



# FCC PART 15.247

## TEST REPORT

For

### Beijing Today Innovation Technology Co., Ltd.

No.118, Floor 1, Building 1, No.7, North Ritan Road, Chaoyang District, Beijing, China

**FCC ID: 2ALIU-DR-01Y**

<b>Report Type:</b> Original Report	<b>Product Type:</b> Tomo 2-in-1 STEM Robotic Kit
<b>Report Number:</b> <u>RSZ170228551-00B</u>	
<b>Report Date:</b> <u>2017-03-14</u>	
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**Note:** This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp.

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## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

The *Beijing Today Innovation Technology Co., Ltd.*'s product, model number: *DR-01Y (FCC ID: 2ALIU-DR-01Y)* in this report is a *Tomo 2-in-1 STEM Robotic Kit*, which was measured approximately: 20 cm (L) \* 20 cm (W) \* 13.2 cm (H), rated with input voltage: DC 6\*AA battery.

*\* All measurement and test data in this report was gathered from production sample serial number: 1702021 (Assigned by BACL, Kunshan). The EUT supplied by the applicant was received on 2017-02-28.*

### Objective

This report is prepared on behalf of *Beijing Today Innovation Technology Co., Ltd.* in accordance with Part 2-Subpart J, Part 15-Subparts A, B and C of the Federal Communication Commission's rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 rules.

### Related Submittal(s)/Grant(s)

No related submittal(s).

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Kunshan). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

### Measurement Uncertainty

	Item	Uncertainty
Radiated emission	30MHz~1GHz	±5.91dB
	Above 1GHz	±4.92dB

### **Test Facility**

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road, Kunshan, Jiangsu province, China.

Test site at Bay Area Compliance Laboratories Corp. (Kunshan) has been fully described in reports submitted to the Federal Communication Commission (FCC). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on November 06, 2014. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.10-2013.

The Federal Communications Commission has the reports on file and is listed under FCC Registration No.: 815570. The test site has been approved by the FCC for public use and is listed in the FCC Public Access Link (PAL) database.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

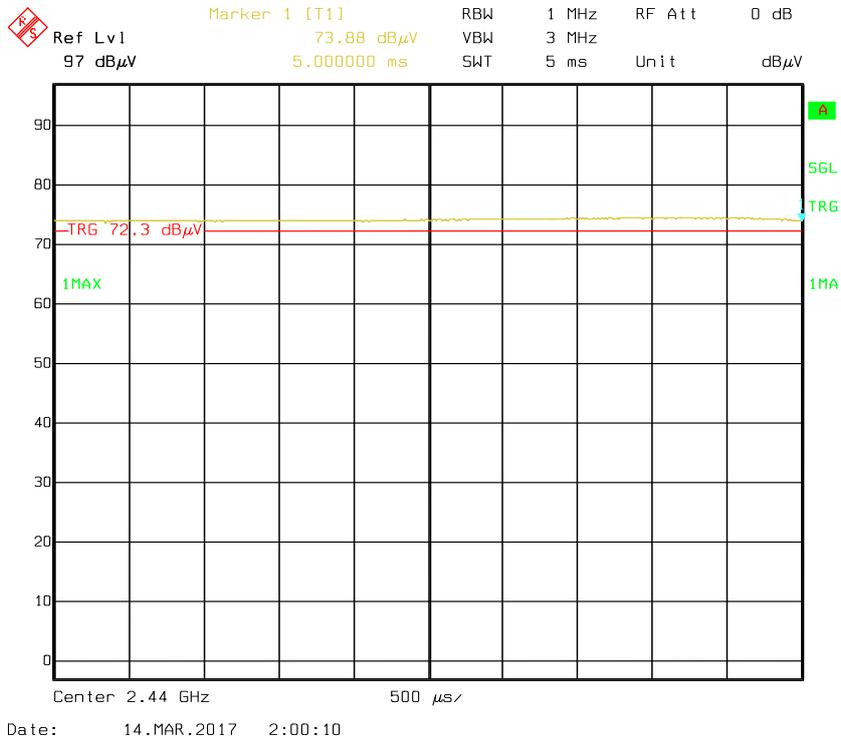
For BLE mode, 40 channels are provided to testing

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	21	2444
2	2406	22	2446
3	2408	23	2448
4	2410	24	2450
5	2412	25	2452
6	2414	26	2454
7	2416	27	2456
8	2418	28	2458
9	2420	29	2460
10	2422	30	2462
11	2424	31	2464
12	2426	32	2466
13	2428	33	2468
14	2430	34	2470
15	2432	35	2472
16	2434	36	2474
17	2436	37	2476
18	2438	38	2478
19	2440	39	2480

EUT was tested with Channel 0, 19 and 39.

