Senton GmbH
Aeussere Fruehlingstrasse 45
D-94315 Straubing

Straubing, October 10, 2007

T E S T - R E P O R T

No. 55503-070899-2 (Edition 1)

for

FS006H

Control unit

Applicant:	Futaba Corporation
Test Specifications:	FCC Code of Federal Regulations, CFR 47, Part 15, Sections 15.107 and 15.109 (Class B) Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 4, Sections 5.3 and 5.5 (Digital Apparatus)

Table of Contents

1 Description of the Equipment Under Test (EUT)

General data of EUT	
Type designation[1]:	FS006H
Parts[2]:	---
Serial number(s):	Without serial number
Manufacturer:	Futaba Corporation
Type of equipment:	Control unit
Version:	As received
FCC ID:	---
Additional parts/accessories:	---

[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.

2 Administrative Data

Application details	
Applicant (full address):	Futaba Corporation 1080 Yabutsuka Chosei-mura, Chosei-gun Chiba-ken 299-4395 Japan
Contact person:	Mr. Kazunori Fujita
Contract identification:	---
Receipt of EUT:	October 2, 2007
Date(s) of test:	October 8 to 9, 2007
Note(s):	---

Report details	
Report number:	55503-070899-2
Edition:	1
Issue date:	October 10, 2007

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 15.107 and 15.109 (Class B)** of the Federal Communication Commission (FCC) and the **Interference-Causing Equipment Standard ICES-003 Issue 4, Sections 5.3 and 5.5 (Digital Apparatus)** of Industry Canada (IC).

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

5 Operation Mode and Configuration of EUT

Operation Mode(s)
- powered by USB - G4 InterLink Testprogram running - stand by

Configuration(s) of EUT
connected via usb to notebook

List of ports and cables

Port	*Description*	*Classification*[3]	*Cable type*	*Cable length*
1	usb data cable	signal/control port	Shielded	2.0 m

List of devices connected to EUT

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	notebook	Latitude		DELL

List of support devices

Item	*Description*	*Type Designation*	*Serial no. or ID*	*Manufacturer*
1	not applicable			

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

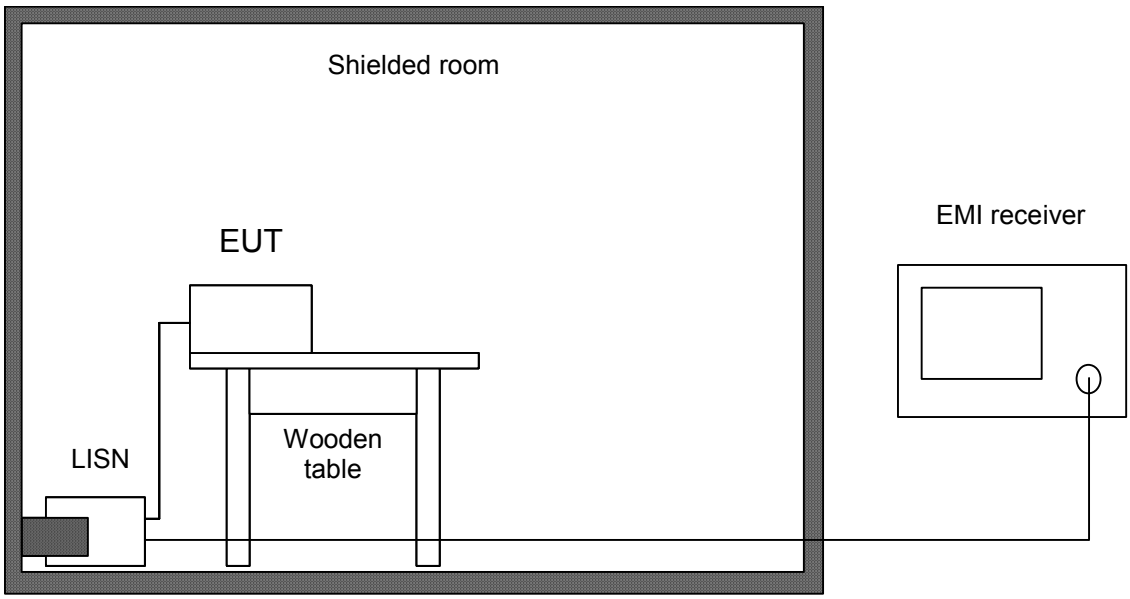
6 Measurement Procedures

6.1 Conducted AC Powerline Emission

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.107 (Class B) IC ICES-003 Issue 4, section 5.3
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.



