SENTON

Choose certainty.
Add value.

August 5, 2009

Prüfbericht / *Test Report* Nr. / *No.* 51116-081582-4 (Edition 2)

Applicant:	Kaba GmbH
Type of equipment:	Inductive TAG Reader
Type designation:	B-Net 91 04
Order No.:	---
Test standards:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.225 Industry Canada Radio Standards Specifications RSS-Gen Issue 2, Section 7.2.2 and RSS-210 Issue 7, Sections 2.2, 2.6, A2.6 (Category I Equipment)

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	B-Net 91 04
Parts[2]:	1
Serial number(s):	---
Manufacturer:	Kaba GmbH
Type of equipment:	Inductive TAG Reader
Version:	
FCC ID:	---
Additional parts/accessories:	---

Technical data of EUT		
Application frequency range:	15.553 MHz -13.567 MHz	
Frequency range:		
Operating frequency:	13.560 MHz	
Type of modulation:	Amplitude modulation	
Pulse train:	---	
Pulse width:	---	
Number of RF-channels:	1	
Channel spacing:	---	
Designation of emissions[3]:	**3K2A1D**	
Type of antenna:	Printed loop an PCB	
Size/length of antenna:	0.032 m^2	
Connection of antenna:	☐ detachable	☒ not detachable
Type of power supply:	DC supply	
Specifications for power supply:	nominal voltage: minimum voltage: maximum voltage:	24 V 16 V 32 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):	Kaba GmbH Albertistraße 3 78056 Villingen-Schwenningen
Contact person:	Mr Hans-Ulrich Kretschmer
Order number:	---
Receipt of EUT:	January 26, 2009
Date(s) of test:	January 2009
Note(s):	

Report details	
Report number:	51116-081582-4
Edition:	2
Issue date:	March 6, 2009

3 Identification of the Test Laboratory

Details of the Test Laboratory	
Company name:	TÜV SÜD SENTON GmbH
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:	3050A-1
Contact person:	Mr. Johann Roidt Phone: +49 9421 5522-0 Fax: +49 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, 15.215 and 15.225** of the Federal Communication Commission (FCC) and the **Radio Standards Specifications** **RSS-Gen Issue 2, Section 7.2.2 and** **RSS-210 Issue 7, Sections 2.2, 2.6, A2.6 (Category I Equipment)** of Industry Canada (IC).

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

5 Operation Mode and Configuration of EUT

Operation Mode(s)
TX mode

Configuration(s) of EUT
EUT is equipped as a stand alone device

List of ports and cables				
Port	*Description*	*Classification*[4]	*Cable type*	*Cable length*
1		signal/control port dc power	Shielded	3 m

List of devices connected to EUT				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	No devices connected			

List of support devices				
Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	AC/ DC power supply	--	--	--

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

6 Measurement Procedures

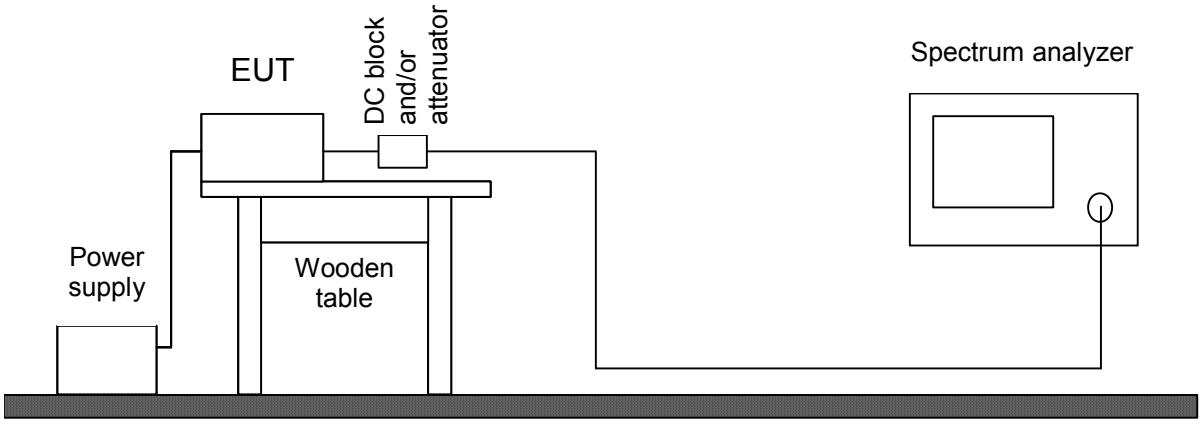
6.1 Bandwidth Measurements

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 2, section 2.202(a) CFR 47 Part 15, section 15.215(c) IC RSS-Gen Issue 2, sections 4.6.1 and 4.6.2 IC RSS-210 Issue 7, section A1.1.3 ANSI C63.4, annex H.6
Guide:	ANSI C63.4 / IC RSS-Gen Issue 2, sections 4.6.1 and 4.6.2
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).



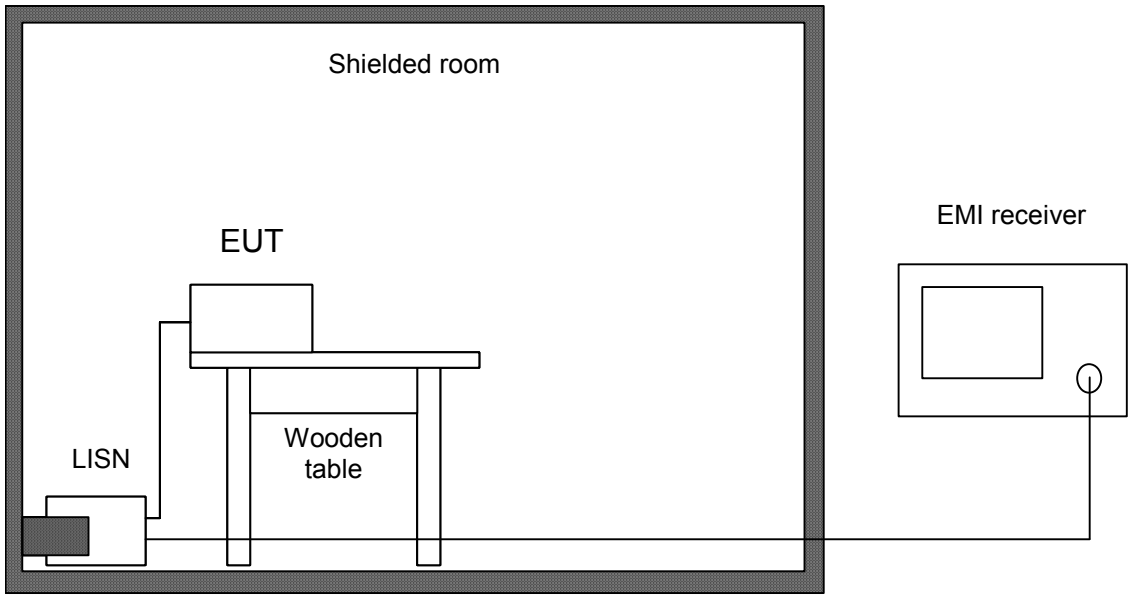
6.2 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2
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 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
☐	Artificial mains network	ESH 2-Z5	842966/004	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, 15.215(b) and 15.225(a)-(d) IC RSS-210 Issue 7, sections 2.2, 2.6 and A2.6
Guide:	ANSI C63.4

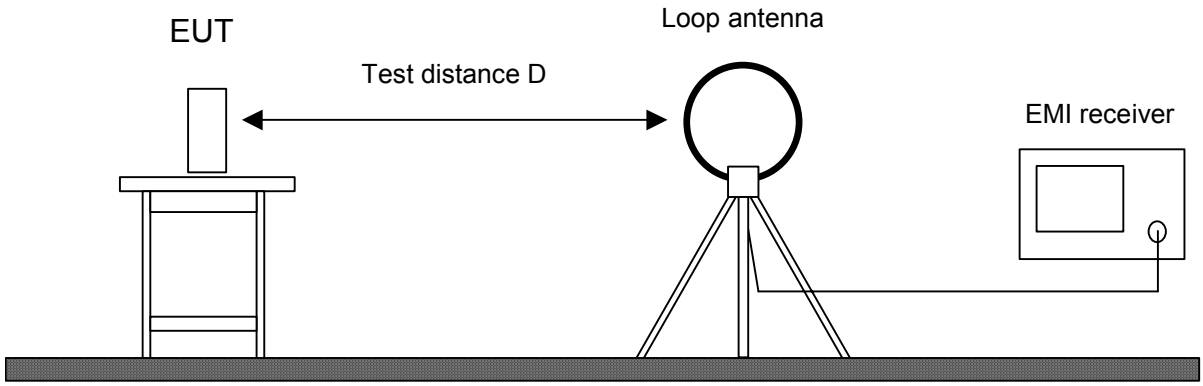
Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. 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.
If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

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 to 90 kHz and 110 to 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 or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6
Guide:	ANSI C63.4

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.

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.

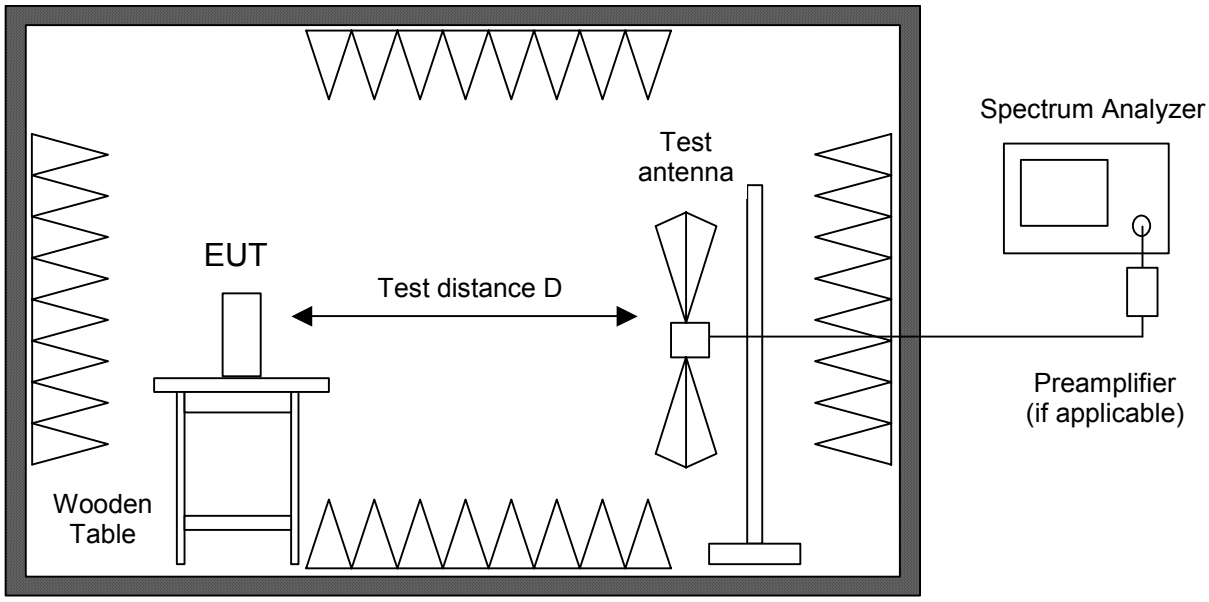
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation 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 or semi anechoic room are indicated as prescans.



