PHOENIX TESTLAB
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32825 Blomberg
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TEST REPORT

Test Report Reference: R60136_D Edition 1

Equipment under Test: SUNNYBEAMU

Serial Number: Q2 204

Applicant: SMA Technologie AG

Manufacturer: SMA Technologie AG

Test Laboratory
(CAB)
accredited by
DATech e.V.
in compliance with DIN EN ISO/IEC 17025
under the
Reg. No. DAT-P-105/99-21,
FCC Test site registration number 90877
and
Industry Canada Test site registration IC3469

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1 IDENTIFICATION

1.1 APPLICANT

Name:	SMA Technologie AG
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	34266 Niestetal
Country:	Germany
Name for contact purposes:	Mr. Gerald KÄMPF
Tel:	+ 49 561 95 22-205
Fax:	+ 49 561 95 22 280
e-mail address:	Gerald.Kaempf@SMA.de

1.2 MANUFACTURER

Name:	SMA Technologie AG
Address:	Hannoversche Straße 1-5
	34266 Niestetal
Country:	Germany
Name for contact purposes:	Mr. Gerald KÄMPF
Tel:	+ 49 561 95 22-205
Fax:	+ 49 561 95 22 280
e-mail address:	Gerald.Kaempf@SMA.de

1.3 DATES

Date of receipt of test sample:	06 January 2006
Start of test:	07 February 2006
End of test:	16 February 2006

1.4 TEST LABORATORY

The tests were carried out at: **PHOENIX TEST-LAB GmbH**
Königswinkel 10
D-32825 Blomberg **Phone: +49 (0) 52 35 / 95 00-0**
Germany **Fax: +49 (0) 52 35 / 95 00-10**

accredited by DATech e.V. in compliance with DIN EN ISO/IEC 17025 under Reg. No. DAT-P-105/99-21, FCC Test site registration number 90877 and Industry Canada Test site registration IC3469

Test engineer:	Thomas KÜHN		17 February 2006
	Name	Signature	Date
Test report checked:	Bernd STEINER		17 February 2006
	Name	Signature	Date

PHOENIX TESTLAB GmbH
Königswinkel 10
32825 Blomberg
Tel. 0 52 35 / 95 00-0
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Stamp

1.5 RESERVATION

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The test results herein refer only to the tested sample. PHOENIX TEST-LAB GmbH is not responsible for any generalisations or conclusions drawn from these test results concerning further samples. Any modification of the tested samples is prohibited and leads to the invalidity of this test report. Each page necessarily contains the PHOENIX TEST-LAB Logo and the TEST REPORT REFERENCE.

1.6 NORMATIVE REFERENCES

[1] **ANSI C63.4-2003** 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 (September 2005)** Radio Frequency Devices

1.7 TEST RESULTS

The requirements of this test document are fulfilled by the equipment under test. The complete test results are presented in the following.

2 TECHNICAL DATA OF EQUIPMENT

2.1 DEVICE UNDER TEST

Type of equipment: *	Short range device transceiver					
Type designation: *	SUNNYBEAMU					
Serial number: *	Q2 204					
Antenna type: *	LINX-TECHNOLOGIES ANT-916-PML					
Antenna gain: *	Not available					
Antenna connector: *	Fixed antenna					
Power supply: *	3.0 V (2x 1.5V Alkaline ACCUCELL AC1800) or via USB					
Supply Voltage:	U_{nom}=	3.0 V DC *	U_{min}=	2.5 V DC *	U_{max}=	3.3 V DC *
Type of modulation: *	FSK					
Operating frequency range:*	917.78 MHz					
Number of channels: *	None channelised equipment					
Highest/lowest internal Frequency: *	917.78 MHz / 32 kHz					
Temperature range: *	0 °C to 55 °C					

The following external I/O cables were used:

Cable	Length	Shielding	Connector
USB cable	2 m	Yes	USB

*: Length during the test if no other specified.

2.2 PERIPHERY DEVICES

- Laptop computer Siemens Fujitsu type LifeBook S Series

3 OPERATIONAL STATES AND PHYSICAL BOUNDARIES

The EUT is a transceiver, which is intended to use for transmission of data from solar converters.
The tests were carried out with an unmodified sample running with a test-software, which allows a communication between the SUNNYBEAMU and the SBAEMPB with the maximum duty cycle. For this maximum duty cycle the time between two transmissions was set to the minimum value of 7 seconds. The duration of each transmission is 46 ms.

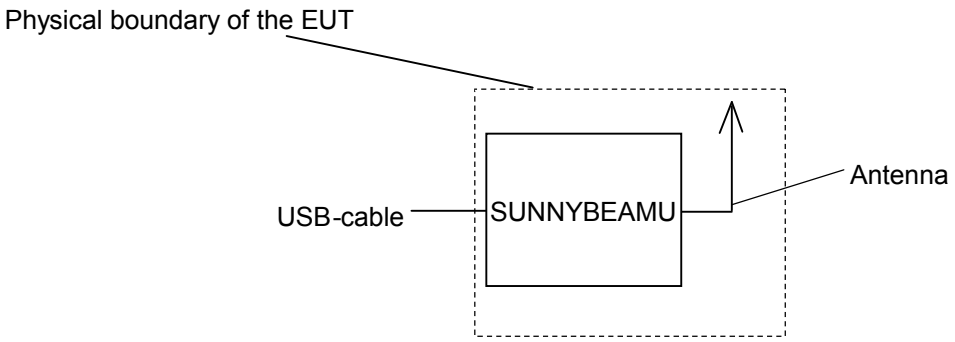
During the tests the test sample was powered by the internal batteries with 3.0 V DC.

Because the EUT is equipped with a USB interface, all tests were carried out with an USB-cable at the USB-port of the EUT, which was terminated and connected to ground. In face of the fact, that the computer, which is connected to the USB-Interface, can power the EUT also, the conducted emissions on the AC supply line were carried out by using a Laptop computer Siemens Fujitsu type LifeBook S Series.

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

The following operation modes were used during the tests:

Operation mode	Description of the operation mode
1	Continuous transmitting on 917.782 MHz with power register setting 0xF0
2	Continuous receiving on 917.782 MHz



4 REQUIREMENT OVERVIEW

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 0.5 to 5 MHz 5 to 30 MHz	66 to 56 dBµV (QP) * 56 to 46 dBµV (AV) * 56 dBµV (QP) 46 dBµV (AV) 60 dBµV (QP) 50 dBµV (AV)	ANSI C63.4 (2003)	-	Passed
*: 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 0.490 to 1.705 MHz 1.705 to 30.0 MHz 30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz	2400/f(kHz) at 300 m 24000/f(kHz) at 30 m 30.0 dBµV/m at 30 m 40.0 dBµV/m at 3 m 43.5 dBµV/m at 3 m 46.0 dBµV/m at 3 m 54.0 dBµV/m at 3 m	ANSI C63.4 (2003);	-	Passed
Radiated emissions FCC 47 CFR Part 15 section 15.109 [2]					
Application	Frequency range	Limits (microvolts/meter)	Reference standard	Remark	Status
Unintentional radiator	30 to 88 MHz 88 to 216 MHz 216 to 960 MHz 960 to 1000 MHz	40.0 dBµV/m at 3 m 43.5 dBµV/m at 3 m 46.0 dBµV/m at 3 m 54.0 dBµV/m at 3 m	ANSI C63.4 (2003);	-	Passed
Radiated emissions FCC 47 CFR Part 15 section 15.249 [2]					
	Frequency range	Limits (microvolts/meter)	Reference standard	Remark	Status
Operation with in the band 902- 928 MHz	902 – 928 MHz	50,000 (fundamental) 500 (harmonics)	ANSI C63.4 (2003);	-	Passed
Antenna requirement FCC 47 CFR Part 15 section 15.203 [2]					
					Status
The antenna is fixed (soldered to the PCB and glued to the housing).					Passed

