TEST REPORT

of

FCC Part 24
FCC ID : STE-QUADCOMM-1900

Equipment Under Test	:	RV-Quadcomm
Model Name	:	Quadcomm-1900
Serial No.	:	N/A
Applicant	:	R-tron Inc.
Manufacturer	:	R-tron Inc.
Date of Test(s)	:	2010-07-14 ~ 2010-08-02
Date of Issue	:	2010-08-03

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

Tested By: **Date** 2010-08-17

Feel Jeong

Approved By **Date** 2010-08-17

Charles Kim

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SGS Testing Korea Co., Ltd. **18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea, 435-040**

Tel. +82 31 428 5700 / Fax. +82 31 427 2371 www.electrolab.kr.sgs.com

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1. General information

1.1. Testing laboratory

SGS Testing Korea Co., Ltd.
- 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.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of applicant

Applicant : R-tron Inc.
Address : Jisan IT Venture Center 3F, 1004-9 Doksna-Dong, Gumchon-Gu, Seoul, Korea
Contact Person : You-Sik, Choi
Phone No. : 82-2-6343-1023

1.3. Description of EUT

Kind of Product	RV-Quadcomm
Model Name	Quadcomm-1900
Serial Number	N/A
Power Supply	110 ~ 220 Vac
Rated Power	30 dBm (Uplink, Downlink)
Frequency Range	1 850 ㎒ ~ 1 910 ㎒(Uplink), 1 930 ㎒ ~ 1 990 ㎒(Downlink)
Antenna Gain	9 ㏈i(Yagi_Uplink), 4.5 ㏈i(Patch_Downlink)

1.4. Description of test mode

Uplink mode

Test mode	Channel	Channel No.	Frequency (㎒)	Measured Channel Power	
				㏈m	㎽
CDMA2000	Low	25	1 851.25	29.79	953
	Mid	600	1 880.00	30.29	1 069
	High	1175	1 908.75	29.87	971
EV-DO	Mid	600	1 880.00	30.18	1 042

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Downlink mode

Test mode	Channel	Channel No.	Frequency (MHz)	Measured Channel Power	
				dB m	mW
CDMA2000	Low	25	1 931.25	30.00	1 000
	Mid	600	1 960.00	30.56	1 138
	High	1175	1 988.75	30.47	1 114
EV-DO	Mid	600	1 960.00	30.41	1 099

We found out the test mode with the highest power level after we analyze. So we chose CDMA2000 (worst case) as a representative.

1.5. Test equipment list

Equipment	Manufacturer	Model	Cal Due.
Signal Generator	Agilent	E4438C	Mar. 31, 2011
Signal Generator	Rohde & Schwarz	SMR40	Sep. 25, 2010
Spectrum Analyzer	Agilent	E4440A	Mar. 31, 2011
Power Divider	Agilent	87302C	Jan. 07, 2011
Attenuator	Agilent	8498A	Apr. 01, 2011
High Pass Filter	Wainwright	WHK3.0/18G-10SS	Sep. 29, 2010
Band Reject Filter	Wainwright	WRCG824/849-814/85 960/10SS	Apr. 01, 2011
AC power Supply	Deakwang	Slidas	Sep. 25, 2010
Preamplifier	H.P.	8447F	Jun. 05, 2011
Preamplifier	Empower RF Systems,Inc	2002-BBSC4AEL	Mar. 31, 2011
Test Receiver	R & S	ESU26	Apr. 15, 2011
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	Jun. 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)	Jan. 27, 2011

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1.6. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD : FCC Part 24		
Section in FCC part	**Test Item**	**Result**
§2.1053 §24.238(a)	Spurious Radiated Emission	Complied
§2.1046(a)	Conducted Output Power	Complied
§2.1049(h) (i)	Occupied Bandwidth	Complied
§2.1051 §24.238(a)	Spurious Emission at Antenna Terminal	Complied
§2.1055 §24.235	Frequency Stability	Complied
§24.238(a)	Band Edge	Complied
§1.1307(b)(1)	Maximum Permissible Exposure (Exposure of Humans to RF Fields)	Complied

1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL004066	Initial
1	F690501/RF-RTL004066-1	Revised FCC ID

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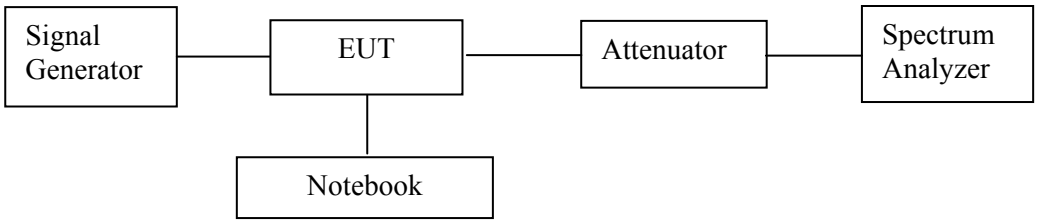
2. RF Output Power

2.1. Limit

Requirements: CFR 47, Section §2.1046

2.2. Test Procedure

1. The transmitter was tested while in a continuous transmit mode.
2. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions.
3. RF power output was measured with an RF input level at the point just before the compression point of the amplifier.
4. This is the point of maximum RF output power. If the RF input level is increased beyond this point, the amplifier gain (and consequently output power) is automatically reduced.



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2.3. Test Result

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

Uplink mode

Test mode	Channel No.	Frequency (㎒)	Measured Channel Power	
			dB m	㎽
Low	25	1 851.25	29.79	953
Mid	600	1 880.00	30.29	1 069
High	1175	1 908.75	29.87	971

Downlink mode

	Channel No.	Frequency (㎒)	Measured Channel Power	
			dB m	㎽
Low	25	1 931.25	30.00	1 000
Mid	600	1 960.00	30.56	1 138
High	1175	1 988.75	30.47	1 114

Please refer to the following plots.

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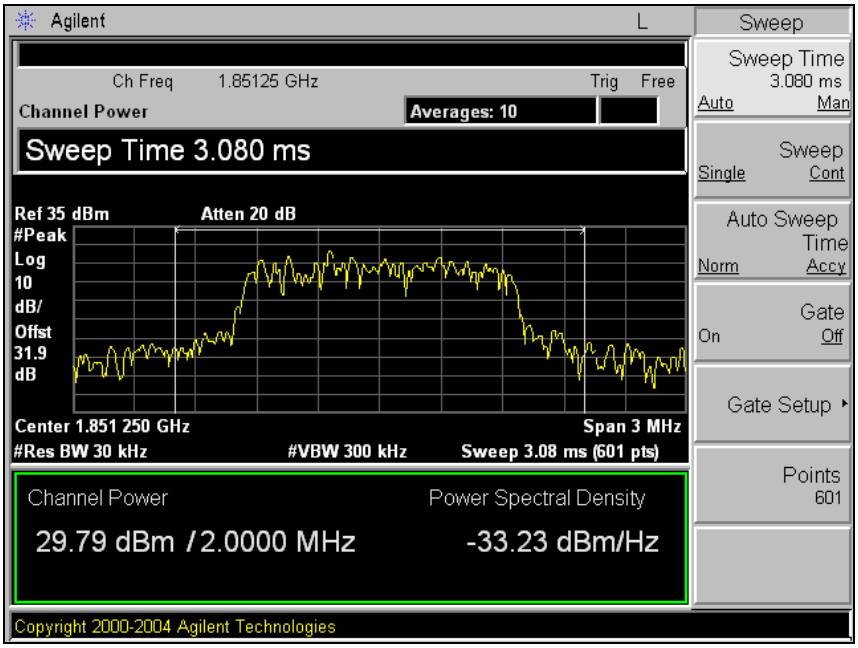
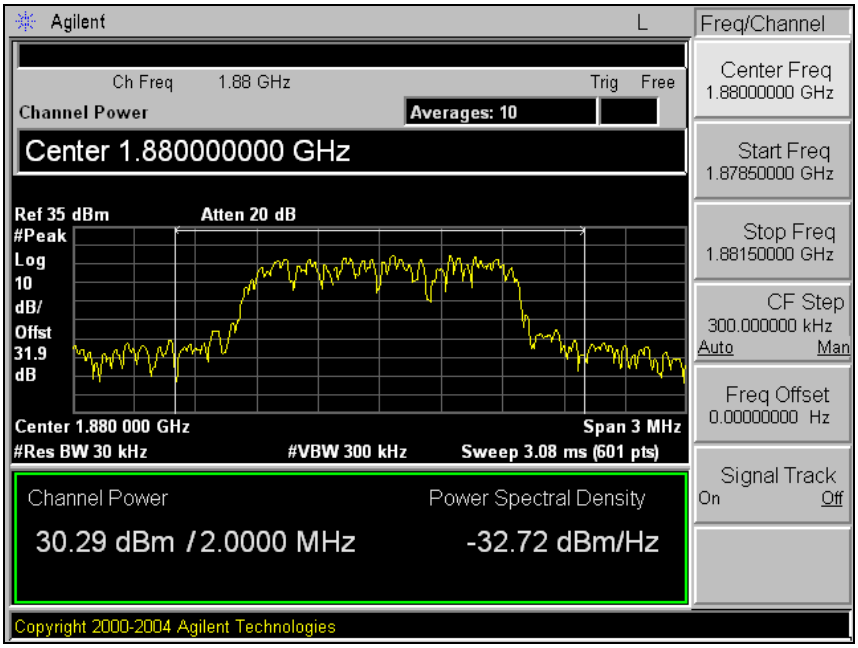
PCS(Uplink)

