



MEASUREMENT REPORT

FCC PART 15.250

FCC ID: 2ALS8-NBPLUS

APPLICANT: Ninebot (Changzhou) Tech Co., Ltd.

Application Type: Certification

Product: Remote Controller

Model No.: N4MZ68

Brand Name: SEGWAY

FCC Classification: Wideband Transmitter (WBT)

FCC Rule Part(s): Part 15, Section 15.250

Test Procedure(s): ANSI C63.10-2013

Test Date: August 02 ~ November 21, 2017

Reviewed By : Sunny Sun
(Sunny Sun)

Approved By : Marlinchen
(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.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1708RSU00101	Rev. 01	Initial Report	11-11-2017	Invalid
1708RSU01401	Rev. 02	Updated the Standard	11-21-2017	Valid

CONTENTS

Description	Page
§2.1033 General Information.....	5
1. INTRODUCTION	6
1.1. Scope	6
1.2. MRT Test Location	6
2. PRODUCT INFORMATION	7
2.1. Feature of Equipment under Test	7
2.2. Test Mode	7
2.3. Description of Test Software.....	7
2.4. Device Capabilities	7
2.5. Test Configuration	7
2.6. EMI Suppression Device(s)/Modifications.....	7
2.7. Labeling Requirements.....	8
3. DESCRIPTION of TEST.....	9
3.1. Evaluation Procedure	9
3.2. AC Line Conducted Emissions	9
3.3. Radiated Emissions.....	10
4. ANTENNA REQUIREMENTS.....	11
5. TEST EQUIPMENT CALIBRATION DATE.....	12
6. MEASUREMENT UNCERTAINTY	13
7. TEST RESULT	14
7.1. Summary.....	14
7.2. Occupied Bandwidth and Operation Frequency Range Measurement.....	15
7.2.1. Test Limit	15
7.2.2. Test Procedure used.....	15
7.2.3. Test Setting.....	15
7.2.4. Test Setup	16
7.2.5. Test Result.....	17
7.3. Radiated Spurious Emission Measurements Below 960MHz.....	18
7.3.1. Test Limit	18
7.3.2. Test Procedure Used	18
7.3.3. Test Setting.....	18
7.3.4. Test Setup	19
7.3.5. Test Setup	20

7.4.	Radiated Spurious Emission Measurements Above 960MHz.....	23
7.4.1.	Test Limit	23
7.4.2.	Test Procedure Used	23
7.4.3.	Test Setting.....	23
7.4.4.	Test Setup	24
7.4.5.	Test Result.....	26
7.5.	Peak Power within 50 MHz bandwidth.....	43
7.5.1.	Test Limit	43
7.5.2.	Test Procedure Used	43
7.5.3.	Test Setting.....	43
7.5.4.	Test Setup	44
7.5.5.	Test Result.....	45
7.6.	AC Conducted Emissions Measurement	48
7.6.1.	Test Limit	48
7.6.2.	Test Procedure Used	48
7.6.3.	Test Setting.....	48
7.6.4.	Test Setup	49
7.6.5.	Test Result.....	49
8.	CONCLUSION	50

§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, section 15.250
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.



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
Modulation:	☐ Frequency Hopping Modulation ☐ Stepped Frequency Modulation ☐ Swept Frequency Modulation ☒ other
SW Power Setting:	6

2.2. Test Mode

Test Mode	Mode 1: Transmit at 6489MHz
-----------	-----------------------------

2.3. Description of Test Software

N/A

2.4. Device Capabilities

This device contains the following capabilities:
Wideband Transmitter Device.

2.5. Test Configuration

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

2.6. EMI Suppression Device(s)/Modifications

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

2.7. 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	2018/08/17
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2017/12/21
Bilog Period Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2018/10/21
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2018/11/18
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06106	1 year	2017/12/10
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2018/04/25
Digital 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
MXE EMI Receiver	Keysight	N9038A	MRTSUE06125	1 year	2018/08/17
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2018/03/27
Programmable Temperature & Humidity Chamber	BAOYT	BYH-1500L	MRTSUE06051	1 year	2017/12/06
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: $\pm 4.18\text{dB}$

1GHz ~ 40GHz: $\pm 4.76\text{dB}$

7. TEST RESULT

7.1. Summary

Product Name: Remote Controller
FCC ID: 2ALS8-NBPLUS
FCC Classification: Wideband Transmitter (WBT)

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
FCC Section 15.250(a)	Operation Frequency	within the 5925-7250 MHz	Conducted	Pass	Section 7.2
FCC Section 15.250(b)	Occupied Bandwidth	>50 MHz	Conducted	Pass	Section 7.2
FCC Section 15.250(d)(4)	Radiated Spurious Emissions below 960 MHz	Refer to Section 7.3	Radiated	Pass	Section 7.3
FCC Section 15.250(d)(1)	Radiated Spurious Emissions above 960 MHz	Refer to Section 7.4		Pass	Section 7.4
FCC Section 15.250(d)(2)	Radiated Spurious Emissions in GPS Band	Refer to Section 7.4		Pass	Section 7.4
FCC Section 15.250(d)(3)	Peak Power within 50 MHz Bandwidth	Refer to Section 7.5		Pass	Section 7.5
FCC Section 15.207	AC Conducted Emission	Refer to Section 7.6	Conducted	N/A	Section 7.6

Notes:

- 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.
- 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 and Operation Frequency Range Measurement

7.2.1. Test Limit

The -10 dB bandwidth of a device operating under the provisions of this section must be contained within the 5925-7250 MHz band under all conditions and the fundamental emission shall be at least 50 MHz.

7.2.2. Test Procedure used

ANSI C63.10-2013, section 10.1

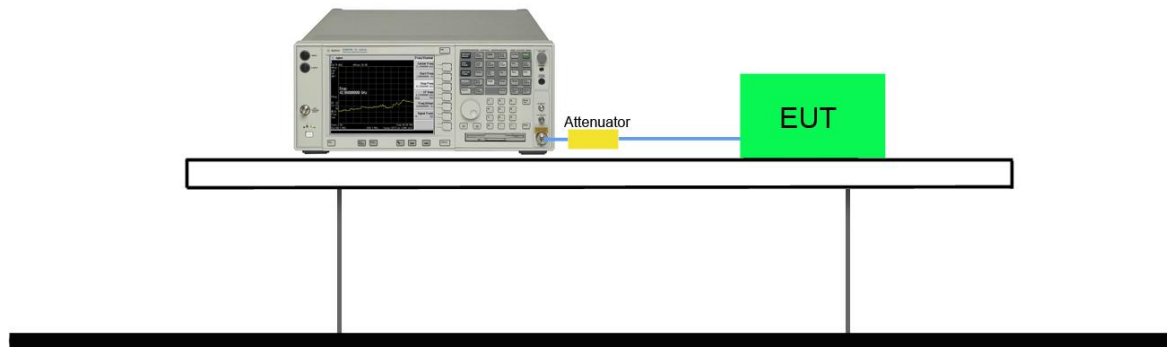
7.2.3. Test Setting

The frequency at which the maximum power level is measured with the peak detector is designated f_M . The peak power measurements shall be made using a spectrum analyzer or EMI receiver with a 1 MHz resolution bandwidth and a video bandwidth of 1 MHz or greater. The instrument shall be set to peak detection using the maximum-hold trace mode. The outermost 1 MHz segments above and below f_M , where the peak power falls by 10 dB relative to the level at f_M , are designated as f_H and f_L , respectively:

- a) For the lowest frequency bound f_L , the emission is searched from a frequency lower than f_M that has, by inspection, a peak power much lower than 10 dB less than the power at f_M and increased toward f_M until the peak power indicates 10 dB less than the power at f_M . The frequency of that segment is recorded.
- b) This process is repeated for the highest frequency bound f_H , beginning at a frequency higher than f_M that has, by inspection, a peak power much lower than 10 dB below the power at f_M . The frequency of that segment is recorded.
- c) The two recorded frequencies represent the highest f_H and lowest f_L bounds of the UWB transmission, and the -10 dB bandwidth ($B - 10$) is defined as $(f_H - f_L)$. The center frequency (f_c) is mathematically determined from $(f_H - f_L) / 2$.
- d) The fractional bandwidth is defined as $2(f_H - f_L) / (f_H + f_L)$.
- e) Determine whether the -10 dB bandwidth ($f_H - f_L$) is ≥ 500 MHz, or whether the fractional bandwidth $2(f_H - f_L) / (f_H + f_L)$ is ≥ 0.2 .

7.2.4.Test Setup

Spectrum Analyzer



7.2.5.Test Result

Product	Remote Controller	Temperature	25°C
Test Engineer	Roy Cheng	Relative Humidity	60%
Test Site	TR3	Test Date	2017/11/21
Test Item	-10dB Occupied Bandwidth & Operation Frequency Range		

Voltage (%)	Power (VDC)	Temp (°C)	-10dB Bandwidth (MHz)				Operation Frequency Range (MHz)	
			0min	2 min	5 min	10 min	Lower (Min)	Upper (Max)
100%	3.70	- 30	661.50	690.00	731.25	774.00	6199.85	6863.85
		- 20	633.75	678.00	681.00	690.00	6147.60	6828.60
		- 10	627.00	665.25	673.50	688.50	6144.60	6833.10
		0	667.50	672.75	674.25	688.50	6149.10	6837.60
		+ 10	677.25	684.75	687.00	687.75	6146.10	6833.85
		+ 20 (Ref)	651.00	657.00	666.00	693.75	6138.60	6832.35
		+ 30	630.75	639.75	663.00	672.00	6147.60	6819.60
		+ 40	654.00	679.50	695.25	733.50	6110.10	6843.60
		+ 50	671.25	673.50	681.00	687.75	6147.60	6835.35
115%	4.26	+ 20	591.75	672.00	684.00	693.75	6139.35	6833.10
85%	3.15	+ 20	662.25	663.75	666.75	669.00	6145.35	6814.35

Note 1: All the test result of -10dB Bandwidth is greater than 50MHz and meet with FCC rule.

Note 2: All the test result of Operation Frequency Range is within the 5925-7250 MHz and meet with FCC rule.

