



# BMW GROUP STANDARD for passive IT infrastructure

**Authors:** **BMW Group**  
**Datacenter Technology**  
 Bremer Str. 6  
 80788 Munich, Germany  
 Telephone: +49-89-382-0

**GHMT AG**  
 In der Kolling 13  
 66450 Bexbach, Germany

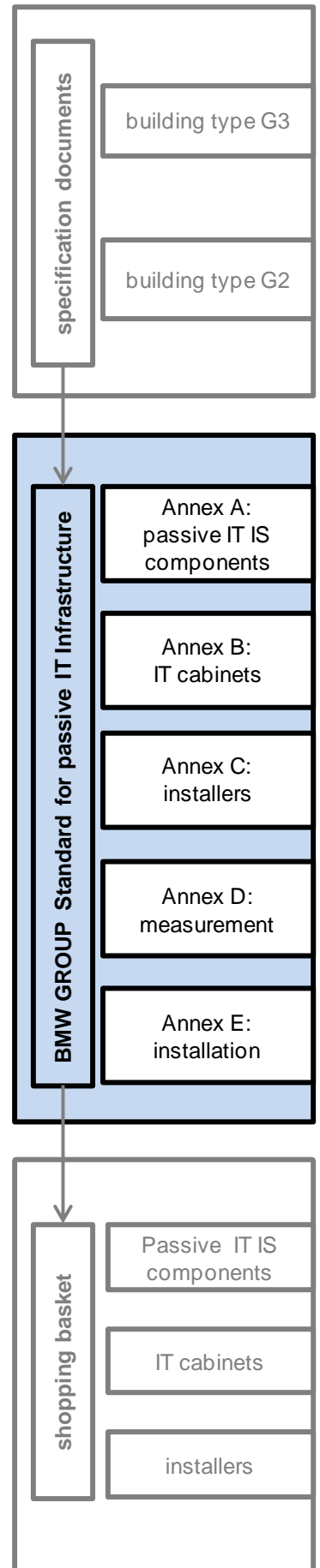
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## Table of Revisions

Version	Date	Modified chapters	Comments
2.0	June 1, 2006	All	Complete revision and text addition
2.1	May 31, 2008	All	Update
3.0	April 1, 2012		Modification of department designation at client side and of annex letters
		All	Update
4.0	April 30, 2016	All	Comprehensive update and revision of the standard and its annexes

## Table of contents

<b>Table of Revisions</b>	<b>2</b>
<b>Table of contents</b>	<b>3</b>
<b>List of Tables</b>	<b>4</b>
<b>1 General planning notes</b>	<b>5</b>
1.1 Scope of application	5
1.2 Contact person	5
1.3 Planning services	6
1.4 Electromagnetic compatibility	6
1.5 Quality assurance during implementation	8
1.6 Construction logistics and handover of IT IS rooms	8
1.7 Referenced documents	9
<b>2 Infrastructure specifications for IT IS rooms</b>	<b>10</b>
2.1 Differentiation by function	10
2.2 Alarm and monitoring systems for IT rooms	10
2.3 Space requirements for IT IS rooms	11
2.4 Usage	12
2.4.1 Installation of mobile radio equipment without antennas	12
2.4.2 Antennas for various radio applications	13
2.5 No routing of media through IT rooms	13
2.6 Trunk lines or signal lines and control circuits	13
2.7 Routing of microwave or mobile radio links into the building	13
2.8 Coding of passive IT IS components (fibre-optic)	13
2.9 Telecommunications outlets	14
2.10 Additional infrastructure requirements	14
<b>3 Requirements passive IT IS components</b>	<b>15</b>
<b>4 Requirements IT cabinets</b>	<b>16</b>
<b>5 Requirements installers</b>	<b>16</b>
<b>6 Requirements measurements</b>	<b>16</b>
<b>7 Requirements installation</b>	<b>16</b>
<b>8 Higher-level appraisal to secure commissioning of the IT infrastructure</b>	<b>17</b>
<b>9 Specifications to ensure EMC</b>	<b>18</b>
9.1 EMC officers appointed by the project companies	18
9.2 EMC system documentation	18
9.3 Basic requirements	19
9.3.1 Classification of interference protection zones	19
9.3.2 Earthing system	19
9.3.3 Meshed bonding network suitable for high frequencies	19
<b>10 Safety and protective measures on construction sites</b>	<b>20</b>
<b>11 Glossary</b>	<b>21</b>



## List of Figures

Figure 1:	Schematic room layout, using a BD as an example	12
Figure 2:	Documentation example for welded steel reinforcement	18
Figure 3:	Documentation example for a fixed earthing terminal welded to the steel reinforcement	18

## List of Tables

Table 1:	Excerpt from MICE table	7
Table 2:	Space requirements of IT IS rooms	11
Table 3:	Installation of mobile radio equipment without antennas	12
Table 4:	Installation of antennas for various radio applications	13

## 1 General planning notes

The present BMW Group standard defines binding specifications for the planning and implementation of passive IT infrastructures. These passive IT infrastructures are exclusively designed for use by the BMW Group IT infrastructure (active IT IS components).

