FCC Part 15
EMI TEST REPORT

Part I - 125kHz

E.U.T. ： Access Controller
Model ： AR-837
FCC ID： 2ACLEAR-837

for

APPLICANT : SOYAL TECHNOLOGY CO., LTD.
ADDRESS : 11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221, Taiwan, R.O.C

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34. LIN 5. DINGFU, LINKOU DIST.,
NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
Tel:(02)26023052 Fax:(02)26010910
http://www.etc.org.tw ; e-mail : emc@etc.org.tw

Report Number : 14-05-RBF-032-05

TEST REPORT CERTIFICATION

Applicant : SOYAL TECHNOLOGY CO., LTD.
11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221, Taiwan, R.O.C

Manufacture : SOYAL TECHNOLOGY CO., LTD.
11F, No.368, Gongjian Rd., Xizhi Dist, New Taipei City 221, Taiwan, R.O.C

Description of Device :

a) Type of EUT : Access Controller
b) Trade Name : SOYAL
c) Model No. : AR-837
d) Power Supply : DC 15V

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Summary of Tests

Test	Results
Radiated Emission	**Pass**
Conducted Emission	**N/A**
Operation Bandwidth	**Pass**

Date Test Item Received	:	*May 22, 2014*
Date Test Campaign Completed	:	*Aug. 22, 2014*
Date of Issue	:	*Aug. 27, 2014*

Test Engineer : Jiapeng Chen

(Jiapeng Chen)

Approve & Authorized : S. S. Liou

S. S. Liou, Section Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents Page

1 GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : Access Controller
b) Trade Name : SOYAL
c) Model No. : AR-837
d) Power Supply : DC 15V

1.2 Characteristics of Device

Access Controller working on frequency 125kHz and 13.56MHz.

1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (2003). Other required measurements were illustrated in separate sections of this test report for details.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan 24442, R.O.C.
This site is FCC 2.948 listed and accepted in a letter dated Jan. 29, 2014.
Registration Number: 90589

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:
A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:
A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :
A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

Except for Class A digital devices, for equipment 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 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency MHz	Quasi Peak dBμV	Average dBμV
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

(2) Radiated Emission Requirement

For intentional device, according to §15.209(a), except as provided elsewhere in this Subpart, the emission from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Distance (Meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

(3) Antenna Requirement

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device:

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation.

All measurements were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
Access Controller *	SOYAL TECHNOLOGY CO., LTD.	AR-837/ 2ACLEAR-837	1.8m Unshielded DC Power Line
Power Supply	LOKO	DPS-300G-RPS	1.5m Unshielded Power Cord

Remark "*" means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For intentional radiators, the radiated emission shall comply with §15.209(a).

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 30 MHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on an open test site.
3. For emission frequencies measured below 1 GHz, set the spectrum analyzer on a 100 kHz resolution bandwidth for each frequency measured in step 2.
4. For emission frequencies measured above 30 MHz, the search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.
8. For emission frequencies measured below 30 MHz, the search antenna is to be set in horizontal and vertical polarized orientation respectively. Rotate the loop antenna when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna rotation again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Figure 1 : Frequencies measured below 30 MHz configuration

