11 - RADIATED EMISSION

11.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is $\pm$4.0 dB.

11.2 Test Setup

The radiated emission tests were performed in the open area 3-meter test site, using the setup in accordance with the ANSI C63.4-2001. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with 120Vac/60Hz power source.

11.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR §15.33 (a) (1), the system was tested to 10000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Frequency Range	***RBW***	***Video B/W***
Below 30MHz	9kHz	9kHz
30 – 1000MHz	120kHz	120kHz
Above 1000MHz	1MHz	1MHz

11.4 Test Procedure

For the radiated emissions test, both the laptop and all peripheral power cords were connected to the AC floor outlet since the power supply used in the laptop did not provide an accessory power outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dBμV of specification limits), and are distinguished with a "**Qp**" in the data table.

11.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBμV means the emission is 7dBμV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

11.6 Test Equipment

Manufacturer	Model No.	Description	Calibration Due Date
Agilent	8564E	Spectrum Analyzer	2004-08-01

11.7 Summary of Test Results

According to the data in section 11.8, the EUT complied with the FCC Title 47, Part 15, Subpart C, section 15.205, 15.207, and 15.247, and had the worst margin of:

For Model: PH10B

-13.4 dB at **7206.00 MHz** in the **Vertical** polarization, Low Channel.

-11.9 dB at **7323.00 MHz** in the **Horizontal** polarization, Middle Channel.

-11.9 dB at **7440.00 MHz** in the **Horizontal** polarization, High Channel.

-8.9 dB at **486.57 MHz** in the **Vertical** polarization, Unintentional Emission

For Model: PH10A

-11.6 dB at **7206.00 MHz** in the **Vertical** polarization, Low Channel.

-11.5 dB at **7323.00 MHz** in the **Vertical** polarization, Middle Channel.

-11.4 dB at **7440.00 MHz** in the **Vertical** polarization, High Channel.

-10.1 dB at **485.90 MHz** in the **Vertical** polarization, Unintentional Emission

11.8 Radiated Emission Test Data

11.8.1 Test Data for model: PH10B

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency MHz	Ampl. dBμV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable Loss dBμV/m	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB	Mode
Low Channel											
2402.00	94.3	30	1.0	V	28.1	3.4	35.2	90.6			FUND/PEAK
2402.00	88.7	45	1.6	H	28.1	3.4	35.2	84.9			FUND/PEAK
2402.00	59.5	30	1.0	V	28.1	3.4	35.2	55.8			FUND/AVE
2402.00	55.8	45	1.6	H	28.1	3.4	35.2	52.1			FUND/AVE
7206.00	33.3	270	1.6	V	35.1	5.6	33.5	40.6	54	-13.4	AVE
7206.00	33.2	200	1.2	H	35.1	5.6	33.5	40.4	54	-13.6	AVE
4804.00	33.2	90	1.8	V	32.5	4.9	33.0	37.6	54	-16.4	AVE
4804.00	31.2	60	1.6	H	32.5	4.9	33.0	35.6	54	-18.4	AVE
7206.00	45.7	270	1.6	V	35.1	5.6	33.5	52.9	74	-21.1	PEAK
7206.00	45.5	200	1.2	H	35.1	5.6	33.5	52.7	74	-21.3	PEAK
4804.00	46.0	90	1.8	V	32.5	4.9	33.0	50.4	74	-23.6	PEAK
4804.00	43.8	60	1.6	H	32.5	4.9	33.0	48.2	74	-25.8	PEAK
Middle Channel											
2441.00	95.0	330	1.1	V	28.1	3.4	35.2	91.3			FUND/PEAK
2441.00	89.5	300	1.8	H	28.1	3.4	35.2	85.8			FUND/PEAK
2441.00	61.2	330	1.1	V	28.1	3.4	35.2	57.5			FUND/AVE
2441.00	56.5	300	1.8	H	28.1	3.4	35.2	52.8			FUND/AVE
7323.00	34.8	90	1.5	H	35.1	5.6	33.5	42.1	54	-11.9	AVE
7323.00	34.7	30	1.5	V	35.1	5.6	33.5	41.9	54	-12.1	AVE
4882.00	33.2	30	1.0	V	32.5	4.9	33.0	37.6	54	-16.4	AVE
4882.00	32.0	180	1.0	H	32.5	4.9	33.0	36.4	54	-17.6	AVE
7323.00	46.3	30	1.5	V	35.1	5.6	33.5	53.6	74	-20.4	PEAK
7323.00	46.0	90	1.5	H	35.1	5.6	33.5	53.2	74	-20.8	PEAK
4882.00	46.2	30	1.0	V	32.5	4.9	33.0	50.6	74	-23.4	PEAK
4882.00	44.7	180	1.0	H	32.5	4.9	33.0	49.1	74	-24.9	PEAK
High Channel											
2480.00	92.5	0	1.6	V	28.1	3.4	35.2	88.8			FUND/PEAK
2480.00	88.0	0	1.0	H	28.1	3.4	35.2	84.3			FUND/PEAK
2480.00	58.5	0	1.6	V	28.1	3.4	35.2	54.8			FUND/AVE
2480.00	56.3	0	1.0	H	28.1	3.4	35.2	52.6			FUND/AVE
7440.00	34.8	150	1.2	H	35.1	5.6	33.5	42.1	54	-11.9	AVE
7440.00	34.8	180	1.4	V	35.1	5.6	33.5	42.0	54	-12.0	AVE
4960.00	32.5	180	1.7	V	32.5	4.9	33.0	36.9	54	-17.1	AVE
4960.00	31.7	300	1.4	H	32.5	4.9	33.0	36.1	54	-17.9	AVE
7440.00	46.3	150	1.2	H	35.1	5.6	33.5	53.6	74	-20.4	PEAK
7440.00	46.2	180	1.4	V	35.1	5.6	33.5	53.4	74	-20.6	PEAK
4960.00	45.3	180	1.7	V	32.5	4.9	33.0	49.7	74	-24.3	PEAK
4960.00	43.5	300	1.4	H	32.5	4.9	33.0	47.9	74	-26.1	PEAK

Unintentional Emission

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB
486.57	40.7	90	1.8	V	18.3	3.1	25.0	37.1	46	-8.9
57.40	44.5	60	2.0	H	9.8	1.7	25.0	31.0	43.5	-12.5
135.11	42.0	90	1.2	H	12.2	1.6	25.0	30.8	43.5	-12.7
492.40	36.3	270	1.3	V	18.7	3.1	25.0	33.2	46	-12.8
246.81	39.3	180	1.0	V	13.8	2.2	25.0	30.3	46	-15.7
356.37	33.3	200	1.2	H	15.5	2.3	25.0	26.2	46	-19.8

Note: The test was performed by placing the EUT on 3-orthogonal axis.

11.8.2 Test Data for model: PH10A

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart C		
Frequency MHz	Ampl. dBμV/m	Direction Degree	Height Meter	Polar H/V	Antenna dBμV/m	Cable Loss dBμV/m	Amp. dB	Corr. Ampl. dBμV/m	Limit dBμV/m	Margin dB	Mode
Low Channel											
2402.00	92.5	330	1.3	V	28.1	3.4	35.2	88.8			FUND/PEAK
2402.00	85.7	90	2.0	H	28.1	3.4	35.2	81.9			FUND/PEAK
2402.00	58.5	330	1.3	V	28.1	3.4	35.2	54.8			FUND/AVE
2402.00	55.7	90	2.0	H	28.1	3.4	35.2	51.9			FUND/AVE
7206.00	35.2	300	1.8	V	35.1	5.6	33.5	42.4	54	-11.6	AVE
7206.00	35.1	270	1.6	H	35.1	5.6	33.5	42.3	54	-11.7	AVE
4804.00	33.0	0	1.5	V	32.5	4.9	33.0	37.4	54	-16.6	AVE
4804.00	31.7	30	1.4	H	32.5	4.9	33.0	36.1	54	-17.9	AVE
7206.00	47.5	300	1.8	V	35.1	5.6	33.5	54.7	74	-19.3	PEAK
7206.00	46.3	270	1.6	H	35.1	5.6	33.5	53.6	74	-20.4	PEAK
4804.00	45.8	0	1.5	V	32.5	4.9	33.0	50.2	74	-23.8	PEAK
4804.00	44.7	30	1.4	H	32.5	4.9	33.0	49.1	74	-24.9	PEAK
Middle Channel											
2441.00	94.2	30	1.2	V	28.1	3.4	35.2	90.4			FUND/PEAK
2441.00	90.7	0	1.0	H	28.1	3.4	35.2	86.9			FUND/PEAK
2441.00	60.5	30	1.2	V	28.1	3.4	35.2	56.8			FUND/AVE
2441.00	57.7	0	1.0	H	28.1	3.4	35.2	53.9			FUND/AVE
7323.00	35.3	150	1.5	V	35.1	5.6	33.5	42.5	54	-11.5	AVE
7323.00	35.0	180	1.2	H	35.1	5.6	33.5	42.2	54	-11.8	AVE
4882.00	33.3	30	1.2	V	32.5	4.9	33.0	37.7	54	-16.3	AVE
4882.00	31.8	270	1.3	H	32.5	4.9	33.0	36.2	54	-17.8	AVE
7323.00	47.2	150	1.5	V	35.1	5.6	33.5	54.4	74	-19.6	PEAK
7323.00	45.8	180	1.2	H	35.1	5.6	33.5	53.0	74	-21.0	PEAK
4882.00	46.2	30	1.2	V	32.5	4.9	33.0	50.6	74	-23.4	PEAK
4882.00	44.5	270	1.3	H	32.5	4.9	33.0	48.9	74	-25.1	PEAK
High Channel											
2480.00	91.3	30	1.0	V	28.1	3.4	35.2	87.6			FUND/PEAK
2480.00	90.5	45	1.8	H	28.1	3.4	35.2	86.8			FUND/PEAK
2480.00	58.5	30	1.0	V	28.1	3.4	35.2	54.8			FUND/AVE
2480.00	57.8	45	1.8	H	28.1	3.4	35.2	54.1			FUND/AVE
7440.00	35.4	60	1.2	V	35.1	5.6	33.5	42.6	54	-11.4	AVE
7440.00	35.3	330	1.8	H	35.1	5.6	33.5	42.5	54	-11.5	AVE
4960.00	33.0	0	1.2	V	32.5	4.9	33.0	37.4	54	-16.6	AVE
4960.00	31.5	250	1.6	H	32.5	4.9	33.0	35.9	54	-18.1	AVE
7440.00	47.1	60	1.2	V	35.1	5.6	33.5	54.3	74	-19.7	PEAK
7440.00	46.4	330	1.8	H	35.1	5.6	33.5	53.6	74	-20.4	PEAK
4960.00	45.8	0	1.2	V	32.5	4.9	33.0	50.2	74	-23.8	PEAK
4960.00	44.3	250	1.6	H	32.5	4.9	33.0	48.7	74	-25.3	PEAK

Unintentional Emission

Indicated			Table	Antenna		Correction Factor			FCC 15 Subpart B	
Frequency	Ampl.	Direction	Height	Polar	Antenna	Cable Loss	Amp.	Corr. Ampl.	Limit	Margin
MHz	dBμV/m	Degree	Meter	H/V	dBμV/m	dBμV/m	dB	dBμV/m	dBμV/m	dB
485.90	39.5	90	1.8	V	18.3	3.1	25.0	35.9	46	-10.1
492.43	37.2	300	1.4	V	18.7	3.1	25.0	34.0	46	-12.0
57.45	43.8	30	1.8	H	9.8	1.7	25.0	30.3	43.5	-13.2
135.00	41.2	270	1.0	H	12.2	1.6	25.0	30.0	43.5	-13.5
246.20	38.5	0	1.2	V	13.8	2.2	25.0	29.5	46	-16.5
356.60	35.7	220	1.5	H	15.5	2.3	25.0	28.5	46	-17.5

Note: The test was performed by placing the EUT on 3-orthogonal axis.

