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Order No.:	10519245
Report No.:	14-10519245-1-FCC
Date:	October 14, 2014
Model No.:	RPM-A432
FCC ID.:	WSX-RPM-A432

FCC Test Report

in accordance with
FCC Part 15 Subpart C Section 15.215 & 15.225

for

Robotic Dispensing and Packaging Machine

INFOPIA CO., Ltd.

132, Anyangcheondong-ro, Dongan-gu, Anyang-si, Gyunggi-do,
Republic of Korea

Summary of Test Results:

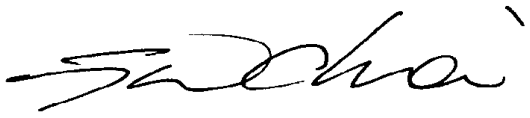
The following tests were performed on a sample submitted for evaluation of compliance with FCC Part 15 Subpart C Section 15.215 & 15.225 and RSS-210 & RSS-Gen

No	Reference Clause No.	FCC Part15 Subpart C Conformance Requirements	Verdict	Remark
1	15.215(c)	20 dB Bandwidth & 99 % Bandwidth	Complied	
2	15.225(a),(b),(c)	The field strength of any emission within the band 13.110-14.010 MHz	Complied	
3	15.225(d)	The field strength of any emission appearing outside of the 13.110-14.010 MHz band	Complied	
4	15.225(e)	The frequency tolerance of the carrier signal	Complied	
5	15.209(a)	Transmitter radiated spurious emissions	Complied	
6	15.207(a)	Transmitter AC power line conducted emission	Complied	

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The test list was determined by the Applicant as being applicable to the Equipment Under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

Tested by
ChangMin Kim, WiSE Project Engineer
UL Verification Services- 3014ASEO
UL Korea Ltd.
October 14, 2014



Reviewed by
Jeawoon, Choi, WiSE Engineering Leader
UL Verification Services- 3014ASEO
UL Korea Ltd.
October 14, 2014

Test Report Details

Witnessed By:	UL Korea Ltd. 26th FL. GFC Center, 737 Yeoksam-dong, Gangnam-gu, Seoul, 135-984, Korea
Test Site:	DT&C Co., Ltd. 42, Yurim-ro, 154beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Korea 449-935 The test facility was deemed to have the environment and capabilities necessary to perform the tests included in the test package.
Applicant:	INFOPIA CO., Ltd. 132, Anyangcheondong-ro, Dongan-gu, Anyang-si, Gyunggi-do, Republic of Korea
Applicant Contact: Title: Phone: E-mail:	Kim Keun Young Manager +82-10-3304-4895 kykim@infopia21.com
Product Type:	Robotic Dispensing and Packaging Machine
Model Number:	RPM-A432
Multi-listing Model Name:	RPM-A360, RPM-A288, RPM-A216, RPM-A144, RPM-A72, RPM-B90
Sample Serial Number:	N/A
Test standards:	FCC Part 15 Subpart C Section 15.215 Additional provisions to the general radiated emission limitations FCC Part 15 Subpart C Section 15.225 Operation within the band 13.110–14.010 MHz.
Sample Receive Date:	August 25, 2014
Testing Start Date:	August 25, 2014
Date Testing Complete:	October 14. 2014
Overall Results:	**Pass**

UL Korea Ltd. reports apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

Report Directory

1. General Product Information

1.1. Equipment Description

RPM-A432 is the Robotic Dispensing and Packaging Machine that integrates NFC (13.56 MHz).

1.2. Details of Test Equipment (EUT)

- Equipment Type : Robotic Dispensing and Packaging Machine
- Model No. : RPM-A432
- Trade name : N/A
- Type of test Equipment : DXX
- Operating characteristic : Operation within the band 13.110–14.010 MHz.
- Manufacturer : INFOPIA CO., Ltd.

1.3. Equipment Configuration

The EUT is consisted of the following component provided by the manufacturer.

Use*	Product Type	Manufacturer	Model	Comments
EUT	Robotic Dispensing and Packaging Machine	INFOPIA CO., Ltd.	RPM-A432	-
Note: Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

1.4. Technical Data

Item	Type of NFC Module
Operating Frequency Ranges	13.56 MHz
Emission Designator	A1D
Kind of modulation (s)	ASK
Antenna information	Integral antenna (Loop Antenna)
Receiver class	Receiver class 3
Duty cycle class	Class 2
Working temperature	-20 ~ 85 ℃
Supply Voltage	AC 120 V

Note ;
1. All the technical data described above were provided by the manufacturer.

1.5. Antenna Information

Antenna model name : Cartridge-Base-NFC-430-01
Antenna Type : Loop Antenna(PCB Pattern) Antenna
Manufacturer : INFOPIA CO., Ltd

1.6. Equipment Type :

☒ Radio and ancillary equipment for fixed or semi-fixed use
☐ Radio and ancillary equipment for vehicular mounted use
☐ Radio and ancillary equipment for portable or handheld use

☒ Stand alone ☐ Host connected ☐ Host connected

☒ Self contained single unit ☐ Module with associated connection or interface

1.7. Technical descriptions and documents

The following documents was provided by the manufacturer.

