

# RF Test Report

Test in accordance with  
Federal Communications Commission(FCC)  
CFR TITLE 47, Parts 2, 22, 24

Product Name : GPS Locator

Model No. : GV500

FCC ID : YQD-GV500

Applicant : Queclink Wireless Solutions Co.,Ltd..  
Address : Room 501, Building 9,No.99, Tianzhou  
Road,Shanghai,China

Date of Receipt : 2014-07-28

Test Date : 2014-07-29~2014-08-03

Issued Date : 2014-08-04

Report No. : UL12620140728FCC016

Report Version : V1.0

**Notes:**

The test results only relate to these samples which have been tested.

Partly using this report will not be admitted unless been allowed by Unilab.

Unilab is only responsible for the complete report with the reported stamp of Unilab.

## Test Report Certification

Issued Date : 2014-08-04  
Report No. : UL20140728FCC016

Product Name : GPS Locator  
Applicant : Queclink Wireless Solutions Co.,Ltd.  
Address : Room 501, Building 9, No.99 Tianzhou Road, Shanghai, China  
Manufacturer : Queclink Wireless Solutions Co.,Ltd.  
Address : Room 501, Building 9, No.99 Tianzhou Road, Shanghai, China  
Model No. : GV500  
EUT Voltage : MIN: 8.0V, NOR:12V, MAX: 32V  
Brand Name : Queclink  
FCC ID: YQD-GV500  
Applicable Standard : ANSI/TIA-603-D-2010; FCC CFR Title 47 Part 2;  
FCC CFR Title 47 Part 22 Subpart H;  
FCC CFR Title 47 Part 24 Subpart E;  
Test Result : Complied  
Performed Location : Unilab (Shanghai) Co., Ltd.  
FCC 2.948 register number is 714465  
No. 1350, Lianxi Rd. Pudong New District, Shanghai, China  
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(Supervisor: Eva Wang)

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## SUMMARY OF TEST RESULT

| Report Section | SPECIFICATION                                   | Description                                   | Limit                        | Result |
|----------------|-------------------------------------------------|-----------------------------------------------|------------------------------|--------|
| 3              | part2.1046                                      | Conducted Output Power                        | N/A                          | PASS   |
| 3              | part 22.913(a)(2)                               | Effective Radiated Power                      | <7 Watts                     | PASS   |
| 3              | part 24.232(c)                                  | Equivalent Isotropic Radiated Power           | <2 Watts                     | PASS   |
| 4              | part 2.1049<br>part 22.917(a)<br>part 24.238(a) | Occupied Bandwidth                            | N/A                          | PASS   |
| 5              | part 2.1051<br>part 22.917(a)<br>part 24.238(a) | Band Edge Measurement                         | $<43+10\lg(P[\text{Watts}])$ | PASS   |
| 6              | part 2.1051<br>part 22.917(a)<br>part 24.238(a) | Conducted Spurious Emission                   | $<43+10\lg(P[\text{Watts}])$ | PASS   |
| 6              | part 2.1053<br>part 22.917(a)<br>part 24.238(a) | Field Strength of Supurious Radiation         | $<43+10\lg(P[\text{Watts}])$ | PASS   |
| 7              | part 2.1055<br>part 22.355<br>part 24.235       | Frequency Stability for Temperature & Voltage | <2.5 ppm                     | PASS   |

## 1.General Information

### 1.1. EUT Description

|                          |                                                                   |
|--------------------------|-------------------------------------------------------------------|
| Product Name:            | GPS Locator                                                       |
| Model Name:              | GV500                                                             |
| Hardware Version:        | V1.04                                                             |
| Software Version:        | A04V14                                                            |
| RF Exposure Environment: | Uncontrolled                                                      |
| <b>GSM/ GPRS</b>         |                                                                   |
| Support Band:            | GSM850/PCS1900                                                    |
| GPRS Class:              | 12                                                                |
| Tx Frequency Range:      | GSM 850: 824.2MHz to 848.8MHz<br>PCS 1900: 1850.2MHz to 1909.8MHz |
| Rx Frequency Range:      | GSM 850: 869.2MHz to 893.8MHz<br>PCS 1900: 1930.2MHz to 1989.8MHz |
| Type of modulation:      | GSM/GPRS for GMSK                                                 |
| Antenna Type:            | Connector                                                         |
| Antenna Peak Gain:       | GSM 850: 0dBi<br>PCS 1900: 0.5dBi                                 |
| <b>Component</b>         |                                                                   |
| Internal Battery         | 250mAh 3.7V                                                       |
| Operating Voltage        | DC 8-32V                                                          |

### 1.2. Mode of Operation

Unilab has verified the construction and function in typical operation. EUT is inlink mode with base station emulator at maximum power level. All the test modes were carried out with the EUT in normal operation, which was shown in this test report is the worst test mode and defined as:

| Test Mode |                         |                         |
|-----------|-------------------------|-------------------------|
| Band      | Radiated TCs            | Conducted TCs           |
| GSM 850   | GSM Link<br>GPRS 8 Link | GSM Link<br>GPRS 8 Link |
| GSM1900   | GSM Link<br>GPRS 8 Link | GSM Link<br>GPRS 8 Link |

Note:

1. Regards to the frequency band operation: the lowest、middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. The maximum power levels are GSM and GPRS multi-slot class 8 mode for GMSK link, only these modes were used for all tests.
3. For the ERP/EIRP and radiated emission test, every axis (X, Y, Z) was verified, and show the worst (Z axis) result on this report.

**The conducted power table is as follows:**

| Conducted Power (Unit: dBm)   |         |       |       |          |       |        |
|-------------------------------|---------|-------|-------|----------|-------|--------|
| Band                          | GSM 850 |       |       | GSM 1900 |       |        |
| Channel                       | 128     | 189   | 251   | 512      | 661   | 810    |
| Frequency                     | 824.2   | 836.4 | 848.8 | 1850.2   | 1880  | 1909.8 |
| GSM (GMSK, 1 Tx slot)<br>CS1  | 32.34   | 32.39 | 32.37 | 28.71    | 28.67 | 28.68  |
| GPRS (GMSK, 1 Tx slot)<br>CS1 | 32.32   | 32.36 | 32.33 | 28.68    | 28.67 | 28.62  |
| GPRS (GMSK, 2 Tx slot)<br>CS1 | 31.05   | 30.84 | 30.75 | 27.33    | 27.25 | 27.23  |
| GPRS (GMSK, 3 Tx slot)<br>CS1 | 28.14   | 27.91 | 27.82 | 24.27    | 24.18 | 24.03  |
| GPRS (GMSK, 4 Tx slot)<br>CS1 | 25.88   | 25.64 | 25.72 | 23.95    | 23.83 | 23.84  |

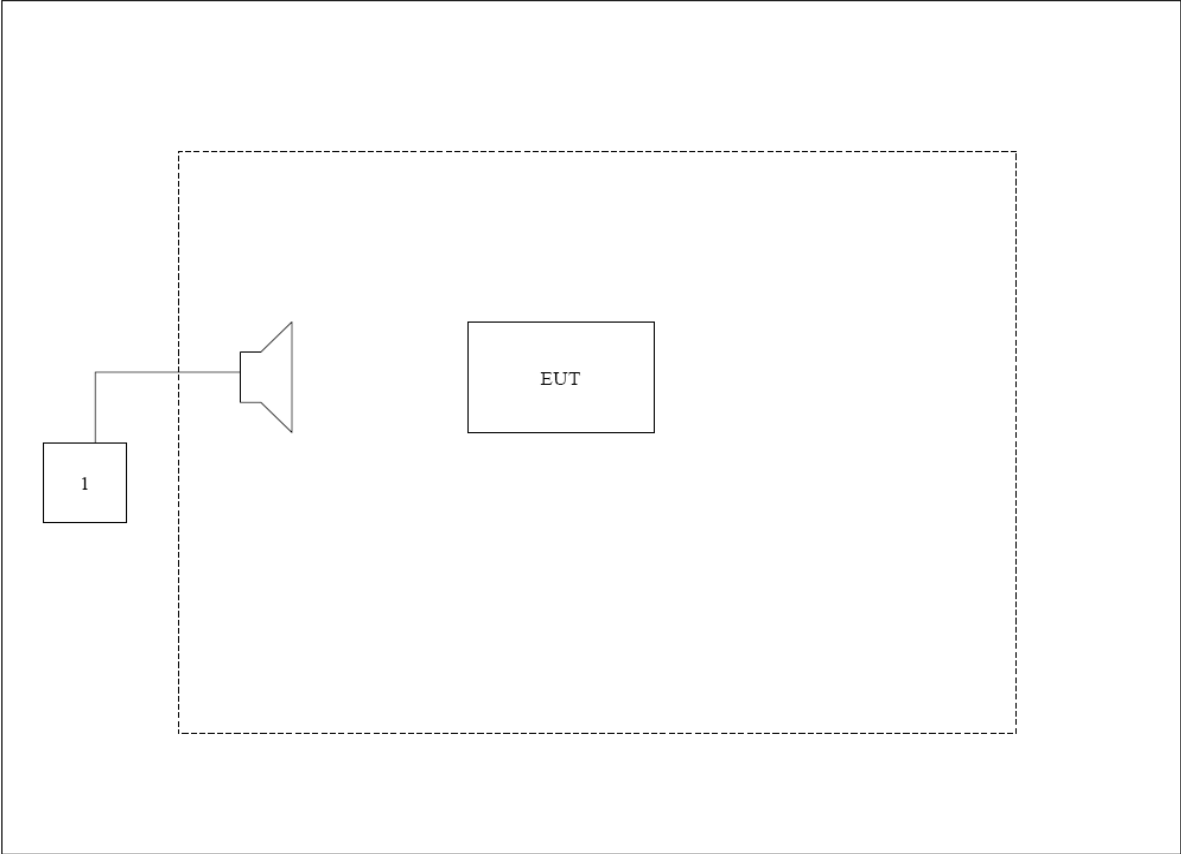
### 1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

| Product |             | Manufacturer | Model  | Serial No. | Power Cord |
|---------|-------------|--------------|--------|------------|------------|
| 1       | Agilent8960 | Agilent      | E5515C | GB46581718 | N/A        |

**1.4. Configuration of Tested System**

Connection Diagram



**1.5. EUT Exercise Software**

|   |                                                           |
|---|-----------------------------------------------------------|
| 1 | Setup the EUT and simulators as shown on above.           |
| 2 | Turn on the power of all equipment.                       |
| 3 | EUT Communicate with E5515C, then select channel to test. |

**2. Technical Test**

**2.1. Test Environment**

| Items                      | Required (IEC 68-1) | Actual   |
|----------------------------|---------------------|----------|
| Temperature (°C)           | 15-35               | 22       |
| Humidity (%RH)             | 25-75               | 54       |
| Barometric pressure (mbar) | 860-1060            | 950-1000 |

### 3. Peak Output Power

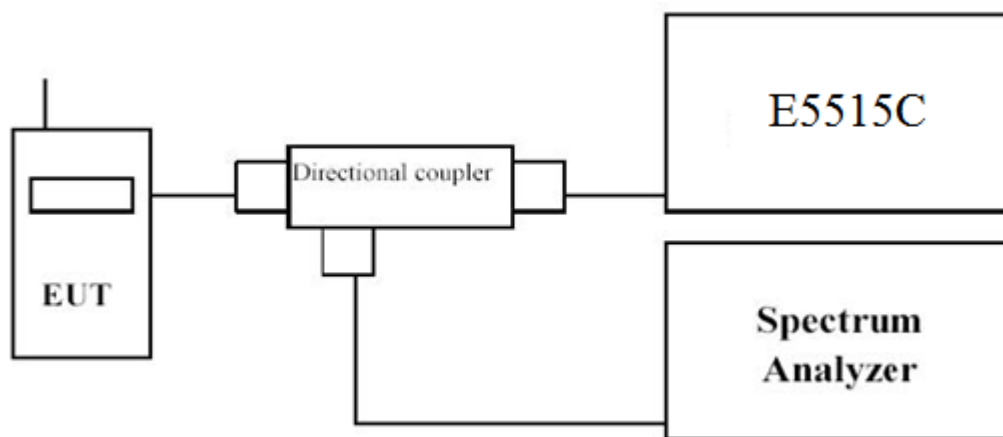
#### 3.1. Test Equipment

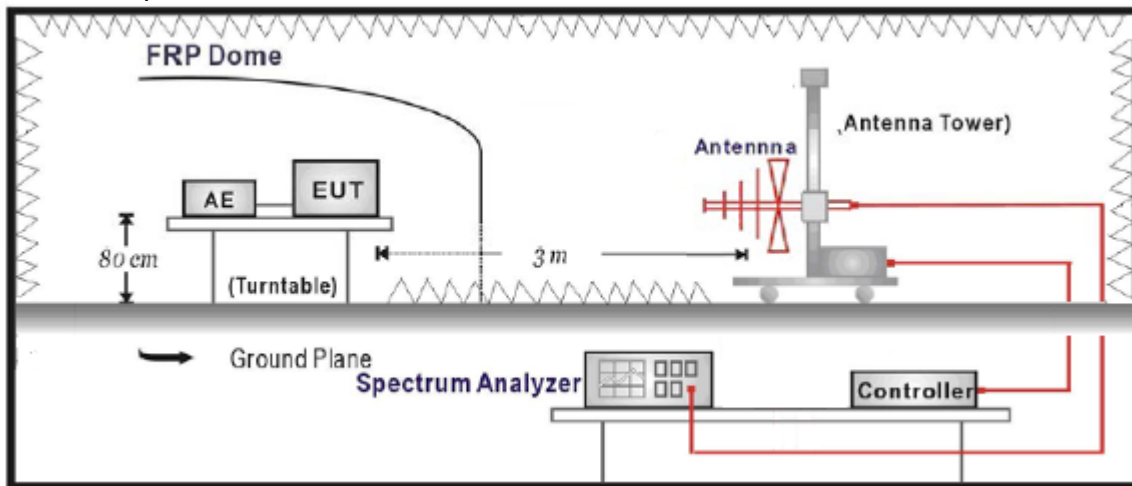
| Instrument                 | Manufacturer | Model     | Serial No. | Cali. Due Date |
|----------------------------|--------------|-----------|------------|----------------|
| Spectrum Analyzer          | Agilent      | N9038A    | MY51210142 | 2014.12.17     |
| Radio Communication Tester | Agilent      | E5515C    | GB46581718 | 2014.10.21     |
| Signal Generator           | Agilent      | N5183A    | MY50140938 | 2015.01.03     |
| Preamplifier               | CEM          | EM30180   | 3008A0245  | 2015.02.28     |
| DC Power Supply            | Agilent      | 6612C     | MY43002989 | 2015.03.03     |
| Bilog Antenna              | Schwarzbeck  | VULB9160  | 9160-3316  | 2015.07.18     |
| VHF-UHF-Biconical Antenna  | Schwarzbeck  | VUBA9117  | 9117-263   | 2015.07.18     |
| Broad-Band Horn Antenna    | Schwarzbeck  | BBHA9120D | 9120D-942  | 2015.07.18     |
| Broad-Band Horn Antenna    | Schwarzbeck  | BBHA9120D | 9120D-943  | 2015.07.18     |

The measure equipment had been calibrated once a year.

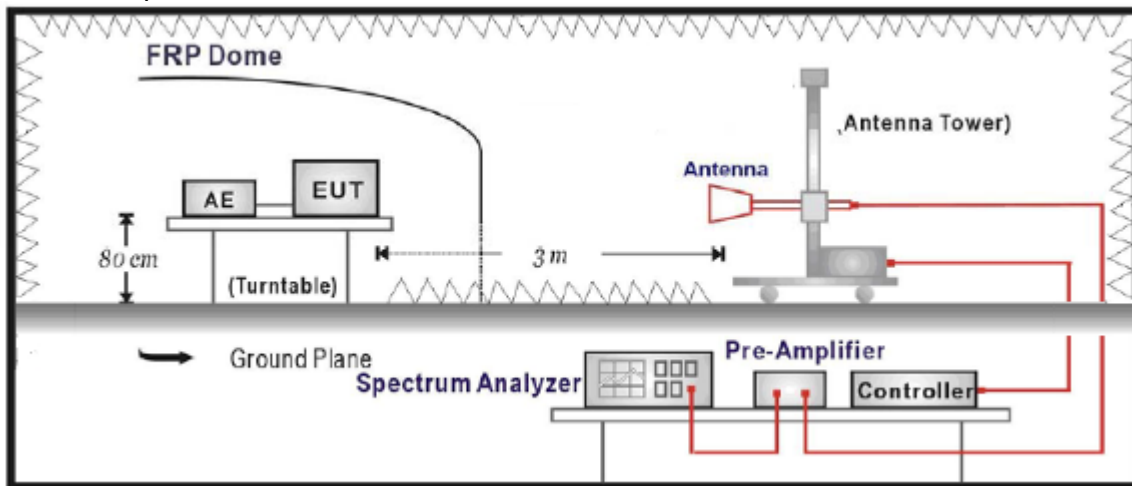
#### 3.2. Test Setup

Conducted Power Measurement:





Radiated Spurious Measurement: above 1GHz



### 3.3. Limit

**For FCC Part 22.913(a)(2):**

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

**For FCC Part 24.232(c):**

The EIRP of mobile transmitters and auxiliary test transmitters must not exceed 2 Watts.

### 3.4. Test Procedure

#### **Conducted Power Measurement:**

- a. Place the EUT on a bench and set it in transmitting mode.
- b. Connect a low loss RF cable from the antenna port to a spectrum analyzer and E5515C by a Directional Couple.
- c. EUT Communicate with E5515C, then selects a channel for testing.
- d. Add a correction factor to the display of spectrum, and then test.

