

TEST REPORT

of

FCC Part 22 Subpart H and Part 24 Subpart E
FCC ID : BEJLPU2100TI

Equipment Under Test : Cellular/PCS GPRS/EDGE USB Modem
Model Name : LPU-2100TI
Serial No. : N/A
Applicant : LG Electronics Inc.
Manufacturer : LG Electronics Inc.
Date of Test(s) : 2010.09.15 ~ 2010.09.29
Date of Issue : 2010.09.29

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

Tested By:



Date

2010.09.29

Duke Ko

Approved By



Date

2010.09.29

Charles Kim

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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 : LG Electronics Inc.
Address : 60-39, Gasan-dong, Gumchon-gu, Seoul, 153-023, Korea
Contact Person : Kim, Hyeon Kyun
Phone No. : +82 +2 2033 1113

1.3. Description of EUT

Kind of Product	Cellular/PCS GSM/EDGE USB Modem
Model Name	LPU-2100TI
Serial Number	N/A
Power Supply	DC 5 V (USB port from PC)
Rated Power	GSM850 : 33.5 dB m GSM1900 : 29.8 dB m
Frequency Range	GSM850 : 824.2 MHz ~ 848.8 MHz GSM1900 : 1 850.2 MHz ~ 1 909.8 MHz
Class of GPRS	Class 12, Class B
Antenna Gain	-2.23 dB i (GSM850), 3.88 dB i (GSM1900)

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1.4. Description of test mode

Band	Frequency (MHz)	Voice GSM (dBm)	GPRS Data			
			GPRS 1 TX Slot	GPRS 2 TX Slot	GPRS 3 TX Slot	GPRS 4 TX Slot
			(dBm)	(dBm)	(dBm)	(dBm)
GSM 850	824.2	N/A	32.4	29.5	27.6	26.5
	836.6	N/A	32.5	29.5	27.7	26.5
	848.8	N/A	32.6	29.5	27.7	26.4
GSM 1900	1850.2	N/A	29.5	26.5	24.6	23.5
	1880.0	N/A	29.4	26.4	24.6	23.4
	1909.8	N/A	29.4	26.3	24.5	23.3

Band	Frequency (MHz)	EDGE Data			
		EDGE 1 TX Slot	EDGE 2 TX Slot	EDGE 3 TX Slot	EDGE 4 TX Slot
		(dBm)	(dBm)	(dBm)	(dBm)
GSM850	824.2	27.0	26.9	26.9	26.5
	836.6	27.0	27.0	27.0	26.5
	848.8	26.9	26.9	26.9	26.5
GSM1900	1 850.2	25.7	25.7	24.6	24.6
	1 880.0	25.7	25.6	24.7	24.7
	1 909.8	25.6	25.6	24.5	24.3

GSM (850 / 1900)

We found out the test mode with the highest power level after we analyze all the data rates. So we chose **GSM(850/1900) GPRS 1 TX slot** (worst case) as a representative.

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1.5. Test equipment list

Equipment	Manufacturer	Model	Cal Due.
Signal Generator	Agilent	E4438C	Mar. 31, 2011
Signal Generator	Rohde & Schwarz	SMR40	Jul. 15, 2011
Spectrum Analyzer	Agilent	E4440A	Mar. 31, 2011
Mobile Test Unit	Rohde & Schwarz	CMU 200	May 25, 2011
Directional Coupler	KAYTAR	152613	Jun. 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
DC power Supply	Agilent	U8002A	Jan. 06, 2011
Preamplifier	H.P.	8447F	Jul. 05, 2011
Preamplifier	Empower RF Systems, Inc	2002-BBS2C4AEL	Mar. 31, 2011
Test Receiver	R & S	ESU26	Apr. 08, 2011
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	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)	Jan. 27, 2011

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1.6. Summary of test results

The EUT has been tested according to the following specifications:

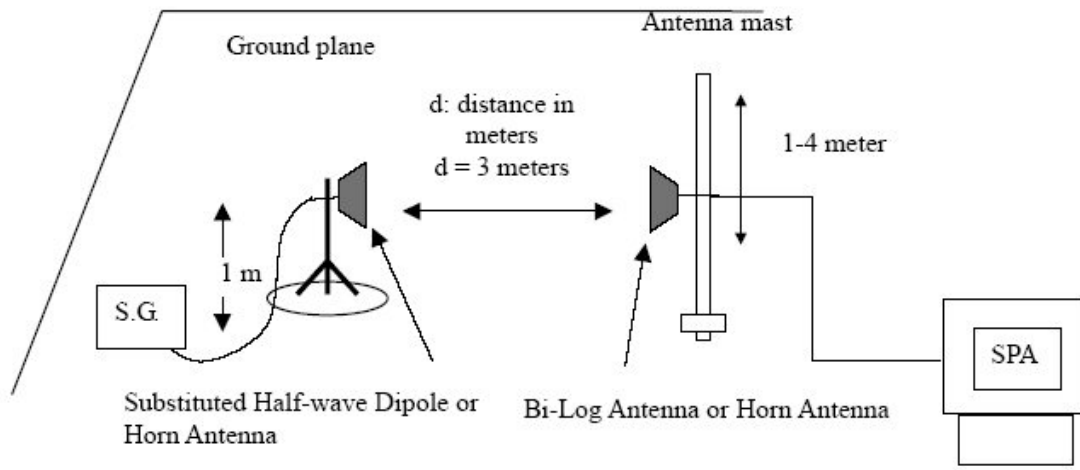
APPLIED STANDARD : FCC Part 22, 24		
Section in FCC part	Test Item	Result
§2.1046 §22.913(a) §24.232(b)	RF Radiated Output Power	Complied
§2.1053 §22.917(e) §24.238(a)	Spurious Radiated Emission	Complied
§2.1046(a)	Conducted Output Power	Complied
§2.1049(h) (i)	Occupied Bandwidth	Complied
§2.1051 §22.917(e)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

1.7. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL004182	Initial

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The diagram below shows the test setup for substituted method



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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 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 1 MHz and the average bandwidth was set to 1 MHz.
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 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 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 MHz) or horn antenna (1 850 ~ 1 910 MHz) connected to a signal generator.
11. In necessary, the input attenuator setting of 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 receiver, 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 dB 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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2.4. Test result for RF radiated output power

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

GSM850

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(mW)
824.2	V	39.08	3.42	-11.17	24.49	281.19
824.2	H	41.27	3.42	-11.17	26.68	465.59
836.4	V	38.41	3.38	-11.47	23.57	227.51
836.4	H	41.47	3.38	-11.47	26.63	460.26
848.8	V	36.94	3.33	-11.76	21.84	152.76
848.8	H	42.85	3.33	-11.76	27.75	595.66

GSM850 (EDGE)

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P.	
					(dB m)	(mW)
848.8	V	31.68	3.33	-11.76	16.58	45.50
848.8	H	37.57	3.33	-11.76	22.47	176.60