Fully or semi anechoic room

Test instruments used:

Used	Type	Model	Serial No. or ID	Manufacturer
☒	Spectrum Analyzer	FSP 30	100063	Rohde & Schwarz
☐	EMI test receiver	ESPI7	101018	Rohde & Schwarz
☐	EMI test receiver	ESMI	839379/013 839587/006	Rohde & Schwarz
☒	Preamplifier	CPA9231A	3393	Schaffner
☐	Preamplifier	R14601		Advantest
☐	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
☐	Semi-anechoic room	No. 3	1453	Siemens

6.5 Radiated Emission at Open Field Test Site

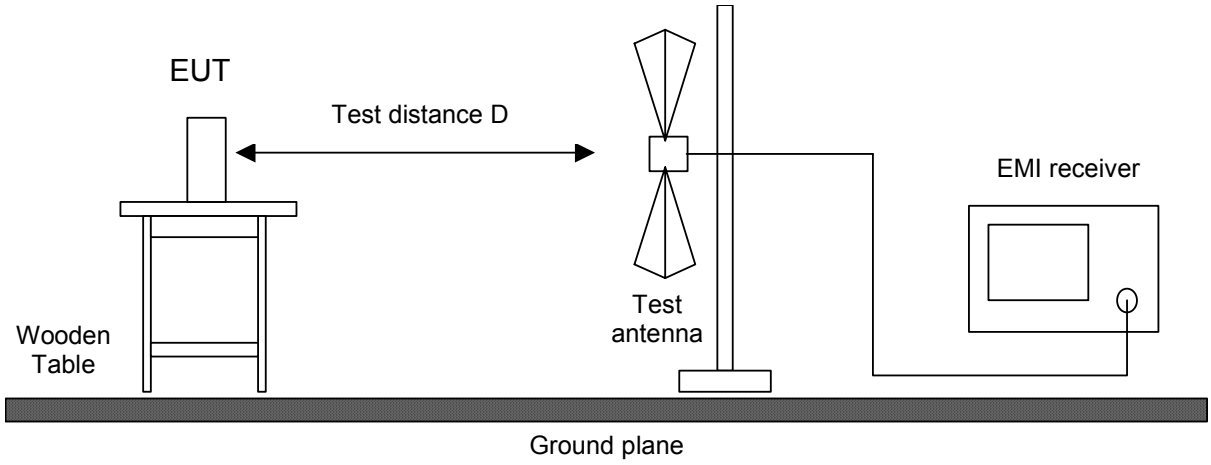
Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, sections 15.205(b) and 15.225(d) IC RSS-210 Issue 7, sections 2.2(b)(c), 2.6 and A2.6
Guide:	ANSI C63.4

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	EG 1	ESVP	881120/024	Rohde & Schwarz
☐	EMI receiver		ESVP	891846/003	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-Gen Issue 2, section 4.7 and IC RSS-210 Issue 7, section A2.6
Guide:	ANSI C63.4

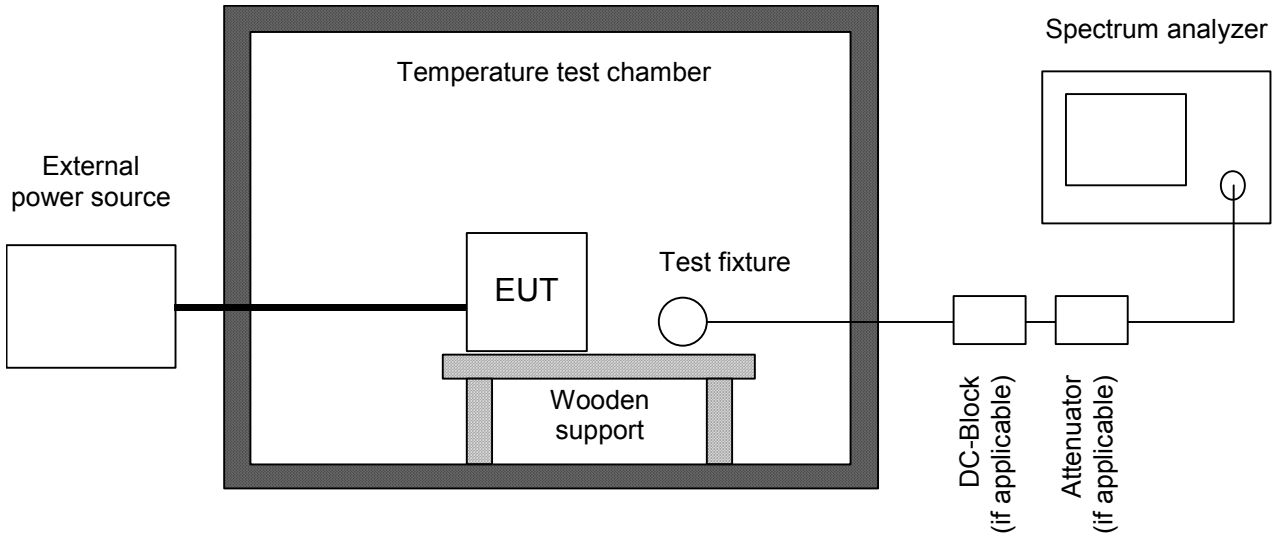
The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 °C.

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.

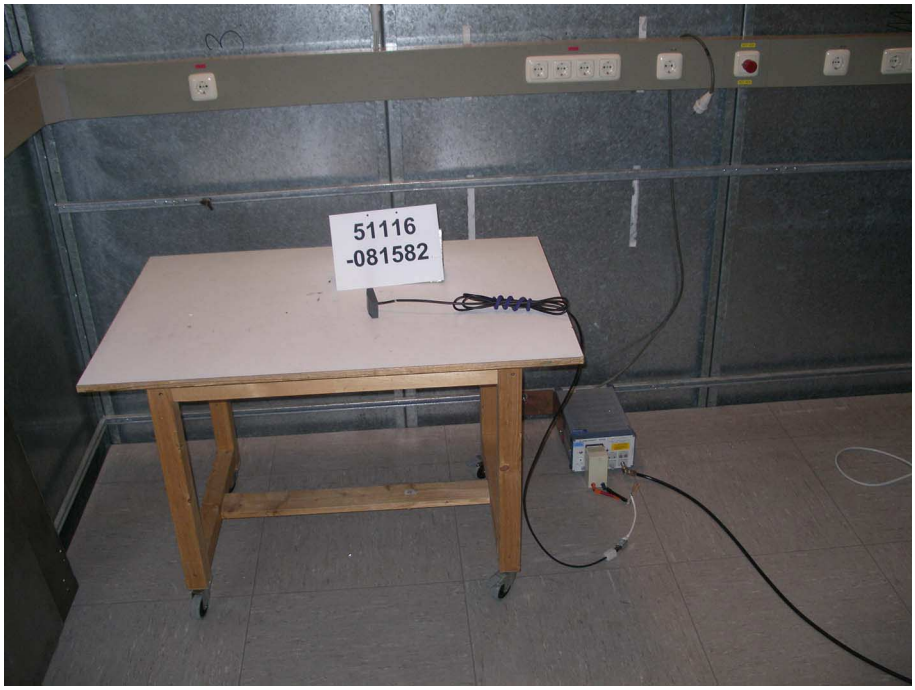


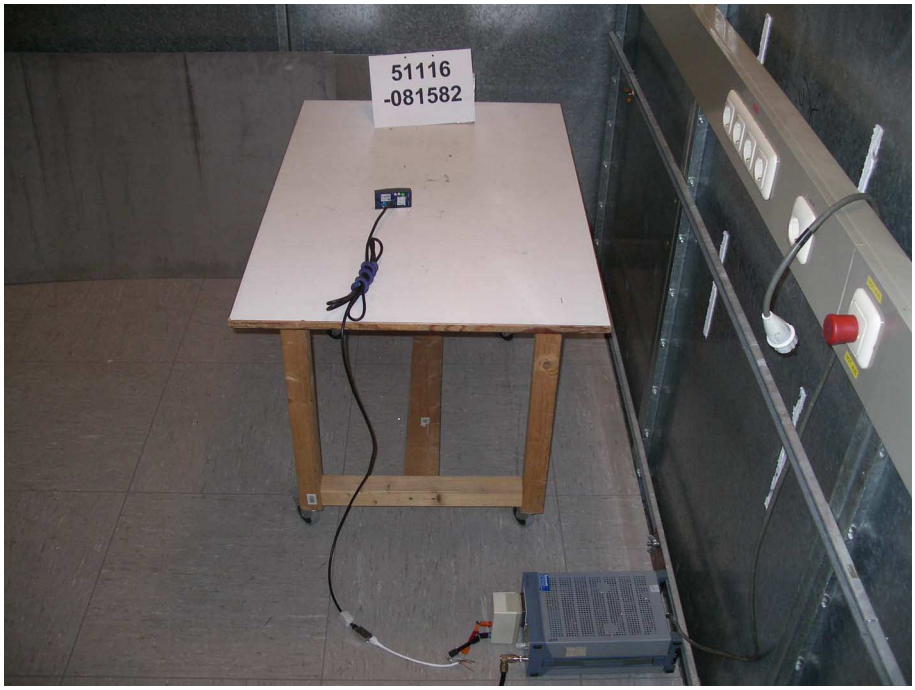
Test instruments used:

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

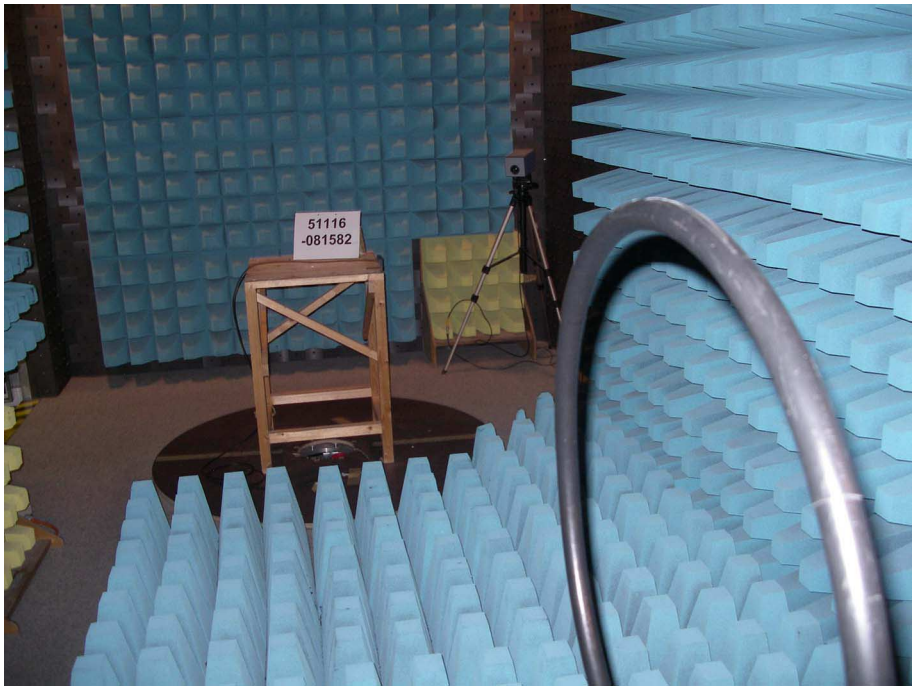
7 Photographs Taken During Testing

Test setup for conducted AC powerline emission measurement



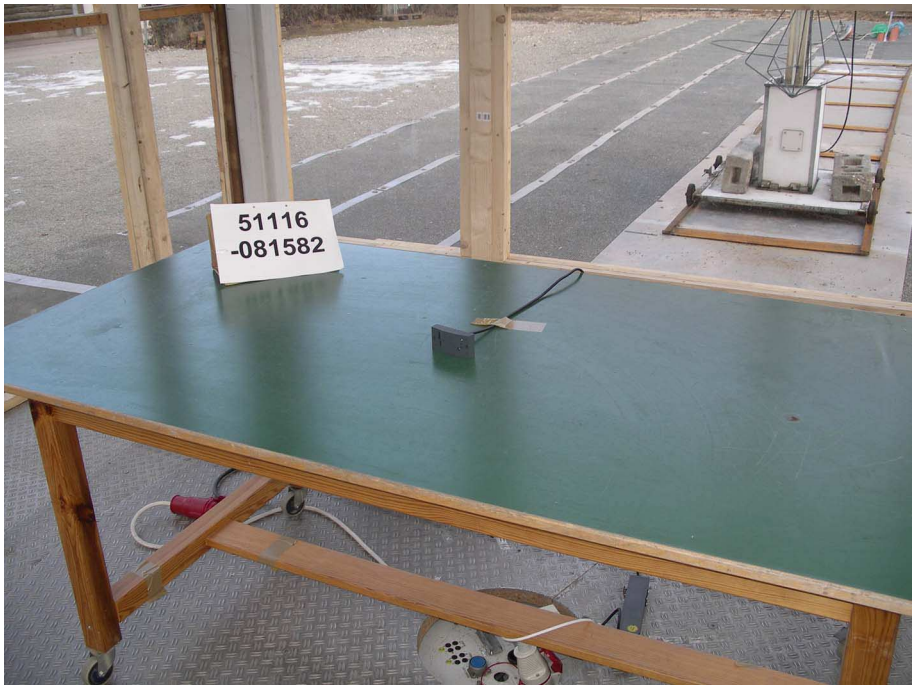


Test setup for radiated emission measurement 9 kHz – 30 MHz

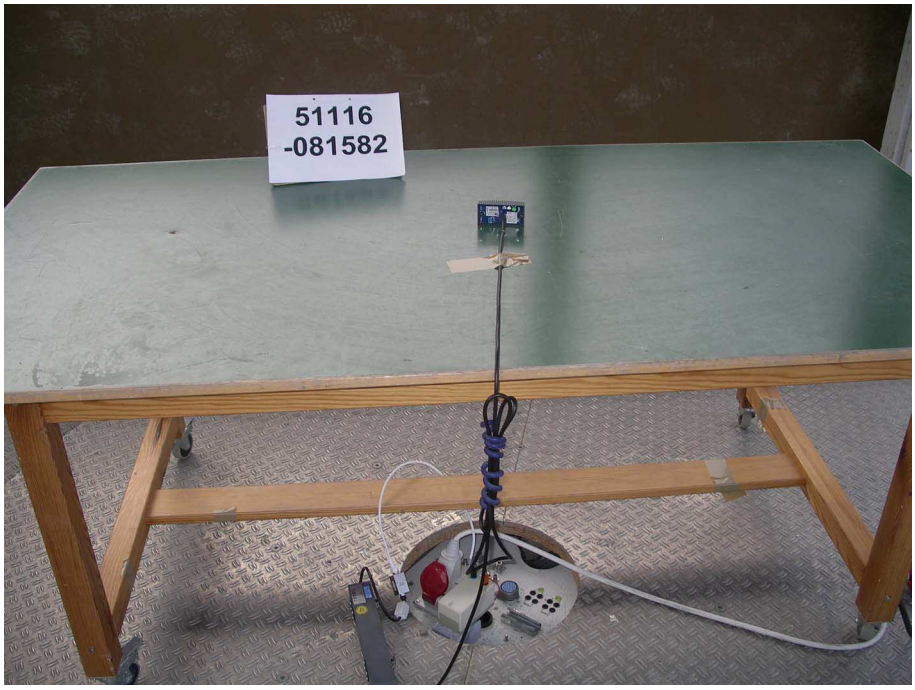


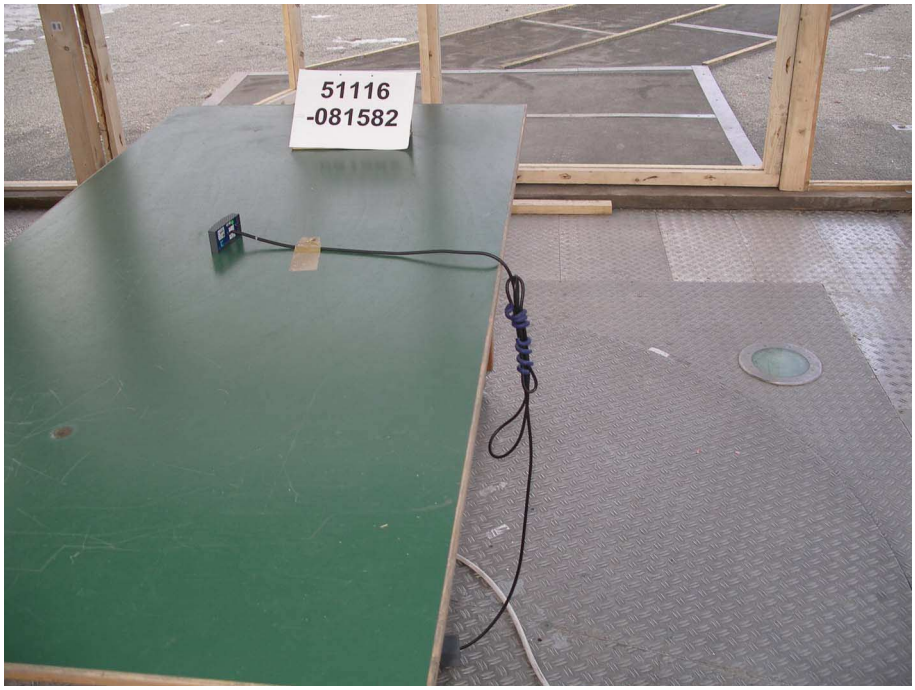
Test setup for radiated emission measurement (fully anechoic room)

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



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





8 Test Results

FCC CFR 47 Parts 2 and 15			
Section(s)	*Test*	*Page*	*Result*
2.1046(a)	Conducted output power	---	Not applicable
2.202(a)	Occupied bandwidth	27	Recorded
15.215(c)	Bandwidth of the emission	31	Test passed
2.201, 2.202	Class of emission	33	Calculated
15.35(c)	Pulse train measurement for pulsed operation	---	Not applicable
15.205(a) 15.205(d)(7)	Restricted bands of operation	---[5]	Test passed
15.207	Conducted AC powerline emission 150 kHz to 30 MHz	34	Test passed
15.225(a)-(d)	Spectrum Mask	35	Test passed
15.205(b) 15.215(b) 15.225(a)(d)	Radiated emission 9 kHz to 30 MHz	37	Test passed
15.205(b) 15.225(d)	Radiated emission 30 MHz to 1 GHz	38	Test passed
15.225(e)	Carrier frequency stability	40	Test passed

[5] See "Spectrum Mask" for the 13.36 to 13.41 MHz band. For all other restricted bands see "Radiated Emission".

IC RSS-Gen Issue 2			
Section(s)	*Test*	*Page*	*Result*
4.8	Transmitter output power (conducted)	---	Not applicable
4.6.1	Occupied Bandwidth	27	Recorded
3.2(h), 8	Designation of emissions	33	Calculated
4.5	Pulsed operation	---	Not applicable
7.2.2	Transmitter AC power lines conducted emissions 150 kHz to 30 MHz	34	Test passed
5.5	Exposure of Humans to RF Fields	43	Exempted from SAR and RF evaluation

IC RSS-210 Issue 7			
Section(s)	*Test*	*Page*	*Result*
2.2(a)	Restricted bands and unwanted emission frequencies	---[6]	Test passed
A2.6	Spectrum Mask	35	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 9 kHz to 30 MHz	37	Test passed
2.2(b)(c), 2.6 A2.6	Unwanted emissions 30 MHz to 1 GHz	38	Test passed
A2.6	Carrier frequency stability	40	Test passed

[6] See "Spectrum Mask" and "Unwanted emissions".

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:

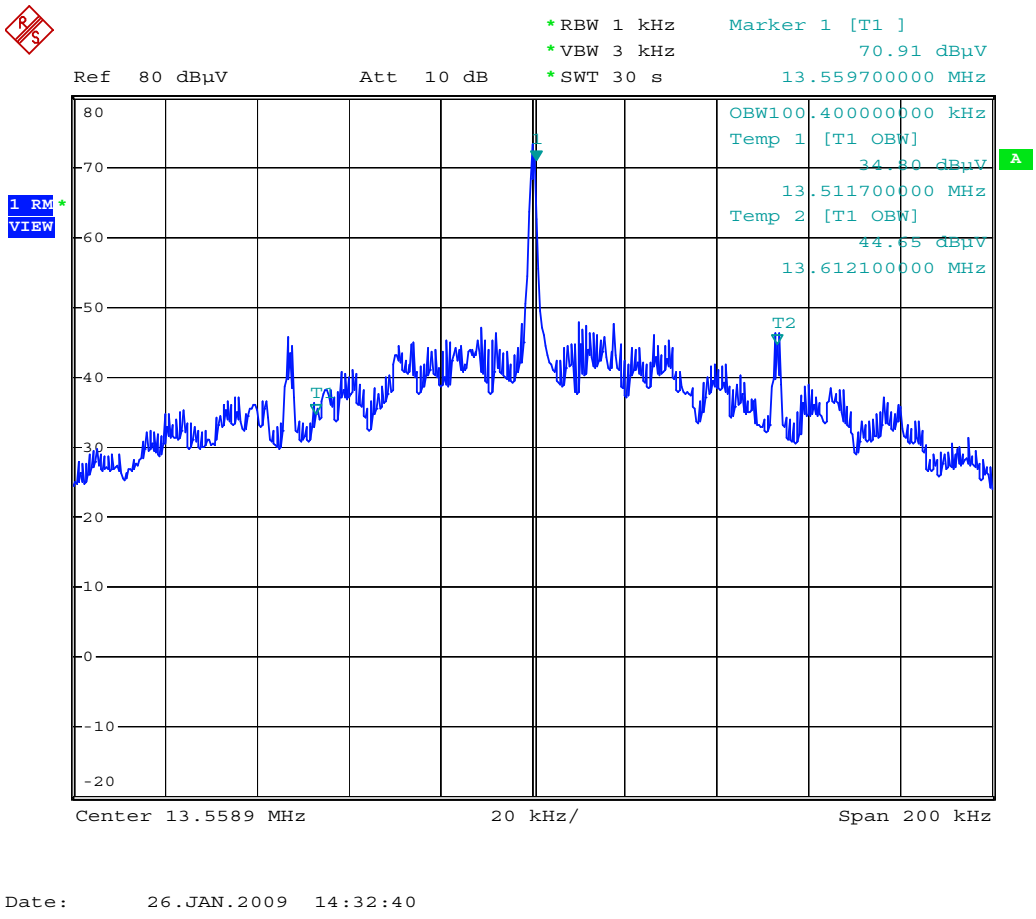
Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 MHz to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

The video bandwidth shall be at least three times greater than the resolution bandwidth.

Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	January 26, 2006
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):



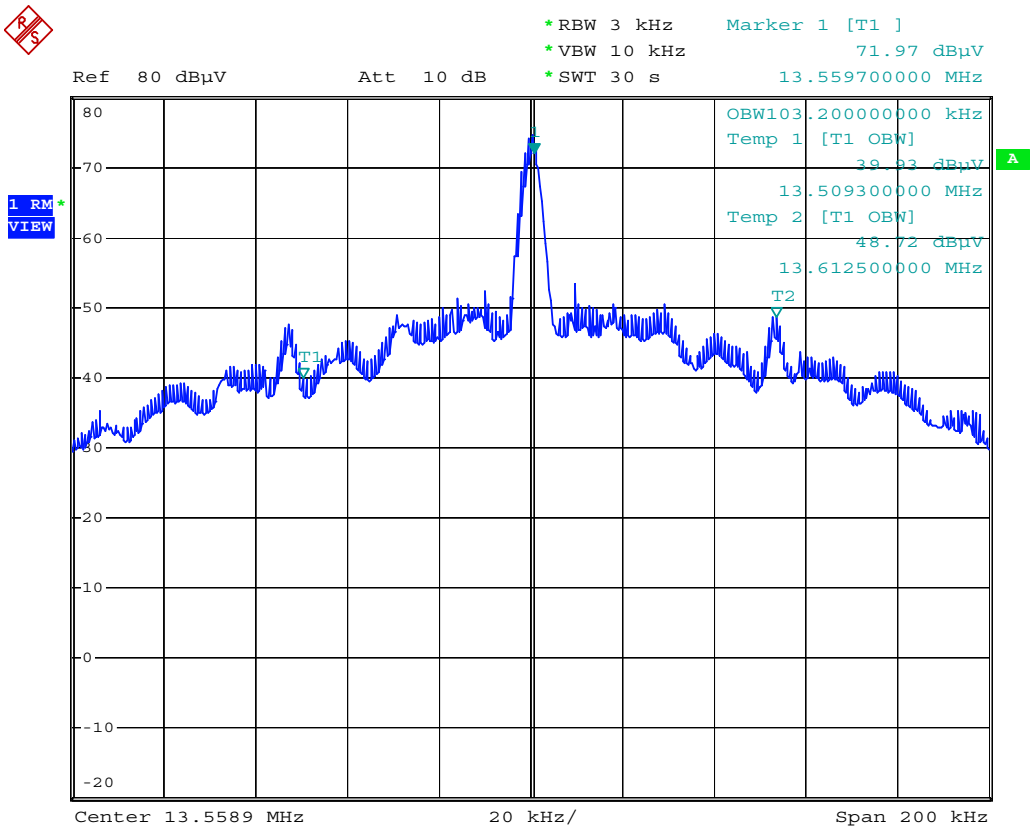
Occupied Bandwidth (99 %):	**100.4 kHz**

Occupied Bandwidth (continued)

Rules and specifications:	IC RSS-Gen Issue 2, section 4.6.1
Guide:	IC RSS-Gen Issue 2, section 4.6.1
Description:	If not specified in the applicable RSS the occupied bandwidth is measuredas the 99% emission bandwidth. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is also recorded. The span between the two recorded frequencies is the occupied bandwidth.
Measurement procedure:	Bandwidth Measurements (6.1)

Comment:	
Date of test:	January 26, 2009
Test site:	Fully anechoic room, cabin no. 2

Occupied Bandwidth (99 %):



Occupied Bandwidth (99 %):	**103.2. kHz**

8.2 Bandwidth of the Emission

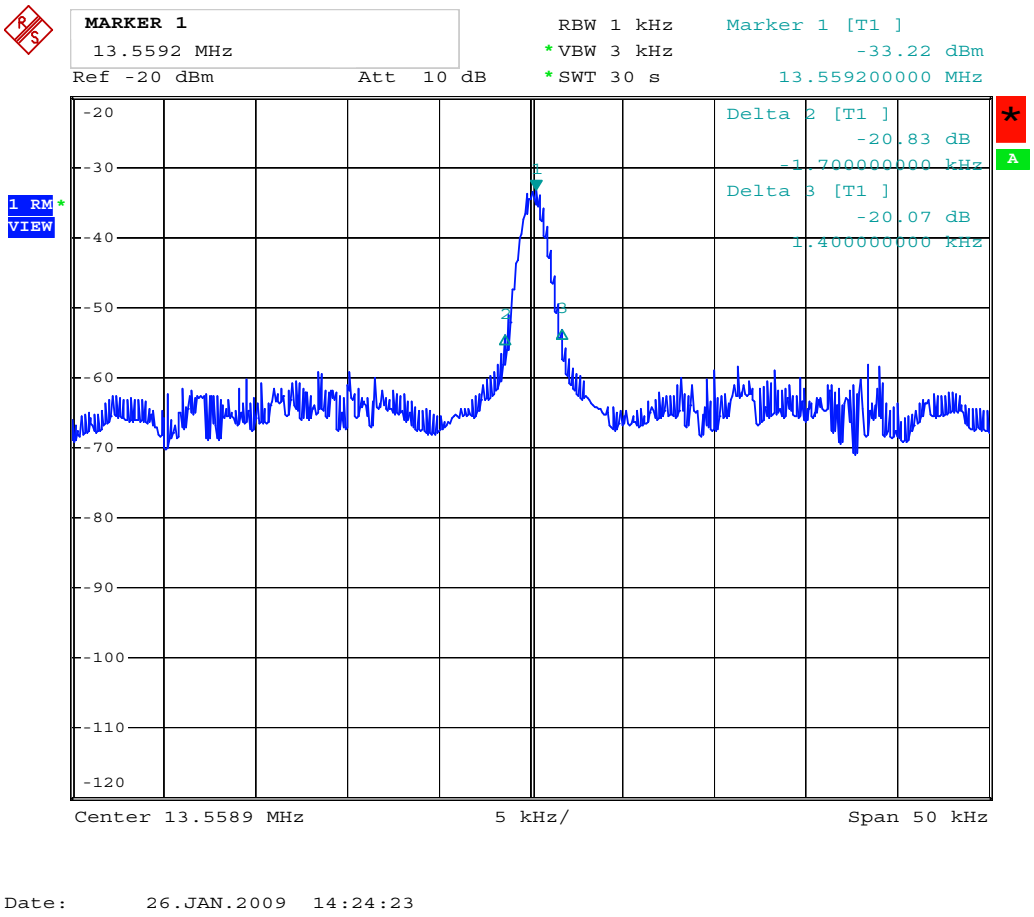
Rules and specifications:	CFR 47 Part 15, section 15.215(c)
Guide:	ANSI C63.4
Description:	The 20 dB bandwidth of the emission is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier. For intentional radiators operating under 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. 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:	January 26, 2008
Test site:	Fully anechoic room, cabin no. 2



Permitted frequency band:	**15.553 MHz -13.567** MHz	
20 dB bandwidth:	**3.1 kHz**	
Carrier frequency stability: Maximum frequency tolerances:	☒ **specified** **+0.086 kHz** **- 0.091. kHz**	☐ **not specified**
Bandwidth of the emission:	**3.277 kHz**	**within permitted frequency band[7]:** ☒ **yes** ☐ **no**

Test Result:	Test passed

[7] If a frequency stability is not specified, it is recommended that the fundamental emission is kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

8.3 Designation of Emissions

Rules and specifications:	CFR 47 Part 2, sections 2.201 and 2.202 IC RSS-Gen Issue 2, sections 3.2(h) and 8
Guide:	ANSI C63.4 / TRC-43

Type of modulation:	Amplitude Modulation

B_n = Necessary Bandwidth	B_n = 2BK
B = Modulation rate	B = 1.6 kHz
K = Overall numerical factor	K = 1
Calculation:	$B_n = 2 \cdot (1.6kHz) \cdot 1 = 3.2$ kHz

Designation of Emissions:	**3K2A1D**

8.4 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.207 IC RSS-Gen Issue 2, section 7.2.2		
Guide:	ANSI C63.4 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Conducted Limit (dBµV)	
		Quasi-peak	Average
	0.15 - 0.5 0.5 - 5 5 - 30	66 to 56 56 60	56 to 46 46 50
Measurement procedure:	Conducted AC Powerline Emission (6.2)		

Comment:	
Date of test:	January 26, 2009
Test site:	Shielded room, cabin no. 1

Test Result:	Test passed

Tested on:	Line cord phase N

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
13.565	Quasi-Peak	51.3	0.0	51.3	60.0	**8.7**
13.555	Average	37.1	0.0	37.1	50.0	12.9

Tested on:	Line cord phase L1

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
13.560	Quasi-Peak	52.2	0.0	52.2	60.0	**7.8**
13.560	Quasi-Peak	38.5	0.0	38.5	50.0	11.5

Sample calculation of final values:

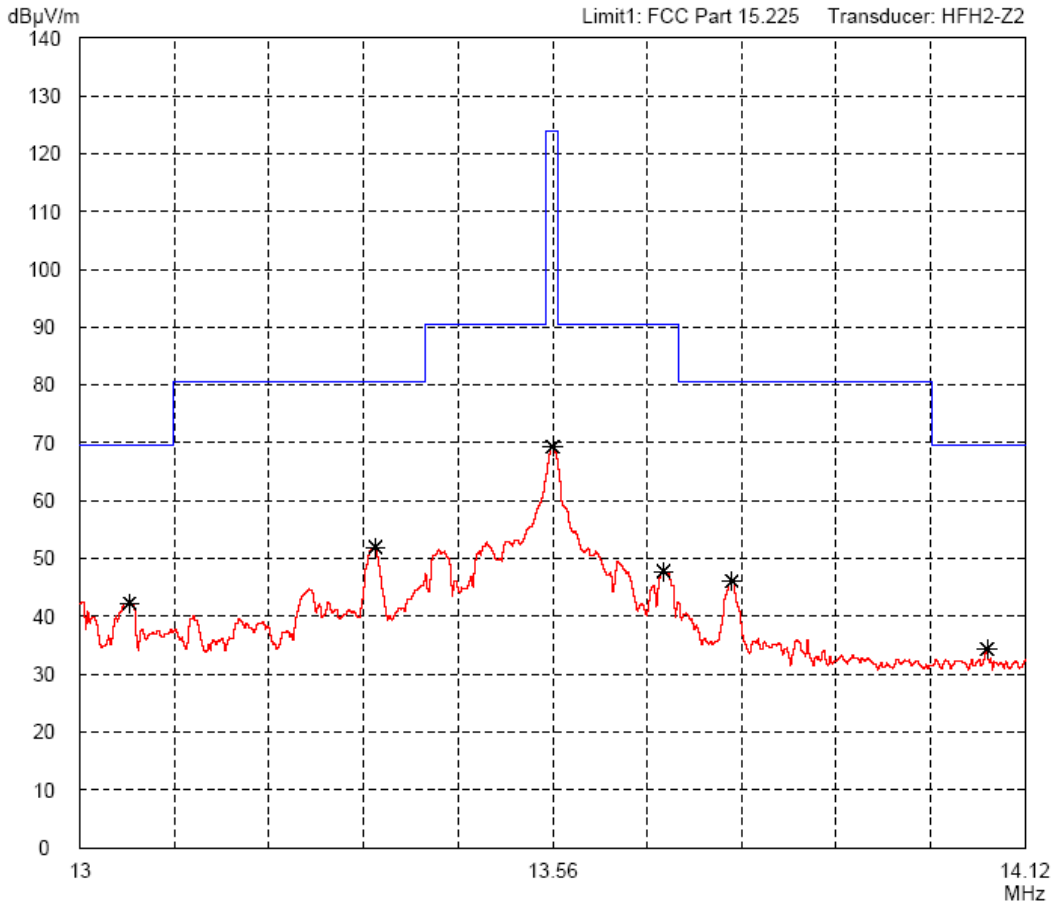
Final Value (dBµV) = Reading Value (dBµV) + Correction Factor (dB)