Low Channel



Middle Channel



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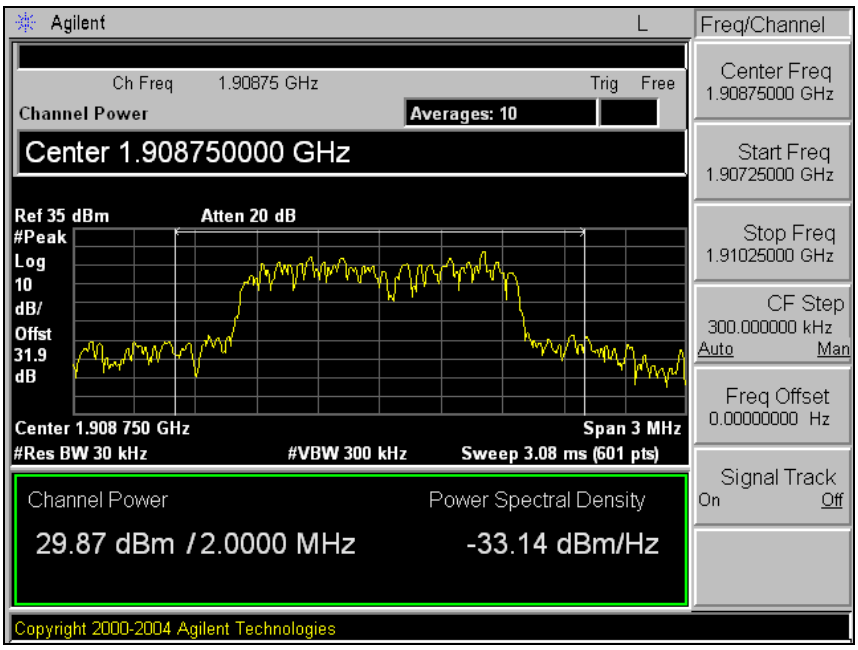
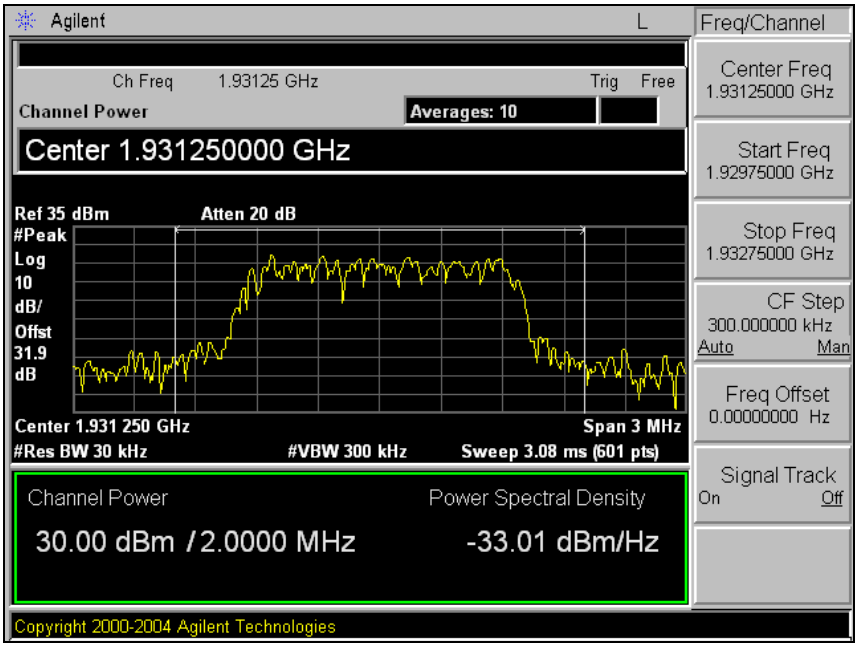
High Channel



PCS(Downlink)

Low Channel



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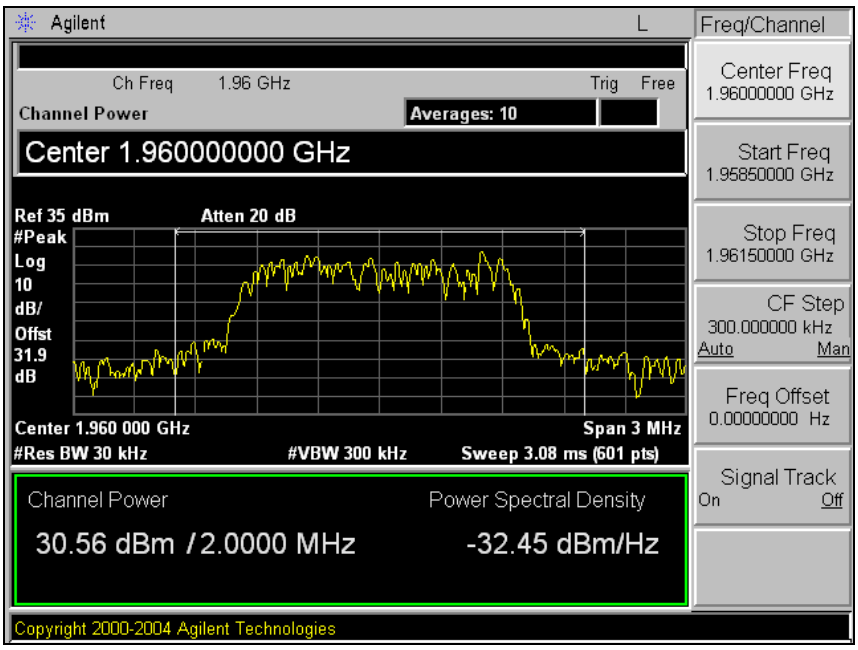
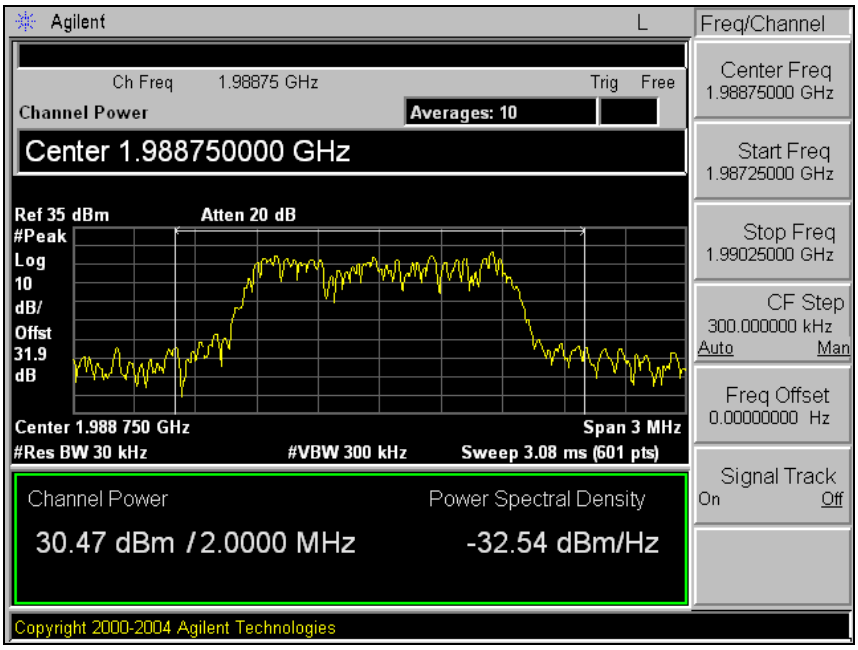
Middle Channel



High Channel



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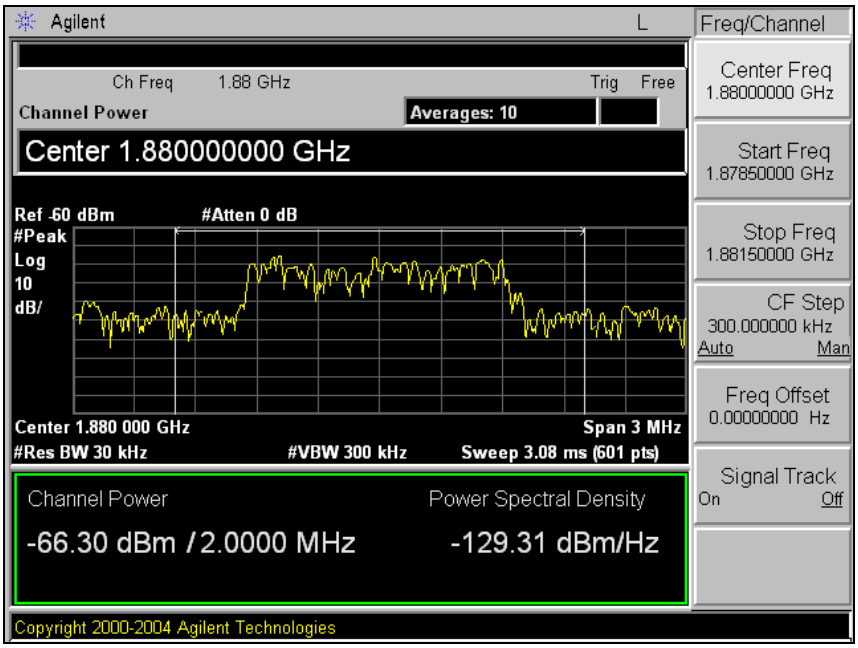
Input Signal Output Power

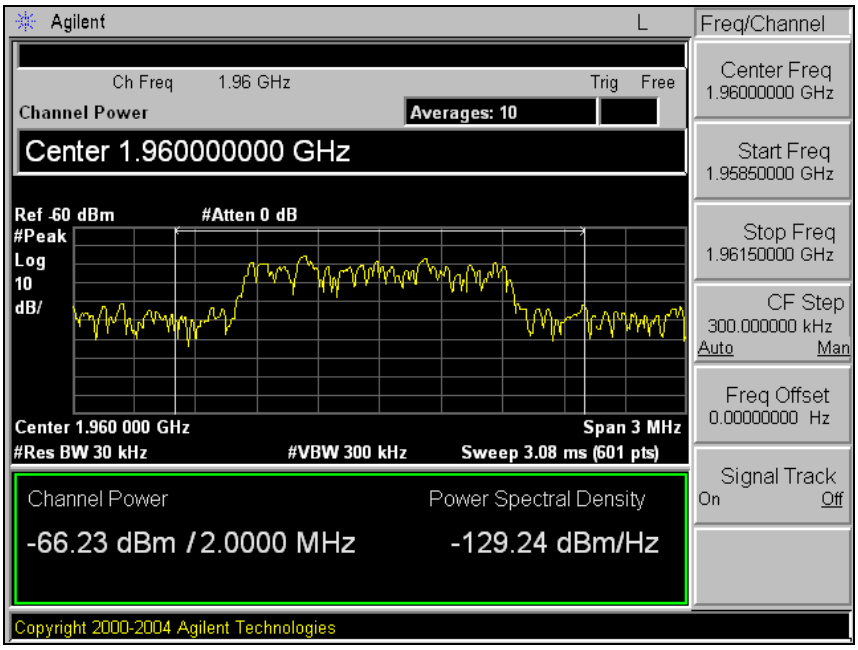
Uplink

Middle Channel



Downlink

Middle Channel



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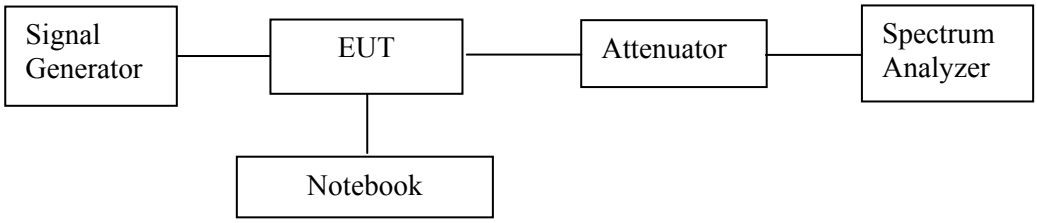
3. Occupied Bandwidth 26 dB

3.1. Limit

Requirements: CFR 47, Section §2.1049.

