



REPORT No.: SZ19120234W01

TEST REPORT

APPLICANT : Anker Innovations Limited

PRODUCT NAME : Nebula Cosmos

MODEL NAME : D2140

BRAND NAME : NEBULA

TEST RULE : MIC Notice No.88 Appendix No.43, Item 19

STANDARD(S) : MIC Ordinance Regulating Radio Equipment
Article 49.20.

RECEIPT DATE : 2019-12-19

TEST DATE : 2020-04-26 to 2020-04-30

ISSUE DATE : 2020-05-22

Edited by:

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Peng Huarui(Supervisor)

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DIRECTORY

1. Technical Information	4
1.1. Applicant and Manufacturer Information	4
1.2. Equipment Under Test (EUT) Description	4
1.3. Table for Filed Antenna	5
1.4. Table for Carrier Frequency	5
1.5. Table for Test Modes	6
1.6. Summary of the test result	7
1.7. Environmental Conditions	7
2. Test Results	8
2.1. Frequency Error Measurement	8
2.2. Occupied Bandwidth and Spread-spectrum Bandwidth / Factor	13
2.3. Unwanted Emission Intensity Measurement	18
2.4. Antenna Power Error Measurement	23
2.5. Limitation of Collateral Emission of Receiver Measurement	26
2.6. Transmission Antenna Gain (EIRP Antenna Power) Measurement	31
2.7. Transmission Radiation Angle Width (3dB Beam width) Measurement	33
2.8. Radio Interference Prevention Capability Measurement	35
2.9. Construction Protection Confirmation Method Limit	37
Annex A Test Uncertainty	38
Annex B Testing Laboratory Information	39



REPORT No.: SZ19120234W01

Change History		
Version	Date	Reason for change
1.0	2020-05-22	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19, Hollywood Plaza, 610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Nebula Cosmos	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	V0.4	
Software Version:	ATV9.0.2	
Equipment Type:	Bluetooth LE	
Modulation Technology:	GFSK	
Operating Frequency Range:	2402MHz – 2480MHz (at interval of 2MHz)	
Power Supply:	AC Adaptor	
Test Voltage:	Normal(NV):	19.0V
	Lowest(LV):	17.1V
	Highest(HV):	20.9V

Note 1: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



1.3. Table for Filed Antenna

Antenna Manufacture:	Dongguan YiJia Electronics Communication Technology C.,Ltd.
Brand Name:	N/A
Model Name:	YJS01.005.016.302
Antenna Type:	FPC Antenna
Antenna Gain:	ANT1: 1.2dBi

1.4. Table for Carrier Frequency

Frequency Band	Channel No.	Frequency (MHz)
2402~2480MHz	0	2402
	1	2404
	2	2406
	:	:
	19	2440
	:	:
	39	2480

Test frequency 2402MHz, 2440MHz and 2480MHz are chosen for tested.



1.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Channel
Frequency Error	Un-modulation	0/19/39
Occupied Bandwidth and Spread-spectrum Bandwidth / Factor	GFSK	0/19/39
Unwanted Emission Intensity	GFSK	0/19/39
Antenna Power Error	GFSK	0/19/39
Limitation of Collateral Emission of Receiver	GFSK	0/19/39
Transmission Antenna Gain	GFSK	0/19/39
Transmission Radiation Angle Width	GFSK	0/19/39
Radio Interference Prevention Capability	GFSK	0/19/39

1.6. Summary of the test result

Applied Standard: MIC Notice No.88 Appendix No.43				
No.	Description of Test	Test Engineer	Result	Method determination /Remark
1	Frequency Error	Tu Yanan	PASS	No deviation
2	Occupied Bandwidth and Spread-spectrum Bandwidth / Factor	Tu Yanan	PASS	No deviation
3	Unwanted Emission Intensity	Tu Yanan	PASS	No deviation
4	Antenna Power Error	Tu Yanan	PASS	No deviation
5	Limitation of Collateral Emission of Receiver	Tu Yanan	PASS	No deviation
6	Transmission Antenna Gain (EIRP Antenna Power)	N/A	N/A ^{Note1}	N/A
7	Transmission Radiation Angle Width (3Db Beamwidth)	N/A	N/A ^{Note1}	N/A
8	Radio Interference Prevention Capability	Tu Yanan	PASS	No deviation
9	Construction Protection Confirmation	N/A	PASS	No deviation
Note 1: The test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less. Note 2: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.				

1.7. Environmental Conditions

Temperature (°C):	5-35
Relative Humidity (%):	45-85
Atmospheric Pressure (kPa):	86-106

2. Test Results

2.1. Frequency Error Measurement

2.1.1. Limit

Item	Limits
Frequency Tolerance	$\pm 50\text{ppm}$

2.1.2. Measuring Instruments and Setting

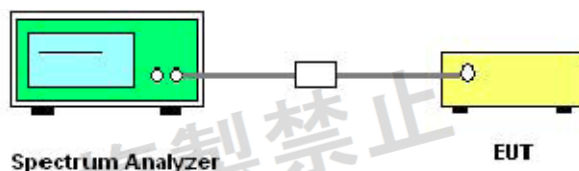
The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Span Frequency	50kHz
RB/VB	10 kHz / 30 kHz

2.1.3. Test Procedures

1. Frequency accuracy of SA shall be less than 10% of limits tolerance (5ppm)
2. Setting of SA is following as: RB:10kHz / VB:30kHz / SPAN: 50kHz
3. Center Frequency: The center frequency of testing for EUT
4. Sweep time: Auto
5. Sweep mode: Continuous sweep
6. Detect mode: Positive peak
7. Mark function: Frequency Counter (Resolution 100Hz)
8. EUT have transmitted absence of modulation signal and fixed channelize. f is using the mark cursor to mark the peak frequency value, fc is declaring of channel frequency. Then the frequency error formula is $(f_c - f) / f_c \times 10^6 \text{ppm}$ and the limit is $\pm 50\text{ppm}$.

2.1.4. Test Setup Layout





2.1.5. Test Deviation

There is no deviation with the original standard.

2.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in un-modulation function.

2.1.7. Test Result

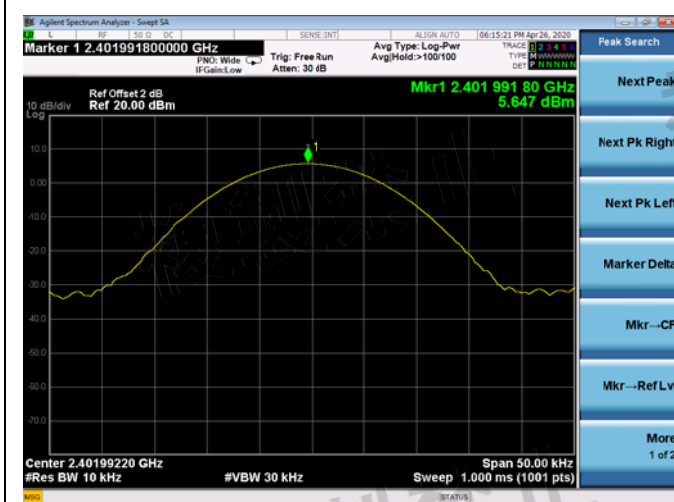
Test Voltage	Channel	Frequency fc (MHz)	Test Frequency f (MHz)	Frequency Error ppm	Verdict
LV	0	2402	2401.9918	-3.41	PASS
	19	2440	2439.9848	-6.23	PASS
	39	2480	2479.9773	-9.15	PASS
NV	0	2402	2401.9916	-3.50	PASS
	19	2440	2439.9848	-6.23	PASS
	39	2480	2479.9772	-9.19	PASS
HV	0	2402	2401.9922	-3.25	PASS
	19	2440	2439.9849	-6.19	PASS
	39	2480	2479.9774	-9.11	PASS



