4.4 Antenna Power Tolerance

4.4.1 Limit

Item	Limits
Antenna Power Density	(1) FH, FH+DS 3mW/MHz (2) OFDM1 10mW/MHz (3) OFDM2 5mW/MHz (used in the range of 2400 – 2483.5 MHz, A modulation system of OFDM1 shall be the occupied bandwidth of 26MHz or less, and OFDM2 shall be the occupied bandwidth of 26MHz or more and 38MHz or less) (4) FH+OFDM 10mW/MHz (Excluding 2427 – 2470.75 MHz) (5) DS 10mW/MHz (6) Other than (1) & (2) (3) & (4) & (5) 10mW
Antenna Power Tolerance	+20%, -80%

4.4.2 Test Procedures

(1) Frequency hopping system (including combined systems of direct spread and orthogonal frequency division multiplexing)

a. Connect the high frequency power meter to the output of the attenuator and measure the total power.

b. Divide the total power by the spread bandwidth and find the average power per MHz

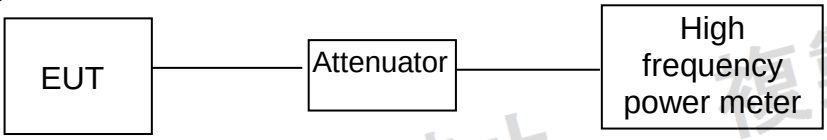
c. Confirm that the frequency distribution of frequency hopping (frequency hopping intervals are equally spaced at less than 1 MHz) and the emergence probability of the various hopping frequencies are even according to the supporting data. Furthermore, if frequency distribution of frequency hopping is not even, consider other measurement methods by referring to “6 Other Conditions”.

d. Set the antenna power as follows:

(1) Continuous waves: value in b.

(2) Burst waves: value in b. and value calculated from the average power within bursts from rates of transmission times.

4.4.3 Test Setup



4.4.4 Test Deviation

There is no deviation with the original standard.

4.4.5 EUT Operation During Test

The EUT was programmed to be in continuously transmitting hopping mode.

4.4.6 Test Result

Test plots of normal input voltage mode as below:

Mode	Average burst power (dBm)	Average burst power (mW)	Duty cycle	Average power (mW)	Spread bandwidth (MHz)	Antenna power (mW/MHz)	Rated output power (mW/MHz)	Antenna power tolerance (%)	Limit of antenna power tolerance (%)
GFSK	1.269	1.339	0.772	1.735	70.886	0.0245	0.03	-18.33%	+20% ~ -80%
π/4-DQPSK	1.501	1.413	0.732	1.930	71.093	0.0271	0.03	-9.66%	
8DPSK	1.794	1.511	0.775	1.950	70.884	0.0275	0.03	8.33%	

Note:

1. The rated output power is 0.03mW/MHz.
2. See the section 4.2 for the spread bandwidth
3. Antenna power = Average power / Spread bandwidth
4. Average power= Average burst power / Duty cycle

4.5 Rx Unwanted Emission Measurement

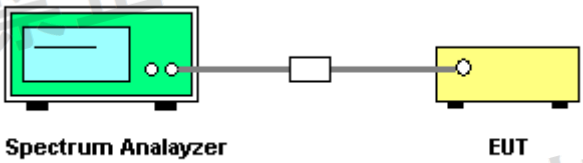
4.5.1 Limit

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

4.5.2 Test Procedures

1. SA set RBW: 100kHz and VBW: 100kHz (blew 1GHz emissions)
2. 1MHz and VBW: 1MHz (above 1GHz emission)
3. Sweep time: Auto
4. Detect mode: Positive peak
5. Trace mode: Max holdTest Setup

