FCC Test Report

Report Number	KSQ-FCC150611			
Applicant	Company Name	HONG International Corp.		
	Address	3F, JnK Digital Tower 222-3, Guro-3Dong, Guro-Gu, Seoul, Republic of Korea		
Product	Product Name	Electronic Dart System		
	Model Name	VSPHOENIX.S DUAL		
	FCC ID	2ABCF-VSPHESDUAL		
	IC ID	9811A-VSPHESDUAL		
	Manufacturer	HONG International Corp.		
	Serial No.	-	Country of origin	Korea
Other	Receipt Date	2015.04.22	Receipt Number	KSQ-2015-N-0424
	Issued Date	2015.06.23	Tested Date	2015.06.11~2015.06.16
Standard	**FCC CFR 47 Part 15 Subpart C, RSS-GEN / RSS-210**			
Tested by	Hak Hyeon, Yun (sign)			
Approved by	Yeoung Ryul, Jo (sign)			

Korea Standard Quality Laboratories

#102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, KOREA.

Revision History

Rev.	Issue Date	Revisions	Revised By
-	2015.06.23	Initial Issue	Hak Hyeon, Yun

CONTENTS

1. APPLICANT AND MANUFACTURER INFORMATION

Applicant Name : HONG International Corp.
Address : 3F, JnK Digital Tower 222-3, Guro-3Dong, Guro-Gu, Seoul, Republic of Korea
Manufacturer : HONG International Corp.
Address : 3F, JnK Digital Tower 222-3, Guro-3Dong, Guro-Gu, Seoul, Republic of Korea

2. TEST RESULT CERTIFICATION

2.1 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.225
- ANSI C63.4-2014
- RSS-Gen Issue 4 – Nov 2014
- RSS-210 Issue 8 – Dec 2010

Applied standard : FCC Part15 subpart C				
TEST Standard Clause		**Test Item**	**Result**	**Remarks**
FCC Rules	**RSS Requirements**			
15.225(a) (b) (c) (d) 15.209, 15.205	RSS-210 Issue 8 A.26 RSS-Gen Issue 4 Clause 8.8	Radiated Emissions	Pass	-
15.225(e)	RSS-210 Issue 8 A2.6(e)	Frequency Stability	Pass	-
15.207	RSS-Gen Issue 4 Clause 8.8	Conducted Emissions Voltage	Pass	-
-	RSS-Gen Issue 4 Clause 6.6	Occupied Bandwidth	Pass	-

3. LABORATORY INFORMATION

3.1 General

Korea Standard Quality Laboratories

#102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, KOREA

The open area field test site and conducted measurement facility are used for these testing. This site at was fully described in a reports submitted to the Federal Communications Commission (FCC).

The Federal Communications Commission (FCC) has the reports on file and Korea Standard Quality Laboratories. is listed under FCC Registration No.100384. The test site has been approved by the FCC for public use and is List in the FCC Public Access Link CORES (Commission Registration System)

3.2 Test Site

- Korea Standard Quality Laboratories

3.3 Location

Korea Standard Quality Laboratories

- #102, Jangduk-Dong, Hwasung-City, Kyunggi-Do, Korea

4. EUT INFORMATION

Equipment Class	DXX - Low Power Communication Device Transmitter
Product name	Smart Card Reader
Model name	Electronic Dart System
Power source	AC 110 V / 60 Hz
Frequency range	13.560 MHz
Modulation Technique	ASK
Antenna Type	Integral loop antenna
Dimensions(W×L×T)	710 (H) mm * 2430 (W) mm * 2497 (T) mm

4.1 Family Model

-. None

4.2 EUT Modifications

-. None

4.3 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.

Antenna Construction:
The transmitter antenna of the EUT is an internal antenna in the EUT, so there is no consideration of replacement by the user.

