

# 920MHz Band Low Power Data Communication System Test Report

Product Name	pewag levo hook LH
Model No.	LH5

Applicant	Pewag Austria GmbH
Address	Gaslaternenweg 4, A-8041 Graz

Date of Receipt	May 21, 2019
Issued Date	Jul. 15, 2019
Report No.	1950307R-RFJPP38V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

The test report shall not be reproduced without the written approval of DEKRA Testing and Certification Co., Ltd.

## Test Report

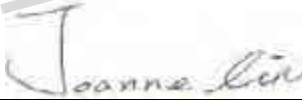
Issued Date : Jul. 15, 2019

Report No. : 1950307R-RFJPP38V00



Product Name	pewag levo hook LH
Applicant	Pewag Austria GmbH
Address	Gaslaternenweg 4, A-8041 Graz
Manufacturer	Pewag Austria GmbH
Model No.	LH5
EUT Rated Voltage	DC 29.6V (Power by battery)
EUT Test Voltage	DC 29.6V (Power by battery)
Trade Name	pewag
Measurement Standard	Public notice of MIC No.88 test method of specified radio equipment (January 26, 2004) Annex 22-3 Article 2 paragraph 1 item 8(Public Notice of No.42 paragraph 1 item 3)
Test Result	Complied

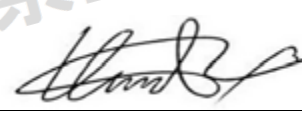
Documented By :

  
( Senior Adm. Specialist / Joanne Lin )

Tested By :

  
( Engineer / Droll Yang )

Approved By :

  
( Director / Vincent Lin )

## TABLE OF CONTENTS

Description	Page
<b>1. GENERAL INFORMATION .....</b>	<b>5</b>
1.1. EUT Description.....	5
1.2. Operation Description .....	6
1.3. EUT Exercise Software .....	7
1.4. Parament of test software setting.....	7
1.5. RF and IF section must be tamper requirement.....	8
1.6. Test Facility .....	9
1.7. List of Test Equipment .....	10
<b>2. Total Power ,EIRP and Output Power Tolerance .....</b>	<b>11</b>
2.1. Test Setup .....	11
2.2. Limits .....	11
2.3. Test Procedure .....	11
2.4. Uncertainty .....	11
2.5. Test Result of Total Power, EIRP and Output Power Tolerance.....	12
<b>3. Occupied Bandwidth .....</b>	<b>14</b>
3.1. Test Setup .....	14
3.2. Test Procedure .....	14
3.3. Limits .....	14
3.4. Uncertainty .....	14
3.5. Test Result of Occupied Bandwidth .....	15
<b>4. Frequency Tolerance .....</b>	<b>16</b>
4.1. Test Setup .....	16
4.2. Test Procedure .....	16
4.3. Limits .....	16
4.4. Uncertainty .....	16
4.5. Test Result of Frequency Tolerance .....	17
<b>5. Adjacent Channel leakage Power .....</b>	<b>18</b>
5.1. Test Setup .....	18
5.2. Test Procedure .....	18
5.3. Limits .....	18
5.4. Uncertainty .....	18
5.5. Test Result of Adjacent Channel Leakage Power.....	19
<b>6. Transmitter Spurious Emissions .....</b>	<b>21</b>
6.1. Test Setup .....	21
6.2. Test Procedure .....	21
6.3. Limits .....	21
6.4. Uncertainty .....	21
6.5. Test Result of Transmitter Spurious Emissions.....	22
<b>7. Receiver Spurious Emissions.....</b>	<b>27</b>
7.1. Test Setup .....	27
7.2. Test Procedure .....	27
7.3. Limits .....	27
7.4. Uncertainty .....	27
7.5. Test Result of Receiver Spurious Emissions .....	28

<b>8.</b>	<b>Carrier Sensing.....</b>	<b>32</b>
8.1.	Test Setup .....	32
8.2.	Test Procedure .....	32
8.3.	Uncertainty .....	32
8.4.	Test Result of Carrier Sensing.....	33
<b>9.</b>	<b>Transmission Time Restriction.....</b>	<b>34</b>
9.1.	Test Setup .....	34
9.2.	Test Procedure .....	34
9.3.	Limits .....	34
9.4.	Uncertainty .....	34
9.5.	Test Result of Transmission Time Restriction.....	35
<b>10.</b>	<b>EMI Reduction Method During Compliance Testing .....</b>	<b>38</b>
<b>Attachment 1 : Conducted Measurement Photographs.....</b>		<b>錯誤! 尚未定義書籤。</b>
<b>Attachment 2 : EUT Detailed Photographs.....</b>		<b>錯誤! 尚未定義書籤。</b>

## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	pewag levo hook LH
Trade Name	pewag
Model No.	LH5
Serial No	N/A
Frequency Range	916.2MHz
Number of Channels	1
Type of Modulation	FSK
Antenna Type	Stubby Antenna
Antenna Gain	Refer to the table “Antenna List”
Channel Control	N/A
Declared Output Power	0.0126 mW

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	pewag	22487	Stubby Antenna	3dBi

#### Frequency of Each Channel

Channel	Frequency
Channel 1:	916.2MHz



## 1.2. Operation Description

The EUT is a pewag levo hook LH with a built-in 916.2MHz transceiver. The EUT operation frequency is 916.2MHz. The signals modulated by FSK are transmitted from the Stubby Antenna of the EUT.

Test Mode	Mode 1: Transmitter
	Mode 2: Receiver

### 1.3. EUT Exercise Software

- (1) The EUT connected to test fixture and tablet PC.
- (2) Tablet PC executed “pewag\_UHF\_Transceiver\_GUI V0.4” program
- (3) Check the mode and channel of the signal.
- (4) Verify that the EUT works correctly.

### 1.4. Parament of test software setting

The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Test Software	Pewag UHF Transceiver GUI V0.4
Frequency	916.2MHz
Setting value	-3

Note: The device use firmware to fixed output power not supports extra software to control or tuning.

Voltage Test Item	Test Voltage	Voltage meter reading value (RF Module IC5 pin 14)
Nominal Voltage	DC 29.6V	3.24V DC
Highest Voltage	DC 32.56V	3.24V DC
Lowest Voltage	DC 26.64V	3.24V DC

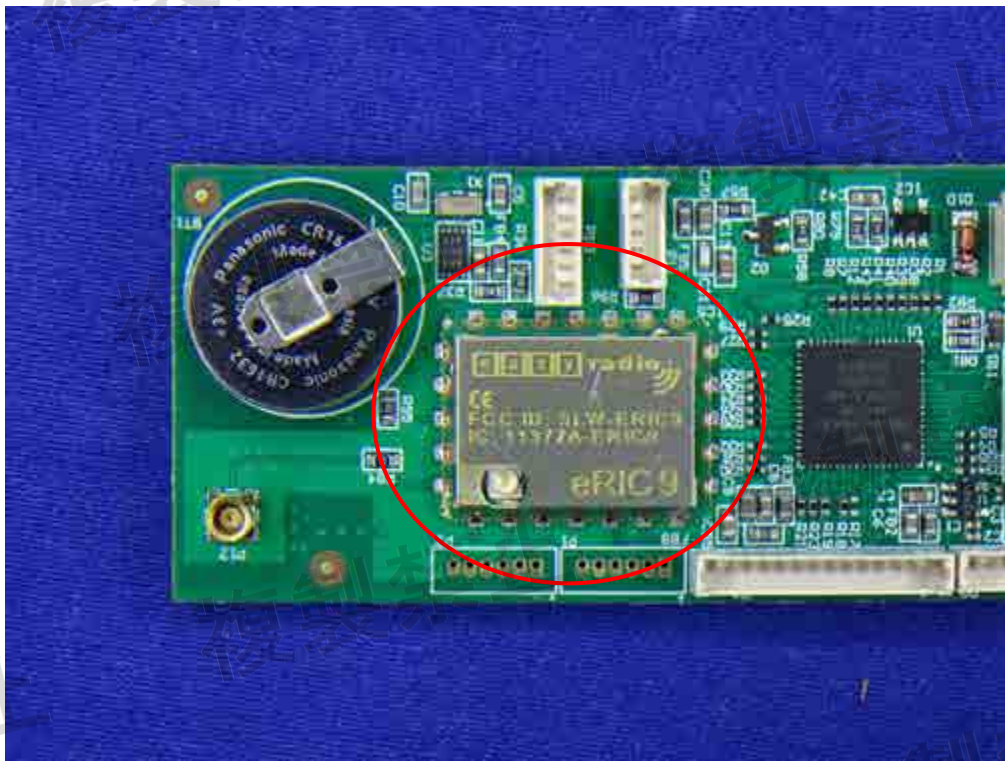
Note: 1. The Voltage supply for RF Module is 3.3V DC.

