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TEST REPORT For FCC

Test Report No.	:	CTK-2014-01475
Date of Issue	:	2014-12-03
FCC ID	:	2ADPK-QR1356-UL4
Model/Type No.	:	QR1356-UL4
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: 2014-12-03

Reviewed by

Young-Joon, Park
Technical Manager
Date: 2014-12-03

REPORT REVISION HISTORY

Date	Revision	Revision
2014-12-03	Issued (CTK-2014-01475)	

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1.0 General Product Description

1.0.1 Tested Equipment

☒ Unless otherwise indicated, all tests were conducted on Model QR1356-UL4

☐ Tests performed on Model _____ were considered to be representative of Model(s) _____.

1.0.2 Equipment Size, Mobility and Identification

Dimensions: 206(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

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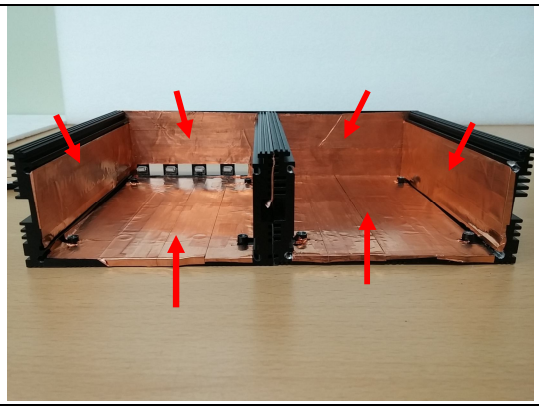
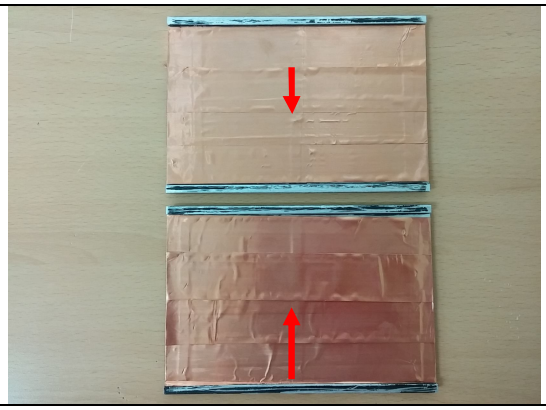
<td>  </td>
<td>  </td>
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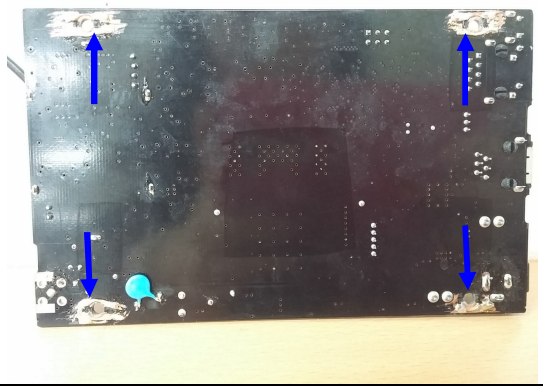
<td>  </td>
<td>Shielding copper tape
Ground expansion</td>
</tr>
</table>

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 ELECTORONICS CO., LTD.
AC/DC ADAPTER2	LA65NS0-00	DF263PA-1650-06D3	Dongguang Lite Power 2nd plant
AC/DC ADAPTER3	SW48-12003500-W	-	SHENZHEN RIHUIDA ELECTORONICS 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 ㎒ 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

