FCC Measurement/Technical Report on

In Cable Control and Protection Device Model IC-CPD

FCC ID: 2AT4E-ICCPDG2HIGH
IC: 25285-ICCPDG2HIGH

Test Report Reference: MDE_BEBRO_1501_FCCa_rev02

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

Deutsche Akkreditierungsstelle D-PL-12140-01-00

Note:
The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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1 APPLIED STANDARDS AND TEST SUMMARY

1.1 APPLIED STANDARDS

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-17 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart B – Unintentional Radiators

§ 15.107 Conducted limits

§ 15.109 Radiated emission limits; general requirements

Note:
ANSI C63.4–2014 is applied.

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 1.3 Measurement Summary / Signatures.

1.2 FCC-IC CORRELATION TABLE

Correlation of measurement requirements for
Information Technology Equipment (ITE)
from
FCC and IC

Measurement	FCC reference	IC reference
Conducted Emissions (AC Power Line)	§15.107	ICES-003 Issue 6: 6.1
Radiated Spurious Emissions	§15.109	ICES-003 Issue 6: 6.2

Remarks:

1. FCC Part 15 subpart B, ICES 003 and CISPR 22 contain different definitions of Class A and Class B limits, i.e. which class is applicable to which kind of EUT.
   ICES 003 and CISPR 22 distinguish between the location where the EUT is intended to operate whilst FCC refers to the method of commercial distribution (distributive trades).
2. The correct assignment of the appropriate class to the concrete EUT is not scope of this test report!
3. A radio apparatus that is specifically subject to an Industry Canada Radio Standard Specification (RSS) and which contains an ITE is not subject to ICES-003 provided the ITE is used only to enable operation of the radio apparatus and the ITE does not control additional functions or capabilities.
4. ISM (Industrial, Scientific or Medical) radio frequency generators, though they may contain ITE, are excluded from the definition of ITE and are not subject to ICES-003. They are instead subject to the Interference-Causing Equipment Standard ICES-001, which specifically addresses ISM radio frequency generators.

1.3 MEASUREMENT SUMMARY / SIGNATURES

47 CFR CHAPTER I FCC PART 15 Subpart B **§ 15.107 Class B**

Conducted Emissions at AC mains
The measurement was performed according to ANSI C63.4 **Final Result**

OP-Mode	**Setup**	**Date**	**FCC**	**IC**
AC mains connection, Test setup				
direct, stand-alone	S01_AA01	2018-08-23	Passed	Passed
direct, stand-alone	S01_AG02	2019-03-26	Passed	Passed

47 CFR CHAPTER I FCC PART 15 Subpart B **§ 15.109 Class B**

Radiated Emissions
The measurement was performed according to ANSI C63.4 **Final Result**

AC mains connection, Measurement range, Test setup	**Setup**	**Date**	**FCC**	**IC**
direct, 1 GHz - 26 GHz, stand-alone	S01_AA01	2018-08-17	Passed	Passed
direct, 1 GHz - 26 GHz, stand-alone	S01_AG02	2019-03-14	Passed	Passed
direct, 30 MHz - 1 GHz, stand-alone	S01_AA01	2018-08-22	Passed	Passed
direct, 30 MHz - 1 GHz, stand-alone	S01_AG02	2019-03-14	Passed	Passed

COMMENT:
The tests were repeated with new Sample with newer Hardware/Software.

7 layers GmbH, Borsigstr. 11
40880 Ratingen, Germany
Phone +49 (0)2102 749 0

(responsible for accreditation scope)
Marco Kullik

(responsible for testing and report)
Wolfgang Richter

2 REVISION HISTORY

Report version control			
Version	**Release date**	**Change Description**	**Version validity**
initial	2019-03-28	--	invalid
rev01	2019-06-18	Detailed date of testing added in summary table	invalid
rev02	2019-07-26	Frontpage: FCC ID and IC changed by applicant	valid

3 ADMINISTRATIVE DATA

3.1 TESTING LABORATORY

Company Name:	7layers GmbH
Address:	Borsigstr. 11 40880 Ratingen Germany

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no:	DAkkS D-PL-12140-01-00
FCC Designation Number:	DE0015
FCC Test Firm Registration:	929146
ISED CAB Identifier	DE0007; ISED#: 3699A
Responsible for accreditation scope:	Marco Kullik
Report Template Version:	2019-02-12

3.2 PROJECT DATA

Responsible for testing and report:	Wolfgang Richter
Employees who performed the tests:	documented internally at 7Layers
Date of Report:	2019-07-26
Testing Period:	2018-08-17 to 2019-03-26

3.3 APPLICANT DATA

Company Name:	eSystems MTG GmbH
Address:	Bahnhofstraße 100 73240 Wendlingen Germany
Contact Person:	Frank Beger

3.4 MANUFACTURER DATA

Company Name:	eSystems MTG GmbH
Address:	Bahnhofstraße 100 73240 Wendlingen Germany
Contact Person:	Frank Beger

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Declared EUT data by the supplier	
Kind of Device product description	In Cable Control and Protection Device IEEE Std. 802.11™ a/b/g/n/ac WLAN/WIFI Device supporting 2.4 GHz band (Channel 1 to 11) and 5 GHz Sub band 1 (5150 – 5250 MHz) All variants of the EUT uses the identical (HW/SW) Wi-Fi-/WLAN-Module.
Product name	In Cable Control and Protection Device
Type	Model IC-CPD
Power Supply Type	AC mains
Nominal Voltage / Frequency	90 V - 240 V / 50 Hz, 60 Hz
Test Voltage / Frequency	tested with 120 V / 60 Hz
Highest internal frequency	5.3 GHz
Ports	Port Infrastructure, port Car
Special software used for testing	Original SW used

Additional EUT data declared by manufacturer:	OEM's trade names: Porsche Mobile Charger Connect Audi Charging System Connect Bentley Home Charging Unit Model: IC-CPD Variants: Porsche: 9Y0.971.675.BE = (7,2 kW) 9Y0.971.675.BG = (11 kW) 9Y0.971.675.BJ = (22 kW) 9Y0.971.675.BL = (9,6 kW) for UL-Region 9Y0.971.675.BM = (9,6 kW) for Japan Audi: 8V4.971.675.BE = (7,2 kW) 8V4.971.675.BG = (11 kW) 8V4.971.675.BJ = (22 kW) 8V4.971.675.BL = (9,6 kW) for UL-Region Bentley: 36A.971.675.F = (7,2 kW) 36A.971.675.G = (9,6 kW) for UL-Region 36A.971.675.J = (9,6 kW) for Japan

The main components of the EUT are listed and described in chapter 3.2 EUT Main components.

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT A	DE1321000aa01	Sample with integral antenna
Sample Parameter	**Value**	
Serial No.	0000680	
HW Version	09	
SW Version	SW_C: 2350, SW_P: 1830	
Comment	Radiated sample	
Variant	9Y0.971.675.BJ	

Sample Name	Sample Code	Description
EUT G	DE1321000ag02	Sample with integral antenna
Sample Parameter	**Value**	
Serial No.	0002136	
HW Version	13	
SW Version	SW_C: 2901, SW_P: 1900	
Comment	Radiated Sample with newer HW/SW	
Variant	9Y0.971.675.BL	

NOTE:The sample name is used to simplify the identification of the EUT in this test report.

4.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless, Ancillary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, OUT Code)	Description
-	-	-

4.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless, Auxiliary Equipment can influence the test results.

Device	Details (Manufacturer, Type Model, HW, SW, S/N)	Description
ANC1	Harting, 7PP.971.678.BH, -, -, -	Cable at Port Infrastructure
ANC2	Harting, 7PP.971.676.BL, -, -, -	Cable at Port Car

4.5 EUT SETUPS

This chapter describes the combination of EUTs, and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
S01_AA01	EUT A, ANC1, ANC2,	
S01_AG02	EUT G, ANC1, ANC2,	

4.6 OPERATING MODES

This chapter describes the operating modes of the EUTs used for testing.

The EUT is in standby mode and powered with 120 V 60 Hz.
Sleep mode is deactivated.
No Car is connected at cable.

4.7 PRODUCT LABELLING

4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

5 TEST RESULTS

5.1 CONDUCTED EMISSIONS AT AC MAINS

Standard **FCC Part 15 Subpart B**

The test was performed according to:
ANSI C63.4

5.1.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C 63.4.
The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50µH || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.

