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Report No.: 1806RSU032-J1
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MEASUREMENT REPORT

2.4GHz Band Wide-Band Low-Power Data Communication System

Applicant: Pico Technology Co., Ltd.

Address: Room 2101, Shining Tower, No.35 Xueyuan Road, HaiDian District, Beijing, The People's Republic of China

Product: Motion Controller

Model No.: C1510

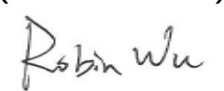
Brand Name: Pico

Standards: ARIB STD-T66 v3.7

Result: Complies

Test Date: June 28 ~ July 08, 2018

Reviewed By : 
(Jame Yuan)

Approved By : 
(Robin Wu)



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 ARIB STD-T66. 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
1803RSU032-J1	Rev. 01	Initial report	07-10-2018	Valid

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§2.1033 General Information

Applicant:	Pico Technology Co., Ltd.
Applicant Address:	Room 2101, Shining Tower, No.35 Xueyuan Road, HaiDian District, Beijing, The People's Republic of China
Manufacturer:	Pico Technology Co., Ltd.
Manufacturer Address:	Room 2101, Shining Tower, No.35 Xueyuan Road, HaiDian District, Beijing, The People's Republic of China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Rule Part(s):	MIC Notice No.88 Annex 43
Model Name:	C1510
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-20025, G-20034, C-20020, T-20020) 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 Ministry of Internal Affairs and Communications.

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. Equipment Description

Product Name	Motion Controller
Model No.	C1510
Brand Name:	
Bluetooth Version:	v4.2 single mode

2.2. Product Specification Subjective to this Report

Frequency Range	2402~2480MHz
Channel Number	40
Type of Modulation	FHSS
Channel Spacing	2MHz
Data Rate	1Mbps(GFSK)
Antenna Type:	FPC Antenna
Antenna Gain	1.51dBi
Declared Output Power	1.00mW

2.3. Opreation Frequency / Channel List

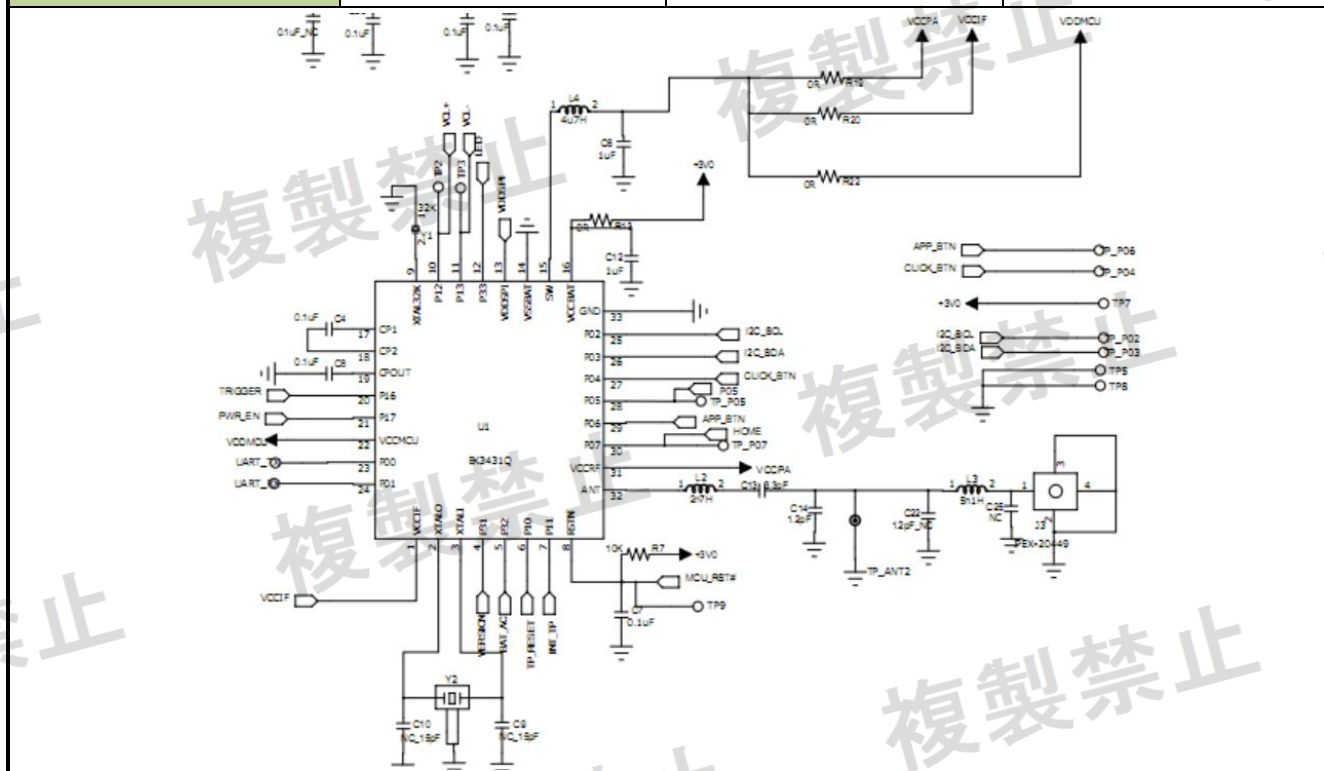
Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

2.4. Test Configuration

The **Motion Controller Model No.: C1510** was tested per the guidance of ARIB STD-T66.

The change of the measured voltage at the radio part of the EUT is below $\pm 1\%$, when input voltage from external power supply to the equipment under test is varied by $\pm 10\%$, thus the RF test is tested at rated voltage only.

Extreme Voltage	3V	3.3V	2.7V
Measure Voltage	3.3V	3.28V	3.31V
Tolerance	-	-0.61%	0.30%



2.5. Test Mode

Test Mode	Mode 1: Transmit by BLE
	Mode 2: Receive by BLE

2.6. Test Software

The test utility software used during testing was “Beken BLE RF Test”, and the version was “1.0”.

3. TEST EQUIPMENT CALIBRATION DATE

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2019/04/20
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2018/12/08
ESG Vector Signal Generator	Agilent	E4438C	MRTSUE06026	1 year	2018/12/06
Programmable Temperature & Humidity Chamber	BAOYT	BYH-1500L	MRTSUE06051	1 year	2018/12/06
Thermohygrometer	YuhuaZe	608-H1	MRTSUE06401	1 year	2018/08/14

Note: All equipments are calibrated by China Ceprei Laboratory, which is the body that the calibration conducted in countries except Japan, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).

4. MEASUREMENT UNCERTAINTY

Conducted Test Item
The maximum measurement uncertainty is defined as: ± 1.127 dB.