4.5.3 Test Setup



4.5.4 Test Deviation

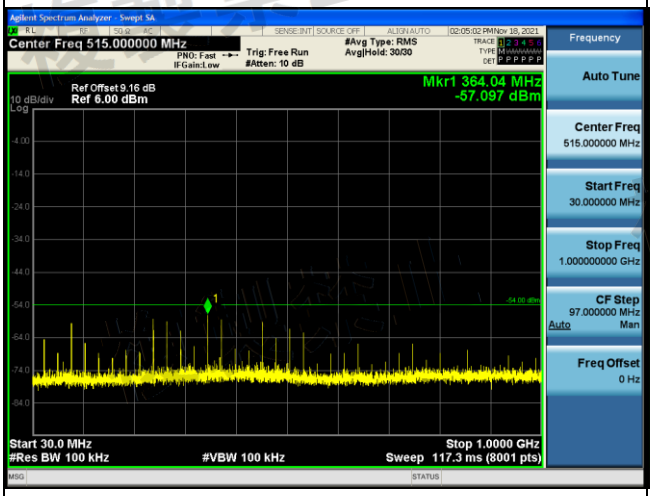
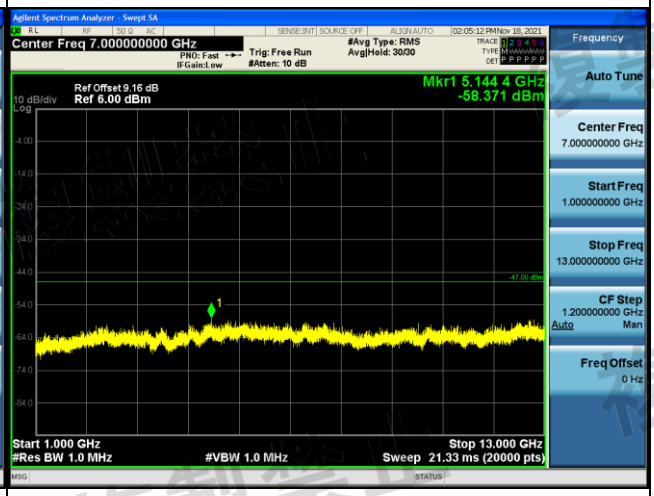
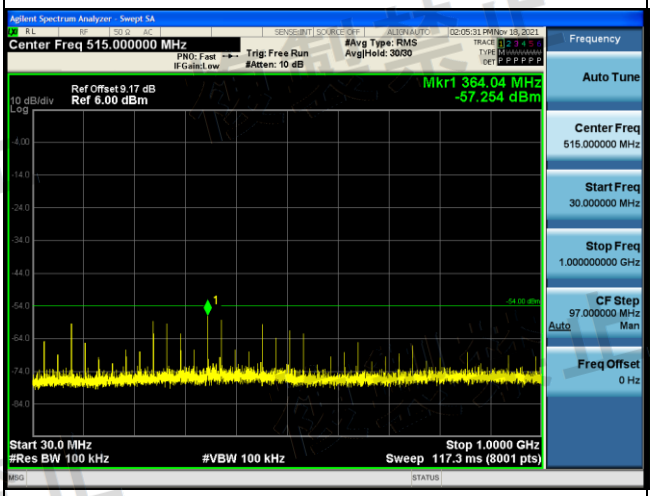
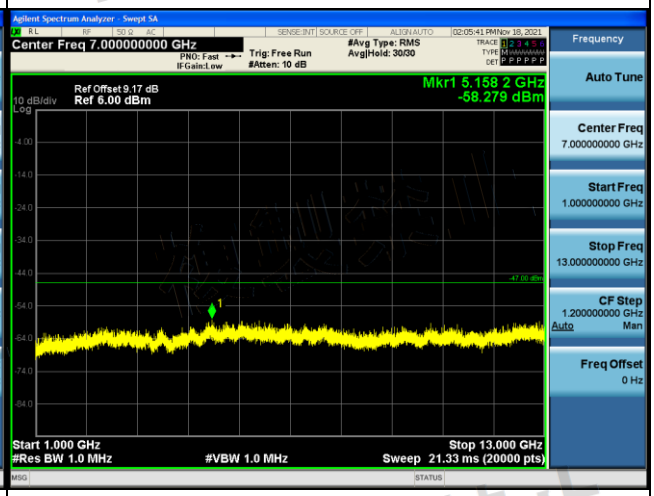
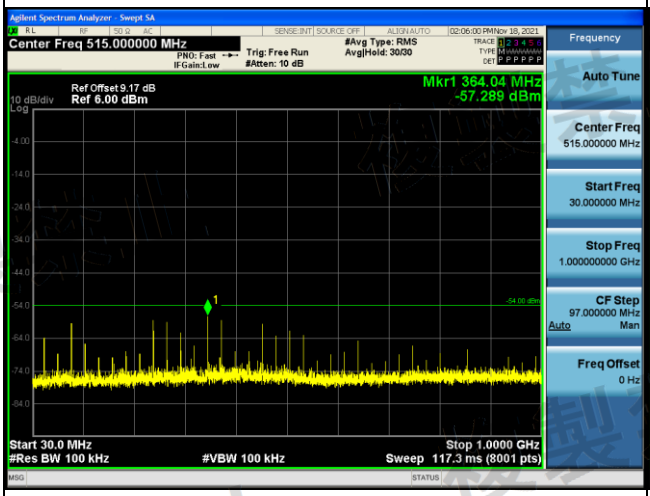
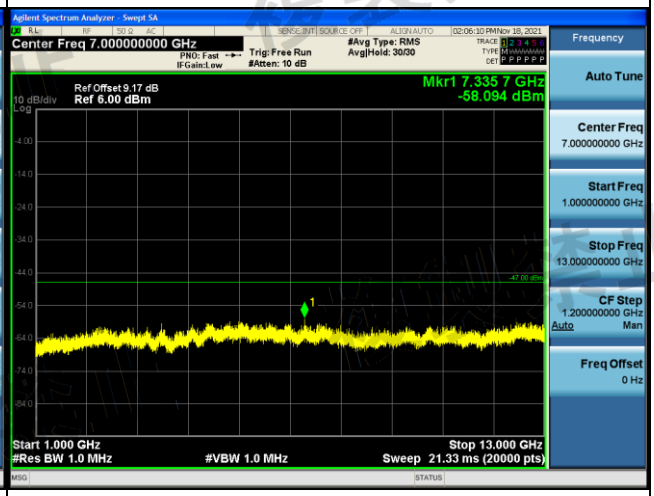
There is no deviation with the original standard.

