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TESTLAB

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Test Report

Report Number: F113050E1

Applicant:

deister electronic GmbH

Manufacturer:

deister electronic GmbH

Equipment under Test (EUT):

PRL5A/2 and KPL5A/2



Laboratory (CAB) accredited by
Deutsche Gesellschaft für Akkreditierung mbH
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. DGA-PL-105/99-22,
FCC Test site registration number 90877 and
Industry Canada Test site registration IC3469A-1

REFERENCES

- [1] **ANSI C63.4-2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC CFR 47 Part 15 (August 2011)** Radio Frequency Devices
- [3] **RSS-210 Issue 8 (December 2010)** Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radio Apparatus

TEST RESULT

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

Test engineer:	Thomas KÜHN <small>Name</small>	 <small>Signature</small>	05 September 2011 <small>Date</small>
Authorized reviewer:	Bernd STEINER <small>Name</small>	 <small>Signature</small>	05 September 2011 <small>Date</small>

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1 IDENTIFICATION

1.1 Applicant

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Phone:	+ 49 51 05 516 - 129
Fax:	+49 51 05 516 - 266
eMail Address:	eichler@deister-gmbh.de
Applicant represented during the test by the following person:	-

1.2 Manufacturer

Name:	deister electronic GmbH
Address:	Hermann-Bahlsen-Str. 11 - 13 30890 Barsinghausen
Country:	Germany
Name for contact purposes:	Mr. Stefan EICHLER
Phone:	+ 49 51 05 516 - 129
Fax:	+49 51 05 516 - 266
eMail Address:	eichler@deister-gmbh.de
Applicant represented during the test by the following person:	-

1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

accredited by DGA Deutsche Gesellschaft für Akkreditierung mbH in compliance with DIN EN ISO/IEC 17025 under Reg. No. DGA-PL-105/99-22, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469A-1.

1.4 EUT (Equipment Under Test)

Test object: *	13.56 MHz RFID reader
Type: *	PRL5A/2 and KPL5A/2
Model name: *	PRL5A and KPL5A
FCC ID: *	IXLPRL5AKPL5A
IC: *	1893B-PRL5AKPL5A
Serial number: *	None
PCB-number: *	071201
Hardware version: *	None
Software version: *	V100224
Highest / lowest internal frequency: *	13.56 MHz / 13.56 MHz

1.5 Technical data of equipment

Equipment category: *	Equipment with integrated antenna					
Channel spacing: *	Not applicable (one channel operation)					
Alignment range: *	Not applicable (one channel operation)					
Switching range: *	Not applicable (one channel operation)					
Modulation: *	AM (by passive TAG)					
Bit rate of transmitter: *	None					
Supply Voltage: *	$U_{nom} =$	12.0 V DC	$U_{min} =$	8.0 V DC	$U_{max} =$	30.0 V DC
Power supply: *	External					
Temperature range: *	-25 °C + 60 °C					
Ancillaries to be tested with:	ISO 14443 A - transponder card					

* declared by the applicant.

The following external I/O cables were used:

Identification	EUT	Shielding	Length
Connection cable (including DC supply lines and Data in/ out lines)	12 pole terminal block	No	2.5 m *
-	-	-	-
-	-	-	-
-	-	-	-

*: Length during the test if no other specified.

1.6 Dates

Date of receipt of test sample:	16 August 2011
Start of test:	19 August 2011
End of test:	22 August 2011

2 OPERATIONAL STATES

During all tests the EUT was supplied with a DC supply voltage, which was provided either by an external power supply or an AC / DC adaptor type FW 3288 (used only for the conducted emissions on AC-mains).

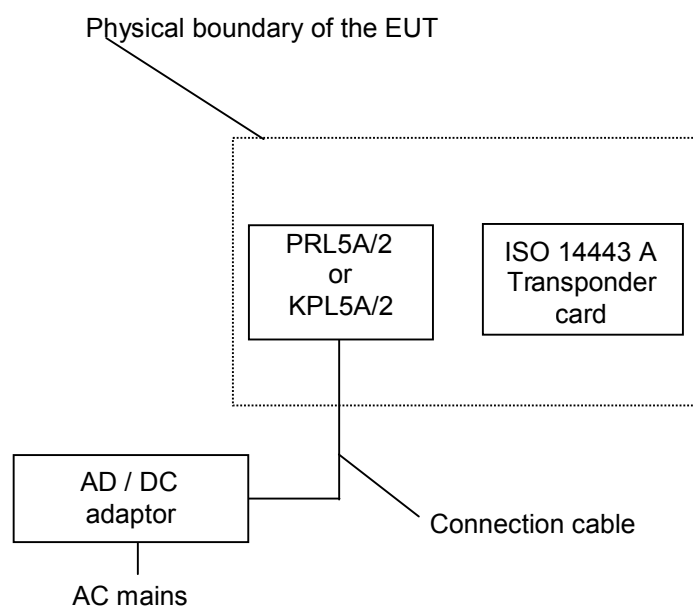
If not otherwise stated, the tests were carried out with the EUT in the following operation mode: Reading a passive 13.56 MHz TAG (type ISO14443, A), because pretests have shown that this transponder card caused higher emissions than the ISO 15693 card or the LEGIG prime card.

For the conducted emission measurement on AC-mains the AC / DC adaptor was supplied with 120 V AC / 60 Hz.

If a variation of the supply voltage was necessary, it was done in the range 8.0 V DC to 30.0 V DC. This range was declared by the applicant as extreme supply voltage range.

The EUT is available with a key pad (KPL5A/2) and without key pad (PRL5A/2). As additional pretests have shown, the PRL5A/2 caused the higher emissions than the KPL5A/2. So all measurements were carried out with the PRL5A/2.

The physical boundaries of the Equipment Under Test are shown below.



3 ADDITIONAL INFORMATION

During the tests the EUT was sealed and not labelled as required by FCC / IC.

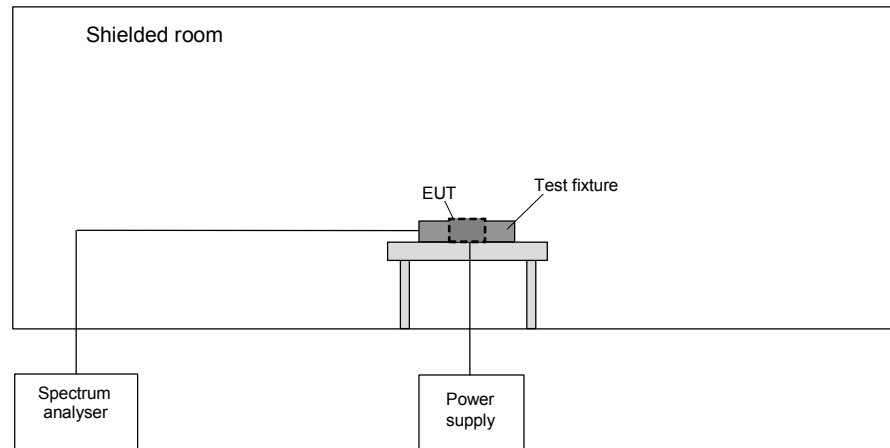
4 OVERVIEW

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	RSS 210, Issue 8 [3] or RSS-Gen, Issue 3 [4]	Status	Refer page
Radiated emissions	13.110 to 14.110	15.225 (a) – (d)	A 2.6	Passed	8 et seq.
20 dB bandwidth	13.560 MHz	15.225 (e)	-	Passed	10 et seq.
Frequency tolerance	13.560 MHz	15.225 (e)	A 2.6	Passed	12 et seq.
Radiated emissions	0.009 - 1,000	15.205 (a) 15.209 (a)	2.5 [3] 7.2.2 [4] 7.2.5 [4]	Passed	14 et seq.
Conducted emissions on supply line	0.15 - 30	15.207 (a)	7.2.4 [4]	Passed	27 et seq.
99 % bandwidth	134.2 kHz	-	4.6.1 [4]	Passed	Annex D