12 - CONDUCTED EMISSION

12.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

12.2 Test Setup

The measurement was performed at shield room, using the same setup per ANSI C63.4 – 2001 measurement procedure. The specification used was FCC Class B limits.

External I/O cables were draped along the edge of the test table and bundle when necessary.

The EUT was connected with 120Vac/60Hz power source.

12.3 Spectrum Analyzer Setup

The spectrum analyzer was set to investigate the spectrum from 150 kHz to 30Mhz.

12.4 Test Procedure

During the conducted emission test, the power cord of the host system was connected to the auxiliary outlet of the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of each modes tested to ensure EUT is compliant with all installation combination.

All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (within -4 dBμV of specification limits). Quasi-peak readings are distinguished with a "**Qp**".

12.5 Summary of Test Results

According to the data in section 12.6, the EUT complied with the FCC Conducted margin for a Class B device, with the *worst* margin reading of:

-8.9 dBμV at 0.350 MHz in the Neutral mode

12.6 Conducted Emissions Test Data

LINE CONDUCTED EMISSIONS				FCC CLASS B	
Frequency MHz	Amplitude dBμV	Detector Qp/Ave/Peak	Phase Line/Neutral	Limit dBμV	Margin dB
0.350	39.1	AVG	Neutral	48	-8.9
0.160	44.7	AVG	Line	54	-9.3
0.180	41.4	AVG	Neutral	53	-11.6
0.330	36.2	AVG	Line	49	-12.8
0.900	32.4	AVG	Neutral	46	-13.6
0.350	44.0	QP	Neutral	58	-14.0
0.160	49.8	QP	Line	64	-14.2
0.900	41.3	QP	Neutral	56	-14.7
0.830	41.0	QP	Line	56	-15.0
0.830	30.8	AVG	Line	46	-15.2
0.180	47.3	QP	Neutral	63	-15.7
0.330	42.6	QP	Line	59	-16.4

12.7 Plot of Conducted Emissions Test Data

Plot(s) of Conducted Emissions Test Data is presented in the following page as reference.

Bay Area Compliance Laboratory Corp 20. Aug 03 17:01

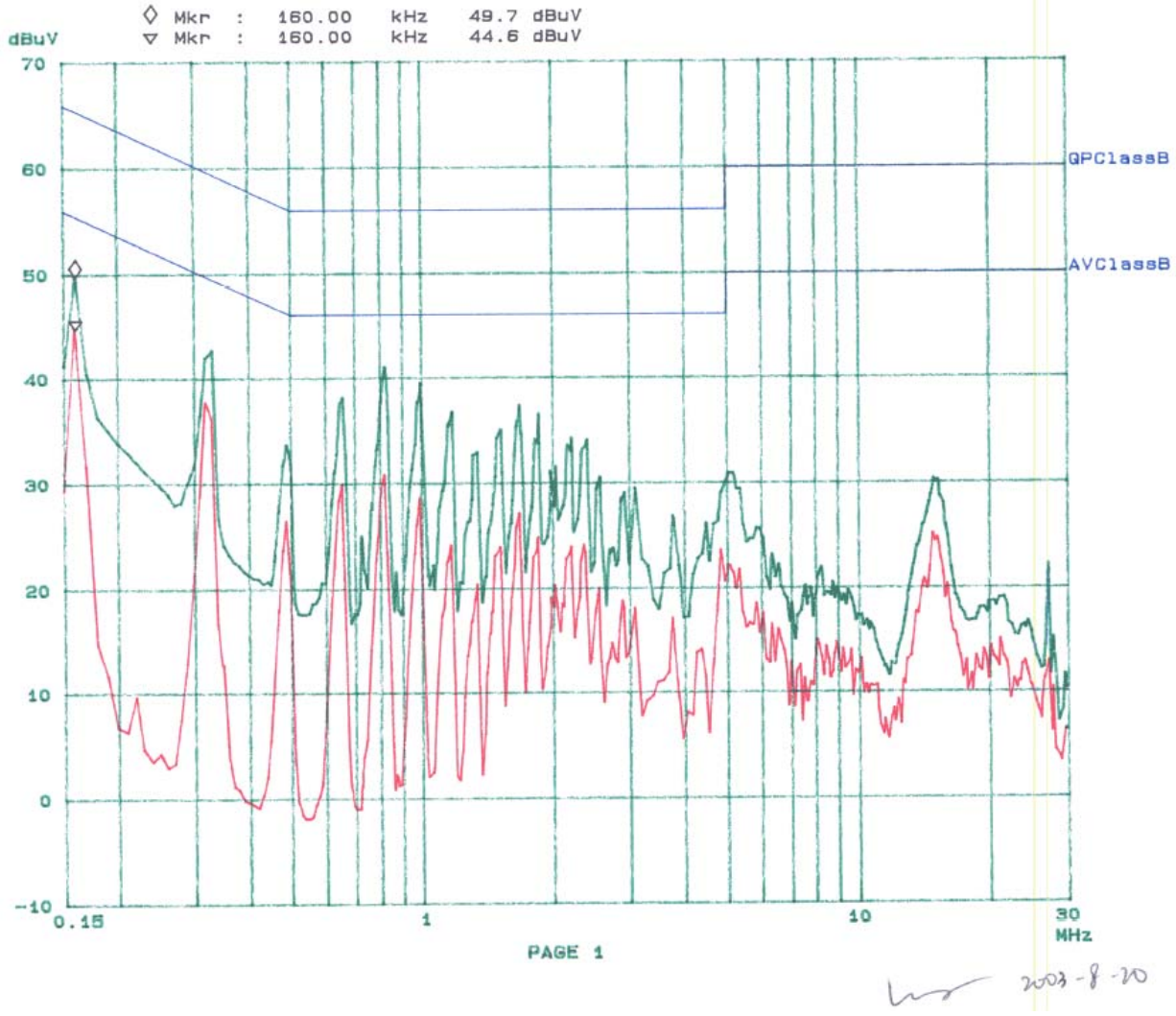
Class B

EUT: PH10B
Manuf: HTC
Op Cond: Normal
Operator: ling
Comment: L

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	10k	9k	QP+AV	20ms	10dBLN	OFF
1M	3M	10k	9k	QP+AV	20ms	10dBLN	OFF
3M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



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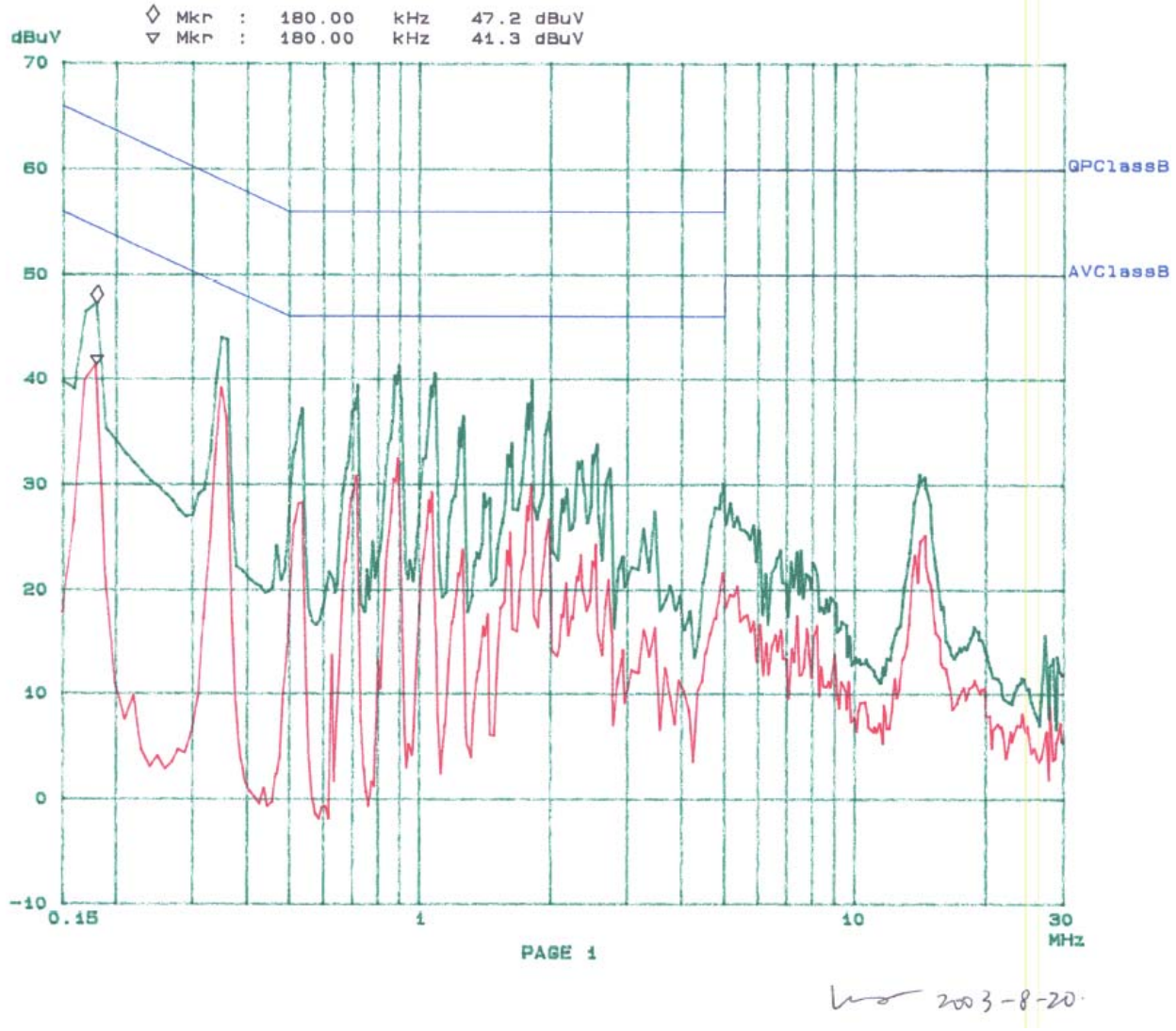
Bay Area Compliance Laboratory Corp 20. Aug 03 16:29
Class B

