TEST REPORT

FOR FCC TYPE ACCEPTANCE

MODEL A181T

BIDIRECTIONAL AMPLIFIER

FCC ID: NKV802

TEST REPORT

P. G. Electronics, Ltd. is pleased to submit this technical report on tests performed on the Model A181T bidirectional amplifier (FCC ID: NKV802) 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__________ Serial Number _____________

____________________________ Date ______________
Paul Liber – Test Engineer

____________________________ Date ______________
Gerry Graham – P. Eng. President

1.0 NAMES AND ADDRESSES

1.1 Manufacturer

The Model A181T bidirectional amplifier (FCC ID: NKV802) is manufactured by:

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

1.2 Applicant

The applicant for the acceptance of the amplifier is:

P. G. Electronics, Inc.
501 Silverside Road, Suite 135,
Wilmington, Delaware,
19809

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.

2.1 Gain

The gain was measured using the test arrangement as shown in Figure 2.1-1 below. Measurements were made at three frequencies in the band.

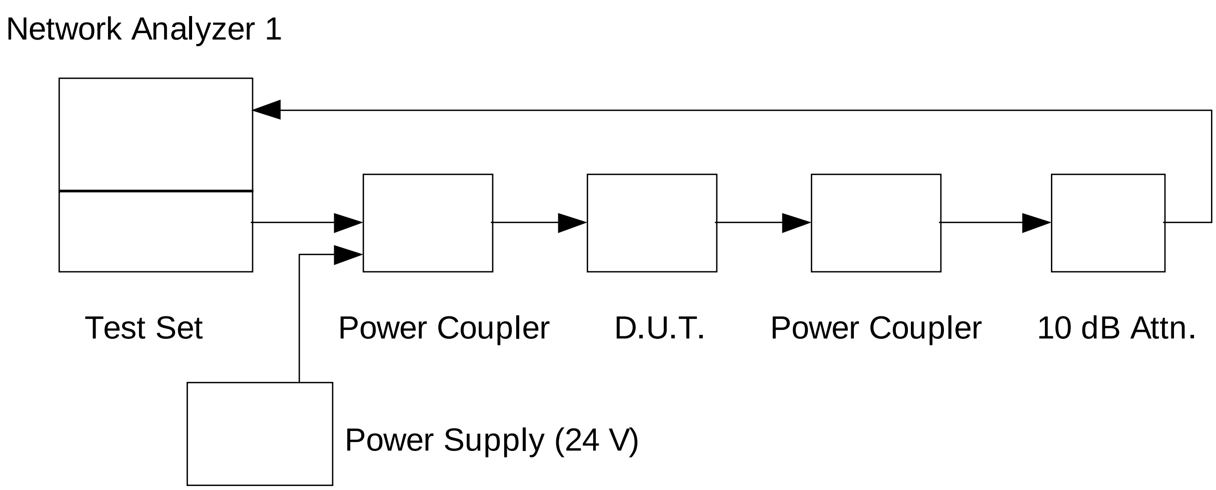
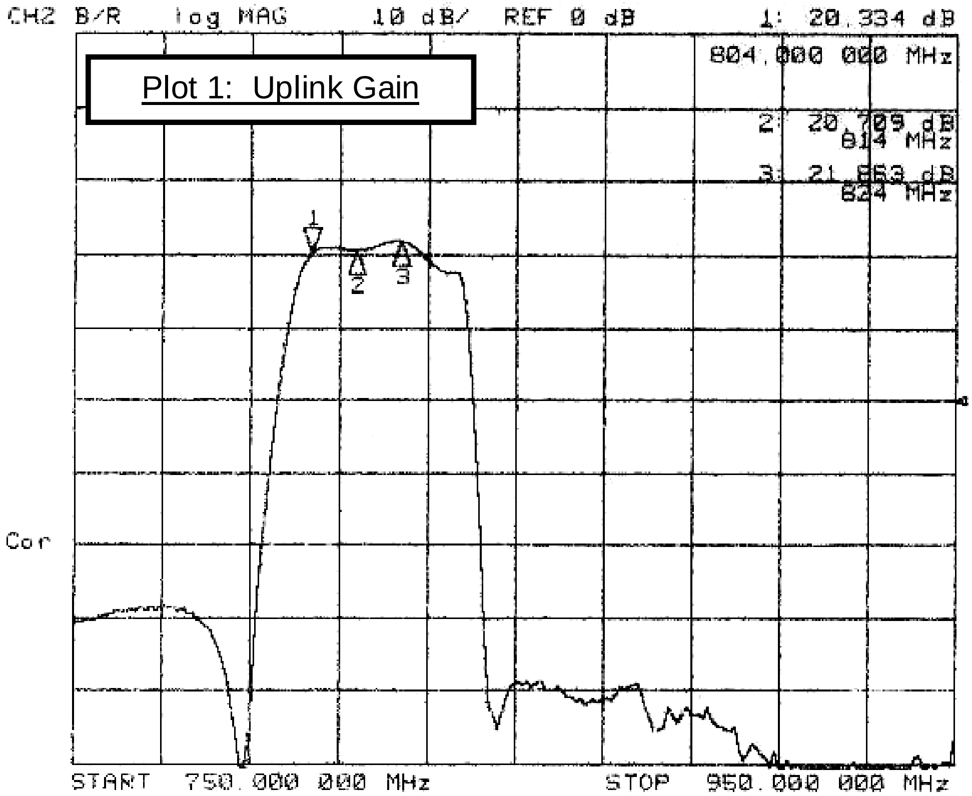
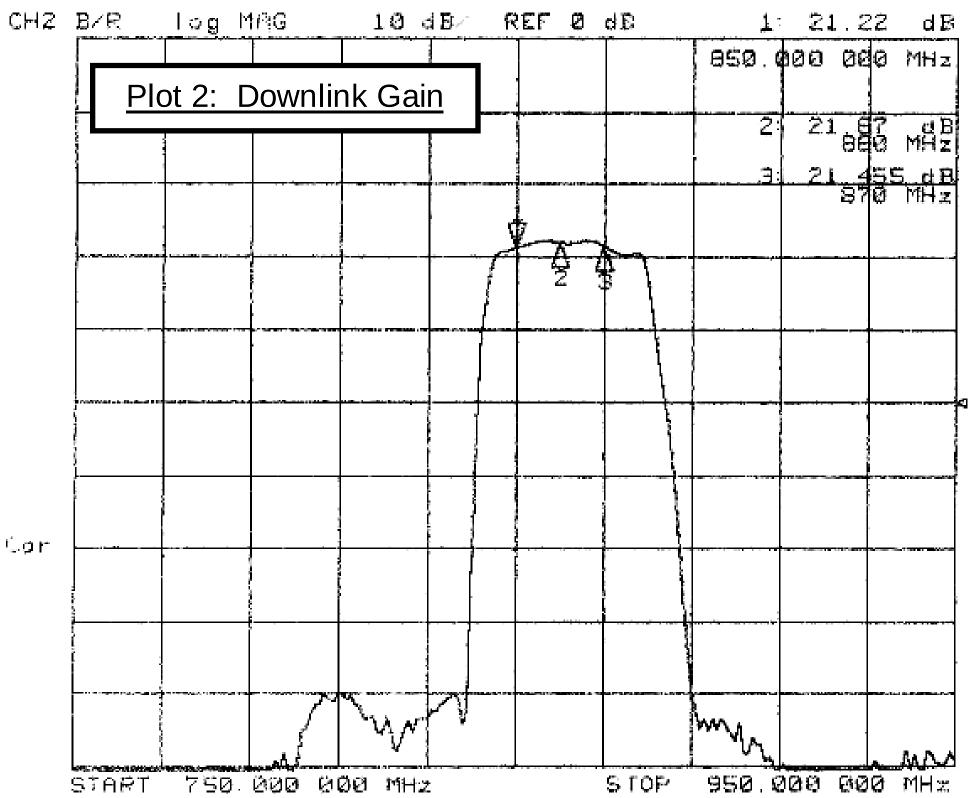


Figure 2.1-1

The unit gain was measured for both directions (uplink and downlink). These results are shown in Plot 1 and Plot 2 that follow.