No.	Document Title and Description
1	User Manual

1.8. Detail Information of Multi-listing Model

-	Model	Description
1	RPM-A432	Model RPM-A432 is identical to Basic model except number of cartridge. (Cassette capacity : 432 / NFC Modules capacity:72)
2	RPM-A360	Model RPM-A360 is identical to Basic model except number of cartridge. (Cassette capacity : 360 / NFC Modules capacity:72)
3	RPM-A288	Model RPM-A288 is identical to Basic model except number of cartridge. (Cassette capacity : 288 / NFC Modules capacity:72)
4	RPM-A216	Model RPM-A216 is identical to Basic model except number of cartridge. (Cassette capacity : 216 / NFC Modules capacity:72)
5	RPM-A144	Model RPM-A144 is identical to Basic model except number of cartridge. (Cassette capacity : 144 / NFC Modules capacity:72)
6	RPM-A72	Model RPM-A72 is identical to Basic model except number of cartridge. (Cassette capacity : 72/ NFC Modules capacity:72)
7	RPM-B90	Model RPM-B90 is identical to Basic model except number of cartridge. (Cassette capacity : 90/ NFC Modules capacity:72)
***Note:** The manufacturer has declared to all the multiple model names into the basic model without any further evaluation by UL.		

2. **Test Specification**

The following test specifications and standards have been applied and used for testing.

1) FCC Part 15 Subpart C Section 15.215 Additional provisions to the general radiated emission limitations
2) FCC Part 15 Subpart C Section 15.225 Operation within the band 13.110–14.010 MHz
3) ANSI C63.4:2009 : American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-
Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Test Conditions

2.1. Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	Robotic Dispensing and Packaging Machine	INFOPIA CO., Ltd.	RPM-A432	-
Note: Use = EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment. SIM - Simulator (Not Subjected to Test)				

2.2. Input/Output Ports

No	Port Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
1	Power Input	AC	N	N	
Note: *AC = AC Power Port DC = DC Power Port N/E = Non-Electrical I/O = Signal Input or Output Port (Not Involved in Process Control) TP = Telecommunication Ports					

2.3. Power Interface

Mode #	**Voltage (V)**	**Current (A)**	**Power (W)**	**Frequency (DC/AC-Hz)**	**Phases (#)**	**Comments**
Rated	(100 - 120) V	8 A	1 000 W	60	-	
1	120 V	-	-	60	-	Normal operating voltage
2	102 V			60		V_{Min}
3	138V			60		V_{Max}

2.4. Operating Frequencies

Mode #	Frequency tested
1	Operating frequency range : 13.56 MHz

2.5. Operation Modes

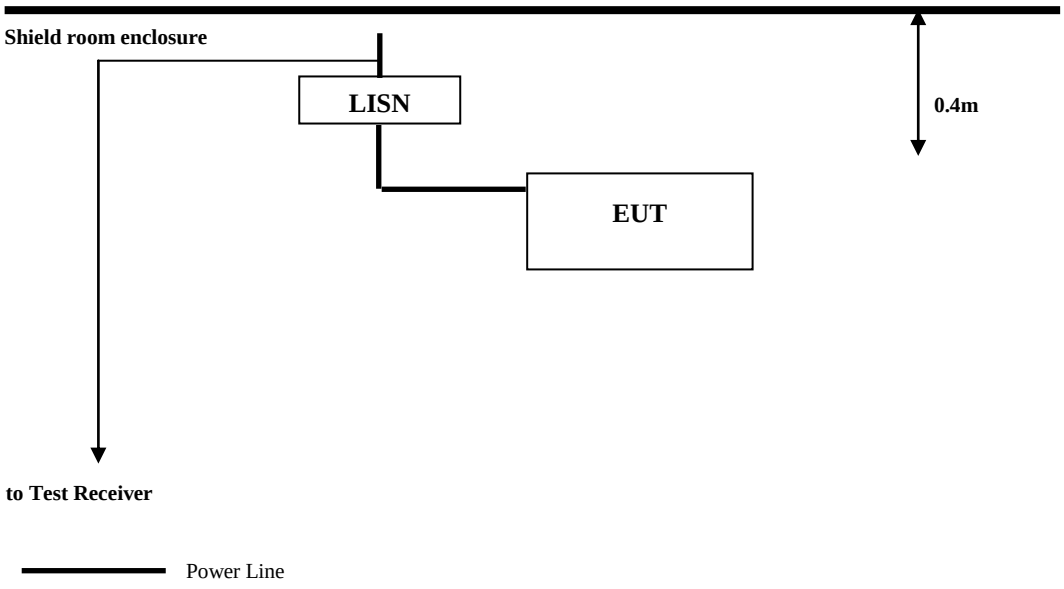
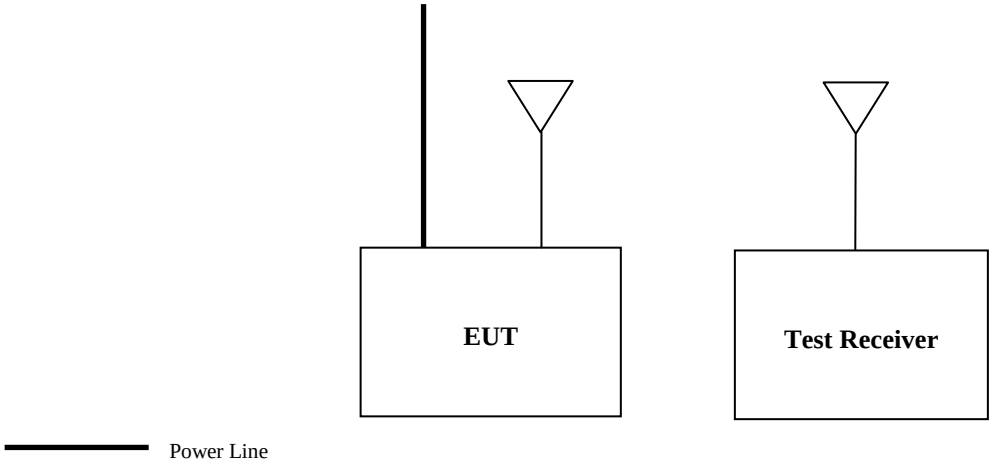
Mode #	Description
1	Carrier on mode with modulation : Signal from the RF module was generated continuously by the test program incorporated (72 transmitters were set to transmit simultaneously during the test.)
2	Carrier off mode

