TEST REPORT
FOR FCC TYPE ACCEPTANCE
MODEL R280C-A
BIDIRECTIONAL CELLULAR REPEATER
FCC ID: P6T804

TEST REPORT

P. G. Electronics, Ltd. is pleased to submit this technical report on tests performed on the Model R280C-A bidirectional repeater (FCC ID: P6T804) 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 R280C-A Serial Number 100111

_____ Date _____
Paul Liber – Test Engineer

_____ Date _____
Gerry Graham – P. Eng. President

1.0 NAMES AND ADDRESSES

1.1 Manufacturer

The Model R280C-A bidirectional repeater (FCC ID: P6T804) 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 repeater is:

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

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.

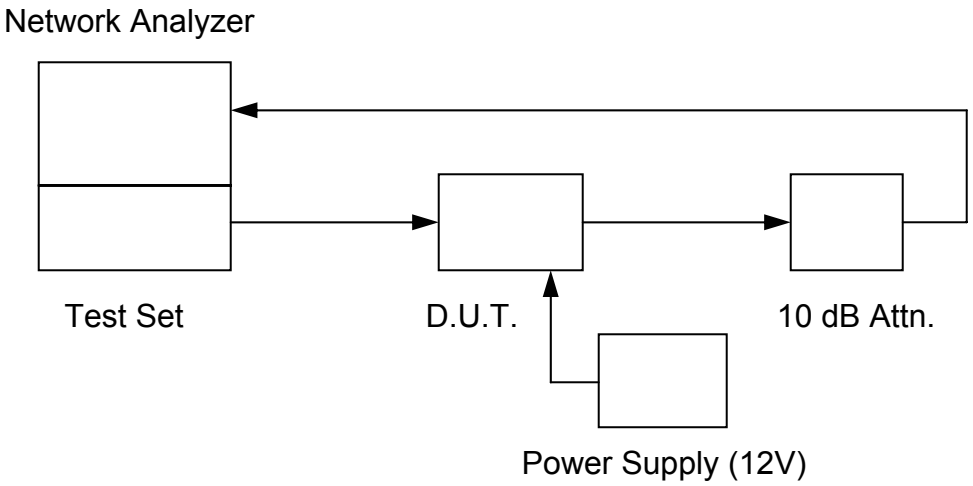
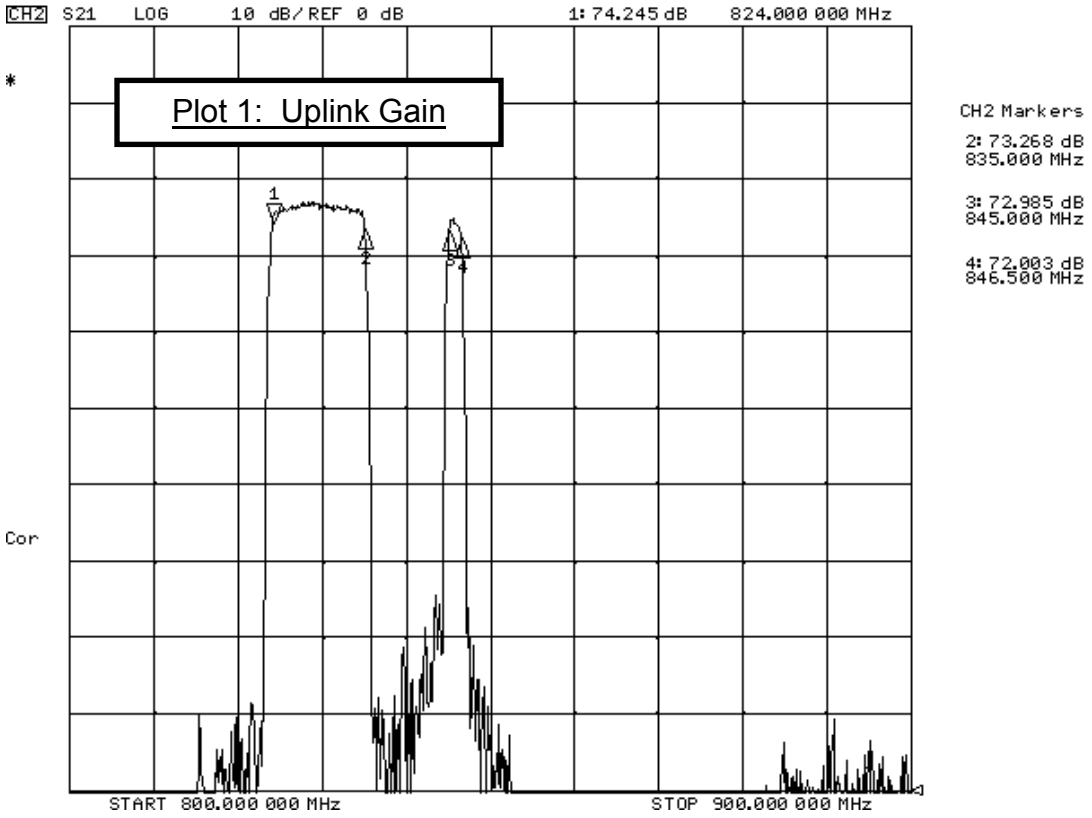
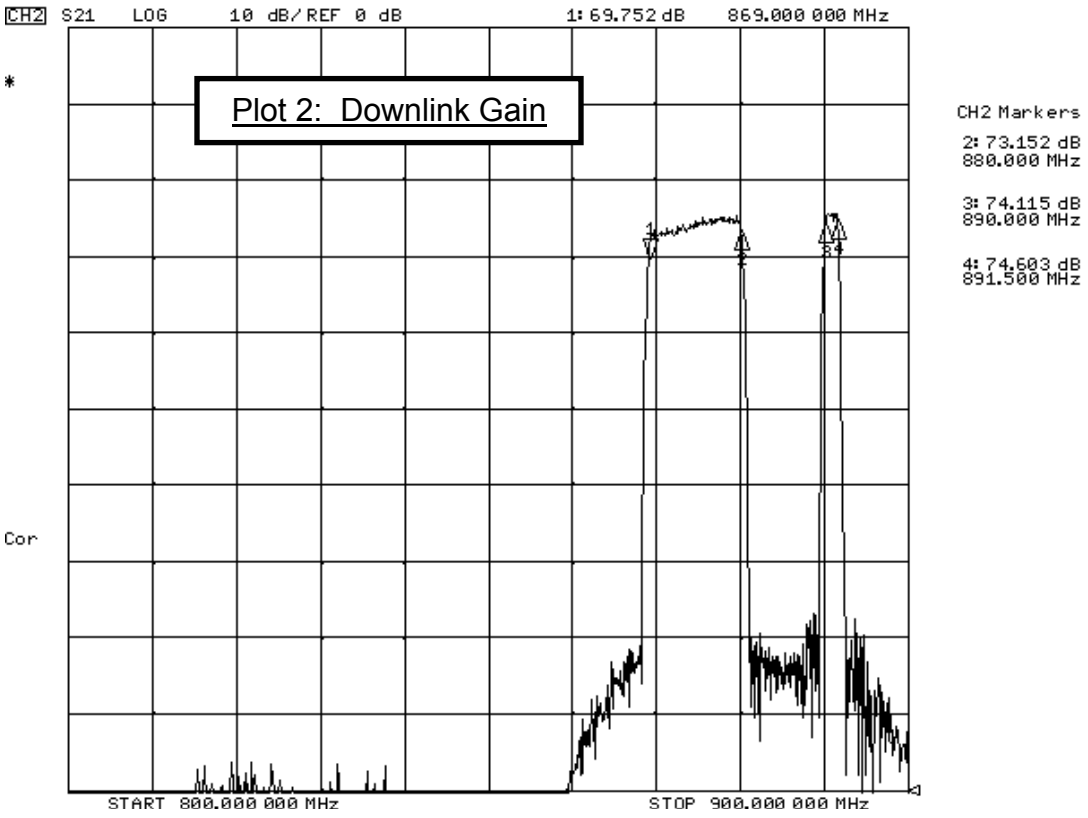


Figure 2.1-1

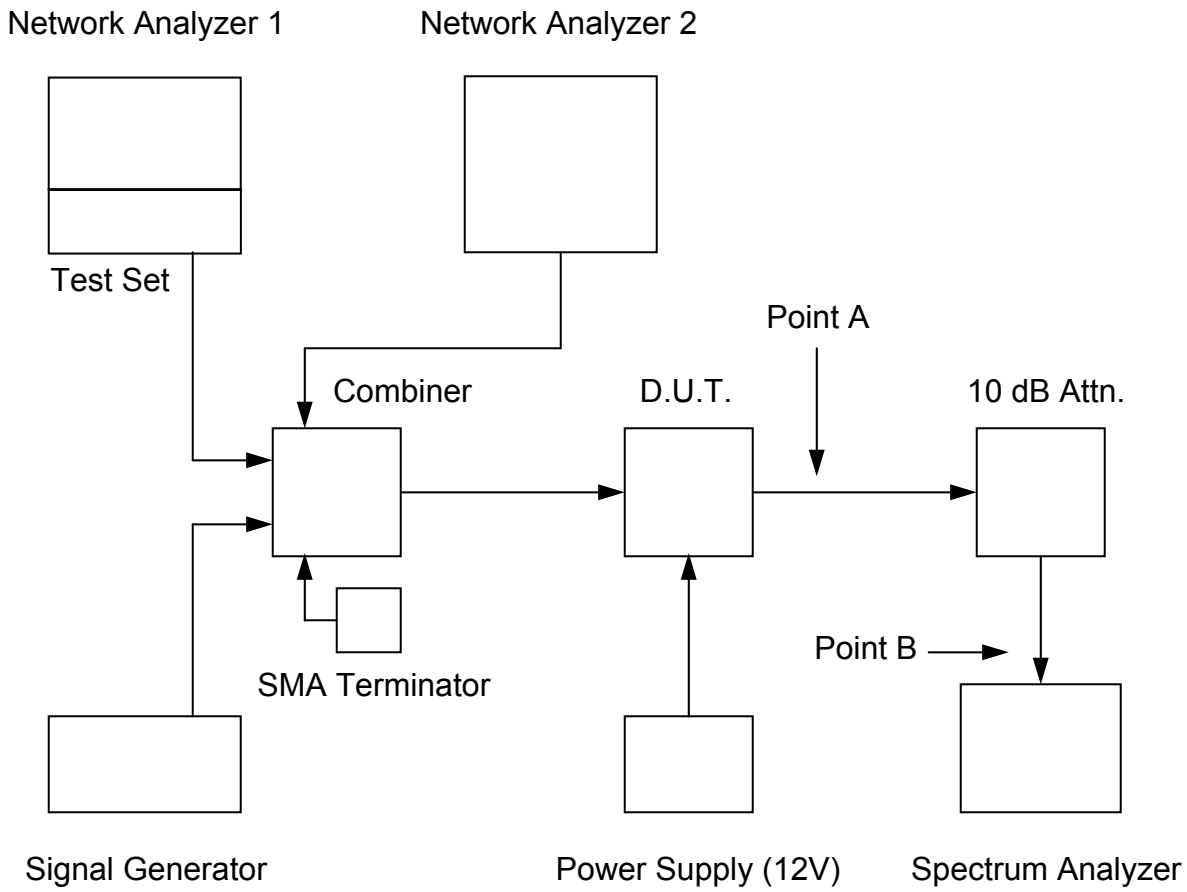
The unit gain was measured for both directions (uplink and downlink). These results are shown in Plot 1 and Plot 2 that follow.