**Duty cycle**

**BLE Mode**



Band	Duty Cycle (%)	T(us)	1/T(kHz)	VBW Setting	10log(1/x)
BLE	100	-	-	10Hz	-

**Equipment Modifications**

No modification was made to the EUT tested.

**EUT Exercise Software**

Software” Smart studio 7” was used.

**Support Equipment List and Details**

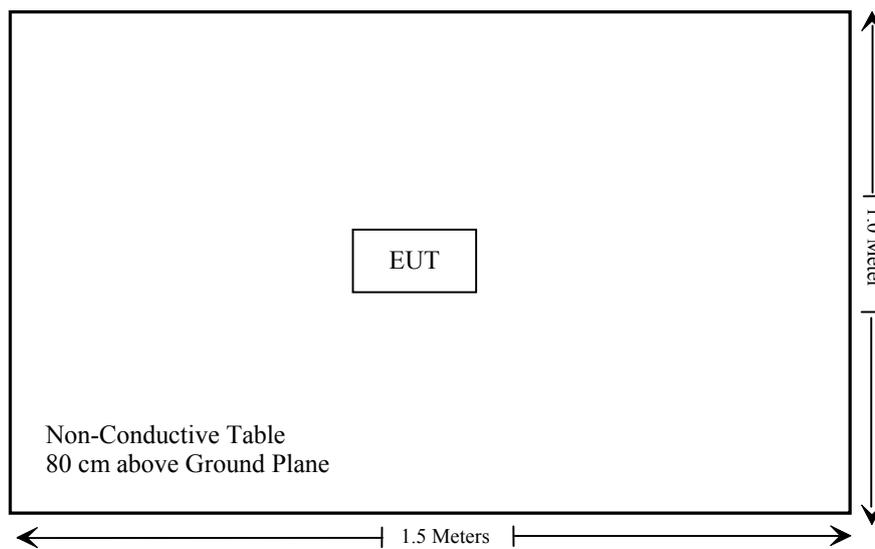
Manufacturer	Description	Model	Serial Number
N/A	N/A	N/A	N/A

**External I/O Cable**

Cable Description	Length (m)	From Port	To
/	/	/	/

**Block Diagram of Test Setup**

For radiated emission below 1GHz



## SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.247 (i) & §1.1307 (b) (1) & §2.1091	Maximum Permissible exposure (MPE)	Compliance
§15.203	Antenna Requirement	Compliance
§15.207 (a)	AC Line Conducted Emissions	Not Applicable
§15.205, §15.209, §15.247(d)	Spurious Emissions	Compliance
§15.247 (a)(2)	6 dB Emission Bandwidth	Compliance*
§15.247(b)(3)	Maximum Conducted Output Power	Compliance*
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliance*
§15.247(e)	Power Spectral Density	Compliance*

**Compliance\*:** The EUT contains a certified BLE module, all antenna port data can be referred to the module report.

The BLE module has been certified on 2016-01-07, the related information about BLE module is listed below:

Model: RF-BM-S02A

FCC ID: 2ABN2-RFBMS02A

Frequency: 2402-2480 MHz

**TEST EQUIPMENT LIST**

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
<b>Radiation test</b>					
Sonoma Instrument	Amplifier	330	171377	2016-12-12	2017-12-12
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2016-11-25	2017-11-25
Sunol Sciences	Broadband Antenna	JB3	A090314-2	2016-01-09	2019-01-08
Narda	Pre-amplifier	AFS42-00101800	2001270	2016-09-08	2017-09-08
EMCO	Horn Antenna	3116	00084159	2016-10-18	2019-10-17
Rohde & Schwarz	Signal Analyzer	FSIQ26	100048	2016-11-25	2017-11-25
ETS	Horn Antenna	3115	6229	2016-12-12	2019-12-12
R&S	Auto test Software	EMC32	V 09.10.0	NCR	NCR
haojintech	Coaxial Cable	Cable-1	001	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-2	002	2016-12-12	2017-12-12
haojintech	Coaxial Cable	Cable-3	003	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-4	004	2016-12-12	2017-12-12
MICRO-COAX	Coaxial Cable	Cable-5	005	2016-12-12	2017-12-12

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

**FCC §15.247 (i) & §1.1307 (b) (1) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

**Applicable Standard**

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Limits for General Population/Uncontrolled Exposure				
Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Averaging Time (Minutes)
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f <sup>2</sup> )	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz

\* = Plane-wave equivalent power density

**Result**

**Calculated Formulary:**

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

Frequency (MHz)	Antenna Gain		Conducted Power		Evaluation Distance (cm)	Power Density (mW/cm <sup>2</sup> )	MPE Limit (mW/cm <sup>2</sup> )
	(dBi)	(numeric)	(dBm)	(mW)			
2402-2480	0	1	-1.0	0.79	20	0.0002	1

Note: To maintain compliance with the FCC’s RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result: Compliance**

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## **FCC §15.203 - ANTENNA REQUIREMENT**

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### **Applicable Standard**

According to § 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 shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### **Antenna Connector Construction**

The EUT has an internal antenna arrangement, which was permanently attached and the antenna gain is 0 dBi, fulfill the requirement of this section. Please refer to the EUT photos.

