

Test Report

Report Number:

F181073E1

Equipment under Test (EUT):

**KPD5/2 HID SF2F
and
PRD5/2 HID SF2F**

Applicant:

deister electronic GmbH

Manufacturer:

deister electronic GmbH



Deutsche
Akkreditierungsstelle
D-PL-17186-01-01
D-PL-17186-01-02
D-PL-17186-01-03

References

- [1] **ANSI C63.10: 2013** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
- [2] **FCC CFR 47 Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 9 (August 2016)** Licence-Exempt Radio Apparatus: Category I Equipment
- [4] **RSS-Gen Issue 5 (March 2019) Amendment 1**
General Requirements for Compliance of Radio Apparatus

Test result

The requirements of the tests performed as shown in the overview (clause 4 of this test report) were fulfilled by the equipment under test.
The complete test results are presented in the following.

Test engineer:	Michael DINTER		29.11.2019
	Name	Signature	Date
Authorized reviewer:	Bernd STEINER		29.11.2019
	Name	Signature	Date

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1 Identification

1.1 Applicant

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Phone:	+49-(0)-5105-516-129
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eMail Address:	info@deister-gmbh.de
Applicant represented during the test by the following person:	None

1.2 Manufacturer

Name:	deister electronic GmbH
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Country:	Germany
Name for contact purposes:	Mr. Stefan EICHLER
Phone:	+49-(0)-5105-516-129
Fax:	+49-(0)- 5105-516-266
eMail Address:	info@deister-gmbh.de
Applicant represented during the test by the following person:	None

1.3 Test Laboratory

The tests were carried out at:

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Germany

accredited by Deutsche Akkreditierungsstelle GmbH (DAkKS) in compliance with DIN EN ISO/IEC 17025 under Reg. No. D-PL-17186-01-02, FCC Test Firm Accreditation with the registration number 469623, designation number DE0004 and Industry Canada Test site registration SITE# IC3469A-1.

1.4 EUT (Equipment Under Test)

Type of equipment	13.56 MHz and 125 kHz RFID Reader
Product model name (PMN): *	KPD5/2 HID SF2F (with Keypad) PRD5/2 HID SF2F (without Keypad)
Model name (HVIN): *	KPD5/2 HID SF2F (with Keypad) PRD5/2 HID SF2F (without Keypad)
Order No.: *	02581.000 (with Keypad) 02570.000 (without Keypad)
Serial No.: *	7217601243 (with Keypad) 7217304787 (without Keypad)
FCC ID: *	IXLPRD52HIDSF2F
IC: *	1893B-PRD52HIDSF2
PCB identifier:*	Not provided by the applicant
Software version (FVIN): *	c41
Lowest internal frequency: *	Not provided by the applicant
Highest internal frequency: *	13.56 MHz
Antenna type:*	Internal loop antenna

*: declared by the applicant.

Note: Phoenix Testlab GmbH does not take samples. The samples used for tests are provided exclusively by the applicant.

1.5 Technical data of equipment

Power supply: *	24 V DC supplied by external power supply		
Supply voltage: *	$U_{nom} = 12$ or 24 V DC	$U_{min} = 8$ V	$U_{max} = 30$ V
Type of modulation: *	ASK		
Operating frequency range: *	125kHz and 13.56 MHz		
Number of channels: *	1		
Antenna type: *	Two internal loop antennas		
Duty cycle: *	100%		
Rated RF power: *	< 250 mW		
Data rate: *	2 kbaud up to 424 kbaud		
Temperature range: *	-25°C to 60°C		

* declared by the applicant.

Ports / Connectors			
Identification	Connector		Length during test
	EUT	Ancillary	
I/O and power supply	12 PIN	customized	2 m

The following ancillary devices were used for the measurements:	
Laptop (delivered by the LAB)	Lenovo Think Pad x201 tablet
External power supply (delivered by the applicant)	AC Adapter Deister FW 3288
RFID TAGs (delivered by the applicant)	RFID TAG type 13.56 MHz: DESFire EV1 RFID TAG type 125 kHz: HID (ISO Prox II)

1.6 Dates

Date of receipt of test sample:	07.08.2018
Start of test:	27.08.2018
End of test:	31.08.2018

2 Operational states and test setup

The EUT is a RFID transponder for universal use with additional keypad.
 All tests were carried out with an unmodified test sample, which operates in normal mode.
 During all test the EUT was reading a TAG.
 Additionally, a RS 485 connection was established with an RS 485 to USB adapter SNG 3.
 The transponder code was shown on the Laptop with a terminal program.

The conducted emission measurement on the power supply line was carried out on an AC/DC adapter Deister FW 3288.

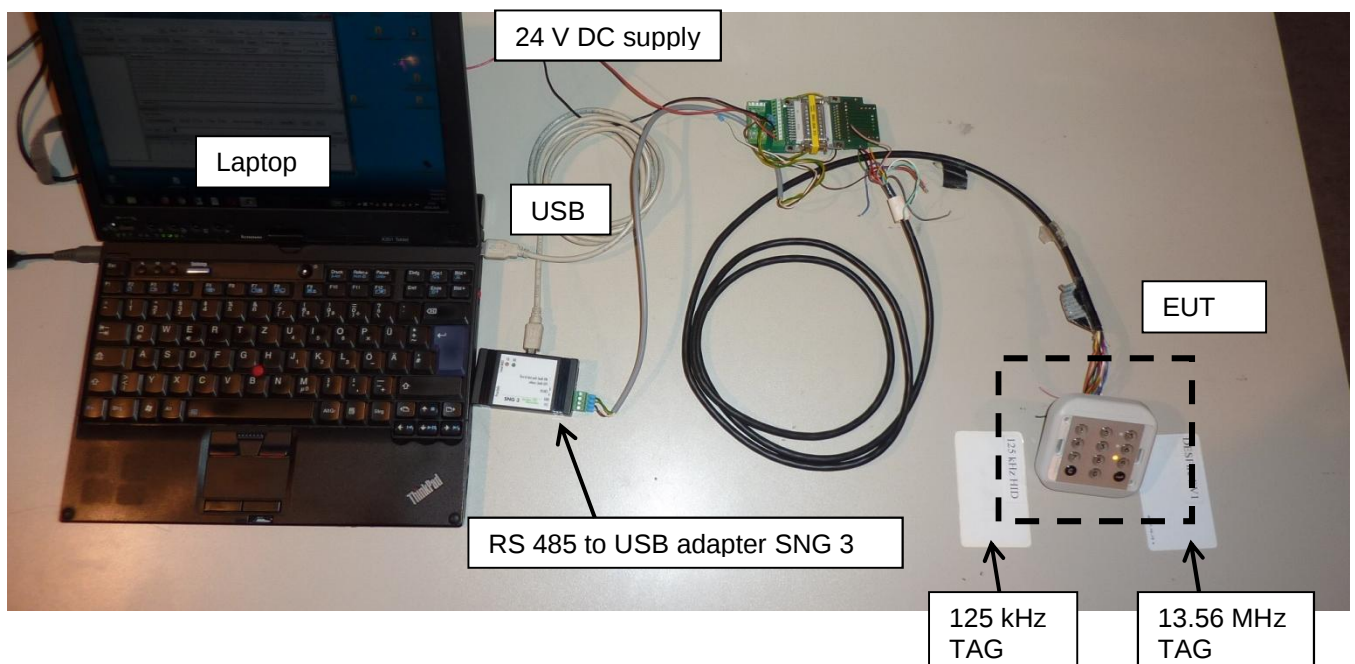
As pretest has shown the KPD5/2 HID SF2F was the worst-case setup and there was no significant difference between 12 V DC or 24 V DC supply.

