FCC PART 15 Subpart C TEST REPORT

Applicant	:	Octonion SA
Address	:	EPFL Innovation Park Batiment C, 1015 Lausanne Switzerland
Manufacturer	:	FIH Mobile Limited
Address	:	No.4, Minsheng St., Tucheng Dist., New Taipei City 23679, Taiwan (R.O.C.)
E.U.T.	:	PIQ1.1
Brand Name	:	PIQ
Model No.	:	PIQ RED1.1, PIQ BLACK1.1, PIQ BLUE1.1, PIQ GREEN1.1
Measurement Standard	:	FCC PART 15.225
FCC ID	:	2AEJC-PIQ1-1
Date of Receiver :	:	May 26, 2016
Date of Test :	:	May 26, 2016 to June 17, 2016
Date of Report :	:	July 01, 2016

This Test Report is Issued Under the Authority of :

Prepared by

Approved & Authorized Signer

Rose

Rose Hu / Engineer

Sunm / Q.A. Director

Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Dongguan Nore Testing Center Co., Ltd. The test results referenced from this report are relevant only to the sample tested.

TEL: +86-769-22022444 FAX: +86-769-22022799 Web: www.ntc-c.com
Address: Building D, Gaosheng Science and Technology Park, Hongtu Road, Nancheng District, Dongguan City, Guangdong, China

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Revision History of This Test Report

Report Number	Description	Issued Date
NTC1605216F	Initial Issue	2016-06-20
NTC1605216F	Change product name / Add model name / Add software version	2016-07-01

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test

Product Name	:	PIQ1.1
Model name	:	PIQ RED1.1, PIQ BLACK1.1, PIQ BLUE1.1, PIQ GREEN1.1
Model Difference Description	:	All models have the same circuitry, electrical mechanical and physical construction. Their differences in model name and enclosure color due to trading purpose.
Power Supply	:	2* DC 3.7V 35mAh Li-lithium Battery for Transmitter 1* DC 3.7V 280mA Li-lithium battery and DC 5V come from external USB Port for Charger
Test Voltage	:	DC 3.7V, DC 5V (Only the worst case was recorded) End point voltage of battery: DC 3.33V, 4.07V
Hardware Version	:	v3.03
Software Version	:	v4, v5
Support radios application	:	NFC Bluetooth v4.1 LE
Frequency Range	:	13.553 ~ 13.567MHz
Modulation	:	ASK
Antenna Type	:	PCBA
Number of Channels	:	1
Note	:	1. This measurement and test report only pertains to the NFC portion of the EUT. For measurement and test results to the Bluetooth function please refer to report number NTC1605184F. 2. All tests carry out on model PIQ RED1.1 and software version v4.

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AEJC-PIQ1-1 filing to comply with Section 15.247 of the FCC Part 15(2016), Subpart C Rule.

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters. All other measurements were made in accordance with the procedures in 47 CFR part 2.

1.4 Equipment Modifications

Not available for this EUT intended for grant.

1.5 Support Device

Notebook	:	Manufacturer: Lenovo Model: ThinkPad E450C
Power Supply	:	Manufacturer: Lenovo Mode: ADLX65NLC3A Input: AC100-240V 50/60Hz 1.8A Output: DC 20.0V 3.25A
Cell phone	:	Manufacturer: VIVO Model: X5SL

1.6 Test Software

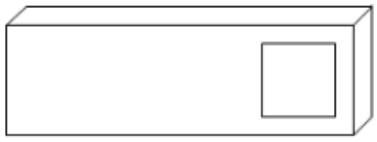
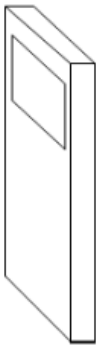
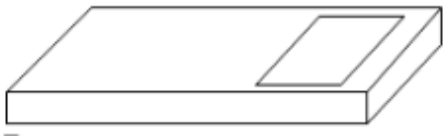
Test Item	Software	Description
Conducted RF Testing and Radiated testing	PiqMonitor-Master-1.2860-Release.apk	Set the EUT to continuously transmit

Note: The test software is installed in the cell phone. During the test, we can control the transmitting mode/selection of test channel of EUT by using this app software in the cell phone.

1.7 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207 (a)	AC Power Conducted Emission	Compliance
§15.225(a) (b) (c)	Field Strength of Fundamental Emissions	Compliance
§15.215 (c)	20dB Bandwidth	Compliance
§15.225(d),15.209	Radiated Spurious Emissions	Compliance
§15.225(e)	Frequency Stability	Compliance
§15.203	Antenna Requirement	Compliance

Note: 1. The full charge battery used during the test.
2. The EUT powered by battery and operating multiple positions, so the EUT shall be performed three orthogonal planes. The worst plane is Z.

X Plane	Y Plane	Z Plane
		

1.8 Test Facility and Location

Listed by FCC, July 03, 2014
The Certificate Registration Number is 665078.
Listed by Industry Canada, June 18, 2014
The Certificate Registration Number is 9743A.

