

Test report

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EMC test report
130078-AU01+E01



**ARRI Austria Cine & Video Geräte
Ges.m.b.H.
RF Module
EMIP2**



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EMV **TESTHAUS** GmbH
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Accreditation:



FCC facility registration number: 221458
Test Firm Type "2.948 listed": Valid until 27.06.2014
Test Firm Type "accredited": Valid until 19.06.2013
MRA US-EU, FCC designation number: DE0010

Location of testing:

EMV **TESTHAUS** GmbH
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94315 Straubing

The technical accuracy is guaranteed through the quality management of the
EMV **TESTHAUS** GmbH.



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1 Test regulation

CFR 47 Part 2: 10-2012	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: 10-2012	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.4: 09-2009	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
CISPR 22: 1997	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, Class B “Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement”



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2 Summary of test results

FCC CFR 47 Part 15C			
Section	Test	Page	Result
15.207	Conducted emission at AC power line 0,150 MHz to 30 MHz	11	Pass
15.209	Radiated emission 30 MHz – 1000 MHz Unintentional radiations 1.705 MHz – 108 MHz	16	Pass
15.209	Radiated emission above 1000 MHz	22	Pass
15.247	Conducted output power	30	Pass



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3 Equipment under test

Product type: RF Module
Model name: EMIP2
Serial number: 132800003
Manufacturer: ARRI
FCC ID: Y7N-EMIP100

Technical changes between EMIP100 and EMIP2

- Form of the circuit board changed (reduced)
- Module supply reduced from 5V to 3,3V and removed the 5V to 3,3V level transducers of the control lines
- Modul plug assembly at backside
- For place reasons set supply (linear regulator) for the HF amplifier into the HF cage. Removed Debug plug



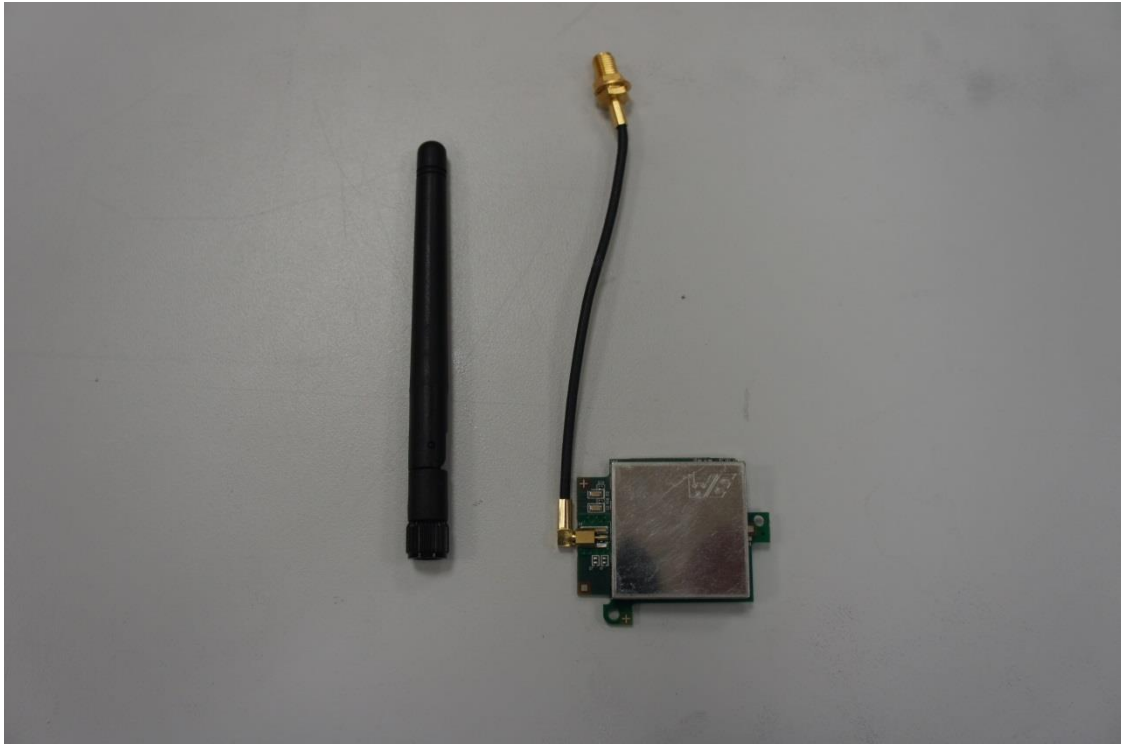
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3.1 Photo documentation of EUT



Picture 1: Equipment under test

3.2 Short description of the EUT

2,4GHz RF module

3.3 Operation Mode

Settings: Transmitting channel 18

Applied Software: Terminal program

3.4 Configuration

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

Device	Model:	S/N
PC System	Maxdata PCMD/63912	30282280013
19" LCD Monitor	Belinea 1930S2	N/A
USB Mouse	Microsoft	N/A
USB Keyboard	Cherry Cymotion DE	G000954
Power supply	Statron 3231.1	0702007

Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
1	RS232 Adapter 0,5m, unshielded	N/A
2	Power cord PC System, 1,5m, unshielded	N/A
1	Antenna cable, 0,1m, shielded	N/A



4 Product labeling

4.1 FCC Label and Location

See user manual



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5 Conducted emission test

according to CFR 47 Part 15 Subpart C Class B, Section 15.207

5.1 Conducted emission measurement from 150 kHz to 30 MHz

5.1.1 Location of measurement

Description	Manufacturer	Inventory Nr.
Shielded chamber	Siemens - Matsushita	E00107

5.1.2 Measurement equipment

	Description	Manufacturer	Inventory Nr.
<input type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCS30	Rohde & Schwarz	E00551
<input type="checkbox"/>	ESH3 Z2	Rohde & Schwarz	E00028
<input checked="" type="checkbox"/>	ESH 2-Z5 (measuring)	Rohde & Schwarz	E00004
<input type="checkbox"/>	ESH 2-Z5 (decoupling)	Rohde & Schwarz	E00005
<input checked="" type="checkbox"/>	E10 v1.4.12	EMV TESTHAUS GmbH	E00443

Information about measurement uncertainty is on page 31.