※ Worst case is to transmit simultaneously , this is normal operating condition.

2.6. Environment Conditions

Parameters	Normal condition
Temperature	+ 15℃ ~ +35℃
Humidity	20% ~ 75%
Supply voltage	120 Vac (Rated nominal voltage)
Note ; - The extreme condition is applied to the boundary limits of the declared operational environmental condition by the manufacturer. - The operating condition for humidity requirement has not been declared in the manufacturer's specification. - Test has been carried out for three frequencies specified above under the normal condition and for the extreme condition, minimum and maximum frequencies has been tested.	

2.7. Test Configurations

Mode #	Description
1	
2	

2.8. List of Test Equipment

	Description	Manufacturer	Model	Identifier	Next Cal Date.
■	MXA Signal Analyzer	Agilent	N9020A	MY50200834	15.09.15
■	Vector Signal Generator	R & S	SMBV100A	255571	15.01.07
■	Multimeter	HP	34401A	3146A13475	15.02.27
■	LOW NOISE PRE AMPLIFIER	TSJ	MLA-100K01-B01-26	1252741	15.02.28
■	Loop Antenna	Schwarzbeck	FMZB1513	1513-128	16.04.29
■	TRILOG Broad Band Antenna	Schwarzbeck	VULB9160	9160-3339	15.02.05
■	EMI TEST RECEIVER	R&S	ESU	100538	15.02.07
■	EMI TEST RECEIVER	R&S	ESCI7	100910	15.02.27
■	CVCF	EM TEST	ENTWAVE 60-400	P1311115470	15.05.26
■	LISN	Schwarzbeck	NNLK8121	NNLK8121-580	15.08.18
■	PULSE LIMITER	R&S	ESH3-Z2	101334	15.01.08
■	Thermohygrometer	BODYCOM	BJ5478	120612-2	15.05.13
■	AC Power Supply(SLIDAC)	DAEKWANG	5KVA	20060321-1	15.02.27
■	Humidity chamber	SJ Science	SJ-TH-R35-130408	SJ-TH-R35-130408	15.05.27

3. **Overview of Technical requirements**

The following essential requirements and test specifications are relevant to the presumption of conformity FCC Part 15 Subpart C Section 15.215 & 15.225			Reported
Reference Clause No.	Essential technical requirements	Test method	
15.215(c)	20 dB Bandwidth & 99 % Bandwidth	ANSI C63.10-2009	[X]
15.225(a),(b),(c)	The field strength of any emission within the band 13.110-14.010 MHz	ANSI C63.10-2009	[X]
15.225(d)	The field strength of any emission appearing outside of the 13.110-14.010 MHz band	ANSI C63.10-2009	[X]
15.225(e)	The frequency tolerance of the carrier signal	ANSI C63.10-2009	[X]
15.209(a)	Transmitter radiated spurious emissions	ANSI C63.4-2009	[X]
15.207(a)	Transmitter AC power line conducted emission	ANSI C63.4-2009	[X]

4. Test Results

4.1. 20 dB Bandwidth & 99 % Bandwidth

TEST: 20 dB Bandwidth & 99 % Bandwidth		
Method	The transmitter output is connected to the Spectrum analyzer. 20 dB Bandwidth from the EUT was measured under the below setting condition. 1. Set resolution bandwidth (RBW) = 1-5 % of the emission bandwidth (EBW). 2. Set the video bandwidth (VBW) ≥ 3 x RBW. 3. Detector = Peak. 4. Trace mode = max hold. 5. Sweep = auto couple. 7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1-5 %.	
Reference Clause	Part15 Subpart C Section 15.215 (c)	
Parameters recorded during the test	Laboratory Ambient Temperature	25 ℃
	Relative Humidity	40 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	13.56 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

Limits

According to §15.215 (c), Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of band operation.

4.1.1. Measurement Results

Table 1. Data Table of 20 dB Bandwidth

Environmental condition				Measured Frequency (MHz)	Lower Frequency (MHz)	Upper Frequency (MHz)	20 dB Bandwidth (kHz)
$T_{Nom.}$	25 ℃	V_{NOM}	120 Vac	13.5602	13.5461	13.5747	28.6

Figure 1. Plots of 20 dB Bandwidth

4.2. The field strength of any emission within the band 13.110-14.010 MHz

TEST: The field strength of any emission within the band 13.110-14.010 MHz		
Method	The E-field produced by the equipment shall be measured at standard distance of 3 m. Where this is not practical, e.g. due to physical size of the equipment including the antenna or with use of special field cancelling antenna, then other distances may be used. When another distance is used, the distance used and the field strength value measured shall be stated in the test report. In this case, the measured value at actual test distance shall be extrapolated to 3 m and stated in the test report. The E-field is measured with a shielded loop antenna connected to a measurement receiver. The measuring bandwidth and detector type of the measurement receiver shall be in accordance with the table as below;	
Reference Clause	Part15 Subpart C Section 15.225(a),(b),(c)	
Parameters recorded during the test	Laboratory Ambient Temperature	23 ℃
	Relative Humidity	44 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	13.110 – 14.010 MHz	3 meter chamber

