

3.4 Antenna Power Tolerance

3.4.1 Limit

Item	Limits
Antenna Power	802.11a/n(HT20)/ac(HT20):10mW/MHz 802.11n(HT40)/ac(HT40): 5mW/MHz 802.11ac(HT80): 2.5mW/MHz
Antenna Power Tolerance	+20%, -80%

3.4.2 Test Procedures

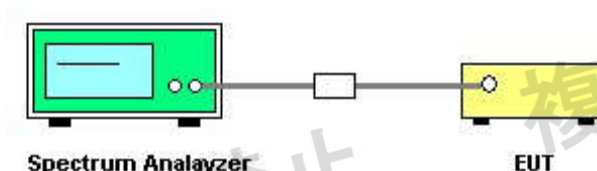
1. Spectrum analyzer setting(Search Frequency of Peak Power):

Frequency	EUT Test Frequency
Span	2 Times of Signal Occupied bandwidth
RBW	1MHz
VBW	3MHz
Sweep Time	Auto
Detector mode	Peak
Indication mode	Max. hold

2. Spectrum Analyzer Setting(Measure of Antenna power):

Frequency	Frequency of Peak Power (from above step)
Span	0Hz
RBW	1MH
VBW	1MHz
Sweep Time	Auto
Detector mode	Peak
Indication mode	Max. hold

3.4.3 Test Setup



3.4.4 Test Deviation

There is no deviation with the original standard.

3.4.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.4.6 Test Result



Test Voltage (V)	Mode	Channel (MHz)	Out Power (dBm/MHz)	Out Power (mW/MHz)	Rated output power (mW/MHz)	Tolerance (%)	Limit	Limit (mW/MHz)
DC 9V	802.11a	5180	0.697	4.975	5	-0.50	-80%~+20%	10
		5200	0.665	4.620	5	-7.60		10
		5240	0.642	4.383	5	-12.34		10
	802.11n(HT20)	5180	0.671	4.692	5	-6.16		10
		5200	0.647	4.434	5	-11.32		10
		5240	0.618	4.145	5	-17.10		10
	802.11n(HT40)	5190	0.628	4.251	5	-14.98		5
		5230	0.634	4.302	5	-13.96		5
	802.11ac(HT20)	5180	0.568	3.699	4	-7.53		10
		5200	0.528	3.375	4	-15.63		10
		5240	0.495	3.124	4	-21.90		10
	802.11ac(HT40)	5190	0.263	1.062	2	-46.90		5
		5230	0.270	1.064	2	-46.80		5
	802.11ac(HT80)	5210	0.242	1.057	2	-47.15		2.5

Test Voltage (V)	Mode	Channel (MHz)	Output Power (dBm/MHz)	Antenna gain (dBi)	EIRP (dBm/MHz)	Limit (dBm/MHz)
DC 9V	802.11a	5180	0.697	1.26	1.957	10
		5200	0.665	1.26	1.925	10
		5240	0.642	1.26	1.902	10
	802.11n(HT20)	5180	0.671	1.26	1.931	10
		5200	0.647	1.26	1.907	10
		5240	0.618	1.26	1.878	10
	802.11n(HT40)	5190	0.628	1.26	1.888	5
		5230	0.634	1.26	1.894	5
	802.11ac(HT20)	5180	0.568	1.26	1.828	10
		5200	0.528	1.26	1.788	10
		5240	0.495	1.26	1.755	10
	802.11ac(HT40)	5190	0.263	1.26	1.523	5
		5230	0.270	1.26	1.530	5
	802.11ac(HT80)	5210	0.242	1.26	1.502	2.5

3.5 Adjacent Channel Leakage Power

3.5.1 Test Configuration

The power in a +/- 9MHz band centered on the operating frequency is measured and used as a reference value. The powers in the +/-9MHz band on the adjacent channels (+/-20MHz from the operating channel) and alternate channels (+/-40MHz from the operating channel) are also measured. The Channel Leakage ratio (CLR) shall be at least 25dB for the adjacent channels and at least 40dB for the alternate channels

3.5.2 Limits

±9MHz bandwidth at 20MHz detuning: -25dB

±9MHz bandwidth at 40MHz detuning: -40dB

3.5.3 Test Results

Environmental Conditions						
Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11a	Mean Power -20 MHz distance of carrier (dBc)	-29.55	-30.00	-30.53	-25
		Mean Power -40 MHz distance of carrier (dBc)	-51.80	-52.33	-54.05	-40
		Mean Power +20 MHz distance of carrier (dBc)	-28.80	-28.84	-29.48	-25
		Mean Power +40 MHz distance of carrier (dBc)	-50.93	-50.92	-52.52	-40

Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11n(HT20)	Mean Power -20 MHz distance of carrier (dBc)	-29.09	-29.79	-29.68	-25
		Mean Power -40 MHz distance of carrier (dBc)	-51.49	-50.91	-52.83	-40
		Mean Power +20 MHz distance of carrier (dBc)	-28.08	-28.41	-28.65	-25
		Mean Power +40 MHz distance of carrier (dBc)	-51.57	-50.38	-52.42	-40

Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11n(HT40)	Mean Power -40 MHz distance of carrier (dBc)	-30.60	/	-28.40	-25
		Mean Power -80 MHz distance of carrier (dBc)	-48.45	/	-47.20	-40
		Mean Power +40 MHz distance of carrier (dBc)	-31.27	/	-27.69	-25
		Mean Power +80 MHz distance of carrier (dBc)	-48.60	/	-48.38	-40

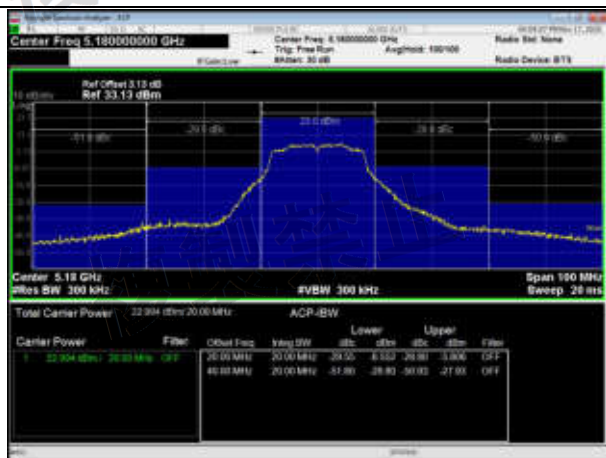
Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11ac(HT20)	Mean Power -20 MHz distance of carrier (dBc)	-29.03	-29.77	-29.80	-25
		Mean Power -40 MHz distance of carrier (dBc)	-51.87	-51.65	-53.43	-40
		Mean Power +20 MHz distance of carrier (dBc)	-28.48	-28.24	-28.77	-25
		Mean Power +40 MHz distance of carrier (dBc)	-51.66	-50.97	-52.48	-40

Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11ac(HT40)	Mean Power -40 MHz distance of carrier (dBc)	-31.28	/	-28.12	-25
		Mean Power -80 MHz distance of carrier (dBc)	-48.21	/	-46.79	-40
		Mean Power +40 MHz distance of carrier (dBc)	-32.11	/	-27.69	-25
		Mean Power +80 MHz distance of carrier (dBc)	-48.85	/	-48.52	-40

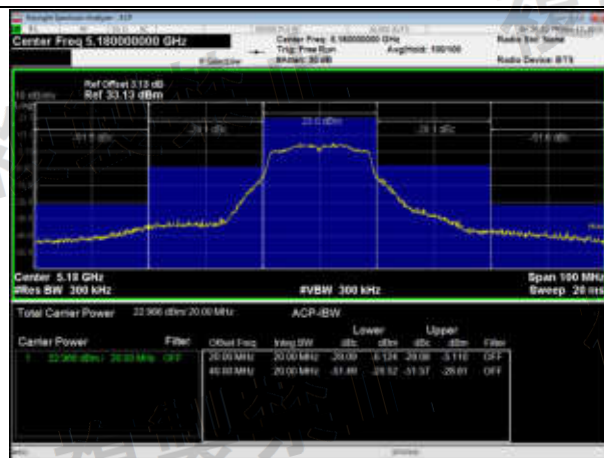
Voltage	Mode	Detuning (MHz)	LCH	MCH	HCH	Limit (dBc/MHz)
V _{normal}	802.11ac(HT80)	Mean Power -80 MHz distance of carrier (dBc)	/	-31.21	/	-25
		Mean Power -160 MHz distance of carrier (dBc)	/	-49.15	/	-40
		Mean Power +80 MHz distance of carrier (dBc)	/	-29.65	/	-25
		Mean Power +160 MHz distance of carrier (dBc)	/	-43.64	/	-40

