

TEST REPORT

Test Report Reference: R70019_A Edition 1

Equipment under Test: SWH-4500

FCC ID: IXLSWH4500

Serial Number: None

Applicant: deister electronic GmbH

Manufacturer: deister electronic GmbH

**Test Laboratory
(CAB)
accredited by
DATech GmbH
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21
and
FCC Test site registration number 90877**

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1 IDENTIFICATION

1.1 APPLICANT

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1.2 MANUFACTURER

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Country:	Germany
Name for contact purposes:	Mr. Stefan EICHLER
Tel:	+ 49 51 05 51 61 29
Fax:	+ 49 51 05 51 62 66
e-mail address:	eichler@deister-gmbh.de

1.3 DATES

Date of receipt of test sample:	22 December 2006
Start of test:	09 January 2007
End of test:	11 January 2007

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2 TECHNICAL DATA OF EQUIPMENT

2.1 DEVICE UNDER TEST

Type of equipment:	125 kHz and 13.56 MHz Reader
Type designation:	SWH-4500
FCC ID:	IXLSWH4500
Serial No.:	None
Lowest internal frequency:	125 kHz
Highest internal frequency:	13.56 MHz
Antenna type:	Integral
Supply Voltage:	8 V DC to 16 V DC

The following external I/O cables were used:

Cable	Length	Shielding	Connector
Connection cable (including DC supply lines and Data in/ out lines)	2.5 m *	Yes	12 pole terminal block
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

*: Length during the test

2.2 PERIPHERY DEVICES

The following equipment was used as control unit and ancillary equipment:

During the occupied bandwidth measurements a 125 kHz (Tiris-Transponder) or a 13.56 MHz (ISO 15693) transponder card was used.

2.3 SPECIAL EMC MEASURES

The following EMC measures were necessary to reach the documented results:

None.

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3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

During all tests the EUT was supplied with a DC supply voltage, which was provided by an external power supply or an AC / DC adaptor type FW 3288 (used only for the conducted emissions on AC-mains). 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 16 V DC. This range was declared by the applicant as extreme supply voltage range.

If not otherwise stated, the tests were carried out with the EUT powered on in awaiting a transponder card. In this mode alternatively a 125 kHz carrier and a 13.56 MHz carrier were produced by the EUT.

During the measurement of occupied bandwidth a 125 kHz transponder card (Tiris-Transponder) or a 13.56 MHz card (ISO 15693) respectively were presented in the front of the EUT.

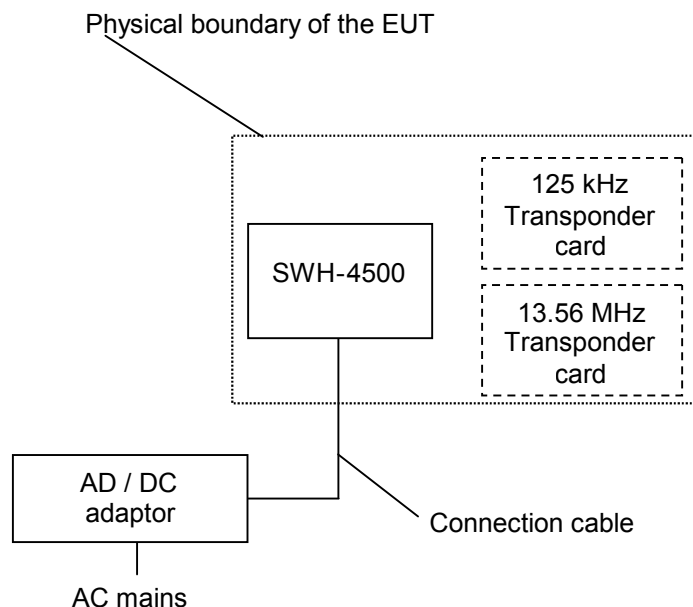
If a variation of the supply voltage was necessary, it was done in the range 8.0 V DC to 16 V DC, because this range was declared by the applicant as extreme supply voltage range.

For the whole frequency range a preliminary measurement in a fully anechoic chamber with a measuring distance of 3 m was carried out to determine the frequencies, which were radiated by the EUT.

The final measurements on the detected frequencies were carried out on an outdoor test site without ground plane (for the frequency range 9 kHz to 30 MHz) and on an open area test site with ground plane (for the frequency range 30 MHz to 1 GHz).

During the tests, the EUT was not sealed or labelled with a FCC-label.

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



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4 LIST OF TEST MODULES

4.1 EMISSION

Conducted emissions FCC 47 CFR Part 15 section 15.207 (a)[2]					
Application	Frequency range	Limits	Reference standard	Remark	Status
On AC supply line	0.15 to 0.5 MHz	66 to 56 dB μ V (QP) * 56 to 46 dB μ V (AV) *	ANSI C63.4 (2003)	-	
	0.5 to 5 MHz	56 dB μ V (QP) 46 dB μ V (AV)			
	5 to 30 MHz	60 dB μ V (QP) 50 dB μ V (AV)			
*: Decreases with the logarithm of the frequency					
Radiated emissions FCC 47 CFR Part 15 section 15.209 [2]					
Application	Frequency range	Limits (microvolts/meter)	Reference standard	Remark	Status
Intentional radiator	0.009 to 0.49 MHz	2400/f(kHz) at 300 m	ANSI C63.4 (2003);	-	
	0.490 to 1.705 MHz	24000/f(kHz) at 30 m			
	1.705 to 30.0 MHz	30.0 dB μ V/m at 30 m			
	30 to 88 MHz	40.0 dB μ V/m at 3 m			
	88 to 216 MHz	43.5 dB μ V/m at 3 m			
	216 to 960 MHz	46.0 dB μ V/m at 3 m			
	960 to 1000 MHz	54.0 dB μ V/m at 3 m			
Radiated emissions FCC 47 CFR Part 15 section 15.225 (a)[2]					
	Frequency range	Limits (microvolts/meter)	Reference standard	Remark	Status
Operation with in the band 13.553 – 13.567 MHz	13.553 to 13.567 MHz	15,848 at 30 m	ANSI C63.4 (2003);	-	Passed
Frequency tolerance over temperature and supply voltage FCC 47 CFR Part 15 section 15.225 (e)[2]					
Application		Limits	Reference standard	Remark	Status
Temperature range -20°C to +50°C and supply voltage 85 to 115 % or new battery		0.01 %	ANSI C63.4 (2003);	-	

