TEST REPORT

Report Number : A-004-14-C

Date of Issue: 20 November 2014

FCC Rules and Regulations Part 15 Subpart C Intentional Radiators.

This test report is to certify that the device was tested according to the requirements of the above.
The results of this report should not be construed to imply compliance of devices other than the sample tested.
Without the laboratory approval by the documents, this report should not be copied in part.

1. Applicant

Company Name	: TAKAYA Corporation
Mailing Address	: 661-1, Ibara-cho, Ibara-city, Okayama, 715-8503, Japan

2. Identification of Tested Device

Type of Device	: Transmitter
FCC ID	: MK4TS-A1-FCC
Device Name	: Store Security Gate
Model Number	: TS-A1-TX-FCC
Serial Number	: TA140001
Trade Name	: TAKAYA
Type of Test	: ☐ Production ☒ Pre-production ☐ Prototype
Test Plan Number	: 50005954 A
Modification of Test Plan	: ☒ No ☐ Yes (refer to deviation information in this report)

3. Test Items

AC Power Line Conducted Emission Measurement	☒ Pass	☐ Fail	☐ N/A
Radiated Emission (The Frequency Range of 9kHz to 30MHz)	☒ Pass	☐ Fail	☐ N/A
Radiated Emission (The Frequency Range of above 30MHz)	☒ Pass	☐ Fail	☐ N/A
6dB Bandwidth Measurement	☒ Pass	☐ Fail	☐ N/A
Frequency Stability	☒ Pass	☐ Fail	☐ N/A

Refer the below reason(s) with respect to the decision and justification not to test.
(*1) EUT Specifications (*2) Request of Applicant (*3) According to Test Plan

KEC Electronic Industry Development Center Testing Division
3-2-2, Hikari-dai, Seika-cho, Soraku-gun, Kyoto 619-0237 Japan

Test Engineer(s)

Naoki Norimoto

Approved by Ikuya Minematsu / Group Manager

Table of Contents

0. REVISION HISTORY

Report Version	Page	Description	Date of Issue
A	-	Initial issue of report	8 October 2014
B	21, 23	Clerical error	20 November 2014

1. LABORATORY INFORMATION

1.1. Laboratory Accreditation

The KEC has been accredited by the following organizations based on their criteria for testing laboratory (ISO/IEC 17025).

(1) Japan Accreditation Board for Conformity Assessment (JAB) : Accreditation Number: RTL02810
(2) Voluntary EMC Laboratory Accreditation Center Inc. (VLAC) : Accreditation Number: VLAC-005

1.2. Test Facility

All tests described in this report were performed by:

Name: KEC Electronic Industry Development Center
Testing Division

Address: 3-2-2, Hikari-dai, Seika-cho, Soraku-gun, Kyoto 619-0237 Japan

Anechoic Chamber	: ☐ No.1	☐ No.2	☐ No.3	☐ No.6	☐ No.7
	☐ No.8	☐ No.9	☐ No.10	☒ No.11	☐ No.12
Shielded Room	: ☐ No.1	☐ No.7	☐ No.8	☒ No.9	☐ No.10
Harmonic Current Meas. Room	: ☐				

1.3. Measurement Uncertainty

The result of a measurement is only an approximation or estimate of the value of a specific quantity.
And thus the measurand is complete only when a statement of uncertainty is given.
KEC quotes Measurement Uncertainty (U) as follows.

Conducted Disturbance at Mains Port (150kHz-30MHz)	+3.1 / -3.7 dB
Conducted Disturbance at Mains Port (9kHz-30MHz)	+3.4 / -4.3 dB
Conducted Disturbance at Telecommunication Ports ISN method (None-Shield type)	+2.5 / -2.9 dB
Conducted Disturbance at Telecommunication Ports ISN method (Shield type)	+2.4 / -2.6 dB
Conducted Disturbance at Telecommunication Ports Current Probe method	+2.3 / -2.8 dB
Conducted Disturbance at Telecommunication Ports 150Ω Load voltage method	+1.9 / -2.5 dB
Conducted Disturbance at Telecommunication Ports None Invasive method	+2.8 / -3.8 dB
Conducted Disturbance at Lead Terminals and Additional Terminals	+1.7 / -2.4 dB
Disturbance Power (30MHz -300MHz)	+3.3 / -3.4 dB
Radiated Disturbance at Frequency Range from 9kHz up to 30MHz 60cm Loop Antenna method	+3.7 / -4.4 dB
Radiated Disturbance at Frequency Range from 9kHz up to 30MHz LLA method	+2.2 / -2.8 dB
Radiated Disturbance at Frequency Range from 30MHz up to 300MHz 3m method	+3.4 / -3.3 dB
Radiated Disturbance at Frequency Range from 300MHz up to 1GHz 3m method	+3.4 / -3.6 dB
Radiated Disturbance at Frequency Range from 30MHz up to 300MHz 10m method	+3.2 / -3.9 dB
Radiated Disturbance at Frequency Range from 300MHz up to 1GHz 10m method	+3.6 / -4.5 dB
Radiated Disturbance at Frequency Range from 30MHz up to 1GHz 10m method (Hybrid Antenna used measurement)	+4.1 / -4.4 dB
Radiated Disturbance at Frequency Range from 1GHz up to 6GHz 3m method	+4.7 / -6.2 dB
Radiated Disturbance at Frequency Range from 6GHz up to 26.5GHz 3m method	+4.5 / -5.0 dB
Harmonics Currents Emissions	+/- 6.5%
Voltage Change, Voltage Fluctuations and Flicker	+/- 2.3%

Expiration Date : 2015/9/30

The above values are calculated as Expanded Uncertainty (k=2 [95%]).

