# 9. SPURIOUS EMISSION

## 9.1 CONDUCTED SPURIOUS EMISSION

### 9.1.1MEASUREMENT METHOD

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. The level of the carrier and the various conducted spurious and harmonic frequency is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to a frequency including its $10^{th}$ harmonic. All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at maximum power, and at the approximate frequencies. All data rates were investigated to determine the worst case configuration.

2. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the equipment of PCS1900 band, this equates to a frequency range of 30 MHz to 19.1 GHz, data taken from 30 MHz to 20 GHz. For GSM850, data taken from 30 MHz to 9 GHz.

3. Determine EUT transmit frequencies: the following typical channelswere chosen to conducted emissions testing.

| Typical Channels for testing of GSM 850 | |
|---|---|
| Channel | Frequency (MHz) |
| 128 | 824.2 |
| 190 | 836.6 |
| 251 | 848.8 |

| Typical Channels for testing of PCS 1900 | |
|---|---|
| Channel | Frequency (MHz) |
| 512 | 1850.2 |
| 661 | 1880.0 |
| 810 | 1909.8 |

| Typical Channels for testing of UMTS band II | |
|---|---|
| Channel | Frequency (MHz) |
| 9262 | 1852.4 |
| 9400 | 1880 |
| 9538 | 1907.6 |

| Typical Channels for testing of UMTS band V | |
|---|---|
| Channel | Frequency (MHz) |
| 4132 | 826.4 |
| 4182 | 836.4 |
| 4233 | 846.6 |

### 9.1.2 PROVISIONS APPLICABLE

On any frequency outside frequency band of the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

### 9.1.3MEASUREMENT RESULT

**Test Results**

**Test Band=GSM850/GSM1900**

**Test Mode=GSM/EDGE**

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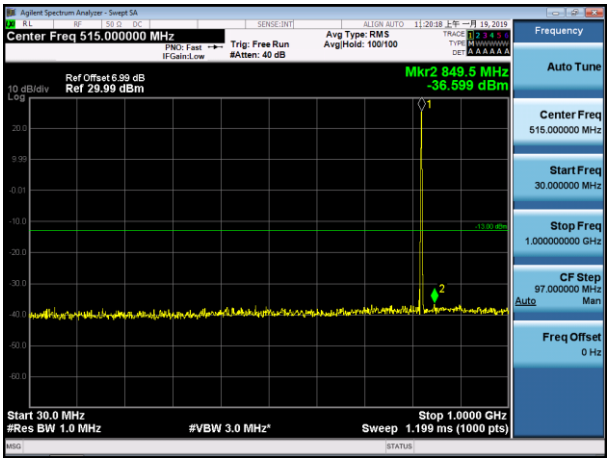
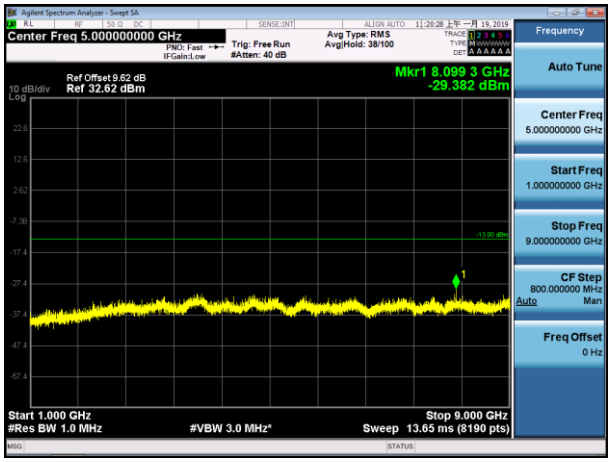
|  |  |

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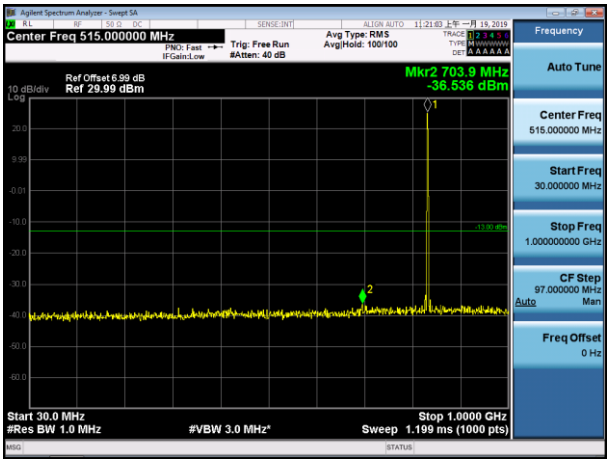
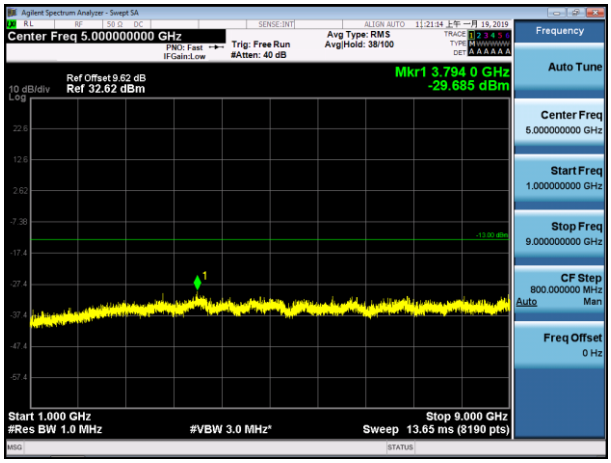
|  |  |

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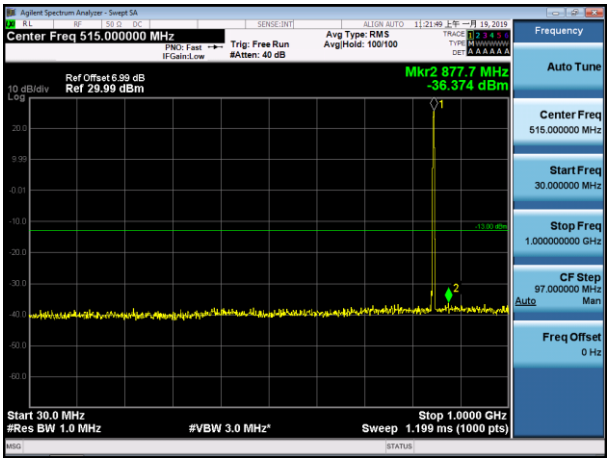
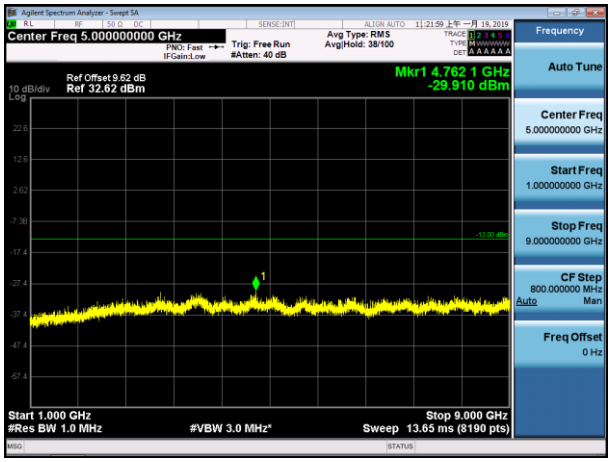
|  |  |

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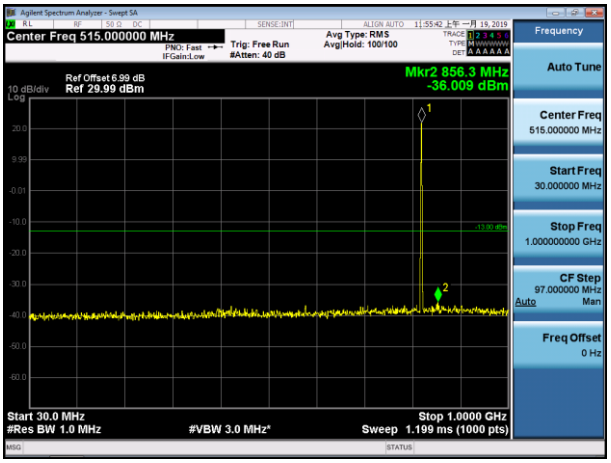
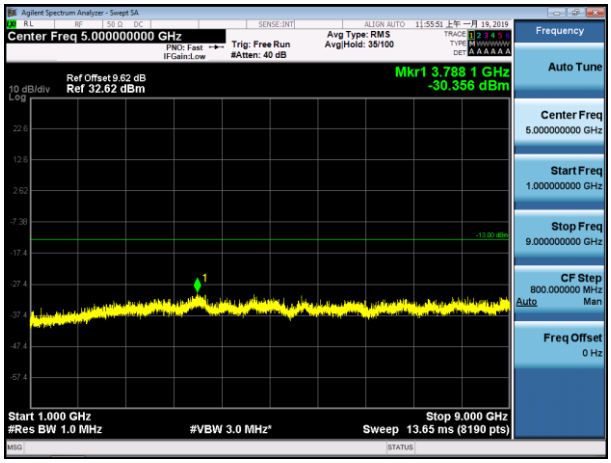
|  |  |

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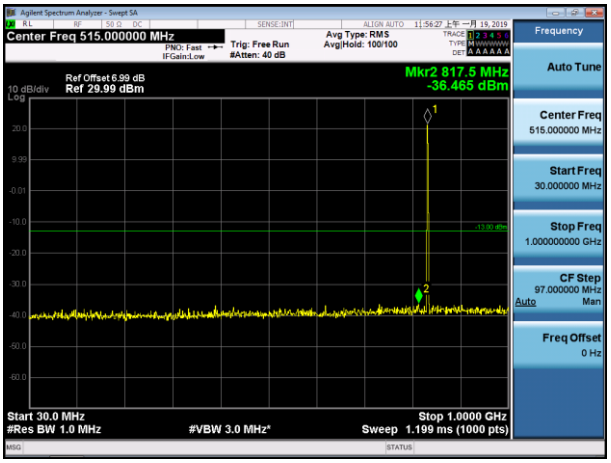
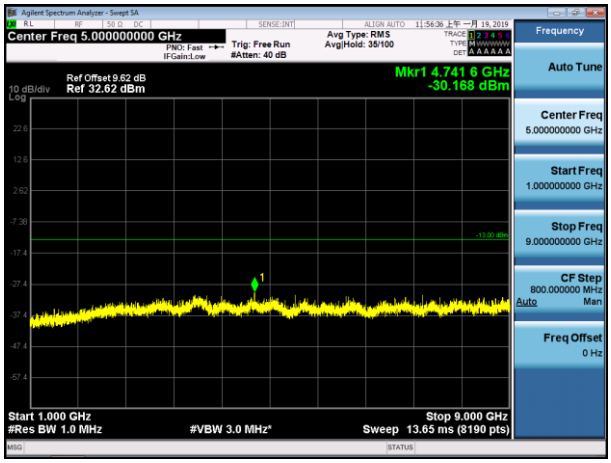
|  |  |