Dongguan NTC Co., Ltd.
(Full Name: Dongguan Nore Testing Center Co., Ltd.)
Building D, Gaosheng Science and Technology Park, Hongtu Road,
Nancheng District, Dongguan City, Guangdong, China
(Full Name: Building D, Gaosheng Science & Technology Park,
Zhouxi Longxi Road, Nancheng District, Dongguan, Guangdong, China.

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 Special Accessories

Not available for this EUT intended for grant.

2.3 Description of test modes

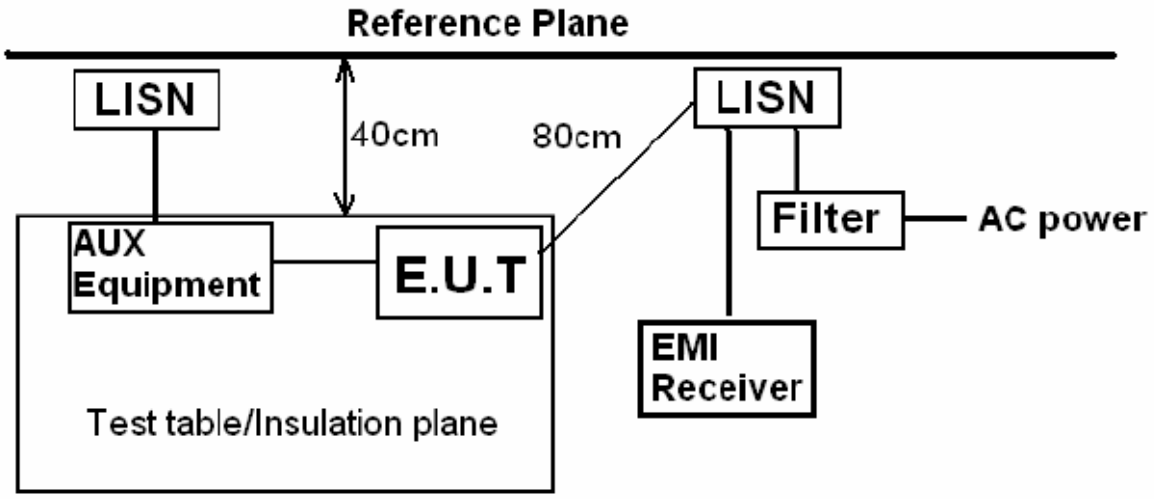
The EUT has been tested under continuous operating condition. Test program used to control the EUT staying in continuous transmitting mode.

2.4 EUT Exercise

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

3. Conducted Emissions Test

3.1 Test SET-UP (Block Diagram of Configuration)



3.2 Test Condition

Test Requirement: FCC Part 15.207

Frequency Range: 150KHz ~ 30MHz

Detector: RBW 9KHz, VBW 30KHz

Operation Mode: Charging+NFC Mode

3.3 Measurement Results

Please refer to following plots.

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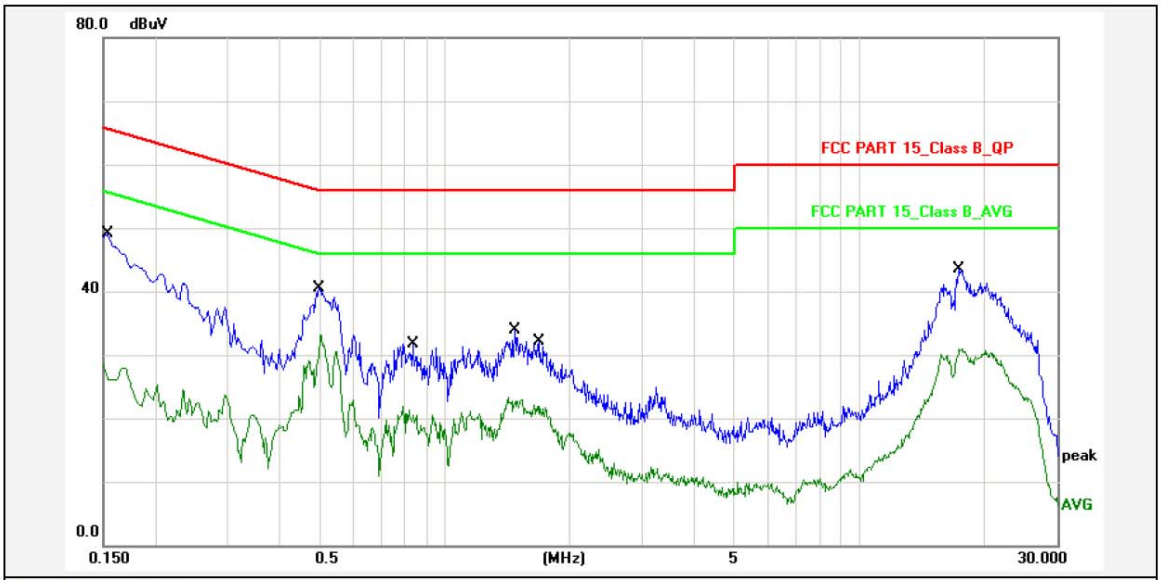
Web: Http://www.ntc-c.com