5 TEST RESULTS

5.1 Spectrum mask

5.1.1 Method of measurement (spectrum mask)



The following procedure will be used for the spectrum mask measurement:

- 1) Place the EUT in the test fixture and switch it on.
- 2) Use the following spectrum analyser settings: $RWB = VBW = 1 \text{ kHz}$, Span = wide enough to capture the whole 13 MHz band including the frequency ranges where the 15.209 limit applies, Trace mode = MaxHold, select the limit line 15225spc
- 3) After trace stabilisation, set the marker to the signal peak.
- 4) The Reference level will be calculated by the amount of the margin of the wanted signal to its 30 m emission limit plus the marker value.
- 5) The whole signal trace has to be below the limit line.

5.1.2 Test results (spectrum mask)

Ambient temperature	21 °C	Relative humidity	55 %
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Supply voltage: The EUT was supplied with 12 V DC.

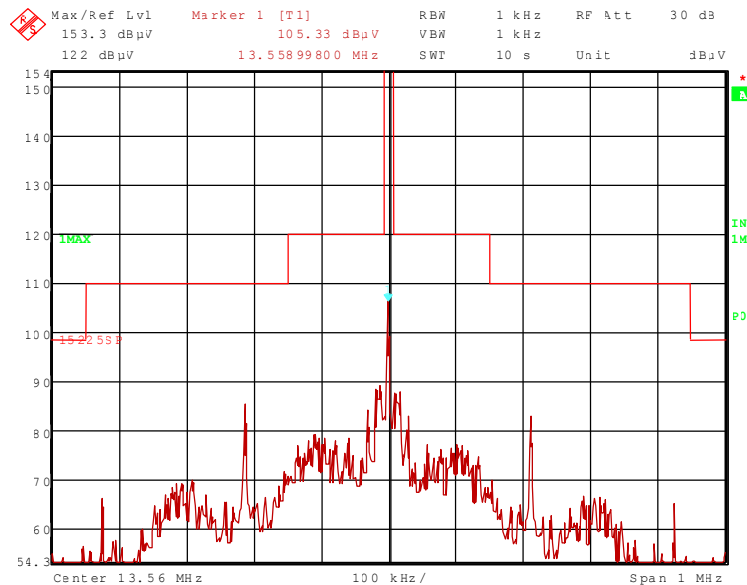
Test record: The test was carried out while the EUT was reading an ISO 14443 A - TAG.

The Reference level in the plot below was calculated with the following formular:

$$\text{Reflevel} = (\text{Limit}_{\text{OATS}} - \text{Level}_{\text{OATS}}) + \text{Marker value}$$

Where $\text{Limit}_{\text{OATS}} = 104.0 \text{ dB}\mu\text{V}/\text{m}$, $\text{Level}_{\text{OATS}} = 56.0 \text{ dB}\mu\text{V}/\text{m}$ and Marker value = 105.3 dB μ V.

113050_6.wmf: Spectrum mask:



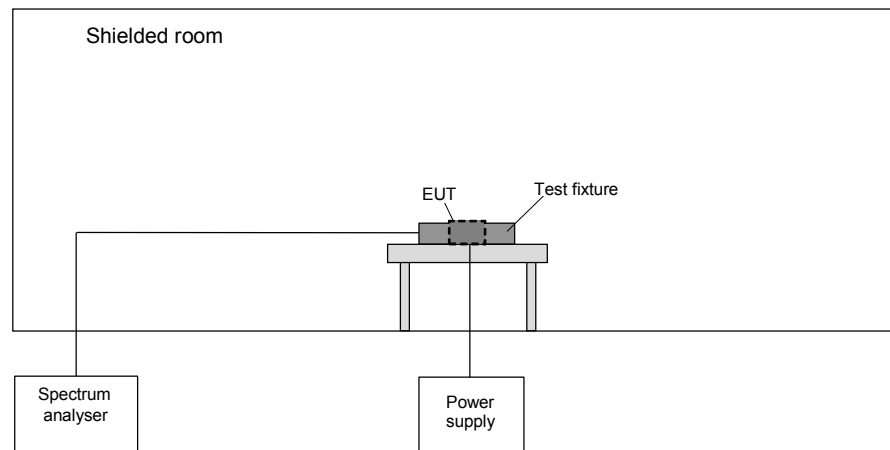
Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

31, 58

5.2 20 dB bandwidth

5.2.1 Method of measurement (20 dB bandwidth)



The following procedure will be used for the occupied bandwidth measurement:

- 1) Place the EUT in the test fixture and switch it on.
- 2) Use the following spectrum analyser settings: RWB = VBW = 10 kHz, Span = wide enough to capture app. 1.5 times the 20 dB bandwidth, Trace mode = MaxHold.
- 3) After trace stabilisation, set the first marker and the first display line to the signal peak. Set the second display line 20 dB below the first display line. The second marker and its delta marker shall be set to cross points of the spectrum line and the second display line and note these frequencies.
- 4) Alternatively the 20 dB down function of the analyser could be used, if this function will be applicable to the displayed spectrum.

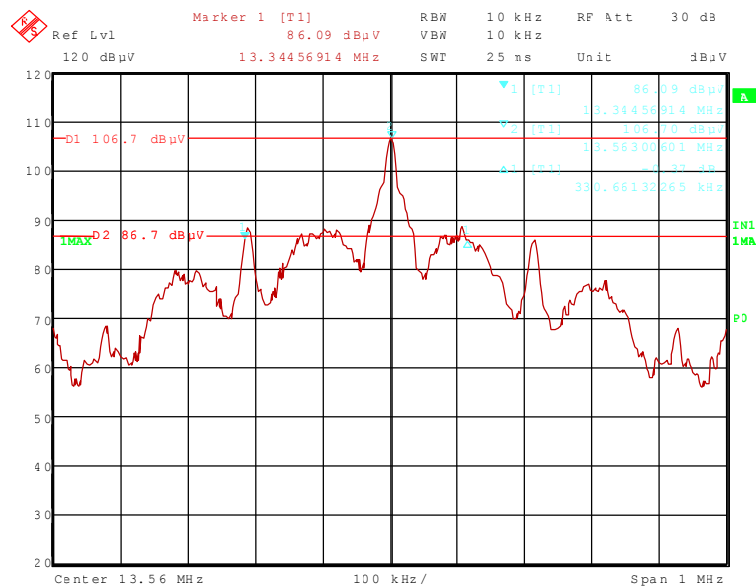
5.2.2 Test results (20 dB bandwidth)

Ambient temperature	21 °C	Relative humidity	55 %
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Supply voltage: The EUT was supplied with 12 V DC.