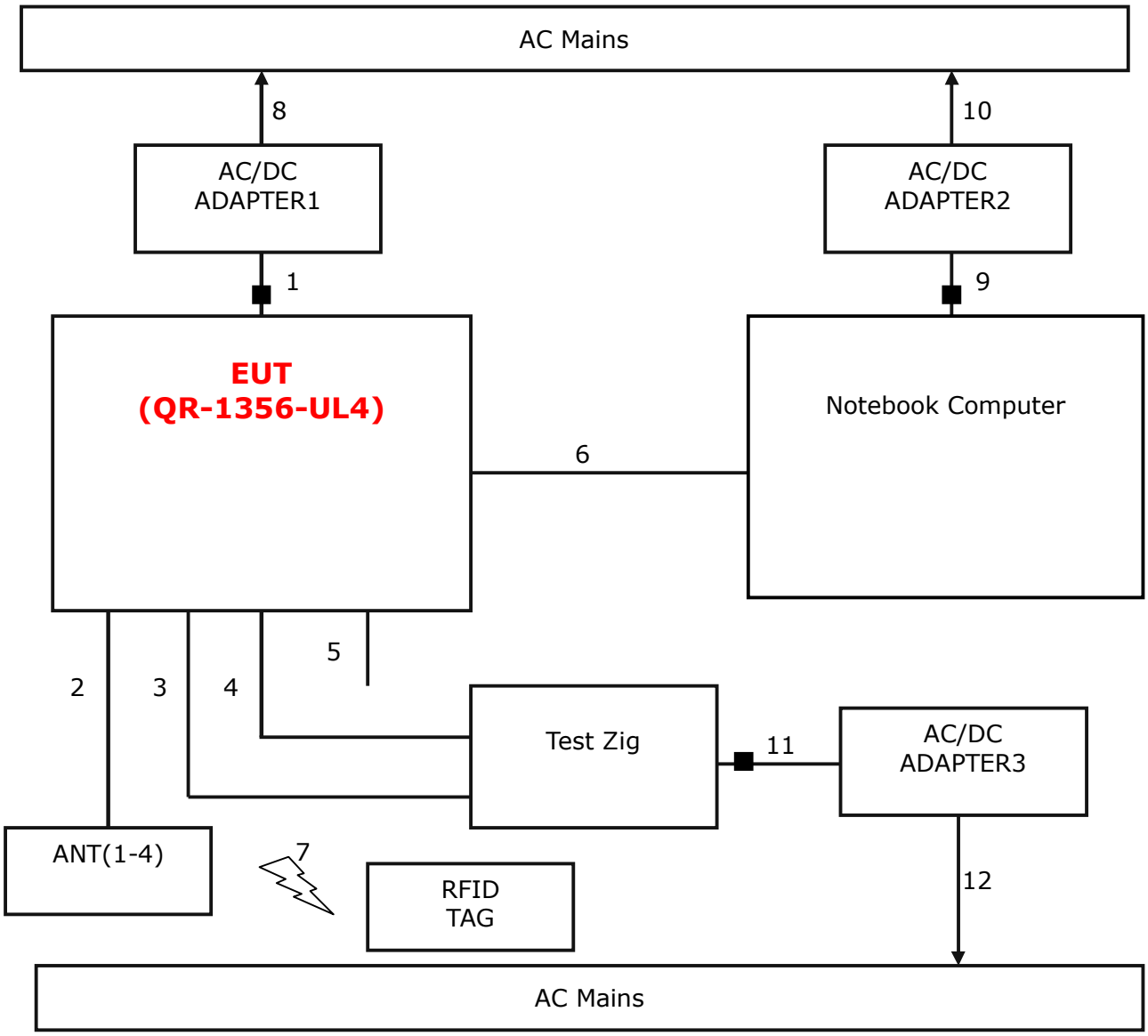
☐ EMC Test V 1.0
☐ Display Test Patterns – V1.5
☐ Ping.exe
☒ Not applicable