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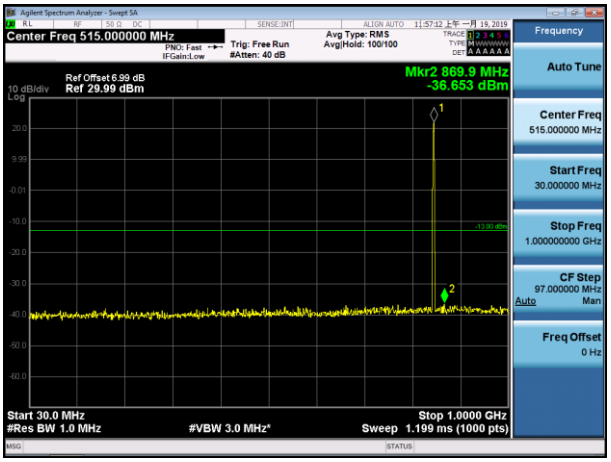
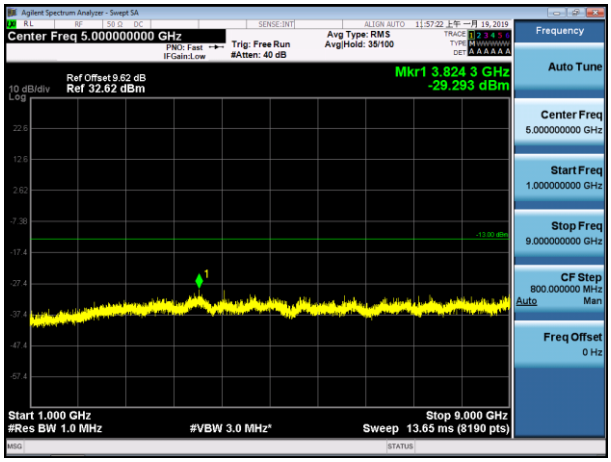
|  |  |





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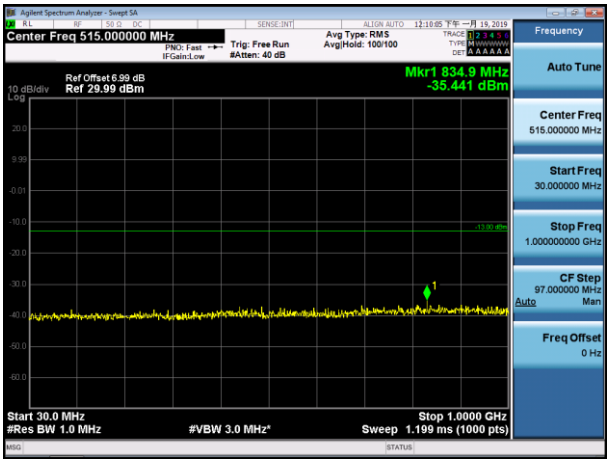
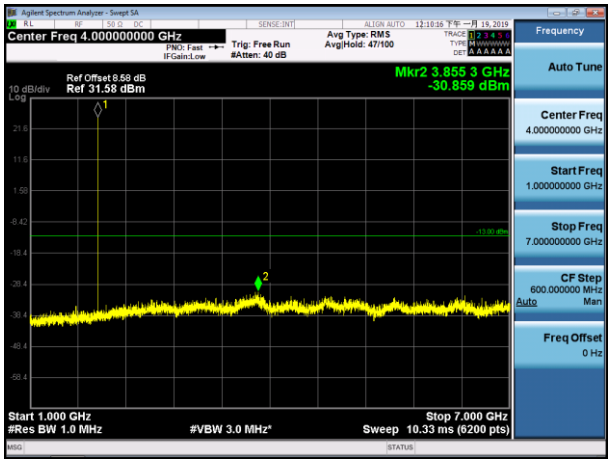
|  |  |





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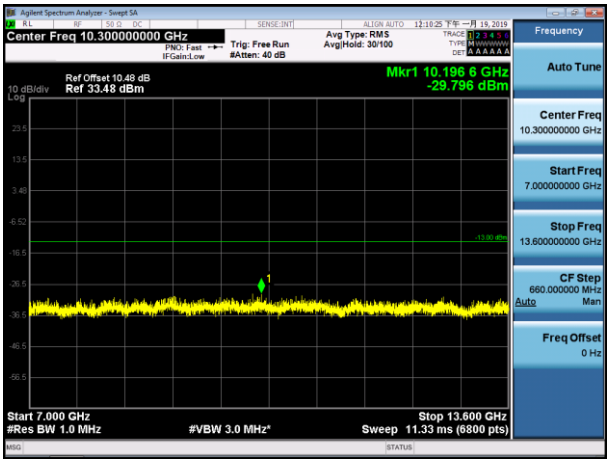
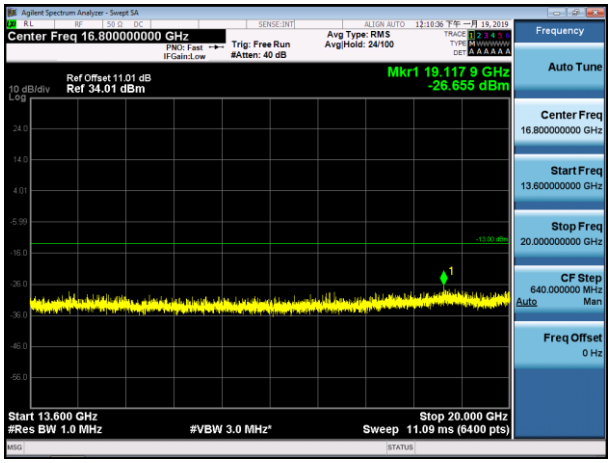
|  |  |

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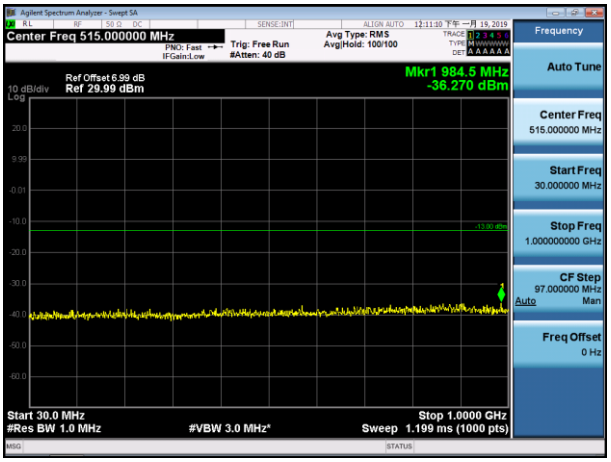
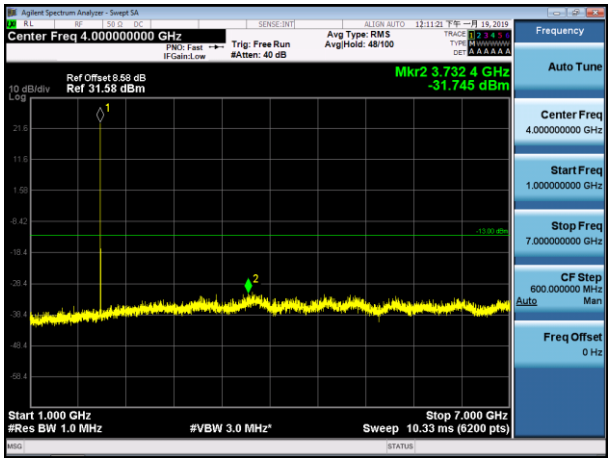
|  |  |

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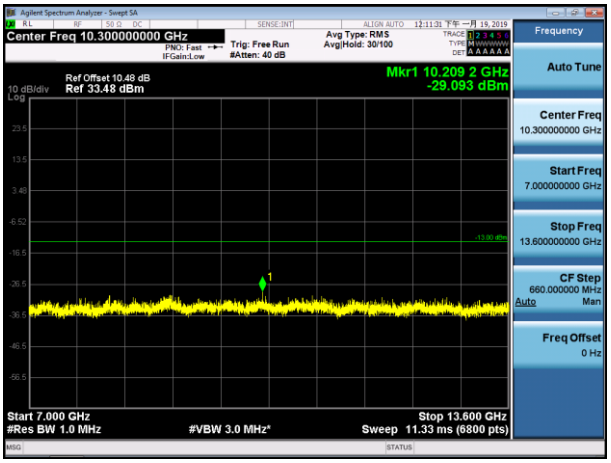
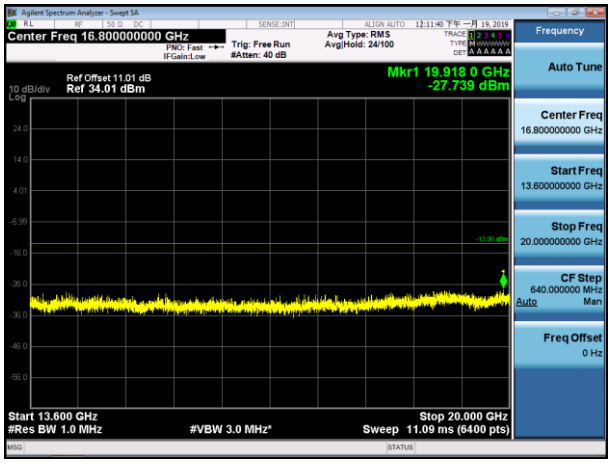
|  |  |

