



CTK Co., Ltd.  
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## CTK Co., Ltd.

(Ho-dong), 113, Yejik-ro, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea  
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# TEST REPORT For FCC

Test Report No. : CTK-2014-01490  
Date of Issue : 2014-12-08  
FCC ID : 2ADPK-QR1356-UM4  
Model/Type No. : QR1356-UM4  
Kind of Product : 13.56MHz RF-ID Reader  
Applicant : Quad Bit System Co., Ltd.  
Applicant Address : 402, 217 Heojun-Ro, Gangseo-Gu, Seoul, Korea  
Manufacturer : Quad Bit System Co., Ltd.  
Manufacturer Address : 402, 217 Heojun-Ro, Gangseo-Gu, Seoul, Korea  
Contact Person : Kim Chang Dong / General Manager  
Telephone : +82-2-3665-8088  
Received Date : 2014-08-28  
Test period : Start : 2014-10-15 End : 2014-11-21  
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: 2014-12-08

Reviewed by

Young-Joon, Park  
Technical Manager  
Date: 2014-12-08



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### REPORT REVISION HISTORY

Date	Revision	Revision
2014-12-08	Issued (CTK-2014-01490)	

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## 1.0 General Product Description

### 1.0.1 Tested Equipment

- ☒ Unless otherwise indicated, all tests were conducted on Model QR1356-UM4
- ☐ Tests performed on Model \_\_\_\_\_ were considered to be representative of Model(s) \_\_\_\_\_.

### 1.0.2 Equipment Size, Mobility and Identification

Dimensions: 106(W) by 152(L) by 50(H) ☒ mm

Mobility: ☐ Portable ☒ Table-top ☐ Built-in  
☐ Floor-standing

Serial No.: Prototype

### 1.0.3 Electrical Ratings

Input : 120 Vac  
Output : -

### 1.0.4 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

Voltage: 120 Vac  
Frequency: 60 Hz

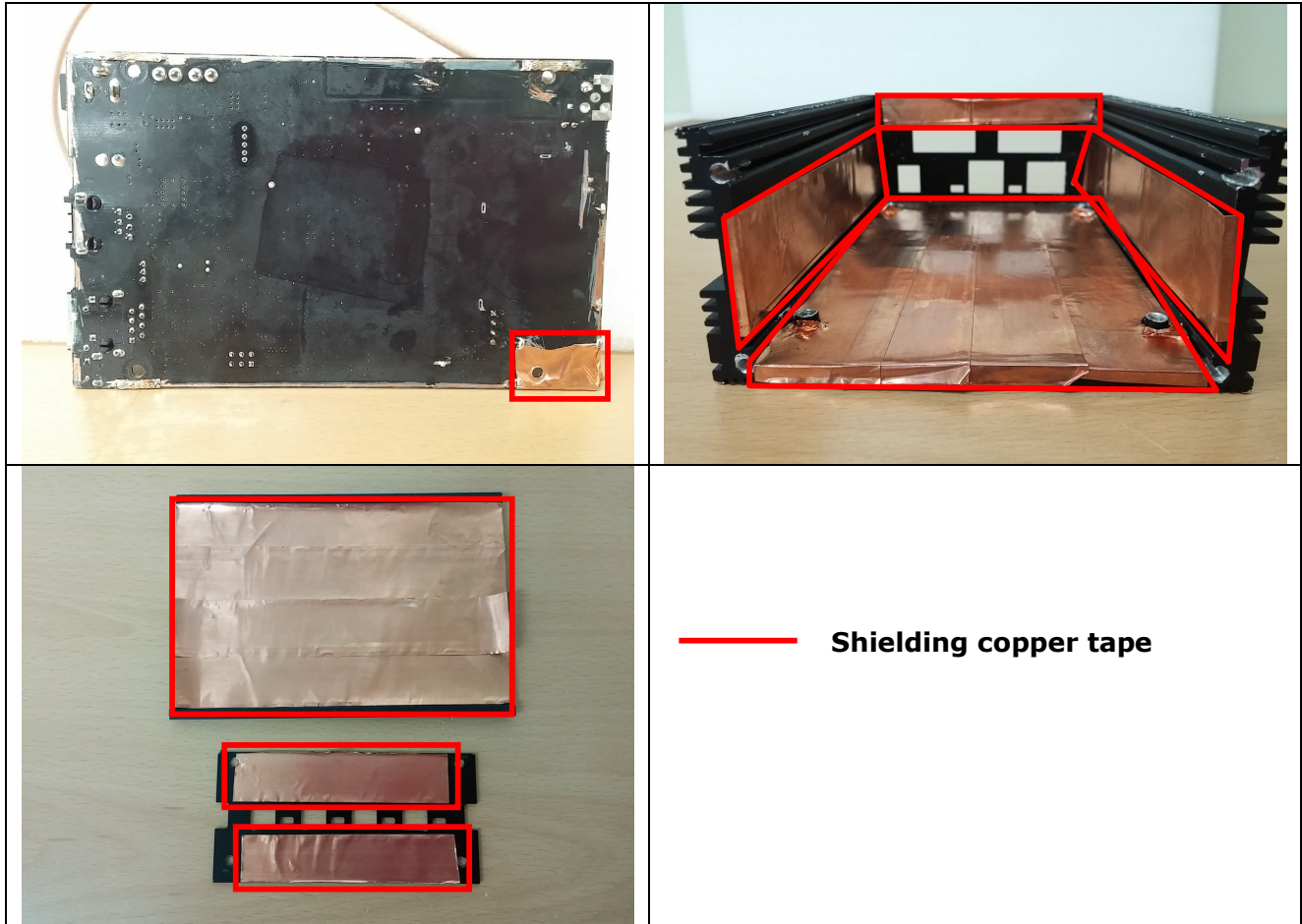
### 1.0.5 Clock & Other Frequencies Utilized