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

6.2 Radiated Emission in Fully or Semi Anechoic Room

Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.109 (Class B) IC ICES-003 Issue 4, section 5.5
Guide:	ANSI C63.4 / CISPR 22

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.

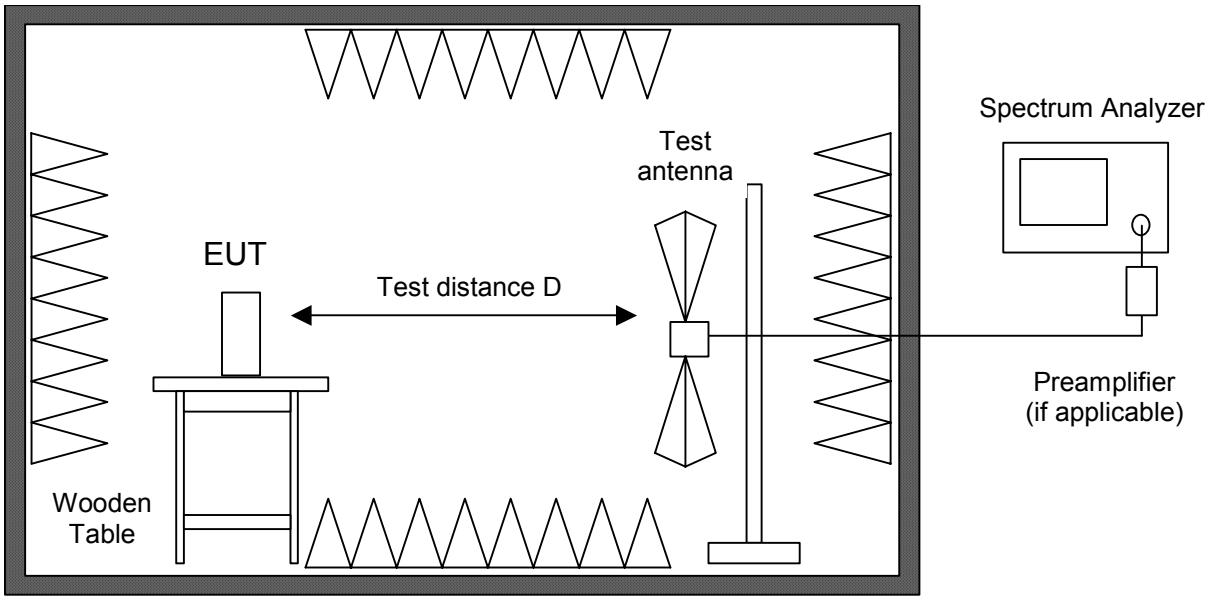
All tests below 18 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance is reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation 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 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
☐	Spectrum analyzer	R 3271	05050023	Advantest
☐	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

6.3 Radiated Emission at Open Field Test Site

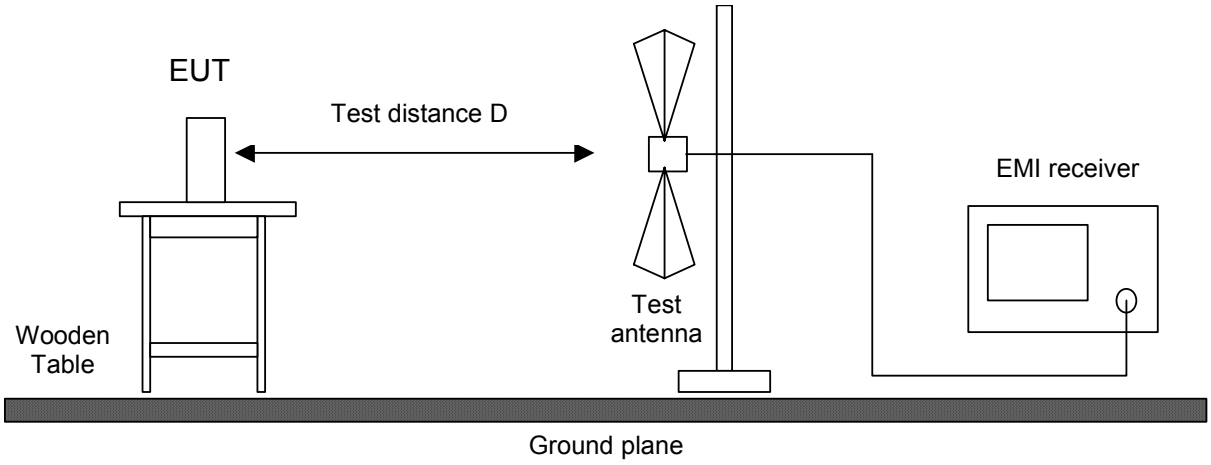
Measurement Procedure:	
Rules and specifications:	CFR 47 Part 15, section 15.109 (Class A) IC RSS-Gen Issue 2, sections 6(a) and 7.2.3.2
Guide:	ANSI C63.4 / CISPR 22