### Comment:

**Any service provider structures must be set up completely separately and must be coordinated with the BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik).**

In addition to detailed requirements to be met by passive IT IS cabling components and their installation, it contains further requirements that must be met for the safe operation of the connected peripherals, such as allocating interference protection zones, lightning protection, earthing and grounding as well as energy supply.

Continuous progress in terms of technical developments must be taken into account in the planning and implementation of a passive IT infrastructure in new buildings, additions to existing buildings as well as in refurbishment projects.

The planner must also ensure that the entire functional area of "passive IT infrastructure" has been created in the documentation system COMMAND and that any documentation required (for example measurement records created by the installation service provider) is correctly filed there.

The passive IT infrastructure has to provide extensive support for **10 Gigabit Ethernet** both via Twisted Pair (= Class E<sub>A</sub>) and via optical fibre. The passive IT infrastructure has to meet the specific requirements laid down by the BMW Group in addition to the standard specifications pursuant to **ISO/IEC 11801**, which always have to be complied with.

For twisted-pair connections, the **maximum channel length must not exceed 100 m (= 90 m permanent link plus max. 10 m patch cable).**

The maximum admissible channel length values for fibre-optic network applications as listed in "**Annex A: Requirements passive IT IS components**" must be taken into account.

Future-oriented planning is required in order to meet the IT requirements that apply currently in the foreseeable future. Planning always has to take into account a customized cost-benefit analysis.

### 1.1 Scope of application

The standard is binding and must be used for the installation and expansion of the passive IT infrastructure in BMW Group buildings.

Should the standard specifications and the specification document of BMW Group differ, the specifications laid down in this standard shall apply.

The continuous further development and adaptation of performance with regard to the requirements to be met by the passive IT IS components to be used are taken into account by updating this document at regular intervals. Care must be taken to ensure that the most up-to-date version is used for every planning project.

### 1.2 Contact person

Below is the principal point of contact for matters relating to the standard and for comments and information:

**BMW Group**  
**FG-942, Datacenter Technology**  
Bremer Str. 6  
80788 München, Germany  
Telephone: +49-89-382-24481  
e-mail: richard.hillmeier@bmw.de



### 1.3 Planning services

**All planning services must be provided by the planning office commissioned on their own responsibility. In this connection, it is in particular not allowed to assign any planning services to installation companies.**

Any deviations from this rule require the written approval by the BMW Group.

The planning process has to follow the structure of the German **HOAI plan of work**<sup>1</sup> and has to include the following:

- (1) "Grundlagenermittlung" (=appraisal; establishing the basis of the project)
- (2) "Vorplanung" (= preliminary design)
- (3) "Entwurfsplanung" (= final design)
- (4) "Genehmigungsplanung" (= building permission application)
- (5) "Ausführungsplanung" (= execution drawings)
- (6) "Vorbereitung der Vergabe" (= preparation of contract awards)
- (7) "Mitwirkung bei der Vergabe" (= assisting award process)
- (8) "Objektüberwachung" (= project supervision) (construction supervision or site management)
- (9) "Objektbetreuung und Dokumentation" (= project management and documentation)

### 1.4 Electromagnetic compatibility

Electromagnetic compatibility (EMC) is the capacity of a device or a system to work smoothly within the electromagnetic environment, without causing any electromagnetic interference that would be unacceptable for other equipment operated in this environment.

This means that the functioning of a system is not restricted by the following influence factors either:

- Overvoltage impact and electromagnetic lightning pulse caused by a direct and nearby lightning stroke; lightning strokes can, for example, cause damage up to a distance of 2 km.
- Electrostatic discharge. Touching connections can, for example, cause damage to electronic equipment.
- High-frequency fields, such as the ones caused by broadcasting or transmission equipment (radio stations, radar, radio relay, radio in general).
- Burst pulses caused by switching. Burst pulses are, for example, caused by the switching of fluorescent lamps.

For planners of the passive IT infrastructure this means that they have to design "their" system so as to enable operation of the system without any restrictions under the given environmental conditions, and without causing any interference to other systems.

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<sup>1</sup> HOAI: Honorarordnung für Architekten und Ingenieure (*Official scale of fees for services by architects and engineers*)



Project-specific risk assessment must be carried out in order to ensure EMC depending on the scope and availability requirements. As a rule, the requirements laid down in the "Planning specifications for building types" must be taken into account; all rooms in which IT cabling is installed must be analysed for their MICE<sup>1</sup> conditions according to IEC TR 29106, and subsequently suitable passive IT IS components must be used for the environmental conditions prevailing in each case (MICE classes). Please refer to the following table for details on the MICE environmental classification for the electromagnetic part.