CH2 S21 LOG 10 dB/ REF 0 dB
1: 74.245 dB
824.000 000 MHz
Plot 1: Uplink Gain
CH2 Markers
2: 73.268 dB
835.000 MHz
3: 72.985 dB
845.000 MHz
4: 72.003 dB
846.500 MHz
Cor
START 800.000 000 MHz
STOP 900.000 000 MHz


CH2 S21 LOG 10 dB/ REF 0 dB
1: 69.752 dB
869.000 000 MHz
Plot 2: Downlink Gain
CH2 Markers
2: 73.152 dB
880.000 MHz
3: 74.115 dB
890.000 MHz
4: 74.603 dB
891.500 MHz
Cor
START 800.000 000 MHz
STOP 900.000 000 MHz

2.2 Intermodulation and Spurious

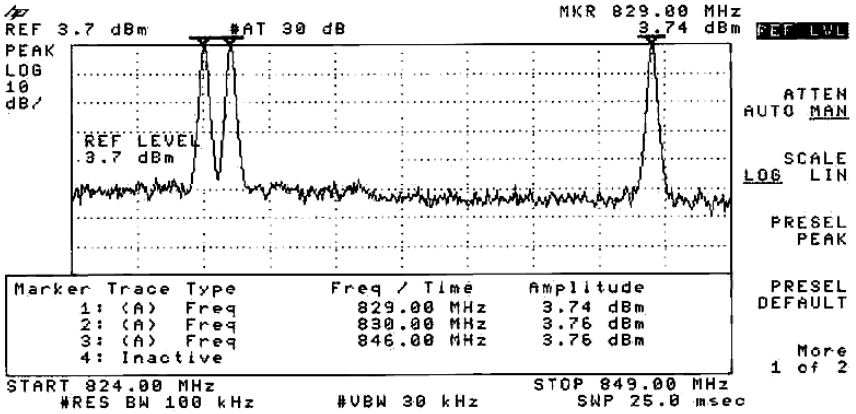
Intermodulation and spurious products were measured with the repeater operating at the maximum total rated power level specified in the Operator's Manual (Refer to TM0054 exhibit provided.). A three tone test was conducted using the equipment test arrangement in Figure 2.2-1 below with the input power levels adjusted to give the rated output power of +14.2 dBm for each tone (+19 dBm total inband power). The Network Analyzers were used as signal sources. The 10.5 dB loss to the spectrum analyzer results in tone levels of +3.7 dBm into the instrument.



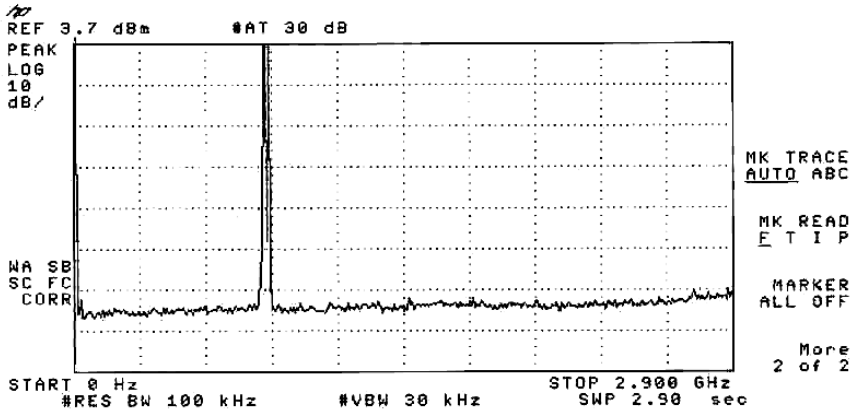
***Note**: Loss from Point A (D.U.T. output) to Point B (Spectrum Analyzer input) was 10.5 dB. This includes the loss of the 10 dB attenuator and cables.

Figure 2.2-1

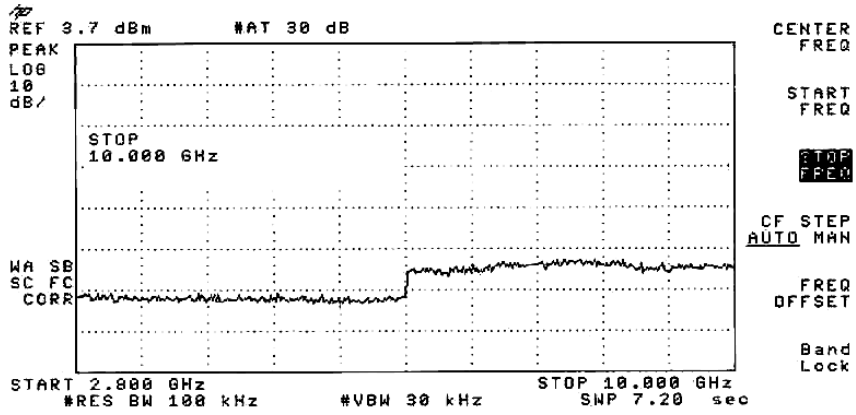
The results of these tests are shown in Plots 3, 4A and 4B that follow with the reference level set at +3.7 dBm. For the uplink direction, in Plot 3 the narrower band setting shows in-band intermodulation products while in Plots 4A and 4B the spectrum outside the cellular band is displayed to show spurious and harmonics. Plots 5, 6A and 6B show the equivalent results for the downlink direction.



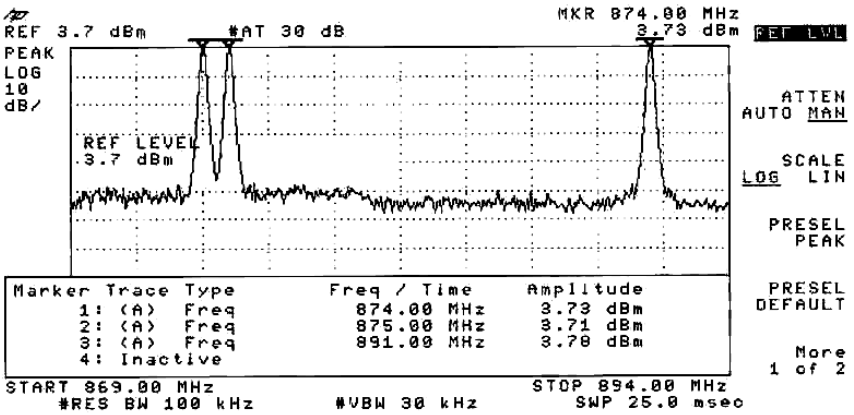
Plot 3: Uplink 3-tone Intermodulation (Narrow Sweep)



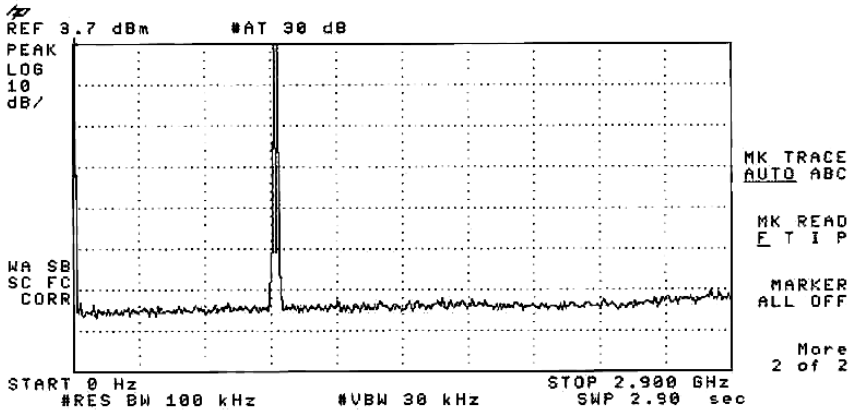
Plot 4A: Uplink 3-tone Intermodulation (Sweep 0 - 2.9 GHz)



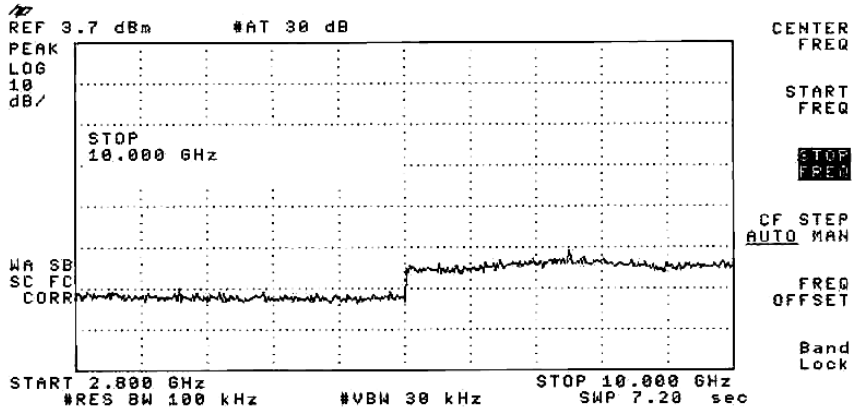
Plot 4B: Uplink 3-tone Intermodulation (Sweep 2.8 - 10 GHz)



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 at least 46 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 repeater.

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.

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

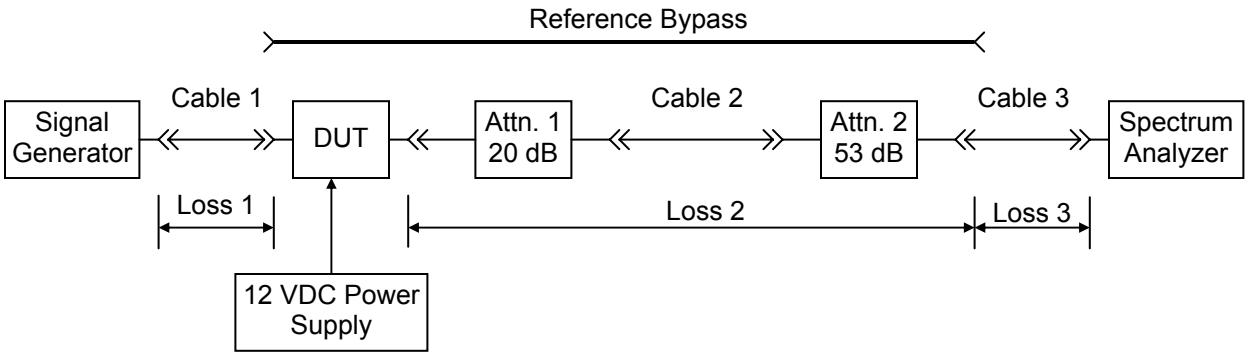


Figure 2.3-1

The following notes apply:

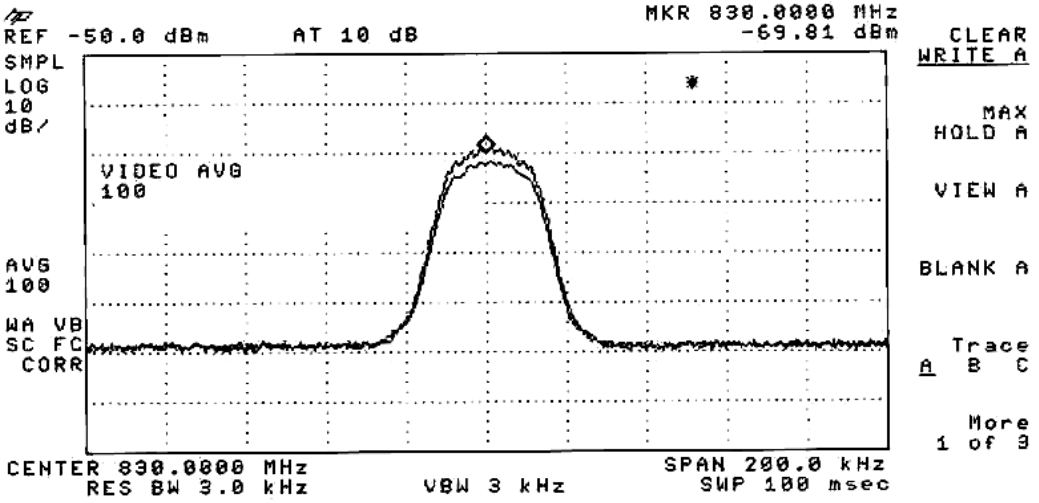
a. Loss 1, loss 2 and loss 3 are measured at the test frequency.

   Loss 1 = 0.6 dB (Cable 1)
   Loss 2 = 75 dB (Attn. 1 + Cable 2 + Attn. 2)
   Loss 3 = 0.6 dB (Cable 3)

b. Signal generator set to test frequency and desired modulation. Amplitude set to DUT maximum rated output level minus 75 dB (DUT gain) plus Loss 1. Therefore, to obtain +19 dBm at the output of the DUT requires a Generator level of: +19 dBm (test level) – 75 dB (DUT gain) + 0.6 dB (Loss 1) = -55.4 dBm.

c. The DUT output level is equal to the spectrum analyzer level + Loss 2 + Loss 3; which is the spectrum analyzer level + 75.6 dB.

