

Test Report

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RF test report

110143-AU01+E02



ARYGON Technologies AG

UHF-Desktop Reader

AUDR-USB



The test result refers exclusively
to the model tested.

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Revision: 1.0



DGA-PL-224/95-03 / BNetzA-CAB-02/21-02/2

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Accreditation:



Registration number: DGA-PL-224/95-03
CAB (EMC) registration number: BNetzA-CAB-02/21-02/3
FCC facility registration number: 221458
MRA US-EU, FCC designation number: DE0010

Test Laboratory:

EMV **TESTHAUS** GmbH
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Germany

The technical accuracy is guaranteed through the quality management of the
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1 Test regulations

CFR 47 Part 2: October 1, 2010	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
CFR 47 Part 15: October 1, 2010	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.4: December 2003	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

1.1 Summary of test results

Standard	Test result
FCC CFR 47 Part 15	Passed



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2 Equipment under Test (EUT)

Product type: UHF-Desktop Reader
Model Name: AUDR-USB
Manufacturer: ARYGON Technologies AG
Serial number: Sample 1
FCC ID: XLWAUDR
Application freq. band: 902 MHz - 928 MHz
Frequency range: 902.75 MHz – 927.25 MHz
Operating frequency: 902.75 MHz – 927.25 MHz
Number of RF-channels: 50
Modulation: FHSS
Antenna type: PCB antenna
 detachable not detachable
Power supply: Host powered
nominal: 5.0 VDC
Temperature range: -20°C to +55°C



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2.2 Photo documentation

Annex A Photos taken during testing

Annex B photos of the EUT

Annex C internal photos of the EUT

2.3 Short description of the EUT

The EUT is a RFID reader for the frequency range 902 MHz - 928 MHz using frequency hopping modulation.

2.4 Operation mode

The EUT was tested in the following operation modes and test settings:
A test software from the manufacturer was used that allowed the configuration of various parameters necessary to perform the tests.

Name:	AS399x Reader Suite
Version:	1.4.1
Manufacturer:	austriamicrosystems AG



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2.5 Configuration

The following peripheral devices and interface cables were connected during the tests:

Device	Model:	S/N
UHF-Desktop Reader	AUDR-USB	Sample 1
19" LCD monitor	Belinea 1019	N/A
Test Notebook	Pro 600 IW	N/A
AC power supply	SADP-65KB AD	N/A
Test PC-System 1	Fujitsu Siemens Esprimo P9900	YL6K001108
USB Mouse	Microsoft	N/A
PS/2 Keyboard	Maxdata	N/A

Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
1	RF connection cable, shielded, 50 cm	N/A
2	AC cable, unshielded, 1.5m	N/A
1	Measuring cables, unshielded, 1.5 m	N/A
1	DVI cable, shielded, 1.5 m	N/A



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2.6 20 dB Bandwith

according to CFR 47 Part 15, section 15.247(a)(1)(i)

2.7 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

2.8 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

2.9 Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

The maximum permissible 20dB bandwidth for this device is 500 kHz

2.10 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with DA 00-705.



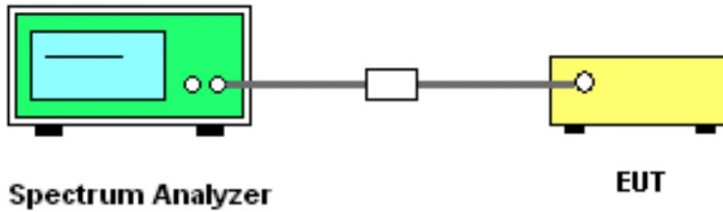
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2.11 Test setup



Picture 1: Test setup for 20 dB bandwidth measurement

2.12 Test deviation

There is no deviation with the original standard.

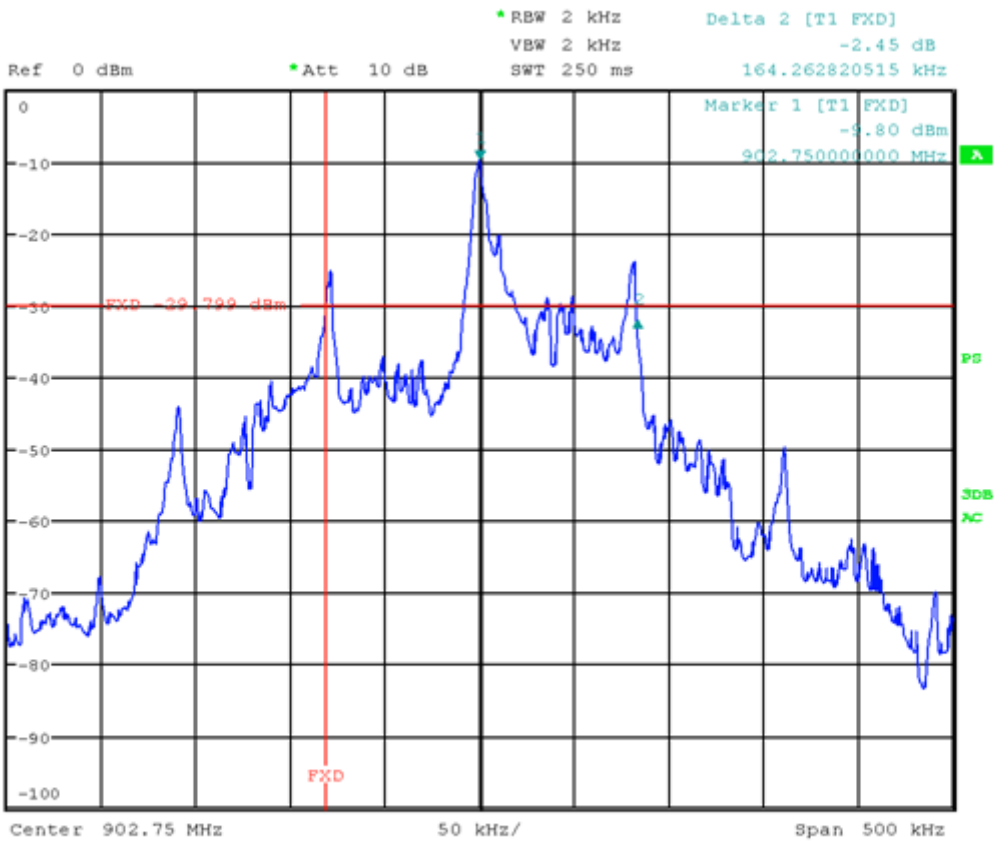
2.13 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.14 Test results

Temperature:	23°C	Humidity:	41%
Tested by:	M. Janker	Test date:	2011-09-13

Frequency (GHz)	Bandwidth (kHz)	Result
902.75	164.263	PASS
915.25	164.263	PASS
927.25	163.462	PASS



Picture 2: 20 dB bandwidth plot at 902.75 MHz



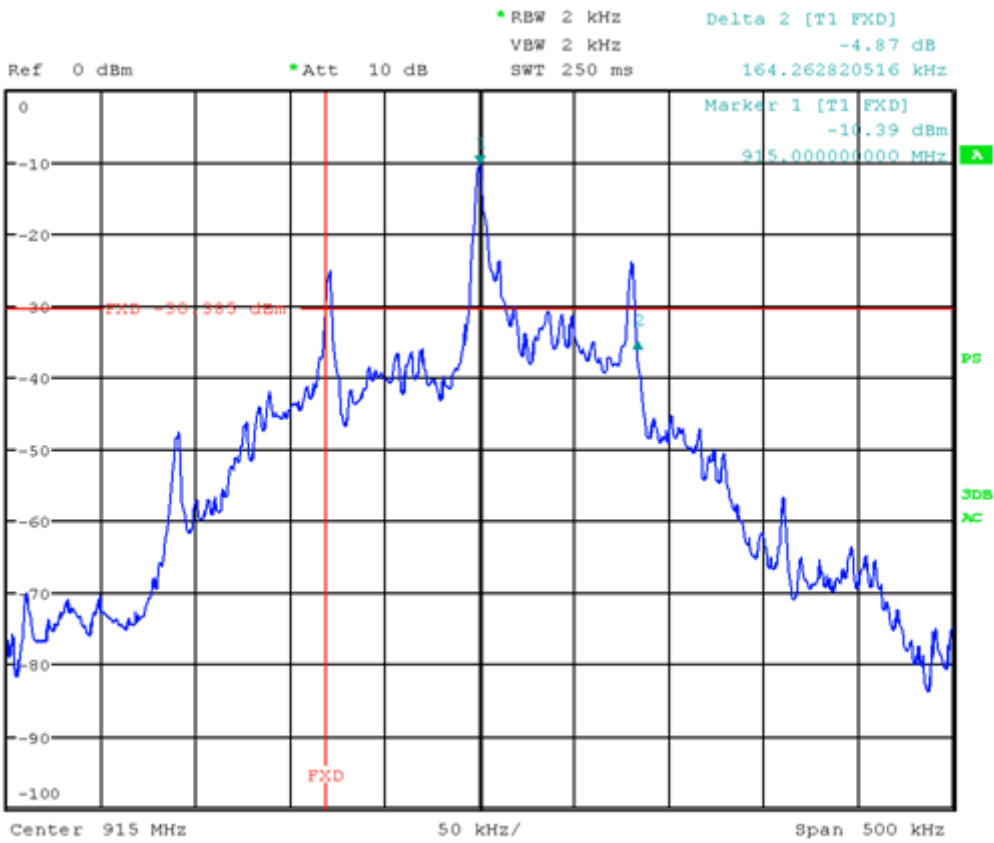
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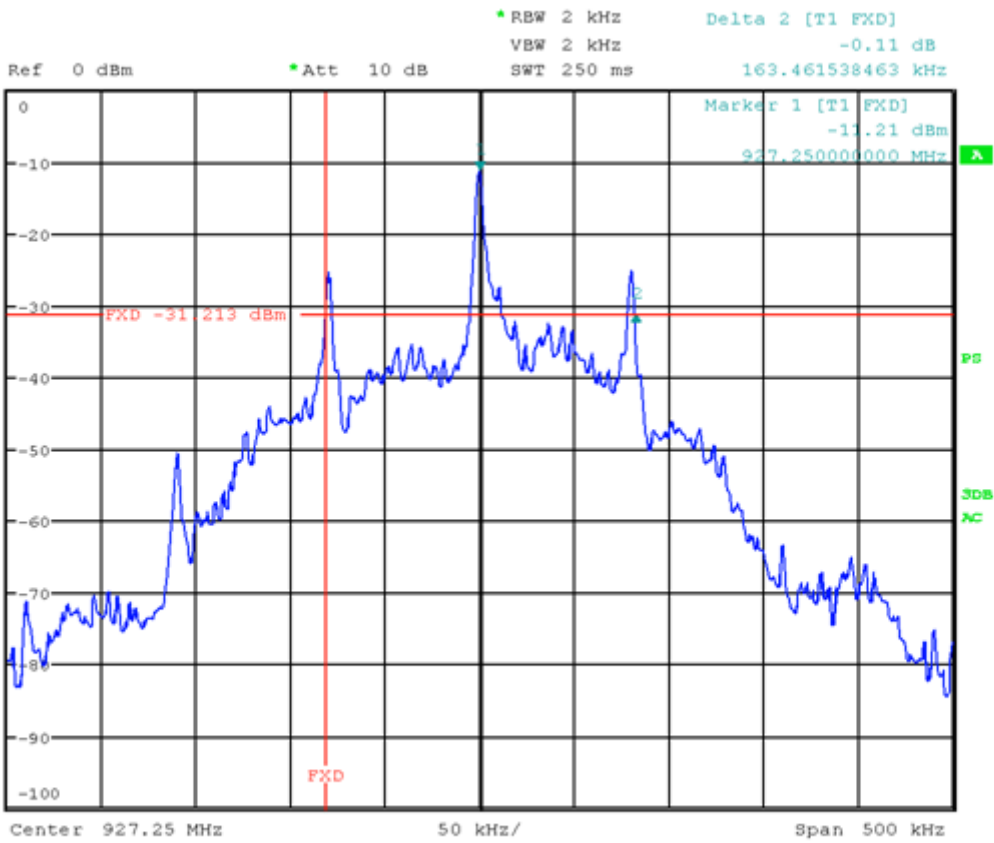
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Picture 3: 20 dB bandwidth plot at 915.25 MHz



