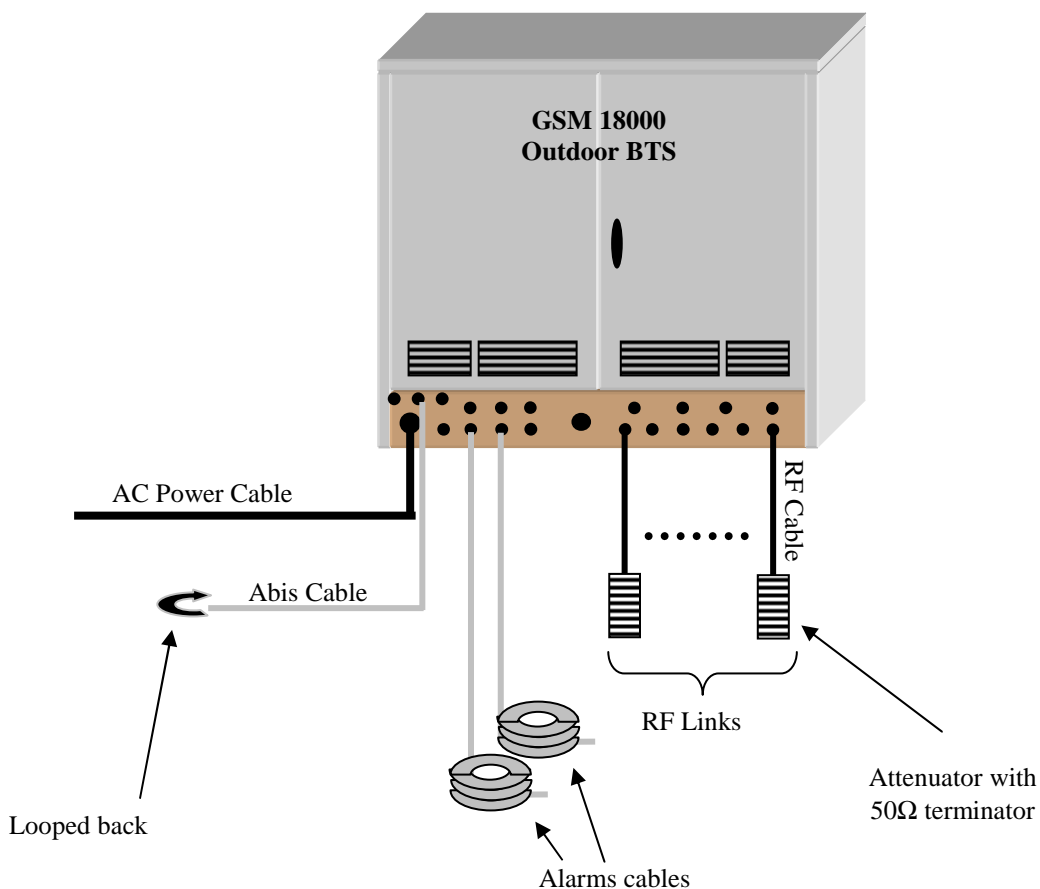
The Abis cable of the BTS is looped back at the end and a PCM signal is transmitted on these cables.

The following ports of the BTS will be available and connected :

- Abis port (telecom port) : cable 16 meters 120Ω. This cable is looped in order to transmit TX signals on RX ones.
- Radio port (signal port) : 12 RF cables RADIALL SHF9TD – DC-2GHz – Insertion loss < 5.5 dB at 2 GHz (15 meters). Attenuators and loads will also be used on RF links.
- GSM external Alarms ports: 1 cable will be looped and the other cable will be in open circuit.
- AC port : Lab cable (about 10 meters).

The hardware, software status and the functional limits are described in the document referenced [R3].

**Figure N°1: Emissions testing configuration**



## 4.1.2 MATRIX RESULTS

This table presents the tests realized and the severity applied:

Test	Compliance	Comments
Conducted Emissions on AC Port FCC Part15 §15.107 ICES003 (0.15 MHz to 30 MHz)	<b>PASS</b>	Configuration: 120/240VAC, Split phase US – 60 Hz Pass the FCC Part §15.107 Class B & ICES 003 with 5.8 dB margin / AVG and 15.8 dB margin / QP without ground strap.  Configuration: Three wires plus protective earth, 208-240V – 60 Hz Pass the FCC Part §15.107 Class B & ICES 003 with 5.4dB margin / AVG and 15.4 dB margin / QP with ground strap.
Radiated Emissions FCC Part 15 § 15.109 ICES003 (30 MHz to 18 GHz)	<b>PASS</b>	Pass the FCC Part §15.109 (30MHz to 18 GHz) Class B with 7 dB margin & ICES 003 with 7 dB margin in worst case.
Radiated Emissions Spurious FCC Part 22 § 22.917 RSS132 § 4.5 (30 MHz to 20 GHz)	<b>PASS</b>	For 60 W, limit is 93.9 dBµV/m @ 1 m or 73.9 dBµV/m @ 10 m.  No spurious (>30dB margin)
Radiated Emissions Spurious FCC Part 24 § 24.238 RSS133 § 6.5 (30 MHz to 20 GHz)	<b>PASS</b>	For 60 W, limit is 93.9 dBµV/m @ 1 m or 73.9 dBµV/m @ 10 m.  No spurious (>30dB margin)

