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Technical Report

**Digital cellular telecommunications system (Phase 2);
Base station and ancillary equipment;
Physical and electrical parameters;
Application of standards and guidance notes
(GSM 11.22 version 4.1.4)**

GSM®

GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS



European Telecommunications Standards Institute

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Foreword

This Technical Report (TR) has been produced by the Special Mobile Group (SMG) Technical Committee (TC) of the European Telecommunications Standards Institute (ETSI).

ETSI Technical Reports (TR's) are informative documents that contain material that is not suitable for adoption as a formal standard.

This TR is a guide for system operators and equipment manufacturers and should be applied to the physical design, functionality and testing of equipment and the equipment environment. Some of the various specifications are required by legislation in many member countries and should be regarded as mandatory in their application.

1 Scope

This TR applies to any Base Station System type or part of a Base Station System and co-located equipment and equipment sites, unless otherwise stated.

It applies regardless of ownership or responsibility for installation and maintenance of the equipment or network.

The document does assume some previous knowledge of the subject matter and in some areas specialist understanding may be required.

This TR addresses the following information:

- Product requirement overview;
- Equipment sites and installations;
- General applicable specifications;
- Acoustic noise;
- Construction;
- Earthing and bonding;
- Environmental Conditions;
- Lightning protection;
- Power supplies;
- Reliability/Dependability;
- Specific applicable specifications for product release;
- EMC;
- Safety;
- Type approval.

2 References

References may be made to:

- a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply; or
- b) all versions up to and including the identified version (identified by "up to and including" before the version identity); or

- c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or
- d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

- [1] 73/23/EEC: "The Low Voltage Directive".
- [2] 89/336/EEC: "Council Directive Relating to Electromagnetic Compatibility".
- [3] 92/31/EEC: "Council Directive Amending 89/336/EEC".
- [4] EN 60721-3-4: "Classification of environmental conditions Part 3: Classification of groups of environmental parameters and their severities, Stationary use at non-weather protected locations".
- [5] EN 60950: "Safety of information technology equipment, including electrical business equipment".
- [6] ETS 300 019-1-1: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-1: Classification of environmental conditions, Storage".
- [7] ETS 300 019-1-2: "Equipment Engineering; Environmental conditions and environmental test for telecommunications equipment, Part 1-2: Classification of environmental conditions, Transportation".
- [8] ETS 300 019-1-3: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment: Part 1-3: Classification of environmental conditions, Stationary use at weatherprotected locations".
- [9] ETS 300 019-1-4: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment: Part 1-4: Classification of environmental conditions, Stationary use at non-weatherprotected locations".
- [10] ETS 300 019-2-1: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment, Part 2-1: Specification of environmental tests, Storage".
- [11] ETS 300 019-2-2: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-2: Specification of environmental tests, Transportation".
- [12] ETS 300 019-2-3: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests, Stationary use at weatherprotected locations".
- [13] ETS 300 019-2-4: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-4: Specification of environmental tests, Stationary use at non-weatherprotected locations".
- [14] ETS 300 119-2: "Equipment Engineering (EE); European telecommunication standard for equipment practice; Part 2: Engineering requirements for racks and cabinets".
- [15] ETS 300 119-4: "Equipment Engineering (EE); European telecommunication standard for equipment practice, Part 4: Engineering requirements for subracks in miscellaneous racks and cabinets".
- [16] ETS 300 132-1: "Equipment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 1: Operated by alternating current (ac) derived from direct current (dc) sources".
- [17] ETS 300 132-2: "Equipment Engineering (EE): Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)".
- [18] ETS 300 253: "Equipment Engineering (EE); Earthing and bonding of telecommunications equipment in telecommunication centres".