3.2. Test Procedure

1. The transmitter was tested while in a continuous transmit mode.
2. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions.
3. The resolution bandwidth of the spectrum analyzer was set at 30 ㎑.



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3.3 Test Results

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

Band	Mode	Frequency (MHz)	Occupied Bandwidth 26 dB (MHz)
PCS	Uplink	1 851.25	1.375
		1 880.00	1.371
		1 908.75	1.373
	Downlink	1 931.25	1.371
		1 960.00	1.372
		1 988.75	1.367

Please refer to the following plots.

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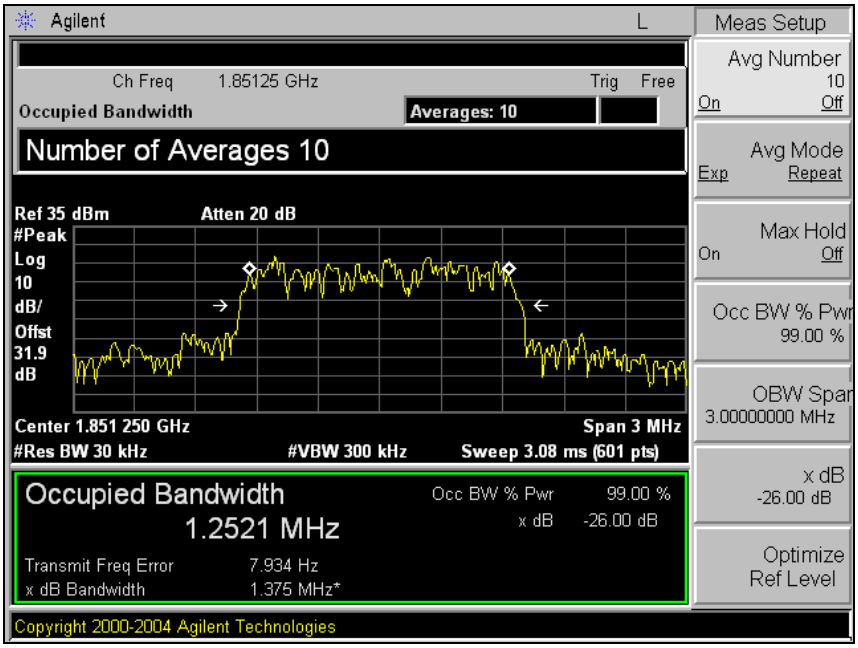
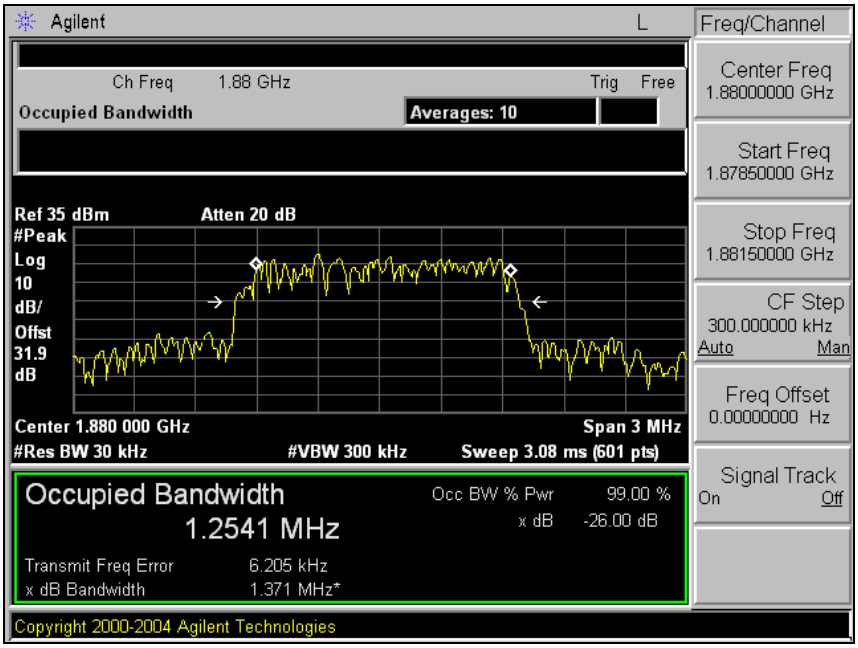
PCS(Uplink)

Low Channel



Middle Channel



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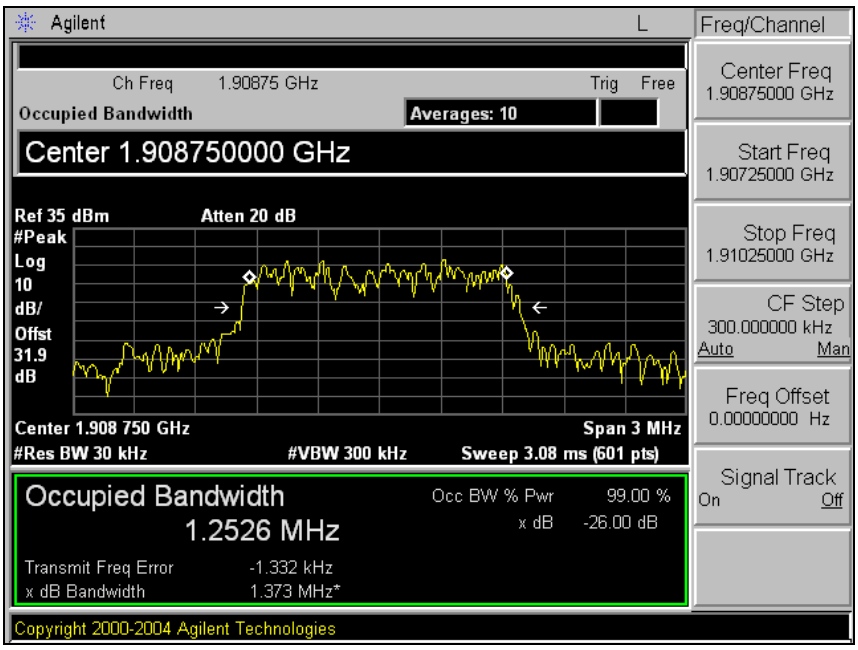
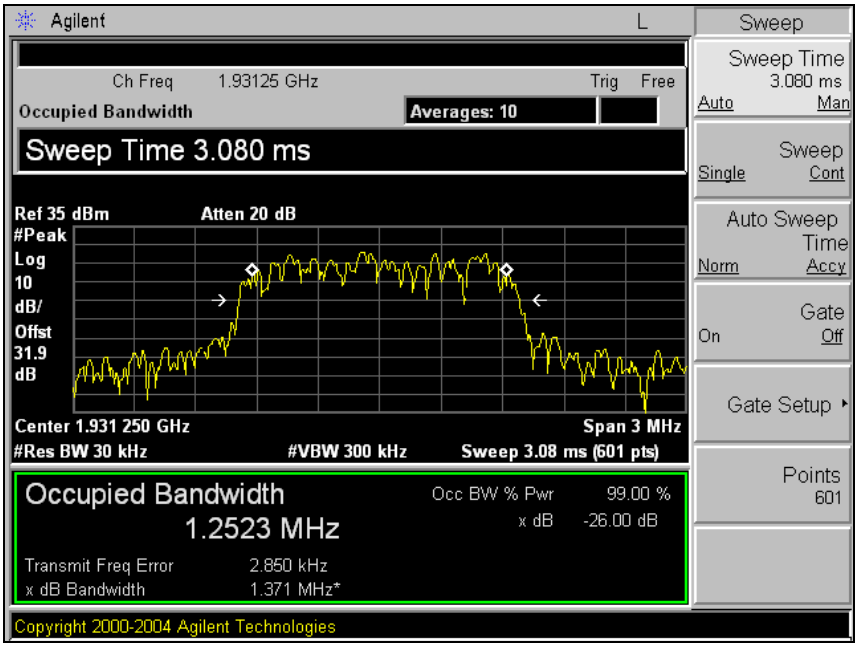
High Channel

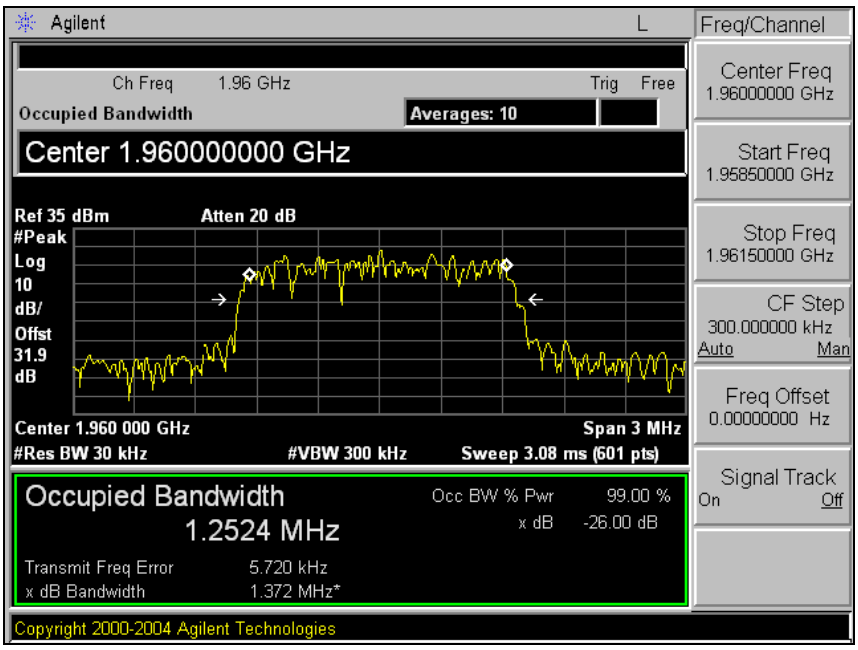


PCS(Downlink)