2. The internal supply gives a fluctuation value less than 0 % (**Around 0% from max. to min.**)

Temperature	23°C
Relative Humidity	54 %

### 1.5. RF and IF section must be tamper requirement

Requirement	Comments	Result
RF, IF and Modulation section must be tamper	<input type="checkbox"/> Use Special Screw <input checked="" type="checkbox"/> Metal Shielding is Soldered <input type="checkbox"/> Use Ball Grid Array (BGA) (Please see Attachment: EUT Detailed Photographs)	Complete
	<input checked="" type="checkbox"/> RF module/Chip pin >10 <input type="checkbox"/> RF module/Chip pins distance <1.5mm (Please see Attachment: EUT Detailed Photographs)	Complete





## 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (JIS Z8703)	Actual
Temperature (°C)	5-35	18-28
Humidity (%RH)	45 - 85%	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: [http://www.dekra.com.tw/index\\_en.aspx](http://www.dekra.com.tw/index_en.aspx)

Site Description: Accredited by TAF  
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd.  
Site Address: No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,  
New Taipei City 24457, Taiwan.  
TEL: 886-2-2602-7968 / FAX : 866-2-2602-3286  
E-Mail : [info.tw@dekra.com](mailto:info.tw@dekra.com)

## 1.7. List of Test Equipment

### For Conducted measurements /ASR2

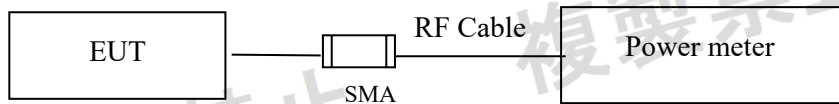
	Equipment	Manufacturer	Model No.	Serial No.	Calibrated	Cal. Method	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSV30	103466	ETC	*(c)	2018.12.22	2019.12.21
X	Power Meter	Anritsu	ML2496A	1548003	ETC	*(c)	2018.12.19	2019.12.18
X	Power Sensor	Anritsu	MA2411B	1531024	ETC	*(c)	2018.12.19	2019.12.18
X	Power Sensor	Anritsu	MA2411B	1531025	ETC	*(c)	2018.12.19	2019.12.18
	Signal Generator	R&S	SMB100A	110724	ETC	*(c)	2019.01.14	2020.01.13
	Bluetooth Tester	R&S	CBT	101238	ETC	*(c)	2019.01.21	2020.01.20

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : DEKRA Conduction Test System V9.0.5.
4.
  - a) Calibration conducted by the National Institute of Information and Communications Technology(NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1)
  - b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)
  - c) Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated agency under Article 102-18 paragraph (1).
  - d) Calibration conducted by using other equipment that listed above from a) to c).

## 2. Total Power ,EIRP and Output Power Tolerance

### 2.1. Test Setup



### 2.2. Limits

Antenna Power  $\leq 0\text{dBm}$  (1mW)

EIRP  $\leq 3\text{dBm}$

Output Power Tolerance: +20% to -80%

### 2.3. Test Procedure

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

- (a) A sample detector function must be used.
- (b) A measurement instrument with an integrated 1MHz power bandwidth function may be used to automate the test process.
- (c) Connect the power meter to the IF output of the spectrum analyzer.
- (d) Set zero span of spectrum analyzer and 'Maximum Hold' than test result will show in power meter.

### 2.4. Uncertainty

$\pm 1.201\text{ dB}$

## 2.5. Test Result of Total Power, EIRP and Output Power Tolerance

Product : pewag levo hook LH  
 Test Item : Output Power and EIRP  
 Test Date : 2019/06/17  
 Test Mode : Mode 1: Transmitter

Maximum Antenna Gain= 3dBi				
Frequency (MHz)	Real Value (dBm)	Limit (dBm)	Real Value (EIRP) (dBm)	Limit (EIRP) (dBm)
916.2	-19.00	0	-16.00	3

Real Value (EIRP) = Real Value + Antenna Gain.

916.2MHz



Test Result	PASS
-------------	------

Product : pewag levo hook LH  
Test Item : Output Power Tolerance  
Test Date : 2019/06/17  
Test Mode : Mode 1: Transmitter

Frequency (MHz)	Declared Output Power (mW)	Total Power (mW)	Tolerance (%)	Limit (%)
916.2	0.0126	0.0126	0.000	+20% to -80%

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

Test Result	PASS
-------------	------



### 3. Occupied Bandwidth

#### 3.1. Test Setup



#### 3.2. Test Procedure

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 slow, 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.

#### 3.3. Limits

$\leq 200\text{kHz}$

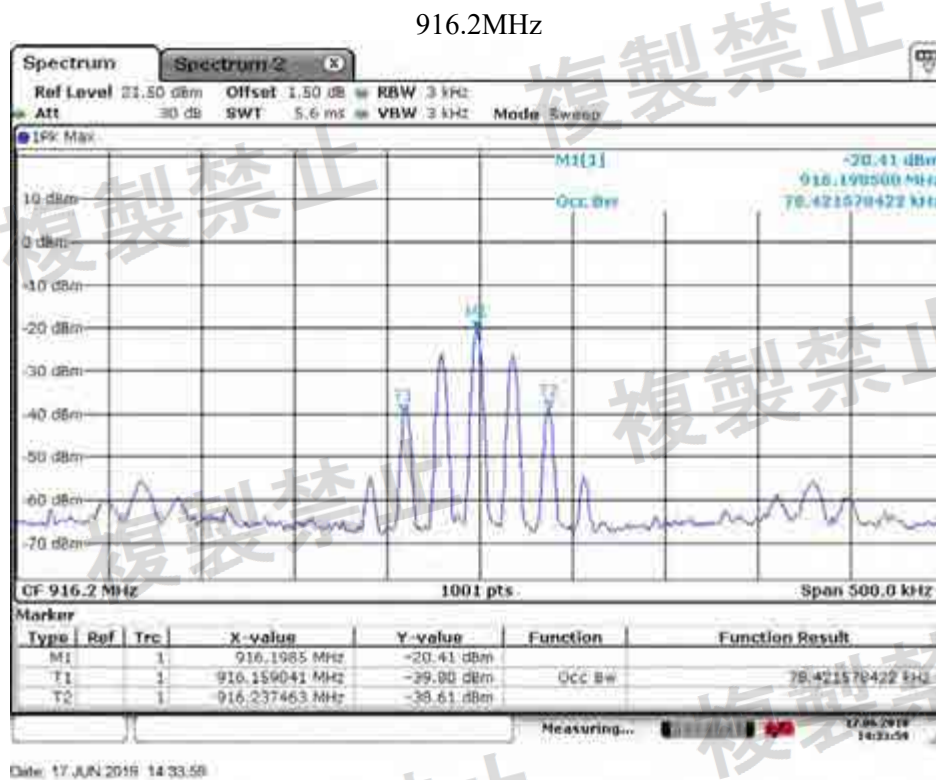
#### 3.4. Uncertainty

$\pm 279.10\text{Hz}$

### 3.5. Test Result of Occupied Bandwidth

Product : pewag levo hook LH  
 Test Item : Occupied Bandwidth  
 Test Mode : Mode 1: Transmitter

Frequency (MHz)	Reading Value (kHz)	Limit (kHz)
916.2	78.422	$\leq 200$



Test Result	PASS
-------------	------

## 4. Frequency Tolerance

### 4.1. Test Setup



### 4.2. Test Procedure

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 slow, 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.