Test Graphs

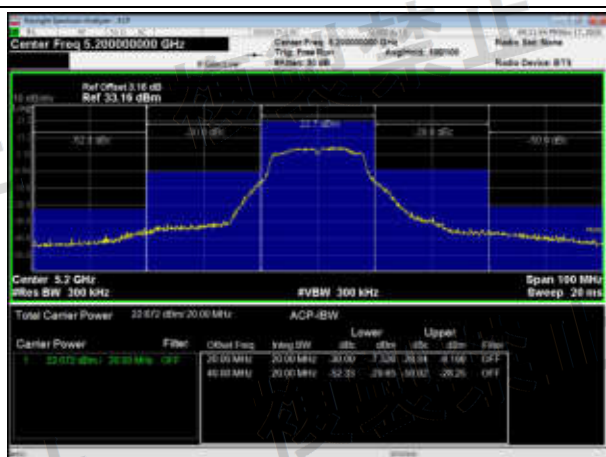
802.11a CH: 5180MHz



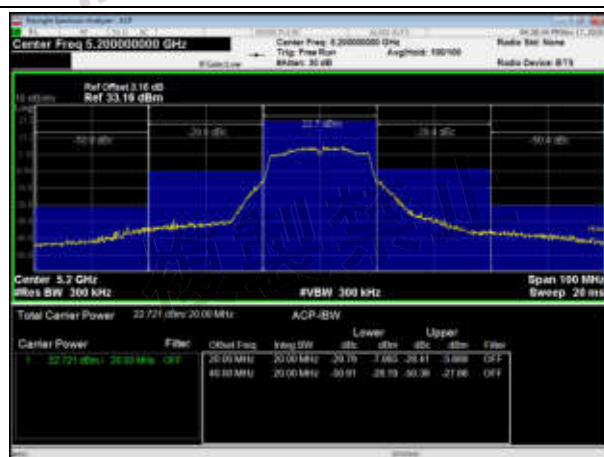
802.11n(HT20) CH: 5180MHz



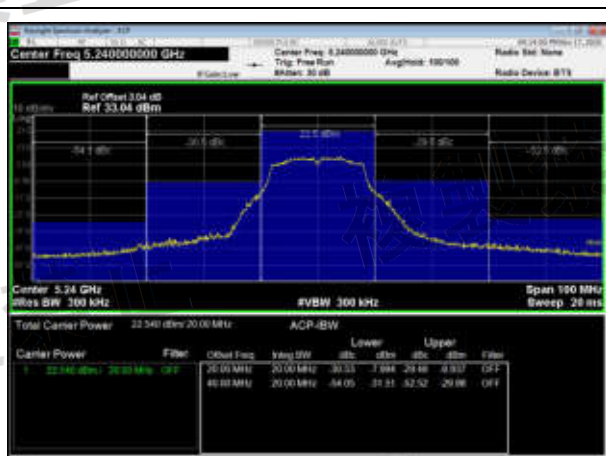
802.11a CH: 5200MHz



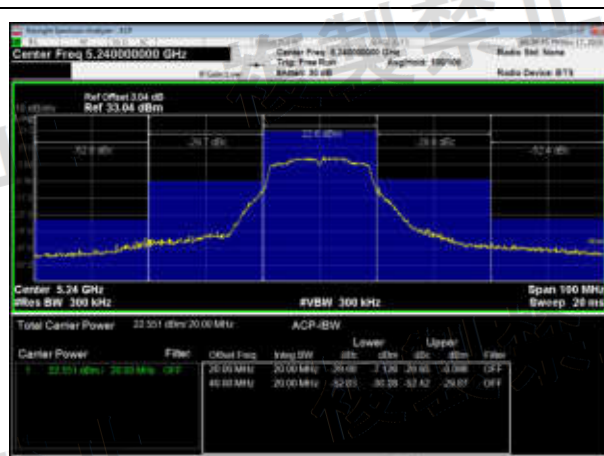
802.11n(HT20) CH: 5200MHz



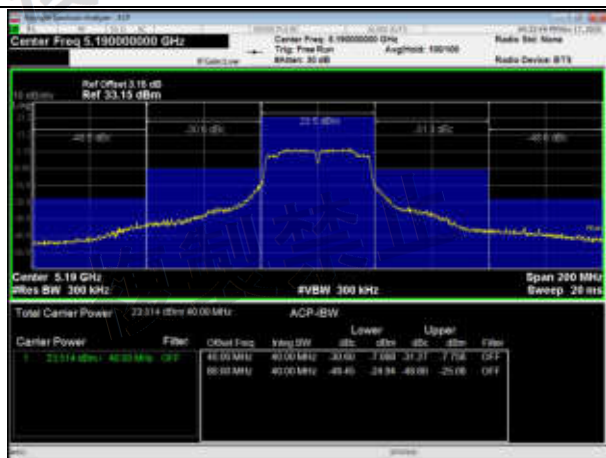
802.11a CH: 5240MHz



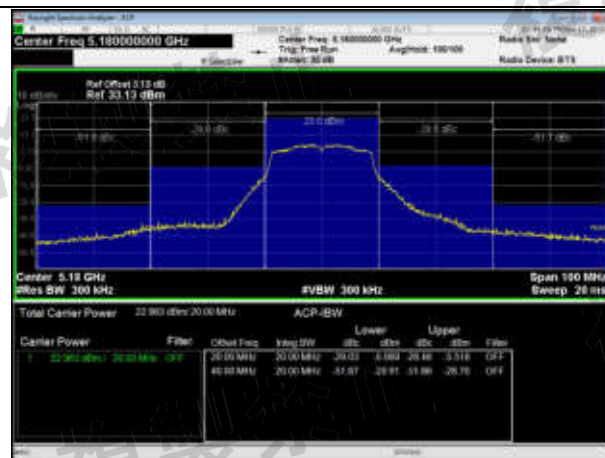
802.11n(HT20) CH: 5240MHz



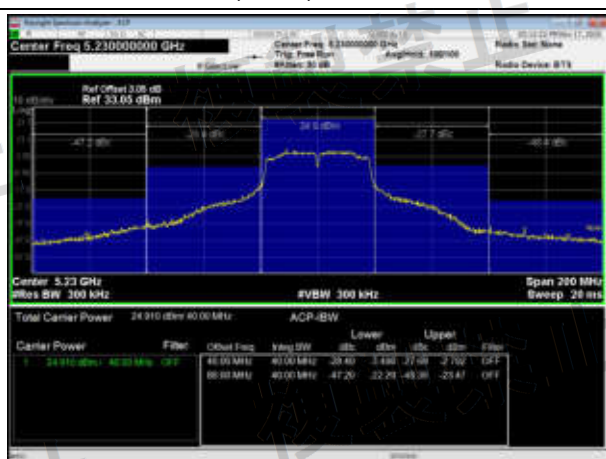
802.11 n(HT40) CH: 5190MHz



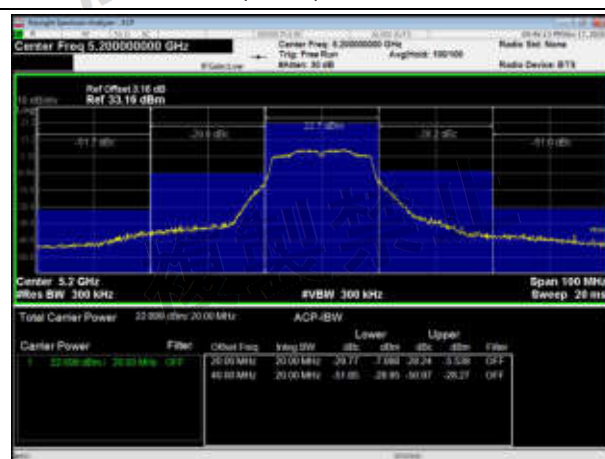
802.11ac(HT20) CH: 5180MHz



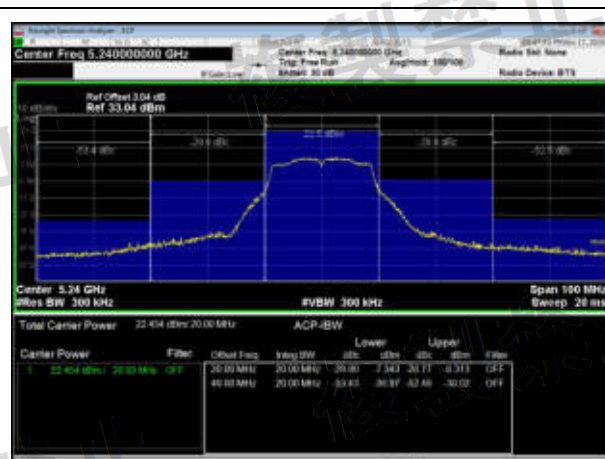
802.11 n(HT40) CH: 5230MHz



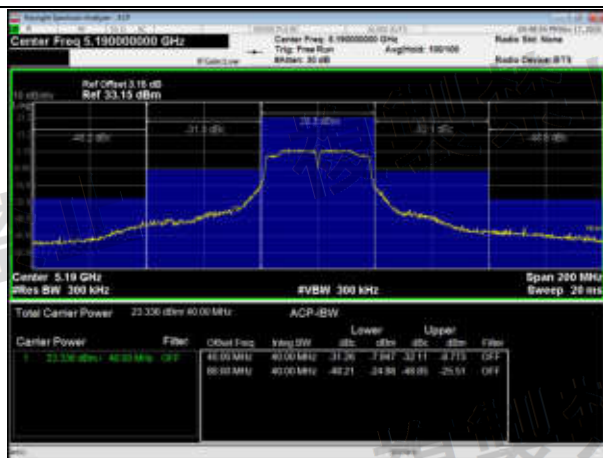
802.11ac(HT20) CH: 5200MHz



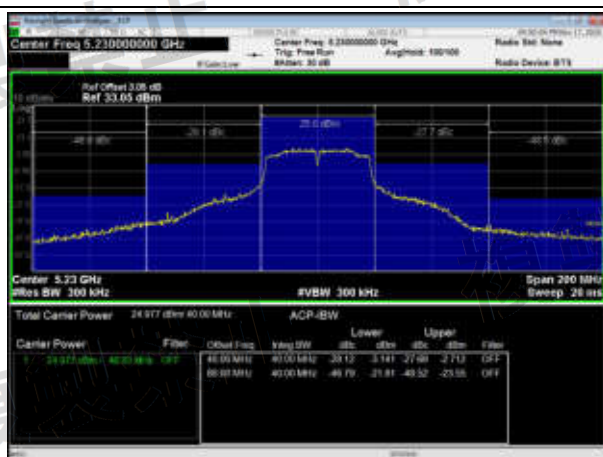
802.11ac(HT20) CH: 5240MHz



802.11 ac(HT40) CH: 5190MHz



802.11 ac(HT40) CH: 5230MHz



802.11 ac(HT80) CH: 5210MHz



3.6 Rx Unwanted Emission Measurement

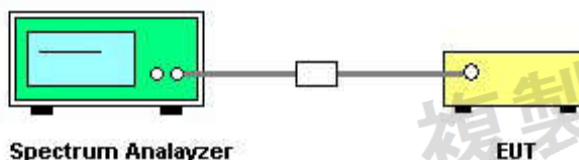
3.6.1 Limit

Item	Limits
RX Spurious Emission:	(1) Below 1 GHz: 4 nW (2) 1 GHz or higher: 20 nW

3.6.2 Test Procedures

1. EUT have the continuous reception mode and fixed only one channelize.
2. SA set RBW: 100KHz and VBW: 100KHz. Then adjust to start frequency 30MHz and stop frequency 1000MHz. Search to mark peak reading value + cable loss shall be less than 4nW.
3. SA set RBW: 1MHz and VBW: 1MHz. Then adjust to start frequency 1000MHz and stop frequency 13000MHz. Search to mark peak reading value + cable loss shall be less than 20nW.
4. If power level of lower emissions is 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.

