

Straubing, 11 September 2006

**TEST - REPORT**

**No. 51104-060093 (Edition 2)**

**for**

**FQR 50**

**Radar Level Sensor**

**Applicant:** Kirchgaesser Industrieelektronik GmbH

**Test Specifications:** FCC Code of Federal Regulations,  
CFR 47, Part 15,  
Sections 15.205, 15.207 and 15.249

**Note:**

The test data of this report is related only to the individual item which has been tested. This report shall not be reproduced except in full extent without the written approval of the testing laboratory.

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## 1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation <sup>1</sup> :	FQR 50
Parts <sup>2</sup> :	N/A
Serial number(s):	3105-2006
Manufacturer:	Kirchgaesser Industrieelektronik GmbH
Type of equipment:	Radar Level Sensor
Version:	
FCC ID:	
Additional parts/accessories:	

Technical data of EUT	
Application frequency range:	
Frequency range:	
Operating frequency:	24.125 GHz
Type of modulation:	CW
Pulse train:	1 ms
Pulse width:	0.33 ms
Number of RF-channels:	1
Channel spacing:	N/A
Designation of emissions <sup>3</sup> :	
Type of antenna:	Integrated
Size/length of antenna:	N/A
Connection of antenna:	<input type="checkbox"/> detachable <input checked="" type="checkbox"/> not detachable
Type of power supply:	DC supply
Specifications for power supply:	nominal voltage: 24 V minimum voltage: 21.6 V maximum voltage: 26.4 V  nominal frequency: N/A Hz

<sup>1</sup> Type designation of the system if EUT consists of more than one part.

<sup>2</sup> Type designations of the parts of the system, if applicable.

<sup>3</sup> Also known as "Class of Emission".

## 2 Administrative Data

Application details	
Applicant (full address):	Kirchgaesser Industrieelektronik GmbH Am Rosenbaum 6 40882 Ratingen Deutschland
Contact person:	Michael Kuhrig
Contract identification:	Verbal
Receipt of EUT:	06 February 2006
Date(s) of test:	March 2006
Note(s):	

Report details	
Report number:	51104-060093 (Edition 2)
Edition:	1
Issue date:	11 September 2006

### 3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	Senton GmbH EMI/EMC Test Center
Address:	Aeussere Fruehlingstrasse 45 D-94315 Straubing Germany
Laboratory accreditation:	DAR-Registration No. DAT-P-171/94-02
FCC test site registration number	90926
Industry Canada test site registration:	IC 3050
Contact person:	Mr. Johann Roidt
	Phone: (+49) (0)9421 5522-0 Fax: (+49) (0)9421 5522-99

## 4 Summary

### Summary of test results

The tested sample complies with the requirements set forth in the

**Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.207 and 15.249**  
of the Federal Communication Commission (FCC).

### Personnel involved in this report

Laboratory Manager:



Mr. Johann Roidt

Responsible for testing:



Mr. Martin Steindl

Responsible for test report:

Mr. Johann Roidt

## 5 Operation Mode and Configuration of EUT

### Operation Mode(s)

Normal operation

### Configuration(s) of EUT

N/A

### List of ports and cables

<i>Port</i>	<i>Description</i>	<i>Classification<sup>4</sup></i>	<i>Cable type</i>	<i>Cable length</i>
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### List of devices connected to EUT

<i>Item</i>	<i>Description</i>	<i>Type Designation</i>	<i>Serial no. or ID</i>	<i>Manufacturer</i>
1	DC 24 V Laboratory Power Supply			

### List of support devices

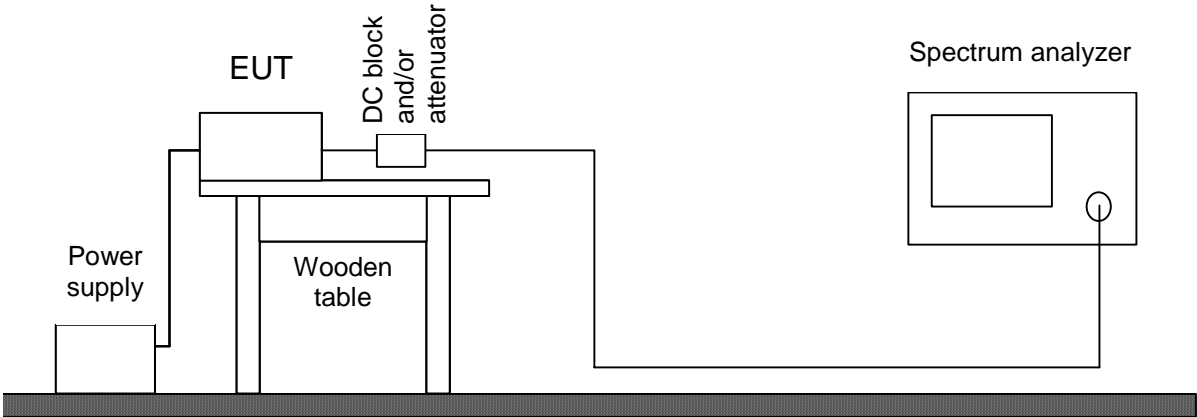
<i>Item</i>	<i>Description</i>	<i>Type Designation</i>	<i>Serial no. or ID</i>	<i>Manufacturer</i>
1	None			

<sup>4</sup> Ports shall be classified as ac power, dc power or signal/control port

6 Measurement Procedures

6.1 Bandwidth Measurements

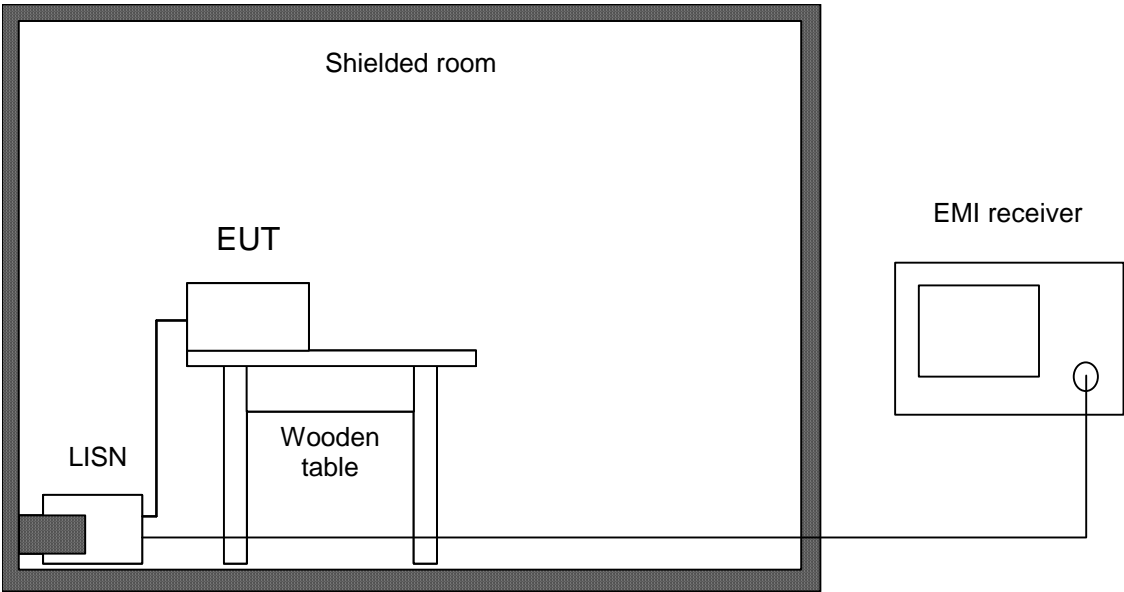
Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, section 15.215(c) ANSI C63.4, annex H.6
Guide:	ANSI C63.4
Measurement setup:	<div><input type="checkbox"/> See below</div> <div>Condu</div> <div>cted:</div> <div><input checked="" type="checkbox"/> Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.3)</div>
<p>If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.</p> <p>If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.</p> <p>The analyzer settings are specified by the test description of the appropriate test record(s).</p>	





6.2 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207
Guide:	ANSI C63.4 / CISPR 22
<p>Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:</p> <p>First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak.</p> <p>If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.</p> <p>According to ANSI C63.4, section 13.1.3.1, testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.</p> <p>Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.</p>	

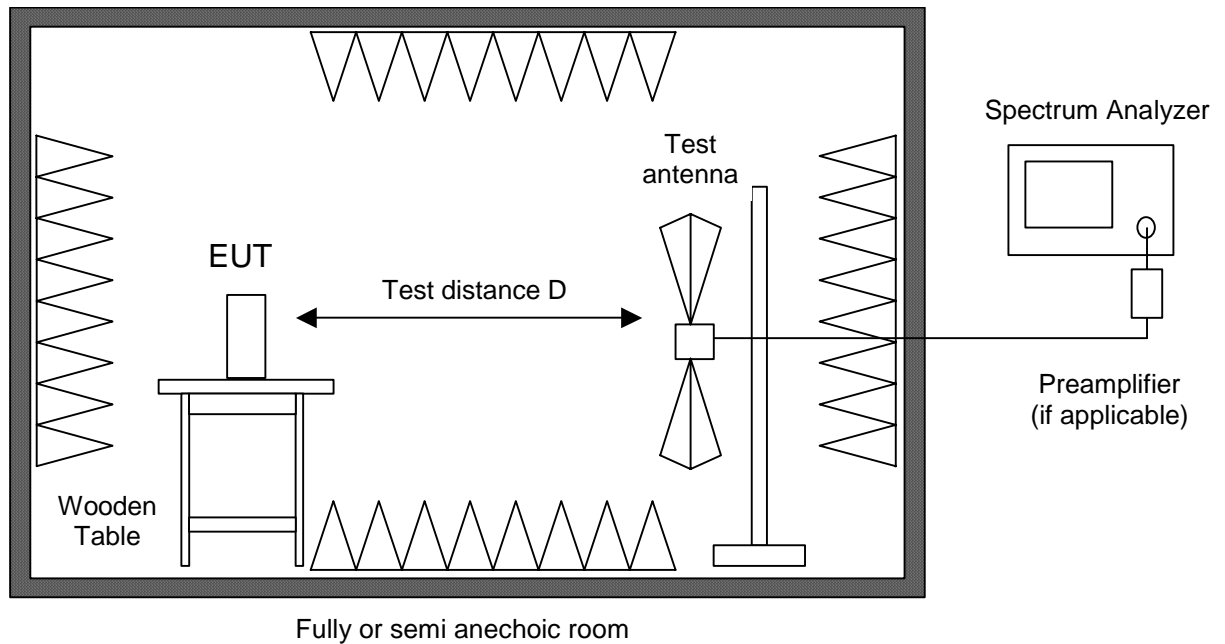


Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/>	EMI receiver	ESHS 10	860043/016	Rohde & Schwarz
<input checked="" type="checkbox"/>	LISN	ESH3-Z5	862770/021	Rohde & Schwarz
<input type="checkbox"/>	LISN	ESH3-Z5	830952/025	Rohde & Schwarz
<input type="checkbox"/>	Artificial mains network	ESH 2-Z5	842966/004	Rohde & Schwarz
<input type="checkbox"/>	Shielded room	No. 1	1451	Albatross Projects
<input checked="" type="checkbox"/>	Shielded room	No. 4	3FD-100 544	Euroshield

### 6.3 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.209
Guide:	ANSI C63.4
<p>Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.</p> <p>Measurements are made in both the horizontal and vertical planes of polarization in a fully anechoic room using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).</p> <p>Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.</p> <p>All tests below 18 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance is reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.</p> <p>If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.</p> <p>Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.</p> <p>During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.</p> <p>For final testing below 1 GHz an open field test-site is used and the plots recorded in the fully or semi anechoic room are indicated as prescans.</p>	

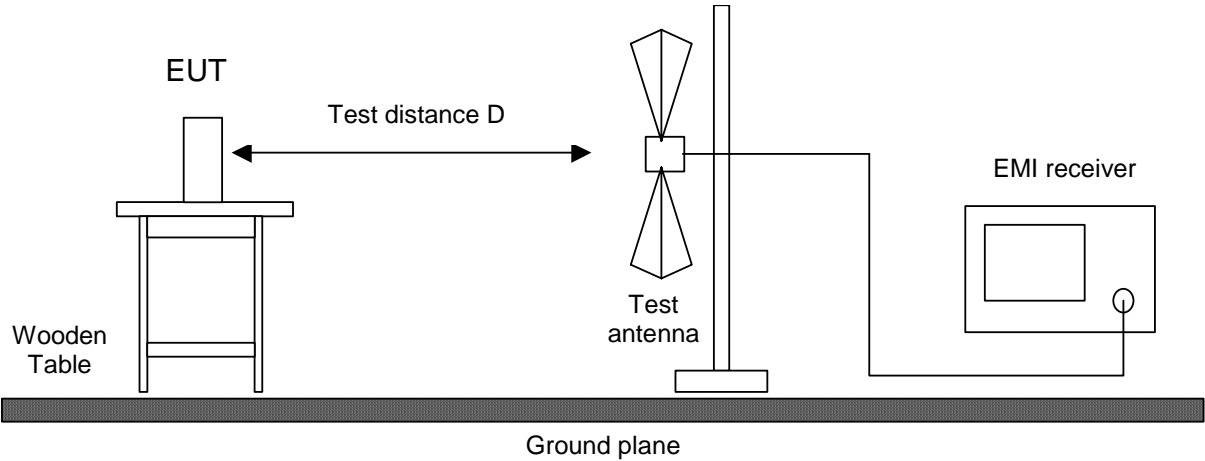


Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/>	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
<input type="checkbox"/>	Spectrum analyzer	R 3271	05050023	Advantest
<input checked="" type="checkbox"/>	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
<input type="checkbox"/>	Preamplifier	CPA9231A	3393	Schaffner
<input type="checkbox"/>	Preamplifier	R14601		Advantest
<input checked="" type="checkbox"/>	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
<input checked="" type="checkbox"/>	Preamplifier 0.5-8 GHz	AMF-4D-005080-25-13P	860149	Miteq
<input checked="" type="checkbox"/>	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
<input type="checkbox"/>	External Mixer	WM782A	845881/005	Tektronix
<input checked="" type="checkbox"/>	Harmonic Mixer	FS-Z30	843389/007	Rohde & Schwarz
	Accessories			
<input checked="" type="checkbox"/>	Trilog broadband antenna	VULB 9163	9163-188	Schwarzbeck
<input checked="" type="checkbox"/>	Horn antenna	3115	9508-4553	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-03	9112-1003	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-04	9112-1001	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-05	9112-1001	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-06	9112-1001	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-07	9112-1008	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-08	9112-1002	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-09	9403-1025	EMCO
<input checked="" type="checkbox"/>	Horn antenna	3160-10	399185	EMCO
<input checked="" type="checkbox"/>	Fully anechoic room	No. 2	1452	Albatross Projects
<input type="checkbox"/>	Semi-anechoic room	No. 3	1453	Siemens

6.4 Radiated Emission at Open Field Test Site

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.209
Guide:	ANSI C63.4
<p>Radiated emission at open field test site is measured in the frequency range 30 MHz to 1 GHz using a biconical antenna up to 300 MHz and a logarithmic periodic antenna above. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.</p> <p>If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.</p> <p>Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in the fully anechoic room. EUT is rotated all around and receiving antenna is raised and lowered within 1 meter to 4 meters to find the maximum levels of emission. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.</p> <p>For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.</p>	



Test instruments used:

Used	Type		Model	Serial No. or ID	Manufacturer
<input checked="" type="checkbox"/>	EMI receiver		ESVP	881120/024	Rohde & Schwarz
<input checked="" type="checkbox"/>	Biconical antenna	EG 1	HK 116	842204/001	Rohde & Schwarz
<input checked="" type="checkbox"/>	Log. per. antenna	EG 1	HL 223	841516/023	Rohde & Schwarz
<input checked="" type="checkbox"/>	Open field test site		EG 1	1450	Senton

