SMG -
SLOTTED MICROWAVE GUIDE

VAHLE
COMMUNICATION SYSTEMS

TABLE OF CONTENTS

SMG-Data Transmission with VAHLE Conductor System for AS/AR warehouse

1.1 General Description

Slotted **M**icrowave **G**uide - Data Transmission System

The SMG data transmission system is highly suitable for automation applications as it transmits free of interference high rates of data to tracked machinery.

SMG was originally developed by MBB (Messerschmitt-Boelkow-Blohm), now EADS, to transmit data to the magnetic levitation train traveling at speeds of up to 250 mph. VAHLE acquired this product by the end of 1994 and now has worldwide over 4000 installations successfully in operation.

VAHLE has embarked on an extensive development program to increase the SMG application range. Presently there are already data interfaces available for the most commonly used bus systems.

Heavy-duty construction makes it possible to install SMG in arduous and environmentally difficult locations; for instance a great number of SMG waveguide systems are functioning reliably in steel mills and foundries.

The SMG data transmission system operates economically already with single channel transmission and low data rates. Modular design easily expands the system to handle at relatively low cost medium and high data rates as well as multi-channel configurations upto 1000 m length. Circual systems from a diameter of 1,80 m could be made out of the SMG-profile and are suitable for the on page 6 mentioned features.

When combined with VAHLE conductor systems for the current supply, SMG data transmission systems become a reliable high-performance component package capable of handling a wide variety of applications as demanded by current and future automation technology.

1.2 Areas of Application

Port Container Terminal

Airport Cargo Terminal

High bay warehouse with stacker crane

Regatta track Duisburg

The fail-safe and variable SMG-concept opens a wide range of applications:

Crane installations
- automatic cranes
- portal cranes
- container cranes

Automated material handling systems
- AS/AR warehouse
- robotics
- production lines
- coke oven machinery

Transit systems
- people movers
- automated feeder-lines

Elevator systems
- passenger elevators
- inclinators

Freight transfer
- airport cargo
- container terminals

Security systems
- mobile video transmission
- target range

Entertainment
- parks & racetracks
- stadiums & arenas

1.3 Features

The SMG – system is constructed for the transmission of digital, serial datas, as it is common usage in data comunication networks. The digital data transmission in mpeg 4-format through a ethernet interface (electronical & optical) is a standard application.

Special transceivers (transmission-/receiving units) with interface modules for all popular bus systems prepare the digital-serial signals via frequency modulation.

To transmit in full duplex two carrier frequencies with high band width at approx. 2.4 GHz are availble. The microwave signal pagates wihtin an slotted, hollow aluminum extrusion (waveguide) between the transceivers.

A transparent structure, resp. the support of numerous data protocols simplify the integration of the SMG data transmission system into an existing bus system. If required, VAHLE can provide engineering and service support for this task.

However, important features, due to the fact of a waveguide, the coexistence of other wifi systems (e.g. Bluetooth, ZigBee, WLAN) and the protection against sabotage and manipulation.

The following characteristics distinguish VAHLE SMG data transmission technology:

- No interference as microwave is completely contained by SMGT waveguide
- Non-contact transmission technology offers maintenance free operation
- SMGT directly combines with all VAHLE conductor systems and may be installed simultaneously
- Faultless transmission of high data rates, up to 10 Mbit/sec.
- Large bandwidth allows full duplex transmission of six data channels simultaneously
- Dynamically very efficient transceivers permit transmission up to 1000 m without amplification
- Simple integration into existing bus systems and upgrade posibility is facilitated by modular design
- Safety relatet transmission capability e.g. PROFISAFE, SafetyNET can be connected
- Multiple vehicles on one waveguide
- Uninterrupted data transmission independent of operating speed
- Environment such as temperature, rain, fog, dust etc. does not degrade the quality of the transmission
- SMG is also suitable for systems with curves, track switches, interruptions, etc.

1.3 Features

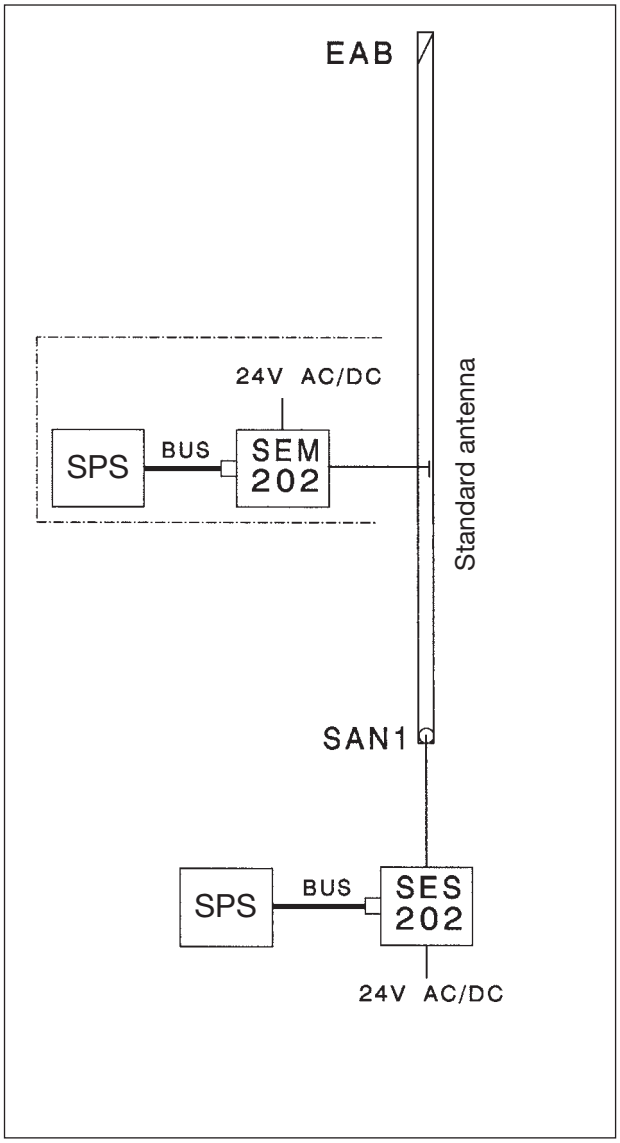
The SMG Data Transmission provides interfaces for all common databus systems as well as special interfaces for video, audio, control and emergency-stop signals. All interfaces are plug-in modules for easy adaption to the existing communication structure. A galvanized seperation of the interface signals is a standard of the SMG-data transmission.

The following data interfaces are available:

Interface	maximum communication rate (kbit/s)	typical applications
TTY/20 mA	20	Sinec L 1-Bus, Programmable Unit, interface converter, communication processor
RS 232 C	20	PC, scanner, scales, etc.
RS 422 point to point	1.500	InterBus-S according to EN 50254 Vol. 2, other 4-wire connection, measurement signal transmission
InterBus - S	2000	InterBus - S communication via SUPI 3 OPC with optical and electrical connector
RS 485	1.500	Profibus EN 50170 Volume 2
DH 485	9,6	Allen-Bradley DH 485 - Databus
A-B DH+ A-B RIO	57,6 230,4	Allen-Bradley Data Highway Plus Allen-Bradley Remote I/O
GE Genius	153,6	General Electric™ - Datenbus standard/extended
Audio	0,3-3,4 kHz	Intercom 600 Ω , 1 Vss
Ethernet wired	10.000	Industrial Ethernet, 10 Base-T acc. IEEE 802.3
Ethernet optical	10.000	Industrial Ethernet, 10 Base-FL acc. IEEE 802.3
Profisafe	1.500	Safety and Control applications
Profinet Safe	10.000	Safety and Control applications
Safty NET p	10.000	Safety and Control applications

1.4 Application Examples

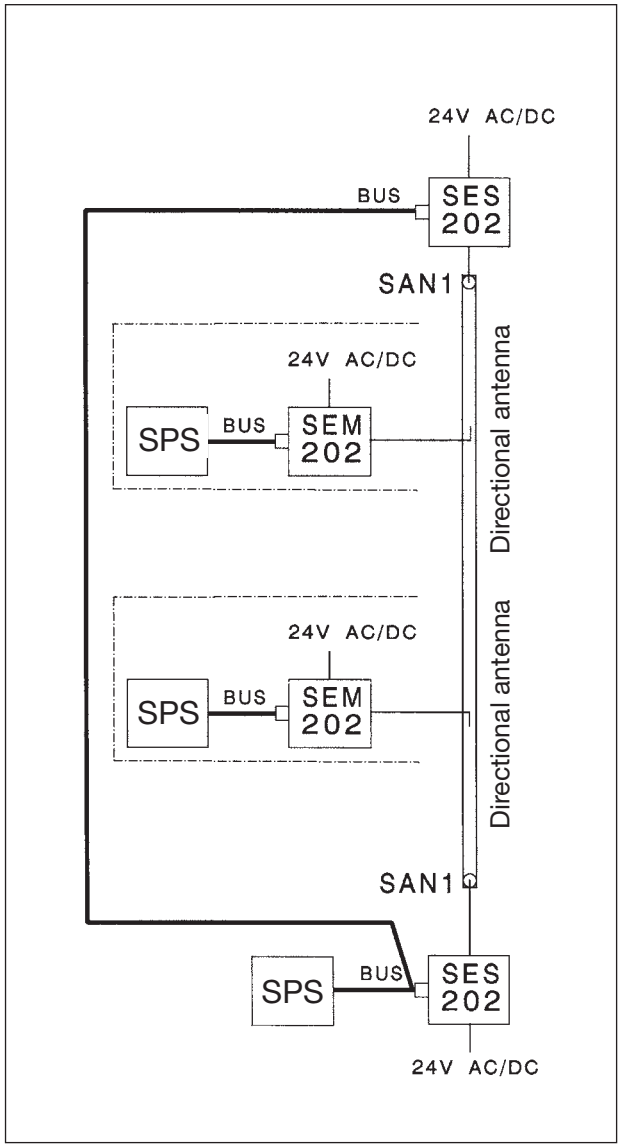
... data communication for industrial automation



Example 1

Communication with one vehicle connected to the SMGT System. The supply of the RF signal is made at the end of the SMGT waveguide section.