Picture 4: 20 dB bandwidth plot at 927.25 MHz



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3 Peak transmitter output power

according to CFR 47 Part 15, section 15.247(b)(2)

3.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

3.2 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

3.3 Limits

For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

The maximum permissible output power for this device employing 50 channels is 1 Watt.

3.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with DA 00-705.



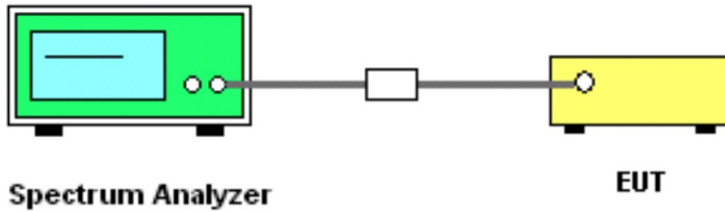
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3.5 Test setup



Picture 5: Test setup for output power measurement

3.6 Test deviation

There is no deviation with the original standard.

3.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode. Measurement was made while the EUT was operating in non-hopping transmission mode.

3.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Janker	Test date:	2011-07-16

Frequency (GHz)	Reading (dBm)	Detector	Limit (dBm)	Result
902.75	-7.16	Peak	30	PASS
915.25	-8.86	Peak	30	PASS
927.25	-10.41	Peak	30	PASS

4 Carrier frequency separation

according to CFR 47 Part 15, section 15.247(a)(1)

4.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

4.2 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

4.3 Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

The minimum permissible channel separation for this system is the 20 dB bandwidth, which is equal to 164 kHz.



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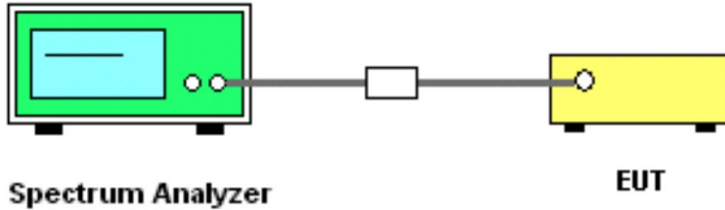
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4.4 Test procedure

3. The transmitter output (antenna port) was connected to the spectrum analyzer.
4. Test was performed in accordance with DA 00-705.

4.5 Test setup



Picture 6: Test setup for channel separation measurement

4.6 Test deviation

There is no deviation with the original standard.

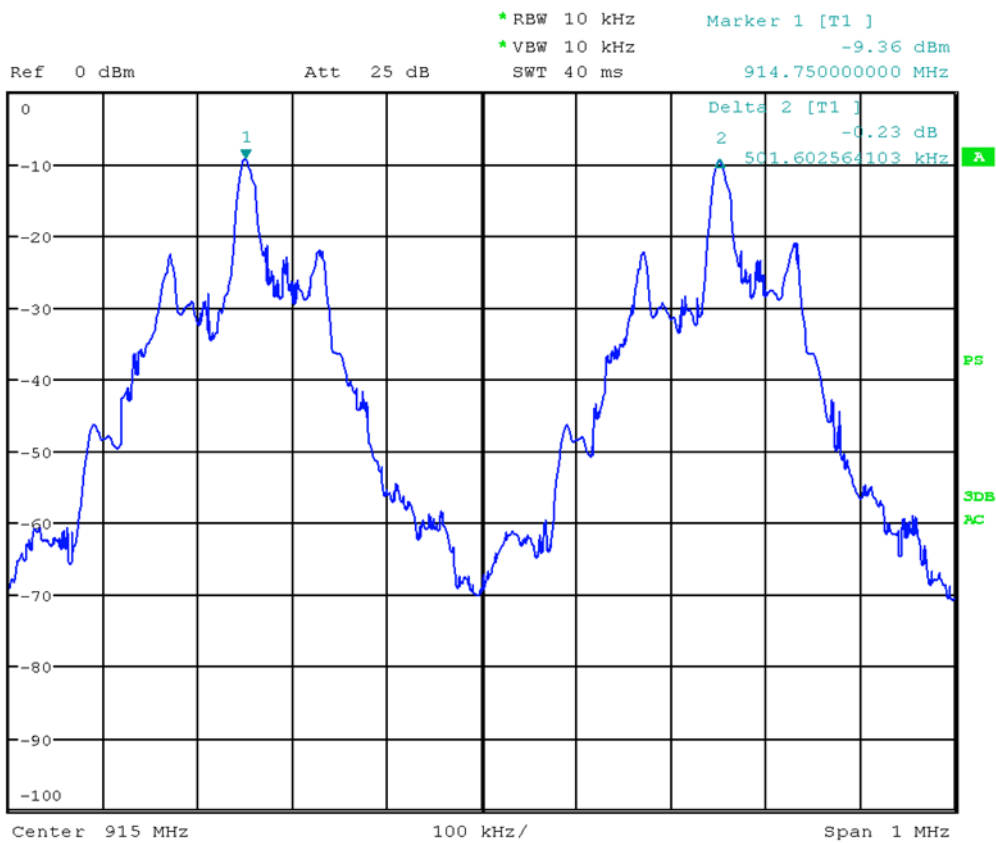
4.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode. Measurement was made with EUT operating in hopping mode.

4.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Janker	Test date:	2011-07-16

The test result is: **PASS**



Picture 7: Channel spacing plot



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5 Number of channels

according to CFR 47 Part 15, section 15.247(a)(1)(i)

5.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

5.2 Test instruments

	Description	Manufacturer	Inventory No.
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<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

5.3 Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

This frequency hopping system must employ a minimum of 50 hopping channels.

5.4 Test procedure

5. The transmitter output (antenna port) was connected to the spectrum analyzer.
6. Test was performed in accordance with DA 00-705.



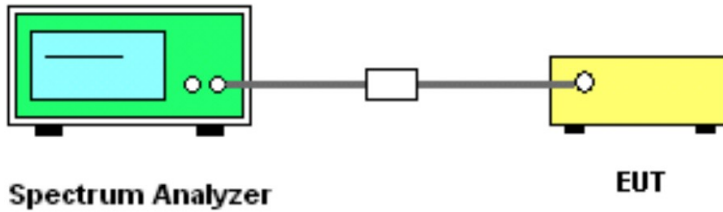
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5.5 Test setup



Picture 8: Test setup for channel measurement

5.6 Test deviation

There is no deviation with the original standard.

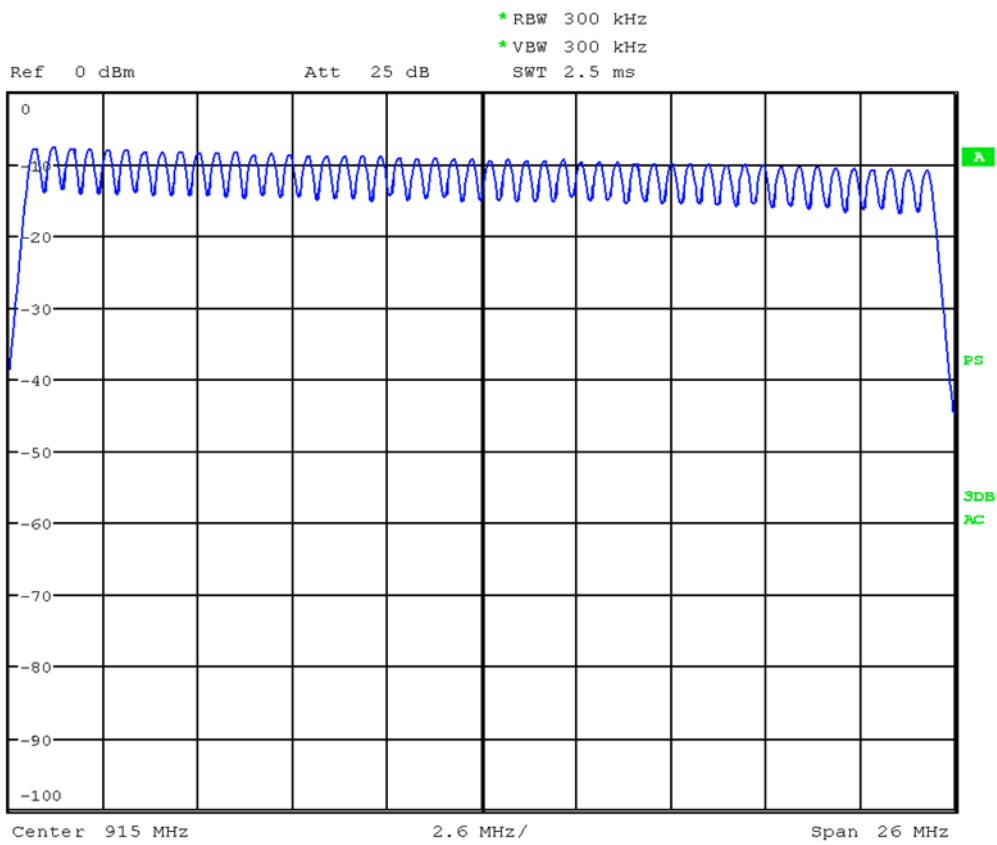
5.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode. Measurement was made with EUT operating in hopping mode.