EUT: PH10B
Manuf: HTC
Op Cond: Normal
Operator: LANG
Comment: N

Scan Settings (3 Ranges)

Frequencies			Receiver Settings				
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp
150k	1M	10k	9k	QP+AV	20ms	10dBLN	OFF
1M	3M	10k	9k	QP+AV	20ms	10dBLN	OFF
3M	30M	100k	9k	QP+AV	1ms	10dBLN	OFF

Final Measurement: x QP / + AV
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB



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13 - ANTENNA REQUIREMENT

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to § 15.247 (1), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The gain of the integrated antenna used for transmitting is 3 dBi and is complied with 15.203. Please see EUT photo for details.

14 – RF EXPOSURE REQUIREMENT

According to the TCB Exclusions List, the limit for general population of portable transmitters that are used less than 2.5cm from a person's body is :

Low Threshold : ($60/f_{GHz}$) mW, d < 2.5 cm => (60/2.4) = 25mW

The maximum output power for the device is 0.0013W (1.3mW) which is less than the limit lited in the TCB exclusions lists (25mW). Therefore, SAR test is not required for the Part15 portion of this device.

15 - SUMMARY OF TEST RESULTS FOR FCC PART 24

FCC RULE	DESCRIPTION OF TEST	Measured	Result
§ 2.1046 (a)	Conducted Output Power	Section 16	Compliant
§ 2.1046 § 24.232(1)	RF Output powr	Section 17	Compliant
§ 2.1049 § 24.238	Emission Bandwidth	Section 18	Compliant
2.1051 § 24.238(a)	Spurious emissions at antenna terminals	Section 19	Compliant
2.1053 § 24.238 (a)	Field strength of spurious radiation	Section 20	Compliant
§2.1049 §24.238	Band Edge Test	Section 21	Compliant
§ 2.1055 (a) § 2.1055 (d) § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Section 22	Compliant
§ 2.1093 § 24.52	RF Exposure Requirement	SAR report	Compliant

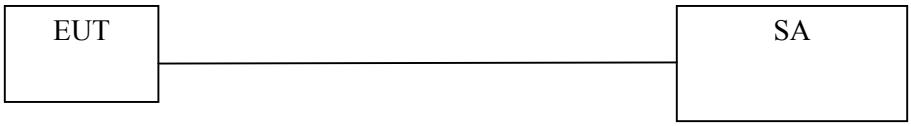
16 - CONDUCTED OUTPUT POWER MEASUREMENT

16.1 Standard Applicable

According to § 2.1046 (a) for transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8).

16.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Add a correction factor to the display.



Note: The antenna is integrated with the EUT. The conducted output power may not be measured exactly.

16.3 Measurement Result

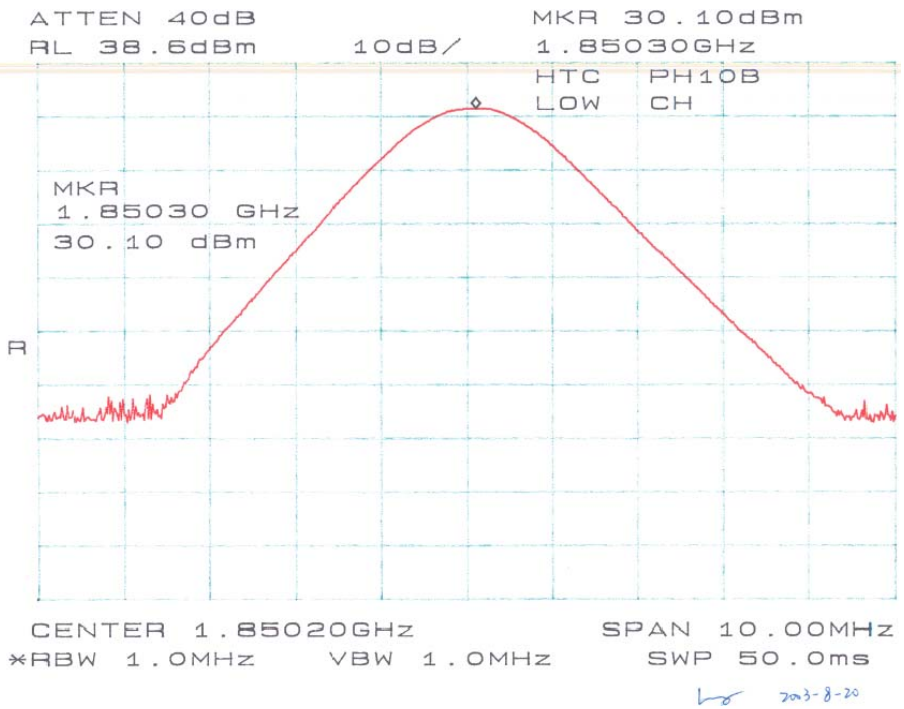
Please refer to the attached pictures for more information.

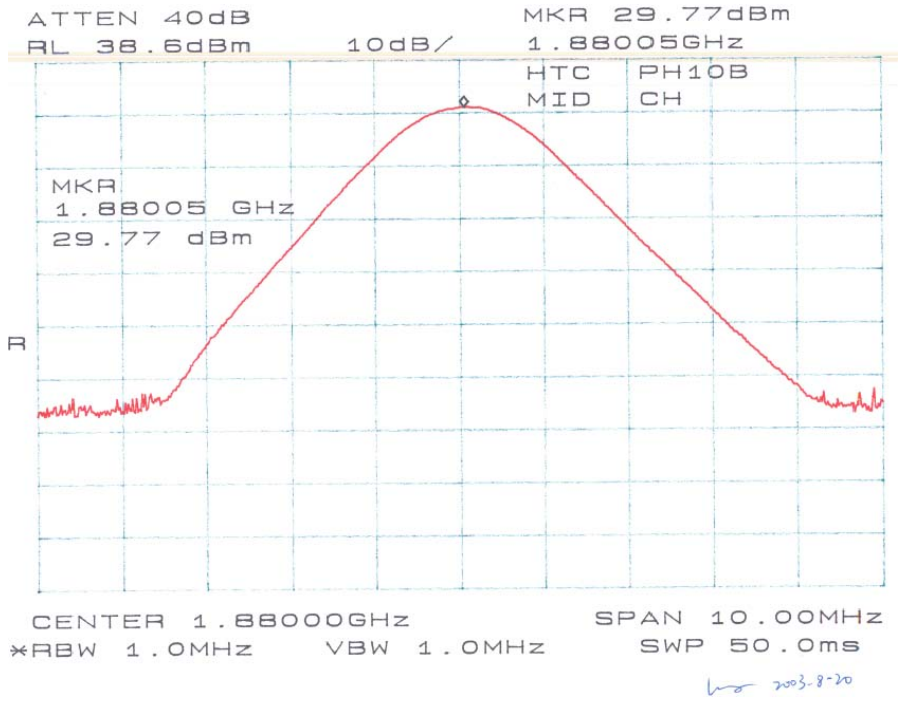
Frequency	Output Power (dBm)	Output Power (W)	Result
1850.2	30.10	1.02	Compliant
1880	29.77	0.95	Compliant
1909.8	29.43	0.88	Compliant

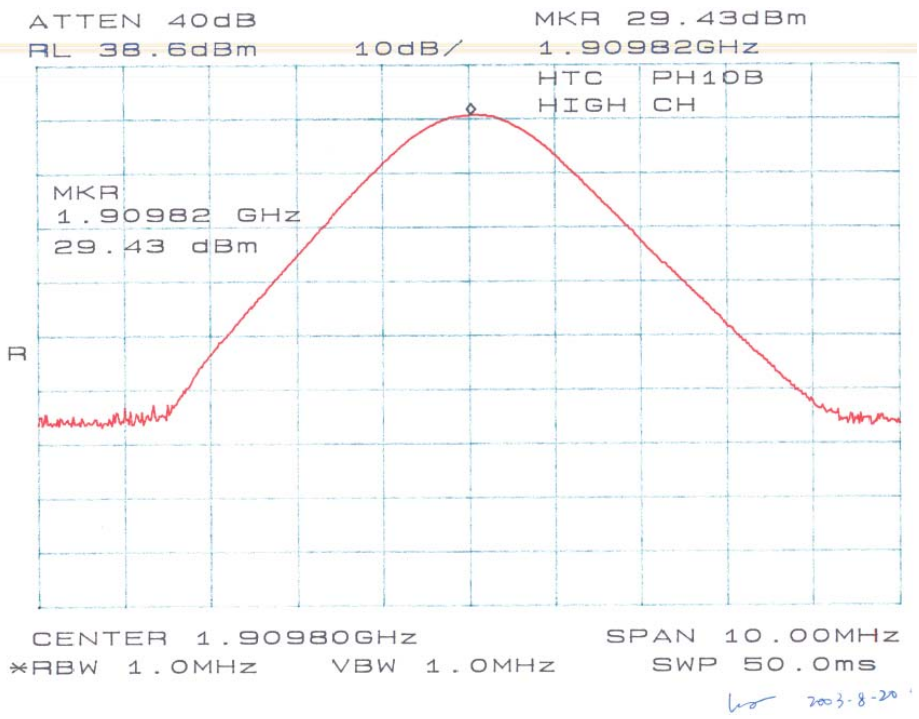
Please also refer to following plots.

