

# FCC Measurement/Technical Report on

RF-Sensor

RF-360

FCC ID: 2AO3N-TH87P6EROZ

IC ID: 23389-TH87P6EROZ

**Test Report Reference:** MDE\_DEDRONE\_1803\_FCCa\_rev1

**Test Laboratory:**

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**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 (10-1-18 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

§ 15.111 Antenna power conduction limits for receivers.

§ 15.121 Scanning receivers and frequency converters used with scanning receivers.

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 A / Class B

Conducted Emissions at AC mains

The measurement was performed according to ANSI C63.4

#### Final Result

#### OP-Mode

AC mains connection, Test setup

AC, computer peripheral

POE, computer peripheral

#### Setup

S01\_AA01

S02\_AA01

#### FCC

Passed

Passed

#### IC

Passed

Passed

#### 47 CFR CHAPTER I FCC PART 15 Subpart B

#### § 15.109 Class A / Class B

Radiated Emissions

The measurement was performed according to ANSI C63.4

#### Final Result

#### OP-Mode

AC mains connection, Measurement range, Test setup

AC, 1 GHz - 18 GHz, computer peripheral

AC, 30 MHz - 1 GHz, computer peripheral

POE, 1 GHz - 18 GHz, computer peripheral

POE, 30 MHz - 1 GHz, computer peripheral

#### Setup

S01\_AA01

S01\_AA01

S02\_AA01

S02\_AA01

#### FCC

Passed

Passed

Passed

Passed

#### IC

Passed

Passed

Passed

Passed

#### 47 CFR CHAPTER I FCC PART 15 Subpart B

#### § 15.111 Class B

Antenna power conduction limits for receivers

The measurement was performed according to ANSI C63.4

#### Final Result

#### OP-Mode

AC mains connection, Measurement range, Test setup

AC, 1 GHz - 18 GHz, computer peripheral

AC, 30 MHz - 1 GHz, computer peripheral

POE, 1 GHz - 18 GHz, computer peripheral

POE, 30 MHz - 1 GHz, computer peripheral

#### Setup

S01\_AA01

S01\_AA01

S02\_AA01

S02\_AA01

#### FCC

Passed <sup>1)</sup>

Passed <sup>1)</sup>

Passed <sup>1)</sup>

Passed <sup>1)</sup>

#### IC

Passed <sup>1)</sup>

Passed <sup>1)</sup>

Passed <sup>1)</sup>

Passed <sup>1)</sup>

#### 47 CFR CHAPTER I FCC PART 15 Subpart B

#### § 15.121 Class B

Scanning receivers and frequency converters used with scanning receivers.

#### OP-Mode

-

#### Setup

-

#### Final Result

#### FCC

N/A <sup>2)</sup>

#### IC

N/A <sup>2)</sup>

N/A: Not applicable

N/P: Not performed


1) The devices antennas are embedded, permanently attached, therefore part §15.111 (b) is applicable, which references the radiated emission limitations in this part (§15.109).

2) The device provides no speech communication and don't has analog voice audio circuitries therefore §15.121 is not applicable

## 2 REVISION HISTORY

Report version control			
Version	Release date	Change Description	Version validity
initial	2019-06-11	--	invalid
rev1	2019-09-12	Applicable §15.111 and §15.121 was added as reference	valid

COMMENT: -



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



(responsible for testing and report)  
Dipl.-Ing. Robert Machulec



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: 2019-02-12

#### 3.2 PROJECT DATA

Responsible for testing and report: Dipl.-Ing. Robert Machulec  
Employees who performed the tests: documented internally at 7Layers  
Date of Report: 2019-09-12  
Testing Period: 2019-03-12 to 2019-04-05

#### 3.3 APPLICANT DATA

Company Name: DEDRONE Holding Inc.  
Address: 220 Sansome Street, 6th Floor  
San Francisco CA 94104  
United States  
Contact Person: Robin Jäger

#### 3.4 MANUFACTURER DATA

Company Name: DEDRONE GmbH  
Address: Miramstraße 87  
34123 Kassel  
Germany  
Contact Person: Robin Jäger