5.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Janker	Test date:	2011-07-16

The test result is: **PASS**



Picture 9: Channel hopping plot



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6 Time of occupancy

according to CFR 47 Part 15, section 15.247(a)(1)(i)

6.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

6.2 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

6.3 Limits

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

This frequency hopping system must employ a maximum permissible time of occupancy of 400 ms within a 20 second period.

6.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. The spectrum analyzer was set to Zero Span mode.
3. Test was performed in accordance with DA 00-705.



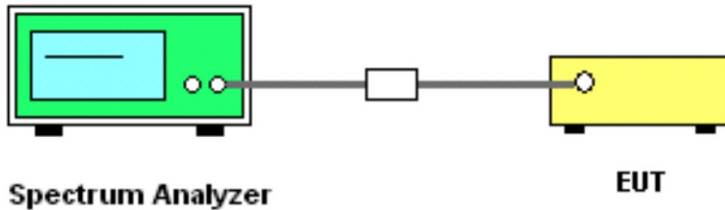
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6.5 Test setup



Picture 10: Test setup for channel measurement

6.6 Test deviation

There is no deviation with the original standard.

6.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode. Measurement was made with EUT operating in hopping mode.

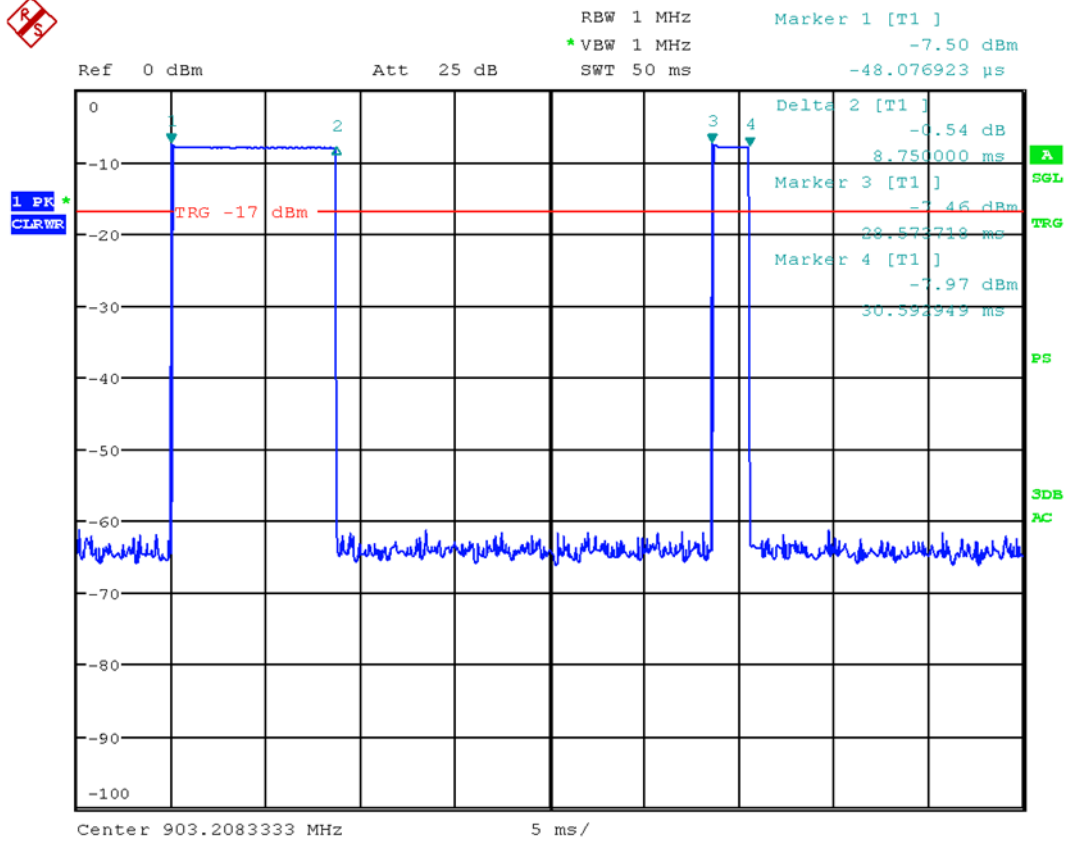
6.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Janker	Test date:	2011-07-16

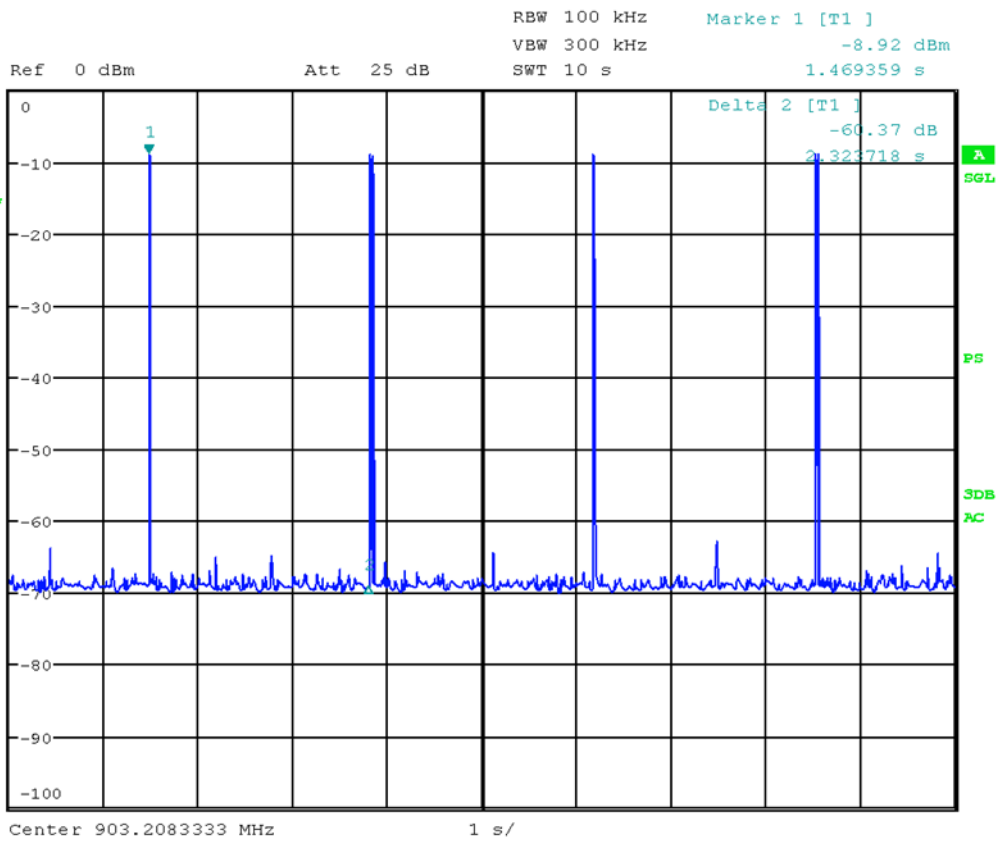
Time of Occupancy Calculation

- Number of channels used = 50 (See Picture 9)
- Pulse Width = 8.75 ms + 2.02 ms = 10.77ms (See Picture 11)
- Number of times that one particular channel appears in a 20 second period = 8 (See Picture 12)
- Time of Occupancy = 10.77 ms/pulse x 8 pulses/20 sec = 86.16 ms/20 sec

The test result is: **PASS**



Picture 11: Pulse width plot



Picture 12: Time of occupancy plot

Note:

- In Picture 12, a particular channel transmits and does not transmit again until the transmitter has cycled through the other 49 channels in a pseudorandom manner. Thus, it is shown that all channels are used equally on average.
- One particular channel can only appear a maximum of 8 times in a 20 second period given the nature of the transmission bursts.

7 Pseudorandom hopping sequence

according to CFR 47 Part 15, section 15.247(a)(1)(i)

7.1 Requirements

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies.

7.2 Description

The manufacturer declares in the systems manual that this function is controlled via software. The system stores a list of frequencies internally. The entries in the list are pseudo randomly ordered, see the table below for an example of such a pseudo randomly ordered frequency list. The frequencies in the list are sequentially selected as transmission channels. At the end of the List, the first channel in the List is selected again. If needed, the List can also be re ordered with commands.

No.	Frequency (MHz)
1	913.750
2	917.750
3	927.250
4	914.750
5	920.250
6	923.750
7	902.750
8	920.750
9	910.250
10	907.250
...	...

The test result is: **PASS**

8 Equal hopping frequency use

according to CFR 47 Part 15, section 15.247(a)(1)(i)

8.1 Requirements

Each frequency must be used equally on the average by each transmitter.

8.2 Description

The manufacturer declares in the systems manual that this function is controlled via software. The hopping algorithm is performed every time a new interrogation is started. Therefore every new interrogation will be done on a different channel.



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The entries in the frequency list mentioned in 7 are used sequentially for hopping. If the end of the list is reached the frequency hopping algorithm will continue by using the first entry in the frequency list. This method guarantees an equal usage of channels.

Exception: Tag replies: In case Tags have a tendency to reply in certain channels, the usage might be unsymmetrical.

Channel usage: The manufacturer built in an optional Listen before talk (LBT) feature that can be enabled. Upon enabling LBT and if no channel is used by other devices the sequential stepping through the frequency list ensures that every channel is used equally.

The test result is: **PASS**

9 Receiver input bandwidth

according to CFR 47 Part 15, section 15.247(a)(1)(i)

9.1 Requirements

The system receivers shall have input bandwidth that matches the hopping channel bandwidth of the transmitted signal.

9.2 Description

The manufacturer declares in the systems manual that the receiver bandwidth is equal to the transmitter bandwidth.

The bandwidth requirements of the receiver system are being derived from the Gen 2 Standard which describes several link frequencies. The reader can work with link frequencies from 40 kHz up to 640 kHz. The Bandwidth can be set accordingly to those Link frequencies. In FCC mode, we use 250 kHz as a Link frequency. 250 kHz is the frequency that is well within the bandwidth of FCC.

