



RADIO TEST REPORT

Test Report No. : 28FE0222-HO-A

Applicant : **Brother Industries, Ltd.**
Type of Equipment : **Multi-Function Center**
Model No. : **MFC-990CW**
FCC ID : **B3Q8CAG19**
Test regulation : **FCC Part 15 Subpart C 2008
Section 15.207, Section 15.247**
Test Result : **Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report must not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

Date of test:

March 21 to 27, 2008


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NVLAP LAB CODE: 200572-0

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MF060b (09.01.08)

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SECTION 1: Customer information

Company Name : Brother Industries, Ltd.
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SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Multi-Function Center
Model No. : MFC-990CW
Serial No. : 999999B8F001800, 999999B8F001728
Rating : AC120V, 60Hz
Receipt Date of Sample : March 21, 2008
Country of Mass-production : China
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT : No Modification by the test lab

2.2 Product Description

Model No: MFC-990CW (referred to as the EUT in this report) is the Multi-Function Center.
EUT is a composite device with the function of FAX, Scanner, Copy, Printer,and cordless phone.

Clock frequency(ies) in the system : 13.824MHz
Equipment Type : Transceiver
Frequency of Operation : 5725.809328MHz to 5848.889420MHz: 139ch*
Bandwidth : 1MHz
Modulation : FHSS
Power Supply (inner) : DC 3.3V
Antenna Type : 1/4 lambda dipole antenna(Installed outside)
Wire antenna(Installed inside)
Antenna Connector Type : None
Antenna Gain : Peak 6.1dBi

*The channels for usage

	0	1	2	3	4	5	6	7	8	9
0	1	3	5	7	9	11	13	15	17	19
10	21	23	25	27	29	31	33	35	37	39
20	41	43	45	47	49	51	53	55	57	59
30	61	63	65	67	69	71	73	75	77	79
40	81	83	85	87	89	91	93	95	97	99
50	101	103	105	107	109	111	113	115	117	119
60	121	123	125	127	129	130	131	132	133	134
70	135	136	137	138	139					

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C: 2008, final revised on March 24, 2008

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.247 Operation within the bands 902-928MHz,
2400-2483.5MHz, and 5725-5850MHz

*The revision on March 24, 2008 does not influence the test specification applied to the EUT.

FCC 15.31 (e)

This EUT provides stable voltage(DC3.3V) constantly to RF Module regardless of input voltage. Therefore, this EUT complies with the requirement.

FCC Part 15.203 Antenna requirement

It is impossible for end users to replace the antenna, because the antenna is mounted inside of the EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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3.2 Procedures and results

[FHSS]

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst Margin	Results
1	Conducted emission	FCC: ANSI C63.4:2003 7. AC powerline conducted emission measurements	FCC: Section 15.207	-	N/A	[QP] 13.2 dB 0.15000MHz, L [AV] 15.7dB 0.56133MHz, L	Complied
		IC: RSS-Gen 7.2.2	IC: RSS-Gen 7.2.2				
2	Carrier Frequency Separation	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(a)(1)	Conducted	N/A	See data.	Complied
		IC: -	IC: RSS-210 A8.1 (b)				
3	20dB Bandwidth	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(a)(1)(ii)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (a) (e)				
4	Number of Hopping Frequency	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(a)(1)(ii)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (e)				
5	Dwell time	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(a)(1)(ii)	Conducted	N/A		Complied
		IC: -	IC: RSS-210 A8.1 (e)				
6	Maximum Peak Output Power	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(b)(1)	Conducted	N/A	Complied	
		IC: RSS-Gen 4.8	IC: RSS-210 A8.4 (3)				
7	Band Edge Compliance	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(d)	Conducted	N/A	Complied	
		IC: -	IC: RSS-210 A8.5				
8	Spurious Emission	FCC: FCC Public Notice DA 00-705	FCC: Section15.247(d)	Conducted/ Radiated	N/A	[Tx] 6.0dB 11697.8MHz Horizontal, PK [Rx] 8.9dB 3359.6MHz Vertical, AV	Complied
		IC: RSS-Gen 4.9 RSS-Gen 4.10	IC: RSS-210 A8.5 RSS-Gen 7.2.1 and 7.2.3				

Note: UL Japan, Inc.'s EMI Work Procedures No.QPM05 and QPM15.