- [19] ETS 300 342-2: "Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) for European digital cellular telecommunications systems (GSM 900 MHz and DCS 1 800 MHz), Part 2: Base Station radio and ancillary equipment".
- [20] ETR 035: "Equipment Engineering (EE); Environmental engineering; Guidance and terminology".
- [21] IEC Publication 99-1: "Part 1: Non-linear resistor type gapped surge arrestors for AC systems".
- [22] IEC Publication 529: "Degrees of protection provided by enclosures (IP Code)".
- [23] IEC 721-2-1: "Classification of environmental conditions"
References: IEC Publication 721 Part 1.
- [24] IEC Publication 721-2-3 [3]: "Part 2: Environmental conditions appearing in nature. Air pressure".
- [25] IEC Publication 1024-1: "Protection of structures against lightning, Part 1 general principles".
- [26] IEC publication 1024-1-1: "Part 1: Guide A - Selection of protection levels for lightning protection systems".
- [27] [IEC 56 (Secretariat) 383: "Use of failure rate data intended for reliability prediction of components in electronic equipment, -Reference conditions, -Stress models for their conversion".]
- [28] ISO 1996/1 (1982-09-15): "Acoustics - Description and measurement of environmental noise - Part 1 Basic quantities and procedures".
- [29] ISO 3461: "Graphic symbols".
- [30] ISO 3864: "Safety signs and colours".
- [31] ISO 7779: "Acoustics - Measurement of airborne noise emitted by computer and business equipment".
- [32] [ISO 9001: "Specification for design/development, production, installation and servicing".]

3 Definitions

3.1 Base Station System

Base Station System shall, for the purposes of this document, be defined as: equipment that contains operational radio and associated support elements that conform to the GSM 900 and DCS 1 800 recommendations within a single supporting fixed structure.

- EXAMPLE Stand alone radio equipment.
 As above but combined with digital processing equipment.
 As above but combined with mains power interfaces.
 As above but combined with external communications equipment.

3.2 Co-located equipment

Co-located equipment shall, for the purposes of this document, be defined as: equipment that is a support element for operational Base Station radio equipment that conforms to the GSM 900 and DCS 1 800 recommendations within a single fixed structure or as a separate unit that is permanently located with the radio equipment.

- EXAMPLE Digital processing equipment.
 Power Supplies.
 Communications equipment.

3.3 Weather protected locations (ETS 300 019-1-3)

A location at which the equipment is protected from weather influences.

3.3.1 Totally weather protected locations

A location where direct weather influences are totally excluded.

3.3.2 Partially weather protected locations

A location where direct weather influences are not completely excluded.

3.4 Non Weather protected locations (ETS 300 019-1-4)

Any location where the equipment is completely open to weather influences.

4 Abbreviations

A.C.	alternating current
D.C.	direct current
EN	European Norm
ETR	ETSI Technical Report
ETSI	European Telecommunications Standards Institute
EU	European Union
IEC	International Electrotechnical Commission
ISO	International Standards Organisation
MTBF	Mean Time Between Failures

5 Product Requirement Overview

This clause describes the basic path for specification of equipment going in to service from initial requirement.

Manufacturers and system operators shall reference data taken from either ETSI, IEC or ISO documentation listed within this document for specification of equipment. Those specifications detail operating environments based on telecommunication standards collected statistical data.

If it is practical, manufacturers and operators should use the class/category system within the documents for simplification of specification. If there is a requirement that falls outside of the class/category system the manufacturer or system operator should state that the equipment shall comply, for example, to ETS 300 019-1-3, class 3.1.

It should be noted that if an ETSI standard is applied to equipment or site specification, then the equipment or site should meet those parameters as a minimum. If there is any requirement for any deviation from the stated parameters detailed within the standards then the core reference documents should be identified and no reference to the ETSI standard should be made.

The climatic and mechanical parameters will be used in type approval testing of RF parameters at extreme conditions.

The EU directive on EMC is mandatory within the EU and the permissible levels and test requirements are described within the detailed clause of this document.

Safety legislation and levels may vary from country to country. It is thought that the standards detailed within this document should be regarded as a minimum requirement to cover the requirements of the majority of operators.

As most of the standards have been derived to cover a range of telecommunication equipment guidance is given as to what would be most appropriate for cellular applications.

6 Equipment sites and installations

The object of this clause is to highlight the necessity for manufacturers and operators to assess the particular needs of equipment in the field. This information is necessary to define equipment for design, installation requirements and type approval parameters and to prevent over or under specification.

The equipment sites and installations are classified within the ETS documentation for most environmental influences. For example acoustic limits, biological conditions, chemically active substances, climatic conditions, dust, shock and vibration are described and are mostly based on IEC and ISO publications.

Other factors should be defined such as power supplied to the equipment and other equipment interfaces. These are also covered by ETSI and other international standards.

It should be noted that for environmental conditions ETR 035 Equipment Engineering (EE); Environmental Engineering, Guidance and terminology, should be consulted thoroughly to establish if the criterion required falls within the scope of the stated documents.