Test record: The test was carried out while the EUT was reading an ISO 14443 A - TAG.

113050_7.wmf: 20 dB bandwidth:



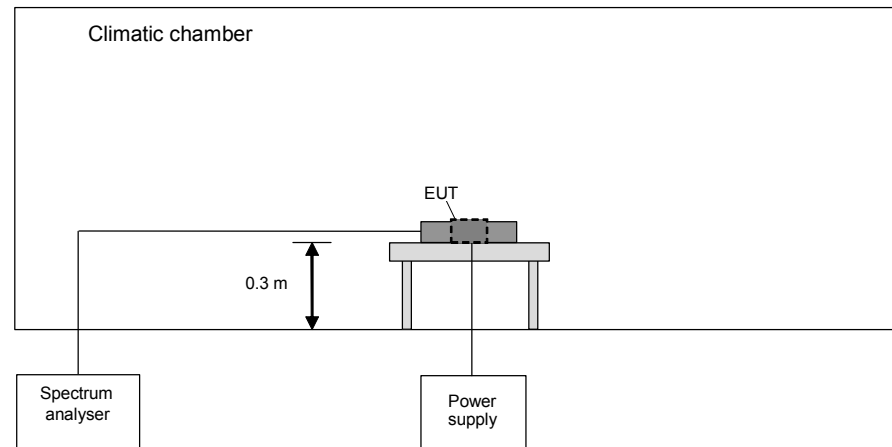
f_L	f_U	BW ($f_U - f_L$)
13.344569 MHz	13.675230 MHz	330.661 kHz
Measurement uncertainty		$< \pm 1 \cdot 10^{-7}$

TEST EQUIPMENT USED FOR THE TEST:

31, 58

5.3 Frequency tolerance

5.3.1 Method of measurement (Frequency tolerance)



The following procedure will be used:

- 1) Place the EUT in the climatic chamber.
- 2) Switch on the EUT and check the correct function and the settings of the spectrum analyser.
- 3) Switch off the EUT and tune the climatic chamber to a temperature of 50 °C. Wait until the thermal balance is obtained.
- 4) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 5) Repeat 4) with the minimum and the maximum of the supply voltage.
- 6) Switch off the EUT and tune the climatic chamber to a temperature range of 50 °C to –20 °C in ten-degree steps. Wait until the thermal balance is obtained for every step.
- 7) Switch the EUT on and record the frequencies at start-up and 2, 5 and 10 minutes after powering on.
- 8) Repeat 7) with the minimum and the maximum of the supply voltage at 20 °C.
- 9) Repeat 6) with the next temperature step until –20 °C were reached.

5.3.2 Test results (Frequency tolerance)

Ambient temperature	21 °C	Relative humidity	55 %
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Test set-up: For this test the EUT was fixed on a wooden table inside the climatic chamber.

Cable guide: For further information of the cable guide refer to the pictures in annex A of this test report.

Temperature	Supply voltage	Minutes after switch on	Frequency [MHz]	Allowed tolerance	Measured tolerance	Result
50 °C	12 VDC	0	13.558890	±1.356 kHz	-83 Hz	Passed
	12 V DC	2	13.558881	±1.356 kHz	-92 Hz	Passed
	12 V DC	5	13.558874	±1.356 kHz	-99 Hz	Passed
	12 V DC	10	13.558875	±1.356 kHz	-98 Hz	Passed
40 °C	12 V DC	0	13.558916	±1.356 kHz	-57 Hz	Passed
	12 V DC	2	13.558912	±1.356 kHz	-61 Hz	Passed
	12 V DC	5	13.558908	±1.356 kHz	-65 Hz	Passed
	12 V DC	10	13.558906	±1.356 kHz	-67 Hz	Passed
30 °C	12 V DC	0	13.558970	±1.356 kHz	-3 Hz	Passed
	12 V DC	2	13.558965	±1.356 kHz	-8 Hz	Passed
	12 V DC	5	13.558959	±1.356 kHz	-14 Hz	Passed
	12 V DC	10	13.558958	±1.356 kHz	-15 Hz	Passed
20 °C	8 V DC (U _{min})	0	13.559020	±1.356 kHz	47 Hz	Passed
	12 V DC (U _{nom})		13.559016	±1.356 kHz	43 Hz	Passed
	30 V DC (U _{max})		13.559013	±1.356 kHz	40 Hz	Passed
	8 V DC (U _{min})	2	13.559001	±1.356 kHz	28 Hz	Passed
	12 V DC (U _{nom})		13.559001	±1.356 kHz	28 Hz	Passed
	30 V DC (U _{max})		13.559003	±1.356 kHz	30 Hz	Passed
	8 V DC (U _{min})	5	13.558994	±1.356 kHz	21 Hz	Passed
	12 V DC (U _{nom})		13.558994	±1.356 kHz	21 Hz	Passed
	30 V DC (U _{max})		13.559000	±1.356 kHz	27 Hz	Passed
	8 V DC (U _{min})	10	13.558974	±1.356 kHz	1 Hz	Passed
	12 V DC (U _{nom})		13.558973	-	-	Reference
	30 V DC (U _{max})		13.558981	±1.356 kHz	8 Hz	Passed
10 °C	12 V DC	0	13.559067	±1.356 kHz	94 Hz	Passed
	12 V DC	2	13.559062	±1.356 kHz	89 Hz	Passed
	12 V DC	5	13.559060	±1.356 kHz	87 Hz	Passed
	12 V DC	10	13.559058	±1.356 kHz	85 Hz	Passed
0 °C	12 V DC	0	13.559102	±1.356 kHz	129 Hz	Passed
	12 V DC	2	13.559098	±1.356 kHz	125 Hz	Passed
	12 V DC	5	13.559096	±1.356 kHz	123 Hz	Passed
	12 V DC	10	13.559095	±1.356 kHz	122 Hz	Passed
-10 °C	12 V DC	0	13.559117	±1.356 kHz	144 Hz	Passed
	12 V DC	2	13.559117	±1.356 kHz	144 Hz	Passed
	12 V DC	5	13.559117	±1.356 kHz	144 Hz	Passed
	12 V DC	10	13.559117	±1.356 kHz	144 Hz	Passed
-20 °C	12 V DC	0	13.559117	±1.356 kHz	144 Hz	Passed
	12 V DC	2	13.559117	±1.356 kHz	144 Hz	Passed
	12 V DC	5	13.559118	±1.356 kHz	145 Hz	Passed
	12 V DC	10	13.559117	±1.356 kHz	144 Hz	Passed
Measurement uncertainty				< ± 1*10 ⁻⁷		

Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

6, 58, 61

5.4 Radiated emissions

5.4.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five 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 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 variable antenna distance and height in the frequency range 1 GHz to 25 / 40 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 25 / 40 GHz.