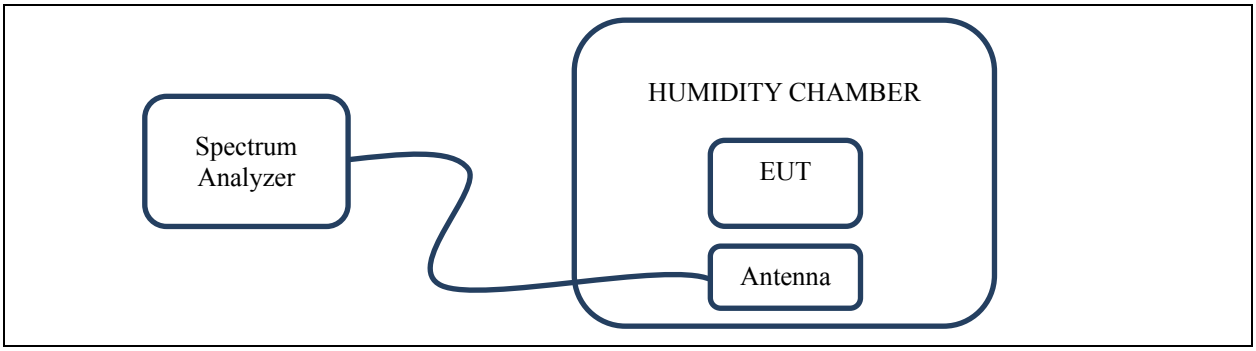
5. Measurement conditions

5.1 Description of test modes

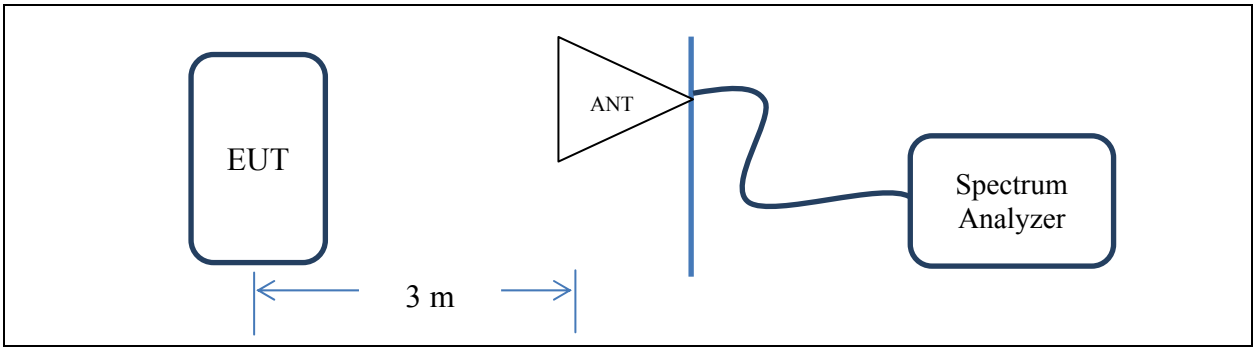
- The EUT had been tested under the operating condition.
- There are one channels have been tested as following:

Channel	Frequency (MHz)
Fundamental	13.560

5.2 Description of test configuration



[System Block Diagram of Test Configuration 1]



[System Block Diagram of Test Configuration 2]

5.3 Setup of equipmet under test

5.3.1. Description of support units

- The EUT has been tested as an independent unit along with the following necessary Accessories or support units, which are adopted to form a representative test configuration.

No.	Equipment	Manufacturer	Model	Note
1	Electronic Dart System	HONG International Corp.	VSPHOENIX.S DUAL	EUT

6. Antenna Requirement

Requirement(s): 47 CFR §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.

Antenna requirement must meet at least one of the following:

a) Antenna must be permanently attached to the device.

b) Antenna must use a unique type of connector to attach to the device.

c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

1) The RFID antenna is integral to the main board permanently to the device which meets the requirement (See Internal Photographs submitted as another Exhibit).

7. Limite And Result

7.1 Radiated Electric Field Emissions

7.1.1 Regulation

According to §15.225(a), The field strength of any emissions within the band 13.553 MHz ~ 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

According to §15.225(b), Within the bands 13.410 MHz ~ 13.553 MHz and 13.567 MHz ~ 13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

According to §15.225(c) Within the bands 13.110 MHz ~ 13.410 MHz and 13.710 MHz ~ 14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

7.1.2 Test Condition

- The EUT is placed on a turntable, which is 0.8m above ground plane.
- Three orientation for the EUT were tried to find out which orientation produces the worst emissions.
- The loop antenna was also moved around to find out worst position for the emissions.
- Set RBW of Spectrum analyzer to 9 kHz, VBW = 300 kHz, Sweep = auto
- The field strength of any emissions within the band 13.553 MHz ~ 13.567 MHz shall not exceed 15,848 μV/m at 30 meters.

