MEASUREMENT REPORT

FCC PART 15.209

FCC ID:	2ALS8-NBPLUS
APPLICANT:	Ninebot (Changzhou) Tech Co., Ltd.
Application Type:	Certification
Product:	Remote Controller
Model No.:	N4MZ68
Brand Name:	SEGWAY
FCC Classification:	Low Power Communication Transmitter(DXX)
FCC Rule Part(s):	Part 15.209
Test Procedure(s):	ANSI C63.10-2013
Test Date:	August 02 ~ September 23, 2017

Reviewed By : Sunny Sun
(Sunny Sun)

Approved By : Marlin Chen
(Marlin Chen)

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANCI 63.10-2013. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date	Note
1708RSU00101	Rev. 01	Initial Report	08-09-2017	Invalid
1708RSU00101	Rev. 02	Modify the FCC standard	09-23-2017	Valid

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Description Page

§2.1033 General Information

Applicant:	Ninebot (Changzhou) Tech Co., Ltd.
Applicant Address:	16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, China.
Manufacturer:	Ninebot (Changzhou) Tech Co., Ltd.
Manufacturer Address:	16F-17F, Block A, Building 3, Changwu Mid Road 18#, Wujin Dist., Changzhou, Jiangsu, China.
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT FCC Registration No.:	893164
FCC Rule Part(s):	FCC CFR 47 Part 15.209
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- **MRT facility is a FCC registered (MRT Reg. No. 893164) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.**
- **MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.**
- **MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.**
- **MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.**


Accredited Laboratory

A2LA has accredited

MRT TECHNOLOGY (SUZHOU) CO., LTD.

Suzhou, Jiangsu, People's Republic of China

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 6th day of September 2016.

Senior Director of Quality and Communications
For the Accreditation Council
Certificate Number 3628.01
Valid to August 31, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

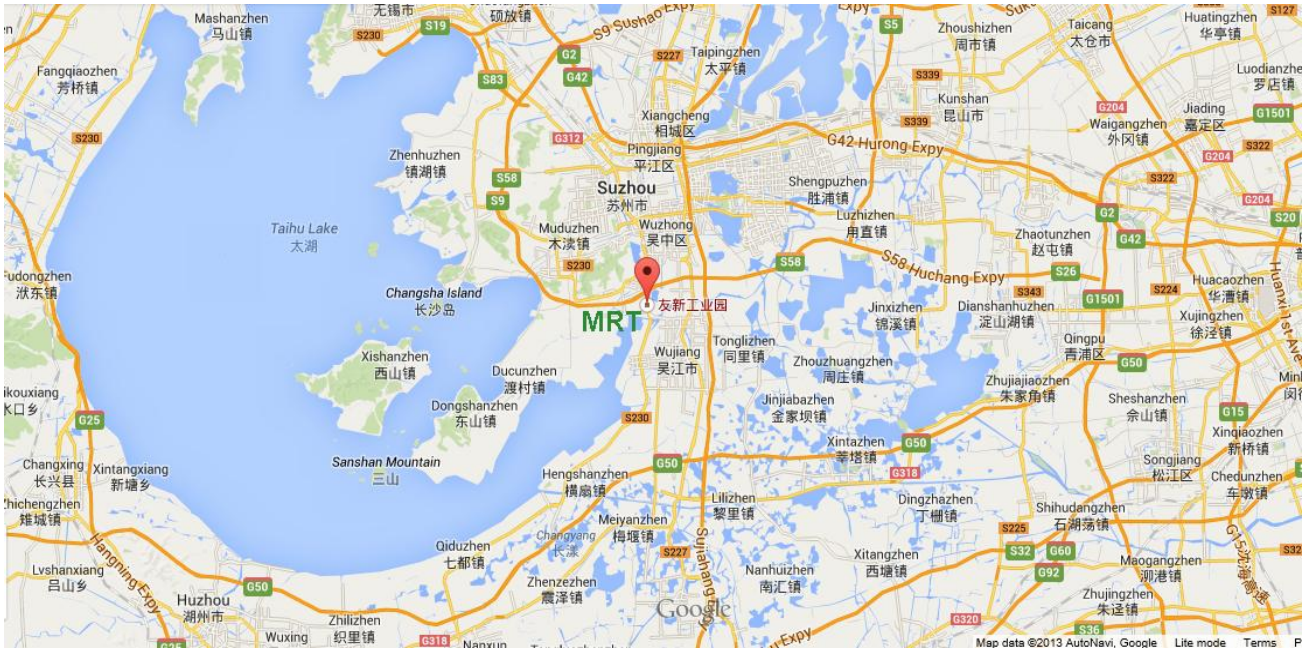
1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	Remote Controller
Model No.:	N4MZ68
Brand Name:	SEGWAY
Operation Frequency:	6489.6 MHz
Antenna Type:	Tag Antenna
Antenna Gain:	6.97dBi
SW Power Setting:	6

