

TEST REPORT For FCC

Test Report No. : CTK-2013-01097
Date of Issue : 2013-07-05
FCC ID : W6G-UM-230
Model/Type No. : UM-230
Kind of Product : CREDIT CARD PAYMENT TERMINAL
Applicant : HANCHANG SYSTEM corp.
Applicant Address : 1058-2, Shinkil-dong, Danwon-gu, Ansan-si, Gyeonggi-do, 425-839 KOREA
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Applicant Address : 1058-2, Shinkil-dong, Danwon-gu, Ansan-si, Gyeonggi-do, 425-839 KOREA
Contact Person : LEE SANG YONG / Senior Research Engineer
Telephone : +82-2-2624-0529
Received Date : 2013-03-15
Test period : Start : 2013-06-17 End : 2013-06-28
Test Results : **In Compliance** **Not in Compliance**

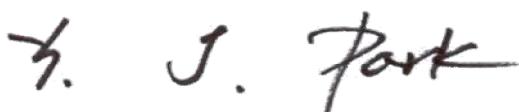
The test results presented in this report relate only to the object tested.

Tested by



Won-Jae, Hwang
Test Engineer
Date: 2013-07-05

Reviewed by



Young-Joon, Park
Technical Manager
Date: 2013-07-05



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CTK Co., Ltd.
386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea
Tel: +82-31-339-9970 Fax: +82-31-339-9855
www.e-ctk.com

REPORT REVISION HISTORY

Date	Revision	Page No
2013-07-05	Issued (CTK-2013-01097)	
2013-07-11	Revision (Conducted Voltage emission)	Page 16-18

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1.0 General Product Description

EUT description	CREDIT CARD PAYMENT TERMINAL
Model name	UM-230
Serial number	Identical prototype
EUT condition	Pre-production, not damaged
Product Classes	1 (Inductive loop coil transmitter)
Antenna type	loop Antenna
Length of antenna	< 30m ²
Frequency Range	13.56 MHz
Temperature range	-20°C ~ 55°C
Power Source	Battery (DC 7.4 V)
Duty cycle	1

1.1 Model Differences

Not applicable

1.2 Device Modifications

Not applicable

1.3 EUT Configuration(s)

See Appendix A for individual test set-up configuration(s). The following peripheral devices and/or interface cables were connected during the measurement:

Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC

Cable Description

#	Description	Ferrite Core	Length (m)	Other Details

1.4 Test Software

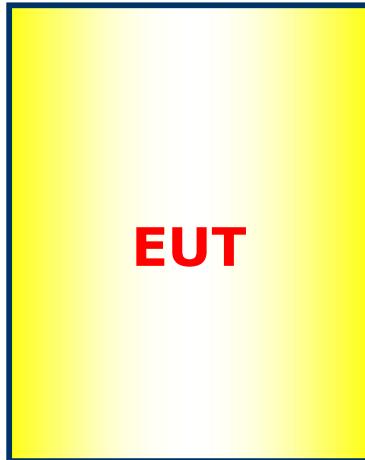
EMC Test V 1.0
 Display Test Patterns – V1.5
 Ping.exe
 Not applicable

1.5 EUT Operating Mode(s)

Equipment under test was operated during the measurement under the following conditions:

<input type="checkbox"/> Standby	<input type="checkbox"/> Scrolling 'H'
<input type="checkbox"/> Display circles pattern	<input type="checkbox"/> Read / Write
<input checked="" type="checkbox"/> Practice operation – EUT transmitting at 13.56 MHz continuously	

1.6 Configuration





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www.e-ctk.com

1.7 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.8 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.9 Measurement Procedure

Preliminary AC power line conducted emissions tests were performed shielded room. To find worst mode, several typical mode and typical cable position were tested. Final AC power line conducted emissions test was performed shielded room. (location is same as Preliminary test) Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

Preliminary radiated emissions test were performed anechoic chamber (Distance of antenna and EUT was 3 m). To find worst mode, several typical mode and typical cable position were tested and peak level and frequency were recorded.

Final radiated emissions test was performed Open Area Test Site. Based on the preliminary tests of the EUT, final test was proceeded worst case test mode and cable configuration.

