

SUMMARY OF TEST RESULTS FOR FCC PART 24

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1047	Modulation Characteristics	Compliant
§ 2.1053	Field Strength of Spurious Radiation	Compliant
§2.1093	RF Exposure (SAR)	Compliant
§ 2.1046, § 24.232	RF Output Power	Compliant
§ 2.1046, § 24.232	Conducted Output Power	Compliant
§ 2.1049 § 24.238	Out of Band Emission, Occupied Bandwidth	Compliant
§ 2.1051, § 24.238(a)	Spurious Emissions at Antenna Terminals	Compliant
§ 2.1055 (a) § 2.1055 (d) § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§24.238	Band Edge	Compliant

§2.1047 - MODULATION CHARACTERISTIC

Applicable Standard

Requirement: FCC § 2.1047.

Test Procedure

GSM digital mode is used by EUT.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

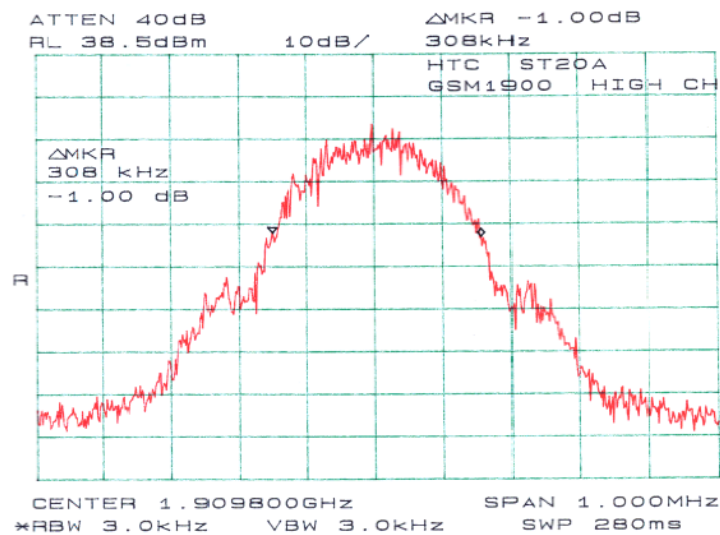
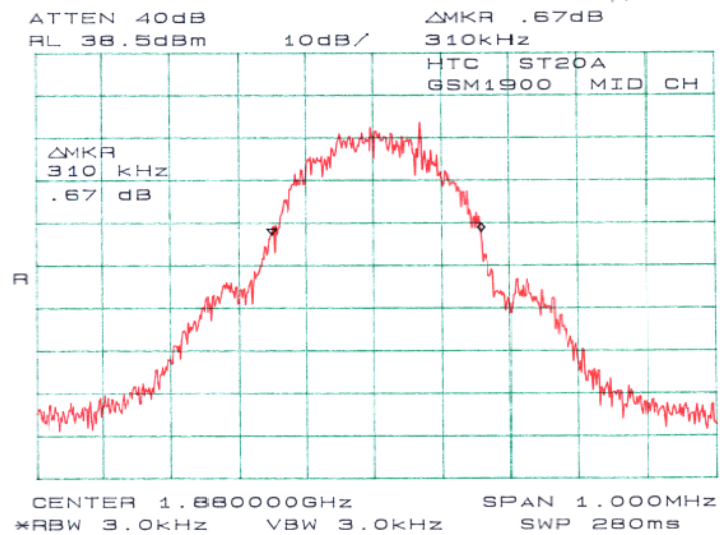
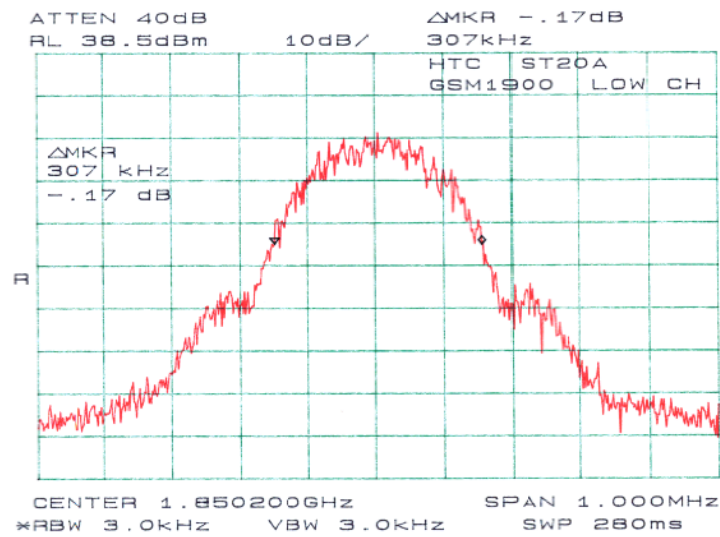
Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

The testing was performed by Ling Zhang on 2004-05-05.

Test Results

Please refer to the hereinafter plots.

Plots of Modulation Characteristic for GSM1900

§2.1053 - SPURIOUS RADIATED EMISSIONS

Applicable Standard

Requirements: CFR 47, § 2.1053.

Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{ Log}_{10} (\text{power out in Watts})$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8568B	2601A02165	2003-07-03
HP	Amplifier	8447E	2944A10187	2003-09-23
HP	Quasi-Peak Adapter	85650A	3019A05393	2003-06-13
EMCO	Biconical Antenna	3110B	9309-1165	2003-10-11
EMCO	Log Periodic Antenna	3146	2101	2003-10-11
AH System	Horn Antenna	SAS-200/511	261	2003-08-02

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

The testing was performed by Ling Zhang on 2004-05-05.

Test Result

FCC Part 24: GSM1900

Low Frequency: -28.7 dBm at 5550.6 MHz

Middle Frequency: -29.0 dBm at 5640 MHz

High Frequency: -28.3 dBm at 5729.4 MHz

Test Data for GSM1900

EUT					Generator					Standard	
Indicated		Table	Test Antenna		Substitution		Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
LOW CHANNEL											
1850.2	124.83	60	1.6	V	1850.2	17.3	8.3	1.2	24.4		
1850.2	128.83	120	1.6	H	1850.2	21.6	8.3	1.2	28.7		
5550.6	51.83	200	1.5	H	5550.6	-49.5	10.6	2.8	-41.7	-13	-28.7
5550.6	51.17	180	1.0	V	5550.6	-50.3	10.6	2.8	-42.5	-13	-29.5
3700.4	49.33	150	1.6	H	3700.4	-52.4	10.3	2.0	-44.1	-13	-31.1
3700.4	48.00	180	1.0	V	3700.4	-54.2	10.3	2.0	-45.9	-13	-32.9
MIDDLE CHANNEL											
1880	125.5	300	1.5	V	1880	17.8	8.3	1.2	24.9		
1880	128.5	0	1.5	H	1880	21.3	8.3	1.2	28.4		
5640	51.17	150	1.5	H	5640	-49.8	10.6	2.8	-42.0	-13	-29.0
5640	50.67	300	1.5	V	5640	-51	10.6	2.8	-43.2	-13	-30.2
3760	48.83	330	1.6	H	3760	-52.7	10.3	2.0	-44.4	-13	-31.4
3760	47.17	330	1.4	V	3760	-54.8	10.3	2.0	-46.5	-13	-33.5
HIGH CHANNEL											
1909.8	125.00	30	1.2	V	1909.8	17.4	8.3	1.2	24.5		
1909.8	128.83	100	1.6	H	1909.8	21.5	8.3	1.2	28.6		
5729.4	52.00	90	1.0	H	5729.4	-49.1	10.6	2.8	-41.3	-13	-28.3
5729.4	51.83	180	1.1	V	5729.4	-50.2	10.6	2.8	-42.4	-13	-29.4
3819.6	49.83	100	1.8	H	3819.6	-52.1	10.3	2.0	-43.8	-13	-30.8
3819.6	48.67	180	1.6	V	3819.6	-53.4	10.3	2.0	-45.1	-13	-32.1

Note: No pre-amplifier for harmonic test.

§2.1046 & §24.232 - RF POWER OUTPUT

Applicable Standard

According to FCC §2.1046 and §24.232 (1), mobile/portable stations are limited to 2 watts EIRP.

Test Procedure

1. On a test site, the EUT shall be placed at 1.5m 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 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. 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.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. 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.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. 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.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8568B	2601A02165	2003-07-03
HP	Amplifier	8447E	2944A10187	2003-09-23
HP	Quasi-Peak Adapter	85650A	3019A05393	2003-06-13
EMCO	Biconical Antenna	3110B	9309-1165	2003-10-11
EMCO	Log Periodic Antenna	3146	2101	2003-10-11
AH System	Horn Antenna	SAS-200/511	261	2003-08-02

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

The testing was performed by Ling Zhang on 2004-05-05.

Test Results

Test Data for GSM1900

Frequency MHz	Substitution Reading dBm	Gain Corrected	Loss dB	EIRP dBm
1850.2	17.3	8.3	1.2	24.4
1850.2	21.6	8.3	1.2	28.7
1880	17.8	8.3	1.2	24.9
1880	21.3	8.3	1.2	28.4
1909.8	17.4	8.3	1.2	24.5
1909.8	21.5	8.3	1.2	28.6

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

$$17.3 + 8.3 - 1.2 = 24.4$$

§2.1046 & §24.232 – CONDUCTED OUTPUT POWER

Applicable Standard

According to 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.

Test Procedure

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

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required
A.H. Systems	Horn Antenna	SAS200	261	2003-05-31
ETS	Logperiodic Antenna	3148	0004-1155	2003-10-11
EMCO	Biconical Antenna	3110B	9603-2315	2003-10-11