4.5.5 EUT Operation During Test

The EUT was programmed to be in continuously reception mode.

4.5.6 Test Result

Test plots of normal input voltage mode as below:

GFSK, 30MHz~1GHz	GFSK, 1GHz~13GHz
	
π/4-DQPSK, 30MHz~1GHz	π/4-DQPSK, 1GHz~13GHz
	
8DPSK, 30MHz~1GHz	8DPSK, 1GHz~13GHz
	

4.6 Dwell time

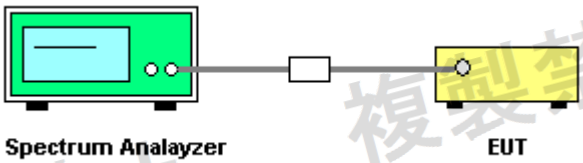
4.6.1 Limit

Item	Limits
Dwell time	FH, FH+DS, FH+OFDM: 0.4s or less

4.6.2 Test Procedures

1. SA set RBW: 1MHz / VBW: 1MHz / span: zero / Detect mode: Positive peak / Trace mode: Max hold/ Trigger: Video trigger.
2. Measure the dwell time by the marker-delta function.

4.6.3 Test Setup



4.6.4 Test Deviation

There is no deviation with the original standard.

4.6.5 EUT Operation During Test

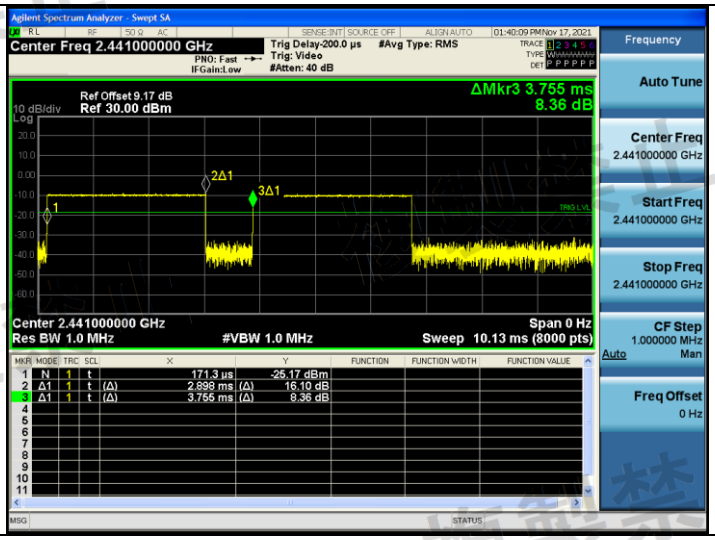
The EUT was programmed to be in continuously transmitting hopping mode.