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:

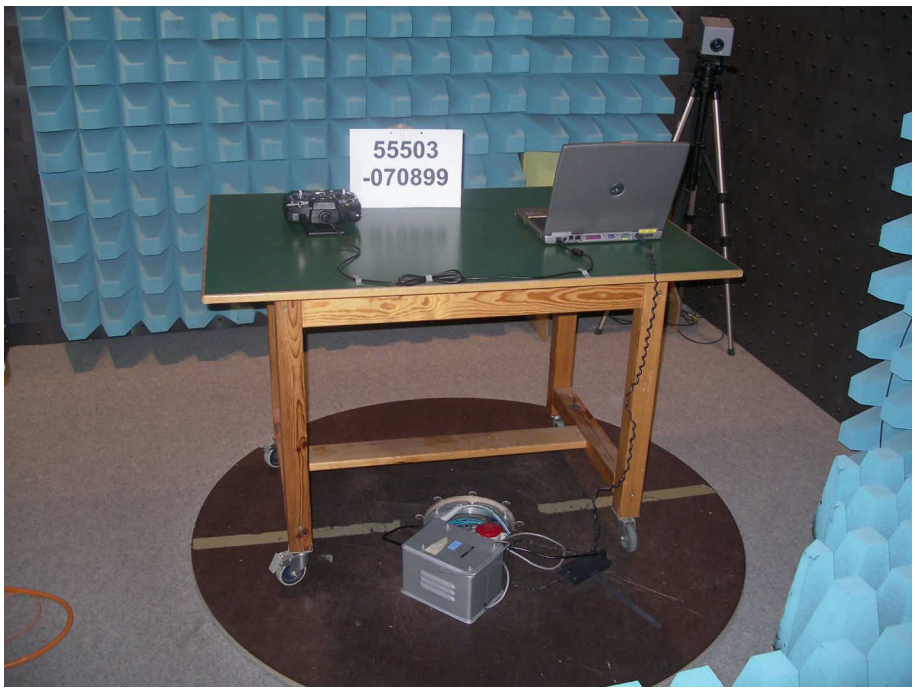
Used	Type		Model	Serial No. or ID	Manufacturer
☒	EMI receiver		ESVP	881120/024	Rohde & Schwarz
☒	Biconical antenna	EG 1	HK 116	842204/001	Rohde & Schwarz
☒	Log. per. antenna	EG 1	HL 223	841516/023	Rohde & Schwarz
☒	Open field test site		EG 1	1450	Senton

7 Photographs Taken During Testing

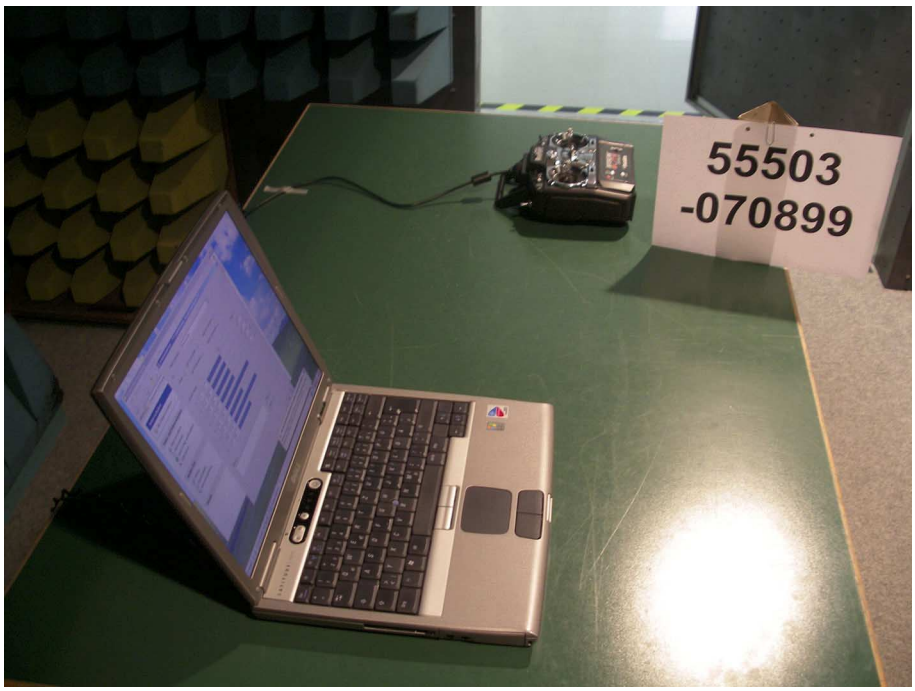
Test setup for conducted AC powerline emission measurement