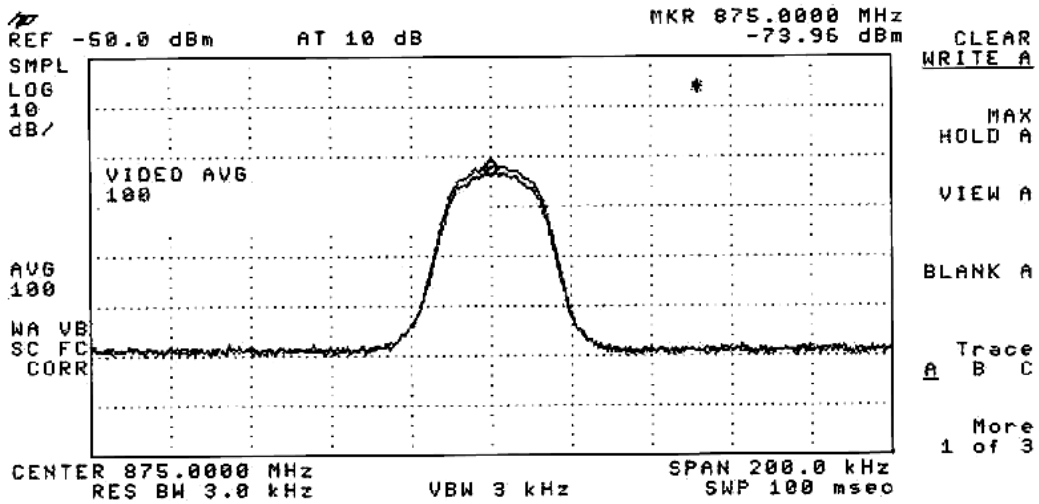
The results of these tests are shown in Plots 7 through 14 that follow. Plots 7 and 8 show results for AMPS modulation, Plots 9 and 10 show results for for NADC modulation, Plots 11 and 12 show results for GSM modulation, and Plots 13 and 14 show results for CDMA modulation.



Plot 7: Uplink AMPS Modulated Channel Test

Input Level = -56 dBm
Deviation = 12KHz
Video Averaging = ON

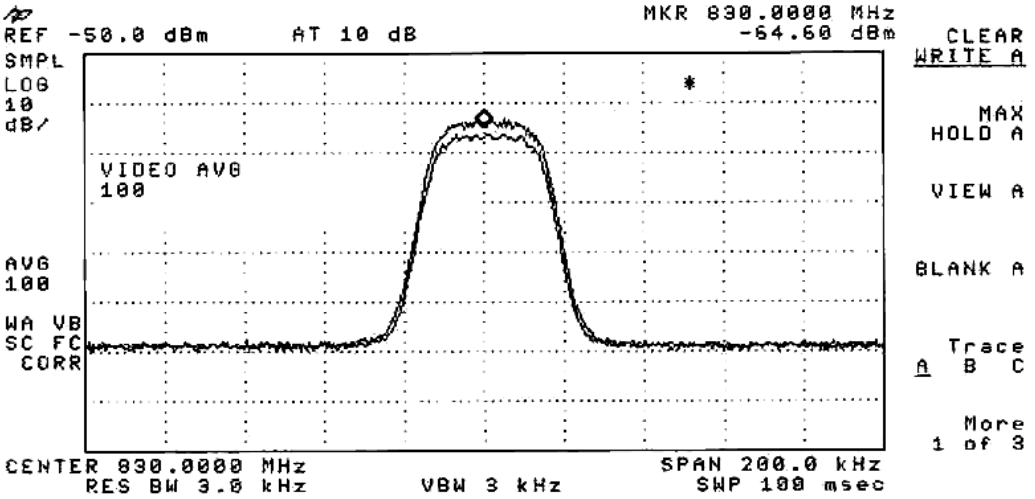
Modulation = 1KHz FM
Span =200 KHz



Plot 8 Downlink AMPS Modulated Channel Test

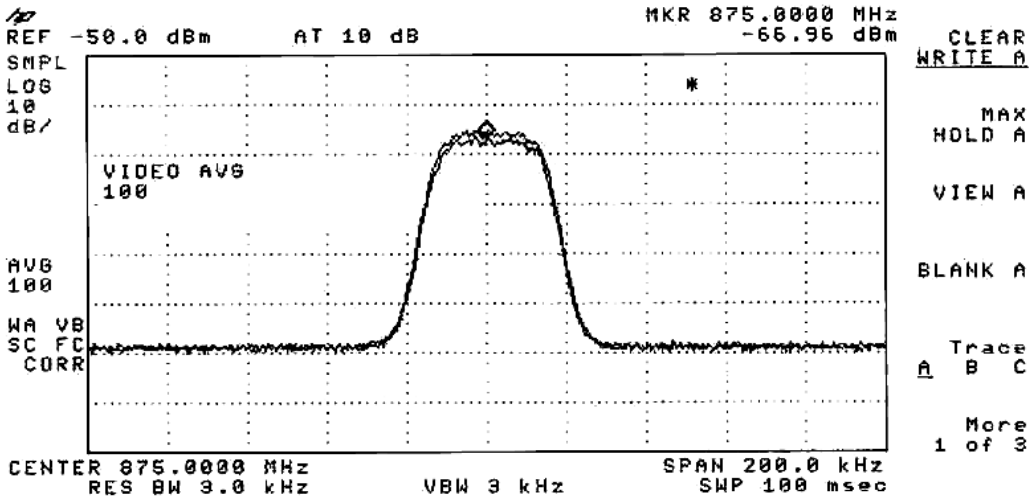
Input Level = -56 dBm
Deviation = 12KHz
Video Averaging = ON

Modulation = 1KHz FM
Span =200 KHz



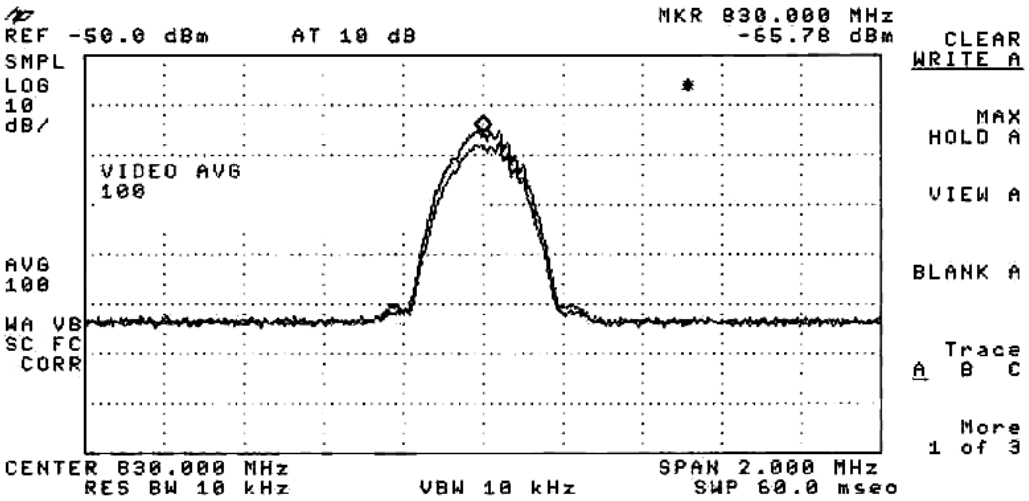
Plot 9: Uplink NADC Modulated Channel Test

Input Level = -56 dBm Modulation = NADC
Span =200 KHz Video Averaging = ON



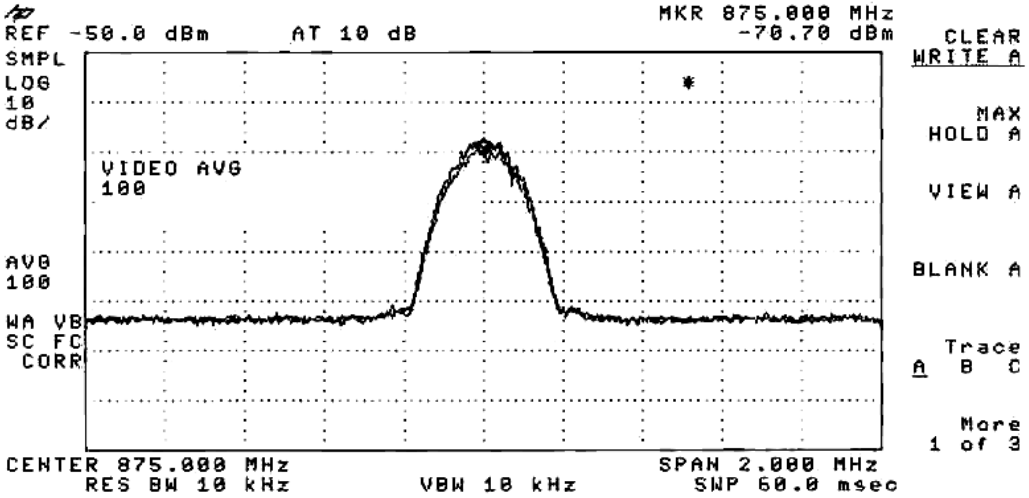
Plot 10 Downlink NADC Modulated Channel Test

Input Level = -56 dBm Modulation = NADC
Span = 200 KHz Video Averaging = ON



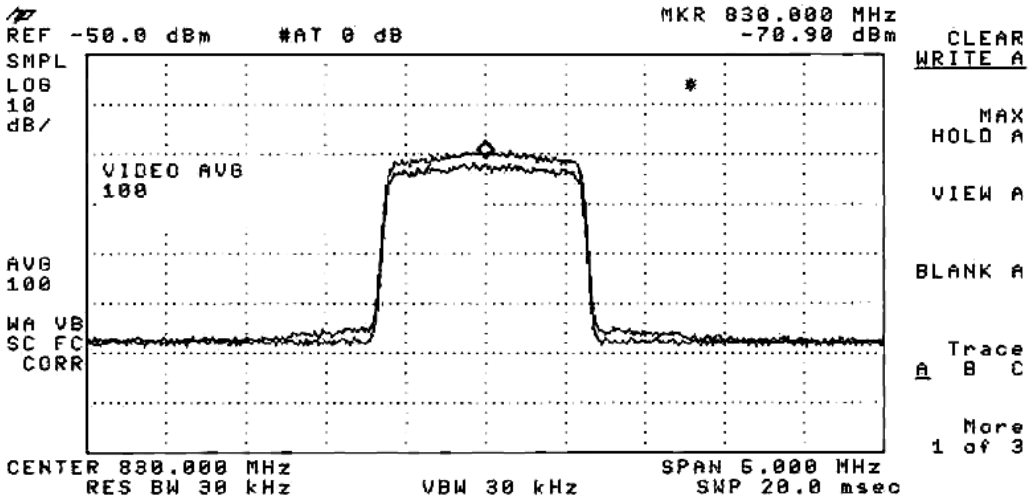
Plot 11 Uplink GSM Modulated Channel Test

Input Level = -56 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON



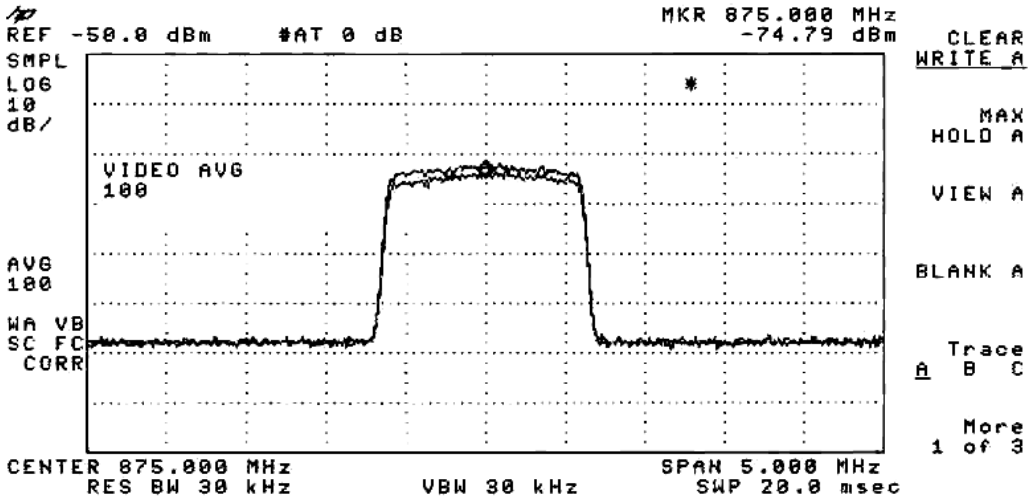
Plot 12: Downlink GSM Modulated Channel Test

Input Level = -56 dBm Modulation = GSM
Span = 2 MHz Video Averaging = ON



Plot 13 Uplink CDMA Modulated Channel Test

Input Level = -56 dBm Modulation = CDMA
Span = 5 MHz Video Averaging = ON



Plot 14: Downlink CDMA Modulated Channel Test

Input Level = -56 dBm Modulation = CDMA
Span = 5 MHz Video Averaging = ON

The results for AMPS at the rated output level show no measurable distortion visible on the spectrum analyzer.

