# TEST REPORT

of

FCC Part 22 Subpart H and Part 24 Subpart E
FCC ID: ZKR- MVT100NET

| | | |
|---|---|---|
| Equipment Under Test | : | Mobile Video Telematics |
| Model Name | : | MVT100NET |
| Serial No. | : | N/A |
| Applicant | : | MLOGSEE, INC. |
| Manufacturer | : | MLOGSEE, INC. |
| Date of Test(s) | : | 2011.05.10 ~ 2011.05.23 |
| Date of Issue | : | 2011.05.23 |

In the configuration tested, the EUT complied with the standards specified above.

**Tested By:** Grant Lee **Date** 2011.05.23

**Approved By:** Charles Kim **Date** 2011.05.23

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# 1. General information

## 1.1. Testing laboratory

SGS Korea Co., Ltd.(Gunpo Laboratory)
- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

www.kr.sgs.com/ee
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

## 1.2. Details of applicant

Applicant : MLOGSEE, INC.
Address : Doosan Venture Digm #522, Dongan-gu Pyeongchon-Dong 126-1, Anyang-city Gyeonggi-Do, Korea
Contact Person : AN Eon-Gi
Phone No. : +82 +31 4782 0620

## 1.3. Description of EUT

| | |
|---|---|
| **Kind of Product** | Mobile Video Telematics |
| **Model Name** | MVT100NET |
| **Serial Number** | N/A |
| **Power Supply** | DC 12 ~ 24 V |
| **Conducted Power** | GSM850 : 31.60 ㏈m<br>GSM1900 : 28.90 ㏈m<br>WCDMA850 : 22.52 ㏈m<br>WCDMA1900 : 22.73 ㏈m |
| **Frequency Range** | GSM850 : 824.2 ㎒ ~ 848.8 ㎒<br>GSM1900 : 1 850.2 ㎒ ~ 1 909.8 ㎒<br>WCDMA850 : 826.4 ㎒ ~ 846.6 ㎒<br>WCDMA1900 : 1 852.4 ㎒ ~ 1 907.6 ㎒ |
| **Class of GPRS** | Class 10, Class B |
| **Ant gain** | GSM850 : 1.875 dBi<br>GSM1900 : 3.800 dBi<br>WCDMA850 : 1.875 dBi<br>WCDMA1900 : 3.800 dBi |

# The EUT is without voice mode

## 1.4. Description of test mode

| Band | Frequency (㎒) | Voice GSM | GPRS Data | | | |
|---|---|---|---|---|---|---|
| | | | GPRS 1 TX Slot | GPRS 2 TX Slot | GPRS 3 TX Slot | GPRS 4 TX Slot |
| | | (dB m ) | (dB m ) | (dB m ) | (dB m ) | (dB m ) |
| GSM 850 | 824.2 | N/A | **31.10** | 29.50 | N/A | N/A |
| | 836.6 | N/A | **31.30** | 29.70 | N/A | N/A |
| | 848.8 | N/A | **31.60** | 30.00 | N/A | N/A |
| GSM 1 900 | 1850.2 | N/A | **28.90** | 26.50 | N/A | N/A |
| | 1880.0 | N/A | **28.40** | 26.80 | N/A | N/A |
| | 1909.8 | N/A | **28.40** | 26.80 | N/A | N/A |

| Band | Frequency (㎒) | EDGE Data | | | |
|---|---|---|---|---|---|
| | | EDGE 1 TX Slot | EDGE 2 TX Slot | EDGE 3 TX Slot | EDGE 4 TX Slot |
| | | (dB m ) | (dB m ) | (dB m ) | (dB m ) |
| GSM 850 | 824.2 | **26.30** | 25.30 | N/A | N/A |
| | 836.6 | **26.40** | 24.50 | N/A | N/A |
| | 848.8 | **26.70** | 24.70 | N/A | N/A |
| GSM 1 900 | 1850.2 | **25.40** | 23.40 | N/A | N/A |
| | 1880.0 | **25.80** | 23.70 | N/A | N/A |
| | 1909.8 | **25.70** | 23.70 | N/A | N/A |

| 3GPP Release version | Mode | 3GPP 34.121 | Cellular Band[dB m ] | | | PCS Band[dB m ] | | |
|---|---|---|---|---|---|---|---|---|
| | | Subtest | 4132 | 4183 | 4233 | 9262 | 9400 | 9538 |
| 99 | WCDMA | 12.2kbps RMC | **22.22** | **22.52** | **22.46** | **22.60** | **22.73** | **22.19** |

GSM (850 / 1900)
We found out the test mode with the highest power level after we analyze all the data rates. So we chose GSM850 / GSM1900 1 TX slot and WCDMA 1900 12.2kbps RMC (worst case) as a representative.

## 1.5. Test equipment list

| Equipment | Manufacturer | Model | Cal Due. |
|---|---|---|---|
| Signal Generator | Agilent | E4438C | Mar. 31, 2012 |
| Signal Generator | Rohde & Schwarz | SMR40 | Jul. 18, 2011 |
| Spectrum Analyzer | Agilent | E4440A | Mar. 31, 2012 |
| Mobile Test Unit | Rohde & Schwarz | CMU200 | Sep. 29, 2011 |
| Directional Coupler | KRYTAR | 152661 | Jun. 01, 2011 |
| High Pass Filter | Wainwright | WHK3.0/18G-10SS | Sep. 29, 2011 |
| Band Reject Filter | Wainwright | WRCG824/849-814/85960/10SS | Apr. 01, 2012 |
| DC power Supply | Agilent | U8002A | Jan. 05, 2012 |
| Preamplifier | H.P. | 8447F | Jul. 05, 2011 |
| Preamplifier | Rohde & Schwarz | 8449B | Mar. 31, 2012 |
| Bilog Antenna | SCHWARZBECK MESSELEKTRONIK | 396 | Jul. 22, 2011 |
| Horn Antenna | Rohde & Schwarz | HF 906 | Oct. 08, 2011 |
| Horn Antenna | SCHWARZBECK | BBH 9120D | Nov. 09, 2011 |
| Dipole Antenna | VHAP/UHAP | 975/958 | Oct. 10, 2011 |
| Antenna Master | EMCO | 1050 | N.C.R. |
| Turn Table | Daeil EMC | DI-1500 | N.C.R. |
| Anechoic Chamber | SY Corporation | L × W × H (9.6 m × 6.4 m × 6.6 m) | N.C.R. |

## 1.6. Summary of test results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD : FCC Part 22, 24 | | |
|---|---|---|
| **Section in FCC part** | **Test Item** | **Result** |
| §2.1046<br>§22.913(a)<br>§24.232(b) | RF Radiated Output Power | Complied |
| §2.1053<br>§22.917(e)<br>§24.238(a) | Spurious Radiated Emission | Complied |
| §2.1046(a) | Conducted Output Power | Complied |
| §2.1049(h) (i) | Occupied Bandwidth | Complied |
| §2.1051<br>§22.917(e)<br>§24.238(a) | Spurious Emission at Antenna Terminal | Complied |
| §2.1055<br>§22.355<br>§24.235 | Frequency Stability | Complied |
| §22.917(e)<br>§24.238(a) | Band Edge | Complied |

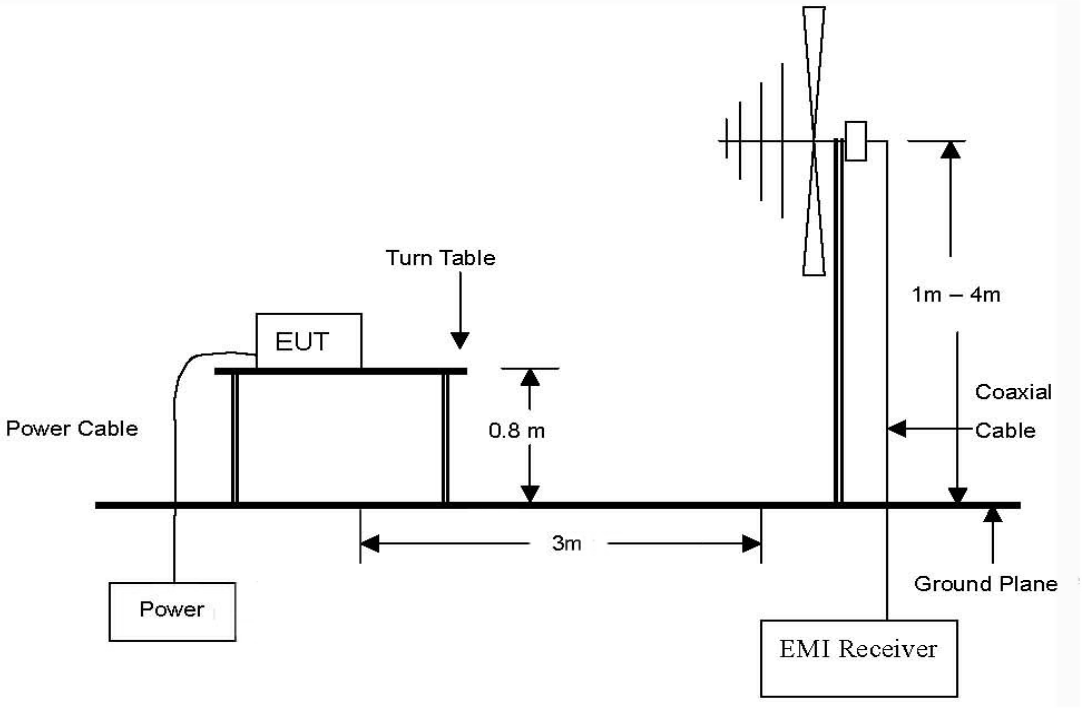
## 1.7. Test report revision

| Revision | Report number | Description |
|---|---|---|
| 0 | F690501/RF-RTL004701 | Initial |

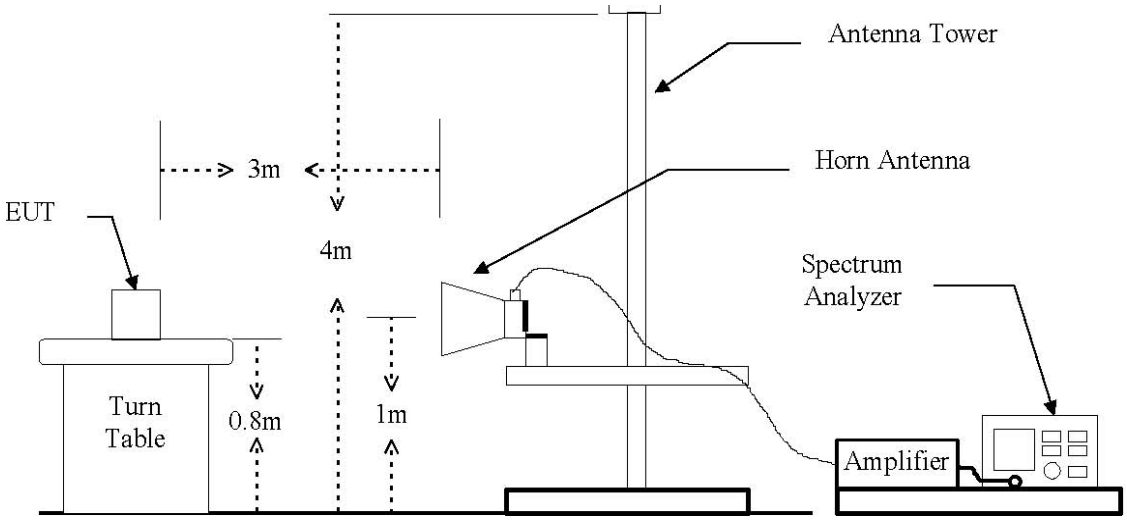
# 2. RF radiated output power & spurious radiated emission

## 2.1. Test setup

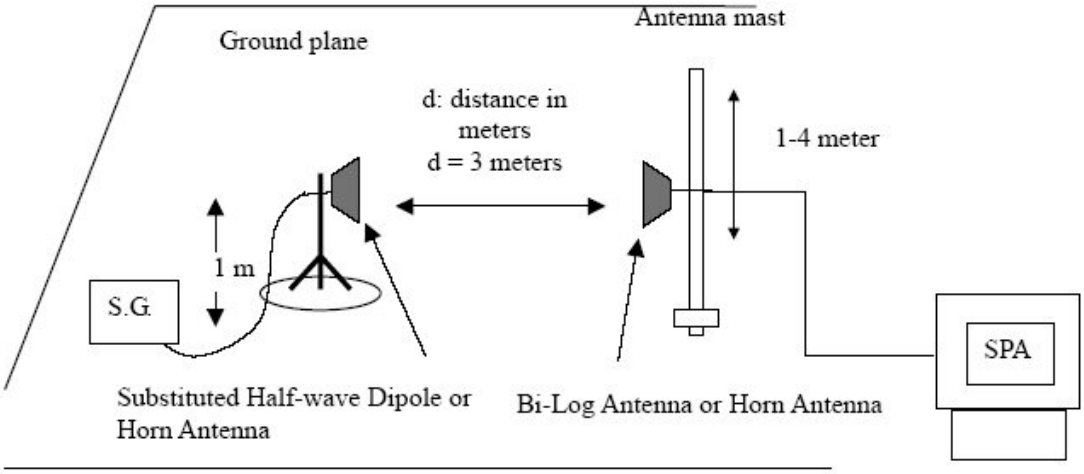
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 18 ㎓ Emissions.