16.4 Test Equipment

Manufacturer	Model No.	Serial No.	Calibration Due Date
HP	8568B	2610A02165	2003-12-06
HP	8593B	2919A0242	2003-12-06


ATTEN 40dB
RL 38.6dBm
10dB/
MKR 30.10dBm
1.85030GHz
HTC PH10B
LOW CH
MKR
1.85030 GHz
30.10 dBm
R
CENTER 1.85020GHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR 29.77dBm
1.88005GHz
HTC PH10B
MID CH
MKR
1.88005 GHz
29.77 dBm
R
CENTER 1.88000GHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR 29.43dBm
1.90982GHz
HTC PH10B
HIGH CH
MKR
1.90982 GHz
29.43 dBm
R
CENTER 1.90980GHz
SPAN 10.00MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms
2003-8-20

17 - RF POWER OUTPUT

17.1 Applicable Standard

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

17.2 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 the 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 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.
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.

17.3 Test Results

For Model PH10B:

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dbm)	OUTPUT POWER (dBm)
1850.2	22.2	6.7	0.1	28.8
1880.0	21.5	6.7	0.1	28.1
1909.8	21.0	6.7	0.1	27.6

For Model PH10A:

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSTS (dbm)	OUTPUT POWER (dBm)
1850.2	21.6	6.7	0.1	28.2
1880.0	21.5	6.7	0.1	28.1
1909.8	21.2	6.7	0.1	27.8

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

22.2+6.7-0.1=28.8

18 - EMISSION BANDWIDTH

18.1 Applicable Standards

According to FCC §2.1049 and §24.238 (b), the emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26dB below the transmitter power.

18.2 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 3 KHz and the spectrum was recorded.

18.3 Test Equipment

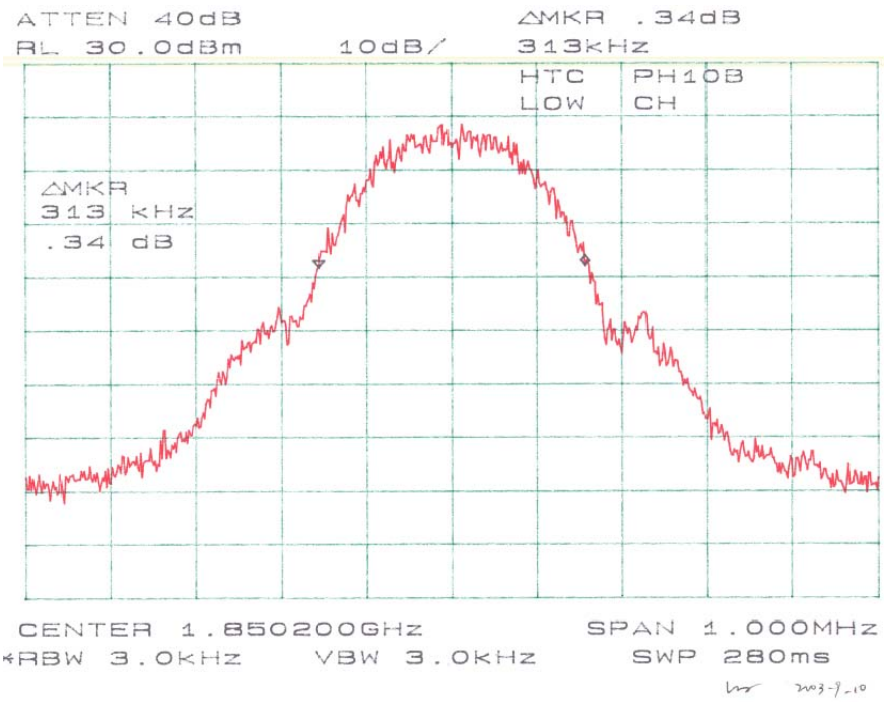
Agilent 8565EC Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Hewlett Packard 8449 Amplifier
A.H. Systems, Inc SAS-200/571 Horn Antenna

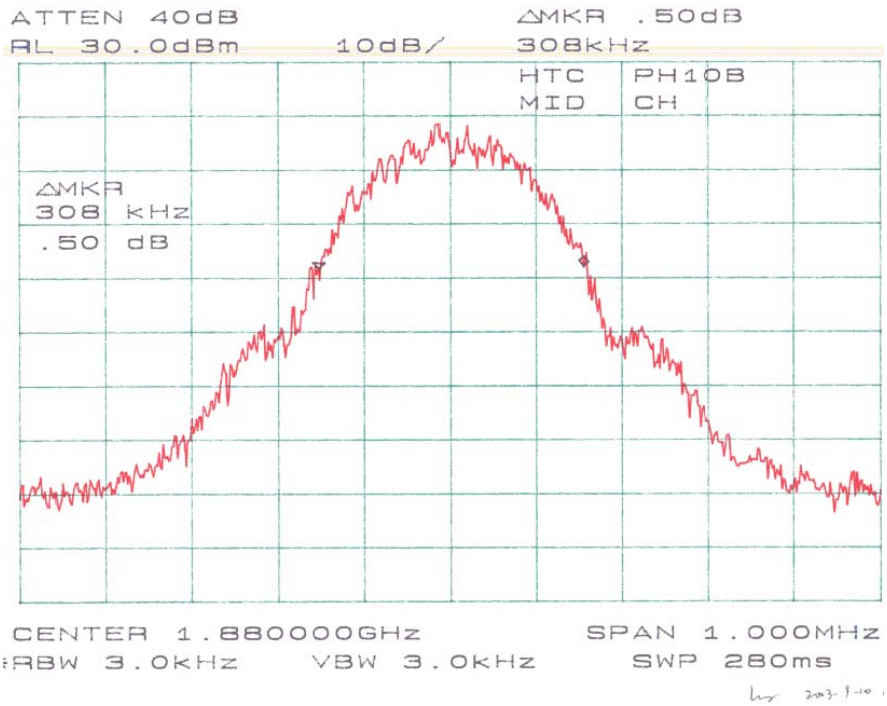
18.4 Plots of Occupied Bandwidth

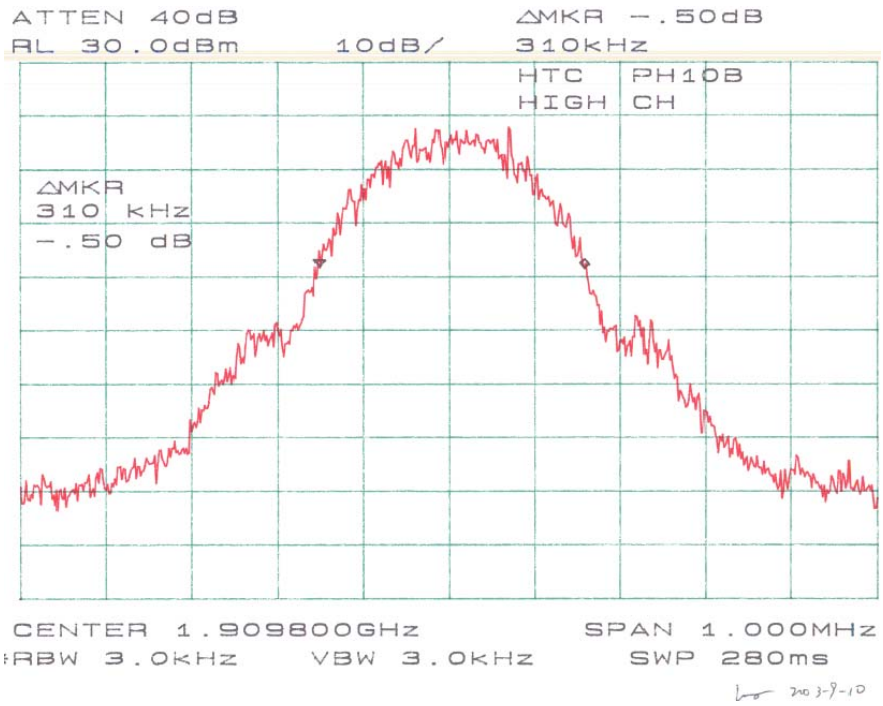
Please refer to plots hereinafter.

Test Data Summary

Channel	Emission Bandwidth in kHz
Low	313
Mid	308
High	310


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .34dB
313kHz
HTC PH10B
LOW CH
ΔMKR
313 kHz
.34 dB
CENTER 1.850200GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .50dB
308kHz
HTC PH10B
MID CH
ΔMKR
308 kHz
.50 dB
CENTER 1.880000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -.50dB
310kHz
HTC PH10B
HIGH CH
ΔMKR
310 kHz
-.50 dB
CENTER 1.909800GHz
SPAN 1.000MHz
RBW 3.0kHz
VBW 3.0kHz
SWP 280ms
2003-9-10

19 - OUT OF BAND EMISSIONS AT ANTENNA TERMINALS

19.1 Applicable Standards

According to FCC §2.1049 and §24.238, on any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

19.2 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 1 MHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

19.3 Test Equipment

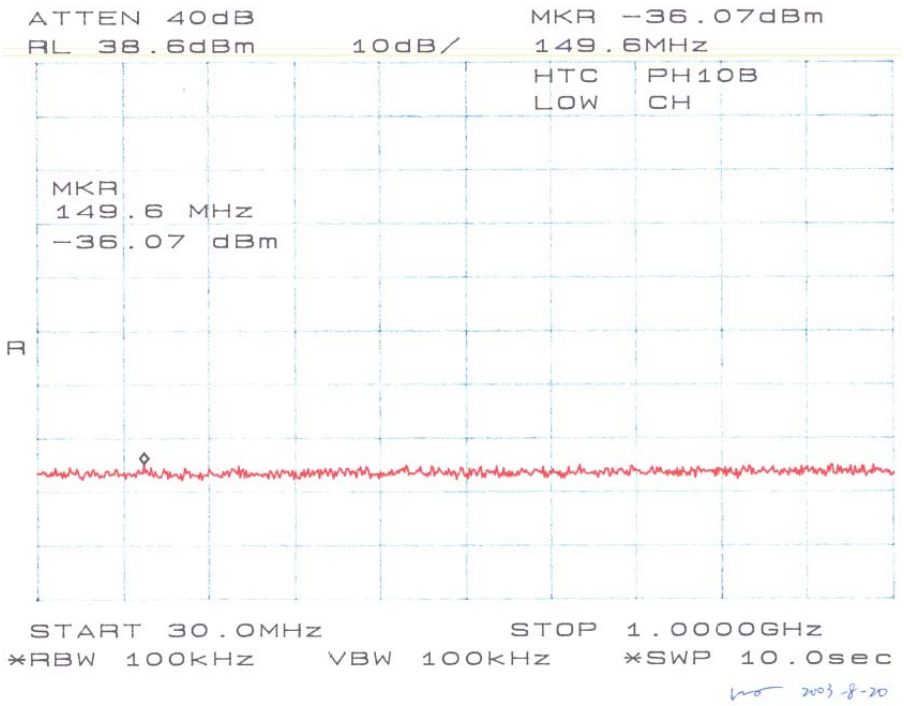
Agilent 8565EC Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Hewlett Packard 8449 Amplifier
A.H. Systems, Inc SAS-200/571 Horn Antenna

