

Class. No.: 8MD00
Descriptors: EMC, short-distance interference suppression, long-distance interference suppression, radio interference suppression, interference emission

Interference Emission Requirements

Preface

Additional tests necessary for evaluation and release are defined and required in the drawing, part-specific Technical Supply Specification (TL), performance specifications or other documents.

Previous issues

TL 965: 1976-01, 1979-04, 1983-04, 1987-04, 1994-03, 1999-11, 2003-06, 2004-10, 2006-11, 2009-04

Changes

The following changes have been made as compared to TL 965: 2009-04:

- Editorially revised
- Table 4: Line 24 added
- Table 6, 8-11: Values corrected

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Check standard for current issue prior to usage.
This electronically generated standard is authentic and valid without signature.
The English translation is believed to be accurate. In case of discrepancies the German version shall govern.
Numerical notation acc. to ISO practice.

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1 Scope

This Technical Supply Standard details requirements and tests concerned with electromagnetic compatibility (EMC) with the aim to limit transient emissions (radio interference suppression) of electric and electronic automotive components. The measuring methods and limit values specified in this TL standard are designed to ensure an interference-free reception of the high-frequency receivers operated in the vehicle.

The measuring methods and limit values described in this TL standard apply to all electric and electronic automotive components. Depending on the radio application in the vehicle, tests must be carried out in the specific frequency bands for radio and TV broadcasting, mobile phone and mobile radio between 0,1 MHz and 2,69 GHz.

A release is issued if component **and** vehicle tests yielded positive results.

The measuring methods, conditions and setups comply to a large extent with the international standard CISPR 25, Edition 3: 2008 "Radio Disturbance Characteristics for the Protection of Receivers Used on Board Vehicles, Boats, and on Internal Combustion Engine Driven Devices – Limits and Methods of Measurement" and were taken from this document with the relevant changes, or the document is referred to. However, the specifications contained in this TL standard take precedence over the specifications in the above mentioned CISPR 25, Edition 3: 2008.

2 Terms and definitions

2.1 Short-term interference sources – permanent interference sources

Interferences that are not explicitly defined as short-term interference sources by the responsible engineering department are considered as permanent interference sources and must be suppressed. Frequency ranges affected by this regulation must be specified in the component performance specifications by the EMC engineering departments.

2.2 Definitions

AV	Average value detector according to CISPR 16-1-1 "Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods – Part 1-1: Radio Disturbance and Immunity Measuring Apparatus – Measuring Apparatus"
	Use of the linear average value detector without consideration of the time constant of the display apparatus is also permissible.
BW	Intermediate frequency (IF) measurement bandwidth of the measuring receiver
PK	Peak value detector according to CISPR 16-1-1
QP	Quasi-peak value detector according to CISPR 16-1-1
AMPS	Advanced Mobile Phone System
BOS	Public safety organizations in Germany
Trunked radio	Terrestrial Trunked Radio (TETRA) ranges
CDMA	Code Division Multiple Access
GPS	Global Positioning System
GSM	Global System for Mobile Communications
IMT-2000	International Mobile Telecommunications – 2000 (3rd generation mobile radio)
ISM	Industrial, Scientific and Medical Band
PDC	Personal Digital Communication
SDARS	Satellite Digital Audio Radio Service
TETRA	Terrestrial Trunked Radio
UMTS	Universal Mobile Telecommunications System
WCDMA	Wideband Code Division Multiple Access

3 General requirements – HF emissions from vehicle and component measurements

General requirements according to CISPR 25, Edition 3: 2008, in addition and/or deviating:

3.1 Description of the operating states

The responsible EMC engineering department of Volkswagen/Audi will decide on the definition of individual operating states within the framework of the EMC project meeting to be held according to the EMC Section of the performance specifications.

Besides the normal operating state of a component (e.g., engine operation, ignition ON in the vehicle), further component-specific operating states must be defined, in which the device under test (DUT) exhibits maximum interference emissions. The different operating states must be presented by the supplier prior to the first component test; their influences on the interference emission must be analyzed in consultation with the responsible engineering departments of Volkswagen/Audi.

On principle, component tests acc. to Section 5 must be conducted by the supplier.

In order for component tests to be verified by a Volkswagen/Audi EMC engineering department, the supplier must provide appropriate test equipment allowing, at least, for the simulation of the operating states mentioned above as well as for the monitoring of these states during testing. The selected operating states and test setups must be documented in the test report in detail.

3.2 Test documentation

For the EMC relevance to be assessed, the following mandatory documents must be presented upon commencement of development:

- System designation
- System description including representation of system functions
- Circuit diagram, component location drawing and bill of materials
- Operating states with sequence description (e.g. switch-on/-off procedure, static/dynamic states)
- Description of sub-circuitry (sub-systems, sensors, actuators)
- System variants and codings
- Interfaces to other vehicle components
- System-inherent fault handling and diagnostic function
- Documentation of the EMC measures (e.g. filter and protective circuitry for inputs/outputs as well as screening measures for supply lines)

Prior to delivery of the samples to be tested, the following documents must be presented in addition:

- Exact schedule of the planned EMC component tests and the planned test location (laboratory)
- Deviations from TL specifications as agreed upon between engineering departments of Volkswagen/Audi and supplier
- Meaningful, complete EMC qualification report for the respective sample version
- Hardware/software version including description/record of the EMC measures

3.3 Frequency ranges

The frequency ranges are specified in Table 1

Table 1

HF emissions	from [MHz]	to [MHz]
Vehicle measurement (vehicle test)	0,1	2690
Measurement at the artificial network (AN test)	0,1	108
Capacitance-voltage measurement (CV test)	0,1	30
Measurement with clamp-on current probe (CP test, optional)	30	108
Measurement with antennas (absorber-lined shielded enclosure (ALSE) test)	0,1	2690
Measurement with TEM cell (TEM test, optional)	0,1	241
Measurement with stripline (SL test, optional)	0,1	1000

3.4 Standard test conditions

The maximum frequency increments and minimum measuring times are specified in Table 2.

If necessary, the measuring time must be extended sufficiently to capture the interference characteristics of the DUT.

Table 2

BW [kHz]	PK		QP		AV	
	Max. increment	Min. measuring time [ms]	Max. increment	Min. measuring time [ms]	Max. increment	Min. measuring time [ms]
9/10	$\leq 0,5 \times BW$	50	$\leq 5 \times BW$	1000	$\leq 0,5 \times BW$	50
120	$\leq 0,5 \times BW$	50 (VHF only) 5	$\leq 5 \times BW$	1000	$\leq 0,5 \times BW$	50 (VHF only) 5
1000	$\leq 0,5 \times BW$	50	-	-	$\leq 0,5 \times BW$	50

Fast emission measuring methods using the fast Fourier transform (FFT) may be used to shorten measuring times. It must be demonstrated that the implemented detectors and measuring bandwidths comply with the requirements of CISPR 16-1-1. An increased displayed value for pulse repetition rates below 20 Hz is permissible when verifying the detector value of pulse signals with differing pulse repetition rate (e.g. Section 4.4.2 of CISPR 16-1-1 for the QP detector).

3.5 Temperatures

Operating temperature range	acc. to drawing, Performance Specifications or Technical Supply Specification
Test temperature range	(23 ± 5) °C; operating temperature in special cases

3.6 Run-in time

Run-in time is 15 min for electrical DUTs with carbon brushes at specified load (acc. to drawing or Performance Specifications) and test voltage.

4 HF emissions – vehicle measurement (vehicle test)

The HF emission measurements in the vehicle are carried out according to CISPR 25, Edition 3: 2008.

In the case of deviations, the specifications in this TL apply.

4.1 Measuring setup

There must be at least 1 m distance between the vehicle edges or components (e.g. antenna) and the absorber tips. Further dimensional specifications see [Figure 1](#).

