

FCC Measurement/Technical Report on

Multimedia Equipment with WLAN and Bluetooth

BCI3L4PTN1(Star 3.5)

FCC ID: 2AUXS- BCI3L4PTN1
IC: 25847-BCI3L4PTN1

Test Report Reference: MDE_BOSCH_2411_FCC_01

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.

7layers GmbH

Borsigstraße 11
40880 Ratingen, Germany
T +49 (0) 2102 749 0
F +49 (0) 2102 749 350

Geschäftsführer/
Managing Directors:
Jörg-Timm Kilisch
Bernhard Retka

Registergericht/registered:
Düsseldorf HRB 75554
USt-Id.-Nr./VAT-No. DE203159652
Steuer-Nr./TAX-No. 147/5869/0385

a Bureau Veritas
Group Company

www.7layers.com

Commerzbank AG Account No. 303 016 000 Bank Code 300 400 00 IBAN DE81 3004 0000 0303 0160 00 Swift Code COBADEFF

Table of Contents

1	Applied Standards and Test Summary	3
1.1	Applied Standards	3
1.2	FCC-IC Correlation Table	4
1.3	Measurement Summary	5
2	Revision History / Signatures	6
3	Administrative Data	7
3.1	Testing Laboratory	7
3.2	Project Data	7
3.3	Applicant Data	7
3.4	Manufacturer Data	8
4	Test object Data	9
4.1	General EUT Description	9
4.2	EUT Main components	9
4.3	Ancillary Equipment	10
4.4	Auxiliary Equipment	10
4.5	EUT Setups	11
4.6	Operating Modes / Test Channels	11
4.7	Product labelling	11
5	Test Results	12
5.1	Radiated Emissions	12
6	Test Equipment	21
6.1	Test Equipment Hardware	21
6.2	Test Equipment Software	24
7	Antenna Factors, Cable Loss and Sample Calculations	25
7.1	Antenna R&S HL562 (30 MHz – 1 GHz)	25
7.2	Antenna R&S HF907 (1 GHz – 18 GHz)	26
7.3	Antenna EMCO 3160-09 (18 GHz – 26.5 GHz)	27
7.4	Antenna EMCO 3160-10 (26.5 GHz – 40 GHz)	28
8	Measurement Uncertainties	29
9	Photo Report	30

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 (10-1-23 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

Applicable ISED Standards

ICES-Gen, Issue 1 + Amendment 1 (March 2019) + Amendment 2 (February 2021)

ICES-003, Issue 7

Note:

ANSI C63.4–2014 is applied.

1.2 FCC-IC CORRELATION TABLE

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

Measurement	FCC reference	ISED reference
Conducted Emissions (AC Power Line)	§15.107	ICES-003 Issue 7: 3.2.1
Radiated Spurious Emissions	§15.109	ICES-003 Issue 7: 3.2.2

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 ISED 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

47 CFR CHAPTER I FCC PART 15

§ 15.109 Class B

Subpart B

Radiated Emissions

The measurement was performed according to ANSI C63.4

Final Result

OP-Mode	Setup	Date	FCC	IC
AC mains connection, Measurement range, Test setup				
via auxiliary equipment, 26 GHz - 40 GHz, stand-alone	S01_AB01#S3.5	2025-01-31	Passed	Passed
via auxiliary equipment, 18 GHz - 26 GHz, stand-alone	S01_AB01#S3.5	2025-01-31	Passed	Passed
via auxiliary equipment, 1 GHz - 18 GHz, stand-alone	S01_AB01#S3.5	2025-01-24	Passed	Passed
via auxiliary equipment, 30 MHz - 1 GHz, stand-alone	S01_AB01#S3.5	2025-01-24	Passed	Passed

N/A: Not applicable

N/P: Not performed

2 REVISION HISTORY / SIGNATURES

Report version control			
Version	Release date	Change Description	Version validity
initial	2025-04-15	--	valid
--	--	--	--

COMMENT:

According to the manufacturer's declaration, the device is not intended to be connected to the AC mains, and therefore the "conducted emissions" requirements for AC power lines do not apply.



(responsible for accreditation scope)
Dipl.-Ing. Marco Kullik



(responsible for testing and report)
BSc. Mhd Mouaz Saad



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

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: Dipl.-Ing. Marco Kullik
Report Template Version: 2025-02-28

3.2 PROJECT DATA

Responsible for testing and report: BSc. Mhd Mouaz Saad
Employees who performed the tests: documented internally at 7Layers
Date of Report: 2025-04-15
Testing Period: 2025-01-24 to 2025-01-31

3.3 APPLICANT DATA

Company Name: Robert Bosch GmbH
Address: Robert-Bosch-Platz 1, 70839 Gerlingen
Germany
Contact Person: Karin Silberhorn

3.4 MANUFACTURER DATA

Manufacturer 1

Company Name: Bosch Car Multimedia Portugal

Address: S.A. Rua Max Grundig
35-Lomar,
4705-820 Braga

Manufacturer 2

Company Name: Bosch Automotive Products (Suzhou) Co., Ltd.