Therefore, during the radiated tests the EUT was supplied with 24 V DC and during the conducted tests with 12 V DC via an AC/DC adapter by an AC-mains network with 120 V AC / 60 Hz.

No spurious emission measurement of the receiver was carried out, because the co located transmitter transmits continuously.

The physical boundaries of the EUT are shown below.

Physical boundaries of the EUT



3 Additional information

The EUT was not loaded as required by FCC / IC.

As declared by the applicant the difference between the KPD5/2 HID SF2F and PRD5/2 HID SF2F is only the keypad. As pretests has shown that the KPD5/2 HID SF2F was the more emitting variant. Therefore, all final measurements were carried out with the KPD5/2 HID SF2F. The conducted emission was carried out with the KPD5/2 HID SF2F as ordered by the applicant.

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS-Gen, Issue 5 [4] and RSS-210, Issue 9 [3]	Status	Refer page
Conducted emissions on supply line	0.15 – 30	15.207 (a)	8.8 [4]	Passed	9 et seq.
Radiated emissions	0.009 – 1.000**	15.205 (a) 15.209 (a)	8.9 and 8.10 [4] 4.1 and 4.4 [3]	Passed	12 et seq.
99 % bandwidth	13.56	-	6.7 [4]	-	26 et seq.
99 % bandwidth	0.125	-	6.7 [4]	-	26 et seq.
Antenna requirement	-	15.203 [2]	6.8 [4]	Passed *	-

*: Integrated antenna only, requirement fulfilled.

**: As declared by the applicant the highest internal frequency below 108 MHz was caused by the digital device the radiated emission measurement was carried out up to 1 GHz only.

5 Results

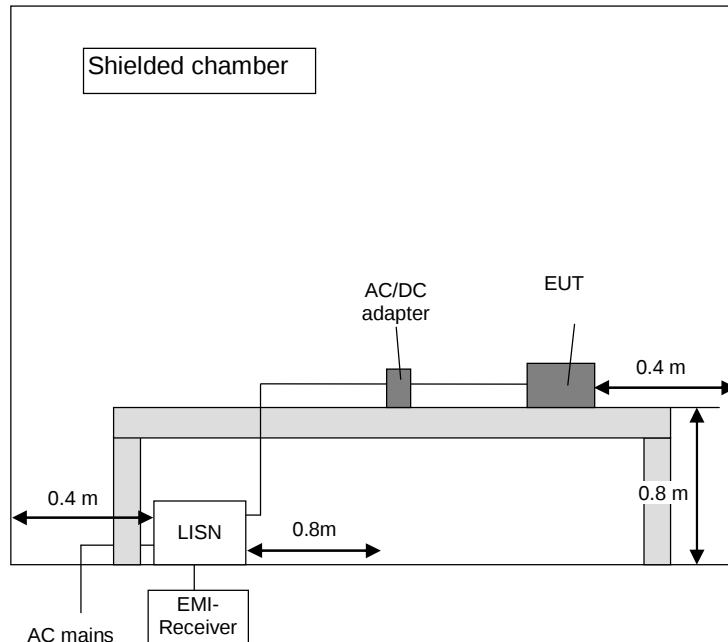
5.1 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.1.1 Method of measurement

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The setup of the Equipment under test will be in accordance to [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz

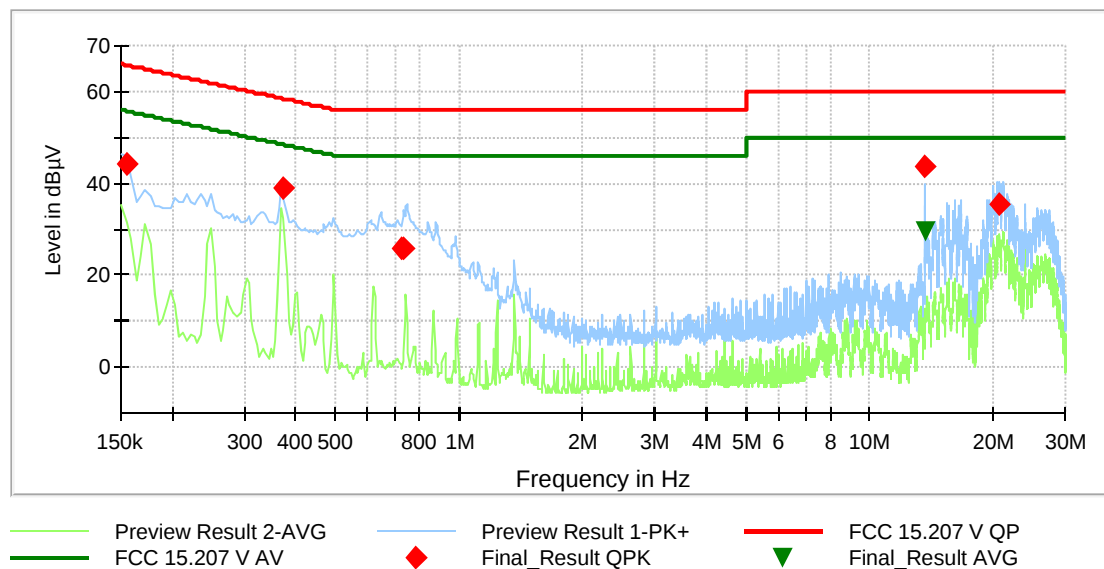


5.1.2 Test results (conducted emissions on power supply lines)

Ambient temperature	21 °C	Relative humidity	59 %
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Position of EUT:	The EUT was set-up on a non-conducting table of a height of 0.8 m.
Cable guide:	The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	The test was carried out reading a TAG continuously (refer also clause 2 of this test report). All results are shown in the following.
Supply voltage:	During this test the EUT was powered with 12 V _{DC} by the AC Adapter Deister FW 3288 delivered by the applicant, which was itself supplied by an AC mains Network with 120 V _{AC} / 60 Hz. As declared by the applicant 12 VDC represents the worst case related to this measurement

The curves in the diagrams below only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by ◆ and the average measured points by ▼.



