

EMC Performance Requirements – Component Tests

Foreword

This engineering standard defines the EMC performance requirements for electrical and electronic components and systems in vehicles. It describes the test methods and specifies the test levels and limits. The objective is to assure the electromagnetic compatibility (EMC) of vehicles.

This standard shall be used in combination with MBN 10284-1 and replaces DC-11224 and DC-11225.

Changes

In comparison with DC-11224 and DC-11225, the following changes have been made:

- Complete rewrite and usage of international standards as far as possible
- Update of emission requirements and new services added
- Usage of spectrum analyzers deleted
- FPSC adapted to recent international standards and grouping with respect to effects instead of functions
- Immunity test levels optimized
- Added new emission test method with capacitive coupling clamp as substitute for the current probe measurements up to 30 MHz
- The following test methods were deleted: TEM cell, DRFI, PCE, and ALSE without ground plane
- Annexes deleted that are not required

NOTE: No guarantee can be given in respect of this translation. In all cases the latest German-language version of this Standard shall be taken as authoritative.

Contents

1	Scope.....	2
2	Normative References.....	2
3	Abbreviations, Acronyms, Definitions, & Symbols	3
4	Regulated Substances and Recyclability	3
5	RF Emissions – Standard Test Conditions.....	4
6	RF Emissions – Artificial Network Measurements (AN-Test).....	4
7	RF Emissions - Capacitive Voltage Measurement (CV-Test)	5
8	RF Emissions – Current Probe Measurement (CP-Test).....	7
9	RF Emissions – Antenna Measurements (RE-Test)	8
10	Transient Emissions on Supply lines (CTE-Test).....	9
11	RF and Magnetic Field Immunity – Standard Test Conditions.....	10
12	RF Immunity – Bulk Current Injection (BCI-Test).....	10
13	RF Immunity – Antenna Irradiation (ALSE-Test).....	13
14	Magnetic Field Immunity (LFM-Test).....	14
15	Transients on Supply Lines (TSUP-Test).....	15
16	Transients on Lines except Supply lines (TOL-Test)	16
17	Electrostatic Discharge – Handling Test (ESDH-Test).....	17
18	Electrostatic Discharge – Direct Discharge (ESDD-Test)	17
19	Electrostatic Discharge – Indirect Discharge (ESDI-Test)	18
	Annex A (normative) Function Performance Status Classification (FPSC)	20
	Annex B (informative) Frequency Tables with Test Levels for Immunity Tests	21
	Annex C (informative) Examples for Applying this Generic Standard.....	28

1 Scope

This engineering standard defines the EMC performance requirements for electrical and electronic components and systems in vehicles. It describes the test methods and specifies the test levels and limits. The objective is to assure the electromagnetic compatibility (EMC) of vehicles.

This standard applies to all electrical and electronic components and systems installed in Daimler vehicles. It shall be used in combination with MBN 10284-1 that defines the EMC performance requirements for vehicle tests.

All deviations shall be explicitly agreed and documented in the Lastenheft (component product specification).

2 Normative References

MBN 10284-1: 2008-03	EMC performance requirements – Vehicle tests
CISPR 16-1-1: 2007-10	Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus (edition 2.2)
CISPR 25 ¹	Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices - Limits and methods of measurement (edition 3)
ISO 7637-1: 2002-03	Road vehicles — Electrical disturbances from conduction and coupling – Part 1: Definitions and general considerations
ISO 7637-1 AMD 1: 2008-01	Road Vehicles — Electrical disturbances from conduction and coupling – Part 1: Definitions and general considerations
ISO 7637-2: 2004-06	Road vehicles — Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only (corrected version 2004-09)

¹ At present Committee Draft (CDV).

ISO 7637-2 AMD 1: 2008-01	Road vehicles — Electrical disturbances from conduction and coupling - Part 2: Electrical transient conduction along supply lines only
ISO 7637-3: 2007-07	Road vehicles — Electrical disturbances from conduction and coupling - Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines
ISO 10605 ²	Road vehicles — Test methods for electrical disturbances from electrostatic discharge (edition 2)
ISO 11452-1: 2005-02	Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 1: General principles and terminology
ISO 11452-1 AMD 1: 2008-01	Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy – Part 1: General principles and terminology
ISO 11452-2: 2004-11	Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 2: Absorber-lined shielded enclosure
ISO 11452-4: 2005-04	Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 4: Bulk Current Injection (BCI)
ISO 11452-8: 2007-07	Road vehicles — Component test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 8: Immunity to magnetic fields

3 Abbreviations, Acronyms, Definitions, & Symbols

AV:	Average detector according to CISPR 16-1-1. The use of the linear average detector without taking into account the meter time constant is also accepted.
BW:	Measurement bandwidth of the measuring receiver.
FPSC:	Function Performance Status Classification (see Annex A).
PK:	Peak detector according to CISPR 16-1-1.
QP:	Quasi-peak detector according to CISPR 16-1-1.
AN:	Artificial Network.
L1:	Field strength (current or voltage respectively) up to which all functions shall stay in Status I (see Annex A).
L2:	Field strength (current or voltage respectively) up to which all functions shall stay at least in Status II (Status I is also allowed; see Annex A).

4 Regulated Substances and Recyclability

All materials, procedures, processes, components, or systems must conform to the current regulatory requirements regarding regulated substances and recyclability.

² At present Final Draft International Standard (FDIS).

5 RF Emissions – Standard Test Conditions

Action shall be taken to ensure that the DUT emits its maximum disturbance power (occurring during normal operation) during measurement.

Maximum frequency step sizes and minimum measurement times are given in Table 1.

Table 1: Maximum Frequency Step Sizes and Minimum Measurement Times

Detector	Maximum Frequency Step Size	Minimum Measurement Time [ms]
PK or AV	$\leq 0,5 \times \text{BW}$	50
QP	$\leq 5 \times \text{BW}$	1000

Fast emission measurement methods incorporating fast Fourier transform (FFT) may be used to reduce test time. It shall be demonstrated that the detectors and resolution bandwidths implemented fulfill the requirements of CISPR 16-1-1. For the verification of the detector response to pulses with different repetition rates (e.g. section 4.4.2 in CISPR 16-1-1 for QP detector), higher detector readings for repetition rates of the test pulses below 20 Hz are allowed.

6 RF Emissions – Artificial Network Measurements (AN-Test)

The RF emissions on supply lines shall be measured according to CISPR 25 section 6.2.

6.1 Test setup

The test setup is given in CISPR 25 section 6.2.

6.2 Test conditions

The standard test conditions of section 5 shall be taken into account.

In case of several power supplies of the DUT, a measurement is required at each power supply separately.

6.3 Requirements

Emissions shall meet both limits (PK and AV or QP and AV) for all measured services and bands. If nothing else is specified, all services and bands of Table 2 are required.

Table 2: Measuring Receiver Settings and Limit Values (AN-Test)

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]
Basic Limit								
AN	-	30 ... 110	70	1000	-	-	60	1000
Broadcast								
1	LW	0,15 ... 0,28	-	-	53	9	50	9
2	MW	0,52 ... 1,73	-	-	40	9	34	9
3	SW 75m	3,85 ... 4,0	-	-	39	9	33	9
4	SW 49m	5,8 ... 6,3	-	-	39	9	33	9
5	SW 41m	7,1 ... 7,6	-	-	39	9	33	9
6	SW 31m	9,3 ... 10,0	-	-	39	9	33	9
7	SW 25m	11,5 ... 12,1	-	-	39	9	33	9
8	SW 22m	13,5 ... 13,9	-	-	39	9	33	9
9	SW 19m	15,0 ... 15,8	-	-	39	9	33	9
10	SW 16m	17,4 ... 17,9	-	-	39	9	33	9

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]
11	SW 15m	18,9 ... 19,1	-	-	39	9	33	9
12	SW 13m	21,4 ... 21,9	-	-	39	9	33	9
13	SW 11m	25,6 ... 26,1	-	-	39	9	33	9
14	VHF	76 ... 108	-	-	30	120	24	120
19	TV I	47 ... 88	49	1000	-	-	34	1000
20	TV II	90 ... 108	49	1000	-	-	34	1000
Mobile Services								
24	CB Radio	26,5 ... 29,7	47 ¹⁾	9	34 ¹⁾	9	28	9
25	Ham Radio	50 ... 54	43	120	-	-	24	120
26	4m	65 ... 88	43 ¹⁾	120	30 ¹⁾	120	24	120
27	BOS	84,015 ... 87,255	-	-	-	-	14	9
¹⁾ For MB Van the QP limit applies, for all others the PK limit applies.								

For short time operating components (e.g. adjustment motors) the limit may be increased by 10 dB if approved by Daimler.

