



# EMI TEST REPORT

Test Report No. : 24IE0033-HO

Applicant : OMRON Corporation  
Industrial Automation Business Company

Type of Equipment : Radio Frequency Identification System and ID Tag

Model No. : V670-CF01  
Model No.(ID Tag) : V670-D13F03/V670-D13F01/V670-D13F01H

Test standard : FCC Part 15 Subpart B : 2004  
Section 15.109  
FCC Part 15 Subpart C : 2004  
Section 15.225 and 15.209

FCC ID : E4E6CYCIDV6700104

Test Result : Complied

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.


Date of test:

June 14 and 15, 2004

Tested by:

  
Makoto Kosaka  
EMC Service

Approved by :

  
Naoki Sakamoto  
Group Leader of  
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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MF060b(10.04.03)

<b>CONTENTS</b>	<b>PAGE</b>
<b>SECTION 1: Client information</b> .....	<b>3</b>
<b>SECTION 2: Equipment under test (E.U.T.)</b> .....	<b>3</b>
<b>SECTION 3: Test specification, procedures &amp; results</b> .....	<b>4</b>
<b>SECTION 4: Operation of E.U.T. during testing</b> .....	<b>6</b>
<b>SECTION 5: Radiated emission (Fundamental and Spurious Emission)</b> .....	<b>7</b>
<b>SECTION 6: -20dB Bandwidth</b> .....	<b>8</b>
<b>SECTION 7: Frequency Tolerance</b> .....	<b>8</b>
<b>APPENDIX 1: Photographs of test setup</b> .....	<b>9</b>
Radiated emission (Spurious emission).....	9
Worst Case Position (Z-axis: 0deg) .....	10
<b>APPENDIX 2: Test instruments</b> .....	<b>11</b>
<b>APPENDIX 3: Data of EMI test</b> .....	<b>12</b>
Radiated emission(Fundamental emission) .....	12
Radiated emission (Spurious emission : below 30MHz).....	14
Radiated emission (Spurious emission : above 30MHz).....	15
-20dB Bandwidth.....	16
Frequency Tolerance .....	17

## **SECTION 1: Client information**

Company Name : OMRON Corporation  
Industrial Automation Business Company  
Brand or Trade name : OMRON  
Address : Shiokoji-hirokawa, Shimogyo-ku, Kyoto, 600-8530 JAPAN  
Telephone Number : +81-75-344-7069  
Facsimile Number : +81-75-344-7069  
Contact Person : Hiroshi Yamazaki

## **SECTION 2: Equipment under test (E.U.T.)**

### **2.1 Identification of E.U.T.**

Type of Equipment : Radio Frequency Identification System and ID Tag  
Model No. : V670-CF01  
Model No.(ID Tag) : V670-D13F03/V670-D13F01/V670-D13F01H  
Serial No. : 4 / 0940V(ID Tag)  
Country of Manufacture : Japan  
Rating : DC3.3V / 0.2A  
Receipt Date of Sample : June 07, 2004  
Condition of EUT : Production model

### **2.2 Product Description**

Model No: V670-CF01 is a ID System.

The Antenna in the V670-CF01 exchanges data to and from various types of Radio Frequency (RF) ID Tags. Each Tag is attached on an object that is to be identified by the Antenna. The data exchange between the Tag and the Antenna is bi-directional.

Equipment Type : Transceiver  
Type of modulation : Amplitude Shift Keying  
Mode of operation : Simplex  
Antenna Type : PWB Loop Antenna  
Antenna area : 176.625 mm<sup>2</sup>  
Method of Frequency Generation : 13.56MHz(Crystal)  
Operating Temperature : 0 deg. C. to +40 deg. C.

#### **FCC 15.31 (e)**

This test was performed with the New Lithium Battery (DC 7.4V/PDA) and the constant voltage(DC 3.3V) was supplied to this EUT during the tests. Therefore, this EUT complies with the requirement.

\*The PDA used with EUT is selected by the client. The PDA has DC 3.3V output power. EUT has the built-in circuit, which has the stable voltage.

#### **FCC Part 15.203 Antenna requirement**

Type of Equipment and its antenna comply with this requirement since it has an original antenna connector in host device Model No. V670-CF01 when they are put up for sale.

