

EMI TEST REPORT

Test Report No. : 25IE0303-HO-1a

Applicant : **KEYENCE CORPORATION**
Type of Equipment : **Radio Frequency Identification System**
Model No. : **RF-500**
Test standard : **FCC Part 15 Subpart C : 2005
Section 15.207 and 15.225**
FCC ID : **RF40773B**
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: August 25 to September 1, 2005

Tested by :


Hiroka Umeyama
EMC Services

Approved by :


Naoki Sakamoto
Group Leader of
EMC Services

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SECTION 1: Client information

Company Name : KEYENCE CORPORATION
Brand or Trade name : KEYENCE
Address : 1-3-14, Higashinakajima, Higashiyodogawa-ku, Osaka, 533-8555, JAPAN
Telephone Number : +81-6-6379-1111
Facsimile Number : +81-6-6379-1182
Contact Person : Hiroaki Yamamoto

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

2.1 Identification of E.U.T.

Type of Equipment : Radio Frequency Identification System
Model No. : RF-500
Serial No. : S001, S002, S003
Rating : DC 5.0V
Country of Manufacture : Japan
Receipt Date of Sample : August 25, 2005
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No.: RF-500 is Radio Frequency Identification device (RFID) for industrial use.
Basically, EUT is installed in the production line, such as conveyor, to get production information from a workpiece.

Equipment Type : Transceiver
Frequency Bands : 13.11-14.01MHz
Frequency of Operation : 13.56 MHz
Type of modulation : ASK
Mode of operation : Simplex
Antenna Type : Loop Antenna
Operating voltage (inner) : DC 5.0V
Operating Temperature : RFID Compact Read/Write Head: 0 to +60 deg. C.
RFID Compact Tag: -20 to +85deg. C.
RFID Coin Tag: -10 to +60deg. C.

FCC 15.31 (e)

The stable voltage (DC5.0V) regulated by DC-DC Converter (5.0V-5.0V) is constantly supplied to RF Module.
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 EUT. Therefore, the equipment complies with the antenna requirement of Section 15.203.

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SECTION 3: Test specification, procedures & results

3.1 Test Specification

Test Specification : FCC Part15 Subpart C : 2005
Title : FCC 47CFR Part15 Radio Frequency Device Subpart C Intentional Radiators
Section 15.207 Conducted limits
Section 15.225 : Operation within the band 13.110-14.010MHz

3.2 Procedures and results

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	Conducted emission	ANSI C63.4:2003 7. AC power line conducted emission measurements	Section 15.207	-	N/A	6.5dB, AV, N 0.20797MHz	Complied
2	Electric Field Strength of Fundamental Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(a)	Radiated	N/A	55.5dB	Complied
3	Spectrum Mask	ANSI C63.4:2003 13. Measurement of intentional radiators	Section 15.225(b)(c)	Radiated	N/A	28.0dB 14.010MHz	Complied
4	-20dB Bandwidth	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.215(c)	Radiated	N/A	N/A	N/A
5	Electric Field Strength of Spurious Emission	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.209, Section 15.225 (d)	Radiated	N/A	2.3dB 143.998MHz Horizontal, QP	Complied
6	Frequency Tolerance	ANSI C63.4:2003 13. Measurement of intentional radiators	Section15.225(e)	Radiated	N/A	*See data.	Complied

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

Uncertainty:

*In case of the margin below the EMC Head Office's uncertainty.

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

Conducted Emission

The measurement uncertainty (with a 95% confidence level) for this test is ± 1.3 dB.

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

Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test using Loop antenna is ± 1.9 dB(3m)/ ± 1.8 dB(10m).

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is ± 4.5 dB(3m)/ ± 4.7 dB(10m).

The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is ± 5.2 dB(3m)/ ± 3.8 dB(10m).

The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is ± 6.6 dB.

The data listed in this report meets the limits unless the uncertainty is taken into consideration.

Other test except Conducted Emission and Spurious Emission (Radiated)

The measurement uncertainty (with a 95% confidence level) for this test is ± 3.0 dB.

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

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

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3.3 Addition to standards

No.	Item	Test Procedure	Specification	Remarks	Deviation	Worst margin	Results
1	99% Occupied Band Width	RSS-210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004 + Amendment4: 2004	RSS-210(issue 5): 2001 + Amendment:2002 + Amendment2:2003 + Amendment3:2004 + Amendment4: 2004	Conducted	N/A	N/A	N/A

3.4 Confirmation

UL Apex Co., Ltd. hereby confirms that E.U.T., in the configuration tested, complies with the specifications FCC Part 15 Subpart C: 2005 Section 15.207 and 15.225.

3.5 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	IC4247A	19.2 x 11.2 x 7.7m	7.0 x 6.0m	Preparation room
No.2 semi-anechoic chamber	June 05, 2002	846015	IC4247A-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.

3.6 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 Modes

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

The mode used for testing : Transmitting mode

1. RF-500 + Compact Tag
2. RF-500 + Coin Tag
3. RF-500 + Compact Tag x 3
4. RF-500 + Coin Tag x 3

*1. There is no difference in the fundamental and spurious emission levels between with and without Tag, and thus tests were performed with Tag.

*2. As for Transmitting modes, 3 and 4:

- RF-500: 50 cm separation from each unit is recommended.

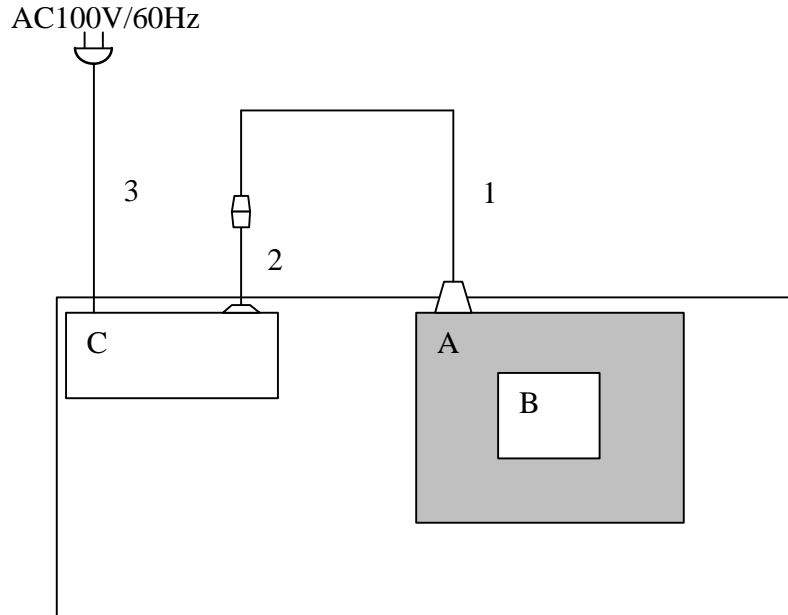
As multiple units might be used at the same time, tests were performed with 3 units together as the worst case.