3.6.3 Test Setup



3.6.4 Test Deviation

There is no deviation with the original standard.

3.6.5 EUT Operation during Test

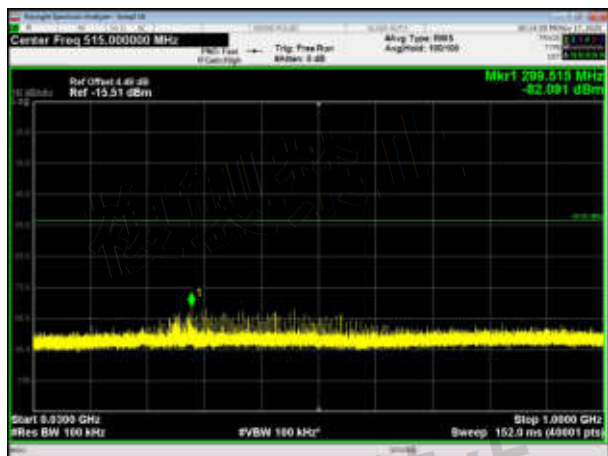
The EUT was programmed to be in continuously reception mode.

3.6.6 Test Result

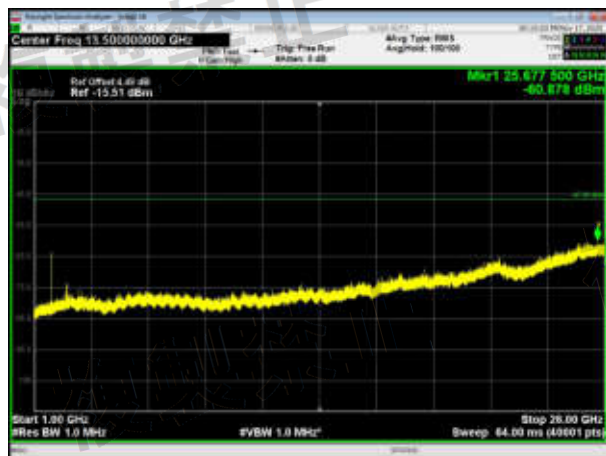


Mode	Frequency (MHz)	Range (MHz)	Emission Frequency (MHz)	Max Value (dBm)	Limit (dBm)	Verdict
a	5180	30-1000	299.515	-82.091	-54	Pass
a	5180	1000-26000	25677.5	-60.878	-47	Pass
a	5200	30-1000	465.918	-81.303	-54	Pass
a	5200	1000-26000	25126.875	-60.691	-47	Pass
a	5240	30-1000	299.515	-82.307	-54	Pass
a	5240	1000-26000	1767.5	-57.706	-47	Pass
n20	5180	30-1000	324.492	-81.314	-54	Pass
n20	5180	1000-26000	25658.75	-59.608	-47	Pass
n20	5200	30-1000	465.942	-81.826	-54	Pass
n20	5200	1000-26000	25572.5	-60.755	-47	Pass
n20	5240	30-1000	722.604	-81.801	-54	Pass
n20	5240	1000-26000	24825	-60.525	-47	Pass
n40	5190	30-1000	324.492	-81.406	-54	Pass
n40	5190	1000-26000	25869.375	-60.009	-47	Pass
n40	5230	30-1000	299.539	-81.068	-54	Pass
n40	5230	1000-26000	25733.75	-60.547	-47	Pass
ac20	5180	30-1000	474.236	-83.249	-54	Pass
ac20	5180	1000-26000	24931.875	-60.079	-47	Pass
ac20	5200	30-1000	324.468	-82.014	-54	Pass
ac20	5200	1000-26000	25991.25	-60.48	-47	Pass
ac20	5240	30-1000	324.468	-82.558	-54	Pass
ac20	5240	1000-26000	25583.125	-60.776	-47	Pass
ac40	5190	30-1000	833.548	-75.643	-54	Pass
ac40	5190	1000-26000	25573.75	-60.696	-47	Pass
ac40	5230	30-1000	324.492	-81.785	-54	Pass
ac40	5230	1000-26000	25988.75	-60.494	-47	Pass
ac80	5210	30-1000	324.492	-83.343	-54	Pass
ac80	5210	1000-26000	25865	-65.222	-47	Pass