*These tests were performed without any deviations from test procedure except for additions or exclusions.

* In case any questions arise about test procedure, ANSI C63.4: 2003 is also referred.

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3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	IC: RSS-Gen 4.6.1	IC: RSS-Gen 4.6.1	Conducted	N/A	N/A	N/A

3.4 Uncertainty

EMI

The following uncertainties have been calculated to provide a confidence level of 95% using a coverage factor k=2.

Test room	Conducted emission	Radiated emission (10m*)				Radiated emission (3m*)			Radiated emission (3m*)	
	150kHz-30MHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	9kHz-30MHz	30MHz-300MHz	300MHz-1GHz	1GHz-18GHz	18GHz-40GHz	
No.1 semi-anechoic Chamber (±)	3.7dB	3.1dB	4.7dB	4.4dB	3.2dB	3.7dB	4.4dB	5.9dB	6.1dB	
No.2 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.3dB	3.9dB	5.9dB	6.1dB	
No.3 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB	
No.4 semi-anechoic chamber (±)	3.7dB	-	-	-	3.2dB	4.2dB	4.4dB	5.9dB	6.1dB	

*10m/3m = Measurement distance

Conducted emission test

The data listed in this test report has enough margin, more than the site margin.

Radiated emission test(3m)

The data listed in this test report has enough margin, more than the site margin.

Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty for this test is 3.0dB.

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3.5 Test Location

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	FCC Registration Number	IC Registration Number	Width x Depth x Height (m)	Size of reference ground plane (m) / horizontal conducting plane	Other rooms
No.1 semi-anechoic chamber	313583	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	No.1 Power source room
No.2 semi-anechoic chamber	655103	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 semi-anechoic chamber	148738	IC4247-3	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.3 Preparation room
No.3 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.4 semi-anechoic chamber	134570	IC4247-4	12.0 x 8.5 x 5.9m	6.8 x 5.75m	No.4 Preparation room
No.4 shielded room	-	-	4.0 x 6.0 x 2.7m	N/A	-
No.5 semi-anechoic chamber	-	-	6.0 x 6.0 x 3.9m	6.0 x 6.0m	-
No.6 shielded room	-	-	4.0 x 4.5 x 2.7m	4.75 x 5.4 m	-
No.6 measurement room	-	-	4.75 x 5.4 x 3.0m	4.75 x 4.15 m	-
No.7 shielded room	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.8 measurement room	-	-	3.1 x 5.0 x 2.7m	N/A	-
No.9 measurement room	-	-	8.0 x 4.5 x 2.8m	2.0 x 2.0m	-
No.10 measurement room	-	-	2.6 x 2.8 x 2.5m	2.4 x 2.4m	-
No.11 measurement room	-	-	3.1 x 3.4 x 3.0m	2.4 x 3.4m	-

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1, No.2, No.3, and No.4 semi-anechoic chambers and No.3 and No.4 shielded rooms.