GSM1900

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(mW)
1 850.2	V	25.66	4.87	9.12	29.91	979.49
1 850.2	H	20.63	4.87	9.12	24.88	307.61
1 880.0	V	23.82	4.91	9.20	28.11	647.14
1 880.0	H	19.25	4.91	9.20	23.54	225.94
1 909.8	V	25.09	4.94	9.27	29.42	874.98
1 909.8	H	18.71	4.94	9.27	23.04	201.37

GSM1900 (EDGE)

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.I.R.P.	
					(dB m)	(mW)
1 850.2	V	22.93	4.87	9.12	27.18	522.40
1 850.2	H	17.03	4.87	9.12	21.28	134.28

Remark:

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

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2.5. Spurious radiated emission

- Modulation Signal : GSM850
- Measured output Power : 27.75 dB m = 0.60 W
- Distance : 3 meters
- Limit : $-(43 + 10\log_{10}(W)) = -40.75$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level (dB m)	Cable loss (dB)	Ant. gain (dB d)	E.R.P (dB m)	dB c	Margin (dB)
Low Channel (824.2 MHz)							
1 648.4	V	-43.48	4.54	6.44	-41.58	-69.33	28.58
1 648.4	H	-46.19	4.54	6.44	-44.29	-72.04	31.29
Middle Channel (836.4 MHz)							
1 673.2	V	-41.85	4.58	6.51	-39.92	-67.67	26.92
1 673.2	H	-45.75	4.58	6.51	-43.82	-71.57	30.82
High Channel (848.8 MHz)							
1 697.6	V	-40.45	4.62	6.57	-38.50	-66.25	25.50
1 697.6	H	-45.61	4.62	6.57	-43.66	-71.41	30.66

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- Modulation Signal : GSM1900
- Measured output Power : 29.91 dB m = 0.98 W
- Distance : 3 meters
- Limit : $-(43 + 10\log_{10}(W)) = 42.91$ dB c

Frequency (MHz)	Ant. Pol. (H/V)	S.G level (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P (dB m)	dB c	Margin (dB)
Low Channel(1 850.2 MHz)							
3 700.4	V	-48.92	7.13	11.85	-44.20	-74.11	31.20
3 700.4	H	-49.83	7.13	11.85	-45.11	-75.02	32.11
Middle Channel(1 880.0 MHz)							
3 760.0	V	-47.67	7.23	11.85	-43.06	-72.97	30.06
3 760.0	H	-50.27	7.23	11.85	-45.66	-75.57	32.66
High Channel(1 909.8 MHz)							
3 819.6	V	-46.98	7.33	11.84	-42.47	-72.38	29.47
3 819.6	H	-50.31	7.33	11.84	-45.80	-75.71	32.80

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.

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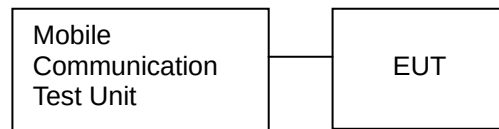
3. Conducted Output Power

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 Mobile Communication Test unit.



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3.3. Test Result

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

Band	Mode	Frequency (MHz)	Average Output Power (dB m)
GSM850	GPRS 1 TX Slot	824.2	32.4
		836.4	32.5
		848.8	32.6
	EDGE 1 TX Slot	824.2	27.0
		836.4	27.0
		848.8	26.9
GSM1900	GPRS 1 TX Slot	1 850.2	29.5
		1 880.0	29.4
		1 909.8	29.4
	EDGE 1 TX Slot	1 850.2	25.7
		1 880.0	25.7
		1 909.8	25.6

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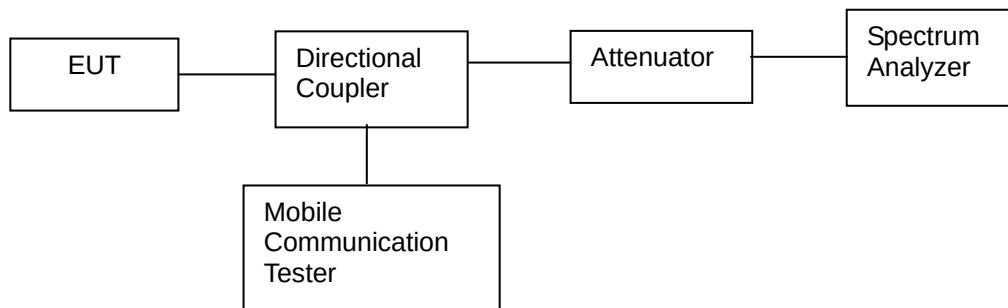
4. Occupied Bandwidth 99 %

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



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4.3 Test Results

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

Band	Mode	Frequency (MHz)	Occupied Bandwidth (MHz)
GSM850	GPRS 1 TX Slot	824.2	0.25
		836.6	0.24
		848.8	0.24
	EDGE	824.2	0.24
GSM1900	GPRS 1 TX Slot	1 850.2	0.25
		1 880.0	0.24
		1 909.8	0.25
	EDGE	1 850.2	0.25

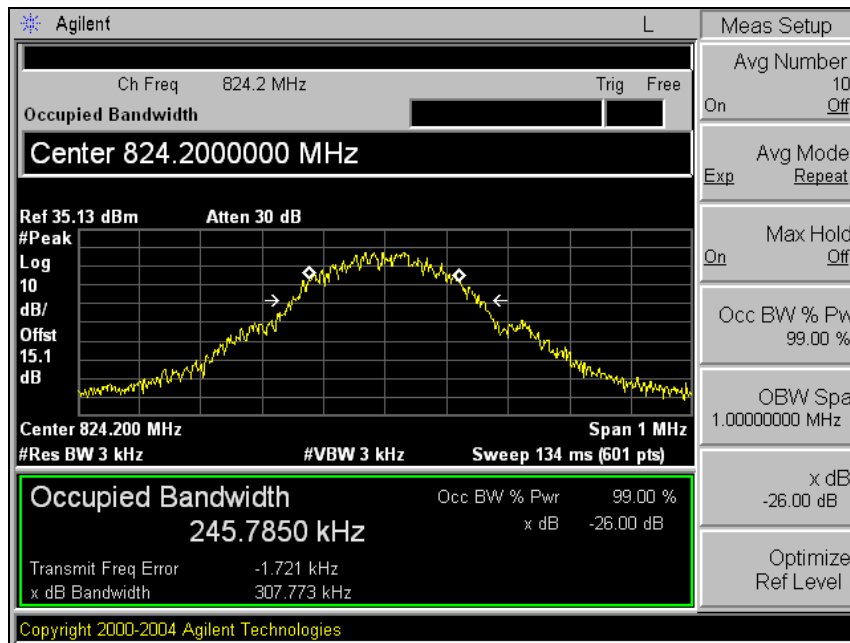
Please refer to the following plots.