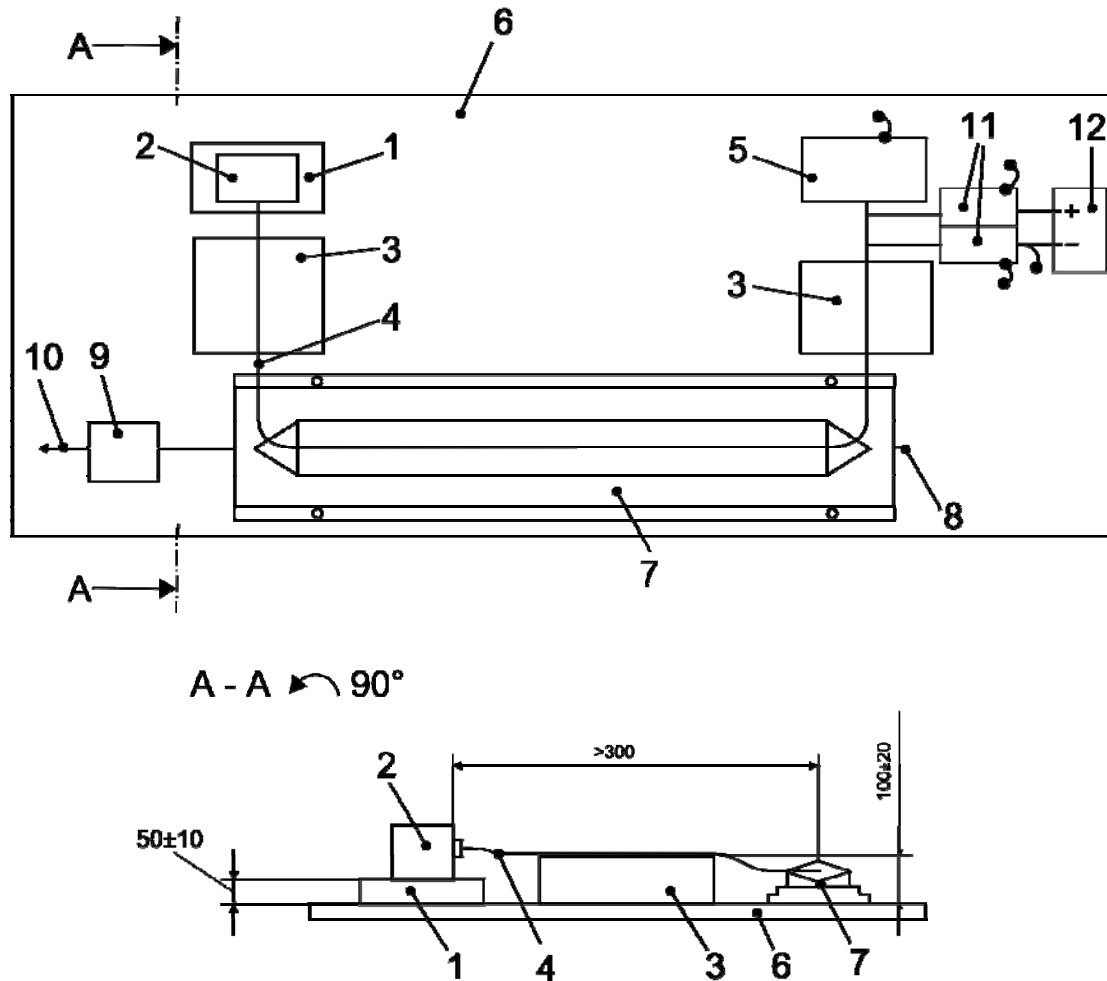
7 RF Emissions - Capacitive Voltage Measurement (CV-Test)

The RF emissions shall be measured on all lines except supply lines with the capacitive coupling clamp from ISO 7637-3 and the antenna impedance matching unit for AM from CISPR 25.

7.1 Test setup

The test setup is given in Figure 1.

The test setup is derived from the setup of ISO 7637-3 but termination of the capacitive coupling clamp shall be high impedant. For this an antenna impedance converter according to CISPR 25 shall be used.



- | | |
|--|---|
| 1. Insulating support for DUT | 7. Capacitive coupling clamp |
| 2. DUT | 8. Open termination of coupling clamp |
| 3. Insulating support for wiring harness | 9. Antenna impedance converter |
| 4. Wiring harness | 10. Connection to measurement receiver (50 Ω) |
| 5. Periphery and load simulator | 11. Artificial Networks |
| 6. Ground plane | 12. Power supply (usually battery) |

All dimensions in mm

Figure 1: Test setup (CV-Test)

7.2 Test conditions

The standard test conditions of section 5 shall be taken into account.

The DUT shall be placed on a 50 mm thick insulating support.

All lines except supply lines shall be placed in the capacitive coupling clamp.

The disturbance voltage shall be measured at the capacitive coupling clamp using an antenna impedance matching unit. The antenna impedance matching unit shall be connected on the side of the DUT, the other end of the coupling clamp shall be open (no 50 Ω termination).

For the correction of the measured values cable attenuations, pre-amplifier, antenna impedance matching unit etc. shall be taken into account. The effects of the coupling clamp are already contained in the limit values.

7.3 Requirements

Emissions shall meet both limits (PK and AV or QP and AV) for all measured services and bands. If nothing else is specified, all services and bands of Table 3 are required.

Table 3: Measuring Receiver Settings and Limit Values (CV-Test)

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]	Limit [dB(μV)]	BW [kHz]
Broadcast								
1	LW	0,15 ... 0,28	-	-	39	9	36	9
2	MW	0,52 ... 1,73	-	-	36	9	30	9
3	SW 75m	3,85 ... 4,0	-	-	36	9	30	9
4	SW 49m	5,8 ... 6,3	-	-	36	9	30	9
5	SW 41m	7,1 ... 7,6	-	-	36	9	30	9
6	SW 31m	9,3 ... 10,0	-	-	36	9	30	9
7	SW 25m	11,5 ... 12,1	-	-	36	9	30	9
8	SW 22m	13,5 ... 13,9	-	-	36	9	30	9
9	SW 19m	15,0 ... 15,8	-	-	36	9	30	9
10	SW 16m	17,4 ... 17,9	-	-	36	9	30	9
11	SW 15m	18,9 ... 19,1	-	-	36	9	30	9
12	SW 13m	21,4 ... 21,9	-	-	36	9	30	9
13	SW 11m	25,6 ... 26,1	-	-	36	9	30	9
Mobile Services								
24	CB Radio	26,5 ... 29,7	49 ¹⁾	9	36 ¹⁾	9	30	9
¹⁾ For MB Van the QP limit applies, for all others the PK limit applies.								

For short time operating components (e.g. adjustment motors) the limit may be increased by 10 dB if approved by Daimler.

8 RF Emissions – Current Probe Measurement (CP-Test)

The RF currents shall be measured on all lines except the supply lines according to CISPR 25 section 6.3.

8.1 Test setup

The test setup is given in CISPR 25 section 6.3.

8.2 Test conditions

The standard test conditions of section 5 shall be taken into account.

All lines except supply lines shall be placed in the current probe.

8.3 Requirements

Emissions shall meet both limits (PK and AV or QP and AV) for all measured services and bands. If nothing else is specified, all services and bands of Table 4 are required.

Table 4: Measuring Receiver Settings and Limit Values (CP-Test).

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μA)]	BW [kHz]	Limit [dB(μA)]	BW [kHz]	Limit [dB(μA)]	BW [kHz]
Basic Limit								
CP		30 ... 110	36	1000	-	-	26	1000
Broadcast								
14	VHF	76 ... 108	-	-	-4	120	-10	120
19	TV I	47 ... 88	15	1000	-	-	0	1000
20	TV II	90 ... 108	15	1000	-	-	0	1000
Mobile Services								
25	Ham Radio	50 ... 54	9	120	-	-	-10	120
26	4m	65 ... 88	9 ¹⁾	120	-4 ¹⁾	120	-10	120
27	BOS	84,015 ... 87,255	-	-	-	-	-20	9
¹⁾ For MB Van the QP limit applies. for all others the PK limit applies.								

¹⁾ For MB Van the QP limit applies, for all others the PK limit applies.

For short time operating components (e.g. adjustment motors) the limit may be increased by 10 dB if approved by Daimler.

9 RF Emissions – Antenna Measurements (RE-Test)

The radiated RF emissions shall be measured with antennas according to CISPR 25 section 6.4.

9.1 Test setup

The test setup is given in CISPR 25 section 6.4.

9.2 Test conditions

The standard test conditions of section 5 shall be taken into account.

For frequencies up to 1 GHz the antenna shall be placed in front of the mid of the harness in 1 m distance (as in CISPR 25). For frequencies above 1 GHz the antenna shall be placed in front of the DUT in 1 m distance (analogous to ISO 11452-2).

9.3 Requirements

Emissions shall meet both limits (PK and AV or QP and AV) for all measured services and bands. If nothing else is specified, all services and bands of Table 5 are required.

Table 5: Measuring Receiver Settings and Limit Values (RE-Test).