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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### **Head Office EMC Lab.**

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**SECTION 3: Test specification, procedures & results**

**3.1 Test Specification**

Test Specification : FCC Part 15 Subpart B : 2003  
Section 15.109  
FCC Part 15 Subpart C : 2003  
Section 15.225 and 15.209

Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators  
Section 15.225 : Operation within the band 13.553 – 13.567 MHz

**3.2 Procedures and results**

**1) FCC Part 15 Subpart C : 2003**

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Electric Field Strength of Fundamental Emission and Band Edges	ANSI C63.4:2003 8. Radiated emission measurements	Section 15.225(a)(b)(c)	Radiated	N/A	61.0dB 13.5610MHz	Complied
2	-20dB Bandwidth	ANSI C63.4:2003 Annex H. 6 Occupied bandwidth measurements	Section15.215(c)	Radiated	N/A	-	N/A
3	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 8. Radiated emission measurements	Section15.225(d) Section15.209	Radiated	N/A	5.4dB 718.817MHz Horizontal	Complied
4	Frequency Tolerance	ANSI C63.4:2003 Annex H. 5 Frequency measurements	Section15.225(e)	Radiated	N/A	87.44 ppm (T nom 50°C V nom DC3.3V Power on)	Complied
5	Conducted emission	ANSI C63.4:2003 7. AC powerline conducted emission measurements	Section15.207	Conducted	N/A	N/A*1	N/A

Note: UL Apex's EMI Work Procedures No.QPM05.

\*1) The PDA with EUT has only built-in DC Battery. In the User's manual, this type of PDA is limited to be connected with EUT.

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

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### 3.3 Uncertainty

#### Fundamental and Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is  $\pm 1.8\text{dB}(10\text{m})$ .

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is  $\pm 4.5\text{dB}(3\text{m})/\pm 4.7\text{dB}(10\text{m})$ .

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is  $\pm 5.2\text{dB}(3\text{m})/\pm 3.8\text{dB}(10\text{m})$ .

The data listed in this test report has enough margin.

### 3.4 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. \*NVLAP Lab. code: 200572-0

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	Listed date (for FCC)	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	February 01, 2002	313583	IC4247	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	June 05, 2002	846015	IC4247-2	7.5 x 5.8 x 5.2m	4.0 x 4.0m	-
No.3 shielded room	-	-	-	4.7 x 7.5 x 2.7m	4.7 x 7.5m	-
No.4 measurement room	-	-	-	3.1 x 5.0 x 2.7m	N/A	-

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

### 3.5 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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

### **4.1 Operating Modes**

The EUT was operated in a manner similar to typical use during the tests.

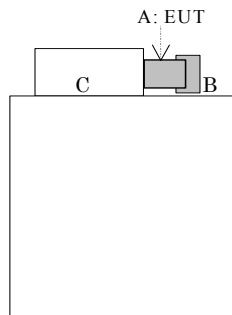
The mode is used : Communication mode (Transmitting)

Justification: The system was configured in typical fashion (as a customer would normally use it) for testing.

Frequency Tolerance:

Temperature for the extreme tests : -20 deg.C.(minimum) to + 50deg.C.(maximum)  
 Voltage for the extreme tests : N/A

### **4.2 Configuration and peripherals**



\*The data of EUT direction is taken in worse condition.

#### **Description of EUT and Support equipment**

No.	Item	Model number	Serial number	Manufacturer	FCC ID	Remarks
A	RFID System	V670-CF01	4	OMRON	E4E6CYCIDV6700104	EUT
B	ID Tags	V670-D13F01H	0940V	OMRON	-	EUT
C	Pocket PC	PDT8046	M1H47V53D	Symbol Technologies INC.	DoC	-

#### **Additional Information for ID Tags**

- 1) All three ID Tags are identical in electrical characteristics according to the client. The test was made with the typical type as shown in the above table.
- 2) All three ID Tags are not Powered Tags (It does not have its power source.)

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## **SECTION 5: Radiated emission (Fundamental and Spurious Emission)**

### **5.1 Operating environment**

Test place : a No.1 semi Anechoic Chamber (Fundamental and Spurious emission  
/below 30MHz and above 30MHz)  
Temperature : See data  
Humidity : See data

### **5.2 Test configuration**

EUT was placed on a platform of nominal size, 0.5m by 0.5m, raised 80cm above the conducting ground plane. The EUT was set on the center of the tabletop and the peripheral was aligned and flushed with rear of tabletop. Test was made with the Loop antenna positioned in 0° to 180° of the polarization. Test was made with the Biconical, and Logperiodic antenna positioned in both the horizontal and vertical planes of polarization. The center of the Loop antenna was 1 m height from the ground plane. The Biconical, and Logperiodic antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. A drawing of the set up is shown in the photos of APPENDIX 1.

### **5.3 Test conditions**

Frequency range : 9kHz -30MHz : 30MHz-1000MHz  
Test distance : 10m : 3 m  
EUT position : Tabletop : Tabletop  
EUT operating mode : Continuous Transmitting: Continuous Transmitting

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#### 5.4 Test procedure

The Radiated Electric Field Strength intensity has been measured on a semi anechoic chamber with a ground plane and at a distance of 10m (9kHz-30MHz) and 3m (30-1000MHz).

The measuring antenna height was varied between 1 to 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity (30-1000MHz).

The measurements were performed for 0 deg. to 180 deg. (Loop antenna) or vertical and horizontal (Biconical and Logperiodic antenna) antenna polarization.

