

RADIO TEST REPORT

The device described below is tested by Dongguan Nore Testing Center Co., Ltd. to determine the maximum emission levels emanating from the device, the severe levels which the device can endure and E.U.T.'s performance criterion. The test results, data evaluation, test procedures, and equipment of configurations shown in this report were made in accordance with the procedures in ANSI C63.10(2013).

Applicant / Manufacturer : Thinker-Tinker, Inc.

Address : 177 E Colorado Blvd, suite 200, Pasadena, CA 91105, USA

Factory : Thinker-Tinker, Inc.

Address : 177 E Colorado Blvd, suite 200, Pasadena, CA 91105, USA

E.U.T. : OCTOBO

Brand Name : Holiot

Model No. : OCTO-001

FCC ID : 2AT7R2019OCTO1

Measurement Standard : FCC PART 15.225

Date of Receiver : August 14, 2019

Date of Test : August 14, 2019 to August 30, 2019

Date of Report : August 30, 2019

This Test Report is Issued Under the Authority of :

Prepared by



Rose Hu / Engineer

Approved, Authorized Signer



Iori Fan / Authorized Signatory

This test report is for the customer shown above and their specific product only. This report applies to above tested sample only and shall not be reproduced in part without written approval of Dongguan Nore Testing Center Co., Ltd.

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Revision History of This Test Report

1. GENERAL INFORMATION

1.1 Product Description for Equipment under Test

Product Name : OCTOBO
Main model number : OCTO-001
Additional Model number : N/A
Brand Name : Holyiot
Power Supply : DC 6.0V (come from 4* DC 1.5V AA battery)
Adapter : N/A
Power Supply : DC 6.0V (come from 4* DC 1.5V AA battery)
Model difference : N/A
Hardware version : V1.0
Software version : V1.0
Serial number : N/A

Technical parameters

NFC Operation Frequency : 13.56MHz
Modulation : ASK
Number of Channel : 1
Antenna Type : Loop antenna

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: **2AT7R2019OCT01** filing to comply with Section 15.247 of the FCC Part 15(2017), Subpart C Rule.

1.3 Test Methodology

The radiated emission measurement was performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in semi-anechoic chamber. 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

None

1.6 Test Facility and Location

Listed by CNAS, August 14, 2018

The certificate is valid until August 13, 2024

The Laboratory has been assessed and proved to be in compliance with
CNAS/CL01

The Certificate Registration Number is L5795.

Listed by A2LA, November 01, 2017

The certificate is valid until December 31, 2019

The Laboratory has been assessed and proved to be in compliance with ISO17025

The Certificate Registration Number is 4429.01

Listed by FCC, November 06, 2017

The Designation Number is CN1214

Test Firm Registration Number: 907417

Listed by Industry Canada, June 08, 2017

The Certificate Registration Number. Is 46405-9743

Dongguan NTC Co., Ltd.

(Full Name: Dongguan Nore Testing Center Co., Ltd.)

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Nancheng District, Dongguan City, Guangdong, China

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Zhouxi Longxi Road, Nancheng District, Dongguan, Guangdong, China.

1.7 Summary of Test Results

FCC Rules	Description Of Test	Uncertainty	Result
§15.207 (a)	AC Power Conducted Emission	N/A	N/A
§15.225(a)(b)(c)	Emission Mask	±1.06dB	Compliance
§15.215	20dB Bandwidth	±1.42 x10 ⁻⁴ %	Compliance
§15.225(e)	Frequency tolerance	±1.06dB	Compliance
§15.247(d)	Band Edge and Conducted Spurious Emissions	±1.70dB & ±2.51dB	Compliance
§15.225(d),§15.209	Radiated Spurious Emissions	±3.70dB	Compliance
§15.203	Antenna Requirement	-----	Compliance

Note: Due to this EUT is powered by button battery only, so the AC Power Conducted Emission is not applicable.