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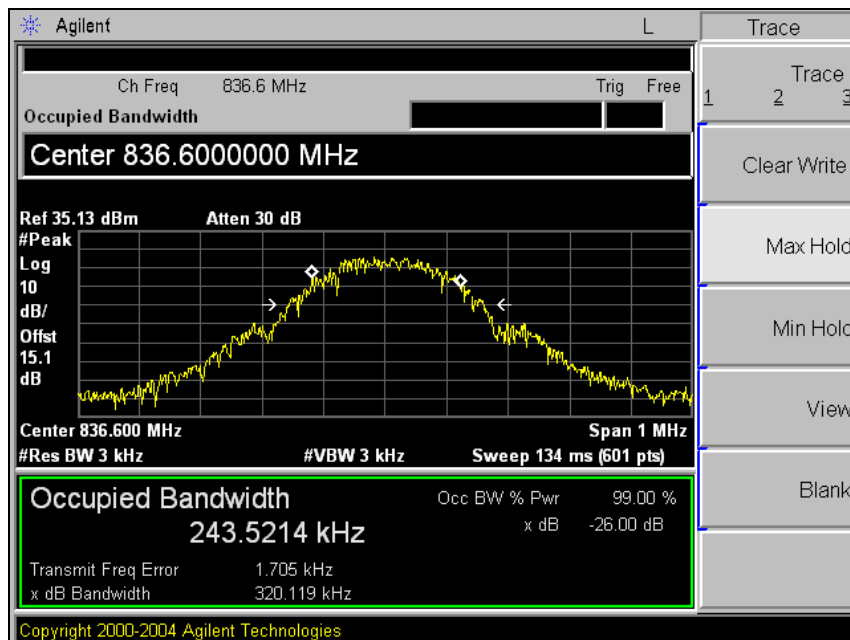
GSM850

99 %

Low Channel

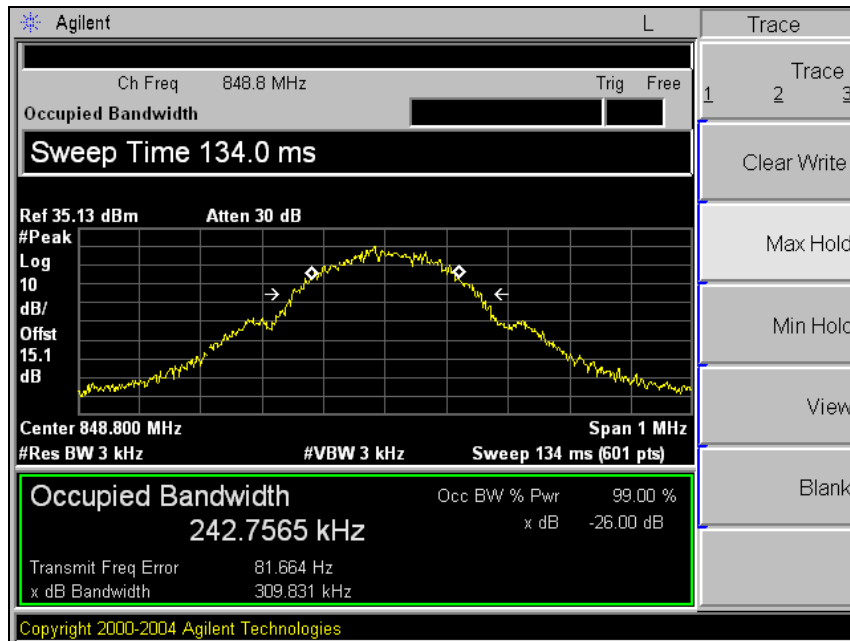


Middle Channel



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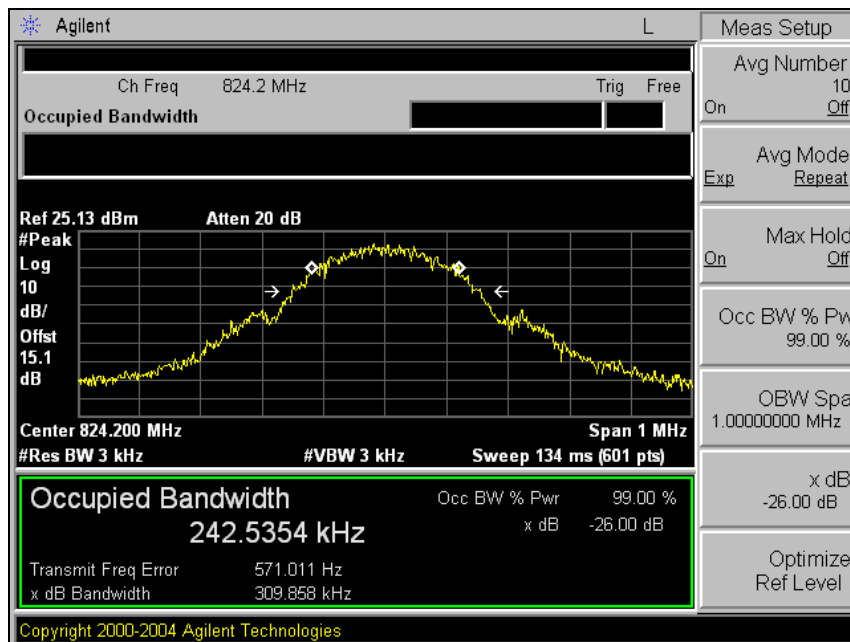
High Channel