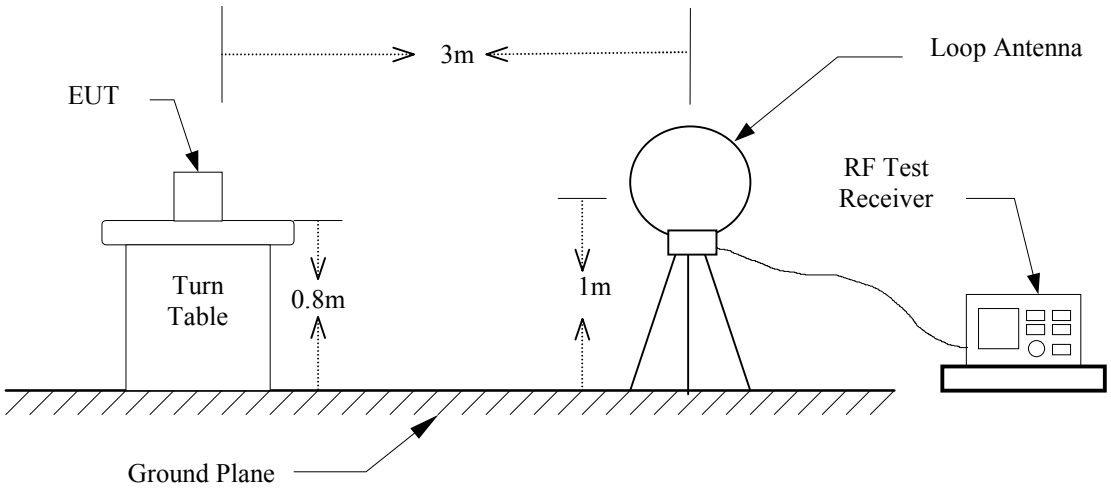
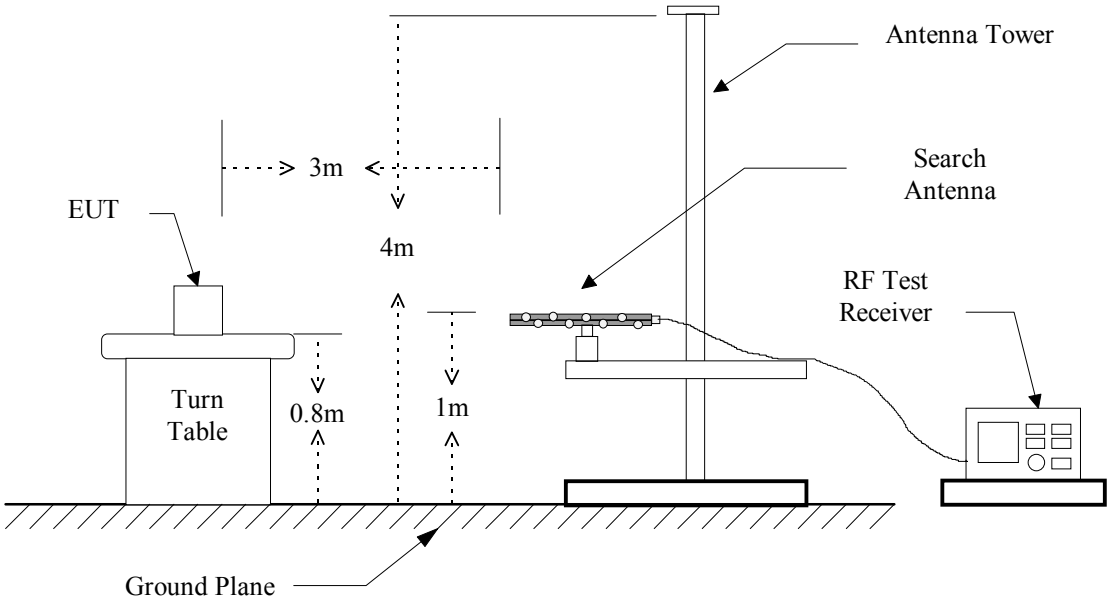


Figure 2 : Frequencies measured above 30 MHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Loop Antenna	EMCO	6512	2013/09/30	2014/09/29
Test Receiver	Rohde & Schwarz	ESVS30	2014/05/29	2015/05/28
EMI Test Receiver	Rohde & Schwarz	ESL	2013/09/11	2014/09/10
Bi-Log Antenna	ETC	MCTD 2756	2014/01/03	2015/01/02
Log-periodic Antenna	EMCO	3146	2013/10/25	2014/10/24
Biconical Antenna	EMCO	3110B	2014/01/27	2015/01/26
Amplifier	HP	8447D	2014/05/29	2015/05/28

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

Operation Mode : TX
Fundamental Frequency : 0.125 MHz
Test Date : Jun. 05, 2014 Temperature : 20 °C Humidity : 60 %

