Test Report

Customer:

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RF test report

120072-AU01+W01

Elatec GmbH

RFID reader

TWN4 Mifare NFC

EMV TESTHAUS

The test result refers exclusively to the model tested.

This report must not be copied without the written authorization by the lab.
Revision: 1.0

DAkkS
Deutsche Akkreditierungsstelle
D-PL-12155-01-01

EMV **TESTHAUS** GmbH

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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
Gustav-Hertz-Straße 35
94315 Straubing
Germany

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

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1 Test regulations

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: September 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
RSS-Gen Issue 3, December 2010	General Requirements and Information for the Certification of Radiocommunication Equimpment, published by Industry Canada
RSS-102 Issue 4, March 2010, updated December 2010	Radio Frequency Exposure Compliance of Radiocommunications Apperatus
RSS-210 Issue 8, December 2010	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada

1.1 Summary of test results

Standard	Test result
FCC CFR 47 Part 15	Passed
RSS-210 Issue 8 and RSS-Gen Issue 3	Passed

2 Equipment under Test (EUT)

Product type:	RFID reader
Model Name:	TWN4 Mifare NFC
Manufacturer:	Elatec GmbH
Serial number:	Xxxxxxxx
FCC ID:	WP5TWN4F
IC Canada:	7948A-TWN4F1
Application freq. band:	N/A
Frequency range:	125kHz / 13,56MHz
Operating frequency:	125kHz / 13,56MHz
Number of RF-channels:	1/1 (125 kHz/13,56MHz)
Modulation:	ASK
Antenna type:	PCB antenna
	☐ detachable ☒ not detachable
Power supply:	External power source nominal: 5.0 VDC (USB powered)
Temperature range:	-20°C to +55°C

Remark:
The tests was performed with 120V AC / 60Hz.

2.1 Photo documentation

For photos of the EUT, see annex B.
For photos taken during testing, see annex A.

2.2 Short description of the EUT

RFID reader 125kHz and 13,56MHz

2.3 Operation mode

The EUT was tested in the following operation modes:

preconfigured by manufacturer –
the RFID reader will be activated via RFID card for continuous transmission.

2.4 Configuration

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

Device	Model:	S/N
RFID reader	TWN4 Mifare NFC	xxxxxxxx
Notebook with PSU	Fujitsu Lifebook A531 PSU: ADP-65JH AD	YLDS0113893

Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
1	(EUT) USB cable / 2.0m / shielded	N/A
1	(Notebook) AC cable, unshielded, 1.5m	N/A

3 AC power line conducted emissions

according to CFR 47 Part 15, section 15.207

3.1 Test location

Description	Manufacturer	Inventory No.
Shielded chamber	Siemens - Matsushita	E00107

3.2 Test instruments

	Description	Manufacturer	Inventory No.
☐	ESCS 30	Rohde & Schwarz	E00003
☑	ESU 26	Rohde & Schwarz	W00002
☐	ESCI	Rohde & Schwarz	E00001
☐	ESH3 Z2	Rohde & Schwarz	E00028
☑	ESH 2-Z5	Rohde & Schwarz	E00004
☑	ESH 2-Z5	Rohde & Schwarz	E00005

3.3 Limits

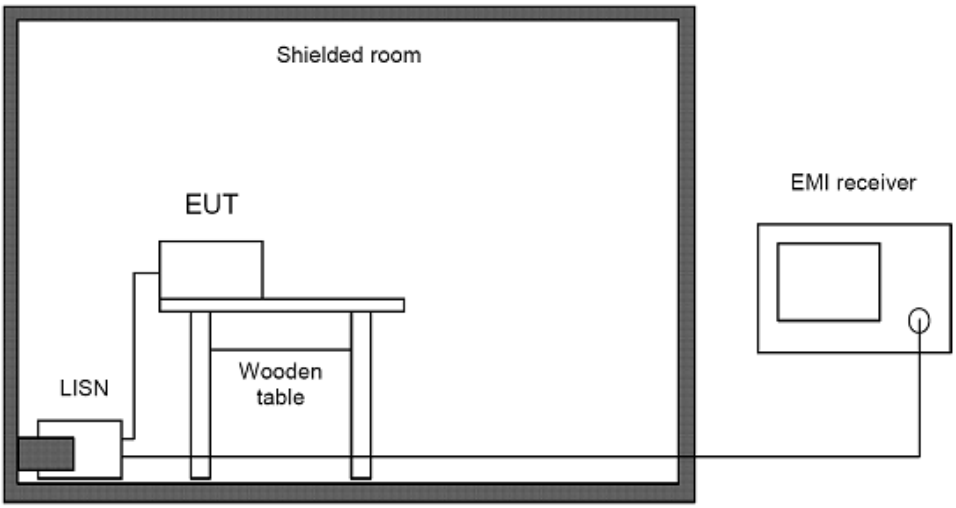
Frequency [MHz]	Quasi-peak [dBµV]	Avarage [dBµV]
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

3.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50 µH/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 form 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 form 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.