4.6.6 Test Result

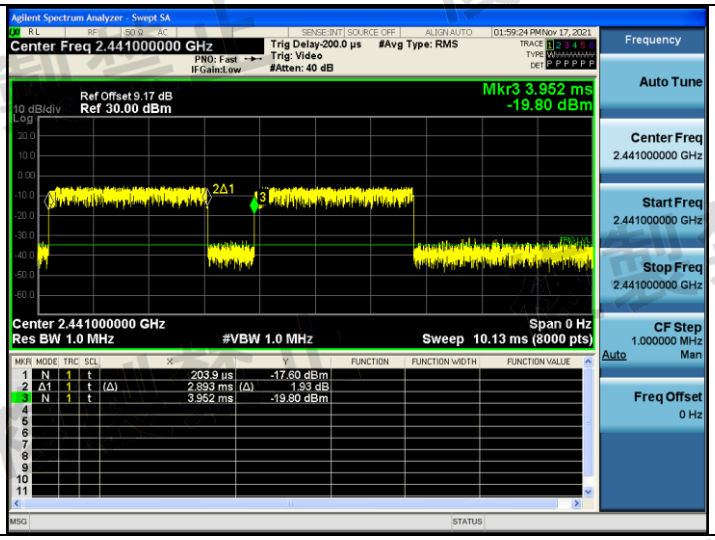
Data Packet	Spreading bandwidth	On time	Total time	Duty cycle	Dwell Time	Limits
	(MHz)	(ms)	(ms)		(s)	(s)
DH5	70.886	2.898	3.755	0.772	0.277	0.400
2DH5	71.093	2.893	3.952	0.732	0.264	0.400
3DH5	70.884	2.908	3.752	0.775	0.278	0.400

Note:
1. Dwell time = 0.4(s) × spreading rate × burst time(s) / (burst cycle(s) × No. of hopping channel)
2. No. of hopping channel = 79
3. See the section 4.2 for the spread rate.
4. The burst cycle = T on + T off

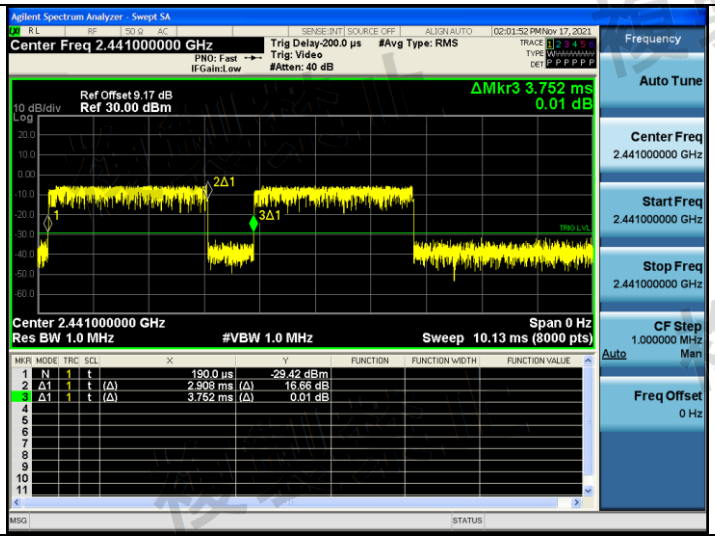
GFSK mode



π/4-DQPSK mode



8DPSK mode



4.7 Radio Interference Prevention Capability Measurement

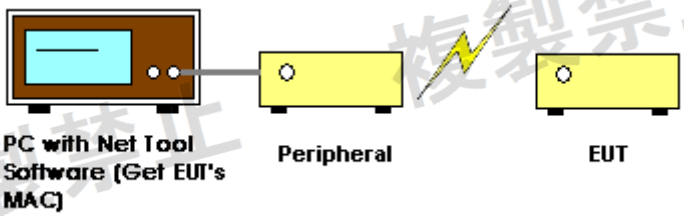
4.7.1 Limit

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

4.7.2 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.