Site: Conduction

Test Time: 2016-6-4 11:08:51



Report No.: PIQ2
Test Standard: FCC PART 15_Class B_QP
Test item: Conducted Emission
Phase: N
Applicant: Octonion SA
Temp.( )/Hum.(%): 22(C) / 54 %
Product: PIQ1.1
Power Rating: AC 120V/60Hz (PC Input)
Model No.: PIQ RED1.1
Test Engineer: Sance

Test Mode: Charging + TX(NFC)
Remark:

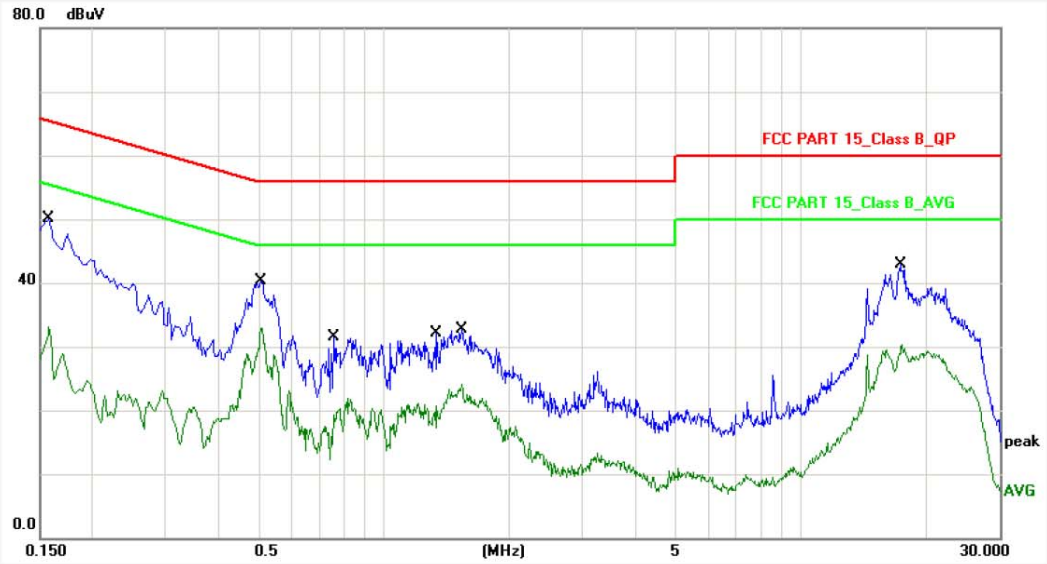
No.	Frequency (MHz)	Factor (dBuV)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1539	10.80	36.40	47.20	65.78	-18.58	QP	P	
2	0.1539	10.80	15.80	26.60	55.78	-29.18	AVG	P	
3	0.4980	10.80	27.70	38.50	56.03	-17.53	QP	P	
4	0.4980	10.80	20.40	31.20	46.03	-14.83	AVG	P	
5	0.8380	10.80	19.00	29.80	56.00	-26.20	QP	P	
6	0.8380	10.80	9.00	19.80	46.00	-26.20	AVG	P	
7	1.4740	10.80	21.10	31.90	56.00	-24.10	QP	P	
8	1.4740	10.80	10.40	21.20	46.00	-24.80	AVG	P	
9	1.6900	10.80	19.40	30.20	56.00	-25.80	QP	P	
10	1.6900	10.80	9.30	20.10	46.00	-25.90	AVG	P	
11	17.3580	10.80	30.80	41.60	60.00	-18.40	QP	P	
12	17.3580	10.80	18.40	29.20	50.00	-20.80	AVG	P	

Note: Level=Reading+Factor.
Margin=Limit-Level.

Dongguan NTC Co., Ltd.
Tel: +86-769-22022444 Fax: +86-769-22022799
Web: Http://www.ntc-c.com

Site: Conduction

Test Time: 2016-6-4 11:15:25



Report No.: PIQ2
Test Standard: FCC PART 15_Class B_QP
Test item: Conducted Emission
Phase: L1
Applicant: Octonion SA
Temp.( )/Hum.(%): 22(C) / 54 %
Product: PIQ1.1
Power Rating: AC 120V/60Hz (PC Input)
Model No.: PIQ RED1.1
Test Engineer: Sance

Test Mode: Charging + TX(NFC)
Remark:

No.	Frequency (MHz)	Factor (dBuV)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F	Remark
1	0.1580	10.80	37.40	48.20	65.56	-17.36	QP	P	
2	0.1580	10.80	20.40	31.20	55.56	-24.36	AVG	P	
3	0.5100	10.80	27.50	38.30	56.00	-17.70	QP	P	
4	0.5100	10.80	20.00	30.80	46.00	-15.20	AVG	P	
5	0.7620	10.80	18.80	29.60	56.00	-26.40	QP	P	
6	0.7620	10.80	8.60	19.40	46.00	-26.60	AVG	P	
7	1.3380	10.80	19.30	30.10	56.00	-25.90	QP	P	
8	1.3380	10.80	8.40	19.20	46.00	-26.80	AVG	P	
9	1.5380	10.80	19.90	30.70	56.00	-25.30	QP	P	
10	1.5380	10.80	11.30	22.10	46.00	-23.90	AVG	P	
11	17.3700	10.80	30.00	40.80	60.00	-19.20	QP	P	
12	17.3700	10.80	17.60	28.40	50.00	-21.60	AVG	P	

Note: Level=Reading+Factor.
Margin=Limit-Level.