5. TEST RESULT

5.1. Summary

Company Name: Pico Technology Co., Ltd.
Product Name: Motion Controller
Method/System: Frequency Hopping Spread Spectrum (FHSS)
Number of Channels: 40

Test Description	Test Limit	Test Condition	Test Result	Reference
Output Power	10mW or less	Conducted	Pass	Section 5.2
Output Power Tolerance	+20% to - 80%		Pass	
E.I.R.P	12.14dBm		Pass	
Spread Bandwidth	≥ 500KHz		N/A	Section 5.3
Spread Factor	≥ 5 for 2400 ~ 2483.5MHz		N/A	
Occupied Bandwidth	≤ 26MHz		Pass	Section 5.4
Frequency Tolerance	-50 ~ +50ppm		Pass	Section 5.5
Transmitter Spurious Emissions	≤ 2.5uW for 30 ~ 2387MHz ≤ 25uW for 2387 ~ 2400MHz ≤ 25uW for 2483.5 ~ 2496.5MHz ≤ 2.5uW for 2496.5 ~ 12500MHz		Pass	Section 5.6
Receiver Spurious Emissions	≤ 4nW for 30 ~ 1000MHz ≤ 20nW for 1000 ~ 12750MHz		Pass	Section 5.7

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 antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

5.2. Output Power, Output Power Tolerance and EIRP

5.2.1. Test Limit

Output Power $\leq 10\text{mW}$

Output Power Tolerance: +20% to -80%

EIRP $\leq 12.14\text{dBm}$

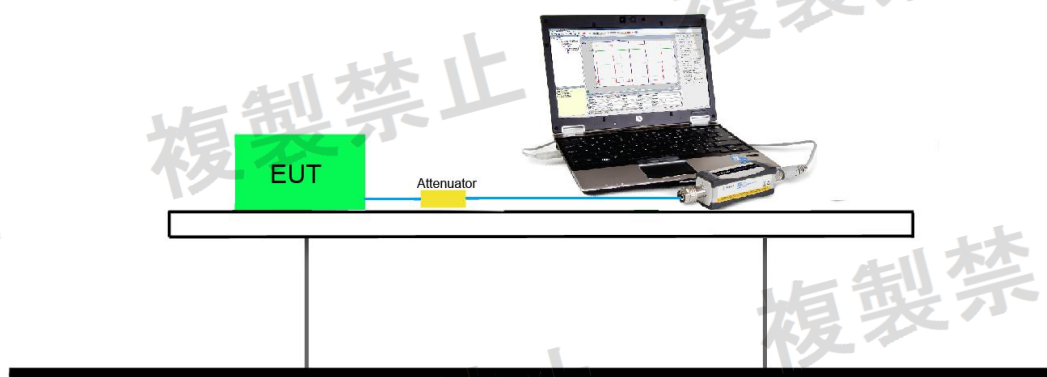
5.2.2. Test Procedure used

Measure the total power by Power Meter in a state of hopping mode (with Average Sensor).

If it's the burst wave, please measure the burst ratio. Then calculate the real total power by burst ratio.

Calculate the mean power per 1MHz by dividing the total power by spread bandwidth.

5.2.3. Test Setup



5.2.4. Test Result

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Item	Output Power	Test Date	2018/06/29

Frequency (MHz)	Reading Value (dBm)	Total Real Value (mW)	Limit (mW)	Result
2402	-0.49	0.89	10	Pass
2440	-0.91	0.81	10	Pass
2480	-1.22	0.76	10	Pass

Note: Real Value (mW/MHz) = $10^{(\text{Reading Value (dBm/MHz)}/10)}$

Output Power	
2402MHz	2440MHz
	
2480MHz	
	

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Item	Output Power Tolerance	Test Date	2018/06/29

Frequency (MHz)	Output Power (mW)	Declared Output Power (mW)	Tolerance (%)	Limit	Result
2402	0.89	1.00	-11.00	+20% ~ -80%	Pass
2440	0.81	1.00	-19.00	+20% ~ -80%	Pass
2480	0.76	1.00	-24.00	+20% ~ -80%	Pass

Note: Tolerance = (Output Power - Declared Output Power) / Declared Output Power*100%

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Item	EIRP	Test Date	2018/06/29

Frequency (MHz)	Output Power (dBm)	EIRP (dBm)	Limit (dBm)	Result
2402	-0.49	1.02	12.14	Pass
2440	-0.91	0.60	12.14	Pass
2480	-1.22	0.29	12.14	Pass

Note: EIRP (dBm) = Output Power (dBm) + Antenna Gain (dBi), Antenna Gain = 1.51 dBi.

5.3. Spread Bandwidth and Spread Factor

5.3.1. Test Limit

Spread Bandwidth ≥ 500 kHz

Spread Factor ≥ 5 for 2400 - 2483.5 MHz

5.3.2. Test Procedure Used

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

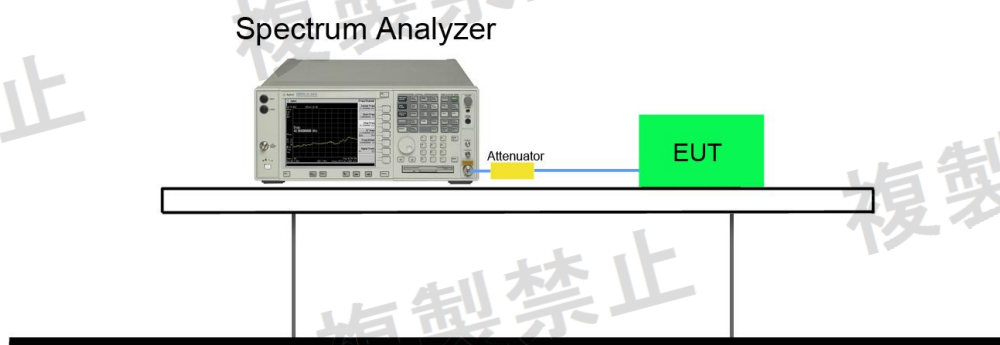
(a) A positive peak detector function must be used.

(b) A measurement instrument with an integrated 90% power bandwidth function may be used to automate the test process.

(c) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.

(d) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.3.3. Test Setup



5.3.4. Test Result

This test item is not applicable for Bluetooth LE device.

