TEST REPORT
FOR FCC TYPE ACCEPTANCE
MODEL A238
PCS BIDIRECTIONAL AMPLIFIER
FCC ID: P6T1903

TEST REPORT

P. G. Electronics, Ltd. is pleased to submit this technical report on tests performed on the Model A238 dual band bidirectional amplifier (FCC ID: P6T1903) to demonstrate compliance with the requirements for Type Acceptance by the FCC.

The undersigned personnel verify that the tests were performed as described herein and the results given were measured on the production unit.

Model Number A238 Serial Number 100955

____________________________ Date _______________
Paul Liber – Test Engineer

____________________________ Date _______________
Gerry Graham – P. Eng. President

1.0 NAMES AND ADDRESSES

1.1 Manufacturer

The Model A238 bidirectional amplifier (FCC ID: P6T1903) is manufactured by:

P. G. Electronics, Ltd.
800 Arrow Rd., Unit 8,
Toronto, Ontario M9M 2Z8
Canada

1.2 Applicant

The applicant for the acceptance of the amplifier is:

P. G. Electronics, Ltd.
800 Arrow Rd., Unit 8,
Toronto, Ontario M9M 2Z8
Canada

2.0 COMPLIANCE

The equipment has been tested in accordance with the following performance tests and the results provided below demonstrate compliance with FCC regulations. Please refer to section 3.0 for the list of test equipment used.

Notes: For all tests, the D.U.T. internal attenuator has been set to 0 dB which makes the overall unit gain equal to 20 dB.

The D.U.T. was locally powered from a PS293 24 VDC power source for all tests.

2.1 Gain

The gain was measured using the test arrangement as shown in Figure 2.1-1 below. Measurements were made over typical customer's bands.

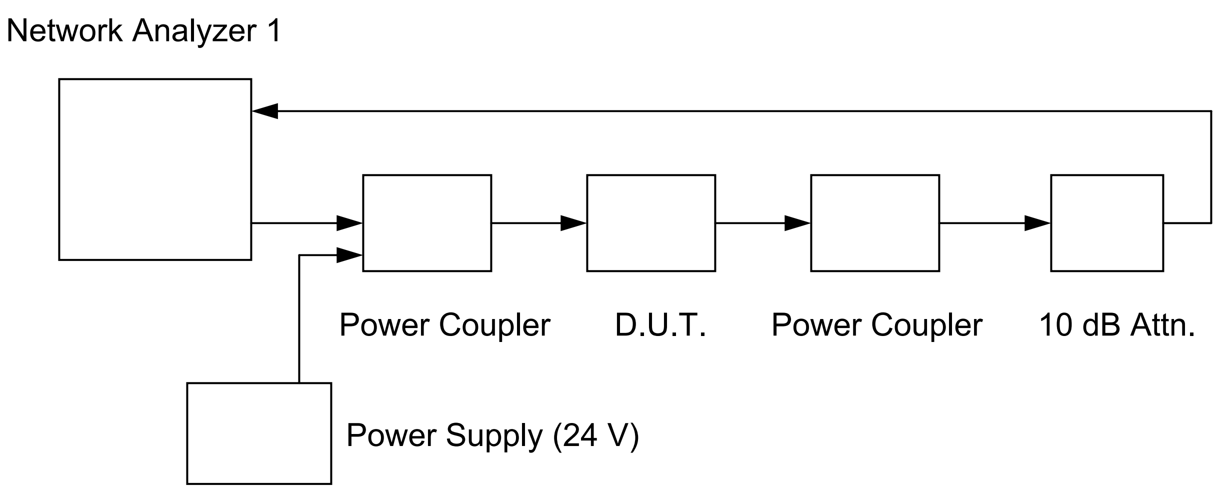
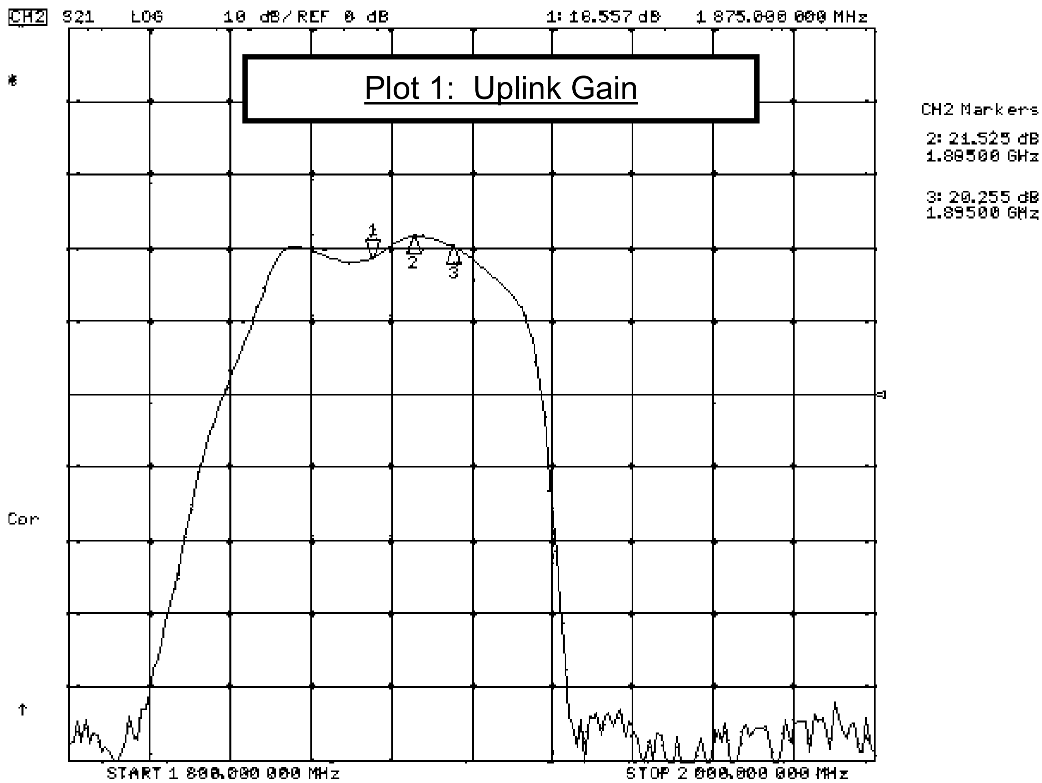
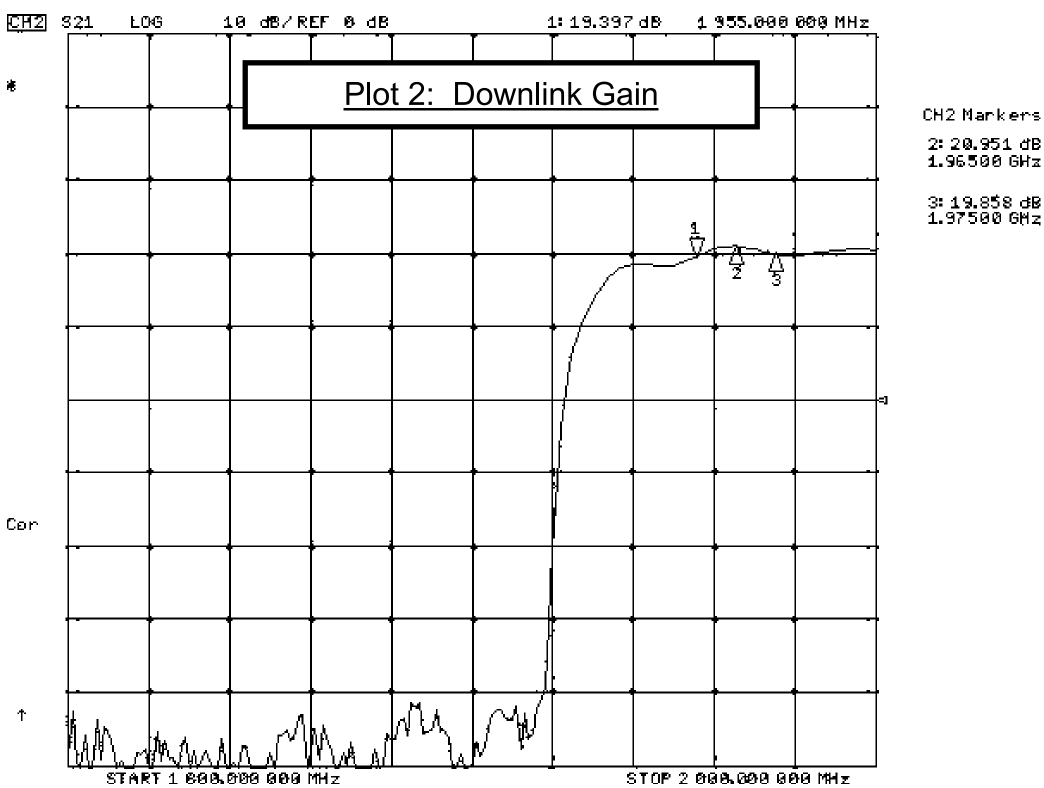