6.1 Weather protected sites

Weather protected sites are varied, they may range from telecommunications centres to roof spaces, and the severity of the site will dictate the cost, performance and life expectancy of the equipment. In addition support facilities for the equipment and accessibility vary in complexity and severity.

For example, telecommunications centres, in most instances, are a benign environment with controlled environmental conditions and without significant impact on maintenance personnel or general population. Equipment designed to meet these conditions can use more economical components and structures and give a reasonable life expectancy.

At the other extreme enclosed unmodified unventilated roof spaces in houses or apartment buildings are considered to be aggressive environments. They suffer from very low (-40°C) and very high ($+70^{\circ}\text{C}$) temperatures. The equipment location should have the minimum of interference on the immediate environment. If active cooling systems are used then the sound emitted should be similar to the level for office equipment to prevent noise pollution. If natural convection is used then, depending on power and performance, large heat sinks and high grade components must be used to ensure the equipment survives. By definition of the engineering involved, this would equate to more expensive equipment with probably less life expectancy.

6.2 Non-weather protected sites

Equipment for use in external environments should be carefully specified as there are more requirements on the equipment that are not in the domain of ETSI or similar bodies. For example foot print and structural requirements for planning permission by local civic legislation and power supply termination to the equipment.

The siting of equipment is important as there may well be local influences that fall outside of predicted phenomena. For example seismic protection for equipment placed in the vicinity of open cast mines, thermal protection from reflected sunlight focused by large areas of glass fronted buildings and highly corrosive atmospheres in chemical processing plants. Rather than specify to take into account unusual places, they should be avoided if possible or added protection given to the equipment, specified separately.

The geographical location will affect the climatic phenomena. The broad definitions in some specifications could not be applied to some areas. It may be necessary to specify for particular needs. This is identified and explained further in ETSI defined locations.

6.3 ETSI defined locations

In the context of cellular equipment the following locations could be applied. Again it should be noted that for environmental conditions ETR 035 Equipment Engineering (EE); Environmental Engineering, Guidance and terminology, should be referenced to ascertain if the criterion is suitable for application. It should be noted that the air temperatures quoted are exclusive of the effects of solar radiation which is stated separately.

6.3.1 Stationary use at weather protected locations.

The following abridged definitions gives two of the most commonly quoted environmental parameters for equipment and are given for guidance. The source documents should be referred to for a better understanding of the characteristics affecting the equipment, see subclause 6.4.1 Equipment in use conditions (ETS 300 019-1-3).

6.3.1.1 Class 3.1: Temperature controlled locations

Site description : Shops, offices, telecommunication centres.

Severity : Benign.

Temperature : +5 °C to +40 °C

Humidity (RH) : 5 % to 85 %

6.3.1.2 Class 3.2: Partly temperature controlled

Site description : Cellars, industrial units, unattended equipment stations, certain telecommunication buildings.

Severity : Moderate.

Temperature : -5 °C to +45 °C

Humidity (RH) : 5 % to 95 %

6.3.1.3 Class 3.3: Not temperature controlled

Site description : Shacks, unventilated small buildings.

Severity : Extreme conditions.

Temperature : -25 °C to +55 °C

Humidity (RH) : 10 % to 100 %

6.3.1.4 Class 3.4: Sites with heat traps

Site description : Shacks, unventilated lofts, telephone booths

Severity : As above, specialised equipment required, high level industrial contamination included.

Temperature : -40°C to +70°C

Humidity (RH) : 5 % to 100 %

6.3.1.5 Class 3.5: Sheltered locations

Site description : Sheds, open telephone booths, under single roofs e.g. carports.

Severity : Relatively open to all external influences.

Temperature : -40 °C to +40 °C

Humidity (RH) : 10% to 100 %

6.3.2 Stationary use at non-weather protected locations.

The following abridged definitions gives two of the most commonly quoted environmental parameters for equipment and are given for guidance. The source documents should be referred to for a better understanding of the characteristics affecting the equipment, see subclause 6.4.2 Equipment in use conditions (ETS 300 019-1-4).

6.3.2.1 Class 4.1: Non-weather protected locations

Site description: This class applies to many ETSI countries (but excludes, for example, northern Scandinavia and the warmest parts of southern Europe).

Severity: Intermediate

Temperature: -33 °C to +40 °C See note 1 of subclause 6.3.2.2

Humidity: 15 % to 100 %

6.3.2.2 Class 4.1E: Non-weather protected locations - extended

Site description : This class covers all ETSI countries.