**Result:** Compliance.

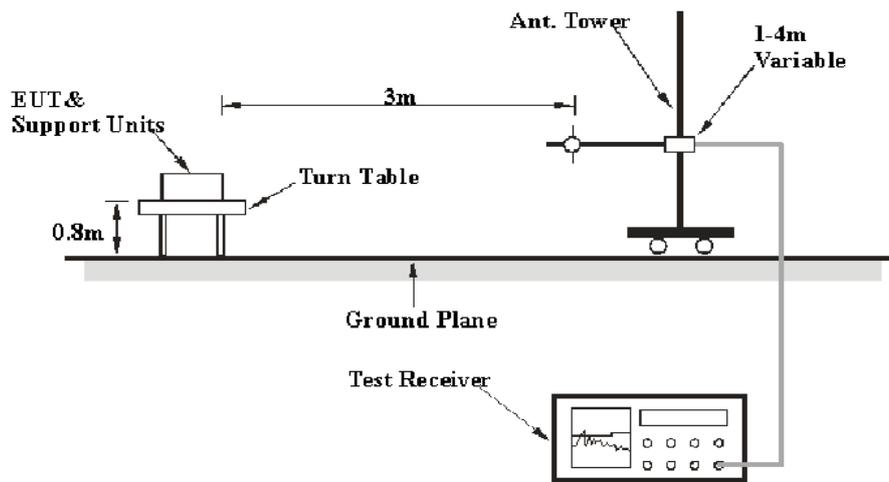
**FCC §15.209, §15.205 & §15.247(d) - SPURIOUS EMISSIONS**

**Applicable Standard**

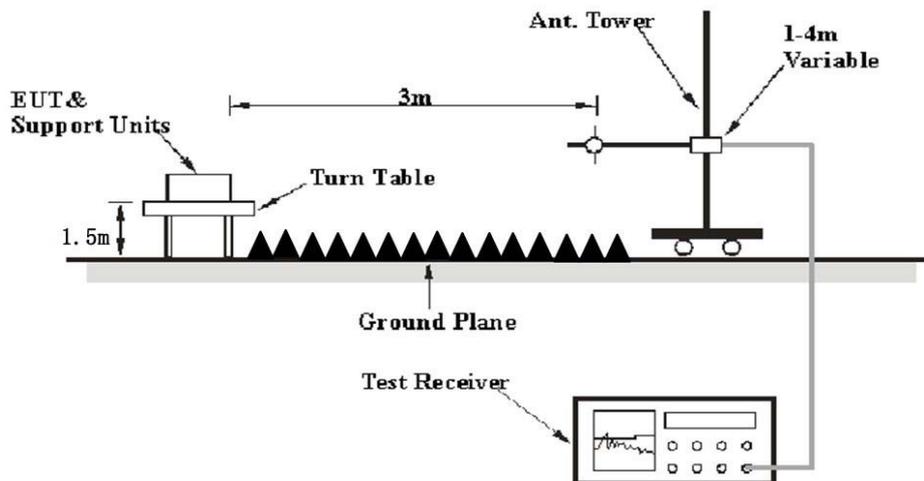
FCC §15.247 (d); §15.209; §15.205;

**EUT Setup**

**Below 1 GHz:**



**Above 1GHz:**



The radiated emission tests were performed in the 3 meters test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.247 limits.

## EMI Test Receiver & Spectrum Analyzer Setup

The system was investigated from 30 MHz to 25 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	100 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz <sup>Note 1</sup>	/	Ave.
	1MHz	> 1/T <sup>Note 2</sup>	/	Ave.

Note 1: when duty cycle is no less than 98%

Note 2: when duty cycle is less than 98%

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

Data was recorded in Quasi-peak detection mode for frequency range of 30 MHz-1 GHz, peak and Average detection modes for frequencies above 1 GHz.

## Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.209 and 15.247.

Refer to CISPR16-4-2:2011 and CISPR 16-4-1:2009, the measured level complies with the limit if

$$L_m + U_{(L_m)} \leq L_{\text{lim}} + U_{\text{cispr}}$$

In BACL,  $U_{(L_m)}$  is less than  $U_{\text{cispr}}$ , if  $L_m$  is less than  $L_{\text{lim}}$ , it implies that the EUT complies with the limit.