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

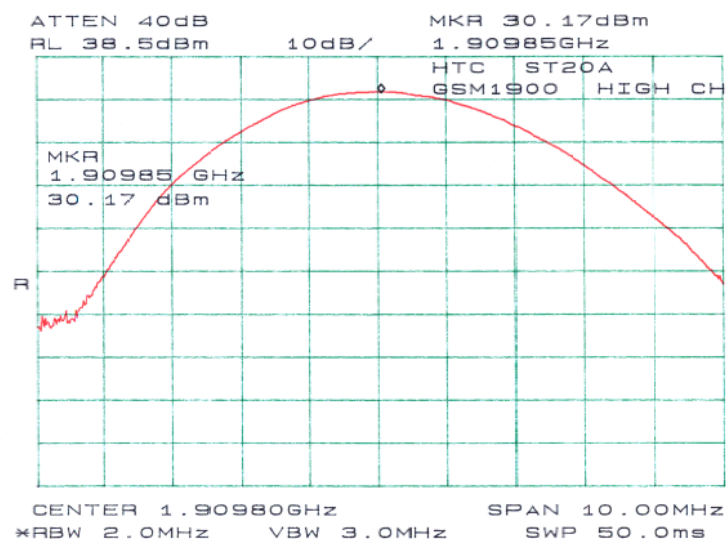
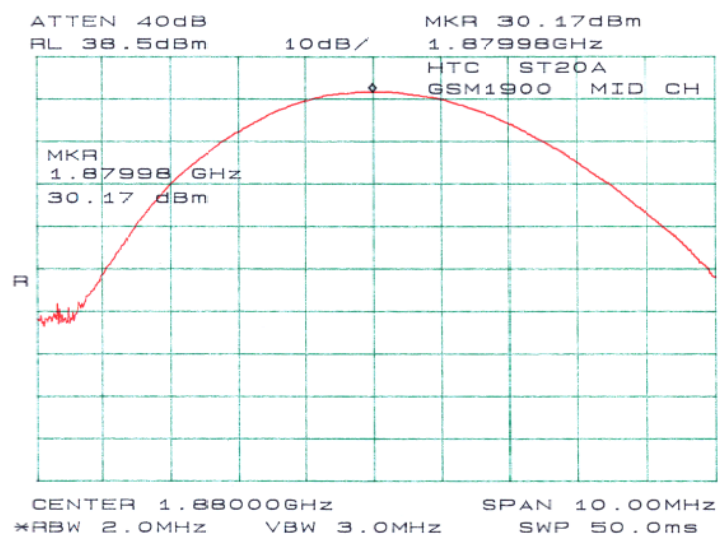
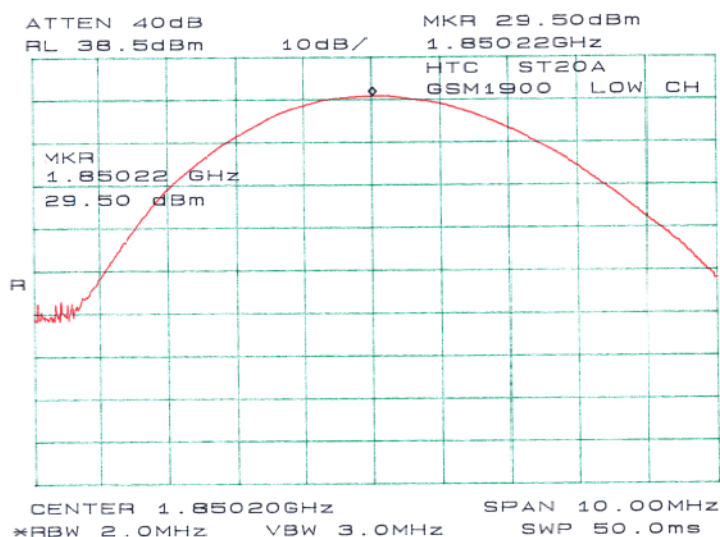
The testing was performed by Ling Zhang on 2004-05-05.

Test Results

GSM1900

Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit in W
LOW	1850.2	29.50	0.891	2
MIDDLE	1880.0	30.17	1.040	2
HIGH	1909.8	30.17	1.040	2

Plots of Conducted Output Power for GSM1900, Part 24



§2.1049 & §24.238 - OCCUPIED BANDWIDTH

Applicable Standard

Requirements: CFR 47, Section 2.1049 and Section 24.238.

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 30 KHz and the 26 dB bandwidth was recorded.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