Similarly, the results for NADC at the rated output level show no measurable distortion visible on the spectrum analyzer.

Similarly, the results for GSM show no measurable distortion visible on the spectrum analyzer.

The uplink result for CDMA modulation at the rated output level (Plot 13) shows maximum uplink adjacent channel distortion at a level of –29.4 dBm (spectrum analyzer level plus Loss 2 plus Loss 3, which is –105 dBm + 75 dB + 0.6 dB = -29.4 dBm.) Since the carrier output level is +19 dBm, the adjacent channel distortion is +19 dBm – (–29.4 dBm) = 48.4 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 -11 dBW (+ 19 dBm), then the required attenuation is 43 dB – 11 = 32 dB. Thus the DUT is compliant.

The downlink result for CDMA modulation shows no measurable distortion visible on the spectrum analyzer.

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.

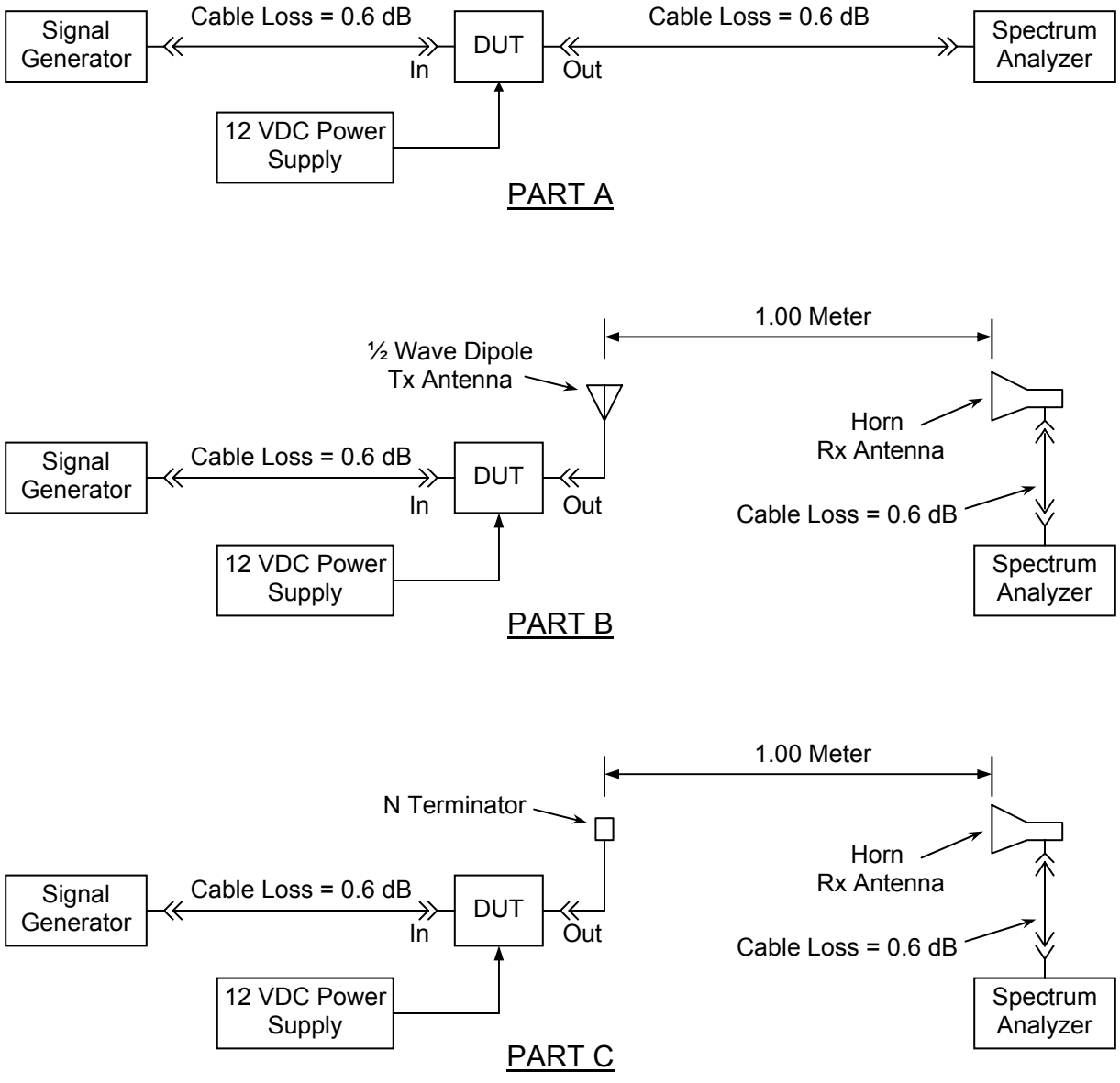


Figure 2.4-1

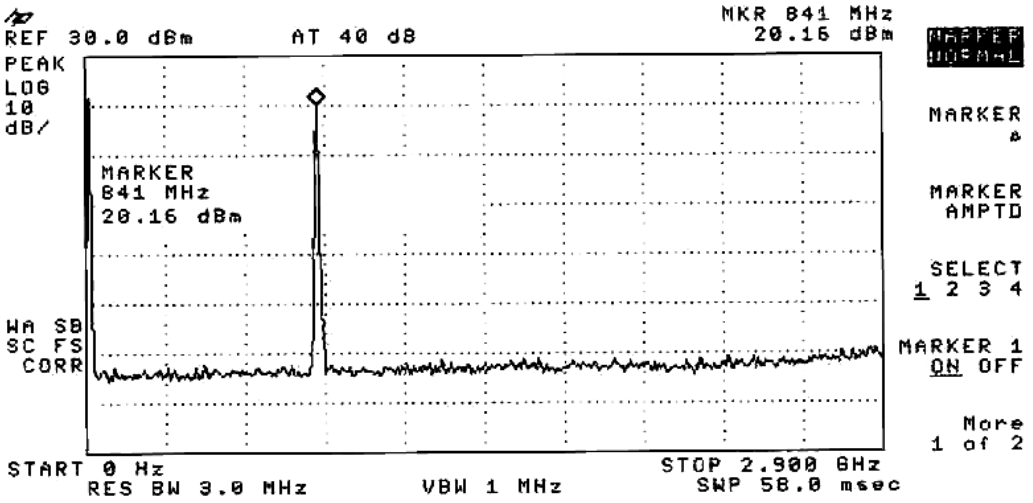
Part A: Antenna Terminal Emissions

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 uplink direction for each of AMPS, NADC, GSM and CDMA type modulations.

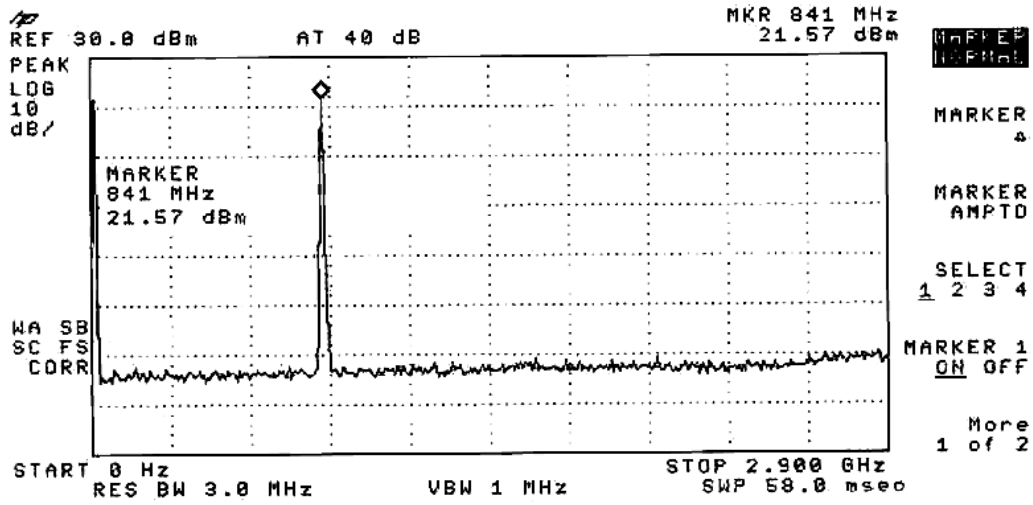
The results are plotted in two overlapping bands 0 – 2.9 GHz and 2.8 – 20 GHz and are shown in Plots 15 through 22 on the following pages.

The test was repeated for the downlink direction for each of AMPS, NADC, GSM and CDMA type modulations. The results are shown in Plots 23 through 30 on the following pages.



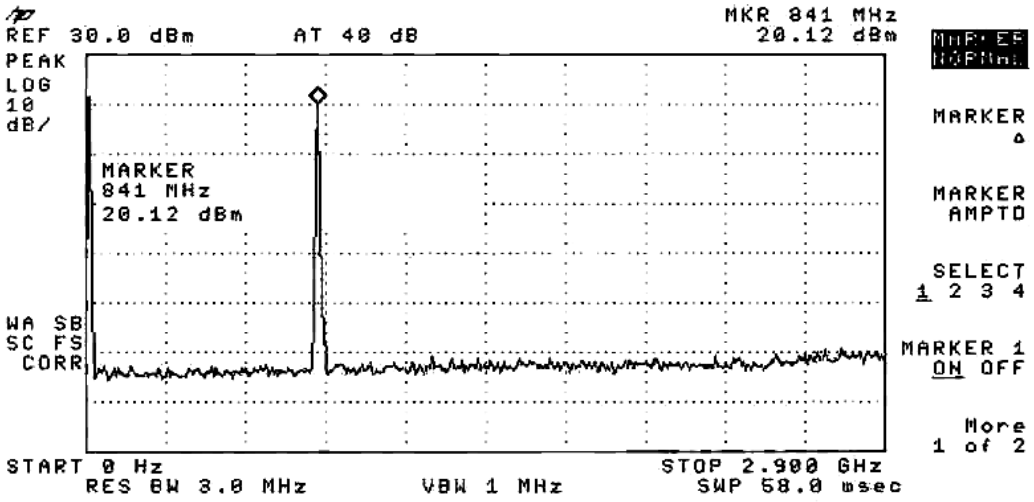
Plot 15: Uplink Antenna Terminal Emissions (AMPS Modulation)

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 0 – 2.9 GHz



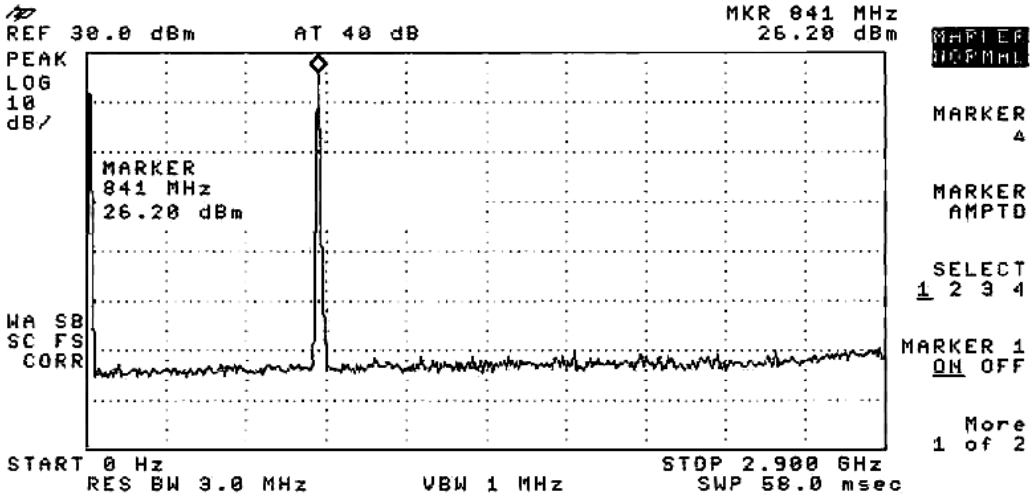
Plot 16: Upink Antenna Terminal Emissions (NADC Modulation)