4. 20dB Bandwidth

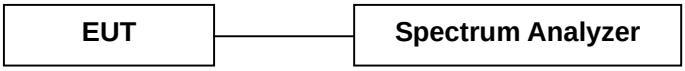
4.1 Measurement Procedure

Spectrum Bandwidth, FCC Rule 15.225 (c):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer was set as below:

1. Set the RBW=1KHz.
2. Set the VBW ≥ 3 x RBW
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Measure the spectrum width with power higher than 20dB below carrier.

4.2 Test SET-UP (Block Diagram of Configuration)



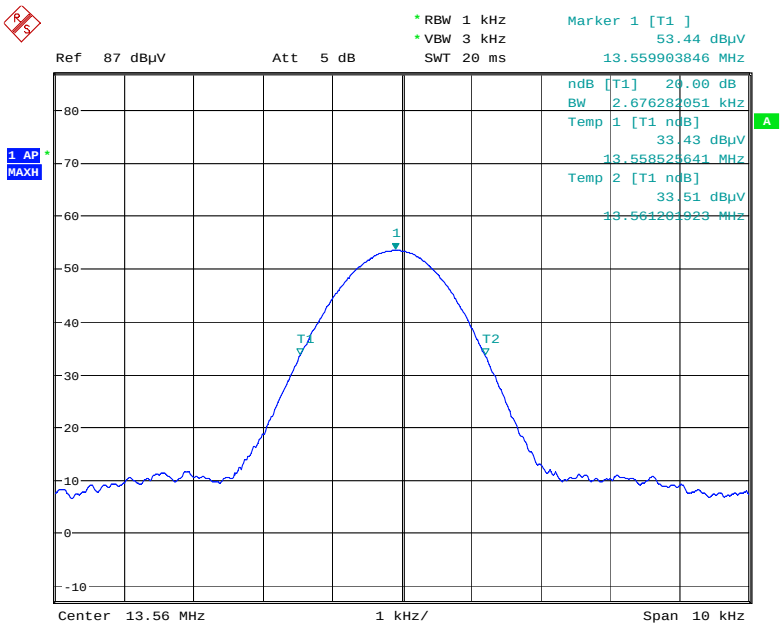
4.3 Measurement Results

Please refer to following table and plots.

Temperature :	21 ℃	Humidity :	49 %
Test By:	Sance	Test Date :	June 05, 2016
Test Result:	PASS		

Frequency MHz	20dB Bandwidth KHz
13.56	2.68

20dB Bandwidth



Date: 5.JUN.2016 14:18:03

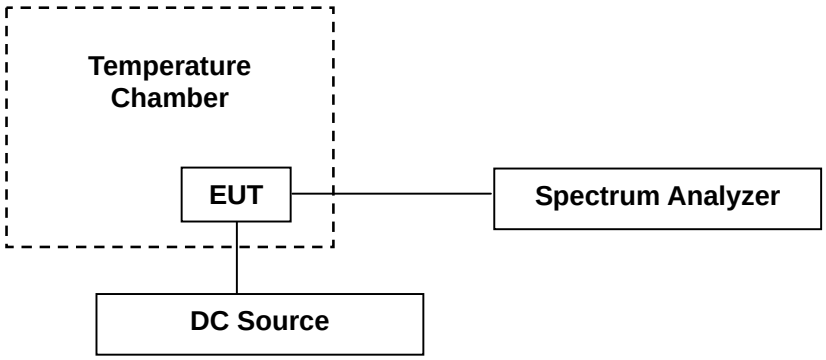
5. Frequency Stability

5.1 Measurement Procedure

Frequency tolerance, FCC Rule 15.225(e):

1. Place the EUT in the temperature chamber.
2. The transmitter output (antenna port) was connected to the spectrum analyzer.
3. EUT have transmitted signal and fixed channelize.
4. Set the spectrum analyzer span to view the entire emissions bandwidth.
5. Set RBW=1kHz
6. Set the VBW ≥ 3 x RBW.
7. Detector = peak.
8. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. The fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc*10^6 ppm and the limit is less than ±100ppm.
10. Extreme temperature rule is -20℃ ~ 50℃
11. Nominal voltage of battery: DC 3.7V
    End point voltage of battery: DC 3.33V, 4.07V