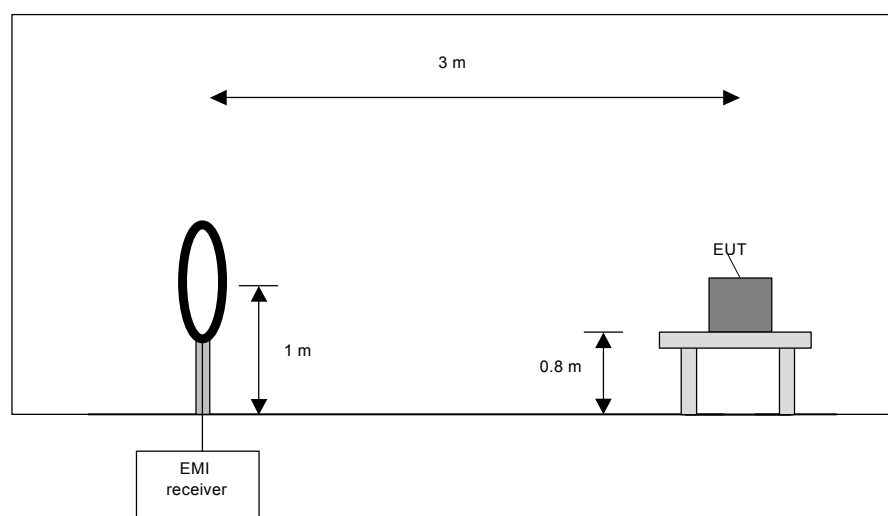
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. 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 ANSI C63.4-2009 [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).

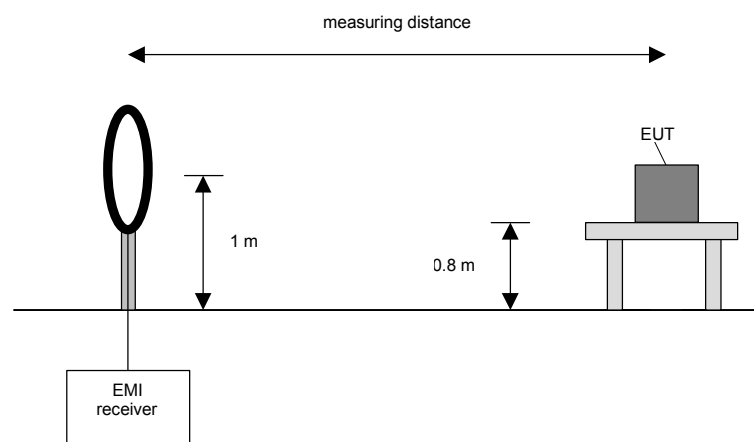
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances is 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 during the preliminary measurement detected frequencies 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 (because of EUT is a module and might be used in a handheld equipment application).

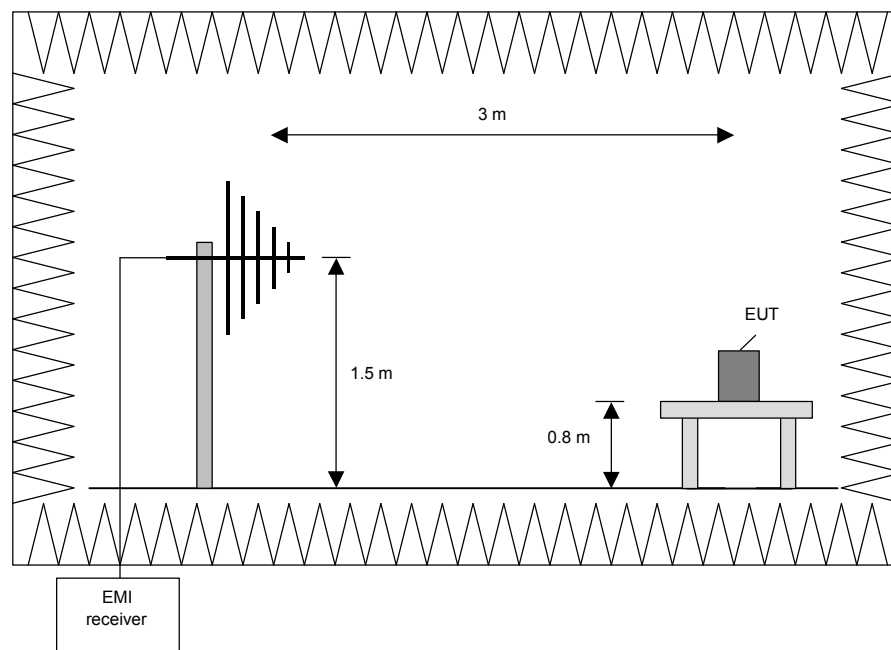
Preliminary measurement (30 MHz to 1 GHz)

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 ANSI C63.4-2009 [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 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 °.

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

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

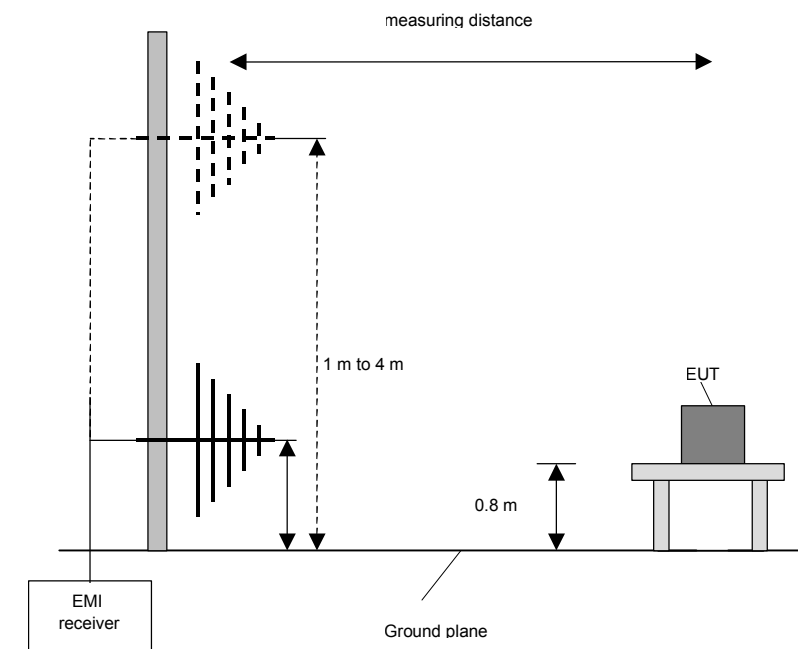
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the 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 (because of EUT is a module and might be used in a handheld equipment application).
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 (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 40 GHz)