8.5 Spectrum Mask

Rules and specifications:	CFR 47 Part 15, section 15.225(a)-(d) IC RSS-210 Issue 7, section A2.6			
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
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.3)			

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 7, sections 2.2(b)(c), 2.6 and A2.6			
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
	Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			
Measurement procedure:	Radiated Emission Measurement 9 kHz to 30 MHz (6.3)			

Comment:	
Date of test:	January 26,2006
Test site:	Open field test site

Test Result:	Test passed

Extrapolation factor: -40 dB/decade

Frequency (MHz)	Detector	Distance d1 (m)	Distance d (m)	Reading Value (dBµV)	Correction Factor (dB/m)	Extrapolation Factor (dB)	Pulse Train Correction (dB)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
13.56000	Quasi-Peak	10	30	46.5	20.0	-19.1		47.4	84.0	**36.6**

Sample calculation of final values:

Extrapolation Factor (dB) = (Log(d) - Log(d_1)) · Extrapolation Factor (dB/decade)

Final Value (dBµV/m) = Reading Value d_1 (dBµV) + Correction Factor (dB/m) + Extrapolation Factor (dB) + Pulse Train Correction (dB)

Note: Extrapolation factor (dB) and final value (dBµV/m) are relating to distance d.

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 7, sections 2.2(b)(c), 2.6 and A2.6		
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 (6.4) Radiated Emission at Open Field Test Site (6.5)		

Comment:	
Date of test:	January 28, 2009
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)
81.350	horizontal	Quasi-Peak	10.5	9.7		20.2	40.0	19.8
81.365	vertical	Quasi-Peak	13.5	9.7		23.2	40.0	16.8
108.470	horizontal	Quasi-Peak	19.1	11.5		30.6	43.5	12.9
108.485	vertical	Quasi-Peak	25.9	11.5		37.4	43.5	6.1
122.030	horizontal	Quasi-Peak	13.1	12.5		25.6	43.5	17.9
122.045	vertical	Quasi-Peak	14.5	12.5		27.0	43.5	16.5
135.590	horizontal	Quasi-Peak	23.1	13.3		36.4	43.5	7.1
135.605	vertical	Quasi-Peak	24.6	13.3		37.9	43.5	**5.6**
149.100	vertical	Quasi-Peak	8.9	13.8		22.7	43.5	20.8
149.150	horizontal	Quasi-Peak	13.5	13.8		27.3	43.5	16.2
162.700	horizontal	Quasi-Peak	15.4	14.3		29.7	43.5	13.8
162.725	vertical	Quasi-Peak	3.1	14.3		17.4	43.5	26.1
176.270	horizontal	Quasi-Peak	8.4	15.0		23.4	43.5	20.1
216.950	horizontal	Quasi-Peak	7.5	16.8		24.3	46.0	21.7
216.965	vertical	Quasi-Peak	0.9	16.8		17.7	46.0	28.3
244.000	horizontal	Quasi-Peak	9.7	17.6		27.3	46.0	18.7
271.190	horizontal	Quasi-Peak	5.9	19.1		25.0	46.0	21.0
298.300	horizontal	Quasi-Peak	6.7	21.8		28.5	46.0	17.5
311.870	horizontal	Quasi-Peak	11.2	15.9		27.1	46.0	18.9
311.875	vertical	Quasi-Peak	3.5	15.9		19.4	46.0	26.6
325.435	vertical	Quasi-Peak	6.8	16.4		23.2	46.0	22.8
338.995	horizontal	Quasi-Peak	10.0	16.9		26.9	46.0	19.1
352.555	horizontal	Quasi-Peak	5.8	17.3		23.1	46.0	22.9
366.110	vertical	Quasi-Peak	9.0	17.5		26.5	46.0	19.5
366.115	horizontal	Quasi-Peak	10.4	17.5		27.9	46.0	18.1
379.675	horizontal	Quasi-Peak	2.1	17.9		20.0	46.0	26.0
393.235	horizontal	Quasi-Peak	10.7	18.5		29.2	46.0	16.8
420.355	vertical	Quasi-Peak	8.4	19.3		27.7	46.0	18.3
447.475	vertical	Quasi-Peak	9.6	20.0		29.6	46.0	16.4
461.035	vertical	Quasi-Peak	3.8	20.2		24.0	46.0	22.0
474.595	horizontal	Quasi-Peak	10.5	20.4		30.9	46.0	15.1
488.150	vertical	Quasi-Peak	3.5	20.7		24.2	46.0	21.8
488.155	horizontal	Quasi-Peak	5.8	20.7		26.5	46.0	19.5
515.275	horizontal	Quasi-Peak	4.6	21.2		25.8	46.0	20.2
542.395	horizontal	Quasi-Peak	8.9	21.6		30.5	46.0	15.5

Sample calculation of final values:

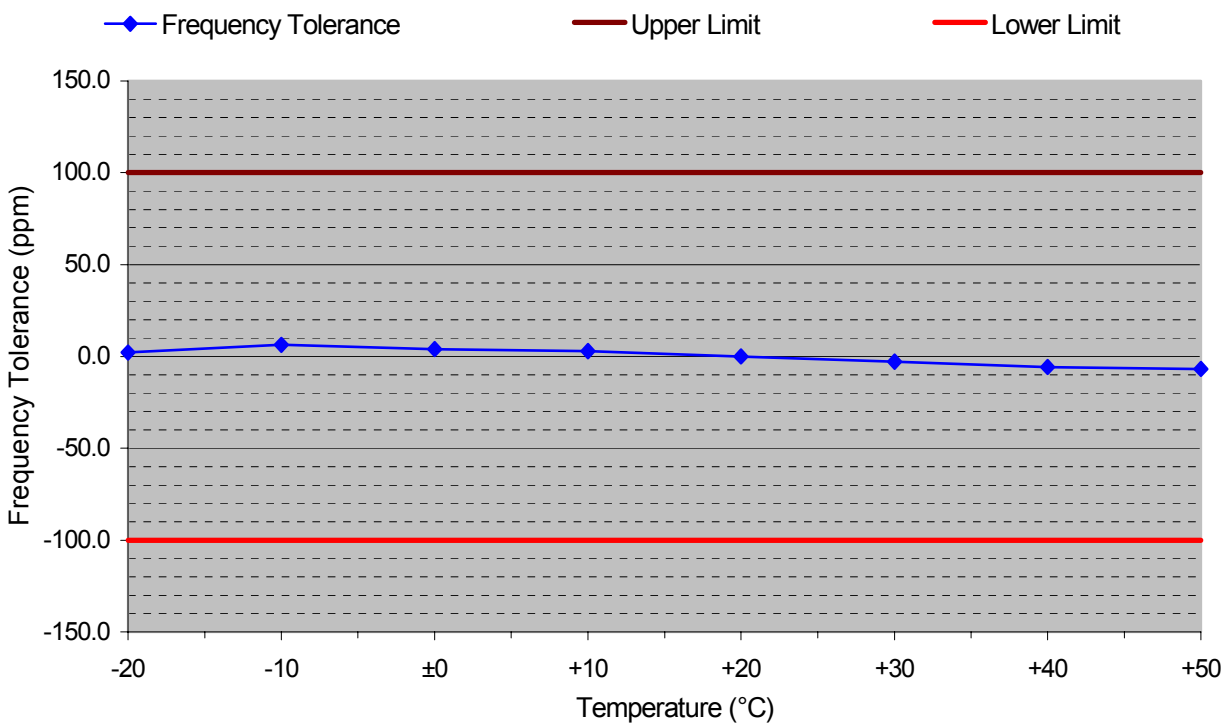
Final Value (dBµV/m) = Reading Value (dBµV) + Correction Factor (dB/m) + Pulse Train Correction (dB)

8.8 Carrier Frequency Stability

Rules and specifications:	CFR 47 Part 15, section 15.225(e) IC RSS-Gen Issue 2, section 4.7 and IC RSS-210 Issue 7, section A2.6
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)
Measurement procedure:	Carrier Frequency Stability (6.6)