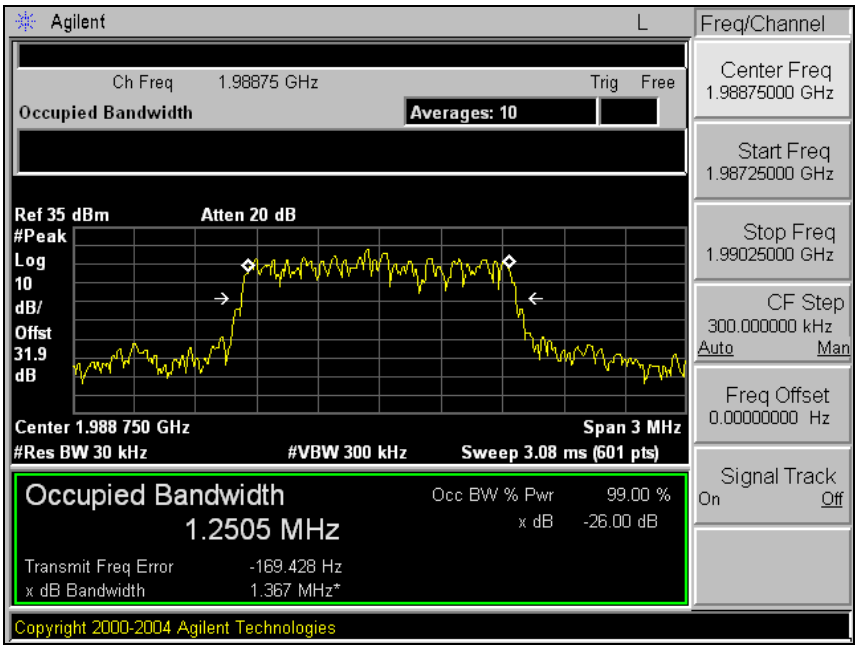
Low Channel



Middle Channel



High Channel



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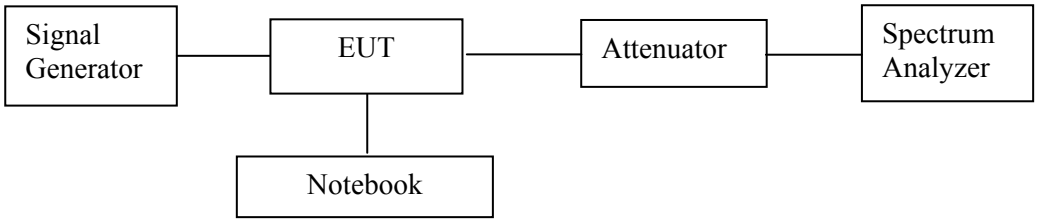
4. Spurious Emissions at Antenna Terminal

4.1. Limit

§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)㎧.

4.2. Test Procedure

1. The transmitter was tested while in a continuous transmit mode.
2. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions.
3. Spurious Emission was tested under



4.3. Test Results

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

Please refer to the following plots.

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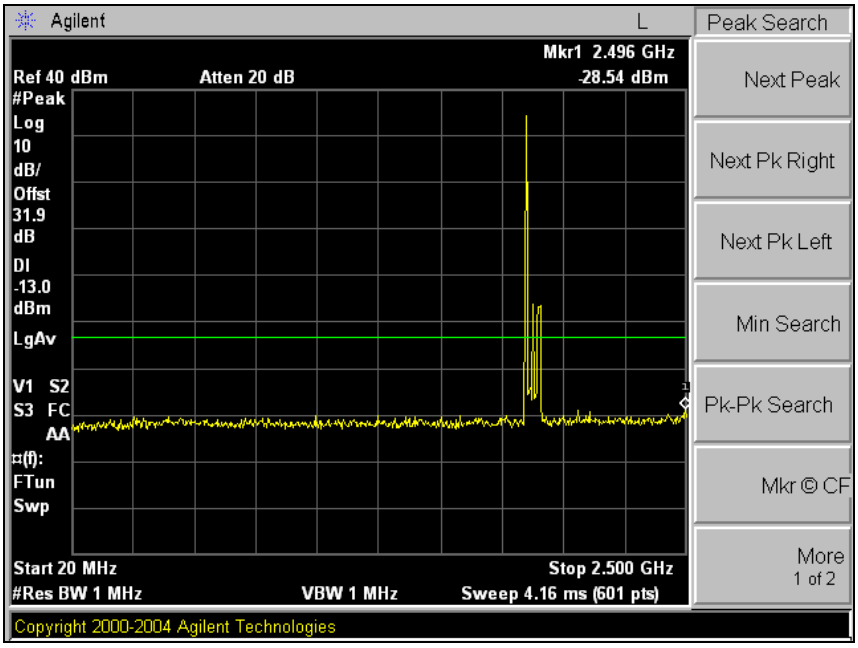
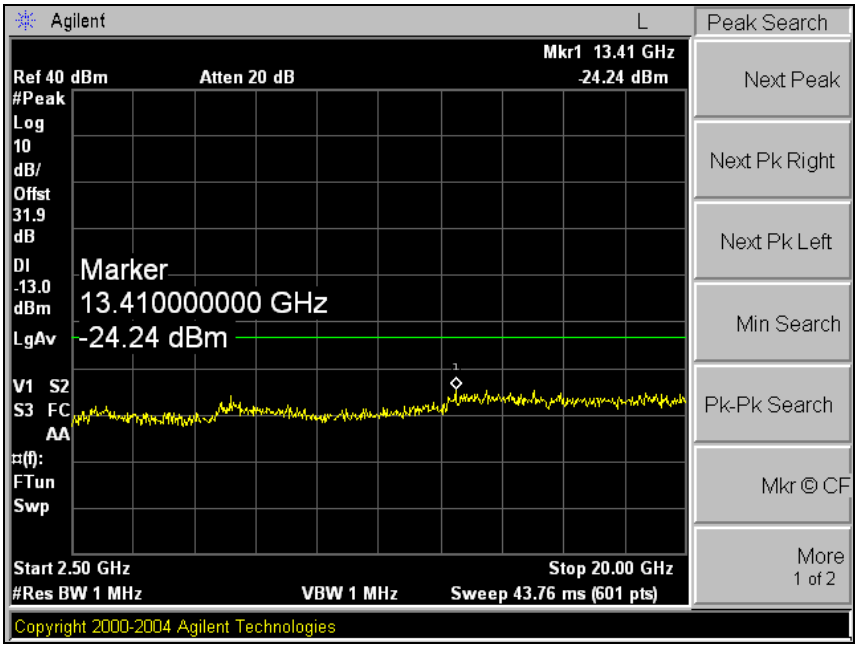
PCS(Uplink)

Low Channel



Low Channel



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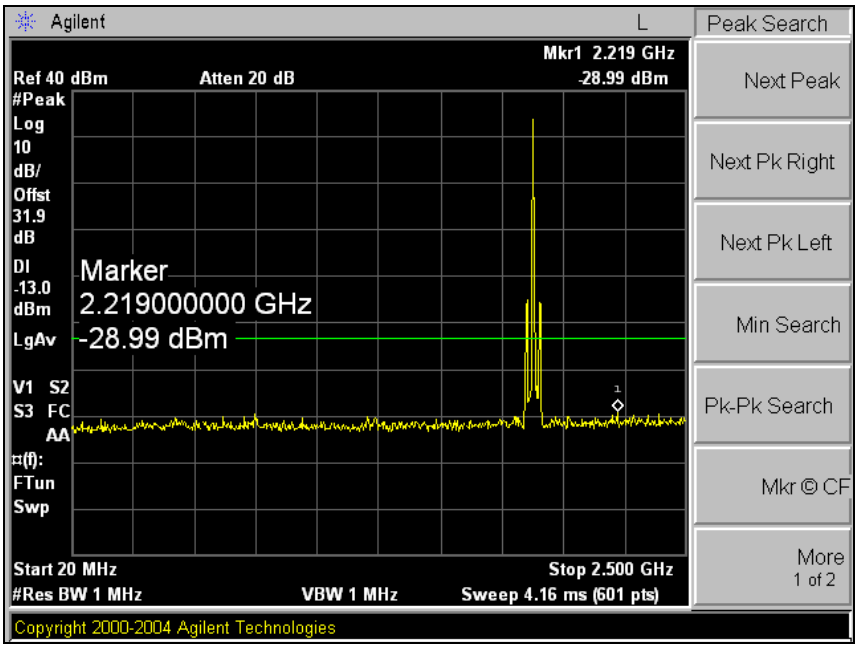
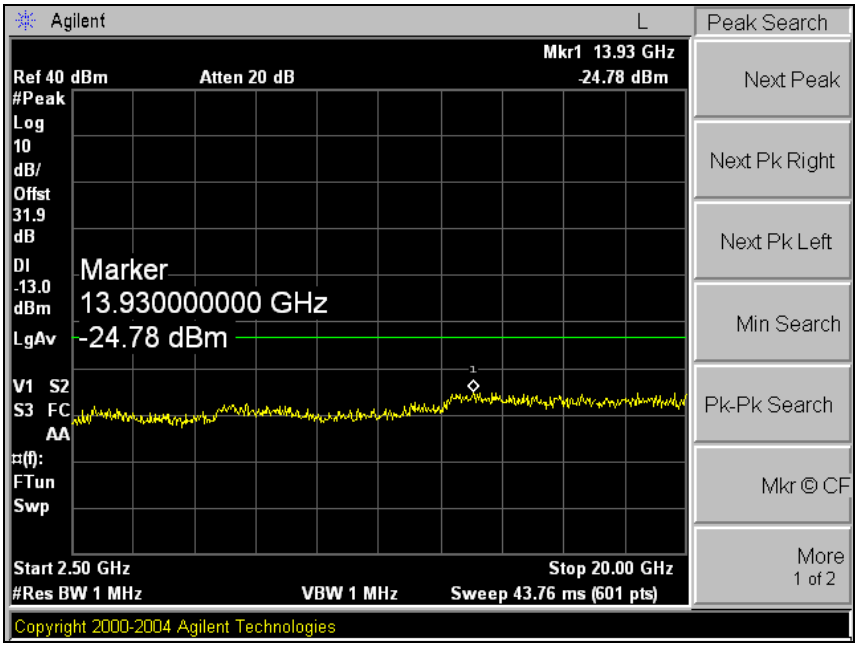
Middle Channel