Electromagnetic	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>
Electrostatic discharge-Contact (0.667 µC)	4 kV	4 kV	4 kV
Electrostatic discharge - Air (0.132 µC)	8 kV	8 kV	8 kV
Radiated radio frequency, amplitude-modulated	3 V/m at (80 to 1,000) MHz 3 V/m at (1,400 to 2,000) MHz 1 V/m at (2,000 to 2,700) MHz	3 V/m at (80 to 1,000) MHz 3 V/m at (1,400 to 2,000) MHz 1 V/m at (2,000 to 2,700) MHz	10 V/m at (80 to 1,000) MHz 3 V/m at (1,400 to 2,000) MHz 1 V/m b at (2,000 to 2,700) MHz
Conducted radio frequency	3 V at 150 kHz to 80 MHz	3 V at 150 kHz to 80 MHz	10 V at 150 kHz to 80 MHz
Fast electric transient/burst including protective conductor	1,000 V	1,000 V	2,000 V
Fast electric transient/burst (signal/data/control)	500 V	500 V	1,000 V
Surge voltage (transient ground potential difference) - signal line/earth	500 V	1,000 V	1,000 V
Magnetic field (50/60 Hz)	1 A/m	3 A/m	30 A/m

**Table 1: Excerpt from MICE table**

**The passive IT infrastructure has to comply with class E2 at least in order to ensure EMC in office areas and with E3 at least for all other areas (for example industrial, workshop areas, computer centre).**

Following the integration of all IT IS components (active and passive IT IS components, and connectors for grounding, earthing, etc.), the overall system must comply with the EMC standards listed in the following and also achieve the protection objectives defined in the **EU EMC directive No. 2014/30/EU**.

(Excerpt)

- IEC/CISPR 22 (Radio disturbance characteristics - limits and methods of measurement)
- IEC/CISPR 24 (Immunity characteristics - Limits and methods of measurement)
- IEC 61000-4-8 (Electromagnetic Compatibility (EMC) - Part 4-8: Testing and Measurement Techniques - Power Frequency Magnetic Field Immunity Test Frequencies)
- IEC 61000-4-9 (Electromagnetic Compatibility (EMC) - Part 4-9: Testing and Measurement Techniques - Pulse Magnetic Field Immunity Test)
- IEC 61000-4-10 (Electromagnetic Compatibility (EMC) - Part 4-10: Testing and Measuring Techniques - Pulse Magnetic Field Immunity Test)
- IEC 61000-6-2 (Generic standards - Immunity for industrial environments)

If designers cannot comply with the specifications because the structural or organisational requirements are not met, they must point this out explicitly and indicate the restrictions and the reasons for this.

<sup>1</sup> MICE :Mechanical, Ingress, Climatic, Electromagnetic



## 1.5 Quality assurance during implementation

Within their purview, planners have to ensure that any faulty or defective implementation of the specifications laid down is identified within the framework of (partial) acceptance and that the repair of said faults or defects according to good professional practice is monitored. To this end, specialists recognized by the BMW Group (EMC experts, cabling experts) should be involved in the project early on (during construction) for the purposes of securing the commissioning phase if required.

### Comment:

**Chapters 8 and 9 include further details on the content of the aforementioned quality assurance measures to secure commissioning.**

## 1.6 Construction logistics and handover of IT IS rooms

As early as during the design of the passive IT infrastructure, special focus must be placed on the systematic implementation following construction logistics aspects. This includes among other things:

- Any requirements that the planners of other areas are responsible for must be defined early on and in writing for them.
- As early as during the installation phase, care must be taken to ensure that sensitive passive IT IS components are handled carefully and are not exposed to any inadmissible stress and environmental conditions.
- The installation sequence of passive IT IS components is to be scheduled so as to exclude damage during and after installation of the components by fitters that are active at the same time or subsequently.

To ensure a smooth handover of the IT IS rooms and areas for IT IS operation, the following requirements must be strictly observed:

- **All** construction work must be completed, which includes for example the following issues:
  - o The room door has to be dust-tight.
  - o The earthing resistance and minimum insulation resistance of the floor covering must comply with the following specifications:  $R_a < 10^8 \Omega$ ,  $R_{iso} > 10^5 \Omega$
- **All** supply structures (power supply, UPS, air-conditioning, etc.) have to be fully functional.
- The **entire** functional area of "passive IT infrastructure" has been created in the documentation system COMMAND, and all documentation required (for example, fibre-optic and copper measuring records from the installation service provider) has been correctly filed.
- It should also be pointed out that the IT IS rooms must undergo top-to-bottom **dry and wet cleaning**; in the process dust and dirt must be removed from all walls, landings, trays, lamps, cabinets and other installations, also under the false floor, if applicable, with a lasting effect.

A **BMW locking system must be installed** for acceptance and handover to the BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik) for IT IS operation. **Non-authorized persons** are not allowed to enter the IT rooms without being accompanied by a BMW staff member.

### Comment:

Experience has shown that failure to comply with the instructions listed above leads to serious installation defects, such as:

- undue mechanical stress on IT cabling, for example caused by increased transverse pressure
- contamination of passive IT IS components (for example connector front faces of optical fibres) by dirt and construction dust





- contamination of network (LAN) components (for example, fans, parts and connectors) by dirt and construction dust
- **The cost incurred for eliminating defects will be charged to the party that caused the defects.**

### 1.7 Referenced documents

This BMW Group standard for passive IT Infrastructure also comprises the following annexes in addition to the present document.

- **Annex A:** Requirements passive IT IS components
- **Annex B:** Requirements IT cabinets
- **Annex C:** Requirements installers
- **Annex D:** Requirements measurements
- **Annex E:** Requirements installation

These must also be taken into account as amended in the planning and installation.