Comment:	
Date of test:	January 27, 2009

8.8.1 Carrier Frequency Stability vs. Temperature

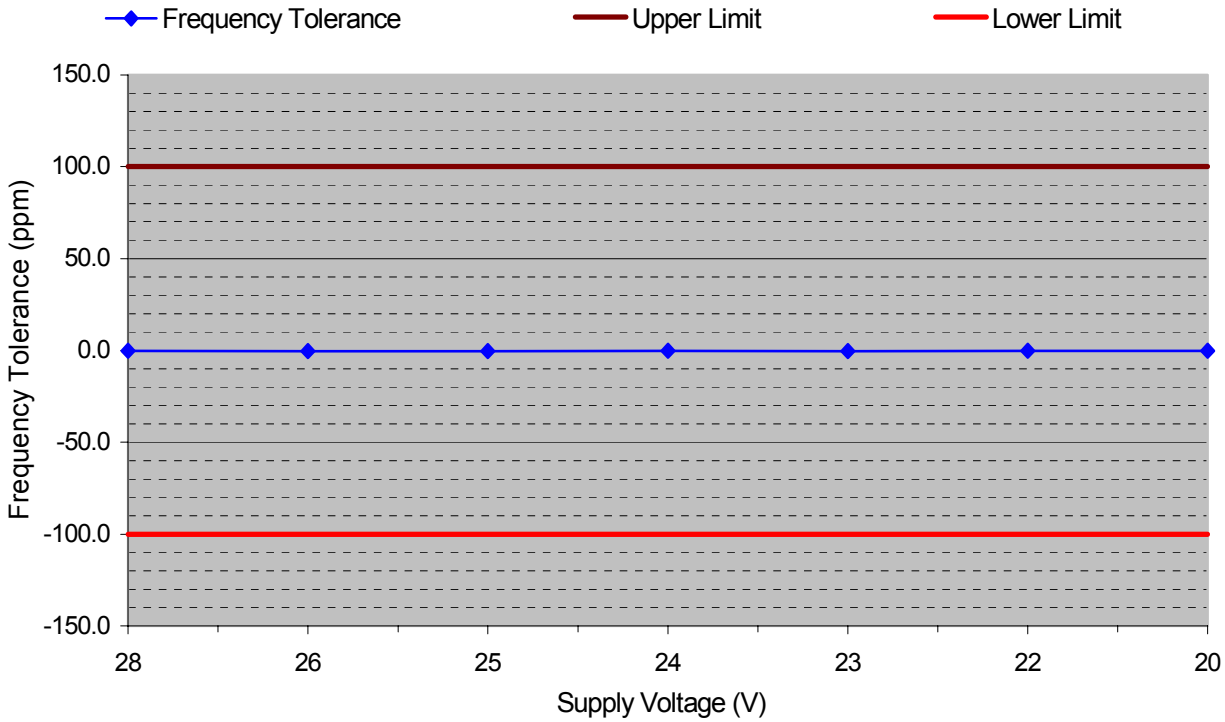


Supply voltage: 24 V Nominal frequency: 13.559114 MHz

Temperature (°C)	Frequency (MHz)	Frequency Tolerance (Hz)	Frequency Tolerance (ppm)	Upper Limit (ppm)	Lower Limit (ppm)	Margin (ppm)
-20	13.559144	30	2.2	+100.0	-100.0	97.8
-10	13.559200	86	6.3	+100.0	-100.0	93.7
±0	13.559168	54	4.0	+100.0	-100.0	96.0
+10	13.559154	40	3.0	+100.0	-100.0	97.0
+20	13.559114	0	0.0	+100.0	-100.0	100.0
+30	13.559075	-39	-2.9	+100.0	-100.0	97.1
+40	13.559036	-78	-5.8	+100.0	-100.0	94.2
+50	13.559022	-92	-6.8	+100.0	-100.0	**93.2**

Test Result:	Test passed

8.8.2 Carrier Frequency Stability vs. Supply Voltage



Temperature: +20 °C
Nominal frequency: 13.559114 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)
28	13.559112	-2	-0.1	+100.0	-100.0	99.9
26	13.559110	-4	-0.3	+100.0	-100.0	**99.7**
25	13.559110	-4	-0.3	+100.0	-100.0	**99.7**
24	13.559112	-2	-0.1	+100.0	-100.0	99.9
23	13.559110	-4	-0.3	+100.0	-100.0	**99.7**
22	13.559112	-2	-0.1	+100.0	-100.0	99.9
20	13.559112	-2	-0.1	+100.0	-100.0	99.9

Test Result:	Test passed

8.9 Exposure of Humans to RF Fields

Rules and specifications:	IC RSS-Gen Issue 2, section 5.5
Guide:	IC RSS-102 Issue 2, section 2.5

Exposure of Humans to RF Fields	Applicable	Declared by applicant	Measured	Exemption
The antenna is				
☐ detachable				
The conducted output power (CP in watts) is measured at the antenna connector: CP = ... **W** The effective isotropic radiated power (EIRP in watts) is calculated using			☐	
☐ the numerical antenna gain: G = ... $EIRP = G \cdot CP \Rightarrow EIRP$ = ... **W**		☐		
☐ the field strength[8] in V/m: FS = ... **V/m** $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = ... **W** with: Distance between the antennas in m: D = ... **m**			☐ ☐	
☒ not detachable				
A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by[8]: $EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP$ = **1.33^{-5} W** with: Field strength in V/m: FS =**0.002 V/m** Distance between the two antennas in m: D = **10 m**			☐ ☐	
Selection of output power				
The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.): TP = **1.33^{-5} W**				

[8] The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses.
If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

Exposure of Humans to RF Fields (continued)	Applicable	Declared by applicant	Measured	Exemption
Separation distance between the user and the transmitting device is				
☐ less than or equal to 20 cm ☒ greater than 20 cm		☒		
Transmitting device is				
☐ in the vicinity of the human head ☐ body-worn		☒		
SAR evaluation				
SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm.				
☐ The device operates from 3 kHz up to 1 GHz inclusively and its source-based time-averaged output power is less than, or equal to 200 mW for General Public Use and 1000 mW for Controlled Use.				☐
☐ The device operates above 1 GHz up to 2.2 GHz inclusively and its source-based time-averaged output power is less than, or equal to 100 mW for General Public Use and 500 mW for Controlled Use.				☐
☐ The device operates above 2.2 GHz up to 3 GHz inclusively and its source-based time-averaged output power is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use.				☐
☐ The device operates above 3 GHz up to 6 GHz inclusively and its source-based time-averaged output power) is less than, or equal to 10 mW for General Public Use and 50 mW for Controlled Use.				☐
☐ SAR evaluation is documented in test report no.				
RF exposure evaluation				
RF exposure evaluation is required if the separation distance between the user and the device is greater than 20 cm.				
☒ The device operates below 1.5 GHz and its e.i.r.p. is equal to or less than 2.5 W.				☒
☐ The device operates at or above 1.5 GHz and the e.i.r.p. of the device is equal to or less than 5 W.				☐
☐ RF exposure evaluation is documented in test report no.				

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, 2008
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	October 1, 2008
☒	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-Gen	Radio Standards Specification RSS-Gen Issue 2 containing General Requirements and Information for the Certification of Radiocommunication Equimpment, published by Industry Canada	June 2007
☒	RSS-210	Radio Standards Specification RSS-210 Issue 7 for Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment, published by Industry Canada	June 2007
☐	RSS-310	Radio Standards Specification RSS-310 Issue 1 for Low Power Licence-Ecempt Radiocommunicaton Devices (All Frequency Bands): Category II Equipment, published by Industry Canada	September 2005
☒	RSS-102	Radio Standards Specification RSS-102 Issue 2: Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	November 2005
☐	ICES-003	Interference-Causing Equipment Standard ICES-003 Issue 4 for Digital Apparatus, published by Industry Canada	February 7, 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

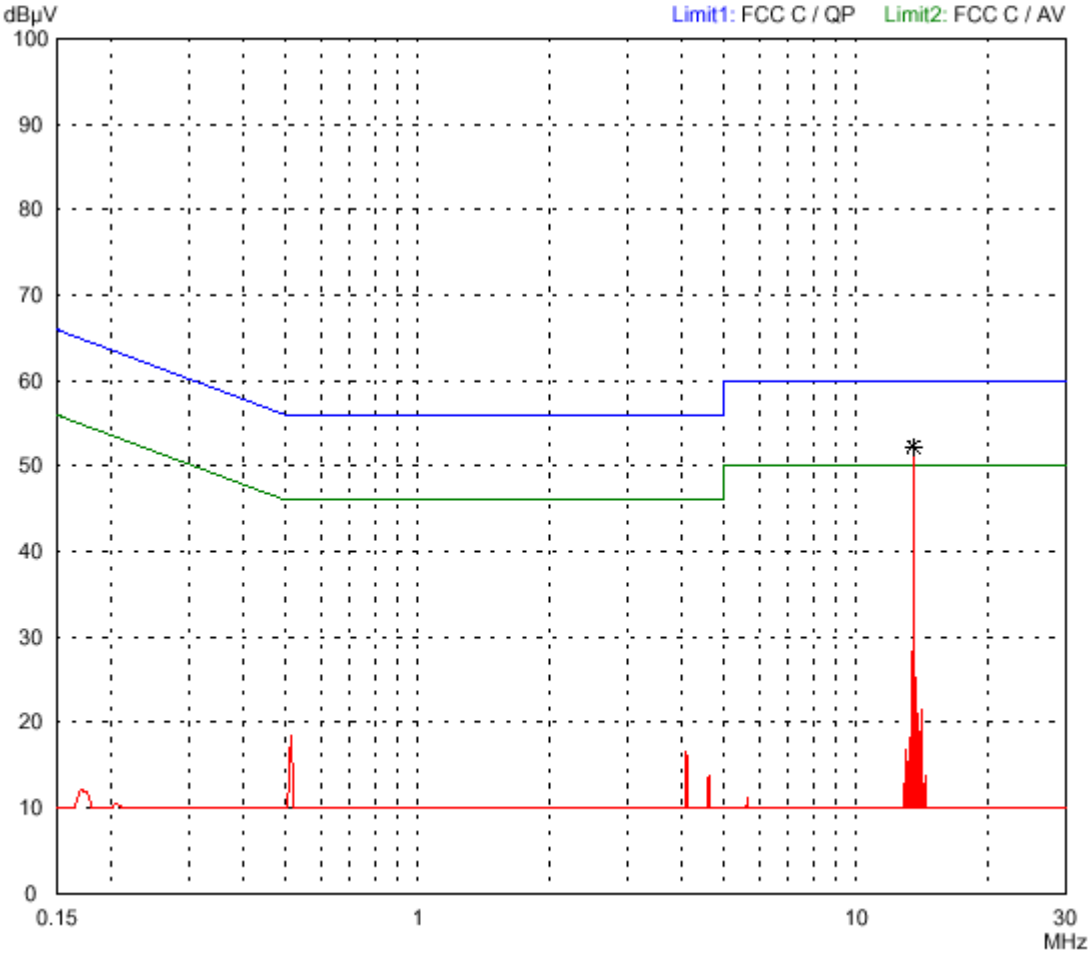
10 Revision History

Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	06.03.2009	T. Eberl (aw)	First Edition
2	05.08.2009	C. Jäger	Edition 2 Modification required for FCC Certification - List of Referenced Standards updated - Measurement procedures for bandwidth measurements: list of used test instruments for conducted measurements removed - Charts taken during testing: sheets for open area tests removed, sheets for anechoic chamber tests added

