# TEST REPORT

of

FCC Part 22 Subpart H and Part 24 Subpart E

FCC ID: TQ8-AT240B1AN

| | | |
|---|---|---|
| Equipment Under Test | : | DIGITAL CAR AVNT SYSTEM |
| Model Name | : | AT240B1AN |
| Serial No. | : | N/A |
| Applicant | : | HYUNDAI MOBIS CO., LTD. |
| Manufacturer | : | HYUNDAI MOBIS CO., LTD. |
| Date of Test(s) | : | 2013.01.17 ~ 2013.02.01 |
| Date of Issue | : | 2013.03.08 |

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

**Tested By:** **Date:** **2013.03.08**

**Logan Lee**

**Approved By:** **Date:** **2013.03.08**

**Denny Ham**

# INDEX

TABLE OF CONTENTS Page

# 1. General information

## 1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 3FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

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## 1.2. Details of applicant

Applicant : HYUNDAI MOBIS CO., LTD.
Address : 80-9, Mabook-Dong, Giheung-Gu, Yongin-shi, Gyunggi-Do, 446-912, South Korea
Contact Person : Kim, Jong-Tae
Phone No. : +82 31 260 0092

## 1.3. Description of EUT

| | |
|---|---|
| **Kind of Product** | DIGITAL CAR AVNT SYSTEM |
| **Model Name** | AT240B1AN |
| **Serial Number** | N/A |
| **Power Supply** | DC 14.4 V (Vehicle Battery) |
| **Rated Power** | CDMA800: 24 ㏈m<br>CDMA1 900: 24 ㏈m |
| **Frequency Range** | CDMA800: 824.70 ㎒ ~ 848.31 ㎒<br>CDMA1900: 1 851.25 ㎒ ~ 1 908.75 ㎒ |
| **Antenna Gain** | CDMA800: 1.34 ㏈i<br>CDMA1 900: 4.02 ㏈i |
| **Support Mode** | 1xRTT, 1xEV-DO |
| **Emission Designator** | CDMA800 (1xRTT): 1M27F9W<br>CDMA1 900 (1xRTT): 1M27F9W<br>CDMA800 (1xEV-DO): 1M27F9W<br>CDMA1 900 (1xEV-DO): 1M27F9W |

## 1.4. Declaration by the manufacturer

- CDMA antenna is mounted on a vehicle with DH H/U in pairs, and it does not use the other kind of antennas.

## 1.5. Description of test mode

The transmitter has a maximum average output power as follows:

**1xRTT**

**Cellular Band**

| Frequency (㎒) | Service Option (SO) | Channel | Average Output Power (㏈m) |
|---|---|---|---|
| 824.70 | RC5 9 (Loopback) | 1 013 | 23.61 |
| 836.52 | | 384 | 24.19 |
| 848.31 | | 777 | 24.02 |

**PCS Band**

| Frequency (㎒) | Service Option (SO) | Channel | Average Output Power (㏈m) |
|---|---|---|---|
| 1 851.25 | RC1 55 (Loopback) | 25 | 23.39 |
| 1 880.00 | | 600 | 23.64 |
| 1 908.75 | | 1 175 | 23.77 |

**1xEV-DO Release 0**

**Cellular Band - RTAP**

| Frequency (㎒) | RTAP Rate | Channel | Average Output Power (㏈m) |
|---|---|---|---|
| 824.70 | 9.6 | 1 013 | 23.61 |
| 836.52 | | 384 | 24.18 |
| 848.31 | | 777 | 23.98 |

**PCS Band - RTAP**

| Frequency (㎒) | RTAP Rate | Channel | Average Output Power (㏈m) |
|---|---|---|---|
| 1 851.25 | 76.8 | 25 | 23.42 |
| 1 880.00 | | 600 | 24.06 |
| 1 908.75 | | 1 175 | 23.84 |

CDMA (800 / 1 900)
We found out the test mode with the highest power level after we investigated average output power of all the modulations and (or) data rates for each mode. So we chose below test mode as a representative of worst case.

- CDMA (800) 1xRTT : RC5 / 9 (Loopback), 1xEV-DO Rel0 : RTAP / 9.6
- CDMA (1 900) 1xRTT : RC1 / 55 (Loopback), 1xEV-DO Rel0 : RTAP / 76.8

## 1.6. Sample calculation for offset

Where relevant, the following sample calculation is provided:

### 1.6.1. Conducted test

Offset value (㏈) = Directional Coupler (㏈) + Attenuator (㏈) + Cable loss (㏈)

### 1.6.2. Radiation test

E.R.P. & E.I.R.P. = [S.G level + Amp.](㏈ m) - Cable loss(㏈) + Ant. gain (㏈ d/㏈ i)

## 1.7. Test equipment list

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Interval | Cal. Due. |
|---|---|---|---|---|---|---|
| Signal Generator | R&S | SMBV100A | 255834 | Jul. 02, 2012 | Annual | Jul. 02, 2013 |
| Signal Generator | R&S | SMR40 | 100272 | Aug. 23, 2012 | Annual | Aug. 23, 2013 |
| Spectrum Analyzer | Agilent | E4440A | MY43362142 | Mar. 29, 2012 | Annual | Mar. 29, 2013 |
| Spectrum Analyzer | R&S | FSV30 | 100768 | Mar. 29, 2012 | Annual | Mar. 29, 2013 |
| Mobile Test Unit | Agilent | E5515C | GB43345198 | Mar. 29, 2012 | Annual | Mar. 29, 2013 |
| Directional Coupler | KRYTAR | 152613 | 140972 | Jul. 19, 2012 | Annual | Jul. 19, 2013 |
| Attenuator | Agilent | 8495B | MY42140907 | Mar. 31, 2012 | Annual | Mar. 31, 2013 |
| Attenuator | Mini-Circuits | BW-N20W5+ | 9050-1 | Mar. 30, 2012 | Annual | Mar. 30, 2013 |
| Low Pass Filter | Mini-Circuits | NLP-1200+ | V8979400903-1 | Jul. 12, 2012 | Annual | Jul. 12, 2013 |
| High Pass Filter | Wainwright | WHK3.0/18G-10SS | 344 | Jul. 12, 2012 | Annual | Jul. 12, 2013 |
| High Pass Filter | Wainwright | WHKX1.5/15G-6SS | 4 | Mar. 30, 2012 | Annual | Mar. 30, 2013 |
| DC Power Supply | Agilent | U8002A | MY50020026 | Mar. 29, 2012 | Annual | Mar. 29, 2013 |
| Preamplifier | H.P. | 8447F | 2944A03909 | Jul. 03, 2012 | Annual | Jul. 03, 2013 |
| Preamplifier | R&S | SCU 18 | 10117 | Jan. 14, 2013 | Annual | Jan. 14, 2014 |
| Preamplifier | MITEQ Inc. | JS44-18004000-35-8P | 1546891 | Jul. 12, 2012 | Annual | Jul. 12, 2013 |
| Test Receiver | R&S | ESU26 | 100109 | Feb. 21, 2012 | Annual | Feb. 21, 2013 |
| Bilog Antenna | SCHWARZBECK MESSELEKTRONIK | VULB9163 | 396 | May 12, 2011 | Biennial | May 12, 2013 |
| Horn Antenna | R&S | HF906 | 100326 | Nov. 23, 2011 | Biennial | Nov. 23, 2013 |
| Horn Antenna | SCHWARZBECK MESSELEKTRONIK | BBHA9170 | BBHA9170431 | Aug. 24, 2012 | Biennial | Aug. 24, 2014 |
| Dipole Antenna | SCHWARZBECK MESSELEKTRONIK | VHA/UHA | 9103/9105 | May 24, 2011 | Biennial | May 24, 2013 |
| Antenna Master | INNCO | MM4000 | N/A | N.C.R. | N/A | N.C.R. |
| Turn Table | INNCO | DS 1200S | N/A | N.C.R. | N/A | N.C.R. |
| Anechoic Chamber | SY Corporation | L × W × H (9.6 m × 6.4 m × 6.4 m) | N/A | N.C.R. | N/A | N.C.R. |

## 1.8. Summary of test results

The EUT has been tested according to the following specifications:

| APPLIED STANDARD : FCC Part 22 Subpart H, Part 24 Subpart E | | |
|---|---|---|
| **Section in FCC part** | **Test Item** | **Result** |
| §2.1046<br>§22.913(a)<br>§24.232(c) | RF Radiated Output Power | Complied |
| §2.1053<br>§22.917(a)<br>§24.238(a) | Spurious Radiated Emission | Complied |
| §2.1046 | Conducted Output Power | Complied |
| §2.1049 | Occupied Bandwidth | Complied |
| §24.232(d) | Peak-Average Ratio | Complied |
| §2.1051<br>§22.917(a)<br>§24.238(a) | Spurious Emission at Antenna Terminal | Complied |
| §2.1055<br>§22.355<br>§24.235 | Frequency Stability | Complied |
| §22.917(a)<br>§24.238(a) | Band Edge | Complied |
| §1.1307<br>§2.1091 | RF Exposure Evaluation | Complied |

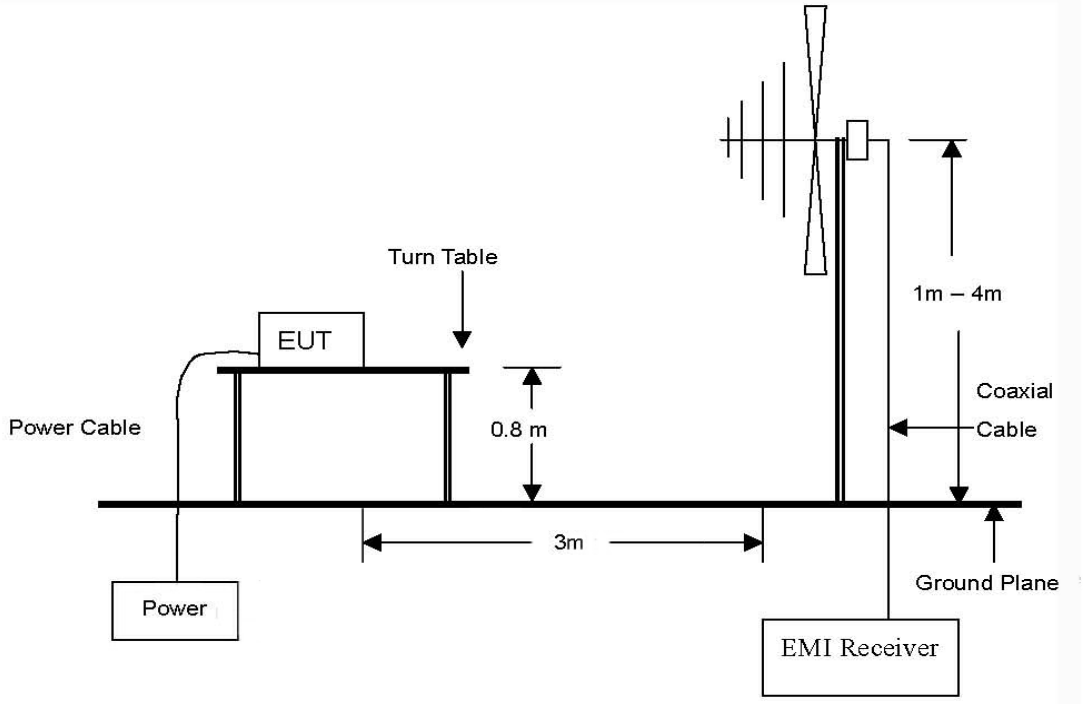
## 1.9. Test report revision

| Revision | Report number | Description |
|---|---|---|
| 0 | F690501/RF-RTL006251 | Initial |
| 1 | F690501/RF-RTL006251-1 | Added Details of EUT setup & MPE data of maximum tune up tolerance |
| 2 | F690501/RF-RTL006251-2 | Separated Details of EUT setup from the report |

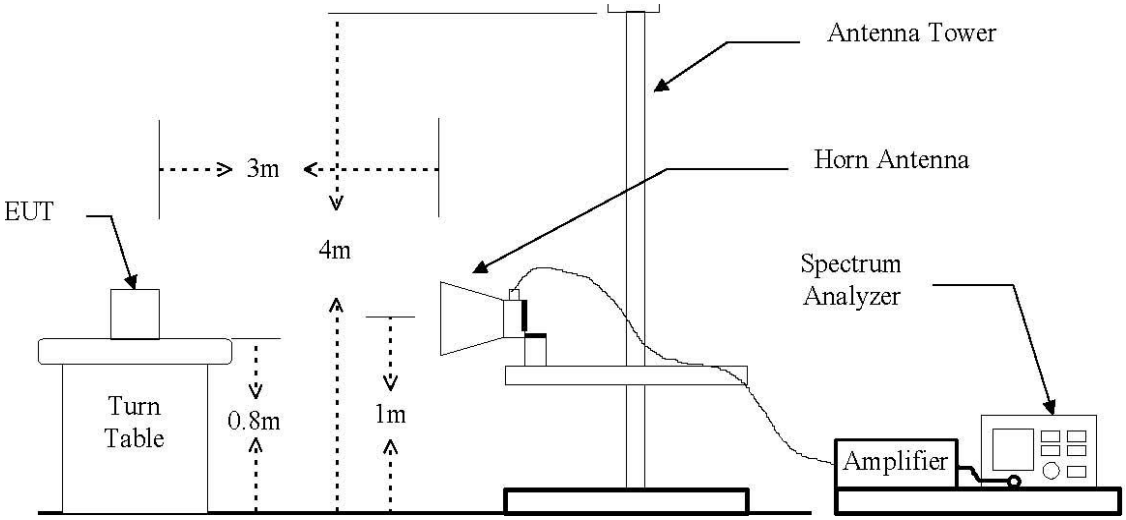
# 2. RF radiated output power & spurious radiated emission

## 2.1. Test setup

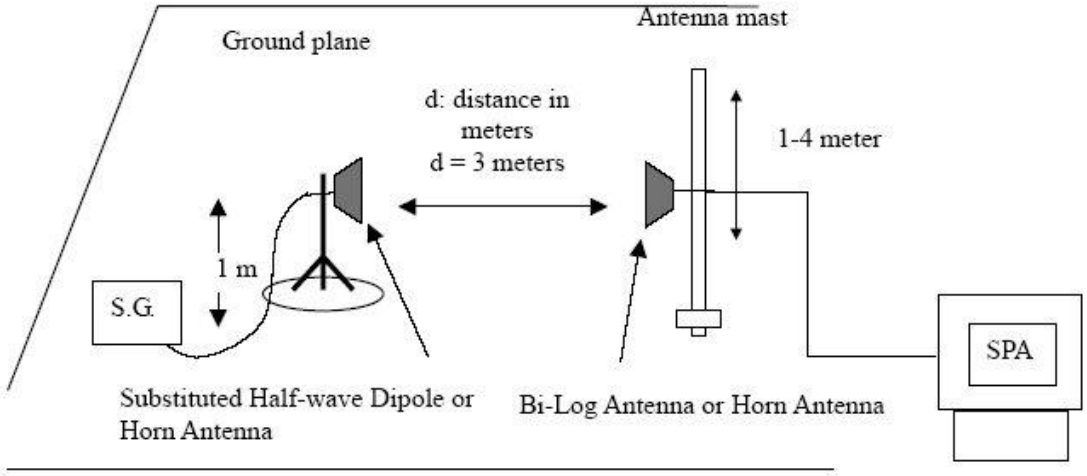
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ Emissions.




The diagram below shows the test setup that is utilized to make the measurements for emission .The spurious emissions were investigated form 1 ㎓ to the 10th harmonic of the highest fundamental frequency or 40 ㎓, whichever is lower.



The diagram below shows the test setup for substituted method



## 2.2. Limit

### 2.2.1. RF radiated output power

FCC §22.913(a), The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.FCC §24.232(c) Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

### 2.2.2. Spurious Radiated emission

§ 22.917(a) 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)㏈.

## 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 close 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 the 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 3 ㎒ and the video bandwidth was set to 3 ㎒.
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 the maximum signal level is detected by the measuring receiver.
7. The transmitter shall be 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 the 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 on the measuring receiver shall be adjusted in order to increase the 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 : 46 % R.H.