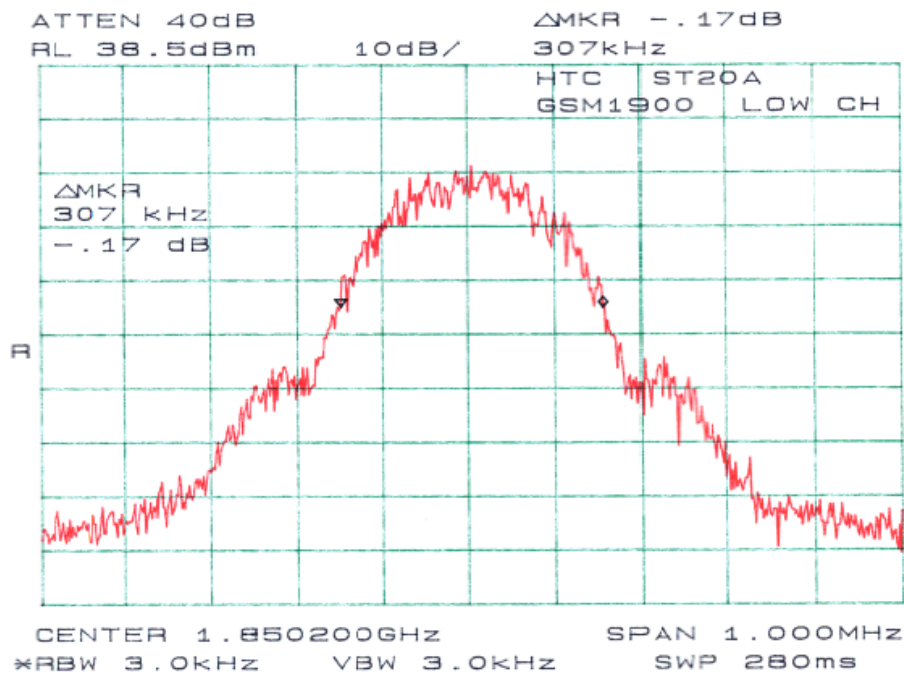
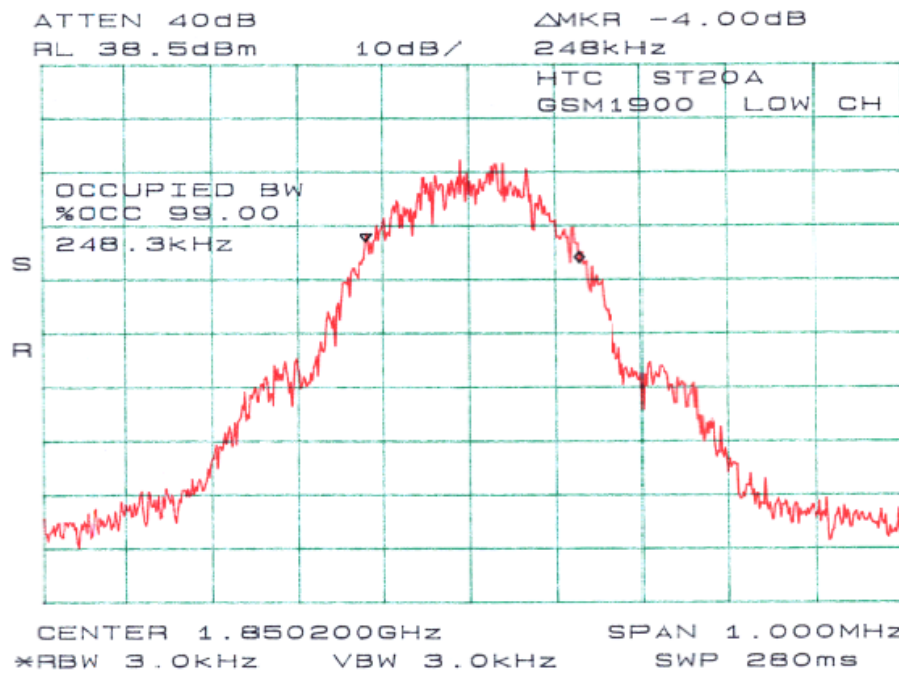
Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

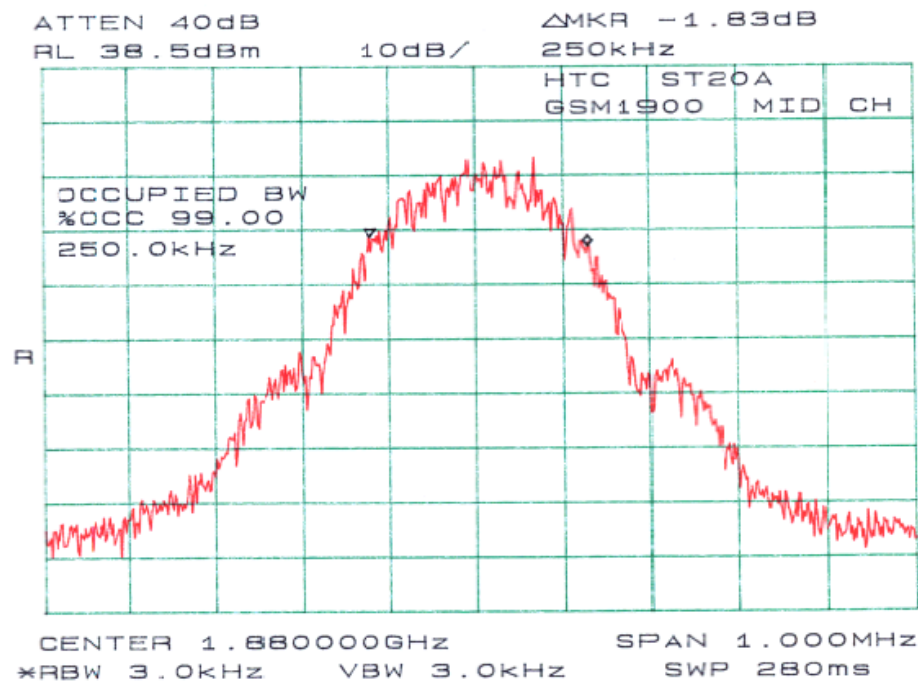
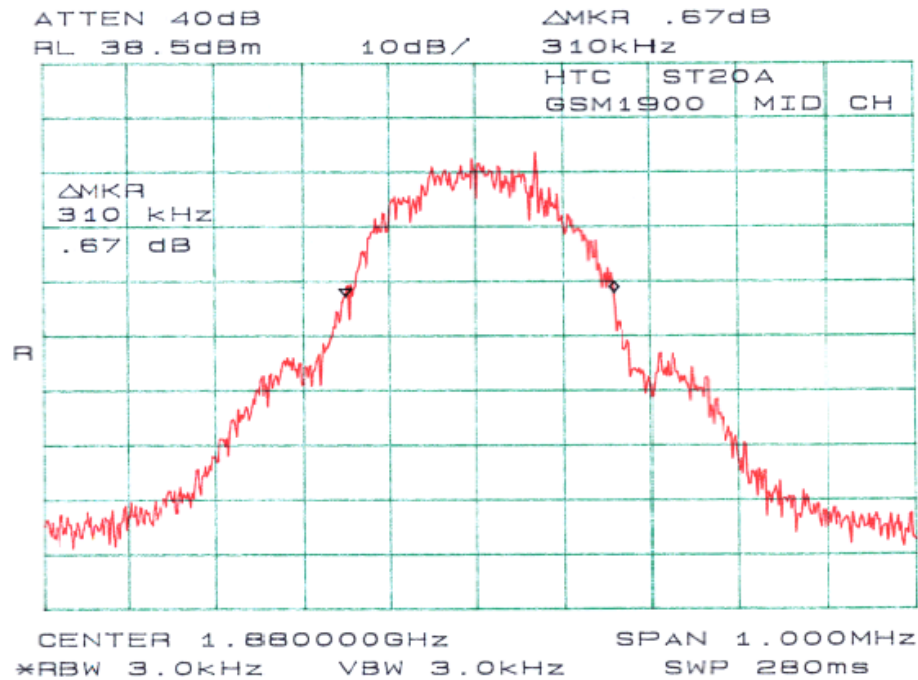
The testing was performed by Ling Zhang on 2004-05-05.