[Note]

If the measured result is below the specification limit and a margin is less than the above measurement uncertainty, it is impossible to determine compliance at a level of confidence of 95%. However, the measured result indicates high probability that the tested device complies with the specification limit.

2. GENERAL INFORMATION

2.1. Product Description

(1) Radio and modulation Type
· TS-A1-TX-FCC, TS-A1-RX-FCC : Carrier swept frequency device (FM)

(2) Frequency Range
· TS-A1-TX-FCC, TS-A1-RX-FCC : 8.2MHz±500kHz with a sweep frequency 122.1Hz

(3) Specify Output Power
· TS-A1-TX-FCC : 2.8W

(4) Antenna Gain : -38.4dBi (Peak)

(5) Antenna Type : Loop antenna

(6) Number of Channels
· TS-A1-TX-FCC, TS-A1-RX-FCC : Continuously swept between 7.7MHz and 8.7MHz (by the sine wave cycle:122.1Hz)

(7) Temperature Range : 10 - 40 °C

(8) Dimension (approx.) : 326(W)×80(D)×1670(H)mm (Floor Standing)

(9) Weight (approx.) : 5.5kg

(10) Environment : Residential and Commercial/industrial environment

(11) Rated Voltage & Frequency : AC100V-240V 50/60Hz (test for AC 120V 60Hz)

3. TESTED SYSTEM

3.1. Reference Rule and Specification

(1) Reference Rule and Regulation	: FCC Rule Part 15 Subpart C, Section 15.223 Operation within the band 1.705-10 MHz ☒ Section 15.205 ☒ Section 15.207 ☒ Section 15.209 ☒ Section 15.215 ☒ Section 15.223
(2) Test Procedure	: ANSI C63.10-2009

3.2. Date of Test

Receipt of Test Sample : 29 September 2014
Condition of Test Sample : ☒ Damage is not found on the set.
☐ Damage is found on the set. (Details are described in this report)

Test Completed on : 3 October 2014
Condition of Test Sample : ☒ Damage is not found on the set.
☐ Damage is found on the set. (Details are described in this report)

3.3. Deviation of Standard

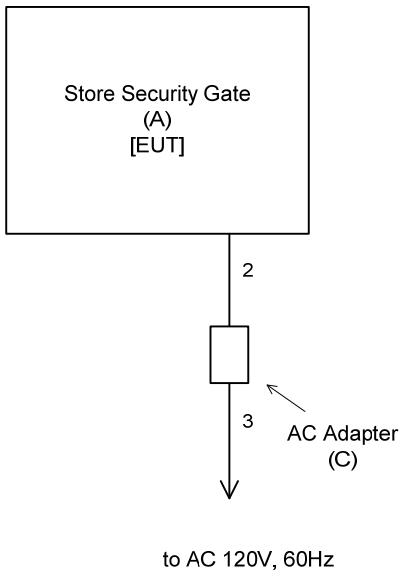
☒ without deviation, ☐ with deviation (details are found inside of this report)

3.4. Test Mode

Mode No.	Test Mode
A1	EUT transmits a swept frequency signal between 7.7MHz and 8.7MHz Pre-check of Conducted Emission ・Antenna attached ・Dummy load

[Note]
(1) The test mode was planned by TÜV Rheinland Test Plan (Test Plan_50005954 A)
(2) Frequency Stability measurement was performed under the following condition.
Voltage : AC102V, 120V and 138V(+/- 15%, AC)
Temperature : -20deg C, +20deg C and 55deg C

3.5. Block Diagram of TEST System



3.6. List of Test System

No.	Device Name	Model Number	Serial Number	Trade Name	Note
A	Store Security Gate	TS-A1-TX-FCC	TA140001	TAKAYA	EUT
C	AC Adapter	GF65I-US1640	-	GO FORWARD ENTERPRISE CORP.	(1)

[Note]
(1) : Accessory of EUT

3.7. List of Cables

No.	Cable Name	Shielded (Y/N)	Length (m)	Note	
2	DC Power Code	N	1.6		(1)
3	AC Power Code	N	1.8		(3)

[Note]
(1) : Undetachable cable type
(2) : Accessories cable of EUT
(3) : 3-wires type, earth plug is grounded.
(4) : 2-wires type

4. AC POWER LINE CONDUCTED EMISSION MEASUREMENT

4.1. Test Procedure

(1) The EUT is placed in accordance with ANSI C63.10-2009.
(2) The EUT is activated as to simulate an actual operation.
(3) Connect the EUT's AC power cord to one Line Impedance Stabilization Network (LISN).
(4) Any other power cord of other equipment is connected to a LISN different from the LISN used for the EUT.
(5) Connect the spectrum analyzer (*1) to the measuring port of the LISN for the EUT, using a calibrated coaxial cable.
(6) To find out the maximum emission of the configuration of the EUT System, the operation mode and the position of the cables are changed, then preliminary conducted measurement are performed.
(7) The spectrums are scanned from 150kHz to 30MHz and collect the six highest emissions minimum on the spectrum analyzer relative to the limits in the whole range.
(8) The test receiver (*2) is connected to the LISN for the EUT, and the six highest emissions minimum recorded above are measured.