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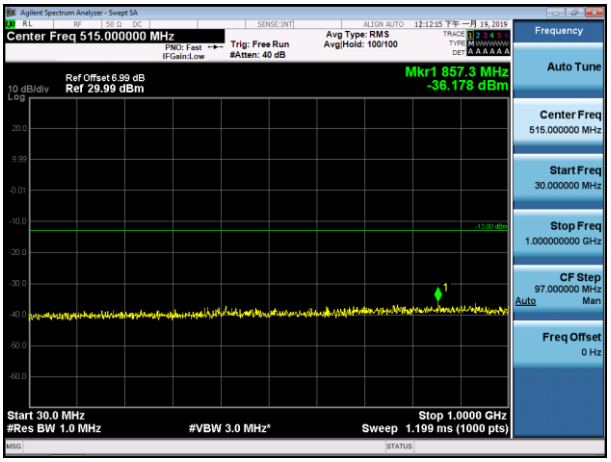
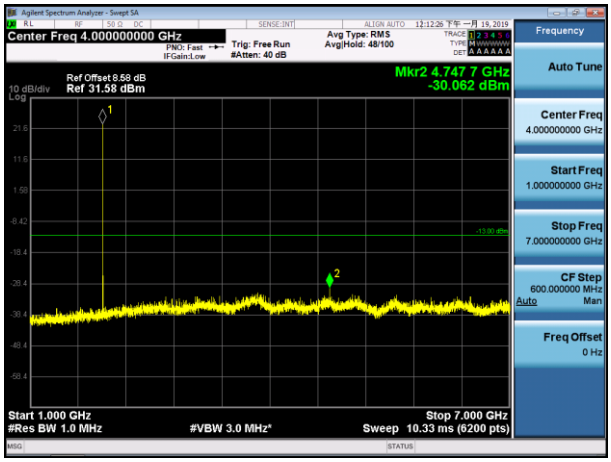
|  |  |

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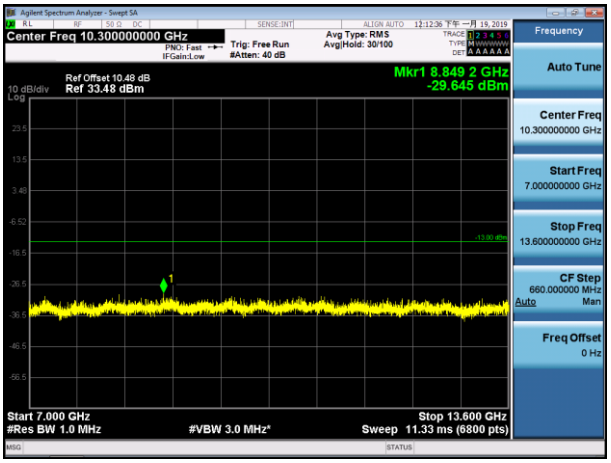
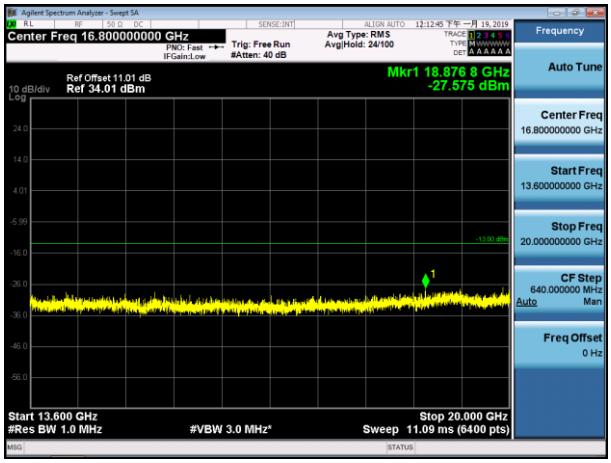
|  |  |

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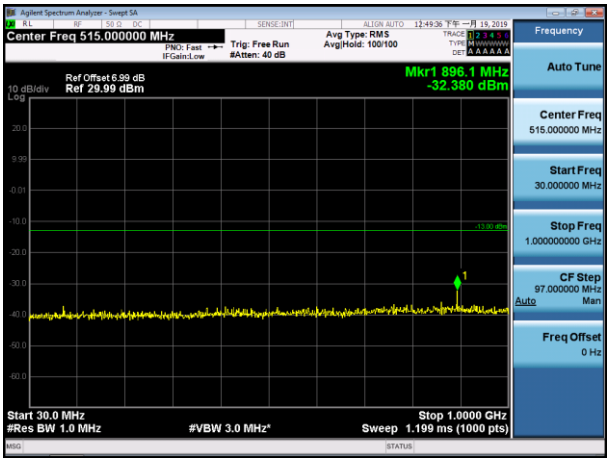
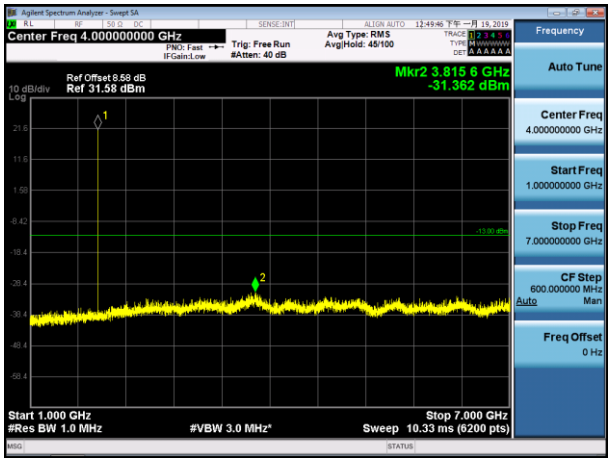
|  |  |

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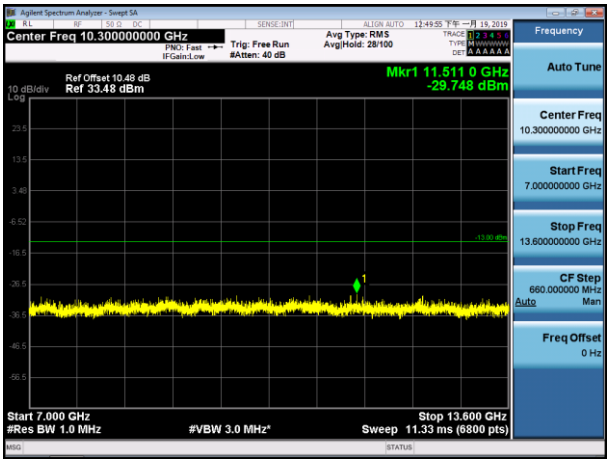
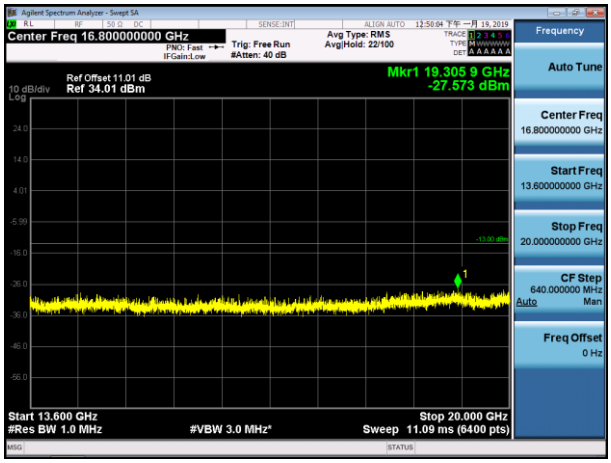
|  |  |

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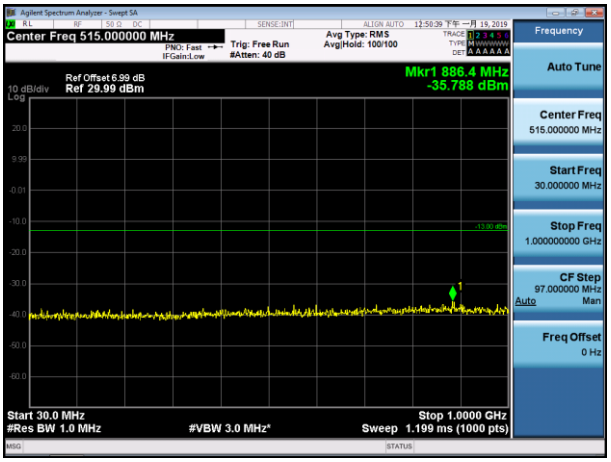
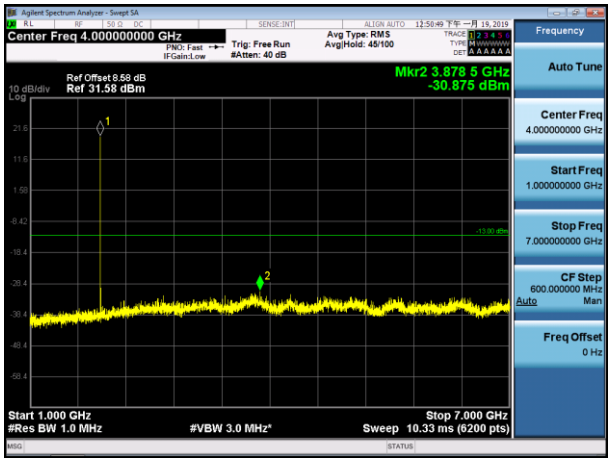
|  |  |

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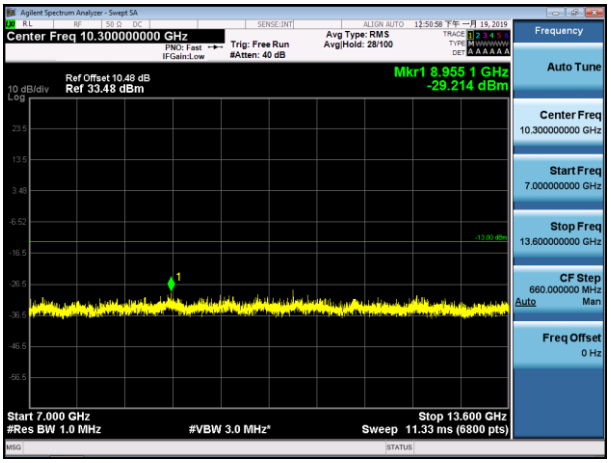
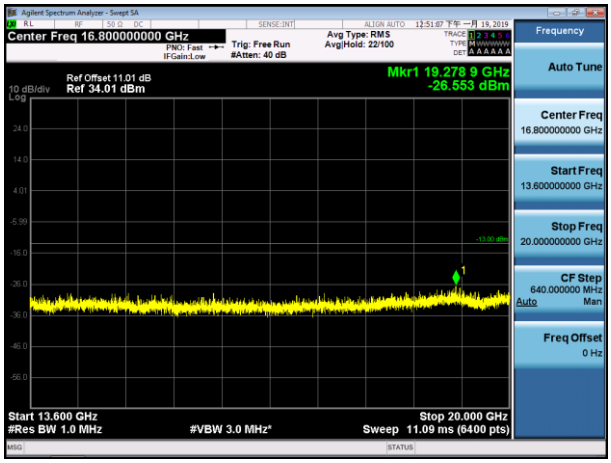
|  |  |

