SENTON

■ EMV-Prüfzentrum ■ EMI/EMC-Testcenter ■

Straubing, 9 December 2003

T E S T - R E P O R T

No. 55145-30560-2

for

5464

Sensor Transmitter

Applicant:	Delta Elettronica
Test Specification:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.209 and 15.249

Table of Contents

Administrative Data

Test item (EUT)	
Type designation	5464
Version of EUT:	As Delivered
Serial number(s):	4M5464A1A-32
Type of equipment:	Microwave Sensor
Parts/accessories:	
FCC-ID:	
Technical data	
Frequency range:	2400 – 2483.5 MHz
Operational frequencies:	2440 MHz
Type of modulation:	
Pulse frequency:	Not Applicable
Pulse width:	Not Applicable
Class of emission:	
Antenna:	Integrated
Power supply:	12 V DC (lead-acid-battery)
Applicant: (full address)	Delta Elettronica Via Astico, 41 I-21100 Varese
Contract identification:	N/A
Contact person:	Mr Scartapacchio (TÜV Pfalz Palatina)
Manufacturer:	Delta Elettronica
Application details	
Receipt of EUT:	26 November 2003
Date of test:	December 2003
Note:	

Identification of 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. TTI-P-G 062/94-01
FCC Test Site registration number	90926
Industry Canada Test site registration:	IC 3050
Name for contact purposes:	Mr. Johann Roidt Phone: (+49) (0)9421 5522-0 Fax: (+49) (0)9421 5522-99

Summary

Summary of test results
The tested sample complies with the requirements set forth in the **Code of Regulations CFR 47, Part 15, Sections 15.207, 15.209 and 15.245** of the Federal Communication Commission (FCC) and the **Radio Standards Specification RSS-210 Issue 5, Section 7 (Category I Receiver)** of Industry Canada (IC).

Personnel involved in this report	
Laboratory Manager:	 Mr. Johann Roidt
Responsible for testing:	Mr. Johann Roidt
Responsible for test report:	Mr. Johann Roidt

Operation Mode and Configuration of EUT

Operation Mode

The EUT transmits continiously, when triggerd by the control-interface. Depending on the respose of the signal the EUT transmits a datatelegram to the control-interface

Configuration of EUT

The EUT is a bus-sharing-unit. The EUT was tested in vertical position.

List of ports and cables

Port	*Description*	*Classification*[1]	*Cable type*	*Cable length*
1	Control-interface	Signal/Control Port with DC power	Unshielded	> 3 m

List of devices connected to EUT

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	HP-laptop	Portable PC		HP

[1] Ports shall be classified as ac power, dc power or signal/control port

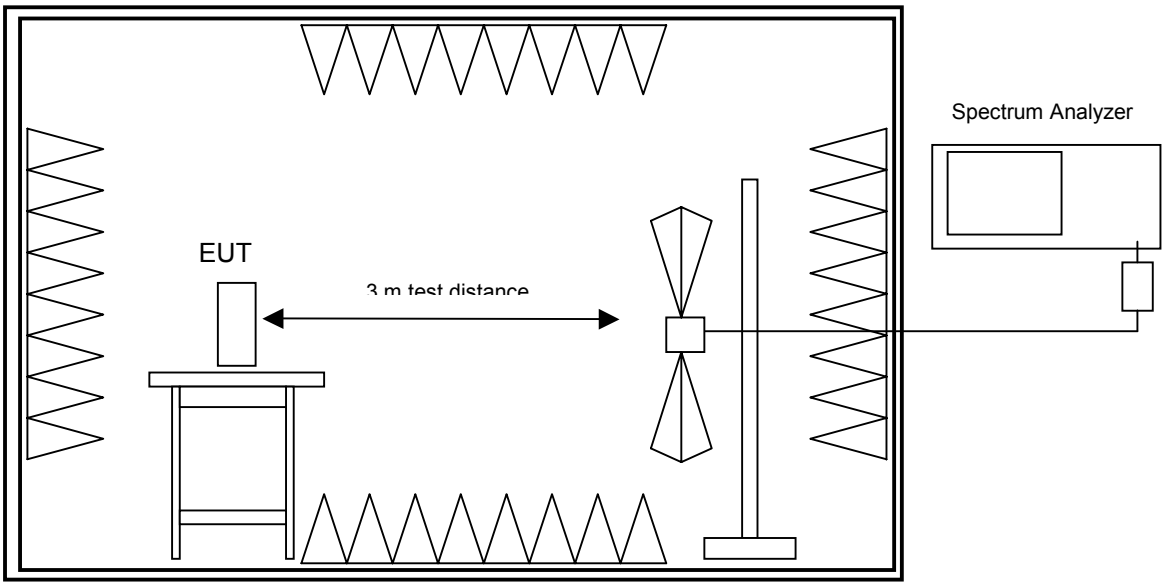
1. Measuring Methods

1.1. Field Strength of Emissions, Prescans in a fully-anechoic Room

Rules and Specifications:	Sections 15.109, 15.209, 15.245
Guide:	ANSI C63.4 1997

Measurement Procedure:

Radiated emissions are measured over the frequency range from 30 MHz to maximum frequency as specified in section 15.33.
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).
All tests are performed at a test-distance of 3 meters. 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. During the tests the EUT is rotated all around to find the maximum levels of emissions. The cables and equipment were placed and moved within the range of position likely to find their maximum emissions.



Fully anechoic chamber

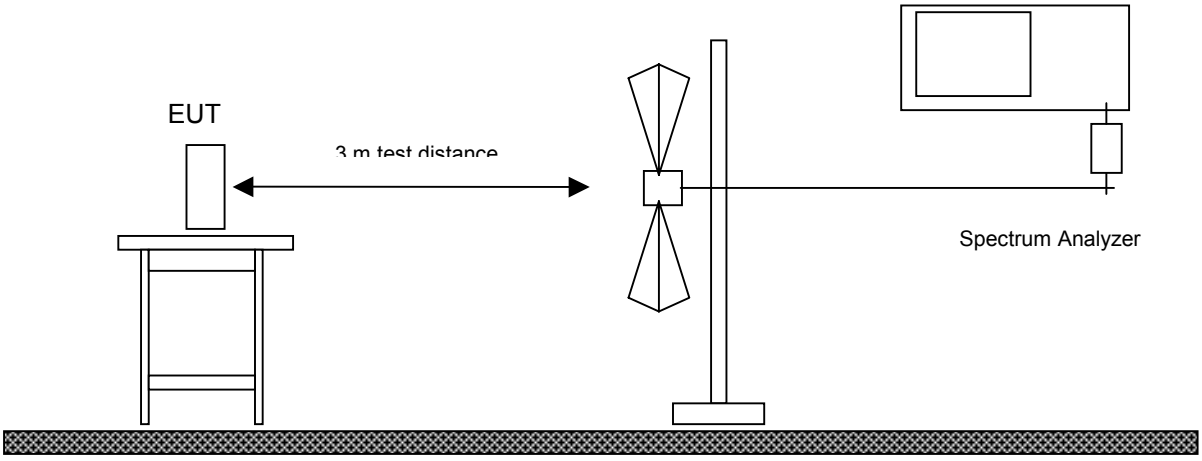
Test instruments used:

No.	Type	Model	Serial Number	Manufacturer
01	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
02	Preamplifier	CPA9231A	3393	Schaffner
03	Biconical antenna	HK 116	829708/006	Rohde & Schwarz
04	Log. periodic antenna	3147	9112-1054	EMCO
05	Horn antenna	3115	9508-4553	EMCO
06	Horn antenna	3160-03	9112-1003	Emco
07	Horn antenna	3160-04	9112-1001	Emco
08	Horn antenna	3160-05	9112-1001	Emco
09	Horn antenna	3160-06	9112-1001	Emco
10	Horn antenna	3160-07	9112-1008	Emco
11	Horn antenna	3160-08	9112-1002	Emco
12	Horn antenna	3160-09	9403-1025	Emco
13	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
14	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
15	Fully anechoic room	No. 2	1452	Albatross Projects

1.2. Radiated Emission Measurement at Open Area Test Site

Rules and Specifications:	Sections 15.109, 15.209, 15.245
Guide:	ANSI C63.4 1997

Measurement Procedure:
Radiated emissions are measured in the frequency range 30 MHz to 1 GHz The measurement bandwidth of the test receiver is set to 120 kHz with detector set to quasi-peak. 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 to find the maximum levels of emission. The cables and equipment are placed and moved within the range of position likely to find their maximum emissions. In general a test-distance of 3 meters is selected. If a test-distance of 10 meters is used the limits are calculated according to 15.31 (d) and (f)(1). If required preamplifiers are used for the whole frequency range. Special care is taken to avoid overload in transmit mode (using appropriate attenuators and filters if necessary).