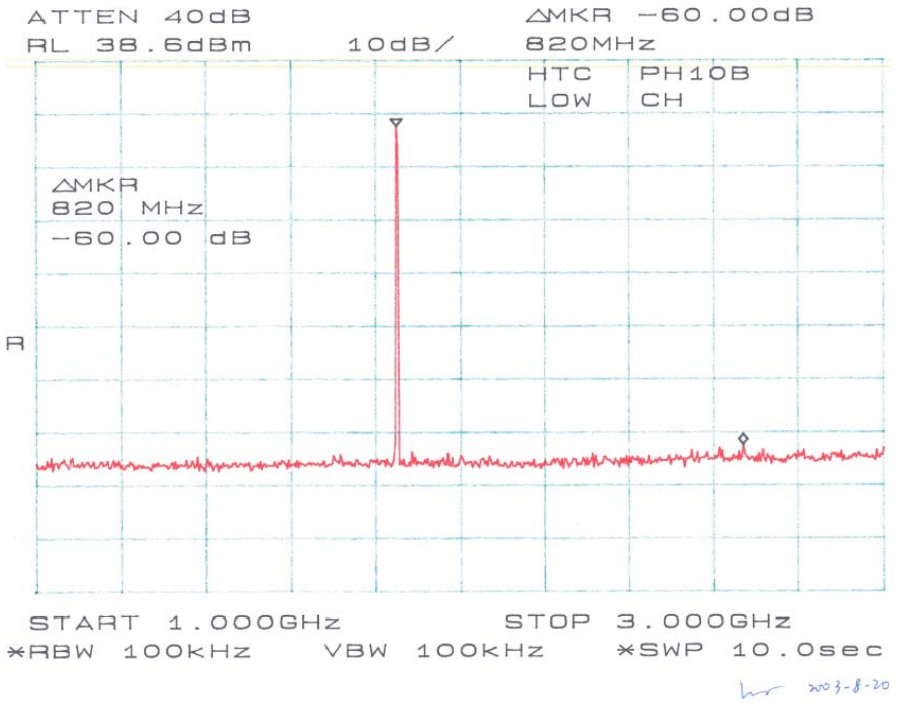
19.4 Test Results

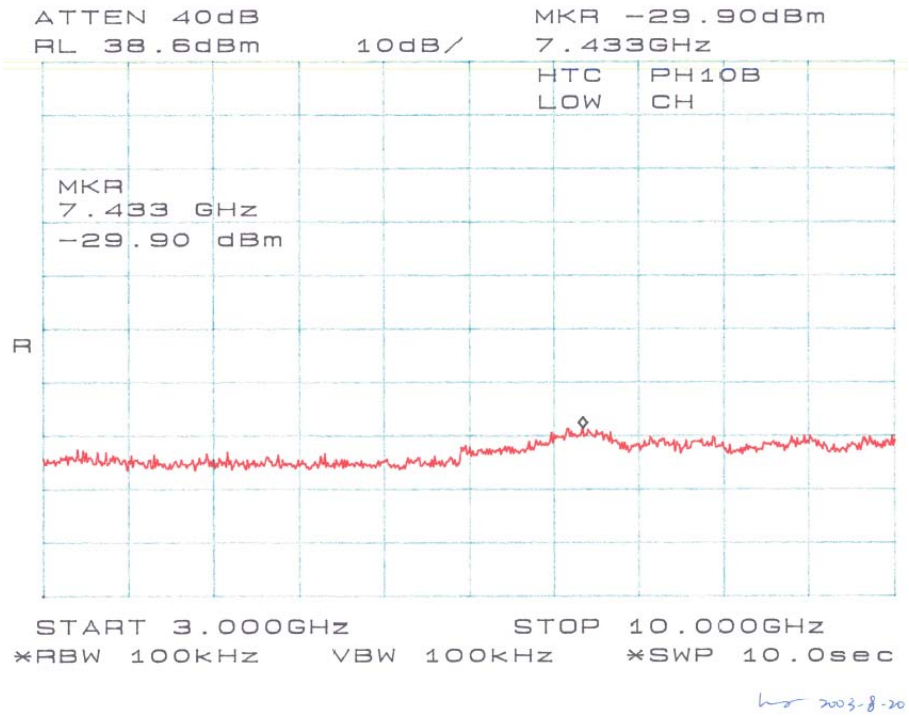
Channel	Measured
Low	< -13dBm
Mid	< -13dBm
High	< -13dBm

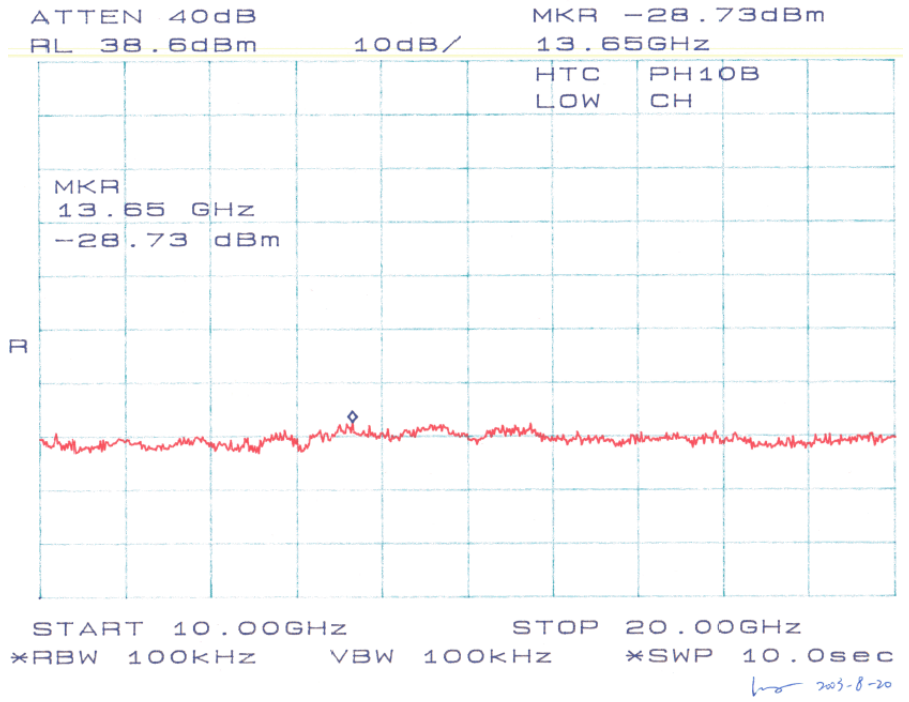
19.5 Plots of Out-of-Band Emissions at Antenna Terminal

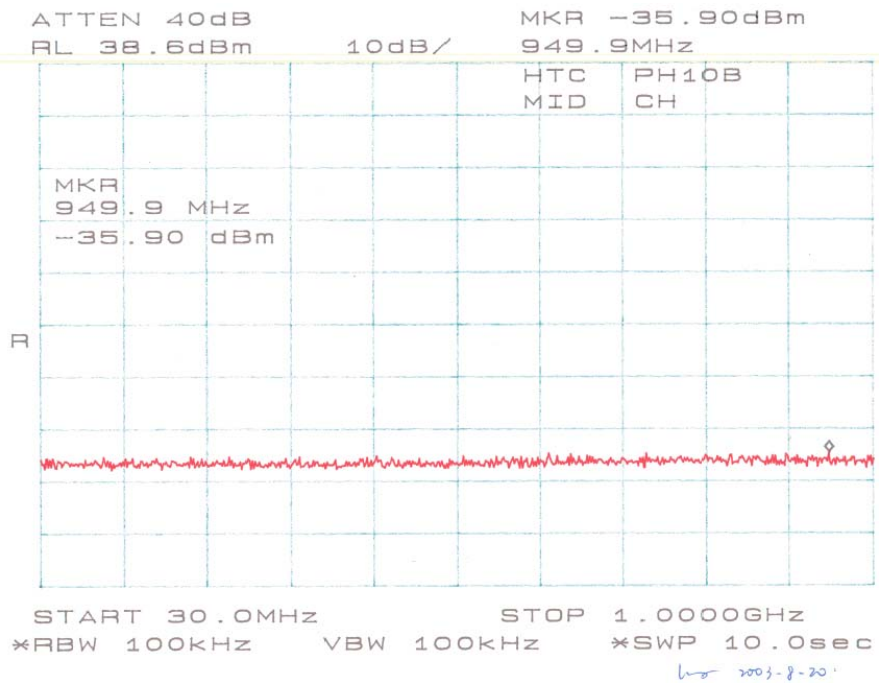
Please refer to plots hereinafter.

