Test Report

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RF test report

140714-AU01+W01

Hottinger Baldwin Messtechnik GmbH

Torque meter

T40S7
T40S8
T40S9

EMV TESTHAUS

The test result refers exclusively
to the tested model.
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EMV **TESTHAUS** GmbH
Revision: 1.0

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

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Accreditation:

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

FCC facility registration number: 221458
Test Firm Type “2.948 listed”: Valid until 2017-04-22
Test Firm Type “accredited”: Valid until 2015-06-11
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BnetzA-CAB-02/21-02/04 Valid until 2018-11-27

Industry Canada test site number: 3472A-1
Registration expiry date: 2015-10-02

Test Laboratory:

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

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1 Test regulations

47 CFR Part 2: 10-2013	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
47 CFR Part 15: 10-2013	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
ICES-003 Issue 5, August 2012	Spectrum Management and Telecommunications Interference-Causing Equipment Standard Information Technology Equipment (ITE) – Limits and methods of measurement
RSS-Gen Issue 4, November 2014	Spectrum Management and Telecommunications Radio Standards Specification General Requirements for Compliance of Radio Apparatus
RSS-102 Issue 4, March 2010, updated December 2010	Spectrum Management and Telecommunications Radio Standards Specification Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
RSS-210 Issue 8, December 2010	Spectrum Management and Telecommunications Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

1.1 Summary of test results

Standard	Test result
47 CFR Part 15, sections 15.207 and 15.209	Passed
RSS-210 Issue 8 clause 2 (with appropriate references to RSS-Gen Issue 4)	Passed

2 Equipment under Test (EUT)

Product type:	Torque meter
Model Name:	T40S7
	T40S8
	T40S9
Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Serial number:	T40S7: 181312019
	T40S8: 183370027
	T40S9: 141630023
FCC ID:	2ADAT-T40S7TOS9
IC certification number:	12438A-T40S7TOS9
Application frequency band:	Not applicable (general requirements apply)
Frequency range:	522.85 kHz -> wireless power supply 1.22 MHz -> wireless data transfer
Operating frequency:	522.85 kHz -> wireless power supply 1.22 MHz -> wireless data transfer
Number of RF-channels:	2
Modulation:	ASK -> wireless power supply PSK -> wireless data transfer
Antenna types:	loop antenna
	☐ detachable ☒ not detachable
Power supply:	External power source nominal: 24.0 VDC
Temperature range:	-20°C to +85°C

Remark:
The tests were performed with 120V AC / 60Hz at mains input of DC power supply.

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

The EUT is a torque meter with wireless measurement data transfer and wireless power supply. The measurement data transfer goes from rotor to stator. The wireless power supply goes the other way round. In the field EUT is part of an engine test bench.

2.3 Operation mode

The EUT is configured to start wireless power supply, measurement and data transfer as soon as supplied by external power.

The position in which the EUT was tested is documented in annex A.

2.4 Configuration

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

Device	Model:	Serial or inventory number
Torque meter	T40S7	181312019
Torque meter	T40S8	183370027
Torque meter	T40S9	141630023
DC power supply	TRIO-PS/1AC/24DC/5 120 VAC / 60 Hz -> 24 VDC	3013539322
Data cable termination box	hbm test device (for radiated measurements)	n/a
AC power source	CHROMA 61602	616020002099

2.5 Used cables

Numbers:	Description: (type / lengths / remarks)	Serial No
1	7-pin shielded cable with 2 screw connectors, 3 m (for radiated measurements)	n/a
1	7-pin shielded cable with 1 screw connector and DC plug, 3 m (for AC power line conducted emissions)	n/a

3 AC power line conducted emissions

according to 47 CFR Part 15, section 15.207, and RSS-210, section 2.1 with RSS-Gen, section 8.8

3.1 Test location

Description	Manufacturer	Inventory No.
Shielded room	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
☒	ESH2-Z5	Rohde & Schwarz	E00004
☐	ESH2-Z5	Rohde & Schwarz	E00005

3.3 Limits

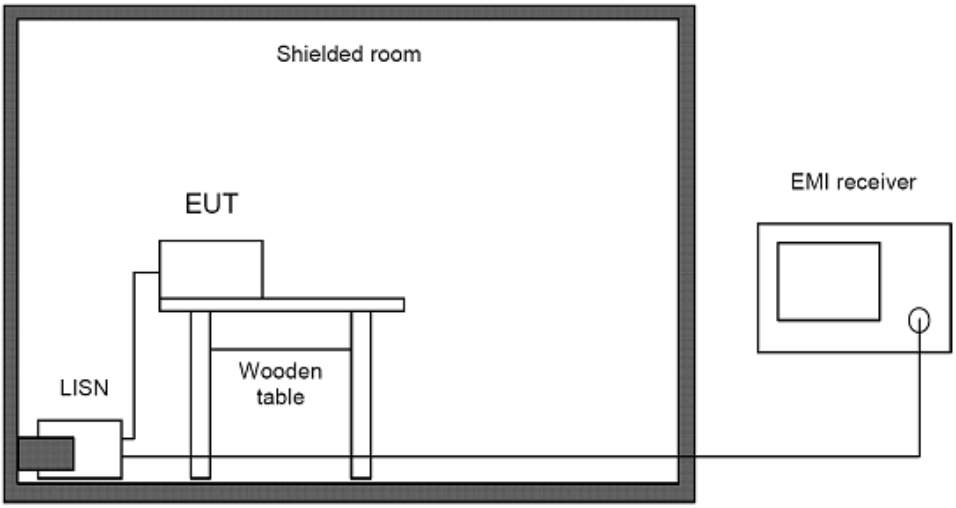
Frequency [MHz]	Quasi-peak [dBµV]	Avarage [dBµV]
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50

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 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 form 0.15 MHz to 30 MHz was scanned.
5. After that all peaks values with less margin 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 then these values were re-measured with average detector.
7. These measurements were done on all power lines.

According to ANSI C63.4, section 13.3.1 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

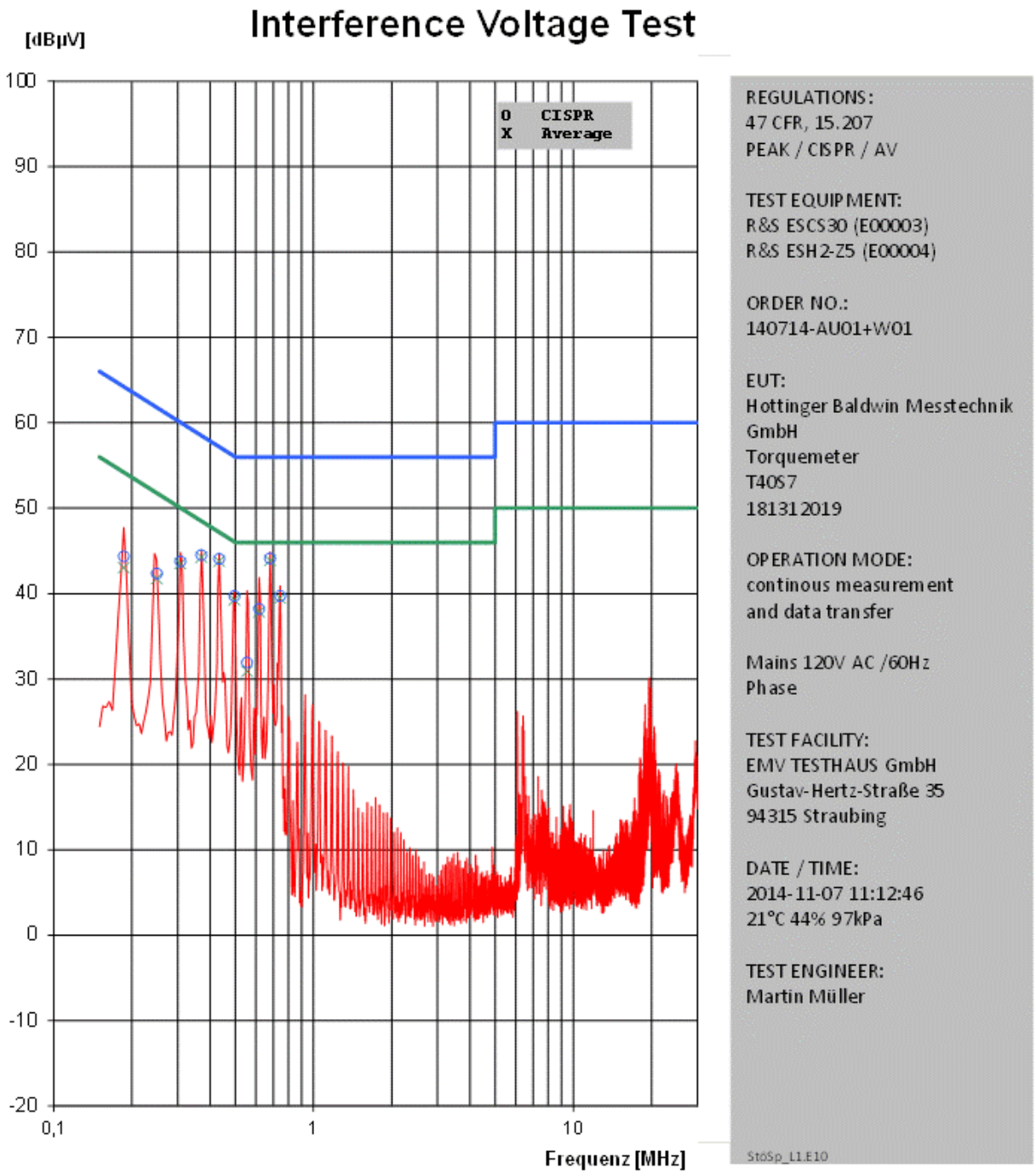


Picture 1: Outline of conducted emission test setup

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

3.6 Test results - T40S7

Temperature:	21°C	Humidity:	44%
Tested by:	Martin Müller	Test date:	2014-11-07

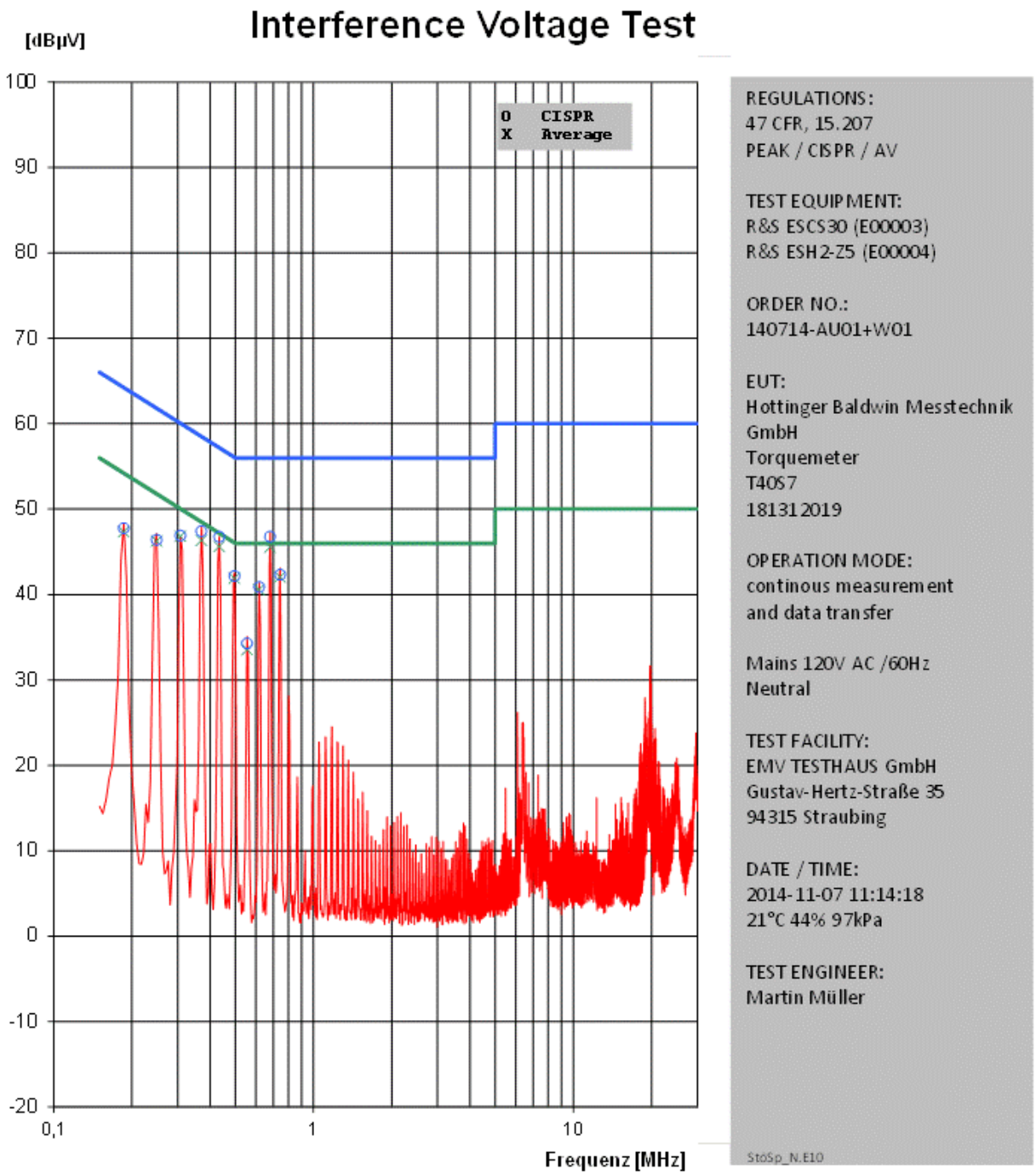


Picture 2: T40S7 - Graphic - Conducted emission on mains, phase 1 (without termination)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	44,4	64,2	19,9	43,0	54,2	11,2	0,0	
0,25	42,3	61,8	19,4	41,7	51,8	10,0	0,0	
0,31	43,8	60,0	16,3	43,5	50,0	6,6	0,0	
0,37	44,5	58,5	14,0	44,3	48,5	4,2	0,0	
0,43	44,0	57,2	13,1	43,8	47,2	3,4	0,0	
0,50	39,7	56,1	16,4	39,3	46,1	6,8	0,0	
0,56	31,9	56,0	24,1	30,9	46,0	15,1	0,0	
0,62	38,2	56,0	17,8	37,9	46,0	8,2	0,0	
0,68	44,1	56,0	11,9	43,9	46,0	2,1	0,0	
0,74	39,7	56,0	16,3	39,5	46,0	6,5	0,0	

Picture 3: T40S7 - Table - Conducted emission on mains, phase 1 (without termination)



Picture 4: T40S7 - Graphic - Conducted emission on mains, neutral (without termination)

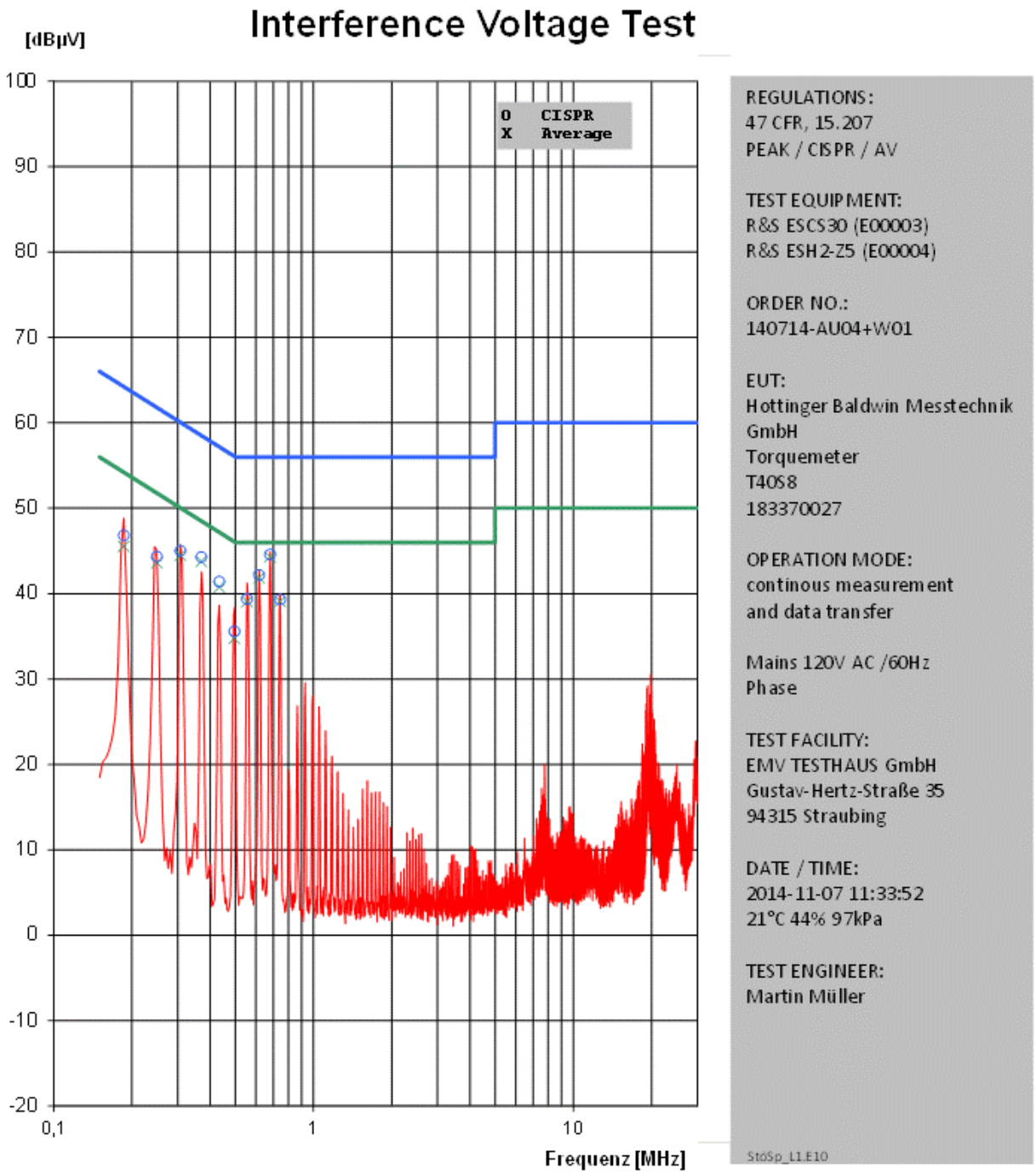
Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	47,8	64,2	16,5	47,4	54,2	6,9	0,0	
0,25	46,4	61,8	15,4	46,2	51,8	5,6	0,0	
0,31	46,9	60,0	13,1	46,8	50,0	3,2	0,0	
0,37	47,4	58,5	11,1	46,3	48,5	2,1	0,0	
0,43	46,8	57,2	10,4	45,6	47,2	1,6	0,0	
0,50	42,2	56,1	13,9	41,9	46,1	4,2	0,0	
0,56	34,3	56,0	21,8	33,5	46,0	12,5	0,0	
0,62	40,9	56,0	15,1	40,6	46,0	5,4	0,0	
0,68	46,8	56,0	9,2	45,5	46,0	0,5	0,0	
0,74	42,3	56,0	13,7	42,1	46,0	4,0	0,0	

Picture 5: T40S7 - Table - Conducted emission on mains, neutral (without termination)