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5.1.3 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

5.1.4 Test method to demonstrate compliance

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 a EMI test receiver.

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.

The EUT was placed on a wooden table and connected to the LISN.

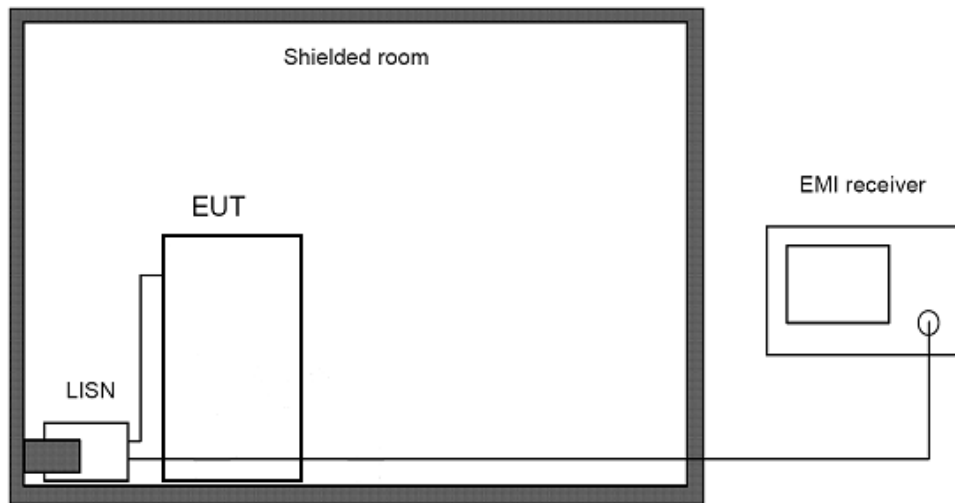
To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range from 0.15 MHz to 30 MHz were scanned. After that all peaks values with fewer margins than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector. 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.

These measurements were done on all current carrying conductors.

The test was performed with 120V/60Hz



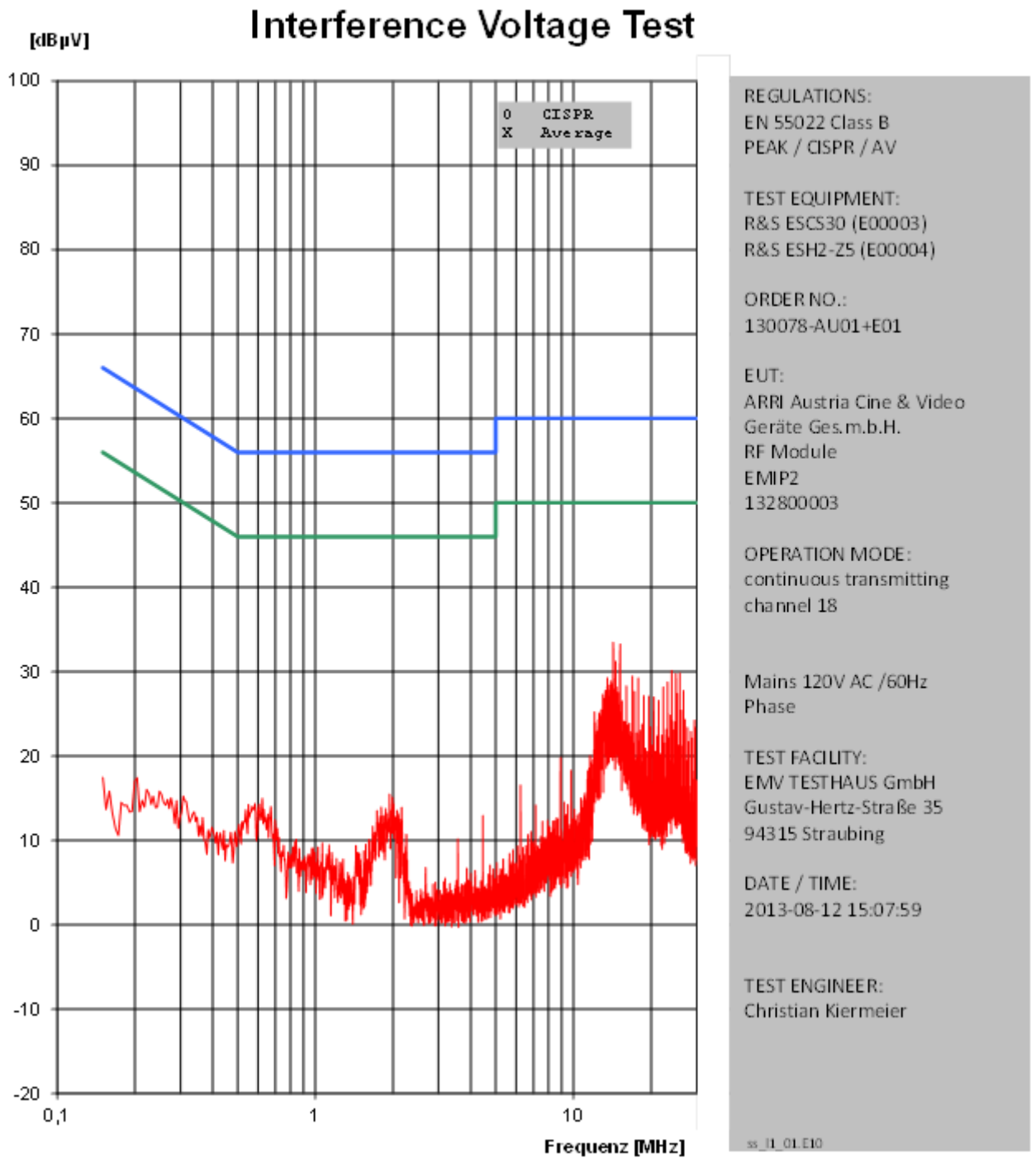
5.1.5 Test setup



Picture 2: Outline of conducted emission test setup

Comments:

5.2 Test result



Picture 3: Conducted emission – Line 1



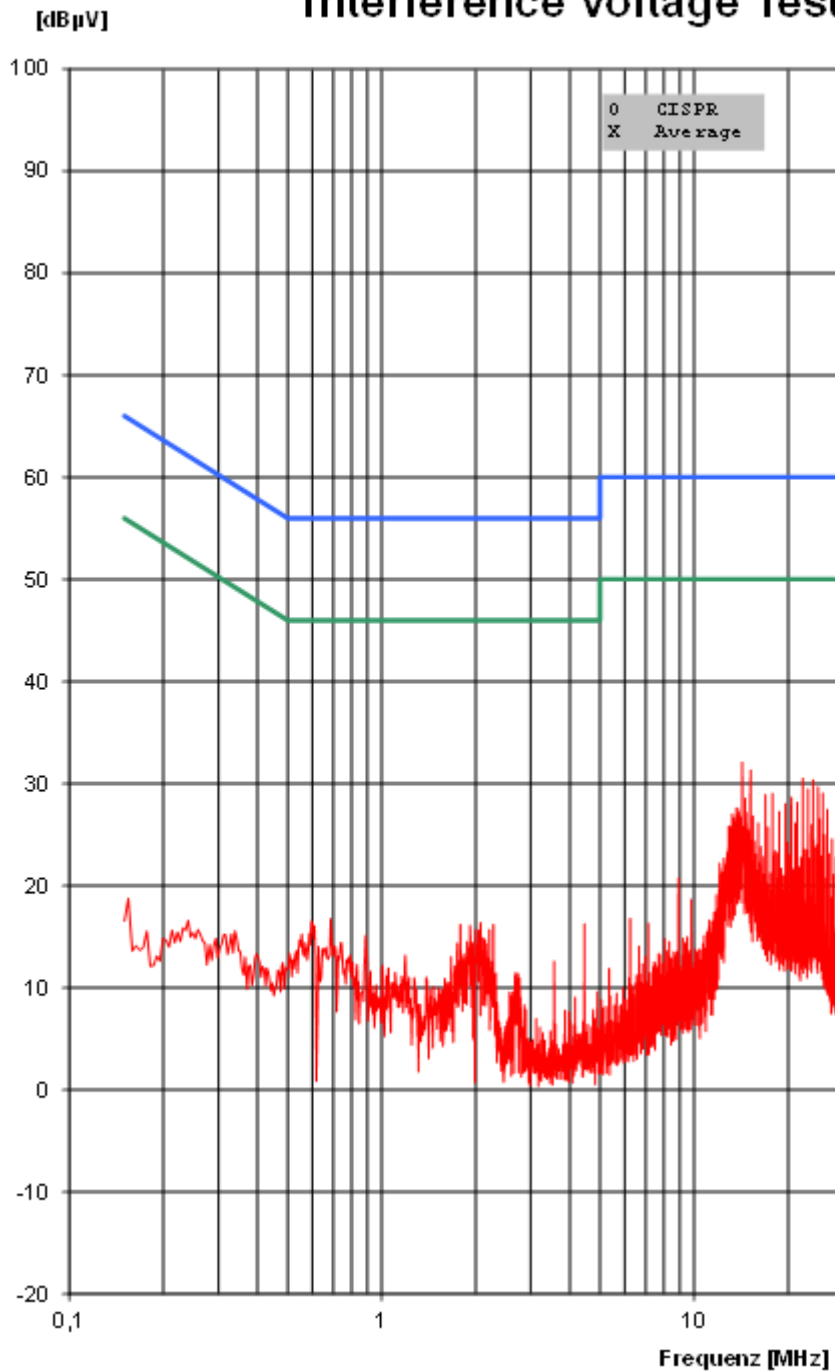
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Interference Voltage Test



REGULATIONS:
EN 55022 Class B
PEAK / CISPR / AV

TEST EQUIPMENT:
R&S ESCS30 (E00003)
R&S ESH2-Z5 (E00004)

ORDER NO.:
130078-AU01+E01

EUT:
ARRI Austria Cine & Video
Geräte Ges.m.b.H.
RF Module
EMIP2
132800003

OPERATION MODE:
continuous transmitting
channel 18

Mains 120V AC /60Hz
Neutral

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

DATE / TIME:
2013-08-12 15:08:41

TEST ENGINEER:
Christian Kiermeier

ss_n_01.E10

Picture 4: Conducted emission – Line 2



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6 Radiated emission test

according to CFR 47 Part 15 Subpart B Class B, Section 15.109

6.1 Radiated emission measurement from 30 MHz to 1000 MHz

6.1.1 Location of measurement

- Scan with peak detector in 3 m CDC which is correlated to the 10 m open site area.
- Final CISPR measurement with quasi peak detector on 10 m open site area.

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open Area Test Site	EMV TESTHAUS GmbH	E00354

6.1.1 Measurement equipment

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCS 30 (OATS)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input checked="" type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011
<input checked="" type="checkbox"/>	VULB 9163 (OATS)	Schwarzbeck	E00013
<input type="checkbox"/>	MDS 21	Rohde & Schwarz	E00010
<input type="checkbox"/>	MDS 20	Rohde & Schwarz	E00132
<input checked="" type="checkbox"/>	E10 v1.4.12	EMV TESTHAUS GmbH	E00443

Information about measurement uncertainty is on page 31.