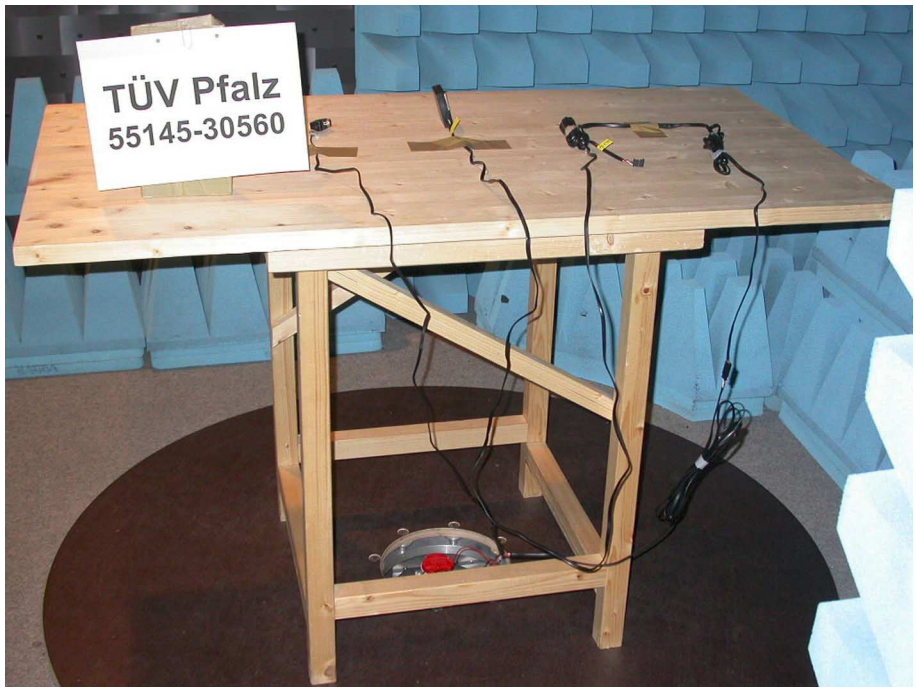


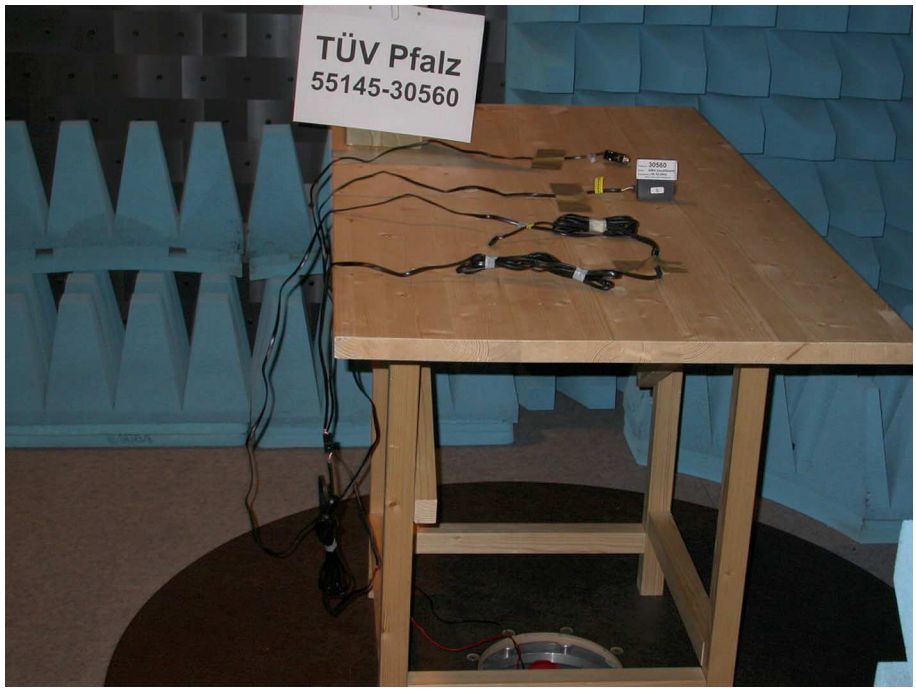
Test instruments used:

No.	Type	Model	Serial Number	Manufacturer
01	EMI Receiver	ESVP	881414/009	Rohde & Schwarz
141	Biconical antenna	HK 116	829708/006	Rohde & Schwarz
143	Log. periodic antenna	3147	9112-1054	EMCO
145	Horn antenna	3115	9508-4553	EMCO
146	Horn antenna set	3160-03/-09	9112-1003	EMCO
114	Preamplifier 1-8 GHz	AFS3-00100800-32-LN	847743	Miteq
115	Preamplifier 8-18 GHz	ACO/180-3530	32641	CTT
003	Open Field Test Site	No. 1	N/A	Senton

2. Photographs Taken During Testing

Test setup for radiated emission measurement (fully anechoic room)





3. List of Measurements

FCC Part 15			
Section(s):	**Test**	**Page(s)**	**Result**
15.205	Restricted Bands		Pass
15.207	AC Powerline Emissions	15	Not Applicable
15.249 (a)	Field Strength of Emissions (Fundamental & Harmonics)	16	Pass
15.249 (d)	Radiated Spurious Emissions	17	Pass

IC RSS-210 Issue 5			
Section(s):	**Test**	**Page(s)**	**Result**
6.6	Transmitter AC Wireline Conducted Emissions	---	Passed
6.2.2 (m2) (1)	Field Strength of Emissions Fundamental & Harmonics	16	Passed
6.2.2. (m2) (3)	Radiated Spurious Emissions (except Fundamental & Harmonics	17	Passed

Field Strength of Emissions

Rules and Specifications:	15.209, 15.249 (a) Radiated Emission Limits		
Guide:	ANSI C63.4		
Limit:	The field strength of emissions from intentional radiators operated in these frequency band shall comply with the following:		
	Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
	902-928 MHz	50	500
	2400-2483.5 MHz	50	500
	5725-5875 MHz	50	500
	24-24.25 GHz	250	2500

Tested Frequency:	
Test Site:	Open Area Test Site (< 1 GHz), Fully anechoic chamber (> 1 GHz)
Distance:	3 Meter

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBµV)	Correction Factor (dB/m)	Duty Cycle Correction (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2450,850	AV	Ver	46,37	34,78	0	81,15	94,00	**-12,9**
4903,800	AV	Hor	17	32,1	0	49,1	54,00	**-4,9**

***** = All emissions showed more than 20 dB margin to the limit**

Sample calculation of erp values:

Field Strength (dBµV/m) = Analyzer Reading (dBµV) + Correction Factor (dB) +Duty Cycle Correction (dB)

Test Results:	Pass	

Spurious Radiation Measurement

Rules and Specifications:	15.209, 15.249 (d) Radiated Emission Limits	
Guide:	ANSI C63.4	
Limit:	Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated at least 50 dB below the level of the fundamental or to the general radiated emission limits below, whichever is the lesser attenuation	
	Frequency of Emission (MHz)	Field Strength (microvolts/meter)
	30 - 88	100
	88 - 216	150
	216 - 960	200
	Above 960	500

Tested Frequency:	
Test Site:	Open Area Test Site (< 1 GHz), Fully anechoic chamber (> 1 GHz)
Distance:	3 Meter

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBµV)	Correction Factor (dB/m)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
30-26000			***				

***** = All emissions showed more than 20 dB margin to the limit**

Sample calculation of erp values:

Field Strength (dBµV/m) = Analyzer Reading (dBµV) + Correction Factor (dB/m)