3.7 Test results - T40S8

Temperature:	21°C	Humidity:	44%
Tested by:	Martin Müller	Test date:	2014-11-07

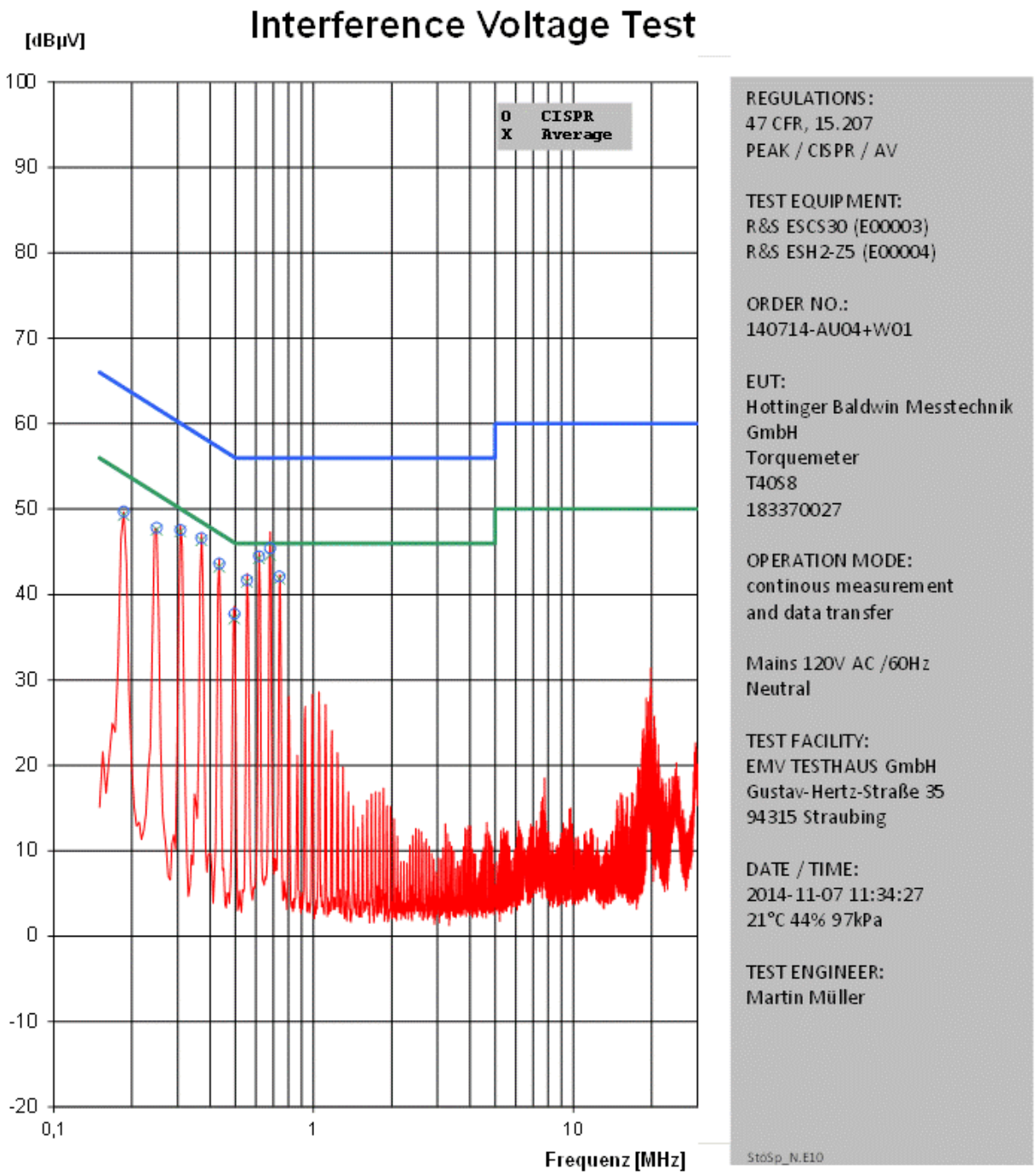


Picture 6: T40S8 - Graphic - Conducted emission on mains, phase 1 (without termination)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	46,8	64,2	17,4	45,5	54,2	8,7	0,0	
0,25	44,3	61,8	17,5	43,6	51,8	8,2	0,0	
0,31	45,0	60,0	15,0	44,5	50,0	5,6	0,0	
0,37	44,3	58,5	14,2	43,8	48,5	4,7	0,0	
0,43	41,4	57,2	15,8	40,7	47,2	6,4	0,0	
0,50	35,6	56,1	20,5	34,7	46,1	11,3	0,0	
0,56	39,4	56,0	16,7	39,1	46,0	7,0	0,0	
0,62	42,2	56,0	13,8	41,8	46,0	4,2	0,0	
0,68	44,6	56,0	11,4	44,3	46,0	1,7	0,0	
0,74	39,3	56,0	16,7	39,1	46,0	6,9	0,0	

Picture 7: T40S8 - Table - Conducted emission on mains, phase 1 (without termination)



Picture 8: T40S8 - Graphic - Conducted emission on mains, neutral (without termination)

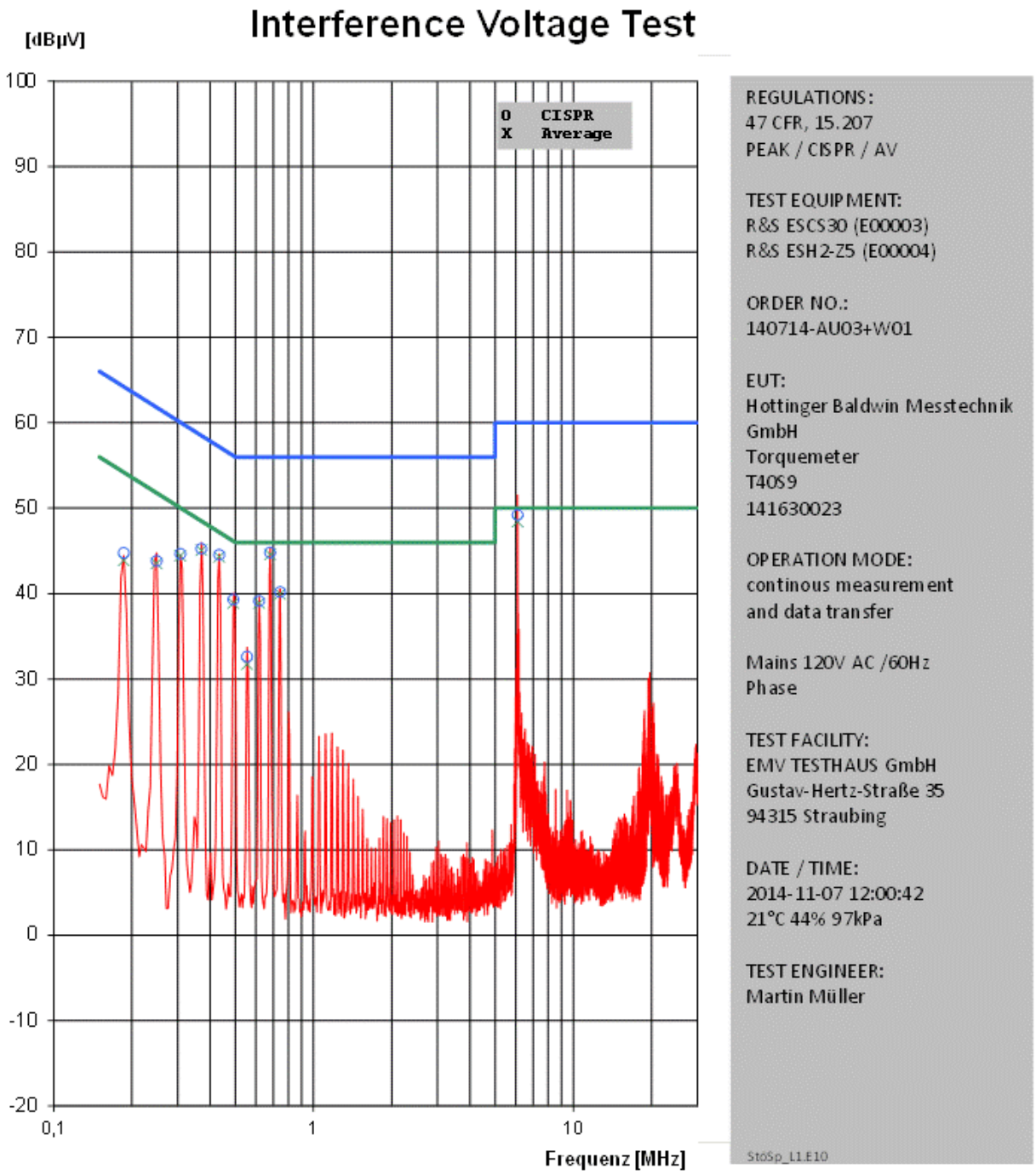
Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	49,7	64,2	14,5	49,3	54,2	4,9	0,0	
0,25	47,8	61,8	14,0	47,6	51,8	4,2	0,0	
0,31	47,5	60,0	12,5	47,4	50,0	2,7	0,0	
0,37	46,6	58,5	11,9	46,3	48,5	2,2	0,0	
0,43	43,6	57,2	13,6	43,2	47,2	4,0	0,0	
0,50	37,7	56,1	18,3	37,2	46,1	8,9	0,0	
0,56	41,7	56,0	14,3	41,5	46,0	4,5	0,0	
0,62	44,5	56,0	11,5	44,2	46,0	1,8	0,0	
0,68	45,4	56,0	10,6	44,6	46,0	1,4	0,0	
0,74	42,1	56,0	13,9	41,8	46,0	4,2	0,0	

Picture 9: T40S8 - Table - Conducted emission on mains, neutral (without termination)

3.8 Test results - T40S9

Temperature:	21°C	Humidity:	44%
Tested by:	Martin Müller	Test date:	2014-11-07

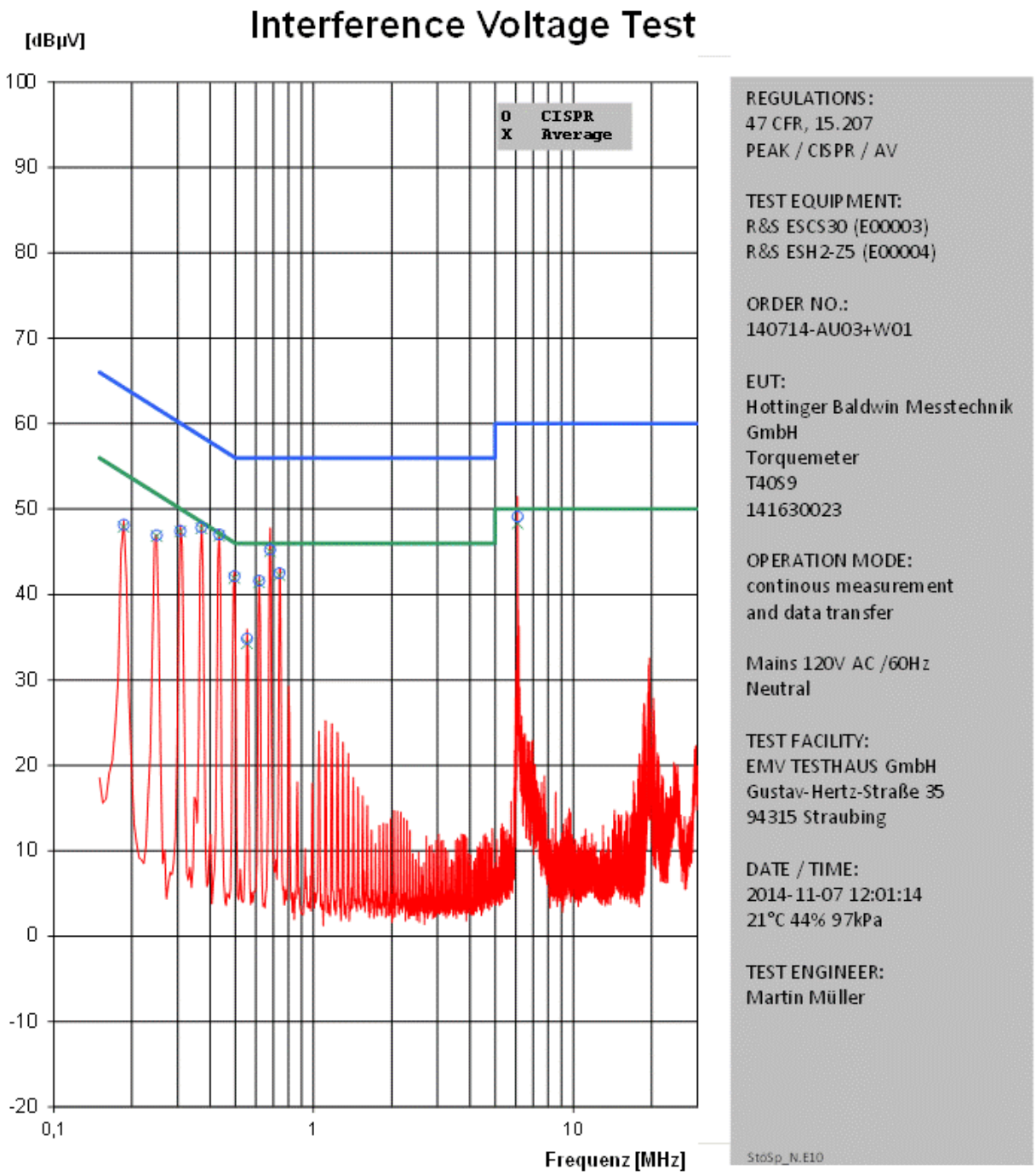


Picture 10: T40S9 - Graphic - Conducted emission on mains, phase 1 (without termination)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	44,8	64,2	19,5	43,9	54,2	10,3	0,0	
0,25	43,8	61,8	18,0	43,5	51,8	8,3	0,0	
0,31	44,6	60,0	15,4	44,4	50,0	5,6	0,0	
0,37	45,2	58,5	13,2	45,1	48,5	3,4	0,0	
0,43	44,5	57,2	12,7	44,3	47,2	2,9	0,0	
0,49	39,3	56,1	16,9	38,9	46,1	7,3	0,0	
0,56	32,6	56,0	23,4	31,7	46,0	14,3	0,0	
0,62	39,1	56,0	16,9	38,9	46,0	7,1	0,0	
0,68	44,8	56,0	11,2	44,6	46,0	1,4	0,0	
0,74	40,2	56,0	15,8	39,9	46,0	6,1	0,0	
6,10	49,2	60,0	10,8	48,4	50,0	1,6	0,0	

Picture 11: T40S9 - Table - Conducted emission on mains, phase 1 (without termination)



Picture 12: T40S9 - Graphic - Conducted emission on mains, neutral (without termination)

Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,19	48,2	64,2	16,1	47,9	54,2	6,3	0,0	
0,25	46,9	61,8	14,9	46,8	51,8	5,0	0,0	
0,31	47,4	60,0	12,6	47,4	50,0	2,7	0,0	
0,37	47,9	58,5	10,6	47,7	48,5	0,8	0,0	
0,43	47,0	57,2	10,2	46,9	47,2	0,3	0,0	
0,50	42,1	56,1	13,9	41,9	46,1	4,2	0,0	
0,56	34,8	56,0	21,2	34,3	46,0	11,8	0,0	
0,62	41,6	56,0	14,4	41,4	46,0	4,6	0,0	
0,68	45,2	56,0	10,8	45,0	46,0	1,0	0,0	
0,74	42,5	56,0	13,5	42,3	46,0	3,7	0,0	
6,10	49,1	60,0	10,9	48,3	50,0	1,7	0,0	

Picture 13: T40S9 - Table - Conducted emission on mains, neutral (without termination)

4 Radiated emission measurement (<1 GHz)

according to 47 CFR Part 15, section 15.205(a), 15.209(a), RSS-210, section 2.5 with RSS-Gen, sections 8.10 and 8.9

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 area test site (OATS)	EMV **TESTHAUS** GmbH	E00354

4.2 Test instruments

	Description	Manufacturer	Inventory No.
☒	ESCS 30 (FF)	Rohde & Schwarz	E00551
☐	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
☒	RF-R 400-1	Langer EMV-Technik	E00270
☒	Feedline OATS	Huber & Suhner	200024

4.3 Limits

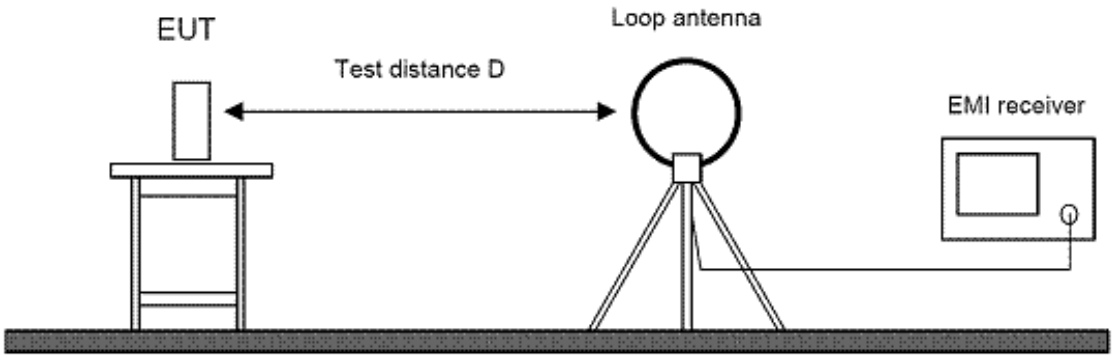
The field strength of any emissions including spurious emissions falling into restricted bands as specified in 15.205(a) shall not exceed the general radiated emission limits as specified in 15.209.

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

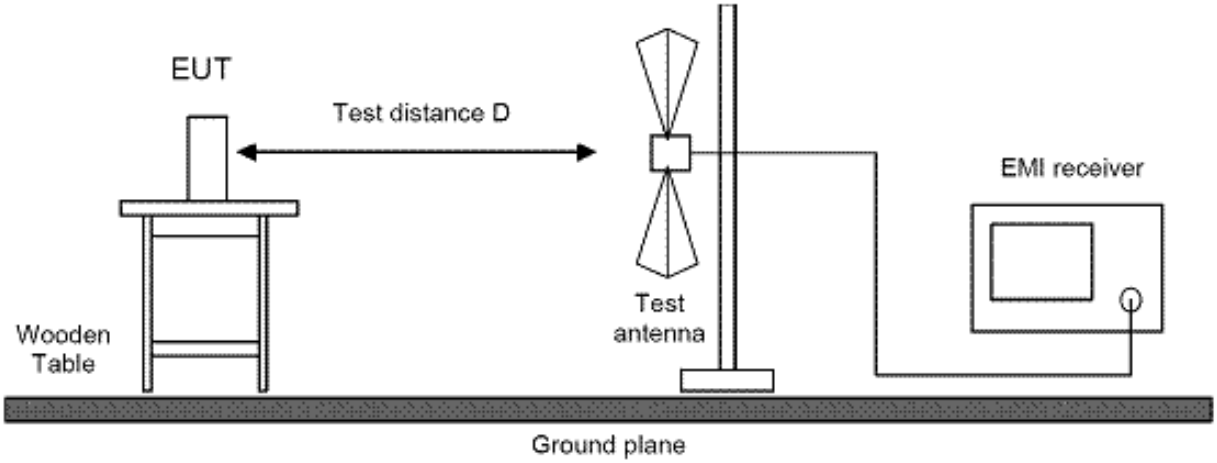
4.4 Test procedure

1. EUT was configured according to ANSI C63.4. It 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. EUT and all peripherals were powered on.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 30 MHz to 1000 MHz with peak detector peak and measurement bandwidth set to 120 kHz.
5. The turn table was rotated to 6 different positions (360° / 6) and the antenna polarization was changed to horizontal.
6. Test procedure at step 4 and 5 was repeated.
7. The test setup was then placed in an OATS at 3 m distance and all peak values over or with less margin to the limit than 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 emission field strength of both horizontal and vertical polarization. The highest value was recorded.
10. For emissions below 30 MHz measurements were done using a loop antenna. Prescans were performed with peak detector and final measurements with quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 k Hz where average detector applies. Antenna height was not changed during this test. Appropriate CISPR bandwidths of 200 Hz for frequencies up to 150 kHz and 9 or 10 kHz for frequencies above were used.