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Transducer (dB)
0.154500	44.31	---	65.75	21.45	5000.0	9.000	L1	GND	9.8
0.371400	38.90	---	58.47	19.57	5000.0	9.000	L1	GND	9.9
0.722400	25.98	---	56.00	30.02	5000.0	9.000	N	GND	9.9
0.733200	25.92	---	56.00	30.08	5000.0	9.000	N	GND	9.9
13.560000	43.04	---	60.00	16.96	5000.0	9.000	L1	FLO	10.7
13.563600	---	18.37	50.00	31.63	5000.0	9.000	L1	FLO	10.7
20.600700	35.47	---	60.00	24.53	5000.0	9.000	N	GND	11.0
Measurement uncertainty					+2.76 dB / -2.76 dB				

Test: Passed

Test equipment used (refer clause 6)

1 - 6

5.2 Radiated emissions

5.2.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into six stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test site without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 30 MHz to 1 GHz.
- A final measurement carried out on an open area test site with reflecting ground plane and various antenna heights in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 40 GHz.

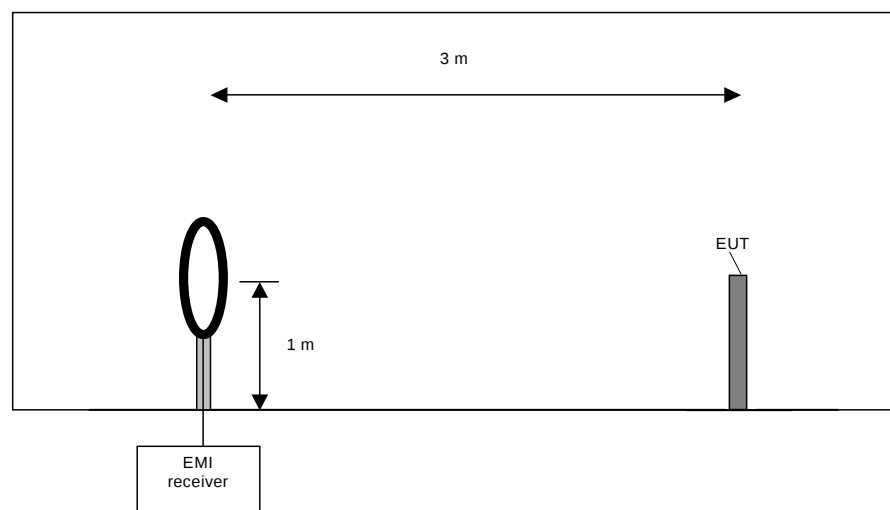
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Table-top devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

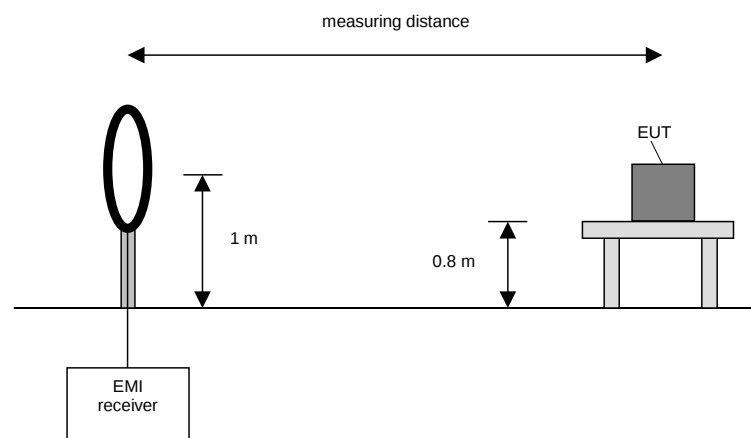
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the frequencies, which were detected during the preliminary measurements, the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (if the EUT is a module and might be used in a handheld equipment application).

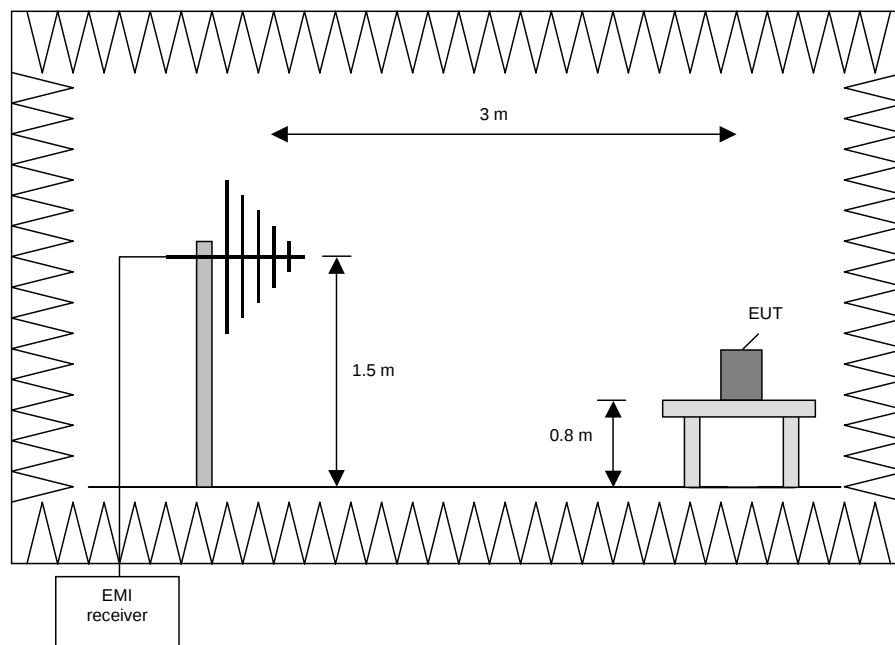
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 120 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 1 GHz.