### 4.3. Limits

$\pm 20$  ppm

### 4.4. Uncertainty

$\pm 279.10$ Hz

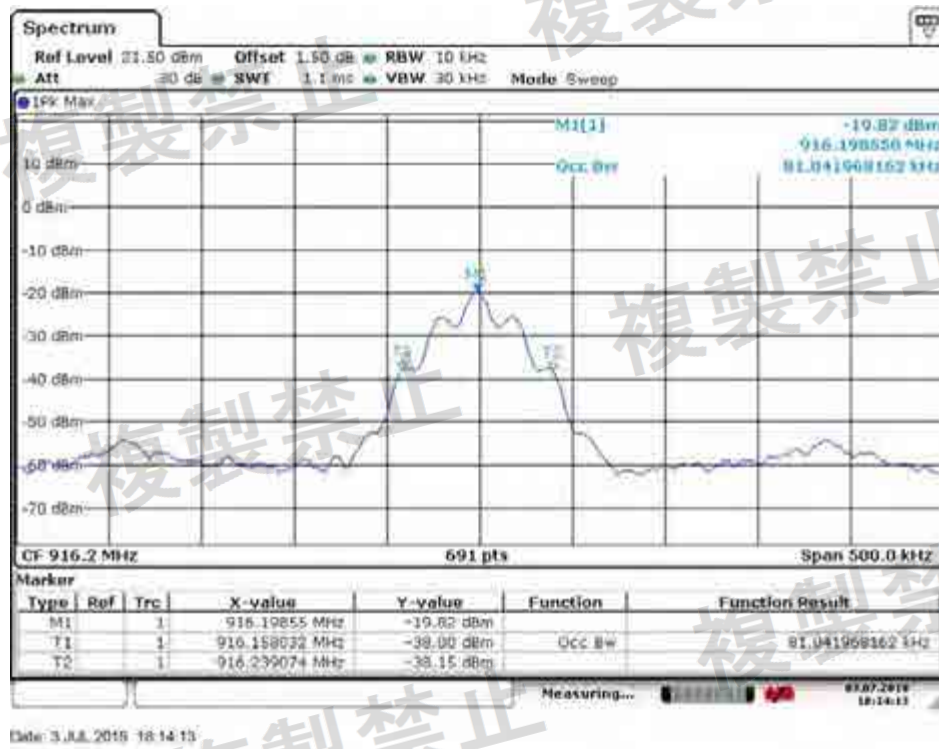
#### 4.5. Test Result of Frequency Tolerance

Product : pewag levo hook LH  
 Test Item : Frequency Tolerance  
 Test Mode : Mode 1: Transmitter

Frequency (MHz)	Reading Value (MHz)	Tolerance (ppm)	Limit (ppm)
916.2	916.198	-2.183	±20

Note: Reading Value (MHz) = (T1+T2)/2

916.2MHz



Test Result	PASS
-------------	------

## 5. Adjacent Channel leakage Power

### 5.1. Test Setup



### 5.2. Test Procedure

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

- (a) A channel power function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slow, 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.

### 5.3. Limits

-26dBm or less

### 5.4. Uncertainty

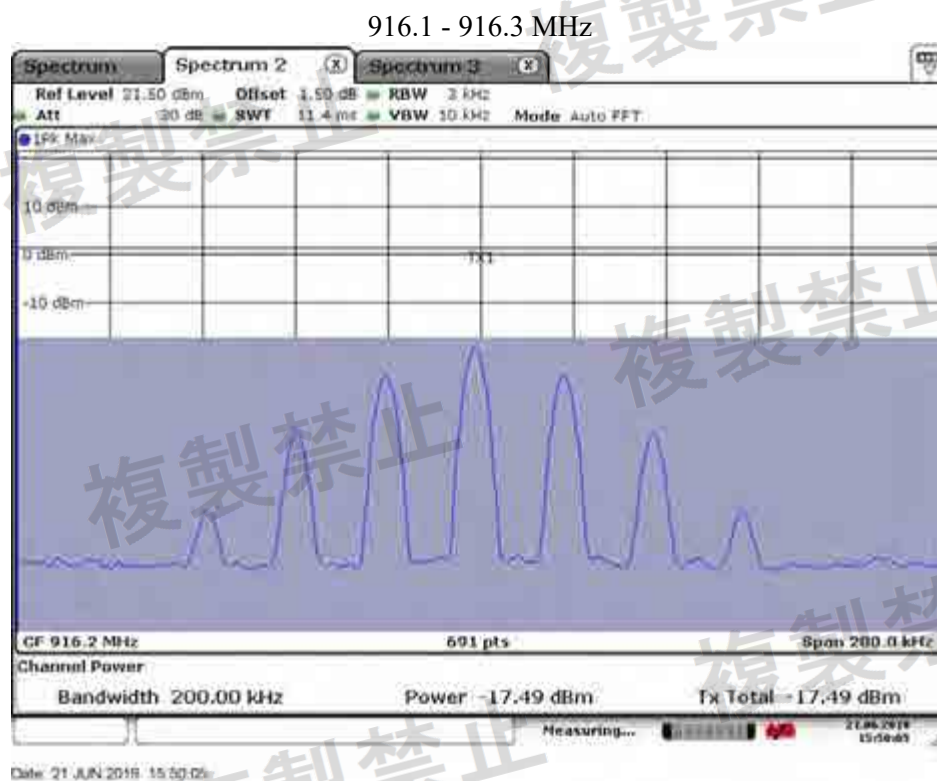
$\pm 1.201$  dB



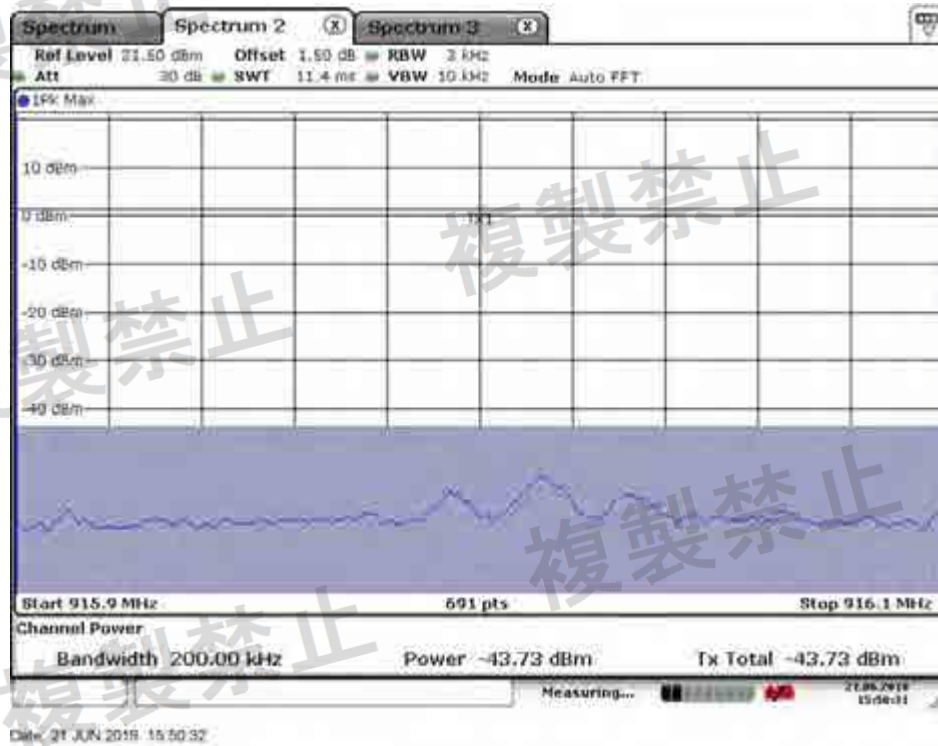
### 5.5. Test Result of Adjacent Channel Leakage Power

Product : pewag levo hook LH  
 Test Item : Adjacent Channel Leakage Power  
 Test Mode : Mode 1: Transmitter

