Senton GmbH
Aeussere Fruehlingstrasse 45
D-94315 Straubing

Straubing, April 1, 2005

T E S T - R E P O R T

No. 50602-050112-6 (Edition 1)

for

ID ISC.PR101

Inductive TAG Reader

Applicant:	FEIG ELECTRONIC GmbH
Test Specifications:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207 and 15.225 Industry Canada Radio Standards Specification RSS-210 Issue 5, Sections 6.2.2(e), 6.3 and 6.6 (Category I Equipment)

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	ID ISC.PR101
Variants covered in this test report:	- with USB interface - with serial interface
Parts[2]:	1
Serial number(s):	6
Manufacturer:	FEIG ELECTRONIC GmbH
Type of equipment:	Inductive TAG Reader
Version:	As delivered
FCC ID:	PJMMR101-PR101
Additional parts/accessories:	---

Technical data of EUT			
Application frequency range:	13.553 – 13.567 MHz		
Frequency range:	13.553 – 13.567 MHz		
Operating frequency:	13.56 MHz		
Type of modulation:	ASK		
Pulse train:	Not Applicable		
Pulse width:	Not Applicable		
Number of RF-channels:	1		
Channel spacing:	Not Applicable		
Designation of emissions[3]:	10K0A1D		
Type of antenna:	Integrated Inductive Loop Coil		
Size/length of antenna:	100 x 70 mm		
Type of power supply:	DC supply		
Specifications for power supply:	nominal voltage: minimum voltage: maximum voltage:	5.0 V 4.5 V 5.5 V	12.0 V 12.0 V 24.0 V

[1] Type designation of the system if EUT consists of more than one part.
[2] Type designations of the parts of the system, if applicable.
[3] Also known as "Class of Emission".

2 Administrative Data

Application details	
Applicant (full address):	FEIG ELECTRONIC GmbH Lange Straße 4 D-35781 Weilburg-Waldhausen
Contact person:	Mr. Carsten Fiedler
Contract identification:	Order no. EB203083 / 16483
Receipt of EUT:	16th March 2005
Date(s) of test:	16th March – 1st April 2005
Note(s):	Mr. Fiedler attended testings on March, 16th.

Report details	
Report number:	50602-050112-6
Edition:	1
Issue date:	April 1, 2005

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 15.225** of the Federal Communication Commission (FCC) and the **Radio Standards Specification RSS-210 Issue 5, Sections 6.2.2(e), 6.3 and 6.6 (Category I Equipment)** of Industry Canada (IC).

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

5 Operation Mode and Configuration of EUT

Operation Mode(s)
Transmitting continuously, reading TAG.

Configuration(s) of EUT
- EUT war configured as stand alone device.
- According to applicant the device is delivered either with an USB- or a serial interface. For testing purposes a device with USB- and serial interface was tested.

List of ports and cables

Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1	DC supply	dc power	Unshielded	> 3m
2	USB	signal/control port	Shielded	> 3m
3	Serial interface	signal/control port	Unshielded	> 3m

List of devices connected to EUT

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
	Not Applicable			

List of support devices

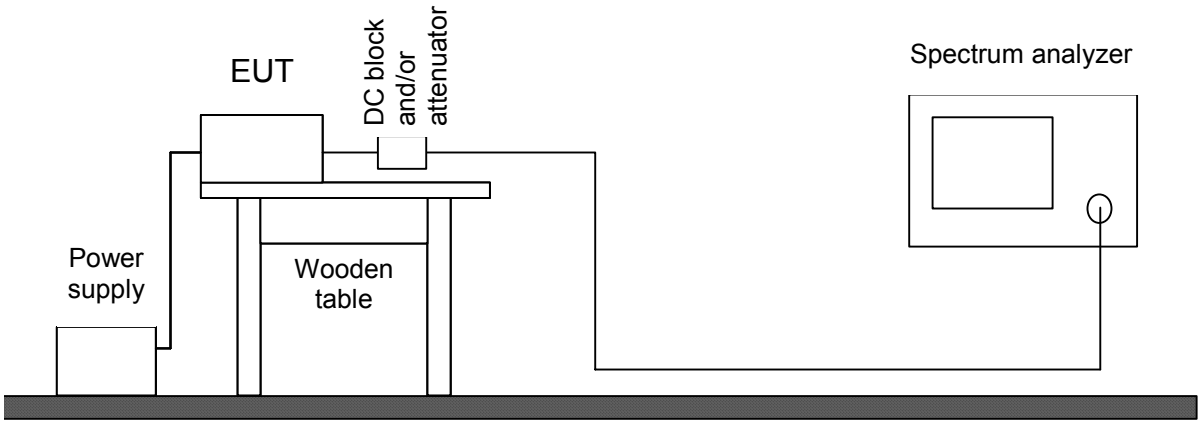
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
	Not Applicable			

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

6 Measuring Methods

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) IC RSS-210 Issue 5, section 5.9.1 IC RSS-210 Issue 5, section 6.1.1(c) ANSI C63.4, annex H.6
Guide:	ANSI C63.4 / IC RSS-210 Issue 5, section 5.9.1
Measurement setup:	☐ Conducted: See below
	☒ Radiated: Radiated Emission Measurement 9 kHz to 30 MHz (6.3)
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. If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range. The analyzer settings are specified by the test description of the appropriate test record(s).	



Test instruments used for conducted measurements:

Used	Type	Model	Serial No. or ID	Manufacturer
☐	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☐	Power meter	NRVS	836856/015	Rohde & Schwarz
☐	Power sensor	NRV-Z52	837901/030	Rohde & Schwarz
☐	Power sensor	NRV-Z4	863828/015	Rohde & Schwarz
☐	DC-block	7006	A2798	Weinschel
☐	Attenuator	4776-10	9412	Narda
☐	Attenuator	4776-20	9503	Narda

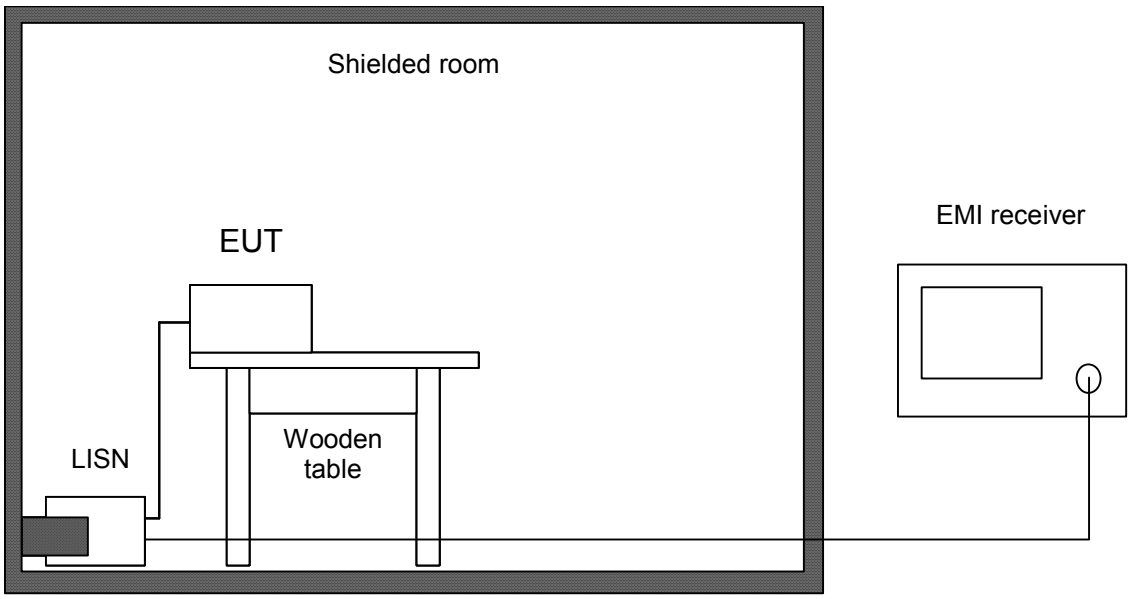
6.2 Conducted AC powerline emission

Measurement Procedure:	
Rules and Specifications:	CFR 47 Part 15, section 15.207 IC RSS-210 Issue 5, section 6.6
Guide:	ANSI C63.4 / CISPR 22

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:

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 (CFR 47 Part 15) or quasi-peak (IC RSS-210) limit are retested with detector set to quasi-peak.
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.

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.
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.



Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
☒	EMI receiver	ESHS 10	860043/016	Rohde & Schwarz
☒	LISN	ESH3-Z5	862770/021	Rohde & Schwarz
☐	LISN	ESH3-Z5	830952/025	Rohde & Schwarz
☐	Shielded room	No. 1	1451	Albatross Projects
☒	Shielded room	No. 4	3FD-100 544	Euroshield

6.3 Radiated Emission Measurement 9 kHz to 30 MHz

Measurement Procedure:	
Rules and Specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d) IC RSS-210 Issue 5, sections 6.2.1, 6.2.2(e) and 6.3
Guide:	ANSI C63.4

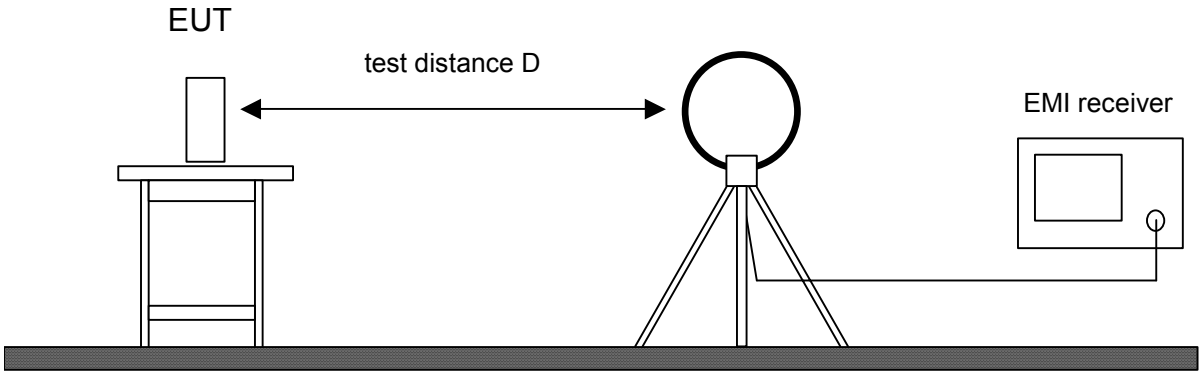
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

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.

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. Due to fixed polarization of the loop antenna, if possible, the EUT is put into a position that gives the maximum levels of emissions.

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 – 90 kHz and 110 – 490 kHz where, for non-pulsed operation, average detector is employed.

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.



Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
☒	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☒	Test receiver	ESHS 10	860043/016	Rohde & Schwarz
☐	Preamplifier	CPA9231A	3393	Schaffner
☒	Loop antenna	HFH2-Z2	882964/1	Rohde & Schwarz
☒	Fully anechoic room	No. 2	1452	Albatross Projects
☐	Semi-anechoic room	No. 3	1453	Siemens
☒	Open field test site	EG 1	1450	Senton

6.4 Radiated emission in Fully Anechoic Room

Measurement Procedure:	
Rules and Specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.3(b)-(d)
Guide:	ANSI C63.4

Radiated emission in fully 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.

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).

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.