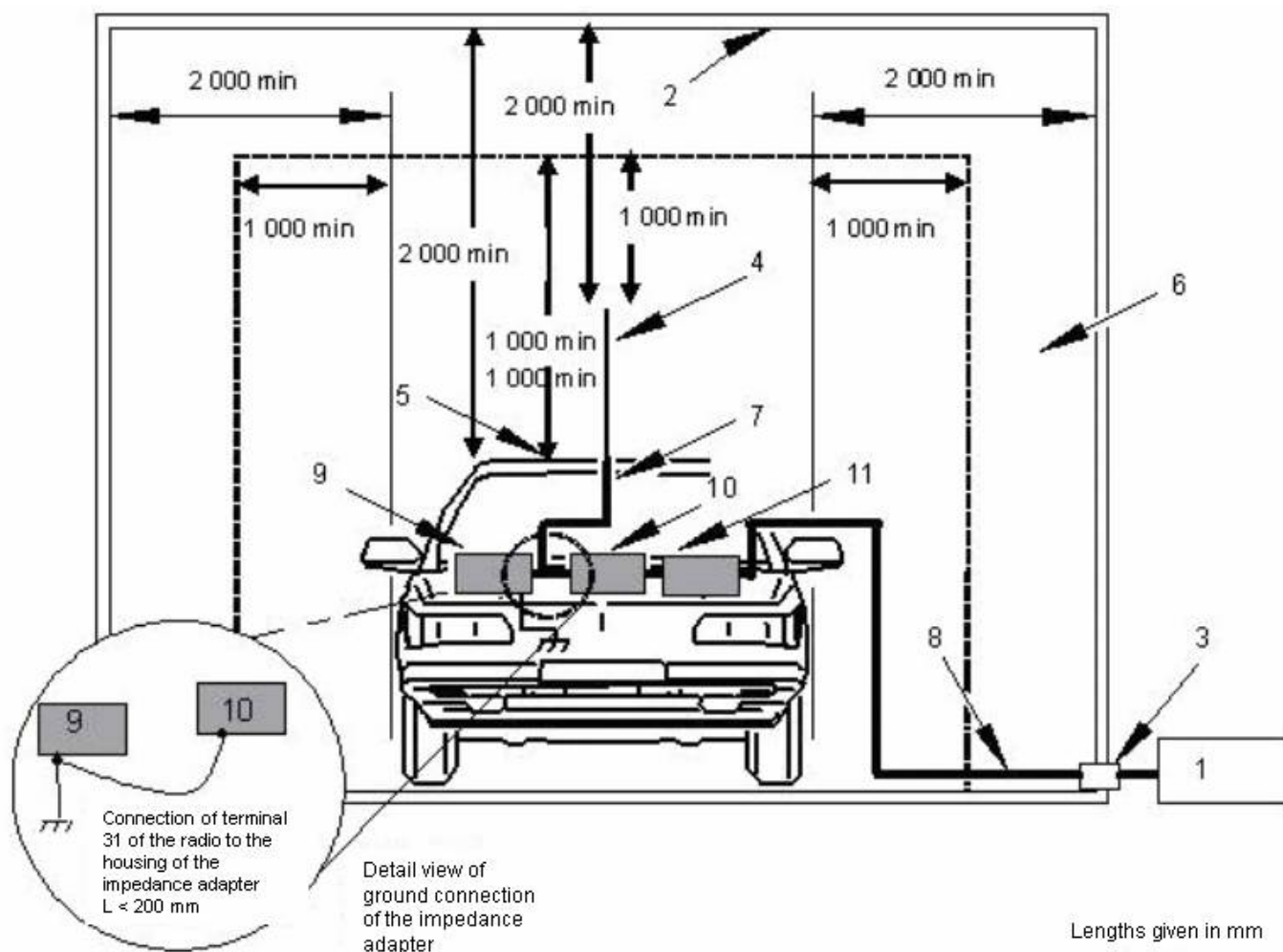


Figure 1 – Measurement setup: vehicle measuring – short-distance interference suppression

Legend

- 1 Measuring instrument¹⁾
- 2 Anechoic chamber
- 3 Lead-through connection
- 4 Antenna (see Section 4.2)
- 5 DUT
- 6 Typical absorber material
- 7 Coaxial antenna cable
- 8 High-quality double-shielded coaxial cable (50 Ω)
- 9 Car radio housing
- 10 Impedance adapter (e.g., R&S EZ12)²⁾
- Antenna adapter³⁾
- 11 Ground-insulation network for AM broadcast band (if required)

1) for LW and MW measurements, measuring receiver must be positioned inside the anechoic chamber

2) for LW, MW, SW measurements

3) for phantom powered vehicle antennas, such as VHF, DAB, TV, GPS measurements

4.2 Antennas and related components

For vehicle measurements, the antennas and mounting locations intended for application in standard production must be used. For LW and MW measurements, the measuring receiver is connected to the impedance adapter; for VHF, DAB, TV and GPS measurements, the measuring receiver is connected to the antenna adapter (dummy) at the installation location of the respective receiver. The ground connection of the adapter is carried out acc. to Figure 1, low-impedance with a maximum length of 200 mm.

4.3 Measurement receiver settings and limits for vehicle measurements

Table 3

Test no.:	Service or band	Frequency	PK		QP		AV	
			Limit	BW	Limit	BW	Limit	BW
		MHz	dB (μV)	kHz	dB (μV)	kHz	dB (μV)	kHz
Broadcast services								
1	125 kHz	0,1 ... 0,15	23	9	-	-	-	-
2	LW	0,15 ... 0,28	26	9	13	9	6	9
3	MW	0,52 ... 1,73	20	9	7	9	0	9
4	SW 75 m	3,85 ... 4,0	20	9	7	9	0	9
5	SW 49 m	5,8 ... 6,3	20	9	7	9	0	9
6	SW 41 m	7,1 ... 7,6	20	9	7	9	0	9
7	SW 31 m	9,3 ... 10,0	20	9	7	9	0	9
8	SW 25 m	11,5 ... 12,1	20	9	7	9	0	9
9	SW 22 m	13,5 ... 13,9	20	9	7	9	0	9
10	SW 19 m	15,0 ... 15,8	20	9	7	9	0	9
11	SW 16 m	17,4 ... 17,9	20	9	7	9	0	9
12	SW 15 m	18,9 ... 19,1	20	9	7	9	0	9
13	SW 13 m	21,4 ... 21,9	20	9	7	9	0	9
14	SW 11 m	25,6 ... 26,1	20	9	7	9	0	9
15	VHF	76 ... 108	20 ^{a)}	120	7	120	0	120
16	DAB	174 ... 241	26	1 000	-	-	16	1 000
17	DAB (L band)	1452 ... 1492	26	1 000	-	-	16	1 000
18	SDARS	2320 ... 2345	26	1 000	-	-	16	1 000
19	TV I	47 ... 88	30	1 000	-	-	20	1 000
20	TV II	90 ... 108	26	1 000	-	-	16	1 000
21	TV III	170 ... 230	26	1 000	-	-	16	1 000
22	TV IV/V	470 ... 862	26	1 000	-	-	16	1 000

Test no.:	Service or band	Frequency	PK		QP		AV	
			Limit	BW	Limit	BW	Limit	BW
		MHz	dB (μV)	kHz	dB (μV)	kHz	dB (μV)	kHz
Broadcast services								
23	GPS	1574 ... 1577	-	-	-	-	0	120
If the frequency range of the antenna noise exceeds the specified limit value, the following limit value applies: Antenna noise +3 dB; the method for determining antenna noise is described in CIS-PR 25, Edition 3: 2008 (Appendix D).								

- a) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak detector limit in the VHF band may be increased by 6 dB. The quasi-peak and average limits must be complied with unchanged.