Input Level = -56 dBm Modulation = NADC
Span = 0 – 2.9 GHz



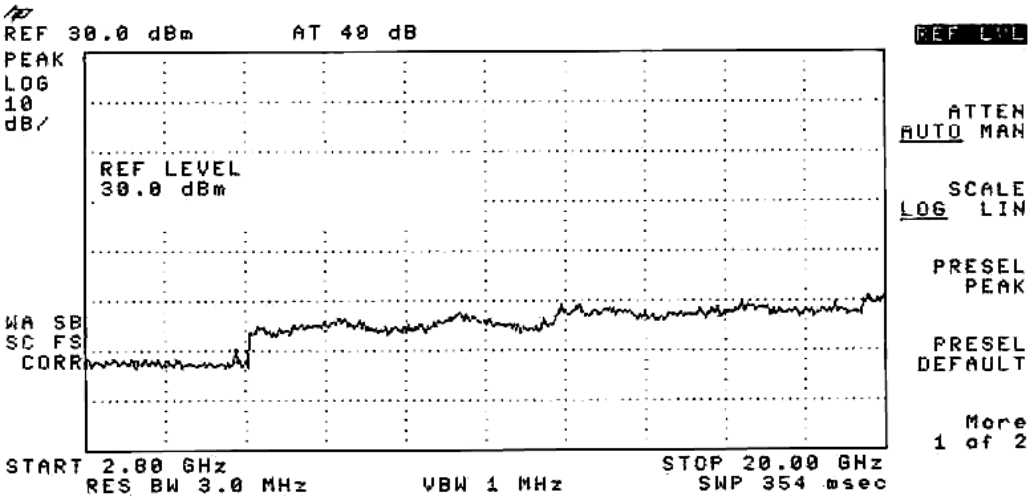
Plot 17: Uplink Antenna Terminal Emissions (GSM Modulation)

Input Level = -56 dBm Modulation = GSM
Span = 0 – 2.9 GHz



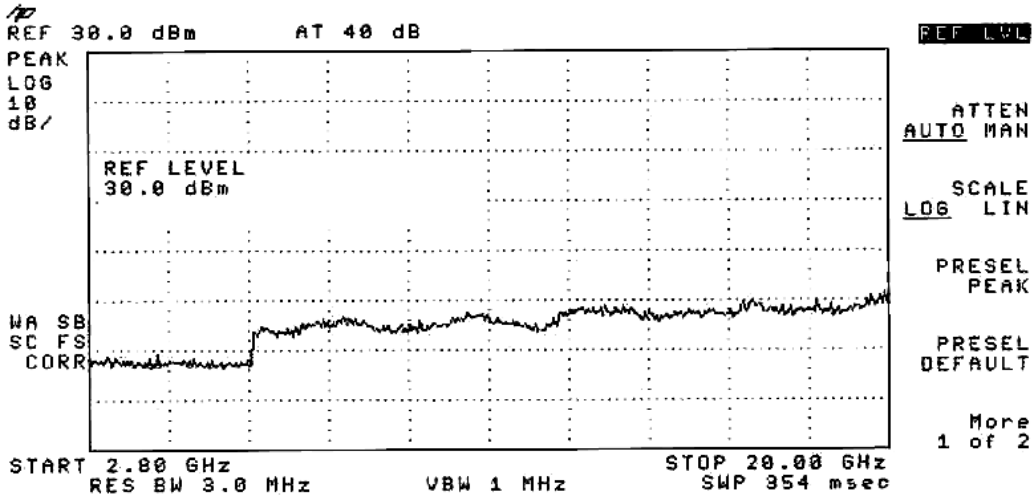
Plot 18: Upink Antenna Terminal Emissions (CDMA Modulation)

Input Level = -56 dBm Modulation = CDMA
Span = 0 – 2.9 GHz



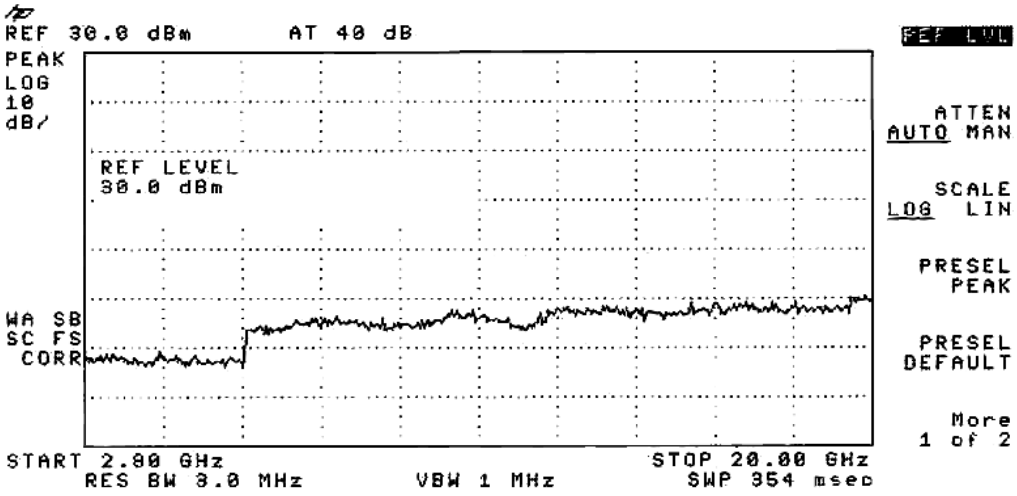
Plot 19: Uplink Antenna Terminal Emissions (AMPS Modulation)

Input Level = -56 dBm Modulation = 1KHz
Deviation = 12KHz Span = 2.8 – 20 GHz



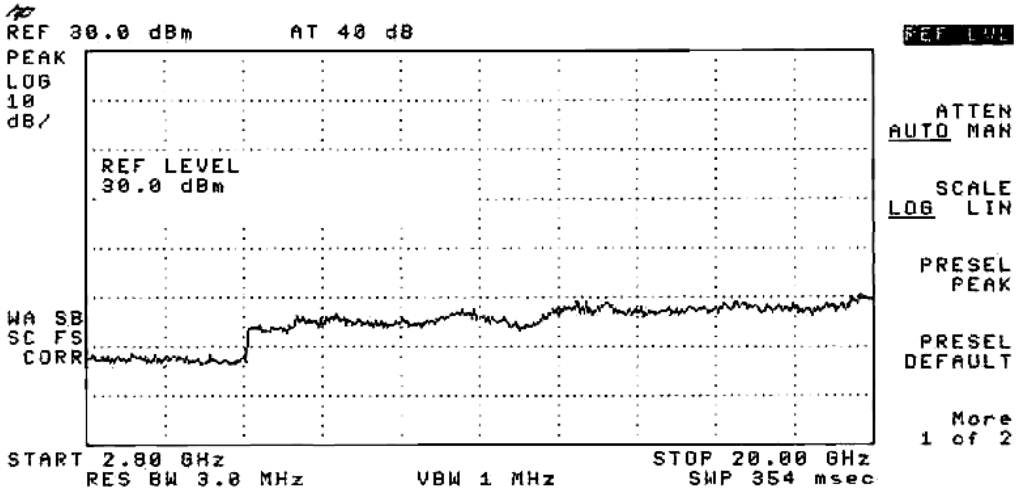
Plot 20: Upink Antenna Terminal Emissions (NADC Modulation)

Input Level = -56 dBm Modulation = NADC
Span = 2.8 – 20 GHz



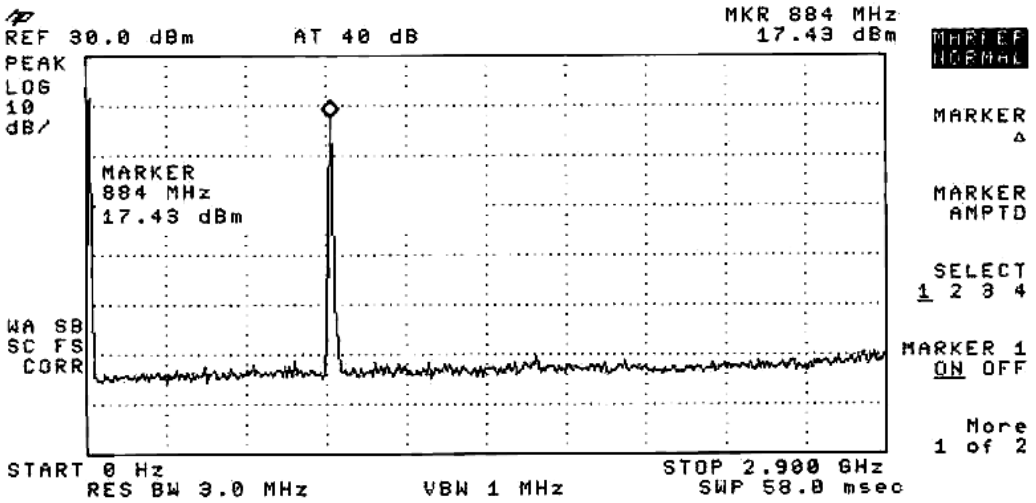
Plot 21: Uplink Antenna Terminal Emissions (GSM Modulation)

Input Level = -56 dBm Modulation = GSM
Span = 2.8 – 20 GHz



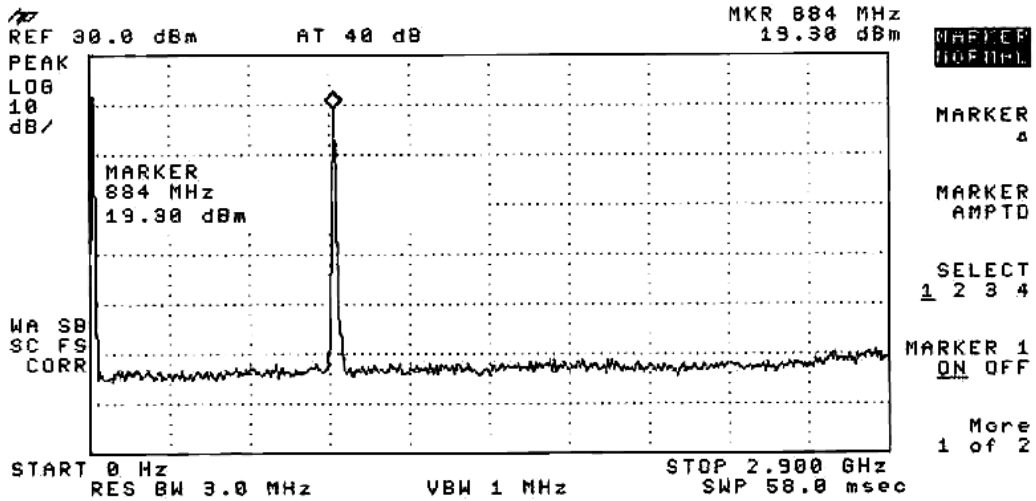
Plot 22: Upink Antenna Terminal Emissions (CDMA Modulation)

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 – 20 GHz



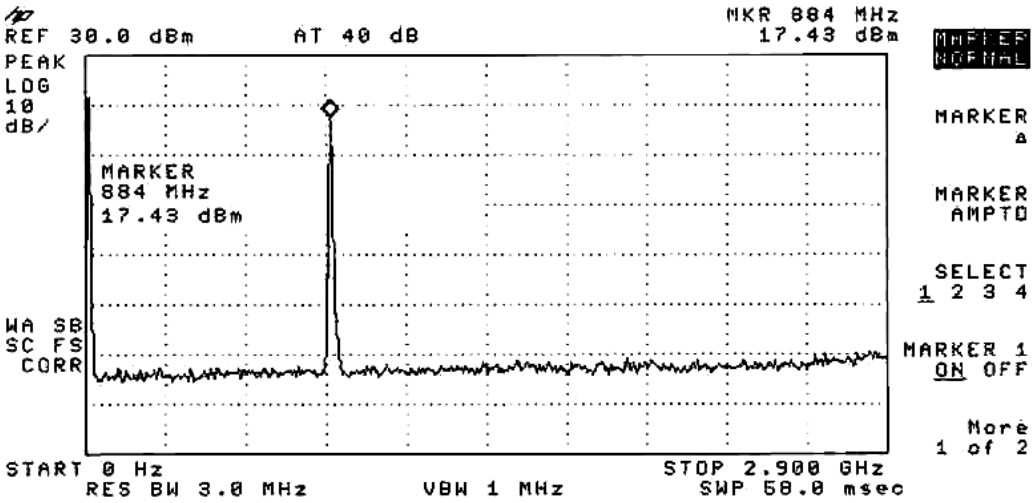
Plot 23: Downlink Antenna Terminal Emissions (AMPS Modulation)

