Straubing, March 30, 1999

T E S T - R E P O R T

No. 50209-90104

for

HFS 3100

Transmitter

Applicant:	Otto Bilz Werkzeugfabrik GmbH & Co.
Purpose of testing:	To show compliance with FCC Code of Federal Regulations, Part 15 Subpart C, Section 15.209

Table of Contents

1. Administrative Data

Equipment Under Test (EUT):	HFS 3100
Type of equipment:	Transmitter 72 MHz
Parts/accessories:	---
Serial number:	N/A
Version of EUT:	N/A
FCC-ID:	**OCLHFS3100-72**

Applicant:	Otto Bilz Werkzeugfabrik GmbH & Co.
(full address)	Vogelsangstrasse 8 D-73760 Ostfildern / Germany
Contract identification:	N/A
Contact person:	Mr. Esslinger
Manufacturer:	N/A

Receipt of EUT:	February 09, 1999
Date of test:	March 09, 1999

Responsible for testing:	Mr. Johann Roidt
Responsible for test report:	Mr. Johann Roidt

2. Summary of Test Results

The tested sample fully complies with the requirements for intentional radiators set forth in the

Code of Federal Regulations CFR 47
Part 15 Subpart C, Section 15.209
of the
Federal Communication Commission (FCC).

Johann Roidt
Technical Manager

3. Operation Mode of EUT

Continous operation of the transmitter.

4. Changes made to the EUT during this certification test

No changes have been made to the EUT during this certification test.

5. Configuration of EUT and Peripheral Devices

Configuration of cables of EUT

Not applicable

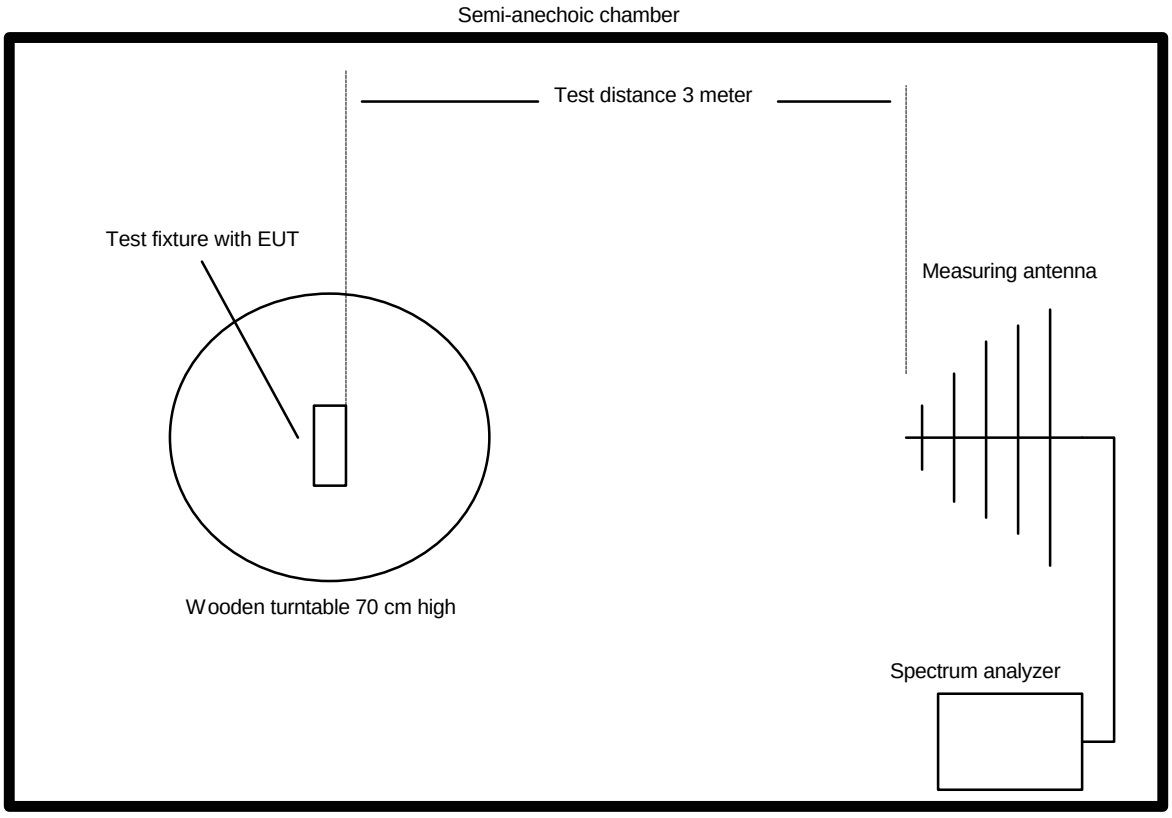
Configuration of peripheral devices connected to EUT