Table 4

Test no.:	Service or band	Frequency	PK		QP		AV	
			Limit	BW	Limit	BW	Limit	BW
		MHz	dB (μV)	kHz	dB (μV)	kHz	dB (μV)	kHz
Mobile services								
24	CB radio	26,5 ... 29,7	30	9	-	-	10	9
25	4 m/BOS	84,015 ... 87,255	33	120	-	-	0	9
26	2 m/taxi	147 ... 164	33	120	-	-	0	9
27	2 m/BOS	167,56 ... 169,38	33	120	-	-	0	9
28	2 m/BOS	172,16 ... 173,98	33	120	-	-	0	9
29	ISM	313 ... 317	15	9	-	-	-5	9
30	Trunked ra- dio	390 ... 400	20	120	-	-	0	120
31	Trunked ra- dio	420 ... 430	20	120	-	-	0	120
32	ISM	433 ... 435	15	9	-	-	-5	9
33	Trunked ra- dio	460 ... 470	20	120	-	-	0	120
34	D-AMPS	851 ... 894	26	120	-	-	6	120
35	ISM	868 ... 876	15	9	-	-	-5	9
36	GSM-900	925 ... 960	26	120	-	-	6	120
37	GSM-1800	1805 ... 1880	26	120	-	-	6	120
38	UMTS	1900 ... 1920	36	1 000	-	-	16	1 000
39	GSM-1900	1930 ... 1990	26	120	-	-	6	120
40	UMTS	2010 ... 2025	30	1 000	-	-	10	1 000
41	UMTS, WCDMA	2110 ... 2170	36	1 000	-	-	16	1 000

Test no.:	Service or band	Frequency	PK		QP		AV	
			Limit	BW	Limit	BW	Limit	BW
		MHz	dB (μV)	kHz	dB (μV)	kHz	dB (μV)	kHz
Mobile services								
42	Bluetooth, WLAN	2402 ... 2497	36	1 000	-	-	16	1 000
43	IMT-2000	2500 ... 2570	36	1 000	-	-	16	1 000
44	IMT-2000	2620 ... 2690	36	1 000	-	-	16	1 000
If the frequency range of the antenna noise exceeds the specified limit value, the following limit value applies: Antenna noise +3 dB; the method for determining antenna noise is described in CIS-PR 25, Edition 3: 2008 (Appendix D).								

5 HF emissions – component measurement

The conditions, explanations and specifications for test setups and for measurement of HF emissions on components largely correspond to those of CISPR 25, Edition 3: 2008.

On principle, the entire frequency range must be measured in all component measurement methods. Only by doing so it is possible to determine whether interferences, which may lead to intermodulations within the radio bands, occur outside the specified radio bands.

For developments within the Group, the component measuring methods to be used must be agreed upon with the EMC engineering department in the test plan in such a way that the entire frequency range from 0,1 MHz to 2 690 MHz is covered.

If no specifications were made, the specifications from [Table 5](#) apply.

If a component is developed also for use by another car manufacturer (BMW, Daimler, Porsche), e.g. for the Industrial Assembly, the component measurement methods from [Table 5](#) must be used also.

Table 5 – Use of measurement methods for developments for cross-OEM application

Component measurement method	Cross-OEM (Audi, BMW, Daimler, Porsche, Volkswagen)
Measurement at the artificial network (AN test)	mandatory
Capacitance-voltage measurement (CV test)	mandatory
Measurements with clamp-on current probe (CP test)	optional
Measurements with antennas (ALSE test)	mandatory
Measurements with TEM cell (TEM test)	optional
Measurements with stripline (SL test)	optional

If no limits are specified in the drawing or the Component Performance Specifications, the values in "bold type" of limit class 5 of the individual limit tables apply.

The limit class 5 has been specified as standard requirements for developments of components for the so-called Industrial Assembly within the framework of OEM standards harmonization of the five

German car manufacturers Audi, BMW, Daimler, Porsche and Volkswagen. For Group-internal developments, deviations can be made from limit class 5.

5.1 HF emissions – measurement at the artificial network (AN test)

The HF emissions on supply lines must be measured according to CISPR 25, Edition 3: 2008, Section 6.2.

5.1.1 Test setup

The test setups are described in CISPR 25, Edition 3: 2008, Section 6.2.2.

5.1.2 Test conditions

The standard test conditions must be applied according to CISPR 25, Edition 3: 2008.

If the DUT has several power supplies, each power supply must be measured individually.

5.1.3 Requirements

Table 6 – Measurement receiver settings and limits (AN test)

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
			dB (µV)				dB (µV)				dB (µV)			
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
Base limits														
B1		0,28 ... 0,52	100 - 59,51 × (lg(f / 0,28) ^a)			120	-			-	80 - 59,51 × (lg(f / 0,28) ^a)			120
B2		0,52 ... 108	84			120	-			-	64			120
Broadcast services														
1	125 kHz	0,1 ... 0,15	93	83	73	9	-	-	-	-	-	-	-	-
2	LW ^{b)}	0,15 ... 0,28	90	80	70	9	77	67	57	9	70	60	50	9
3	MW ^{b)}	0,52 ... 1,73	70	62	54	9	57	49	41	9	50	42	34	9
4	SW 75 m	3,85 ... 4,0	65	59	53	9	52	46	40	9	45	39	33	9
5	SW 49 m	5,8 ... 6,3	65	59	53	9	52	46	40	9	45	39	33	9
6	SW 41 m	7,1 ... 7,6	65	59	53	9	52	46	40	9	45	39	33	9
7	SW 31 m	9,3 ... 10,0	65	59	53	9	52	46	40	9	45	39	33	9
8	SW 25 m	11,5 ... 12,1	65	59	53	9	52	46	40	9	45	39	33	9
9	SW 22 m	13,5 ... 13,9	65	59	53	9	52	46	40	9	45	39	33	9
10	SW 19 m	15,0 ... 15,8	65	59	53	9	52	46	40	9	45	39	33	9
11	SW 16 m	17,4 ... 17,9	65	59	53	9	52	46	40	9	45	39	33	9

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
			dB (µV)				dB (µV)				dB (µV)			
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
12	SW 15 m	18,9 ... 19,1	65	59	53	9	52	46	40	9	45	39	33	9
13	SW 13 m	21,4 ... 21,9	65	59	53	9	52	46	40	9	45	39	33	9
14	SW 11 m	25,6 ... 26,1	65	59	53	9	52	46	40	9	45	39	33	9
15	VHF	76 ... 108	44	38	32	120	31	25	19	120	24	18	12	120
19	TV I	47 ... 88	60	54	48	1 000	-	-	-	-	45	39	33	1 000
20	TV II	90 ... 108	55	49	43	1 000	-	-	-	-	40	34	28	1 000
Mobile services														
24	CB radio	26,5 ... 29,7	75	69	63	9	-	-	-	-	55	49	43	9
25	4 m/BOS	84,015 ... 87,255	53	47	41	120	-	-	-	-	20	14	8	9
In the LW, MW, SW and VHF frequency ranges, the limit values for average, peak and quasi-peak must be complied with.														
For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.														

a) In the formulae, the frequency f must be entered in MHz; "lg" denominates the logarithm to the base 10.

b) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak and quasi-peak detector limits in the LW band may be increased by 3 dB and in the MW band by 9 dB. The average limit must be complied with unchanged.

5.2 HF emissions – capacitance-voltage measurement (CV test)

On all lines except supply lines, the HF emissions must be measured with a capacitive coupling clamp according to ISO 7637-3 and an impedance adapter for LW, MW and SW ranges according to CIS-PR 25, Edition 3: 2008.

5.2.1 Test setup

The test setup is represented in Figure 2 and based on the test setup according to ISO 7637-3, but with the capacitive coupling clamp terminated with high impedance. An impedance adapter according to CISPR 25, Edition 3: 2008 must be used.

The measurements with the capacitive coupling clamp must be performed in a shielded chamber.

All dimensions in mm.

