Test Report (NFC)

Applicant:	FCC: NAYAX LTD IC: NAYAX
Address of Applicant:	FCC: 18 Raoul Wallenberg St. building D 2 floor, Tel Aviv 6971915, Israel IC: 4 Hanechoshet st. TLV 69710 Israel
Manufacturer:	FCC: NAYAX LTD IC: NAYAX
Address of Manufacturer:	FCC: 18 Raoul Wallenberg St. building D 2 floor, Tel Aviv 6971915, Israel IC: 4 Hanechoshet st. TLV 69710 Israel

Equipment Under Test (EUT)

Product Name:	Innovative card reader & telemetry device Featuring NFC payments & QR codes
Model No.:	Onyx, Onyx+
Trade Mark:	Onyx, Onyx+
FCC ID:	2AK6L-ONYX
IC:	10840A-ONYX
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.225 RSS-Gen Issue 5: March 2019 RSS-210 Issue 9: August 2016
Date of sample receipt:	July 11, 2019
Date of Test:	July 12, 2019-September 03, 2019
Date of report issued:	September 04, 2019
Test Result :	PASS

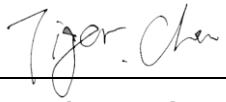
Authorized Signature:

Robinson Lo
Laboratory Manager

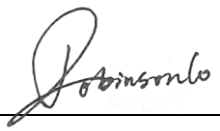
Testing Cert #381383

2 Version

Version No.	Date	Description
00	*September 04, 2019*	*Original*

Prepared By:  ***Date:*** *September 04, 2019*

Project Engineer

Check By:  ***Date:*** *September 04, 2019*

Reviewer

3 Contents

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203	Pass
AC Power Line Conducted Emission	15.207	Pass
Field Strength of Fundamental Emissions and Mask Measurement	15.225(a)(b)(c)	Pass
Radiated Emission	15.225(d)&15.209	Pass
20dB Emission Bandwidth	15.225&15.215	Pass
Frequency Stability Measurement	15.225(e)	Pass

Test Item	Section	Result
Antenna requirement	RSS-Gen 6.8	Pass
AC Power Line Conducted Emission	RSS-Gen 8.8	Pass
Field strength of the fundamental signal	RSS-210 B.6	Pass
Spurious emissions	RSS-210 B.6& RSS-Gen Clause 8.9&8.10	Pass
Band edge	RSS-210 B.6 & RSS-Gen Clause 8.9&8.10	Pass
99% Occupied Bandwidth	RSS-Gen 6.7	Pass
Frequency Stability Measurement	RSS-210 B.6	Pass

Remark:

1. Pass: The EUT complies with the essential requirements in the standard.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	±3.8039dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 3.9679dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.29dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.44dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 General Description of EUT

Product Name:	Innovative card reader & telemetry device Featuring NFC payments & QR codes
Model No.:	Onyx, Onyx+
Test Model No:	Onyx+
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are color and model name for commercial purpose.	
Serial No.:	0611112318000563
Hardware Version:	N/A
Software Version:	N/A
Sample(s) Status	Engineered sample
Operation Frequency:	13.56MHz
Channel Number:	1
Modulation:	ASK
Antenna type:	Integral antenna
Antenna gain:	0dBi(declare by applicant)
Power supply:	AC ADAPTER MODEL: RS-025/24-S335 INPUT: AC 100-240V, 50/60Hz, 1.2A MAX OUTPUT: DC 24V, 2.5A

5.2 Test mode

Transmitter mode	Keep the EUT in continuously transmitting.

Pre-test mode.

GTS has verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	58.44	58.50	57.81

Final Test Mode:

According to ANSI C63.4 standards, the test results are both the “worst case” and “worst setup”: Y axis (see the test setup photo)

5.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

● **FCC —Registration No.: 381383**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 381383, January 08, 2018.

● **NVLAP (LAB CODE:600179-0)**

Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

● **IC —Registration No.: 9079A**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. Has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A

5.4 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102
Tel: 0755-27798480
Fax: 0755-27798960

5.5 Description of Support Units

None.