7.3. Radiated Spurious Emission Measurements Below 960MHz

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

7.3.2. Test Procedure Used

ANSI C63.10-2013, sections 10.2, 10.3

7.3.3. Test Setting

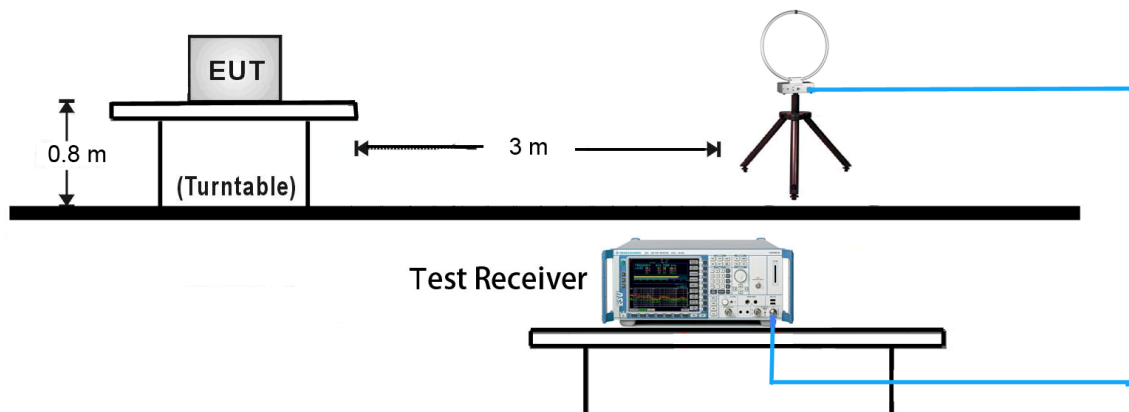
1. RBW = as specified in Table 1
2. VBW $\geq$ 3 RBW
3. Sweep Detector = peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize and record the test result with Table 1 measurement detector.

Table 1 - RBW as a function of frequency

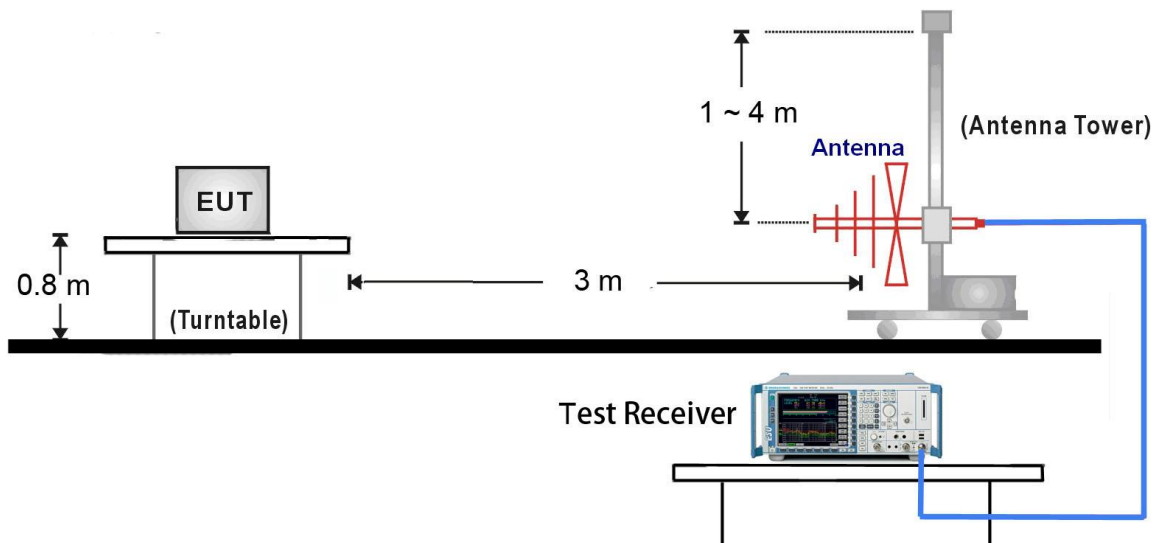
Frequency	RBW	Measurement Detector
9 ~ 150 kHz	200 ~ 300 Hz	Peak or CISPR quasi-peak
0.15 ~ 30 MHz	9 ~ 10 kHz	Peak or CISPR quasi-peak
30 ~ 1000 MHz	100 ~ 120 kHz	CISPR quasi-peak

7.3.4.Test Setup

9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



7.3.5.Test Setup

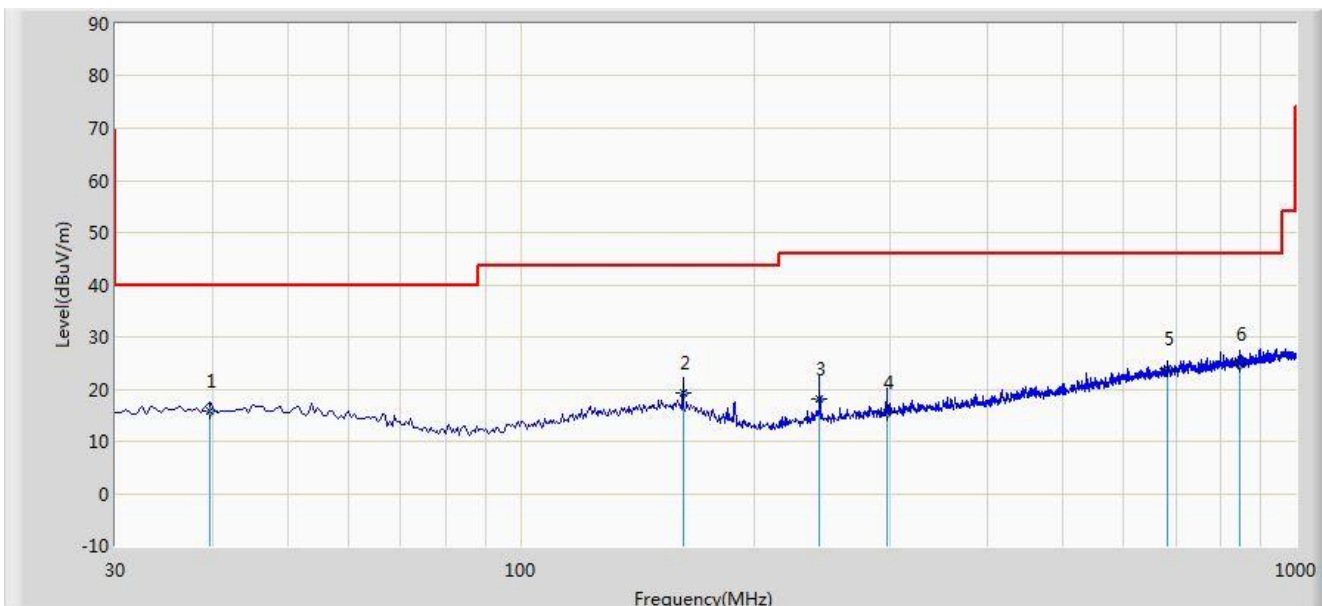
Product	Remote Controller	Temperature	25°C
Test Engineer	Roy Cheng	Relative Humidity	60%
Test Site	AC1	Test Date	2017/08/06
Test Item	Radiated Spurious Emission Measurements Below 960MHz		

Frequency (MHz)	Equivalent field strength in MHz (dBμv/m)	Limit in MHz (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 at 6489MHz	



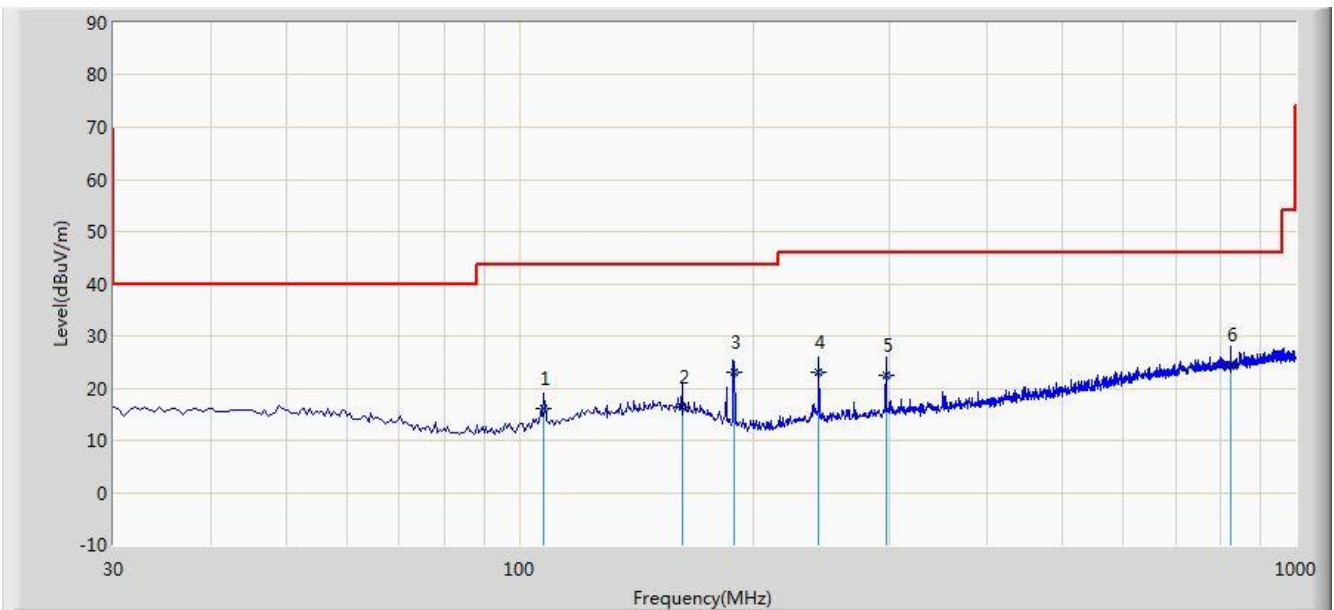
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			39.700	15.849	1.291	-24.151	40.000	14.558	QP
2			161.920	19.321	4.298	-24.179	43.500	15.023	QP
3			242.915	18.079	5.292	-27.921	46.000	12.787	QP
4			296.750	15.470	1.298	-30.530	46.000	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 (dBuV/m) = Reading Level (dBuV) + 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 at 6489MHz	



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 (dBuV/m) = Reading Level (dBuV) + 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.

7.4. Radiated Spurious Emission Measurements Above 960MHz

7.4.1. Test Limit

Radiated emission average limits above 960MHz			
Frequency [MHz]	RBW [kHz]	EIRP of spurious [dBm]	Equivalent field strength limit @ 1m [dB(μV/m)]
960 - 1610	1000	-75.3	29.4
1610 - 1990	1000	-63.3	41.4
1990 - 3100	1000	-61.3	43.4
3100 - 5925	1000	-51.3	53.4
5925 - 7250	1000	-41.3	63.4
7250-10600	1000	-51.3	53.4
Above 10600	1000	-61.3	43.4
Radiated emission average limits in GPS Band			
1164 - 1240	≥ 1	-85.3	19.4
1559 - 1610	≥ 1	-85.3	19.4

Note 1: Because the limits are so low, some bands may have been scanned at a distance closer than 1 meter. If any emissions were detected in these bands, final measurements were made at distance of 1 meter or greater. The actual distance for final measurement was indicated in the measurement data.