The radiated emission measurements were made with the following detector function of the test receiver.

Detector Type : PK

IF Bandwidth : 1 kHz (13.553MHz and 13.567MHz)

Remark: This is a reference data for the confirmation of complied Bandedge.

Measurements were performed with a QP, PK, and AV detector.

The radiated emission measurements were made with the following detector function of the test receiver.

	From 9kHz to 90kHz and From 110kHz to 150kHz	From 90kHz to 110kHz	From 150kHz to 490kHz	From 490kHz to 30MHz	From 30MHz to 1GHz
Detector Type	PK/AV	QP	PK/AV	QP	QP
IF Bandwidth	200Hz	200Hz	9kHz	9kHz	120kHz

\* Part 15 Section 15.31 (f)(2) (9kHz-30MHz)

[Limit at 10m]=[Limit at 300m]-40 x log (10[m]/300[m])

[Limit at 10m]=[Limit at 30m]-40 x log (10[m]/30[m])

### **SECTION 6: -20dB Bandwidth**

#### **Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data : APPENDIX 3**

### **SECTION 7: Frequency Tolerance**

#### **Test Procedure**

The measurement was performed in the antenna height to gain the maximum of Electric field strength.

**Test data : APPENDIX 3**

**Test result : Pass**

**UL Apex Co., Ltd.**

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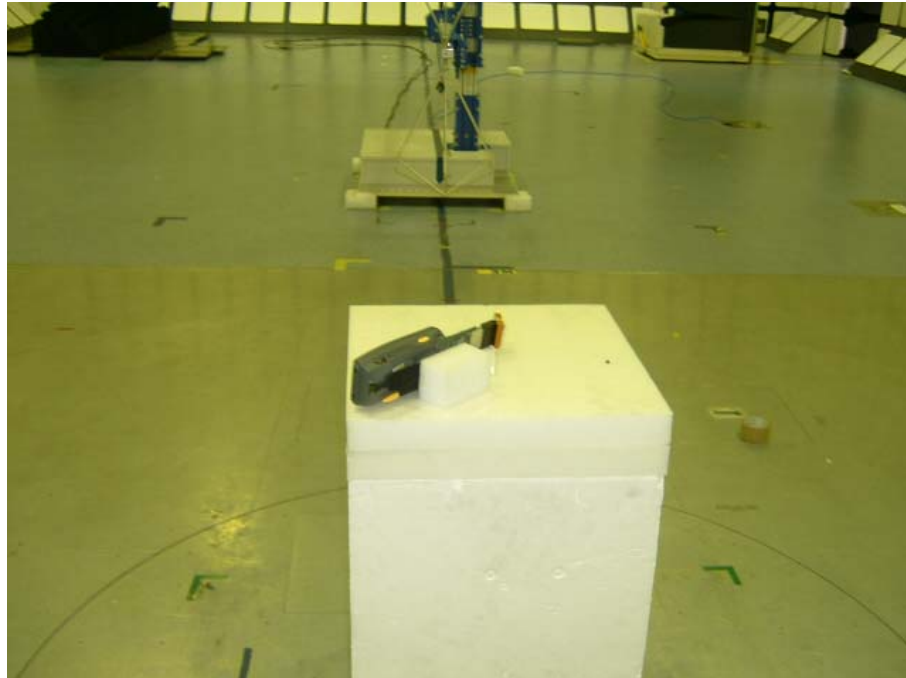
**APPENDIX 1: Photographs of test setup**

**Radiated emission (Spurious emission)**

**Front**



**Rear**



**Worst Case Position (Y-axis: 0deg)**

**X-axis**



**Y-axis**



**Z-axis**



## APPENDIX 2: Test instruments

### EMI test equipment

Control No.	Instrument	Manufacturer	Model No	Test Item	Calibration Date * Interval(month)
MAEC-01	Anechoic Chamber	TDK	Semi Anechoic Chamber 10m	1,2,3	2003/12/27 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	1,2,3	2003/11/12 * 12
MAT-02	Attenuator(3dB)	Weinschel Corp	2	1,2,3	2003/12/16 * 12
MAT-06	Attenuator(6dB)	Weinschel Corp	2	1	2003/12/16 * 12
MBA-01	Biconical Antenna	Schwarzbeck	BBA9106	1	2003/10/15 * 12
MLA-01	Logperiodic Antenna	Schwarzbeck	USLP9143	1	2003/10/15 * 12
MPA-04	Pre Amplifier	Agilent	8447D	1,2,3	2004/05/25 * 12
MCC-01	Coaxial Cable	Suhner/storm/Agilent/TSJ	-	1	2003/12/19 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/Agilent/TSJ	-	1,2,3	2003/12/24 * 12
MCC-07	coaxial cable	-	-	1,2,3	2004/01/26 * 12
MCC-08	coaxial cable	-	-	1,2,3	2004/01/26 * 12
MLPA-01	Loop Antenna	Rohde & Schwarz	HFH2-Z2	1,2,3	2004/01/08 * 12
MCH-01	Temperature and Humidity Chamber	Tabai Spec	PL-2KP	3	2003/12/18 * 12