## 4 TEST OBJECT DATA

### 4.1 GENERAL EUT DESCRIPTION

Kind of Device product description	The RF-360 is a passive, network-attached sensor for the detection of frequencies (RF) and WiFi signals.
Product name	RF-Sensor
Type	RF-360
<b>Declared EUT data by the supplier</b>	
Power Supply Type	AC
Nominal Voltage / Frequency	120 V
Test Voltage / Frequency	120 V
Highest internal frequency	5875 MHz
General Description	
Ports	AC, PoE

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
Sample #aa01	aa01	Radiated test sample #aa01
Sample Parameter	Value	
Serial No.	DR03601908P1001023	
HW Version	1	
SW Version	4-gbcc27bf	
Comment		

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, S/N)	Description
Laptop RE 02	Fujitsu Lifebook E series E782, 2012-08, Win7 Prof. Engl., DSCM004672	
AC Adapter	Fujitsu Ltd. PJW1942NA, 13300281B	
TFT Display	LG L17MB-P, 412WAPLOU560	
Mouse	Logitech M-BT58, HC60915A2XC	
Keyboard	CHERRY RS 6000 USB ON, G 0000273 2P28	
PoE adapter	ZyXEL, PoE12-HP, S/N: S160H42003015	The <b>PoE12-HP</b> is a single-port PoE injector that delivers both power and data to other PoE devices via a single CAT-5 Ethernet cable

#### 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
-	-	-

#### 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,	
S02_AA01	EUT A, PoE adapter	

## 4.6 OPERATING MODES

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

### 4.6.1 TEST MODES

The device is powered via AC or PoE. All receives are activated during testing.

## 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 50 $\mu$ H || 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

#### Class A:

Frequency (MHz)	QP Limits (dBμV)	AV Limits (dBμV)
0.15 – 0.5	79	66
0.5 - 30	73	60

### 5.1.3 TEST PROTOCOL

Temperature: 25 °C  
 Air Pressure: 996 hPa  
 Humidity: 30 %  
 Computer Peripheral

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

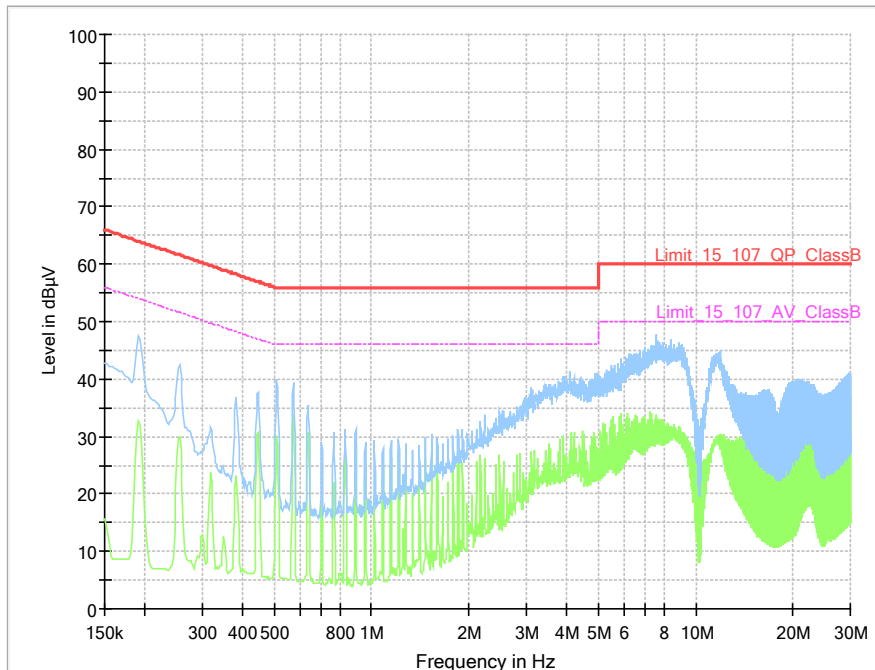
### 5.1.4 MEASUREMENT PLOT

AC mains connection = AC, Test setup = computer peripheral  
 (S01\_AA01)

## Diagram 1.01

### Common Information

Test Description:	Conducted Emissions
Test Standard:	FCC §15.107, ANSI C63.4
EUT / Setup Code:	DE1270002aa01 / DR0360
Operating Conditions:	AC, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX,
Operator Name:	URO
Comment:	computer peripheral setup, 120V/60Hz
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final
Tested Port / used LISN:	AC mains => ESH3-Z5
Termination of other ports:	AC of AUX => 2nd LISN ESH3-Z5 +50 Ohm