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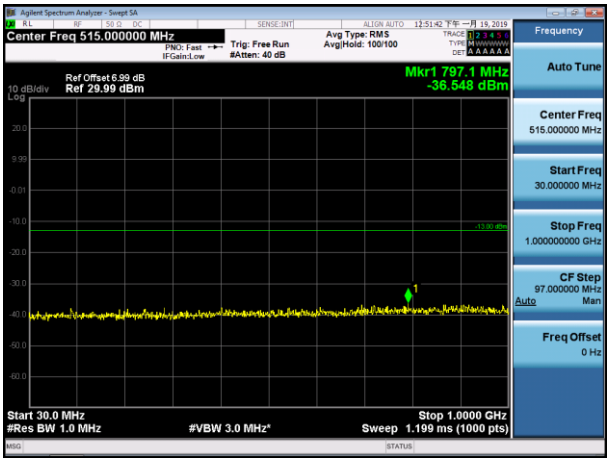
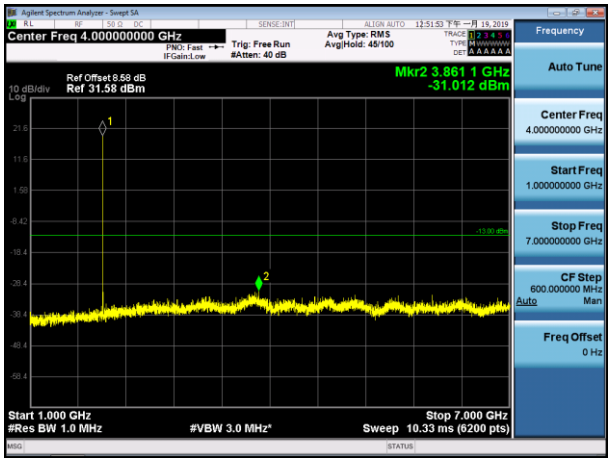
|  |  |

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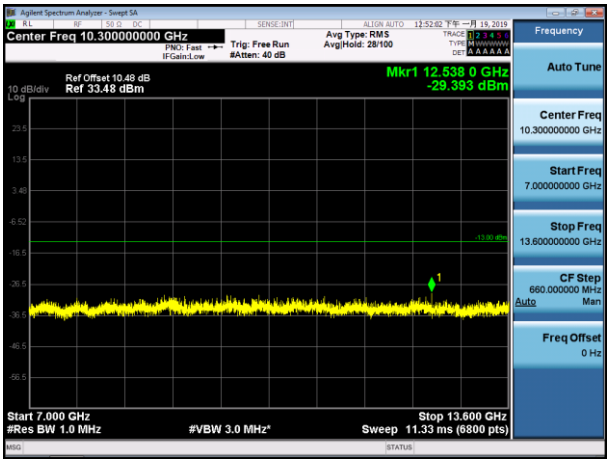
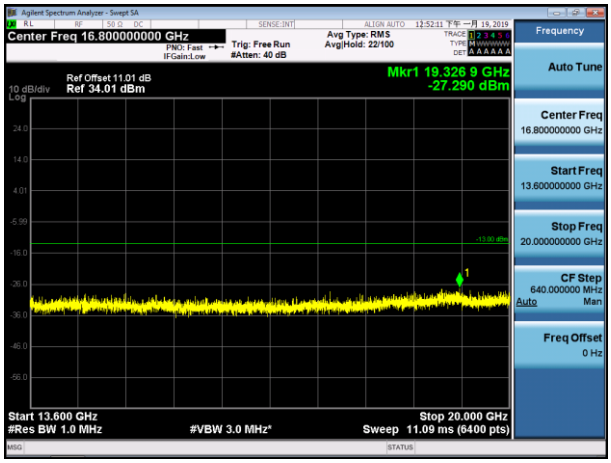
|  |  |

**Test Band=WCDMA850/WCDMA1900**

**Test Mode=UMTS**

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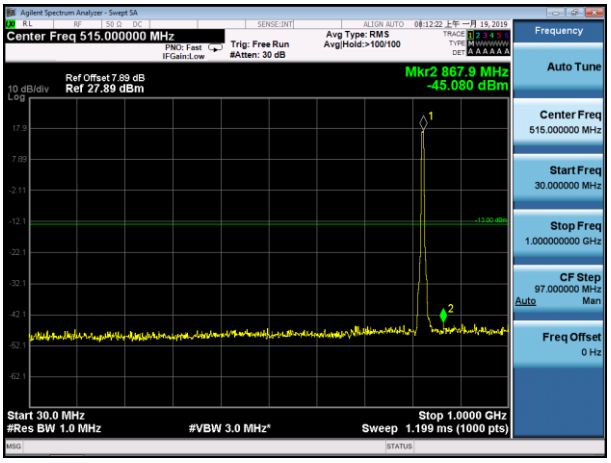
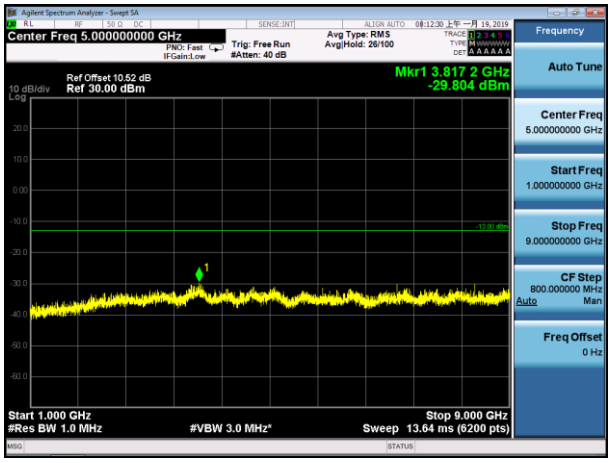
|  |  |





| WCDMA 850-MCH | WCDMA 850-MCH |
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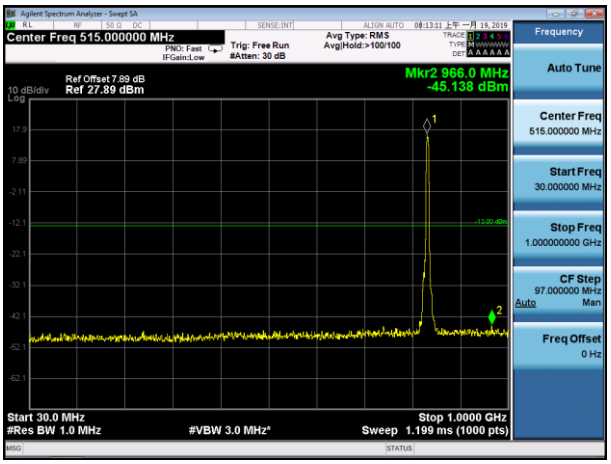
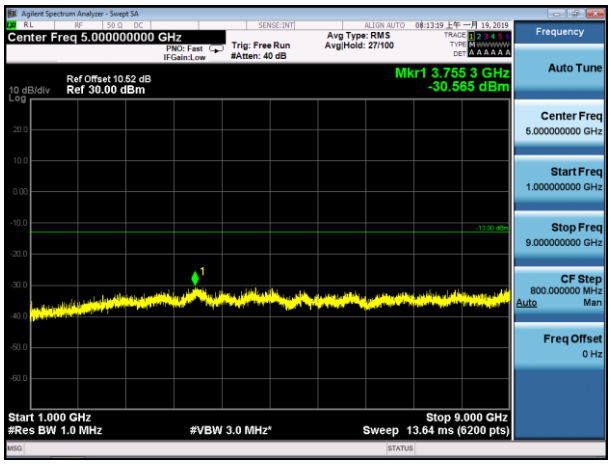
|  |  |





| WCDMA 850-HCH | WCDMA 850-HCH |
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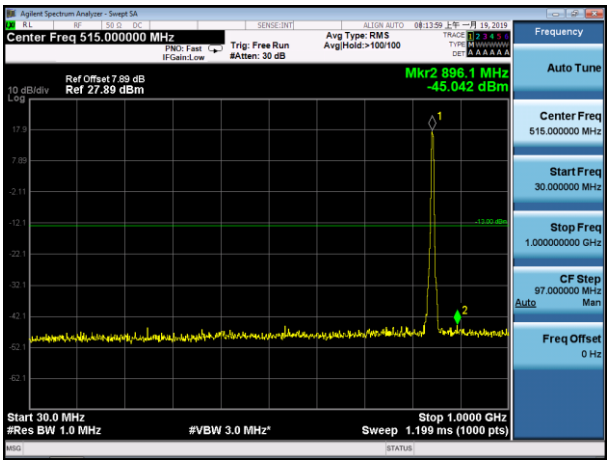
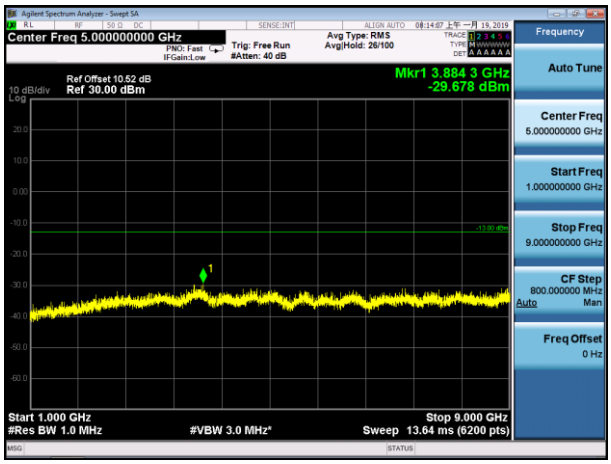
|  |  |