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μV/m)]	BW [kHz]	Limit [dB(μV/m)]	BW [kHz]	Limit [dB(μV/m)]	BW [kHz]
Basic Limits								
RE1		30 ... 75	$68 - 25,13 \lg(f/30)^{2)}$	1000	-	-	$58 - 25,13 \lg(f/30)^{2)}$	1000
RE2		75 ... 400	$58 + 15,13 \lg(f/75)^{2)}$	1000	-	-	$48 + 15,13 \lg(f/75)^{2)}$	1000
RE3		400 ... 1000	69	1000	-	-	59	1000
Broadcast								
1	LW	0,15 ... 0,28	-	-	27	9	24	9
2	MW	0,52 ... 1,73	-	-	24	9	18	9
3	SW 75m	3,85 ... 4,0	-	-	24	9	18	9
4	SW 49m	5,8 ... 6,3	-	-	24	9	18	9
5	SW 41m	7,1 ... 7,6	-	-	24	9	18	9
6	SW 31m	9,3 ... 10,0	-	-	24	9	18	9
7	SW 25m	11,5 ... 12,1	-	-	24	9	18	9
8	SW 22m	13,5 ... 13,9	-	-	24	9	18	9

Test No.	Service or Band	Frequency Range [MHz]	PK		QP		AV	
			Limit [dB(μV/m)]	BW [kHz]	Limit [dB(μV/m)]	BW [kHz]	Limit [dB(μV/m)]	BW [kHz]
9	SW 19m	15,0 ... 15,8	-	-	24	9	18	9
10	SW 16m	17,4 ... 17,9	-	-	24	9	18	9
11	SW 15m	18,9 ... 19,1	-	-	24	9	18	9
12	SW 13m	21,4 ... 21,9	-	-	24	9	18	9
13	SW 11m	25,6 ... 26,1	-	-	24	9	18	9
14	VHF	76 ... 108	-	-	18	120	12	120
15	WB	162,4 ... 162,55	-	-	18	120	12	120
16	DAB	174 ... 241	32	1000	-	-	22	1000
17	DAB	1452 ... 1492	45	1000	-	-	35	1000
18	SDARS	2320 ... 2345	56	1000	-	-	46	1000
19	TV I	47 ... 88	33	1000	-	-	18	1000
20	TV II	90 ... 108	37	1000	-	-	22	1000
21	TV III	170 ... 230	37	1000	-	-	22	1000
22	TV IV/V	470 ... 862	44	1000	-	-	29	1000
23	GPS	1574 ... 1577	-	-	-	-	25	120
Mobile Services								
24	CB Radio	26,5 ... 29,7	37 ¹⁾	9	24 ¹⁾	9	18	9
25	Ham Radio	50 ... 54	34	120	-	-	15	120
26	4m	65 ... 88	31 ¹⁾	120	18 ¹⁾	120	12	120
27	BOS	84,015 ... 87,255	-	-	-	-	2	9
28	2m	140 ... 180	31 ¹⁾	120	18 ¹⁾	120	12	120
29	Taxi	147 ... 164	-	-	-	-	2	9
30	BOS	167,56 ... 169,38	-	-	-	-	2	9
31	BOS	172,16 ... 173,98	-	-	-	-	2	9
32	Trunking	380 ... 430	38	120	-	-	19	120
33	ISM	313 ... 317	38	120	-	-	14	9
34	ISM	432 ... 436	38	120	-	-	14	9
35	PDC	860 ... 885	44	120	-	-	25	120
36	D-AMPS	851 ... 894	44	120	-	-	25	120
37	GSM-900	925 ... 960	44	120	-	-	25	120
38	Ham Radio	1260 ... 1300	44	120	-	-	25	120
39	PDC	1477 ... 1501	44	120	-	-	25	120
40	GSM-1800	1805 ... 1880	44	120	-	-	25	120
41	GSM-1900	1930 ... 1990	44	120	-	-	25	120
42	UMTS	1900 ... 1920	45	1000	-	-	35	1000
43	UMTS	2010 ... 2025	45	1000	-	-	35	1000
44	UMTS/WCDMA	2110 ... 2170	45	1000	-	-	35	1000
45	Bluetooth/WLAN	2402 ... 2497	56	1000	-	-	46	1000
¹⁾ For MB Van the QP limit applies, for all others the PK limit applies.								
²⁾ In the formulas, f is in MHz and lg denotes the logarithm to the base 10.								

For short time operating components (e.g. adjustment motors) the limit may be increased by 10 dB if approved by Daimler.

10 Transient Emissions on Supply lines (CTE-Test)

The transient emissions on supply lines shall be measured with the test setup for fast pulses according to ISO 7637-2.

10.1 Test setup

The test setup is given in ISO 7637-2 section 4.3 Figure 1b.

10.2 Test conditions

The transient emissions shall be measured due to the following switching events of the DUT:

- the turn ON,
- the turn OFF,
- and the switching of actuators.

10.3 Requirements

The measured transient voltages are limited to the values given in Table 6 depending of power supply voltage and pulse width (10% / 90% amplitude).

Table 6: Limits (CTE-Test)

Supply Voltage [V]	Pulse width [µs]	Limit [V]
12	< 100	+100 / -150
12	≥ 100	+80 / -80
24	All pulses	+80 / -150

11 RF and Magnetic Field Immunity – Standard Test Conditions

The operating condition of the DUT shall allow the test of all relevant functions of the DUT. If this cannot be done in one operation condition, tests have to be rerun with different operating conditions.

The minimum dwell time is two seconds (2 s). If it is known that the DUT reacts slower to disturbances, the dwell time shall be increased accordingly.

The maximum frequency steps are given in Table 7.

Table 7: Maximum Frequency Steps

Frequency Range [MHz]	Logarithmic Frequency Steps [%]
0 (DC)	Single step
0,000015 ... 0,03	10
1 ... 10	4
10 ... 100	2
100 ... 1000	1
1000 ... 3200	0,5

Annex C lists as example the resulting test frequencies for the maximum allowed steps.

DUT effects observed at the required test level shall be thresholded. Effects, frequency, disturbance threshold and functional performance status shall be documented in the test report.

12 RF Immunity – Bulk Current Injection (BCI-Test)

The RF immunity against induced RF currents into the harness shall be tested according to the substitution method of ISO 11452-4.

12.1 Test setup

The test setup is given in ISO 11452-4 in Figure 1.

Deviating from ISO 11452-4 the harness length should be 1700...2000 mm.

12.2 Test Conditions

The standard test conditions are given in section 11.

12.3 Requirements

The modulations and the test levels are defined in Table 8 and 9. Figures 2 and 3 show the test levels over frequency for passenger cars and vans, and for heavy trucks and buses.

Table 8: Modulations and Test Levels for Passenger Cars and Vans (BCI-Test)

Frequency Range [MHz]	Test Current [dB(μA)]	Modulation
1 ... 15	111-20 lg (15/f)	CW and AM (1 kHz, 80%)
15 ... 30	111	
30 ... 54	111-10 lg (f/30)	CW
54 ... 65	105-10 lg (f/30)	
65 ... 88	111-10 lg (f/30)	
88 ... 140	105-10 lg (f/30)	
140 ... 180	111-10 lg (f/30)	
180 ... 380	105-10 lg (f/30)	
380 ... 400	111-10 lg (f/30)	
In the formulas, f is in MHz and lg denotes the logarithm to the base 10.		

Table 9: Modulations and Test Levels for Heavy Trucks and Buses (BCI-Test)

Frequency Range [MHz]	Test Current [dB(μA)]	Modulation
1 ... 5	$114-20 \lg (5/f)$	CW and AM (1 kHz, 80%)
5 ... 15	114	
15 ... 30	$114-10 \lg (f/15)$	
30 ... 54	$114-10 \lg (f/15)$	CW
54 ... 65	$108-10 \lg (f/15)$	
65 ... 88	$114-10 \lg (f/15)$	
88 ... 140	$108-10 \lg (f/15)$	
140 ... 180	$114-10 \lg (f/15)$	
180 ... 380	$108-10 \lg (f/15)$	
380 ... 400	$114-10 \lg (f/15)$	
In the formulas, f is in MHz and lg denotes the logarithm to the base 10.		

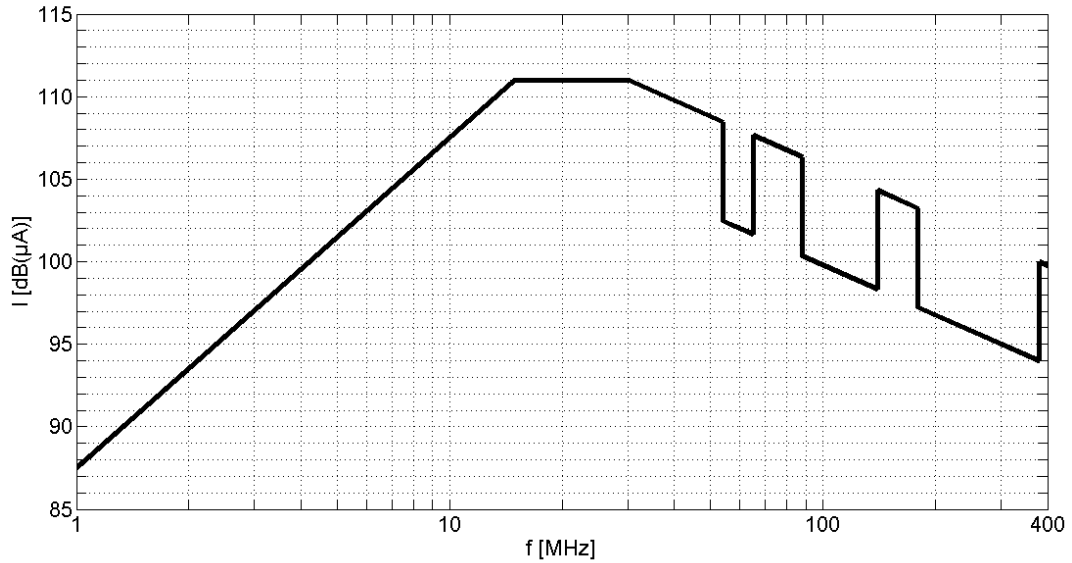


Figure 2: Test Levels over Frequency for Passenger Cars and Vans (BCI-Test)