The measurement procedure consists of two steps. It is implemented into the EMI test software EMC-32 from R&S.

Step 1: Preliminary scan
Intention of this step is, to determine the conducted EMI-profile of the EUT.
EMI receiver settings:
- Detector: Peak – Maxhold & Average
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 2.5 kHz
- IF–Bandwidth: 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

Step 2: Final measurement
Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.
EMI receiver settings:
- Detector: Quasi-Peak
- IF Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:
1) Neutral lead - reference ground (PE grounded)
2) Phase lead - reference ground (PE grounded)
3) Neutral lead - reference ground (PE floating)
4) Phase lead - reference ground (PE floating)

The highest value is reported.

5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart B, §15.107

Class B:

Frequency (MHz)	QP Limits (dBµV)	AV Limits (dBµV)
0.15 – 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

5.1.3 TEST PROTOCOL

Temperature: 24 °C
Air Pressure: 1014 hPa
Humidity: 40 %
Stand Alone

Power line	PE	Frequency [MHz]	Level [dBµV]	Detector	Limit [dBµV]	Margin [dB]
Details please see tables below diagrams	-	-	-	-	-	-

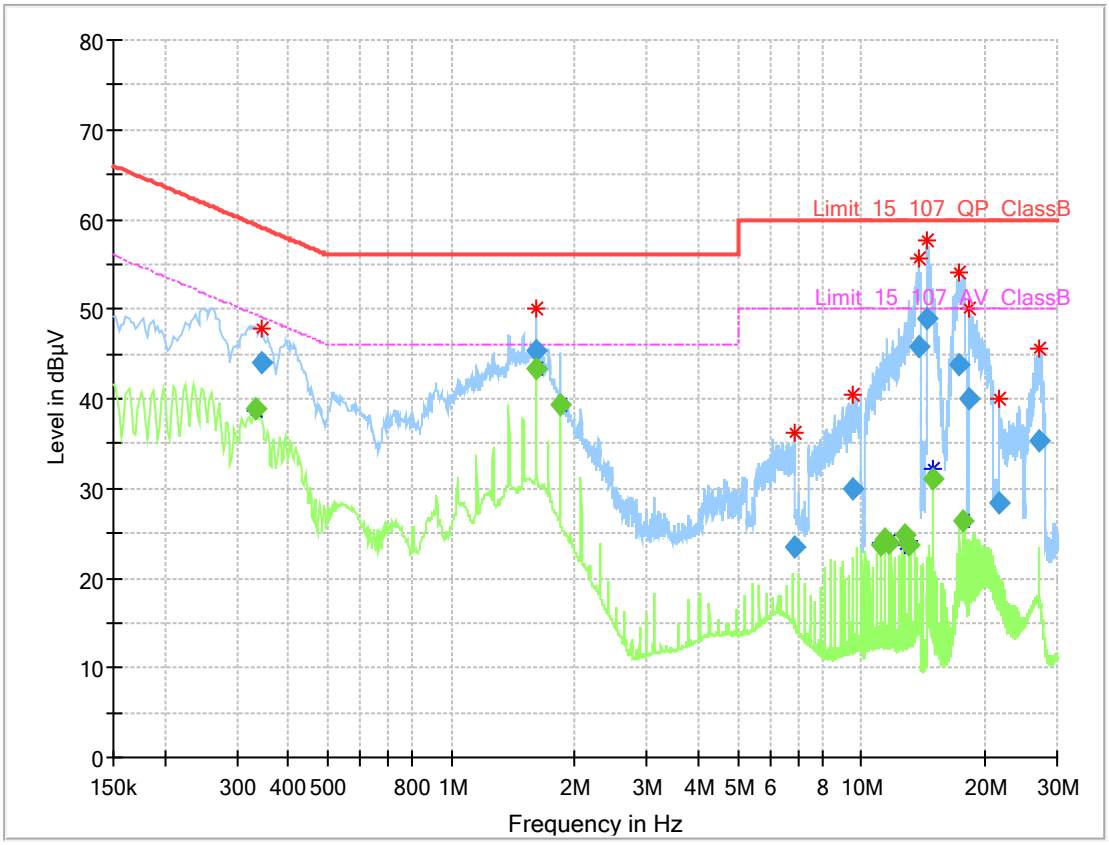
5.1.4 TEST EQUIPMENT USED

- Conducted Emissions FCC

5.1.5 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, “WORST CASE”)

AC mains connection = direct, Test setup = stand-alone, (S01_AA01)

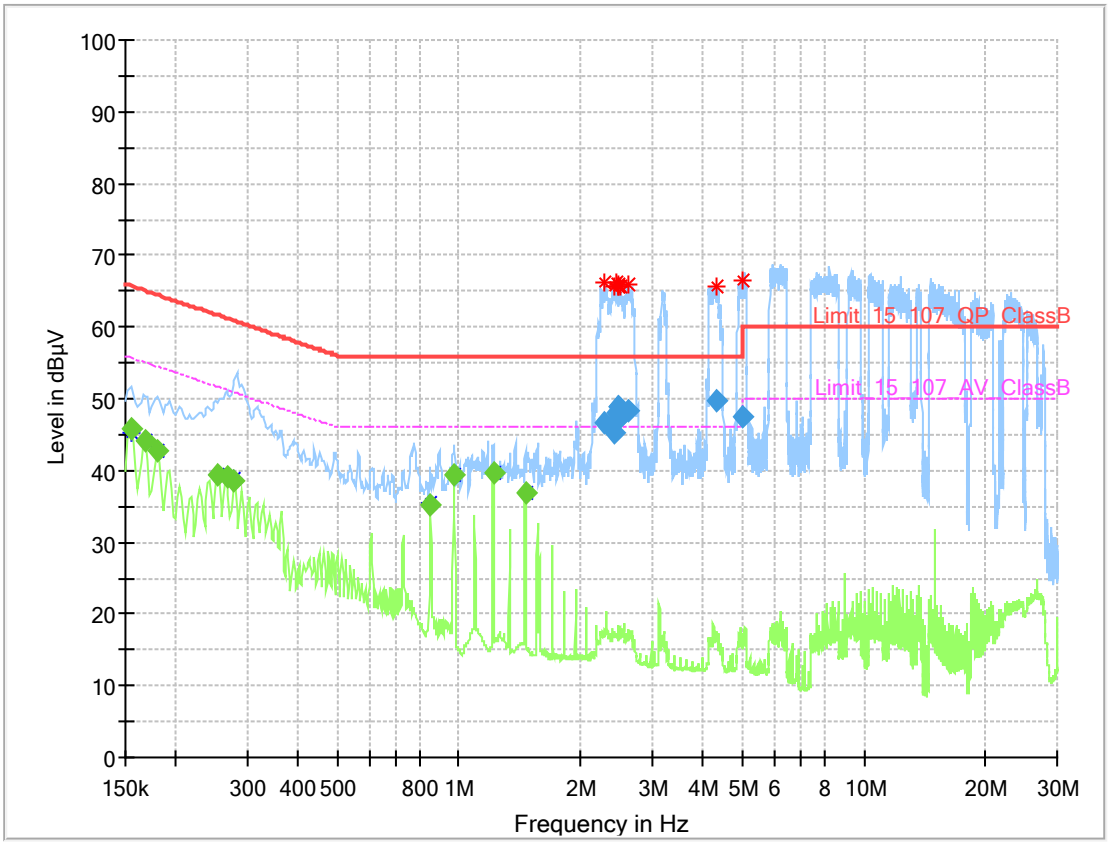
Test Description:	Conducted Emissions
Test Standard:	FCC §15.107, ANSI C63.4
EUT / Setup Code:	DE1321000aa01
Operating Conditions:	120 V 60 Hz, power on, standby
Comment:	no car connected
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final CISPR AV
Tested Port / used LISN:	AC mains => ESH3-Z5
Termination of other ports:	Car port => no connection to GND



