

## 4.6 Transmitter Radiated Spurious Emission

### Limit

According to the ANSI/TIA-603 test method, and according to Section 90.210, the power of each unwanted emission shall be less than Transmitted Power as specified below:

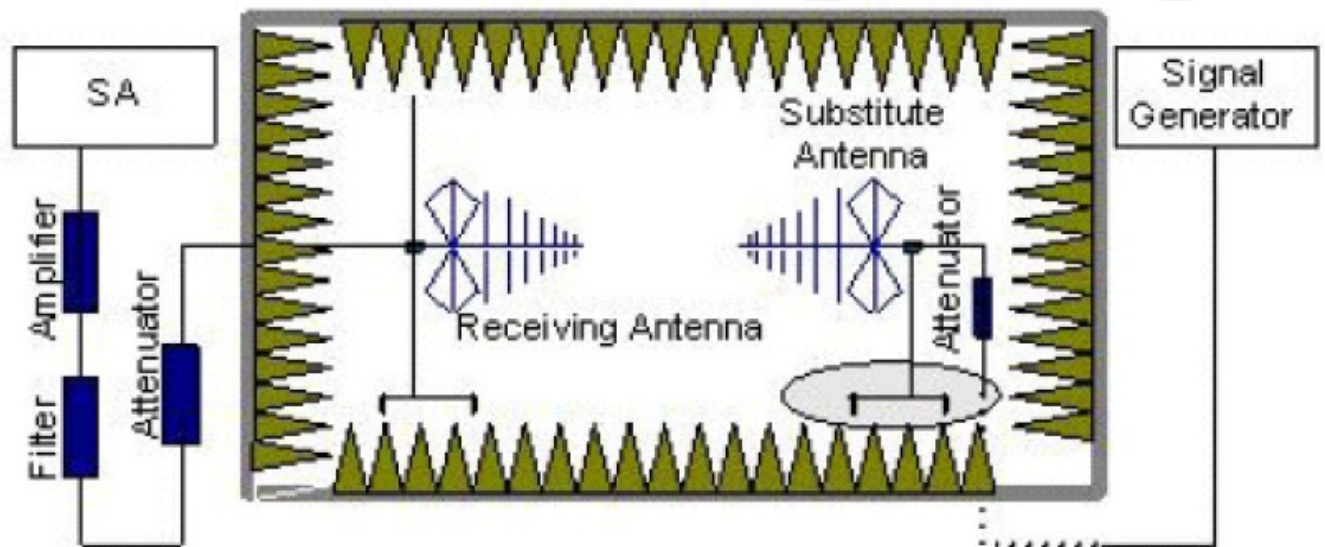
For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

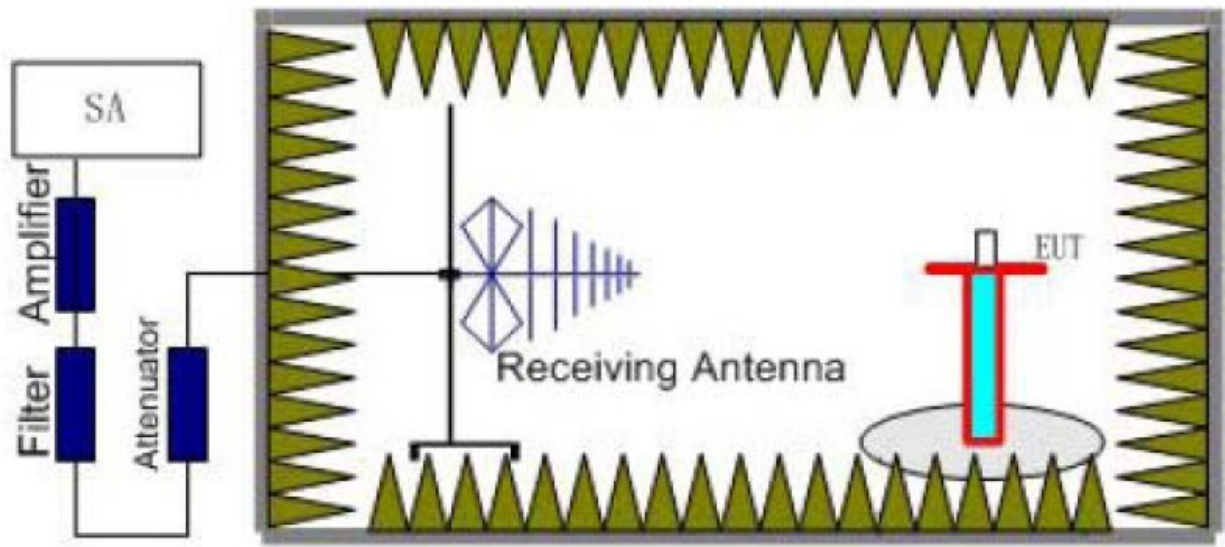
- 1 On any frequency from the center of the authorized bandwidth  $f_0$  to 3.0 kHz removed from  $f_0$ : Zero dB.
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in kHz) of more than 3.0 kHz but no more than 4.6 kHz: At least  $30 + 16.67(f_d - 3 \text{ kHz})$  or  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.
- 3 On any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.

For transmitters designed to operate with 12.5 KHz channel bandwidth:

- 1 On any frequency removed from the center of the authorized bandwidth  $f_0$  to 5.625 KHz removed from  $f_0$ : Zero dB
- 2 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in KHz)  $f_0$  of more than 5.625 KHz but no more than 12.5 KHz: At least 7.27dB
- 3 On any frequency removed from the center of the authorized bandwidth by a displacement frequency ( $f_d$  in KHz)  $f_0$  of more than 12.5 KHz: At least  $50 + 10 \log(P)$  dB or 70 dB, whichever is lesser attenuation.

### Test Configuration





### Test Procedure

- EUT was placed on a 0.8 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.0m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all test transmit frequencies were measured with peak detector.
- A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
- The EUT is then put into continuously transmitting mode at its maximum power level during the test. Set Test Receiver or Spectrum 100 kHz below 1GHz and 1MHz above 1GHz, Sweep from 30MHz to the 10th harmonic of the fundamental frequency; and recorded the level of the concerned spurious emission point as ( $P_r$ ).
- The EUT then replaced by a substitution antenna. In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization. The measurement results are obtained as described below:

$$\text{Power}_{(EIRP)} = P_{Mea} - G_a + P_{cl}$$

Where;

- $P_{Mea}$  is the recorded signal generator level
- $P_{cl}$  is the cable loss connect between instruments
- $G_a$  Substitution Antenna Gain

- This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
- ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dBi}$ .
- Test site anechoic chamber refer to ANSI C63.4

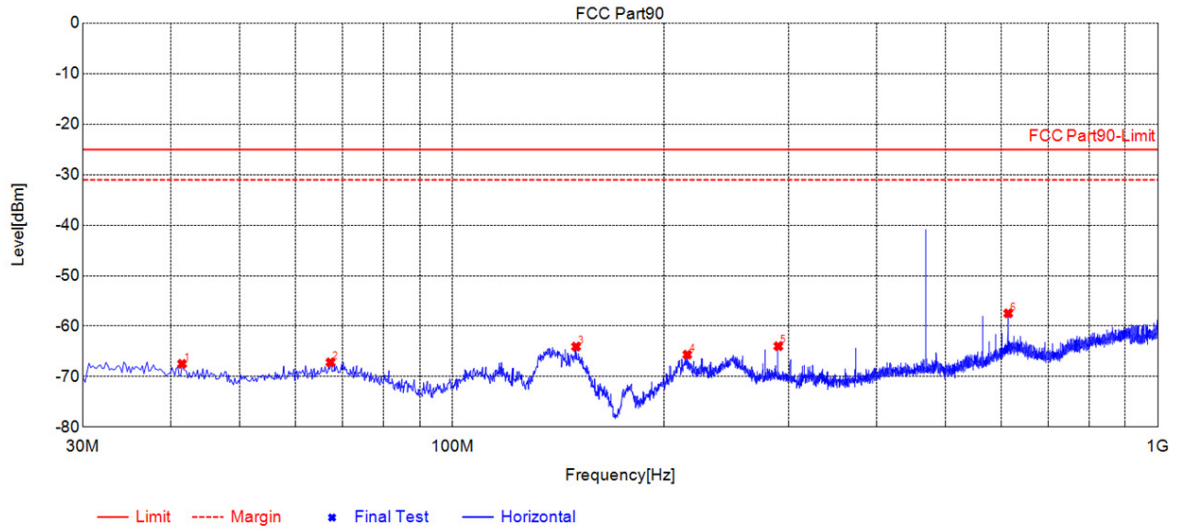
### Test Results

All the test modes completed for test. Only the worst result was reported as below:  
Worst mode: 450-470MHz High Channel

For 30M-1GHz

Analog:

Antenna polarity: Horizontal

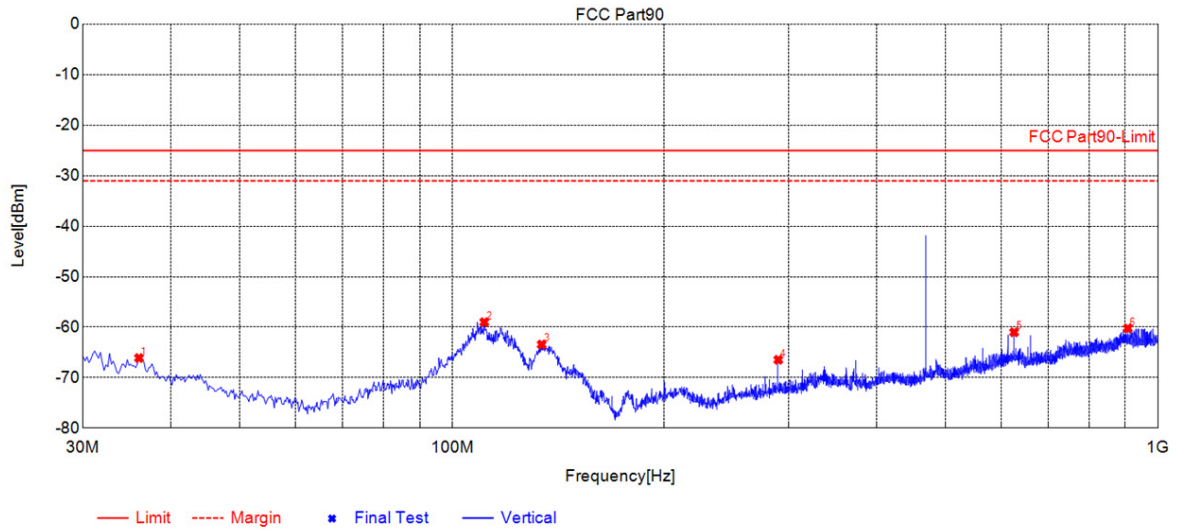


### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity   |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|------------|
| 1   | 41.4483        | -71.35           | -67.47         | -25.00         | 42.47          | 3.88           | Horizontal |
| 2   | 67.2555        | -71.57           | -67.18         | -25.00         | 42.18          | 4.39           | Horizontal |
| 3   | 149.916        | -66.56           | -64.07         | -25.00         | 39.07          | 2.49           | Horizontal |
| 4   | 215.501        | -68.93           | -65.65         | -25.00         | 40.65          | 3.28           | Horizontal |
| 5   | 290.012        | -67.09           | -63.98         | -25.00         | 38.98          | 3.11           | Horizontal |
| 6   | 614.056        | -64.98           | -57.47         | -25.00         | 32.47          | 7.51           | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