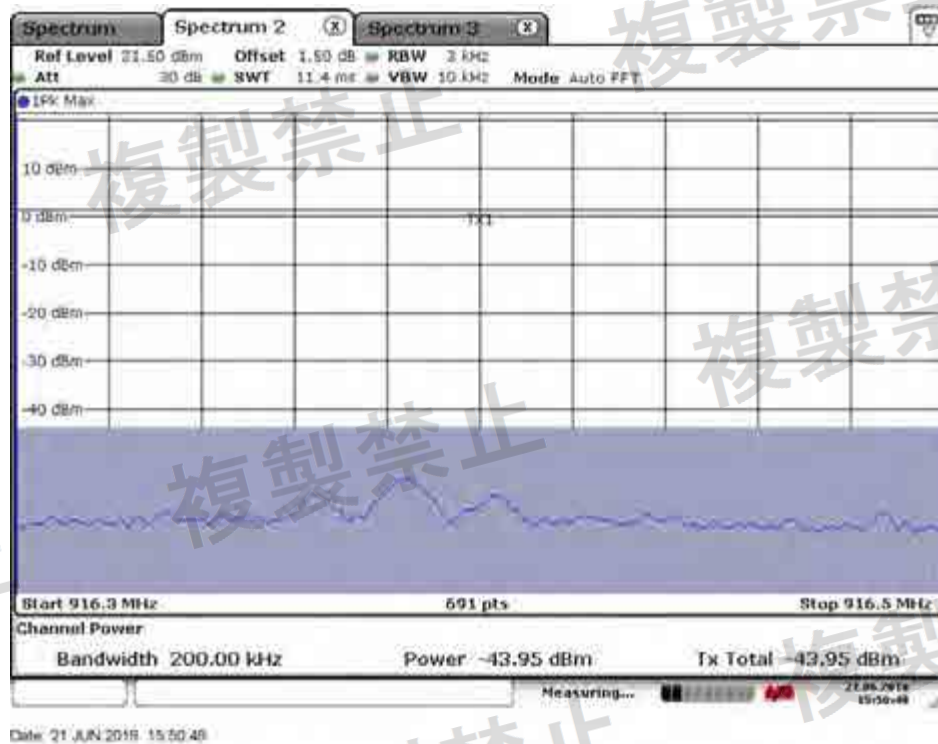
Frequency Range (MHz)	Measurement Level (dBm)	Limit (dBm)
916.1-916.3	-17.49	--
915.9-916.1	-43.73	-26
916.3-916.5	-43.95	-26



915.9 - 916.1 MHz

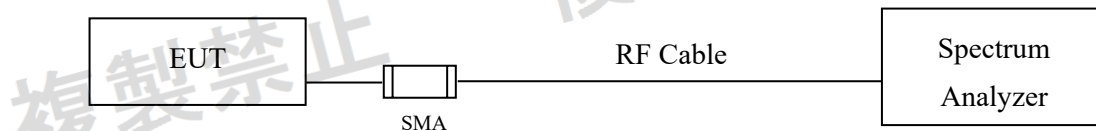


916.3 - 916.5 MHz



## 6. Transmitter Spurious Emissions

### 6.1. Test Setup



### 6.2. Test Procedure

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 slow, 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.

### 6.3. Limits

30-710MHz  $\leq$  -36dBm/100kHz

710-900MHz  $\leq$  -55dBm/1MHz

900-915MHz  $\leq$  -55dBm/100kHz

915-930MHz  $\leq$  -36dBm/100kHz (Except  $\pm 150$ kHz from the center frequency)

930-1000MHz  $\leq$  -55dBm/100kHz

1000-1215MHz  $\leq$  -45dBm/1MHz

1215-5000MHz  $\leq$  -30dBm/1MHz

### 6.4. Uncertainty

$\pm 1.201$  dB

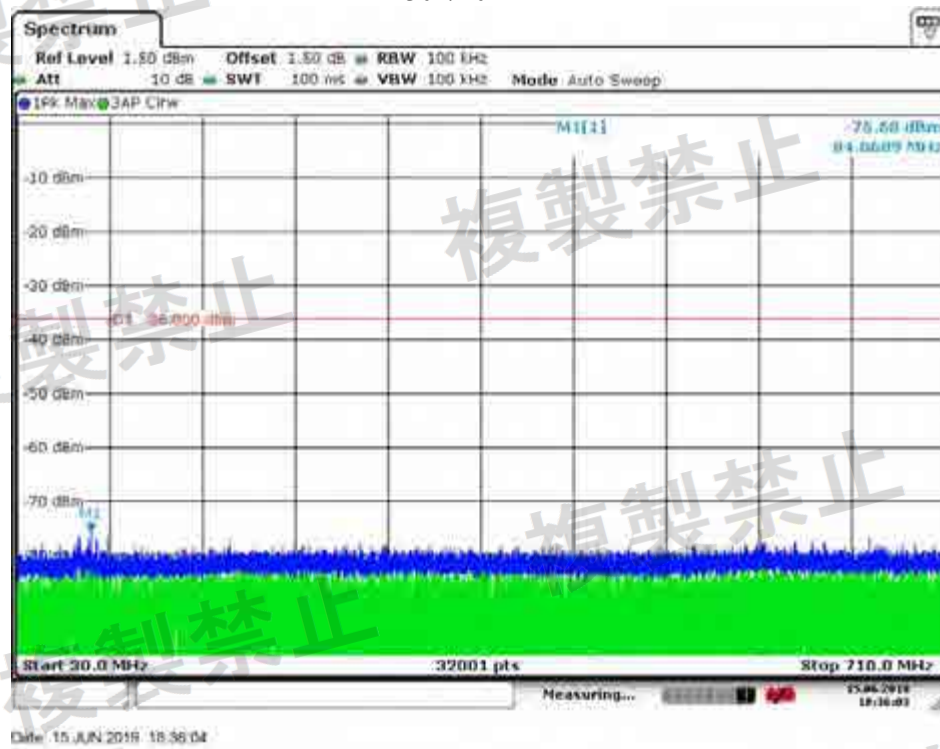
## 6.5. Test Result of Transmitter Spurious Emissions

Product : pewag levo hook LH  
Test Item : Transmitter Spurious Emissions  
Test Mode : Mode 1: Transmitter (916.2MHz)

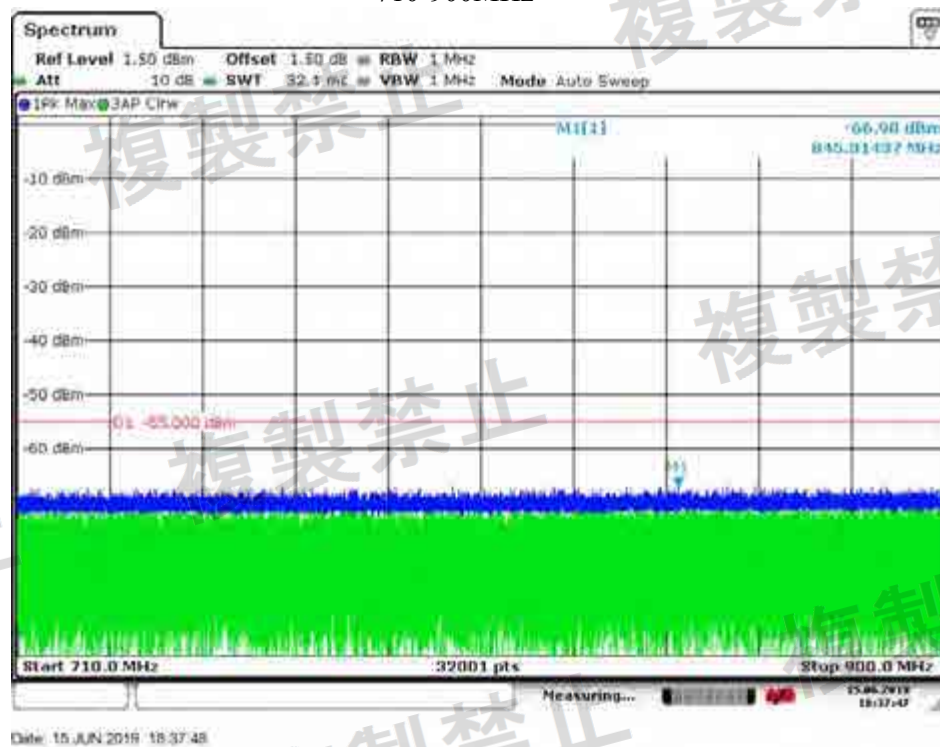
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30-710	-75.58	-36
710-900	-66.90	-55
900-915	-76.27	-55
915-916.05	-37.48	-36
916.35-930	-46.87	-36
930-1000	-74.42	-55
1000-1215	-66.84	-45
1215-5000	-39.01	-30