Not applicable

6. Measuring Methods

6.1. Transmitter Parameter Tests (§ 15.249 (a)).

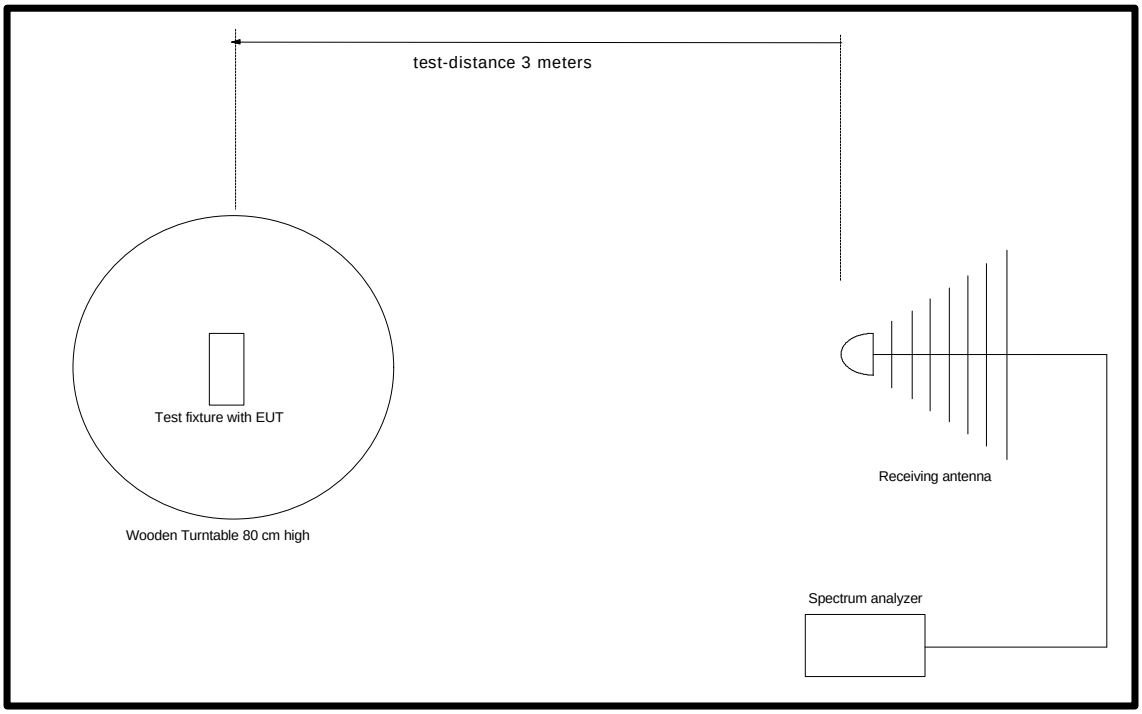
All transmitter parameter tests were performed at a test-distance of 3 meters in a semi-anechoic room (radiated). During the tests the EUT was rotated all around and the receiving-antenna was raised and lowered from 1 meter to 4 meters to find the maximum levels of emissions. Cables and equipment were placed and moved within the range of position likely to find their maximum emissions. Measurements were made in horizontal and vertical polarization.
EUT was operating in transmit mode at the appropriate frequency with its internal modulation.
The bandwidth of the emission was measured with a spectrum analyzer. Resolution (RBW) and video bandwidth (VBW) were set to 10 kHz (RBW and VBW)



Test equipment used (see equipment list for details:
02, 08, 10, 40, 61, 64

6.2. Radiated Emissions 30 MHz - 1 GHz (§15.209, §15.231)

Radiated emissions were measured over the frequency range from 30 MHz to 1 GHz. The bandwidth of the EMI-receiver was set to 100 kHz and the detector-function was set to CISPR quasi-peak.
The test setup was made in accordance with ANSI C63.4-1992. Measurements were made in horizontal and vertical polarization. Preliminary scans were taken in a semi-anechoic room using a spectrum analyzer with the detector function set to peak. All tests were performed at a test-distance of 3 meters. For final testing an open-area test-site was used. During the tests the EUT was rotated all around and the receiving-antenna was raised and lowered from 1 meter to 4 meters to find the maximum levels of emissions. Cables and equipment were placed and moved within the range of position likely to find their maximum emissions.