[Note]
(*1) Spectrum Analyzer Set Up Conditions

Frequency range	: 150kHz – 30MHz
Resolution bandwidth	: 10kHz
Video bandwidth	: 1MHz
Detector function	: Peak mode

(*2) Test Receiver Set Up Conditions

Detector function	: Quasi – Peak / Average (if necessary)
IF bandwidth	: 10kHz

4.2. Test Results

Measured Frequency	LISN Factor	Meter Reading				Maximum RF Voltage		Limit		Margin for Limit	
		Q-Peak		Average							
(MHz)	(dB)	Va (dBμV)	Vb (dBμV)	Va (dBμV)	Vb (dBμV)	Q-Peak (dBμV)	Average (dBμV)	Q-Peak (dBμV)	Average (dBμV)	Q-Peak (dB)	Average (dB)
0.150	10.4	35.1	34.9	5.1	5.2	45.5	15.6	66.0	56.0	20.5	40.4
0.179	10.3	40.1	40.1	23.0	24.1	50.4	34.4	64.5	54.5	14.1	20.1
0.238	10.3	33.0	33.1	15.7	18.3	43.4	28.6	62.2	52.2	18.8	23.6
0.301	10.2	28.5	28.3	13.0	15.7	38.7	25.9	60.2	50.2	21.5	24.3
7.658	10.4	40.9	41.0	18.8	18.5	51.4	29.2	60.0	50.0	8.6	20.8
8.656	10.5	45.3	45.2	23.3	22.8	55.8	33.8	60.0	50.0	4.2	16.2
17.406	10.9	21.3	19.4	15.3	13.0	32.2	26.2	60.0	50.0	27.8	23.8
22.958	11.1	22.2	21.6	5.3	4.4	33.3	16.4	60.0	50.0	26.7	33.6

[Note]
LISN Factor includes the cable loss and attenuator loss.

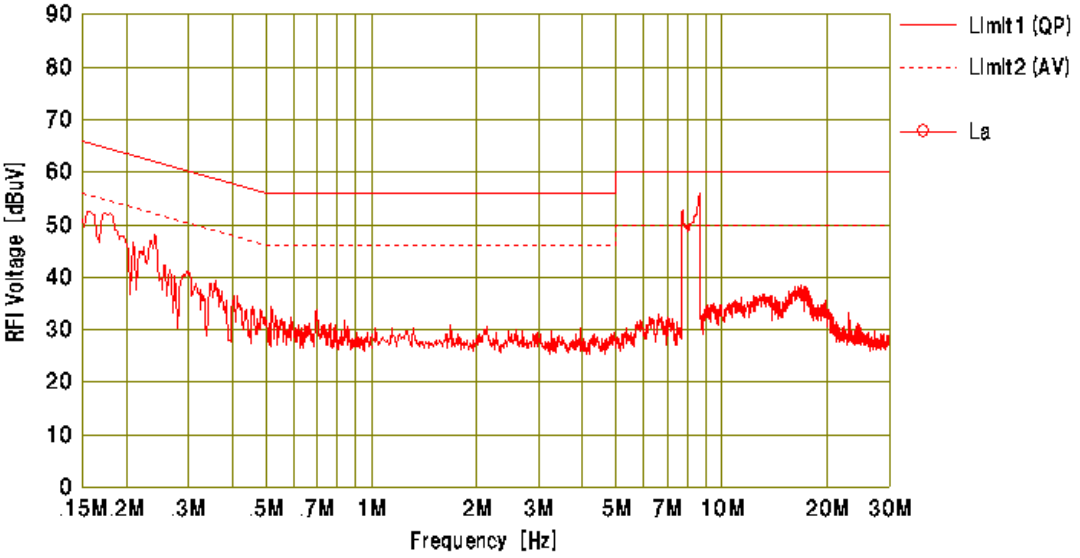
[Calculation method]
Maximum RF Voltage (dBμV)
= Meter Reading (at maximum level of Va or Vb) (dBμV) + LISN Factor (dB)

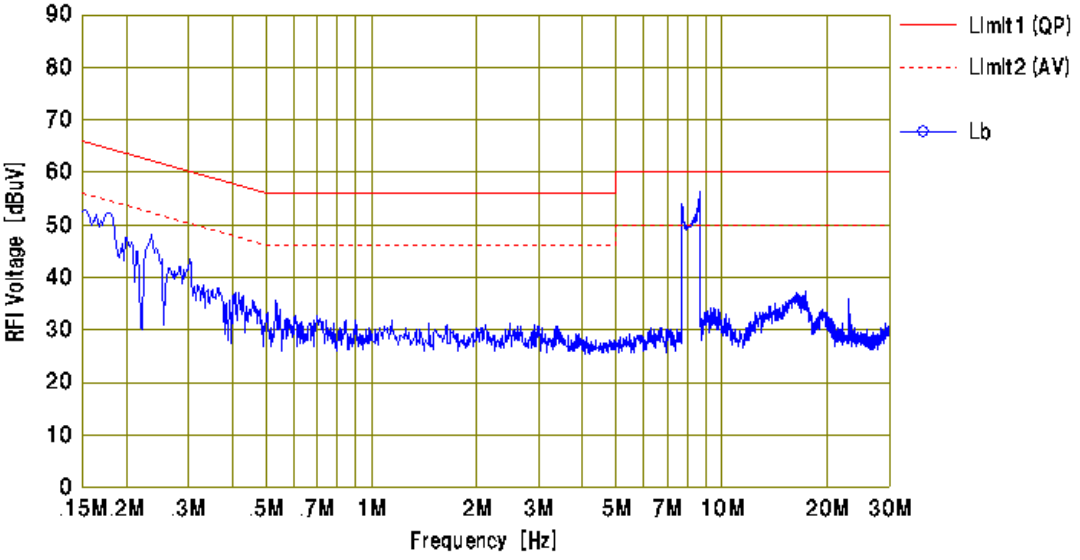
At the next page, the result of exploratory conducted emission measurement by using the spectrum analyzer is shown by the spectrum chart.