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

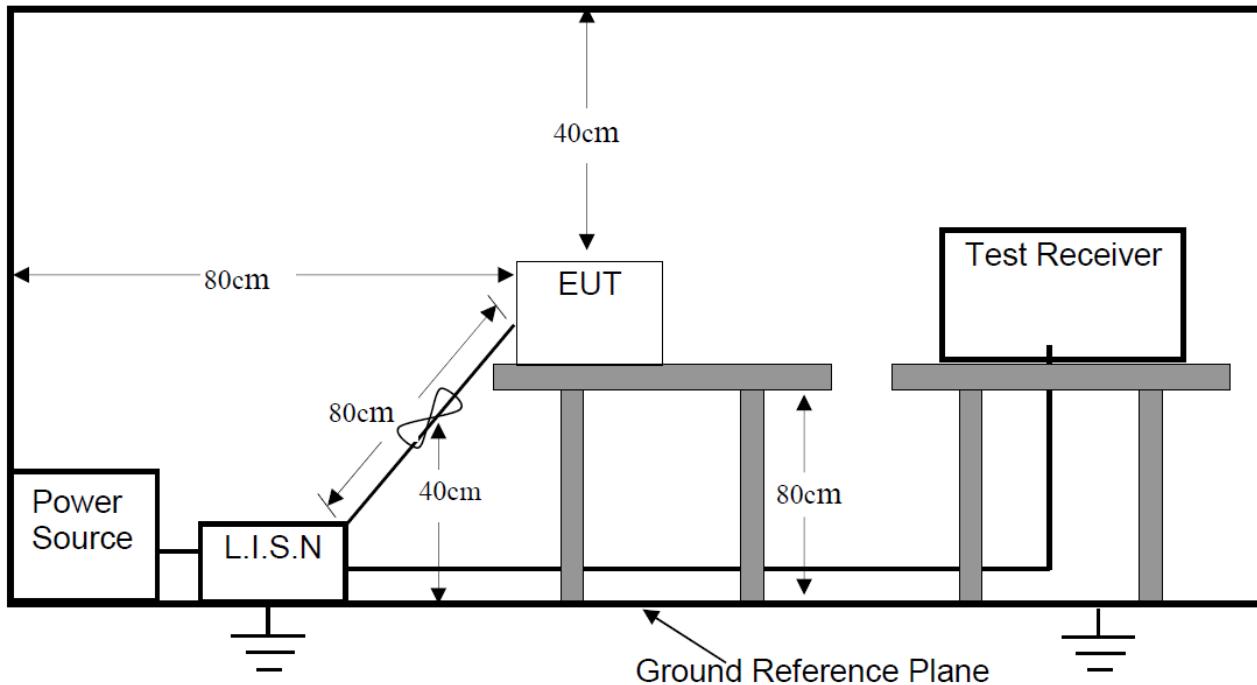
The EUT has been tested under continuous operating condition.

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: TX

3.3 Measurement Results

Not Applicable.

4. Frequency Tolerance

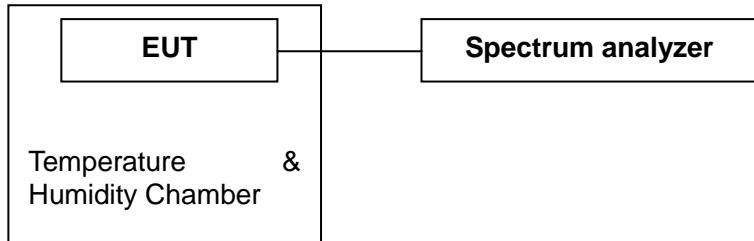
4.1 Measurement Procedure

Maximum Conducted Output power at Antenna Terminals, FCC Rules 15.225:

Limit:

- (a) The field strength of any emissions within the band 13.553-13.567MHz shall not exceed 15.848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410-13.553MHz and 13.567-13.710MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110-13.410MHz and 13.710-14.010MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110-14.010MHz band shall not exceed the general radiated emission limits in section 15.209.

4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Results

Please refer to following table.

Modulation:	GFSK	Humidity :	50 %
Temperature :	24 °C	Test Date :	August 26, 2019
Test By:	Sance		
Test Result:	PASS		

Test conditions		Test result MHz	Deviation KHz	Limit KHz	Result
Temp (°C)	Volt (V AC)				
-20	120	13.56008	0.08	$\pm 0.01\%$ (1.3560KHz)	PASS
-10	120	13.56007	0.07		PASS
0	120	13.56008	0.08		PASS
10	120	13.56008	0.08		PASS
20	120	13.56009	0.09		PASS
30	120	13.56007	0.07		PASS
40	120	13.56008	0.08		PASS
50	120	13.56009	0.09		PASS
20	102	13.56010	0.10		PASS
	138	13.56008	0.08		PASS

Note: Deviation (KHz)=(Test result-13.56MHz)*1000

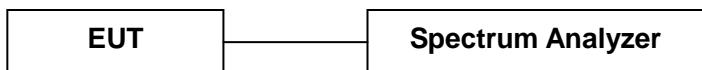
5. 20dB Bandwidth

5.1 Measurement Procedure

20dB Bandwidth, FCC Rule 15.215:

The antenna port of the EUT was connected to the input of a spectrum analyzer.