Severity: Severe

Temperature: -45 °C to +45 °C see note 1.

Humidity: 8 % to 100 %

NOTE 1: In cloudless nights an object exposed to atmospheric radiation will radiate more heat than it receives off the surface, compared to the ambient air temperature. This will result in a lower surface temperature in the order of -10 °C to -20 °C below that of the ambient air temperature. For further information see IEC Publication 721-2-3 [3].

NOTE 2: If the ETSI standard is applied to equipment, then the equipment should meet those parameters as a minimum. If there is any requirement for any deviation from the stated parameters detailed within the standards then the core reference documents should be identified and no reference to the ETSI standard should be made.

NOTE 3: If there is intention to deviate from the ETSI specifications, which is not preferred, it should be noted that the range of conditions found within these categories falls into three IEC environmental classes. Depending on which area the equipment is intended to operate and due to the extremes of the conditions, the manufacturer or operator should specify a band of conditions derived from climatic data from IEC 721-2-1, Classification of environmental conditions. This should be used in conjunction with EN 60721-3-4 Classification of environmental conditions Part 3: Classification of groups of environmental parameters and their severity's, Stationary use at non-weather protected locations.

NOTE 4: For a more detailed description ETS 300 019 and ETR 035 should be read or for a more in-depth study the core reference IEC publication 721-3-3 or IEC publication 721-3-4 and their reference documents should be read. A reference of associated documents is included in Appendix A of this document.

7 General applicable specifications and guidance notes

This clause details specifications and guidance in their application. The full titles of specifications have been included for the convenience of the reader. It should be noted that most specifications are not generated specifically for cellular equipment and careful interpretation and application should be used. If an ETSI standard is applied to equipment or site specification, then the equipment or site should meet those parameters as a minimum. If there is any requirement for any deviation from the stated parameters detailed within the standards then the core reference documents should be identified and no direct reference to the ETSI standard should be made. This clause deals with the subject matter in alphabetical order.

7.1 Acoustic noise

There is no appropriate ETSI standard for equipment noise level limits at this time although further work in this area is expected. However, it is recommended that sound power (Bels) is used as the unit of measurement in specification and reporting of results. It should be noted that sound pressure characteristics should also be recorded.

7.1.1 Method of test

The equipment should be tested in accordance to ISO 7 779 Acoustics - Measurement of airborne noise emitted by computer and business equipment and the declared results shall be made in accordance with ISO 9 296 Acoustics - Declared noise emission values of computer and business equipment. The equipment shall simulate maximum worst case operational conditions for the purposes of the tests. i.e. the equipment should be fully functional at maximum operating temperature.

7.1.2 On site measurements

It is recommended that ISO 1996/1, Acoustics - Description and measurement of environmental noise - Part 1 Basic quantities and procedures, should be used assess the effect of the equipment in relation to the surrounding environment. The unit of measurement should be sound pressure in dB (A).

7.2 Construction

7.2.1 For stationary use at weather protected locations.

The construction of equipment racks and cabinets should conform to ETS 300 119-2. Equipment Engineering (EE), European Telecommunication Standard for equipment practice Part 2 Engineering requirements for racks and cabinets, and the construction of the sub racks should conform to ETS 300 119-4. Equipment Engineering (EE), European telecommunication standard for equipment practice, Part 4 Engineering requirements for sub racks in miscellaneous racks and cabinets. These specifications describes physical dimension, heat dissipation, floor loading, structural loading, temperature limits, etc.

All equipment should to use the safety elements from these documents.

The equipment housing or its enclosure should offer a degree of protection to the equipment from external hazards as described in EN 60529, Degrees of protection provided by enclosures (IP Code). This specification describes the levels of protection to objects and moisture ingress given by the enclosure. For safety requirements IP 20 is advised, this classification does not permit objects greater that 12 mm in diameter to be inserted into the equipment.

7.2.2 For stationary use at non-weather protected locations

The equipment housing or its enclosure should offer a degree of protection to the equipment from external hazards as described in EN 60529, Degrees of protection provided by enclosures (IP Code). This specification describes the levels of protection to objects and moisture ingress given by the enclosure. For commercial requirements IP 54 is advised. Equipment complying to this specification would prevent for example driving rain and wind driven dust particles from damaging the operation of the equipment.