The test result is: **PASS**

10 Receiver hopping capability

according to CFR 47 Part 15, section 15.247(a)(1)(i)

10.1 Requirements

The system receivers shall shift frequencies in synchronization with the transmitted signal.

10.2 Description

The manufacturer declares in the systems manual that the receiver shifts frequencies in synchronization to the transmitted signal.

In RFID Backscatter modulation is being used. This method inherently guarantees that the receiving frequency is symmetrical around the carrier.

The test result is: **PASS**



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110143-AU01+E02

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11 Band edge compliance

according to CFR 47 Part 15, section 15.247(d)

11.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	CDC	Albatross Projects	E00026
<input type="checkbox"/>	Open area test site	EMV TESTHAUS GmbH	E00354

11.2 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

11.3 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

This frequency hopping system must employ a maximum permissible emission level of 20 dBc.



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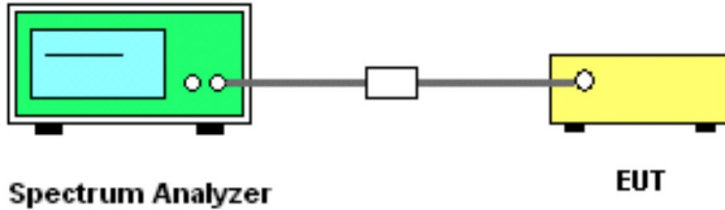
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11.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with DA 00-705.

11.5 Test setup



Picture 13: Test setup for band edge measurement

11.6 Test deviation

There is no deviation with the original standard.

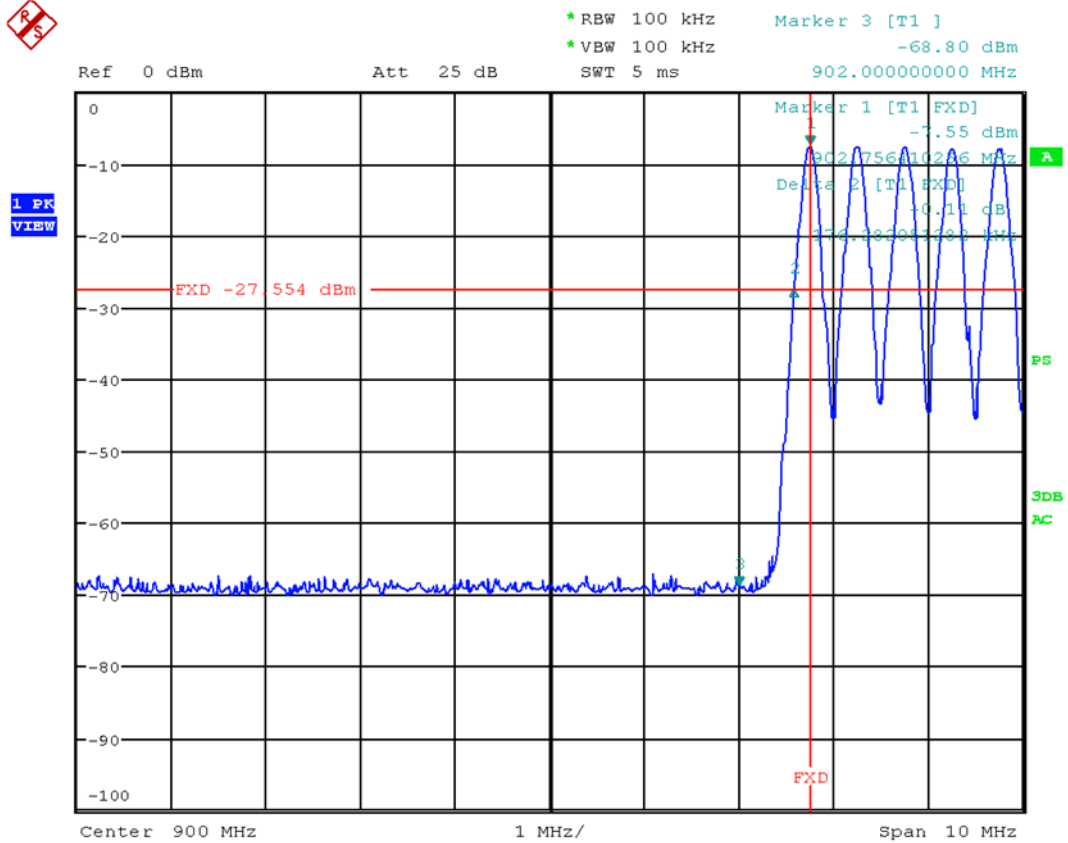
11.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode. Measurement was made with EUT operating in hopping mode.

11.8 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	M. Janker	Test date:	2011-07-16

The test result is: **PASS**



Picture 14: Band edge plot 902.75 MHz

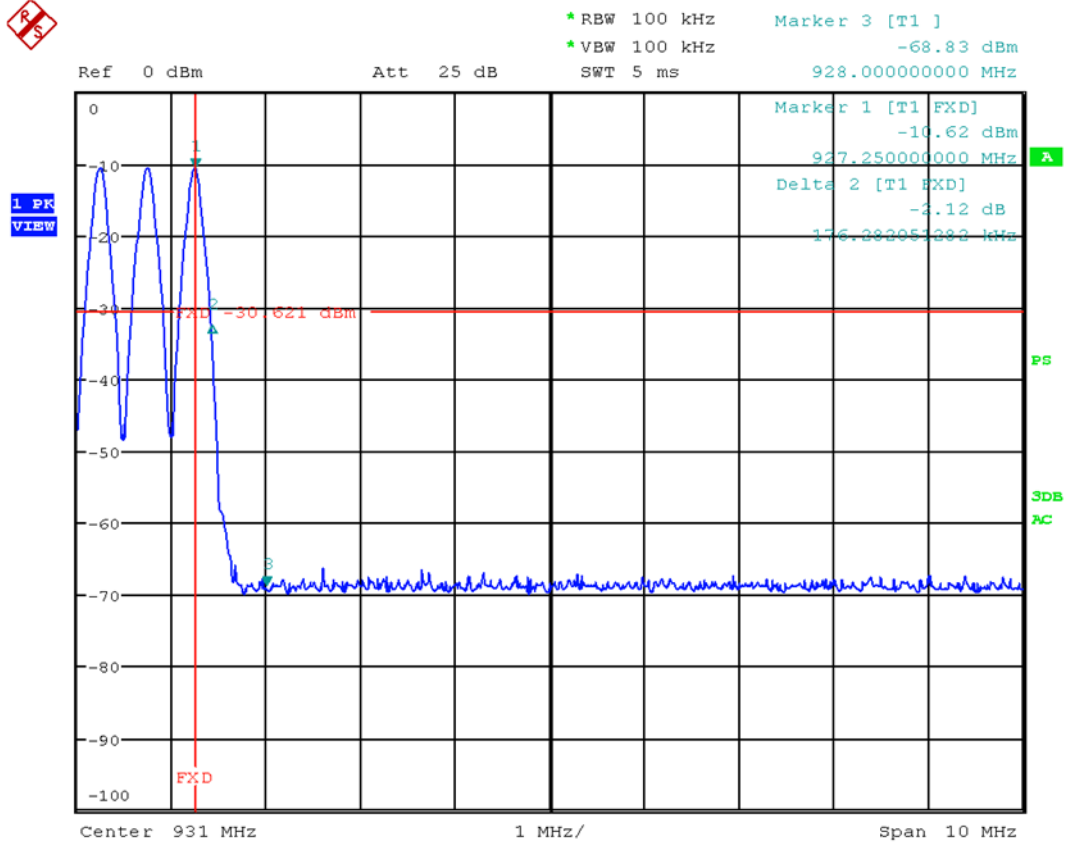


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Picture 15: Band edge plot 927.25 MHz

12 AC power line conducted emissions

according to CFR 47 Part 15, section 15.207

12.1 Test location

Description	Manufacturer	Inventory No.
Shielded chamber	Siemens - Matsushita	E00107

12.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESCI	Rohde & Schwarz	E00001
<input checked="" type="checkbox"/>	ESH3 Z2	Rohde & Schwarz	E00028
<input checked="" type="checkbox"/>	ESH 2-Z5	Rohde & Schwarz	E00004
<input checked="" type="checkbox"/>	ESH 2-Z5	Rohde & Schwarz	E00005

12.3 Limits

Frequency [MHz]	Quasi-peak [dB μ V]	Average [dB μ V]
0.15 – 0.5	66 - 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

12.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50 μ H/50 Ohms and an EMI test receiver.
2. The EMI test receiver was connected to the LISN and set to a measurement bandwidth of 9 kHz in the frequency range from 0.15 MHz to 30 MHz.
3. The EUT was placed on a wooden table and connected to the LISN.
4. To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range from 0.15 MHz to 30 MHz were scanned.
5. After that all peaks values with fewer margins than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector.
6. If after that all values are under the average limit no addition measurement is necessary. In case there are still values between quasi-peak and average limit than these values were re-measured again with an average detector.
7. These measurements were done on all current carrying conductors.

According to ANSI C63.4, section 13.1.3.1 testing of intentional radiators with detachable antennas shall be done with a dummy load otherwise the tests should be done with connected antenna and if adjustable fully extended.