Figure 2.1-1

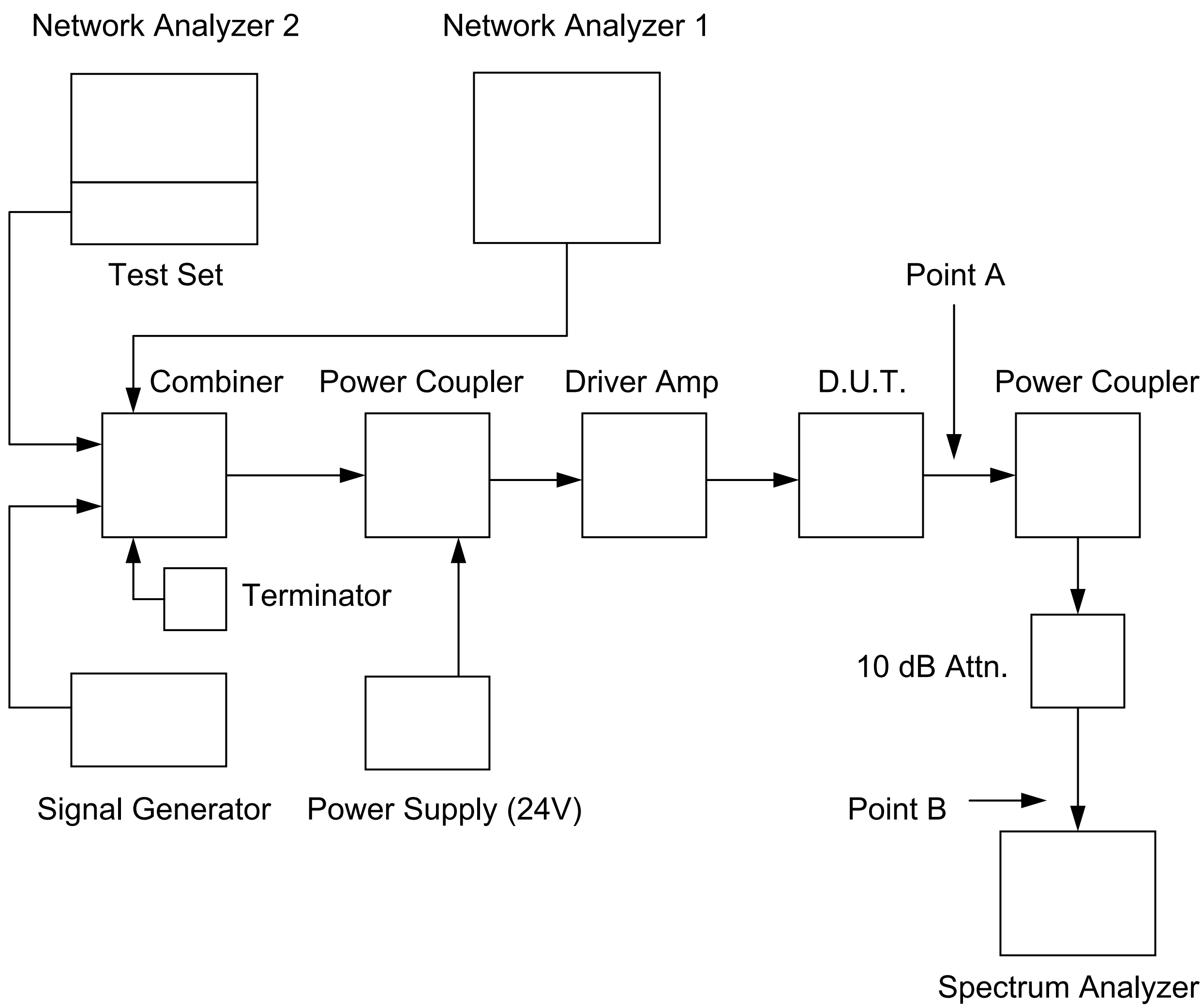
The unit gain was measured in both uplink and downlink directions. These results are shown in Plots 1 and 2 that follow. Plot 1 shows the uplink gain and Plot 2 shows the downlink gain.


CH2 S21 LOG 10 dB/ REF 0 dB 1: 18.557 dB 1 875.000 000 MHz
Plot 1: Uplink Gain
CH2 Markers
2: 21.525 dB
1.88500 GHz
3: 20.255 dB
1.89500 GHz
Cor
START 1 800.000 000 MHz
STOP 2 000.000 000 MHz


CH2 S21 LOG 10 dB/ REF 0 dB 1: 19.397 dB 1 955.000 000 MHz
Plot 2: Downlink Gain
CH2 Markers
2: 20.951 dB
1.96500 GHz
3: 19.858 dB
1.97500 GHz
Cor
START 1 800.000 000 MHz
STOP 2 000.000 000 MHz

2.2 Intermodulation and Spurious

Intermodulation and spurious products were measured with the amplifier operating at the maximum rated total inband power level as specified in the Operator's Manual. Three tone intermodulation tests were performed using the equipment test arrangement in Figure 2.2-1 below.



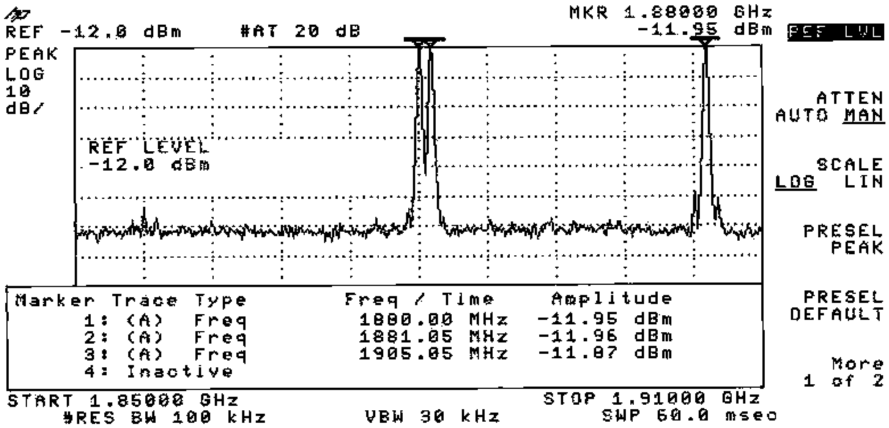
***Notes**: Model A211 driver amp was used for testing.

Loss from Point A (D.U.T. output) to Point B (Spectrum Analyzer input) was 11.2 dB at PCS. This includes the loss of the 10 dB attenuator, Power Coupler and cables.

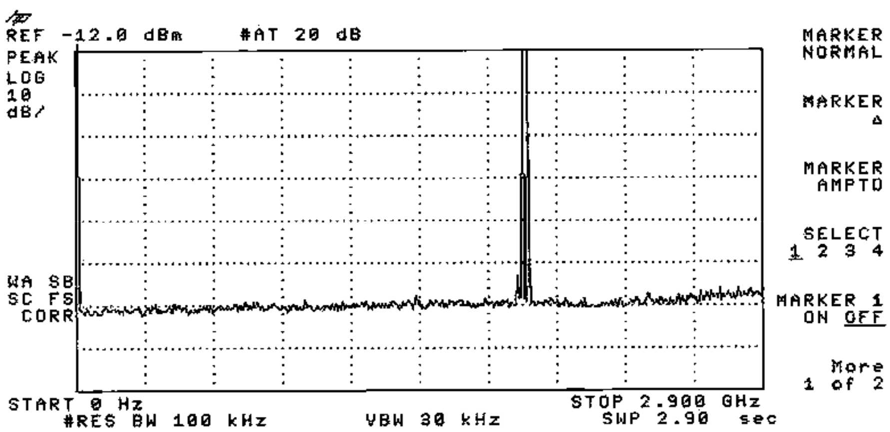
Figure 2.2-1

A three tone test was performed on the unit in the uplink band with the input set to give the output power of –0.8 dBm for each uplink tone (+4 dBm maximum rated total inband power). The Network Analyzers were used as signal sources. The 11.2 dB loss to the spectrum analyzer results in tone levels of –12 dBm into the instrument. Plots 3, 4A and 4B show the results of the test. In Plot 3, the narrower sweep setting shows in-band intermodulation products, while in Plots 4A and 4B the spectrum outside the PCS band is displayed on a broad sweep to show harmonics and spurious. The spectrum analyzer reference level was set to –12 dBm.