3.6 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

SECTION 4: Operation of E.U.T. during testing

4.1 Operating Mode(s)

Test Item	Operating Mode	Tested frequency
Conducted Emission	Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz Mid Channel (ch 71): 5788.240269MHz High Channel (ch 139): 5848.889420MHz
	Receiving (Rx) Hopping off	Mid Channel (ch 71): 5788.240269MHz
Carrier Frequency Separation	Transmitting (Tx) mode Hopping on *1)	5725.809328MHz to 5848.889420MHz
20dB Bandwidth Maximum Peak Output Power	Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz Mid Channel (ch 71): 5788.240269MHz High Channel (ch 139): 5848.889420MHz
Number of Hopping Frequency	Transmitting (Tx) mode Hopping on *1)	5725.809328MHz to 5848.889420MHz
Dwell time	Transmitting (Tx) mode Hopping on *1)	5725.809328MHz to 5848.889420MHz
Spurious Emission	<Conducted> Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz Mid Channel (ch 71): 5788.240269MHz High Channel (ch 139): 5848.889420MHz
	<Radiated> Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz Mid Channel (ch 71): 5788.240269MHz High Channel (ch 139): 5848.889420MHz
	Receiving (Rx) Hopping off	Mid Channel (ch 71): 5788.240269MHz
Band Edge Compliance (Conducted)	Transmitting (Tx) mode Hopping on *1)	Low Channel (ch 1): 5725.809328MHz High Channel (ch 139): 5848.889420MHz
	Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz High Channel (ch 139): 5848.889420MHz
99% Occupied Bandwidth	Transmitting (Tx) mode Hopping on *1)	5725.809328MHz to 5848.889420MHz
	Transmitting (Tx) mode Hopping off	Low Channel (ch 1): 5725.809328MHz Mid Channel (ch 71): 5788.240269MHz High Channel (ch 139): 5848.889420MHz

*1) EUT communicates with Digital Cordless Handset.

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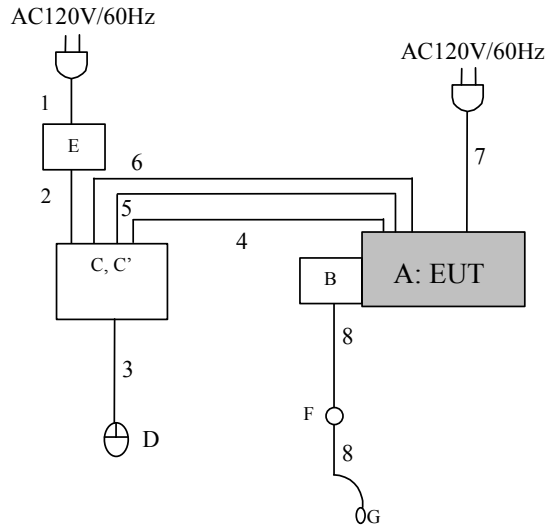
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4.2 Configuration and peripherals



* Cabling and setup were taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

No.	Item	Model number	Serial number	Manufacturer	Remarks
A	Multi-Function Center	MFC-990CW	999999B8F001800 *1), 999999B8F001728 *2)	Brother Industries, Ltd.	EUT
B	Digital Cordless	BCL-D60	0700138E	Brother Industries, Ltd.	-
C	Note PC	267LJ3	97ALT9W	IBM	- *3)
C'	Note PC	2366LJ7	99D4L	IBM	- *4)
D	Mouse	TK-MSUK	060801070	Sanwa Supply	-
E	AC Adapter	02K6750	11S02K6750Z1Z2UP3561HY	IBM	-
F	Microphone	-	-	Brother Industries, Ltd.	-
G	Earphone	-	-	Brother Industries, Ltd.	-

*1) For External antenna tests *2) For Internal antenna tests

*3) Used for Conducted emission test *4) Used for Radiated emission test

List of cables used

No.	Name	Length (m)	Shield	
			Cable	Connector
1	AC Cable	1.0	Unshielded	Unshielded
2	DC Cable	1.6	Unshielded	Unshielded
3	USB Cable	1.5	Shielded	Shielded
4	TEL Cable	1.5	Unshielded	Unshielded
5	USB Cable	3.0	Shielded	Shielded
6	LAN Cable	3.0	Unshielded	Unshielded
7	AC Cable	1.8	Unshielded	Unshielded
8	Audio Cable	1.0	Unshielded	Unshielded

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SECTION 5: Conducted Emission

Test Procedure and conditions

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. The rear of EUT, including peripherals aligned and flushed with rear of tabletop. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from a Line Impedance Stabilization Network (LISN)/ Artificial mains Network (AMN) and excess AC cable was bundled in center.