## Final\_Result

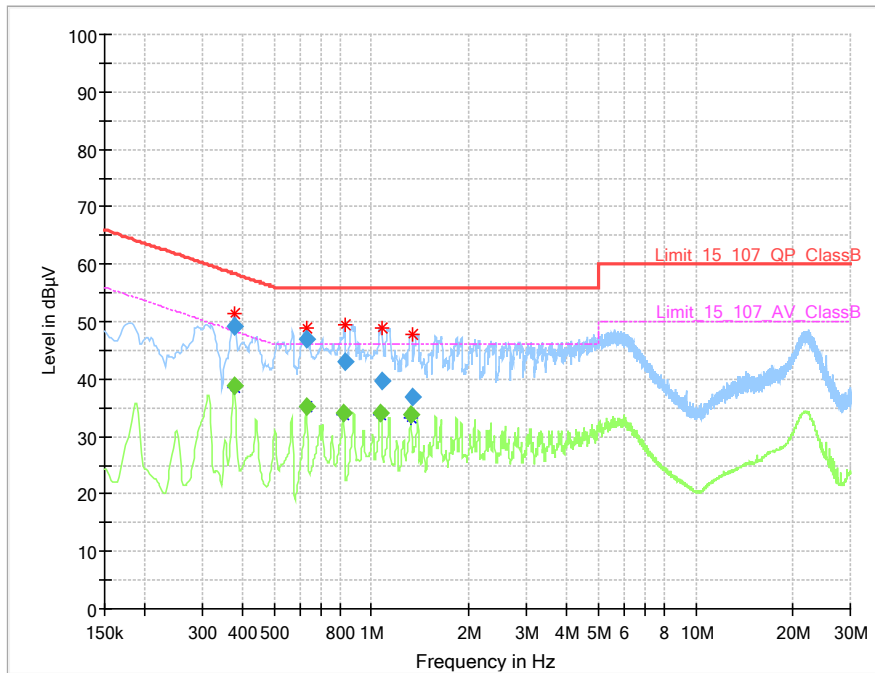
Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Measurement Time	Bandwidth (kHz)	Line	PE	Correction (dB)
---	---	---	---	---	---	---			---

AC mains connection = POE, Test setup = computer peripheral (S02\_AA01)

## Diagram 1.02

## Common Information

Test Description:	Conducted Emissions
Test Standard:	FCC §15.107, ANSI C63.4
EUT / Setup Code:	DE1270002aa01 / DR0360
Operating Conditions:	PoE, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX, eFDD5 idle
Operator Name:	URO
Comment:	computer peripheral setup, 120V/60Hz
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final
Tested Port / used LISN:	AC mains => ESH3-Z5
Termination of other ports:	AC of AUX => 2nd LISN ESH3-Z5 +50 Ohm



## Final\_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Measurement Time	Bandwidth (kHz)	Line	PE	Correction (dB)
0.377250	---	38.73	48.34	9.61	1000.	9.000	N	FLO	10.1
0.379500	49.27	---	58.29	9.02	1000.	9.000	N	FLO	10.1
0.629250	---	35.12	46.00	10.88	1000.	9.000	N	FLO	10.1
0.631500	46.86	---	56.00	9.14	1000.	9.000	N	FLO	10.1
0.818250	---	34.06	46.00	11.94	1000.	9.000	N	FLO	10.1
0.825000	42.91	---	56.00	13.09	1000.	9.000	N	GND	10.1
1.070250	---	34.21	46.00	11.79	1000.	9.000	N	FLO	10.2
1.079250	39.55	---	56.00	16.45	1000.	9.000	N	GND	10.2
1.322250	---	33.84	46.00	12.16	1000.	9.000	N	GND	10.2
1.333500	37.00	---	56.00	19.00	1000.	9.000	N	GND	10.2

### 5.1.5 TEST EQUIPMENT USED

- Conducted Emissions FCC

## 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 m<sup>2</sup> 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 pyramidal 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  $\pm 45^\circ$  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  $\pm 100$  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:  $\pm 45^\circ$  around the determined value
- Height variation range:  $\pm 100$  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 – 18 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:  $-180^{\circ}$  to  $135^{\circ}$
- Turntable step size:  $45^{\circ}$
- 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  $\pm 22.5^{\circ}$  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  $\pm 45$  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:  $\pm 22.5^{\circ}$  around the determined value
- Height variation range:  $\pm 45$  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