Test Results:	Pass	

4. Referenced Regulations

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

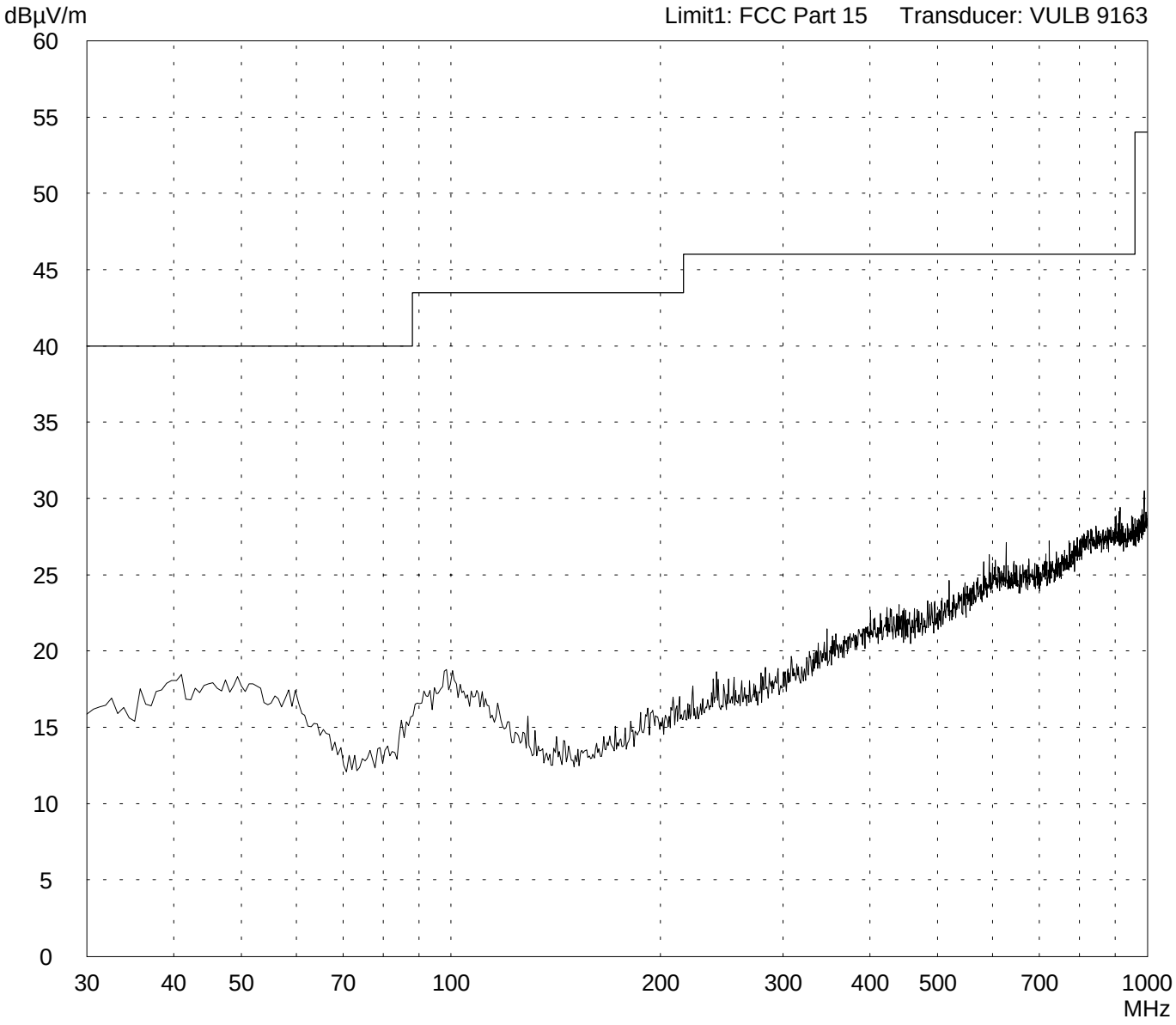
☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency Allocations And Radio Treaty Matters, General Rules And Regulations) of the Federal Communication Commission (FCC)	October 1, 2001
☐	CFR 47 Part 15 Subpart A	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart A (General) of the Federal Communication Commission (FCC)	March 13, 2003
☒	CFR 47 Part 15 Subpart B	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart B (Unintentional Radiators) of the Federal Communication Commission (FCC)	March 13, 2003
☐	CFR 47 Part 15 Subpart C	Code of Federal Regulations Part 15 (Radio Frequency Devices), Subpart C (Intentional Radiators) of the Federal Communication Commission (FCC)	March 13, 2003
☒	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 - 40 GHz	October, 1992
☒	RSS-210	Radio Standards Specification RSS-210 Issue 5 for Low Power Licence-Exempt Radiocommuniction Devices of Industry Canada	November 2001
☐	TIA/EIA-603	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	February 1993
☐	TIA/EIA-603-1	Addendum to TIA/EIA-603	March 4, 1998

Charts taken during testing

Radiated Emission Test 30 MHz - 1 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	

Detector: Peak	List of values: 10 dB Margin / 50 Subranges

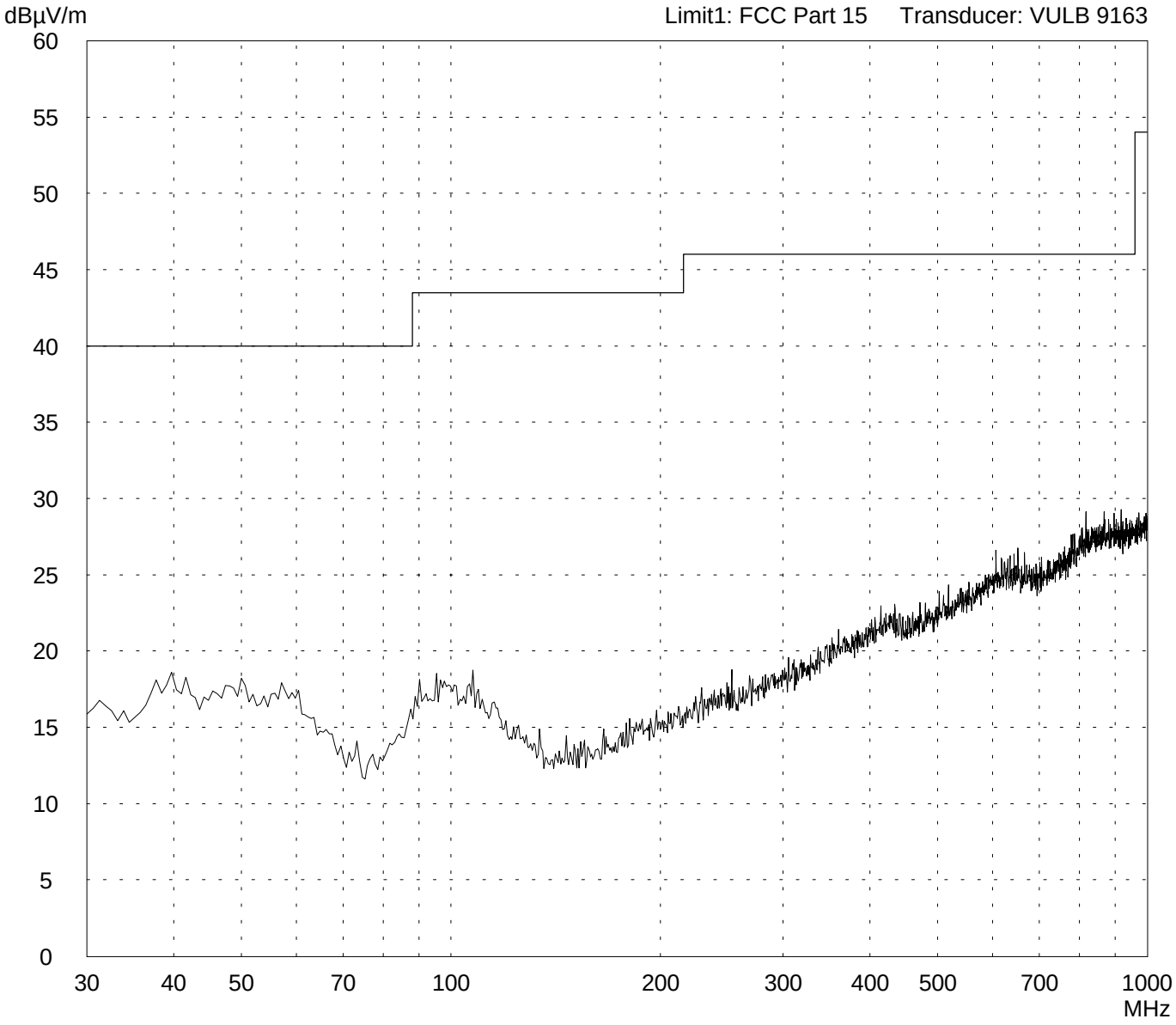


Result: Prescan	Project file: 55145-30560-2 / Page 17 of 30 Pages

Radiated Emission Test 30 MHz - 1 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	

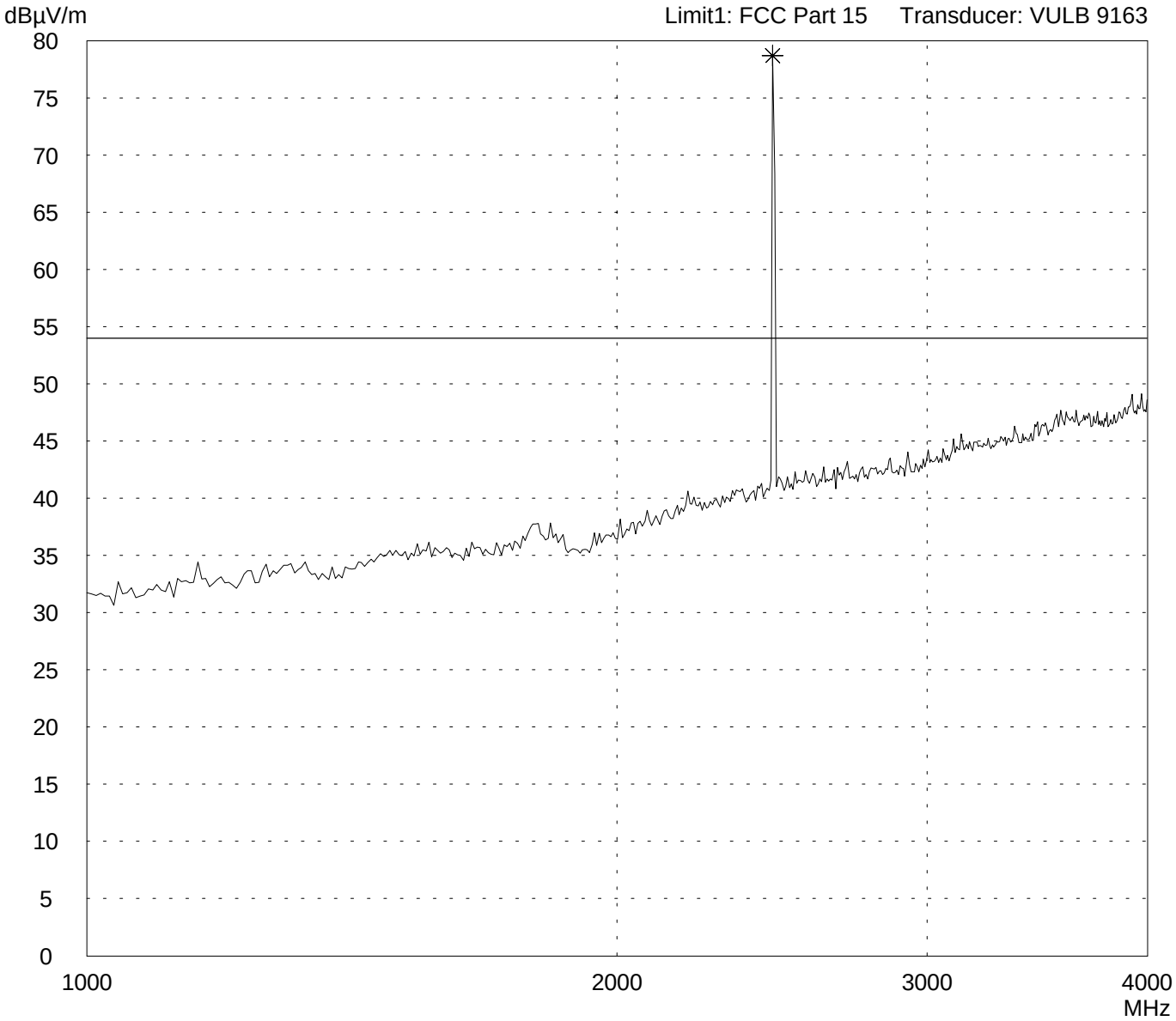
Detector: Peak	List of values: 10 dB Margin / 50 Subranges