The vehicle is equipped with a standard antenna.



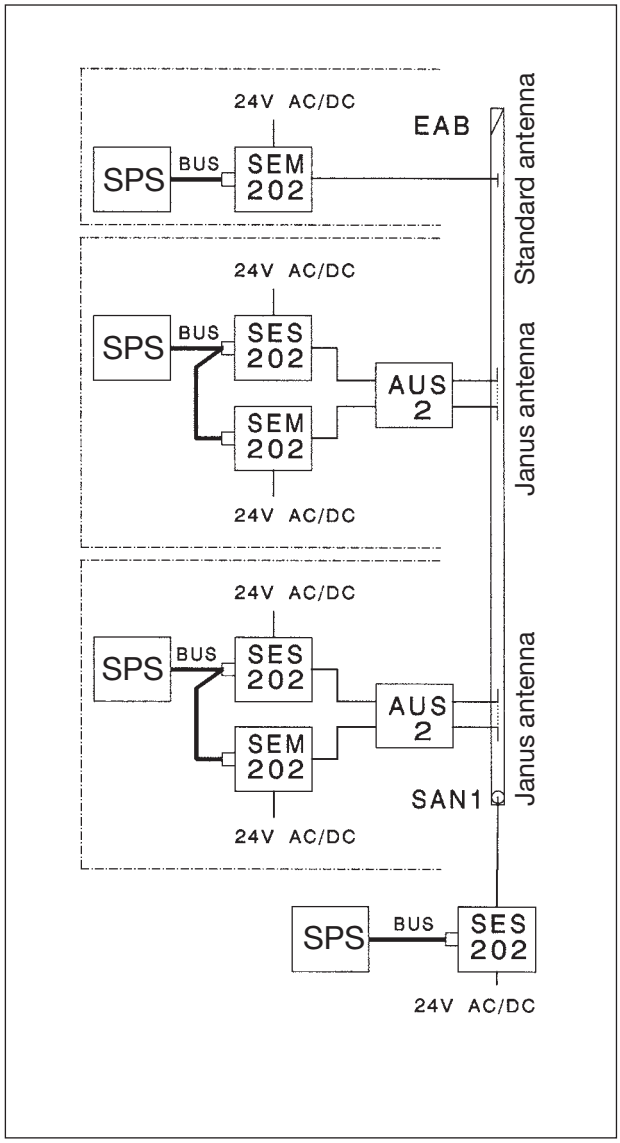
Example 2

Communication with two vehicles connected to the SMGT System. The supply of the RF signal is made at both ends of the SMGT waveguide section.

For the separation of the two RF links, the system is equipped with directional antennas.

1.4 Application Examples

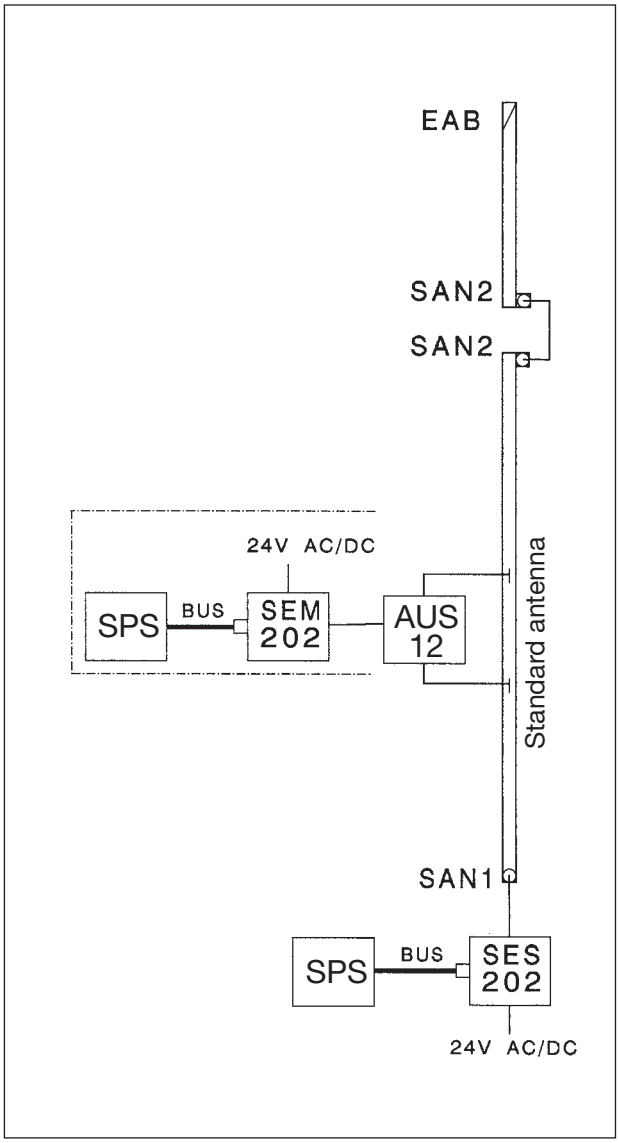
... in data communication for industrial automation



Example 3

Communication with two or more vehicles connected to the SMGT System by using two transceivers for each vehicle (SES/SEM) and Janus antennas.

If one vehicle of the transmission line is shut down, the automatic antenna switch AUS-2 provides the transmission of the RF signal to the remaining vehicles.



Example 4

Communication with one vehicle if the SMGT waveguide is interrupted by gap.

By using the antenna switch AUS-12 and two antennas installed at an adequate distance, the SMGT waveguide gap can be passed without communication loss.

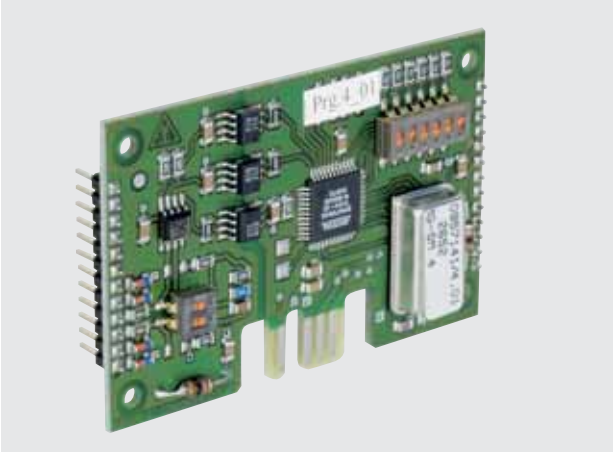
1.5 Module Configuration

Transceiver **SMG-SES/SEM**

The **transceiver Unit SMG-SES/SEM** is prepard to accept the data module SMG-DM .. and is factory assembeld with a RF-module and 24 V AC/DC power supply module.

Data module **SMG-DM..**

The **Data module SMG-DM..** is prepared to accept the interface module SMG-SM.. and is equipped with a connector for the external communication system.
For available modules see page 26.
Further technical description on request.



Interface module **SMG-SM..**

The **Interface modul SMG-SM..** is made for adaption to the serial data signals of the external communication system.
For available modules see page 26.
Further technical description on request.

2.1 SMG Transceiver

SMG Transceiver - SES/SEM

Transceiver with protective cover

A basic data transmission arrangement requires two transceivers; type SMG-SES will be stationary and type SMG-SEM will be installed at the moving equipment.

The standard transceiver configuration consists of a RF-module type RFM 01 and a power supply moudle.

Two transceiver specifications are available; type 202 with two data module plug-in slots and type 203 with three slots.

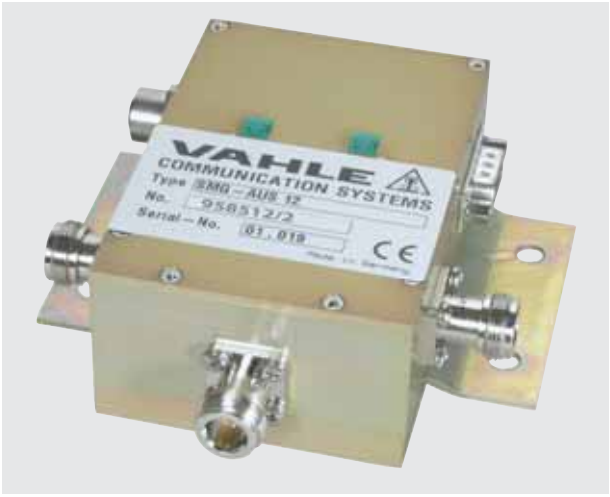
A protective cover is available to protect the front side of the transceiver in an dusty environment. Connection to the transceiver is made through openings at the bottom of the cover.

Adjustable installation brackets are included to facilitate the installation of the transceiver.

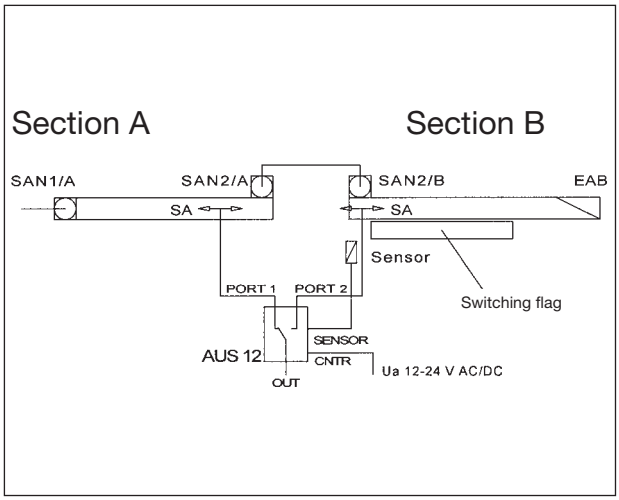
Specification	
Type	SES / SEM
Dimensions - type 202 - type 203	 153 x 276 x 281mm 153 x 328 x 281mm
Protection class with cover	IP 50 IP 53
Operating temperature Storage temperature	–0 to +50°C (1) –20 to +70°C (moisture condensation and direct sun heat inadmissible)
Power supply	24 V AC/DC
Power consumption	approx. 24 VA
Housing and cover	Steel sheet coated RAL 7032

(1) Climate controlled enclosures are available.