4.7.3 Test Setup



4.7.4 Test Deviation

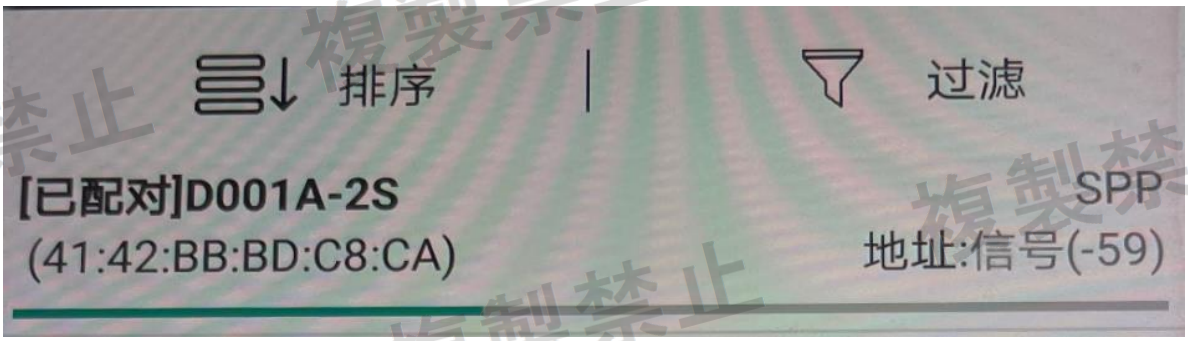
There is no deviation with the original standard.

4.7.5 EUT Operation During Test

The EUT was programmed to be in normal transmitting mode.

4.7.6 Test Result

Pass. The interference prevention function of EUT is good.

MAC Address


4.8 Eirp Antenna Power Measurement

4.8.1 Limit

Modulation	Frequency band	Antenna power	Max EIRP	
			Non-directional	Beam directional$_{Note1}$
DS	2,400-2,483.5MHz	10mW/MHz	12.14dBm/MHz	22.14dBm/MHz
OFDM1$_{Note2}$	2,400-2,483.5MHz	10mW/MHz	12.14dBm/MHz	22.14dBm/MHz
OFDM2	2,400-2,483.5MHz	5mW/MHz	9.14dBm/MHz	19.14dBm/MHz
FH,DS-FH,FH-OFDM	2,400-2,483.5MHz	3mW/MHz	6.91dBm/MHz	16.91dBm/MHz
	2,427-2,470.75MHz	10mW/MHz	12.14dBm/MHz	22.14dBm/MHz
Other than those above	2,400-2,483.5MHz	10mW	12.14dBm	22.14dBm

Note 1: This test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less.

4.8.2 Measuring Instruments And Setting

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

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

4.8.3 Test Procedures

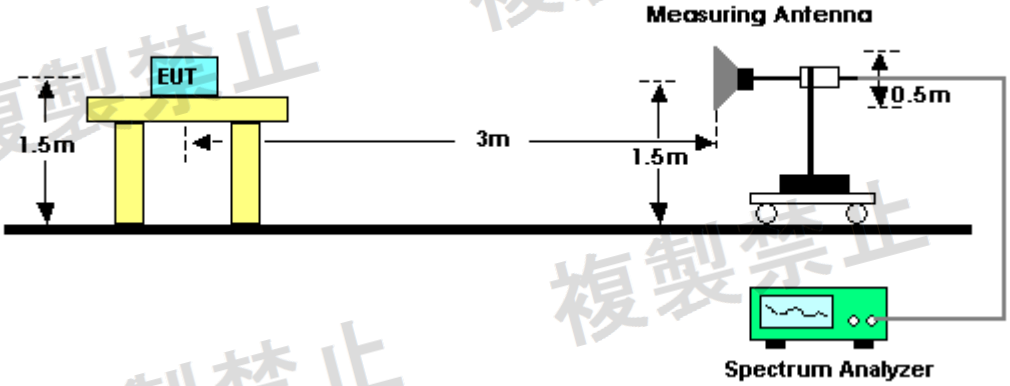
1. Set EUT ad measuring antenna at the same height and roughly facing each other.
2. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of the measuring antenna. The output level at the spectrum analyzer is read sa “E“.
3. Remove the EUT 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 ± 50cm of replacing antenna height and swing it to find the maximum receiving level.
6. Set SSG output power at Pt to give the equivalent output level of “E” or caluate Pt with SSG output which gives the nearest of “E” and difference (± 1dB). Record the Pt.
7. Calculate EIRP by the formula below EIRP = Gt – L + Pt.