13.56 MHz, 50MHz

## 1.1 Model Differences

Not applicable

## 1.2 Device Modifications



### 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	Model No.	Serial No.	Manufacturer
RFID TAG	-	-	-
Test Zig	-	-	-
ANT(1-4)	-	-	-
Notebook Computer	PP20L	FG034A02DC4	Computadores Do Brasil LTDA, Dell
AC/DC ADAPTER1	SW48-12003500-W	-	SHENZHEN RIHUIDA ELECTRONICS CO., LTD.
AC/DC ADAPTER2	LA65NS0-00	DF263PA-1650-06D3	Dongguang Lite Power 2nd plant
AC/DC ADAPTER3	SW48-12003500-W	-	SHENZHEN RIHUIDA ELECTRONICS CO., LTD.

☒ Cable Description

No.	From		To		Type of Cable		
	Device	I/O Port	Device	I/O Port	Length (m)	Shielded or Unshielded	Ferrite Core [Y/N]
1	EUT	DC IN	AC/DC ADAPTER1	DC OUT	1.0	U	Y
2		OUT(1 - 4)	ANT(1 - 4)	-	3.0	S	N
3		D-IN	Test Zig	-	1.0	U	N
4		D-OUT	Test Zig	-	1.0	U	N
5		CONSOL	Cable	-	1.5	U	N
6		LAN	Notebook Computer	LAN	3.0	U	N
7		13.56 MHz Wireless Communication	RFID TAG	-	-	-	-
8	AC/DC ADAPTER1	AC Power	AC Mains	-	1.5	U	N
9	Notebook Computer	DC IN	AC/DC ADAPTER2	DC OUT	1.0	U	Y
10	AC/DC ADAPTER2	AC Power	AC Mains	-	1.5	U	N
11	Test Zig	DC IN	AC/DC ADAPTER3	DC OUT	1.0	U	Y
12	AC/DC ADAPTER3	AC Power	AC Mains	-	1.5	U	N