11 Charts taken during testing

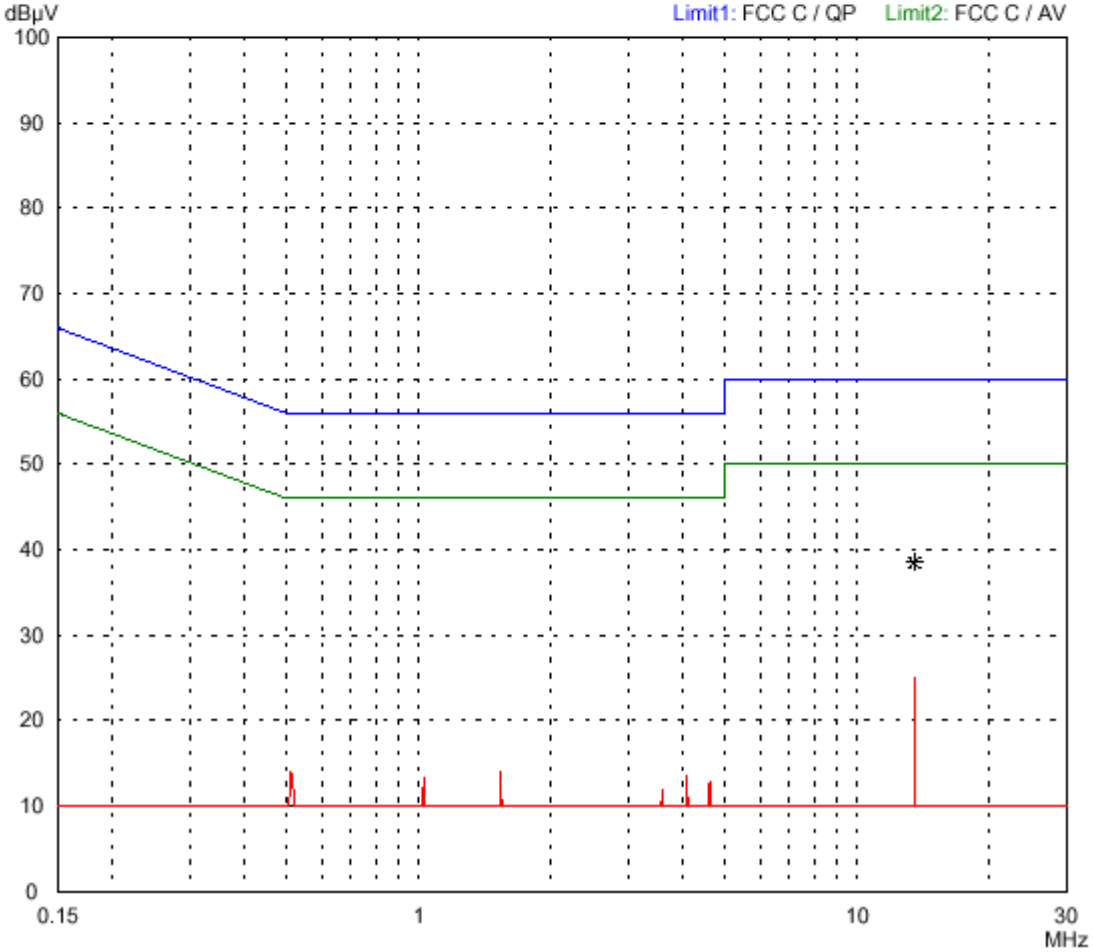
Conducted Emission Test 150 kHz - 30 MHz
according to FCC Part 15 Subpart C

Model: B-Net 91 04	Mode: - TX mode
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Shielded room, cabin no. 4	
Tested on: Linecord Power supply Phase L1	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name:	
Detector: Peak / Final Results: QP	Final results: 20 dB Margin 25 Subranges



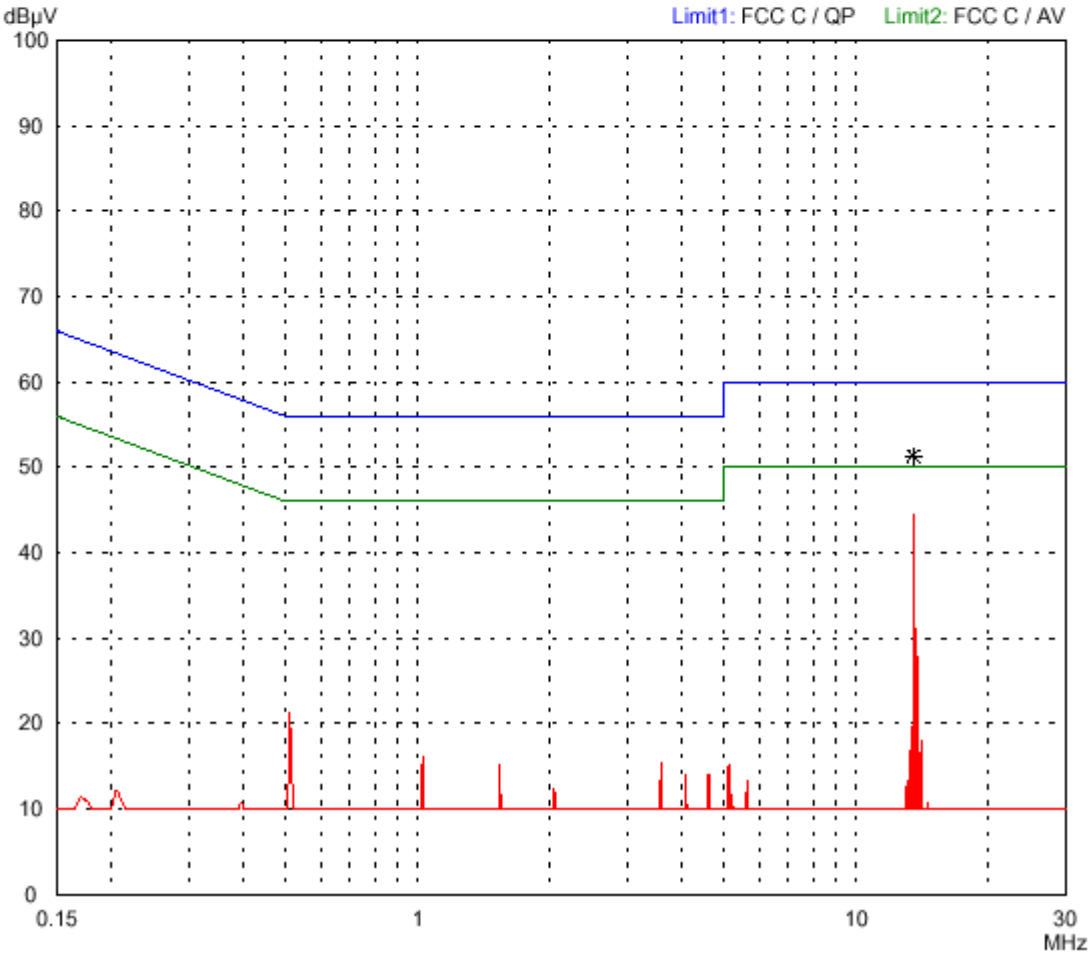
Conducted Emission Test 150 kHz - 30 MHz
according to FCC Part 15 Subpart C

Model: B-Net 91 04	Mode: - TX mode
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Shielded room, cabin no. 4	
Tested on: Linecord Power supply Phase L1	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name:	
Detector: Average / Final Results: AV	Final results: Selected by hand



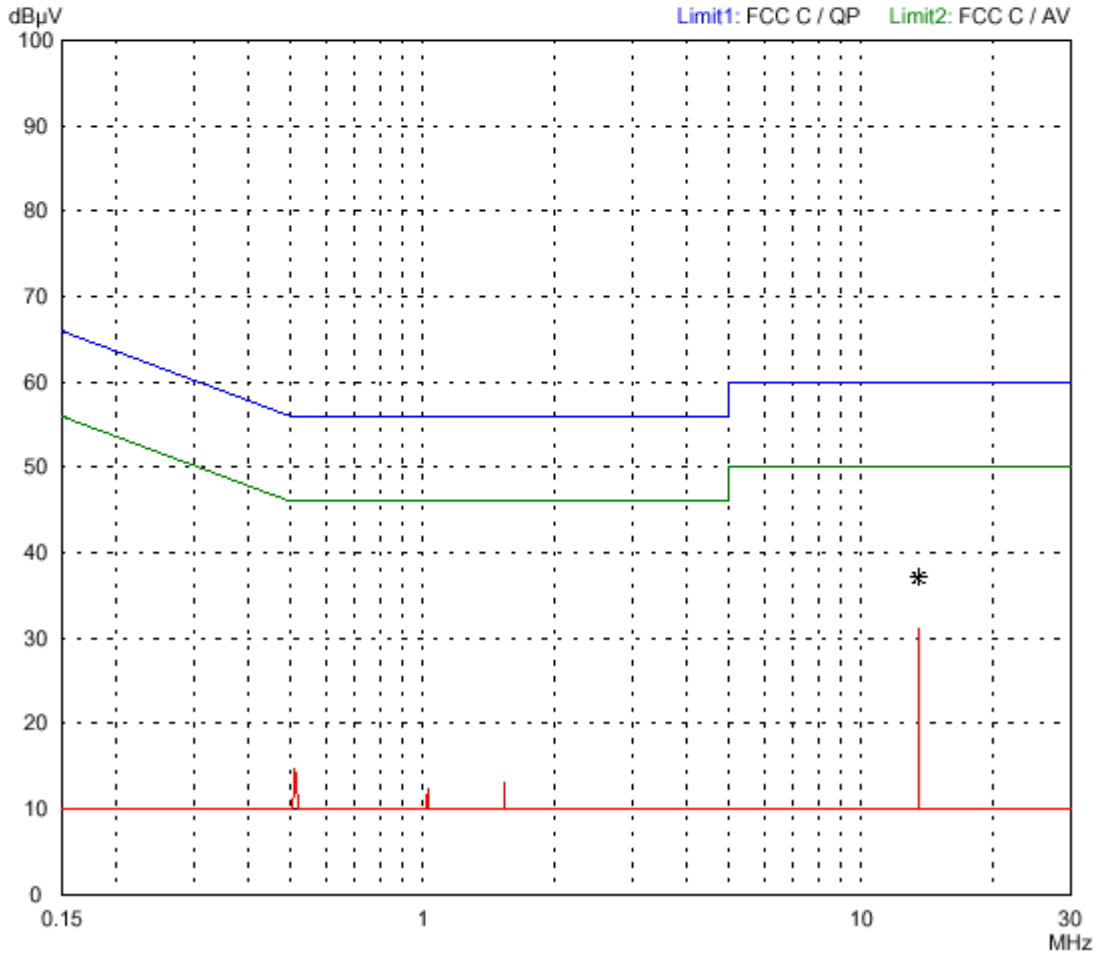
Conducted Emission Test 150 kHz - 30 MHz
according to FCC Part 15 Subpart C

Model: B-Net 91 04	Mode: - TX mode
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Shielded room, cabin no. 4	
Tested on: Linecord Power supply Phase N	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name:	
Detector: Peak / Final Results: QP	Final results: 20 dB Margin 25 Subranges