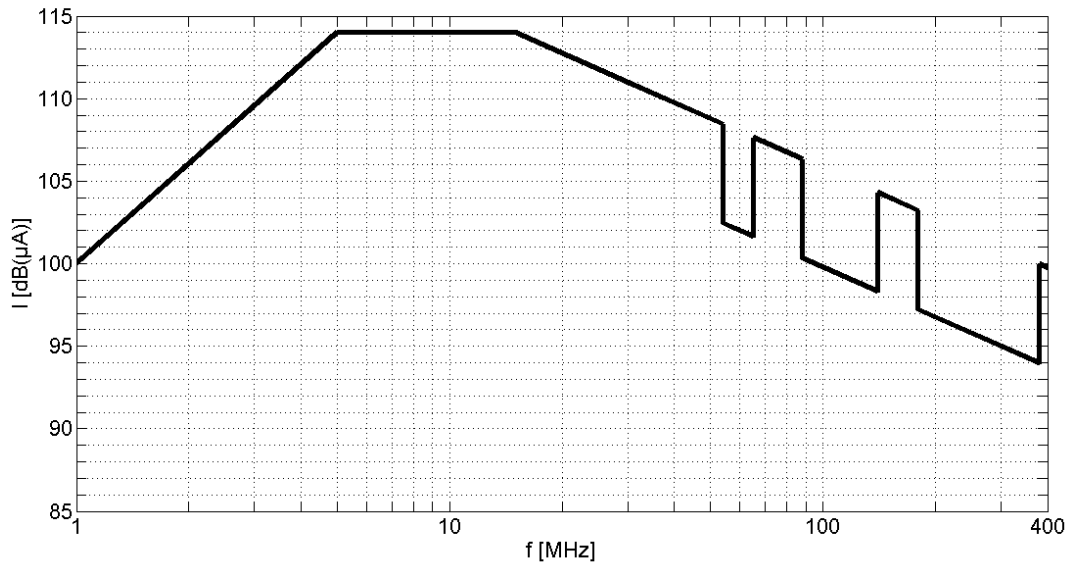


Figure 3: Test Levels over Frequency for Heavy Trucks and Busses (BCI-Test)

Tables 10 and 11 define the FPSC (see Annex A) for the evaluation of DUT effects.

Table 10: FPSC for Passenger Cars and Vans

Test Severity Level	Frequency Range [MHz]	Category 1 [dB(μA)]	Category 2 [dB(μA)]	Category 3 [dB(μA)]
L2	1 ... 15	111-20 lg (15/f)	111-20 lg (15/f)	not specified
	15 ... 30	111	111	
	30 ... 400	111-10 lg (f/30)	111-10 lg (f/30)	
L1	1 ... 15	101-20 lg (15/f)	107-20 lg (15/f)	111-20 lg (15/f)
	15 ... 30	101	107	111
	30 ... 400	101-10 lg (f/30)	107-10 lg (f/30)	111-10 lg (f/30)
In the formulas, f is in MHz and lg denotes the logarithm to the base 10.				

Table 11: FPSC for Heavy Trucks and Buses

Test Severity Level	Frequency Range [MHz]	Category 1 [dB(μA)]	Category 2 [dB(μA)]	Category 3 [dB(μA)]
L2	1 ... 5	114-20 lg (5/f)	114-20 lg (5/f)	not specified
	5 ... 15	114	114	
	15 ... 400	114-10 lg (f/15)	114-10 lg (f/15)	
L1	1 ... 5	104-20 lg (5/f)	110-20 lg (5/f)	114-20 lg (5/f)
	5 ... 15	104	110	114
	15 ... 400	104-10 lg (f/15)	110-10 lg (f/15)	114-10 lg (f/15)
In the formulas, f is in MHz and lg denotes the logarithm to the base 10.				

13 RF Immunity – Antenna Irradiation (ALSE-Test)

The RF immunity against RF fields shall be tested according to ISO 11452-2.

13.1 Test setup

The test setup is given in ISO 11452-2.

13.2 Test Conditions

The standard test conditions are given in section 11.

13.3 Requirements

The modulations and the test levels are defined in Table 12. Figure 4 shows the test levels over frequency.

Table 12: Modulations and Test Levels (ALSE-Test)

Frequency Range [MHz]	Test Level [V/m]	Modulations
200 ... 380	70	CW
380 ... 520	150	CW
520 ... 806	70	CW
806 ... 915	150	CW and pulse modulation (577 μs duration, 217 Hz repetition rate)
915 ... 1200	70	CW
1200 ... 1400	150	CW and pulse modulation (3 μs duration, 300 Hz repetition rate)
1400 ... 1710	70	CW
1710 ... 1980	150	CW and pulse modulation (577 μs duration, 217 Hz repetition rate)
1980 ... 2700	70	CW
2700 ... 3200	150	CW and pulse modulation (3 μs duration, 300 Hz repetition rate)

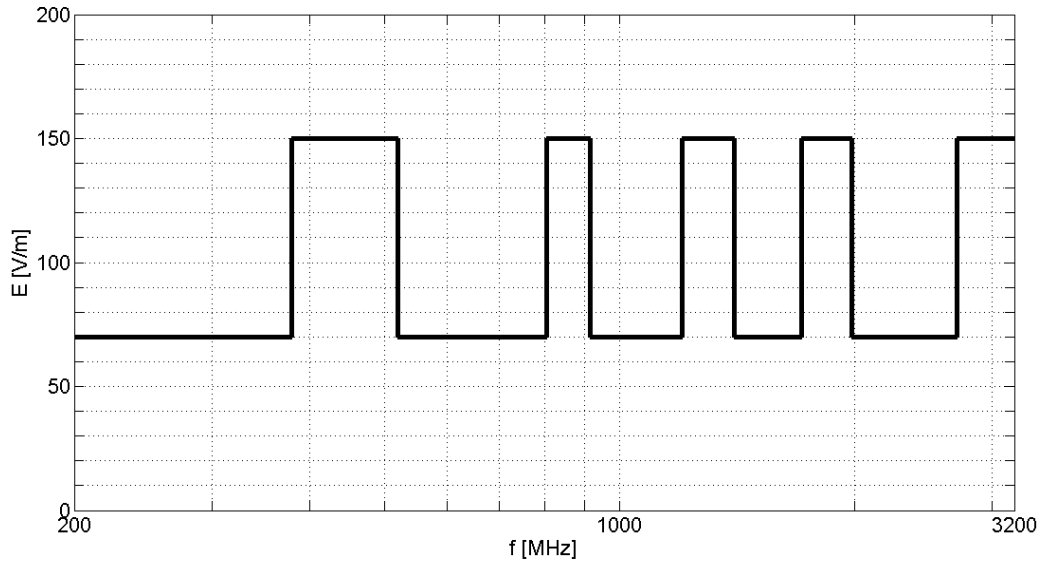


Figure 4: Test Levels over Frequency (ALSE-Test)

Table 13 defines the FPSC (see Annex A) for the evaluation of DUT effects.

Table 13: FPSC (ALSE-Test)

Test Severity Level	Category 1 [V/m]	Category 2 [V/m]	Category 3 [V/m]
L2	150	150	not specified
L1	50	100	150

14 Magnetic Field Immunity (LFM-Test)

The immunity against magnetic fields shall be tested according to ISO 11452-8 using the radiating loop method.

14.1 Test setup

The test setup is given in ISO 11452-8 section 6.4 figure 1.

14.2 Test conditions

The standard test conditions are given in section 11.

14.3 Requirements

The modulations and the test levels are defined in Table 14. Figure 5 shows the test levels over frequency.

Table 14: Modulations and Test Levels (LFM-Test)

Frequency Range [kHz]	Test Level [A/m]	Modulations
0 (DC)	1000 (3200 ¹⁾)	DC
0,015 ... 0,06	1000	CW
0,06 ... 6	60 / f	CW
6 ... 30	10	CW
f is the frequency in kHz. The DC point is not shown in Figure 7. ¹⁾ If required in the product specification (only for heavy trucks).		

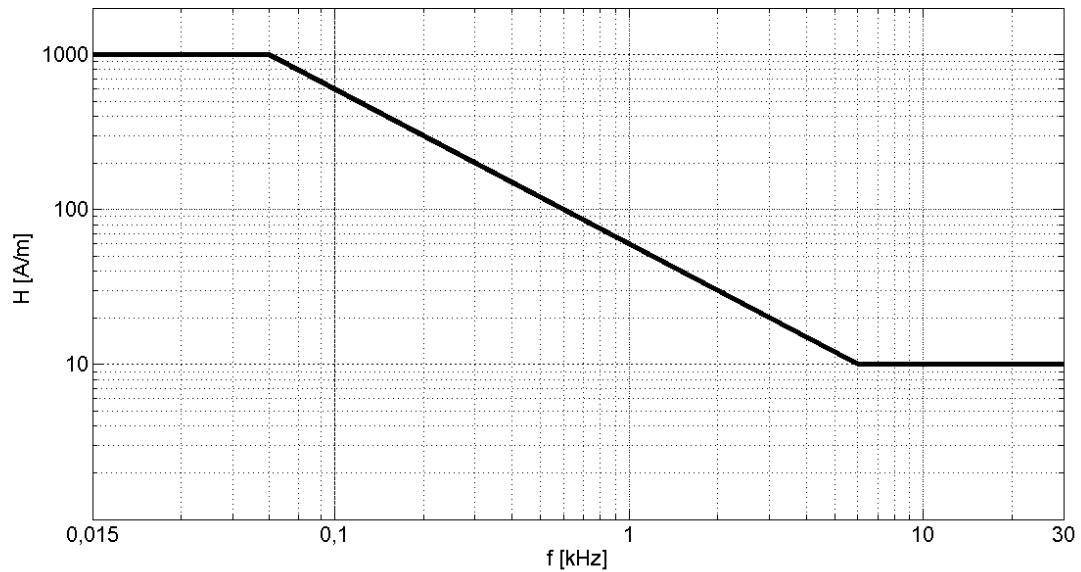


Figure 5: Test Levels over Frequency (LFM-Test)

There shall be no malfunctions or effects of the DUT, all functions of the DUT shall stay in Status I.

