

Straubing, 12 December 2002

TEST-REPORT

No. 50217-20770

for

CAS 2

Inductive Reader

Applicant: Bayerische Motoren Werke AG

Purpose of testing: To show compliance with

FCC Code of Federal Regulations,
CFR 47, Part 15, Subpart C,
Section 15.209

Note:

The test data of this report relate only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

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1. Identification of the Test Laboratory

DETAILS OF THE TEST LABORATORY	
COMPANY NAME:	Senton GmbH EMI/EMC Test Center
ADDRESS:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
LABORATORY ACCREDITATION:	DAR-Registration No. TTI-P-G 062/94-40
FCC TEST SITE REGISTRATION NUMBER:	90926
INDUSTRY CANADA FILE NUMBER:	IC 3050
NAME FOR CONTACT PURPOSES:	Mr. Johann Roidt
TELEPHONE: (+49) 09421 5522-0	FAX: (+49) 09421 5522-99
EMAIL: j.roidt@senton.de	

PERSONNEL INVOLVED IN THIS TEST REPORT	
TECHNICAL DIRECTOR:	 Mr. Johann Roidt
RESPONSIBLE FOR TESTING:	Mr. Johann Roidt
RESPONSIBLE FOR TEST REPORT:	Mr. Johann Roidt

2. Administrative Data

IDENTIFICATION OF EUT	
TYPE DESIGNATION OF EUT (i.e. system if EUT consists of more than one part):	CAS 2
PARTS OF THE SYSTEM (including appropriate type designations)	
SERIAL NUMBER(S):	Prototype
APPLICATION (see note):	Inductive Applications
SECTION OF FCC RULES	15.209
FREQUENCY RANGE:	N/A
OPERATING FREQUENCY:	125 kHz
CARRIER POWER	19.5 µV/m at 300 meters
CHANNEL SPACING:	Not applicable
ITU DESIGNATION:	10K0A1D
NUMBER OF RF-CHANNELS:	1
NUMBER OF CONTROL FUNCTIONS:	N/A
POWER SUPPLY:	12 regulated lead acid battery
TYPE OF ANTENNA:	Fix connected
SIZE / LENGTH OF ANTENNA:	N/A
INTERFACE(S):	N/A

ADMINISTRATIVE DATA

APPLICANT (full address):	Bayerische Motoren Werke Petuelring 130 D-80788 München
CONTACT PERSON:	Mr. Richard Hochleitner
TELEPHONE NO.:	+49 (0) 89 382 32965
FAX NO.:	+49 (0) 89 382 732965
EMAIL-ADDRESS:	Richard.hochleitner@bmw.de
RECEIPT OF EUT:	9 December 2002
VERSION OF EUT:	As delivered
DATE(S) OF TEST:	11 December 2002
NOTE(S):	---

3. Summary of Test Results

The tested sample complies with the requirements for set forth in the

The Code of Federal Regulations 47, Part 15, Subpart C, Section 15.209

of the Federal Communication Commission (FCC).

4. Deviations from the Test Specifications

All tests were performed without deviations from the test specifications.

5. Additional Information to EUT and Testing

EUT MODE OF OPERATION
Continuously reading a TAG

LIST OF ANCILLARY DEVICES USED FOR TESTING (SEE NOTE)			
Description	Designation	Serial no.	Manufacturer
None			

LIST OF PERIPHERAL DEVICES USED FOR TESTING			
Description	Designation	Serial no.	Manufacturer
None			

6. Measuring Methods

6.1. Field strength emissions < 30 MHz (15.209)

Radiated emissions in the frequency range 9 kHz – 30 MHz will be measured initially at a distance of 3 meters. A prescan at 3 meter distance will be performed in a shielded room with the detector of the spectrum analyzer or EMI Receiver set to peak. Final measurement is then performed at 30 meter distance. In case the regulation requires testing at other distances, the result will be extrapolated. The extrapolation factor will be determined by making a second measurement at 10 meter distance. The provisions of 15.31 (d) apply.

According to section 15.209 (d) final measurement is performed with the detector set to Quasi Peak except for the frequency bands 9 – 90 kHz and 110 – 490 kHz where average detector is employed.

6.2. Unwanted Emission 30 MHz - 1 GHz (§15.225 (b))

Radiated emissions were measured over the frequency range from 30 MHz to 1 GHz. For final testing the detector-function of the spectrum analyzer was set to quasi peak

Measurements were made in both the horizontal and vertical planes of polarization. Preliminary scans were taken in a semi-anechoic room using a spectrum analyzer with the detector function set to peak and resolution bandwidth set to 100 kHz. All tests were performed at a test-distance of 3 meters. Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing. For final testing an open-area test-site was used. During the tests the EUT was rotated all around and the receiving-antenna was raised and lowered from 1 meter to 4 meters to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions.

See figure 1 for the measurement setup.