Test setup for conducted AC powerline emission measurement
- continued -

Test setup for radiated emission measurement (fully anechoic room)



Test setup for radiated emission measurement (fully anechoic room) - continued -



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 Part 15 (Class B)			
Section(s)	*Test*	*Page*	*Result*
15.107	Conducted AC powerline emission 150 kHz to 30 MHz	20	Test passed
15.109	Radiated emission 30 MHz to 1 GHz	22	Test passed

IC ICES-003 Issue 4 (Class B)			
Section(s)	*Test*	*Page*	*Result*
5.3	Conducted power supply lines emission 150 kHz to 30 MHz	20	Test passed
5.5	Field intensity of radio noise emissions (Radiated) 30 MHz to 1 GHz	22	Test passed

8.1 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

Rules and specifications:	CFR 47 Part 15, section 15.107 (Class B) ICES-003 Issue 4, section 5.3		
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 (6.1)		

Comment:	---
Date of test:	09.10.2007
Test site:	Shielded room, cabin no. 1

Test Result:	Test passed

Tested on:	Linecord power supply line notebook, phase L1

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.205	Quasi-Peak	51.0	0.0	51.0	63.4	**12.4**
0.310	Quasi-Peak	42.1	0.0	42.1	60.0	17.9
0.620	Quasi-Peak	39.6	0.0	39.6	56.0	16.4
0.830	Quasi-Peak	36.2	0.0	36.2	56.0	19.8
10.255	Quasi-Peak	38.0	0.0	38.0	60.0	22.0
18.335	Quasi-Peak	37.7	0.0	37.7	60.0	22.3

Tested on:	Linecord power supply line notebook, phase N

Frequency (MHz)	Detector	Reading Value (dBµV)	Correction Factor (dB)	Final Value (dBµV)	Limit (dBµV)	Margin (dB)
0.210	Quasi-Peak	50.1	0.0	50.1	63.2	13.1
0.310	Quasi-Peak	42.8	0.0	42.8	60.0	17.2
0.415	Quasi-Peak	39.6	0.0	39.6	57.5	17.9
0.520	Quasi-Peak	42.5	0.0	42.5	56.0	13.5
0.535	Quasi-Peak	37.0	0.0	37.0	56.0	19.0
0.725	Quasi-Peak	43.8	0.0	43.8	56.0	**12.2**
0.930	Quasi-Peak	39.5	0.0	39.5	56.0	16.5
1.035	Quasi-Peak	41.0	0.0	41.0	56.0	15.0
1.345	Quasi-Peak	40.1	0.0	40.1	56.0	15.9
1.760	Quasi-Peak	39.9	0.0	39.9	56.0	16.1
2.070	Quasi-Peak	39.4	0.0	39.4	56.0	16.6
2.385	Quasi-Peak	38.2	0.0	38.2	56.0	17.8
4.145	Quasi-Peak	37.8	0.0	37.8	56.0	18.2
5.285	Quasi-Peak	39.2	0.0	39.2	60.0	20.8
7.770	Quasi-Peak	40.6	0.0	40.6	60.0	19.4

Sample calculation of final values:

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

8.2 Radiated Emission Measurement 30 MHz to 1 GHz

Rules and specifications:	CFR 47 Part 15, section 15.109 (Class B) IC ICES-003 Issue 4, section 5.5		
Guide:	ANSI C63.4 / CISPR 22		
Limit:	Frequency of Emission (MHz)	Field Strength (dBµV/m)	Measurement Distance (meters)
	30 - 230	30.0	10
	230 - 1000	37.0	10
	Above 1000	54.0	3

Comment:	---	
Date of test:	09.10.2007	
Test site:	Frequencies ≤ 1 GHz:	Open field test site
	Frequencies > 1 GHz:	Fully anechoic room, cabin no. 2
Test distance:	Frequencies ≤ 1 GHz:	10 meters
	Frequencies > 1 GHz:	3 meters