15 Transients on Supply Lines (TSUP-Test)

The immunity against transient pulses on supply lines shall be tested according to ISO 7637-2.

15.1 Test setup

The test setup is given in ISO 7637-2.

15.2 Test pulses

The test pulses 1, 2a, 3a and 3b are given in ISO 7637-2. Test pulse 1b is shown in Figure 6 and the parameters are listed in Table 15.

Figure 6: Test pulse 1b

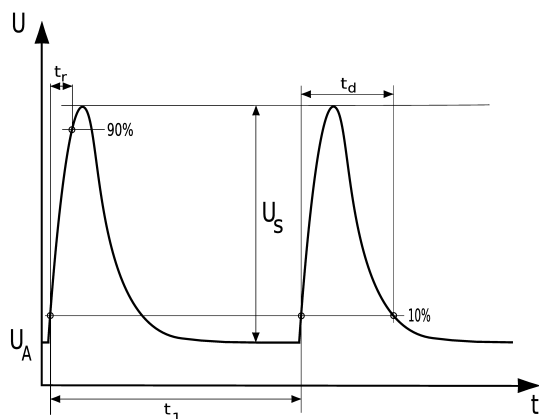


Table 15: Parameters of Test Pulse 1b

Parameters	12 V System	24 V System
U_A [V]	13,5	27
t_r [μ s]	1	3
t_d [ms]	2	1
t_1 [s]	5	5
R_i [Ω]	10	50

15.3 Test Conditions

Test Pulses 1, 1b, 2a, 3a and 3b shall be applied for 10 minutes each.

15.4 Requirements

The test levels are defined in Table 16.

Table 16: Test Levels (TSUP-Test)

Pulse No.	Test Level U _s [V]	
	12 V System	24 V System
1	-100	-600
1b	30	50
2a	75	75
3a	-150	-200
3b	100	200

The FPSC is given in Table 17.

Table 17: FPSC (TSUP-Test)

Pulse No.	Category 1	Category 2 and 3
1	Status II	Status II
1b	Status II	Status I
2a	Status II	Status I
3a	Status II	Status I
3b	Status II	Status I

Components containing several power supplies shall be tested separately for all power supplies. On the non-tested power supplies, the CTE-Test according to Section 10 has to be performed during the transient immunity tests and the given limits from Table 6 shall be met.

16 Transients on Lines except Supply lines (TOL-Test)

The immunity against transient pulses to lines except supply lines shall be tested using the capacitive coupling clamp according to ISO 7637-3 (CCC method).

16.1 Test setup

The test setup is given in ISO 7637-3 section 3.4.2 figure 1.

16.2 Test pulses

The test pulses a and b are given in ISO 7637-3.

16.3 Test Conditions

Test Pulses a and b shall be applied for 5 minutes each.

16.4 Requirements

The test levels are defined in Table 18.

Table 18: Test Levels (TOL-Test)

Pulse No.	Test Level U _s [V]	
	12 V System	24 V System
a	-75	-80
b	60	80

The FPSC is given in Table 19.

Table 19: FPSC (TOL-Test)

Pulse No.	Category 1	Category 2 and 3
a	Status II	Status I
b	Status II	Status I

17 Electrostatic Discharge – Handling Test (ESDH-Test)

The immunity against electrostatic discharges during handling shall be tested according to ISO 10605.

17.1 Test setup

The test setup is given in ISO 10605 section 5.2.

The DUT shall be placed directly on the HCP. A dissipative mat shall not be used.

17.2 Test conditions

A discharge network containing 150 pF and 330 Ω shall be used.

The DUT shall be tested at each discharge point and for each test voltage with positive and negative polarity.

At each discharge point for each test voltage and with both polarities 3 discharges shall be applied.

17.3 Requirements

The test levels are defined in Table 20.

Table 20: Test Levels (ESDH-Test)

All Parts of Case	Conductive Parts of Case	Connector Pins
Air Discharge [kV]	Contact Discharge [kV]	Contact Discharge [kV]
$\pm 8, \pm 15$	$\pm 4, \pm 8$	$\pm 3, \pm 4$

There shall be no damage to the DUT. After the test, the DUT shall operate as specified, without any effect on stored data.

18 Electrostatic Discharge – Direct Discharge (ESDD-Test)

The immunity against direct electrostatic discharges during operation of the DUT shall be tested according to ISO 10605 Annex F.

18.1 Test setup

The test setup is given in ISO 10605 Annex F.

18.2 Test conditions

Table 21 defines the discharge network.

Table 21: Discharge network (ESDD-Test)

Discharge point touchable	R [Ω]	C [pF]
only from outside the vehicle.	330	150
from inside the vehicle.	330	330

The DUT shall be tested at each discharge point and for each test voltage with positive and negative polarity.

At each discharge point for each test voltage and with both polarities 10 discharges shall be applied.

18.3 Requirements

The test levels are defined in Table 22.

Table 22: Test Levels (ESDD-Test)

All Parts of Case	Conductive Parts of Case
Air Discharge [kV]	Contact Discharge [kV]
±4, ±8, ±15 (,±20 ¹⁾)	±3, ±4 , ±8
¹⁾ If required in the product specification.	

Table 23 defines the FPSC.

Table 23: FPSC (ESDD-Test)

Test Severity Level	Category 1 [kV]	Category 2 [kV]	Category 3 [kV]
L2	±15 (,±20 ¹⁾)	±15 (,±20 ¹⁾)	not specified
L1	±4	±8	±15 (,±20 ¹⁾)
¹⁾ If required in the product specification.			

For safety restraint systems special requirements apply. These components shall be additionally tested with ±20 kV and ±25 kV. There shall be no activation of the safety restraint system.

19 Electrostatic Discharge – Indirect Discharge (ESDI-Test)

The immunity against indirect electrostatic discharges during operation of the DUT shall be tested according to ISO 10605 Annex F.

19.1 Test setup

The test setup is given in ISO 10605 Annex F.

19.2 Test conditions

A discharge network containing 330 pF and 330 Ω shall be used.

The DUT shall be tested at each discharge island and for each test voltage with positive and negative polarity.

At each discharge island for each test voltage and with both polarities 10 discharges shall be applied.

If there are more than 40 lines in the wiring harness bundle, the harness bundle shall be flipped over (180° rotation around the longitudinal axis) and the test shall be repeated.

19.3 Requirements

The test levels are defined in Table 24.

Table 24: Test Levels (ESDI-Test)

Discharge Islands	
Air Discharge [kV]	Contact Discharge [kV]
$\pm 4, \pm 8, \pm 15 (, \pm 20^{1})$	$\pm 3, \pm 4, \pm 8$
¹⁾ If required in the product specification.	

Table 25 defines the FPSC.

Table 25: FPSC (ESDI-Test)

Test Severity Level	Category 1 [kV]	Category 2 [kV]	Category 3 [kV]
L2	$\pm 15 (, \pm 20^{1})$	$\pm 15 (, \pm 20^{1})$	not specified
L1	± 4	± 8	$\pm 15 (, \pm 20^{1})$
¹⁾ If required in the product specification.			

For safety restraint systems special requirements apply. These components shall be additionally tested with ± 20 kV and ± 25 kV. There shall be no activation of the safety restraint system.

End of Main Document

#####

Annex A (normative)

Function Performance Status Classification (FPSC)

This standard applies the FPSC defined in ISO 11452-1 AMD 1, ISO 7637-1 AMD 1 and ISO 10605.

Daimler uses the following status definitions of ISO 11452-1 AMD 1, ISO 7637-1 AMD 1 and ISO 10605:

Status I: The function performs as designed during and after the test.

Status II: The function does not perform as designed during the test but returns automatically to normal operation after the test.

Daimler differentiates three categories of effects based on the customer impact:

Category 1: Minor effects or negligible malfunctions of the DUT without any risk for persons or environment which may lead to slight inconvenience of the driver or other passengers.

Category 2: Effects or malfunctions of the DUT without any risk for persons or environment which may lead to inconvenience of the driver or other passengers.

Category 3: All other effects and malfunctions of the DUT.

The categorization of effects occurring during testing is determined by Daimler.

Note: ISO 11452-1 AMD 1, ISO 7637-1 AMD 1 and ISO 10605 exemplify to categorize functions instead of effects.