The following procedure will be used:

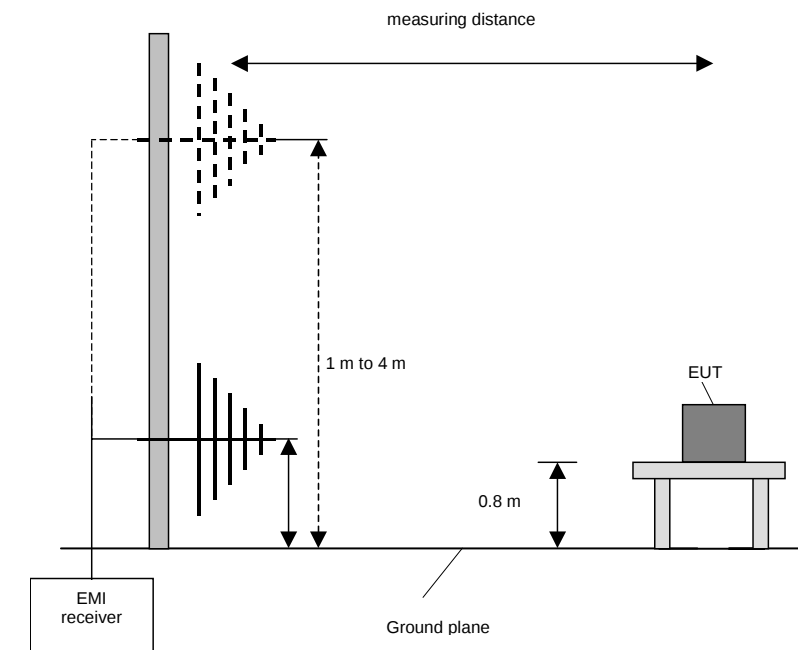
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT if handheld equipment.
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT if handheld equipment.

Preliminary and final measurement (1 GHz to 110 GHz)

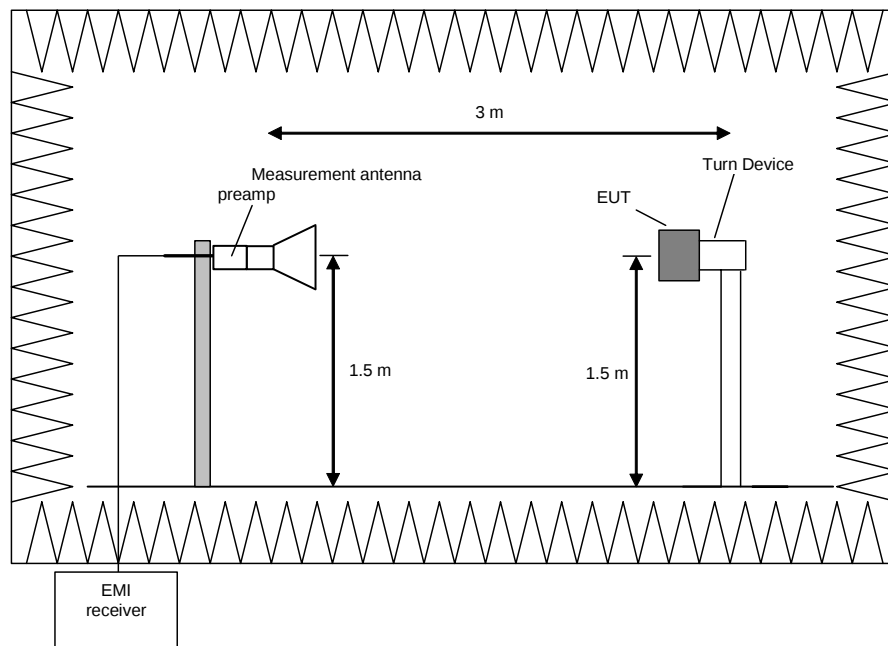
This measurement will be performed in a fully anechoic chamber. Table top devices will set up on a non-conducting turn device on the height of 1.5 m. The set-up of the Equipment under test will be in accordance to [1].

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °. This measurement is repeated after raising the EUT in 30 ° steps according 6.6.5.4 in [1].

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 1 to 40 GHz.

The following procedure will be used:

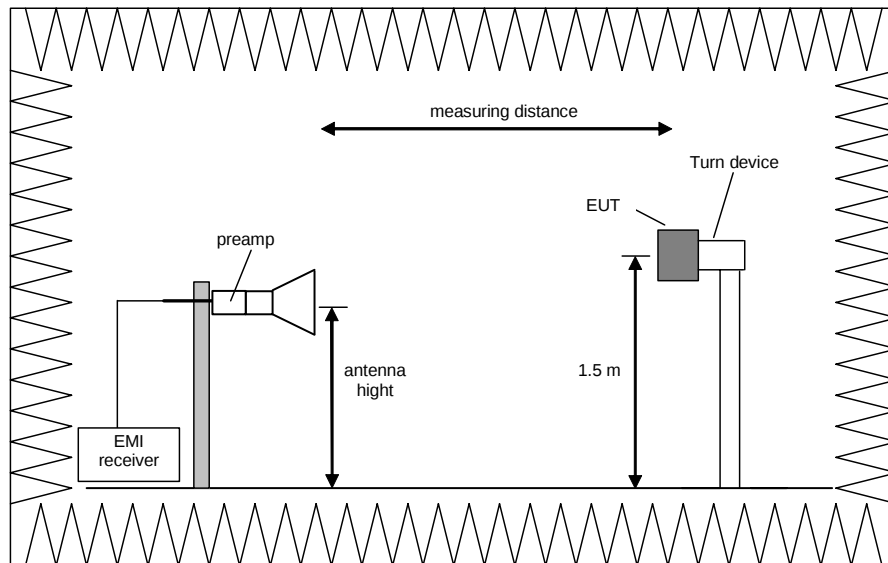
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0°.
2. Rotate the EUT by 360° to maximize the detected signals.
3. Repeat 1) to 2) with the vertical polarisation of the measuring antenna.
4. Make a hardcopy of the spectrum.
5. Repeat 1) to 4) with the EUT raised by an angle of 30° (60°, 90°, 120° and 150°) according to 6.6.5.4 in [1].
6. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
7. The measurement antenna polarisation, with the according EUT position (Turntable and Turn device) which produces the highest emission for each frequency will be used for the final measurement. The six closest values to the applicable limit will be used for the final measurement.

Final measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed by rotating the turntable through 0 to 360° in the worst-case EUT orientation which was obtained during the preliminary measurements.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 110 GHz.

The following procedure will be used:

- 1) Set the turntable and the turn device to obtain the worst-case emission for the first frequency identified in the preliminary measurements.
- 2) Set the measurement antenna polarisation to the orientation with the highest emission for the first frequency identified in the preliminary measurements.
- 3) Set the spectrum analyser to EMI mode with peak and average detector activated.
- 4) Rotate the turntable from 0° to 360° to find the EUT angle that produces the highest emissions.
- 5) Note the highest displayed peak and average values
- 6) Repeat the steps 1) to 5) for each frequency detected during the preliminary measurements.

5.2.2 Test results (radiated emissions)

5.2.2.1 Preliminary radiated emission measurement 9 kHz to 1 GHz

Ambient temperature	21 °C	Relative humidity	42 %
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Position of EUT: The EUT was set-up on a non-conducting table.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out reading a TAG continuously (refer also clause 2 of this test report). The tests were carried out in normal positions as declared by the applicant.