7.3 Earthing and bonding

Various requirements are made for earthing and bonding within equipment and in some instances are in conflict with design aims. For example a requirement of EN 60950 could induce earth loops that could amplify the effect of EMC radiation within the equipment. This has implications that can affect EMC compliance. For equipment, the text of the specifications listed in the safety clause should be applied.

Earthing and bonding of Base Stations, Base Station Controllers and other co-located equipment in equipment rooms and sites should conform to the criterion detailed in ETS 300 253, Equipment Engineering (EE); Earthing and bonding of telecommunications equipment in telecommunication centres. This document describes the bonding networks of telecommunication centres and related installations, equipment and the interfaces between the two for safety reliability and EMC performance

For specific equipment rooms or cell site installations IEC 364-3 Part 3: Assessment of general characteristics, should be used.

7.4 Environmental conditions

7.4.1 Equipment in use conditions

The operator should choose operating conditions from ETS 300 019-1-3 and ETS 300 019-1-4 as stated below. It should be noted that temperature, humidity and vibration characteristics from the selected class will be used for conformance testing of RF parameters.

The characteristics contained in the classes in ETS 300 019-1-3 and ETS 300 019-1-4 series specifications are for operational conditions only. The operator shall not combine characteristics from other classes to describe fault or unusual conditions in the surrounding environment external to the equipment.

Equipment installed for Stationary Use At Weather Protected Locations should operate in the specified limits as described in ETS 300 019-1-3, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-3: Classification of environmental conditions, Stationary use at weather protected locations. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions.

The applicable test methods are contained in ETS 300 019-2-3 Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-3: Specification of environmental tests T3.1 to T3.5, stationary use at weather protected locations and are for testing physical parameters only.

Equipment installed for Stationary Use At Non-Weather Protected Locations should operate in the specified limits as described in ETS 300 019-1-4, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-4: Classification of environmental conditions, Stationary use at non-weather protected locations. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions.

The applicable test methods are contained in ETS 300 019-2-4, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-4: Specification of environmental tests T4.1 and T4.1E, Stationary use at non-weather protected locations and are for testing physical parameters only.

7.4.2 Earthquake conditions

The earthquake parameters are contained within the standard environmental classifications and test documentation of the ETS 300 019 series. The operator should quite clearly specify that in addition to the standard environmental class, earthquake parameters should also be included, otherwise it is assumed that they are not required.

7.4.3 Storage

It is advisable that the equipment should be able to survive in suitable packaging such as an anti static bag for PCB's in the storage conditions as described in ETS 300 019-1-1, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-1: Classification of environmental conditions, storage, without damage. This specification describes the environmental characteristics for climatic, biological, chemically active substances, mechanically active substances and mechanical conditions that occur in warehousing or storage sheds. It is suggested that for conditions within most of Europe, class 1.2 Weather protected, temperature-controlled storage locations is used.

The test method for this category is contained in ETS 300 019-2-1, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-1: Specification of environmental tests T1.1 to T1.3, Storage.

7.4.4 Transportation

The equipment should be able to survive the transport conditions, in suitable packaging, as described in ETS 300 019-1-2, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-2: Classification of environmental conditions, Transportation without damage. This specification describes the environmental characteristics for climatic, biological, chemically active substances,

mechanically active substances and mechanical conditions. It is suggested that for conditions within most of Europe, class 2.2, careful transportation, is used.

The test method for this category is contained in ETS 300 019-2-2, Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-2: Specification of environmental tests T2.1 to T2.3, Transportation.

7.4.5 Underground conditions

ETS 300 019-1-8 should be referenced for conditions affecting components or equipment that is contained in or used in association with the BTS that are located in enclosures below ground level in partly weather protected locations. ETS 300 019-2-8 should be specified to prove compliance to the standard.

7.5 Lightning protection

7.5.1 Equipment

It should be noted that in the design of the equipment there may be conflict between lightning protection, earthing and EMC requirements

Equipment site lightning protection systems may be inadequate to prevent damage to equipment. In the construction of equipment every opportunity should be taken to prevent or attenuate current surges in to the equipment. Isolated connections should be able to withstand residual voltages with controlled breakdown points.

For AC supplies to equipment IEC Publication 99-1 (1991) Part 1: Non-linear resistor type gapped surge arrestors for AC systems, could be considered.