6 Test Instruments list

Radiated Emission:

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 26 2019	June. 25 2020
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 26 2019	June. 25 2020
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 26 2019	June. 25 2020
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 26 2019	June. 25 2020
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 26 2019	June. 25 2020
9	Coaxial Cable	GTS	N/A	GTS211	June. 26 2019	June. 25 2020
10	Coaxial cable	GTS	N/A	GTS210	June. 26 2019	June. 25 2020
11	Coaxial Cable	GTS	N/A	GTS212	June. 26 2019	June. 25 2020
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 26 2019	June. 25 2020
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 26 2019	June. 25 2020
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 26 2019	June. 25 2020
15	Band filter	Amindeon	82346	GTS219	June. 26 2019	June. 25 2020
16	Power Meter	Anritsu	ML2495A	GTS540	June. 26 2019	June. 25 2020
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 26 2019	June. 25 2020
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 26 2019	June. 25 2020
19	Splitter	Agilent	11636B	GTS237	June. 26 2019	June. 25 2020
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 26 2019	June. 25 2020
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 20 2018	Oct. 19 2019
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 20 2018	Oct. 19 2019
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 20 2018	Oct. 19 2019
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 26 2019	June. 25 2020

Conducted Emission						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 26 2019	June. 25 2020
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 26 2019	June. 25 2020
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 26 2019	June. 25 2020
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 26 2019	June. 25 2020
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 26 2019	June. 25 2020

General used equipment:						
Item	**Test Equipment**	**Manufacturer**	**Model No.**	**Inventory No.**	**Cal.Date (mm-dd-yy)**	**Cal.Due date (mm-dd-yy)**
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 26 2019	June. 25 2020
2	Barometer	ChangChun	DYM3	GTS255	June. 26 2019	June. 25 2020

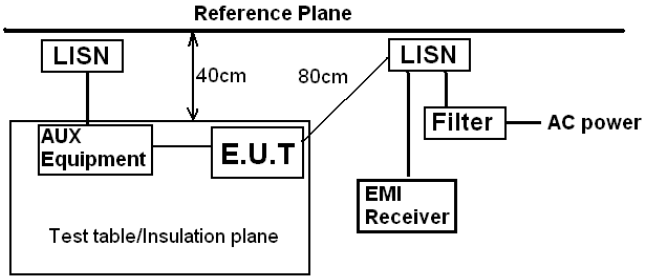
7 Test results and Measurement Data

7.1 Antenna requirement:

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: 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.	
E.U.T Antenna:	
The NFC antenna is integral antenna; the best case gain of the antenna is 0dBi. reference to the appendix II for details	

Standard requirement:	RSS-Gen Section 6.8
A transmitter can only be sold or operated with antennas with which it was approved. When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. For transmitters of RF output power of 10 milliwatts or less, only the portion of the antenna gain that is in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power to demonstrate compliance with the radiated power limits specified in the applicable standard. For transmitters of output power greater than 10 milliwatts, the total antenna gain shall be added to the measured RF output power to demonstrate compliance to the specified radiated power	
EUT Antenna:	
The NFC antenna is integral antenna; the best case gain of the antenna is 0dBi. reference to the appendix II for details	

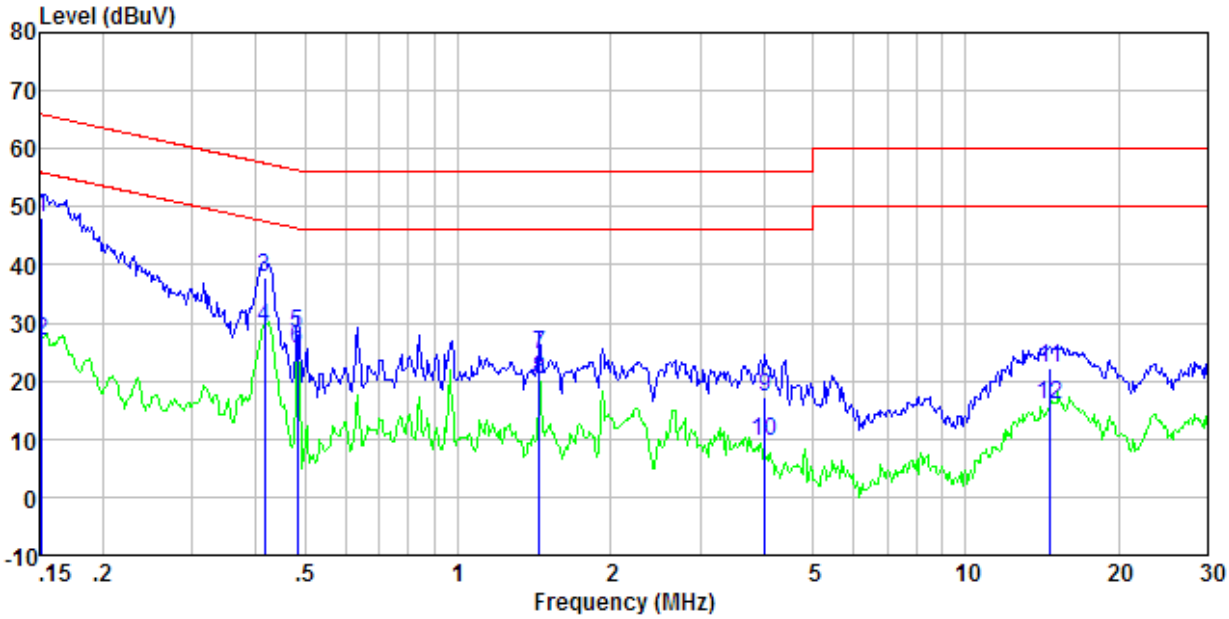
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207 RSS-Gen Section 8.8
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Class / Severity:	Class B
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto
Limit:	Frequency range (MHz) / Limit (dBuV): Quasi-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.
Test setup:	 *Remark:* *E.U.T: Equipment Under Test* *LISN: Line Impedence Stabilization Network* *Test table height=0.8m*
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test voltage:	AC120V 60Hz
Test results:	Pass