30-710MHz

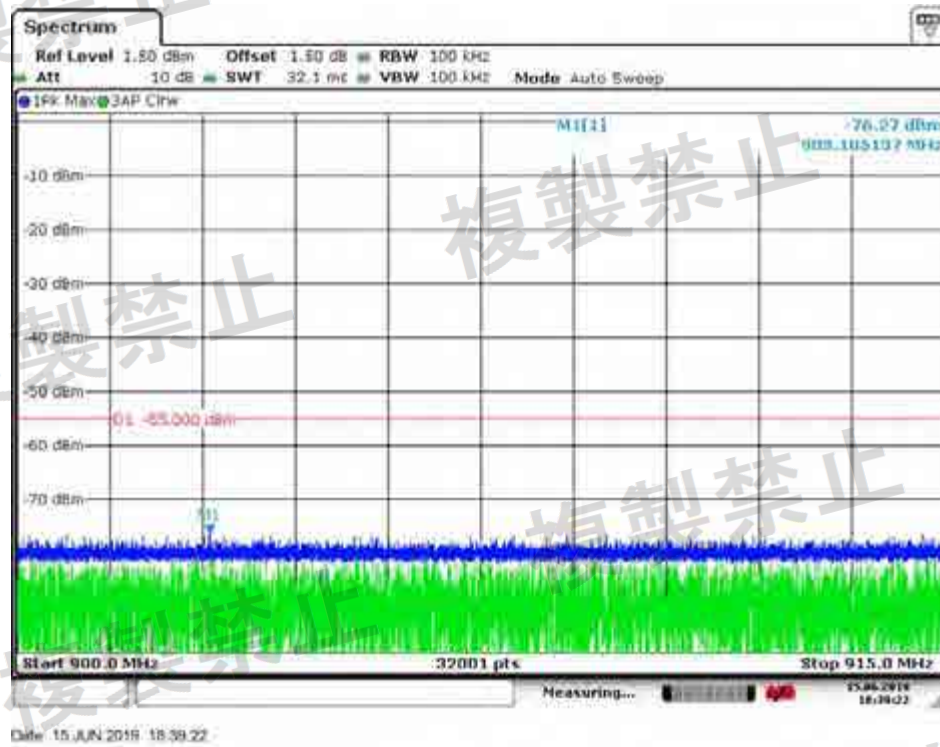


710-900MHz

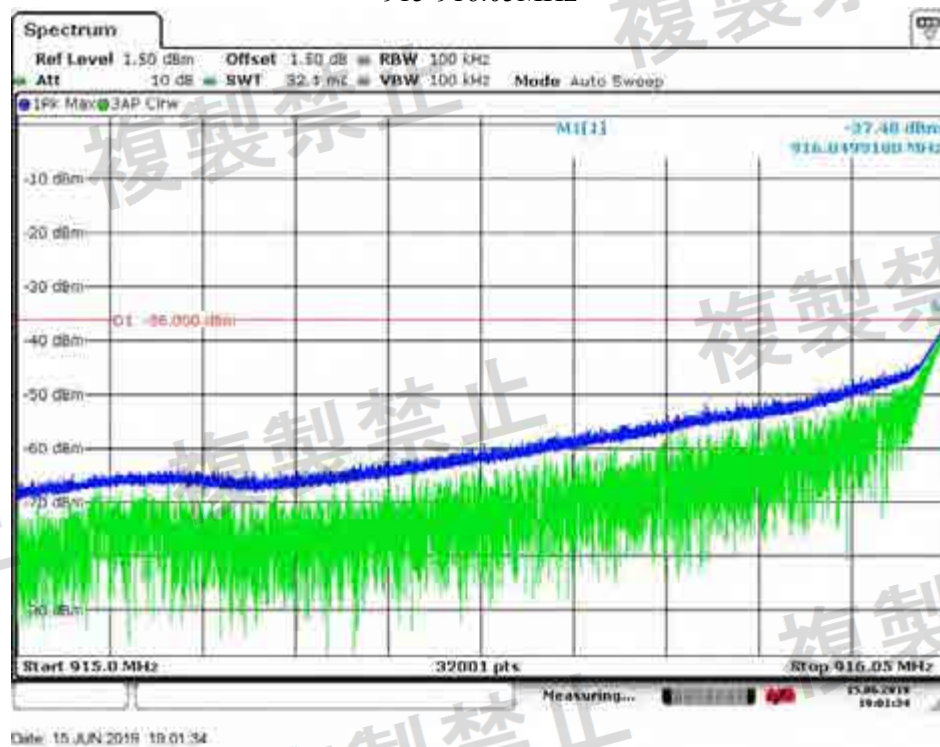




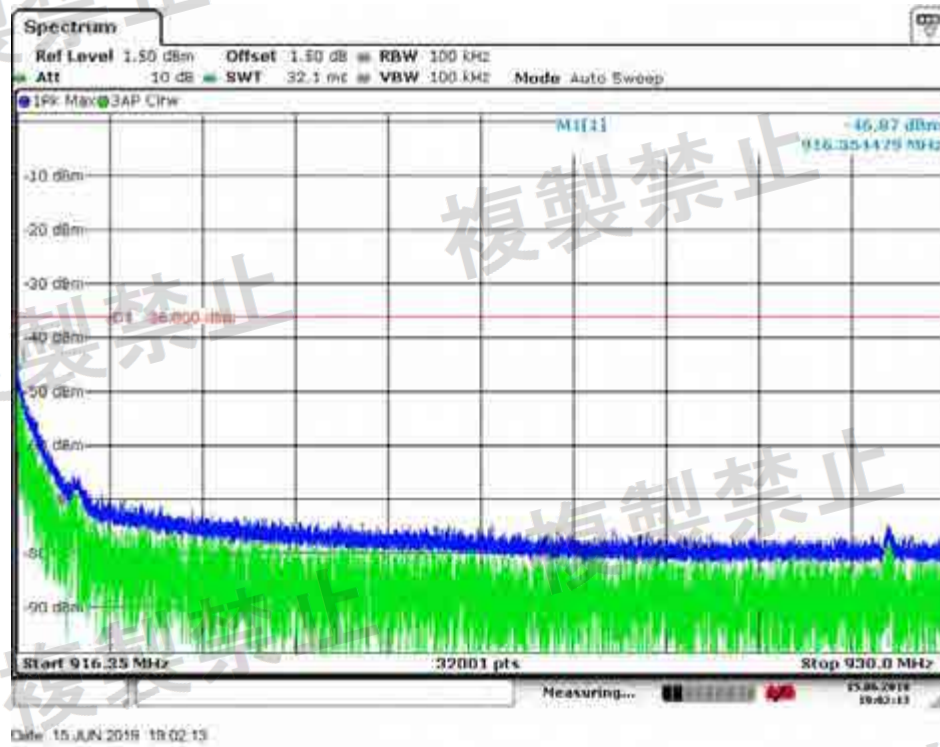
900-915MHz



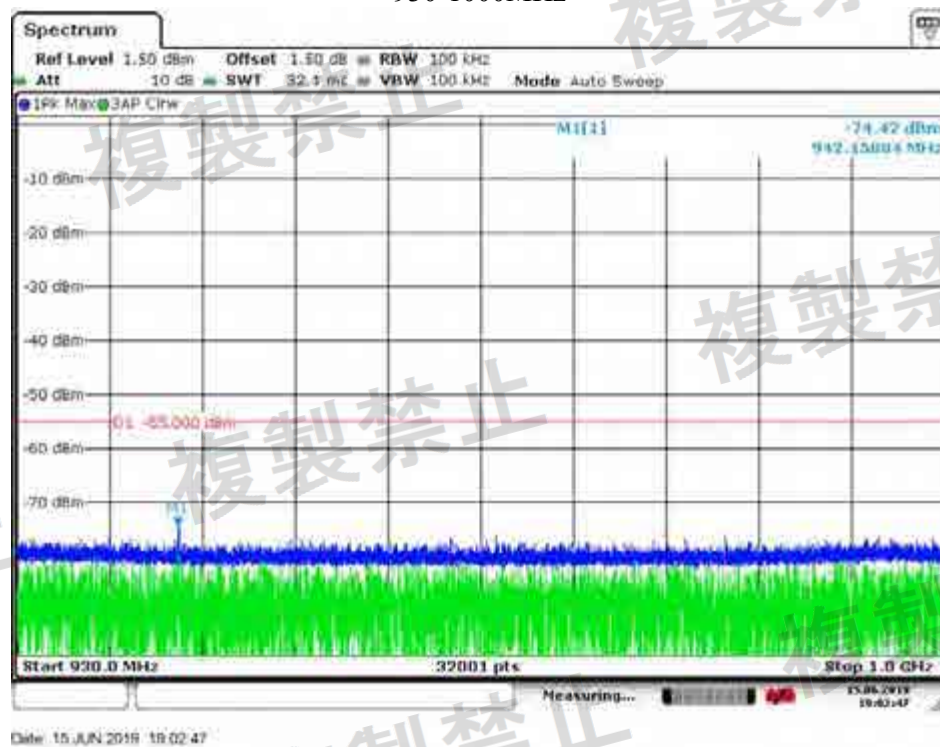
915-916.05MHz



916.35-930MHz



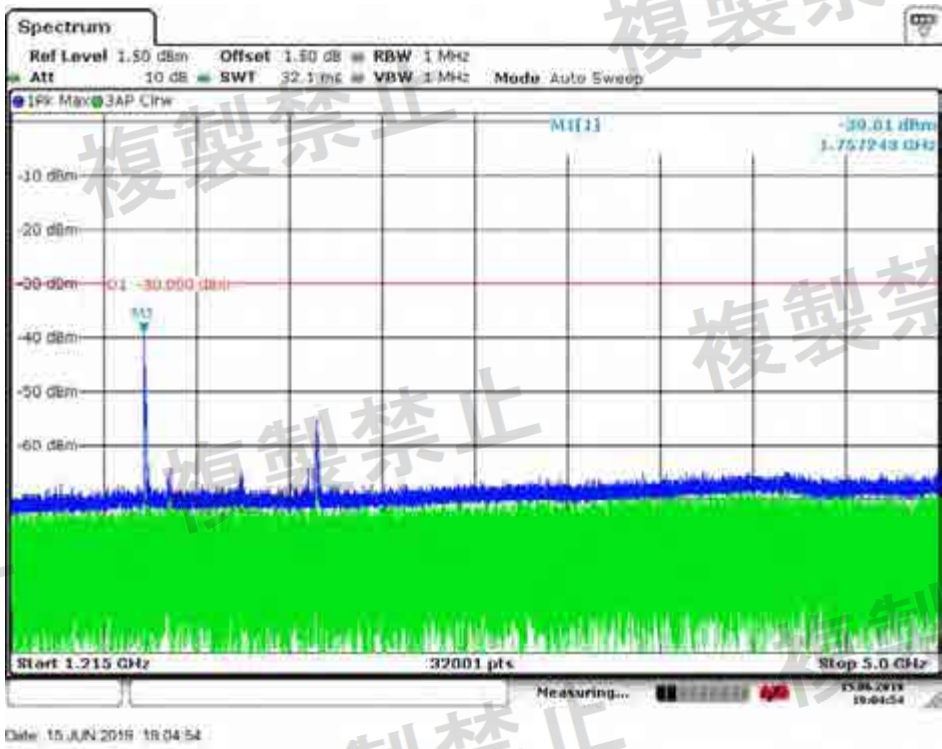
930-1000MHz



1000-1215MHz



1215-5000MHz



Test Result	PASS
-------------	------



## 7. Receiver Spurious Emissions

### 7.1. Test Setup



### 7.2. Test Procedure

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 slow, 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.

### 7.3. Limits

- $\leq -54\text{dBm}/100\text{kHz}$  for 30 – 710 MHz
- $\leq -55\text{dBm}/1\text{MHz}$  for 710 – 900 MHz