7.1.3 Test result

Table 1 : Measured values of the Radiated Electric Field Emissions

Frequency (MHz)	Polarization (V/H)	Cable Loss +Ant. Factor	Reading dBμV/m @ 3 m	Actual dBμV/m @ 3 m	Actual dBμV/m @ 30 m	Actual μV/m @ 30 m	Limit (μV/m)	Verdict
13.291	H	14.52	22.48	37.00	-3.00	0.70	< 106 μV/m @ 30 m	PASS
13.204	V	14.53	29.78	44.31	4.31	1.64		PASS
13.553	H	14.49	35.86	50.35	10.35	3.29	< 334 μV/m @ 30 m	PASS
13.553	V	14.49	47.30	61.79	21.79	12.28		PASS
13.559	H	14.49	49.99	64.48	24.48	16.74	< 15,848 μV/m @ 30 m	PASS
13.560	V	14.49	61.68	76.17	36.17	64.34		PASS
13.567	H	14.49	35.64	50.13	10.13	3.20	< 334 μV/m @ 30 m	PASS
13.567	V	14.49	44.47	58.96	18.96	8.87		PASS
13.860	H	14.46	22.44	63.90	23.90	15.66	< 106 μV/m @ 30 m	PASS
13.977	V	14.45	27.32	41.77	1.77	1.22		PASS

7.2 Radiated Electric Field Emissions

7.2.1 Regulation

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

According to §15.209(a), for an intentional device, the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (meters)
0.009 ~ 0.490	2 400/F(kHz)	-	300
0.490 ~ 1.705	24 000/F(kHz)	-	30
1.705 ~ 30	30	29.5	30
30 ~ 88	100	40.0	3
88 ~ 216	150	43.5	3
216 ~ 960	200	46.0	3

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the above table.

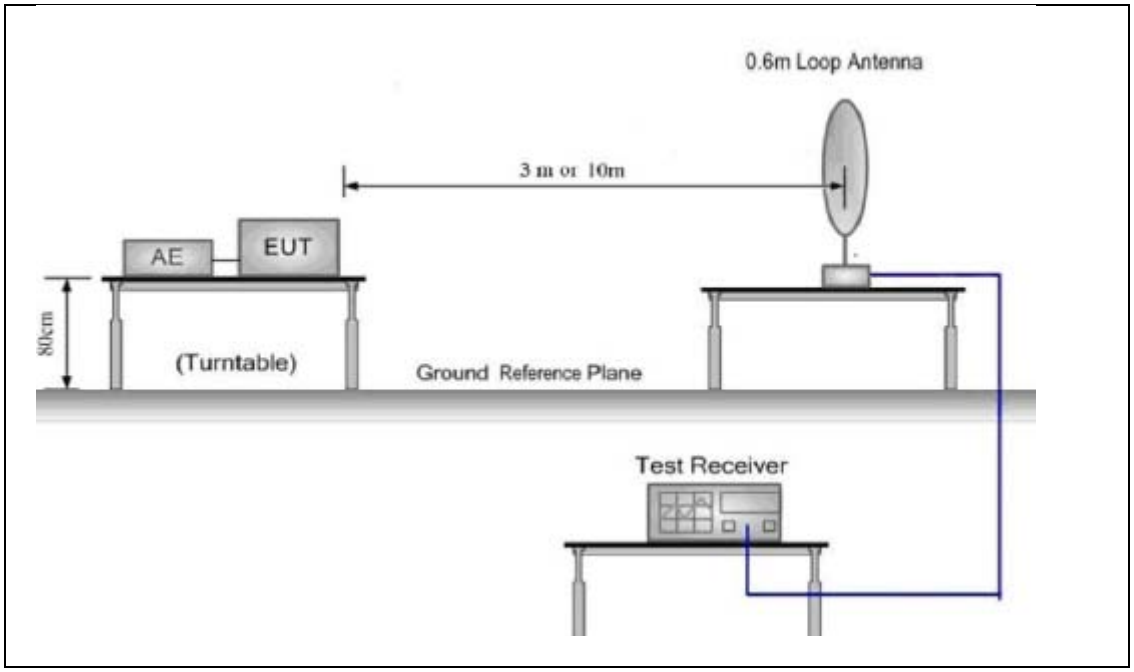
** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector.