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

## 5.2.3 TEST PROTOCOL

Ambient temperature: 23 °C  
 Air Pressure: 999 hPa  
 Humidity: 30 %  
 Computer Peripheral Setup, AC via auxiliary equipment

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

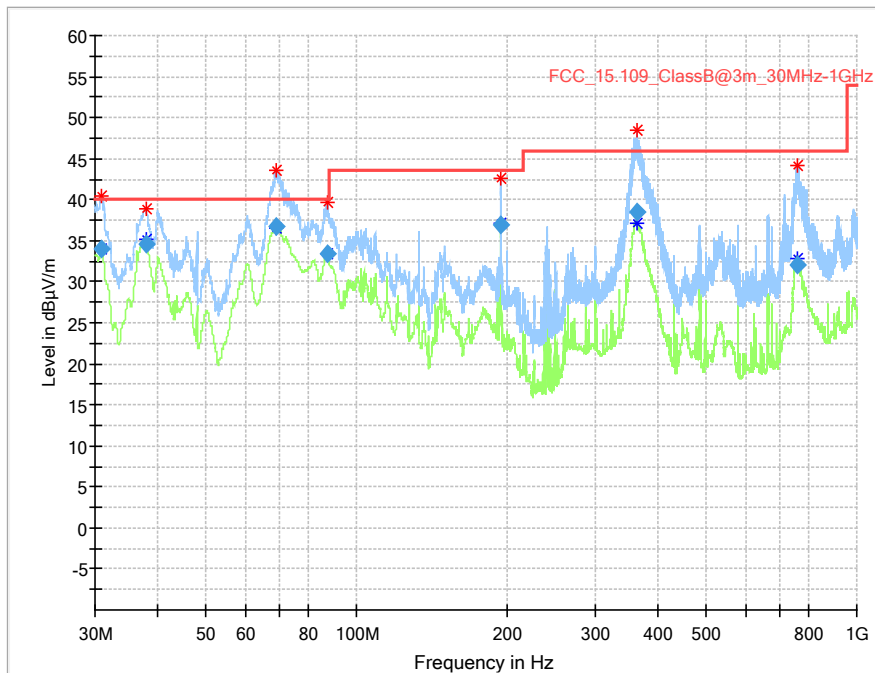
#### 5.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE, "WORST CASE")

AC mains connection = AC, Measurement range = 30 MHz - 1 GHz, Test setup = computer peripheral (S01\_AA01)

**Diagram 2.01**

#### Common Information

Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 4
Test Standard:	FCC §15.109, ANSI C63.4
EUT / Setup Code:	DE1270002aa01
Operating Conditions:	AC, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX;
Operator Name:	MER
Comment:	computer peripheral setup, 120V/60Hz
Legend:	Trace: blue = PK, green = QP; Star: red or blue = critical frequency; Rhombus: blue = final QP



#### Final\_Result

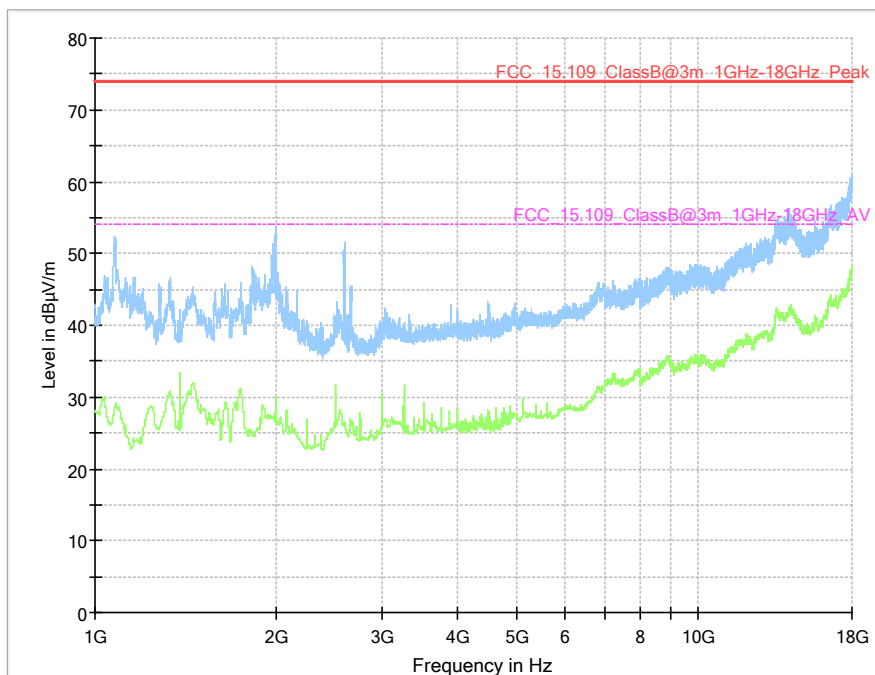
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth	Comment
30.870000	34.06	40.00	5.94	1000.	120.000	103.	V	-	
37.980000	34.62	40.00	5.38	1000.	120.000	105.	V	-	
69.240000	36.75	40.00	3.25	1000.	120.000	118.	V	132.	
87.210000	33.44	40.00	6.56	1000.	120.000	103.	V	-	
194.07000	36.94	43.50	6.56	1000.	120.000	105.	V	3.0	
363.66000	38.51	46.00	7.49	1000.	120.000	119.	H	-	
762.00000	32.10	46.00	13.90	1000.	120.000	108.	V	-	