- $\leq -55\text{dBm}/100\text{kHz}$  for 900 – 915 MHz
- $\leq -54\text{dBm}/100\text{kHz}$  for 915 – 930 MHz
- $\leq -55\text{dBm}/100\text{kHz}$  for 930 – 1000 MHz
- $\leq -47\text{dBm}/1\text{MHz}$  for 1000 – 5000 MHz

### 7.4. Uncertainty

$\pm 1.201\text{ dB}$

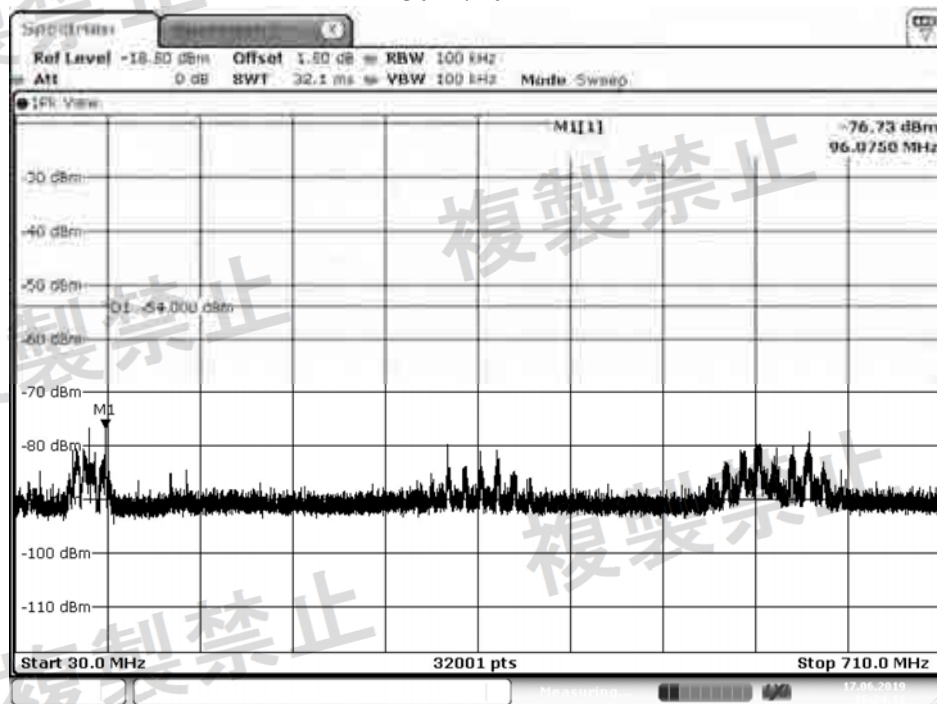
### 7.5. Test Result of Receiver Spurious Emissions

Product : pewag levo hook LH  
Test Item : Receiver Spurious Emissions  
Test Mode : Mode 2: Receiver (916.2MHz)

Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 – 710	-76.73	-54
710 – 900	-76.44	-55
900 – 915	-85.69	-55
915 – 930	-86.65	-54
930 – 1000	-86.18	-55
1000 – 5000	-51.58	-47