Address: Changzhou Branch
No. 17, Long Men Road,
Wujin Hi-tech Industrial Zone
Changzhou, Jiangsu, P.R. China

4 TEST OBJECT DATA

4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Central In-Vehicle Infotainment Computer	
Product name	Multimedia Device with WLAN and Bluetooth	
Model name	BCI3L4PTN1(Star 3.5)	
Declared EUT data by the supplier		
Power Supply Type	DC (via AUX01)	
Nominal Voltage / Frequency	12 VDC (via AUX01)	
Test Voltage / Frequency	12 VDC (via AUX01)	
Highest internal frequency	5825 MHz	
General Description	Central In-Vehicle Infotainment Computer Gen20x.i3 infotainment system is the main unit in the vehicle, which combines the instrument cluster and infotainment functionality. It supports Bluetooth classic (BT), Bluetooth Low Energy(BTLE) and Wi-Fi (2.4GHz and 5GHz).	
Ports	Main Connector A(unshielded, 1m)	GNSS antenna (shielded, 1.5m)
	Main Connector B (unshielded, 1m)	BT/WLAN Antenna (shielded, 1.5m)
	Ethernet (shielded, 1.5m)	HD-BaseT (shielded, 1.5m)
	FM/AM/SDARS/Ref.-Antennas	USB 2.0 – TGS (shielded, 1.5m)
	Video-Out Displays (shielded, 1.5m)	USB 2.0 - MM-Box (shielded, 1.5m)
	CamsControl(shielded, 1.5m)	Video-in Cameras (shielded, 1.5m)
	USB 3.0 High Speed Flashing/CAM Logging (shielded, 1.5m)	
Special software used for testing	ETGui.exe	

4.2 EUT MAIN COMPONENTS

Sample Name	Sample Code	Description
EUT B	DE1050025ab01	Radiated Sample
Sample Parameter	Value	
Serial No.	0015673	
HW Version	D5	
SW Version	E064.4	
Comment	BCI3L4PTN1 - Star 3.5	

NOTE:The short description 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
ANC 1	Continental, RKE223E1GNS, DE1050025/026AUX01	GNSS Antenna + Antenna Cable (1.5m)
ANC 2	Mercedes-Benz, A1779052902, DE1050025/026AUX45	4x WIFI/BT Antenna + 4x Antenna Cable (1.5m)

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
AUX01	Rohde&Schwarz, NGP800, -, -, 101178	Lab Power Supply
AUX02	BOSCH, -, -, -	Main Harnes
AUX03	Harman Becker, M782, 24/03.01, 24/08.01, M7829cR166900040	MMA Amplifier
AUX04	BOSCH, A1749051903, 23/30, -, E10 00550L24064	Vehicle Passenger Camera
AUX05	BOSCH, Cams-Cntrl termination box, -, -, -	Termination Box Cams
AUX06	BOSCH, Diamler_CIVIC_I2, -, -, -	USB Box
AUX07	BOSCH, Main loadbox CIVIC I3, -, -, -	Main Load box
AUX08	Vector, VN5610A, -, -, 007167-017648	Ethernet/CAN box
AUX09	Vector, FW75550/12, -, -, 0092880	AC/DC Adaptor for Vector Box
AUX10	HP, HSN-C13C-5, -, Windows 11, CND2290G6L	Customer Laptop
AUX11	Lit-on, TPN-CA11, -, -, 0A3UGMG1T	AC/DC Adaptor for Laptop
AUX12	BOSCH, A1748207801, 24/11, 24/11, 22407300630	Display Cluster

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_AB01#S3.5	EUT B, ANC 1, ANC 2, AUX01 to AUX12	Radiated Setup

4.6 OPERATING MODES / TEST CHANNELS

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

- TX Standby with Vehicle Ethernet Traffic

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 RADIATED EMISSIONS

Standard **FCC Part 15 Subpart B**

The test was performed according to:
ANSI C63.4

5.1.1 TEST DESCRIPTION

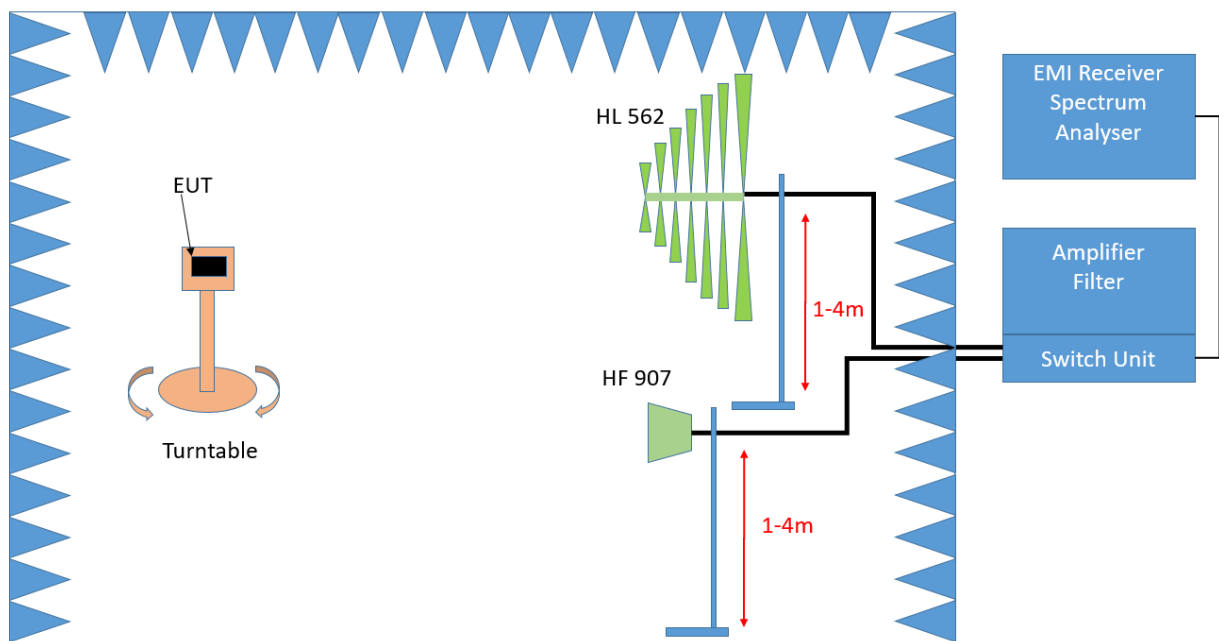
The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The measurements were performed according to the following sub-chapters of ANSI C63.4:

- 30 MHz – 1 GHz: Chapter 8.3.2.1
- > 1 GHz: Chapter 8.3.2.2

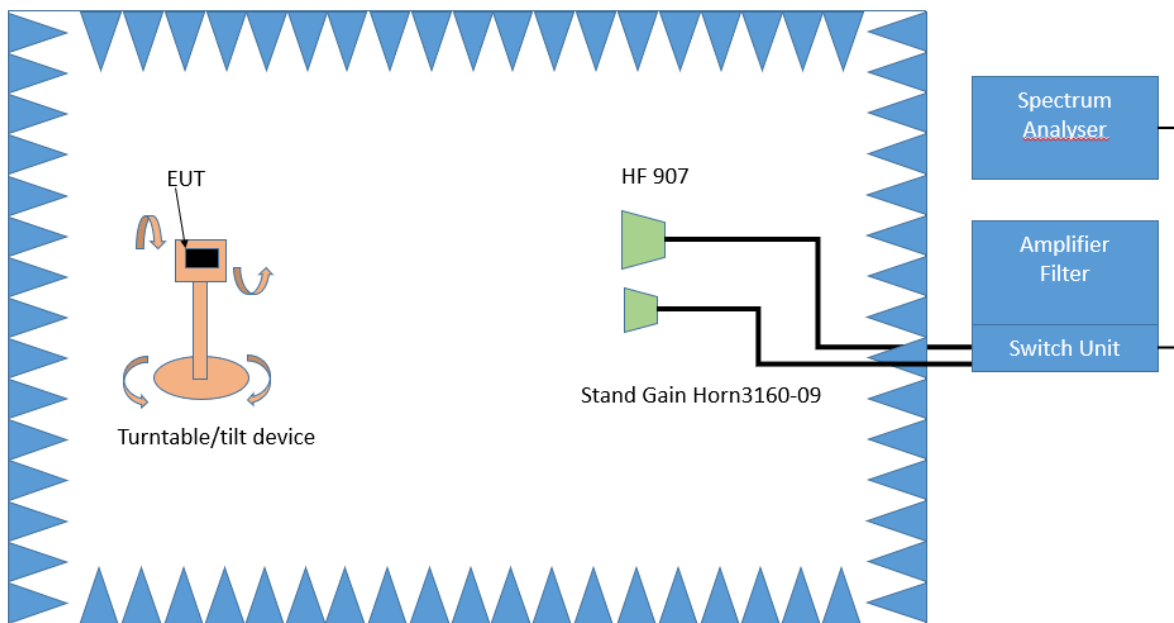
The measurement procedure is implemented into the EMI test software EMC32 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is also performed at 3 axes. A pre-check is performed while the EUT is powered.

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

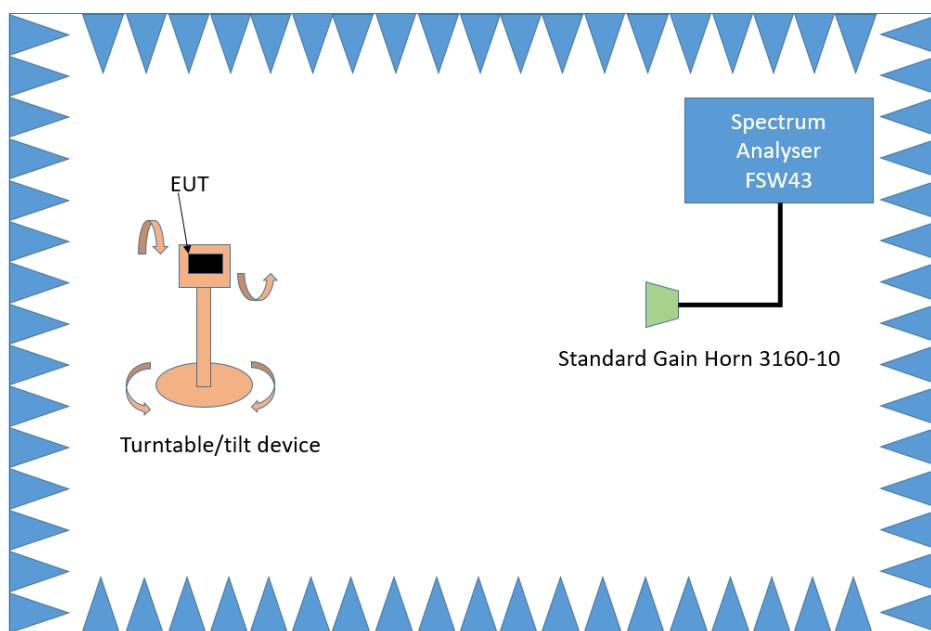
1. Measurement setup



Test Setup; Spurious Emission Radiated (SAC)



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz



Test Setup; Spurious Emission Radiated (FAC), 26.5 – 40 GHz

Frequency range 30 MHz – 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-Max-hold / Quasi-Peak (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 – 4 m
- Height variation step size: 1.5 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 360° . 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 slowly vary between 1 – 4 m. 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 – Max-hold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: 360°
- Height variation range: 1 – 4 m
- Antenna Polarization: max. value determined in step 1

Step 3: Final measurement with QP detector

With the settings determined in step 2, the final measurement will be performed:

EMI receiver settings for step 3:

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

Above 1 GHz:

The following changes apply to the measurement procedure for the frequency range above 1 GHz:

Step 1:

- Turntable step size: 45°
- Detector: Peak, Average (Max-hold)
- IF – Bandwidth: 1 MHz
- Frequency steps: 250 kHz
- Measuring time: 500 ms / GHz

Step 2:

- IF – Bandwidth: 1 MHz

Step 3:

- Detector: Peak / CISPR Average
- IF – Bandwidth: 1 MHz

After every measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

5.1.2 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

Class A:

Frequency (MHz)	Limit (µV/m)	Measurement distance (m)	Limits (dBµV/m)
30 – 88	90@10m	3	39.1@10m
88 – 216	150@10m	3	43.5@10m
216 – 960	210@10m	3	46.4@10m
960 – 26000	300@10m	3	49.5@10m
26000 – 40000	300@10m	1	49.5@10m

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: $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)} / 1\text{µV/m})$

5.1.3 TEST PROTOCOL

Ambient temperature: 21 - 24 °C
 Air Pressure: 998 - 1009 hPa
 Humidity: 34 - 42 %
 via auxiliary equipment, stand-alone

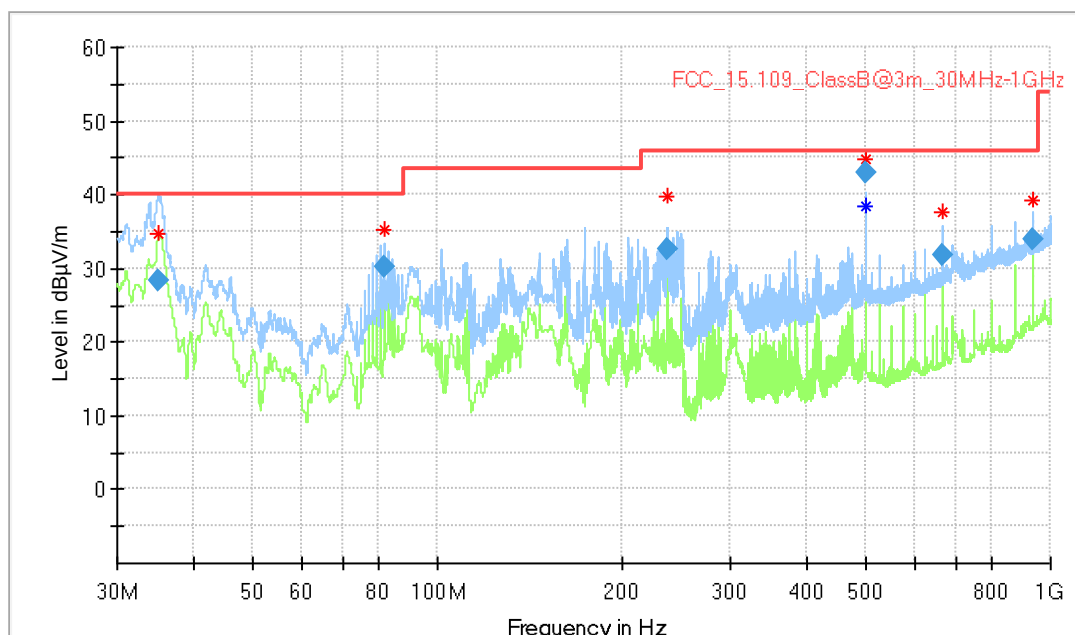
Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]
35.0	28.4	QP	120	40.0	11.6
81.8	30.1	QP	120	40.0	9.9
237.6	32.7	QP	120	46.0	13.3
500.0	42.9	QP	120	46.0	3.1
666.7	31.7	QP	120	46.0	14.3
933.3	33.9	QP	120	46.0	12.1
2700.0	36.0	AV	1000	54.0	18.0
2700.0	42.9	PEAK	1000	74.0	31.1
4944.8	28.0	AV	1000	54.0	26.1
4944.8	42.1	PEAK	1000	74.0	32.0
5194.3	26.5	AV	1000	54.0	27.5
5194.3	41.2	PEAK	1000	74.0	32.8
5863.3	27.9	AV	1000	54.0	26.1
5863.3	44.7	PEAK	1000	74.0	29.4
5940.0	37.3	AV	1000	54.0	16.7
5940.0	45.9	PEAK	1000	74.0	28.1
6221.8	28.8	AV	1000	54.0	25.2
6221.8	43.0	PEAK	1000	74.0	31.0

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

5.1.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Common Information

Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 3 m
Test Standard:	FCC §15.109, ANSI C63.4
EUT / Setup Code:	DE1050025ab01 / S01_AB01#S3.5
Operating Conditions:	AC:120 V 60 Hz, DC via AUX01: 12 V
Comment:	TX Standby with Vehicle Ethernet Traffic
Legend:	Trace (preview): blue = PK, green = QP; Star: red or blue = critical frequency; Rhombus: blue = final QP