**CDMA800 1xRTT mode**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 824.70 | V | 30.83 | 3.42 | -3.44 | 23.97 | 249.46 |
| 824.70 | H | 31.69 | 3.42 | -3.44 | 24.83 | 304.09 |
| 836.52 | V | 31.28 | 3.38 | -3.45 | 24.45 | 278.61 |
| 836.52 | H | 29.73 | 3.38 | -3.45 | 22.90 | 194.98 |
| 848.31 | V | 30.03 | 3.34 | -3.42 | 23.27 | 212.32 |
| 848.31 | H | 30.97 | 3.34 | -3.42 | 24.21 | 263.63 |

**CDMA1 900 1xRTT mode**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB i) | E.I.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 1 851.25 | V | 24.32 | 4.87 | 7.56 | 27.01 | 502.34 |
| 1 851.25 | H | 20.73 | 4.87 | 7.56 | 23.42 | 219.79 |
| 1 880.00 | V | 21.72 | 4.91 | 7.63 | 24.44 | 277.97 |
| 1 880.00 | H | 19.22 | 4.91 | 7.63 | 21.94 | 156.31 |
| 1 908.75 | V | 24.76 | 4.94 | 7.70 | 27.52 | 564.94 |
| 1 908.75 | H | 19.48 | 4.94 | 7.70 | 22.24 | 167.49 |

*Remark:*
*1. E.R.P. & E.I.R.P. = S.G level (dBm) - Cable loss (dB) + Ant. gain (dBd/dBi)*

**CDMA800 1xEV-DO mode**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB d) | E.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 824.70 | V | 31.05 | 3.42 | -3.44 | 24.19 | 262.42 |
| 824.70 | H | 30.79 | 3.42 | -3.44 | 23.93 | 247.17 |
| 836.52 | V | 31.22 | 3.38 | -3.45 | 24.39 | 274.79 |
| 836.52 | H | 29.04 | 3.38 | -3.45 | 22.21 | 166.34 |
| 848.31 | V | 29.44 | 3.34 | -3.42 | 22.68 | 185.35 |
| 848.31 | H | 31.03 | 3.34 | -3.42 | 24.27 | 267.30 |

**CDMA1 900 1xEV-DO mode**

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dB m) | Cable loss (dB) | Ant. gain (dB i) | E.I.R.P. | |
|---|---|---|---|---|---|---|
| | | | | | (dB m) | (㎽) |
| 1 851.25 | V | 24.48 | 4.87 | 7.56 | 27.17 | 521.19 |
| 1 851.25 | H | 21.07 | 4.87 | 7.56 | 23.76 | 237.68 |
| 1 880.00 | V | 21.35 | 4.91 | 7.63 | 24.07 | 255.27 |
| 1 880.00 | H | 20.21 | 4.91 | 7.63 | 22.93 | 196.34 |
| 1 908.75 | V | 23.49 | 4.94 | 7.70 | 26.25 | 421.70 |
| 1 908.75 | H | 20.39 | 4.94 | 7.70 | 23.15 | 206.54 |

*Remark:*
*1. E.R.P. & E.I.R.P. = S.G level (dBm) - Cable loss (dB) + Ant. gain (dBd/dBi)*

## 2.5. Spurious radiated emission

- Measured output Power: 24.83 dBm = 0.304 1 W
- Modulation Signal: CDMA800 1xRTT
- Distance: 3 meters
- Limit: -(43 + 10log$_{10}$(W)) = 37.83 dBc

| Frequency (MHz) | Ant. Pol. (H/V) | S.G level + Amp. (dBm) | Cable loss (dB) | Ant. gain (dBd) | E.R.P. (dBm) | dBc | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low Channel (824.70 MHz) | | | | | | | |
| 1 648.76 | V | -35.98 | 4.54 | 6.44 | -34.08 | -58.91 | 21.08 |
| 1 650.12 | H | -45.04 | 4.54 | 6.44 | -43.14 | -67.97 | 30.14 |
| 2 474.04 | V | -45.94 | 5.68 | 7.98 | -43.64 | -68.47 | 30.64 |
| 2 474.10 | H | -42.20 | 5.68 | 7.98 | -39.90 | -64.73 | 26.90 |
| Middle Channel (836.52 MHz) | | | | | | | |
| 1 672.32 | V | -35.11 | 4.58 | 6.50 | -33.19 | -58.02 | 20.19 |
| 1 672.54 | H | -42.64 | 4.58 | 6.50 | -40.72 | -65.55 | 27.72 |
| 2 511.33 | V | -45.55 | 5.72 | 8.02 | -43.25 | -68.08 | 30.25 |
| 2 512.10 | H | -41.75 | 5.72 | 8.03 | -39.44 | -64.27 | 26.44 |
| High Channel (848.31 MHz) | | | | | | | |
| 1 696.17 | V | -32.09 | 4.61 | 6.57 | -30.13 | -54.96 | 17.13 |
| 1 696.65 | H | -42.29 | 4.61 | 6.57 | -40.33 | -65.16 | 27.33 |
| 2 543.42 | V | -47.04 | 5.75 | 8.07 | -44.72 | -69.55 | 31.72 |
| 2 543.54 | H | -43.01 | 5.75 | 8.07 | -40.69 | -65.52 | 27.69 |

*Remark:*
*1. E.R.P. & E.I.R.P. = S.G level (dBm) - Cable loss (dB) + Ant. gain (dBd/dBi)*
*2. No more harmonic above 3$^{rd}$ harmonic for all channel.*

- Measured output Power : 27.52 dBm = 0.564 9 W
- Modulation Signal : CDMA1 900 1xRTT
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = 40.52 dBc

| Frequency (MHz) | Ant. Pol. (H/V) | S.G level + Amp. (dBm) | Cable loss (dB) | Ant. gain (dBi) | E.I.R.P. (dBm) | dBc | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low Channel(1 851.25 MHz) | | | | | | | |
| 3 703.05 | V | -43.07 | 7.14 | 11.85 | -38.36 | -65.88 | 25.36 |
| 3 703.30 | H | -43.95 | 7.14 | 11.85 | -39.24 | -66.76 | 26.24 |
| 5 553.70 | V | -24.02 | 9.24 | 12.12 | -21.14 | -48.66 | 8.14 |
| 5 553.75 | H | -32.37 | 9.24 | 12.12 | -29.49 | -57.01 | 16.49 |
| Middle Channel(1 880.00 MHz) | | | | | | | |
| 3 760.71 | V | -41.02 | 7.23 | 11.85 | -36.40 | -63.92 | 23.40 |
| 3 760.64 | H | -45.36 | 7.23 | 11.85 | -40.74 | -68.26 | 27.74 |
| 5 639.05 | V | -26.15 | 9.36 | 12.08 | -23.43 | -50.95 | 10.43 |
| 5 641.39 | H | -34.22 | 9.36 | 12.08 | -31.50 | -59.02 | 18.50 |
| High Channel(1 908.75 MHz) | | | | | | | |
| 3 817.51 | V | -39.21 | 7.33 | 11.84 | -34.70 | -62.22 | 21.70 |
| 3 817.15 | H | -45.89 | 7.33 | 11.84 | -41.38 | -68.90 | 28.38 |
| 5 726.45 | V | -25.12 | 9.46 | 12.04 | -22.54 | -50.06 | 9.54 |
| 5 726.14 | H | -32.78 | 9.46 | 12.04 | -30.20 | -57.72 | 17.20 |

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

- Measured output Power: 24.39 dBm = 0.274 8 W
- Modulation Signal: CDMA800 1xEV-DO
- Distance: 3 meters
- Limit: -(43 + 10log$_{10}$(W)) = 37.39 dBc

| Frequency (MHz) | Ant. Pol. (H/V) | S.G level + Amp. (dBm) | Cable loss (dB) | Ant. gain (dBd) | E.R.P. (dBm) | dBc | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low Channel (824.70 MHz) | | | | | | | |
| 1 648.70 | V | -36.03 | 4.54 | 6.44 | -34.13 | -58.52 | 21.13 |
| 1 649.52 | H | -45.26 | 4.54 | 6.44 | -43.36 | -67.75 | 30.36 |
| 2 474.60 | V | -44.65 | 5.68 | 7.98 | -42.35 | -66.74 | 29.35 |
| 2 474.40 | H | -42.20 | 5.68 | 7.98 | -39.90 | -64.29 | 26.90 |
| Middle Channel (836.52 MHz) | | | | | | | |
| 1 672.40 | V | -36.44 | 4.58 | 6.50 | -34.52 | -58.91 | 21.52 |
| 1 672.54 | H | -42.24 | 4.58 | 6.50 | -40.32 | -64.71 | 27.32 |
| 2 511.36 | V | -45.40 | 5.72 | 8.02 | -43.10 | -67.49 | 30.10 |
| 2 512.18 | H | -42.33 | 5.72 | 8.03 | -40.02 | -64.41 | 27.02 |
| High Channel (848.31 MHz) | | | | | | | |
| 1 696.10 | V | -32.09 | 4.61 | 6.57 | -30.13 | -54.52 | 17.13 |
| 1 696.50 | H | -42.49 | 4.61 | 6.57 | -40.53 | -64.92 | 27.53 |
| 2 543.00 | V | -46.37 | 5.75 | 8.07 | -44.05 | -68.44 | 31.05 |
| 2 543.74 | H | -43.00 | 5.75 | 8.07 | -40.68 | -65.07 | 27.68 |

*Remark:*
*1. E.R.P. & E.I.R.P. = S.G level (dBm) - Cable loss (dB) + Ant. gain (dBd/dBi)*
*2. No more harmonic above 3$^{rd}$ harmonic for all channel.*

- Measured output Power : 27.17 dBm = 0.521 2 W
- Modulation Signal : CDMA1 900 1xEV-DO
- Distance : 3 meters
- Limit : -(43 + 10log$_{10}$(W)) = 40.17 dBc

| Frequency (㎒) | Ant. Pol. (H/V) | S.G level + Amp. (dBm) | Cable loss (dB) | Ant. gain (dBi) | E.I.R.P. (dBm) | dBc | Margin (dB) |
|---|---|---|---|---|---|---|---|
| Low Channel(1 851.25 ㎒) | | | | | | | |
| 3 703.29 | V | -43.04 | 7.14 | 11.85 | -38.33 | -65.50 | 25.33 |
| 3 703.40 | H | -43.85 | 7.14 | 11.85 | -39.14 | -66.31 | 26.14 |
| 5 553.70 | V | -24.84 | 9.24 | 12.12 | -21.96 | -49.13 | 8.96 |
| 5 553.72 | H | -32.44 | 9.24 | 12.12 | -29.56 | -56.73 | 16.56 |
| Middle Channel(1 880.00 ㎒) | | | | | | | |
| 3 760.79 | V | -41.69 | 7.23 | 11.85 | -37.07 | -64.24 | 24.07 |
| 3 760.61 | H | -44.78 | 7.23 | 11.85 | -40.16 | -67.33 | 27.16 |
| 5 639.00 | V | -26.08 | 9.36 | 12.08 | -23.36 | -50.53 | 10.36 |
| 5 641.32 | H | -33.79 | 9.36 | 12.08 | -31.07 | -58.24 | 18.07 |
| High Channel(1 908.75 ㎒) | | | | | | | |
| 3 817.59 | V | -40.70 | 7.33 | 11.84 | -36.19 | -63.36 | 23.19 |
| 3 817.15 | H | -45.43 | 7.33 | 11.84 | -40.92 | -68.09 | 27.92 |
| 5 726.49 | V | -25.12 | 9.46 | 12.04 | -22.54 | -49.71 | 9.54 |
| 5 726.18 | H | -32.80 | 9.46 | 12.04 | -30.22 | -57.39 | 17.22 |

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

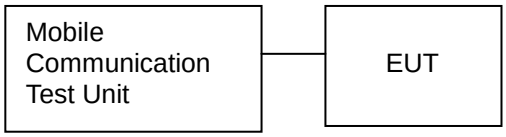
# 3. Conducted Output Power

## 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 Mobile Communication Test Unit through sufficient attenuation.
2. The EUT was set up for the max. output power with pseudo random data modulation.
3. The power was measured with Mobile Communication Test unit.




## 3.3.Test Settings

### - CDMA2000 1xRTT

- Protocol Rev > 6 (IS-2000-0)
- System ID: 14655; NID:1; Reg. Ch. #. 384(Cell) & 600(PCS)
- Radio Config (RC) > Please see following table for details
- FCH Service Option (SO) Setup > Please see following table for details
- Traffic Data Rate > Full
- TDSO SCH info > F-SCH parameters > F-SCH Data Rate > 153.6kbps
  > R-SCH Parameters > R-SCH Data Rate > 153.6kbps
- RVS Power Ctrl > All Up bits (Maximum TxPout)

### - CDMA2000 1xEV-DO

FTAP

- Protocol Rev > 0 (1xEVDO)
- Application Config > Enhanced Test Application Protocol > FTAP
- FTAP Rate > 307.2 kbps (2 slot, QPSK)
- Access Network Info > Termination Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 slots
- RVS Power Ctrl > All Up bits (Maximum TxPout)

RTAP

- Protocol Rev > 0 (1xEVDO)
- Application Config > Enhanced Test Application Protocol > RTAP
- RTAP Rate > 153.6 kbps
- Access Network Info > Termination Parameters > Sector ID > 00000000 > Subnet Mask > 0
- Generator Info > Termination Parameters > Max Forward Packet Duration > 16 slots
- RVS Power Ctrl > All Up bits (Maximum TxPout)

## 3.4. Test Result

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

### CDMA2000 1xRTT

### - Cellular Band (Preliminary Measurement Results @ Middle channel)

| Radio Configuration (RC) | Service Option (SO) | Average Output Power (dBm) | | |
|---|---|---|---|---|
| | | Ch. 1 013 / 824.70 ㎒ | Ch. 384 / 836.52 ㎒ | Ch. 777 / 848.31 ㎒ |
| RC1 (Fwd1, Rvs1) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 24.05 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | - | 24.08 | - |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC2 (Fwd2, Rvs2) | 9 (Loopback) | - | 24.01 | - |
| | 14 (SMS) | - | - | - |
| | 17 (Voice) | - | - | - |
| | 55 (Loopback) | - | 24.16 | - |
| | 32768 (Voice) | - | - | - |
| RC3 (Fwd3, Rvs3) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 24.16 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | | 24.06 | - |
| | 32 (+F-SCH) | - | 24.17 | - |
| | 32 (+SCH) | - | 24.06 | - |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC4 (Fwd4, Rvs3) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 24.10 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | - | 24.08 | - |
| | 32 (+F-SCH) | - | 24.05 | - |
| | 32 (+SCH) | - | 24.05 | - |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC5 (Fwd5, Rvs4) | 9 (Loopback) | 23.61 | **24.19** | 24.02 |
| | 14 (SMS) | - | - | - |
| | 17 (Voice) | - | - | - |
| | 55 (Loopback) | - | 24.18 | - |
| | 32768 (Voice) | - | - | - |

- The measurement is average output power for Low, Middle and High channel in worst case.
- The service option 9 of RC5 of worst case is bigger than other power compared with each service option.

**- PCS Band (Preliminary Measurement Results @ Middle channel)**

| Radio Configuration (RC) | Service Option (SO) | Average Output Power (dBm) | | |
|---|---|---|---|---|
| | | Ch. 25 / 1 851.25 ㎒ | Ch. 600 / 1 880.00 ㎒ | Ch. 1 175 / 1 908.75 ㎒ |
| RC1 (Fwd1, Rvs1) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 23.50 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | 23.39 | **23.64** | 23.77 |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC2 (Fwd2, Rvs2) | 9 (Loopback) | - | 23.57 | - |
| | 14 (SMS) | - | - | - |
| | 17 (Voice) | - | - | |
| | 55 (Loopback) | - | 23.61 | - |
| | 32768 (Voice) | - | - | - |
| RC3 (Fwd3, Rvs3) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 23.52 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | - | 23.50 | |
| | 32 (+F-SCH) | - | 23.54 | - |
| | 32 (+SCH) | - | 23.56 | - |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC4 (Fwd4, Rvs3) | 1 (Voice) | - | - | - |
| | 2 (Loopback) | - | 23.58 | - |
| | 3 (Voice) | - | - | - |
| | 6 (SMS) | - | - | - |
| | 55 (Loopback) | - | 23.53 | - |
| | 32 (+F-SCH) | - | 23.53 | - |
| | 32 (+SCH) | - | 23.52 | |
| | 68 (Voice) | - | - | - |
| | 70 (Voice) | - | - | - |
| RC5 (Fwd5, Rvs4) | 9 (Loopback) | - | 23.52 | - |
| | 14 (SMS) | - | - | - |
| | 17 (Voice) | - | - | - |
| | 55 (Loopback) | - | 23.48 | - |
| | 32768 (Voice) | - | - | - |

- The measurement is average output power for Low, Middle and High channel in worst case.
- The service option 55 of RC1 of worst case is bigger than other power compared with each service option.