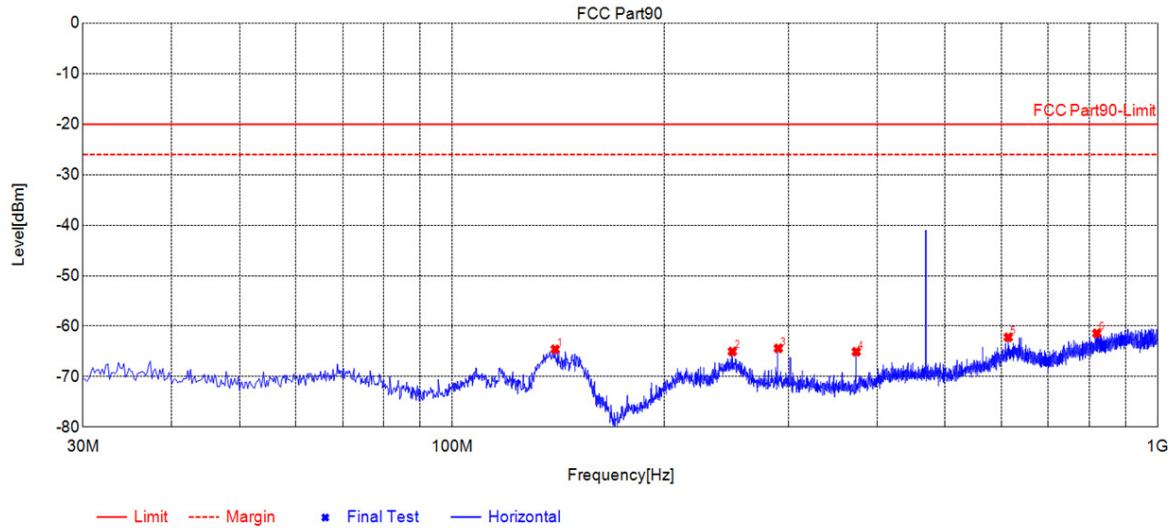
### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|----------|
| 1   | 36.0152        | -66.99           | -66.12         | -25.00         | 41.12          | 0.87           | Vertical |
| 2   | 111.108        | -70.92           | -59.02         | -25.00         | 34.02          | 11.90          | Vertical |
| 3   | 134.004        | -63.04           | -63.45         | -25.00         | 38.45          | -0.41          | Vertical |
| 4   | 290.012        | -67.12           | -66.47         | -25.00         | 41.47          | 0.65           | Vertical |
| 5   | 626.087        | -67.15           | -61.02         | -25.00         | 36.02          | 6.13           | Vertical |
| 6   | 907.249        | -69.63           | -60.25         | -25.00         | 35.25          | 9.38           | Vertical |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Digital:

Antenna polarity: Horizontal

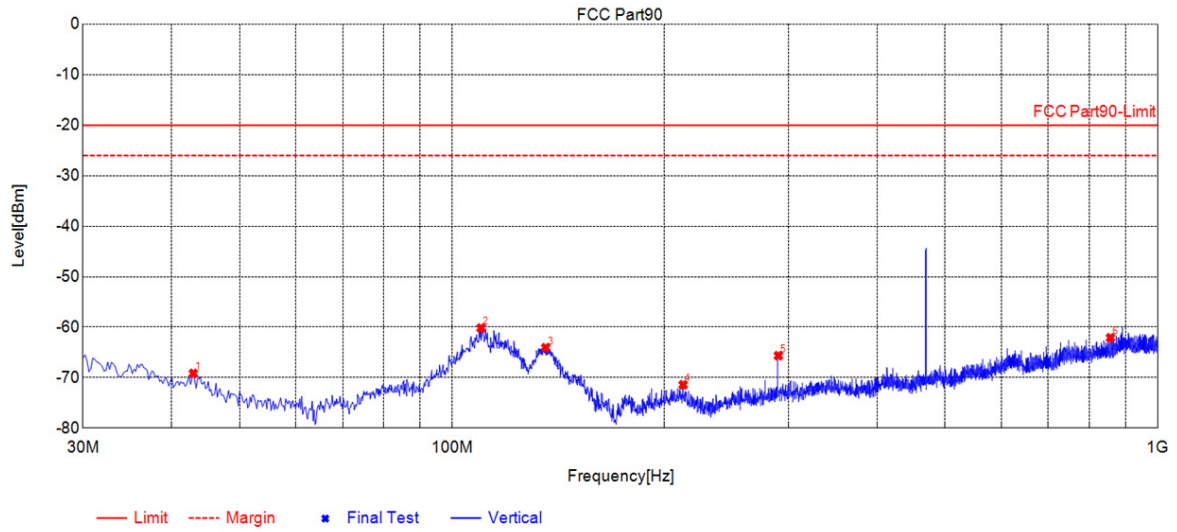


### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity   |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|------------|
| 1   | 140.02         | -64.69           | -64.58         | -20.00         | 44.58          | 0.11           | Horizontal |
| 2   | 249.651        | -71.17           | -65.03         | -20.00         | 45.03          | 6.14           | Horizontal |
| 3   | 290.012        | -67.52           | -64.41         | -20.00         | 44.41          | 3.11           | Horizontal |
| 4   | 374.030        | -66.69           | -65.08         | -20.00         | 45.08          | 1.61           | Horizontal |
| 5   | 614.056        | -69.74           | -62.23         | -20.00         | 42.23          | 7.51           | Horizontal |
| 6   | 819.932        | -70.48           | -61.42         | -20.00         | 41.42          | 9.06           | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



### Suspected List

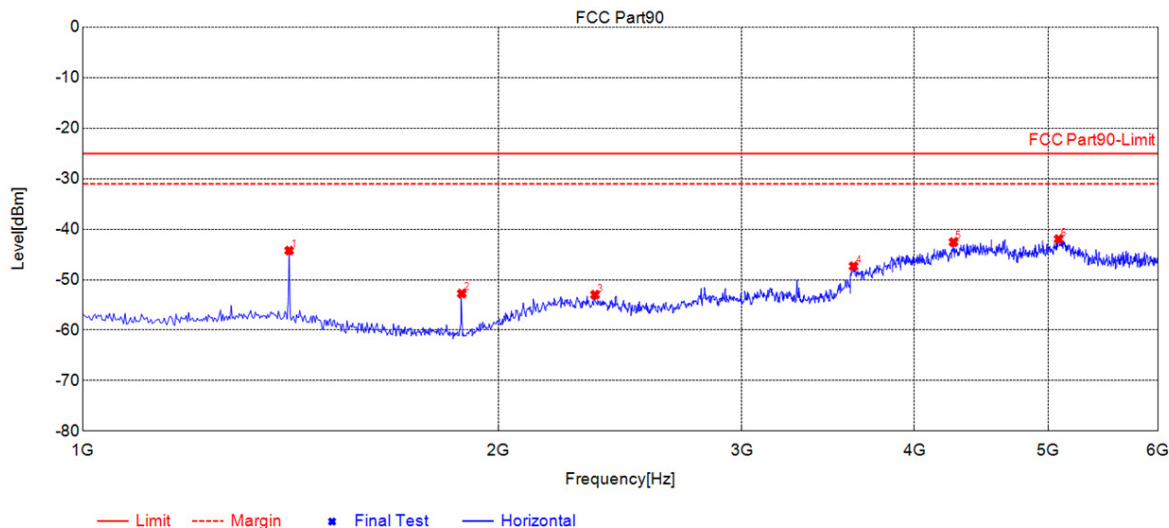
| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|----------|
| 1   | 43.0006        | -67.42           | -69.17         | -20.00         | 49.17          | -1.75          | Vertical |
| 2   | 109.944        | -72.75           | -60.18         | -20.00         | 40.18          | 12.57          | Vertical |
| 3   | 135.751        | -63.60           | -64.08         | -20.00         | 44.08          | -0.48          | Vertical |
| 4   | 212.590        | -70.93           | -71.43         | -20.00         | 51.43          | -0.50          | Vertical |
| 5   | 290.012        | -66.31           | -65.66         | -20.00         | 45.66          | 0.65           | Vertical |
| 6   | 857.187        | -70.21           | -62.11         | -20.00         | 42.11          | 8.10           | Vertical |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

For 1G-6GHz

Analog:

Antenna polarity: Horizontal

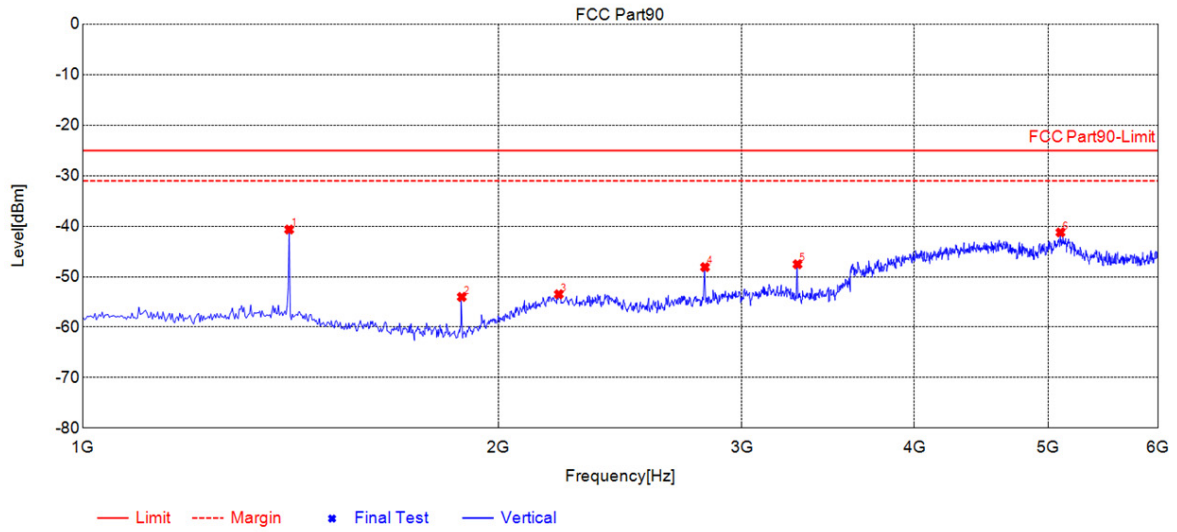


### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity   |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|------------|
| 1   | 1410.20        | -40.94           | -44.24         | -25.00         | 19.24          | -3.30          | Horizontal |
| 2   | 1880.44        | -49.11           | -52.76         | -25.00         | 27.76          | -3.65          | Horizontal |
| 3   | 2348.17        | -52.61           | -52.99         | -25.00         | 27.99          | -0.38          | Horizontal |
| 4   | 3613.80        | -50.71           | -47.34         | -25.00         | 22.34          | 3.37           | Horizontal |
| 5   | 4269.13        | -47.68           | -42.56         | -25.00         | 17.56          | 5.12           | Horizontal |
| 6   | 5087.04        | -51.83           | -41.96         | -25.00         | 16.96          | 9.87           | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



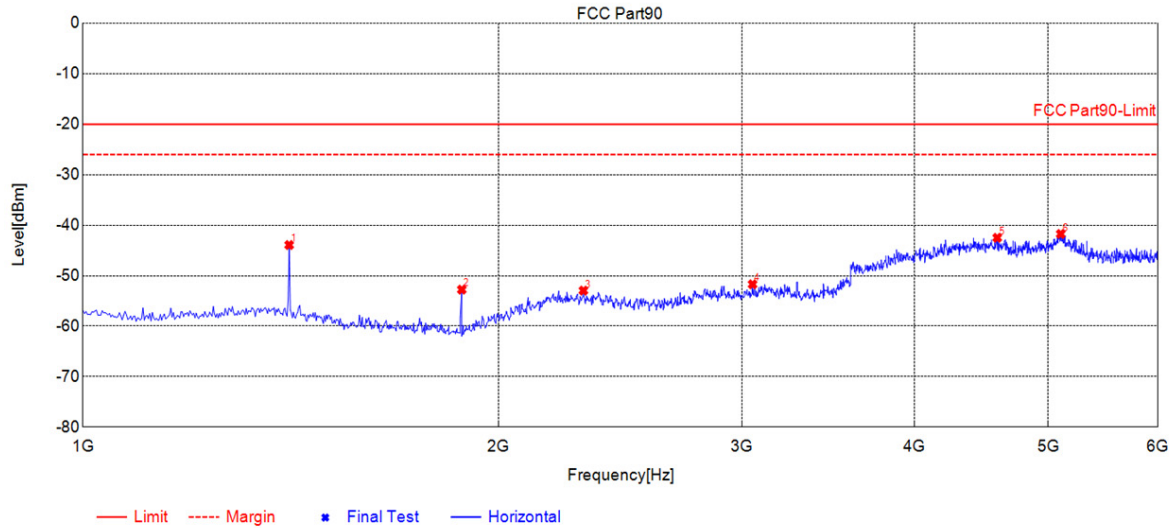
### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|----------|
| 1   | 1410.20        | -37.33           | -40.66         | -25.00         | 15.66          | -3.33          | Vertical |
| 2   | 1880.44        | -50.32           | -54.02         | -25.00         | 29.02          | -3.70          | Vertical |
| 3   | 2210.60        | -53.46           | -53.49         | -25.00         | 28.49          | -0.03          | Vertical |
| 4   | 2820.91        | -47.75           | -48.11         | -25.00         | 23.11          | -0.36          | Vertical |
| 5   | 3291.14        | -47.93           | -47.55         | -25.00         | 22.55          | 0.38           | Vertical |
| 6   | 5102.05        | -51.06           | -41.24         | -25.00         | 16.24          | 9.82           | Vertical |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Digital:

Antenna polarity: Horizontal

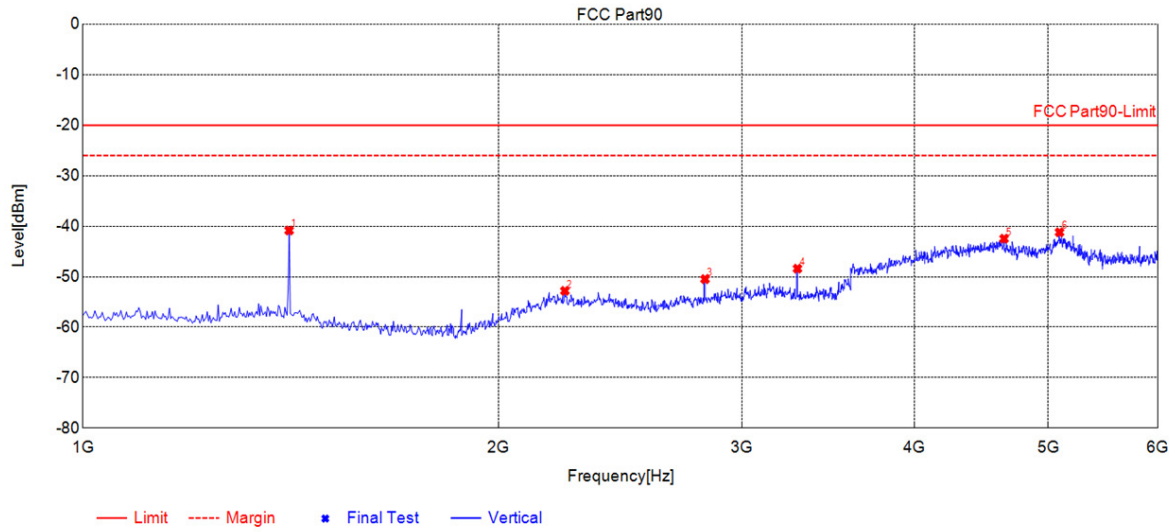


### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity   |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|------------|
| 1   | 1410.20        | -40.62           | -43.92         | -20.00         | 23.92          | -3.30          | Horizontal |
| 2   | 1880.44        | -49.12           | -52.77         | -20.00         | 32.77          | -3.65          | Horizontal |
| 3   | 2303.15        | -52.76           | -52.96         | -20.00         | 32.96          | -0.20          | Horizontal |
| 4   | 3053.52        | -52.76           | -51.71         | -20.00         | 31.71          | 1.05           | Horizontal |
| 5   | 4591.79        | -48.86           | -42.50         | -20.00         | 22.50          | 6.36           | Horizontal |
| 6   | 5104.55        | -51.72           | -41.73         | -20.00         | 21.73          | 9.99           | Horizontal |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Antenna polarity: Vertical



### Suspected List

| NO. | Freq.<br>[MHz] | Reading<br>[dBm] | Level<br>[dBm] | Limit<br>[dBm] | Margin<br>[dB] | Factor<br>[dB] | Polarity |
|-----|----------------|------------------|----------------|----------------|----------------|----------------|----------|
| 1   | 1410.20        | -37.52           | -40.85         | -20.00         | 20.85          | -3.33          | Vertical |
| 2   | 2233.11        | -52.63           | -52.82         | -20.00         | 32.82          | -0.19          | Vertical |
| 3   | 2820.91        | -50.13           | -50.49         | -20.00         | 30.49          | -0.36          | Vertical |
| 4   | 3291.14        | -48.79           | -48.41         | -20.00         | 28.41          | 0.38           | Vertical |
| 5   | 4644.32        | -49.23           | -42.48         | -20.00         | 22.48          | 6.75           | Vertical |
| 6   | 5094.54        | -50.98           | -41.21         | -20.00         | 21.21          | 9.77           | Vertical |

Remark: Factor = Cable loss + Antenna factor + Attenuator – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

## 4.7 Transmitter Spurious Emissions (Conducted)

### Limit

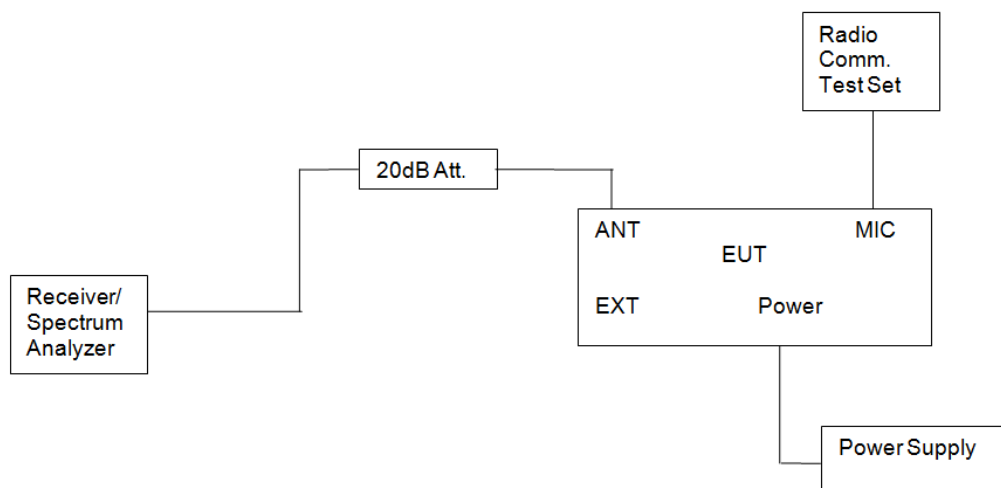
12.5K: Per Part 90.210, For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth: at least  $50 + 10 \log(P)$  dB or 70 dB, whichever is the lesser attenuation.