5.4. Occupied Bandwidth

5.4.1. Test Limit

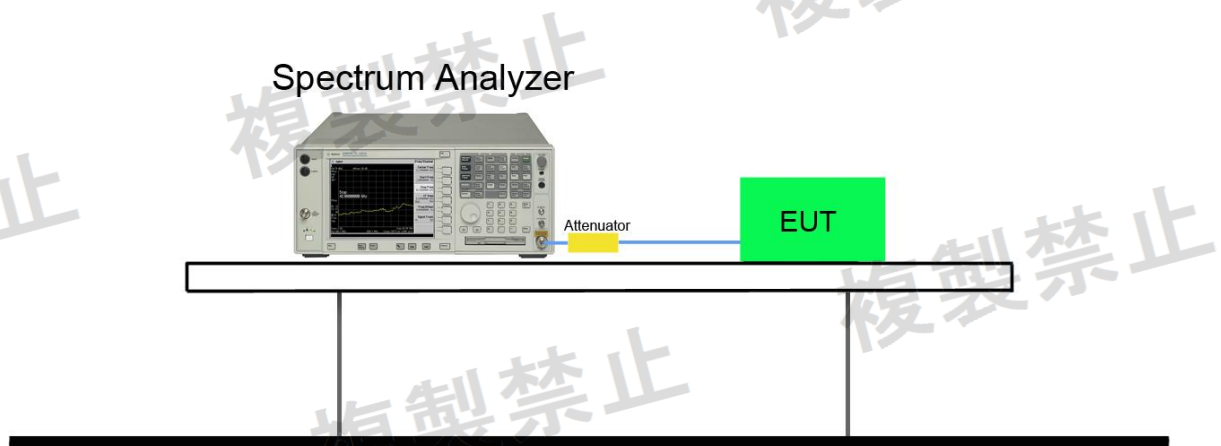
≤ 26 MHz

5.4.2. Test Procedure Used

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) A measurement instrument with an integrated 99% power bandwidth function may be used to automate the test process.
- (c) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (d) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

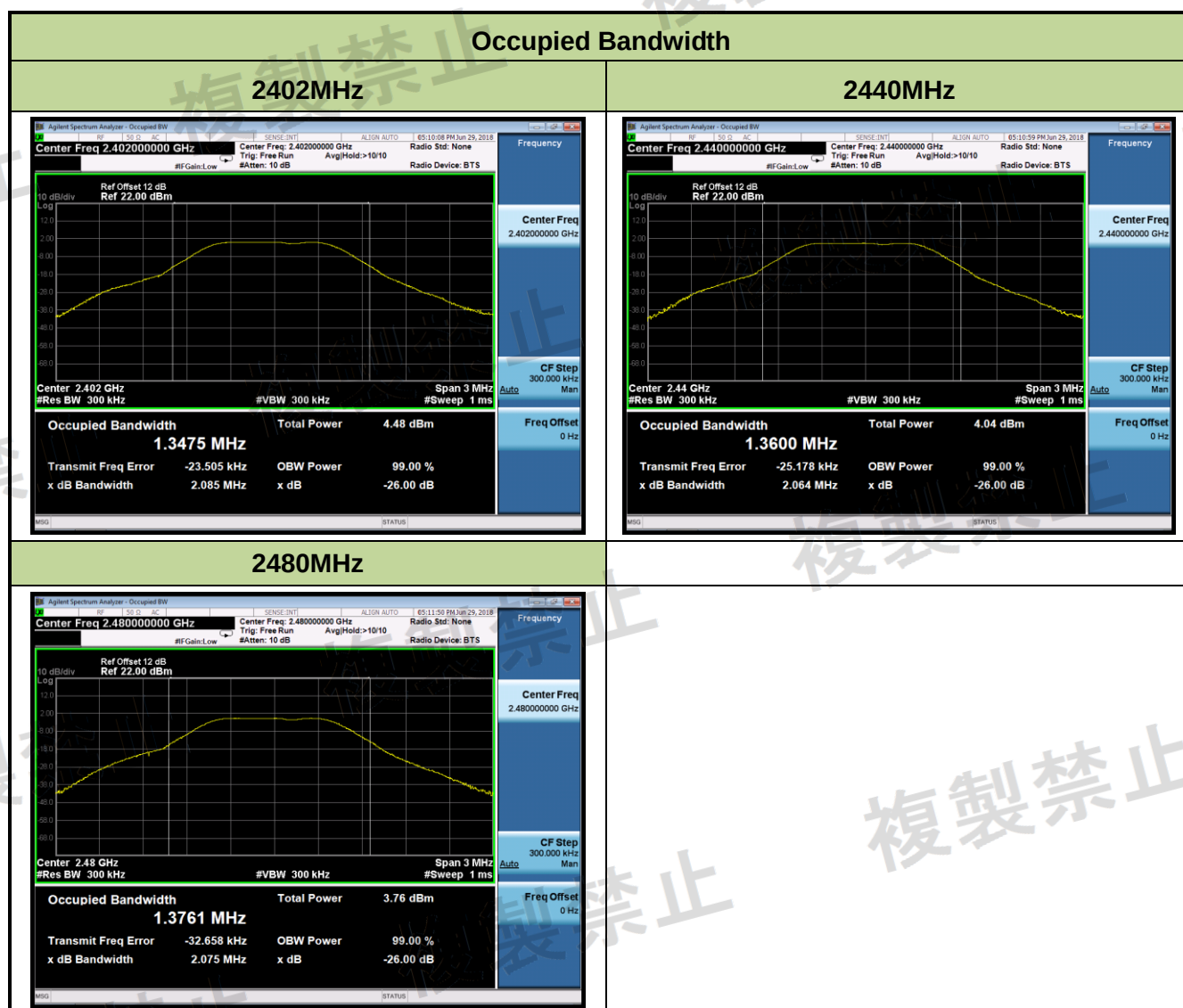
5.4.3. Test Setup



5.4.4. Test Result

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Site	TR3	Test Date	2018/06/29

Frequency (MHz)	Occupied Bandwidth (MHz)	Limit (MHz)	Result
2402	1.35	≤ 26	Pass
2440	1.36	≤ 26	Pass
2480	1.38	≤ 26	Pass



