

EMC Test Report

E.u.T.:	OBd Diagnostic Modul
Type:	ScanDoc Compact
Manufacturer:	Quantex GmbH Borriesstr. 174 32257 Bünde Germany
Date of tests:	2016-04-18 to 2016-04-22 2016-05-27
Place of tests:	Perl-Sinz
Project number:	54112_18042016_ScanDoc Compact 54112_27052016_ScanDoc Compact
Date of report:	2016-05-30
Complete pages:	38

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The test data of this test report relate only to the individual item which have been tested.**

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1. Identification of test laboratory

Company name	SGS-TÜV Saarland Forster GmbH
Address	Saarbruecker Strasse 1 66706 Perl Germany
Laboratory accreditation	D-PL-12103-01-01 Registration FCC 90572 KBA-P-00029-98
Name for contact purposes	MR. Karl-Heinz Forster
Telephone	(+49)-6866-93200
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E-mail	emv-forster@t-online.de

Personel involved in this test report

Responsible for test report:	Mr K.-H. Forster
Responsible for testing:	Mr Dipl.-Ing. (FH) S. E. Weber
Reviewed by:	K.-H. Forster

Signature: _____

Tested by: Dipl.-Ing. (FH) S. E. Weber

Signature: _____

Stamp:



2. Standards and requirements

General Requirements according 2014/30/EU

EN55022:2010/AC:2011
 EN55024:2010

EN61000-3-2:2014
 EN61000-3-3:2013

EN61000-4-2:2009
 EN61000-4-3:2006+A1:2008+A2:2010
 EN61000-4-4:2012
 EN61000-4-5:2006
 EN61000-4-6:2014
 EN61000-4-8:2010
 EN61000-4-11:2004

Radio and telecommunications terminal equipment (RTTE) according 1999/5/EC

ETSI EN 301489-1, V1.9.2
 ESTI EN 301489-3, V1.6.1
 ISO 7637-2:2004
 EN 55025:2009

Test environmental

Temperature	21,2° C
Rel. humidity	52 %
Air pressure	930-1060 hPa
Power supply	12V DC over On-board Power Supply

3. Interpretation and overview of test results

E. u. T.: OB Diagnostic Modul
 Type: ScanDoc Compact
 Date of tests: 2016-04-18 to 2016-04-22

Emissions:

	ScanDoc – Diagnostic Mode
Conducted Emission on dc-power-line EN55022, Class B EN301489-1	Passed
Field Strength EN55022, Class B EN301489-1	Passed
Hamonics EN 61000-3-2 EN301489-1	N/A DC-Power Supply
Flicker EN 61000-3-3 EN301489-1	N/A DC-Power Supply

Immunity:

Electro static discharge EN61000-4-2 EN301489-1	Passed
RF electro- magnetic fields EN61000-4-3 EN301489-1	Passed
Fast transients (Burst) EN61000-4-4 EN301489-1	Passed
Surge EN61000-4-5 EN301489-1	N/A DC-Power Supply shorter than 3m
Conducted RF disturbance EN61000-4-6 EN301489-1	Passed
Electromagnetic fields EN61000-4-8 EN301489-1	N/A No sensitive parts inside
Voltage Dips and Interrupts EN61000-4-11 EN301489-1	N/A DC-Power Supply
Conducted Impulses ISO7637-2 EN301489-1	Passed

4. Test results Emissions

4.1. Test setup and results conducted emission

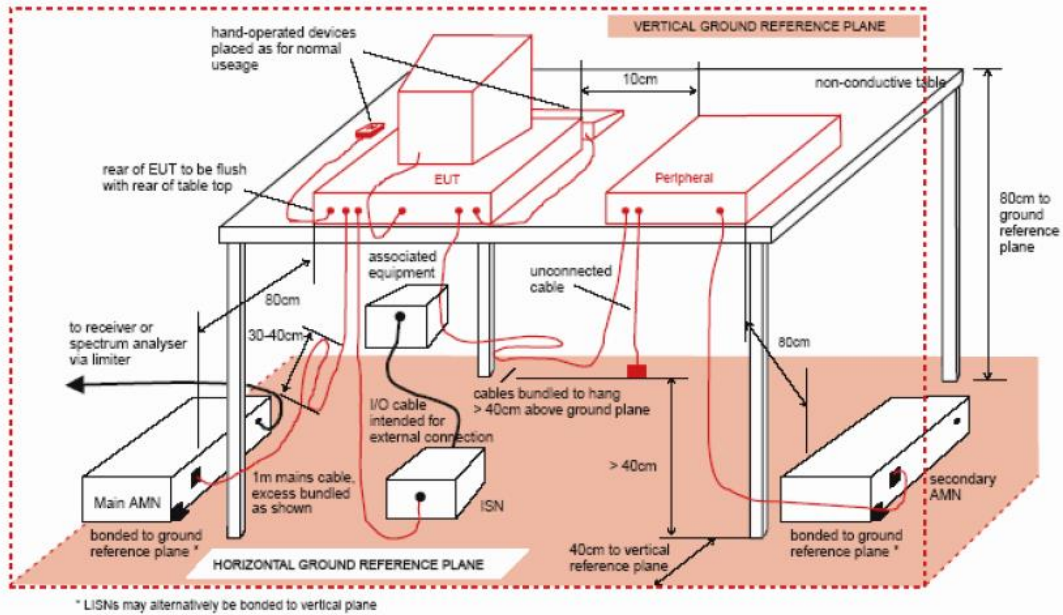


Photo test setup:

Measurement Negative – EN55025 LISN



Measurement Positive – EN55025 LISN



Test Report

EUT Information

EUT Name: OBD WLAN Diagnostic Modul
 Manufacturer: Quantex GmbH
 Typ: ScanDoc compact
 S/N: 06047
 HW Rev: 05/2016 (Modified 2nd sample)
 SW/FW Rev: None
 Operating cond.: Operating with Control-Interface
 Operator: Dipl.-Ing.(FH) Sven Eric Weber
 Test Spec.: EN55022:2010, Class B
 Test Side: LAB
 Supply: DC12V over external power-supply
 Polarisation: None
 Line: DC-Power-Line
 Project: 54412_27052016_ScanDoc compact
 Connected Devices: None
 Comment: None

EMI Auto Test Template: EN55022B Conducted Emissions on Power-Line

Hardware Setup: EN550xx Conducted Emissions on Power Line
 Measurement Type: 4 Line LISN
 Frequency Range: 150 kHz - 30 MHz
 Graphics Level Range: -10 dBµV - 80 dBµV

Preview Measurements:

Scan Test Template: EN550xx Conducted Emission on Power-Line Prescan

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	PK+; AVG	10 kHz	0,01 s	dB

Receiver: [ESPC]

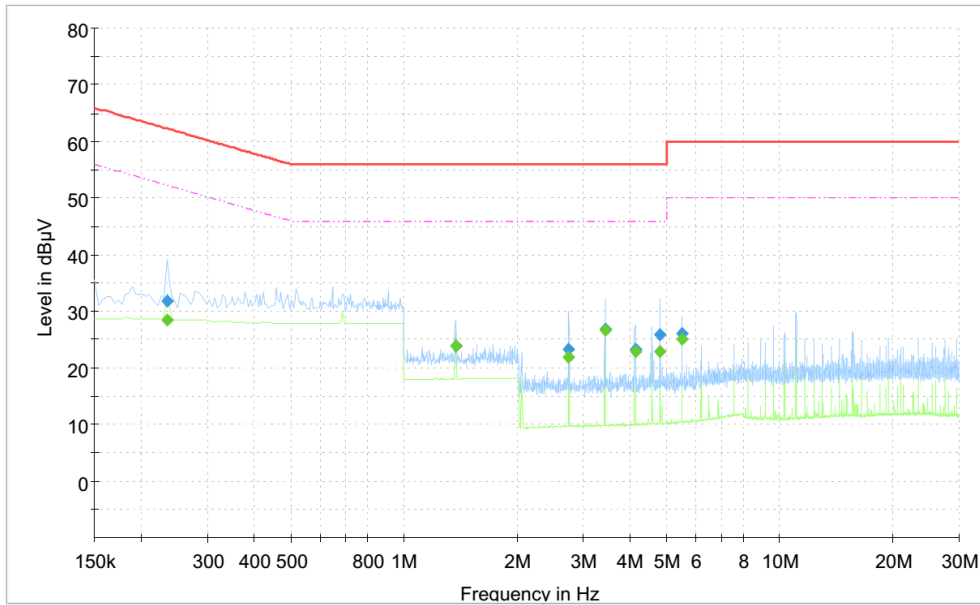
Final Measurements:

Template for Single Meas.: EN550xx Conducted Emission on Power-Line Final

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
150 kHz - 30 MHz	4 kHz	QPK; AVG	10 kHz	10 s	dB

Receiver: [ESPC]