End of Annex A
#####

Annex B (informative)

Frequency Tables with Test Levels for Immunity Tests

Table B.1: Test Frequencies and Test Levels for the BCI-Test (Passenger Cars and Vans)

Line no.	1 ... 14 MHz		15 ... 72 MHz		73 ... 188 MHz		189 ... 400 MHz	
	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]
1	1,00	87,5	15,16	111,0	73,90	103,7	189,05	95,9
2	1,04	93,5	15,46	111,0	75,37	103,6	190,94	95,9
3	1,08	97,0	15,77	111,0	76,88	103,6	192,85	95,9
4	1,12	99,5	16,08	111,0	78,42	103,6	194,77	95,8
5	1,17	101,5	16,41	111,0	79,99	103,5	196,72	95,8
6	1,22	103,0	16,73	111,0	81,59	103,5	198,69	95,8
7	1,27	104,4	17,07	111,0	83,22	103,5	200,68	95,8
8	1,32	105,5	17,41	111,0	84,88	103,5	202,68	95,8
9	1,37	106,6	17,76	111,0	86,58	103,4	204,71	95,8
10	1,42	107,5	18,11	111,0	88,31	97,4	206,76	95,7
11	1,48	108,3	18,48	111,0	90,08	97,4	208,82	95,7
12	1,54	109,1	18,85	111,0	91,88	97,4	210,91	95,7
13	1,60	109,8	19,22	111,0	93,72	97,3	213,02	95,7
14	1,67	110,4	19,61	111,0	95,59	97,3	215,15	95,7
15	1,73	111,0	20,00	111,0	97,50	97,3	217,30	95,7
16	1,80	111,6	20,40	111,0	99,45	97,3	219,48	95,6
17	1,87	112,1	20,81	111,0	100,00	97,2	221,67	95,6
18	1,95	112,6	21,22	111,0	101,00	97,2	223,89	95,6
19	2,03	113,1	21,65	111,0	102,01	97,2	226,13	95,6
20	2,11	113,5	22,08	111,0	103,03	97,2	228,39	95,6
21	2,19	113,9	22,52	111,0	104,06	97,1	230,67	95,6
22	2,28	114,3	22,97	111,0	105,10	97,1	232,98	95,5
23	2,37	114,7	23,43	111,0	106,15	97,1	235,31	95,5
24	2,46	115,1	23,90	111,0	107,21	97,1	237,66	95,5
25	2,56	115,4	24,38	111,0	108,29	97,0	240,04	95,5
26	2,67	115,8	24,87	111,0	109,37	97,0	242,44	95,5
27	2,77	116,1	25,36	111,0	110,46	97,0	244,86	95,5
28	2,88	116,4	25,87	111,0	111,57	97,0	247,31	95,4
29	3,00	116,7	26,39	111,0	112,68	97,0	249,79	95,4
30	3,12	117,0	26,92	111,0	113,81	96,9	252,28	95,4
31	3,24	117,3	27,45	111,0	114,95	96,9	254,81	95,4
32	3,37	117,6	28,00	111,0	116,10	96,9	257,35	95,4
33	3,51	117,8	28,56	111,0	117,26	96,9	259,93	95,4
34	3,65	118,1	29,13	111,0	118,43	96,8	262,53	95,3
35	3,79	118,4	29,72	111,0	119,61	96,8	265,15	95,3
36	3,95	118,6	30,31	105,1	120,81	96,8	267,80	95,3
37	4,10	118,8	30,92	105,0	122,02	96,8	270,48	95,3
38	4,27	119,1	31,54	105,0	123,24	96,8	273,19	95,3
39	4,44	119,3	32,17	105,0	124,47	96,7	275,92	95,3
40	4,62	119,5	32,81	104,9	125,72	96,7	278,68	95,2
41	4,80	119,7	33,47	104,9	126,97	96,7	281,46	95,2
42	4,99	119,9	34,14	104,9	128,24	96,7	284,28	95,2
43	5,19	120,1	34,82	104,8	129,53	96,6	287,12	95,2
44	5,40	120,3	35,51	104,8	130,82	96,6	289,99	95,2
45	5,62	120,5	36,23	104,8	132,13	96,6	292,89	95,2
46	5,84	120,7	36,95	104,7	133,45	96,6	295,82	95,2

Line no.	1 ... 14 MHz		15 ... 72 MHz		73 ... 188 MHz		189 ... 400 MHz	
	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]
47	6,07	120,9	37,69	104,7	134,78	96,6	298,78	95,1
48	6,32	121,1	38,44	104,6	136,13	96,5	301,77	95,1
49	6,57	121,3	39,21	104,6	137,49	96,5	304,79	95,1
50	6,83	121,5	40,00	104,6	138,87	96,5	307,83	95,1
51	7,11	121,6	40,80	104,5	140,26	102,5	310,91	95,1
52	7,39	121,8	41,61	104,5	141,66	102,5	314,02	95,1
53	7,69	122,0	42,44	104,5	143,08	102,4	317,16	95,1
54	7,99	122,1	43,29	104,5	144,51	102,4	320,33	95,0
55	8,31	122,3	44,16	104,4	145,95	102,4	323,54	95,0
56	8,65	122,4	45,04	104,4	147,41	102,4	326,77	95,0
57	8,99	122,6	45,94	104,4	148,89	102,4	330,04	95,0
58	9,35	122,7	46,86	104,3	150,38	102,3	333,34	95,0
59	9,73	122,9	47,80	104,3	151,88	102,3	336,67	95,0
60	10,00	123,0	48,75	104,3	153,40	102,3	340,04	95,0
61	10,20	123,2	49,73	104,2	154,93	102,3	343,44	94,9
62	10,40	123,3	50,72	104,2	156,48	102,3	346,87	94,9
63	10,61	123,5	51,74	104,2	158,05	102,2	350,34	94,9
64	10,82	123,6	52,77	104,1	159,63	102,2	353,85	94,9
65	11,04	123,7	53,83	104,1	161,22	102,2	357,38	94,9
66	11,26	123,9	54,91	98,1	162,83	102,2	360,96	94,9
67	11,49	124,0	56,00	98,0	164,46	102,2	364,57	94,8
68	11,72	124,1	57,12	98,0	166,11	102,1	368,21	94,8
69	11,95	124,3	58,27	98,0	167,77	102,1	371,90	94,8
70	12,19	124,4	59,43	98,0	169,45	102,1	375,61	94,8
71	12,43	124,5	60,62	97,9	171,14	102,1	379,37	94,8
72	12,68	124,6	61,83	97,9	172,85	102,1	383,16	100,8
73	12,94	124,7	63,07	97,9	174,58	102,0	387,00	100,8
74	13,19	124,9	64,33	97,8	176,33	102,0	390,87	100,8
75	13,46	125,0	65,62	103,8	178,09	102,0	394,77	100,7
76	13,73	125,1	66,93	103,8	179,87	102,0	398,72	100,7
77	14,00	125,2	68,27	103,8	181,67	96,0	400,00	100,7
78	14,28	125,3	69,63	103,7	183,49	96,0	-	-
79	14,57	125,4	71,03	103,7	185,32	95,9	-	-
80	14,86	125,5	72,45	103,7	187,17	95,9	-	-
Logarithmic Steps: 4% from 1 to 10 MHz, 2% from 10 to 100 MHz and 1% from 100 to 400 MHz.								

Table B.2: Test Frequencies and Test Levels for the BCI-Test (Heavy Trucks and Buses)

Line no.	1 ... 14 MHz		15 ... 72 MHz		73 ... 188 MHz		189 ... 400 MHz	
	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]
1	1,00	100,0	15,16	114,0	73,90	99,5	189,05	97,0
2	1,04	100,4	15,46	113,9	75,37	99,5	190,94	96,9
3	1,08	100,7	15,77	113,8	76,88	99,5	192,85	96,9
4	1,12	101,0	16,08	113,7	78,42	99,4	194,77	96,8
5	1,17	101,4	16,41	113,6	79,99	99,4	196,72	96,8
6	1,22	101,7	16,73	113,5	81,59	99,3	198,69	96,7
7	1,27	102,1	17,07	113,4	83,22	99,3	200,68	96,7
8	1,32	102,4	17,41	113,4	84,88	99,2	202,68	96,7
9	1,37	102,7	17,76	113,3	86,58	99,2	204,71	96,6
10	1,42	103,1	18,11	113,2	88,31	99,2	206,76	96,6

Line no.	1 ... 14 MHz		15 ... 72 MHz		73 ... 188 MHz		189 ... 400 MHz	
	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]
11	1,48	103,4	18,48	113,1	90,08	99,1	208,82	96,5
12	1,54	103,8	18,85	113,0	91,88	99,1	210,91	96,5
13	1,60	104,1	19,22	112,9	93,72	99,0	213,02	96,4
14	1,67	104,4	19,61	112,8	95,59	99,0	215,15	96,4
15	1,73	104,8	20,00	112,8	97,50	98,9	217,30	96,4
16	1,80	105,1	20,40	112,7	99,45	98,9	219,48	96,3
17	1,87	105,5	20,81	112,6	100,00	98,9	221,67	96,3
18	1,95	105,8	21,22	112,5	101,00	98,8	223,89	96,2
19	2,03	106,2	21,65	112,4	102,01	98,8	226,13	96,2
20	2,11	106,5	22,08	112,3	103,03	98,7	228,39	96,1
21	2,19	106,8	22,52	112,2	104,06	98,7	230,67	96,1
22	2,28	107,2	22,97	112,1	105,10	98,6	232,98	96,0
23	2,37	107,5	23,43	112,1	106,15	98,6	235,31	96,0
24	2,46	107,9	23,90	112,0	107,21	98,6	237,66	96,0
25	2,56	108,2	24,38	111,9	108,29	98,5	240,04	95,9
26	2,67	108,5	24,87	111,8	109,37	98,5	242,44	95,9
27	2,77	108,9	25,36	111,7	110,46	98,4	244,86	95,8
28	2,88	109,2	25,87	111,6	111,57	98,4	247,31	95,8
29	3,00	109,6	26,39	111,5	112,68	98,3	249,79	95,7
30	3,12	109,9	26,92	111,5	113,81	98,3	252,28	95,7
31	3,24	110,2	27,45	111,4	114,95	104,3	254,81	95,7
32	3,37	110,6	28,00	111,3	116,10	104,2	257,35	95,6
33	3,51	110,9	28,56	111,2	117,26	104,2	259,93	95,6
34	3,65	111,3	29,13	111,1	118,43	104,1	262,53	95,5
35	3,79	111,6	29,72	111,0	119,61	104,1	265,15	95,5
36	3,95	111,9	30,31	110,9	120,81	104,0	267,80	95,4
37	4,10	112,3	30,92	110,8	122,02	104,0	270,48	95,4
38	4,27	112,6	31,54	110,7	123,24	103,9	273,19	95,4
39	4,44	113,0	32,17	110,6	124,47	103,9	275,92	95,3
40	4,62	113,3	32,81	110,6	125,72	103,9	278,68	95,3
41	4,80	113,6	33,47	110,5	126,97	103,8	281,46	95,2
42	4,99	114,0	34,14	110,4	128,24	103,8	284,28	95,2
43	5,19	114,0	34,82	110,3	129,53	103,7	287,12	95,1
44	5,40	114,0	35,51	110,2	130,82	103,7	289,99	95,1
45	5,62	114,0	36,23	110,1	132,13	103,6	292,89	95,1
46	5,84	114,0	36,95	110,0	133,45	103,6	295,82	95,0
47	6,07	114,0	37,69	110,0	134,78	103,6	298,78	95,0
48	6,32	114,0	38,44	109,9	136,13	103,5	301,77	94,9
49	6,57	114,0	39,21	109,8	137,49	103,5	304,79	94,9
50	6,83	114,0	40,00	109,7	138,87	103,4	307,83	94,8
51	7,11	114,0	40,80	109,6	140,26	103,4	310,91	94,8
52	7,39	114,0	41,61	109,5	141,66	103,3	314,02	94,8
53	7,69	114,0	42,44	109,4	143,08	103,3	317,16	94,7
54	7,99	114,0	43,29	109,4	144,51	103,3	320,33	94,7
55	8,31	114,0	44,16	109,3	145,95	103,2	323,54	94,6
56	8,65	114,0	45,04	109,2	147,41	103,2	326,77	94,6
57	8,99	114,0	45,94	109,1	148,89	97,1	330,04	94,5
58	9,35	114,0	46,86	109,0	150,38	97,1	333,34	94,5
59	9,73	114,0	47,80	108,9	151,88	97,0	336,67	94,4
60	10,00	114,0	48,75	108,8	153,40	97,0	340,04	94,4
61	10,20	114,0	49,73	108,8	154,93	99,5	343,44	94,4
62	10,40	114,0	50,72	108,7	156,48	99,5	346,87	94,3