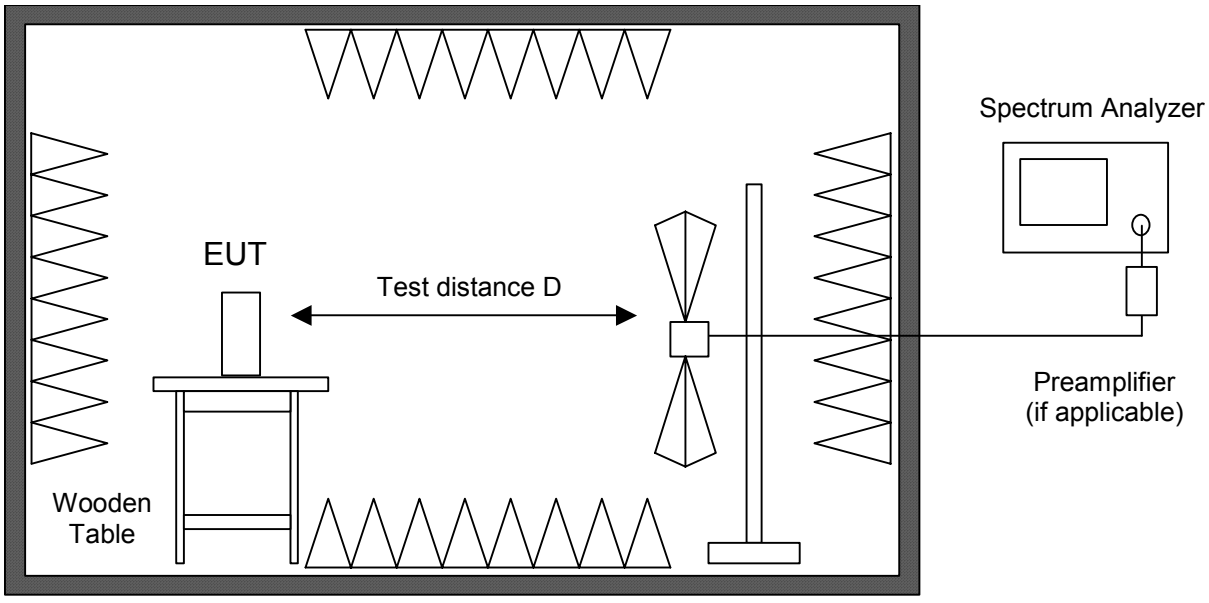
All tests below 18 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance is reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation 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.

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.

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 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.

For final testing below 1 GHz an open field test-site is used and the plots recorded in the fully anechoic room are indicated as prescans.



Fully anechoic room

Test instruments used:

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

6.5 Radiated emission at Open Field Test Site

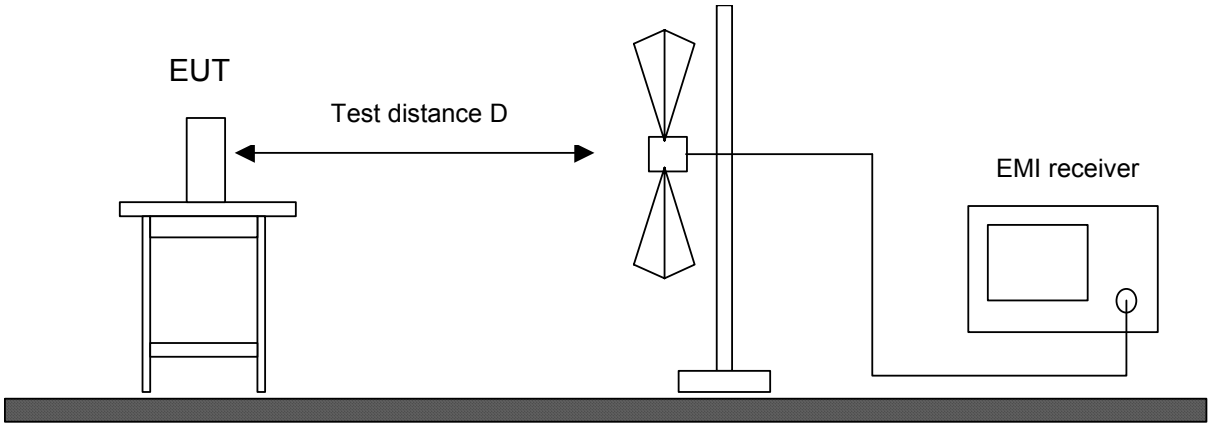
Measurement Procedure:	
Rules and Specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.3(b)-(d)
Guide:	ANSI C63.4

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.

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.

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.

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.



Test instruments used:

Used	Type		Model	Serial No. or ID	Manufacturer
☒	EMI receiver		ESVP	881414/009	Rohde & Schwarz
☒	Biconical antenna	EG 1	HK 116	842204/001	Rohde & Schwarz
☒	Log. per. antenna	EG 1	HL 223	841516/023	Rohde & Schwarz
☒	Open field test site		EG 1	1450	Senton

6.6 Carrier Frequency Stability

Measurement Procedure:	
Rules and Specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.4
Guide:	ANSI C63.4

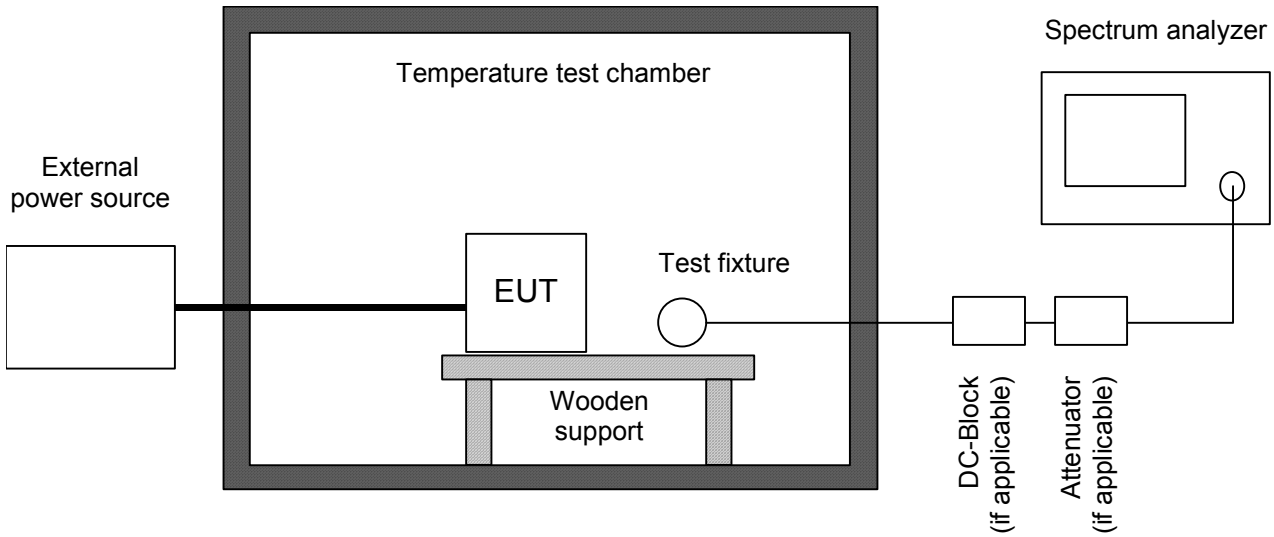
The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.

If the EUT provides an antenna connector the spectrum analyzer is connected to this port. 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). In cases where the EUT does not provide an antenna connector a test fixture is used.

For battery operated equipment, the test is performed using a new battery. Alternatively, an external supply voltage can be used and is at least set to:

- the maximum battery voltage as delivered by a new battery or 115% of the battery nominal voltage
- the battery nominal voltage
- 85% of the battery nominal voltage
- the battery operating end point voltage which shall be specified by the equipment manufacturer

The EUT is operating providing an unmodulated carrier. The peak detector of the spectrum analyzer is selected and resolution as well as video bandwidth are set to values appropriate to the shape of the spectrum of the EUT. The frequency counter mode of the spectrum analyzer is used to maximize the accuracy of the measured frequency tolerance.
If an unmodulated carrier is not available a significant and stable point on the spectrum is selected and the span is reduced to a value that delivers an accuracy which shall be better than 1% of the maximum frequency tolerance allowed for the carrier signal. This method may be performed as long as the margin to the frequency tolerance allowed is larger than the uncertainty of the measured frequency tolerance.



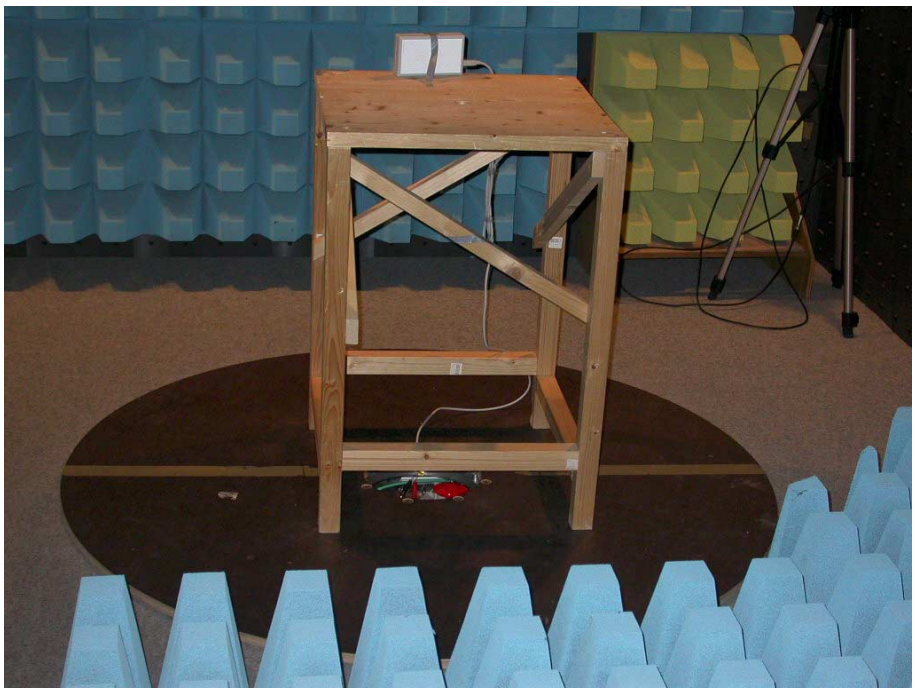
Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
☐	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☒	EMI test receiver	ESPI7	836914/0002	Rohde & Schwarz
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☐	DC-block	7006	A2798	Weinschel
☐	Attenuator	4776-10	9412	Narda
☐	Attenuator	4776-20	9503	Narda
☒	Test probe	TP01	001	Senton
☐	DC power supply	NGSM 32/10	203	Rohde & Schwarz
☐	Isolating transformer	RT 5A	10387	Grundig
☐	Isolating transformer	RT 5A	10416	Grundig
☒	Temperature test chamber	HT4010	07065550	Heraeus

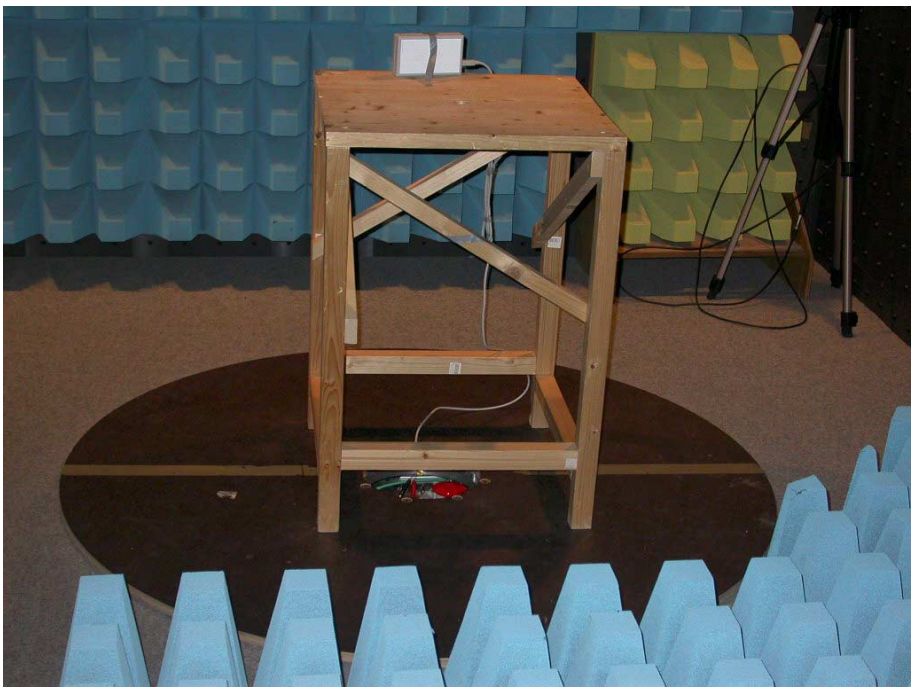
7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement

Test setup for radiated emission measurement 9 kHz – 30 MHz



Test setup for radiated emission measurement (fully anechoic room)



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

Test setup for carrier frequency stability measurement

8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.202(a)	Occupied bandwidth	28	Recorded
2.201, 2.202	Class of emission	33	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Recorded
15.205(a)	Restricted bands of operation	---	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	34	Test passed
15.225(a)-(d)	Spectrum Mask	36	Test passed
15.205(b) 15.225(a)(d)	Radiated emission 9 kHz to 30 MHz	38	Test passed
15.205(b) 15.225(d)	Radiated emission 30 MHz to 1 GHz	39	Test passed
15.225(e)	Carrier Frequency Stability	40	Test passed

IC RSS-210 Issue 5			
Section(s)	*Test*	*Page*	*Result*
5.9.1	Emission bandwidth	31	Recorded
5.9.2	Designation of emissions	33	Calculated
6.5	Pulsed operation	---	Recorded
6.3(a)	Restricted bands and unwanted emission frequencies	---	See "Spectrum Mask"
6.6	Transmitter AC wireline conducted emissions 450 kHz to 30 MHz	34	Test passed
6.2.2(e)	Spectrum Mask	36	Test passed
6.2.2(e) 6.3(b)-(d)	Field strength of emissions 9 kHz to 30 MHz	38	Test passed
6.2.2(e) 6.3(b)-(d)	Field strength of emissions 30 MHz to 1 GHz	39	Test passed
6.2.2(e) 6.4	Carrier Frequency Stability	40	Test passed

8.1 Occupied Bandwidth

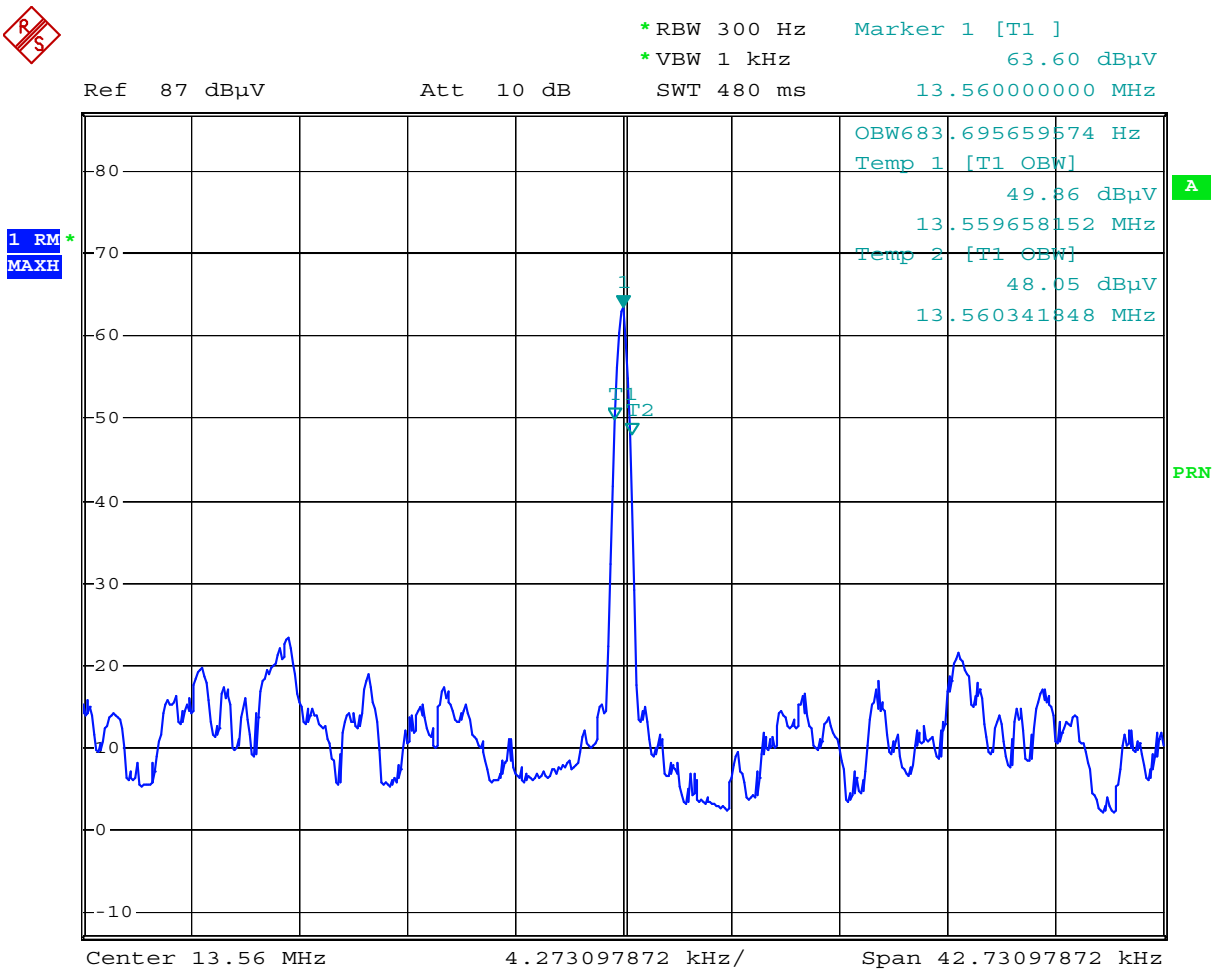
Rules and specifications:	CFR 47 Part 2, section 2.202(a) ANSI C63.4, annex H.6
Guide:	ANSI C63.4
Description:	The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated 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.

Comment:	
Date of test:	30th March 2005
Test site:	Fully anechoic room, cabin no. 2

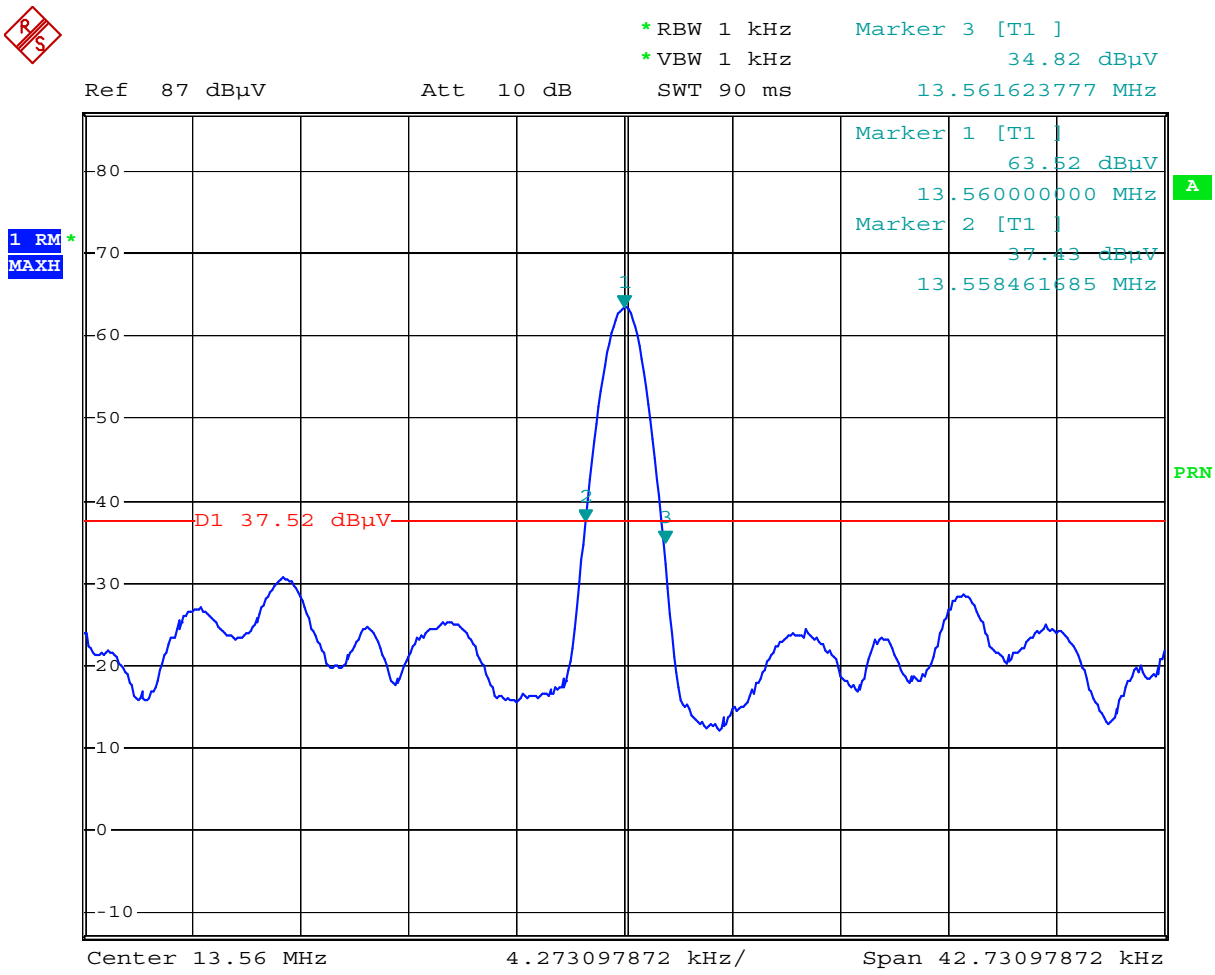
Occupied Bandwidth (99 %):



Comment: FEIG: Occupied Bandwidth
Date: 30.MAR.2005 11:14:38

Occupied Bandwidth (99 %):	**0.68 kHz**

Occupied Bandwidth (-26 dB):