#### **Radiated Power Measurement:**

- a. The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- b. The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
- c. The output of the test antenna shall be connected to the measuring receiver.
- d. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- e. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- f. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
- g. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- h. The maximum signal level detected by the measuring receiver shall be noted.
- i. The transmitter shall be replaced by a substitution antenna.
- j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- k. The substitution antenna shall be connected to a calibrated signal generator.
- l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- q. Test site anechoic chamber refer to ANSI C63.4: 2009.

### 3.5. Uncertainty

The measurement uncertainty is defined as for Conducted Power Measurement  $\pm 1.1$  dB,  
for Radiated Power Measurement  $\pm 3.1$  dB

### 3.6. Test Result

The following table shows the conducted power measured:

Table 1

| GSM850          |           |                 |                       |                     |
|-----------------|-----------|-----------------|-----------------------|---------------------|
| Modes           | Channel   | Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) |
| GSM850 (GSM)    | 128(Low)  | 824.2           | 32.34                 | 1.71                |
|                 | 189(Mid)  | 836.4           | 32.39                 | 1.73                |
|                 | 251(High) | 848.8           | 32.37                 | 1.73                |
| GSM850 (GPRS 8) | 128(Low)  | 824.2           | 32.32                 | 1.71                |
|                 | 189(Mid)  | 836.4           | 32.36                 | 1.72                |
|                 | 251(High) | 848.8           | 32.33                 | 1.71                |

Table 2

| GSM1900          |           |                 |                       |                     |
|------------------|-----------|-----------------|-----------------------|---------------------|
| Modes            | Channel   | Frequency (MHz) | Conducted Power (dBm) | Conducted Power (W) |
| GSM1900 (GSM)    | 512(Low)  | 1850.2          | 28.71                 | 0.74                |
|                  | 661(Mid)  | 1880.0          | 28.67                 | 0.74                |
|                  | 810(High) | 1909.8          | 28.68                 | 0.74                |
| GSM1900 (GPRS 8) | 512(Low)  | 1850.2          | 28.68                 | 0.74                |
|                  | 661(Mid)  | 1880.0          | 28.67                 | 0.74                |
|                  | 810(High) | 1909.8          | 28.62                 | 0.73                |

The following table shows the Radiated power measured :

GSM850 (GSM Link)

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | ERP (dBm) | ERP (W) |
|--------------------------------|-----------------|------------------|-----------------|------------|-----------|---------|
| Low Channel 128 (824.20MHz)    |                 |                  |                 |            |           |         |
| 824.2                          | H               | 36.33            | 3.83            | -2.99      | 29.51     | 0.89    |
| 824.2                          | V               | 35.27            | 3.83            | -2.99      | 28.45     | 0.70    |
| Middle Channel 189 (836.40MHz) |                 |                  |                 |            |           |         |
| 836.4                          | H               | 36.43            | 3.96            | -3.04      | 29.43     | 0.88    |
| 836.4                          | V               | 35.43            | 3.96            | -3.04      | 28.43     | 0.70    |
| High Channel 251 (848.80MHz)   |                 |                  |                 |            |           |         |
| 848.8                          | H               | 36.45            | 3.97            | -3.10      | 29.38     | 0.87    |
| 848.8                          | V               | 35.46            | 3.97            | -3.10      | 28.39     | 0.70    |

GSM850 (GPRS 8 Link)

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | ERP (dBm) | ERP (W) |
|--------------------------------|-----------------|------------------|-----------------|------------|-----------|---------|
| Low Channel 128 (824.20MHz)    |                 |                  |                 |            |           |         |
| 824.2                          | H               | 34.56            | 3.83            | -2.99      | 28.74     | 0.75    |
| 824.2                          | V               | 32.53            | 3.83            | -2.99      | 25.71     | 0.37    |
| Middle Channel 189 (836.40MHz) |                 |                  |                 |            |           |         |
| 836.4                          | H               | 35.96            | 3.96            | -3.04      | 28.96     | 0.79    |
| 836.4                          | V               | 33.13            | 3.96            | -3.04      | 26.13     | 0.41    |
| High Channel 251 (848.80MHz)   |                 |                  |                 |            |           |         |
| 848.8                          | H               | 35.98            | 3.97            | -3.10      | 28.91     | 0.78    |
| 848.8                          | V               | 33.32            | 3.97            | -3.10      | 26.25     | 0.42    |

GSM1900 (GSM Link)

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBi) | EIRP (dBm) | EIRP (W) |
|---------------------------------|-----------------|------------------|-----------------|------------|------------|----------|
| Low Channel 512(1850.20MHz)     |                 |                  |                 |            |            |          |
| 1850.2                          | H               | 22.57            | 6.26            | 10.40      | 26.71      | 0.47     |
| 1850.2                          | V               | 20.01            | 6.26            | 10.40      | 24.15      | 0.26     |
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |            |            |          |
| 1880.0                          | H               | 22.43            | 6.19            | 10.43      | 26.67      | 0.46     |
| 1880.0                          | V               | 19.73            | 6.19            | 10.43      | 23.97      | 0.25     |
| High Channel 810 (1909.80MHz)   |                 |                  |                 |            |            |          |
| 1909.8                          | H               | 22.59            | 6.15            | 10.44      | 26.68      | 0.47     |
| 1909.8                          | V               | 19.59            | 6.15            | 10.44      | 23.88      | 0.24     |

GSM1900 (GPRS 8 Link)

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBi) | EIRP (dBm) | EIRP (W) |
|---------------------------------|-----------------|------------------|-----------------|------------|------------|----------|
| Low Channel 512(1850.20MHz)     |                 |                  |                 |            |            |          |
| 1850.2                          | H               | 22.14            | 6.26            | 10.40      | 26.28      | 0.42     |
| 1850.2                          | V               | 19.27            | 6.26            | 10.40      | 23.41      | 0.22     |
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |            |            |          |
| 1880.0                          | H               | 21.43            | 6.19            | 10.43      | 25.67      | 0.37     |
| 1880.0                          | V               | 18.64            | 6.19            | 10.43      | 22.98      | 0.20     |
| High Channel 810 (1909.80MHz)   |                 |                  |                 |            |            |          |
| 1909.8                          | H               | 21.36            | 6.15            | 10.44      | 25.65      | 0.37     |
| 1909.8                          | V               | 18.81            | 6.15            | 10.44      | 23.10      | 0.21     |

4. Occupied Bandwidth

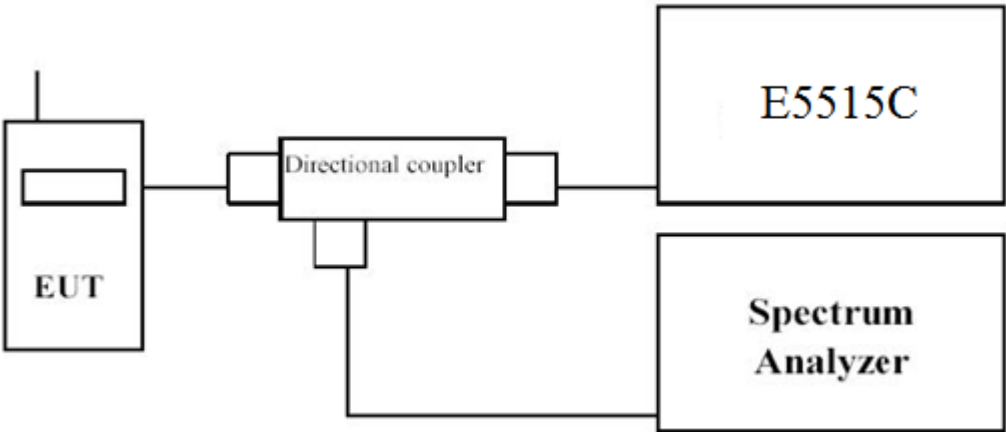
4.1. Test Equipment

Occupied Bandwidth

| Instrument                 | Manufacturer | Model  | Serial No  | Cal. Date  |
|----------------------------|--------------|--------|------------|------------|
| Radio Communication Tester | Agilent      | E5515C | GB46581718 | 2014.10.21 |
| Spectrum Analyzer          | Agilent      | N9038A | MY51210142 | 2014.12.17 |
| DC Power Supply            | Agilent      | 6612C  | MY43002989 | 2015.03.03 |

The measure equipment had been calibrated once a year.

4.2. Test Setup



#### **4.3. Limit**

N/A

#### **4.4. Test Procedure**

Using Occupied Bandwidth measurement function of spectrum analyzer, and setting as follows:  
For GSM850/1900 test --- RBW = 3 kHz and VBW = 10 kHz  
For WCDMA Band V/II test --- RBW = 100 kHz and VBW = 300 kHz

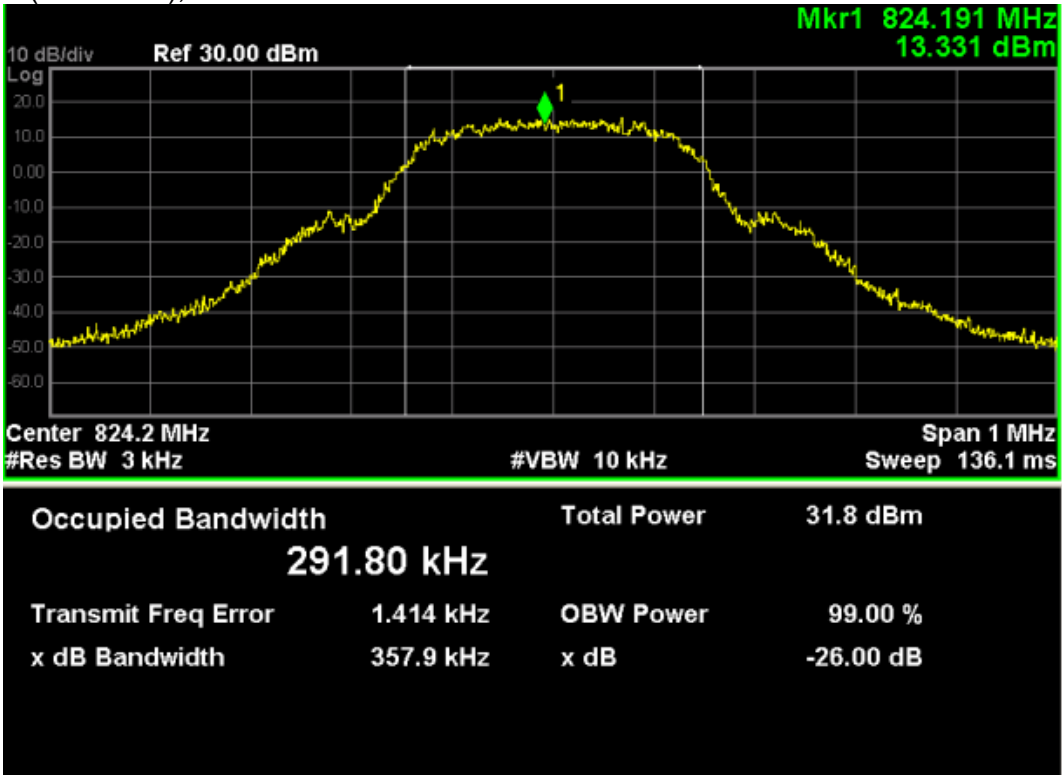
#### **4.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 10$  Hz

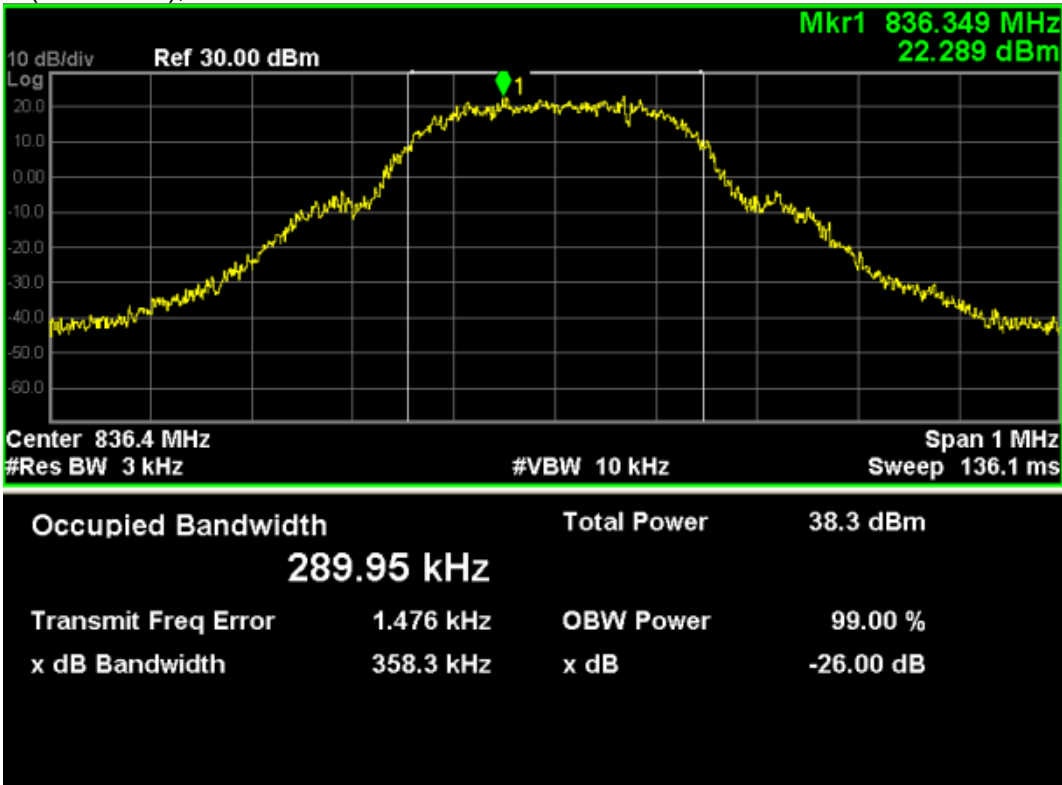
GSM850 (GSM Link)

| Channel No. | Frequency (MHz) | -26dB Occupied Bandwidth (kHz) | 99% Occupied Bandwidth (kHz) |
|-------------|-----------------|--------------------------------|------------------------------|
| 128         | 824.20          | 357.9                          | 291.8                        |
| 189         | 836.40          | 358.3                          | 290.0                        |
| 251         | 848.80          | 353.1                          | 289.1                        |