2.2. Test Mode

Test Mode	Mode 1: Transmit at 6489.6MHz

2.3. Description of Test Software

N/A

2.4. Test Configuration

The **Remote Controller** was tested per the guidance of ANSI C63.10-2013.

2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.6. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

3. DESCRIPTION of TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Procedures for measuring ultra-wideband devices (ANSI C63.10-2013).

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the Radio Controller is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **Remote Controller** unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Radiated Disturbance - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
MXE EMI Receiver	Agilent	N9038A	MRTSUE06125	1 year	2018/08/03
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2017/12/21
Bilog Period Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2017/10/22
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2017/11/19
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06106	1 year	2017/12/10
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2018/04/25
Digitial Thermometer & Hygrometer	Minggao	ETH529	MRTSUE06170	1 year	2017/11/30
Anechoic Chamber	RIKEN	Chamber-AC1	MRTSUE06213	1 year	2018/05/10

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2018/04/25
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06184	1 year	2017/12/22

Software	Version	Function
e3	V8.3.5	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

Radiated Emission Measurement - AC1
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: ± 4.18dB 1GHz ~ 40GHz: ± 4.76dB

7. TEST RESULT

7.1. Summary

Product Name: **Remote Controller**

FCC ID: **2ALS8-NBPLUS**

FCC Classification: **Low Power Communication Transmitter (DXX)**

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
FCC Section 15.215(c)	Occupied Bandwidth	N/A	Conducted	Pass	Section 7.2
FCC Section 15.209	Radiated Spurious Emissions below 960 MHz	Refer to Section 7.3	Radiated	Pass	Section 7.3
FCC Section 15.209	Radiated Spurious Emissions above 960 MHz	Refer to Section 7.3		Pass	Section 7.3
FCC Section 15.203	Antenna Requirement	N/A	N/A	Complies	Section 4
FCC Section 15.205	Restricted Bands of Operation	Refer to Section 7.4	Radiated	Pass	Section 7.4

Notes:

1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified and showed the worst axis in the test setup photos. The test results shown in the following sections represent the worst case emissions.

7.2. Occupied Bandwidth Measurement

7.2.1.Test Limit

N/A

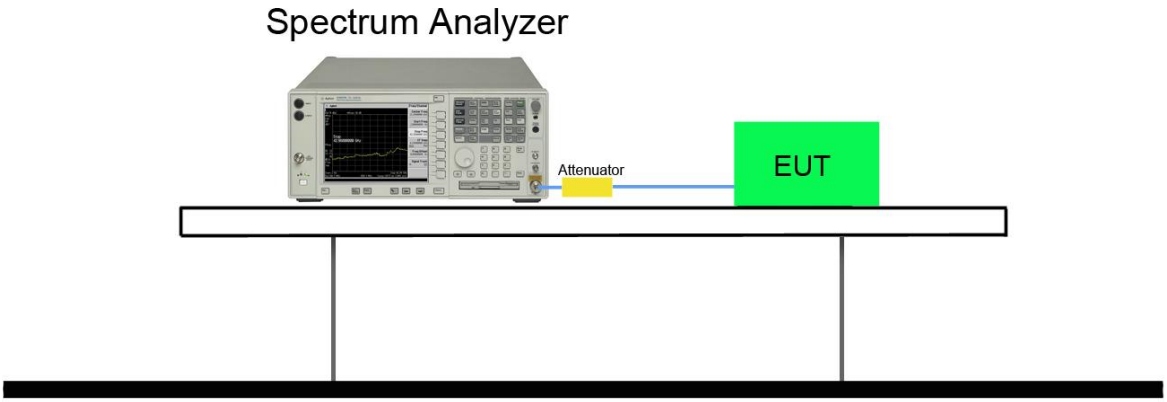
7.2.2.Test Procedure used

ANSI C63.10-2013, section 10.1

7.2.3.Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 20dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 20. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