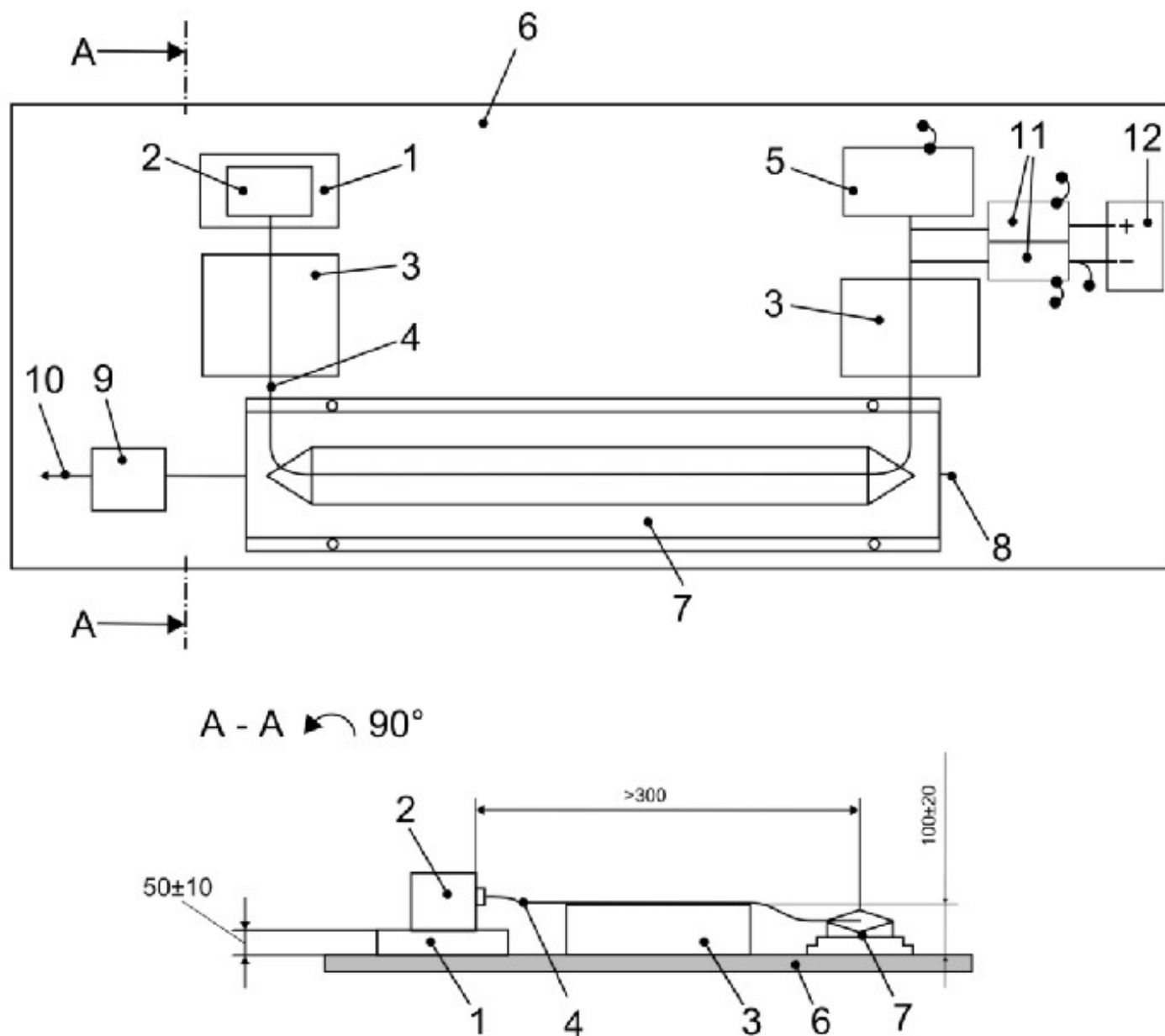


Figure 2 – Test setup (CV test)

Legend

- | | |
|----|-----------------------------------------------------|
| 1 | Insulating spacer for DUT |
| 2 | DUT |
| 3 | Insulating spacer for wiring harness |
| 4 | Wiring harness |
| 5 | Periphery and simulated load |
| 6 | Ground plate |
| 7 | Coupling clamp |
| 8 | Open connection for coupling clamp |
| 9 | Antenna impedance converter |
| 10 | Connection to measurement receiver (50 Ω) |
| 11 | Artificial networks |
| 12 | Power supply (usually battery or power supply unit) |

5.2.2 Test conditions

The component must be placed on a 50 mm high, insulating spacer.

The following line configurations must be measured:

- All lines except the supply lines of the DUT must be placed in the capacitive coupling clamp. If a DUT has several harnesses, they must be tested individually.
- All lines including the supply lines of the DUT must be placed in the capacitive coupling clamp. If a DUT has several harnesses, they must be tested individually.

The combinations to be tested must be specified in the test plan.

The interference voltage is measured at the capacitive coupling clamp via the antenna impedance converter. The antenna impedance converter is connected on the DUT side, the other end of the coupling clamp remains open (no 50 Ω termination).

For measurement correction, the line attenuation, pre-amplifiers, antenna impedance converters etc. must be taken into consideration. The effects of the coupling clamp are already included in the limits.

5.2.3 Requirements

Table 7 – Measurement receiver settings and limits (CV test)

Test no.:	Service or band	Frequency	PK				QP				AV			
			Limit		BW kHz	Limit		BW kHz	Limit		BW kHz			
		MHz		dB (µV)		dB (µV)			dB (µV)					
		Class		Class		Class			Class					
		3	4	5		3	4		5	3		4	5	
Base limits														
B2		0,28 ... 30	80		120	-		-		60		120		
Broadcast services														
1	125 kHz	0,1 ... 0,15	73	63	53	9	-	-	-	-	-	-	-	-
2	LW ^{a)}	0,15 ... 0,28	73	63	53	9	60	50	40	9	53	43	33	9
3	MW ^{a)}	0,52 ... 1,73	66	58	50	9	53	45	37	9	46	38	30	9
4	SW 75 m	3,85 ... 4,0	62	56	50	9	49	43	37	9	42	36	30	9
5	SW 49 m	5,8 ... 6,3	62	56	50	9	49	43	37	9	42	36	30	9
6	SW 41 m	7,1 ... 7,6	62	56	50	9	49	43	37	9	42	36	30	9
7	SW 31 m	9,3 ... 10,0	62	56	50	9	49	43	37	9	42	36	30	9
8	SW 25 m	11,5 ... 12,1	62	56	50	9	49	43	37	9	42	36	30	9
9	SW 22 m	13,5 ... 13,9	62	56	50	9	49	43	37	9	42	36	30	9
10	SW 19 m	15,0 ... 15,8	62	56	50	9	49	43	37	9	42	36	30	9
11	SW 16 m	17,4 ... 17,9	62	56	50	9	49	43	37	9	42	36	30	9
12	SW 15 m	18,9 ... 19,1	62	56	50	9	49	43	37	9	42	36	30	9
13	SW 13 m	21,4 ... 21,9	62	56	50	9	49	43	37	9	42	36	30	9
14	SW 11 m	25,6 ... 26,1	62	56	50	9	49	43	37	9	42	36	30	9
Mobile services														
24	CB radio	26,5 ... 29,7	72	66	60	9	-	-	-	-	52	46	40	9
In the LW, MW, SW and VHF frequency ranges, the limit values for average, peak and quasi-peak must be complied with.														
For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.														

a) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak and quasi-peak detector limits in the LW band may be increased by 3 dB and in the MW band by 9 dB. The average limit must be complied with unchanged.

5.3 HF emissions – measurements with antennas (ALSE test)

The radiated HF emissions must be measured with antennas according to CISPR 25, Edition 3: 2008, Section 6.4.2.1.

Measurements in anechoic chambers with and without floor damper are permissible.

5.3.1 Test setup

The test setup is described in CISPR 25, Edition 3: 2008, Section 6.4.2.

5.3.2 Test conditions

The standard test conditions must be applied according to CISPR 25, Edition 3: 2008, Section 6.4.3.

5.3.3 Requirements

The emissions must comply with all limits specified in Table 8 for the individual bands. The base limits comply with the requirements of EC Directive 72/245/EEC, Version 2006/96/EC.