Full Spectrum

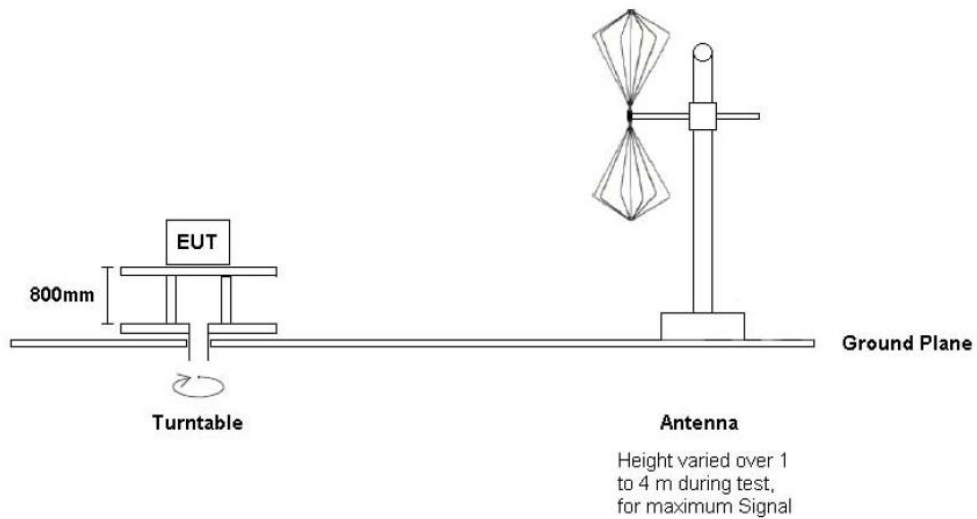


Final Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.234000	31.75	---	62.31	30.56	10000.0	10.000	N	FLO	10.8
0.234000	---	28.39	52.31	23.92	10000.0	10.000	N	FLO	10.8
1.374000	---	23.92	46.00	22.08	10000.0	10.000	L1	FLO	10.5
1.374000	23.99	---	56.00	32.01	10000.0	10.000	L1	FLO	10.5
2.746000	---	21.99	46.00	24.01	10000.0	10.000	L1	FLO	10.5
2.746000	23.22	---	56.00	32.78	10000.0	10.000	L1	FLO	10.5
3.434000	26.93	---	56.00	29.07	10000.0	10.000	L1	FLO	10.6
3.434000	---	26.75	46.00	19.25	10000.0	10.000	L1	FLO	10.6
4.122000	---	22.91	46.00	23.09	10000.0	10.000	N	FLO	10.5
4.122000	23.32	---	56.00	32.68	10000.0	10.000	N	FLO	10.5
4.810000	---	22.83	46.00	23.17	10000.0	10.000	N	FLO	10.5
4.810000	25.85	---	56.00	30.15	10000.0	10.000	N	FLO	10.5
5.494000	---	25.12	50.00	24.88	10000.0	10.000	N	FLO	10.6
5.494000	26.03	---	60.00	33.97	10000.0	10.000	N	FLO	10.6

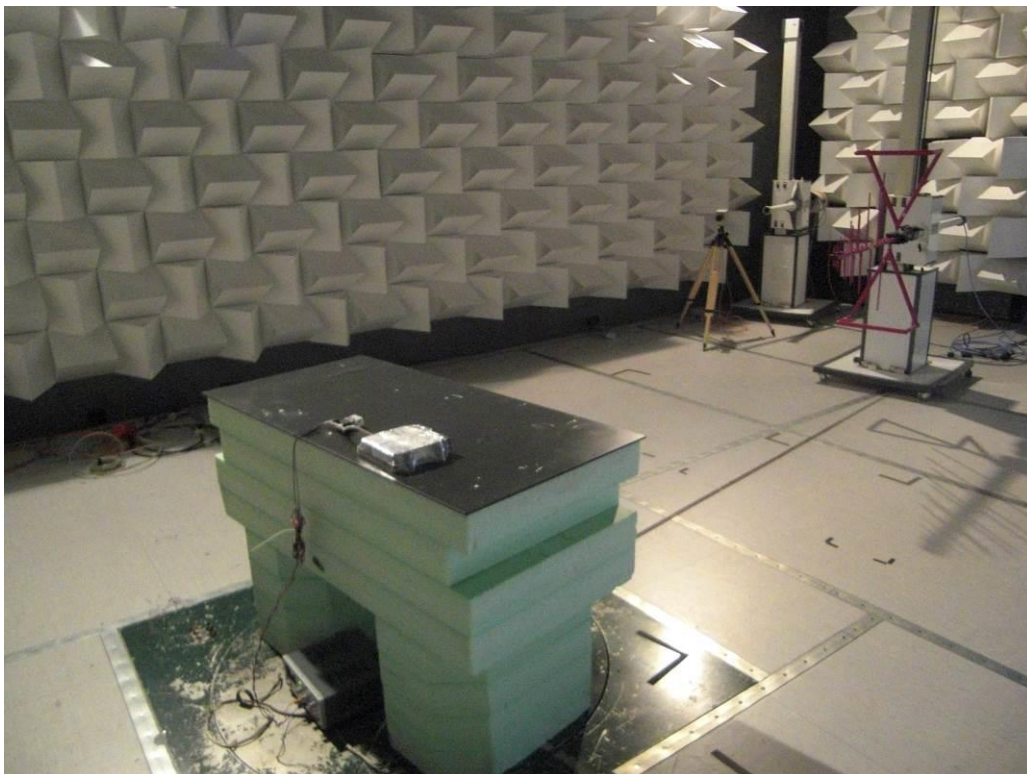
4.2. Test setup and results field strength

4.2.1. Frequency range 30MHz to 1GHz



Distance: 3m

Photo test setup:



Test Report

EUT Information

EUT Name: OBD WLAN Diagnostic Modul
 Manufacturer: Quantex GmbH
 Typ: ScanDoc compact
 S/N: 06002
 HW.-Rev: 04/2016
 SW/FW Rev: None
 Operating cond.: Operating with Control-Interface
 Operator: Dipl. -Ing. (FH) Sven Eric Weber
 Test Spec.: EN55022:2010, Class B
 Test Side: SAC 1
 Supply: DC12V over external power-supply
 Polarisation: Vertical/Horizontal
 Project No.: 54112_18042016_ScanDoc compact
 Connected Devices: VAG Control Interface (L DOHC, 01 Engine)
 Comment: With communications

EMI Auto Test Template: EN55022B (30M-1000M)

Hardware Setup: ElectricField Strength VULB
 Measurement Type: Open-Area-Test-Site
 Frequency Range: 30 MHz - 1 GHz
 Graphics Level Range: 0 dBµV/m - 80 dBµV/m

Preview Measurements:
 Graphics Display: Show separate traces for horizontal and vertical polarization
 Scan Test Template: Prescan Field Strength VULB

Data Reduction:
 Limit Line #1: EN 55022B Electric Field Strength 3 m QP
 Peak Search: 6 dB , Maximum Results: 15
 Subrange Maxima: 14 Subranges , Maxima per Subrange: 1
 Acceptance Offset: -10 dB
 Maximum Number of Results: 15
 After Data Reduction: Interactive data reduction

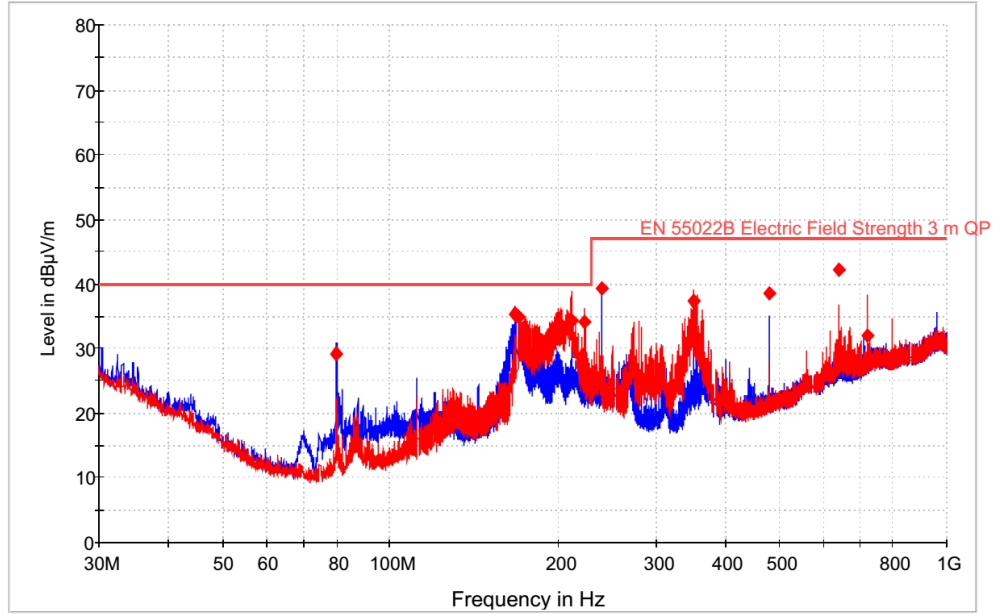
Maximization Measurements:
 Template for Single Meas.: Max Field Strength VULB

Adjustment:
 Template for Single Meas.: Max Field Strength VULB

Final Measurements:
 Template for Single Meas.: Final Field Strength VULB

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
30 MHz - 1 GHz	40 kHz	QPK	120 kHz	10 s	20 dB

EN55022B (30M-1000M)



— EN 55022B Electric Field Strength 3 m QP — Preview Result 1V-PK+
 — Preview Result 1H-PK+ ◆ Final Result 1-QPK

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
79.980000	29.3	10000.0	120.000	118.0	V	11.0	8.9	10.7	40.0	
168.060000	35.3	10000.0	120.000	100.0	V	2.0	12.5	4.7	40.0	
169.500000	35.0	10000.0	120.000	100.0	V	146.0	12.4	5.0	40.0	
200.430000	32.0	10000.0	120.000	199.0	H	48.0	12.0	8.0	40.0	
211.620000	34.4	10000.0	120.000	132.0	H	34.0	12.7	5.6	40.0	
224.010000	34.2	10000.0	120.000	117.0	H	11.0	13.6	5.8	40.0	
240.000000	39.3	10000.0	120.000	118.0	V	214.0	13.1	7.7	47.0	
351.000000	37.3	10000.0	120.000	100.0	H	2.0	15.5	9.7	47.0	
480.000000	38.6	10000.0	120.000	172.0	H	227.0	18.4	8.4	47.0	
639.990000	42.3	10000.0	120.000	132.0	H	138.0	21.9	4.7	47.0	
720.000000	32.0	10000.0	120.000	100.0	H	56.0	22.8	15.0	47.0	