## 2 Infrastructure specifications for IT IS rooms

The following planning specifications apply to IT IS rooms (network control centres - NCCs, building distributors - BDs, floor distributors - FDs).

### 2.1 Differentiation by function

IT IS rooms are distinguished by function according to the following categories:

- Network Control Centre (NCC):  
The central IT network components for data and voice transmission (without mobile radio) and those that are required for cascading as well as the system components of service providers (WAN, for instance Telekom, BT) are installed in the network control centre.
- Building Distributor (BD):  
The LAN components required for cascading are installed in the building distributors (BDs). The building distributor can also be used to implement an FD (floor distributor) function, which requires additional footprint.
- Floor Distributor (FD):  
The LAN components required for connecting terminals are installed in the floor distributor (FD).

**As far as mobile radio components are concerned, these must be installed in a separate room to be provided for this purpose (Mobile radio Communications Room - MCR).**

Separate power distribution units must be provided for every IT IS room. Switching status and operating parameters are visible from outside (no opening required). **Electrical system and IT system distributors must be installed in different cabinets.**

Horizontal cabling must be laid in separate metal cable management systems. The minimum bending radius of the horizontal cabling laid must be adhered to. Cabling must be fastened with cable clamps and shims or with velcro strips only.

**The use of cable ties for bundling and securing items is not permitted.**

### 2.2 Alarm and monitoring systems for IT rooms

It must be ensured that the following alarm and monitoring systems are permanently operational and that the information generated by said alarm and monitoring systems is forwarded to a control centre that is manned around the clock (365 days/year):

- Fire alarm system
- Intrusion detection system
- Access monitoring system
- Liquid detector
- Temperature monitoring system
- Fault messages
- ...

## 2.3 Space requirements for IT IS rooms

The size of the IT IS rooms depends on the number of IT cabinets and IT IS components.

IT IS rooms must be provided in the interior of the building, without windows if possible.

	FD	BD	NCC / server room
Room size	Preferred dimensions – 5.0 m x 3.0 m, no space restrictions  Please provide for additional space requirements of at least 3 m² for every further IT cabinet.		The space requirements and the usage of the NCC may vary strongly, which is why the relevant data centre engineering group should be contacted for the actual requirements (min. 30 m², preferred dimensions 5.0 m x 6.0 m)..
Number of IT cabinets	1 active-open IT cabinet 1 IT passive-open cabinet for max. 240 ports Space for 1 back-up IT cabinet	1 active-open IT cabinet 1 IT passive-open cabinet for max.240 ports 1 closed IT cabinet (EMC) Space for 1 back-up cabinet	
Access to the IT cabinets	IT cabinets accessible from the front and the rear (clearance of at least 1.0 m at each side)		
Access to the room	Barrier-free access for the entire transport route, for example by means of the ramps (must be positioned outside the room, ramp slope of max. 8 %) and freight elevators required, which are accessible without any obstacles and are amply dimensioned for the system parts used (IT cabinets etc.).		
Room height	at least 3.0 m		at least 4.0 m
Raised floor	No		Yes, minimum height 600 mm
Room door dimensions	Room door of sufficient dimensions (minimum width 1,000 mm; minimum height 2,300 mm)		Plan room door as double-wing door (minimum width of 1,800 mm and minimum height of 2,300 mm)
Opening the room door	Swing-out equipment room door, if the building design allows for that (please take escape routes into account).		

**Table 2: Space requirements of IT IS rooms**

Planning also needs to take into account that depending on the **length constraints applicable to the permanent link** ( $\leq 90$  m), at least one floor distributor (FD) is to be provided per 1,000 m<sup>2</sup> of office space.

At least one floor distributor is to be provided per floor.

Exceptions: floors with a low number of telecommunications outlets and a permanent link length of  $\leq 90$  m; in this case, the floor distributor of the adjacent floor will be sufficient to handle both floors.