The diagram below shows the test setup for substituted method



## 2.2. Limit

FCC §22.913(a), the ERP of mobile transmitters must not exceed 7 watts. FCC §24.232(b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

## 2.3. Test procedure : Based on ANSI/TIA 603C: 2004

1. On a test site, the EUT shall be placed at 80cm height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to he fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. During the measurement of the EUT, the resolution bandwidth was to 1 ㎒ and the average bandwidth was set to 1 ㎒.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. 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.
7. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. 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.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. The EUT was replaced by half-wave dipole (824 ~ 849 ㎒) or horn antenna (1 850 ~ 1 910 ㎒) connected to a signal generator.
11. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase he sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which 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.
14. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for any change of input attenuator setting of the measuring receiver.
15. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

## 2.4. Test result for RF radiated output power

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

**GSM850**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 824.2 | V | 38.01 | 3.42 | -11.17 | 23.42 | 219.79 |
| 824.2 | H | 47.33 | 3.42 | -11.17 | 32.74 | 1 879.32 |
| 836.6 | V | 33.61 | 3.38 | -11.47 | 18.77 | 75.34 |
| 836.6 | H | 47.13 | 3.38 | -11.47 | 32.29 | 1 694.34 |
| 848.8 | V | 34.95 | 3.33 | -11.76 | 19.85 | 96.61 |
| 848.8 | H | 46.54 | 3.33 | -11.76 | 31.44 | 1 393.16 |

**GSM850 (EDGE)**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 824.2 | V | 36.20 | 3.42 | -11.17 | 21.61 | 144.88 |
| 824.2 | H | 45.57 | 3.42 | -11.17 | 27.98 | 628.06 |

**GSM1900**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB i) | E.I.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 1 850.2 | V | 23.22 | 4.87 | 9.12 | 27.47 | 558.47 |
| 1 850.2 | H | 25.80 | 4.87 | 9.12 | 30.05 | 1 011.58 |
| 1 880.0 | V | 21.49 | 4.91 | 9.20 | 25.78 | 378.44 |
| 1 880.0 | H | 25.45 | 4.91 | 9.20 | 29.74 | 941.89 |
| 1 909.8 | V | 24.57 | 4.94 | 9.27 | 28.90 | 776.25 |
| 1 909.8 | H | 25.80 | 4.94 | 9.27 | 30.13 | 1 030.39 |

**GSM1900 (EDGE)**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.I.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 1 909.8 | V | 21.02 | 4.94 | 9.27 | 25.35 | 342.77 |
| 1 909.8 | H | 22.32 | 4.94 | 9.27 | 26.65 | 462.38 |

**WCDMA 850**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 826.40 | V | 26.45 | 3.41 | -11.22 | 11.82 | 15.21 |
| 826.40 | H | 38.08 | 3.41 | -11.22 | 23.45 | 221.31 |
| 836.60 | V | 27.51 | 3.38 | -11.47 | 12.67 | 18.49 |
| 836.60 | H | 37.62 | 3.38 | -11.47 | 22.78 | 189.67 |
| 846.60 | V | 27.54 | 3.34 | -11.71 | 12.49 | 17.74 |
| 846.60 | H | 38.17 | 3.34 | -11.71 | 23.12 | 205.12 |

**WCDMA1900**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB i) | E.I.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 1 852.4 | V | 18.05 | 4.87 | 9.12 | 22.30 | 169.82 |
| 1 852.4 | H | 21.04 | 4.87 | 9.12 | 25.29 | 338.06 |
| 1 880.0 | V | 17.41 | 4.91 | 9.20 | 21.70 | 147.91 |
| 1 880.0 | H | 20.90 | 4.91 | 9.20 | 25.19 | 330.37 |
| 1 907.6 | V | 17.82 | 4.94 | 9.27 | 22.15 | 164.06 |
| 1 907.6 | H | 18.81 | 4.94 | 9.27 | 23.14 | 206.06 |

*Remark:*
*1. E.R.P. & E.I.R.P = [S.G level + Amp.](dB m) - Cable loss(dB) + Ant. gain (dB d/dB i)*
*2. The E.R.P. & E.I.R.P was measured in three orthogonal EUT position (x-axis, y-axis and z-axis). Worst cases are x-axis.*

## 2.5. Spurious radiated emission

- Modulation Signal : GSM850
- Measured output Power : 32.74 ㏈m = 1.879 W
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = -45.74 ㏈c

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level (㏈m) | Cable loss (㏈) | Ant. gain (㏈d) | E.R.P. (㏈m) | ㏈c | Margin (㏈) |
|---|---|---|---|---|---|---|---|
| Low Channel (824.2 ㎒) | | | | | | | |
| 1 648.26 | V | -35.53 | 4.54 | 6.44 | -33.63 | -66.37 | 20.63 |
| 1 648.26 | H | -35.75 | 4.54 | 6.44 | -33.85 | -66.59 | 20.85 |
| Middle Channel (836.6 ㎒) | | | | | | | |
| 1 673.20 | V | -32.30 | 4.58 | 6.51 | -30.37 | -63.11 | 17.37 |
| 1 673.20 | H | -36.12 | 4.58 | 6.51 | -34.19 | -66.93 | 21.19 |
| High Channel (848.8 ㎒) | | | | | | | |
| 1 697.52 | V | -30.47 | 4.62 | 6.57 | -28.52 | -61.26 | 15.52 |
| 1 697.52 | H | -35.55 | 4.62 | 6.57 | -33.60 | -66.34 | 20.60 |

- Modulation Signal : GSM1900
- Measured output Power : 30.13 dBm = 1.030 W
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = - 43.13 dBc

| Frequency (MHz) | Ant. Pol. (H/V) | S.G level (dBm) | Cable loss (dB) | Ant. gain (dBi) | E.I.R.P. (dBm) | dBc | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low Channel(1 850.2 MHz) | | | | | | | |
| 3 700.48 | V | -35.06 | 7.13 | 11.85 | -30.34 | -60.47 | 17.34 |
| 3 700.48 | H | -38.15 | 7.13 | 11.85 | -33.43 | -63.56 | 20.43 |
| Middle Channel(1 880.0 MHz) | | | | | | | |
| 3 760.16 | V | -35.89 | 7.23 | 11.85 | -31.28 | -61.41 | 18.28 |
| 3 760.16 | H | -37.74 | 7.23 | 11.85 | -33.13 | -63.26 | 20.13 |
| High Channel(1 909.8 MHz) | | | | | | | |
| 3 819.43 | V | -37.18 | 7.33 | 11.84 | -32.67 | -62.80 | 19.67 |
| 3 819.43 | H | -43.42 | 7.33 | 11.84 | -38.91 | -69.04 | 25.91 |

- Modulation Signal : WCDMA850
- Measured output Power : 23.45 ㏈m =0.221 W
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = -36.44 ㏈c

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level (㏈m) | Cable loss (㏈) | Ant. gain (㏈d) | E.R.P. (㏈m) | ㏈c | Margin (㏈) |
|---|---|---|---|---|---|---|---|
| Low Channel (826.4 ㎒) | | | | | | | |
| 1 648.26 | V | -35.53 | 4.54 | 6.44 | -33.63 | -57.08 | 20.63 |
| 1 648.26 | H | -35.75 | 4.54 | 6.44 | -33.85 | -57.30 | 20.85 |
| Middle Channel (836.6 ㎒) | | | | | | | |
| 1 673.18 | V | -32.30 | 4.58 | 6.51 | -30.37 | -53.82 | 17.37 |
| 1 673.18 | H | -36.12 | 4.58 | 6.51 | -34.19 | -57.64 | 21.19 |
| High Channel (846.60 ㎒) | | | | | | | |
| 1 697.52 | V | -30.47 | 4.61 | 6.57 | -28.52 | -51.97 | 15.52 |
| 1 697.52 | H | -35.55 | 4.61 | 6.57 | -33.60 | -57.05 | 20.60 |

- Modulation Signal : WCDMA1900
- Measured output Power : 25.29 ㏈m = 0.338 W
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = - 38.29 ㏈c

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level (㏈m) | Cable loss (㏈) | Ant. gain (㏈i) | E.I.R.P. (㏈m) | ㏈c | Margin (㏈) |
|---|---|---|---|---|---|---|---|
| Low Channel(1 852.40 ㎒) | | | | | | | |
| 3 702.53 | V | -47.70 | 7.13 | 11.85 | -42.99 | -68.28 | 29.99 |
| 3 702.53 | H | -47.18 | 7.13 | 11.85 | -42.47 | -67.76 | 29.47 |
| Middle Channel(1 880.0 ㎒) | | | | | | | |
| 3 757.60 | V | -45.84 | 7.23 | 11.85 | -41.22 | -66.51 | 28.22 |
| 3 757.60 | H | -47.73 | 7.23 | 11.85 | -43.11 | -68.40 | 30.11 |
| High Channel(1 907.60 ㎒) | | | | | | | |
| 3 817.68 | V | -44.54 | 7.33 | 11.84 | -40.03 | -65.32 | 27.03 |
| 3 817.68 | H | -48.52 | 7.33 | 11.84 | -44.01 | -69.30 | 31.01 |

*Remark:*
*1. E.R.P. & E.I.R.P = S.G level (㏈m) - Cable loss (㏈) + Ant. gain (㏈d/㏈i)*
*2. No more harmonic above 3rd harmonic for all channel.*

# 3. Conducted Output Power

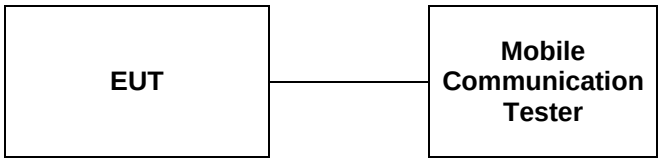
## 3.1. Limit

Requirements: CFR 47, Section §2.1046

## 3.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

2. The mobile was set up for the max. output power with pseudo random data modulation.
3. The power was measured with



## 3.3. Test Result

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

| Band | Frequency (㎒) | Voice GSM | GPRS Data | | | |
|---|---|---|---|---|---|---|
| | | | GPRS | GPRS | GPRS | GPRS |
| | | | 1 TX Slot | 2 TX Slot | 3 TX Slot | 4 TX Slot |
| | | (dB m ) | (dB m ) | (dB m ) | (dB m ) | (dB m ) |
| GSM 850 | 824.2 | N/A | **31.10** | 29.50 | N/A | N/A |
| | 836.6 | N/A | **31.30** | 29.70 | N/A | N/A |
| | 848.8 | N/A | **31.60** | 30.00 | N/A | N/A |
| GSM 1 900 | 1850.2 | N/A | **28.90** | 26.50 | N/A | N/A |
| | 1880.0 | N/A | **28.40** | 26.80 | N/A | N/A |
| | 1909.8 | N/A | **28.40** | 26.80 | N/A | N/A |

| Band | Frequency (㎒) | EDGE Data | | | |
|---|---|---|---|---|---|
| | | EDGE | EDGE | EDGE | EDGE |
| | | 1 TX Slot | 2 TX Slot | 3 TX Slot | 4 TX Slot |
| | | (dB m ) | (dB m ) | (dB m ) | (dB m ) |
| GSM 850 | 824.2 | **26.30** | 25.30 | N/A | N/A |
| | 836.6 | **26.40** | 24.50 | N/A | N/A |
| | 848.8 | **26.70** | 24.70 | N/A | N/A |
| GSM 1 900 | 1850.2 | **25.40** | 23.40 | N/A | N/A |
| | 1880.0 | **25.80** | 23.70 | N/A | N/A |
| | 1909.8 | **25.70** | 23.70 | N/A | N/A |

| 3GPP Release version | Mode | 3GPP 34.121 | Cellular Band[dB m ] | | | PCS Band[dB m ] | | |
|---|---|---|---|---|---|---|---|---|
| | | Subtest | 4132 | 4183 | 4233 | 9262 | 9400 | 9538 |
| 99 | WCDMA | 12.2kbps RMC | **22.22** | **22.52** | **22.46** | **22.60** | **22.73** | **22.19** |

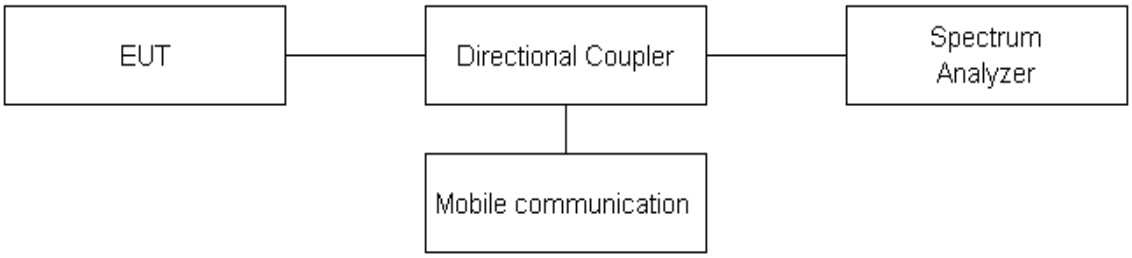
# 4. Occupied Bandwidth 99 %

## 4.1. Limit

Requirements: CFR 47, Section §2.1049.

## 4.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The resolution bandwidth of the spectrum analyzer was set.
   Occupied Bandwidth 99 % was tested under



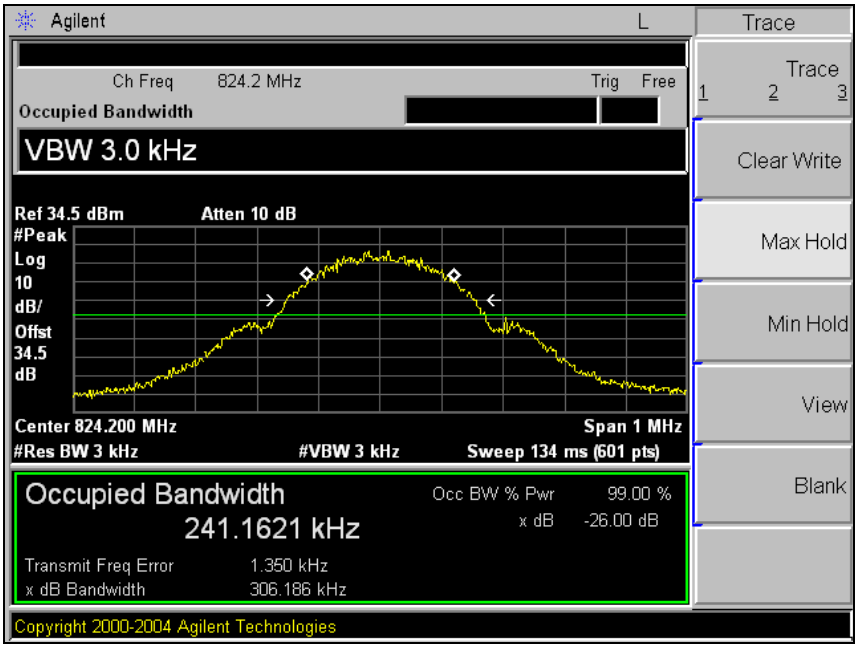
## 4.3 Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

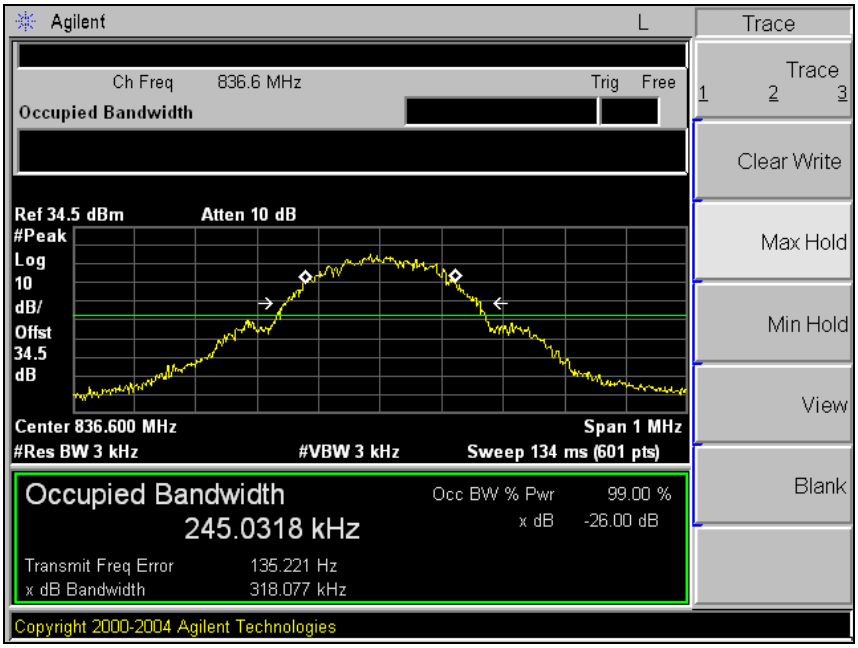
| Band | Mode | Frequency (㎒) | Occupied Bandwidth (㎒) |
|---|---|---|---|
| **GSM850** | GPRS 1 TX | 824.2 | 0.241 |
| | | 836.6 | 0.245 |
| | | 848.8 | 0.240 |
| | EDGE | 836.6 | 0.247 |
| **GSM1900** | GPRS 1 TX | 1 850.2 | 0.243 |
| | | 1 880.0 | 0.242 |
| | | 1 909.8 | 0.243 |
| | EDGE | 1 909.8 | 0.245 |
| **WCDMA850** | 12.2kbps RMC | 826.4 | 4.170 |
| | | 836.6 | 4.175 |
| | | 848.6 | 4.165 |
| **WCDMA1900** | 12.2kbps RMC | 1 852.4 | 4.187 |
| | | 1 880.0 | 4.184 |
| | | 1 907.6 | 4.172 |

Please refer to the following plots.