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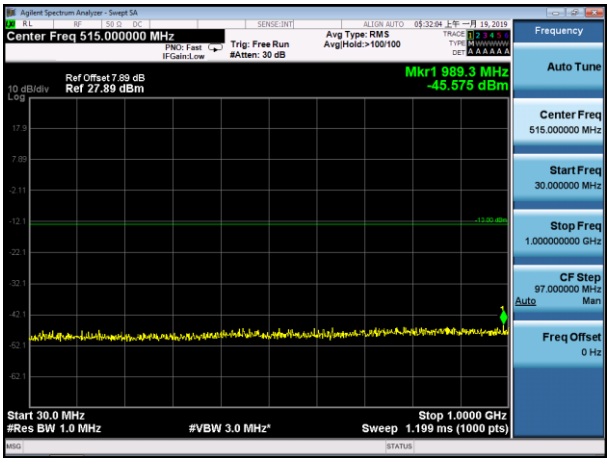
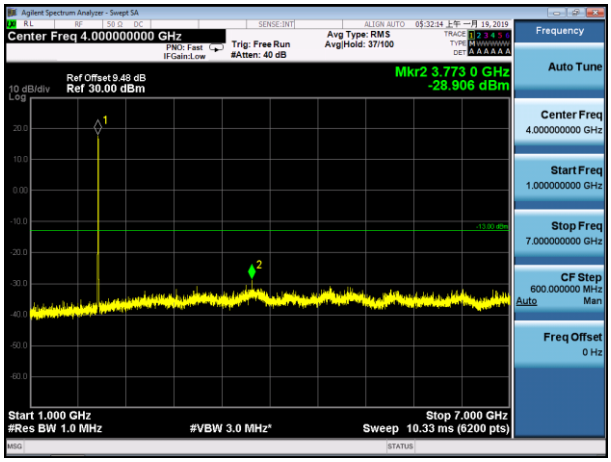
|  |  |

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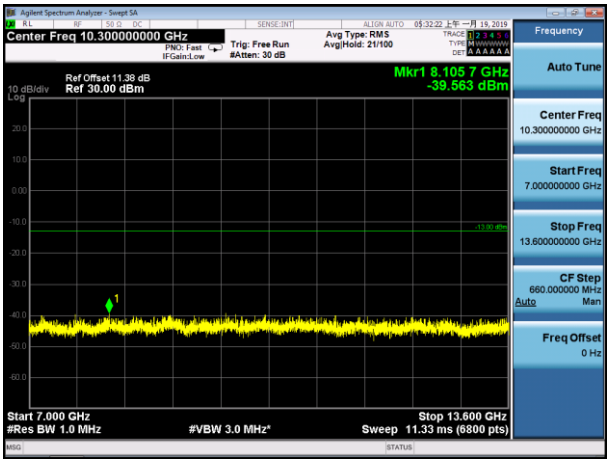
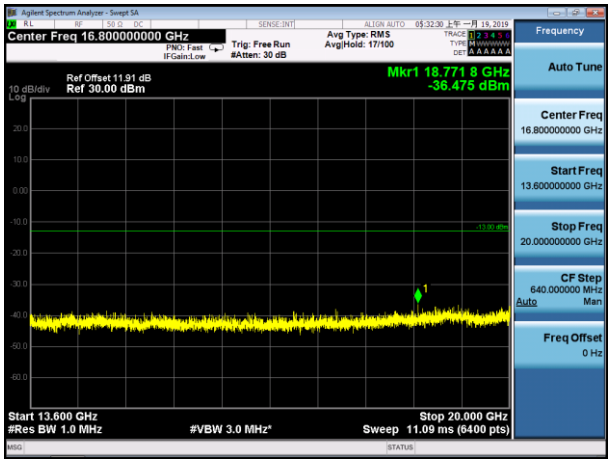
|  |  |

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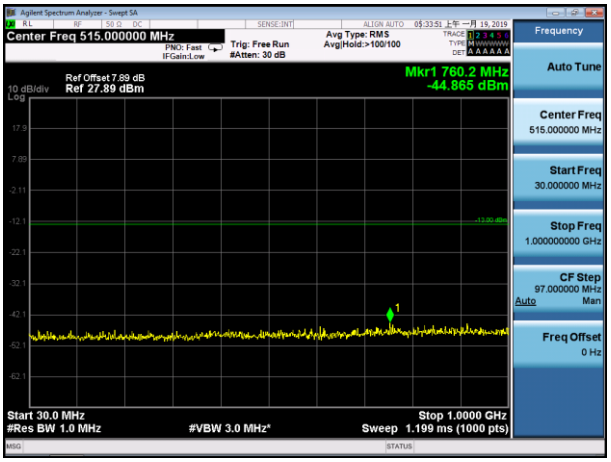
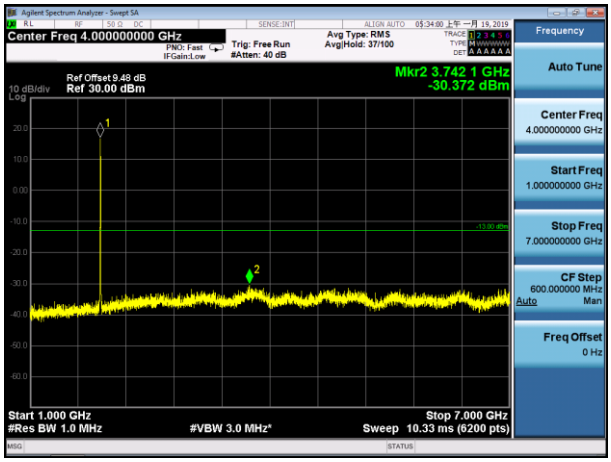
|  |  |

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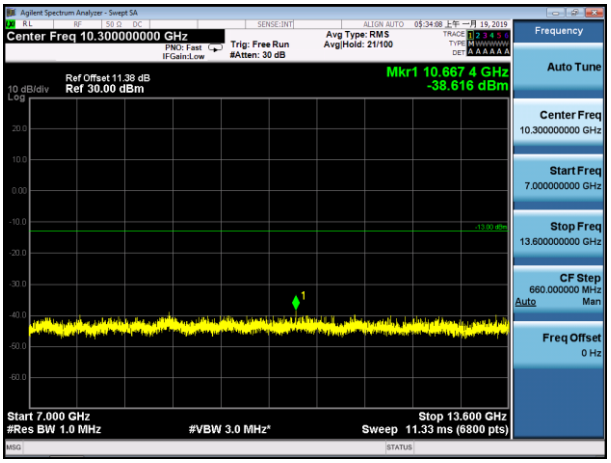
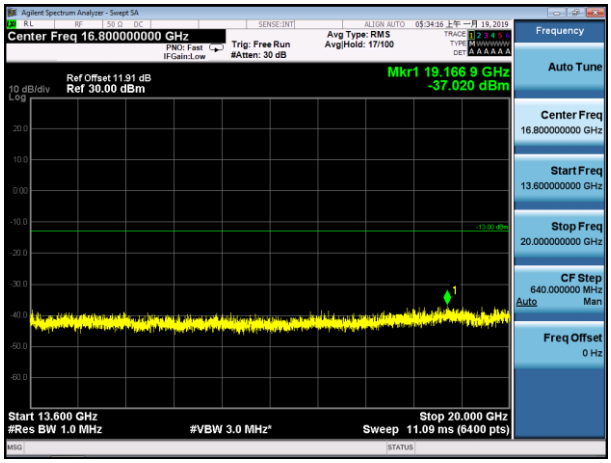
|  |  |

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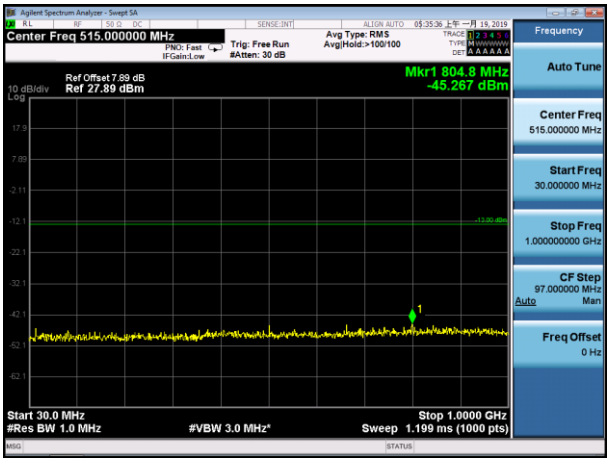
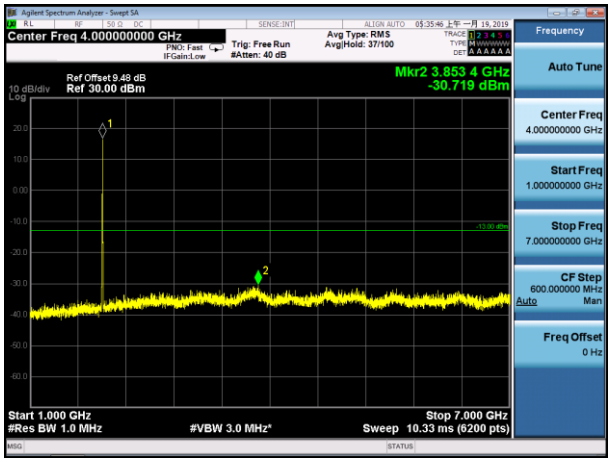
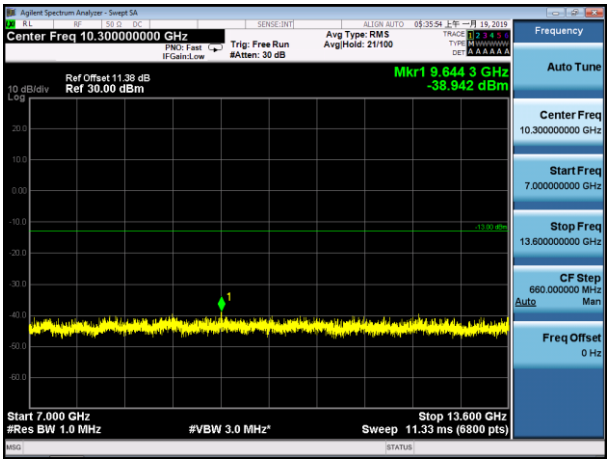
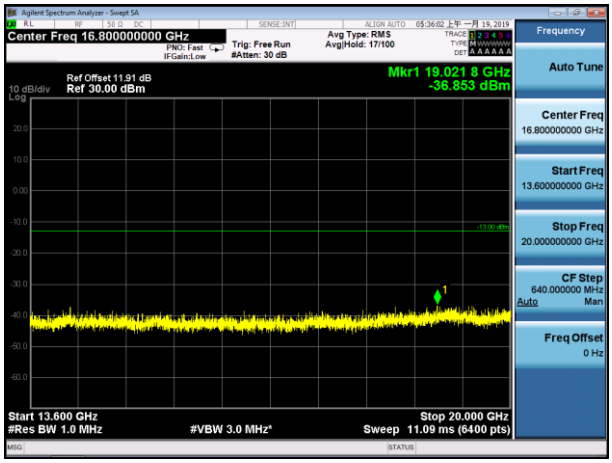
|  |  |