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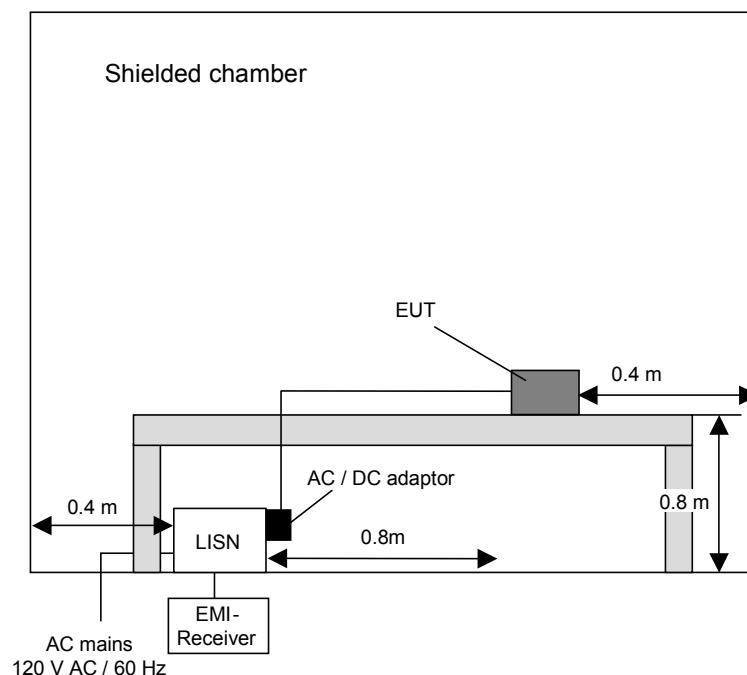
5 METHOD OF MEASUREMENT

5.1 CONDUCTED EMISSIONS ON POWER SUPPLY LINES (150 kHz to 30 MHz)

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 C63.4-2003 [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



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5.2 RADIATED EMISSIONS 9 kHz to 30 MHz

The radiated emission measurement is divided into two stages.

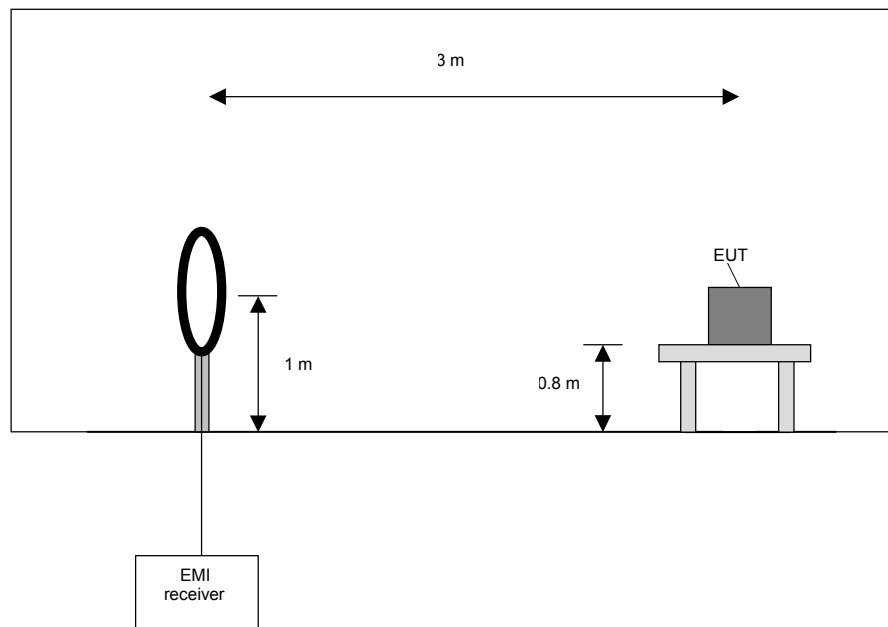
Preliminary measurement:

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 C63.4-2003 [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



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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 4) with the other orthogonal axes of the EUT.
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

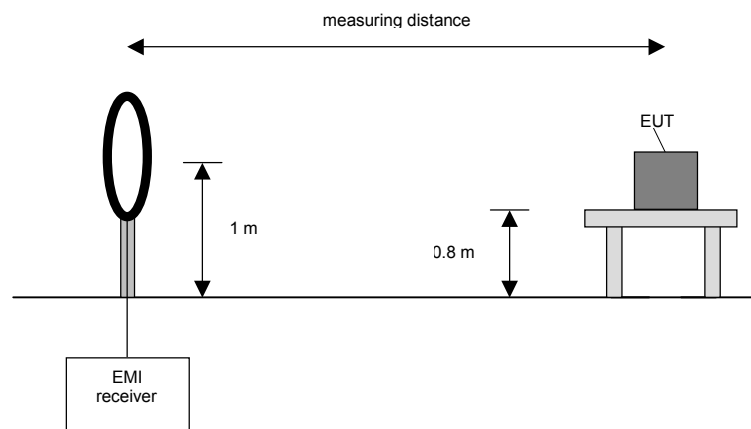
Final measurement:

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 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



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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 applicable (handheld equipment).

5.3 RADIATED EMISSIONS 30 MHz to 1 GHz

The radiated emission measurement is divided into two stages.