Note 2: Equivalent field strength limit @ 1m = EIRP of spurious[dBm] + 95.2 + 20*log(3m/1m)

7.4.2. Test Procedure Used

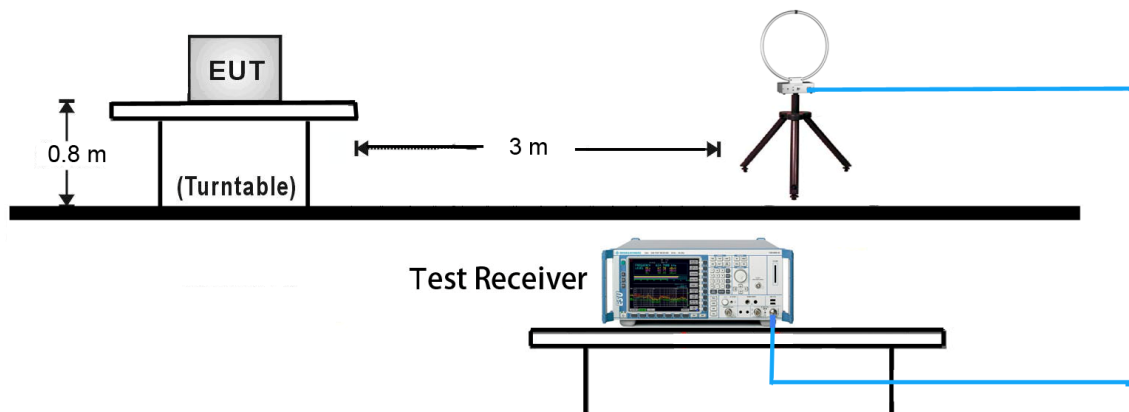
ANSI C63.10-2013, sections 10.2, 10.3

7.4.3. Test Setting

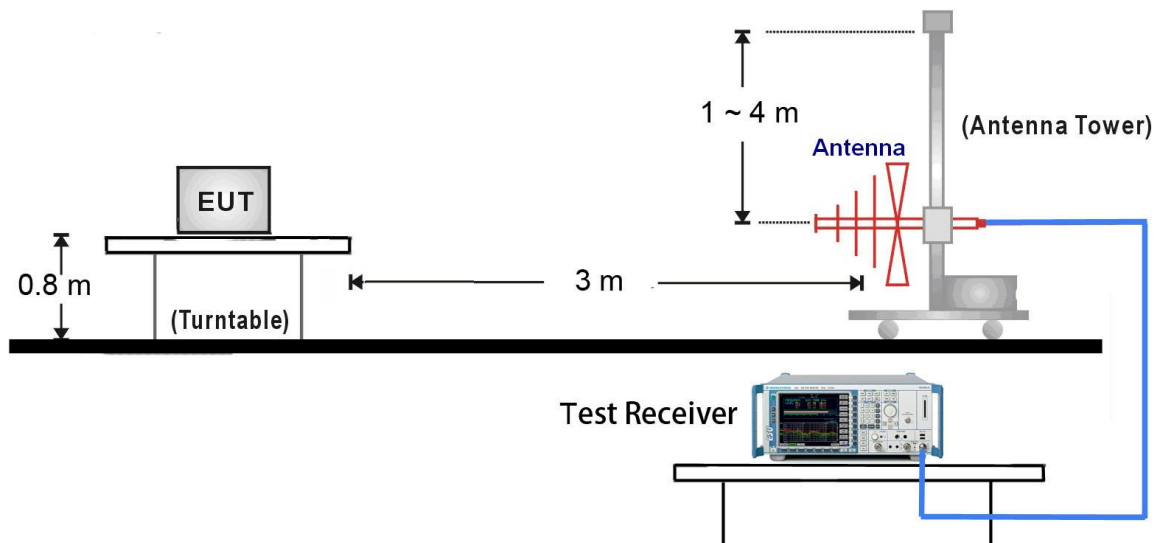
The rms detector is selected, make the trace to max hold and the sweep time and number of measurement bins are set to provide the requisite 1 ms integration time. In this test, the RBW may be reduced to a minimum of 1 kHz (30 kHz is recommended) to enhance the resolution of the individual spectral lines. A ratio of VBW / RBW > 3 shall be maintained when possible.

7.4.4. Test Setup

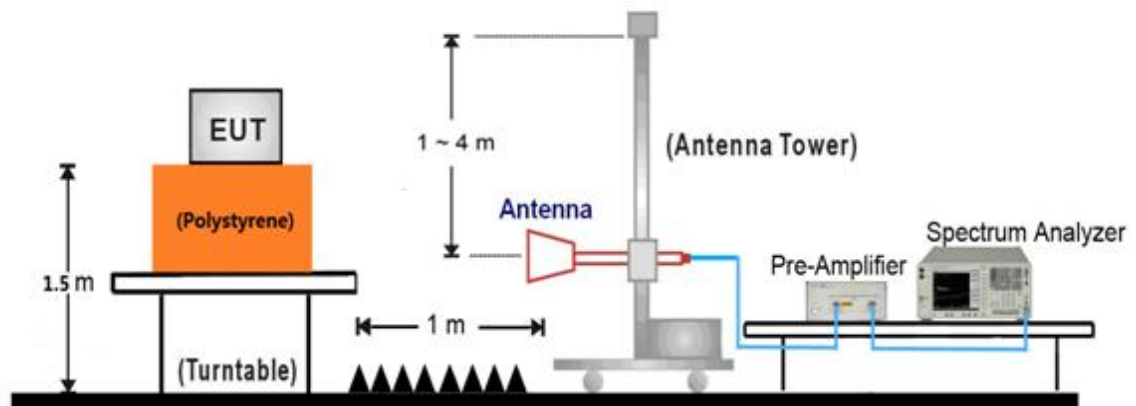
9kHz ~ 30MHz Test Setup:



30MHz ~ 1GHz Test Setup:



1GHz ~ 40GHz Test Setup:



7.4.5. Test Result

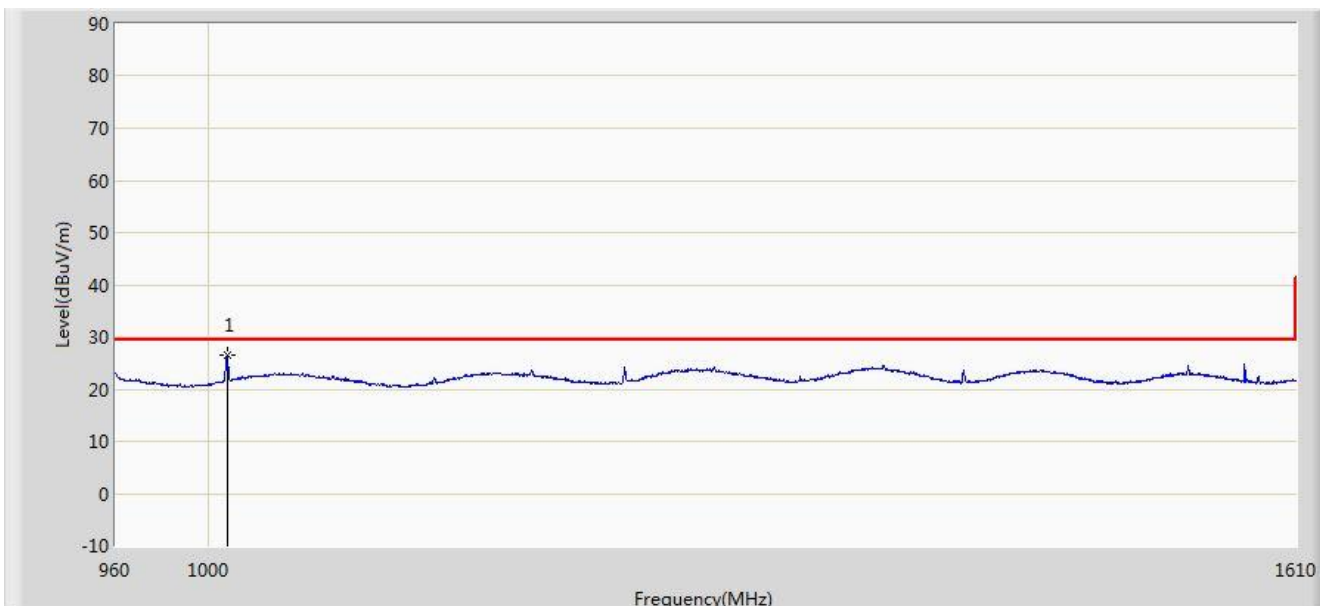
Product	Remote Controller	Temperature	25°C
Test Engineer	Roy Cheng	Relative Humidity	60%
Test Site	AC1	Test Date	2017/08/06
Test Item	Radiated Spurious Emission Measurements above 960MHz		

Frequency Range (MHz)	Equivalent field strength in MHz (dBμv/m)	Limit in MHz (dBμv/m)	Margin (dB)	Polarity	Verdict
960 ~ 1610	26.47	29.40	-2.93	Horizontal	Pass
	24.15	29.40	-5.25	Vertical	Pass
1610 ~ 1990	23.09	41.40	-18.31	Horizontal	Pass
	23.09	41.40	-18.31	Vertical	Pass
1990 ~ 3100	25.34	43.40	-18.06	Horizontal	Pass
	30.78	43.40	-12.62	Vertical	Pass
3100 - 5925	27.21	53.40	-26.19	Horizontal	Pass
	27.28	53.40	-26.12	Vertical	Pass
5925 - 7250	50.79	63.40	-12.61	Horizontal	Pass
	52.24	63.40	-11.16	Vertical	Pass
7250-10600	35.89	53.40	-17.51	Horizontal	Pass
	35.87	53.40	-17.53	Vertical	Pass
Above 10600	40.94	43.40	-2.46	Horizontal	Pass
	41.17	43.40	-2.23	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 - 19:42
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

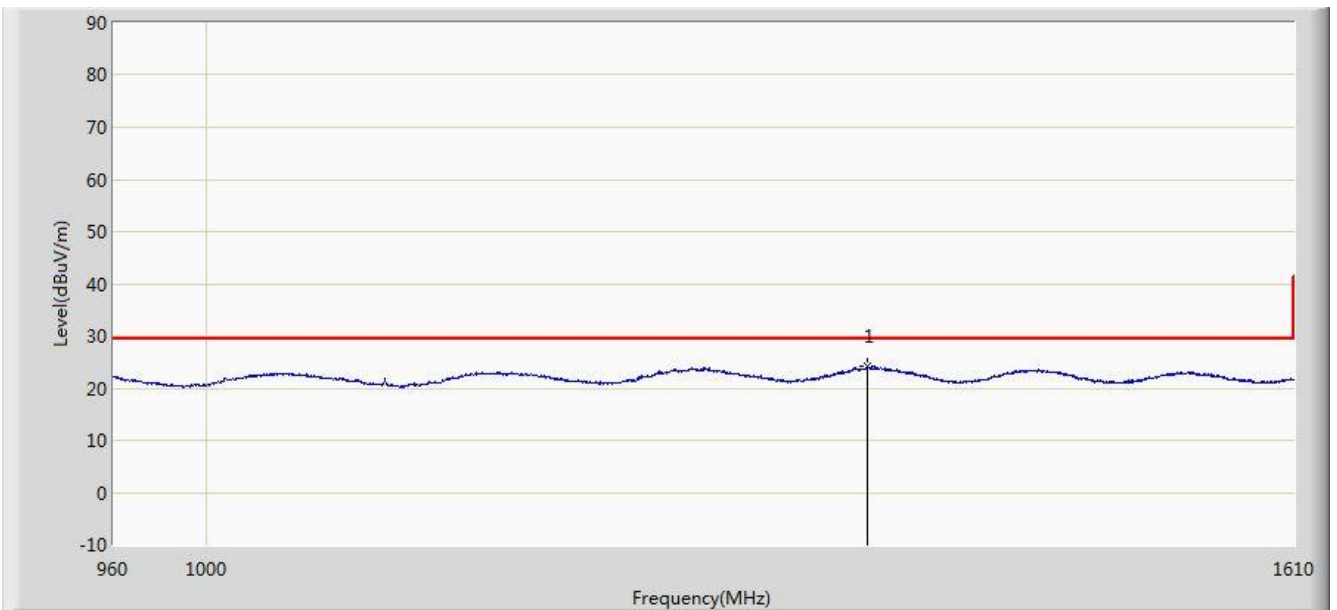


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1008.100	26.467	37.682	-2.933	29.400	-11.214	AV