## 5. CONCLUSION

The GSM 18000 BTS Outdoor GSM 850 MHz & Dual GSM 850 MHz / PCS 1900 MHz with New Digital Board RICAM, Rectifier 1.4kW Artesyn CR as described in this document complies with the FCC part 15 [Part 15.107 (subpart B)]/ICES 003 Class B, the FCC Part 22 [Part 22.917 (subpart H)]/RS132 and the FCC Part 24 [Part 24.238 (subpart E)]/RS133 .

## 6. ABBREVIATIONS AND DEFINITIONS

### 6.1. ABBREVIATIONS

AC	Alternative Current (Power source)
AC/DC	Alternative Current to Direct Current converter
AE	Auxiliary Equipment
AM	Amplitude Modulation
AV	Average
BER	Bit Error Rate
CW	Continuous Waves
dBm	Decibel milliwatt
DC	Direct Current
EFT/B	Electrical Fast Transient / Burst
EM	ElectroMagnetic
EMC	ElectroMagnetic Compatibility
EMI	Electro-Magnetic Interference
EN	European Norm
ERM	Electromagnetic compatibility and Radio spectrum Matters
ESD	ElectroStatic Discharge
ETS	ETSI Standard
EUT	Equipment Under Test
GRP	Ground Reference Plane
HCP	Horizontal Coupling Plane
IT	Information Technology
PE	Protective Earth
N/A	Not Applicable
NTP	Network Termination Point
RF	Radio Frequency
RFI	Radio Frequency Interference
TDMA	Time Division Multiple Access
VCP	Vertical Coupling Plane

## 6.2. DEFINITIONS

**Air discharge method** : a method of testing, in which the charged electrode of the test generator is brought close to the EUT, and the discharge actuated by a spark to the EUT.

**Amplitude modulation** : process by which the amplitude of a carrier wave is varied following a specified law.

**Anechoic chamber** : shielded enclosure which is lined with radio-frequency absorbers to reduce reflections from the internal surfaces.

**Antenna** : transducer which either emits radio-frequency power into space from a signal source or intercepts an arriving electromagnetic field, converting it into an electrical signal.

**Antistatic material** : material exhibiting properties which minimize charge generation when rubbed against or separated from the same or other similar materials.

**Artificial hand** : an electrical network simulating the impedance of the human body under average operational conditions between a hand-held electrical appliance and earth

**Auxiliary equipment** : equipment necessary to provide the EUT with the signals required for normal operation and equipment to verify the performance of the equipment under test.

**Balanced lines** : a pair of symmetrically driven conductors with a conversion loss from differential to common mode of less than 20 dB.

**Balun** : device for transforming an unbalanced voltage to a balanced voltage or vice versa.

**Burst** : a sequence of a limited number of distinct pulses or an oscillation of limited duration.

**Contact discharge method** : a method of testing, in which the electrode of the test generator is held in contact with the EUT, and the discharge actuated by the discharge switch within the generator.

**Clamp injection** : clamp injection is obtained by means of a clamp-on "current" injecting device on the cable.

**Continuous waves** : electromagnetic waves, the successive oscillations of which are identical under steady-state conditions, which can be interrupted or modulated to convey information.

**Coupling clamp** : device of defined dimensions and characteristics for common mode coupling of the disturbance signal to the circuit under test without any galvanic connection to it.

**Coupling network** : electrical circuit for the purpose of preventing EFT voltage applied to the EUT from affecting other devices, equipment or systems which are not under test.

**Coupling plane** : a metal sheet or plate, to which discharges are applied to simulate electrostatic discharge to objects adjacent to the EUT.

**Current clamp** : a transformer, the secondary winding of which consists of the cable into which the injection is made.

**Current surge** : the front time  $T_1$  of a surge voltage is a virtual parameter defined as 1.25 times the interval  $T$  between the instants when the impulse is 10% and 90% of the peak value.

**Decoupling network** : electrical circuit for the purpose of preventing surges applied to the EUT from affecting other devices, equipment or systems which are not under test.



**Degradation of performance** : an undesired departure in the operational performance of any device, equipment or system from its intended performance.

**Direct application** : application of the discharge directly to the EUT.

**Duration** : the absolute value of the interval during which a specified waveform or feature exists or continues.

**Electrical installation** : an assembly of associated electrical equipment to fulfil a specific purpose or purposes and having coordinated characteristics.

**Electromagnetic clamp** : (EM-clamp) injection devices with combined capacitive and inductive coupling.

**Electromagnetic compatibility** : the ability of an equipment or system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

**Electromagnetic wave** : radiant energy produced by the oscillation of an electric charge characterized by oscillation of the electric and magnetic field.