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Results

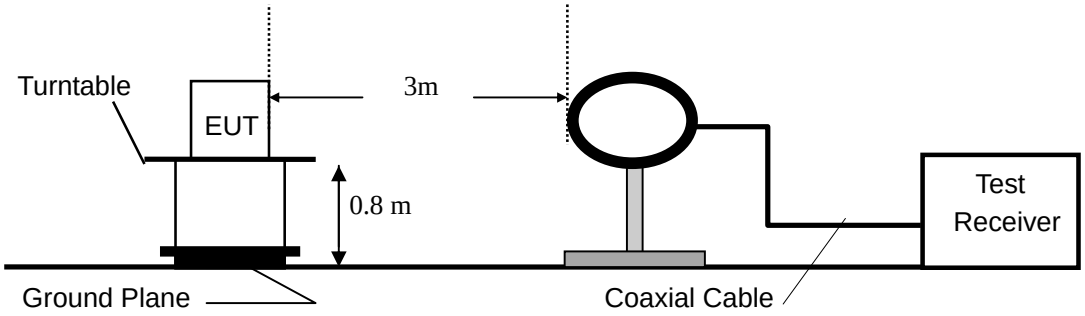
Please refer to following table and plots.

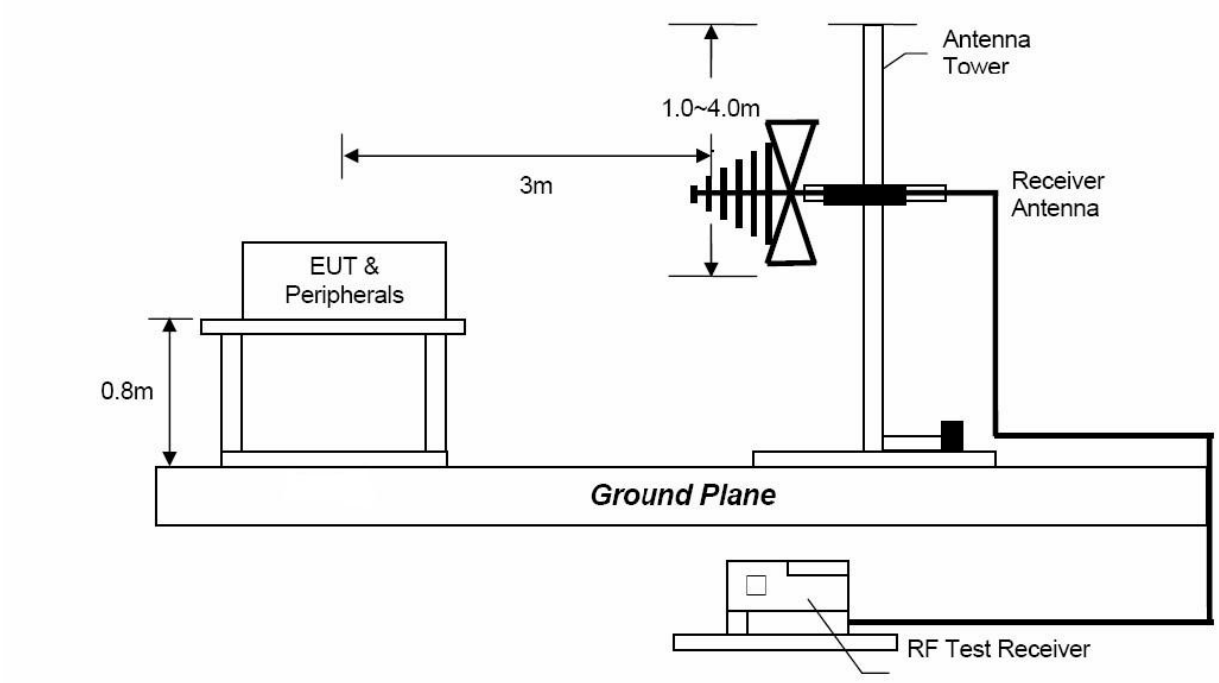
NFC				
Humidity :	49 %	Temperature :	21 ℃	
Mode:	TX	Test By:	Sance	
Test Result:	PASS			
Temperature (℃)	**Power Supplied (Vdc)**	**Frequency Error (MHz)**	**Frequency Error (ppm)**	**Limit (ppm)**
-20	3.70	0.00043	31.71	100
-10		0.00022	16.22	100
0		0.00012	8.85	100
10		-0.00019	-14.01	100
20		-0.00025	-18.44	100
30		-0.00021	-15.49	100
40		-0.00031	-22.86	100
50		-0.00042	-30.97	100
20	3.70	-0.00019	-14.01	100
	3.33	-0.00018	-13.27	100
	4.07	-0.00022	-16.22	100