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

4.2 Configuration and peripherals

[for Conducted Emission test]

Mode 1: RF-500 + Compact Tag and Mode 2: RF-500 + Coin Tag



* Cabling was 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	FCC ID	Remarks
A	RFID Compact Read/Write Head	RF-500	S003	KEYENCE CORPORATION	RF40773B	EUT (1, 2)
B	RFID Compact Tag	RF-T5F20	ST001	KEYENCE CORPORATION	-	(1)
B	RFID Coin Tag	RF-T5P10	CT220	KEYENCE CORPORATION	-	(2)
C	Power Supply/Communication Unit	BL-U1	5103198	KEYENCE CORPORATION	-	-

Mode 1: RF-500 + Compact Tag , Mode 2: RF-500 + Coin Tag

List of cables used

No.	Name	Model Number	Length (m)	Shield	Backshell Material
1	Main Cable	-	2.0m	N	Polyvinyl chloride
2	Extension Cable	NX-C08R	8.0m	N	Polyvinyl chloride
3	Main Power Cable	-	2.0m	N	Polyvinyl chloride

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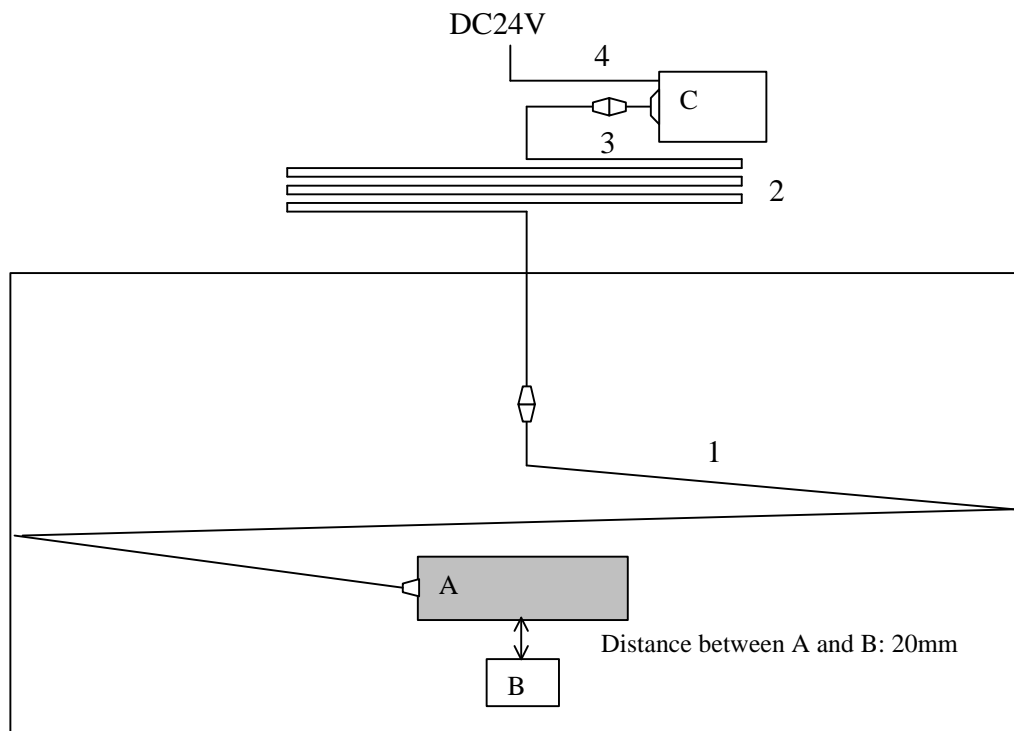
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[for Radiated Emission test]

Mode 1: RF-500 + Compact Tag and Mode 2: RF-500 + Coin Tag



* Cabling was 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	FCC ID	Remarks
A	RFID Compact Read/Write Head	RF-500	S003	KEYENCE CORPORATION	RF40773B	EUT (1, 2)
B	RFID Compact Tag	RF-T5F20	ST001	KEYENCE CORPORATION	-	(1)
B	RFID Coin Tag	RF-T5P10	CT220	KEYENCE CORPORATION	-	(2)
C	Power Supply/Communication Unit	BL-U2	5749128	KEYENCE CORPORATION	-	-

Mode 1: RF-500 + Compact Tag , Mode 2: RF-500 + Coin Tag

List of cables used

No.	Name	Model Number	Length (m)	Shield	Backshell Material
1	Main Cable	-	2.0m	N	Polyvinyl chloride
2	Extension Cable	NX-C08R	8.0m	N	Polyvinyl chloride
3	D-sub conversion cable	RF-CM2D	0.2m	N	Polyvinyl chloride
4	DC Cable	-	0.5m	N	Polyvinyl chloride

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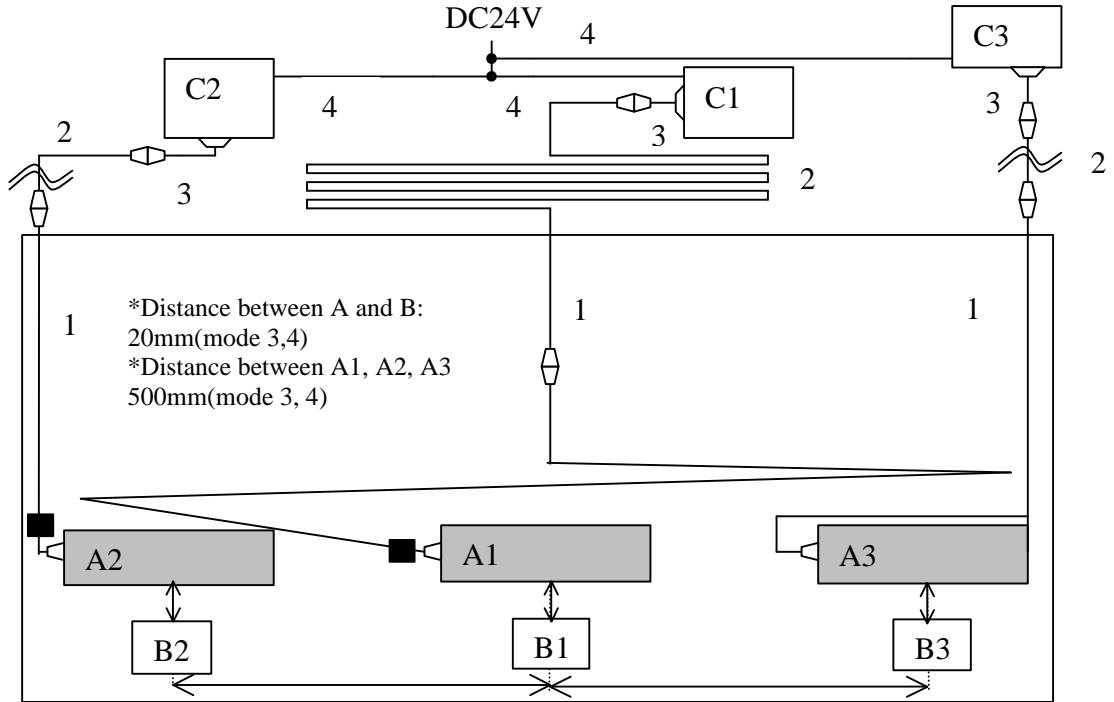
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[for Radiated Emission tests]

Mode 3: RF-500 + Compact Tag x 3 and Mode 4: RF-500 + Coin Tag x 3



* Cabling was 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	FCC ID	Remarks
A1, A2, A3	RFID Compact Read/Write Head	RF-500	S001, S002, S003	KEYENCE CORPORATION	RF40773B	EUT (3, 4)
B1, B2, B3	RFID Compact Tag	RF-T5F20	ST001, ST007, ST005	KEYENCE CORPORATION	-	(3)
B1, B2, B3	RFID Coin Tag	RF-T5P10	CT220, CT218, CT219	KEYENCE CORPORATION	-	(4)
C1,C2,C3	Power Supply/Communication Unit	BL-U2	5749128, 4762172, 5726425	KEYENCE CORPORATION	-	-

Mode 3: RF-500 + Compact Tag x 3, Mode 4: RF-500 + Coin Tag x 3

List of cables used

No.	Name	Model Number	Length (m)	Shield	Backshell Material
1	Main Cable	-	2.0m	N	Polyvinyl chloride
2	Extension Cable	NX-C08R	8.0m	N	Polyvinyl chloride
3	D-sub conversion cable	RF-CM2D	0.2m	N	Polyvinyl chloride
4	DC Cable	-	0.5m	N	Polyvinyl chloride

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SECTION 5: Conducted emission

5.1 Operating environment

Test place : No.1 semi anechoic chamber.
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane. The rear of tabletop was located 40cm to the vertical conducting plane. All other surfaces of tabletop were at least 80cm from any other grounded conducting surface. EUT was located 80cm from LISN/AMN and excess AC cable was bundled in center. I/O cables that were connected to the peripherals were bundled in center. Each EUT current-carrying power lead, except the ground (safety) lead, was individually connected through a LISN/ an AMN to the input power source. All unused 50ohm connectors of the LISN/ AMN were resistively terminated in 50ohm when not connected to the measuring equipment. The AC Mains Terminal Continuous disturbance Voltage has been measured with the EUT on a horizontal conducting plane 4.0 x 4.0m and a vertical conducting plane 2.0 x 2.0m in a No.1 semi Anechoic Chamber. A drawing of the set up is shown in the photos of APPENDIX 1.