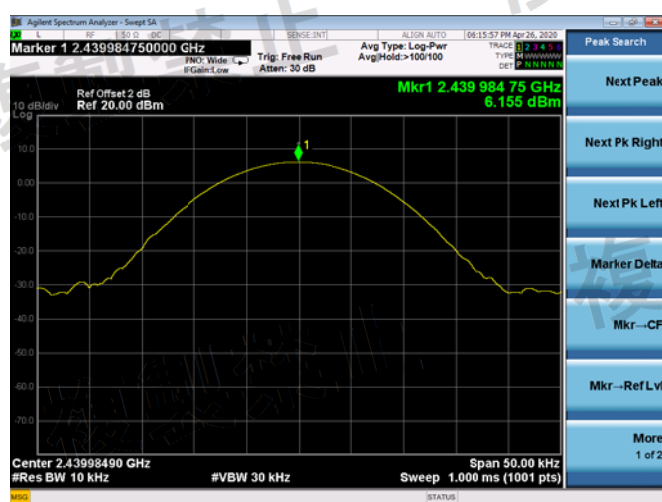
REPORT No.: SZ19120234W01

Frequency Error

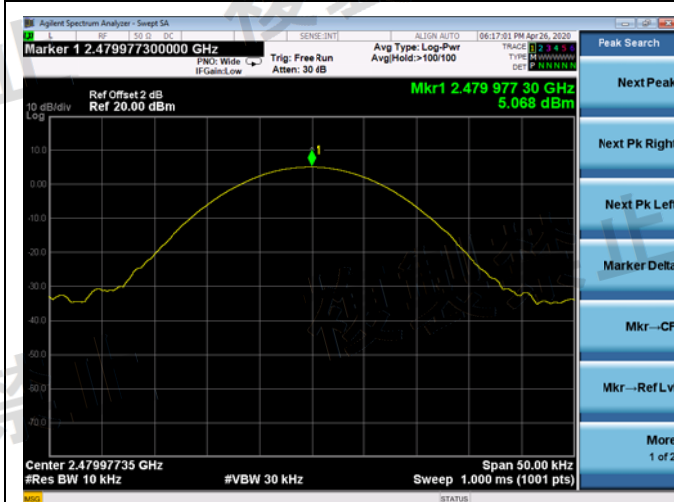
CH0, 2402MHz, LV



CH19, 2440MHz, LV



CH39, 2480MHz, LV



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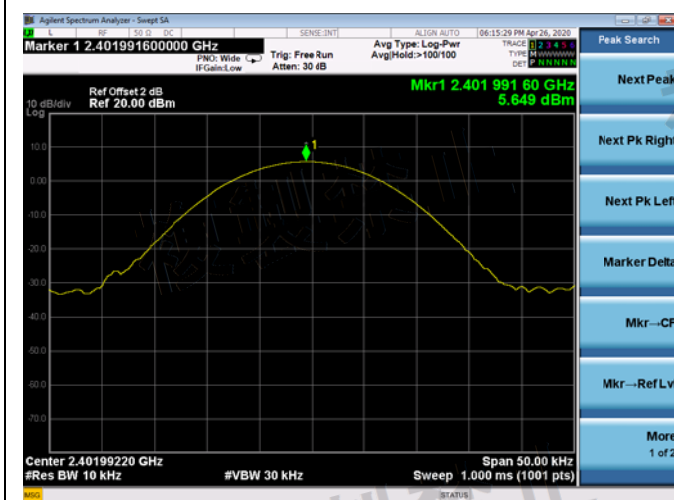
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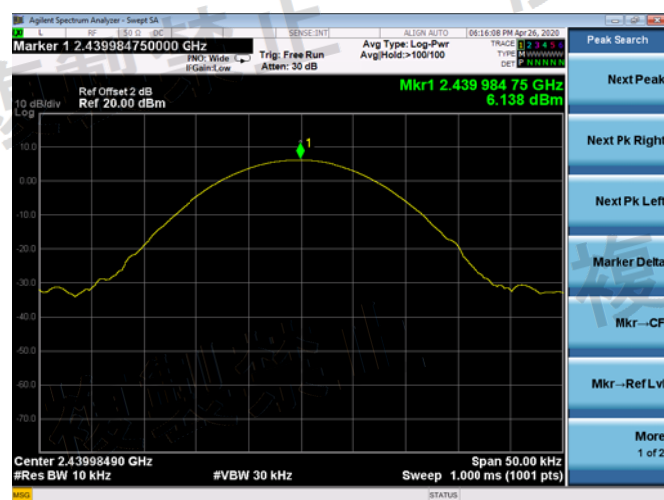
REPORT No.: SZ19120234W01

Frequency Error

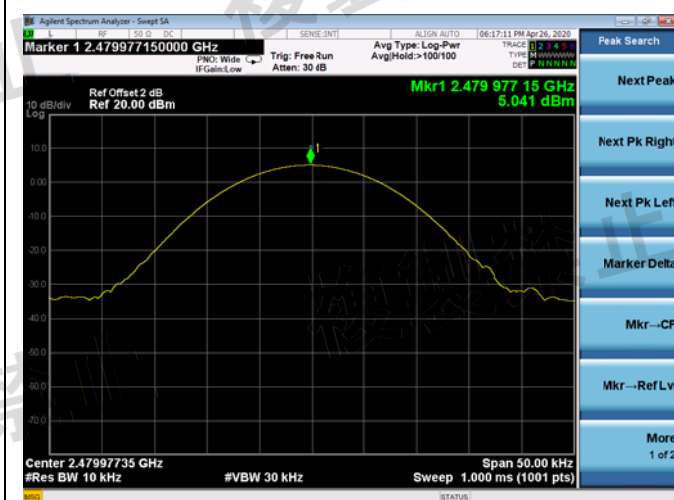
CH0, 2402MHz, NV



CH19, 2440MHz, NV



CH39, 2480MHz, NV



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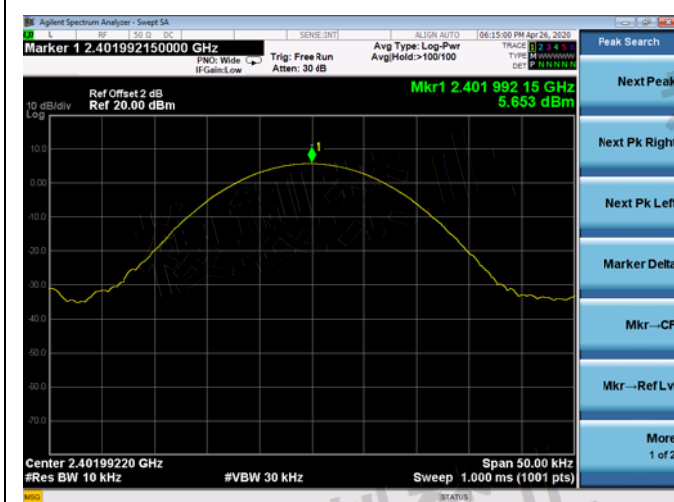
E-mail: service@morlab.cn