Line no.	1 ... 14 MHz		15 ... 72 MHz		73 ... 188 MHz		189 ... 400 MHz	
	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]	Test Frequency [MHz]	Test Current [dB(μA)]
63	10,61	114,0	51,74	108,6	158,05	99,5	350,34	94,3
64	10,82	114,0	52,77	108,5	159,63	99,4	353,85	94,2
65	11,04	114,0	53,83	108,4	161,22	99,4	357,38	94,2
66	11,26	114,0	54,91	108,3	162,83	99,3	360,96	94,1
67	11,49	114,0	56,00	108,2	164,46	99,3	364,57	94,1
68	11,72	114,0	57,12	108,2	166,11	99,2	368,21	94,1
69	11,95	114,0	58,27	108,1	167,77	99,2	371,90	94,0
70	12,19	114,0	59,43	108,0	169,45	99,2	375,61	94,0
71	12,43	114,0	60,62	107,9	171,14	99,1	379,37	93,9
72	12,68	114,0	61,83	107,8	172,85	99,1	383,16	99,9
73	12,94	114,0	63,07	107,7	174,58	99,0	387,00	99,8
74	13,19	114,0	64,33	107,6	176,33	99,0	390,87	99,8
75	13,46	114,0	65,62	107,6	178,09	98,9	394,77	99,8
76	13,73	114,0	66,93	107,5	179,87	98,9	398,72	99,7
77	14,00	114,0	68,27	107,4	181,67	98,9	400,00	99,7
78	14,28	114,0	69,63	107,3	183,49	98,8	-	-
79	14,57	114,0	71,03	107,2	185,32	98,8	-	-
80	14,86	114,0	72,45	107,1	187,17	98,7	-	-
Logarithmic Steps: 4% from 1 to 10 MHz, 2% from 10 to 100 MHz and 1% from 100 to 400 MHz.								

Table B.3: Test Frequencies and Test Levels (ALSE-Test)

Line no.	200 ... 539 MHz		540 ... 1207 MHz		1208 ... 1989 MHz		1990 ... 3200 MHz	
	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]
1	200,0	70	541,0	150	1209	150	1990	70
2	202,0	70	546,4	150	1215	150	2000	70
3	204,0	70	551,8	150	1221	150	2010	70
4	206,1	70	557,4	150	1227	150	2020	70
5	208,1	70	562,9	150	1233	150	2030	70
6	210,2	70	568,6	150	1239	150	2041	70
7	212,3	70	574,2	150	1245	150	2051	70
8	214,4	70	580,0	150	1252	150	2061	70
9	216,6	70	585,8	150	1258	150	2071	70
10	218,7	70	591,6	150	1264	150	2082	70
11	220,9	70	597,6	150	1270	150	2092	70
12	223,1	70	603,5	150	1277	150	2103	70
13	225,4	70	609,6	150	1283	150	2113	70
14	227,6	70	615,7	150	1290	150	2124	70
15	229,9	70	621,8	150	1296	150	2134	70
16	232,2	70	628,0	150	1303	150	2145	70
17	234,5	70	634,3	150	1309	150	2156	70
18	236,9	70	640,7	150	1316	150	2166	70
19	239,2	70	647,1	150	1322	150	2177	70
20	241,6	70	653,5	150	1329	150	2188	70
21	244,0	70	660,1	150	1335	150	2199	70
22	246,5	70	666,7	70	1342	150	2210	70
23	248,9	70	673,3	70	1349	150	2221	70
24	251,4	70	680,1	70	1356	150	2232	70
25	253,9	70	686,9	70	1362	150	2243	70
26	256,5	70	693,7	70	1369	150	2255	70

Line no.	200 ... 539 MHz		540 ... 1207 MHz		1208 ... 1989 MHz		1990 ... 3200 MHz	
	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]
27	259,1	70	700,7	70	1376	150	2266	70
28	261,6	70	707,7	70	1383	150	2277	70
29	264,3	70	714,8	70	1390	150	2289	70
30	266,9	70	721,9	70	1397	150	2300	70
31	269,6	70	729,1	70	1404	70	2312	70
32	272,3	70	736,4	70	1411	70	2323	70
33	275,0	70	743,8	70	1418	70	2335	70
34	277,7	70	751,2	70	1425	70	2346	70
35	280,5	70	758,7	70	1432	70	2358	70
36	283,3	70	766,3	70	1439	70	2370	70
37	286,2	70	774,0	70	1446	70	2382	70
38	289,0	70	781,7	70	1454	70	2394	70
39	291,9	70	789,5	70	1461	70	2406	70
40	294,8	70	797,4	70	1468	70	2418	70
41	297,8	70	805,4	70	1476	70	2430	70
42	300,8	70	813,5	150	1483	70	2442	70
43	303,8	70	821,6	150	1490	70	2454	70
44	306,8	70	829,8	150	1498	70	2466	70
45	309,9	70	838,1	150	1505	70	2479	70
46	313,0	70	846,5	150	1513	70	2491	70
47	316,1	70	855,0	150	1520	70	2504	70
48	319,3	70	863,5	150	1528	70	2516	70
49	322,4	70	872,2	150	1536	70	2529	70
50	325,7	70	880,9	150	1543	70	2541	70
51	328,9	70	889,7	150	1551	70	2554	70
52	332,2	70	898,6	150	1559	70	2567	70
53	335,5	70	907,6	150	1567	70	2580	70
54	338,9	70	916,6	70	1574	70	2592	70
55	342,3	70	925,8	70	1582	70	2605	70
56	345,7	70	935,1	70	1590	70	2618	70
57	349,2	70	944,4	70	1598	70	2632	70
58	352,7	70	953,9	70	1606	70	2645	70
59	356,2	70	963,4	70	1614	70	2658	70
60	359,7	70	973,0	70	1622	70	2671	70
61	363,3	70	982,8	70	1630	70	2685	70
62	367,0	70	992,6	70	1638	70	2698	70
63	370,6	70	1000	70	1647	70	2712	150
64	374,3	70	1005	70	1655	70	2725	150
65	378,1	70	1010	70	1663	70	2739	150
66	381,9	150	1015	70	1671	70	2752	150
67	385,7	150	1020	70	1680	70	2766	150
68	389,5	150	1025	70	1688	70	2780	150
69	393,4	150	1030	70	1697	70	2794	150
70	397,4	150	1036	70	1705	70	2808	150
71	401,4	150	1041	70	1714	150	2822	150
72	405,4	150	1046	70	1722	150	2836	150
73	409,4	150	1051	70	1731	150	2850	150
74	413,5	150	1056	70	1740	150	2864	150
75	417,6	150	1062	70	1748	150	2879	150
76	421,8	150	1067	70	1757	150	2893	150
77	426,0	150	1072	70	1766	150	2908	150
78	430,3	150	1078	70	1775	150	2922	150

Line no.	200 ... 539 MHz		540 ... 1207 MHz		1208 ... 1989 MHz		1990 ... 3200 MHz	
	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]	Test Frequency [MHz]	Test Level [V/m]
79	434,6	150	1083	70	1783	150	2937	150
80	439,0	150	1088	70	1792	150	2951	150
81	443,3	150	1094	70	1801	150	2966	150
82	447,8	150	1099	70	1810	150	2981	150
83	452,3	150	1105	70	1819	150	2996	150
84	456,8	150	1110	70	1828	150	3011	150
85	461,3	150	1116	70	1838	150	3026	150
86	466,0	150	1122	70	1847	150	3041	150
87	470,6	150	1127	70	1856	150	3056	150
88	475,3	150	1133	70	1865	150	3072	150
89	480,1	150	1138	70	1875	150	3087	150
90	484,9	150	1144	70	1884	150	3102	150
91	489,7	150	1150	70	1893	150	3118	150
92	494,6	150	1156	70	1903	150	3133	150
93	499,6	150	1161	70	1912	150	3149	150
94	504,6	150	1167	70	1922	150	3165	150
95	509,6	150	1173	70	1932	150	3181	150
96	514,7	150	1179	70	1941	150	3197	150
97	519,9	150	1185	70	1951	150	3200	150
98	525,1	70	1191	70	1961	150	-	-
99	530,3	70	1197	70	1971	150	-	-
100	535,6	70	1203	150	1980	150	-	-
Logarithmic Steps: 1% from 200 to 1000 MHz and 0,5% from 1000 to 3200 MHz.								

