



L C I E

EMC Test report for the introduction of RICAM and GSM 850MHz band in GSM 6000 Outdoor BTS (FCC)

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Product: GSM 6000 BTS 850 MHz

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1. INTRODUCTION

This document presents the EMC tests report for the FCC EMC qualification of GSM 6000 BTS in the 850 MHz frequency band with RICAM & ICAM module.

For the qualification of GSM 6000 BTS in the 850 MHz GSM band, a full EMC qualification has been done on GSM 6000 BTS Outdoor cabinet in AC and DC versions.

The GSM 6000 BTS Indoor cabinet in AC version has been introduced by similarity with GSM 6000 BTS Outdoor cabinet in AC version.

Those both versions are identical except door, enclosure and gaskets. Gaskets of Outdoor version are less efficient than Indoor version gaskets concerning EMC aspect, so we'll be able to deduce EMC conformity of GSM 6000 BTS Indoor cabinet in AC version from results of GSM 6000 BTS Outdoor cabinet in AC version.

For North America, applicable standard for EMC Base stations are the FCC part 15 [Part 15.107 and 15.109 (subpart B)]/ICES 003 Class B and the FCC Part 22/RS132 [Part 22.917 (subpart H)]/RS132.

We covered also the FCC Part 15 [Part 15.207 and 15.209 in frequency range 30MHz to 18 GHz (subpart C)] class B.

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 6000 Outdoor BTS |
| Manufacturer | NORTEL |
| Serial Number | - |
| Alimentation of the EUT | AC or DC |



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] | IC ES 003 (NMB 003) | Industry Canada - Digital apparatus |
| [A5] | RSS 132 | Industry Canada - 800 MHz Cellular Telephones Employing New Technologies. |

2.2. REFERENCE DOCUMENTS

| | | |
|------|--------------------------------|---|
| [R1] | PE/BTS/DPL/021882 | GSM 6000 BTS Project Qualification Plan For GSM850&PCS1900 Cabinet and RICAM Introduction for CE & FCC Marking |
| [R2] | 60056545-557308-C-TP-FCC | EMC Test plan for the introduction of RICAM and GSM 850MHz band in GSM 6000 BTS (FCC) |
| [R3] | PE/BTS/DJD/022074 01.01/EN | GSM 6000 outdoor BTS 850 MHz hardware delivery notice |
| [R4] | PE/BTS/DJD/022074 02.01/EN | GSM 6000 outdoor BTS 850 MHz hardware delivery Notice |
| [R5] | 60049617- 550144_A_T_NORTEL | ELECTROMAGNETIC COMPATIBILITY TESTS ACCORDING TO THE PUBLICATIONS 47 CFR PART 15 CLASS B of 2005, ICES003 CLASS B of 2004 & 47 CFR PART 22 of 2004 and RSS132 of 2005 on GSM 1900 BTS 6000 OUTDOOR (A.C.) |
| [R6] | 60049617- 550144_C_T_NORTEL | ELECTROMAGNETIC COMPATIBILITY TESTS ACCORDING TO THE PUBLICATIONS 47 CFR PART 15 CLASS B of 2005, ICES003 CLASS B of 2004 & 47 CFR PART 22 of 2004 and RSS132 of 2005 on GSM 1900 BTS 6000 OUTDOOR (D.C.) |



3. IDENTIFICATION OF EQUIPMENT UNDER TEST

This document applies to:

Product: GSM 6000 BTS
 OUTDOOR (AC & DC version)
Manufacturer: NORTEL
Frequencies: 850 MHz

Configuration: AC or DC OUT

Option: CALPRO2 & CPRIPRO2

| | |
|--|-----------------------------------|
| AVLM Recipient: LCIE | Date of delivery: 18/APR/2007 |
| Product: GSM 6000 Outdoor BTS | |
| Article delivered: AC version of GSM 6000 Outdoor BTS | Article code: NTQ610FA D1 |
| Section transmitting: SU00 | Designer name: Chenet Stéphane |
| Cabinet Serial Number: NNTM@T004K62 / 434137 | |
| Documents related to the Hardware Design Specifications - PE/BTS/DD.016672 V01.05/EN BTS 6000 Product Specification | |
| Documents dealing with specifications: | |
| Issues fixed on the cabinet: | |
| Missing Equipment: | |
| Software compatibility: | |
| Modules software version : | |
| - Load BTS : v15f1e04 / CD1118000 | |
| > IC WABM : v15f104 / CD1117970 | |
| > RM : v15e403 / CD1117006 | |
| PI software tools : | |
| - WINTMI: | v03d306 |
| - TIL COAM: | v15e403 |
| - TIL Alarm: | v15e402 |
| - WINTOOL: | v04b4e10 |