5.2 Test SET-UP (Block Diagram of Configuration)



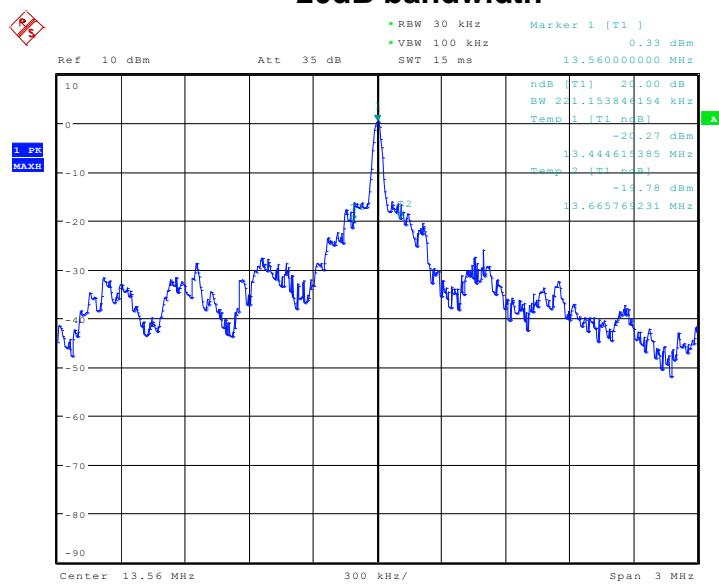
5.3 Measurement Results

Please refer to following table and plots.

Modulation:	GFSK	Humidity :	50 %
Temperature :	24 °C	Test Date :	August 29, 2019
Test By:	Sance		
Test Result:	PASS		