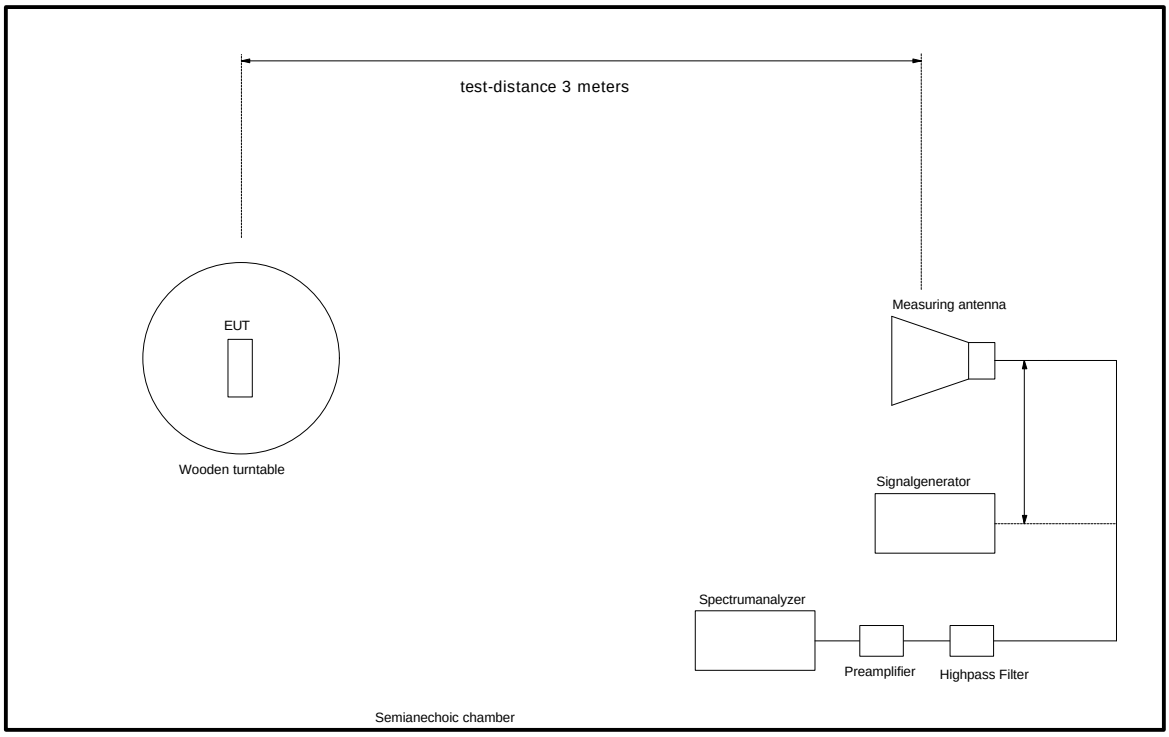


Test equipment used (see equipment list for details:
01, 05, 12, 38, 39, 40, 41, 58, 61, 64, 66

6.3. Radiated Emissions above 1 GHz

Radiated emissions were measured in the frequency range 1 GHz to 3.15 GHz in transmit mode .The resolution bandwidth and the video bandwidth of the spectrum analyzer was set to 1 MHz. Prescans with video bandwidth 1 MHz (peak mode) were taken to check out the highest levels (with reference to the limits), see 6.4 for details to prescan procedure. Final measurements were performed at the three highest emissions per band. EUT was rotated all around and receiving antenna was raised and lowered to find the maximum levels of emission. Cables and equipment were placed and moved within the range of position likely to find their maximum emissions. Measurements were made in horizontal and vertical polarization.
All tests were performed in a semi-anechoic chamber with a test-distance of 3 meters.
To avoid overload in transmit mode a high pass filter was connected to the input of the preamplifier (in case when a preamplifier was necessary)). In this case a signal generator was used for substitution to eliminate the influence of filter and preamplifier.
Substitution was performed in the following steps:

- antenna cable was disconnected from receiving antenna and connected to signal generator output
- level of signal generator was increased until the reading value of the analyzer was the same as caused by EUT
- level of signal generator was noted
- final value was calculated by converting the signal generator level to dBµV/m and adding the antenna correction factor.



Test equipment used (see equipment list for details:
02, 13, 14, 16, 42, 46, 47, 57, 64, 67

6.4. Procedure for Preliminary Radiated Emission Tests

The procedure for preliminary radiated emission tests follows section 13.4.1 of ANSI C63.4-1992.
The EUT is a control transmitter with integral antenna, no modulation, battery supply and no cables to be connected. Therfore the prescanning procedure is as follows:

Prescans are made in the frequency ranges:

30 - 300 MHz
300 -1000 MHz

with the receiving antenna set to horizontal and vertical polarization.

The following step-by-step procedure will be used:

1) Monitor the frequency range at a fixed antenna height and and EUT azimuth
2) Rotate the EUT 360° to maximize the suspected highest azimuth signals. Note the amplitude and frequency of the signals. Orient the EUT azimuth for maximum emission.
3) Move the antenna over its full allowed range of travel to maximize the emission. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to step 2) with the antenna fixed at this height. Otherwise move the antenna to the height that repeats the highest amplitude observation and proceed.

4) Make a hardcopy of the spectrum.

5) Repeat steps 1 through 5 for orthogonal antenna polarisation

6.5. Method for comparing spectrum analyzer output to the limit

The following procedure will be used:

1) Maximize the emission according to 6.4.

2) Set the spectrum analyzer to **Max Hold**

3) Wait until the noise is fully maximized.