* Measurement procedures was In accordance with ANSI C63.4-2003 7.2.3, 7.2.4, 8.3.1.1, 8.3.1.2

1.10 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 m & 10 m SAC and Conducted Test Site to perform FCC Part 15/18 measurements	 805871
JAPAN	VCCI	3 m & 10 m SAC and Conducted Test Site	 R-948, C-986, T-1843
KOREA	KCC	EMI (10 m SAC and Conducted Test Site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and Interruptions)	 No. 51, KR0025
International	KOLAS	EMC	

2.0 Radiated Electric Field Emissions - 15.225(a)

Reference Standard

FCC Part 15.225(a)

Test Date

2013-06-18

Test Location

EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2013-12-14
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2014-06-06

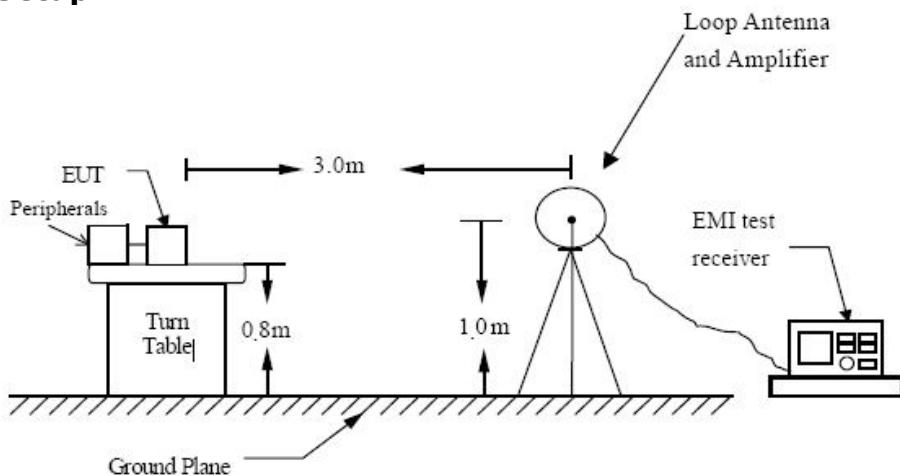
Frequency Range of Measurement

13.553 MHz to 13.567 MHz

Instrument Settings

IF Band Width: 10 kHz

Test Setup



Measurement Procedure(below 30 MHz)

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. Three orientation for the EUT were tried to find out which orientation produces the worst emissions.
3. The loop antenna was also moved around to find out worst position for the emissions.
4. Set the spectrum analyzer in the following setting as:
For Below 30 MHz :
RBW = 9 kHz / VBW = 300 kHz / Sweep = AUTO
5. Repeat above procedures until the measurements for all frequencies are complete.

Radiated emission limits

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 uV/m at 30 meters.

Test Results

Frequency (MHz)	Field Strength of Fundamental uV/m@ 30 m	Field Strength of Fundamental dBuV/m @ 30 m	Field Strength of Fundamental dBuV/m @ 3 m
13.553-13.567	1.12	0.96	40.96

The requirements are:

MET
 NOT MET
 NOT APPLICABLE

Remarks

See Appendix A for test data

2.1 Radiated Electric Field Emissions - 15.225(b)(c)

Reference Standard

FCC Part 15.225(b)(c)

Test Date

2013-06-19

Test Location

EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2013-12-14
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2014-06-06

Frequency Range of Measurement

13.410 MHz to 13.553 MHz, 13.567 MHz to 13.710 MHz
13.110 MHz to 13.410 MHz, 13.710 MHz to 14.010 MHz

Instrument Settings

IF Band Width: 10 kHz

Radiated emission limits

Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 uV/m at 30 meters.

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 uV/m at 30 meters.