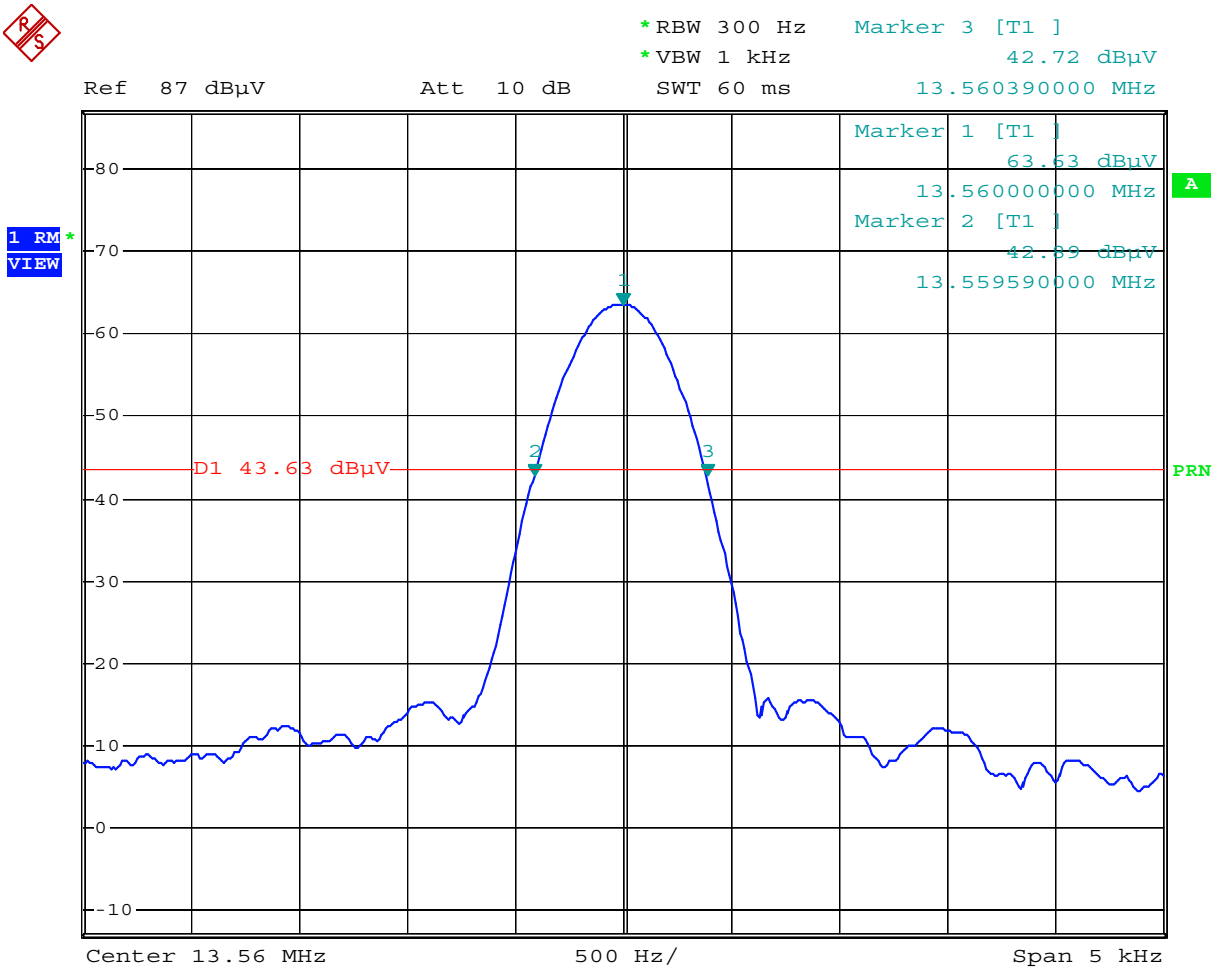
Comment: FEIG: Occupied Bandwidth
Date: 30.MAR.2005 11:18:00

Occupied Bandwidth (-26 dB):	**3.16 kHz**

8.2 Emission Bandwidth

Rules and specifications:	IC RSS-210 Issue 5, section 5.9.1
Guide:	IC RSS-210 Issue 5, section 5.9.1
Description:	The 20 dB bandwidth is measured at the points when the spectral density of the signal is 20 dB down from the inband spectral density of the modulated signal, with the transmitter modulated by a representative signal. Spectral density (power per unit bandwidth) is measured with a spectrum analyzer with resolution bandwidth set to 300 Hz or alternatively equal to approximately 1.0% of the emission bandwidth. The video bandwidth shall be at least three times greater than the resolution bandwidth.

Comment:	
Date of test:	30th March 2005
Test site:	Fully anechoic room, cabin no. 2



Comment: FEIG: Occupied Bandwidth
Date: 30.MAR.2005 11:19:48

Emission bandwidth (-20 dB):	**0.80 kHz**

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-210 Issue 5, section 5.9.2
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 5 kHz
K = Overall numerical factor	K = 1
Calculation:	B_n = 2 · 5 kHz) · 1 = 10 kHz

Designation of Emissions:	**10k0A1D**

8.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-210 Issue 5, section 6.6				
Guide:	ANSI C63.4 / CISPR 22				
Limit:	CFR 47 Part 15			IC RSS-210	
	Frequency of Emission (MHz)	Conducted Limit (dBµV)		Frequency of Emission (MHz)	Conducted Limit (dBµV)
		Quasi-peak	Average		Quasi-peak
	0.15 - 0.5	66 to 56	56 to 46	0.45 - 30	48
	0.5 - 5	56	46		
	5 - 30	60	50		

Comment:	Test performed with version of EUT with internal antenna. Emissions measured at AC input of Host System.
Date of test:	31st March 2005
Test site:	Shielded room, cabin no. 4

Test Result:	Test passed

Sample calculation of final values:

Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

Tested on:	L1

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	CFR 47 Part 15 Limit (dBµV)	CFR 47 Part 15 Margin (dB)	RSS-210 Limit (dBµV)	RSS-210 Margin (dB)
0.155	Quasi-Peak	44.1	0.0	44.1	65.7	21.6		
0.190	Average	44.2	0.0	44.2	54.0	9.8		
0.195	Quasi-Peak	56.1	0.0	56.1	63.8	**7.7**		
0.355	Average	33.1	0.0	33.1	48.8	15.7		
0.495	Average	26.6	0.0	26.6	46.1	19.5		
0.565	Average	34.5	0.0	34.5	46.0	11.5		
0.780	Average	31.4	0.0	31.4	46.0	14.6		
0.850	Average	34.0	0.0	34.0	46.0	12.0		
1.060	Average	34.2	0.0	34.2	46.0	11.8		
1.275	Average	32.6	0.0	32.6	46.0	13.4		
1.555	Average	34.0	0.0	34.0	46.0	12.0		
1.980	Quasi-Peak	34.9	0.0	34.9	56.0	21.1	48.0	13.1
1.980	Average	32.6	0.0	32.6	46.0	13.4		
2.475	Average	32.2	0.0	32.2	46.0	13.8		
2.970	Average	30.8	0.0	30.8	46.0	15.2		
3.680	Average	28.3	0.0	28.3	46.0	17.7		
13.560	Quasi-Peak	40.0	0.0	40.0	60.0	20.0	48.0	**8.0**
13.560	Average	34.7	0.0	34.7	50.0	15.3		
27.120	Quasi-Peak	34.8	0.0	34.8	60.0	25.2	48.0	13.2
27.120	Average	34.5	0.0	34.5	50.0	15.5		

Tested on:	N

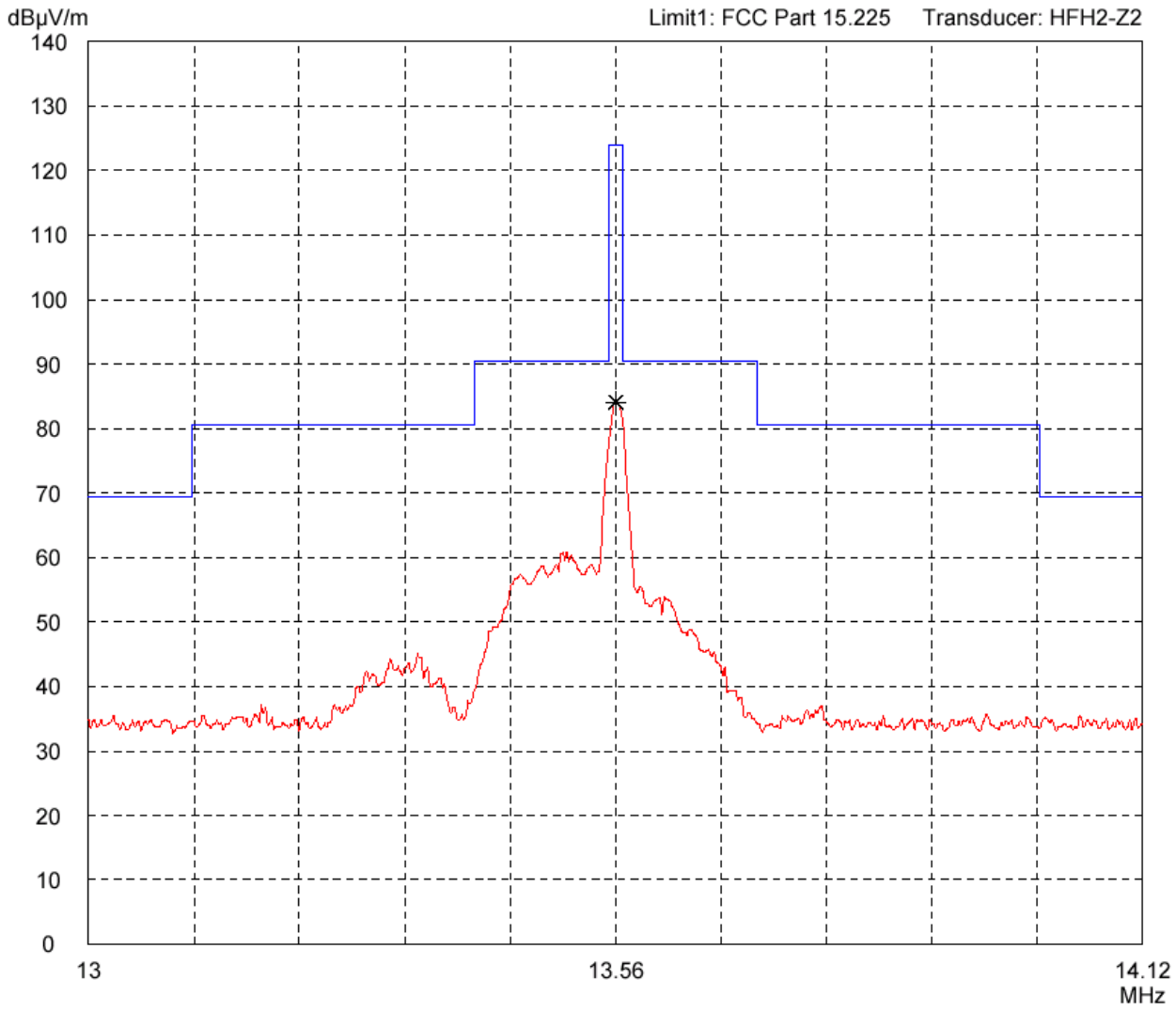
Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	CFR 47 Part 15 Limit (dBµV)	CFR 47 Part 15 Margin (dB)	RSS-210 Limit (dBµV)	RSS-210 Margin (dB)
0.150	Quasi-Peak	44.7	0.0	44.7	66.0	21.3		
0.190	Quasi-Peak	54.4	0.0	54.4	64.0	9.6		
0.190	Average	43.8	0.0	43.8	54.0	10.2		
0.565	Average	29.4	0.0	29.4	46.0	16.6		
0.780	Average	29.0	0.0	29.0	46.0	17.0		
0.850	Average	30.4	0.0	30.4	46.0	15.6		
1.060	Average	28.5	0.0	28.5	46.0	17.5		
1.345	Average	30.5	0.0	30.5	46.0	15.5		
1.670	Average	28.7	0.0	28.7	46.0	17.3		
2.050	Quasi-Peak	35.2	0.0	35.2	56.0	20.8	48.0	12.8
2.050	Average	30.6	0.0	30.6	46.0	15.4		
2.435	Average	30.0	0.0	30.0	46.0	16.0		
2.950	Average	28.2	0.0	28.2	46.0	17.8		
4.745	Average	25.6	0.0	25.6	46.0	20.4		
13.560	Quasi-Peak	46.8	0.0	46.8	60.0	13.2	48.0	**1.2**
13.560	Average	45.7	0.0	45.7	50.0	**4.3**		
27.120	Average	34.3	0.0	34.3	50.0	15.7		