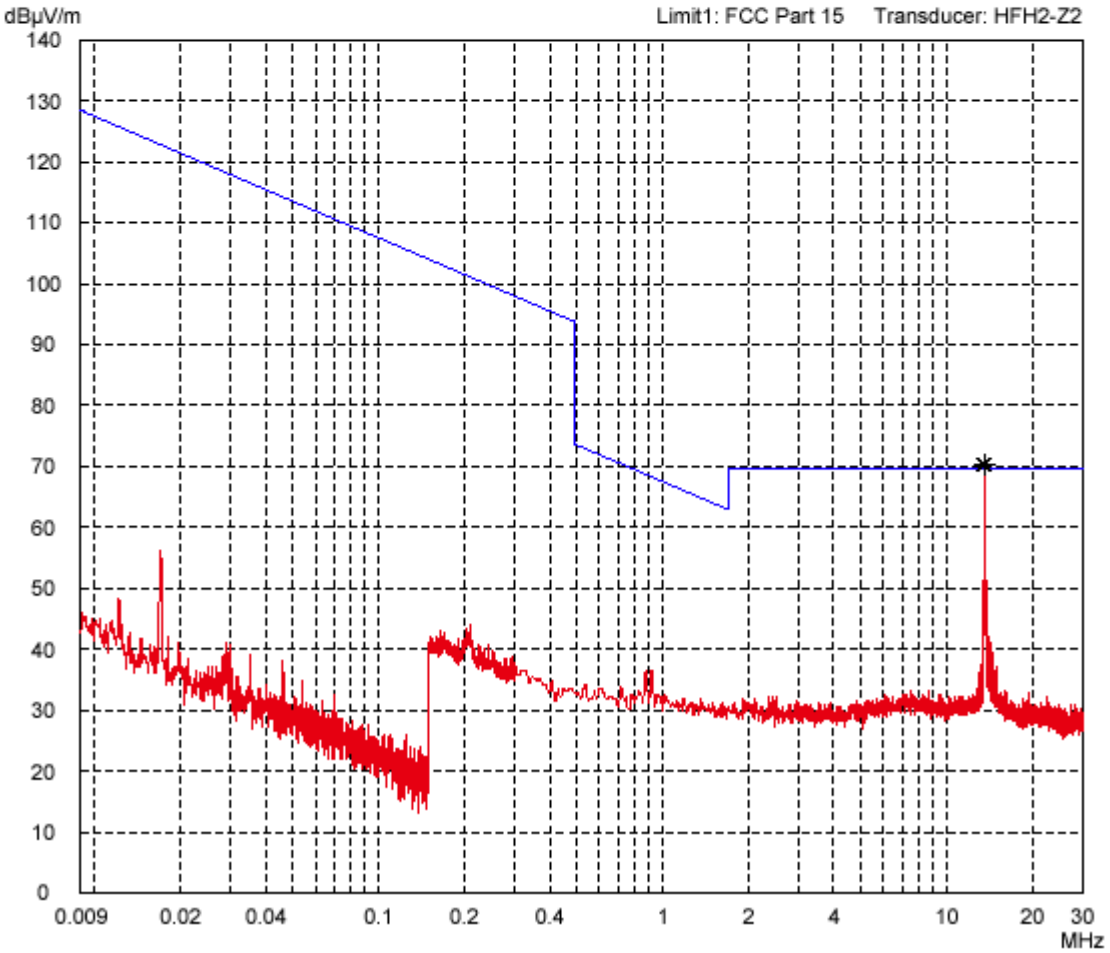
Conducted Emission Test 150 kHz - 30 MHz
according to FCC Part 15 Subpart C

Model: B-Net 91 04	Mode: - TX mode
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Shielded room, cabin no. 4	
Tested on: Linecord Power supply Phase N	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name:	
Detector: Average / Final Results: AV	Final results: 20 dB Margin 25 Subranges



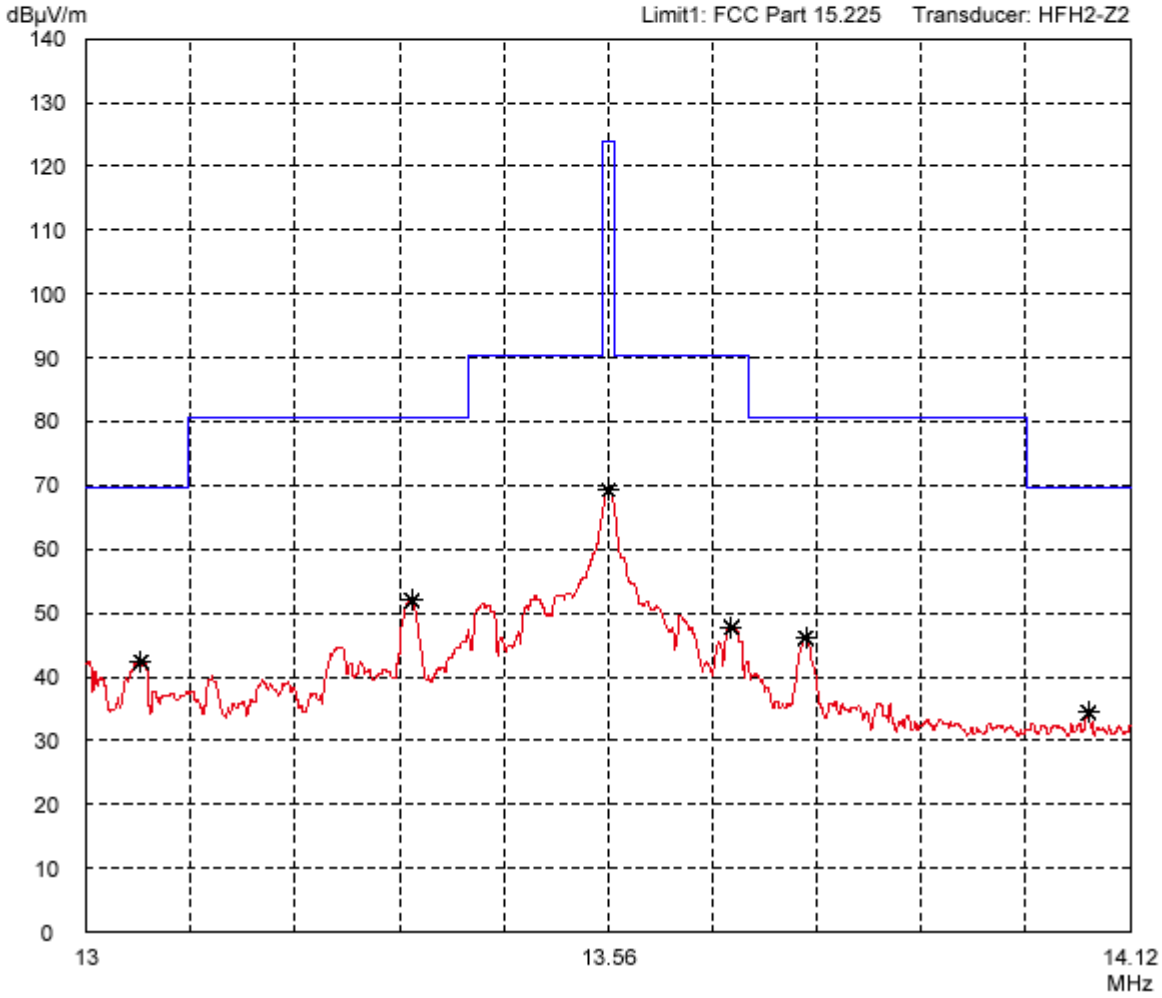
Radiated Emission Test 9 kHz - 30 MHz
acc. to FCC Part 15 Subpart C (FAR)

Model: B-Net 91 04	Comment: - TX mode - without TAG
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: by hand / File name: default.emi	
Detector: Peak	List of values: 10 dB Margin / 50 Subranges



Radiated Emission Test 13 MHz - 14.12 MHz
acc. to FCC Part 15.225 (Fully Anechoic Chamber)

Model: B-Net 91 04	Comment: - TX mode - without TAG
Serial no.: -----	
Applicant: Kaba GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 01/29/2009 / Operator: T. Eberl	
Test performed: by hand / File name: default.emi	
Detector: Peak	List of values: Selected by hand

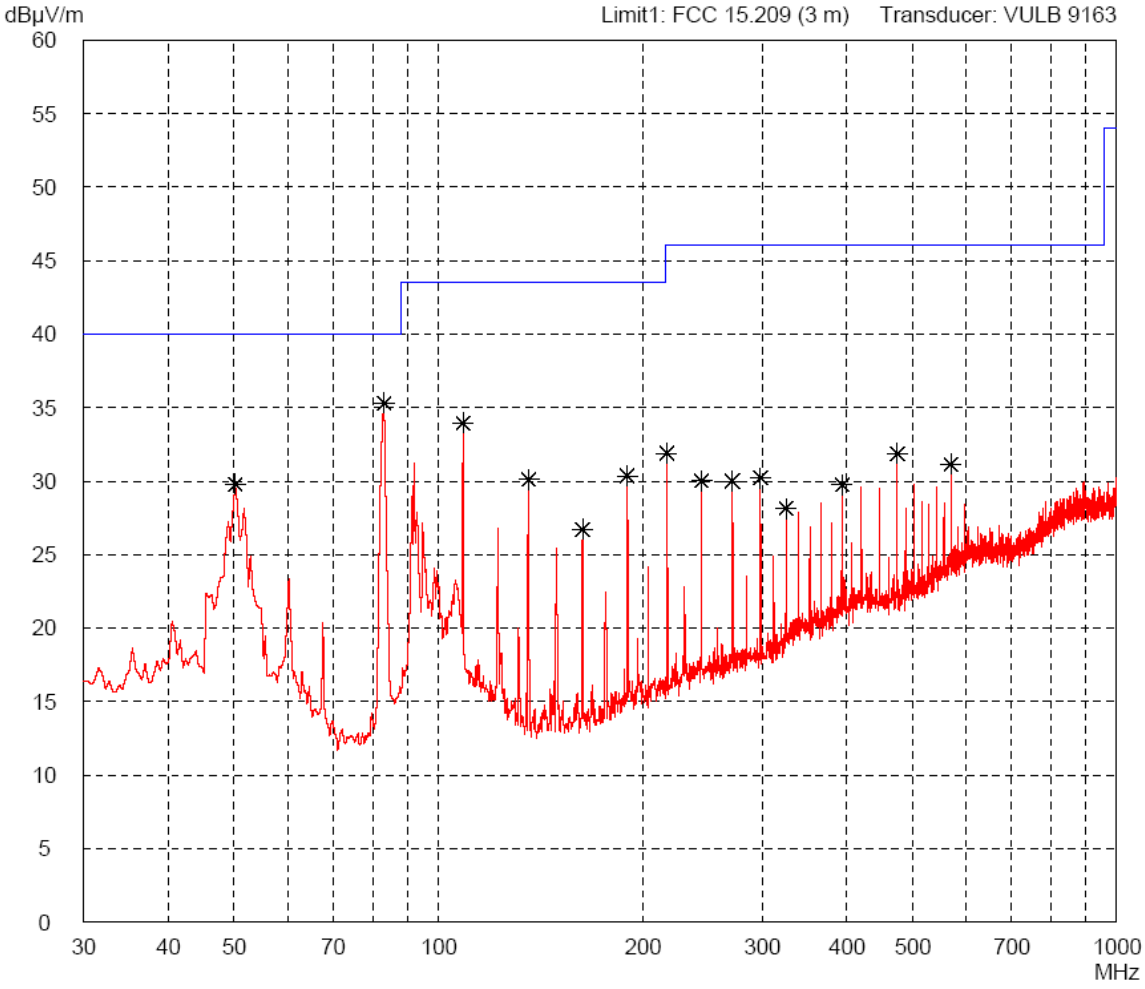


TÜV SÜD SENTON GmbH
Äußere Frühlingstraße 45
94315 Straubing
Germany

Phone: +49 9421 5522-0
Fax: +49 9421 5522-99
Web: www.tuev-sued.com/senton

Radiated Emission Test 30 MHz - 1 GHz
acc. to FCC Part 15 Subpart C (FAR)

Model: B-Net 91 04	Comment: - TX mode - without TAG
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand



Radiated Emission Test 30 MHz - 1 GHz
acc. to FCC Part 15 Subpart C (FAR)

Model: B-Net 91 04	Comment: - TX mode - without TAG
Serial no.: ---	
Applicant: Kaba GmbH	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 01/26/2009 / Operator: T. Eberl	
Test performed: automatically / File name: default.emi	
Detector: Peak	List of values: Selected by hand