3.5 Test setup

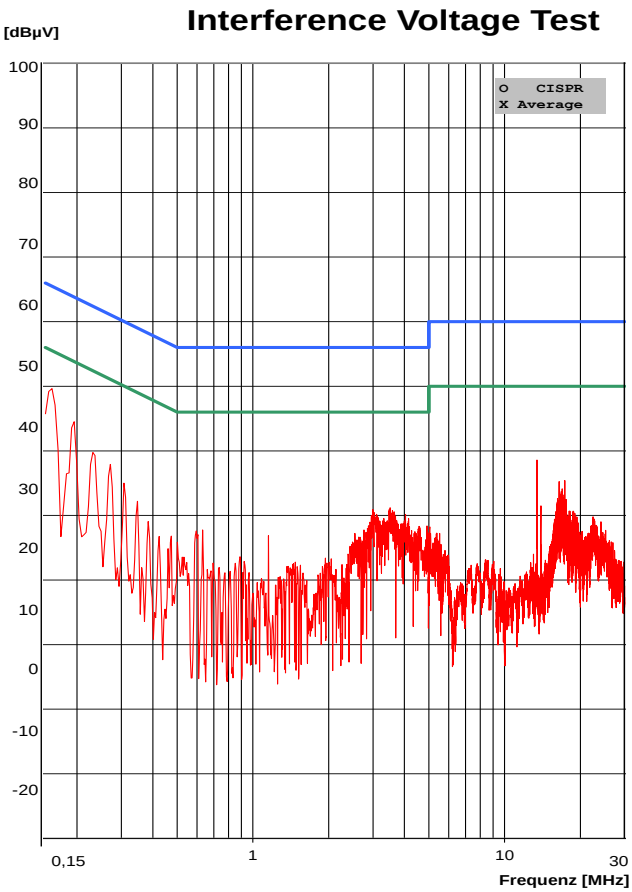


Picture 1: Outline of conducted emission test setup

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

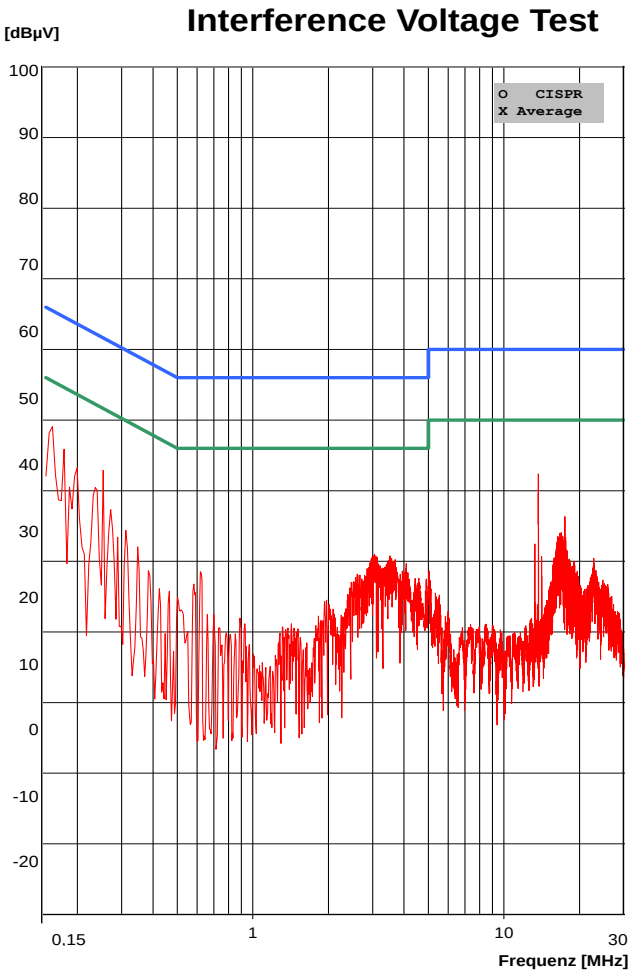
3.6 Test results

Temperature:	21°C	Humidity:	41%
Tested by:	Markus Biberger	Test date:	2013-03-25



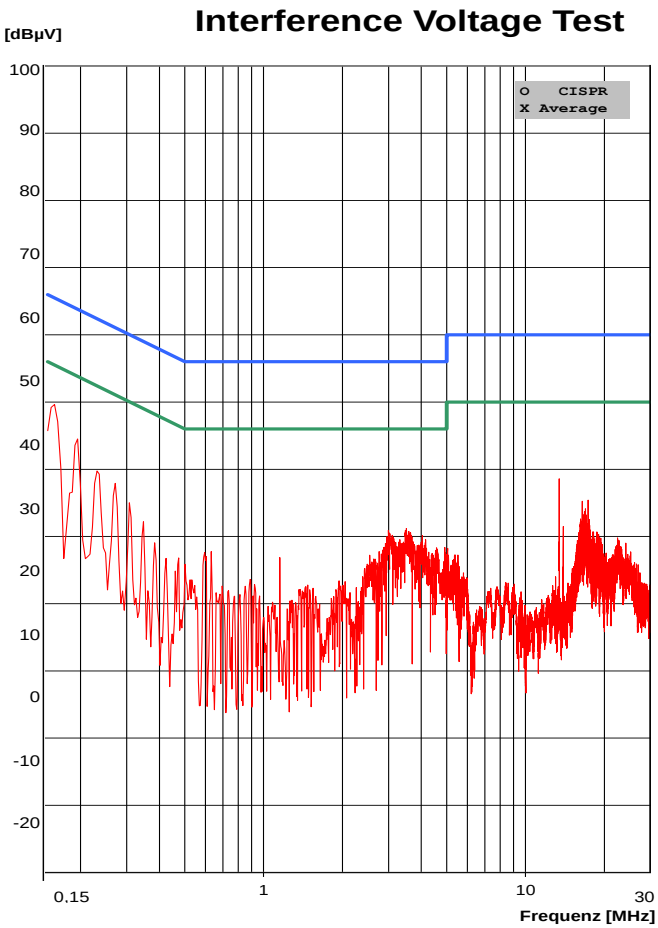
Picture 2: Conducted emission on mains, phase 1 (125 kHz)

Note: There was no measurement in QPK because all PK values are below the average limit line



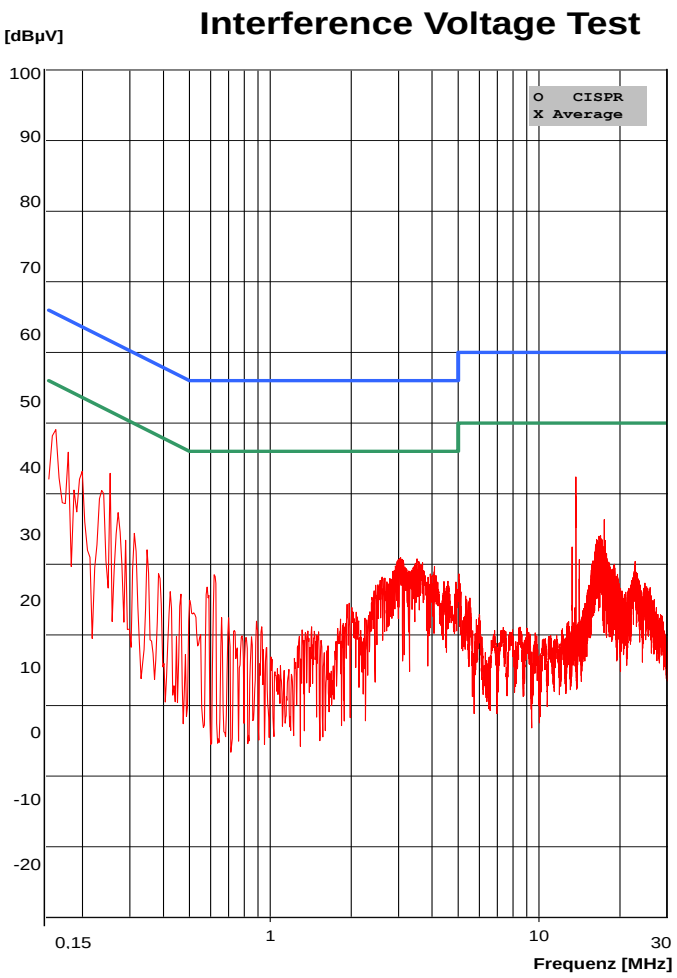
Picture 3: Conducted emission on mains, neutral (125 kHz),