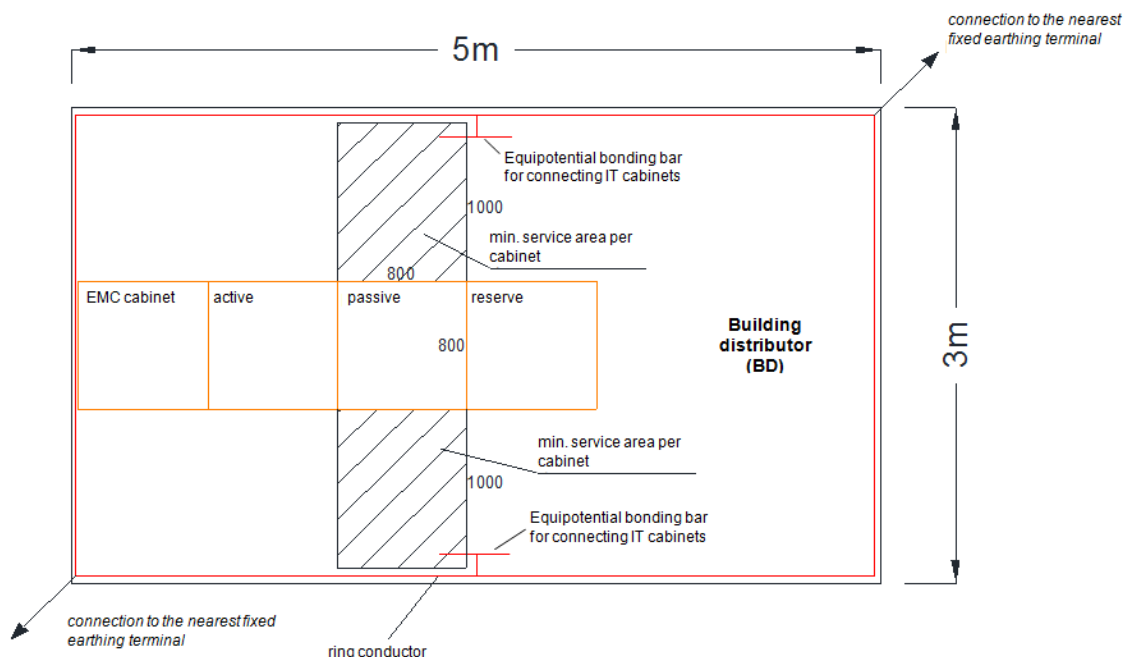
The earthing resistance and minimum insulation resistance of the floor covering must comply with the following specifications:  $R_a < 10^8 \Omega$ ,  $R_{iso} > 10^5 \Omega$

The raised floor must have a point load carrying capacity of at least 5 kN.

### **Comment:**

**Media lines (such as for water, heating, waste water, energy supply, air-conditioning, BOS equipment (public-security authorities and organisations) and other plant equipment) that are not required for the operation of ICT equipment or its components must not be routed through IT IS rooms.**

**If need be, IT IS rooms and their facilities must be protected by adequate structural measures (for instance, troughs, ramps, etc.).**



**Figure 1:** Schematic room layout, using a BD as an example

## 2.4 Usage

**All IT rooms are designed for exclusive use by the IT Infrastructure** and for communications equipment that does not cause EMC interference for the IT IS.

Rooms must not be used for any other purposes, i. e. for printers or for paper storage.

Storage facilities, toilets, kitchens, escape routes, storage rooms for cleaning material, flood-prone rooms, etc. are not suited as IT IS rooms for reasons of safety and availability.

**As far as mobile radio components are concerned, these must be installed in a separate room to be provided for this purpose (Mobile radio Communications Room - MCR)!**

Furthermore, it is essential to comply with the following specifications:

### 2.4.1 Installation of mobile radio equipment without antennas

	Area	FD	BD	NCC / server room
Installation permitted?	N	Y	on a case-by-case basis <sup>1</sup>	N
Transmitters permitted? (for example, base stations)	N	N	N	N

**Table 3:** Installation of mobile radio equipment without antennas

Mobile radio equipment includes for example coaxial cables and fibre-optic repeaters.

Transmitters (for example, base stations) are not permitted in IT IS rooms and must be accommodated in a **separate room for mobile radio equipment (MCR)**.

<sup>1</sup> Group FG-942, Datacenter Technology (Rechenzentrumstechnik), must check the installation of mobile radio equipment.

## 2.4.2 Antennas for various radio applications

	Area	FD	BD	NCC / server room
WLAN and antennas	Y	Y	Y	Y
Mobile radio (GSM, UMTS and LTE) antennas	Y	N	N	N
BOS antennas <sup>1</sup>	Y	Y	Y	Y

**Table 4: Installation of antennas for various radio applications**

Antennas that primarily serve to cover IT IS rooms are permitted if the maximum level of 1 V/m is not exceeded.

The minimum distance between mobile phone antennas must be at least 4.3 m for a transmission power of 2W. The distance must be greater as transmission power increases. The exact safety distance must be determined on the basis of calculations.

## 2.5 No routing of media through IT rooms

**Media lines** (such as for water, heating, waste water, energy supply, air-conditioning, BOS equipment (public-security authorities and organisations) and other plant equipment) **that are not required for the operation of ICT equipment or its components must not be routed through IT IS rooms.**

If need be, IT IS rooms and their facilities must be protected by adequate structural measures (for instance, troughs, ramps, etc.).

## 2.6 Trunk lines or signal lines and control circuits

If multi-pair telecommunications cables in use then the cables are terminated on Cat.3 patch panels or LSA+ terminals. Cat.3 patch panels are installed in the passive network cabinet and positioned at the lower end of the 19" rack.

National or local regulations may require special components for the connection of outdoor cabling and also have to be taken into account accordingly.

## 2.7 Routing of microwave or mobile radio links into the building

Microwave and mobile radio antennae are frequently installed at an exposed position outside the building. If lines from these facilities are routed into the building, suitable measures must be taken to avoid the introduction of interference signals (EMC protection concept, surge protection).

## 2.8 Coding of passive IT IS components (fibre-optic)

The segments of passive IT IS components (fibre-optic) must be installed with **"uncrossed" coding** for every fibre pair. This means that every optical fibre of a fibre pair must be assigned in the same way on both sides. (= assignment A-A or B-B)

<sup>1</sup> BOS stands for "Behörden und Organisationen mit Sicherheitsaufgaben", i.e. public-security authorities and organisations. BOS radio is a radio telephony system that is used by the members of a wide range of organisations, such as the police, federal border guards, fire brigades, civil-protection units or rescue services for communicating with one another.