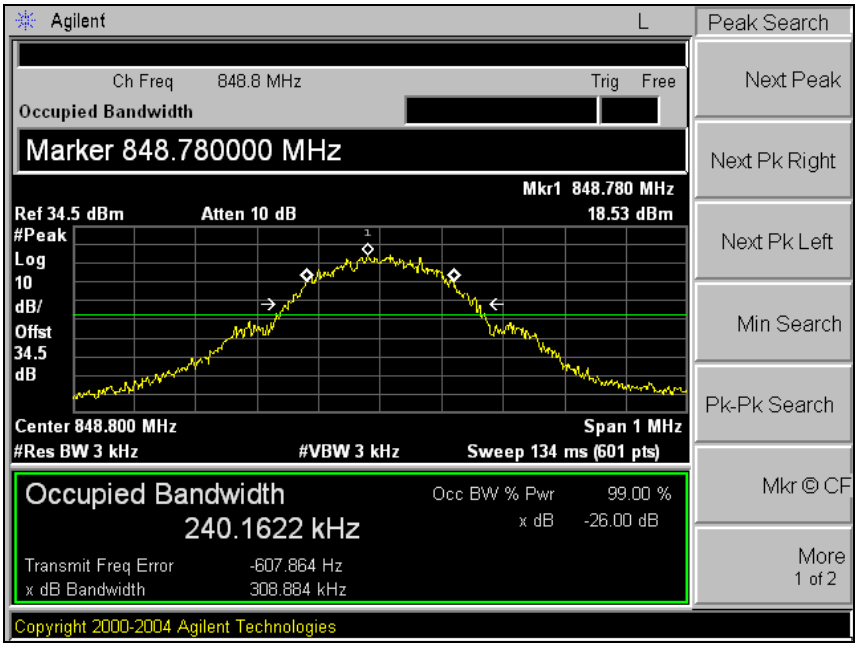
**GSM850**
99 %
Low Channel



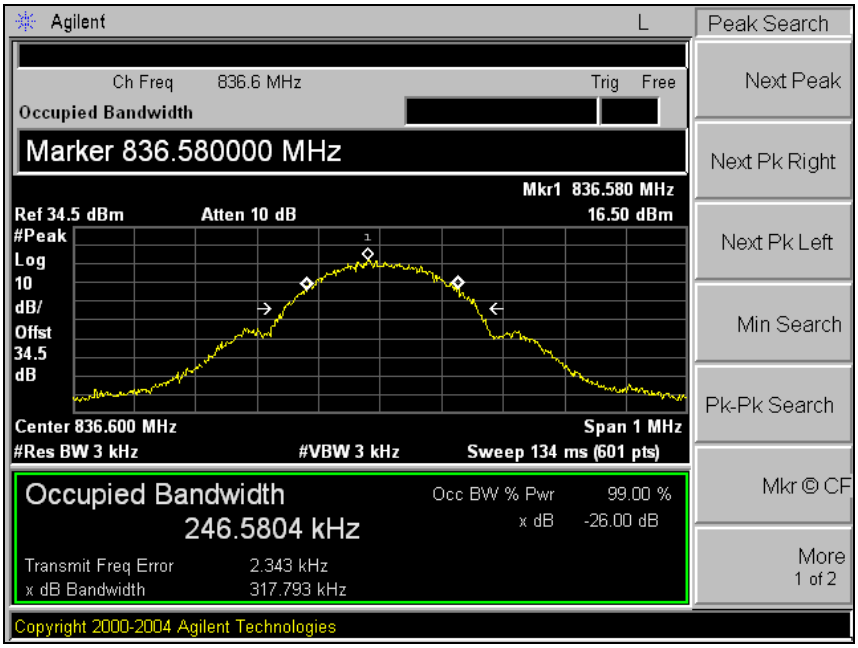

Middle Channel



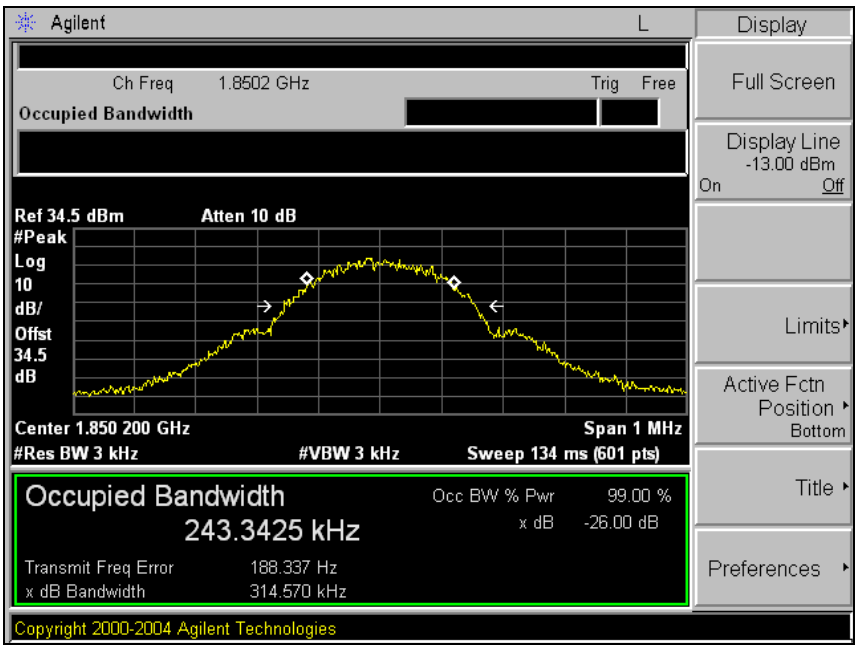
High Channel



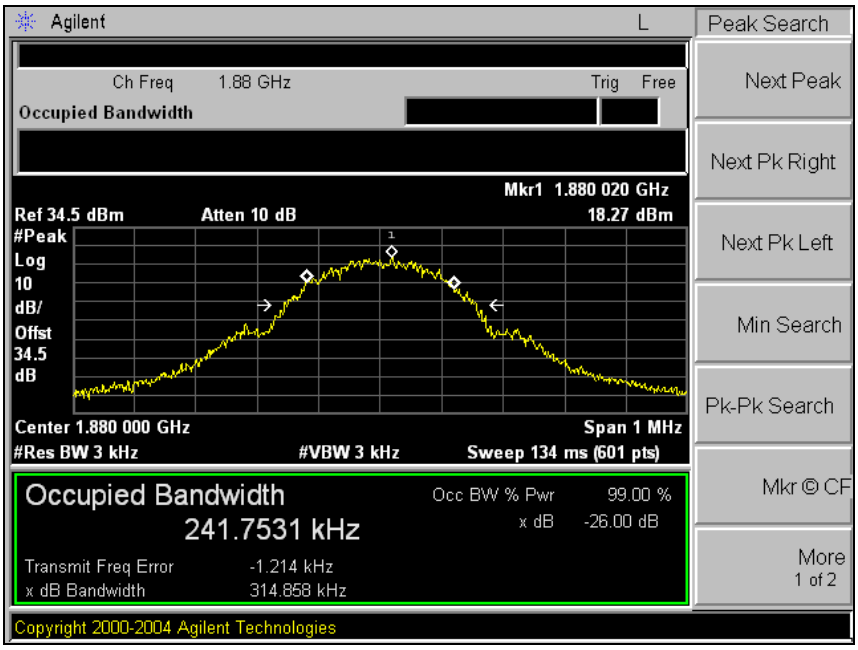

**GSM850 EDGE**
99 %
Middle Channel



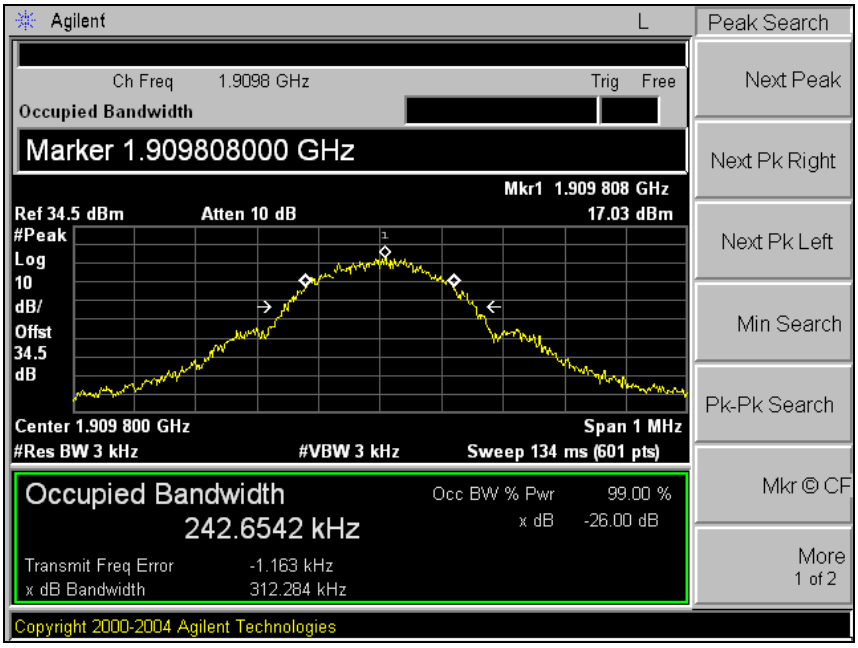
**GSM1900**
99 %
Low Channel



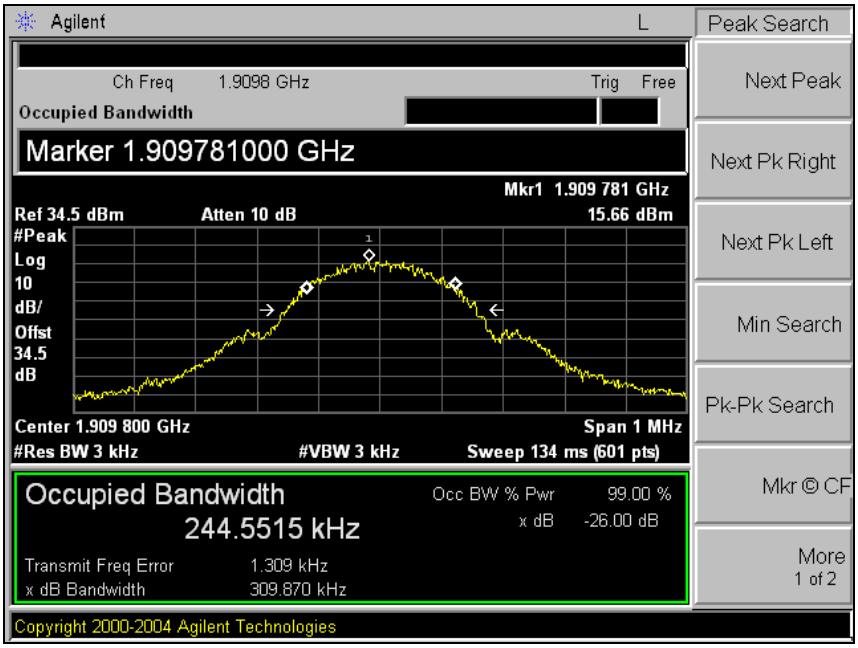

Middle Channel



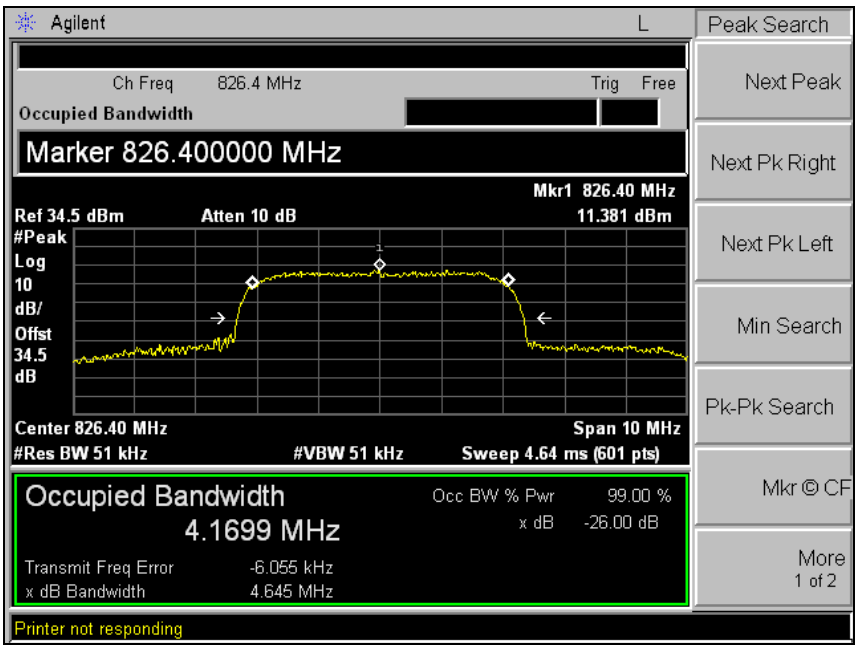
High Channel



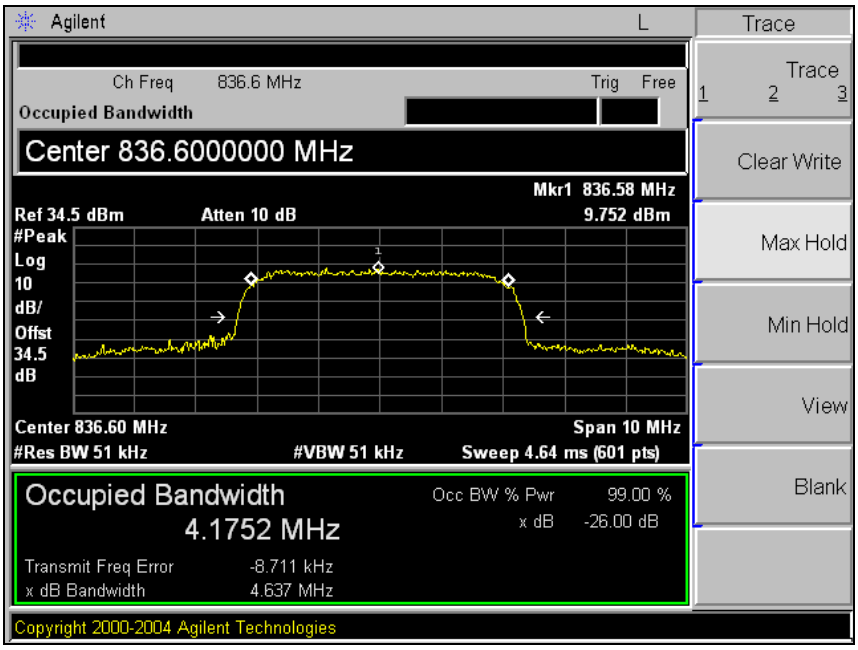

**GSM1900 EDGE**
99 %
High Channel



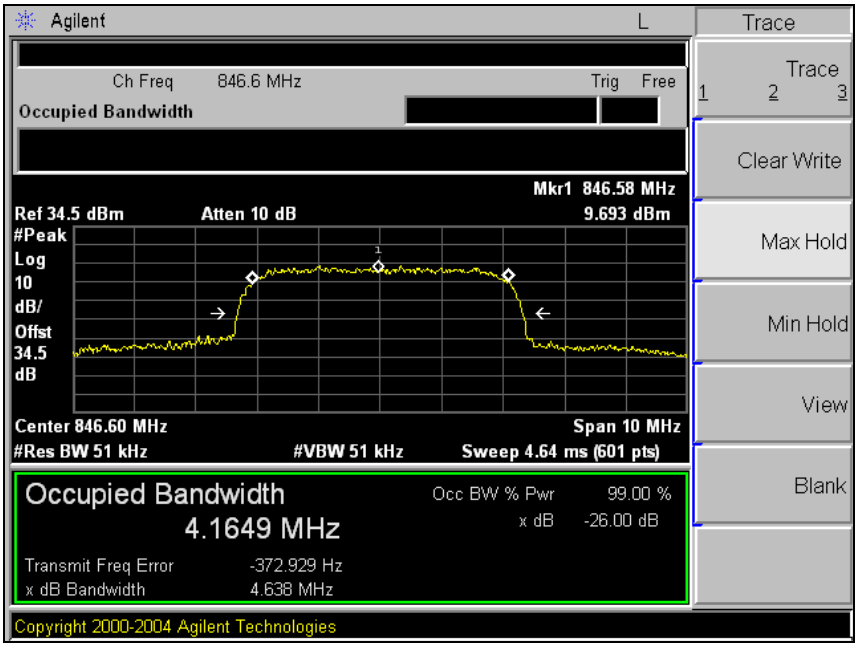
**WCDMA850**
99 %
Low Channel



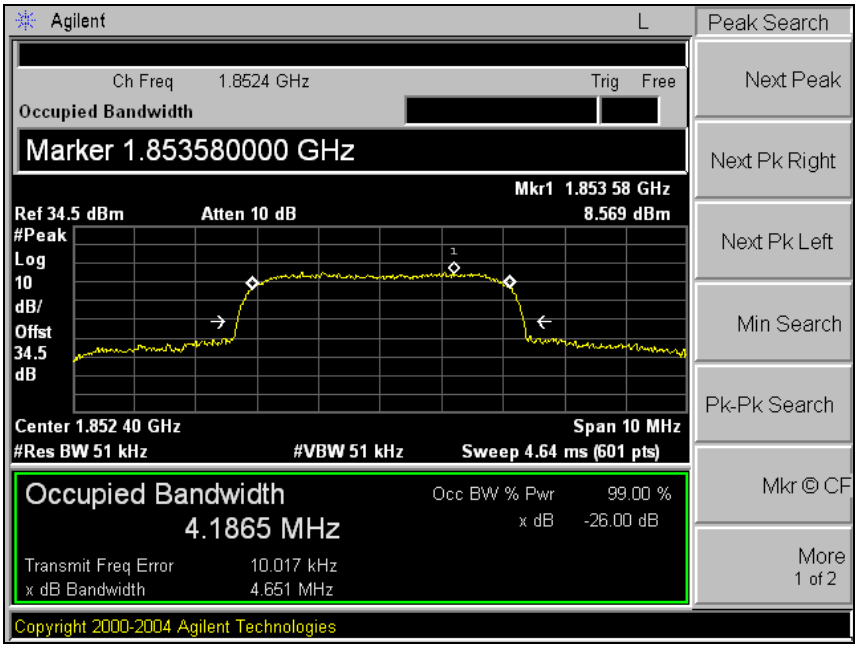

Middle Channel



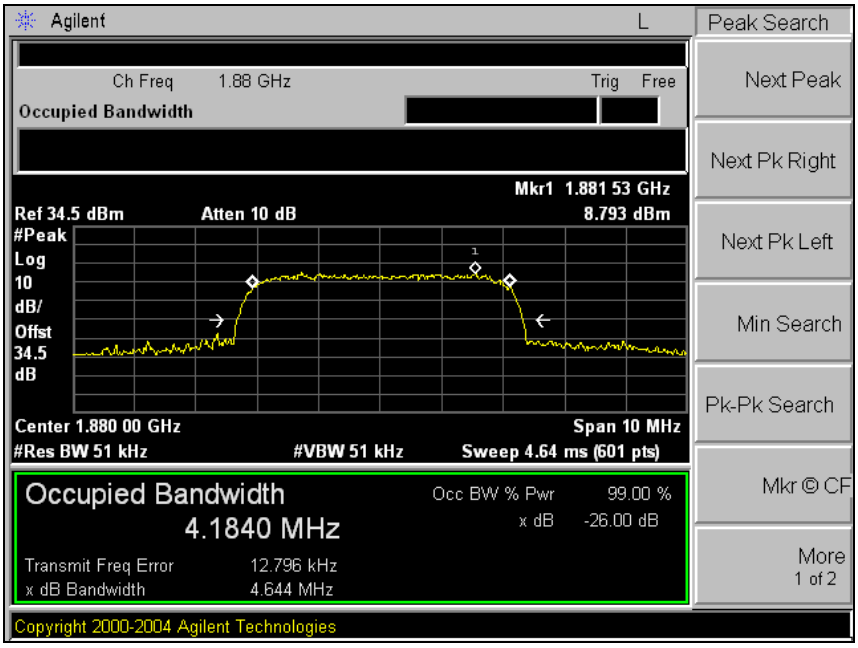
High Channel