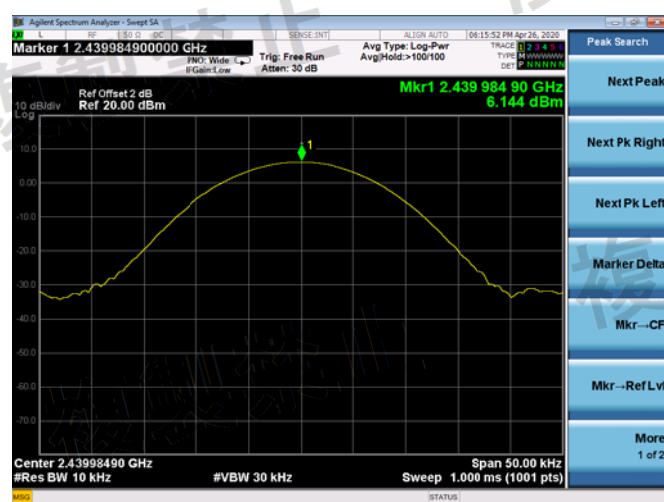
REPORT No.: SZ19120234W01

Frequency Error

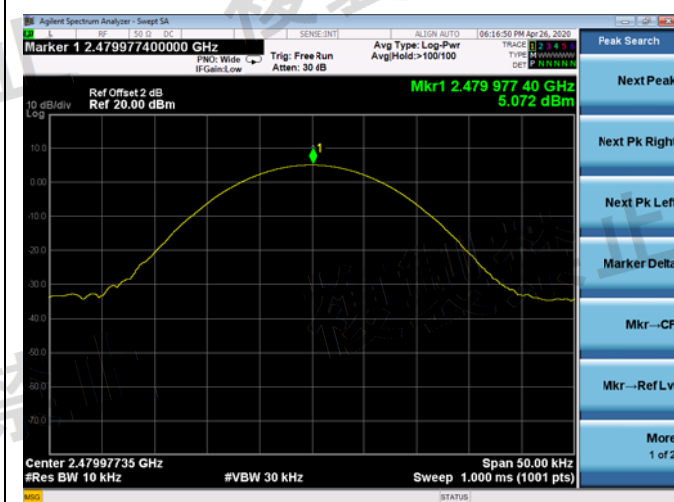
CH0, 2402MHz, HV



CH19, 2440MHz, HV



CH39, 2480MHz, HV



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2.2. Occupied Bandwidth and Spread-spectrum Bandwidth / Factor

2.2.1. Limit

Item	Limits
Occupied Band Width	FH≤83.5MHz; OFDM, DS≤26MHz; Others≤26MHz;
Spread-spectrum Bandwidth	≥500KHz (FH, DS)

2.2.2. Measuring Instruments and Setting

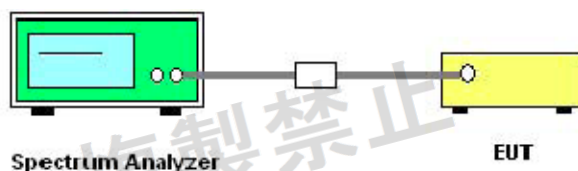
The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Span Frequency	3MHz
RB/VB	100KHz/300 kHz

2.2.3. Test Procedures

1. Setting of SA is following as: RB: 100 kHz / VB: 300 kHz / SPAN: 3MHz / / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
2. EUT have transmitted the maximum modulation signal and fixed channelize (For DSSS or OFDM Device) or continuous maximum power of hopping mode (For FHSS Device). SA set to 99% of occupied Bandwidth to measure occupied Bandwidth. The limit is less than 26MHz (For DSSS or OFDM Device) or 83.5MHz (For FHSS Device).
3. SA set to 90% of occupied Bandwidth to measure Spread Spectrum Bandwidth and must greater than 500kHz.
4. Spread Spectrum Factor = Spread Spectrum Bandwidth/ modulation rate of EUT.
5. Spread Spectrum Factor limit is greater than 5

2.2.4. Test Setup Layout





2.2.5. Test Deviation

There is no deviation with the original standard.

2.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.2.7. Test Result

Results of Occupied Bandwidth

Test Voltage	Channel	Frequency (MHz)	Measured 99% Occupied Bandwidth (MHz)	Verdict
LV	0	2402	1.087	PASS
	19	2440	1.088	PASS
	39	2480	1.087	PASS
NV	0	2402	1.087	PASS
	19	2440	1.088	PASS
	39	2480	1.088	PASS
HV	0	2402	1.090	PASS
	19	2440	1.089	PASS
	39	2480	1.089	PASS



99% Occupied Bandwidth

CH0, 2402MHz, LV



CH19, 2440MHz, LV



CH39, 2480MHz, LV





REPORT No.: SZ19120234W01

99% Occupied Bandwidth

CH0, 2402MHz, NV



CH19, 2440MHz, NV



CH39, 2480MHz, NV



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99% Occupied Bandwidth

CH0, 2402MHz, HV



CH19, 2440MHz, HV



CH39, 2480MHz, HV



2.3. Unwanted Emission Intensity Measurement

2.3.1. Limit

Item	Limits
TX Spurious Emission	$\leq 2.5 \mu\text{W}/\text{MHz}$ ($30\text{MHz} \leq f < 2387\text{MHz}$; $2496.5\text{MHz} < f$)
	$\leq 25 \mu\text{W}/\text{MHz}$ ($2387\text{MHz} \leq f < 2400\text{MHz}$) ; ($2483.5\text{MHz} < f \leq 2496.5\text{MHz}$)

2.3.2. Measuring Instruments and Setting

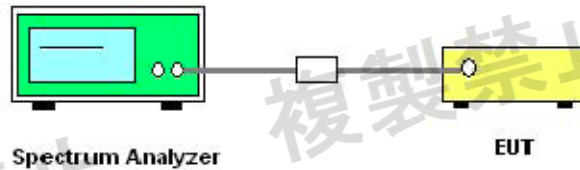
The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	100KHz/100KHz(below 1GHz emissions) ; 1MHz/1MHz(above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.3.3. Test Procedures

1. EUT have transmitted the maximum modulation signal and fixed channelize.
2. Setting of SA is following as: RB/VB: 100 kHz/100kHz (below 1GHz emissions), 1MHz/1MHz (above 1GHz emissions) / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
3. Setting of SA is following as 30MHz and stop frequency 2387MHz Then to mark peak reading value + cable loss shall be less than 2.5 μW .
4. SA adjusted to start frequency 2387MHz and stop frequency 2400MHz. Then to mark peak reading value + cable loss shall be less than 25 μW .
5. SA adjusted to start frequency 2483.5MHz and stop frequency 2496.5MHz. Then to mark peak reading value + cable loss shall be less than 25 μW
6. SA adjusted to start frequency 2496.5MHz and stop frequency 12500MHz. Then to mark peak reading value + cable loss shall be less than 2.5 μW

2.3.4. Test Setup Layout



2.3.5. Test Deviation

There is no deviation with the original standard.

2.3.6. EUT Operation during Test

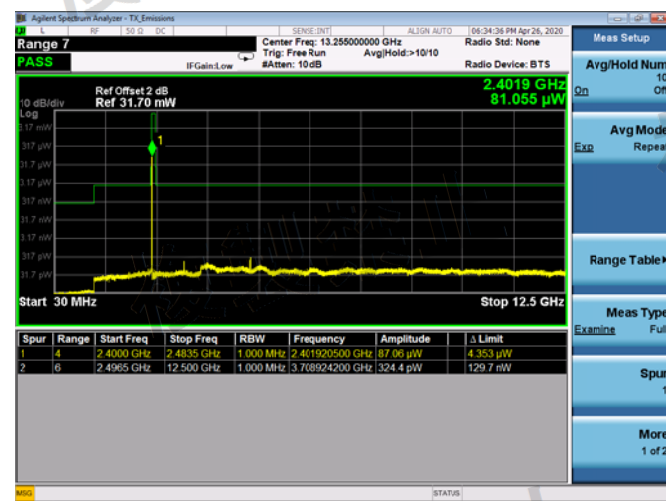
The EUT was programmed to be in continuously transmitting mode.