7.2.4.Test Setup

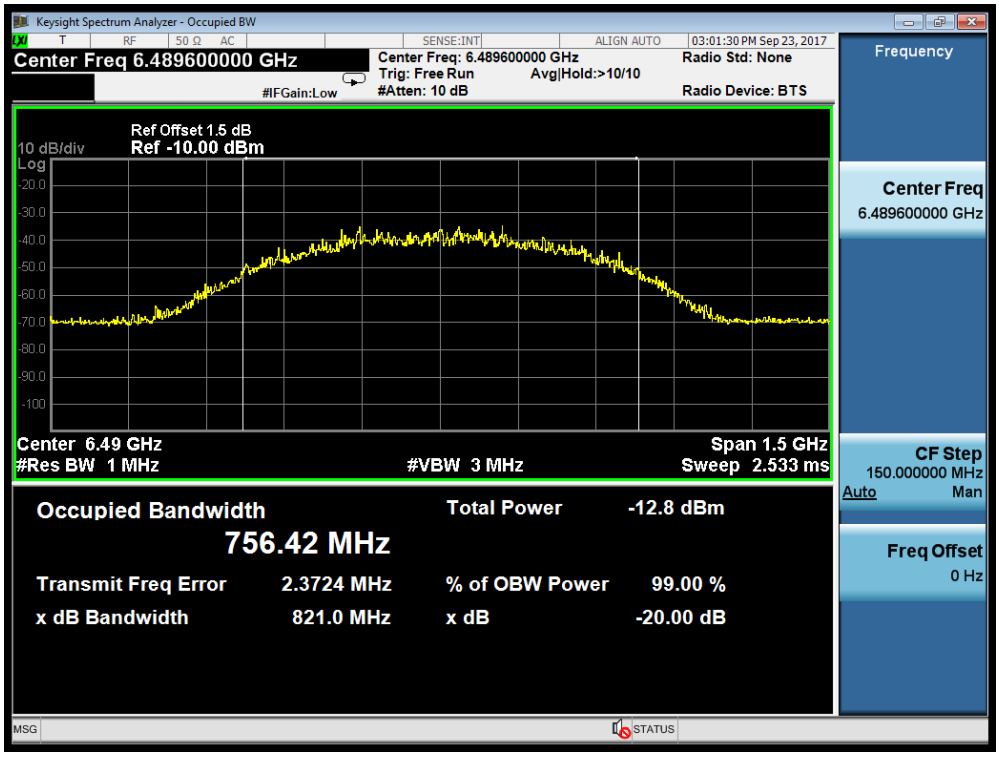


7.2.5.Test Result

Product	Remote Controller	Temperature	25°C
Test Engineer	Lewis Huang	Relative Humidity	60%
Test Site	TR3	Test Date	2017/09/23
Test Item	20dB Occupied Bandwidth		

Frequency (MHz)	20dB Bandwidth (MHz)	Result
6489.6	821.0	Pass

20dB Occupied Bandwidth



7.3. Radiated Spurious Emission Measurements

7.3.1.Test Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note: For above 1GHz limit, we used the 1m distance, and added the factor - 20*log(3m/1m).