Frequency (f)	Detector type	Bandwidth
9 kHz ≤ f < 150 kHz	Quasi Peak	200 Hz to 300 Hz
150 kHz ≤ f < 30 MHz	Quasi Peak	9 kHz to 10 kHz
30 MHz ≤ f ≤ 1 000 MHz	Quasi Peak	100 kHz to 120 kHz

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

Limits

According to the Section 15.225,
(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

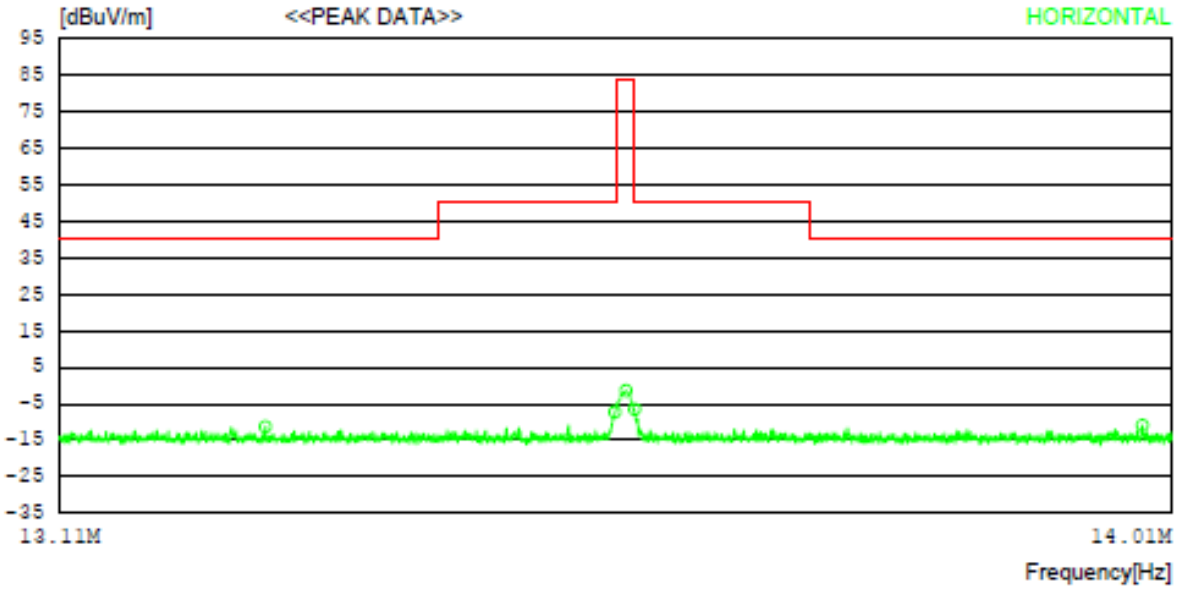
Frequency range (㎒)	E-field strength limit (Ef) dBμV/m at 30 m	E-field strength limit (Ef) dBμV/m at 3 m
13.553–13.567	84.0	124.0 (Note)
13.410 to 13.553 13.567 to 13.710	50.5	90.5 (Note)
13.110 to 13.410 13.710 to 14.010	40.5	80.5 (Note)

Note : According to section 15.31(f)(2), 40 dB/decade is used for the inverse linear distance below 30 MHz.
Limit at 3 m (dBuV/m) = Limit at 30 m (dBuV/m) + 40 log(30/3) (dB)

Measurement Results

Table 2. Data Table of within the band 13.110-14.010 MHz

Radiated emissions				Ant	Correction factors	Limit (dBuV/m)	Total	
Frequency range (MHz)	Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)+ Amp gain+CL (dB)		Actual (dBuV/m)	Margin (dB)
13.110 ~ 13.410	13.272	8.60	Peak	H	20.10	40.51	-11.30	51.81
13.410 ~ 13.553	13.552	12.60	Peak	H	20.10	50.47	-7.30	57.77
13.553 ~ 13.567	13.561	18.50	Peak	H	20.10	84.00	-1.40	85.40
13.567 ~ 13.710	13.568	13.40	Peak	H	20.10	50.47	-6.50	56.97
13.710 ~ 14.010	13.986	9.00	Peak	H	20.10	40.51	-10.90	51.41



No.	FREQ [MHz]	READING PEAK [dBuV]	ANT FACTOR [dB]	LOSS [dB]	GAIN [dB]	SITE FACTOR [dB]	RESULT [dBuV/m]	LIMIT [dBuV/m]	MARGIN [dB]	ANTENNA [cm]	TABLE [DEG]
----- Horizontal ------											
1	13.272	8.6	19.7	0.4	0.0	-40.0	-11.3	40.5	51.8	99	358
2	13.552	12.6	19.7	0.4	0.0	-40.0	-7.3	50.5	57.8	99	208
3	13.561	18.5	19.7	0.4	0.0	-40.0	-1.4	84.0	85.4	99	334
4	13.568	13.4	19.7	0.4	0.0	-40.0	-6.5	50.5	57	99	40
5	13.986	9.0	19.7	0.4	0.0	-40.0	-10.9	40.5	51.4	99	358