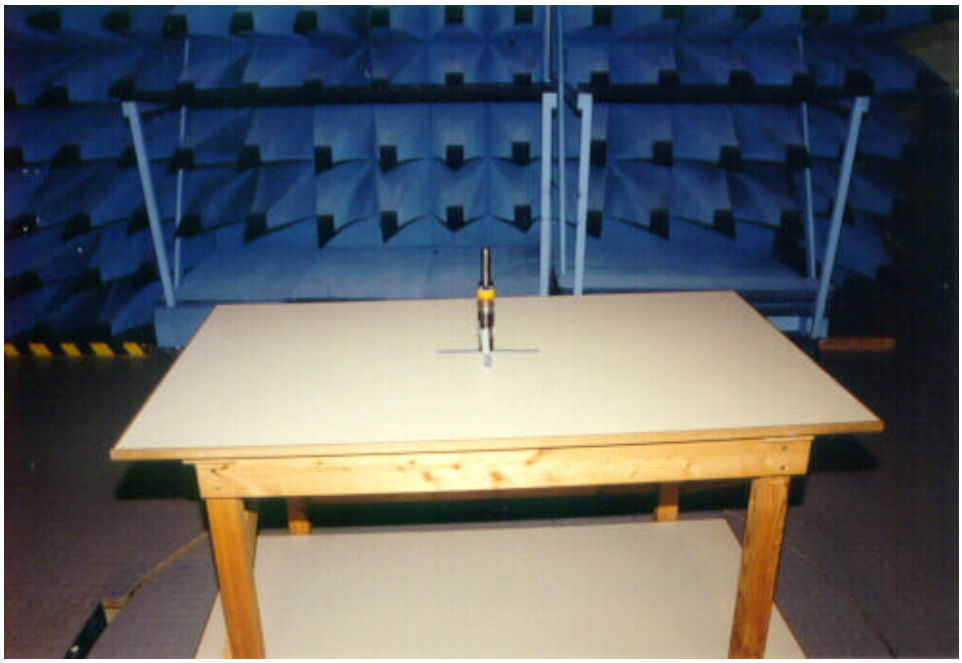
4) Put the **marker** on top of the investigated signal

5) Note frequency and level of the investigated signal

6.6. Spectrum analyzer settings for final test

Frequency range	Detector	Resolution Bandwidth	Video Bandwidth	Trace Mode
30 - 1000 MHz	Quasi Peak	100 kHz	1 MHz	Max Hold
> 1000 MHz	Peak	1 MHz	1 MHz	Max Hold

7. Photographs Taken During Testing



8. List of Measurements

FCC Part 15 Subpart C			
Section(s):	**Test**	**Page**	**Result**
	Transmit mode (TX):		
§15.209.a	Field strength of emissions	17	passed

9. Test Results

Field Strength of Emissions according to FCC Rules, Part 15, Subpart C, Section 15.231

Model: HFS 3100
Type:
Serial No.:
Applicant: Otto Bilz GmbH & Co.

Test Site: Open Field Test Site (< 1GHz)
Semi-anechoic chamber (>1GHz)
Distance: 3 Meter
Date of test: March 09, 1999

Frequency (MHz)	Detector	Antenna Polarization	Analyzer Reading (dBµV)	Correction Factor (dB)	Field Strength (dBµV/m)	Margin to limit (dB)
72.0	QP	Vertical	19.3	10.2	**29.5**	**10.5**

Sample calculation of field strength values:

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

Test equipment used (see equipment list for details:
02, 13, 14, 16, 38, 40 ,42, 57, 64, 67

10. Equipment List

To facilitate reference to test equipment used for related tests, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory.