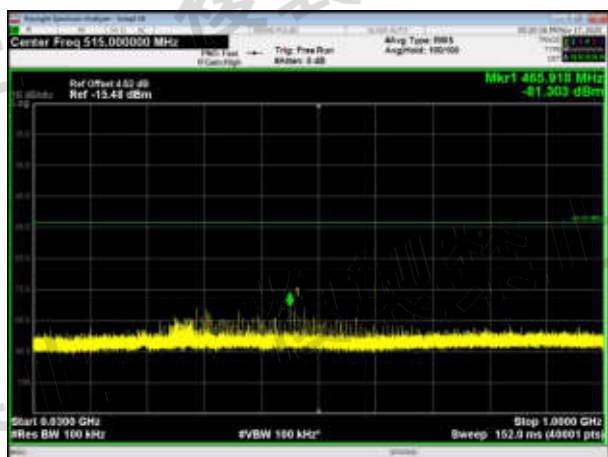
802.11a CH: 5180MHz, 30MHz~1GHz



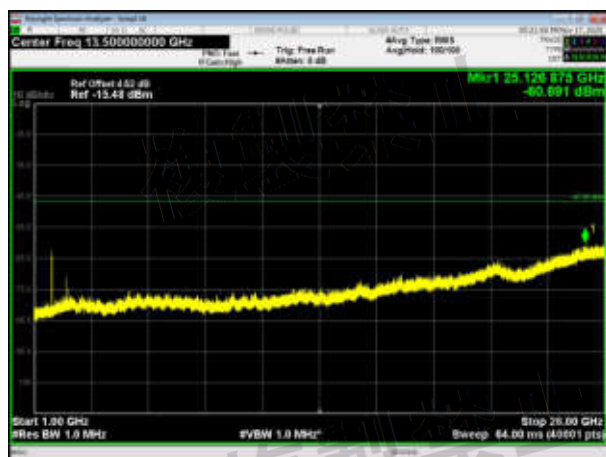
802.11a CH: 5180MHz, 1GHz~26.5GHz



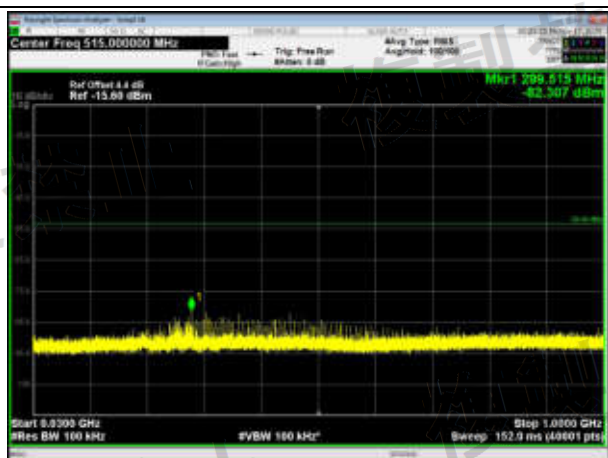
802.11a CH: 5200MHz, 30MHz~1GHz



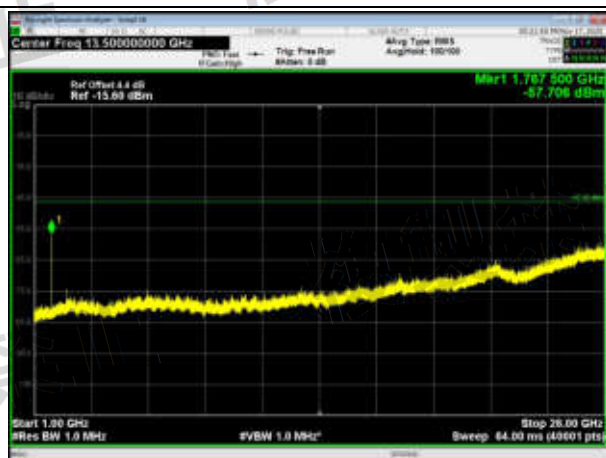
802.11a CH: 5200MHz, 1GHz~26.5GHz



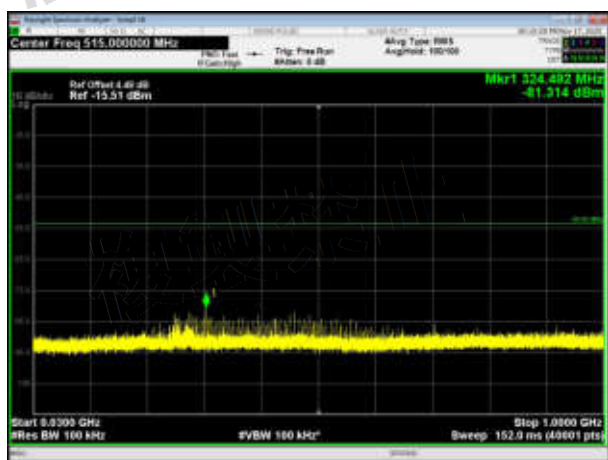
802.11a CH: 5240MHz, 30MHz~1GHz



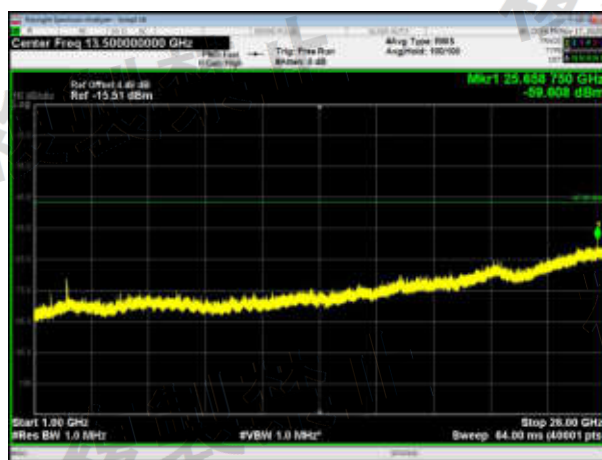
802.11a CH: 5240MHz, 1GHz~26.5GHz



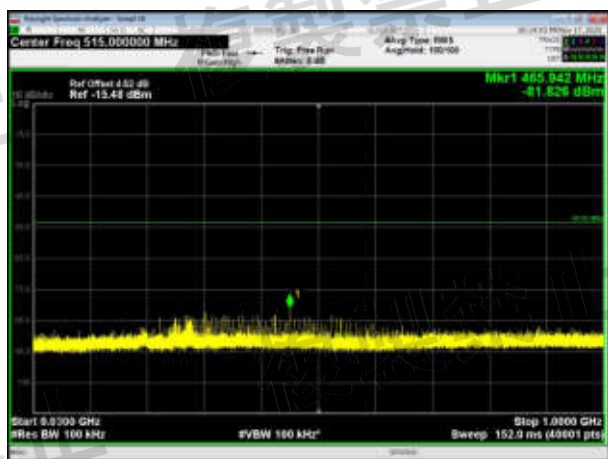
802.11n20 CH: 5180MHz, 30MHz~1GHz



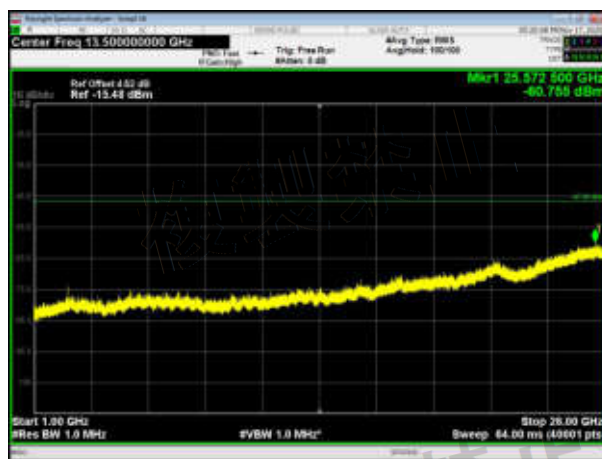
802.11n20 CH: 5180MHz, 1GHz~26.5GHz



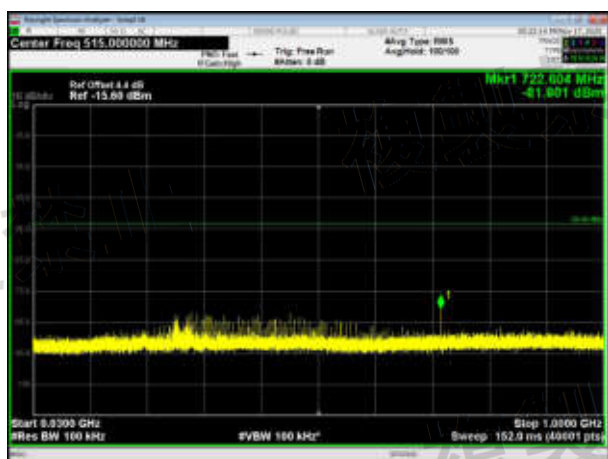
802.11n20 CH: 5200MHz, 30MHz~1GHz



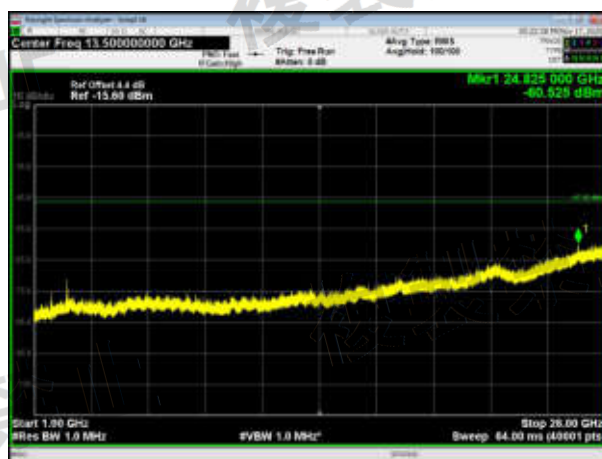
802.11n20 CH: 5200MHz, 1GHz~26.5GHz



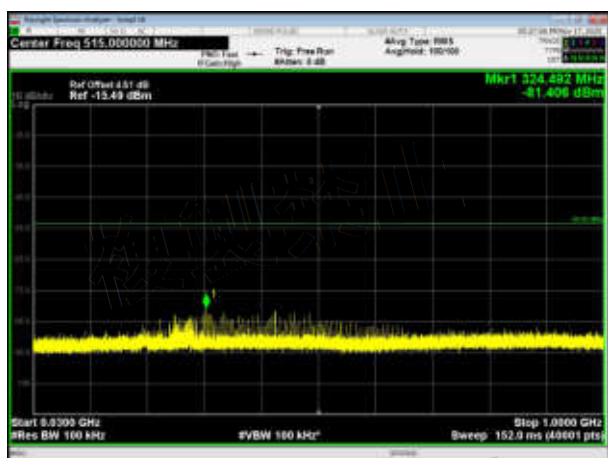
802.11n20 CH: 5240MHz, 30MHz~1GHz



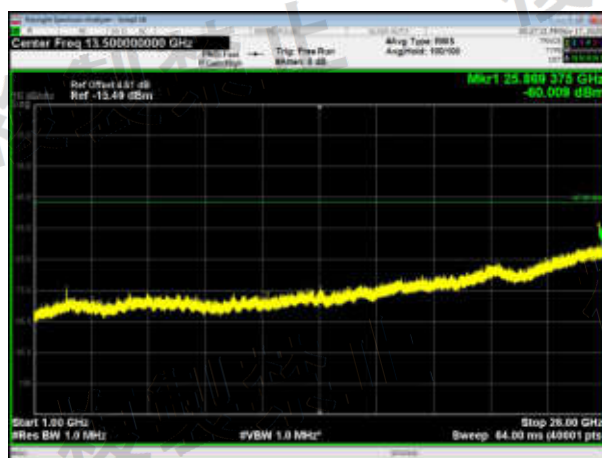
802.11n20 CH: 5240MHz, 1GHz~26.5GHz



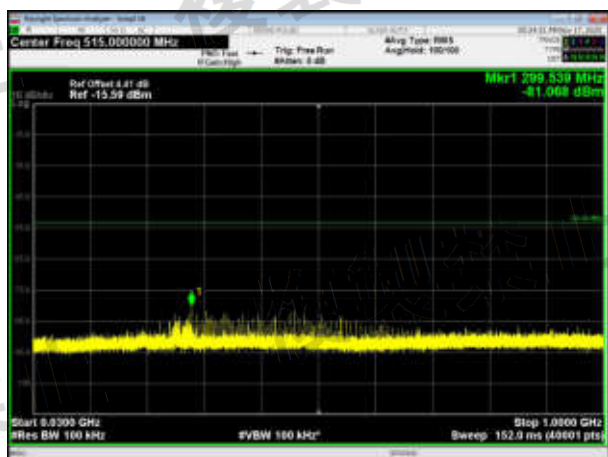
802.11n40 CH: 5190MHz, 30MHz~1GHz



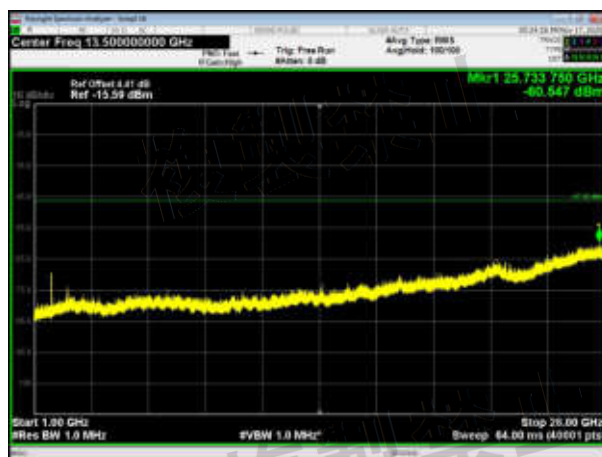
802.11n40 CH: 5190MHz, 1GHz~26.5GHz



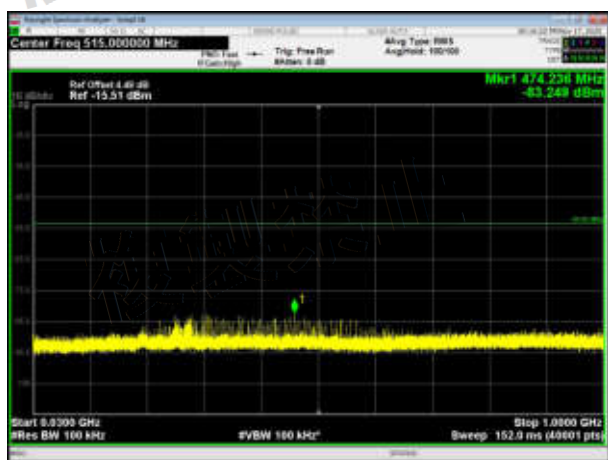
802.11n40 CH: 5230MHz, 30MHz~1GHz



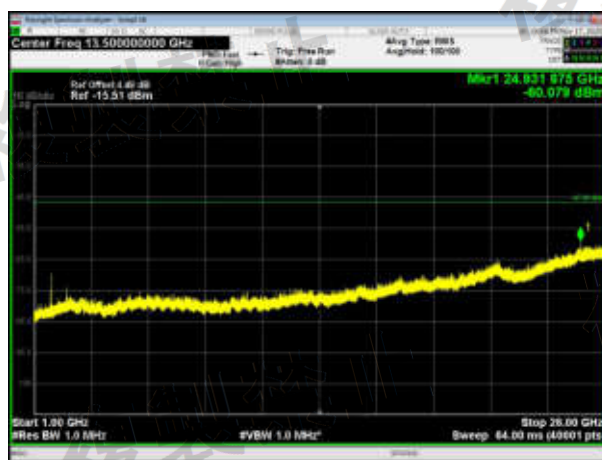
802.11n40 CH: 5230MHz, 1GHz~26.5GHz



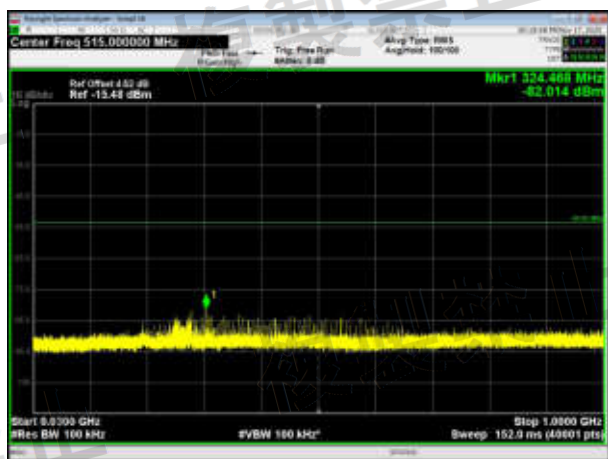
802.11ac20 CH: 5180MHz, 30MHz~1GHz



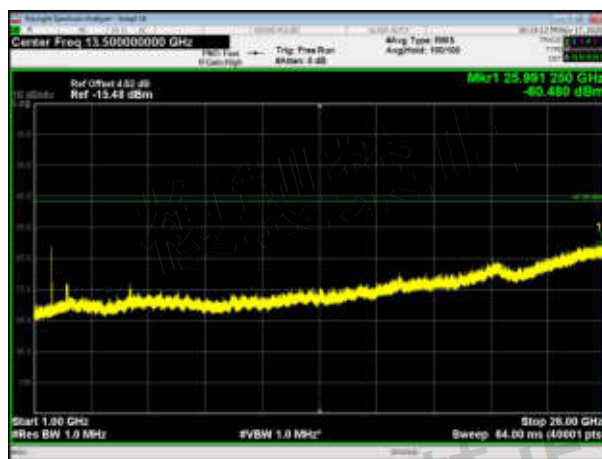
802.11ac20 CH: 5180MHz, 1GHz~26.5GHz



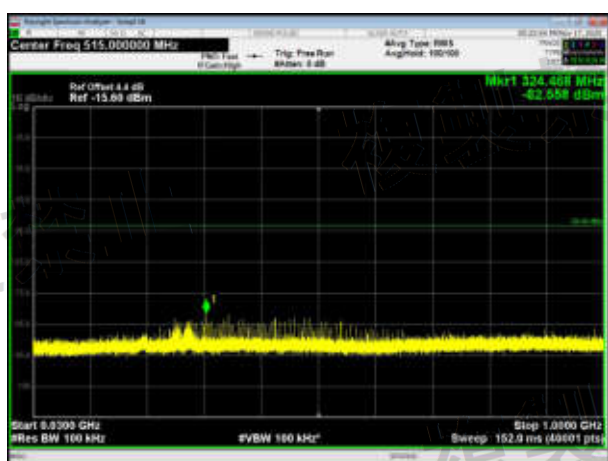
802.11ac20 CH: 5200MHz, 30MHz~1GHz



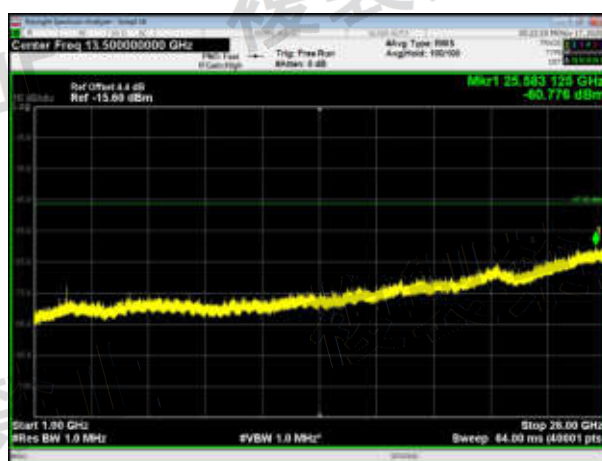
802.11ac20 CH: 5200MHz, 1GHz~26.5GHz



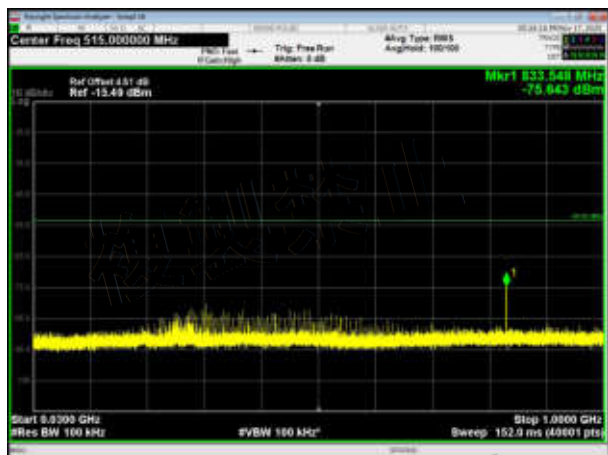
802.11ac20 CH: 5240MHz, 30MHz~1GHz



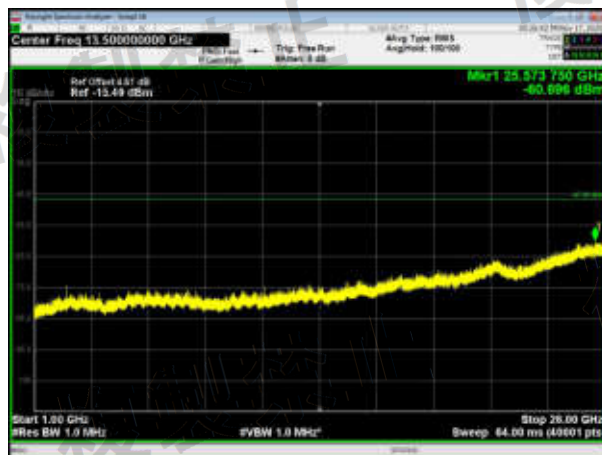
802.11ac20 CH: 5240MHz, 1GHz~26.5GHz



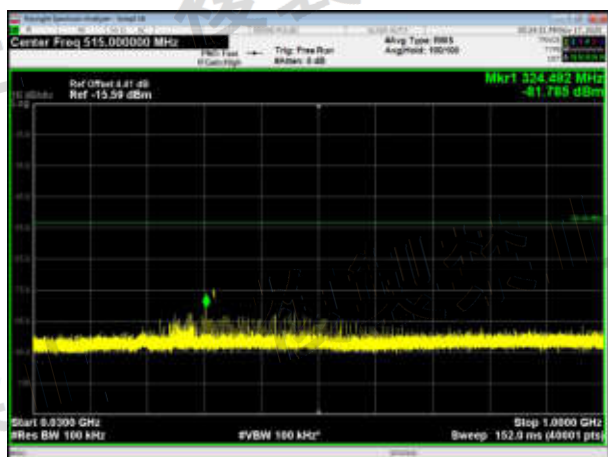
802.11ac40 CH: 5190MHz, 30MHz~1GHz



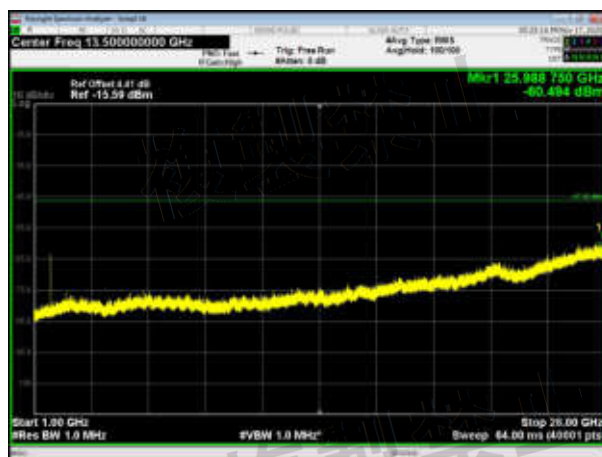
802.11ac40 CH: 5190MHz, 1GHz~26.5GHz



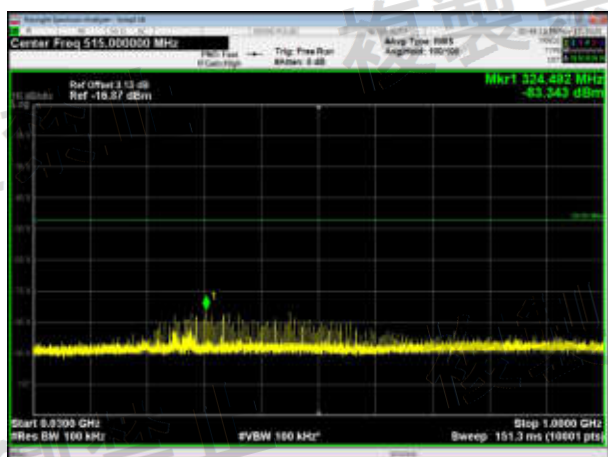
802.11ac40 CH: 5230MHz, 30MHz~1GHz



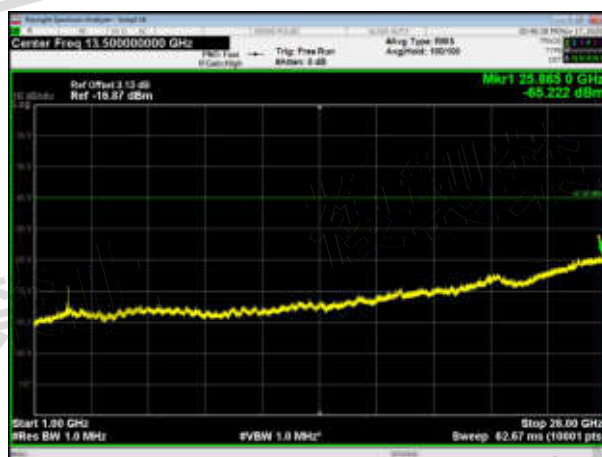
802.11ac40 CH: 5230MHz, 1GHz~26.5GHz



802.11ac80 CH: 5210MHz, 30MHz~1GHz



802.11ac80 CH: 5210MHz, 1GHz~26.5GHz