Table 8 – Measurement receiver settings and limits (ALSE test)

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
			dB (µV)				dB (µV)				dB (µV)			
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
Base limits														
B4		30 ... 75	68 - 25,13 × (lg(f / 30) ^a)			1 000	-			-	58 - 25,13 × (lg(f / 30) ^a)			1 000
B5		75 ... 400	58 + 15,13 × (lg(f / 75) ^a)			1 000	-			-	48 - 15,13 × (lg(f / 75) ^a)			1 000
B6		400 ... 1 000	69			1 000	-			-	59			1 000
Broadcast services														
1	125 kHz	0,1 ... 0,15	61	51	41	9	-	-	-	-	-	-	-	-
2	LW ^{b)}	0,15 ... 0,28	61	51	41	9	48	38	28	9	41	31	21	9
3	MW ^{b)}	0,52 ... 1,73	54	46	38	9	41	33	25	9	32	24	18	9
4	SW 75 m	3,85 ... 4,0	50	44	38	9	37	31	25	9	30	24	18	9
5	SW 49 m	5,8 ... 6,3	50	44	38	9	37	31	25	9	30	24	18	9
6	SW 41 m	7,1 ... 7,6	50	44	38	9	37	31	25	9	30	24	18	9
7	SW 31 m	9,3 ... 10,0	50	44	38	9	37	31	25	9	30	24	18	9
8	SW 25 m	11,5 ... 12,1	50	44	38	9	37	31	25	9	30	24	18	9
9	SW 22 m	13,5 ... 13,9	50	44	38	9	37	31	25	9	30	24	18	9

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
			dB (µV)				dB (µV)				dB (µV)			
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
10	SW 19 m	15,0 ... 15,8	50	44	38	9	37	31	25	9	30	24	18	9
11	SW 16 m	17,4 ... 17,9	50	44	38	9	37	31	25	9	30	24	18	9
12	SW 15 m	18,9 ... 19,1	50	44	38	9	37	31	25	9	30	24	18	9
13	SW 13 m	21,4 ... 21,9	50	44	38	9	37	31	25	9	30	24	18	9
14	SW 11 m	25,6 ... 26,1	50	44	38	9	37	31	25	9	30	24	18	9
15	VHF	76 ... 108	44	38	32	120	31	25	19	120	24	18	12	120
16	DAB	174 ... 241	44	38	32	1 000	-	-	-	-	34	28	22	1 000
17	DAB (L band)	1452 ... 1492	57	51	45	1 000	-	-	-	-	47	41	35	1 000
18	SDARS	2320 ... 2345	68	62	56	1 000	-	-	-	-	58	52	46	1 000
19	TV I	47 ... 88	50	44	38	1 000	-	-	-	-	35	29	23	1 000
20	TV II	90 ... 108	49	43	37	1 000	-	-	-	-	34	28	22	1 000
21	TV III	170 ... 230	49	43	37	1 000	-	-	-	-	34	28	22	1 000
22	TV IV/V	470 ... 862	56	50	44	1 000	-	-	-	-	41	35	29	1 000
23	GPS	1574 ... 1577	-	-	-	-	-	-	-	-	37	31	25	120
Mobile services														
24	CB radio	26,5 ... 29,7	60	54	48	9	-	-	-	-	40	34	28	9
25	4 m/ BOS	84,015 ... 87,255	47	41	35	120	-	-	-	-	14	8	2	9
26	2 m/ taxi	147 ... 164	57	51	45	120	-	-	-	-	24	18	12	9
27	2 m/ BOS	167,56 ... 169,38	57	51	45	120	-	-	-	-	24	18	12	9
28	2 m/ BOS	172,16 ... 173,98	47	41	35	120	-	-	-	-	14	8	2	9
29	ISM	313 ... 317	46	40	34	9	-	-	-	-	26	20	14	9
30	Trunked radio	390 ... 400	51	45	39	120	-	-	-	-	31	25	19	120
31	Trunked radio system	420 ... 430	51	45	39	120	-	-	-	-	31	25	19	120
32	ISM	433 ... 435	46	40	34	9	-	-	-	-	26	20	14	9

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW	Limit			BW	Limit			BW
			dB (μV)			kHz	dB (μV)			kHz	dB (μV)			kHz
			Class				Class				Class			
3	4	5	3	4	5	3	4	5	3	4	5			
33	Trunked radio system	460 ... 470	51	45	39	120	-	-	-	-	31	25	19	120
34	PDC, D-AMPS	851 ... 894	63	57	51	120	-	-	-	-	43	37	31	120
35	ISM	868 ... 876	52	46	40	9	-	-	-	-	32	26	20	9
36	GSM-900	925 ... 960	63	57	51	120	-	-	-	-	43	37	31	120
37	GSM-1800	1805 ... 1880	63	57	51	120	-	-	-	-	43	37	31	120
38	UMTS	1900 ... 1920	67	61	55	1 000	-	-	-	-	47	41	35	1 000
39	GSM-1900	1930 ... 1990	63	57	51	120	-	-	-	-	43	37	31	120
40	UMTS	2010 ... 2025	67	61	55	1 000	-	-	-	-	47	41	35	1 000
41	UMTS, WCDMA	2110 ... 2170	67	61	55	1 000	-	-	-	-	47	41	35	1 000
42	Blue-tooth, WLAN	2402 ... 2497	78	72	66	1 000	-	-	-	-	58	52	46	1 000
43	IMT-2000	2500 ... 2570	78	72	66	1 000	-	-	-	-	58	52	46	1 000
44	IMT-2000	2620 ... 2690	78	72	66	1 000	-	-	-	-	58	52	46	1 000

In the LW, MW, SW and VHF frequency ranges, the limit values for average, peak and quasi-peak must be complied with.

For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.

a) In the formulae, the frequency f must be entered in MHz; "lg" denominates the logarithm to the base 10.

b) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak and quasi-peak detector limits in the LW band may be increased by 3 dB and in the MW band by 9 dB. The average limit must be complied with unchanged.

5.4 HF emissions – measurements with clamp-on current probe (CP test)

The HF currents must be measured on all lines except supply lines according to CISPR 25, Edition 3: 2008, Section 6.3.

5.4.1 Test setup

The test setup is described in CISPR 25, Edition 3: 2008, Section 6.3.

5.4.2 Test conditions

The standard test conditions must be applied according to CISPR 25, Edition 3: 2008, Section 6.3.2. All connecting lines except the supply lines must be placed in the clamp-on current probe.

5.4.3 Requirements

Table 9 – Measurement receiver settings and limits (CP test)

Test no.:	Service or band	Frequency	PK			QP			AV					
			Limit		BW	Limit		BW	Limit		BW			
		MHz	dB (μV)		kHz	dB (μV)		kHz	dB (μV)		kHz			
			Class			Class			Class					
			3	4		5	3		4	5		3	4	5
Base limits														
B7		30 ... 108	28		120	-		-	8		120			
Broadcast services														
15	VHF	76 ... 108	10	4	-2	120	-3	-9	-15	120	-10	-16	-22	120
19	TV I	47 ... 88	26	20	14	1 000	-	-	-	-	11	5	-1	1 000
20	TV II	90 ... 108	21	15	9	1 000	-	-	-	-	6	0	-6	1 000
Mobile services														
25	4 m/ BOS	84,015 ... 87,255	19	13	7	120	-	-	-	-	-14	-20	-26	9
For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.														

5.5 HF emissions – measurements with TEM cell (TEM test)

5.5.1 Test setup

The test setup is described in CISPR 25, Edition 3: 2008, Section 6.5.2.

5.5.2 Test conditions

The standard test conditions must be applied according to CISPR 25, Edition 3: 2008, Section 6.5.3.