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6.1.2 Limits

Frequency [MHz]	Field strength Fs [$\mu\text{V/m}$]	Field strength [$\text{dB}\mu\text{V/m}$]	Measurement distance d [m]
30 – 88	100	40	3
88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

To calculate the limit for 10m measurement distance the following calculation was used.

$$L_{dm} = L_d + (-20 \frac{dB}{dec} * (\log(dm) - \log(d)))$$

L_{dm} = Limit at the new distance
 L_d = Limit according ANSI 63.4
 d = Distance according to ANSI 63.4
 dm = New distance for limit

$$L_{dm} = 40 \frac{dB\mu V}{m} + (-20 \frac{dB}{dec} * (\log(10 m) - \log(3 m))) = 30 dB \quad \text{for 30MHz to 88MHz}$$

$$L_{dm} = 43,5 \frac{dB\mu V}{m} + (-20 \frac{dB}{dec} * (\log(10 m) - \log(3 m))) = 33,5 dB \quad \text{for 88MHz to 216MHz}$$

$$L_{dm} = 46 \frac{dB\mu V}{m} + (-20 \frac{dB}{dec} * (\log(10 m) - \log(3 m))) = 36 dB \quad \text{for 216MHz to 960MHz}$$

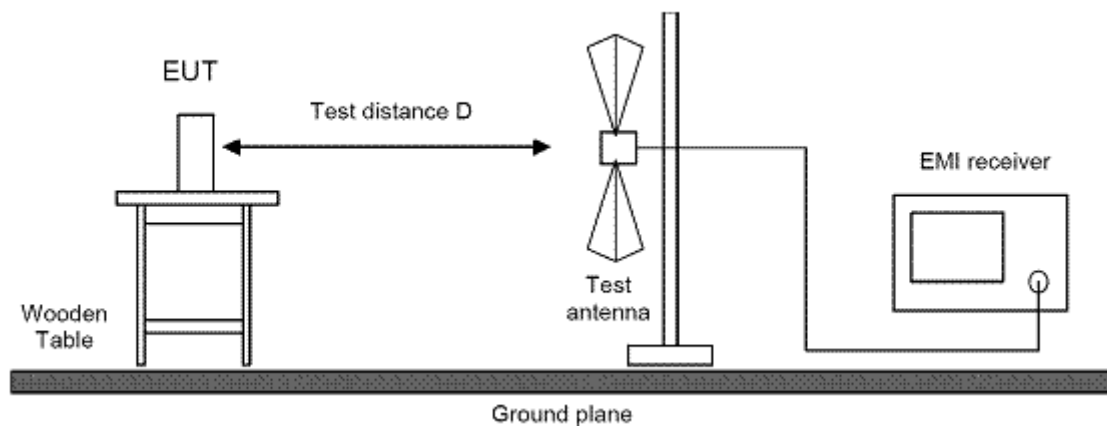
$$L_{dm} = 54 \frac{dB\mu V}{m} + (-20 \frac{dB}{dec} * (\log(10 m) - \log(3 m))) = 44 dB \quad \text{above 960MHz}$$



6.1.3 Test method to demonstrate compliance

1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 m 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 30 MHz to 1000 MHz 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 10 m distance and all peak values over or with less distance to limit then 6 dB were marked and re-measured with a quasi-peak detector.
8. The turntable was rotated by 360° to determine the position of the highest radiation.
9. The height of the broadband receiving antenna was varied between 1 m and 4 m above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value was recorded.