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

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

Site: AC1	Time: 2017/08/06 - 19:48
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

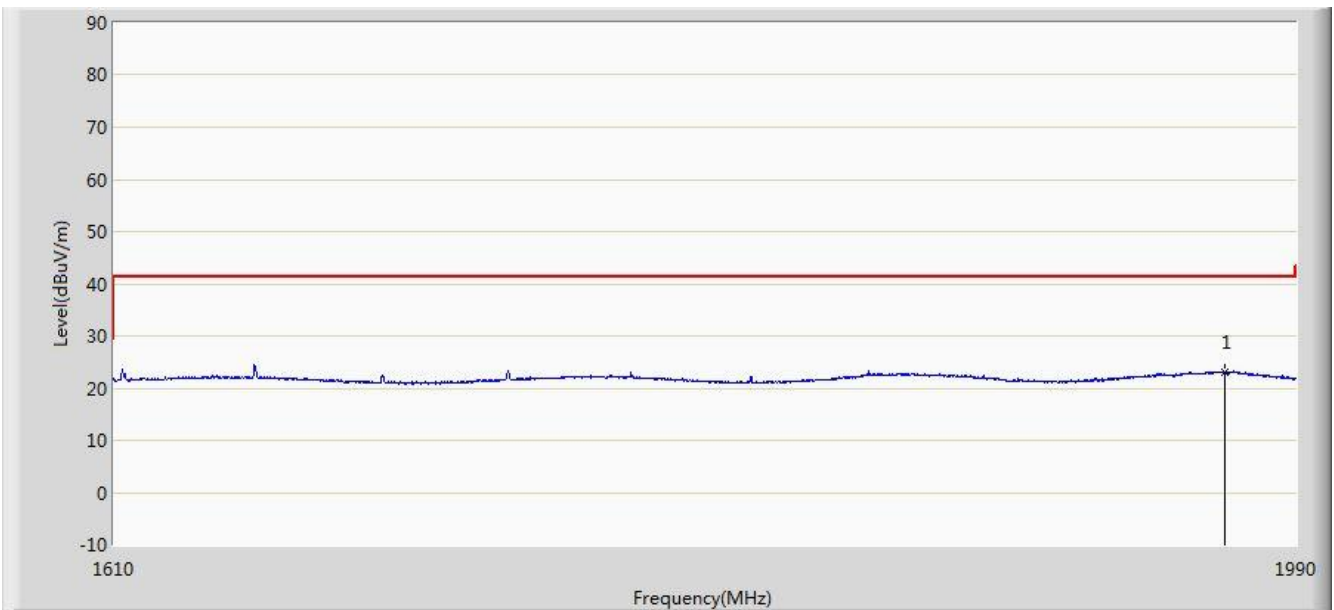


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1335.375	24.153	32.129	-5.247	29.400	-7.976	AV

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

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

Site: AC1	Time: 2017/08/06 - 19:52
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

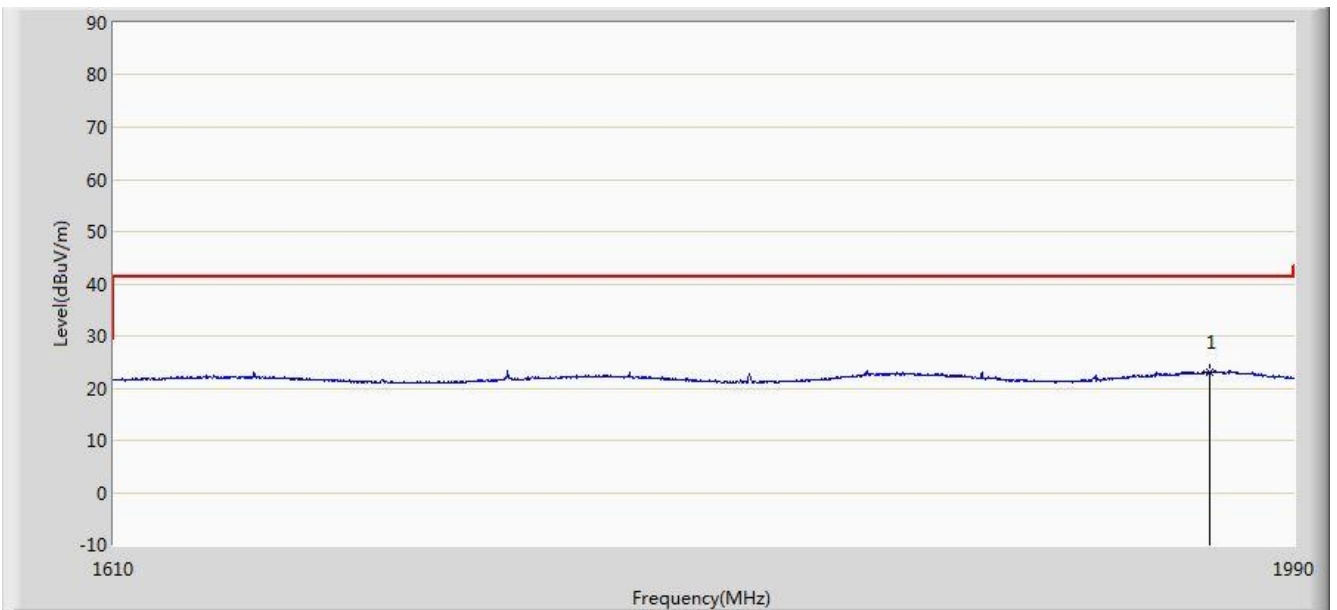


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1964.920	23.086	29.031	-18.314	41.400	-5.944	AV

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

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

Site: AC1	Time: 2017/08/06 - 19:55
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

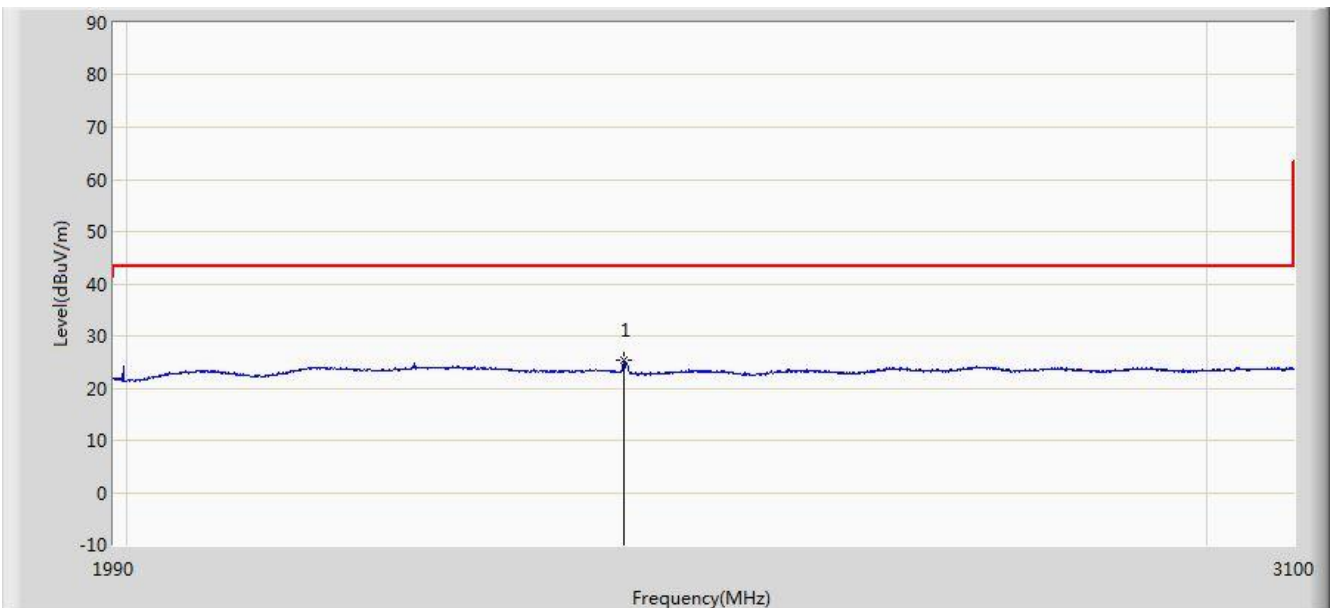


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1959.980	23.094	29.066	-18.306	41.400	-5.972	AV

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

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

Site: AC1	Time: 2017/08/06 - 19:59
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

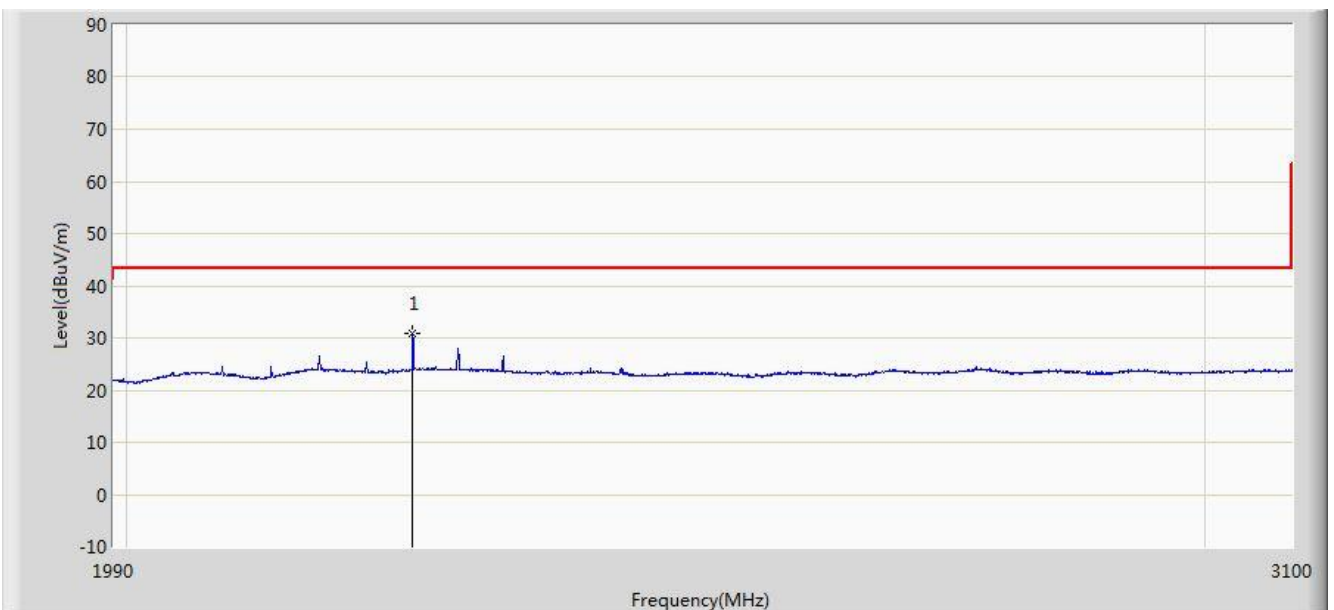


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2410.690	25.428	29.189	-17.972	43.400	-3.760	AV