\* Shielded or Unshielded : Unshielded=U, Shielded=S

### 1.4 Test Software

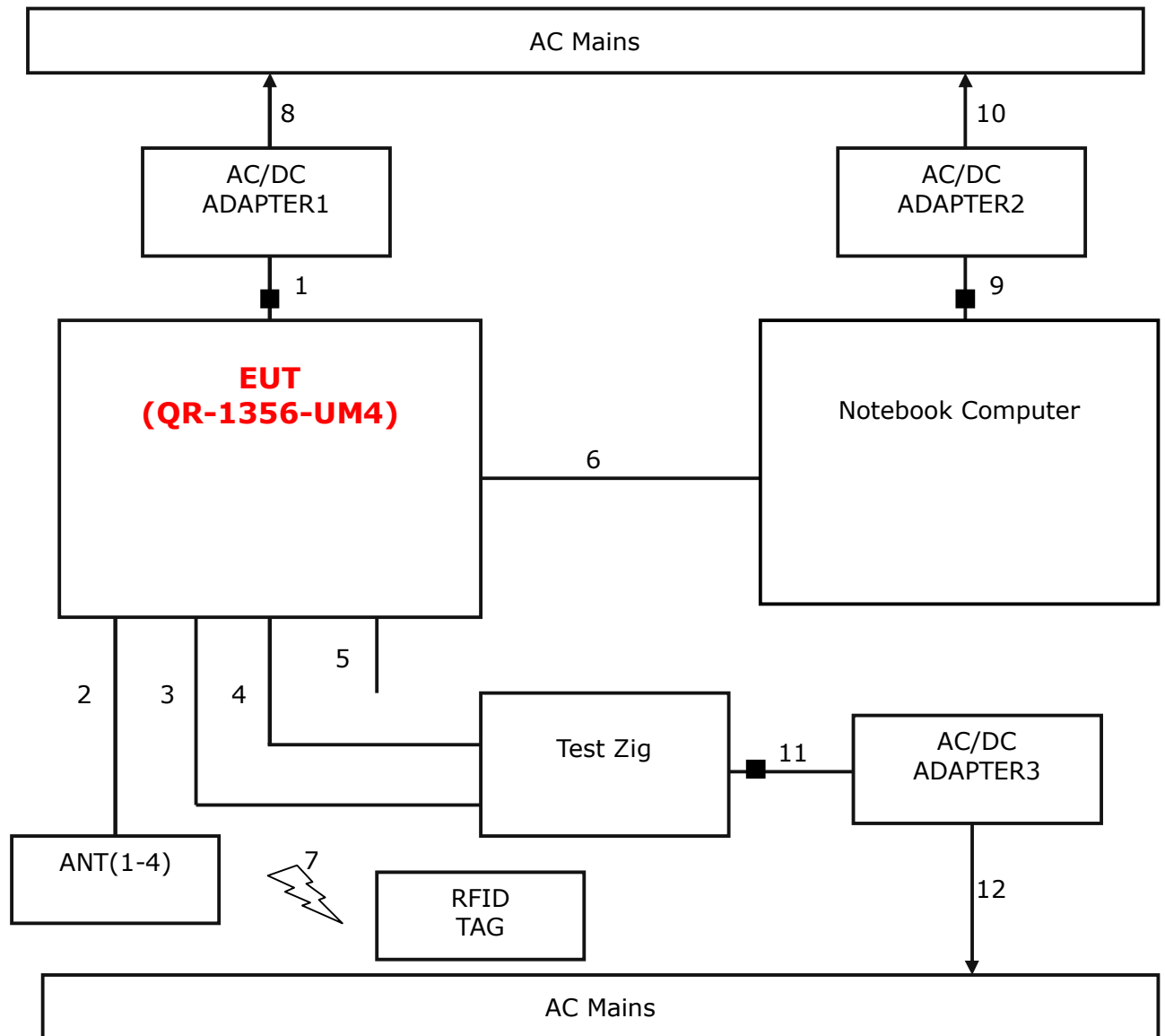
- ☐ EMC Test V 1.0  
☐ Display Test Patterns - V1.5  
☐ Ping.exe  
☒ Not applicable

### 1.5 EUT Operating Mode(s)

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

- ☐ Standby  
☐ Display circles pattern  
☒ Practice operation - EUT transmitting at 13.56 MHz continuously  
☐ Scrolling 'H'  
☐ Read / Write

## 1.6 Configuration





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### 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 (Ho-dong), 113, Yejik-ro, 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





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### 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	MSIP	EMI (Electromagnetic Interference / Emission) EMS (Electromagnetic Susceptibility / Immunity)	 No. 51, KR0025
International	KOLAS	EMC	



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## 2.0 Emissions Test Regulations

The emissions tests were performed according to following regulations:

☐ EN 61000-6-3:2007

☐ EN 61000-6-4:2007

☐ EN 55011:2007 +A2:2007

☐ Group 1

☐ Class A

☐ Group 2

☐ Class B

☐ EN 55013:2001 +A1:2003 +A2:2006

☐ EN 55014-1:2006

☐ EN 55015:2006

☐ EN 61204-3:2000

☐ Class A

☐ Class B

☐ EN 61131-2:2003

☐ EN 61326-1:2006

☐ Class A

☐ Class B

☐ EN 55022:2006

☐ Class A

☐ Class B

☐ EN 61000-3-2:2006

☐ EN 61000-3-3:1995 +A1:2001 +A2:2005

☐ VCCI V-3/2008.04

☐ Class A

☐ Class B

☐ AS/NZS CISPR22:2006

☐ Class A

☐ Class B

☒ FCC Part 15 Subpart C

☐ CISPR 22:2006

☐ Class A

☐ Class B

## 2.1 Radiated Electric Field Emissions - 15.225(a)

### Reference Standard

FCC Part 15.225(a)

### Test Date

2014-10-15

### 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	2014-12-06
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2016-06-13

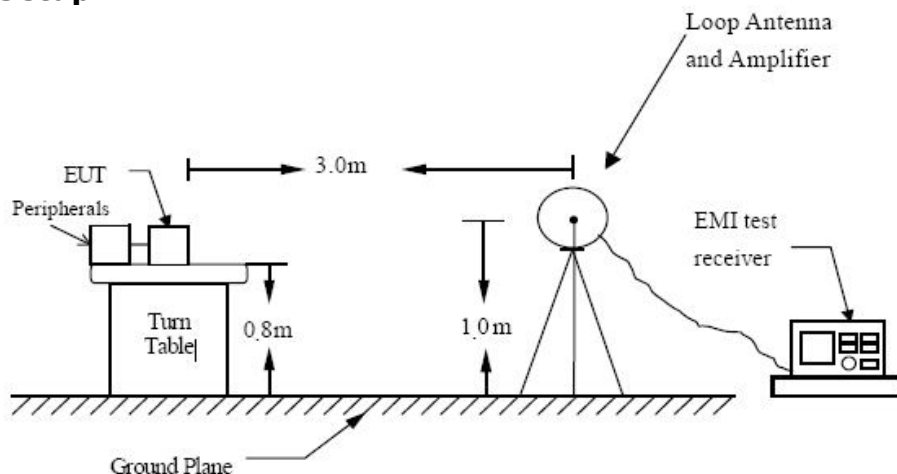
### Frequency Range of Measurement

13.553 MHz to 13.567 MHz

### Instrument Settings

IF Band Width: 10 kHz

### Test Setup





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### Measurement Procedure(blow 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	744.73	57.44	77.44

The requirements are:

- ☒ MET  
☐ NOT MET  
☐ NOT APPLICABLE

### Remarks

See Appendix A for test data

1. The field strength of spurious emission was measured in the following position: EUT Antenna stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(Y axis) and the worst case was recorded.



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## 2.2 Radiated Electric Field Emissions - 15.225(b)(c)

### Reference Standard

FCC Part 15.225(b)(c)

### Test Date

2014-10-15

### 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	2014-12-06
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2016-06-13

### 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  $\mu\text{V/m}$  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  $\mu\text{V/m}$  at 30 meters.

### Test Results

Frequency (MHz)	Field Strength of Fundamental $\mu\text{V/m}$ @ 30 m	Field Strength of Fundamental dBuV/m @ 30 m	Field Strength of Fundamental dBuV/m @ 3 m
13.410-13.553	10.56	20.47	40.47
13.567-13.710	10.33	20.28	40.28
13.110-13.410	26.85	28.58	48.58
13.710-14.010	26.18	28.36	48.36

The requirements are:

- ☒ MET  
☐ NOT MET  
☐ NOT APPLICABLE



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## 2.3 Radiated Electric Field Emissions - 15.225(d)

### Reference Standard

FCC Part 15.225(d), 15.209

### Test Date

2014-10-15

### 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	2014-12-06
<input checked="" type="checkbox"/>	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-08
<input checked="" type="checkbox"/>	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2016-06-13

### 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 kHz / VBW = 300 kHz / Sweep = AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.