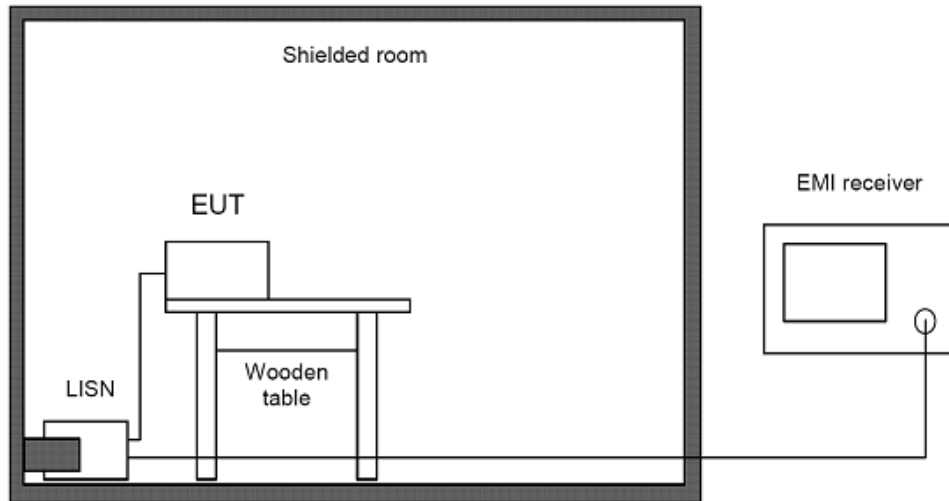
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12.5 Test setup



Picture 16: Outline of conducted emission test setup

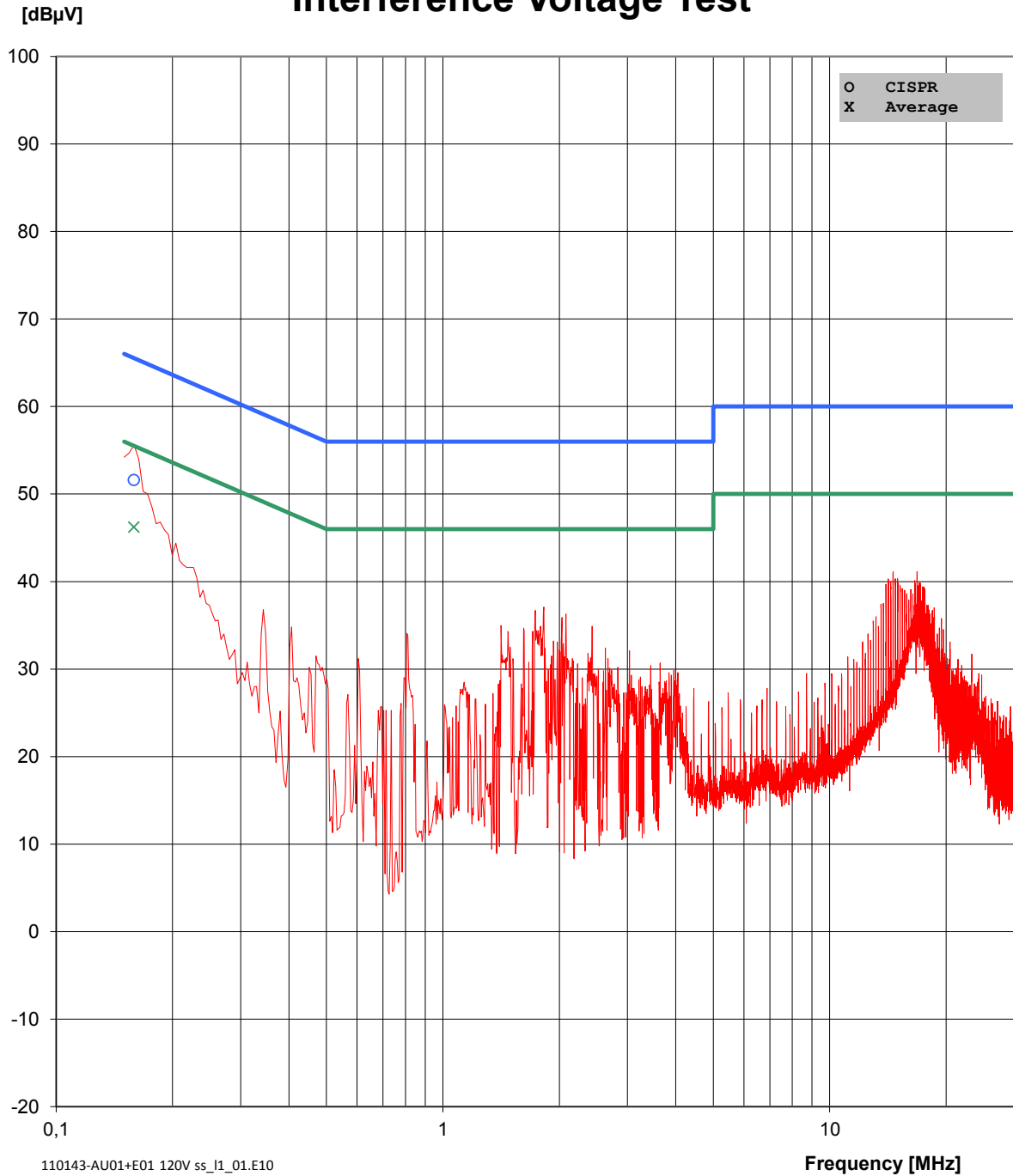
Comments: All peripheral devices were additionally decoupled by means of a line stabilization network.

12.6 Test results

Temperature:	23°C	Humidity:	42%
Tested by:	M. Janker	Test date:	2011-07-27

The test result is: **PASS**

Interference Voltage Test



Picture 17: Conducted emission on mains, phase 1 (Chart)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,16	51,6	65,5	13,9	46,2	55,5	9,3	0,0	110143-AU01+E01_120V ss_l1_01.E10

Picture 18: Conducted emission on mains, phase 1 (Table)



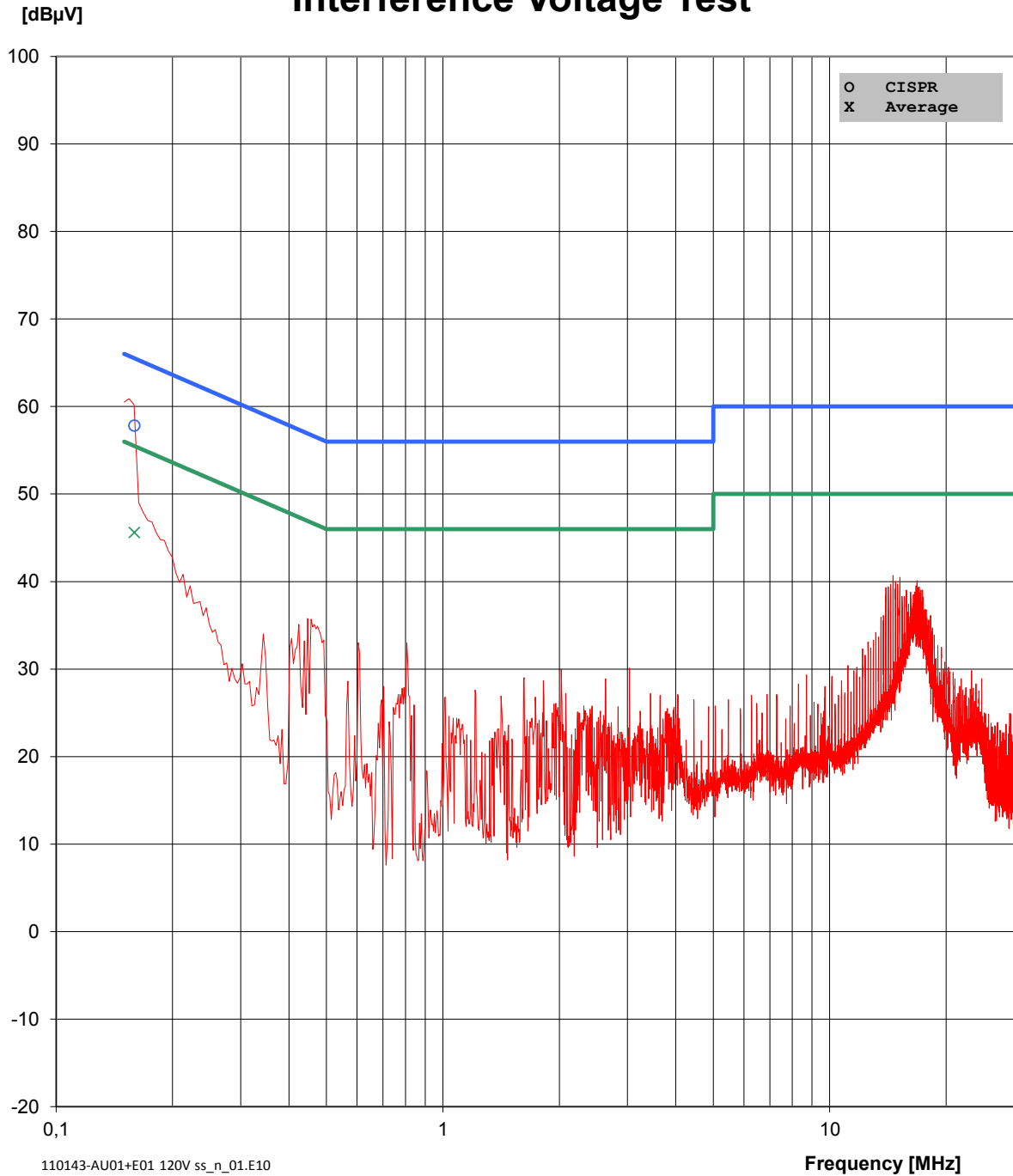
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Interference Voltage Test



110143-AU01+E01 120V ss_n_01.E10

Picture 19: Conducted emission on mains, neutral (Chart)



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Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,16	57,8	65,8	8,0	45,6	55,8	10,2	0,0	110143-AU01+E01_120V ss_n_01.E10

Picture 20: Conducted emission on mains, neutral (Table)



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13 Radiated emission measurement (<1 GHz)

according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.247(d)

13.1 Test Location

- Scan with peak detector in 3 m CDC.
- Final CISPR measurement with quasi peak detector on 3 m open area test site.