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

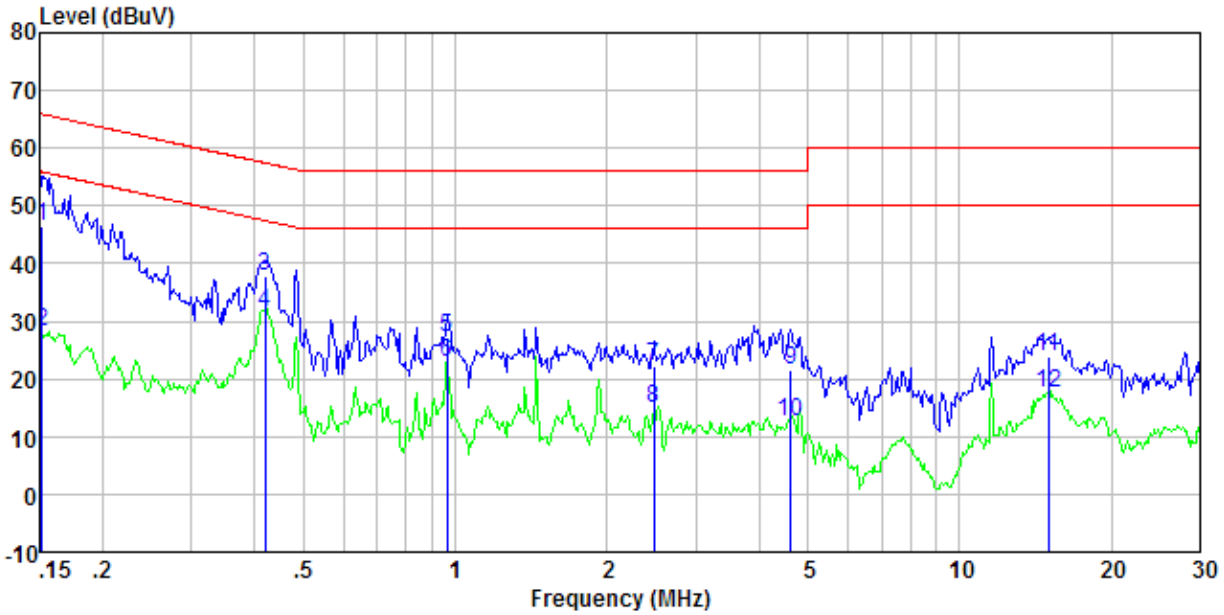
Measurement data:

Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.15	47.69	0.40	0.07	48.16	65.91	-17.75	QP
0.15	26.46	0.40	0.07	26.93	55.91	-28.98	Average
0.42	37.41	0.34	0.11	37.86	57.51	-19.65	QP
0.42	28.89	0.34	0.11	29.34	47.51	-18.17	Average
0.48	27.81	0.32	0.11	28.24	56.27	-28.03	QP
0.48	25.13	0.32	0.11	25.56	46.27	-20.71	Average
1.45	24.07	0.20	0.16	24.43	56.00	-31.57	QP
1.45	19.88	0.20	0.16	20.24	46.00	-25.76	Average
4.03	17.00	0.20	0.18	17.38	56.00	-38.62	QP
4.03	9.08	0.20	0.18	9.46	46.00	-36.54	Average
14.67	21.86	0.20	0.21	22.27	60.00	-37.73	QP
14.67	15.58	0.20	0.21	15.99	50.00	-34.01	Average

Neutral:

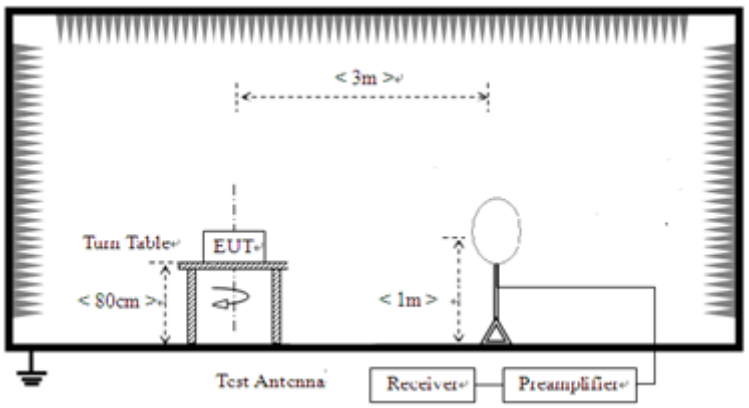


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.15	46.00	0.40	0.07	46.47	65.91	-19.44	QP
0.15	27.78	0.40	0.07	28.25	55.91	-27.66	Average
0.42	37.48	0.34	0.11	37.93	57.46	-19.53	QP
0.42	30.91	0.34	0.11	31.36	47.46	-16.10	Average
0.96	26.87	0.21	0.15	27.23	56.00	-28.77	QP
0.96	22.58	0.21	0.15	22.94	46.00	-23.06	Average
2.47	21.74	0.20	0.18	22.12	56.00	-33.88	QP
2.47	14.53	0.20	0.18	14.91	46.00	-31.09	Average
4.62	21.17	0.20	0.17	21.54	56.00	-34.46	QP
4.62	12.07	0.20	0.17	12.44	46.00	-33.56	Average
14.99	23.38	0.20	0.21	23.79	60.00	-36.21	QP
14.99	17.04	0.20	0.21	17.45	50.00	-32.55	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

7.3 Field Strength of Fundamental Emissions and Mask Measurement

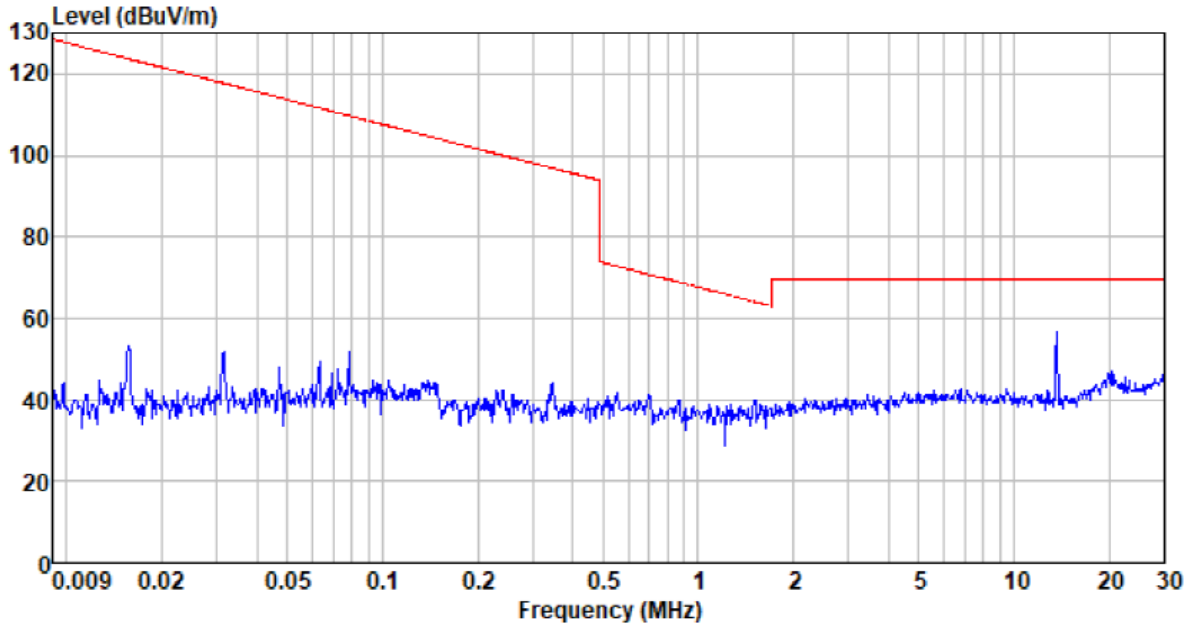
Test Requirement:	FCC Part15 C Section 15.225(a)(b)(c) RSS-210 b.6& RSS-Gen 8.9& RSS-Gen 8.10
Test Method:	ANSI C63.10:2013 & ANSI C63.4: 2014 &RSS-Gen
Test site:	Measurement Distance: 3m
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=Auto
limit:	FCC Part 15.225 & 15.209 RSS-210, Annex B.6 RSS-Gen, Section 8.9
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