4.5 Test setup



Picture 14: Test setup for radiated emission measurement (< 30 MHz)



Picture 15: Test setup for radiated emission measurement (< 1 GHz)

4.6 Test deviation

There is no deviation from the standards referred to.

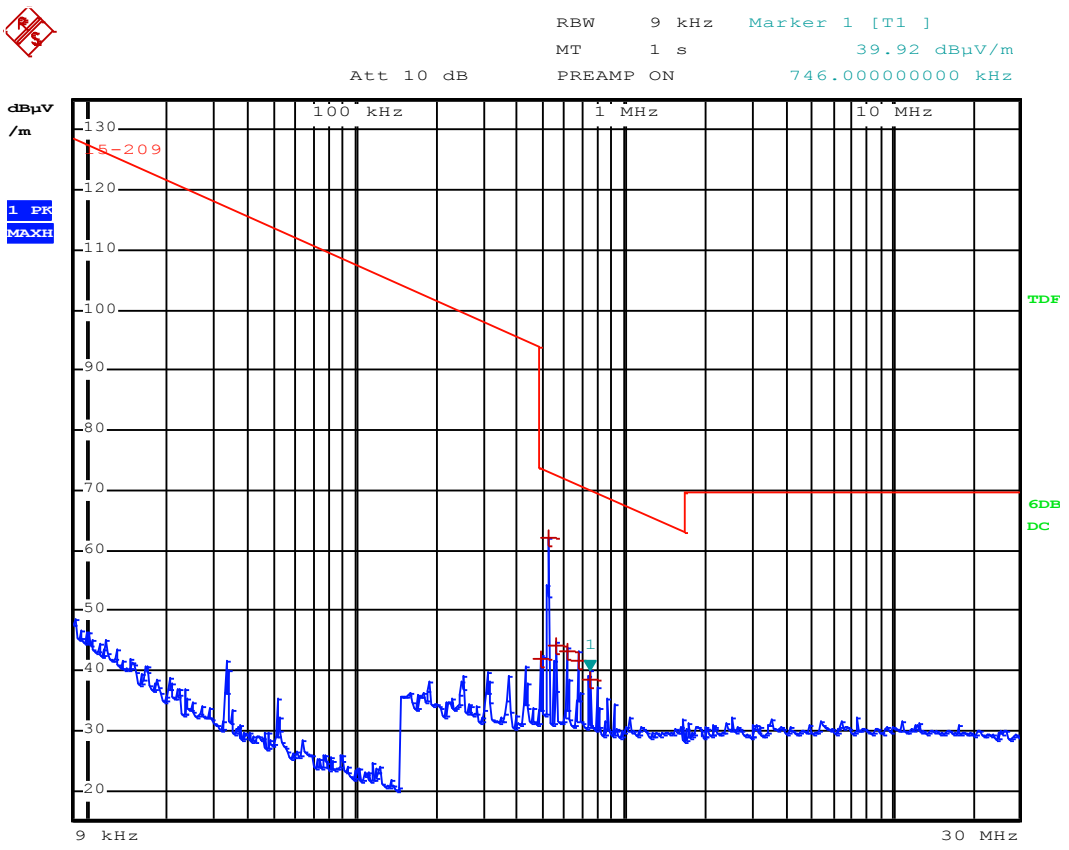
4.7 Test results - T40S7

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Radiated Emission Measurement 9 kHz - 30 MHz

Test procedure

The EUT was placed in a full anechoic chamber and the spurious emission testing was performed in accordance with ANSI C63.4, and 47 CFR Part 15, Subpart C. The measurement distance was 3 m.



EDIT PEAK LIST (Final Measurement Results)

Trace1:	15-209
Trace2:	---
Trace3:	---

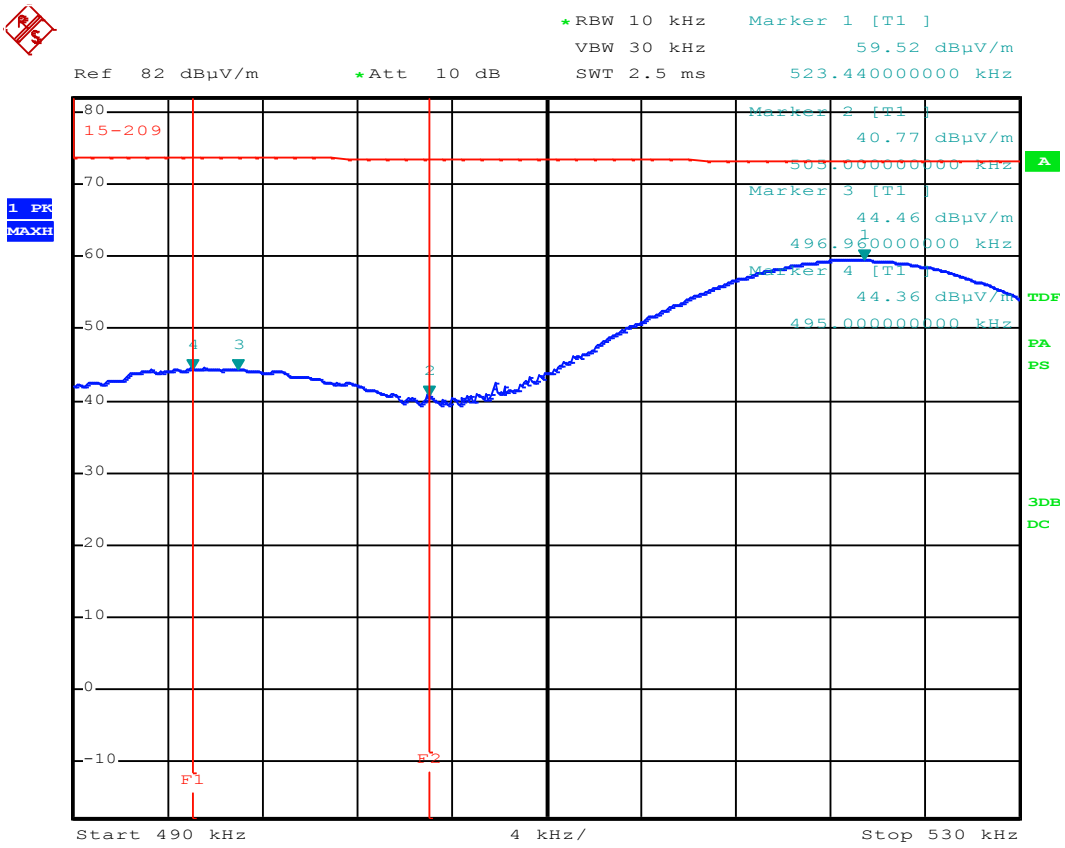
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	494 kHz	41.86	-31.86
1 Quasi Peak	522 kHz	62.01	-11.23
1 Quasi Peak	558 kHz	44.26	-28.40
1 Quasi Peak	622 kHz	43.29	-28.44
1 Quasi Peak	682 kHz	41.68	-29.25
1 Quasi Peak	746 kHz	38.35	-31.80

Picture 16: T40S7 - Radiated emission 9 kHz – 30 MHz @ 3m distance

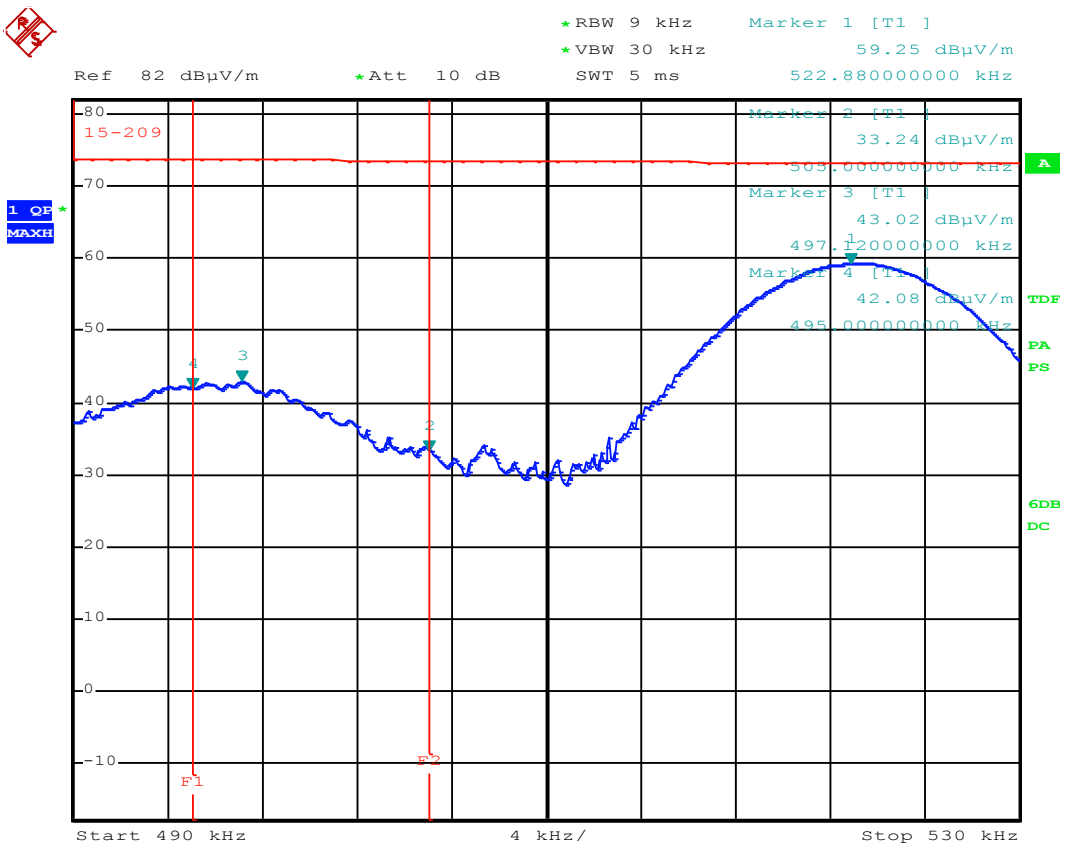
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
494	41.86	QP	40	**1.86**	33.73	31.87	PASS
[1)] 522	62.01	QP	40	**22.01**	33.25	11.24	PASS
558	44.26	QP	40	**4.26**	32.67	28.41	PASS
622	43.29	QP	40	**3.29**	31.72	28.43	PASS
682	41.68	QP	40	**1.68**	30.93	29.25	PASS
746	38.35	QP	40	**-1.65**	30.15	31.79	PASS

[1)] Note:
Measured value = 62.01 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 62.01 dBµV/m @ 3 m - 40 dB = **22.01 dBµV/m @ 30 m**

Restricted Band (495 kHz - 505 kHz)



Picture 17: T40S7 - Restricted Band - PK @ 3m distance



Picture 18: T40S7 - Restricted Band - QP @ 3m distance

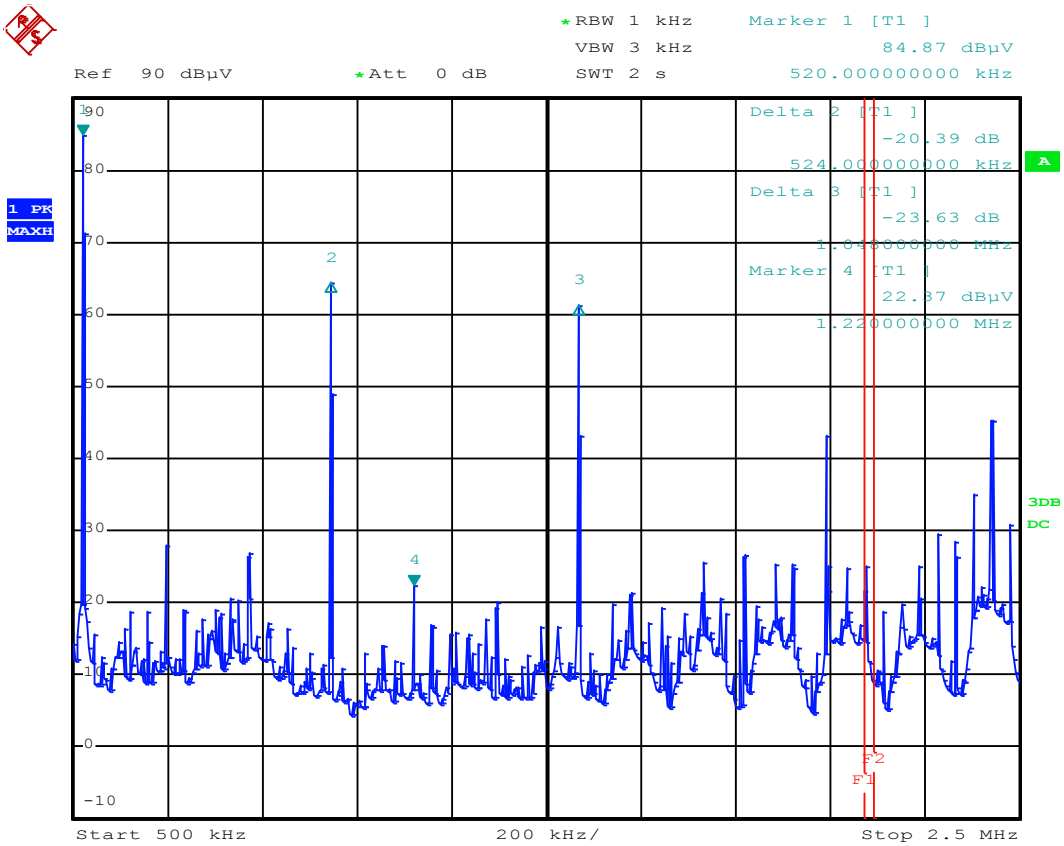
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
495.00	44.36	PK	40	**4.36**	- - - -	- - - -	PASS
495.00	42.08	QP	40	**2.08**	33.71	31.63	PASS
496.96	44.46	PK	40	**4.46**	- - - -	- - - -	PASS
497.12	43.02	QP	40	**3.02**	33.68	30.66	PASS
505.00	40.77	PK	40	**0.77**	- - - -	- - - -	PASS
505.00	33.24	QP	40	**-6.76**	33.54	40.30	PASS
523.44	59.52	PK	40	**19.52**	- - - -	- - - -	PASS
[1)] 522.88	59.25	QP	40	**19.25**	33.24	13.99	PASS

[1)] Note:
Measured value = 59.25 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 59.25 dBµV/m @ 3 m - 40 dB = **19.25 dBµV/m @ 30 m**

Additional note:
Emissions in restricted band are spurious emissions not caused by carrier or modulation.

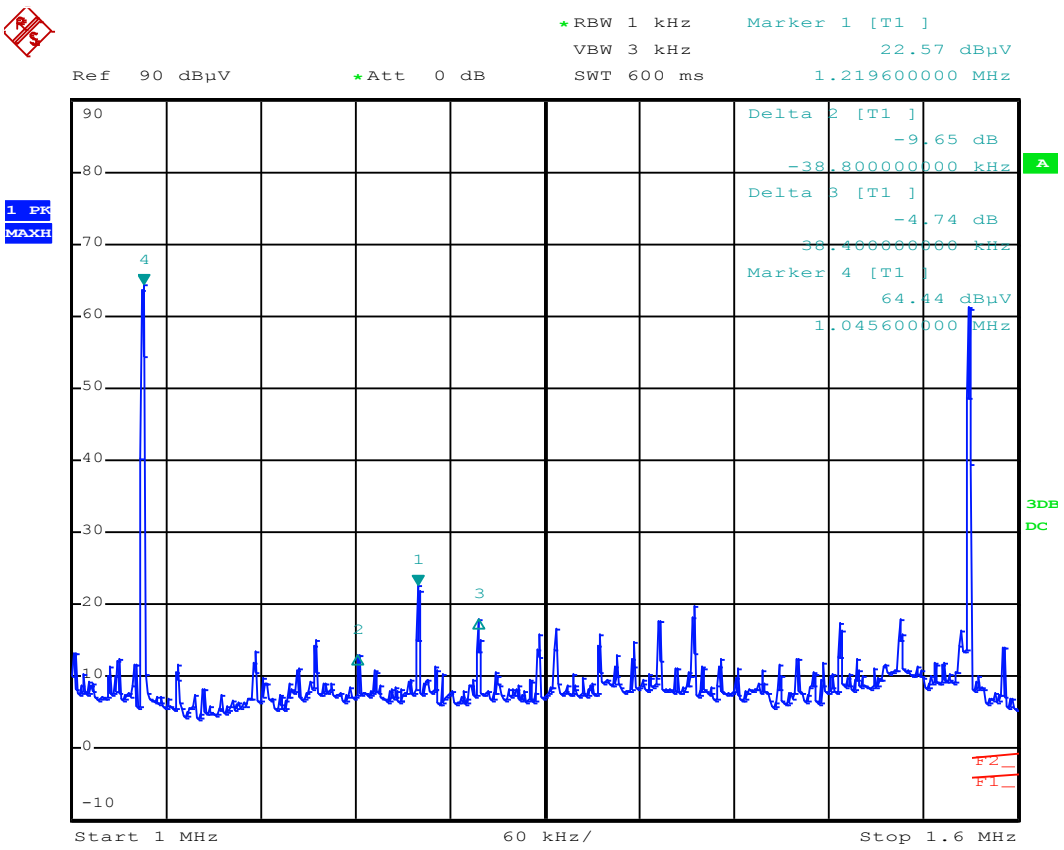
Restricted Band (2.1735 MHz - 2.1905 MHz)

Remark: This measurement was performed using magnetic field probe RF-R 400-1 to show that there are no emissions caused by carrier or modulation. During the "radiated emission 9kHz - 30MHz"-measurement no carrier at 1.22 MHz was detected because of its low amplitude. The setup is documented in Annex A.