2.2 SMG Antenna switch for crossover function



Antenna switch SMG-AUS 12



Function diagram SMG-AUS 12

Function

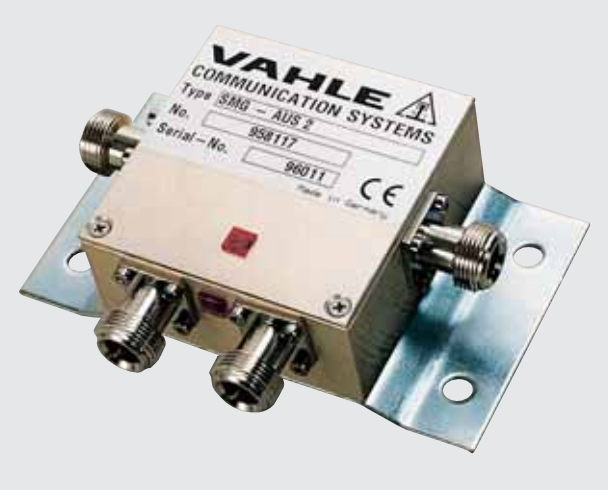
The antenna switch SMG-AUS 12 is always required when the waveguide has a gap due to system's specifications and data transmission can not be interrupted when the vehicle is traversing this gap.

The antenna switch is installed between antennas and mobile transceiver (SEM). 12-24 V AC/DC is required which may be supplied externally or from the interface module SM 10. In either case, the connecting cable must be a shielded twisted pair.

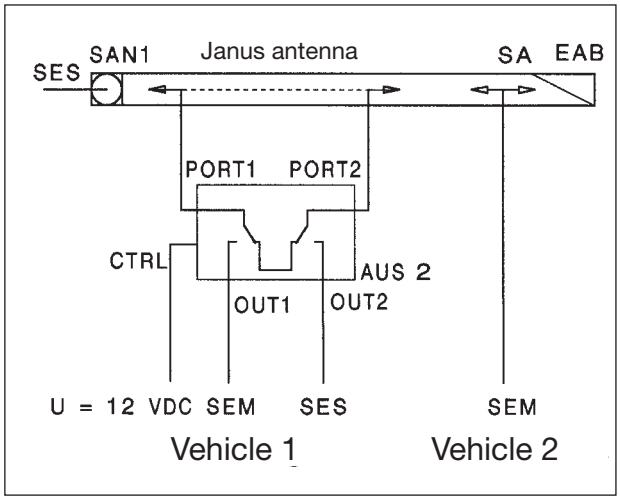
With the proximity switch, which the client has to provide, the position depending antenna switch will be activated. An installation of the required switching flags can be made directly at the T-groove of the SMGT-profile. A LED at the antenna switch signals the actual RF-status.

Specification	
Typ	SMG - AUS 12
Dimensions in mm (H x B x T)	48 x 120 x 68
Protection class	IP 50
RF-connector	3 x N-Type (female)
Power connector	9 -pol Sub-D (male)
Sensor connector	M 12 (E 2)
Consumption	max. 100 mA w/o Sensor
Power supply	12V-24 V AC/DC floating

2.3 SMG Antenna switch for bypass function



Antenna switch SMG-AUS 2



Function diagram SMG-AUS 2

Function

When communicating with two or more vehicles on a SMG waveguide the antenna switch SMG-AUS 2 automatically bridges the switched off SES / SEM transceiver pair by disconnecting the power supply (e.g. when one vehicle is inoperative).

The supply voltage amounts to 12 V DC and could be provided external or with the interface module SM 10. In every case a shielded twisted pair cable has to be used.

A LED at the antenna switch shows the actual RF-status.

Specification	
Type	SMG - AUS 2
Dimensions	31 x 68 x 68 mm
Protection class	IP 50
RF connection	4 x N-Type (female)
Connection for sensoric and power supply	9 - pole Sub-D (male)
Power supply	+12 V DC potential-free
Consumption	max. 100 mA

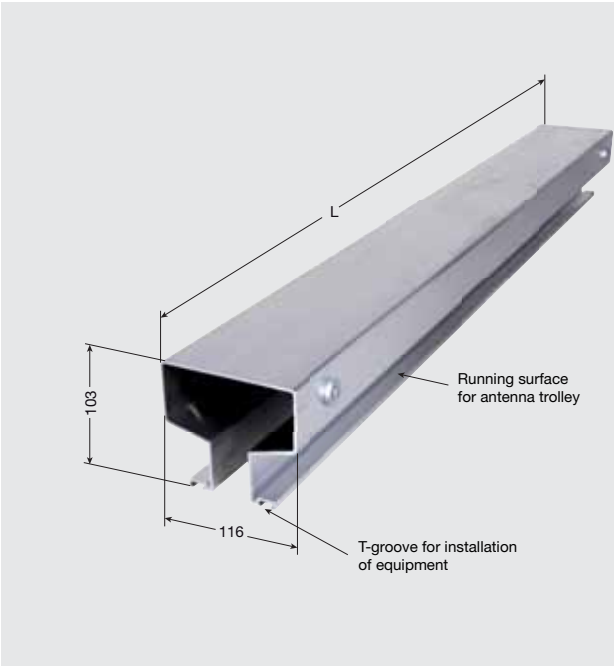
2.4 Possible SMG-module combinations

Data module	DM 11	DM 12			DM 13		DM 131	
Data bus/ interface		CH 1	CH 2 w/o DM 15	CH 2 with DM 15	CH 1	CH 2	CH 1	CH 2
TTY	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s	SM 1 9,6 kBit/s	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s
RS 232	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s	SM 2 9,6 kBit/s	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s
RS 422	SM 3 2 MBit/s	SM 3 2 MBit/s	SM 3 250 kBit/s	SM 3 9,6 kBit/s	SM 3 375 kBit/s	SM 3 375 kBit/s	SM 3 187,5kBit/s	SM 3 187,5kBit/s
Interbus S electrical	SM 3 500 kBit/s	SM 3 500 kBit/s	-	-	-	-	-	-
Interbus S optical	-	-	-	-	-	-	-	-
Profibus/RS 485	SM 4 1,5 MBit/s	SM 4 1,5 MBit/s	SM 4 187,5 kBit/s	SM 4 9,6 kBit/s	SM 4 187,5kBit/s	SM 4 187,5kBit/s	SM 4 187,5kBit/s	SM 4 187,5kBit/s
DH 485	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s	SM 41 9,6 kBit/s	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s
A-B DH+	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s	-	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s
A-B DH RIO	SM 6 230,4 kBit/s	SM 6 230,4 kBit/s	SM 6 115,2 kBit/s	-	SM 6 115,2 kBit/s	SM 6 115,2 kBit/s	SM 6 57,6 kBit/s	SM 6 57,6 kBit/s
GE Genius IO	SM 13 153,6 kBit/s	SM 13 153,6 kBit/s	SM 13 153,6 kBit/s	-	SM 13 76,8 kBit/s	SM 13 76,8 kBit/s	SM 13 38,4 kBit/s	SM 13 38,4 kBit/s
Voice	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz	-	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz
Ethernet electr. 10Base-T	-	-	-	-	-	-	-	-
Ethernet optic. 10Base-FL	-	-	-	-	-	-	-	-

2.4 Possible SMG-module combinations

Data module	DM 14/141 with DM13/131		DM 15 with DM12 or DM23/24		DM 20	DM 42-CU	DM 42-FO
Data bus/ interface	CH 1	CH 2	CH 1	CH 2		- -	-
TTY	SM 1 19,2 kBit/s	SM 1 19,2 kBit/s	SM 1 9,6 kBit/s	SM 1 9,6 kBit/s	-		
RS 232	SM 2 115,2 kBit/s	SM 2 115,2 kBit/s	SM 2 9,6 kBit/s	SM 2 9,6 kBit/s	-		
RS 422	SM 3 187,5 kBit/s	SM 3 187,5 kBit/s	SM 3 9,6 kBit/s	SM 3 9,6 kBit/s	-	ohne SM 2,0 MBit/s	-
Interbus S electrical	-	-	-	-	-	with Supi 3 500 k and 2,0 Mbit/s	-
Interbus S optical	-	-	-	-	-	-	with Supi 3 500 k and 2,0 Mbit/s
Profibus/ RS 485	SM 4 187,5 kBit/s	SM 4 187,5 kBit/s	SM 4 9,6 kBit/s	SM 4 9,6 kBit/s	-	-	-
DH 485	SM 41 19,2 kBit/s	SM 41 19,2 kBit/s	SM 41 9,6 kBit/s	SM 41 9,6 kBit/s	-	-	-
A-B DH+	SM 6-AB3 57,6 kBit/s	SM 6-AB3 57,6 kBit/s	-	-	-	-	-
A-B DH RIO	SM 6 57,6 kBit/s	SM 6 57,6 kBit/s	-	-	-	-	-
GE Genius IO	SM 13 38,4 kBit/s	SM 13 38,4 kBit/s	-	-	-	-	- -
Voice	SM 7 0,3-3,4 kHz	SM 7 0,3-3,4 kHz	-	- -	-		-
Ethernet electr. 10Base-T	-	-	-	-	SM 21 10 MBit/s	-	-
Ethernet optical 10Base-FL	-	-	-	-	SM 21 10 MBit/s	-	-

3.1 SMGT Waveguide



SMGT Waveguide section

Function

The SMGT waveguide, manufactured of extruded aluminum, serves as the RF transmission medium. The specific shape of the waveguide is configured for the use with a frequency of approx. 2,4 GHz, its design also assures minimum attenuation of signal propagation. Also, the waveguide shape provides the necessary interference shielding from the outside and towards the outside.