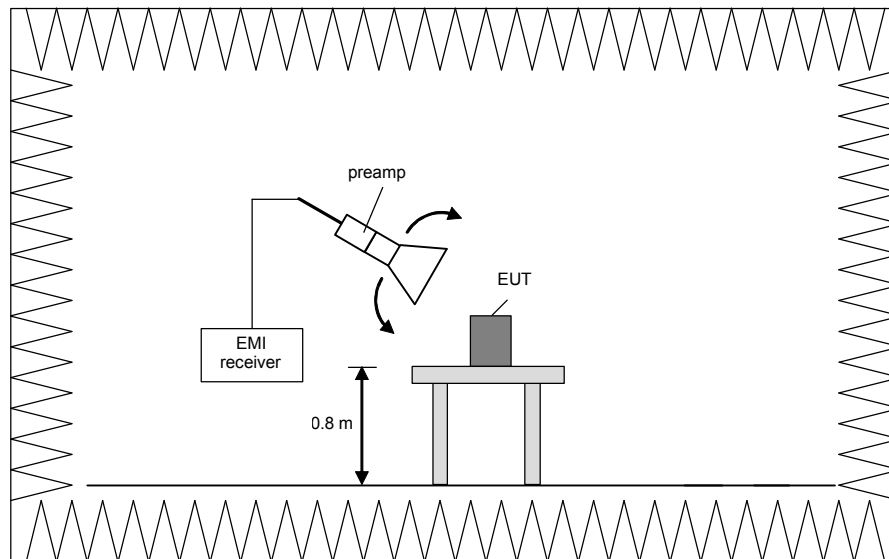
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

Preliminary measurement (1 GHz to 40 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, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and than the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

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

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 25 / 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz

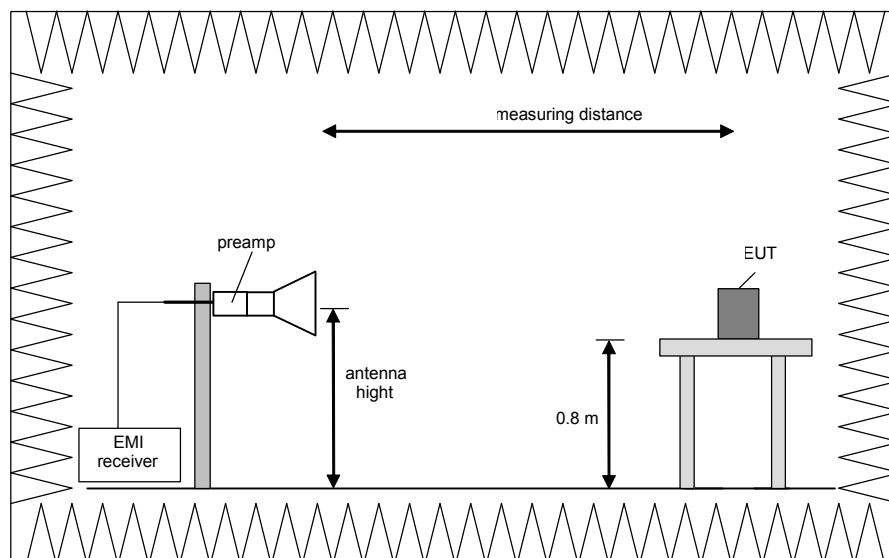


Final measurement (1 GHz to 40 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. 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 ° in order to have the antenna inside the cone of radiation.

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 25 / 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency ranges 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 25 /26.5 GHz and 26.5 GHz to 40 GHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

Step 1) to 6) are defined as preliminary measurement.

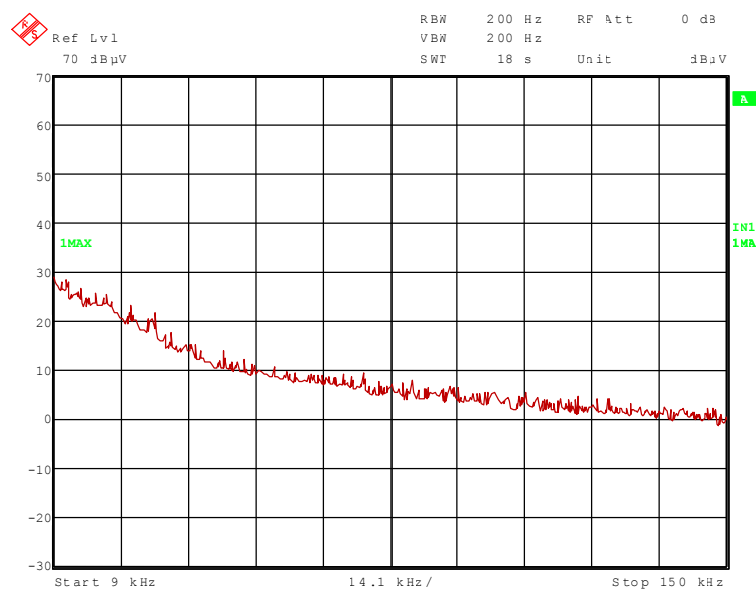
5.4.2 Test results (radiated emissions)

5.4.2.1 Preliminary radiated emission measurement

Ambient temperature	20 °C	Relative humidity	60 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: No cable was connected to the EUT. For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.
- Test record: All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 12 V DC by an external power supply and the EUT was reading an ISO 14443 A - TAG

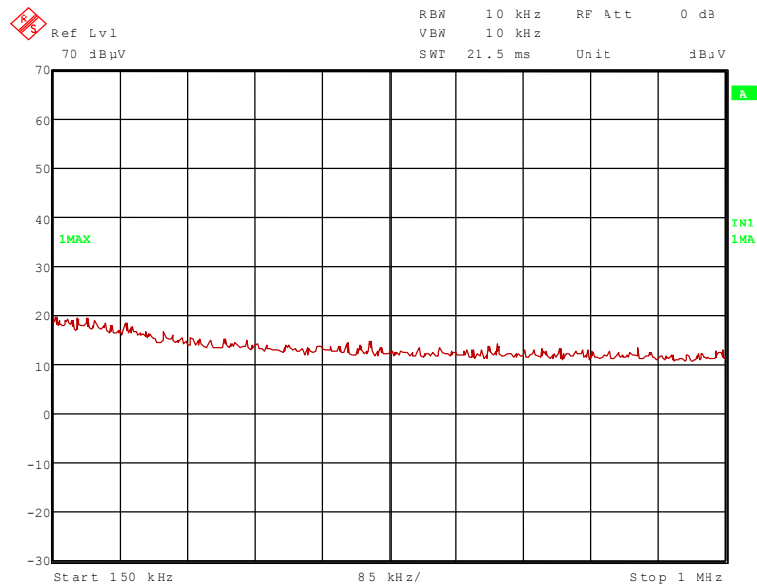
113050_2.wmf: Spurious emissions from 9 kHz to 150 kHz:



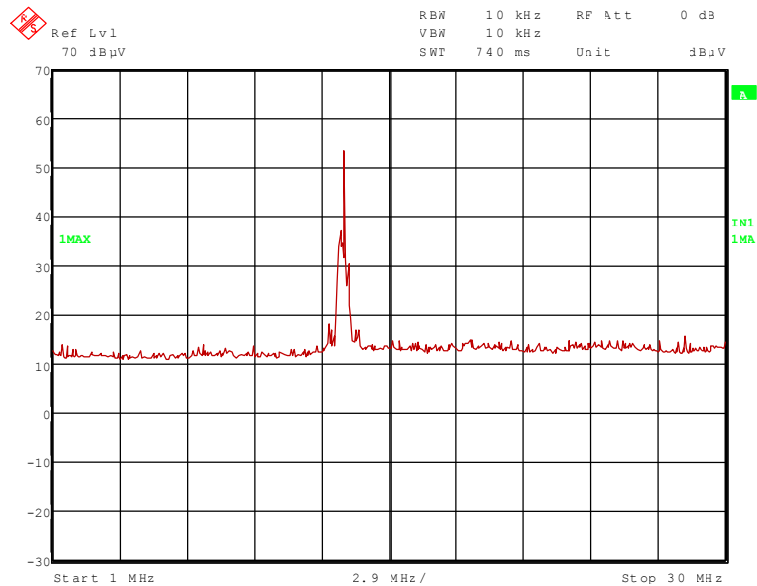
TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 43, 56

113050_3.wmf: Spurious emissions from 150 kHz to 1 MHz:



113050_1.wmf: Spurious emissions from 1 MHz to 30 MHz:



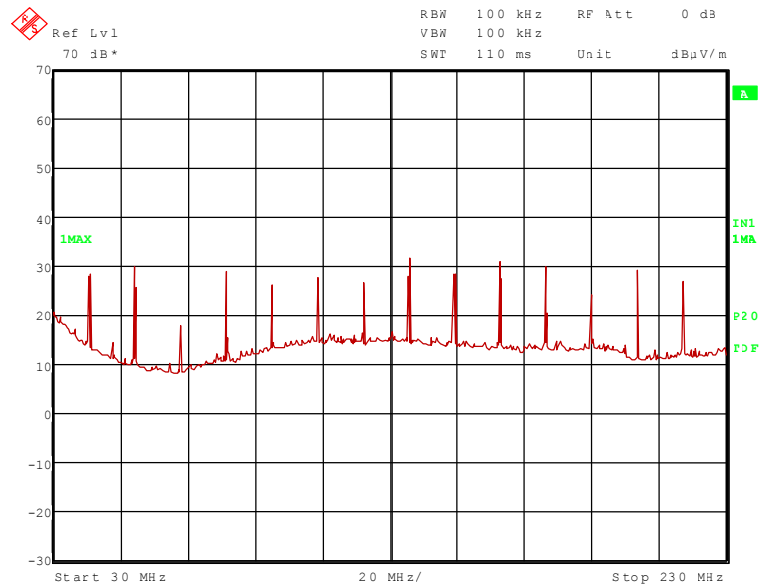
The following frequencies were found during the preliminary radiated emission test:

13.559 MHz and 27.118 MHz.

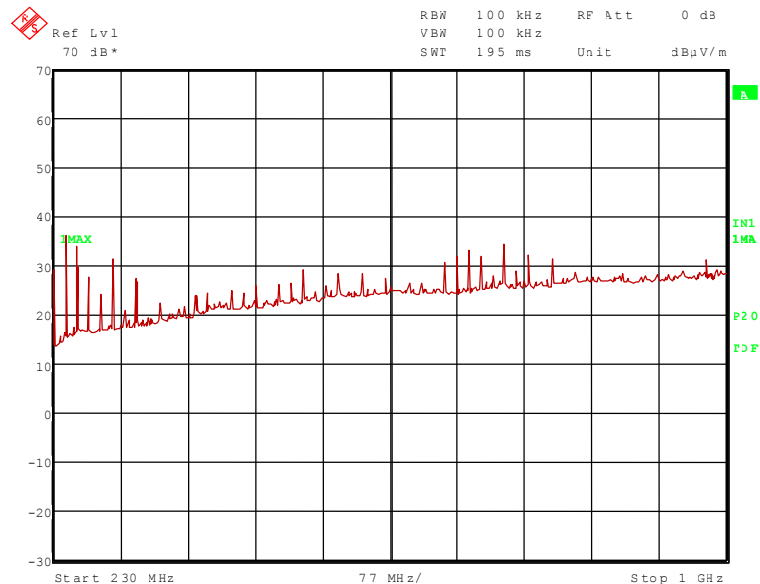
No frequencies were found inside the restricted bands during the preliminary radiated emission test.

This frequency has to be measured on the open area test site. The result is presented in the following.

113050_4.wmf: Spurious emissions from 30 MHz to 230 MHz:



113050_5.wmf: Spurious emissions from 230 MHz to 1 GHz:



The following frequencies were found during the preliminary radiated emission test:

54.236 MHz, 81.354 MHz, 176.267 MHz, 515.242 MHz, 705.068 MHz and 745.745 MHz.

The following frequencies were found inside the restricted bands during the radiated emission test.

108.472 MHz, 135.590 MHz, 162.708 MHz, 244.062 MHz, 257.621 MHz and 976.248 MHz.

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

5.4.2.2 Final radiated emission test (9 kHz to 30 MHz)

Ambient temperature	12 °C	Relative humidity	72 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

Cable guide: No cable was connected to the EUT. For detail information of test set-up and the cable guide refer to the photographs in annex A of this test report.

Test record: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 12 V DC by an external power supply and the EUT was reading an ISO 14443 A - TAG

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

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{antenna factor [dB/m]}$$

Results with measuring distance of 3 m						
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor ^{*2} dB/m
13.559	67.0	124.0 ^{*1}	57.0	QP	47.0	20.0
27.118	30.0	69.5 ^{*1}	39.5	QP	10.0	20.0
Results with measuring distance of 10 m						
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor ^{*2} dB/m
13.559	56.0	104.0 ^{*1}	48.0	QP	36.0	20.0
27.118	Signal was below the noise floor of the measuring system					
Measurement uncertainty				+2.2 dB / -3.6 dB		