5.3 Test conditions

Frequency range : 0.15MHz – 30MHz
EUT position : Table top
EUT operation mode : Transmitting

5.4 Test procedure

The AC Mains Terminal Continuous disturbance Voltage had been measured with the EUT in the semi Anechoic Chamber. The EUT was connected to a Line Impedance Stabilization Network (LISN)/ Artificial Mains Network (AMN). An overview sweep with peak detection has been performed. The measurements had been performed with a quasi-peak detector and if required, with an average detector. The conducted emission measurements were made with the following detector function of the test receiver.

Detector Type : QP and AV
IF Bandwidth : 9kHz

5.5 Test result

Summary of the test results : Pass

Date : August 25, 2005 Test engineer : Hiroka Umeyama

SECTION 6: Radiated emission (Fundamental , Spurious Emission and Spectrum Mask)

6.1 Operating environment

The test was carried out in a No.1 semi Anechoic Chamber

Temperature : See data
Humidity : See data

6.2 Test Procedure

The Radiated Electric Field Strength intensity has been measured on No.1 semi anechoic chamber with a ground plane and at a distance of 3m.

Frequency : From 9kHz to 30MHz at distance 3m

The EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity.

The measurements were performed for each antenna angle 0deg. , 45deg. and 90deg.

Frequency : From 30MHz to 1GHz at distance 3m

The measuring antenna height was 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.

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)

9kHz – 490kHz [Limit at 3m]=[Limit at 300m]-40log (3[m]/300[m])

490kHz – 30MHz[Limit at 3m]=[Limit at 30m]-40log (3[m]/30[m])