Test equipment used (see equipment list for details):

01, 06, 12, 15, 38, 39, 40, 41, 55, 58, 61, 64, 66

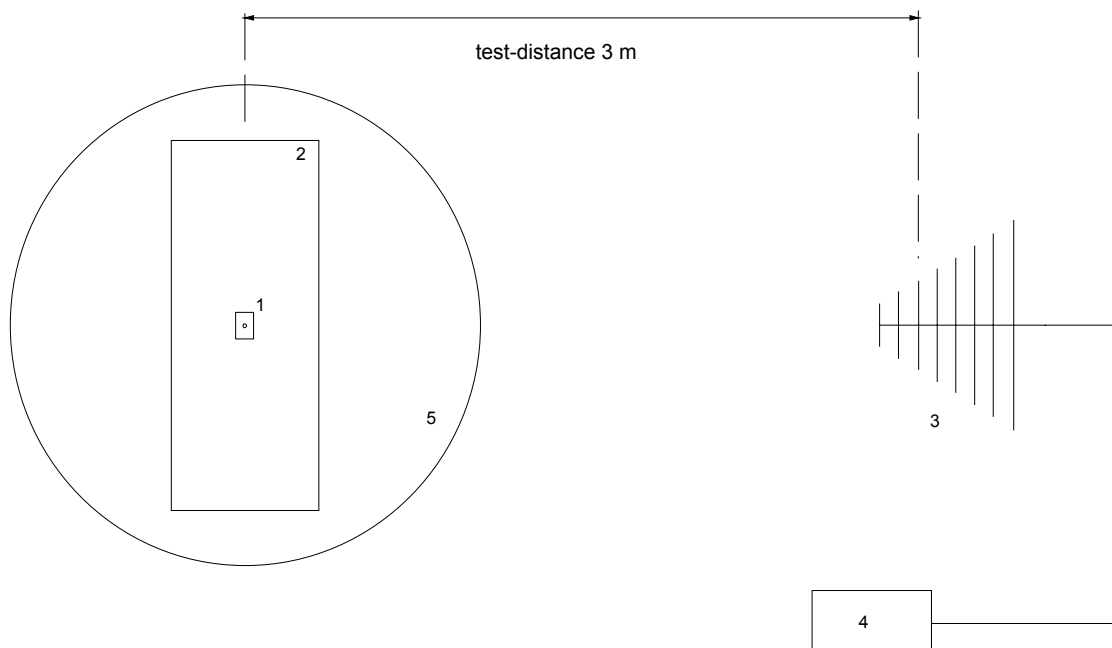


Figure 1: Measurement setup for radiated emission test

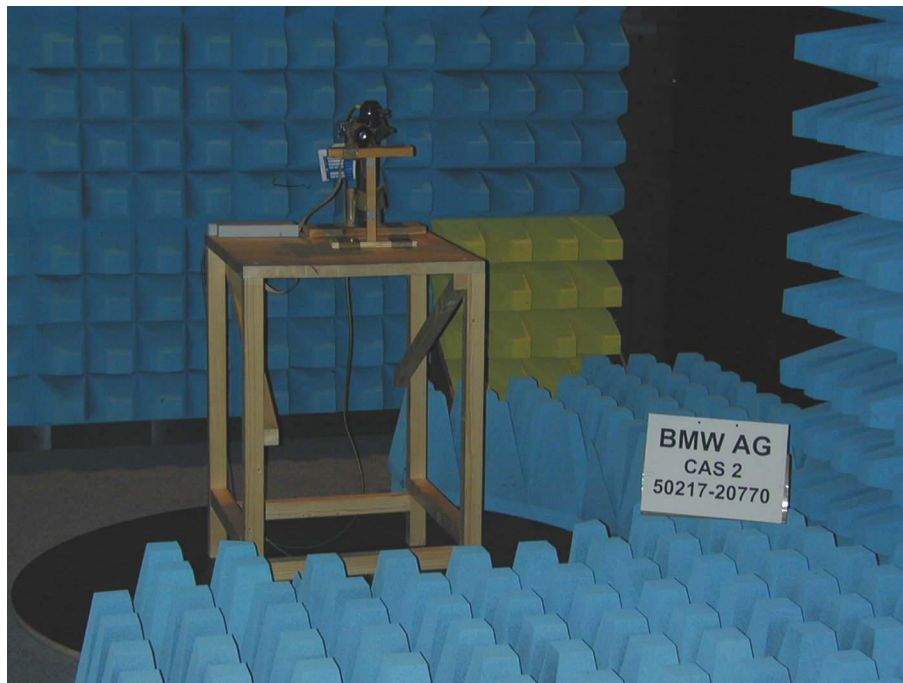
- | | |
|---------------------|-----------------------|
| 1 Transmitter (EUT) | 3 Measurement antenna |
| 2 Wooden table | 4 Test receiver |
| | 5 Turn table |

7. Photographs of Test Setups

7.1. Radiated Emissions 9 kHz – 30 MHz



7.2. Radiated Emissions 30 – 1000 MHz



8. Equipment List

To facilitate reference to test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