Test Results

Frequency (MHz)	Field Strength of Fundamental uV/m @ 30 m	Field Strength of Fundamental dBuV/m @ 30 m	Field Strength of Fundamental dBuV/m @ 3 m
13.410-13.553	0.07	-23.44	16.56
13.567-13.710	0.07	-22.98	17.02
13.110-13.410	0.59	-4.52	35.48
13.710-14.010	0.56	-4.96	35.04

The requirements are:

- MET
- NOT MET
- NOT APPLICABLE

2.2 Radiated Electric Field Emissions - 15.225(d)

Reference Standard

FCC Part 15.225(d), 15.209

Test Date

2013-06-19

Test Location

EMI-Anechoic chamber with a conductive ground plane:
Testing was performed at a test distance of 3 m

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2013-12-14
<input checked="" type="checkbox"/>	Trilog Broadband Antenna	SCHWARZBECK	VULB 9161 SE	9161-4133	2014-06-11
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2014-06-06

Frequency Range of Measurement

9 kHz to 1000 MHz

Instrument Settings

IF Band Width: 10 kHz (9 kHz to 30 MHz)
IF Band Width: 120 kHz (30 MHz to 1000 MHz)

Measurement Procedure(above 30 MHz)

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
For 30 MHz ~ 1000 MHz :
$$RBW = 120 \text{ kHz} / VBW = 300 \text{ kHz} / Sweep = AUTO$$
7. Repeat above procedures until the measurements for all frequencies are complete.



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www.e-ctk.com

Radiated emission limits

Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
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

** Except as provided in 15.209(g). fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Test Results

The requirements are:

- MET
- NOT MET
- NOT APPLICABLE

Remarks

See Appendix A for test data

2.3 Frequency Stability – 15.225(e)

Reference Standard

FCC Part 15.225(e)

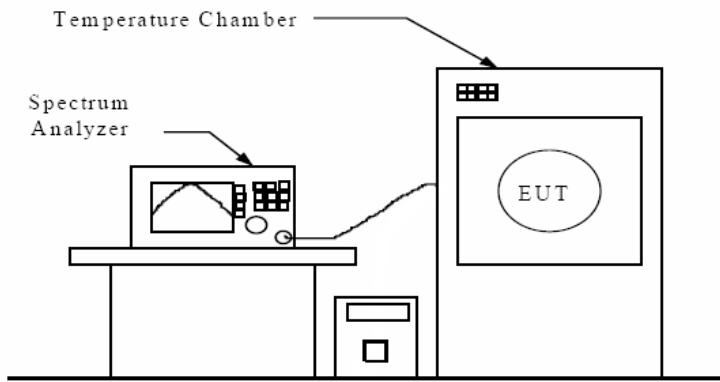
Test Date

2013-06-21

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	Signal Analyzer	Agilent	N9020A	MY48011598	2013-11-08
<input checked="" type="checkbox"/>	Temp & Humi Chamber	Kunpoong Engineering	JT-TH-556-2	9QE5-003	2014-01-16

Test Setup



Test Procedure

A. 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

B. 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.

Frequency tolerance Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 °C to +50 °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 °C.

- Operating frequency : 13.56 MHz
- Limit : 13.56 MHz * (\pm) 0.0001 = (\pm) 1356 Hz
- Within the band : 13.558644 MHz – 13.561356 MHz.

Test Data

Timing	-20 °C	-10 °C	0 °C	10 °C	20 °C	30 °C	40 °C	50 °C
Start-up	13.560210	13.560212	13.560204	13.560208	13.560194	13.560170	13.560176	13.560164
10 min	13.560210	13.560210	13.560208	13.560204	13.560184	13.560166	13.560171	13.560164
30 min	13.560206	13.560212	13.560210	13.560200	13.560178	13.560166	13.560176	13.560161

Timing	Power 85%	Power 115%
Start-up	13.560174 MHz	13.560176 MHz
10 min	13.560174 MHz	13.560174 MHz
30 min	13.560174 MHz	13.560176 MHz

Test Results

The requirements are:

- MET
- NOT MET
- NOT APPLICABLE

2.4 Conducted Voltage Emissions – 15.207

Reference Standard

FCC Part 15.207

Test Location

Shielded Room

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	EMI Test Receiver	Rohde & Schwarz	ESCI3	100032	2014-02-04
<input checked="" type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	101151	2013-11-09
<input type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	101236	2013-08-06