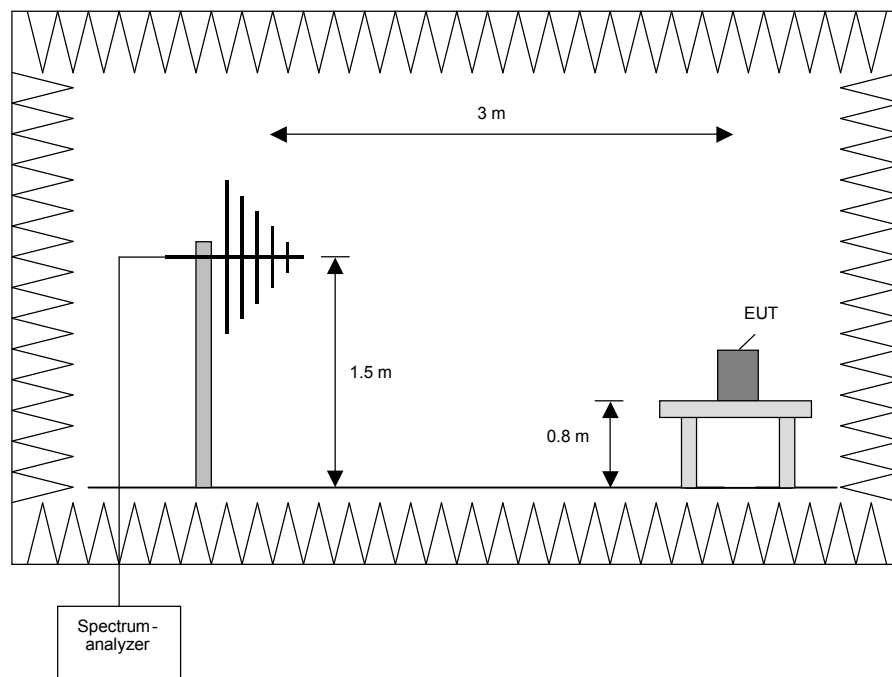
Preliminary measurement:

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 C63.4-2003 [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 1 GHz	100 kHz



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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:

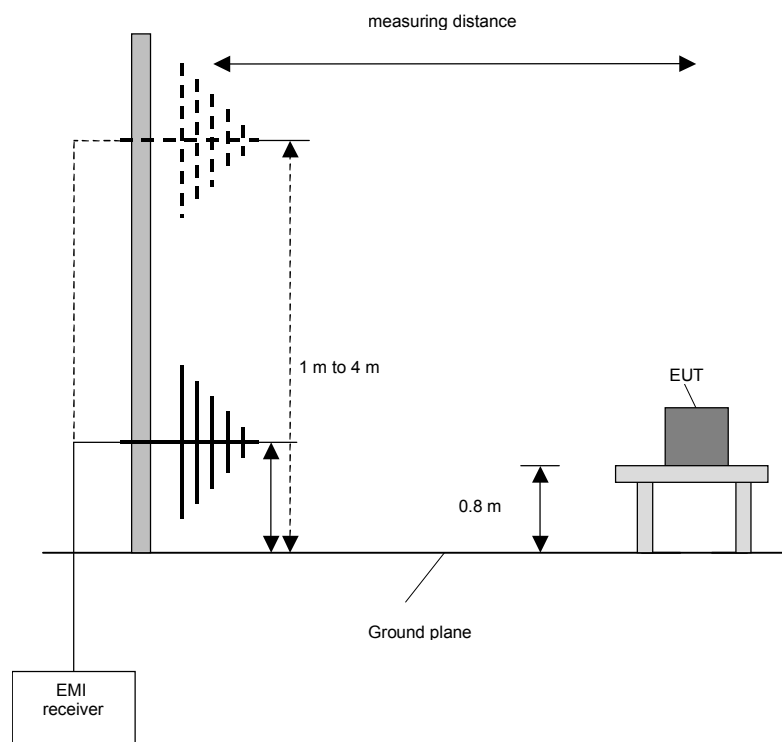
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of 3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

Final Measurement:

In the second stage 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



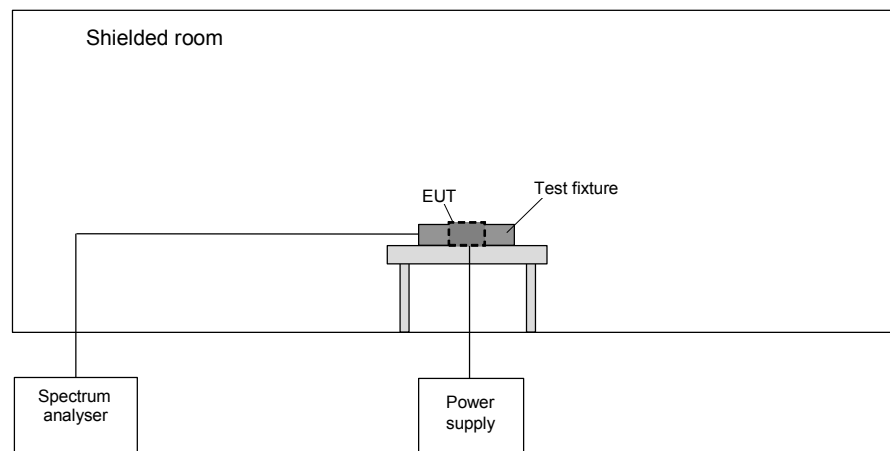
TEST REPORT REFERENCE: R70019_A Edition 1

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 or 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.

5.4 SPECTRUM MASK AND OCCUPIED BANDWIDTH



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

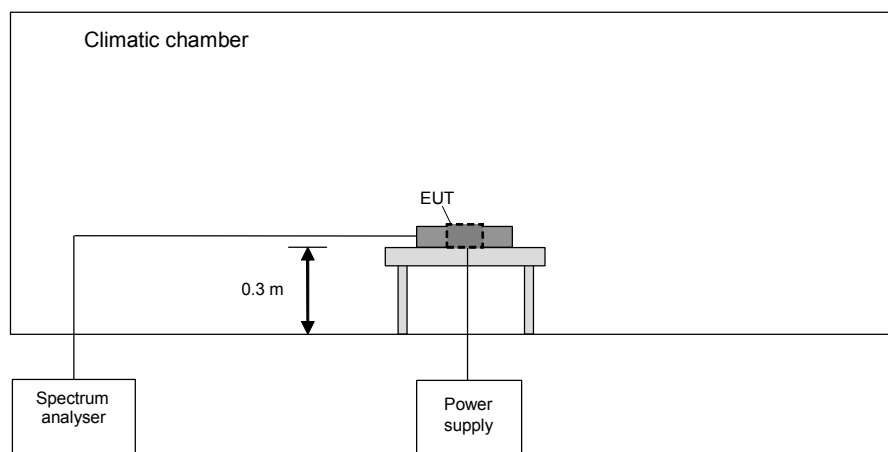
- 1) Place the EUT in the test fixture and switch it on.
- 2) Use the following spectrum analyser settings: RWB = VBW = 1 kHz, Span = wide enough to capture the whole 13 MHz band including the frequency ranges where the 15.209 limit applies, Trace mode = MaxHold, select the limit line 15225spc
- 3) After 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.