Standard length L is 6 m. Short length are aswell available. (see order information chapter 5).

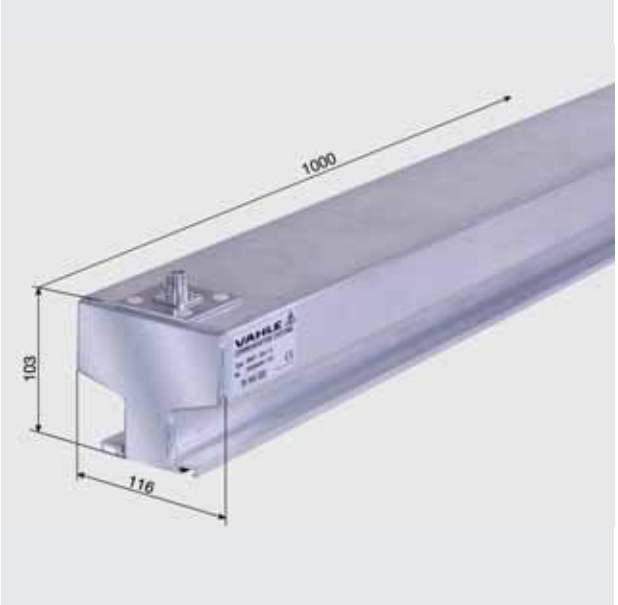
SMGT waveguide curve sections for horizontal or vertical curves are also available, minimum radius 900 mm.

Depending on the environmental requirements the SMGT-Profile is available in three different surface treatments.

As an extentation to the known SMG-profile the SMGT-profile provides an additional running surface of an antenna trolley aswell as a T-groove for installation of equipment.

Surface Treatment	Designation	Environmental Requirements
SMGT Waveguide bright	SMGT/B	No surface treatment to aluminum section, for indoor installation without environmental problems.
SMGT Waveguide anodized	SMGT/E	Anodized aluminum waveguide for outdoor installations with medium environmental conditions and at oceanside installations.
SMGT Waveguide epoxy coated	SMGT/SB	Epoxy coated aluminum waveguide for installation with severe environmental conditions, such as: - Sulfuric acid - Potassium hydroxide - Deicing solution - Decontamination solution - Fuel

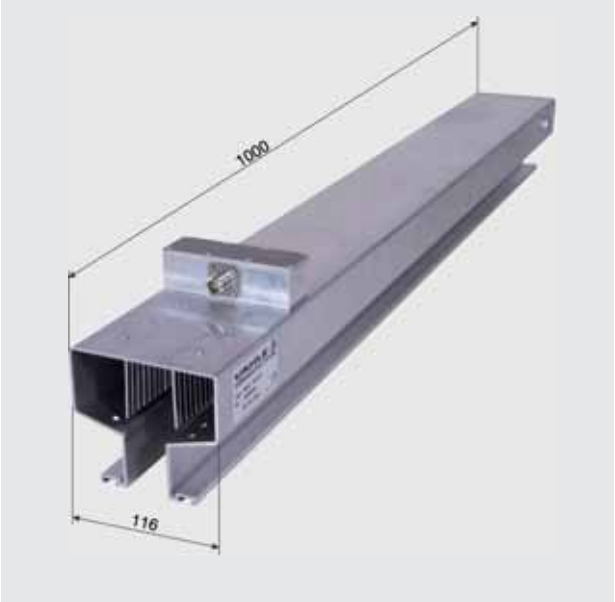
3.2 RF Connection



RF Connection **SMGT-SAN 1** (not traversable)

The RF Signal, provided by the Transceiver, is connected to the SMGT Waveguide by the RF Connector **SMGT-SAN 1.**

The RF Connector has a total length of 1 m and has to be mounted generally at the beginning of the SMGT-Waveguide section. It is not traversable by the SMG antenna. The RF Connector is equipped with a coax N-connector (female).



RF Connector **SMGT-SAN 2** with mounted antenna connection (traversable)

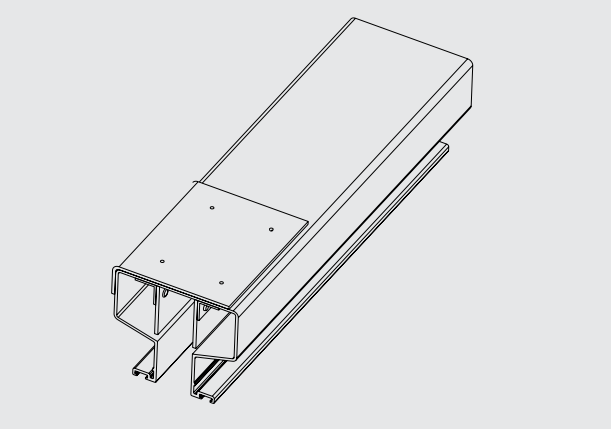
The RF Connector **SMGT-SAN 2** is equipped with a coax N-female connector for the RF-cable.

With system required interupts of the transfer track, is the SMGT-SAN 2 with through passable RF-connector instead of the SMGT-SAN 1 to be used.

RF-cable-connection rotated by 180° if required.

According to the SMGT-profile are the RF-connections SMGT-SAN 1 and SAN 2 available in the three surface versions bright, anodized and epoxy coated.

3.3 RF Termination



RF Termination **SMGT-EAB**

The RF termination **SMGT-EAB** has to be installed generally (with one sided RF-signal feeding) at the end of the system, in the last SMGT-profile. This has to be done with help of the installation material which is in the scope of supply.

It provides the required RF termination.

3.4 Joint Splice Clamp

Joint Splice Clamp **SMGT-PV**

The profile joint splice clamp **SMGT-PV** creates a save mechanical and high frequency technical connection of single SMGT-profile sections.

The joint splice clamp is made of stainless steel.

3.5 Waveguide Anchor Bracket

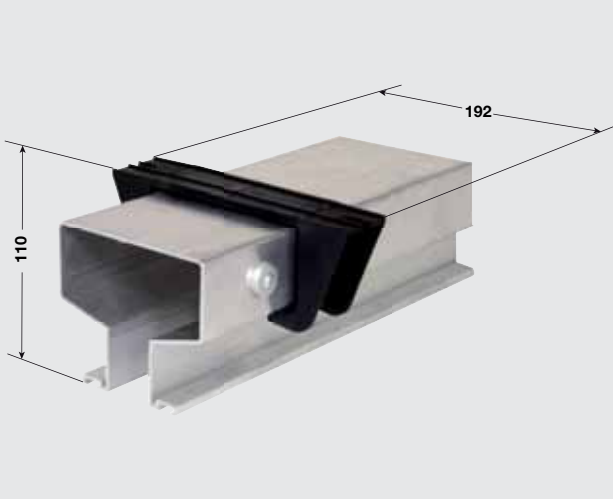
Waveguide Anchor Bracket **SMGT-FL**

As the SMGT-profile is installed in a sliding way, it needs to be fixed through the anchor bracket **SMGT-FL**. With this is a temperature depending movement to both system ends possible.

The anchor bracket is further used as an earthing connection. It is availale in three surface versions bright, anodized and epoxy coated.

In the scope of supply is aswell the required installation material.

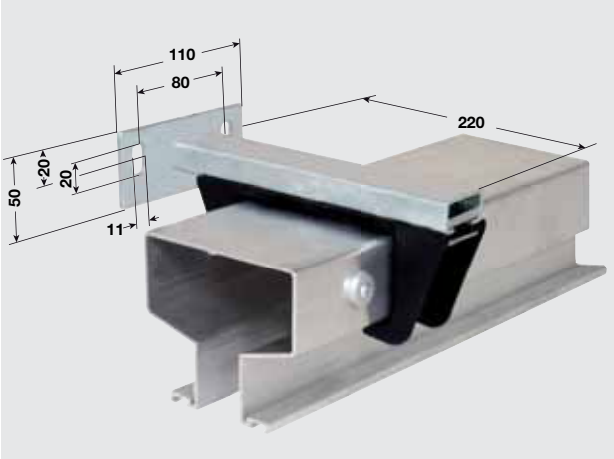
3.6 Support Bracket / 3.7 Support Arm



Support Arm **SMG-HBP 4**

The support bracket **SMG-HBP 4**, enables a sliding support of the SMGT-profile.

Due to the special design this support bracket could be used for installations under L-consoles or C-rails with 12 or 18 mm slot width to be installed twist save. The support bracket HBP 4 is supplied with paired galvanized or stainless steel hardware.

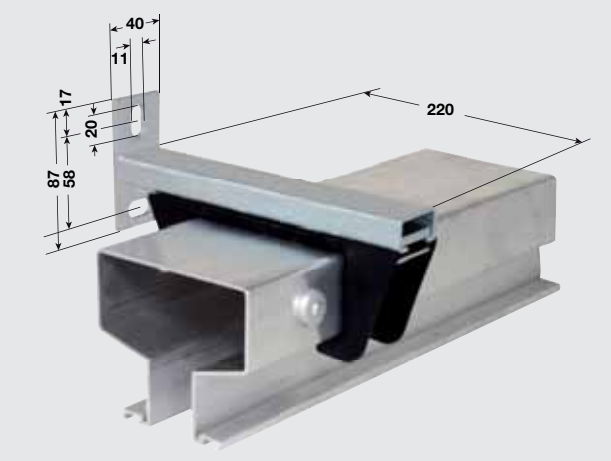


Support Arm **SMG-HT-1/220**

The support arm **SMG-HT 1/220** is used with the support bracket HBP 4 and HBP 2/18 (See chapter 3.6 support bracket). The max. support distance of the SMGT-profile should not exceed 3 m. At least 2 support points per profile segment are required.