## 2.9 Telecommunications outlets

The telecommunications outlets may be located in walls, on floors or at any other location depending on the building structure.

The outlets are to be distributed over the entire usable area in order to ensure maximum telecommunications outlet density and they have to be mounted at easily accessible locations. A high degree of outlet density increases flexibility for change.

**If the furnishings layout for the user-related coverage of office areas is not yet available at the relevant planning stage, a blanket coverage of**

- **the office areas is to be implemented by way of installing at least 1.5**
- **and in development areas at least 2.0 RJ45 telecommunications outlet per workplace.**

**This requirement may have to be reconsidered for workplace with special user requirements,** and, if necessary, additional or divergent terminals (for instance, ceiling-mounted IT distributors in workshop environments in accordance with "Annex A: Requirements passive IT IS components") must be provided.

## 2.10 Additional infrastructure requirements

In addition to the instructions, the following specifications from the documents on building types must be taken into account in the planning stage:

- **Electrical installations,** for example Average number of power take-off points in the IT distributor
- **Air conditioning and ventilation installation,** for example temperature range
- **Fire protection specifications,** for example smoke detection for cavities (ceiling, floor, room)
- **Building specifications,** for example, traffic routes, doors, service areas
- **Security aspects,** such as badge readers, keys, access options
- **Monitoring,** for example, leakage detector, smoke detector

It is absolutely necessary for planning to take into account and document regional site conditions with regard to local supply infrastructure, such as the availability of the local utility supplying power (mains failure statistics). Any exposure to frequent lightning strikes in the region must be reduced by EMC protective measures.

Further conditions to be taken into consideration in planning result from the fire protection expert opinion, specifications laid down by the property insurance company as well as from the BMW security concept that was created in-house for access control (key/badge reader/factory security) and protection against forced entry (intrusion detection system with video, glass breakage detector/motion detector, security services, etc.)

**Country-specific official requirements define the minimum requirements** for the infrastructure areas described in the following (for example, emergency illumination, light intensity, manual fire extinguishers).

### 3 Requirements passive IT IS components

For the passive IT infrastructure to meet the requisite stringent quality standard, only passive IT IS components and systems may be installed that are approved by the **BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik)** at the time of planning or implementation. The **currently approved passive IT IS components** are checked at regular intervals for compliance with the specifications defined as part of the GHMT PREMIUM Verification Program; please refer to the B2B portal of BMW Group or the BMW Group IT intranet for a list or request said information from these BMW units.

To this end, specific requirements were defined for the passive IT IS components of

- balanced copper cabling
  - o data cables
  - o connectivity
  - o work area and patch cords (patch cables)
  - o pre-assembled trunk
- and
- fibre-optic cabling
  - o fibre optic cables
  - o fibre optic connector
  - o fibre optic work area and patch cords (patch cables)
  - o pre-assembled trunk
  - o splice box and distribution box

These requirements include normative and additional specifications laid down by the BMW Group. If an IT IS component is prohibited for use during project implementation, approved and released back-up products (as described above) are to be used in consultation with the data centre engineering group. If special solutions that deviate from the specifications laid down in the BMW Group standard need to be installed, this must be coordinated in advance with the data centre engineering group.

**As a rule, the use of materials that contain silicone or substances harmful to paint structures (LABS free) is not allowed in general. The manufacturers of passive IT IS components have to present a written confirmation on said substances.**

**The inter-building installation of balanced copper cabling is not allowed. Only fibre optics must be used for campus and building backbone cabling.**

In addition, supplementary requirements for the specific applications industrial environment / production area and computer centres have been defined. Special connection components must be provided for special applications (temperature, bending), for instance bodyshop (welding).

**Automobile workshops** also require special connection components since a particularly large number of mating cycles occurs per LAN connection, for example by replugging the vehicle testers. Therefore particular connection components have been defined for these applications.

**The specific requirements are listed in "Annex A: Requirements passive IT IS components".**





## 4 Requirements IT cabinets

For the passive IT infrastructure to meet the stringent availability and quality requirements in this area, too, only closed and open IT cabinets may be installed that are approved by the **BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik)** at the time of implementation.

Please refer to the B2B portal of the BMW Group or the BMW Group IT intranet for a list of currently approved IT cabinets; or you may request said information from these BMW units.

If an IT cabinet is prohibited for use during the project implementation period, approved back-up products are to be used in consultation with the data centre engineering group. **The detailed configurations for the various IT cabinets (for example, active-open IT cabinet) are listed in "Annex B: Requirements IT cabinets".**

If special solutions that deviate from the specifications laid down in the BMW Group cabinet standard need to be installed, this must be coordinated in advance with the BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik).

## 5 Requirements installers

BMW Group has defined quality assurance measures in order to achieve a high level of product and service quality for the passive IT infrastructure, thus ensuring smooth communication between IT systems.