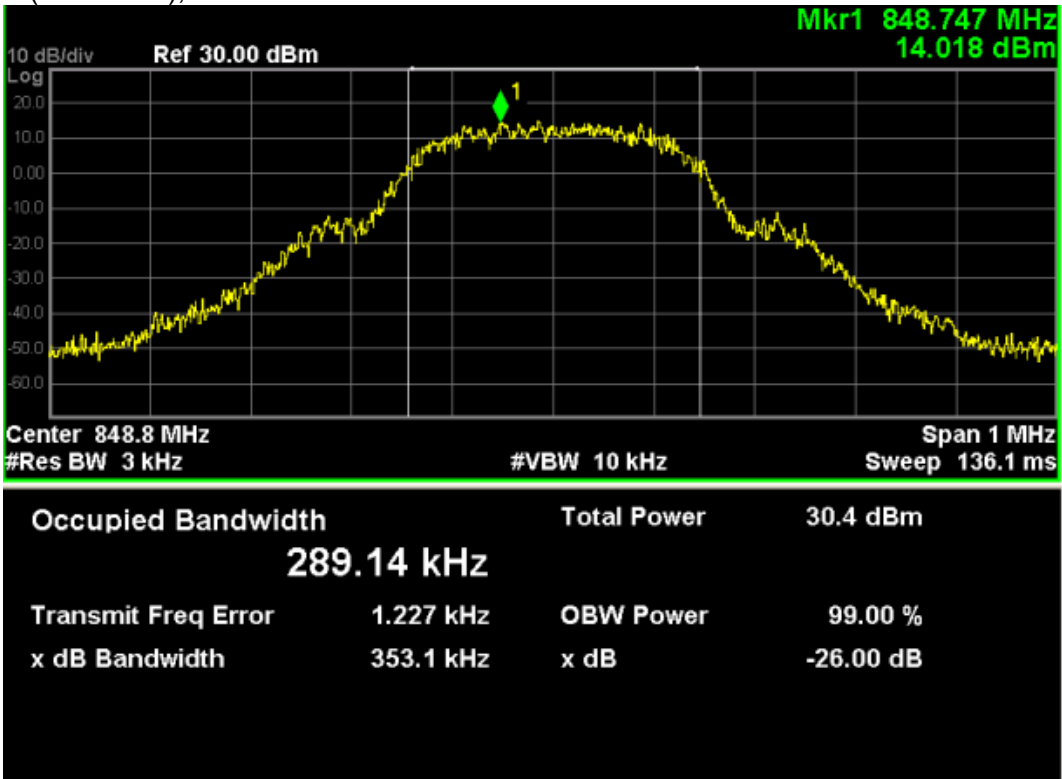
GSM850 (GSM Link), Channel 128



GSM850 (GSM Link), Channel 189



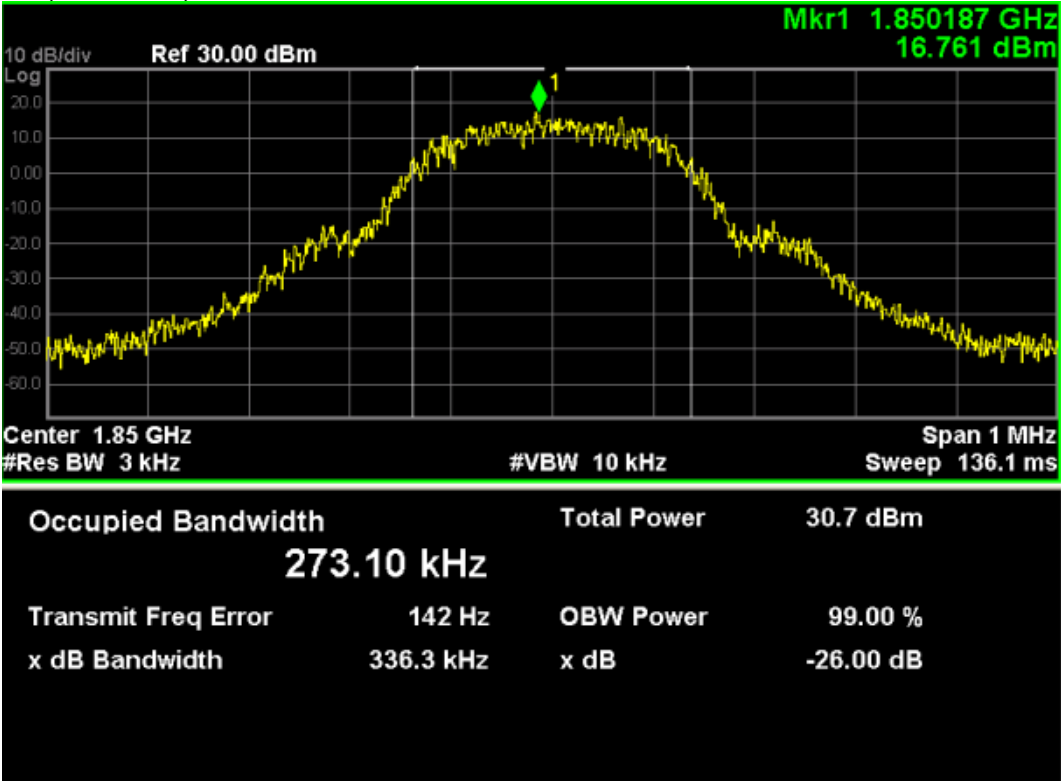
GSM850 (GSM Link), Channel 251



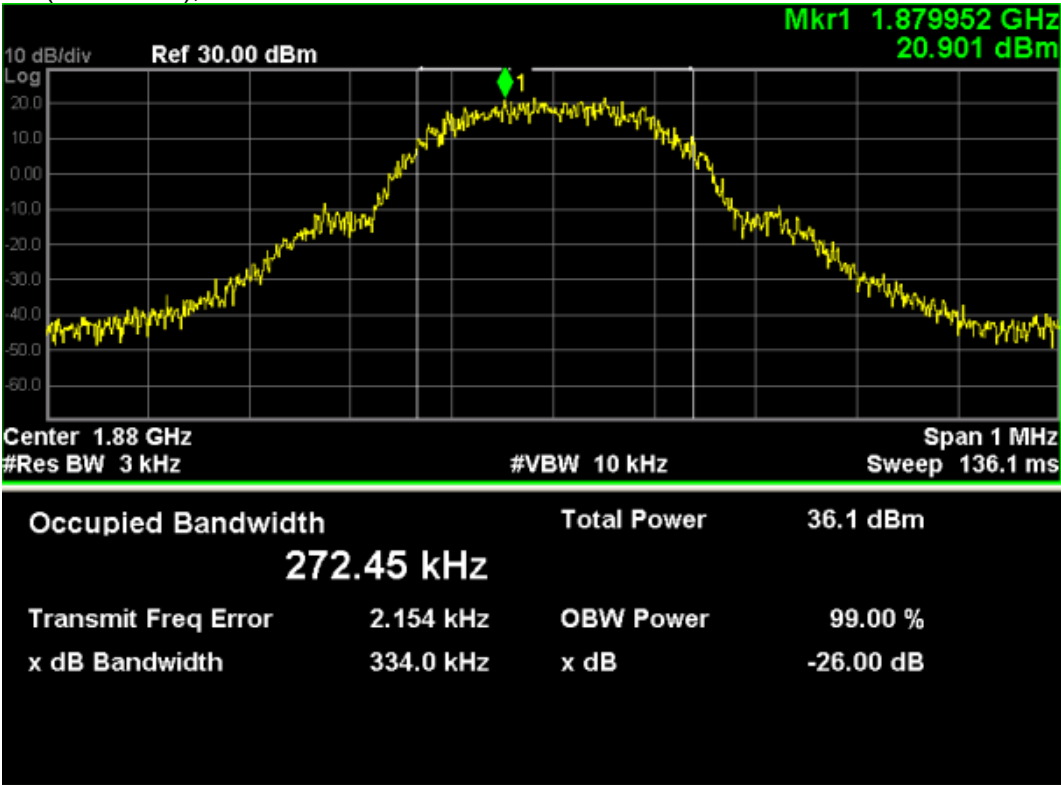
GSM 1900 (GSM Link)

| Channel No. | Frequency (MHz) | -26dB Occupied Bandwidth (kHz) | 99% Occupied Bandwidth (kHz) |
|-------------|-----------------|--------------------------------|------------------------------|
| 512         | 1850.20         | 336.3                          | 273.1                        |
| 661         | 1880.00         | 334.0                          | 272.5                        |
| 810         | 1909.80         | 333.8                          | 271.2                        |

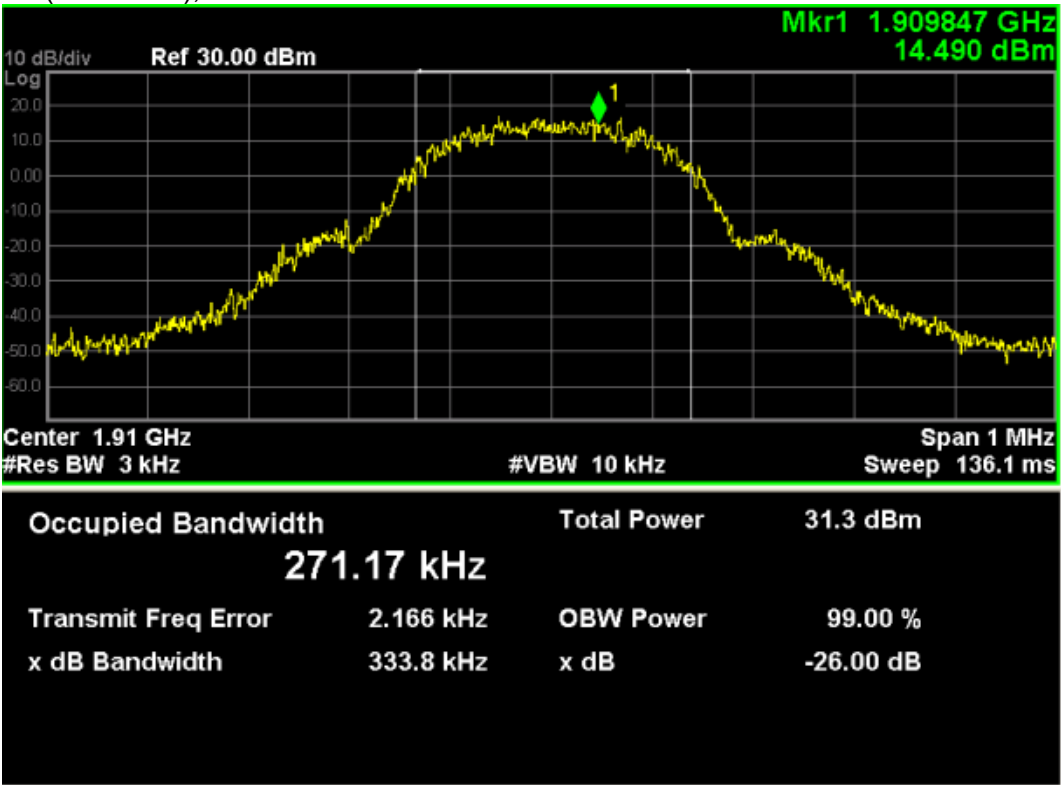
GSM1900 (GSM Link), Channel 512



GSM1900 (GSM Link), Channel 661

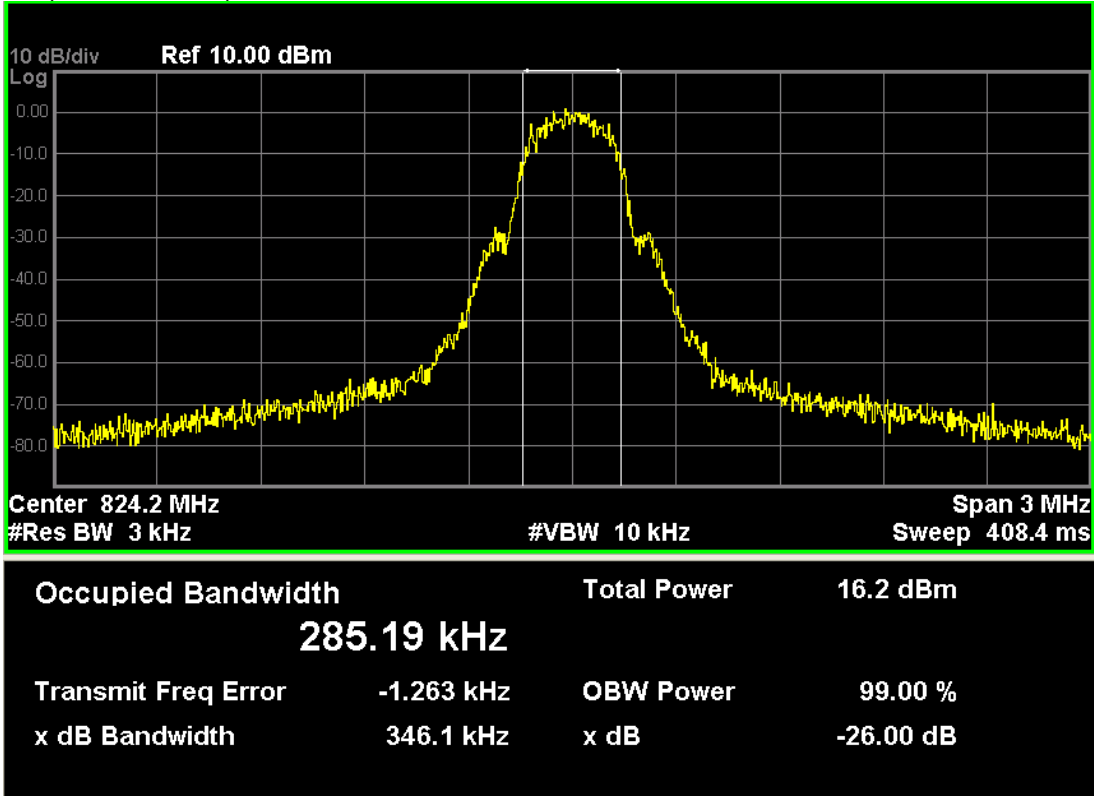


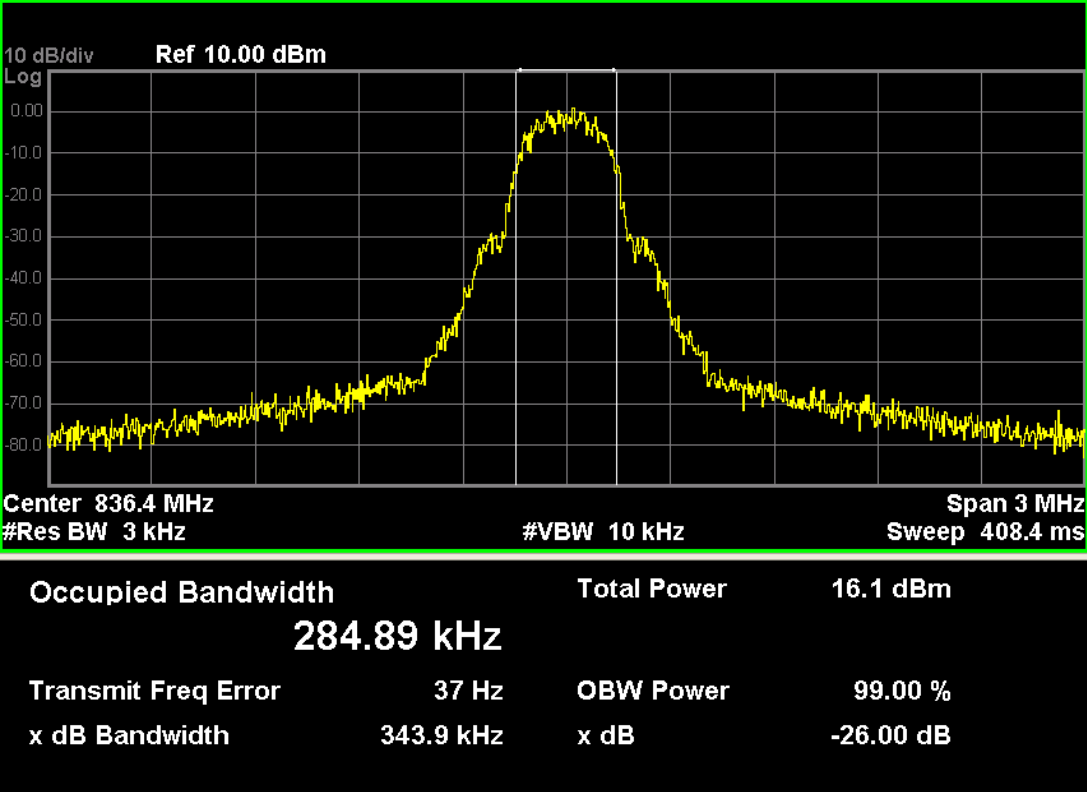
GSM1900 (GSM Link), Channel 810



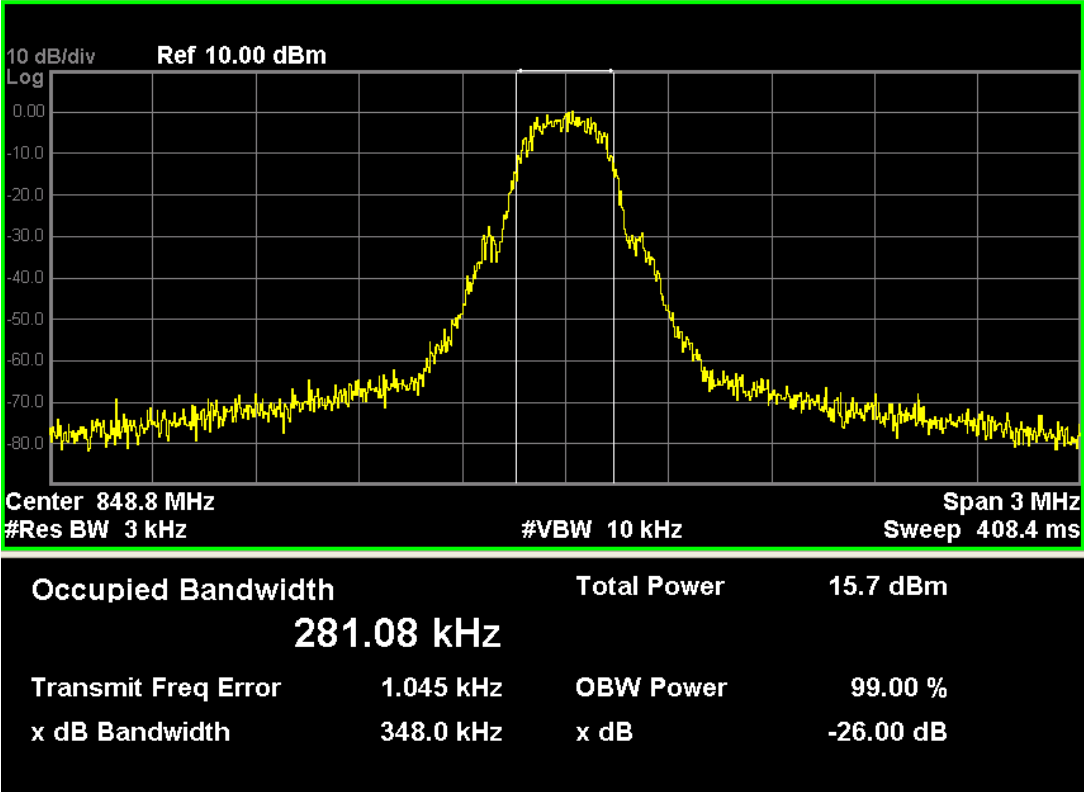
| Channel No. | Frequency (MHz) | -26dB Occupied Bandwidth (kHz) | 99% Occupied Bandwidth (kHz) |
|-------------|-----------------|--------------------------------|------------------------------|
| 128         | 824.20          | 346.1                          | 285.2                        |
| 189         | 836.40          | 343.9                          | 284.9                        |
| 251         | 848.80          | 348.0                          | 281.1                        |