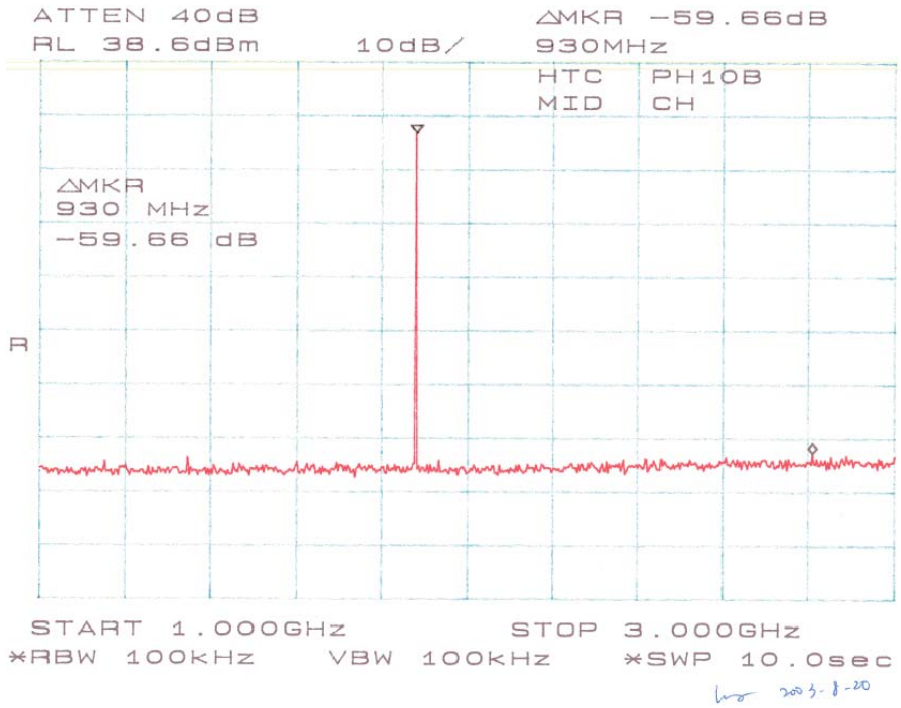

ATTEN 40dB
RL 38.6dBm
10dB/
MKR -36.07dBm
149.6MHz
HTC PH10B
LOW CH
MKR
149.6 MHz
-36.07 dBm
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

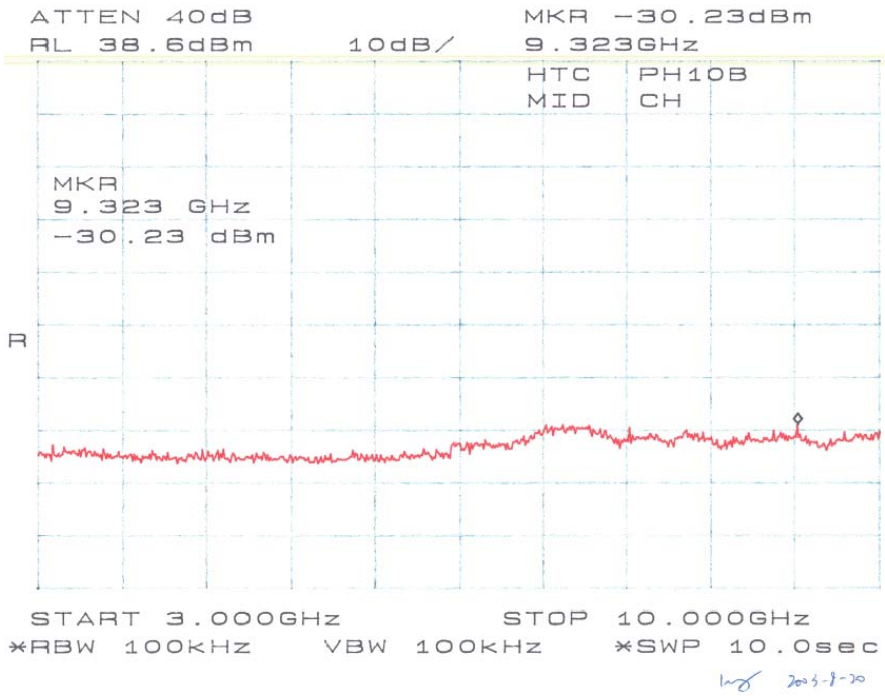

ATTEN 40dB
RL 38.6dBm
10dB/
ΔMKR -60.00dB
820MHz
HTC PH10B
LOW CH
ΔMKR
820 MHz
-60.00 dB
R
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

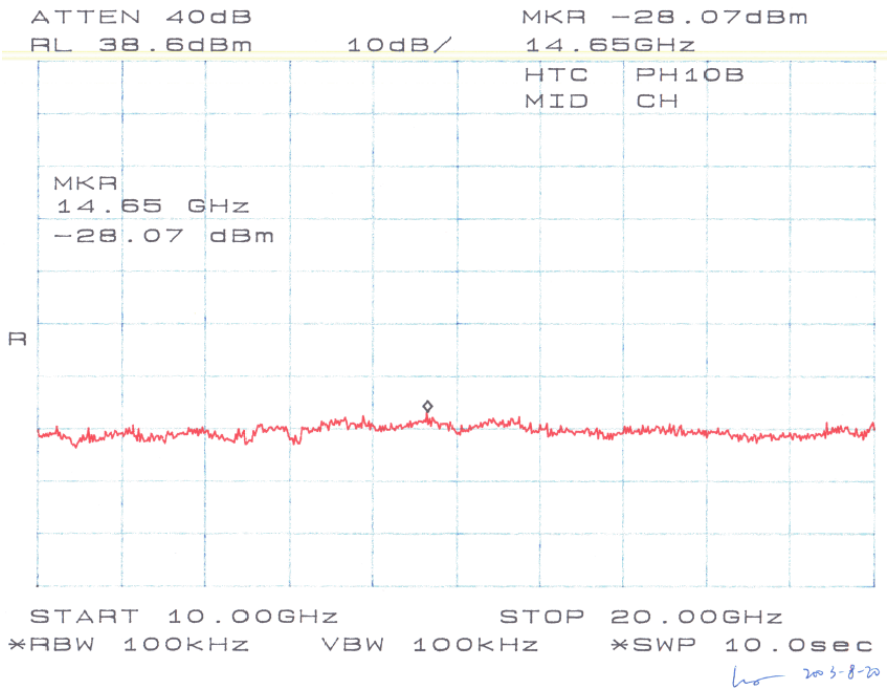

ATTEN 40dB
RL 38.6dBm
10dB/
MKR -29.90dBm
7.433GHz
HTC PH10B
LOW CH
MKR
7.433 GHz
-29.90 dBm
R
START 3.000GHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

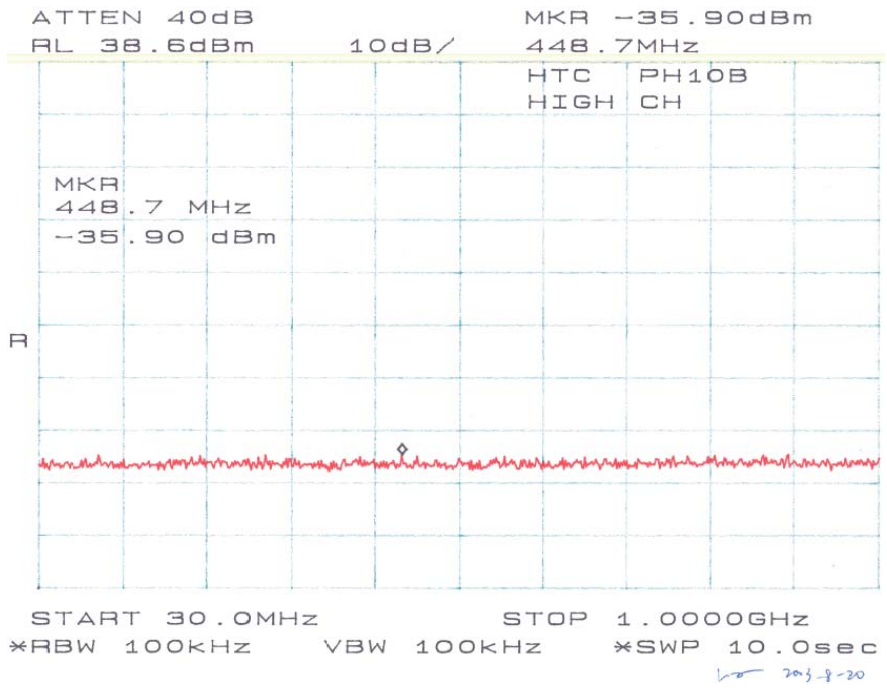

ATTEN 40dB
RL 38.6dBm
10dB/
MKR -28.73dBm
13.65GHz
HTC PH10B
LOW CH
MKR
13.65 GHz
-28.73 dBm
R
START 10.00GHz
STOP 20.00GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

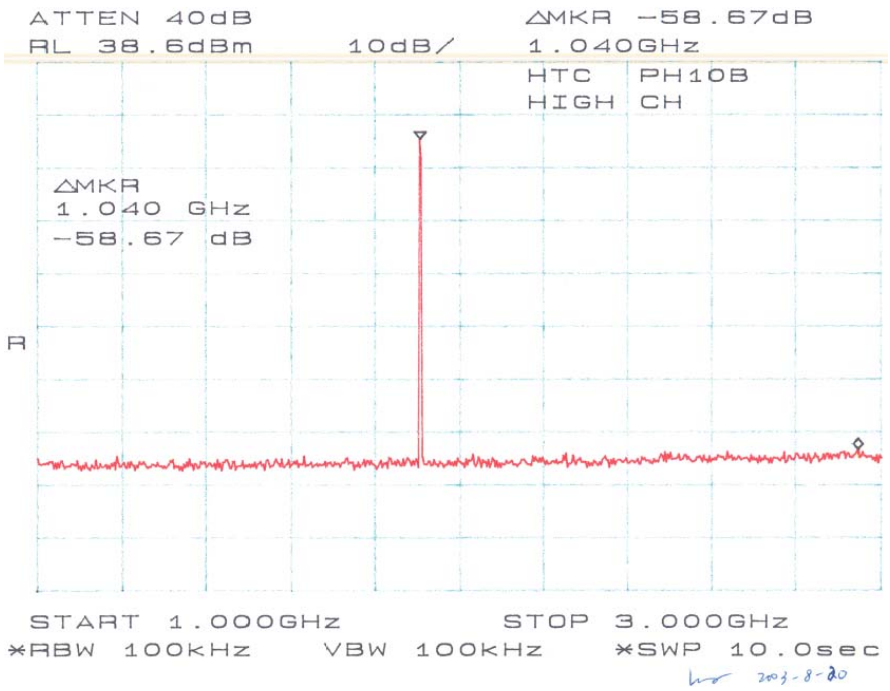

ATTEN 40dB
RL 38.6dBm
10dB/
MKR -35.90dBm
949.9MHz
HTC PH10B
MID CH
MKR
949.9 MHz
-35.90 dBm
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