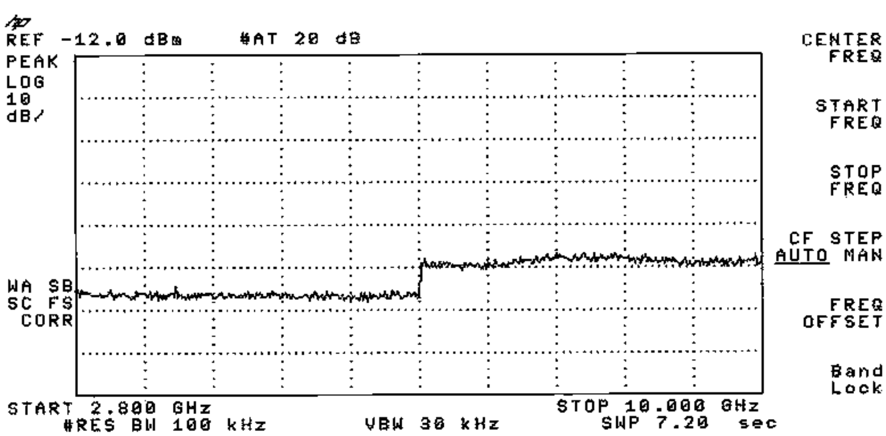
A three tone test was also performed in the downlink band with the input power levels adjusted to give the output power of +19.2 dBm for each downlink tone (+24 dBm maximum rated total inband power). The 11.2 dB loss to the spectrum analyzer results in tone levels of +8 dBm into the instrument. Plots 5, 6A and 6B show the results of the test for both narrow and broad sweeps with the spectrum analyzer reference level set to +8 dBm.



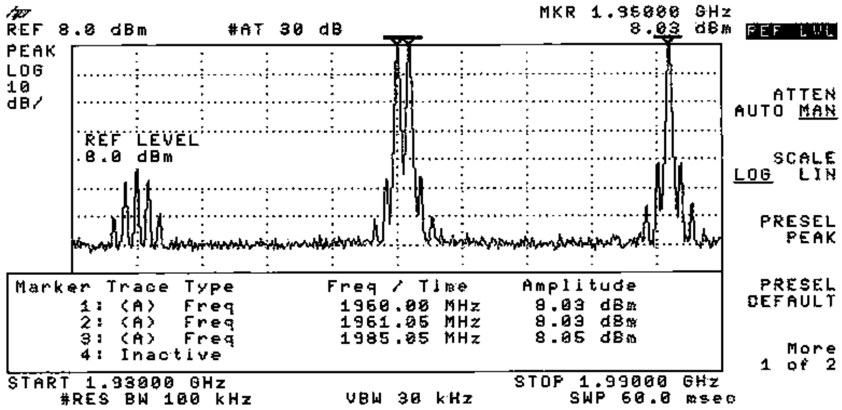
Plot 3: Uplink 3-tone Intermodulation (Narrow Sweep)



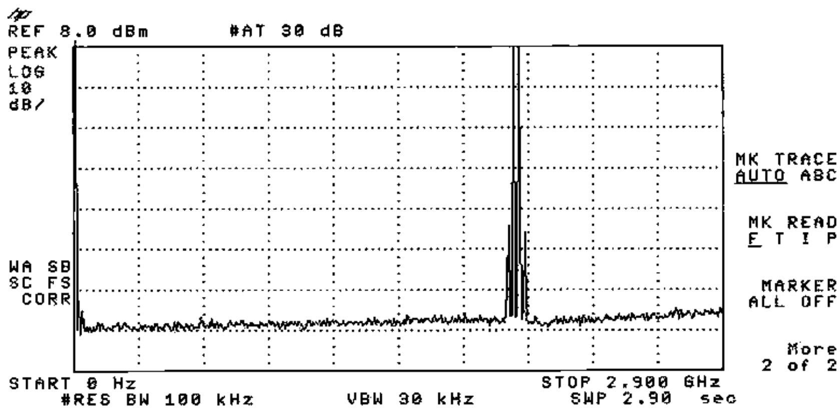
Plot 4A: Uplink 3-tone Intermodulation (Sweep 0 – 2.9 GHz)



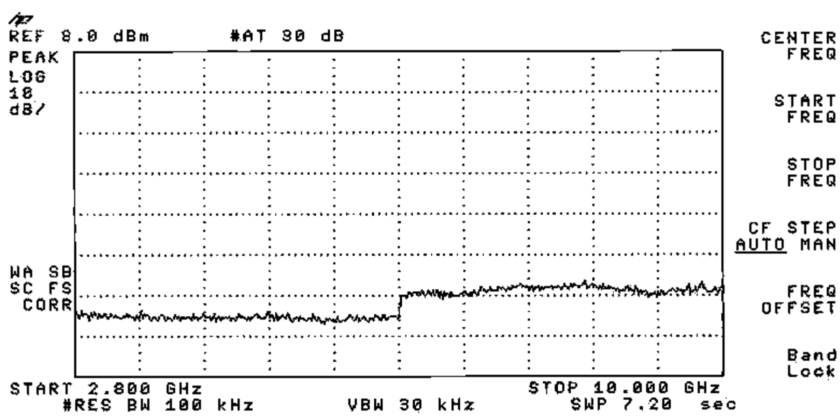
Plot 4B: Uplink 3-tone Intermodulation (Sweep 2.8 – 10 GHz)



Plot 5: Downlink 3-tone Intermodulation (Narrow Sweep)



Plot 6A: Downlink 3-tone Intermodulation (Sweep 0 – 2.9 GHz)



Plot 6B: Downlink 3-tone Intermodulation (Sweep 2.8 – 10 GHz)

Examination of the above results shows that all products are more than 40 dB down.

2.3 Modulated Channel Tests

These tests show a comparison of the input and output signals for operation with a single modulated signal at the maximum rated RF input drive level of the amplifier.

Figure 2.3-1 below shows the test arrangement used for the tests. All the test results display the input level and the output level with sufficient attenuation to display it as an overlay on the same screen.

Tests were performed for both the uplink and downlink directions. Tests were performed for each of NADC, GSM and CDMA modulations.

The CDMA test signal was generated by using an external CDMA baseband modulation source connected to the signal generator as shown in the diagram. The CDMA baseband source was not connected to the signal generator for other modulation tests.

The input signal is displayed on the spectrum analyzer using the reference bypass. The output signal is displayed on the spectrum analyzer with the equipment connected as shown in the diagram.

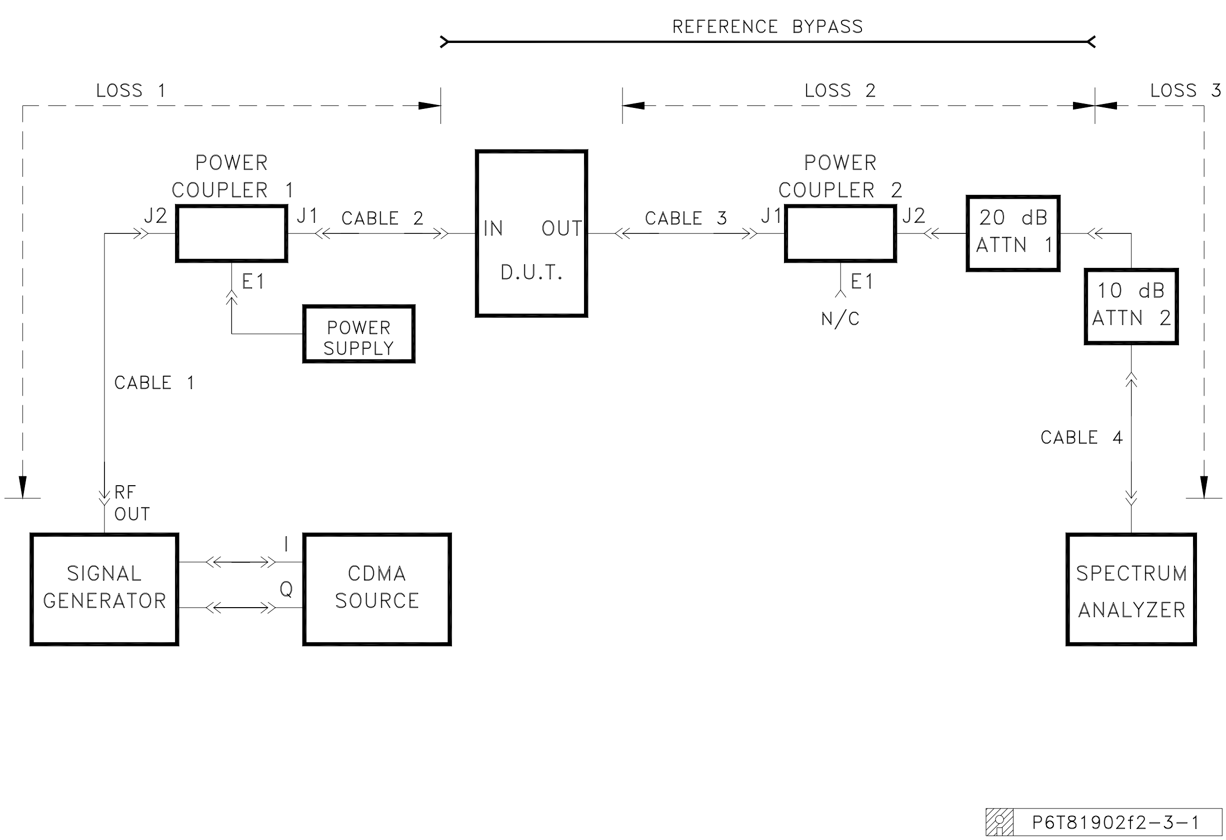


Figure 2.3-1

The following notes apply:

a. Loss 1, loss 2 and loss 3 measured at the test frequency.