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open site area	EMV TESTHAUS GmbH	E00354

13.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input checked="" type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input checked="" type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input checked="" type="checkbox"/>	Feedline OATS	Huber & Suhner	200024

13.3 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequency [MHz]	Field strength Fs [μ V/m]	Field strength [dB μ V/m]	Measurement distance d [m]
0.009 – 0.490	266.6 – 4.9	48.5 – 13.8	300
0.490 – 1.705	48.98 – 14.08	33.8 – 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40	3



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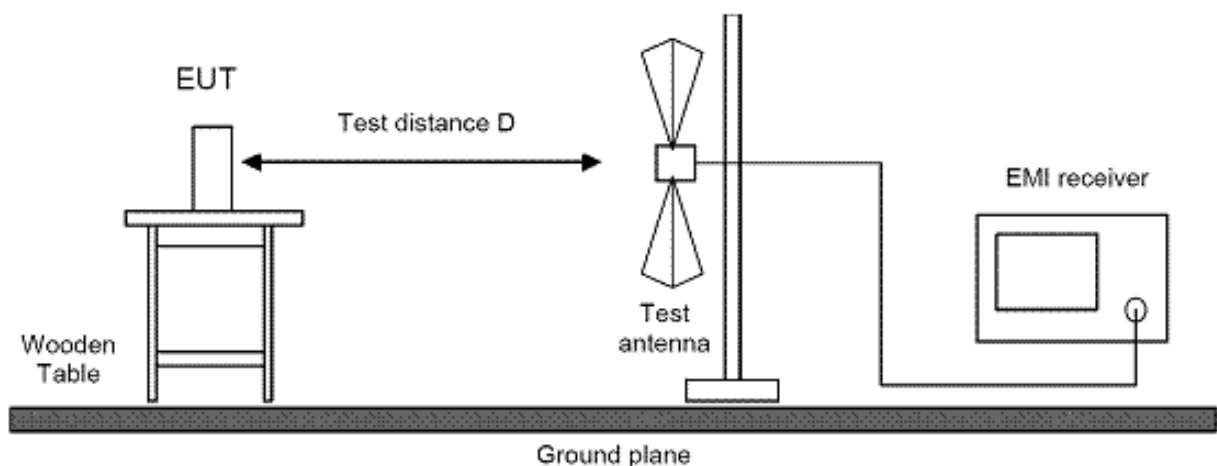
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88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

13.4 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a compact diagnostic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 30MHz to 1000MHz with the detector set to peak and the measurement bandwidth to 120 kHz.
5. The turn table was rotated to 6 different positions ($360^\circ / 6$) and the antenna polarization was changed to horizontal.
6. Repeat the test procedure at step 4 and 5.
7. The test setup was then placed in an OATS at 3 m distance and all peak values over or with less distance to limit then 6dB were marked and re-measured with a quasi-peak detector.
8. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
9. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value was recorded.
10. For emissions below 30MHz, measurement were done with a loop antenna. The recorded data were measured in QP mode off he receiver. The antenna height was not changed during this test.

13.5 Test setup



Picture 22: Test setup for radiated emission measurement (< 1 GHz)

13.6 Test deviation

There is no deviation with the original standard.

13.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

13.8 Test results

The test result is: **PASS**

Transmit mode

Temperature:	20°C	Humidity:	33%
Tested by:	M. Janker	Test date:	2011-05-04

Radiated Emission Measurement 9 kHz – 30 MHz

Note: Amplitudes of spurious emissions that are attenuated more than 20 dB below the permissible limit are not reported. No emissions below 30 MHz were found.



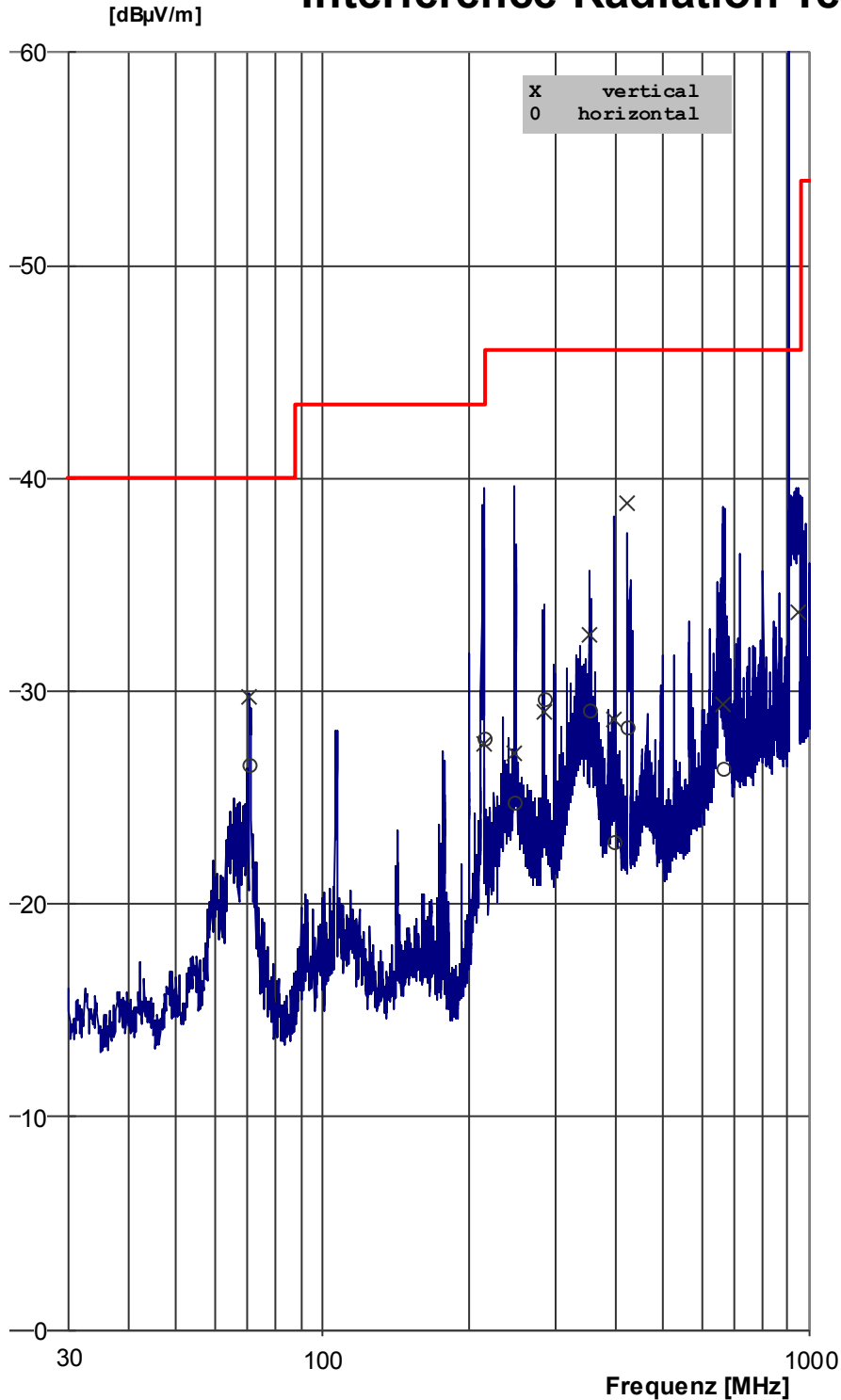
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Interference Radiation Test



REGULATIONS:
FCC 15.209

TEST EQUIPMENT:
R&S ESCS30 (E00003)
VULB 9163 (E00012)

ORDER NO.:
110143-AU01+E01

EUT:
SCM Microsystems GmbH
UHF-Desktop Reader
AUDR-USB

OPERATION MODE:
automatic mode f=902.75
MHz
Test-NB PRO 600 IW

TEST FACILITY:
EMV TESTHAUS GmbH
Gustav-Hertz-Straße 35
94315 Straubing

DATE / TIME:
2011-05-04 15:14:00
20 °C 33 %H 99 kPa

TEST ENGINEER:
Marco Janker

110143-AU01 902,75 MHz CDC
02.E10

Picture 24: Radiated emission 30 MHz – 1000MHz (902.75 MHz)



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Interference Radiation Test

Freq. [MHz]	U_Rec [dBµV/m]	Limit [dBµV/m]	Corr. [dB]	U_Ant. [dBµV]	delta_U [dB]	Turn- table	Antenna	Pol.	Remark
70,70	29,7	40,0	9,4	20,3	10,3	150°	100 cm	V	110143-AU01 902.75 MHz CDC 02.E10
70,70	26,6	40,0	9,4	17,2	13,5	28°	250 cm	H	
213,60	27,5	43,5	12,5	15,0	16,0	50°	100 cm	V	
213,60	27,8	43,5	12,5	15,3	15,7	53°	250 cm	H	
247,10	27,1	46,0	13,6	13,5	18,9	141°	100 cm	V	
247,10	24,8	46,0	13,6	11,1	21,2	113°	250 cm	H	
284,80	29,0	46,0	14,5	14,5	17,0	158°	100 cm	V	
284,80	29,6	46,0	14,5	15,1	16,4	64°	250 cm	H	
352,60	32,7	46,0	16,3	16,4	13,3	154°	100 cm	V	
352,60	29,1	46,0	16,3	12,8	16,9	69°	250 cm	H	
397,50	28,6	46,0	17,1	11,6	17,4	134°	100 cm	V	
397,50	22,9	46,0	17,1	5,8	23,1	146°	250 cm	H	
423,00	38,8	46,0	17,4	21,4	7,2	157°	100 cm	V	
423,00	28,3	46,0	17,4	10,9	17,7	84°	250 cm	H	
663,70	26,4	46,0	21,5	4,9	19,7	80°	250 cm	H	
663,70	29,4	46,0	21,5	8,0	16,6	154°	100 cm	V	
948,80	33,7	46,0	27,0	6,6	12,3	131°	100 cm	V	

Picture 25: Radiated emission 30 MHz – 1000MHz (Table, 902.75 MHz)