## CDMA2000 1xEV-DO Release 0 (Rel 0)

### - Cellular Band (Preliminary Measurement Results @ Middle channel)

| Application Protocol | Rate | Average Output Power (dB m) | | |
|---|---|---|---|---|
| | | Ch. 1 013 / 824.70 ㎒ | Ch. 384 / 836.52 ㎒ | Ch. 777 / 848.31 ㎒ |
| RTAP | 9.6 | 23.61 | **24.18** | 23.98 |
| | 19.2 | - | 24.16 | - |
| | 38.4 | - | 24.16 | - |
| | 76.8 | - | 24.06 | - |
| | 153.6 | - | 24.05 | - |
| FTAP | 307.2 kbps (2 slot, QPSK) | 23.65 | 24.18 | 23.91 |

- The measurement is average output power for Low, Middle and High channel in worst case.
- The rate 9.6 of RTAP of worst case is bigger than other power compared with each rate.

### - PCS Band (Preliminary Measurement Results @ Middle channel)

| Application Protocol | Rate | Average Output Power (dB m) | | |
|---|---|---|---|---|
| | | Ch. 25 / 1 851.25 ㎒ | Ch. 600 / 1 880.00 ㎒ | Ch. 1 175 / 1 908.75 ㎒ |
| RTAP | 9.6 | - | 24.00 | - |
| | 19.2 | - | 24.01 | - |
| | 38.4 | - | 24.03 | - |
| | 76.8 | 23.42 | **24.06** | 23.84 |
| | 153.6 | - | 24.01 | - |
| FTAP | 307.2 kbps (2 slot, QPSK) | 23.48 | 23.98 | 23.78 |

- The measurement is average output power for Low, Middle and High channel in worst case.
- The rate 76.8 of RTAP of worst case is bigger than other power compared with each rate.

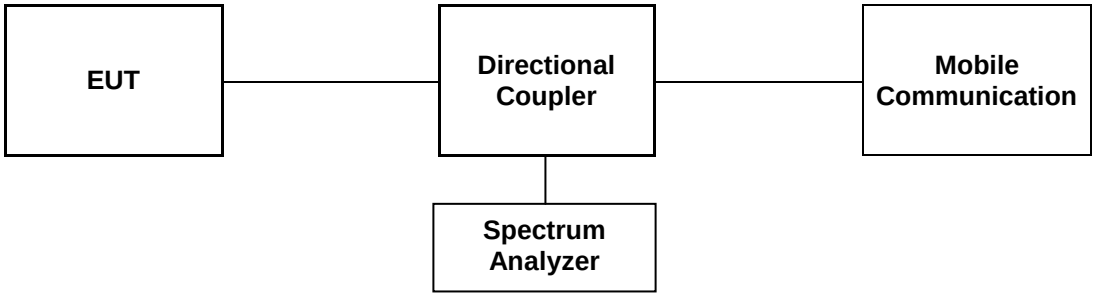
# 4. Occupied Bandwidth 99 %

## 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.
3. OBW was measured with Mobile Communication Test unit for each channel.



## 4.3 Test Results

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

| Band | Mode | Frequency (㎒) | Occupied Bandwidth (㎒) |
|---|---|---|---|
| CDMA800 | 1xRTT<br>RC5<br>9 (Loopback) | 824.70 | 1.268 |
| | | 836.52 | 1.270 |
| | | 848.31 | 1.269 |
| CDMA1 900 | 1xRTT<br>RC1<br>55 (Loopback) | 1 851.25 | 1.268 |
| | | 1 880.00 | 1.267 |
| | | 1 908.75 | 1.269 |

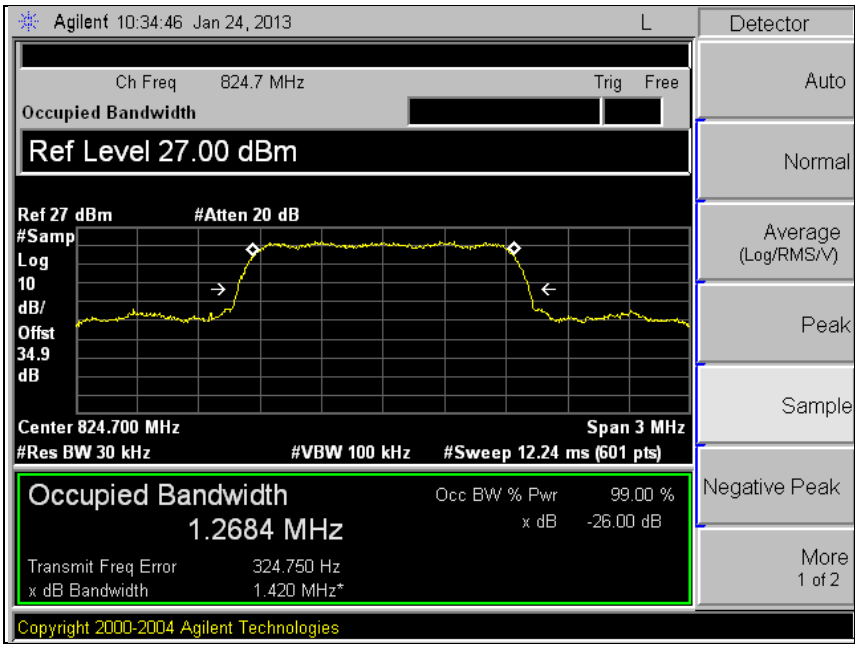
| Band | Mode | Frequency (㎒) | Occupied Bandwidth (㎒) |
|---|---|---|---|
| CDMA800 | 1xEV-DO(Rel0)<br>RTAP<br>9.6 | 824.70 | 1.265 |
| | | 836.52 | 1.267 |
| | | 848.31 | 1.266 |
| CDMA1 900 | 1xEV-DO(Rel0)<br>RTAP<br>76.8 | 1 851.25 | 1.267 |
| | | 1 880.00 | 1.273 |
| | | 1 908.75 | 1.270 |

Please refer to the following plots.