7.2.2 Test Procedure

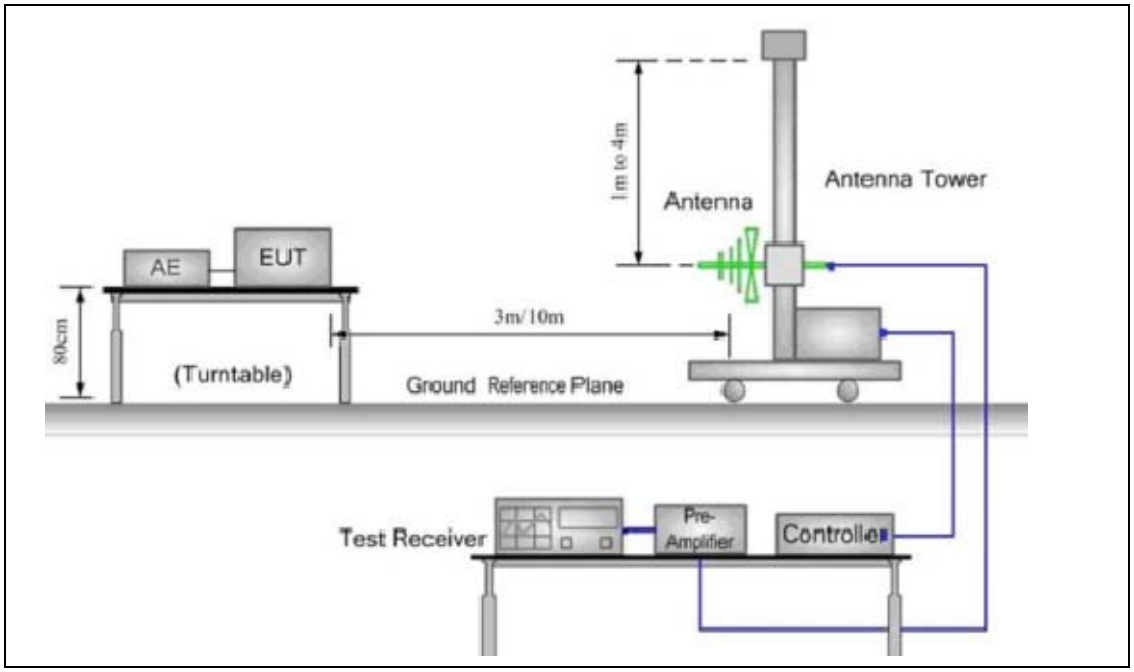
1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions in an anechoic chamber at a distance of 3 meters for above 30 MHz, and at 1 meter distance for below 30 MHz.
2. The EUT was placed on the top of the 0.8 meter height, (1 × 1.5) meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360°.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, from 30 MHz to 1 000 MHz using the Trilog broadband antenna.
4. To obtain the final measurement data, the EUT was arranged on a turntable situated on a (4 × 4) meter. The EUT was tested at a distance 3 meters.
5. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.
6. The EUT is situated in three orthogonal planes (if appropriate)
7. The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT.
8. If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

7.2.3 Test Setup Layout

7.2.3.1 Radiated Emission Test Set-Up, Frequency Below 30 MHz



7.2.3.2 Radiated Emission Test Set-UP Frequency Below 1 000 MHz



Below 30 MHz

Table 3 : Measured values of the Radiated Electric Field Emissions					
Frequency (MHz)	**Detect Mode**	**Polarization (V/H)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m) @ 3m**	**Margin (dB)**
	There are not find the point				