GSM850 EDGE

99 %

Low Channel

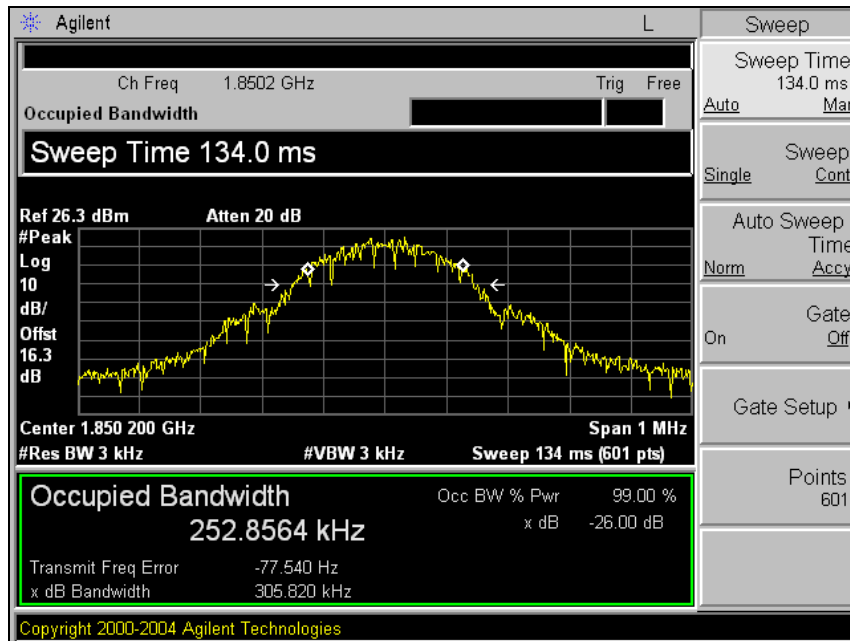


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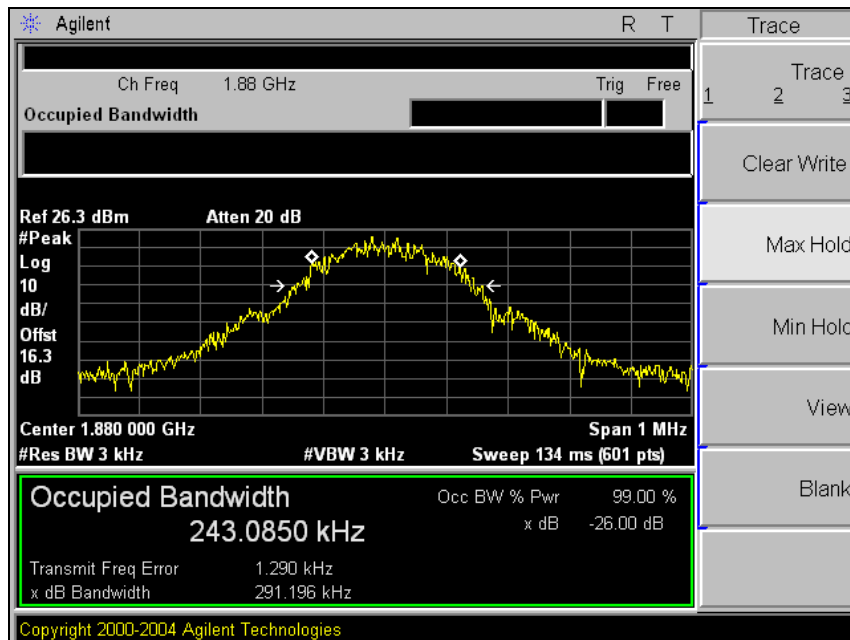
GSM1900

99 %

Low Channel

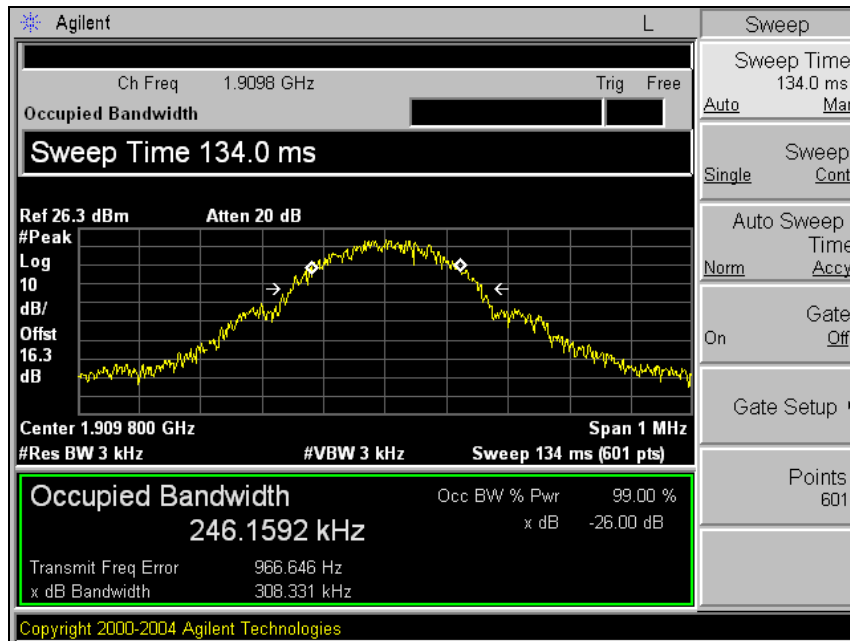


Middle Channel



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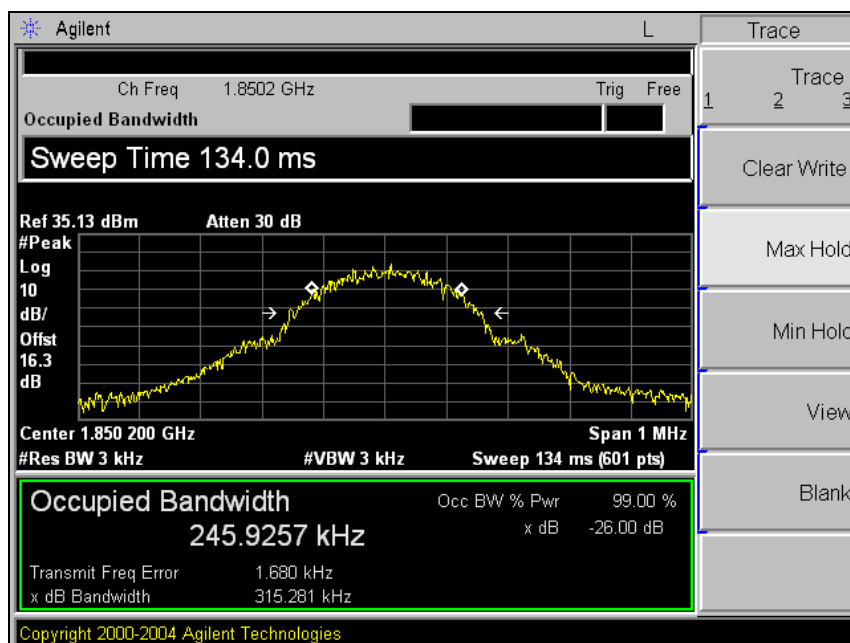
High Channel



GSM1900 EDGE

99 %

Middle Channel



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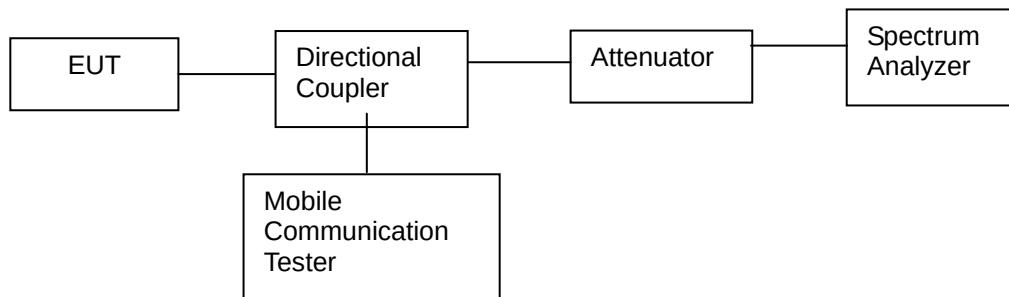
5. Spurious Emissions at Antenna Terminal

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 $43 + 10\log(P)$ dB.