The length of the support arm is 220 or optional 420 mm. The arm is available in galvanized or epoxy coated version.

3.7 Support Arm



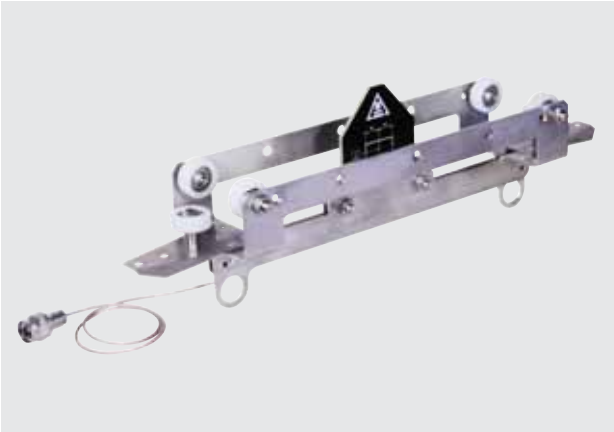
Support Arm **SMG-HT 2/220**

The Support Arm **SMG-HT 2/220** is similar in fuction to the Support Arm type HT 1/220. It is equipped with a vertical flange for mounting.

The length of the support arm is 220 or optionally 420 mm. It is delivered in galvanized or special coated version.

SMG in action for Ethernet data transmission for coking machinery

3.8 Antenna trolleys



SMGT-SAE-LW-2-02

The antenna trolley **SMGT-XXE-LW-2-02** consists of the antenna body and a guiding construction. The antenna trolley with the standard antenna can be used in installations with a transfer free SMGT-profile.

With help of running wheels a guiding of the antenna trolley on the SMGT-profile is achieved. The tolerances of the antennas could be kept and therefore is for the installation only a towing arm required.

The antenna trolley is factory assembled and supplied with a 60 mm long RF-cable. The towing arm (see picture) has to be ordered seperatly.

SMGT-RAE-LW-2-01

The antenna trolley **SMGT-XX-E-LW-2-01** consists of the antenna body and a guiding construction. The antenna trolley with the directional antenna can be used in installations with transfers in the SMGT-profile. A simply design is available for systems without transfers.

With help of running wheels a guiding of the antenna trolley on the SMGT-profile is archieved. The tolerances of the antennas could be kept and therefore is for the installation only a towing arm required. With help of the skids bigger tolerances are possible during transfers.

The antenna trolley is factory assembled and supplied with a 60 mm long RF-cable. The towing arm (see picture) has to be ordered seperatly.

Two arm

The antenna trolley with the Janus antenna is aswell for systems with and without transfers available.

3.8 Antenna

Antenna **SMG-SAE-XY-3**

The Antenna **SMG-SAE- (RAE, JAE) -XY-3** consists of the antenna element and the antenna support arm.

Through this the lateral (x-axis) and vertical (y-axis) movements of the connected mobile user are covered up to the below mentioned tolerances, allowing the antenna body to travel contactless in the SMGT-profile.

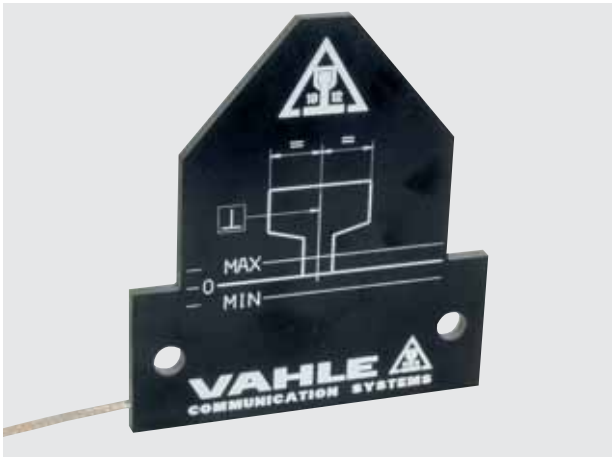
The antenna unit is factory assembled. The flange plate is attached with two slotted holes and could be bolted with two M8 screws (not in the scope of supply) to the support construction.

Chart of the max. permissible tolerances

Description		Type	Permissible Tolerances (mm)	
Antenna	Model		x - Axis	Y - Axis
Standard-	01 02	SMG-SAE-XY-3	± 20 ± 40	+5 – 5 +5 – 5
Directional-	01 02	SMG-RAE-XY-3	± 20 ± 40	+5 – 5 +5 – 5
Janus-	01 02	SMG-JAE-XY-3	± 20 ± 40	+5 – 5 +5 – 5

Antennas for larger permissible tolerances on request.

3.10 Mobile Antennas (Spare parts only)



Standard antenna **SMG-SA**

The standard antenna **SMG-SA** is used for basic SMG data transmission installations such as bus or point-to-point connection with a mobile unit. Two standard antennas, installed at a given distance from each other and connected with an antenna switch SMG-AUS 12, form a double antenna to bridge gaps in the Waveguide caused by system's requirements (see chapter 2.4, SMG antenna switch).

The antenna has a flexible, 0.6 m long RF connecting cable with N-plug.

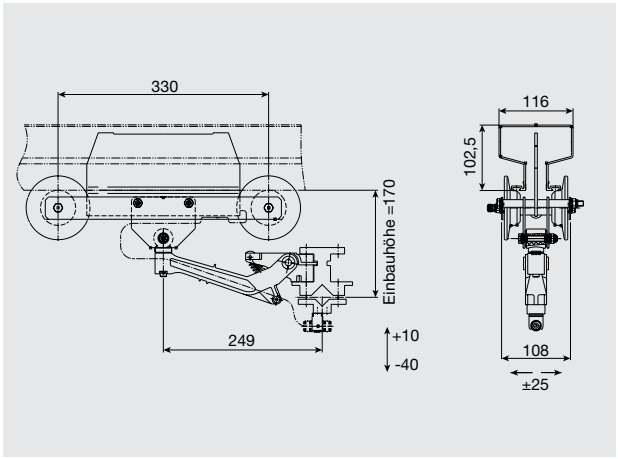
Directional antenna **SMG-RA**

The directional antenna **SMG-RA**, for instance, is used when there are two mobile participants on the waveguide and the RF connection is on each end of the waveguide (see also system's diagram 2, page 7).

Also, the directional antenna may be utilized with double transceivers (SES/SEM) and with two or more participants on the waveguide (similar to system's diagram 3, page 8). The janus antenna SMG-JA is in principle consisting of two constructive connected directional antennas.

The antenna has a flexible, 0.6 m long RF connecting cable with N-plug. The janus antenna has two RF connecting cables.

3.11 Special Antenna assembly



Directional antenna **SMG-RAE-XY 6**

Antenna units with standard, directional and janus antenas in special design for different applications in the material handling (suitable aswell for transfers).

Example:
Antenna assembly **SMG-RAE-XY 6** for large cranes, coking machinery and other material handling systems with tolerances of ± 50 mm in X-Y-direction.

3.12 RF cables with Accessories

HF Connecting cable **SMG-HF**

The RF Connecting cable **SMG-HF** is required to connect the stationary transceiver (SMG-SES) with the SMG Waveguide or to connect the transceiver and the antennas with the antenna switch SMG-AUS 12 and SMG-AUS 2.

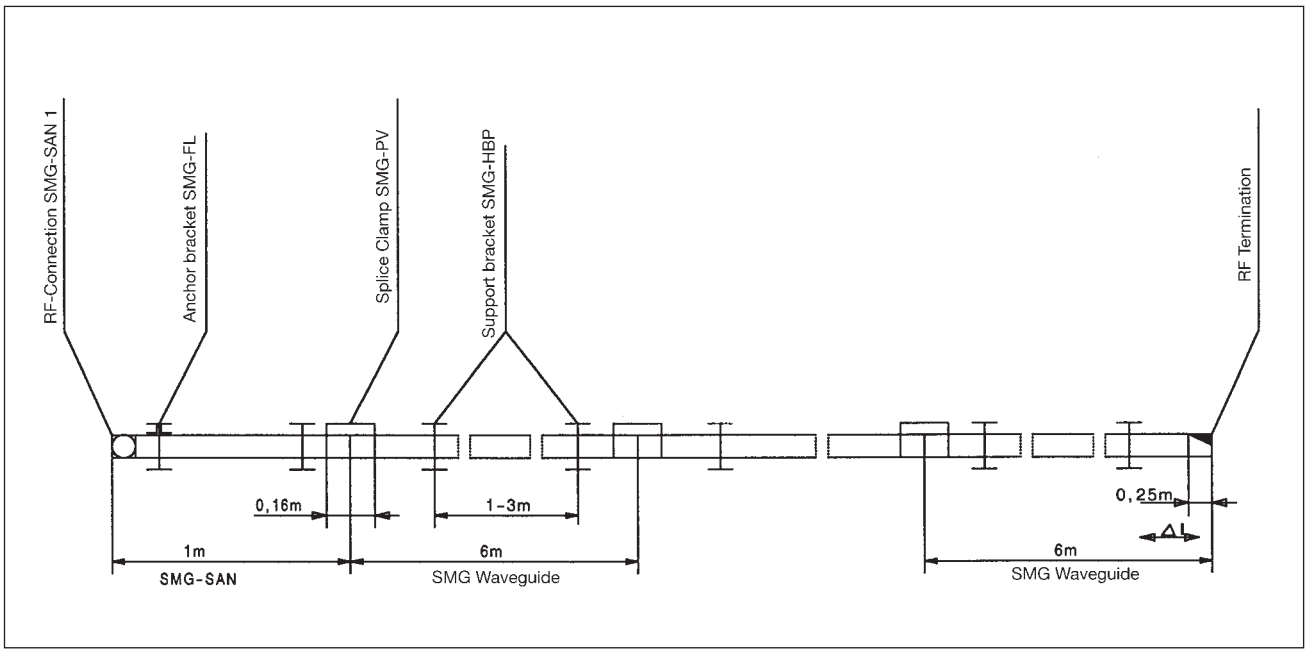
SMG-HF is a specially made cable with low attenuation, minimum bending radius of 100 mm and can only be used for fixed (non-flexing) installation. The cable has an OD of 10 mm with factory installed N-type connectors at each end, available in lengths of 1 m, 2 m, 3 m, 4 m and 5 m.