5.5. Frequency Tolerance

5.5.1. Test Limit

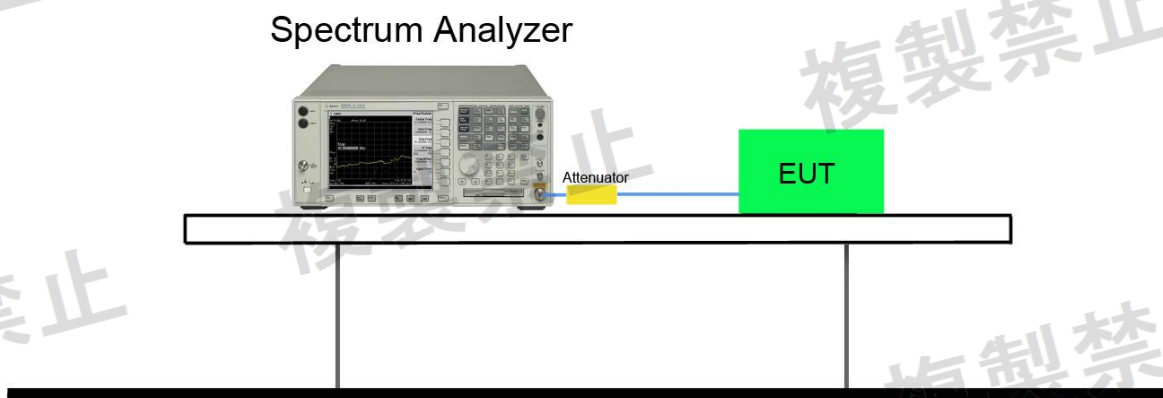
$\leq 50\text{ppm}$

5.5.2. Test Procedure Used

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.5.3. Test Setup

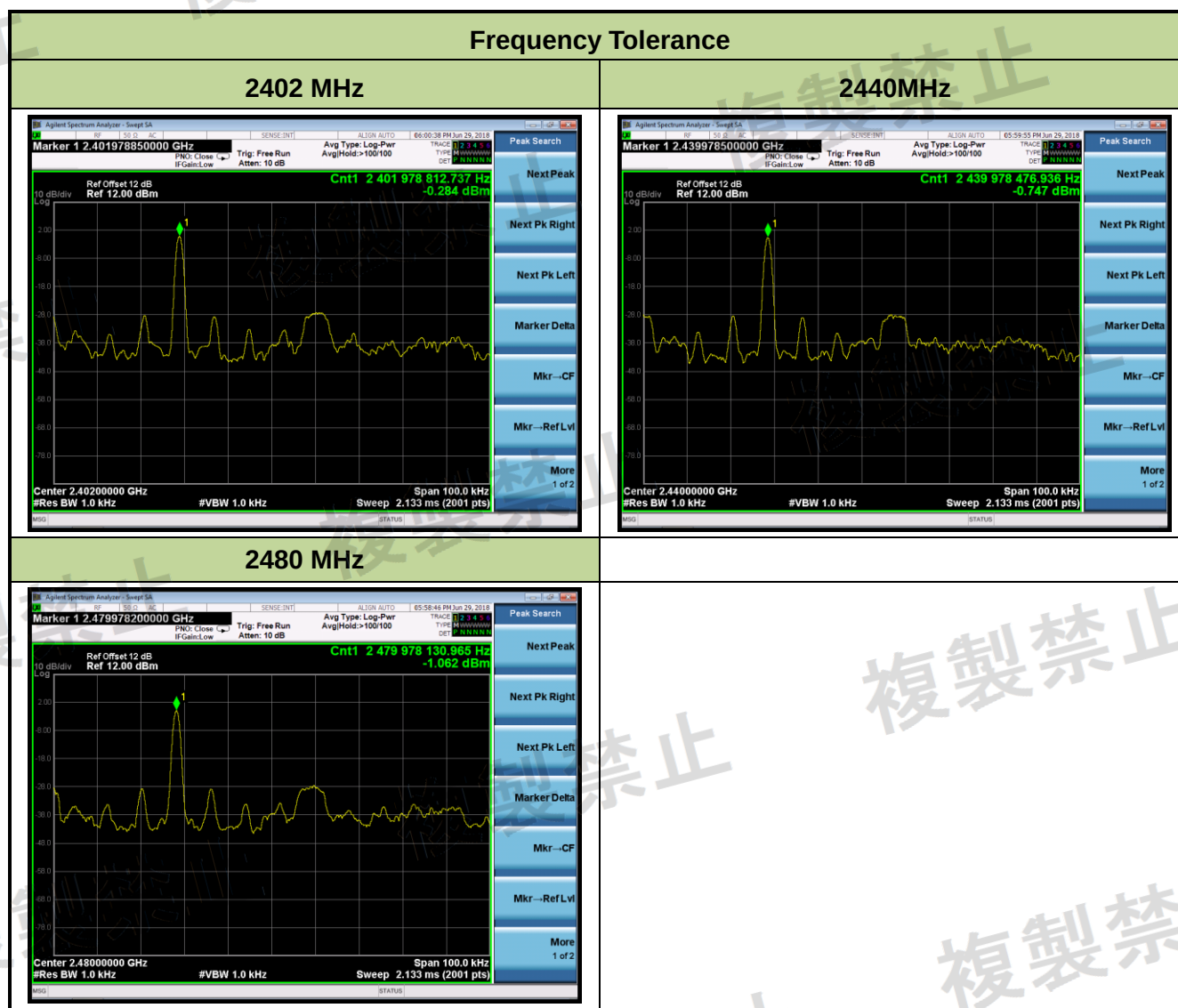


5.5.4. Test Result

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Site	TR3	Test Date	2018/06/29

Test Mode	Center Frequency (MHz)	Measurement Frequency (MHz)	Frequency Tolerance (ppm)	Limit (ppm)	Result
Carrier Wave	2402	2401.978813	-8.82	-50 ~ +50	Pass
	2440	2439.978477	-8.82	-50 ~ +50	Pass
	2480	2479.978131	-8.82	-50 ~ +50	Pass

Note: Frequency Tolerance (ppm) = [Measurement Frequency - Center Frequency] / Center Frequency * 10^6



5.6. Transmitter Spurious Emissions

5.6.1. Test Limit

$\leq 2.5\mu\text{W}$ for 30 ~ 2387MHz

$\leq 25\mu\text{W}$ for 2387 ~ 2400MHz

$\leq 25\mu\text{W}$ for 2483.5 ~ 2496.5MHz

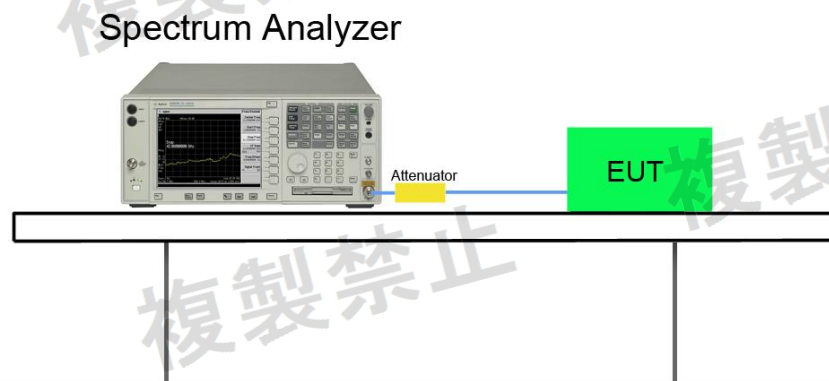
$\leq 2.5\mu\text{W}$ for 2496.5 ~ 12500MHz

5.6.2. Test Procedure Used

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.6.3. Test Setup



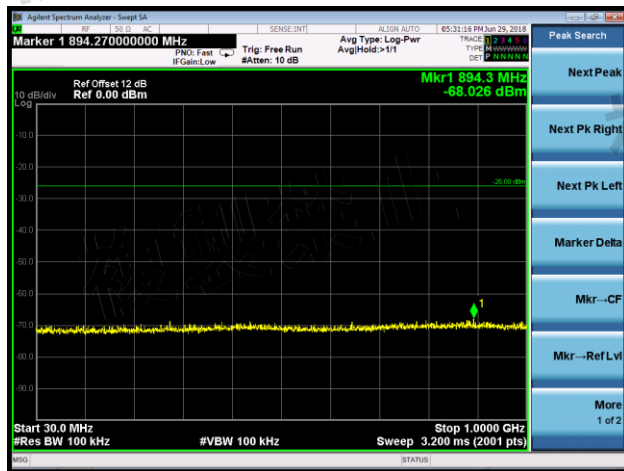
5.6.4. Test Result

EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Site	TR3	Test Date	2018/06/29