8.5 Spectrum mask

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 5, section 6.2.2(e)			
Guide:	ANSI C63.4			
Description:	Compliance with the spectrum mask is tested using a spectrum analyzer with resolution bandwidth set to a 1 kHz for the band 13.553 to 13.567 MHz and to 10 kHz outside this band. The video bandwidth shall be at least three times greater than the resolution bandwidth.			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	1.705 - 13.110	30	29.5	30
	13.110 - 13.410	106	40.5	30
	13.410 - 13.553	334	50.5	30
	13.553 - 13.567	15848	84.0	30
	13.567 - 13.710	334	50.5	30
	13.710 - 14.010	106	40.5	30
	14.010 - 30.000	30	29.5	30

Comment:	
Date of test:	
Test site:	Fully anechoic room, cabin no. 2
Test distance:	3 meters
Extrapolation Factor:	40 dB/decade

Test Result:	Test passed


dBµV/m
Limit1: FCC Part 15.225
Transducer: HFH2-Z2
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
13
13.56
14.12
MHz

8.6 Radiated Emission Measurement 9 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, sections 15.205 and 15.225(a)-(d) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.3(b)-(d)			
Guide:	ANSI C63.4			
Limit:	Frequency of Emission (MHz)	Field Strength (µV/m)	Field Strength (dBµV/m)	Measurement Distance d (meters)
	0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
	0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
	1.705 - 13.110	30	29.5	30
	13.110 - 13.410	106	40.5	30
	13.410 - 13.553	334	50.5	30
	13.553 - 13.567	15848	84.0	30
	13.567 - 13.710	334	50.5	30
	13.710 - 14.010	106	40.5	30
	14.010 - 30.000	30	29.5	30

Comment:	
Date of test:	22nd March 2005
Test site:	Open field test site

Test Result:	Test passed

Frequency (MHz)	Detector	Distance d_1 (m)	Distance d_2 (m)	Reading Value d_1 (dBµV)	Reading Value d_2 (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB/dec)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
13.560	QP	3	10	66.1	54.2	20.0	-22.7	-10.8		63.4	84.0	**20.6**
27.120	QP		3		19.1	20.0	-40.0	-40.0		-0.9	29.5	30.4

Sample calculation of final values:

$$\text{Extrapolation Factor (dB/decade)} = \begin{cases} -40 \text{ (dB/decade)} & \text{if } d_1 = d_2 \\ \dfrac{\text{Reading Value } d_2 \text{ (dBµV)} - \text{Reading Value } d_1 \text{ (dBµV)}}{\text{Log}(d_2) - \text{Log}(d_1)} & \text{if } d_1 \neq d_2 \end{cases}$$

$$\text{Extrapolation Factor (dB)} = (\text{Log}(d) - \text{Log}(d_2)) \cdot \text{Extrapolation Factor (dB/decade)}$$

$$\text{Final Value (dBµV/m)} = \text{Reading Value } d_2 \text{ (dBµV)} + \text{Correction Factor (dB/m)} + \text{Extrapolation Factor (dB)} + \text{Pulse Train Correction (dB)}$$

8.7 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.3(b)-(d)		
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

Comment:	
Date of test:	1st April 2005
Test site:	Frequencies ≤ 1 GHz: Open field test site Frequencies > 1 GHz: Fully anechoic room, cabin no. 2
Test distance:	3 meters

Test Result:	Test passed

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)
176.280	horizontal	Quasi-Peak	18.1	15.1		33.2	43.5	**10.3**

Sample calculation of final values:

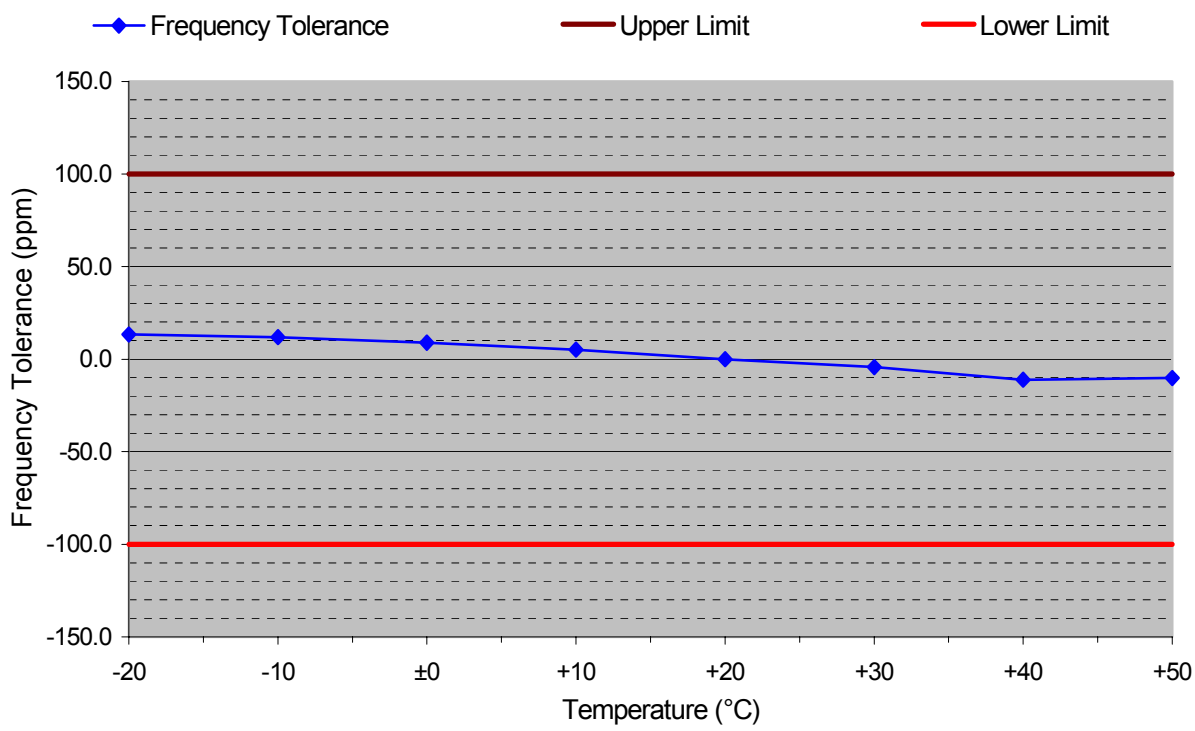
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

8.8 Carrier Frequency Stability

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-210 Issue 5, sections 6.2.2(e) and 6.4
Guide:	ANSI C63.4
Limit:	The frequency tolerance of the carrier signal shall be maintained within ±0.01 % (±100 ppm) of the carrier frequency under nominal conditions.
Temperature range: Voltage range:	-20°C to +50°C (at normal supply voltage) 85% to 115% of the rated supply voltage (at a temperature of +20 °C)

Comment:	
Date of test:	22nd March 2005

8.8.1 Carrier Frequency Stability vs. Temperature

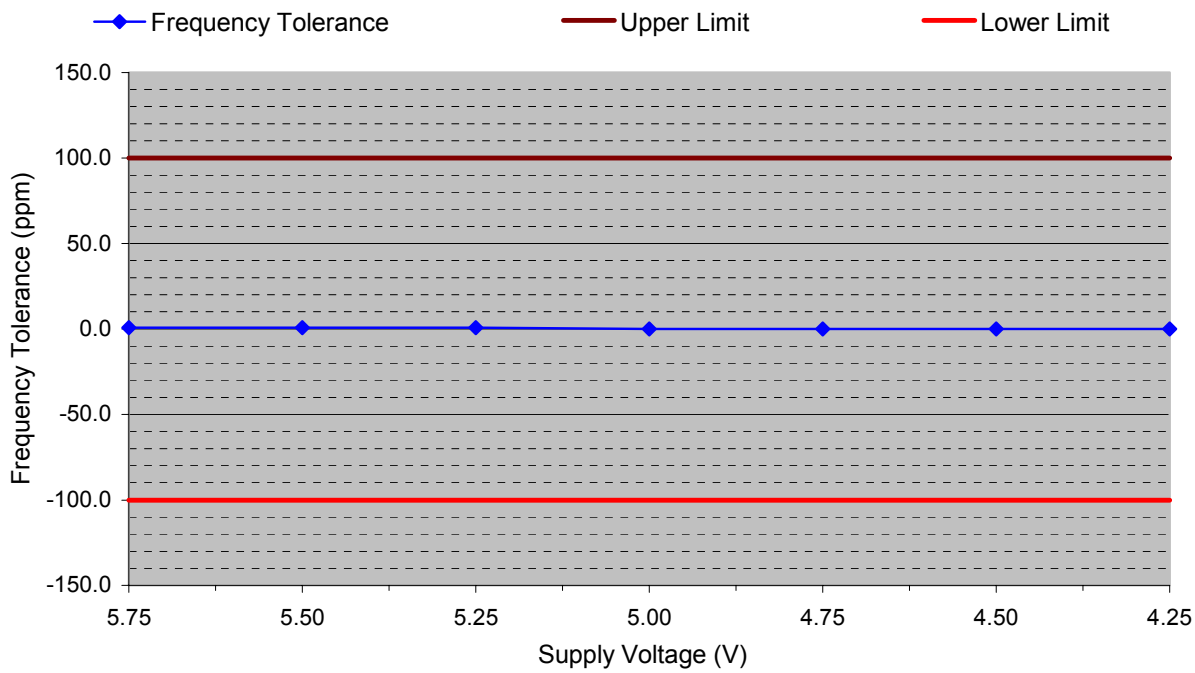


Supply voltage: 12 V Nominal frequency: 13.559900 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.560080	180	13.3	+100.0	-100.0	**86.7**
-10	13.560060	160	11.8	+100.0	-100.0	88.2
±0	13.560020	120	8.8	+100.0	-100.0	91.2
+10	13.559970	70	5.2	+100.0	-100.0	94.8
+20	13.559900	0	0.0	+100.0	-100.0	100.0
+30	13.559840	-60	-4.4	+100.0	-100.0	95.6
+40	13.559750	-150	-11.1	+100.0	-100.0	88.9
+50	13.559760	-140	-10.3	+100.0	-100.0	89.7

Test Result:	Test passed

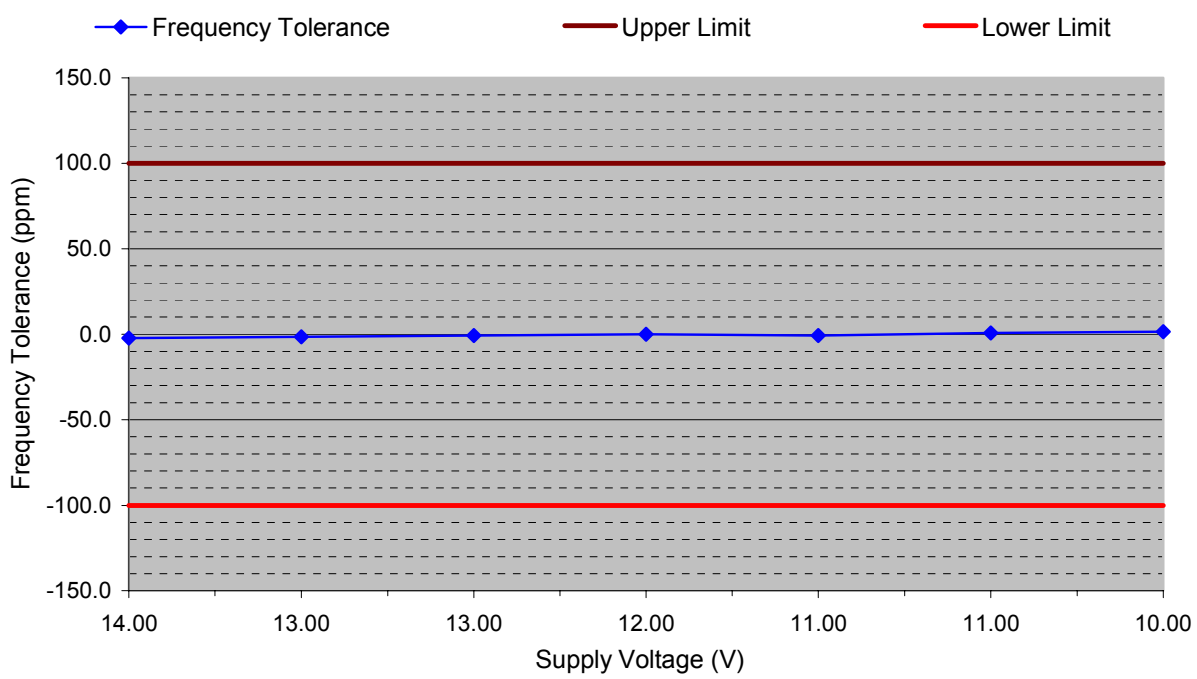
8.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C
Nominal frequency: 13.560010 MHz
Battery End Point: Not applicable