GSM850 (GPRS 8 Link), Channel 128



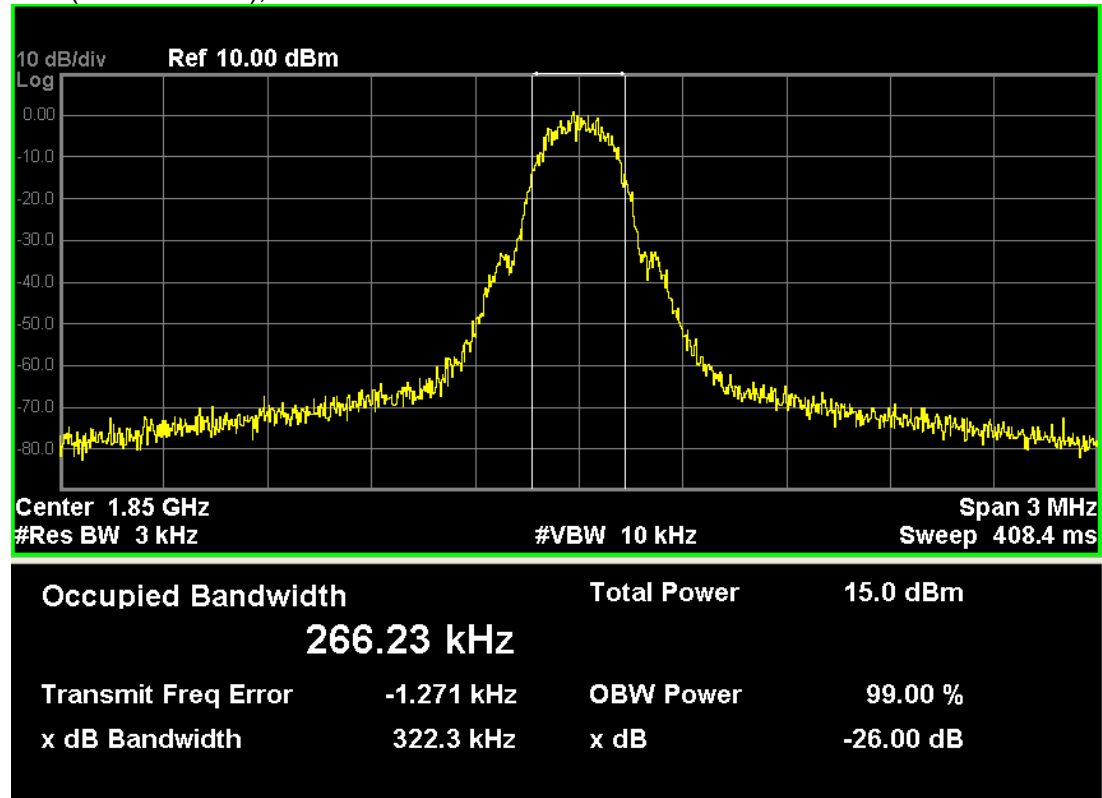


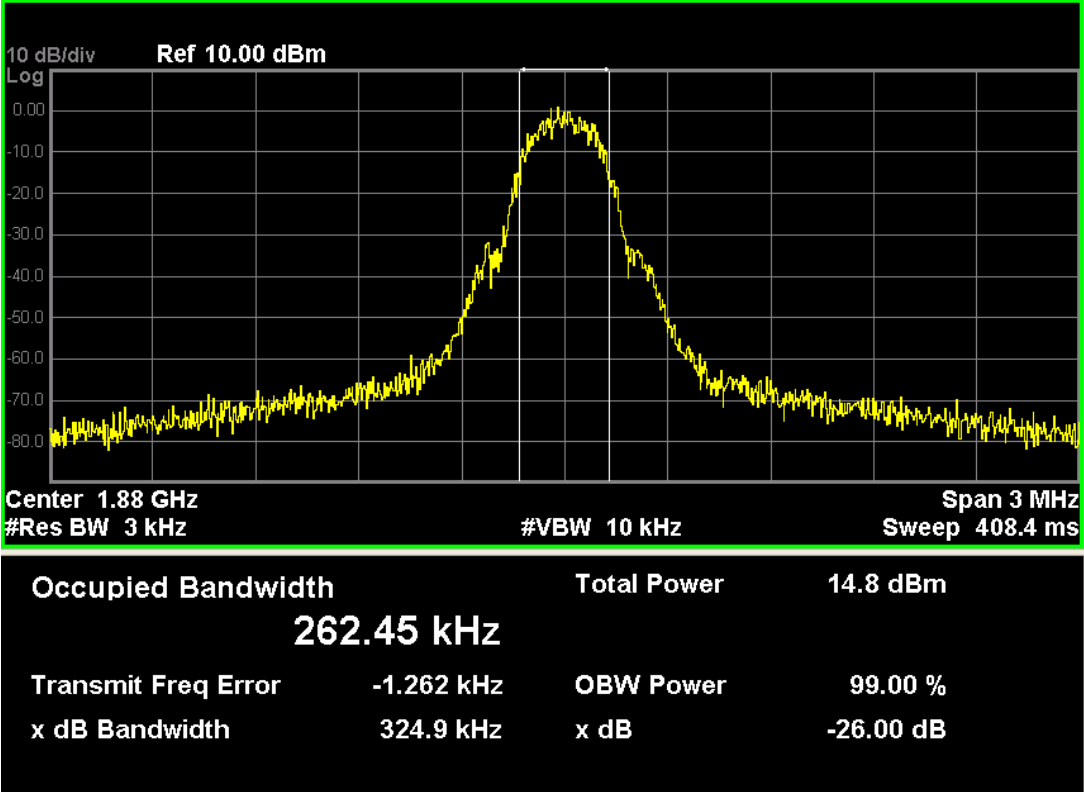
GSM850 (GPRS 8 Link), Channel 251



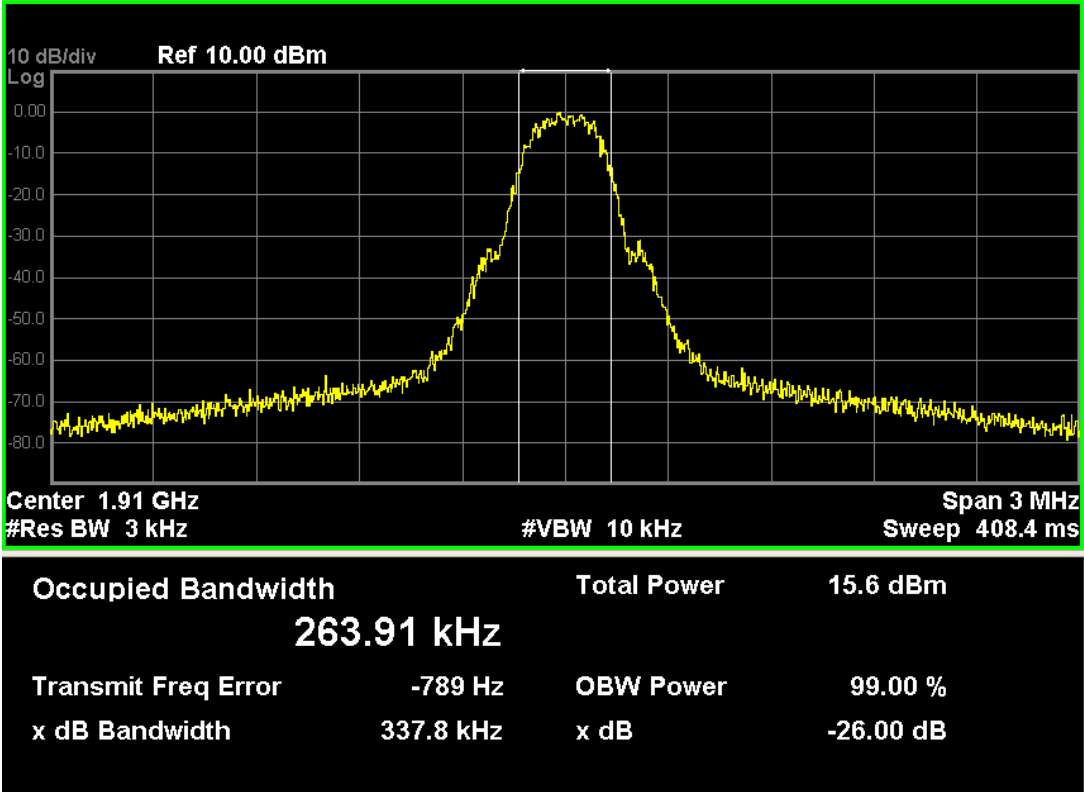
| Channel No. | Frequency (MHz) | -26dB Occupied Bandwidth (kHz) | 99% Occupied Bandwidth (kHz) |
|-------------|-----------------|--------------------------------|------------------------------|
| 512         | 1850.20         | 322.3                          | 266.2                        |
| 661         | 1880.00         | 324.9                          | 262.5                        |
| 810         | 1909.80         | 337.8                          | 263.9                        |

GSM1900 (GPRS 8 Link), Channel 512





GSM1900 (GPRS 8 Link), Channel 810



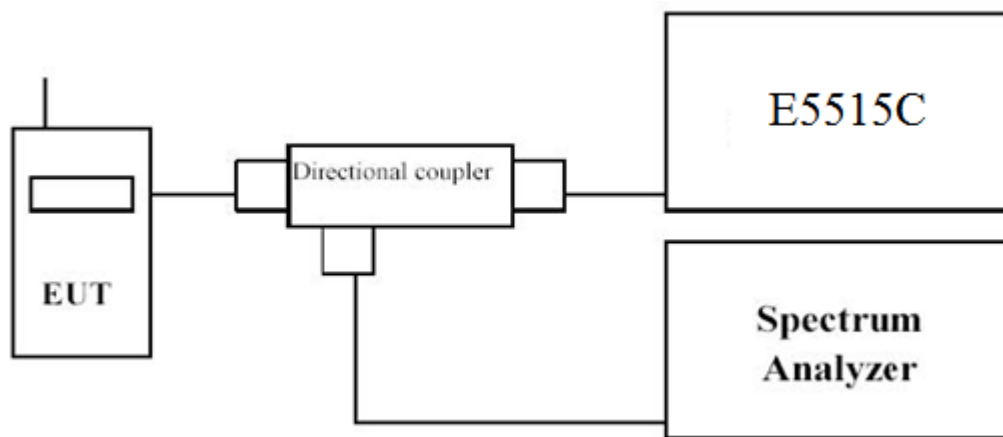
## 5.Spurious Emission At Antenna Terminals (+/- 1MHz)

### 5.1. Test Equipment

| Instrument                 | Manufacturer | Model  | Serial No  | Cal. Date  |
|----------------------------|--------------|--------|------------|------------|
| Radio Communication Tester | Agilent      | E5515C | GB46581718 | 2014.10.21 |
| Spectrum Analyzer          | Agilent      | N9038A | MY51210142 | 2014.12.17 |
| DC Power Supply            | Agilent      | 6612C  | MY43002989 | 2015.03.03 |

The measure equipment had been calibrated once a year.

### 5.2. Test Setup



### **5.3. Limit**

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10\log(P)$  dB.

### **5.4. Test Procedure**

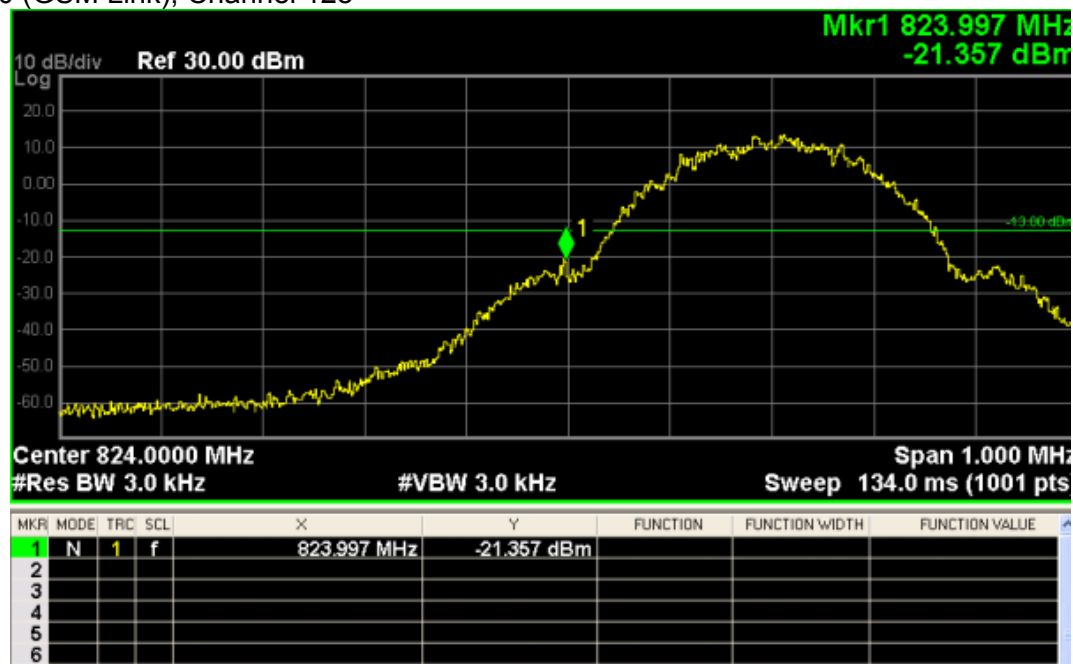
In the 1MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed to measure the out of band Emissions.

### **5.5. Uncertainty**

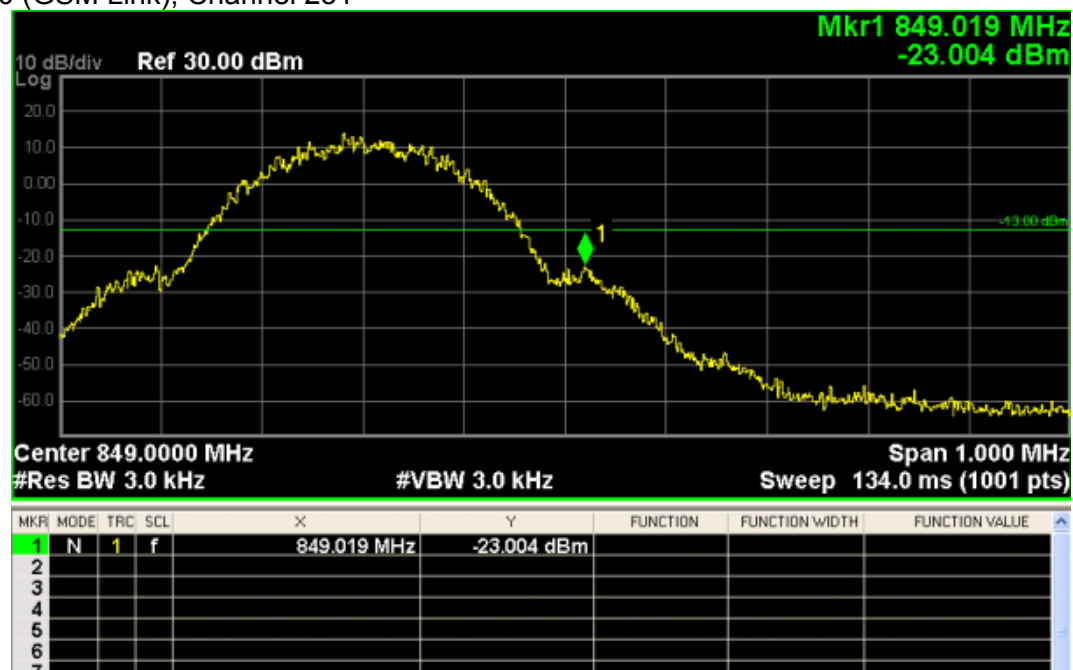
The measurement uncertainty is defined as  $\pm 1.2$  dB.