When  $P = 2W$ , Limit = -20 dBm

6.25K: Per Part 90.210, For transmitters designed to operate with a 6.25 kHz or less bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth: on any frequency removed from the center of the authorized bandwidth by more than 4.6 kHz: At least  $55 + 10 \log(P)$  or 65 dB, whichever is the lesser attenuation.

When  $P = 2W$ , Limit = -25 dBm

### Test Configuration



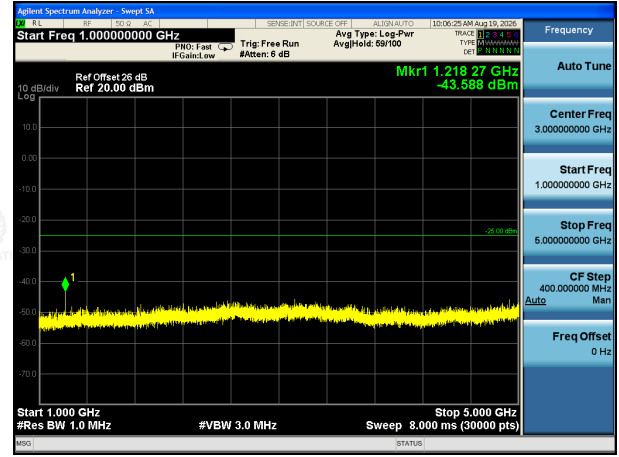
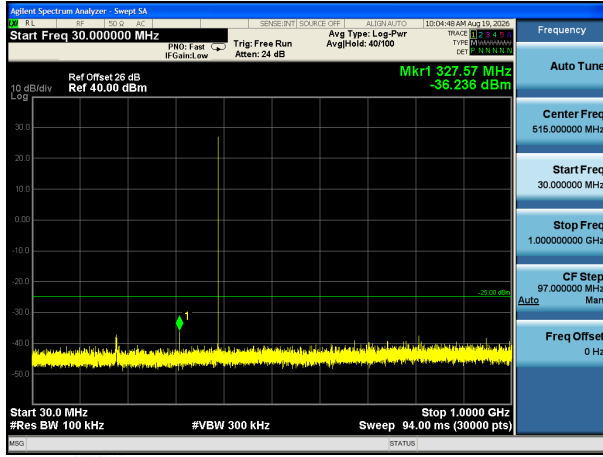
### Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set to 10 kHz/1MHz. Sufficient scans were taken to show any out of band emission up to 10th. Harmonic for the lower and the highest frequency range. Set RBW 100 kHz, VBW 300 kHz in the frequency band 30MHz to 1GHz, while set RBW=1MHz, VBW=3MHz from the 1GHz to 10<sup>th</sup> Harmonic.

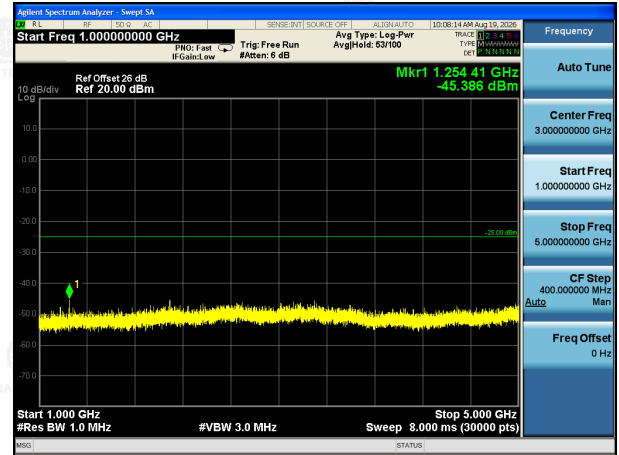
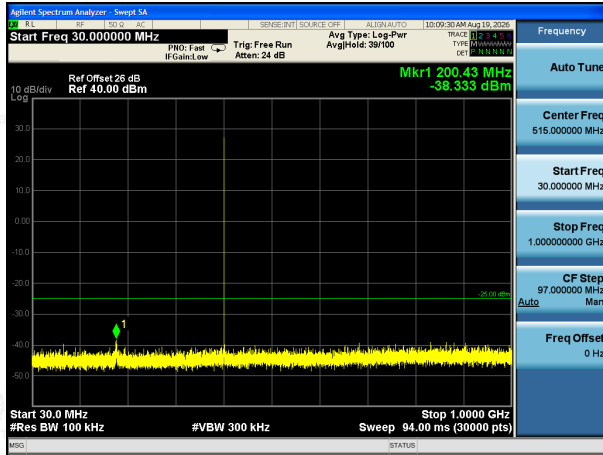
## Test Results

### 406.1-430MHz: LOW

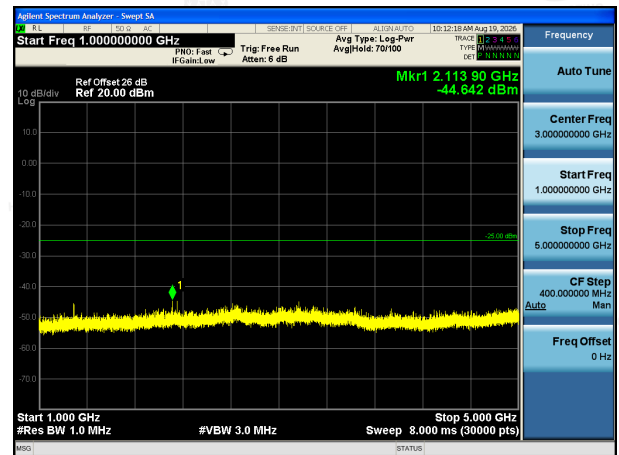
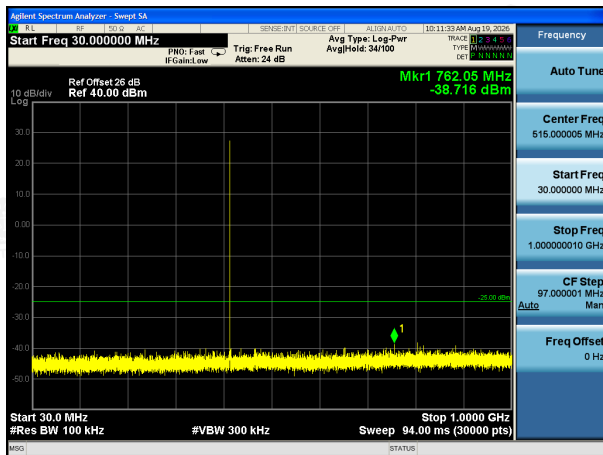
#### FM



#### CH1



#### CH2



#### CH3

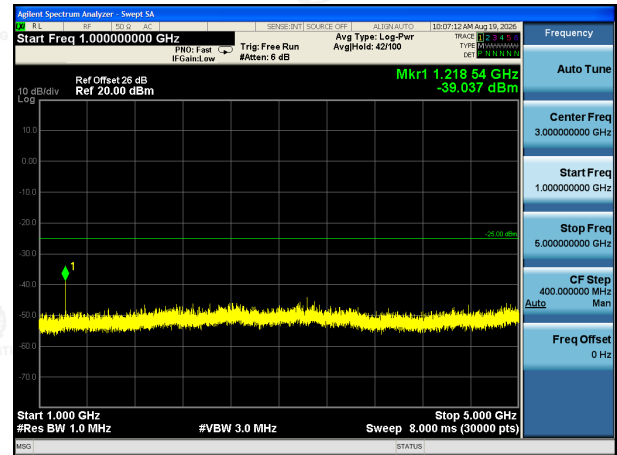
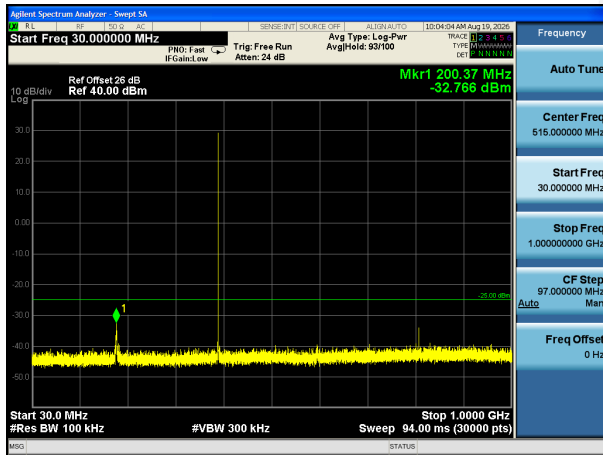
The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.



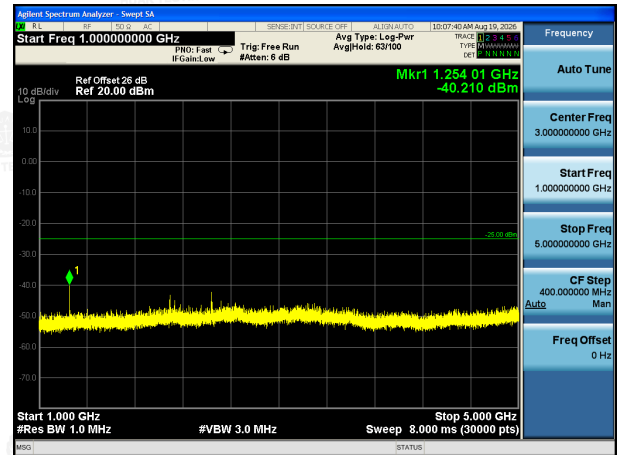
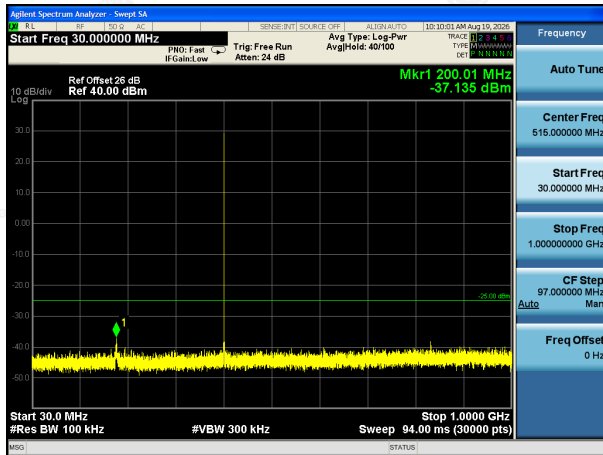
HUAKE TESTING