2.3.7. Test Result

Test Channel	Test Frequency (MHz)	Test Result Value	Limit	Verdict
		Max Value		
0	30~1000	<0.25uW/100kHz	0.25uW/100kHz	PASS
	1000~2387	<2.5uW/MHz	2.5uW/MHz	PASS
	2387~2400	<25uW/MHz	25uW/MHz	PASS
	2483.5~2496.5	< 25uW/MHz	25uW/MHz	PASS
	2496.5~12500	<2.5uW/MHz	2.5uW/MHz	PASS
19	30~1000	<0.25uW/100kHz	0.25uW/100kHz	PASS
	1000~2387	<2.5uW/MHz	2.5uW/MHz	PASS
	2387~2400	<25uW/MHz	25uW/MHz	PASS
	2483.5~2496.5	< 25uW/MHz	25uW/MHz	PASS
	2496.5~12500	<2.5uW/MHz	2.5uW/MHz	PASS
39	30~1000	<0.25uW/100kHz	0.25uW/100kHz	PASS
	1000~2387	<2.5uW/MHz	2.5uW/MHz	PASS
	2387~2400	<25uW/MHz	25uW/MHz	PASS
	2483.5~2496.5	< 25uW/MHz	25uW/MHz	PASS
	2496.5~12500	<2.5uW/MHz	2.5uW/MHz	PASS



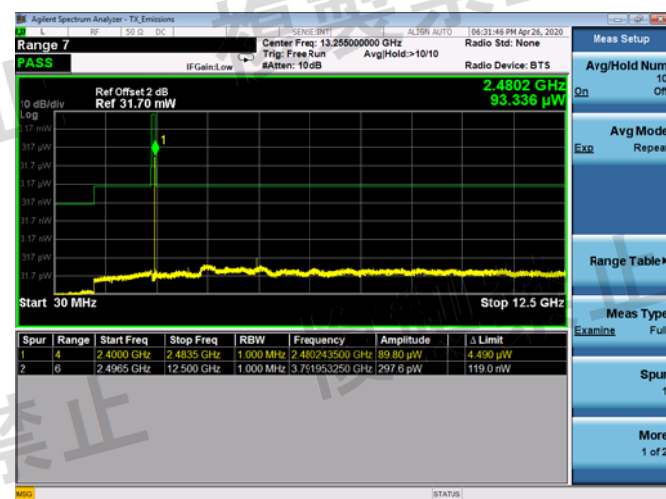
30MHz – 12.5GHz, CH0, 2402MHz, LV



30MHz – 12.5GHz, CH19, 2440MHz, LV

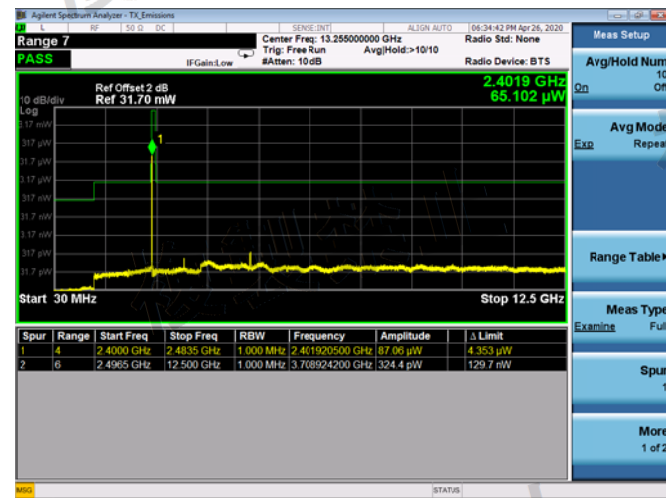


30MHz – 12.5GHz, CH39, 2480MHz, LV

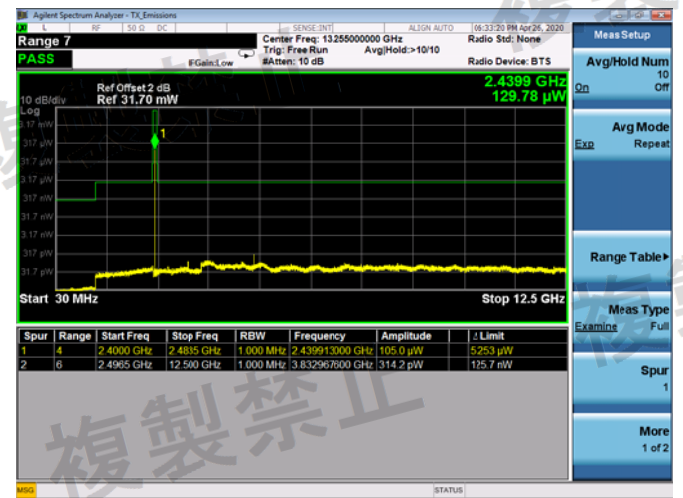




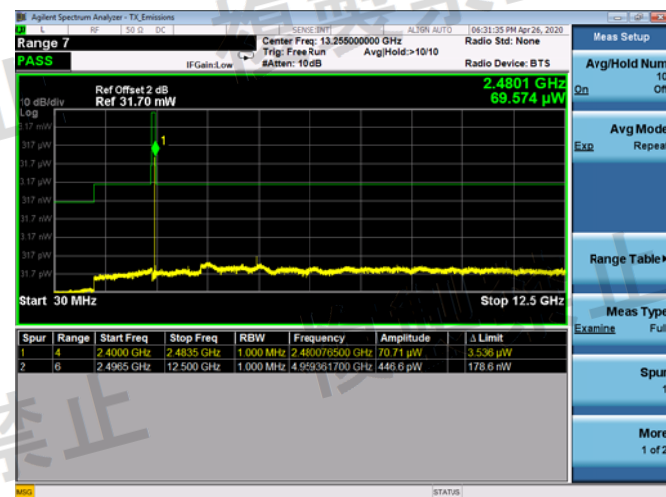
30MHz – 12.5GHz, CH0, 2402MHz, NV



30MHz – 12.5GHz, CH19, 2440MHz, NV



30MHz – 12.5GHz, CH39, 2480MHz, NV





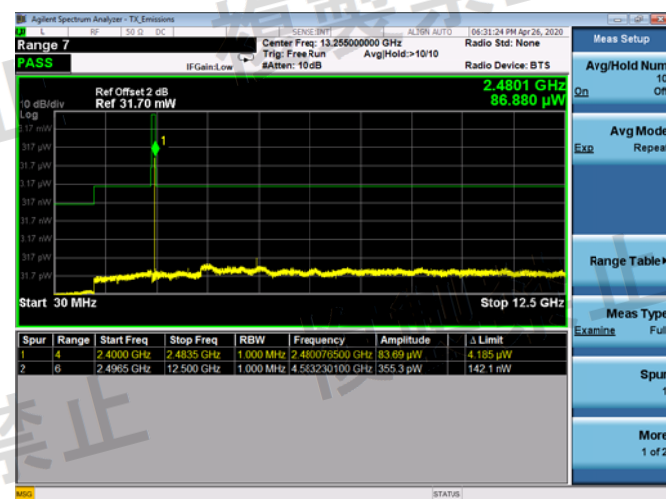
30MHz – 12.5GHz, CH0, 2402MHz, HV



30MHz – 12.5GHz, CH19, 2440MHz, HV



30MHz – 12.5GHz, CH39, 2480MHz, HV



Note1: The spurious emissions mask that displayed on the plots is composed of several frequency ranges below:

Range	Start Freq. (MHz)	Stop Freq. (MHz)	RBW	VBW	Detector Type	Trace Mode	Limit (uW)
1	30	1000	100kHz	100kHz	Peak	Max Hold	0.25
2	1000	2387	1MHz	1MHz	Peak	Max Hold	2.5
3	2387	2400	1MHz	1MHz	Peak	Max Hold	25
4	2400	2483.5	1MHz	1MHz	Peak	Max Hold	20000
5	2483.5	2496.5	1MHz	1MHz	Peak	Max Hold	25
6	2496.5	12500	1MHz	1MHz	Peak	Max Hold	2.5

Note 2: Only the spurious with the minimum margin from the limit line will be displayed in the mark table(The lower window on the test plots).