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### 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

## 2.4 Frequency Stability – 15.225(e)

### Reference Standard

FCC Part 15.225(e)

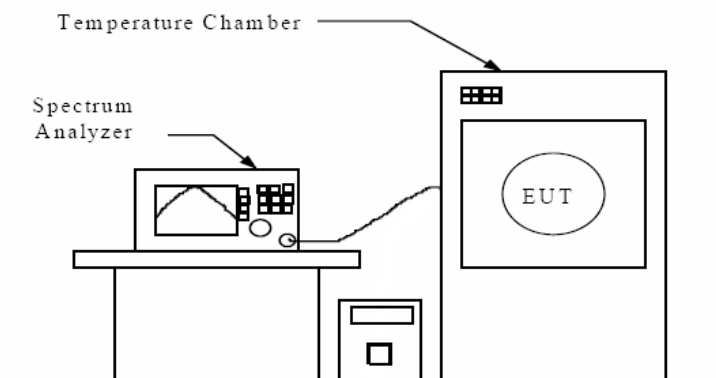
### Test Date

2014-11-18

### Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
<input checked="" type="checkbox"/>	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2015-11-07
<input checked="" type="checkbox"/>	Temp & Humi Chamber	Kunpoong Engineering	JT-TH-556-2	9 Q E 5 - 0 0 3	2015-01-16

### 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.





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### 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 \* (±) 0.0001 = (±) 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	13.559305	13.559370	13.559420	13.559432	13.559447	13.559430	13.559442	13.559438
10 min	13.559300	13.559374	13.559423	13.559437	13.559444	13.559435	13.559440	13.559443
30 min	13.559297	13.559376	13.559427	13.559435	13.559442	13.559434	13.559438	13.559446

Timing	Power 85%	Power 115%
Start-up	13.559425	13.559432
10 min	13.559427	13.559435
30 min	13.559434	13.559437

### Test Results

The requirements are:

- ☒ MET
- ☐ NOT MET
- ☐ NOT APPLICABLE



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## 2.5 Conducted Voltage Emissions – 15.207

### Reference Standard

FCC Part 15.207

### Test Date

2014-10-15

### 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	ESCI7	100816	2014-12-06
<input checked="" type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	101235	2015-07-30
<input type="checkbox"/>	LISN	Rohde & Schwarz	ENV216	101236	2015-07-30

### 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

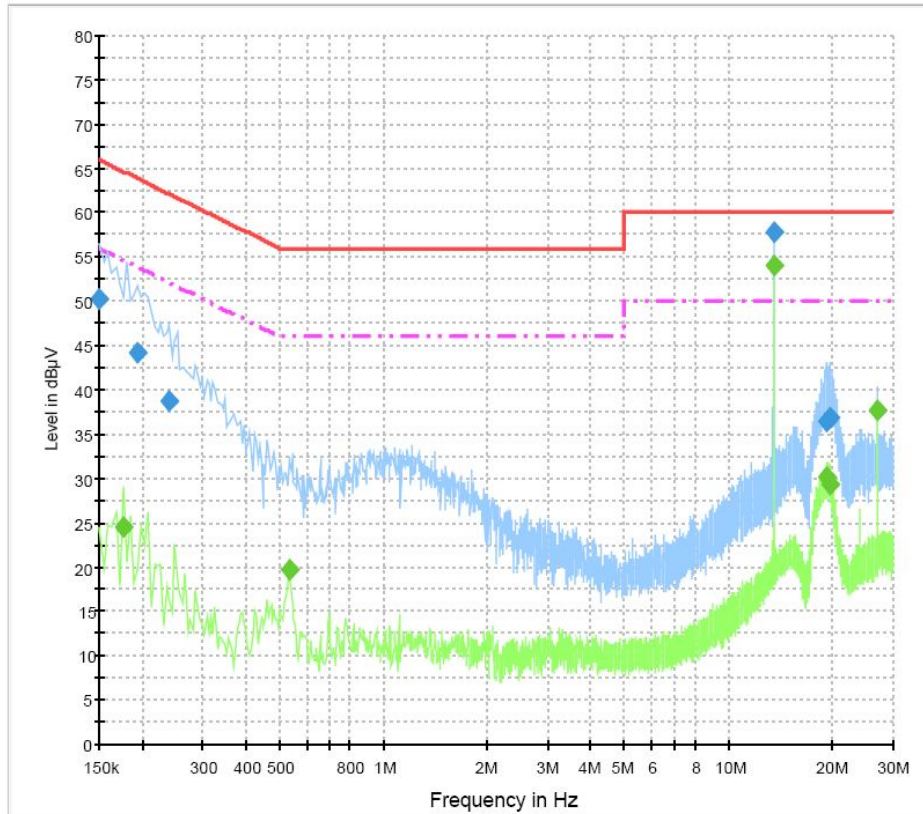
Frequency (MHz)	Measured Data (dBuV)	Margin (dB)	Remark
27.1185	37.7	12.3	Average