AC mains connection = AC, Measurement range = 1 GHz - 18 GHz, Test setup = computer peripheral (S01\_AA01)

## Diagram 2.02

### Common Information

Test Description: Radiated Emissions, Test Site: Semi Anechoic Chamber @ 4  
 Test Standard: FCC §15.109, ANSI C63.4  
 EUT / Setup Code: DE1270002aa01  
 Operating Conditions: AC, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX, eFDD2 idle  
 Operator Name: MER  
 Comment: computer peripheral setup, 120V/60Hz  
 Legend: Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final



### Final\_Result

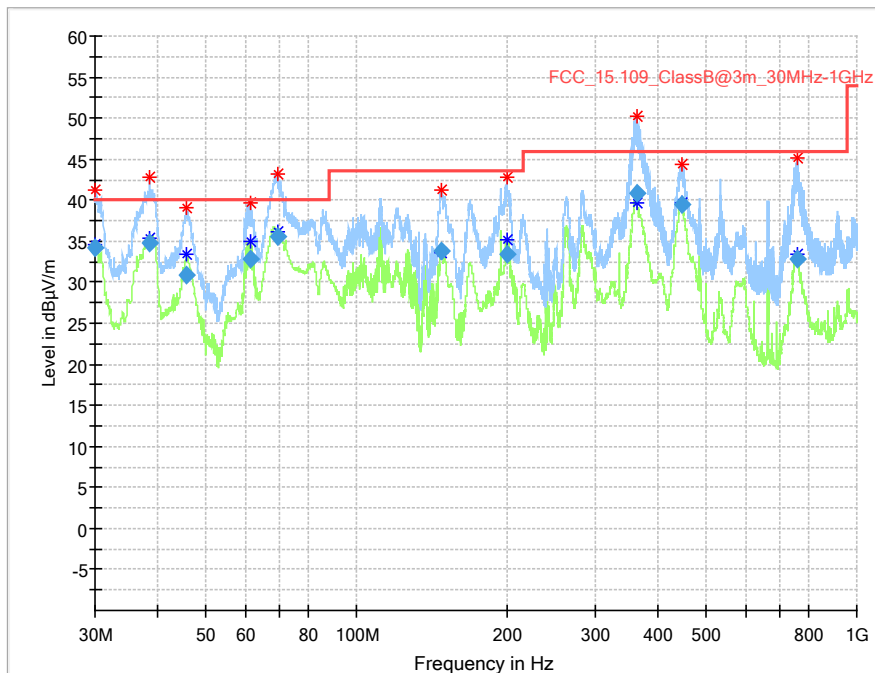
Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/)	Limit (dBµV/m)	Margin (dB)	Meas. Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth
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AC mains connection = POE, Measurement range = 30 MHz - 1 GHz, Test setup = computer peripheral (S02\_AA01)

## Diagram 2.03

### Common Information

Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 4
Test Standard:	FCC §15.109, ANSI C63.4
EUT / Setup Code:	DE1270002aa01
Operating Conditions:	PoE, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX;
Operator Name:	MER
Comment:	computer peripheral, 120V/60Hz
Legend:	Trace: blue = PK, green = QP; Star: red or blue = critical frequency; Rhombus: blue = final QP