2.4. Antenna Power Error Measurement

2.4.1. Limit

Item	Limits
Antenna Power Density	$\leq 3\text{mW/MHz}$ (FH form 2400~2483.5MHz) $\leq 10\text{mW/MHz}$ (OFDM, DS from 2400~2483.5MHz, 802.11b/g/n20) $\leq 5\text{mW/MHz}$ (OFDM, from 2400~2483.5MHz, 802.11n40) $\leq 10\text{ mW}$ (Other from 2400~2483.5MHz)
Antenna Power Error	+20%, -80% (Base on manufacturer declare antenna power density)

2.4.2. Measuring Instruments and Setting

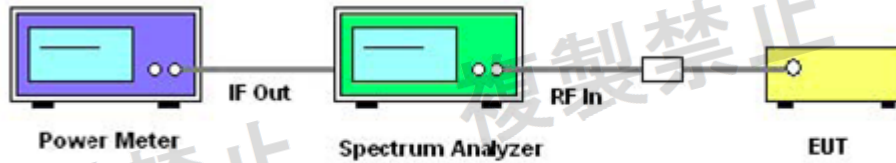
The following table is the setting of the power meter.

Power Meter Parameter	Setting
Filter No.	Auto
Measurement time	0.135 s ~ 26 s
Used Average Sensor	NRV-Z55

2.4.3. Test Procedures

1. A power meter is connected on the IF output port of the spectrum analyzer.
2. Adjust the spectrum analyzer to have the center frequency the same with the measured carrier. RBW=VBW=1MHz, detector mode is positive peak. Turn off the averaging function and use zero span.
3. The calibrating signal power shall be reduced to 0 dBm and it shall be verified that the power meter reading also reduces by 10 dB.
4. Connect the equipment to be measured. Using the following settings of the spectrum analyzer in combination with "max hold" function, find the frequency of highest power output in the power envelope: center frequency equal to operating frequency; RBW & VBW: 1 MHz; detector mode: positive peak; averaging: off; span: 3 times the spectrum width; amplitude: adjust for middle of the instrument's range. The frequency found shall be recorded.
5. Set the center frequency of the spectrum analyzer to the found frequency and switch to zero span. The power meter indicates the measured power density "Pt".
6. Calculate antenna power density by the formula below $PD = Pt + 10 \cdot \log(1/x)$. x: The duty cycle of the EUT in continuously transmitting mode
7. Antenna Power Error is definition that actual measure antenna power tolerance between + 20% to - 80% power range that base on manufacturer declare the conducted power density.

2.4.4. Test Setup Layout



2.4.5. Test Deviation

There is no deviation with the original standard.

2.4.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4.7. Test Result

Duty cycle = 0.6250, Manufacturer declare the conducted power = 4.0mW

Channel	Test Voltage	Test Value P _t (dBm)	Antenna Power P(dBm)	Antenna Power P (mW)	Antenna Power Error	Verdict
2402	LV	-2.54	-0.50	0.89	-77.75%	PASS
	NV	-2.56	-0.52	0.89	-77.75%	PASS
	HV	-2.67	-0.63	0.86	-78.50%	PASS
2440	LV	-1.07	0.97	1.25	-68.75%	PASS
	NV	-1.13	0.91	1.23	-69.25%	PASS
	HV	-1.22	0.82	1.21	-69.75%	PASS
2480	LV	-1.68	0.36	1.09	-72.75%	PASS
	NV	-1.76	0.28	1.07	-73.25%	PASS
	HV	-1.82	0.22	1.05	-73.75%	PASS

Note: Antenna Power tolerance = $(P - P_c) / P_c$

$$P = P_t + 10 \cdot \log(1/x)$$

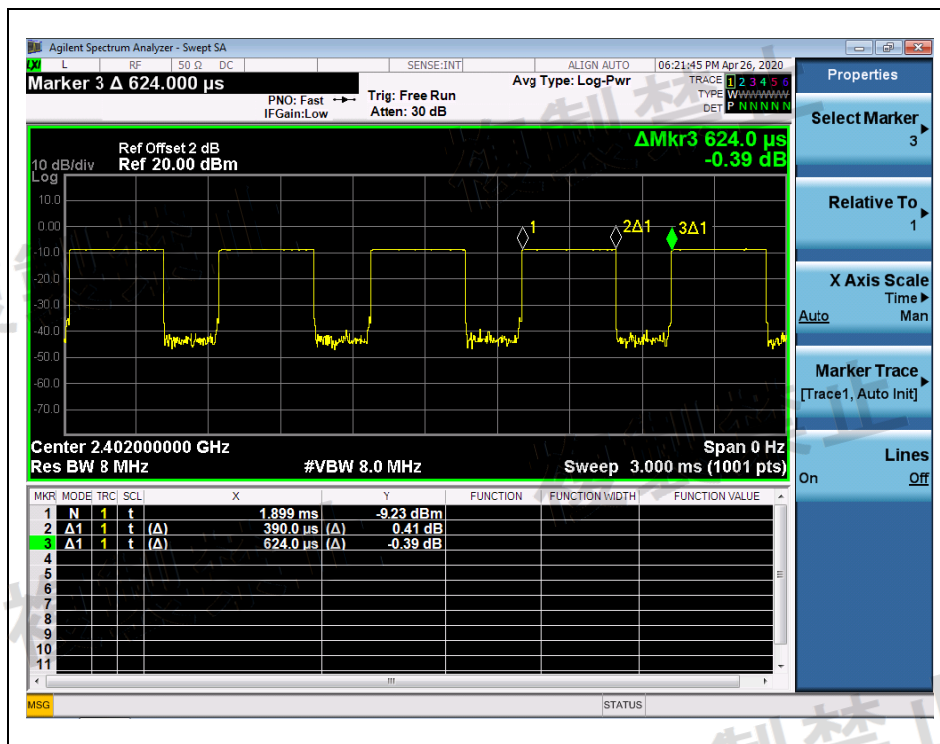
P: Antenna Power; x: Duty cycle;

P_t: Test Value; P_c: The conducted power declared by manufacturer.



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Test plots:



(Duty cycle)

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2.5. Limitation of Collateral Emission of Receiver Measurement

2.5.1. Limit

Item	Limits
RX Spurious Emission:	$\leq 4\text{nW}$ ($f < 1\text{GHz}$)
	$\leq 20\text{nW}$ ($1\text{GHz} \leq f$)

2.5.2. Measuring Instruments and Setting

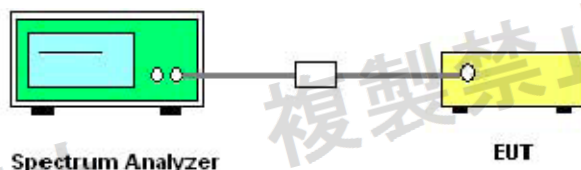
The following table is the setting of the spectrum.