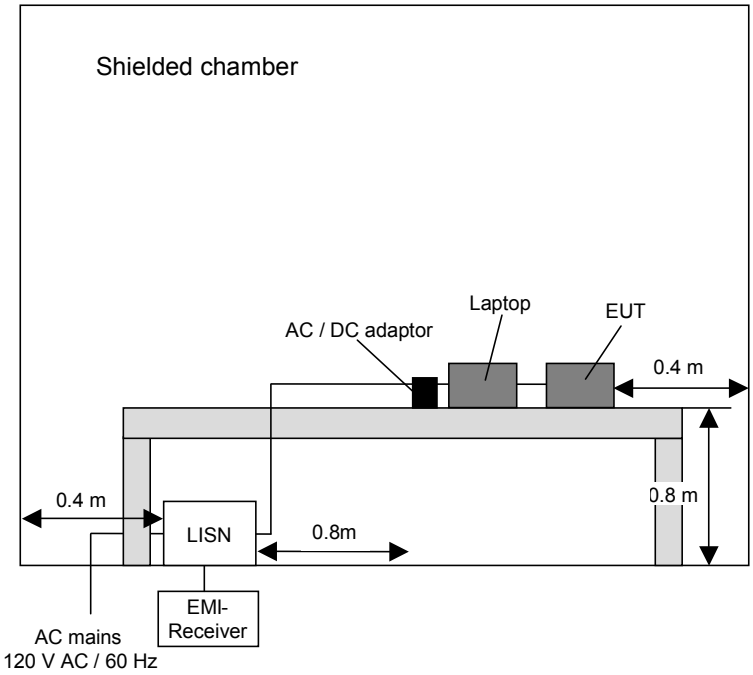
5 METHOD OF MEASUREMENT

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 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



5.2 RADIATED EMISSIONS 9 kHz to 30 MHz

The radiated emission measurement is divided into two stages.

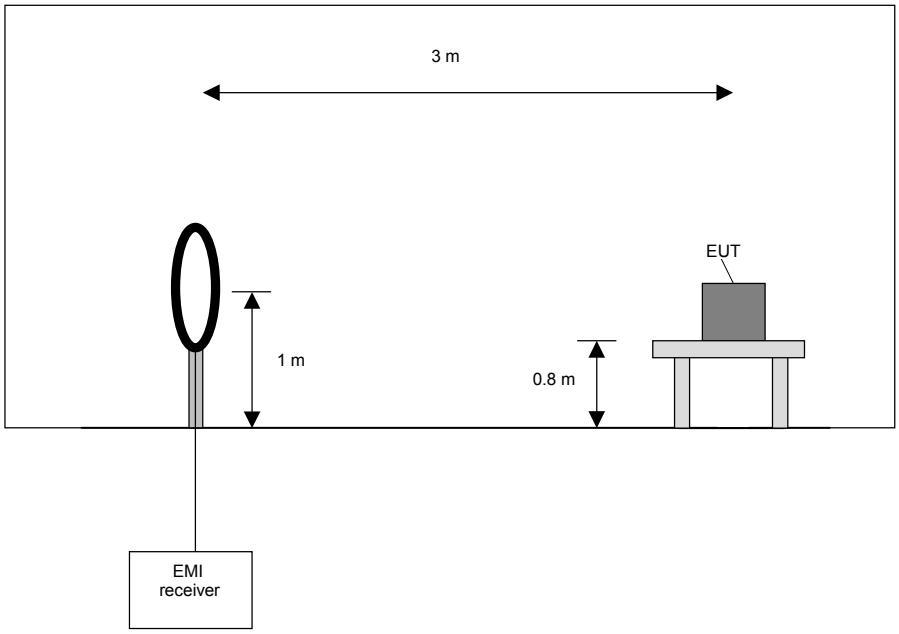
Preliminary measurement:

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



Preliminary measurement procedure:

Prescans were performed in the frequency ranges 9 kHz to 150 kHz, 150 kHz to 1 MHz and 1 MHz 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).

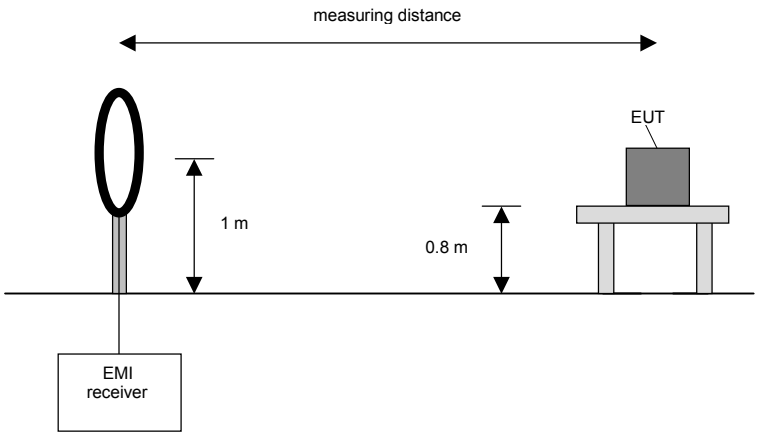
Final measurement:

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.

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 if applicable (handheld equipment).

5.3 RADIATED EMISSIONS 30 MHz to 1 GHz

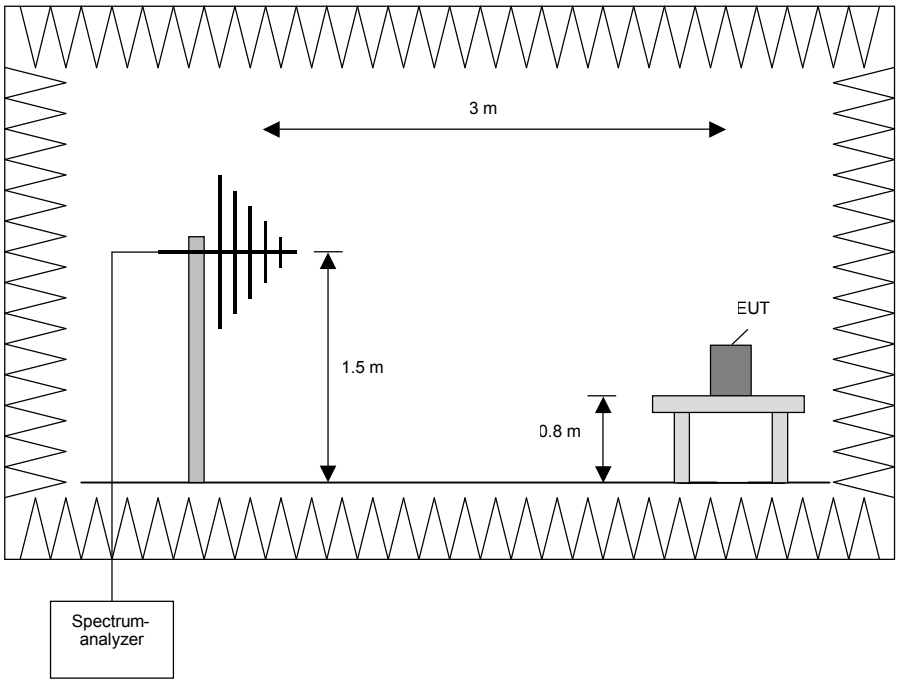
The radiated emission measurement is divided into two stages.