6.3 Test result

Summary of the test results : Pass

Date : August 26 and 30, 2005 Test engineer : Hiroka Umeyama

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SECTION 7: -20dB Bandwidth

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

SECTION 8: 99% Occupied Bandwidth

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

SECTION 9: 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

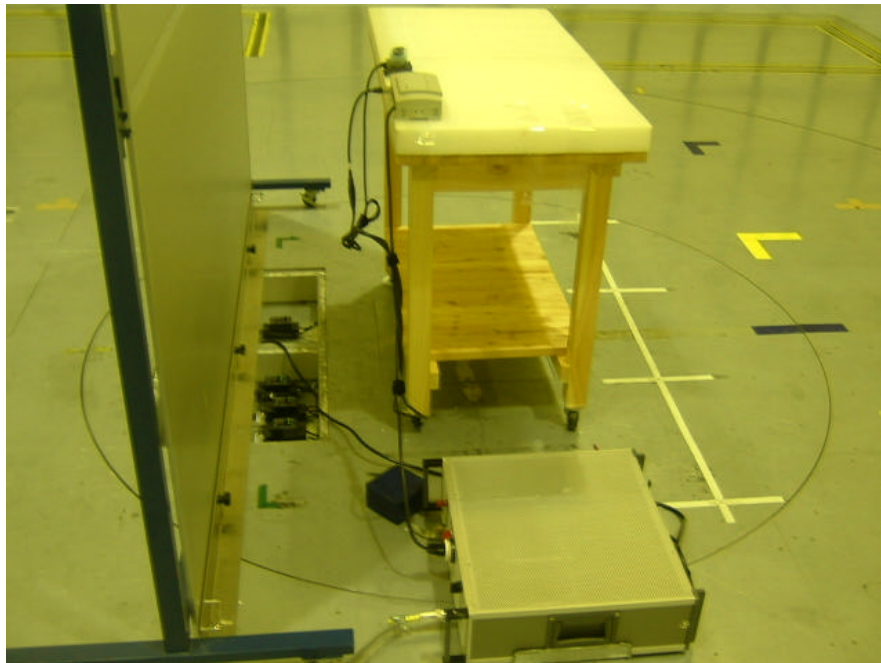
APPENDIX 1: Photographs of test setup

Conducted emission

Front

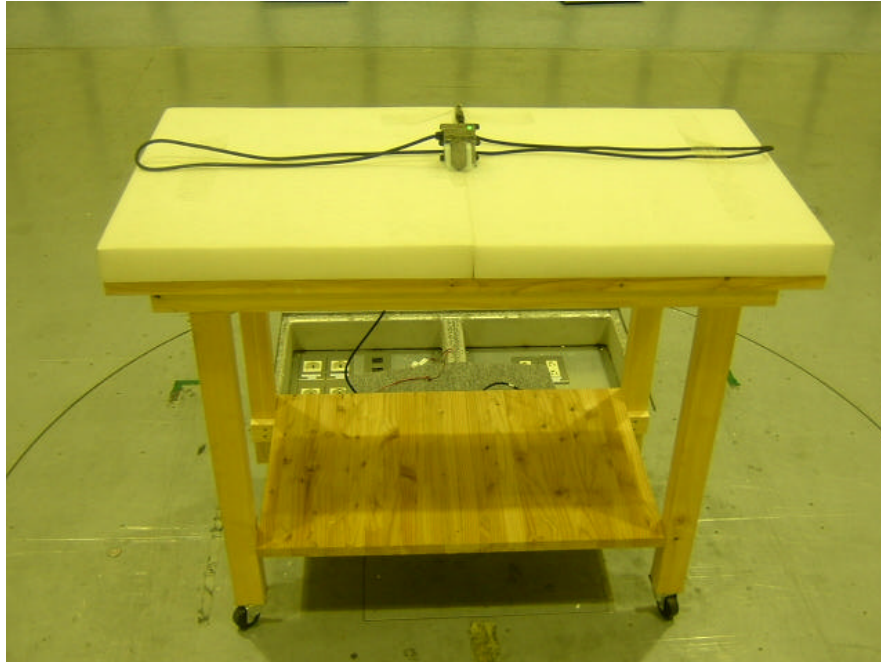


Rear

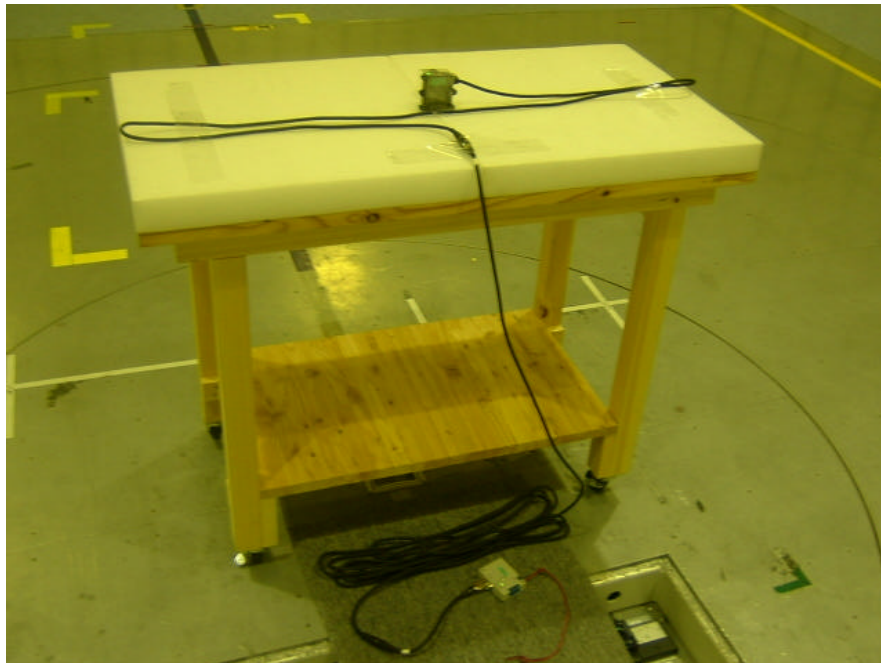


Radiated emission

Front



Rear



Radiated emission: EUT x 3

Front



Rear



Worst Case Position: Y-axis

X-axis



Y-axis



Kinds of Tag

Compact tag



Coin tag



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	RE / CE	2004/11/13 * 12
MTR-01	Test Receiver	Rohde & Schwarz	ESI40	RE / CE	2004/11/12 * 12
MLS-03	LISN(AMN)	Schwarzbeck	NSLK8127	CE	2004/11/10 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/Agilent/TSJ	-	CE	2004/12/24 * 12
MBA-01	Biconical Antenna	Schwarzbeck	BBA9106	RE	2004/10/14 * 12
MLA-01	Logperiodic Antenna	Schwarzbeck	USLP9143	RE	2004/10/14 * 12
MPA-04	Pre Amplifier	Agilent	8447D	RE	2005/05/24 * 12
MCC-01	Coaxial Cable 0.1-3000MHz	Suhner/storm/Agilent/TSJ	-	RE	2004/12/19 * 12
MAT-06	Attenuator(6dB)	Weinschel Corp	2	RE	2004/12/16 * 12
MLPA-02	Loop Antenna	Rohde & Schwarz	HFH2-Z2	RE	2004/12/10 * 12
MCC-03	Coaxial Cable	Fujikura/Suhner/Agilent/TSJ	-	RE	2004/12/24 * 12
MCC-31	coaxial cable	ULApex	-	RE	2005/06/02 * 12

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

Test Item :

CE: Conducted emission,

RE: Radiated emission,

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APPENDIX 3: Data of EMI test

Conducted Emission

* The carrier frequency, 13.56MHz is excluded.

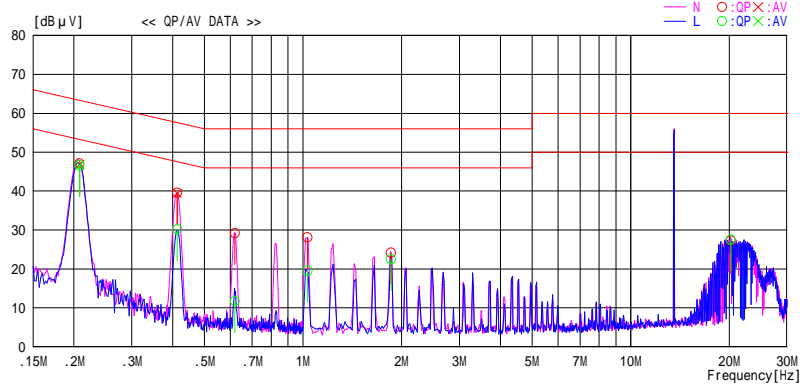
DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/25 10:39:11

Applicant : KEYENCE CORPORATION
 Kind of EUT : RFID System
 Model No. : RF-500
 Serial No. : S003
 Report No. : 25IE0303-HO
 Power : AC100V/60Hz(DC Power Supply)
 Temp /Humi% : 24deg.C / 60%
 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting Mode (13.56MHz) compact tag

LIMIT : FCC15C § 15.207 (QP)
 FCC15C § 15.207 (AV)



Frequency [MHz]	Reading Level		Corr. Factor	Results		Limit		Margin		Phase
	QP [dBuV]	AV [dBuV]		QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	QP [dBuV]	AV [dBuV]	
0.20797	46.1	46.0	0.6	46.7	46.6	63.3	53.3	16.6	6.7	L
0.20797	46.5	46.2	0.6	47.1	46.8	63.3	53.3	16.2	6.5	N
0.41317	39.3	39.1	0.3	39.6	39.4	57.6	47.6	18.0	8.2	N
0.41317	29.9	---	0.3	30.2	---	57.6	---	27.4	---	L
0.62020	28.6	---	0.6	29.2	---	56.0	---	26.8	---	N
0.62020	11.1	---	0.6	11.7	---	56.0	---	44.3	---	L
1.03150	27.6	---	0.5	28.1	---	56.0	---	27.9	---	N
1.03150	19.1	---	0.5	19.6	---	56.0	---	36.4	---	L
1.85610	23.6	---	0.6	24.2	---	56.0	---	31.8	---	N
1.85610	21.9	---	0.6	22.5	---	56.0	---	33.5	---	L
20.18540	24.8	---	2.5	27.3	---	60.0	---	32.7	---	N
20.18500	25.1	---	2.5	27.6	---	60.0	---	32.4	---	L

CHART: WITH FACTOR, Peak hold data. Data is uncorrected. CALCULATION: RESULT=READING+C.F.(LISN LOSS+CABLE LOSS)
 Except for the above table : adequate margin data below the limits.

Conducted Emission

* The carrier frequency, 13.56MHz is excluded.

DATA OF CONDUCTED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/25 14:49:34

Applicant : KEYENCE CORPORATION
 Kind of EUT : RFID System
 Model No. : RF-500
 Serial No. : S003
 Report No. : 25IE0303-HO
 Power : AC100V/60Hz(DC Power Supply)
 Temp /Humid% : 24deg.C / 60%
 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting Mode (13.56MHz), coin tag

LIMIT : FCC15C § 15.207 (QP)
 FCC15C § 15.207 (AV)

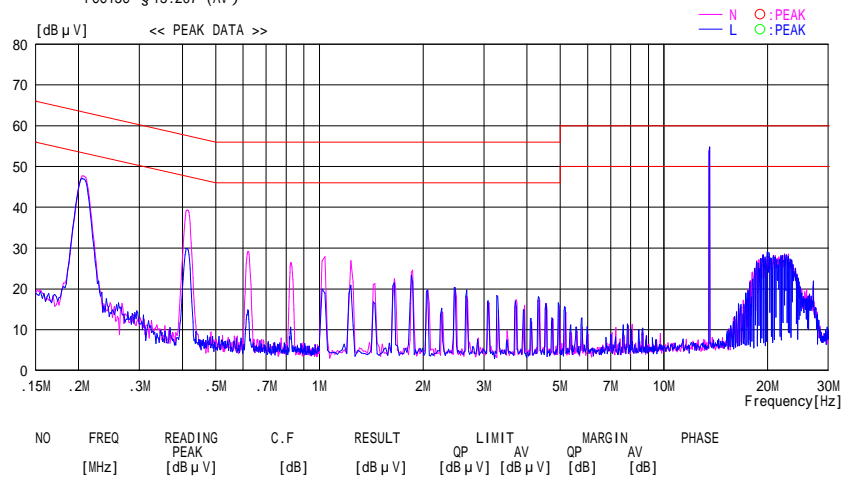


CHART:WITH FACTOR, Peak hold data.Data is uncorrected. CALCURATION:RESULT=READING+C.F(LIEN LOSS+CABLE LOSS)
 Except for the above table : adequate margin data below the limits.