4.2.2. Frequency range 1GHz to 6GHz

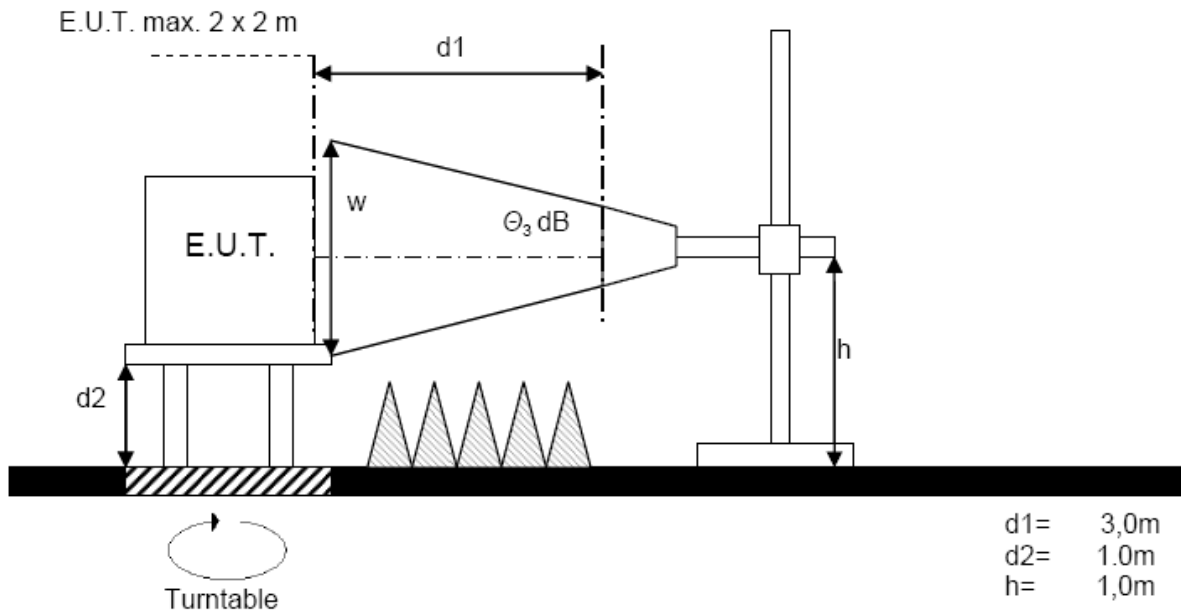
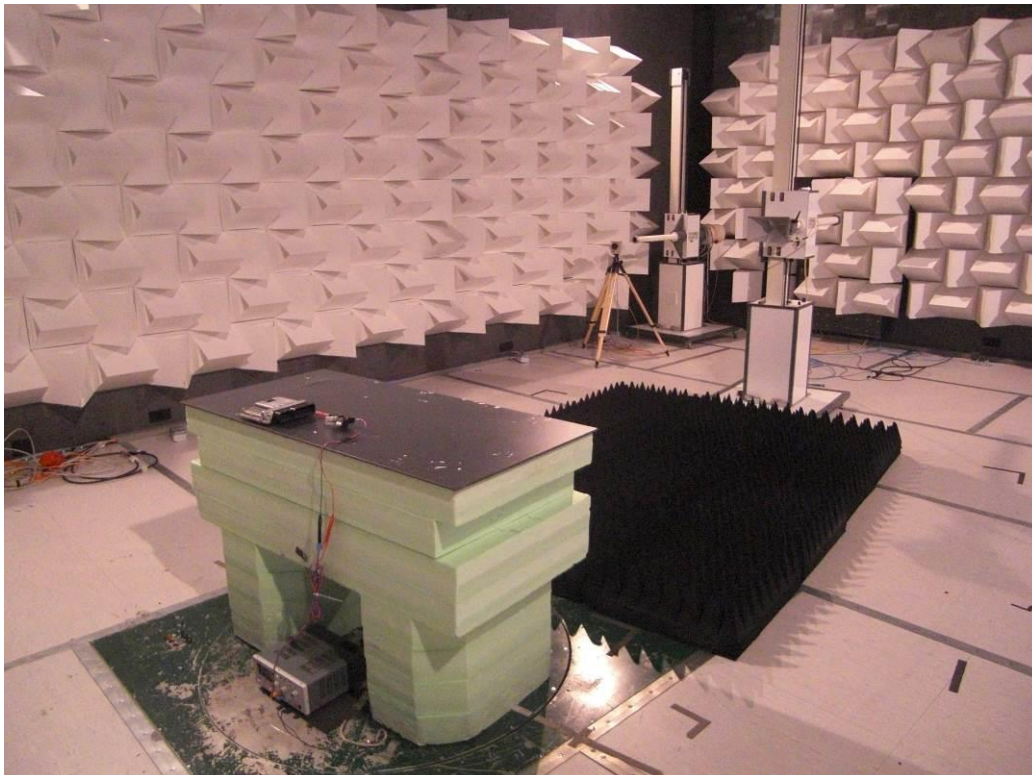


Photo test setup



Test Report

EUT Information

EUT Name: OBD WLAN Diagnostic Modul
 Manufacturer: Quantex GmbH
 Typ: ScanDoc compact
 S/N: 06002
 HW.-Rev.: 04/2016
 SW/FW Rev.: None
 Operating cond.: Operating with Control-Interface
 Operator: Dipl.-Ing. (FH) Sven Eric Weber
 Test Spec.: EN55022:2010, Class B
 Test Side: SAC 1
 Supply: DC12V over external power-supply
 Polarisation: Vertical/Horizontal
 Project No.: 54112_18042016_ScanDoc compact
 Connected Devices: VAG Control Interface (L DOHC, 01 Engine)
 Comment: With communications

EMI Auto Test Template: EN55022B (1G-6G)

Hardware Setup: ElectricField Strength BBHA 9120D
 Measurement Type: Open-Area-Test-Site
 Frequency Range: 1 GHz - 6 GHz
 Graphics Level Range: 0 dBµV/m - 80 dBµV/m

Preview Measurements:
 Graphics Display: Show separate traces for horizontal and vertical polarization
 Scan Test Template: Prescan Field Strength BBHA

Data Reduction:
 Limit Line #1: EN 55022B Electric Field Strength 3 m PK
 Limit Line #2: EN 55022B Electric Field Strength 3 m AV
 Peak Search: 6 dB , Maximum Results: 1
 Subrange Maxima: 40 Subranges , Maxima per Subrange: 1
 Acceptance Offset: -20 dB
 Maximum Number of Results: 15
 After Data Reduction: Interactive data reduction
 Before the Final Meas.: Interactive data reduction

Maximization Measurements:
 Template for Single Meas.: Prescan Field Strength BBHA

Adjustment:
 Template for Single Meas.: Prescan Field Strength BBHA

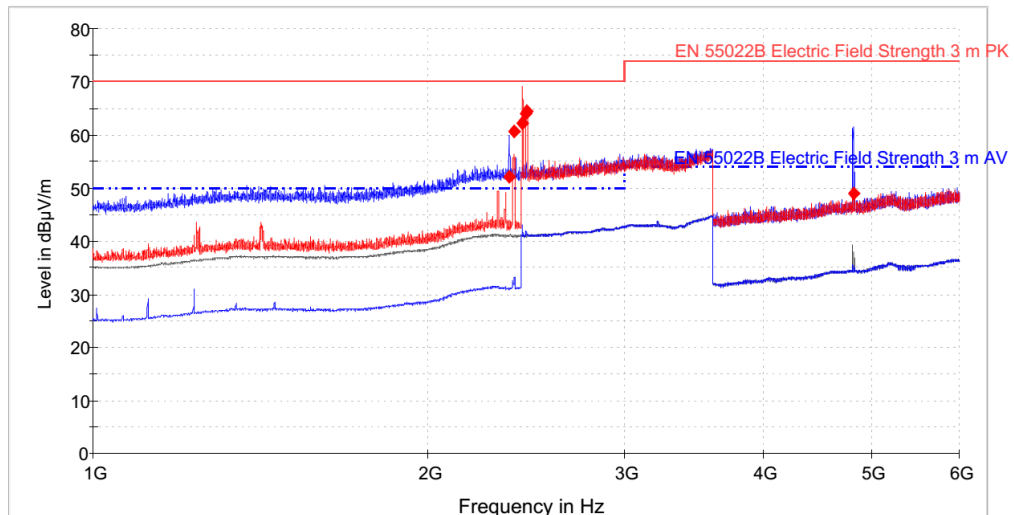
Final Measurements:
 Template for Single Meas.: Final Field Strength BBHA

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
1 GHz - 18 GHz	400 kHz	PK+; CAV	1 MHz	10 s	30 dB

Receiver: [ESU 26]

Report Settings:
 Report Template: SGS Auto Test Report

EN55022B (1G-6G)



- EN 55022B Electric Field Strength 3 m PK
- EN 55022B Electric Field Strength 3 m AV
- Preview Result 1V-PK+
- Preview Result 2V-AVG
- Preview Result 1H-PK+
- Preview Result 2H-AVG
- ◆ Final Result 1-PK+

Final Result 1

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
2365.750000	52.2	10000.0	1000.000	129.0	V	219.0	31.2	17.8	70.0	
2388.000000	60.6	10000.0	1000.000	129.0	V	70.0	31.2	9.4	70.0	
2428.000000	62.3	10000.0	1000.000	124.0	V	3.0	31.2	7.7	70.0	
2446.500000	64.0	10000.0	1000.000	124.0	H	138.0	31.2	6.0	70.0	
2452.250000	64.5	10000.0	1000.000	129.0	H	263.0	31.2	5.5	70.0	
4817.750000	48.9	10000.0	1000.000	115.0	H	84.0	36.7	25.1	74.0	

Remark:

The transmission frequency of WLAN (IEEE802.11) 2,4GHz is excluded from the measurements according EN55022:2010.