3.7 Transmission Antenna Gain (EIRP Antenna Power) Measurement

3.7.1 Limit

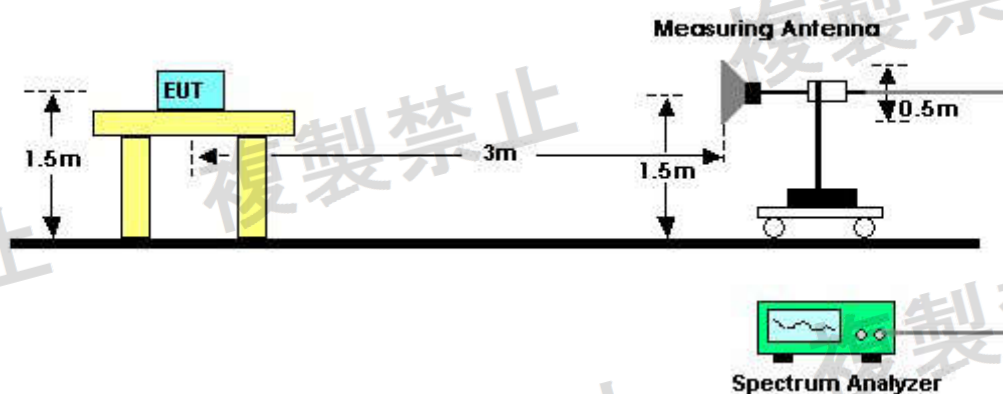
Item	Limits
EIRP Power Density	$\leq 22.14\text{dBm/MHz}$ (OFDM or DS)
Remark: This test item will not be applied to EIRP power of EUT is lower than 12.14dBm/MHz	

3.7.2 Test Procedures

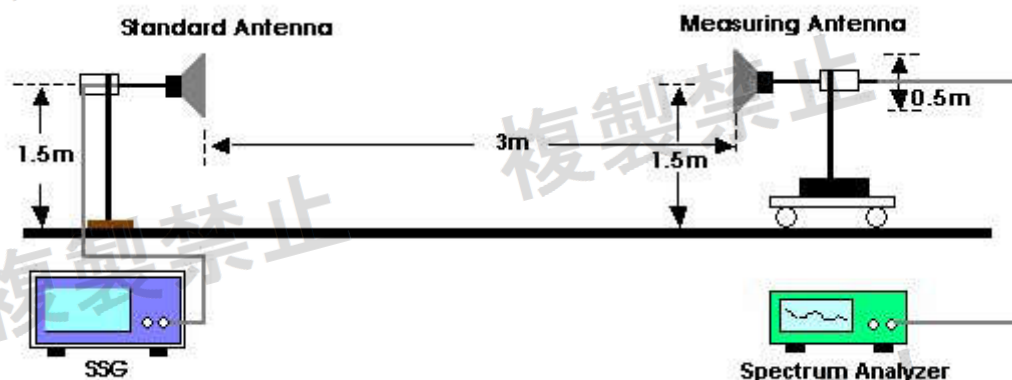
1. Set EUT and measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within $\pm 50\text{cm}$ of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read as "E".
3. Remove 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 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 $\text{EIRP} = G_t - L + P_t$.
 G_t : gain of replacing antenna (dBi)
 L : feeder loss between SSG and replacing antenna
 P_t : Output power of the SSG
8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

3.7.3 Test Setup

For EUT radiation measurement



For standard antenna measurement



3.7.4 Test Deviation

There is no deviation with the original standard.

3.7.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.7.6 Test Result

Not applicable (The maximum antenna gain is 1.26dBi).

3.8 Transmission Radiation Angle Width (3db Beamwidth) Measurement

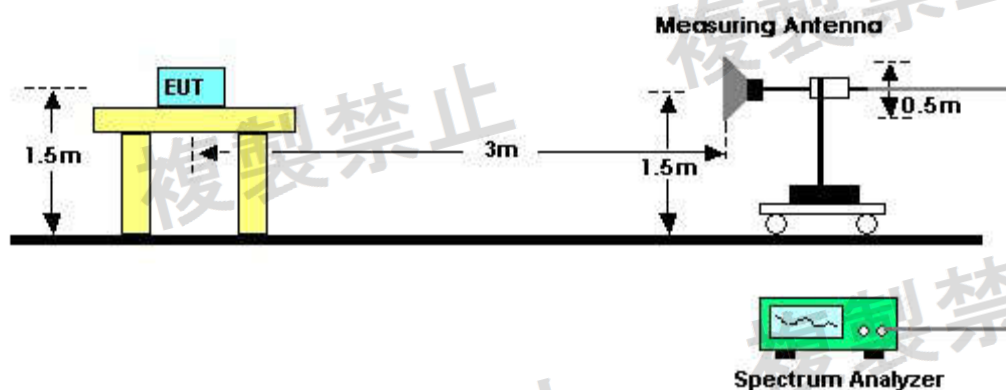
3.8.1 Limit

Item	Limits
3dB antenna beam width	360/A (If $A < 1$; then $A = 1$) $A = \{ \text{EIRP Power [mW]} / 12.14 \text{ for DS, OFDM} \}$

3.8.2 Test Procedures

1. Set 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 vertically 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 $A = 1$).
 $A = \{ \text{EIRP Power [mW]} / 12.14 \text{ for DS, OFDM} \}.$

3.8.3 Test Setup Layout



3.8.4 Test Deviation

There is no deviation with the original standard.

3.8.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

3.8.6 Test Result

Not applicable (The maximum antenna gain is 1.26dBi).

3.9 Radio Interference Prevention Capability Measurement

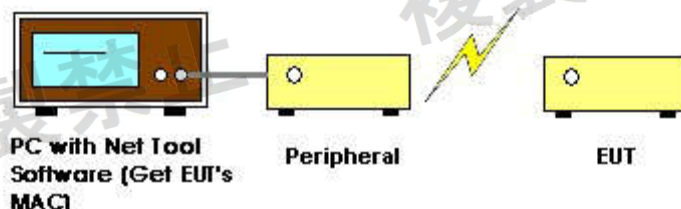
3.9.1 Limit

Product shall have the function of automatic transmission and reception of identification sign.

3.9.2 4.8.2. 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.

3.9.3 Test Setup



3.9.4 Test Deviation

There is no deviation with the original standard.