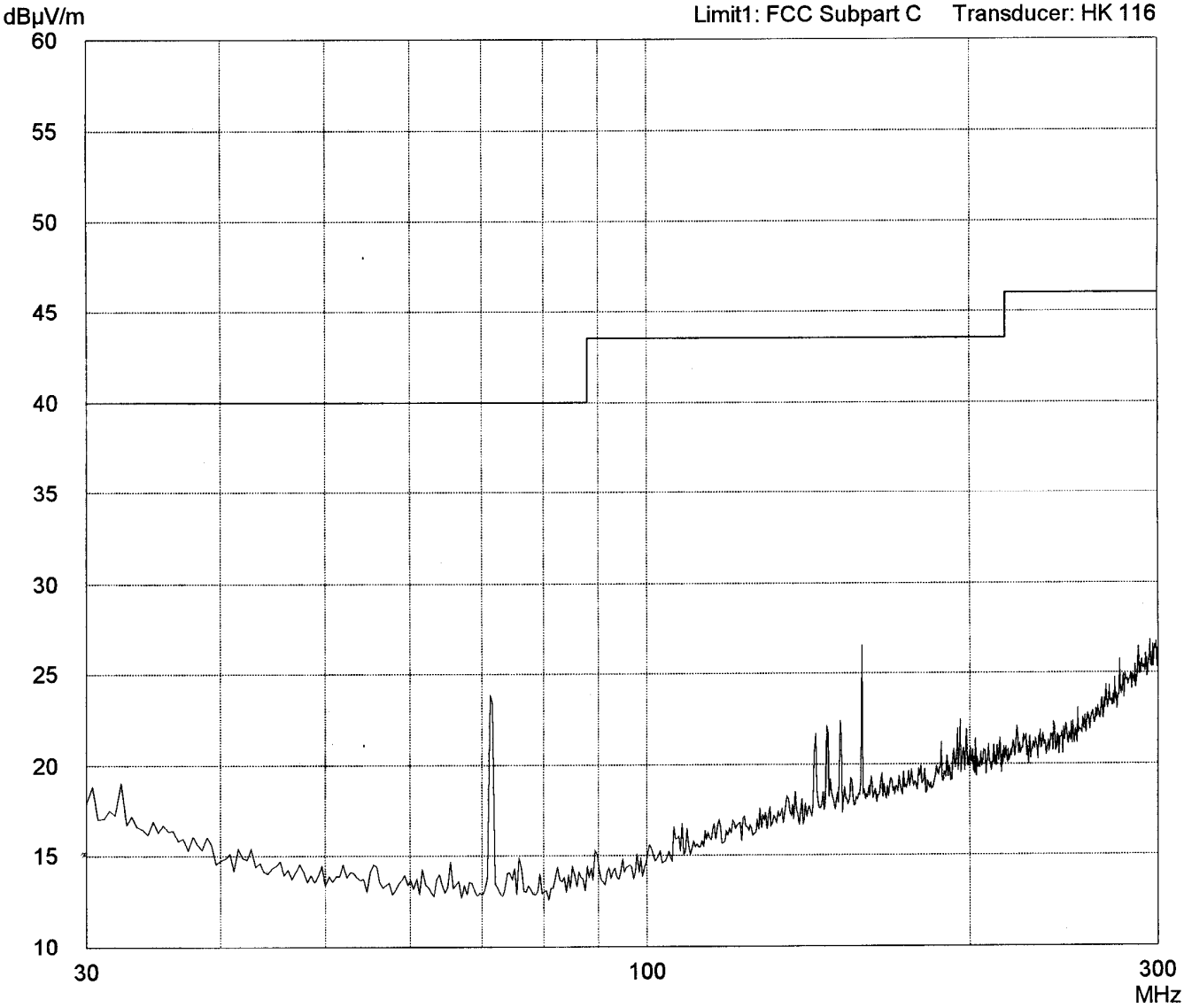
No.	Type	Model	Serial Number	Manufacturer
01	Spectrum Analyzer	R 3261 A	91720155	Advantest
02	Spectrum Analyzer	R 3271	05050023	Advantest
03	Test Receiver	ESH 3	880112/032	Rohde & Schwarz
04	Test Receiver	ESHS 10	860043/016	Rohde & Schwarz
05	Test Receiver	ESV	881414/009	Rohde & Schwarz
06	Test Receiver	ESVP	881120/024	Rohde & Schwarz
07	Audio Analyzer	UPA	862954	Rohde & Schwarz
08	Power Meter	NRVS	836856/015	Rohde & Schwarz
09	Power Sensor	NRV-Z52	837901/030	Rohde & Schwarz
10	Power Sensor	NRV-Z4	863828/015	Rohde & Schwarz
11	Preamplifier	ESV-Z3	860907/004	Rohde & Schwarz
12	Preamplifier	R14601		Advantest
13	Preamplifier	ACX/080-3030	32640	CTT
14	Preamplifier	ACO/180-3530	32641	CTT
15	Signal Generator	SMS	872166/039	Rohde & Schwarz
16	Signal Generator	HP 8673 D	2930A00966	Hewlett Packard
17	Waveform Generator	HP 33120 A	US34005375	Hewlett Packard
18	UHF Attenuator Set	DPU	300771/075	Rohde & Schwarz
19	UHF Attenuator Set	DPU	300788/006	Rohde & Schwarz
20	Pulse Limiter	ESH 3-Z2	1144	Rohde & Schwarz
21	Pulse Limiter	11947 A	3107A00566	Hewlett Packard
22	V-Network	ESH 3-Z5	862770/018	Rohde & Schwarz
23	V-Network	ESH 3-Z5	894785/005	Rohde & Schwarz
24	V-Network	ESH 3-Z5	830952/025	Rohde & Schwarz
25	V-Network	ESH 3-Z6	830722/010	Rohde & Schwarz
26	V-Network	NSLK 8127	8127152	Schwarzbeck
27	V-Network	NNLA 8119	8119148	Schwarzbeck
28	V-Network	SE 01	01	Senton
29	T-Network	ESH 3-Z4	890602/011	Rohde & Schwarz
30	T-Network	ESH 3-Z4	890602/012	Rohde & Schwarz
31	High Impedance Probe	TK 9416	01	Schwarzbeck
32	High Impedance Probe	TK 9416	02	Schwarzbeck
33	Current Probe	ESH 2-Z1	863366/18	Rohde & Schwarz
34	Current Probe	ESV-Z1	862553/3	Rohde & Schwarz

No.	Type	Model	Serial Number	Manufacturer
35	Absorbing Clamp	MDS 21	80911	Lüthi
36	Absorbing Clamp	MDS 21	79690	Lüthi
37	Loop Antenna	HFH2-Z2	882964/1	Rohde & Schwarz
38	Biconical Antenna	HK 116	836239/02	Rohde & Schwarz
39	Biconical Antenna	BBA 9106	A0379 324	Schwarzbeck
40	Log. Periodic Antenna	HL 223	834408/12	Rohde & Schwarz
41	Log. Periodic Antenna	UHALP 9107	9107150	Schwarzbeck
42	Horn Antenna	3115	9508-4553	Emco
43	Horn Antenna	3160-03	9112-1003	Emco
44	Horn Antenna	3160-04	9112-1001	Emco
45	Horn Antenna	3160-05	9112-1001	Emco
46	Horn Antenna	3160-06	9112-1001	Emco
47	Horn Antenna	3160-07	9112-1008	Emco
48	Horn Antenna	3160-08	9112-1002	Emco
49	Horn Antenna	3160-09	9403-1025	Emco
50	Digital multimeter	199	463386	Keithley
51	DC Power Supply	NGSM 32/10	203	Rohde & Schwarz
52	DC Power Supply	NGB	2455	Rohde & Schwarz
53	DC Power Supply	NGA	386	Rohde & Schwarz
54	Temperature Test Chamber	HT4010	07065550	Heraeus
55	Cable	RG214	1309	Senton
56	Cable	150CM_001	1479	Rosenberger
57	Cable	150CM_002	1480	Rosenberger
58	Cable Set EG1	RG214	1189 - 1191	Senton
59	Cable Set Cabine 1	RG214		Senton
60	Cable Set Cabine 2	RG214		Senton
61	Cable Set Cabine 3	RG214		Senton
62	Shielded Room	Nr. 1	1451	Senton
63	Shielded Room	Nr. 2	1452	Senton
64	Semi-anechoic Chamber	Nr. 3	1453	Siemens
65	Shielded Room	Nr. 4	1454	Euroshield
66	Open Area Test Site	EG 1		Senton
67	High pass filter			AT & T