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

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

Site: AC1	Time: 2017/08/06 - 20:01
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

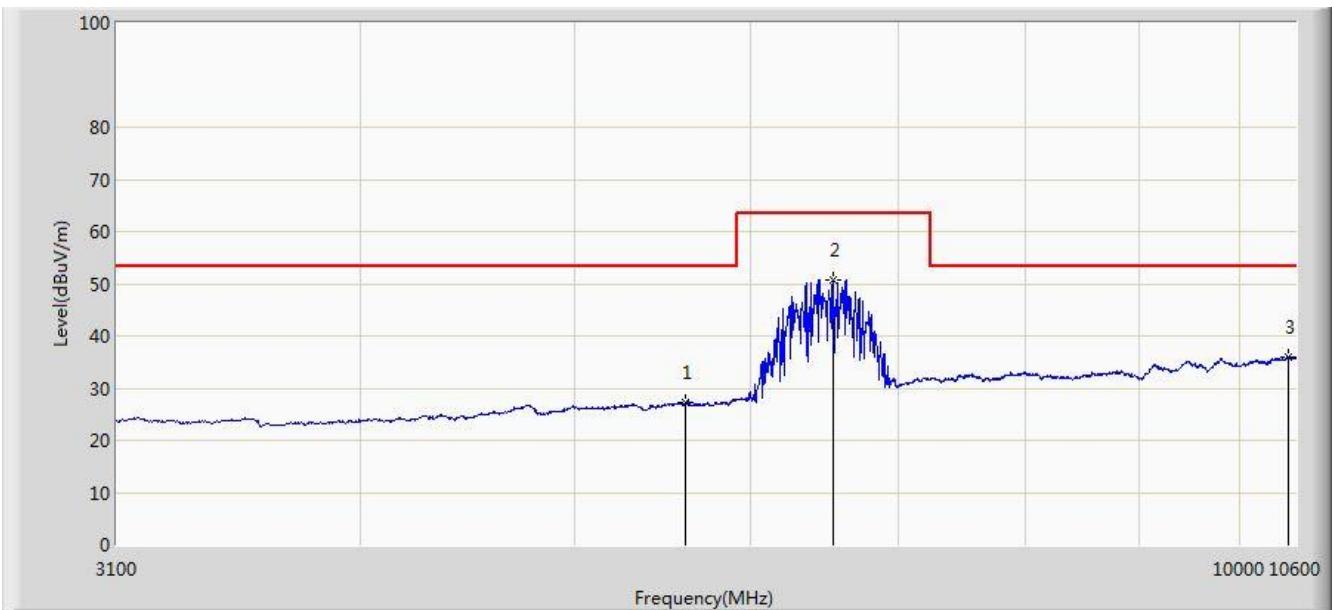


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2226.985	30.776	34.297	-12.624	43.400	-3.521	AV

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

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

Site: AC1	Time: 2017/08/06 - 20:05
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

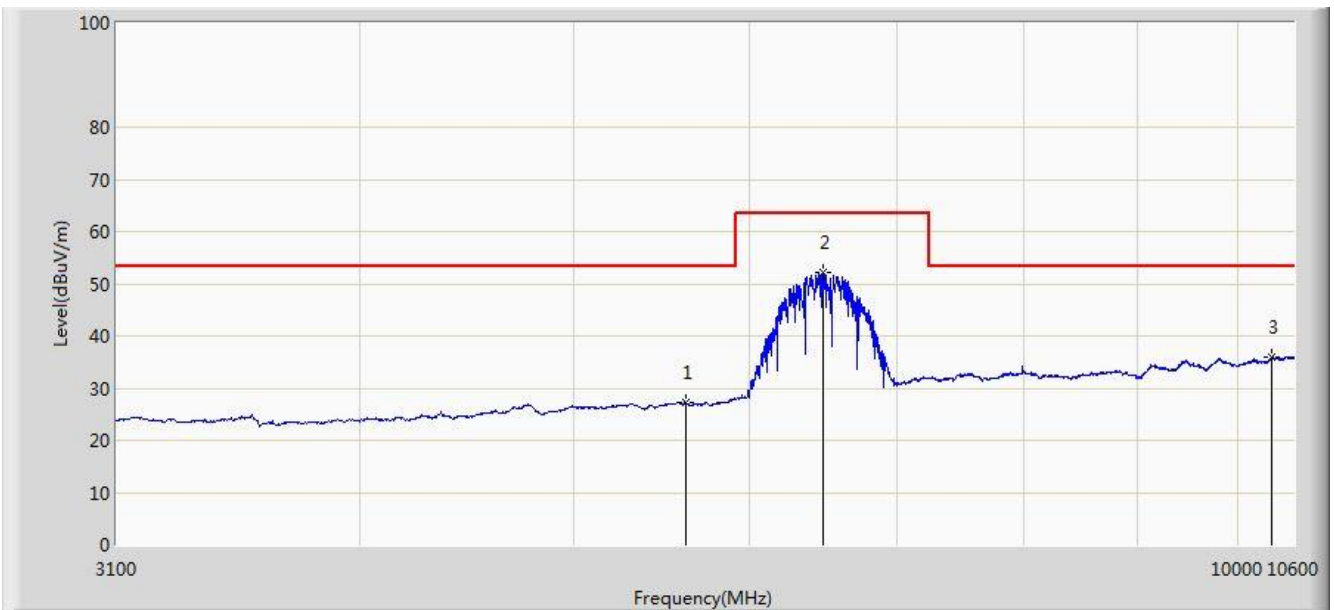


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			5612.500	27.208	23.688	-26.192	53.400	3.520	AV
2		*	6489.250	50.789	44.859	-12.611	63.400	5.930	AV
3			10517.500	35.890	23.444	-17.510	53.400	12.445	AV

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

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

Site: AC1	Time: 2017/08/06 - 20:09
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

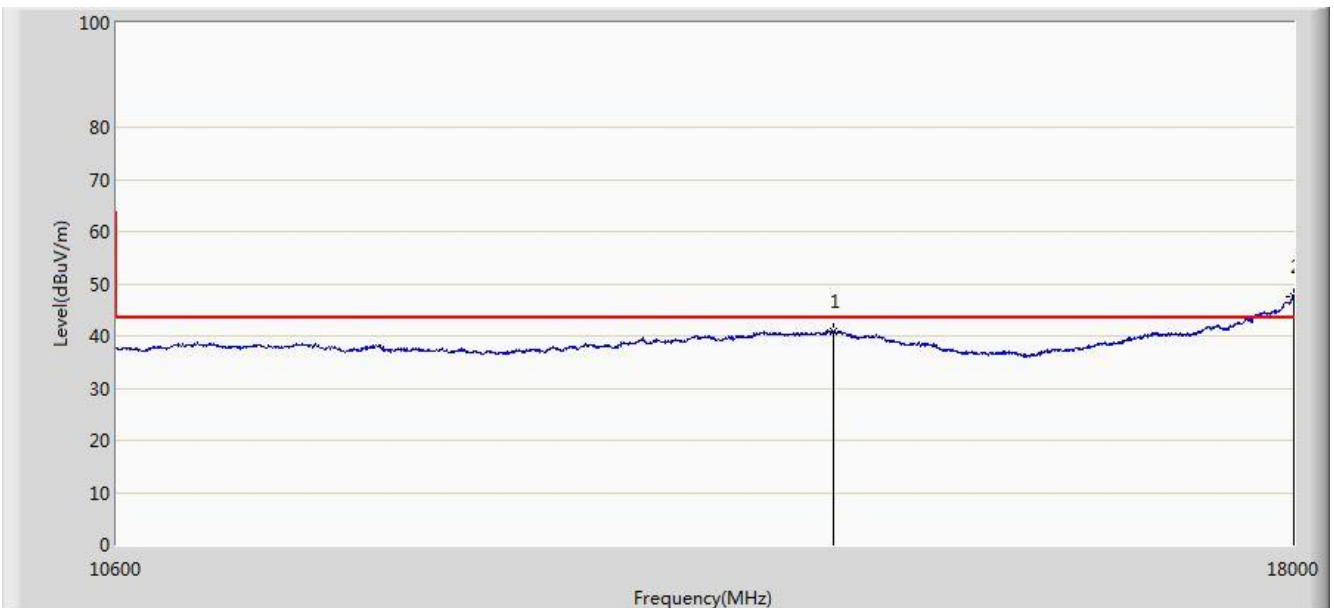


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			5616.250	27.276	23.746	-26.124	53.400	3.530	AV
2		*	6486.250	52.244	46.363	-11.156	63.400	5.881	AV
3			10363.750	35.870	23.691	-17.530	53.400	12.179	AV

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

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

Site: AC1	Time: 2017/08/06 - 20:17
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	