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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.

5.5 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.

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6 TEST RESULTS EMISSION TEST

6.1 CONDUCTED EMISSION MEASUREMENT ON AC MAINS (150 kHz to 30 MHz)

Ambient temperature:	20 °C	Relative humidity:	43 %
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Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

Cable guide: All cables of the EUT were fixed on the wooden 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 in normal operation mode of the EUT (without reading a TAG). All results are shown in the following.

Power supply: During this test the EUT was powered by an AC/DC adaptor type FW 3288 with 12 V DC.

Title: AC Powerline Conducted Emission Test with protective ground conductor simulating network

EUT: SWH-4500

Manufacturer: deister electronic GmbH

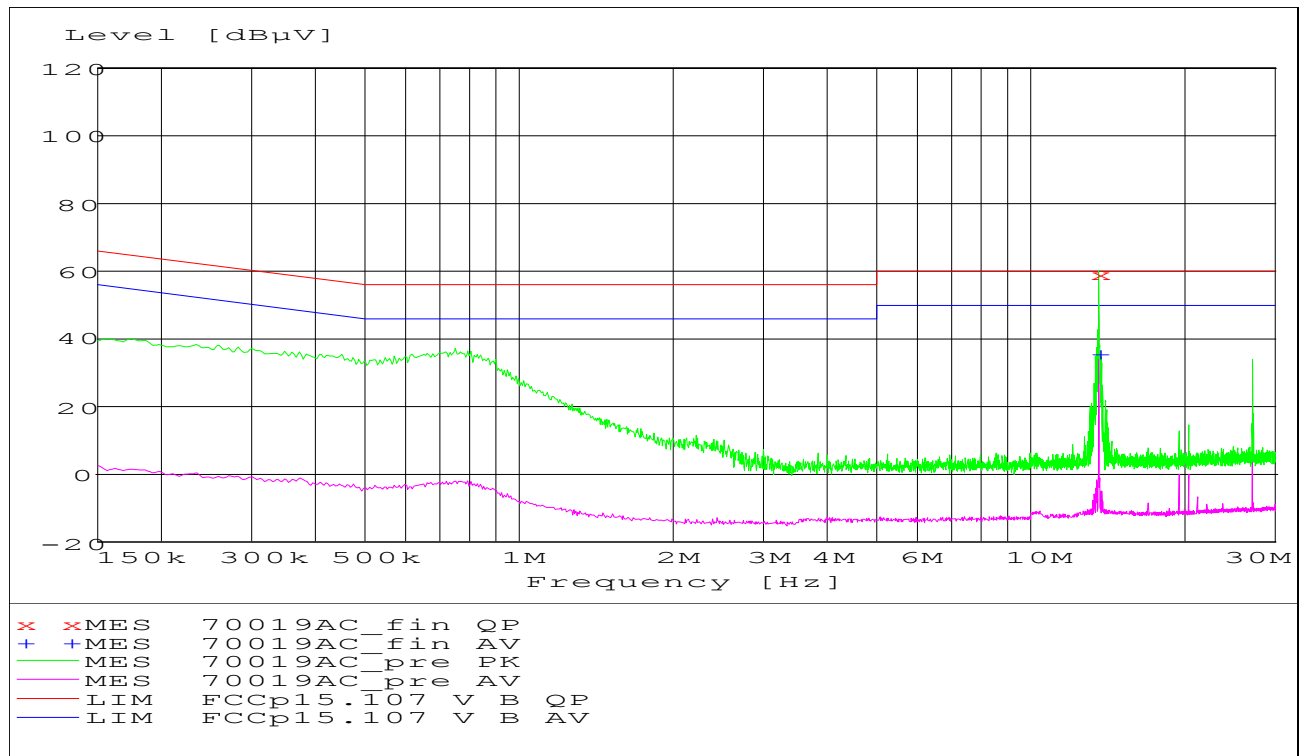
Operating Condition: Active

Test site: PHOENIX TEST-LAB Blomberg M4

Operator: Th. KÜHN

Test Specification: Powered with external 115 V AC

Comment: Using FW 3288 AC/DC adaptor



Data record name: 70019AC

TEST REPORT REFERENCE: R70019_A Edition 1

Result measured with the quasipeak detector:

(These values are marked in the above diagram by x)

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
13.561080	59.40	1.9	60.0	0.6	N	FLO

Data record name: 70019AC_fin QP

Result measured with the average detector:

(These values are marked in the above diagram by +)

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
13.559100	35.90	1.8	50.0	14.1	L1	FLO

Data record name: 70019AC_fin AV

Test: Passed

TEST EQUIPMENT USED:
1 - 3, 5, 6

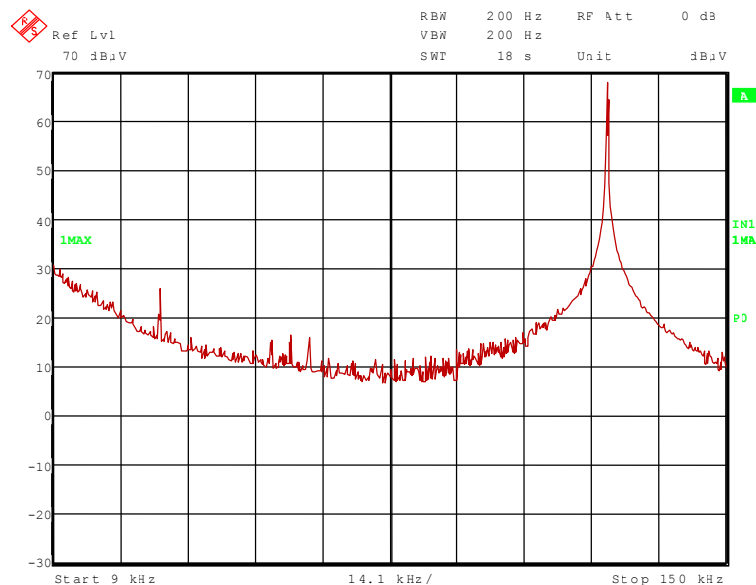
TEST REPORT REFERENCE: R70019_A Edition 1