Test Result:	Test passed

Frequency (MHz)	Antenna Polarization	Detector	Receiver Reading (dBµV)	Correction Factor (dB/m)	Final Value (dBµV/m)	Limit (dBµV/m)	Margin (dB)
200.100	vertical	Quasi-Peak	8.9	16.7	25.6	30.0	4.4
200.200	horizontal	Quasi-Peak	11.8	16.7	28.5	30.0	**1.5**
216.000	vertical	Quasi-Peak	7.1	16.9	24.0	30.0	6.0
216.100	horizontal	Quasi-Peak	10.8	16.9	27.7	30.0	2.3

Sample calculation of field final values:

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

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, 2006
☒	CFR 47 Part 15	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)	May 4, 2007
☒	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

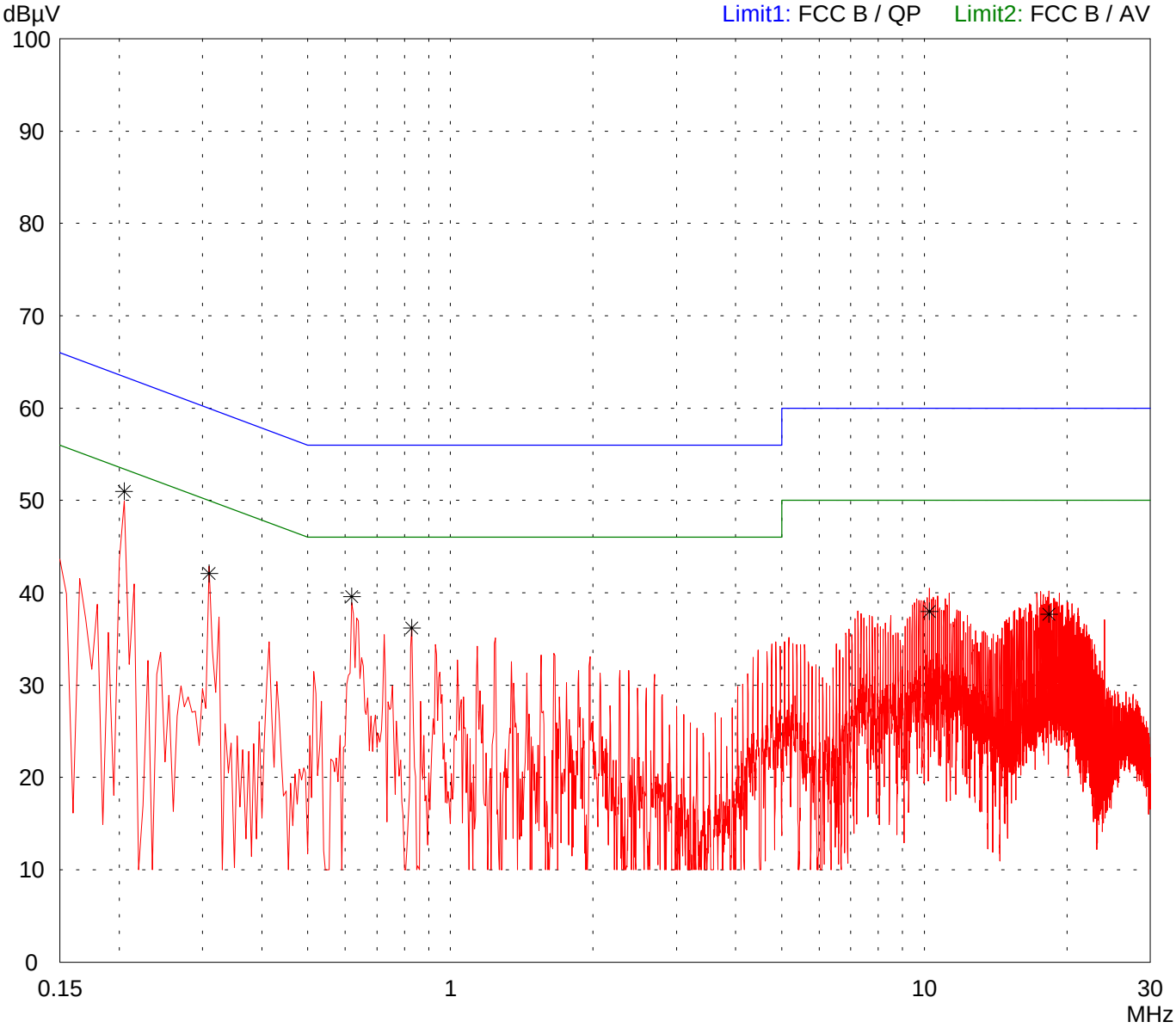
Revision History			
Edition	*Date*	*Issued by*	*Modifications*
1	10.10.2007	S. Weiherer	First Edition