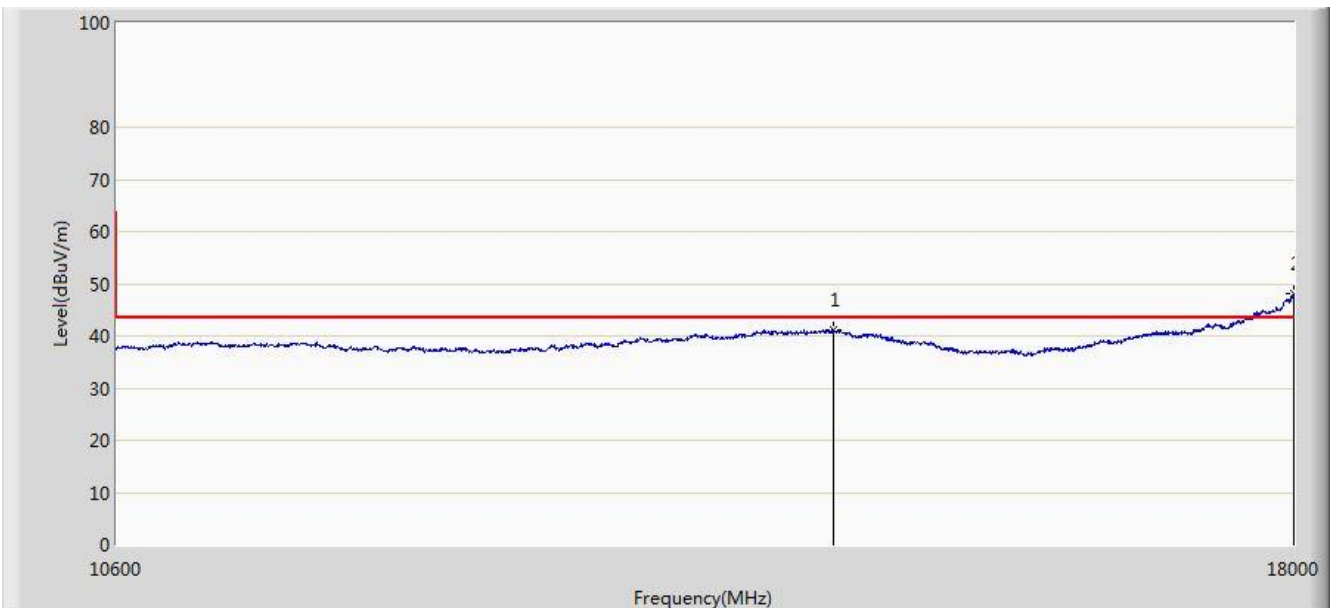
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			14636.700	40.935	33.059	-2.465	43.400	7.876	AV
2		*	18000.000	47.527	33.204	N/A	N/A	14.323	AV

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

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

Note 2: The test plot of this frequency range was base noise unrelated to the UWB transmission. We had reduced the RBW to assess this frequency range.

Site: AC1	Time: 2017/08/06 - 21:25
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	



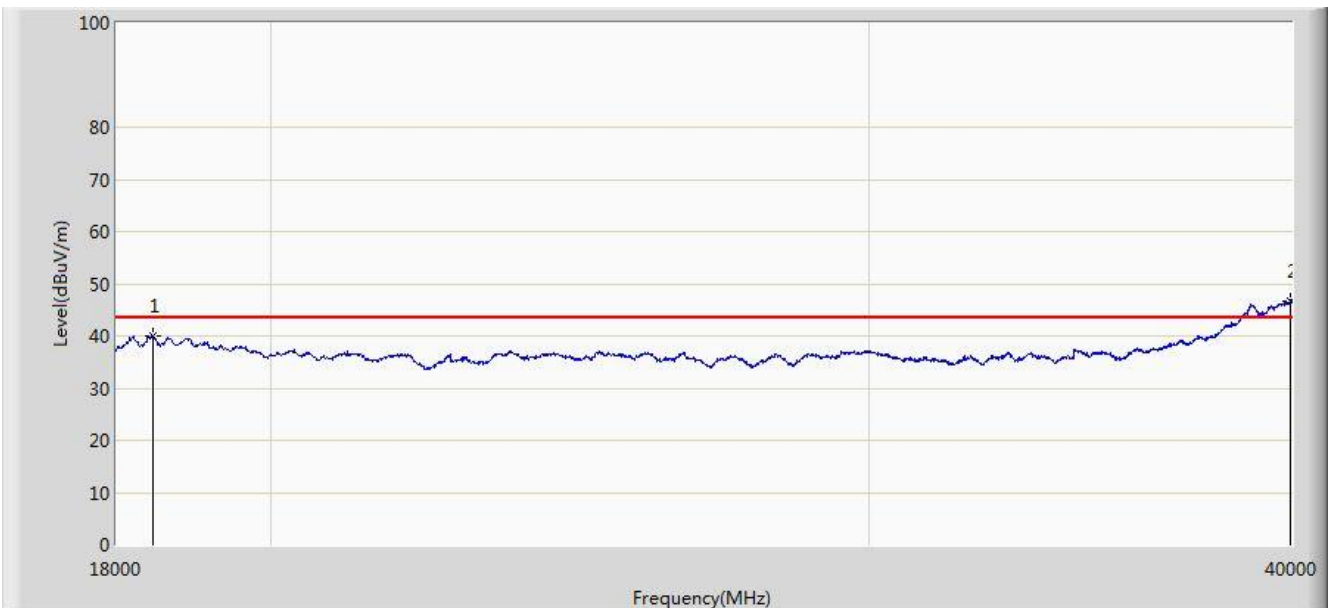
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			14629.300	41.168	33.290	-2.232	43.400	7.878	AV
2		*	18000.000	47.993	33.670	N/A	N/A	14.323	AV

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

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

Note 2: The test plot of this frequency range was base noise unrelated to the UWB transmission. We had reduced the RBW to assess this frequency range.

Site: AC1	Time: 2017/08/06 - 21:35
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9170_18-40GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	



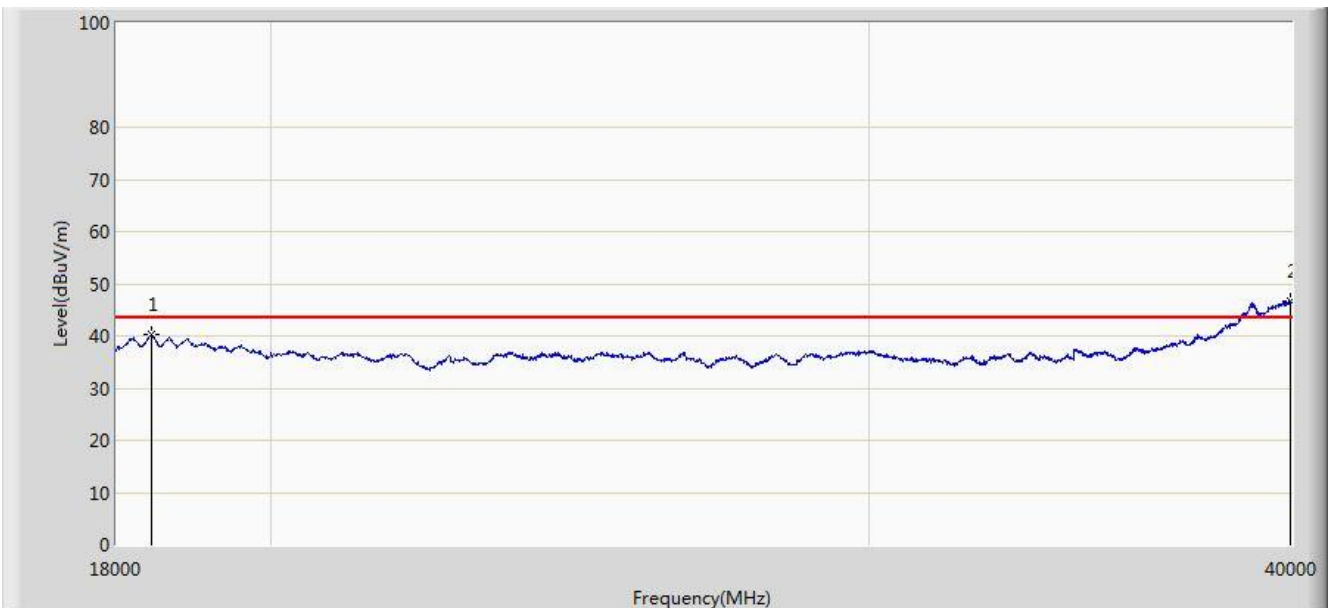
No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			18451.000	40.094	30.712	-3.306	43.400	9.382	AV
2		*	39978.000	46.772	27.885	N/A	N/A	18.887	AV

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

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

Note 2: The test plot of this frequency range was base noise unrelated to the UWB transmission. We had reduced the RBW to assess this frequency range.

Site: AC1	Time: 2017/08/06 - 21:36
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9170_18-40GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			18429.000	40.154	30.755	-3.246	43.400	9.399	AV
2		*	39978.000	46.716	27.829	N/A	N/A	18.887	AV

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

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

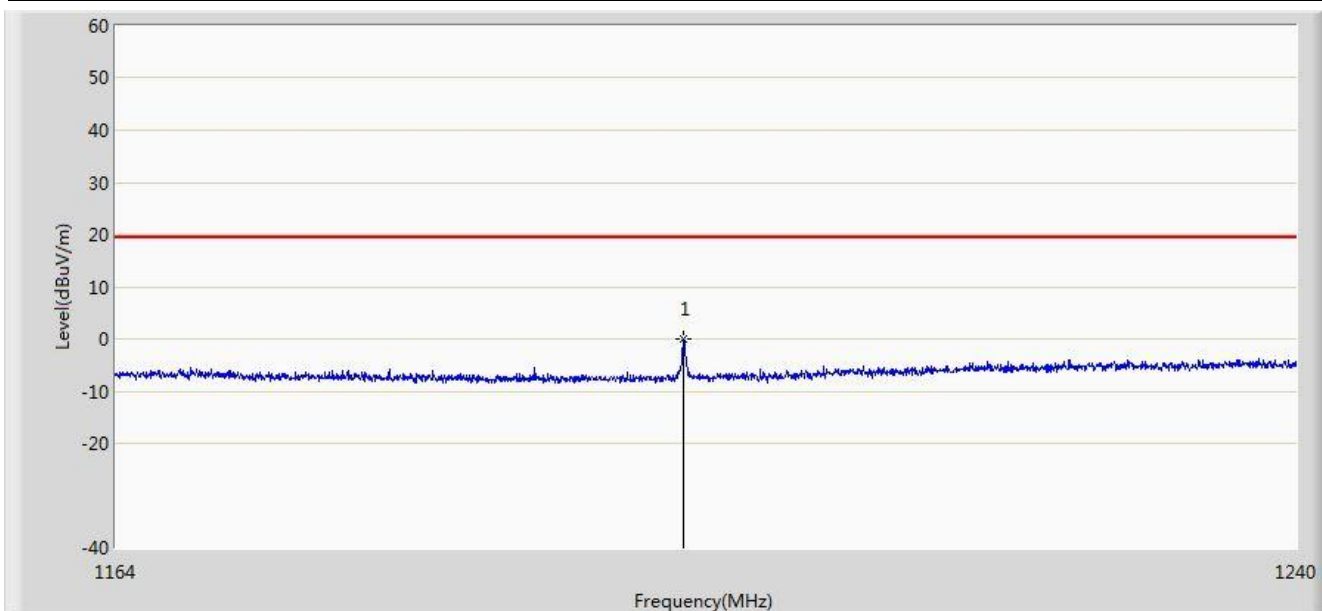
Note 2: The test plot of this frequency range was base noise unrelated to the UWB transmission. We had reduced the RBW to assess this frequency range.

Radiated Emission in GPS Receive Band Test Result Summary

Frequency (MHz)	Equivalent field strength in MHz (dB μ V/m)	Limit in MHz (dB μ V/m)	Margin (dB)	Polarity	Verdict
1164 ~ 1240	0.04	19.40	-19.36	Horizontal	Pass
	-3.50	19.40	-22.90	Vertical	Pass
1559 ~ 1610	6.36	19.40	-13.04	Horizontal	Pass
	-0.49	19.40	-19.89	Vertical	Pass

Note 1: The Margin = Equivalent field strength – Limit.
Note 2: The detail test plots have been showed as below.