3.9.5 EUT Operation during Test

The EUT was programmed to be in normal transmitting mode.

3.9.6 Test Result

Pass. The interference prevention function of EUT is good.

MAC address: a46b400685b1

3.10 Carrier Sense

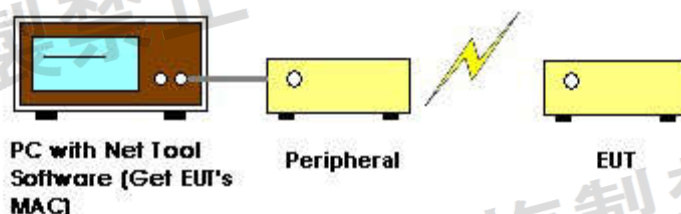
3.10.1 Limit

The radio equipment connected to telecommunication circuit equipment shall be equipped with a device which detects emissions radiated from another radio station and prevents interference, or a device which prevents interference by operation on a receive signal and a signal for diffusion for signal level detection.

3.10.2 Test Procedures

1. Set the EUT link with a peripheral, access point 802.11n40,
2. Set a signal generator (simulate a radio device which co-exists with EUT) at same frequency channel, with a proper signal level (exceeding 100mV/m) output to act as interference signal.
3. Monitor the signal transmission between the EUT and peripheral, while the interference signal presents. The EUT would stop transmitting once it detects interference signal over the air, then record it pass, otherwise, the result is fail.

3.10.3 Test Setup



3.10.4 Test Deviation

There is no deviation with the original standard.

3.10.5 EUT Operation during Test

The EUT was programmed to be in normal transmitting mode.

3.10.6 Test Result

Pass. The carrier sense function of EUT is good.

3.11 Burst Length

3.11.1 Limit

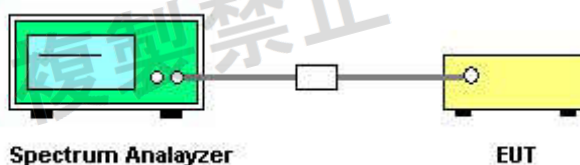
Item	Limits
Transmitter Burst Length	≤8ms

3.11.2 Teasuring Instruments And Setting

Please refer to section 5 in this report. The following table is the setting of spectrum analyzer.

Spectrum Parameter	Setting
Center frequency	Test frequency
Sweep bandwidth	0Hz
Resoluble bandwidth	1MHz
Video bandwidth	equivalent to resolvable bandwidth
Sweep Time	Minimum time to assure measuring accuracy
Y-axis scale	10dB/Div.
Detection mode	Positive peak
Trigger condition	Rising up of level

3.11.3 Test Setup



3.11.4 Test Deviation

There is no deviation with the original standard.

3.11.5 EUT Operation during Test

The EUT was programmed to be in normal transmitting mode.

3.11.6 Test Result

Pass.