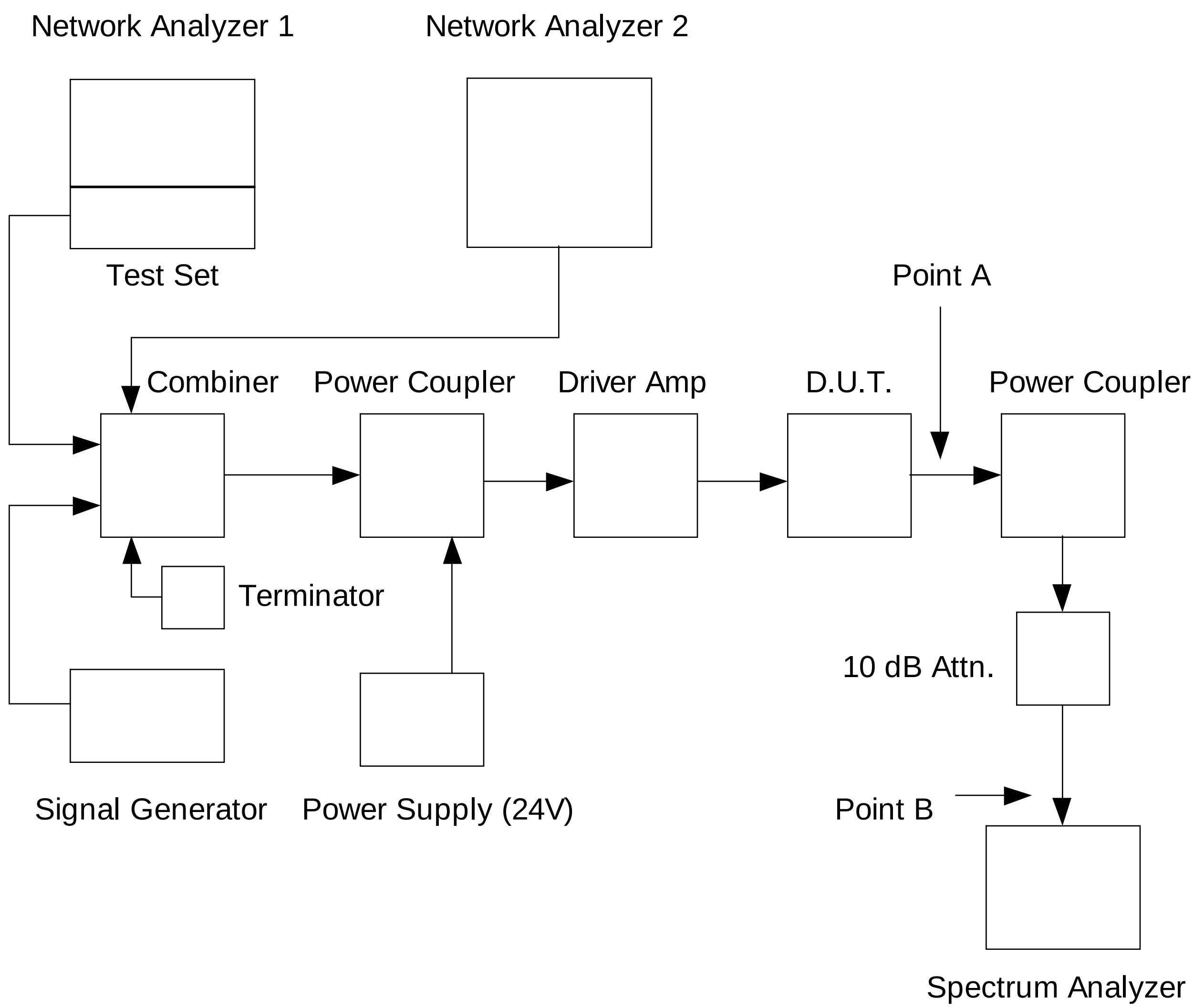
Plot 1: Uplink Gain



Plot 2: Downlink Gain

2.2 Intermodulation and Spurious

Intermodulation and spurious products were measured with the amplifier operating at the same composite power level specified in the Operator's Manual. A three tone test was conducted using the equipment test arrangement in Figure 2.2-1 below with the input power levels adjusted to give the rated output power of 7.2 dBm for each tone (+12 dBm total composite). The Network Analyzers were used as signal sources. The 10.7 dB loss to the spectrum analyzer results in tone levels of –3.5 dBm into the instrument.

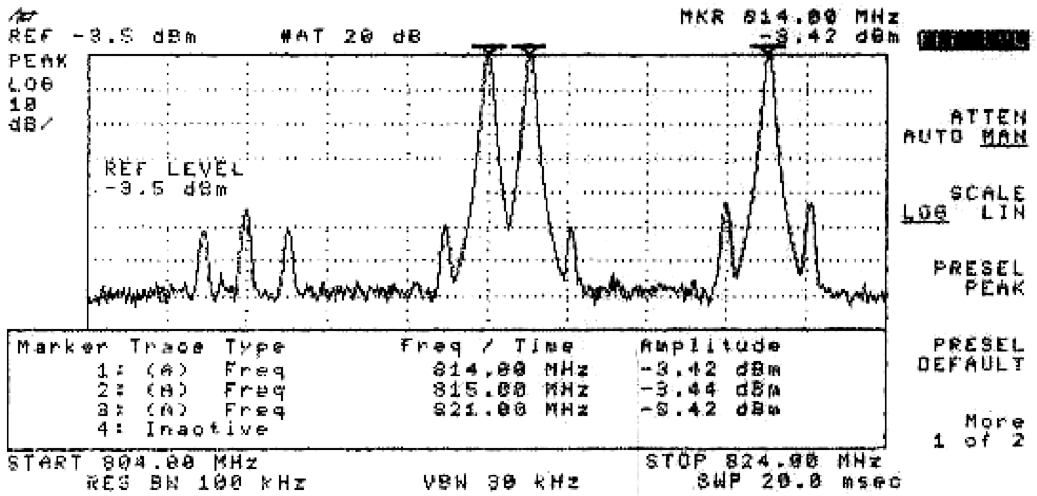


***Notes**: Model A181T driver amp was used for testing.

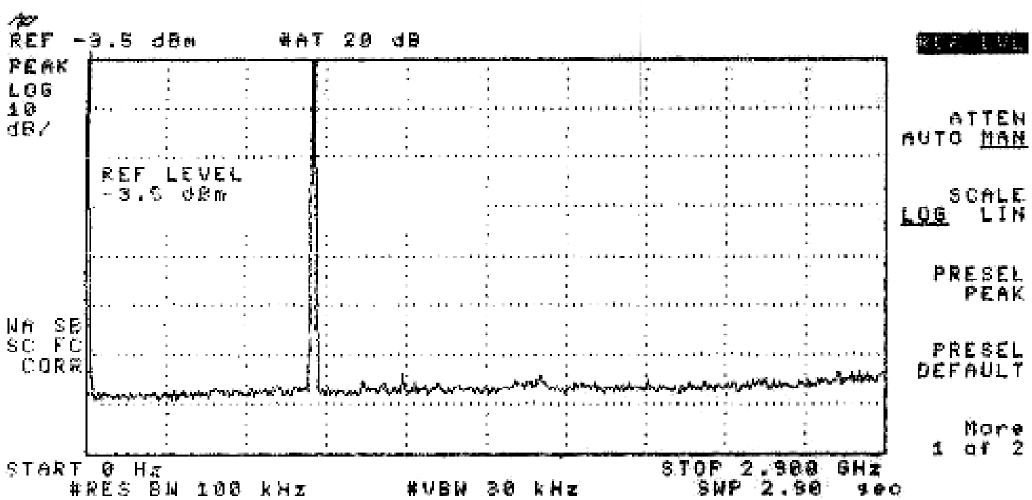
Loss from Point A (D.U.T. output) to Point B (Spectrum Analyzer input) was 10.7 dB. This includes the loss of the 10 dB attenuator, Power Coupler and cables.