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Revised date : September 15, 2005
FCC ID : RF40773B

Radiated emission:below 30MHz
(Fundamental emission, Spectrum Mask and Spurious emission)

DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co.,LTD. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/30 09:20:49

Applicant : KEYENCE CORPORATION Report No. : 25IE0303-HO
Kind of EUT : RFID System Power : DC5V
Model No. : RF-500 Temp./ Humi. : 24deg.C / 60%
Serial No. : S003 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, compact tag

LIMIT : FCC15C § 15.225 3m
All other spurious emissions were less than 20dB for the limit.

Freq.	Reading	DET	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table		Comment
										[MHz]	[dBuV]	
13.56000	62.2	QP	20.0	7.1	27.9	61.4	123.9	62.5	0deg	359	Y-Axis(MAX)	
13.56000	60.6	QP	20.0	7.1	27.9	59.8	123.9	64.1	45deg	359	Y-Axis	
13.56000	57.6	QP	20.0	7.1	27.9	56.8	123.9	67.1	90deg	296	Y-Axis	
13.56000	50.2	QP	20.0	7.1	27.9	49.4	123.9	74.5	0deg	153	X-Axis	
13.56000	48.9	QP	20.0	7.1	27.9	48.1	123.9	75.8	45deg	250	X-Axis	
13.56000	41.9	QP	20.0	7.1	27.9	41.1	123.9	82.8	90deg	260	X-Axis	
13.11000	37.3	QP	20.0	7.0	27.9	36.4	69.5	33.1	90deg	296	Y-Axis(MAX)	
13.41000	33.1	QP	20.0	7.0	27.9	32.2	80.5	48.3	90deg	296	Y-Axis(MAX)	
13.55300	50.7	QP	20.0	7.0	27.9	49.8	90.4	40.6	0deg	359	Y-Axis(MAX)	
13.56700	49.2	QP	20.0	7.1	27.9	48.4	90.4	42.0	0deg	359	Y-Axis(MAX)	
13.71000	39.9	QP	20.0	7.1	27.9	39.1	80.5	41.4	90deg	296	Y-Axis(MAX)	
14.01000	36.8	QP	20.0	7.1	27.9	36.0	69.5	33.5	90deg	296	Y-Axis(MAX)	
27.12000	25.9	QP	19.9	7.7	28.0	25.5	69.5	44.0	90deg	296	Y-Axis(MAX)	

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

Page :

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MF060b(10.04.03)

Test report No. : 25IE0303-HO-1a
Page : 22 of 33
Issued date : September 8, 2005
Revised date : September 15, 2005
FCC ID : RF40773B

Radiated emission
(Fundamental emission, Spectrum Mask and Spurious emission :below 30MHz)

DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co.,LTD. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/30 09:20:49

Applicant : KEYENCE CORPORATION Report No. : 25IE0303-HO
Kind of EUT : RFID System Power : DC5V
Model No. : RF-500 Temp./ Humi. : 24deg.C / 60%
Serial No. : S003 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, coin tag

LIMIT : FCC15C §15.225 3m
All other spurious emissions were less than 20dB for the limit.

Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac	Loss	Gan	Result	Limit	Margin	Antenna [deg]	Table	Comment
			[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]			
13.11000	39.4	QP	20.0	7.0	27.9	38.5	69.5	31.0	90deg	190	Y-Axis(MAX)
13.41000	37.3	QP	20.0	7.0	27.9	36.4	80.5	44.1	90deg	190	Y-Axis(MAX)
13.55300	50.9	QP	20.0	7.0	27.9	50.0	90.4	40.4	0deg	359	Y-Axis(MAX)
13.56000	61.8	QP	20.0	7.1	27.9	61.0	123.9	62.9	0deg	359	Y-Axis(MAX)
13.56700	49.0	QP	20.0	7.1	27.9	48.2	90.4	42.2	0deg	359	Y-Axis(MAX)
13.71000	41.6	QP	20.0	7.1	27.9	40.8	80.5	39.7	90deg	190	Y-Axis(MAX)
14.01000	42.3	QP	20.0	7.1	27.9	41.5	69.5	28.0	90deg	190	Y-Axis(MAX)
27.12000	25.6	QP	19.9	7.7	28.0	25.2	69.5	44.3	90deg	359	Y-Axis(MAX)

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

Page:

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MF060b(10.04.03)

Test report No. : 25IE0303-HO-1a
Page : 23 of 33
Issued date : September 8, 2005
Revised date : September 15, 2005
FCC ID : RF40773B

Radiated emission
(Fundamental emission, Spectrum Mask and Spurious emission :below 30MHz)

DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co.,LTD. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/30 10:17:35

Applicant : KEYENCE CORPORATION Report No. : 25IE0303-HO
Kind of EUT : RFID System Power : DC5V
Model No. : RF-500 Temp./ Humi. : 24deg.C / 60%
Serial No. : S001,S002,S003 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, EUT x 3, 50cm, compact tag

LIMIT : FCC15C §15.225 3m
All other spurious emissions were less than 20dB for the limit.

Freq	Reading	DET	Ant.Fac	Loss	Gain	Result	Limit	Margin	Antenna	Table	Comment
[MHz]	[dBuV]		[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]		[deg]	
13.56000	69.2	QP	20.0	7.1	27.9	68.4	123.9	55.5	0deg	359	Y-Axis(MAX)
13.56000	66.3	QP	20.0	7.1	27.9	65.5	123.9	58.4	45deg	342	Y-Axis
13.56000	63.9	QP	20.0	7.1	27.9	63.1	123.9	60.8	90deg	249	Y-Axis
13.56000	58.2	QP	20.0	7.1	27.9	57.4	123.9	66.5	0deg	208	X-Axis
13.56000	52.8	QP	20.0	7.1	27.9	52.0	123.9	71.9	45deg	205	X-Axis
13.56000	45.5	QP	20.0	7.1	27.9	44.7	123.9	79.2	90deg	359	X-Axis
13.11000	35.5	QP	20.0	7.0	27.9	34.6	69.5	34.9	90deg	249	Y-Axis(MAX)
13.41000	33.3	QP	20.0	7.0	27.9	32.4	80.5	48.1	90deg	249	Y-Axis(MAX)
13.55300	58.2	QP	20.0	7.0	27.9	57.3	90.4	33.1	0deg	359	Y-Axis(MAX)
13.56700	56.8	QP	20.0	7.1	27.9	56.0	90.4	34.4	0deg	359	Y-Axis(MAX)
13.71000	39.7	QP	20.0	7.1	27.9	38.9	80.5	41.6	90deg	249	Y-Axis(MAX)
14.01000	38.3	QP	20.0	7.1	27.9	37.5	69.5	32.0	90deg	249	Y-Axis(MAX)
27.12000	25.8	QP	19.9	7.7	28.0	25.4	69.5	44.1	90deg	249	Y-Axis(MAX)

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

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MF060b(10.04.03)

Radiated emission
(Fundamental emission, Spectrum Mask and Spurious emission :below 30MHz)

DATA OF MAGNETIC RADIATED EMISSION TEST

UL Apex Co.,LTD. Head Office EMC Lab. No.1 Semi Anechoic Chamber
Date : 2005/08/30 10:17:35

Applicant : KEYENCE CORPORATION Report No. : 25IE0303-HO
Kind of EUT : RFID System Power : DC5V
Model No. : RF-500 Temp./ Humi. : 24deg.C / 60%
Serial No. : S001,S002,S003 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, EUT x 3, 50cm, coin tag

LIMIT : FCC15C §15.225 3m
All other spurious emissions were less than 20dB for the limit.