The delivery includes :

| ARTICLE | PEC code | Release | Serial number | Comment |
|------------------------------------|----------|--------------|----------------|--|
| CAB: PRECA | NTQ610FA | D1 | NNTMG T004KG2 | |
| UCPS Rectifier 1.4kW | NTN070BF | 04 | ATSNZH152588 | ARTESYN Rectifier CR |
| UCPS Rectifier 1.4kW | NTN070BF | 04 | ATSNZH152431 | ARTESYN Rectifier CR |
| UCPS CCU UMTS/GSM | NTUM44AF | 01 | ATSNZH085686 | |
| DDU | NTN066AA | D1 | ATSNZH096636 | |
| ADU | NTQ666CA | 01 | ATSNZH116616 | |
| SAFT Battery | NTQ675AA | 0D | 07445L000010 | |
| CRICO | NTQ620CA | D1 | NNTMG T004JQT | |
| CECU FAN TRAY AC | NTQ675JG | 01 | NNTMG T004YU7 | |
| CECU Control Board | NTQ629AA | 01 | N/A | Control board without SN |
| RICAM | NTN024AA | D1 MIR 1+ | FLAMESAREMAGIX | IC M O : IP → 47.164.182.160 IC M O : IP → 47.164.182.161 IABM O : IP → 47.164.182.162 |
| HPRM 3T 850 | NTN050JA | D1 | CDN200651003 | IP 47.164.182.178 with new PSU CR NTN058AM 04 / ATSNZH155432 |
| HPRM 3T 850 | NTN050JA | D1 | CDN200651010 | IP 47.164.182.179 with new PSU CR NTN058AM 04 / ATSNZH155424 |
| DDM 850 W/V/SW/R W/HYBRIDS ROHS | NTN063HM | D2 | FIC T03002119 | |
| DDM 850 W/V/SW/R W/HYBRIDS ROHS | NTN063HM | D2 | FIC T0300212D | |
| DDM 850 W/V/SW/R W/HYBRIDS ROHS | NTN063HM | D1 | FIC T0200204F | |
| CALPRO2 | NTQ675CA | D1 | NNTMG T004MHX | |
| CUSER-ICO | NTQ650AA | D1 | NNTMG T004LBZ | |

Additional delivery:

| ARTICLE | PEC code | Release | Serial number | Comment |
|----------------|----------|---------|---------------|---------|
| AC Power cable | | | | |
| PC M cable | | | | |
| 850 Duplexer | NTQA38DA | 01 | NNTM7503KYZ5 | |
| | | | | |



| | |
|--|-----------------------------------|
| AVLM Recipient: LCIE | Date of delivery: 11/MAY/2007 |
| Product: GSM 6000 Outdoor BTS | |
| Article delivered: DC version of GSM 6000 Outdoor BTS | Article code: NTQ610AA D1 |
| Section transmitting: 8U00 | Designer name: Chenet Stéphane |
| Cabinet Serial Number: NNTMGT004R9N / 445082 | |
| Documents related to the Hardware Design Specifications - PE/BTS/DD.016672 V01.05/EN BTS 6000 Product Specification | |
| Documents dealing with specifications: | |
| Issues fixed on the cabinet: | |
| Missing Equipment: - Antennas cables from output of DDM to bukhead are missing ; Use antennas cables from the BTS 6000 AC previously delivered. | |
| Software compatibility: Modules software version : - Load BTS : v15f1e04 / CD1118000 > ICWABM : v15f104 / CD1117970 > RM : v15e403 / CD1117006 | |
| PI software tools : - WINTMI: v03d306 - TIL COAM: v15e403 - TIL Alarm: v15e402 - WINTOOL: v04b4e10 | |