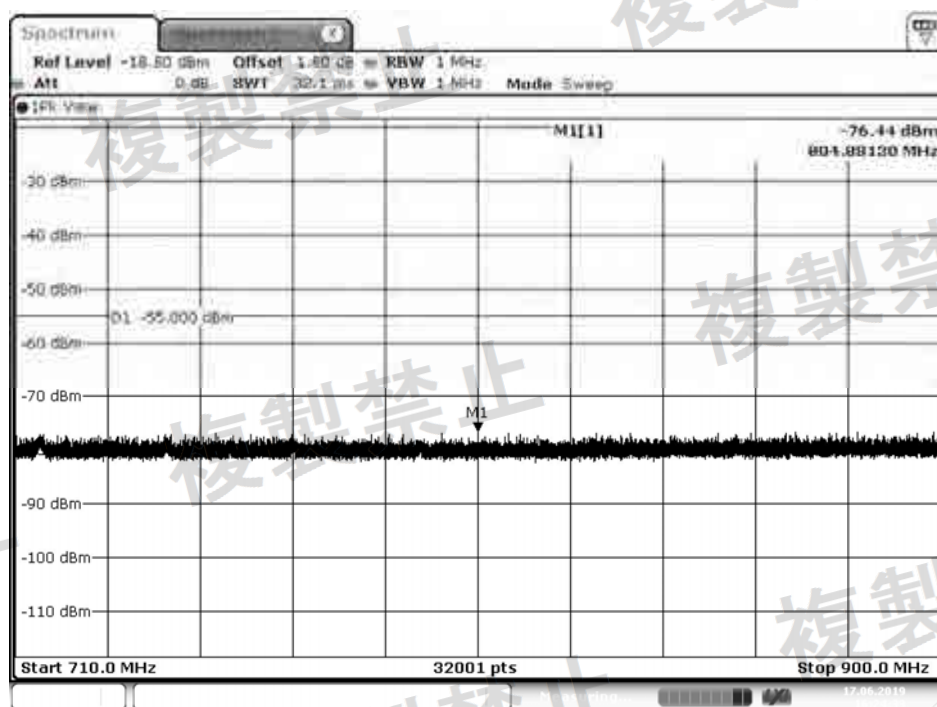


30 – 710MHz



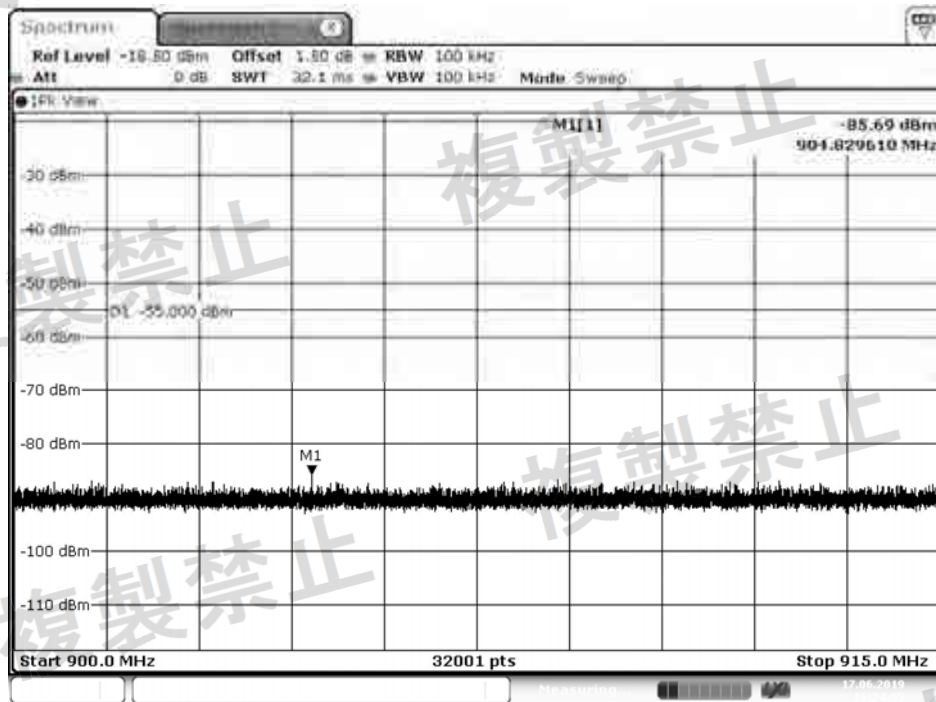
Date: 17.JUN.2019 16:24:12

710 – 900MHz



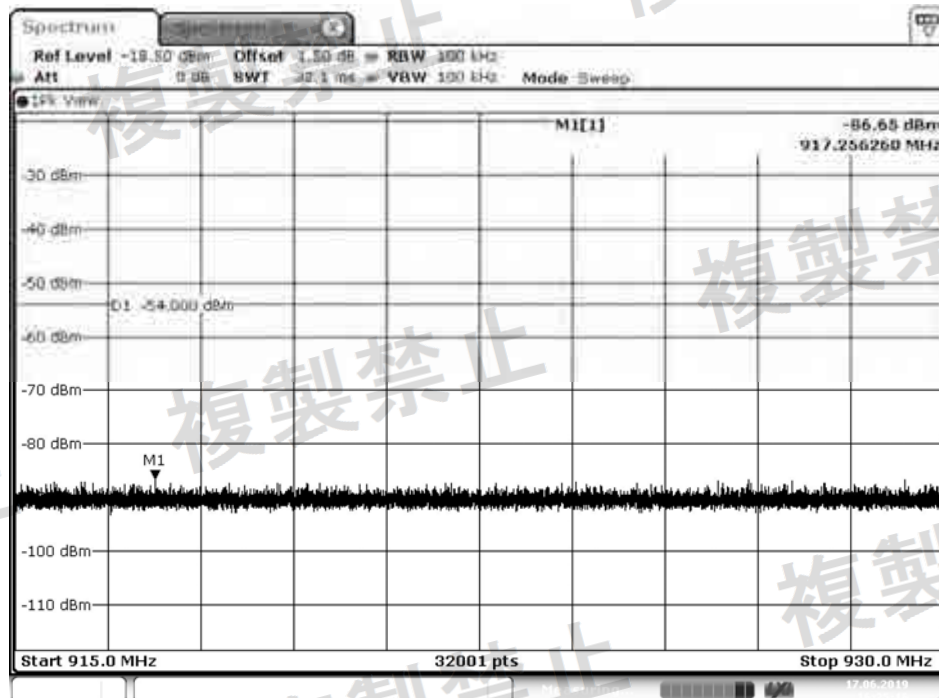
Date: 17.JUN.2019 16:24:34

900 – 915MHz



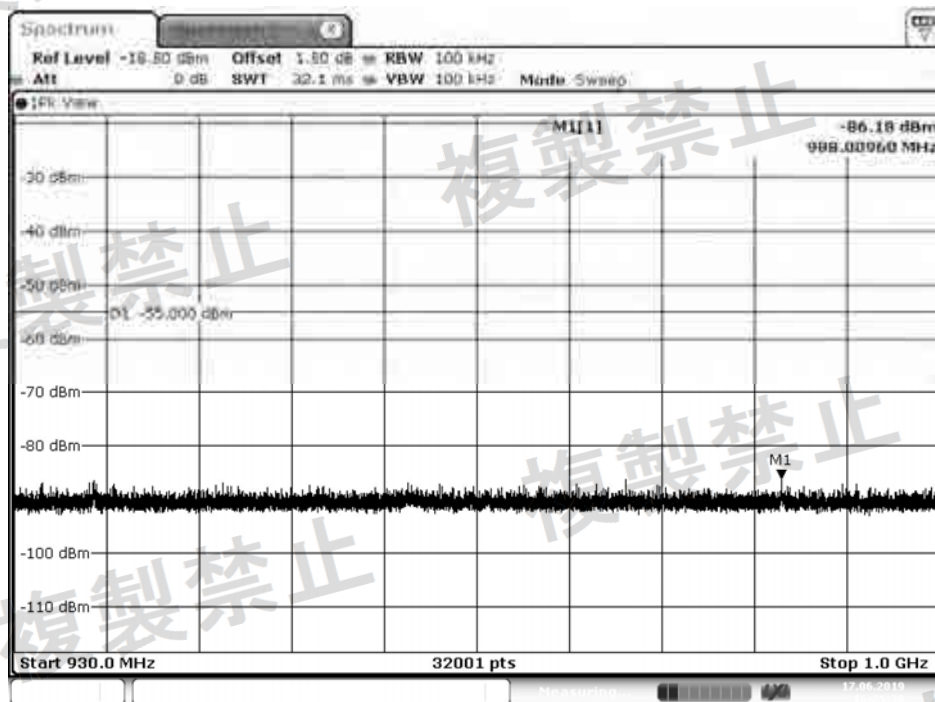
Date: 17.JUN.2019 16:24:55

915 – 930MHz



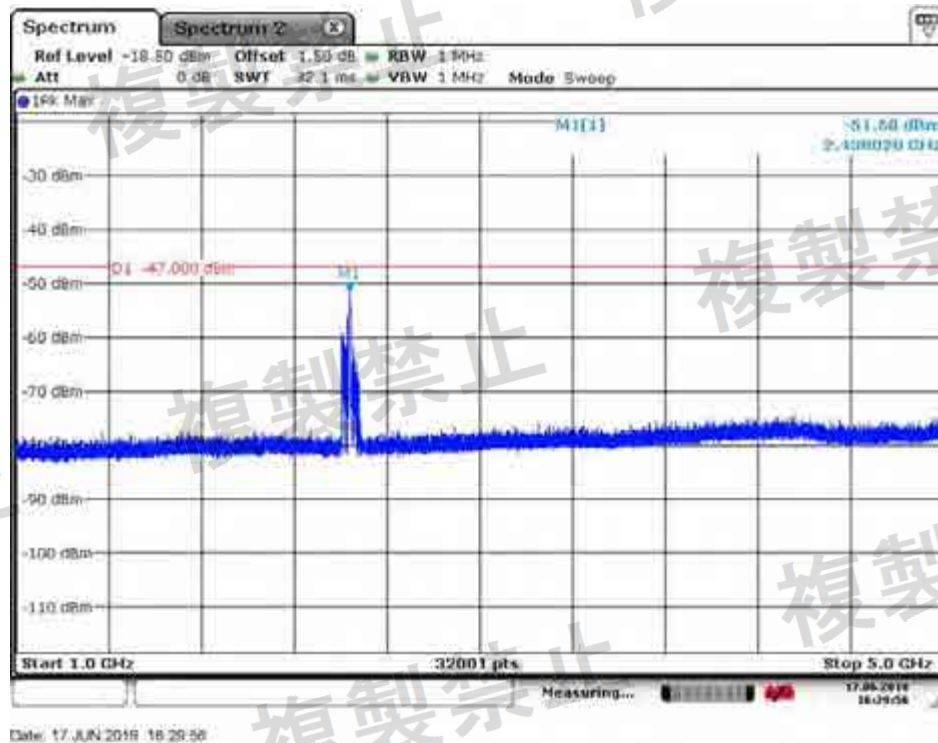
Date: 17.JUN.2019 16:25:17

930 – 1000MHz



Date: 17 JUN 2019 16:25:38

1000 – 5000MHz

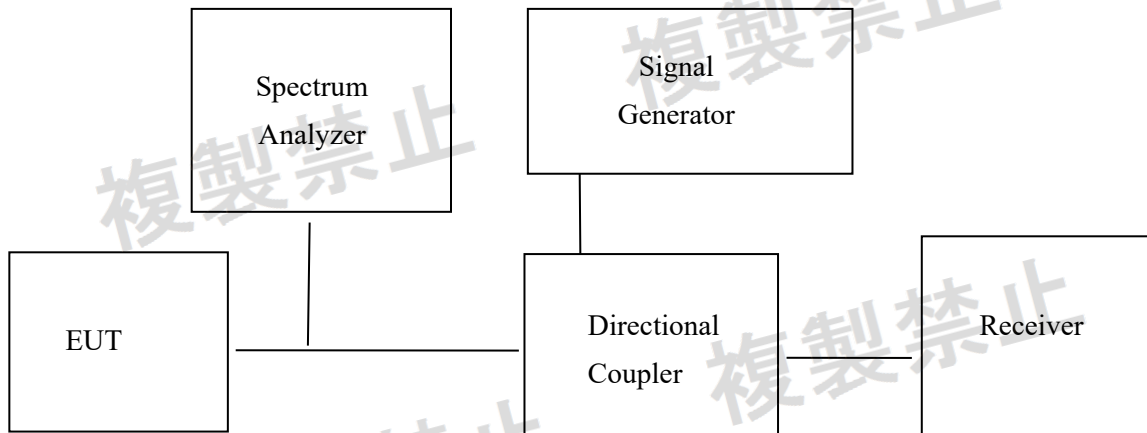


Test Result

PASS

## 8. Carrier Sensing

### 8.1. Test Setup



### 8.2. Test Procedure

- Link EUT and Receiver to Directional Coupler input port.
- Link Signal Generator and Spectrum Analyzer to test port and output port in the Directional Coupler separately.
- A positive Peak Detector function in Spectrum Analyzer must be used.
- Set the Span to Zero.
- Press the Signal Generator on and it will output the Carrier Signal. When the Link breaks off, wait a period of time and press the Signal Generator off. After a while, reset the Link and done the test.

### 8.3. Uncertainty

$\pm 2.31\text{ms}$

#### 8.4. Test Result of Carrier Sensing

No requirement, so this item does not need to test.