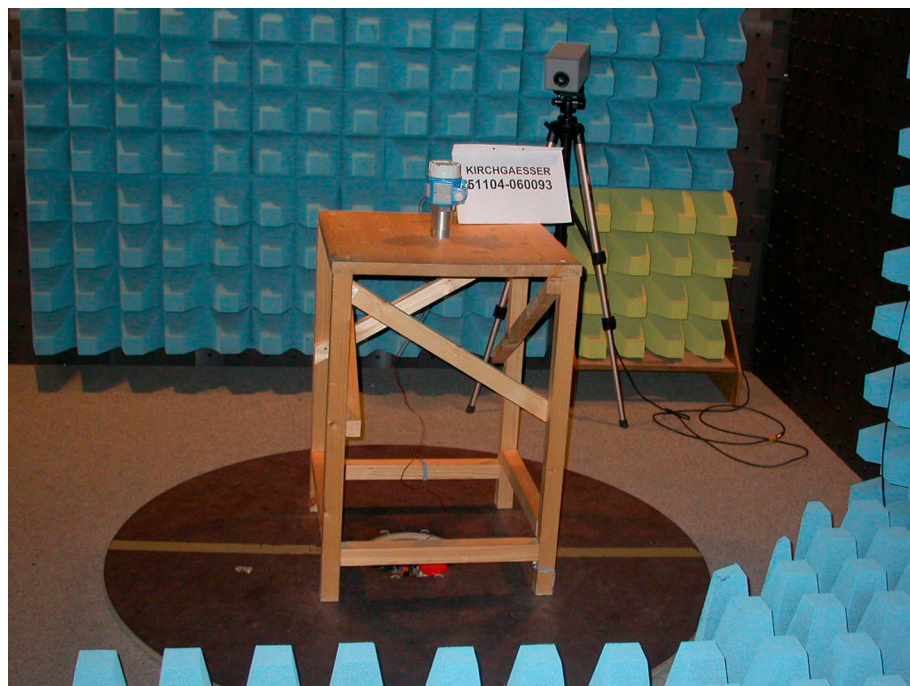
## **7      Photographs Taken During Testing**

**Test setup for conducted AC powerline emission measurement**





**Test setup for radiated emission measurement  
(fully anechoic room)**





**Test setup for radiated emission measurement  
(open field test site)**



## 8 Test Results

FCC CFR 47 Parts 2 and 15			
<i>Section(s)</i>	<i>Test</i>	<i>Page</i>	<i>Result</i>
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	19	Recorded
2.201, 2.202	Class of emission	23	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a)	Restricted bands of operation	24	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	27	Test passed
15.205(b) 15.209	Radiated emission 9 kHz to 30 MHz	---	Not applicable
15.205(b) 15.249	Radiated emission 30 MHz to 1 GHz	30	Test passed

## 8.1 Occupied Bandwidth

Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6	
Guide:	ANSI C63.4	
Description:	The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.	
	The occupied bandwidth according to ANSI C63.4, annex H.6; is measured as the frequency range defined by the points that are 26 dB down relative to the maximum level of the modulated carrier.	
	The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:	
	Fundamental frequency	Minimum resolution bandwidth
	9 kHz to 30 MHz	1 kHz
	30 MHz to 1000 MHz	10 kHz
	1000 MHz to 40 GHz	100 kHz
	The video bandwidth shall be at least three times greater than the resolution bandwidth.	
Measurement procedure:	Bandwidth Measurements (6.1)	

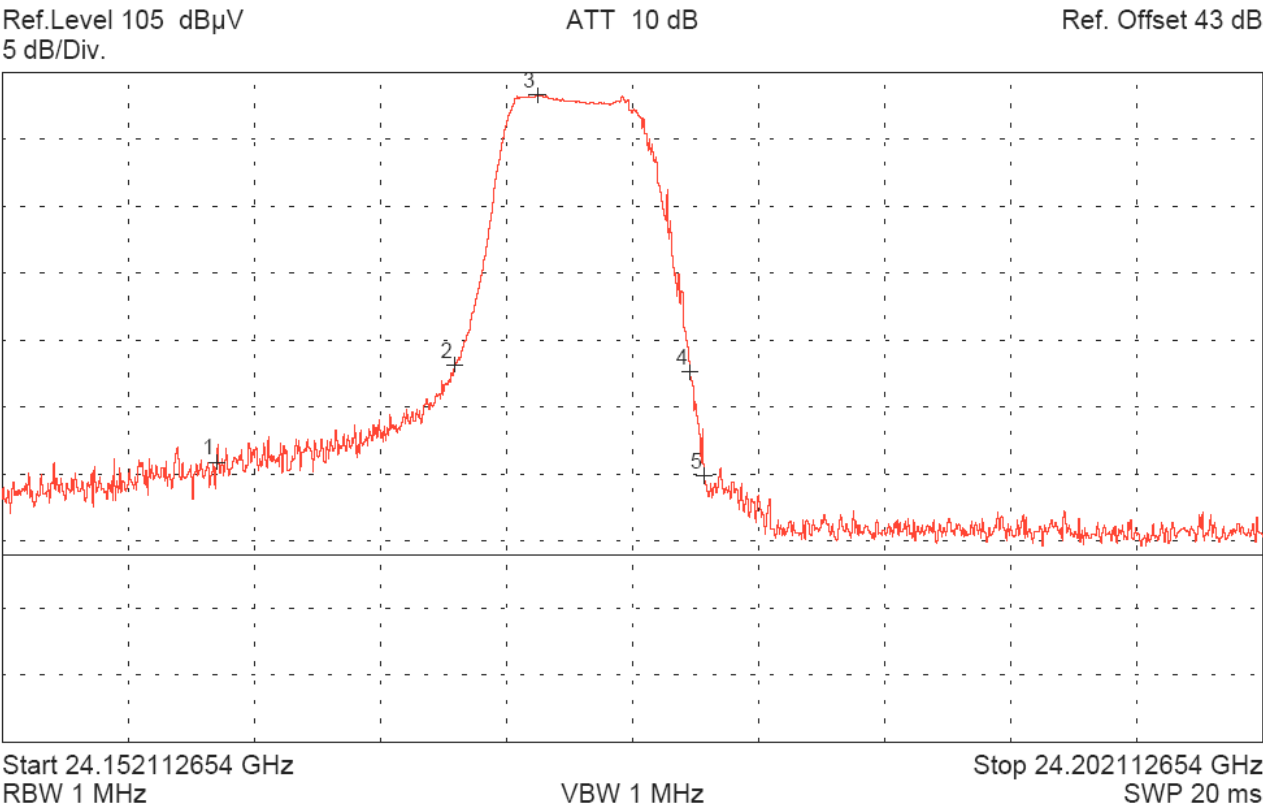
Comment:	
Date of test:	09 February 2006
Test site:	Fully anechoic room, cabin no. 2

## Ref. Offset 43 dB

Occupied Bandwidth (99 %): **9.33 MHz**Occupied Bandwidth (-26 dB): **19.33 MHz**

## 8.2 Bandwidth of the Emission

Rules and specifications:									
Guide:									
Description:	<p>The 20 dB bandwidth of the emission is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier.</p> <p>For intentional radiators operating under the alternative provisions to the general emission limits the requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.</p> <p>The resolution bandwidth of the spectrum analyzer shall be set to a value greater than 5.0% of the allowed bandwidth. If no bandwidth specifications are given, the following guidelines are used:</p> <table> <tr> <th>Fundamental frequency</th><th>Minimum resolution bandwidth</th></tr> <tr> <td>9 kHz to 30 MHz</td><td>1 kHz</td></tr> <tr> <td>30 MHz to 1000 MHz</td><td>10 kHz</td></tr> <tr> <td>1000 MHz to 40 GHz</td><td>100 kHz</td></tr> </table> <p>The video bandwidth shall be at least three times greater than the resolution bandwidth.</p>	Fundamental frequency	Minimum resolution bandwidth	9 kHz to 30 MHz	1 kHz	30 MHz to 1000 MHz	10 kHz	1000 MHz to 40 GHz	100 kHz
Fundamental frequency	Minimum resolution bandwidth								
9 kHz to 30 MHz	1 kHz								
30 MHz to 1000 MHz	10 kHz								
1000 MHz to 40 GHz	100 kHz								
Measurement procedure:	Bandwidth Measurements (6.1)								
Comment:									
Date of test:	09 February 2006								
Test site:	Fully anechoic room, cabin no. 2								



Bandwidth of the emission:	9.33 MHz
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### 8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Pulse Modulation (ASK)
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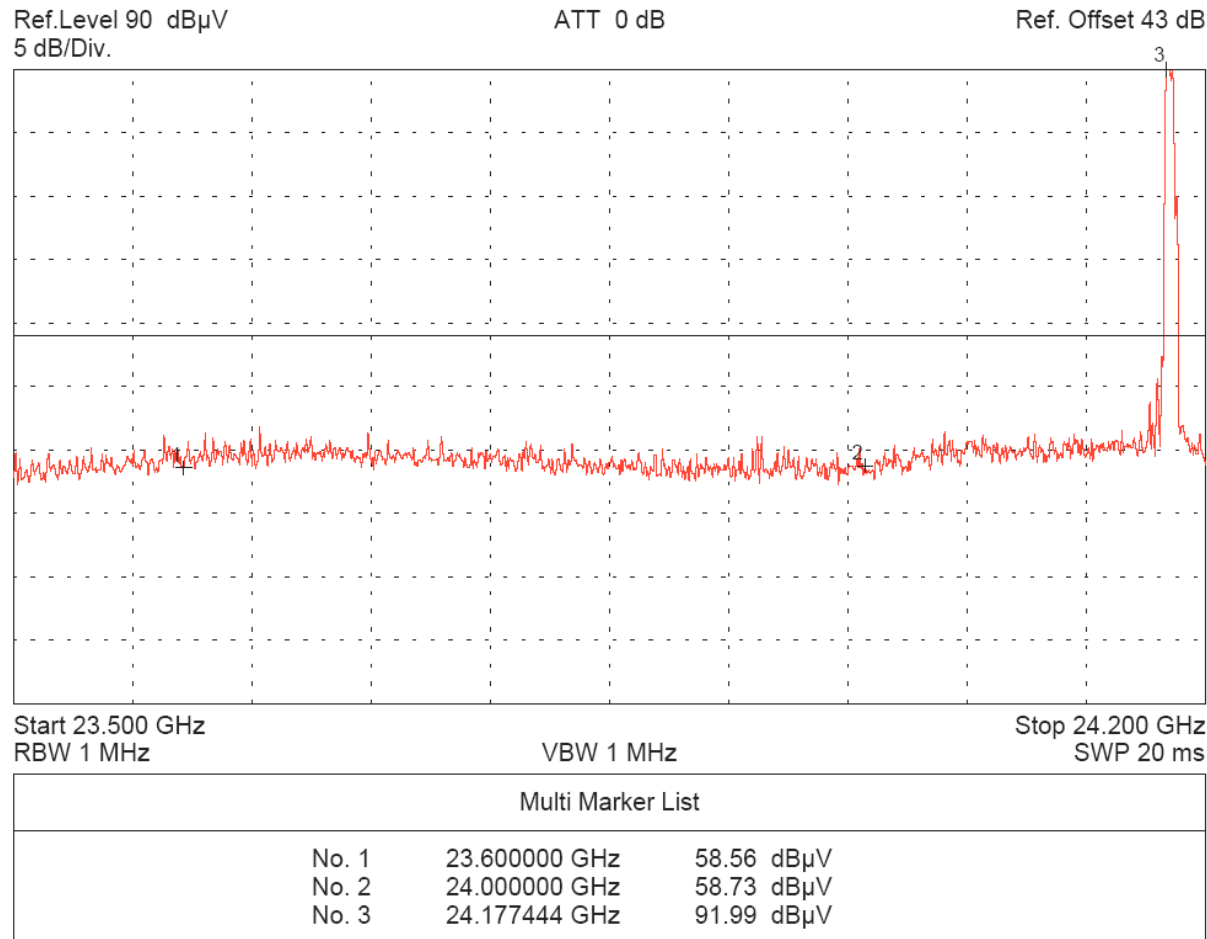
$B_n$ = Necessary Bandwidth	$B_n = 2BK$
$B$ = Modulation rate	$B = 1 \text{ kHz}$
$K$ = Overall numerical factor	$K = 1$
Calculation:	$B_n = 2 \cdot (1 \text{ kHz}) \cdot 1 = 2 \text{ kHz}$

Designation of Emissions:	<b>2K0A1D</b>
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8.4 Restricted Bands of Operation

Rules and specifications:	CFR 47 Part 15, section 15.205(a)
Guide:	ANSI C63.4
Limit:	Only spurious emissions are permitted in any of the frequency bands listed in CFR 47 Part 15, section 15.205(a)
Measurement procedure:	Radiated Emission in Fully or Semi Anechoic Room (6.3)

Comment:	
Date of test:	07 February 2006
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters



Test Result:	Test passed
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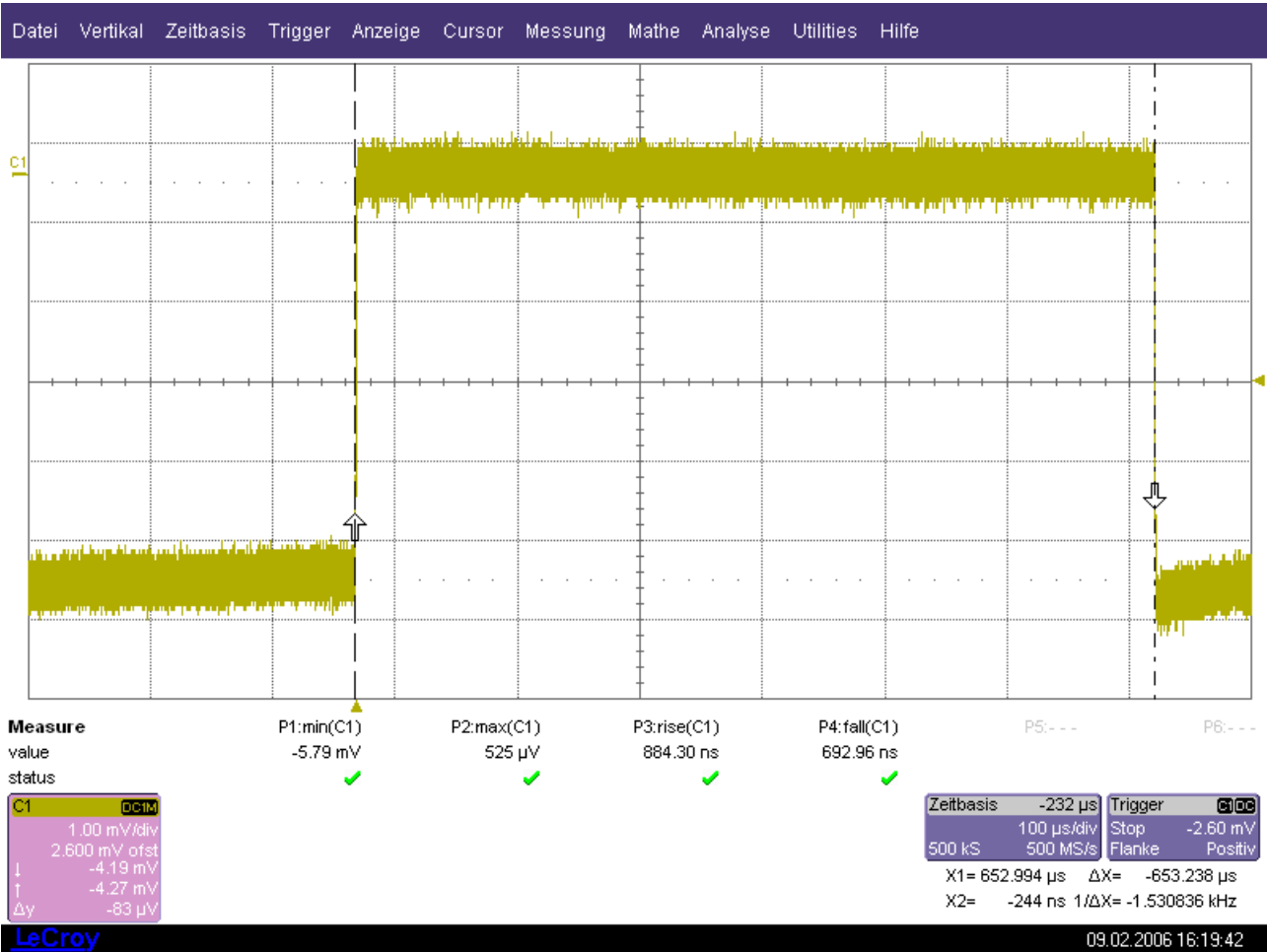