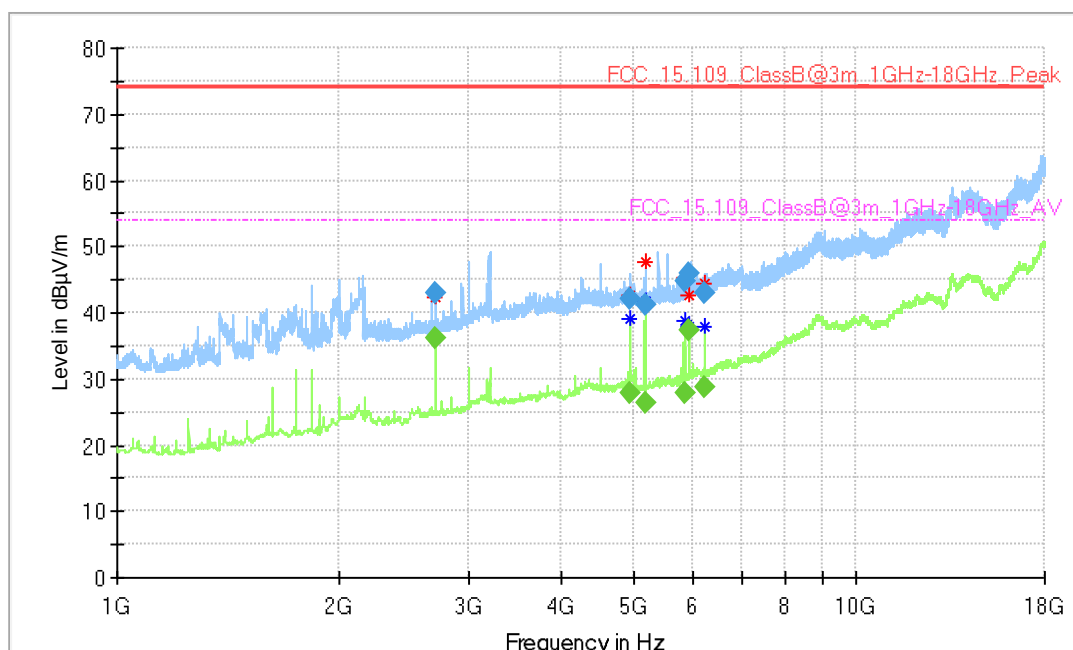


Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.040000	28.40	40.00	11.60	1000.0	120.000	107.0	V	12.0	16.7
81.750000	30.12	40.00	9.88	1000.0	120.000	400.0	H	25.0	10.7
237.630000	32.66	46.00	13.34	1000.0	120.000	115.0	H	48.0	12.3
500.010000	42.93	46.00	3.07	1000.0	120.000	100.0	H	152.0	20.9
666.660000	31.68	46.00	14.32	1000.0	120.000	179.0	V	201.0	24.2
933.330000	33.93	46.00	12.07	1000.0	120.000	104.0	H	184.0	28.1

Common Information

Test Description:	Radiated Emissions @ 3 m, SAC + mobile floor absorber
Test Standard:	FCC 15.109 Class B
EUT / Setup Code:	DE1050025ab01 / S01_AB01#S3.5
Operating Conditions:	AC:120 V 60 Hz, DC via AUX01: 12 V
Comment:	TX Standby with Vehicle Ethernet Traffic
Legend:	Trace (preview): blue = PK, green = AV; Star: red or blue = critical frequency; Rhombus: blue = final Peak, green = Final CISPR AV