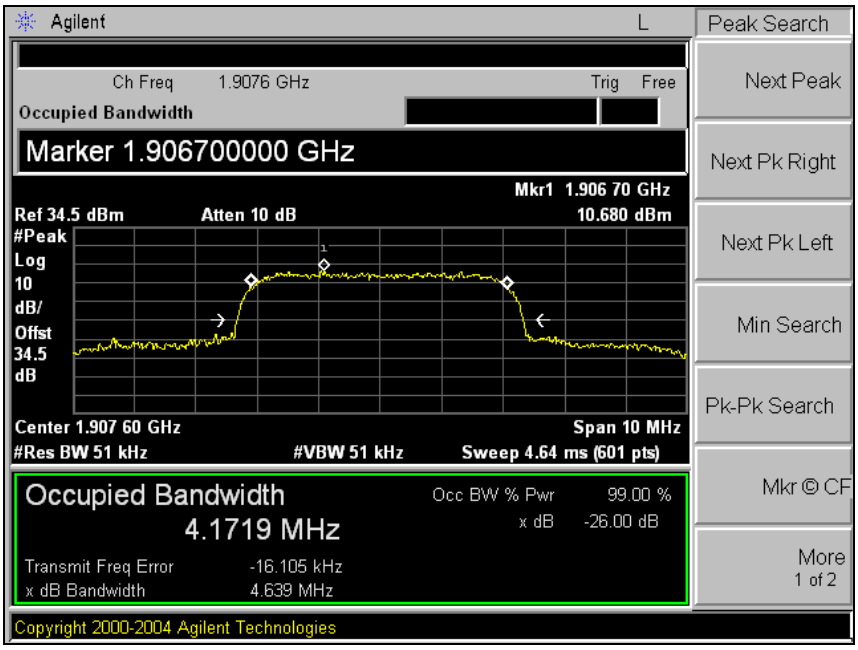

**WCDMA1900**
99 %
Low Channel



Middle Channel




High Channel



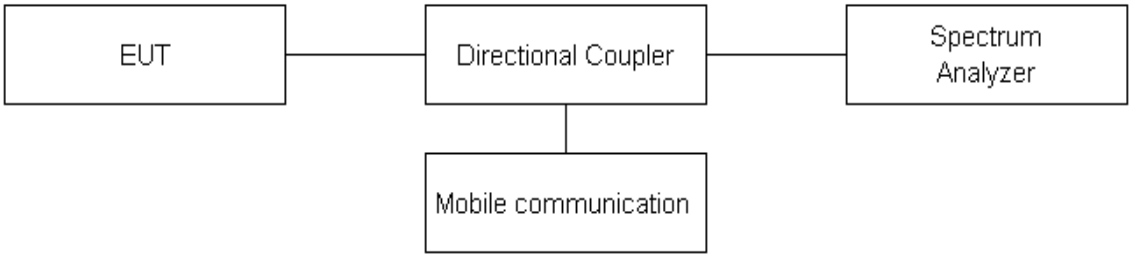
# 5. Spurious Emissions at Antenna Terminal

## 5.1. Limit

§ 22.917(e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least 43 + 10log(P)㏈.

## 5.2. Test Procedure

1. The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation.
2. The resolution bandwidth of the spectrum analyzer was set at 1 ㎒. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.
3. Spurious Emission was tested under

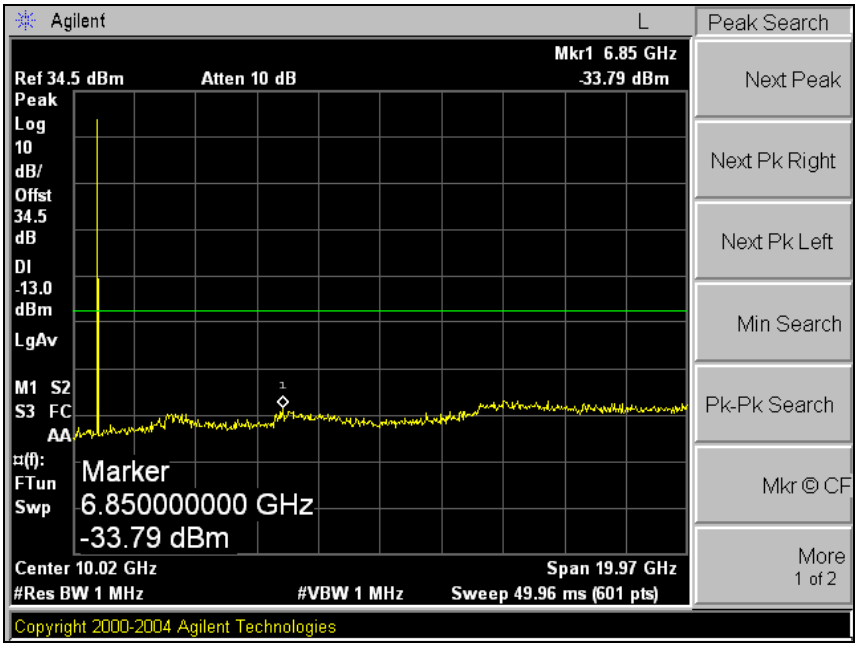



## 5.3. Test Results

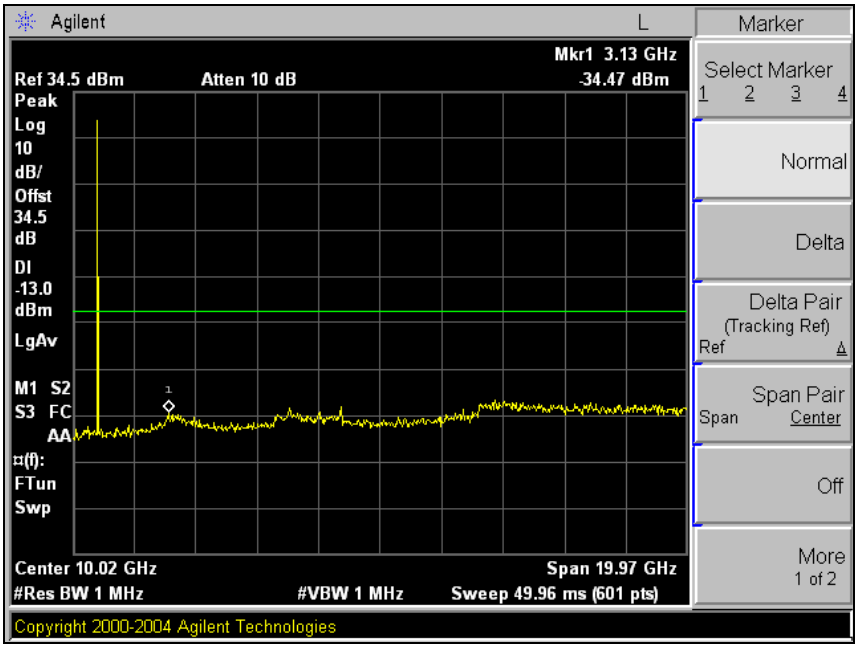
| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

Please refer to the following plots.