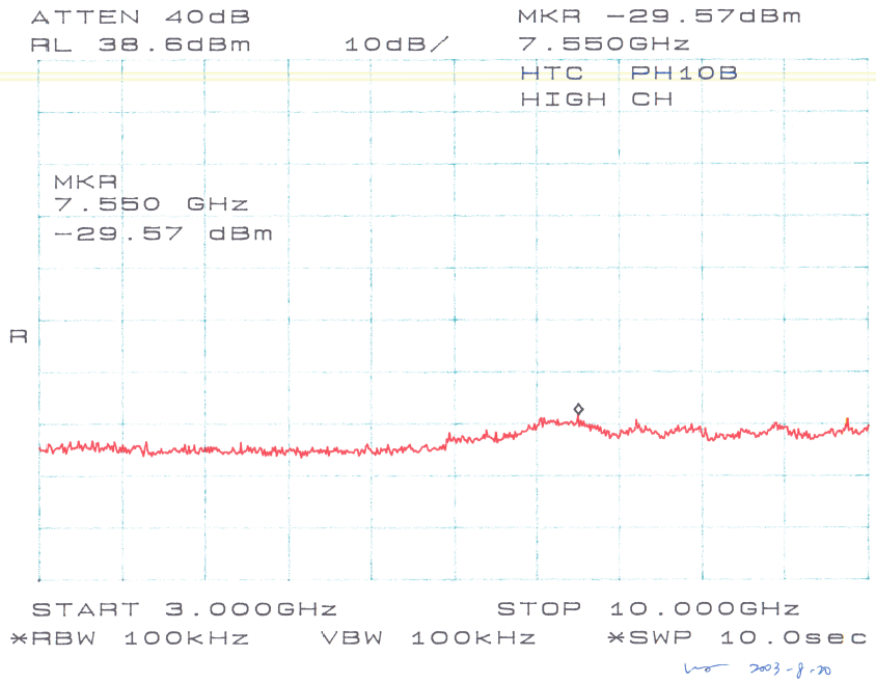

ATTEN 40dB
RL 38.6dBm
10dB/
△MKR -59.66dB
930MHz
HTC PH10B
MID CH
△MKR
930 MHz
-59.66 dB
R
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

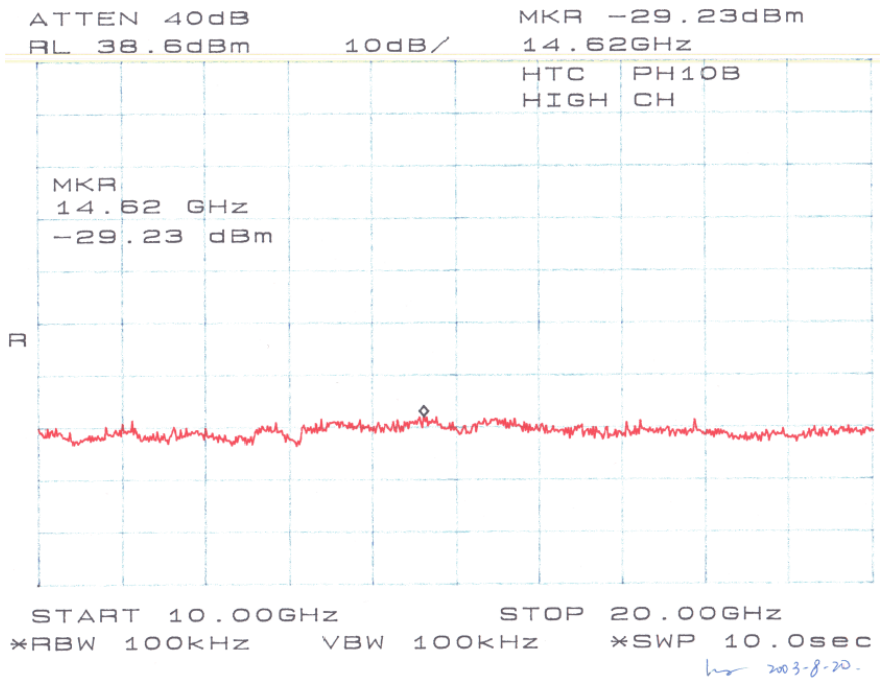

ATTEN 40dB
RL 38.6dBm
10dB/
MKR -30.23dBm
9.323GHz
HTC PH10B
MID CH
MKR
9.323 GHz
-30.23 dBm
R
START 3.000GHz
STOP 10.000GHz
*RBW 100KHz
VBW 100KHz
*SWP 10.0sec
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -28.07dBm
14.65GHz
HTC PH10B
MID CH
MKR
14.65 GHz
-28.07 dBm
R
START 10.00GHz
STOP 20.00GHz
*RBW 100KHz
VBW 100KHz
*SWP 10.0sec
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -35.90dBm
448.7MHz
HTC PH10B
HIGH CH
MKR
448.7 MHz
-35.90 dBm
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
ΔMKR -58.67dB
1.040GHz
HTC PH10B
HIGH CH
ΔMKR
1.040 GHz
-58.67 dB
R
START 1.000GHz
STOP 3.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -29.57dBm
7.550GHz
HTC PH10B
HIGH CH
MKR
7.550 GHz
-29.57 dBm
R
START 3.000GHz
STOP 10.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -29.23dBm
14.62GHz
HTC PH10B
HIGH CH
MKR
14.62 GHz
-29.23 dBm
R
START 10.00GHz
STOP 20.00GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec
2003-8-20

20 - FIELD STRENGTH OF SPURIOUS RADIATION

20.1 Test Procedure

Requirements: CFR 47, § 2.1053, § 24.238 (a).

20.2 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 (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

20.3 Test Equipment

CDI B100/200/300 Biconical Antennas
EMCO Bi-logcon Antenna
EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
Preamplifiers
HP8640 Generator
Non-radiating Load

20.4 Test Result

For Model: PH10B

Low Channel: -10.17 dBm at 3700.4 MHz
Middle Channel: -12.00 dBm at 3760 MHz
High Channel: -8.5 dBm at 3819.6 MHz

For Model: PH10A

Low Channel: -11.6 dBm at 3700.4 MHz
Middle Channel: -11.1 dBm at 3760 MHz
High Channel: -8.5 dBm at 3819.6 MHz

20.4.1 Test Data for Model: PH10B

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	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1850.2	118.8	90	1.5	V	1850.2	22.2	V	6.7	0.1	28.8		
1850.2	116	150	2.1	H	1850.2	19.8	H	6.7	0.1	26.4		
3700.4	55	0	2	V	3700.4	-31.7	V	8.8	0.3	-23.17	-13	-10.17
3700.4	54	300	1.5	H	3700.4	-32.6	H	8.8	0.3	-24.1	-13	-11.1
5550.6	52.5	330	1.8	V	5550.6	-36.2	V	9.1	0.5	-27.6	-13	-14.6
5550.6	48.67	330	2.5	H	5550.6	-40.1	H	9.1	0.5	-31.5	-13	-18.5
MIDDLE CHANNEL												
1880	117	0	2	V	1880	21.5	V	6.7	0.1	28.1		
1880	114.5	120	1.8	H	1880	19.2	H	6.7	0.1	25.8		
3760	53.33	330	2	V	3760	-33.5	V	8.8	0.3	-25	-13	-12
3760	52.17	150	2.2	H	3760	-36.3	H	8.8	0.3	-27.8	-13	-14.8
5640	51.17	150	2.2	H	5640	-37	H	9.1	0.5	-28.4	-13	-15.4
5640	50.83	300	1.8	V	5640	-38.1	V	9.1	0.5	-29.5	-13	-16.5
HIGH CHANNEL												
1909.8	116.5	120	1.5	V	1909.8	21	V	6.7	0.1	27.6		
1909.8	114.2	330	1.5	H	1909.8	19	H	6.7	0.1	25.6		
3819.6	57	330	2.5	V	3819.6	-30	V	8.8	0.3	-21.5	-13	-8.5
3819.6	56.17	90	2.5	H	3819.6	-30.6	H	8.8	0.3	-22.1	-13	-9.1
5729.4	52.5	100	2.2	V	5729.4	-36.5	V	9.1	0.5	-27.9	-13	-14.9
5729.4	52.67	150	2.2	H	5729.4	-36.6	H	9.1	0.5	-28	-13	-15

Sample Calculation:

Absolute Level = Substitution Level + Antenna Gain – Cable Loss

For Example:

22.2 + 6.7 - 0.1 = 28.8

20.4.2 Test Data for Model: PH10A

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	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1850.2	117.8	220	1.8	V	1850.2	21.6	V	6.7	0.1	28.2		
1850.2	114.7	300	2.5	H	1850.2	18.5	H	6.7	0.1	25.1		
3700.4	54.5	120	1.8	H	3700.4	-33.1	H	8.8	0.3	-24.6	-13	-11.6
3700.4	54.17	150	1.8	V	3700.4	-33.2	V	8.8	0.3	-24.7	-13	-11.7
5550.6	51.17	150	1.6	V	5550.6	-36.1	V	9.1	0.5	-27.5	-13	-14.5
5550.6	49.83	150	2.2	H	5550.6	-37.8	H	9.1	0.5	-29.2	-13	-16.2
MIDDLE CHANNEL												
1880	117	100	1.8	V	1880	21.5	V	6.7	0.1	28.1		
1880	114.5	120	2.5	H	1880	18.4	H	6.7	0.1	25		
3760	54	200	1.7	V	3760	-32.6	V	8.8	0.3	-24.1	-13	-11.1
3760	53.33	270	2	H	3760	-33	H	8.8	0.3	-24.5	-13	-11.5
5640	51.8	0	1.8	V	5640	-36.8	V	9.1	0.5	-28.2	-13	-15.2
5640	48.5	270	1.5	H	5640	-39.5	H	9.1	0.5	-30.9	-13	-17.9
HIGH CHANNEL												
1909.8	117.2	100	2	V	1909.8	21.2	V	6.7	0.1	27.8		
1909.8	113.3	330	1.5	H	1909.8	18.2	H	6.7	0.1	24.8		
3819.6	57.17	90	2.2	H	3819.6	-30	H	8.8	0.3	-21.5	-13	-8.5
3819.6	57	0	2.3	V	3819.6	-30.1	V	8.8	0.3	-21.6	-13	-8.6
5729.4	54.17	0	2	V	5729.4	-33.2	V	9.1	0.5	-24.6	-13	-11.6
5729.4	50.83	270	1.5	H	5729.4	-37.3	H	9.1	0.5	-28.7	-13	-15.7

Sample Calculation:

Absolute Level = Substitution Level + Antenna Gain – Cable Loss

For Example:

21.6 + 6.7 - 0.1 = 28.2

21 – BAND EDGE TEST

21.1 Applicable Standards

According to FCC §2.1049 and §24.238, when measuring the emission limits, carrier frequency shall be adjusted as close to the frequency block edges, both upper and lower.