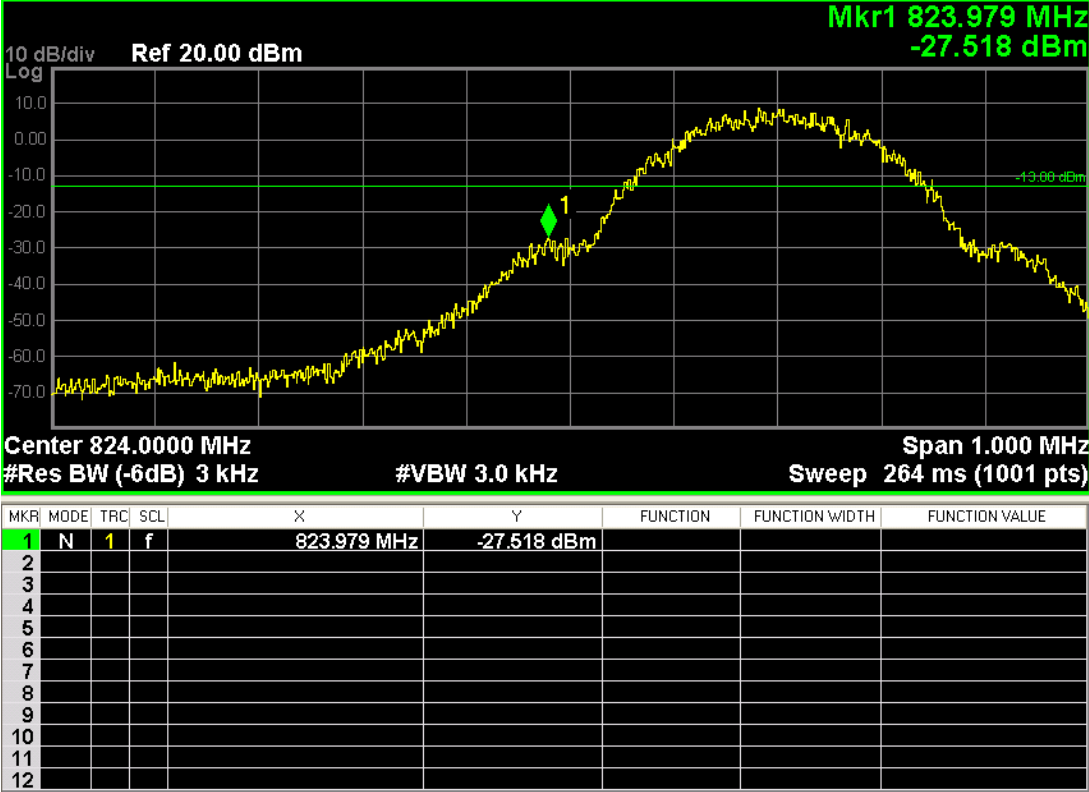
5.6. Test Result

GSM850 (GSM Link), Channel 128

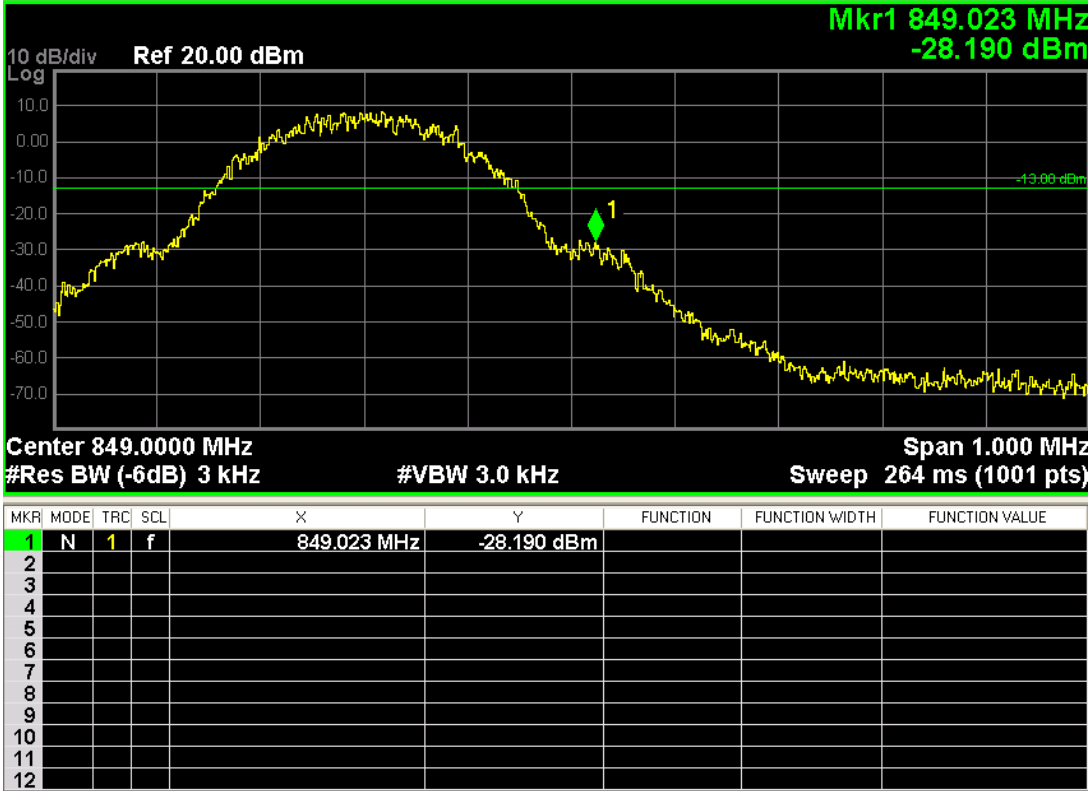


GSM850 (GSM Link), Channel 251

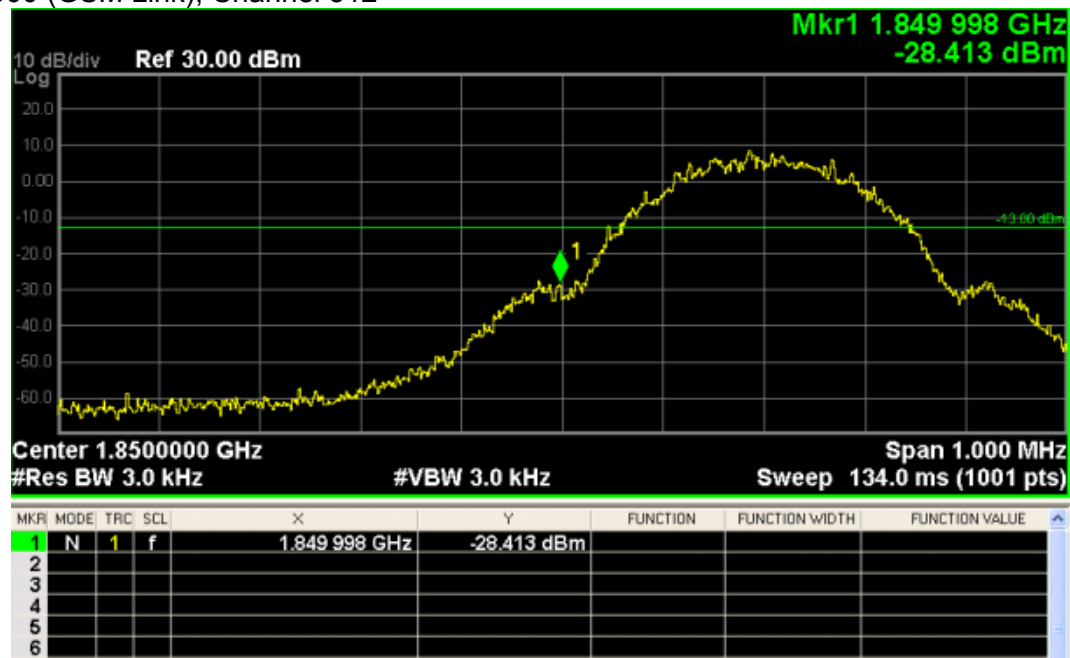




GSM850 (GPRS 8 Link), Channel 251

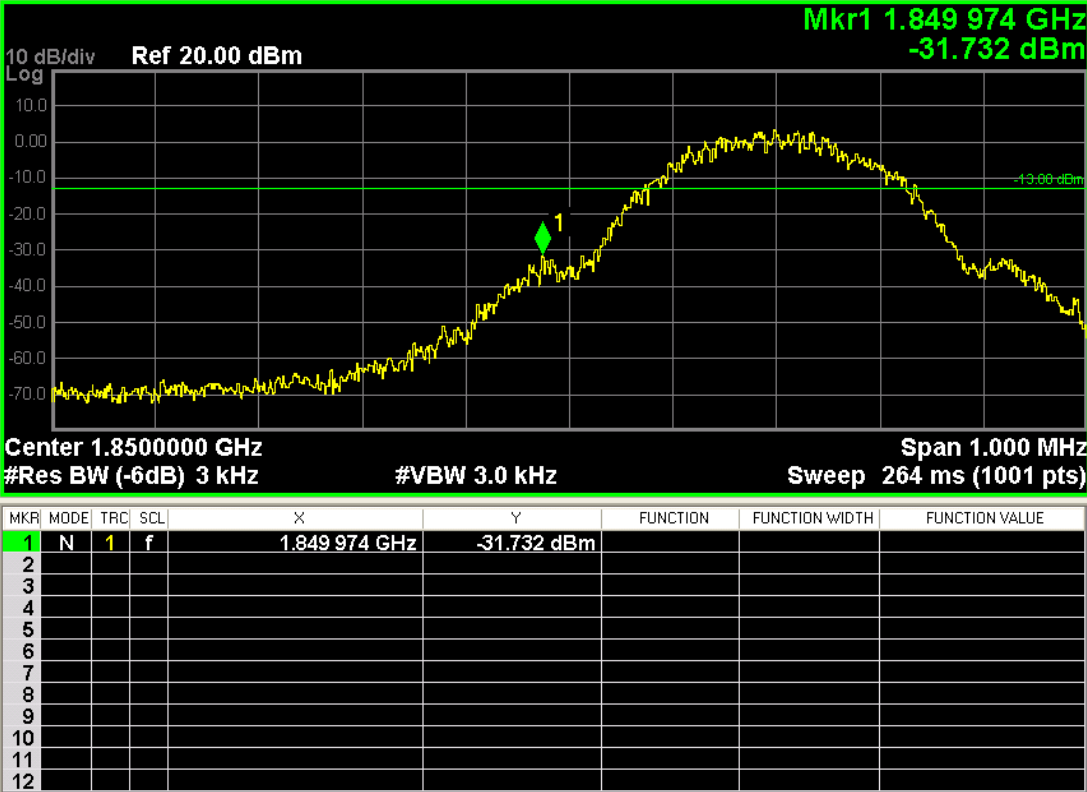


GSM 1900 (GSM Link), Channel 512

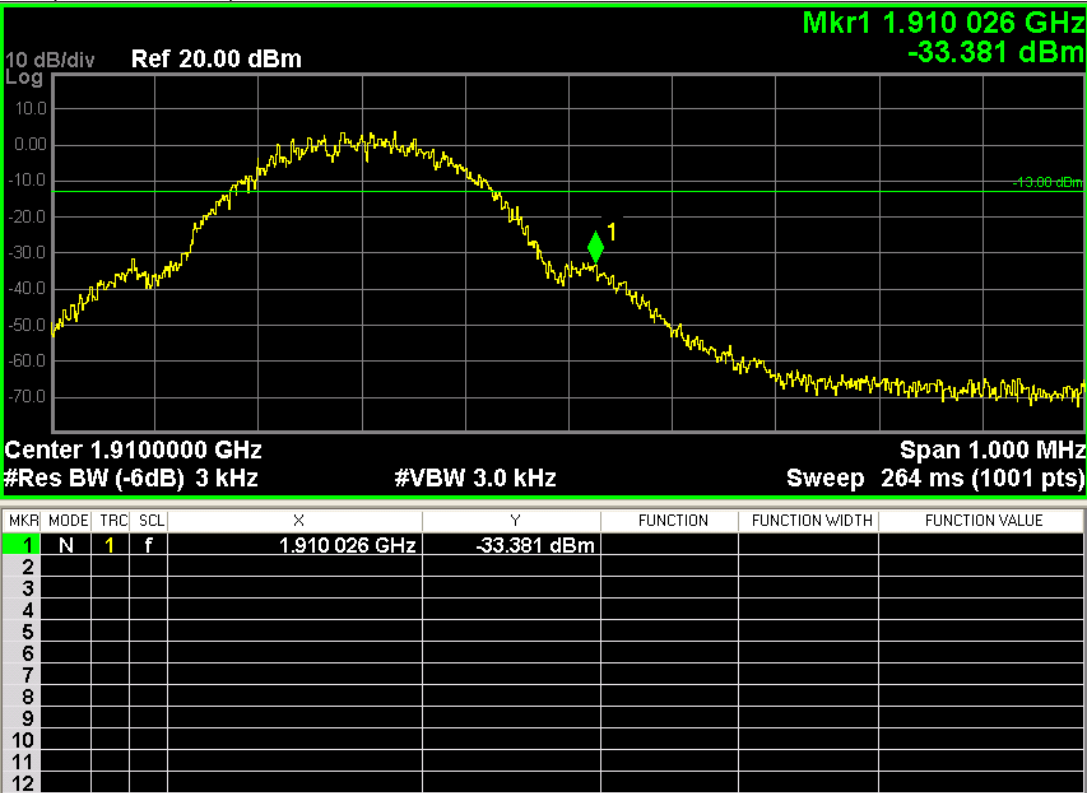


GSM 1900 (GSM Link), Channel 810





GSM1900 (GPRS 8 Link), Channel 810



## 6.Spurious Emission

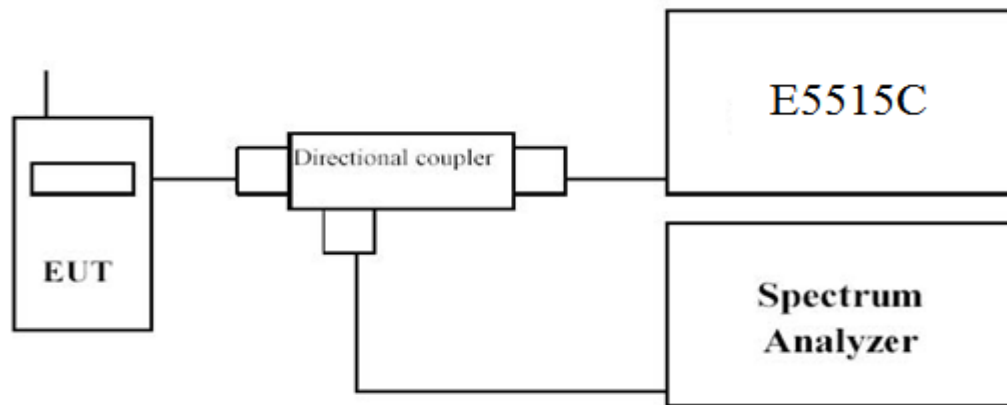
### 6.1. Test Equipment

| Instrument                 | Manufacturer | Model     | Serial No. | Cali. Due Date |
|----------------------------|--------------|-----------|------------|----------------|
| Spectrum Analyzer          | Agilent      | N9038A    | MY51210142 | 2014.12.17     |
| Radio Communication Tester | Agilent      | E5515C    | GB46581718 | 2014.10.21     |
| Signal Generator           | Agilent      | N5183A    | MY50140938 | 2015.01.03     |
| Preamplifier               | CEM          | EM30180   | 3008A0245  | 2015.02.28     |
| Loop Antenna               | Schwarzbeck  | FMZB1519  | 1519-020   | 2015.03.26     |
| Bilog Antenna              | Schwarzbeck  | VULB9160  | 9160-3316  | 2015.07.18     |
| VHF-UHF-Biconical Antenna  | Schwarzbeck  | VUBA9117  | 9117-263   | 2015.07.18     |
| Broad-Band Horn Antenna    | Schwarzbeck  | BBHA9120D | 9120D-942  | 2015.07.18     |
| Broad-Band Horn Antenna    | Schwarzbeck  | BBHA9120D | 9120D-943  | 2015.07.18     |

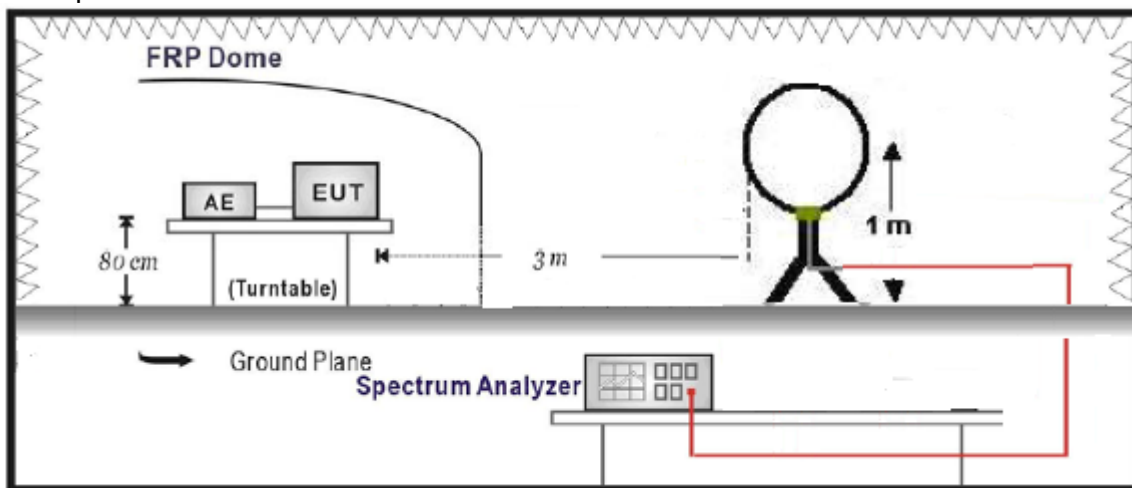
The measure equipment had been calibrated once a year.

## 6.2. Test Setup

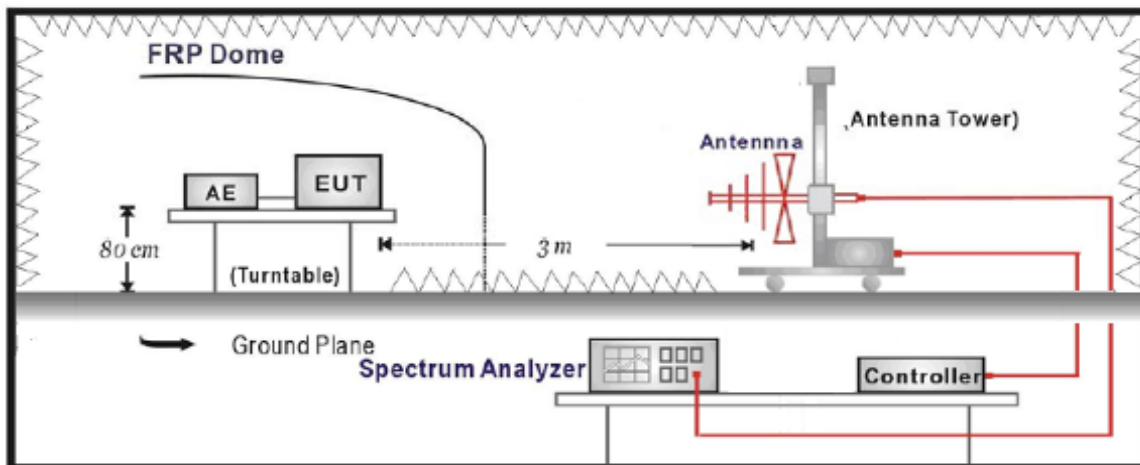
Conducted Spurious Emission Measurement:



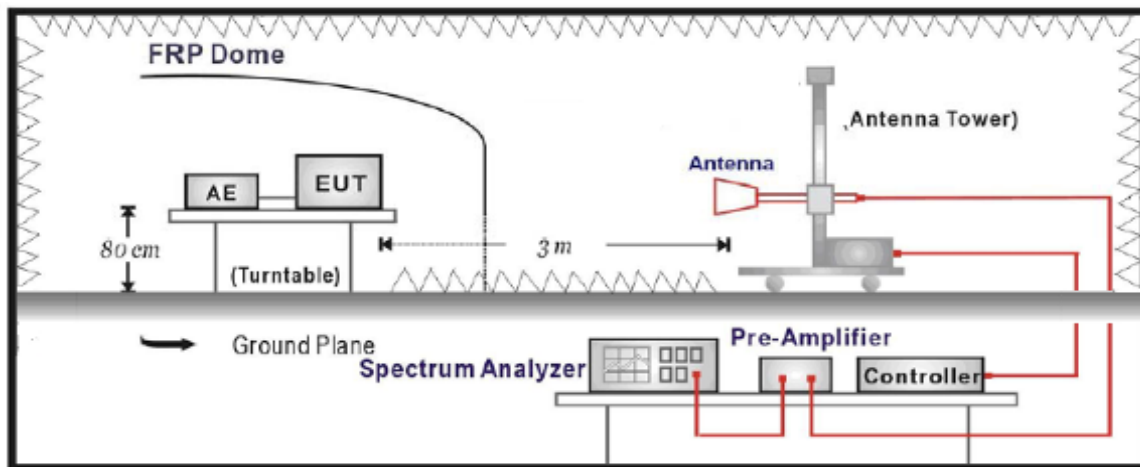
Radiated Spurious Measurement: below 30MHz



Radiated Spurious Measurement: 30MHz to 1GHz



### Radiated Spurious Measurement: above 1GHz



### 6.3. Limit

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10\log(P)$  dB.