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
5.75	13.560020	10	0.7	+100.0	-100.0	**99.3**
5.50	13.560020	10	0.7	+100.0	-100.0	**99.3**
5.25	13.560020	10	0.7	+100.0	-100.0	**99.3**
5.00	13.560010	0	0.0	+100.0	-100.0	100.0
4.75	13.560010	0	0.0	+100.0	-100.0	100.0
4.50	13.560010	0	0.0	+100.0	-100.0	100.0
4.25	13.560010	0	0.0	+100.0	-100.0	100.0

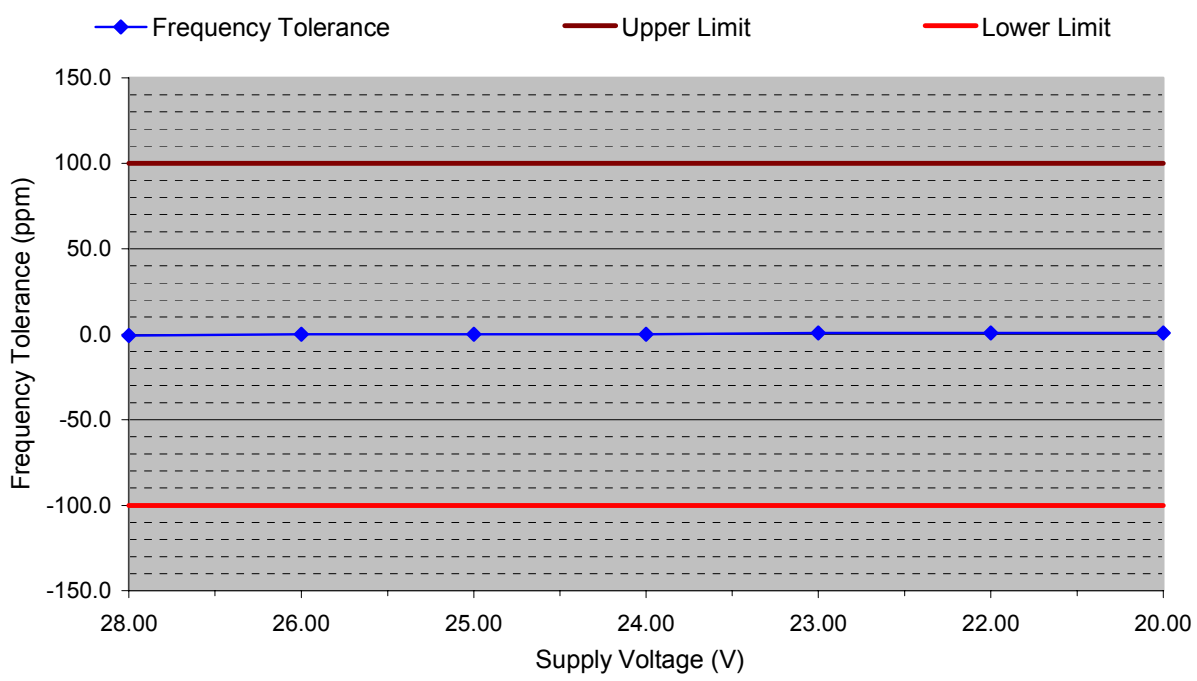
Test Result:	Test passed



Temperature: +20 °C Battery End Point: Not applicable
Nominal frequency: 13.559900 MHz

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
14.00	13.559870	-30	-2.2	+100.0	-100.0	**97.8**
13.00	13.559880	-20	-1.5	+100.0	-100.0	98.5
13.00	13.559890	-10	-0.7	+100.0	-100.0	99.3
12.00	13.559900	0	0.0	+100.0	-100.0	100.0
11.00	13.559890	-10	-0.7	+100.0	-100.0	99.3
11.00	13.559910	10	0.7	+100.0	-100.0	99.3
10.00	13.559920	20	1.5	+100.0	-100.0	98.5

Test Result:	Test passed



Temperature: +20 °C Battery End Point: Not applicable
Nominal frequency: 13.559850 MHz

Supply Voltage (V)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
28.00	13.559840	-10	-0.7	+100.0	-100.0	**99.3**
26.00	13.559850	0	0.0	+100.0	-100.0	100.0
25.00	13.559850	0	0.0	+100.0	-100.0	100.0
24.00	13.559850	0	0.0	+100.0	-100.0	100.0
23.00	13.559860	10	0.7	+100.0	-100.0	99.3
22.00	13.559860	10	0.7	+100.0	-100.0	99.3
20.00	13.559860	10	0.7	+100.0	-100.0	99.3

9 Referenced Regulations

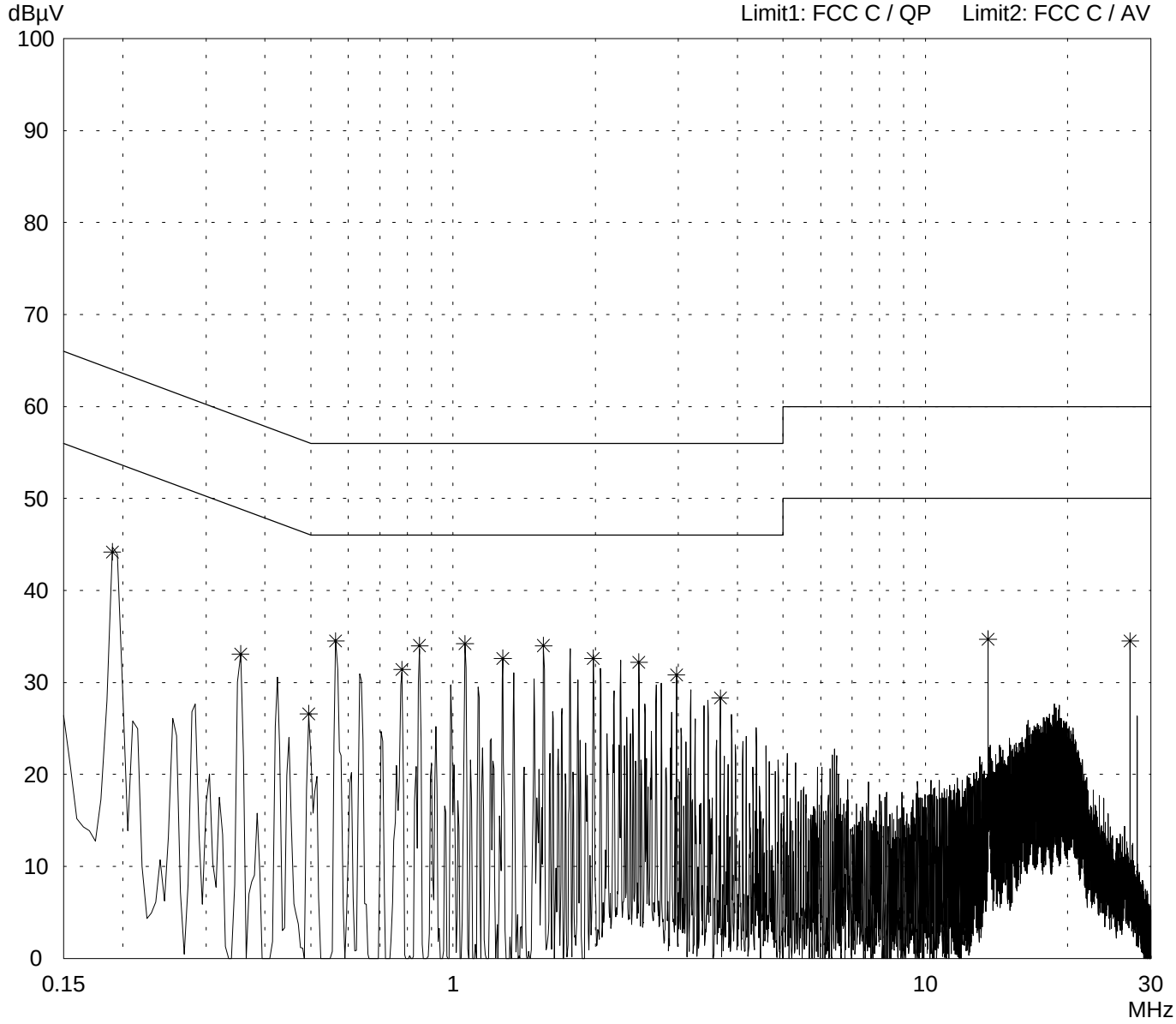
All tests were performed with reference to the following regulations and standards:

☒	CFR 47 Part 2	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)	October 1, 2003
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	July 12, 2004
☒	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)
☒	RSS-210	Radio Standards Specification RSS-210 Issue 5 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands), published by Industry Canada	November 2001
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 2004
☒	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
☐	CAN/CSA-CEI/IEC CISPR 22	Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment	2002
☒	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