Middle Channel



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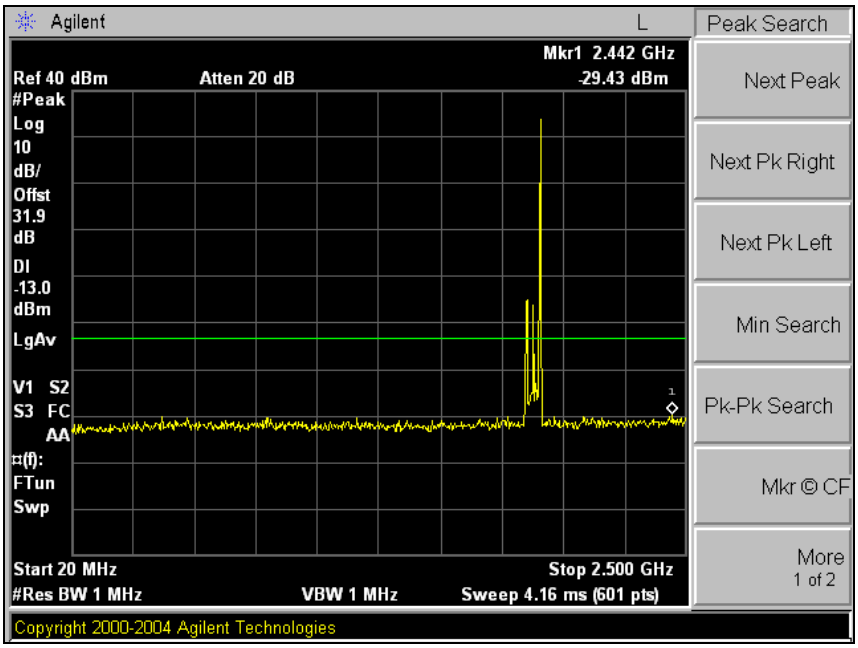
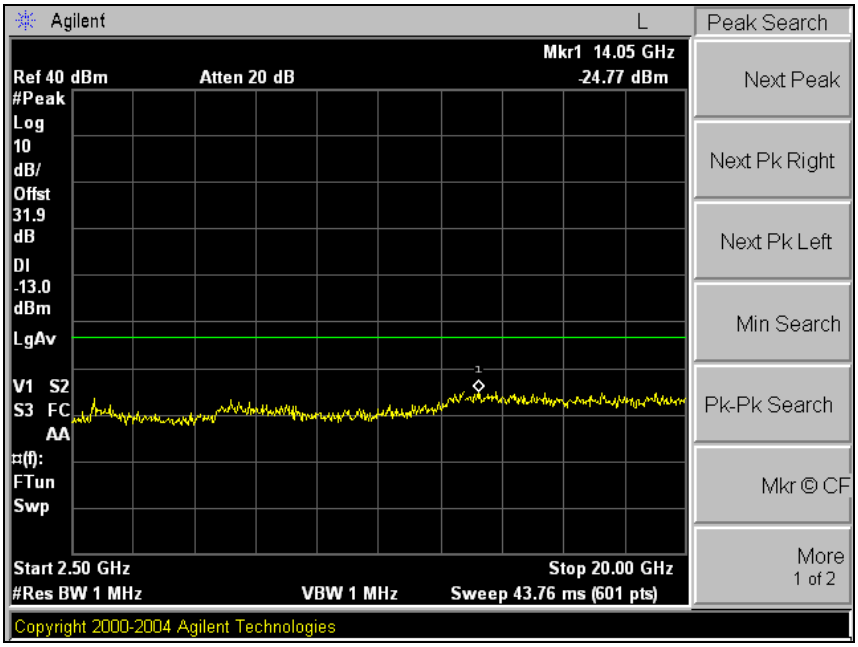
High Channel



High Channel



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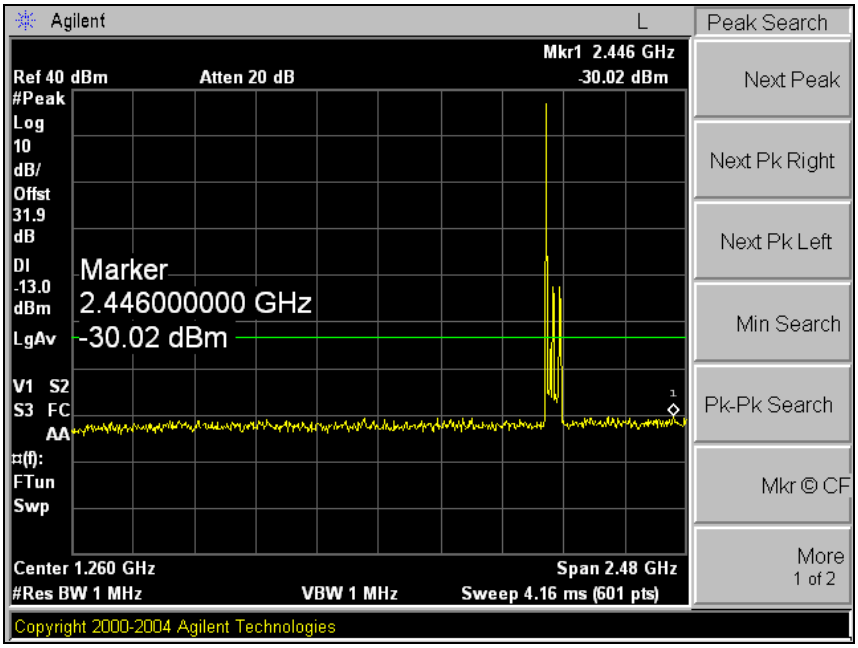
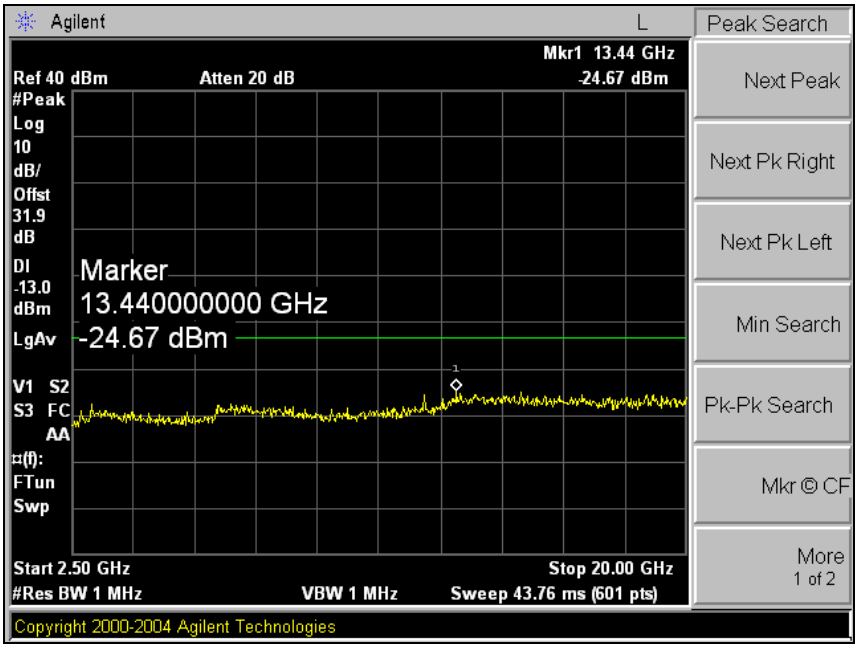
PCS(Downlink)

Low Channel



Low Channel



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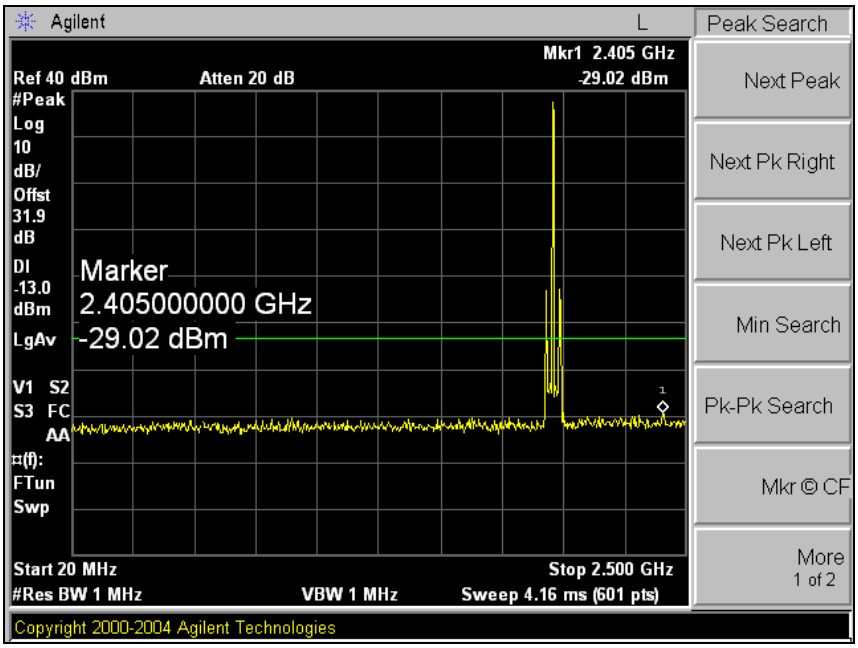
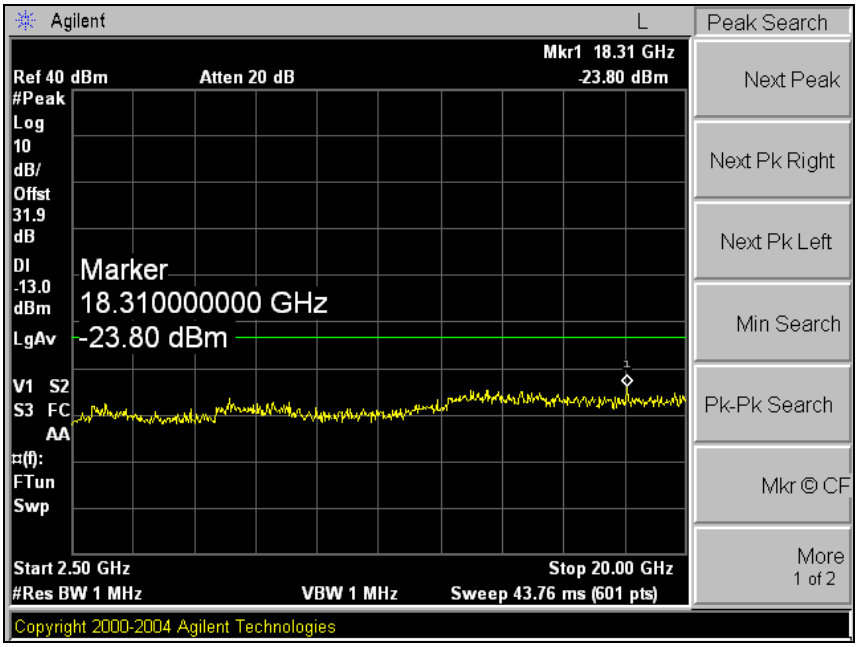
Middle Channel