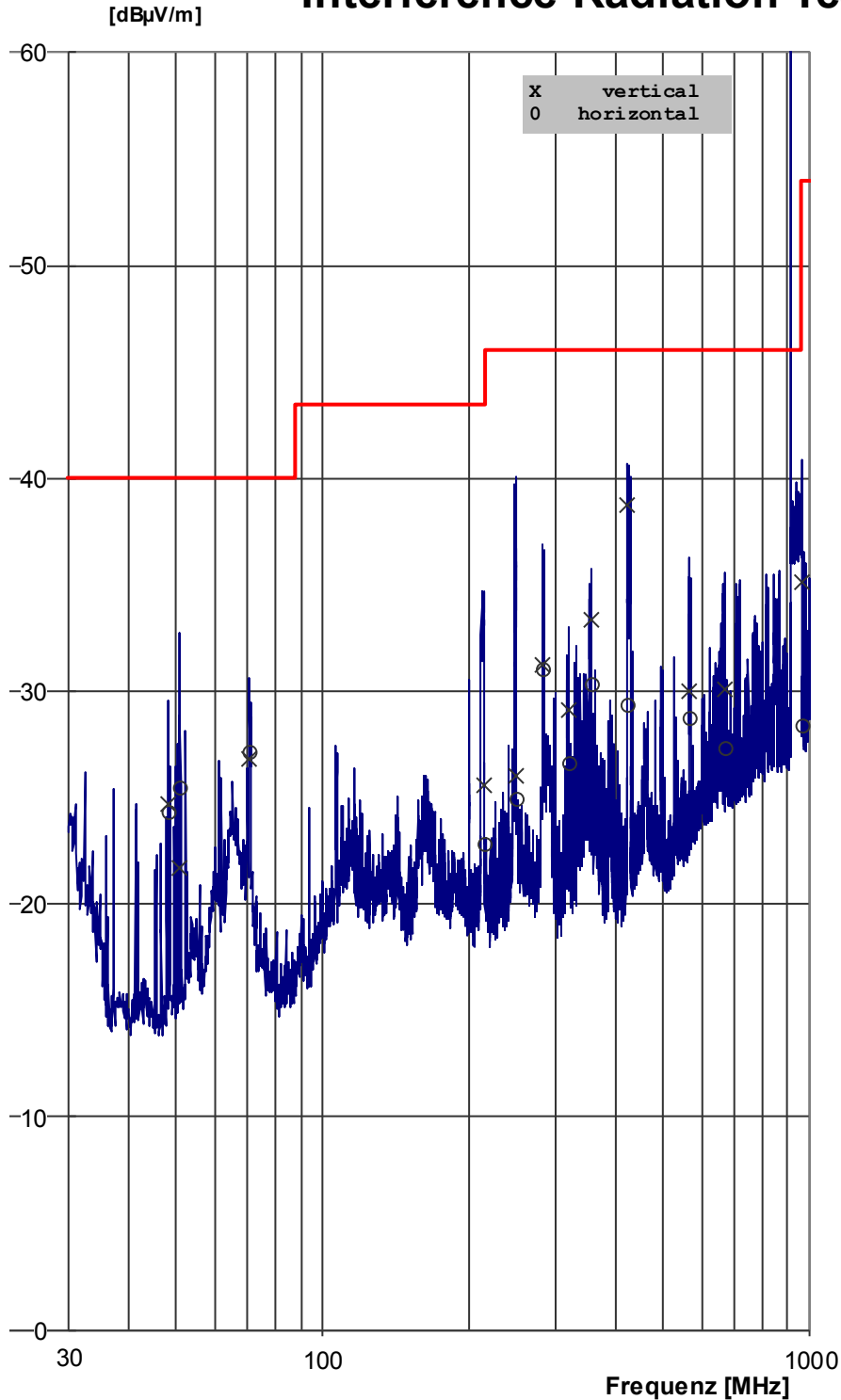
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Interference Radiation Test



REGULATIONS:
FCC 15.209

TEST EQUIPMENT:
R&S ESCS30 (E00003)
VULB 9163 (E00012)

ORDER NO.:
110143-AU01+E01

EUT:
SCM Microsystems GmbH
UHF-Desktop Reader
AUDR-USB

OPERATION MODE:
automatic mode f=915 MHz
Test-NB PRO 600 IW

TEST FACILITY:
EMV TESTHAUS GmbH
Gustav-Hertz-Straße 35
94315 Straubing

DATE / TIME:
2011-05-05 14:11:22
18 °C 38 %H 99 kPa

TEST ENGINEER:
Marco Janker

110143-AU01 915 MHz CDC 01E10

Picture 26: Radiated emission 30 MHz – 1000MHz (915 MHz)



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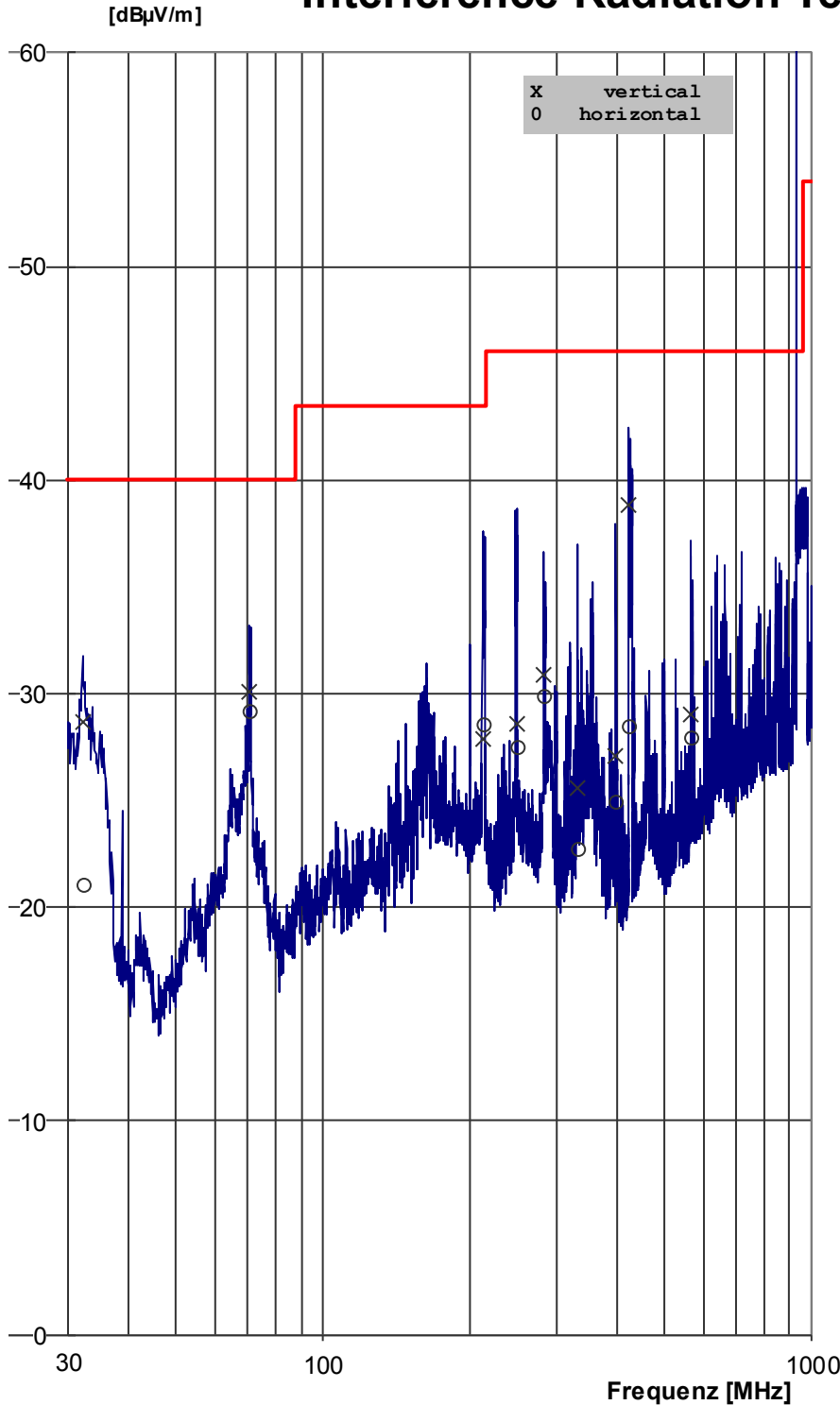
Interference Radiation Test

Freq. [MHz]	U_Rec [dBµV/m]	Limit [dBµV/m]	Corr. [dB]	U_Ant. [dBµV]	delta_U [dB]	Turn- table	Antenna	Pol.	Remark
									110143-AU01_915 MHz CDC 01_E10
48,00	24,3	40,0	14,1	10,3	15,7	322°	250 cm	H	
48,00	24,7	40,0	14,1	10,7	15,3	265°	100 cm	V	
50,70	25,5	40,0	13,9	11,6	14,5	210°	250 cm	H	
50,70	21,7	40,0	13,9	7,8	18,3	138°	100 cm	V	
70,60	27,1	40,0	9,4	17,7	12,9	359°	250 cm	H	
70,60	26,8	40,0	9,4	17,4	13,2	105°	100 cm	V	
213,40	25,5	43,5	12,5	13,0	18,0	258°	100 cm	V	
213,40	22,8	43,5	12,5	10,3	20,7	57°	250 cm	H	
249,10	24,9	46,0	13,7	11,3	21,1	90°	250 cm	H	
249,10	26,0	46,0	13,7	12,3	20,0	37°	100 cm	V	
282,10	31,0	46,0	14,5	16,6	15,0	97°	250 cm	H	
282,10	31,2	46,0	14,5	16,7	14,8	158°	100 cm	V	
320,00	26,6	46,0	15,4	11,2	19,4	69°	250 cm	H	
320,00	29,2	46,0	15,4	13,7	16,8	130°	100 cm	V	
356,00	33,4	46,0	16,3	17,0	12,7	178°	100 cm	V	
356,00	30,3	46,0	16,3	14,0	15,7	67°	250 cm	H	
423,10	29,4	46,0	17,4	12,0	16,6	53°	250 cm	H	
423,10	38,7	46,0	17,4	21,3	7,3	149°	100 cm	V	
564,10	28,7	46,0	20,3	8,4	17,3	101°	250 cm	H	
564,10	30,0	46,0	20,3	9,7	16,0	25°	100 cm	V	
666,80	27,4	46,0	21,5	5,9	18,6	142°	250 cm	H	
666,80	30,1	46,0	21,5	8,6	15,9	57°	100 cm	V	
960,80	35,2	54,0	24,9	10,3	18,8	137°	100 cm	V	
960,80	28,5	54,0	24,9	3,6	25,6	77°	250 cm	H	

Picture 27: Radiated emission 30 MHz – 1000MHz (Table, 915 MHz)



Interference Radiation Test



REGULATIONS:
 FCC 15.209

TEST EQUIPMENT:
 R&S ESCS30 (E00003)
 VULB 9163 (E00012)

ORDER NO.:
 110143-AU01+E01

EUT:
 SCM Microsystems GmbH
 UHF-Desktop Reader
 AUDR-USB

OPERATION MODE:
 automatic mode f=927.25 MHz
 Test-NB PRO 600 IW

TEST FACILITY:
 EMV TESTHAUS GmbH
 Gustav-Hertz-Straße 35
 94315 Straubing

DATE / TIME:
 2011-05-05 09:12:28
 18 °C 38 %H 99 kPa

TEST ENGINEER:
 Marco Janker

110143-AU01 927,25 MHz CDC
 01.E10

Picture 28: Radiated emission 30 MHz – 1000MHz (927.25 MHz)



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ARYGON Technologies AG
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Interference Radiation Test

Freq. [MHz]	U_Rec [dBµV/m]	Limit [dBµV/m]	Corr. [dB]	U_Ant. [dBµV]	delta_U [dB]	Turn- table	Antenna	Pol.	Remark
32,10	21,1	40,0	13,3	7,9	18,9	304°	250 cm	H	110143-AU01 927.25 MHz CDC 01.E10
32,10	28,7	40,0	13,3	15,4	11,3	89°	100 cm	V	
70,60	29,2	40,0	9,4	19,8	10,8	144°	250 cm	H	
70,60	30,1	40,0	9,4	20,7	10,0	210°	100 cm	V	
211,60	28,6	43,5	12,5	16,2	14,9	77°	250 cm	H	
211,60	27,9	43,5	12,5	15,4	15,6	45°	100 cm	V	
249,20	27,5	46,0	13,7	13,8	18,5	65°	250 cm	H	
249,20	28,6	46,0	13,7	14,9	17,4	153°	100 cm	V	
282,10	29,9	46,0	14,5	15,5	16,1	100°	250 cm	H	
282,10	30,8	46,0	14,5	16,4	15,2	146°	100 cm	V	
332,60	25,6	46,0	15,8	9,8	20,4	154°	100 cm	V	
332,60	22,8	46,0	15,8	7,0	23,2	61°	250 cm	H	
397,50	25,0	46,0	17,1	7,9	21,0	186°	250 cm	H	
397,50	27,1	46,0	17,1	10,1	18,9	356°	100 cm	V	
423,10	28,5	46,0	17,4	11,1	17,5	73°	250 cm	H	
423,10	38,8	46,0	17,4	21,4	7,2	169°	100 cm	V	
564,50	28,0	46,0	20,3	7,6	18,1	299°	250 cm	H	
564,50	29,0	46,0	20,3	8,7	17,0	158°	100 cm	V	

Picture 29: Radiated emission 30 MHz – 1000MHz (Table, 927.25 MHz)



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14 Radiated emission measurement (>1 GHz)

according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.247(d)

14.1 Test location

- Scan with peak detector in 3 m anechoic chamber
- Final measurement max peak detector.