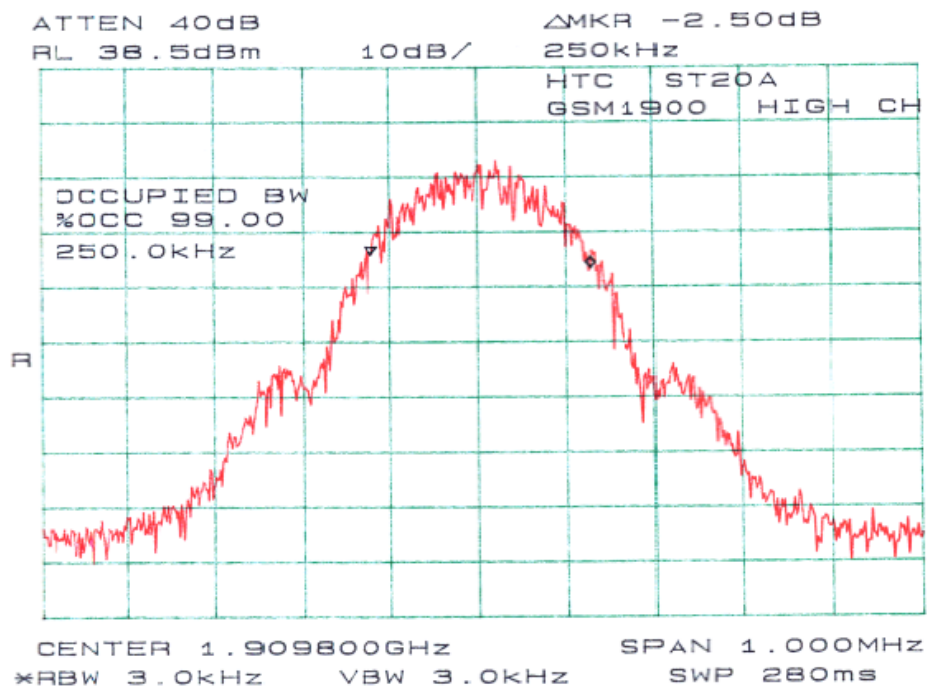
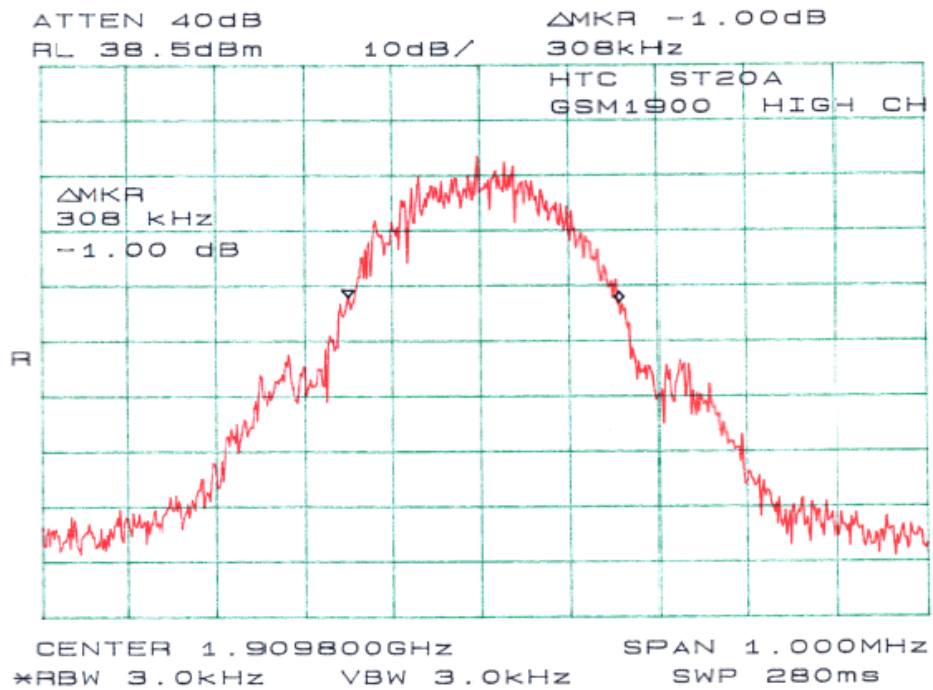
Test Results

Please refer to the following plots.