N-type Connector straight, and right angle

If a RF Connecting cable has to be lengthened an additional connecting cable can be added with the straight N-type connector **SMG-HF-N-VBB**.

The N-type angle connector **SMG-HF-N-WV** enables a space saving cable connection arrangement to the transceiver. The connector is tightened with a hexnut, use a torque setting of 0.7 to 1.1 Nm. If the protective cover IP 53 is installed with a transceiver, an angle connector is included with the shipment and it must be used.

4.1 Constructional design of the SMG waveguide



SMG Waveguide components

Installation of SMGT Waveguide

SMGT Waveguide is installed parallel with the vehicle track, slot opening pointing downward. The waveguide is supported with sliding hanger bracket on 3 m centers and may be installed together with the conductor system.

Standard length for a SMGT Waveguide section is 6 m. Sections are joined with bolted joint splice clamps to make the required system's length. Be certain to have at least 200 mm clearence between joint splice clamp and hanger bracket.

The support hanger permits the waveguide to slide freely during thermal expansion or contraction. Systems up to 200 m long may be anchored anywhere along the system with the included anchor bracket so that controlled expansion/contraction is assured.

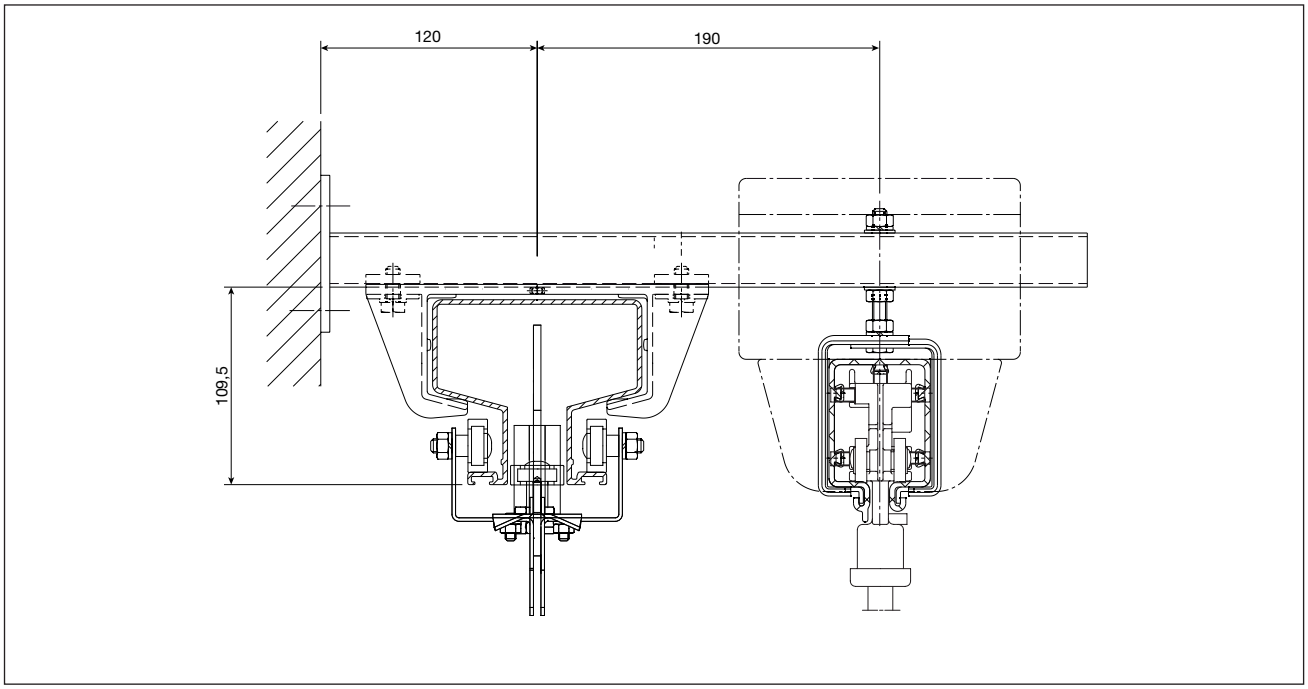
Installations exceeding 200 m and having large temperature variations must be anchored at the center of the system. The very last sliding hanger bracket should be positioned approx. 500 mm from the end of the system.

RF Connection and termination

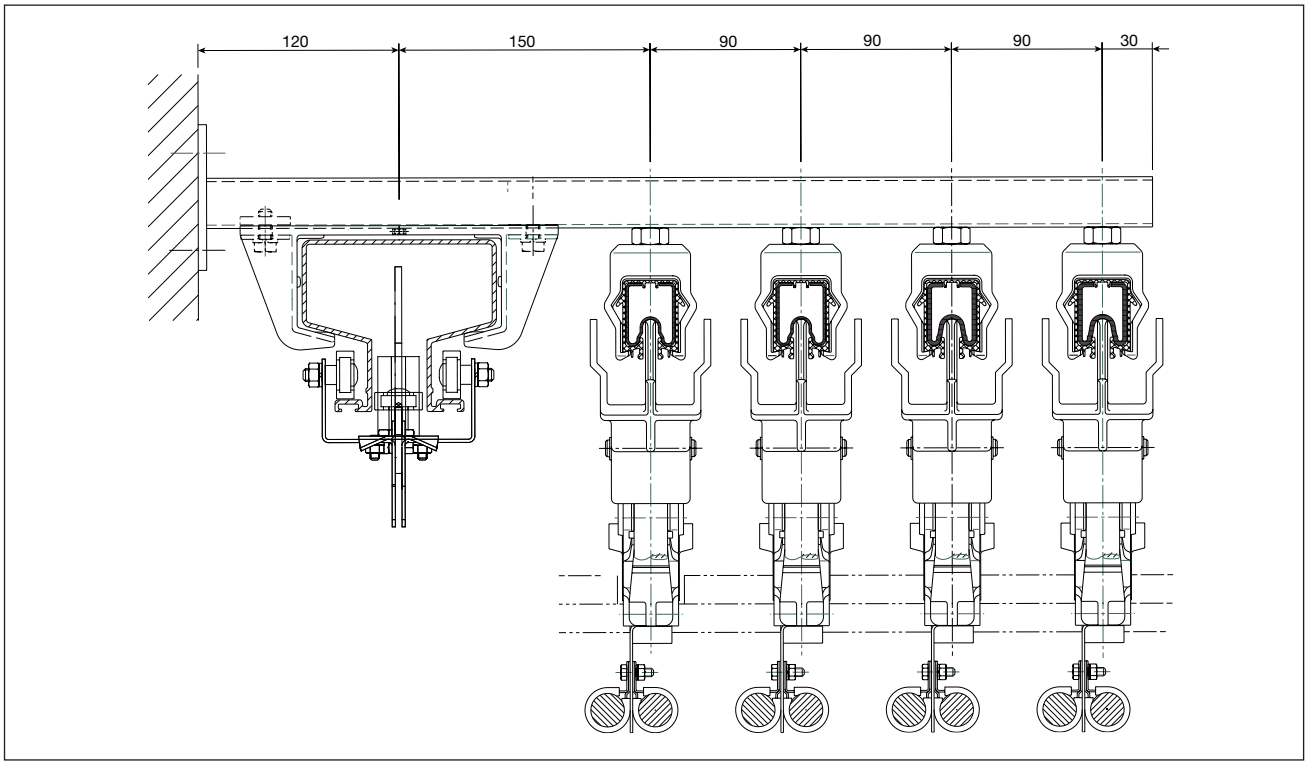
The waveguide section SMG-SAN 1 must be installed at one of the ends of the waveguide. Here the connection is made to the stationary transceiver SES with the use of the special RF Connecting cable SMG-HF.

RF Termination SMG-EAB is installed at the other end of the waveguide unless a SAN-SAN 1 connection is also required as shown on system's diagram 2, page 7.