Location of measurement

Description	Manufacturer	Inventory No.
Anechoic chamber	EMV TESTHAUS GmbH	E00100

Measurement equipment

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	AMF-5D-00501800-28-13P	Parzich	W00089
<input type="checkbox"/>	AMF-6F-16002650-25-10P	Parzich	W00090
<input checked="" type="checkbox"/>	BBHA 9170	Schwarzbeck	W00054
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input checked="" type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

14.2 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.



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General limits according 15.209(a)

Frequency [MHz]	Field strength Fs [$\mu\text{V/m}$]	Field strength [dB $\mu\text{V/m}$]	Measurement distance d [m]
0.009 – 0.490	266.6 – 4.9	48.5 – 13.8	300
0.490 – 1.705	48.98 – 14.08	33.8 – 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40	3
88 – 216	150	43.5	3
216 – 960	200	46	3
Above 960	500	54	3

Restricted bands of operation:

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209:

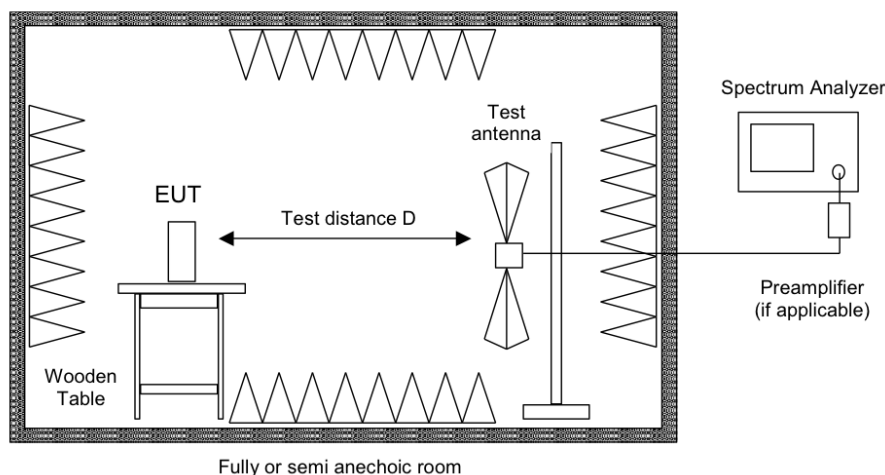
MHz	MHz	MHz	MHz
0.090 – 0.110	16.42 – 16.423	399.9 – 410	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	608 – 614	5.35 – 5.46
2.1735 – 2.1905	16.80425 – 16.80475	960 – 1240	7.25 – 7.75
4.125 – 4.128	25.5 – 25.67	1300 – 1427	8.025 – 8.5
4.17725 – 4.17775	37.5 – 38.25	1435 – 1626.5	9.0 – 9.2
4.20725 – 4.20775	73 – 74.6	1645.5 – 1646.5	9.3 – 9.5
6.215 – 6.218	74.8 – 75.2	1660 – 1710	10.6 – 12.7
6.26775 – 6.26825	108 – 121.94	1718.8 – 1722.2	13.25 – 13.4
6.31175 – 6.31225	123 – 138	2200 – 2300	14.47 – 14.5
8.291 – 8.294	149.9 – 150.05	2310 – 2390	15.35 – 16.2
8.362 – 8.366	156.52475 – 156.52525	2483.5 – 2500	17.7 – 21.4
8.37625 – 8.38675	156.7 – 156.9	2690 – 2900	22.01 – 23.12
8.41425 – 8.41475	162.0125 – 167.17	3260 – 3267	23.6 – 24.0
12.29 – 12.293	167.72 – 173.2	3332 – 3339	31.2 – 31.8
12.51975 – 12.52025	240 – 285	3345.8 – 3358	36.43 – 36.5
12.57675 – 12.57725	322 – 335.4	3600 – 4400	Above 38.6



14.3 Test procedure

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The spectrum analyzer was set up to record the frequency range from 1000 MHz to 10th harmonic (10000 MHz) of the fundamental frequency with the detector set to peak and the measurement bandwidth set to 1 MHz (VBW = RBW). The trace data was recorded with the receiver Max Hold function.
5. The turn table was rotated in intervals of 15°.
6. After a full 360°-turn the antenna polarization was changed to horizontal and the test was repeated at step 4 and 5.
7. After the scan suspicious frequencies were selected and the RBW was set to 1 MHz and the VBW was set to 10Hz.
8. The receiving antenna was set to vertical polarization.
9. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
10. The receiving antenna was then set to horizontal polarization and the measurement was repeated at step 9.
11. The highest recorded level was noted.
12. For testing above 1GHz, if the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported
13. For measurements above 18 GHz, first a scan was done with RBW set to 1 MHz and VBW set to 10 MHz to determine existing peaks of the spectrum. If there was any, the measurement was carried out as described above.

14.4 Test setup



Picture 30: Test setup for radiated emission measurement (> 1 GHz)

14.5 Test deviation

There is no deviation with the original standard.

14.6 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

14.7 Test results

The test result is: **PASS**



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Test results 902.75 MHz

Temperature:	23°C	Humidity:	58%
Tested by:	M. Janker	Test date:	2011-09-14

Frequency (GHz)	Reading (dB μ V/m)	Detector	Polarity	Limit (dB μ V/m)	Margin
1.34423	48.34	PK	V	74.98	-26.64
1.34423	39.57	AV	V	53.98	-14.41
2.70801	56.63	PK	V	74.98	-18.35
2.70801	36.74	AV	V	53.98	-17.24

Remarks: Vertical polarization showed the highest value.

Test results 915 MHz

Temperature:	23°C	Humidity:	58%
Tested by:	M. Janker	Test date:	2011-09-14

Frequency (GHz)	Reading (dB μ V/m)	Detector	Polarity	Limit (dB μ V/m)	Margin
1.3444	49.65	PK	V	74.98	-25.33
1.3444	38.38	AV	V	53.98	-15.60
2.7449	56.20	PK	V	74.98	-18.78
2.7449	37.33	AV	V	53.98	-16.65

Remarks: Vertical polarization showed the highest value.

Test results 927.25 MHz

Temperature:	23°C	Humidity:	58%
Tested by:	M. Janker	Test date:	2011-09-14

Frequency (GHz)	Reading (dB μ V/m)	Detector	Polarity	Limit (dB μ V/m)	Margin
2.7816	56.67	PK	V	74.98	-18.31
2.7816	36.00	AV	V	53.98	-17.98

Remarks: Vertical polarization showed the highest value.

In receive mode there were no significant emissions detected!



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15 Equipment calibration status

Inventory Number	Model Number	Manufacturer	Last calibration	Next calibration	Cycle of calibration
W00002	ESU26	Rohde & Schwarz	Sep 09	Sep 11	2 Years
E00001	ESCI	Rohde & Schwarz	Jul. 11	Jul. 13	2 Years
E00003	ESCS 30	Rohde & Schwarz	Oct. 10	Oct. 12	2 Year
E00004	ESH 2-Z5	Rohde & Schwarz	Jan. 11	Jan. 13	2 Years
E00005	ESH 2-Z5	Rohde & Schwarz	Sep 09	Sep 11	2 Years
E00060	HFH2-Z2	Rohde & Schwarz	Oct 08	Oct 11	2 Years
E00012	VULB 9163	Schwarzbeck	Mar. 11	Mar. 12	2 Years
W00054	BBHA 9170	Schwarzbeck	Nov. 06	Nov. 12	6 Years
W00055	BBHA 9170	Schwarzbeck	Nov. 06	Nov. 12	6 Years
W00052	BBHA 9120 D	Schwarzbeck	Feb. 10	Feb. 13	3 Years
W00053	BBHA 9120 D	Schwarzbeck	Feb. 10	Feb. 13	3 Years
C00015	VC ³ 4034	Vötsch	Aug 10	Aug 14	4 Years
E00099	Multimeter	Metra Hit 29S	---	---	---

Table 1: Equipment Calibration status



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16 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (9kHz to 30 MHz)	± 4,0 dB	2
Radiated emission open field (30 MHz to 1 GHz)	± 4,5 dB	2
Radiated emission absorber chamber (> 1000 MHz)	± 5,4 dB	2

Table 2: Measurement uncertainty

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. If k=2 the value of the measurements lies within the assigned range of values with a probability of 95 %.



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17 Summary

The EMC Regulations according to the marked specifications are

KEPT

The EUT does fulfill the general approval requirements mentioned.

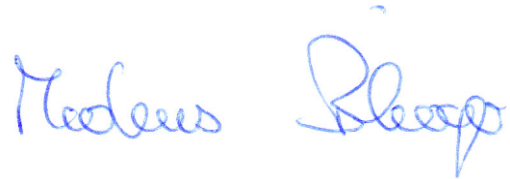
NOT KEPT

The EUT does not fulfill the general approval requirements mentioned.

Place, Date: Straubing, August 22, 2011



Marco Janker
EMI / EMC Test Engineer



Markus Biberger
Technical Executive / EMV **TESTHAUS**
GmbH



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