Site: AC1	Time: 2017/08/07 - 10:54
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

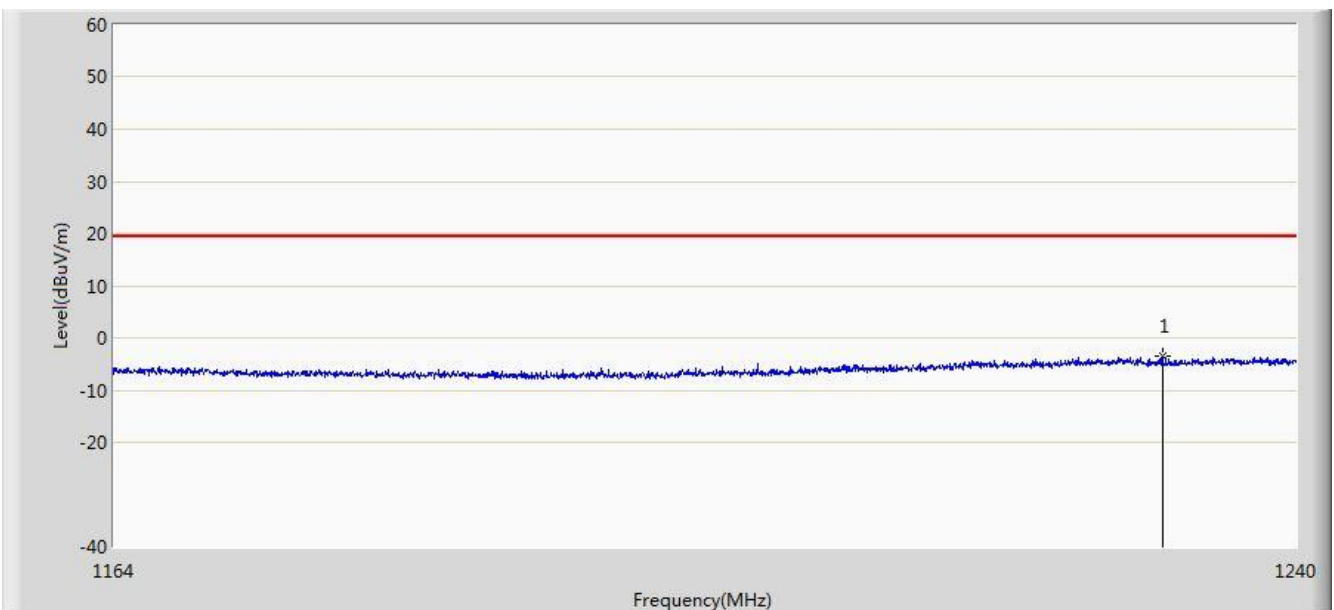


No	Flag	Mark	Frequency (MHz)	Measure Level (dB μ V/m)	Reading Level (dB μ V)	Over Limit (dB)	Limit (dB μ V/m)	Factor	Type
1		*	1199.986	0.040	9.260	-19.360	19.400	-9.221	AV

Note: Measure Level (dB μ V/m) = Reading Level (dB μ V) + Factor (dB)

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

Site: AC1	Time: 2017/08/07 - 11:04
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

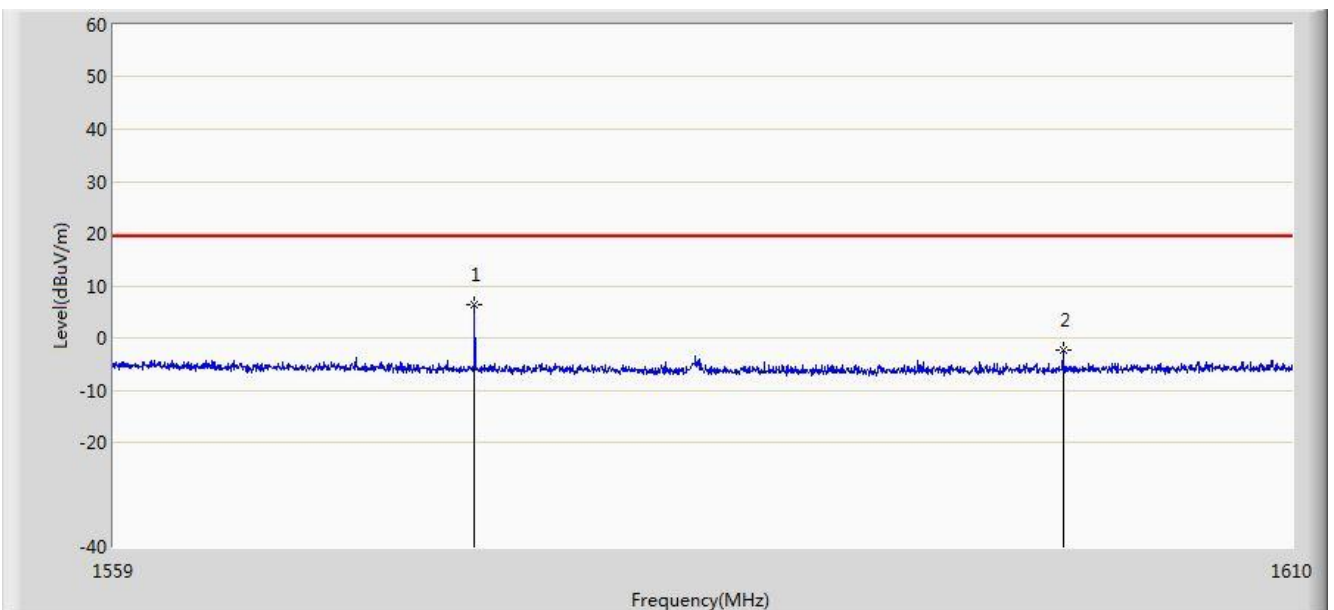


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1231.184	-3.502	5.278	-22.902	19.400	-8.780	AV

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

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

Site: AC1	Time: 2017/08/07 - 10:39
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	

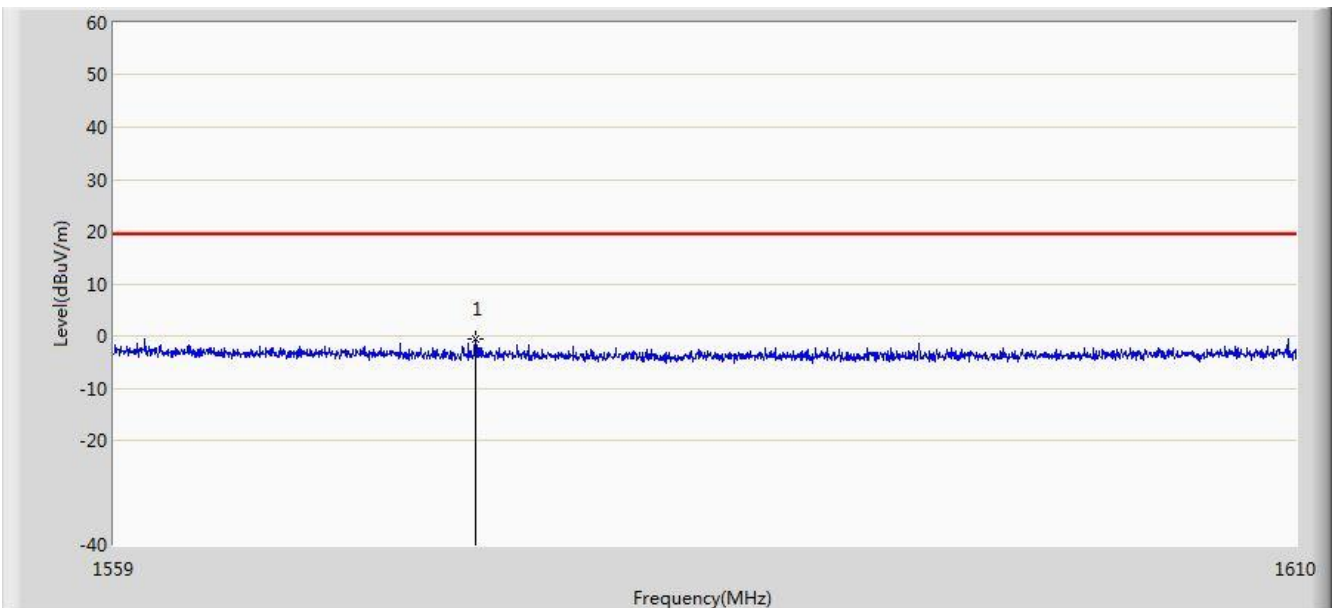


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1574.453	6.355	14.039	-13.045	19.400	-7.685	AV
2			1599.979	-2.385	5.307	-21.785	19.400	-7.691	AV

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

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

Site: AC1	Time: 2017/08/07 - 10:46
Limit: FCC_Part 15.250_RMS (1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Transmit at 6489MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	1574.453	-0.487	7.197	-19.887	19.400	-7.685	AV

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

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

7.5. Peak Power within 50 MHz bandwidth

7.5.1. Test Limit

This test was performed to measure effective radiated power emanated by transmitter at carrier frequency. Specification test limits are given in the following table.

Peak Power Limit (EIRP)

Assigned frequency band (MHz)	EIRP in 50MHz BW (dBm)	Equivalent field strength limit in MHz @ 1m (dBμv/m)
FCC section 15.250(d)(3)		
5925 ~ 7250	$20 \log^{(RBW/50)}$	70.74

Note 1: Because the limits are so low, some bands may have been scanned at a distance closer than 1 meter. If any emissions were detected in these bands, final measurements were made at distance of 1 meter or greater. The actual distance for final measurement was indicated in the measurement data.