406.1-430MHz: HIGH

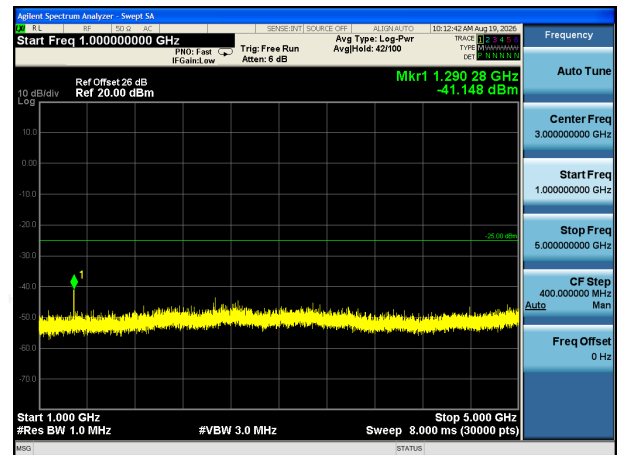
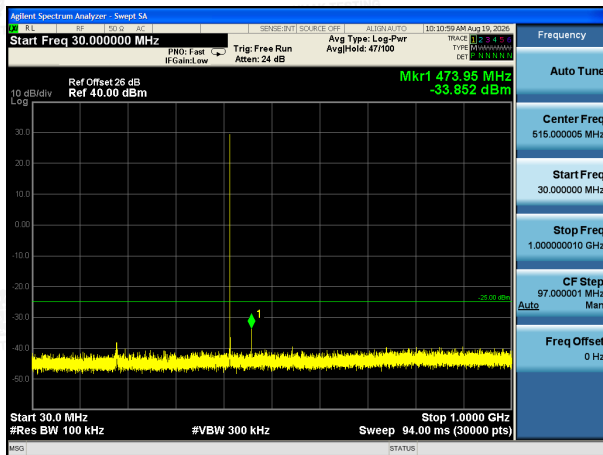
FM



CH1



CH2



CH3

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

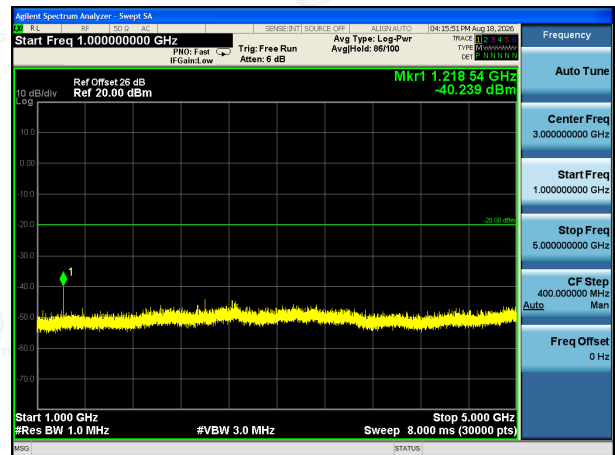
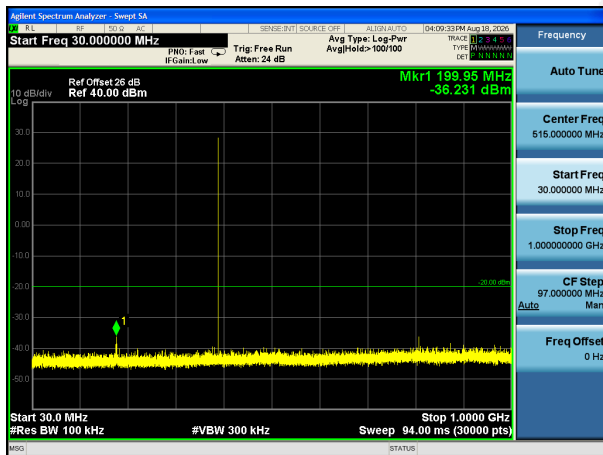
**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com  
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



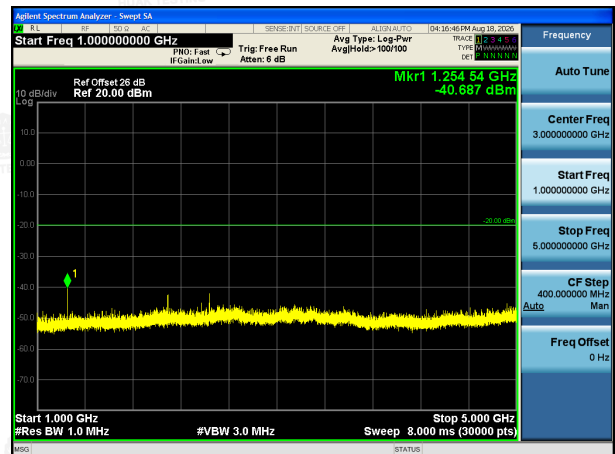
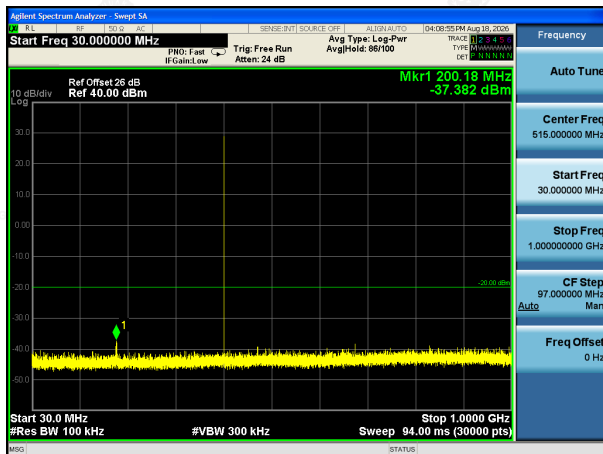
HUAKE TESTING

406.1-430MHz: LOW

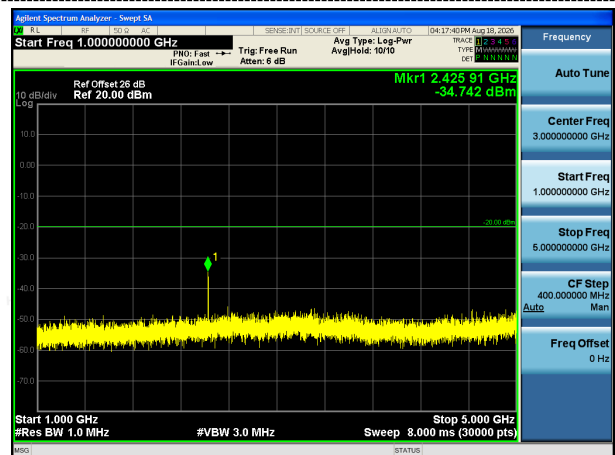
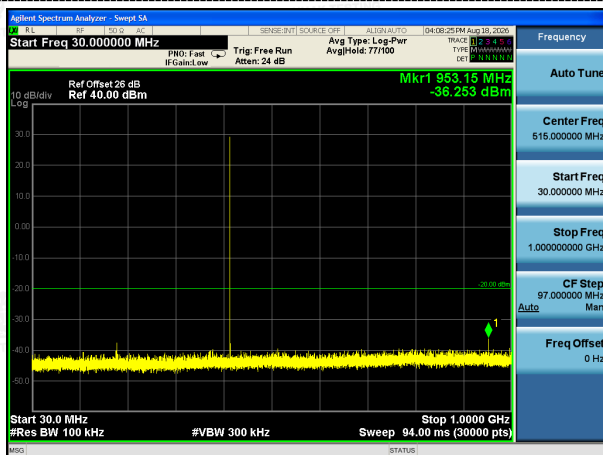
4FSK



CH7



CH8



CH9

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com

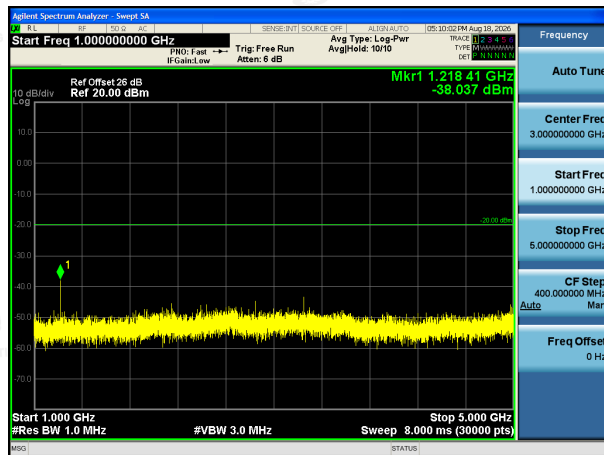
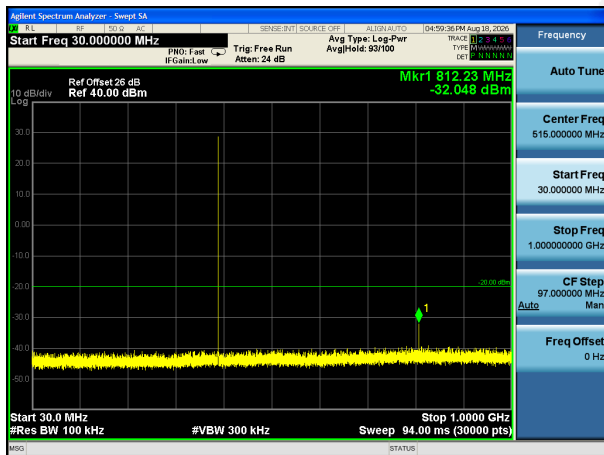
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