Plots of Occupied Bandwidth and 99% Bandwidth for GSM1900, Part24:

*204-5-5**204-5-5*





§2.1051 & §24.238(a) - SPURIOUS EMISSIONS AT ANTENNA TERMINALS**Applicable Standard**

Requirements: CFR 47, § 2.1051 & §24.238(a).

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

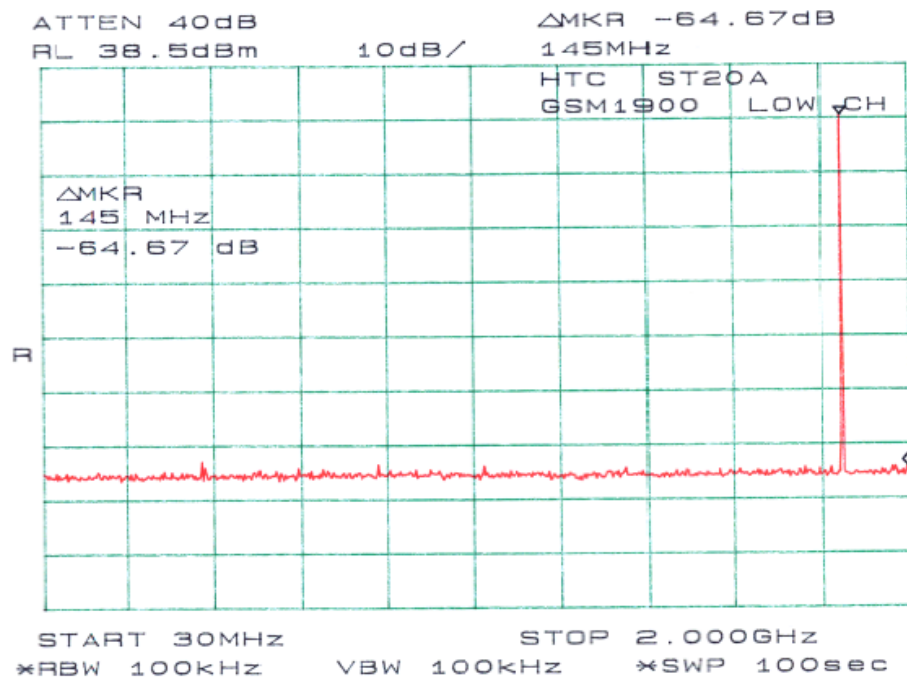
Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

The testing was performed by Ling Zhang on 2004-05-05.

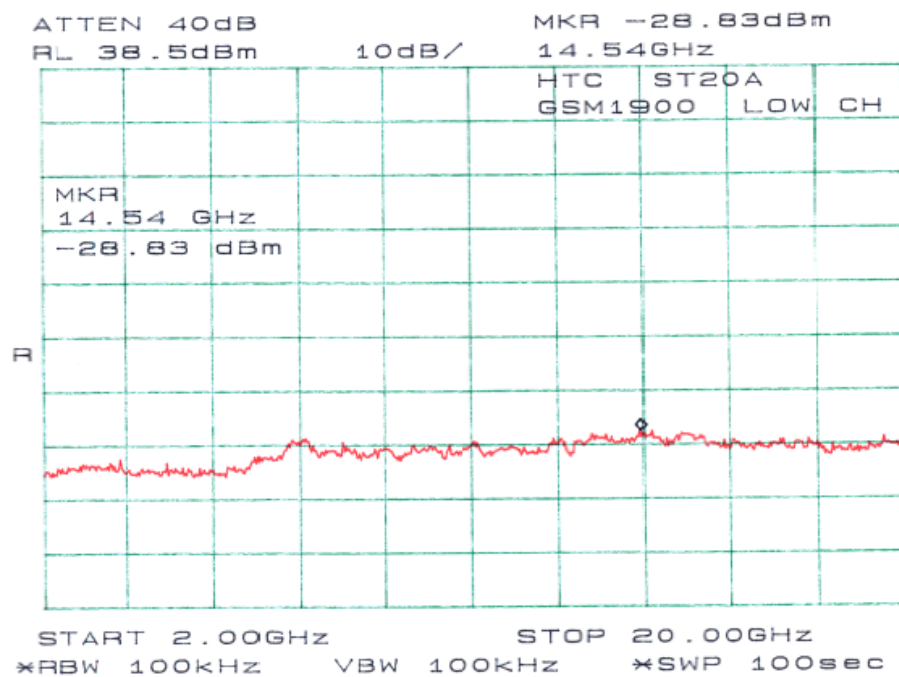
Test Results

Please refer to the hereinafter plots.