Below 1 GHz

Table 3 : Measured values of the Radiated Electric Field Emissions					
Frequency (MHz)	**Detect Mode**	**Polarization (V/H)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m) @ 3m**	**Margin (dB)**
32.60	Quasi-peak	V	32.42	40.00	7.40
71.21	Quasi-peak	H	28.70	40.00	11.30
79.97	Quasi-peak	V	35.86	40.00	4.14
132.67	Quasi-peak	H	34.54	43.50	8.96
282.47	Quasi-peak	V	33.01	46.00	12.99
354.83	Quasi-peak	H	34.04	46.00	11.96

Note.
1. Margin (dB) = Limit – Emission Level
2. H = Horizontal, V = Vertical Polarization

7.3 Frequency Stability

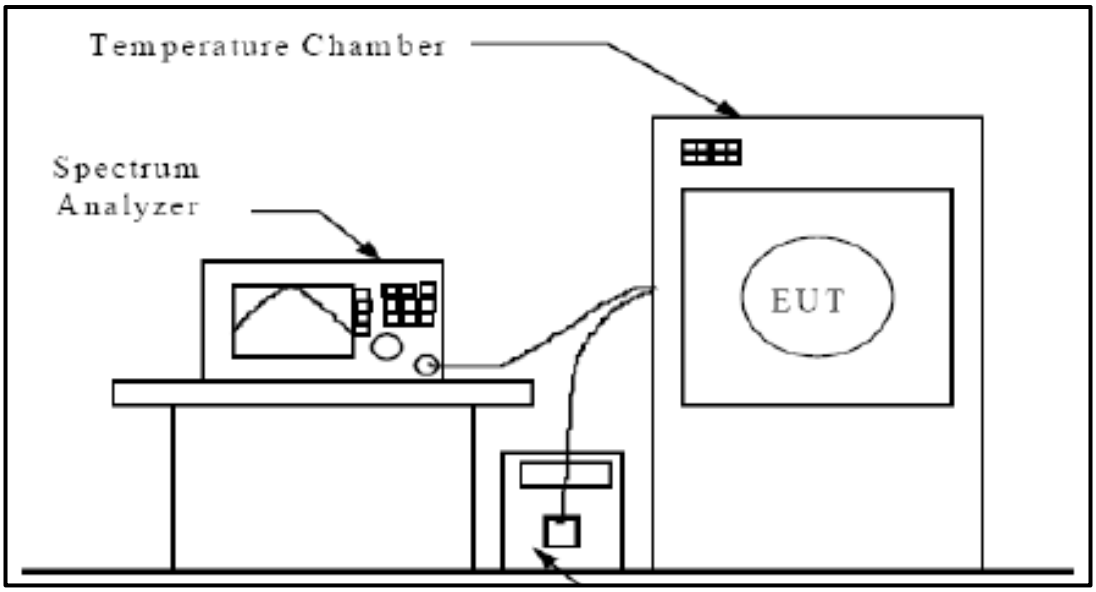
7.3.1 Regulation

According to §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.

7.3.2 Test Condition

1. Frequency stability vs. temperature measurement
   - The EUT was placed into the constant temperature chamber.
   - The spectrum analyzer was used to read the EUT operating frequency.
   - Set the constant temperature chamber temperature within the range of -20 °C to +50 °C
2. Frequency stability vs. input voltage measurement
   - The EUT was placed into the constant temperature chamber and set the temperature to 20 °C.
   - The spectrum analyzer was used to read the EUT operating frequency.
   - The EUT is powered with the DC Power Supplied it with 85 % and 115 % voltage, and measured the EUT operating frequency.

7.3.3 Test Setup Layout



7.3.4 Test result

Table 4 : Measured values of the Frequency Stability					
Frequency (Hz)	**Test Data (Hz)**				**Limit (Hz)**
	-20°C	**-10°C**	**0°C**	**+10°C**	
13 560 000	13 560 045	13 560 082	13 560 105	13 560 118	± 1 356 Hz (13 559 730 Hz ~ 13 560 510Hz)
	+20°C	**+30°C**	**+40°C**	**+50°C**	
	13 560 064	13 560 071	13 560 095	13 560 125	
	Test Voltage				
	Power 85 %		**Power 115 %**		
	13 560 021		13 560 118		