Result: Prescan	Project file: 55145-30560-2 / Page 18 of 30 Pages

Radiated Emission Test 1 GHz - 4 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand

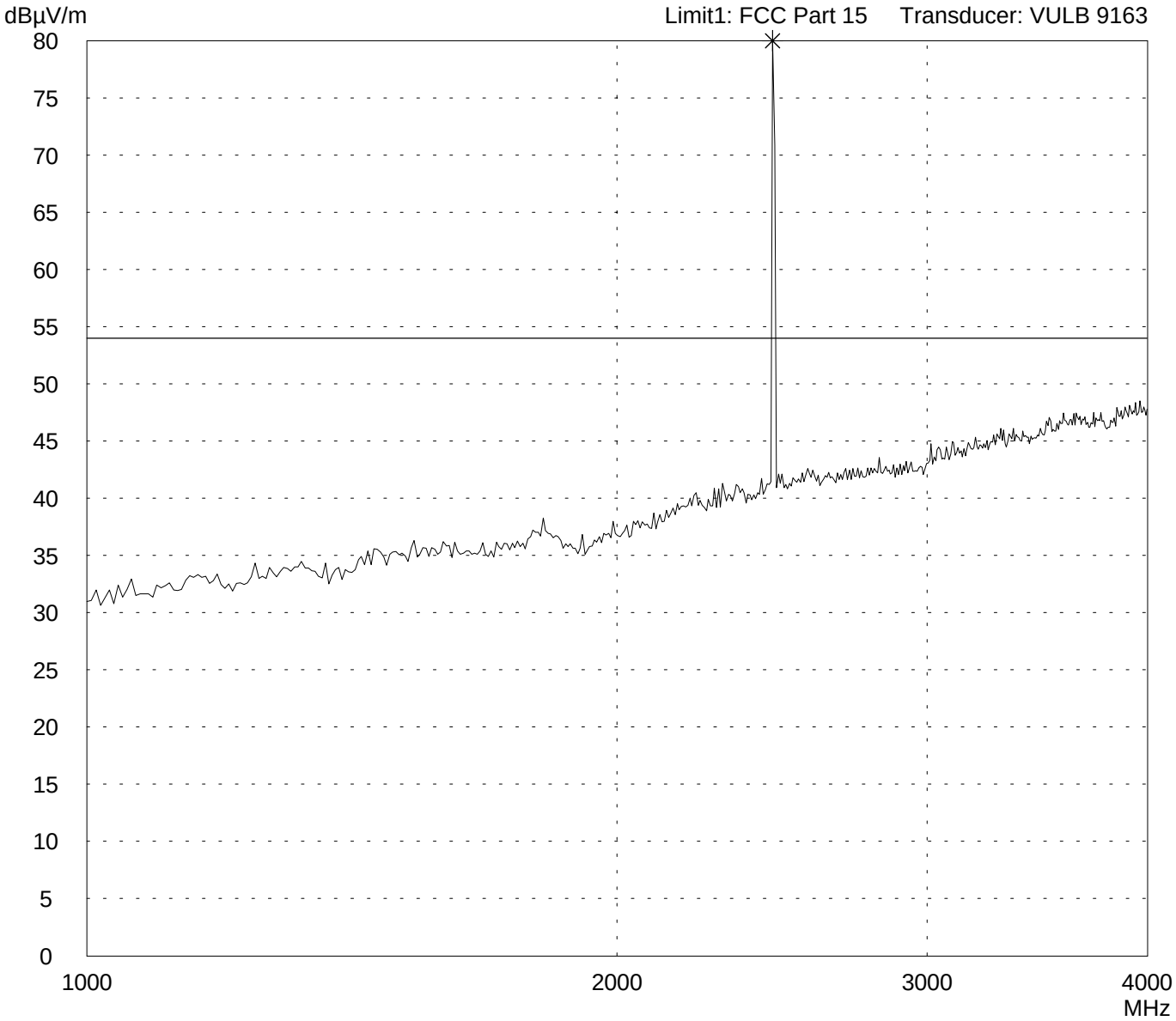


Result: Limit kept (carrier excluded)	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 1 GHz - 4 GHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand



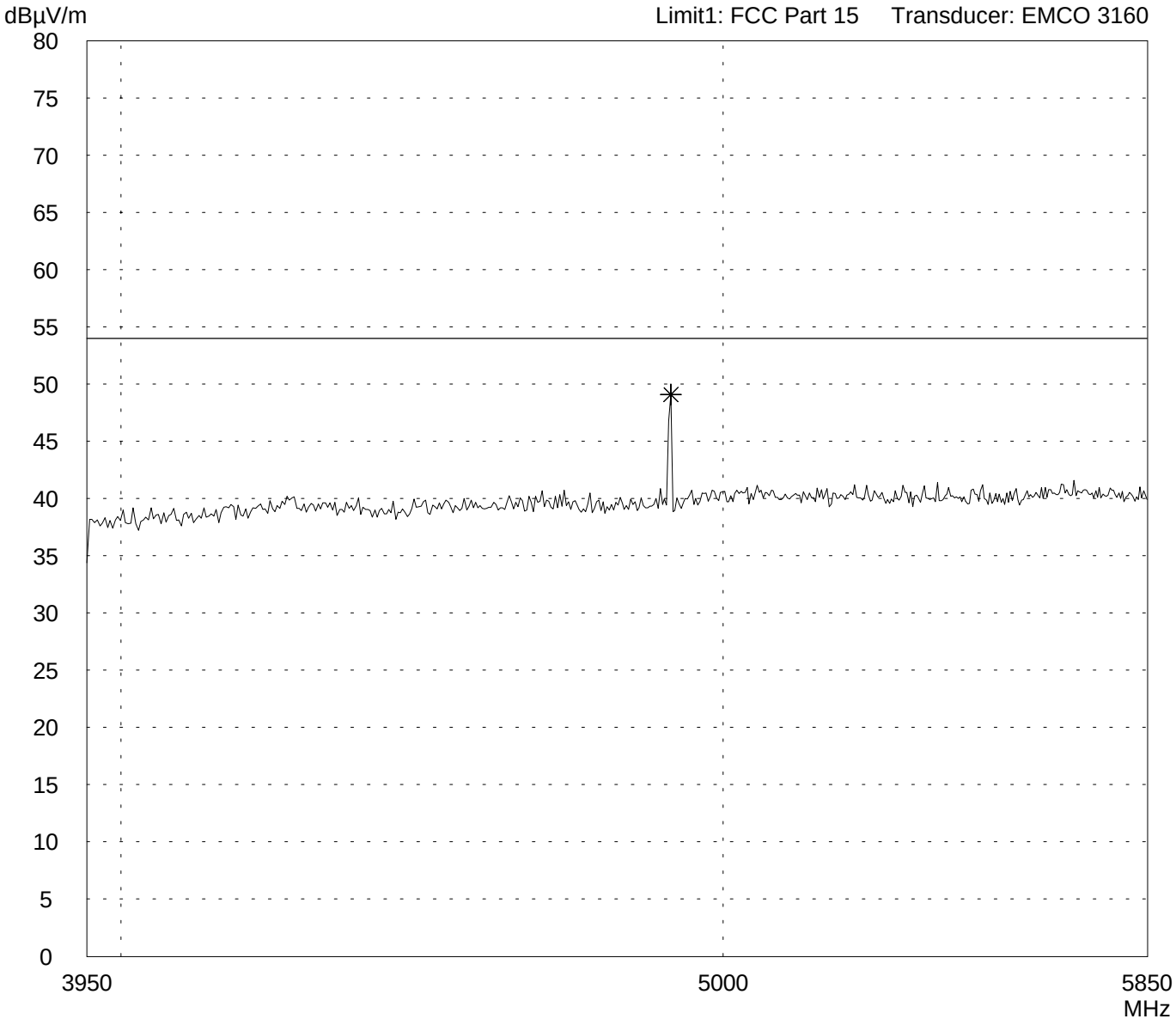
Result: Limit kept (carrier excluded)	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 3.95 GHz - 5.85 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously - with WHK3M/13G-10SS high pass filter
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: last.emi	