The delivery includes :

| ARTICLE | PEC code | Release | Serial number | Comment |
|-------------------------------|----------|---------------|---------------|--|
| CAB: PRECA | NTQ610AA | D1 | NNTMG T004R9N | |
| FILLER REC TIFIER | NTW70351 | 01 | ATSNZH056168 | |
| FILLER REC TIFIER | NTW70351 | 01 | ATSNZH056166 | |
| UCPS CCU UMTS/GSM | NTUM44AF | 01 | ATSNZH085723 | |
| DDU | NTN066AA | D1 | ATSNZH096624 | |
| DCU | NTQ666BA | 01 | ATSNZH125868 | Input filter updated to be compliant to CLASSE B in CEM test |
| CRICO | NTQ620CA | D1 | NNTMG T004KVD | |
| CECU | NTQ675JA | D1 | NNTMG T004R9J | |
| CECU Control Board | NTQ629AA | 01 | NNTM75012345 | |
| | | | | |
| RICAM | NTN024AA | D1 MIR 2.5 | FANTASTIX | ICM0 : IP → 47.164.182.180 ICM0 : IP → 47.164.182.181 ABM0 : IP → 47.164.182.182 |
| HPRM3T 850 | NTN050JA | D1 | CDN200651001 | IP 47.164.182.183 with new PSU CR NTN058AM 04 / ATSNZH155429 For Radio test |
| HPRM3T 850 | NTN050JA | D1 | CDN200651004 | IP 47.164.182.184 with new PSU CR NTN058AM 04 / ATSNZH155427 |
| DDM 850 W/VSWR W/HYBRIDS ROHS | NTN063HA | D2 | FICT0300213H | |
| DDM 850 W/VSWR W/HYBRIDS ROHS | NTN063HA | D2 | FICT0300212F | |
| DDM 850 W/VSWR W/HYBRIDS ROHS | NTN063HA | D2 | FICT0300212G | |
| | | | | |
| CALPRO2 | NTQ675CA | D1 | NNTMG T004MHZ | |
| CUSER-ICO | NTQ650AA | D1 | NNTMG T004L73 | |

Additional delivery:

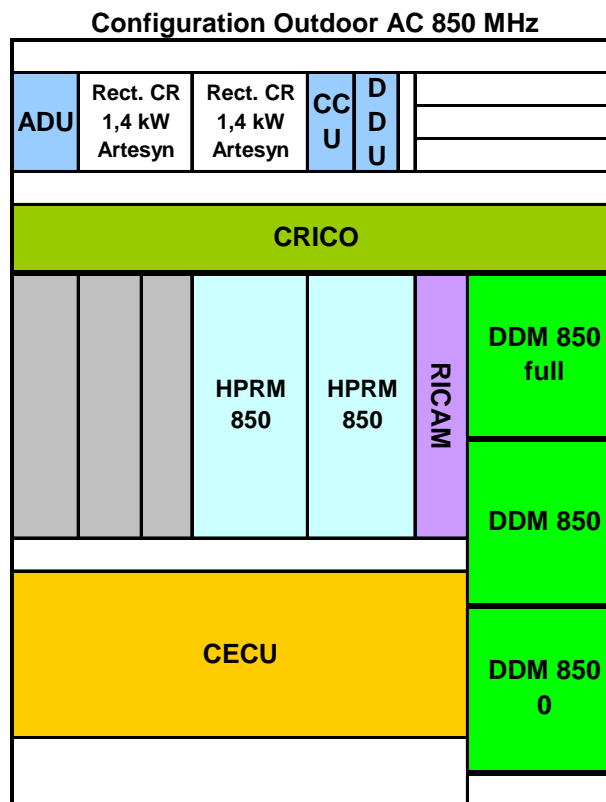
| ARTICLE | PEC code | Release | Serial number | Comment |
|----------------------|----------|---------|---------------|---------|
| DC Power cable | | | | |
| PC M cable | | | | |
| CPRIPRO2 | NTQ675SA | D1 | NNTMG T004MZ7 | |
| External Alarm Cable | | | | |