7.3.2.Test Procedure Used

ANSI C63.10-2013, sections 10.2, 10.3

7.3.3.Test Setting

Peak Field Strength Measurements

Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

RBW = as specified in Table 1

VBW = 3MHz

Detector = peak

Sweep time = auto couple

Trace mode = max hold

Trace was allowed to stabilize

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Average Field Strength Measurements

Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

RBW = 1MHz

VBW ≥ 1/T

De As an alternative, the instrument may be set to linear detector mode. Ensure that video filtering is applied in linear voltage domain (rather than in a log or dB domain). Some instruments require linear display mode in order to accomplish this. Others have a setting for Average-VBW Type, which can be set to “Voltage” regardless of the display mode

Detector = Peak

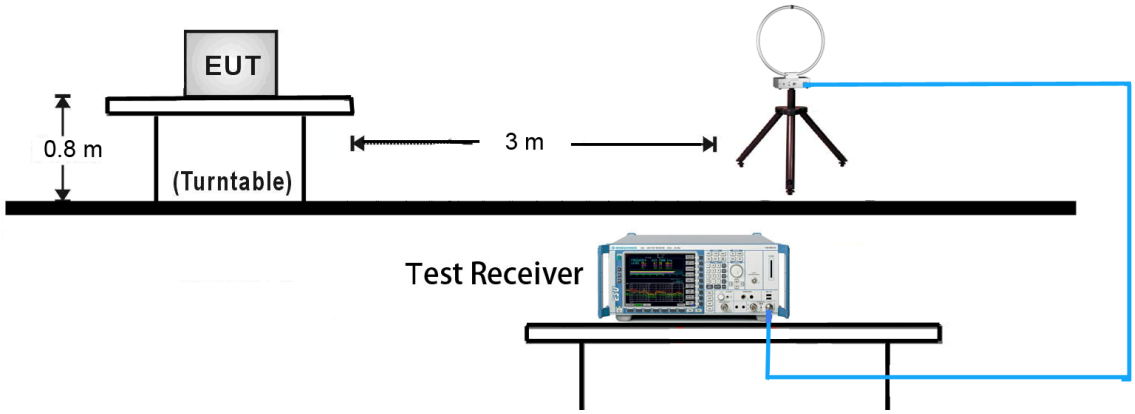
Sweep time = auto

Trace mode = max hold

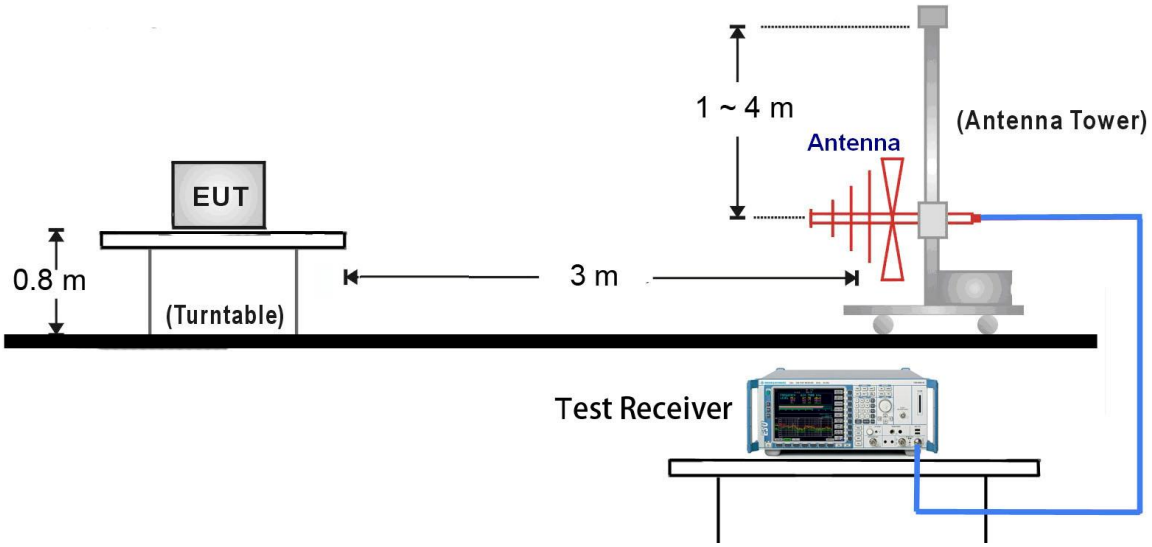
Allow max hold to run for at least 50 times (1/duty cycle) traces