**Test Data**

**Environmental Conditions**

<b>Temperature:</b>	25 °C
<b>Relative Humidity:</b>	48%
<b>ATM Pressure:</b>	101.0 kPa

The testing was performed by Layne Li on 2017-03-08.

EUT operation mode: Transmitting

**30 MHz- 25 GHz:**

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
<b>Low Channel (2402 MHz)</b>									
480.15	40.52	QP	23	1.2	V	-7.21	33.31	46	12.69
2402.00	84.48	PK	48	2.0	H	-6.19	78.29	/	/
2402.00	82.77	Ave.	48	2.0	H	-6.19	76.58	/	/
2402.00	79.74	PK	248	1.5	V	-6.19	73.55	/	/
2402.00	78.16	Ave.	248	1.5	V	-6.19	71.97	/	/
2352.64	46.38	PK	115	1.2	H	-6.19	40.19	74	33.81
2352.64	32.06	Ave.	115	1.2	H	-6.19	25.87	54	28.13
2362.26	45.55	PK	173	2.1	H	-6.19	39.36	74	34.64
2362.26	32.06	Ave.	173	2.1	H	-6.19	25.87	54	28.13
2490.34	47.46	PK	293	1.6	H	-5.97	41.49	74	32.51
2490.34	33.57	Ave.	293	1.6	H	-5.97	27.60	54	26.40
4804.00	57.05	PK	251	2.4	H	1.6	58.65	74	15.35
4804.00	40.38	Ave.	251	2.4	H	1.6	41.98	54	12.02
<b>Middle Channel (2440 MHz)</b>									
480.15	40.45	QP	23	1.2	V	-7.21	33.24	46	12.76
2440.00	86.93	PK	122	1.5	H	-6.19	80.74	/	/
2440.00	84.93	Ave.	122	1.5	H	-6.19	78.74	/	/
2440.00	82.63	PK	92	2.3	V	-6.19	76.44	/	/
2440.00	81.25	Ave.	92	2.3	V	-6.19	75.06	/	/
2347.51	45.26	PK	159	1.3	H	-6.42	38.84	74	35.16
2347.51	30.91	Ave.	159	1.3	H	-6.42	24.49	54	29.51
2365.47	45.55	PK	43	2.1	H	-6.19	39.36	74	34.64
2365.47	30.72	Ave.	43	2.1	H	-6.19	24.53	54	29.47
2488.09	46.96	PK	353	2.1	H	-5.97	40.99	74	33.01
2488.09	33.57	Ave.	353	2.1	H	-5.97	27.60	54	26.40
4880.00	51.84	PK	187	1.3	H	1.83	53.67	74	20.33
4880.00	36.97	Ave.	187	1.3	H	1.83	38.80	54	15.20

Frequency (MHz)	Receiver		Turntable Degree	Rx Antenna		Corrected Factor (dB)	Corrected Amplitude (dBµV/m)	FCC Part 15.247/205/209	
	Reading (dBµV)	Detector (PK/QP/Ave.)		Height (m)	Polar (H/V)			Limit (dBµV/m)	Margin (dB)
<b>High Channel (2480 MHz)</b>									
480.15	40.68	QP	23	1.2	V	-7.21	33.47	46	12.53
2480.00	88.94	PK	141	1.2	H	-5.97	82.97	/	/
2480.00	87.65	Ave.	141	1.2	H	-5.97	81.68	/	/
2480.00	85.39	PK	133	1.2	V	-5.97	79.42	/	/
2480.00	83.13	Ave.	133	1.2	V	-5.97	77.16	/	/
2377.81	45.36	PK	227	1.8	H	-6.19	39.17	74	34.83
2377.81	32.06	Ave.	227	1.8	H	-6.19	25.87	54	28.13
2483.50	58.27	PK	317	2.4	H	-5.97	52.30	74	21.70
2483.50	50.15	Ave.	317	2.4	H	-5.97	44.18	54	9.82
2483.89	54.12	PK	325	2.3	H	-5.97	48.15	74	25.85
2483.89	45.87	Ave.	325	2.3	H	-5.97	39.90	54	14.10
4960.00	51.97	PK	114	1.5	V	2.06	54.03	74	19.97
4960.00	35.69	Ave.	114	1.5	V	2.06	37.75	54	16.25

**Note:**

Corrected Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

Corrected Amplitude = Corrected Factor + Reading

Margin = Limit - Corrected. Amplitude

The other spurious emission which is 20dB to the limit was not recorded.

**\*\*\*\*\* END OF REPORT \*\*\*\*\***