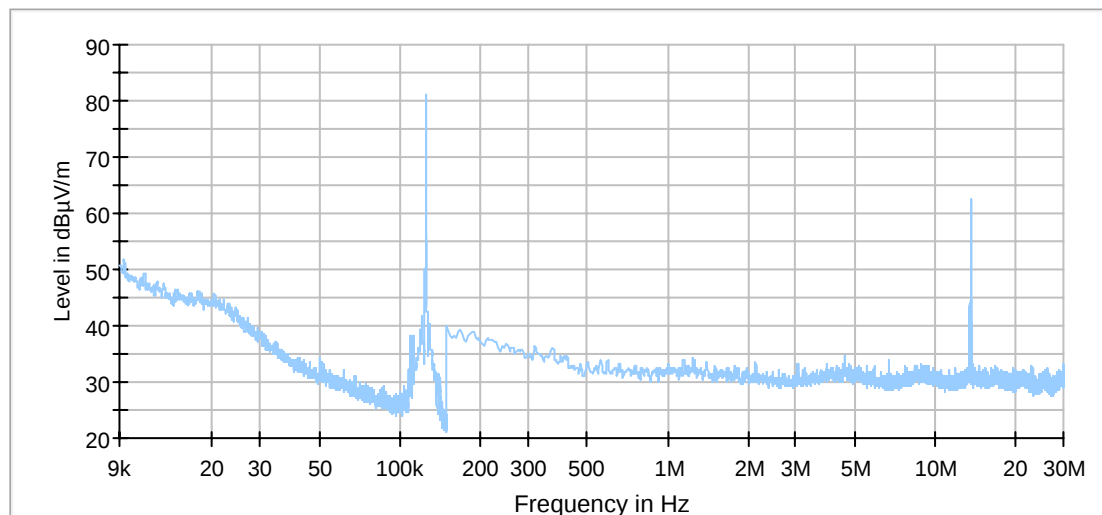
Power supply: During this test the EUT was powered with 24 V_{DC}.

Remark: As pre-tests have shown there were no noticeable differences between 24 V_{DC} and 12 V_{DC} power supply.

Frequency range: According to [2] from 9 kHz to 1 GHz.

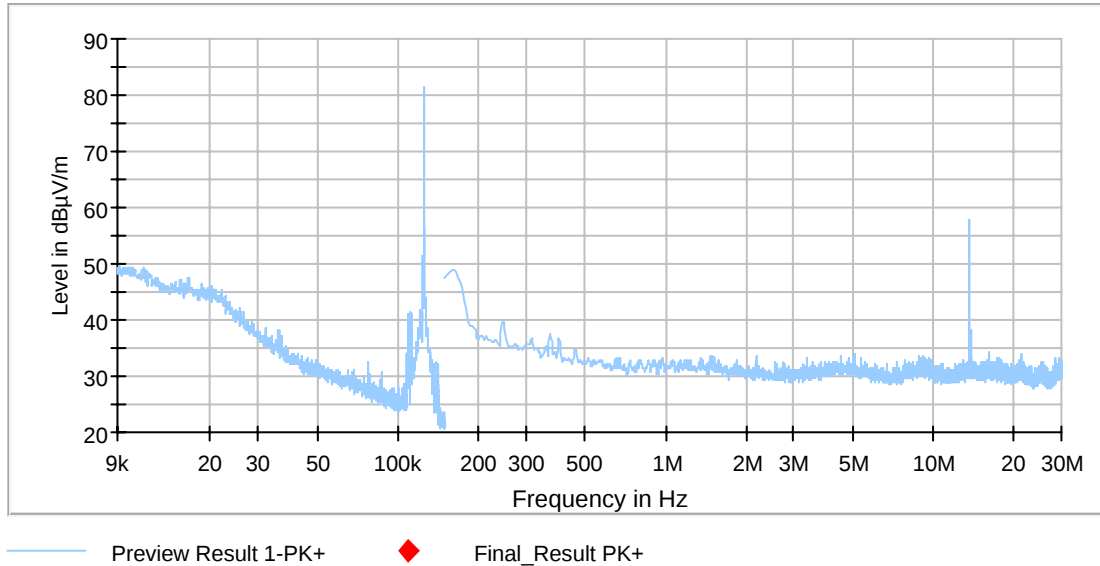
Emissions from 9 kHz to 30 MHz
reading a 125 kHz and a 13.56 MHz TAG simultaneously

Preliminary measurement KPD5/2 HID SF2F with keypad.



— Preview Result 1-PK+ ◆ Final_Result PK+

Preliminary measurement PRD5/2 HID SF2F without keypad.



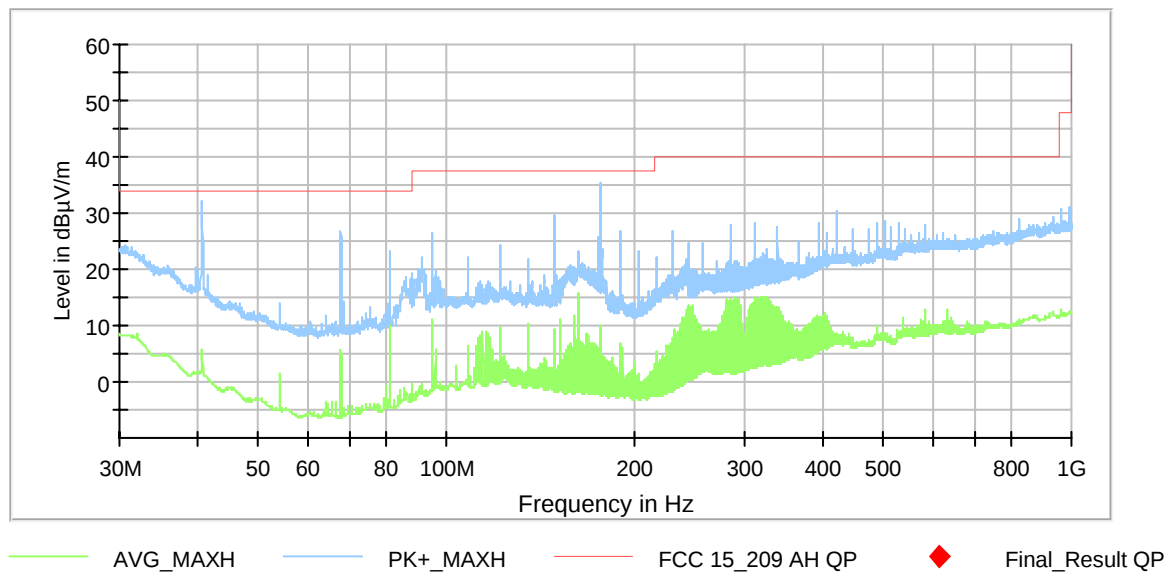
The following emissions were found according to [2] and [3].