7.3.4.Test Setup

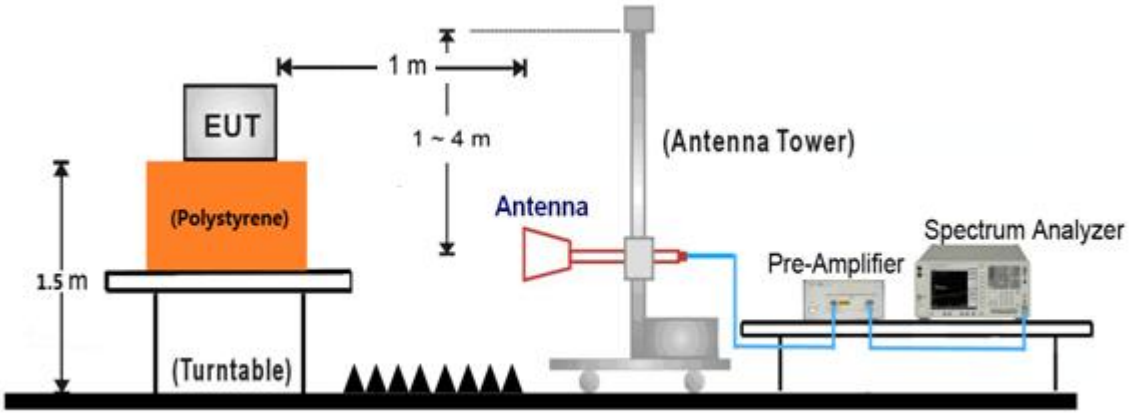
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



1GHz ~ 40GHz Test Setup:

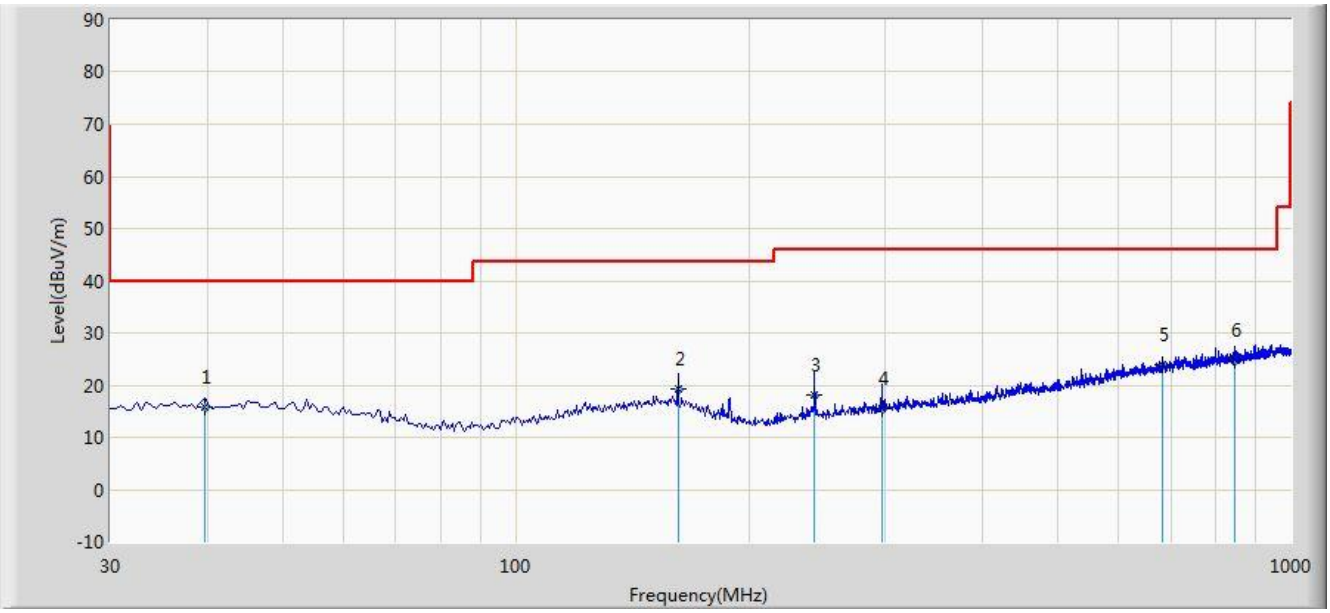


7.3.5.Test Result

Product	Remote Controller	Temperature	26°C
Test Engineer	Roy Cheng	Relative Humidity	56%
Test Site	AC1	Test Date	2017/08/06
Remark:	Radiated Emission below 1000MHz Test Result Summary (3m Limit)		