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.332250	---	38.89	49.40	10.50	1000.0	9.000	N	FLO	10.1
0.343500	43.98	---	59.12	15.14	1000.0	9.000	N	GND	10.1
1.610250	45.29	---	56.00	10.71	1000.0	9.000	N	GND	10.1
1.612500	---	43.37	46.00	2.63	1000.0	9.000	N	FLO	10.1
1.842000	---	39.30	46.00	6.70	1000.0	9.000	N	FLO	10.1
6.841500	23.53	---	60.00	36.47	1000.0	9.000	L1	GND	10.5
9.557250	29.83	---	60.00	30.17	1000.0	9.000	L1	GND	10.6
11.166000	---	23.73	50.00	26.27	1000.0	9.000	L1	GND	10.6
11.395500	---	24.43	50.00	25.57	1000.0	9.000	L1	FLO	10.6
11.627250	---	23.85	50.00	26.15	1000.0	9.000	L1	FLO	10.6
12.777000	---	24.75	50.00	25.25	1000.0	9.000	L1	GND	10.7
13.008750	---	23.62	50.00	26.38	1000.0	9.000	L1	GND	10.7
13.857000	45.81	---	60.00	14.19	1000.0	9.000	N	GND	10.7
14.502750	48.93	---	60.00	11.07	1000.0	9.000	N	FLO	10.7
15.000000	---	31.05	50.00	18.95	1000.0	9.000	N	GND	10.8
17.286000	43.80	---	60.00	16.20	1000.0	9.000	N	GND	10.9
17.612250	---	26.30	50.00	23.70	1000.0	9.000	L1	GND	10.9
18.348000	39.99	---	60.00	20.01	1000.0	9.000	N	FLO	10.9
21.603750	28.45	---	60.00	31.55	1000.0	9.000	N	GND	11.1
27.147750	35.37	---	60.00	24.63	1000.0	9.000	L1	GND	11.2

AC mains connection = direct, Test setup = stand-alone, (S01_AG02)

Test Description:	Conducted Emissions
Test Standard:	FCC §15.107, ANSI C63.4
EUT / Setup Code:	DE1321000ag02
Operating Conditions:	120 V 60 Hz, power on, standby
Comment:	no car connected
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final CISPR AV
Tested Port / used LISN:	AC mains => ESH3-Z5
Termination of other ports:	Car port => no connection to GND



Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.154500	---	45.86	55.75	9.90	1000.0	9.000	N	FLO	10.1
0.168000	---	44.25	55.06	10.81	1000.0	9.000	N	FLO	10.1
0.179250	---	42.65	54.52	11.87	1000.0	9.000	N	FLO	10.1
0.253500	---	39.32	51.64	12.32	1000.0	9.000	N	FLO	10.1
0.267000	---	38.97	51.21	12.24	1000.0	9.000	N	FLO	10.1
0.278250	---	38.58	50.87	12.29	1000.0	9.000	N	FLO	10.1
0.849750	---	35.31	46.00	10.69	1000.0	9.000	N	GND	10.1
0.971250	---	39.51	46.00	6.49	1000.0	9.000	N	GND	10.1
1.214250	---	39.59	46.00	6.41	1000.0	9.000	N	GND	10.2
1.457250	---	36.80	46.00	9.20	1000.0	9.000	N	GND	10.2
2.287500	46.69	---	56.00	9.31	1000.0	9.000	L1	FLO	10.2
2.429250	45.32	---	56.00	10.68	1000.0	9.000	N	FLO	10.3
2.447250	48.08	---	56.00	7.92	1000.0	9.000	L1	FLO	10.3
2.465250	47.25	---	56.00	8.75	1000.0	9.000	N	FLO	10.3
2.472000	48.84	---	56.00	7.16	1000.0	9.000	L1	FLO	10.3
2.485500	48.92	---	56.00	7.08	1000.0	9.000	N	GND	10.3
2.492250	47.40	---	56.00	8.60	1000.0	9.000	L1	FLO	10.3
2.607000	48.26	---	56.00	7.74	1000.0	9.000	N	GND	10.3
4.341750	49.77	---	56.00	6.23	1000.0	9.000	L1	GND	10.4
4.987500	47.43	---	56.00	8.57	1000.0	9.000	N	GND	10.4

5.2 RADIATED EMISSIONS

Standard **FCC Part 15 Subpart B**

The test was performed according to:
ANSI C63.4

5.2.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used was evaluated. For the measurement above 1 GHz an absorber field with 30 cm pyramidical absorber is placed between EUT table and antenna (required to fulfil the CISPR 16.1.4 S-VSWR criteria).
The measurement procedure is implemented into the EMI test software EMC32 from R&S.

1. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 3 m
- Detector: Peak-Maxhold / Quasipeak (FFT-based)
- Frequency range: 30 – 1000 MHz
- Frequency steps: 30 kHz
- IF–Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: –180° to 90°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by ± 45° around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 100 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: ± 45 ° around the determined value
- Height variation range: ± 100 cm around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with QP detector
With the settings determined in step 3, the final measurement will be performed:
EMI receiver settings for step 4:

- Detector: Quasi-Peak
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

2. Measurement above 1 GHz

Step 1: Preliminary scan
This is a preliminary test to identify the highest amplitudes relative to the limit.
Settings for step 1:
- Antenna distance: 3 m
- Detector: Peak-Maxhold / Average (up to 7 GHz FFT-based)
- Frequency range: 1 GHz – 26 GHz
- Frequency steps: 250 kHz
- IF–Bandwidth: 1 MHz
- Measuring time / Frequency step: 100 ms (up to 7 GHz) / 500µs (above 7 GHz
- Turntable angle range: –180° to 135°
- Turntable step size: 45°
- Height variation range: 1 – 3.7 m (due to the small antenna lobe, a tilt-mast is used)
- Height variation step size: 0.9 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: Adjustment measurement
In this step the accuracy of the turntable azimuth and antenna height will be improved. This is necessary to find out the maximum value of every frequency.
For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by ± 22.5° around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 45 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.
- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 100 ms
- Turntable angle range: ± 22.5 ° around the determined value
- Height variation range: ± 45 cm around the determined value
- Antenna Polarisation: max. value determined in step 1

Step 3: Final measurement with Max-Peak / CISPR-Average detector
With the settings determined in step 2, the final measurement will be performed:
EMI receiver settings for step 3:
- Detector: Max-Peak / CISPR-Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 200 ms

After each measurement, a report will be generated which contains a diagram with the results of the preliminary scan and a table with the frequencies, values and polarisation of the results of the final measurement.

5.2.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart B, §15.109, Radiated Emission Limits

Class B:

Frequency (MHz)	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
30 – 88	100@3m	3	40.0@3m
88 – 216	150@3m	3	43.5@3m
216 – 960	200@3m	3	46.0@3m
960 - 26000	500@3m	3	54.0@3m
26000 - 40000	500@3m	1	54.0@3m

The measured values for Class A and for Class B (> 26 GHz) measurements are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