Frequency (MHz)
0.125
13.561

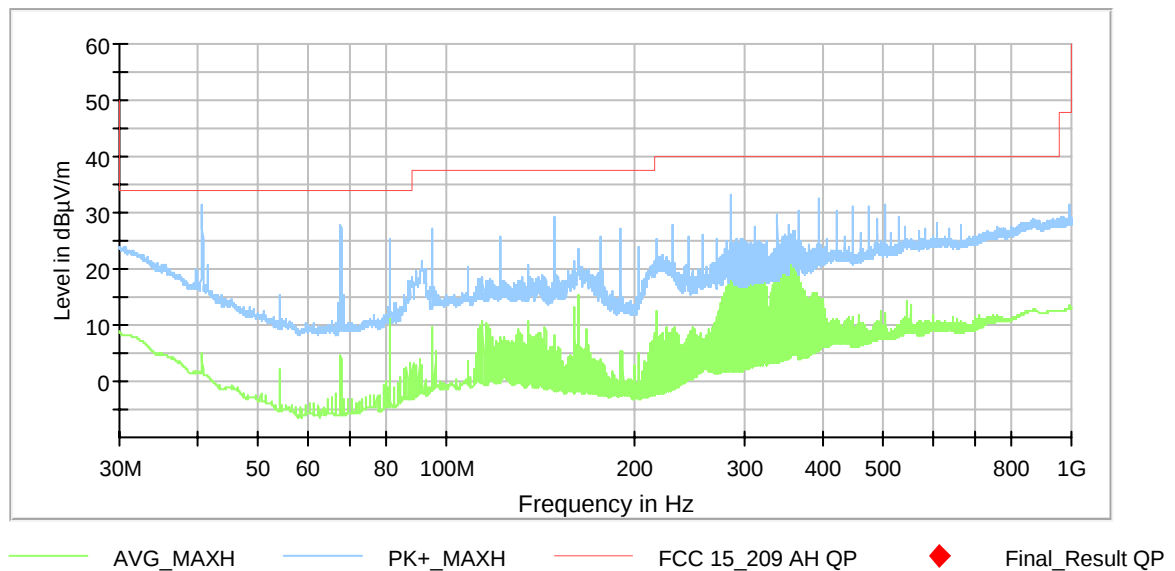
These frequencies have to be measured on the outdoor test site. The result is presented in the following.

Emissions from 30 MHz to 1000 MHz
reading a 125 kHz and a 13.56 MHz TAG simultaneously

Preliminary measurement KPD5/2 HID SF2F with keypad.



Preliminary measurement PRD5/2 HID SF2F without keypad.



The following frequencies were found emission test outside and inside restricted bands during the preliminary radiated:

Frequency (MHz)
40.680000
67.800000
81.360000
149.160000
176.280000
284.760000
339.000000
474.600000

These frequencies of the KPD5/2 HID SF2F have to be measured on the open area test site. The results were presented in the following.

Test equipment used (refer clause 6)

7 - 18

5.2.2.2 Final radiated emission measurement from 9 kHz to 30 MHz

Ambient temperature	18 °C	Relative humidity	53 %
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Position of EUT: The EUT was set-up on a non-conducting table.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out reading a TAG continuously (refer also clause 2 of this test report). The tests were carried out in normal positions as declared by the applicant.

Power supply: During this test the EUT was powered with 24 V_{DC}.

Test results: The test results were calculated with the following formula:

Reading a 125 kHz and a 13.56 MHz TAG simultaneously

Final measurement KPD5/2 HID SF2F with keypad.

Frequency	Reading	Result*	Limit acc. 15.209	Margin	Detector (acc to §15.209 (d))	Antenna factor	Measuring Distance	Distance corection factor**
[MHz]	[dBµV]	[dBµV/m]	[dBµV/m]	[dB]		[dB/m]	[m]	[dB]
0.125000 ¹⁾	12.4	-26.5 @ 300m	25.7	52.2	AV	20.2	10	59.1
0.125000 ¹⁾	41.6	-18.2 @ 300m	25.7	43.9	AV	20.2	3	80.0
13.561000 ¹⁾	36.3	16.2 @ 30m	29.5	13.3	QP	19.9	3	40.0
Measurement uncertainty: +4.69 dB / -4.69 dB								

Note *Result @ norm dist = Reading + Antenna factor - Distance Extrapolation Factor

** 40dB/decade according Part §15.31 (f) (2) Cable loss included

¹⁾: Wanted signal RFID system

Test: Passed

Test equipment used (refer clause 6)

12, 18 - 20

5.2.2.3 Final radiated emission measurement from 30 MHz to 1 GHz

Ambient temperature	24 °C	Relative humidity	54 %
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Position of EUT: The EUT was set-up on a non-conducting table.

Cable guide: The cables of the EUT were fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

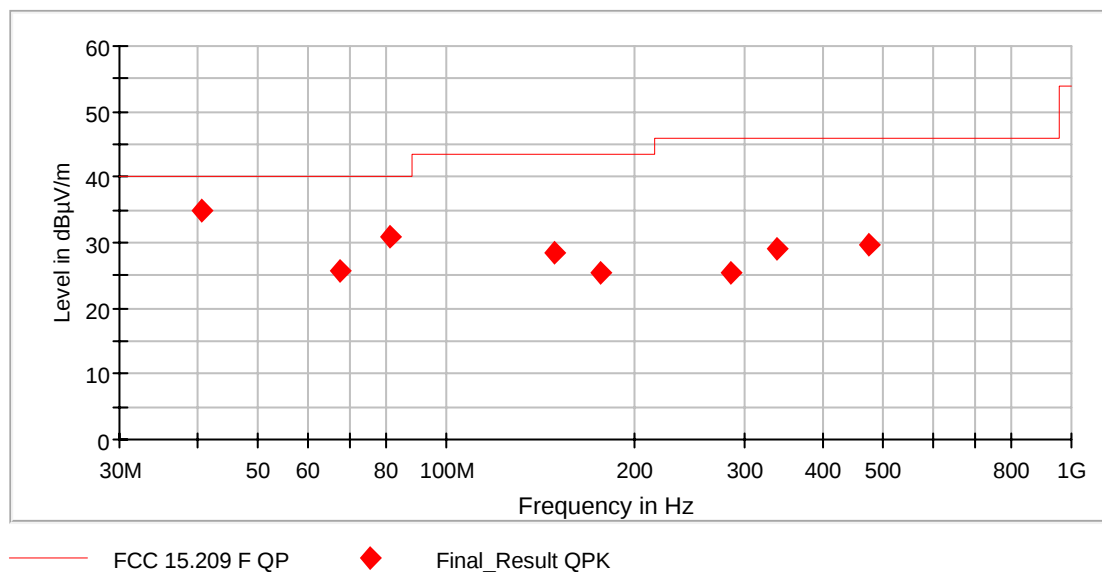
Test record: The test was carried out reading a TAG continuously (refer also clause 2 of this test report). The tests were carried out in normal positions as declared by the applicant.