Frequency (MHz)	Measure Level (dBμV/m)	Limit (dBμv/m)	Margin (dB)	Polarity	Verdict
39.70	15.85	40.00	-24.15	Horizontal	Pass
161.92	19.32	43.50	-24.18	Horizontal	Pass
242.92	18.08	46.00	-27.92	Horizontal	Pass
296.75	15.47	46.00	-30.53	Horizontal	Pass
682.33	23.86	46.00	-22.14	Horizontal	Pass
845.77	24.75	46.00	-21.25	Horizontal	Pass
107.60	15.98	43.50	-27.52	Vertical	Pass
161.92	16.32	43.50	-27.18	Vertical	Pass
189.08	23.04	43.50	-20.47	Vertical	Pass
242.92	23.07	46.00	-22.93	Vertical	Pass
296.75	22.46	46.00	-23.55	Vertical	Pass
825.89	24.59	46.00	-21.41	Vertical	Pass
Note 1: The Margin = Equivalent field strength – Limit. Note 2: The detail test plots have been showed as below.					

Site: AC1	Time: 2017/08/06 - 17:08
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: VULB 9168_20-2000MHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit with UWB function	



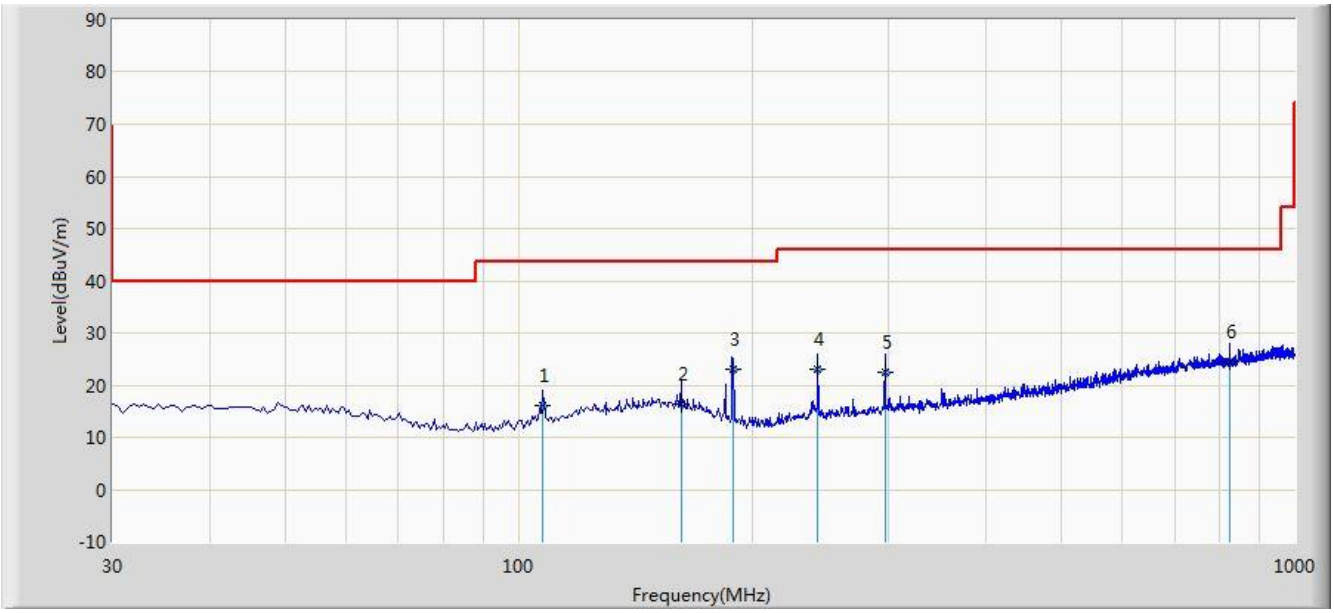
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			39.700	15.849	1.291	-24.151	40.000	14.558	QP
2			161.920	19.321	4.298	-24.179	43.500	15.023	QP
3			242.915	18.079	5.292	-27.921	46.000	12.787	QP
4			296.750	15.470	1.298	-30.530	46.000	14.172	QP
5			682.325	23.864	2.198	-22.136	46.000	21.666	QP
6		*	845.770	24.752	1.299	-21.248	46.000	23.453	QP

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz), therefore no data appear in the report.