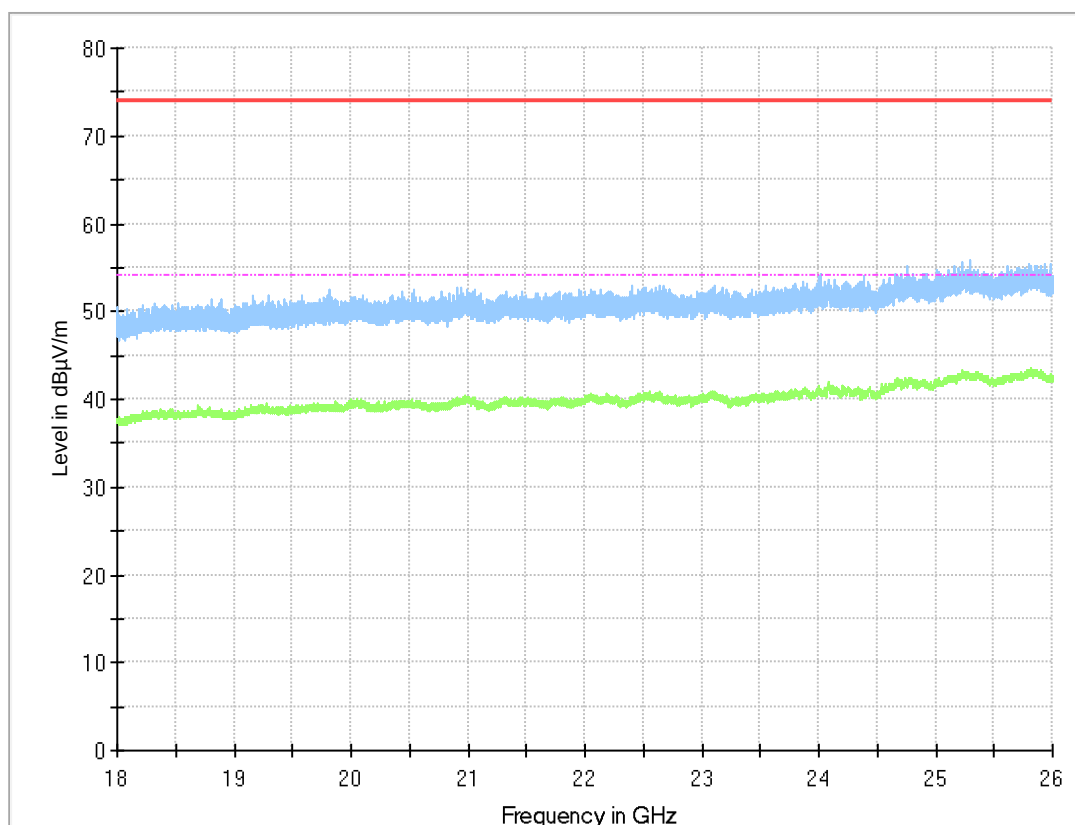


Final Result

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)
2700.000000	---	36.03	54.00	17.97	200.0	1000.000	170.0	V	-184.0	8.5
2700.000000	42.86	---	74.00	31.14	200.0	1000.000	170.0	V	-184.0	8.5
4944.750000	---	27.95	54.00	26.05	200.0	1000.000	206.0	H	-223.0	16.5
4944.750000	42.05	---	74.00	31.95	200.0	1000.000	206.0	H	-223.0	16.5
5194.250000	---	26.48	54.00	27.52	200.0	1000.000	368.0	V	-226.0	16.3
5194.250000	41.16	---	74.00	32.84	200.0	1000.000	368.0	V	-226.0	16.3
5863.250000	---	27.89	54.00	26.11	200.0	1000.000	265.0	V	-203.0	17.2
5863.250000	44.65	---	74.00	29.35	200.0	1000.000	265.0	V	-203.0	17.2
5940.000000	---	37.30	54.00	16.70	200.0	1000.000	225.0	H	-189.0	17.7
5940.000000	45.86	---	74.00	28.14	200.0	1000.000	225.0	H	-189.0	17.7
6221.750000	---	28.83	54.00	25.17	200.0	1000.000	283.0	V	104.0	18.4
6221.750000	42.99	---	74.00	31.01	200.0	1000.000	283.0	V	104.0	18.4

Common Information

Test Description: Radiated Emissions @ 3 m, FAC
 Test Standard: FCC 15.109 Class B
 EUT / Setup Code: DE1050025ab01 / S01_AB01#S3.5
 Operating Conditions: AC:120 V 60 Hz, DC via AUX01: 12 V
 Comment: TX Standby with Vehicle Ethernet Traffic
 Legend: Trace (preview): blue = PK, green = AV; Star: red or blue = critical frequency; Rhombus: blue = final Peak, green = Final CISPR AV

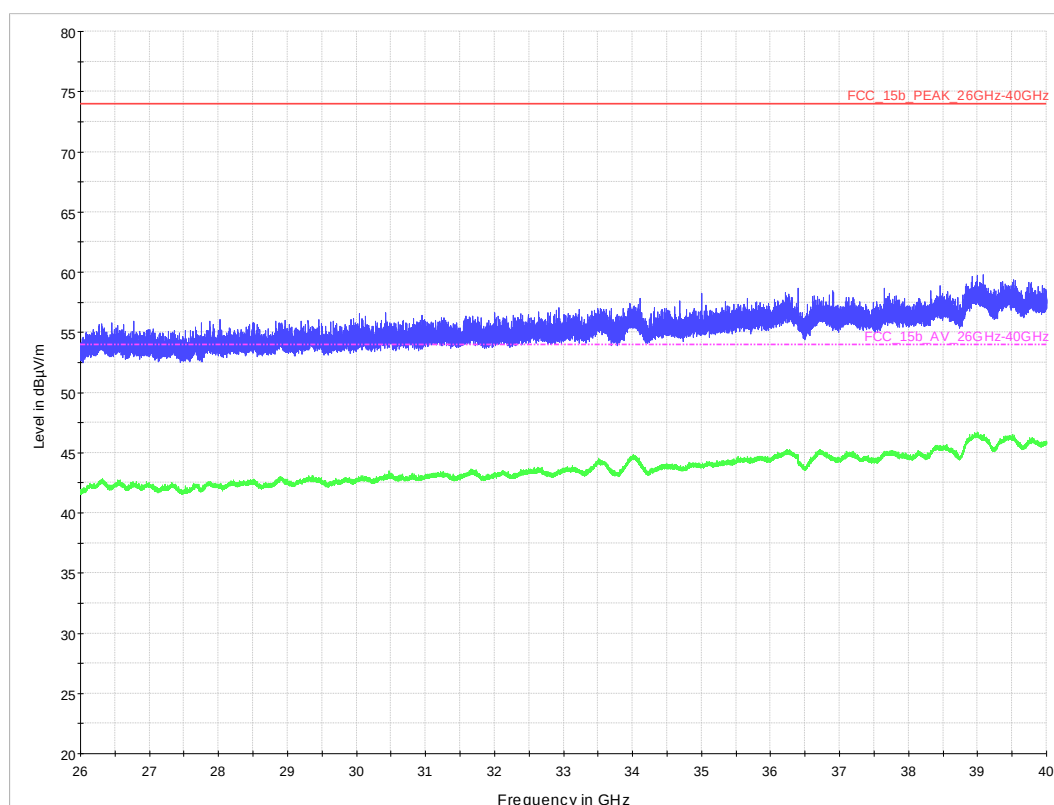


Final Result

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)	Comment

Common Information

Test Description: Radiated Emissions, FAC
 Test Standard: FCC 15.109 Class B
 EUT / Setup Code: DE1050025ab01 / S01_AB01#S3.5
 Operating Conditions: AC:120 V 60 Hz, DC via AUX01: 12 V
 Comment: TX Standby with Vehicle Ethernet Traffic
 Legend: Trace (preview): blue = PK, green = AV; Star: red or blue = critical frequency; Rhombus: blue = final Peak, green = Final CISPR AV



Final Result

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)	Comment
---	---	---	---	---	---	---	---	---	---	---	---

5.1.5 TEST EQUIPMENT USED

- Radiated Emissions SAC above 1 GHz
- Radiated Emissions SAC up to 1 GHz
- Radiated Emissions FAR 5 GHz FCC

6 TEST EQUIPMENT

6.1 TEST EQUIPMENT HARDWARE

- 1 Radiated Emissions SAC above 1 GHz
Radiated emission tests above 1 GHz in a semi anechoic room with floor absorbers