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



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:

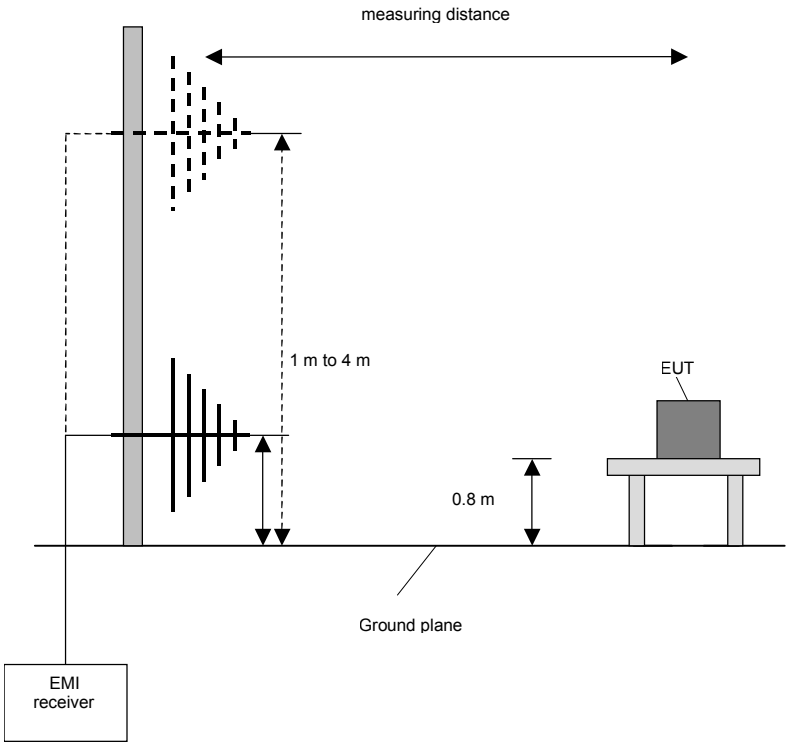
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of 3 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



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 RADIATED EMISSIONS 1 GHz to 10 GHz

This 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].

Preliminary measurement (1 GHz to 10 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 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 °. If the EUT is larger than the antenna beamwidth, the antenna will be moved to various positions, to cover the whole surface of the EUT. It might be possible to shorter the measuring distance to higher the measurement sensitivity.

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

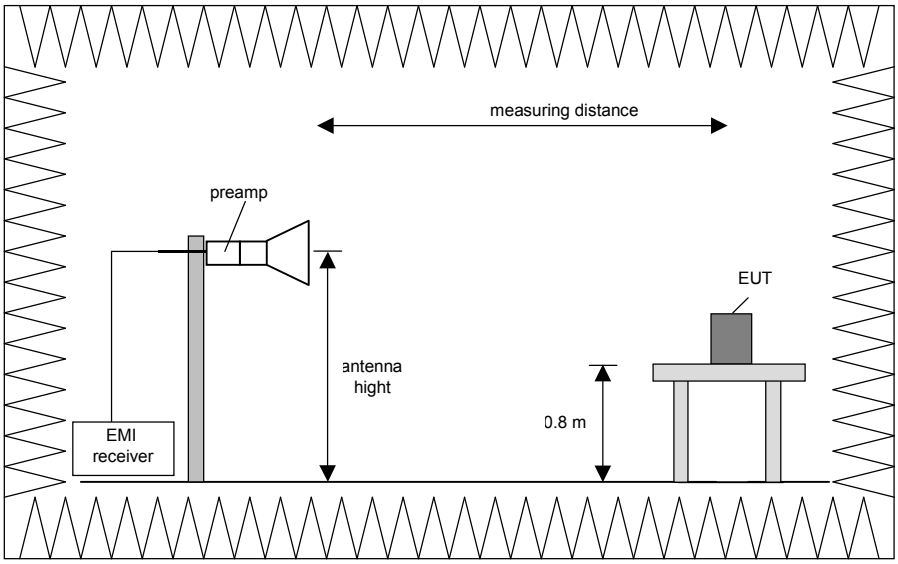
Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 10 GHz	100 kHz

Final measurement (1 GHz to 10 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 MAX Hold 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 °. If the EUT is larger than the antenna beamwidth, the antenna will be moved to various positions, to cover the whole surface of the EUT. It might be possible to shorter the measuring distance to higher the measurement sensitivity.

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 10 GHz	1 MHz



Procedure of measurement:

Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz and 4 GHz to 10 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) Change the antenna polarisation.
4) Rotate the EUT by 360 ° to maximize the detected signals.
5) Make a hardcopy of the spectrum.
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) 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) with the other orthogonal axes of the EUT if handheld equipment.
9) Repeat steps 1) to 8) for the next antenna spot if the EUT is lager than the antenna beamwidth.

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

6 TEST RESULTS

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

Ambient temperature:	19 °C	Relative humidity:	47 %

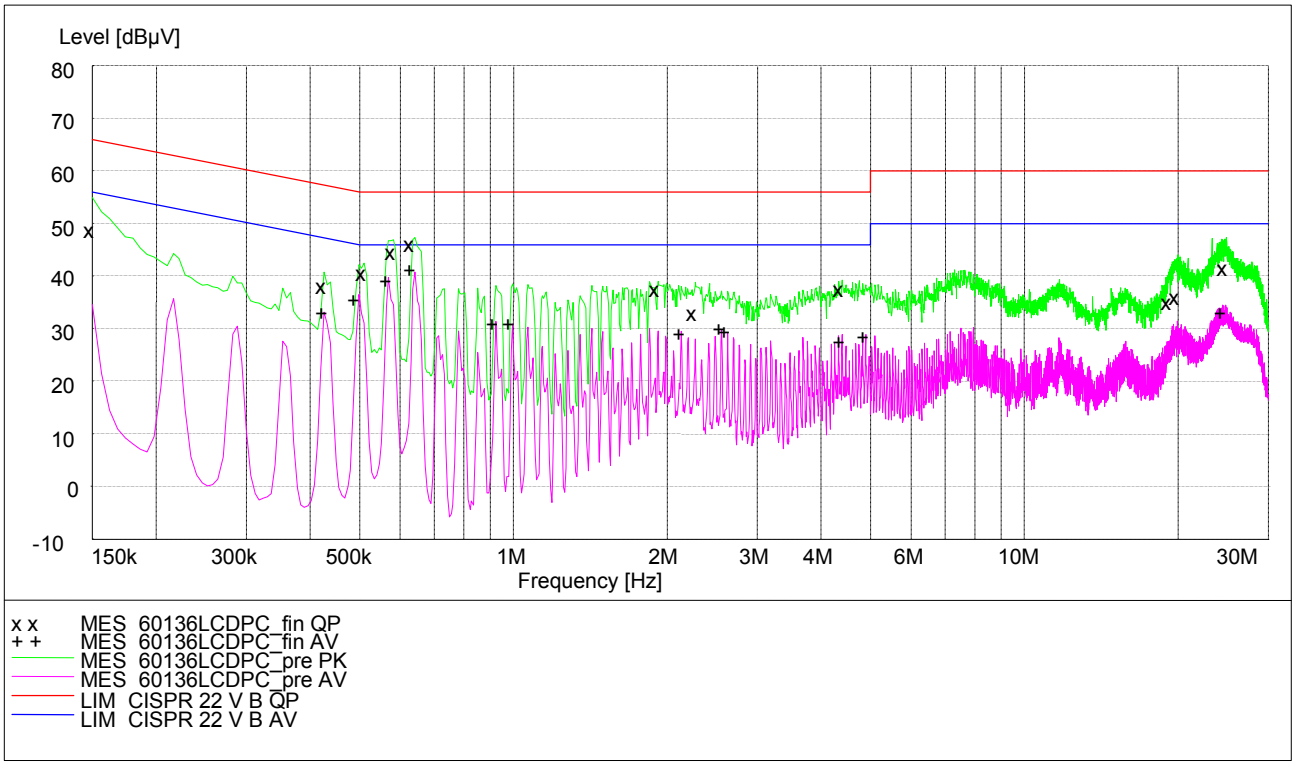
Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

Cable guide: The cable of the EUT was 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: Where not otherwise stated the test was carried out in test mode 1 of the EUT. All results are shown in the following.