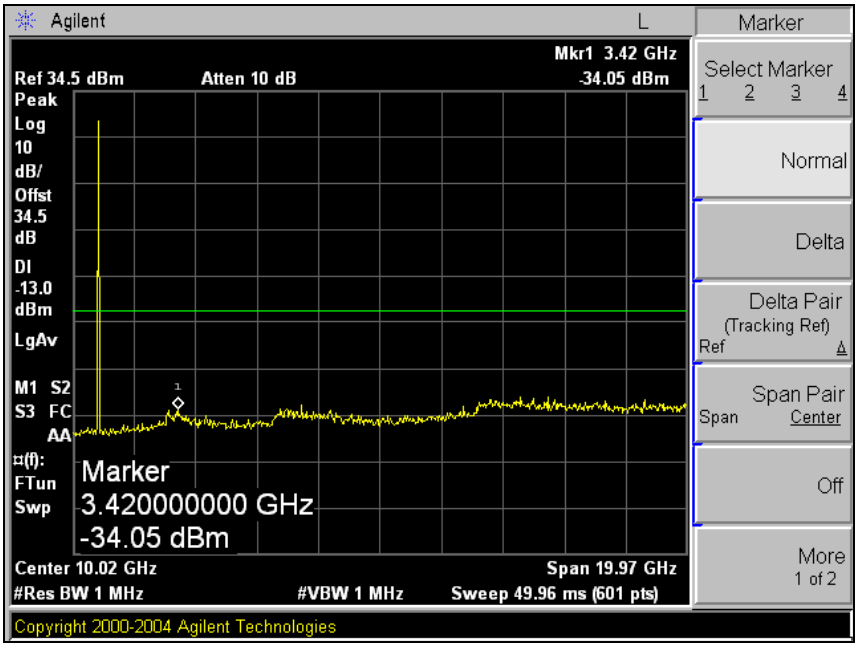
**GSM850**
Low Channel



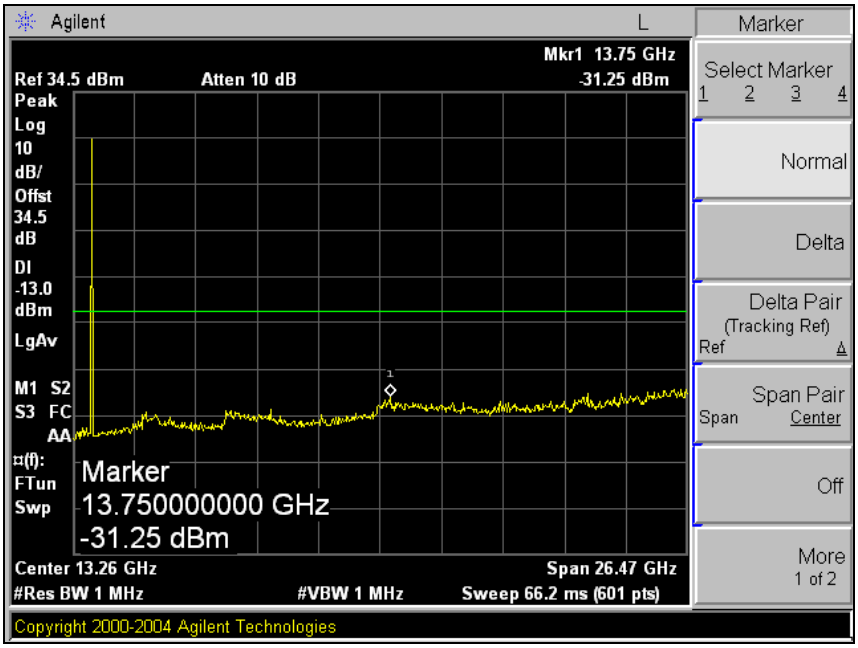

Middle Channel



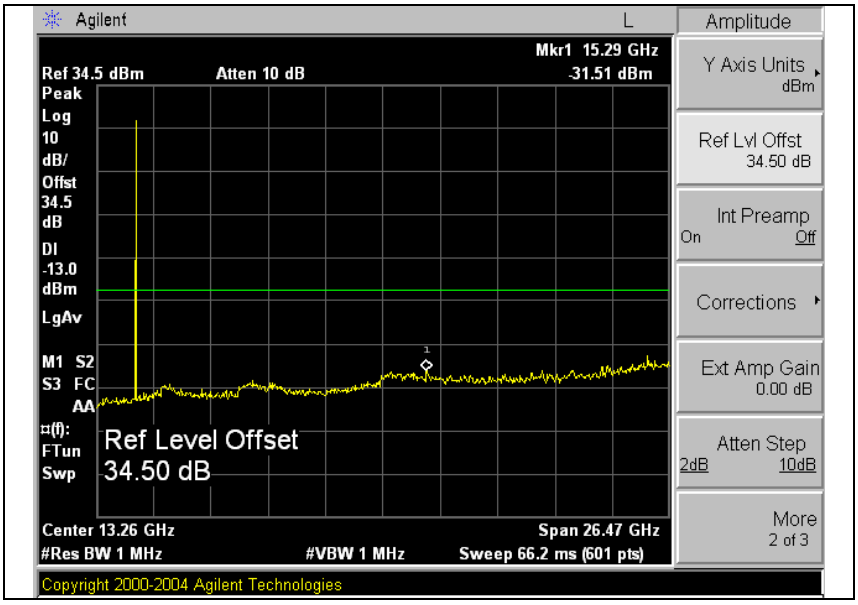
High Channel



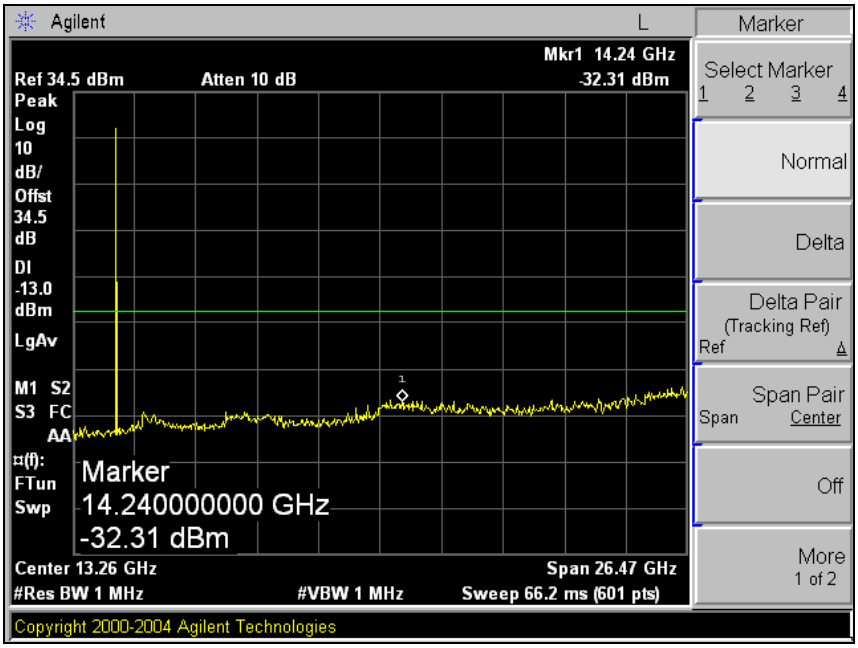

**GSM850 EDGE**
Middle Channel



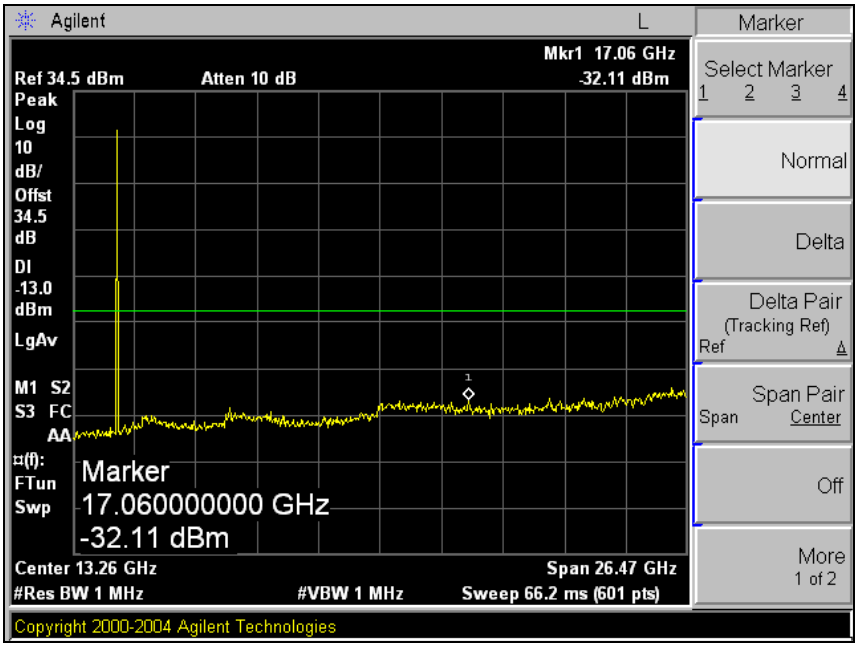
**GSM1900**
Low Channel




Middle Channel

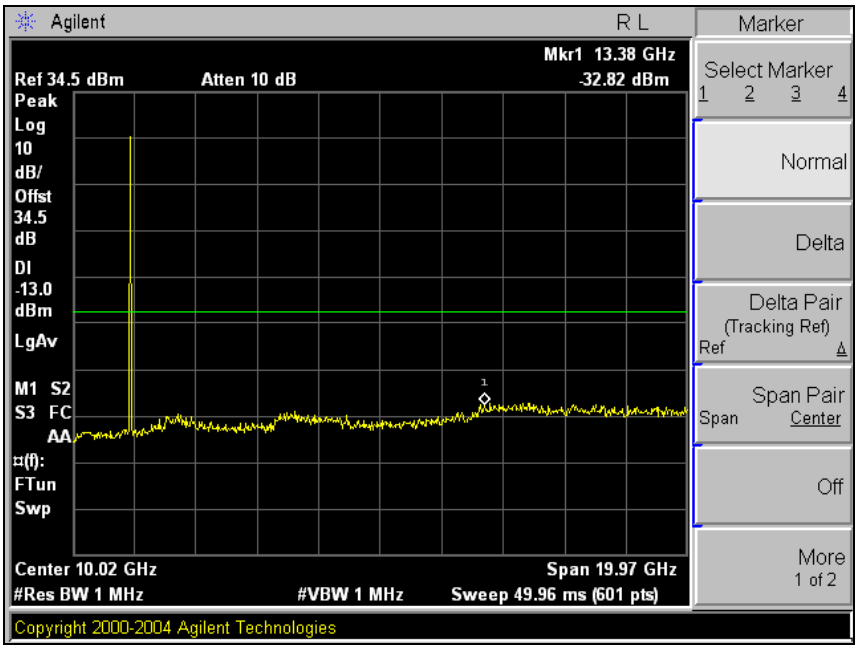


High Channel

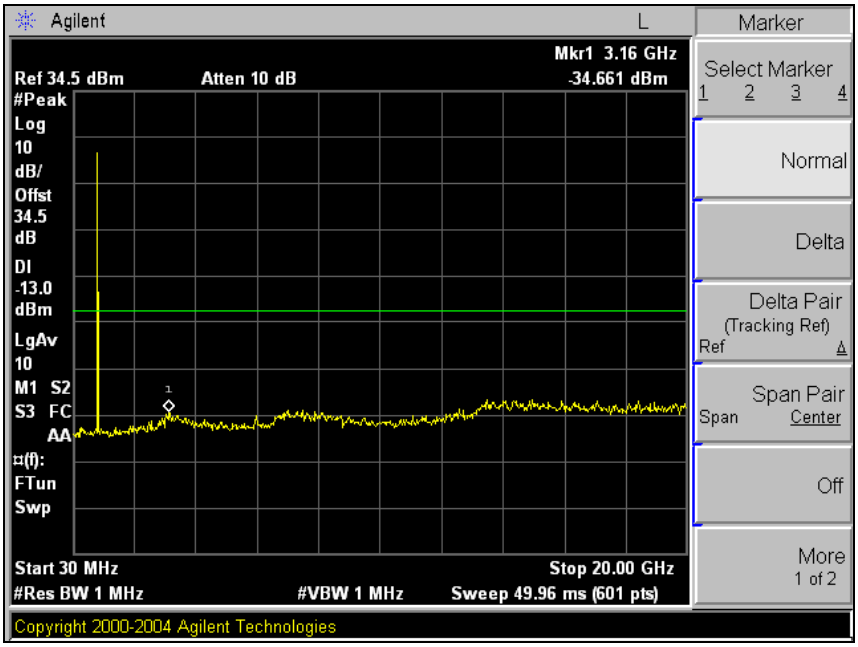



**EDGE1900**

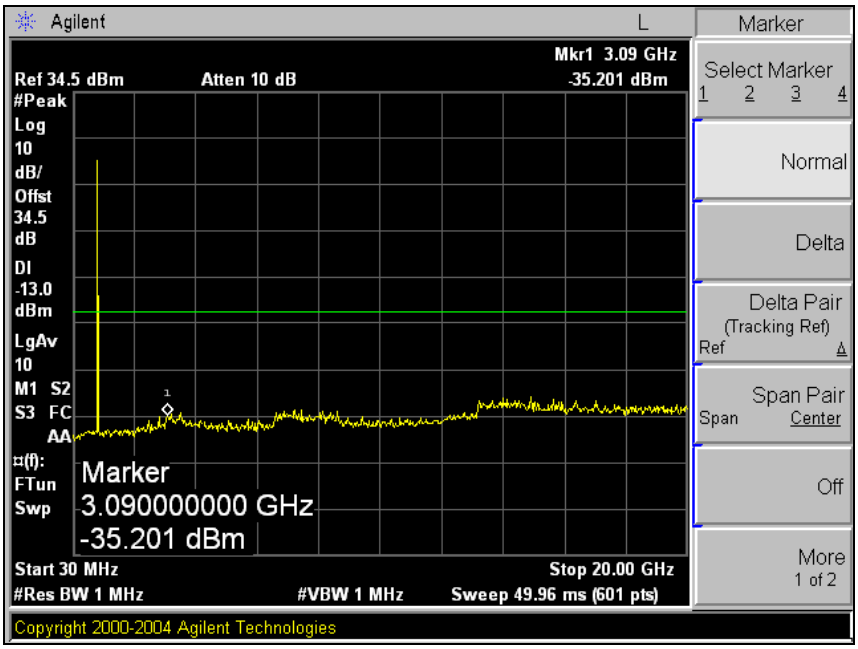
Middle Channel



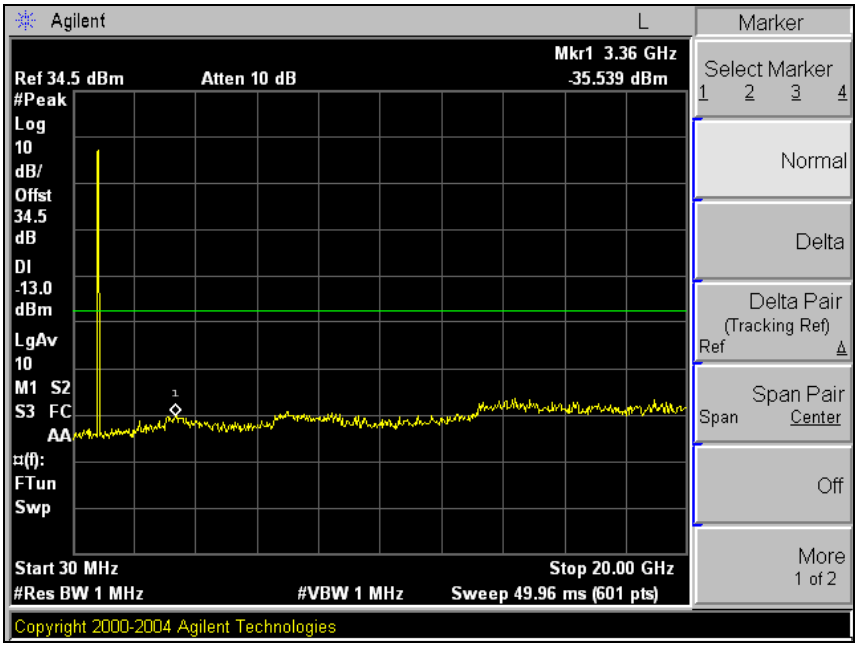
**WCDMA850**
Low Channel




Middle Channel

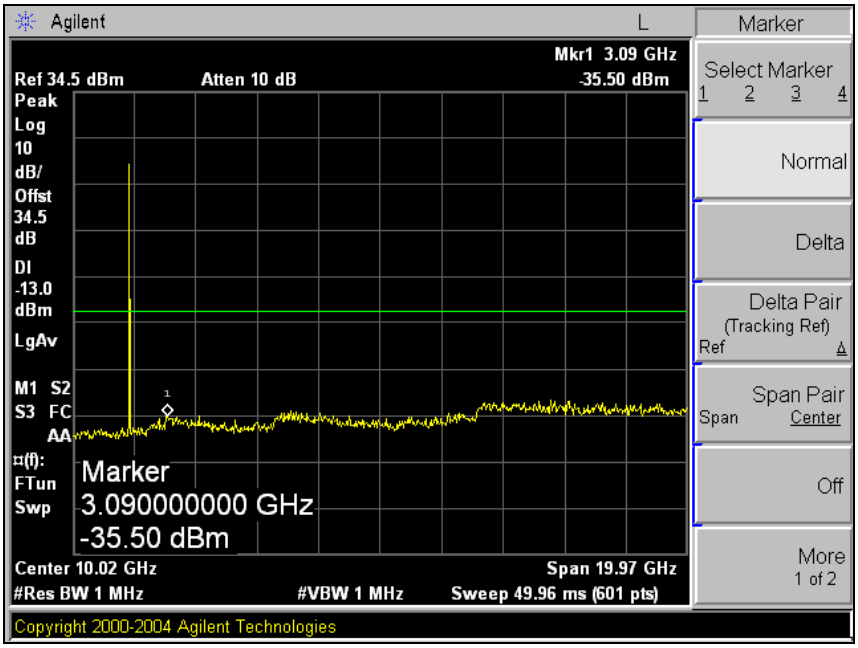


High Channel

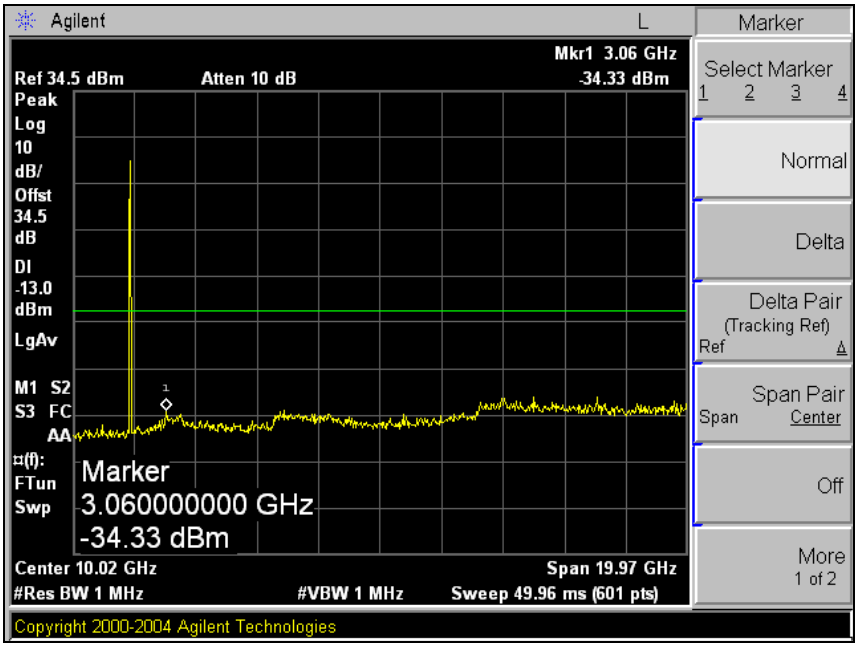