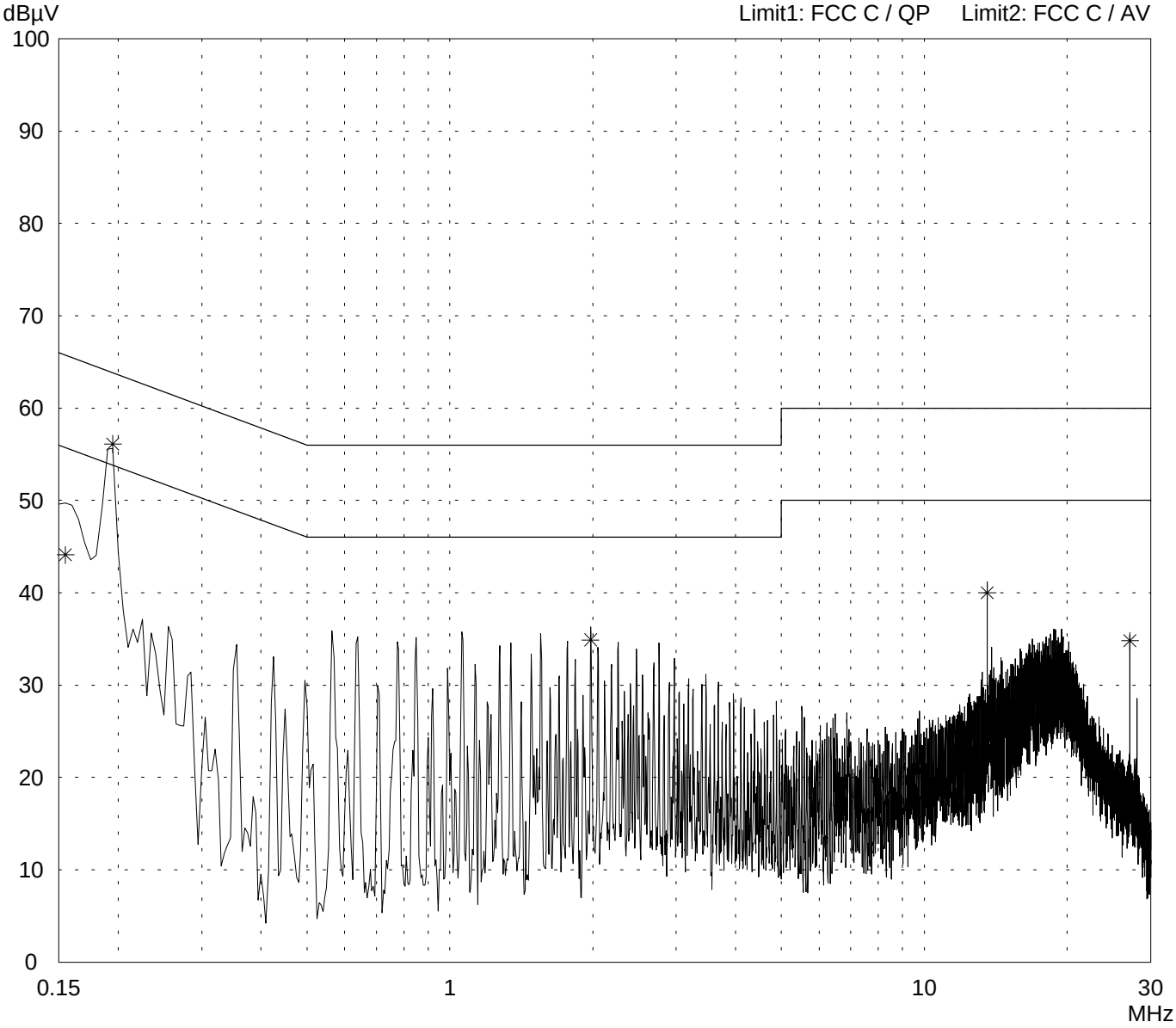
Model: ID ISC.PR101	Mode: - AC 115 V power supply - with DELL Optiplex PC - transmitting continiously
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord Phase L1	
Date of test: 04/19/2005 / Operator: M. Steindl	
Test performed: automatically / File name:	
Detector: Average / Final Results: AV	Final results: Selected by hand



Result: Limit kept	Project file: 50602-50112 Page of Pages

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

Model: ID ISC.PR101	Mode: - AC 115 V power supply - with DELL Optiplex PC - transmitting continiously
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord Phase L1	
Date of test: 04/19/2005 / Operator: M. Steindl	
Test performed: semi automatically / File name:	
Detector: Peak / Final Results: QP	Final results: Selected by hand

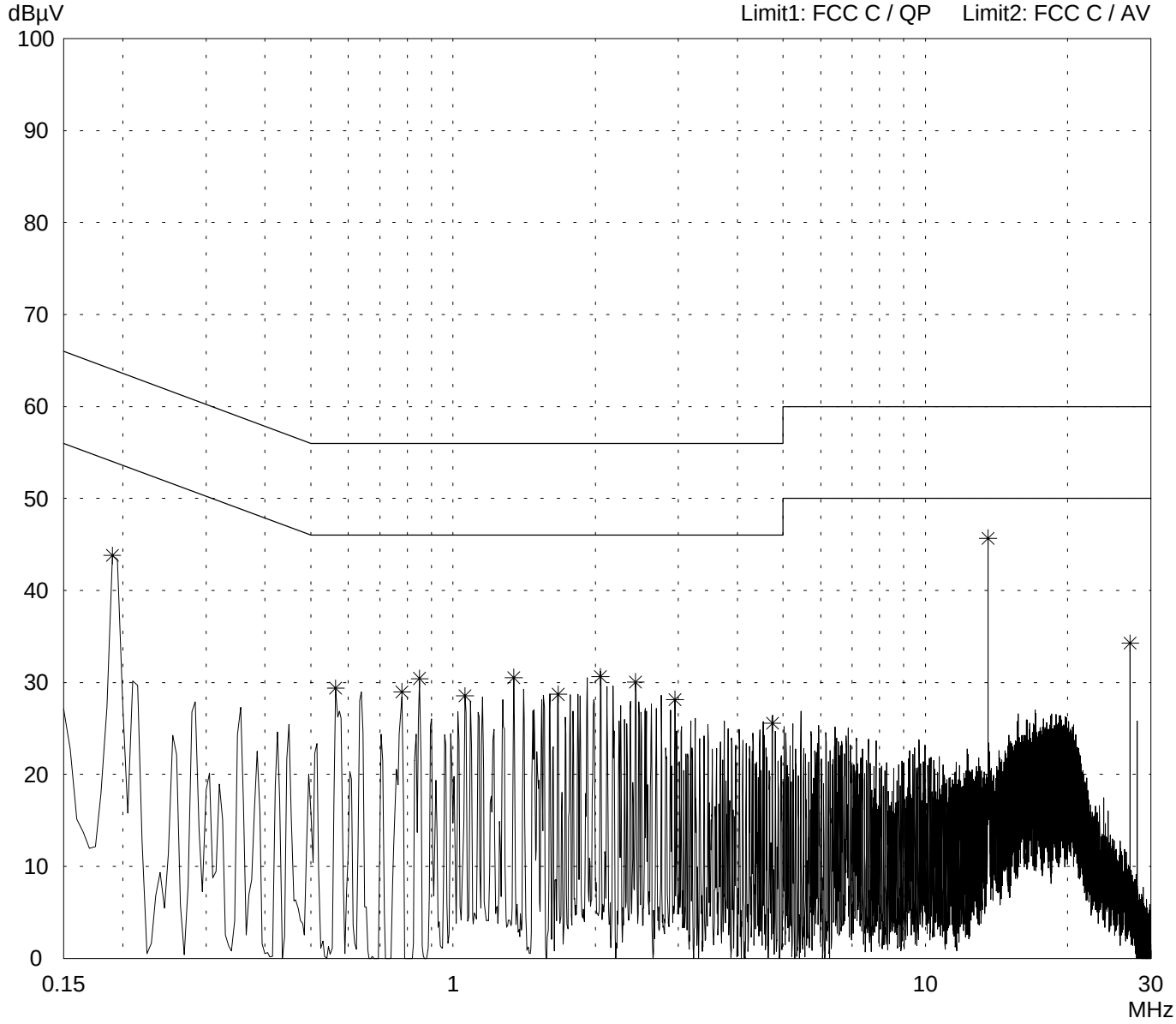


Result: Limit kept	Project file: 50602-50112 Page of Pages

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

Model: ID ISC.PR101	Mode: - AC 115 V power supply - with DELL Optiplex PC - transmitting continiously
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord Phase N	
Date of test: 04/19/2005 / Operator: M. Steindl	
Test performed: automatically / File name:	

Detector: Average / Final Results: AV	Final results: 20 dB Margin 25 Subranges

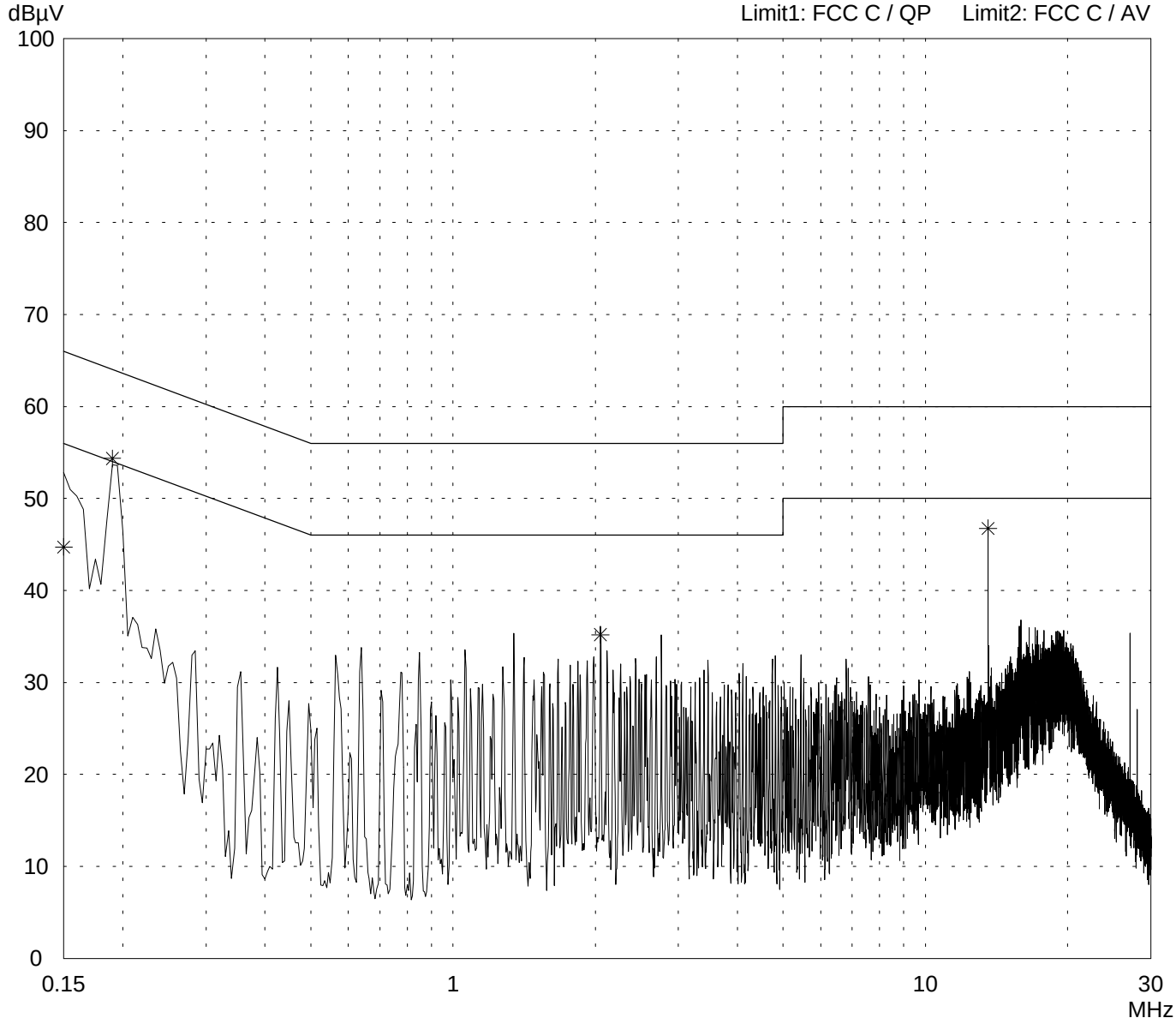


Result:	Project file: 50602-50112 Page of Pages

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

Model: ID ISC.PR101	Mode: - AC 115 V power supply - with DELL Optiplex PC - transmitting continiously
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord Phase N	
Date of test: 04/19/2005 / Operator: M. Steindl	
Test performed: semi automatically / File name:	