### 6.4. Test Procedure

#### Conducted Spurious Measurement:

- Place the EUT on a bench and set it in transmitting mode.
- Connect a low loss RF cable from the antenna port to a spectrum analyzer and E5515C by a Directional Coupler.
- EUT Communicate with E5515C, then select a channel for testing.
- Add a correction factor to the display of spectrum, and then test.
- The resolution bandwidth of the spectrum analyzer was set at 1 MHz, sufficient scans were taken to show the out of band Emission if any up to 10th harmonic.

#### Radiated Spurious Measurement:

- The EUT shall be placed at the specified height on a support, and in the position closest to normal use as declared by provider.
- The test antenna shall be oriented initially for vertical polarization and shall be chosen to correspond to the frequency of the transmitter
- The output of the test antenna shall be connected to the measuring receiver. The transmitter shall be switched on and the measuring receiver shall be tuned to the frequency of the transmitter under test.
- The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
- The transmitter shall then be rotated through  $360^\circ$  in the horizontal plane, until the maximum signal level is detected by the measuring receiver.

- f. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
- h. The maximum signal level detected by the measuring receiver shall be noted.
- i. The transmitter shall be replaced by a substitution antenna.
- j. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
- k. The substitution antenna shall be connected to a calibrated signal generator.
- l. If necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
- m. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
- n. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
- o. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.
- p. The measure of the effective radiated power is the larger of the two levels recorded at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.
- q. The frequency range was checked up to 10<sup>th</sup> harmonic.
- r. Test site anechoic chamber refer to ANSI/TIA-603-C-2004.

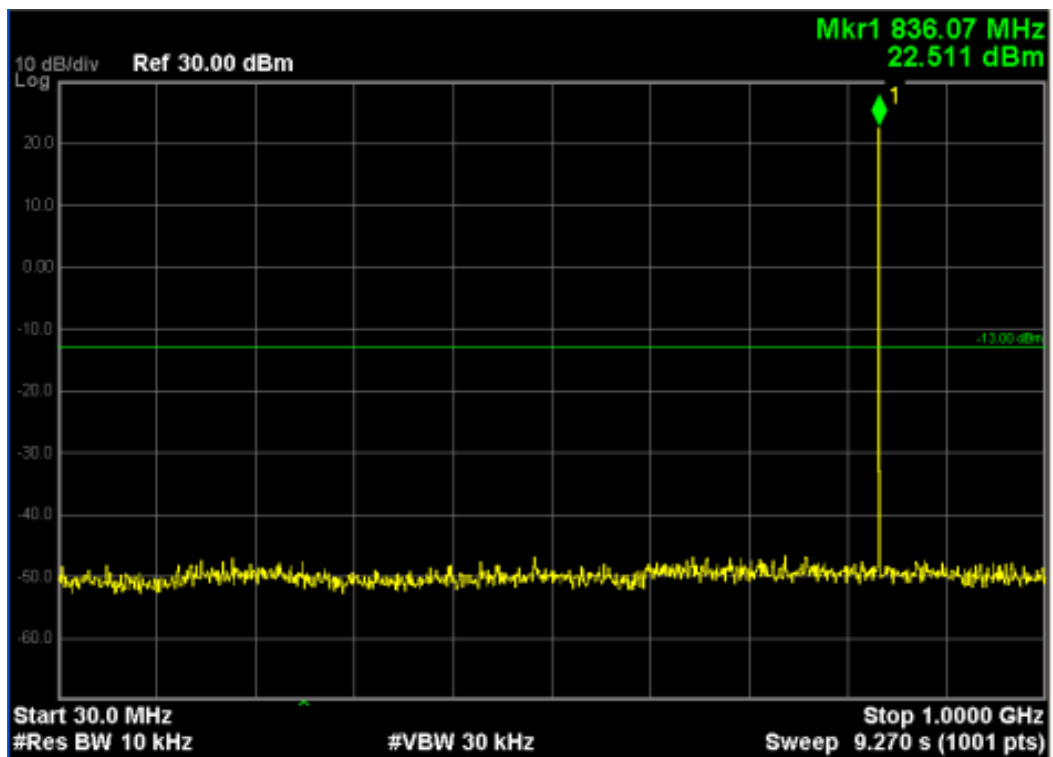
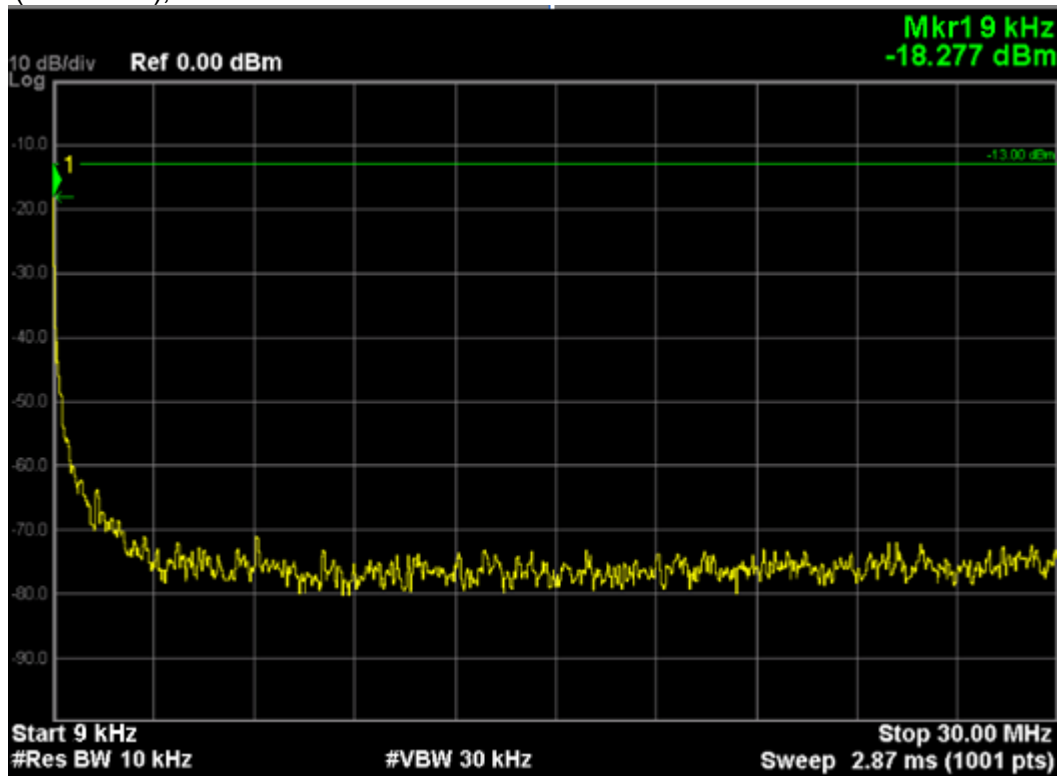
## 6.5. Uncertainty

The measurement uncertainty is defined as 3.2 dB for Radiated Power Measurement.

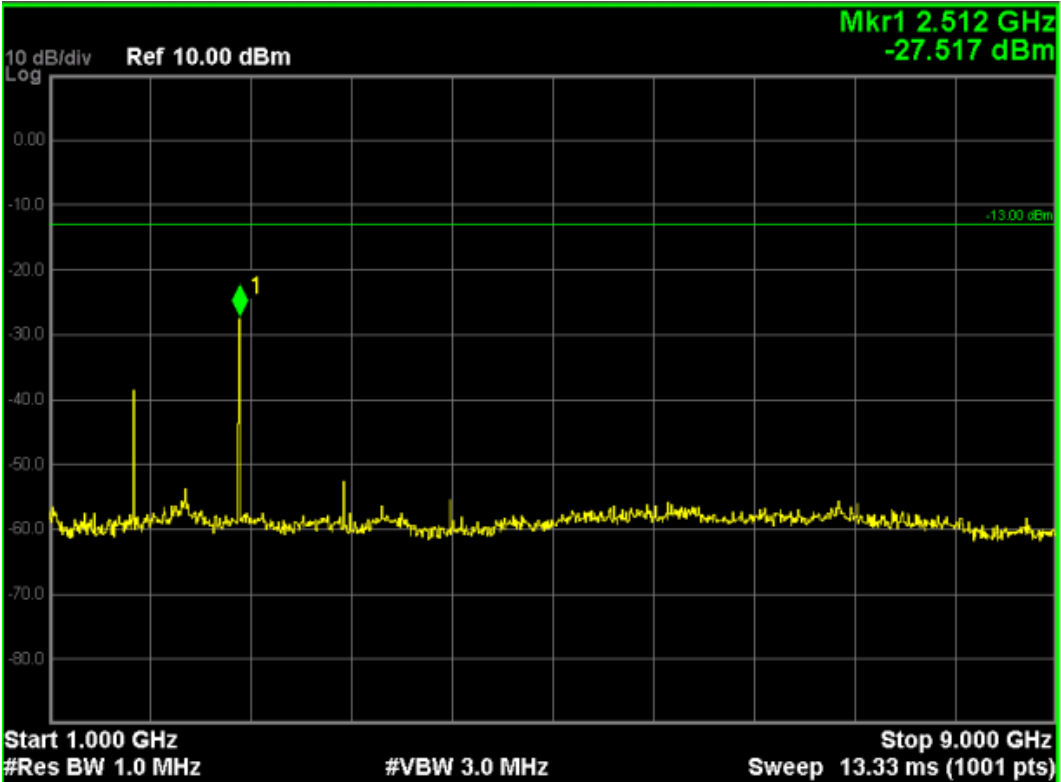
## 6.6. Test Result

### Conducted Spurious Measurement:

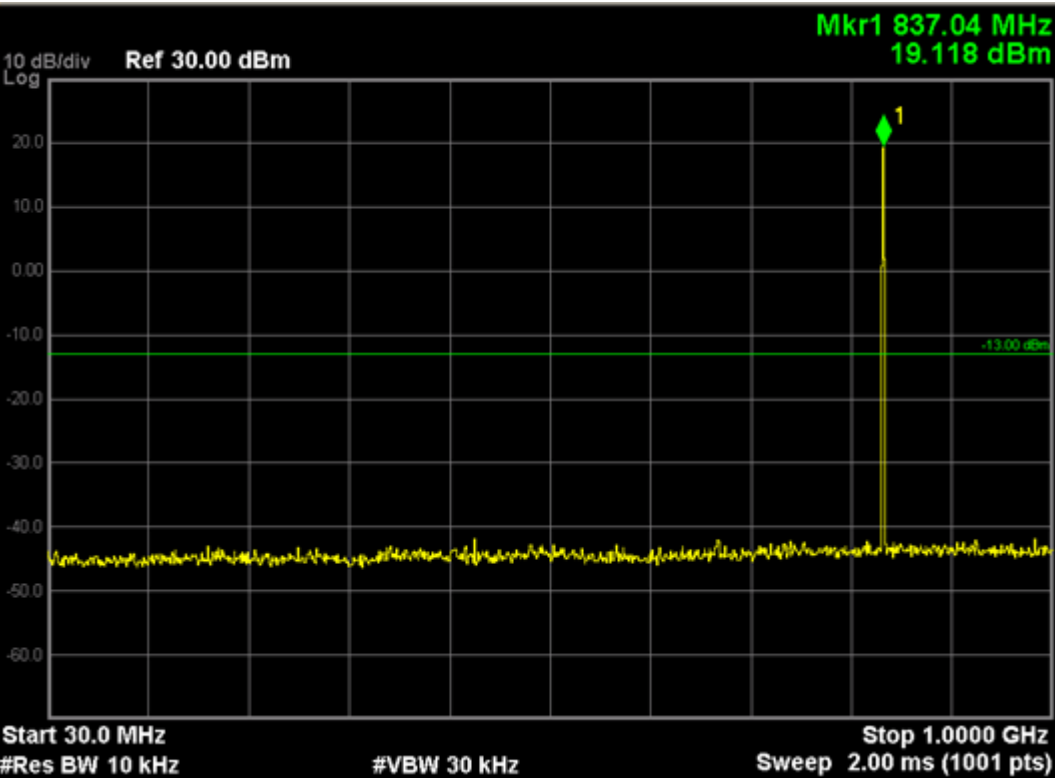
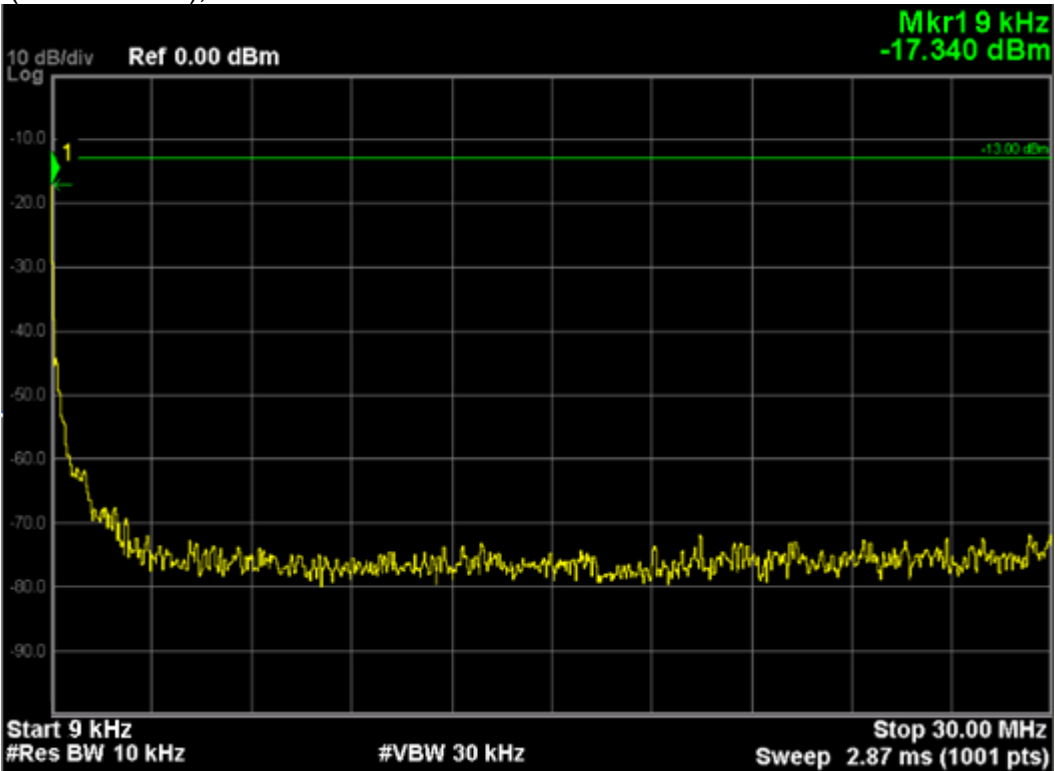
GSM850 (GSM Link), Channel 189