Spectrum Parameter	Setting
Attenuation	Auto
RB/VB	100KHz/100KHz(below 1GHz emissions) ; 1MHz/1MHz(above 1GHz emissions)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.5.3. Test Procedures

- EUT has the continuous reception mode and fixed only one channelize.
- Setting of SA is following as Setting of SA is following as: RB/VB: 100 kHz/100kHz(below 1GHz emissions), 1MHz/1MHz(above 1GHz emissions) / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
- Adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW
- Adjust to start frequency 1000MHz and stop frequency 12500MHz. Search to mark peak reading value + cable loss shall be less than 20nW
- If power level of lower emissions are more than 1/10 of limit (0.4nW for $f < 1\text{GHz}$, 2nW for $f \geq 1\text{GHz}$), all those are to be indicated in the 2nd and 3rd lines. If others are 1/10 or less more of the limit, no necessary to be indicated

2.5.4. Test Setup Layout



2.5.5. Test Deviation

There is no deviation with the original standard.

2.5.6. EUT Operation during Test

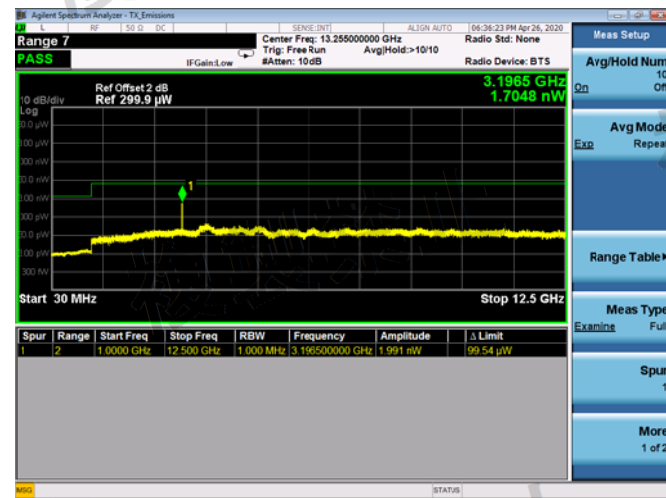
The EUT was programmed to be in continuously transmitting mode.

2.5.7. Test Result

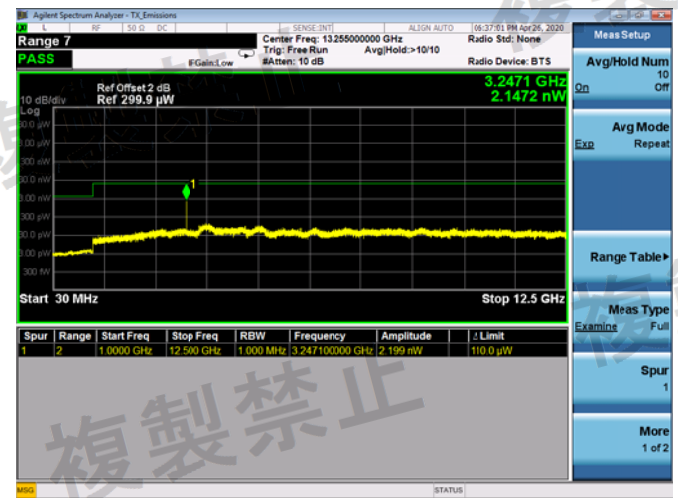
Test Channel	Test Frequency (MHz)	Measured Max. Emission(nW)	Limit (nW)	Verdict
0	30~1000	<4	≤4 (f<1GHz);	PASS
	1000~12500	<20	≤20 (1GHz≤f)	PASS
19	30~1000	< 4	≤4 (f<1GHz);	PASS
	1000~12500	<20	≤20 (1GHz≤f)	PASS
39	30~1000	< 4	≤4 (f<1GHz);	PASS
	1000~12500	<20	≤20 (1GHz≤f)	PASS