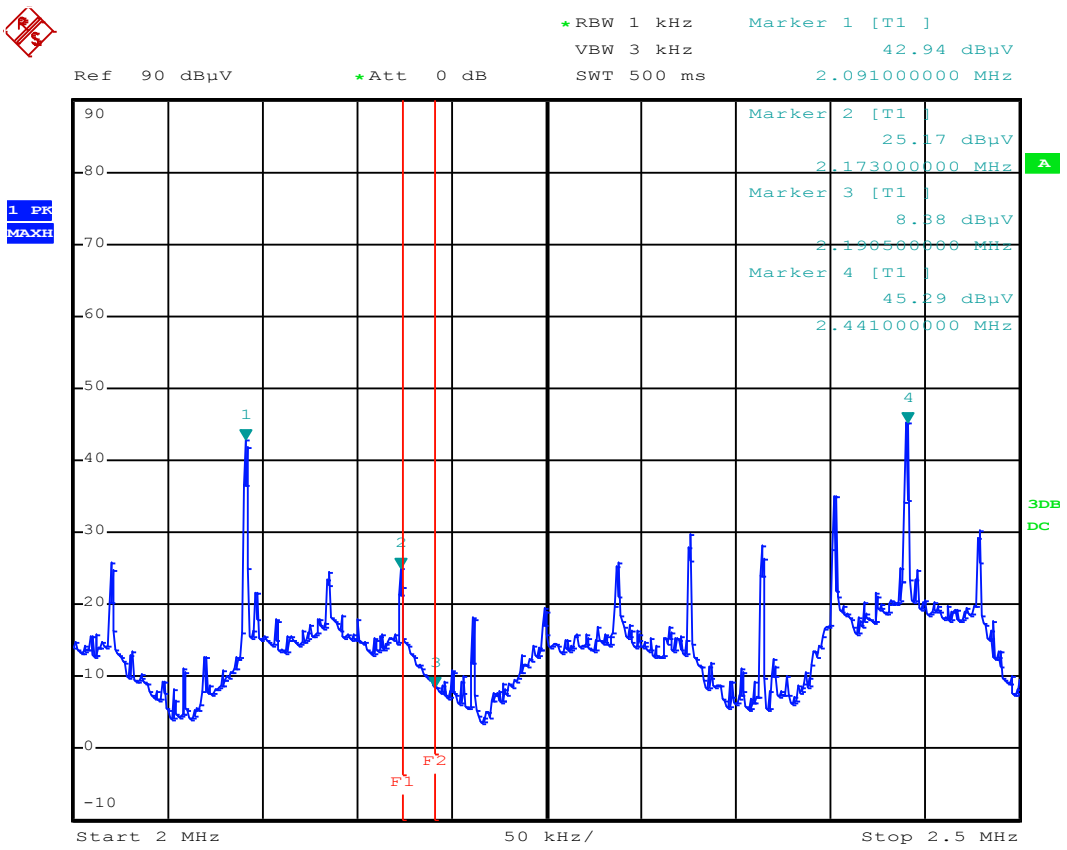
f [MHz]	E_{meas} [dBµV]	Detector	Remark
0.5200	84.87	PK	carrier power supply
1.0440	64.48	PK	2nd harmonic power supply
1.2200	22.37	PK	carrier data transfer
1.5680	61.24	PK	3rd harmonic power supply

Picture 19: T40S7 - carrier (1.22 MHz) and restricted band



f [MHz]	E_{meas} [dBµV]	Detector	Remark
1.0456	64.44	PK	2nd harmonic power supply
1.1808	12.92	PK	lower sideband data transfer
1.2196	22.57	PK	carrier data transfer
1.2580	17.83	PK	upper sideband data transfer

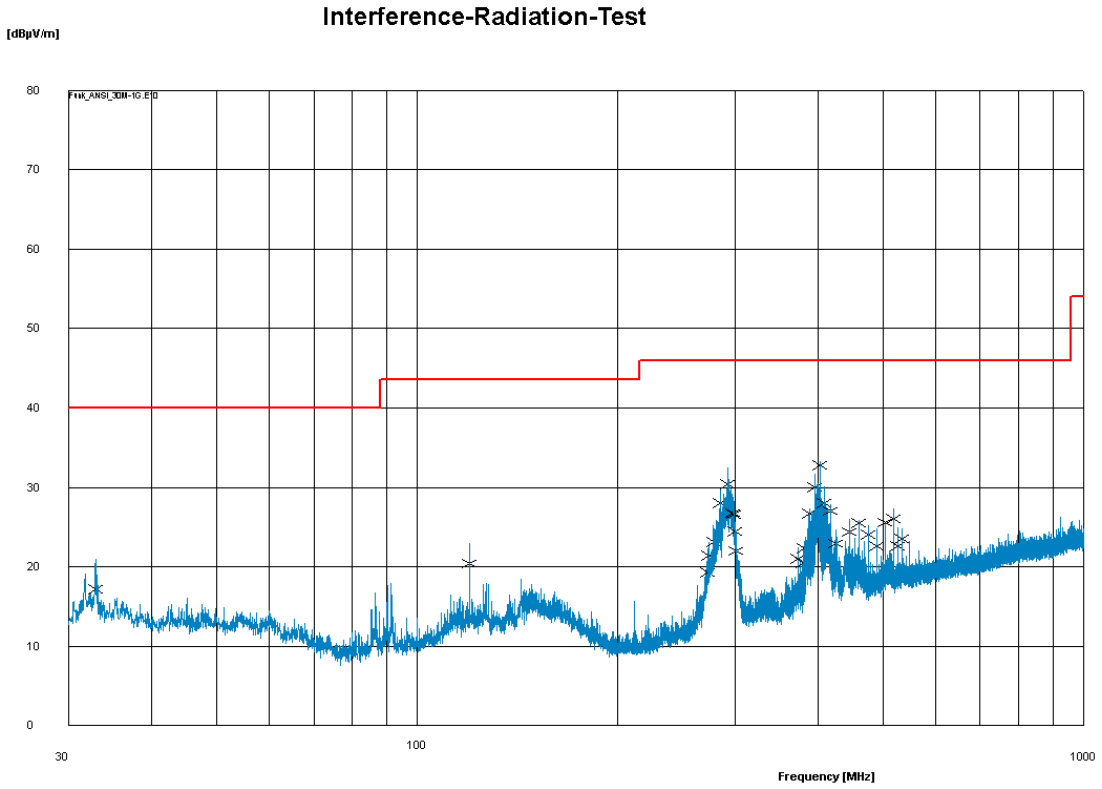
Picture 20: T40S7 - zoomed to carrier (1.22 MHz)



f [MHz]	E_{meas} [dBµV]	Detector	Remark
2.0910	42.94	PK	4th harmonic power supply
2.1730	25.17	PK	lower edge restricted band
2.1905	8.38	PK	upper edge restricted band
2.4410	45.29	PK	- - - -

Picture 21: T40S7 - zoomed to restricted band

Radiated Emission Measurement 30 MHz - 1000 MHz



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	32,94	17,2	12,1	40,0	- 22,8	V	100	356	2014-11-11 14:41...		20,9	0,0
☑	120	20,4	12,5	43,5	- 23,1	V	100	183	2014-11-11 14:42...		22,9	0,0
☑	273,42	19,2	12,1	46,0	- 26,8	V	100	353	2014-11-11 14:43...		22,3	0,0
☑	274,5	21,4	12,1	46,0	- 24,6	V	100	361	2014-11-11 14:44...		23,0	0,0
☑	278,7	23,1	12,3	46,0	- 22,9	V	100	353	2014-11-11 14:45...		25,2	0,0
☑	285	28,0	12,4	46,0	- 18,0	V	100	361	2014-11-11 14:46...		29,7	0,0
☑	292,32	30,4	12,6	46,0	- 15,6	V	100	6	2014-11-11 14:47...		32,4	0,0
☑	298,38	26,8	12,7	46,0	- 19,2	V	100	22	2014-11-11 14:48...		28,7	0,0
☑	299,58	26,6	12,8	46,0	- 19,4	V	100	17	2014-11-11 14:48...		28,2	0,0
☑	300,66	24,4	12,8	46,0	- 21,6	V	100	16	2014-11-11 14:49...		25,6	0,0
☑	301,74	22,0	12,8	46,0	- 24,0	V	100	17	2014-11-11 14:50...		24,6	0,0
☑	373,32	21,0	14,2	46,0	- 25,0	V	100	361	2014-11-11 14:51...		22,4	0,0
☑	380,16	20,5	14,3	46,0	- 25,5	V	100	17	2014-11-11 14:52...		22,5	0,0
☑	381,18	22,3	14,3	46,0	- 23,7	V	100	361	2014-11-11 14:53...		23,1	0,0
☑	387,96	26,7	14,4	46,0	- 19,3	V	100	17	2014-11-11 14:54...		27,3	0,0
☑	395,82	30,0	14,6	46,0	- 16,0	V	100	20	2014-11-11 14:55...		31,6	0,0
☑	402,6	32,8	14,7	46,0	- 13,2	V	100	29	2014-11-11 14:56...		33,2	0,0
☑	409,38	28,0	14,9	46,0	- 18,0	V	100	19	2014-11-11 14:57...		30,0	0,0
☑	417,24	27,0	15,1	46,0	- 19,0	V	100	29	2014-11-11 14:58...		27,9	0,0
☑	425,1	22,9	15,2	46,0	- 23,1	V	100	19	2014-11-11 14:59...		24,6	0,0
☑	446,52	24,4	15,7	46,0	- 21,7	V	100	17	2014-11-11 15:00...		26,0	0,0
☑	461,16	25,5	16,0	46,0	- 20,5	V	100	32	2014-11-11 15:01...		25,9	0,0
☑	475,8	24,0	16,2	46,0	- 22,0	V	100	58	2014-11-11 15:02...		25,2	0,0
☑	490,44	22,6	16,4	46,0	- 23,4	V	100	343	2014-11-11 15:03...		24,8	0,0
☑	505,08	25,6	16,6	46,0	- 20,4	V	100	6	2014-11-11 15:03...		25,4	0,0
☑	519,72	26,0	16,8	46,0	- 20,0	V	100	7	2014-11-11 15:04...		27,3	0,0
☑	527,04	22,6	16,9	46,0	- 23,4	V	100	6	2014-11-11 15:05...		24,9	0,0
☑	534,36	23,5	17,1	46,0	- 22,5	V	100	20	2014-11-11 15:06...		24,8	0,0

Picture 22: T40S7 - Radiated emission 30 MHz - 1000MHz @ 3m distance

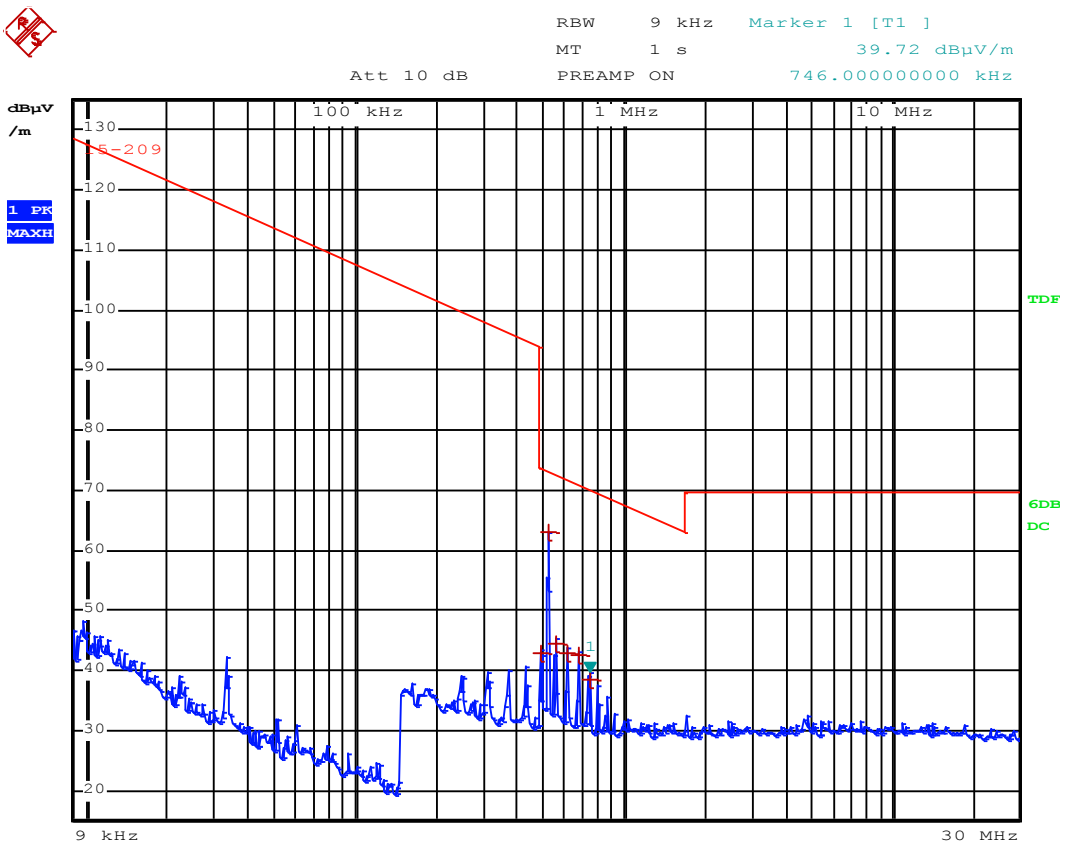
4.8 Test results - T40S8

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Radiated Emission Measurement 9 kHz - 30 MHz

Test procedure

The EUT was placed in a full anechoic chamber and the spurious emission testing was performed in accordance with ANSI C63.4, and 47 CFR Part 15, Subpart C. The measurement distance was 3 m.



EDIT PEAK LIST (Final Measurement Results)

Trace1:	15-209
Trace2:	---
Trace3:	---

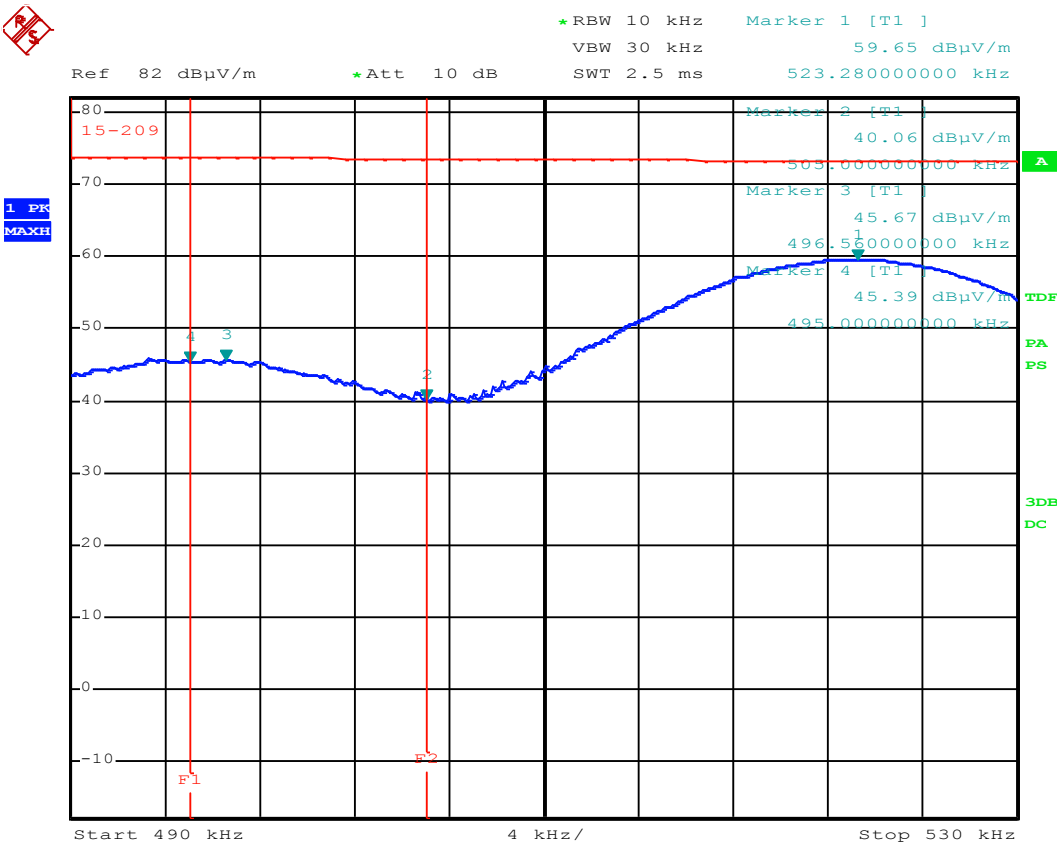
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	494 kHz	42.74	-30.98
1 Quasi Peak	522 kHz	63.12	-10.13
1 Quasi Peak	558 kHz	44.49	-28.17
1 Quasi Peak	622 kHz	42.79	-28.94
1 Quasi Peak	682 kHz	42.48	-28.45
1 Quasi Peak	746 kHz	38.31	-31.84

Picture 23: T40S8 - Radiated emission 9 kHz – 30 MHz @ 3m distance

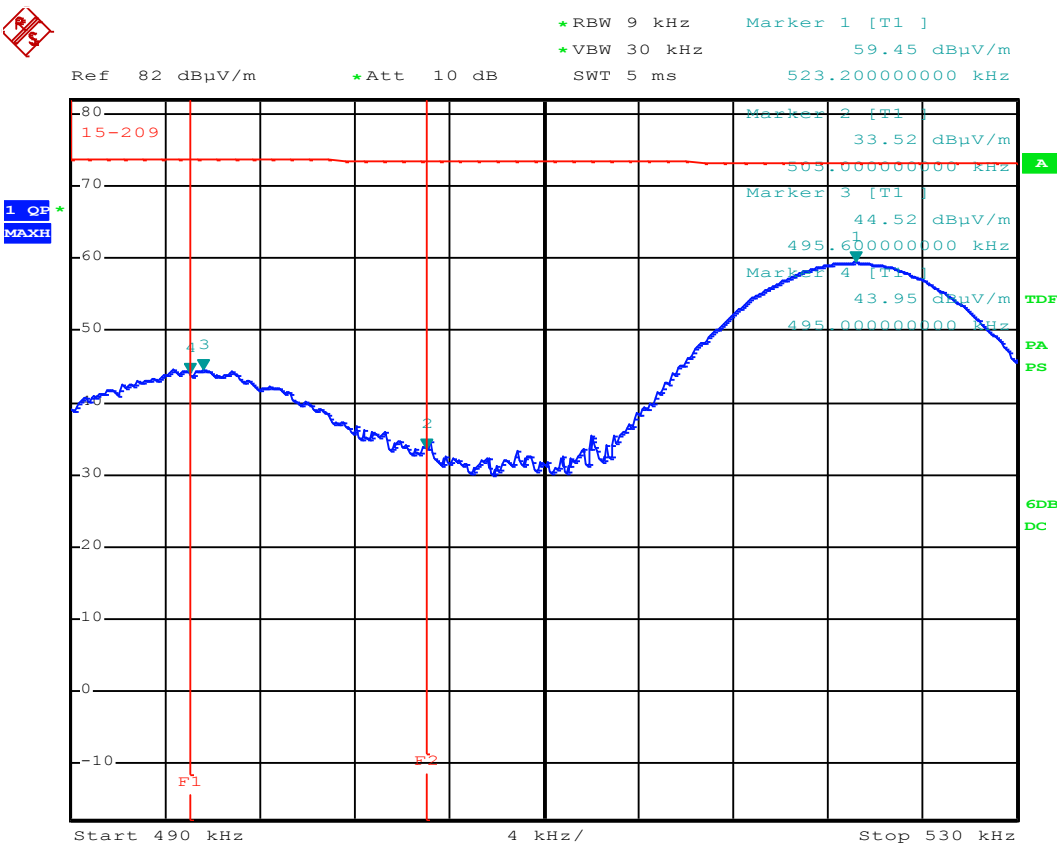
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
494	42.74	QP	40	**2.74**	33.73	30.99	PASS
[1)] 522	63.12	QP	40	**23.12**	33.25	10.13	PASS
558	44.49	QP	40	**4.49**	32.67	28.18	PASS
622	42.79	QP	40	**2.79**	31.72	28.93	PASS
682	42.48	QP	40	**2.48**	30.93	28.45	PASS
746	38.31	QP	40	**-1.69**	30.15	31.84	PASS

[1)] Note:
Measured value = 63.12 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 63.12 dBµV/m @ 3 m - 40 dB = **23.12 dBµV/m @ 30 m**

Restricted Band (495 kHz - 505 kHz)