### Final\_Result

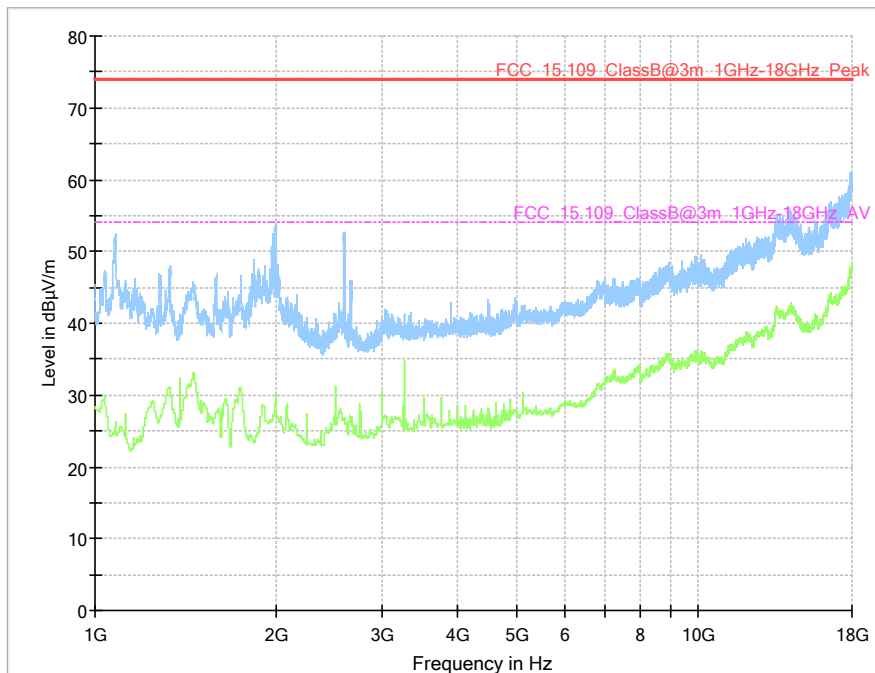
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Measurement Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth	Comment
30.090000	34.21	40.00	5.79	1000.	120.000	106.	V	-	
38.580000	34.68	40.00	5.32	1000.	120.000	104.	V	-	
45.780000	30.93	40.00	9.07	1000.	120.000	137.	V	9.0	
61.260000	32.79	40.00	7.21	1000.	120.000	169.	V	-	
69.480000	35.60	40.00	4.40	1000.	120.000	172.	V	-	
148.08000	33.71	43.50	9.79	1000.	120.000	103.	V	-	
199.74000	33.47	43.50	10.03	1000.	120.000	109.	V	-	
363.30000	40.76	46.00	5.24	1000.	120.000	103.	H	-	
446.34000	39.50	46.00	6.50	1000.	120.000	110.	V	-	
760.02000	32.87	46.00	13.13	1000.	120.000	108.	V	-	

AC mains connection = AC, Measurement range = 1 GHz - 18 GHz, Test setup = computer peripheral (S02\_AA01)

## Diagram 2.04

### Common Information

Test Description:	Radiated Emissions, Test Site: Semi Anechoic Chamber @ 4
Test Standard:	FCC §15.109, ANSI C63.4
EUT / Setup Code:	DE1270002aa01
Operating Conditions:	PoE, LAN traffic: Detector on: RX 2.4 & 5 GHz, GPS RX;
Operator Name:	MER
Comment:	computer peripheral setup
Legend:	Trace: blue = PK, green = CISPR AV; Star: red or blue = critical frequency; Rhombus: blue = final QP, green = final



### Final\_Result

Frequency (MHz)	MaxPeak (dBμV/m)	CAverage (dBμV/)	Limit (dBμV/m)	Margin (dB)	Measurement Time	Bandwidth (kHz)	Height (cm)	Pol	Azimuth	Comment
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### 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	Fluke 177	Digital Multimeter 03 (Multimeter)	Fluke Europe B.V.	86670383	2018-04	2020-04
1.3	ESH3-Z5	Two-Line V-Network	Rohde & Schwarz	828304/029	2017-05	2019-05
1.4	EP 1200/B, NA/B1	Amplifier with integrated variable Oscillator	Spitzenberger & Spieß	B6278		
1.5	Chroma 6404	AC Power Source	Chroma ATE INC.	64040001304		
1.6	Shielded Room 02	Shielded Room for conducted testing, 12qm	Frankonia	-		
1.7	ESH3-Z5	Two-Line V-Network	Rohde & Schwarz	829996/002	2017-05	2019-05
1.8	ESR 7	EMI Receiver / Spectrum Analyzer	Rohde & Schwarz	101424	2019-01	2020-01
1.9	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 <sup>3</sup>	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		
2.18	3160-09	Standard Gain / Pyramidal Horn Antenna 26.5 GHz	EMCO Elektronik 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 Elektronik GmbH	00086675		