1.5 EUT Operating Mode(s)

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

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

1.6 Configuration



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

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	

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
2014-11-15

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

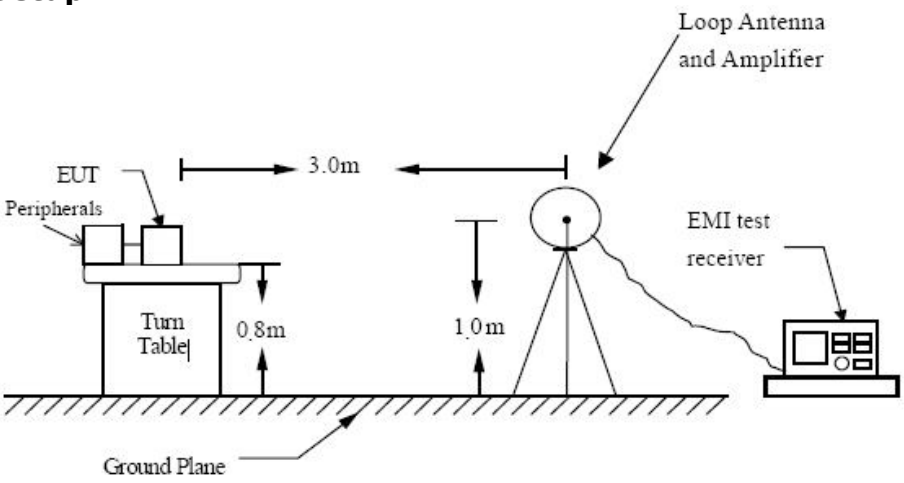
Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
☒	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2014-12-06
☒	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



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	824.14	58.32	78.32

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.

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

Reference Standard
FCC Part 15.225(b)(c)

Test Date
2014-11-15

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
☒	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2014-12-06
☒	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 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	5.23	14.37	34.37
13.567-13.710	5.55	14.88	34.88
13.110-13.410	13.24	22.44	42.44
13.710-14.010	9.81	19.83	39.83

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

2.3 Radiated Electric Field Emissions - 15.225(d)

Reference Standard
FCC Part 15.225(d), 15.209

Test Date
2014-11-15

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
☒	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2014-12-06
☒	Bilog Antenna	Schaffner	CBL6111C	2551	2016-05-08
☒	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.

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)

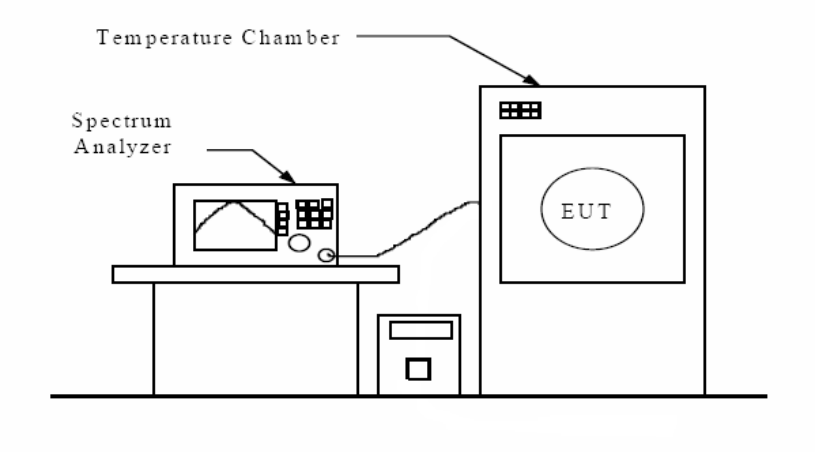
Reference Standard
FCC Part 15.225(e)

Test Date
2014-11-18

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
☒	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2015-11-07
☒	Temp & Humi Chamber	Kunpoong Engineering	JT-TH-556-2	9QE5-003	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.

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	13.558956	13.558791	13.558838	13.558846	13.558858	13.558859	13.558852	13.558848
10 min	13.558950	13.558793	13.558839	13.558847	13.558859	13.558856	13.558855	13.558852
30 min	13.558755	13.558799	13.558842	13.558849	13.558859	13.558860	13.558857	13.558855

Timing	Power 85%	Power 115%
Start-up	13.558756	13.558805
10 min	13.558760	13.558809
30 min	13.558762	13.558812

Test Results

The requirements are:

☒ MET
☐ NOT MET
☐ NOT APPLICABLE

2.5 Conducted Voltage Emissions – 15.207

Reference Standard
FCC Part 15.207

Test Date
2014-11-18

Test Location
Shielded Room

Test Equipment

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
☒	EMI Test Receiver	Rohde & Schwarz	ESCI7	100816	2014-12-06
☒	LISN	Rohde & Schwarz	ENV216	101235	2015-07-30
☐	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:

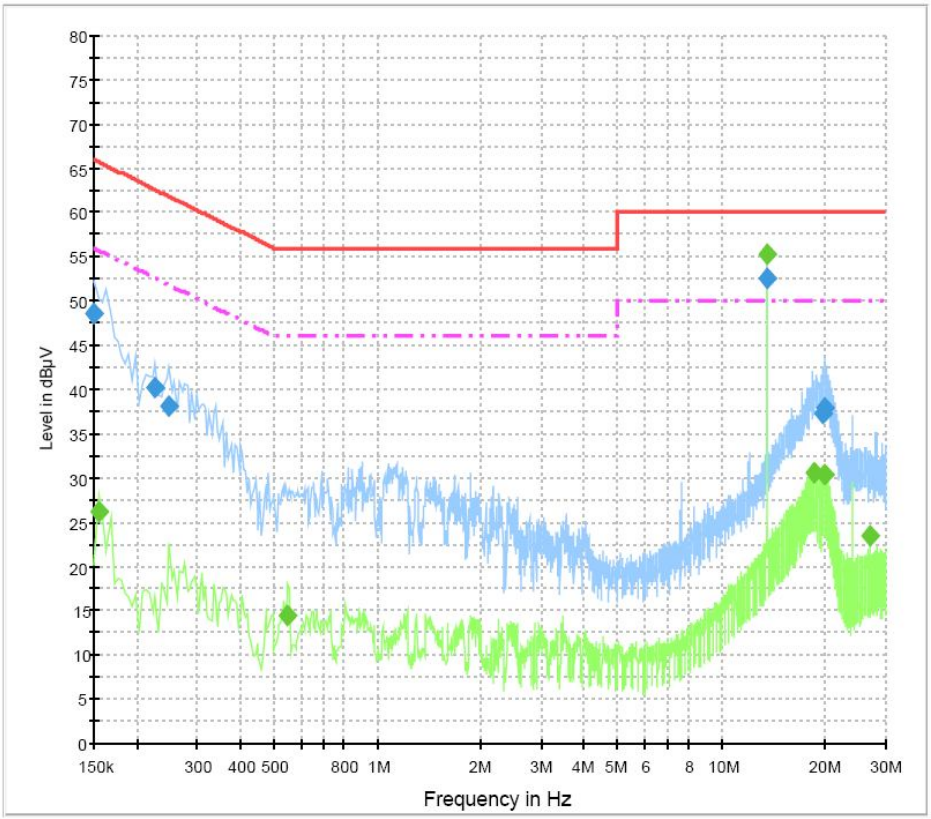
☒ MET

Frequency (MHz)	Measured Data (dBuV)	Margin (dB)	Remark
0.150	48.5	17.5	Quasi-peak

☐ NOT MET
☐ NOT APPLICABLE

APPENDIX A – TEST DATA

[HOT]