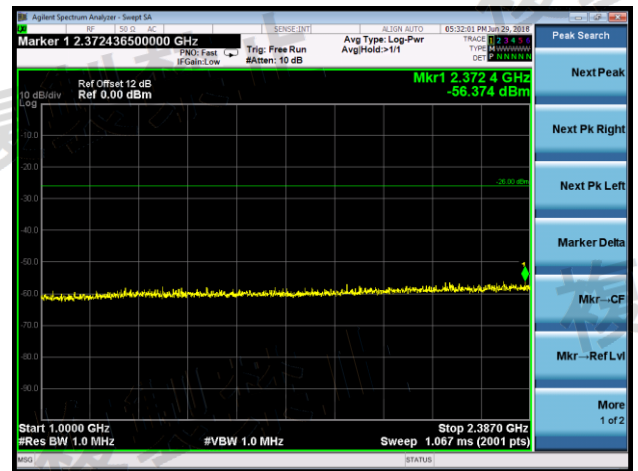
Test Frequency	Frequency Range (MHz)	Max Reading Level (dBm)	Limit (dBm)	Result
2402MHz	30 ~1000	-68.03	-26 (2.5uW)	Pass
	1000 ~ 2387	-56.37	-26 (2.5uW)	Pass
	2387 ~ 2400	-29.83	-16 (25uW)	Pass
	2483.5 ~ 2496.5	-55.86	-16 (25uW)	Pass
	2496.5 ~ 8000	-37.79	-26 (2.5uW)	Pass
	8000 ~ 12500	-53.81	-26 (2.5uW)	Pass
2440MHz	30 ~1000	-68.45	-26 (2.5uW)	Pass
	1000 ~ 2387	-56.25	-26 (2.5uW)	Pass
	2387 ~ 2400	-55.54	-16 (25uW)	Pass
	2483.5 ~ 2496.5	-56.28	-16 (25uW)	Pass
	2496.5 ~ 8000	-39.44	-26 (2.5uW)	Pass
	8000 ~ 12500	-54.29	-26 (2.5uW)	Pass
2480MHz	30 ~1000	-68.27	-26 (2.5uW)	Pass
	1000 ~ 2387	-55.11	-26 (2.5uW)	Pass
	2387 ~ 2400	-55.00	-16 (25uW)	Pass
	2483.5 ~ 2496.5	-46.56	-16 (25uW)	Pass
	2496.5 ~ 8000	-40.80	-26 (2.5uW)	Pass
	8000 ~ 12500	-54.07	-26 (2.5uW)	Pass

Transmitter Spurious Emissions - 2402MHz

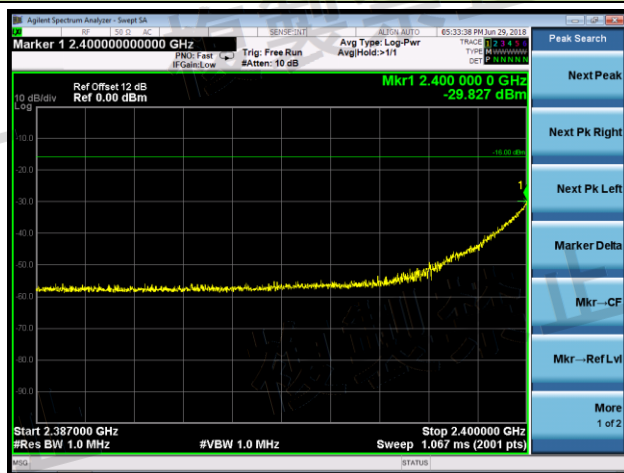
30 ~ 1000MHz



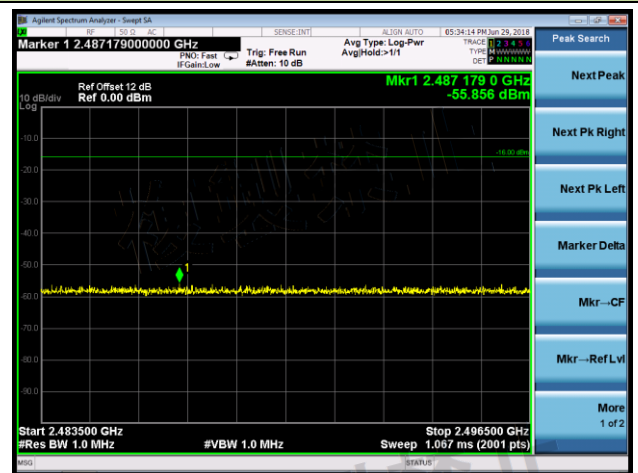
1000 ~ 2387MHz



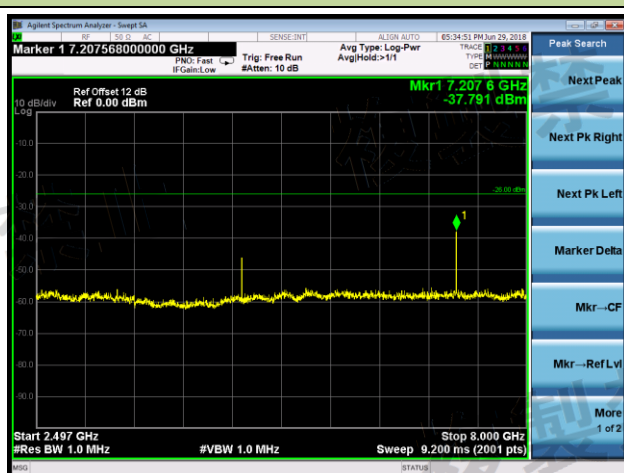
2387 ~ 2400MHz



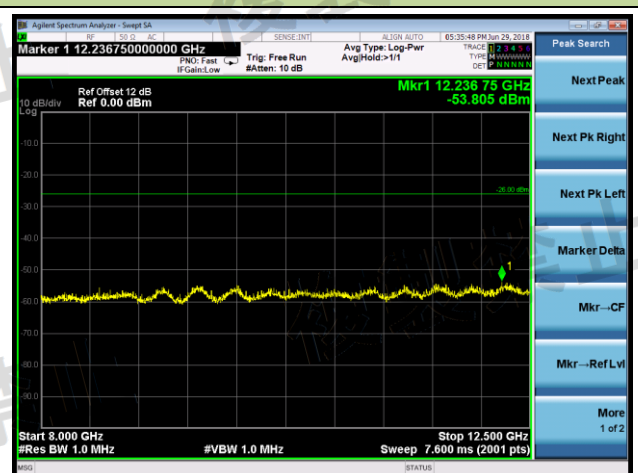
2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz

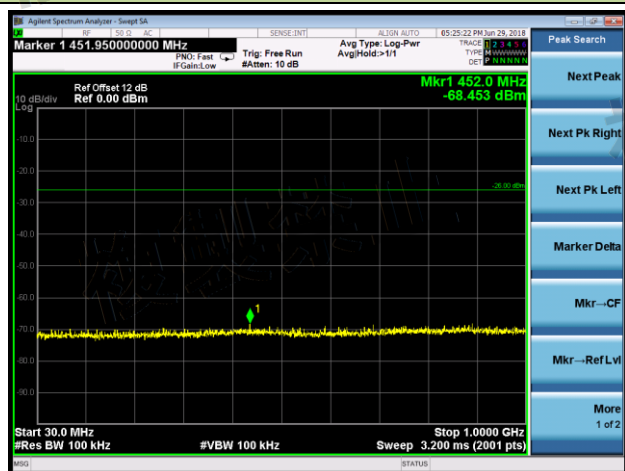


8000 ~ 12500MHz

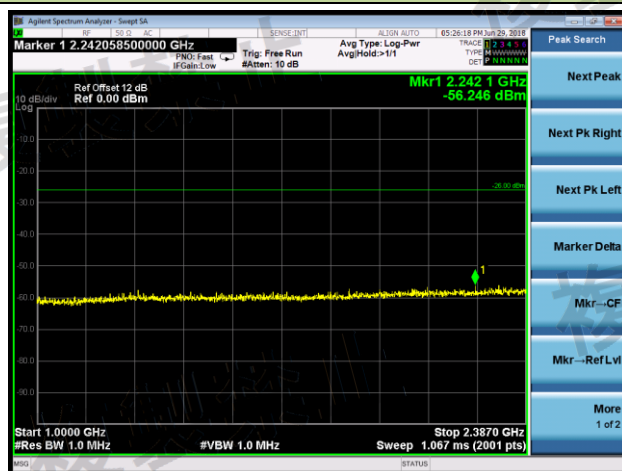


Transmitter Spurious Emissions - 2440MHz

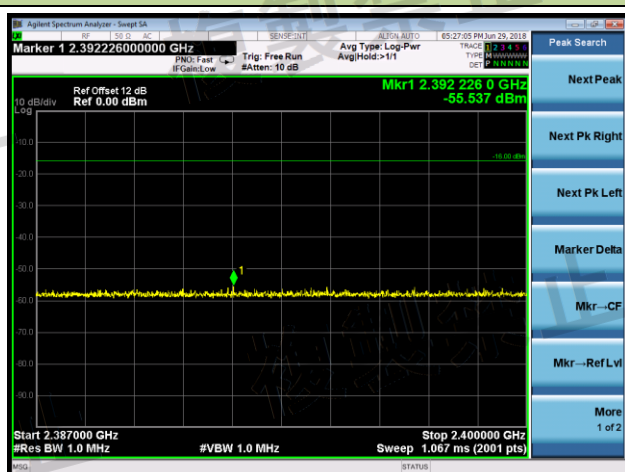
30 ~ 1000MHz



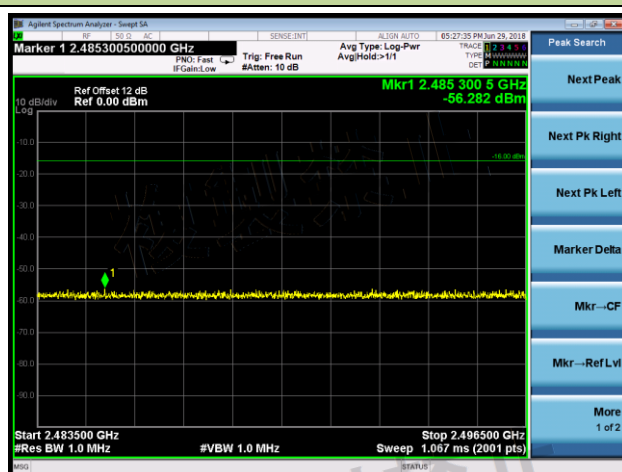
1000 ~ 2387MHz



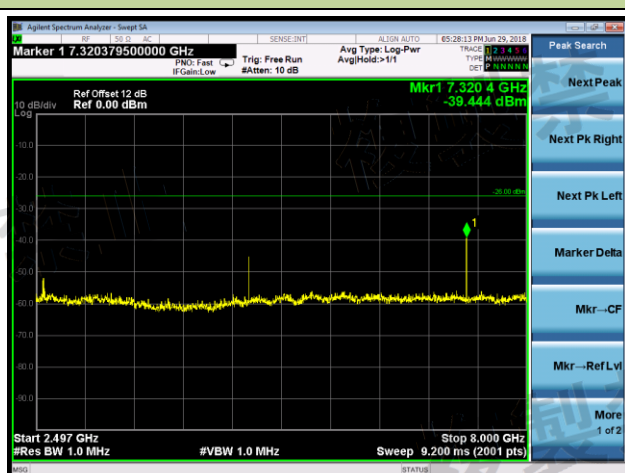
2387 ~ 2400MHz



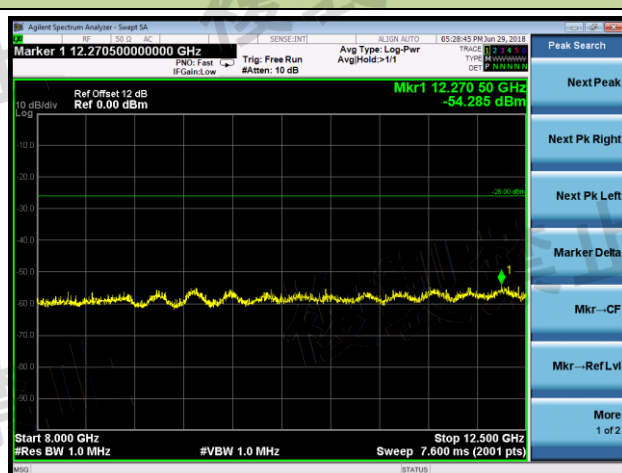
2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz

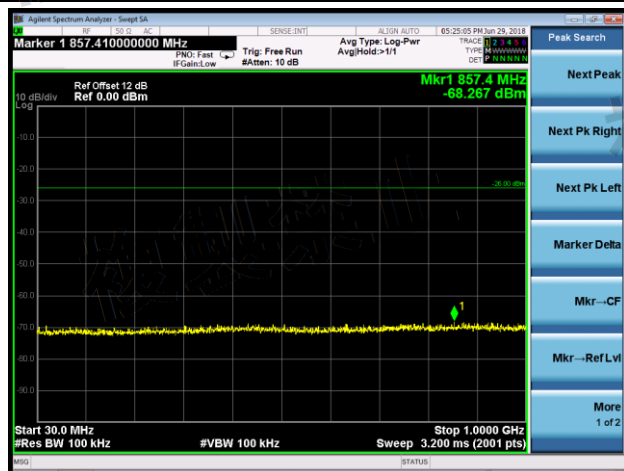


8000 ~ 12500MHz

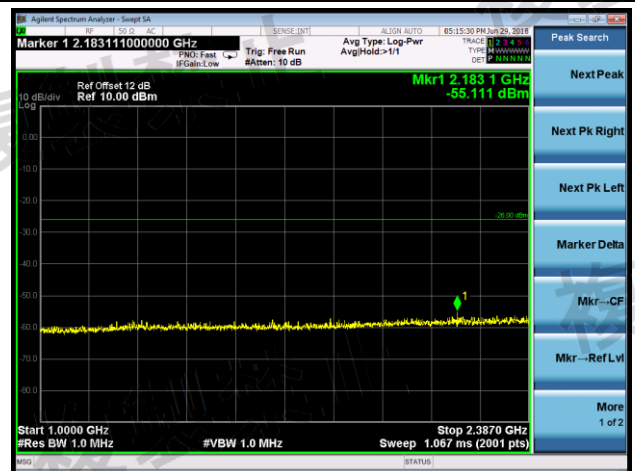


Transmitter Spurious Emissions - 2480MHz

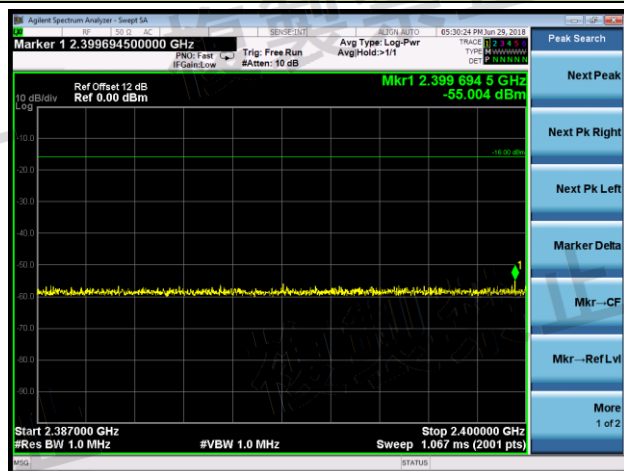
30 ~ 1000MHz



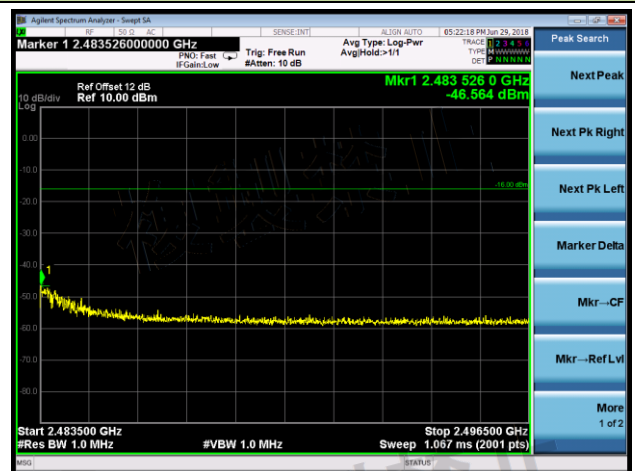
1000 ~ 2387MHz



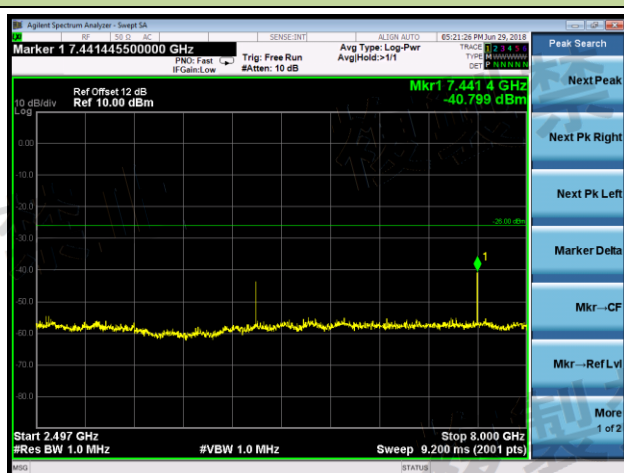
2387 ~ 2400MHz



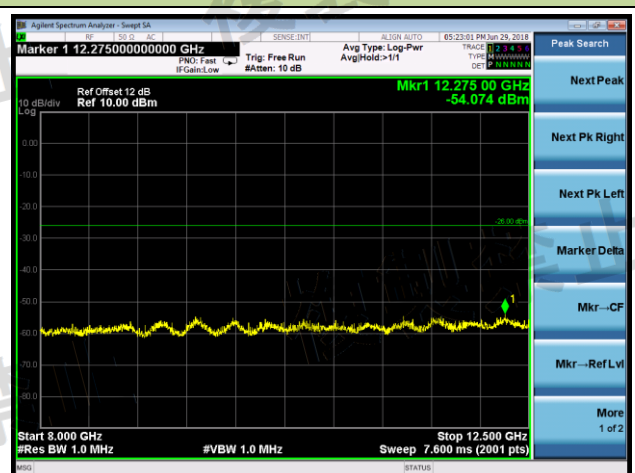
2483.5 ~ 2496.5MHz



2496.5 ~ 8000MHz



8000 ~ 12500MHz



5.7. Receiver Spurious Emissions

5.7.1. Test Limit

$\leq 4\text{nW}$ for 30 – 1000 MHz

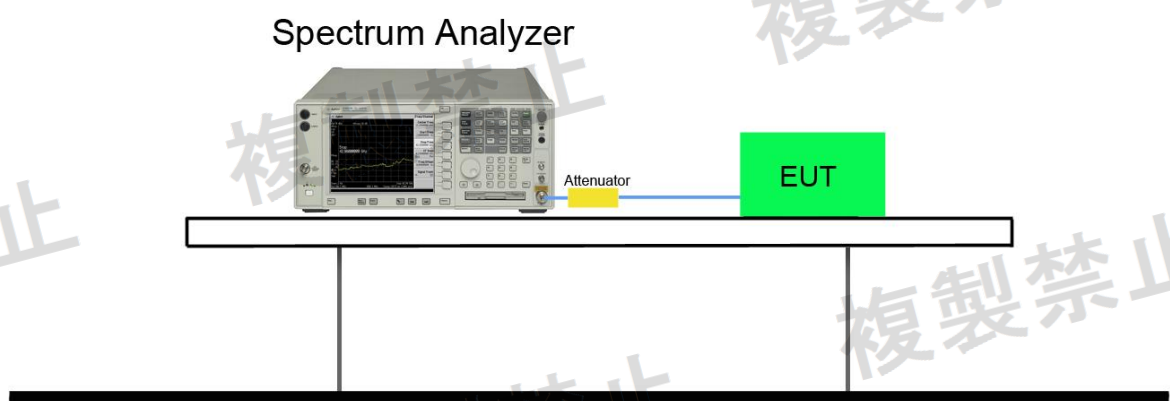
$\leq 20\text{nW}$ for 1000 – 12500 MHz

5.7.2. Test Procedure Used

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slowly, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