Frequency MHz	20dB Bandwidth KHz
13.56	221

20dB bandwidth

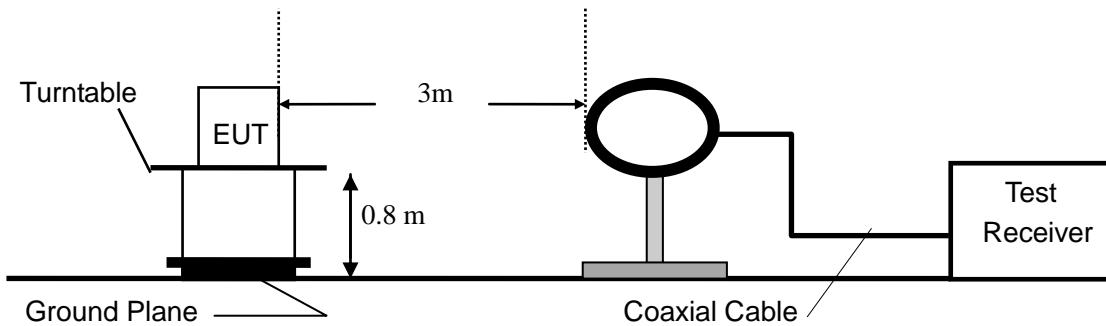


Date: 29.AUG.2019 16:20:41

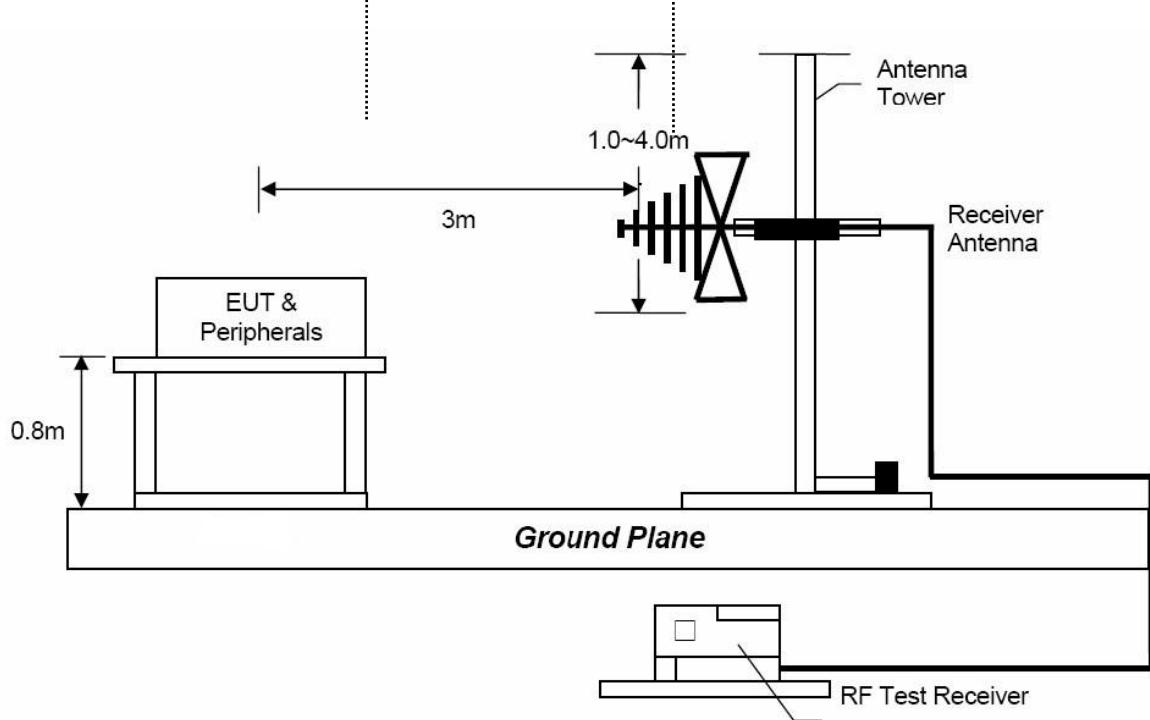
6. Radiated Spurious Emissions and Restricted Bands

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 30MHz-1000MHz



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. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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.
- e. A Quasi-peak measurement was then made for that frequency point for below 1GHz test. During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Band (MHz)	Level	Resolution Bandwidth	Video Bandwidth
30 to 1000	QP	120 kHz	300 kHz

6.3 Limit

Frequency range MHz	Distance Meters	Field Strengths Limit (15.209)
		μ V/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

- Remark: (1) Emission level (dB) μ V = 20 log Emission level μ V/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) §15.247(d) specifies that emissions which fall in the restricted bands, as defined in §15.205 comply with radiated emission limits specified in §15.209.

6.4 Measurement Results

Please refer to following plots.



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Radiated Emission Measurement

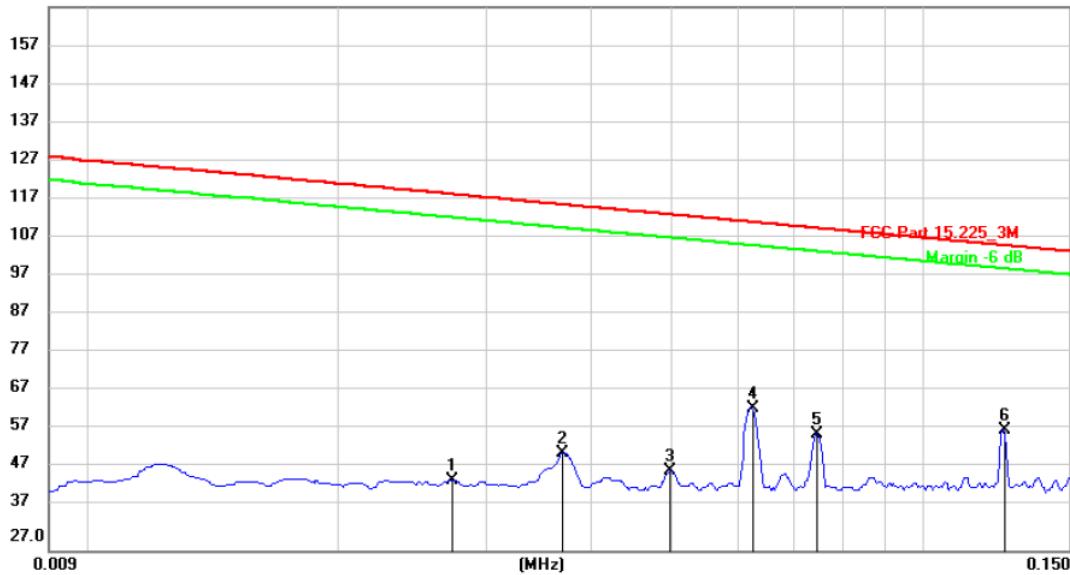
File : M1

Data : #10

Date: 2019/8/20

Time: 9:18:24

167.0 dBuV/m



Site: 3m Chamber

Polarization: **Horizontal**

Temperature: 26

Limit: FCC Part 15.225_3M

Power: DC6V

Humidity: 60 %

EUT: OCTOBO

Distance:

M/N: OCTO-001

Mode: NFC

Note:

No. Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height	Table Degree	Comment
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree
1	0.0273	12.83	32.26	45.09	118.74	-73.65	QP		
2	0.0371	19.87	32.32	52.19	116.09	-63.90	QP		
3	0.0498	15.13	32.36	47.49	113.55	-66.06	QP		
4	0.0626	31.34	32.30	63.64	111.57	-47.93	QP		
5	0.0747	24.55	32.30	56.85	110.05	-53.20	QP		
6 *	0.1250	25.83	32.30	58.13	105.60	-47.47	QP		



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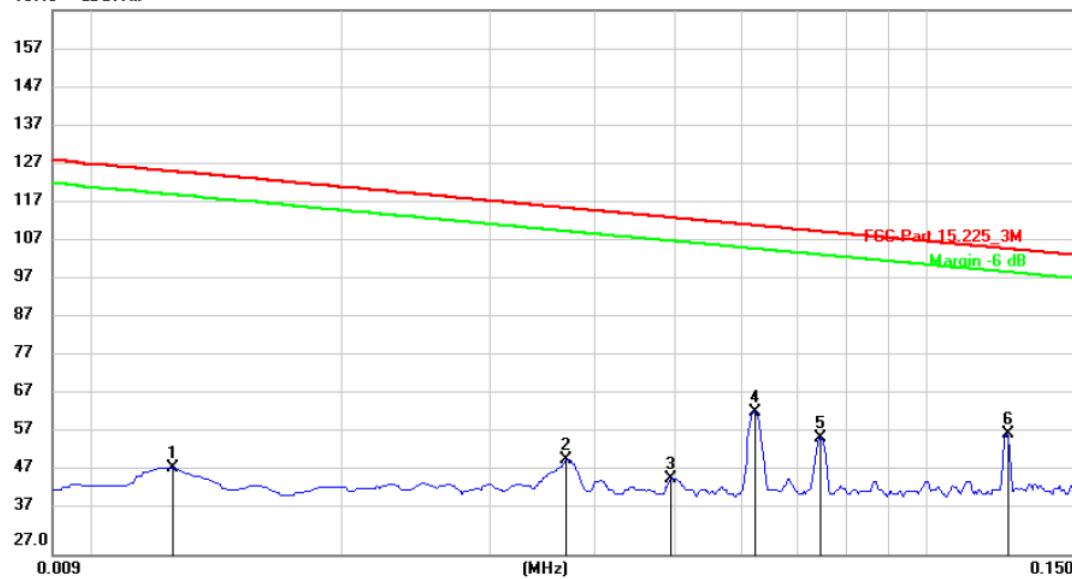
Radiated Emission Measurement

File :M1
167.0 dBuV/m

Data :#9

Date: 2019/8/20

Time: 9:10:19



Site: 3m Chamber

Polarization: **Vertical**

Temperature: 26

Limit: FCC Part 15.225_3M

Power: DC6V

Humidity: 60 %

EUT: OCTOBO

Distance:

M/N: OCTO-001

Mode: NFC

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		0.0125	17.67	31.58	49.25	125.49	-76.24	QP		
2		0.0371	19.08	32.32	51.40	116.09	-64.69	QP		
3		0.0495	13.99	32.36	46.35	113.60	-67.25	QP		
4		0.0623	31.34	32.30	63.64	111.61	-47.97	QP		
5		0.0747	24.79	32.30	57.09	110.05	-52.96	QP		
6	*	0.1250	25.55	32.30	57.85	105.60	-47.75	QP		



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Radiated Emission Measurement