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Conducted Emission limits

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

Test Results

The requirements are: MET NOT MET

Frequency (MHz)	Measured Data (dBuV)	Margin (dB)	Remark
0.1545	526	13.1	Quasi-peak

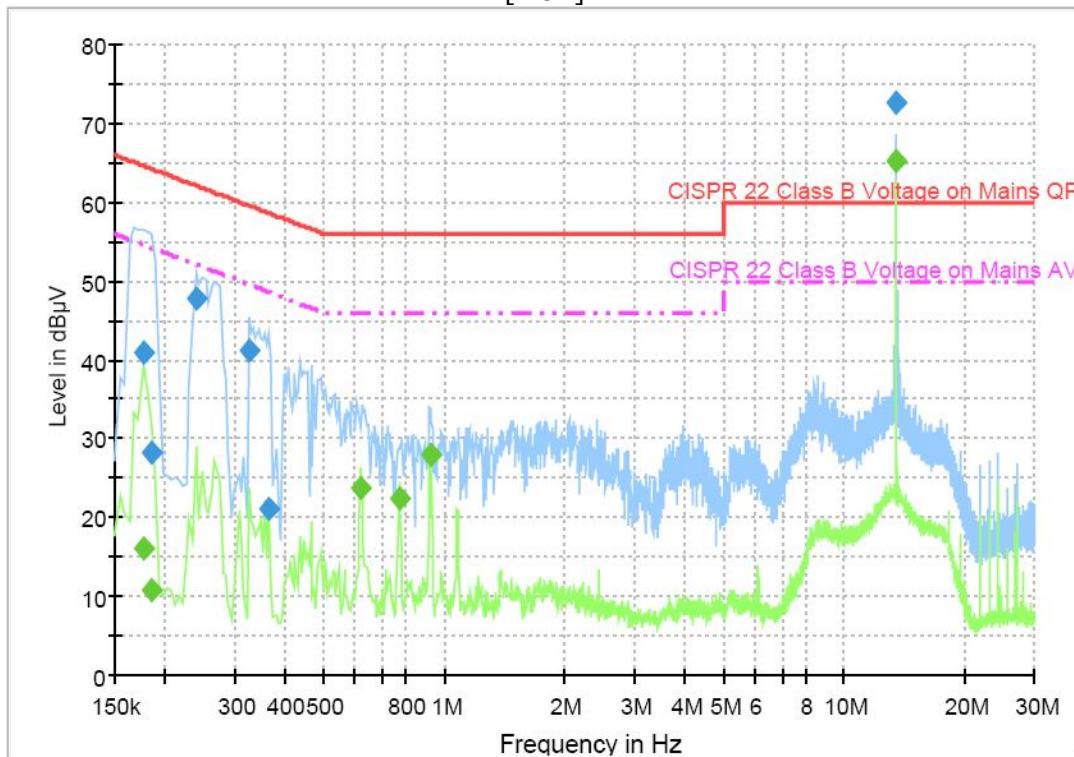
The Result is calculated by using the following formula;

* Result = Limit - Margin (Result included the correction factor)

* Correction factor = Cable Loss + Insertion loss of LISN

Test Data

[HOT]