5.5.3 Requirements

Table 10 – Measurement receiver settings and limits (TEM test)

Test no.:	Service or band	Frequency	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
		MHz			dB (µV)			dB (µV)						
		Class			Class			Class						
		3	4	5	3		4	5	3		4	5		
Base limits														
B8		0,28 ... 230	50			120	-			-	30			120
Broadcast services														
1	125 kHz	0,1 ... 0,15	43	33	23	9	-	-	-	-	-	-	-	-
2	LW ^{a)}	0,15 ... 0,28	43	33	23	9	30	20	10	9	23	13	3	9
3	MW ^{a)}	0,52 ... 1,73	36	28	20	9	21	15	7	9	16	8	0	9
4	SW 75 m	3,85 ... 4,0	32	26	20	9	19	13	7	9	12	6	0	9
5	SW 49 m	5,8 ... 6,3	32	26	20	9	19	13	7	9	12	6	0	9
6	SW 41 m	7,1 ... 7,6	32	26	20	9	19	13	7	9	12	6	0	9
7	SW 31 m	9,3 ... 10,0	32	26	20	9	19	13	7	9	12	6	0	9
8	SW 25 m	11,5 ... 12,1	32	26	20	9	19	13	7	9	12	6	0	9
9	SW 22 m	13,5 ... 13,9	32	26	20	9	19	13	7	9	12	6	0	9
10	SW 19 m	15,0 ... 15,8	32	26	20	9	19	13	7	9	12	6	0	9
11	SW 16 m	17,4 ... 17,9	32	26	20	9	19	13	7	9	12	6	0	9
12	SW 15 m	18,9 ... 19,1	32	26	20	9	19	13	7	9	12	6	0	9
13	SW 13 m	21,4 ... 21,9	32	26	20	9	19	13	7	9	12	6	0	9
14	SW 11 m	25,6 ... 26,1	32	26	20	9	19	13	7	9	12	6	0	9
15	VHF	76 ... 108	32	26	20	120	19	13	7	120	12	6	0	120
16	DAB	174 ... 241	32	26	20	1 000	-	-	-	-	22	16	10	1 000
19	TV I	47 ... 88	42	36	30	1 000	-	-	-	-	27	21	15	1 000
20	TV II	90 ... 108	37	31	25	1 000	-	-	-	-	22	16	10	1 000
21	TV III	170 ... 230	37	31	25	1 000	-	-	-	-	22	16	10	1 000
Mobile services														
24	CB radio	26,5 ... 29,7	42	36	30	9	-	-	-	-	22	16	10	9
25	4 m/BOS	84,015 ... 87,255	45	39	33	120	-	-	-	-	12	6	0	9
26	2 m/ taxi	147 ... 164	45	39	33	120	-	-	-	-	12	6	0	9
27	2 m/BOS	167,56 ... 169,38	45	39	33	120	-	-	-	-	12	6	0	9
28	2 m/BOS	172,16 ... 173,98	45	39	33	120	-	-	-	-	12	6	0	9

Test no.:	Service or band	Frequency MHz	PK			QP			AV		
			Limit			Limit			Limit		
			dB (μV)			dB (μV)			dB (μV)		
			Class			Class			Class		
			3	4	5	3	4	5	3	4	5

In the LW, MW, SW and VHF frequency ranges, the limit values for average, peak and quasi-peak must be complied with.

For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.

a) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak and quasi-peak detector limits in the LW band may be increased by 3 dB and in the MW band by 9 dB. The average limit must be complied with unchanged.

5.6 HF emissions – measurements with stripline (SL test)

The HF emissions must be measured with the stripline according to CISPR 25, Edition 3: 2008, Annex G.

5.6.1 Test setup

The test setup is described in CISPR 25, Edition 3: 2008, Section G.2.

5.6.2 Test conditions

The standard test conditions must be applied according to CISPR 25, Edition 3: 2008, Section G.3.

5.6.3 Requirements

Table 11 – Measurement receiver settings and limits (SL test)

Test no.:	Service or band	Frequency MHz	PK			QP			AV		
			Limit			Limit			Limit		
			dB (μV)			dB (μV)			dB (μV)		
			Class			Class			Class		
			3	4	5	3	4	5	3	4	5

Base limits

B9		0,28 ... 960	71		120	-		-	51		120
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Broadcast services

1	125 kHz	0,1 ... 0,15	64	54	44	9	-	-	-	-	-
2	LW ^{a)}	0,15 ... 0,28	64	54	44	9	51	41	31	9	44 34 24 9
3	MW ^{a)}	0,52 ... 1,73	57	49	41	9	44	26	28	9	37 29 21 9
4	SW 75 m	3,85 ... 4,0	53	47	41	9	40	34	28	9	33 27 21 9
5	SW 49 m	5,8 ... 6,3	53	47	41	9	40	34	28	9	33 27 21 9

Test no.:	Service or band	Frequency MHz	PK				QP				AV			
			Limit			BW kHz	Limit			BW kHz	Limit			BW kHz
			dB (µV)				dB (µV)				dB (µV)			
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
6	SW 41 m	7,1 ... 7,6	53	47	41	9	40	34	28	9	33	27	21	9
7	SW 31 m	9,3 ... 10,0	53	47	41	9	40	34	28	9	33	27	21	9
8	SW 25 m	11,5 ... 12,1	53	47	41	9	40	34	28	9	33	27	21	9
9	SW 22 m	13,5 ... 13,9	53	47	41	9	40	34	28	9	33	27	21	9
10	SW 19 m	15,0 ... 15,8	53	47	41	9	40	34	28	9	33	27	21	9
11	SW 16 m	17,4 ... 17,9	53	47	41	9	40	34	28	9	33	27	21	9
12	SW 15 m	18,9 ... 19,1	53	47	41	9	40	34	28	9	33	27	21	9
13	SW 13 m	21,4 ... 21,9	53	47	41	9	40	34	28	9	33	27	21	9
14	SW 11 m	25,6 ... 26,1	53	47	41	9	40	34	28	9	33	27	21	9
15	VHF	76 ... 108	38	32	26	120	25	19	13	120	18	12	6	120
16	DAB	174 ... 241	48	42	36	1 000	-	-	-	-	28	22	16	1 000
19	TV I	47 ... 88	48	42	36	1 000	-	-	-	-	33	27	21	1 000
20	TV II	90 ... 108	43	37	31	1 000	-	-	-	-	28	22	16	1 000
21	TV III	170 ... 230	43	37	31	1 000	-	-	-	-	28	22	16	1 000
22	TV IV/V	470 ... 862	43	37	31	1 000	-	-	-	-	28	22	16	1 000
Mobile services														
24	CB radio	26,5 ... 29,7	63	57	51	9	-	-	-	-	43	37	31	9
25	4 m/BOS	84,015 ... 87,255	51	45	39	120	-	-	-	-	18	12	6	9
26	2 m/ taxi	147 ... 164	51	45	39	120	-	-	-	-	18	12	6	9
27	2 m/BOS	167,56 ... 169,38	51	45	39	120	-	-	-	-	18	12	6	9
28	2 m/BOS	172,16 ... 173,98	51	45	39	120	-	-	-	-	18	12	6	9
29	ISM	313 ... 317	27	21	15	9	-	-	-	-	7	1	-5	9
30	Trunked radio system	390 ... 400	38	32	26	120	-	-	-	-	18	12	6	120
31	Trunked radio system	420 ... 430	38	32	26	120	-	-	-	-	18	12	6	120
32	ISM	433 ... 435	27	21	15	9	-	-	-	-	7	1	-5	9
33	Trunked radio system	460 ... 470	38	32	26	120	-	-	-	-	18	12	6	120

Test no.:	Service or band	Frequency	PK				QP				AV			
			Limit			BW	Limit			BW	Limit			BW
		MHz	dB (µV)			kHz	dB (µV)			kHz	dB (µV)			kHz
			Class				Class				Class			
			3	4	5		3	4	5		3	4	5	
34	PDC, D-AMPS	851 ... 894	44	38	32	120	-	-	-	-	24	18	12	120
35	ISM	868 ... 876	33	27	21	9	-	-	-	-	13	7	1	9
36	GSM-900	925 ... 960	44	38	32	120	-	-	-	-	24	18	12	120
In the LW, MW, SW and VHF frequency ranges, the limit values for average, peak and quasi-peak must be complied with.														
For short-term interference (e.g. by actuator motors), limits may be increased by 10 dB – but only upon agreement with the EMC engineering departments.														

a) For interference caused by commutators, high-voltage ignition systems and pulsed fuel injection systems (diesel, Otto) the peak and quasi-peak detector limits in the LW band may be increased by 3 dB and in the MW band by 9 dB. The average limit must be complied with unchanged.