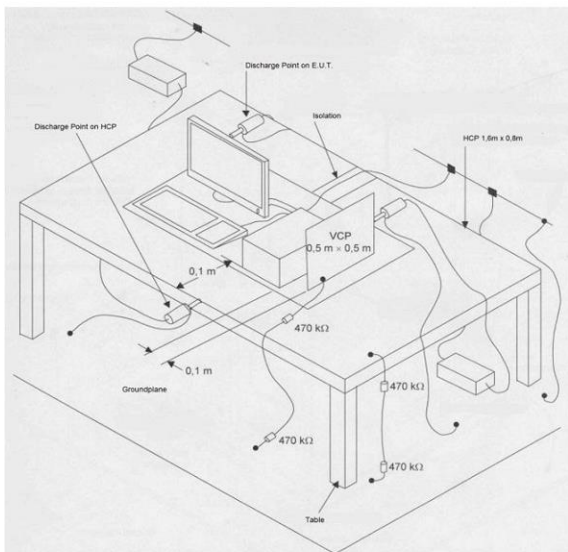
5. Test results Immunity

5.1. Test setup and results electrostatic discharge

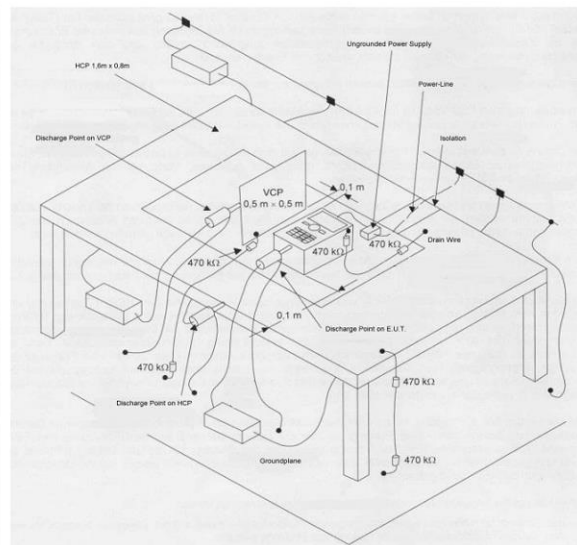
EN61000-4-2 (ESD) Test-setup

Tabletop and Floor-mounted Testdive

1. Schematic set-up for Tabletop-mounted devices

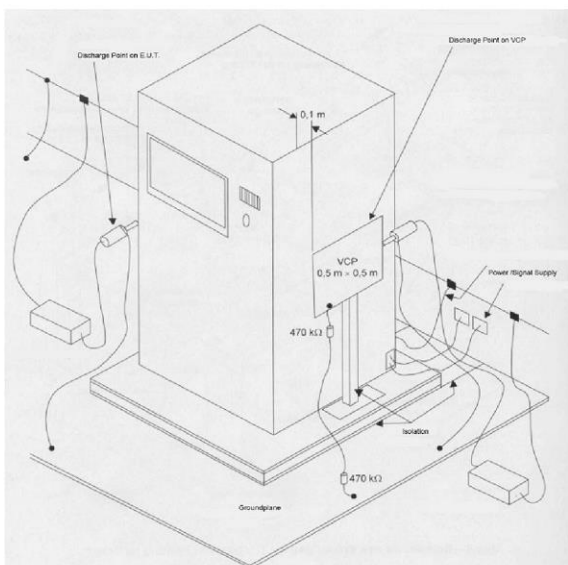


Grounded E.U.T.

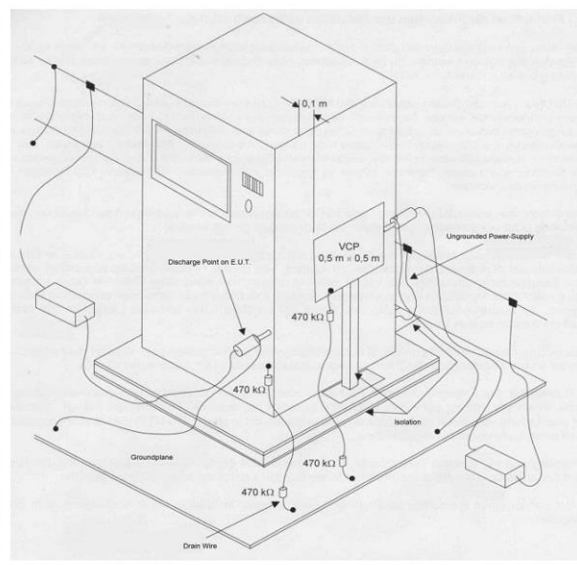


Ungrounded E.U.T. with Drain wire

2. Schematic set-up for Floor-mounted devices

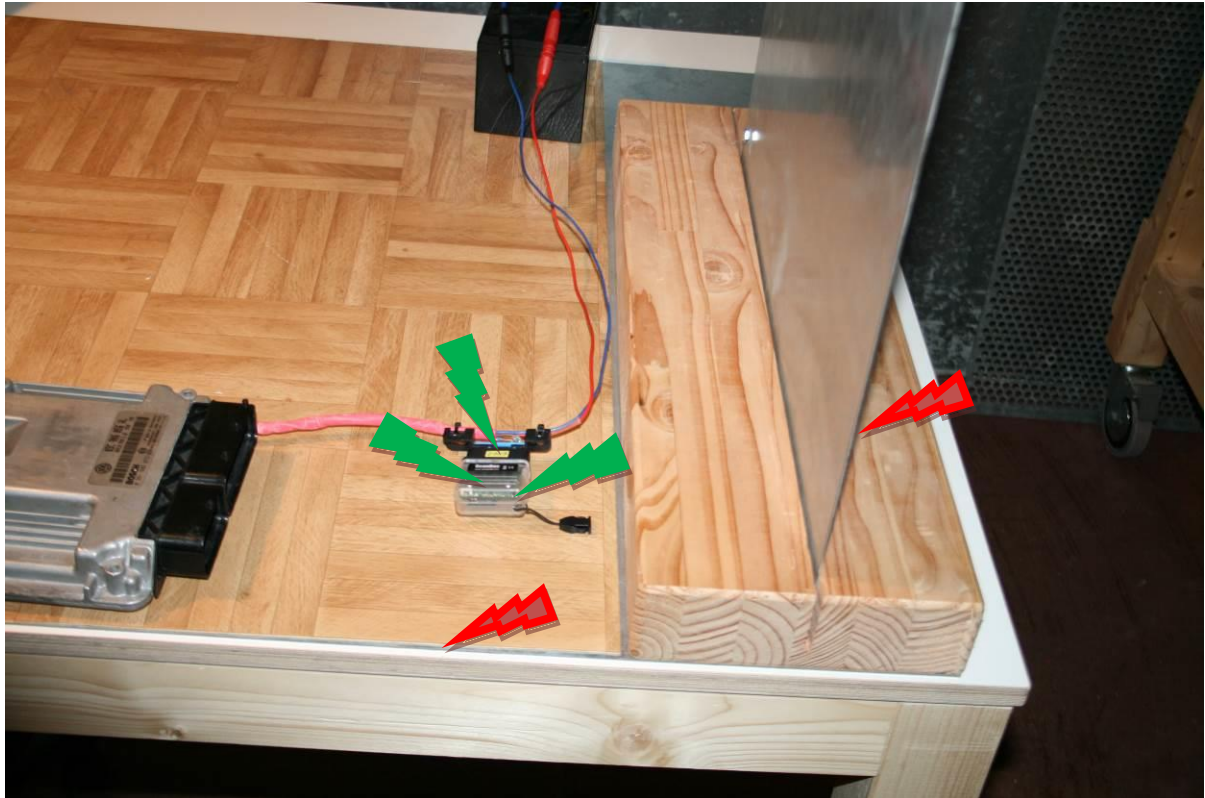


Grounded E.U.T.



Ungrounded E.U.T. with Drain wire

Photo discharging points



Contact discharge (CD)



Air discharge (AD)

E. u. T.: OB D Diagnostic Modul
 Type: ScanDoc Compact
 Applicant: Quantex GmbH
 Requirements: EN 61000-4-2
 EN 55024
 EN 301489-1
 Tested modes: Diagnostic-Mode with VAG L DOHC 01 Engine

Test parameter	Required	Tested
Shape of impulse	1/30 ns	1/30 ns
Amplitude	4kV CD / 8kV AD	4kV CD / 8kV AD
Polarity/ Time	+/-/per 1s	+/-/per 1s
Number	25 CD (min. 200 discharges) 10 AD	25 CD (min. 200 discharges) 10 AD
Kind of discharge (contact/air)	CD/AD	CD/AD

Discharge points: Indirect via HCP/VCP
 Air discharge on E.U.T. see picture

TEST RESULT:

Contact discharge: Passed (Class "A")
 No degradation of performance

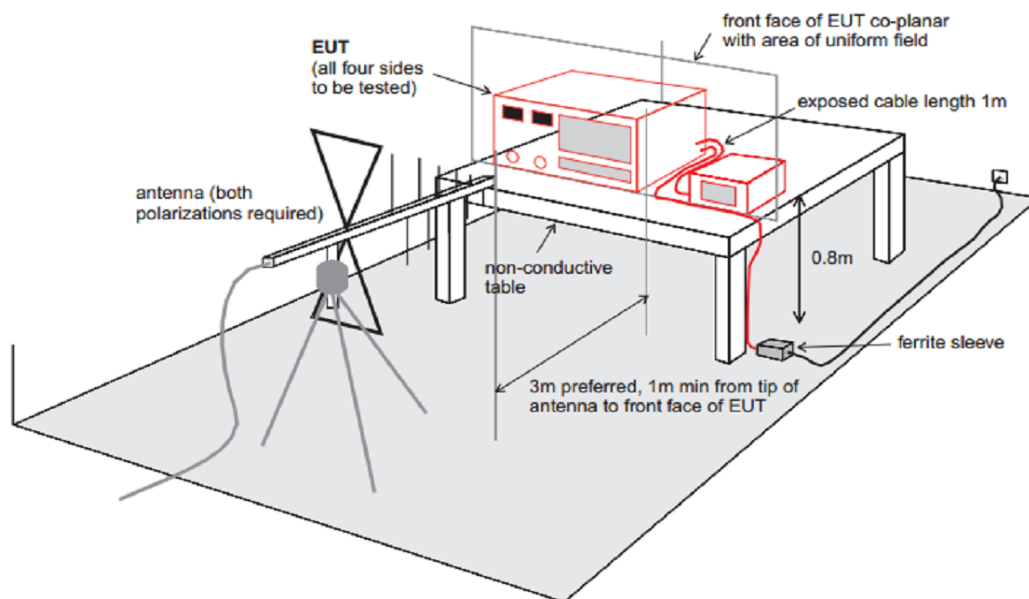
Air discharge: Passed (Class "A")
 No degradation of performance