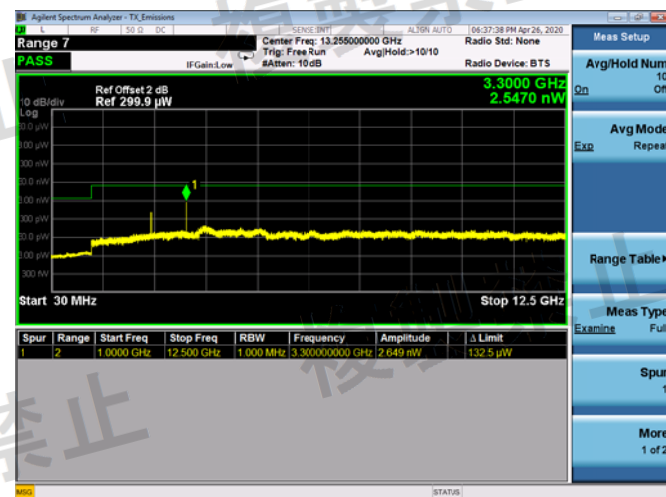
30MHz – 12.5GHz, CH0, 2402MHz, LV



30MHz – 12.5GHz, CH19, 2440MHz, LV

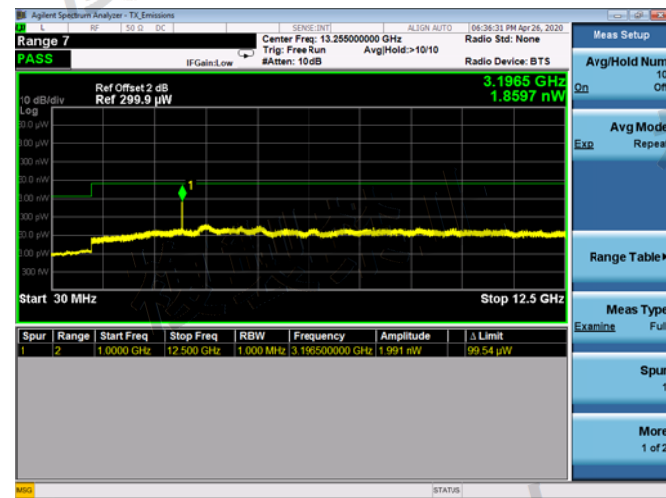


30MHz – 12.5GHz, CH39, 2480MHz, LV





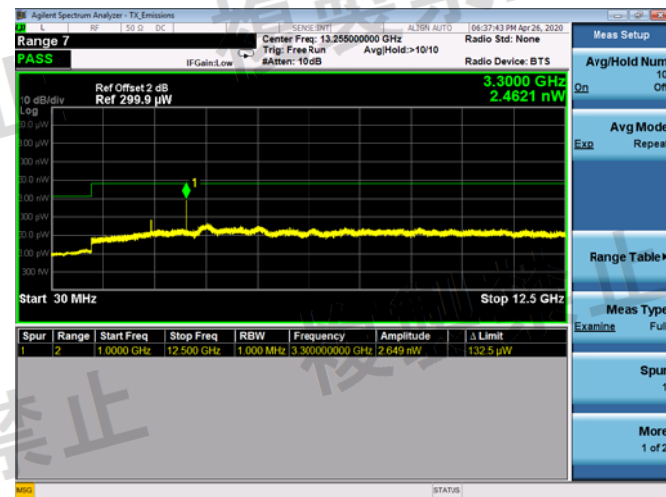
30MHz – 12.5GHz, CH0, 2402MHz, NV



30MHz – 12.5GHz, CH19, 2440MHz, NV

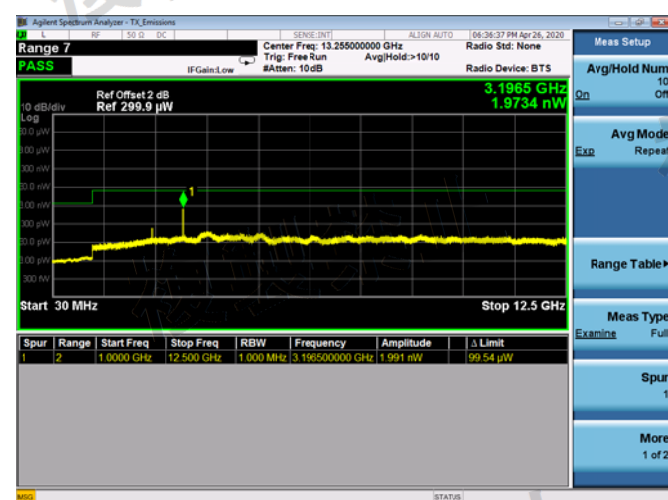


30MHz – 12.5GHz, CH39, 2480MHz, NV

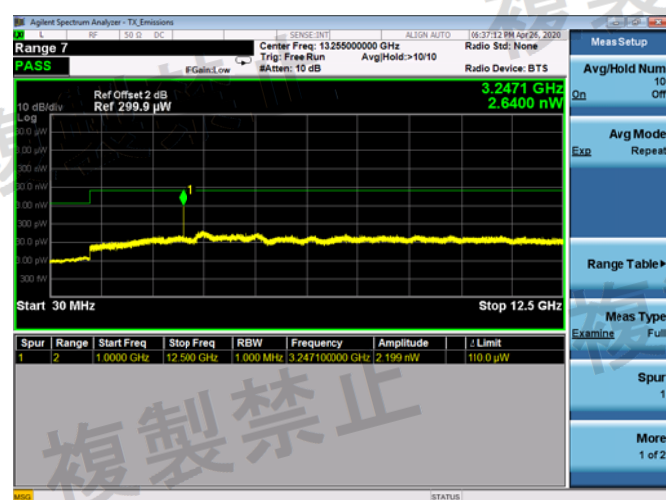




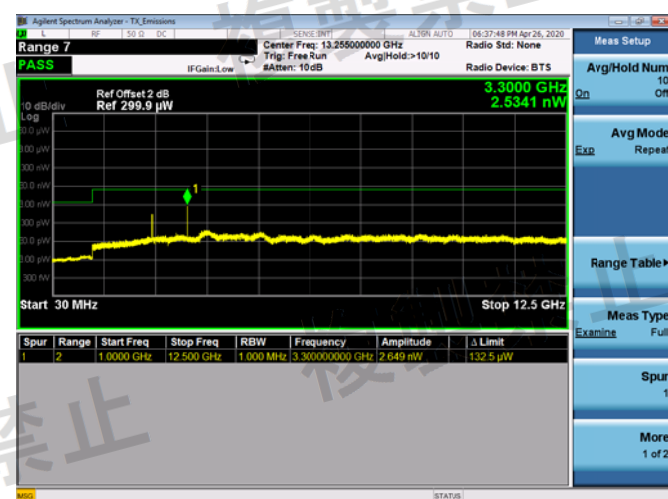
30MHz – 12.5GHz, CH0, 2402MHz, HV



30MHz – 12.5GHz, CH19, 2440MHz, HV



30MHz –12.5GHz, CH39, 2480MHz, HV



Note 1: The spurious emissions mask that displayed on the plots is composed of several frequency ranges below:

Range	Start Freq. (MHz)	Stop Freq. (MHz)	RBW	VBW	Detector Type	Trace Mode	Limit (nW)
1	30	1000	100kHz	100kHz	Peak	Max Hold	4
2	1000	12500	1MHz	1MHz	Peak	Max Hold	20

Note 2: Only the spurious with the minimum margin from the limit line will be displayed in the mark table(The lower window on the test plots).



2.6. Transmission Antenna Gain (EIRP Antenna Power) Measurement

2.6.1. Limit

Item	Limits
EIRP Power	12.14dBm/MHz or 22.14 dBm/MHz (OFDM,DS from 2400~2483.5MHz,802.11b/g/n20)
	12.14dBm/MHz or 22.14 dBm/MHz (Others from 2400~2483.5MHz)
	6.91 dBm/MHz or 16.91 dBm/MHz(FH from 2400~2483.5MHz)
Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

2.6.2. Measuring Instruments and Setting

The following table is the setting of the spectrum.

Spectrum Parameter	Setting
RB/VB	1MHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

2.6.3. Test Procedures

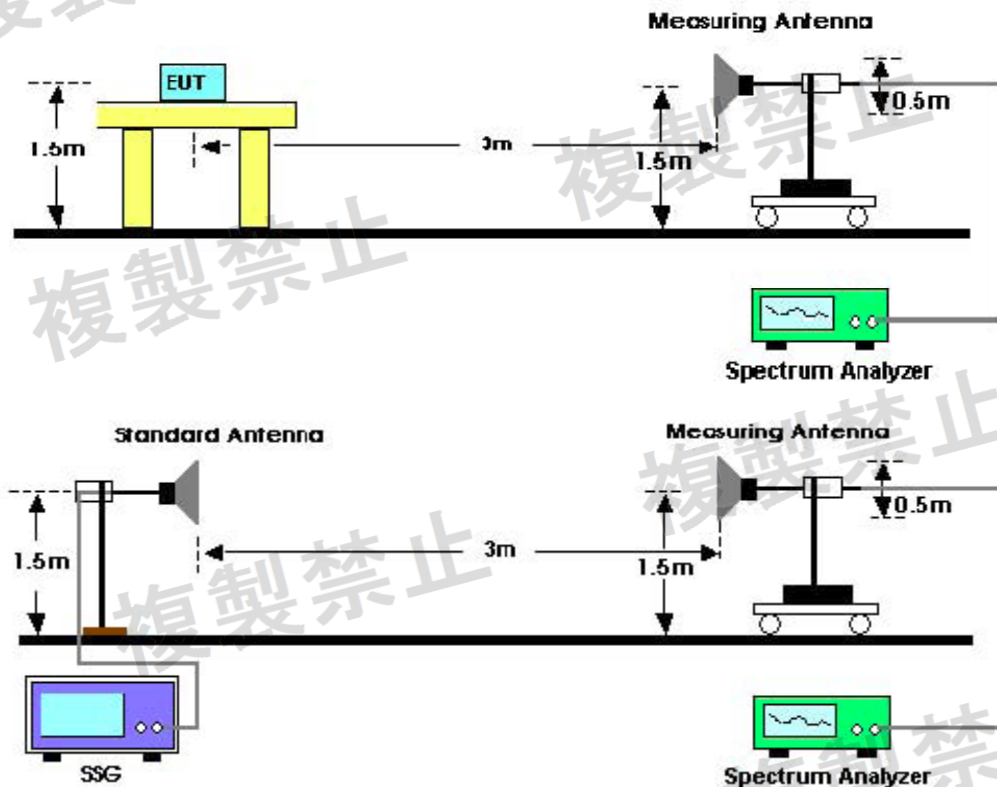
- 1.Set the EUT and measuring antenna at the same height and roughly facing each other.
- 2.Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read as "E".
- 3.Remove the EUT from the turn table and put the replacing antenna facing to measuring antenna at same height. Set the standard signal generator (SSG) at same frequency and transmit on then receive the signal
- 4.Swing the replacing antenna give a maximum receiving level.
- 5.Move the measuring antenna height up and down within $\pm 50\text{cm}$ of replacing antenna height and swing it to find the maximum receiving level.
- 6.Set the SSG output power at P_t to give the equivalent output level of "E" or calculate P_t with SSG output which gives the nearest of "E" and difference ($\pm 1\text{dB}$). Record the P_t .
- 7.Calculate EIRP by the formula below $\text{EIRP} = G_t - L + P_t$.
Gt: gain of replacing antenna (dBi)

L: feeder loss between SSG and replacing antenna

Pt: Output power of the SSG

8If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

2.6.4. Test Setup Layout



2.6.5. Test Deviation

There is no deviation with the original standard.