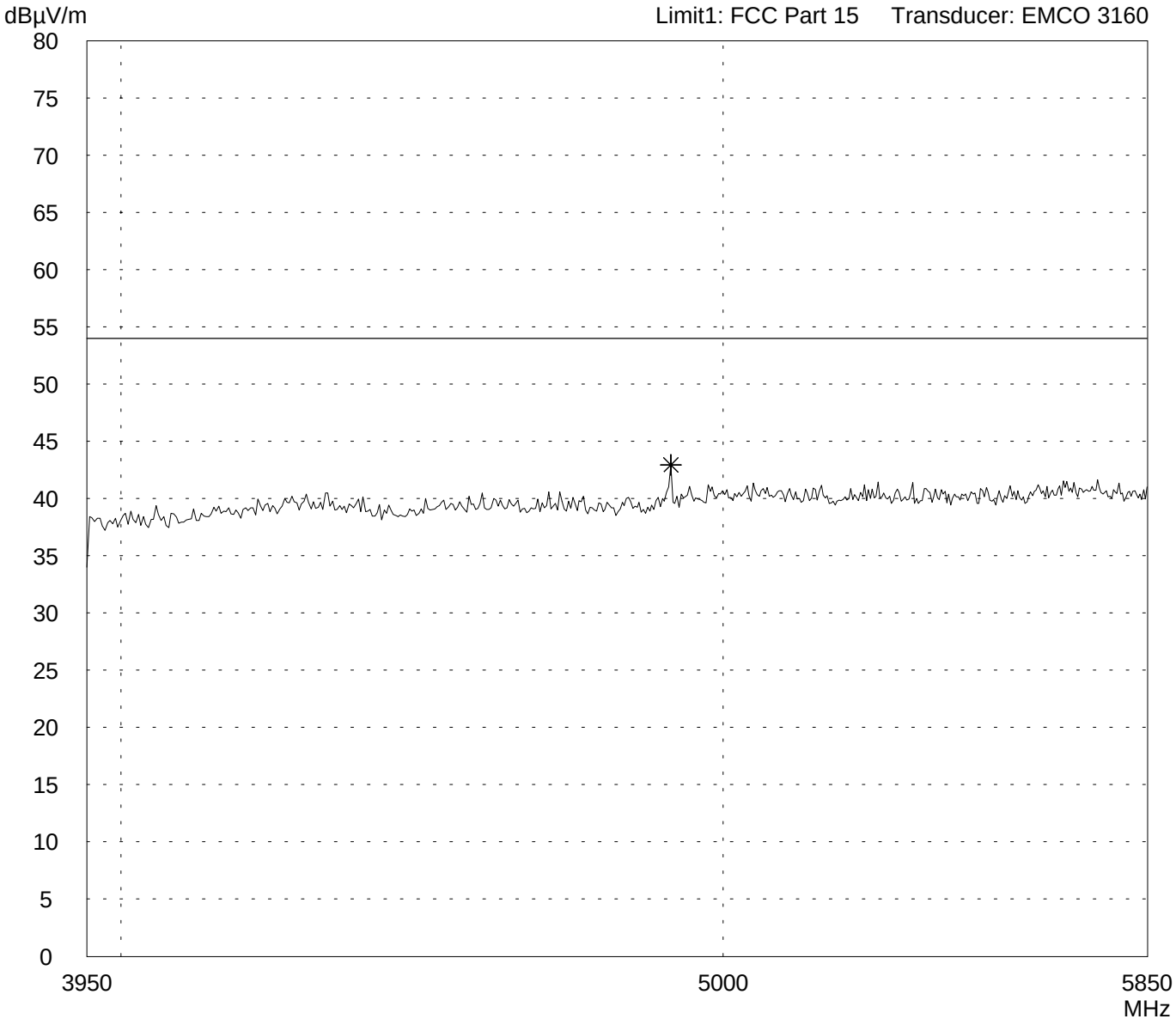
Detector: Peak	List of values: 10 dB Margin / 50 Subranges



Result: Limit kept	Project file: 55145-30560 / Page 21 of 30 Pages

Radiated Emission Test 3.95 GHz - 5.85 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply
Serial no.: sample M1	- EUT on master-port of bus - transmitting continiously
Applicant: TÜV Pfalz	- with WHK3M/13G-10SS high pass filter
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand



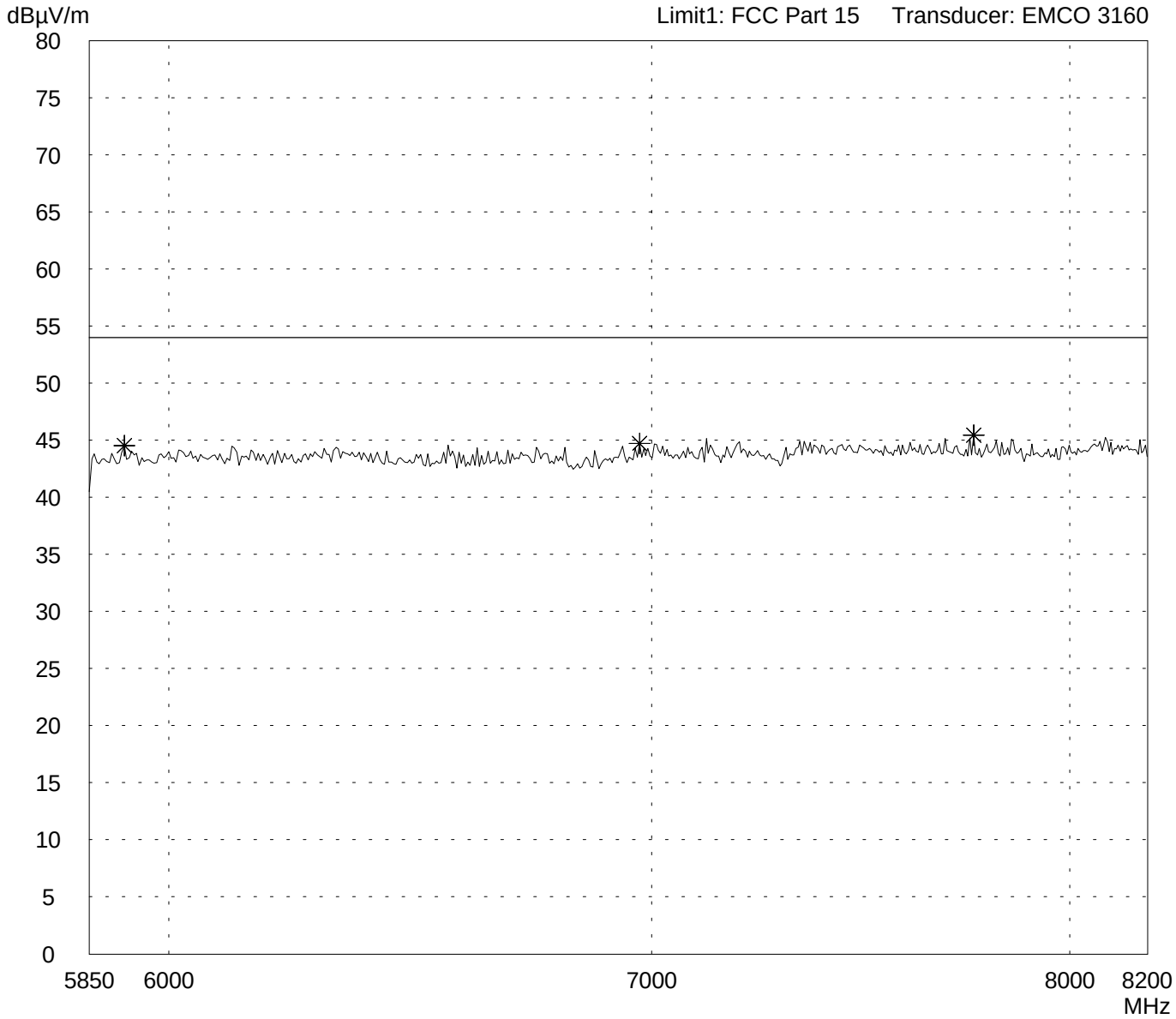
Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

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

Model: 5464	Comment: - 12 V DC power supply
Serial no.: sample M1	- EUT on master-port of bus - transmitting continiously
Applicant: TÜV Pfalz	- with WHK3M/13G-10SS high pass filter
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	