**Electrostatic discharge** : a transfer of electric charge between bodies of different electrostatic potential in proximity or through direct contact.

**Energy storage capacitor** : the capacitor of the ESD generator representing the capacity of a human body charged to the test voltage value. This may be provided as a discrete component, or a distributed capacitance.

**Far field** : region where the power flux density from an antenna approximately obeys an inverse square law of the distance.

**Field strength** : the term "field strength" is applied only to measurements made in the far field. The measurement may be of either the electric or the magnetic component of the field and may be expressed as V/m, A/m or W/m<sup>2</sup>; any one of these may be converted into the others.

**Frequency band** : continuous of frequencies extending between two limits.

**Fully anechoic chamber** : shielded enclosure whose internal surfaces are totally lined with anechoic material.

**Ground reference plane** : a flat conductive surface whose potential is used as a common reference

**Holding time** : interval of time within the decrease of the test voltage due to leakage, prior to the discharge, is not greater than 10%.

**Human body-mounted equipment** : equipment which is intended for use when attached to the human body. This definition included hand-held devices which are carried by people while in operation (e.g. pocket devices) as well as electronics aid devices and implants.

**Immunity to a disturbance** : the ability of a device, equipment or system to perform without degradation in the presence of an electromagnetic disturbance.

**Indirect application** : application of the discharge to a coupling plane in the vicinity of the EUT, and simulation of personnel discharge to objects which are adjacent to the EUT.

**Induction field** : predominant electric and/or magnetic field existing at a distance  $d < \lambda/2\pi$ , where  $\lambda$  is the wavelength and the physical dimensions of the source are much smaller than distance  $d$ .



**Isotropic** : having properties of equal values in all directions

**Malfunction** : the termination of the ability of an equipment to carry out intended functions or the execution of unintended functions by the equipment.

**Maximum RMS value** : the highest short-term RMS value of a modulated RF signal during an observation time of one modulation period. The short-term RMS is evaluated over a single carrier cycle.

**Modified semi-anechoic chamber** : semi-anechoic chamber which has additional absorbers installed on the ground plane.

**Non-constant envelope modulation** : RF modulation schemes where the amplitude of the carrier wave varies slowly in time compared with the period of the carrier itself. Examples include conventional modulation and TDMA.

**Polarization** : orientation of the electric field vector of a radiated field.

**Port** : particular interface of the EUT with the external electromagnetic environment

**Primary protection** : the means by which the majority of stressful energy is prevented from propagating beyond the designated interface.

**Rise time** : the interval of time between the instants at which the instantaneous value of a pulse first reaches 10% value and then the 90% values.

**Secondary protection** : the means by which the let-through energy from primary protection is suppressed. It may be a special device or an inherent characteristic of the EUT.

**Semi-anechoic chamber** : shielded enclosure where all internal surfaces are covered with anechoic material with the exception of the floor, which shall be reflective (ground plane).

**Shielded enclosure** : screened or solid metal housing designed expressly for the purpose of isolating the internal from the external electromagnetic environment. The purpose is to prevent outside ambient electromagnetic fields from causing performance degradation and to prevent emission from causing interference to outside activities.

**Short interruption** : the disappearance of the supply voltage for a period of time typically not exceeding 1 min. Short interruptions can be considered as voltage dips with 100% amplitude.

**Spurious radiation** : any undesired electromagnetic emission from an electrical device.

**Stripline** : terminated transmission line consisting of two parallel plates between which a wave is propagated in the transverse electromagnetic mode to produce a specified field for testing purposes.

**Surge** : a transient wave of electrical current, voltage, or power propagating along a line or a circuit and characterized by a rapid increase followed by a slower decrease.

**Surge voltage** : the front time  $T_1$  of a surge voltage is a virtual parameter defined as 1.67 times the interval  $T$  between the instants when the impulse is 30% and 90% of the peak value.

**Sweep** : continuous or incremental traverse over a range of frequencies

**System** : set of interdependent elements constituted to achieve a given objective by performing a specified function.

**TDMA** : a time multiplexing modulation scheme which places several communication channels on the same carrier wave at an allocated frequency. Each channel is assigned a time slot during which, if the channel is active, the information is transmitted as a pulse of RF power. If the



channel is not active no pulse is transmitted, thus the carrier envelope is not constant. During the pulse, the amplitude is constant and the RF carrier is frequency or phase modulated.

**Time to half-value  $T_2$**  : the time to half value  $T_2$  of a surge is a virtual parameter defined as the time interval between the virtual origin  $O_1$  and the instant when the voltage current has decreased to half the peak value.

**Transceiver** : Combination of radio transmitting and receiving equipment in a common housing.

**Transient** : pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval which is short compared with the time-scale of interest.

**Voltage dips** : a sudden reduction of the voltage at a point in the electrical system, followed recovery after a short period of time, from half a cycle to a few second.

**Voltage variation** : a gradual change of the supply voltage to a higher or lower value than the rated voltage. The duration of the change can be short or long with regard to the period.

❧END OF DOCUMENT❧