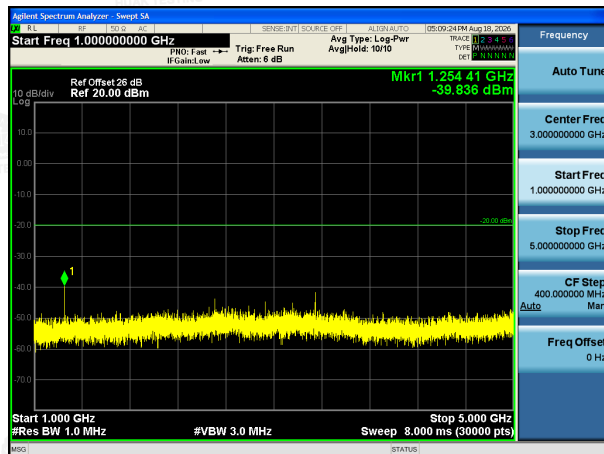
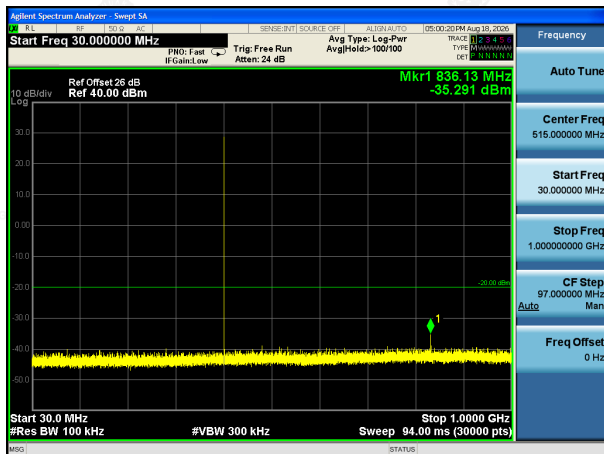
HUAKE TESTING

406.1-430MHz: HIGH

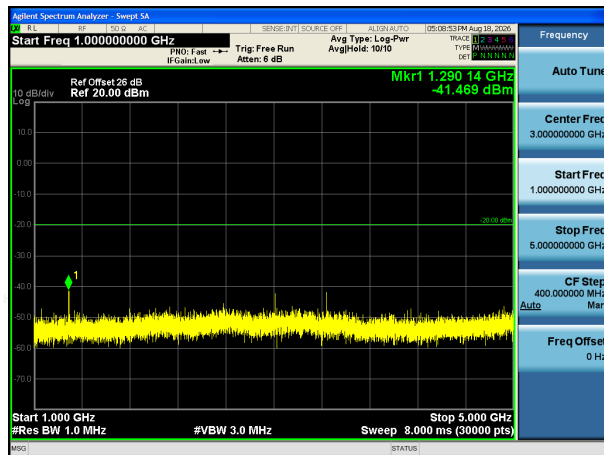
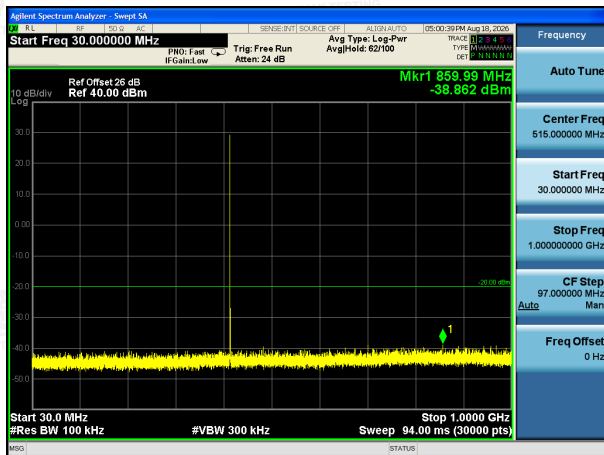
4FSK



CH1



CH2



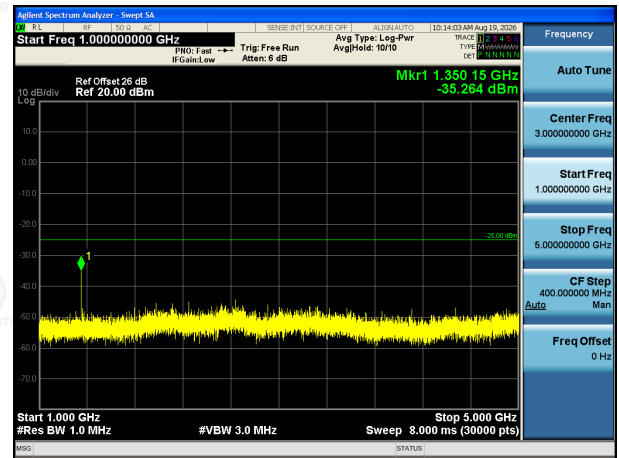
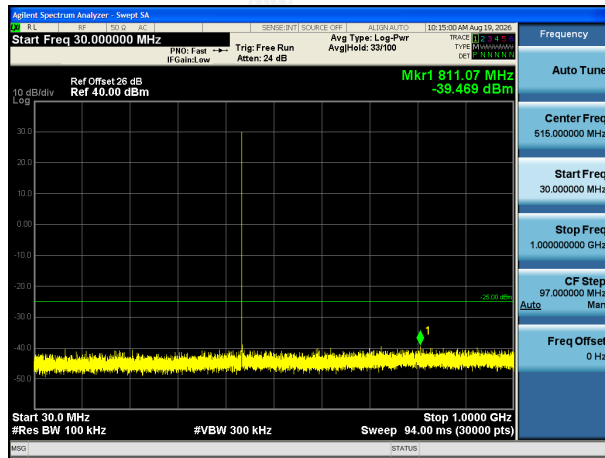
CH3

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

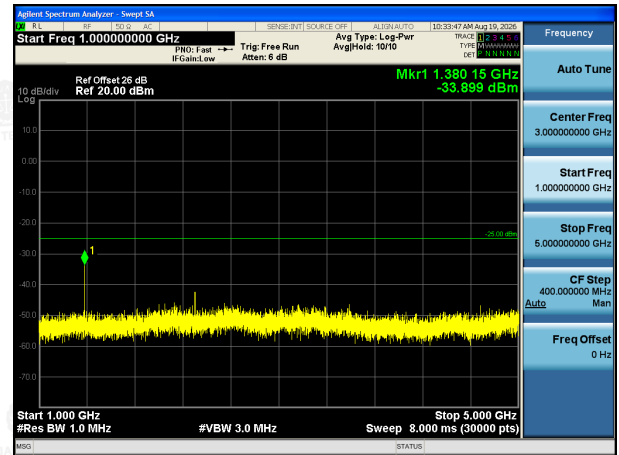
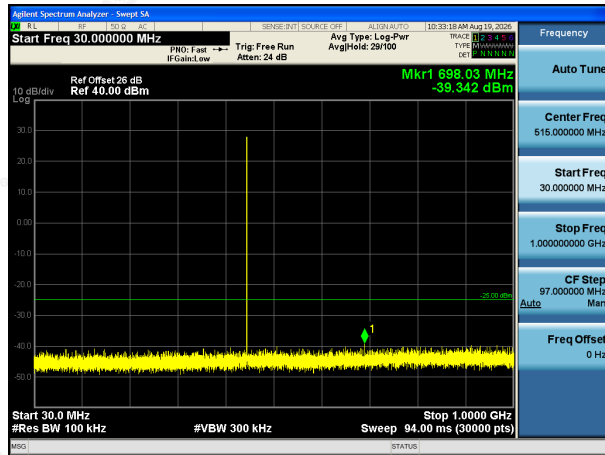
**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com  
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

**450-470MHz: LOW**

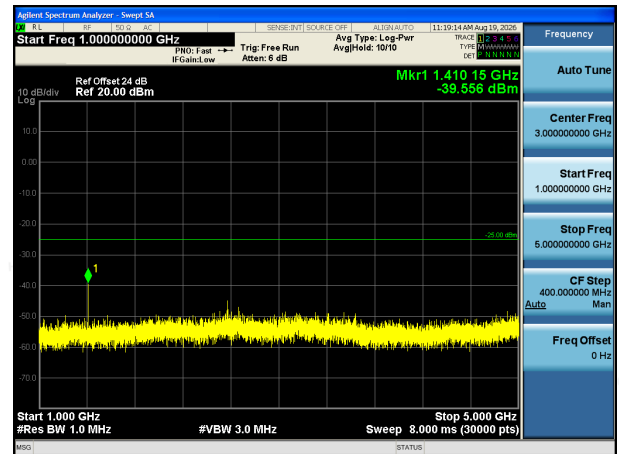
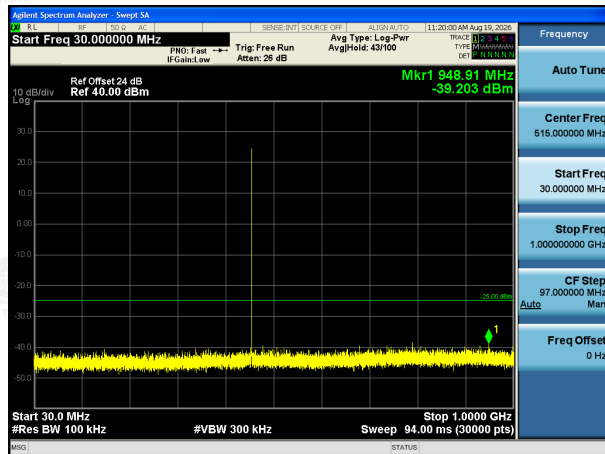
**FM**



**CH4**



**CH5**



**CH6**

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

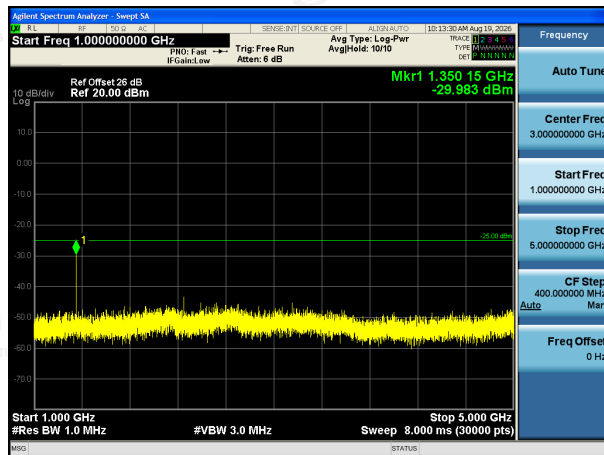
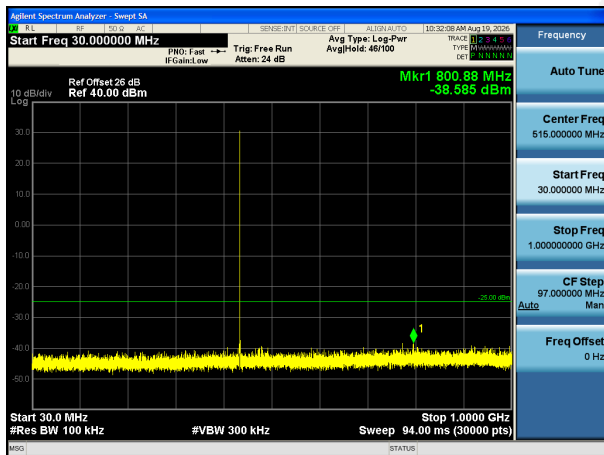
**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com  
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