Power supply: During this test the EUT was powered with 12 V_{DC}

Test results: The test results were calculated with the following formula:
Result [dBμV/m] = reading [dBμV] + antenna factor [dB/m]

Final measurement KPD5/2 HID SF2F with keypad.

The measured points and the limit line in the following diagrams refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with an ◆ are the measured results of the standard final measurement on the open area test site.



181073ff

The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.
The measurement time with the quasi-peak measuring detector is 1 seconds.

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
40.680000	34.97	40.00	5.03	1000.0	120.000	132.0	V	338.0	22.4
67.800000	25.63	40.00	14.37	1000.0	120.000	154.0	V	242.0	13.2
81.360000	30.85	40.00	9.15	1000.0	120.000	150.0	V	90.0	15.4
149.160000	28.52	43.50	14.98	1000.0	120.000	254.0	H	316.0	19.0
176.280000	25.54	43.50	17.96	1000.0	120.000	123.0	H	208.0	17.2
284.760000	25.29	46.00	20.71	1000.0	120.000	150.0	V	226.0	21.6
339.000000	29.07	46.00	16.93	1000.0	120.000	103.0	H	316.0	22.9
474.600000	29.80	46.00	16.20	1000.0	120.000	197.0	H	237.0	27.2
Measurement uncertainty ± 4.78 dB									

Result: Passed

The correction factor was calculated as follows.

Corr. (dB) = cable attenuation (dB) + 6 dB attenuator (dB) + antenna factor (dB)

Therefore the reading can be calculated as follows:

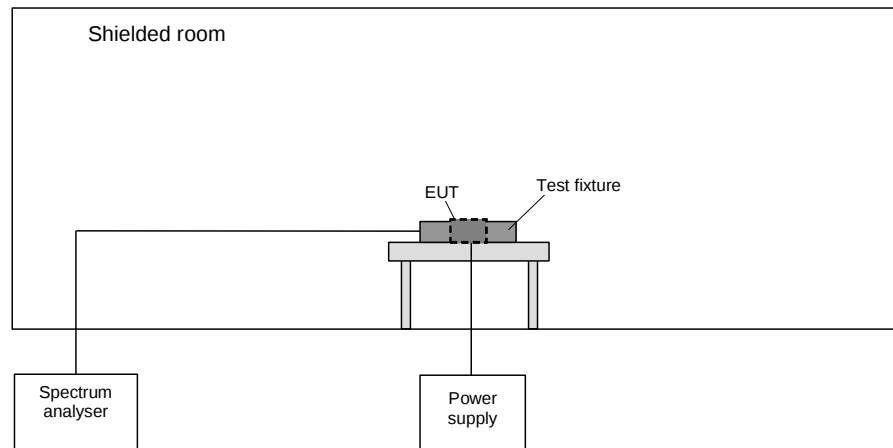
Reading (dBμV/m) = result QuasiPeak (dBμV/m) - Corr. (dB)

Test equipment used (refer clause 6)

2, 4, 18, 21 – 25, 27

5.3 99 % bandwidth

5.3.1 Method of measurement



The following procedure will be used for the occupied bandwidth measurement according to [1]:

The span of the analyzer shall be set to capture all products of the modulation process including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical a sampling detector shall be used since a peak or peak hold may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points beginning at the lowest frequency are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

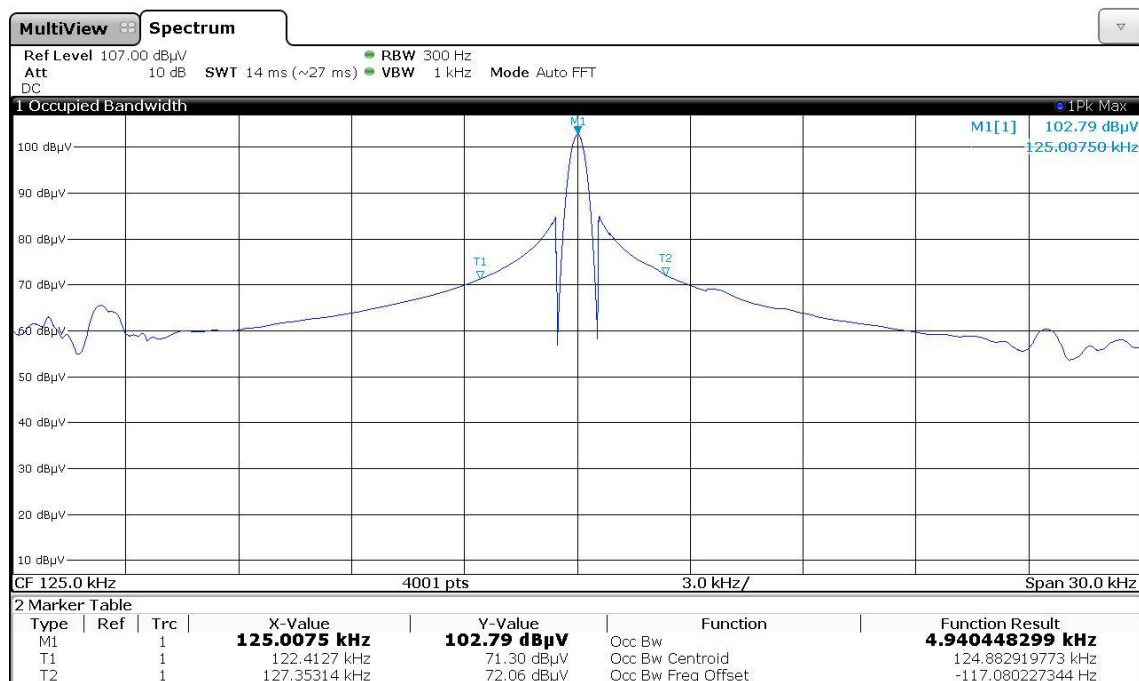
5.3.2 Test results 99 % bandwidth

Ambient temperature:	22 °C	Relative humidity:	47 %
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Test record: The test was carried out reading a TAG continuously (refer also clause 2 of this test report). The tests were carried out in normal positions as declared by the applicant.