*Note
- Limit : Operating frequency X (±) 0.000 1 = (±) 1 356 Hz
- Within the band : 13 559 730 Hz ~ 13 560 510 Hz

7.4. AC Power Line Conducted Emissions

7.4.1. Regulation

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 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω 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 boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

7.4.2. Test Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50 Ω / 50 μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

7.4.3. Test Results

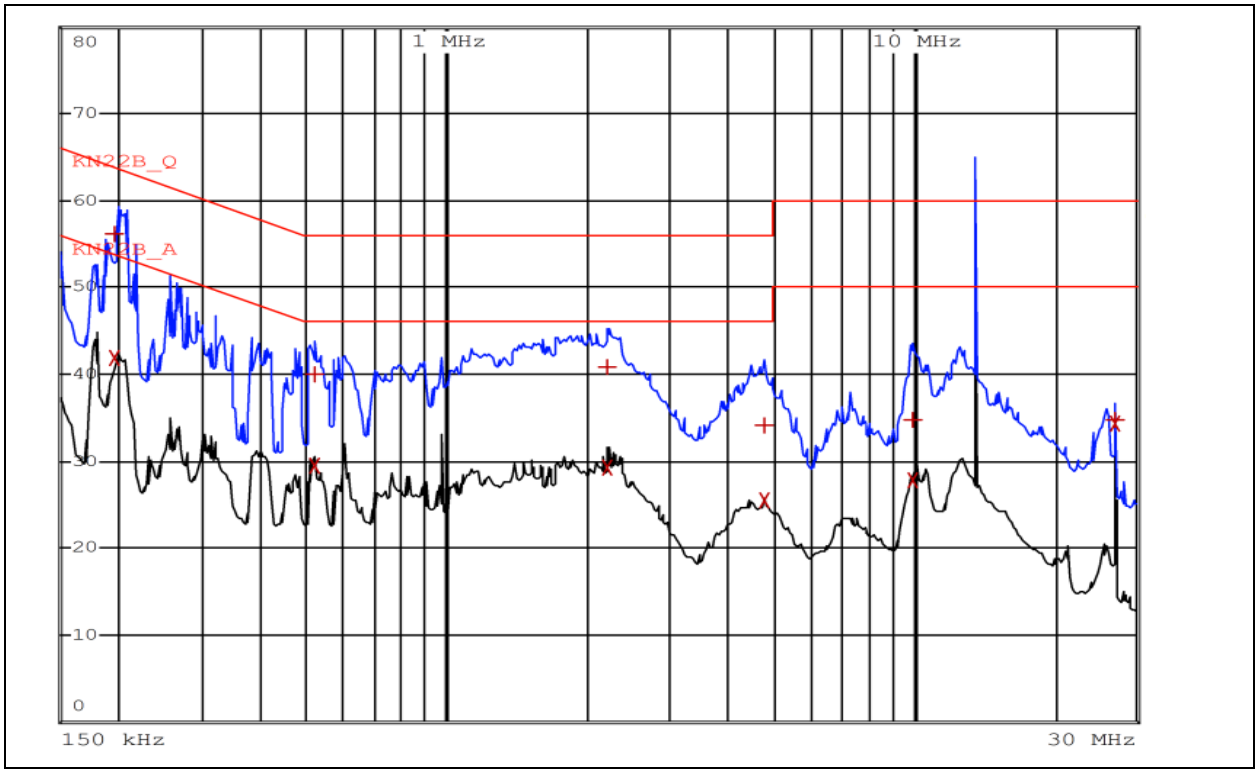
Table 5-1 : Measured values of the AC Power Line Conducted Emissions