Gt: gain of replacing antenna (dBi)
L: feeder loss between SSG and replacing antenna

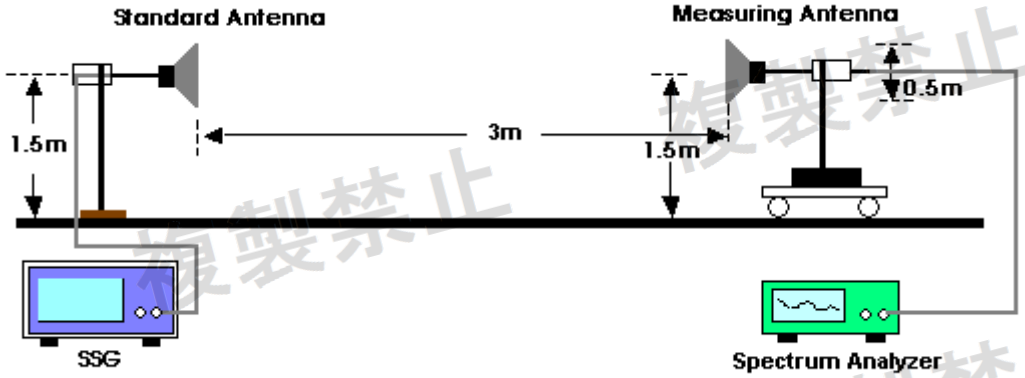
Pt: Output power of the SSG
8. If the antenna for the EUT has circular polarization, sum of V-field and H-field will be result if measuring antenna is linear polarization.

4.8.4 TEST SETUP LAYOUT

For EUT radiation measurement



For standard antenna measurement



4.8.5 TEST DEVIATION

There is no deviation with the original standard.

4.8.6 EUT OPERATION DURING TEST

The EUT was programmed to be in continuously transmitting mode.

4.8.7 RESULTS OF TRANSMISSION ANTENNA GAIN

Note: Not applicable. The peak antenna gain of the EUT which is less than 2.14dBi.

4.9 Transmission Radiation Angle Width (3dB Beam width)

4.9.1 Limit

Item	Limits
3dB antenna beam width	360/A (If A<1; then A=1) A = {EIRP Power [mW] / 16.36 for DS, OFDM} or A = {EIRP Power [mW] / 4.9 for FH}
Note: This test item is not applied for radio equipment with equivalent isotropic radiation power lower than 12.14dBm/MHz, but Antenna Power(Conducted) limit is 10 mW/MHz (10 dBm/MHz), So the test item will not be applied to the transmission antenna which has a gain of 2.14dBi or less	

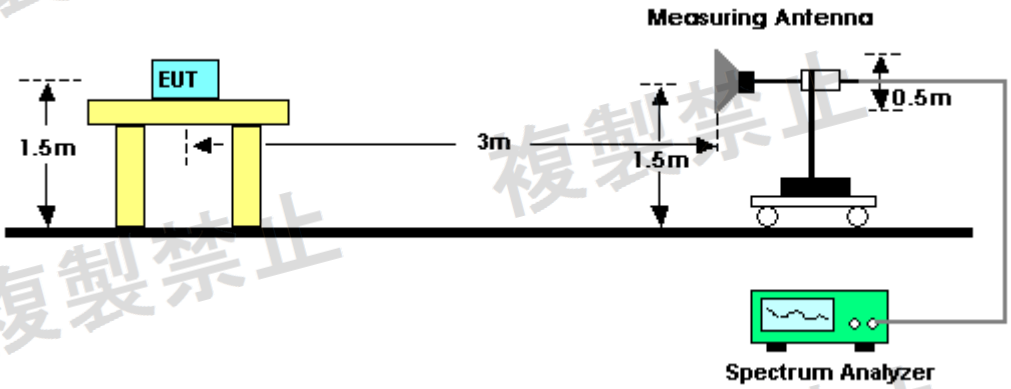
4.9.2 MEASURING INSTRUMENTS AND SETTING

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	0 MHz
RB	1 MHz
VB	1 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.9.3 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 receving signal position.
3. Rotate directions of the EUT horizontally and ertically to find the maximum receiving power.
4. Move the measuring antenna height up and down within ± 50cm of EUT height and swing it to find the maximum output of measuing 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 Power [mW] / 16.36 for DS, OFDM} or
A = {EIRP Power [mW] / 4.9 for FH}

4.9.4 TEST SETUP LAYOUT



4.9.5 TEST DEVIATION

There is no deviation with the original standard.