8.5 Pulse Train Measurement

Rules and specifications:	CFR 47 Part 15, section 15.35(c)
Guide:	ANSI C63.4
Measurement procedure:	Pulse Train Measurement (6.2)

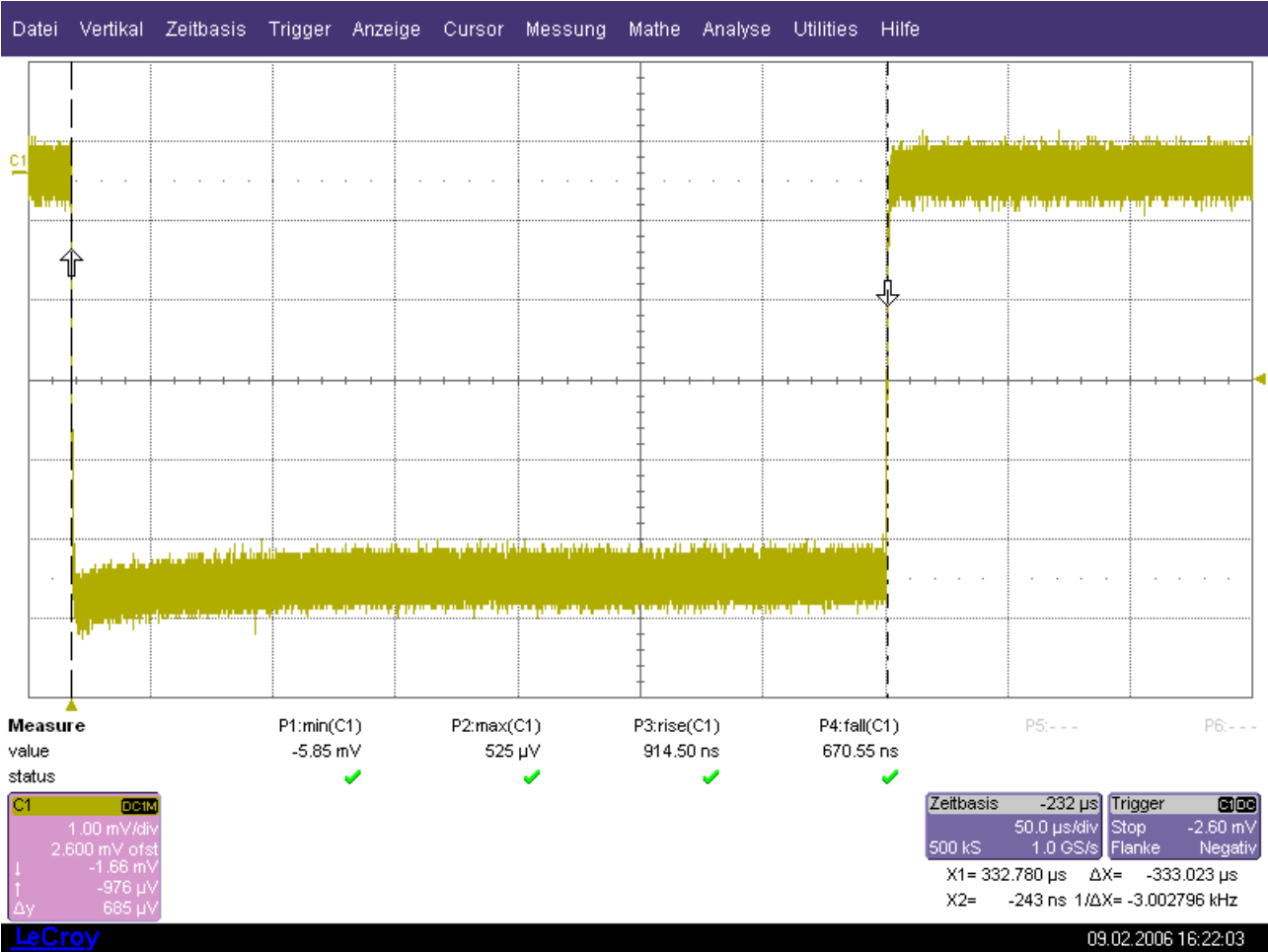
Comment:	
Date of test:	09 February 2006
Test site:	Fully anechoic room, cabin no. 2

T on:



Note: Due to the detector used (negative diode), the above graph is inverse.

T off :



Calculation of pulse train correction:

TX-On-Time (worst case):	$T_{on}$	=	0.33 ms
Pulse Train Time:	$T_{pt}$	=	1.00 ms
Period Time:	$T_{period}$	=	1.00 ms
Pulse Train Correction:	$C_{pt}$	=	$20 \cdot \text{Log}(T_{on} / T_{period}) \text{ dB}$
		=	9.6 dB

Note: Due to the detector used (negative diode), the above graph is inverse.

## 8.6 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207		
Guide:	ANSI C63.4 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dB $\mu$ V)	
		Quasi-peak	Average
	0.15 - 0.5	66 to 56	56 to 46
	0.5 - 5	56	46
	5 - 30	60	50
Measurement procedure:	Conducted AC Powerline Emission (6.2)		

Comment:	
Date of test:	11 May 2006
Test site:	Shielded room, cabin no. 1

Test Result:	Test passed
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Tested on: Linecord AC supply of AC/DC convertor - Phase L1

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.180	Quasi-Peak	47.0	0.0	47.0	64.5	17.5
0.180	Average	37.4	0.0	37.4	54.5	17.1
0.240	Average	36.3	0.0	36.3	52.1	15.8
0.300	Average	35.7	0.0	35.7	50.2	14.5
0.355	Quasi-Peak	36.6	0.0	36.6	58.8	22.2
0.360	Average	35.0	0.0	35.0	48.7	13.7
0.475	Average	34.5	0.0	34.5	46.4	11.9
0.535	Quasi-Peak	34.1	0.0	34.1	56.0	21.9
0.535	Average	32.9	0.0	32.9	46.0	13.1
0.775	Quasi-Peak	51.3	0.0	51.3	56.0	4.7
0.775	Average	45.8	0.0	45.8	46.0	<b>0.2</b>
0.840	Quasi-Peak	37.4	0.0	37.4	56.0	18.6
0.895	Average	34.8	0.0	34.8	46.0	11.2
1.015	Average	29.8	0.0	29.8	46.0	16.2
1.490	Average	28.5	0.0	28.5	46.0	17.5
1.610	Average	27.7	0.0	27.7	46.0	18.3
1.965	Average	27.9	0.0	27.9	46.0	18.1
2.860	Average	23.8	0.0	23.8	46.0	22.2
2.920	Average	23.1	0.0	23.1	46.0	22.9
4.110	Average	22.9	0.0	22.9	46.0	23.1
5.155	Quasi-Peak	39.6	0.0	39.6	60.0	20.4
5.180	Average	29.7	0.0	29.7	50.0	20.3
5.535	Average	29.4	0.0	29.4	50.0	20.6
18.445	Quasi-Peak	42.5	0.0	42.5	60.0	17.5
19.210	Average	32.7	0.0	32.7	50.0	17.3
19.660	Quasi-Peak	40.5	0.0	40.5	60.0	19.5
20.280	Average	27.0	0.0	27.0	50.0	23.0

**Sample calculation of final values:**

$$\text{Final Value (dBµV)} = \text{Reading Value (dBµV)} + \text{Correction Factor (dB)}$$

Tested on: Linecord AC supply of AC/DC convertor - Phase N

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.180	Quasi-Peak	44.3	0.0	44.3	64.5	20.2
0.180	Average	40.0	0.0	40.0	54.5	14.5
0.235	Quasi-Peak	41.0	0.0	41.0	62.3	21.3
0.240	Average	39.3	0.0	39.3	52.1	12.8
0.295	Quasi-Peak	41.1	0.0	41.1	60.4	19.3
0.295	Average	40.0	0.0	40.0	50.4	10.4
0.355	Quasi-Peak	40.7	0.0	40.7	58.8	18.1
0.355	Average	39.6	0.0	39.6	48.8	9.2
0.475	Quasi-Peak	38.0	0.0	38.0	56.4	18.4
0.475	Average	36.8	0.0	36.8	46.4	9.6
0.535	Average	34.4	0.0	34.4	46.0	11.6
0.655	Quasi-Peak	35.6	0.0	35.6	56.0	20.4
0.770	Quasi-Peak	52.7	0.0	52.7	56.0	3.3
0.770	Average	45.5	0.0	45.5	46.0	<b>0.5</b>
0.830	Average	38.5	0.0	38.5	46.0	7.5
0.835	Quasi-Peak	41.1	0.0	41.1	56.0	14.9
1.070	Average	30.6	0.0	30.6	46.0	15.4
1.485	Average	28.5	0.0	28.5	46.0	17.5
1.545	Average	27.6	0.0	27.6	46.0	18.4
1.960	Average	26.1	0.0	26.1	46.0	19.9
2.375	Average	25.5	0.0	25.5	46.0	20.5
3.560	Average	27.1	0.0	27.1	46.0	18.9
4.450	Average	28.9	0.0	28.9	46.0	17.1
5.280	Average	33.7	0.0	33.7	50.0	16.3
5.365	Quasi-Peak	40.8	0.0	40.8	60.0	19.2
5.515	Average	35.5	0.0	35.5	50.0	14.5
5.530	Quasi-Peak	40.7	0.0	40.7	60.0	19.3
19.145	Average	39.3	0.0	39.3	50.0	10.7
19.305	Quasi-Peak	47.4	0.0	47.4	60.0	12.6
19.690	Quasi-Peak	42.8	0.0	42.8	60.0	17.2
20.095	Average	35.3	0.0	35.3	50.0	14.7

**Sample calculation of final values:**

$$\text{Final Value (dB}\mu\text{V)} = \text{Reading Value (dB}\mu\text{V)} + \text{Correction Factor (dB)}$$

## 8.7 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, section 15.249		
Guide:	ANSI C63.4		
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)
	30 - 88	100	40.0
	88 - 216	150	43.5
	216 - 960	200	46.0
	Above 960	500	54.0
Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
Measurement procedures:	Radiated Emission in Fully or Semi Anechoic Room (6.3) Radiated Emission at Open Field Test Site (6.4)		

Comment:	09 February / 11 May 2006 Frequencies ≤ 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Date of test:	
Test site:	
Test distance:	
	3 meters

Test Result:	Test passed
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Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
24173.000	vertical	Peak	69.0	43.0	-6.9	105.1	108.0	2.9
48350.000	horizontal	Quasi-Peak	17.5	44.1	-6.9	54.7	68.0	13.3
72525.000	horizontal	Quasi-Peak	21.4	46.2	-6.9	60.7	68.0	7.3
96700.000	horizontal	Quasi-Peak	18.0	49.6	-6.9	60.7	68.0	7.3

### Sample calculation of final values:

$$\text{Final Value (dBµV/m)} = \text{Reading Value (dBµV)} + \text{Correction Factor (dB/m)} + \text{Pulse Train Correction (dB)}$$

## 9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

<input checked="" type="checkbox"/>	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 10, 2004
<input checked="" type="checkbox"/>	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	September 19, 2005
<input checked="" type="checkbox"/>	ANSI C63.4	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	December 11, 2003 (published on January 30, 2004)
<input type="checkbox"/>	RSS-Gen	Radio Standards Specification RSS-Gen Issue 1 containing General Requirements and Information for the Certification of Radiocommunication Equipmment, published by Industry Canada	September 2005
<input type="checkbox"/>	RSS-210	Radio Standards Specification RSS-210 Issue 6 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	September 2005
<input type="checkbox"/>	RSS-310	Radio Standards Specification RSS-310 Issue 1 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	September 2005
<input type="checkbox"/>	RSS-102	Radio Standards Specification RSS-102 Issue 2: Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	November 2005
<input type="checkbox"/>	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 7, 2004
<input checked="" type="checkbox"/>	CISPR 22	Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement"	1997
<input type="checkbox"/>	CAN/CSA-CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment	2002
<input type="checkbox"/>	TRC-43	Notes Regarding Designation of Emission (Including Necessary Bandwidth and Classification), Class of Station and Nature of Service, published by Industry Canada	October 9, 1982

## **10 Charts taken during testing**



# Conducted Emission Test 150 kHz - 30 MHz according to FCC Part 15 Subpart C

Model:  
**FQR50**

Serial no.:  
**3105-2006**

Applicant:  
**Kirchgaesser Industrieelektronik GmbH**

Test site:  
**Shielded room, cabin no. 4**

Tested on:  
**Linecord AC supply of AC/DC convertor  
Phase L1**

Date of test:  
**05/11/2006**

Operator:  
**M. Steindl**

Test performed:  
**semi automatically**

File name:

Mode:

- DC 24 V power supply
- EUT in normal position
- transmitting continuously
- with SIEMENS SITOP AC/DC convertor

Detector:

**Peak / Final Results: QP**

Final results:

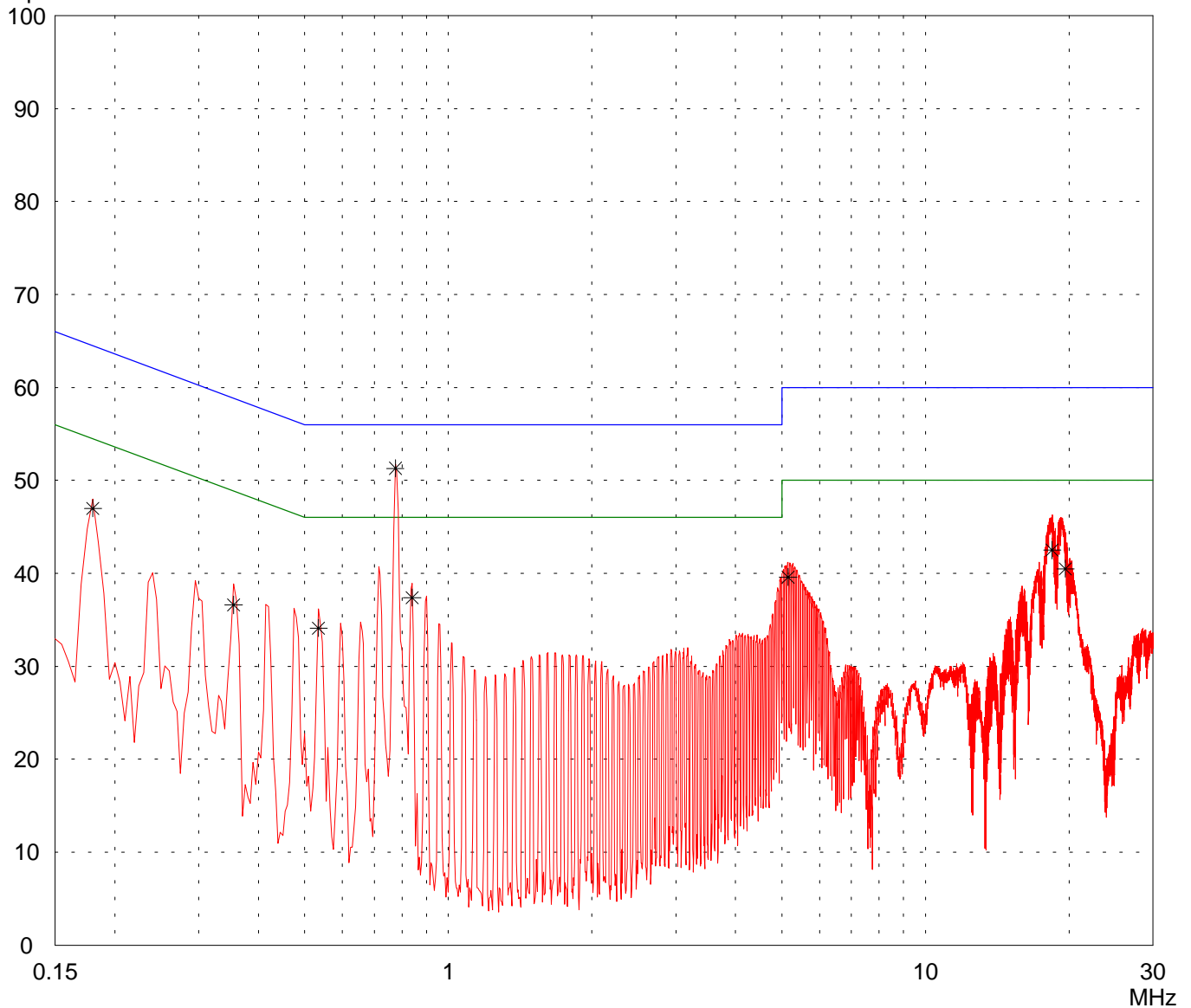
**20 dB Margin**

**25 Subranges**

**dB $\mu$ V**

**Limit1: FCC C / QP**

**Limit2: FCC C / AV**



Result:  
**Limit kept**

Project file:

**51104-060093**

# Conducted Emission Test 150 kHz - 30 MHz according to FCC Part 15 Subpart C

Model:  
**FQR50**

Serial no.:  
**3105-2006**

Applicant:  
**Kirchgaesser Industrieelektronik GmbH**

Test site:  
**Shielded room, cabin no. 4**

Tested on:  
**Linecord AC supply of AC/DC convertor  
Phase L1**

Date of test:  
**05/11/2006**

Operator:  
**M. Steindl**

Test performed:  
**automatically**

File name:

Mode:

- DC 24 V power supply
- EUT in normal position
- transmitting continuously
- with SIEMENS SITOP AC/DC convertor

Detector:

**Average / Final Results: AV**

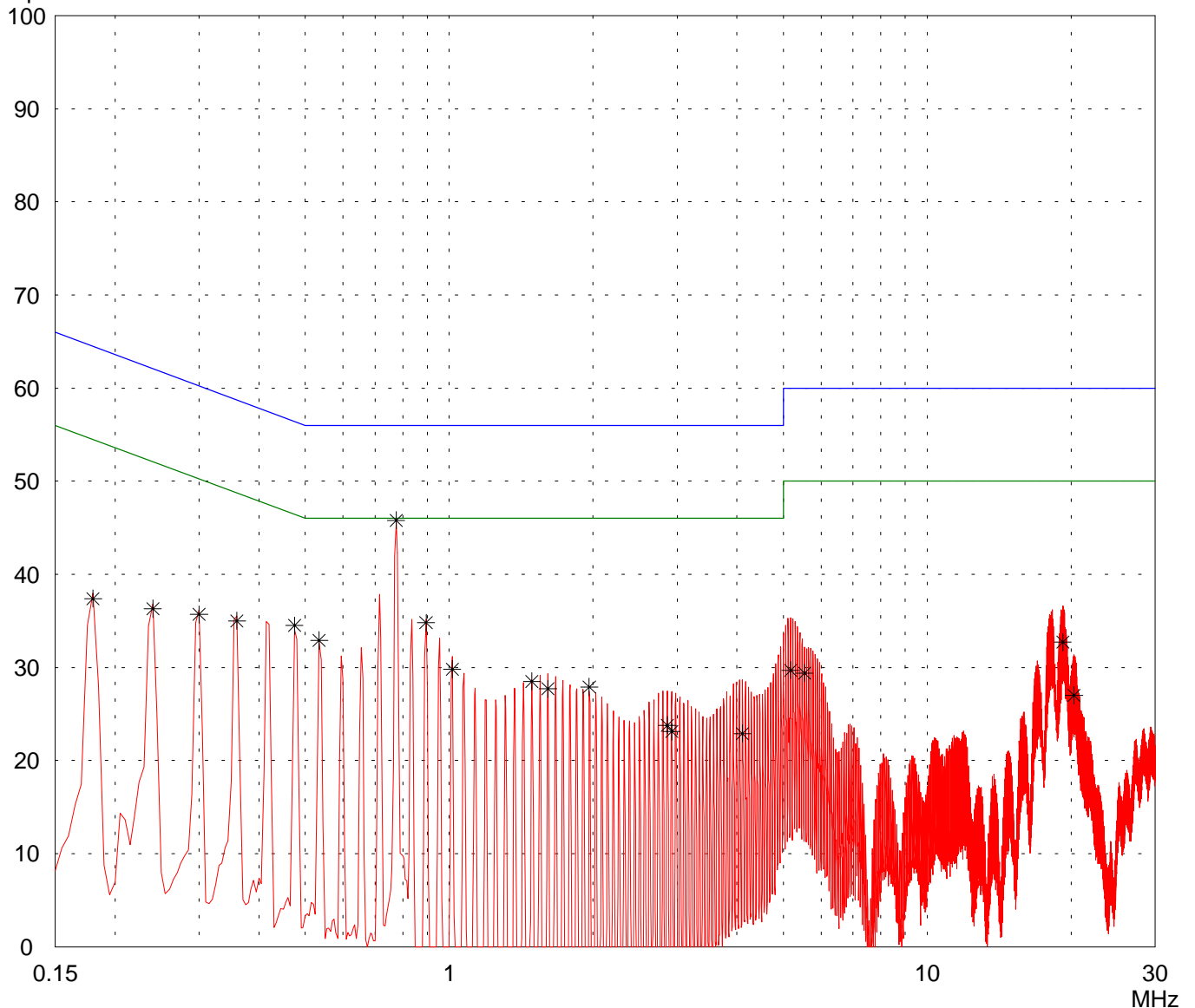
Final results:

**20 dB Margin**

**25 Subranges**

dB $\mu$ V

Limit1: FCC C / QP    Limit2: FCC C / AV



Result:  
**Limit kept**

Project file:  
**51104-060093**

# Conducted Emission Test 150 kHz - 30 MHz according to FCC Part 15 Subpart C

Model:  
**FQR50**

Serial no.:  
**3105-2006**

Applicant:  
**Kirchgaesser Industrieelektronik GmbH**

Test site:  
**Shielded room, cabin no. 4**

Tested on:  
**Linecord AC supply of AC/DC convertor  
Phase N**

Date of test:  
**05/11/2006**

Operator:  
**M. Steindl**

Test performed:  
**automatically**

File name:

Mode:

- DC 24 V power supply
- EUT in normal position
- transmitting continuously
- with SIEMENS SITOP AC/DC convertor

Detector:

**Peak / Final Results: QP**

Final results:

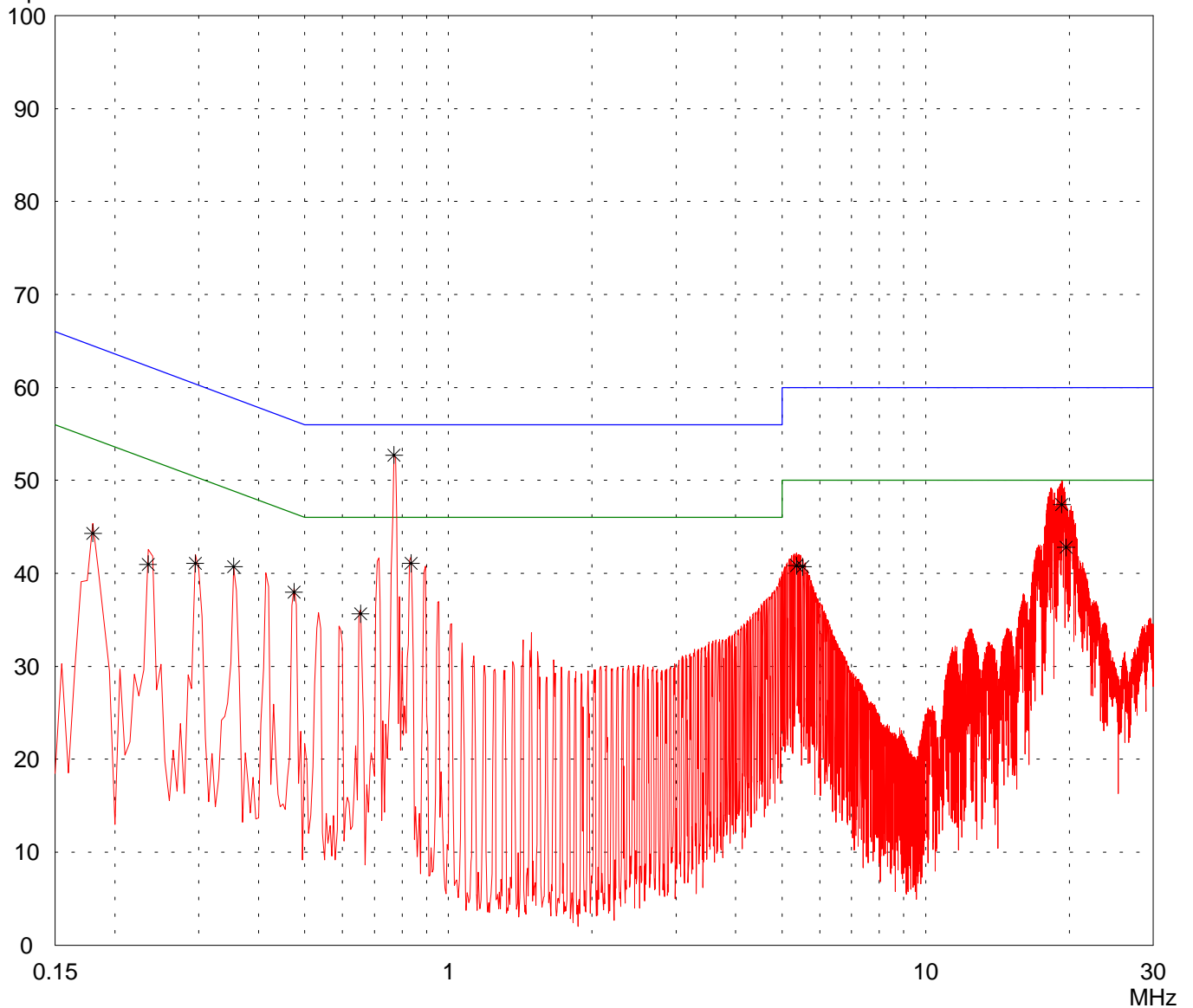
**20 dB Margin**

**25 Subranges**

**dB $\mu$ V**

**Limit1: FCC C / QP**

**Limit2: FCC C / AV**



Result:  
**Limit kept**

Project file:  
**51104-060093**

# Conducted Emission Test 150 kHz - 30 MHz according to FCC Part 15 Subpart C

Model:  
**FQR50**

Serial no.:  
**3105-2006**

Applicant:  
**Kirchgaesser Industrieelektronik GmbH**

Test site:  
**Shielded room, cabin no. 4**

Tested on:  
**Linecord AC supply of AC/DC convertor  
Phase N**

Date of test:  
**05/11/2006**

Operator:  
**M. Steindl**

Test performed:  
**automatically**

File name:

Mode:

- DC 24 V power supply
- EUT in normal position
- transmitting continuously
- with SIEMENS SITOP AC/DC convertor

Detector:

**Average / Final Results: AV**

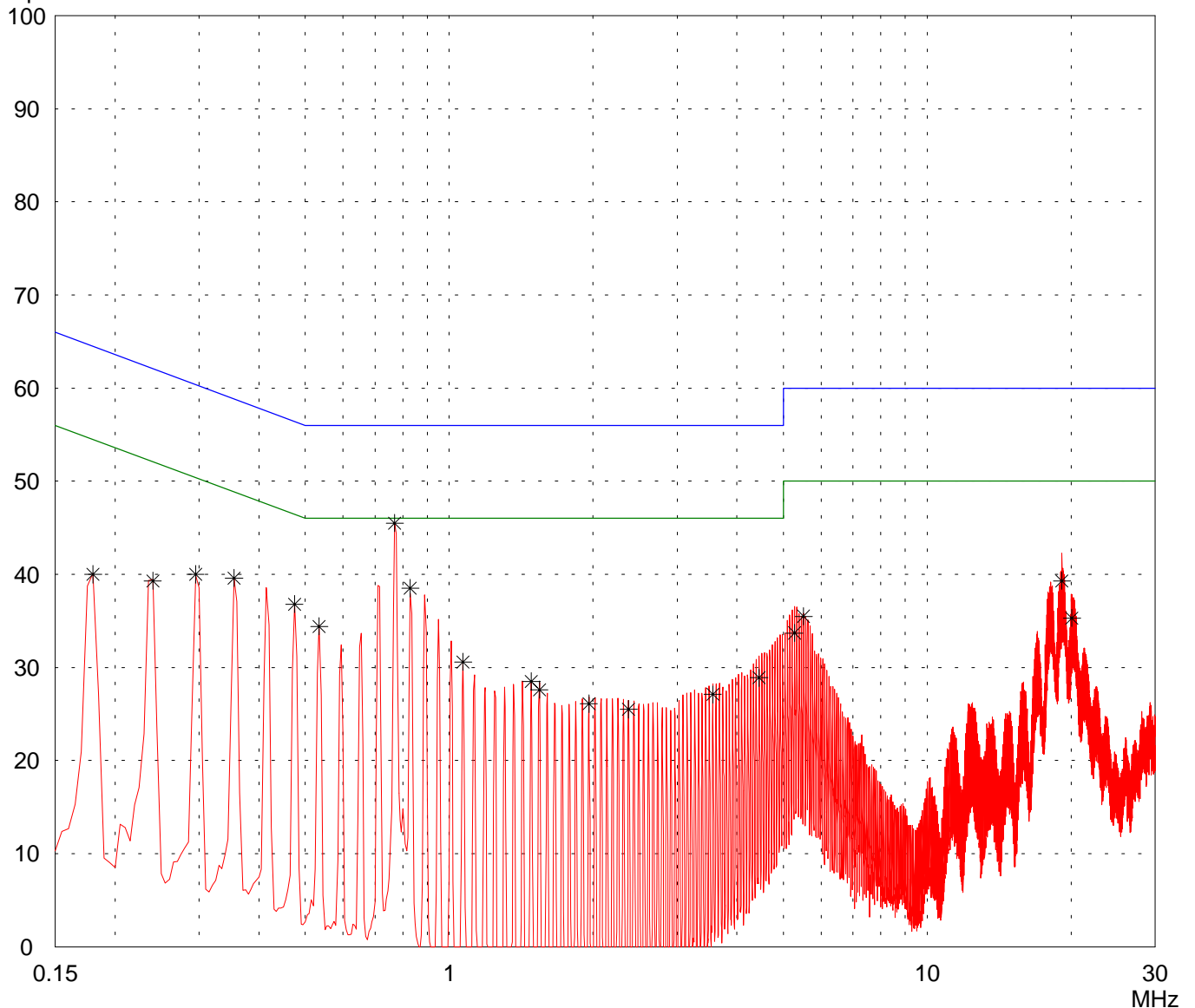
Final results:

**20 dB Margin**

**25 Subranges**

dB $\mu$ V

Limit1: FCC C / QP    Limit2: FCC C / AV



Result:  
**Limit kept**

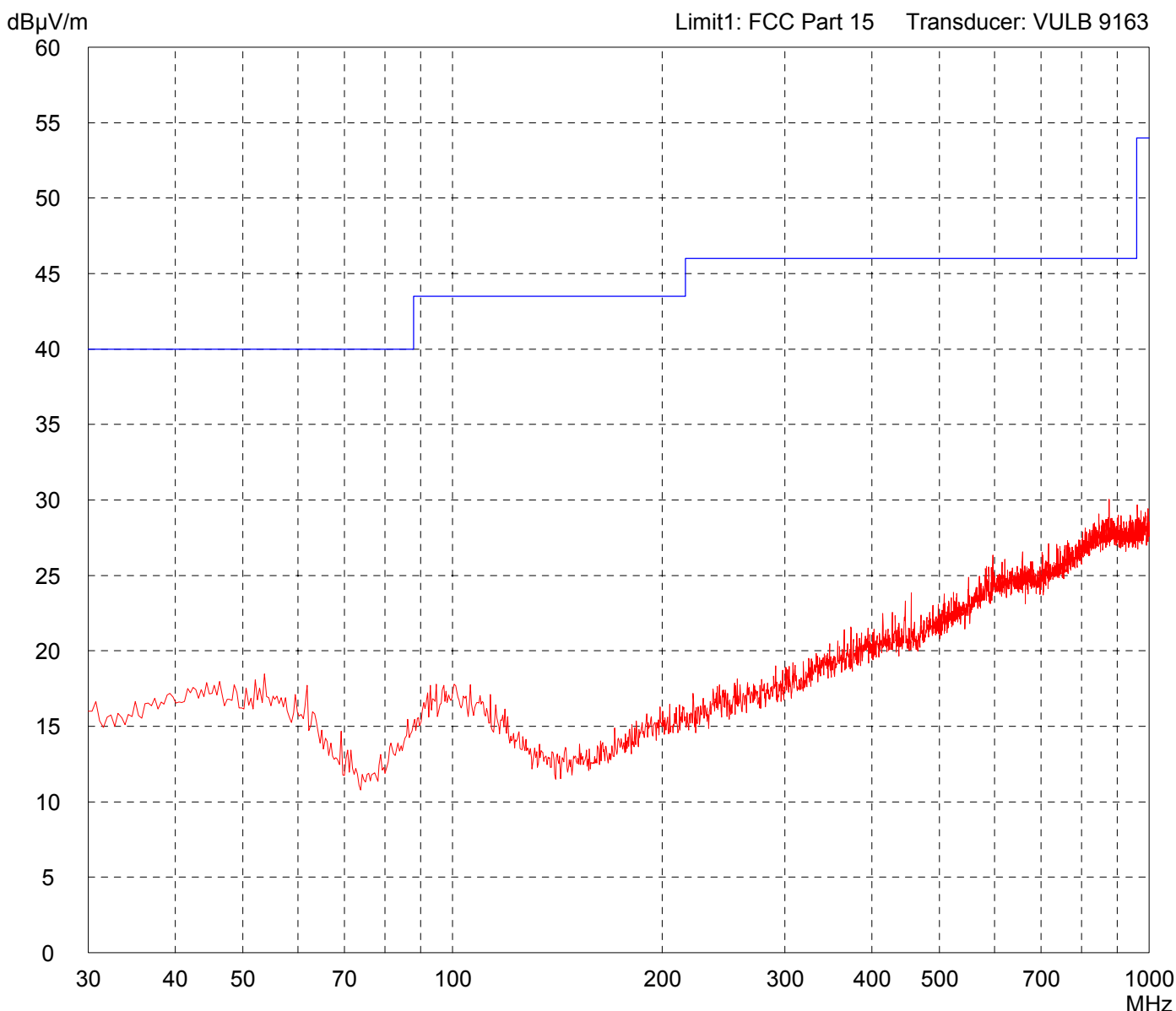
Project file:  
**51104-060093**

# Radiated Emission Test 30 MHz - 1 GHz acc. to FCC Part 15.225 (Fully Anechoic Chamber)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres Horizontal Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <div style="display: flex; justify-content: space-between;"> <span><b>10 dB Margin</b></span> <span><b>50 Subranges</b></span> </div>
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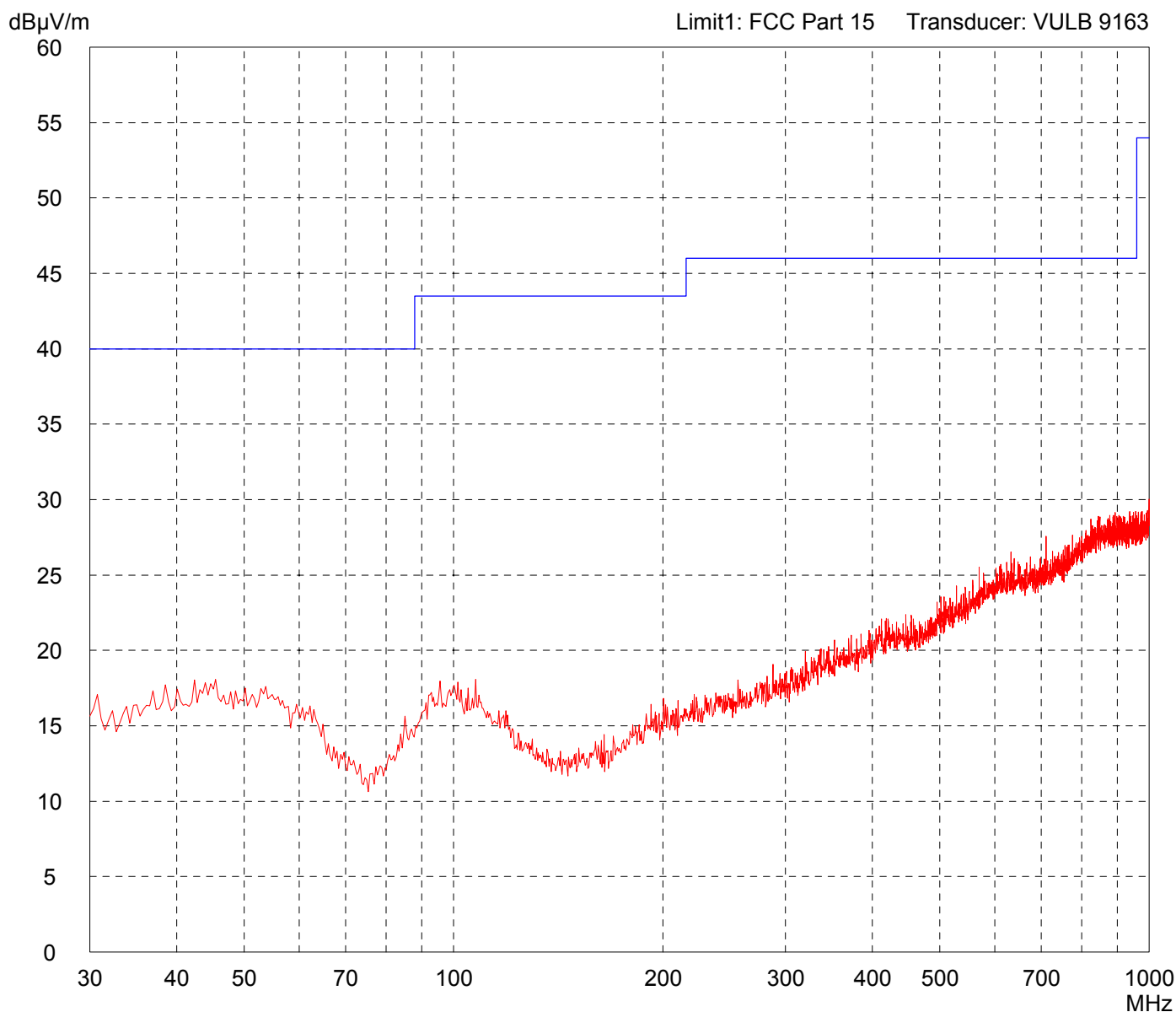
Result: <b>Prescan</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 30 MHz - 1 GHz acc. to FCC Part 15.225 (Fully Anechoic Chamber)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres Vertical Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <div style="display: flex; justify-content: space-between;"> <span><b>10 dB Margin</b></span> <span><b>50 Subranges</b></span> </div>
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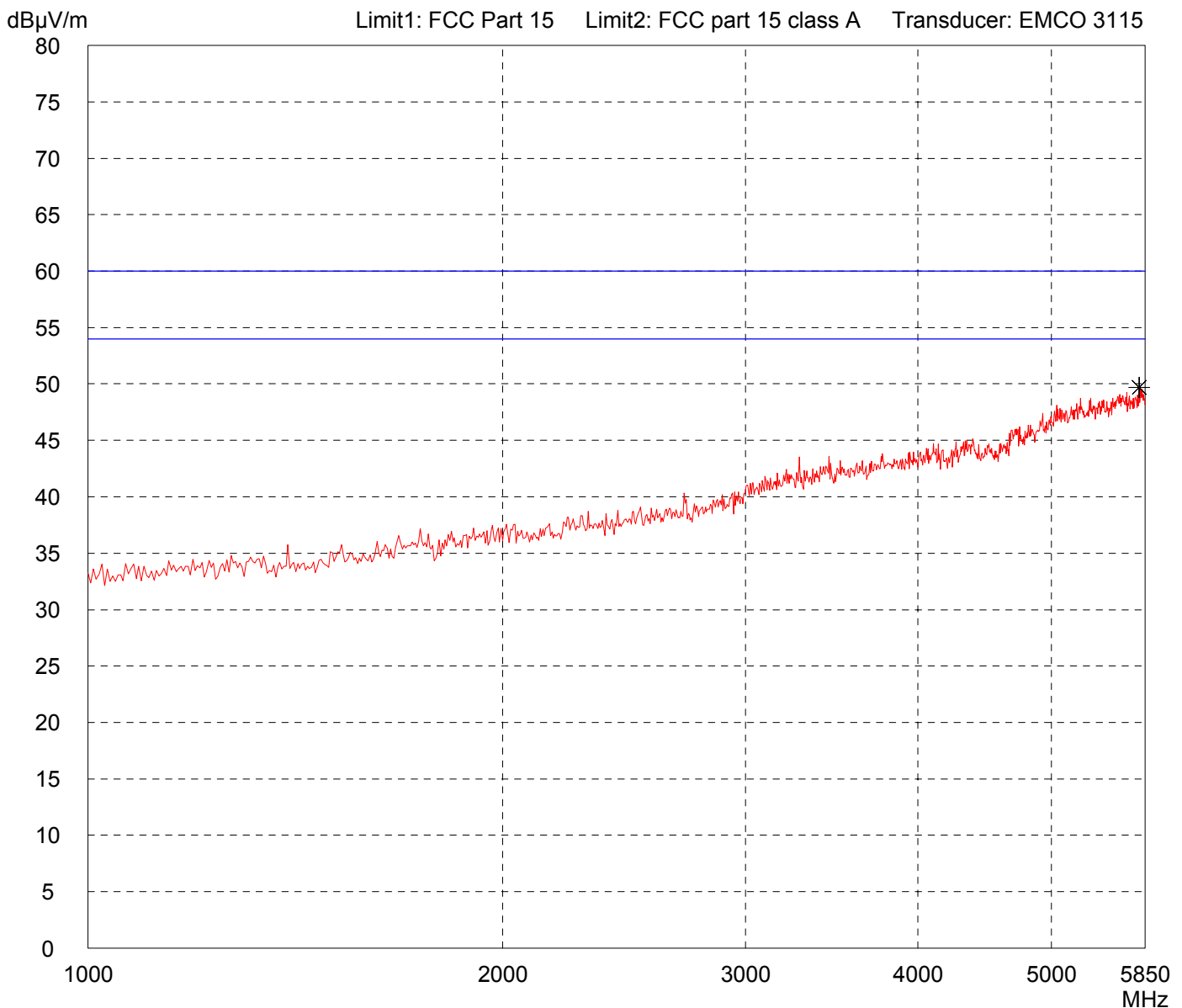
Result: <b>Prescan</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 1 GHz - 5.85 GHz acc. to FCC Part 15 (EMCO 3115)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres Horizontal Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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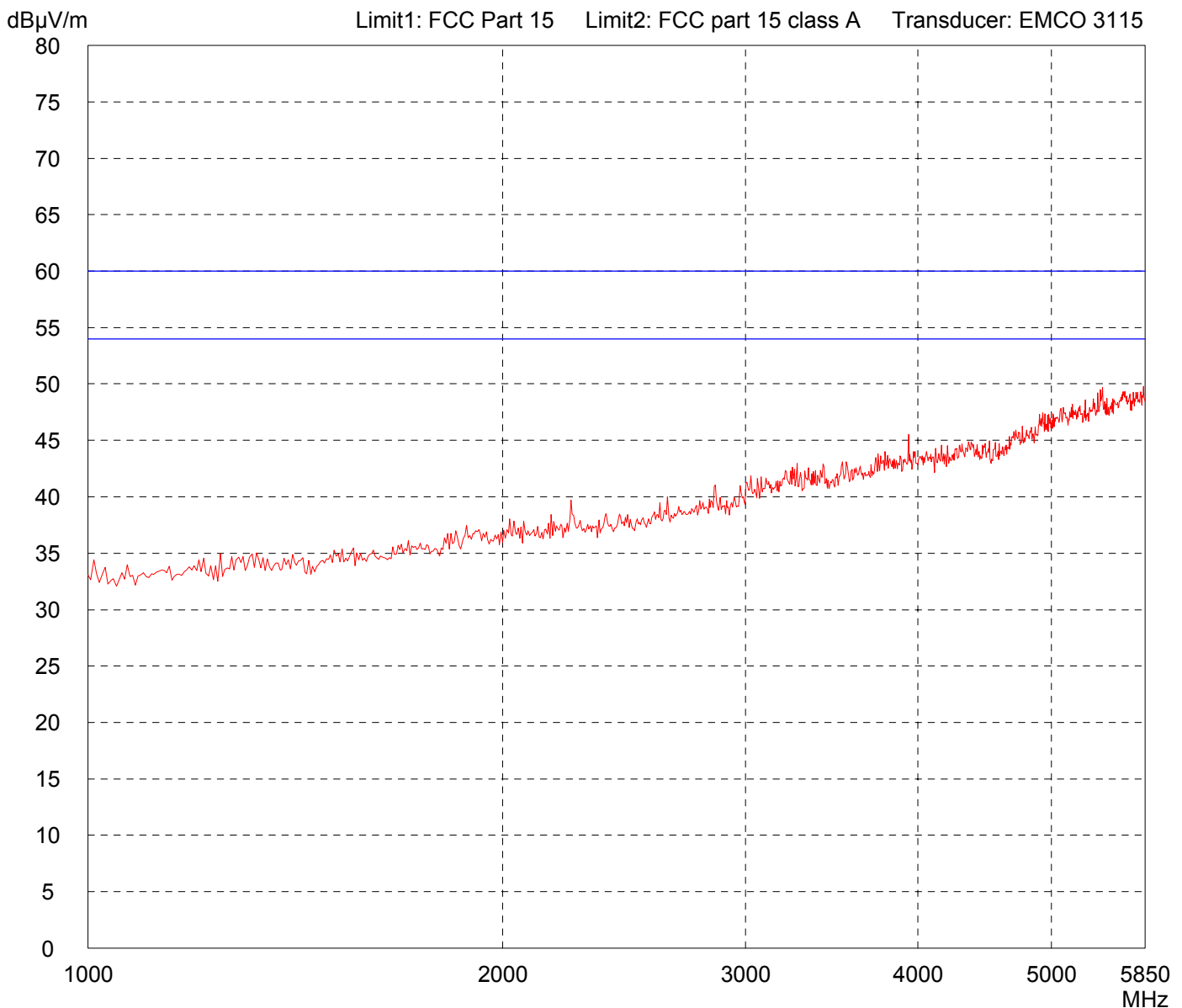
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 1 GHz - 5.85 GHz acc. to FCC Part 15 (EMCO 3115)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres Vertical Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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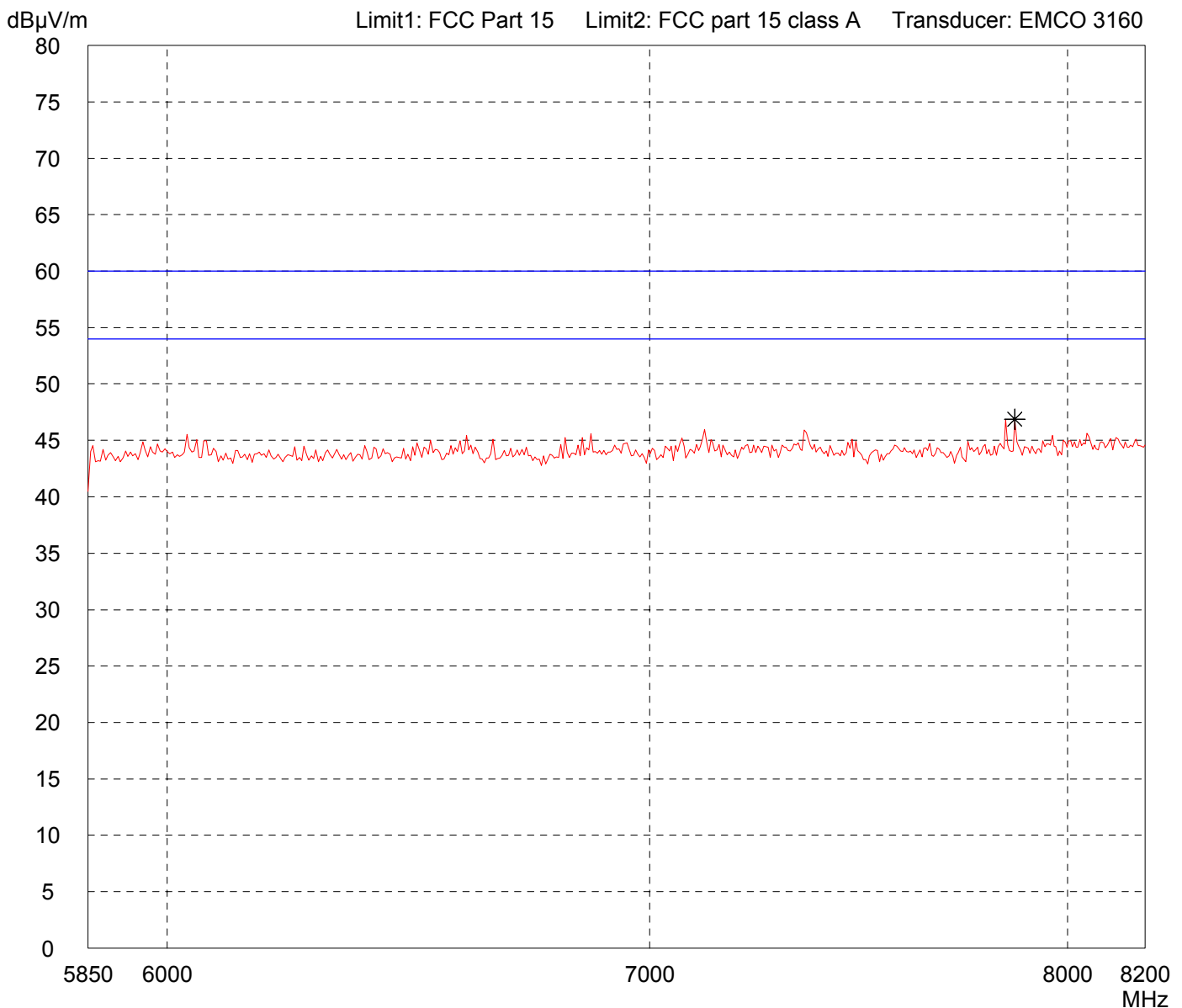