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 MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.
3. Spurious Emission was tested



5.3. Test Results

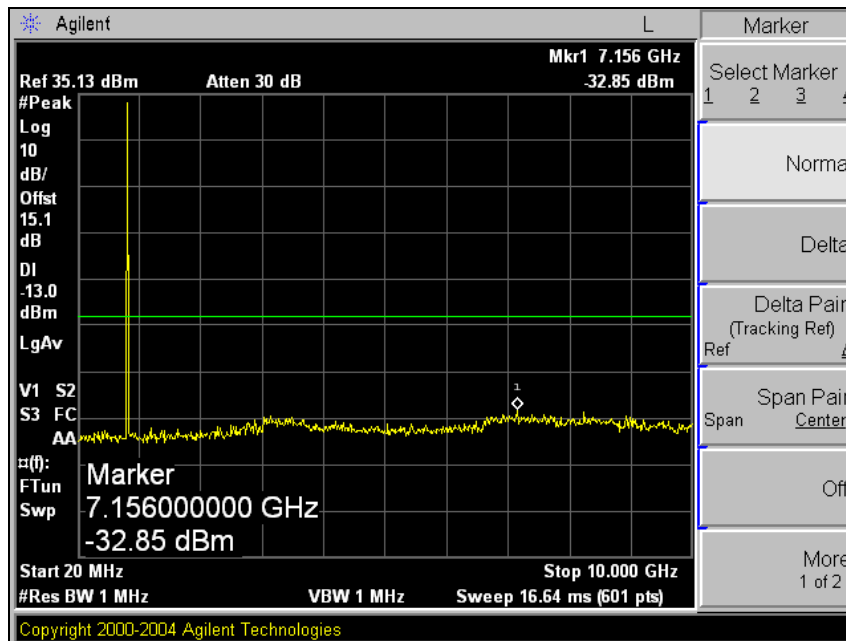
Ambient temperature : $(24 \pm 2) ^\circ\text{C}$
Relative humidity : 47 % R.H.

Please refer to the following plots.

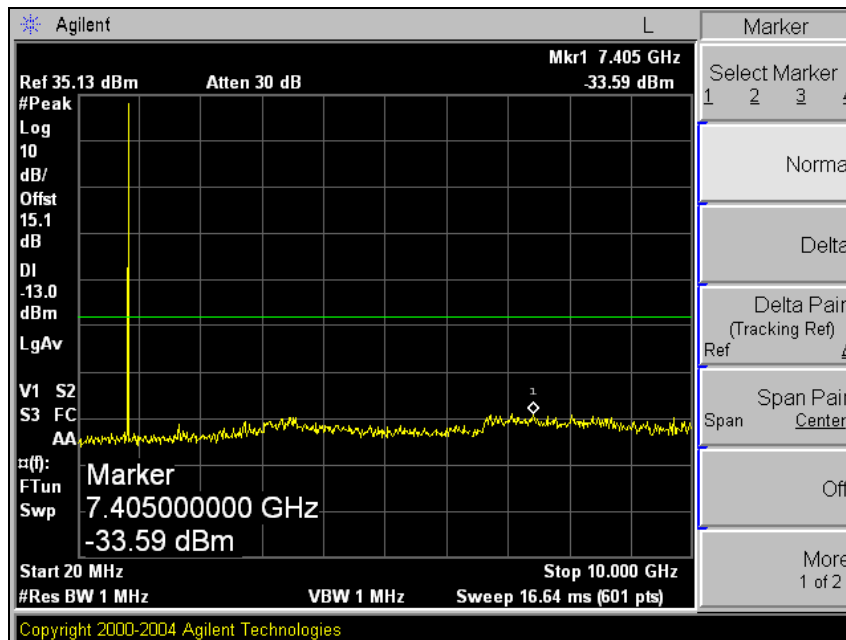
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GSM850

Low Channel

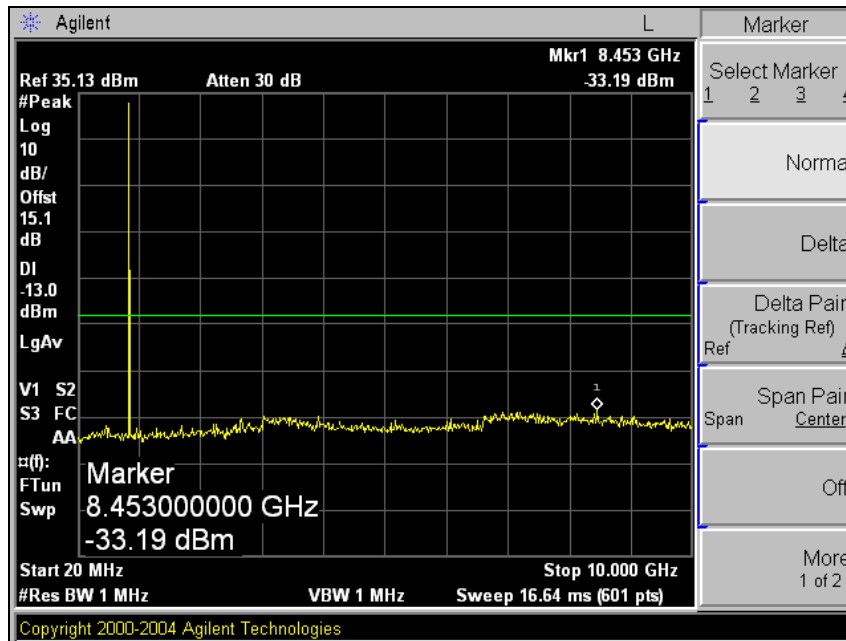


Middle Channel



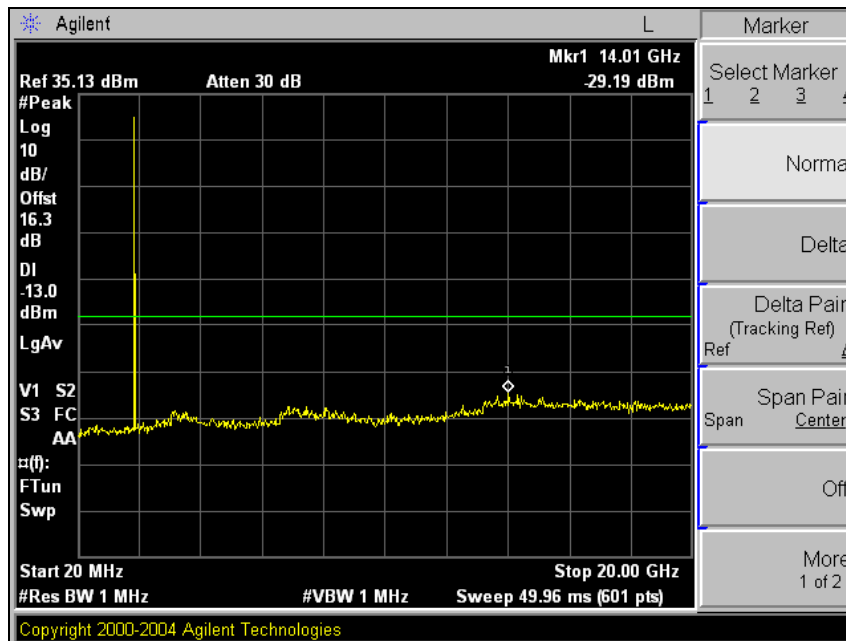
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High Channel