One of the steps required in this regard is to enhance fibre-optic installation quality. This is achieved by target-oriented training and the corresponding certification of the parties performing the installation.

Please refer to "**Annex C: Requirements installers**" for the detailed requirements.

## 6 Requirements measurements

All installed fibre optic and copper data links must be tested on the basis of measurements by the installation company within the framework of quality assurance. The test methods to be employed and the applicable assessment criteria are listed and explained in detail in "**Annex D: Requirements measurements**".

## 7 Requirements installation

The installation must be implemented in conformity with DIN EN 50174-1 and DIN EN 50174-2 as amended.

Please refer to "**Annex E: Requirements installation**" for the detailed installation requirements.

## 8 Higher-level appraisal to secure commissioning of the IT infrastructure

During the implementation stage, a qualified test laboratory / staff (for example GHMT AG, Bexbach) is to carry out **inspections** for the purposes of securing commissioning in order to identify any potential deviations from the BMW standard defined for the passive IT infrastructure early on during the implementation stage, and to avoid repeating these deviations in the further course of the project as well as any project delays resulting from them. The inspection results will be forwarded to the technical construction management in charge and to the **BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik)** in the form of a report.

These inspections must include in particular the following exemplary steps:

- Visual inspection of the passive IT infrastructure (copper and optical fibre) and the installation and cabling practice, taking into account the BMW Group cabling standard. Visual inspection also comprises inspection points in areas that are not directly accessible (for example raised floors, suspended ceilings, and areas that are accessible through inspection openings only).
- Checking the balanced communication cabling in accordance with IEC 61935-1 and DIN EN 50346, taking into account DIN EN 50173-1 or, as the case may be, ISO/IEC 11801.
- Determination of the EMC parameter coupling attenuation in accordance with DIN EN 50289-1-16
- Microscopic inspection of fibre optic connector front faces including documentation
- Determination of
  - o Insertion and return loss of single-mode optical fibres at 1,310 nm and 1,550 nm as well as 1,625 nm for MAN and WAN connections
  - o Insertion and return loss of multi-mode optical fibres at 850 nm and 1,300 nm
  - o Discharge capacity of the raised floor system (if required)incl. documentation
- Checking the connections of the passive IT infrastructure to the equipotential bonding system for low impedance and high-frequency capacity
- Checking the passive IT IS components used for their currently valid approval by BMW Group
- Plausibility checks of existing test records created by the installation service provider

### Comment:

**The exact scope and content of every appraisal is defined by the BMW Group IT IS Function Datacenter Technology (Rechenzentrumstechnik).**

## 9 Specifications to ensure EMC

### 9.1 EMC officers appointed by the project companies

In his purview, the planner must ensure that the project companies appoint EMC officers that serve as contacts for the EMC measures to be taken. Said EMC officers will be informed by the planner about all EMC protection measures to be taken.

### 9.2 EMC system documentation

In his purview, the planner must see to it that there is a complete system documentation to ensure that the implementation of the EMC protection measures can be traced. To this end, pictures of welded steel reinforcement must be taken amongst other things.

The documentation must be continuously updated during the construction stage and any subsequent alterations, and is part of the operation manual.

#### Example:

The following section shows by way of example how EMC measures must be documented on the basis of photographs that form part of the EMC system documentation.

In the process, the EMC officer must ensure that the photographs correlate with the CAD plans and can be allocated clearly. (cf. Figure 2 and Figure 3)

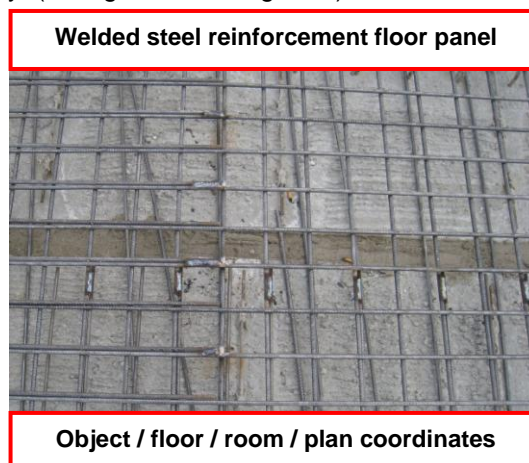


Figure 2: Documentation example for welded steel reinforcement

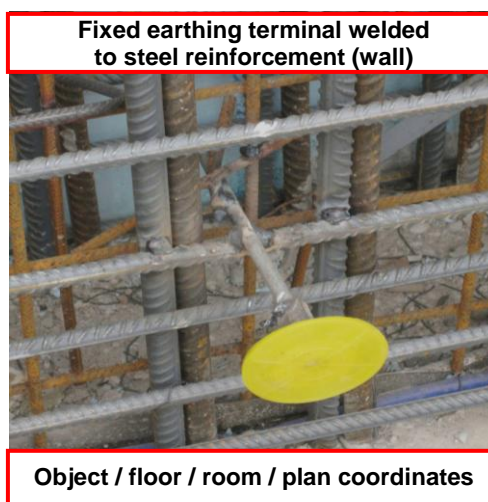


Figure 3: Documentation example for a fixed earthing terminal welded to the steel reinforcement

### **9.3 Basic requirements**

For the planner's purposes, the owner has to ensure that the following requirements are met on the basis of appropriate implementation of the requirements:

- A risk-dependent classification of the facilities concerned in interference protection zones
- An earthing system that is capable of carrying lightning currents and that meets the requirements of personal protection
- An equipotential bonding system suitable for high frequencies with connectivity to the passive IT IS components
- An EMC-compliant power supply that meets the requirements in terms of topology and voltage quality.