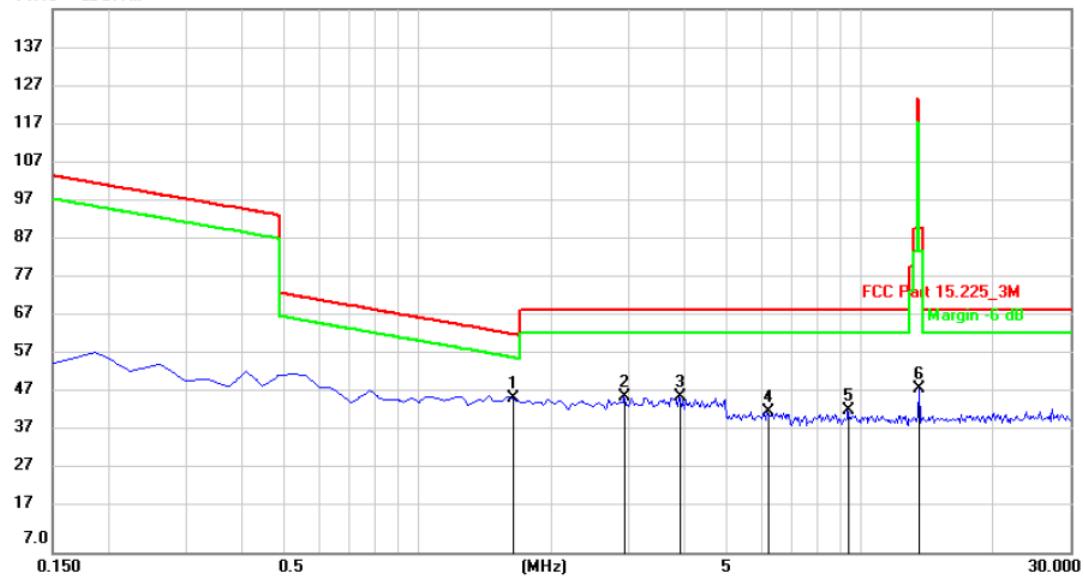
File :M1

Data :#7

Date: 2019/8/20

Time: 8:54:01

147.0 dBuV/m



Site: 3m Chamber

Polarization: **Horizontal**

Temperature: 26

Limit: FCC Part 15.225_3M

Power: DC6V

Humidity: 60 %

EUT: OCTOBO

Distance:

M/N: OCTO-001

Mode: NFC

Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over		Antenna Height cm	Table Degree degree	Comment
						dB	Detector			
1 *	1.6491	14.46	32.17	46.63	63.21	-16.58	QP			
2	2.9483	14.81	32.17	46.98	69.54	-22.56	QP			
3	3.9186	15.01	32.20	47.21	69.54	-22.33	QP			
4	6.2318	11.03	32.24	43.27	69.54	-26.27	QP			
5	9.4406	11.19	32.33	43.52	69.54	-26.02	QP			
6	13.5600	16.89	32.33	49.22	124.00	-74.78	QP			



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Radiated Emission Measurement

File :M1

Data :#8

Date: 2019/8/20

Time: 9:02:54

147.0 dBuV/m



Site: 3m Chamber

Polarization: **Vertical**

Temperature: 26

Limit: FCC Part 15.225_3M

Power: DC6V

Humidity: 60 %

EUT: OCTOBO

Distance:

M/N: OCTO-001

Mode: NFC

Note:

No. Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB/m	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm		Table Degree	Comment
							Detector	cm		
1	2.7246	14.81	32.17	46.98	69.54	-22.56	QP			
2 *	4.4408	14.82	32.21	47.03	69.54	-22.51	QP			
3	6.4184	11.03	32.24	43.27	69.54	-26.27	QP			
4	11.0824	11.81	32.36	44.17	69.54	-25.37	QP			
5	13.5600	21.40	32.33	53.73	124.00	-70.27	QP			
6	20.7836	10.72	32.30	43.02	69.54	-26.52	QP			



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Radiated Emission Measurement