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
1.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
1.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufth Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
1.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
1.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
1.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
1.6	Opus10 THI (8152.00)	T/H Logger 10	Lufth Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
1.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
1.8	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
1.9	JS4-00102600-42-5A	Broadband Amplifier 30 MHz - 26 GHz	Miteq	619368	N/A	N/A
1.10	MA4985-XP-ET	Bore Sight Antenna Mast	innco systems GmbH	none	N/A	N/A
1.11	BB4312-C30-H3x	Filter Universal 1A	Siemens Matsushita Components	none	N/A	N/A
1.12	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10
1.13	HF 907-2	Double-ridged horn	Rohde & Schwarz	102817	2022-07	2025-07

2 Radiated Emissions SAC up to 1 GHz
Radiated emission tests up to 1 GHz in a semi anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.1	N5000/NP	Filter for EUT, 2 Lines, 250 V, 16 A	ETS-LINDGREN	241515	N/A	N/A
2.2	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
2.3	ESW44	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	101603	2024-03	2026-03
2.4	Anechoic Chamber 01	SAC/FAR, 10.58 m x 6.38 m x 6.00 m	Frankonia Germany EMC Solution GmbH	none	N/A	N/A
2.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
2.6	Opus10 THI (8152.00)	T/H Logger 10	Lufft Mess- und Regeltechnik GmbH	12488	2023-12	2025-12
2.7	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
2.8	DS 420S	Turn Table 2 m diameter	HD GmbH	420/573/99	N/A	N/A
2.9	HL562E ULTRALOG	Biconical-log-per Antenna (30 MHz - 6 GHz)	Rohde & Schwarz GmbH & Co. KG	102299	2024-07	2027-07
2.10	CS-RUB6	Rubidium Frequency Standard	Rohde & Schwarz GmbH & Co. KG	100321	2023-10	2025-10
2.11	AM 4.0	Antenna Mast 4 m	Maturo GmbH	AM4.0/180/11920513	N/A	N/A

3 Radiated Emissions FAR 5 GHz FCC
 Radiated Emissions Tests for 5 GHz bands in a fully anechoic room

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
3.1	Opus10 TPR (8253.00)	T/P Logger 13	Lufft Mess- und Regeltechnik GmbH	13936	2023-12	2025-12
3.2	Innco Systems CO3000	Controller for bore sight mast FAC	innco systems GmbH	CO3000/1460/54740522/P	N/A	N/A
3.3	AMF-7D00101800-30-10P-R	Broadband Amplifier 100 MHz - 18 GHz	Miteq		N/A	N/A
3.4	Anechoic Chamber 03	FAR, 8.80m x 4.60m x 4.05m (l x w x h)	Albatross Projects	P26971-647-001-PRB	N/A	N/A
3.5	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2023-08	2025-08
3.6	JS4-18002600-32-5P	Broadband Amplifier 18 GHz - 26 GHz	Miteq	849785	N/A	N/A
3.7	FSW43	Spectrum Analyzer	Rohde & Schwarz GmbH & Co. KG	103779	2023-04	2025-04
3.8	EP 1200/B, NA/B1	AC Source, Amplifier with integrated variable Oscillator	Spitzenberger & Spies GmbH & Co. KG	B6278	N/A	N/A
3.9	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik GmbH	00083069	N/A	N/A
3.10	WHKX 7.0/18G-8SS	High Pass Filter	Wainwright Instruments GmbH	09	N/A	N/A
3.11	MA3000/0800-XP-ET-compact	Bore Sight Antenna Mast	innco systems GmbH	9210522	N/A	N/A
3.12	TT 1.5 WI	Turn Table	Maturo GmbH	-	N/A	N/A
3.13	3160-10	Standard Gain / Pyramidal Horn Antenna 40 GHz	EMCO Elektronik GmbH	00086675	N/A	N/A
3.14	Opus 20 THI (8120.00)	ThermoHygro Datalogger	Lufft Mess- und Regeltechnik GmbH	115.0318.0802.033	2023-08	2025-08
3.15	TD1.5-10kg	EUT Tilt Device (Rohacell)	Maturo GmbH	TD1.5-10kg/024/3790709	N/A	N/A
3.16	AFS42-00101800-25-S-42	Broadband Amplifier 25 MHz - 18 GHz	Miteq	2035324	N/A	N/A
3.17	HF 907	Double-ridged horn	Rohde & Schwarz	102444	2024-10	2027-10

The calibration interval is the time interval between "Last Calibration" and "Calibration Due"

6.2 TEST EQUIPMENT SOFTWARE

Semi-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
INNCO Mast Controller	1.02.62
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
MATURO Controller	1.24
MATURO Mast	12.19
MATURO Turn-Table	30.10
Fully-Anechoic Chamber:	
Software	Version
EMC32 Measurement Software	10.60.10
MATURO Controller	1.30
MATURO Turn-Unit	11.10
MATURO Mast	12.10
MATURO Turntable	12.11
INNCO Controller	1.03.02
INNCO Mast Height	34.10
INNCO Mast Elevation	36.11
TS 8997	
WMS32 Measurement Software	11.60.00 (till 2024-03-19), 11.70.00 + Hotfix 01
Conducted AC Emissions:	
Software	Version
EMC32 Measurement Software	10.60.20

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 ANTENNA R&S HL562 (30 MHZ – 1 GHZ)

($d_{\text{Limit}} = 3 \text{ m}$)

Frequency MHz	AF R&S HL562 dB (1/m)	Corr. dB	cable loss 1 (inside chamber) dB	cable loss 2 (outside chamber) dB	cable loss 3 (switch unit) dB	cable loss 4 (to receiver) dB	distance corr. (-20 dB/ decade) dB	d_{Limit} (meas. distance (limit)) m	d_{used} (meas. distance (used)) 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

($d_{\text{Limit}} = 10 \text{ m}$)

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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + \text{Corr. (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.