| WCDMA 1900-HCH | WCDMA 1900-HCH |
|---|---|
|  |  |

**Note:**1. Below 30MHZ no Spurious found and Above is the worst mode data.

2. As no emission found in standby or receive mode, no recording in this report.

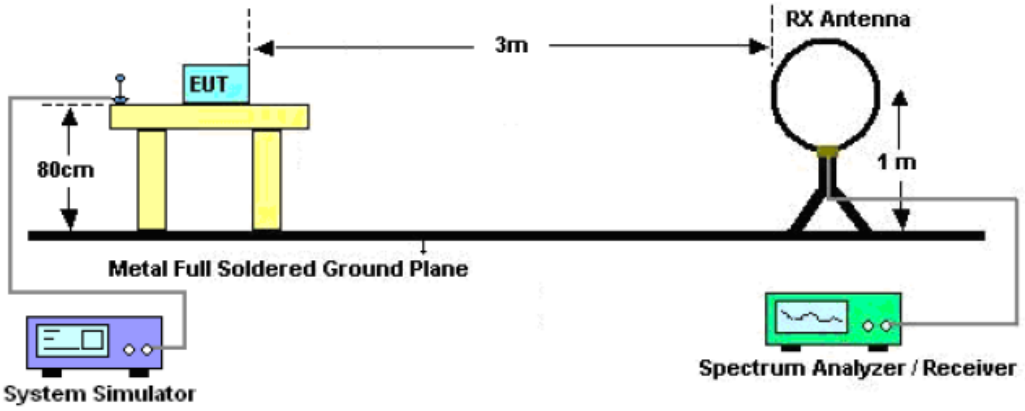
## 9.2 RADIATED SPURIOUS EMISSION

### 9.2.1MEASUREMENT METHOD

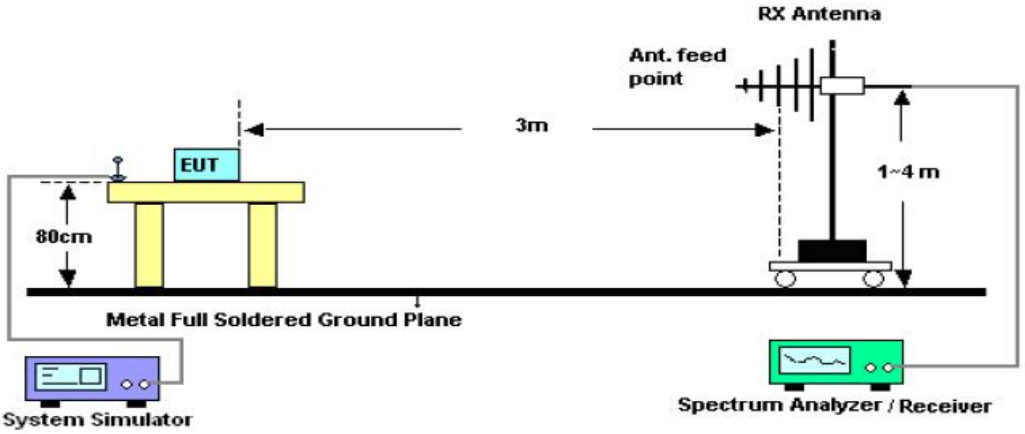
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

**9.2.2 TEST SETUP**

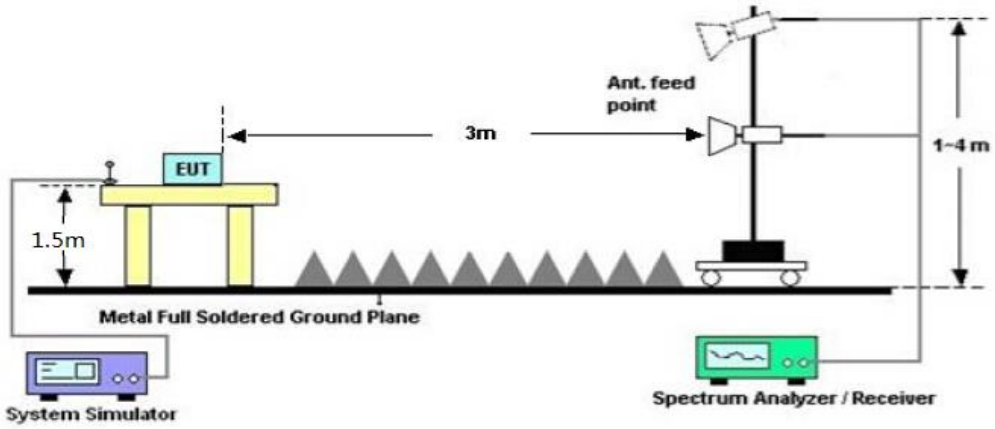
Radiated Emission Test-Setup Frequency Below 30MHz




RADIATED EMISSION TEST SETUP 30MHz-1000MHz




RADIATED EMISSION TEST SETUP ABOVE 1000MHz



**9.2.3 PROVISIONS APPLICABLE**

(a) On any frequency outside a licensee's frequency block (e.g. A, D, B, etc.) within the USPCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least 43+10Log(P) dB. The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

**Note:** only result the worst condition of each test mode:

**9.2.4 MEASUREMENT RESULT**

**GSM 850:**

| The Worst Test Results for Channel 251/848.8 MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1967.60 | -49.20 | -13 | -36.20 | Horizontal |
| 3456.47 | -34.15 | -13 | -21.15 | Horizontal |
| 6722.25 | -46.15 | -13 | -33.15 | Horizontal |
| 1967.60 | -38.97 | -13 | -25.97 | Vertical |
| 3399.54 | -50.92 | -13 | -37.92 | Vertical |
| 6749.64 | -32.44 | -13 | -19.44 | Vertical |

**GSM 850(EDGE 8):**

| The Worst Test Results for Channel 251/848.8 MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1967.60 | -51.55 | -13 | -38.55 | Horizontal |
| 3485.45 | -40.55 | -13 | -27.55 | Horizontal |
| 6799.64 | -49.17 | -13 | -36.17 | Horizontal |
| 1967.60 | -37.42 | -13 | -24.42 | Vertical |
| 3464.47 | -50.60 | -13 | -37.60 | Vertical |
| 6846.25 | -32.80 | -13 | -19.80 | Vertical |

**PCS 1900:**

| The Worst Test Results for Channel 810/1909.8MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1847.52 | -49.88 | -13 | -36.88 | Horizontal |
| 3819.60 | -36.08 | -13 | -23.08 | Horizontal |
| 7569.22 | -47.68 | -13 | -34.68 | Horizontal |
| 1845.48 | -36.77 | -13 | -23.77 | Vertical |
| 3845.12 | -48.35 | -13 | -35.35 | Vertical |
| 7644.23 | -35.84 | -13 | -22.84 | Vertical |

**PCS 1900(EDGE):**

| The Worst Test Results for Channel 810/1909.8MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1800.12 | -52.67 | -13 | -39.67 | Horizontal |
| 3819.60 | -40.55 | -13 | -27.55 | Horizontal |
| 7635.22 | -49.54 | -13 | -36.54 | Horizontal |
| 1814.21 | -39.32 | -13 | -26.32 | Vertical |
| 3819.60 | -48.33 | -13 | -35.33 | Vertical |
| 7631.47 | -34.58 | -13 | -21.58 | Vertical |

**HSPA band II:**

| The Worst Test Results for Channel 9538/1907.6MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1489.55 | -46.50 | -13 | -33.50 | Horizontal |
| 3815.20 | -30.92 | -13 | -17.92 | Horizontal |
| 7621.02 | -50.08 | -13 | -37.08 | Horizontal |
| 1815.42 | -32.66 | -13 | -19.66 | Vertical |
| 3815.20 | -46.63 | -13 | -33.63 | Vertical |
| 7633.53 | -30.48 | -13 | -17.48 | Vertical |

**HSPA band V:**

| The Worst Test Results for Channel 4233/846.6MHz | | | | |
|---|---|---|---|---|
| Frequency | Emission Level | Limits | Margin | Comment |
| (MHz) | (dBm) | (dBm) | (dB) | |
| 1693.20 | -49.65 | -13 | -36.65 | Horizontal |
| 3025.46 | -33.60 | -13 | -20.60 | Horizontal |
| 6643.97 | -48.30 | -13 | -35.30 | Horizontal |
| 1693.20 | -31.06 | -13 | -18.06 | Vertical |
| 315.23 | -45.99 | -13 | -32.99 | Vertical |
| 6513.18 | -32.50 | -13 | -19.50 | Vertical |

**RESULT: PASS**

**Note:**

1. Margin = Emission Level -Limit
2. Below 30MHZ no Spurious found and Above is the worst mode data

# 10. FREQUENCY STABILITY

## 10.1 MEASUREMENT METHOD

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMU200 DIGITAL RADIO COMMUNICATION TESTER.

1 Measure the carrier frequency at room temperature.

2 Subject the EUT to overnight soak at -10℃.

3 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on channel 661 for PCS 1900 band , channel 190 for GSM 850 band, channel 9400 for UMTS band II and channel 4175 for UMTS band V measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

4 Repeat the above measurements at 10℃ increments from -10℃ to +50℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

5 Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1 1/2 hours unpowered, to allow any self-heating to stabilize, before continuing.

6 Subject the EUT to overnight soak at +50℃.

7 With the EUT, powered via nominal voltage, connected to the CMU200 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.

8 Repeat the above measurements at 10℃ increments from +50℃ to -10℃. Allow at least 1 1/2 hours at each temperature, unpowered, before making measurements.

9 At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.

**10.2 PROVISIONS APPLICABLE**

**10.2.1 FOR HAND CARRIED BATTERY POWERED EQUIPMENT**

According to the ANSI/TIA-603-E-2016, the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d)(2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.4VDC and 4.2VDC, with a nominal voltage of 3.7VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance of -10 % and +12.5 %. For the purposes of measuring frequency stability these voltage limits are to be used.

**10.2.2 FOR EQUIPMENT POWERED BY PRIMARY SUPPLY VOLTAGE**

According to the ANSI/TIA-603-E-2016,the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. For this EUT section 2.1055(d)(1) applies. This requires varying primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment, the normal environment temperature is 20$^{o}$C.