2.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.6.7. Test Result

Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.



2.7. Transmission Radiation Angle Width (3dB Beam width) Measurement

2.7.1. Limit

Item	Limits
3dB antenna beamwidth	$360/A$ (If $A < 1$; then $A = 1$) $A = \{EIRP / 12.14 \text{ for DS, OFDM, Other Digital Methods}\}$ or $A = \{EIRP / 6.91 \text{ for FHSS operating in 2400MHz-2483.5MHz}\}$
Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

2.7.2. Measuring Instruments and Setting

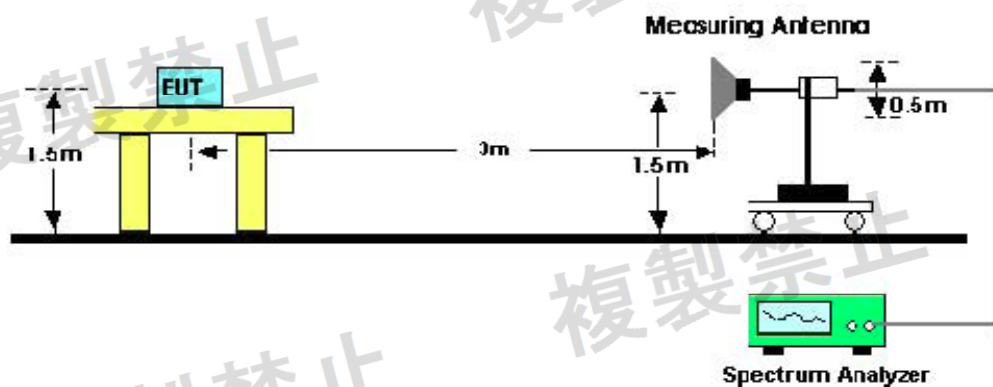
The following table is the setting of the spectrum.

Spectrum Parameter	Setting
RB	1 MHz
VB	1 KHz
Y scale	5 dB
Detector	Peak
Trace	Max Hold

2.7.3. Test Procedures

1. Set the EUT and measuring antenna at the same height and roughly facing each other.
2. Set spectrum analyzer with condition in section 4.7.2 and tune reference level to observe receiving signal position.
3. Rotate directions of the EUT horizontally and erotically to find the maximum receiving power.
4. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of measuring antenna. The output level at the spectrum analyzer is read as "E"
5. Calculate permitted radiation angle in horizontal and vertical using EIRP measured in another test method.
6. Calculate 3dB antenna beam width by the formula below $360/A$ (If $A < 1$; then $A = 1$). $A = \{EIRP \text{ Power [mW]} / 16.36 \text{ for DS, OFDM}\}$ or $A = \{EIRP \text{ Power [mW]} / 4.9 \text{ for FH}\}$

2.7.4. Test Setup Layout



2.7.5. Test Deviation

There is no deviation with the original standard.

2.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.7.7. Test Result

Note: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.

2.8. Radio Interference Prevention Capability Measurement

2.8.1. Limit

Item	Limits
Identification	≥ 48 bits

2.8.2. Test Procedures

1 In the case that the EUT has the function of automatically transmitting the identification code: a. Transmit the predetermined identification codes form EUT. b. Check the transmitted identification codes with the demodulator.

2 In the case of receiving the identification code: a. Transmit the predetermined identification codes form the counterpart. b. Check if communication is normal. c. Transmit the signals other than predetermined ID codes form the counterpart. d. check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

2.8.3. Test Setup Layout



2.8.4. Test Deviation

There is no deviation with the original standard.

2.8.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.



REPORT No.: SZ19120234W01

2.8.6. Test Result

Channel	Test Result (ID Code)	Verdict
0	GOOD	PASS
19	GOOD	PASS
39	GOOD	PASS

2.9. Construction Protection Confirmation Method Limit

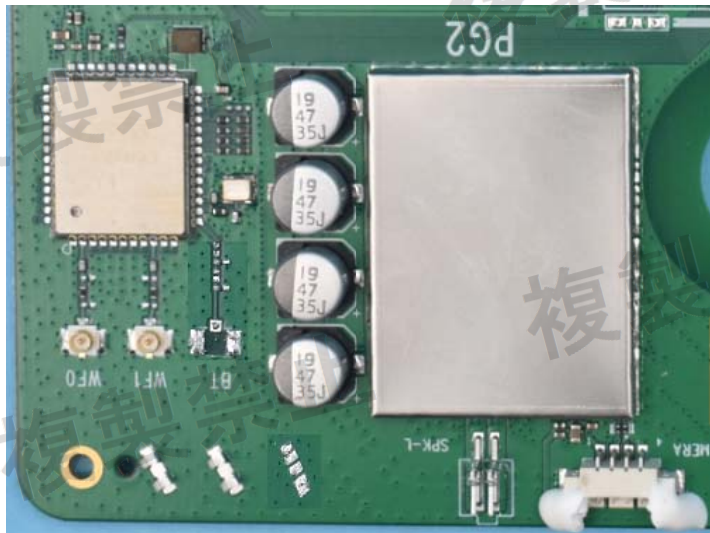
The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

2.9.1. Confirmation Method

The RF and modulation portions are protected against illegal modification as following method:

Protected Method	Description
Shielding box	RF and Modulation components are covered within RF module shielding box of EUT and this shielding box used solder to protect anybody to open this shielding box. Then use the special tool and slot to compress tightly and protect the outer cover is not opened easily.

2.9.2. Reference Documents

Reference Documents	Item
Photo	



REPORT No.: SZ19120234W01

Annex A Test Uncertainty

Test Items	Uncertainty	Remark
Frequency Error / 99% & 90% Bandwidth	$\pm 1.75 \times 10^{-6}$	Confidence levels of 95%
Antenna Power	$\pm 0.849\text{dB}$	Confidence levels of 95%
TX-RX Spurious Emissions	$\pm 0.614\text{dB}$	Confidence levels of 95%
Transmission Antenna Gain	$\pm 2.49\text{dB}$	Confidence levels of 95%
Temperature	$\pm 0.8^{\circ}\text{C}$	Confidence levels of 95%
Humidity	$\pm 4.1\%$	Confidence levels of 95%
DC / AC Power Source	$\pm 0.04\%$	Confidence levels of 95%



REPORT No.: SZ19120234W01

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.MorlabLaboratory
Laboratory Address:	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.1-3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China



REPORT No.: SZ19120234W01

3. Test Equipments Utilized

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due Date
EXA Signal analyzer	Agilent	N9010A	MY53470836	2020.04.01	2021.03.31
DC Power Supply	IVYTECH	IV3610	1709D361010	2020.01.08	2021.01.07
Power Sensor	Agilent	U2021XA	MY54210011	2020.04.01	2021.03.31
RF cable	CB01	RF01	Morlab	N/A	N/A
Note 1: The equipments were calibrated by CCIC (Shenzhen) Metrology&Testing Service Co.,Ltd and Shenzhen Academy of Metrology and Quality Inspection.					
Note 2: The cable loss is 0dB.					

List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8

____ END OF REPORT ____