7.5.2 Structures

As there are no international standards available in this field it is recommended that the Deutsche Norm Din VDE 0185 Part 1, DIN VDE 0845 Part 1 and DIN VDE 0855 parts 1 and 2 should be used as a reference material. These standards apply to lightning stroke currents, potentially hazardous or interfering over-voltages in telecommunication installations and antenna systems.

7.6 Power supplies

It should be noted that all equipment should comply to the EU directive 73/23/EEC The Low Voltage Directive, see subclause 7.2.1 on safety.

7.6.1 AC Power Supply conditions for Base Stations, Base Station Controllers

7.6.1.1 Single Phase

The adoption of the EU directive 72/23/EEC harmonisation mains supply voltages has not yet been ratified by all member states. In addition not all ETSI members are members of the EU. It is therefore recommended that a band of 187V (220V -15 %) to 264V (240V +10 %) should be used to take in to account the tolerances of both 220V and 240V, 48 to 65 Hz systems.

The characteristics of mains supplies are described in IEC Publication 555-1 Disturbances in supply systems caused by household appliances and similar electrical systems. Part 1: Definitions, IEC Publication 555-2 Disturbances in supply systems caused by household appliances and similar electrical systems. Part 2: Harmonics and IEC Publication 555-3 Disturbances in supply systems caused by household appliances and similar electrical systems. Part 3: Voltage fluctuations.

The A.C. power supply to the Base Station, Base Station Controller and co-located equipment should conform to the characteristics in prETS 300 132-1, Equipment Engineering: Power supply interface at the input to telecommunications equipment, interface operated by alternating current "A.C."

The D.C. output from any power supply with an A.C. input that is used for powering external equipment should conform to IEC 1204, Low-voltage power supply devices D.C. output - Performance characteristics and safety requirements.

7.6.1.2 Three Phase

It should be noted that there are different requirements by the various member countries that govern the use and connection of three phase supplies to equipment. There are no specific international standards available for this category of supply at present

7.6.2 DC Power Supply conditions for Base Stations, Base Station Controllers

The D.C. power supply to the Base Station, Base Station Controller and co-located equipment should conform to the characteristics in prETS 300 132-2, Equipment Engineering: Power supply interface at the input to telecommunications equipment, interface operated by alternating current "D.C."

The D.C. output from any power supply with an D.C. input that is used for powering external equipment should conform to IEC 1204, Low-voltage power supply devices D.C. output - Performance characteristics and safety requirements.

7.7 Reliability/Dependability

Reliability predictions should be used in the evaluation of designs. The material gathered can be used in assessing the amount of field support required for the equipment. The data that is used should take into account failure criterion and the mechanical and electrical stresses that contribute to assembly failure.

The MTBF should be calculated for replaceable assemblies that are fitted within the overall base Station or Base Station Controller in the stated environment.

It is recommended that IEC 56 (Secretariat) 383, Use of failure rate data intended for reliability prediction of components in electronic equipment, -Reference conditions, -Stress models for their conversion should be used. However other methods may be used to present similar predictions and other related information.

The results of the MTBF calculations should be stated in values of years. The calculation should be valid for a period of 10 years from the point at which the equipment becomes operational and after the equipment has been installed and accepted by the operator.

The manufacturer should identify and provide a schedule for service replaceable parts and recommendations for maintenance of the system to maintain proper function of the equipment with regard to its MTBF rating.

7.8 Environmental considerations in the design of BTS and related equipment

This subclause introduces environmental issues that may be facing the design and operation of equipment. As there are no international specifications available at present, it makes no recommendations.

At present, there are a large number of bodies formulating legislative requirements. For example, the EU have legislative instruments of regulations, directives and decisions on the environment and long term environmental action programmes. These may have an impact on products during their manufacture, usage and disposal at the end of their working life.

In recent years, a major public opinion change, backed increasingly by legislation, is why products and increasingly electronic products are being designed with the environment in mind. Going beyond simply designing out hazardous or toxic materials, industry may have to consider products may not just be thrown away.

The EU has designated electrical and electronic equipment a priority waste stream, with the responsibility for reducing the amount of waste firmly with the producer of the original equipment in mind. Manufacturers in the future may have the responsibility to ensure that products are designed with due consideration of the effect the equipment may have on the environment. This could result in some manufacturers having to take back product at the end of its useful life for disposal. The objective of this is to recycle and reduce waste in land fill sites etc. and reduce usage of natural resource.