5.2. Test setup and results electromagnetic Rf-fields

EN61000-4-3 (RF-Fields Immunity) Test-setup

Frequency-range 26MHz - 6000MHz

1. General Test-Setup



2. General Equipment Configuration

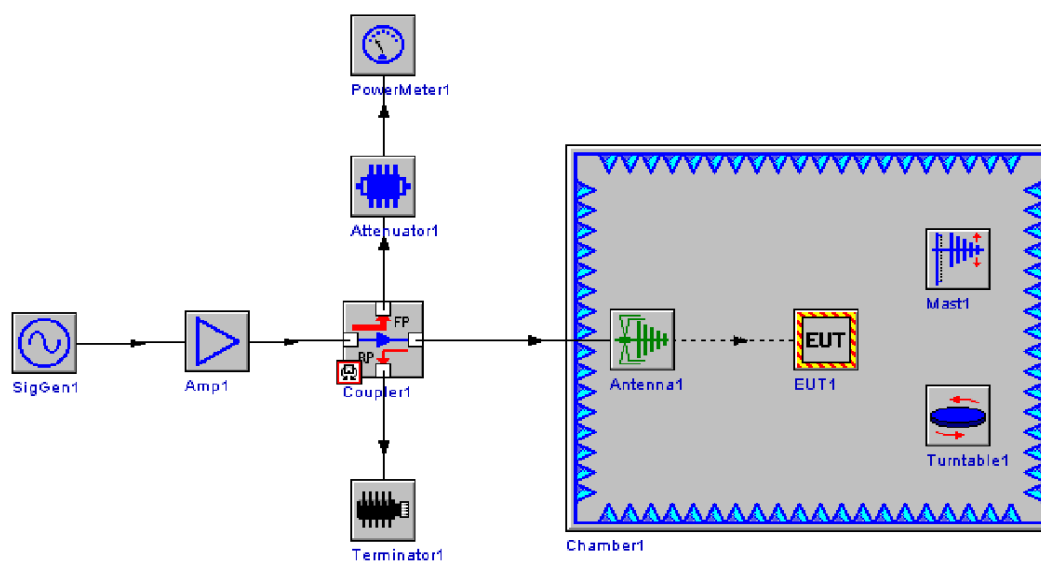


Photo test setup 80MHz to 2700 MHz



E. u. T.: OBD Diagnostic Modul
 Type: ScanDoc Compact
 Applicant: Quantex GmbH
 Standards/ Requirements: EN 61000-4-3
 EN 55024
 EN 301489-1
 Tested modes: Diagnostic-Mode with VAG L DOHC 01 Engine

Test parameter	Required	Tested
Frequency range	80-1000MHz 1400-2700MHz	80-1000MHz 1400-2700MHz
Amplitude	3V/m	3V/m
Modulation	AM, 1kHz/80%	AM, 1kHz/80%
Frequency step	1%/2s	1%/2s
Distance (EUT – Antenna)	1 to 3 meter	1,5 meter

Side: Front-Side

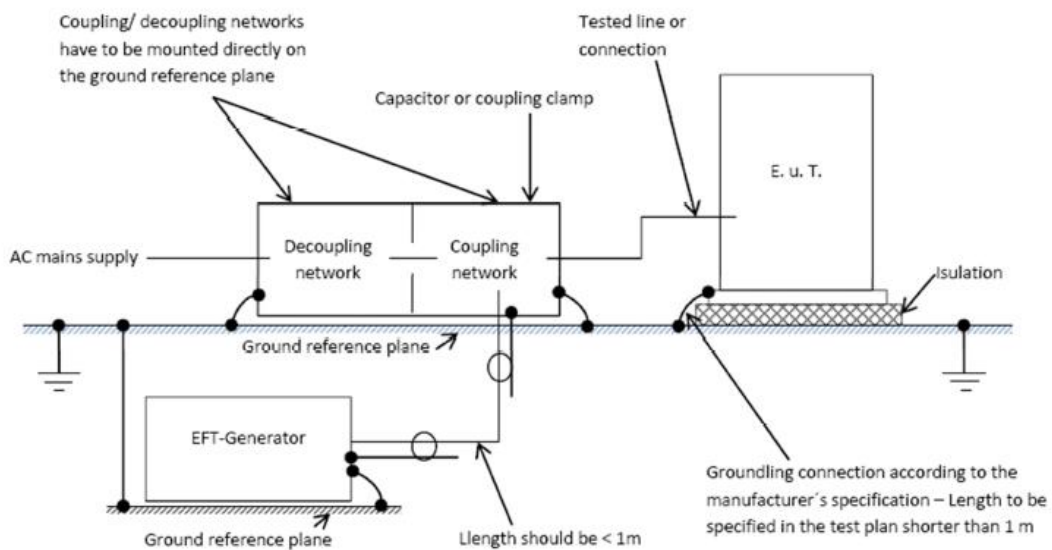
TEST RESULT: **Passed** (Class A)
 No degradation of any performance

5.3. Test setup and results fast transients (Burst)

EN61000-4-4 (Fast Transients) Test-setup

Coupling network / Coupling clamp

1. Schematic set-up for immunity using coupling/ decoupling networks



2. General principle of a test set-up using a capacitive coupling clamp

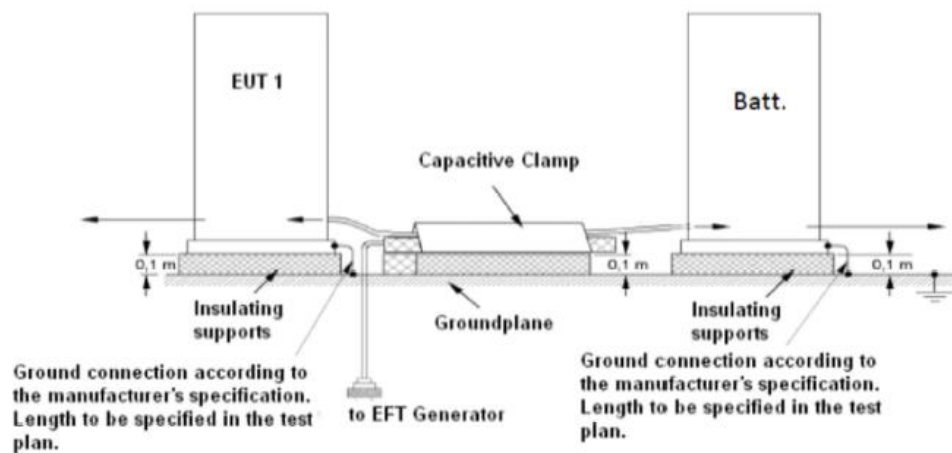
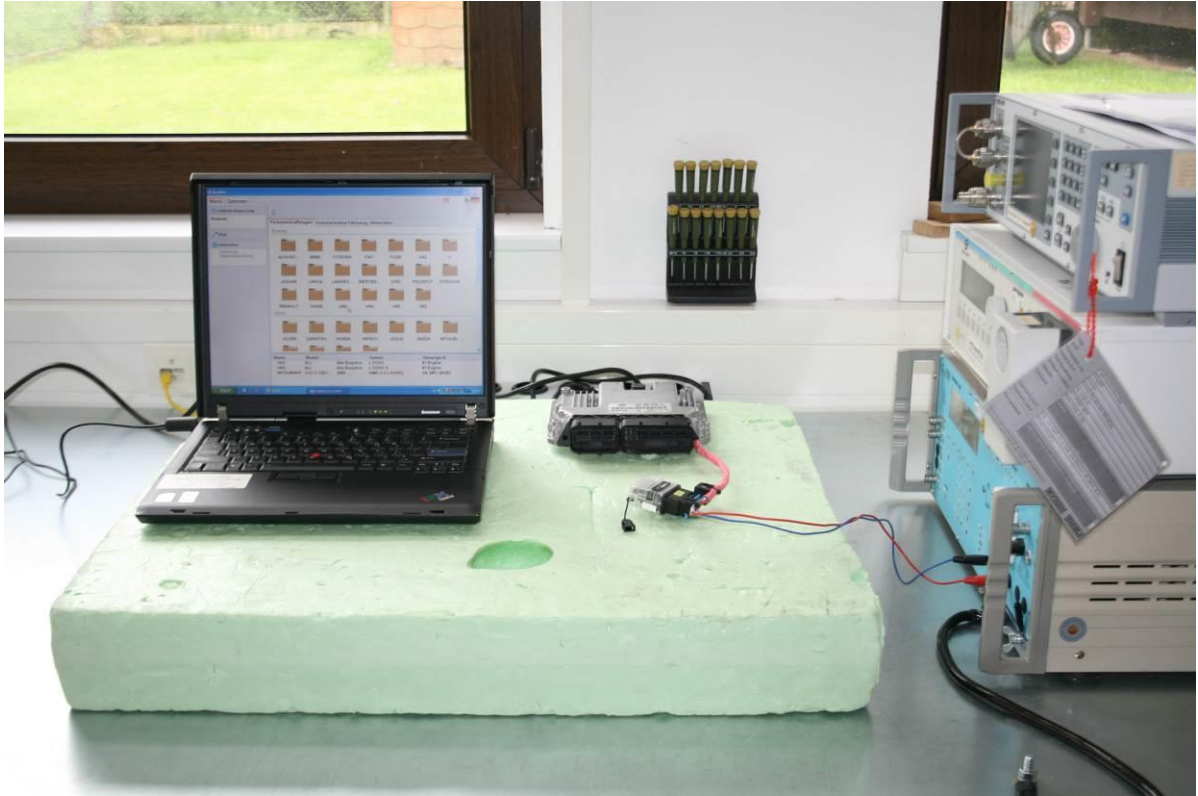