Final Result 1

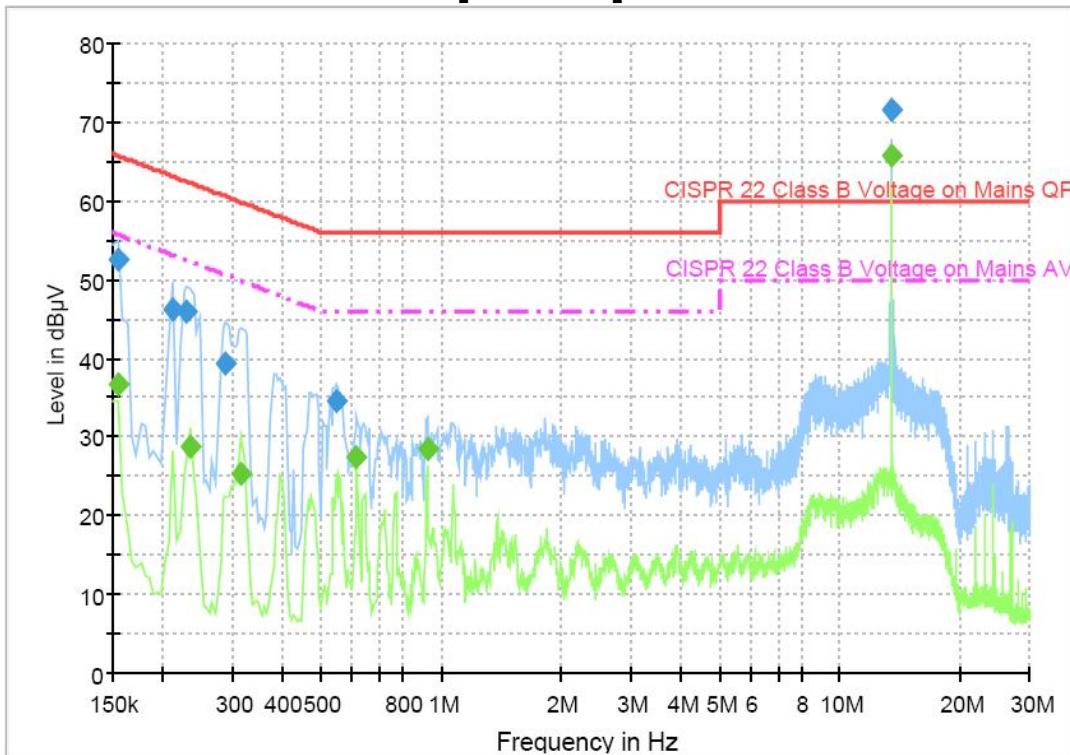
Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.177000	40.8	1000.0	9.000	On	L1	10.2	23.8	64.6
0.186000	28.2	1000.0	9.000	On	L1	10.1	36.0	64.2
0.240000	47.8	1000.0	9.000	On	L1	10.0	14.3	62.1
0.325500	41.2	1000.0	9.000	On	L1	10.0	18.3	59.6
0.366000	21.2	1000.0	9.000	On	L1	10.0	37.4	58.6
13.560000	72.6	1000.0	9.000	On	L1	9.9	-12.6	60.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.177000	16.1	1000.0	9.000	On	L1	10.2	38.6	54.6
0.186000	10.8	1000.0	9.000	On	L1	10.1	43.4	54.2
0.618000	23.9	1000.0	9.000	On	L1	10.0	22.1	46.0
0.771000	22.6	1000.0	9.000	On	L1	10.0	23.4	46.0
0.924000	28.0	1000.0	9.000	On	L1	9.9	18.0	46.0
13.560000	65.2	1000.0	9.000	On	L1	9.9	-15.2	50.0

=> Operating frequency and radiated emissions from antenna port is excluded from test data.
(13.56 MHz)

[NEUTRAL]



Final Result 1

Frequency (MHz)	QuasiPeak (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.154500	52.6	1000.0	9.000	On	N	10.0	13.1	65.8
0.213000	46.1	1000.0	9.000	On	N	10.0	16.9	63.1
0.231000	46.1	1000.0	9.000	On	N	10.0	16.4	62.4
0.289500	39.2	1000.0	9.000	On	N	10.0	21.3	60.5
0.546000	34.6	1000.0	9.000	On	N	10.1	21.4	56.0
13.560000	71.5	1000.0	9.000	On	N	9.9	-11.5	60.0

Final Result 2

Frequency (MHz)	Average (dB μ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)
0.154500	36.6	1000.0	9.000	On	N	10.0	19.2	55.8
0.235500	28.7	1000.0	9.000	On	N	10.0	23.6	52.3
0.316500	25.3	1000.0	9.000	On	N	10.0	24.5	49.8
0.613500	27.5	1000.0	9.000	On	N	10.0	18.5	46.0
0.924000	28.5	1000.0	9.000	On	N	9.9	17.5	46.0
13.560000	65.8	1000.0	9.000	On	N	9.9	-15.8	50.0