Detector: Peak	List of values: Selected by hand

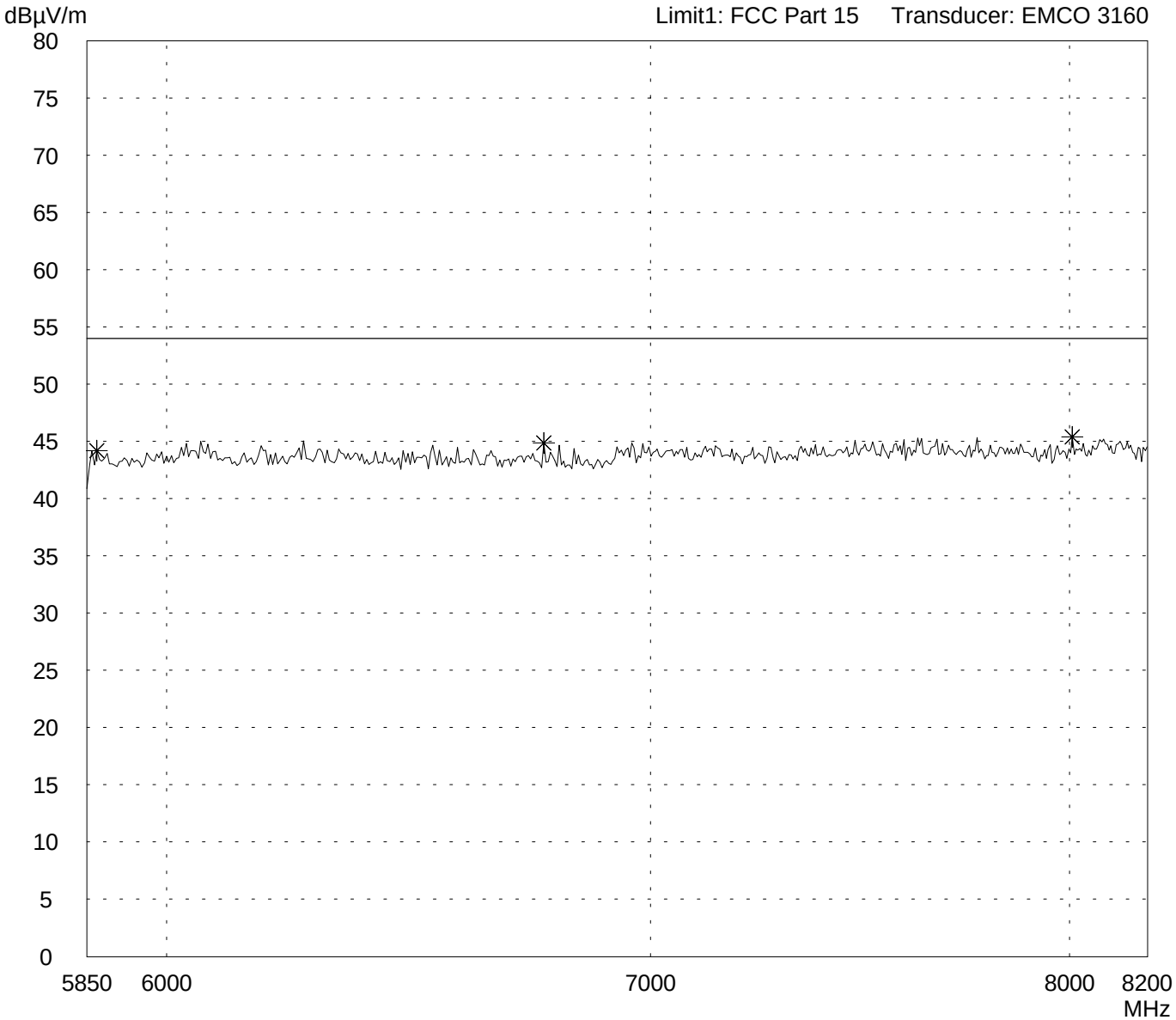


Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

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

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously - with WHK3M/13G-10SS high pass filter
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand



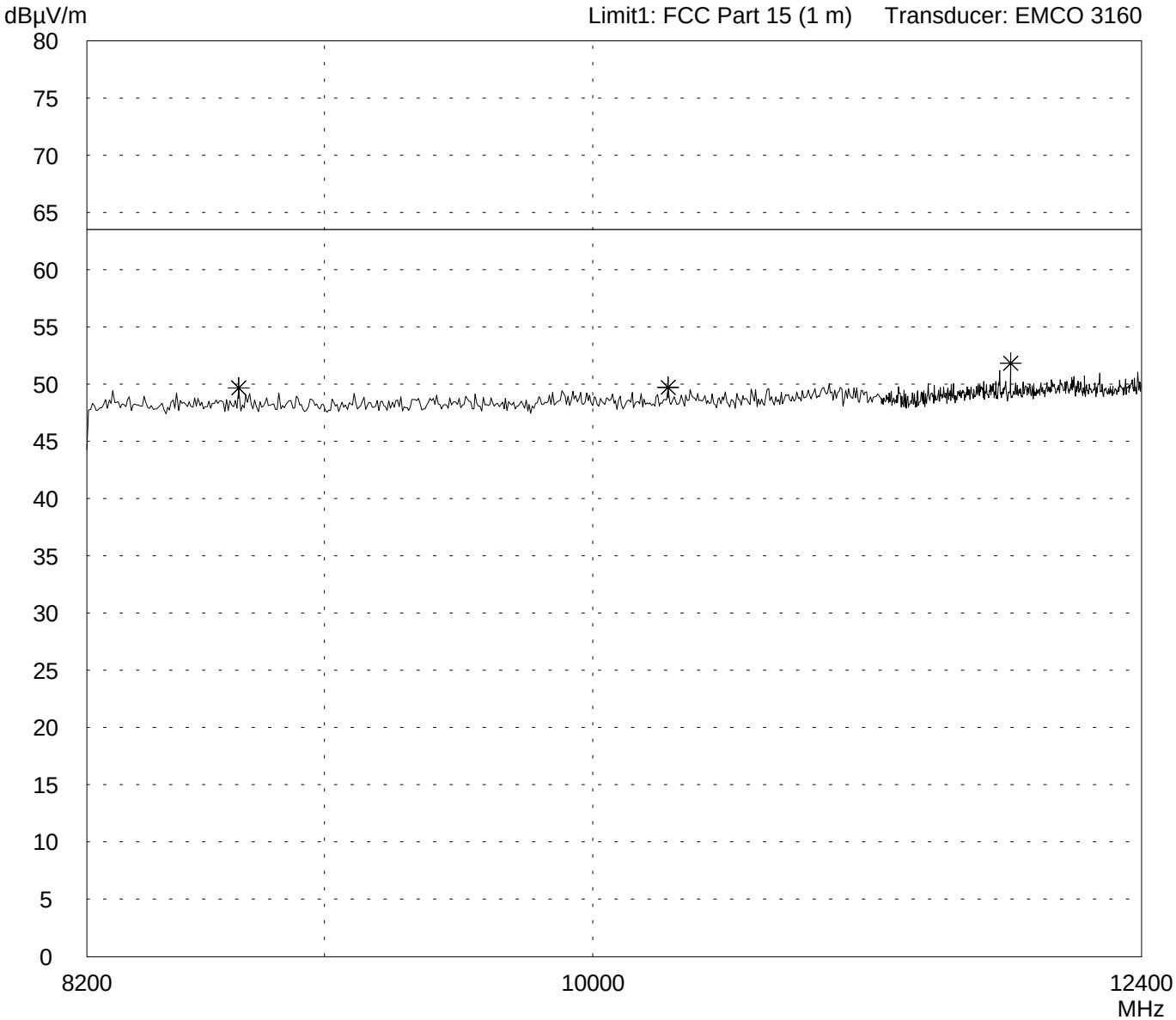
Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 8.2 GHz - 12.4 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously - with WHK3M/13G-10SS high pass filter
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 1 meter Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	