**WCDMA1900**

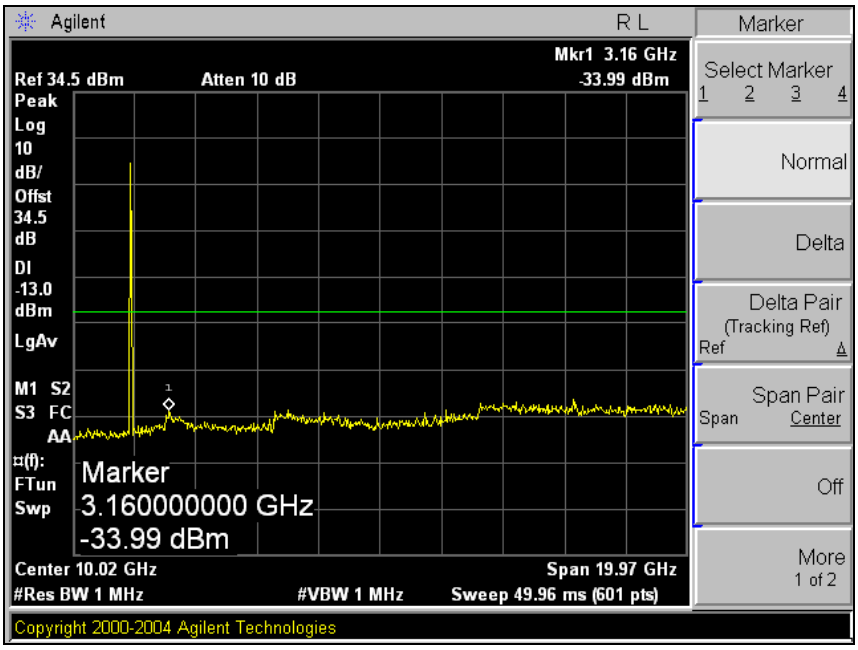
Low Channel



Middle Channel




High Channel



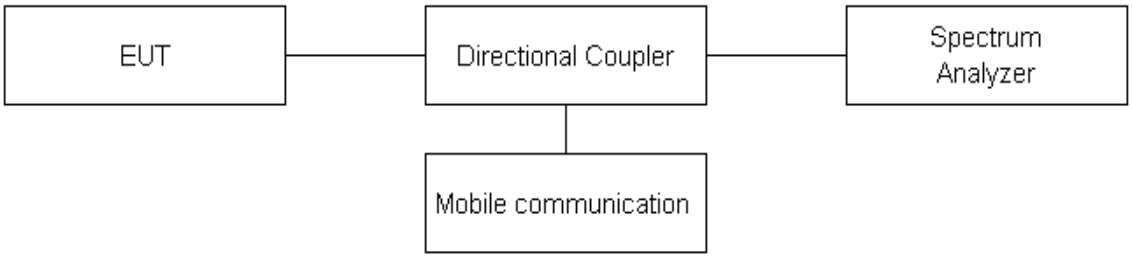
# 6. Band Edge

## 6.1. Limit

§ 22.917(e) and §24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency must be attenuated below the transmitting (P) by a factor of at least 43+10log(P)dB.

## 6.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to block edge frequency.
3. RBW, VBW are more than 1 % of 26 dB bandwidth.



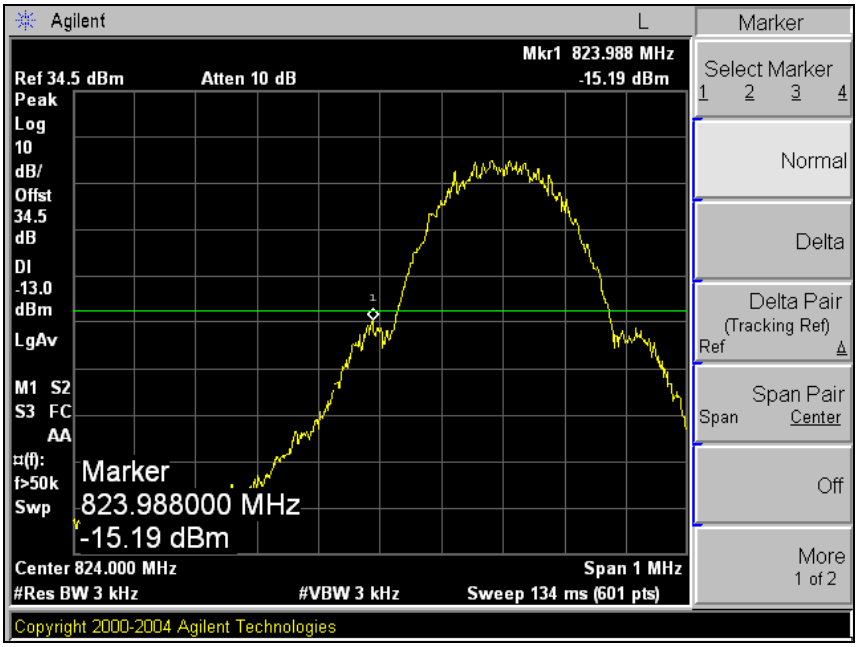

## 6.3. Test Results

| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

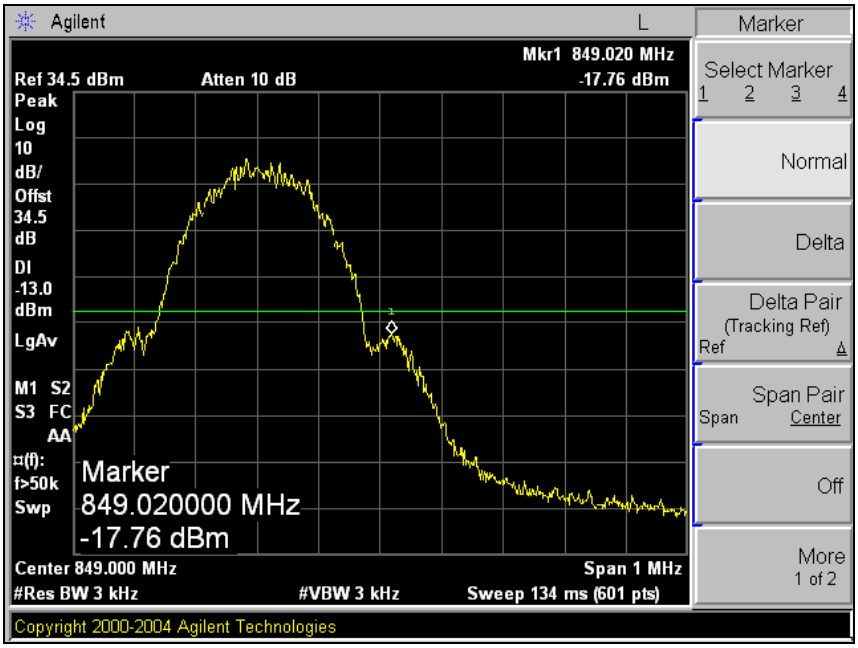
Please refer to the following plots.