Site: AC1	Time: 2017/08/06 - 17:12
Limit: FCC_Part15.209_RE(3m)	Engineer: Will Yan
Probe: VULB 9168_20-2000MHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit with UWB function	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			107.600	15.981	4.219	-27.519	43.500	11.762	QP
2			161.920	16.321	1.298	-27.179	43.500	15.023	QP
3		*	189.080	23.035	11.298	-20.465	43.500	11.737	QP
4			242.915	23.071	10.284	-22.929	46.000	12.787	QP
5			296.750	22.455	8.283	-23.545	46.000	14.172	QP
6			825.885	24.586	1.298	-21.414	46.000	23.288	QP

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz), therefore no data appear in the report.

Product	Remote Controller	Temperature	26°C
Test Engineer	Roy Cheng	Relative Humidity	56%
Test Site	AC1	Test Date	2017/08/06
Remark:	Radiated Emission above 1000MHz Test Result Summary (1m Limit)		

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
1000MHz ~ 1610MHz							
1344.8	42.9	-7.9	35.0	83.5	-48.5	PK	Horizontal
1008.1	37.7	-11.2	26.5	63.5	-37.0	AV	Horizontal
1343.5	43.4	-7.9	35.5	83.5	-48.0	PK	Vertical
1335.4	32.1	-8.0	24.1	63.5	-39.4	AV	Vertical
1610MHz ~ 1990MHz							
1753.1	41.8	-7.2	34.6	83.5	-48.9	PK	Horizontal
1964.9	29.0	-5.9	23.1	63.5	-40.4	AV	Horizontal
1850.2	42.0	-6.6	35.4	83.5	-48.1	PK	Vertical
1960.0	29.1	-6.0	23.1	63.5	-40.4	AV	Vertical
1990MHz ~ 3100MHz							
2252.0	39.7	-3.4	36.3	83.5	-47.2	PK	Horizontal
2410.7	29.2	-3.8	25.4	63.5	-38.1	AV	Horizontal
2227.0	40.6	-3.5	37.1	83.5	-46.4	PK	Vertical
2227.0	34.3	-3.5	30.8	63.5	-32.7	AV	Vertical
3100MHz ~ 10600MHz							
6647.5	56.2	6.0	62.2	83.5	-21.3	PK	Horizontal
6565.0	57.4	6.0	63.4	83.5	-20.1	PK	Vertical
10600MHz ~ 18000MHz							
14525.7	43.6	7.9	51.5	83.5	-32.0	PK	Horizontal
14636.7	33.1	7.9	41.0	63.5	-22.5	AV	Horizontal
14614.5	45.3	7.9	53.2	83.5	-30.3	PK	Vertical
14629.3	33.3	7.9	41.2	63.5	-22.3	AV	Vertical

Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
18000MHz ~ 40000MHz							
39989.0	38.4	19.0	57.4	83.5	-26.1	PK	Horizontal
39989.0	30.7	9.4	40.1	63.5	-23.4	AV	Horizontal
18176.0	40.3	9.9	50.2	83.5	-33.3	PK	Vertical
18176.0	30.8	9.4	40.2	63.5	-23.3	AV	Vertical

Note 1: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Note 2: The duty cycle is 5.14%, PK measurement level less than average limit, so fundamental average level is not be recorded. Any measurement level of unwanted emission, exclude harmonic, are used PK & Average detector showing in the table.

8. CONCLUSION

The data collected relate only the item(s) tested and show that the **Remote Controller FCC ID:**

2ALS8-NBPLUS is in compliance with Part 15 of the FCC Rules.

The End