Picture 24: T40S8 - Restricted Band - PK @ 3m distance



Picture 25: T40S8 - Restricted Band - QP @ 3m distance

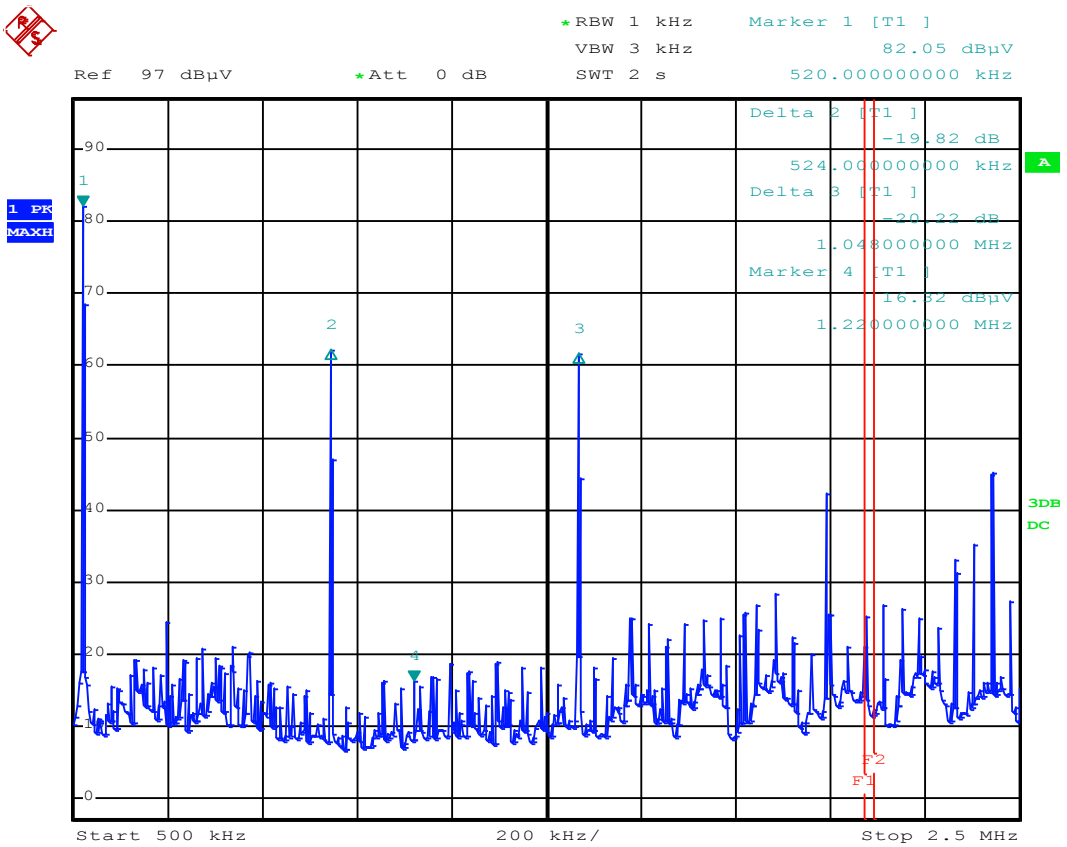
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
495.00	45.39	PK	40	**5.39**	- - - -	- - - -	PASS
495.00	43.95	QP	40	**3.95**	33.71	29.76	PASS
496.56	45.67	PK	40	**5.67**	- - - -	- - - -	PASS
495.60	44.52	QP	40	**4.52**	33.70	29.18	PASS
505.00	40.06	PK	40	**0.06**	- - - -	- - - -	PASS
505.00	33.52	QP	40	**-6.48**	33.54	40.02	PASS
523.28	59.65	PK	40	**19.65**	- - - -	- - - -	PASS
[1)] 523.20	59.45	QP	40	**19.45**	33.23	13.78	PASS

[1)] Note:
Measured value = 59.45 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 59.45 dBµV/m @ 3 m - 40 dB = **19.45 dBµV/m @ 30 m**

Additional note:
Emissions in restricted band are spurious emissions not caused by carrier or modulation.

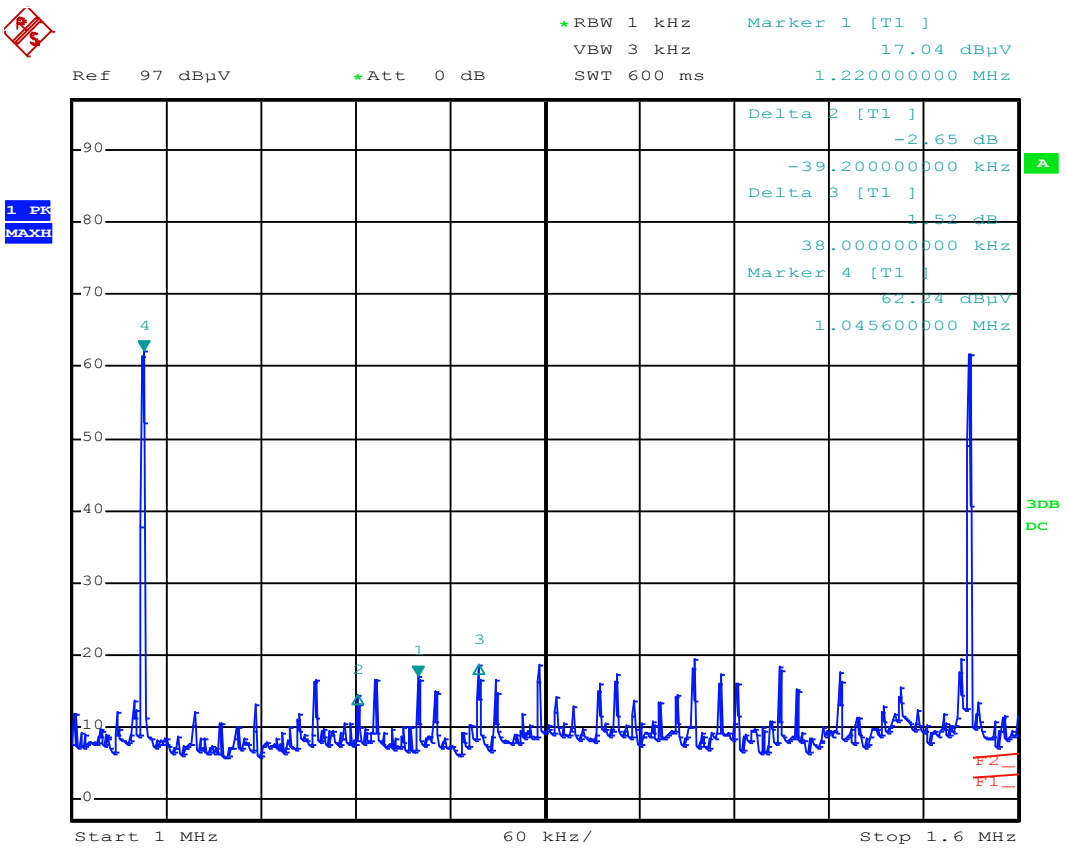
Restricted Band (2.1735 MHz - 2.1905 MHz)

Remark: This measurement was performed using magnetic field probe RF-R 400-1 to show that there are no emissions caused by carrier or modulation. During the "radiated emission 9kHz - 30MHz"-measurement no carrier at 1.22 MHz was detected because of its low amplitude. The setup is documented in Annex A.



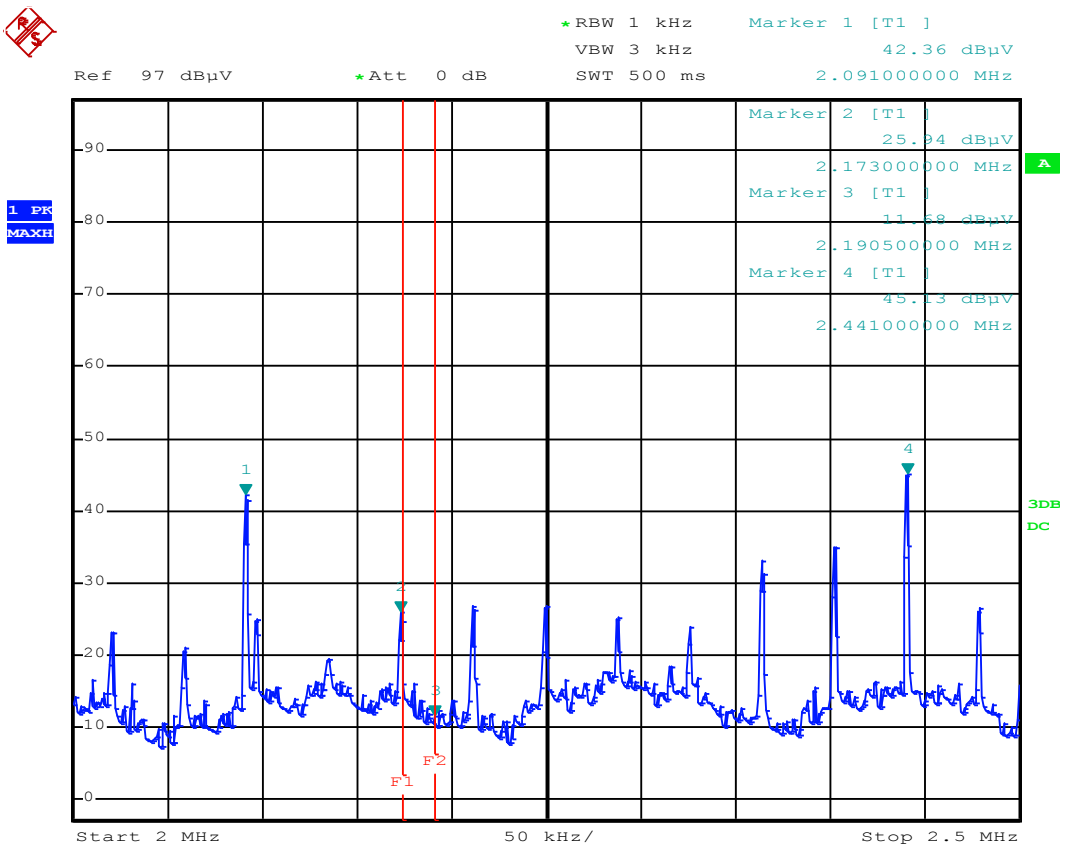
f [MHz]	E_{meas} [dBµV]	Detector	Remark
0.5200	82.05	PK	carrier power supply
1.0440	62.23	PK	2nd harmonic power supply
1.2200	16.82	PK	carrier data transfer
1.5680	61.83	PK	3rd harmonic power supply

Picture 26: T40S8 - carrier (1.22 MHz) and restricted band



f [MHz]	E_{meas} [dBµV]	Detector	Remark
1.0456	62.24	PK	2nd harmonic power supply
1.1808	14.39	PK	lower sideband data transfer
1.2200	17.04	PK	carrier data transfer
1.2580	18.56	PK	upper sideband data transfer

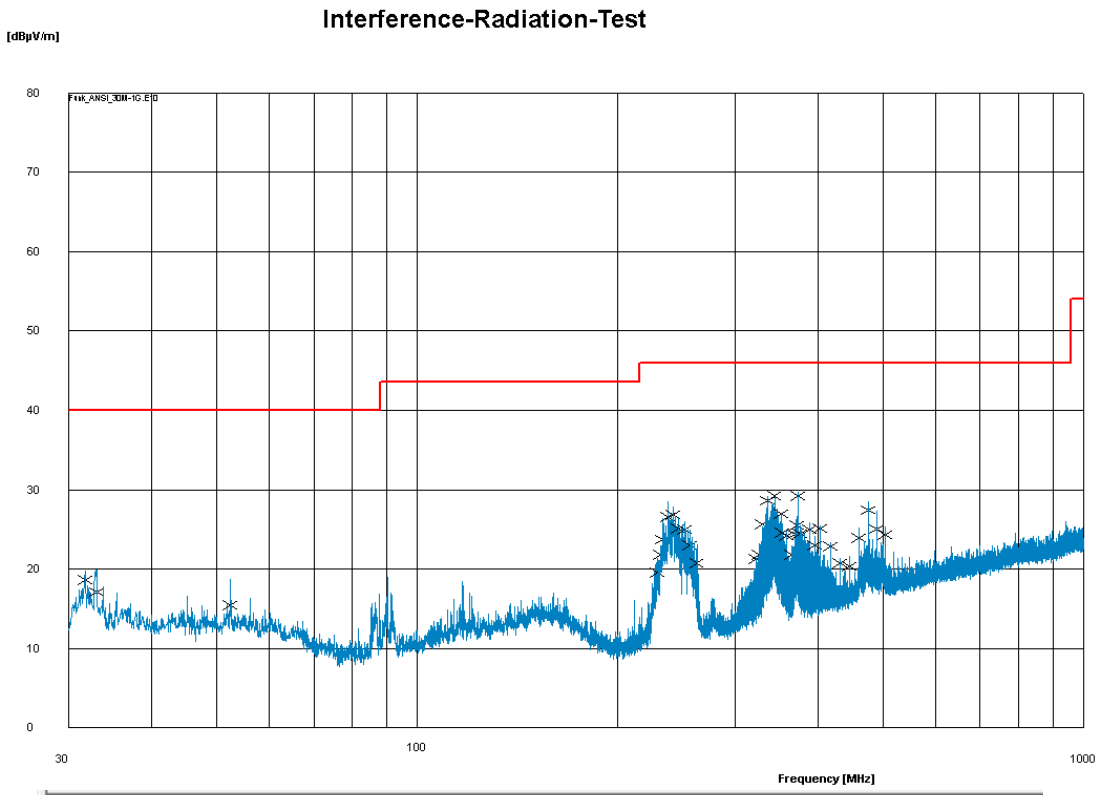
Picture 27: T40S8 - zoomed to carrier (1.22 MHz)



f [MHz]	E_{meas} [dBµV]	Detector	Remark
2.0910	42.36	PK	4th harmonic power supply
2.1730	25.94	PK	lower edge restricted band
2.1905	11.68	PK	upper edge restricted band
2.4410	45.13	PK	- - - -

Picture 28: T40S8 - zoomed to restricted band

Radiated Emission Measurement 30 MHz - 1000 MHz



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	31,74	18,6	12,1	40,0	- 21,4	V	100	99	2014-11-11 18:07...		19,7	0,0
☑	33,06	17,1	12,1	40,0	- 22,9	V	100	46	2014-11-11 18:08...		19,9	0,0
☑	52,5	15,5	12,6	40,0	- 24,5	V	100	83	2014-11-11 18:08...		18,7	0,0
☑	229,92	19,5	10,8	46,0	- 26,5	V	100	8	2014-11-11 18:09...		21,3	0,0
☑	231,84	21,8	10,8	46,0	- 24,2	V	100	-1	2014-11-11 18:10...		23,0	0,0
☑	233,7	23,7	10,9	46,0	- 22,3	V	100	8	2014-11-11 18:11...		26,4	0,0
☑	237,9	26,6	11,1	46,0	- 19,4	V	100	-1	2014-11-11 18:12...		28,5	0,0
☑	242,1	26,8	11,3	46,0	- 19,2	V	100	361	2014-11-11 18:13...		27,8	0,0
☑	246,96	25,1	11,4	46,0	- 20,9	V	100	8	2014-11-11 18:14...		26,5	0,0
☑	252,54	24,9	11,5	46,0	- 21,1	V	100	5	2014-11-11 18:15...		26,0	0,0
☑	256,74	23,0	11,6	46,0	- 23,0	V	100	8	2014-11-11 18:16...		24,8	0,0
☑	263,04	20,8	11,8	46,0	- 25,3	V	100	5	2014-11-11 18:17...		23,1	0,0
☑	322,62	21,3	13,2	46,0	- 24,7	V	100	21	2014-11-11 18:18...		21,3	0,0
☑	326,82	21,8	13,3	46,0	- 24,2	V	100	17	2014-11-11 18:19...		23,2	0,0
☑	329,4	25,6	13,4	46,0	- 20,4	V	100	21	2014-11-11 18:20...		25,3	0,0
☑	336,24	28,6	13,5	46,0	- 17,4	V	100	20	2014-11-11 18:21...		29,1	0,0
☑	344,04	29,2	13,6	46,0	- 16,8	V	100	30	2014-11-11 18:22...		29,0	0,0
☑	351,9	27,0	13,7	46,0	- 19,0	V	100	20	2014-11-11 18:23...		27,1	0,0
☑	354	24,6	13,8	46,0	- 21,5	V	100	30	2014-11-11 18:23...		25,7	0,0
☑	358,68	24,2	13,9	46,0	- 21,8	V	100	19	2014-11-11 18:24...		24,7	0,0
☑	365,52	21,8	14,0	46,0	- 24,3	V	100	355	2014-11-11 18:25...		22,9	0,0
☑	368,64	24,4	14,1	46,0	- 21,6	V	100	339	2014-11-11 18:26...		25,3	0,0
☑	371,76	25,5	14,1	46,0	- 20,5	V	100	357	2014-11-11 18:27...		26,7	0,0
☑	373,32	29,2	14,2	46,0	- 16,8	V	100	339	2014-11-11 18:28...		29,7	0,0
☑	375,96	24,4	14,2	46,0	- 21,6	V	100	357	2014-11-11 18:29...		25,5	0,0
☑	387,96	25,0	14,4	46,0	- 21,0	V	100	5	2014-11-11 18:30...		25,8	0,0
☑	395,82	23,0	14,6	46,0	- 23,1	V	100	21	2014-11-11 18:31...		24,2	0,0
☑	402,6	25,1	14,7	46,0	- 20,9	V	100	20	2014-11-11 18:32...		25,5	0,0
☑	417,24	22,8	15,1	46,0	- 23,2	V	100	30	2014-11-11 18:33...		23,3	0,0
☑	431,88	20,8	15,4	46,0	- 25,3	V	100	352	2014-11-11 18:34...		21,4	0,0
☑	446,52	20,4	15,7	46,0	- 25,6	V	100	57	2014-11-11 18:35...		21,7	0,0
☑	461,16	23,9	16,0	46,0	- 22,1	V	100	315	2014-11-11 18:36...		25,2	0,0
☑	475,8	27,4	16,2	46,0	- 18,6	V	100	328	2014-11-11 18:37...		28,5	0,0
☑	490,5	25,1	16,4	46,0	- 21,0	V	100	330	2014-11-11 18:37...		27,3	0,0
☑	505,14	24,3	16,6	46,0	- 21,7	V	100	340	2014-11-11 18:38...		25,3	0,0

Picture 29: T40S8 - Radiated emission 30 MHz - 1000MHz @ 3m distance

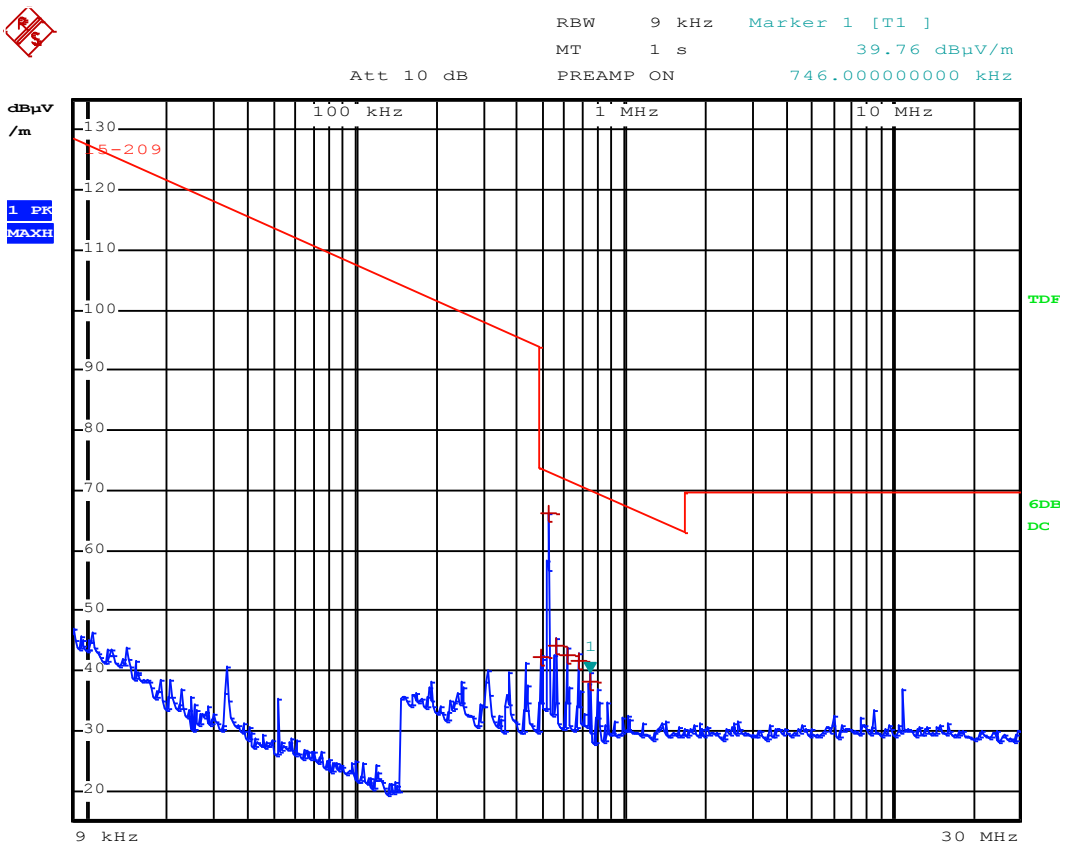
4.9 Test results - T40S9

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Radiated Emission Measurement 9 kHz - 30 MHz

Test procedure

The EUT was placed in a full anechoic chamber and the spurious emission testing was performed in accordance with ANSI C63.4, and 47 CFR Part 15, Subpart C. The measurement distance was 3 m.