^{*1}: Limit corrected with 40 dB / decade

^{*2}: Cable loss included

Test: Passed

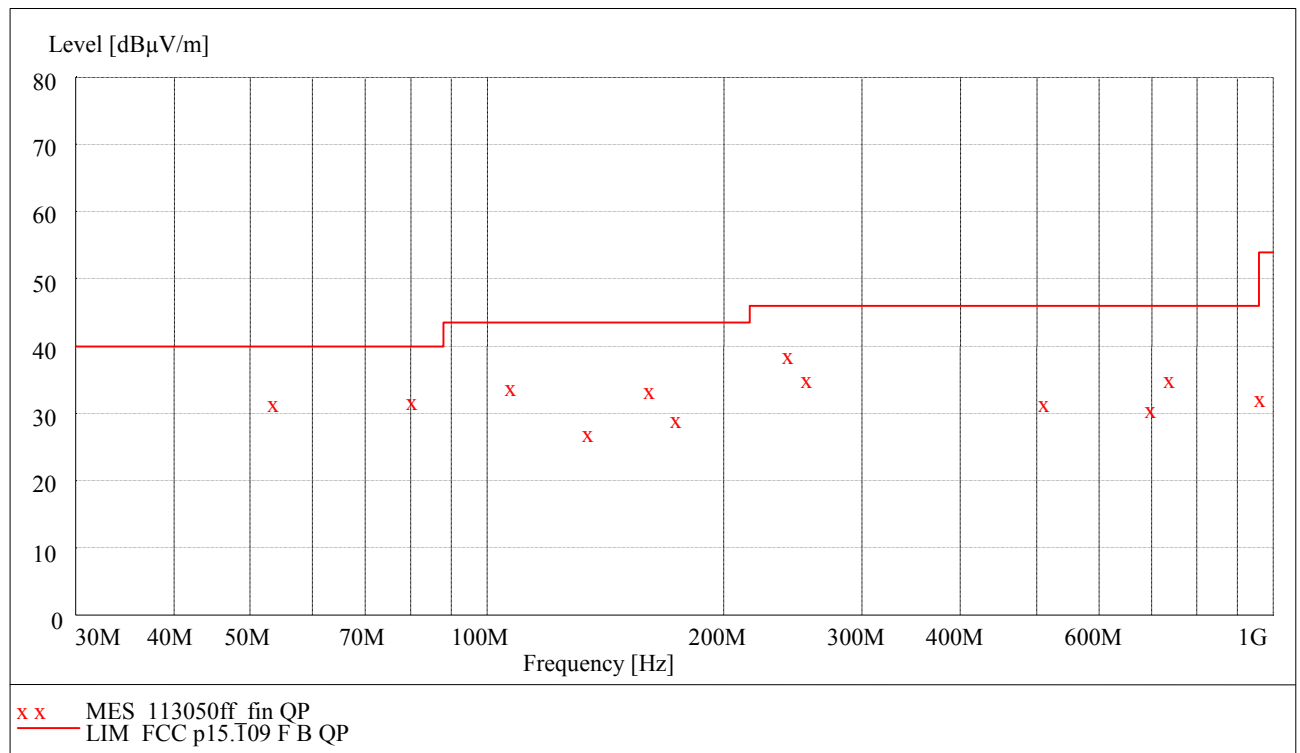
TEST EQUIPMENT USED FOR THE TEST:
9, 56, 57

5.4.2.3 Final radiated emission measurement (30 MHz to 1 GHz)

Ambient temperature	20 °C	Relative humidity	60 %
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- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: For detail information of test set-up and the cable guide refer to the pictures in annex A of this test report.
- Test record: All results are shown in the following.
- Supply voltage: During all measurements the EUT was supplied with 12 V DC by an external power supply and the EUT was reading an ISO 14443 A - TAG
- Test results: The test results were calculated with the following formula:
- $$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

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 x are the measured results of the standard final measurement on the open area test site.



Data record name: 113050ff

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 second.

Result measured with the quasi-peak detector:
(These values were marked in the diagrams by an x)

Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dB μ V/m	dB μ V/m	dB	dB μ V	dB/m	dB	cm	deg	
54.236	32.1	40.0	7.9	24.1	7.2	0.8	100.0	271.0	Vert.
81.354	32.3	40.0	7.7	23.1	8.2	1.0	125.0	1.0	Vert.
176.267	29.6	43.5	13.9	18.3	9.8	1.5	193.0	120.0	Hor.
515.242	32.1	46.0	13.9	11.8	17.7	2.6	175.0	103.0	Hor.
705.068	31.1	46.0	14.9	7.8	20.3	3.0	225.0	68.0	Vert.
745.745	35.5	46.0	10.5	10.7	21.7	3.1	352.0	3.0	Vert.
Spurious emissions inside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dB μ V/m	dB μ V/m	dB	dB μ V	dB/m	dB	cm	deg	
108.472	34.3	43.5	9.2	21.6	11.6	1.1	100.0	281.0	Vert.
135.590	27.8	43.5	15.7	14.6	11.9	1.3	325.0	315.0	Vert.
162.708	34.0	43.5	9.5	21.7	10.9	1.4	175.0	105.0	Hor.
244.062	39.2	46.0	6.8	25.8	11.7	1.7	103.0	248.0	Hor.
257.621	35.5	46.0	10.5	21.2	12.5	1.8	125.0	103.0	Hor.
976.248	32.7	54.0	21.3	5.4	23.8	3.5	102.0	100.0	Hor.
Measurement uncertainty				+2.2 dB / -3.6 dB					

The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
14 - 20

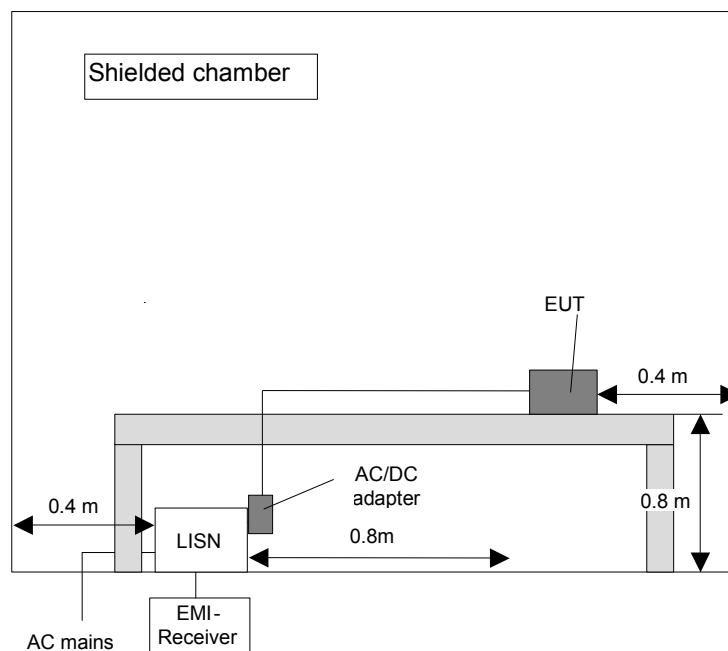
5.5 Conducted emissions on power supply lines (150 kHz to 30 MHz)

5.5.1 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 set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [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 appropriate 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