## 9. Transmission Time Restriction

### 9.1. Test Setup



### 9.2. Test Procedure

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 center frequency is set to the test frequency and the span is switched to zero.
- (c) The measurement instrument bandwidth must be set sufficiently with, and, the scan time set sufficiently slow, 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) "Single sweep" mode may be used to capture a packet over a single scan.

### 9.3. Limits

Total Transmission time: 3.6s/hour or less

Transmission time: 0.1s or less

Suspend time: 0.1s or more

### 9.4. Uncertainty

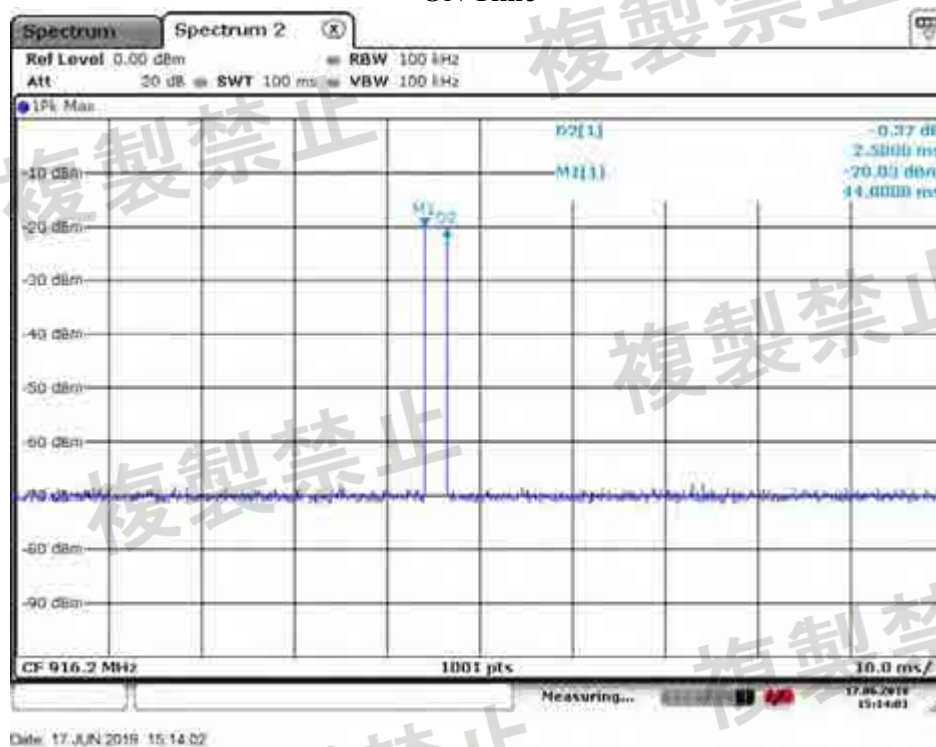
$\pm 2.31\text{ms}$

### 9.5. Test Result of Transmission Time Restriction

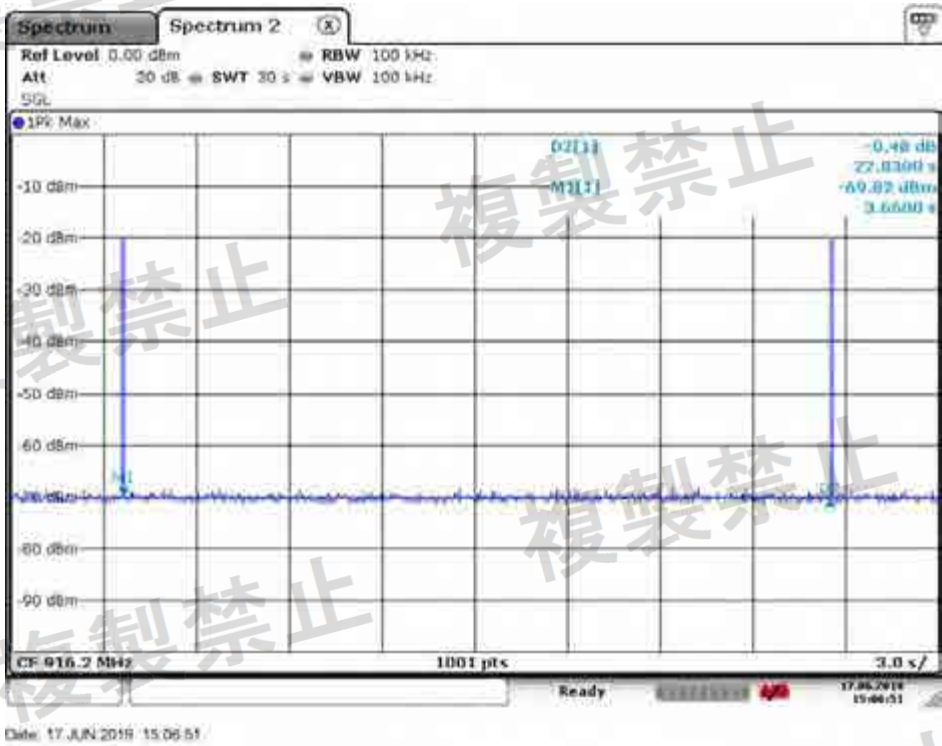
Product : pewag levo hook LH  
 Test Item : Transmission Time Restriction  
 Test Mode : Mode 1: Transmitter

Frequency (MHz)	ON Time (ms)	ON time Limit (ms)	OFF time (ms)	OFF time Limit (ms)	Result
916.2	2.50	<100	22830.00	>100	Pass

ON Time



OFF time



Product : pewag levo hook LH  
Test Item : Transmission Time Restriction  
Test Mode : Mode 1: Transmitter

Frequency (MHz)	Total ON Time (s)	Total ON time Limit (s)	Observation time (s)	Result
916.2	0.394	<3.6	3600	Pass

Note: Total ON Time(/hour)= ON Time / (ON Time + OFF time)\*3600s

**10. EMI Reduction Method During Compliance Testing**

No modification was made during testing.