5.2.3 TEST PROTOCOL

Ambient temperature: 23 °C
Air Pressure: 997 hPa
Humidity: 31 %
AC direct

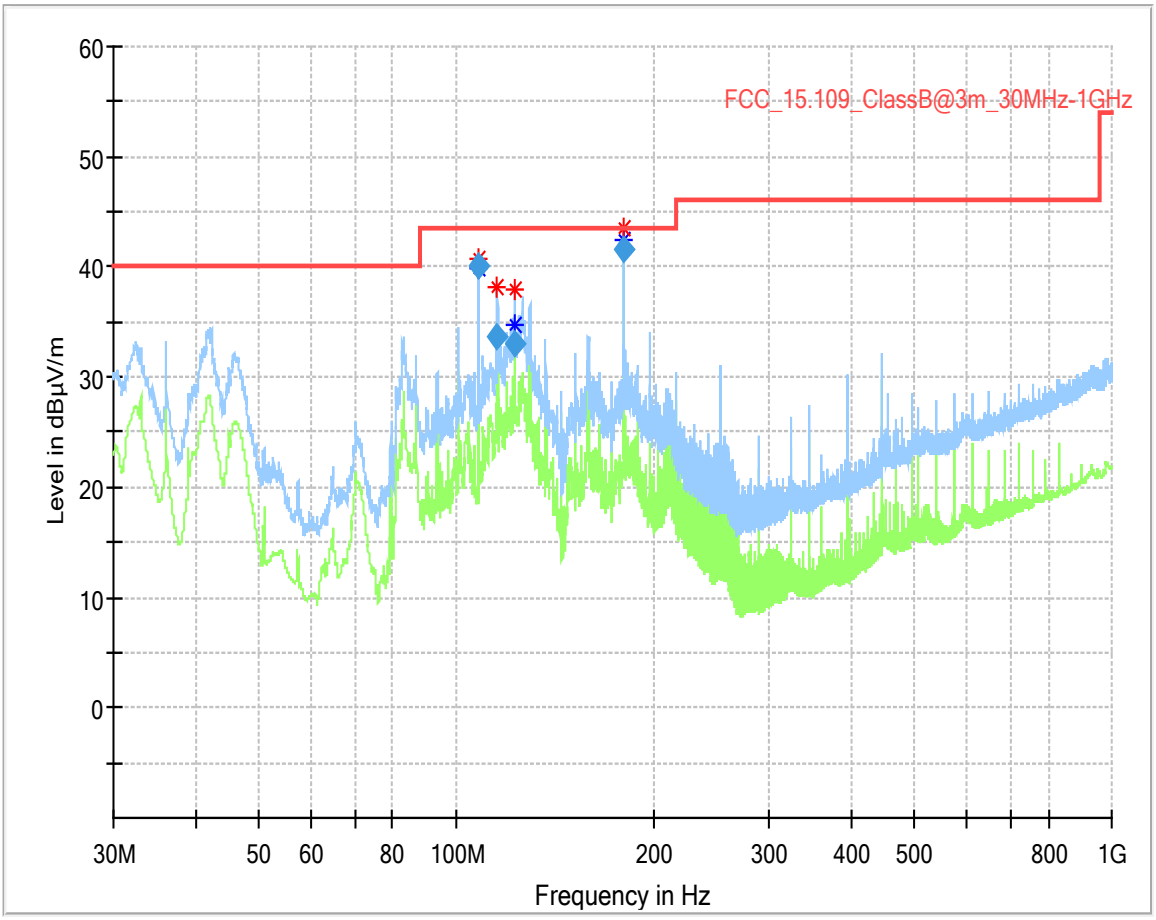
Spurious Freq. [MHz]	Spurious Level [dBµV/m]	Detector	RBW [kHz]	Limit [dBµV/m]	Margin to Limit [dB]
please see tables below diagrams	-	-	-	-	-

Remark: Please see next sub-clause for the measurement plot.

5.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, “WORST CASE”)

AC mains connection = direct, Measurement range = 30 MHz - 1 GHz,
Test setup = stand-alone, (S01_AA01)

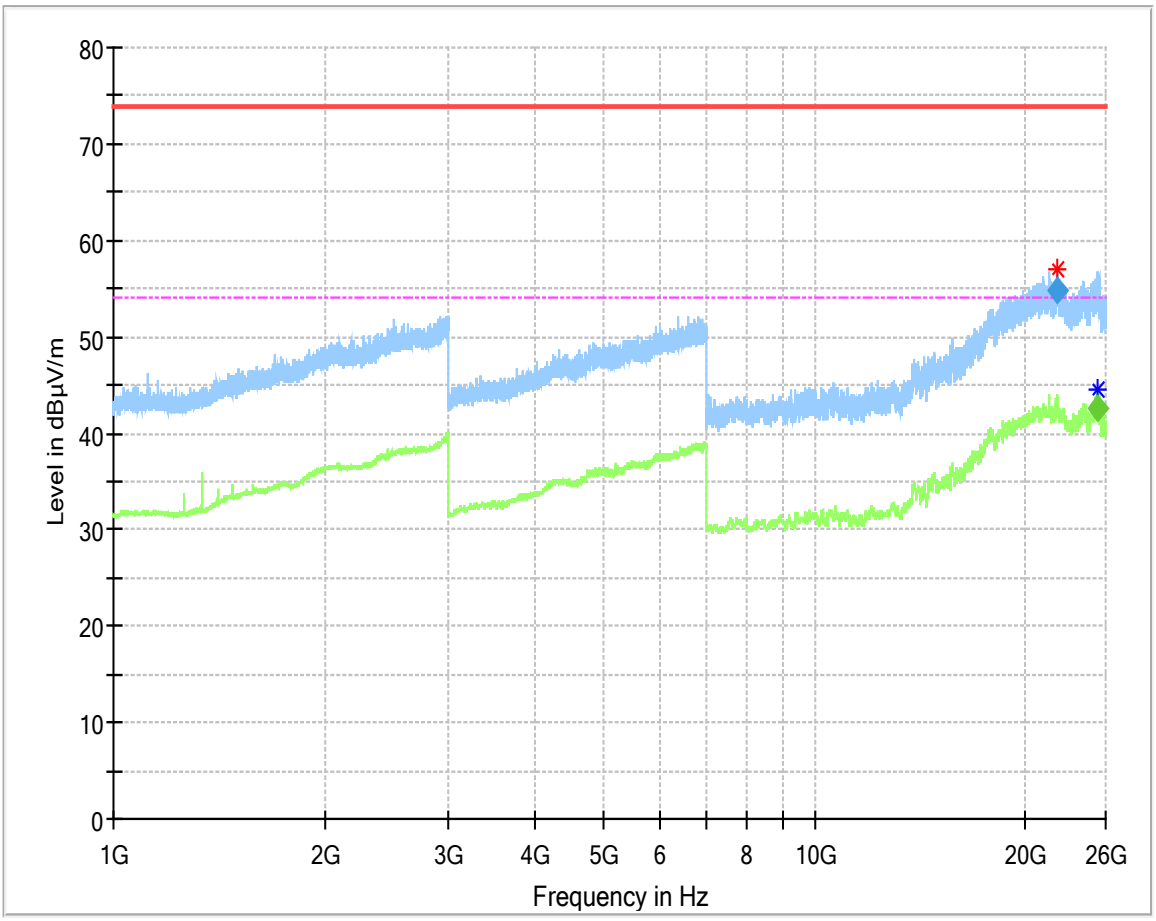
Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 3 m
Test Standard:	FCC §15.109, ANSI C63.4
EUT / Setup Code:	DE1321000aa01
Operating Conditions:	120 V 60 Hz, standby, power on
Comment:	No car connected
Legend:	Trace: blue = PK, green = QP; Star: red or blue = critical frequency; Rhombus: blue = final QP



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
108.270000	40.12	43.50	3.38	1000.0	120.000	100.0	V	-100.0	11.1
115.620000	33.72	43.50	9.78	1000.0	120.000	114.0	V	-96.0	11.5
123.030000	33.08	43.50	10.42	1000.0	120.000	110.0	V	-90.0	11.2
180.420000	41.56	43.50	1.94	1000.0	120.000	103.0	V	1.0	10.1

AC mains connection = direct, Measurement range = 1 GHz - 26 GHz,
Test setup = stand-alone, (S01_AA01)