6. Radiated Spurious Emissions and Mask

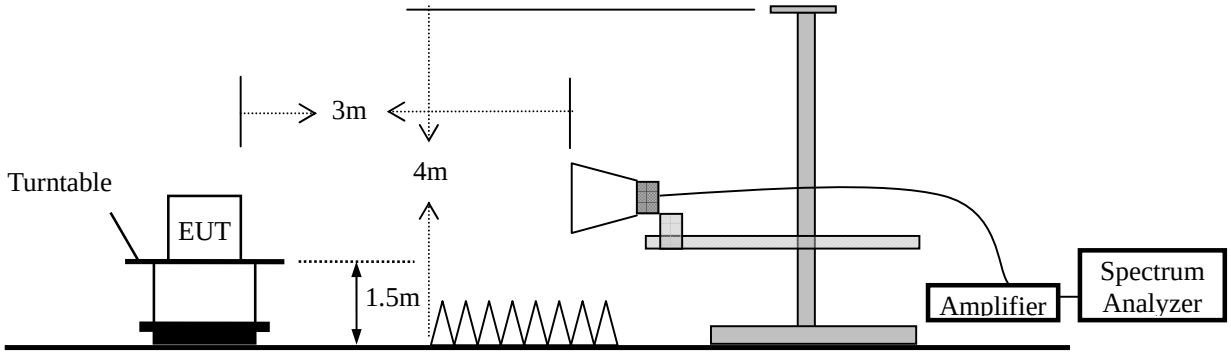
6.1 Test SET-UP (Block Diagram of Configuration)

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





6.1.2 Radiated Emission Test Set-Up, Frequency above 1GHz



6.2 Measurement Procedure

a. Blow 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi- anechoic chamber room.
b. For the radiated emission test above 1GHz:
The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
c. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
d. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
e. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to peak detect function and specified bandwidth with maximum hold mode.
f. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. PK and AV for above 1GHz emission test.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Detector	Resolution Bandwidth	Video Bandwidth
0.009~0.15	QP	200Hz	1KHz
0.15 ~ 30.0	QP	9 kHz	30 kHz
30.0 ~ 1000	QP	120 kHz	300 kHz

6.3 Limit

Rules and Specifications	FCC Rule 15.225(a)-(d)			
Description	Compliance with the spectrum mask is tested using a spectrum analyzer with RBW set to 9kHz for the band 13.553-13.567MHz			
Frequency range MHz	Field Strength (uV/m) at 30m	Field Strength (dBuV/m) at 30m	Field Strength (dBuV/m) at 10m	Field Strength (dBuV/m) at 3m
1.705 ~ 13.110	30	29.5	48.58	69.5
13.110 ~ 13.410	106	40.5	59.58	80.5
13.410 ~ 13.553	334	50.5	69.58	90.5
13.553 ~ 13.567	15848	84.0	103.08	124.0
13.567 ~ 13.710	334	50.5	69.58	90.5
13.710 ~ 14.010	106	40.5	59.58	80.5
14.010 ~ 30.000	30	29.5	48.58	69.5

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209) μV/m
0.009 ~ 0.490	300	2400/F(kHz)
0.490 ~ 1.705	30	24000/F(kHz)
1.705 ~ 30	30	30
30 ~ 88	3	100
88 ~ 216	3	150
216 ~ 960	3	200
Above 960	3	500

Remark：(1) Emission level (dB)μV = 20 log Emission level μV/m
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
(4) The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.
(5) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz, Radiated emission limits in these two bands are based on measurements employing an average detector.

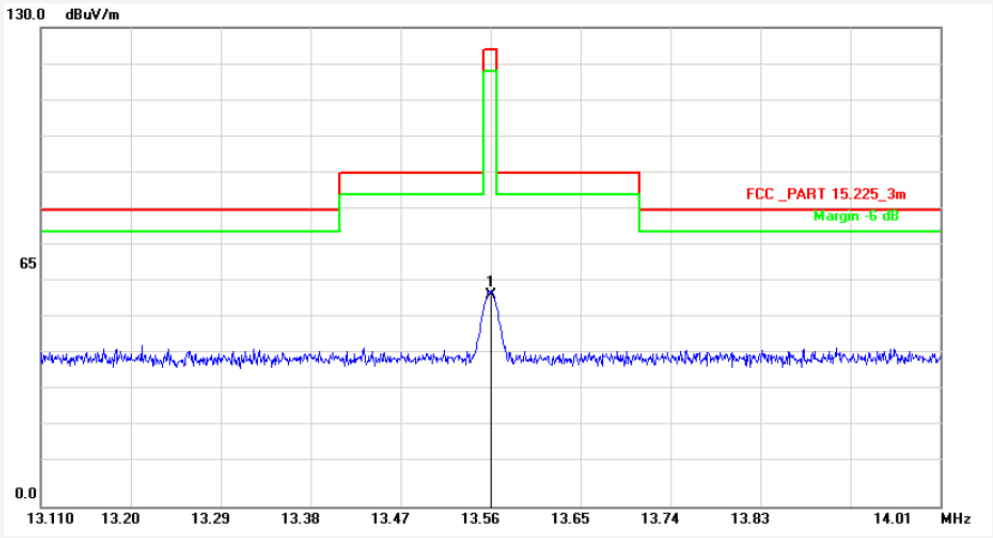
6.4 Measurement Results

Please refer to following plots of the plots.