Ref.No.	Device Name	Description	Manufacturer	Serial Number	Last Calibration	Calibration Due
2.29	SGH-08	Standard Gain / Pyramidal Horn Antenna (90 - 140 GHz)	RPG-Radiometer Physics GmbH	064		
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	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

$$U_{\text{LISN}} (\text{dB } \mu\text{V}) = U (\text{dB } \mu\text{V}) + \text{Corr. (dB)}$$

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	Corr.	cable loss 1	cable loss 2	cable loss 3	cable loss 4	distance corr.	d <sub>Limit</sub>	d <sub>used</sub>
MHz	dB (1/m)	dB	(inside chamber)	(outside chamber)	(switch unit)	(to receiver)	(-40 dB/decade)	(meas. distance (limit))	(meas. distance (used))
			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

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

U = Receiver reading

AF = Antenna factor

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

distance correction =  $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

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

Table shows an extract of values

### 7.3 ANTENNA R&S HL562 (30 MHz – 1 GHz)

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

Frequency	AF R&S HL562	Corr.
MHz	dB (1/m)	dB
30	18.6	0.6
50	6.0	0.9
100	9.7	1.2
150	7.9	1.6
200	7.6	1.9
250	9.5	2.1
300	11.0	2.3
350	12.4	2.6
400	13.6	2.9
450	14.7	3.1
500	15.6	3.2
550	16.3	3.5
600	17.2	3.5
650	18.1	3.6
700	18.5	3.6
750	19.1	4.1
800	19.6	4.1
850	20.1	4.4
900	20.8	4.7
950	21.1	4.8
1000	21.6	4.9

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)	$d_{\text{Limit}}$ (meas. distance (limit))	$d_{\text{used}}$ (meas. distance (used))
dB	dB	dB	dB	dB	m	m
0.29	0.04	0.23	0.02	0.0	3	3
0.39	0.09	0.32	0.08	0.0	3	3
0.56	0.14	0.47	0.08	0.0	3	3
0.73	0.20	0.59	0.12	0.0	3	3
0.84	0.21	0.70	0.11	0.0	3	3
0.98	0.24	0.80	0.13	0.0	3	3
1.04	0.26	0.89	0.15	0.0	3	3
1.18	0.31	0.96	0.13	0.0	3	3
1.28	0.35	1.03	0.19	0.0	3	3
1.39	0.38	1.11	0.22	0.0	3	3
1.44	0.39	1.20	0.19	0.0	3	3
1.55	0.46	1.24	0.23	0.0	3	3
1.59	0.43	1.29	0.23	0.0	3	3
1.67	0.34	1.35	0.22	0.0	3	3
1.67	0.42	1.41	0.15	0.0	3	3
1.87	0.54	1.46	0.25	0.0	3	3
1.90	0.46	1.51	0.25	0.0	3	3
1.99	0.60	1.56	0.27	0.0	3	3
2.14	0.60	1.63	0.29	0.0	3	3
2.22	0.60	1.66	0.33	0.0	3	3
2.23	0.61	1.71	0.30	0.0	3	3

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

30	18.6	-9.9
50	6.0	-9.6
100	9.7	-9.2
150	7.9	-8.8
200	7.6	-8.6
250	9.5	-8.3
300	11.0	-8.1
350	12.4	-7.9
400	13.6	-7.6
450	14.7	-7.4
500	15.6	-7.2
550	16.3	-7.0
600	17.2	-6.9
650	18.1	-6.9
700	18.5	-6.8
750	19.1	-6.3
800	19.6	-6.3
850	20.1	-6.0
900	20.8	-5.8
950	21.1	-5.6
1000	21.6	-5.6