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

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
1000	24.4	-19.4
2000	28.5	-17.4
3000	31.0	-16.1
4000	33.1	-14.7
5000	34.4	-13.7
6000	34.7	-12.7
7000	35.6	-11.0

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)		
dB	dB	dB	dB		
0.99	0.31	-21.51	0.79		
1.44	0.44	-20.63	1.38		
1.87	0.53	-19.85	1.33		
2.41	0.67	-19.13	1.31		
2.78	0.86	-18.71	1.40		
2.74	0.90	-17.83	1.47		
2.82	0.86	-16.19	1.46		

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
3000	31.0	-23.4
4000	33.1	-23.3
5000	34.4	-21.7
6000	34.7	-21.2
7000	35.6	-19.8

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
dB	dB	dB	dB	dB	
0.47	1.87	0.53	-27.58	1.33	
0.56	2.41	0.67	-28.23	1.31	
0.61	2.78	0.86	-27.35	1.40	
0.58	2.74	0.90	-26.89	1.47	
0.66	2.82	0.86	-25.58	1.46	

Frequency	AF R&S HF907	Corr.
MHz	dB (1/m)	dB
7000	35.6	-57.3
8000	36.3	-56.3
9000	37.1	-55.3
10000	37.5	-56.2
11000	37.5	-55.3
12000	37.6	-53.7
13000	38.2	-53.5
14000	39.9	-56.3
15000	40.9	-54.1
16000	41.3	-54.1
17000	42.8	-54.4
18000	44.2	-54.7

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)
dB	dB	dB	dB	dB	dB
0.56	1.28	-62.72	2.66	0.94	1.46
0.69	0.71	-61.49	2.84	1.00	1.53
0.68	0.65	-60.80	3.06	1.09	1.60
0.70	0.54	-61.91	3.28	1.20	1.67
0.80	0.61	-61.40	3.43	1.27	1.70
0.84	0.42	-59.70	3.53	1.26	1.73
0.83	0.44	-59.81	3.75	1.32	1.83
0.91	0.53	-63.03	3.91	1.40	1.77
0.98	0.54	-61.05	4.02	1.44	1.83
1.23	0.49	-61.51	4.17	1.51	1.85
1.36	0.76	-62.36	4.34	1.53	2.00
1.70	0.53	-62.88	4.41	1.55	1.91

Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + \text{Corr. (dB)}$

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.

7.3 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + \text{Corr. (dB)}$

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.

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

Frequency GHz	AF EMCO 3160-10 dB (1/m)	Corr. dB	cable loss 1 (inside chamber) dB	cable loss 2 (outside chamber) dB	cable loss 3 (switch unit) dB	cable loss 4 (to receiver) dB	distance corr. (-20 dB/ decade) dB	d _{Limit} (meas. distance (limit) m	d _{used} (meas. distance (used) 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

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

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 = $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

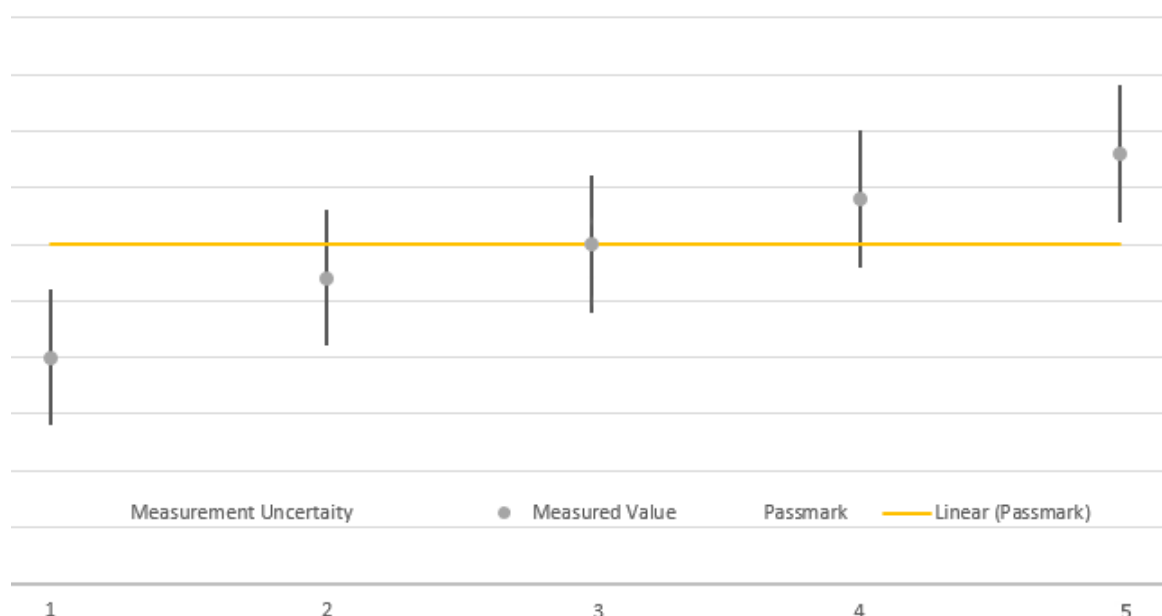
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

8 MEASUREMENT UNCERTAINTIES

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

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	on pass mark	within pass mark	Passed
4	above pass mark	within pass mark	Failed
5	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so-called shared risk principle.

9 PHOTO REPORT

Please see separate photo report.

*****END OF TEST REPORT*****