Dongguan NTC Co., Ltd.
Tel:+86-769-22022444 Fax:+86-769-22022799
Web: Http://www.ntc-c.com

Site: Radiation

Test Time: 2016-6-12 12:50:29



Report No.:	**PIQ2**		
Test Standard:	**FCC _PART 15.225_3m**	**Test Distance:**	**3m**
Test item:	**Radiation Emission**	**Ant. Polarization:**	
Applicant:	**Octonion SA**	**Temp.(C)/Hum.(%):**	**22(C) / 54 %**
Product:	**PIQ1.1**	**Power Rating:**	**DC 3.7V**
Model No.:	**PIQ RED1.1**	**Test Engineer:**	**Ryan**

Test Mode: **TX(NFC)**

Remark:

No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	13.5600	23.09	34.12	57.21	124.00	-66.79	QP			P	

Note: Level=Reading+Factor.
Margin=Limit-Level.

Other emissions below 30MHz are lower than 20dB below the allowable limit.

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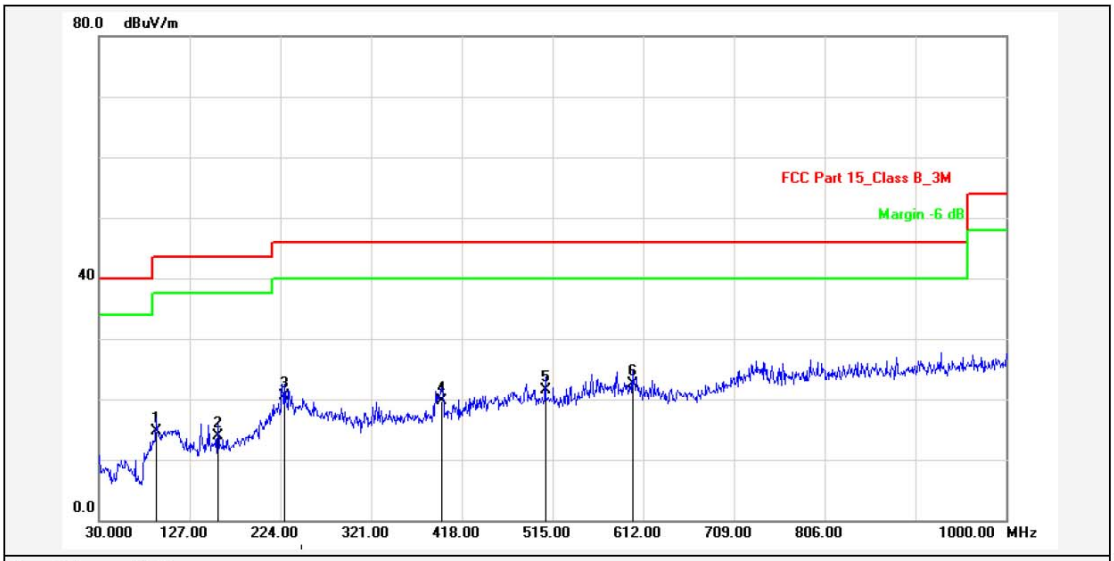
Web: Http://www.ntc-c.com

Site: Radiation

Test Time: 2016-6-13 10:54:41



Report No.:	**PIQ2**		
Test Standard:	**FCC Part 15_Class B_3M**	**Test Distance:**	**3m**
Test item:	**Radiation Emission**	**Ant. Polarization:**	**Horizontal**
Applicant:	**Octonion SA**	**Temp.(C)/Hum.(%):**	**22(C) / 54 %**
Product:	**PIQ1.1**	**Power Rating:**	**DC 3.7V**
Model No.:	**PIQ RED1.1**	**Test Engineer:**	**Ryan**
Test Mode:	**TX(NFC)**		
Remark:			

No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	91.1100	-13.66	28.46	14.80	43.50	-28.70	QP			P	
2	157.0700	-15.27	29.17	13.90	43.50	-29.60	QP			P	
3	228.8500	-12.52	33.02	20.50	46.00	-25.50	QP			P	
4	396.6600	-9.13	28.93	19.80	46.00	-26.20	QP			P	
5	507.2400	-6.74	28.34	21.60	46.00	-24.40	QP			P	
6	600.3600	-5.00	27.60	22.60	46.00	-23.40	QP			P	

Note: Level=Reading+Factor.
Margin=Limit-Level.