6.2 PRELIMINARY RADIATED EMISSION TEST (9 kHz to 30 MHz)

Ambient temperature:	21 °C	Relative humidity:	45 %
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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:** The cable of the EUT was 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 in normal operation mode of the EUT (without reading a TAG). All results are shown in the following.
- Remark:** The emissions found at 31 kHz, 54 kHz, 58 kHz and 62 kHz caused by the measuring system and not by the EUT.

70019_1.wmf: Spurious emissions from 9 kHz to 150 kHz:



TEST EQUIPMENT USED THE TEST:

29, 31 – 33, 54, 56

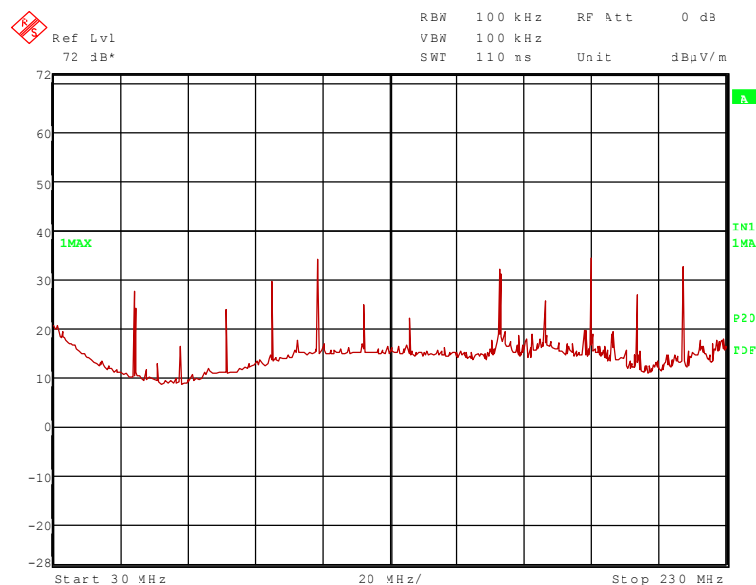
TEST REPORT REFERENCE: R70019_A Edition 1

6.3 PRELIMINARY RADIATED EMISSION TEST (30 MHz to 1 GHz)

Ambient temperature:	21 °C	Relative humidity:	45 %
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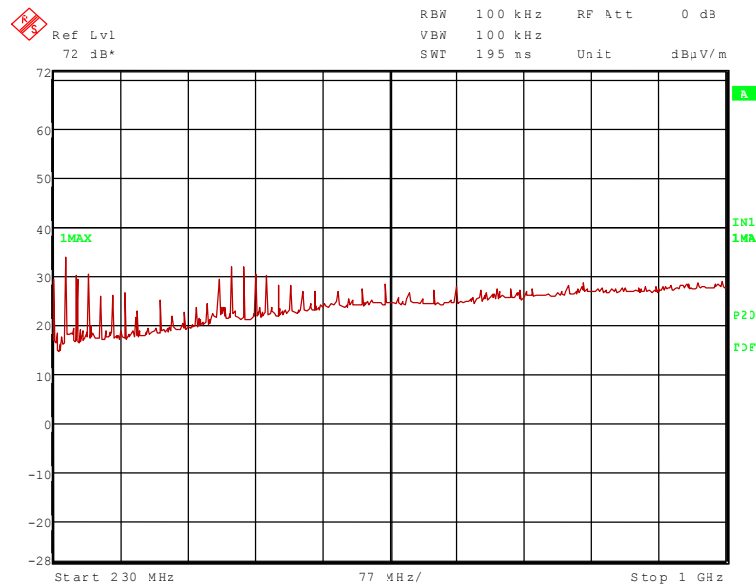
- Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.
- Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.
- Test record: The test was carried out in normal operation mode of the EUT (without reading a TAG). All results are shown in the following.
- Supply voltage: The EUT was supplied with 12 V DC, because no difference was noticeable with supply voltages from 8 V DC to 16 V DC.

70019_4.wmf: Spurious emissions from 30 MHz to 230 MHz:



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70019_5.wmf: Spurious emissions from 230 MHz to 1 GHz:



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

54.244 MHz, 189.854 MHz, 203.416 MHz, 216.978 MHz, 433.955 MHz, 447.517 MHz, 461.076 MHz and 474.637 MHz.

The following frequencies were found inside the restricted bands according to FCC 47 CFR Part 15 section 15.205 [2].

108.489 MHz, 162.732 MHz, 244.098 MHz, 257.661 MHz and 271.223 MHz.

These frequencies have to be measured on the open area test site. The results of this final measurement are shown in subclause 6.5 of this test report.