**10.3 MEASUREMENT RESULT**

Test Results

Frequency Error vs. Voltage:

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | GSM | LCH | TN | VL | 10.85 | 0.013164 | ±2.5 | PASS |
| | | | TN | VN | 12.98 | 0.015749 | ±2.5 | PASS |
| | | | TN | VH | 10.53 | 0.012776 | ±2.5 | PASS |
| | | MCH | TN | VL | 11.62 | 0.013890 | ±2.5 | PASS |
| | | | TN | VN | 12.07 | 0.014427 | ±2.5 | PASS |
| | | | TN | VH | 14.46 | 0.017284 | ±2.5 | PASS |
| | | HCH | TN | VL | 15.30 | 0.018025 | ±2.5 | PASS |
| | | | TN | VN | 11.56 | 0.013619 | ±2.5 | PASS |
| | | | TN | VH | 14.79 | 0.017425 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | EDGE | LCH | TN | VL | 15.98 | 0.019388 | ±2.5 | PASS |
| | | | TN | VN | 18.02 | 0.021864 | ±2.5 | PASS |
| | | | TN | VH | 14.53 | 0.017629 | ±2.5 | PASS |
| | | MCH | TN | VL | 13.62 | 0.016280 | ±2.5 | PASS |
| | | | TN | VN | 13.62 | 0.016280 | ±2.5 | PASS |
| | | | TN | VH | 13.92 | 0.016639 | ±2.5 | PASS |
| | | HCH | TN | VL | 11.27 | 0.013278 | ±2.5 | PASS |
| | | | TN | VN | 11.69 | 0.013772 | ±2.5 | PASS |
| | | | TN | VH | 11.56 | 0.013619 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt. (V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS 1900 | GSM | LCH | TN | VL | 90.08 | 0.048687 | PASS |
| | | | TN | VN | 93.11 | 0.050324 | PASS |
| | | | TN | VH | 93.82 | 0.050708 | PASS |
| | | MCH | TN | VL | 96.73 | 0.051452 | PASS |
| | | | TN | VN | 94.86 | 0.050457 | PASS |
| | | | TN | VH | 92.34 | 0.049117 | PASS |
| | | HCH | TN | VL | 96.53 | 0.050545 | PASS |
| | | | TN | VN | 95.63 | 0.050073 | PASS |
| | | | TN | VH | 95.76 | 0.050141 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt. (V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS 1900 | EDGE | LCH | TN | VL | 91.40 | 0.049400 | PASS |
| | | | TN | VN | 92.05 | 0.049751 | PASS |
| | | | TN | VH | 86.30 | 0.046644 | PASS |
| | | MCH | TN | VL | 84.56 | 0.044979 | PASS |
| | | | TN | VN | 81.75 | 0.043484 | PASS |
| | | | TN | VH | 84.27 | 0.044824 | PASS |
| | | HCH | TN | VL | 85.88 | 0.044968 | PASS |
| | | | TN | VN | 83.46 | 0.043701 | PASS |
| | | | TN | VH | 81.88 | 0.042874 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

**Frequency Error vs. Temperature:**

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | GSM | LCH | VN | -10 | 12.66 | 0.015360 | ±2.5 | PASS |
| | | | VN | 0 | 10.20 | 0.012376 | ±2.5 | PASS |
| | | | VN | 10 | 12.91 | 0.015664 | ±2.5 | PASS |
| | | | VN | 20 | 10.53 | 0.012776 | ±2.5 | PASS |
| | | | VN | 30 | 12.59 | 0.015275 | ±2.5 | PASS |
| | | | VN | 40 | 14.59 | 0.017702 | ±2.5 | PASS |
| | | | VN | 50 | 14.98 | 0.018175 | ±2.5 | PASS |
| GSM850 | GSM | MCH | VN | -10 | 13.88 | 0.016591 | ±2.5 | PASS |
| | | | VN | 0 | 12.98 | 0.015515 | ±2.5 | PASS |
| | | | VN | 10 | 15.50 | 0.018527 | ±2.5 | PASS |
| | | | VN | 20 | 13.75 | 0.016436 | ±2.5 | PASS |
| | | | VN | 30 | 14.21 | 0.016985 | ±2.5 | PASS |
| | | | VN | 40 | 10.01 | 0.011965 | ±2.5 | PASS |
| | | | VN | 50 | 11.43 | 0.013662 | ±2.5 | PASS |
| GSM850 | GSM | HCH | VN | -10 | 14.59 | 0.017189 | ±2.5 | PASS |
| | | | VN | 0 | 12.59 | 0.014833 | ±2.5 | PASS |
| | | | VN | 10 | 13.17 | 0.015516 | ±2.5 | PASS |
| | | | VN | 20 | 13.37 | 0.015752 | ±2.5 | PASS |
| | | | VN | 30 | 12.79 | 0.015068 | ±2.5 | PASS |
| | | | VN | 40 | 11.75 | 0.013843 | ±2.5 | PASS |
| | | | VN | 50 | 11.95 | 0.014079 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| GSM850 | EDGE | LCH | VN | -10 | 17.60 | 0.021354 | ±2.5 | PASS |
| | | | VN | 0 | 27.25 | 0.033062 | ±2.5 | PASS |
| | | | VN | 10 | 21.73 | 0.026365 | ±2.5 | PASS |
| | | | VN | 20 | 21.21 | 0.025734 | ±2.5 | PASS |
| | | | VN | 30 | 19.18 | 0.023271 | ±2.5 | PASS |
| | | | VN | 40 | 13.88 | 0.016841 | ±2.5 | PASS |
| | | | VN | 50 | 17.08 | 0.020723 | ±2.5 | PASS |
| GSM850 | EDGE | MCH | VN | -10 | 12.98 | 0.015515 | ±2.5 | PASS |
| | | | VN | 0 | 16.50 | 0.019723 | ±2.5 | PASS |
| | | | VN | 10 | 16.18 | 0.019340 | ±2.5 | PASS |
| | | | VN | 20 | 14.66 | 0.017523 | ±2.5 | PASS |
| | | | VN | 30 | 15.37 | 0.018372 | ±2.5 | PASS |
| | | | VN | 40 | 15.63 | 0.018683 | ±2.5 | PASS |
| | | | VN | 50 | 15.50 | 0.018527 | ±2.5 | PASS |
| GSM850 | EDGE | HCH | VN | -10 | 14.33 | 0.016883 | ±2.5 | PASS |
| | | | VN | 0 | 14.24 | 0.016777 | ±2.5 | PASS |
| | | | VN | 10 | 14.33 | 0.016883 | ±2.5 | PASS |
| | | | VN | 20 | 14.24 | 0.016777 | ±2.5 | PASS |
| | | | VN | 30 | 10.94 | 0.012889 | ±2.5 | PASS |
| | | | VN | 40 | 14.79 | 0.017425 | ±2.5 | PASS |
| | | | VN | 50 | 16.47 | 0.019404 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| PCS 1900 | GSM | LCH | VN | -10 | 90.27 | 0.048789 | PASS |
| | | | VN | 0 | 91.95 | 0.049697 | PASS |
| | | | VN | 10 | 92.40 | 0.049941 | PASS |
| | | | VN | 20 | 90.34 | 0.048827 | PASS |
| | | | VN | 30 | 93.82 | 0.050708 | PASS |
| | | | VN | 40 | 90.79 | 0.049070 | PASS |
| | | | VN | 50 | 91.56 | 0.049487 | PASS |
| PCS 1900 | GSM | MCH | VN | -10 | 95.24 | 0.050660 | PASS |
| | | | VN | 0 | 93.31 | 0.049633 | PASS |
| | | | VN | 10 | 96.92 | 0.051553 | PASS |
| | | | VN | 20 | 95.70 | 0.050904 | PASS |
| | | | VN | 30 | 90.79 | 0.048293 | PASS |
| | | | VN | 40 | 93.05 | 0.049495 | PASS |
| | | | VN | 50 | 94.08 | 0.050043 | PASS |
| PCS 1900 | GSM | HCH | VN | -10 | 94.86 | 0.049670 | PASS |
| | | | VN | 0 | 98.60 | 0.051628 | PASS |
| | | | VN | 10 | 97.44 | 0.051021 | PASS |
| | | | VN | 20 | 97.89 | 0.051257 | PASS |
| | | | VN | 30 | 100.28 | 0.052508 | PASS |
| | | | VN | 40 | 96.34 | 0.050445 | PASS |
| | | | VN | 50 | 101.70 | 0.053252 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| GSM1900 | EDGE | LCH | VN | -10 | 109.74 | 0.059313 | PASS |
| | | | VN | 0 | 95.57 | 0.051654 | PASS |
| | | | VN | 10 | 98.70 | 0.053346 | PASS |
| | | | VN | 20 | 93.50 | 0.050535 | PASS |
| | | | VN | 30 | 89.17 | 0.048195 | PASS |
| | | | VN | 40 | 88.14 | 0.047638 | PASS |
| | | | VN | 50 | 86.78 | 0.046903 | PASS |
| GSM1900 | EDGE | MCH | VN | -10 | 88.27 | 0.046952 | PASS |
| | | | VN | 0 | 77.62 | 0.041287 | PASS |
| | | | VN | 10 | 90.34 | 0.048053 | PASS |
| | | | VN | 20 | 83.98 | 0.044670 | PASS |
| | | | VN | 30 | 73.42 | 0.039053 | PASS |
| | | | VN | 40 | 89.14 | 0.047415 | PASS |
| | | | VN | 50 | 77.32 | 0.041128 | PASS |
| | | | VN | -10 | 84.40 | 0.044193 | PASS |
| | | | VN | 0 | 80.29 | 0.042041 | PASS |
| | | | VN | 10 | 85.98 | 0.045020 | PASS |
| | | | VN | 20 | 86.33 | 0.045204 | PASS |
| | | | VN | 30 | 90.27 | 0.047267 | PASS |
| | | | VN | 40 | 80.78 | 0.042298 | PASS |
| | | | VN | 50 | 87.24 | 0.045680 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