Tested Date	Environment	
	Temperature	Humidity
1 October 2014	25 °C	35 %

Test Results in Graph

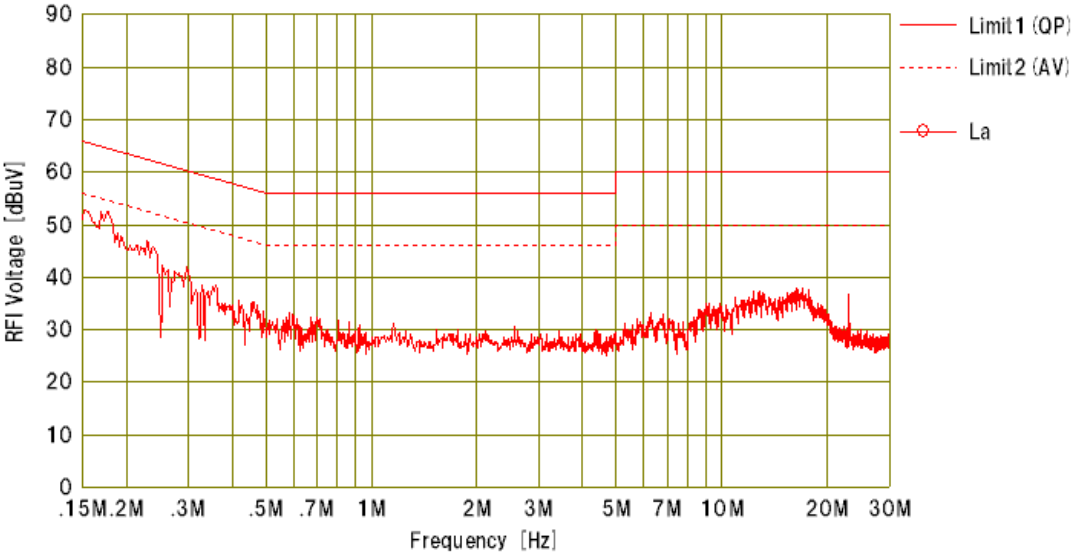
・Antenna attached

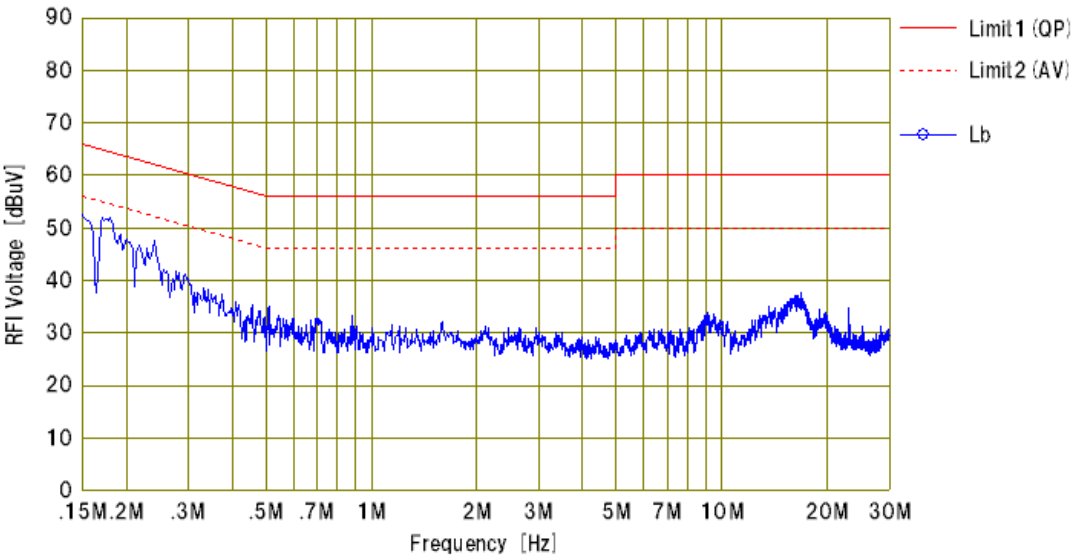




Test Results in Graph

・Dummy load





5. Radiated Emission (The Frequency Range of 9kHz to 30MHz)

5.1. Test Procedure

(1) The EUT is placed in accordance with ANSI C63.10-2009.
(2) The EUT is activated as to simulate an actual operation.
(3) To find out the maximum emission of the configuration of the EUT System, the operation mode and the position of the cables are changed, then preliminary radiated measurement are performed using the spectrum analyzer (*1) and the loop antenna.
(4) The emissions recorded are measured at the specified distance using the loop antenna and the test receiver (*2).
(5) If the emission level is low and not detected at the specified distance, compliance test is performed at a closer distance and judged from calculating field strength at specified distance by using the measured data at a closer distance.