6 Referenced documents

The following documents cited in this standard are necessary for application.

In this Section terminological inconsistencies may occur as the original titles are used.

CISPR 12, Edition 6: 2007	Vehicles, Boats and Internal Combustion Engine Driven Devices – Radio Disturbance Characteristics – Limits and Methods of Measurement for the Protection of Off-board Receivers
CISPR 16-1-1	Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods – Part 1-1: Radio Disturbance and Immunity Measuring Apparatus – Measuring Apparatus
CISPR 25, Edition 3: 2008	Radio Disturbance Characteristics for the Protection of Receivers Used on Board Vehicles, Boats, and on Internal Combustion Engine Driven Devices – Limits and Methods of Measurement
ISO 7637-3	Road vehicles - Electrical disturbances from conduction and coupling - Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines

Appendix A (normative)

A.1 Measurements in the AM range

For vehicle measurements in the LW, MW and SW ranges up to a frequency of 30 MHz, an impedance adapter (dummy) with high input impedance must be used (e.g., R&S EZ12).

The output impedance of the impedance adapter must be 50 Ω . In order to avoid interferences coupled into the measuring receiver by external sources, the following boundary conditions must be taken into consideration:

- The impedance adapter must usually be powered internally using batteries and must be placed inside the vehicle so that it is insulated from the vehicle body.
- The ground connection (housing) of the impedance adapter must be connected to the radio connector (T.31) of the original vehicle harness, low-impedance, with a maximum cable length of 200 mm.

See also Figure 1 Section 4.1.

- In cases where the impedance adapter is to be powered by the power supply system, an input filter circuit corresponding to the radio must be connected into the dummy's power supply input.
- The measuring receiver must be completely decoupled from the chamber shield (if necessary, operated by battery or isolation transformer; shield of measuring cable and chamber shield must not be connected). The measuring line must not be longer than 3 000 mm and must be protected against eddies by ferrites.

A.2 Subjective evaluation of interference suppression

For a final subjective evaluation of the interference suppression in the free field or in the EMC chamber when feeding in a useful signal, the following requirements must be fulfilled.

A.2.1 Analog broadcast and TV ranges, radio services (LW, MW, SW, VHF, 2-m, 4-m bands):

For analog broadcast and TV ranges, the following applies:

The responsible Volkswagen/Audi EMC engineering department determines the minimum number of points to be achieved in the different broadcasting ranges.

For analog radio services, the following applies:

Useful signals without noise must be interference-free, noise suppression (set to lowest sensitivity) must not be deactivated.

Test procedure:

- Feeding-in of a LF-modulated HF signal via a broadcasting/radio antenna into the EMC chamber with frequencies and modulations according to Table A.1.
- Measuring of this HF signal with a measurement receiver and antenna adapter at the end of the antenna cable of the built-in vehicle antenna.
- For radio services, an applicable monopole antenna must be used.
- The measurements are performed with the average detector and an IF bandwidth of 120 kHz in the VHF range and 9/10 kHz in the LW, MW, SW, 2-m and 4-m ranges (see measurement setup in Figure A 1)

The HF generator level must be adjusted such that the following useful signals are present at the measuring receiver (or car radio):

Useful signal level default settings:

LW range	30 dB(μV)
MW range	15 dB(μV) (20 dB(μV))
VHF range	12 dB(μV) (20 dB(μV))
2-m/4-m band	6 dB(μV)

NOTE 1 Values in parentheses can be used as an alternative for low-requirement vehicles. This must be determined by the responsible Volkswagen/Audi EMC engineering department.

Table A.1 – Settings of HF transmission signals for analog broadcast and radio ranges

Frequency band	Frequency	Ext. modulation	Mod. rate/degree
LW	Depending on the interference spectrum measured, tests must be conducted in the frequency bands using different frequencies	Test CD	- / 80%
MW			- / 80%
SW			- / 80%
VHF			75 kHz / -
4m band			2,8 kHz / -
2m band			2,8 kHz / -

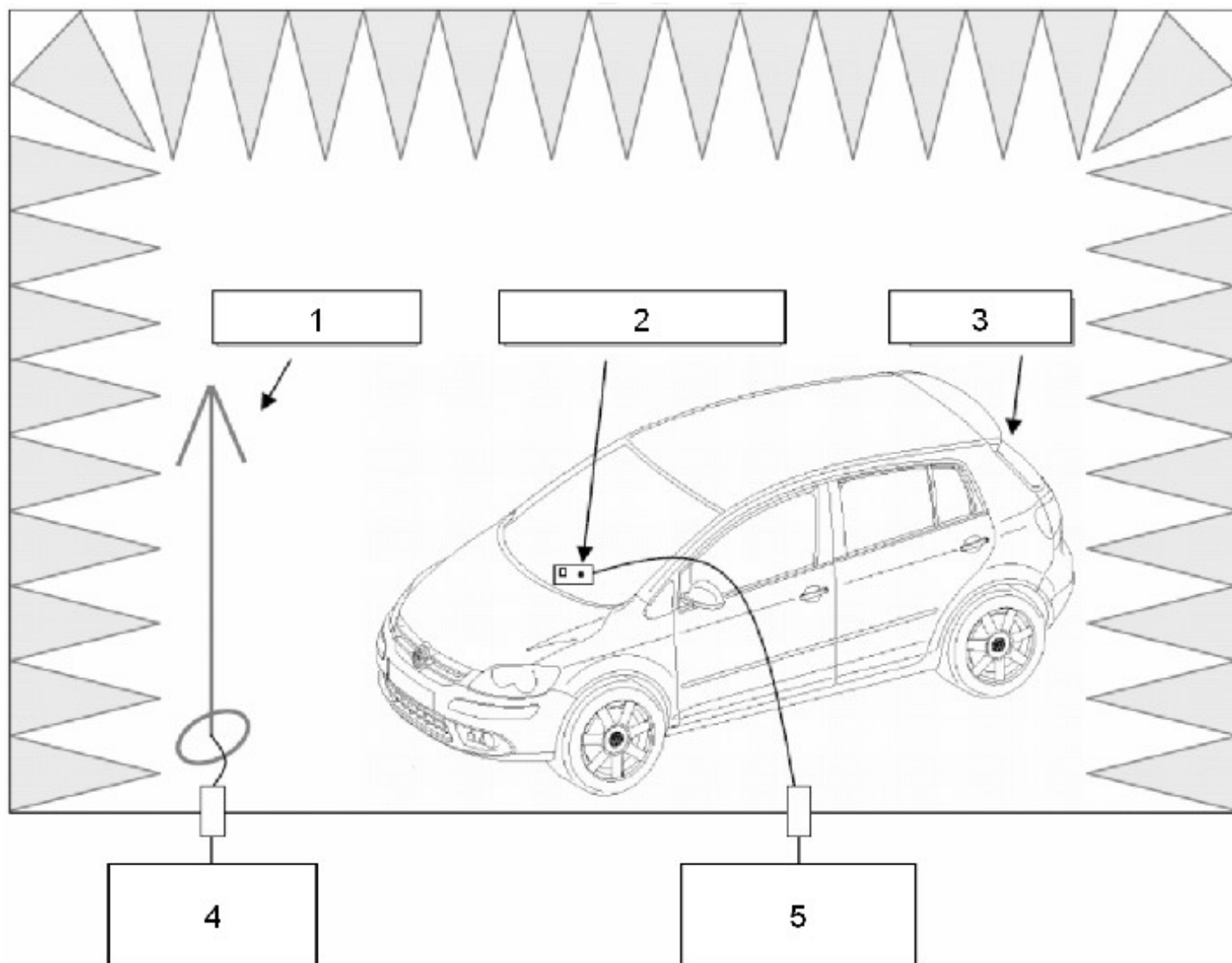


Figure A.1 – Measuring setup for measuring the useful signal level for subjective interference suppression evaluation of analog broadcast and radio services

Legend

- | | |
|---|-----------------------------------|
| 1 | Transmitting antenna |
| 2 | Radio dummy AM/FM |
| 3 | Vehicle antenna |
| 4 | Measuring transmitter + CD player |
| 5 | Measuring receiver |

Table A.2 – Evaluation table for subjective interference suppression evaluation of analog broadcast and radio services

Points	Reception	
1	No reception, no station available, noise	unacceptable
2	A station can be conjectured noise and interference predominant	unacceptable
3	A station is available information cannot be clearly recognized	unacceptable
4	Station audible information recognizable, but annoying	still unacceptable
5	Station clearly recognizable definite degree of interference, but not annoying	“I would listen if it were important”
6	Station has continuous slight interference	Usable
7	Strong signal, with temporary interfer- ence interference mostly concealed during driving operation	still good
8	Good signal interference during driving operation only audible if focused on	good
9	Signal without interference no interference audible during driving op- eration	very good
10	Signal absolutely free of interference can be used for stereo even with vehicle standing still, free of noise	excellent

A.2.2 Digital broadcast and TV ranges (DAB, DVB-T, ...)