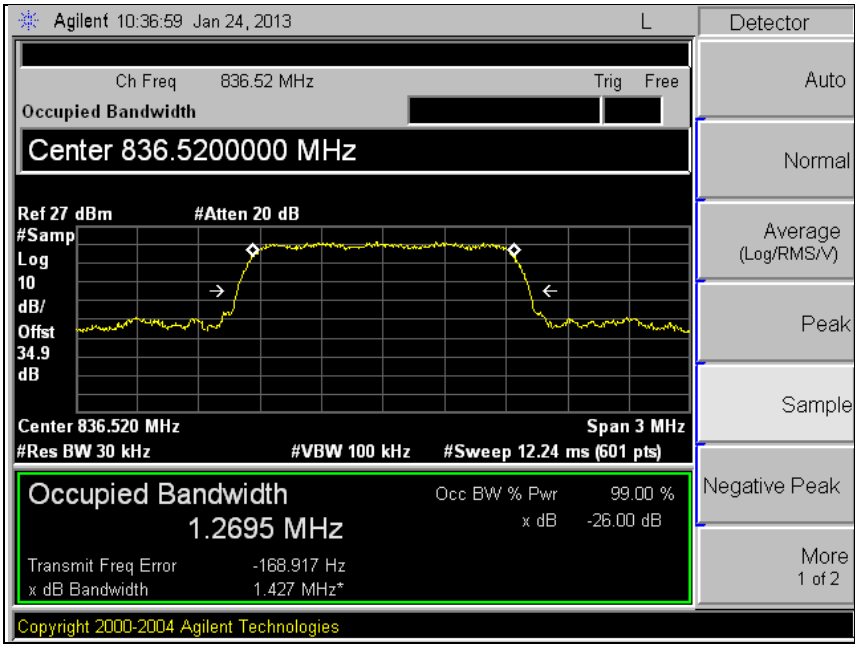
**CDMA800**

**1xRTT**

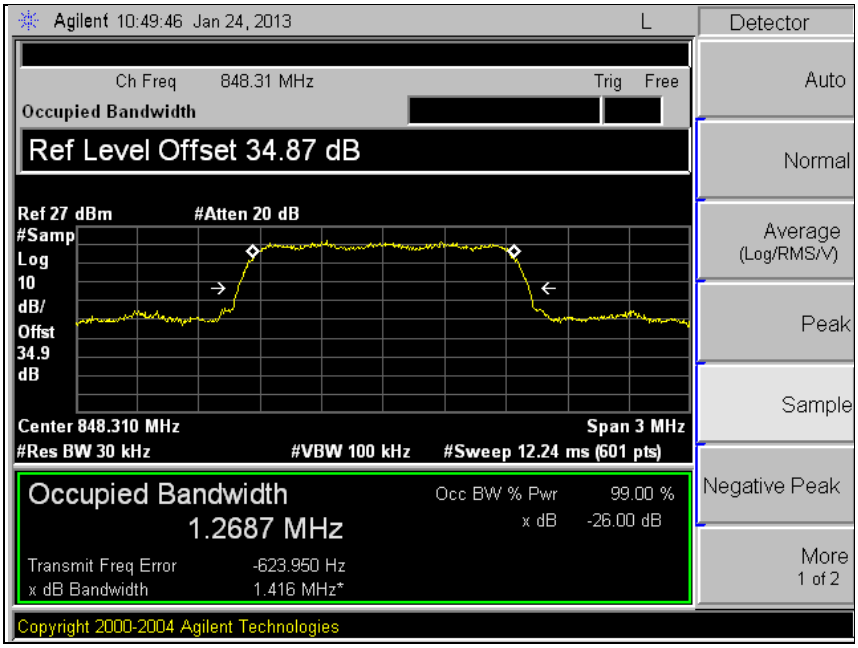
Low Channel




Middle Channel



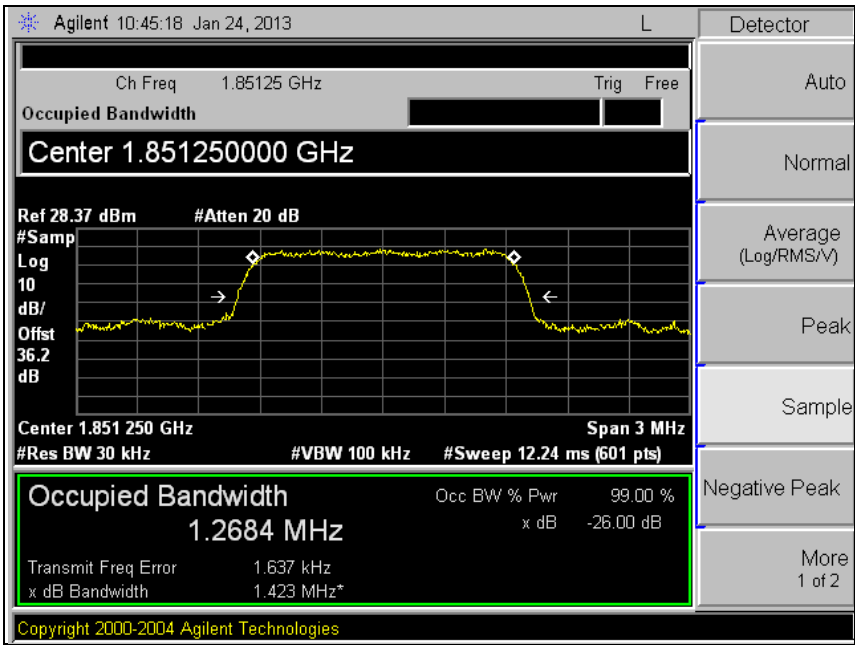
High Channel



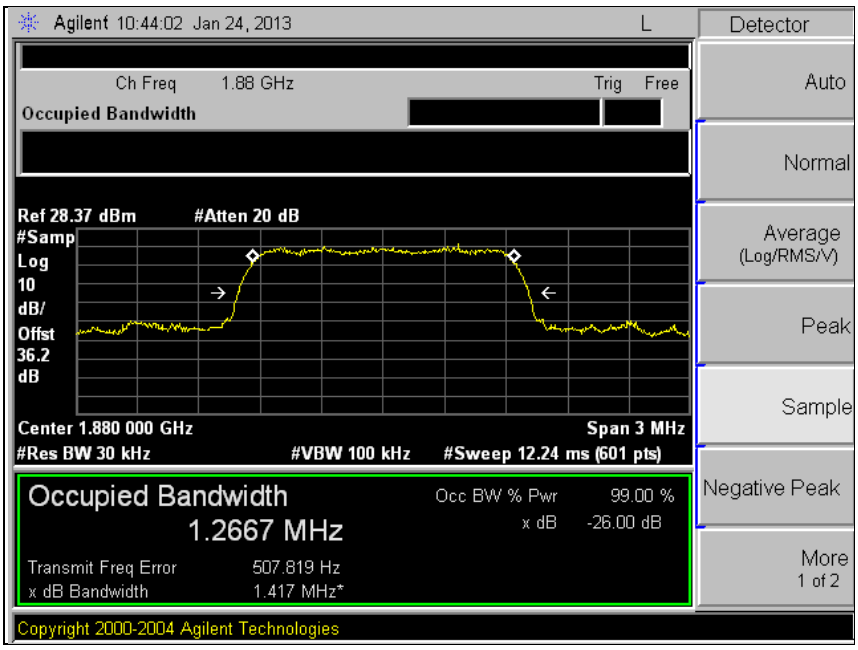
**CDMA1 900**

**1xRTT**

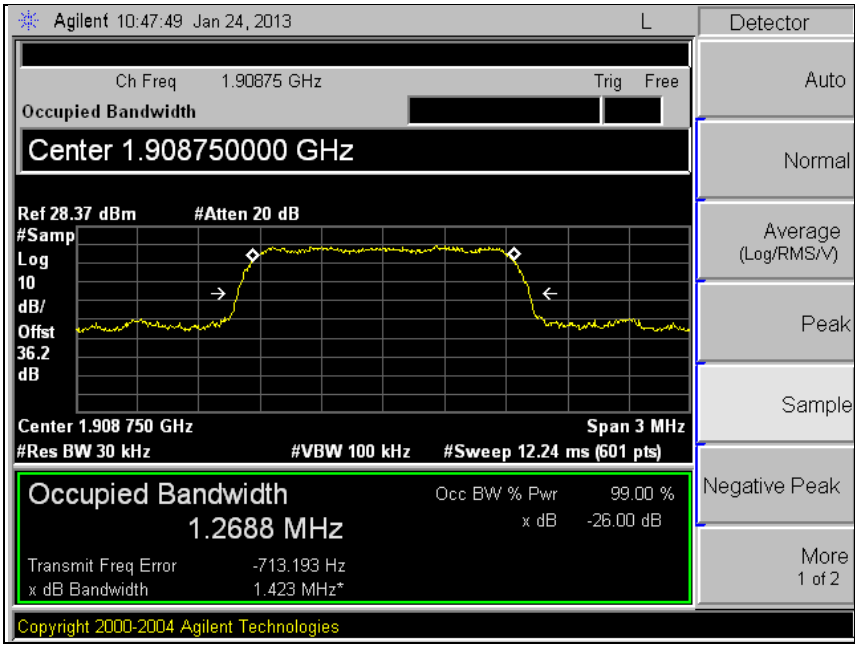
Low Channel




Middle Channel



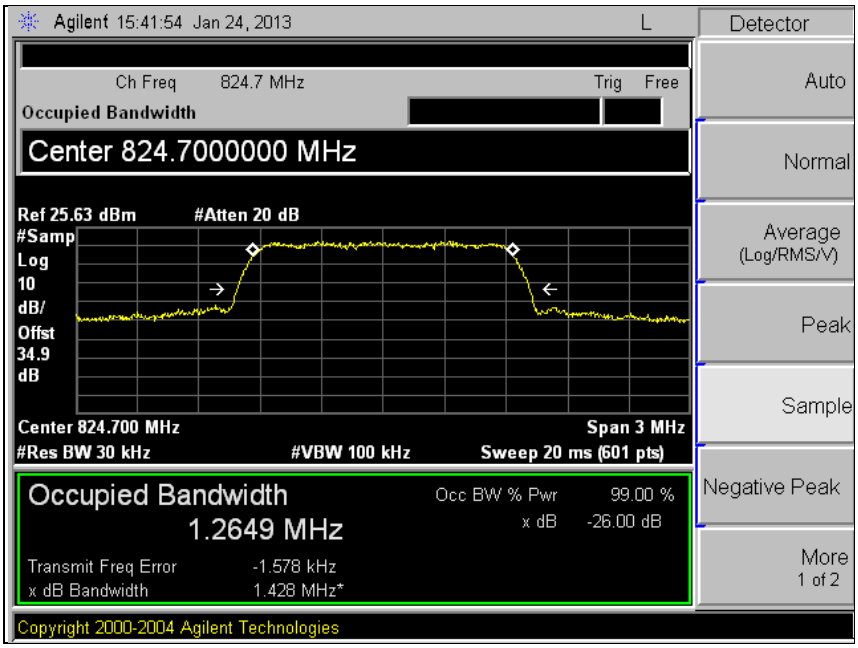
High Channel



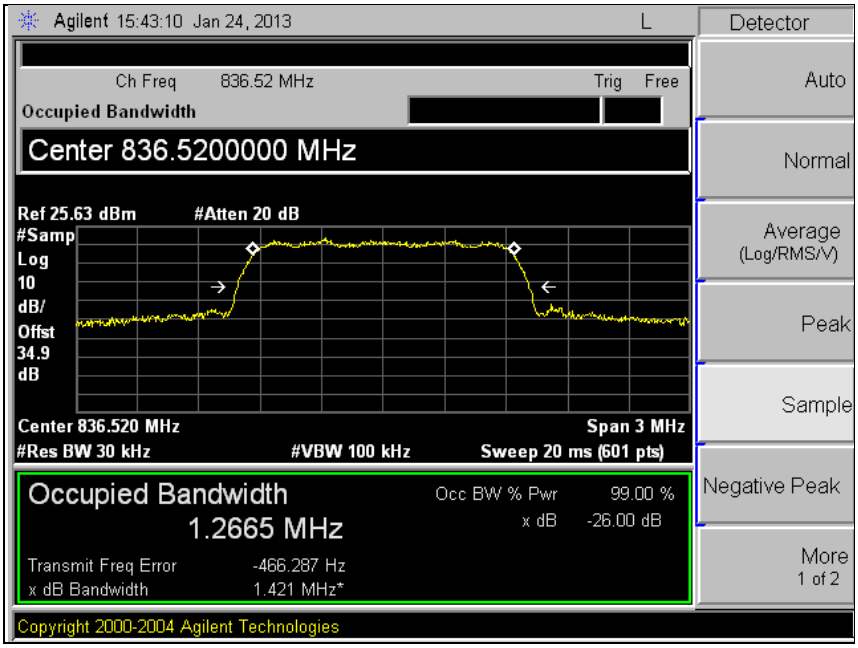
**CDMA800**

**1xEV-DO**

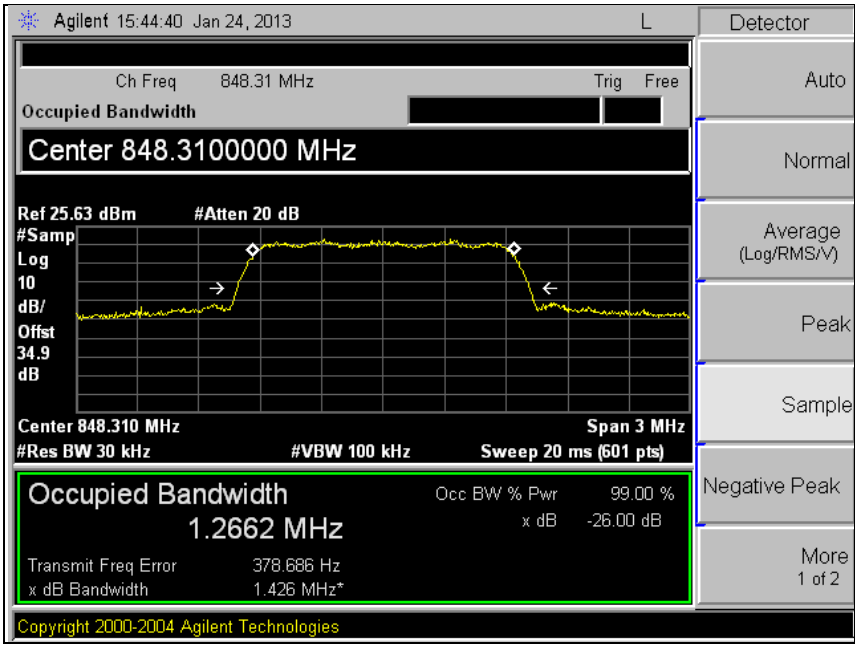
Low Channel




Middle Channel



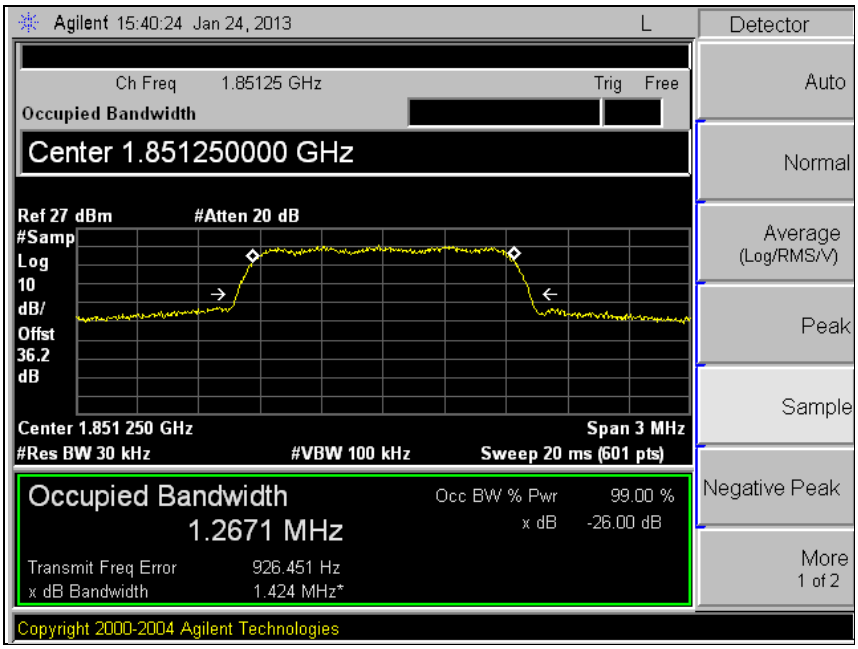
High Channel



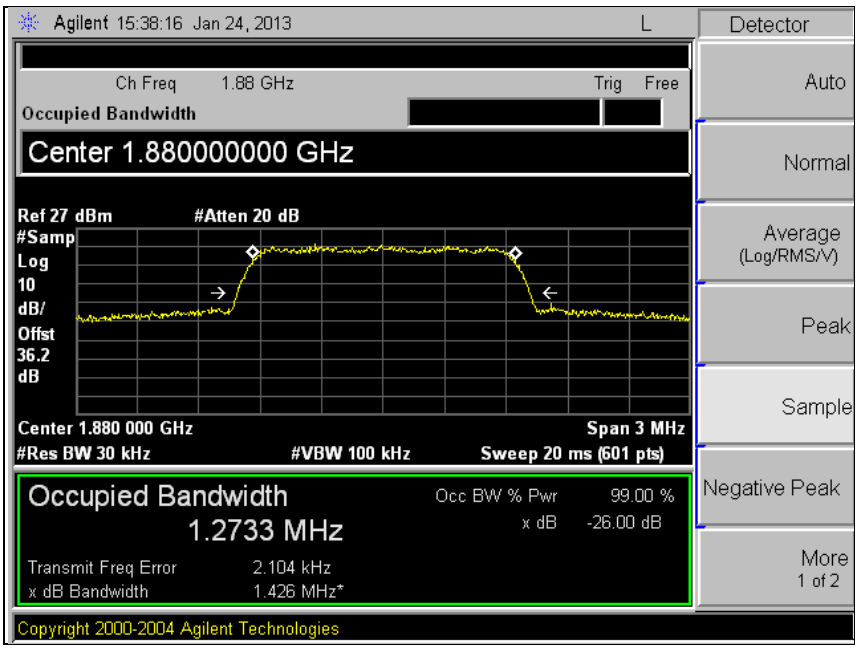
**CDMA1 900**

**1xEV-DO**

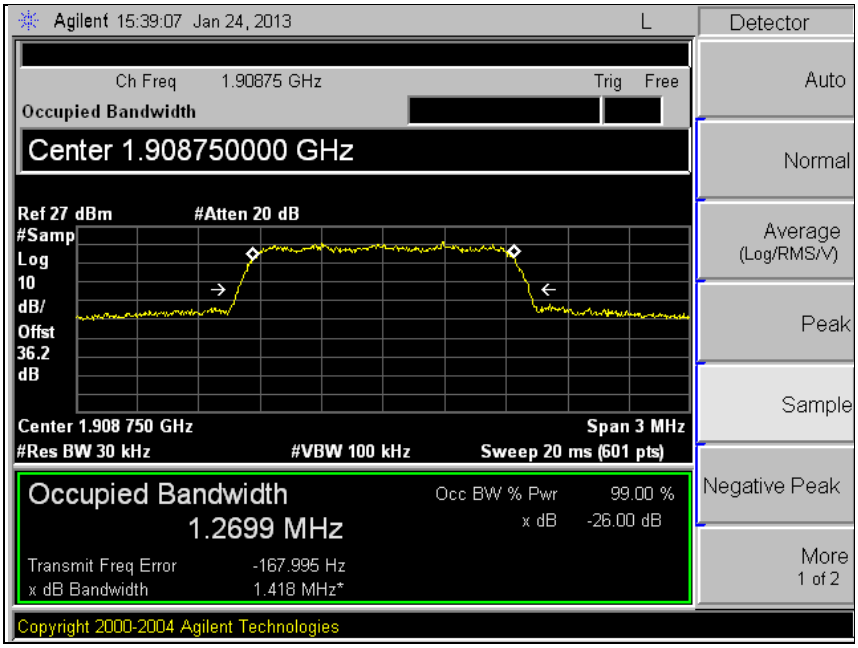
Low Channel




Middle Channel



High Channel



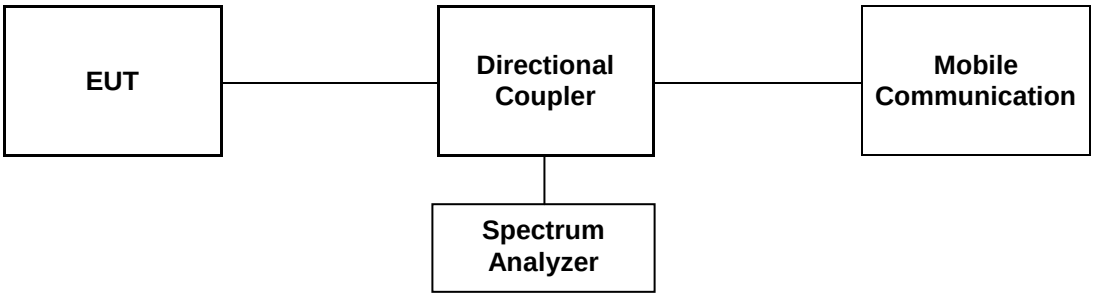
# 5. Peak-Average Ratio

## 5.1. Limit

§24.232(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 ㏈.

## 5.2. Test Procedure

1. The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.
2. The CCDF function of the spectrum analyzer was set.
3. PAR was measured with spectrum analyzer for each channel.



## 4.3 Test Results

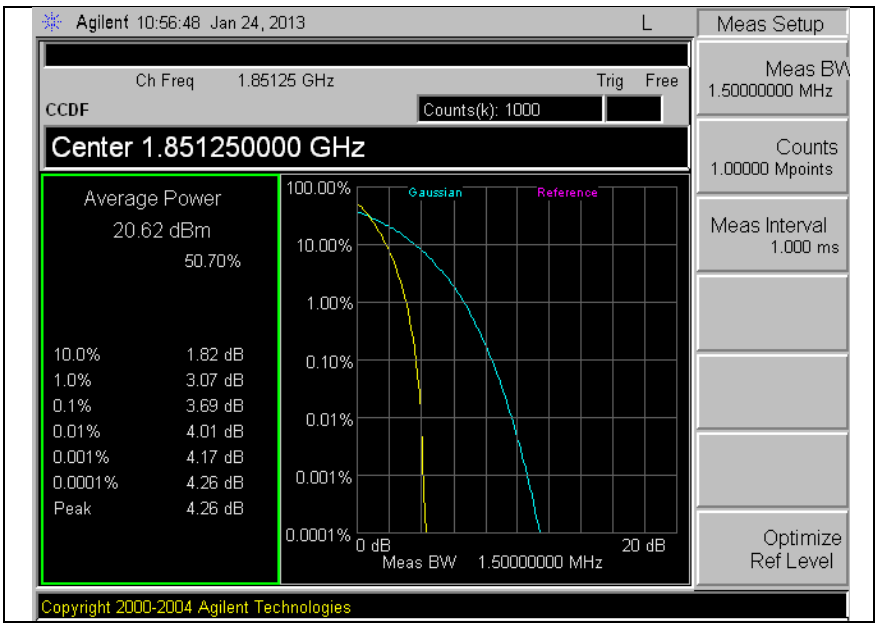
| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

Please refer to the following plots.