Photo test setup

Coupling to DC line- direct injection



E. u. T.: OB D Diagnostic Modul
 Type: ScanDoc Compact
 Applicant: Quantex GmbH
 Standards/ Requirements: EN 61000-4-4
 EN 55024
 EN 301489-1
 Tested modes: Diagnostic-Mode with VAG L DOHC 01 Engine

Test parameter	Required	Tested
Impulse form	5/50ns	5/50ns
Test amplitude	0,5kV	0,5kV
Polarity	+/-	+/-
Coupling	direct, clamp	direct
Duration	each 1 min.	each 1 min.
Rep. Rate	100kHz	100kHz

Tested Lines: DC-Line with 0,5kV – Direct coupling

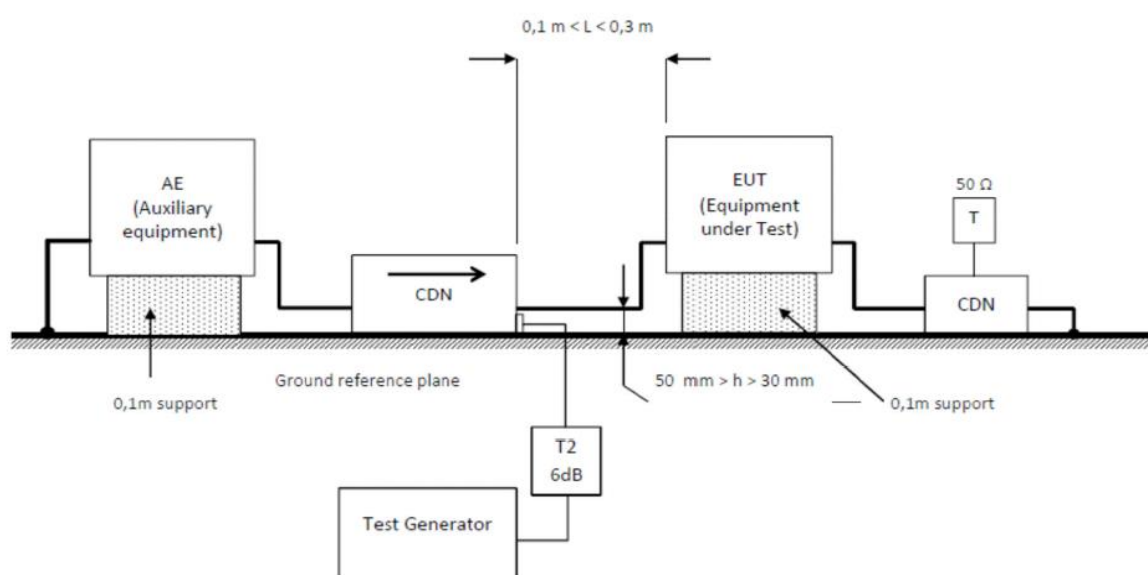
TEST RESULT: **Passed** (Class A)
 No degradation of any performance

5.4. Test setup and results conducted RF-disturbance

EN61000-4-6 (HF-disturbances) Test-setup

Coupling network / Injection clamp

1. Schematic set-up for immunity using coupling/ decoupling networks



2. General principle of a test set-up using injection clamps

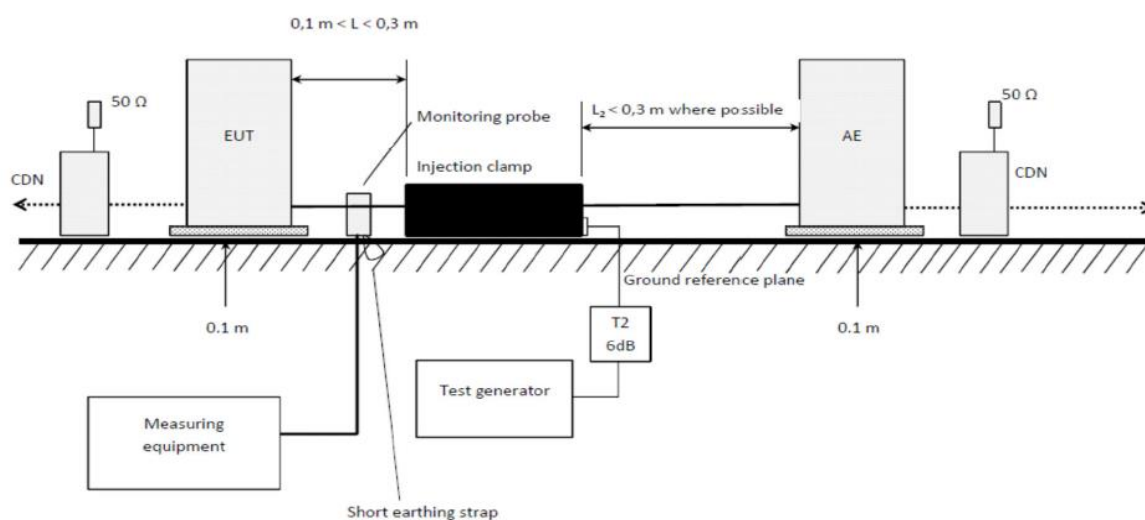


Photo test setup

Coupling supply-lines with CDN-M2



Test Report

EUT Information

Description:

EUT Name:	OBD Diagnostic Scanner
Manufacturer:	Qunatex GmbH.
Typ:	Scan Doc Compact
S/N:	06002
HW Rev:	04/2016 (Modified)
SW/FW Rev:	None
Operating cond.:	Live Analysis VAG L DOHC 01 Engine
Operator:	SEW
Test Spec.:	EN61000-4-6:2016
Connected Line	DC-Power-Line (CDN-M2)
Supply:	DC12V over external power supply
Ambient cond.	Temp: 20C° ; Humidity: 1020hPa ; Pressure: 50%
Project No.:	54412_18042016_ScanDoc Compact
Comment:	None
Result File Name:	DC-Power.res