Note: Measurement uncertainty : ±3.7dB

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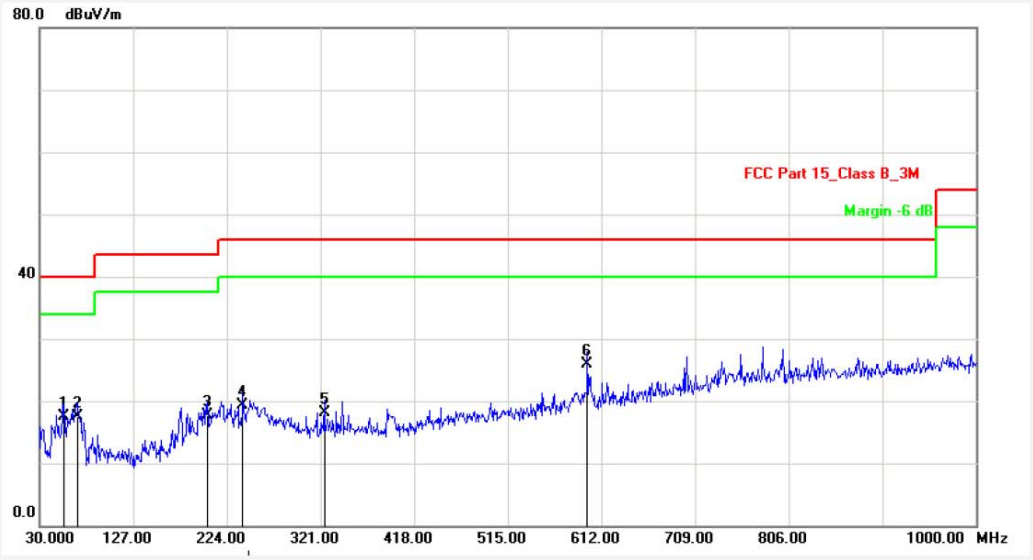
Site: Radiation

Test Time: 2016-6-13 11:01:19



Report No.:	PIQ2		
Test Standard:	FCC Part 15_Class B_3M	Test Distance:	3m
Test item:	Radiation Emission	Ant. Polarization:	Vertical
Applicant:	Octonion SA	Temp.(C)/Hum.(%):	22(C) / 54 %
Product:	PIQ1.1	Power Rating:	DC 3.7V
Model No.:	PIQ RED1.1	Test Engineer:	Ryan
Test Mode:	TX(NFC)		
Remark:			

No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg.)	P/F	Remark
1	55.2200	-13.72	31.22	17.50	40.00	-22.50	QP			P	
2	68.8000	-16.95	34.55	17.60	40.00	-22.40	QP			P	
3	203.6300	-16.37	34.17	17.80	43.50	-25.70	QP			P	
4	240.4900	-14.96	34.36	19.40	46.00	-26.60	QP			P	
5	324.8800	-11.78	29.98	18.20	46.00	-27.80	QP			P	
6	597.4500	-7.07	32.97	25.90	46.00	-20.10	QP			P	

Note: Level=Reading+Factor.

Margin=Limit-Level.

Note: Measurement uncertainty : ±3.7dB

7. Antenna Application

7.1 Antenna requirement

According to of FCC part 15C section 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.2 Measurement Results

The antenna is PCBA antenna and it consist of antenna connector and PCB. The antenna connector using a special construction and size, and it no consideration of replacement, therefore, the antenna is consider meet the requirement.

8. Test Equipment List

Description	Manufacturer	Model Number	Serial Number	Characteristics	Calibration Date	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESCI7	100837	9KHz~7GHz	Nov. 23, 2015	Nov. 22, 2016
Antenna	Schwarzbeck	VULB9162	9162-010	30MHz~7GHz	Nov. 26, 2015	Nov. 25, 2016
Positioning Controller	UC	UC 3000	N/A	0~360°, 1-4m	N/A	N/A
Color Monitor	SUNSPO	SP-140A	N/A	N/A	N/A	N/A
Single Phase Power Line Filter	SAEMC	PF201A-32	110210	32A	N/A	N/A
3 Phase Power Line Filter	SAEMC	PF401A-200	110318	200A	N/A	N/A
DC Power Filter	SAEMC	PF301A-200	110245	200A	N/A	N/A
Cable	Huber+Suhner	CBL2-NN-1M	22390001	9KHz~7GHz	Nov. 07, 2015	Nov. 06, 2016
Cable	Huber+Suhner	CIL02	N/A	9KHz~7GHz	Nov. 07, 2015	Nov. 06, 2016
RF Cable	Huber+Suhner	SF-104	MY16559/4	9KHz~25GHz	Mar. 06, 2016	Mar. 05, 2017
Power Amplifier	HP	HP 8447D	1145A00203	100KHz~1.3GHz	Nov. 07, 2015	Nov. 06, 2016
Loop antenna	Daze	ZA30900A	0708	9KHz~30MHz	Oct.10, 2015	Oct.09, 2016
L.I.S.N.	Rohde & Schwarz	ENV 216	101317	9KHz~30MHz	Nov. 07, 2015	Nov. 06, 2016
Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/029	20Hz~26.5GHz	Sep. 01, 2015	Aug. 31, 2016
Temporary antenna connector	TESCOM	SS402	N/A	9KHz-25GHz	N/A	N/A
DC Source	HUAYI	HY5003-2	N/A	0~36V	Dec. 24, 2015	Dec. 23, 2016
Temperature & Humidity Chamber	BELL	BE-TH-408	N/A	-30~85℃	Dec. 24, 2015	Dec. 23, 2016

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

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