4.3. The field strength of any emission appearing outside of the 13.110-14.010 MHz band

TEST: The field strength of any emission appearing outside of the 13.110-14.010 MHz band		
Method	The E-field produced by the equipment shall be measured at standard distance of 3 m. Where this is not practical, e.g. due to physical size of the equipment including the antenna or with use of special field cancelling antenna, then other distances may be used. When another distance is used, the distance used and the field strength value measured shall be stated in the test report. In this case, the measured value at actual test distance shall be extrapolated to 3 m and stated in the test report. The E-field is measured with a shielded loop antenna connected to a measurement receiver. The measuring bandwidth and detector type of the measurement receiver shall be in accordance with the table as below;	

Frequency (f)	Detector type	Bandwidth
9 kHz ≤ f < 150 kHz	Quasi Peak	200 Hz to 300 Hz
150 kHz ≤ f < 30 MHz	Quasi Peak	9 kHz to 10 kHz
30 MHz ≤ f ≤ 1 000 MHz	Quasi Peak	100 kHz to 120 kHz

Reference Clause	Part15 Subpart C Section 15.225(d) RSS-210 A2.6	
Parameters recorded during the test	Laboratory Ambient Temperature	22 ℃
	Relative Humidity	36 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	9 kHz ~ 30 MHz	3 meter chamber

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

Limits

According to the Section 15.225,
(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209..

Frequency range (㎒)	**E-field strength limit (Ef) μV/m**	**E-field strength limit (Ef) dBμV/m at 3 m**
0.009 to 0.150	2400/F(kHz) at 300 m	128.5 to 104.1
0.150 to 0.490	2400/F(kHz) at 300 m	104.1 to 93.8
0.490 to 1.705	24000/F(kHz) at 30 m	73.8 to 63.0
1.705 to 30	30 at 30 m	69.5

Note : According to section 15.31(f)(2), 40 dB/decade is used for the inverse linear distance below 30 MHz.
Limit at 3 m (dBuV/m) = Limit at 300 m (dBuV/m) + 40 log(300/3) (dB)
Limit at 3 m (dBuV/m) = Limit at 30 m (dBuV/m) + 40 log(30/3) (dB)

Measurement Result

Table 3. Data Table of The field strength of any emission appearing outside of the 13.110-14.010 MHz band (Carrier On Mode)

Radiated emissions				Ant	Correction factors	Limit (dBuV/m)	Total	
Frequency range (MHz)	Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)+ Amp gain+CL (dB)		Actual (dBuV/m)	Margin (dB)
0.009 ~ 0.150	-	-	Q.P.	-	-	-	-	-
0.150 ~ 0.490	-	-	Q.P.	-	-	-	-	-
0.490 ~ 1.705	0.601*	34.1	Q.P.	H	17.5	32.0	11.6	20.4
1.705 ~ 13.110	-	-	Q.P.	-	-	-	-	-
14.010 ~ 30	-	-	Q.P.	-	-	-	-	-

Table 4. Data Table of The field strength of any emission appearing outside of the 13.110-14.010 MHz band (Carrier Off Mode)

Radiated emissions				Ant	Correction factors	Limit (dBuV/m)	Total	
Frequency range (MHz)	Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)+ Amp gain+CL (dB)		Actual (dBuV/m)	Margin (dB)
0.009 ~ 0.150	-	-	Q.P.	-	-	-	-	-
0.150 ~ 0.490	-	-	Q.P.	-	-	-	-	-
0.490 ~ 1.705	0.601*	36.2	Q.P.	-	17.5	32.0	13.7	18.3
1.705 ~ 13.110	-	-	Q.P.	-	-	-	-	-
14.010 ~ 30	-	-	Q.P.	-	-	-	-	-

Note.
* These frequencies are belonging to Part 15B digital signal.

Figure 2. The field strength of any emission appearing outside of the 13.110-14.010 MHz band (Carrier On Mode)