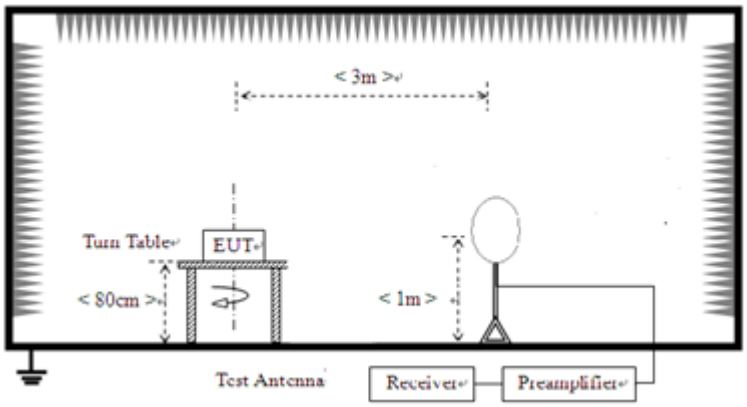
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Remark
13.56	33.29	24.70	0.51	58.50	64	-5.5	QP

Test plot as follows:

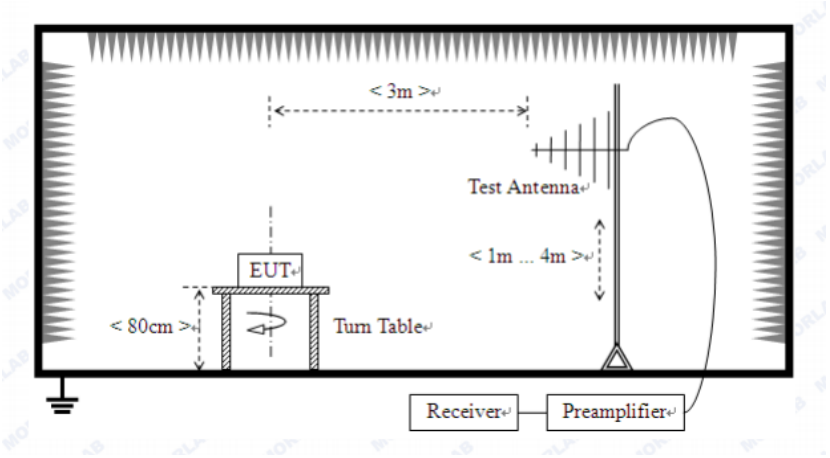
Test data combines x, y, z-axis



7.4 Radiated Emission

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.225(d) and 15.209
RSS-210 B.6& RSS-Gen 8.9& RSS-Gen 8.10</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013 & ANSI C63.4: 2014 &RSS-Gen</td></tr>
<tr><td>Test Frequency Range:</td><td>9KHz to 1000MHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Remark</th></tr>
<tr><td>9kHz-150kHz</td><td>Quasi-peak</td><td>200Hz</td><td>300Hz</td><td>Quasi-peak Value</td></tr>
<tr><td>150kHz-30MHz</td><td>Quasi-peak</td><td>9kHz</td><td>10kHz</td><td>Quasi-peak Value</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120KHz</td><td>300KHz</td><td>Quasi-peak Value</td></tr>
</table>
</td></tr>
<tr><td>Limit:</td><td>All out of band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.
<table>
<tr><th>Frequency (MHz)</th><th>Field strength (micorvolts/meter)</th><th>Measurement distance (meters)</th></tr>
<tr><td>0.009~0.490</td><td>2400/F(KHz)</td><td>300</td></tr>
<tr><td>0.490~1.705</td><td>24000/F(KHz)</td><td>30</td></tr>
<tr><td>1.705~30</td><td>30</td><td>30</td></tr>
<tr><td>30~88</td><td>100</td><td>3</td></tr>
<tr><td>88~216</td><td>150</td><td>3</td></tr>
<tr><td>216~960</td><td>200</td><td>3</td></tr>
<tr><td>960~1000</td><td>500</td><td>3</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>Below 30MHz
 