Feed-in of an HF signal assigned to the digital service to be tested via a broadcast/radio antenna in the EMC chamber, with settings according to Table A.3.

Table A.3 – Settings for HF transmission signal, digital broadcast and TV

Frequency band	Transmission signal level	Data	Modulation	Parameter
DAB (band III Germany)	Sound stability threshold + 2 dB	MPEG stream (e.g., from R&S SFE Broadcast tester)	QPSK	
DAB (band L Germany)	Sound stability threshold + 2 dB		QPSK	
DVB-T (Europe) ^{a)}	Sound stability threshold + 2 dB		16 QAM	Carrier: 8k Code rate: 2/3 Guard interval: 1/4
ISDB-T (Japan)	Sound stability threshold + 2 dB		tbd	tbd
DMB-T (China)	Sound stability threshold + 2 dB		tbd	tbd

a) The settings most usual in Europe were selected.
 Optional worst-case setting 64 QAM, code rate 2/3, guard interval 1/4

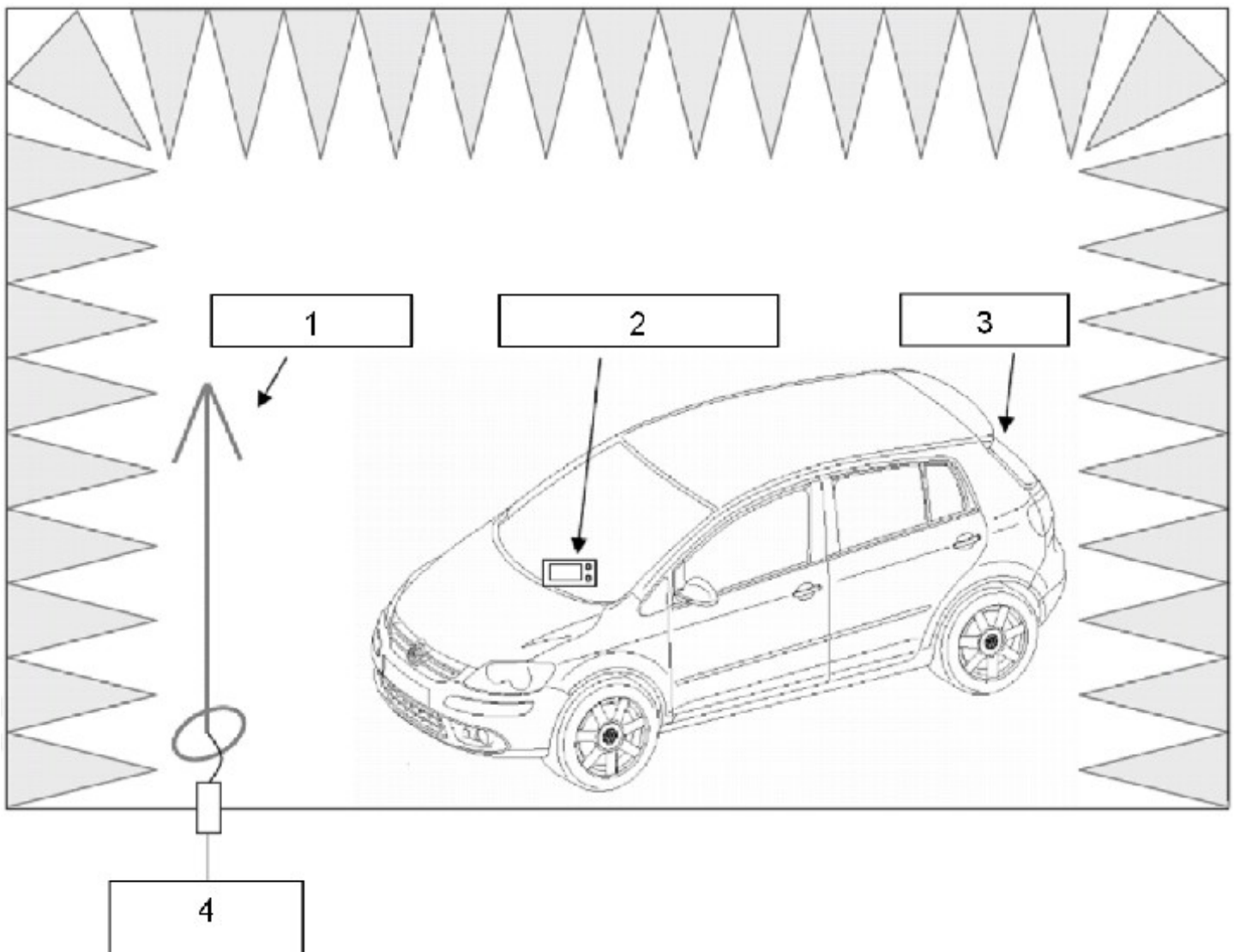


Figure A.2 – Test setup for subjective interference suppression evaluation of digital broadcast and TV services

Legend

- | | |
|---|--------------------------|
| 1 | Transmitting antenna |
| 2 | Digital receiver |
| 3 | Vehicle antenna |
| 4 | Digital signal generator |

Definitions:

1. Since in digital broadcast and TV services, a customer-relevant signal interference is first noticed in the sound, the following definition is made for subjective evaluation:

The **sound stability threshold** is the point at which, at a level reduction (HF transmission signal level) in 1 dB increments, the first interference with the sound signal is audible.

2. The **test signal transmission level**, which represents a weak station/transmitter, is **2 dB** above the sound stability limit --> **test signal transmission level = sound stability threshold level + 2 dB**.

Procedure for setting the transmission signal level and evaluation of the interference potential:

1. Deactivate interfering components. Increase signal level of measurement signal transmitter until interference-free reception is possible.
2. Reduce transmission signal level in 1 dB increments until first interference of sound signal is audible = **sound stability threshold**.
3. Increase transmission signal level by 2 dB = **test signal transmission level**.
4. Activate interfering components.
5. If now an audible interference with the sound signal is present, by slowly increasing or reducing the transmission signal level the transmission level must be determined at which an interference-free reception is just possible = **transmission signal level of the interfered-with station/transmitter**.
6. The difference between the **test signal transmission level** and the **transmission signal level of the interfered-with station/transmitter** is the value for the evaluation criterion.

Table A.4

Difference ^{a)}	Effect	Evaluation
0 dB	no customer-relevant interference	OK
1 – 2 dB	Reduction of reception range	Acceptable
≥ 3 dB	Reduction of reception range that is clearly perceivable for the customer	Not acceptable

a) Difference between transmission signal level of the interfered-with station/transmitter and the test signal transmission level

A.3 Long-distance interference suppression

Measurement of narrowband and broadband radio interferences outside the vehicle intended to protect long-distance reception.

Test procedure:

See CISPR 12, Edition 6: 2007 "Vehicles, Boats and Internal Combustion Engine Driven Devices – Radio Disturbance Characteristics – Limits and Methods of Measurement for the Protection of Off-board Receivers"

Limit values:

See CISPR 12, Edition 6: 2007