**802.11a:**

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5180	2.089	≤8ms	Pass
3.8V	25°C	5200	2.089	≤8ms	Pass
3.8V	25°C	5240	2.089	≤8ms	Pass

802.11n20:

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5180	3.977	≤8ms	Pass
3.8V	25°C	5200	3.977	≤8ms	Pass
3.8V	25°C	5240	3.977	≤8ms	Pass

802.11n40:

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5190	3.973	≤8ms	Pass
3.8V	25°C	5230	3.973	≤8ms	Pass

802.11ac20:

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5180	3.945	≤8ms	Pass
3.8V	25°C	5200	3.945	≤8ms	Pass
3.8V	25°C	5240	3.945	≤8ms	Pass

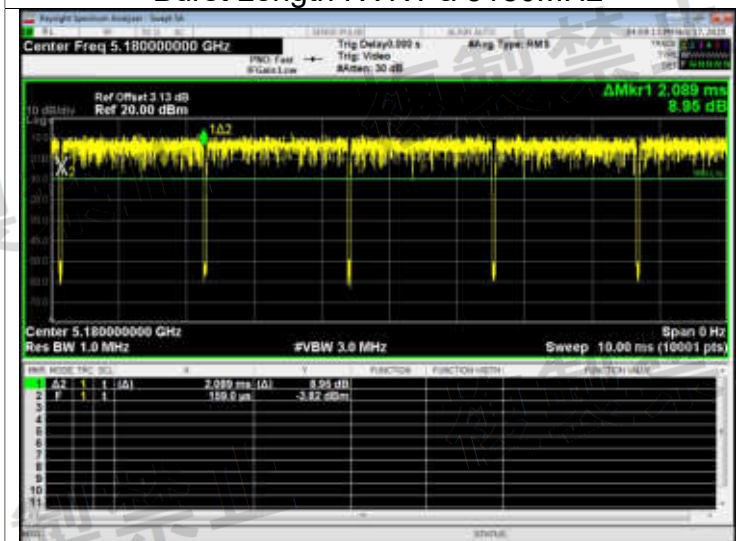
802.11ac40:

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5190	3.961	≤8ms	Pass
3.8V	25°C	5230	3.961	≤8ms	Pass

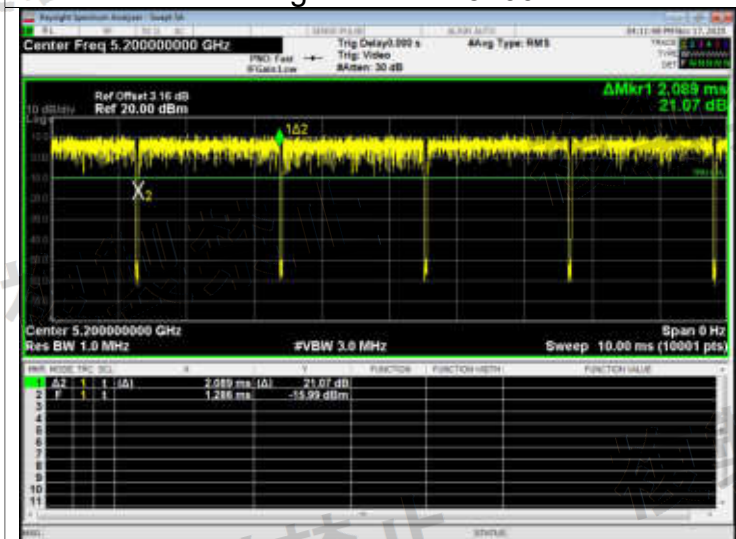
802.11ac80:

Test conditions		Frequency(MHz)	Test Result (ms)	Limit	Result
V(DC)	(°C)				
3.8V	25°C	5210	3.968	≤8ms	Pass