No.	Type	Model	Serial Number	Manufacturer
01	Spectrum Analyzer	R 3271	05050023	Advantest
02	EMI Test Receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
03	Test Receiver	ESH 3	880112/032	Rohde & Schwarz
04	Test Receiver	ESHS 10	860043/016	Rohde & Schwarz
05	Test Receiver	ESV	881414/009	Rohde & Schwarz
06	Test Receiver	ESVP	881120/024	Rohde & Schwarz
07	Audio Analyzer	UPA	862954	Rohde & Schwarz
08	Power Meter	NRVS	836856/015	Rohde & Schwarz
09	Power Sensor	NRV-Z52	837901/030	Rohde & Schwarz
10	Power Sensor	NRV-Z4	863828/015	Rohde & Schwarz
11	Preamplifier	ESV-Z3	860907/004	Rohde & Schwarz
12	Preamplifier	R14601		Advantest
13	Preamplifier	ACX/080-3030	32640	CTT
14	Preamplifier	ACO/180-3530	32641	CTT
15	Signal generator	SMY 01	830694/001	Rohde & Schwarz
16	Signal Generator	HP 8673 D	2930A00966	Hewlett Packard
17	Waveform Generator	HP 33120 A	US34005375	Hewlett Packard
18	Attenuator 20 dB	4776-20	9503	Narda
19	Attenuator 10 dB	4776-10	9412	Narda
20	Pulse Limiter	ESH 3-Z2	1144	Rohde & Schwarz
21	Pulse Limiter	11947 A	3107A00566	Hewlett Packard
22	V-Network	ESH 3-Z5	862770/018	Rohde & Schwarz
23	V-Network	ESH 3-Z5	894785/005	Rohde & Schwarz
24	V-Network	ESH 3-Z5	830952/025	Rohde & Schwarz
25	V-Network	ESH 3-Z6	830722/010	Rohde & Schwarz
26	V-Network	NSLK 8127	8127152	Schwarzbeck
27	V-Network	NNLA 8119	8119148	Schwarzbeck
28	V-Network	SE 01	01	Senton
29	T-Network	ESH 3-Z4	890602/011	Rohde & Schwarz
30	T-Network	ESH 3-Z4	890602/012	Rohde & Schwarz
31	High Impedance Probe	TK 9416	01	Schwarzbeck
32	High Impedance Probe	TK 9416	02	Schwarzbeck
33	Current Probe	ESH 2-Z1	863366/18	Rohde & Schwarz
34	Current Probe	ESV-Z1	862553/3	Rohde & Schwarz

No.	Type	Model	Serial Number	Manufacturer
35	Absorbing Clamp	MDS 21	80911	Lüthi
36	Absorbing Clamp	MDS 21	79690	Lüthi
37	Loop Antenna	HFH2-Z2	882964/1	Rohde & Schwarz
38	Biconical Antenna	HK 116	842204/001	Rohde & Schwarz
39	Biconical Antenna	HK 116	836239/02	Rohde & Schwarz
40	Log. Periodic Antenna	HL 223	841516/023	Rohde & Schwarz
41	Log. Periodic Antenna	HL 223	834408/12	Rohde & Schwarz
42	Horn Antenna	3115	9508-4553	Emco
43	Horn Antenna	3160-03	9112-1003	Emco
44	Horn Antenna	3160-04	9112-1001	Emco
45	Horn Antenna	3160-05	9112-1001	Emco
46	Horn Antenna	3160-06	9112-1001	Emco
47	Horn Antenna	3160-07	9112-1008	Emco
48	Horn Antenna	3160-08	9112-1002	Emco
49	Horn Antenna	3160-09	9403-1025	Emco
50	Digital multimeter	199	463386	Keithley
51	DC Power Supply	NGSM 32/10	203	Rohde & Schwarz
52	DC Power Supply	NGB	2455	Rohde & Schwarz
53	DC Power Supply	NGA	386	Rohde & Schwarz
54	Temperature Test Chamber	HT4010	07065550	Heraeus
55	Cable	RG214	1309	Senton
56	Cable	200CM_001	1357	Rosenberger
57	Cable	150CM_001	1479	Rosenberger
58	Cable Set EG1	RG214	1189 - 1191	Senton
59	Cable Set Cabine 1	RG214		Senton
60	Cable Set Cabine 2	RG214		Senton
61	Cable Set Cabine 3	RG214		Senton
62	Shielded Room	No. 1	1451	Senton
63	Shielded Room	No. 2	1452	Senton
64	Semi-anechoic Chamber	No. 3	1453	Siemens
65	Shielded Room	No. 4	1454	Euroshield
66	Open Area Test Site	EG 1		Senton
67	Cable for Antenna Connector			Lucent Technologies
68	DC Block 0.01-18GHz		8037	Inmet Corp.
69	High pass filter			Lucent Technologies
69	DC Block	7006	A2798	Weinschel Corp.
70	Cable for Antenna Connector			Senton
71	Dummy load			Futaba Corporation