Middle Channel



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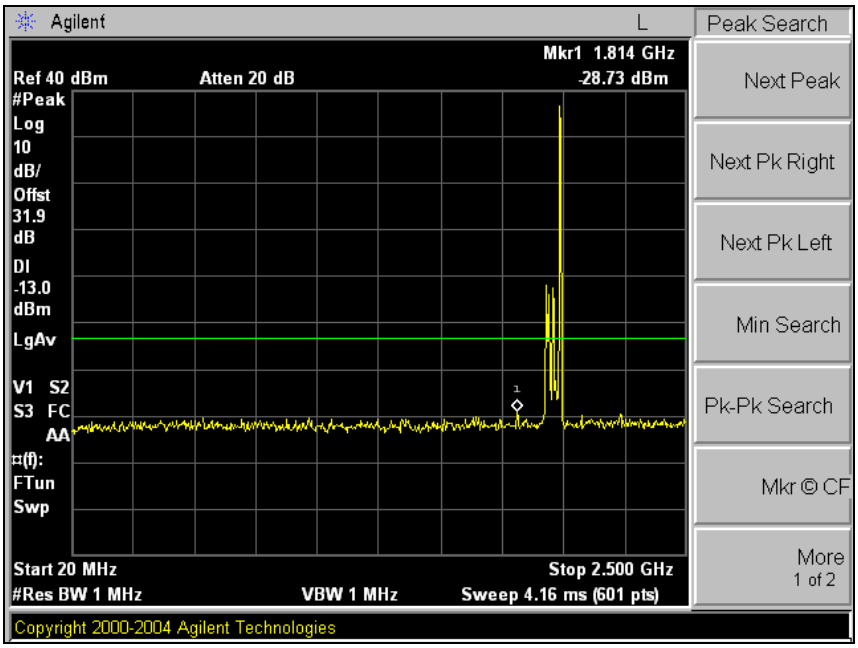
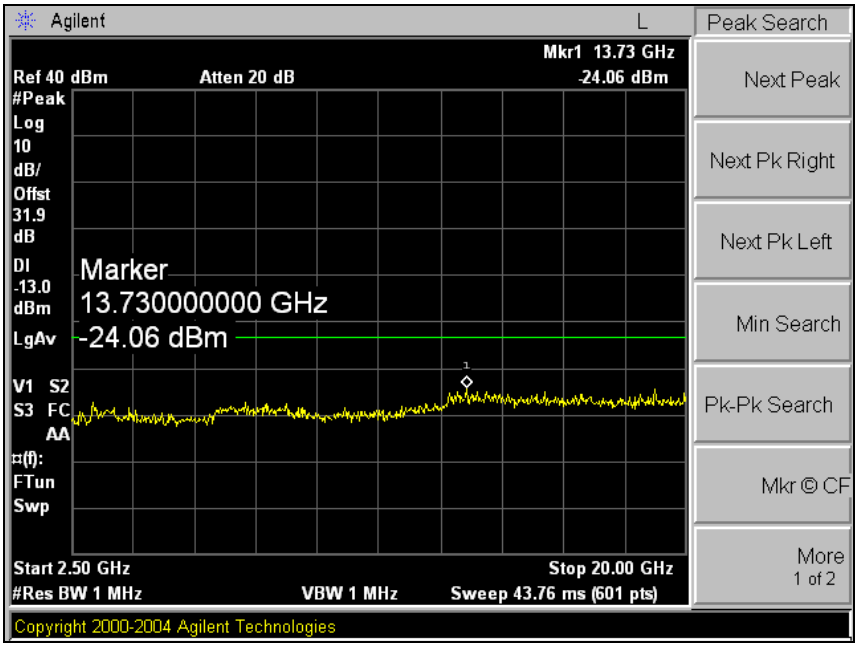
High Channel



High Channel



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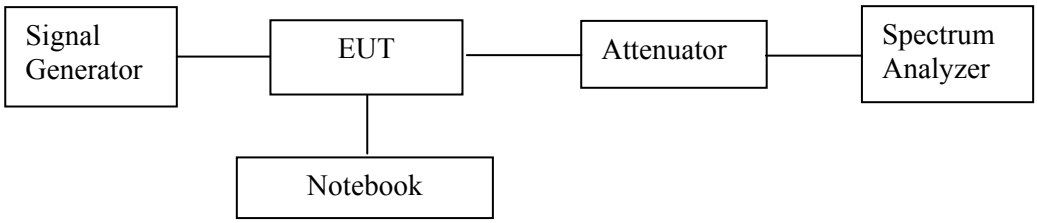
5. Band Edge

5.1. Limit

§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 transmitter was tested while in a continuous transmit mode.
2. The EUT was tuned to a low, middle, and high channel in both the downlink (base to mobile) and uplink (mobile to base) directions.
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.

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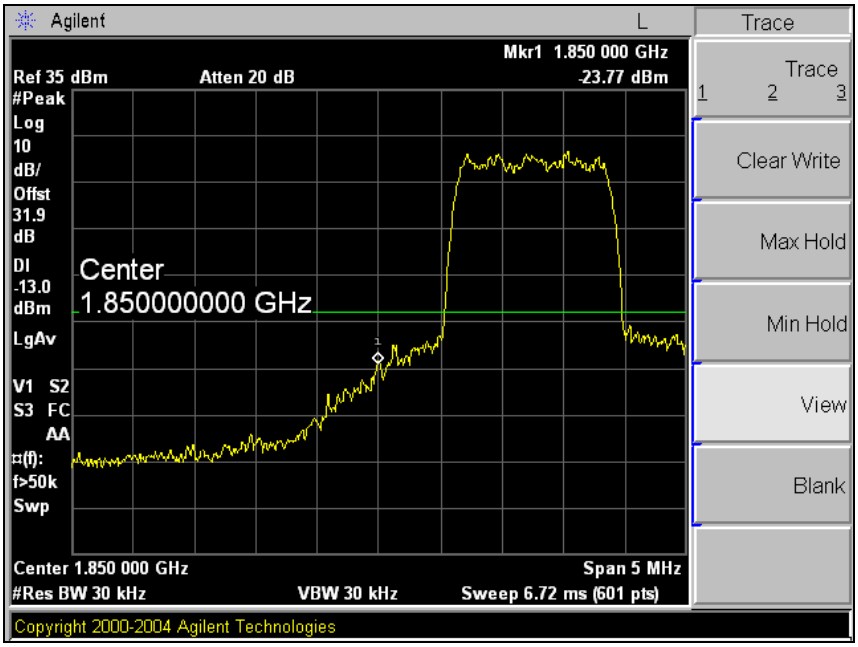
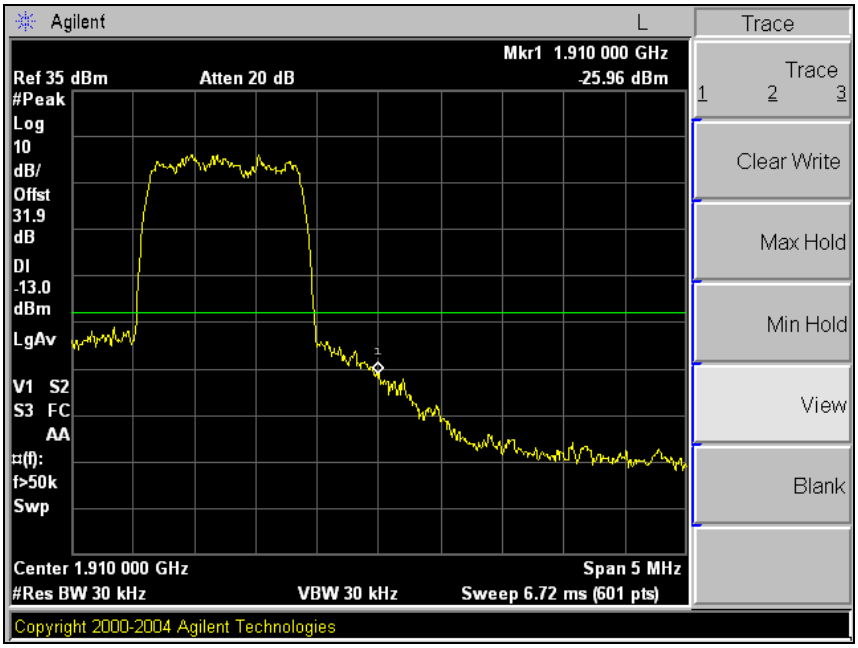
PCS(Uplink)