**Frequency Error vs. Voltage:**

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| WCDMA850 | UMTS | LCH | TN | VL | -0.58 | -0.000702 | ±2.5 | PASS |
| | | | TN | VN | -1.02 | -0.001234 | ±2.5 | PASS |
| | | | TN | VH | 0.32 | 0.000387 | ±2.5 | PASS |
| | | MCH | TN | VL | 1.56 | 0.001865 | ±2.5 | PASS |
| | | | TN | VN | 1.37 | 0.001638 | ±2.5 | PASS |
| | | | TN | VH | 3.46 | 0.004137 | ±2.5 | PASS |
| | | HCH | TN | VL | 1.14 | 0.001347 | ±2.5 | PASS |
| | | | TN | VN | 3.02 | 0.003567 | ±2.5 | PASS |
| | | | TN | VH | 3.98 | 0.004701 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Temp. | Test Volt.(V) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| WCDMA1900 | UMTS | LCH | TN | VL | -3.11 | -0.001679 | PASS |
| | | | TN | VN | 3.43 | 0.001852 | PASS |
| | | | TN | VH | 1.24 | 0.000669 | PASS |
| | | MCH | TN | VL | 123.11 | 0.065484 | PASS |
| | | | TN | VN | 197.77 | 0.105197 | PASS |
| | | | TN | VH | 1.86 | 0.000989 | PASS |
| | | HCH | TN | VL | 1228.56 | 0.644034 | PASS |
| | | | TN | VN | 1822.63 | 0.955457 | PASS |
| | | | TN | VH | 1599.95 | 0.838724 | PASS |

Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

**Frequency Error vs. Temperature:**

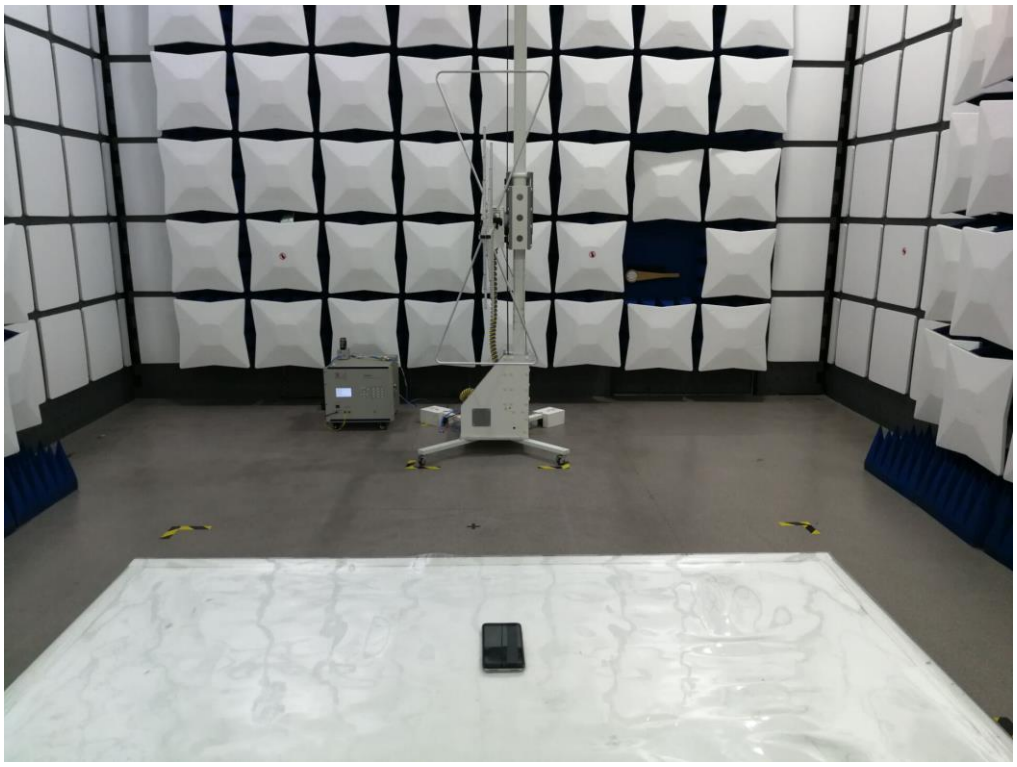
| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Limit (ppm) | Verdict |
|---|---|---|---|---|---|---|---|---|
| WCDMA850 | UMTS | LCH | VN | -10 | 0.95 | 0.001150 | ±2.5 | PASS |
| | | | VN | 0 | 1.31 | 0.001585 | ±2.5 | PASS |
| | | | VN | 10 | 4.14 | 0.005010 | ±2.5 | PASS |
| | | | VN | 20 | -2.20 | -0.002630 | ±2.5 | PASS |
| | | | VN | 30 | 0.24 | 0.000290 | ±2.5 | PASS |
| | | | VN | 40 | 3.63 | 0.004393 | ±2.5 | PASS |
| | | | VN | 50 | -0.87 | -0.001053 | ±2.5 | PASS |
| WCDMA850 | UMTS | MCH | VN | -10 | 4.39 | 0.005249 | ±2.5 | PASS |
| | | | VN | 0 | 0.21 | 0.000251 | ±2.5 | PASS |
| | | | VN | 10 | 3.43 | 0.004101 | ±2.5 | PASS |
| | | | VN | 20 | 0.60 | 0.000717 | ±2.5 | PASS |
| | | | VN | 30 | 3.14 | 0.003754 | ±2.5 | PASS |
| | | | VN | 40 | 3.75 | 0.004484 | ±2.5 | PASS |
| | | | VN | 50 | 2.12 | 0.002535 | ±2.5 | PASS |
| WCDMA850 | UMTS | HCH | VN | -10 | 6.07 | 0.007170 | ±2.5 | PASS |
| | | | VN | 0 | 1.27 | 0.001500 | ±2.5 | PASS |
| | | | VN | 10 | 4.49 | 0.005304 | ±2.5 | PASS |
| | | | VN | 20 | 1.24 | 0.001465 | ±2.5 | PASS |
| | | | VN | 30 | 6.04 | 0.007134 | ±2.5 | PASS |
| | | | VN | 40 | 0.81 | 0.000957 | ±2.5 | PASS |
| | | | VN | 50 | 5.66 | 0.006686 | ±2.5 | PASS |

| Test Band | Test Mode | Test Channel | Test Volt. | Test Tem. (℃) | Freq.Error (Hz) | Freq.vs.rated (ppm) | Verdict |
|---|---|---|---|---|---|---|---|
| WCDMA1900 | UMTS | LCH | VN | -10 | 5.31 | 0.002867 | PASS |
| | | | VN | 0 | 0.23 | 0.000124 | PASS |
| | | | VN | 10 | 3.43 | 0.001852 | PASS |
| | | | VN | 20 | 1.51 | 0.000815 | PASS |
| | | | VN | 30 | 5.29 | 0.002856 | PASS |
| | | | VN | 40 | 3.22 | 0.001738 | PASS |
| | | | VN | 50 | 0.81 | 0.000437 | PASS |
| WCDMA1900 | UMTS | MCH | VN | -10 | 2.15 | 0.001144 | PASS |
| | | | VN | 0 | 2.84 | 0.001511 | PASS |
| | | | VN | 10 | 121.44 | 0.064596 | PASS |
| | | | VN | 20 | 9.38 | 0.004989 | PASS |
| | | | VN | 30 | 345.70 | 0.183883 | PASS |
| | | | VN | 40 | 117.14 | 0.062309 | PASS |
| | | | VN | 50 | 319.44 | 0.169915 | PASS |
| WCDMA1900 | UMTS | HCH | VN | -10 | 1921.84 | 1.022255 | PASS |
| | | | VN | 0 | 1503.30 | 0.799628 | PASS |
| | | | VN | 10 | 1974.90 | 1.050479 | PASS |
| | | | VN | 20 | 1959.18 | 1.042117 | PASS |
| | | | VN | 30 | 1450.68 | 0.771638 | PASS |
| | | | VN | 40 | 2104.26 | 1.119287 | PASS |
| | | | VN | 50 | 1088.99 | 0.579250 | PASS |

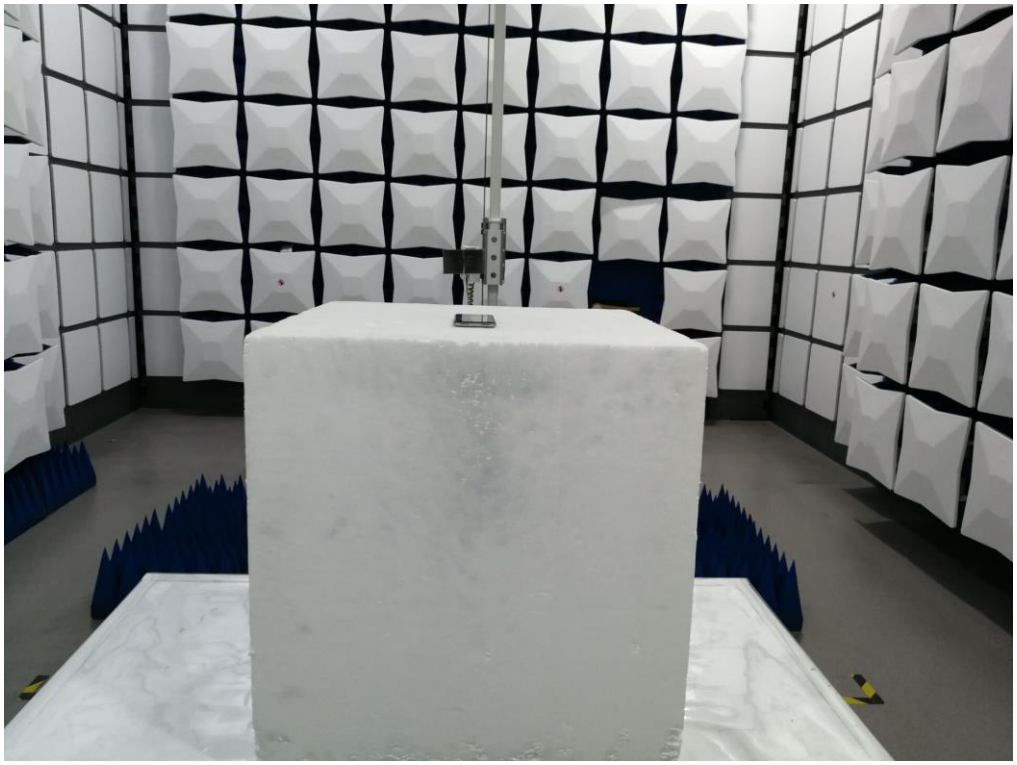
Note: Based on the results of the frequency stability test at the center channel the frequency deviation results measured are very samll. As such it is determined that channels at the band edge would remain in-band when the maximum measured frequency deviation noted duing the frequency stability tests is applied. Therefore the device is detemined to remain operating in band over the temperture and voltage range as tested.

## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED SPURIOUS EMISSION



RADIATED SPURIOUS ABOVE 1G EMISSION



**----END OF REPORT----**