It is this concept of sustainable development, environmental legislation and environmental management that is being proposed for use in organisations by the various bodies involved. There are many groups that have an interest in aspects of this subject at national and international levels. They are developing new processes and systems, such as the World Business Council for Sustainable Development (WBCSD), the Industry Council for Electronic Equipment, the European Environmental Agency and ECTEL etc. The pressure to implement policy in the three areas concerned may initially be market driven (e.g. ECTEL) rather than by specific legislation. If manufacturers or operators adopt any particular policy, it could be advisable to consider that any requirements or recommendations made do not differ negatively from those being developed by industry or regulatory bodies.

There is already some national specific legislation in this area. At the moment, there is no specific legislation relating to the whole life cycle assessment of electronic products. Anticipating such demands may be a beneficial approach, for example material marking will assist in recycling.

8 Specific applicable specifications and guidance notes for product release to the operator

8.1 Electro-magnetic Compatibility

The Base Station and ancillary equipment should be tested to ETS 300 342-2, Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) for European digital cellular telecommunications systems (GSM 900 MHz and DCS 1 800 MHz); Part 2: Base Station radio and ancillary equipment to show conformance to the EU directive 89/336/EEC Council Directive Relating to Electromagnetic Compatibility and 92/31/EEC the Council Directive Amending 89/336/EEC.

NOTE: The above specification has been derived specifically for GSM 900 MHz and DCS 1 800 MHz product however other non preferred specifications may be used to test equipment to prove compliance to the EU directive.

8.2 Safety

8.2.1 Safety of equipment

In the EU all low voltage electrical equipment must conform to the directive 73/23/EEC The Low Voltage Directive. Compliance to EN 60950 fulfils the requirements of that directive.

It should be regarded as mandatory that all equipment meets the requirements of the standards listed below were applicable. However the equipment may be required to meet national specifications in addition to or in stead of the stated EN documentation. There are however conflicting requirements in some areas between the EN documentation and in some member country national standards. In addition to the national standards of some countries, there may differing regional specifications which will take precedence even over the national standards. It will be necessary in these instances to have country or region specific equipment.

8.2.1.1 Recommended Standards

EN 60215: Safety requirements for radio transmitter equipment.

EN 60950: Safety of information technology equipment, including electrical business equipment.

EN 41003: Particular safety requirements for equipment to be connected to telecommunication networks.

EN 60825: Fibre optic equipment.

8.2.2 Safety marking and labelling of the equipment

The safety marking and labelling of the equipment is mandatory in some member countries and in part detailed in the stated standards of the previous clause. It will be necessary to identify all hazards such as power termination's, Earthing points, fibre optic output (laser class [1]), hot surfaces, Beryllium oxide content etc.

The labelling should conform to ISO 3 864 - Safety signs and colours and symbols to ISO 3461, Graphic symbols.

8.3 Radio Type Approval

It is a requirement in some countries for the equipment and their variants to conform to a minimum performance standard. It is the responsibility of the manufacturer to design towards this goal. The parameters to be tested are the minimum requirements to meet the GSM 900 and DCS 1 800 stated parameters for radio operation under the operational conditions stated by the manufacturer. After passing the type approval tests the certificate is then granted for the equipment to operate within the manufacturers stated limits for the equipment. It does not however mean that the equipment has passed any other statutory requirements such as compliance to the EU directives regarding EMC.

The equipment to be approved should be representative of production build units, in other words prototype or pre production units that may differ in any manner are not suitable.

The type approval body will require model numbers/type names, a full description of the functionality of the equipment to be tested as well as drawings and test data.

The manufacturer should supply a list of serial numbers for all assemblies and sub assemblies that constitute the equipment to be tested.

The equipment must be tested by an accredited testing body that is permitted to carry out the type approval tests.

8.4 Testing of equipment (guidance note)

In terms of testing equipment to meet national or international directives or legislation the manufacturer will have to use a licensing or governmental body accredited test facility. Any test data provided by a manufacturer which is ISO 9 001 (Specification for design/development, production, installation and servicing) accredited may be taken into consideration by the testing authority.

In terms of non legislative testing the operator and manufacturer must agree what tests are required and what data can be accepted as proof of compliance. In general terms testing of equipment by independent accredited test bodies is universally accepted and is recommended. Manufacturers with ISO 9 001 compliance should be able to support any data required to a suitable standard.