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 0 – 2.9 GHz



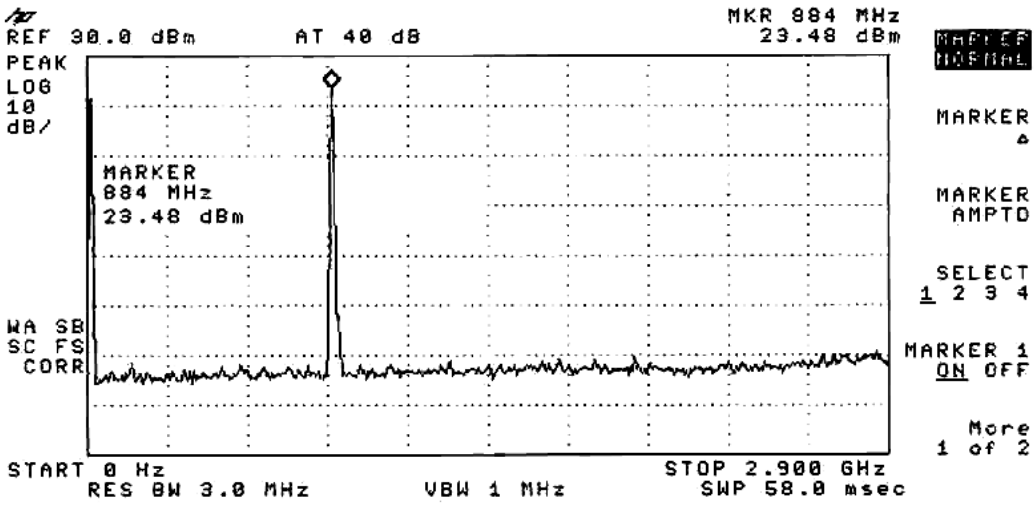
Plot 24: Downlink Antenna Terminal Emissions (NADC Modulation)

Input Level = -56 dBm Modulation = NADC
Span = 0 – 2.9 GHz



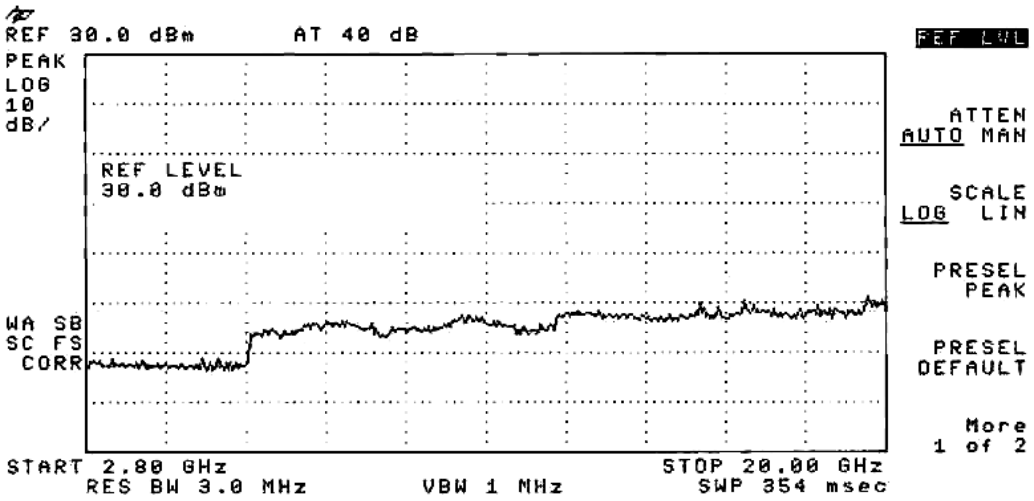
Plot 25: Downlink Antenna Terminal Emissions (GSM Modulation)

Input Level = -56 dBm Modulation = GSM
Span = 0 – 2.9 GHz



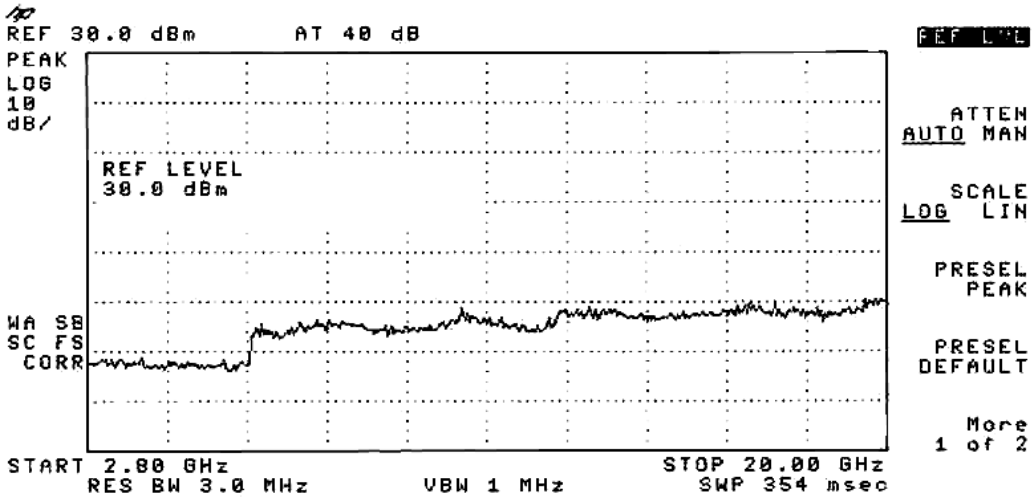
Plot 26: Downlink Antenna Terminal Emissions (CDMA Modulation)

Input Level = -56 dBm Modulation = CDMA
Span = 0 – 2.9 GHz



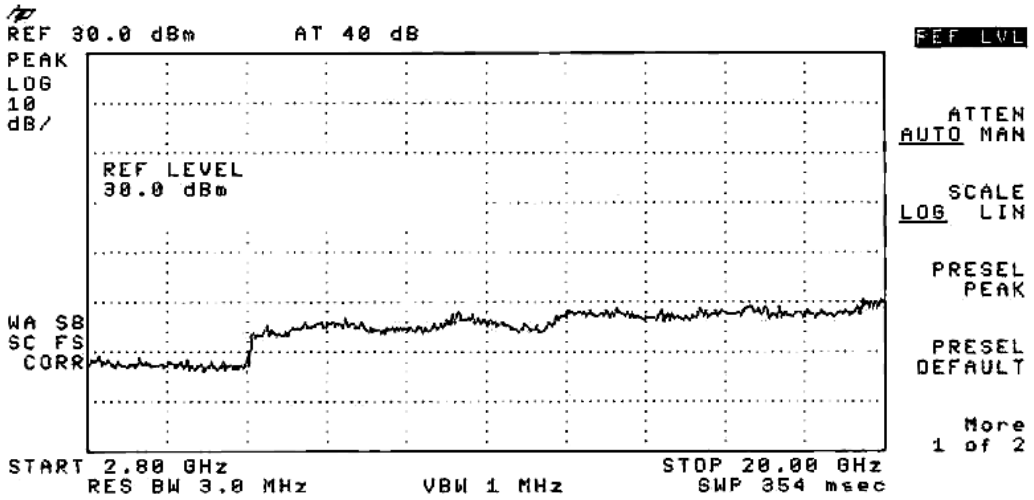
Plot 27: Downlink Antenna Terminal Emissions (AMPS Modulation)

Input Level = -56 dBm Modulation = 1KHz
Deviation = 12KHz Span = 2.8 – 20 GHz



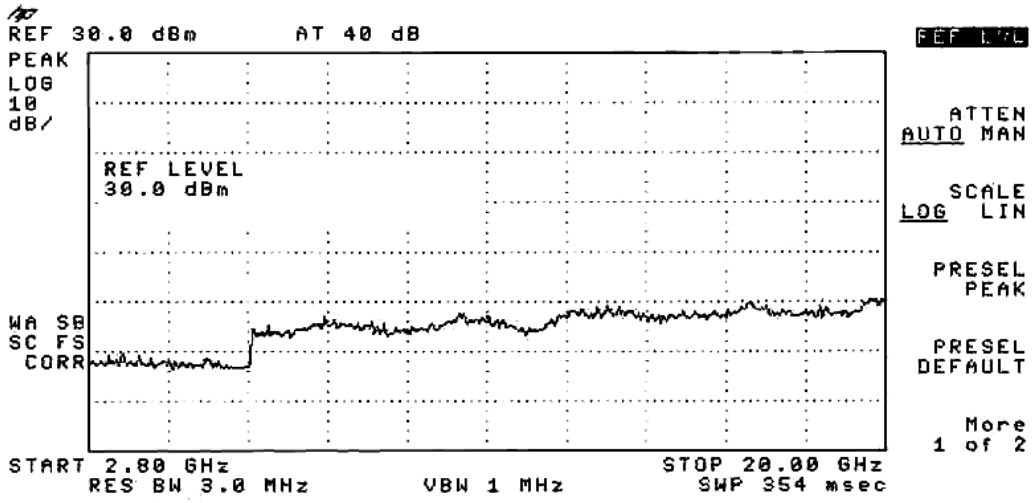
Plot 28: Downlink Antenna Terminal Emissions (NADC Modulation)

Input Level = -56 dBm Modulation = NADC
Span = 2.8 – 20 GHz



Plot 29: Downlink Antenna Terminal Emissions (GSM Modulation)

Input Level = -56 dBm Modulation = GSM
Span = 2.8 – 20 GHz



Plot 30: Downlink Antenna Terminal Emissions (CDMA Modulation)

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 – 20 GHz

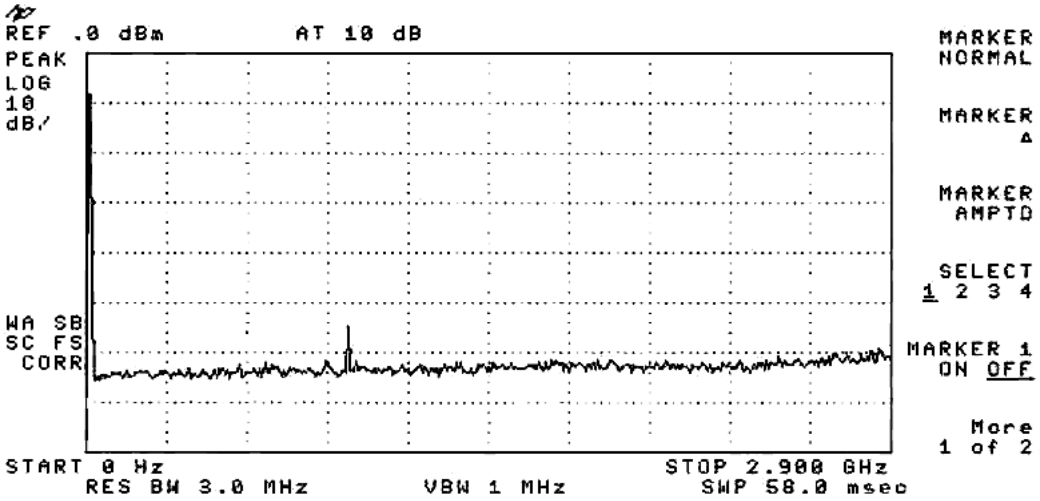
The specification limit for spurious signals is 43 dB + 10 log (P); where P is in watts. For an output signal of +19 dBm, the required spurious to carrier ratio is 32 dB. The results in Plots 15 through 30 show no measurable spurious above the analyzer noise floor of –20 dBm or lower. Thus the unit is 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. Tests were performed for AMPS, NADC, GSM and CDMA modulations. Figure 2.4-1 part B shows the test arrangement.