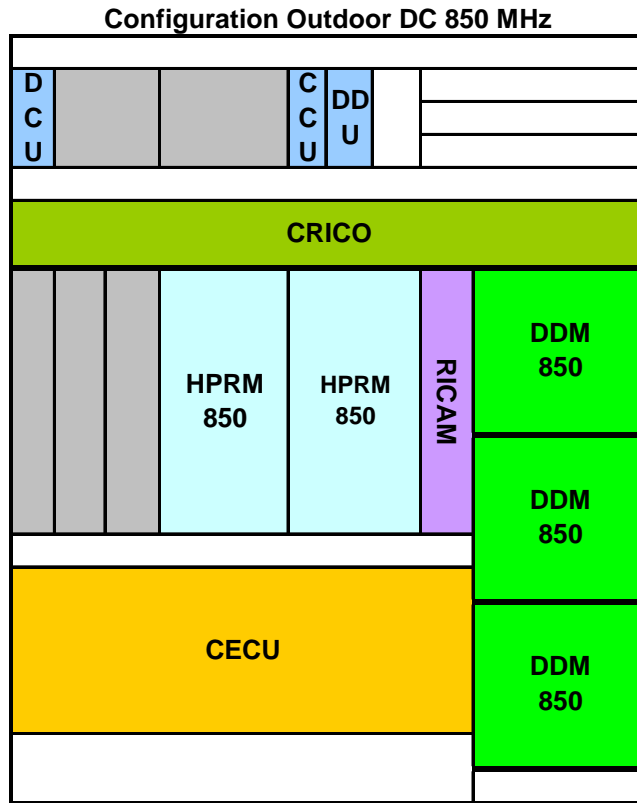
4. TESTS RESULTS

4.1. EMISSIONS TESTS

4.1.1 TEST CONFIGURATION

The BTS is configured as close to normal intended use. The GSM 6000 BTS 850 MHz is configured to transmit on all RF channels at Pmax on all the frequency band.





Frequencies configurations:
 On 850 MHz HPRM0 (Channel 128, 190, 251).
 On 850 MHz MPRM1 (Channel 128, 190, 251).

CPRIPRO2 is present during this EMC campaign.
 CALPRO2 is present during this EMC campaign.

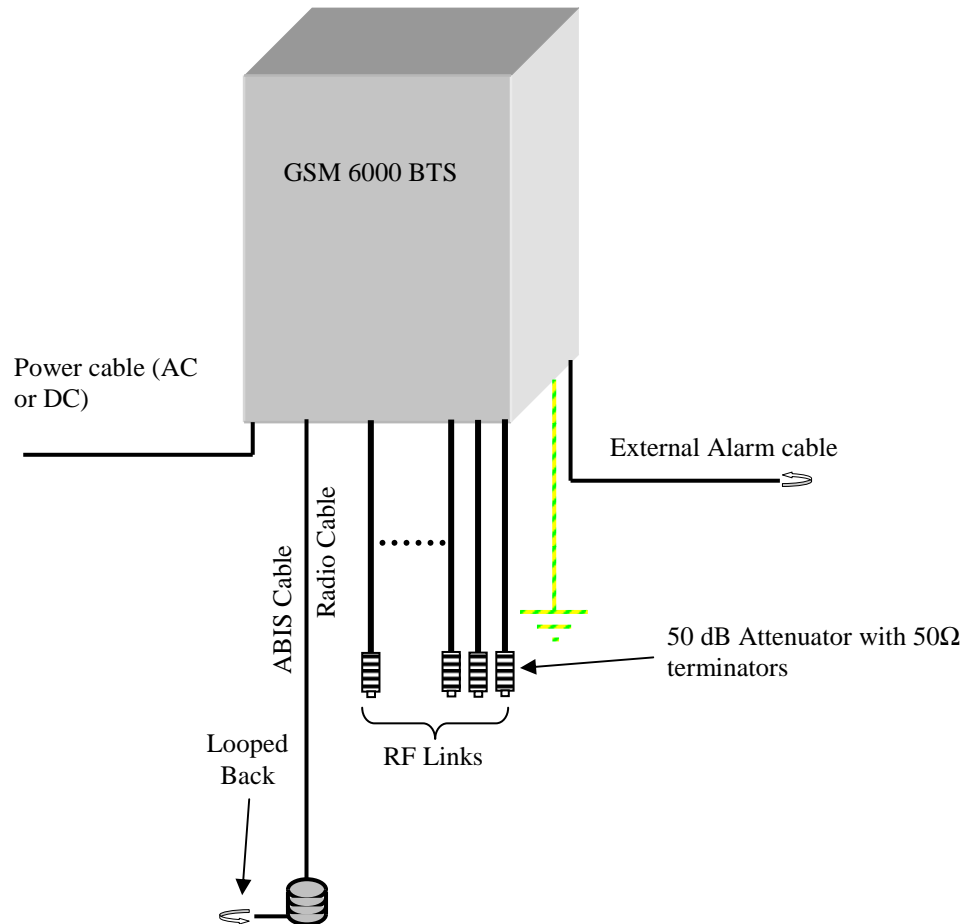
The Abis cable of the BTS is looped back at the end and a PCM signal is transmitted on these cables.

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.
- GSM external Alarms ports: 1 cable is in open circuit.
- Radio port (signal port) : 4 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.
- AC or DC port : Lab cable (about 10 meters).