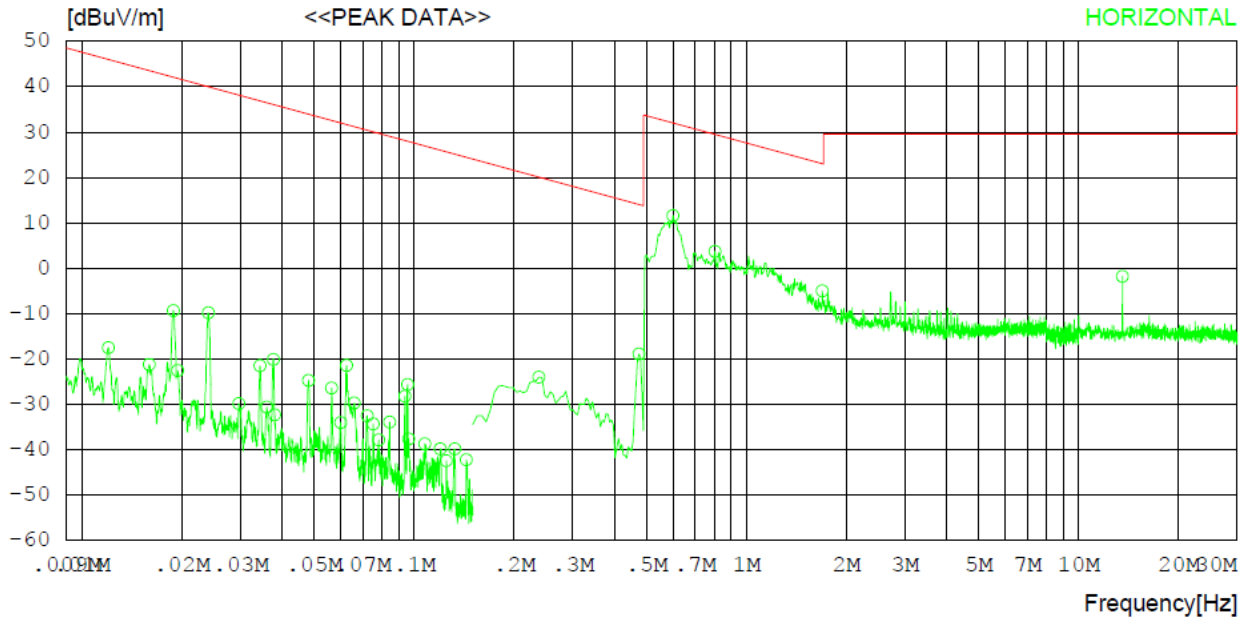
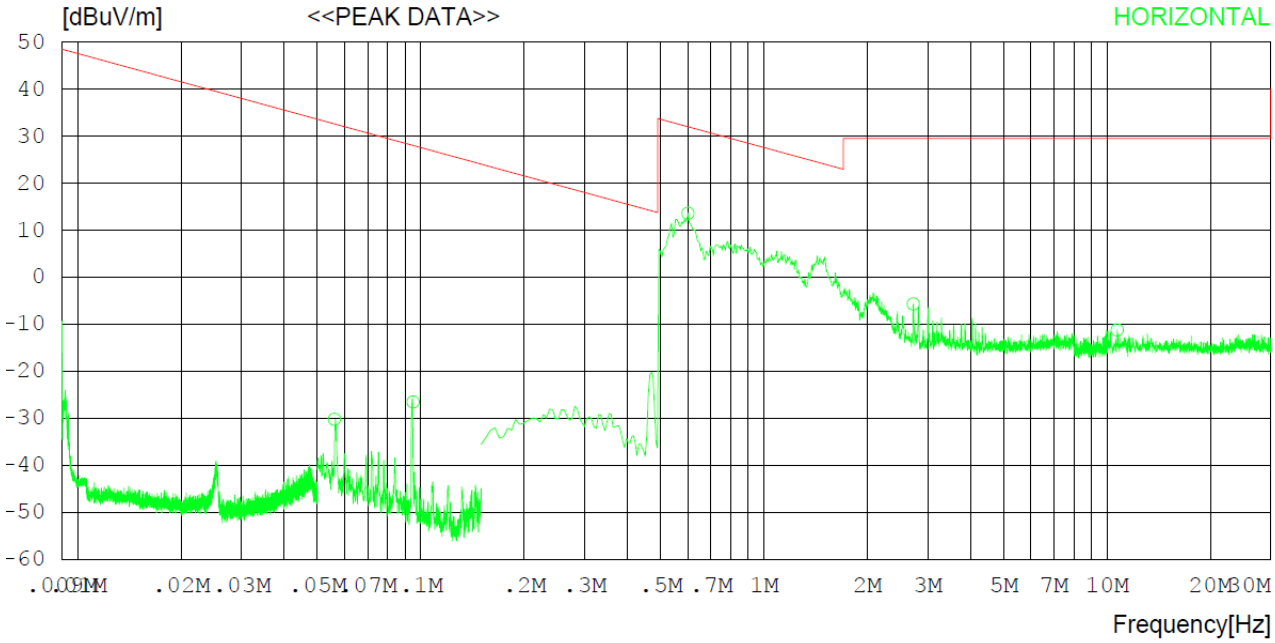


Figure 3. The field strength of any emission appearing outside of the 13.110-14.010 MHz band (Carrier Off Mode)



4.4. The frequency tolerance of the carrier signal

Radiated Spurious Emissions Measurement

TEST: The frequency tolerance of the carrier signal		
Method	1. The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the CW Microwave Frequency Counter. The test was performed at frequency using all applicable un-modulation. 2. The EUT was placed inside the temperature chamber. 3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.	
Reference Clause	Part15 Subpart C Section 15.225(e)	
Parameters recorded during the test	Laboratory Ambient Temperature	24 ℃
	Relative Humidity	43 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	13.56 MHz	Antenna port

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1,2,3	1	2
Supplementary information: None		

Limits

According to the Section 15.225(e), The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a. temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Measurement Results

Table 5. Test Result

Frequency Stability versus Temperature				
Environment Temperature (℃)	Power Supplied (Vac)	Frequency Measure with Time Elapse		
		Measured Frequency (MHz)	Frequency Error (㎐)	%
50	120	13.560181	181	0.001335
40		13.560185	185	0.001364
30		13.560192	192	0.001416
20		13.560209	209	0.001541
10		13.560182	182	0.001342
0		13.560208	208	0.001534
-10		13,560135	135	0.000992
-20		13,560106	106	0.000782
Frequency Stability versus power Supply				
Environment Temperature (℃)	Power Supplied (Vac)	Frequency Measure with Time Elapse		
		Measured Frequency (MHz)	Frequency Error (㎐)	%
20	120	13.560209	209	0.001541
	102	13.560242	242	0.001785
	138	13.560211	211	0.001556