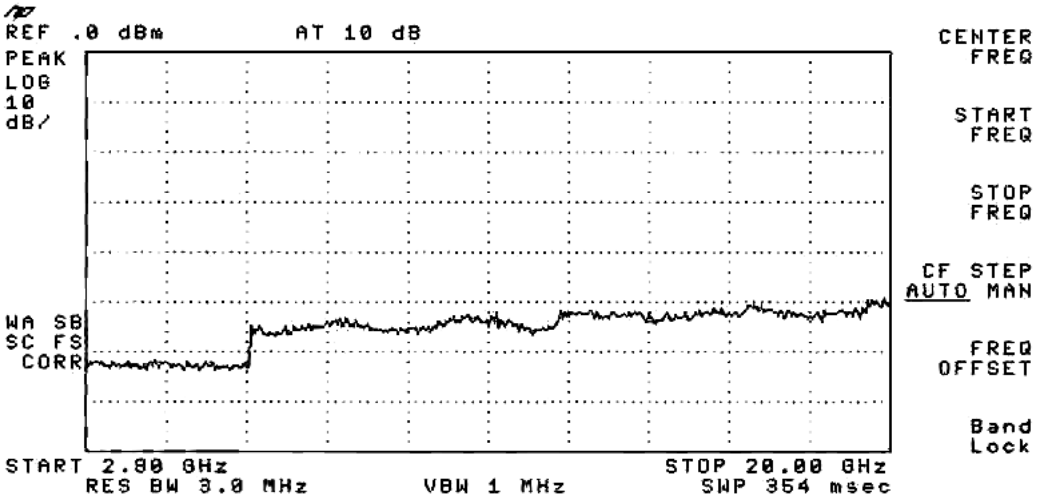
Plots 31 through 48 that follow show the results of the above tests. Plots 31 and 32 show the site background noise. Plots 33 through 36 show the measured uplink radiated signals for each of AMPS, NADC, GSM and CDMA modulations with the DUT connected to a ½ wave dipole antenna over a 0 – 2.9 GHz sweep. Plots 37 through 40 show the measured radiated signals with the DUT connected to a ½ wave dipole antenna over a 2.8 - 20 GHz sweep.

Similarly, for the downlink direction plots 41 through 44 show the measured downlink radiated signals for each of AMPS, NADC, GSM and CDMA modulations with the DUT connected to a ½ wave dipole antenna over a 0 – 2.9 GHz sweep. Plots 45 through 48 show the measured radiated signals with the DUT connected to a ½ wave dipole antenna over a 2.8 - 20 GHz sweep.



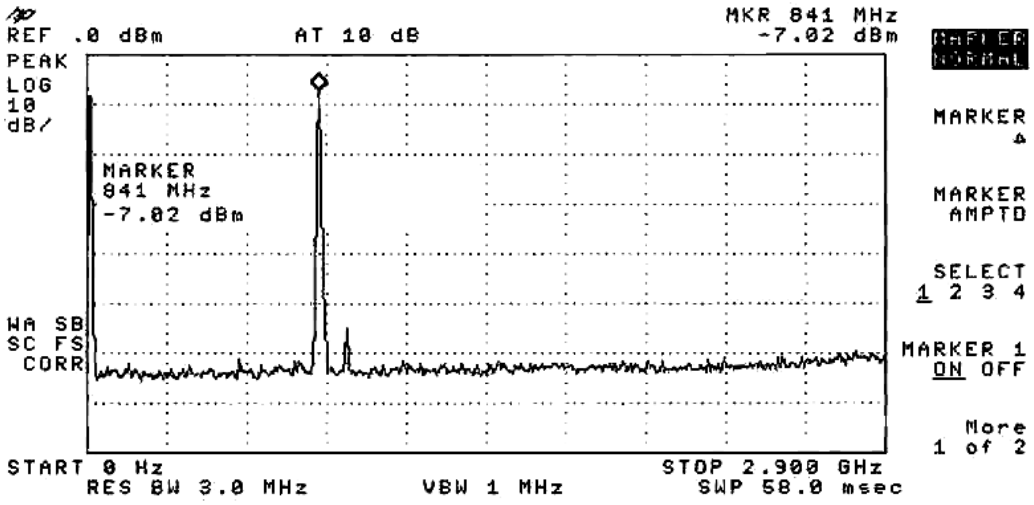
Plot 31 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 0 – 2.9 GHz



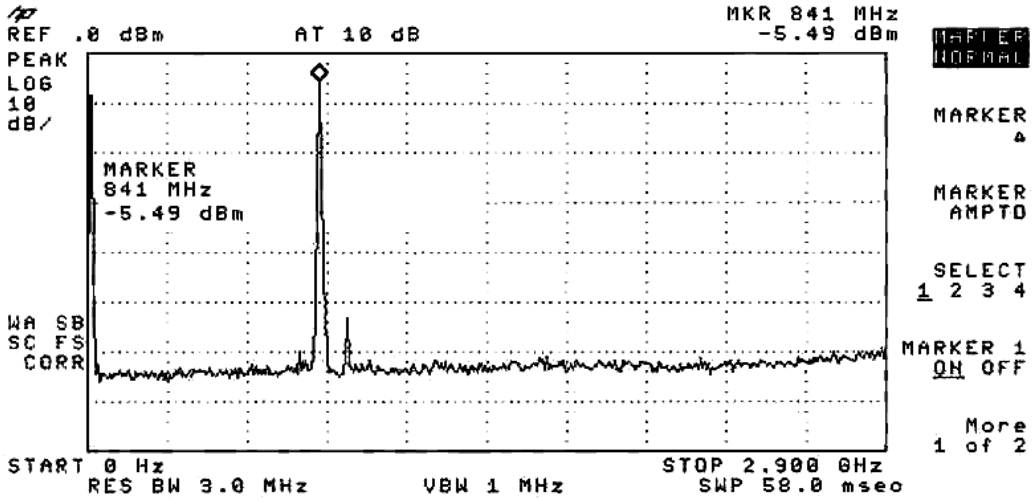
Plot 32 Radiated Spurious – Site Noise (DUT Unpowered)

Span = 2.8 – 20 GHz



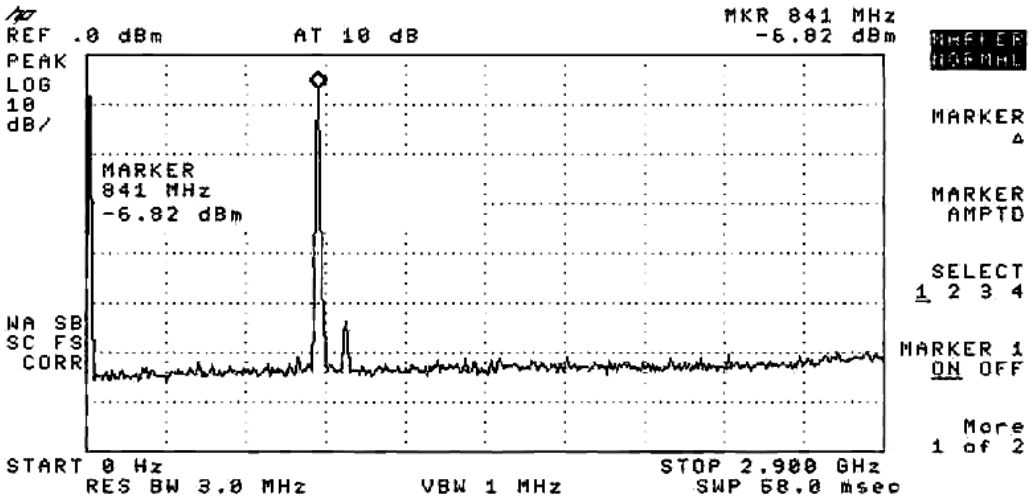
Plot 33 Uplink Radiated Spurious – AMPS Modulation

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 0 – 2.9 GHz



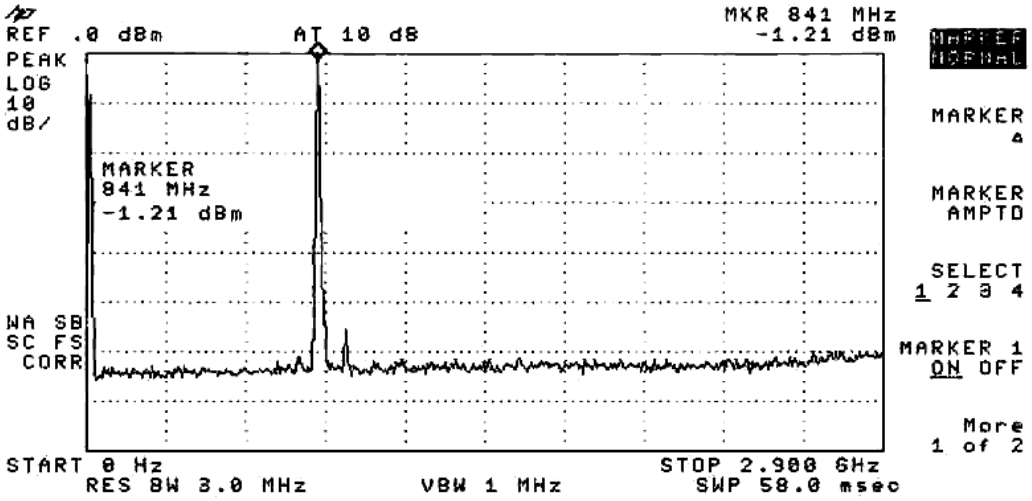
Plot 34 Uplink Radiated Spurious – NADC Modulation

Input Level = -56 dBm Modulation = NADC
Span = 0 - 2.9 GHz



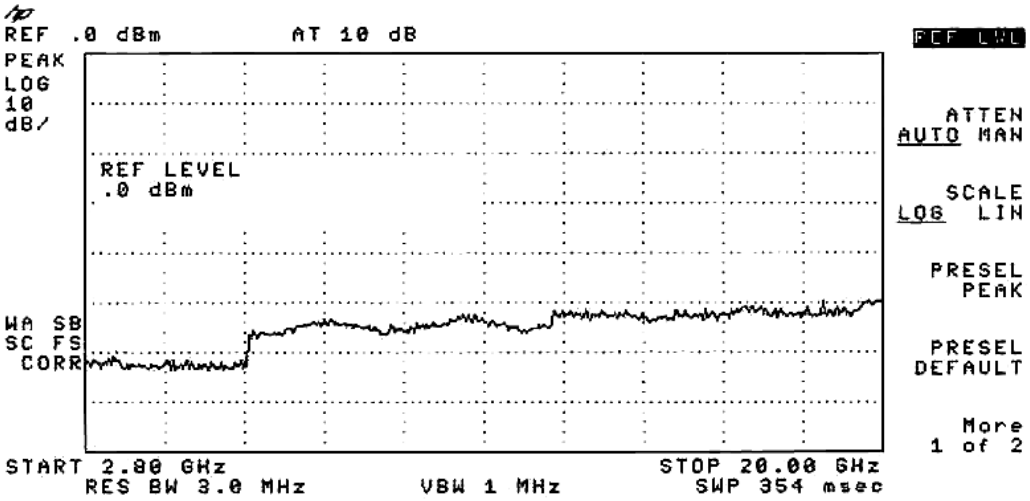
Plot 35 Uplink Radiated Spurious – GSM Modulation

Input Level = -56 dBm Modulation = GSM
Span = 0 - 2.9 GHz



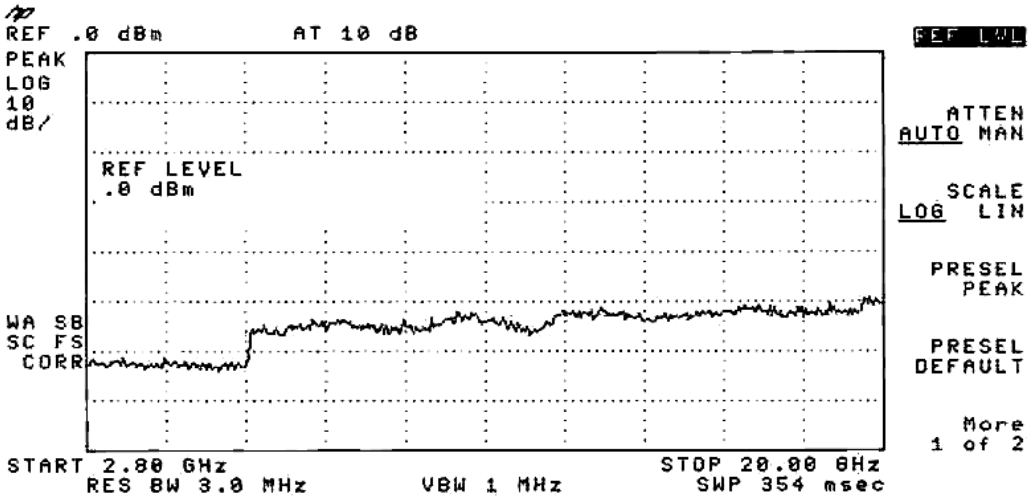
Plot 36 Uplink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 0 - 2.9 GHz