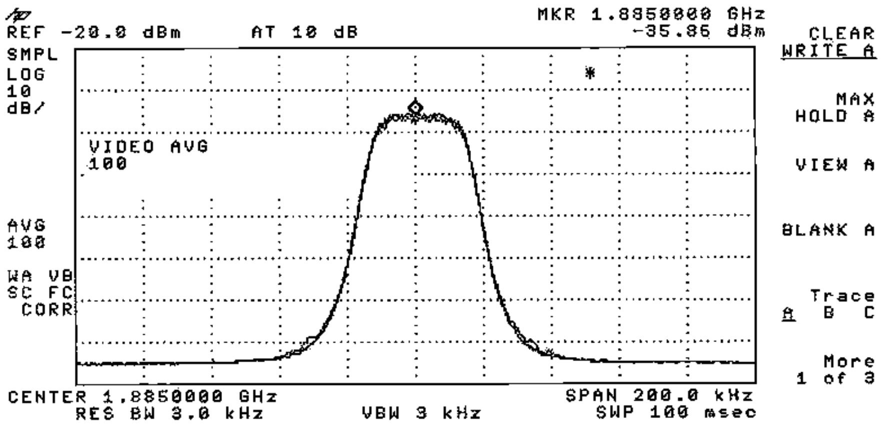
   Loss 1 = 1.5 dB (Cable 1 + Power Coupler 1 + Cable 2)
   Loss 2 = 20.8 dB (Cable 3 + Power Coupler 2 + 20 dB Attn.)
   Loss 3 = 10.8 dB at PCS (10 dB Attn. + Cable 4)

b. Cable 1 and Cable 4 loss measured 1.0 dB each.

c. Signal generator set to test frequency and desired modulation. Amplitude set to DUT maximum rated output level minus 20 dB (DUT gain) plus Loss 1. Therefore, to obtain +4 dBm at the output of the DUT requires a Generator level of: +4 dBm (test level) – 20 dB (DUT gain) + 1.5 dB (Loss 1) = -14.5 dBm. Similarly, to obtain +24 dBm at the output of the DUT requires a Generator level of: +24 dBm (test level) - 20 dB (DUT gain) + 1.5dB (Loss 1) = +5.5 dBm.

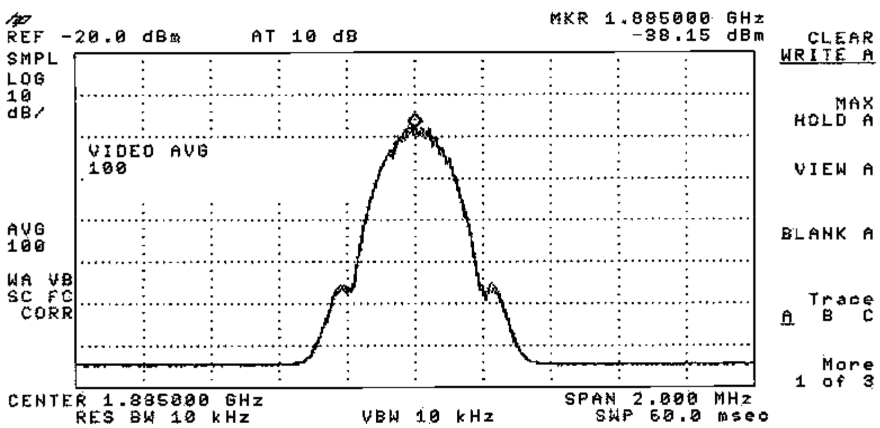
d. The DUT output level is equal to the displayed spectrum analyzer level + Loss 2 + Loss 3; which is the spectrum analyzer level + 31.6 dB.

The results of these tests are shown in Plots 7 through 12 that follow. Plots 7 through 9 show uplink results for NADC, GSM and CDMA modulations; Plots 10 through 12 show downlink results for results for NADC, GSM and CDMA modulations.



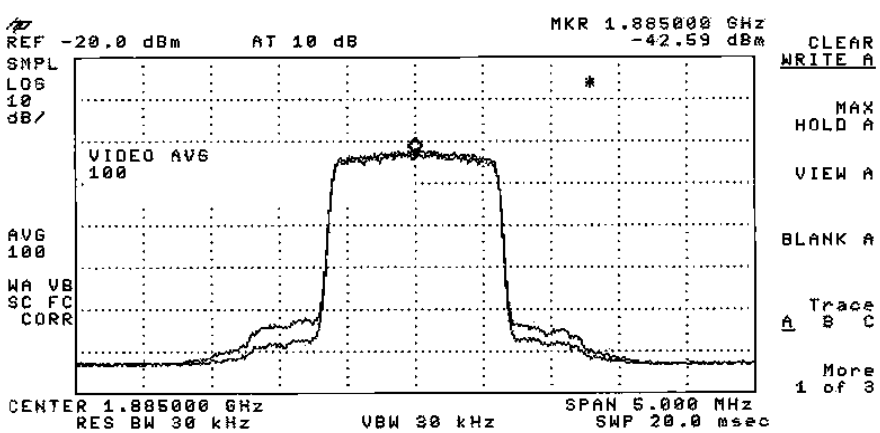
Plot 7: Uplink NADC Modulated Channel Test

Generator Level = -14.5 dBm Modulation = NADC
Span = 200 KHz Video Averaging = ON



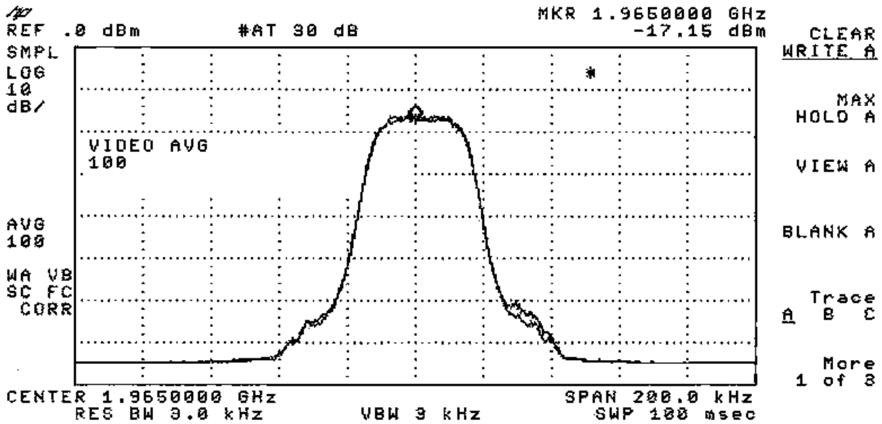
Plot 8: Uplink GSM Modulated Channel Test

Generator Level = -14.5 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON



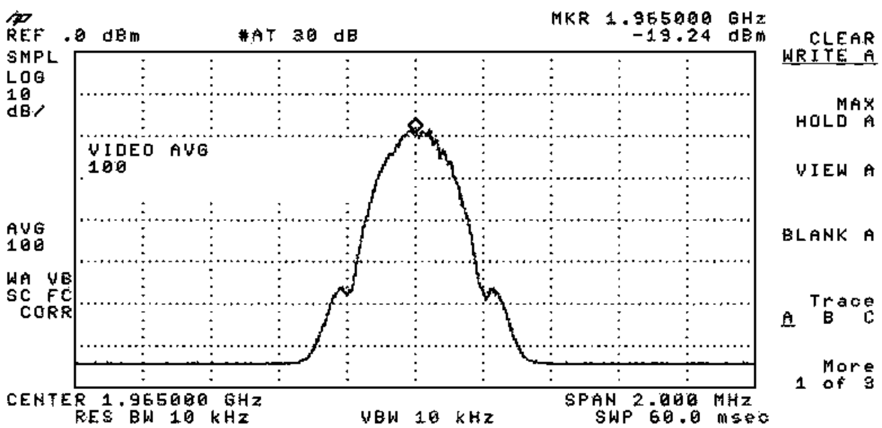
Plot 9: Uplink CDMA Modulated Channel Test