11 Charts taken during testing

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

Model: FS006H	Mode: G4 InterLink Testprogram running stand by
Serial no.: ---	
Applicant: Futaba Corporation	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord power supply line notebook Phase L1	
Date of test: 10/09/2007 / Operator: S. Weiherer	
Test performed: automatically / File name:	

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

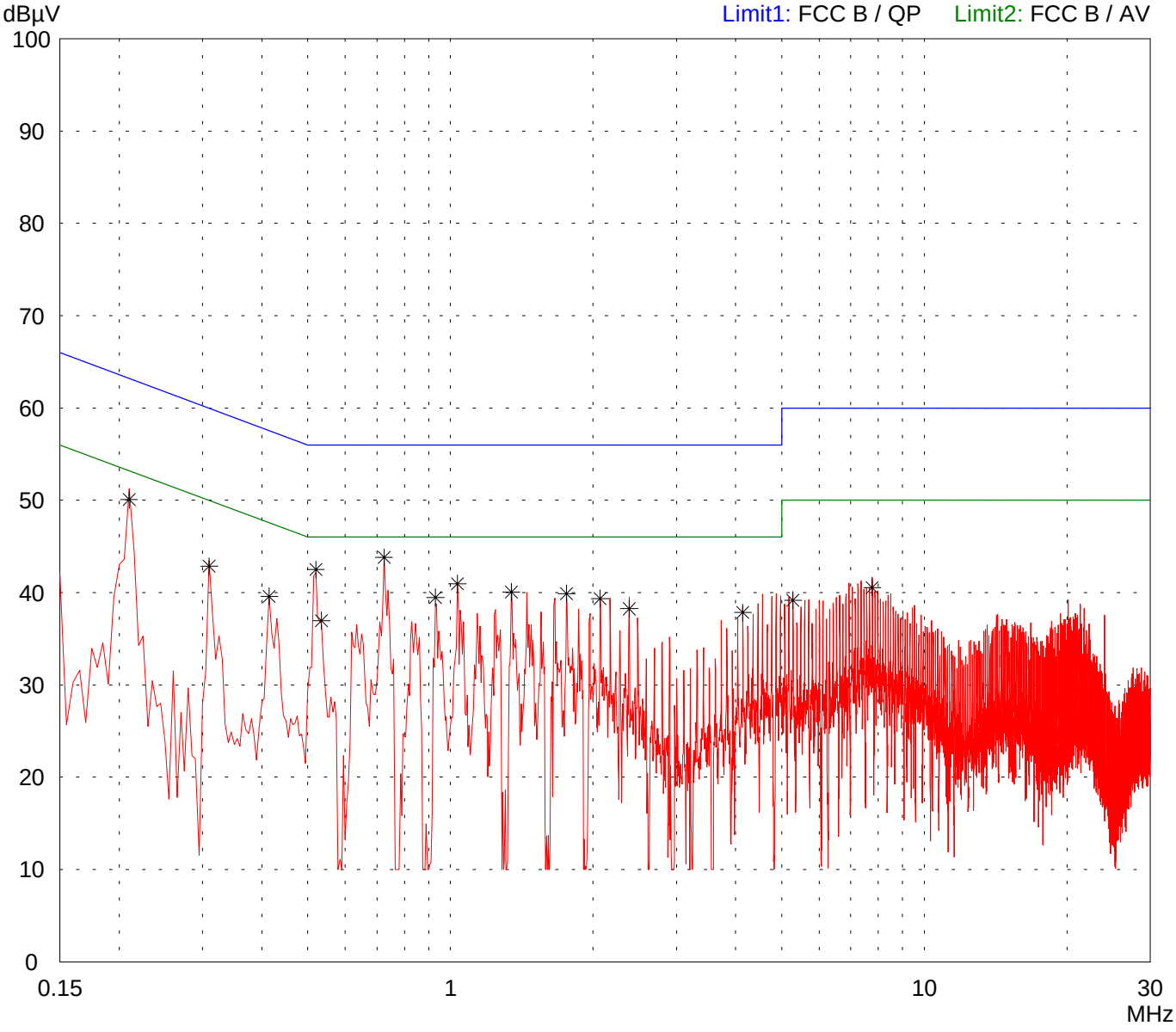


Result: Limit kept	Project file: 55503-070899

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

Model: FS006H	Mode: G4 InterLink Testprogram running stand by
Serial no.: ---	
Applicant: Futaba Corporation	
Test site: Shielded room, cabin no. 1	
Tested on: Linecord power supply line notebook Phase N	
Date of test: 10/09/2007 / Operator: S. Weiherer	
Test performed: automatically / File name:	