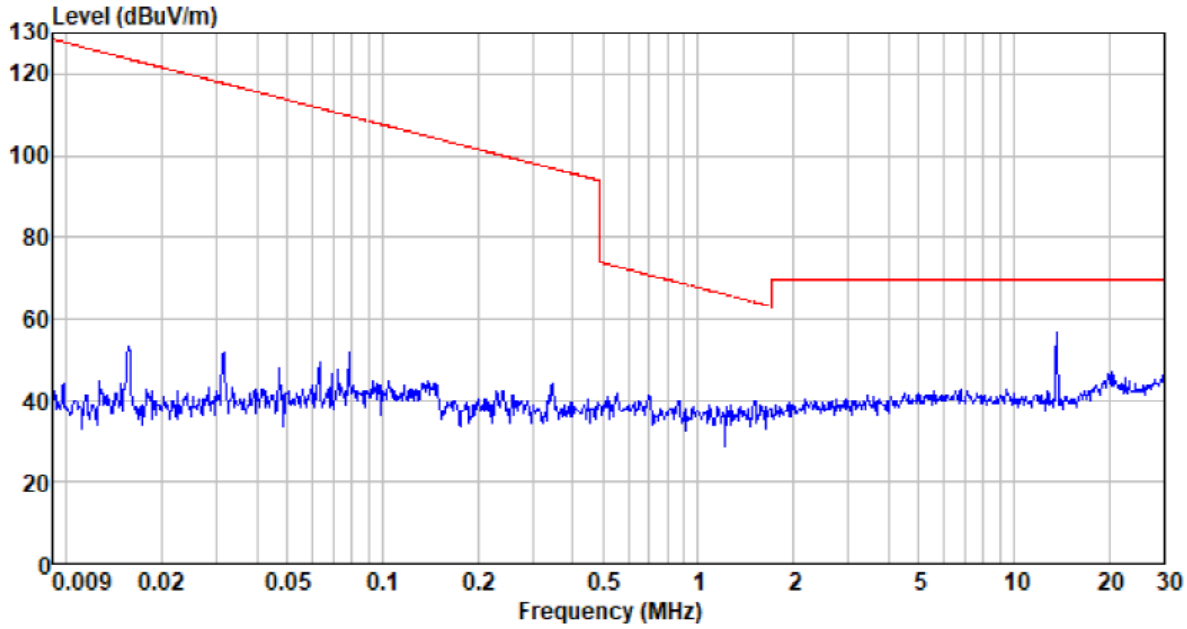
Above 30MHz</td></tr>
</table>

	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

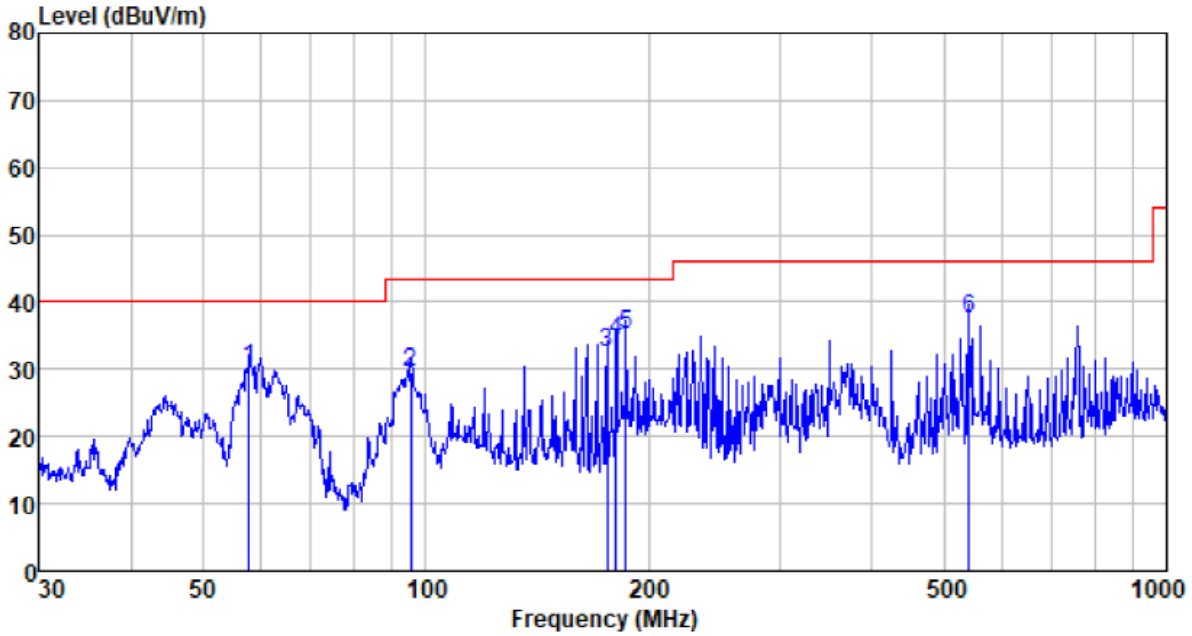
■ **9kHz~30MHz**

Test data combines x, y, z-axis; the radiation emission more than 20dB below the limit