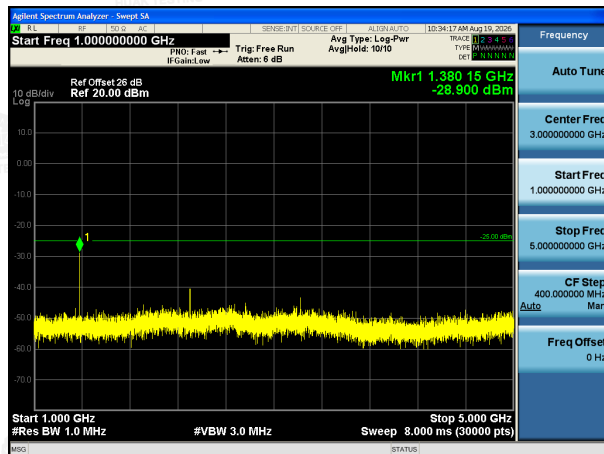
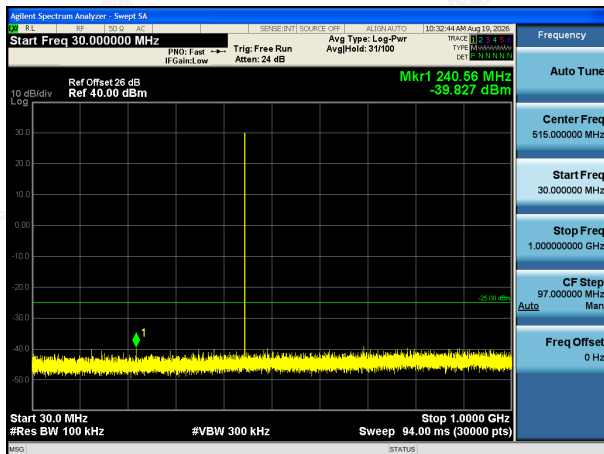
HUAKE TESTING

450-470MHz: HIGH

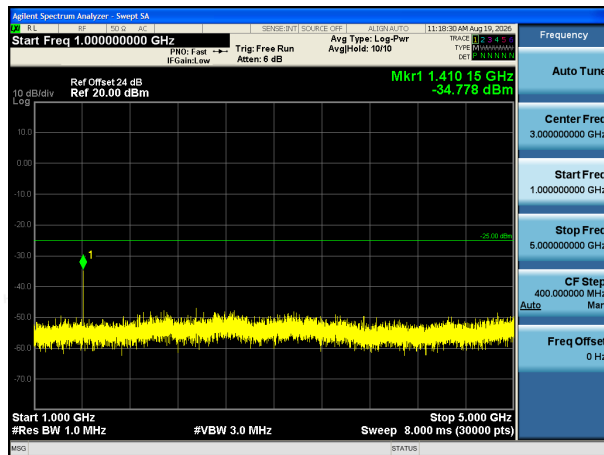
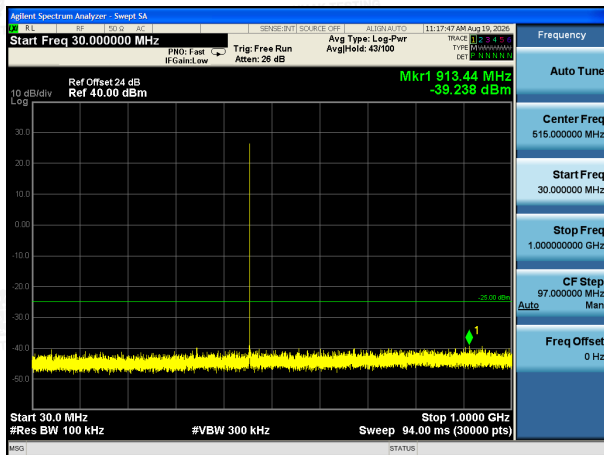
FM



CH4



CH5



CH6

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

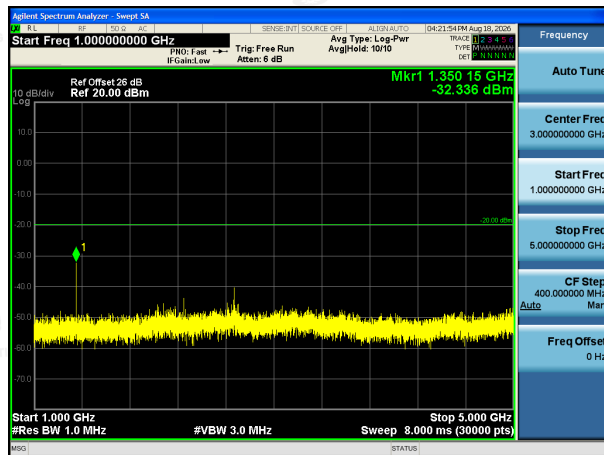
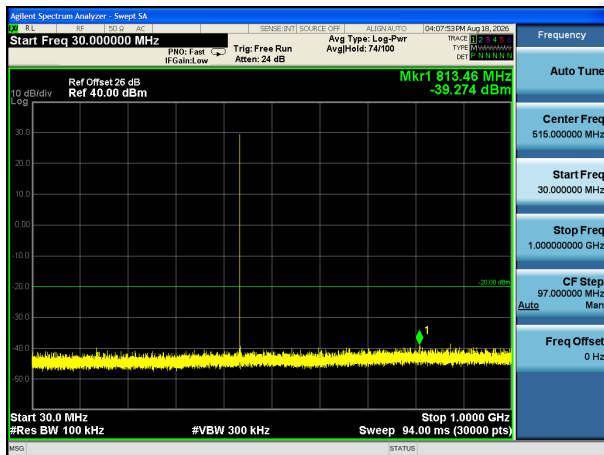
**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com  
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



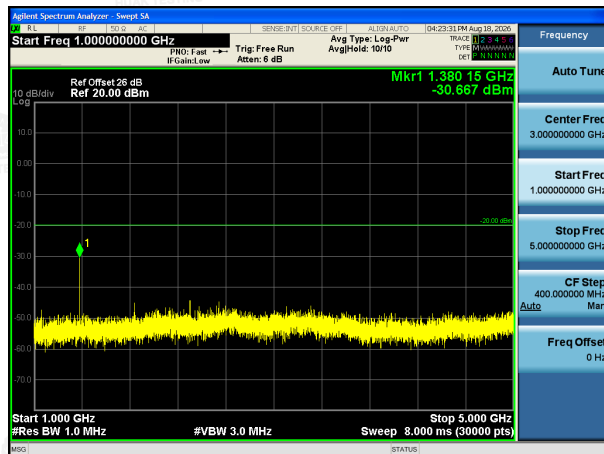
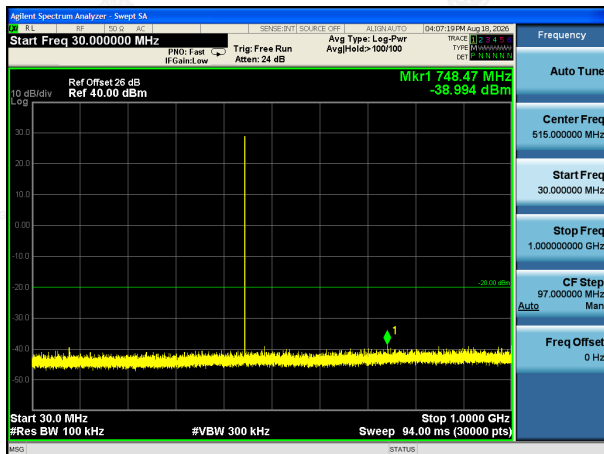
HUAKE TESTING

450-470MHz: LOW

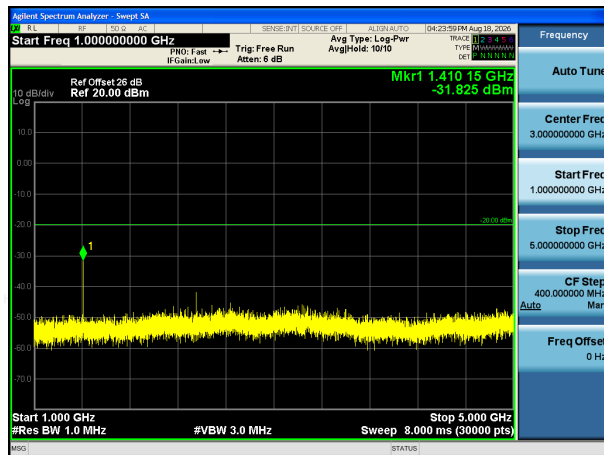
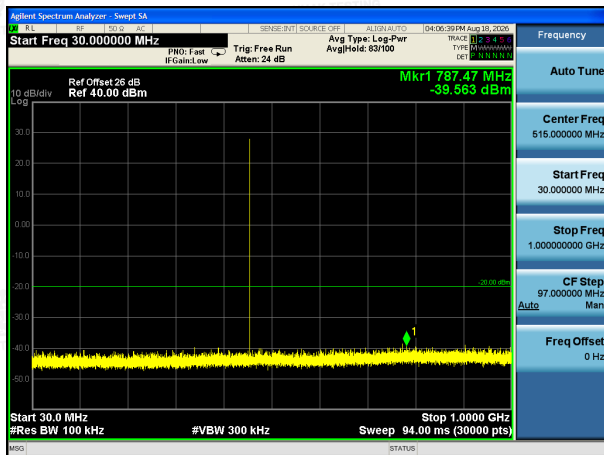
4FSK