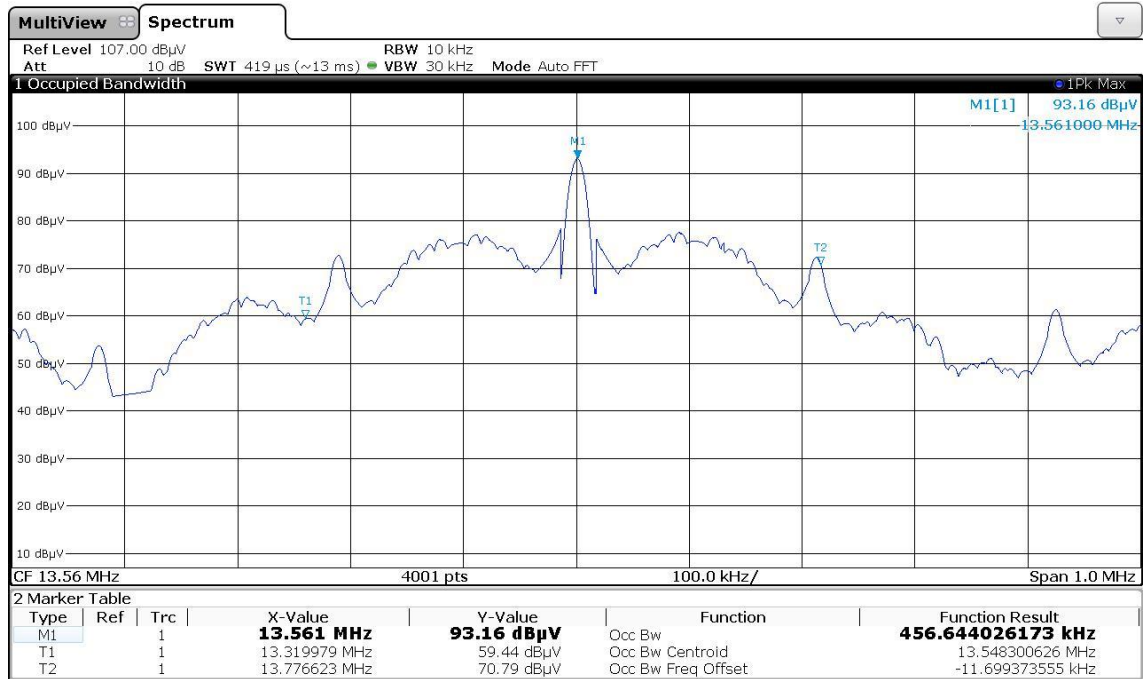
Power supply: During this test the EUT was powered with 24 V_{DC}.

181073k125 with TAG.JPEG: 99 % bandwidth reading a 125 kHz ASK TAG



F _L	F _U	BW (F _U - F _L)
122.413 kHz	127.353 kHz	4.940 kHz
Measurement uncertainty		< 1*10 ⁻⁷

181073M13_56 with TAG.JPEG: 99 % bandwidth reading a 13.56 kHz ASK TAG



FL	FU	BW (FU - FL)
13.319979 MHz	13.776623 MHz	456.644 kHz
Measurement uncertainty		< 1*10 ⁻⁷

Test equipment used (refer clause 6)

7, 18, 26

6 Test equipment

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal Due
1	Transient Filter Limiter	CFL 9206A	Teseq GmbH	38268	481982	14.03.2018	03.2020
2	EMI Receiver / Spectrum Analyser	ESIB 26	Rohde & Schwarz	100292	481182	28.02.2018	02.2020
3	Shielded chamber M4	B83117-S1-X158	Siemens	190075	480088	Calibration not necessary	
4	Software	EMC32	Rohde & Schwarz	100061	481022	Calibration not necessary	
5	LISN	NSLK8128	Schwarzbeck	8128155	480058	14.03.2018	03.2020
6	AC Supply	AC6803A AC Quelle 2000VA	Keysight	JPVJ002509	482350	Calibration not necessary	
7	EMI Receiver / Spectrum Analyser	ESW44	Rohde & Schwarz	101635	482467	22.06.2017	06.2019
8	Fully anechoic chamber M20	B83117-E2439-T232	Albatross Projects	103	480303	Calibration not necessary	
9	Turntable	DS420 HE	Deisel	420/620/00	480315	Calibration not necessary	
10	Antenna support	AS620P	Deisel	620/375	480325	Calibration not necessary	
11	Multiple Control Unit	MCU	Maturo GmbH	MCU/043/9711 07	480832	Calibration not necessary	
12	loop antenna	HFH2-Z2	Rohde & Schwarz	100417	481912	19.12.2017	12.2018
13	Antenna mast	AS615P	Deisel	615/310	480187	Calibration not necessary	
14	Antenna (Bilog)	CBL6112B	Schaffner EMV GmbH (-Chase)	2688	480328	19.06.2017	06.2020
15	Software	WMS32	Rohde & Schwarz		481800	Calibration not necessary	
16	RF-cable No.36	Sucoflex 106B	Suhner	0587/6B / Kabel 36	480865	Calibration not necessary	
17	HF-Cable	Sucoflex 104	Huber+Suhner	517402	482392	Calibration not necessary	
18	DC Power Supply	TOE8951	Toellner Electronic Inst.	81995	481252	Calibration not necessary	
19	Outdoor test site	-	PHOENIX TESTLAB GmbH	-	480293	Calibration not necessary	
20	EMI Receiver / Spectrum Analyser	ESI 40	Rohde & Schwarz	100064/040	480355	27.02.2018	02.2019
21	Open area test site M6	Freifeld M6	Phoenix Contact	-	480085	Calibration not necessary	
22	Antenna mast	MA240-0	Inn-Co GmbH	MA240-0/030/6600603	480086	Calibration not necessary	
23	Turntable	DS412	Deisel	412/316	480087	Calibration not necessary	
24	Controller	HD100	Deisel	100/349	480139	Calibration not necessary	
25	Antenna (Bilog)	CBL6111D	Schaffner Elektrottest GmbH / Teseq GmbH	25761	480894	19.10.2017	10.2020
26	Lopp antenna	Loop antenna 22.5cm	PHOENIX TESTLAB GmbH	-	410085	Calibration not necessary	
27	Attenuator 6 dB	WA2-6	Weinschel		482794	Calibration not necessary	

7 Test site Validation

Test equipment	PM. No.	Frequency range	Type of validation	According to	Val. Date	Val Due
OATS Outdoor	480293	9 kHz – 30 MHz	-	ANSI C63.4-2014	-	-
OATS M6	480085	30 – 1000 MHz	NSA	ANSI C63.4-2014	25.10.2018	24.10.2020
Fully anechoic chamber M20	480303	30 – 1000 MHz	NSA	ANSI C63.4-2014	13.02.2018	12.02.2020
Shielded chamber M4	480088	9 kHz – 30 MHz	GND-Plane	ANSI C63.4-2014	06.11.2018	05.11.2020

8 Report history

Report Number	Date	Comment
F181073E1	29.11.2019	Document created
-	-	-

9 List of annexes

Annex A	Test Setup Photos	4 pages
Annex B	EUT External Photos	5 pages
Annex C	EUT Internal Photos	8 pages