If these basic requirements are not met in their entirety, the planner has to inform the technical construction management in writing.

The aforementioned requirements are described briefly in the following sections.

#### **9.3.1 Classification of interference protection zones**

Interference protection zones are designed to ensure specifically defined electromagnetic conditions in the individual zones. This is achieved, for example, by reducing excessive field strength values and conducted disturbances caused by lightning electromagnetic pulses (LEMP) and switching electromagnetic pulses (SEMP), for instance, or even by harmonics and high-frequency disturbance couplings. Since, from an engineering and business point of view, frequently it is not possible to create a uniform electromagnetic environment for the entire building, the facilities are classified as belonging to different protection zones. The protection zones thus support the clearly structured protection of sensitive plants and systems. Key systems that are of particular importance to the operation of the plant are allocated to a zone with a lower electromagnetic interference potential than those systems whose impairment or even breakdown can be tolerated.

The BMW Group allocates the IT IS rooms closets to availability categories. Facilities that are part of the highest availability category are assigned to protection zone 2.

#### **9.3.2 Earthing system**

Earthing measures form an absolute prerequisite for efficient personal and lightning protection. If implemented correctly, they ensure that protection elements are triggered and that disturbances, in particular lightning-induced currents, are discharged to earth. In this connection, reference is made to DIN 18014. In countries outside its scope, care must be taken to ensure implementation according to this standard.

#### **9.3.3 Meshed bonding network suitable for high frequencies**

The equipotential bonding system facilitates a safe connection to the earthing system in the entire building at the lowest impedance possible. Ideally, the equipotential bonding system is implemented as a 3D meshed bonding network, which ensures a potential that is as uniform as possible throughout the entire building/plant. The planner therefore ensures that a sufficient number of connection options in the form of earth electrode terminals are available.



## 10 Safety and protective measures on construction sites

When work is performed on real estate owned by BMW Group, the local safety regulations and provisions must be strictly obeyed and implemented. The instructions provided by the health and safety coordinator ("Sicherheits- und Gesundheitsschutzkoordinator - SiGeKo) must always be complied with.

For example, in relation to:

- Building site regulations
- Personal protective equipment ("Persönliche Schutzausrüstung - PSA")
- Fire protection provisions
- Escape and rescue routes
- Fire-fighting facilities
- Hazard-increasing projects



## 11 Glossary

AP	workplace	SiGeKo	Sicherheits- und Gesundheitsschutzkoordinator (= Coordinator for safety and health matters)
BD	building distributor (= Gebäudeverteiler GVT)	TR	Technical Report
BMUZ-IT	Brandmeldeunterzentrale für IT (= fire-alarm substation IT)	UMTS	Universal Mobile Telecommunications System
BOS	Public-security authorities and organisations	VDE	Verband Deutscher Elektrotechniker (= association of German electrical engineers)
CAD	Computer-aided design	VPAA	Vermaschte Potential-Ausgleichsanlage (= meshed bonding network)
CC	Computer centre (= Rechenzentrum RZ)	WAN	Wide Area Network
CISPR	Comité International Spécial des Perturbations Radioélectriques	WLAN	Wireless Local Area Network
Cu	Copper		
DIN	Deutsche Industrie Norm (= German Industrial Standard)		
EMC	electromagnetic compatibility (= Elektromagnetische Verträglichkeit EMV)		
EN	European Standard (= Europäische Norm)		
FD	floor distributor (= Etagenverteiler EVT)		
FO	fibre-optic cables (= Lichtwellenleiter LWL)		
GSM	Global System of Mobile Communications		
HOAI	Honorarordnung für Architekten und Ingenieure (= Official scale of fees for services by architects and engineers)		
IEC	International Electrotechnical Commission		
IS	Infrastructure		
ISO	International Organization for Standardization		
IT	Information Technology		
LABS	Substances containing silicone or harmful to the wetting properties of paints		
LAN	Local Area Network		
LEMP	Lightning Electromagnetic Pulse		
LSA	löt-, schraub und abisolierfreie Anschlusstechnik (= connecting hardware without solder, screws or wire-stripping)		
LTE800	Long Term Evolution		
LV	Leistungsverzeichnis (= specifications)		
MICE	Mechanical, Ingress, Climatic, Electromagnetic		
NCC	network control centre (= Netzwerkzentrale NWZ)		
PA	Potentialausgleich (= equipotential bonding, bonding network)		
PAS	Potentialausgleichsschiene (= equipotential bonding bar)		
PSA	Persönliche Schutzausrüstung (= personal protective equipment)		
RJ45	Registered Jack type 45		
SEMP	Switching Electromagnetic Pulse		
SF/UTP	Screened Foiled Unshielded Twisted Pair		