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 35, 43, 54

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6.4 FINAL RADIATED EMISSION TEST (9 kHz to 30 MHz)

Ambient temperature:	10 °C	Relative humidity:	50 %
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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, 10 m and 30 m.
- Cable guide:** The cable of the EUT was 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 in normal operation mode of the EUT (without reading a TAG). All results are shown in the following.
- Supply voltage:** The EUT was supplied with 12 V DC, because no difference was noticeable with supply voltages from 8 V DC to 16 V DC.
- 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	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * dB/m
125.014 kHz	84.7	105.7	21.0	QP	64.7	20.0
13.561 MHz	66.1	124.0	57.9	QP	46.1	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 * dB/m
125.014 kHz	54.6	85.7	29.1	QP	34.6	20.0
13.561 MHz	49.4	104.0	54.6	QP	29.4	20.0
Results with measuring distance of 30 m						
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * dB/m
125.014 kHz	Signal was below the noise floor of the system					
13.561 MHz	28.3	84.0	55.7	QP	8.3	20.0
Measurement uncertainty				+2.2 dB / -3.6 dB		

*: Cable loss included

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:
54 – 57

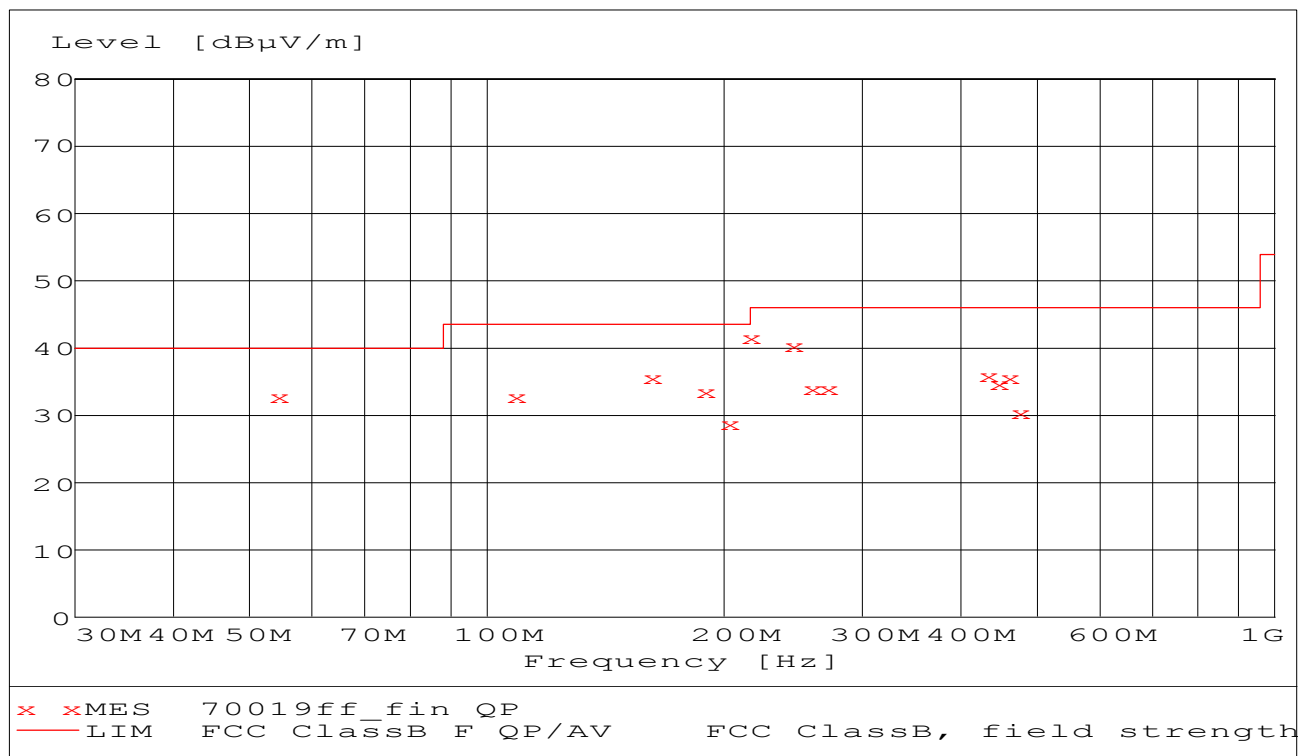
TEST REPORT REFERENCE: R70019_A Edition 1

6.5 FINAL RADIATED EMISSION TEST (30 MHz to 1 GHz)

Ambient temperature:	19 °C	Relative humidity:	40 %
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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:** The cable of the EUT was 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 in normal operation mode of the EUT (without reading a TAG). All results are shown in the following.
- Supply voltage:** The EUT was supplied with 12 V DC, because no difference was noticeable with supply voltages from 8 V DC to 16 V DC.
- 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 diagram refer to the standard measurement of the emitted interference in compliance with the above-mentioned standard. The measured points marked with x are the measured results of the standard final measurement on the open area test site.



Data record name: 70019ff

TEST REPORT REFERENCE: R70019_A Edition 1

The results of the standard final 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 quasipeak detector:

(These values are marked in the above diagram by x)

Spurious emissions outside restricted bands									
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
54.244	32.9	40.0	7.8	25.1	7.3	0.5	175.0	157.0	Vert.
189.854	33.7	43.5	9.8	23.9	9.0	0.8	100.0	0.0	Vert.
203.416	29.0	43.5	14.5	19.1	9.0	0.9	100.0	22.0	Vert.
216.978	41.5	46.0	4.5	31.2	9.4	0.9	144.0	247.0	Hor.
433.955	36.2	46.0	9.8	18.6	16.3	1.3	143.0	47.0	Vert.
447.517	35.1	46.0	10.9	17.3	16.5	1.3	199.0	151.0	Hor.
461.076	35.9	46.0	10.1	17.9	16.7	1.3	199.0	228.0	Hor.
474.637	30.4	46.0	15.6	12.3	16.8	1.3	174.0	212.0	Hor.
Spurious emissions in restricted bands									
Frequency MHz	Result dB μ V/m	Limit dB μ V/m	Margin dB	Readings dB μ V	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
108.489	33.0	43.5	10.5	20.8	11.6	0.6	105.0	337.0	Vert.
162.732	35.8	43.5	7.7	24.0	11.0	0.8	185.0	249.0	Hor.
244.098	40.5	46.0	5.5	28.0	11.5	1.0	125.0	246.0	Hor.
257.661	34.0	46.0	12.0	20.5	12.5	1.0	111.0	112.0	Hor.
271.223	34.2	46.0	11.8	20.9	12.3	1.0	122.0	112.0	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

TEST REPORT REFERENCE: R70019_A Edition 1

6.6 SPECTRUM MASK

Ambient temperature:	21 °C	Relative humidity:	35 %
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Supply voltage: The EUT was supplied with 12 V DC.