**GSM850**

Low Channel

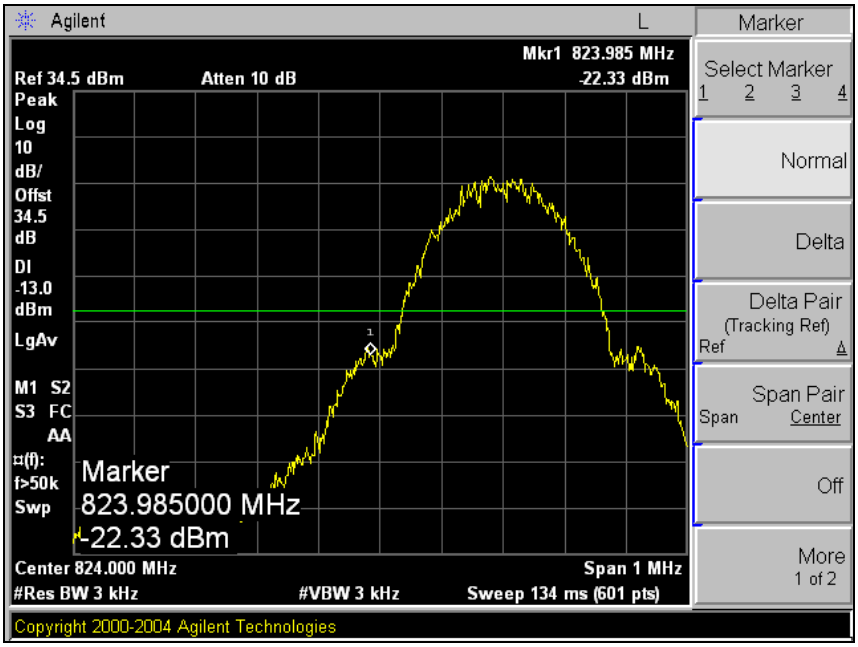



High Channel

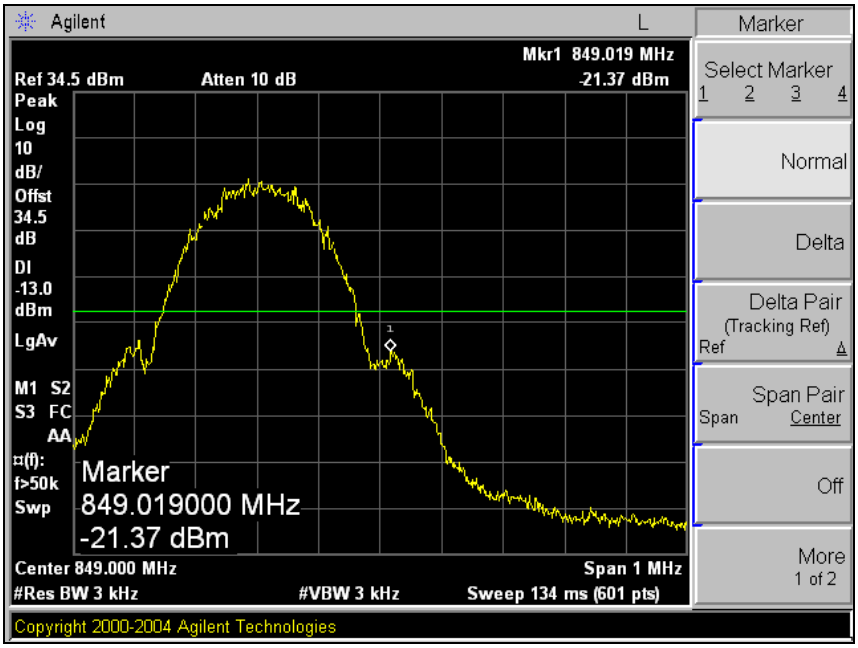


**GSM850 EDGE**

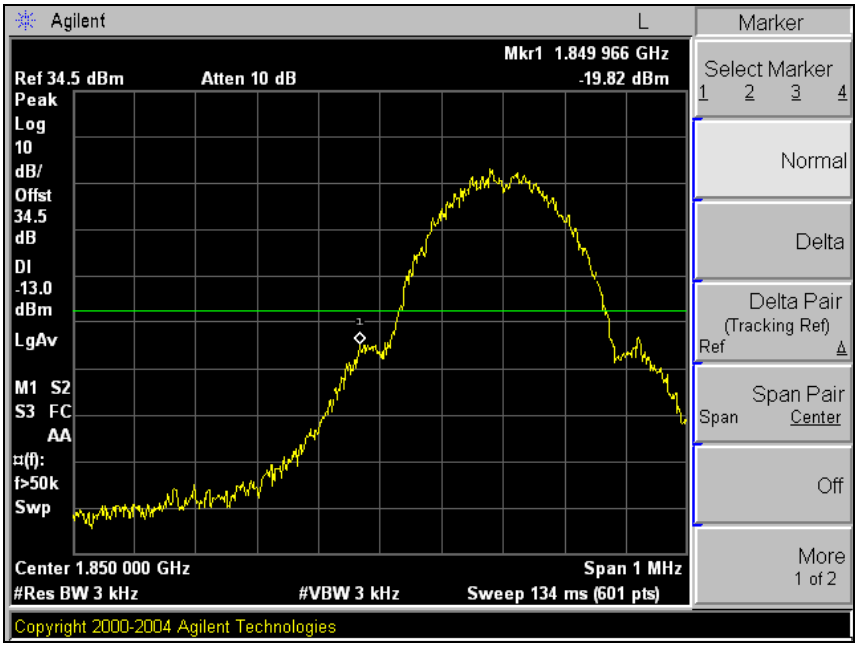
Low Channel



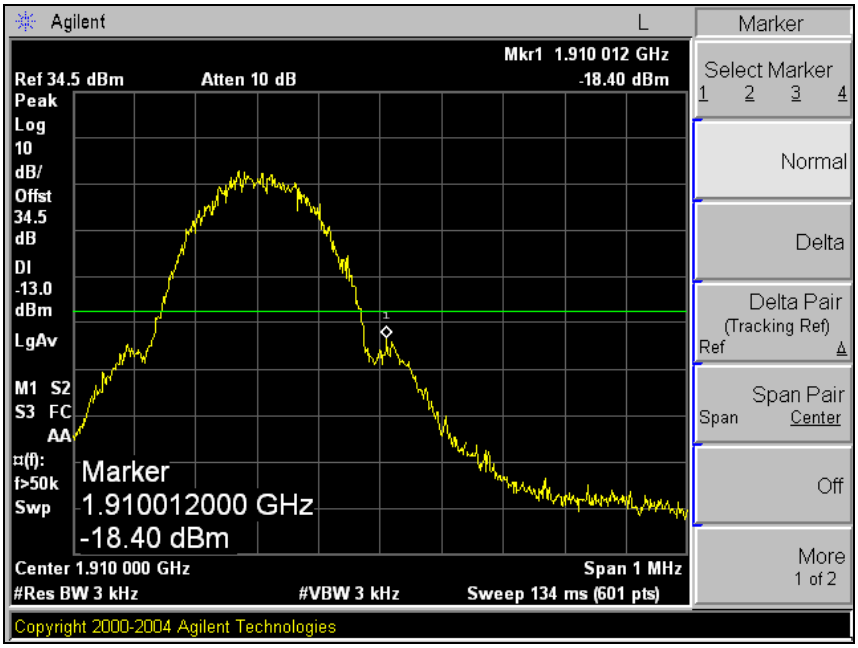

High Channel



**GSM1900**
Low Channel

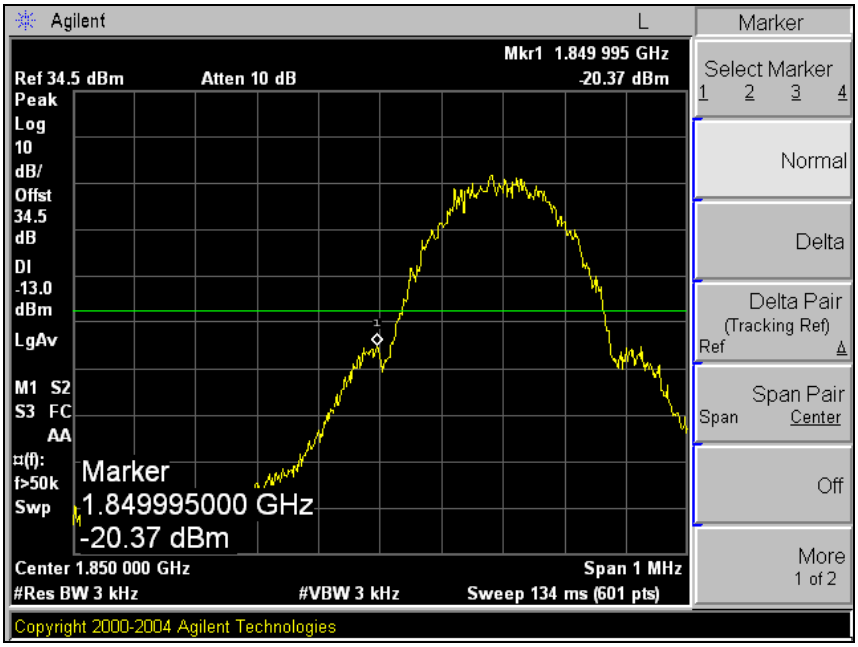



High Channel

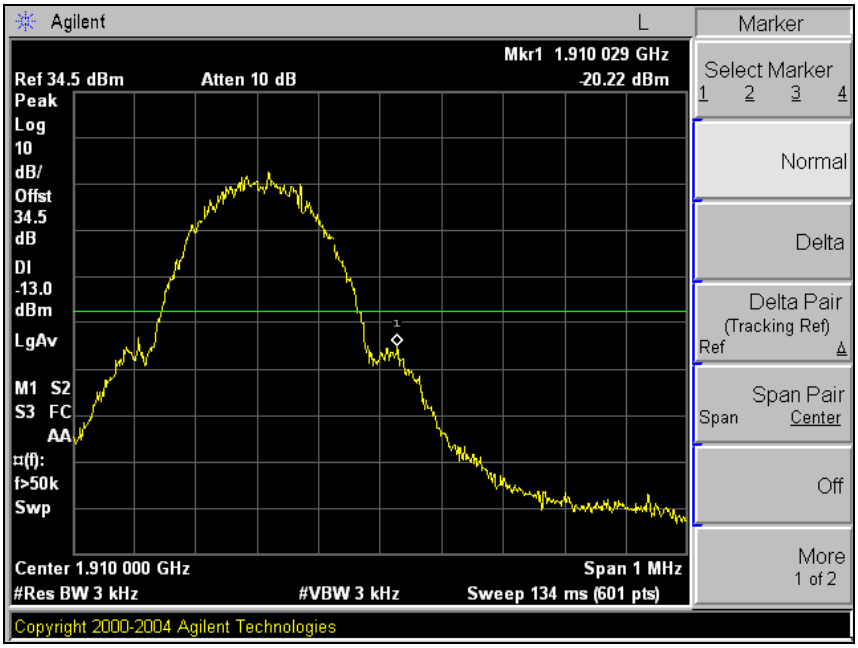


**GSM1900 EDGE**

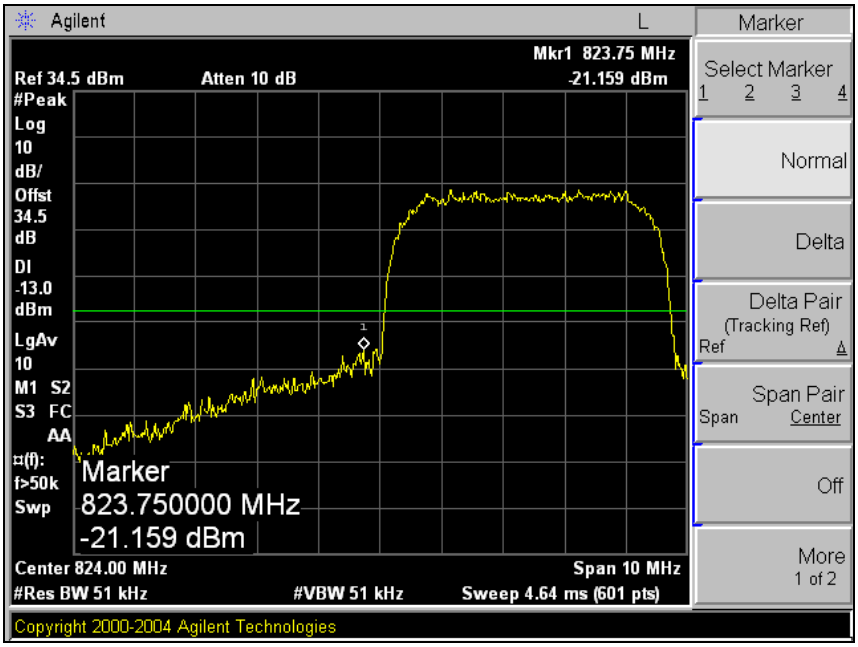
Low Channel



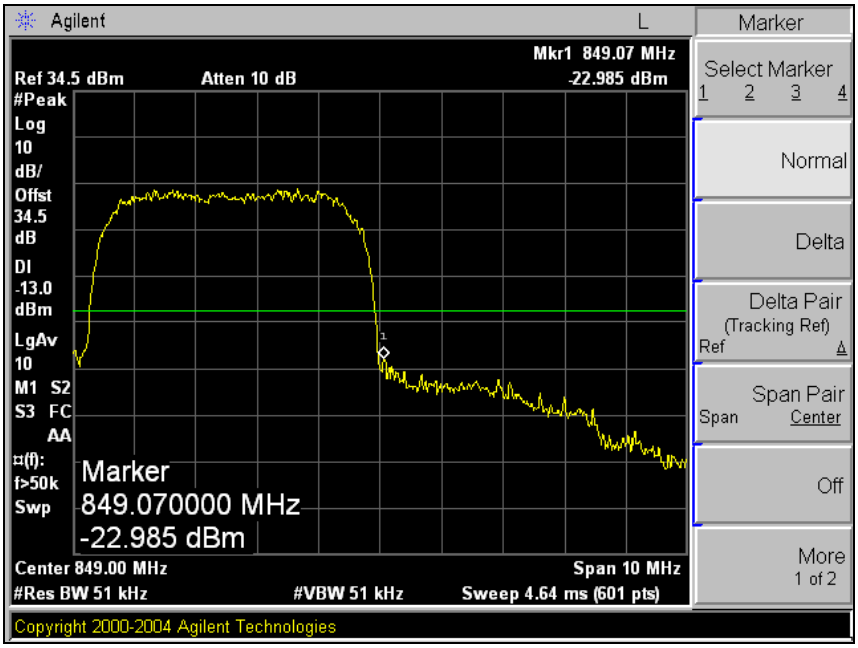

High Channel



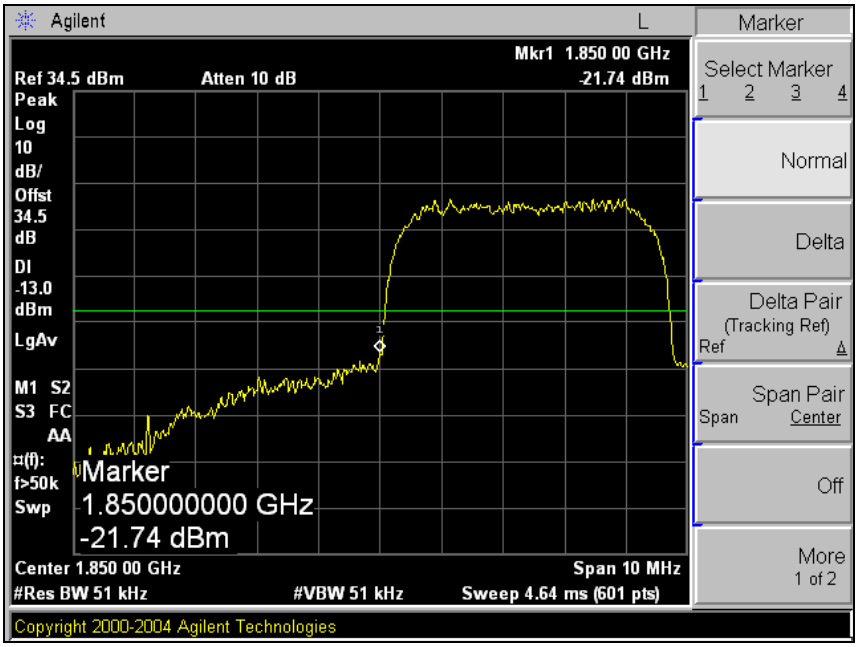
**WCDMA850**
Low Channel



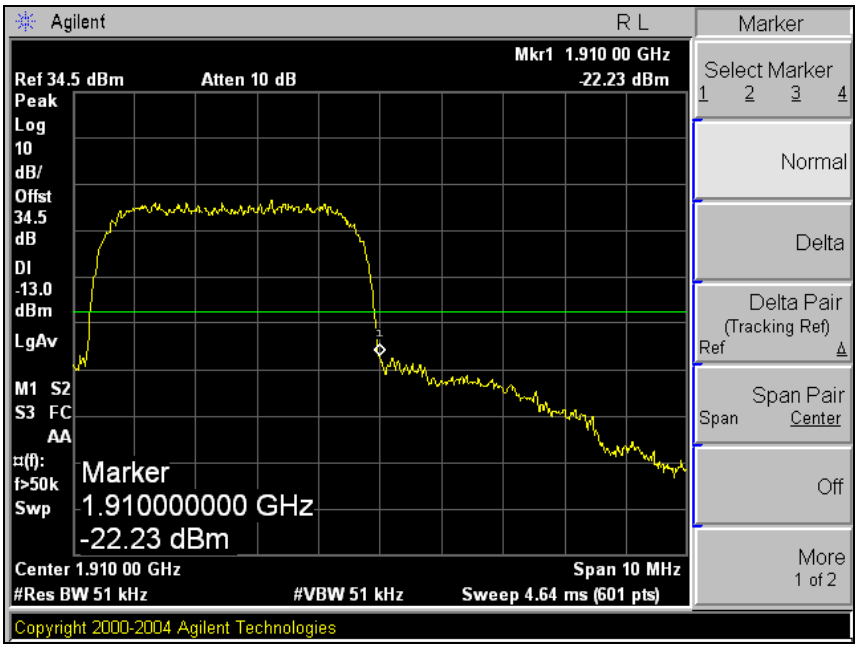

High Channel



**WCDMA1900**
Low Channel

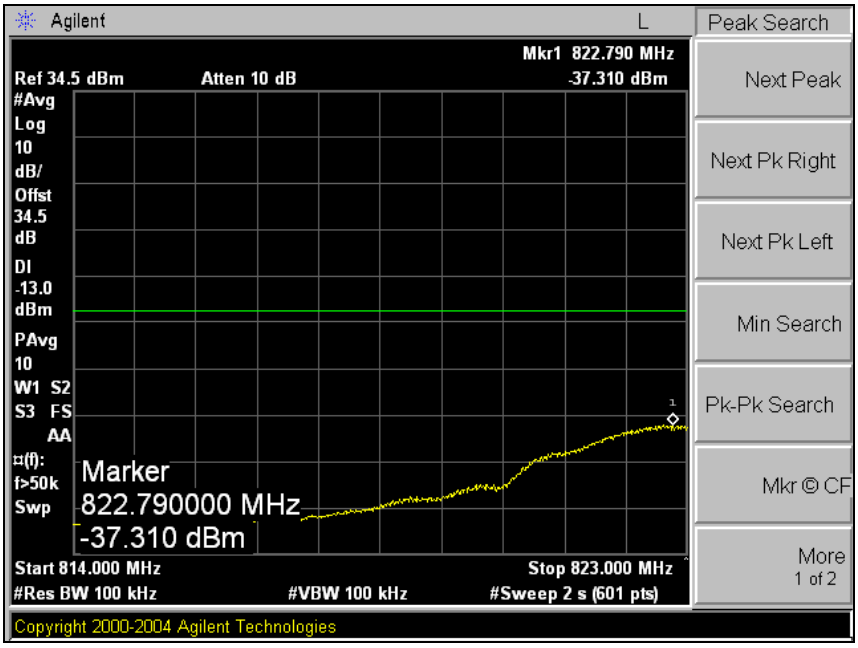



High Channel

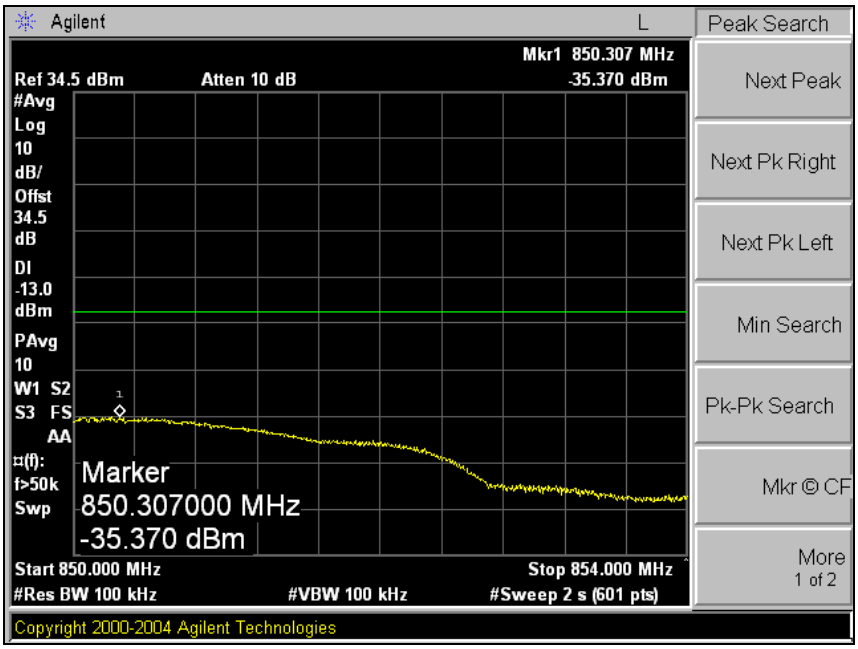


**4 ㎒ span plot_WCDMA850**

Low Channel

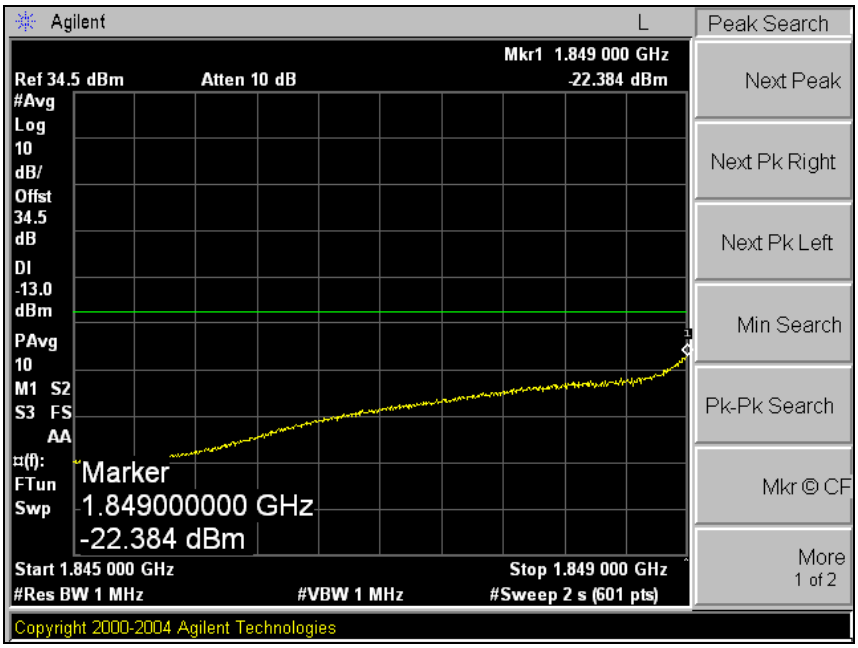



High Channel

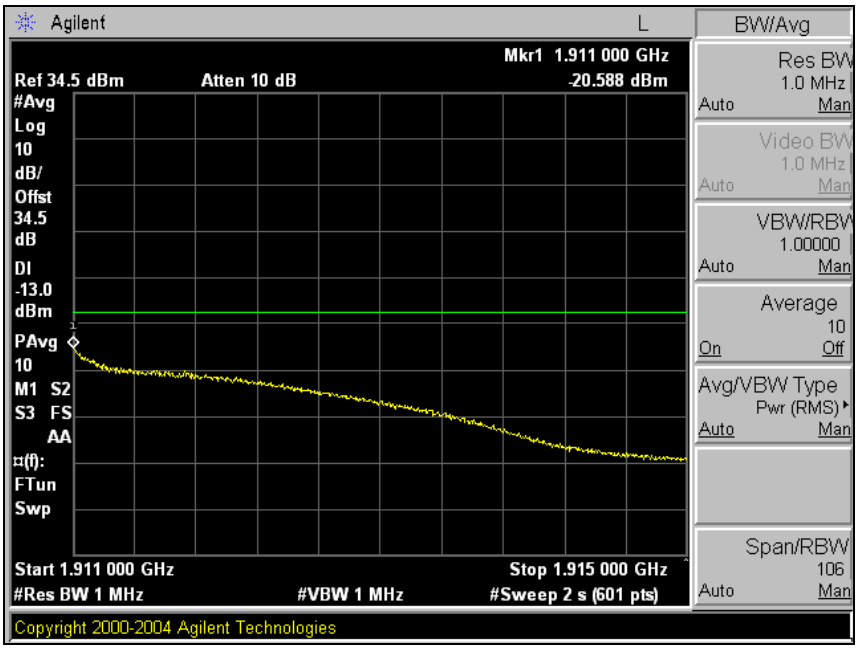


**4 ㎒ span plot_WCDMA1900**

Low Channel




High Channel



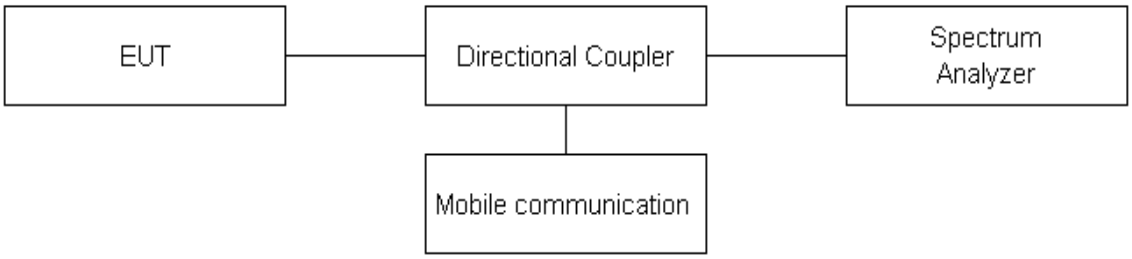
# 7. Peak-Average Ratio

## 7.1. Limit

Requirements: FCC § 24.232 (d),
(d) Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (e) of this section. In both instances, equipment employed must be authorized in accordance with the provisions of §24.51. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

## 7.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The center of the spectrum analyzer was set to center frequency.



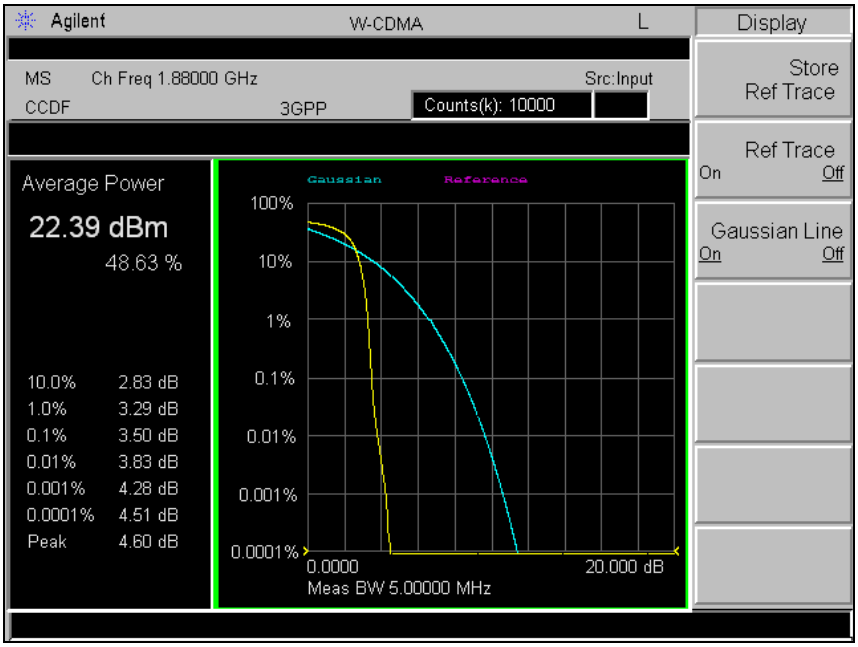

## 7.3. Test Results

| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

Please refer to the following plots.

**PAR plot_WCDMA1900**

Middle Channel



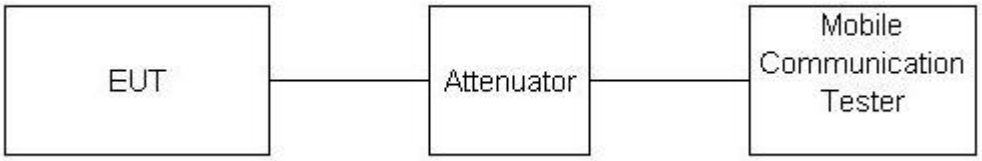
# 8. Frequency Stability

## 8.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:
According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.
For Mobile devices operating in the 824 to 849 ㎒ band at a power level less than or equal to 3 Watts, the limit specified in Table C-1 is +/- 2.5 ppm.
§24.235 The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

## 8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.



## 8.3. Test Results

Ambient temperature : (24 ± 2) ℃
Relative humidity : 47 % R.H.

**GSM850 mode at middle channel**

| Reference Frequency: 836.6 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 50 | 12 | 77 | 0.093 |
| 40 | | 74 | 0.088 |
| 30 | | -81 | -0.096 |
| 24 | | -82 | -0.098 |
| 10 | | 79 | 0.094 |
| 0 | | -89 | -0.107 |
| -10 | | 73 | 0.087 |
| -20 | | 61 | 0.072 |
| -30 | | 64 | 0.076 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (Hz)** | **ppm** |
| 24 | 27.6 | -72 | -0.086 |
| | 10.2 | -65 | -0.078 |

**GSM1900 mode at middle channel**

| Reference Frequency: 1880.0 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 50 | 12 | -65 | -0.035 |
| 40 | | -70 | -0.037 |
| 30 | | -89 | -0.047 |
| 24 | | -82 | -0.044 |
| 10 | | 76 | 0.041 |
| 0 | | 68 | 0.036 |
| -10 | | -80 | -0.043 |
| -20 | | 72 | 0.038 |
| -30 | | -84 | -0.045 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (Hz)** | **ppm** |
| 24 | 27.6 | -79 | -0.042 |
| | 10.2 | -69 | -0.037 |

**WCDMA850 mode at middle channel**

| Reference Frequency: 836.6 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 50 | 12 | 73 | 0.087 |
| 40 | | -84 | -0.100 |
| 30 | | 68 | 0.082 |
| 24 | | -88 | -0.105 |
| 10 | | -87 | -0.104 |