Generator Level = -14.5 dBm Modulation = CDMA
Span = 5 MHz Video Averaging = ON



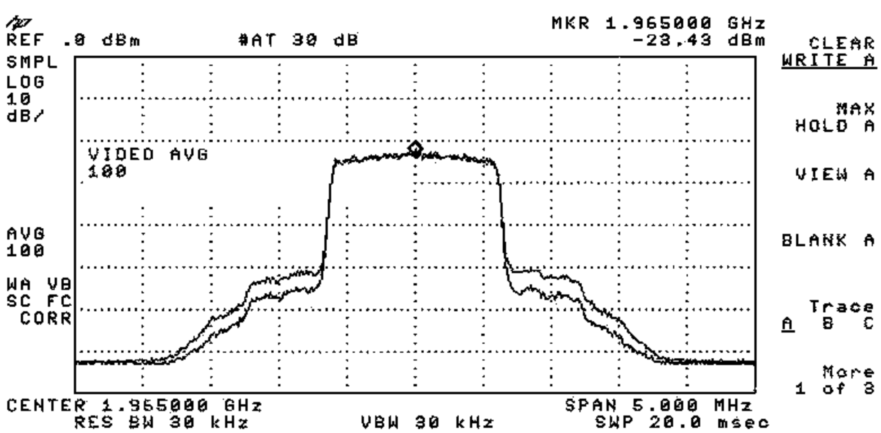
Plot 10: Downlink NADC Modulated Channel Test

Generator Level = +5.5 dBm Modulation = NADC
Span = 200 KHz Video Averaging = ON



Plot 11: Downlink GSM Modulated Channel Test

Generator Level = +5.5 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON



Plot 12: Downlink CDMA Modulated Channel Test

Generator Level = +5.5 dBm Modulation = CDMA
Span = 5 MHz Video Averaging = ON

The uplink results for NADC and GSM modulations at the rated output level (Plots 7 and 8) show no measurable distortion visible on the spectrum analyzer.

The uplink result for CDMA modulation at the rated output level (Plot 9) shows that the maximum uplink adjacent channel distortion is at a level of –50.4 dBm (spectrum analyzer level plus Loss 2 plus Loss 3, which is –82 dBm + 20.8 dB + 10.8 dB = -50.4 dBm.) Since the carrier output level is +4 dBm, the adjacent channel distortion is +4 dBm – (–50.4 dBm) = 54.4 dB below the carrier. The requirement is that the attenuation be 43 dB + 10 log (P); where P is the signal power in watts. Since the output power is -26 dBW (+ 4 dBm), then the required attenuation is 43 dB – 26 dB = 17 dB. Thus the DUT is compliant.

The downlink result for NADC modulation at the rated output level (Plot 10) shows that the maximum uplink adjacent channel distortion is at a level of –28.4 dBm (spectrum analyzer level plus Loss 2 plus Loss 3, which is –60 dBm + 20.8 dB + 10.8 dB = -28.4 dBm.) Since the carrier output level is +24 dBm, the adjacent channel distortion is +24 dBm – (–28.4 dBm) = 52.4 dB below the carrier. The requirement is that the attenuation be 43 dB + 10 log (P); where P is the signal power in watts. Since the output power is -6 dBW (+ 24 dBm), then the required attenuation is 43 dB – 6 dB = 37 dB. Thus the DUT is compliant.

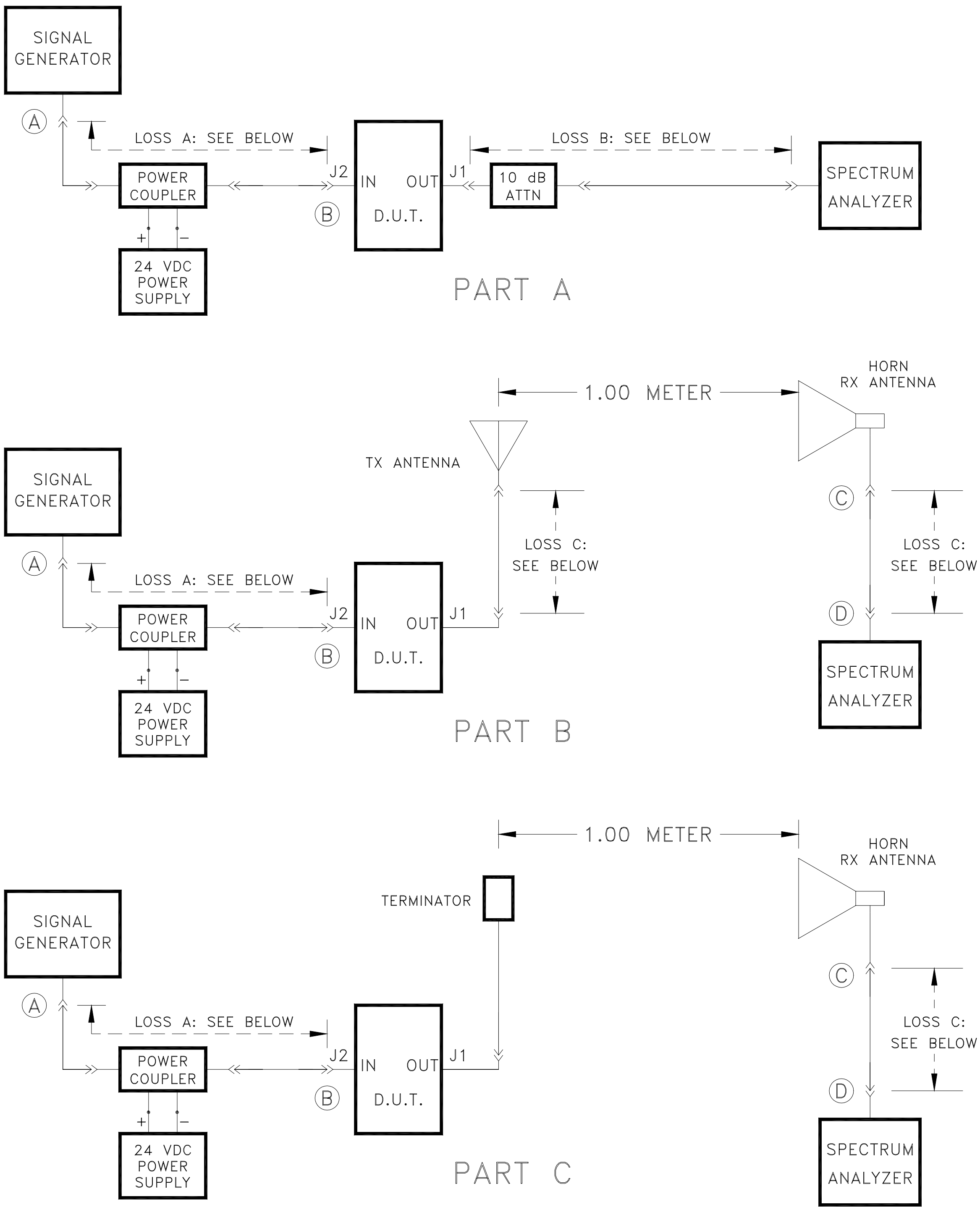
The downlink result for GSM modulation at the rated output level (Plot 11) shows no measurable distortion visible on the spectrum analyzer.

The downlink result for CDMA modulation at the rated output level (Plot 12) shows that the maximum downlink adjacent channel distortion is at a level of –18.4 dBm (spectrum analyzer level plus Loss 2 plus Loss 3, which is –50 dBm + 20.8 dB + 10.8 dB = -18.4 dBm.) Since the carrier output level is +24 dBm, the adjacent channel distortion is +24 dBm – (–18.4 dBm) = 42.4 dB below the carrier. The requirement is that the attenuation be 43 dB + 10 log (P); where P is the signal power in watts. Since the output power is -6 dBW (+ 24 dBm), then the required attenuation is 43 dB – 6 dB = 37 dB. Thus the DUT is compliant.

2.4 Radiated Spurious Emissions

These tests address the requirements for spurious emissions as specified in Sections 2.991 and 2.997 of the FCC R&Rs.

The testing was performed in three parts using the equipment arrangements shown in Figure 2.4-1 parts A, B, and C as shown below. Note that for these tests, DC was blocked to the DUT output by removing an internal jumper as would be done in a typical application in which DC is blocked to a connected antenna.