Note: There was no measurement in QPK because all PK values are below the average limit line



Picture 4: Conducted emission on mains, neutral (13.56 MHz),

Note: There was no measurement in QPK because all PK values are below the average limit line



Picture 5: Conducted emission on mains, neutral (13.56 MHz),

Note: There was no measurement in QPK because all PK values are below the average limit line

4 Radiated emission measurement (<1 GHz)

according to CFR 47 Part 15, section 15.205(a), 15.209(a), 15.225(a, e)

4.1 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

4.2 Test instruments

	Description	Manufacturer	Inventory No.
☑	ESCS 30 (FF)	Rohde & Schwarz	E00003
☐	ESU 26	Rohde & Schwarz	W00002
☑	ESCI (CDC)	Rohde & Schwarz	E00001
☑	VULB 9163 (FF)	Schwarzbeck	E00013
☑	VULB 9160 (CDC)	Schwarzbeck	E00011
☐	HFH2-Z2	Rohde & Schwarz	E00060
☑	Feedline OATS	Huber & Suhner	200024

4.3 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 [µV/m]	Field strength [dBµV/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

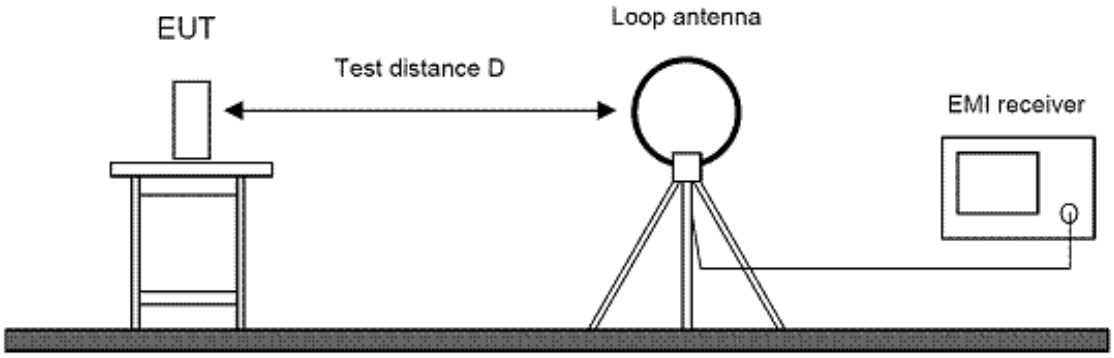
In case the emission fall within the restricted band specified on 15.225 limit in the table below has to be followed.

Frequency [MHz]	Field strength Fs [µV/m]	Field strength [dBµV/m]	Measurement distance d [m]
13.553 – 13.567	15848	84	30
13.401 – 13.553	334	50.47	30
13.567 – 13.710	334	50.47	30

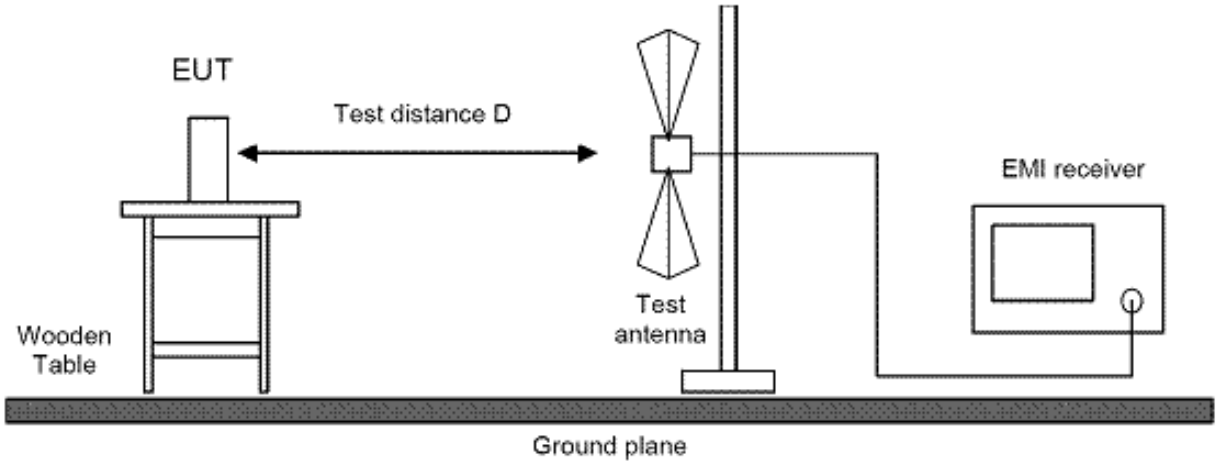
4.4 Test procedure

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° / 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 oft he receiver. Antenna height was not changed during this test.

4.5 Test setup



Picture 6: Test setup for radiated emission measurement (< 30 MHz)



Picture 7: Test setup for radiated emission measurement (< 1 GHz)

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.