Frequency (MHz)	Detect Mode	Hot/Neutral (H/N)	Measured Value (dBµV)	Correction Factor (dB)	Cable Loss (dB)	Emission Level (dBµV)	Limit (dBµV)	Margin (dB)
0.19	Peak	H	45.86	9.75	0.53	56.14	64.04	7.90
	Average		31.68			41.96	54.04	12.08
0.19	Peak	N	43.95	9.82	0.53	54.30	64.04	9.74
	Average		31.68			42.03	54.04	12.01
0.48	Peak	N	28.29	9.80	0.58	38.67	56.34	17.67
	Average		17.82			28.20	46.34	18.14
0.51	Peak	H	29.63	9.71	0.57	39.91	56.00	16.09
	Average		19.29			29.57	46.00	16.43
0.97	Peak	N	27.82	9.68	0.61	38.11	56.00	17.89
	Average		22.72			33.01	46.00	12.99
2.21	Peak	H	30.79	9.50	0.64	40.93	56.00	15.07
	Average		19.13			29.27	46.00	16.73
4.57	Peak	N	21.83	9.58	0.63	32.04	56.00	23.96
	Average		8.37			18.58	46.00	27.42
4.81	Peak	H	24.08	9.49	0.64	34.21	56.00	21.79
	Average		15.47			25.60	46.00	20.40
9.54	Peak	N	25.05	9.61	0.73	35.39	60.00	24.61
	Average		16.94			27.28	50.00	22.72
10.00	Peak	H	24.47	9.52	0.80	34.79	60.00	25.21
	Average		17.49			27.81	50.00	22.19
27.12	Peak	H	24.06	9.50	1.14	34.70	60.00	25.30
	Average		23.75			34.39	50.00	15.61
27.12	Peak	N	23.23	9.65	1.14	34.02	60.00	25.98
	Average		23.10			33.89	50.00	16.11

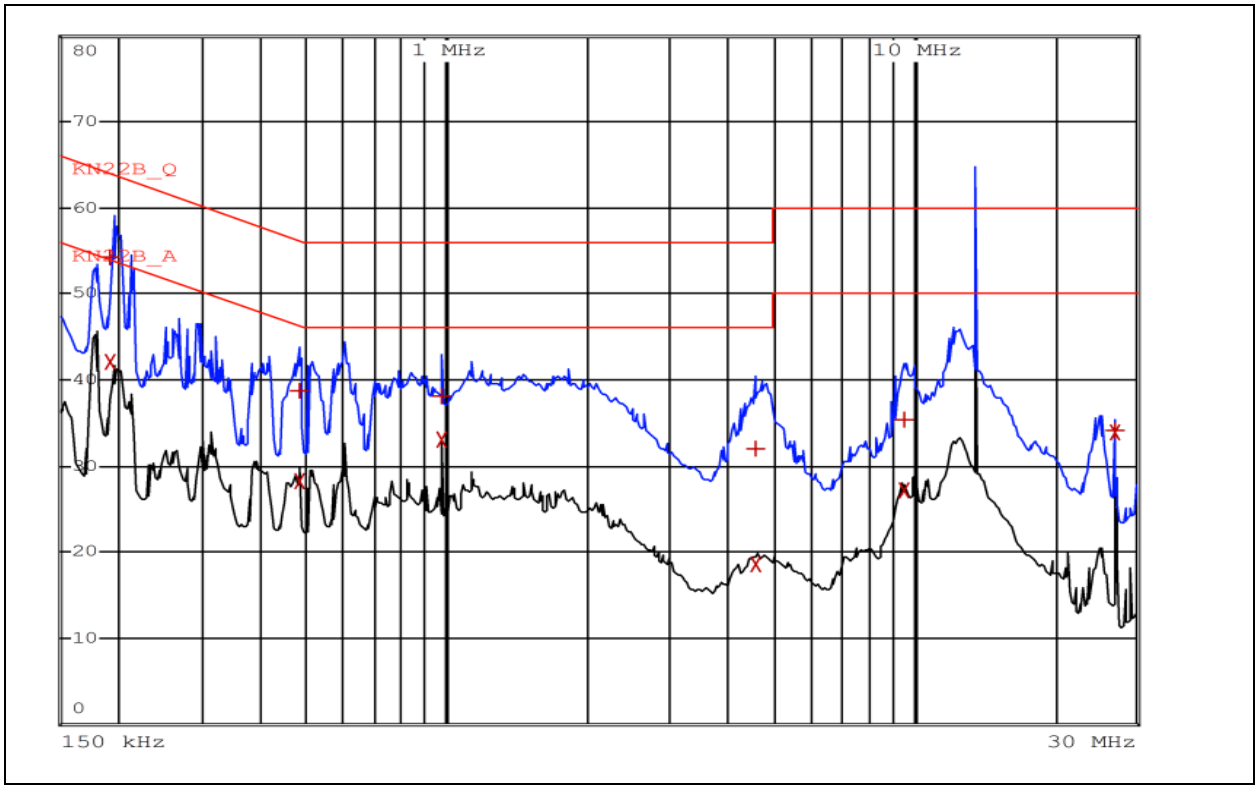
1. Margin (dB) = Limit – Emission Level
2. Emission Level = Measured Value + CF + CL