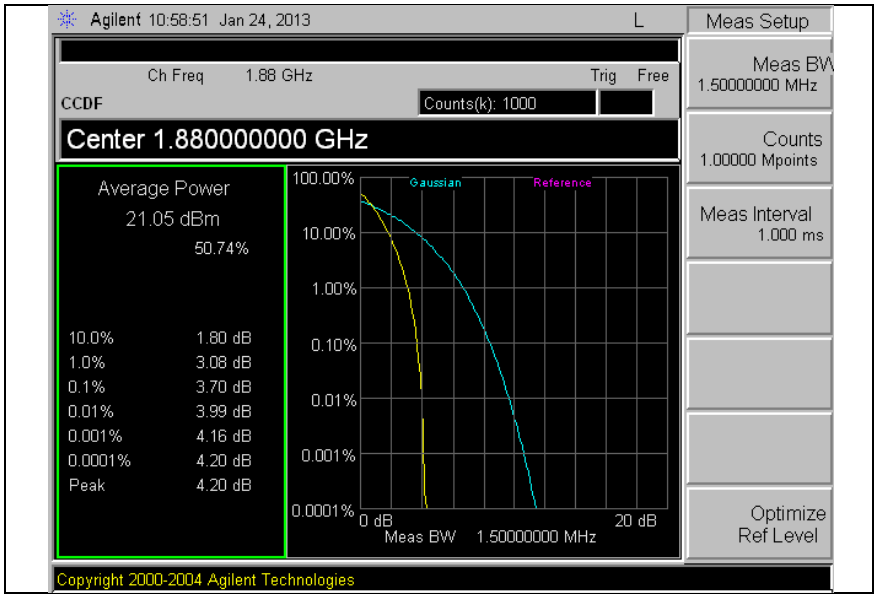
**CDMA1 900**

**1xRTT**

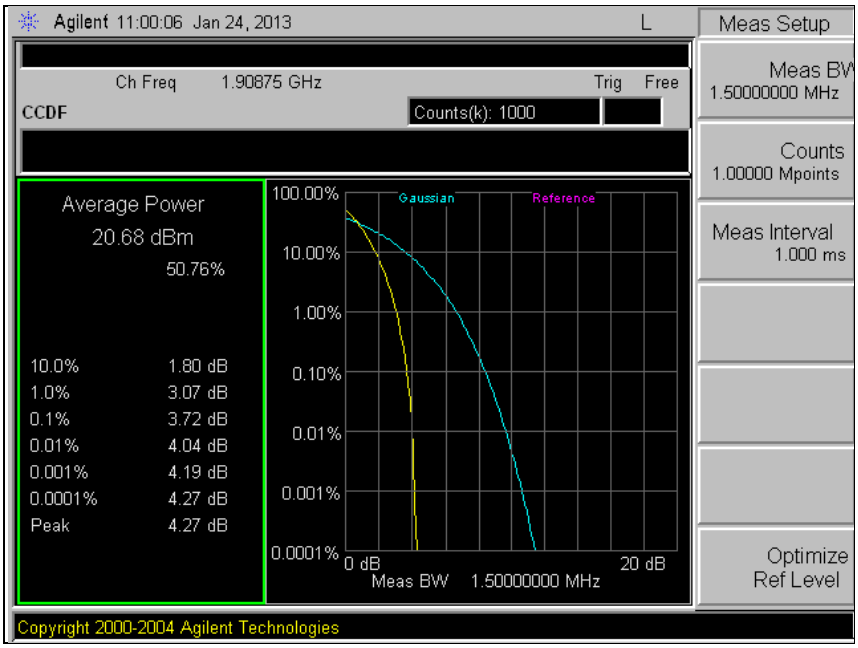
Low Channel




Middle Channel



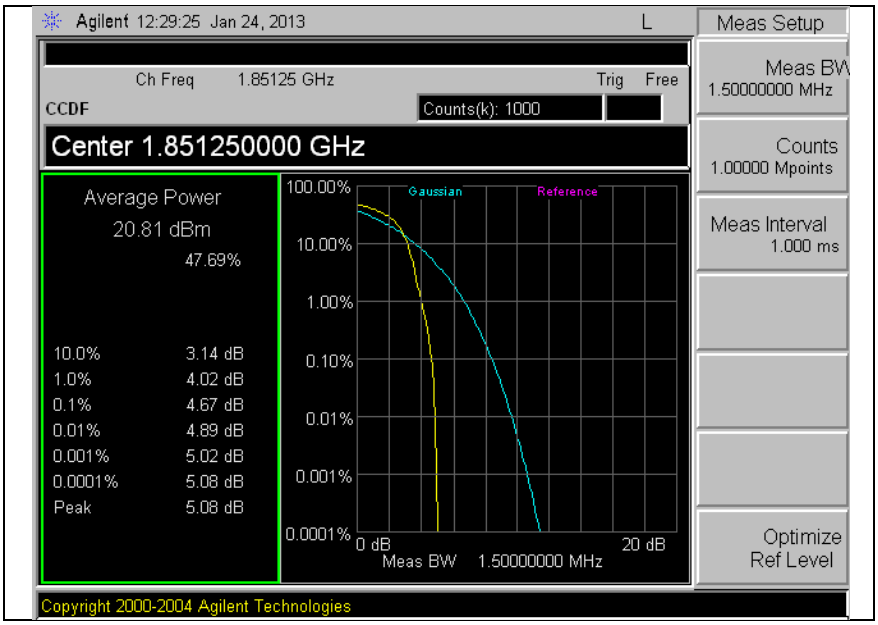
High Channel



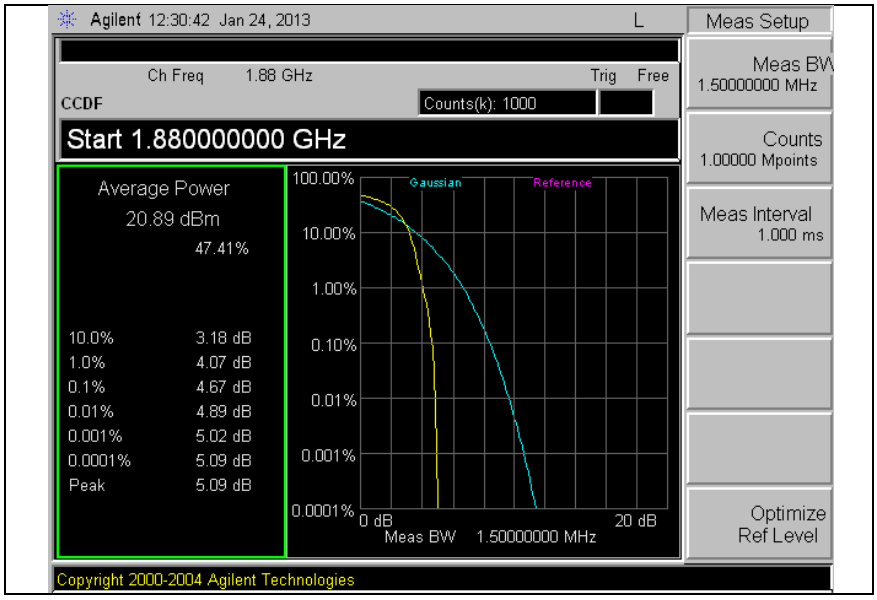
**CDMA1 900**

**1xEV-DO**

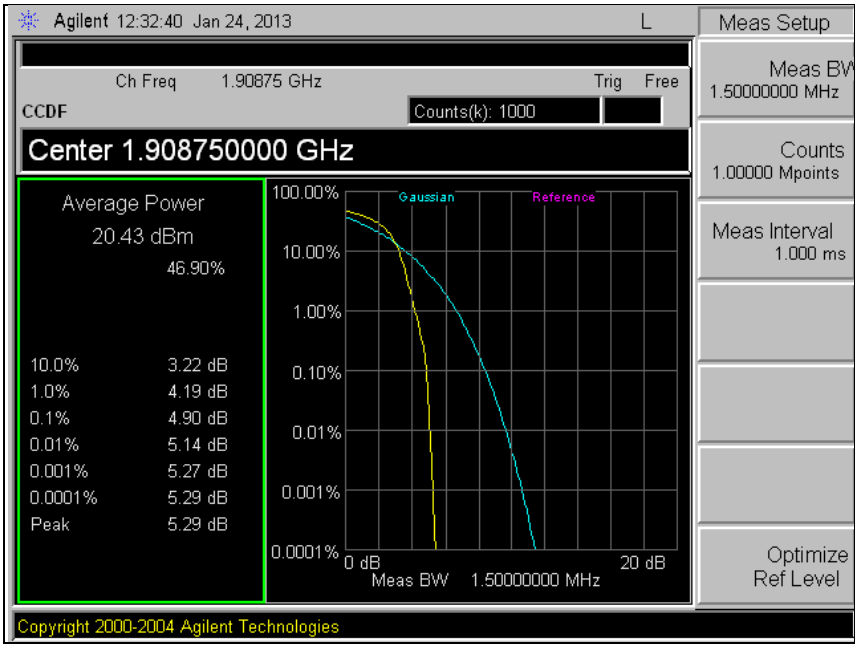
Low Channel




Middle Channel



High Channel



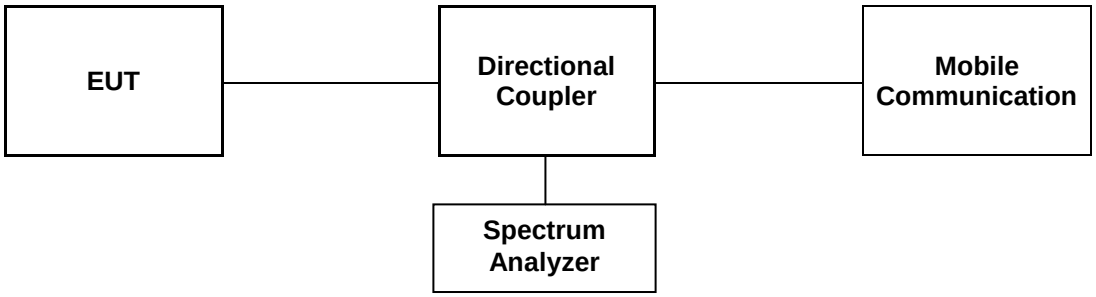
# 6. Spurious Emissions at Antenna Terminal

## 6.1. Limit

§22.917(a) 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)㏈.

## 6.2. 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.



## 6.3. Test Results

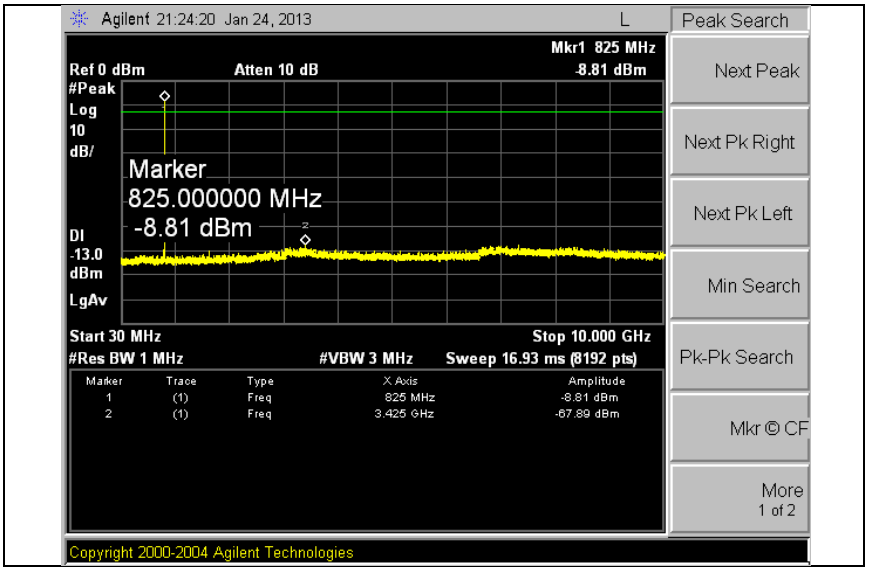
| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

Please refer to the following plots.

**CDMA800**

**1xRTT**

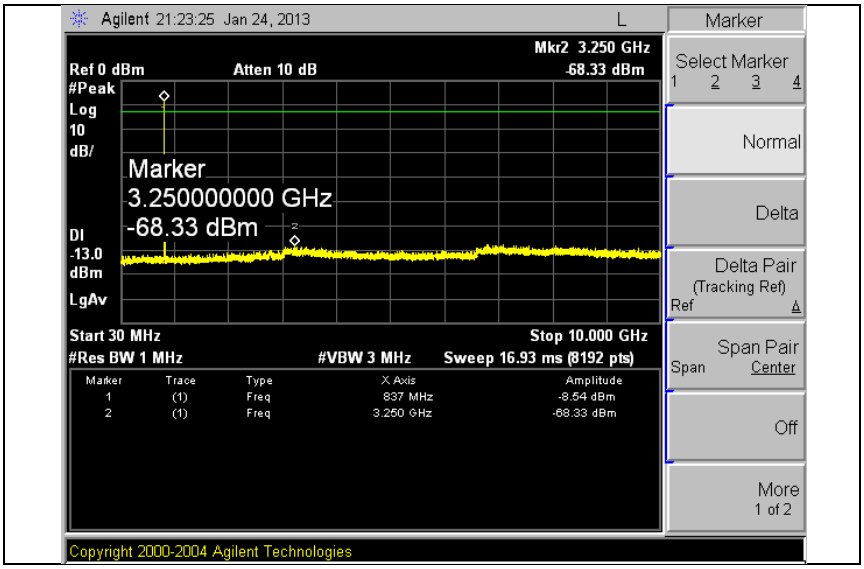
Low Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 3 425.00 | 36.12 | -67.89 | -31.77 |

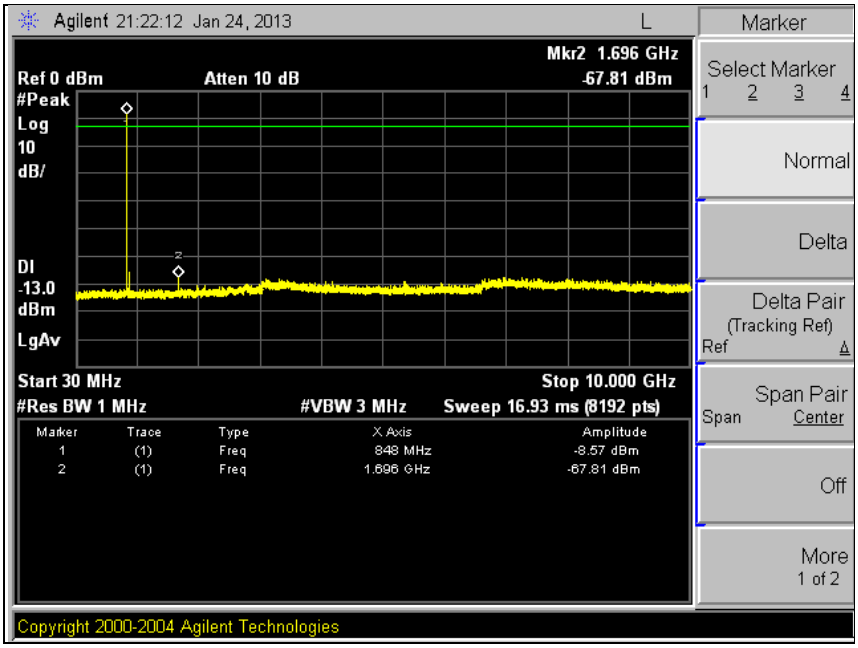
Middle Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (Mhz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 3 250.00 | - | Noise level | - |

High Channel



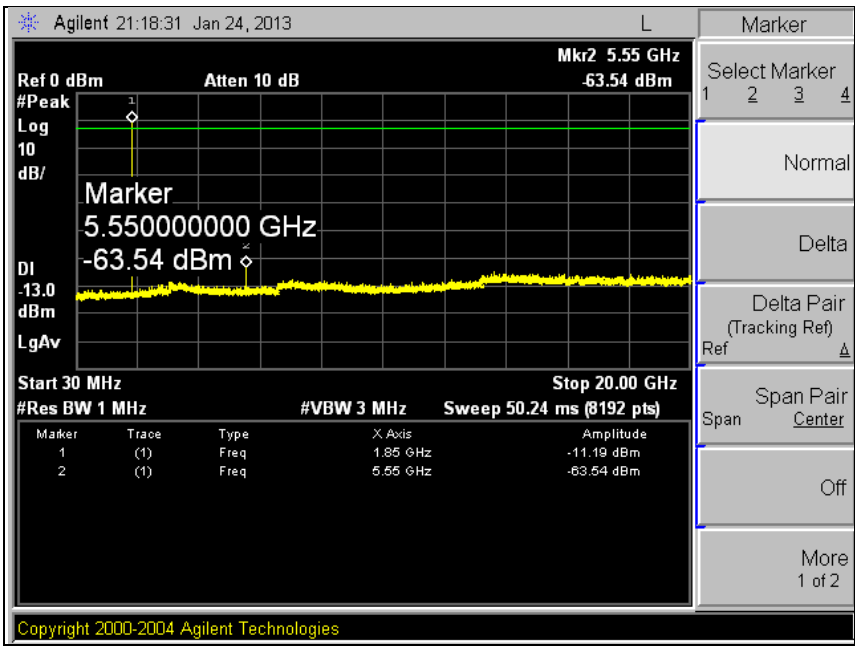

Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (㎒) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 1 696.00 | 35.64 | -67.81 | -32.17 |