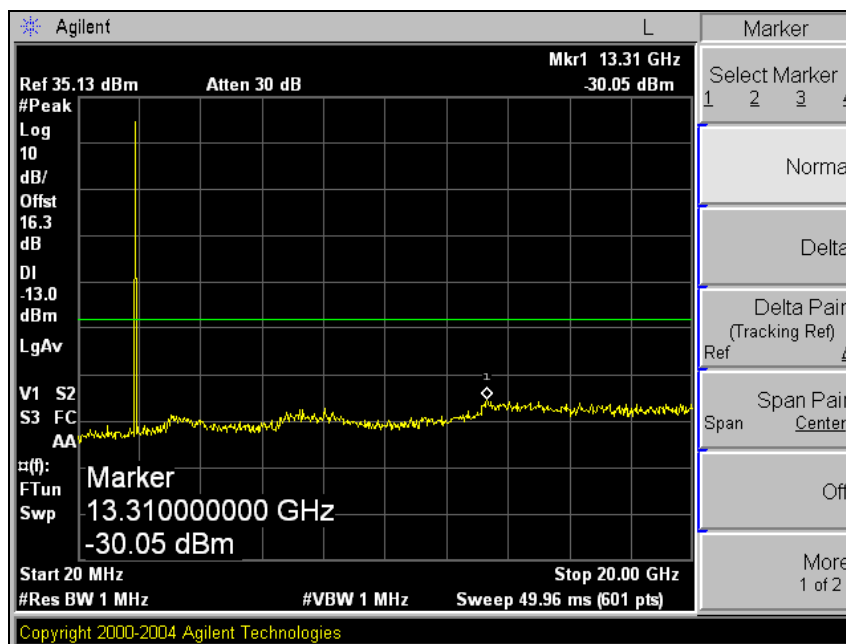


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GSM1900 Low Channel

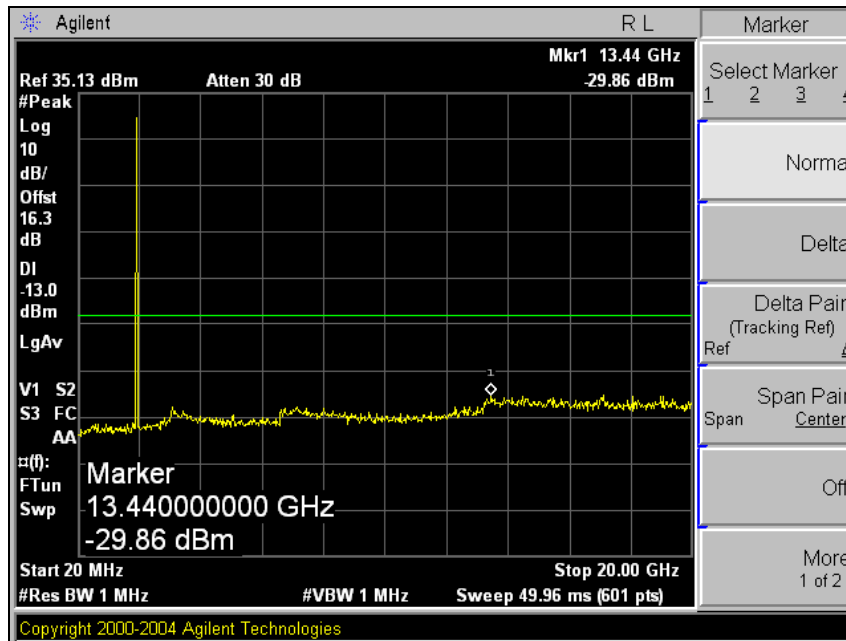


Middle Channel



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High Channel



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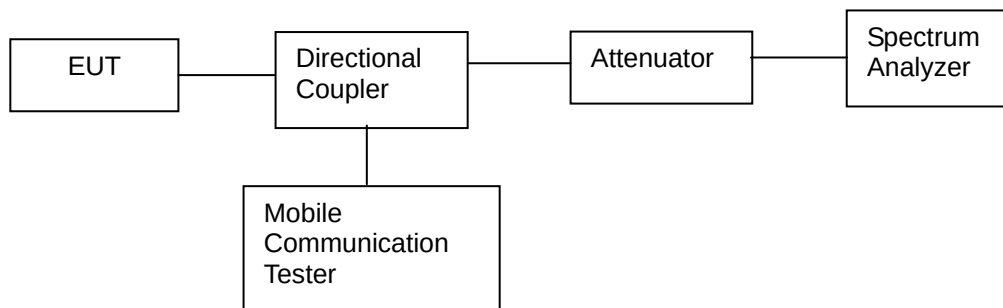
6. Band Edge

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 $43+10\log(P)$ 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.



6.3. Test Results

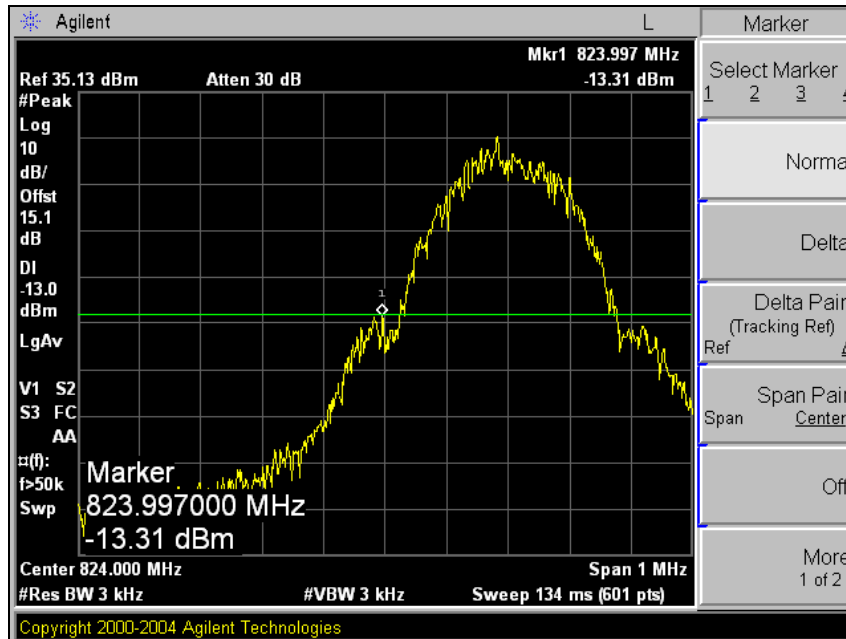
Ambient temperature : $(24 \pm 2) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

Please refer to the following plots.