[Note]
(*1) Spectrum Analyzer Set Up Conditions
Frequency range : 9kHz – 150kHz / 150kHz – 30MHz
Resolution bandwidth : 300Hz / 10kHz
Detector function : Peak mode
RMS mode (long sweep time)
(*2) Test Receiver Set Up Conditions
Detector function : Quasi – Peak
IF bandwidth : 200Hz (9kHz – 150kHz)
: 10kHz (150kHz – 30MHz)

5.2. Test Results

Fundamental Frequency Measurement from 1.705MHz to 10MHz (FCC 15.223)

Measured Frequnecy (MHz)	Antenna Factor (dB)	Meter Reading (dBμV/m)	Maximum Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin for Limit (dB)
Peak detector					
7.649	20.6	67.7	88.3	100.0	11.7
8.660	20.6	70.7	91.3	100.0	8.7
Average detector					
7.649	20.6	55.0	75.6	80.0	4.4
8.660	20.6	58.0	78.6	80.0	1.4

Spurious Emission measurement from 9kHz to 30MHz (except 1.705MHz to 10MHz) (FCC 15.209)

Measured Frequnecy (MHz)	Antenna Factor (dB)	Meter Reading (dBμV/m)	Maximum Field Strength at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin for Limit (dB)
Quasi-Peak detector					
15.290	21.2	33.7	54.9	69.6	14.7
17.325	21.4	27.0	48.4	69.6	21.2
22.914	22.0	29.6	51.6	69.6	18.0
25.979	22.3	28.5	50.8	69.6	18.8

[Note]
(1) Antenna Factor includes the cable loss and 20dB constant antenna factor.
(2) Measurement Distance : 3m
(3) Conversion Factor of Limit : FCC Part 15 Subpart A Section 15.31(f) (2) is applied.

[Calculation method]
Maximum Field Strength (dBμV/m) = Meter Reading (dBμV/m) + Antenna Factor (dB)

Tested Date	Environment	
	Temperature	Humidity
1 October 2014	24°C	50 %

6. Radiated Emission (The Frequency Range of above 30MHz)

6.1. Test Procedure

(1) The EUT is placed in accordance with ANSI C63.10-2009.
(2) The EUT is activated as to simulate an actual operation.
(3) To find out the maximum emission of the configuration of the EUT System, the operation mode and the position of the cables are changed, then preliminary radiated measurement are performed using the spectrum analyzer (*1) and the broad band antenna.
(4) The spectrums are scanned from 30MHz to 1GHz, and collect the highest emissions on the spectrum analyzer relative to the limits in the whole range.
In the frequency above 1GHz, it is performed using the spectrum analyzer (*2) and the horn antenna.
(5) The highest emissions are measured at the specified distance using the test receiver (*3) and the broad band antenna or the tuned dipole. In the frequency above 1GHz, they are measured using the spectrum analyzer (*4) and the horn antenna.

[Note]

(*1) Spectrum Analyzer Set Up Conditions

Frequency range	: 30MHz – 1GHz
Resolution bandwidth	: 100kHz
Detector function	: Peak mode

(*2) Spectrum Analyzer Set Up Conditions (Pre-measurement)

Frequency range	: 1GHz – Upper frequency of measurement range
Resolution bandwidth	: 1MHz

(*3) Test Receiver Set Up Conditions

Detector function	: Quasi – Peak
IF bandwidth	: 120kHz

(*4) Spectrum Analyzer Set Up Conditions

Center Frequency	: Measurement Frequency
Resolution bandwidth	: 1MHz
Video bandwidth	: 1MHz (Peak measurement) 10Hz or 30Hz (Average measurement)
Attenuator	: 10dB
Y axis	: Linear (Average measurement)

6.2. Test Results

Measured Frequency (MHz)	Antenna Factor (dB/m)	Meter Reading		Maximum Field Strength (dBμV/m)	Limit (dBμV/m)	Margin for Limit (dB)
		Horizontal Polarization (dBμV)	Vertical Polarization (dBμV)			
30.58	19.3	<0.0	6.6	25.9	40.0	14.1
40.87	17.6	<0.0	13.2	30.8	40.0	9.2
45.86	16.8	<0.0	5.7	22.5	40.0	17.5
64.36	16.2	<0.0	0.5	16.7	40.0	23.3
500.00	20.3	<0.0	<0.0	<20.3	46.0	>25.7
1000.00	27.6	<0.0	<0.0	<27.6	54.0	>26.4

[Note]

(1) ☐ Antenna Factor includes the cable loss, attenuator loss and pre-amplifier gain.
☒ Antenna Factor includes the cable loss and attenuator loss.
Above 1000MHz, the antenna factor includes the cable loss and pre-amplifier gain.

(2) * mark in Measured Frequency : Measured with the tuned dipole antenna.
no mark in Measured Frequency : Measured with the broadband antenna.

(3) Upper Frequency : ☒Transmitter Frequency (TX): TX < 10GHz
☒1GHz ☐10th harmonic of the highest frequency / ☐Up to 40GHz
☐Transmitter Frequency (TX): 10GHz ≦ TX < 30GHz
☐10th harmonic of the highest frequency / ☐Up to 100GHz
☐Transmitter Frequency (TX): 30GHz ≦ TX
☐10th harmonic of the highest frequency / ☐Up to 200GHz

The emissions were checked to the upper frequency, and the lower emissions than the listed emissions in the above tables were omitted.