11. Charts Taken During Testing

Radiated Emission Test 30 MHz - 300 MHz
according to FCC Part 15 Subpart C

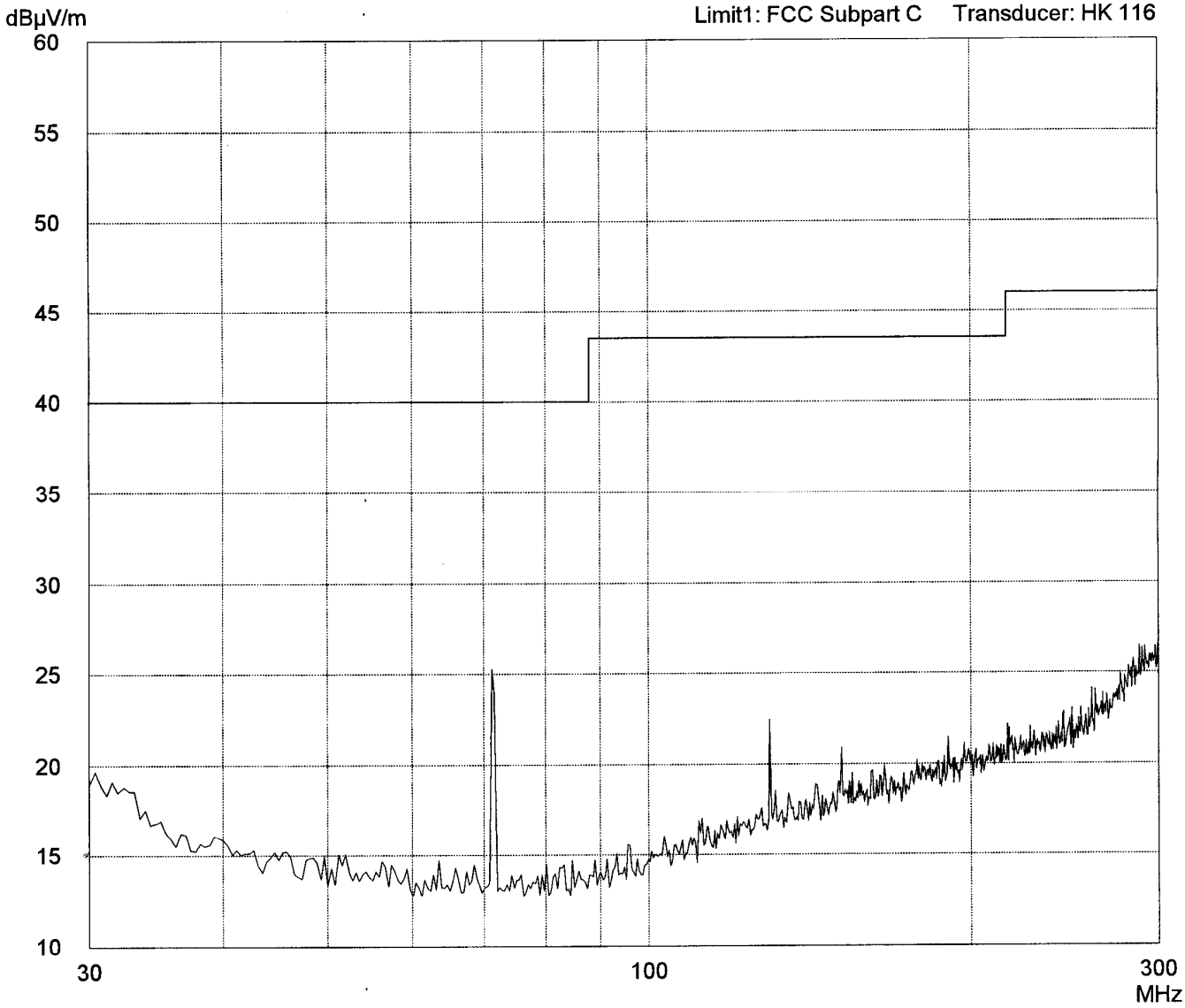
Model: HFS 3100	Mode: - TX mode - 3.6 V DC battery supply
Serial no.: WFL 130 - 20Z	
Applicant: Otto Bilz GmbH	
Test site: Semi anechoic room, cabin no. 3	
Tested on: Test distance 3 meters Horizontal Polarization	
Date of test: 03/09/1999 — Operator: R. Kohlhäufl	
Test performed: automatically — File name:	
Detector: Peak	List of values: 10 dB Margin — 50 Subranges