Power supply: During all measurements the EUT was supplied with 3.0 V from the internal batteries and buffered by the PC via the USB interface.

Title: AC Powerline Conducted Emission Test with protective ground conductor simulating network
EUT: SUNNYBEAMU
Manufacturer: SMA Technologie AG
Operating Condition: Connected to Siemens Laptop LifeBook S Series via USB
Test site: PHOENIX TEST-LAB Blomberg M4
Operator: Th. KÜHN
Test Specification:



Data record name: 60136LCDPC

Result measured with the quasi-peak detector:

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.150180	49.1	2.1	66.0	16.8	N	FLO
0.425940	38.5	0.9	57.3	18.8	N	FLO
0.510540	41.3	0.8	56.0	14.7	N	FLO
0.581190	45.2	0.8	56.0	10.8	N	FLO
0.639870	46.8	0.8	56.0	9.2	N	FLO
1.919760	38.0	0.7	56.0	18.0	L1	FLO
2.278410	33.5	0.7	56.0	22.5	L1	GND
4.400070	38.0	0.7	56.0	18.0	N	FLO
19.286430	35.5	2.4	60.0	24.5	N	FLO
19.963860	36.5	2.4	60.0	23.5	L1	FLO
24.836370	42.1	2.8	60.0	17.9	L1	FLO

Data record name: 60136LCDPC_fin QP

Result measured with the average detector:

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

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.427290	33.7	0.9	47.3	13.6	N	GND
0.497400	36.4	0.8	46.0	9.6	N	FLO
0.568140	39.8	0.8	46.0	6.2	L1	FLO
0.639600	41.5	0.8	46.0	4.5	N	FLO
0.923190	31.5	0.7	46.0	14.5	N	FLO
0.994380	31.4	0.7	46.0	14.7	N	FLO
2.130000	29.3	0.8	46.0	16.7	L1	FLO
2.555610	30.5	0.7	46.0	15.5	L1	FLO
2.626350	29.9	0.7	46.0	16.1	L1	FLO
4.400610	28.0	0.7	46.0	18.0	N	FLO
4.897140	28.9	0.9	46.0	17.1	N	GND
24.411660	33.5	2.8	50.0	16.5	L1	FLO

Data record name: 60136LCDPC_fin AV

Test: Passed

TEST EQUIPMENT USED:

1 - 3, 5, 6

6.2 RADIATED EMISSIONS (TRANSMITTER)

6.2.1 PRELIMINARY MEASUREMENT (9 kHz to 10 GHz)

Ambient temperature	21 °C	Relative humidity	32 %

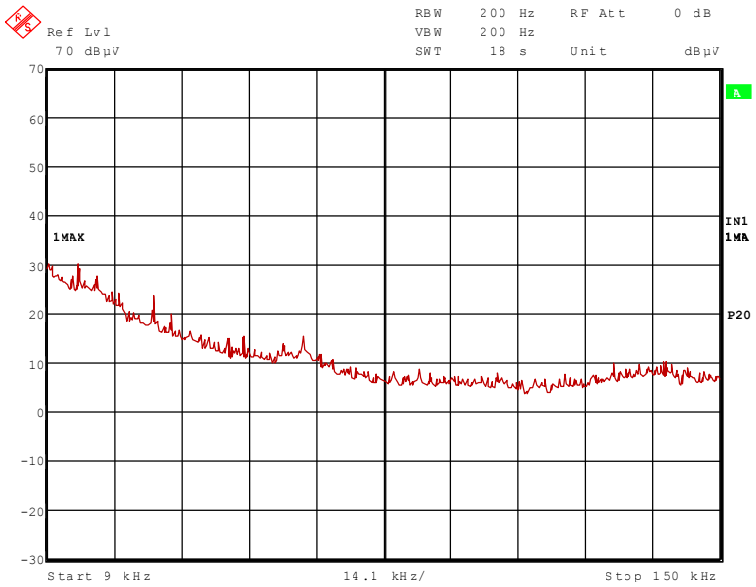
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

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.

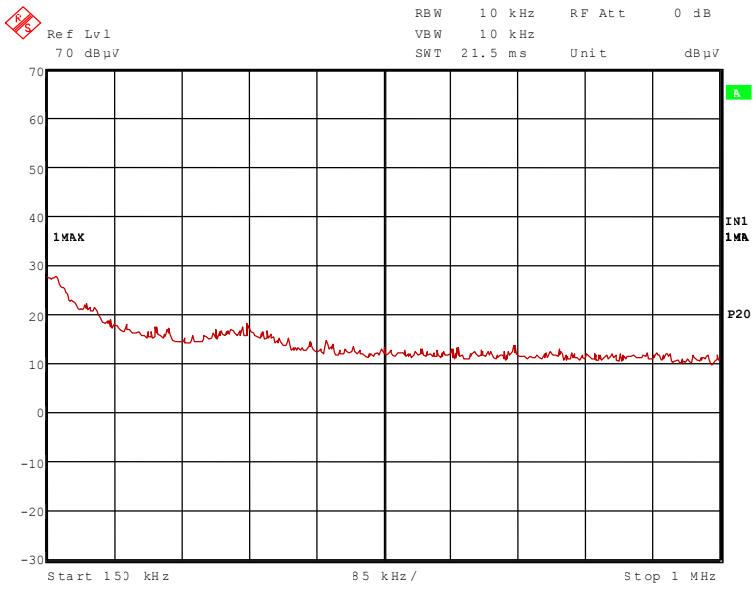
Test record: Where not otherwise stated the test was carried out in test mode 1 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

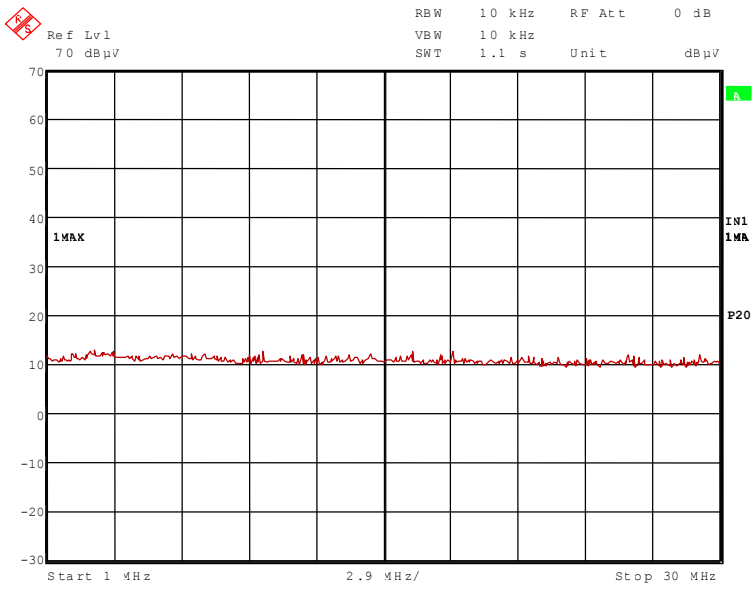
60136_48.wmf: Spurious emissions from 9 kHz to 150 kHz:



60136_49.wmf: Spurious emissions from 150 kHz to 1 MHz:



60136_50.wmf: Spurious emissions from 1 MHz to 30 MHz:

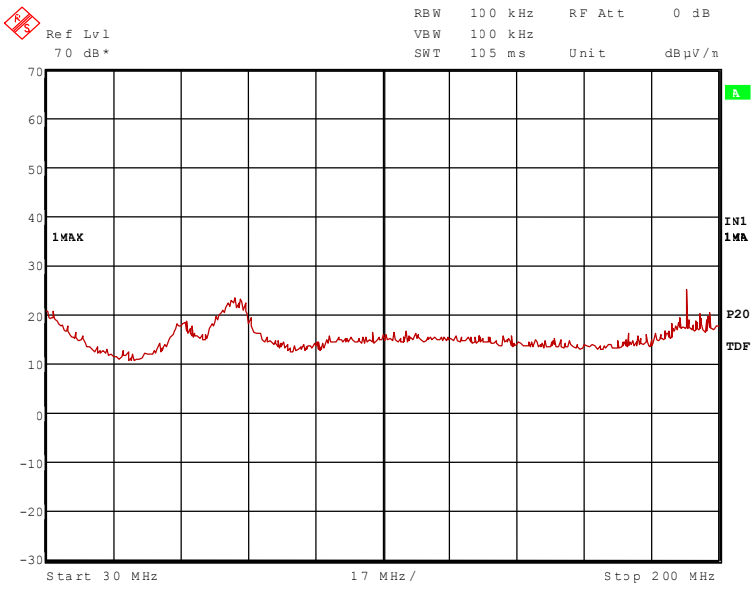


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

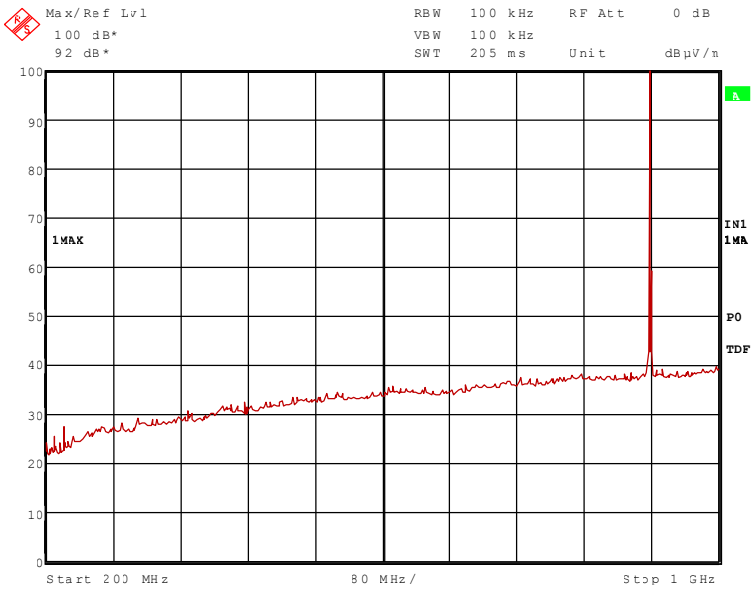
TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 36, 43, 44, 49, 55 – 57

60136_22.wmf: Spurious emissions from 30 MHz to 200 MHz:



60136_23.wmf: Spurious emissions from 200 MHz to 1 GHz:

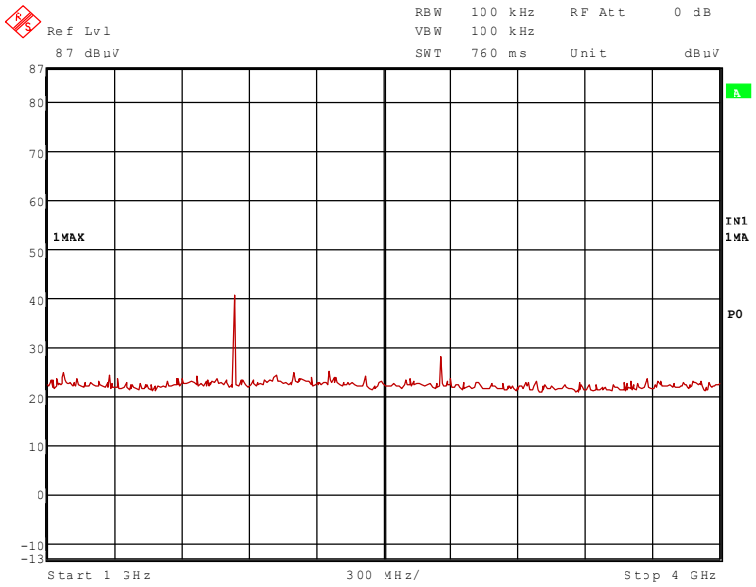


The following emissions were found according to FCC 47 CFR Part 15 section 15.209.

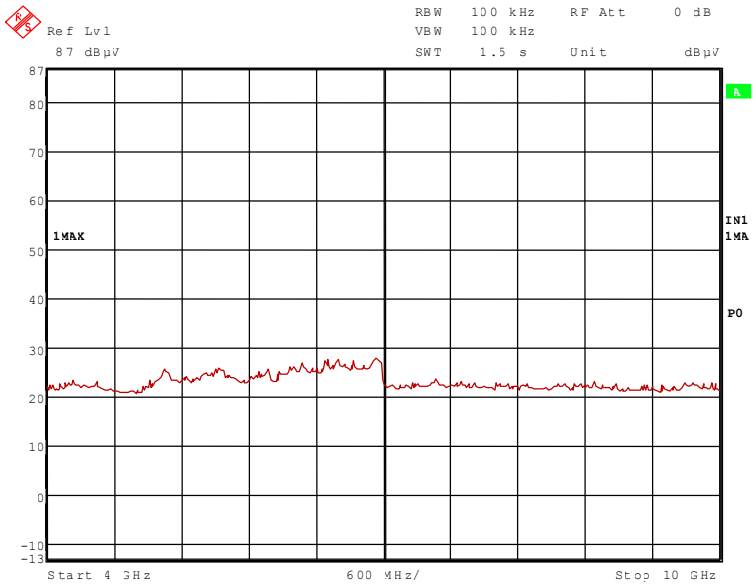
66.764 MHz, 77.079 MHz, 191.698 MHz, 221.191 MHz and 917.841 MHz.

These frequencies have to be measured on the outdoor test site. The result of this final measurement is shown in subclause 6.2.2 of this test report.

60136_20.wmf: Spurious emissions from 1 GHz to 4 GHz:



60136_21.wmf: Spurious emissions from 4 GHz to 10 GHz:



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

The following frequency was found outside the restricted bands during the preliminary radiated emission test:

- 1.8357 GHz.

These frequencies have to be measured in a final measurement. The result of this final measurement is shown in subclause 6.2.2 of this test report.

6.2.2 FINAL MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature:	20 °C	Relative humidity:	35 %

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.