4.1 Constructional Design of the SMG Waveguide



Typical arrangement of the SMGT Waveguide and Conductor Rail



Typical arrangement of the SMGT Antenna and unipole insulated conductor U 35

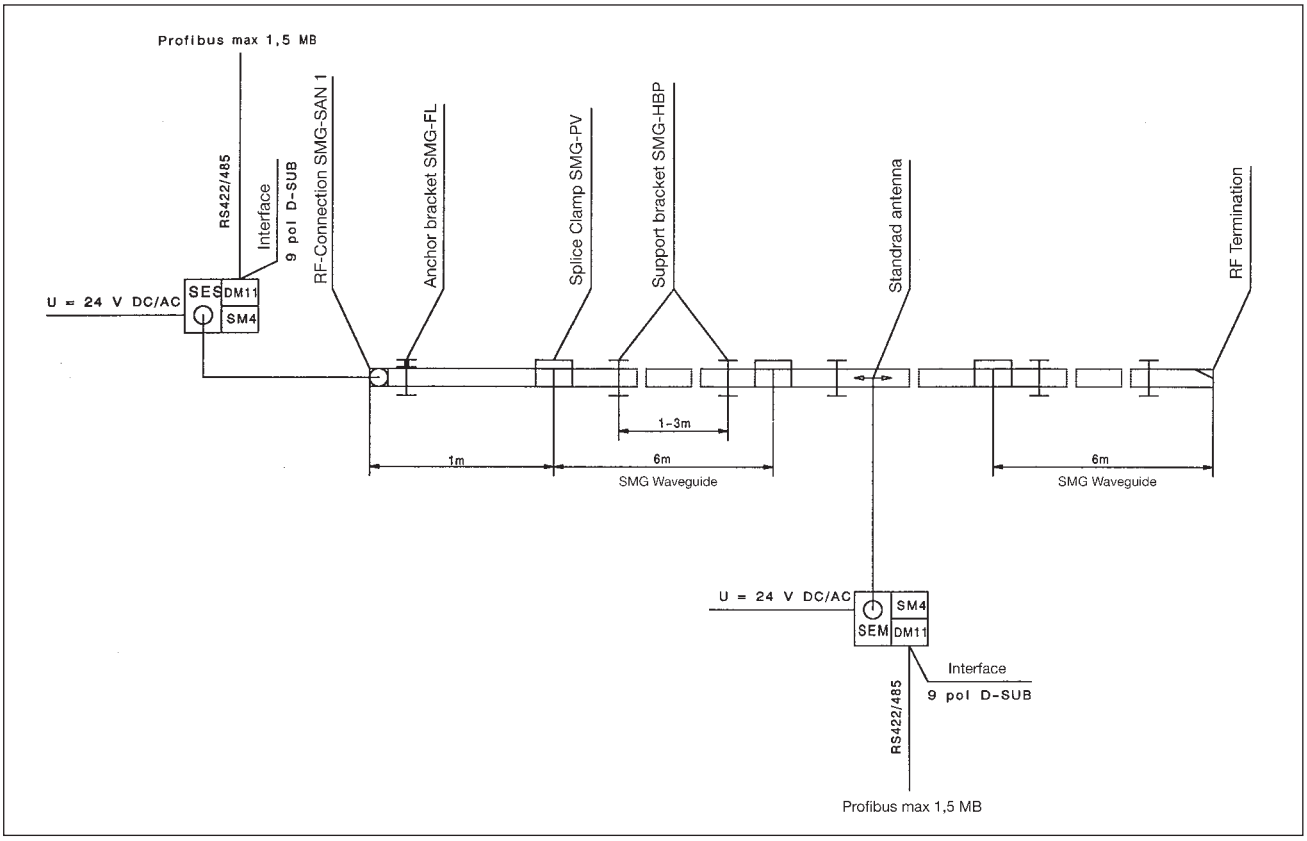
4.2 Configuration Example

System length (Transmission Link): 100 m
Number of users: 1
Communication Interface Profibus (RS 485 - Interface)

The following components are available:

Description	Type	Number	Order-No.
SMG Waveguide, untreated, 6 m long	SMGT/B-6	16	955 940-6000
SMGT Waveguide, untreated, 3 m long	SMGT/B-3	1	955 940-3000
HF-Connection, 1 m long	SMGT-SAN 1B	1	955 938-01B
Anchor Bracket (Installation set)	SMG-FL/B	1	952 410
Clamping Sleeve galvanized	SMGT-PV	17	955 943
HF Termination (Installation set)	SMG-EAB	1	952 400
Support Bracket, galvanized	SMG-HBP 4	36	952 541
Support Arm 1/220	SMG-HT 1/220	36	952 551
Transceiver Unit stationary	SMG-SES 202	1	955 111
Transceiver Unit mobile	SMG-SEM 202	1	955 211
Data module 1-channel	SMG-DM 11	2	955 311
Interface module RS 485	SMG-SM 4	2	957 141
Antenna Device	SMGT-SAE-LW2-02	1	955 935-02
HF Connecting cable 2 m long	SMG-HF 2	1	958 312
HF Connecting cable 1 m long	SMG-HF 1	1	958 311
HF N-Connector, straight	SMG-HF-N-VBB	1	958 391

4.2 Configuration example



System diagram for the configuration example

Please consider the following aspects when designing a system:

Position the stationary transceiver SES as closely as possible to the RF Connection SMG-SAN 1 and the mobile transceiver SEM as closely as possible to the antenna (SMG-SAE-LW2-02) to keep the RF connecting cable as short as possible (5 m max. length).

The for the example selected hanger brackets require a defined available space to be installed. If the available space is limited, special hanger brackets are available (please see page 18 and 19). It is also possible to install the waveguide on the same bracket which supports the conductor system.

If frequency inverters are used please follow the instructions of the manufacturer with reference to interference elimination, cable support and cable shielding. Data cables and power cables must be separated by at least 100 mm.

4.3 Questionnaire

For a detailed quotation, please complete this page and send it by fax. For special applications which cannot be covered by this questionnaire, please contact our Head Office in Germany or our local office in your area.

	Address: _____
	Contact Person: _____
	Tel./Fax: _____
	Date: _____

1. Type of vehicle or mobile device?

   a) crane ☐ b) material handling ☐ c) AS/RS warehouse ☐

   d) monorails ☐

   e) others _____

2. Length of runway (s): _____ m

3. Number of vehicles on runway: _____

4. Type of communication interface:

   _____

   _____

5. Max. needed data rate _____ kbit/s

6. Ambient temperature: _____°C min. _____°C max.

7. What environmental conditions have to be expected?

   a) Outdoor system ☐ b) Indoor system ☐ c) Dust ☐ d) Electromagnetic influence ☐

   e) Acid ☐ f) Humidity ☐ g) Oils ☐

   h) Others: _____

8. Additional Notes: _____

   _____

Description		Type	Weight kg/pc.	Order-No.
SMG-Transceiver and accessories				
Transceiver	stationary, with 2 slots	SMG-SES 202	5.000	955 111
	mobile, with 2 slots	SMG-SEM 202	5.000	955 211
	stationary, with 3 slots	SMG-SES 203	5.500	955 121
	mobile, with 3 slots	SMG-SEM 203	5.500	955 221
Protective cover for model 202 } incl. Angle joint		SMG-SCHH 202	1.000	955 911
model 203 } SMG-HF-N-WV		SMG-SCHH 203	1.200	955 921
Transformer 230/115-24 V AC		SMG-NT	0.820	954 124
SMG Data module				
Data module	1-channel	SMG-DM 11	0.195	955 311
	2-channel	SMG-DM 12	0.214	955 321
	4-channel	SMG-DM 13	0.214	955 331
	2-channel extension	SMG-DM 14	0.180	955 341
	Option 5 V	SMG-ODM 14-5	0.012	957 342
	Option 12 V	SMG-ODM 14-12	0.012	957 341
	2-channel extension	SMG-DM 15	0.192	955 351
	6-channel for model 203	SMG-DM 131	0.214	955 322
	6-channel extension for SMG-DM 131	SMG-DM 141	0.180	955 344
Data module	Interbus fiber optic IN	SMG-DM 42 FO	0,170	955 620/0-FO-I
Data module	Interbus fiber optic OUT	SMG-DM 42 FO	0,170	955 620/0-FO-O
Data module	Interbus electrical IN	SMG-DM 42 CU	0,170	955 620/0-CU-I
Data module	Interbus electrical OUT	SMG-DM 42 CU	0,170	955 620/0-CU-O
Data module	Ethernet fiber optic	SMG-DM 20	0.180	955 401
SMG Interface module				
Interface module	TTY/20 mA	SMG-SM 1	0.020	957 111
	RS 232 C	SMG-SM 2	0.020	957 121
	RS 422 Point-to-Point	SMG-SM 3	0.030	957 131
	RS 485	SMG-SM 4	0.030	957 141
	Allen Bradley DH+/RIO	SMG-SM 6	0.035	957 161
	Allen Bradley DH 485-Bus	SMG-SM 41	0.030	957 142
	Allen Bradley DH plus	SMG-SM 6 AB 3	0,035	957 163
	GE Genius Databus	SMG-SM 13	0.030	957 231
	Audio	SMG-SM 7	0.060	957 171
	Ethernet for DM 20 (FL)	SMG-SM 20	0.060	957 301
	Ethernet for DM 20 (ITP)	SMG-SM 21	0.060	957 311
	Power supply 12 V DC	SMG-SM 10	0.020	957 112
SMG Antenna switch				
Antenna switch	for crossover	SMG-AUS 12	0.460	958 512
	for bypass	SMG-AUS 2	0.460	958 117