Freq. [MHz]	Reading [dBuV]	DET	Ant.Fac	Loss	Gan	Result	Limit	Margin	Antenna	Table	Comment
			[dB/m]	[dB]	[dB]	[dBuV/m]	[dBuV/m]	[dB]		[deg]	
13.11000	36.5	QP	20.0	7.0	27.9	35.6	69.5	33.9	90deg	249	Y-Axis(MAX)
13.41000	32.5	QP	20.0	7.0	27.9	31.6	80.5	48.9	90deg	249	Y-Axis(MAX)
13.55300	57.7	QP	20.0	7.0	27.9	56.8	90.4	33.6	0deg	359	Y-Axis(MAX)
13.56000	68.5	QP	20.0	7.1	27.9	67.7	123.9	56.2	0deg	359	Y-Axis(MAX)
13.56700	56.5	QP	20.0	7.1	27.9	55.7	90.4	34.7	0deg	359	Y-Axis(MAX)
13.71000	41.6	QP	20.0	7.1	27.9	40.8	80.5	39.7	90deg	249	Y-Axis(MAX)
14.01000	37.4	QP	20.0	7.1	27.9	36.6	69.5	32.9	90deg	249	Y-Axis(MAX)
27.12000	25.7	QP	19.9	7.7	28.0	25.3	69.5	44.2	90deg	249	Y-Axis(MAX)

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

Page:

Radiated emission (Spurious emission : above 30MHz)

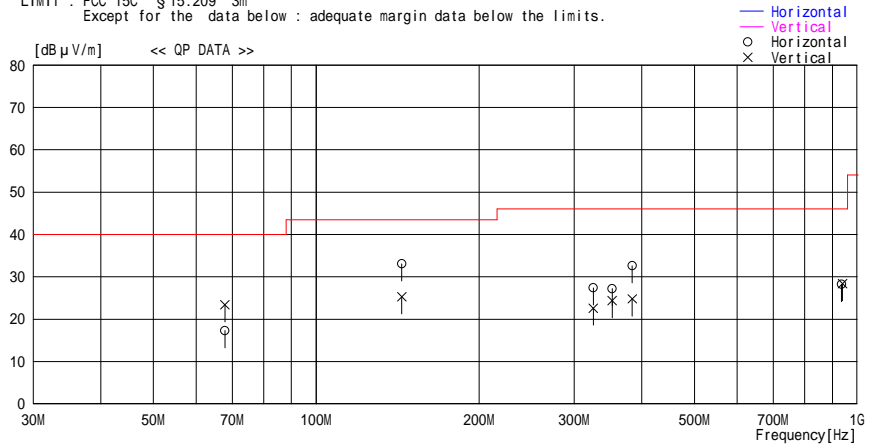
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : KEYENCE CORPORATION
 Kind of EUT : RFID system
 Model No. : RF-500
 Serial No. : S003
 Report No. : 25IE0303-HO
 Power : DC5V
 Temp /Humi% : 21deg.C / 60%
 Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, compact tag, Y-Axis

LIMIT : FCC 15C §15.209 3m
 Except for the data below : adequate margin data below the limits.



Frequency [MHz]	Reading [dBuV]	DET	Antenna		Level [dBuV/m]	Angle [Deg]	Height [cm]	Polar.	Limit	
			Factor [dB/m]	Loss& Gain [dB]					[dBuV/m]	[dB]
67.798	36.6	QP	7.2	-20.4	23.4	176	100	Vert.	40.0	16.6
67.801	30.5	QP	7.2	-20.4	17.3	82	278	Hori.	40.0	22.7
143.991	37.4	QP	14.7	-19.0	33.1	359	223	Hori.	43.5	10.4
144.002	29.6	QP	14.7	-19.0	25.3	112	100	Vert.	43.5	18.2
325.422	28.8	QP	15.6	-17.0	27.4	0	100	Hori.	46.0	18.6
325.424	24.0	QP	15.6	-17.0	22.6	142	100	Vert.	46.0	23.4
352.542	27.7	QP	16.5	-17.0	27.2	310	100	Hori.	46.0	18.8
352.539	24.9	QP	16.5	-17.0	24.4	240	150	Vert.	46.0	21.6
383.998	32.2	QP	17.5	-17.1	32.6	305	100	Hori.	46.0	13.4
384.007	24.4	QP	17.5	-17.1	24.8	247	130	Vert.	46.0	21.2
939.617	21.2	QP	22.3	-15.1	28.4	359	100	Vert.	46.0	17.6
935.497	21.1	QP	22.2	-15.1	28.2	359	100	Hori.	46.0	17.8

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP_30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
 CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

Radiated emission (Spurious emission : above 30MHz)

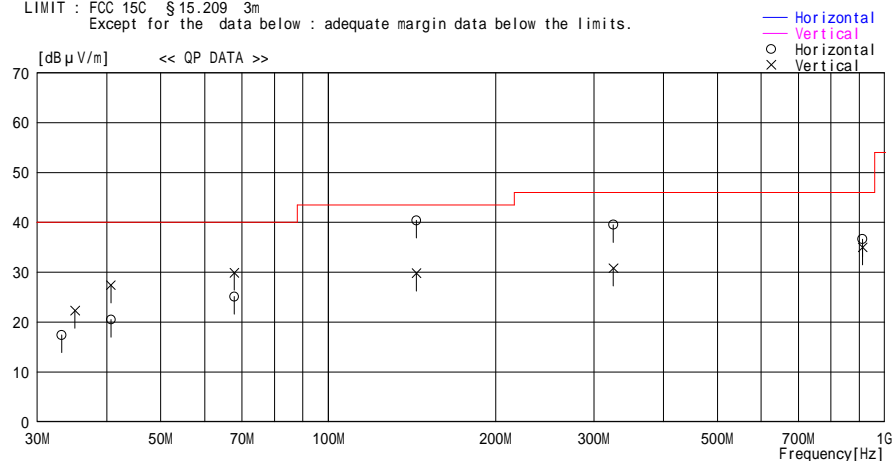
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : KEYENCE CORPORATION	Report No. : 25IE0303-HO
Kind of EUT : RFID system	Power : DC5V
Model No. : RF-500	Temp /Humi% : 21deg.C / 60%
Serial No. : S001,S002,S003	Operator : Hiroka Umeyama

Mode / Remarks : Transmitting 13.56MHz, compact tag, EUT x 3 , 50cm, Y-Axis

LIMIT : FCC 15C §15.209 3m
 Except for the data below : adequate margin data below the limits.



Frequency	Reading	DET	Antenna		Level	Angle	Height	Polar.	Limit	Margin
			Factor	Loss&Gain						
[MHz]	[dBuV]		[dB/m]	[dB]	[dBuV/m]	[Deg]	[cm]		[dBuV/m]	[dB]
33.186	21.0	QP	17.4	-21.0	17.4	359	300	Hori.	40.0	22.6
35.080	26.7	QP	16.6	-21.0	22.3	243	100	Vert.	40.0	17.7
40.684	27.6	QP	13.6	-20.7	20.5	0	232	Hori.	40.0	19.5
40.676	34.5	QP	13.6	-20.7	27.4	87	100	Vert.	40.0	12.6
67.802	38.3	QP	7.2	-20.4	25.1	359	292	Hori.	40.0	14.9
67.799	43.1	QP	7.2	-20.4	29.9	260	100	Vert.	40.0	10.1
143.995	44.7	QP	14.7	-19.0	40.4	0	226	Hori.	43.5	3.1
143.989	34.1	QP	14.7	-19.0	29.8	328	100	Vert.	43.5	13.7
325.440	40.9	QP	15.6	-17.0	39.5	85	120	Hori.	46.0	6.5
325.435	32.2	QP	15.6	-17.0	30.8	12	174	Vert.	46.0	15.2
912.011	28.5	QP	21.7	-15.2	35.0	256	164	Vert.	46.0	11.0
911.988	30.1	QP	21.7	-15.2	36.6	92	150	Hori.	46.0	9.4