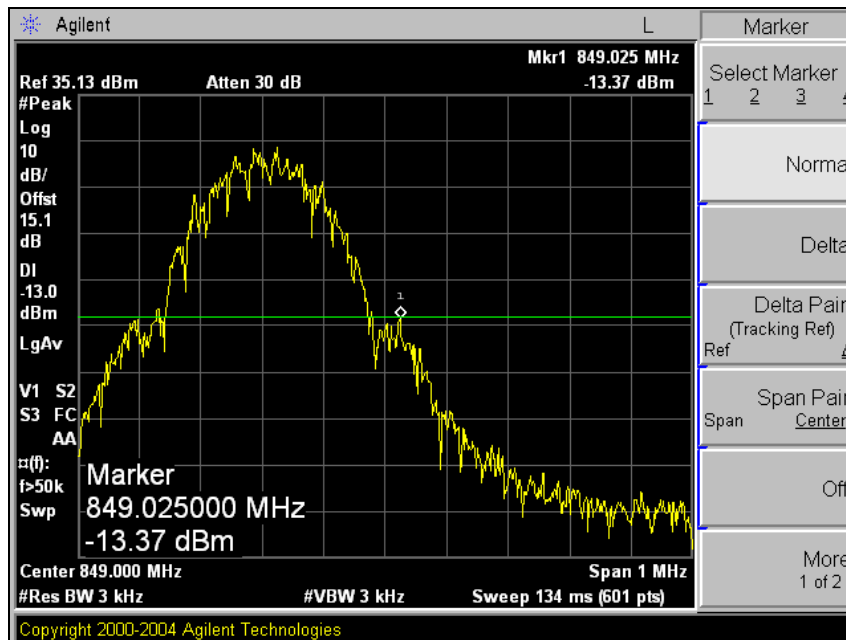
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GSM850