**CDMA1 900**

**1xRTT**

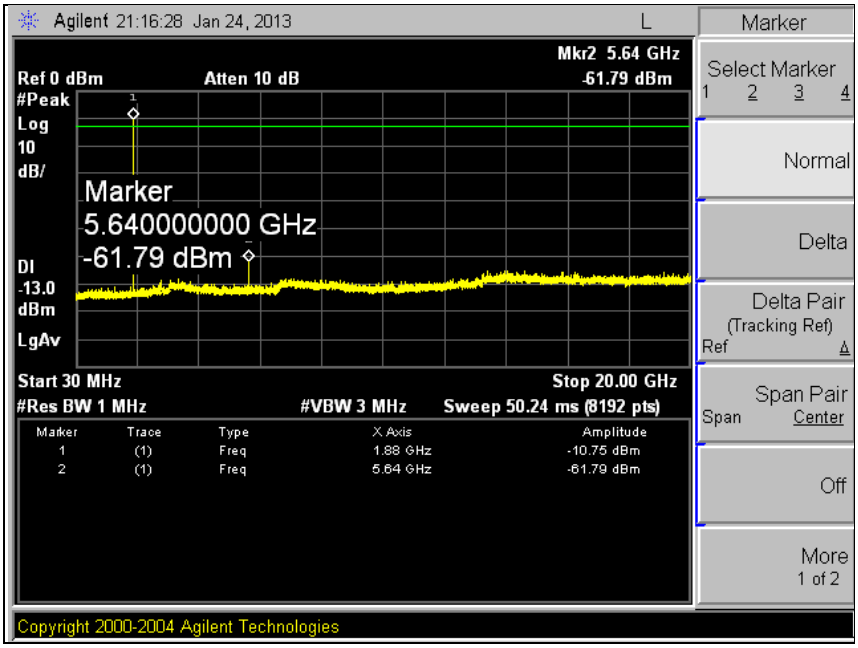
Low Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 550.00 | 37.35 | -63.54 | -26.19 |

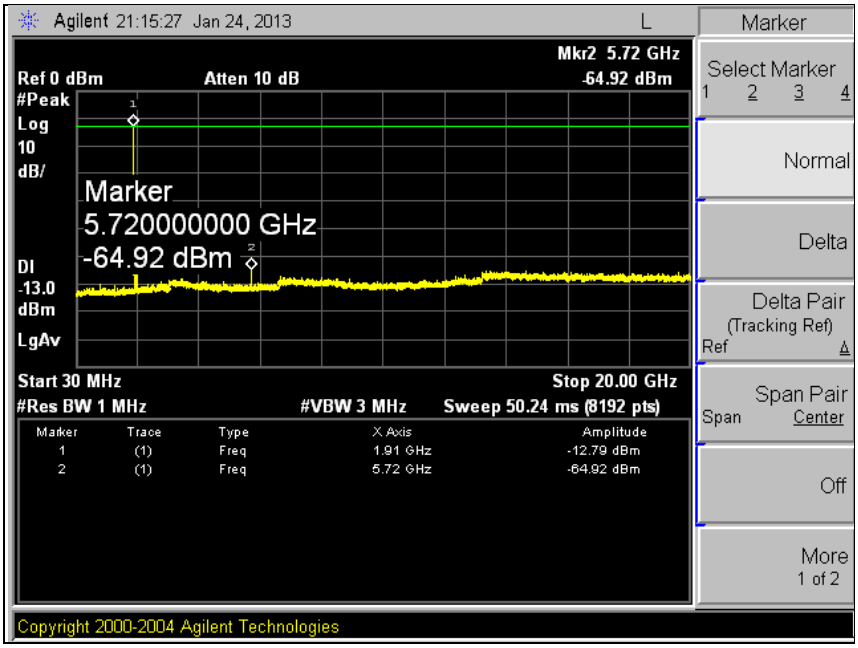
Middle Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 640.00 | 37.38 | -61.79 | -24.41 |

High Channel



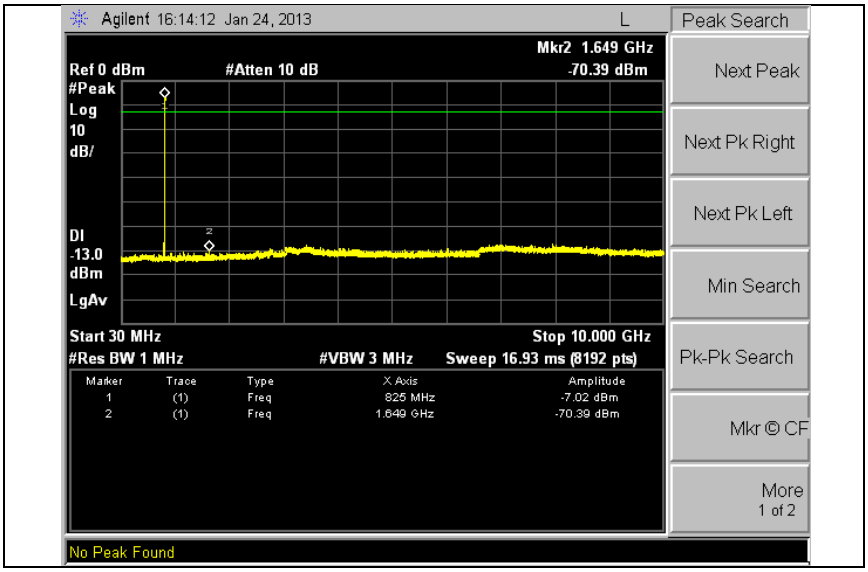

Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 720.00 | 37.41 | -64.92 | -27.51 |

**CDMA800**

**1xEV-DO**

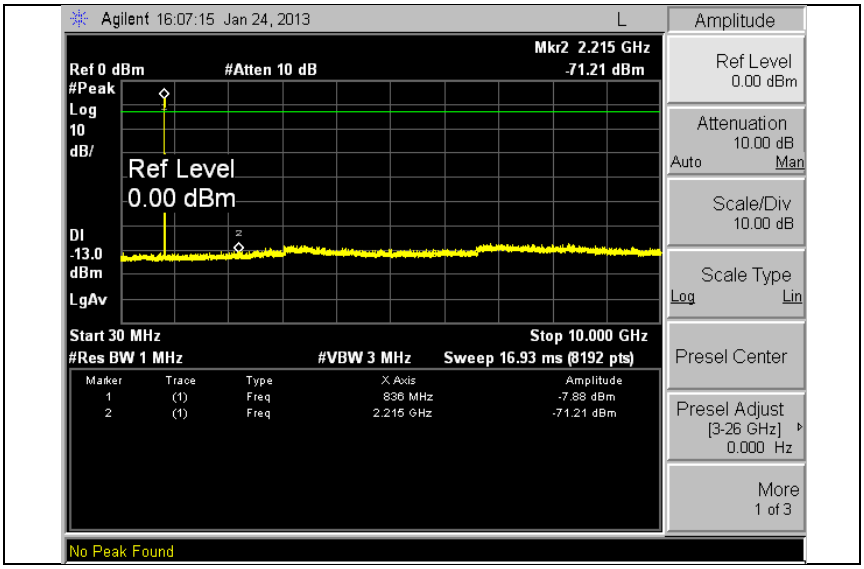
Low Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 1 649.00 | - | Noise level | - |

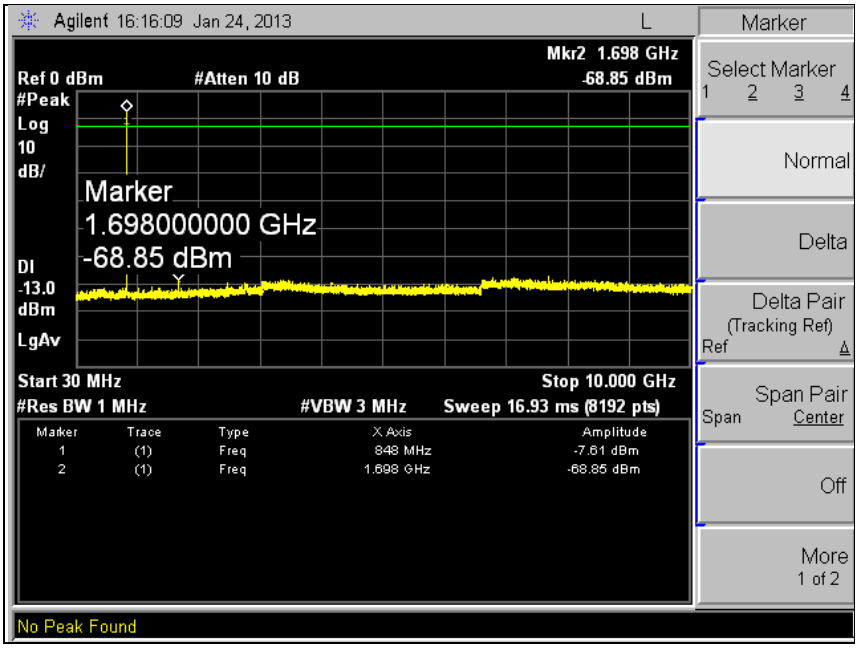
Middle Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (Mhz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 2 215.00 | - | Noise level | - |

High Channel



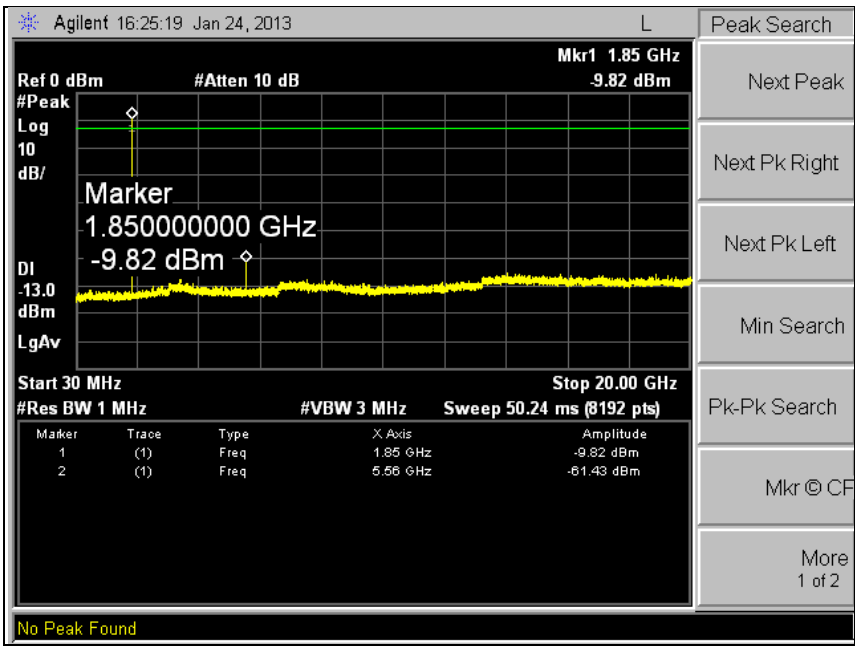

Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 1 698.00 | 35.63 | -68.85 | -33.22 |

**CDMA1 900**

**1xEV-DO**

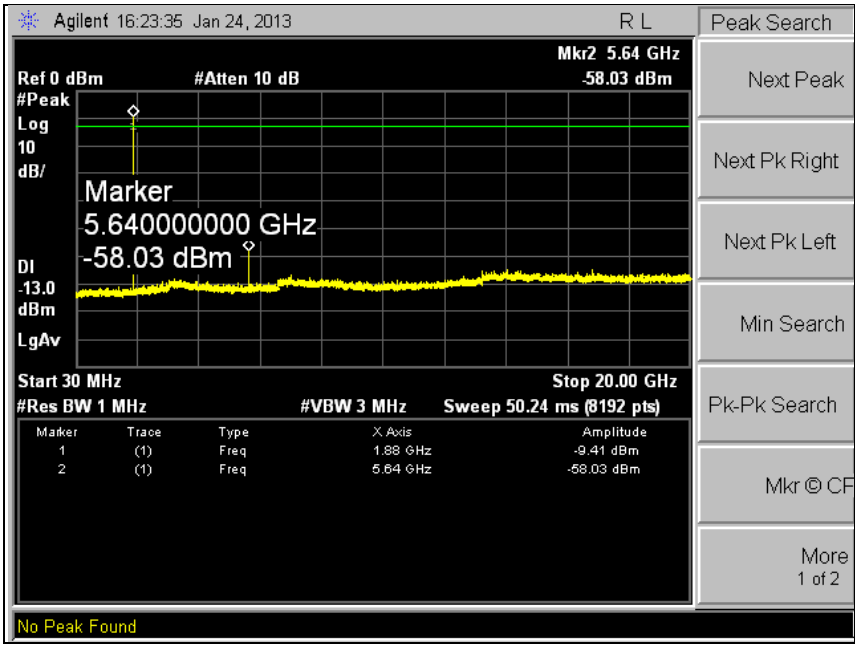
Low Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 560.00 | 37.36 | -61.43 | -24.07 |

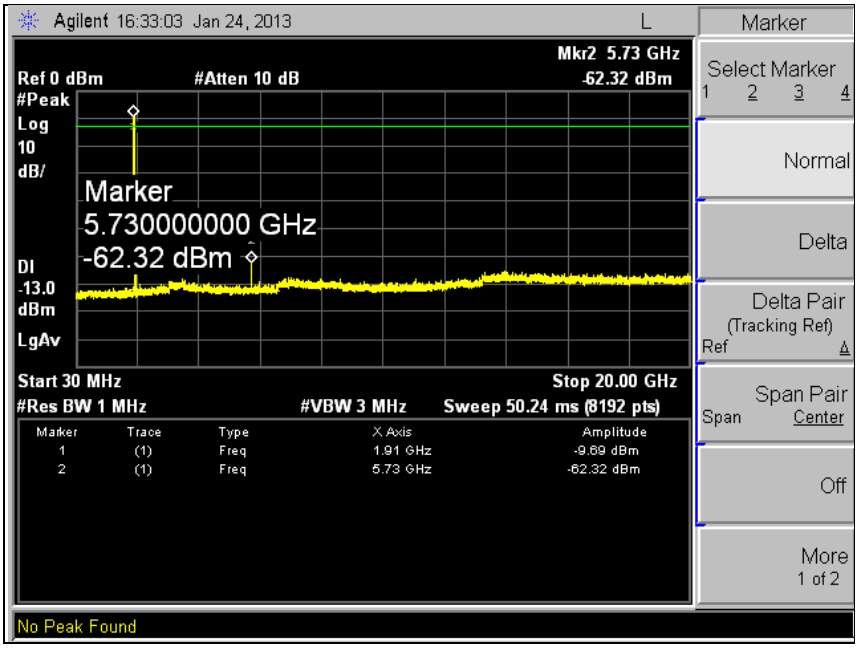
Middle Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 640.00 | 37.38 | -58.03 | -20.65 |

High Channel




Note:
Offset (dB) = Directional Coupler (dB) + Attenuator(dB) + Cable loss (dB)
Result (dB m) = Spurious offset (dB) + Reading values (dB m)

| Frequency (MHz) | Spurious offset (dB) | Reading values (dB m) | Result (dB m) |
|---|---|---|---|
| 5 730.00 | 37.42 | -62.32 | -24.90 |

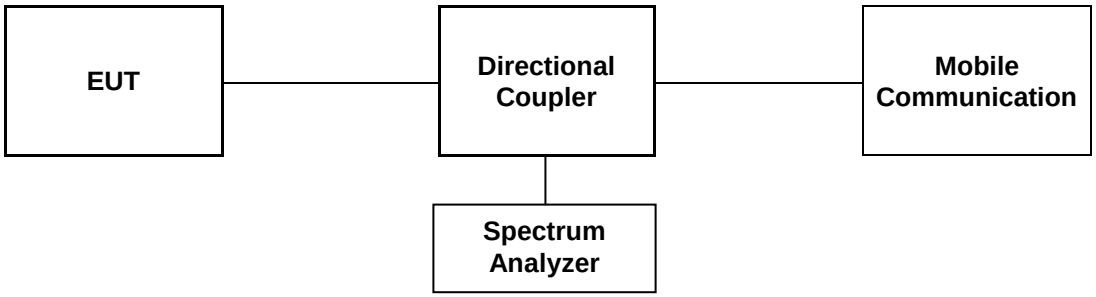
# 7. Band Edge

## 7.1. Limit

§22.917(a) 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.