5.7.3. Test Setup



5.7.4. Test Result

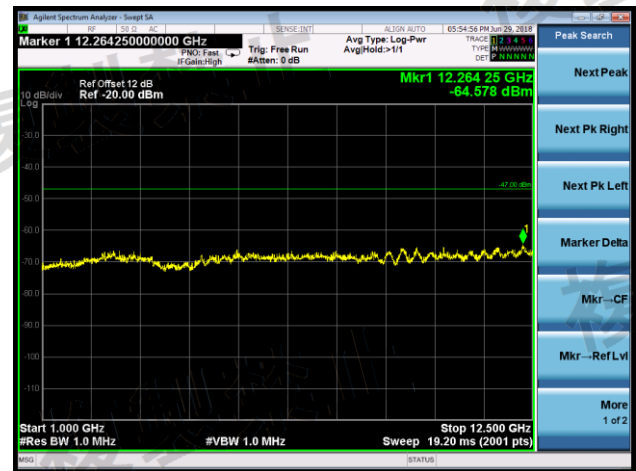
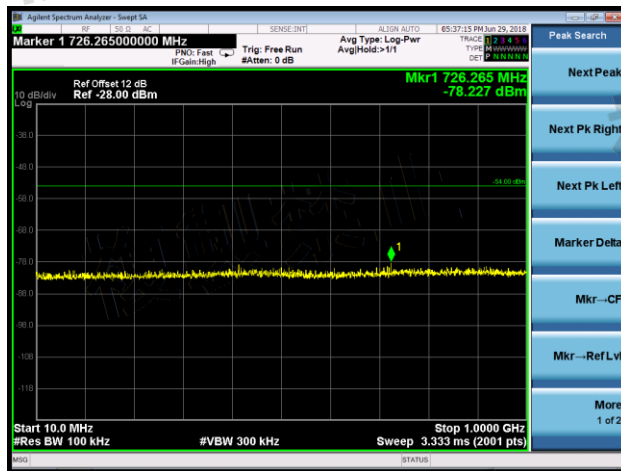
EUT	Motion Controller	Temperature	22°C
Test Engineer	Dandy Li	Relative Humidity	53%
Test Site	TR3	Test Date	2018/06/29

Test Frequency	Frequency Range (MHz)	Max Reading Level (dBm)	Limit (dBm)	Result
2402MHz	30 ~ 1000	-78.23	-54 (4nW)	Pass
	1000 ~ 12500	-64.58	-47 (20nW)	Pass
2440MHz	30 ~ 1000	-79.30	-54 (4nW)	Pass
	1000 ~ 12500	-64.83	-47 (20nW)	Pass
2480MHz	30 ~ 1000	-79.45	-54 (4nW)	Pass
	1000 ~ 12500	-64.79	-47 (20nW)	Pass

Receiver Spurious Emissions - 2402MHz

30 ~1000MHz

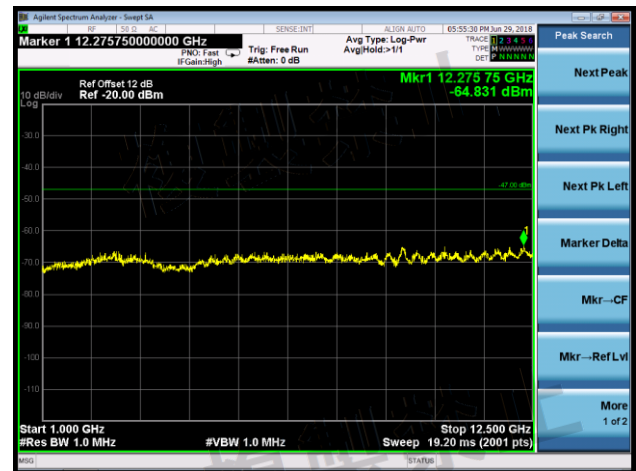
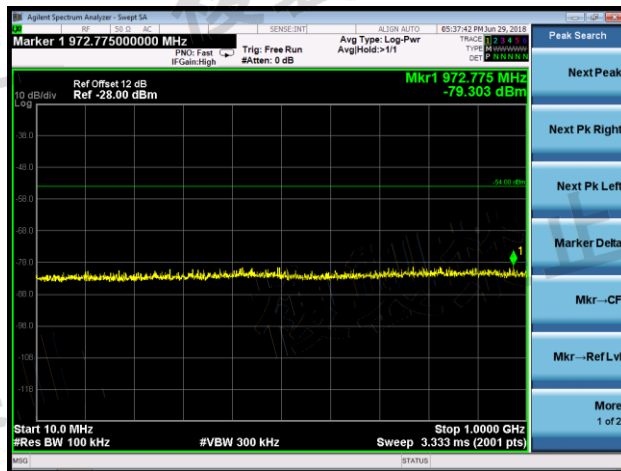
1000 ~ 12500MHz



Receiver Spurious Emissions - 2440MHz

30 ~1000MHz

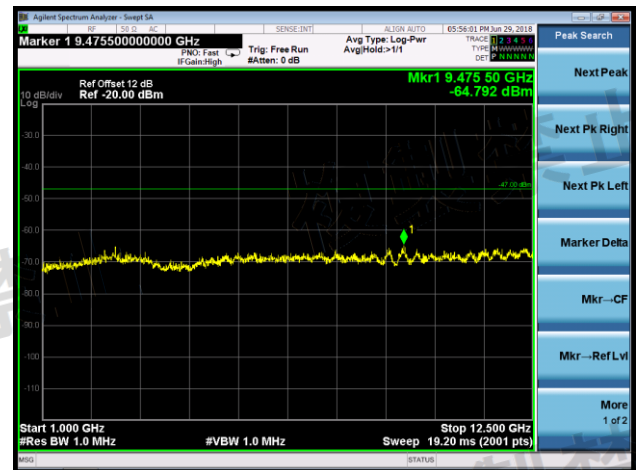
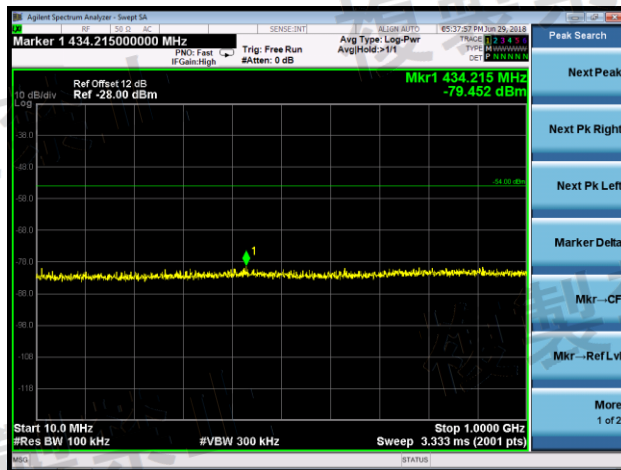
1000 ~ 12500MHz



Receiver Spurious Emissions - 2480MHz

30 ~1000MHz

1000 ~ 12500MHz



6. CONCLUSION

The data collected relate only the item(s) tested and show that the **Motion Controller Model No.:**

C1510 is in compliance with MIC Notice No.88 Annex 43.

_____ The End _____