=> Operating frequency and radiated emissions from antenna port is excluded from test data.
(13.56 MHz)

APPENDIX A – TEST DATA

Radiated Electric Field Emissions (Quasi-Peak reading)

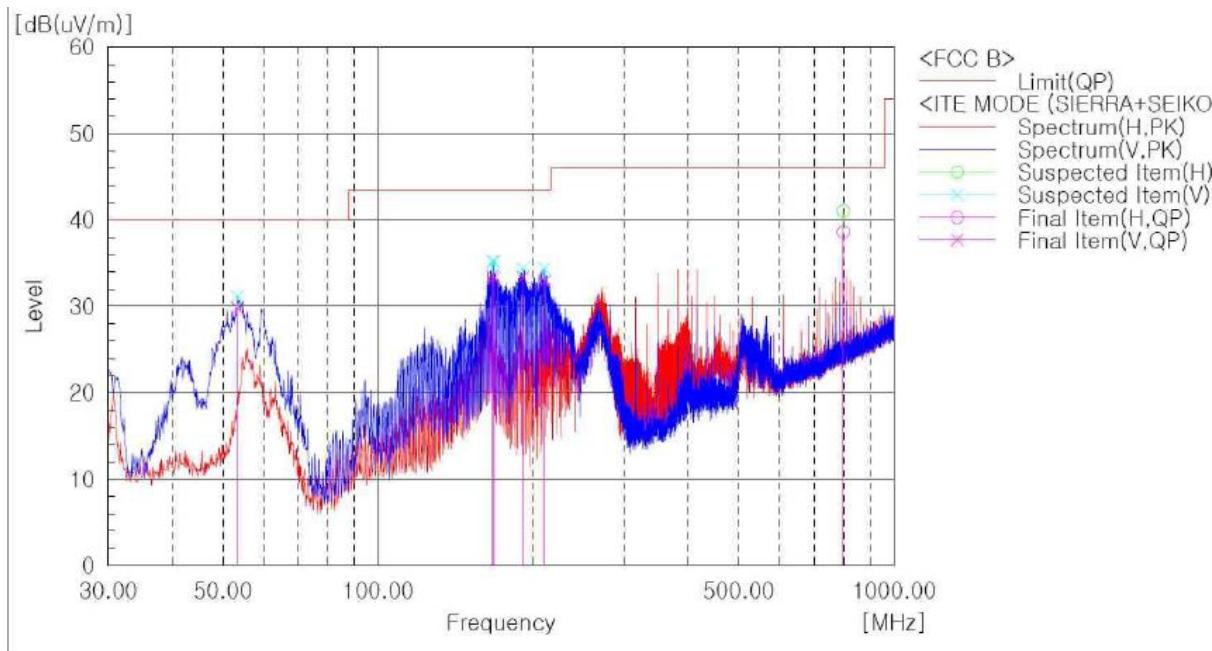
1) Fundamental Frequency Test Data

Frequency [MHz]	Reading [dB μ N/m@3m]	Height [m]	Correction Factor		Limits [dBuV/m@3m]	Result [dBuV/m@3m]	Margin [dB]
			Antenna	Cable			
13.56	13.93	1.0	20.53	6.50	124.0	41.0	83.0

2) Frequency Range from 9 kHz to 30 MHz Test Data

Frequency [MHz]	Reading [dB μ N/m@3m]	Height [m]	Correction Factor		Limits [dBuV/m@3m]	Result [dBuV/m@3m]	Margin [dB]
			Antenna	Cable			
Not detected emissions.							

3) Frequency Range from 30 MHz to 1000 MHz Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	53.401	V	44.9	-15.1	29.8	40.0	10.2	100.0	181.0
2	166.649	V	39.3	-5.8	33.5	43.5	10.0	100.0	70.0
3	167.861	V	40.2	-6.9	33.3	43.5	10.2	100.0	70.0
4	190.899	V	45.2	-11.8	33.4	43.5	10.1	100.0	107.0
5	210.178	V	45.5	-12.6	32.9	43.5	10.6	100.0	107.0
6	798.119	H	37.1	1.5	38.6	46.0	7.4	100.0	268.0