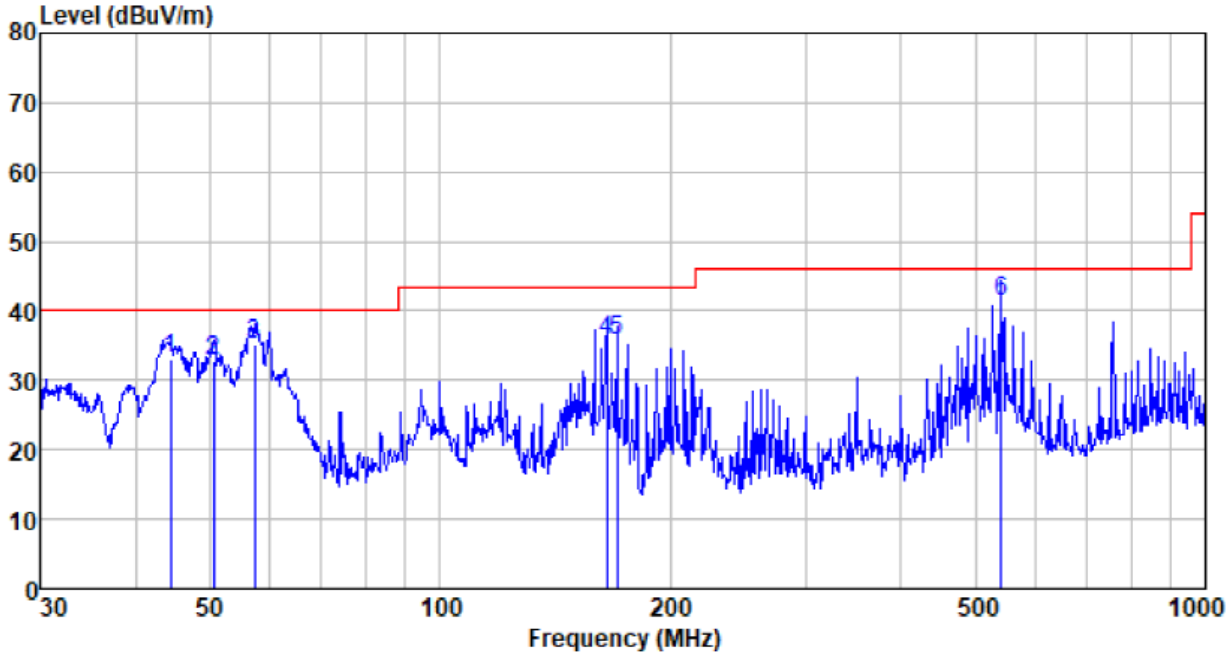
■ **30MHz~1GHz**

Horizontal:



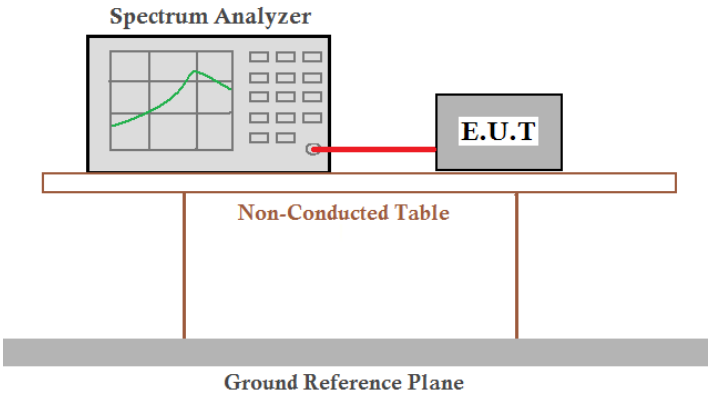
Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
57.796	53.95	11.58	0.84	36.29	30.08	40.00	-9.92	QP
95.427	53.23	11.86	1.16	36.68	29.57	43.50	-13.93	QP
175.652	59.01	8.88	1.72	37.22	32.39	43.50	-11.11	QP
180.649	60.28	9.34	1.74	37.24	34.12	43.50	-9.38	QP
186.441	60.69	9.86	1.77	37.27	35.05	43.50	-8.45	QP
541.373	53.70	17.88	3.49	37.52	37.55	46.00	-8.45	QP