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

Radiated emission (Spurious emission : above 30MHz)

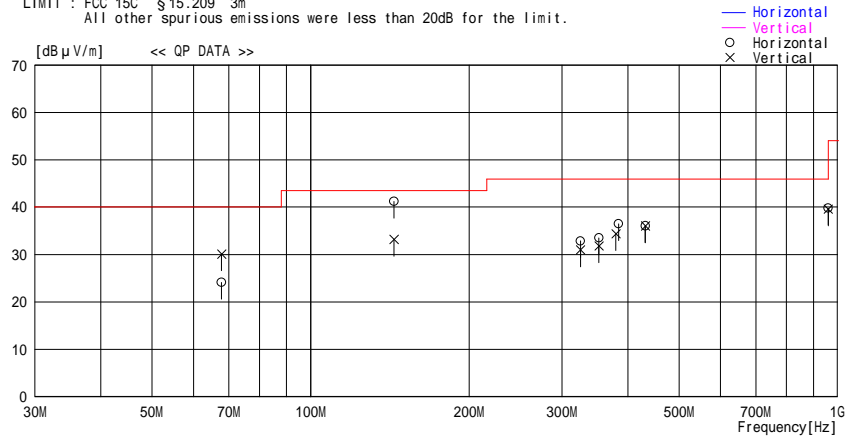
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No.1 Semi Anechoic Chamber

Applicant : KEYENCE CORPORATION
 Kind of EUT : RFID system
 Model No. : RF-500
 Serial No. : S001,S002,S003
 Report No. : 25IE0303-HO
 Power : DC5V
 Temp /Humi% : 21deg.C / 60%
 Operator : Hiroka Uneyama

Mode / Remarks : Transmitting 13.56MHz, coin tag, EUT x 3 , 50cm, Y-Axis

LIMIT : FCC 15C §15.209 3m
 All other spurious emissions were less than 20dB for the limit.



Frequency [MHz]	Reading [dBμV]	DET	Antenna		Level [dBμV/m]	Angle [Deg]	Height [cm]	Polar.	Limit [dBμV/m]	Margin [dB]
			Factor [dB/m]	Loss&Gain [dB]						
67.790	37.3	QP	7.2	-20.4	24.1	359	274	Hori.	40.0	15.9
67.792	43.3	QP	7.2	-20.4	30.1	115	100	Vert.	40.0	9.9
143.998	45.5	QP	14.7	-19.0	41.2	0	229	Hori.	43.5	2.3
143.986	37.5	QP	14.7	-19.0	33.2	300	100	Vert.	43.5	10.3
325.430	34.3	QP	15.6	-17.0	32.9	102	100	Hori.	46.0	13.1
325.426	32.4	QP	15.6	-17.0	31.0	301	100	Vert.	46.0	15.0
352.551	34.0	QP	16.5	-17.0	33.5	300	100	Hori.	46.0	12.5
352.551	32.3	QP	16.5	-17.0	31.8	300	100	Vert.	46.0	14.2
383.983	36.1	QP	17.5	-17.1	36.5	291	100	Hori.	46.0	9.5
379.668	34.0	QP	17.4	-17.0	34.4	184	130	Vert.	46.0	11.6
431.996	35.1	QP	18.2	-17.2	36.1	57	100	Hori.	46.0	9.9
431.990	35.0	QP	18.2	-17.2	36.0	165	126	Vert.	46.0	10.0
959.990	32.1	QP	22.7	-15.0	39.8	0	200	Hori.	46.0	6.2
959.990	31.9	QP	22.7	-15.0	39.6	148	126	Vert.	46.0	6.4

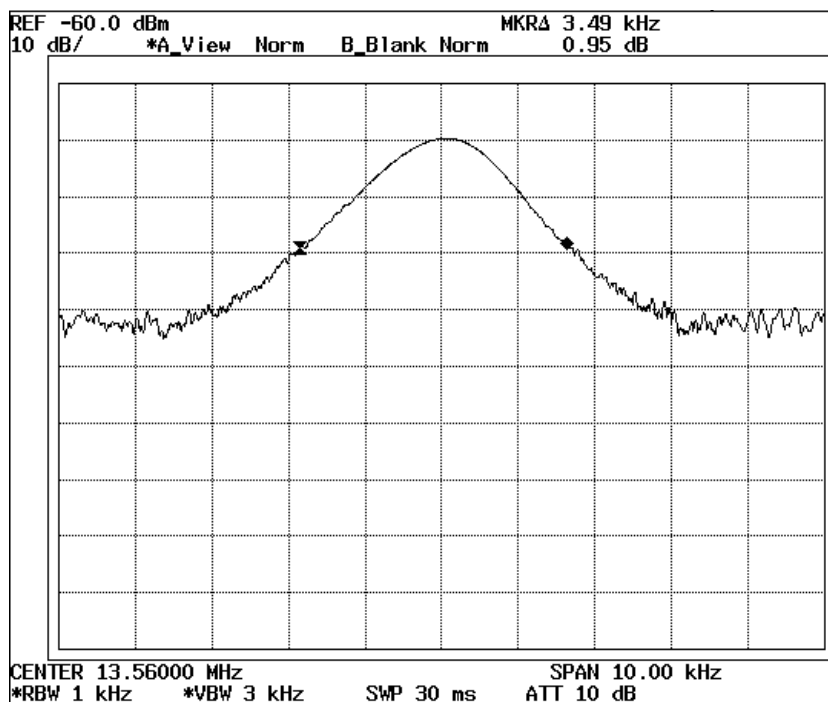
CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
 CALCULATION: RESULT = READING + ANT FACTOR + LOSS(CABLE+ATTEN.) - GAIN(AMP)

-20dB Bandwidth

UL Apex Co., Ltd.
Head Office EMC Lab. No.3 Measurement Room

COMPANY : KEYENCE CORPORATION	REPORT NO. : 25IE0303-HO
EQUIPMENT : Radio Frequency Identification System	REGULATION : FCC15.225
MODEL : RF-500	TEST DISTANCE : 3m
S/ N : S003	DATE : 09/01/2005
POWER : DC5V	TEMPERATURE : 23 deg. C
MODE : Transmitting , compact tag	HUMIDITY : 56 %
	ENGINEER : Hiroka Umeyama