Result: Prescan	Project file: 50209-90104 — Page 28 of 35 Pages

Radiated Emission Test 30 MHz - 300 MHz
according to FCC Part 15 Subpart C

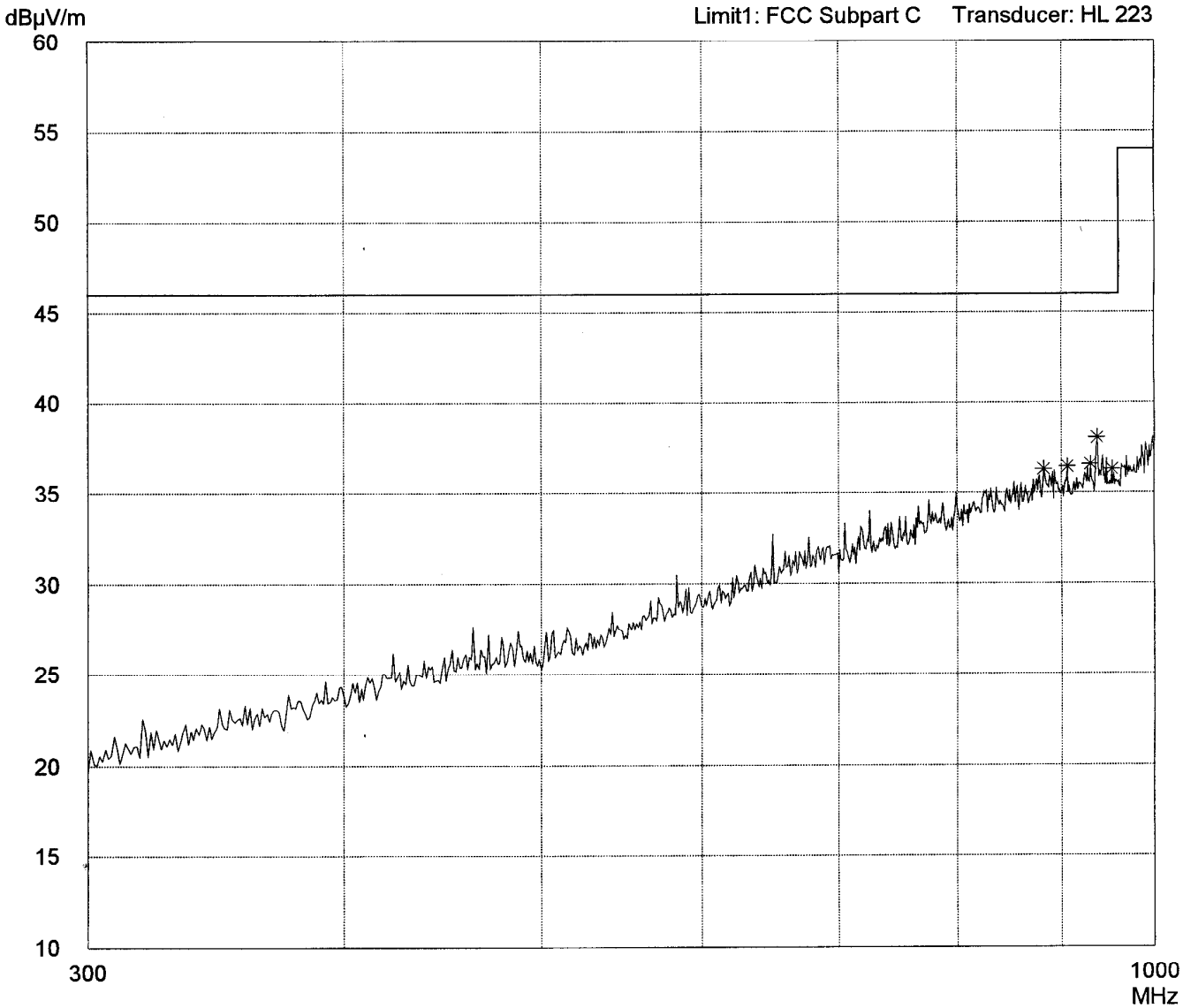
Model: HFS 3100	Mode: - TX mode - 3.6 V DC battery supply
Serial no.: WFL 130 - 20Z	
Applicant: Otto Bilz GmbH	
Test site: Semi anechoic room, cabin no. 3	
Tested on: Test distance 3 meters Vertical Polarization	
Date of test: 03/09/1999 — Operator: R. Kohlhäufl	
Test performed: automatically — File name:	
Detector: Peak	List of values: 10 dB Margin — 50 Subranges



Result: Prescan	Project file: 50209-90104 — Page 30 of 35 Pages

Radiated Emission Test 300 MHz - 1 GHz
according to FCC Part 15 Subpart C

Model: HFS 3100	Mode: - TX mode - 3.6 V DC battery supply
Serial no.: WFL 130 - 20Z	
Applicant: Otto Bilz GmbH	
Test site: Semi anechoic room, cabin no. 3	
Tested on: Test distance 3 meters Horizontal Polarization	
Date of test: 03/09/1999 / Operator: R. Kohlhäufl	
Test performed: automatically / File name:	
Detector: Peak	List of values: 10 dB Margin / 50 Subranges