Figure 2.2-1

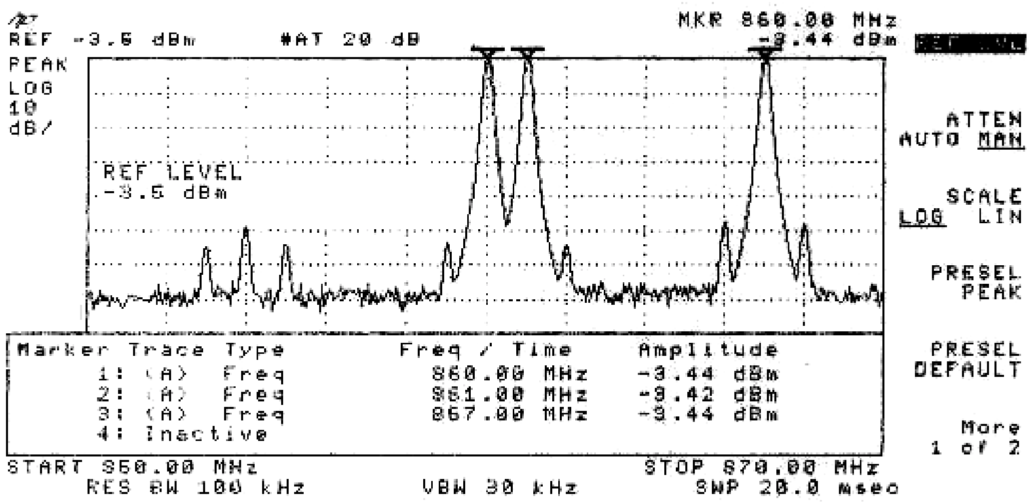
The results of these tests are shown in Plots 3 and 4 that follow for two spectrum analyzer sweep settings with the reference level set at –3.5 dBm. For the uplink direction, in Plot 3, the narrower band setting shows in-band intermodulation products, while in Plot 4 the spectrum outside the SMR band is displayed to show harmonics and spurious. Plots 5 and 6 show the equivalent results for the downlink direction.



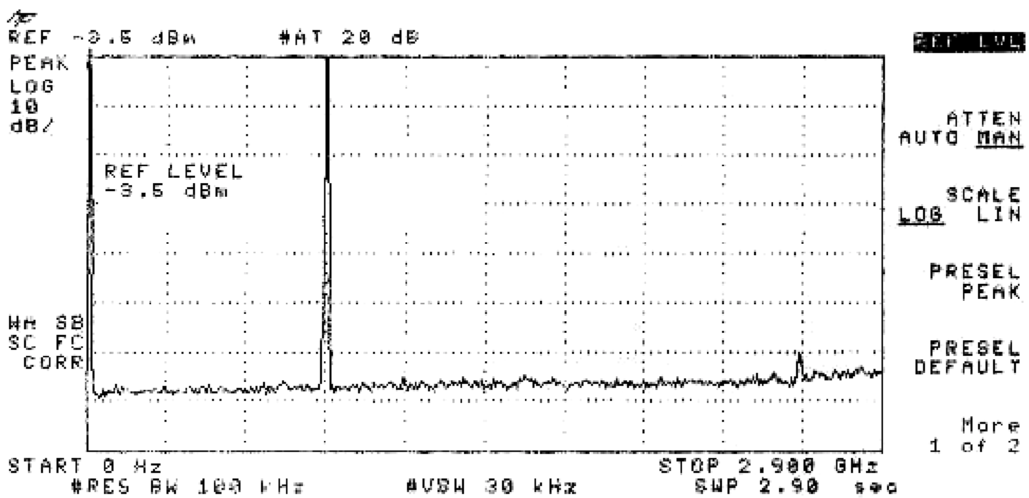
Plot 3: Uplink 3-tone Intermodulation (Narrow Sweep)



Plot 4: Uplink 3-tone Intermodulation (Broad Sweep)



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



Plot 6: Downlink 3-tone Intermodulation (Broad Sweep)

Examination of the above results shows that all products are at least 40 dB below the fundamentals.

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 are performed for both the uplink and downlink directions for FM and two types of digital modulations.

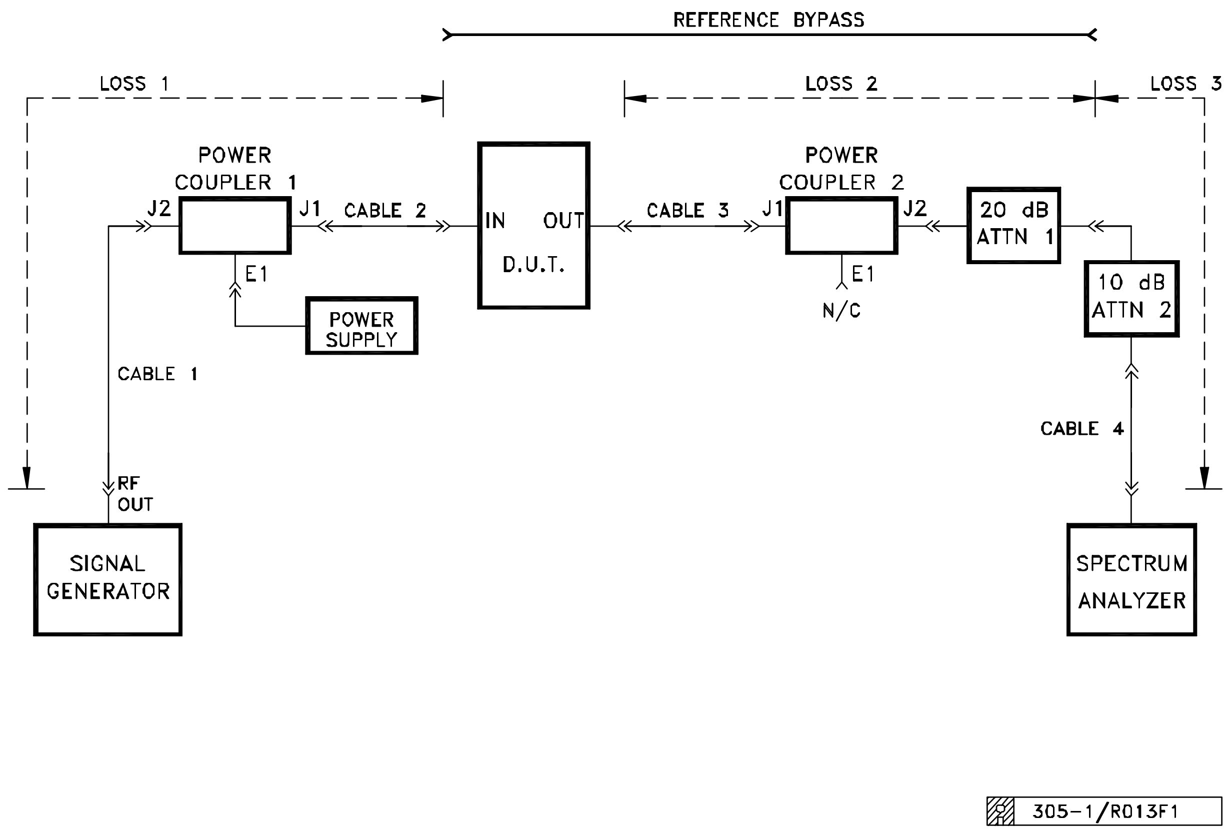


Figure 2.3-1

The following notes apply:

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

Loss 1 = 0.7 dB (Cable 1 + Power Coupler 1 + Cable 2)
Loss 2 = 20.7 dB (Cable 3 + Power Coupler 2 + 20 dB Attn.)
Loss 3 = 10.5 dB (10 dB Attn. + Cable 4)

b. Cable 1 and Cable 4 loss measured 0.6 dB each.