Detector: Peak	List of values: Selected by hand



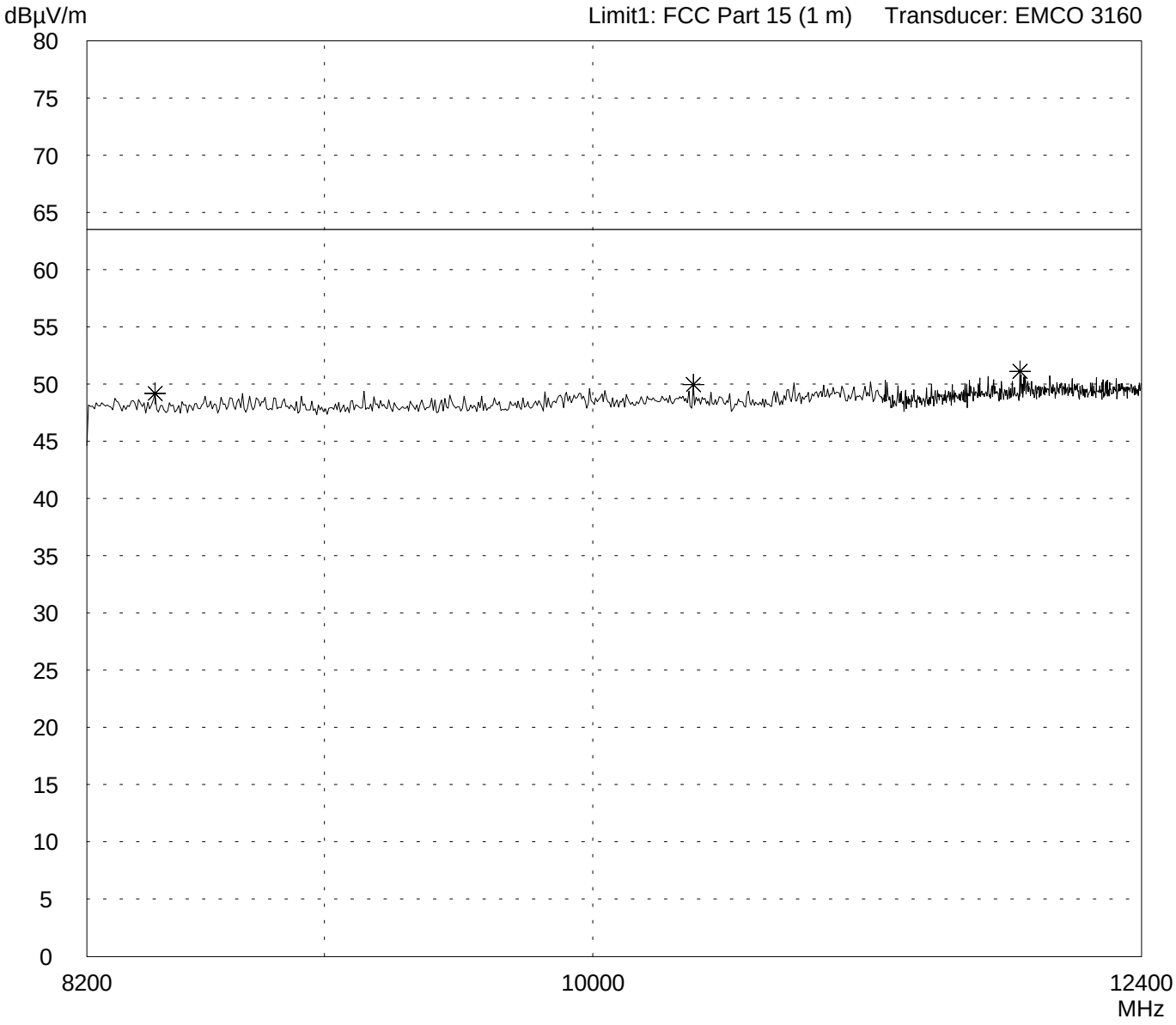
Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 8.2 GHz - 12.4 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply
Serial no.: sample M1	- EUT on master-port of bus - transmitting continiously
Applicant: TÜV Pfalz	- with WHK3M/13G-10SS high pass filter
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 1 meter Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	

Detector: Peak	List of values: Selected by hand

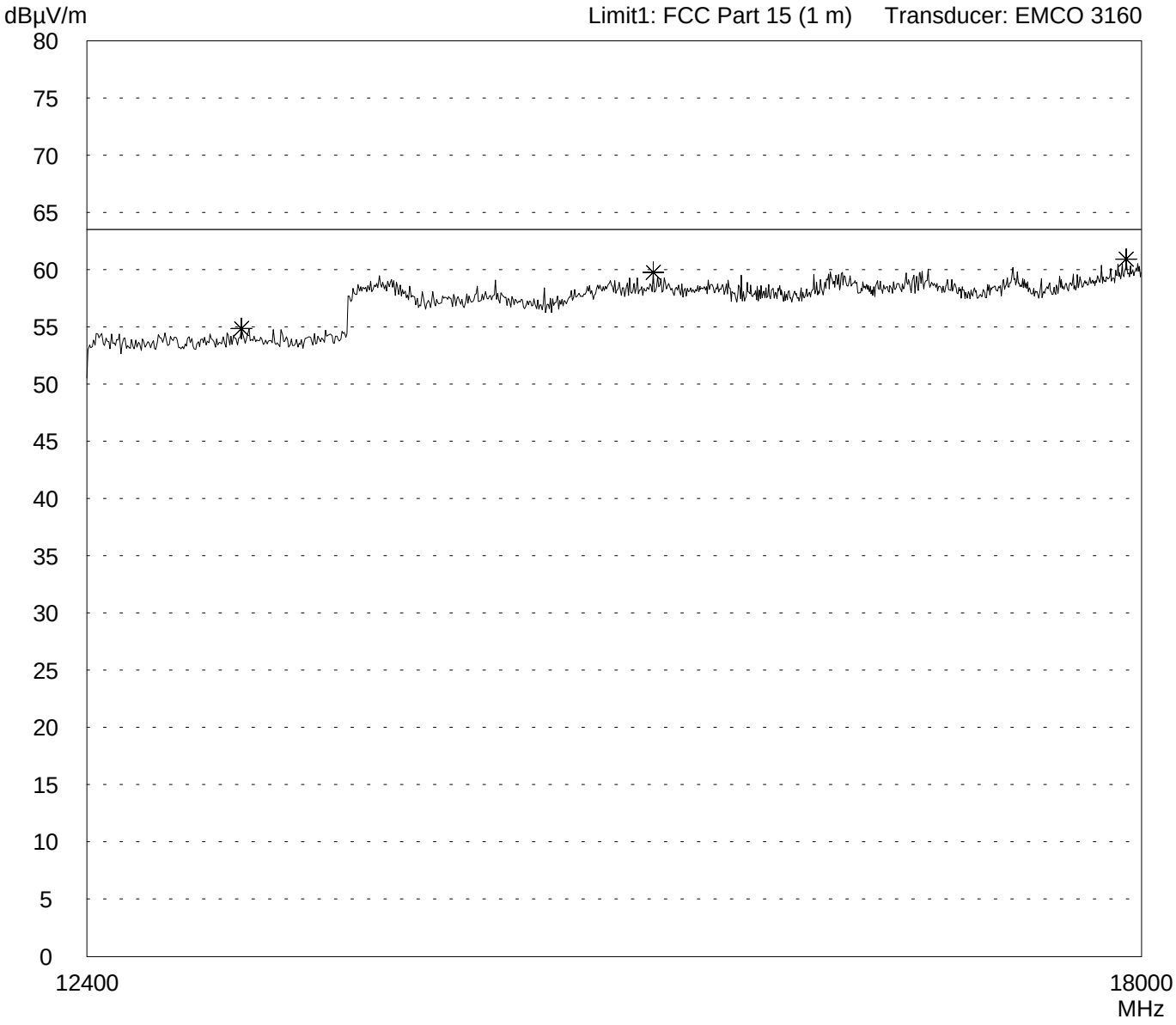


Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 12.4 GHz - 18 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 1 meter Horizontal Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand

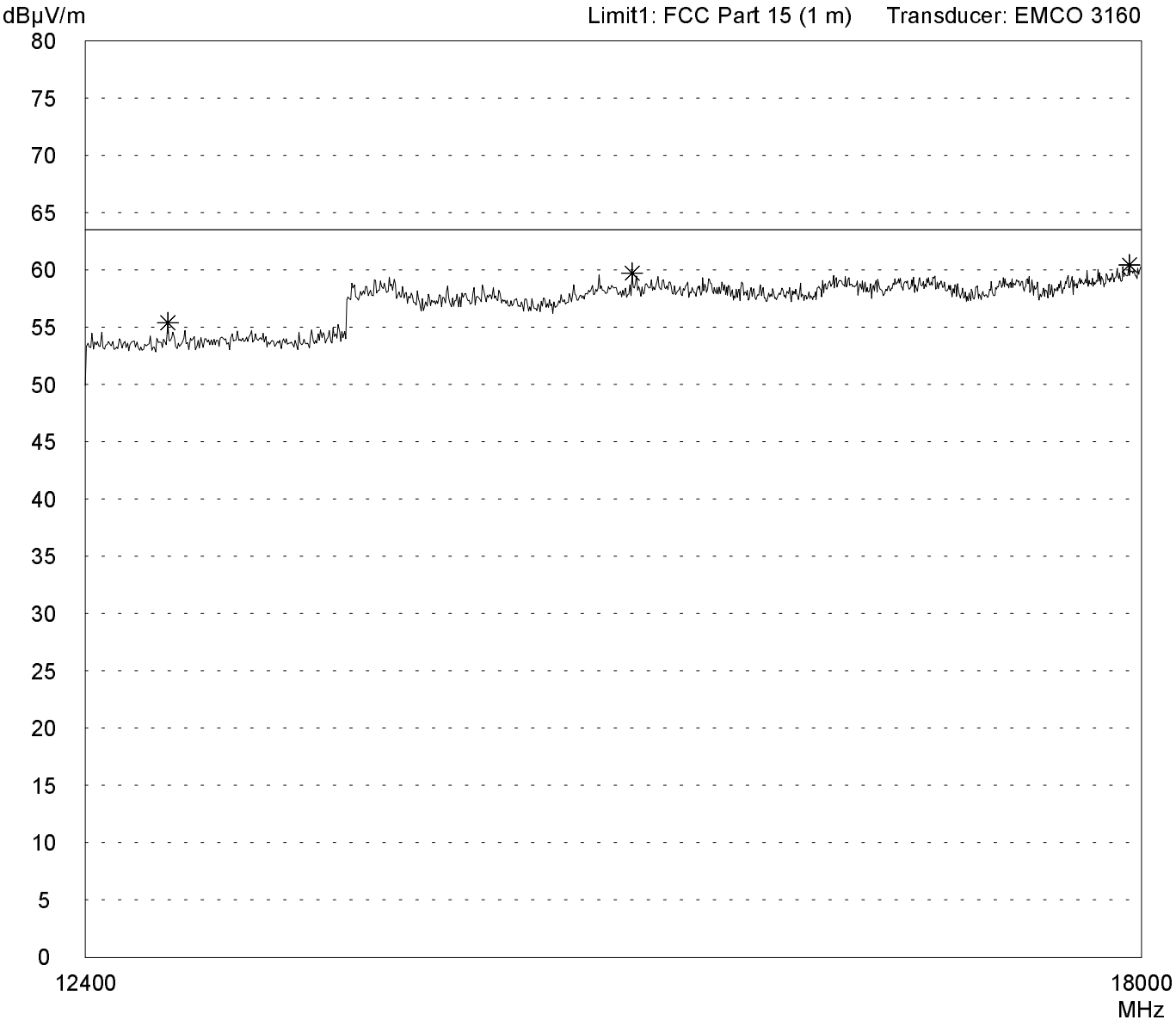


Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test 12.4 GHz - 18 GHz
acc. to FCC Part 15 (EMCO 3160)

Model: 5464	Comment: - 12 V DC power supply - EUT on master-port of bus - transmitting continiously
Serial no.: sample M1	
Applicant: TÜV Pfalz	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 1 meter Vertical Polarization	
Date of test: 12/03/2003 / Operator: M. Steindl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand



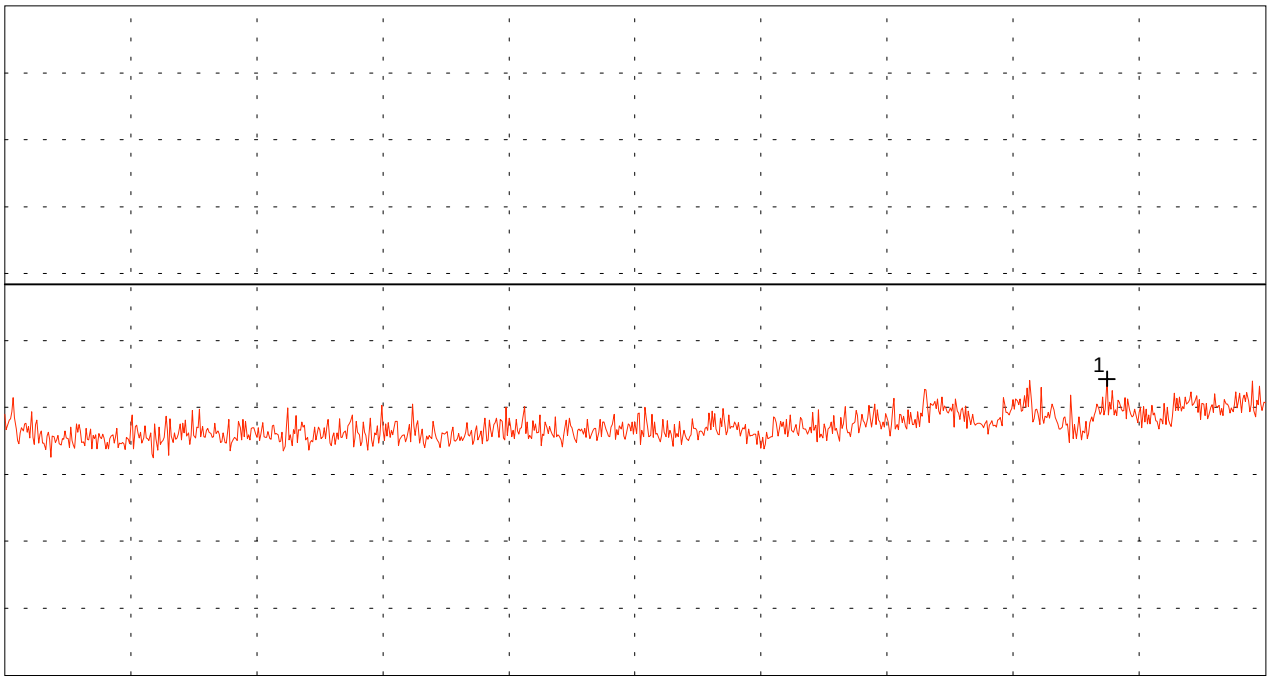
Result: Limit kept	Project file: 55145-30560

Senton GmbH / Aeussere Fruehlingstrasse 45 / D-94315 Straubing / Germany / Tel. +49 (0)9421 5522-0 / Fax +49 (0)9421 5522-99

Radiated Emission Test acc. to FCC Part 15.249

Model: 5464	Mode: - 12 V DC power supply - EUT on master port of bus - transmitting continiously - horizontal polarisation
Serial No.: sample M1	
Applicant: TÜV Pfalz	

Ref.Level 89.8 dBµV
5 dB/Div.
ATT 0 dB
Ref. Offset 42.8 dB



Start 18.000 GHz
RBW 1 MHz
VBW 1 MHz
Stop 25.000 GHz
SWP 40 ms

Multi Marker List

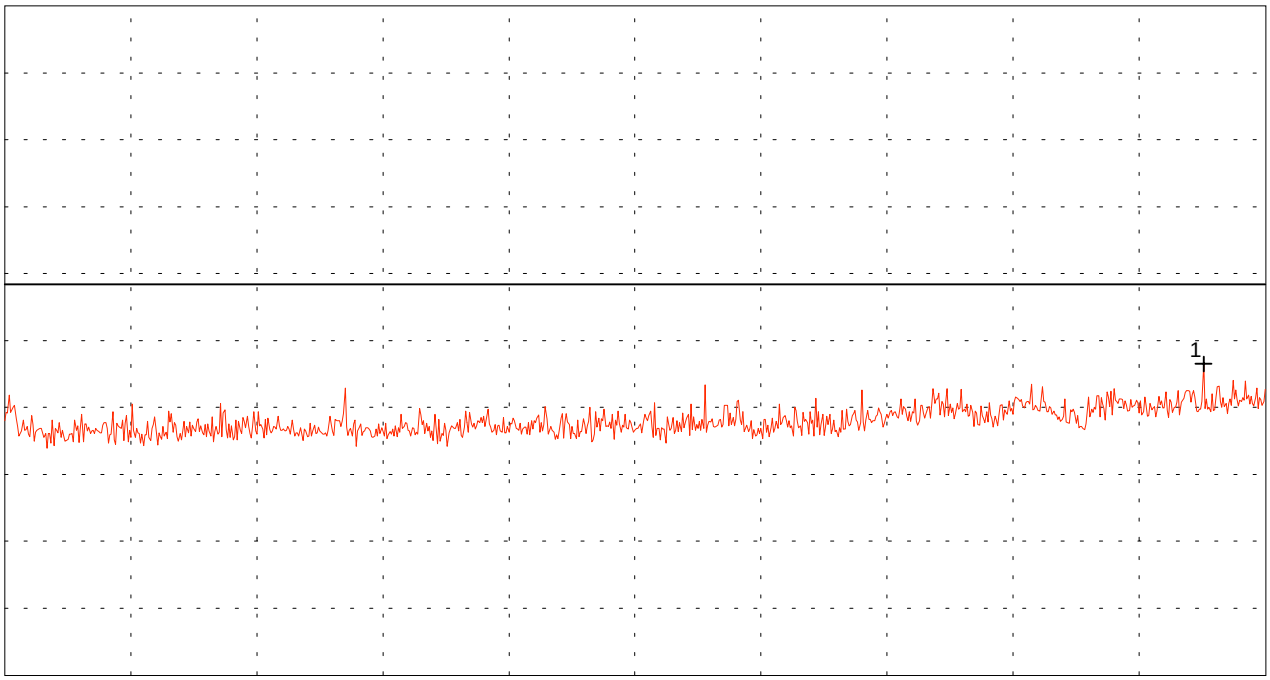
No. 1	24.121111 GHz	61.92 dBµV

Tested by: M. Steindl	Project-No.: 55145-30560-2
Date: 12/5/2003	Page 29 of 30 pages

Radiated Emission Test acc. to FCC Part 15.249

Model: 5464	Mode: - 12 V DC power supply - EUT on master port of bus - transmitting continiously - vertical polarisation
Serial No.: sample M1	
Applicant: TÜV Pfalz	

Ref.Level 89.8 dBµV ATT 0 dB Ref. Offset 42.8 dB
5 dB/Div.



Start 18.000 GHz Stop 25.000 GHz
RBW 1 MHz VBW 1 MHz SWP 40 ms

Multi Marker List

No. 1 24.657778 GHz 63.04 dBµV

Tested by: M. Steindl	Project-No.: 55145-30560-2
Date: 12/5/2003	

Senton GmbH / EMI/EMC Test Center / Aeussere Fruehlingstrasse 45 / 94315 Straubing / Tel. +49 9421 55220