4.8 Test results

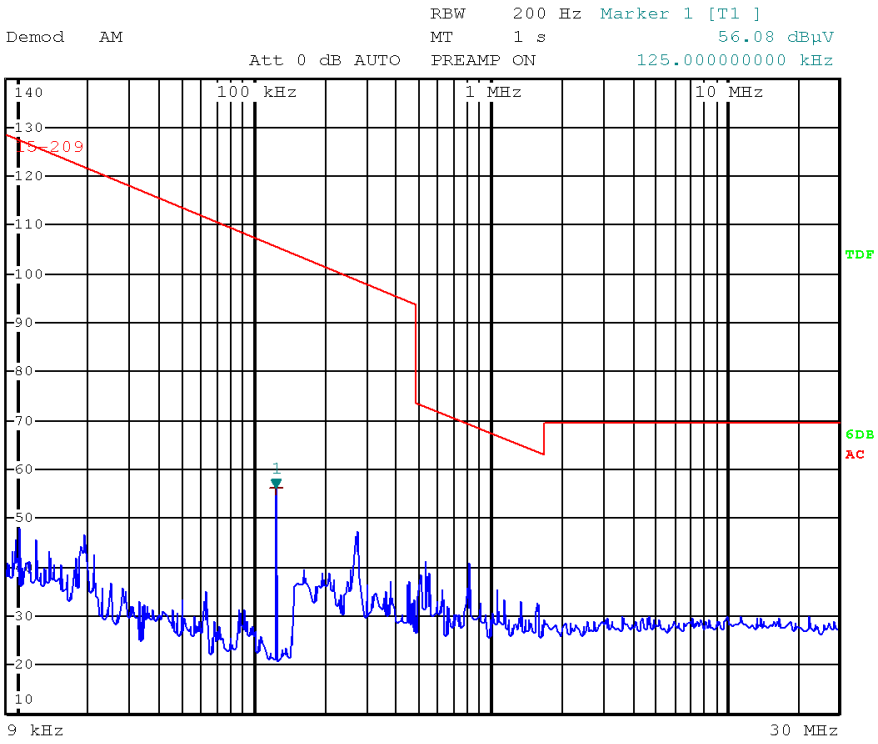
Transmit mode

Temperature:	21°C	Humidity:	40%
Tested by:	M. Biberger	Test date:	2013-03-25

Radiated Emission Measurement 9 kHz – 30 MHz

Test procedure

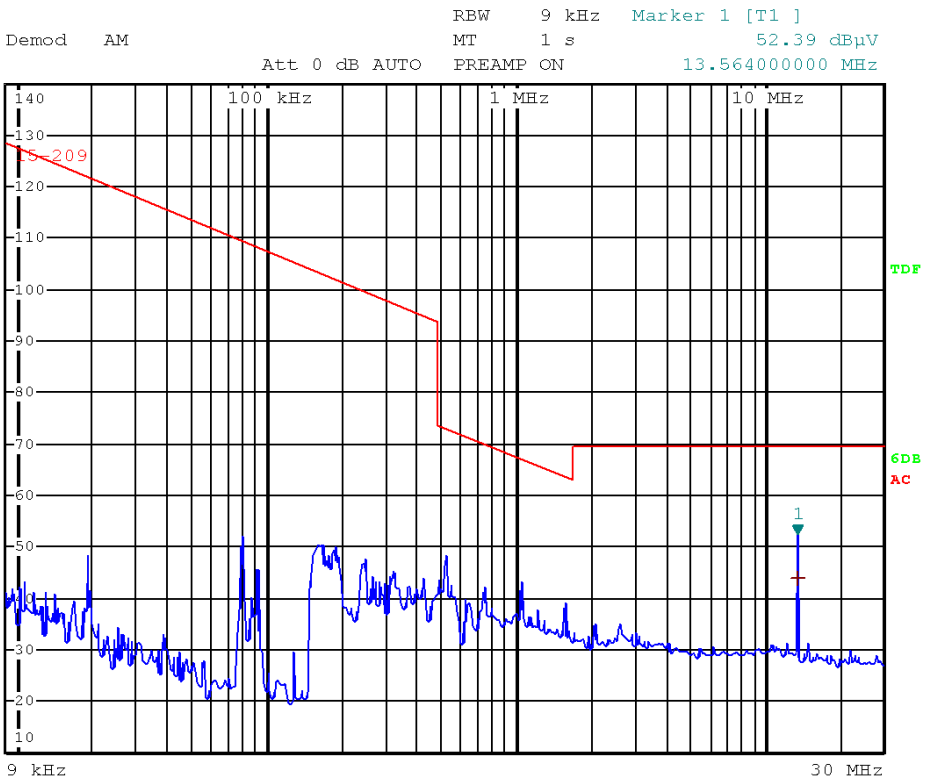
The EUT was placed in a full anechoic chamber and the spurious emissions testing was performed in accordance with ANSI C63.4, FCC Part 15, Subpart C. The measurement distance was 3 m.



Picture 8: Radiated emission 9 kHz – 30 MHz @ 3m distance (125 kHz)

Frequency (MHz)	Reading (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
0.125	56,25	QP	80	**-23.75**	25,66	-49,41	PASS

Measured value = 56.25 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 56,25 dBµV/m @ 3 m - 80 dB = **-23.75 dBµV/m @ 300 m**