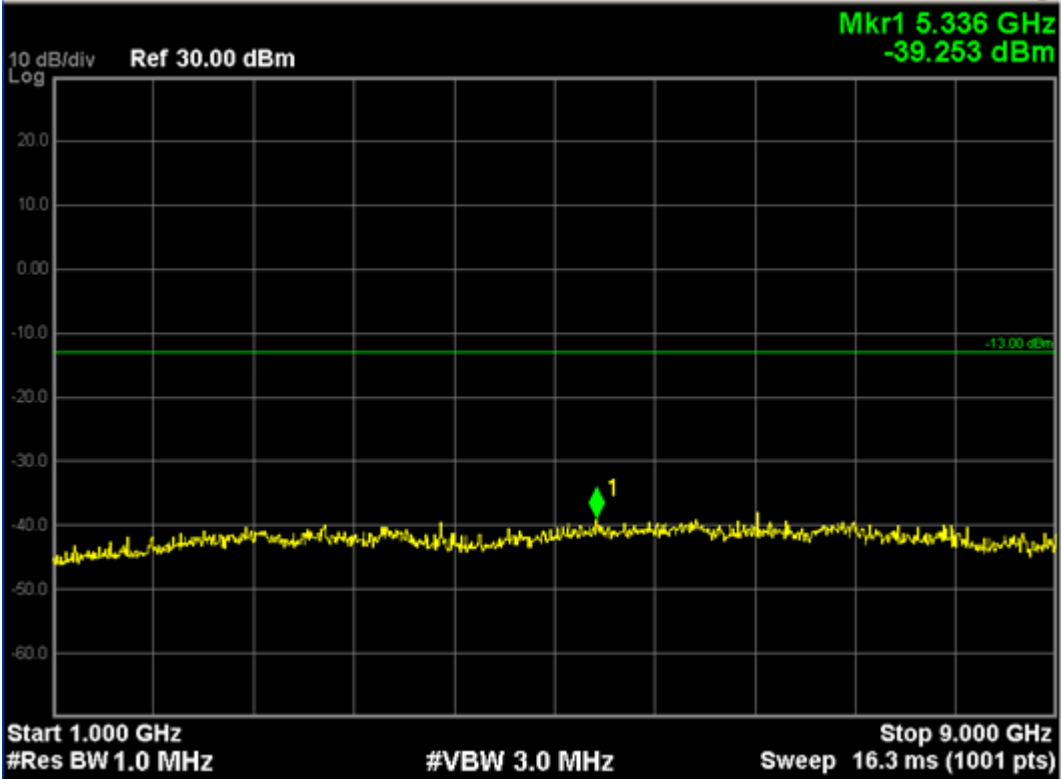
Note: The signal at point 1 is carrier



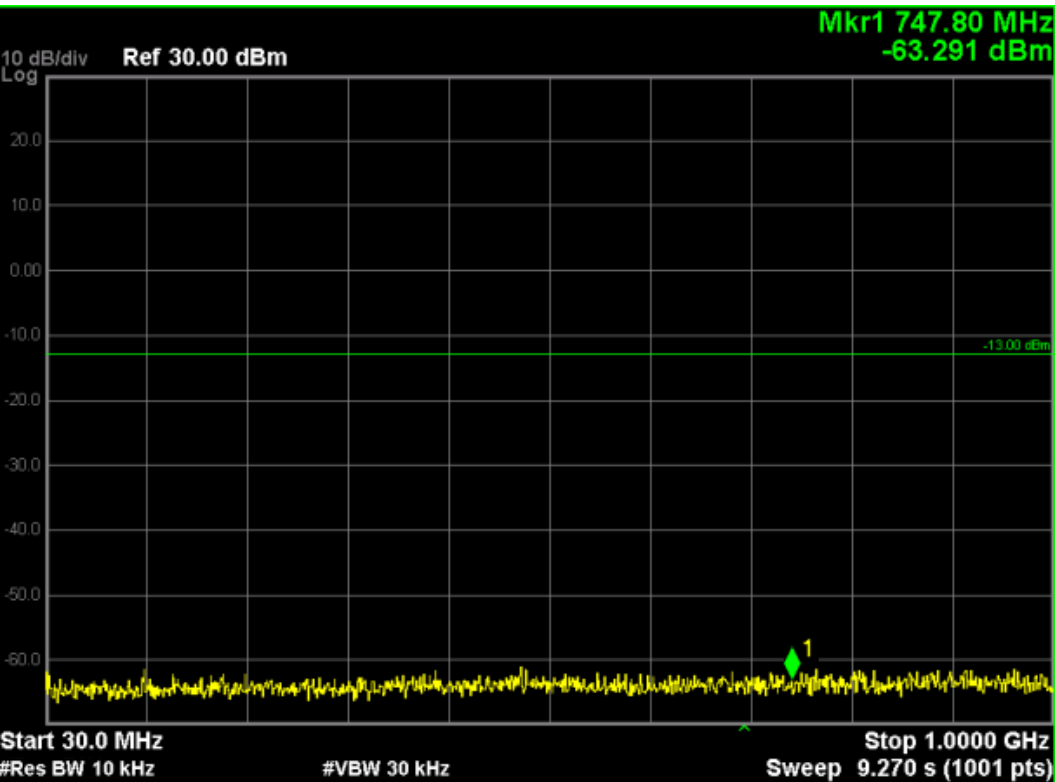
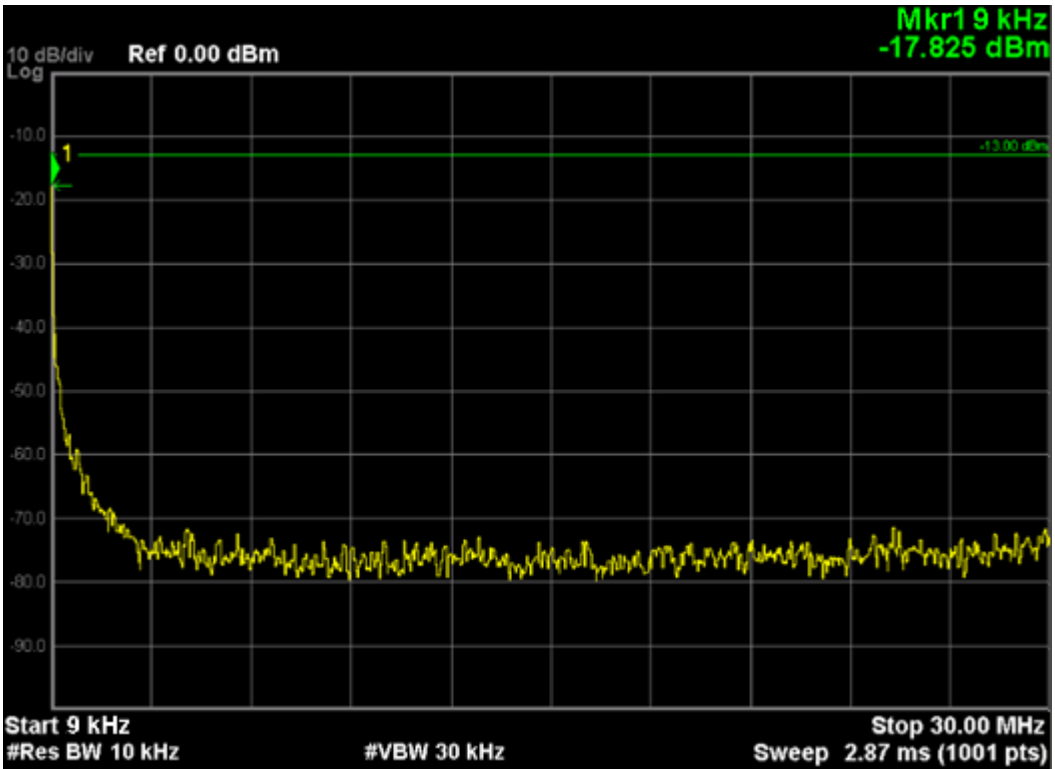
GSM850 (GPRS 8 Link), Channel 189

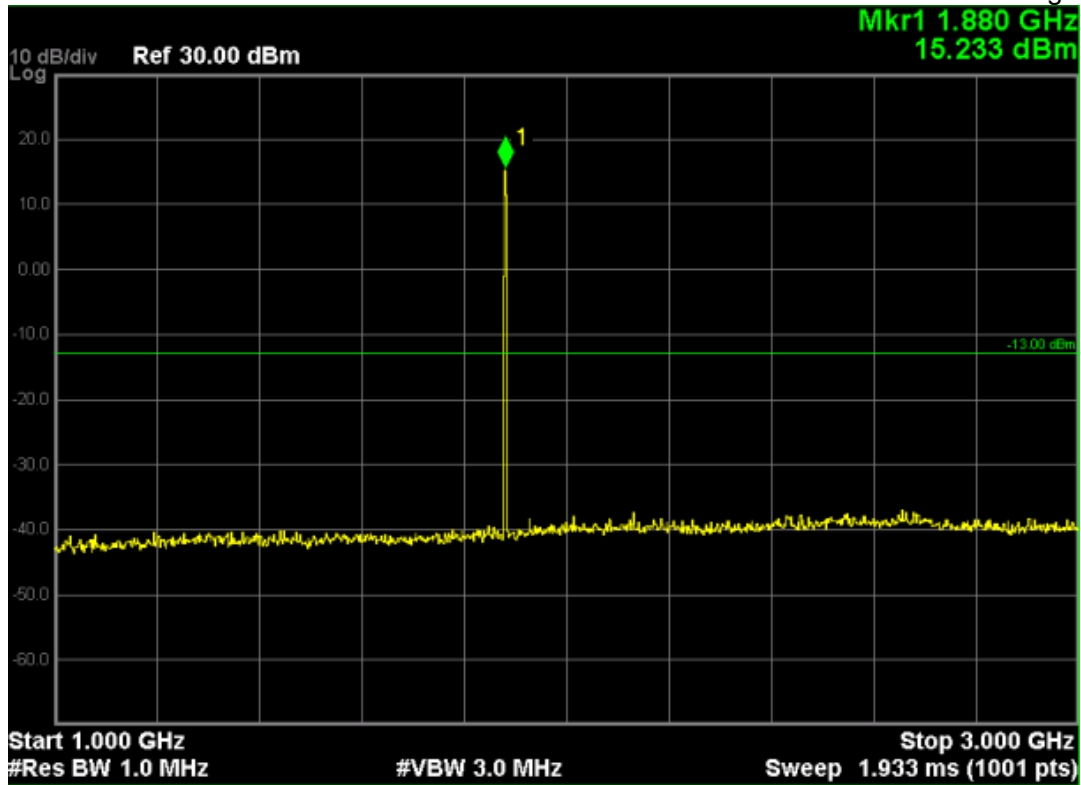


Note: The signal at point 1 is carrier.

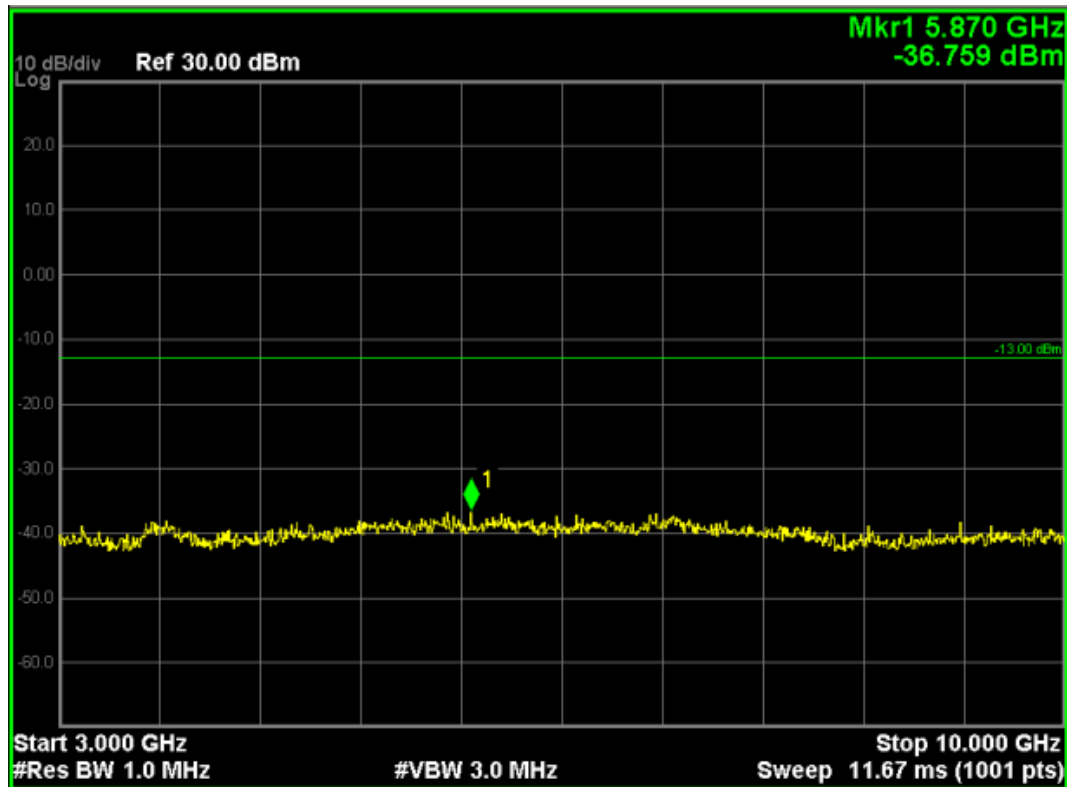


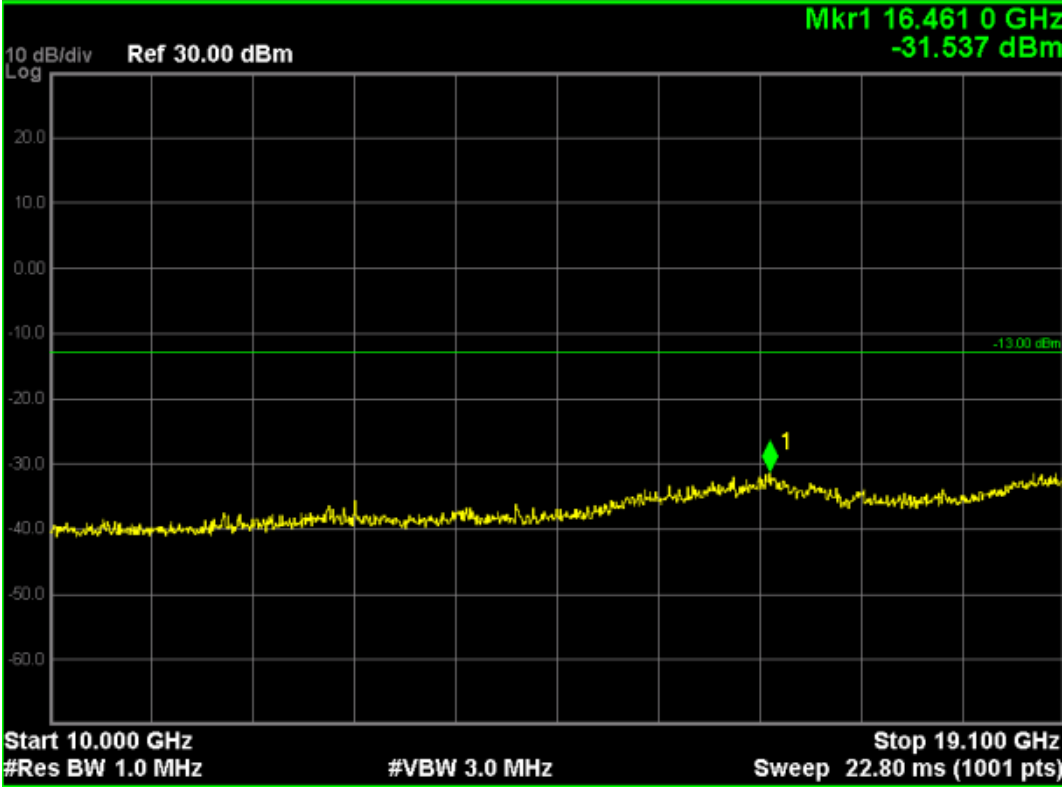
GSM 1900 (GSM Link), Channel 661

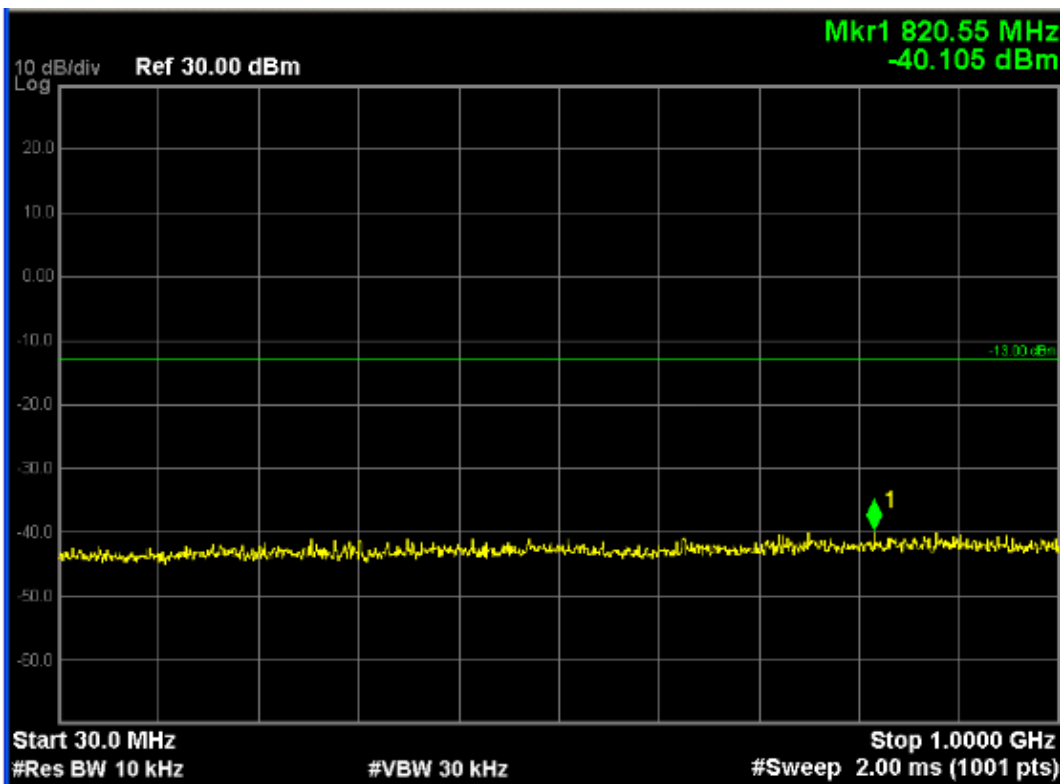
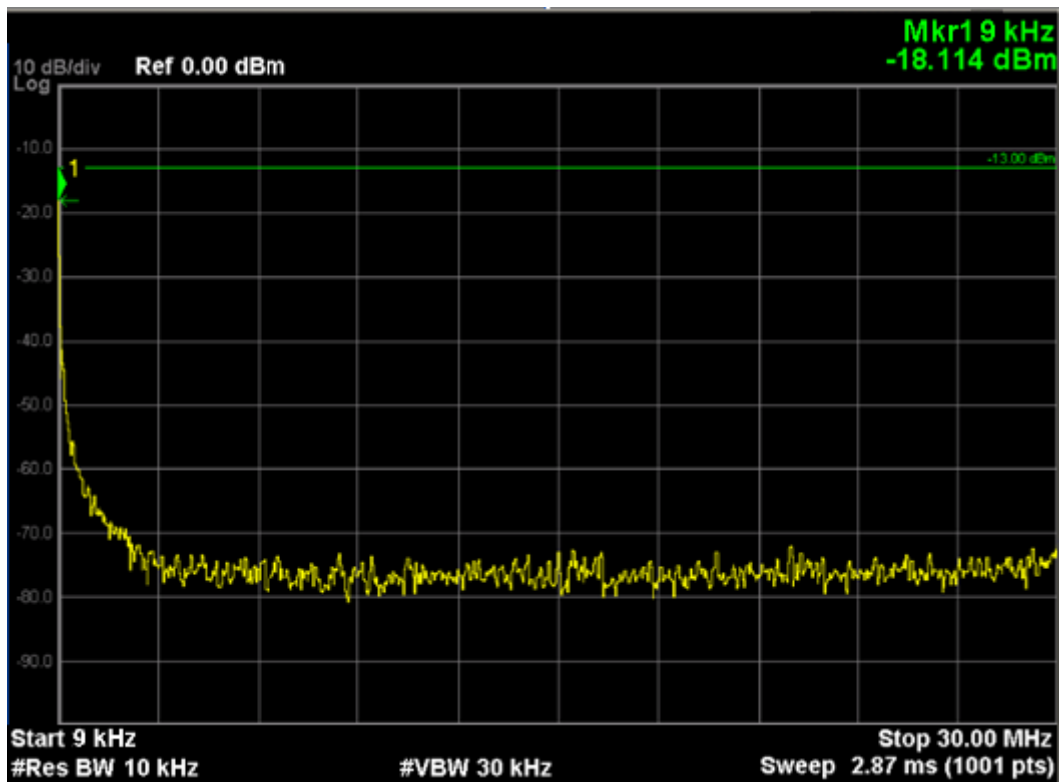