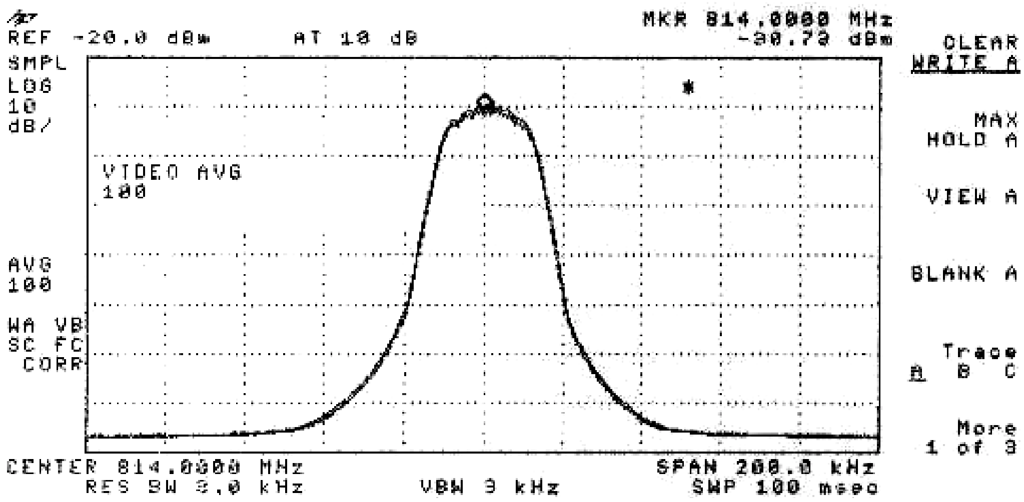
c. Signal generator set to test frequency and desired modulation. Amplitude set to required DUT input test level plus Loss 1. Therefore, to supply -4.5 dBm at the input of the DUT requires a Generator level of: -4.5 dBm (test level) + 0.7 dB (Loss 1) = -3.8 dBm.

d. The input signal is displayed on the spectrum analyzer using the reference bypass.

e. The output signal is displayed on the spectrum analyzer with the equipment connected as shown.

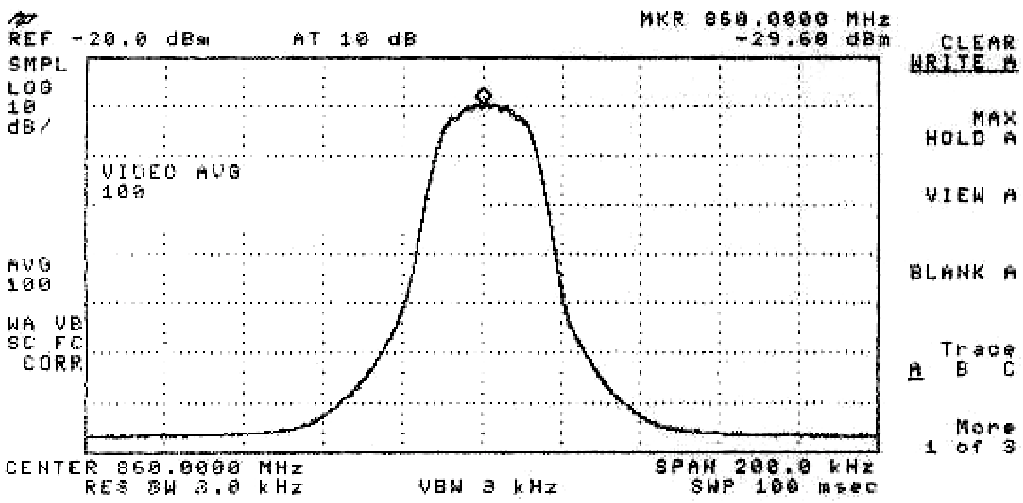
f. The DUT output level is equal to the spectrum analyzer level + Loss 2 + Loss 3; which is the spectrum analyzer level + 31.2 dB.

The results of these tests are shown in Plots 7 through 12 that follow. Plots 7 and 8 show results for FM modulation (AMPS), Plots 9 and 10 show results for for Digital Modulation 1 (NADC), and Plots 11 and 12 show results for Digital Modulation 2 (GSM).



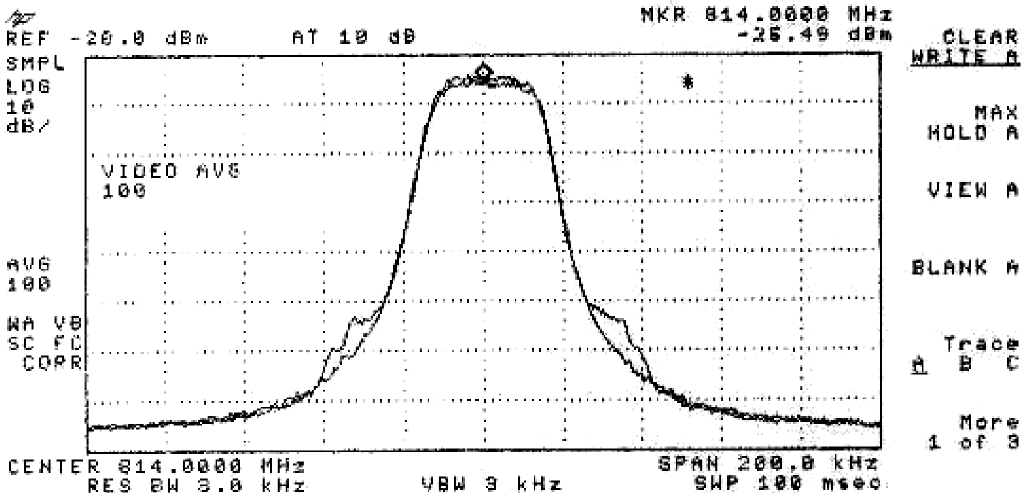
Plot 7: Uplink FM Modulated Channel Test

Input Level = -4.5 dBm Modulation = 1KHz
Deviation = 12KHz Span = 200 KHz
Video Averaging = ON



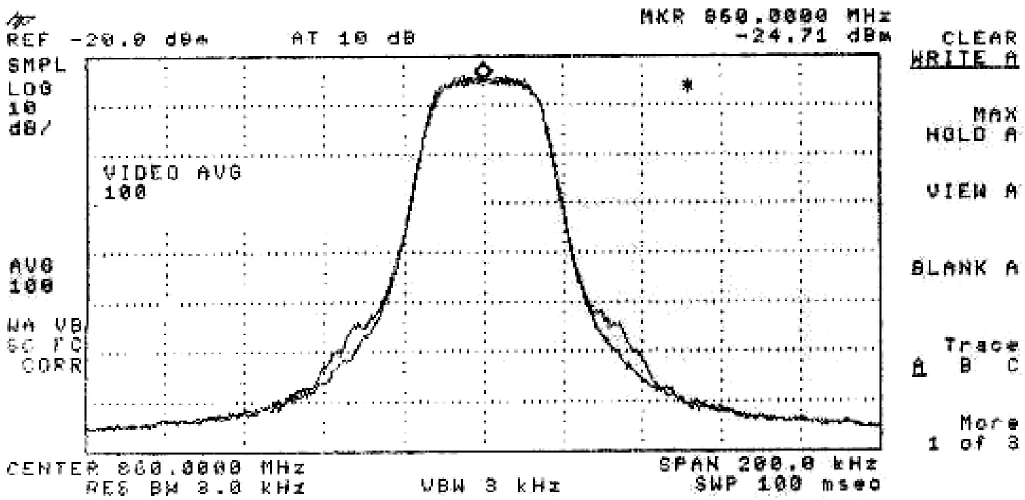
Plot 8: Downlink FM Modulated Channel Test

Input Level = -4.5 dBm Modulation = 1KHz
Deviation = 12KHz Span = 200 KHz
Video Averaging = ON