Low Channel



High Channel



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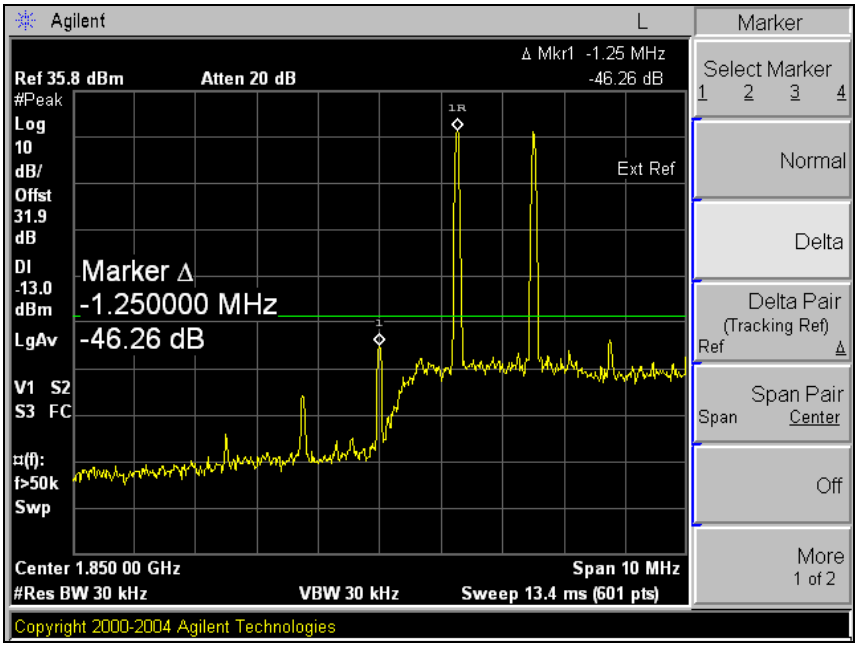
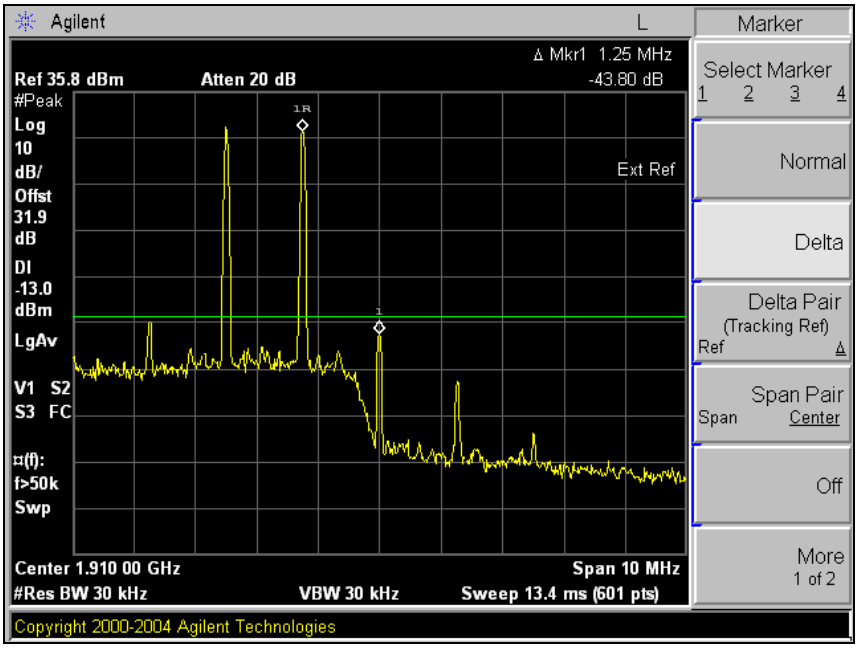
PCS(Uplink)_IMD

Low Channel



High Channel



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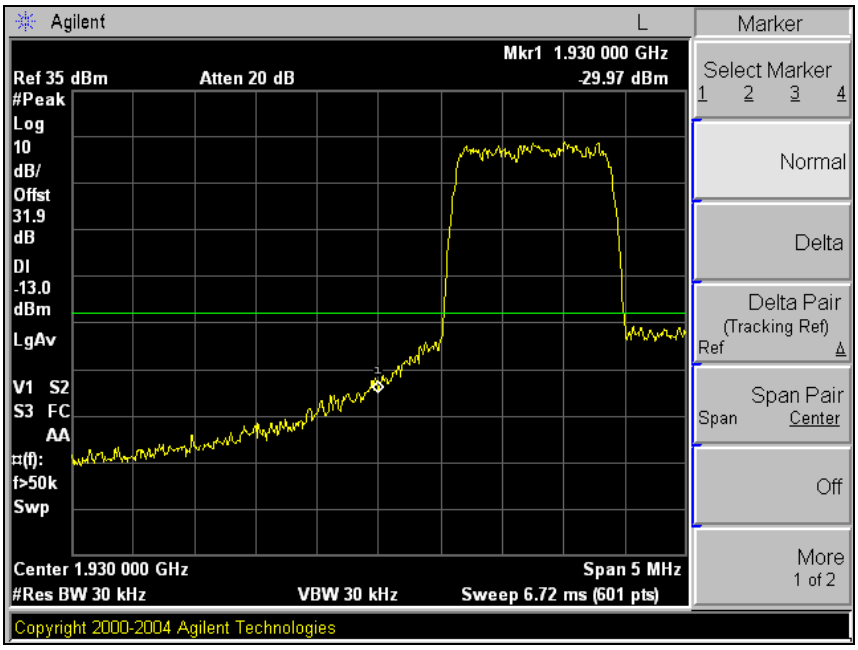
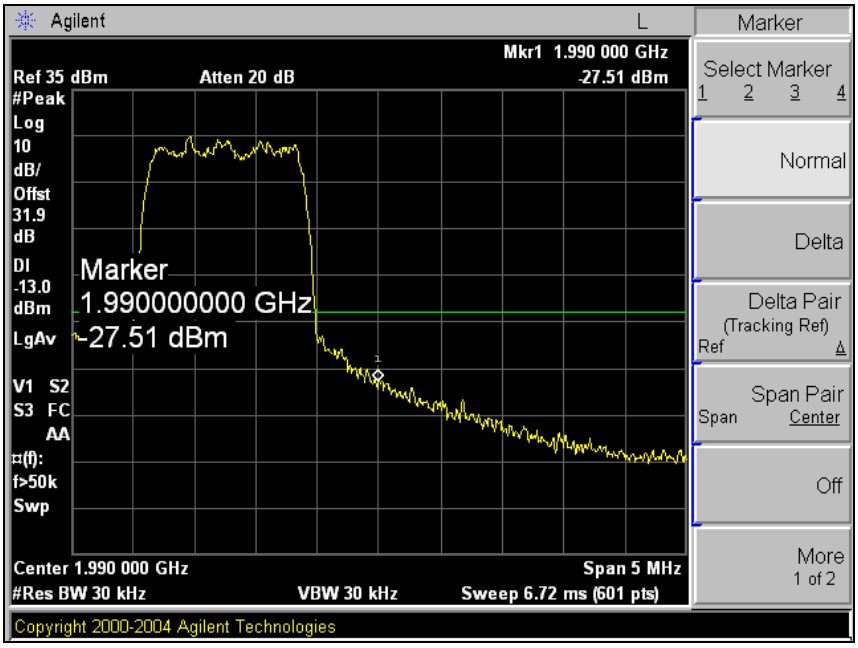
PCS(Downlink)

Low Channel



High Channel



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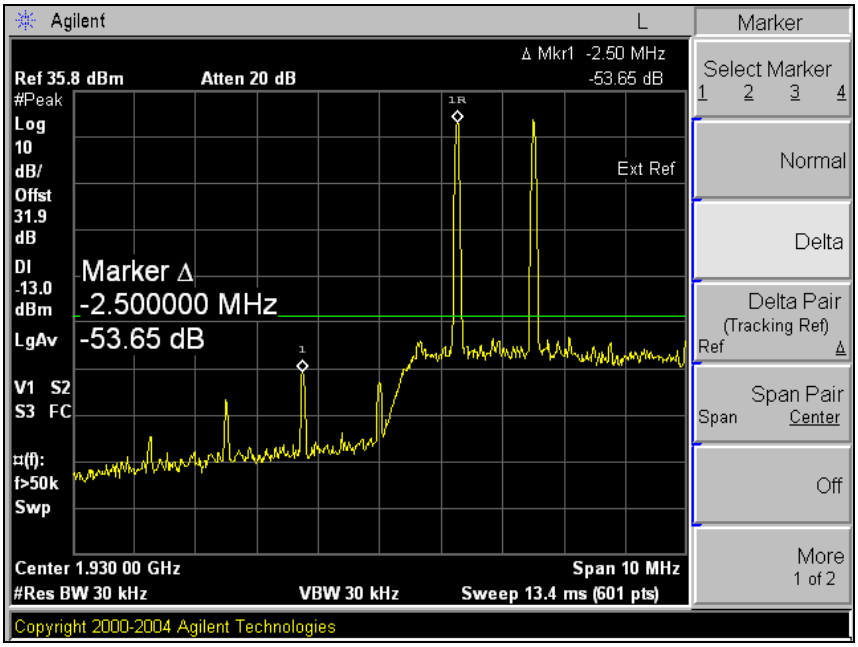
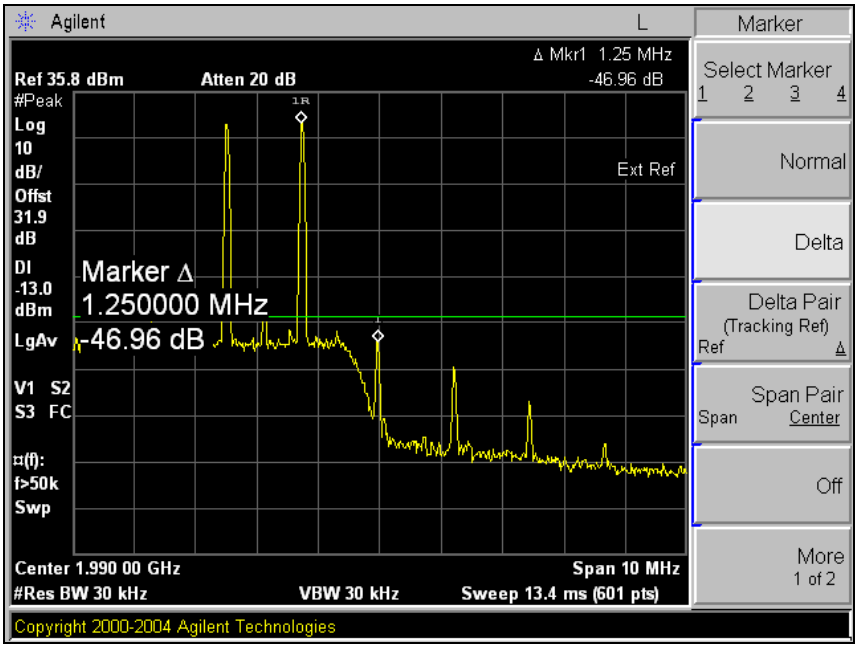
PCS(Downlink)_IMD