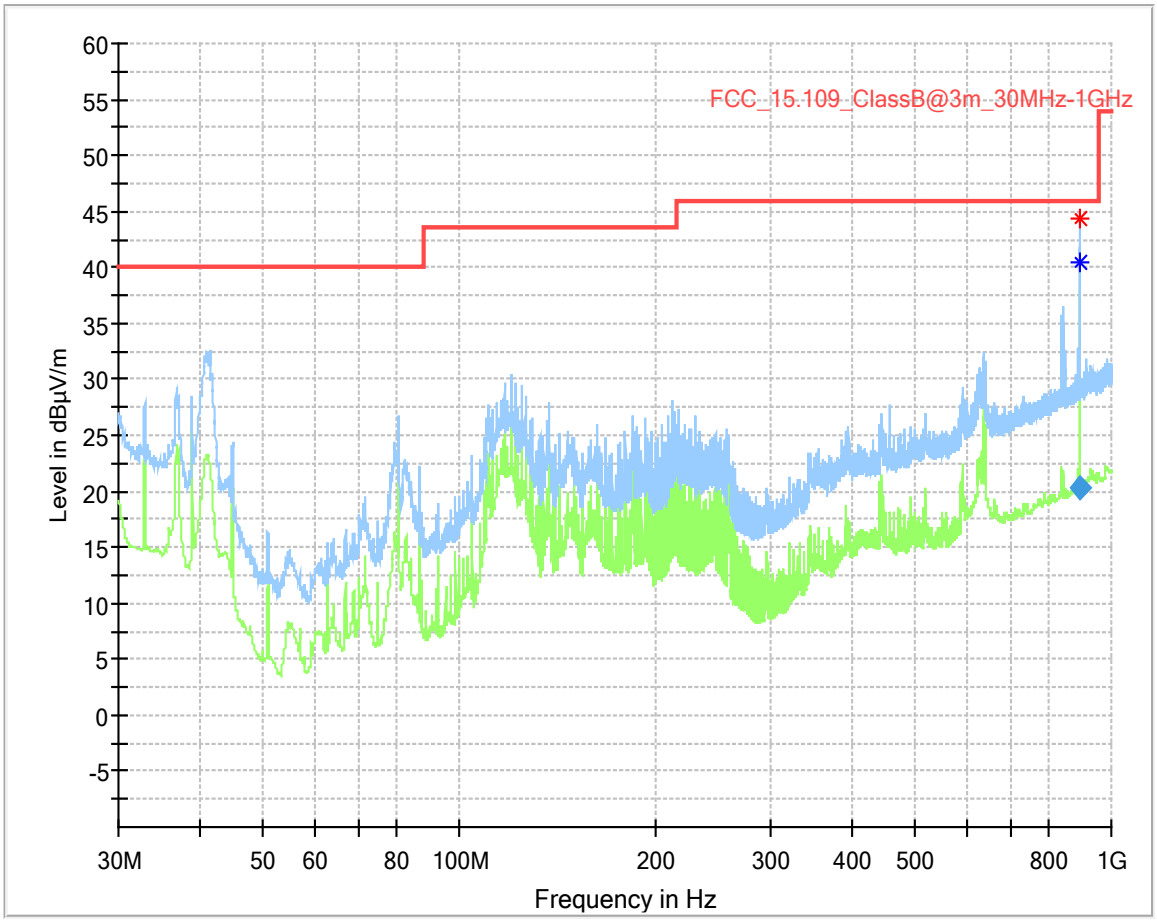
Test Description:	Radiated Emissions in FAR at 3 m
Standard:	FCC §15.109, ANSI C63.4
EUT:	DE1321000aa01
Operating Conditions:	120 V 60 Hz, standby, power on
Comment:	No car connected
Legend:	Curve: blue = PK, green = AV, Star = critical freq., Rhombus: blue = final PK, green = final CAV



Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Elevation (deg)	Corr. (dB/m)
22171.600	54.8	---	74.00	19.18	1000.0	1000.000	150.0	V	57.0	15.0	23.0
25360.000	---	42.6	54.00	11.41	1000.0	1000.000	150.0	H	-41.0	75.0	22.7

AC mains connection = direct, Measurement range = 30 MHz - 1 GHz,
Test setup = stand-alone, (S01_AG02)

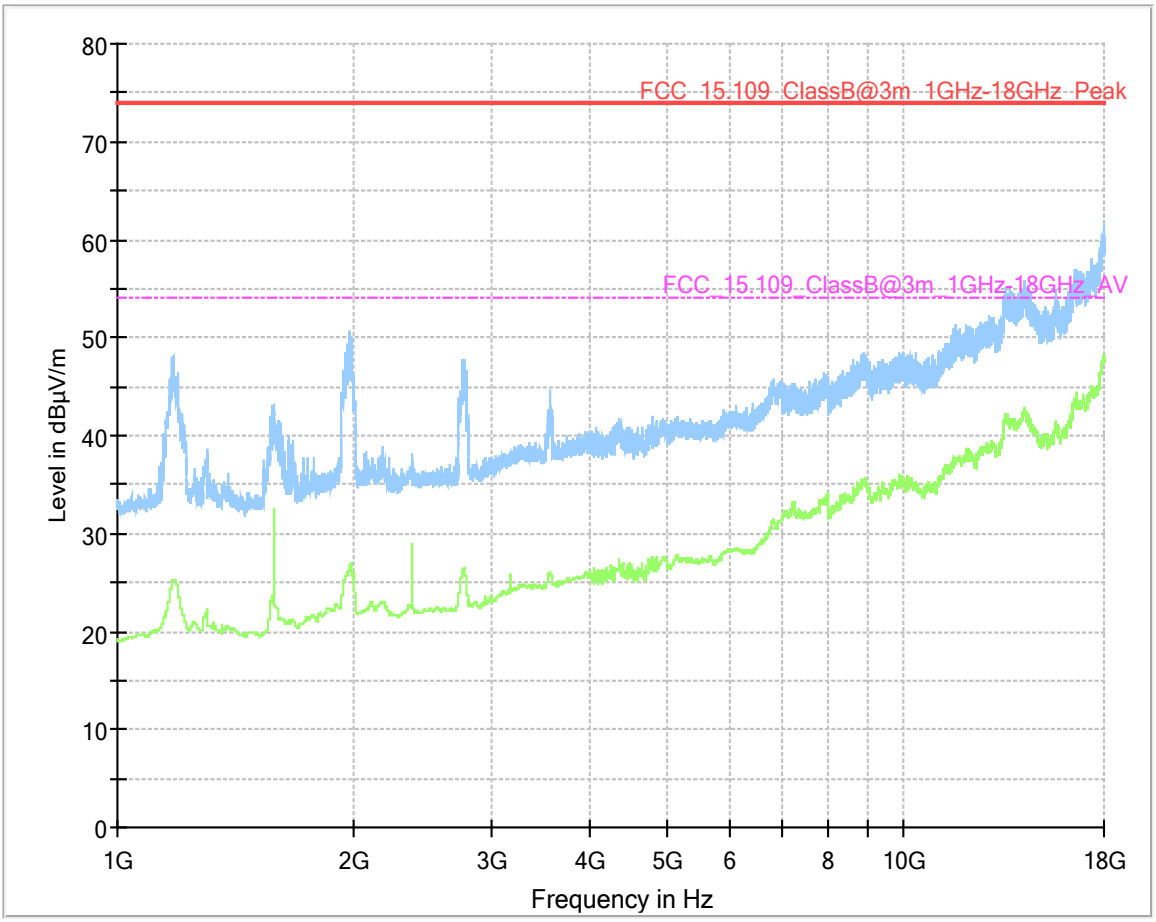
Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 3 m
Test Standard:	FCC §15.109, Class B, ANSI C63.4
EUT / Setup Code:	DE1321000ag02
Operating Conditions:	120 V 60 Hz, standby, power on
Comment:	No car connected
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final CISPR AV



Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Cor (dB)	Comment
892.920000	20.22	46.00	25.78	1000.0	120.000	212.0	V	56.0	24.6	External GSM interferer

AC mains connection = direct, Measurement range = 1 GHz - 18 GHz,
Test setup = stand-alone, (S01_AG02)

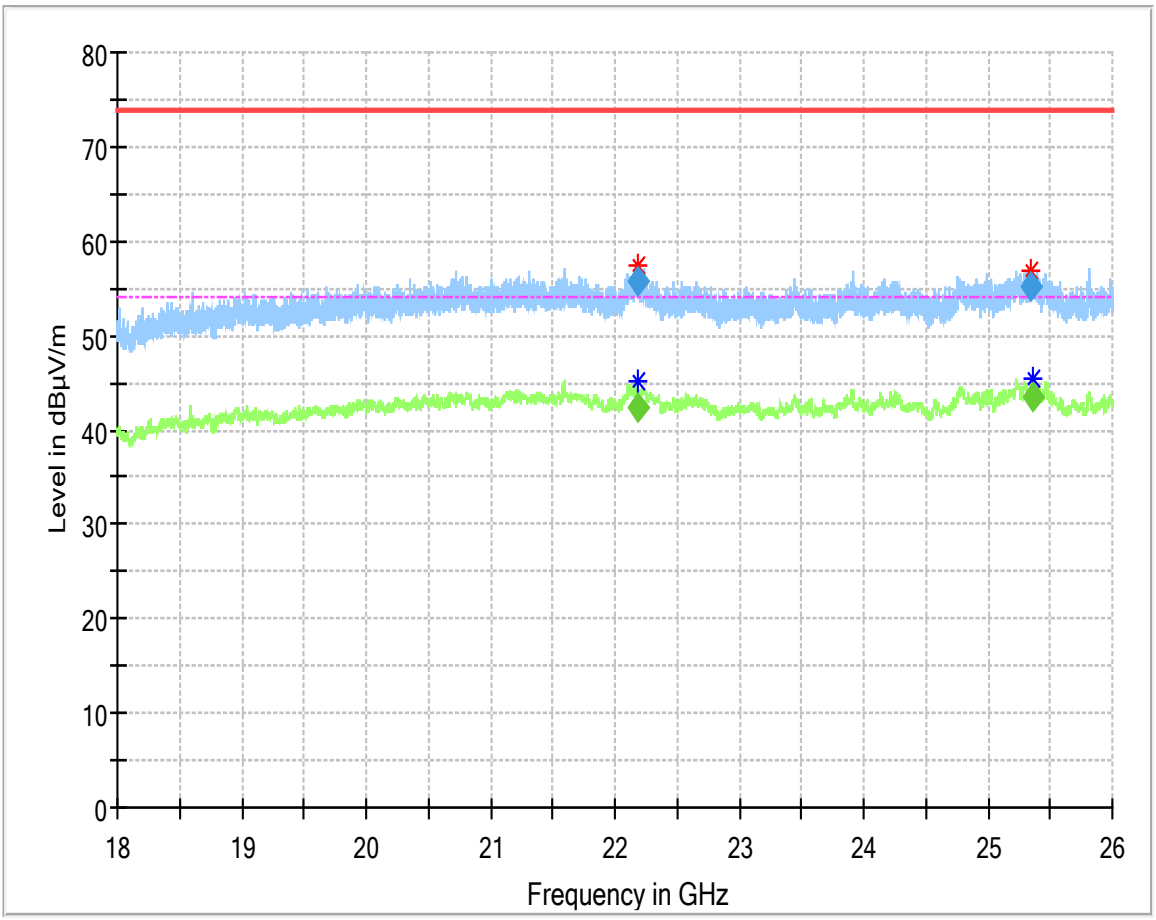
Test Description:	Radiated Emissions, SAC with mobile floor absorber @ 3 m
Test Standard:	FCC §15.109 Class B, ANSI C63.4
EUT / Setup Code:	DE1321000ag02
Operating Conditions:	120 V 60 Hz, standby, power on
Comment:	No car connected
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final CISPR AV



Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Cor (dB)
---	---	---	---	---	---	---	---		---	---

AC mains connection = direct, Measurement range = 18 GHz - 26 GHz,
Test setup = stand-alone, (S01_AG02)

Test Description:	Radiated Emissions in FAR at 3 m
Standard	FCC §15.109 Class B, ANSI C63.4
EUT	DE1321000ag02
Operating Conditions:	120 V 60 Hz, standby, power on
Comment:	No car connected
Legend	Trace: blue = PK, green = AV, Star = critical freq., Rhombus: blue = final PK, green = final CAV



Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
22177.333	55.9	---	74.00	18.14	1000.0	1000.000	150.0	H	67.0	23.1
22178.400	---	42.4	54.00	11.57	1000.0	1000.000	150.0	H	113.0	23.1
25346.933	55.2	---	74.00	18.81	1000.0	1000.000	150.0	V	157.0	21.7
25359.733	---	43.4	54.00	10.61	1000.0	1000.000	150.0	H	126.0	22.7

5.2.5 TEST EQUIPMENT USED

- Radiated Emissions

6 TEST EQUIPMENT

1 Conducted Emissions FCC

Conducted Emissions power line for FCC standards

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13 (Environ)	Lufft Mess- und Regeltechnik GmbH	13936	2017-04	2019-04
1.2	ESW44	EMI Test Receiver	Rohde & Schwarz GmbH & Co. KG	101603	2018-05	2019-05
1.3	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2018-04	2020-04
1.4	ESH3-Z5	Two-Line V-Network	Rohde & Schwarz	828304/029	2017-05	2019-05
1.5	EP 1200/B, NA/B1	Amplifier with integrated variable Oscillator	Spitzenberger & Spieß	B6278		
1.6	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304		
1.7	Shielded Room 02	Shielded Room for conducted testing, 12qm	Frankonia	-		
1.8	ESH3-Z5	Two-Line V-Network	Rohde & Schwarz	829996/002	2017-05	2019-05
1.9	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2017-01 2019-01	2019-01 2020-01
1.10	Opus10 THI (8152.00)	ThermoHygro Datalogger 02 (Environ)	Lufft Mess- und Regeltechnik GmbH	7489	2017-04	2019-04

2 Radiated Emissions

Lab to perform radiated emission tests

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	NRV-Z1	Sensor Head A	Rohde & Schwarz GmbH & Co. KG	827753/005	2018-07	2019-07
2.2	MFS	Rubidium Frequency Normal MFS	Datum GmbH	002	2018-10	2020-10
2.3	Opus10 TPR (8253.00)	ThermoAirpressure Datalogger 13 (Environ)	Lufft Mess- und Regeltechnik GmbH	13936	2017-04	2019-04
2.4	ESW44	EMI Test Receiver	Rohde & Schwarz GmbH & Co. KG	101603	2018-05	2019-05
2.5	Anechoic Chamber	10.58 x 6.38 x 6.00 m^3	Frankonia	none	2018-06	2020-06
2.6	FS-Z60	Harmonic Mixer 40 - 60 GHz	Rohde & Schwarz Messgerätebau GmbH	100178	2016-12	2019-12
2.7	FS-Z220	Harmonic Mixer 140 - 220 GHz	Rohde & Schwarz Messgerätebau GmbH	101005	2017-03	2020-03

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.8	SGH-05	Standard Gain / Pyramidal Horn Antenna (140 - 220 GHz)	RPG-Radiometer Physics GmbH	075		
2.9	HL 562	Ultralog new biconicals	Rohde & Schwarz	830547/003	2018-07	2021-07
2.10	5HC2700/12750-1.5-KK	High Pass Filter	Trilithic	9942012		
2.11	ASP 1.2/1.8-10 kg	Antenna Mast	Maturo GmbH	-		
2.12	Fully Anechoic Room	8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	2018-06	2020-06
2.13	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2018-04	2020-04
2.14	NRVD	Power Meter	Rohde & Schwarz GmbH & Co. KG	828110/016	2018-07	2019-07
2.15	HF 906	Double-ridged horn	Rohde & Schwarz	357357/002	2018-09	2021-09
2.16	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785		
2.17	FSW 43	Spectrum Analyzer	Rohde & Schwarz	103779	2019-02	2021-02
2.18	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronic GmbH	00083069		
2.19	SGH-19	Standard Gain / Pyramidal Horn Antenna (40 - 60 GHz)	RPG-Radiometer Physics GmbH	093		
2.20	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright	09		
2.21	4HC1600/12750-1.5-KK	High Pass Filter	Trilithic	9942011		
2.22	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304		
2.23	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368		
2.24	TT 1.5 WI	Turn Table	Maturo GmbH	-		
2.25	HL 562 Ultralog	Log.-per. Antenna	Rohde & Schwarz	100609	2016-04	2019-04
2.26	HF 906	Double-ridged horn	Rohde & Schwarz	357357/001	2018-03	2021-03
2.27	FS-Z325	Harmonic Mixer 220 - 325 GHz	Rohde & Schwarz Messgerätebau GmbH	101006	2017-03	2020-03
2.28	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronic GmbH	00086675		
2.29	SGH-08	Standard Gain / Pyramidal Horn Antenna (90 - 140 GHz)	RPG-Radiometer Physics GmbH	064		

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.30	SGH-12	Standard Gain / Pyramidal HornAntenna (60 - 90 GHz)	RPG-Radiometer Physics GmbH	326		
2.31	5HC3500/18000-1.2-KK	High Pass Filter	Trilithic	200035008		
2.32	FS-Z140	Harmonic Mixer 90 -140 GHz	Rohde & Schwarz Messgerätebau GmbH	101007	2017-02	2020-02
2.33	HFH2-Z2	Loop Antenna	Rohde & Schwarz	829324/006	2018-01	2021-01
2.34	Opus10 THI (8152.00)	ThermoHygro Datalogger 12 (Environ)	Lufft Mess- und Regeltechnik GmbH	12482	2017-03	2019-03
2.35	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2017-01 2019-01	2019-01 2020-01
2.36	JS4-00101800-35-5P	Broadband Amplifier 30 MHz - 18 GHz	Miteq	896037		
2.37	AS 620 P	Antenna mast	HD GmbH	620/37		
2.38	Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	Maturo GmbH	TD1.5-10kg/024/3790709		
2.39	SGH-03	Standard Gain / Pyramidal Horn Antenna (220 - 325 GHz)	RPG-Radiometer Physics GmbH	060		
2.40	FS-Z90	Harmonic Mixer 60 - 90 GHz	Rohde & Schwarz Messgerätebau GmbH	101686	2017-03	2020-03
2.41	ESIB 26	Spectrum Analyzer	Rohde & Schwarz	830482/004	2018-01	2020-01
2.42	PAS 2.5 - 10 kg	Antenna Mast	Maturo GmbH	-		
2.43	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324		
2.44	AM 4.0	Antenna mast	Maturo GmbH	AM4.0/180/11920513		
2.45	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2018-07	2021-07