Supplementary information:

The percent of the reference frequency (%) = (Measured frequency – Reference frequency) / Reference frequency

4.5. Radiated Spurious Emissions Measurement

TEST: Radiated spurious emissions measurement		
Method	Radiated emissions from the EUT were measured according to ANSI C63.4 procedure. 1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation. The antenna is is varied from 1 to 4 meters above the ground to find the maximum field strength. Measurement are made with both horizontal and vertical polarizations For fundamental investigation, the EUT was positioned for 3 orthogonal orientations. 2. For measurement below 1GHz, the resolution bandwidth is set to 100 kHz for peak detection or 120kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.	
Reference Clause	Part15 Subpart C Section 15.209(a)	
Parameters recorded during the test	Laboratory Ambient Temperature	23 ℃
	Relative Humidity	44 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30 MHz – 1 GHz	3 meter chamber

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	2
Supplementary information: None		

Limits

According to § 15.209(a), the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Distance (meters)	Field Strength (dBuV/m)	Field Strength (uV/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

Measurement Results

Table 6. Test Result (Carrier On Mode)

Radiated emissions			Ant	Correction factors	Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)+ Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*64.782	48.7	QP	V	-13.4	35.3	40.0	4.7
*198.739	50.2	QP	V	-14.7	35.5	43.5	8.0
*384.002	53.3	QP	H	-9.4	43.9	46.0	2.1*
*993.699	45.2	QP	H	-0.2	45.0	54.0	9.0

Table 7. Test Result (Carrier Off Mode)

Radiated emissions			Ant	Correction factors	Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)+ Amp gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
59.399	48.0	QP	V	-13.4	35.2	40.0	4.8
*64.782	49.9	QP	V	-13.4	35.0	40.0	5.0
*198.739	50.0	QP	V	-14.7	35.3	43.5	8.2
*384.002	53.1	QP	H	-9.4	43.7	46.0	2.3
*993.699	45.5	QP	H	-0.2	45.3	54.0	8.7

Note.
* These frequencies are belonging to Part 15B digital signal.

Supplementary information:
- The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels of 30 dB below than the limit is not reported.
- The worst case is x-axis and reported.
- Actual = Reading + AF + CL (AF : Antenna factor, CL : Cable loss)
- Distance factor = 20log(Measurement distance / The measured distance)
- Margin = Limit (dBuV/m) - Actual (dBuV/m)

4.6. Transmitter AC Power Line Conducted Emission

TEST: Transmitter AC Power Line Conducted Emission		
Method	AC line conducted emissions from the EUT were measured according to the dictates of ANSI C63.4-2003. 1. The test procedure is performed in a 5.05m × 4.0m× 3.0m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m(W)× 1.5 m(L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane. 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. 3. The excess power cable between the EUT and the LISN was bundled. All connecting cables of EUT were moved to find the maximum emission.	
Basic Standard	Part15 Subpart C Section 15.207(a)	
Parameters recorded during the test	Laboratory Ambient Temperature	24℃
	Relative Humidity	52%
-	Frequency range on each side of line	Measurement Point
Fully configured sample scanned over the following frequency range	150 kHz to 30 MHz	A.C. Input port of A.C. to D.C. adapter.

Configuration Settings

Power Interface Mode # (See Section 3.3)	EUT Operation Mode # (See Section 3.5)	Test Configurations Mode # (See Section 3.7)
1	1	1
Supplementary information: None		

Limits

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 ㎑ to 30 ㎒, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (㎒)	Conducted limit (㏈ μV)	
	Quasi-peak	Average
0.15 – 0.5	66 - 56*	56 - 46*
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