(4) Measurement Distance : <below 1GHz>☒ 3m ☐ 10m
<above 1GHz>☐ 3m ☐ 10m

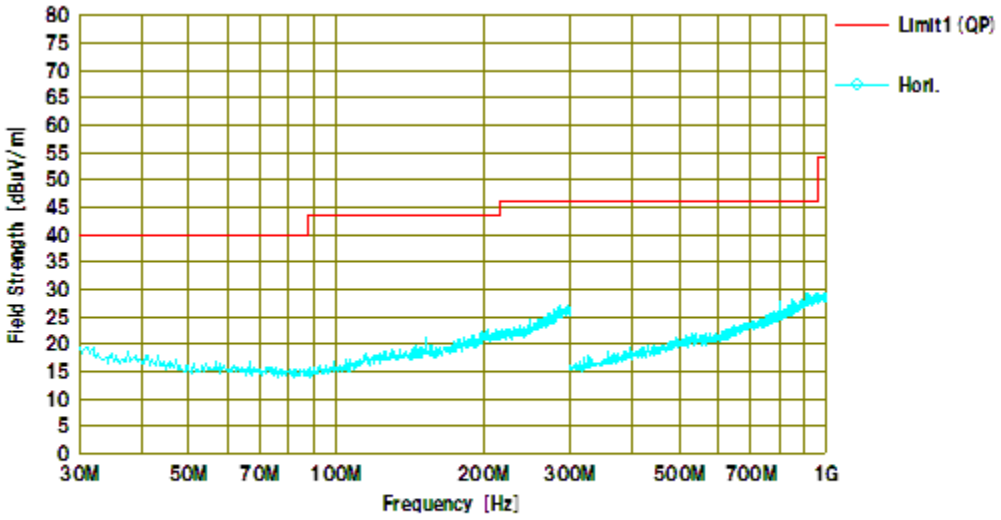
[Calculation method]

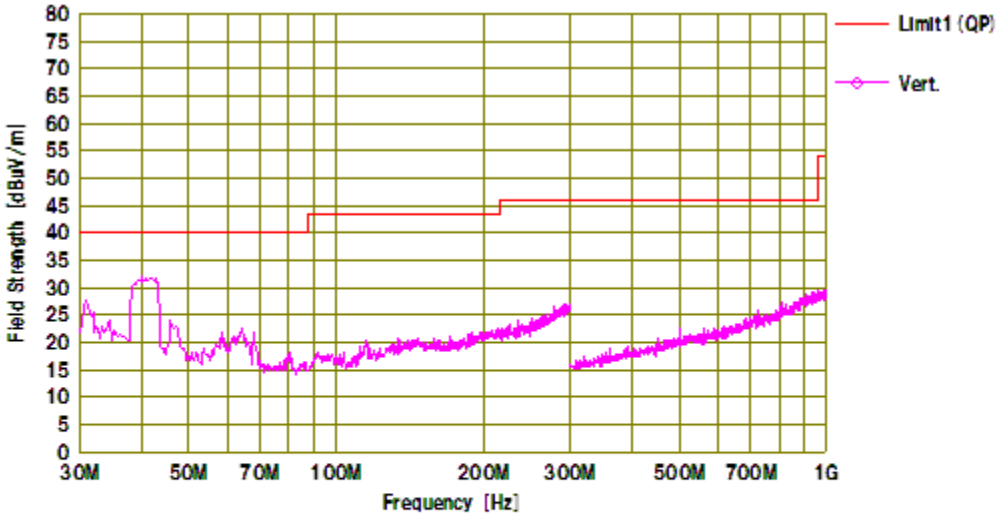
Maximum Field Strength (dBμV/m)
= Meter Reading (at maximum level of Horizontal or Vertical) (dBμV) + Antenna Factor (dB/m)

At the next page, the result of exploratory radiated emission measurement by using the spectrum analyzer is shown by the spectrum chart.