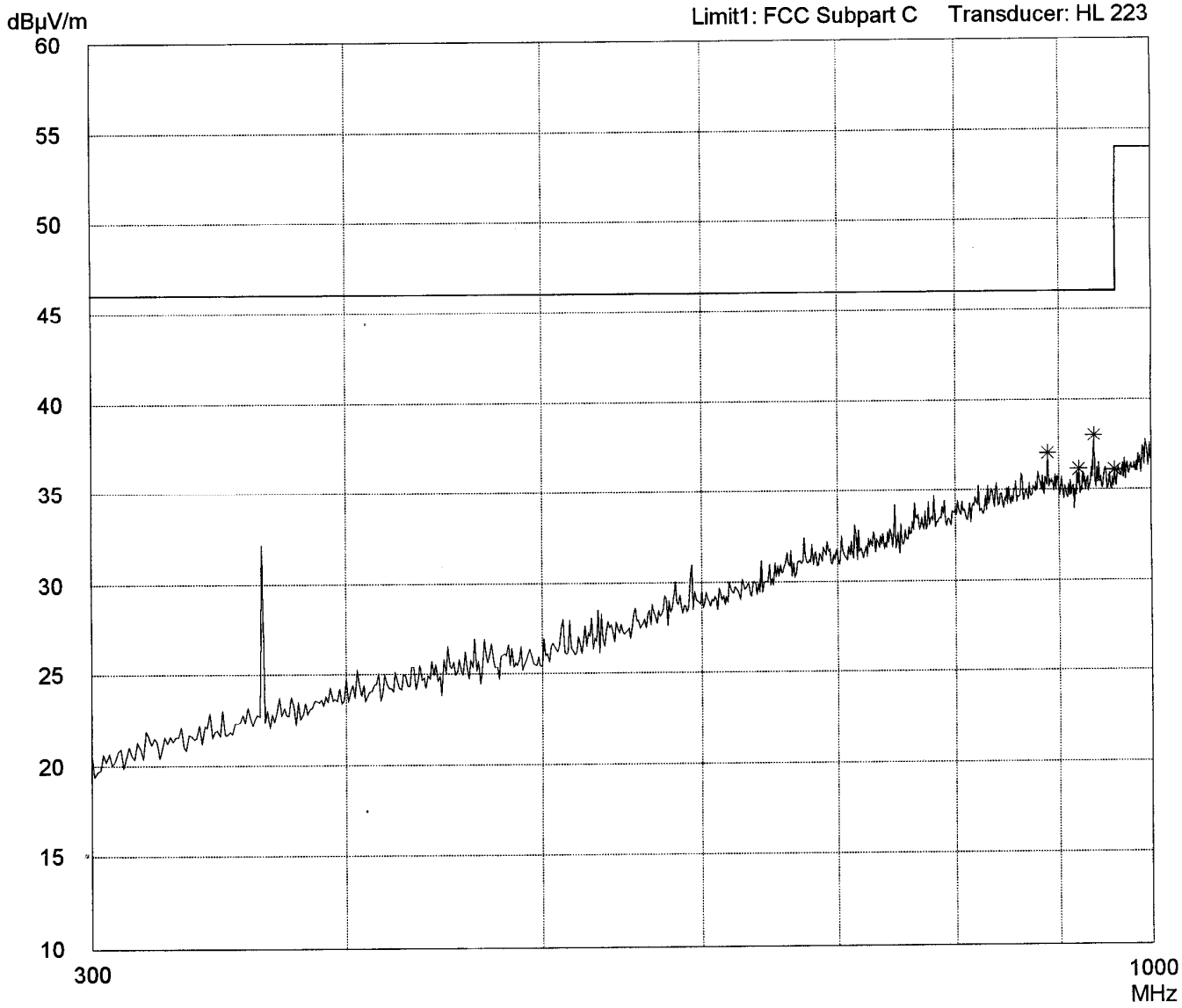


Result: Prescan	Project file: 50209-90104

Senton GmbH / EMI/EMC Laboratories / Aeussere Fruehlingsstrasse 45 / D-94315 Straubing / Tel. +49 9421 55220

Radiated Emission Test 300 MHz - 1 GHz
according to FCC Part 15 Subpart C

Model: HFS 3100	Mode: - TX mode - 3.6 V DC battery supply
Serial no.: WFL 130 - 20Z	
Applicant: Otto Bilz GmbH	
Test site: Semi anechoic room, cabin no. 3	
Tested on: Test distance 3 meters Vertical Polarization	
Date of test: 03/09/1999 / Operator: R. Kohlhäufl	
Test performed: automatically / File name:	
Detector: Peak	List of values: 10 dB Margin / 50 Subranges



Result: Prescan	Project file: 50209-90104

Senton GmbH / EMI/EMC Laboratories / Aeussere Fruehlingsstrasse 45 / D-94315 Straubing / Tel. +49 9421 55220