## 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 block edge frequency.



## 7.3. Test Results

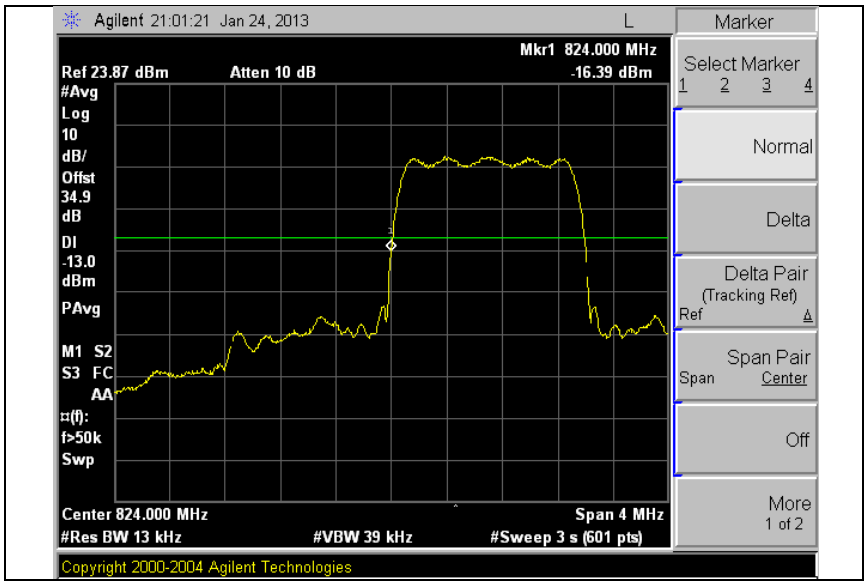
| | | |
|---|---|---|
| Ambient temperature | : | (24 ± 2) ℃ |
| Relative humidity | : | 47 % R.H. |

Please refer to the following plots.