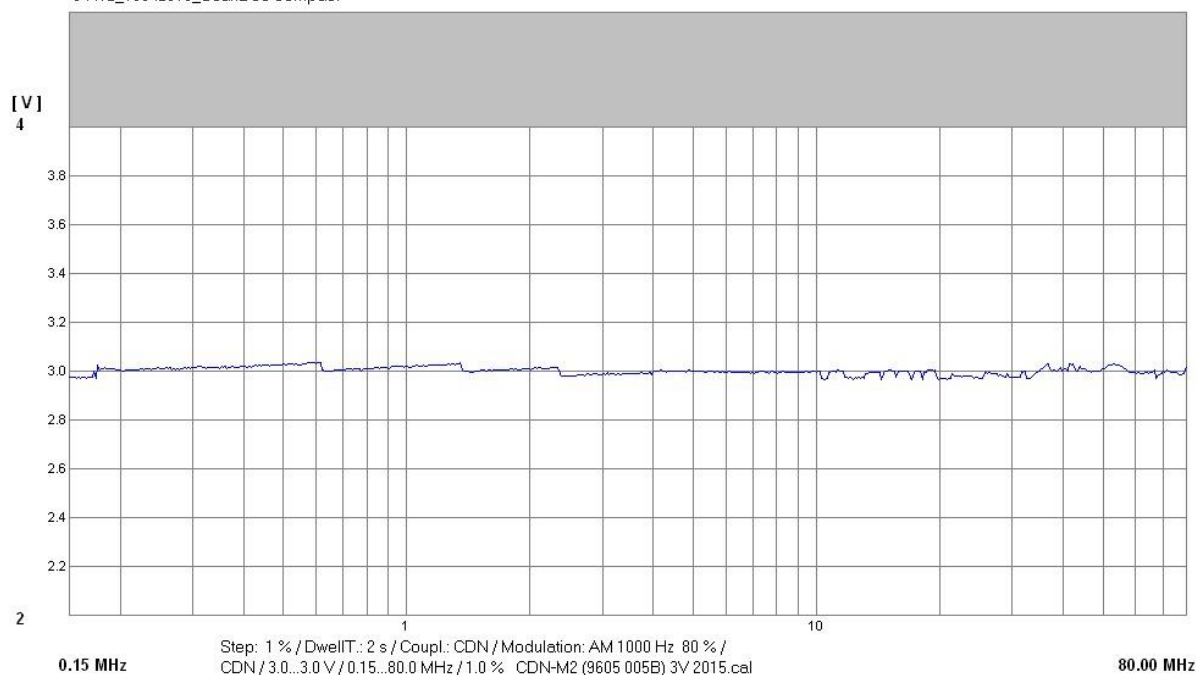
Setup: Conducted Disturbances

Hardware Setup: NSG 4070 - CDN / EM-CLAMP / CIP

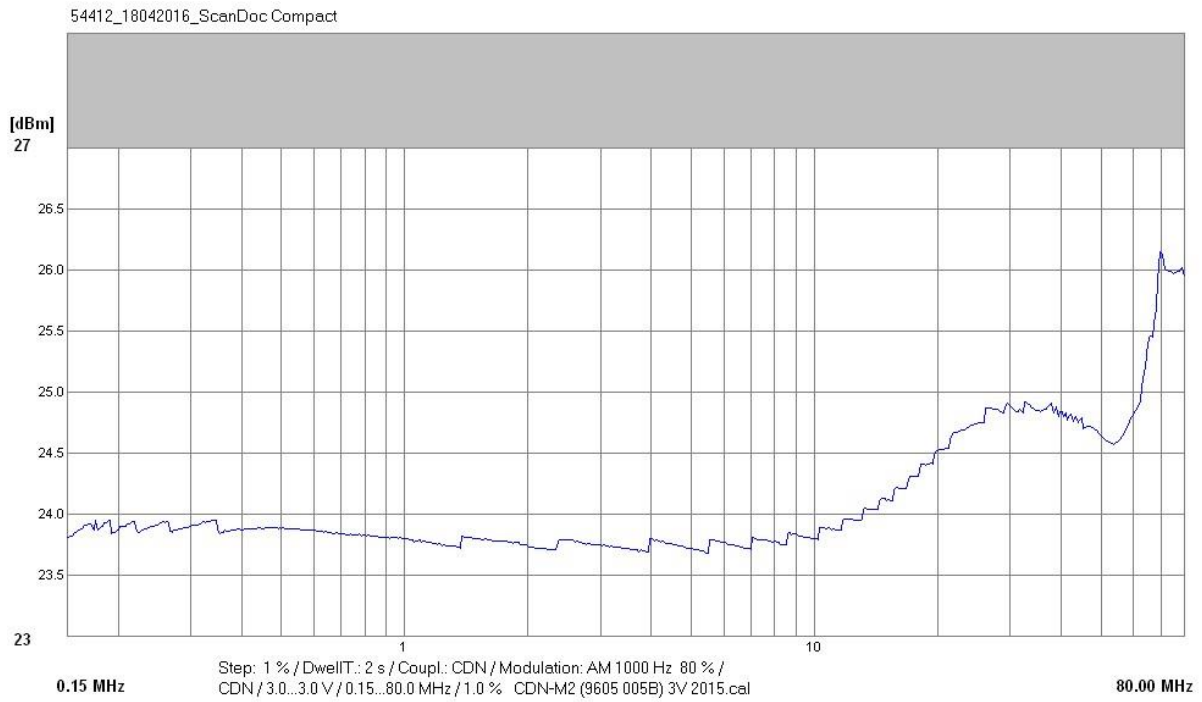
Subrange	Test Level	Freq. Step	Dwell Time	Coupling Device
0.15 - 80 MHz	3...3 V	1 %	2.000 ms	CDN
Modulation	Amplifier int./-ext.	Nr. of Steps		
AM 1000 Hz 80 %	internal	633		

Test Level

54412_18042016_ScanDoc Compact



Forward Power



TEST RESULT:

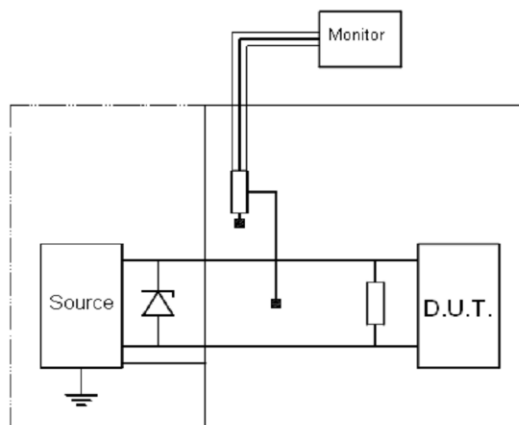
Passed (Class A)
 No degradation of any performance

5.5. Test setup and results voltage transients in vehicular environment

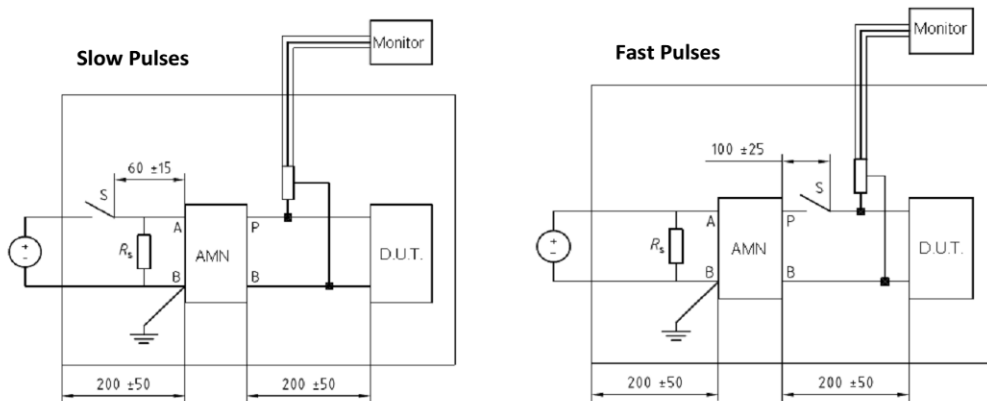
ISO7637-2 Electrical disturbance

Conduction and coupling along supply lines

1. Transient immunity test-setup (Pulse injection)



2. Transient emission test-setup (Slow and Fast Pulses)

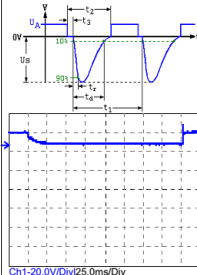
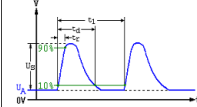
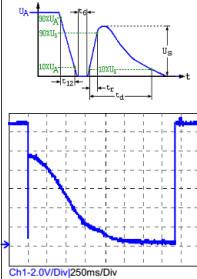


Spitzenberger & Spies
Viechtach

Tester: SEW
EMC-Laboratory
SGS-TÜV Saarland Forster
Specimen: ISO7637-2
OBD Diagnostic Scanner
Quantex Lab
DOS version: 03/2016
Date: 25.04.2016

Test date: 25.04.2016
Scan Doc Compact
54412_18042016_ScanDoc Co
Info: 06002
12V
None
None

Nominal voltage: 12.00 Volt
Shunt resistor Rs: no shunt
Executed test: ETSI EN301489-1 - DC12V
Test description: KFZ-Komponenten, Vollprüfung, Funk

Pulse	U_Puls	Ri	Test parameters	Pulses Time	Delay	Figure
ISO 7637-2 (2008) AMD1 - Pulse 1	-	10.00 Ohm	Us = -75.0V, tr = 1.0us, td = 2.0ms, t1 = 2.5s, t2 = 200.0ms	10 P.	0.0 s	
ISO 7637-2 (2008) AMD1 - Pulse 2A	-	2.00 Ohm	Us = 37.5V, td = 50.0us, t1 = 3.0s	10 P.	0.0 s	 No oscilloscope screenshot available for this pulse
ISO 7637-2 (2008) AMD1 - Pulse 2B	-	0.0 Ohm	Us = 10.0V, td = 1.0s	10 P.	60.0 s	

Spitzenberger & Spies
 Viechtach

Pulse	U_Puls	Ri	Test parameters	Pulses Time	Delay	Figure
ISO 7637-2 (2008) AMD1 - Pulse 4	-	0.0 Ohm	Ua = -4.0V, Us = -6.0V, t7 = 30.0ms, t8 = 30.0ms, t9 = 10.0s, t10 = 5.0ms, t11 = 50.0ms	10 P.	60.0 s	<p>Ch1-2.0V/Div/2.50s/Div</p>
ISO 7637-2 (2008) AMD1 - Pulse 3A	-	50.00 Ohm	Us = -112.2V, t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms	20.0 min	0.0 s	<p>Ch1-100.0V/Div/25.0ms/Div</p>
ISO 7637-2 (2008) AMD1 - Pulse 3B	-	50.00 Ohm	Us = 75.9V, t1 = 100.0us, t4 = 10.0ms, t5 = 90.0ms	20.0 min	0.0 s	<p>Ch1-50.0V/Div/25.0ms/Div</p>

Comment: Passed

6. List of test instruments

Conducted Emissions on power line and Click Rate

INV #	Test equipment	Type	Manufacturer	S/N #
#A5	LISN	ESH 2-Z5	Rohde & Schwarz	844006/0023
#A19	RF-Coaxial-Cable	BNC-BNC/ 5m	Huber & Suhner	001
#A20	RF-Coaxial-Cable	BNC-BNC/ 2m	Huber & Suhner	001
#A95	Impulse limiter	ESH3-Z2	Rohde & Schwarz	357.8810.52
#A189	RF-Coaxial-Cable	N-N/ 10m	Alexander Meier	22166
#A236	EMI Test Receiver	ESR7	Rohde & Schwarz	101272
#A250	10dB Attenuator	LFP-50	Trilithic	None
#S001	Software	EMC32/ V9.26.01	Rohde & Schwarz	None
#S003	Software	ClickRate / V2.3.1	Rohde & Schwarz	None

Electric Field Strength (30MHz to 18GHz)

INV #	Test equipment	Type	Manufacturer	S/N #
#A10	Antenna Mast	HD	Deisel	None
#A12	Turntable	DS 420	Deisel	None
#A13	Controller	MCU	Maturo GmbH	1131108
#M27-1	RF-Coaxial-Cable	Sucoflex 106	Pasternack Enterprises	PE302-72 1306
#A83	EMI Test Receiver	ESU26	Rohde & Schwarz	100325
#A99	RF-Coaxial-Cable	Sucoflex 106	Sucoflex	MFR65474
#A100	RF-Coaxial-Cable	Sucoflex 106	Sucoflex	MFR65474
#A138	Horn Antenna	BBHA9120D	Schwarzbeck	9120D-374
#A254	RF-Coaxial-Cable	Sucoflex 106	RUPPtronic	32051-29080-29080-10M
#A260	BiLog Antenna	CBL 6141B	Teseq	27414
#S002	Software	EMC32/ V8.54.00	Rohde & Schwarz	None

Electrostatic discharge

INV #	Test equipment	Type	Manufacturer	S/N #
#A27	ESD Resistors	HTE 102	Powertron	Keine

#A40	Coupling Plate	VCP	Eigen	Keine
#A164	ESD Generator	SESD30000	Schlöder	507146

Electromagnetic RF-Field 80MHz – 6GHz (SAC)