Low Channel



High Channel



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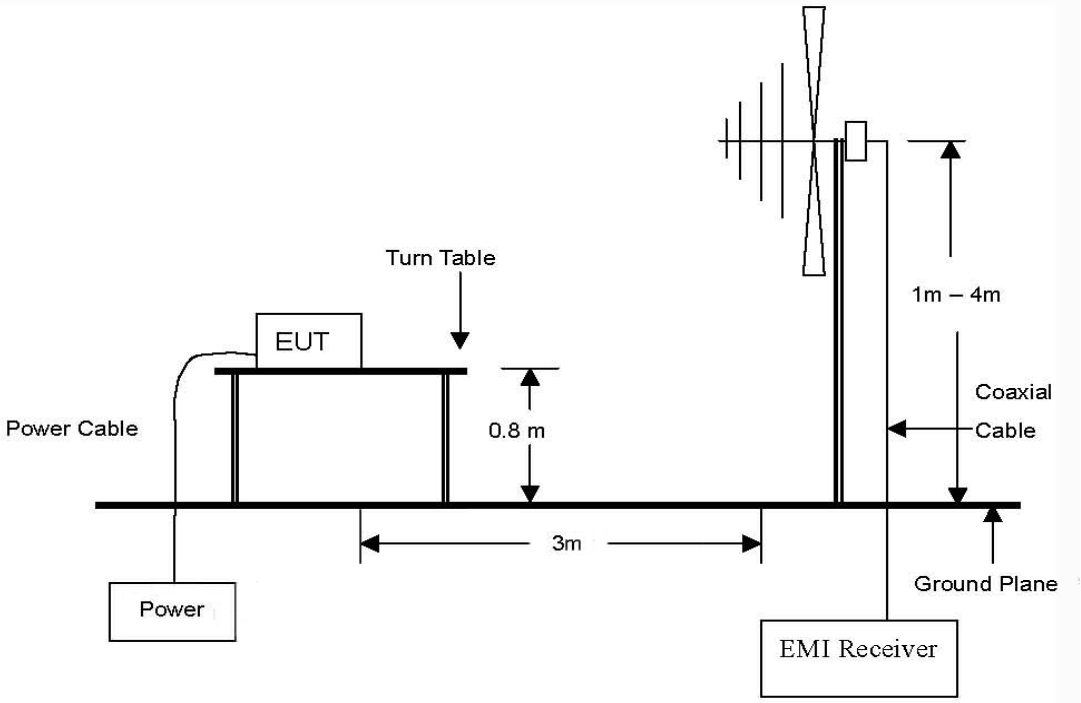
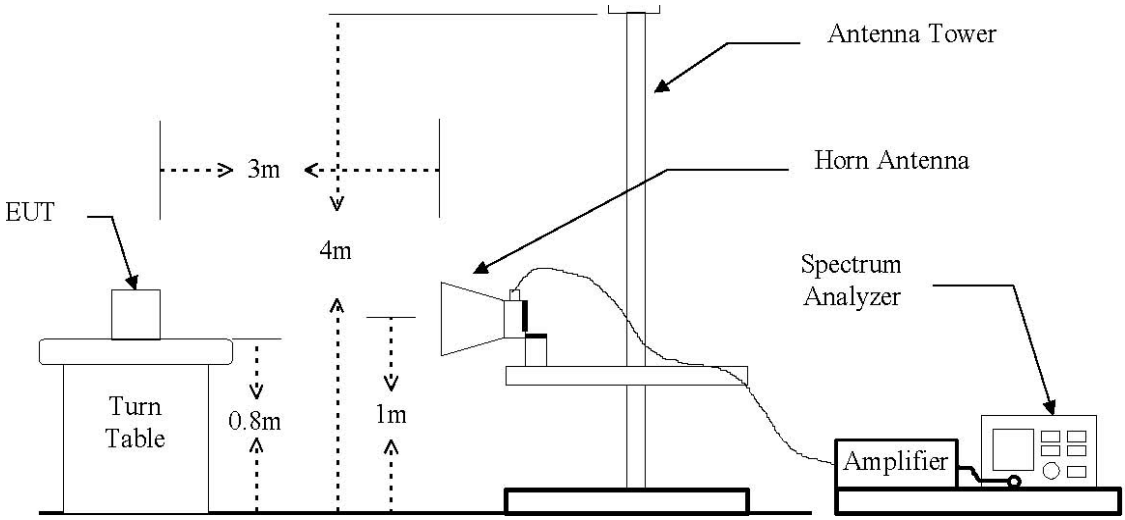
6. Spurious radiated emission

6.1. Test setup

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



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to 40 ㎓ Emissions.



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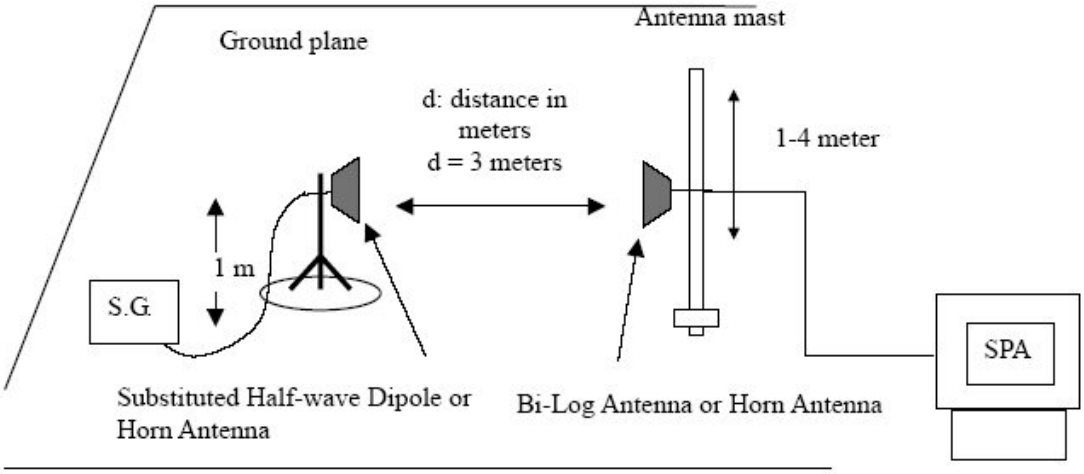
The diagram below shows the test setup for substituted method



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6.2. Limit

§24.238 (a) Out of band emissions. The power of any emission outside of the authorized operating frequency

6.3. 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 or horn antenna 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.

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6.4. Spurious radiated emission

PCS(Uplink)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P. (dB m)	Margin (dB)
Low Channel (1 851.25 ㎒)						
89.410	H	-51.41	0.96	-7.94	-60.31	47.31
103.554	H	-49.06	1.01	-7.85	-57.92	44.92
750.025	H	-49.21	3.16	-8.05	-60.42	47.42
Middle Channel (1 880.00 ㎒)						
89.419	H	-51.37	0.96	-7.94	-60.27	47.27
103.556	H	-49.63	1.01	-7.85	-58.49	45.49
750.058	H	-49.53	3.16	-8.05	-60.74	47.74
High Channel (1 908.75 ㎒)						
89.412	H	-50.32	0.96	-7.94	-59.22	46.22
103.553	H	-50.12	1.01	-7.85	-58.98	45.98
750.063	H	-49.21	3.16	-8.05	-60.42	47.42

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PCS(Downlink)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	Margin (㏈)
Low Channel (1 931.25 ㎒)						
89.418	H	-50.27	0.96	-7.94	-59.17	46.17
103.562	H	-50.12	1.01	-7.85	-58.98	45.98
750.063	H	-49.53	3.16	-8.05	-60.74	47.74
Middle Channel (1 960.00 ㎒)						
89.419	H	-50.33	0.96	-7.94	-59.23	46.23
103.553	H	-49.71	1.01	-7.85	-58.57	45.57
750.056	H	-49.44	3.16	-8.05	-60.65	47.65
High Channel (1 988.75 ㎒)						
89.412	H	-50.74	0.96	-7.94	-59.64	46.64
103.559	H	-49.73	1.01	-7.85	-58.59	45.59
750.063	H	-49.53	3.16	-8.05	-60.74	47.74

Remark:
1. E.R.P. & E.I.R.P. = S.G level (㏈m) - Cable loss (㏈) + Ant. gain (㏈d/㏈i)
2. No more spurious emissions above 760 ㎒ for all channel.

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7. Frequency Stability

7.1. 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.

7.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external AC 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. The AC leads and RF output cable exited the chamber through an opening made for the purpose.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.
4. Frequency Stability vs. Voltage: An external variable AC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the AC end point. The output frequency was recorded for each AC.

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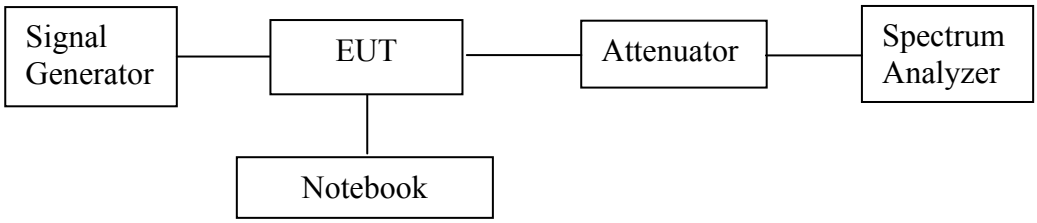

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7.3. Test Results

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

PCS(Uplink) mode at middle channel

Reference Frequency: 1 880.88 ㎒, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (Vac)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	110	-23	-0.012
40		-19	-0.010
30		-13	-0.007
24		-4	-0.002
10		-5	-0.003
0		8	0.004
-10		15	0.008
-20		18	0.010
-30		19	0.010
Frequency Stability versus power Supply			
Environment Temperature (℃)	**Power Supplied (Vac)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	126.5	-5	-0.003
	93.5	-4	-0.002
	85(End point)	-5	-0.003

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PCS(Downlink) mode at middle channel

Reference Frequency: 1 960.00 ㎒, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (Vac)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	110	-18	-0.009
40		-16	-0.008
30		-12	-0.006
24		-4	-0.002
10		-8	-0.004
0		1	0.001
-10		4	0.002
-20		15	0.008
-30		19	0.010
Frequency Stability versus power Supply			
Environment Temperature (℃)	**Power Supplied (Vac)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
24	126.5	-4	-0.002
	93.5	-5	-0.003
	85(End point)	-3	-0.002

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8. RF Exposure Evaluation

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 (MHz)	Electric Field Strength(V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	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 – 1500	--	--	F/1500	6
1 500 – 100 000	--	--	1	30

8.1 Friis transmission formula : Pd = (Pout*G)/(4*pi*R^2)

Where
Pd = power density in mW/cm^2
Pout = output power to antenna in mW
G = gain of antenna in linear scale
Pi = 3.1416
R = distance between observation point and center of the radiator in cm
Pd the limit of MPE, 1 mW/cm^2. 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.

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8.2 Test Result of RF Exposure Evaluation

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

8.2.1 Output Power into Antenna & RF Exposure Evaluation Distance

PCS band

Uplink mode

Channel	Frequency (㎒)	Output Power to Antenna (dB m)	Antenna Gain (dB i)	R (㎝)
Low	1 851.25	29.29	9	23.174
Mid	1 880.00	30.29	9	26.002
High	1 908.75	29.87	9	24.775

Downlink mode

Channel	Frequency (㎒)	Output Power to Antenna (dB m)	Antenna Gain (dB i)	R (㎝)
Low	1 931.25	30.00	4.5	14.980
Mid	1 960.00	30.56	4.5	15.977
High	1 988.75	30.47	4.5	15.813

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