Note 2: Peak power limit at 1m = $20 \cdot \log(1\text{MHz}/50\text{MHz}) + 95.2 + 20 \cdot \log(3\text{m}/1\text{m}) = 70.74\text{dB}\mu\text{v/m}$

7.5.2. Test Procedure Used

ANSI C63.10-2013, Section 10.3

7.5.3. Test Setting

Bandwidth conversion of peak power measurements

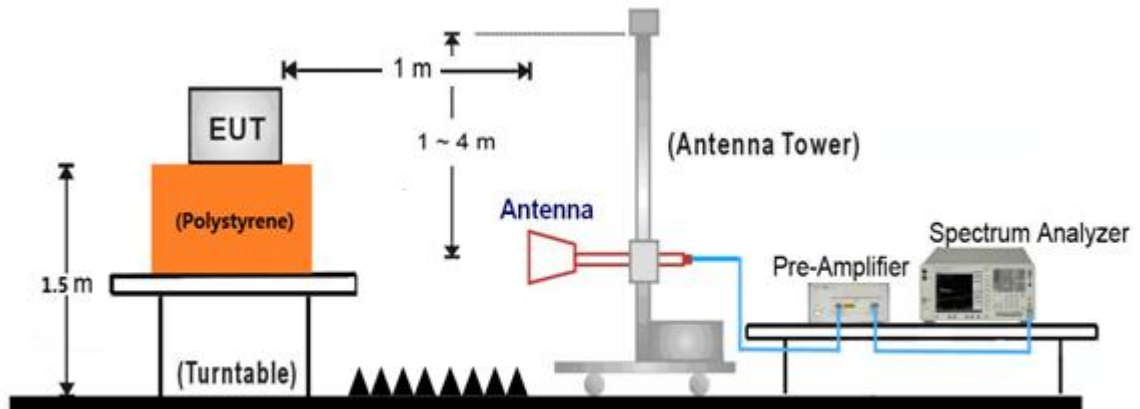
It is acceptable to employ an RBW(1MHz) of less than 50 MHz (but no less than 1 MHz) when performing the required peak power measurements. When this approach is employed, the peak emissions EIRP limit (0 dBm / 50 MHz) is converted to a limit commensurate with the RBW by employing a $[20 \log (RBW/50 \text{ MHz})]$ relationship. For example, the peak power limit could be expressed in a 1 MHz bandwidth as follows in Equation:

$$EIRP_{1\text{MHz}} = 20\log(1\text{MHz}/50\text{MHz}) \text{ dBm} = (-34\text{dB}) = -34\text{dBm}$$

When a resolution bandwidth of less than 50 MHz is used, this measurement shall be performed over a 50 MHz span centered on the frequency associated with the highest detected average emission level.

7.5.4. Test Setup

1GHz ~ 40GHz Test Setup:



7.5.5. Test Result

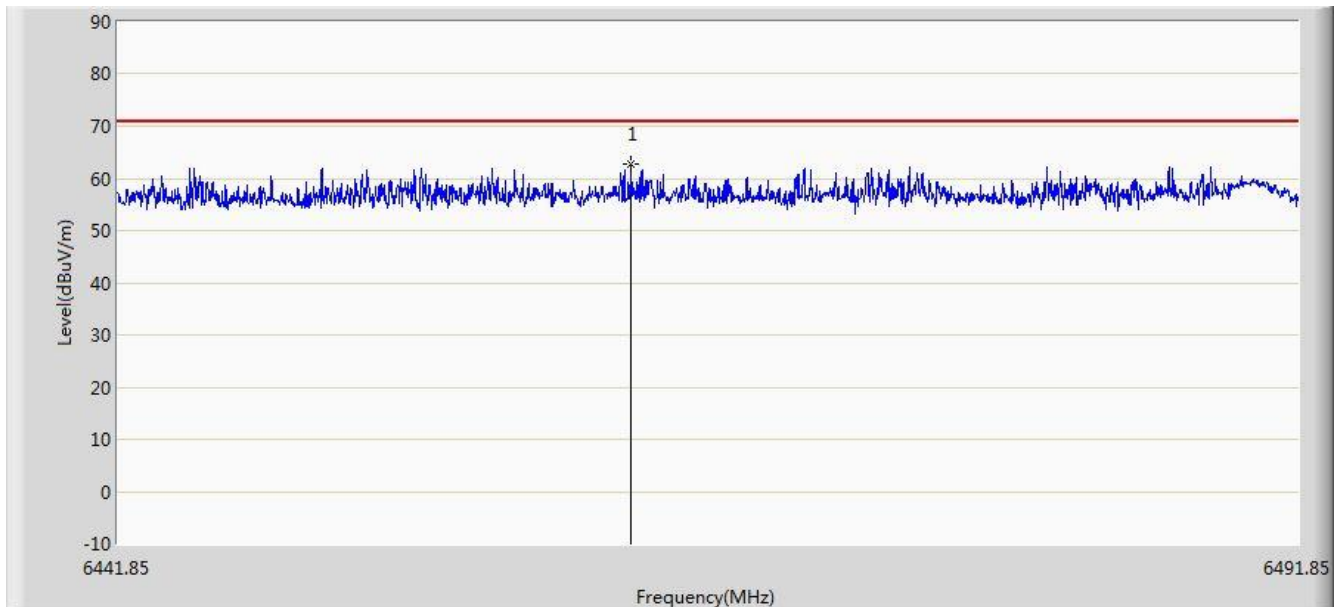
Product	Remote Controller	Temperature	25°C
Test Engineer	Roy Cheng	Relative Humidity	60%
Test Site	AC1	Test Date	2017/08/07
Test Item	Peak Power within 50MHz BW		

Frequency (MHz)	Equivalent field strength in MHz (dBμv/m)	Limit in MHz (dBμv/m)	Margin (dB)	Polarity	Verdict
6463.55	62.68	70.74	-8.06	Horizontal	Pass
6260.15	65.35	70.74	-5.39	Vertical	Pass

Note 1: The Margin = Equivalent field strength – Limit.

Note 2: The detail test plots have been showed as below.

Site: AC1	Time: 2017/08/07 - 01:15
Limit: FCC_Part 250_(1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Remote Controller	Power: By Battery
Note: Bandwidth conversion of peak power measurements	

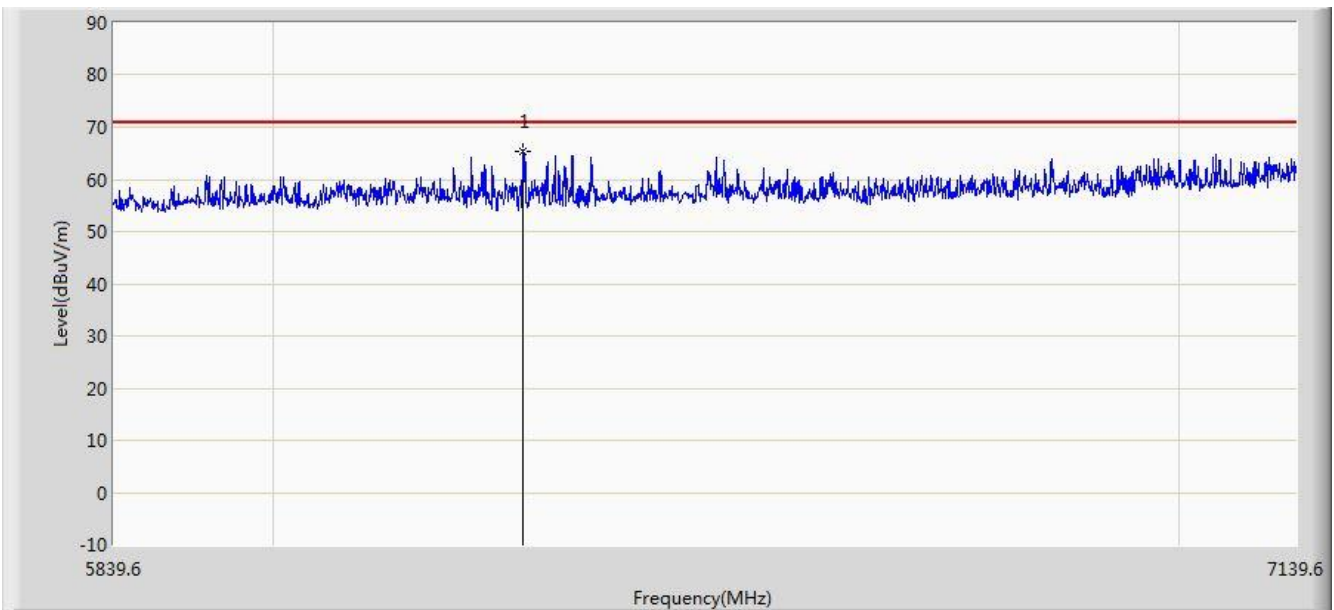


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	6463.550	62.681	56.896	-8.059	70.740	5.786	PK

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

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

Site: AC1	Time: 2017/08/07 - 01:12
Limit: FCC_Part 250_(1m)	Engineer: Will Yan
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Remote Controller	Power: By Battery
Note: Bandwidth conversion of peak power measurements	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	6260.150	65.354	60.579	-5.386	70.740	4.776	PK

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

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

7.6. AC Conducted Emissions Measurement

7.6.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

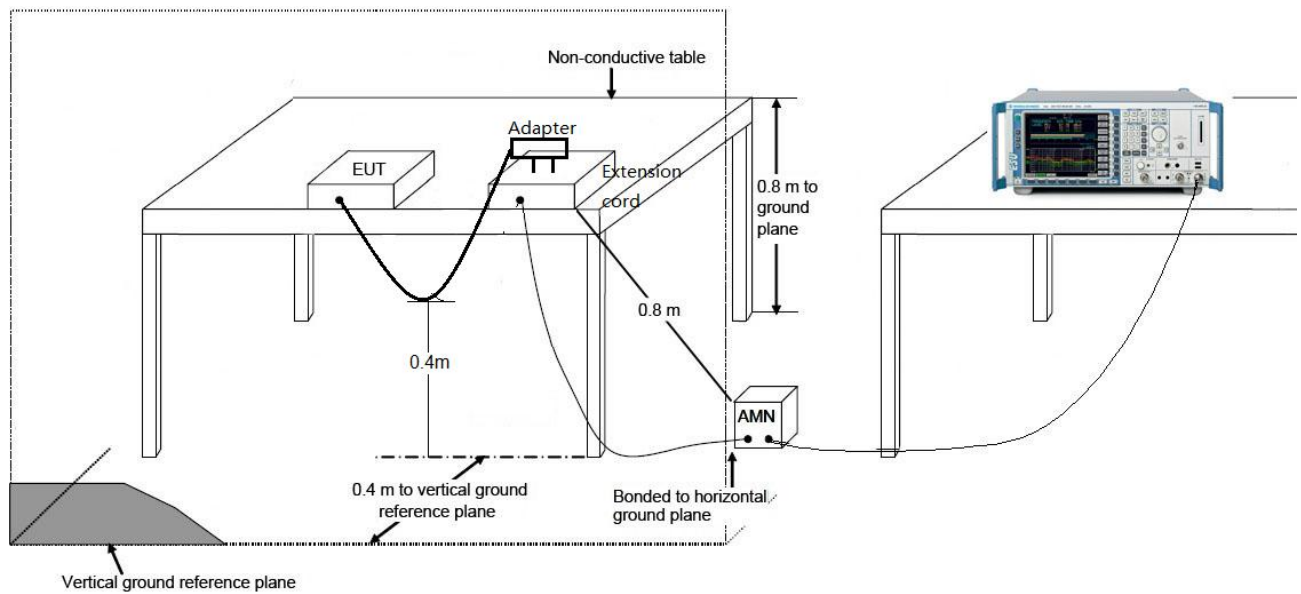
7.6.2. Test Procedure Used

FCC Part 15 Subpart C Paragraph 15.207

7.6.3. Test Setting

The radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

7.6.4.Test Setup



7.6.5.Test Result

Note applicable with battery supply.

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 15.250 of the FCC Rules.

The End