The calibration interval is the time interval between “Last Calibration” and “Calibration Due”

7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

7.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

Frequency		Corr.	LISN insertion loss ESH3-Z5	cable loss (incl. 10 dB atten-uator)
MHz		dB	dB	dB
0.15		10.1	0.1	10.0
5		10.3	0.1	10.2
7		10.5	0.2	10.3
10		10.5	0.2	10.3
12		10.7	0.3	10.4
14		10.7	0.3	10.4
16		10.8	0.4	10.4
18		10.9	0.4	10.5
20		10.9	0.4	10.5
22		11.1	0.5	10.6
24		11.1	0.5	10.6
26		11.2	0.5	10.7
28		11.2	0.5	10.7
30		11.3	0.5	10.8

Sample calculation

U_{LISN} (dB µV) = U (dB µV) + Corr. (dB)
U = Receiver reading
LISN Insertion loss = Voltage Division Factor of LISN
Corr. = sum of single correction factors of used LISN, cables, switch units (if used)
Linear interpolation will be used for frequencies in between the values in the table.

7.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

Frequency	AF HFH-Z2)	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-40 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
0.009	20.50	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.01	20.45	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.015	20.37	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.02	20.36	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.025	20.38	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.03	20.32	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.05	20.35	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.08	20.30	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.1	20.20	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.2	20.17	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.3	20.14	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.49	20.12	-79.6	0.1	0.1	0.1	0.1	-80	300	3
0.490001	20.12	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.5	20.11	-39.6	0.1	0.1	0.1	0.1	-40	30	3
0.8	20.10	-39.6	0.1	0.1	0.1	0.1	-40	30	3
1	20.09	-39.6	0.1	0.1	0.1	0.1	-40	30	3
2	20.08	-39.6	0.1	0.1	0.1	0.1	-40	30	3
3	20.06	-39.6	0.1	0.1	0.1	0.1	-40	30	3
4	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
5	20.05	-39.5	0.2	0.1	0.1	0.1	-40	30	3
6	20.02	-39.5	0.2	0.1	0.1	0.1	-40	30	3
8	19.95	-39.5	0.2	0.1	0.1	0.1	-40	30	3
10	19.83	-39.4	0.2	0.1	0.2	0.1	-40	30	3
12	19.71	-39.4	0.2	0.1	0.2	0.1	-40	30	3
14	19.54	-39.4	0.2	0.1	0.2	0.1	-40	30	3
16	19.53	-39.3	0.3	0.1	0.2	0.1	-40	30	3
18	19.50	-39.3	0.3	0.1	0.2	0.1	-40	30	3
20	19.57	-39.3	0.3	0.1	0.2	0.1	-40	30	3
22	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
24	19.61	-39.3	0.3	0.1	0.2	0.1	-40	30	3
26	19.54	-39.3	0.3	0.1	0.2	0.1	-40	30	3
28	19.46	-39.2	0.3	0.1	0.3	0.1	-40	30	3
30	19.73	-39.1	0.4	0.1	0.3	0.1	-40	30	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -40 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values

7.3 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

(d_{Limit} = 3 m)

Frequency	AF R&S HL562	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
30	18.6	0.6	0.29	0.04	0.23	0.02	0.0	3	3
50	6.0	0.9	0.39	0.09	0.32	0.08	0.0	3	3
100	9.7	1.2	0.56	0.14	0.47	0.08	0.0	3	3
150	7.9	1.6	0.73	0.20	0.59	0.12	0.0	3	3
200	7.6	1.9	0.84	0.21	0.70	0.11	0.0	3	3
250	9.5	2.1	0.98	0.24	0.80	0.13	0.0	3	3
300	11.0	2.3	1.04	0.26	0.89	0.15	0.0	3	3
350	12.4	2.6	1.18	0.31	0.96	0.13	0.0	3	3
400	13.6	2.9	1.28	0.35	1.03	0.19	0.0	3	3
450	14.7	3.1	1.39	0.38	1.11	0.22	0.0	3	3
500	15.6	3.2	1.44	0.39	1.20	0.19	0.0	3	3
550	16.3	3.5	1.55	0.46	1.24	0.23	0.0	3	3
600	17.2	3.5	1.59	0.43	1.29	0.23	0.0	3	3
650	18.1	3.6	1.67	0.34	1.35	0.22	0.0	3	3
700	18.5	3.6	1.67	0.42	1.41	0.15	0.0	3	3
750	19.1	4.1	1.87	0.54	1.46	0.25	0.0	3	3
800	19.6	4.1	1.90	0.46	1.51	0.25	0.0	3	3
850	20.1	4.4	1.99	0.60	1.56	0.27	0.0	3	3
900	20.8	4.7	2.14	0.60	1.63	0.29	0.0	3	3
950	21.1	4.8	2.22	0.60	1.66	0.33	0.0	3	3
1000	21.6	4.9	2.23	0.61	1.71	0.30	0.0	3	3

(d_{Limit} = 10 m)

30	18.6	-9.9	0.29	0.04	0.23	0.02	-10.5	10	3
50	6.0	-9.6	0.39	0.09	0.32	0.08	-10.5	10	3
100	9.7	-9.2	0.56	0.14	0.47	0.08	-10.5	10	3
150	7.9	-8.8	0.73	0.20	0.59	0.12	-10.5	10	3
200	7.6	-8.6	0.84	0.21	0.70	0.11	-10.5	10	3
250	9.5	-8.3	0.98	0.24	0.80	0.13	-10.5	10	3
300	11.0	-8.1	1.04	0.26	0.89	0.15	-10.5	10	3
350	12.4	-7.9	1.18	0.31	0.96	0.13	-10.5	10	3
400	13.6	-7.6	1.28	0.35	1.03	0.19	-10.5	10	3
450	14.7	-7.4	1.39	0.38	1.11	0.22	-10.5	10	3
500	15.6	-7.2	1.44	0.39	1.20	0.19	-10.5	10	3
550	16.3	-7.0	1.55	0.46	1.24	0.23	-10.5	10	3
600	17.2	-6.9	1.59	0.43	1.29	0.23	-10.5	10	3
650	18.1	-6.9	1.67	0.34	1.35	0.22	-10.5	10	3
700	18.5	-6.8	1.67	0.42	1.41	0.15	-10.5	10	3
750	19.1	-6.3	1.87	0.54	1.46	0.25	-10.5	10	3
800	19.6	-6.3	1.90	0.46	1.51	0.25	-10.5	10	3
850	20.1	-6.0	1.99	0.60	1.56	0.27	-10.5	10	3
900	20.8	-5.8	2.14	0.60	1.63	0.29	-10.5	10	3
950	21.1	-5.6	2.22	0.60	1.66	0.33	-10.5	10	3
1000	21.6	-5.6	2.23	0.61	1.71	0.30	-10.5	10	3