Tested Date	Environment	
	Temperature	Humidity
30 September 2014	23°C	45 %

Test Results in Graph



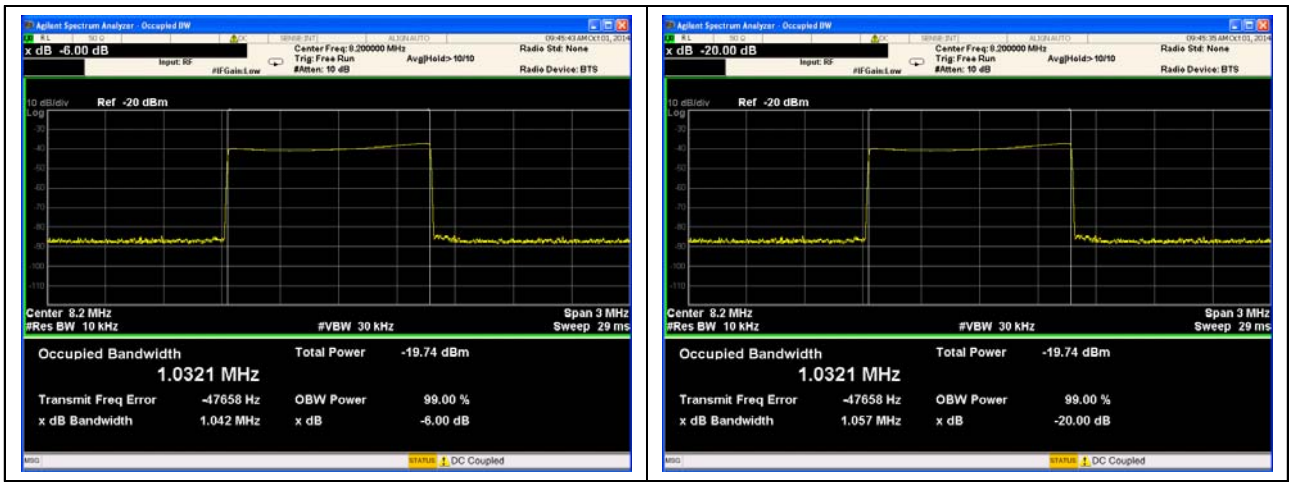


7. 6dB BANDWIDTH MEASUREMENT

7.1. Test Procedure

(1) Connect the EUT RF output port to spectrum analyzer (*1) via calibrated coaxial cable and suitable attenuator (if necessary). (2) Activates the EUT System and execute the software prepared for test, if necessary. (3) To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate. (4) 6dB Bandwidth is measured using the function of spectrum analyzer.
[Note] (*1) Spectrum Analyzer Set Up Conditions Frequency Span : 3MHz Resolution bandwidth : 10kHz Video bandwidth : ≧RBW Detector function : Peak x dB : -6dB

7.2. Test Results



6dB Bandwidth (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
1.042	1.057	1.032

Tested Date	Environment	
	Temperature	Humidity
1 October 2014	24 °C	50 %

8. FREQUENCY STABILITY

8.1. Test Procedure

(1) Connect the EUT RF output port to spectrum analyzer (*1) via calibrated coaxial cable and suitable attenuator (if necessary). (2) Activates the EUT System and execute the software prepared for test, if necessary. (3) To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate. (4) The frequency stability measured the 6dB Bandwidth of the fundamental emission. .
[Note] (*1) Spectrum Analyzer Set Up Conditions Center Frequency : Equal to operating frequency of EUT Resolution bandwidth : 10kHz Video bandwidth : 30kHz Sweep : Auto

8.2. Test Results

Test Condition		Measured Frequency		F_M	Limit	
Temp.	Volt.	F_L (MHz)	F_H (MHz)	(MHz)	Lower (MHz)	Higher (MHz)
normal	normal	7.6926	8.6952	8.1939	2.5345	9.1705
	min	7.6931	8.6949	8.1940		
	max	7.6922	8.6956	8.1939		
min	normal	7.5242	8.5683	8.0463		
	min	7.5210	8.5699	8.0454		
	max	7.5269	8.5664	8.0467		
max	normal	7.6137	8.6934	8.1536		
	min	7.6144	8.6928	8.1536		
	max	7.6132	8.6940	8.1536		

[Note]
Limit : central 80% of the permitted band(1.705MHz to 10MHz)
$F_M = F_L + ((F_H - F_L) / 2)$

Tested Date	Environment	
	Temperature	Humidity
3 October 2014	20 °C	41 %

9. TEST EQUIPMENT

· AC Power Line Conducted Emission Measurement

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AT-144	Low Power Attenuator	HUBER+SUHNER	6810.01.A	2014/09	2015/09
FL-107	LISN	KYORITSU	KNW-407	2014/09	2015/09
FS-083	Test Receiver	ROHDE & SCHWARZ	ESHS10	2013/12	2014/12
FS-103	Test Receiver	Schwarzbeck	FCKL1528	2013/12	2014/12
MM-252	RF Relay Matrix	TSJ	RFM-E121	2014/09	2015/09
SA-049	Spectrum Analyzer	Agilent	E4403B	2013/11	2014/11

· Radiated Emission (9kHz to 30MHz)
· 6dB Bandwidth Measurement

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AN-054	Loop Antenna	ROHDE & SCHWARZ	HFH2-Z2	2014/04	2016/04
FS-099	Test Receiver	ROHDE & SCHWARZ	ESS	2013/11	2014/11
SA-058	Spectrum Analyzer	Agilent	N9010A	2014/05	2015/04

· Radiated Emission (above 30MHz)

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
AM-098	Pre-Amplifier	SONOMA	SONOMA 310N	2014/03	2015/04
AN-220	LPDA Antenna	Schwarzbeck	UHALP 9108A	2014/04	2015/04
AN-296	Biconical Antenna	Schwarzbeck	VHBB9124	2014/04	2015/04
AT-158	Fixed Attenuator	Anritsu	MP721B	2014/03	2015/04
FS-099	Test Receiver	ROHDE & SCHWARZ	ESS	2013/11	2014/11
MM-302	RF Selector	TOYO	NS4900	2014/04	2015/04
SA-058	Spectrum Analyzer	Agilent	N9010A	2014/05	2015/04

· Frequency Stability

KEC No.	Equipment	Manufacturer	Model No.	Last Cal.	Next Cal.
SA-052	Spectrum Analyzer	Agilent	E4446A	2013/10	2014/10
SF-093	Temperature Chamber	ESPEC CORP.	SH-641	2014/07	2015/07

Note : (*1) We check the performance, before using this device.