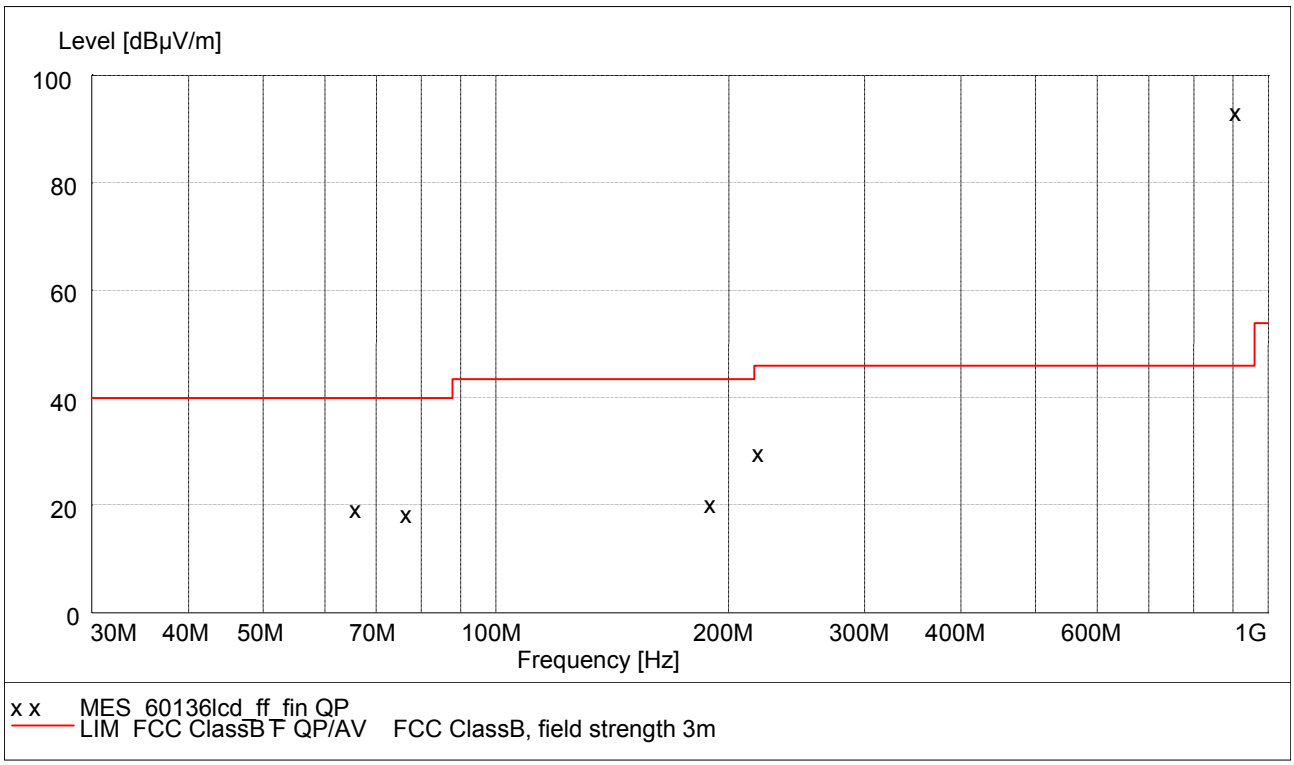
Test record: Where not otherwise stated the test was carried out in test mode 1 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

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

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + 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: 60136lcd_ff

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 10 seconds.

Spurious emissions outside restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
66.764	19.7	40.0	20.3	13.0	6.2	0.5	148.0	355.0	Vert.
77.079	18.9	40.0	21.1	10.8	7.6	0.5	135.0	287.0	Vert.
191.699	20.8	43.5	22.7	10.9	9.0	0.9	128.0	105.0	Hor.
221.187	30.2	46.0	15.8	20.4	8.9	0.9	141.0	247.0	Hor.
917.783	93.9	94.0	0.1	68.9	23.0	2.0	106.0	287.0	Vert.
Spurious emissions in restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

6.2.3 FINAL MEASUREMENT (1 GHz to 10 GHz)

Ambient temperature	21 °C	Relative humidity	38 %

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: Where not otherwise stated the test was carried out in test mode 1 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

Resolution bandwidth: For all measurements a resolution bandwidth of 1 MHz was used.

Result measured with the peak detector:

Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.8357	48.3	74.0	25.7	43.4	28.4	26.5	3.0	150	Vert.	No

Result measured with the average detector:

Frequency GHz	Corr. value dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor 1/m	Preamp dB	Cable loss dB	Height cm	Pol.	Restr. Band
1.8357	24.8	54.0	29.2	19.9	28.4	26.5	3.0	150	Vert.	No

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 30 – 34, 36, 44, 49, 54 - 56

6.3 RADIATED EMISSIONS (RECEIVER)

6.3.1 PRELIMINARY MEASUREMENT (9 kHz to 10 GHz)

Ambient temperature	21 °C	Relative humidity	38 %

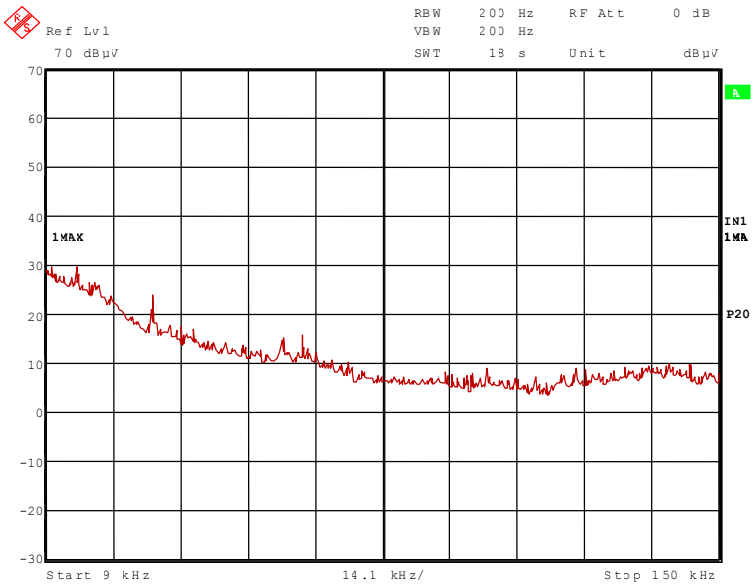
Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m.

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.

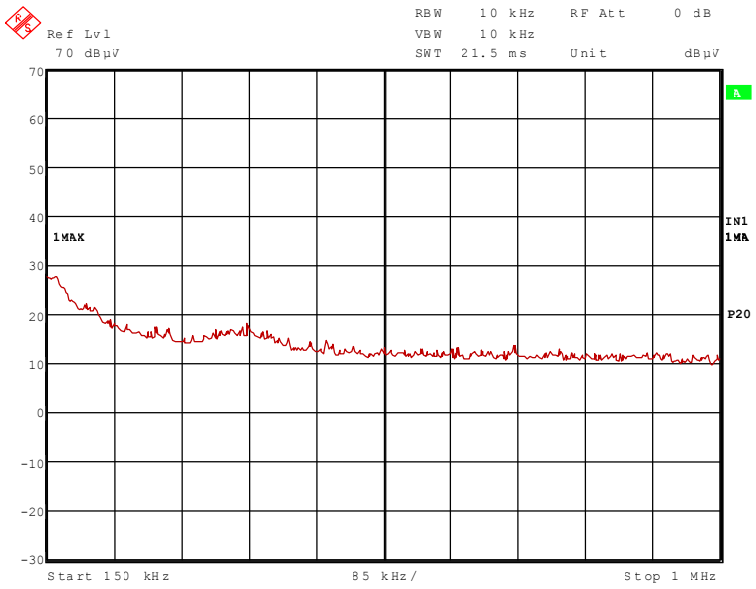
Test record: Where not otherwise stated the test was carried out in test mode 2 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

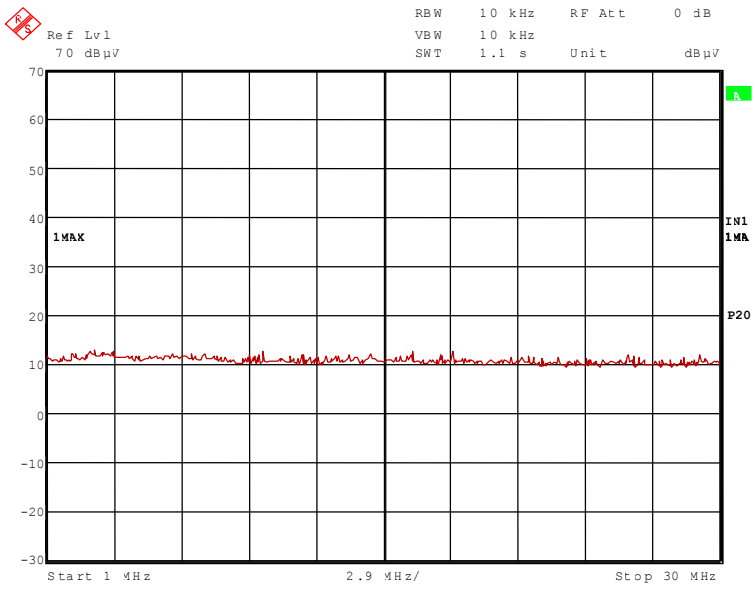
60136_51.wmf: Spurious radiation from 9 kHz to 150 kHz:



60136_52.wmf: Spurious radiation from 150 kHz to 1 MHz:

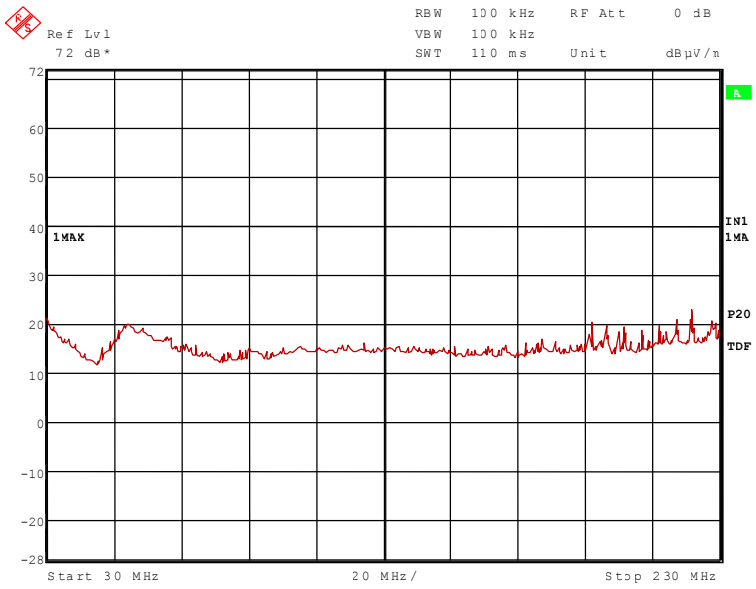


60136_53.wmf: Spurious radiation from 1 MHz to 30 MHz:

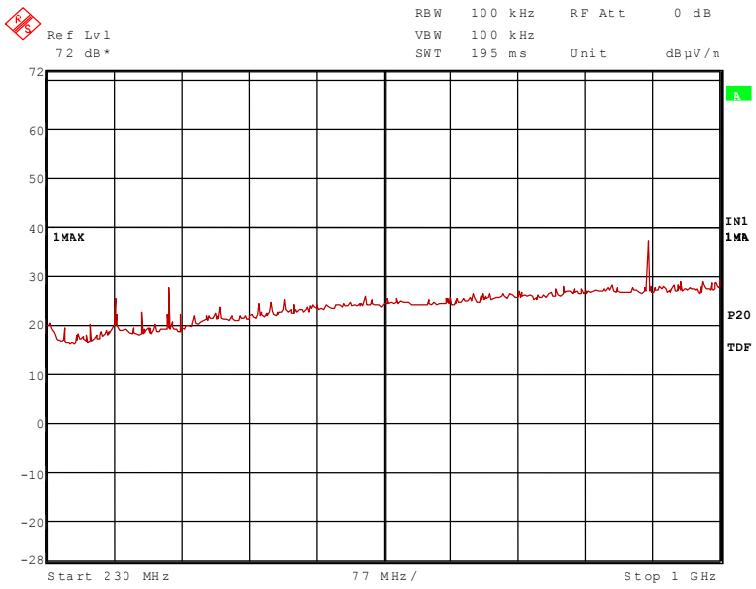


No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no measurements were carried out on the outdoor test site.

60136_54.wmf: Spurious radiation from 30 MHz to 230 MHz:



60136_55.wmf: Spurious radiation from 230 MHz to 1 GHz:

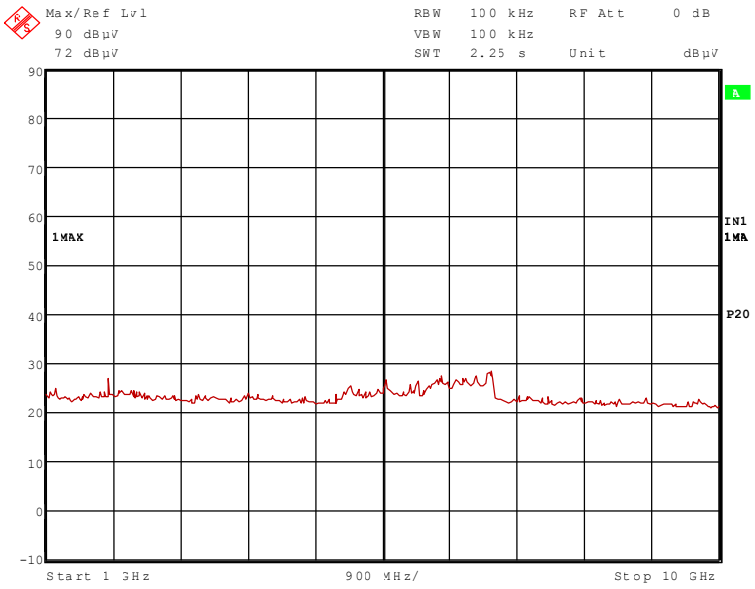


The following emissions were found according to FCC 47 CFR Part 15 section 15.109.

191.694 MHz, 221.191 MHz, 309.667 MHz, 368.653 MHz and 917.945 MHz

These frequencies have to be measured on the outdoor test site. The result of this final measurement is shown in subclause 6.3.2 of this test report.

60136_56.wmf: Spurious radiation from 1 GHz to 10 GHz:



No significant frequencies above the noise floor of the system were found during the preliminary radiated emission test, so no final measurements were carried out.

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

29, 31 – 36, 43, 44, 49, 57

6.3.2 FINAL MEASUREMENT (30 MHz to 1 GHz)

Ambient temperature	20 °C	Relative humidity	38 %

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.