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

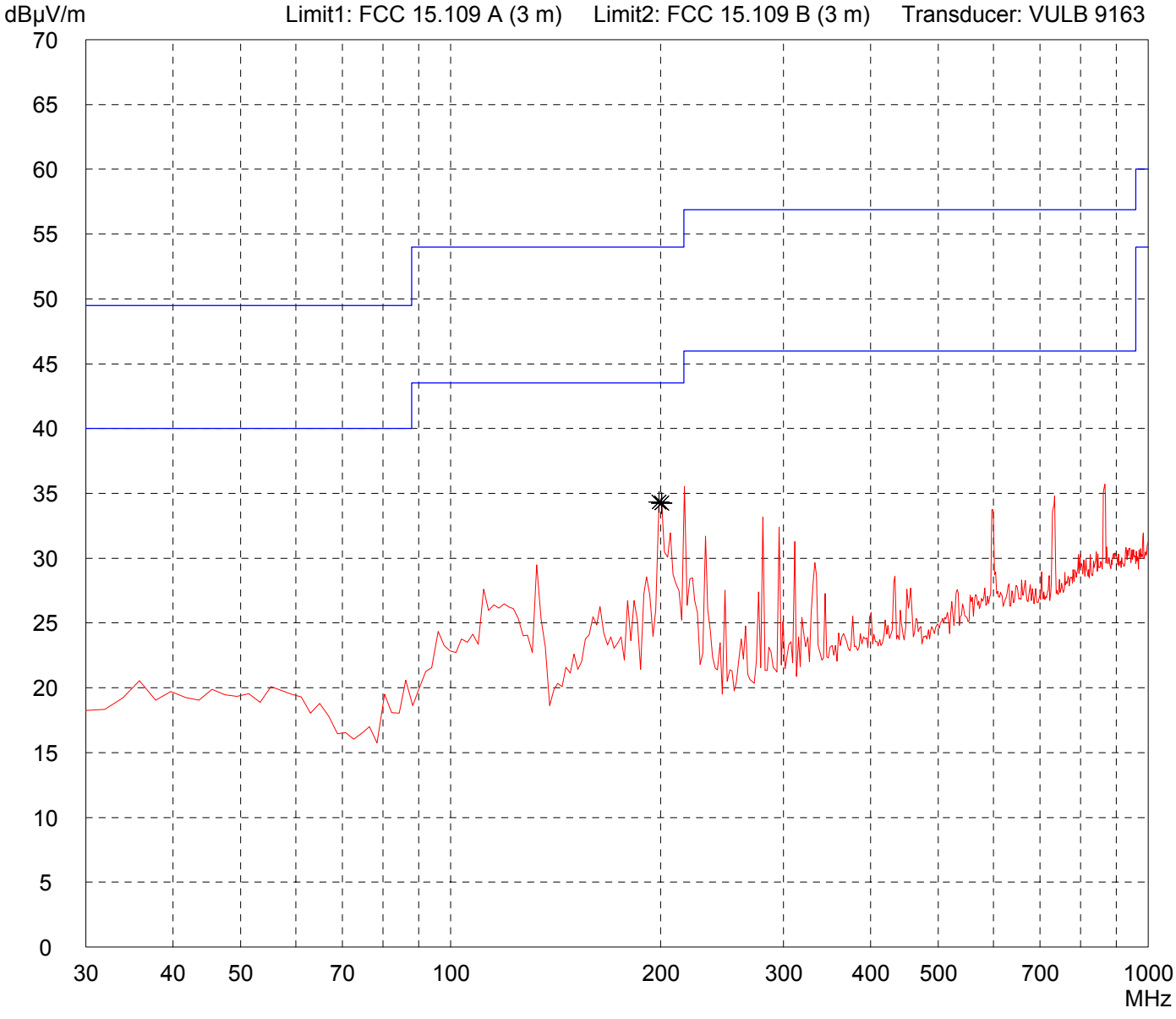


Result: Limit kept	Project file: 55503-070899

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

Model: FS006H	Comment: G4 InterLink Testprogram running stand by
Serial no.: ---	
Applicant: Futaba Corporation	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Horizontal Polarization	
Date of test: 10/09/2007 / Operator: S. Weiherer	
Test performed: automatically / File name: default.emi	