A. Fundamental

Frequency (MHz)	Ant Pol (H/V)	Reading (dBuV) Peak	Reading (dBuV) Ave	Corr. Factor (dB)	Result @3m (dBuV/m) Peak	Result @3m (dBuV/m) Ave	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave	Margin (dB)
0.125	V	41.2	37.2	64.7	80.1	76.1	125.7	105.7	-45.6

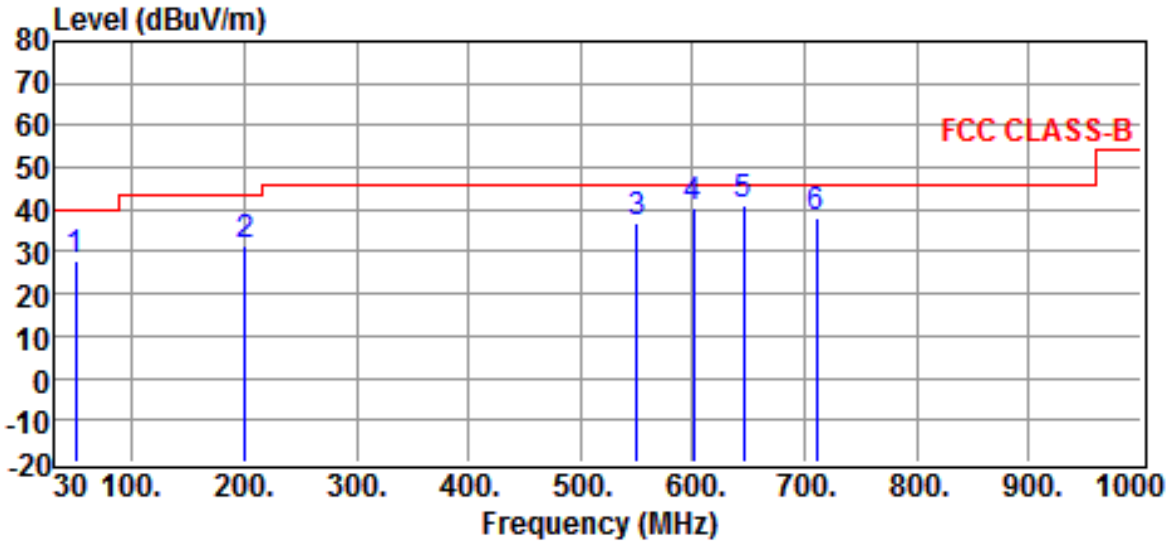
Note :
1. Item of margin shown in above table refer to average limit.
2. Remark "***" means that the average measurements are not necessary because the peak values of all emissions were below the average limit.
3. Limit for 125kHz at 300m distances is 19.2 uV/m or 25.7 dBuV/m. The equivalent limit at 3m distances is 105.7 dBuV/m.
4. The expanded uncertainty of the radiated emission tests is 3.53 dB.

B. Harmonics

Frequency (MHz)	Ant Pol (H/V)	Reading (dBuV) Peak	Reading (dBuV) Ave	Corr. Factor (dB)	Result @3m (dBuV/m) Peak	Result @3m (dBuV/m) Ave	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave	Margin (dB)
0.250	---	---	---	58.6	---	---	119.65	99.65	---
0.375	---	---	---	54.9	---	---	116.12	96.12	---
0.500	---	---	---	52.4	---	---	93.62	73.62	---
0.625	---	---	---	51.1	---	---	91.69	71.69	---
0.750	---	---	---	49.7	---	---	90.10	70.10	---
0.875	---	---	---	48.3	---	---	88.76	68.76	---
1.000	---	---	---	46.9	---	---	87.60	67.60	---
1.125	---	---	---	46.5	---	---	86.58	66.58	---
1.250	---	---	---	46.1	---	---	85.67	65.67	---

Note :
1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emission level is too low to be measured.
3. Mark "*" means that the emission level is measured with a Quasi-Peak function.
4. Remark "***" means that the average measurements are not necessary because the peak values of all emissions were below the average limit.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.2 Other Emission