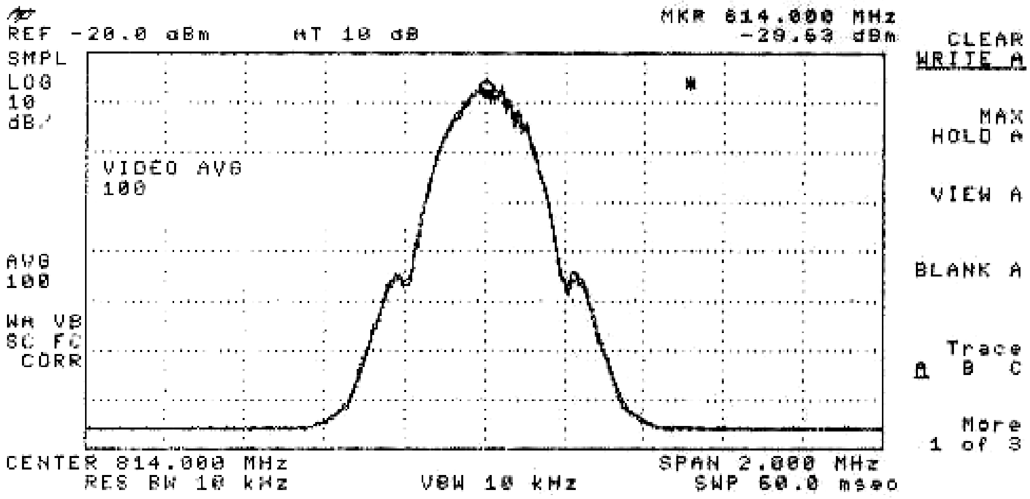
Plot 9: Uplink NADC Modulated Channel Test

Input Level = -4.5 dBm	Modulation = NADC
Span = 200 KHz	Video Averaging = ON



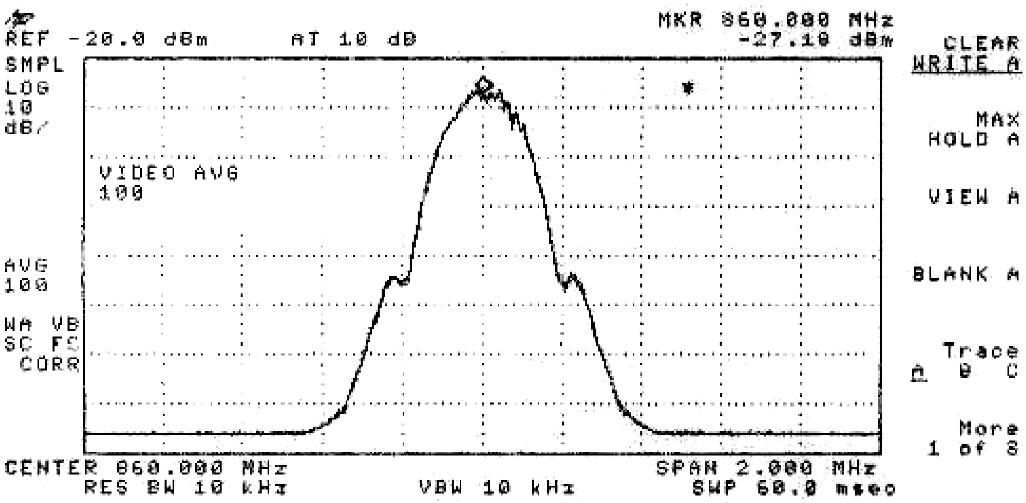
Plot 10: Downlink NADC Modulated Channel Test

Input Level = -4.5 dBm	Modulation = NADC
Span = 200 KHz	Video Averaging = ON



Plot 11: Uplink GSM Modulated Channel Test

Input Level = -4.5 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON



Plot 12: Downlink GSM Modulated Channel Test

Input Level = -4.5 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON

The results for FM modulation at the rated output level shows no measurable distortion visible on the spectrum analyzer.

The results for Digital Modulation 1 (NADC) shows that the adjacent channel noise produced is at least 45 dB below the level of 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 –13.5 dBW (nominal DUT gain of 20 dB), then the required attenuation is 43 dB –13.5 = 29.5 dB. Thus the DUT is compliant.

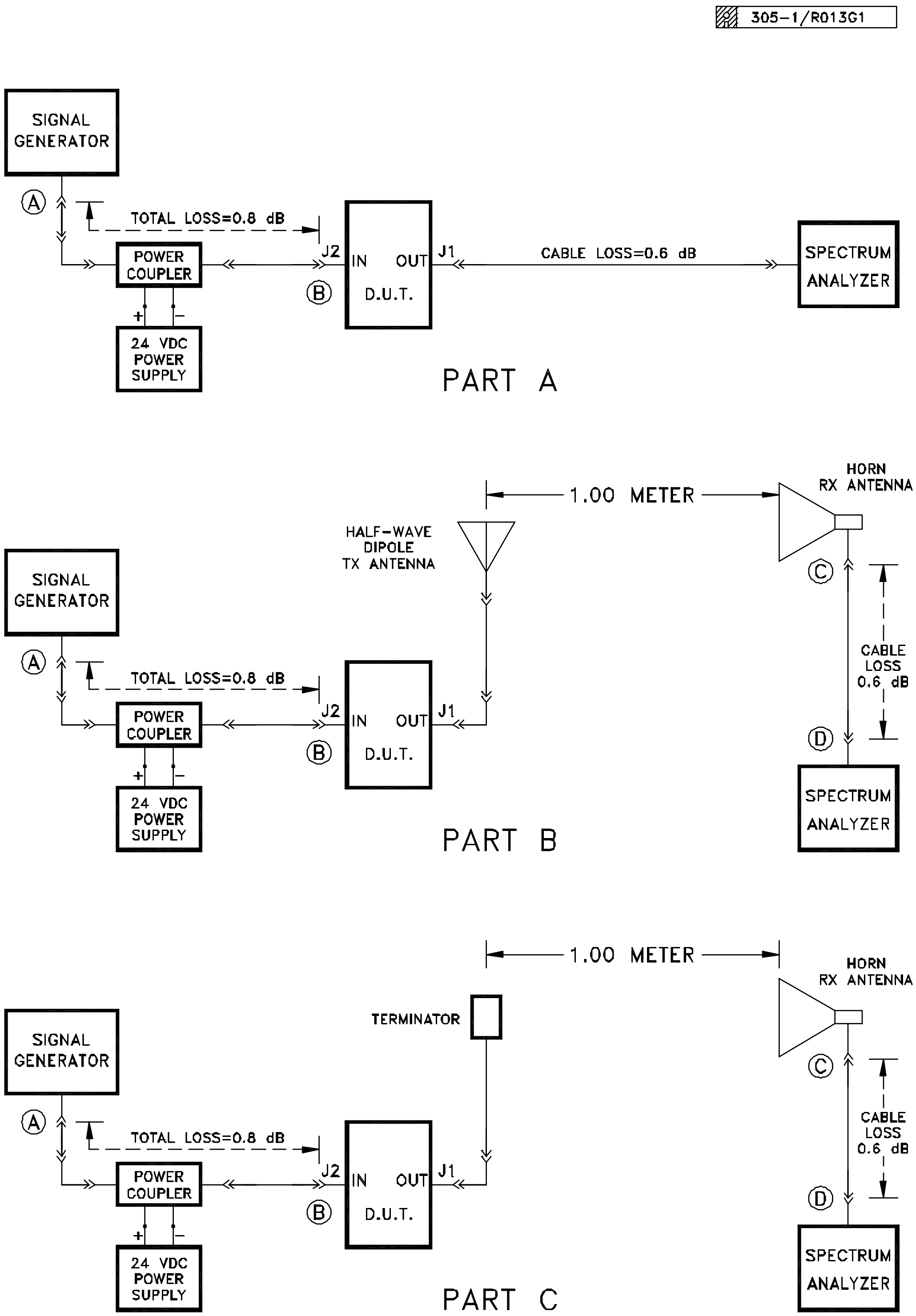
The results for Digital Modulation 2 (GSM) shows no measurable distortion visible on the spectrum analyzer.

It should be noted that while a single channel power rating has been given for customer comparisons, all actual applications of this system will use the ratings for multiple signals and hence will have lower average power and reduced distortion for each signal.

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.



NOTE: DC blocked internally within DUT.