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

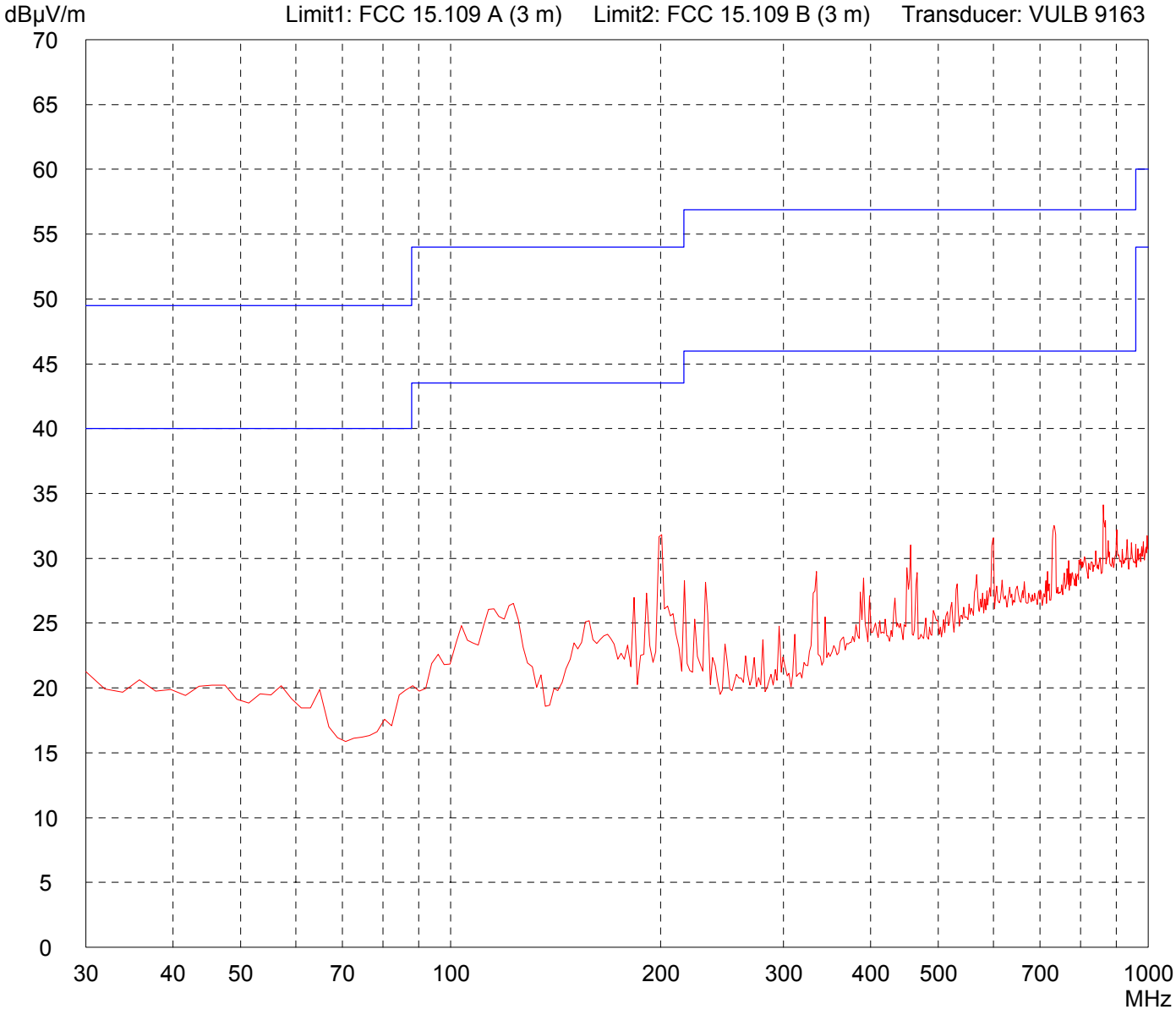


Result: Prescan	Project file: 55503-70899

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

Model: FS006H	Comment: G4 InterLink Testprogram running stand by
Serial no.: ---	
Applicant: Futaba Corporation	
Test site: Fully anechoic room, cabin no. 2	
Tested on: Test distance 3 metres Vertical Polarization	
Date of test: 10/09/2007 / Operator: S. Weiherer	
Test performed: automatically / File name: default.emi	

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



Result: Prescan	Project file: 55503-70899