# Radiated Emission Test 5.85 GHz - 8.2 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres Horizontal Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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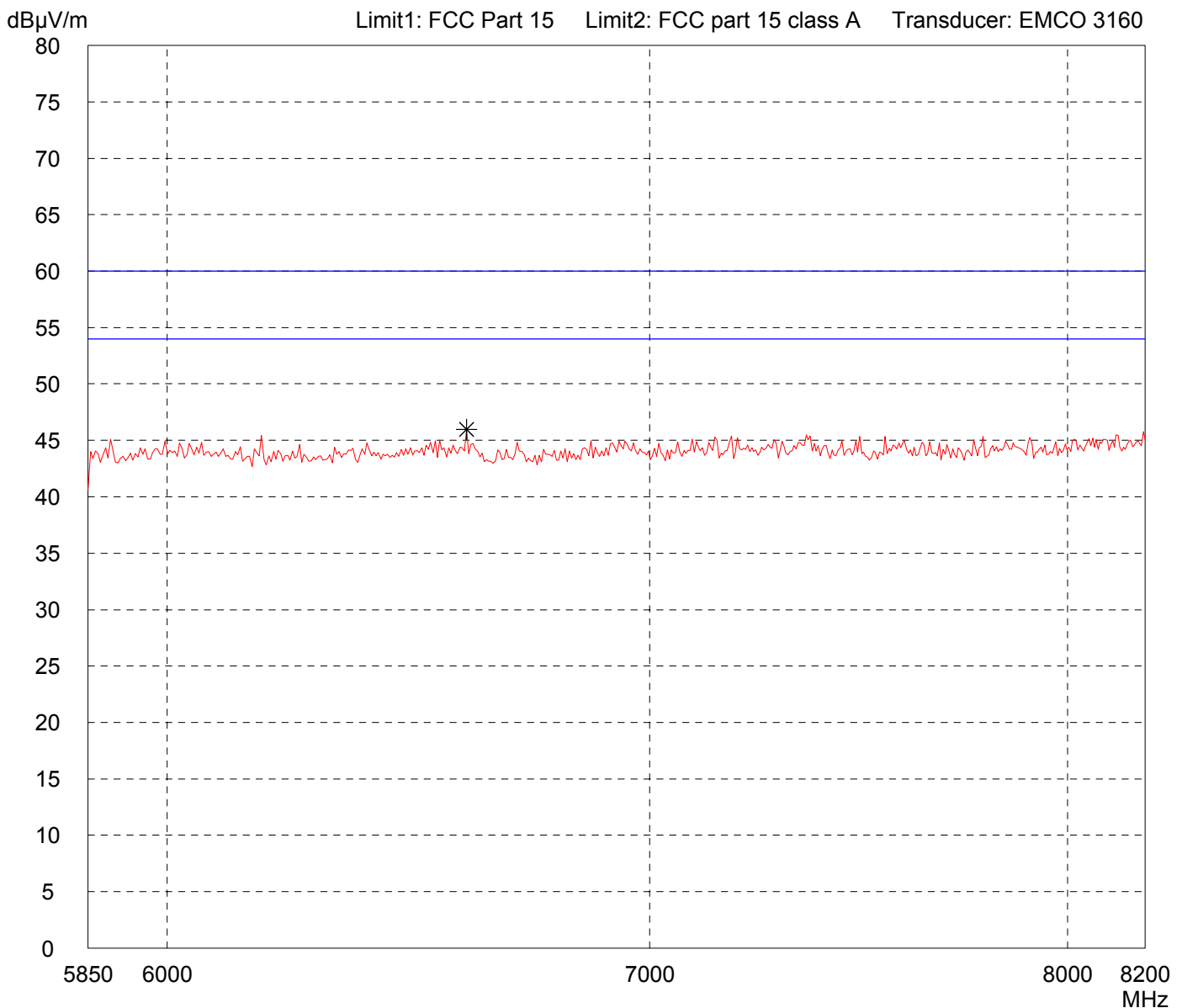
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 5.85 GHz - 8.2 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 3 metres</b> <b>Vertical Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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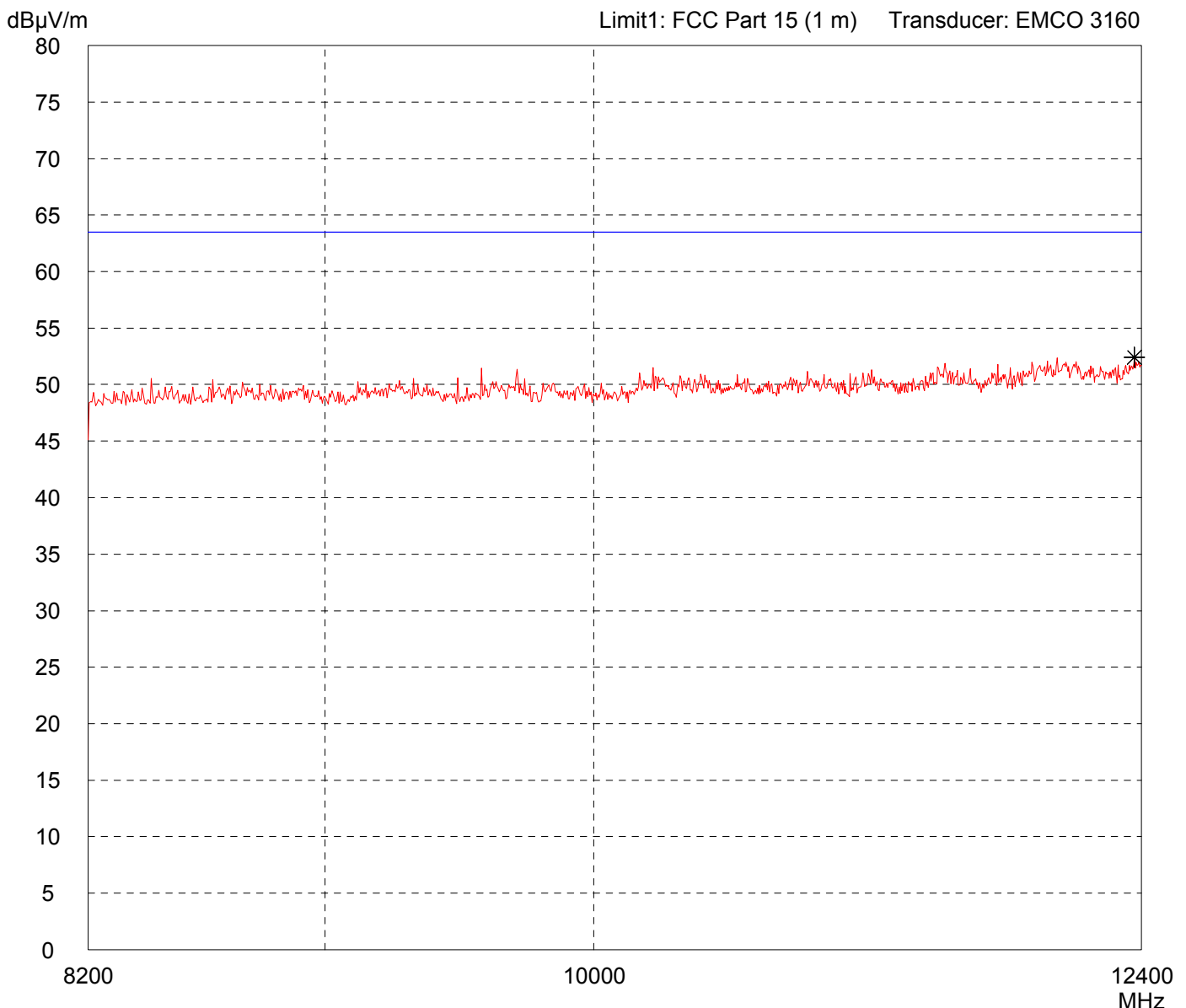
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 8.2 GHz - 12.4 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 1 meter Horizontal Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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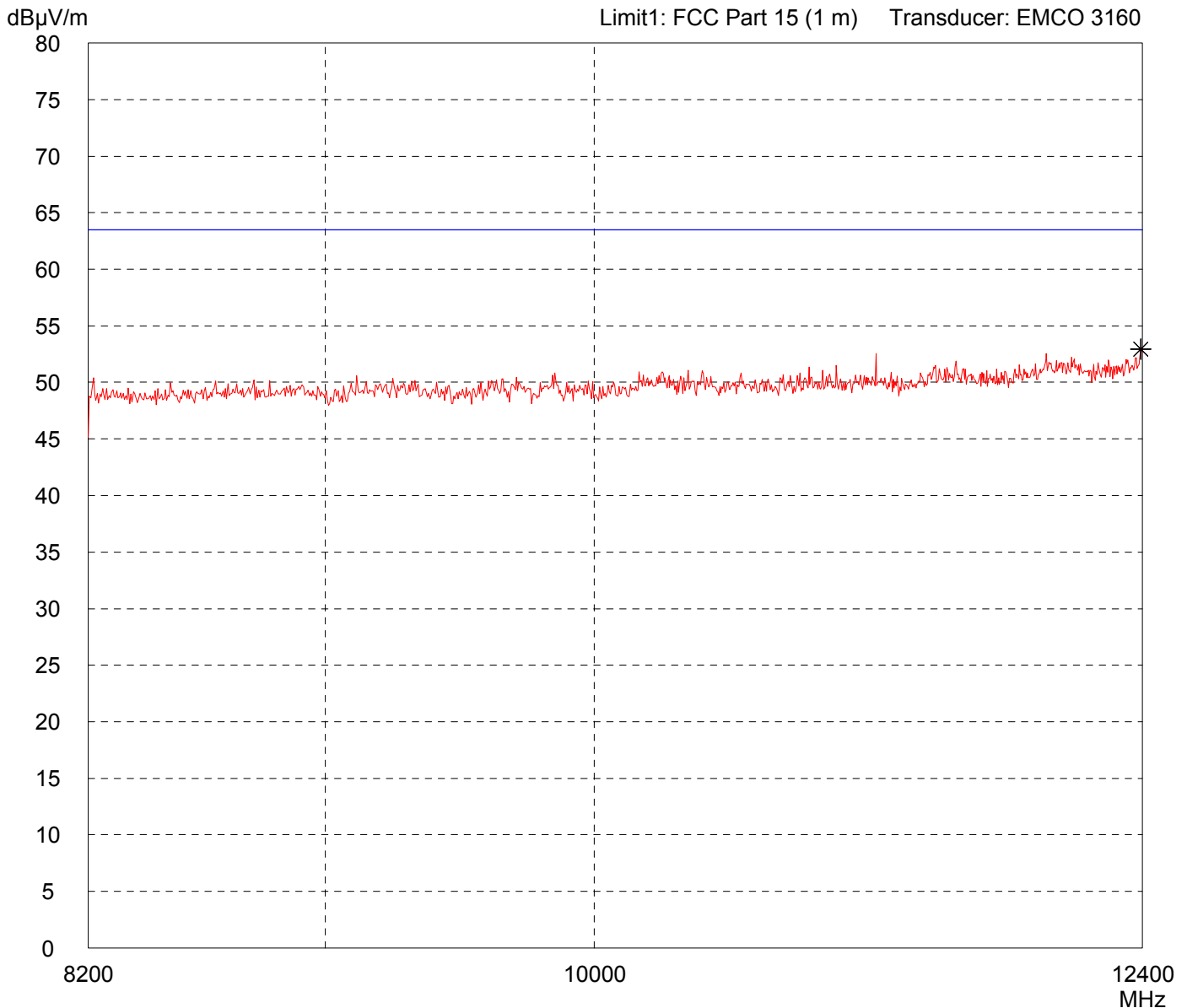
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 8.2 GHz - 12.4 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 1 meter Vertical Polarization</b>	
Date of test: <b>02/07/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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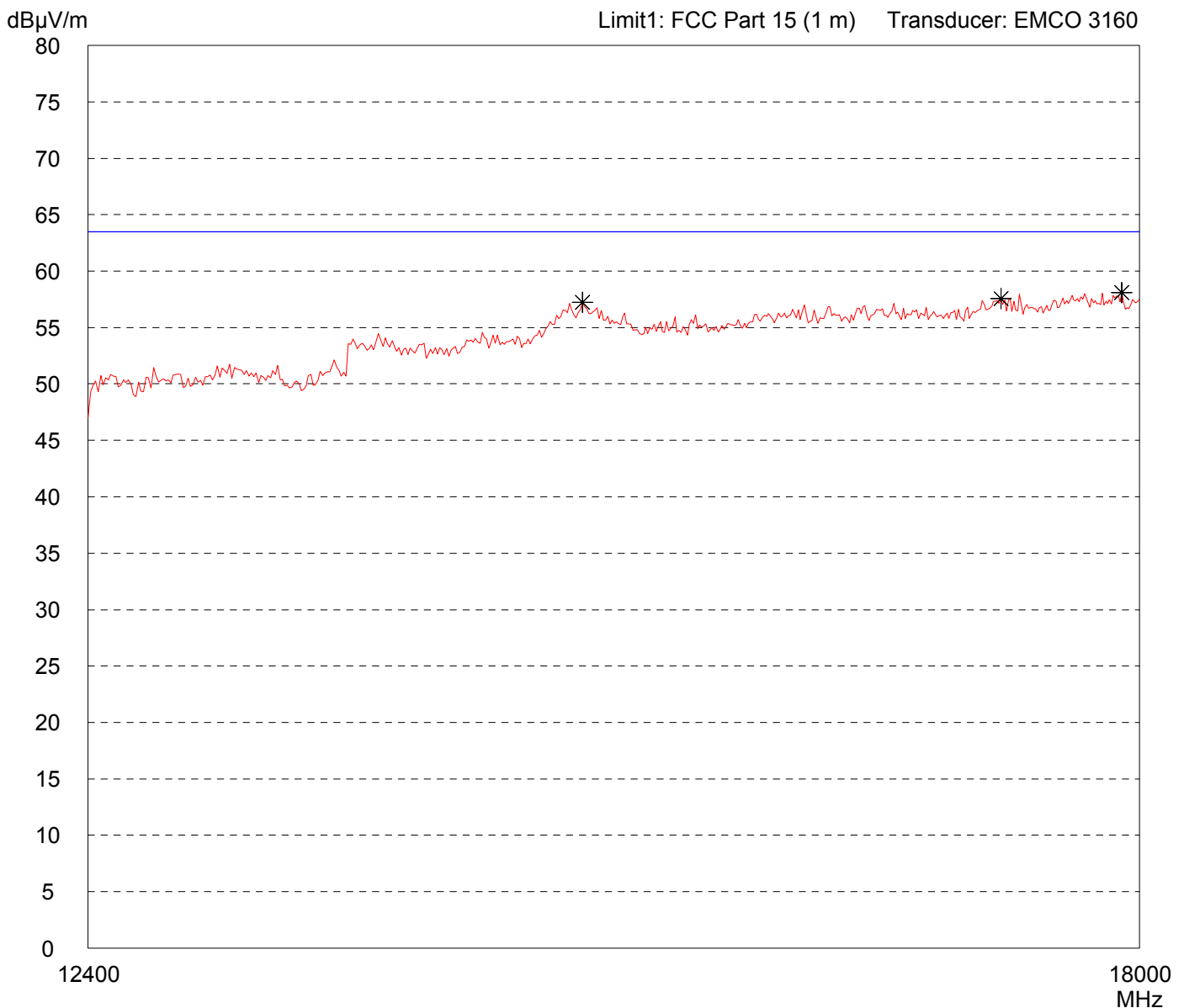
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 12.4 GHz - 18 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously - VBW = 100 kHz
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 1 meter Horizontal Polarization</b>	
Date of test: <b>02/08/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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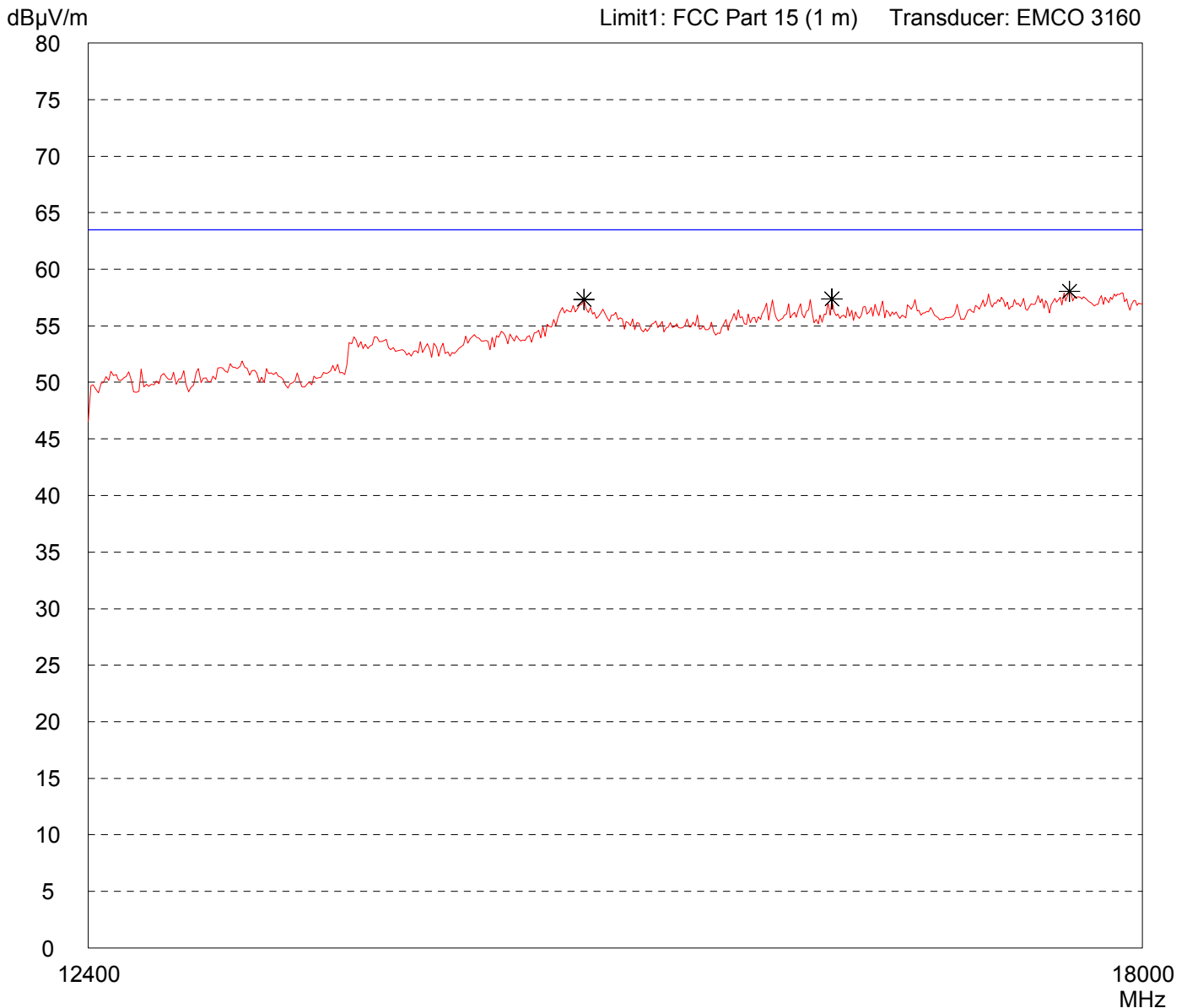
Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test 12.4 GHz - 18 GHz acc. to FCC Part 15 (EMCO 3160)