FREQ	Result
[MHz]	[kHz]
13.56	3.49

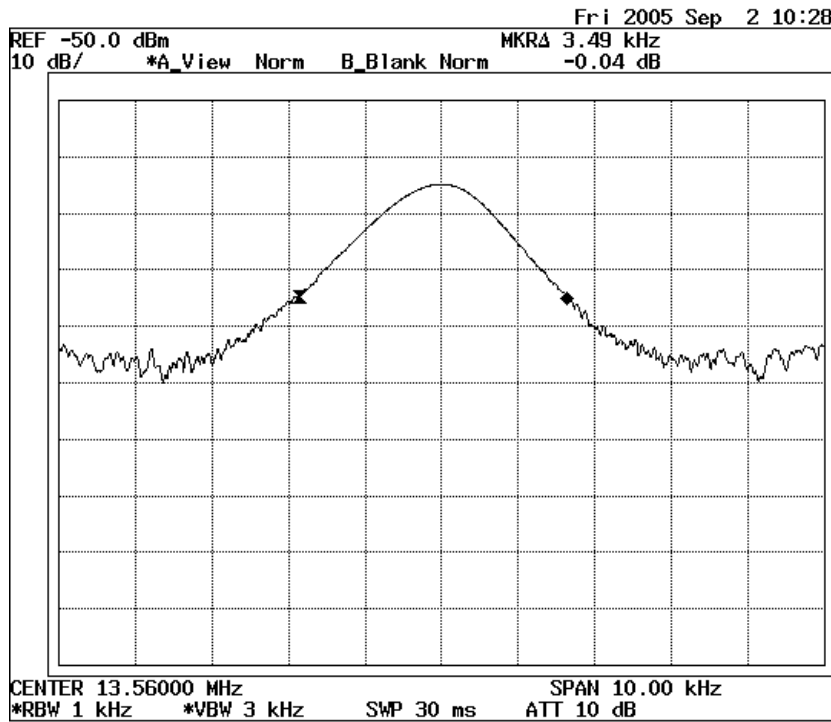


-20dB Bandwidth

UL Apex Co., Ltd.
 Head Office EMC Lab. No.3 Measurement Room

COMPANY : KEYENCE CORPORATION	REPORT NO. : 25IE0303-HO
EQUIPMENT : Radio Frequency Identification System	REGULATION : FCC15.225
MODEL : RF-500	TEST DISTANCE : 3m
S/ N : S003	DATE : 09/01/2005
POWER : DC5V	TEMPERATURE : 23 deg. C
MODE : Transmitting , coin tag	HUMIDITY : 56 %
	ENGINEER : Hiroka Umeyama

FREQ	Result
[MHz]	[kHz]
13.56	3.49

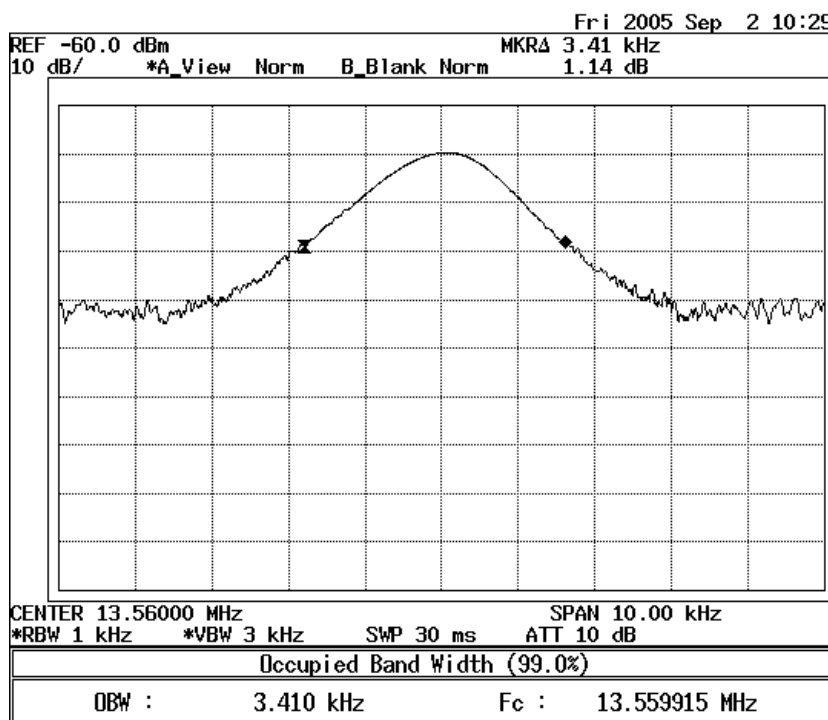


99% Occupied Bandwidth

UL Apex Co., Ltd.
Head Office EMC Lab. No.3 Measurement Room

COMPANY : KEYENCE CORPORATION	REPORT NO. : 25IE0303-HO
EQUIPMENT : Radio Frequency Identification System	REGULATION : FCC15.225
MODEL : RF-500	TEST DISTANCE : 3m
S/ N : S003	DATE : 09/01/2005
POWER : DC5V	TEMPERATURE : 23 deg. C
MODE : Transmitting , compact tag	HUMIDITY : 56 %
	ENGINEER : Hiroka Umeyama

FREQ	Result
[MHz]	[kHz]
13.56	3.41

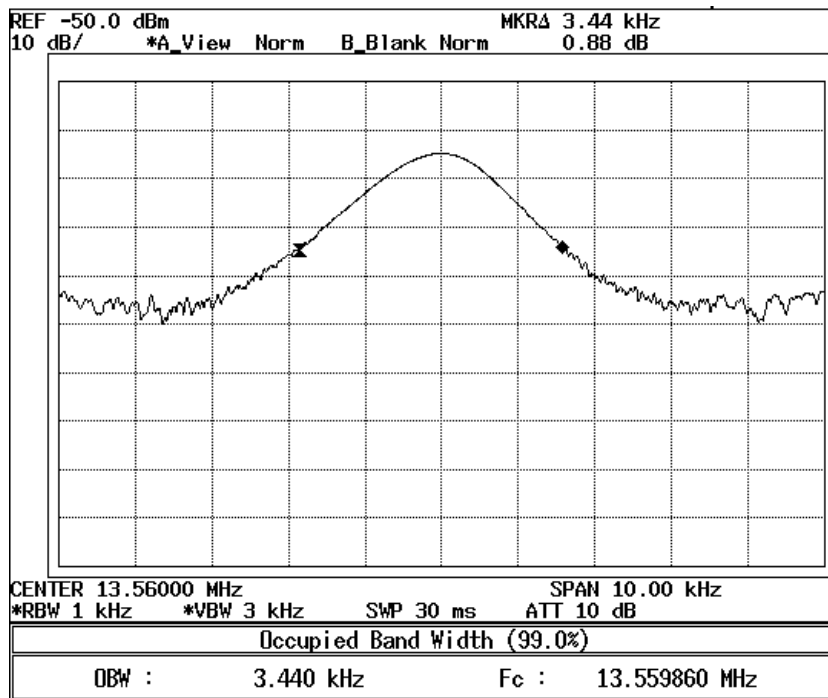


99% Occupied Bandwidth

UL Apex Co., Ltd.
 Head Office EMC Lab. No.3 Measurement Room

COMPANY : KEYENCE CORPORATION	REPORT NO. : 25IE0303-HO
EQUIPMENT : Radio Frequency Identification System	REGULATION : FCC15.225
MODEL : RF-500	TEST DISTANCE : 3m
S/ N : S003	DATE : 09/01/2005
POWER : DC5V	TEMPERATURE : 23 deg. C
MODE : Transmitting , coin tag	HUMIDITY : 56 %
	ENGINEER : Hiroka Umeyama

FREQ	Result
[MHz]	[kHz]
13.56	3.44



Frequency Stability

UL Apex Co., Ltd.
Head Office EMC Lab. No.3 Measurement Room

COMPANY	: KEYENCE CORPORATION	REPORT NO.	: 25IE0303-HO
EQUIPMENT	: Radio Frequency Identification System	REGULATION	: FCC15.225
MODEL	: RF-500	TEST DISTANCE	: 3m
S/ N	: S003	DATE	: 09/01/2005
POWER	: DC5V	TEMPERATURE	: 23 deg. C
MODE	: Transmitting	HUMIDITY	: 56 %
		ENGINEER	: Hiroka Umeyama

Test Condition	Test Timing	FREQ [MHz]	Result	Limit	Margin
T min -20	Power on	13.559705	-0.002176%	0.010000%	0.007824%
	on 2min.	13.559706	-0.002168%	0.010000%	0.007832%
	on 5min.	13.559708	-0.002153%	0.010000%	0.007847%
	on 10min.	13.559716	-0.002094%	0.010000%	0.007906%
T max 50	Power on	13.559886	-0.000841%	0.010000%	0.009159%
	on 2min.	13.559886	-0.000841%	0.010000%	0.009159%
	on 5min.	13.559886	-0.000841%	0.010000%	0.009159%
	on 10min.	13.559899	-0.000745%	0.010000%	0.009255%

Limit : 13.56 MHz +/-0.01 %