| 0 | | -84 | -0.101 |
| -10 | | 64 | 0.077 |
| -20 | | -81 | -0.097 |
| -30 | | 61 | 0.073 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (Hz)** | **ppm** |
| 24 | 27.6 | -80 | -0.096 |
| | 10.2 | -86 | -0.103 |

**WCDMA1900 mode at middle channel**

| Reference Frequency: 1880.0 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 50 | 12 | -76 | -0.040 |
| 40 | | 62 | 0.033 |
| 30 | | -81 | -0.043 |
| 24 | | -84 | -0.045 |
| 10 | | 63 | 0.033 |
| 0 | | -76 | -0.040 |
| -10 | | -73 | -0.039 |
| -20 | | 67 | 0.036 |
| -30 | | 65 | 0.035 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (Hz)** | **ppm** |
| 24 | 27.6 | -85 | -0.045 |
| | 10.2 | -72 | -0.038 |

# 9. RF Exposure Evaluation

## 9.1 Environmental evaluation and exposure limit according to FCC CFR 47 part 1, 1.1307(b), 1.1310

According to FCC 1.1310 : The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

**LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)**

| Frequency Range (㎒) | Electric Field Strength(V/m) | Magnetic Field Strength (A/m) | Power Density (㎽/㎠) | Average Time |
|---|---|---|---|---|
| (A) Limits for Occupational /Control Exposures | | | | |
| 300 – 1 500 | -- | -- | F/300 | 6 |
| 1 500 – 100 000 | -- | -- | 5 | 6 |
| (B) Limits for General Population/Uncontrol Exposures | | | | |
| **300 – 1 500** | **--** | **--** | **F/1500** | **6** |
| **1 500 – 100 000** | **--** | **--** | **1** | **30** |

### 9.1.1. Friis transmission formula: Pd = (Pout*G)/(4*pi*R$^2$)

Where Pd = power density in ㎽/㎠

Pout = output power to antenna in ㎽

G = gain of antenna in linear scale

Pi = 3.1416

R = distance between observation point and center of the radiator in ㎝

Pd the limit of MPE, 1 ㎽/㎠. If we know the maximum gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance where the MPE limit is reached.

## 9.2 Test Result of RF Exposure Evaluation

Test Item : RF Exposure Evaluation Data
Test Mode : Normal Operation

### 9.2.1 Output Power into Antenna & RF Exposure Evaluation Distance

**GSM 850**

| Test mode | Frequency (㎒) | Output Power to Antenna (dB m) | Antenna Gain (dB i) | Power density at 20 ㎝ (㎽/㎠) | Limit (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 824.20 | 31.10 | 1.875 | 0.394 67 | 0.549 |
| Mid | 836.60 | 31.30 | 1.875 | 0.413 27 | 0.558 |
| High | 848.80 | 31.60 | 1.875 | 0.442 82 | 0.566 |

**GSM1900**

| Test mode | Frequency (㎒) | Output Power to Antenna (dB m) | Antenna Gain (dB i) | Power density at 20 ㎝ (㎽/㎠) | Limit (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 1 850.20 | 28.90 | 3.800 | 0.093 05 | 1 |
| Mid | 1 880.00 | 28.40 | 3.800 | 0.330 16 | |
| High | 1 909.80 | 28.40 | 3.800 | 0.330 16 | |

**WCDMA850**

| Test mode | Frequency (㎒) | Output Power to Antenna (dB m) | Antenna Gain (dB i) | Power density at 20 ㎝ (㎽/㎠) | Limit (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 826.40 | 22.22 | 1.875 | 0.051 08 | 0.551 |
| Mid | 836.60 | 22.52 | 1.875 | 0.054 73 | 0.558 |
| High | 846.60 | 22.46 | 1.875 | 0.053 98 | 0.564 |

**WCDMA1900**

| Test mode | Frequency (㎒) | Output Power to Antenna (dB m) | Antenna Gain (dB i) | Power density at 20 ㎝ (㎽/㎠) | Limit (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 1 852.40 | 22.60 | 3.800 | 0.086 84 | 1 |
| Mid | 1 880.00 | 22.73 | 3.800 | 0.089 48 | |
| High | 1 907.60 | 22.19 | 3.800 | 0.079 02 | |