The hardware, software status and the functional limits are described in the document referenced [R3 & R4].

Figure N1: Emissions testing configuration



4.1.2 MATRIX RESULTS

This table presents the tests realized and the severity applied :

Configuration Outdoor AC 850 MHz

| Test | Compliance | Comments |
|---|-------------|---|
| Conducted Emissions on AC Port FCC Part15 §15.107 & §15.207 ICES003 (0.15 MHz to 30 MHz) | PASS | Split phase 240V – 60 Hz: Pass the FCC Part §15.107 & 15.207 Class B & ICES 003 with 6 dB margin / AVG and 16 dB margin / QP.. |
| Radiated Emissions FCC Part 15 § 15.109 & 15.209 ICES003 (30 MHz to 18 GHz) | PASS | Pass the FCC Part §15.109 & 15.209 (30MHz to 18 GHz) Class B with 9 dB margin & ICES 003 with 8 dB margin in worst case. |
| Radiated Emissions Spurious FCC Part 22 § 22.917 RSS132 § 4.5 (30 MHz to 20 GHz) | PASS | For 60 W, limit is 93.9 dBµV/m @ 1 m or 73.9 dBµV/m @ 10 m. No spurious (44dB margin) |

Configuration Outdoor DC 850 MHz

| Test | Compliance | Comments |
|---|-------------|---|
| Conducted Emissions on DC Port FCC Part15 §15.107 & §15.207 ICES003 (0.15 MHz to 30 MHz) | PASS | For information only: DC -48 V: Pass the FCC Part §15.107 & 15.207 Class B with 3 dB margin / AVG and 13 dB margin / QP. |
| Radiated Emissions FCC Part 15 § 15.109 & 15.209 ICES003 (30 MHz to 18 GHz) | PASS | Pass the FCC Part §15.109 & 15.209 (30MHz to 18 GHz) Class B with 7.5 dB margin & ICES 003 with 7.5 dB margin in worst case. |
| Radiated Emissions Spurious FCC Part 22 § 22.917 RSS132 § 4.5 (30 MHz to 20 GHz) | PASS | For 60 W, limit is 93.9 dBµV/m @ 1 m or 73.9 dBµV/m @ 10 m. No spurious (44.5dB margin) |

4.2. CONCLUSIONS OF EMISSIONS TESTS

During this assessment, we have validated the qualification of the GSM 6000 BTS Outdoor cabinet in AC and DC versions as described in the document referenced [R1].

The GSM 6000 BTS Indoor cabinet in AC version has be introduced by similarity with GSM 6000 BTS Outdoor cabinet in AC version.

Those both versions are identical except door, enclosure and gaskets. Gaskets of Outdoor version are less efficient than Indoor version gaskets concerning EMC aspect, according to the EMC results of the GSM 6000 BTS Outdoor cabinet in AC version, we deduce the EMC conformity of GSM 6000 BTS Indoor cabinet in AC version.



5. CONCLUSION

The GSM 6000 BTS Outdoor cabinet in AC version equipped with RICAM or ICAM, and GSM 6000 BTS Outdoor cabinet in DC version equipped with RICAM or ICAM as described in this document complies with the FCC part 15 [Part 15.107 and 15.207 (subpart B)]/ICES 003 Class B and the FCC Part 22 [Part 22.917 (subpart H)]/RS132.

They comply also with the FCC Part 15 [Part 15.109 and 15.209 in frequency range 30MHz to 18 GHz (subpart C)] class B.

Note: This qualification take account also ICAM Module. The Interface Control Alarm Module (ICAM) is the same board of RICAM without the redundancy function.

| PEC CODE | TITLE | COMMENT |
|----------|-------|-------------------------------|
| NTN024AA | RICAM | |
| NTN024BA | ICAM | Same RICAM without redundancy |

The GSM 6000 BTS Indoor cabinet in AC version is introduced by similarity with GSM 6000 BTS Outdoor cabinet in AC version and by analysis of the EMC results obtained during this qualification of GSM 6000 BTS products.

The GSM 6000 BTS Indoor cabinet in AC version as described in this document comply with the FCC part 15 [Part 15.107 and 15.207 (subpart B)]/ICES 003 Class B and the FCC Part 22 [Part 22.917 (subpart H)]/RS132.

It complies also with the FCC Part 15 [Part 15.109 and 15.209 in frequency range 30MHz to 18 GHz (subpart C)] class B.

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/m²; 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 λ 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❧