EDIT PEAK LIST (Final Measurement Results)

Trace1:	15-209
Trace2:	---
Trace3:	---

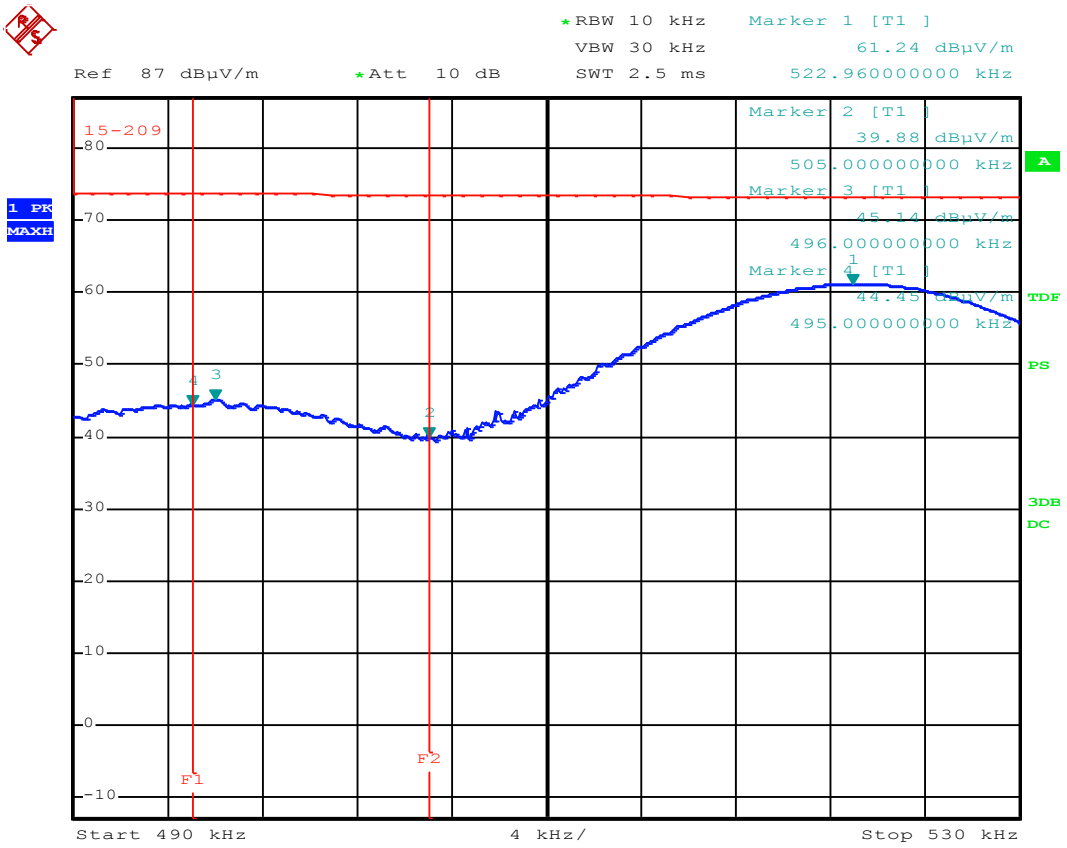
TRACE	FREQUENCY	LEVEL dBµV/m	DELTA LIMIT dB
1 Quasi Peak	494 kHz	42.20	-31.52
1 Quasi Peak	522 kHz	66.05	-7.19
1 Quasi Peak	558 kHz	44.27	-28.40
1 Quasi Peak	622 kHz	42.68	-29.05
1 Quasi Peak	682 kHz	41.57	-29.35
1 Quasi Peak	746 kHz	38.25	-31.90

Picture 30: T40S9 - Radiated emission 9 kHz – 30 MHz @ 3m distance

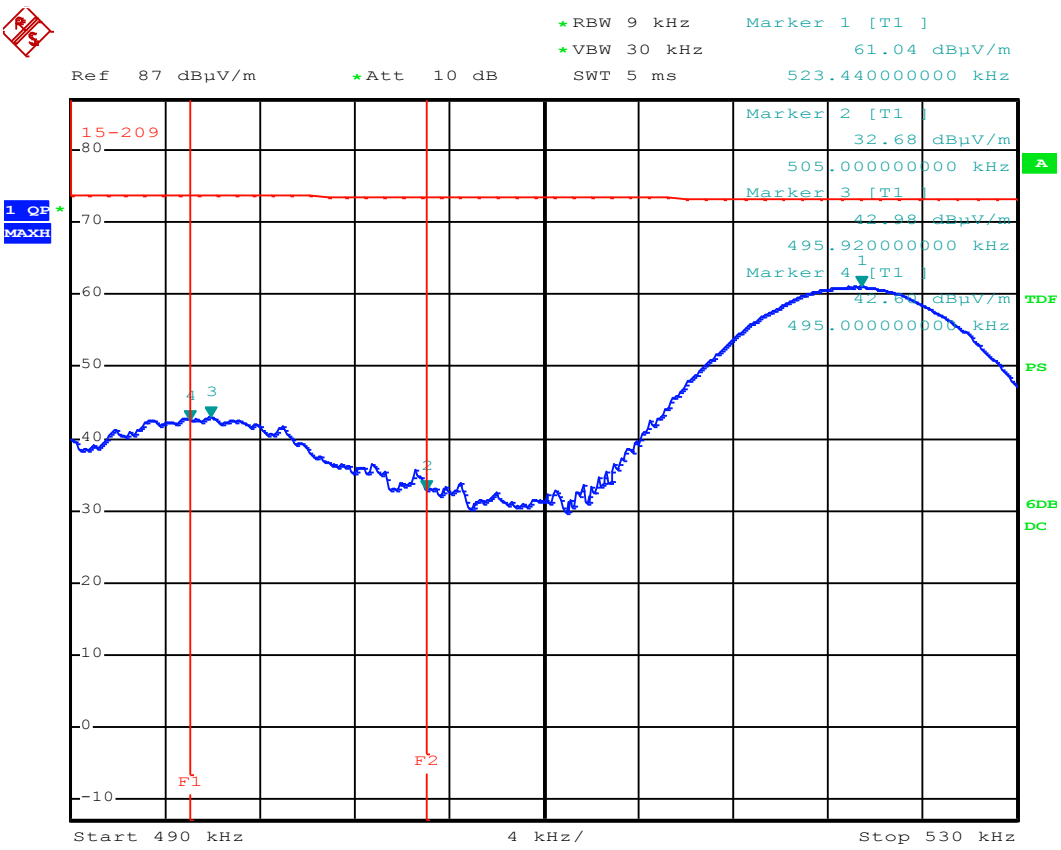
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
494	42.20	QP	40	**2.20**	33.73	31.53	PASS
[1)] 522	66.05	QP	40	**26.05**	33.25	7.20	PASS
558	44.27	QP	40	**4.27**	32.67	28.40	PASS
622	42.68	QP	40	**2.68**	31.73	29.05	PASS
682	41.57	QP	40	**1.57**	30.93	29.36	PASS
746	38.25	QP	40	**-1.75**	30.15	31.90	PASS

[1)] Note:
Measured value = 66.05 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 66.05 dBµV/m @ 3 m - 40 dB = **26.05 dBµV/m @ 30 m**

Restricted Band (495 kHz - 505 kHz)



Picture 31: T40S9 - Restricted Band - PK @ 3m distance



Picture 32: T40S9 - Restricted Band - QP @ 3m distance

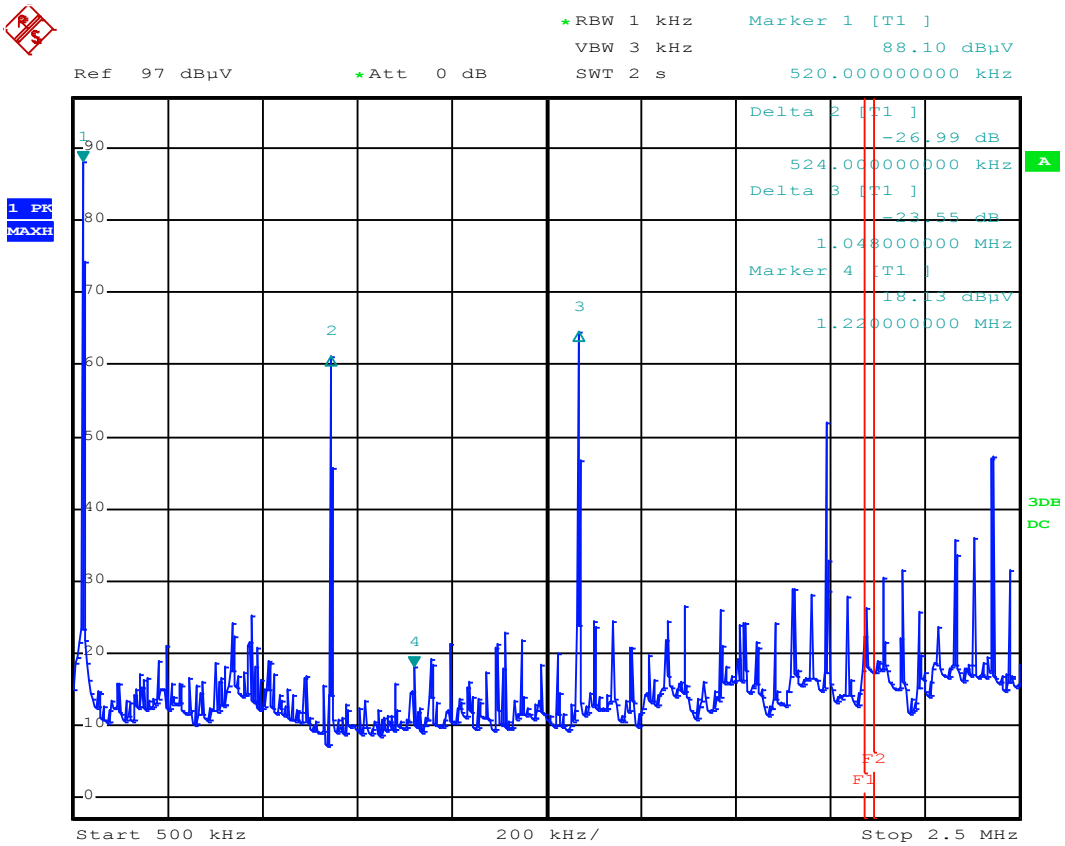
Frequency (kHz)	Measured value (dBµV/m)	Detector	Recalculation factor (dB/decade)	Field strength (dBµV/m)	Limit (dBµV/m)	Margin	Result
495.00	44.45	PK	40	**4.45**	- - - -	- - - -	PASS
495.00	42.60	QP	40	**2.60**	33.71	31.11	PASS
496.00	43.14	PK	40	**3.14**	- - - -	- - - -	PASS
495.92	42.98	QP	40	**2.98**	33.70	30.72	PASS
505.00	39.88	PK	40	**-0.12**	- - - -	- - - -	PASS
505.00	32.68	QP	40	**-7.32**	33.54	40.86	PASS
522.96	61.24	PK	40	**21.24**	- - - -	- - - -	PASS
[1] 523.44	61.04	QP	40	**21.04**	33.23	12.19	PASS

[1] Note:
Measured value = 61.04 dBµV/m @ 3 m
Recalculation factor = 40 dB / decade
Recalculated value = 61.04 dBµV/m @ 3 m - 40 dB = **21.04 dBµV/m @ 30 m**

Additional note:
Emissions in restricted band are spurious emissions not caused by carrier or modulation.

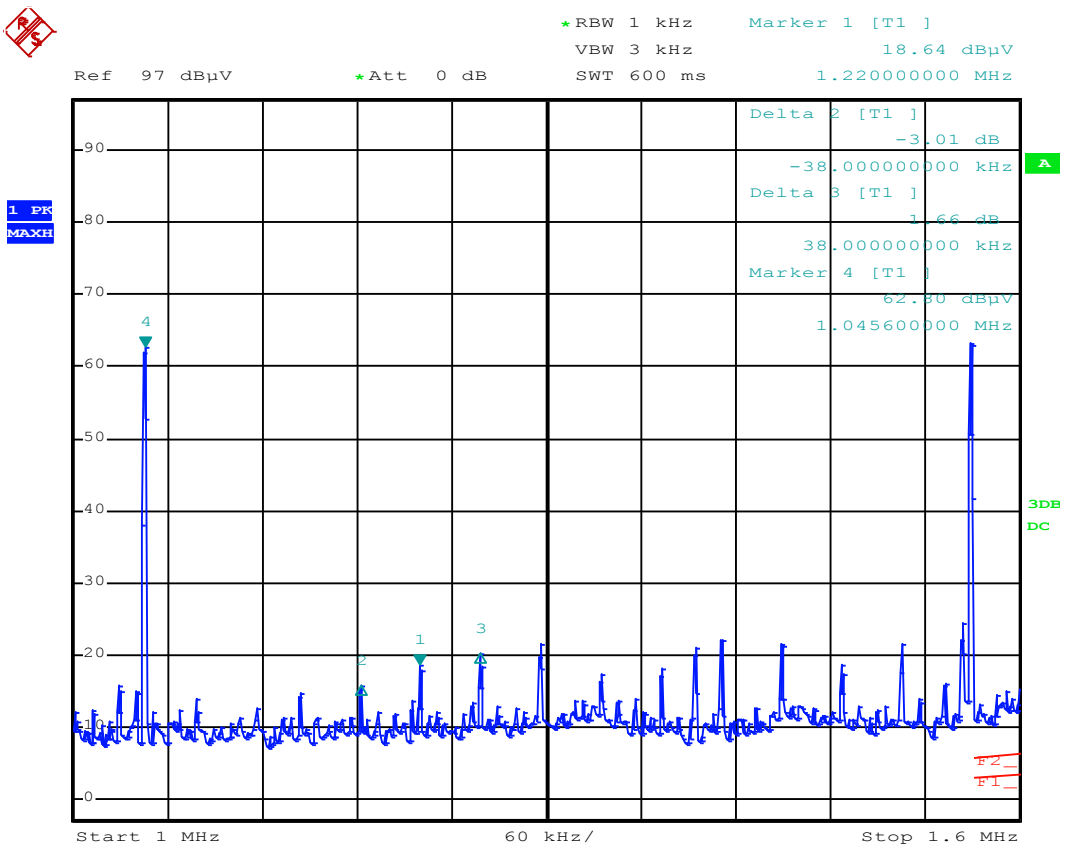
Restricted Band (2.1735 MHz - 2.1905 MHz)

Remark: This measurement was performed using magnetic field probe RF-R 400-1 to show that there are no emissions caused by carrier or modulation. During the “radiated emission 9kHz - 30MHz”-measurement no carrier at 1.22 MHz was detected because of its low amplitude. The setup is documented in Annex A.



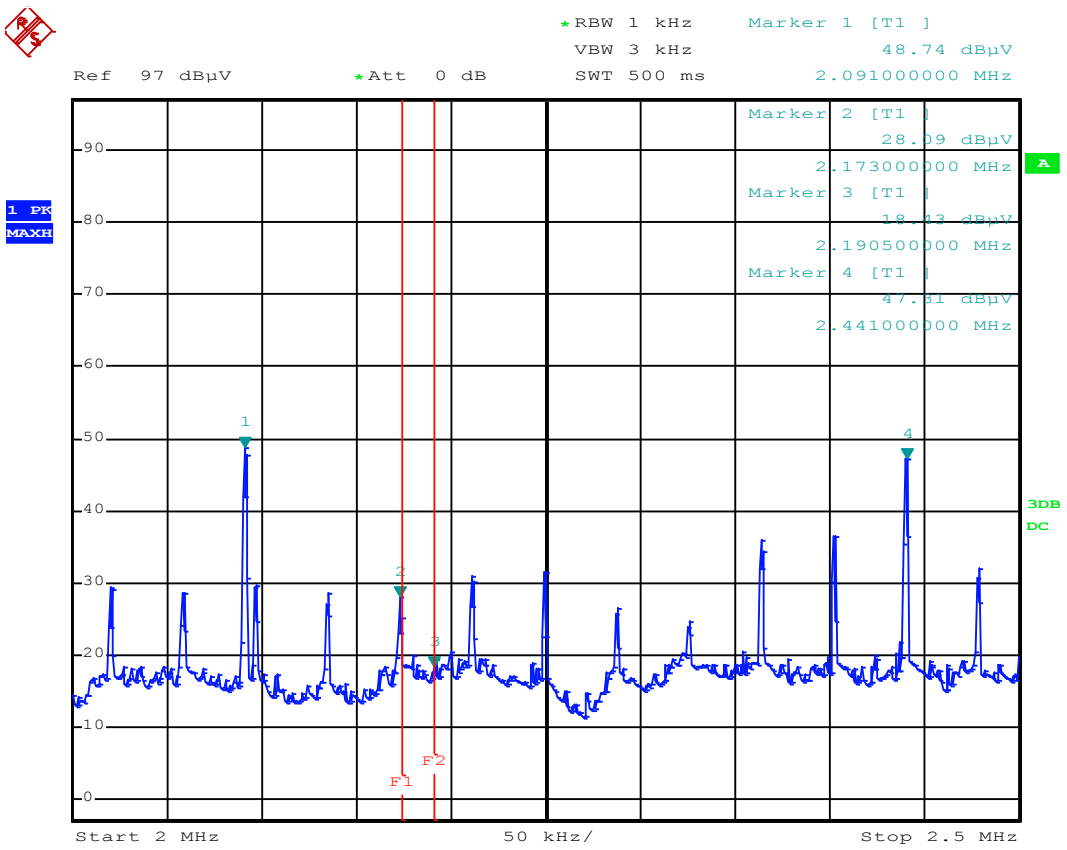
f [MHz]	E_{meas} [dBµV]	Detector	Remark
0.5200	88.10	PK	carrier power supply
1.0440	61.11	PK	2nd harmonic power supply
1.2200	18.13	PK	carrier data transfer
1.5680	64.55	PK	3rd harmonic power supply

Picture 33: T40S9 - carrier (1.22 MHz) and restricted band



f [MHz]	E_{meas} [dBµV]	Detector	Remark
1.0456	62.80	PK	2nd harmonic power supply
1.1820	15.63	PK	lower sideband data transfer
1.2200	18.64	PK	carrier data transfer
1.2580	20.30	PK	upper sideband data transfer