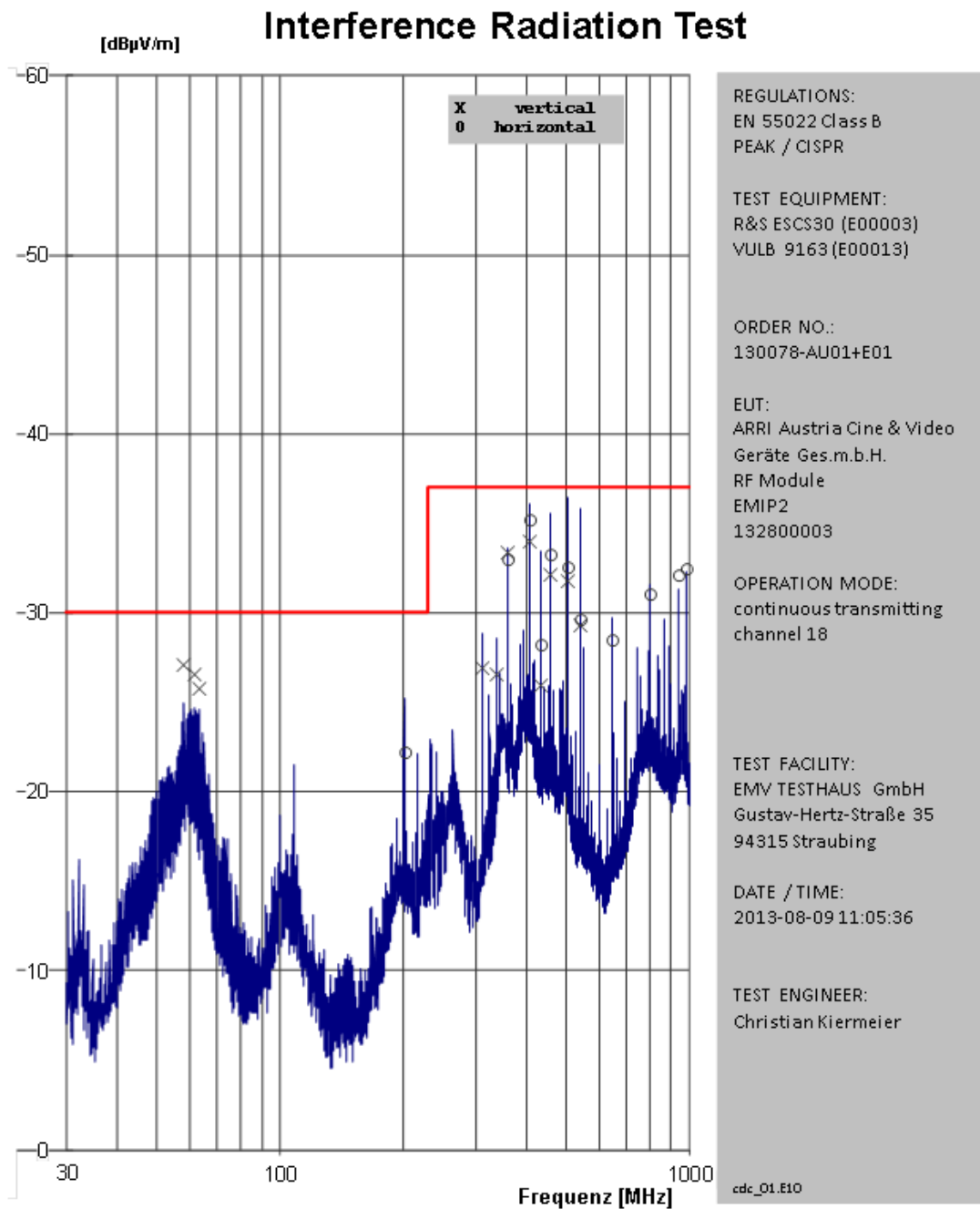
6.1.4 Test setup



Picture 5: Outline of radiated emission measurement (< 1 GHz)

Comments:

6.2 Test result



Picture 6: Radiated emission, graphic (< 1 GHz)



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Interference Radiation Test

Freq. [MHz]	U Rec [dB μ V/m]	Limit [dB μ V/m]	Corr. [dB]	U Ant. [dB μ V]	delta U [dB]	Turn- table	Antenna	Pol.	Remark
58,20	27,1	30,0	14,7	12,4	2,9	321°	100 cm	V	
61,50	26,6	30,0	13,3	13,3	3,4	295°	100 cm	V	
63,50	25,7	30,0	12,1	13,7	4,3	265°	100 cm	V	
200,50	22,2	30,0	12,7	9,5	7,8	332°	250 cm	H	
312,00	26,9	37,0	15,9	11,0	10,1	178°	100 cm	V	
336,00	26,6	37,0	16,8	9,8	10,4	196°	100 cm	V	
360,00	33,4	37,0	17,2	16,2	3,7	151°	100 cm	V	
360,00	33,0	37,0	17,2	15,8	4,0	307°	250 cm	H	
408,00	34,0	37,0	18,2	15,7	3,0	50°	100 cm	V	
408,00	35,2	37,0	18,2	17,0	1,8	153°	250 cm	H	
431,90	26,0	37,0	18,6	7,4	11,0	188°	100 cm	V	
431,90	28,2	37,0	18,6	9,6	8,8	151°	250 cm	H	
456,00	32,2	37,0	19,0	13,1	4,9	275°	100 cm	V	
456,00	33,2	37,0	19,0	14,2	3,8	13°	250 cm	H	
504,00	32,6	37,0	20,0	12,6	4,4	299°	250 cm	H	
504,00	31,7	37,0	20,0	11,7	5,3	288°	100 cm	V	
539,80	29,3	37,0	20,8	8,5	7,7	282°	100 cm	V	
539,80	29,7	37,0	20,8	8,9	7,3	219°	250 cm	H	
647,80	28,5	37,0	22,7	5,8	8,5	207°	250 cm	H	
796,50	31,1	37,0	25,1	6,0	5,9	122°	250 cm	H	
936,00	32,2	37,0	27,1	5,0	4,9	157°	250 cm	H	
984,00	32,5	37,0	27,7	4,8	4,5	115°	250 cm	H	

Picture 7: Radiated emission, chart (< 1 GHz)



6.3 Radiated emission measurement above 1000 MHz

- Scan with peak detector in 3 m anechoic chamber.
- Final measurement with average detector on 3 m open site area.

6.3.1 Location of measurement

Description	Manufacturer	Inventory No.
Anechoic chamber	EMV TESTHAUS GmbH	E00100

6.3.2 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 9120 D	Schwarzbeck	W00052
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input checked="" type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

Information about measurement uncertainty is on page 31.



6.3.3 Limits

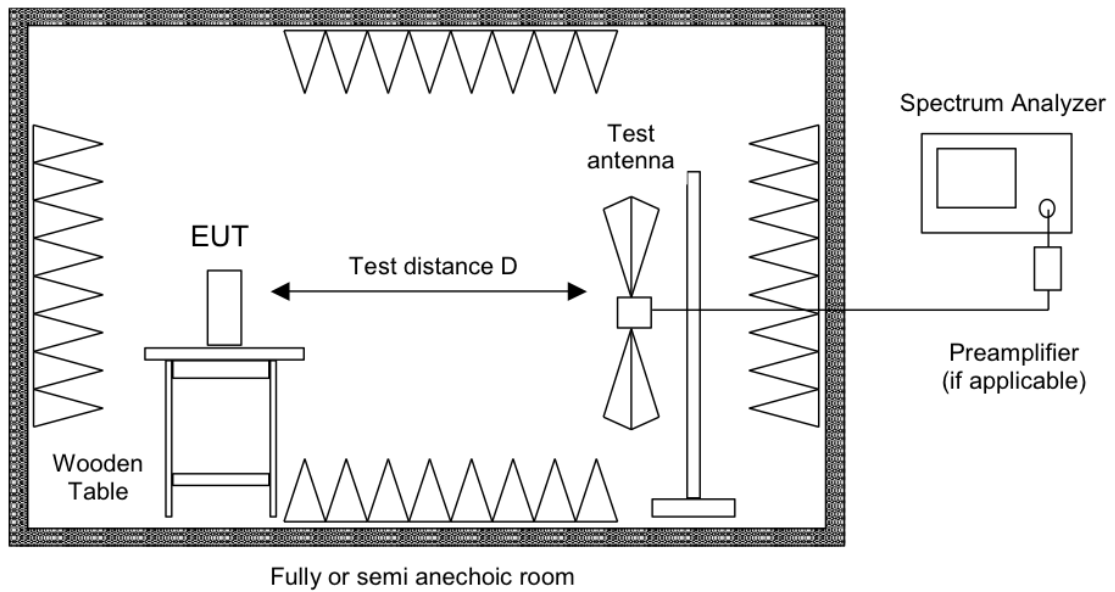
Frequency [MHz]	Field strength Fs [$\mu\text{V}/\text{m}$]	Field strength [$\text{dB}\mu\text{V}/\text{m}$]	Measurement distance d [m]
Above 960	500	54	3