5 TECHNICAL DESCRIPTION FOR ORDERING

Description		Type	Weight kg/pc.	Order.-No.
Antenna trolley mobile antennas				
Antenna trolley for standard antenna with 0.6 m connecting cable				
without transfer		SMGT-SAE-LW-2-02	1,200	955 935-02
with transfer		SMGT-SAE-LW-2-01	1,000	955 935-01
for curves		SMGT-SAE-LW-1	0,800	955 977
Antenna trolley for directional antenna with 0.6 m connecting cable				
without transfer		SMGT-RAE-LW-2-02	1,600	955 936-02
with transfer		SMGT-RAE-LW-2-01	1,400	955 936-01
Antenna trolley for janus antenna with 0.6 m connecting cable				
without transfer		SMGT-JAE-LW-2-02	1,700	955 937-02
with transfer		SMGT-JAE-LW-2-01	1,500	955 937-01
Antenna unit mobile antennas				
Standard antenna 0,6 m cable,	model 01	SMG-SAE-XY-3	1,630	958 161
	model 02	SMG-SAE-XY-3	1,635	958 161-2
Directional antenna 0,6 m cable,	model 01	SMG-RAE-XY-3	2,000	958 162
	model 02	SMG-RAE-XY-3	2,005	958 162-2
Janus antenna, 0,6 m cable,	model 01	SMG-JAE-XY-3	2,180	958 163
	model 02	SMG-JAE-XY-3	2,185	958 163-2
Antenna (for spare only)				
Standard antenna, 0,6 m cable		SMG-SA	0,160	958 111
Directional antenna, 0,6 m cable		SMG-RA	0,530	958 112
Janus antenna, 0,6 m cable		SMG-JA	0,710	958 113
HF-Cable and Accessories				
HF-cabel with N-connector,	1 m	SMG-HF-1	0,225	958 311
	2 m	SMG-HF-2	0,450	958 312
	3 m	SMG-HF-3	0,675	958 313
	4 m	SMG-HF-4	0,900	958 314
	5 m	SMG-HF-5	1,125	958 315
HF-N-connector, straight, with cable clamp		SMG-HF-N-VBB	0,034	958 394
HF-N-connector, right angle		SMG-HF-N-WV	0,080	958 390
HF-Rotary coupler		SMG-HF-DK	1,000	958 395
HF-Connectors and Accessories				
SMGT-HF-connector untread, 1 m long		SMGT-SAN 1 B	3,100	955 938-01B
as above, but traversable design A		SMGT-SAN 2 B	3,200	955 939-01B
as above, but traversable design B			3,200	955 939-04B
SMGT-HF-connector anodized, 1 m long		SMGT-SAN 1 E	3,100	955 938-02E
as above, but traversable design A		SMGT-SAN 2 E	3,200	955 939-02E
as above, but traversable design B			3,200	955 939-05E
SMGT-HF-connector special coated, 1 m		SMGT-SAN 1 SB	3,200	955 938-03SB
as above, but traversable design A		SMGT-SAN 2 SB	3,300	955 939-03SB
as above, but traversable design B			3,300	955 939-06SB
SMGT-enter skids as installation kit		SMGT-EK	0,100	955 944
HF-Termination				
SMGT-HF-Termination (installation kit)		SMG-EAB	0,150	952 400

Description		Type	Weight kg/pc.	Order-No.
SMG Waveguide untreated				
SMG Waveguide	1 m	SMGT/B-1	3,000	955 940-1000
	2 m	SMGT/B-2	6,000	955 940-2000
	3 m	SMGT/B-3	9,000	955 940-3000
	4 m	SMGT/B-4	12,000	955 940-4000
	5 m	SMGT/B-5	15,000	955 940-5000
	6 m	SMGT/B-6	18,000	955 940-6000
SMG Waveguide anodized				
SMG Waveguide	1 m	SMGT/E-1	3,000	955 941-1000
	2 m	SMGT/E-2	6,000	955 941-2000
	3 m	SMGT/E-3	9,000	955 941-3000
	4 m	SMGT/E-4	12,000	955 941-4000
	5 m	SMGT/E-5	15,000	955 941-5000
	6 m	SMGT/E-6	18,000	955 941-6000
SMG Waveguide epoxy coated				
SMG Waveguide	1 m	SMGT/SB-1	3,100	955 945-1000
	2 m	SMGT/SB-2	6,200	955 945-2000
	3 m	SMGT/SB-3	9,300	955 945-3000
	4 m	SMGT/SB-4	12,400	955 945-4000
	5 m	SMGT/SB-5	15,500	955 945-5000
	6 m	SMGT/SB-6	18,600	955 945-6000
SMG Joint Splice Clamp				
SMGT Joint Splice Clamp galvanized		SMGT-PV	0,800	955 943
SMG Support Bracket				
pair of support brackets		SMG-HBP 4	0.250	952 541

5 TECHNICAL DESCRIPTION FOR ORDERING

Description		Type	Weight kg/pc.	Order-No.
SMG Support Bracket				
pair of support brackets	2/0 galvanized	SMG-HBP 2/0	0.400	952 521
	special-coated	SMG-HBP 2/0 SB	0.400	952 522
	2/12 galvanized	SMG-HBP 2/12	0.400	952 523
	special-coated	SMG-HBP 2/12 SB	0.400	952 524
	2/18 galvanized	SMG-HBP 2/18	0.400	952 525
	special-coated	SMG-HBP 2/18 SB	0.400	952 526
SMG Support Arm				
support arm	1/220 galvanized	SMG-HT 1/220	0.500	952 551
	special-coated	SMG-HT 1/220 SB	0.550	952 552
	1/420 galvanized	SMG-HT 1/420	0.850	952 651
	special-coated	SMG-HT 1/420 SB	0.950	952 652
	2/220 galvanized	SMG-HT 2/220	0.500	952 553
	special-coated	SMG-HT 2/220 SB	0.550	952 554
SMG Anchor Bracket				
SMG anchor bracket, installation kit	untreated	SMG-FL/B	0.200	952 410
	anodized	SMG-FL/E	0.200	952 430
	special-coated	SMG-FL/SB	0.200	952 450

Antenna guiding SMG-RAE-XY-6 in use at a large crane application.

CETECOM ICT Services GmbH

CERTIFICATE OF CONFORMITY

Registration-No.: **E811185M-CC** Number of annexes: ---

Certificate Holder: **Paul Vahle GmbH & Co. KG**
Westicker Straße 52

D-59174 Kamen

Product Designation: **SMG-SES 202/203; SMG-SEM 202/203**

Product Description: **Short Range Device**

Product Manufacturer: **Paul Vahle GmbH & Co. KG**
Westicker Straße 52

D-59174 Kamen

Specifications and test reports:

Specification	Test report no. & date	Name of test laboratory	Notes
Draft EN 300 440, April 1999	2-1148b/00 dated 31.05.2000	CETECOM GmbH	conform
ETS 300 683, June 1997	2-1148a/00 dated 31.05.2000	CETECOM GmbH	conform

Statement **This equipment fulfils the requirements or parts thereof in the above mentionend specifications.**

By decree Vfg 28/2000, issued in the Official Journal 6/2000 of the Regulierungsbehörde für Telekommunikation und Post, CETECOM ICT Services is authorized to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of 09. March 1999

Saarbrücken, 11.07.00
Place, Date of Issue

Signed by Ernst Hussinger
Notified Body

CETECOM ICT Services GmbH

EC Identification number 0682

authorized by the German Government

with decree Vfg 28/2000 , issued in the Official Journal 6/2000 of the Regulierungsbehörde für Telekommunikation und Post, to act as Notified Body in accordance with the R&TTE Directive 1999/5/EC of 09. March 1999.

CERTIFICATE
EXPERT OPINION

Registration-No.: **E811185M-EO**

Certificate Holder: **Paul Vahle GmbH & Co. KG**
Westicker Straße 52

D-59174 Kamen

Product Designation: **SMG-SES 202/203; SMG-SEM 202/203**

Product Description: **Short Range Device**

Product Manufacturer: **Paul Vahle GmbH & Co. KG**
Westicker Straße 52

D-59174 Kamen

Essential requirements	Specifications / Standards	Submitted documents
Safety (R&TTE, Article 3.1a)	-	Not assessed
Health (R&TTE, Article 3.1a)	-	Not assessed
EMC (R&TTE, Article 3.1b)	ETS 300 683, June 1997	Test Report
Radio spectrum (R&TTE, Article 3.2)	Draft EN 300 440, April 1999	Test Report

Marking: **The product shall be signed with CE, our notified body number and the Class II identifier (Alert sign) as shown right hand.**

CE 0682 ⚠

The certificate is only valid in conjunction with the following number of annexes:

Number of annexes: 1

Saarbrücken, 11.07.00
Place, Date of Issue

Signed by Ernst Hussinger
Notified Body

FCC ID: KKVSMG – 202 – 203

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference; and (2) This device must accept any interference received, including interference that may cause undesired operation.

SES/SEM 202/3 SMG DATA TRANSMISSION

FCC Certificate for use in North America

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

Prüfschein **Test certificate**

Nr. D09-96.29

PTB Certificate for measurement signal transmission

Negativ-Bescheinigung NB- 96 / 00165

Beweismittel im Sinne des § 10 Abs. 1 Satz 2 der Außenwirtschaftsverordnung (AWV)

1. Aufgrund Ihres Antrages und des zur Spezifikation eingereichten technischen Datenmaterials wird Ihnen **zwecks Vorlage bei der Zollstelle** bescheinigt, daß folgende Waren:

Stat. Waren-Nr.	Genaue Warenbeschreibung	Hersteller	Typ
86080030	SMG-Datenübertragungssys. Serie 202, gemäß Anlage	VAHLE	
86080030	SMG-Datenübertragungssys. Serie 203, gemäß Anlage	VAHLE	

Federal Office Export Control Certificat


19
12

Catalog No. 6b/E 2010

Products and Service

MANAGEMENTSYSTEM

certified by DQS according to Din EN ISO 9001:2008 OHSAS 18001:2007 (Reg. Nr. 003140 QM 08/BSOH)

VAHLE COMMUNICATION SYSTEMS

PAUL VAHLE GMBH & CO. KG • Westicker Str. 52 • D 59174 KAMEN/GERMANY • TEL. (+49) 23 07/70 40
Internet: www.vahle.de • E-Mail: info@vahle.de • FAX (+49) 23 07/70 44 44

0410 • Printed in Germany • 1105485/00E • DS • 1000 • 4/10

Catalog No. 6b/E 2010

Products and Service

Catalog No.

MANAGEMENTSYSTEM

certified by DQS according to Din EN
ISO 9001:2008 OHSAS 18001:2007
(Reg. Nr. 003140 QM 08/BSOH)

0410 • Printed in Germany • 1105485/00E • DS • 200 • 4/10

POWERAIL LTD.
WORKING FOR THE FUTURE WITH

VAHLE COMMUNICATION SYSTEMS

Powerail Ltd. High Road, Finchley, London, N12 8PT,
Phone 020 8446 0350/1246 • Fax 020 8446 7054
E-mail: enquiries@powerailltd.com