1) For the tests on EUT with other peripherals (as a whole system)

I/O cable and AC cables that were connected to the peripherals were bundled in center. They were folded back and forth forming a bundle 30cm to 40cm long and were hanged at a 40cm height to the ground plane. All unused 50ohm connectors of the LISN(AMN) were resistivity terminated in 50ohm when not connected to the measuring equipment.

The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT in a Semi Anechoic Chamber or a Measurement Room.

The EUT was connected to a LISN (AMN).

An overview sweep with peak detection has been performed.

Detector : quasi-peak and average detector (IF BW 9 kHz)
Measurement range : 0.15-30MHz
Test data : APPENDIX 2
Test result : Pass

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SECTION 6: Spurious Emission

[Conducted]

Test Procedure

The Out of Band Emission was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- RBW: 100kHz
- VBW: 300kHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

Test data : APPENDIX 2

Test result : Pass

[Radiated]

Test Procedure

EUT was placed on a urethane platform of nominal size, 1.0m by 1.5m, raised 80cm above the conducting ground plane. The Radiated Electric Field Strength intensity has been measured in a Semi Anechoic Chamber with a ground plane and at a distance of 3m(Below 10GHz) and 1m(10GHz-26.5GHz) and 0.5m (26.5GHz-40GHz).

The height of the measuring varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer (in linear mode).

The test was made with the detector (RBW/VBW) in the following table.

When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator confirmed 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on a radiated measurement.

20dBc was applied to the frequency over the limit of FCC 15.209 / Table 2 of RSS-210 2.7 (IC) and outside the restricted band of FCC15.205 / Table 1 of RSS-210 2.7 (IC).

Frequency	Below 1GHz	Above 1GHz
Instrument used	Test Receiver / Spectrum Analyzer	Spectrum Analyzer
Detector	QP: BW 120kHz(T/R)	PK: RBW:1MHz/VBW: 1MHz
IF Bandwidth	20dBc : RBW: 100kHz VBW: 300kHz (S/A)	AV: RBW:1MHz/VBW:10Hz 20dBc : RBW:100kHz/VBW:300kHz

- The carrier level and noise levels were confirmed at each position of 0 deg., 90deg. and 180 deg. of External antenna, and Internal antenna to see the position of maximum noise, and the test was made at the position that has the maximum noise.

Test data : APPENDIX 2

Test result : Pass

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SECTION 7: Bandwidth

Test Procedure

The bandwidth was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- Span: 1.5MHz
- RBW: 30kHz
- VBW: 30kHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

Test data : APPENDIX 2
Test result : Pass

SECTION 8: Maximum Peak Output Power

Test Procedure

The Maximum Peak Output Power was measured with a power meter (tested bandwidth: 50MHz) connected to the antenna port.

Test data : APPENDIX 2
Test result : Pass

SECTION 9: Carrier Frequency Separation

Test Procedure

The carrier frequency separation was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- Span: 6MHz/3MHz
- RBW: 100kHz
- VBW: 300kHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

Test data : APPENDIX 2
Test result : Pass

SECTION 10: Number of Hopping Frequency

Test Procedure

The Number of Hopping Frequency was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- Span: 30MHz
- RBW: 300kHz
- VBW: 1MHz
- Sweep: Auto
- Detector: Peak
- Trace: Max Hold

Test data : APPENDIX 2
Test result : Pass

SECTION 11: Dwell time

Test Procedure

The Dwell time was measured with a spectrum analyzer connected to the antenna port.
The following spectrum analyzer setting was used:

- Span: Zero Span
- RBW: 100kHz
- VBW: 100kHz
- Sweep: as necessary to capture the entire dwell time per hopping channel
- Detector: function peak
- Trace: Max Hold

Test data : APPENDIX 2
Test result : Pass

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