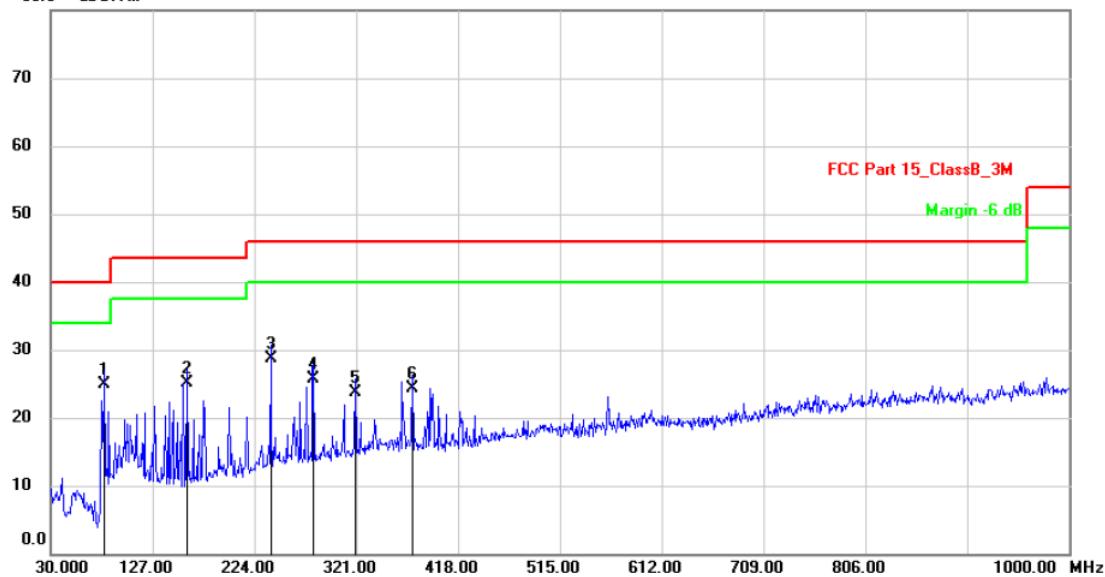
File : M1

Data : #3

Date: 2019/8/15

Time: 16:01:15

80.0 dBuV/m



Site: 3m Chamber

Polarization: **Horizontal**

Temperature: 26

Limit: FCC Part 15_ClassB_3M

Power: DC6V

Humidity: 47 %

EUT: OCTOBO

Distance: 3m

M/N: OCTO-001

Mode: NFC

Note:

No. Mk.	Freq. MHz	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height	Table Degree	Comment
		dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	
1 *	81.4100	40.77	-15.87	24.90	40.00	-15.10	QP		
2	159.9800	40.26	-15.16	25.10	43.50	-18.40	QP		
3	239.5200	40.76	-12.06	28.70	46.00	-17.30	QP		
4	280.2600	36.77	-10.97	25.80	46.00	-20.20	QP		
5	320.0300	33.63	-9.93	23.70	46.00	-22.30	QP		
6	374.3500	33.48	-9.18	24.30	46.00	-21.70	QP		



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Radiated Emission Measurement