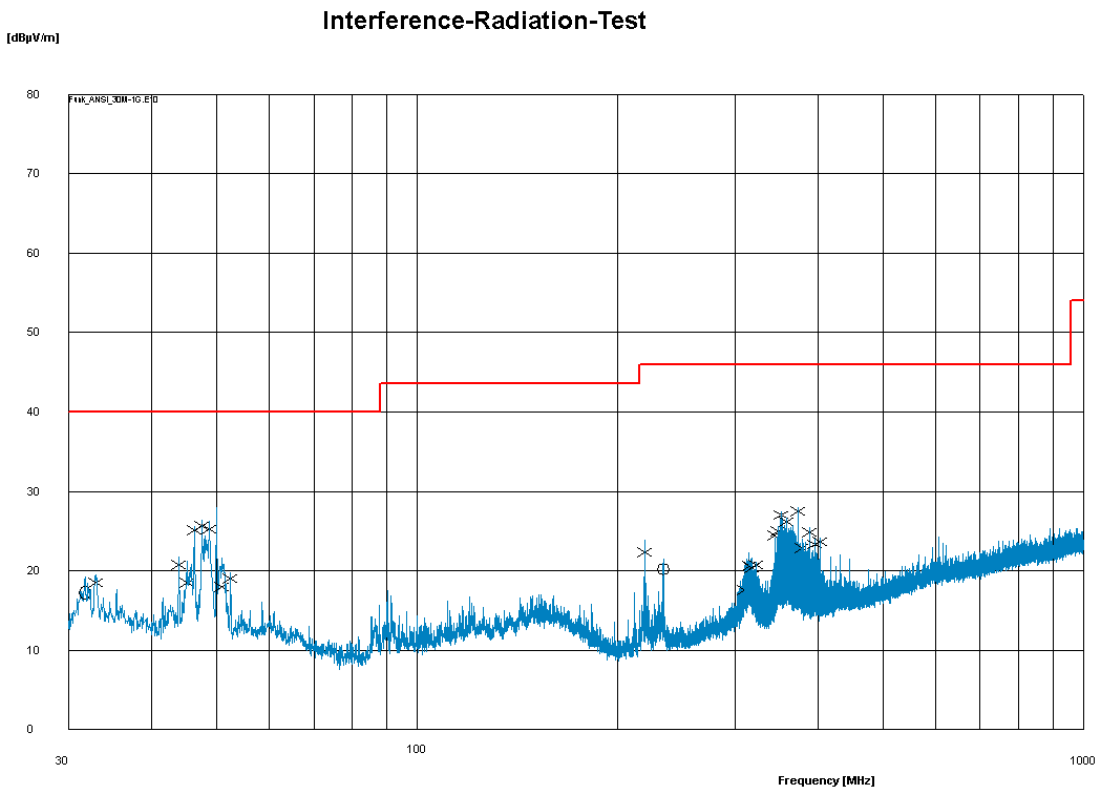
Picture 34: T40S9 - zoomed to carrier (1.22 MHz)



f [MHz]	E_{meas} [dBµV]	Detector	Remark
2.0910	48.74	PK	4th harmonic power supply
2.1730	28.09	PK	lower edge restricted band
2.1905	10.48	PK	upper edge restricted band
2.4410	47.31	PK	- - - -

Picture 35: T40S9 - zoomed to restricted band

Radiated Emission Measurement 30 MHz - 1000 MHz



M.	Freq [M...	VMaxC...	Corr...	Limit	dLimit	Pol	Ant	TT	Date	Remarks	VSca...	Corr ...
☑	31,74	17,2	12,1	40,0	- 22,8	H	100	357	2014-11-11 17:43...		19,2	0,0
☑	32,94	18,5	12,1	40,0	- 21,5	V	100	86	2014-11-11 17:23...		19,5	0,0
☑	43,92	20,8	12,7	40,0	- 19,2	V	100	74	2014-11-11 17:24...		21,7	0,0
☑	45,18	18,5	12,7	40,0	- 21,5	V	100	83	2014-11-11 17:25...		21,2	0,0
☑	46,38	25,1	12,7	40,0	- 14,9	V	100	102	2014-11-11 17:26...		25,6	0,0
☑	47,58	25,6	12,7	40,0	- 14,4	V	100	99	2014-11-11 17:26...		26,4	0,0
☑	48,78	25,3	12,7	40,0	- 14,7	V	100	99	2014-11-11 17:27...		26,3	0,0
☑	51	17,9	12,7	40,0	- 22,1	V	100	96	2014-11-11 17:28...		21,6	0,0
☑	52,44	19,0	12,6	40,0	- 21,0	V	100	86	2014-11-11 17:29...		19,8	0,0
☑	219,6	22,3	10,2	46,0	- 23,7	V	100	353	2014-11-11 17:30...		23,8	0,0
☑	234,24	20,2	11,0	46,0	- 25,8	H	100	182	2014-11-11 17:44...		21,4	0,0
☑	310,08	17,6	13,0	46,0	- 28,4	V	100	361	2014-11-11 17:31...		20,7	0,0
☑	315,3	20,6	13,1	46,0	- 25,4	V	100	17	2014-11-11 17:32...		22,3	0,0
☑	318,42	20,3	13,2	46,0	- 25,7	V	100	7	2014-11-11 17:33...		21,6	0,0
☑	322,62	20,8	13,2	46,0	- 25,2	V	100	17	2014-11-11 17:34...		21,1	0,0
☑	344,04	24,5	13,6	46,0	- 21,5	V	100	19	2014-11-11 17:35...		24,1	0,0
☑	348,78	25,0	13,7	46,0	- 21,0	V	100	29	2014-11-11 17:36...		25,5	0,0
☑	351,9	27,0	13,7	46,0	- 19,0	V	100	20	2014-11-11 17:37...		27,4	0,0
☑	358,68	26,2	13,9	46,0	- 19,9	V	100	29	2014-11-11 17:38...		26,6	0,0
☑	373,32	27,5	14,2	46,0	- 18,6	V	100	33	2014-11-11 17:39...		27,9	0,0
☑	378,06	22,8	14,3	46,0	- 23,2	V	100	45	2014-11-11 17:40...		24,0	0,0
☑	387,96	24,8	14,4	46,0	- 21,2	V	100	46	2014-11-11 17:41...		25,4	0,0
☑	395,82	23,3	14,6	46,0	- 22,7	V	100	57	2014-11-11 17:41...		24,0	0,0
☑	402,6	23,7	14,7	46,0	- 22,3	V	100	32	2014-11-11 17:42...		24,2	0,0

Picture 36: T40S9 - Radiated emission 30 MHz - 1000MHz @ 3m distance

5 Radiated emission measurement (>1 GHz)

according to 47 CFR Part 15, section 15.209(a), RSS-210, section 2.5 with RSS-Gen, section 8.9

Remark:

This measurement needs not to be applied because

- the intentional radiator operates below 10 GHz and tenth harmonic of the highest fundamental frequency is lower than 1 GHz (see 47 CFR Part 15, section 15.33(a)(1), and RSS-Gen, section 6.13), and
- the digital part of the device does not generate or use internal frequencies higher than 108 MHz (see 47 CFR Part 15 section 15.33(b)(1), and RSS-Gen, section 2.3.3 with ICES-003, section 6.2).

6 Bandwidths

according to CFR 47 Part 2, section 2.202(a), and RSS-Gen, section 6.6

6.1 Test Location

See clause 4.1 on page 25.

6.2 Test instruments

See clause 0 on page 25.

6.3 Limits

The bandwidths are recorded only. There are no limits specified in CFR 47 Part 15, section 15.209, and RSS-210, Annex 2.6

6.4 Test setup

See clause 4.5 on page 28.

6.5 Test deviation

There is no deviation from the standards referred to.

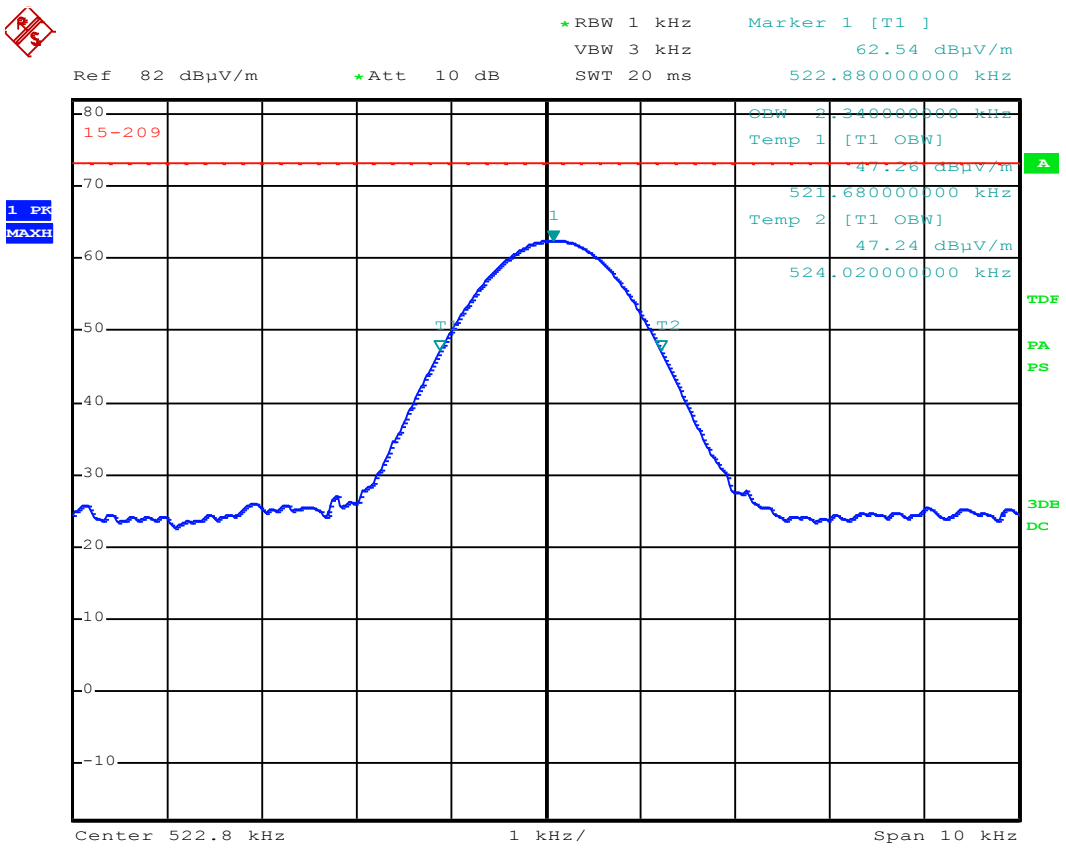
6.6 Test results - T40S7

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Occupied bandwidth (99 %)

Test procedure

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
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. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and 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 recorded. The span between the two recorded frequencies is the occupied bandwidth. For this purpose the appropriate measurement function of the spectrum analyzer is used.



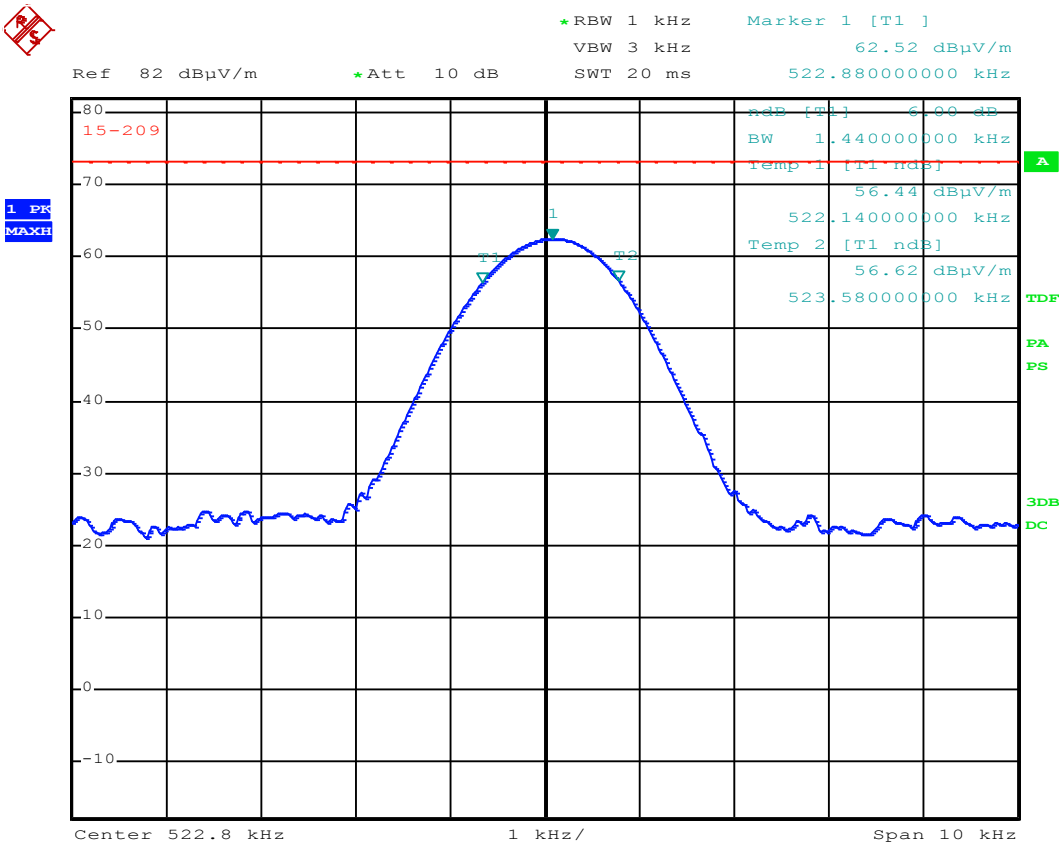
Picture 37: T40S7 - Occupied bandwidth (99 %) - 522 kHz

Measured occupied bandwidth (99 %) - 522 kHz: 2.3400 kHz

-6 dB emission bandwidth

Test procedure

Where indicated, the -6 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 6 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth



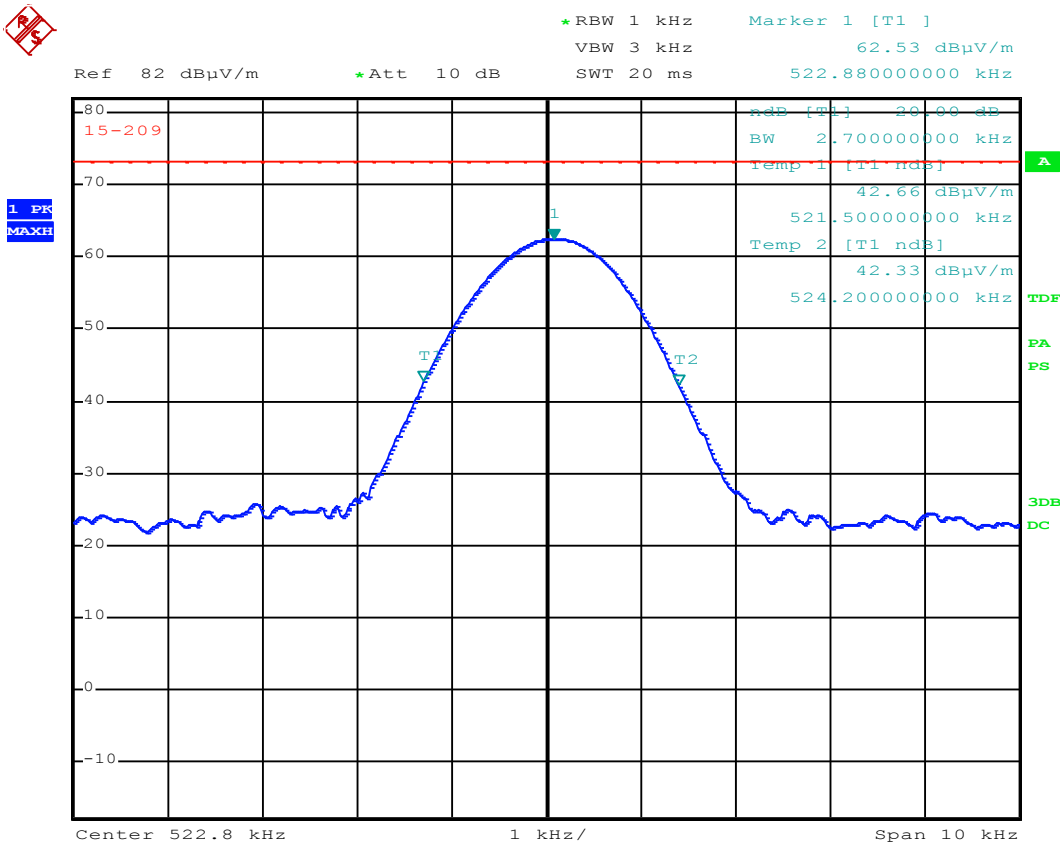
Picture 38: T40S7 - -6 dB emission bandwidth - 522 kHz

Measured -6 dB emission bandwidth - 522 kHz: 1.4400 kHz

-20 dB emission bandwidth

Test procedure

Where indicated, the -20 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.



Picture 39: T40S7 - -20 dB emission bandwidth - 522 kHz

Measured -20 dB emission bandwidth - 522 kHz: 2.7000 kHz

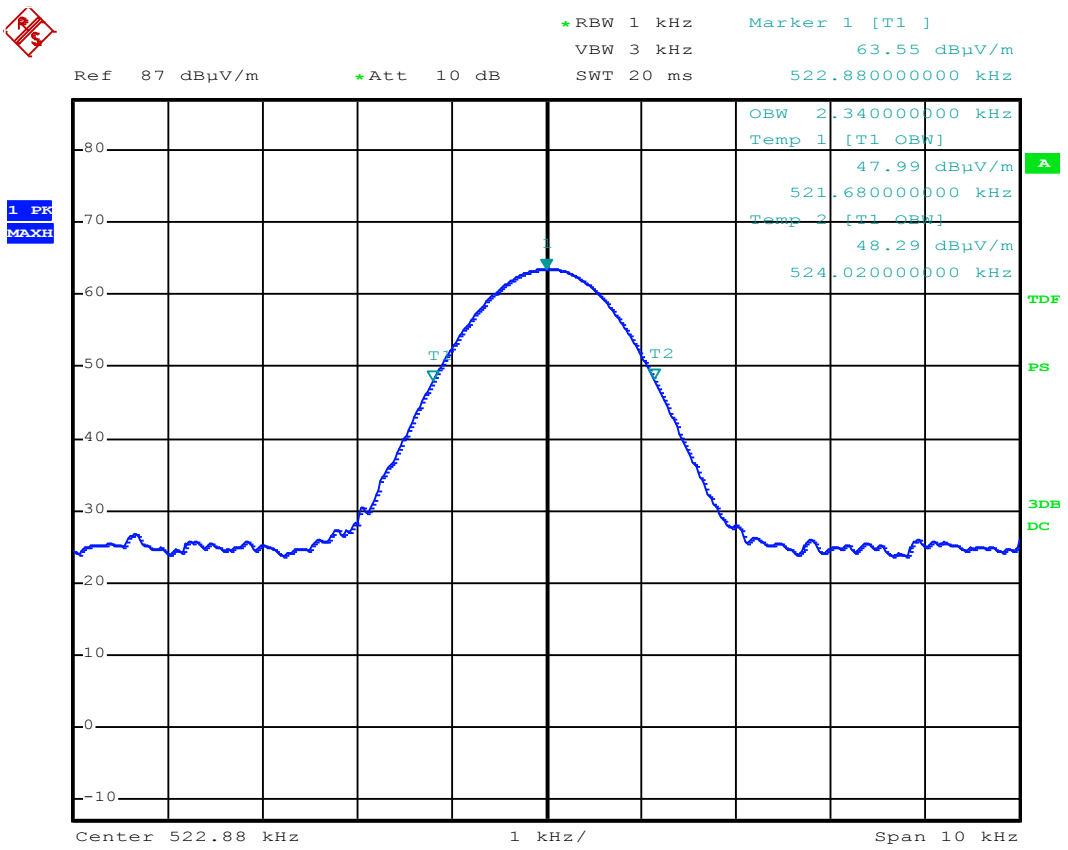
6.7 Test results - T40S8

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Occupied bandwidth (99 %)

Test procedure

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
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. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and 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 recorded. The span between the two recorded frequencies is the occupied bandwidth. For this purpose the appropriate measurement function of the spectrum analyzer is used.