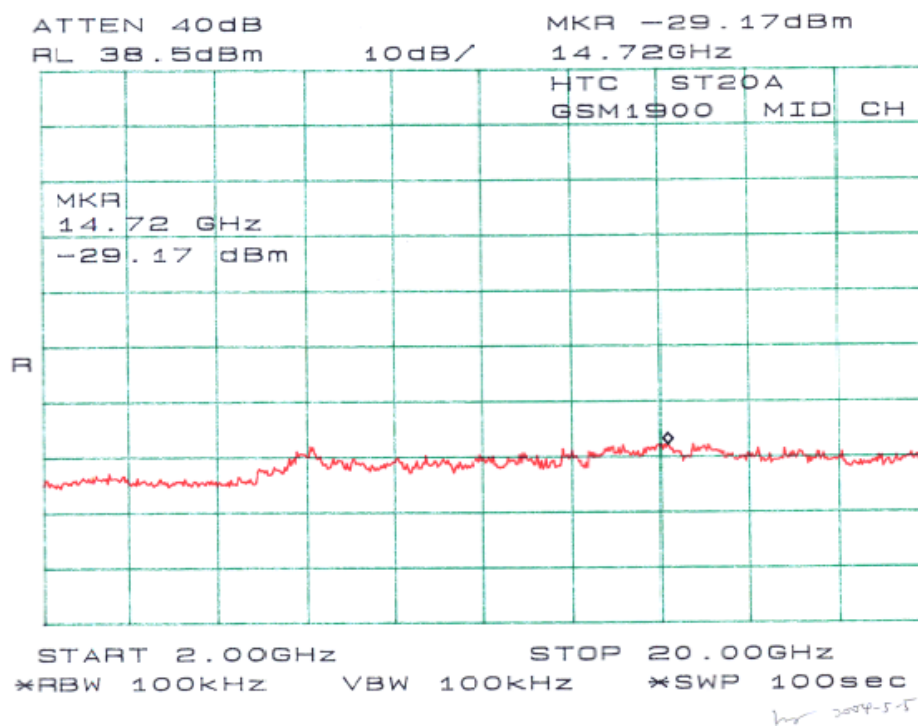
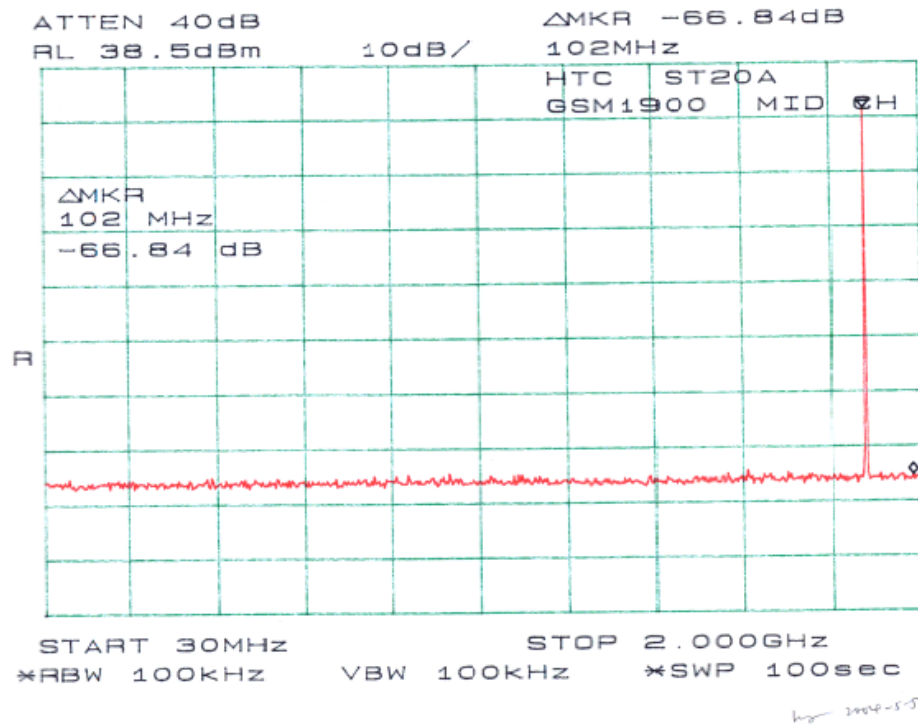
Plots of Spurious Emission for GSM1900, Part24