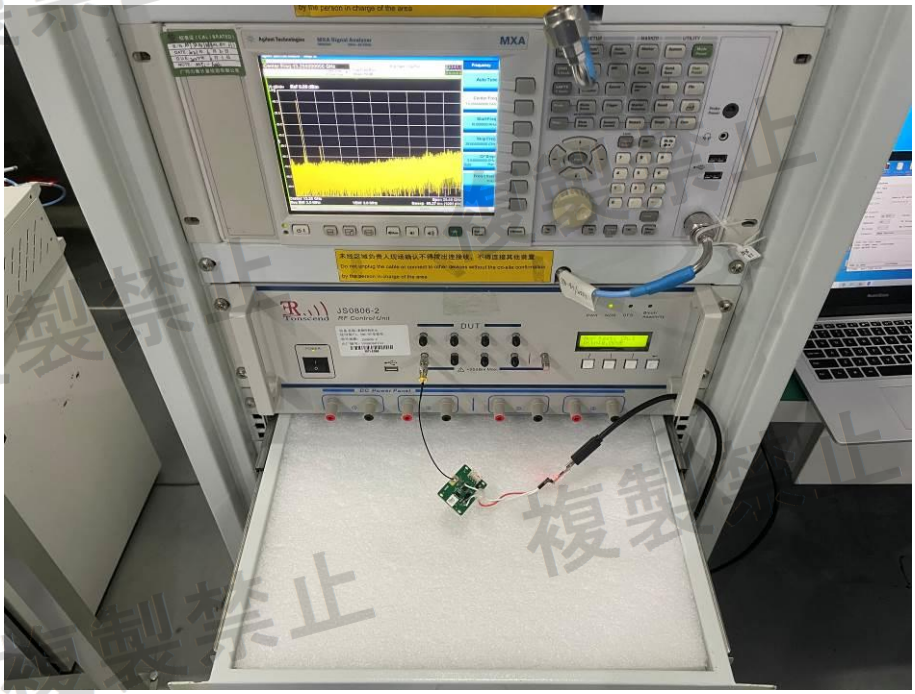
4.9.6 EUT OPERATION DURING TEST

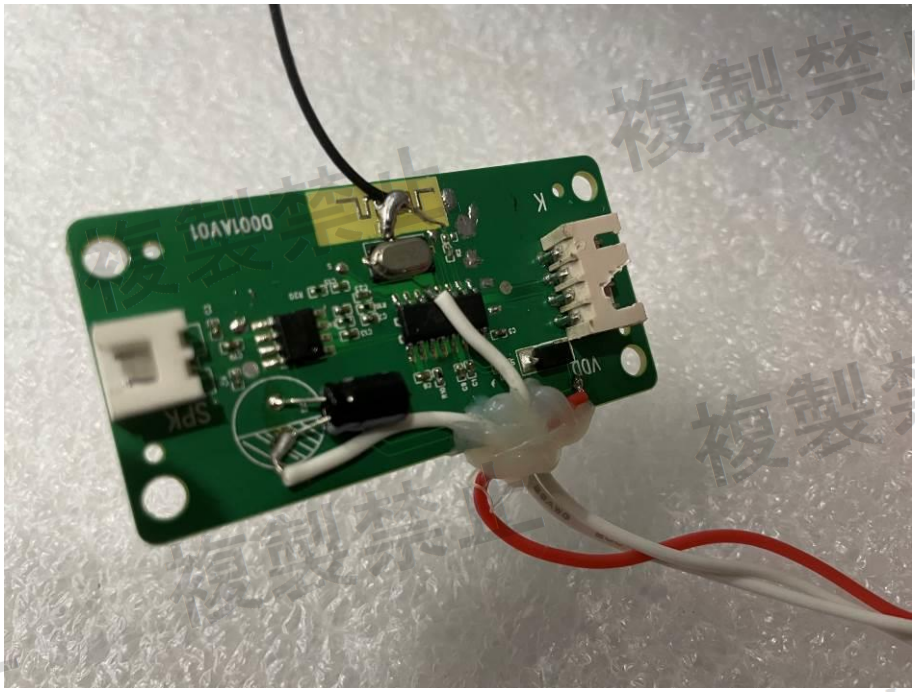
The EUT was programmed to be in continuously transmitting mode.

4.9.7 TEST RESULT

Note: Not applicable. The maximum EIRP is less than 6.91 dBm/MHz.

Photographs of the Test Setup





PHOTOGRAPHS OF THE EUT

See the APPENDIX 1- EUT PHOTO.

----END OF REPORT----