☐ NOT MET

☐ NOT APPLICABLE

## APPENDIX A – TEST DATA

[HOT]



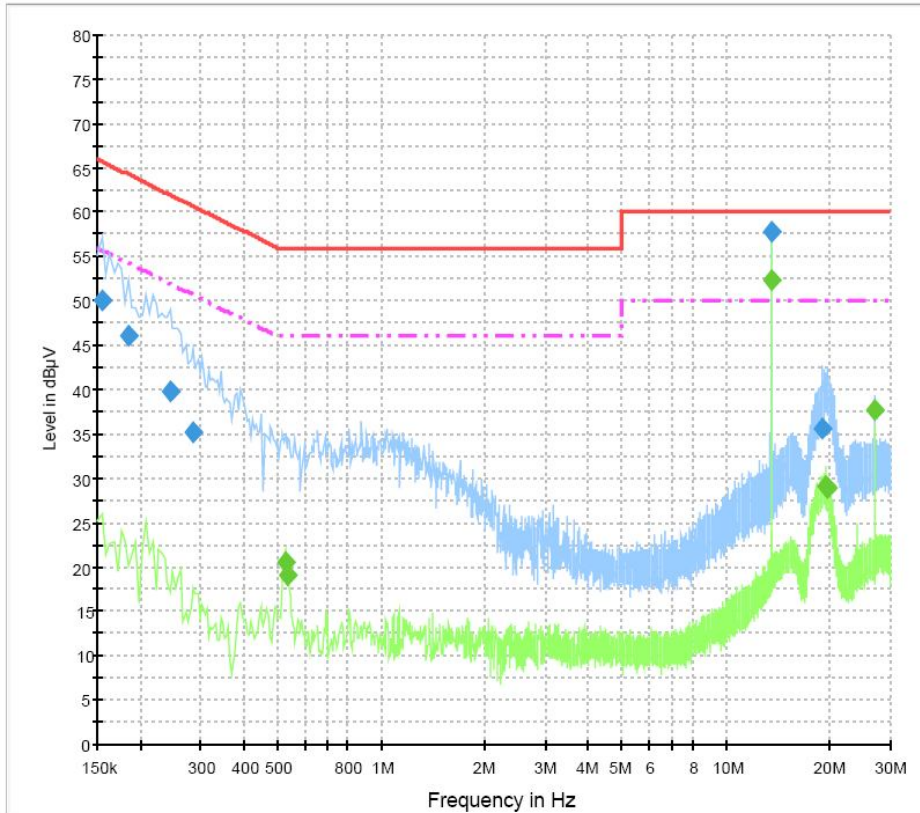
### Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	50.2	1000.0	9.000	On	L1	10.0	15.8	66.0
0.195000	44.1	1000.0	9.000	On	L1	9.9	19.7	63.8
0.240000	38.8	1000.0	9.000	On	L1	9.9	23.3	62.1
13.560000	57.8	1000.0	9.000	On	L1	9.9	2.2	60.0
19.144500	36.4	1000.0	9.000	On	L1	10.0	23.6	60.0
19.662000	36.9	1000.0	9.000	On	L1	10.0	23.1	60.0

### Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.177000	24.5	1000.0	9.000	On	L1	10.2	30.2	54.6
0.532500	19.6	1000.0	9.000	On	L1	10.2	26.4	46.0
13.560000	54.0	1000.0	9.000	On	L1	9.9	-4.0	50.0
19.225500	30.1	1000.0	9.000	On	L1	10.0	19.9	50.0
19.779000	29.3	1000.0	9.000	On	L1	10.0	20.7	50.0
27.118500	37.7	1000.0	9.000	On	L1	10.1	12.3	50.0

**[NEUTRAL]**



**Final Result 1**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.154500	50.0	1000.0	9.000	On	N	9.9	15.7	65.8
0.186000	46.1	1000.0	9.000	On	N	10.1	18.1	64.2
0.244500	39.8	1000.0	9.000	On	N	10.0	22.2	61.9
0.285000	35.3	1000.0	9.000	On	N	10.1	25.4	60.7
13.560000	57.7	1000.0	9.000	On	N	10.0	2.3	60.0
18.955500	35.7	1000.0	9.000	On	N	10.1	24.3	60.0