7.4.4. Graph of the AC Power Line Conducted Emissions

HOT LINE



NEUTRAL LINE



7.5. Occupied Bandwidth

Requirement(s): RSS-210 (5.9.1)

Procedures: Occupied Bandwidth was measured according to RSS-210 (5.9.1). Measurement was taken with spectrum analyzer. The spectrum analyzer bandwidth and span was set to read in hertz.

Frequency	Occupied Bandwidth (99%)
13.560 MHz	7.31 kHz

8. TEST EQUIPMENT USED FOR TEST

No.	Test Equipment	Manufacturer	Model No.	Cal. Data	calibration interval	Used equipment
1	Spectrum Analyzer	Agilent	E4440A	14.11.12	1 year	■
2	Frequency Counter	HP	5350B	15.06.02	1 year	■
3	DC Power Supply	ALINCO	DM-340MV	15.06.02	1 year	■
4	Signal Generator	Leader Electronics	3220	15.06.02	1 year	□
5	Synthesized CW Generator	HP	83711B	15.06.02	1 year	□
6	SYNTHESIZED SWEEPER	HP	8340B	15.05.07	1 year	□
7	Function Generator	IWATSU	SG-4105	15.04.13	1 year	□
8	Modulation Analyzer	Agilent	8901B	15.06.03	1 year	□
9	Audio Analyaer	Agilent	8903B	15.06.02	1 year	□
10	Power Meter	Agilent	E4418B	15.06.02	1 year	□
11	Power Sensor	HP	8485A	15.06.04	1 year	□
12	Power Sensor	Agilent	8482B	15.06.03	1 year	□
13	Pre Amplifier	GTC	GA-1825A	15.06.02	1 year	□
14	Attenuator	Weinschel	53-30-33	15.04.10	1 year	□
15	Step Attenuator	Agilent	8494B	15.06.02	1 year	□
17	Step Attenuator	Agilent	8495B	15.06.02	1 year	□
18	Step Attenuator	Agilent	8496B	15.06.02	1 year	□
19	Attenuator	HP	8493C	15.06.03	1 year	□
20	Attenuator	HP	30dB	15.04.10	1 year	□
21	Attenuator	TAE SUNG	SMA-1	15.06.02	1 year	□

22	Attenuator	TAE SUNG	SMA-2	15.06.02	1 year	☐
23	Termination	KWANG YEOK	KYTE-NJ-150W	15.06.02	1 year	☐
24	Bluetooth Tester	TESCOM	TC-3000A	15.06.05	1 year	☐
25	Loop ANT.	Com-Power	AL-130	14.07.22	2 years	■
26	Horn ANT.	SCHWARZBECK	BBHA 9120D	15.06.03	2 years	☐
27	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	15.06.11	1 year	■
28	Vibration Tester	Gana	GNV-400	15.06.10	1 year	☐
29	Drop Tester	Self-made	DOC-800	N/A	N/A	☐
30	Power Divider	Agilent	11636B	15.06.03	1 year	☐
31	Power Divider	Agilent	11636B	15.06.03	1 year	☐
32	RMS Multimeter	RMS Multimeter	FLUKE87	15.06.02	1 year	■
33	TEST RECEIVER	ROHDE&SCHWARZ	101014	15.06.03	1 year	■
34	Bi-log Antenna	SCHWARZBECK	VULB9160	15.05.11	2 years	■
35	Slidacs	HAN CHANG	5kV	N/A	N/A	■

8. EUT Photographs

8.1 Front view

8.2 Back view