NOTES:

LOSS A = 0.8 dB AT CELLULAR, 1.5 dB AT PCS
LOSS B = 10.5 dB AT CELLULAR, 10.8 dB AT PCS
LOSS C = 0.6 dB AT CELLULAR, 1.0 dB AT PCS
DC BLOCKED INTERNALLY WITHIN DUT

P6T81902F2-4-1

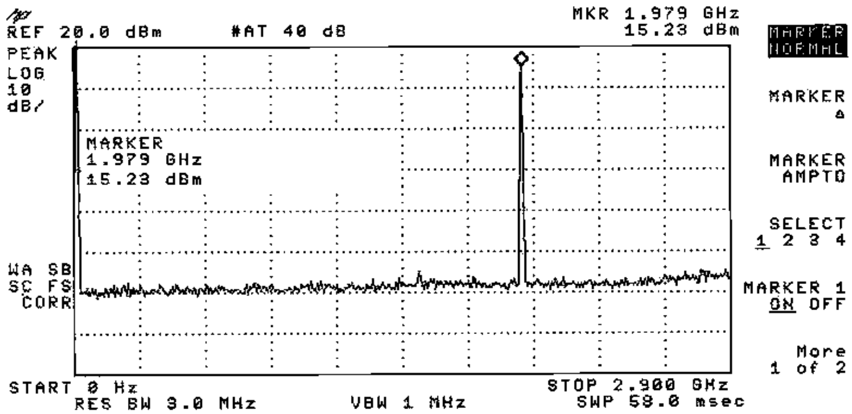
<u>Figure 2.4-1</u>

Part A: Antenna Terminal Emissions

In these tests, the generator fed the maximum rated input signal into the DUT and the spectrum analyzer was connected to the output of the DUT through a 10 dB attenuator as per Figure 2.4.-1 Part A. The maximum rated input level is the maximum rated output level minus the DUT gain (20dB).

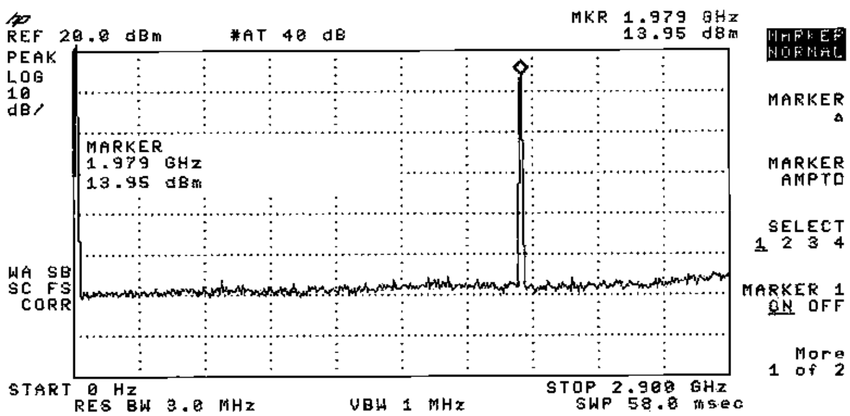
The signal generator was set to the maximum rated DUT output level minus 20 dB (DUT gain) plus Loss A. Therefore to obtain +24 dBm at the output of the DUT required a Generator level of: +24 dBm (test level) - 20 dB (DUT gain) + 1.5 dB (Loss A) = +5.5 dBm.

In each test, the results are plotted with two overlapping sweeps. Results are plotted with sweeps of 0 – 2.9 GHz and 2.8 – 20 GHz. The results are shown in Plots 13 through 18 on the following pages.



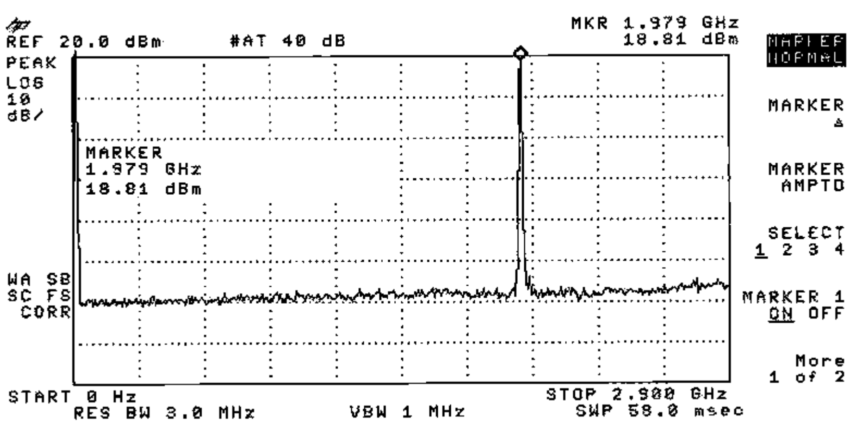
Plot 13 Antenna Terminal Emissions - NADC Modulation

Input Level = +4 dBm Modulation = NADC
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



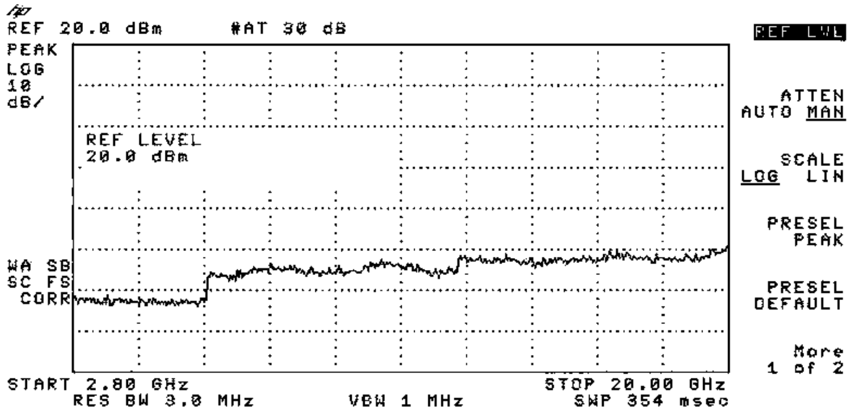
Plot 14 Antenna Terminal Emissions - GSM Modulation

Input Level = +4 dBm Modulation = GSM
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



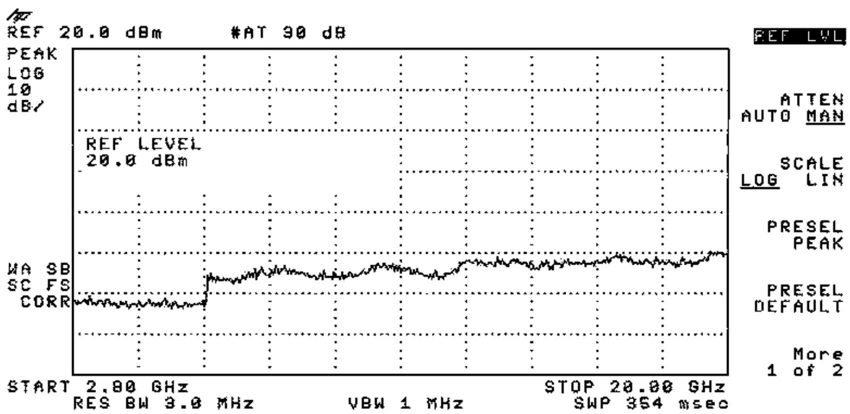
Plot 15 Antenna Terminal Emissions - CDMA Modulation

Input Level = +4 dBm Modulation = CDMA
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



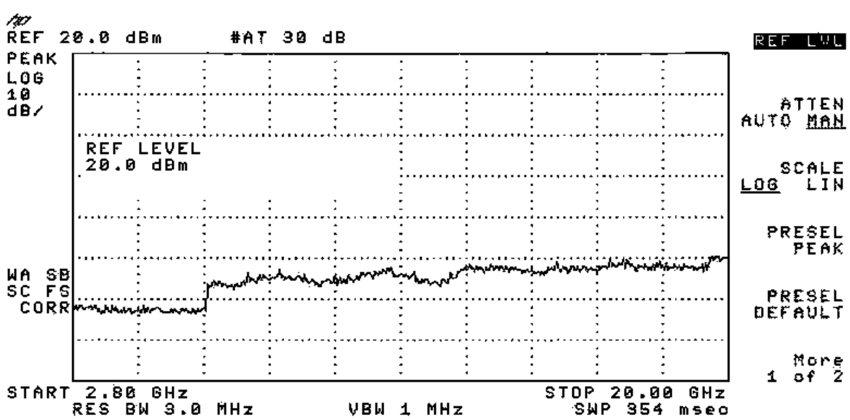
Plot 16 Antenna Terminal Emissions - NADC Modulation

Input Level = +4 dBm
Span = 2.8 - 20 GHz
Modulation = NADC
Generator Level = +5.5 dBm



Plot 17 Antenna Terminal Emissions - GSM Modulation

Input Level = +4 dBm
Span = 2.8 - 20 GHz
Modulation = GSM
Generator Level = +5.5 dBm



Plot 18 Antenna Terminal Emissions - CDMA Modulation

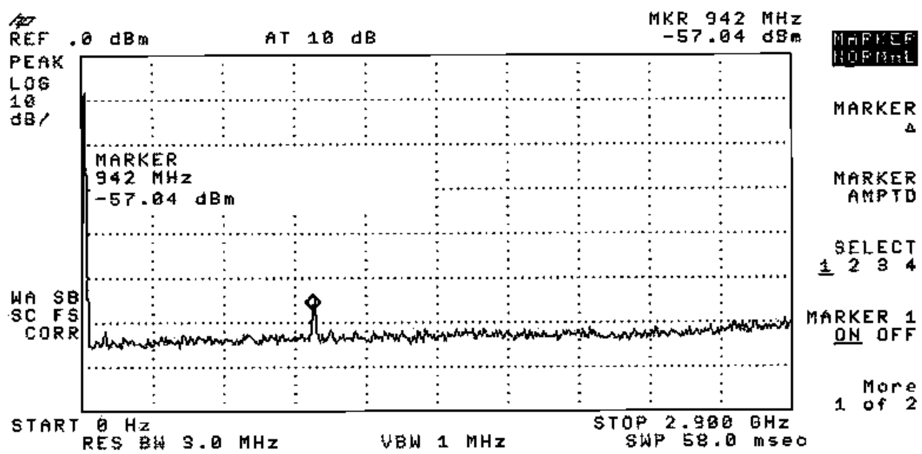
Input Level = +4 dBm
Span = 2.8 - 20 GHz
Modulation = CDMA
Generator Level = +5.5 dBm

The specification limit for spurious signals is 43 dB + 10 log (P); where P is in watts. For an output signal of +24 dBm, the required spurious to carrier ratio is 37 dB. The results in Plots 13 through 18 show no measurable spurious above the analyzer noise floor which is at least 50 dB below the output signal. Thus the unit is compliant with the requirement.