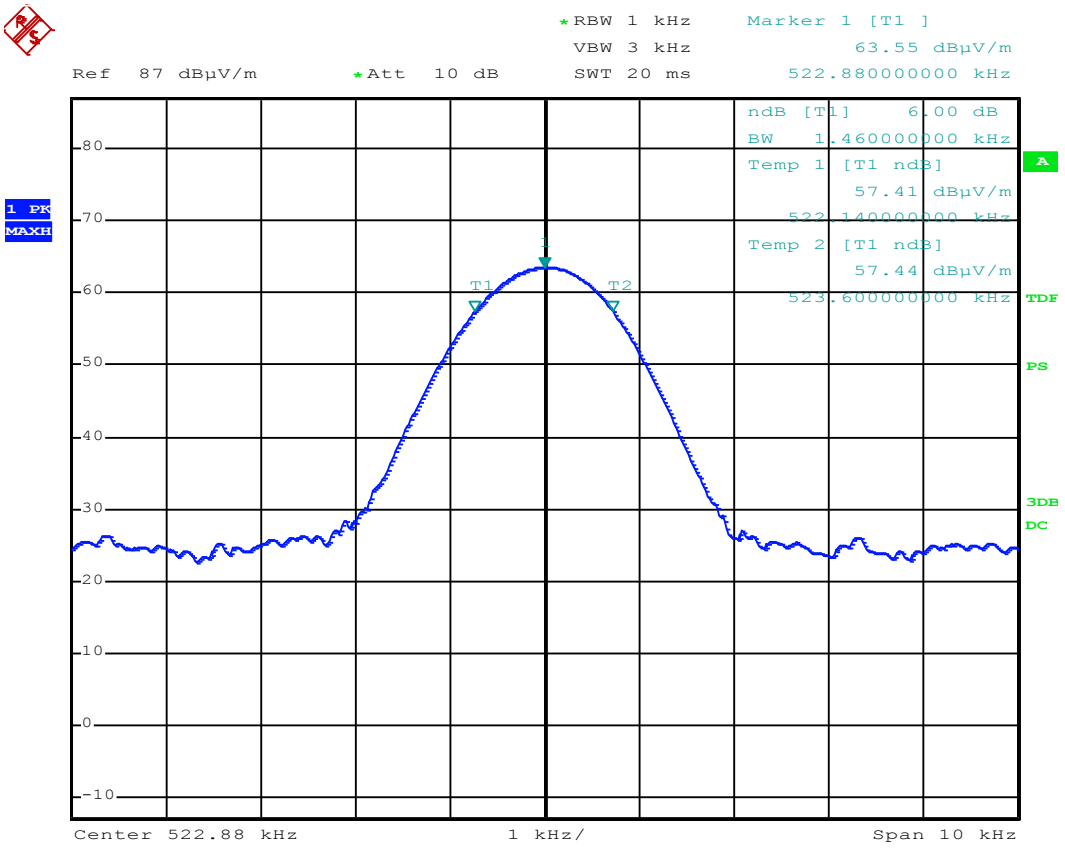
Picture 40: T40S8 - Occupied bandwidth (99 %) - 522 kHz

Measured occupied bandwidth (99 %) - 522 kHz: 2.3400 kHz

-6 dB emission bandwidth

Test procedure

Where indicated, the -6 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 6 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth



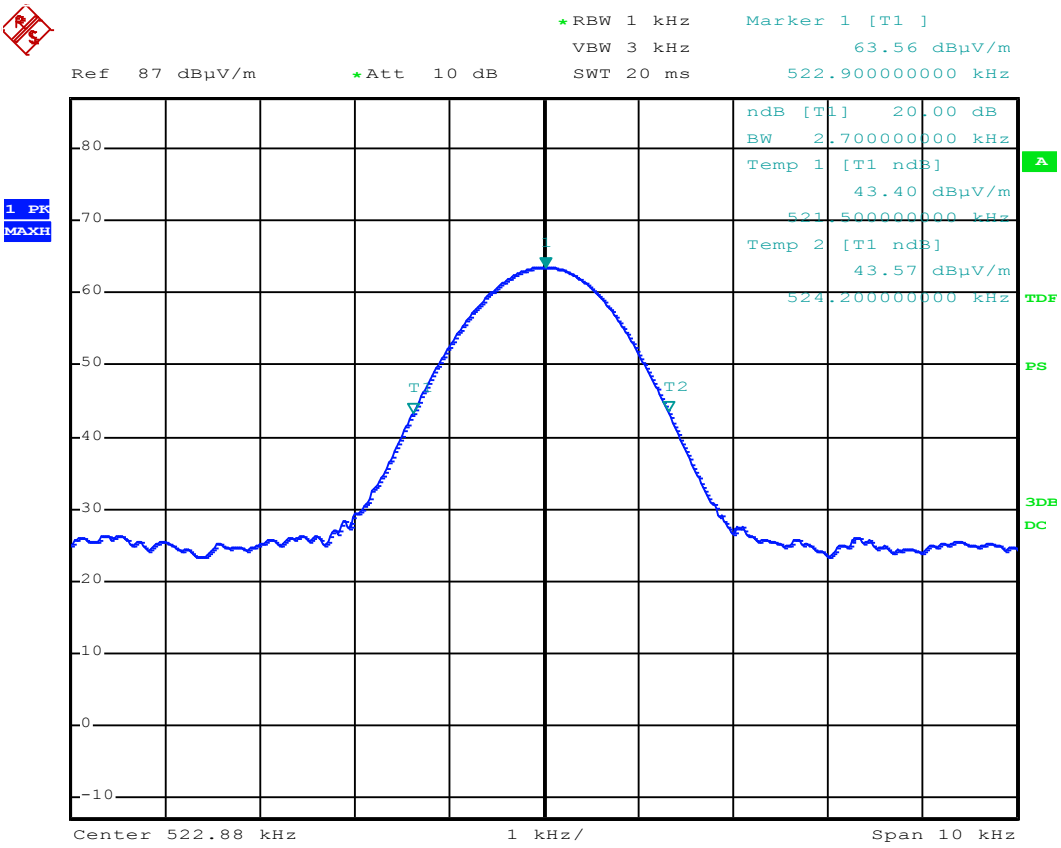
Picture 41: T40S8 - -6 dB emission bandwidth - 522 kHz

Measured -6 dB emission bandwidth - 522 kHz: 1.4600 kHz

-20 dB emission bandwidth

Test procedure

Where indicated, the -20 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.



Picture 42: T40S8 - -20 dB emission bandwidth - 522 kHz

Measured -20 dB emission bandwidth - 522 kHz: 2.7000 kHz

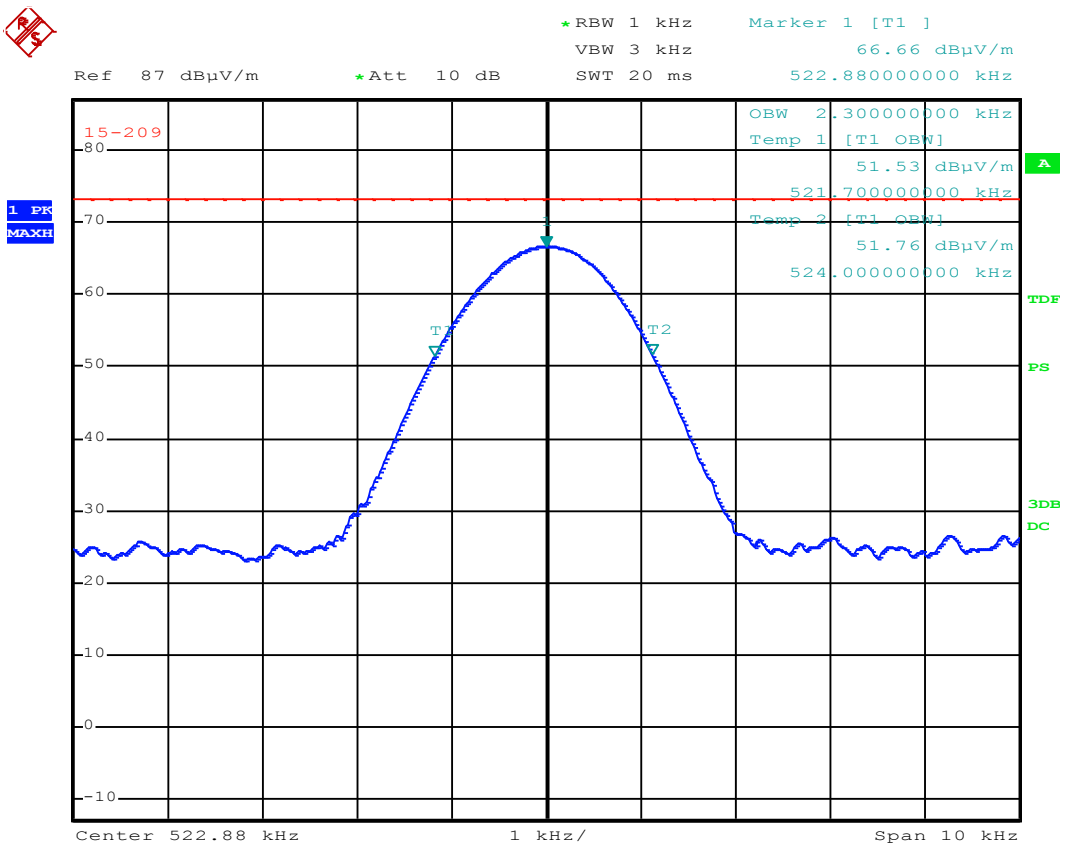
6.8 Test results - T40S9

Temperature:	18°C	Humidity:	47%
Tested by:	Martin Müller	Test date:	2014-11-11

Occupied bandwidth (99 %)

Test procedure

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured. The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
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. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and 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 recorded. The span between the two recorded frequencies is the occupied bandwidth. For this purpose the appropriate measurement function of the spectrum analyzer is used.



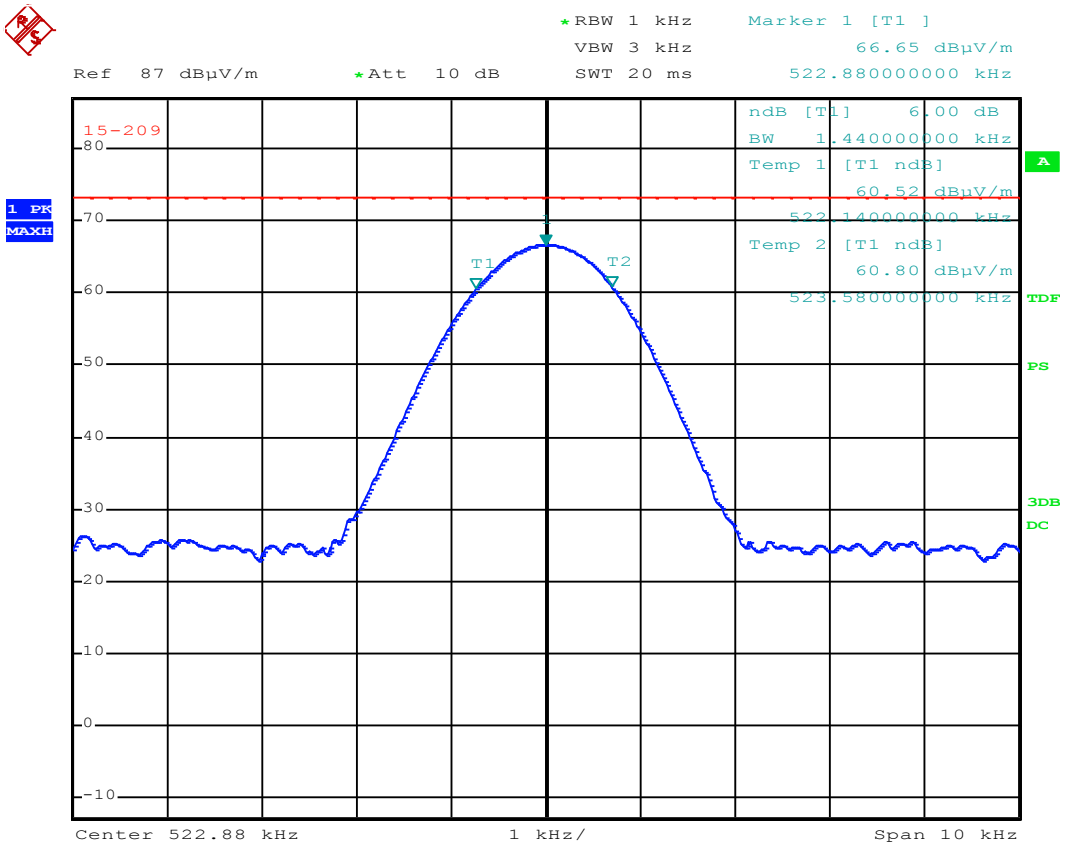
Picture 43: T40S9 - Occupied bandwidth (99 %) - 522 kHz

Measured occupied bandwidth (99 %) - 522 kHz: 2.3000 kHz

-6 dB emission bandwidth

Test procedure

Where indicated, the -6 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 6 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth



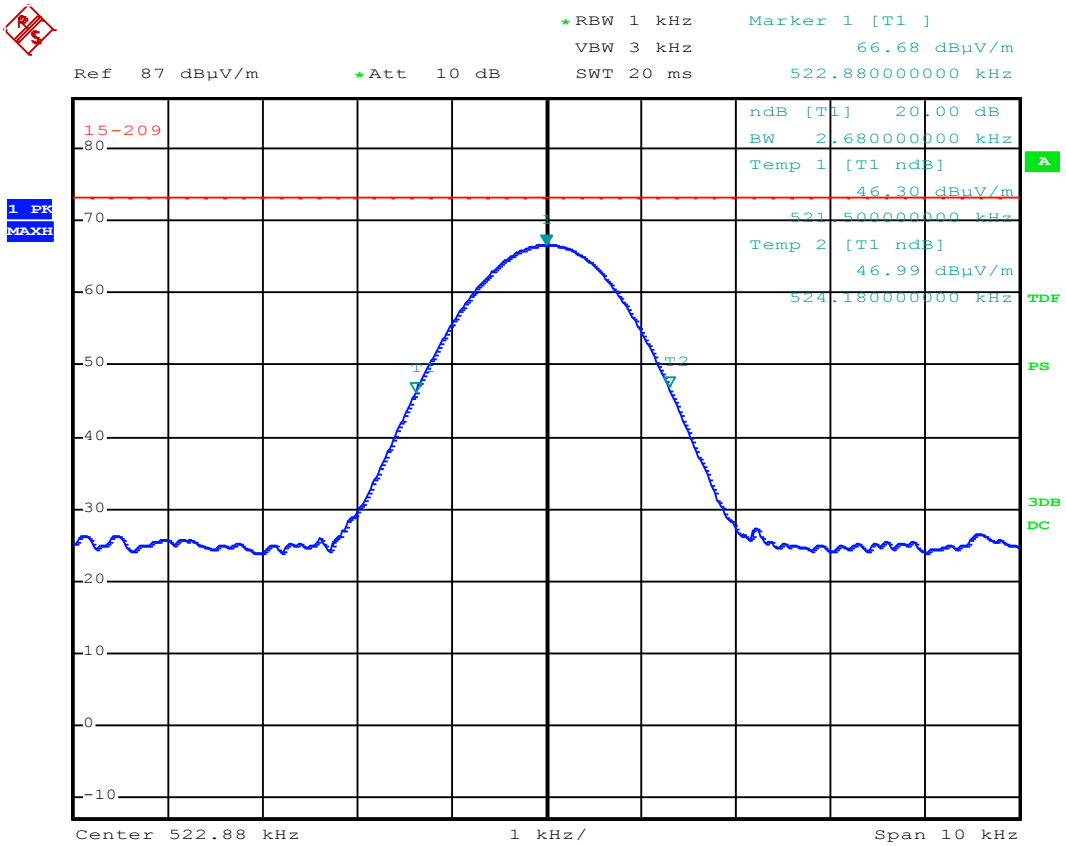
Picture 44: T40S9 - -6 dB emission bandwidth - 522 kHz

Measured -6 dB emission bandwidth - 522 kHz: 1.4400 kHz

-20 dB emission bandwidth

Test procedure

Where indicated, the -20 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 20 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.



Picture 45: T40S9 - -20 dB emission bandwidth - 522 kHz

Measured -20 dB emission bandwidth - 522 kHz: 2.6800 kHz

6.9 Necessary bandwidth - data transfer carrier (1.22 MHz)

Test procedure

Calculated according to TRC-43, Issue 3, November 2012

Formula for PSK: $$B_n = \frac{2 \times R \times K}{\log_2 S}$$

R = 1.2 Mbps [1)]

K = 1

S = 3 [1)]

$$\underline{\underline{B_n = 1.5142 \text{ MHz}}}$$

Note[1)] : customer information

Remark: The calculation of the data transfer carrier is valid for all the models because the parameters are the same. Due to extremely low levels the bandwidth cannot be verified by measurements of e. g. occupied bandwidth..

7 Equipment calibration status

Description	Modell number	Serial number	Inventory number	Last calibration	Next calibration
Test receiver	ESU 26	100026	W00002	2014-02	2016-02
Test receiver	ESCI 3	100013	E00001	2013-12	2015-12
Test receiver	ESCI 3	100328	E00552	2014-07	2016-07
Test receiver	ESCS 30	825442/0002	E00003	2014-02	2015-02
Test receiver	ESCS 30	845552/0008	E00551	2014-01	2015-01
LISN	ESH2-Z5	881362/037	E00004	2013-03	2015-03
LISN	ESH2-Z5	893406/009	E00005	2014-01	2016-01
Broadband antenna	VULB 9163	9163-114	E00013	2013-09	2015-09
Loop antenna	HFH2-Z2	871398/0050	E00004	2014-07	2016-07
Magnetic field probe	RF-R 400-1	02-1165	E00270	N/A (see note 1)	
Shielded room	P92007	B83117C1109T211	E00107	N/A	
Compact Diagnostic Chamber (CDC)	VK041.0174	D62128-A502-A69-2-0006	E00026	N/A	
Open area test site (OATS)	---	---	E00354	2014-10	2015-10
Climatic chamber 340 l	VC³ 4034	58566123250010	C00015	2014-09	2016-09

Table 1: Equipment calibration status

Note 1: Used for relative measurements only.

Note 2: Expiration date of measurement facility registration (OATS) by
- FCC (registration number 221458): 2017-04
- Industry Canada (test site number 3472A-1): 2015-10

8 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (9kHz to 30 MHz)	± 3.8 dB	2
Radiated emission open field (3 m) (30 MHz to 300 MHz) (300MHz to 1 GHz)	± 5.4 dB ± 5.9 dB	2
Radiated emission absorber chamber (> 1000 MHz)	± 4.5 dB	2

Table 2: Measurement uncertainty

The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. For a confidence level of 95 % the coverage factor k is 2.

9 Summary

The EMC Regulations according to the marked specifications are

☑ **KEPT**

The EUT does fulfill the general approval requirements mentioned.

☐ **<u>NOT</u> KEPT**

The EUT does not fulfill the general approval requirements mentioned.

Place, Date: Straubing, November 17th, 2014

Martin Müller	Rainer Heller
Test engineer	Head of EMC / radio department
EMV **TESTHAUS** GmbH	EMV **TESTHAUS** GmbH

10 Revision History

Date	Description	Person	Revision
2014-11-17	First edition	M. Müller	- - -

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