Model: <b>FQR50</b>	Comment: - DC 24 V power supply - EUT in normal position - transmitting continuously - VBW = 100 kHz
Serial no.: <b>3105 - 2006</b>	
Applicant: <b>Kirchgaesser Industrieelektronik GmbH</b>	
Test site: <b>Fully anechoic room, cabin no. 2</b>	
Tested on: <b>Test distance 1 meter Vertical Polarization</b>	
Date of test: <b>02/08/2006</b>	Operator: <b>M. Steindl</b>
Test performed: <b>automatically</b>	File name: <b>default.emi</b>

Detector: <b>Peak</b>	List of values: <b>Selected by hand</b>
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Result: <b>Limit kept</b>	Project file: <b>51104-60093</b>
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# Radiated Emission Test acc. to FCC Part 15 C

Model:  
FPR50

Serial No.:  
3105 - 2006

Applicant:  
Kirchgaesser Industrieelektronik GmbH

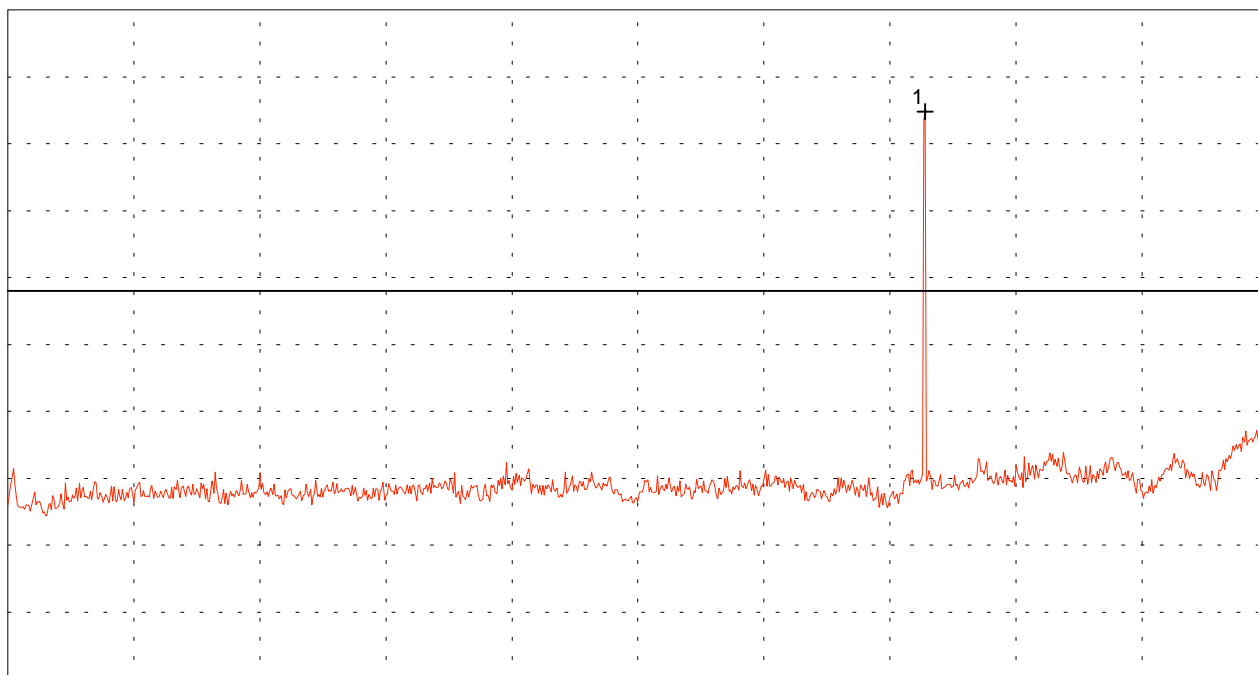
Mode:

- DC 24 V power supply
- EUT in normal position
- transmitting continuously
- Distance: 0.50 m
- Polarisation: horizontal

Ref.Level 90 dB $\mu$ V  
5 dB/Div.

ATT 0 dB

Ref. Offset 43 dB



Start 18.000 GHz  
RBW 1 MHz

VBW 100 kHz

Stop 26.500 GHz  
SWP 260 ms

## Multi Marker List

No.	Frequency	Amplitude
1	24.186111 GHz	82.40 dB $\mu$ V

Tested by:  
M. Steindl

Date:  
02/07/2006

Project-No.:  
51104-060093

# Radiated Emission Test acc. to FCC Part 15 C

Model:  
FPR50

Serial No.:  
3105 - 2006

Applicant:  
Kirchgaesser Industrieelektronik GmbH

Mode:

- DC 24 V power supply

- In antenna direction

- transmitting continuously

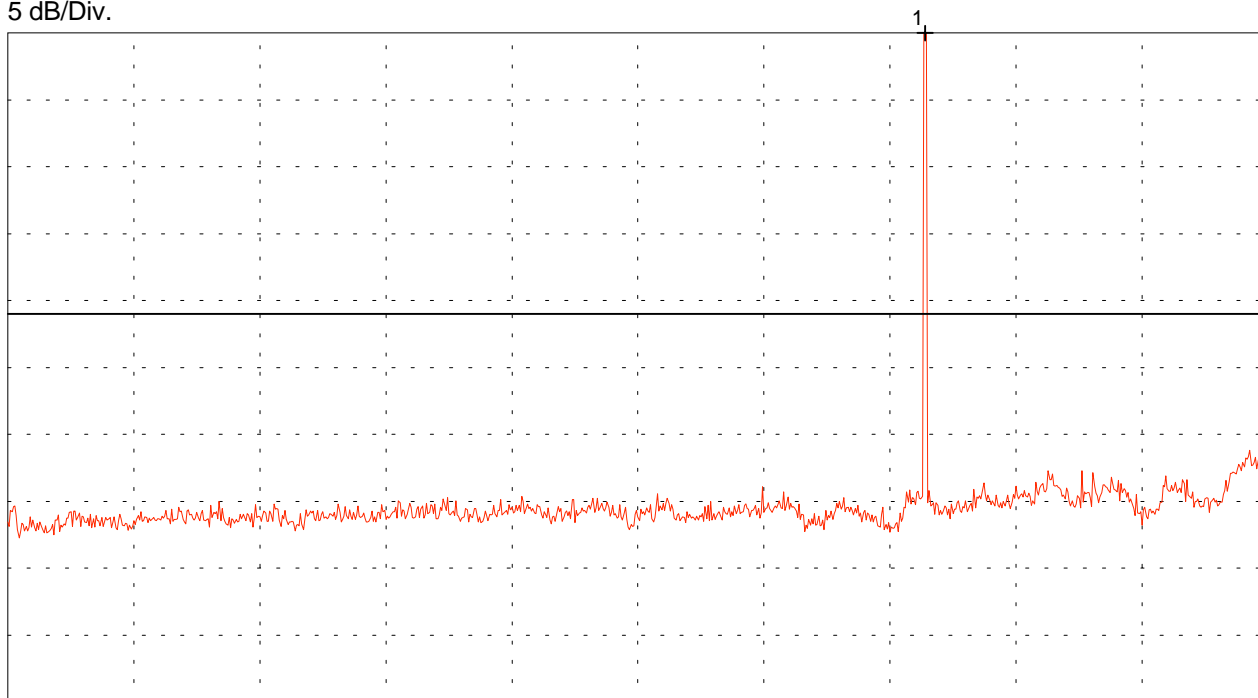
- Distance: 0.50 m

- Polarisation: vertical

Ref.Level 90 dB $\mu$ V  
5 dB/Div.