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

#### Test Item:

- 1: Fundamental and Spurious Emission
- 2: -20dB Bandwidth
- 3: Frequency Tolerance

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**APPENDIX 3: Data of EMI test**

**Radiated emission(Fundamental emission)**

**Transmitter carrier output level (13.56MHz)**

UL Apex Co., Ltd.  
No1 SEMI ANECHOIC CHAMBER

COMPANY : OMRON Corporation  
EQUIPMENT : Radio Frequency Identification system  
MODEL : V670-CF01  
S/ N : 4  
POWER : DC 3.3V  
MODE : TRANSMITTING

REPORT NO : 24IE0033-HO  
REGULATION : FCC 15.225 (a)  
TEST DISTANCE : 10m  
DATE : 06/14/2004  
TEMPERATURE : 25 deg. C  
HUMIDITY : 50%

ENGINEER : Makoto Kosaka

FREQ	T/R Reading	Ant Factor	C.F	Result	Limit	Margin	Antenna angle
[MHz]	[dBuV]	[dB/m]	[dB]	[dBuV/m]	[dBuV/m]	[dB]	[deg.]
13.5610	45.6	20.2	-23.7	42.1	103.1	61.0	0

Calculation : Reading + Ant. Factor + C.F(Cable loss - AMP.Gain + Atten).

※The data of EUT direction is taken in worse condition.

Max-axis : 0deg.

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## DATA OF MAGNETIC RADIATED EMISSION TEST (Band Edges)

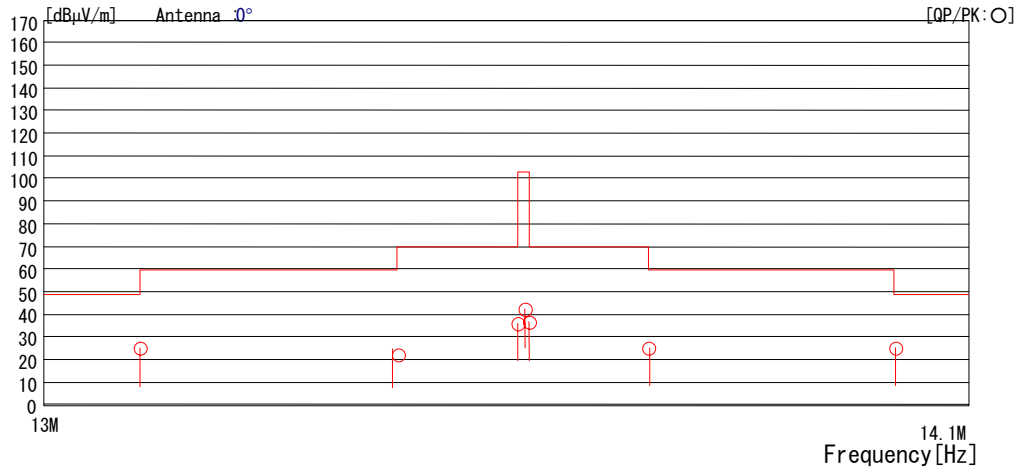
UL Apex Co., LTD. HEAD OFFICE EMC DIVISION  
 Date : 2004/06/14 21:45:43

Applicant : OMRON Corporation  
 Kind of EUT : RFID system  
 Model No. : V670-CF01  
 Serial No. : 4

Report No. : 241E0033-HO  
 Power : DC3.3V  
 Temp°C/Humi% : 25deg. C / 50%  
 Operator : MakoTo Kosaka

Mode / Remarks : Tx, Rx (13.56MHz) / Y-axis

LIMIT : FCC15C §15.225(a) (b) 10m



No.	FREQ [MHz]	READING QP/PK [dBµV]	ANT FACTOR [dB]	LOSS [dB]	RESULT [dBµV/m]	LIMIT [dBµV/m]	MARGIN [dB]	ANTENNA TABLE [DEG]	COMMENT
1	13.561	45.6	20.2	-23.7	42.1	103.1	61.0	0°	Carrier, QP
2	13.110	28.8	20.1	-23.7	25.1	48.6	23.4	0°	QP
3	13.410	28.7	20.1	-23.7	25.1	59.6	34.5	0°	QP
4	13.553	39.5	20.2	-23.7	36.0	69.6	33.6	0°	PK
5	13.567	40.0	20.2	-23.7	36.5	69.6	33.1	0°	PK
6	13.710	28.7	20.2	-23.7	25.2	59.6	34.4	0°	QP
7	14.010	28.7	20.2	-23.7	25.2	48.6	23.4	0°	QP