Vertical:



Freq	Reading level	Antenna factor	Cable loss	Preamp factor	level	Limit level	Over limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV	dBuV/m	dB	
44.431	55.92	12.30	0.71	35.91	33.02	40.00	-6.98	QP
50.586	56.08	11.97	0.78	36.19	32.64	40.00	-7.36	QP
57.191	58.97	11.62	0.84	36.28	35.15	40.00	-4.85	QP
164.908	62.94	8.23	1.66	37.16	35.67	43.50	-7.83	QP
170.195	62.86	8.44	1.69	37.19	35.80	43.50	-7.70	QP
541.373	57.56	17.88	3.49	37.52	41.41	46.00	-4.59	QP

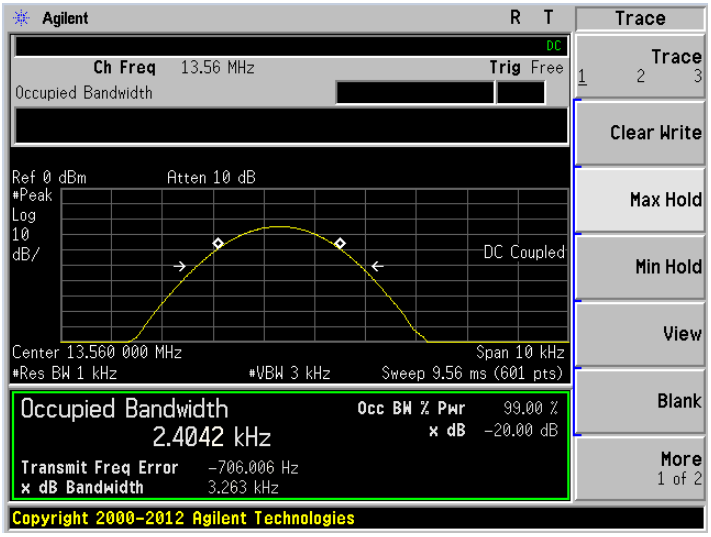
7.5 Occupied Bandwidth

Test Requirement:	FCC Part15 C Section 15.225 and 15.215 RSS-Gen 6.7
Test Method:	ANSI C63.10:2013 & RSS-Gen
Limit:	N/A
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Max hold the radiated emissions, mark the peak power frequency point and the -20dB upper and lower frequency points. 4. Read 20dB bandwidth & 99%bandwidth.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

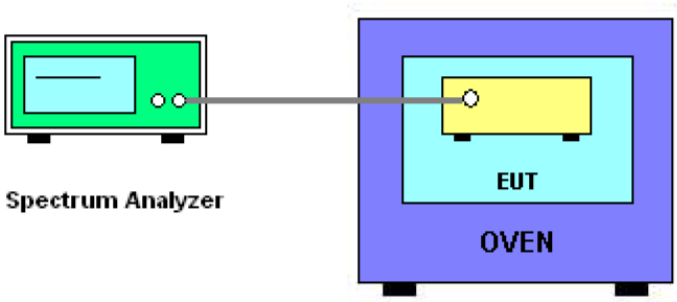
Measurement Data

Test frequency(MHz)	20dB bandwidth(KHz)	99% bandwidth(KHz)	Result
13.56	3.263	2.4042	Pass

Test plot as follows:



7.6 Frequency Stability Measurement

Test Requirement:	FCC Part15 C Section 15.225 (e) RSS-210, B.6
Test Method:	ANSI C63.10: 2013
Receiver setup:	RBW=1KHz, VBW=1KHz, Sweep time=Auto
Limit:	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, 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.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

Reference Frequency: 13.56MHz					
Power supplied (Vac)	Temperature (℃)	Frequency error		Limit	Result
		Hz	%		
120	-20	82	0.00060	+/- 0.01%	Pass
	-10	75	0.00055		
	0	87	0.00064		
	10	89	0.00066		
	20	81	0.00060		
	30	73	0.00054		
	40	87	0.00058		
	50	75	0.00056		

Reference Frequency: 13.56MHz					
Temperature (℃)	Power supplied (Vac)	Frequency error		Limit	Result
		Hz	%		
20	102	81	0.00060	+/- 0.01%	Pass
	120	89	0.00066		
	138	81	0.00060		

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

------ End ------