Detector: Peak / Final Results: QP	Final results: 20 dB Margin 25 Subranges

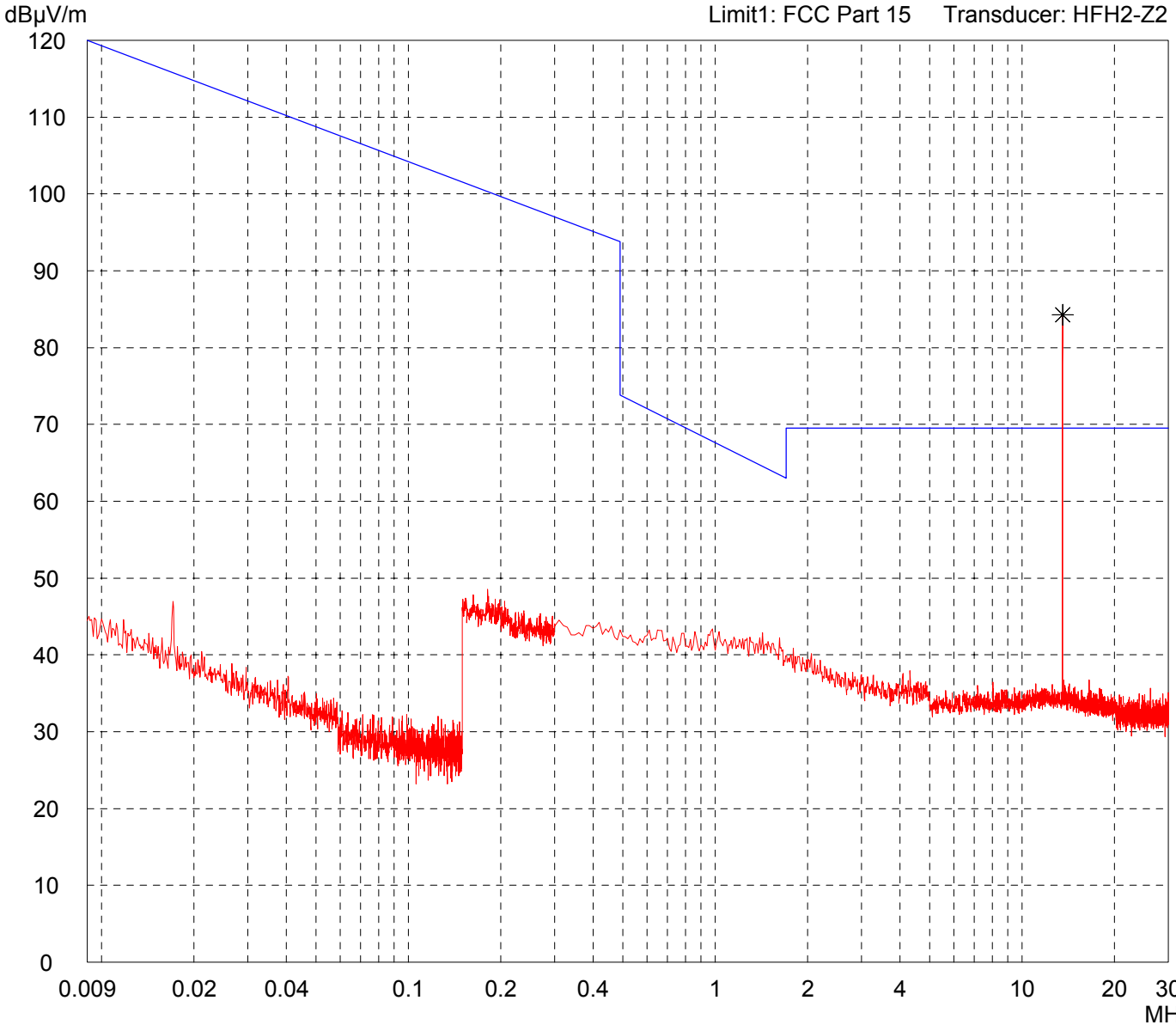


Result: Limit kept	Project file: 50602-50112 Page of Pages

Radiated Emission Test 9 kHz - 30 MHz
acc. to FCC Part 15 (Fully Anechoic Chamber)

Model: ID ISC.PR101	Comment: - USB cable connected - J4 open
Serial no.: 2	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres	
Date of test: 03/30/2005 / Operator: M. Steindl	
Test performed: by hand / File name: default.emi	

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



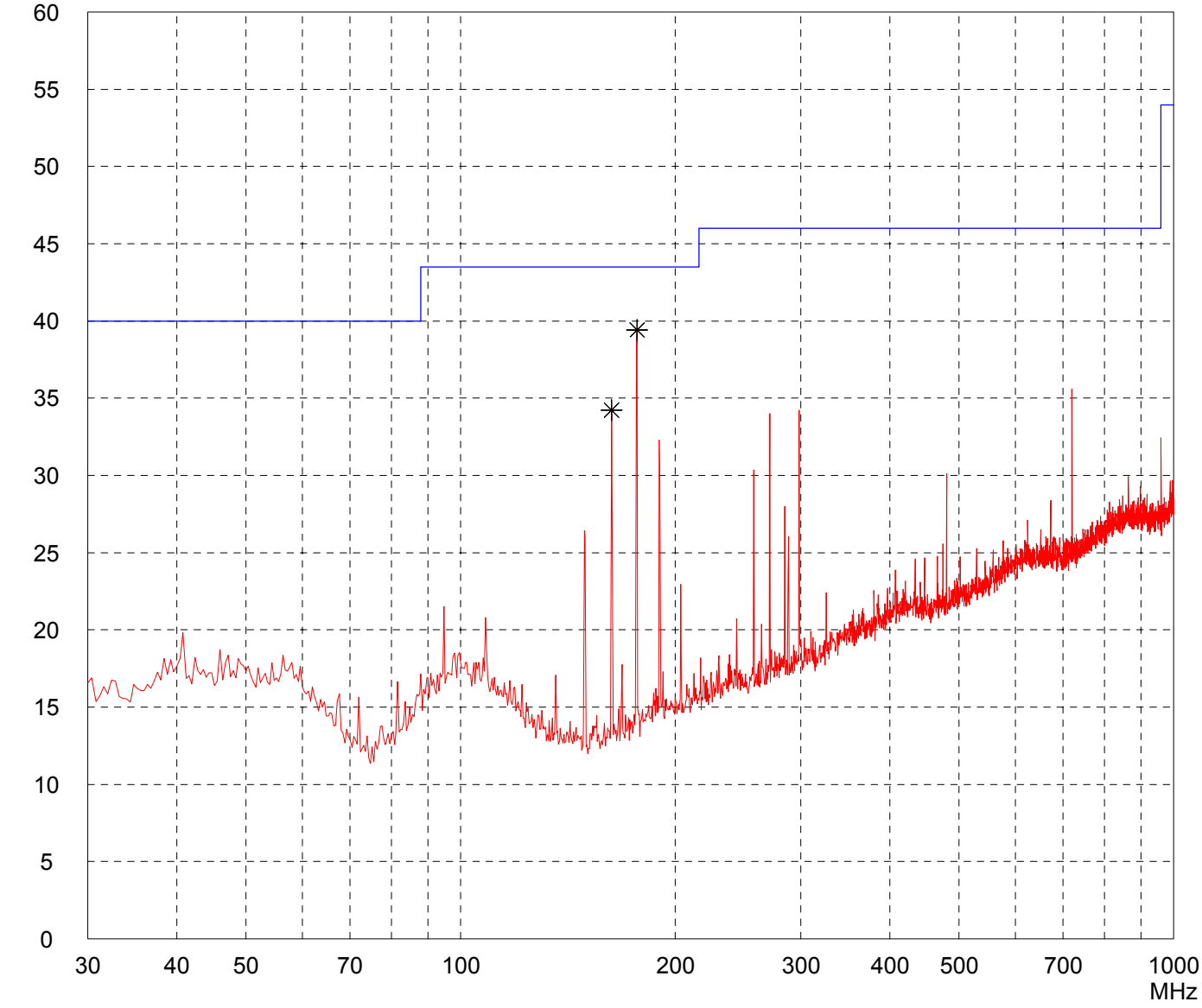
Result: Prescan	Project file: 50602-50112-1 Page of Pages

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

Model: ID ISC. PR101	Comment: - USB cable connected - J4 open
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 03/16/2005 / Operator: J. Roidt	
Test performed: automatically / File name: default.emi	

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

dBµV/m — Limit1: FCC Part 15 — Transducer: VULB 9163

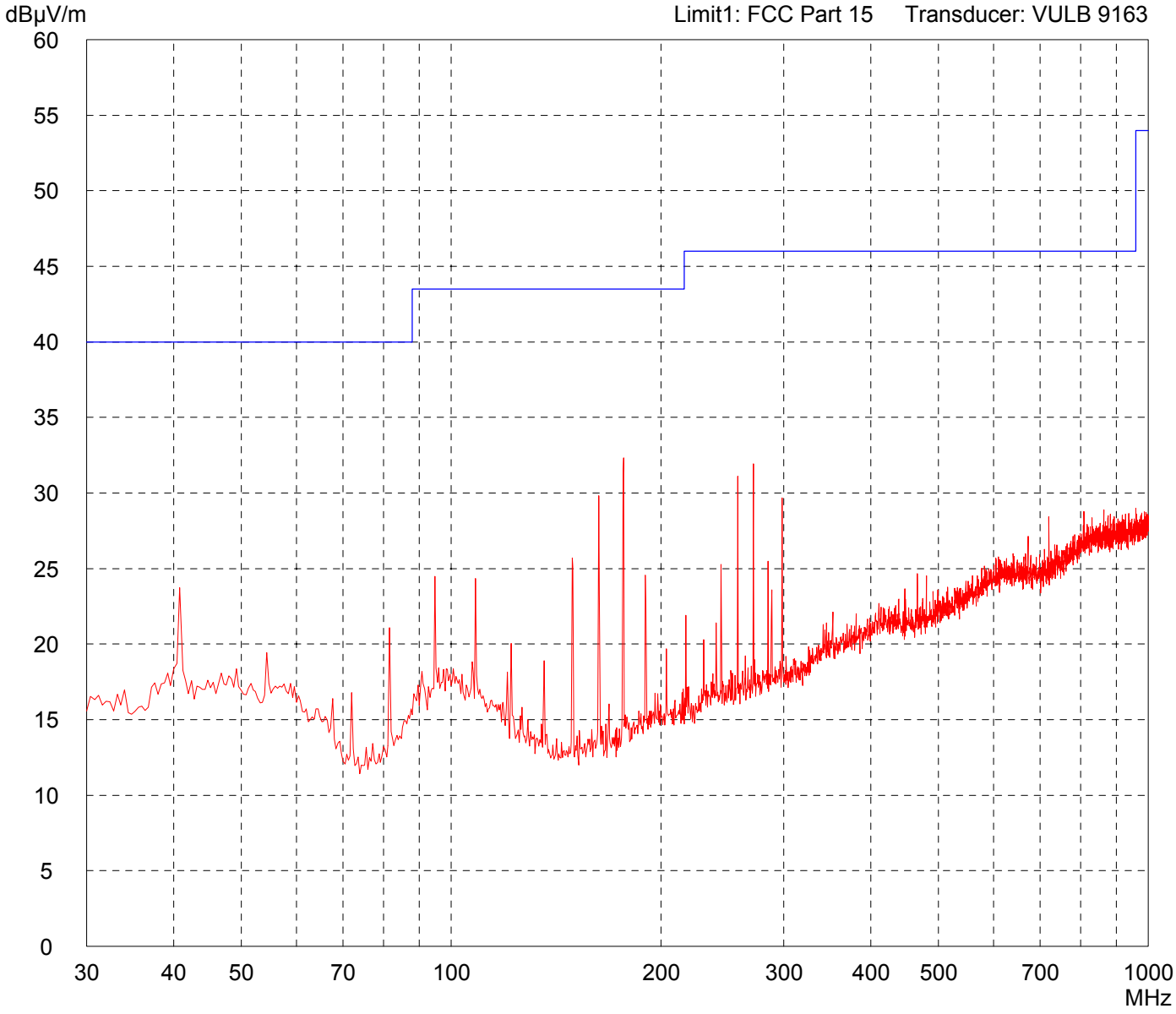


Result: Prescan	Project file: 50602-50112-2 Page of Pages

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

Model: ID ISC. PR101	Comment: - USB cable connected - J4 open
Serial no.: 6	
Applicant: FEIG ELECTRONIC GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 03/16/2005 / Operator: J. Roidt	
Test performed: automatically / File name: default.emi	

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



Result: Prescan	Project file: 50602-50112-2 Page of Pages