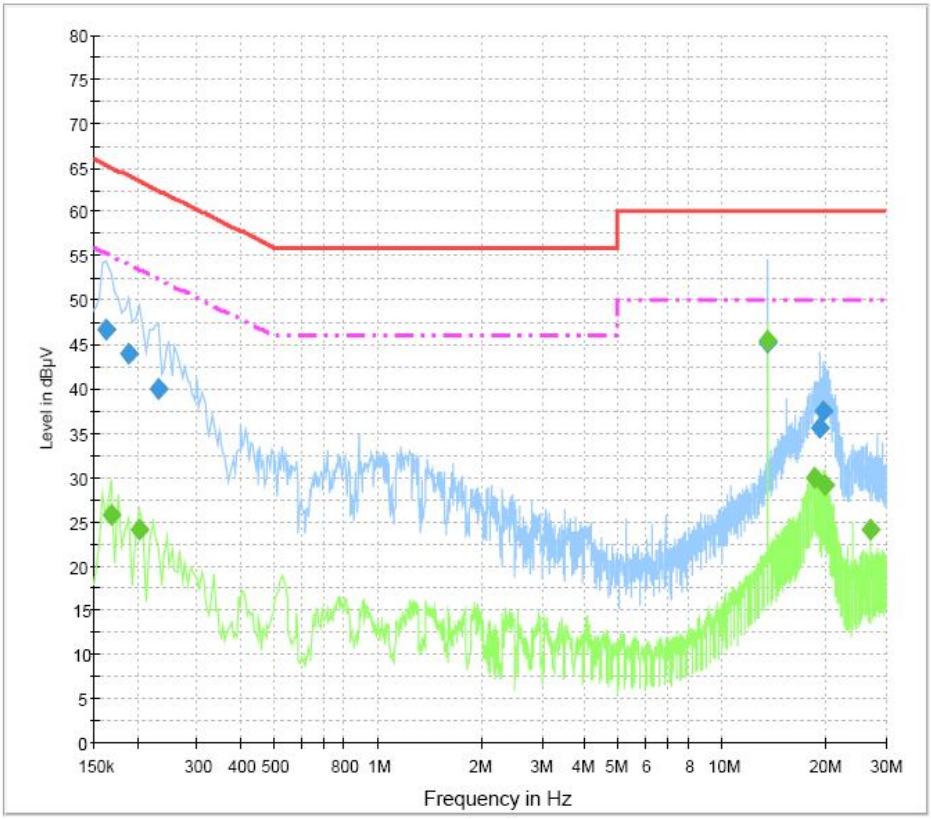
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150000	48.5	1000.0	9.000	On	L1	10.0	17.5	66.0
0.226500	40.2	1000.0	9.000	On	L1	9.9	22.3	62.6
0.249000	38.1	1000.0	9.000	On	L1	10.0	23.7	61.8
13.560000	52.7	1000.0	9.000	On	L1	9.9	7.3	60.0
19.608000	37.4	1000.0	9.000	On	L1	10.0	22.6	60.0
19.833000	37.8	1000.0	9.000	On	L1	10.0	22.2	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.154500	26.2	1000.0	9.000	On	L1	10.1	29.5	55.8
0.550500	14.4	1000.0	9.000	On	L1	10.2	31.6	46.0
13.560000	55.3	1000.0	9.000	On	L1	9.9	-5.3	50.0
18.519000	30.6	1000.0	9.000	On	L1	10.0	19.4	50.0
19.963500	30.3	1000.0	9.000	On	L1	10.0	19.7	50.0
27.118500	23.5	1000.0	9.000	On	L1	10.1	26.5	50.0

[NEUTRAL]



Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.163500	46.7	1000.0	9.000	On	N	10.1	18.5	65.3
0.190500	44.0	1000.0	9.000	On	N	10.1	20.0	64.0
0.231000	40.1	1000.0	9.000	On	N	10.0	22.3	62.4
13.564500	45.3	1000.0	9.000	On	N	10.0	14.7	60.0
19.180500	35.5	1000.0	9.000	On	N	10.1	24.5	60.0
19.819500	37.5	1000.0	9.000	On	N	10.1	22.5	60.0

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.168000	25.8	1000.0	9.000	On	N	10.1	29.3	55.1
0.204000	24.1	1000.0	9.000	On	N	10.0	29.4	53.4
13.564500	45.5	1000.0	9.000	On	N	10.0	4.5	50.0
18.604500	29.9	1000.0	9.000	On	N	10.1	20.1	50.0
19.851000	29.1	1000.0	9.000	On	N	10.1	20.9	50.0
27.118500	24.0	1000.0	9.000	On	N	10.2	26.0	50.0

Radiated Electric Field Emissions (Quasi-Peak reading)