Table B.4: Test Frequencies and Test Levels (LFM -Test)

Line no.	0 ... 0,14 kHz		0,14 ... 1,6 kHz		1,6 ... 16 kHz		16 ... 30 kHz	
	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]
1	0	1000	0,148	406	1,601	37	17,344	10
2	0,015	1000	0,163	369	1,761	34	19,078	10
3	0,017	1000	0,179	336	1,937	31	20,986	10
4	0,018	1000	0,197	305	2,131	28	23,085	10
5	0,020	1000	0,216	277	2,344	26	25,393	10
6	0,022	1000	0,238	252	2,578	23	27,933	10
7	0,024	1000	0,262	229	2,836	21	30,000	10
8	0,027	1000	0,288	208	3,119	19	-	-
9	0,029	1000	0,317	189	3,431	17	-	-
10	0,032	1000	0,348	172	3,775	16	-	-
11	0,035	1000	0,383	157	4,152	14	-	-
12	0,039	1000	0,422	142	4,567	13	-	-
13	0,043	1000	0,464	129	5,024	12	-	-
14	0,047	1000	0,510	118	5,526	11	-	-
15	0,052	1000	0,561	107	6,079	10	-	-
16	0,057	1000	0,617	97	6,687	10	-	-
17	0,063	958	0,679	88	7,356	10	-	-
18	0,069	871	0,747	80	8,091	10	-	-
19	0,076	791	0,821	73	8,900	10	-	-
20	0,083	719	0,904	66	9,790	10	-	-
21	0,092	654	0,994	60	10,769	10	-	-
22	0,101	595	1,093	55	11,846	10	-	-

Line no.	0 ... 0,14 kHz		0,14 ... 1,6 kHz		1,6 ... 16 kHz		16 ... 30 kHz	
	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]	Test Frequency [kHz]	Test Level [A/m]
23	0,111	541	1,203	50	13,031	10	-	-
24	0,122	491	1,323	45	14,334	10	-	-
25	0,134	447	1,455	41	15,767	10	-	-
0 Hz, Logarithmic Steps: 10% from 0,015 to 30 kHz.								

End of Annex B
#####

Annex C (informative)

Examples for Applying this Generic Standard

C.1 Examples for choosing appropriate test methods

Table C.1 shows an example of a test selection matrix.

Table C.1: Example of an EMC Test Selection Matrix

TEST	ELECTRONIC COMPONENTS						MOTORS		INDUCTIVE DEVICES	
	Category				Subcategory ¹⁾		Category		Category	
	P	A	B	HV	MS	Y	BCM	ECM	R	IP
EMISSIONS										
AN-Test		X		X			X	X		X
CV-Test		X		X						
CP-Test		X		X						
RE-Test		X		X			X	X		
CTE-Test						X	X	X	X	X
IMMUNITY										
BCI-Test		X		X				X		
ALSE-Test		X	X	X				X		
LFM-Test					X					
TRANSIENTS										
TSUP-Test	X	X					X	X		
TOL-Test		X						X		
ESDH-Test	X	X	X	X				X		
ESDD-Test	X	X	X	X				X		
ESDF-Test	X	X	X	X				X		

¹⁾ In addition to category.

Electronic component categories:

- P: A passive electrical component. Examples: resistor, capacitor or diode.
A: A component that contains active electronic devices. Examples: an analog op amp circuit, switching power supply or microprocessor controller.
B: An electronic component that operates without a wiring connection to the vehicle (e.g. tire pressure monitor).
HV: Components that operate at high voltage (greater than 60 V).

Electronic component subcategories (in addition to the electronic components category).

- MS: An electronic component that contains magnetically sensitive devices.
Y: An electronic component that contains larger inductivities, e.g. motors or relays.

Electric motor categories:

- BCM: Brush commutated DC electric motor.
ECM: Electronically commutated dc electric motor.

Inductive device categories:

- R: Relays and solenoids operating at a rate less than 100 Hz.
IP: Inductive devices operating at a rate of 100 Hz or greater.

C.2 Examples for choosing emission test methods

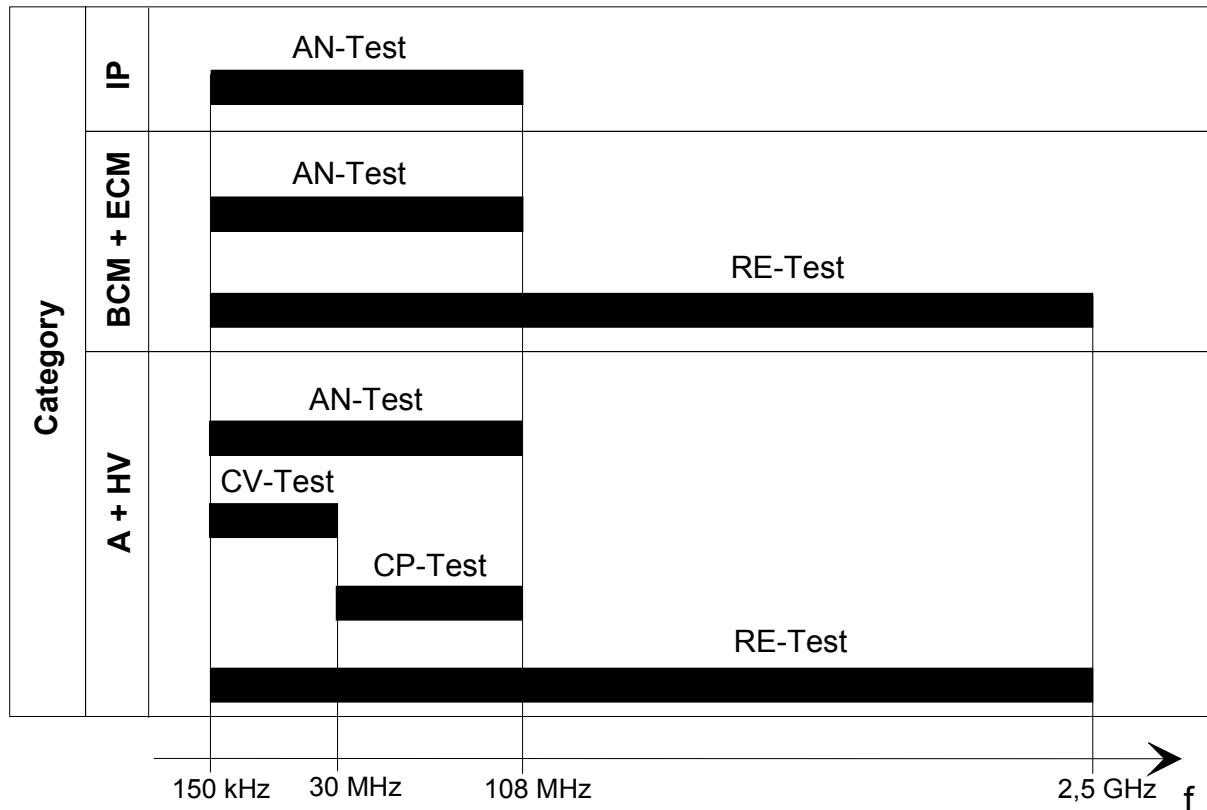


Figure C.1 – Emission test methods over frequency

For DUTs that cannot radiate directly but only from connecting lines the emission test using antennas (RE-Test) below 75 MHz may be omitted if agreed with Daimler (e.g., small DUTs or DUTs with metal housing).

C.3 Examples for choosing immunity test methods

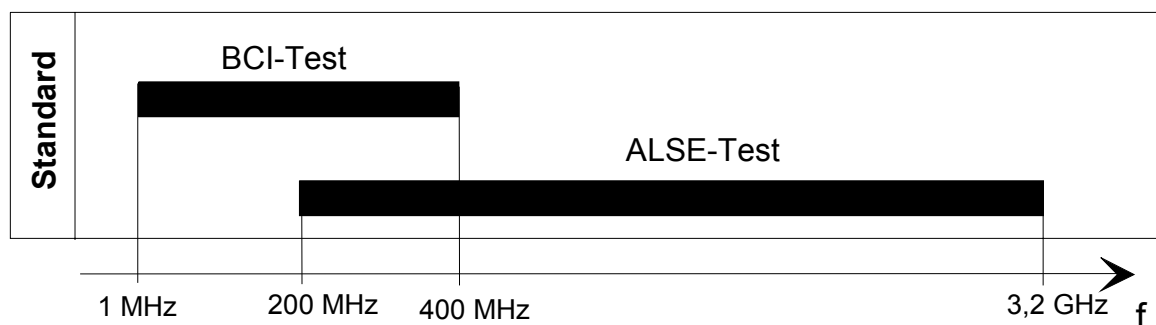


Figure C.2 – Immunity test methods over frequency

End of Annex C
#####