21.2 Test Procedure

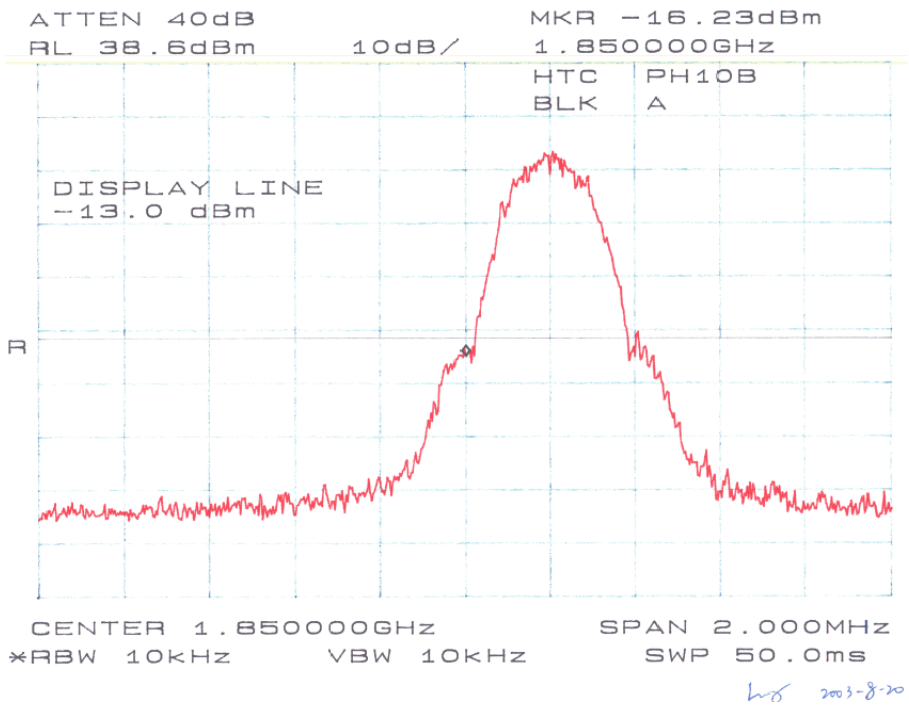
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. Adjust the carrier frequency as close to the frequency block edges both upper and lower. Sufficient scans were taken to show any out of band-edge emission.

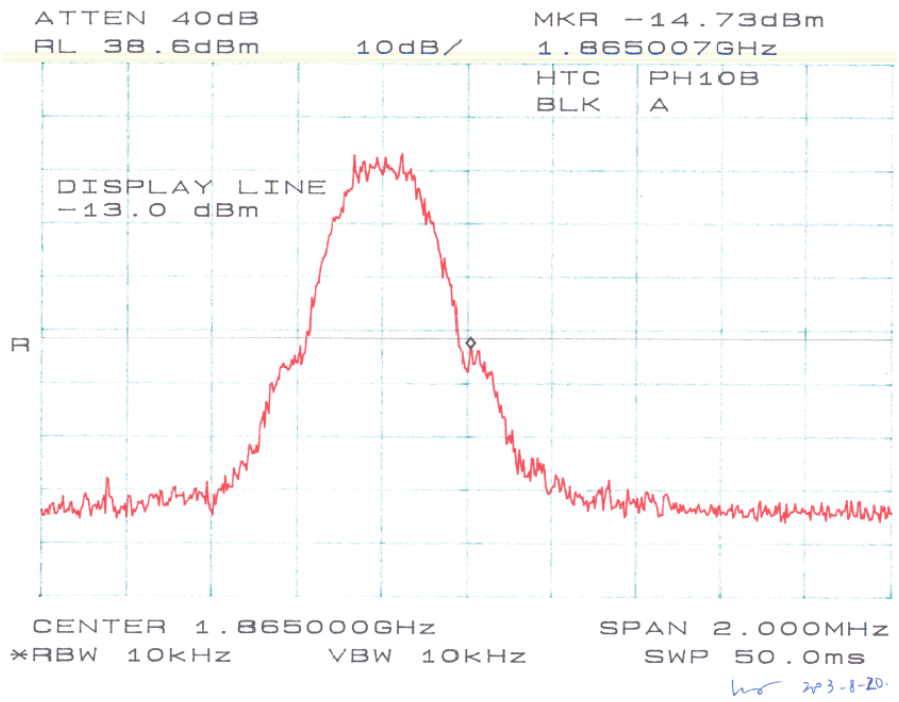
21.3 Test Equipment

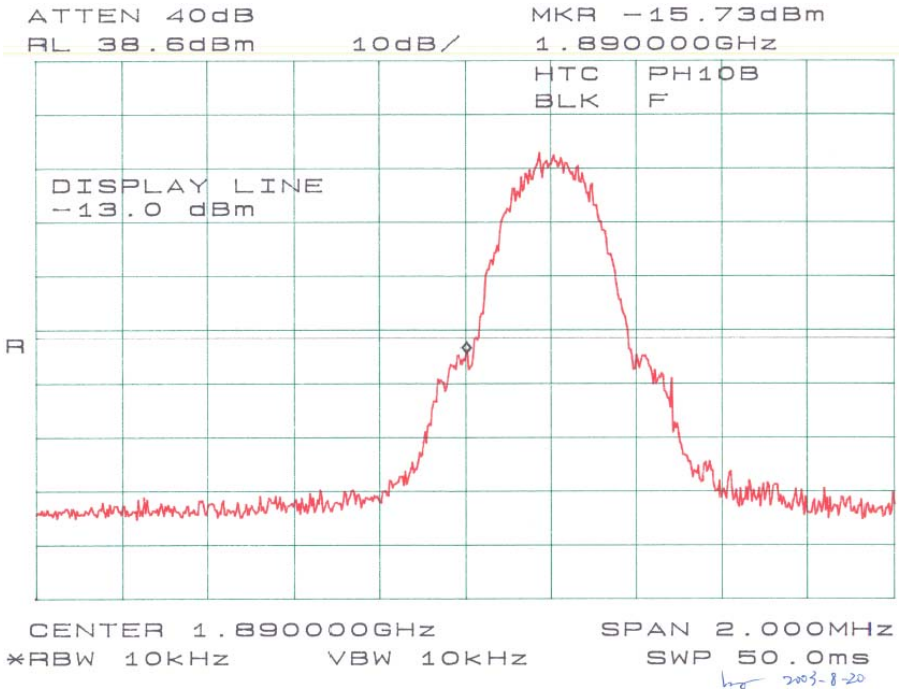
Agilent 8565EC Spectrum Analyzer
HP 7470A Plotter
Hewlett Packard HP8566B Spectrum Analyzer
Hewlett Packard HP 7470A Plotter
Rohde & Schwarz SMIQ03B Signal Generator
Rohde & Schwarz AMIQ I/Q Modulation Generator
Hewlett Packard 8449 Amplifier
A.H. Systems, Inc SAS-200/571 Horn Antenna

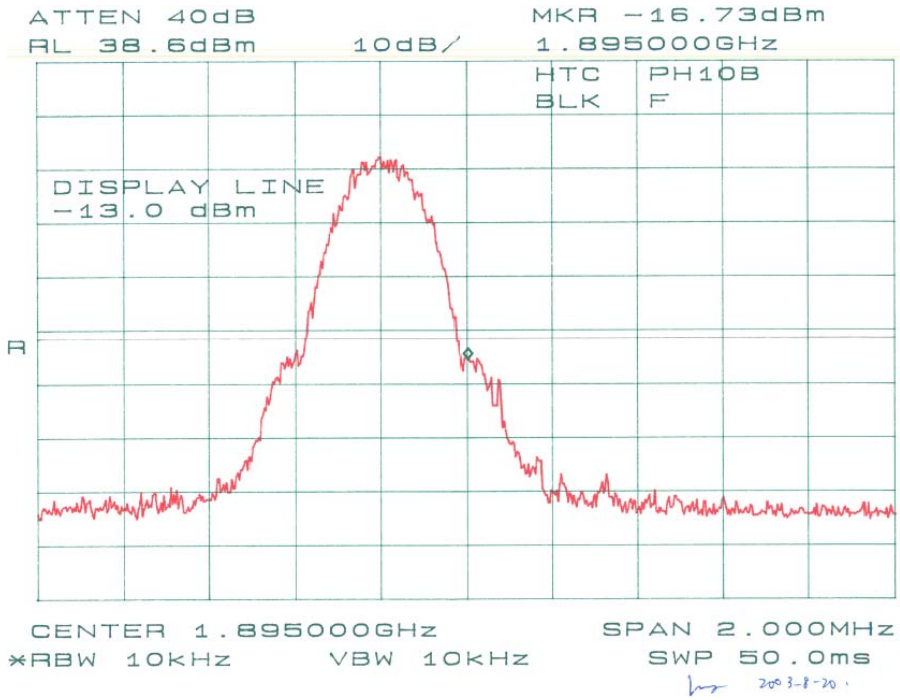
21.4 Plots of Out-of-Band-Edge Emissions at Antenna Terminal

Please refer to plots hereinafter.


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -16.23dBm
1.850000GHz
HTC PH10B
BLK A
DISPLAY LINE
-13.0 dBm
R
CENTER 1.850000GHz
SPAN 2.000MHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -14.73dBm
1.865007GHz
HTC PH10B
BLK A
DISPLAY LINE
-13.0 dBm
R
CENTER 1.865000GHz
SPAN 2.000MHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -15.73dBm
1.890000GHz
HTC PH10B
BLK F
DISPLAY LINE
-13.0 dBm
R
CENTER 1.890000GHz
SPAN 2.000MHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms
2003-8-20


ATTEN 40dB
RL 38.6dBm
10dB/
MKR -16.73dBm
1.895000GHz
HTC PH10B
BLK F
DISPLAY LINE
-13.0 dBm
R
CENTER 1.895000GHz
SPAN 2.000MHz
*RBW 10kHz
VBW 10kHz
SWP 50.0ms
2003-8-20

22 - FREQUENCY STABILITY

Frequency Stability vs Temperature

Reference Frequency: 1880 MHz		
Temperature (°C)	MHz	%
50	1880.004	0.00021%
40	1880.002	0.00011%
30	1880.001	0.00005%
20	1880.001	0.00005%
10	1880.001	0.00005%
0	1879.998	-0.00011%
-10	1879.997	-0.00016%
-20	1879.997	-0.00016%

Frequency Stability vs Battery Voltage

Reference Frequency: 1880 MHz		
Power Supplied (Vdc)	MHz	%
3.6	1880.001	0.00005%
4.2	1880.000	0.00000%