5.5.2 Test results (conducted emissions on power supply lines)

Ambient temperature	20 °C	Relative humidity	60 %
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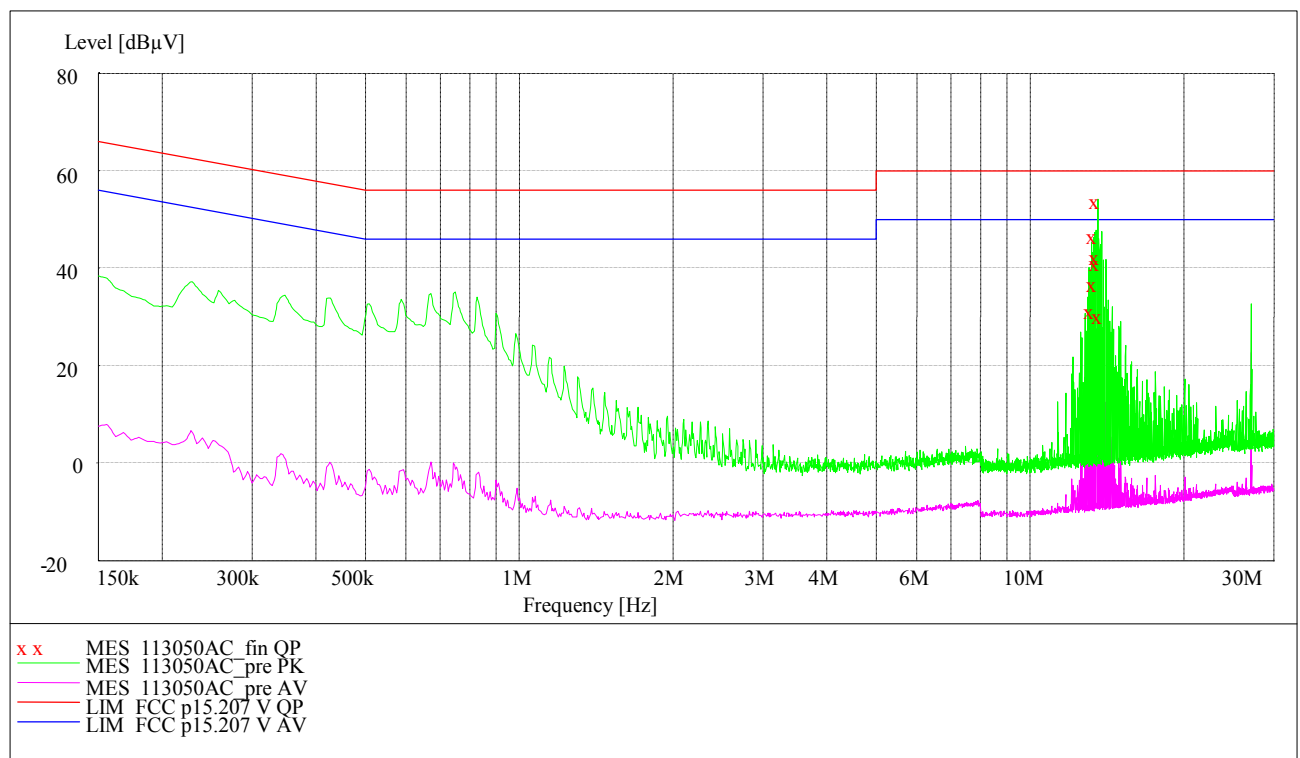
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m.

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: All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 12.0 V DC by an AC / DC adaptor type FW3288, which was supplied by 120 V AC / 60 Hz. The EUT was reading an ISO 14443 A - TAG

The curves in the diagram 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.



Data record name: 113050AC

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
13.299000	32.0	2.6	60.0	28.0	N	FLO
13.398900	37.3	2.6	60.0	22.7	N	FLO
13.453800	47.4	2.7	60.0	12.6	N	FLO
13.573500	54.4	2.7	60.0	5.6	N	FLO
13.608600	41.8	2.8	60.0	18.2	N	FLO
13.635600	43.0	2.8	60.0	17.0	L1	FLO
13.836300	30.9	2.8	60.0	29.1	L1	FLO
Measurement uncertainty				+3.6 dB / -4.5 dB		

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
1 - 4, 20

6 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088	Weekly verification (system cal.)	
2	Measuring receiver	ESIB 26	Rohde & Schwarz		481182		
3	LISN	NSLK8128	Schwarzbeck	8128155	480058		
4	DC-filter	B84266-A21-E13	Siemens	940164525	480099	Weekly verification (system cal.)	
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097	Weekly verification (system cal.)	
6	Spectrum analyser	FSU	Rohde & Schwarz	200125	480956	04/15/2010	04/2012
9	Outdoor test site	-	Phoenix Test-Lab	-	480293	Six-month verification (system cal.)	
14	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
16	Controller	HD100	Deisel	100/670	480139	-	-
17	Turntable	DS420HE	Deisel	420/620/80	480087	-	-
18	Antenna support	AS615P	Deisel	615/310	480086	-	-
19	Antenna	CBL6111 A	Chase	1643	480147	08/01/2007	08/2012
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	-
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	07/29/2011	07/2013
32	Controller	MCU	Maturo GmbH	MCU/043/971107	480832	-	-
33	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
34	Antenna support	AS615P	Deisel	615/310	480187	-	-
35	Antenna	CBL6112 B	Chase	2688	480328	04/21/2011	04/2014
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
56	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	03/10/2010	03/2012
57	EMI test receiver	ESPC	Rohde & Schwarz	843756/006	480150	03/12/2010	03/2012
58	Loop Antenna Ø = 225 mm	-	Phoenix Test-Lab	-	410085	Weekly verification	
59	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102	Weekly verification	
61	Climatic chamber	MK 240	BINDER	05-79022	480462	04/06/2010	04/2012

7 REPORT HISTORY

Report Number	Date	Comment
F113050E1	05 September 2011	Document created
-	-	-
-	-	-

8 LIST OF ANNEXES

ANNEX A	TEST SETUP PHOTOGRAPHS	7 pages
	113050_c.JPG: PRL5A/2, test setup fully anechoic chamber 113050_a.JPG: PRL5A/2, test setup fully anechoic chamber 113050_e.JPG: PRL5A/2, test setup fully anechoic chamber 113050_j.JPG: PRL5A/2, test setup outdoor test site 113050_f.JPG: PRL5A/2, test setup open area test site 113050_k.JPG: PRL5A/2, test setup climatic chamber 113050_g.JPG: PRL5A/2, test setup shielded chamber	
ANNEX B	INTERNAL PHOTOGRAPHS	11 pages
	113050_12.JPG: PRL5A/2 internal view, unsealed sample 113050_14.JPG: PRL5A/2, main PCB, top view 113050_13.JPG: PRL5A/2, main PCB, bottom view 113050_15.JPG: PRL5A/2, antenna PCB, top view 113050_16.JPG: PRL5A/2, antenna PCB, bottom view 113050_4.JPG: KPL5A/2 internal view, unsealed sample 113050_6.JPG: KPL5A/2 internal view, unsealed sample 113050_5.JPG: KPL5A/2, main PCB, top view 113050_9.JPG: KPL5A/2, main PCB, bottom view 113050_7.JPG: KPL5A/2, antenna PCB, top view 113050_8.JPG: KPL5A/2, antenna PCB, bottom view	
ANNEX C	EXTERNAL PHOTOGRAPHS	2 pages
	113050_11.JPG: PRL5A/2, 3-D-view 1 113050_3.JPG: KPL5A/2, 3-D-view 1	
ANNEX D	ADDITIONAL RESULTS FOR INDUSTRY CANADA	2 Pages