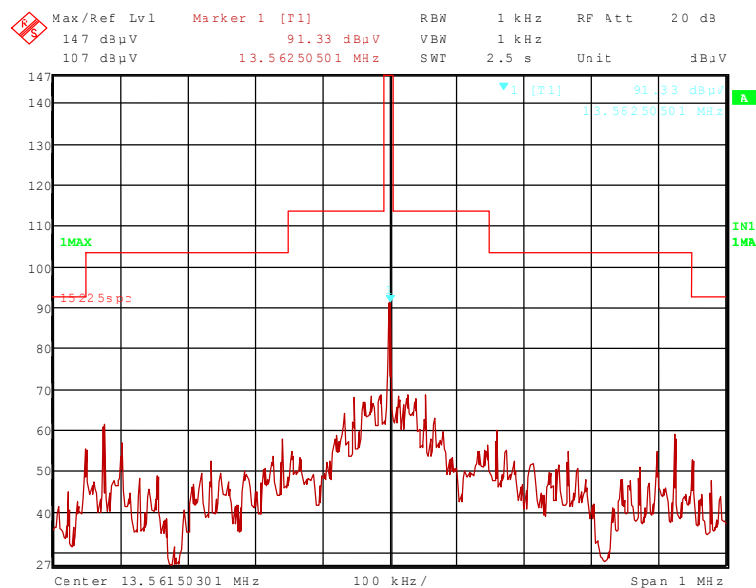
Test record: The test was carried out while the EUT was reading a TAG.

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 $\text{Limit}_{\text{OATS}} = 84.0 \text{ dB}\mu\text{V}/\text{m}$, $\text{Level}_{\text{OATS}} = 28.3 \text{ dB}\mu\text{V}/\text{m}$ and Marker value = $91.3 \text{ dB}\mu\text{V}$.

70019_7.wmf: Spectrum mask at 13.561 MHz:



Test result: Passed

TEST EQUIPMENT USED THE TEST:

22, 54, 58, 59

TEST REPORT REFERENCE: R70019_A Edition 1

6.7 OCCUPIED BANDWIDTH

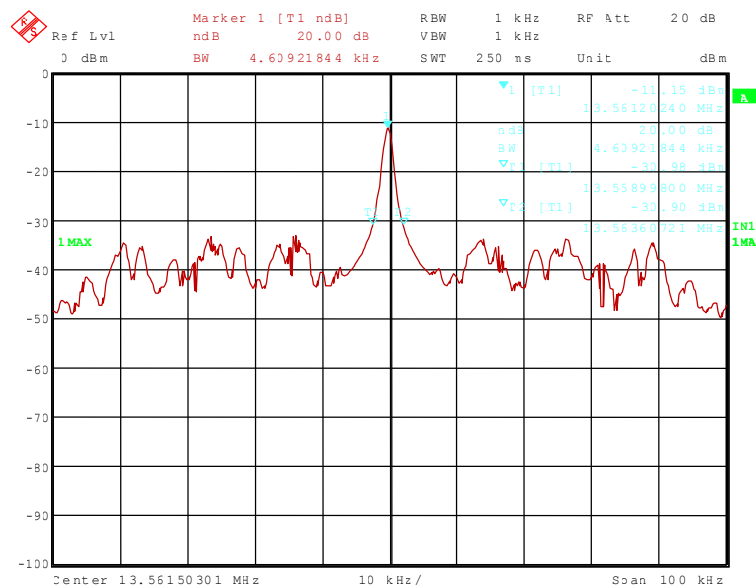
Ambient temperature: 21 °C

Relative humidity: 35 %

Supply voltage: The EUT was supplied with 12 V DC.

Test record: The test was carried out while the EUT was reading a TAG.

70019_6.wmf: Occupied bandwidth at 13.561 MHz:



F_L	F_U	BW ($F_U - F_L$)
13.558998 MHz	13.563607 MHz	4.609 kHz
Measurement uncertainty		$< \pm 1 \cdot 10^{-7}$

TEST EQUIPMENT USED THE TEST:

22, 54, 58, 59

TEST REPORT REFERENCE: R70019_A Edition 1

6.8 FREQUENCY TOLERANCE

Ambient temperature	21 °C	Relative humidity	35 %
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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	13.561014	±1.356 kHz	-22 Hz	Passed
	12 V DC	2	13.560987	±1.356 kHz	-49 Hz	Passed
	12 V DC	5	13.560980	±1.356 kHz	-56 Hz	Passed
	12 V DC	10	13.560980	±1.356 kHz	-56 Hz	Passed
40 °C	12 V DC	0	13.560994	±1.356 kHz	-42 Hz	Passed
	12 V DC	2	13.560994	±1.356 kHz	-42 Hz	Passed
	12 V DC	5	13.560985	±1.356 kHz	-51 Hz	Passed
	12 V DC	10	13.560984	±1.356 kHz	-52 Hz	Passed
30 °C	12 V DC	0	13.561007	±1.356 kHz	-29 Hz	Passed
	12 V DC	2	13.561011	±1.356 kHz	-25 Hz	Passed
	12 V DC	5	13.561008	±1.356 kHz	-28 Hz	Passed
	12 V DC	10	13.561007	±1.356 kHz	-29 Hz	Passed
20 °C	8 V DC (U _{min})	0	13.561044	±1.356 kHz	+8 Hz	Passed
	12 V DC (U _{nom})		13.561045	±1.356 kHz	+9 Hz	Passed
	16 V DC (U _{max})		13.561044	±1.356 kHz	+8 Hz	Passed
	8 V DC (U _{min})	2	13.561036	±1.356 kHz	0 Hz	Passed
	12 V DC (U _{nom})		13.561037	±1.356 kHz	+1 Hz	Passed
	16 V DC (U _{max})		13.561036	±1.356 kHz	0 Hz	Passed
	8 V DC (U _{min})	5	13.561031	±1.356 kHz	-5 Hz	Passed
	12 V DC (U _{nom})		13.561034	±1.356 kHz	-2 Hz	Passed
	16 V DC (U _{max})		13.561030	±1.356 kHz	-6 Hz	Passed
	8 V DC (U _{min})	10	13.561037	±1.356 kHz	+1 Hz	Passed
	12 V DC (U _{nom})		13.561036	-	-	Reference
	16 V DC (U _{max})		13.561035	±1.356 kHz	-1 Hz	Passed
10 °C	12 V DC	0	13.561055	±1.356 kHz	+19 Hz	Passed
	12 V DC	2	13.561065	±1.356 kHz	+29 Hz	Passed
	12 V DC	5	13.561062	±1.356 kHz	+26 Hz	Passed
	12 V DC	10	13.561061	±1.356 kHz	+25 Hz	Passed
0 °C	12 V DC	0	13.561075	±1.356 kHz	+39 Hz	Passed
	12 V DC	2	13.561075	±1.356 kHz	+39 Hz	Passed
	12 V DC	5	13.561074	±1.356 kHz	+38 Hz	Passed
	12 V DC	10	13.561071	±1.356 kHz	+35 Hz	Passed
-10 °C	12 V DC	0	13.561064	±1.356 kHz	+28 Hz	Passed
	12 V DC	2	13.561068	±1.356 kHz	+32 Hz	Passed
	12 V DC	5	13.561069	±1.356 kHz	+33 Hz	Passed
	12 V DC	10	13.561069	±1.356 kHz	+33 Hz	Passed
-20 °C	12 V DC	0	13.561024	±1.356 kHz	-12 Hz	Passed
	12 V DC	2	13.561034	±1.356 kHz	-2 Hz	Passed
	12 V DC	5	13.561037	±1.356 kHz	+1 Hz	Passed
	12 V DC	10	13.561036	±1.356 kHz	0 Hz	Passed
Measurement uncertainty				< ± 1*10 ⁻⁷		