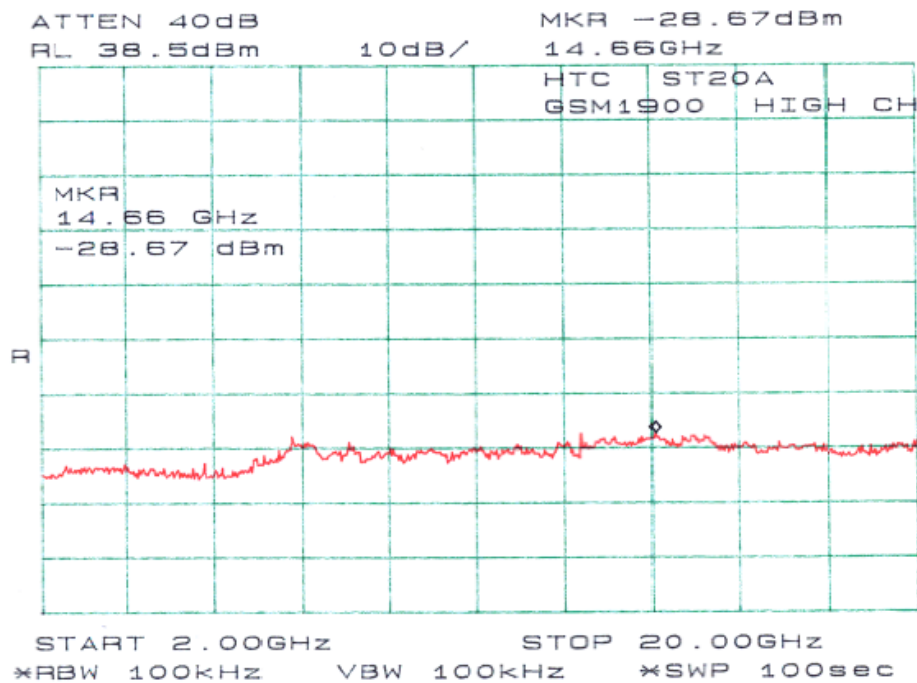
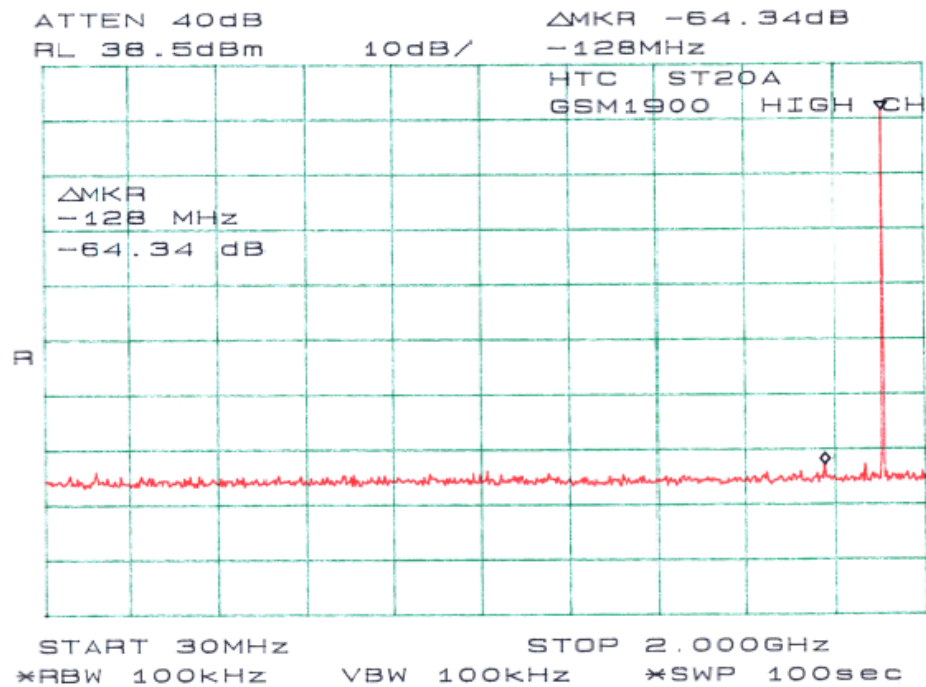


by 2004-5-5



by 2004-5-5





§2.1055 (a), §2.1055 (d) & §24.235 - FREQUENCY STABILITY

Applicable Standard

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 C-1 of this section.

Table C-1_Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Mobile Base, fixed	[SU][le]/ (ppm)	Mobile SU]3 watts [le]3 watts
	(ppm)	(ppm)	(ppm)
25 to 50.....	20.0	20.0	50.0
50 to 450.....	5.0	5.0	50.0
450 to 512.....	2.5	5.0	5.0
821 to 896.....	1.5	2.5	2.5
928 to 929.....	5.0	n/a	n/a
929 to 960.....	1.5	n/a	n/a
2110 to 2220.....	10.0	n/a	n/a

According to §24.235, The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Procedure

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. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage: An external variable DC 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 battery end point. The output frequency was recorded for each battery voltage.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required
Tenney	Temperature Chamber -50° to + 100°	Versa	12.222-193	2003-04-23

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1035 mbar

The testing was performed by Ling Zhang on 2004-05-05.

Test Results

Test Result for GSM1900

Frequency Stability Versus Temperature

Reference Frequency: 1880 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed MHz	PPM Error
50	3.7	1880.000048	0.026
40	3.7	1880.000046	0.024
30	3.7	1880.000039	0.021
20	3.7	1880.000037	0.020
10	3.7	1880.000049	0.026
0	3.7	1880.000044	0.023
-10	3.7	1880.000043	0.023
-20	3.7	1880.000050	0.027
-30	3.7	1880.000055	0.029

Battery normal voltage: 3.7v

Frequency Stability Versus Battery Voltage

Reference Frequency: 1880MHz, Limit: 2.5ppm			
Power Supplied (Vdc)	Environment Temperature (°C)	MHz	ppm
3.6	20	1880.000047	0.025

Battery end point: 3.6v

§24.238 – BAND EDGE

Applicable Standard

According to §24.238, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency, RBW set to 30KHz.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	HP8564E	3943A01781	2003-08-01
HP	Plotter	HP7470A	2541A49659	Not Required

* **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	35%
ATM Pressure:	1019 mbar

The testing was performed by Ling Zhang on 2004-05-05.

Test Results

Please refer to the following plots.

Plots of Band Edge for GSM1900, Part 24