The overall program of calibration and verification of equipment is designed and operated so as to ensure that measurements made by KEC are traceable to national standards of measurement or equivalent abroad.

APPENDIX A (DECLARATION OF COMPLIANCE TO MAXIMUM PERMISSIBLE EXPOSURE LIMITS FOR HUMANS)

The Model TS-A1-TX-FCC with 7.7-8.7MHz swept transmitter complies with Maximum permissible exposure limits for humans as called out in §1.1310. It is exempt from Maximum Permissible Exposure based on its operating frequency, and power density 0.04mW/cm^2.

Calculation formula :

$$S = PG / 4\pi D^2$$

S : power density (W/m^2)
P : peak output power (W)
G : antenna gain (isotropic)
D : measurement distance (m)

$$PG = (rE)^2 / 30$$

r : measurement distance of Electric field strength (m)
E : Electric field strength (V/m)

Where :
D = 0.2m
r = 3.0m
E = 91.3dBμV/m

Therefore :

$$S(W/m^2) = \frac{\left(3\times10^{\frac{91.3}{20}}\times10^{-6}\right)^2}{\frac{30}{4\times3.14\times0.2\times0.2}} = 0.0008051029$$

S≒0.0000805 (mW/cm^2)

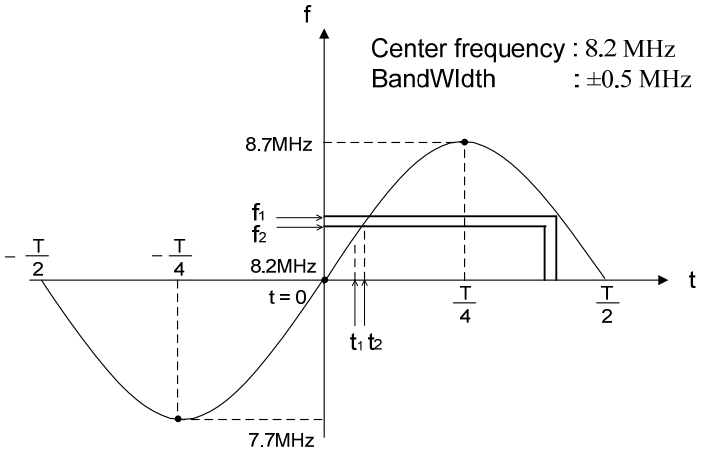
This would be less than 1mW/cm^2 when the separation distance between the user and the device's radiating element is less than 20cm.

APPENDIX B (RESTRICTED BANDS OF OPERATION)

The following devices are exempt from the requirements of this §15.205:

Swept frequency field disturbance sensors operating between 1.705-37MHz provided their emissions only sweep through the bands listed in §15.205 (a), the sweep is never stopped with the fundamental emission within the bands listed in §15.205 (a), and the fundamental emission is outside of the bands listed in §15.205 (a) more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

There are 4 restricted bands. The worst occupation time in the restricted band 8.37625-8.38675MHz was calculated as following.



$$f(t) = 8.2 + 0.5\sin\left(2\pi\frac{t}{T}\right)\ (MHz) \quad \cdots\cdots\cdots\ (1)$$

$$f_1 = f(t_1) = 8.37625\ (MHz) \quad \cdots\cdots\cdots\ (2)$$

$$f_2 = f(t_2) = 8.38675\ (MHz) \quad \cdots\cdots\cdots\ (3)$$

$$\left(0 < t_1 < \frac{T}{4} > 0 < t_2 \frac{T}{4}\right)$$

substituted the formula (2) into the formula (1)

$$f(t_1) = 8.2 + 0.5\sin\left(2\pi\frac{t_1}{T}\right) = 8.37625 \quad \cdots\cdots\ (4)$$

calculated formula (4), $\sin\left(2\pi\frac{t_1}{T}\right) = 0.3525$ …(5)

substituted the formula (3) into the formula (1)

$$f(t_2) = 8.2 + 0.5\sin\left(2\pi\frac{t_2}{T}\right) = 8.38675 \quad \cdots\cdots\ (6)$$

calculated formula (6), $\sin\left(2\pi\frac{t_2}{T}\right) = 0.3735$ …(7)

calculate by following inverse function theorem

$y = \sin x \iff x = \sin^{-1} y$"

(5) $\Rightarrow$ $2\pi\frac{t_1}{T} = \sin^{-1}(0.3525)$

$$t_1 = \frac{T}{2\pi}\sin^{-1}(0.3525) \quad \cdots\cdots\cdots\cdots(8)$$

(7) $\Rightarrow$ $2\pi\frac{t_2}{T} = \sin^{-1}(0.3735)$

$$t_2 = \frac{T}{2\pi}\sin^{-1}(0.3735) \quad \cdots\cdots\cdots\cdots(9)$$

by the result of (8), (9) $t_2 - t_1 = \frac{T}{2\pi}\{\sin^{-1}(0.3735) - \sin^{-1}(0.3525)\} \approx T(3.587\times 10^{-3})$

Therefore, time occupancy in each cycle (t) ;

$$8.37625\ (\mathrm{MHz}) < f\ (\mathrm{MHz}) < 8.38675(\mathrm{MHz})$$

$$2(t_1 - t_2)/\ T = 7.174 \times 10^{-3}$$

$$= 0.7174\%$$