Part B: Radiated Spurious Emissions – DUT Connected to Radiating Antenna

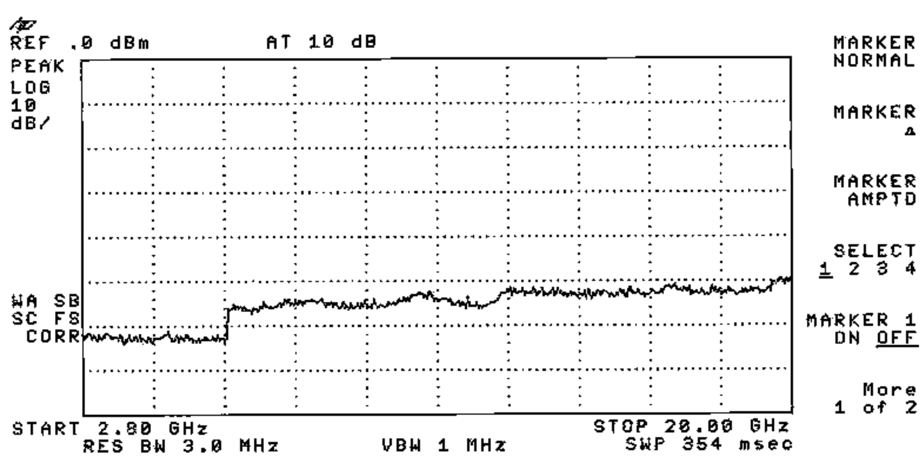
To check radiated spurious emissions, the (DUT) was located in an open test area and emissions were measured with a radiating antenna connected to the output connector. The receiving horn antenna was placed at a distance of 1 meter from the radiating antenna. Figure 2.4-1 part B shows the test arrangement. Tests were performed for each of NADC, GSM and CDMA type modulations.

Plots 19 through 26 that follow show the results of the above tests. Plots 19 and 20 show the site background noise. Plots 21 through 23 show the measured radiated signals with the DUT connected to PCS ¼-wave ceiling mount omnidirectional antenna over a 0 – 2.9 GHz sweep for NADC, GSM and CDMA type modulations. Plots 24 through 26 show the measured radiated signals over a 2.8 - 20 GHz sweep.



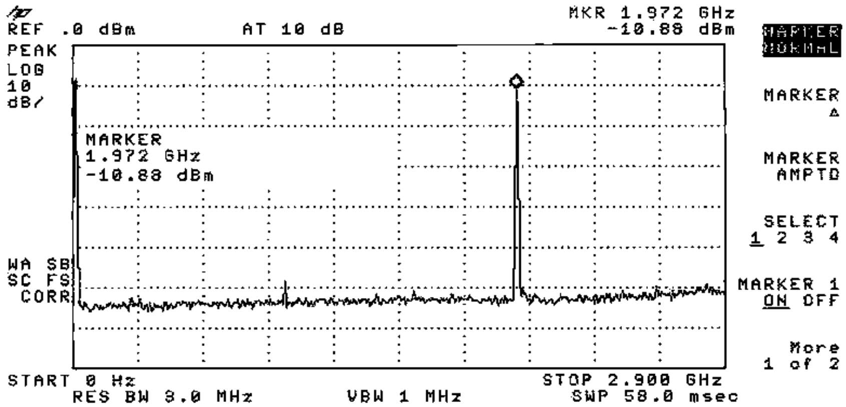
Plot 19 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 0 – 2.9 GHz



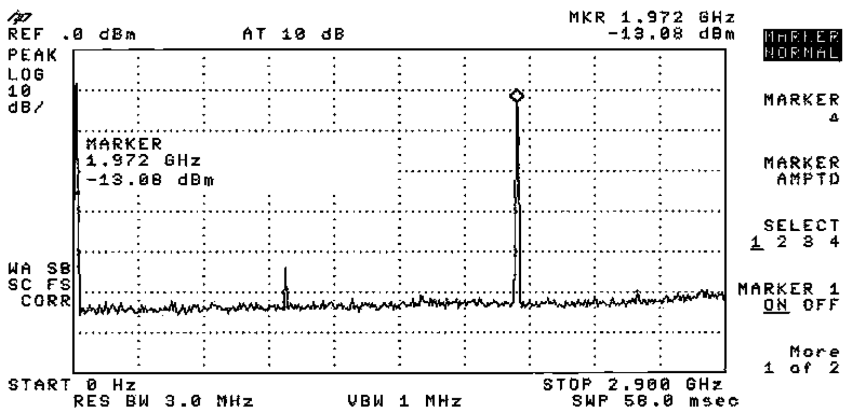
Plot 20 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 2.8 – 20 GHz



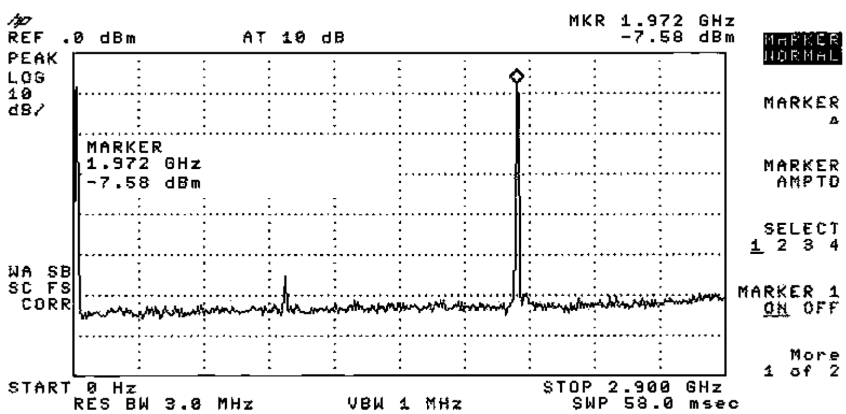
Plot 21Radiated Spurious – PCS NADC Modulation

Input Level = +4 dBm Modulation = NADC
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



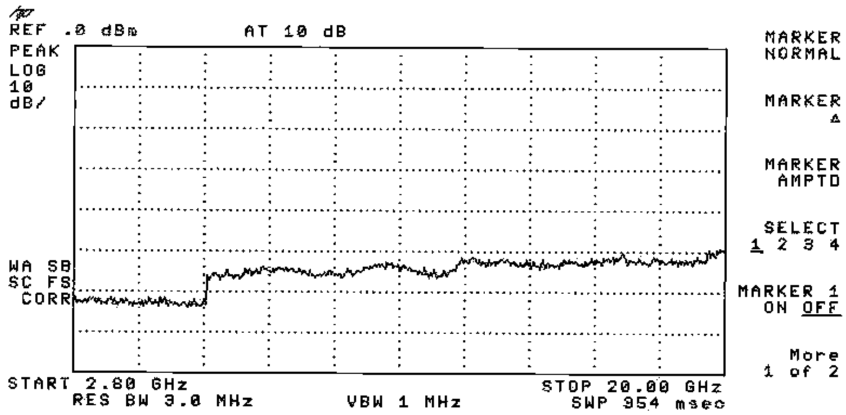
Plot 22 Radiated Spurious – PCS GSM Modulation

Input Level = +4 dBm Modulation = GSM
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