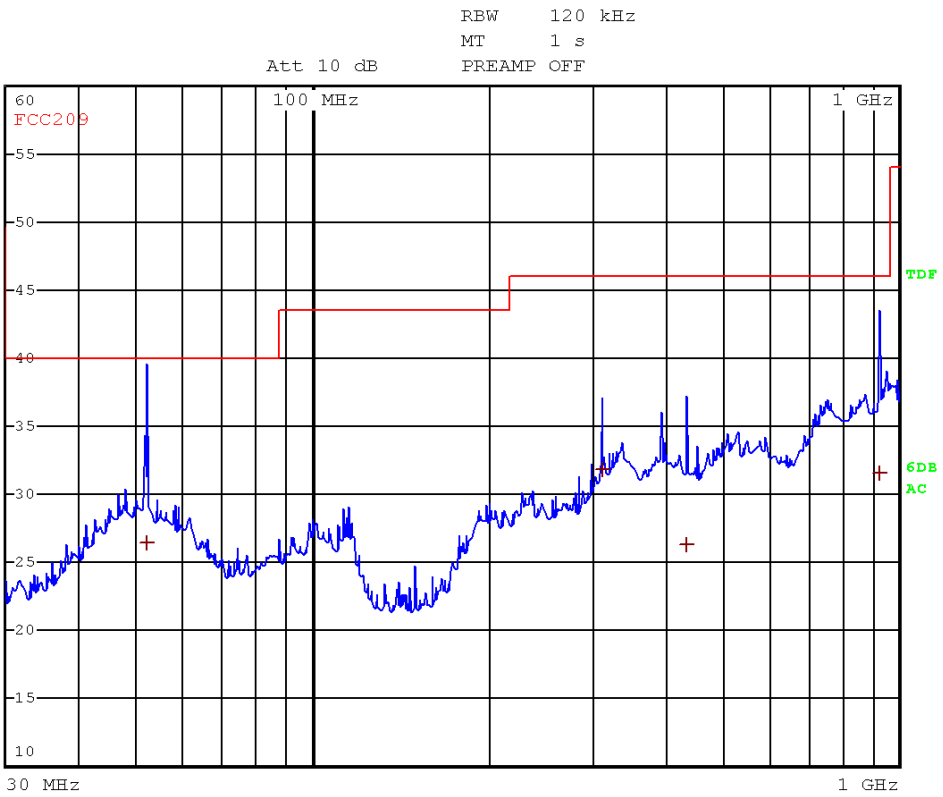


Picture 9: Radiated emission 9 kHz – 30 MHz @ 3m distance (13.56 MHz)

Frequency (MHz)	Reading (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
13.56	44.08	QP	40	**4.08**	84	-79.92	PASS

Note:
Measured value = 44.08 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 44.08 dBµV/m @ 3 m - 40 dB = **4.08 dBµV/m @ 30 m**

Radiated Emission Measurement 30 MHz – 1000 MHz

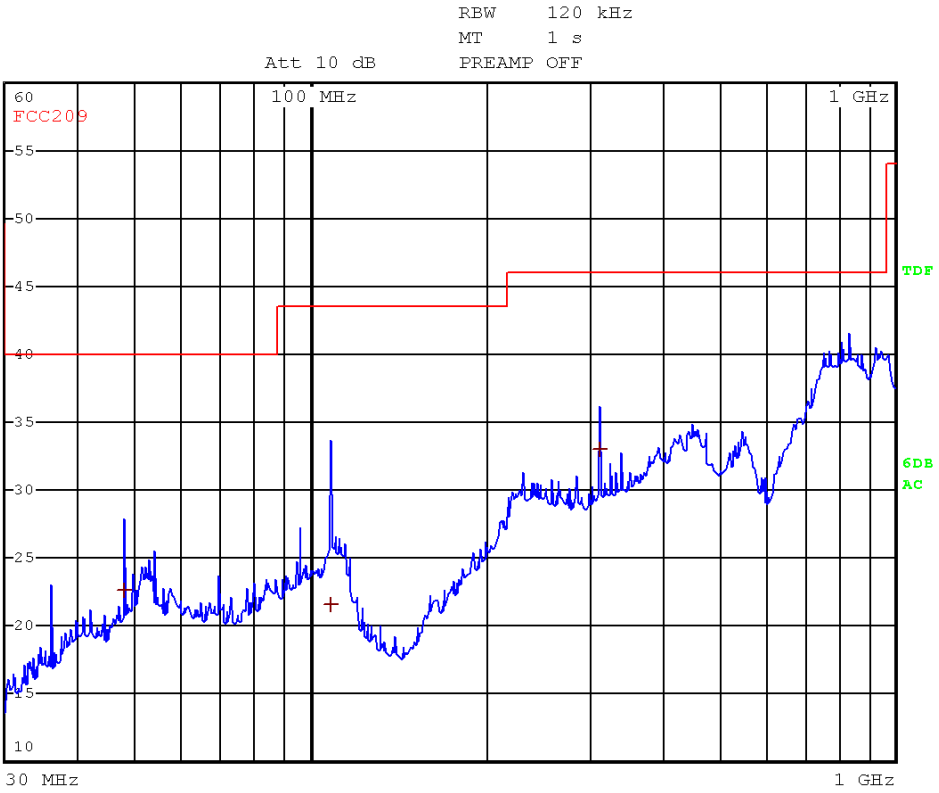


EDIT PEAK LIST (Final Measurement Results)

Trace1: FCC209
Trace2: ---
Trace3: ---

TRACE		FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	52.24 MHz	26.46	-13.53
1	Quasi Peak	311.88 MHz	31.78	-14.21
1	Quasi Peak	433.84 MHz	26.33	-19.66
1	Quasi Peak	925.64 MHz	31.55	-14.44

Picture 10: Radiated emission table 30 MHz – 1000MHz @ 3m distance, Vertical (13.56MHz)