Low Channel

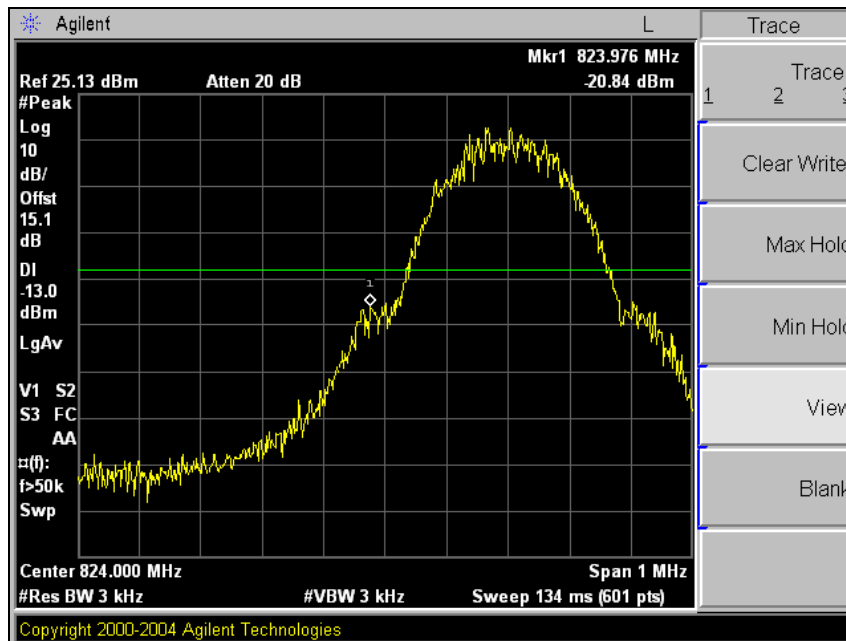


High Channel

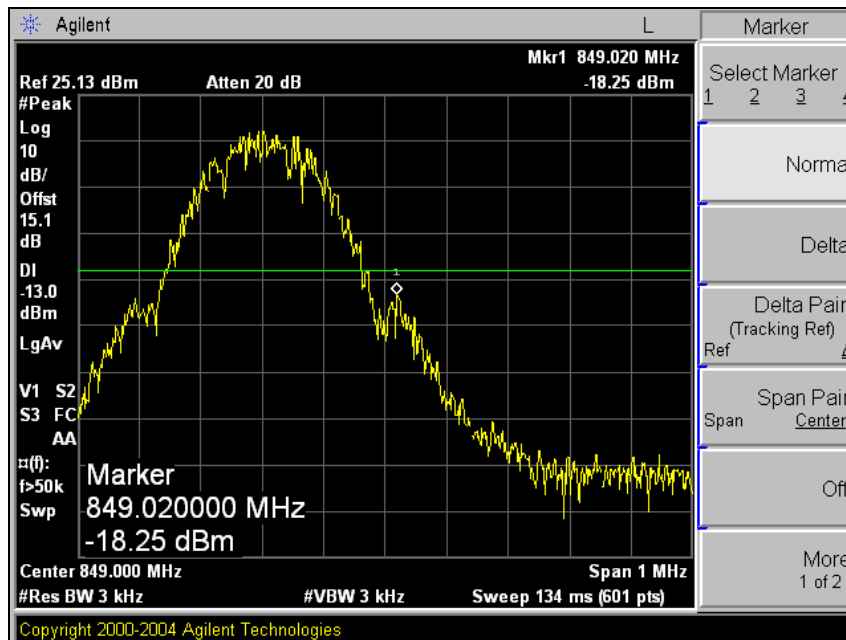


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GSM850 EDGE Low Channel

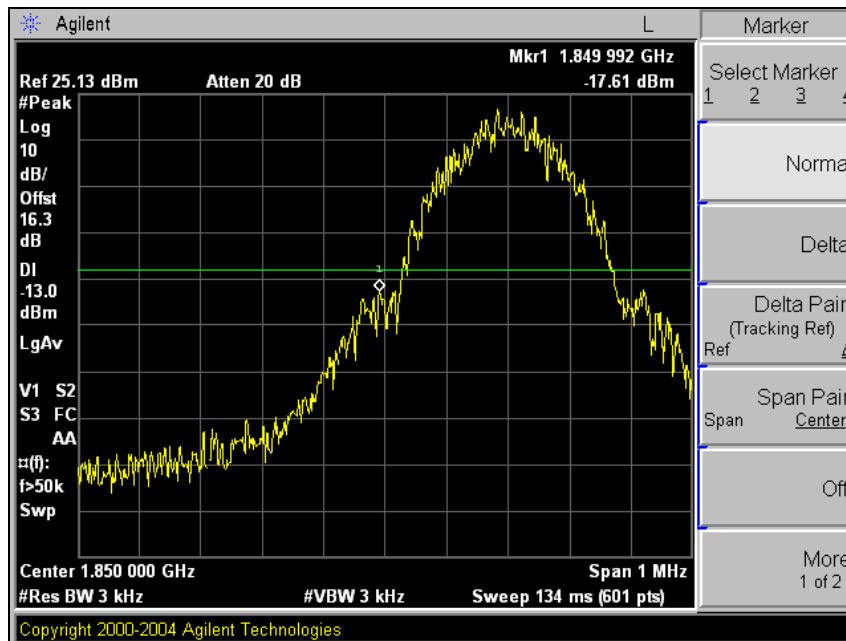


High Channel

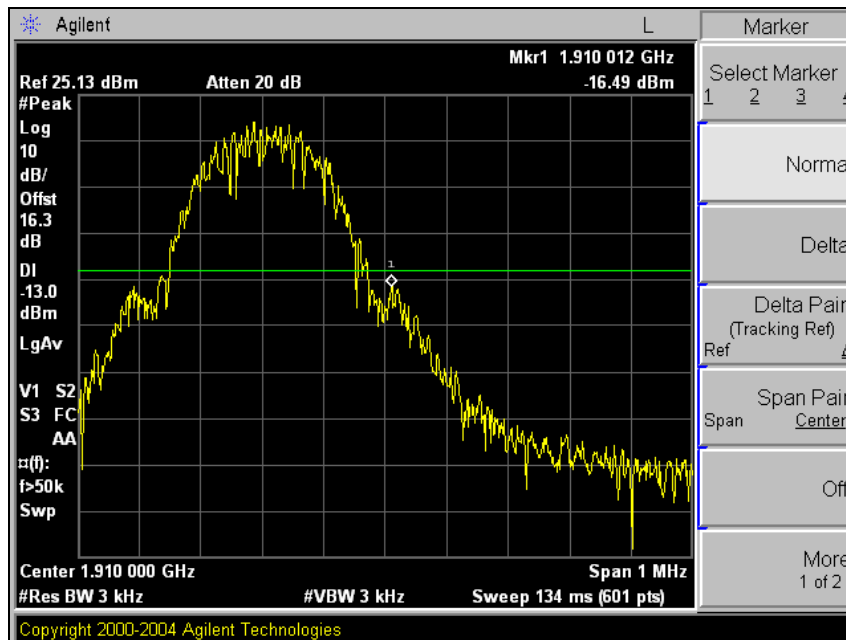


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GSM1900 Low Channel

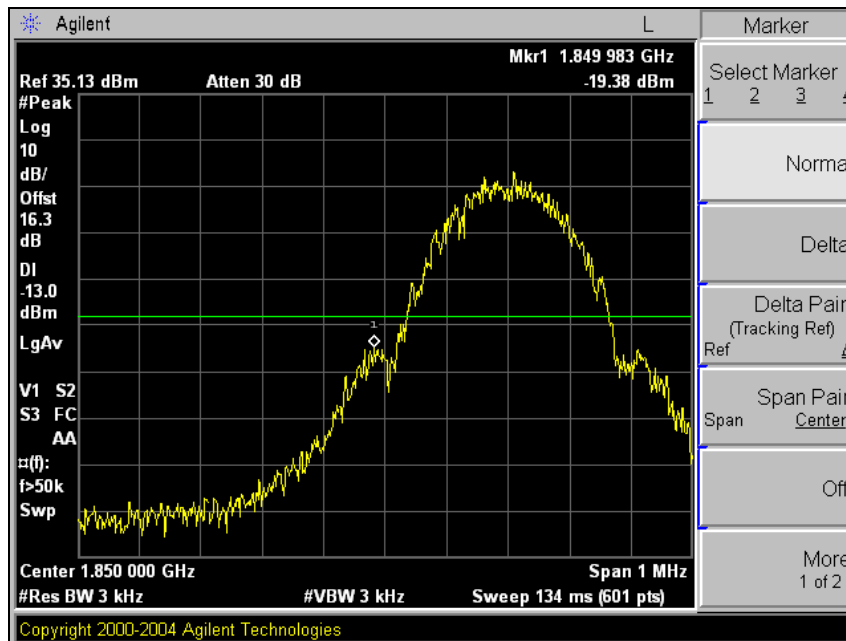


High Channel

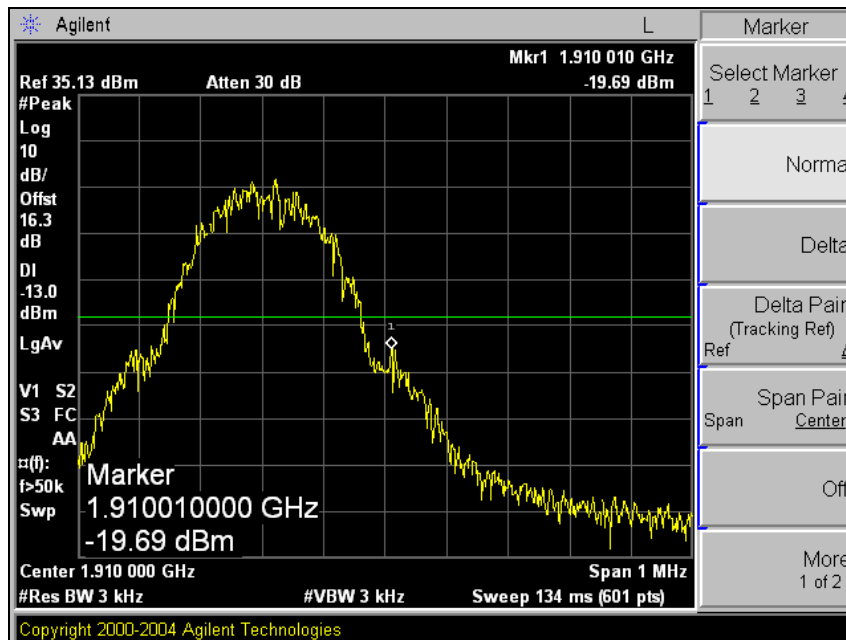


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GSM1900 EDGE Low Channel



High Channel



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7. Frequency Stability

7.1. Limit

Requirements: FCC § 2.1055 (a), § 2.1055 (d) & following:

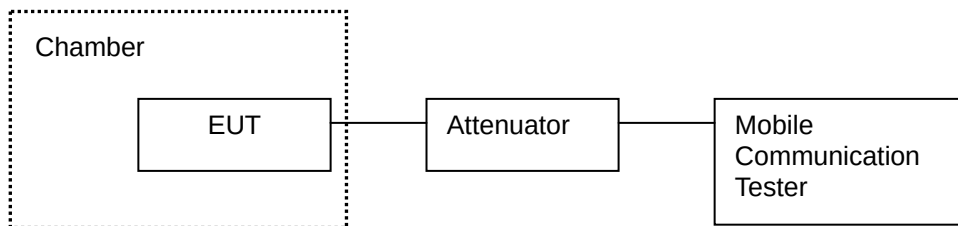
According to §22.355, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table of this section.

For Mobile devices operating in the 824 to 849 MHz 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 mobile communication tester 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.



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7.3. Test Results

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

GSM850 mode at middle channel

Reference Frequency: 836.6 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	110	18	0.021 5
40		20	0.023 9
30		-17	-0.020 3
24		15	0.017 9
10		24	0.028 7
0		11	0.013 1
-10		-16	-0.019 1
-20		-15	-0.017 9
-30		-20	-0.023 9
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	126.5	17	0.020 3
	93.5	13	0.015 5

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GSM1900 mode at middle channel

Reference Frequency: 1880.0 MHz, Limit: 2.5 ppm			
Frequency Stability versus Temperature			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
50	110	31	0.016 5
40		42	0.022 3
30		-24	-0.012 8
24		31	0.016 5
10		35	0.018 6
0		19	0.010 1
-10		-36	-0.019 1
-20		25	0.013 3
-30		26	0.013 8
Frequency Stability versus power Supply			
Environment Temperature (°C)	Power Supplied (Vac)	Frequency Measure with Time Elapse	
		Frequency Error (Hz)	ppm
24	126.5	28	0.014 9
	93.5	-20	-0.010 6

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