CH10



CH11



CH12

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

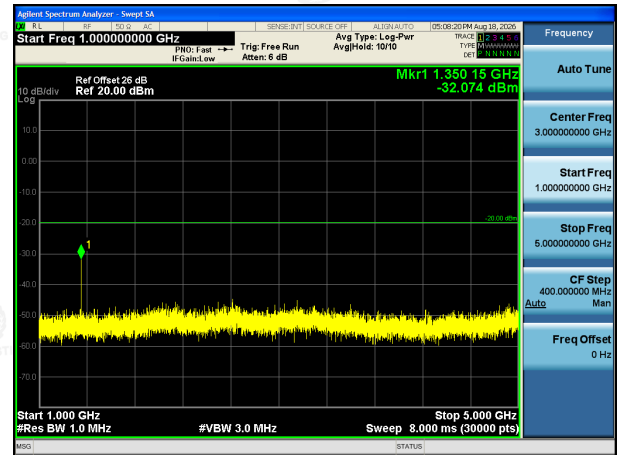
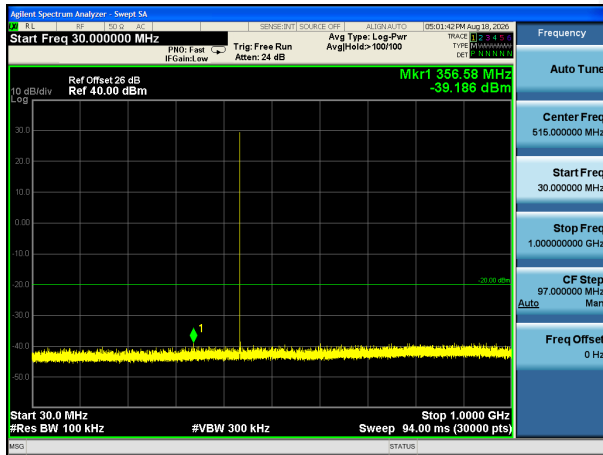
**Shenzhen HUAKE Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: info@huak.com Web.: www.huak.com  
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China



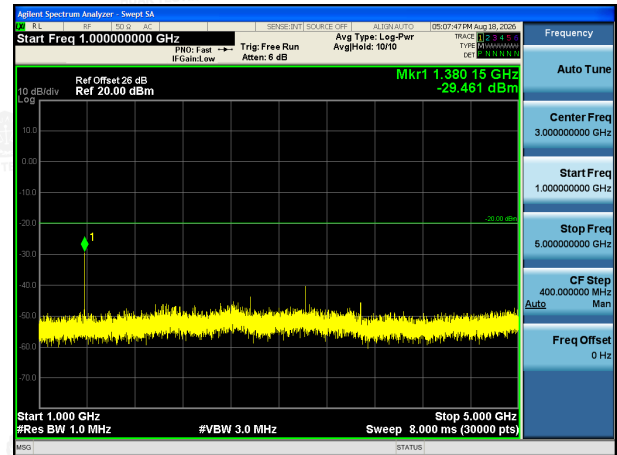
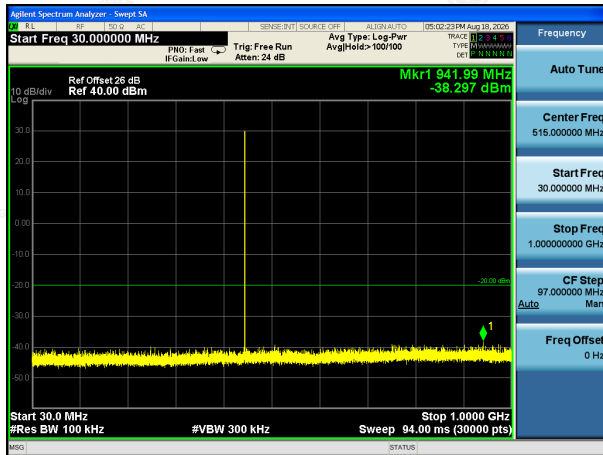
HUAKE TESTING

450-470MHz: HIGH

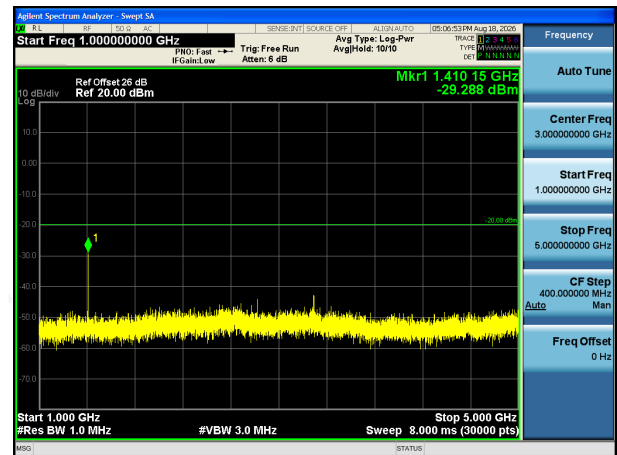
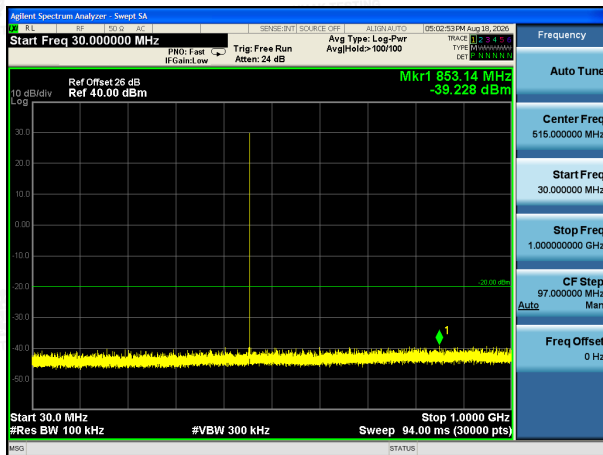
### 4FSK



### CH10



### CH11



### CH12

The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAKE Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

**Shenzhen HUAKE Testing Technology Co., Ltd.**

Tel.: +86-0755-2302 9901

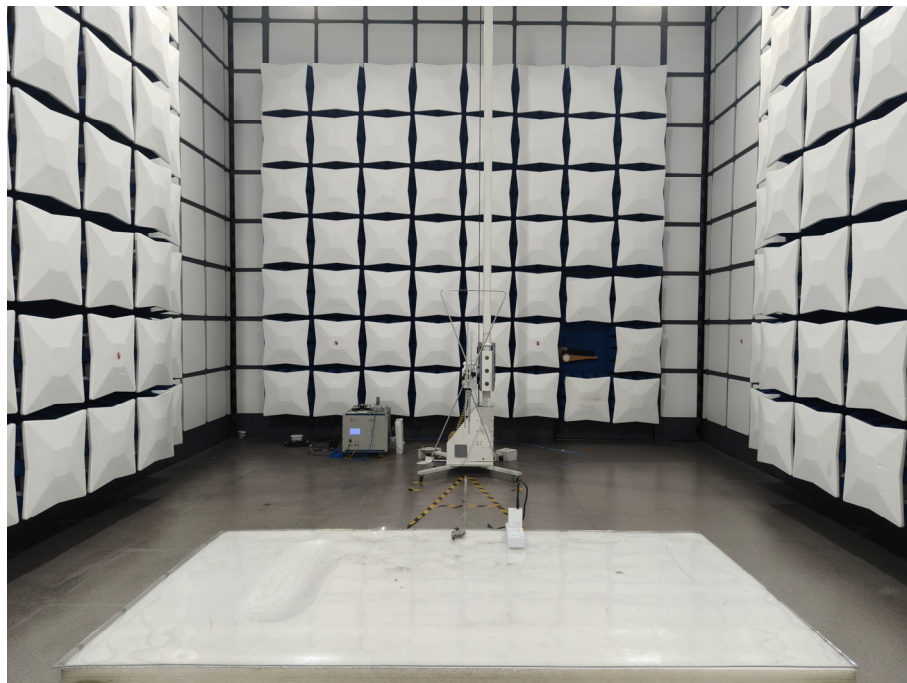
E-mail: [info@huak.com](mailto:info@huak.com)

Web.: [www.huak.com](http://www.huak.com)

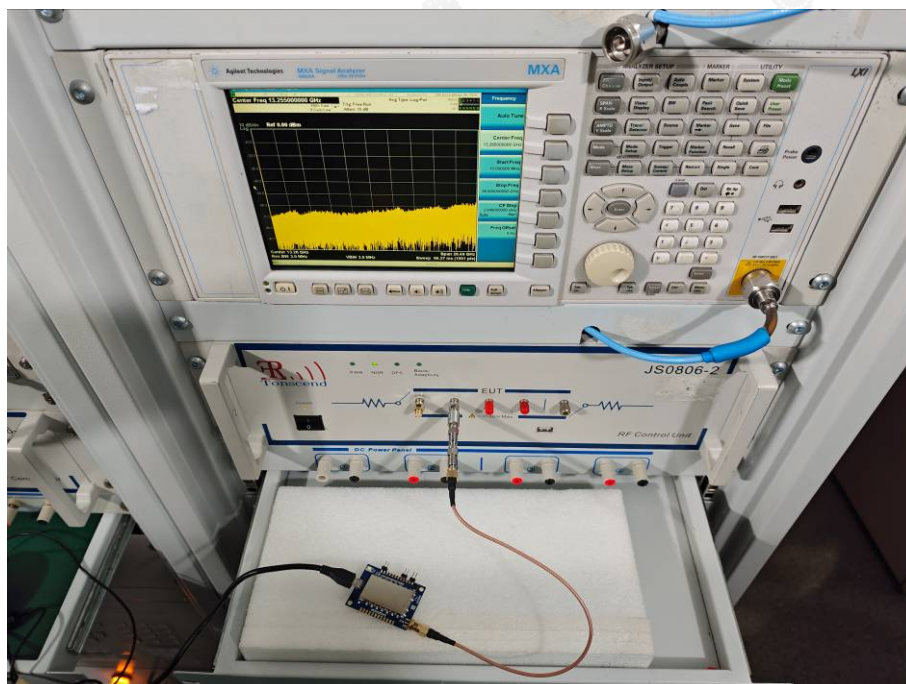
Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

## 5 Test Setup Photos of The EUT

### Radiated Emission



# RF Conducted Emission



The results shown in this test report refer only to the sample(s) tested unless otherwise stated and the sample(s) are retained for 15 days only. The document is issued by Shenzhen HUAK Testing Technology Co., Ltd., this document cannot be reproduced except in full with our prior written permission.

**Shenzhen HUAK Testing Technology Co., Ltd.** Tel.: +86-0755-2302 9901 E-mail: [info@huak.com](mailto:info@huak.com) Web.: [www.huak.com](http://www.huak.com)  
 Add.: 1-2/F., Building B2, Junfeng Zhongcheng Zhizao Innovation Park, Heping, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

## 6 Photos of the EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos

-----End of test report-----