6.3.4 Test method to demonstrate compliance

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 semi anechoic 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 1000 MHz to max. the 5th harmonic of the highest internal frequency with the detector set to peak and the measurement bandwidth set to 1 MHz ($\text{VBW} \geq 3 \text{ MHz}$). 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 detector was changed to average reading.
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.



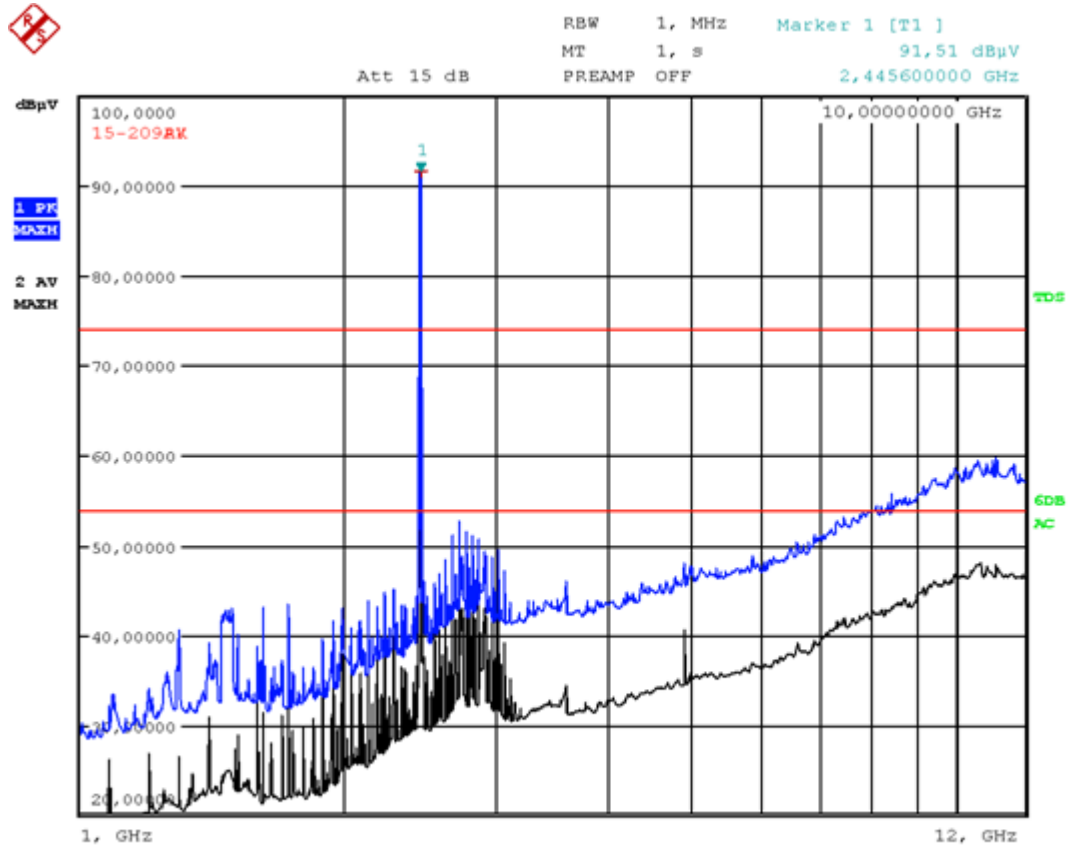
6.3.5 Test setup



Picture 8: Outline of radiated emission measurement (> 1 GHz)

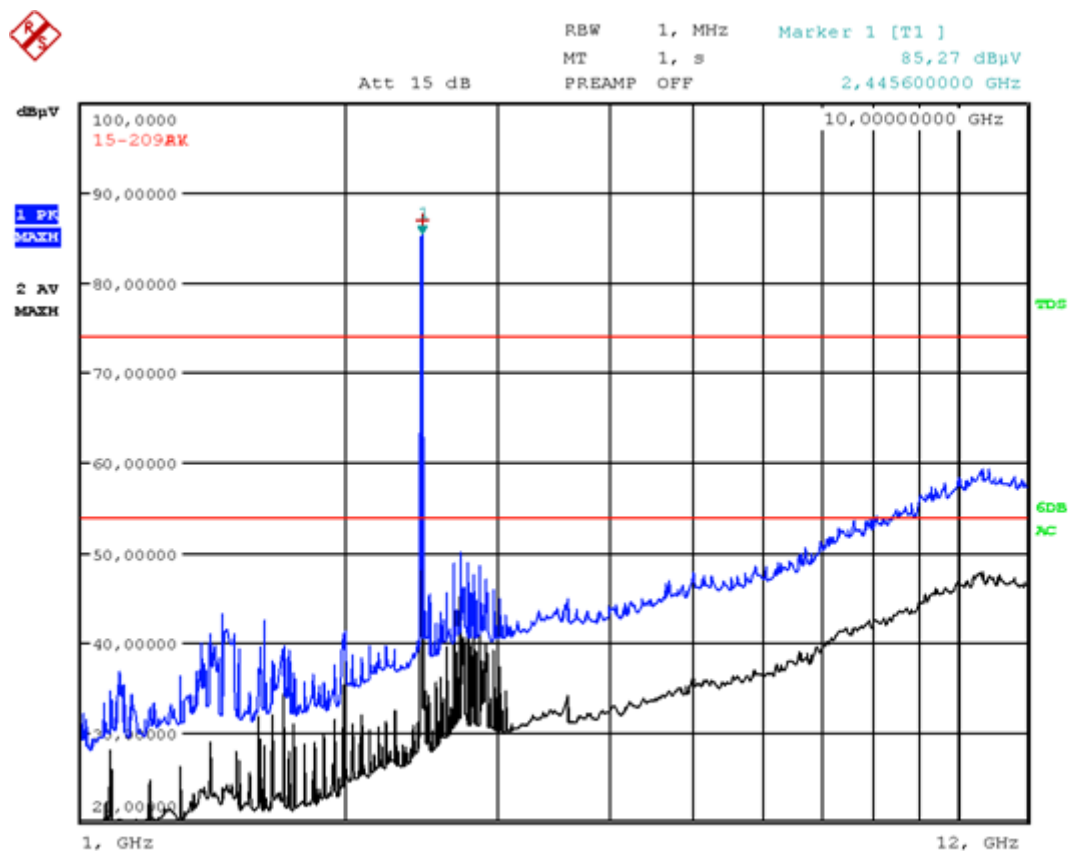
Comments:

6.3.6 Test result vertical

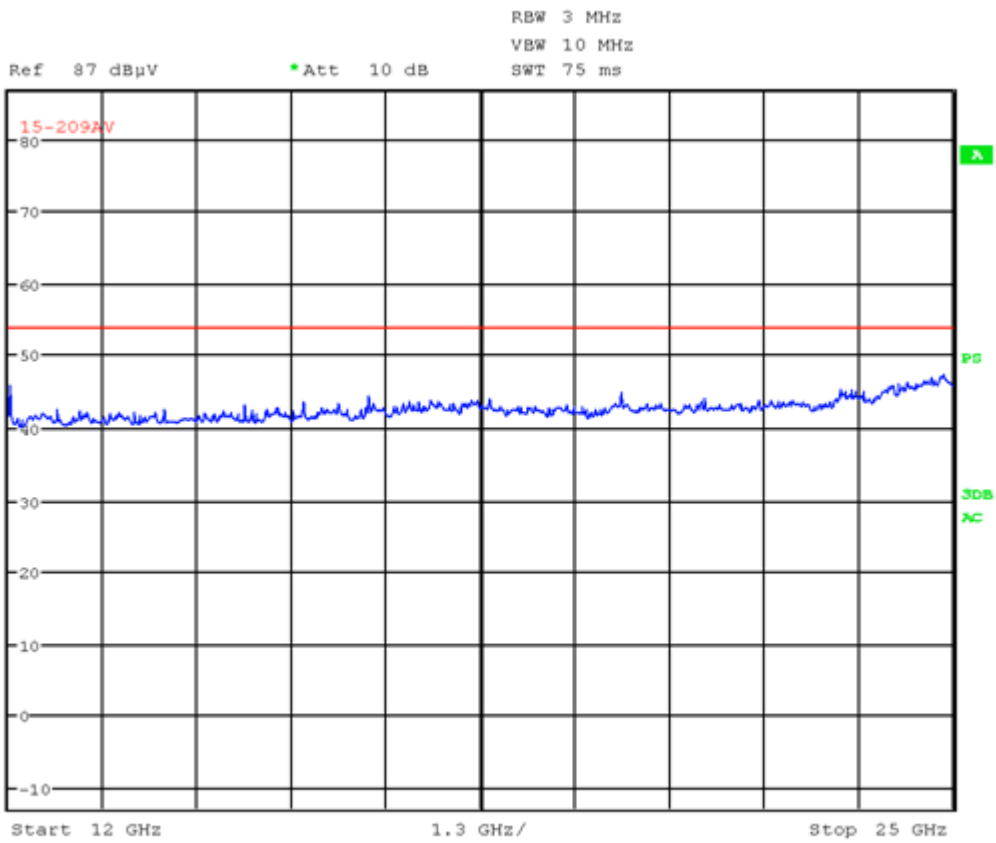


Picture 9: Radiated emission graphic, vertical (> 1 GHz)

6.3.7 Test result horizontal



Picture 10: Radiated emission graphic, horizontal (> 1 GHz)



Picture 11: Conductede spurious emission (> 12 GHz)



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6.4 Maximum conducted output power

- 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

6.4.1 Location of measurement

Description	Manufacturer	Inventory No.
Anechoic chamber	EMV TESTHAUS GmbH	E00100

6.4.2 Measurement equipment

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input type="checkbox"/>	AMF-5D-00501800-28-13P	Parzich	W00089
<input type="checkbox"/>	AMF-6F-16002650-25-10P	Parzich	W00090
<input type="checkbox"/>	BBHA 9120 D	Schwarzbeck	W00052
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

Information about measurement uncertainty is on page 31.



6.4.3 Limits

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands is 1 Watt (30dBm).

Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. The conducted output power limit is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.4.4 Test method to demonstrate compliance

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. Test was performed in accordance with Measurement of Digital Transmission Systems Operating under Section 15.247.