**Final Result 2**

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.528000	20.4	1000.0	9.000	On	N	10.2	25.6	46.0
0.537000	19.1	1000.0	9.000	On	N	10.2	26.9	46.0
13.560000	52.4	1000.0	9.000	On	N	10.0	-2.4	50.0
19.513500	29.1	1000.0	9.000	On	N	10.1	20.9	50.0
19.653000	28.9	1000.0	9.000	On	N	10.1	21.1	50.0
27.118500	37.6	1000.0	9.000	On	N	10.2	12.4	50.0

## Radiated Electric Field Emissions (Quasi-Peak reading)

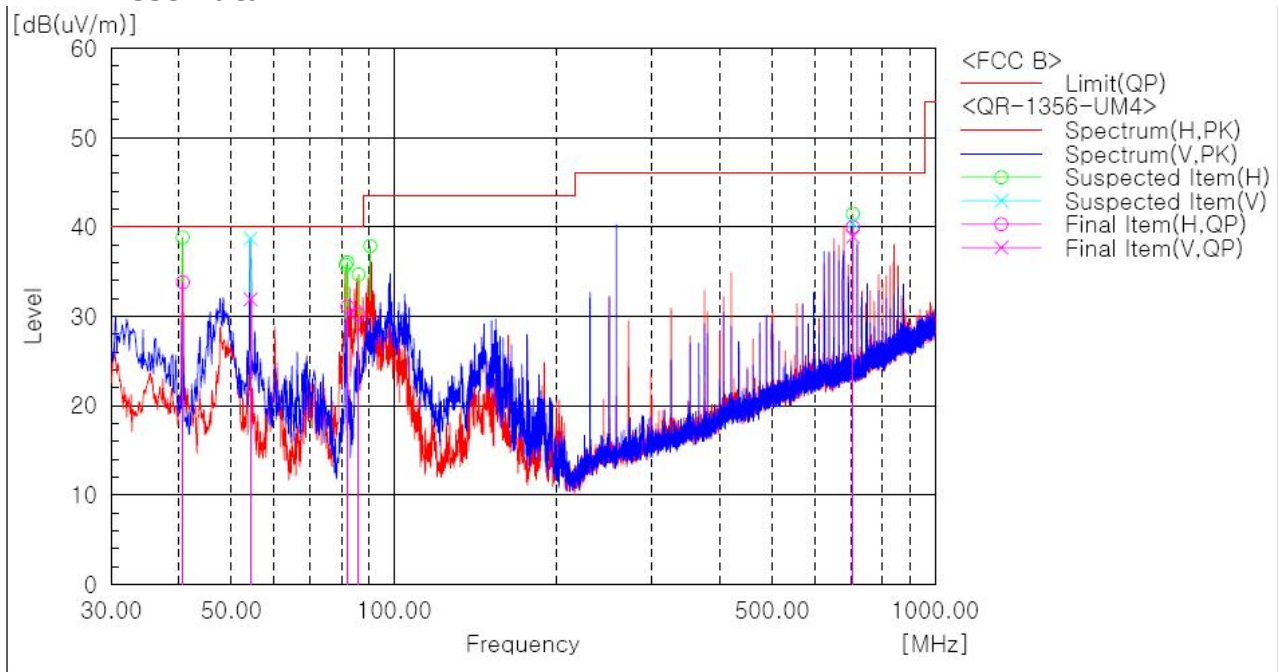
EUT	13.56MHz RF-ID Reader	Measurement Detail	
Model	QR1356-UM4	Frequency Range	Below 1000MHz
Test mode	Operating	Detector function	Quasi-Peak / Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
705.120	40.0	6.0	Quasi-Peak

### 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	40.702	H	45.3	-11.5	33.8	40.0	6.2	100.0	118.0
2	54.294	V	49.0	-17.1	31.9	40.0	8.1	199.0	354.0
3	82.016	H	47.4	-16.3	31.1	40.0	8.9	208.0	47.0
4	86.018	H	45.9	-15.7	30.2	40.0	9.8	208.0	9.0
5	705.120	H	39.3	0.7	40.0	46.0	6.0	208.0	271.0
6	705.120	V	38.2	0.7	38.9	46.0	7.1	100.0	159.0

### Remark :

1. The field strength of spurious emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(Y axis) and the worst case was recorded.



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### Bandwidth of the Operating Frequency