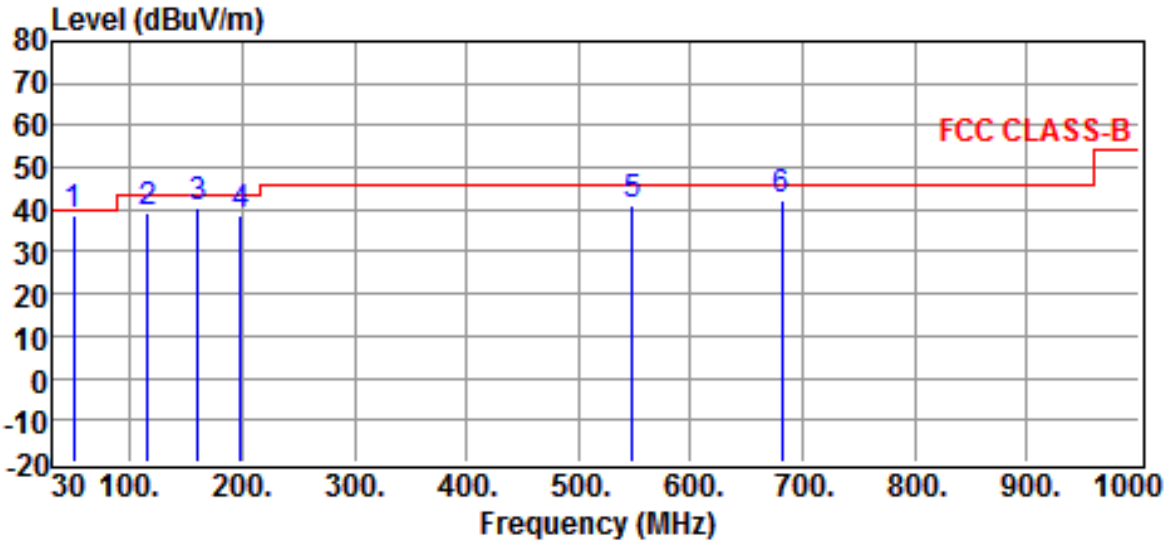


Site	:Open Site	Date	:2014-06-05
Limit	:FCC CLASS-B	Ant. Pol.	:HORIZONTAL
EUT	:Access Controller	Temp.	:23°C
Power Rating	:DC 15.0V	Humi.	:58%
Model	:AR-837	Engineer.	:Jiapeng
Test Mode	:125kHz & 13.56MHz		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
49.4000	15.5	12.3	27.8	40.0	-12.2	QP
200.7200	14.6	16.8	31.4	43.5	-12.1	QP
549.9200	14.4	22.3	36.7	46.0	-9.3	QP
600.3600	17.3	23.0	40.3	46.0	-5.7	QP
644.9800	17.2	23.8	41.0	46.0	-5.0	QP
710.9400	13.0	25.3	38.3	46.0	-7.7	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result



Site	:Open Site	Date	:2014-06-05
Limit	:FCC CLASS-B	Ant. Pol.	:VERTICAL
EUT	:Access Controller	Temp.	:23°C
Power Rating	:DC 15.0V	Humi.	:58%
Model	:AR-837	Engineer.	:Jiapeng
Test Mode	:125kHz & 13.56MHz		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
50.0000	26.2	12.2	38.4	40.0	-1.6	QP
115.3600	27.4	12.2	39.6	43.5	-3.9	QP
159.9800	26.6	14.2	40.8	43.5	-2.7	QP
198.7800	21.6	17.0	38.6	43.5	-4.9	QP
547.9800	18.8	22.3	41.1	46.0	-4.9	QP
681.8400	17.4	24.7	42.1	46.0	-3.9	QP

Note :

1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

where Corrected Factor

= Antenna FACTOR + Cable Loss - Amplifier Gain

4.6 Photos of Radiation Measuring Setup

5 CONDUCTED EMISSION MEASUREMENT

5.1 Description

This EUT is excused from investigation of conducted emission, for it is powered by DC battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

6 ANTENNA REQUIREMENT

6.1 Standard Applicable

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

6.2 Antenna Construction

The antenna is permanently attached on PCB, no consideration of replacement. Please refer to construction Photos of Exhibit B for details.