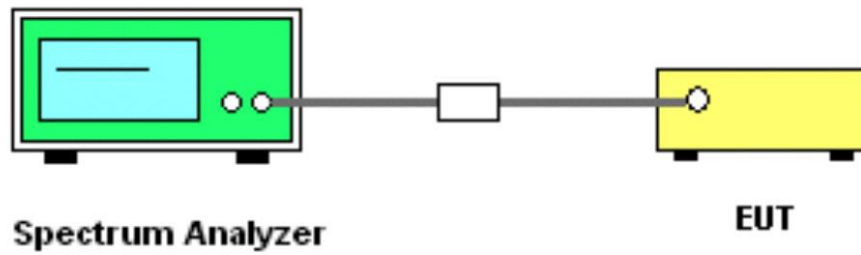
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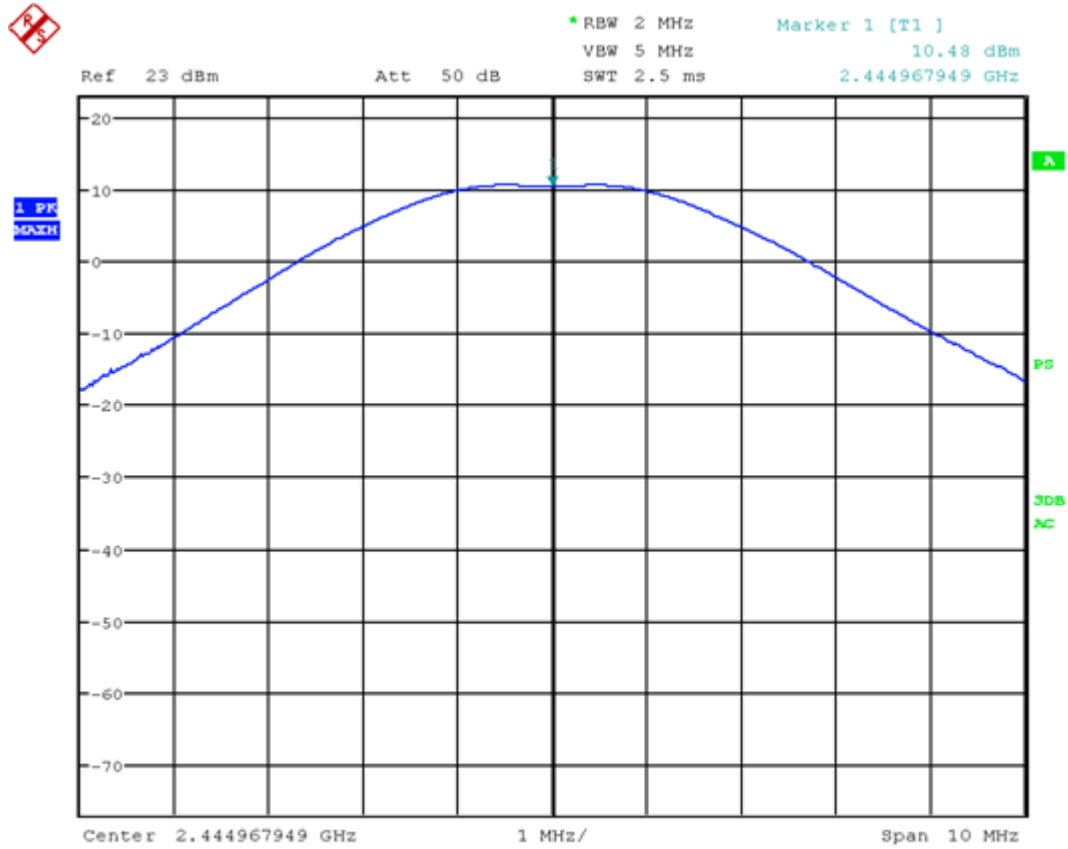
6.4.5 Test setup



Picture 12: test setup output power conducted

Comments:

6.4.6 Test



Picture 13: Output power conducted (channel 18)

Reading value:	10,48dBm
Correction (Duty cycle)	<u>-7,4dBm</u>
Output power conducted:	3,08dBm

7 Equipment Calibration Status

Inventory Number	Model Number	Manufacturer	Last calibration	Next calibration	Cycle of calibration
W00002	ESU26	Rohde & Schwarz	Jan. 12	Jan. 14	2 Years
E00001	ESCI	Rohde & Schwarz	Jul. 13	Jul. 15	2 Years
E00003	ESCS 30	Rohde & Schwarz	Feb. 13	Feb. 14	1 Years
E00004	ESH 2-Z5	Rohde & Schwarz	Mar. 13	Mar. 15	2 Years
E00005	ESH 2-Z5	Rohde & Schwarz	Jan. 12	Jan. 14	2 Years
E00060	HFH2-Z2	Rohde & Schwarz	Oct. 12	Oct. 16	4 Years
E00551	ESCS 30	Rohde & Schwarz	Nov. 12	Nov. 13	1 Years
E00011	VULB 9160	Schwarzbeck	---	---	---
E00013	VULB 9163	Schwarzbeck	Aug. 13	Aug. 15	2 Years
W00052	BBHA9120D	Schwarzbeck	Dec. 11	Dec. 15	4 Years
W00055	BBHA9170	Schwarzbeck	---	---	---
E00354	OATS	EMV TESTHAUS	Sep. 12	Sep. 13	1 Year

8 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (150 kHz to 30 MHz)	$\pm 4,1$ dB	2
Radiated emission open field (30 MHz to 300 MHz) (300 MHz to 1 GHz)	$\pm 5,4$ dB $\pm 4,7$ dB	2
Radiated emission anechoic chamber (above 1 GHz)	$\pm 4,5$ dB	2

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 measurands lies within the assigned range of values with a probability of 95 %.



9 Summary

Result according to the marked specifications:

PASS

The EUT does fulfill the general approval requirements mentioned.

FAIL

The EUT does not fulfill the general approval requirements mentioned.

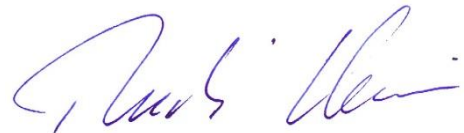
Straubing, 06.09.2013



Christian Kiermeier

Test engineer

EMV **TESTHAUS** GmbH



Rudolf Klein

Technical executive

EMV **TESTHAUS** GmbH

The equipment shall be retested to demonstrate continued compliance with the applicable requirements if any modifications or changes that could adversely affect the emanation characteristics of the equipment are made. The responsible party bears responsibility for the continued compliance of subsequently produced equipment.

Official of responsible party



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Revision: 2.0

Arnold & Richter
Cine Technik GmbH & Co. Betriebs KG
RF Module
EMIP2

130078-AU01+E01

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