0.29	0.04	0.23	0.02	-10.5	10	3
0.39	0.09	0.32	0.08	-10.5	10	3
0.56	0.14	0.47	0.08	-10.5	10	3
0.73	0.20	0.59	0.12	-10.5	10	3
0.84	0.21	0.70	0.11	-10.5	10	3
0.98	0.24	0.80	0.13	-10.5	10	3
1.04	0.26	0.89	0.15	-10.5	10	3
1.18	0.31	0.96	0.13	-10.5	10	3
1.28	0.35	1.03	0.19	-10.5	10	3
1.39	0.38	1.11	0.22	-10.5	10	3
1.44	0.39	1.20	0.19	-10.5	10	3
1.55	0.46	1.24	0.23	-10.5	10	3
1.59	0.43	1.29	0.23	-10.5	10	3
1.67	0.34	1.35	0.22	-10.5	10	3
1.67	0.42	1.41	0.15	-10.5	10	3
1.87	0.54	1.46	0.25	-10.5	10	3
1.90	0.46	1.51	0.25	-10.5	10	3
1.99	0.60	1.56	0.27	-10.5	10	3
2.14	0.60	1.63	0.29	-10.5	10	3
2.22	0.60	1.66	0.33	-10.5	10	3
2.23	0.61	1.71	0.30	-10.5	10	3

#### Sample calculation

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

U = Receiver reading

AF = Antenna factor

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

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

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

Tables show an extract of values.

## 7.4 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

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

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.

## 7.5 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

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

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.

Table shows an extract of values.

## 7.6 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 <sub>Limit</sub> (meas. distance (limit) m	d <sub>used</sub> (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.

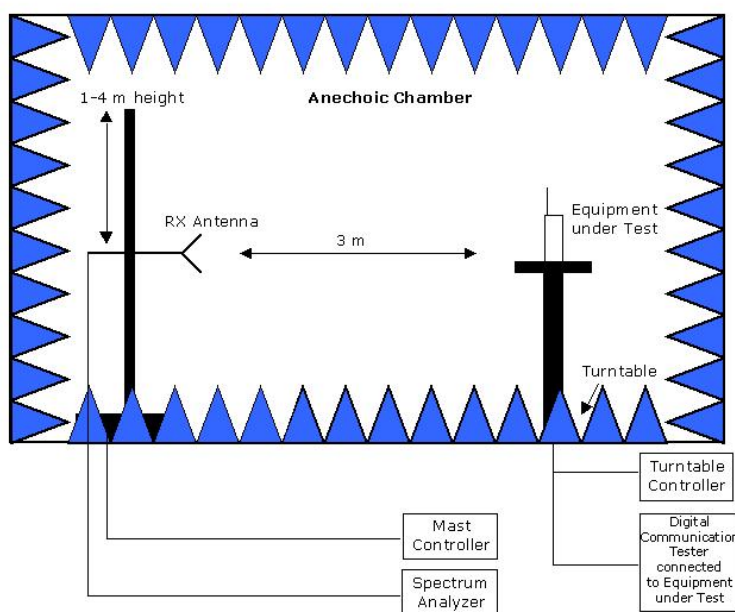
distance correction =  $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

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

Table shows an extract of values.

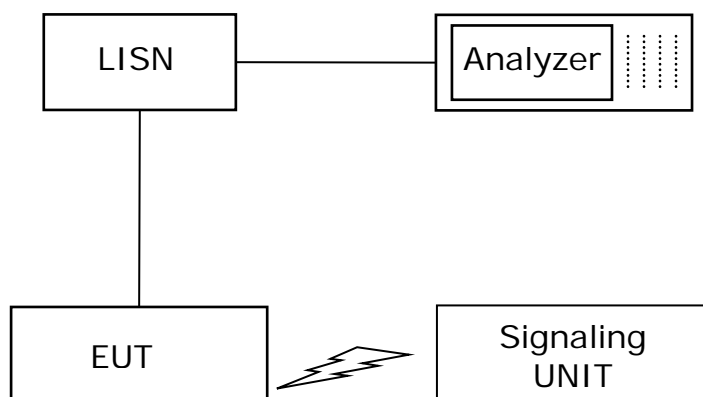
## 8 SETUP DRAWINGS

### 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	$\pm 3.4$ dB
Radiated Emissions	Field Strength	$\pm 5.5$ dB

## 10 PHOTO REPORT

Please see separate photo report.