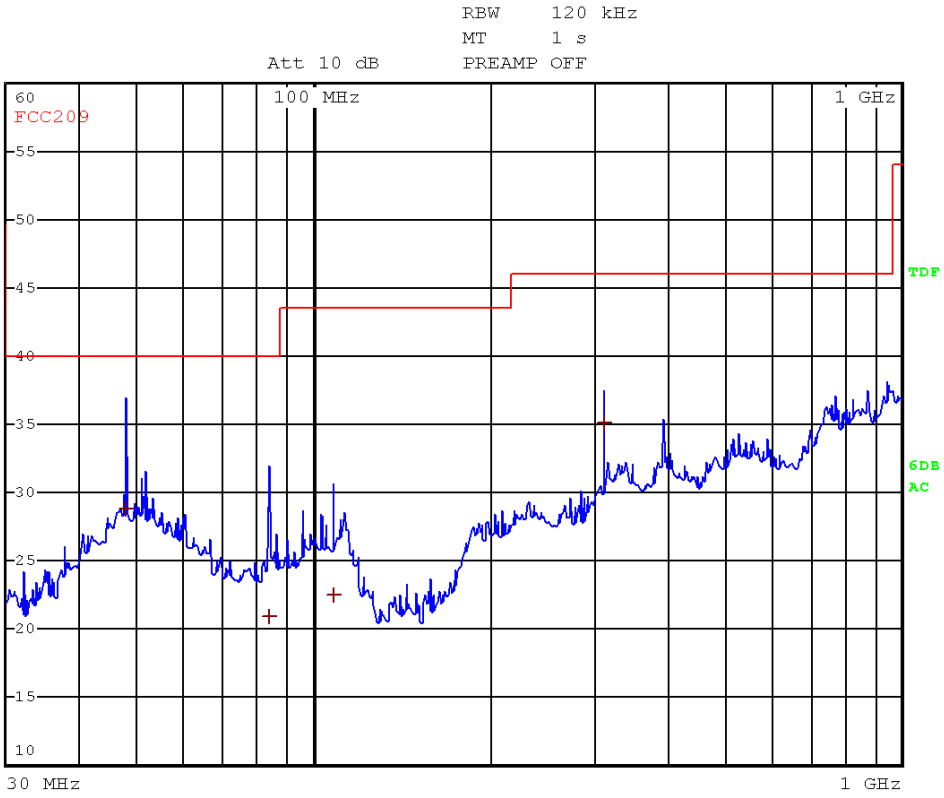


EDIT PEAK LIST (Final Measurement Results)

Trace1: FCC209
Trace2: ---
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	48 MHz	22.66	-17.33
1	Quasi Peak	108 MHz	21.67	-21.82
1	Quasi Peak	311.88 MHz	32.98	-13.02

Picture 11: Radiated emission table 30 MHz – 1000MHz @ 3m distance, Horizontal (13.56MHz)

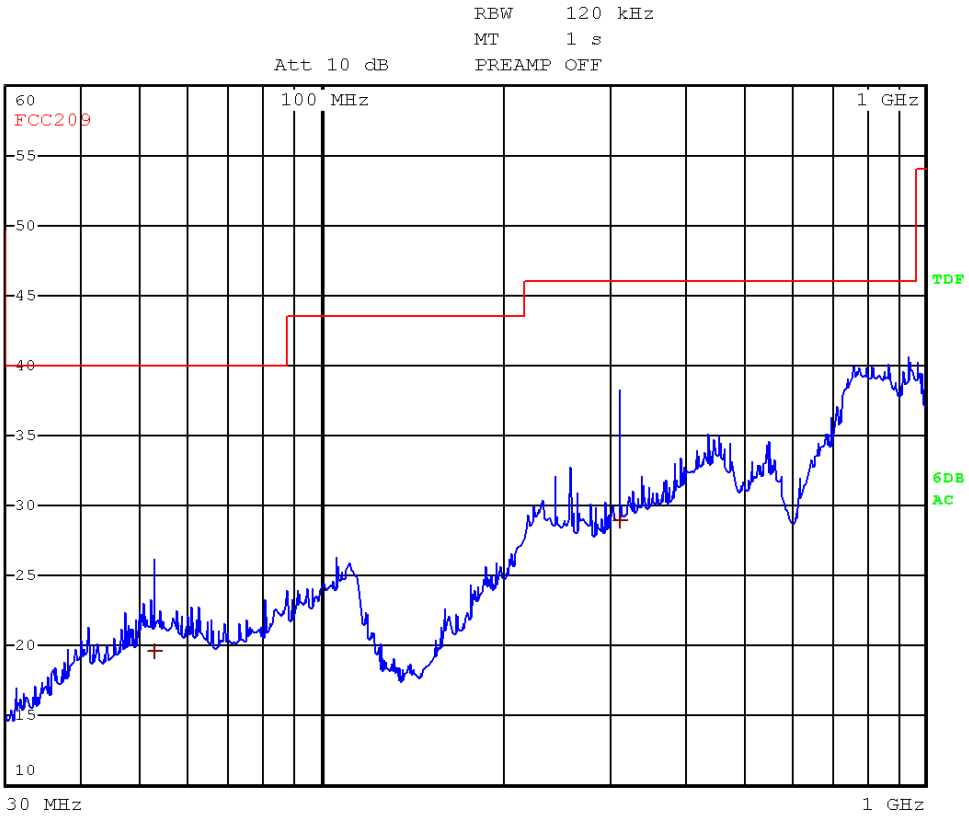


EDIT PEAK LIST (Final Measurement Results)

Trace1: FCC209
Trace2: ---
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	48.04 MHz	28.78	-11.21
1	Quasi Peak	84 MHz	20.90	-19.10
1	Quasi Peak	108 MHz	22.54	-20.95
1	Quasi Peak	311.88 MHz	35.12	-10.87

Picture 12: Radiated emission table 30 MHz – 1000MHz @ 3m distance, Vertical (125 kHz)



EDIT PEAK LIST (Final Measurement Results)

Trace1: FCC209
Trace2: ---
Trace3: ---

	TRACE	FREQUENCY	LEVEL dBµV	DELTA LIMIT dB
1	Quasi Peak	52.88 MHz	19.68	-20.32
1	Quasi Peak	311.88 MHz	28.98	-17.01

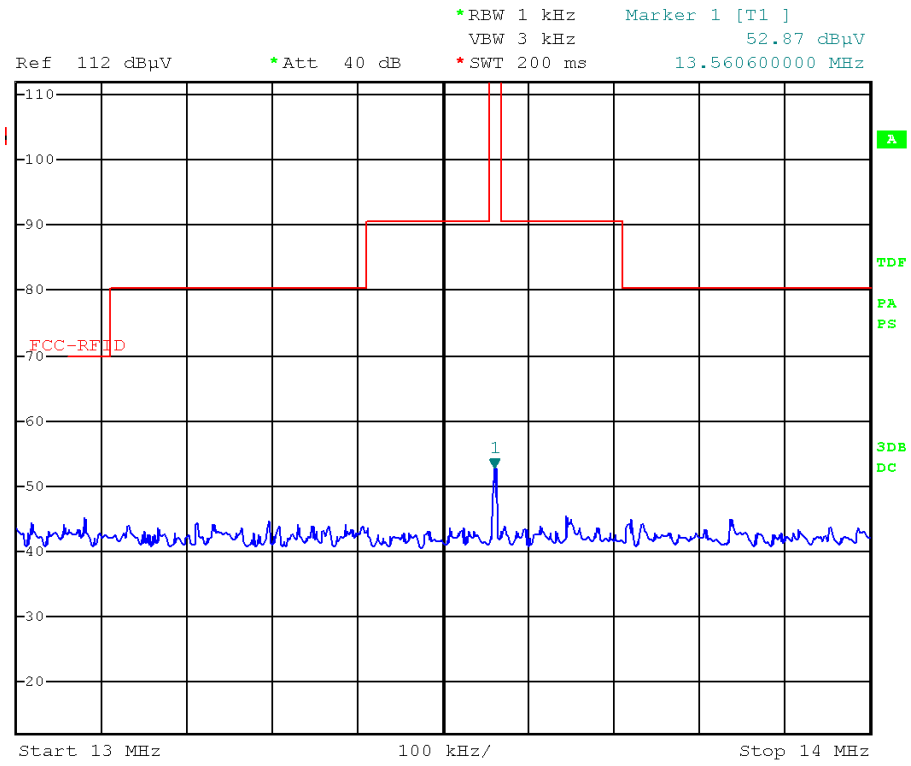
Picture 13: Radiated emission table 30 MHz – 1000MHz @ 3m distance, Horizontal (125 kHz)