Annex A: Standards as applied to weather and non-weather protected locations

This annex details the referenced documents that can be applied to weather and non-weather protected locations and is intended as a guide in equipment specification. The relevant sections pertaining to these documents should be read and further investigations into equipment needs made, before stipulating a requirement.

A.1 Weather protected locations

89/336/EEC: "Council Directive Relating to Electromagnetic Compatibility".

92/31/EEC: "Council Directive Amending 89/336/EEC".

EN 60215: "Safety requirements for radio transmitter equipment".

EN 60950: "Safety of information technology equipment, including electrical business equipment".

EN 41003: "Particular safety requirements for equipment to be connected to telecommunication networks".

ETS 300 019-1-3: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-3: Classification of environmental conditions, Stationary use at weather protected locations".

ETS 300 019-2-3: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-3: Specification of environmental tests T3.1 to T3.5, stationary use at weather protected locations".

ETS 300 119-2: "Equipment Engineering (EE), European telecommunication standard for equipment practice Part 2 Engineering requirements for racks and cabinets".

ETS 300 119-4: "Equipment Engineering (EE), European telecommunication standard for equipment practice, Part 4 Engineering requirements for sub racks in miscellaneous racks and cabinets".

ETS 300 132-1: "Equipment Engineering: Power supply interface at the input to telecommunications equipment. interface operated by alternating current "AC"".

ETS 300 132-2: "Equipment Engineering: Power supply interface at the input to telecommunications equipment. interface operated direct current "DC"".

ETS 300 253: "Equipment Engineering (EE); Earthing and bonding of telecommunications equipment in telecommunication centres".

ETS 300 342-2: "Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) for European digital cellular telecommunications systems (GSM 900 MHz and DCS 1 800 MHz); Part 2: Base Station radio and ancillary equipment".

IEC Publication 529: "Degrees of protection provided by enclosures (IP Code)".

IEC 56 (Secretariat) 383: "Use of failure rate data intended for reliability prediction of components in electronic equipment, -Reference conditions, -Stress models for their conversion".

ISO 1996/1: "Acoustics - Description and measurement of environmental noise - Part 1 Basic quantities and procedures".

ISO 3461: "Graphic symbols".

ISO 3 864: "Safety signs and colours".

ISO 7 779: "Acoustics - Measurement of airborne noise emitted by computer and business equipment".

A.2 Non-weather protected locations

89/336/EEC: "Council Directive Relating to Electromagnetic Compatibility".

92/31/EEC: "Council Directive Amending 89/336/EEC".

EN 60215: "Safety requirements for radio transmitter equipment".

EN 60721-3-4: "Classification of environmental conditions Part 3: Classification of groups of environmental parameters and their severities, Stationary use at non-weather protected locations".

EN 60950: "Safety of information technology equipment, including electrical business equipment".

EN 41003: "Particular safety requirements for equipment to be connected to telecommunication networks".

ETS 300 019-1-4: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 1-4: Classification of environmental conditions, Stationary use at non-weather protected locations".

ETS 300 019-2-4: "Equipment Engineering (EE); Environmental conditions and environmental test for telecommunications equipment, Part 2-4: Specification of environmental tests T4.1 and T4.1E, Stationary use at non-weather protected locations".

ETS 300 132-1: "Equipment Engineering: Power supply interface at the input to telecommunications equipment. interface operated by alternating current "AC"".

ETS 300 132-2: "Equipment Engineering: Power supply interface at the input to telecommunications equipment. interface operated direct current "DC"".

ETS 300 253: "Equipment Engineering (EE); Earthing and bonding of telecommunications equipment in telecommunication centres".

ETS 300 342-2: "Radio Equipment and Systems (RES); Electro-Magnetic Compatibility (EMC) for European digital cellular telecommunications systems (GSM 900 MHz and DCS 1 800 MHz); Part 2: Base Station radio and ancillary equipment".

IEC Publication 529: "Degrees of protection provided by enclosures (IP Code)".

IEC Publication 721-2-1: "Classification of environmental conditions".

IEC 56 (Secretariat) 383: "Use of failure rate data intended for reliability prediction of components in electronic equipment, -Reference conditions, -Stress models for their conversion".

ISO 1996/1: "Acoustics - Description and measurement of environmental noise - Part 1 Basic quantities and procedures".

ISO 3 461: "Graphic symbols".

ISO 3 864: "Safety signs and colours".

ISO 7 779: "Acoustics - Measurement of airborne noise emitted by computer and business equipment".

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