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**Radiated emission (Spurious emission : below 30MHz)**

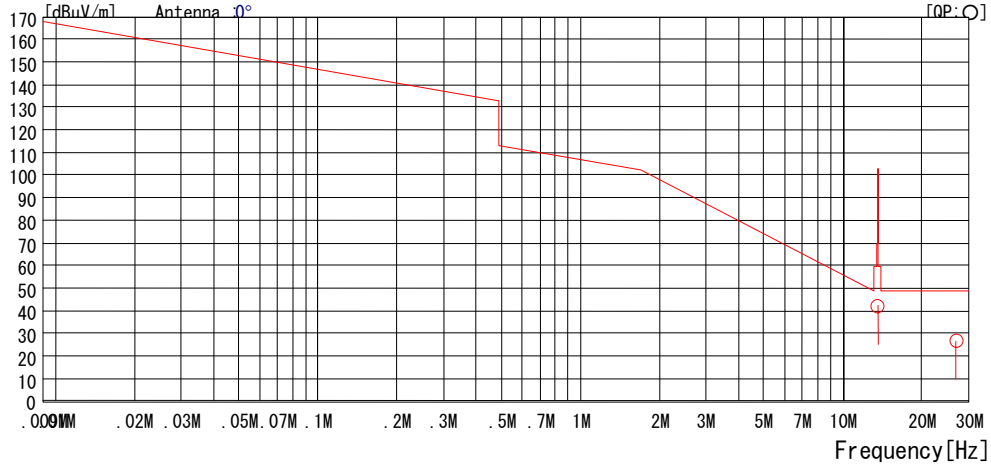
**DATA OF MAGNETIC RADIATED EMISSION TEST**

UL Apex Co., LTD. HEAD OFFICE EMC DIVISION  
Date : 2004/06/14 21:45:43

Applicant : OMRON Corporation  
Kind of EUT : RFID system  
Model No. : V670-CF01  
Serial No. : 4  
Report No. : 241E0034-H0  
Power : DC3.3V  
Temp°C/Humi% : 25deg. C / 50%  
Operator : Makoto Kosaka

Mode / Remarks : Tx, Rx (13.56MHz) / Y-axis

LIMIT : FCC15C §15.225 (a) (b) 10m



No.	FREQ [MHz]	READING QP [dBuV]	ANT FACTOR [dB]	LOSS [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA TABLE [DEG]
1	27.120	28.9	20.8	-23.1	26.6	48.6	22.0	0° 318

CHART : WITH FACTOR ANT TYPE : LOOP  
CALCULATION : READING + ANT FACTOR + LOSS ( CABLE + ATTEN. -AMP. )

Page:

**Radiated emission (Spurious emission : above 30MHz)**

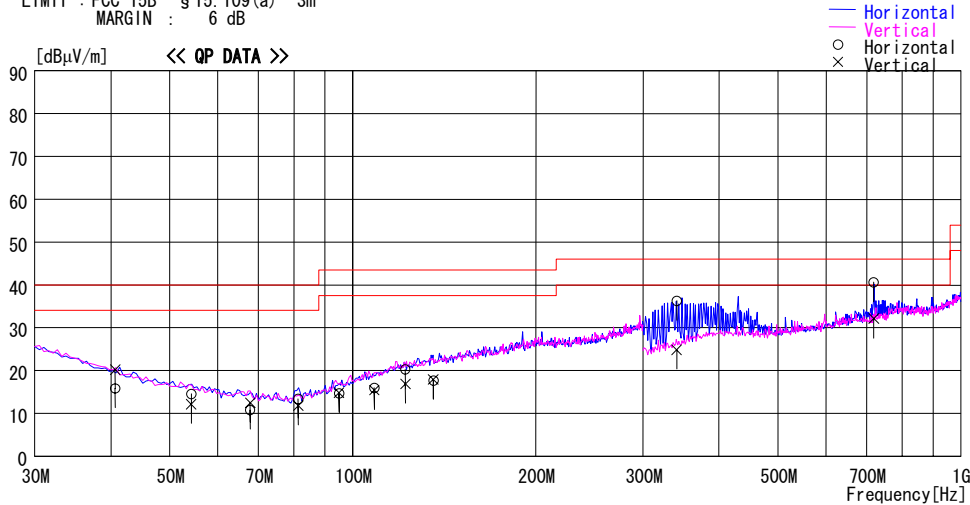
**DATA OF RADIATED EMISSION TEST**

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber  
Date : 2004/06/15 03:10:21

Applicant : OMRON Corporation  
Kind of EUT : RFID system  
Model No. : V670-CF01  
Serial No. : 4  
Report No. : 241E0033-HO  
Power : DC3.3V  
Temp°C/Humi% : 25 / 50  
Operator : Makoto Kosaka