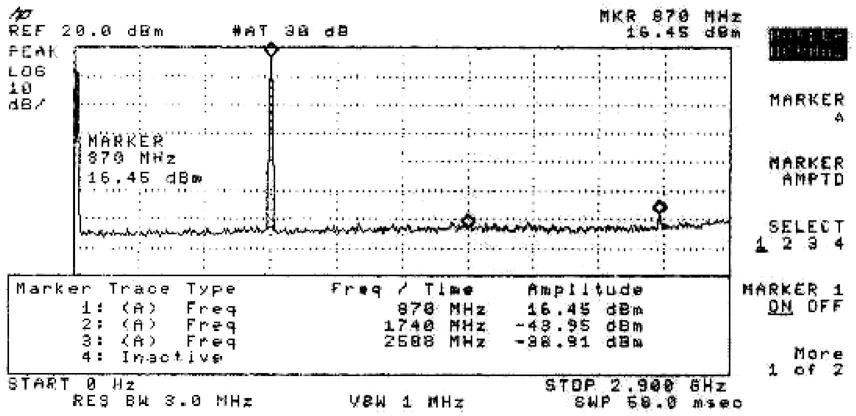
Figure 2.4-1

Part A: Antenna Terminal Emissions

In these tests, the generator fed the maximum rated input signal into the DUT and the spectrum analyzer was directly connected to the output of the DUT as per Figure 2.4.-1 Part A.

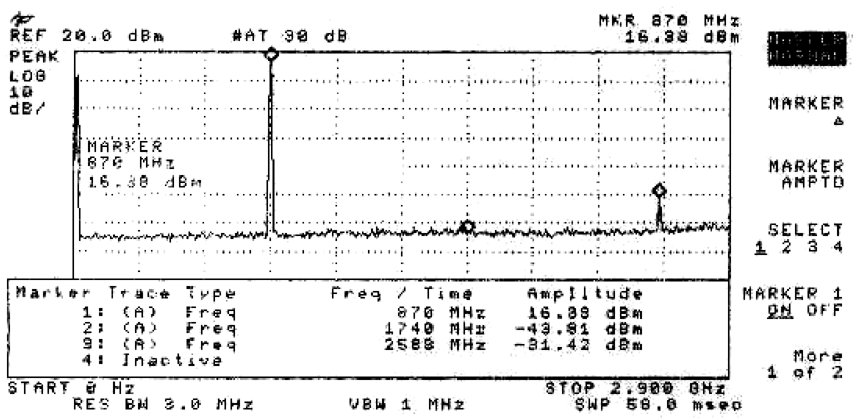
The output spectrum was recorded in the downlink direction for each of FM, Digital 1 (NADC) and Digital 2 (GSM) type modulations.

The results are plotted in the two overlapping bands 0 – 2.9 GHz and 2.8 – 10 GHz and are shown in Plots 13 through 18 on the following pages. For clarity, the fourth and fifth harmonics for NADC modulation are also shown on an expanded sweep in Plots 19 and 20.



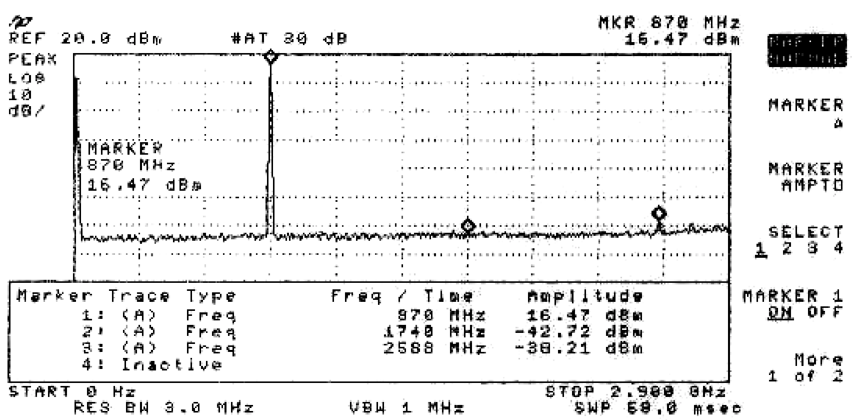
Plot 13: Antenna Terminal Emissions (FM Modulation)

Input Level = -4.5 dBm Modulation = FM
Span = 0 – 2.9 GHz



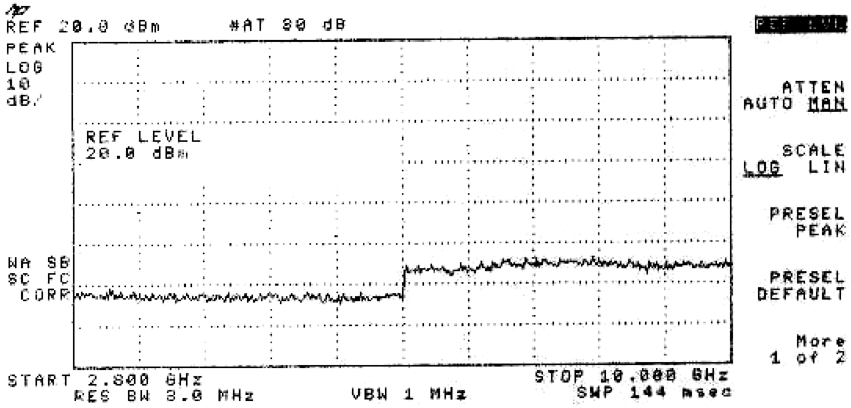
Plot 14: Antenna Terminal Emissions (NADC Modulation)

Input Level = -4.5 dBm Modulation = NADC
Span = 0 – 2.9 GHz



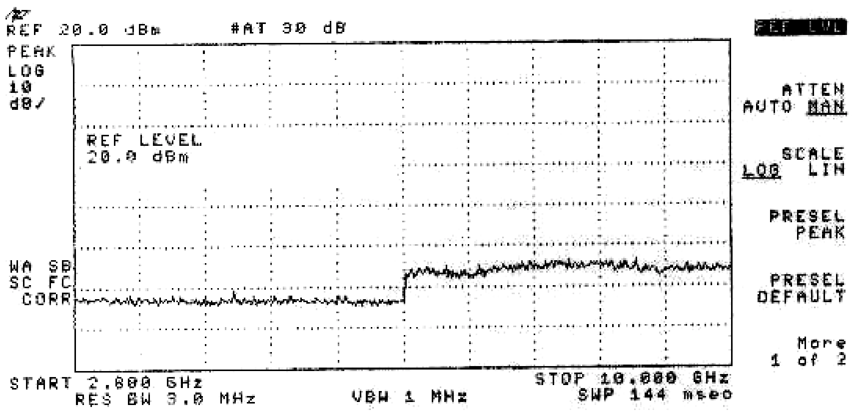
Plot 15 Antenna Terminal Emissions (GSM Modulation)

Input Level = -4.5 dBm Modulation = GSM
Span = 0 – 2.9 GHz



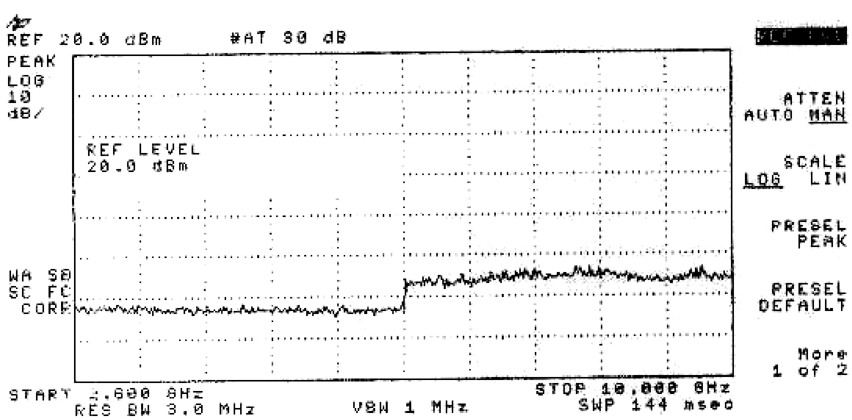
Plot 16: Antenna Terminal Emissions (FM Modulation)