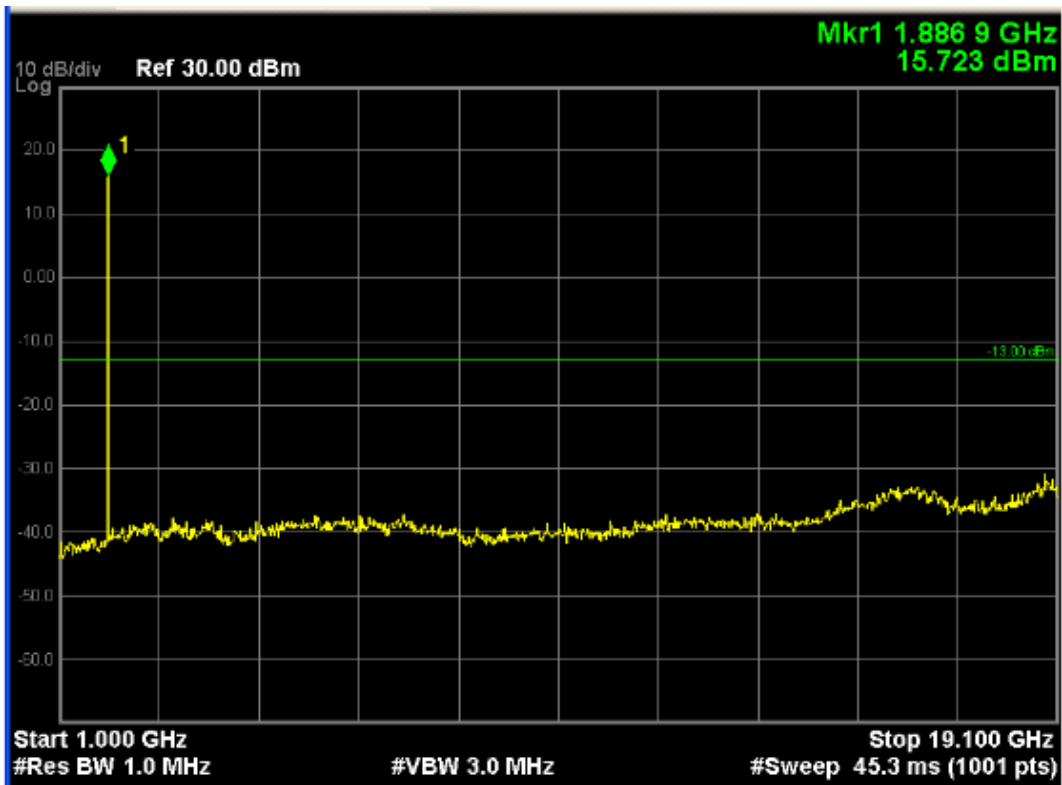


Note: The signal at point 1 is carrier









Note: The signal at point 1 is carrier.

### Radiated Spurious Measurement:

#### GSM850 (GSM Link), 9KHz to 30MHz

The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line, and that was not reported per 2.1057 (c).

#### GSM850 (GSM Link), 30MHz to 1GHz

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Antenna Factor (dBm) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------------------|-----------------|------------------|-----------------|----------------------|-----------|-------------|-------------|
| Middle Channel 189 (836.40MHz) |                 |                  |                 |                      |           |             |             |
| 236.7                          | H               | -60.21           | 2.10            | -0.70                | -63.01    | -13.00      | -50.01      |
| 845.1                          | H               | -65.32           | 3.42            | -2.32                | -71.06    | -13.00      | -58.06      |
| 236.7                          | V               | -61.14           | 2.10            | -0.70                | -63.96    | -13.00      | -50.96      |
| 845.1                          | V               | -67.20           | 3.42            | -2.32                | -72.94    | -13.00      | -59.94      |

#### GSM850 (GSM Link), Above 1GHz

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------------------|-----------------|------------------|-----------------|------------|-----------|-------------|-------------|
| Middle Channel 189 (836.40MHz) |                 |                  |                 |            |           |             |             |
| 1572.5                         | H               | -60.44           | 2.10            | -0.70      | -63.24    | -13.00      | -50.24      |
| 7174.6                         | H               | -66.21           | 3.42            | -2.32      | -71.95    | -13.00      | -58.95      |
| 1572.5                         | V               | -62.23           | 2.10            | -0.70      | -65.03    | -13.00      | -52.03      |
| 7174.6                         | V               | -65.42           | 3.42            | -2.32      | -71.16    | -13.00      | -58.16      |

#### GSM850 (GPRS 8 Link), 30MHz to 1GHz

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------------------|-----------------|------------------|-----------------|------------|-----------|-------------|-------------|
| Middle Channel 189 (836.40MHz) |                 |                  |                 |            |           |             |             |
| 236.5                          | H               | -61.35           | 2.10            | -0.70      | -64.15    | -13.00      | -51.15      |
| 845.2                          | H               | -67.20           | 3.42            | -2.32      | -72.94    | -13.00      | -59.94      |
| 236.5                          | V               | -63.27           | 2.10            | -0.70      | -66.07    | -13.00      | -53.07      |
| 845.2                          | V               | -66.41           | 3.42            | -2.32      | -72.15    | -13.00      | -59.15      |

**GSM850 (GPRS 8 Link), Above 1GHz**

| Frequency (MHz)                | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | ERP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------------------|-----------------|------------------|-----------------|------------|-----------|-------------|-------------|
| Middle Channel 189 (836.40MHz) |                 |                  |                 |            |           |             |             |
| 1662.3                         | H               | -51.40           | 5.82            | 7.62       | -50.00    | -13.00      | -37.00      |
| 3321.4                         | H               | -43.56           | 7.21            | 8.20       | -42.57    | -13.00      | -29.57      |
| 1662.3                         | V               | -53.82           | 5.82            | 7.62       | -52.02    | -13.00      | -39.02      |
| 3321.4                         | V               | -45.15           | 7.21            | 8.20       | -44.16    | -13.00      | -31.16      |

**GSM1900 (GSM Link), 9KHz to 30MHz**

The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line, and that was not reported per 2.1057 (c).

**GSM 1900 (GSM Link), 30MHz to 1GHz**

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Antenna Factor (dBm) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------------|-----------------|------------------|-----------------|----------------------|------------|-------------|-------------|
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |                      |            |             |             |
| 256.9                           | H               | -95.72           | 2.17            | 26.41                | -67.14     | -13.00      | -54.14      |
| 779.8                           | H               | -95.67           | 3.82            | 40.01                | -51.84     | -13.00      | -38.84      |
| 256.9                           | V               | -96.64           | 2.17            | 23.20                | -71.17     | -13.00      | -58.17      |
| 779.8                           | V               | -95.10           | 3.82            | 32.23                | -59.05     | -13.00      | -46.05      |

**GSM 1900 (GSM Link), Above 1GHz**

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBi) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------------|-----------------|------------------|-----------------|------------|------------|-------------|-------------|
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |            |            |             |             |
| 1821.8                          | H               | -50.74           | 6.22            | 1.61       | -46.13     | -13.00      | -33.13      |
| 3757.2                          | H               | -62.90           | 8.95            | -3.16      | -50.79     | -13.00      | -37.79      |
| 1821.8                          | V               | -43.17           | 6.22            | 1.61       | -38.56     | -13.00      | -25.56      |
| 3757.2                          | V               | -56.64           | 8.95            | -3.16      | -44.53     | -13.00      | -31.53      |

**GSM1900 (GPRS 8 Link), 30MHz to 1GHz**

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------------|-----------------|------------------|-----------------|------------|------------|-------------|-------------|
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |            |            |             |             |
| 312.4                           | H               | -63.50           | 2.17            | 1.58       | -64.09     | -13.00      | -51.09      |
| 824.5                           | H               | -68.46           | 3.85            | -0.35      | -72.66     | -13.00      | -59.66      |
| 312.4                           | V               | -71.28           | 2.17            | 1.58       | -71.87     | -13.00      | -58.87      |
| 824.5                           | V               | -70.51           | 3.85            | -0.35      | -74.71     | -13.00      | -61.71      |

**GSM1900 (GPRS 8 Link), Above 1GHz**

| Frequency (MHz)                 | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Gain (dBd) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|---------------------------------|-----------------|------------------|-----------------|------------|------------|-------------|-------------|
| Middle Channel 661 (1880.00MHz) |                 |                  |                 |            |            |             |             |
| 3742.5                          | H               | -59.12           | 8.98            | 12.84      | -55.26     | -13.00      | -42.26      |
| 8405.3                          | H               | -63.38           | 11.35           | 13.24      | -61.49     | -13.00      | -48.49      |
| 3742.5                          | V               | -61.15           | 8.98            | 12.84      | -57.29     | -13.00      | -44.29      |
| 8405.3                          | V               | -65.24           | 11.35           | 13.24      | -63.35     | -13.00      | -50.35      |

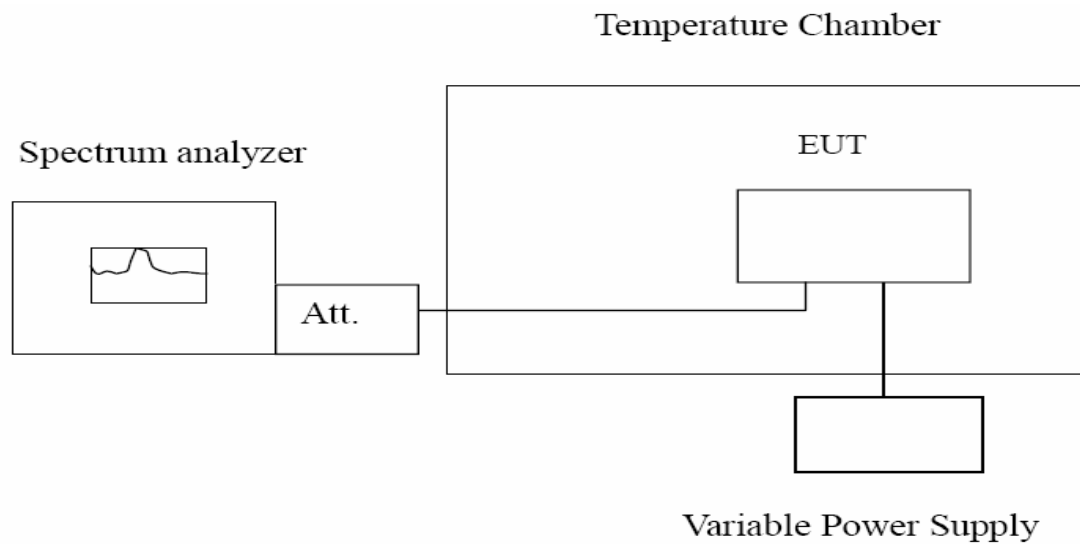
## 7. Frequency Stability Under Temperature & Voltage Variations

### 7.1. Test Equipment

| Instrument                 | Manufacturer | Model    | Serial No.     | Cali. Due Date |
|----------------------------|--------------|----------|----------------|----------------|
| Spectrum Analyzer          | Agilent      | N9038A   | MY51210142     | 2014.12.17     |
| Radio Communication Tester | Agilent      | E5515C   | GB46581718     | 2014.10.21     |
| DC Power Supply            | Agilent      | 6612C    | MY43002989     | 2015.03.03     |
| Temperature Chamber        | WEISS        | DU/20/40 | 58226017340050 | 2015.01.03     |

The measure equipment had been calibrated once a year.

### 7.2. Test Setup



### 7.3. Limit

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

|       |                         |
|-------|-------------------------|
| Limit | $< \pm 2.5 \text{ ppm}$ |
|-------|-------------------------|

### 7.4. Test Procedure

#### Frequency Stability Under Temperature Variations:

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -20°C. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C increased per stage until the highest temperature of +50°C reached.

#### Frequency Stability Under Voltage Variations:

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency. Reduce the input voltage to specify extreme voltage variation ( $\pm 15\%$ ) and endpoint, record the maximum frequency change.

### 7.5. Uncertainty

The measurement uncertainty is defined as  $\pm 10 \text{ Hz}$ .

## 7.6. Test Result

### GSM850 (GSM Link):

#### Frequency Stability under Temperature

| Temperature Interval (°C) | Test Frequency (MHz) | Deviation | Limit (Hz) |
|---------------------------|----------------------|-----------|------------|
|                           |                      | (Hz)      |            |
| -20                       | 836.40               | -25.23    | ± 2091     |
| -10                       | 836.40               | -23.99    | ± 2091     |
| 0                         | 836.40               | -18.21    | ± 2091     |
| 10                        | 836.40               | -13.17    | ± 2091     |
| 20                        | 836.40               | -11.25    | ± 2091     |
| 30                        | 836.40               | -24.61    | ± 2091     |
| 40                        | 836.40               | -34.12    | ± 2091     |
| 50                        | 836.40               | -33.52    | ± 2091     |
| 60                        | 836.40               | -35.57    | ± 2091     |

#### Frequency Stability under Voltage

| DC Voltage (V) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|----------------|----------------------|----------------|------------|
| 10.2           | 836.40               | -18.51         | ± 2091     |
| 12             | 836.40               | -21.30         | ± 2091     |
| 13.8           | 836.40               | -29.74         | ± 2091     |

**Notes:** the manufacture declared that the EUT could work between voltages 8V~32V, and this EUT could normally work under the condition from -20°C to 60°C, otherwise this EUT will shut down and not transmit.

Frequency Stability under Temperature

| Temperature Interval (°C) | Test Frequency (MHz) | Deviation | Limit (Hz) |
|---------------------------|----------------------|-----------|------------|
|                           |                      | (Hz)      |            |
| -20                       | 836.40               | -20.62    | ±2091      |
| -10                       | 836.40               | -17.52    | ±2091      |
| 0                         | 836.40               | -18.56    | ±2091      |
| 10                        | 836.40               | -17.20    | ±2091      |
| 20                        | 836.40               | -21.22    | ±2091      |
| 30                        | 836.40               | -30.61    | ±2091      |
| 40                        | 836.40               | -18.22    | ±2091      |
| 50                        | 836.40               | -20.16    | ±2091      |
| 60                        | 836.40               | -22.19    | ±2091      |

Frequency Stability under Voltage

| DC Voltage (V) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|----------------|----------------------|----------------|------------|
| 10.2           | 836.40               | -13.55         | ±2091      |
| 12             | 836.40               | -27.20         | ±2091      |
| 13.8           | 836.40               | -31.16         | ±2091      |

**Notes:** the manufacture declared that the EUT could work between voltages 8V~32V, and this EUT could normally work under the condition from -20°C to 60°C, otherwise this EUT will shut down and not transmit.

**GSM 1900 (GSM Link):**

Frequency Stability under Temperature

| Temperature Interval (°C) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|---------------------------|----------------------|----------------|------------|
| -20                       | 1880.00              | 28.32          | ±4700      |
| -10                       | 1880.00              | 25.21          | ±4700      |
| 0                         | 1880.00              | 12.01          | ±4700      |
| 10                        | 1880.00              | 5.34           | ±4700      |
| 20                        | 1880.00              | 10.88          | ±4700      |
| 30                        | 1880.00              | 22.31          | ±4700      |
| 40                        | 1880.00              | 30.24          | ±4700      |
| 50                        | 1880.00              | 38.95          | ±4700      |
| 60                        | 1880.00              | 41.05          | ±4700      |

Frequency Stability under Voltage

| DC Voltage (V) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|----------------|----------------------|----------------|------------|
| 10.2           | 1880.00              | 29.21          | ±4700      |
| 12             | 1880.00              | 25.74          | ±4700      |
| 13.8           | 1880.00              | 26.61          | ±4700      |

**Notes:** the manufacture declared that the EUT could work between voltages 8V~32V, and this EUT could normally work under the condition from -20°C to 60°C, otherwise this EUT will shut down and not transmit.

Frequency Stability under Temperature

| Temperature Interval (°C) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|---------------------------|----------------------|----------------|------------|
| -20                       | 1880.00              | -30.61         | ±4700      |
| -10                       | 1880.00              | -20.47         | ±4700      |
| 0                         | 1880.00              | -19.63         | ±4700      |
| 10                        | 1880.00              | -20.16         | ±4700      |
| 20                        | 1880.00              | -35.32         | ±4700      |
| 30                        | 1880.00              | -18.03         | ±4700      |
| 40                        | 1880.00              | -42.31         | ±4700      |
| 50                        | 1880.00              | -50.58         | ±4700      |
| 60                        | 1880.00              | -48.53         | ±4700      |

Frequency Stability under Voltage

| DC Voltage (V) | Test Frequency (MHz) | Deviation (Hz) | Limit (Hz) |
|----------------|----------------------|----------------|------------|
| 10.2           | 1880.00              | -17.51         | ±4700      |
| 12             | 1880.00              | -21.23         | ±4700      |
| 13.8           | 1880.00              | -10.38         | ±4700      |

**Notes:** the manufacture declared that the EUT could work between voltages 8V~32V, and this EUT could normally work under the condition from -20℃ to 60℃, otherwise this EUT will shut down and not transmit.

## **9.Attachment**

### **PHOTOGRAPHS OF TEST SETUP**

Please refer to the file named “RF Setup Photos”.

### **PHOTOGRAPHS OF EUT**

Please refer to the two files named “GV500\_EUT Photos”.

----End of the report----