Mode / Remarks: Tx, Rx (13.56MHz) / MAX(Y)-Axis

LIMIT : FCC 15B § 15.109(a) 3m  
MARGIN : 6 dB



No.	FREQ [MHz]	READING QP [dBµV]	ANT FACTOR [dB/m]	LOSS [dB]	GAIN [dB]	RESULT [dBµV/m]	LIMIT [dBµV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal -----										
1	40.680	23.1	13.5	7.1	27.9	15.8	40.0	24.2	141	319
2	54.240	25.3	9.4	7.4	27.6	14.5	40.0	25.5	171	336
3	67.800	24.0	7.0	7.5	27.7	10.8	40.0	29.2	298	130
4	81.360	27.0	6.5	7.7	27.8	13.4	40.0	26.6	166	348
5	94.920	25.1	9.0	8.0	27.5	14.6	43.5	28.9	209	341
6	108.480	24.2	11.4	8.0	27.7	15.9	43.5	27.6	210	293
7	122.040	26.5	13.2	8.1	27.6	20.2	43.5	23.3	279	355
8	135.600	22.8	13.8	8.5	27.4	17.7	43.5	25.8	221	359
9	340.979	37.7	15.9	10.2	27.5	36.3	46.0	9.7	100	0
10	718.817	36.4	20.5	12.4	28.7	40.6	46.0	5.4	114	315
----- Vertical -----										
11	40.680	27.5	13.5	7.1	27.9	20.2	40.0	19.8	100	49
12	54.240	22.9	9.4	7.4	27.6	12.1	40.0	27.9	100	20
13	67.800	25.6	7.0	7.5	27.7	12.4	40.0	27.6	100	359
14	81.360	25.4	6.5	7.7	27.8	11.8	40.0	28.2	100	4
15	94.920	25.3	9.0	8.0	27.5	14.8	43.5	28.7	149	359
16	108.480	23.7	11.4	8.0	27.7	15.4	43.5	28.1	100	72
17	122.040	23.2	13.2	8.1	27.6	16.9	43.5	26.6	129	272
18	135.600	23.0	13.8	8.5	27.4	17.9	43.5	25.6	100	301
19	340.992	26.2	15.9	10.2	27.5	24.8	46.0	21.2	100	242
20	718.831	27.9	20.5	12.4	28.7	32.1	46.0	13.9	114	262

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN  
CALCULATION : READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - AMP. GAIN Page:

### -20dB Bandwidth

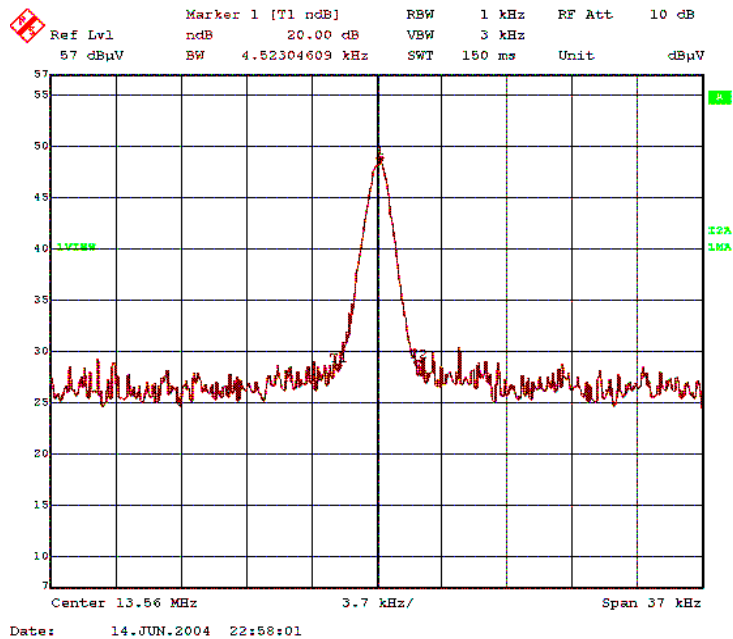
UL Apex Co., Ltd.  
No1 SEMI ANECHOIC CHAMBER

COMPANY : OMRON Corporation  
EQUIPMENT : Radio Frequency Identification system  
MODEL : V670-CF01  
S/ N : 4  
POWER : DC 3.3V  
MODE : TRANSMITTING

REPORT NO : 24IE0033-HO  
REGULATION : FCC 15.215 (e)  
TEST DISTANCE : 10m  
DATE : '06/14/2004  
TEMPERATURE : 25 deg. C  
HUMIDITY : 50%

ENGINEER : Makoto Kosaka

FREQ [MHz]	-20dB Bandwidth [kHz]
13.56	4.52





**Frequency Tolerance**

UL Apex Co., Ltd.  
No.3 Measurement room

COMPANY	: OMRON Corporation	REPORT NO	: 24IE033-HO
EQUIPMENT	: Radio Frequency Identification system	REGULATION	: FCC 15.225 (c)
MODEL	: V670-CF01	TEST DISTANCE	: -
S/N	: 4	DATE	: 06/14/2004
POWER	: DC 3.3V	TEMPERATURE	: 25 deg. C
MODE	: TRANSMITTING	HUMIDITY	: 50%