7 OPERATION BANDWIDTH REQUIREMENT

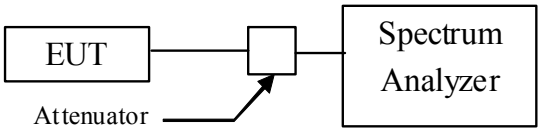
7.1 Standard Applicable

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.

7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value. The settings of spectrum analyzer is as followings.
   1) Set RBW = 30 kHz.
   2) Set the video bandwidth (VBW) ≥ RBW.
   3) Detector = Peak.
   4) Trace mode = max hold.
   5) Sweep = auto couple.
   6) Allow the trace to stabilize.
   7) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.
3. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



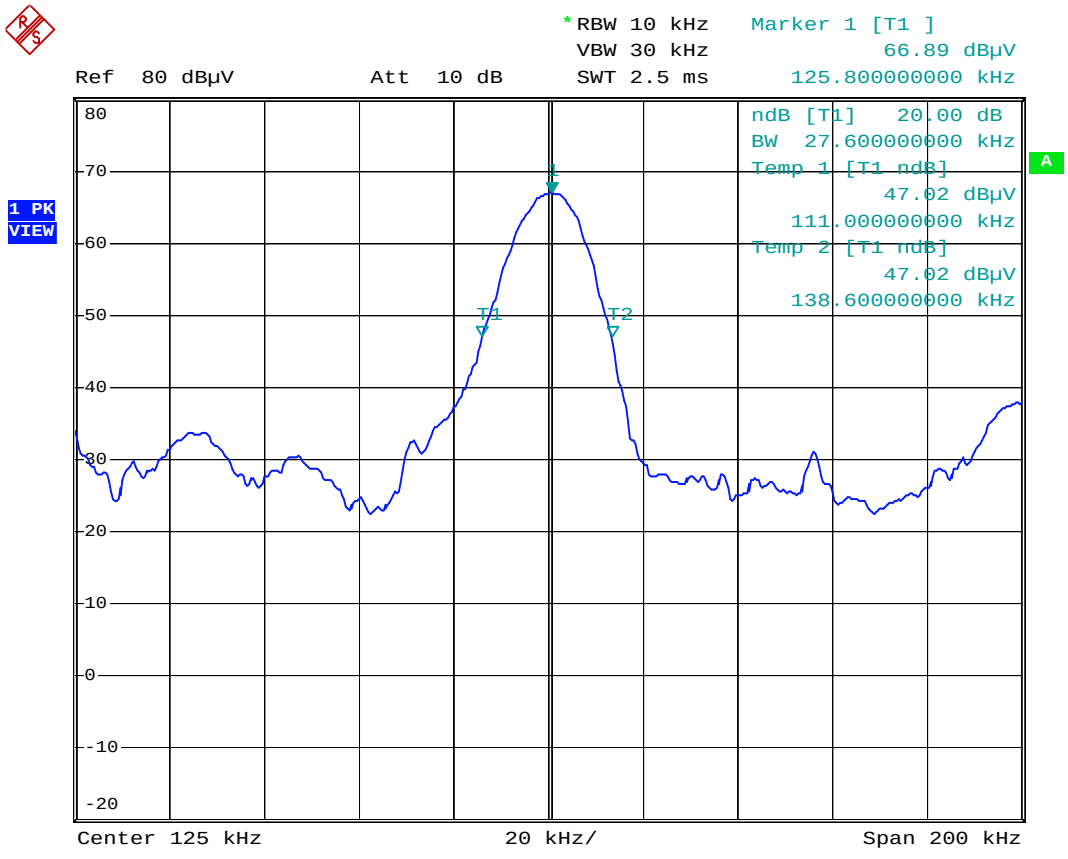
7.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2014/01/21	2015/01/20

7.4 Measurement Data

Test Date : Aug. 22, 2014 Temperature : 22 °C Humidity : 60 %

a) 20 dB Emission Bandwidth is 27.6 kHz



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