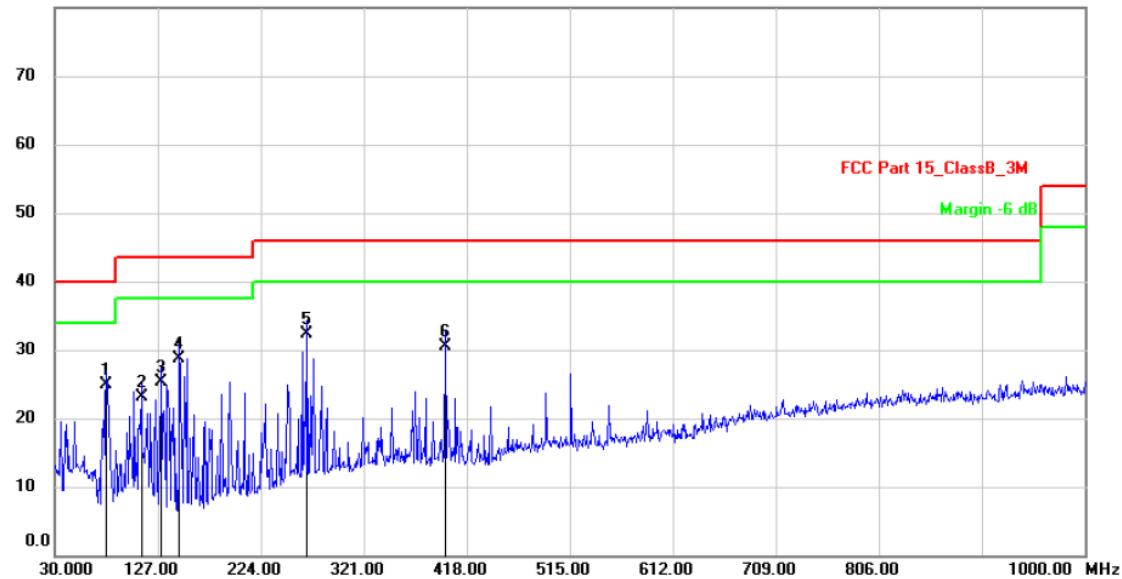
File : M1

Data : #4

Date: 2019/8/15

Time: 16:08:32

80.0 dBuV/m



Site: 3m Chamber

Polarization: **Vertical**

Temperature: 26

Limit: FCC Part 15_ClassB_3M

Power: DC6V

Humidity: 47 %

EUT: OCTOBO

Distance: 3m

M/N: OCTO-001

Mode: NFC

Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure- ment	Limit	Over	Antenna Height	Table Degree		
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		78.5000	44.00	-19.10	24.90	40.00	-15.10	QP			
2		111.4800	39.22	-16.12	23.10	43.50	-20.40	QP			
3		129.9100	43.55	-18.15	25.40	43.50	-18.10	QP			
4		147.3700	47.35	-18.55	28.80	43.50	-14.70	QP			
5	*	267.6500	45.54	-13.24	32.30	46.00	-13.70	QP			
6		397.6300	41.73	-11.13	30.60	46.00	-15.40	QP			

7. Antenna Application

7.1 Antenna requirement

According to of FCC part 15C section 15.203 and 15.240:

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.

EUT Antenna:

The antenna is loop antenna and no consideration of replacement.

8. Test Equipment List

Description	Manufacturer	Model Number	Serial Number	Characteristics	Calibration Date	Calibration Due Date
Test Receiver	Rohde & Schwarz	ESCI7	100837	9KHz~7GHz	Mar. 13, 2019	Mar. 12, 2020
Antenna	Schwarzbeck	VULB9162	9162-010	30MHz~7GHz	Mar. 14, 2019	Mar. 13, 2020
Cable	Huber+Suhner	CBL2-NN-1M	22390001	9KHz~7GHz	Mar. 13, 2019	Mar. 12, 2020
Cable	Huber+Suhner	CIL02	N/A	9KHz~7GHz	Mar. 13, 2019	Mar. 12, 2020
RF Cable	Huber+Suhner	SF-104	MY16559/4	9KHz~25GHz	Apr. 25, 2019	Apr. 25, 2020
Power Amplifier	HP	HP 8447D	1145A00203	100KHz~1.3GHz	Mar. 13, 2019	Mar. 12, 2020
Horn Antenna	Schwarzbeck	BBHA9170	9170-242	15GHz~40GHz	Mar. 13, 2019	Mar. 12, 2020
Horn Antenna	Com-Power	AH-118	071078	1GHz~18GHz	Mar. 14, 2019	Mar. 13, 2020
RF Cable	Huber+Suhner	SF-104	N/A	9KHz~40GHz	Apr. 25, 2019	Apr. 25, 2020
Loop antenna	Daze	ZA30900A	0708	9KHz~30MHz	Apr. 25, 2019	Apr. 25, 2020
Spectrum Analyzer	Rohde & Schwarz	FSU26	200409/026	20Hz~26.5GHz	Apr. 25, 2019	Apr. 25, 2020
Spectrum Analyzer	Rohde & Schwarz	FSV40	101003	10Hz~40GHz	Apr. 06, 2019	Apr. 05, 2020
Pre-Amplifier	EMCI	EMC 184045	980102	18GHz~40GHz	Nov. 02, 2018	Nov. 01, 2019
Pre-Amplifier	Agilent	8449B	3008A02964	1GHz~26.5GHz	Apr. 25, 2019	Apr. 25, 2020
L.I.S.N.	Rohde & Schwarz	ENV 216	101317	9KHz~30MHz	Mar. 13, 2019	Mar. 12, 2020
Temporary antenna connector	TESCOM	SS402	N/A	9KHz-25GHz	N/A	N/A
Power Meter	Anritsu	ML2495A	1139001	100k-65GHz	Nov. 02, 2018	Nov. 01, 2019
Temperature & Humidity Chamber	REMAFEE	SYHR225L	N/A	N/A	Apr. 24, 2019	Apr. 23, 2020

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.

---End---