ENGINEER : Makoto Kosaka

Test Condition	Test Timing	Measured freq [MHz]	Freq error [MHz]	Result [ppm]	Limit (+/- 0.01%) [+/- ppm]	Margin [ppm]
T nom 20°C Vnom DC3.3V	Power on	13.56001002	0.00001002	0.74	100.00	99.26
	on 2min.	13.56003006	0.00003006	2.22	100.00	97.78
	on 5min.	13.56009018	0.00009018	6.65	100.00	93.35
	on 10min.	13.56009018	0.00009018	6.65	100.00	93.35
T min -20°C Vnom DC3.3V	Power on	13.56005010	0.00005010	3.69	100.00	96.31
	on 2min.	13.56013026	0.00013026	9.61	100.00	90.39
	on 5min.	13.56007014	0.00007014	5.17	100.00	94.83
	on 10min.	13.56013026	0.00013026	9.61	100.00	90.39
T max 50°C Vnom DC3.3V	Power on	13.56017034	0.00017034	12.56	100.00	87.44
	on 2min.	13.56007014	0.00007014	5.17	100.00	94.83
	on 5min.	13.55996994	-0.00003006	-2.22	100.00	97.78
	on 10min.	13.56013026	0.00013026	9.61	100.00	90.39

Limit : 13.56 MHz +/-0.01 % (+/- 100ppm)  
+/- 0.001356 MHz

**UL Apex Co., Ltd.**

**Head Office EMC Lab.**

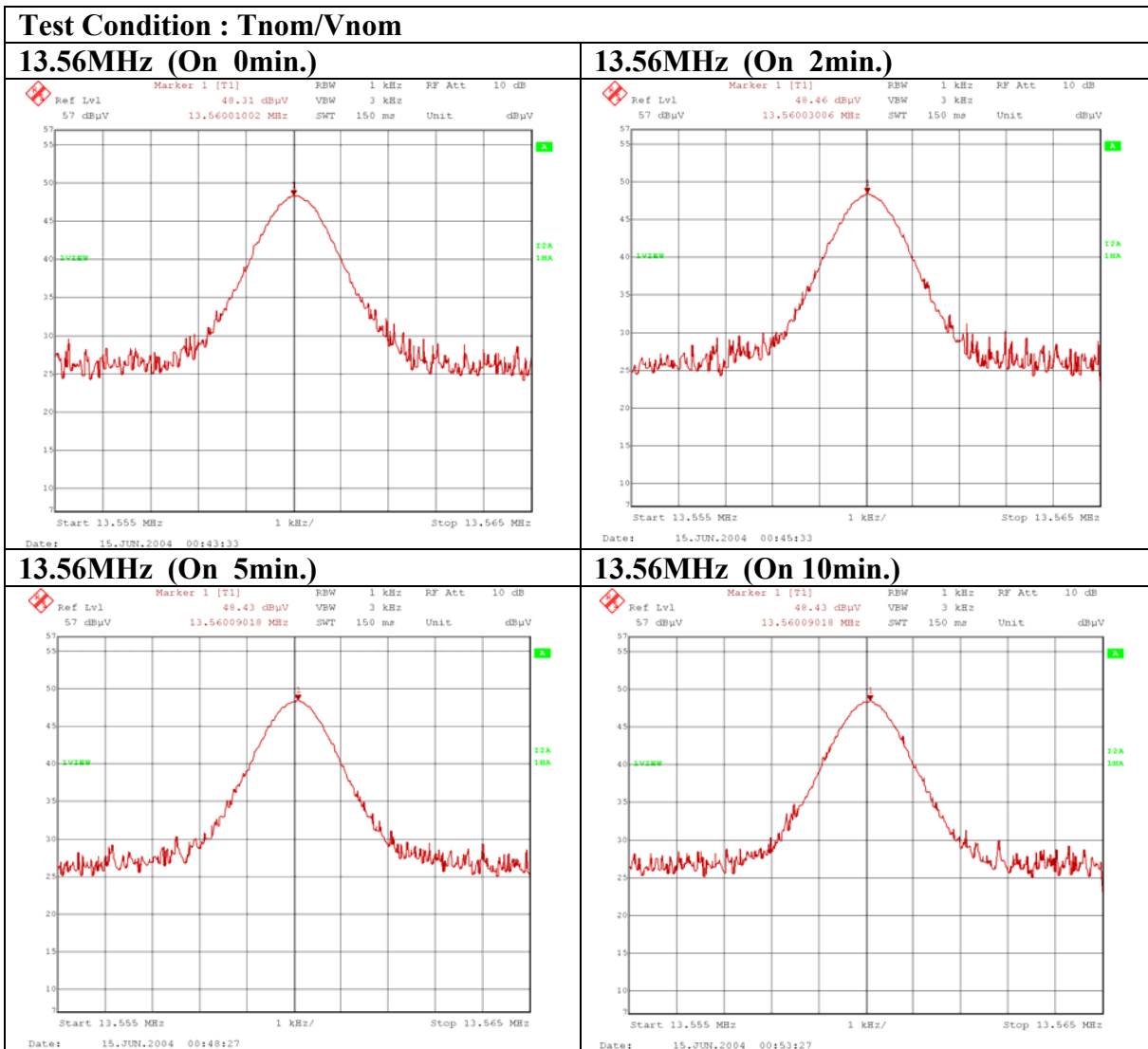
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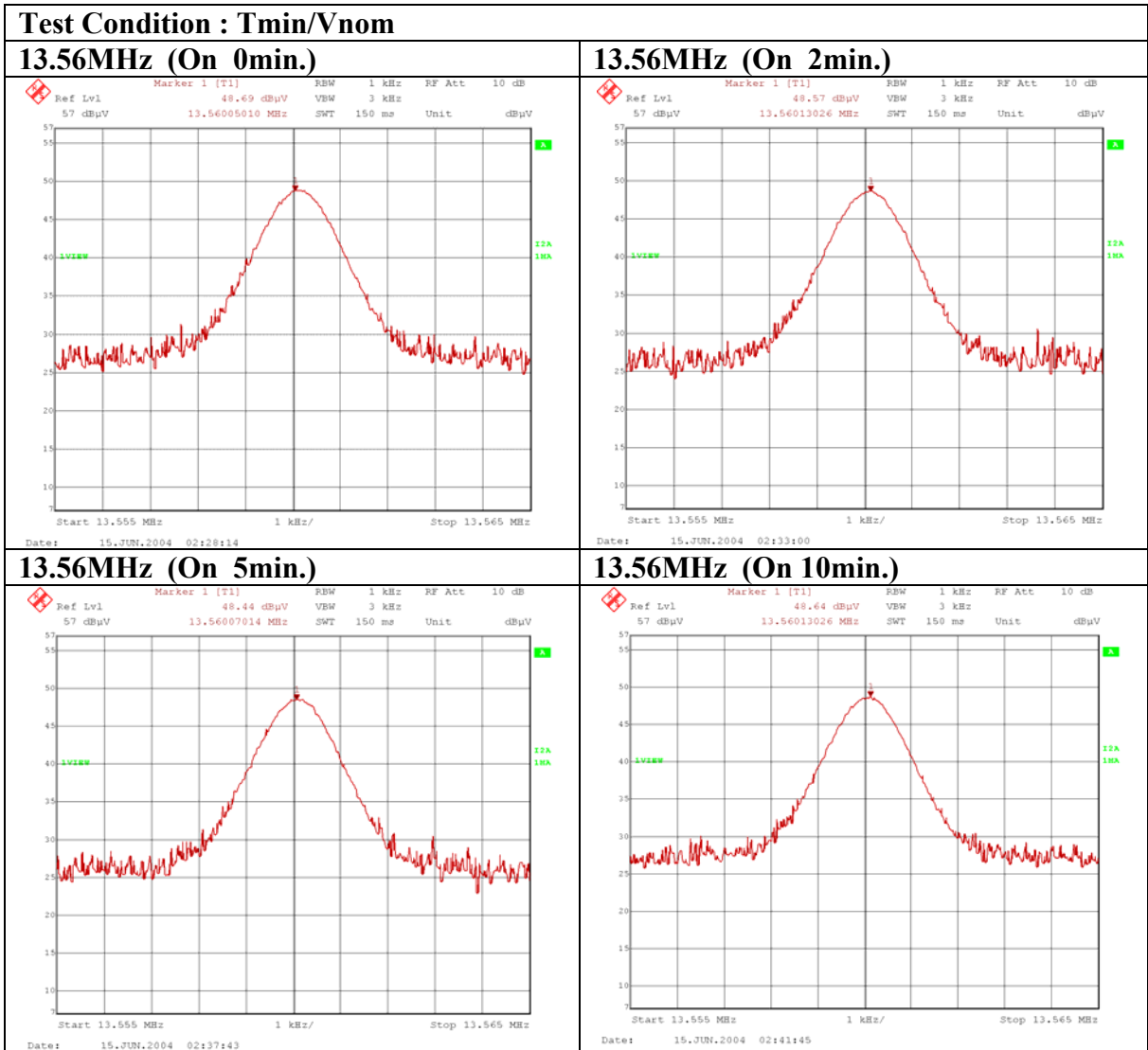
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MF060b(10.04.03)

### Frequency Tolerance



## Frequency Tolerance



## Frequency Tolerance