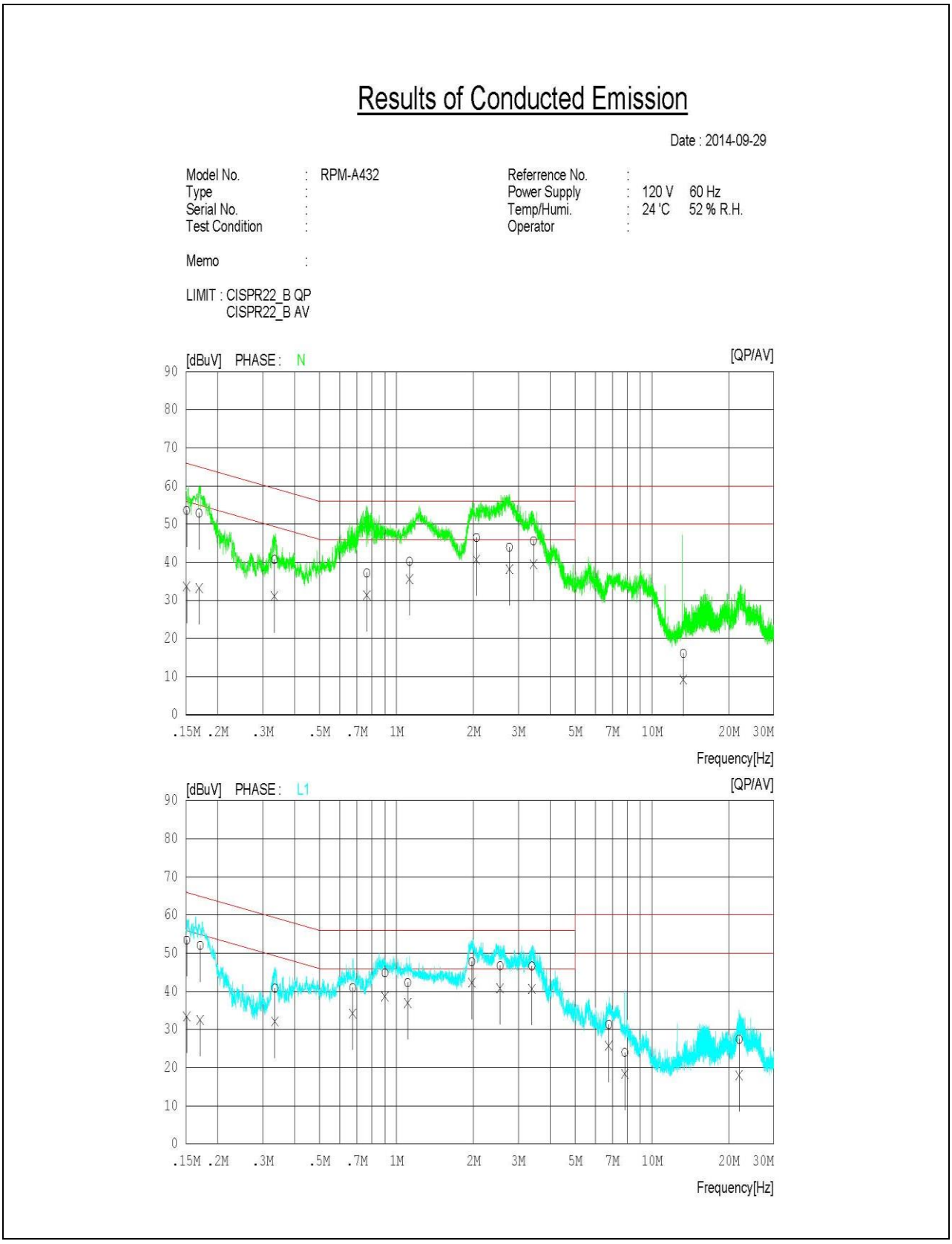
Measurement Results

4.6.1. Test data for conducted emission

NO	FREQ	READING QP	READING AV	C.FACTOR	RESULT QP	RESULT AV	LIMIT QP	LIMIT AV	MARGIN QP	MARGIN AV	PHASE
	[MHz]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	[dBuV]	
1	0.15079	43.7	23.7	9.9	53.6	33.6	66.0	56.0	12.4	22.4	N
2	0.16867	43.0	23.3	9.9	52.9	33.2	65.0	55.0	12.1	21.8	N
3	0.33294	30.8	21.2	9.9	40.7	31.1	59.4	49.4	18.7	18.3	N
4	0.76486	27.3	21.4	9.9	37.2	31.3	56.0	46.0	18.8	14.7	N
5	1.12400	30.3	25.7	9.9	40.2	35.6	56.0	46.0	15.8	10.4	N
6	2.05680	36.5	30.7	10.0	46.5	40.7	56.0	46.0	9.5	5.3	N
7	2.76640	33.8	28.1	10.1	43.9	38.2	56.0	46.0	12.1	7.8	N
8	3.43720	35.5	29.4	10.1	45.6	39.5	56.0	46.0	10.4	6.5	N
9	13.27140	5.8	-1.1	10.3	16.1	9.2	60.0	50.0	43.9	40.8	N
10	0.15103	43.5	23.5	9.9	53.4	33.4	65.9	55.9	12.5	22.5	L1
11	0.17042	42.1	22.6	9.9	52.0	32.5	64.9	54.9	12.9	22.4	L1
12	0.33463	30.9	22.2	9.9	40.8	32.1	59.3	49.3	18.5	17.2	L1
13	0.67396	31.1	24.3	9.9	41.0	34.2	56.0	46.0	15.0	11.8	L1
14	0.90120	35.0	28.7	9.9	44.9	38.6	56.0	46.0	11.1	7.4	L1
15	1.10580	32.4	27.1	9.9	42.3	37.0	56.0	46.0	13.7	9.0	L1
16	1.97120	37.8	32.3	10.0	47.8	42.3	56.0	46.0	8.2	3.7	L1
17	2.54720	36.6	30.7	10.1	46.7	40.8	56.0	46.0	9.3	5.2	L1
18	3.39040	36.5	30.5	10.1	46.6	40.6	56.0	46.0	9.4	5.4	L1
19	6.77580	21.2	15.7	10.1	31.3	25.8	60.0	50.0	28.7	24.2	L1
20	7.83240	13.8	8.2	10.2	24.0	18.4	60.0	50.0	36.0	31.6	L1
21	21.94720	17.0	7.6	10.4	27.4	18.0	60.0	50.0	32.6	32.0	L1

<Note>
1. Margin(dB) = Limit(dBuV) - Result(dBuV)

Figure 4. Graphical representation of Conducted Emission



APPENDIX A. Accreditations and Authorizations

DT&C has been accredited / filed / authorized by the agencies listed in the following table;

Certificate	Nation	Agency	Code	Mark
Accreditation	Korea	KOLAS	No. 393	ISO/IEC 17025
Site Filing	USA	FCC	596748	Test Facility list & NSA Data
	Japan	VCCI	C-1427 R-4076 T-1442	Test Facility list & NSA Data
Certification	Korea	KC	KR0034	Test Facility list & NSA Data

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the "General requirements for the competent of calibration and testing laboratory".