Emission Bandwidth

Test procedure

The EUT was placed in a full anechoic chamber and the spurious emissions testing was performed in accordance with ANSI C63.4, FCC Part 15.225, Subpart C. The measurement distance was 3 m. The intentional radiator frequency and band edge frequencies inolves quasi-peak detection were then maximized. Maximizing a frequency involves find the angle of the highest emission level by rotating the EUT 360 degrees. The antenna, which was fixed at 1 meter height, was rotated until the highest emission levels found.

Test result



Picture 14: Lower – Upper band edge at 13.56 MHz @ 3m distance

Temperature:	20°C	Humidity:	40%
Tested by:	M. Biberger	Test date:	2013-03-25

Frequency Stability

Test procedure

The Frequency Stability was measured using the radiated signals from the EUT so that the measurement equipment would not load the radio frequency circuits. A frequency counter was used for the frequency stability measurments. A close field probe was attached to the counter and placed near the antenna of the reader for measurement. The Reader was put into a continiuous output mode through instructions from the host computer. The freqeuncy was measured while the input DC Power to the intenional radiator was varied over the required input range.

Test result

Temperature:	20°C	Humidity:	40%
Tested by:	M. Biberger	Test date:	2013-03-22

Carrier Frequency	Voltage range	Frequency change
13,56 MHz	Nominal: 5 V DC	--
13,56 MHz	4.25 V DC (85%)	< 0.01 %
13,56 MHz	5.75 V DC (115%)	< 0.01 %

Carrier Frequency	Temperature range	Frequency change
13,56 MHz	-20 °C	< 0.01 %
13,56 MHz	+50°C	< 0.01 %

5 Occupied Bandwidth (99%)

according to RSS Gen Issue 2, section 4.6.1

5.1 Test location

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

5.2 Test Instruments

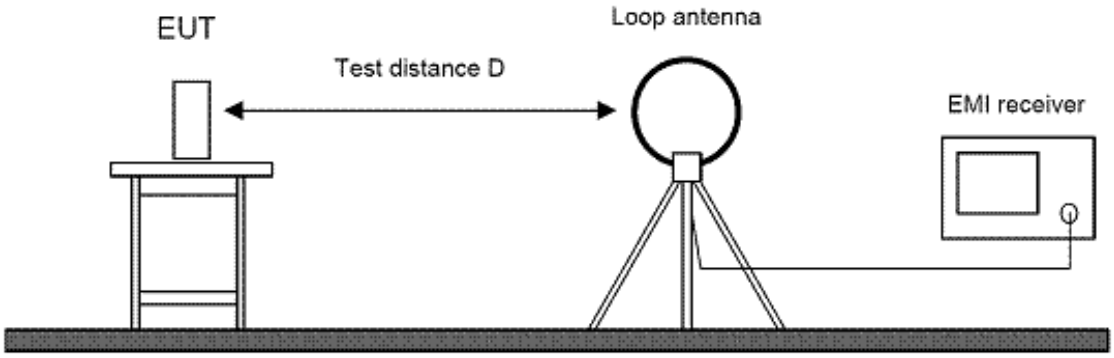
	Description	Manufacturer	Inventory No.
☑	ESCS 30 (FF)	Rohde & Schwarz	E00003
☐	ESU 26	Rohde & Schwarz	W00002
☑	ESCI (CDC)	Rohde & Schwarz	E00001
☐	VULB 9163 (FF)	Schwarzbeck	E00013
☐	VULB 9160 (CDC)	Schwarzbeck	E00011
☑	HFH2-Z2	Rohde & Schwarz	E00060
☑	Feedline OATS	Huber & Suhner	200024