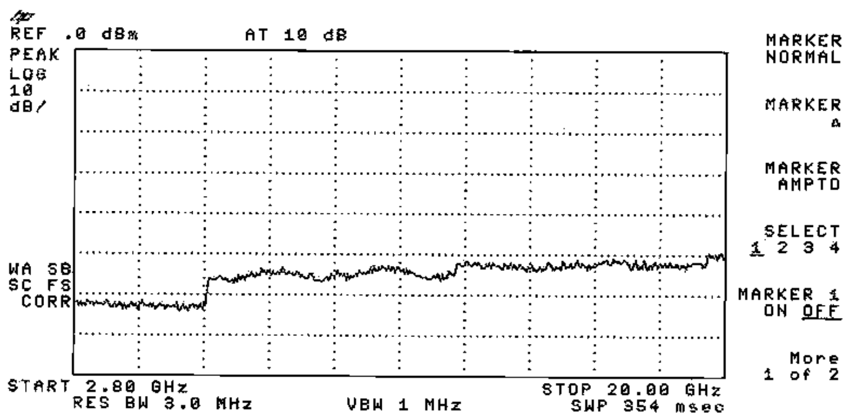
Plot 23 Radiated Spurious – PCS CDMA Modulation

Input Level = +4 dBm Modulation = CDMA
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



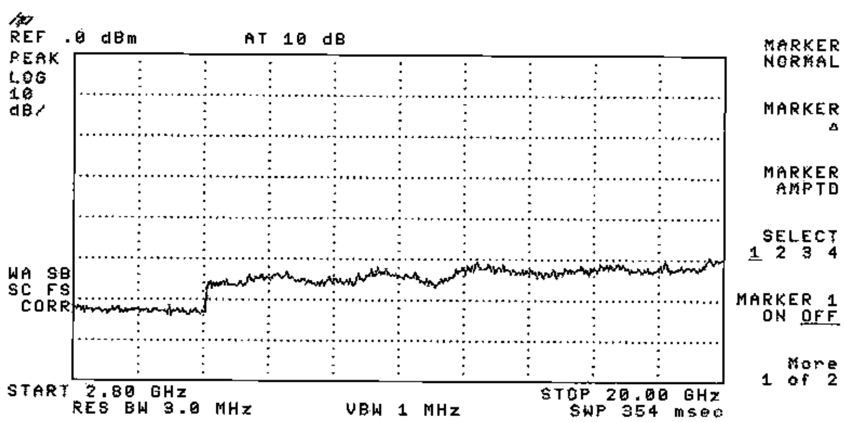
Plot 24Radiated Spurious – PCS NADC Modulation

Input Level = +4 dBm Modulation = NADC
Span = 2.8 - 20 GHz Generator Level = +5.5 dBm



Plot 25 Radiated Spurious – PCS GSM Modulation

Input Level = +4 dBm Modulation = GSM
Span = 2.8 - 20 GHz Generator Level = +5.5 dBm



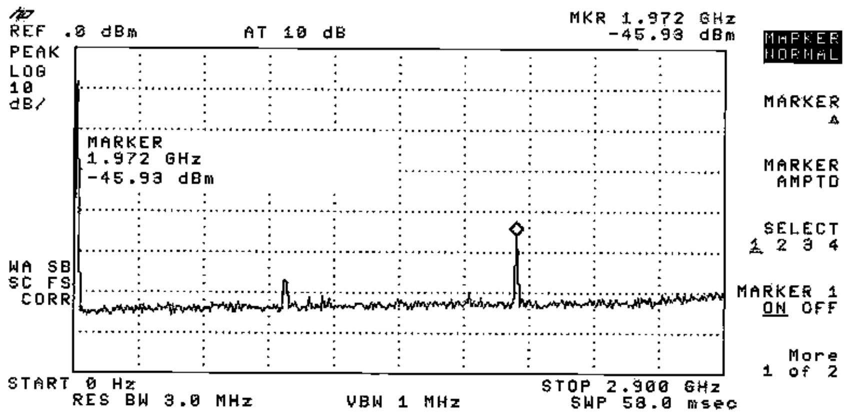
Plot 26 Radiated Spurious – PCS CDMA Modulation

Input Level = +4 dBm Modulation = CDMA
Span = 2.8 - 20 GHz Generator Level = -+5.5 dBm

The results in Plots 21 through 26 above show no measurable spurious above the background noise measured in Plots 19 and 20. The test demonstrates that radiated emissions are well below the required level.

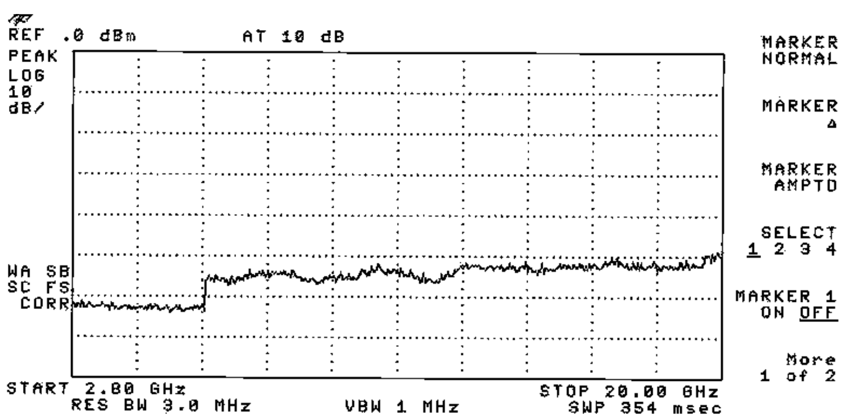
Part C: Radiated Spurious Emissions – DUT Terminated

The tests of Part B were repeated with the DUT connected to a 50 ohm termination instead of a radiating antenna. Figure 2.4-1 part C shows the test arrangement. The orientation of the terminated enclosure was varied in various planes in order to find the highest radiated signals. Results are shown in plots 27 through 28 that follow.



Plot 27 Radiated Spurious – DUT Terminated

Input Level = +4 dBm Modulation = CDMA
Span = 0 – 2.9 GHz Generator Level = +5.5 dBm



Plot 28 Radiated Spurious – DUT Terminated

Input Level = +4 dBm Modulation = CDMA
Span = 2.8 - 20 GHz Generator Level = +5.5 dBm

The results in Plots 27 and 28 above show no measurable spurious signals from the DUT. The only signal measurable is the fundamental leakage from the enclosure as shown on Plot 27. This is the same desired signal that is intentionally radiated from the antenna normally connected to the unit and thus does not impact system performance and is not considered a radiated spurious signal

3.0 TEST EQUIPMENT LIST

The test equipment used in performing the tests is listed below:

REFERENCE	PART NUMBER	MANUFACTURER	SERIAL NO.	DESCRIPTION
DUT	001-0238-003	P. G. Electronics	100955	A238 Device Under Test
Network Analyzer 1	HP8753ES	Hewlett-Packard	MY40002281	3 GHz Network Analyzer
Network Analyzer 2	HP8753C	Hewlett-Packard	3029A01161	3 GHz Network Analyzer
Test Set	HP85044A	Hewlett-Packard	2542A02097	Test set used with HP8753C
Spectrum Analyzer	HP8592L	Hewlett-Packard	3801A01119	22 GHz Spectrum Analyzer
Signal Generator	HP ESG-D3000A	Hewlett-Packard	US36260112	3 GHz Signal Generator
CDMA Source	Zebra (P/N 0032-G)	Berkeley Varitronics	987083	CDMA Baseband Source
Power Supply	1627	BK Precision	D30300443	Power Supply (set to 24 V)
PS293 Power Source	001-0293-001	P. G. Electronics		24 VDC DUT Power Source
Combiner	2089-6406-00	M/A-COM	--------	Power Divider/Combiner
Terminator	NTRM-50G	Mini-Circuits	--------	50 Ohm Terminator
10 dB Attn.	771-10	Narda	--------	10dB Attenuator
20 dB Attn.	RFA-60-NFF	RES-NET	--------	20dB Attenuator
Driver Amp	001-0211-002	P. G. Electronics	--------	A211 Amp used as driver
Power Coupler	193-0001-034	P. G. Electronics	--------	Used to couple DC to DUT
Horn Antenna	SAS-299/571	AH Systems	289	Horn Antenna
PCS Tx Antenna	DB794SM5N-M	Decibel Products	--------	1/4 Wave PCS Tx Ant

4.0 TEST FACILITY DESCRIPTION

The testing in this exhibit was performed at the factory of the manufacturer:

P. G. Electronics, Ltd.
800 Arrow Rd., Unit 8,
Toronto, Ontario M9M 2Z8
Canada

P. G. Electronics has recently been granted equipment authorization on the Model A289 by the FCC (FCC ID: P6T81902, Grant Date: June 21, 2002). The A238 is essentially the A289 with the cellular circuitry removed. The construction, components and rated output power of both units are the same.

Both units use diplexers which are fixed-tuned and neither unit requires any tuning. The units contain no oscillators or frequency translation circuitry.

All tests described herein were performed in the company laboratory using the same test arrangements as for the A289 (FCC ID: P6T81902).

5.0 CONCLUSIONS

Testing has demonstrated that the unit meets the requirements for FCC Type Acceptance.