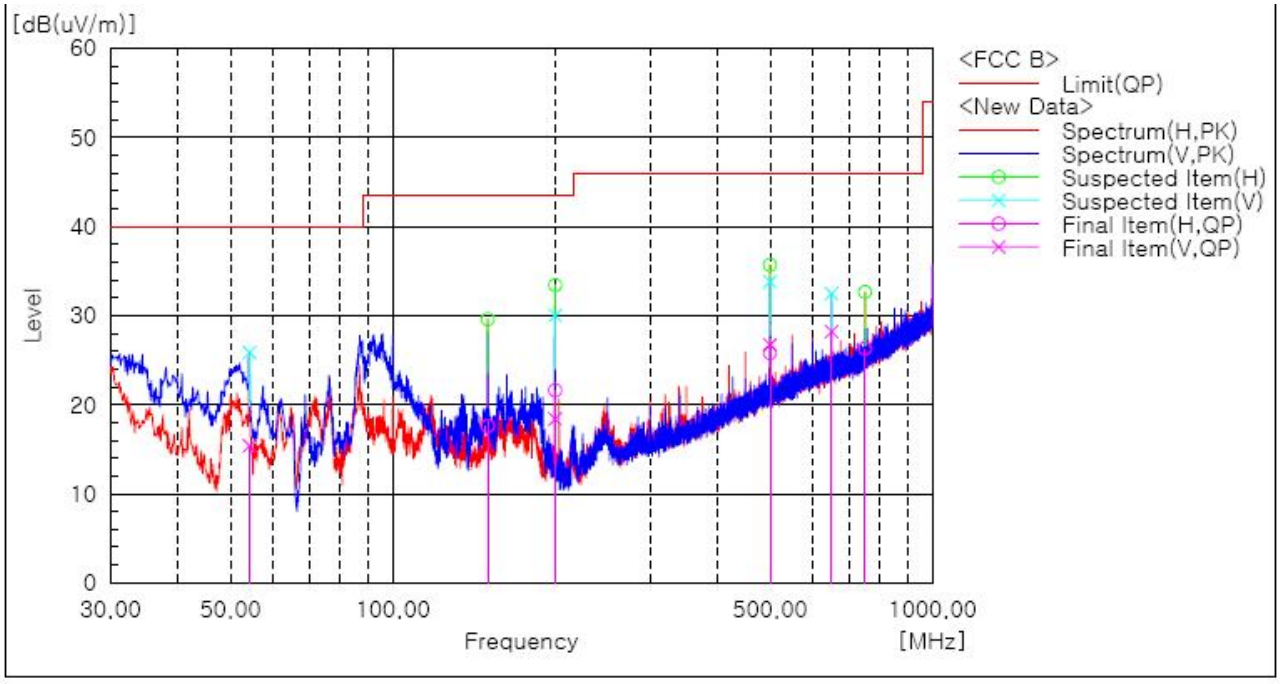
EUT	13.56MHz RF-ID Reader	Measurement Detail	
Model	QR1356-UL4	Frequency Range	Below 1000MHz
Test mode	Operating	Detector function	Quasi-Peak / Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
649.951	28.2	17.8	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	54.250	V	32.5	-17.1	15.4	40.0	24.6	100.0	11.0
2	150.038	H	30.1	-12.5	17.6	43.5	25.9	207.0	272.0
3	199.993	H	35.7	-14.1	21.6	43.5	21.9	100.0	350.0
4	199.993	V	32.5	-14.1	18.4	43.5	25.1	100.0	123.0
5	499.965	H	28.9	-3.1	25.8	46.0	20.2	100.0	164.0
6	499.965	V	29.8	-3.1	26.7	46.0	19.3	100.0	197.0
7	649.951	V	28.4	-0.2	28.2	46.0	17.8	100.0	123.0
8	749.983	H	24.9	1.4	26.3	46.0	19.7	100.0	350.0

Remark :
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.

Bandwidth of the Operating Frequency