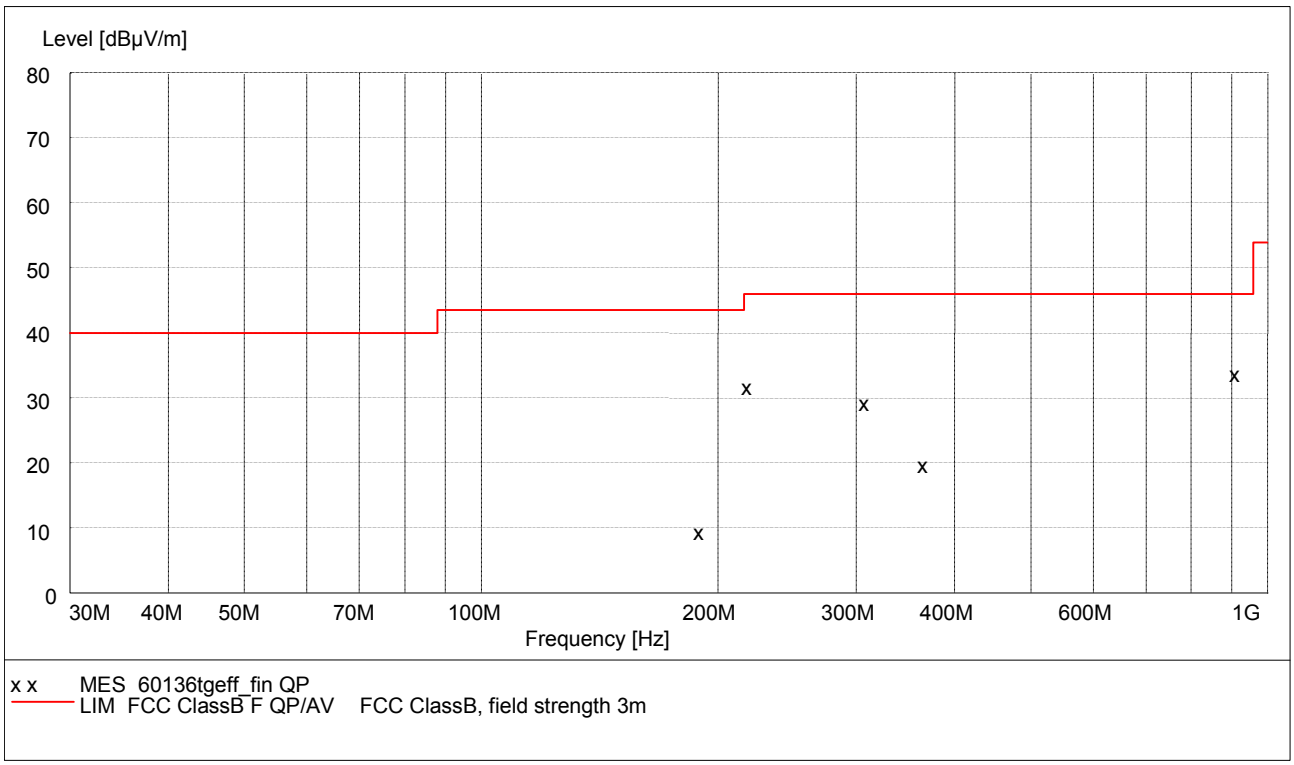
Test record: Where not otherwise stated the test was carried out in test mode 2 of the EUT. All results are shown in the following.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

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

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + 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: 60136tgeff

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.

Spurious emissions outside restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
191.694	9.7	43.5	33.8	-0.2	9.0	0.9	331.0	294.00	Vert.
221.191	32.1	46.0	13.9	22.3	8.9	0.9	277.0	67.00	Hor.
309.667	29.5	46.0	16.5	15.5	12.9	1.1	100.0	104.00	Hor.
368.653	20.0	46.0	26.0	4.2	14.6	1.2	240.0	203.00	Vert.
917.945	34.0	46.0	12.0	9.0	23.0	2.0	100.0	46.00	Vert.
Spurious emissions in restricted bands									
Frequency MHz	Result dBµV/m	Limit dBµV/m	Margin dB	Readings dBµV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-

The test results were calculated with the following formula:

Result [dBµV/m] = reading [dBµV] + cable loss [dB] + antenna factor [dB/m]

Test: Passed

TEST EQUIPMENT USED FOR THE TEST:

14 – 20

6.4 OCCUPIED BANDWIDTH

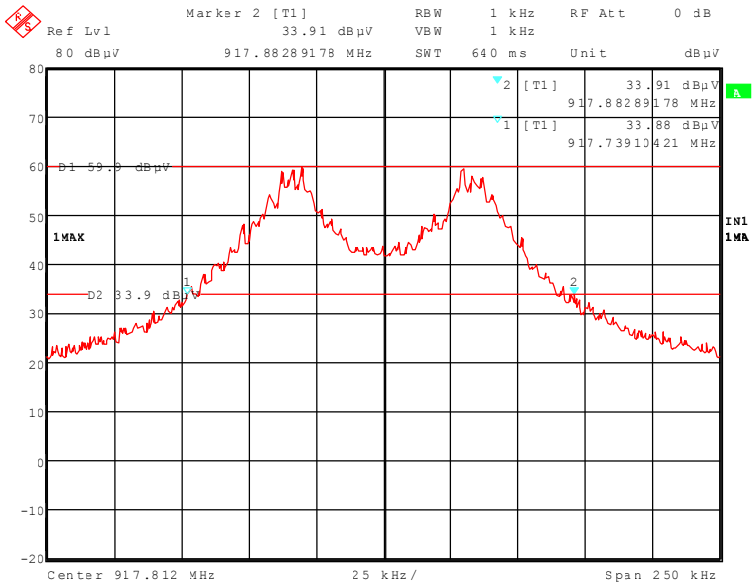
Ambient temperature:	21 °C	Relative humidity:	38 %

Test set-up: For this test a test fixture was used, to couple the transmitter output signal to the spectrum analyser.

Supply voltage: During all measurements the EUT was supplied with 3.0 V from the internal batteries.

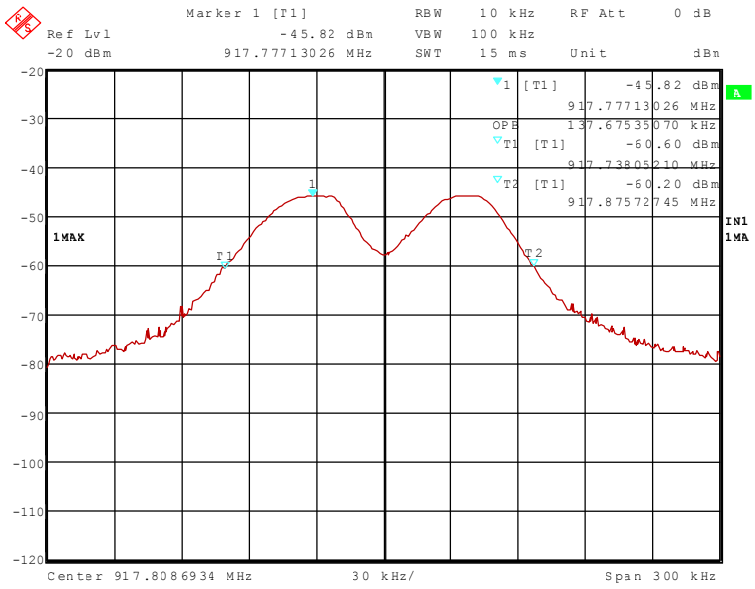
Test record: Where not otherwise stated the test was carried out in test mode 1 of the EUT. All results are shown in the following.

60136_57.wmf: Occupied bandwidth (26 dB) of the SUNNYBEAMU:



F_L	F_U	BW (F_U - F_L)
917.739104 MHz	917.882892 MHz	143.788 kHz

60136_a.wmf: 99% bandwidth of the SUNNYBEAMU:



F_L	F_U	BW (F_U - F_L)
917.738052 MHz	917.875727 MHz	137.675 kHz

TEST EQUIPMENT USED THE TEST:

29, 30, 34, 35, 43

7 TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

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	DC-filter	B84266-A21-E13	Siemens	940164525	480099
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

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 11.9GHz – 18GHZ	18240-20	Flann Microwave	483	480294
38	Standard Gain Horn 11.9GHz – 18GHZ	18240-20	Flann Microwave	482	480295
39	Standard Gain Horn 17.9GHz – 26.7GHZ	20240-20	Flann Microwave	411	480297
40	Standard Gain Horn 17.9GHz – 26.7GHZ	20240-20	Flann Microwave	410	480296
41	Standard Gain Horn 26.4GHz – 40.1GHZ	22240-20	Flann Microwave	469	480299

No.	Test equipment	Type	Manufacturer	Serial No.	PM-No
42	Standard Gain Horn 26.4GHz – 40.1GHZ	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	High Pass Filter	HP4000	Dirk Fischer Elektronik	-	480445
56	High Pass Filter	WHJS1000C 11/60EF	Wainwright Instruments GmbH	1	480413
57	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059
-	-	-	-	-	-

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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ANNEX B	**INTERNAL PHOTOGRAPHS OF THE TEST SAMPLE**:	**3 pages**
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