Input Level = -4.5 dBm Modulation = FM
Span = 2.8 - 10 GHz



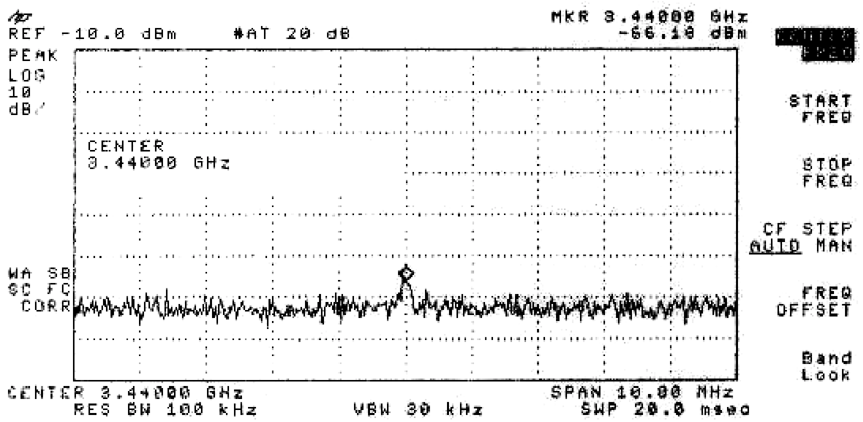
Plot 17: Antenna Terminal Emissions (NADC Modulation)

Input Level = -4.5 dBm Modulation = NADC
Span = 2.8 - 10 GHz



Plot 18 Antenna Terminal Emissions (GSM Modulation)

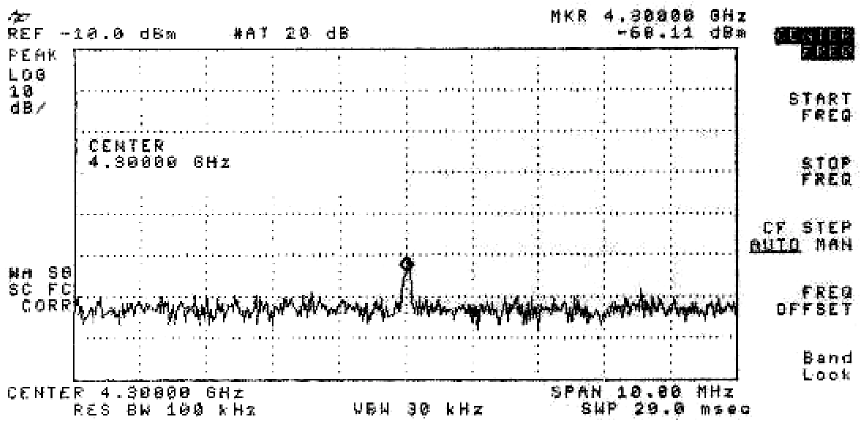
Input Level = -4.5 dBm Modulation = GSM
Span = 2.8 - 10 GHz



Plot 19 Antenna Terminal Emissions (NADC Modulation)

Input Level = -4.5 dBm Modulation = NADC

4^{th} Harmonic Span = 10 MHz



Plot 20 Antenna Terminal Emissions (NADC Modulation)

Input Level = -4.5 dBm Modulation = NADC

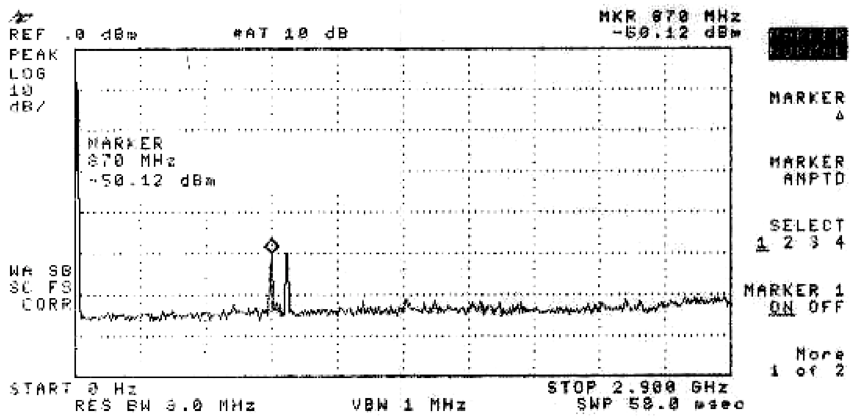
5^{th} Harmonic Span = 10 MHz

The specification limit for spurious signals is 43 dB + 10 log (P); where P is in watts. For an output signal of +18 dBm, the required spurious to carrier ratio is 31 dB. The worst measured spurious is for Digital1 (NADC) modulation shown on Plot 14. The spurious is at 2588 MHz and is down by 16.38 + 31.42 = 47.8 dB which is compliant with the specification.

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

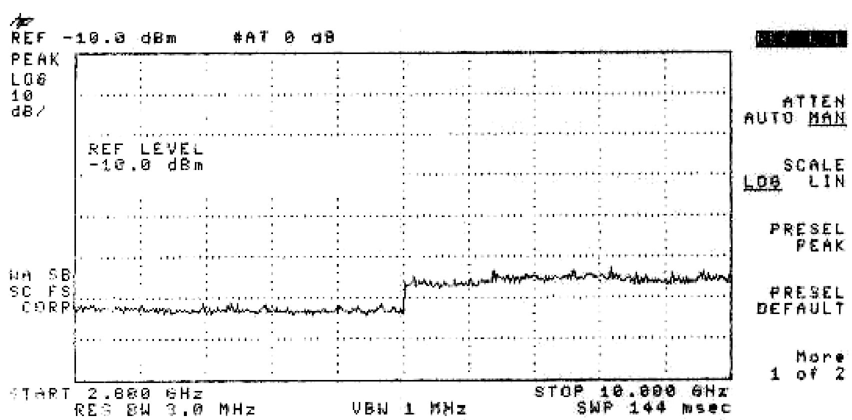
To check radiated spurious emissions, the (DUT) was located in an open test area and emissions were measured with a radiating antenna connected to the output connector. The receiving horn antenna was placed at a distance of 1 meter from the radiating antenna. Figure 2.4-1 part B shows the test arrangement.

Plots 21 through 28 that follow show the results of the above tests. Plots 21 and 22 show the site background noise. Plots 23 through 25 show the measured radiated signals with the DUT connected to a half wave dipole antenna over a 0 – 2.9 GHz sweep. Plots 26 through 28 show the measured radiated signals with the DUT connected to a half wave dipole antenna over a 2.8 - 10 GHz sweep.



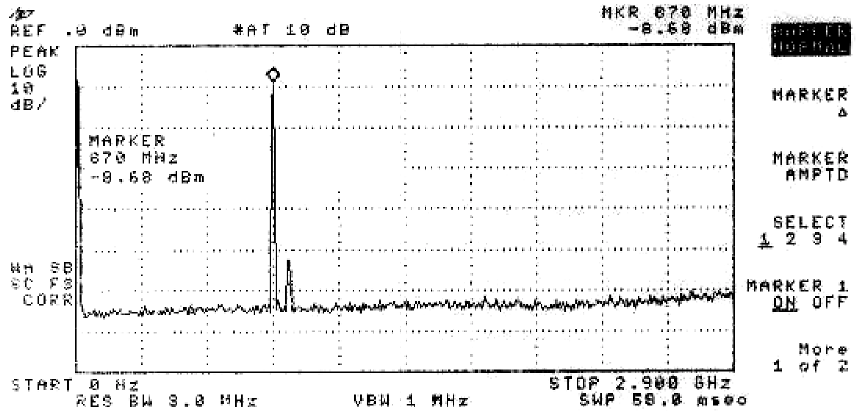
Plot 21 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 0 – 2.9 GHz



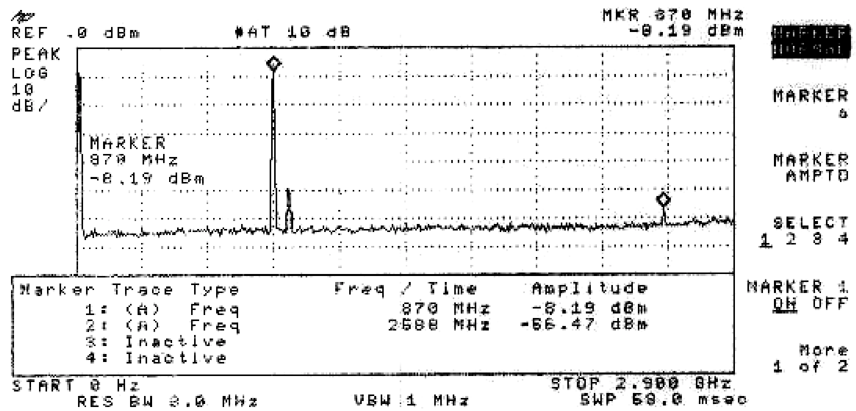
Plot 22 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 2.8 – 10 GHz