**CDMA800 (band edge)**

**1xRTT**

Low Channel

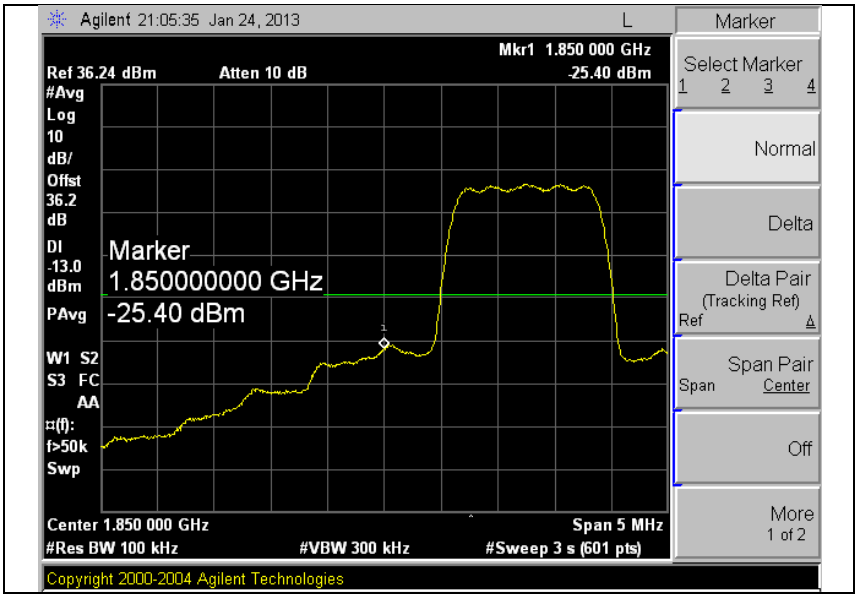



High Channel

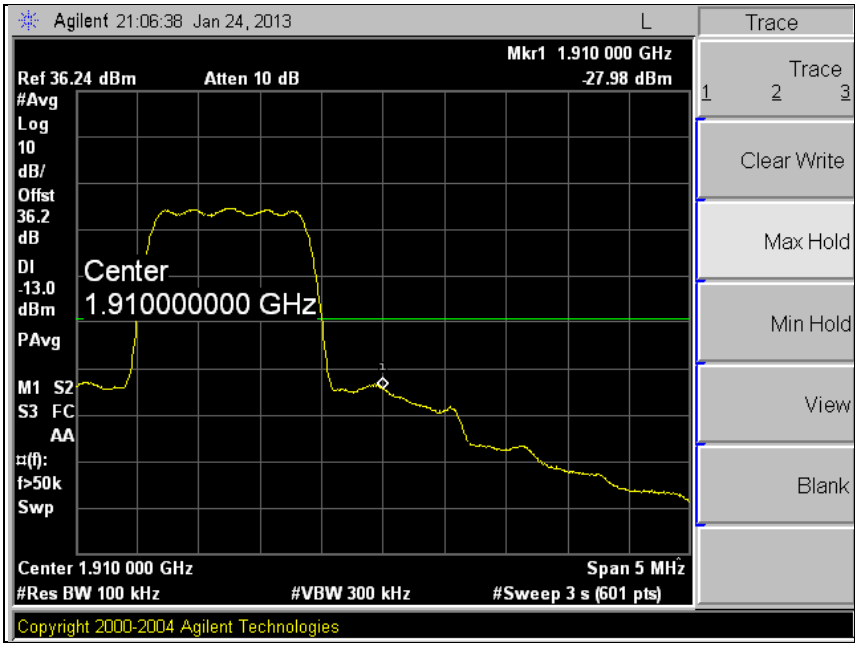
**CDMA1 900 (Band edge)**

**1xRTT**

Low Channel



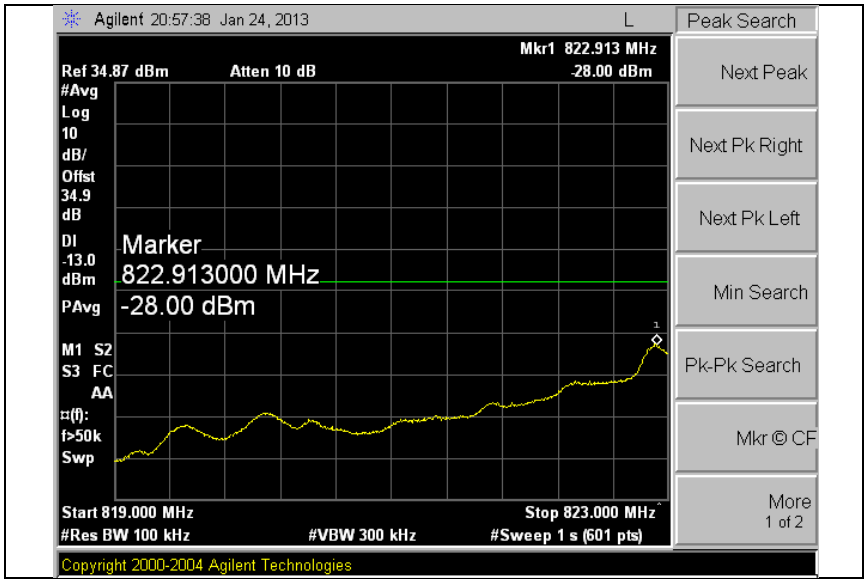

High Channel



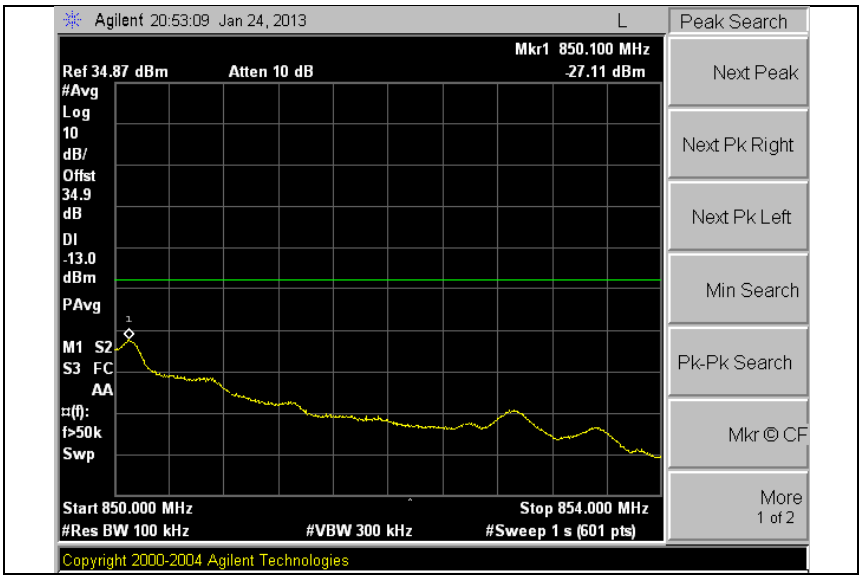
**CDMA800 (4 ㎒ SPAN)**

**1xRTT**

Low Channel



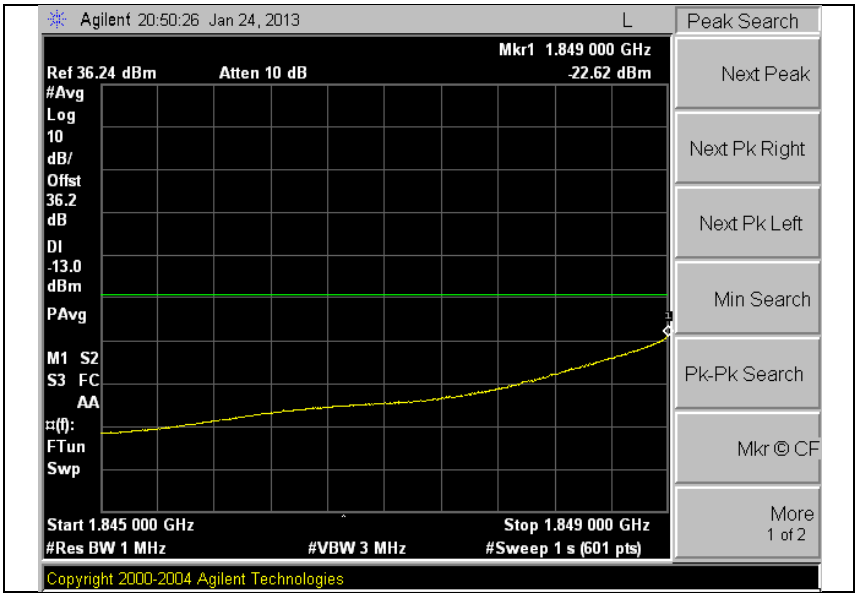

High Channel



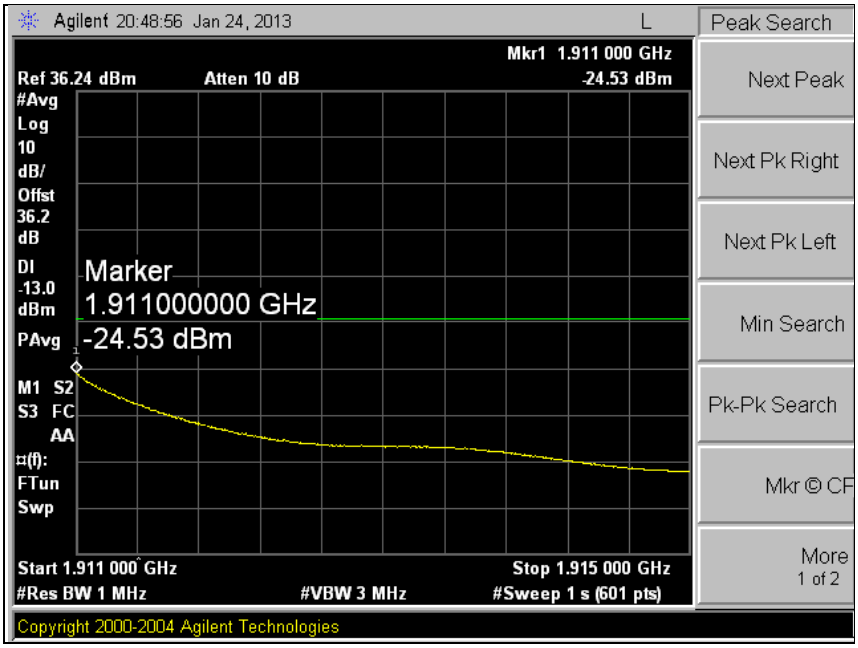
**CDMA1 900 (4 ㎒ SPAN)**

**1xRTT**

Low Channel



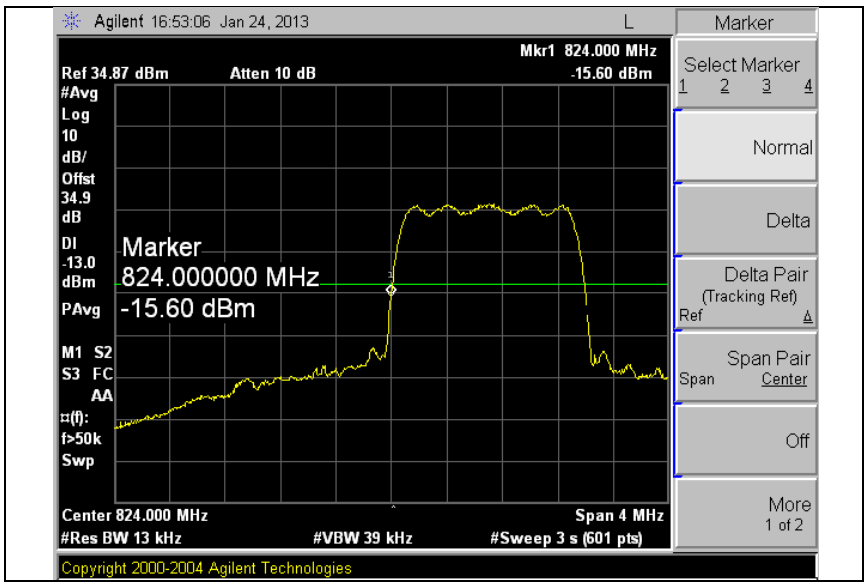

High Channel



**CDMA800 (band edge)**

**1xEV-DO**

Low Channel

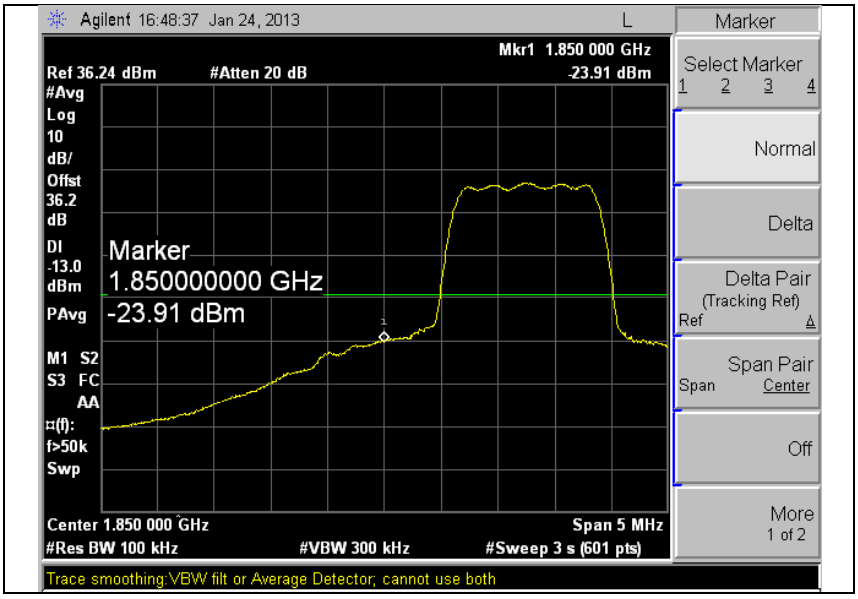



High Channel

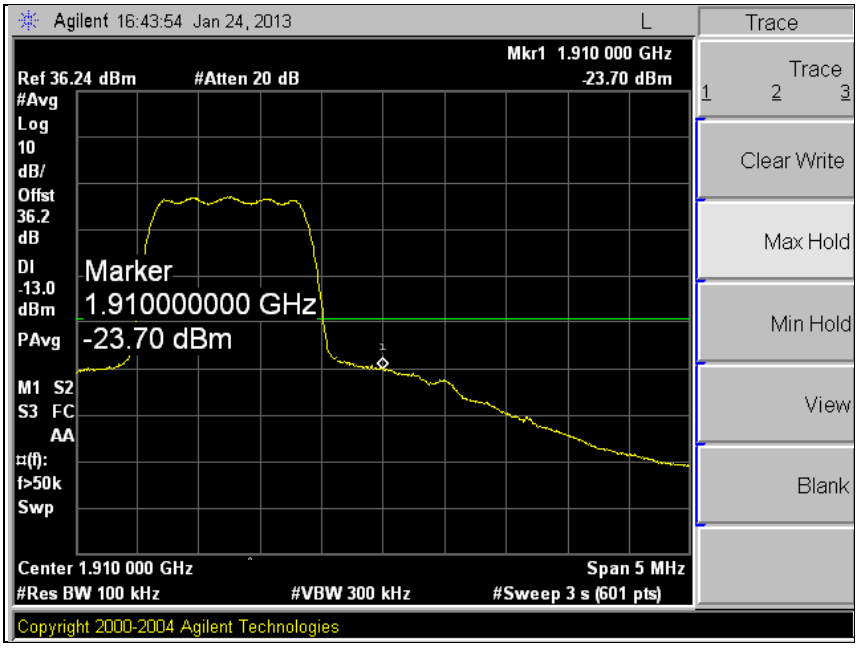
**CDMA1 900 (Band edge)**

**1xEV-DO**

Low Channel



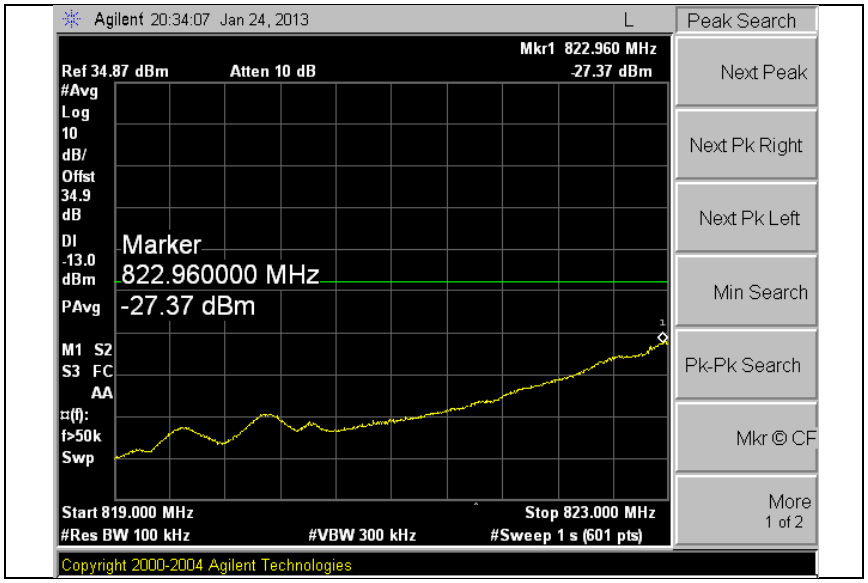

High Channel



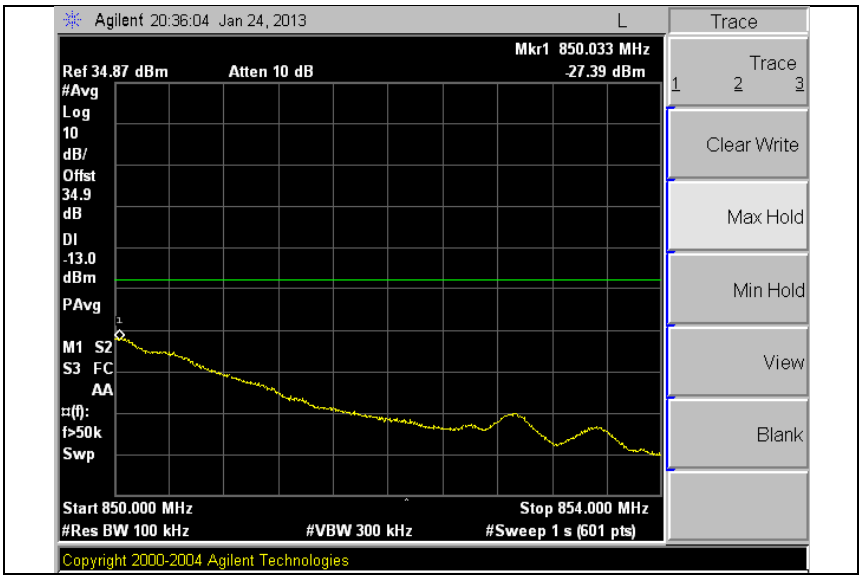
**CDMA800 (4 ㎒ SPAN)**

**1xEV-DO**

Low Channel



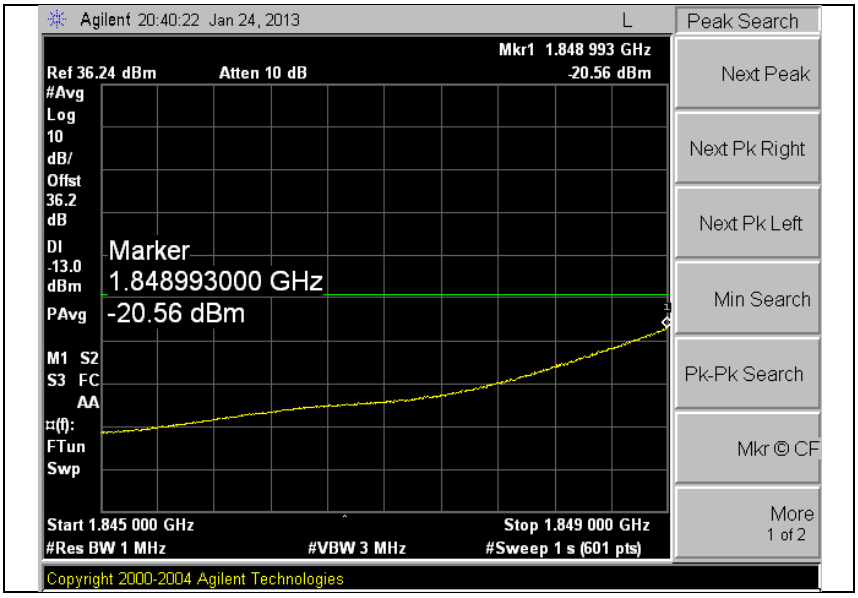

High Channel



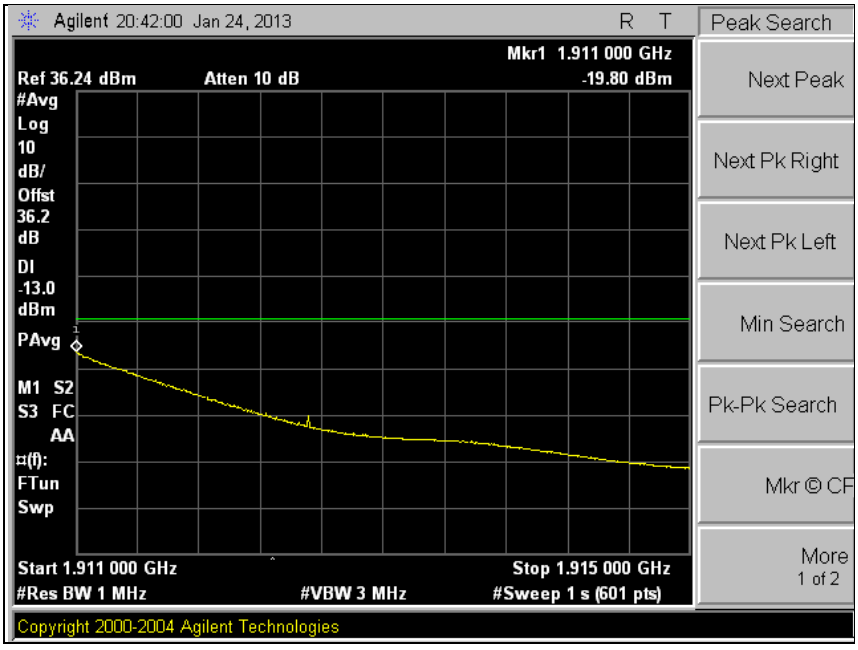
**CDMA1 900 (4 ㎒ SPAN)**

**1xEV-DO**

Low Channel




High Channel



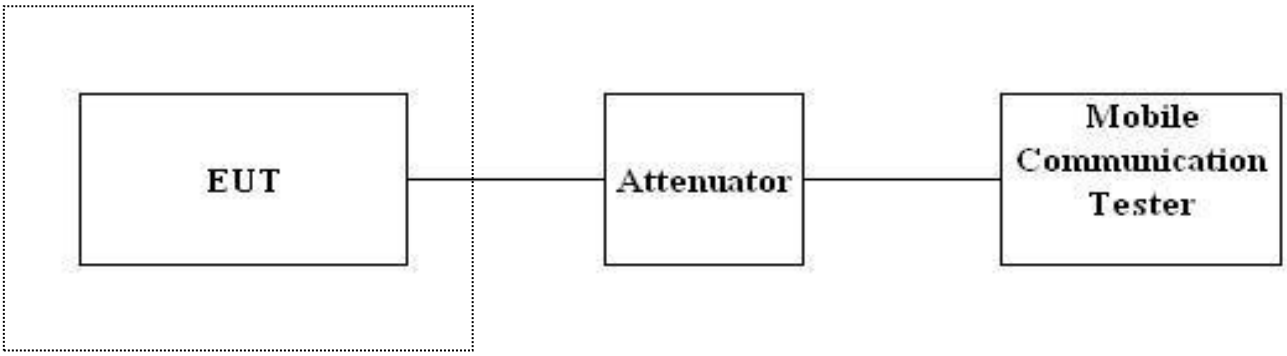
# 8. Frequency Stability

## 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.




Temperature Chamber

## 8.3. Test Results

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

**CDMA800 1xRTT mode at middle channel**

| Reference Frequency: 836.52 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| -30 | 14.4 | 5 | 0.003 586 |
| -20 | | 4 | 0.002 391 |
| -10 | | 3 | 0.001 195 |
| 0 | | 2 | 0.000 000 |
| 10 | | 2 | 0.000 000 |
| 20 | | 2 | **Ref** |
| 30 | | 3 | 0.001 195 |
| 40 | | 4 | 0.002 391 |
| 50 | | 4 | 0.002 391 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 24 | (+15 %) | 2 | 0.000 000 |
| | (-15 %) | 2 | 0.000 000 |

**CDMA1 900 1xRTT mode at middle channel**

| Reference Frequency: 1 880.0 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| -30 | 14.4 | 6 | 0.002 128 |
| -20 | | 4 | 0.001 064 |
| -10 | | 4 | 0.001 064 |
| 0 | | 2 | 0.000 000 |
| 10 | | 1 | -0.000 532 |
| 20 | | 2 | **Ref** |
| 30 | | 3 | 0.000 532 |
| 40 | | 3 | 0.000 532 |
| 50 | | 4 | 0.001 064 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **Ppm** |
| 24 | (+15 %) | 2 | 0.000 000 |
| | (-15 %) | 3 | 0.000 532 |

**CDMA800 1xEV-DO mode at middle channel**

| Reference Frequency: 836.52 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| -30 | 14.4 | 4 | 0.002 391 |
| -20 | | 4 | 0.002 391 |
| -10 | | 3 | 0.001 195 |
| 0 | | 2 | 0.000 000 |
| 10 | | 2 | 0.000 000 |
| 20 | | 2 | **Ref** |
| 30 | | 3 | 0.001 195 |
| 40 | | 4 | 0.002 391 |
| 50 | | 5 | 0.003 586 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 24 | (+15 %) | 3 | 0.001 195 |
| | (-15 %) | 2 | 0.000 000 |

**CDMA1 900 1xEV-DO mode at middle channel**

| Reference Frequency: 1 880.0 ㎒, Limit: 2.5 ppm | | | |
|---|---|---|---|
| **Frequency Stability versus Temperature** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| -30 | 14.4 | 5 | 0.001 596 |
| -20 | | 4 | 0.001 064 |
| -10 | | 3 | 0.000 532 |
| 0 | | 2 | 0.000 000 |
| 10 | | 2 | 0.000 000 |
| 20 | | 2 | **Ref** |
| 30 | | 4 | 0.001 064 |
| 40 | | 4 | 0.001 064 |
| 50 | | 4 | 0.001 064 |
| **Frequency Stability versus power Supply** | | | |
| **Environment Temperature (℃)** | **Power Supplied (Vdc)** | **Frequency Measure with Time Elapse** | |
| | | **Frequency Error (㎐)** | **ppm** |
| 24 | (+15 %) | 2 | 0.000 000 |
| | (-15 %) | 3 | 0.000 532 |

# 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/1 500** | **30** |
| **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.

## 9.1.2. Test Result of RF Exposure Evaluation

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

## 9.1.3. Output Power into Antenna & RF Exposure Evaluation Distance

**Mode: CDMA800 1xRTT**

| Channel | Channel Frequency (㎒) | Measured E.R.P. (dB m) | Duty Cycle (%) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 824.70 | 24.83 | 100 | 0.099 250 | 0.549 80 |
| Middle | 836.52 | 24.45 | 100 | 0.090 935 | 0.557 68 |
| High | 848.31 | 24.21 | 100 | 0.086 046 | 0.565 54 |

| Mode | Channel Frequency (㎒) | Output Average Power to Antenna (dB m) | Antenna Gain (dB i) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Maximum tune up tolerance | 824.70 | 25.50 | 1.34 | 0.096 101 | 0.549 80 |

**Mode: CDMA1 900 1xRTT**

| Channel | Channel Frequency (㎒) | Measured E.I.R.P. (dB m) | Duty Cycle (%) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 1 851.25 | 27.01 | 100 | 0.099 938 | 1 |
| Middle | 1 880.00 | 24.44 | 100 | 0.055 301 | 1 |
| High | 1 908.75 | 27.52 | 100 | 0.112 390 | 1 |

| Mode | Channel Frequency (㎒) | Output Average Power to Antenna (dB m) | Antenna Gain (dB i) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Maximum tune up tolerance | 1 908.75 | 25.50 | 4.02 | 0.178 127 | 1 |

Note :
1. The power density Pd (5th column) at a distance of 20 ㎝ calculated from the friis transmission formula is far below the limit .

**Mode: CDMA800 1xEV-DO**

| Channel | Channel Frequency (㎒) | Measured E.R.P. (dB m) | Duty Cycle (%) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 824.70 | 24.19 | 100 | 0.085 650 | 0.549 80 |
| Middle | 836.52 | 24.39 | 100 | 0.089 687 | 0.557 68 |
| High | 848.31 | 24.27 | 100 | 0.087 243 | 0.565 54 |

| Mode | Channel Frequency (㎒) | Output Average Power to Antenna (dB m) | Antenna Gain (dB i) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Maximum tune up tolerance | 836.52 | 25.50 | 1.34 | 0.096 101 | 0.557 68 |

**Mode: CDMA1900 1xEV-DO**

| Channel | Channel Frequency (㎒) | Measured E.I.R.P. (dB m) | Duty Cycle (%) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Low | 1 851.25 | 27.17 | 100 | 0.103 688 | 1 |
| Middle | 1 880.00 | 24.07 | 100 | 0.050 784 | 1 |
| High | 1 908.75 | 26.05 | 100 | 0.080 118 | 1 |

| Mode | Channel Frequency (㎒) | Output Average Power to Antenna (dB m) | Antenna Gain (dB i) | Power Density at 20 ㎝ (㎽/㎠) | LIMITS (㎽/㎠) |
|---|---|---|---|---|---|
| Maximum tune up tolerance | 1 851.25 | 25.50 | 4.02 | 0.178 127 | 1 |

Note :
1. The power density Pd (5th column) at a distance of 20 ㎝ calculated from the friis transmission formula is far below the limit .