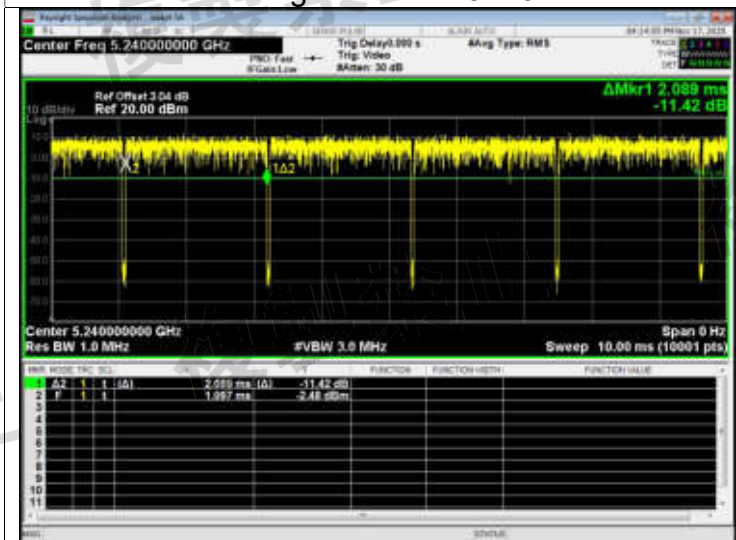
Test Graphs Burst Length NVNT a 5180MHz



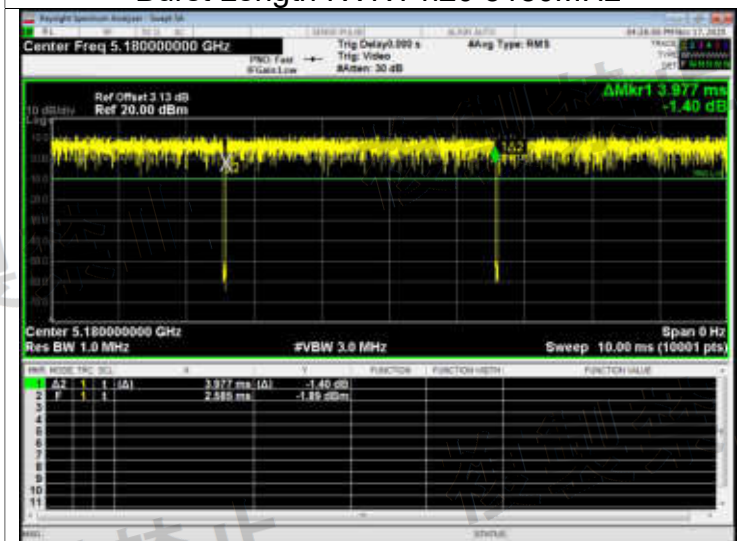
Burst Length NVNT a 5200MHz



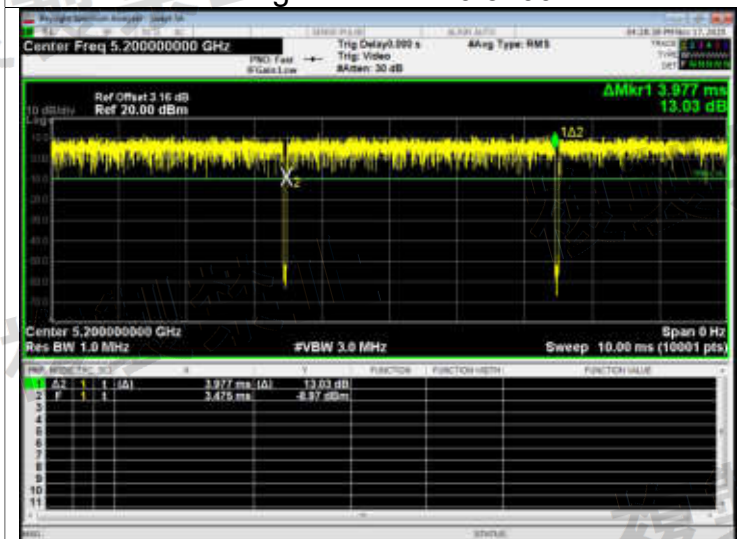
Burst Length NVNT a 5240MHz



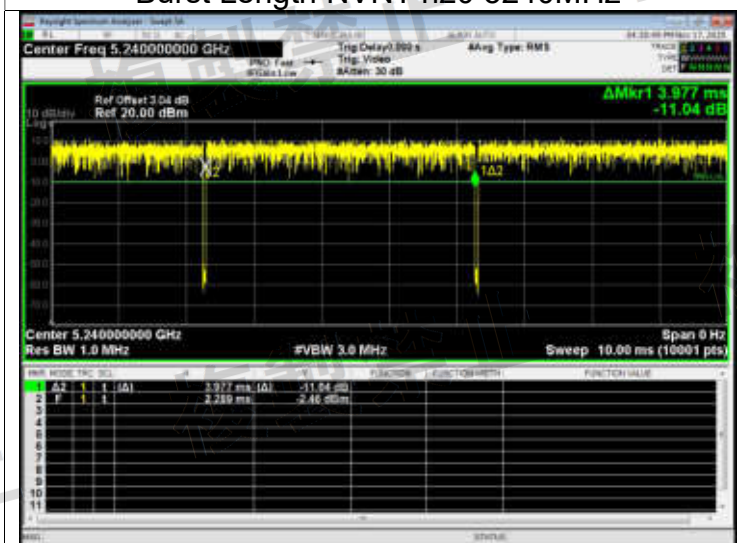
Burst Length NVNT n20 5180MHz



Burst Length NVNT n20 5200MHz



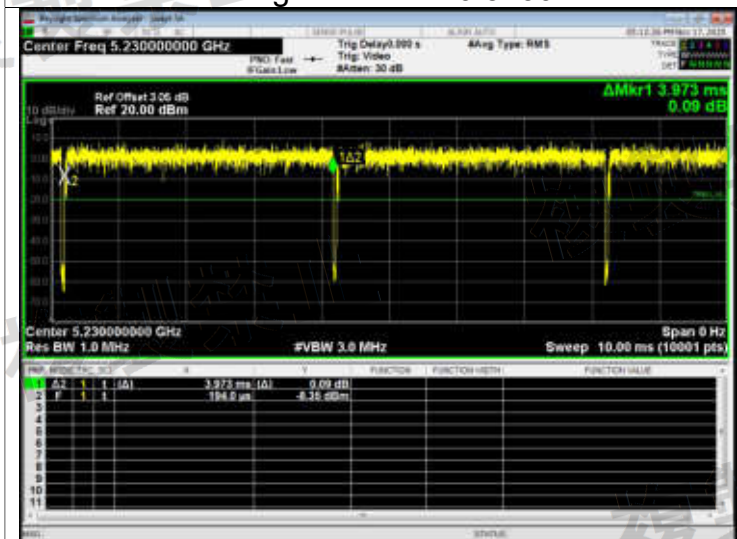
Burst Length NVNT n20 5240MHz



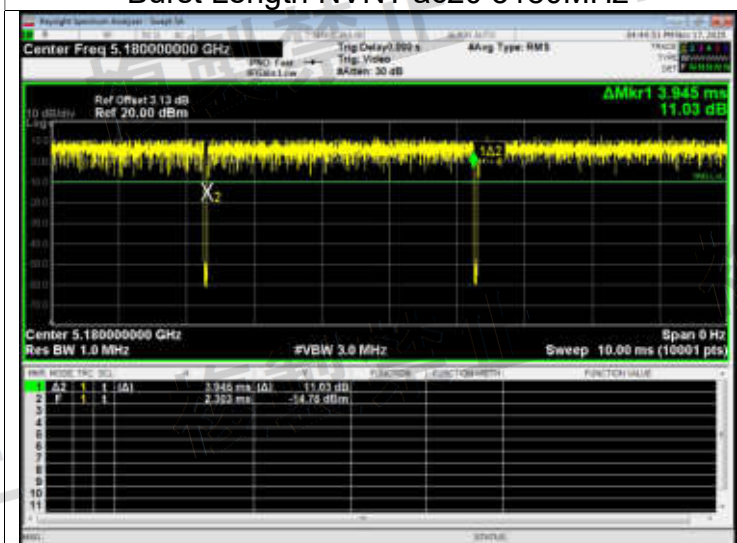
Burst Length NVNT n40 5190MHz



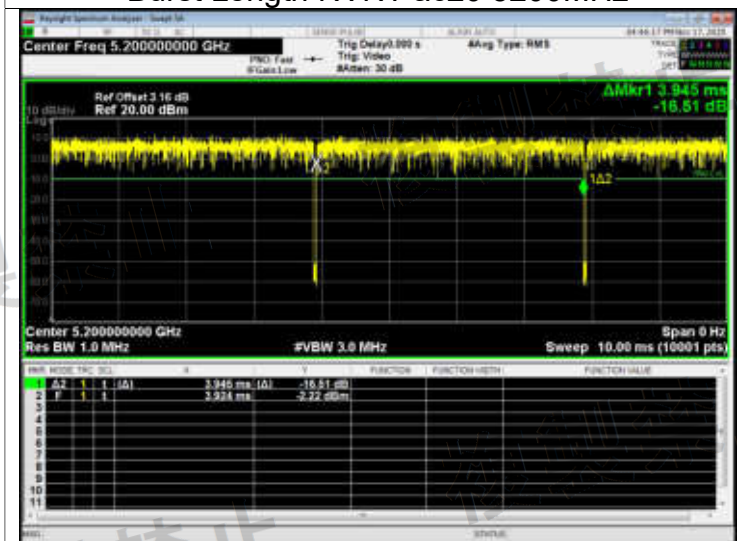
Burst Length NVNT n40 5230MHz



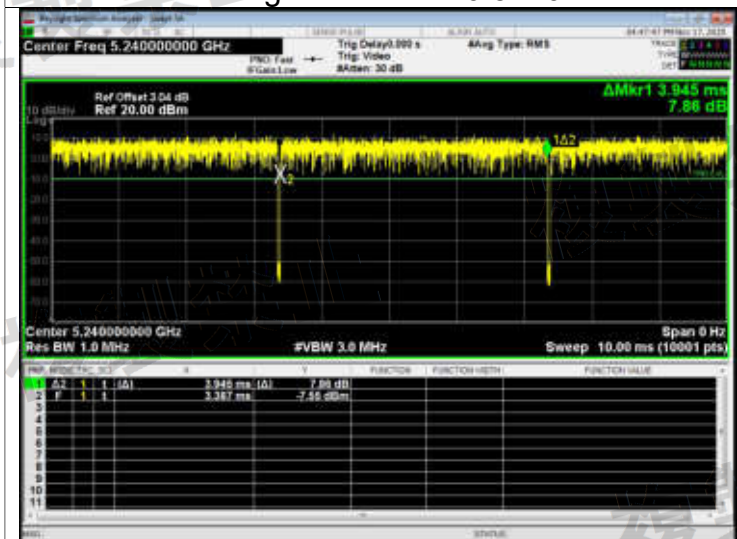
Burst Length NVNT ac20 5180MHz



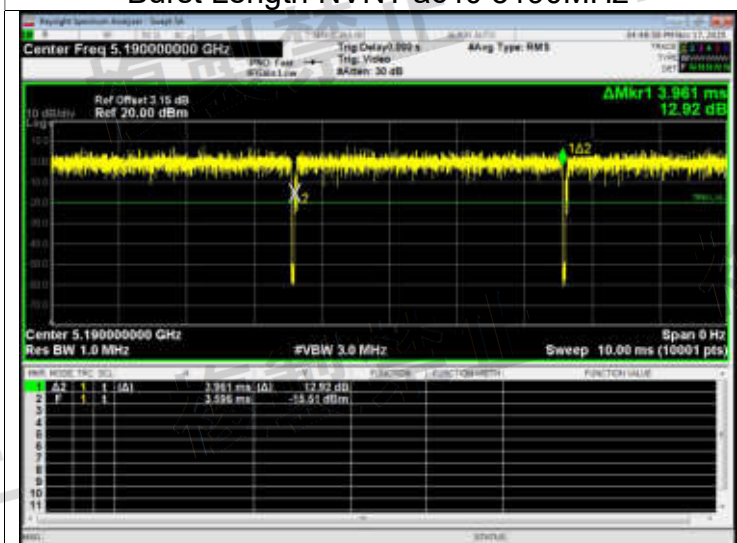
Burst Length NVNT ac20 5200MHz



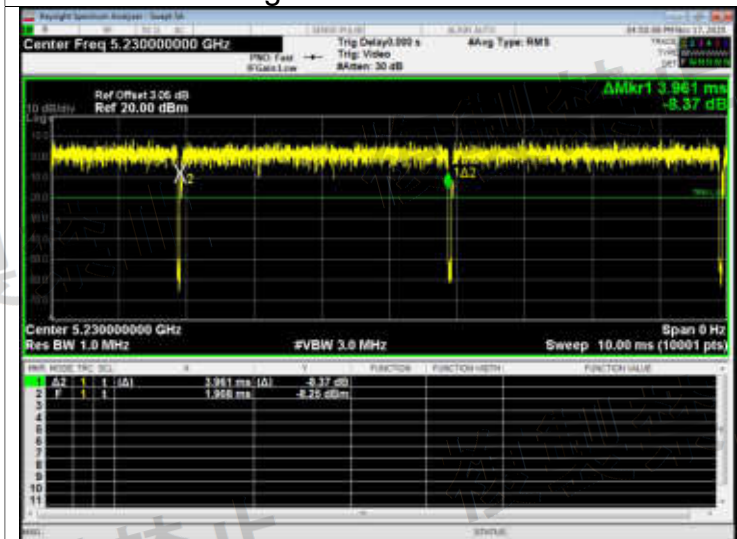
Burst Length NVNT ac20 5240MHz



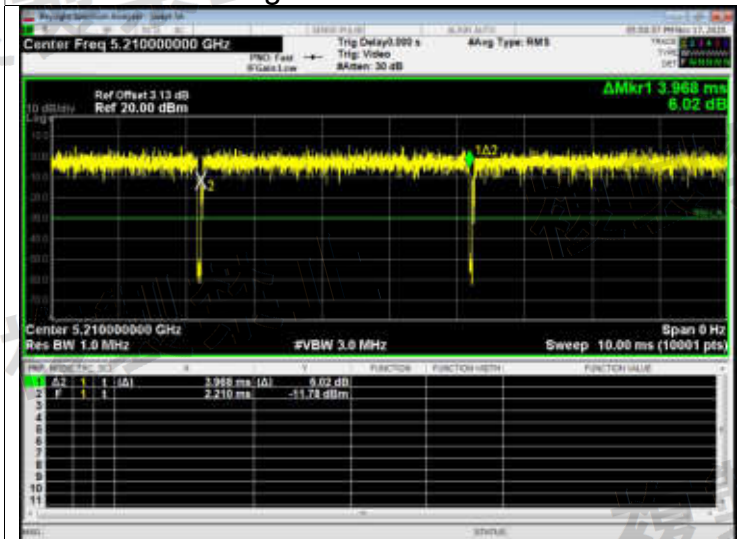
Burst Length NVNT ac40 5190MHz



Burst Length NVNT ac40 5230MHz

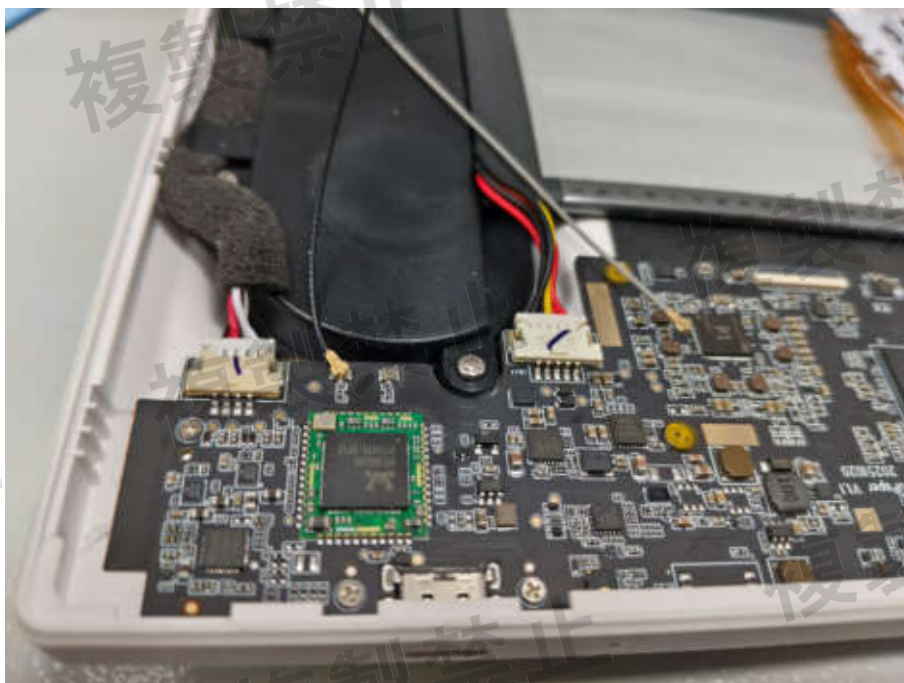


Burst Length NVNT ac80 5210MHz



Photographs of the Test Setup

Measurement Photos





Photographs of the EUT

Reference to the **appendix II_External photos** and **appendix II_Internal photos** for details.

----END OF REPORT----