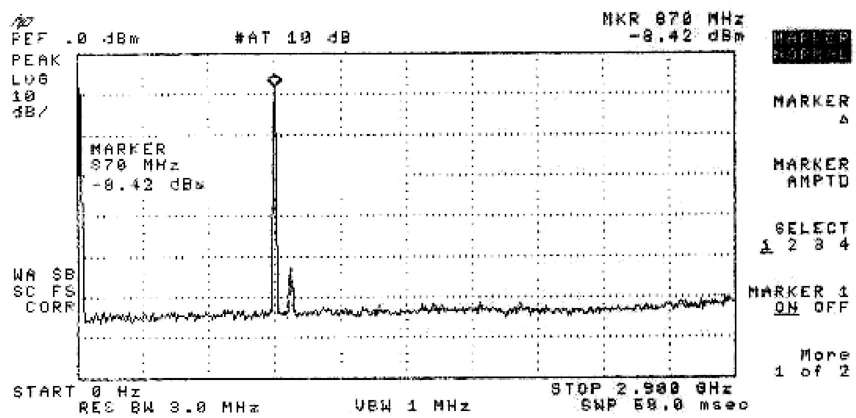
Plot 23 Radiated Spurious – FM Modulation

Input Level = -4.5 dBm Modulation = FM
Span = 0 – 2.9 GHz



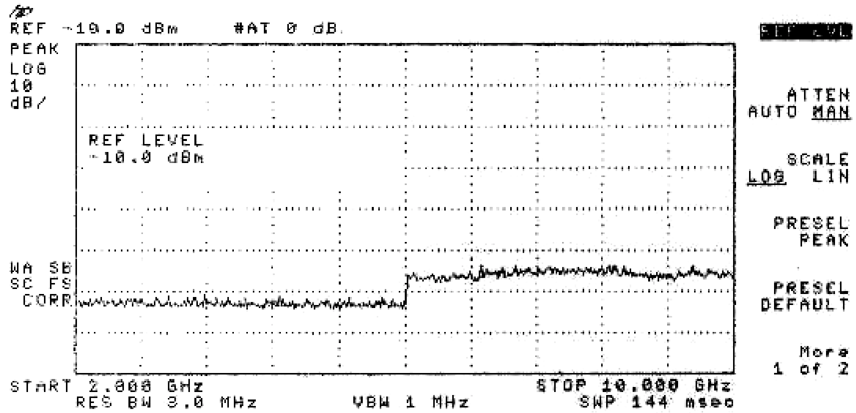
Plot 24 Radiated Spurious – NADC Modulation

Input Level = -4.5 dBm Modulation = NADC
Span = 0 - 2.9 GHz



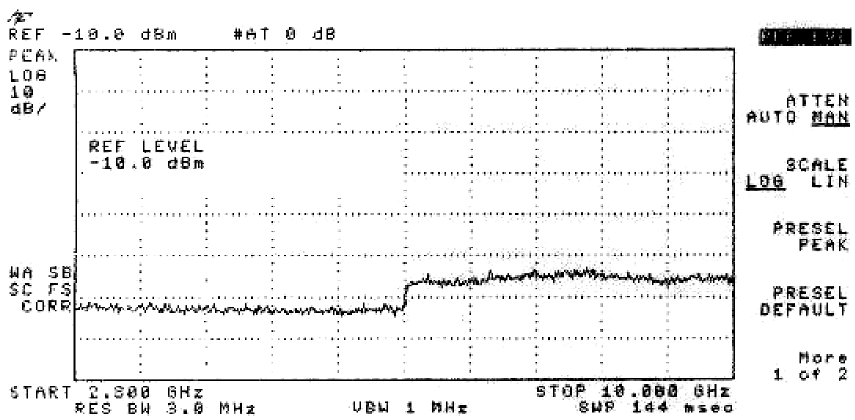
Plot 25 Radiated Spurious – GSM Modulation

Input Level = -4.5 dBm Modulation = GSM
Span = 0 - 2.9 GHz



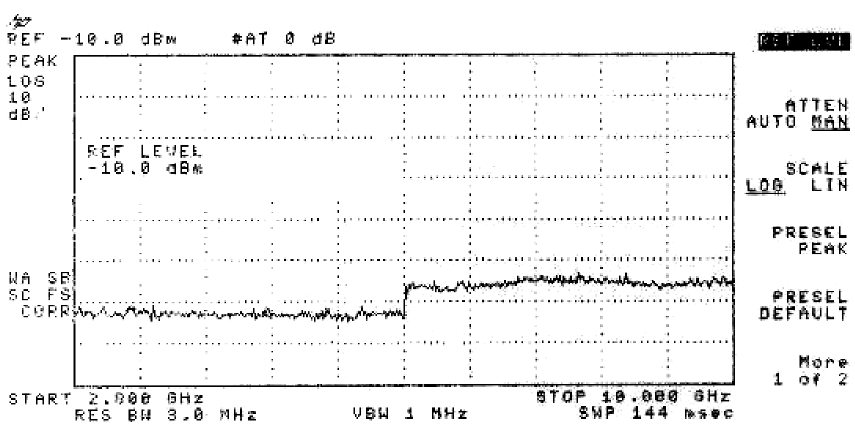
Plot 26 Radiated Spurious – FM Modulation

Input Level = -4.5 dBm Modulation = FM
Span = 2.8 – 10 GHz



Plot 27 Radiated Spurious – NADC Modulation

Input Level = -4.5 dBm Modulation = NADC
Span = 2.8 – 10 GHz



Plot 28 Radiated Spurious – GSM Modulation

Input Level = -4.5 dBm Modulation = GSM
Span = 2.8 – 10 GHz

The test demonstrates that radiated emissions are well below requirements with respect to the desired radiated signal. The highest spurious measured is on Plot 24 which shows the 3rd harmonic at –56.47 dBm which is 48.28 dB below the fundamental. No other spurious shows above the noise floor.

Part C: Radiated Spurious Emissions – DUT Terminated

In the case of the terminated measurements, no signals were measured that were above the test site background noise measurement. No signal radiation was detectable at any other frequency up to 10 GHz, showing that there was no spurious leakage from the enclosure. The orientation of the terminated enclosure was varied in various planes with no spurious radiation measurable.

3.0 TEST EQUIPMENT LIST

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

REFERENCE	PART NUMBER	MANUFACTURER	SERIAL NUMBER	DESCRIPTION
DUT	001-0181-008	P. G. Electronics	100286	A181T Device Under Test
Network Analyzer 1	HP8753C	Hewlett-Packard	3029A01161	3 GHz Network Analyzer
Test Set	HP85044A	Hewlett-Packard	2542A02097	Test set used with HP8753C
Network Analyzer 2	HP8753ES	Hewlett-Packard	MY40002281	3 GHz Network Analyzer
Spectrum Analyzer	HP8592L	Hewlett-Packard	3801A01119	22 GHz Spectrum Analyzer
Signal Generator	HP ESG-D3000A	Hewlett-Packard	US36260112	3 GHz Signal Generator
Power Supply	1627	BK Precision	D30300443	Power Supply (set to 24 V)
Combiner	ZB4PD1-930W	Mini-Circuits	--------	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	001-0181-008	P. G. Electronics	--------	A181T 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
½ Wave Dipole	SEXE	Sinclabs	--------	½ Wave Dipole Antenna

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,
Weston, Ontario
M9M 2Z8

P. G. Electronics has been granted equipment authorization on the Model A181 by the FCC (FCC ID: NKV801, file number: 31010/EQU 17.9). The A181T RF circuitry is identical to that of the A181 but makes use of SMR band diplexers instead of cellular band diplexers. The amplifier stages are identical and thus the RF performance is identical in the applicable frequency band. The two units differ only in operating frequencies.

All tests described herein were performed in the company laboratory using the test arrangements shown with the test equipment listed in section 3.0.

4.0 CONCLUSIONS

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