Test result: Passed

TEST EQUIPMENT USED FOR THE TEST:

22, 54, 58, 59, 61

TEST REPORT REFERENCE: R70019_A Edition 1

7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

TEST REPORT REFERENCE: R70019_A Edition 1

Emission measurement at AC mains and DC in / out ports at M4					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
1	Shielded chamber M4	-	Siemens	B83117S1-X158	480088
2	Measuring receiver	ESAI	Rohde & Schwarz	831953/001 833181/018	480025 480026
3	LISN	NSLK8128	Schwarzbeck	8128155	480058
4	LISN	NSLK 8128-	Schwarzbeck	8128161	480138
5	AC-filter	B84299-D87-E3	Siemens	930262292	480097
6	EMI-Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M5					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
7	Fully anechoic chamber M5	-	Siemens	B83177-S1-X156	480073
8	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
9	Controller	HD100	Deisel	100/324	480067
10	Antenna support	MA240	Deisel	228/314	480069
11	Turntable	DS412	Deisel	412/317	480070
12	Antenna	CBL6112C	Chase	2689	480327
13	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M6					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
14	Open area test site	-	Phoenix Test-Lab	-	480085
15	Measuring receiver	ESVS30	Rohde & Schwarz	829673/012	480024
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
20	EMI Software	ES-K1	Rohde & Schwarz	-	480111

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Radiated emission measurement at M8					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
21	Fully anechoic chamber M8	-	Siemens	B83117-E7019-T231	480190
22	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
23	Measuring receiver	ESCS 30	Rohde & Schwarz	828985/014	480270
24	Controller	HD100	Deisel	100/427	480181
25	Turntable	DS420	Deisel	420/435/97	480186
26	Antenna support	AS615P	Deisel	615/310	480187
27	Antenna	CBL6112 A	Chase	2034	480185
28	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Radiated emission measurement at M20					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
29	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303
30	Measuring receiver	ESMI	Rohde & Schwarz	843977/001 843530/018	480179 480180
31	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355
32	Controller	HD100	Deisel	100/670	480326
33	Turntable	DS420HE	Deisel	420/620/80	480315
34	Antenna support	AS615P	Deisel	615/310	480187
35	Antenna	CBL6112 B	Chase	2688	480328
36	Antenna	3115 A	EMCO	9609-4918	480183
37	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	483	480294
38	Standard Gain Horn 11.9 GHz – 18 GHz	18240-20	Flann Microwave	482	480295
39	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	411	480297
40	Standard Gain Horn 17.9 GHz – 26.7 GHz	20240-20	Flann Microwave	410	480296
41	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	469	480299

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No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
42	Standard Gain Horn 26.4 GHz – 40.1 GHz	22240-20	Flann Microwave	468	480298
43	RF-cable No. 30	RTK 081	Rosenberger	-	410141
44	RF-cable No. 31	RTK 081	Rosenberger	-	410142
45	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480300
46	RF-cable 1m	KPS-1533- 400-KPS	Insulated Wire	-	480301
47	RF-cable 2m	KPS-1533- 400-KPS	Insulated Wire	-	480302
48	RF-cable No. 5	RTK 081	Rosenberger		410097
49	Preamplifier	JS3- 00101200- 23-5A	Miteq	681851	480337
50	Preamplifier	JS3- 12001800- 16-5A	Miteq	571667	480343
51	Preamplifier	JS3- 18002600- 20-5A	Miteq	658697	480342
52	Preamplifier	JS3- 26004000- 25-5A	Miteq	563593	480344
53	EMI Software	ES-K1	Rohde & Schwarz	-	480111

Ancillary equipment used for testing					
No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
54	Power supply	TOE 8852	Toellner	51712	480233
55	Outdoor test site	-	Phoenix Test-Lab	-	480293
56	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059
57	EMI test receiver	ESPC	Rohde & Schwarz	843756/006	480150
58	Loop Antenna $\varnothing = 225$ mm	-	Phoenix Test-Lab	-	410085
59	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102
60	AC power source / analyser	6813A	Hewlett Packard	3524A-00484	480155
61	Climatic chamber	MK 240	BINDER	05-79022	480462

All used measurement equipment was calibrated (if necessary). The calibration intervals and the calibration history will be given out on request.

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8 LIST OF ANNEXES

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