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

7.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay + cable inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit, atten-uator & pre-amp)	cable loss 4 (to receiver)		
MHz	dB (1/m)	dB	dB	dB	dB	dB		
1000	24.4	-19.4	0.99	0.31	-21.51	0.79		
2000	28.5	-17.4	1.44	0.44	-20.63	1.38		
3000	31.0	-16.1	1.87	0.53	-19.85	1.33		
4000	33.1	-14.7	2.41	0.67	-19.13	1.31		
5000	34.4	-13.7	2.78	0.86	-18.71	1.40		
6000	34.7	-12.7	2.74	0.90	-17.83	1.47		
7000	35.6	-11.0	2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (inside chamber)	cable loss 3 (outside chamber)	cable loss 4 (switch unit, atten-uator & pre-amp)	cable loss 5 (to receiver)	used for FCC 15.247
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	
3000	31.0	-23.4	0.47	1.87	0.53	-27.58	1.33	
4000	33.1	-23.3	0.56	2.41	0.67	-28.23	1.31	
5000	34.4	-21.7	0.61	2.78	0.86	-27.35	1.40	
6000	34.7	-21.2	0.58	2.74	0.90	-26.89	1.47	
7000	35.6	-19.8	0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.	cable loss 1 (relay inside chamber)	cable loss 2 (High Pass)	cable loss 3 (pre-amp)	cable loss 4 (inside chamber)	cable loss 5 (outside chamber)	cable loss 6 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB	dB
7000	35.6	-57.3	0.56	1.28	-62.72	2.66	0.94	1.46
8000	36.3	-56.3	0.69	0.71	-61.49	2.84	1.00	1.53
9000	37.1	-55.3	0.68	0.65	-60.80	3.06	1.09	1.60
10000	37.5	-56.2	0.70	0.54	-61.91	3.28	1.20	1.67
11000	37.5	-55.3	0.80	0.61	-61.40	3.43	1.27	1.70
12000	37.6	-53.7	0.84	0.42	-59.70	3.53	1.26	1.73
13000	38.2	-53.5	0.83	0.44	-59.81	3.75	1.32	1.83
14000	39.9	-56.3	0.91	0.53	-63.03	3.91	1.40	1.77
15000	40.9	-54.1	0.98	0.54	-61.05	4.02	1.44	1.83
16000	41.3	-54.1	1.23	0.49	-61.51	4.17	1.51	1.85
17000	42.8	-54.4	1.36	0.76	-62.36	4.34	1.53	2.00
18000	44.2	-54.7	1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Tables show an extract of values.

7.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

Frequency	AF EMCO 3160-09	Corr.	cable loss 1 (inside chamber)	cable loss 2 (pre-amp)	cable loss 3 (inside chamber)	cable loss 4 (switch unit)	cable loss 5 (to receiver)
MHz	dB (1/m)	dB	dB	dB	dB	dB	dB
18000	40.2	-23.5	0.72	-35.85	6.20	2.81	2.65
18500	40.2	-23.2	0.69	-35.71	6.46	2.76	2.59
19000	40.2	-22.0	0.76	-35.44	6.69	3.15	2.79
19500	40.3	-21.3	0.74	-35.07	7.04	3.11	2.91
20000	40.3	-20.3	0.72	-34.49	7.30	3.07	3.05
20500	40.3	-19.9	0.78	-34.46	7.48	3.12	3.15
21000	40.3	-19.1	0.87	-34.07	7.61	3.20	3.33
21500	40.3	-19.1	0.90	-33.96	7.47	3.28	3.19
22000	40.3	-18.7	0.89	-33.57	7.34	3.35	3.28
22500	40.4	-19.0	0.87	-33.66	7.06	3.75	2.94
23000	40.4	-19.5	0.88	-33.75	6.92	3.77	2.70
23500	40.4	-19.3	0.90	-33.35	6.99	3.52	2.66
24000	40.4	-19.8	0.88	-33.99	6.88	3.88	2.58
24500	40.4	-19.5	0.91	-33.89	7.01	3.93	2.51
25000	40.4	-19.3	0.88	-33.00	6.72	3.96	2.14
25500	40.5	-20.4	0.89	-34.07	6.90	3.66	2.22
26000	40.5	-21.3	0.86	-35.11	7.02	3.69	2.28
26500	40.5	-21.1	0.90	-35.20	7.15	3.91	2.36

Sample calculation

E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

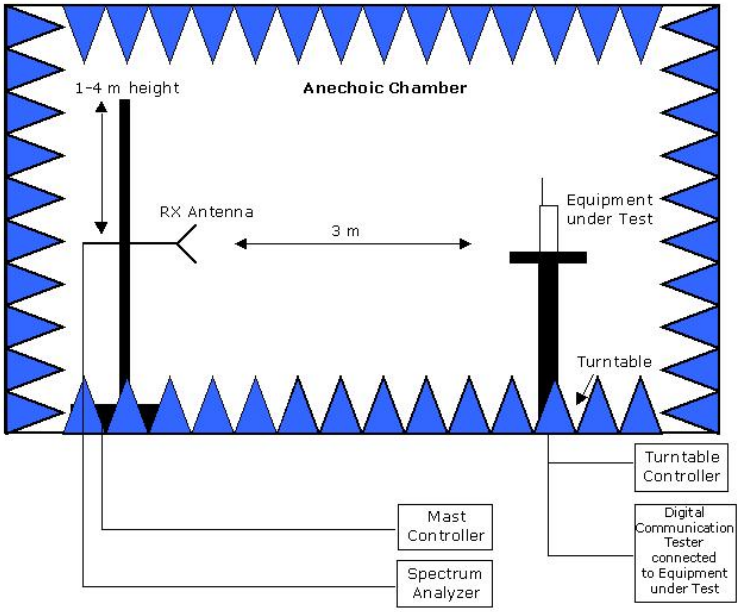
7.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

Frequency	AF EMCO 3160-10	Corr.	cable loss 1 (inside chamber)	cable loss 2 (outside chamber)	cable loss 3 (switch unit)	cable loss 4 (to receiver)	distance corr. (-20 dB/ decade)	d_{Limit} (meas. distance (limit)	d_{used} (meas. distance (used)
GHz	dB (1/m)	dB	dB	dB	dB	dB	dB	m	m
26.5	43.4	-11.2	4.4				-9.5	3	1.0
27.0	43.4	-11.2	4.4				-9.5	3	1.0
28.0	43.4	-11.1	4.5				-9.5	3	1.0
29.0	43.5	-11.0	4.6				-9.5	3	1.0
30.0	43.5	-10.9	4.7				-9.5	3	1.0
31.0	43.5	-10.8	4.7				-9.5	3	1.0
32.0	43.5	-10.7	4.8				-9.5	3	1.0
33.0	43.6	-10.7	4.9				-9.5	3	1.0
34.0	43.6	-10.6	5.0				-9.5	3	1.0
35.0	43.6	-10.5	5.1				-9.5	3	1.0
36.0	43.6	-10.4	5.1				-9.5	3	1.0
37.0	43.7	-10.3	5.2				-9.5	3	1.0
38.0	43.7	-10.2	5.3				-9.5	3	1.0
39.0	43.7	-10.2	5.4				-9.5	3	1.0
40.0	43.8	-10.1	5.5				-9.5	3	1.0

Sample calculation

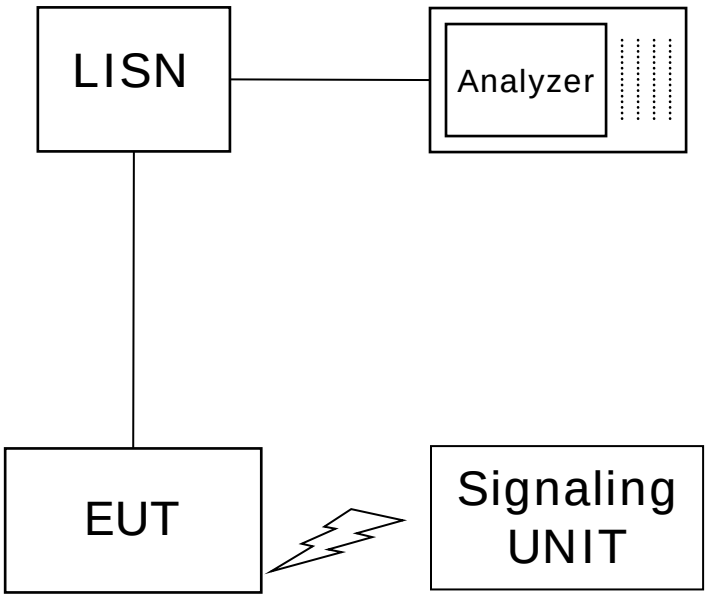
E (dB µV/m) = U (dB µV) + AF (dB 1/m) + Corr. (dB)
U = Receiver reading
AF = Antenna factor
Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)
Linear interpolation will be used for frequencies in between the values in the table.
distance correction = -20 * LOG (d_{Limit}/ d_{used})
Linear interpolation will be used for frequencies in between the values in the table.
Table shows an extract of values.

8 SETUP DRAWINGS



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting ground plane.



Setup in the shielded room for conducted measurements at AC mains port

9 MEASUREMENT UNCERTAINTIES

Test Case	Parameter	Uncertainty
Conducted Emissions at AC mains	Voltage	± 3.4 dB
Radiated Emissions	Field Strength	± 5.5 dB

10 PHOTO REPORT

Please see separate photo report.