5.3 Test method to demonstrate compliance

The EUT has no detachable antenna therefore the radiated method was used

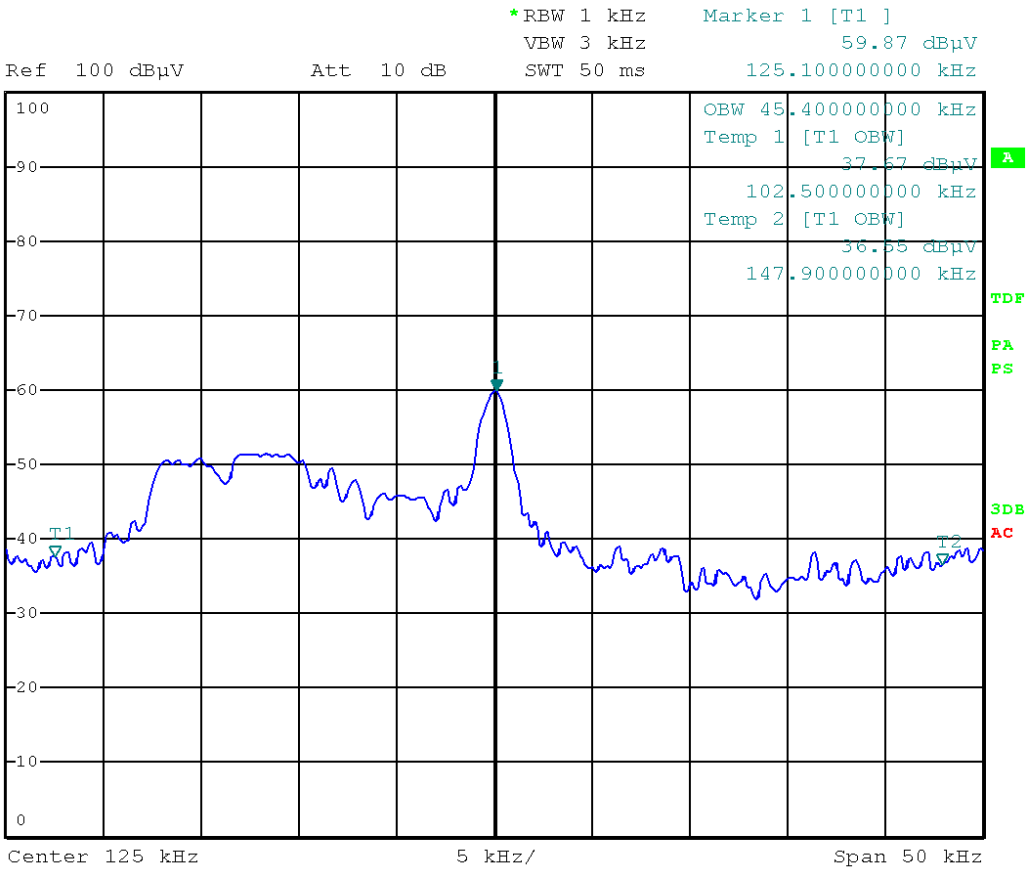
If not specified in the applicable RSS the occupied bandwidth is measured as the 99% emission bandwidth.
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth.
The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.

5.4 Test setup



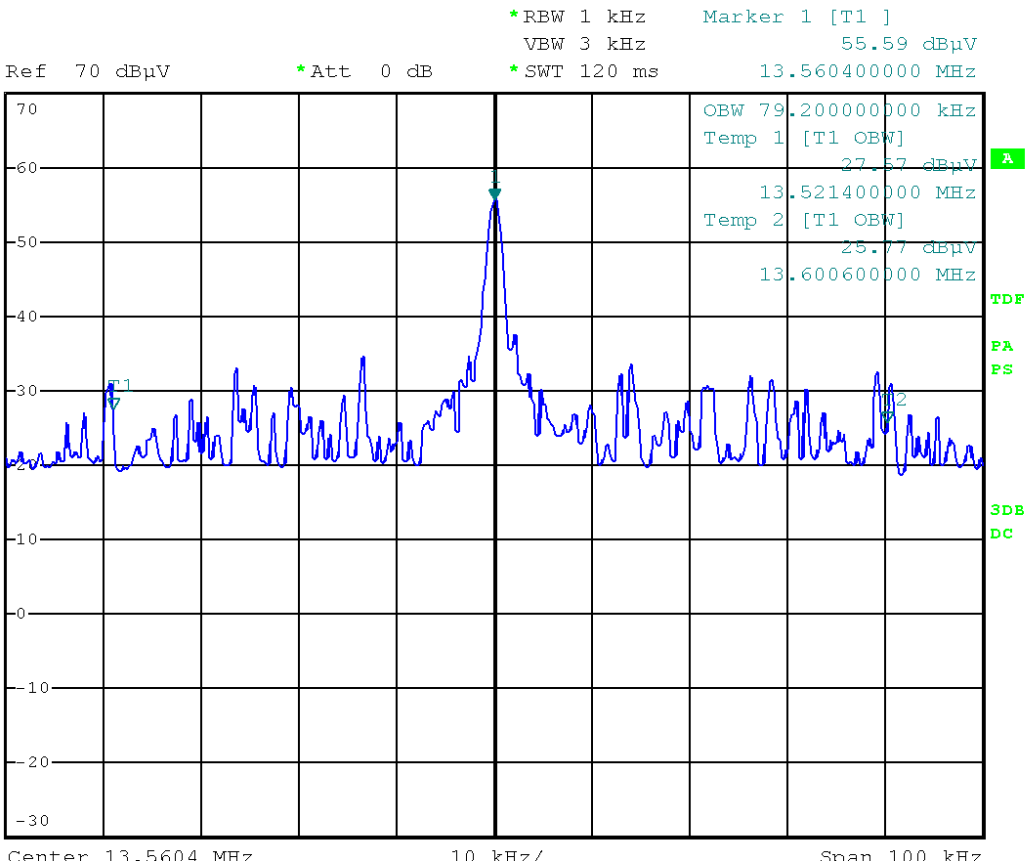
Picture 15: Test setup for radiated emission measurement (< 30 MHz)

5.5 Test results



Picture 16: Occupied bandwidth 99% (125kHz)

Occupied Bandwidth: **45,40 kHz**



Picture 17: Occupied bandwidth 99% (13,56MHz)

Occupied Bandwidth: **79,20 kHz**

6 Radiated emission measurement (<1 GHz)

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

Remark:

This measurement is not applicable becauser there are no internal frequencies higher than 108 MHz!

7 Equipment calibration status

Inventory Number	Equipment type	Model Number	Manufacturer	Last calibration	Next calibration	Cycle of calibration
W00002	Test receiver	ESU26	Rohde & Schwarz	Dec 11	Dec 13	2 Years
E00001	Test receiver	ESCI	Rohde & Schwarz	Jul 11	Jul 13	2 Years
E00003	Test receiver	ESCS 30	Rohde & Schwarz	Dec 12	Dec 13	1 Year
E00004	NNB	ESH 2-Z5	Rohde & Schwarz	Jan. 11	Oct. 13	2 Years
E00005	NNB	ESH 2-Z5	Rohde & Schwarz	Dec 11	Dec 13	2 Years
E00060	Antenna	HFH2-Z2	Rohde & Schwarz	Dec 11	Dec 13	2 Years
E00012	Antenna	VULB 9163	Schwarzbeck	Mar. 12	Apr. 13	1 Years

Table 1: Equipment Calibration status

8 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 %.

9 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, March 25, 2013

Markus Biberger	Rudolf Klein
EMC Test Engineer	General Manager / EMV **TESTHAUS** GmbH