9. Referenced Regulations

All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency Allocations And Radio Treaty Matters, General Rules And Regulations) of the Federal Communication Commission (FCC)	October 1, 1999
☐	CFR 47 Part 15 Subpart A	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart A (General) of the Federal Communication Commission (FCC)	May 30, 2002
☐	CFR 47 Part 15 Subpart B	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart B (Unintentional Radiators) of the Federal Communication Commission (FCC)	May 30, 2002
☒	CFR 47 Part 15 Subpart C	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart C (Intentional Radiators) of the Federal Communication Commission (FCC)	May 30, 2002
☐	CFR 47 Part 95 Subpart C/E	Code of Federal Regulations Part 95 (Personal Radio Services), Subpart C/E (Radio Control(R/C) Radio Service) of the Federal Communication Commission (FCC)	October 1, 1998
☒	ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz - 40 GHz	October, 1992
☒	RSS-210	Radio Standards Specification RSS-210 Issue 5 for Low Power Licence-Exempt Radiocommunication Devices of Industry Canada	November 2001
☐	TIA/EIA-603	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	February, 1993
☐	TIA/EIA-603-1	Addendum to TIA/EIA-603	March 4, 1998

10. List of Measurements

CFR 47 Part 15 Subpart C			
Section(s):	Test	Page	Result
15.205	Restricted band compliance	---	Not applicable
15.207	Conducted AC powerline emission	---	Not applicable
§15.209	Field Strength of Emissions	21 - 25	Pass

11. Test Results

**Field Strength of Emissions according to FCC Rules,
Part 15, Subpart C, Section 15.209
Frequency Band < 30 MHz**

Model:	CAS 2
Type:	Inductive Reader
Serial No.	Prototype
Applicant:	Bayerische Motoren Werke AG
Test Site:	Open Field Test Site (without Ground Plane)
Distance:	30 Meter
Date of Test:	10 December 2002

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit dBμV/m	Margin dB
0.125	Average	Vertical	-2.5	20	17.5	69.5	52.0
				20			
				20			

*** = No emissions above noise floor detected

Limits:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	300
1.705-30	30	30

Sample calculation of field strength values:

Field Strength (dBμV/m) = Analyzer Reading (dBμV) + Correction Factor (dB)

**Field Strength of Emissions according to FCC Rules,
 Part 15, Subpart C, Section 15.209
 Frequency Band > 30 MHz**

Model:	CAS 2
Type:	Inductive Reader
Serial No.	Prototype
Applicant:	Bayerische Motoren Werke AG
Test Site:	Open Field Test Site
Distance:	3 Meter
Date of Test:	10 December 2002

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBμV)	Correction Factor (dB)	Field Strength (dBμV/m)	Limit dBμV/m	Margin dB
30-1000	Peak	Hor/Ver	***				

*** = No emissions above noise floor detected

Limits:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Sample calculation of field strength values:

Field Strength (dBμV/m) = Analyzer Reading (dBμV) + Correction Factor (dB)

12. Charts taken during testing

Radiated Emission Test 9 kHz - 30 MHz according to FCC Part 15 Subpart C

Model:

CAS 2

Serial no.:

ID-No.: 639

Applicant:

BMW AG

Test site:

Shielded room, cabin no. 2

Tested on:

Test distance 3 metres

Date of test:

12/09/2002

Operator:

M. Steindl

Test performed:

automatically

File name:

Mode:

- with power supply 12 V DC

- transmitting continuously

- with key

Final result with AV detector:

0.125 MHz: 72.5 dB μ V/m

Detector:

Peak / Final Results: QP

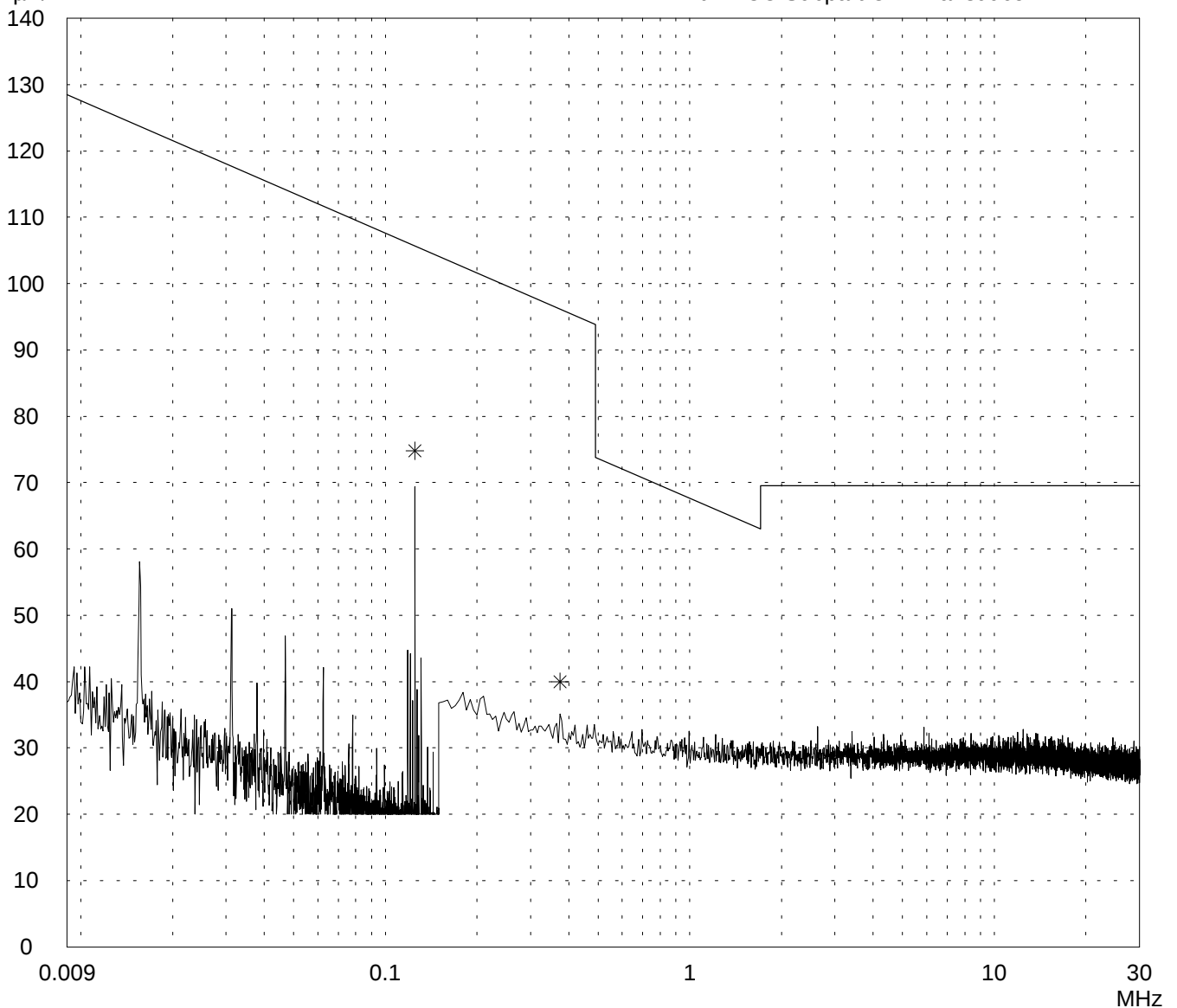
Final results:

Selected by hand

dB μ V/m

Limit1: FCC Subpart C

Transducer: HFH2-Z2



Result:

Prescan

Project file:

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Radiated Emission Test 30 MHz - 200 MHz acc. to FCC Part 15 (Fully Anechoic Chamber)

Model:

CAS 2

Serial no.:

ID-Nr.: 639

Applicant:

BMW AG

Test site:

Fully anechoic room

Tested on:

Test distance 3 metres
Horizontal Polarization

Date of test:

12/09/2002

Operator:

M. Steindl

Test performed:

automatically

File name:

default.emi

Comment:

- power supply with 12 V DC
- transmitting continuously
- with key

Detector:

Peak

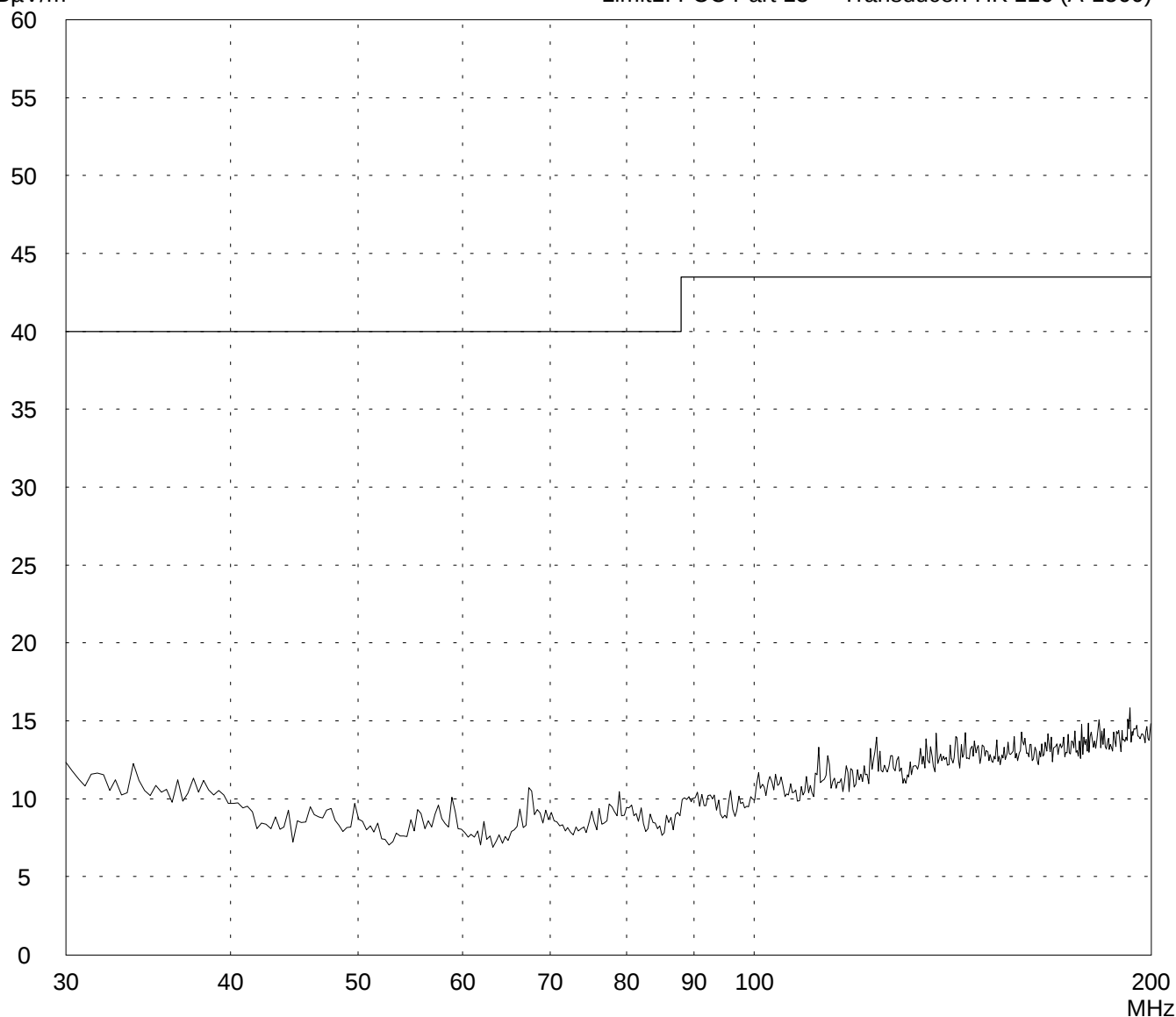
List of values:

10 dB Margin

50 Subranges

dB μ V/m

Limit1: FCC Part 15 Transducer: HK 116 (A-1560)



Result:

Prescan

Project file:

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Radiated Emission Test 30 MHz - 200 MHz acc. to FCC Part 15 (Fully Anechoic Chamber)

Model:

CAS 2

Serial no.:

ID-Nr.: 639

Applicant:

BMW AG

Test site:

Fully anechoic room

Tested on:

Test distance 3 metres
Vertical Polarization

Date of test:

12/09/2002

Operator:

M. Steindl

Test performed:

automatically

File name:

default.emi

Comment:

- power supply with 12 V DC

- transmitting continuously

- with key

Detector:

Peak

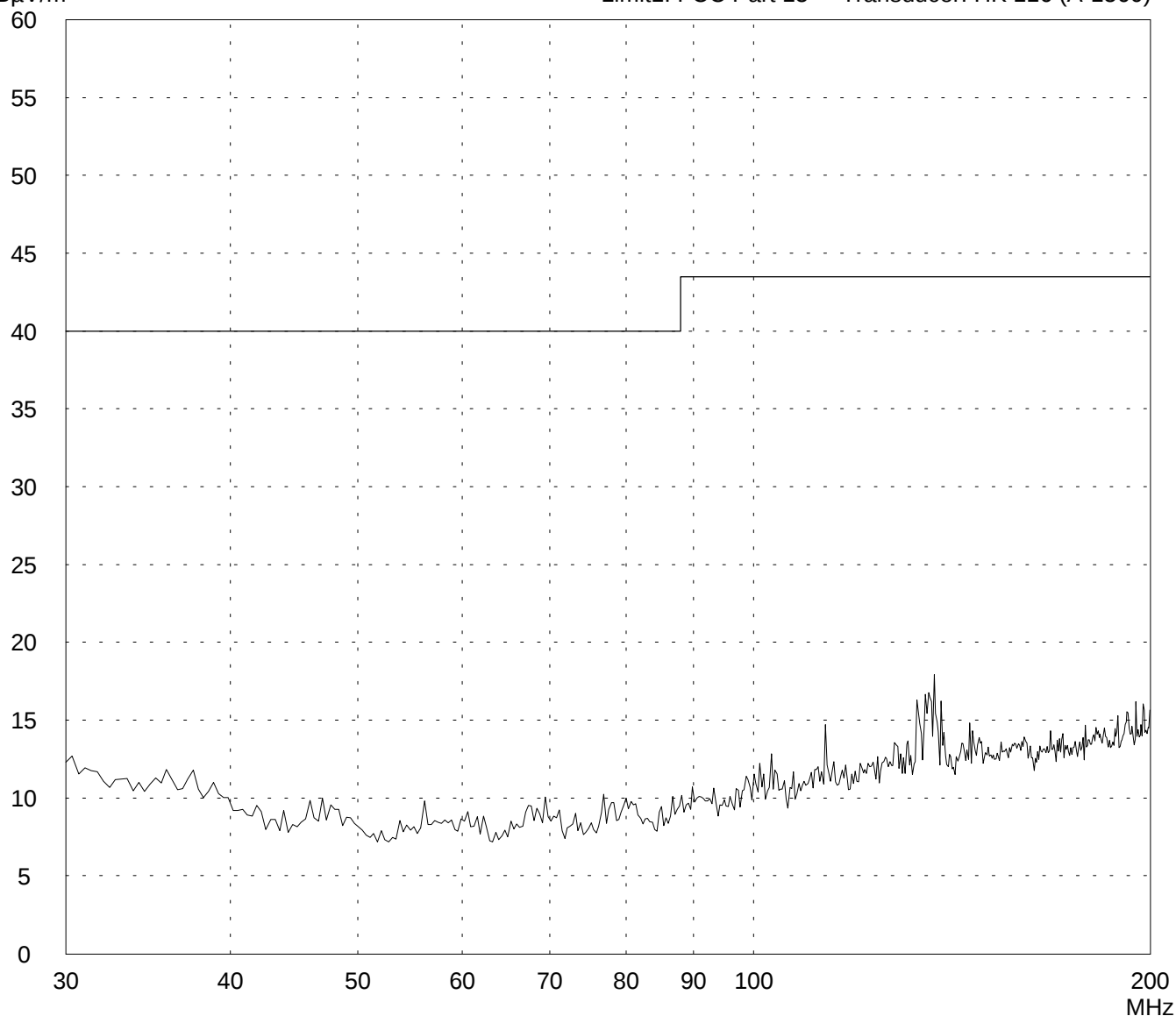
List of values:

10 dB Margin

50 Subranges

dB μ V/m

Limit1: FCC Part 15 Transducer: HK 116 (A-1560)



Result:

Prescan

Project file:

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Radiated Emission Test 200 MHz - 1 GHz acc. to FCC Part 15 (Fully Anechoic Chamber)

Model:

CAS 2

Serial no.:

ID-Nr.: 639

Applicant:

BMW AG

Test site:

Fully anechoic room

Tested on:

Test distance 3 metres
Horizontal Polarization

Date of test:

12/09/2002

Operator:

M. Steindl

Test performed:

automatically

File name:

default.emi

Comment:

- power supply with 12 V DC

- transmitting continuously

- with key

Detector:

Peak

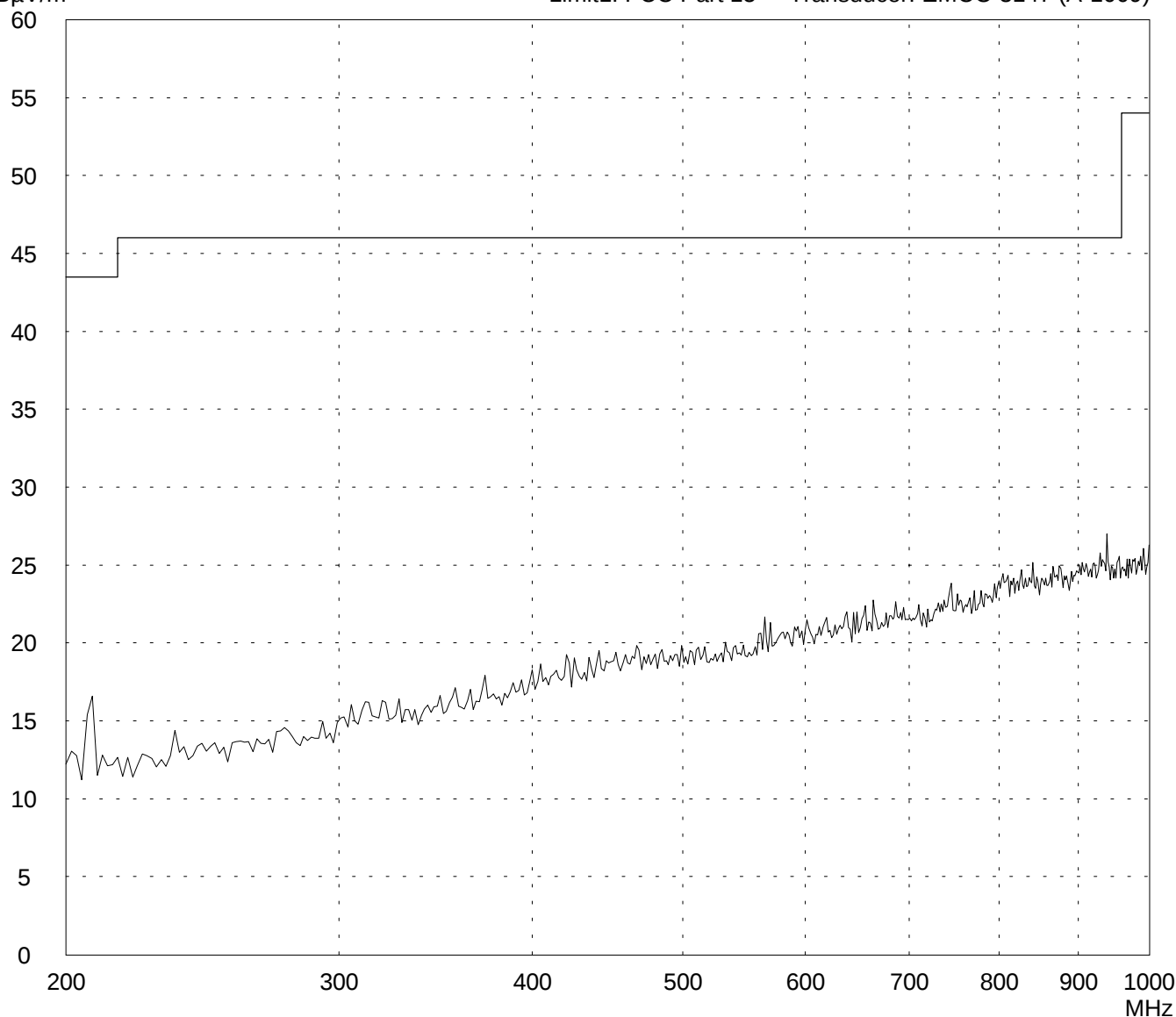
List of values:

10 dB Margin

50 Subranges

dB μ V/m

Limit1: FCC Part 15 Transducer: EMCO 3147 (A-1009)



Result:

Prescan

Project file:

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Radiated Emission Test 200 MHz - 1 GHz acc. to FCC Part 15 (Fully Anechoic Chamber)

Model:

CAS 2

Serial no.:

ID-Nr.: 639

Applicant:

BMW AG

Test site:

Fully anechoic room

Tested on:

Test distance 3 metres
Vertical Polarization

Date of test:

12/09/2002

Operator:

M. Steindl

Test performed:

automatically

File name:

default.emi

Comment:

- power supply with 12 V DC

- transmitting continuously

- with key

Detector:

Peak

List of values:

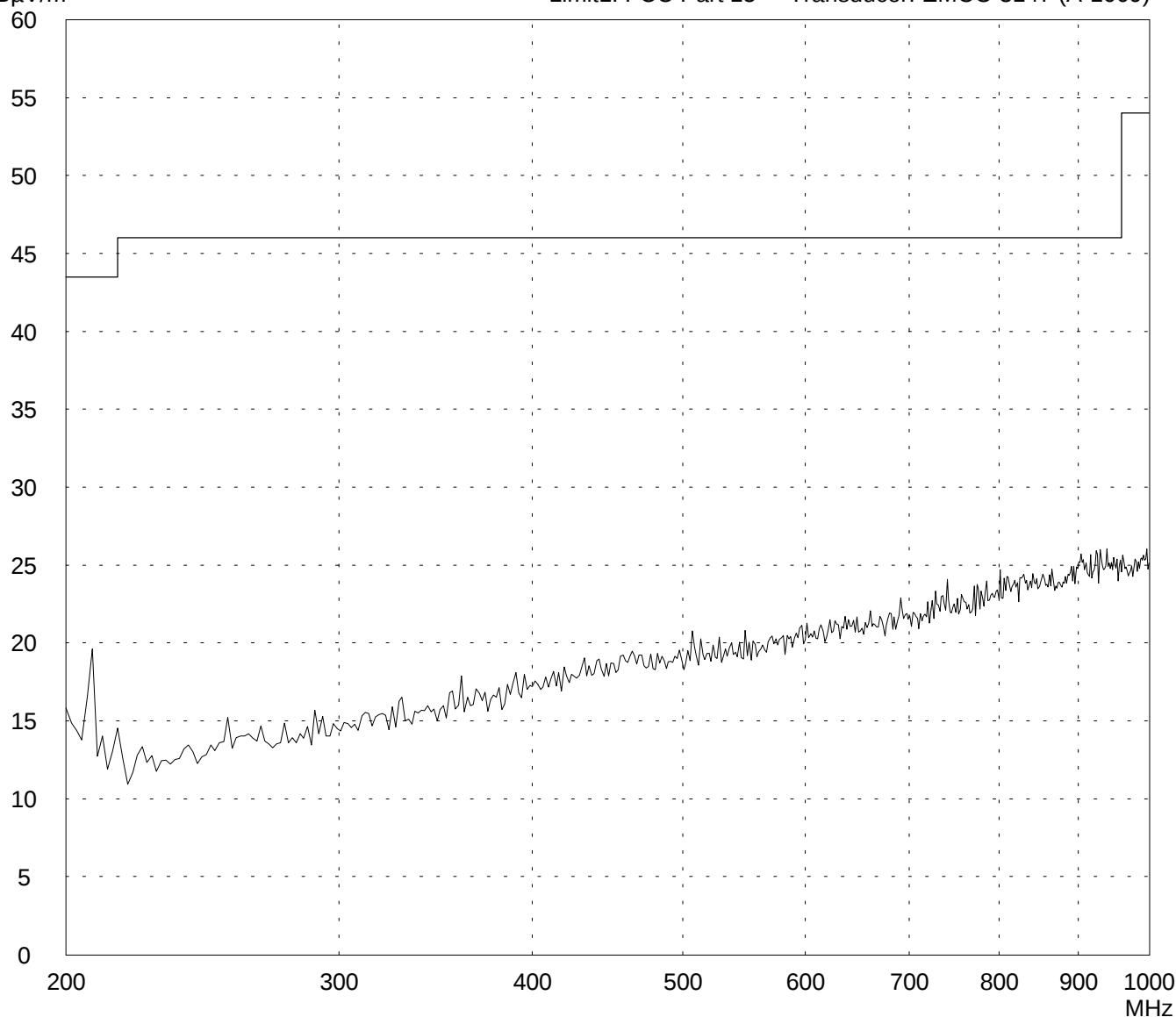
10 dB Margin

50 Subranges

$\text{dB}\mu\text{V/m}$

Limit1: FCC Part 15

Transducer: EMCO 3147 (A-1009)



Result:

Prescan

Project file:

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