INV #	Test equipment	Type	Manufacturer	S/N #
#A10	Antenna Mast	HD	Deisel	None
#A12	Turntable	DS420	Deisel	None
#A13	Controller	MCU	Maturo GmbH	1131108
#A37	Electrical Field Probe	EMC 300	NARDA	W-0032/ C0013
#A52	Bidirectional Coupler	3020A	NARDA	36045
#A55	Horn Antenna	AT 4510	Amplifier Research	28921
#A103	CCD- Camera	Pontis Imago	Pontis	1
#A126	Attenuator	24-20-34	Weinschel	BZ8505
#A138	Horn Antenna	BBHA9120D	Schwarzbeck	9120D-374
#A144	Power Amplifier	AS0825-20L	MILMEGA	1005708
#A149	Power Amplifier	UX55	Prâna	1211-1270
#A177	Attenuator	20dB-10W	Schaffner	001-002
#A186	Power Amplifier	AR1000M7A	Amplifier Research	23666
#A217	Bidirectional Coupler	3022	NARDA	50171
#A218	Bidirectional Coupler	3004-20	NARDA	3086
#A220	Signal Generator	SMR20	Rohde & Schwarz	834671/004
#A221	Power Meter	4231A-30	Boonton	40101
#A221-1	Power Sensor + Sensor Data Adapter	51013-4E	Boonton	20984
#A249	Stacked Double Log- Per Antenna	STLP9128D	Schwarzbeck	9128D0093
#A259	Power Amplifier	AS0840-100/100	Millmega	995833
#S004	Software	Compliance 5I/ V5.26.48	Teseq	None

Burst (5kHz, 100kHz)

INV #	Test equipment	Type	Manufacturer	S/N #
#A24	Immunity Test System	UCS500	EM-Test	A446801
#A30	1-phase coupling-network	CNI	EM- Test	None
#A61	Cap. Coupling Clamp	HFK	EM- Test	None
#A62	Cap. Coupling Clamp	TRA2000 CC	H + H	None
#A170	Cap. Coupling Clamp	HFK	EM- Test	1
#A198	Burst Generator	TRA2000	H + H	665

Conducted RF Disturbance (150kHz – 230MHz)

INV #	Test equipment	Type	Manufacturer	S/N #
#A26	Immunity Test System	NSG4070	TESEQ	24433
#A28	Attenuator	ATT6/75W	EM- Test	0206-23
#A29	Coupling Network	CDN-M2	EM- Test	9605005B
#A31	Coupling Network	CDN-AF4	EM- Test	9607009B
#A32	Coupling Clamp	EM101	EM- Test	35352
#A33	Attenuator	ATT6/75	EM- Test	9606009A
#A41	R.F. current probe	6741-1	Solar Electronics	839708
#A53	Current Probe – Clamp-on	CIP9136	Schaffner	22452
#A63	Coupling Network	CDN-M1	Schlöder	A3001029
#A84	Coupling Network	CDN-M3	Fiedler	06K003
#S005	Software	NSG 4070/ V1.2.0 B5	TESEQ	None

Pulses and Transients

INV #	Test equipment	Type	Manufacturer	S/N #
#A22	EMV E5000/PAS/KFZ System	PAS5000	Spitzenberger & Spies	AA446801
#A49	100:1 Divider	KW/50	EM-Test	0804-33
#A50-1/-2	Vehicle-LISN	NNBM8125	Schwarzbeck	1169+1170
#A60	Coupling clamp	ACC	EMTest	1201-02
#A163	Car Tester	Car-Tester 1	Hilo Test	20053112
#A165	Digital Storage Oscilloscope	TDS3052	Tektronix	B018118
#A233	Temperature Cabinet	VT4002	Vötsch	58566095270010
#A261	Electronic Car Switch	CAR TE14	HILLO Test	1504087
#S006	Software	SPS_KFZ/ 2.3.2	Spitzenberger & Spies	None

7. Measurement uncertainty

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Berechnung der Messunsicherheiten nach GUM					
Übersicht der Messverfahren für Störaussendungen und Störfestigkeit (CE)					
Störaussendungen/Emission:	Prüfung	Norm	Details	Betrag	Bemerkung
Messung der Störspannung		CISPR16/11/22	9kHz-150MHz (Band A) 150kHz-30MHz (Band B)	3,49dB 3,33dB	Netznachbildung ESH3-2Z5 + ESR Netznachbildung ESH3-2Z5 + ESR
Messung der Störleistung		CISPR16/13/14	30MHz-300MHz (Band C)	4,37dB	MDS21 + ESR
Messung auf TK-Port (Stromzange)		CISPR22	150kHz-30MHz (Band B)	2,74dB	9123-1N + ESR
Messung auf TK-Port (ISN)		CISPR22	150kHz-30MHz (Band B)	4,00dB	ISN+ESR
Messung der Störfeldstärke (SAC)		CISPR16/11/14/22/32	30MHz-1000MHz (Band C/D) 1000MHz-6000MHz (Band E)	4,63dB 4,28dB	VULB9160 + ESU BBHA 9120 + ESR
Messung von magnetischen Feldern		EN62233	10Hz bis 120kHz	6,04%	ELT-400
Messung der induzierten Stromdichte		EN62493	20kHz bis 10MHz	1,65dB	Van der Hoofden Test Kopf
Messung von Oberschwingungen		EN61000-3-2	AC-Einphasig, 110-230V, 50Hz	4,65%	PAS5000 + ARS 16/1
Messung von Flicker		EN61000-3-3	AC-Einphasig, 110-230V, 50Hz	4,69%	PAS5000 + ARS 16/1
Störfestigkeit/Immunity:	Prüfung	Norm	Details	Betrag	Bemerkung
Elektrostatistische Entladung		EN61000-4-2	150pf, 330Ohm	6% U _{peak} ; 2,5% U	SESD3000
Einstrahlung elektromagnetisches Feld		EN61000-4-3	80MHz-6000MHz	2,63dB	SAC-Halle (0-6dB Feldhomogenität)
Schnelle Transienten		EN61000-4-4	5kHz Wiederholrate	10% U _{pk}	Kompactgenerator UCS 500
Schnelle Transienten		EN61000-4-4	100kHz Wiederholrate	10% U _{pk}	Kompactgenerator TRA 2000
Stoßspannungen		EN61000-4-5	HV Out, AC-Coupling	10% U _J	Kompactgenerator UCS 500
Geleitete Hochfrequenz		EN61000-4-6	150kHz bis 80MHz	1,16dB	CDN + NSG4070
Geleitete Hochfrequenz		EN61000-4-6	150kHz bis 80MHz	3,11dB	EM101 + NSG4070
Geleitete Hochfrequenz		EN61000-4-6	150kHz bis 80MHz	3,26dB	CIP + NSG4070
Immunität gegenüber Magnetfeldern		EN61000-4-8	50Hz, 60Hz	6,10%	Rahmen: d=1m
Netzunterbrechungen		EN61000-4-11	50Hz, 60Hz	3%-U; 5µs-T	PAS5000

Die Ermittlung der Gesamtunsicherheit wurde nach der „Ermittlungsmethode B“ vorgenommen. Die ausführlichen Abschätzungen und Berechnungen wurden in einem gesonderten Dokument aufgestellt. Dieses kann beim Labor eingesehen werden. Es wird angenommen, dass der Prüfling die Prüfung bestanden hat, wenn er die angegebenen Bewertungskriterien bei festgelegtem oder einem höherem Schärfegrad erfüllt. Die in den Grundnormen aufgeführte Messunsicherheit bei den Kalibrierverfahren wurde berücksichtigt. Für die Konformitätsbewertung kommt der in der Norm beschriebene Grenzwert ohne die Einhaltung eines Sicherheitsabstandes zur Anwendung. Danach hat der Prüfling bestanden, wenn der Messwert kleiner oder gleich dem Grenzwert ist.

Stand: 23.04.2015

Version 1.3

Dipl.-Ing. (FH) Sven Eric Weber

Line-tangent (w) for Emission Measurements above 1 GHz

Linientangens (w) für Feldstärkemessungen über 1 GHz

Antenna:	"Schwarzbeck" Double Ridged Broadband Horn Antenna BBHA 9120D
S/N:	374
Fixture:	#A138

Frequency [GHz]	DRG-Hornantenna					
	Φ 3dB (E)	Φ 3dB (H)	d= 1m (E)	d=1m (H)	d=3m (E)	d=3m (H)
	[°]	[°]	W [m]	W [m]	w [m]	w [m]
1,00	96,40	57,90	2,24	1,11	6,71	3,32
2,00	52,90	41,30	0,99	0,75	2,98	2,26
3,00	37,60	32,10	0,68	0,58	2,04	1,73
4,00	32,40	37,30	0,58	0,68	1,74	2,03
5,00	51,70	35,80	0,97	0,65	2,91	1,94
6,00	46,20	37,30	0,85	0,68	2,56	2,03
7,00	51,70	37,50	0,97	0,68	2,91	2,04
8,00	49,20	35,30	0,92	0,64	2,75	1,91
9,00	46,50	35,30	0,86	0,64	2,58	1,91
10,00	48,70	36,90	0,91	0,67	2,72	2,00
11,00	49,50	33,30	0,92	0,60	2,77	1,79
12,00	45,70	35,90	0,84	0,65	2,53	1,94
13,00	45,80	36,10	0,84	0,65	2,53	1,96
14,00	46,90	34,10	0,87	0,61	2,60	1,84
15,00	15,00	9,00	0,26	0,16	0,79	0,47
16,00	13,00	9,00	0,23	0,16	0,68	0,47
17,00	43,00	16,10	0,79	0,28	2,36	0,85
18,00	12,00	11,10	0,21	0,19	0,63	0,58

Legend: (E) = E-Pattern (Ver.)
(H) = H-Pattern (Hor.)

Limits calculated according EN55016-2-3 with:
 $w = 2 \cdot d \cdot \tan(0,5 \cdot \Phi_{3dB})$

8. Photo E. u. T.