ATT 0 dB

Ref. Offset 43 dB



Start 18.000 GHz  
RBW 1 MHz

VBW 100 kHz

Stop 26.500 GHz  
SWP 260 ms

## Multi Marker List

No.	Frequency	Amplitude
1	24.186111 GHz	91.99 dB $\mu$ V

Tested by:  
M. Steindl

Date:  
02/07/2006

Project-No.:

51104-060093



# Radiated Emission Test acc. to FCC Part 15 C

Model:  
FPR50

Serial No.:  
3105 - 2006

Applicant:  
Kirchgaesser Industrieelektronik GmbH

Mode:

- DC 24 V power supply

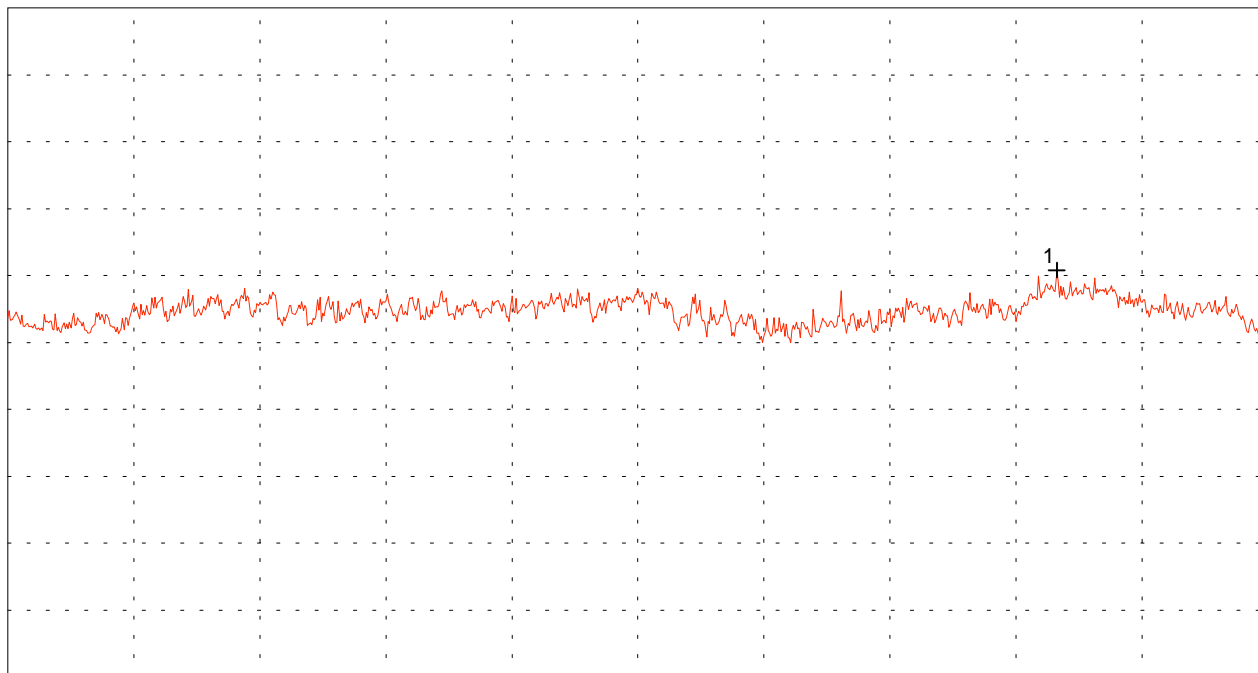
- EUT in normal position  
- transmitting continuously

- Distance: 0.50 m

- Polarisation: horizontal

Ref.Level 32 dB $\mu$ V  
5 dB/Div.

ATT 0 dB



Start 26.500 GHz  
RBW 1 MHz

VBW 100 kHz

Stop 40.000 GHz  
SWP 420 ms

## Multi Marker List

No.	Frequency (GHz)	Amplitude (dB $\mu$ V)
1	37.735000	12.41

Tested by:  
M. Steindl

Date:  
02/07/2006

Project-No.:

51104-060093

# Radiated Emission Test acc. to FCC Part 15 C

Model:  
FPR50

Serial No.:  
3105 - 2006

Applicant:  
Kirchgaesser Industrieelektronik GmbH

Mode:

- DC 24 V power supply

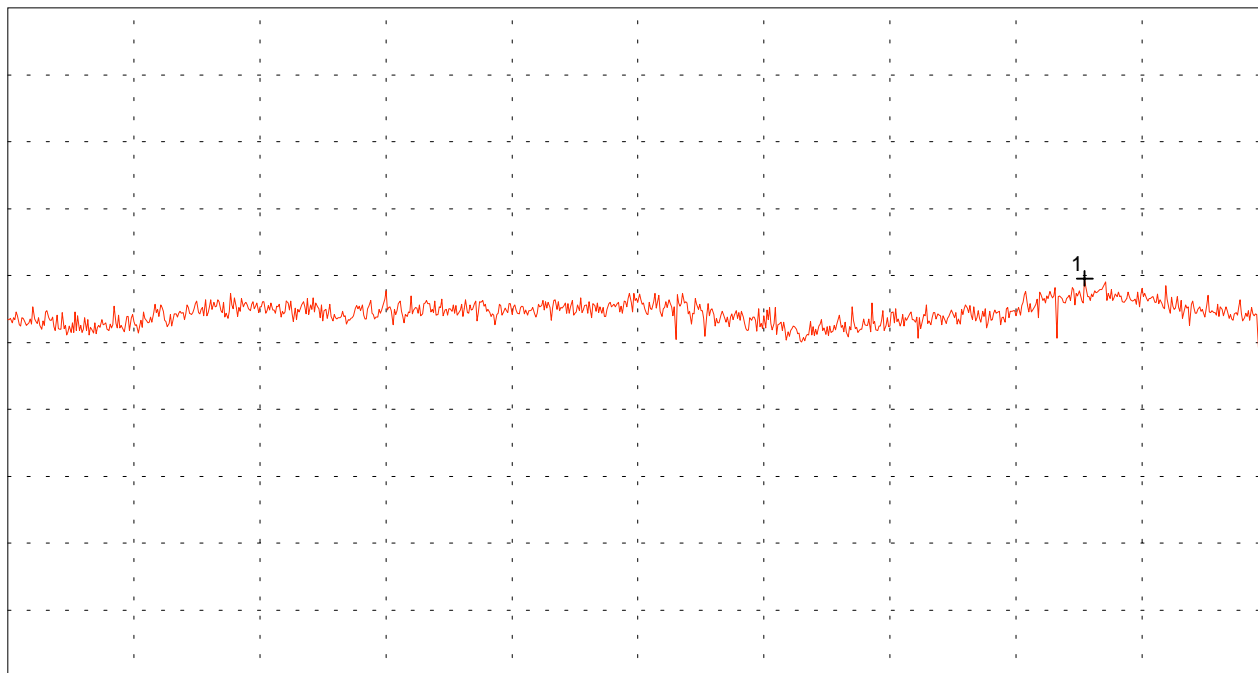
- EUT in normal position  
- transmitting continuously

- Distance: 0.50 m

- Polarisation: vertical

Ref.Level 32 dB $\mu$ V  
5 dB/Div.

ATT 0 dB



Start 26.500 GHz  
RBW 1 MHz

VBW 100 kHz

Stop 40.000 GHz  
SWP 420 ms

## Multi Marker List

No.	Frequency (GHz)	Amplitude (dB $\mu$ V)
No. 1	38.035000 GHz	11.79 dB $\mu$ V

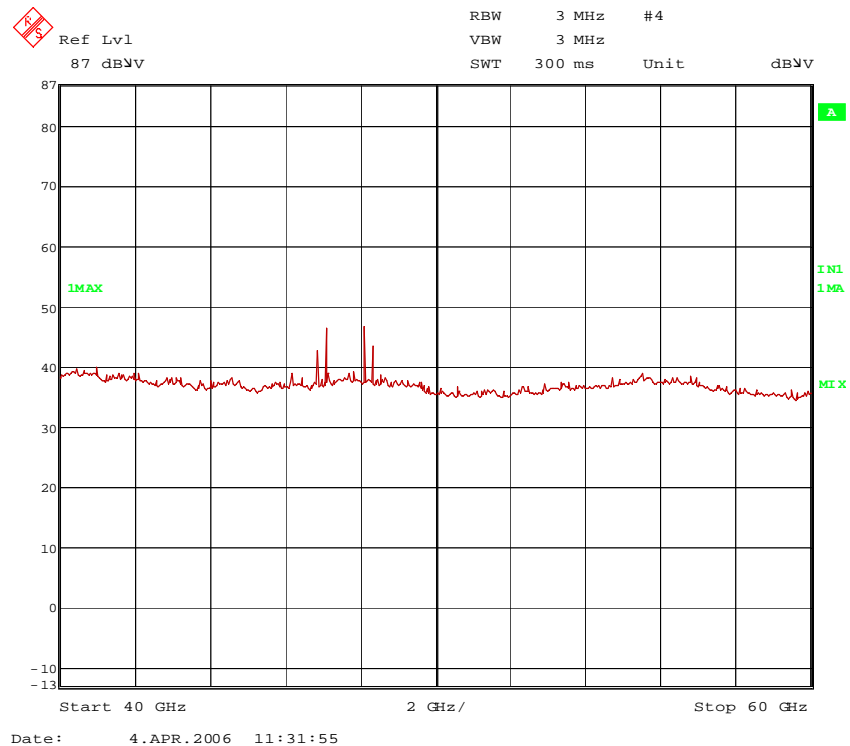
Tested by:  
M. Steindl

Date:  
02/07/2006

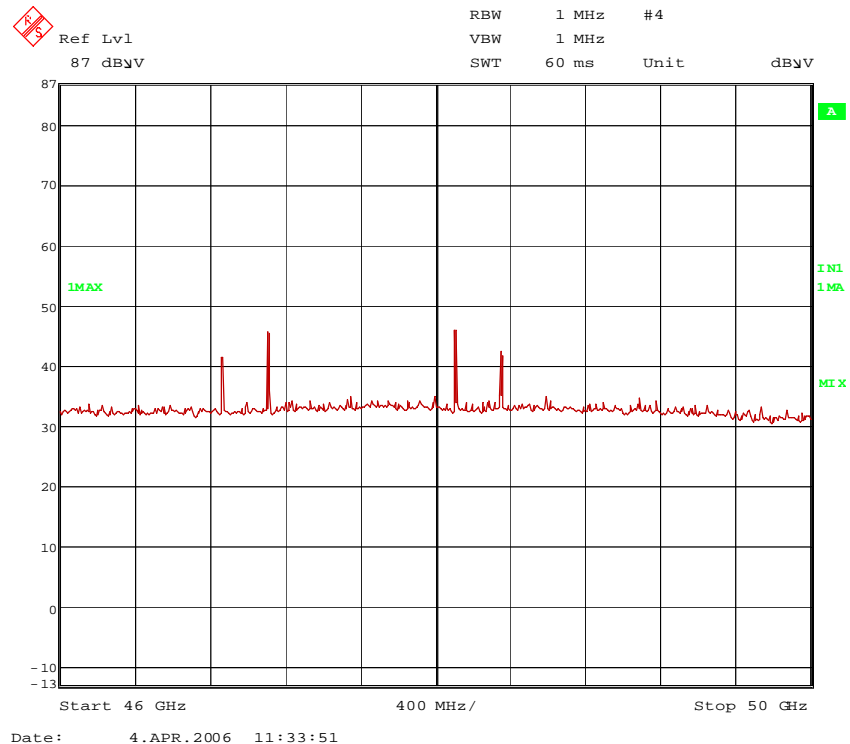
Project-No.:

51104-060093

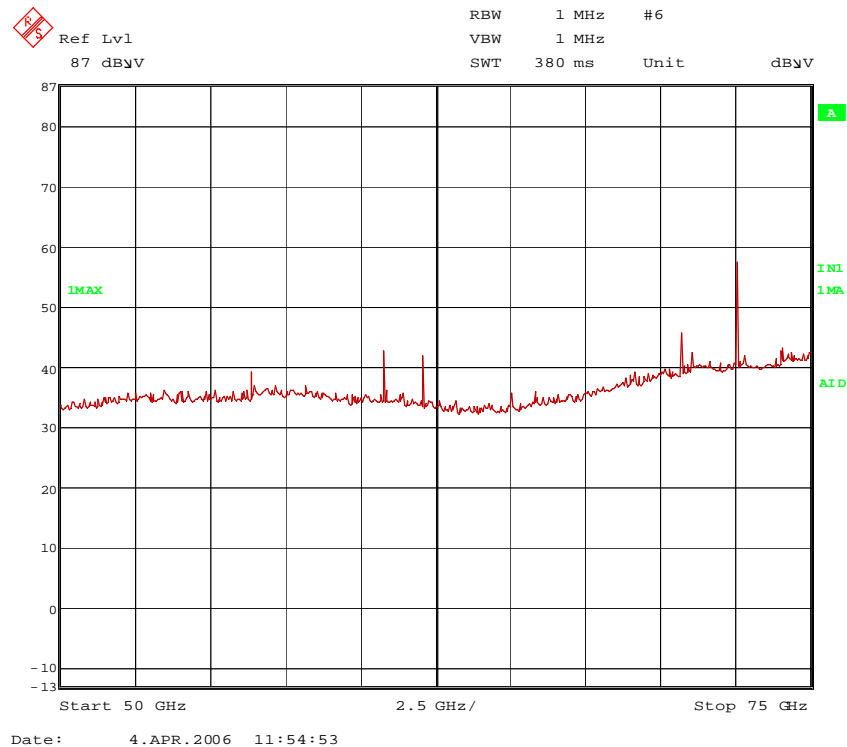
Radiated spurious emissions:



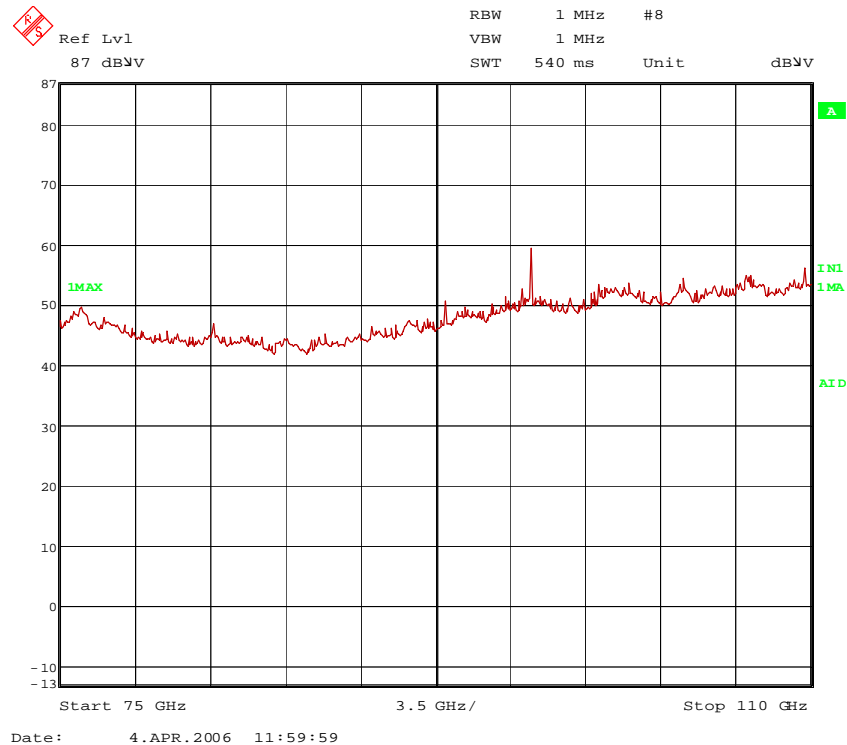
60645emi8.wmf: 40 GHz to 60 GHz, transmit mode



60645emi8a.wmf: 46 GHz to 60 GHz, transmit mode



60645emi9.wmf: 50 GHz to 75 GHz, transmit mode



60645emi10.wmf: 75 GHz to 110 GHz, transmit mode