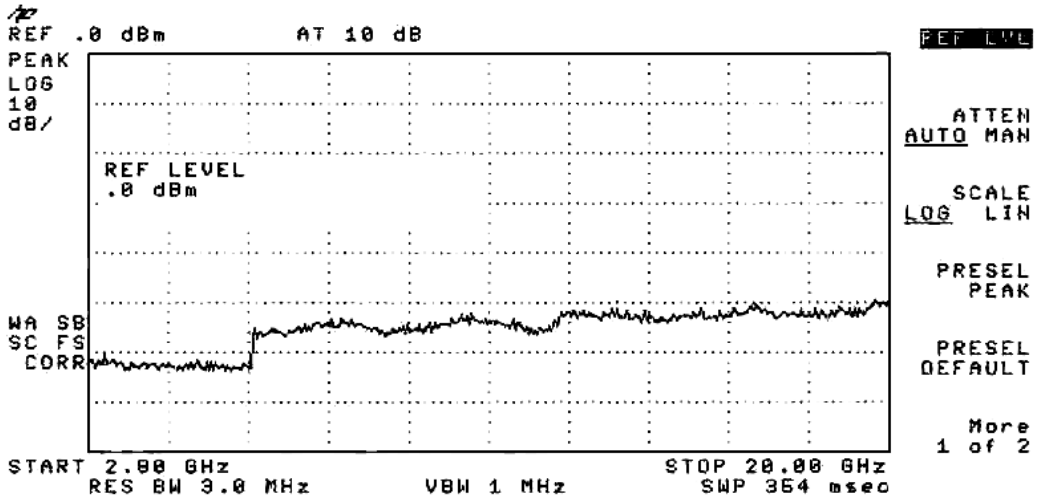
Plot 37 Uplink Radiated Spurious – AMPS Modulation

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 2.8 - 20 GHz



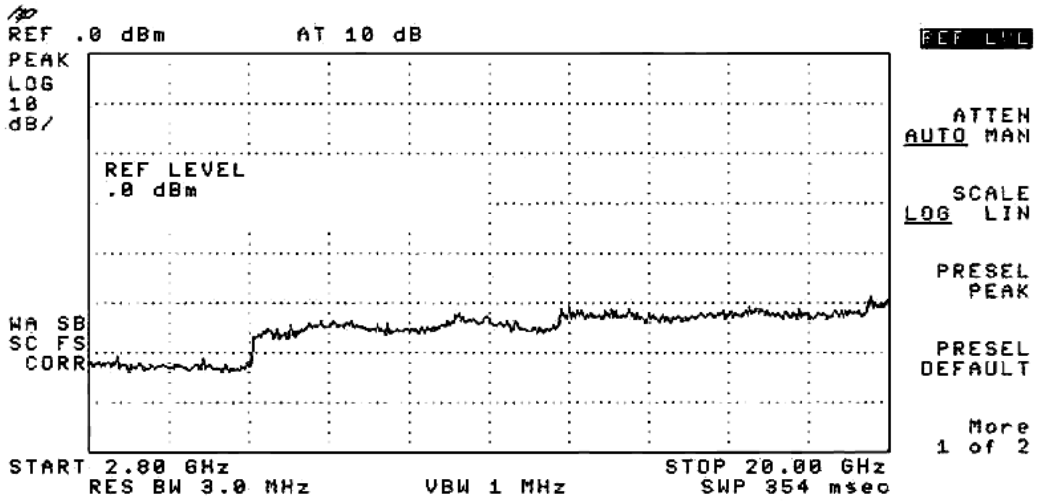
Plot 38 Uplink Radiated Spurious – NADC Modulation

Input Level = -56 dBm Modulation = NADC
Span = 2.8 - 20 GHz



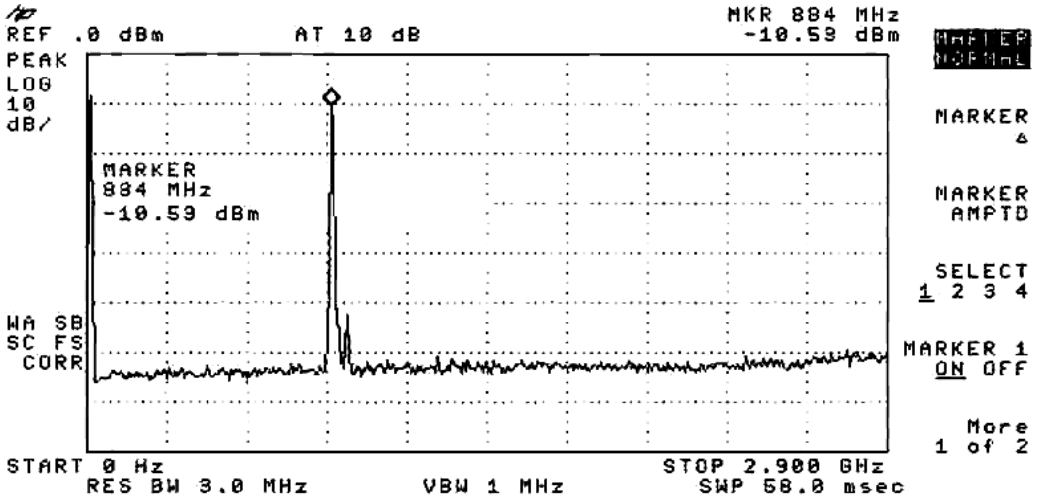
Plot 39 Uplink Radiated Spurious – GSM Modulation

Input Level = -56 dBm Modulation = GSM
Span = 2.8 – 20 GHz



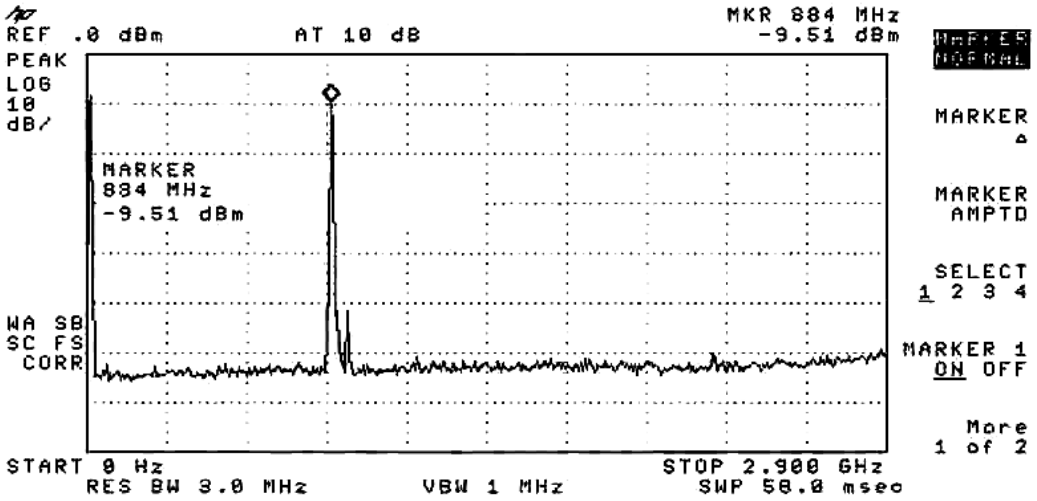
Plot 40 Uplink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 - 20 GHz



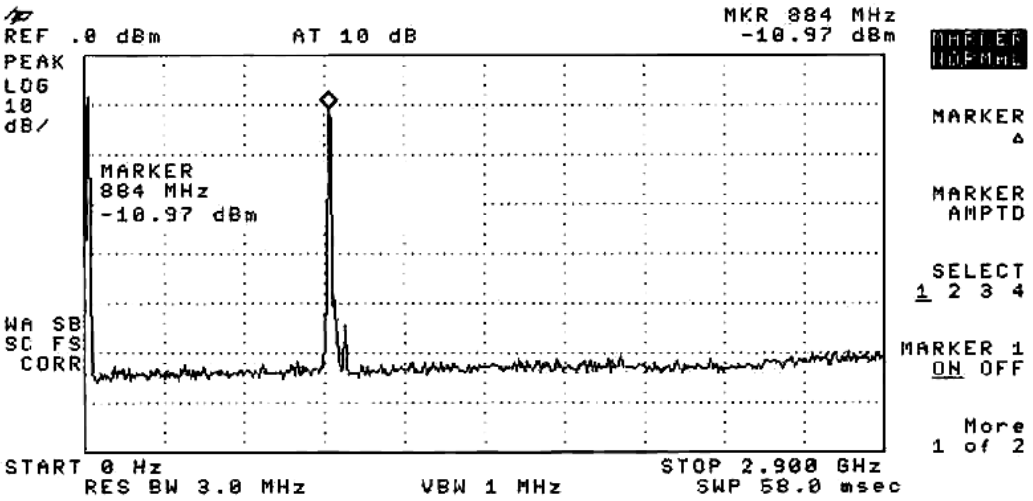
Plot 41 Downlink Radiated Spurious – AMPS Modulation

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 0 – 2.9 GHz



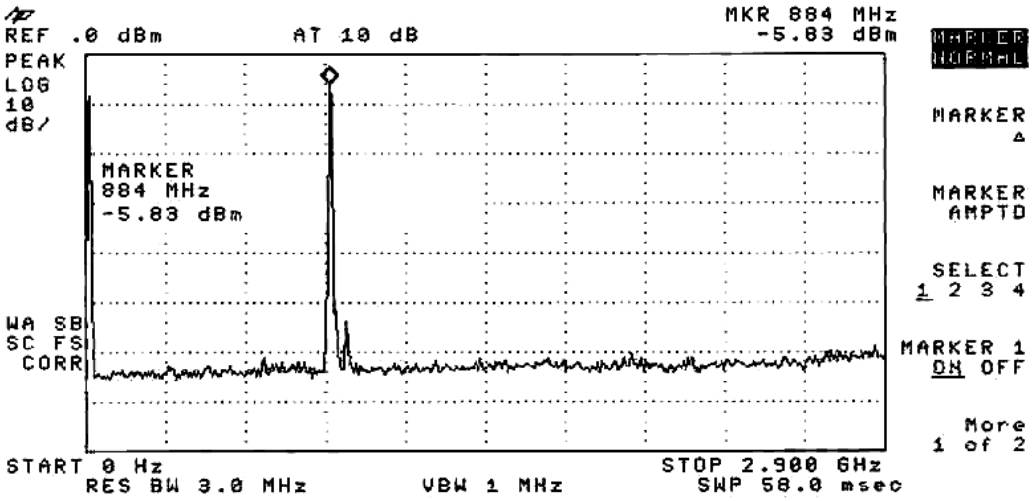
Plot 42 Downlink Radiated Spurious – NADC Modulation

Input Level = -56 dBm Modulation = NADC
Span = 0 - 2.9 GHz



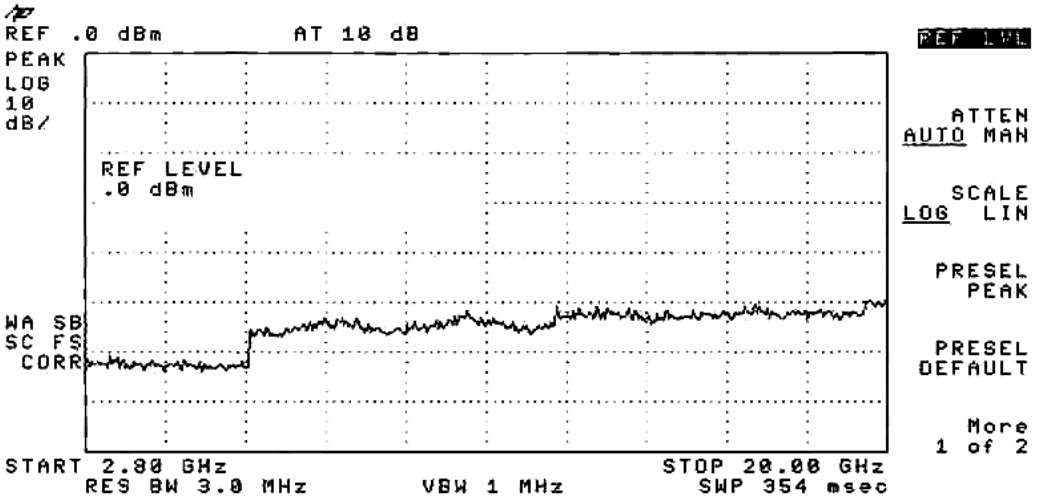
Plot 43 Downlink Radiated Spurious – GSM Modulation

Input Level = -56 dBm Modulation = GSM
Span = 0 - 2.9 GHz



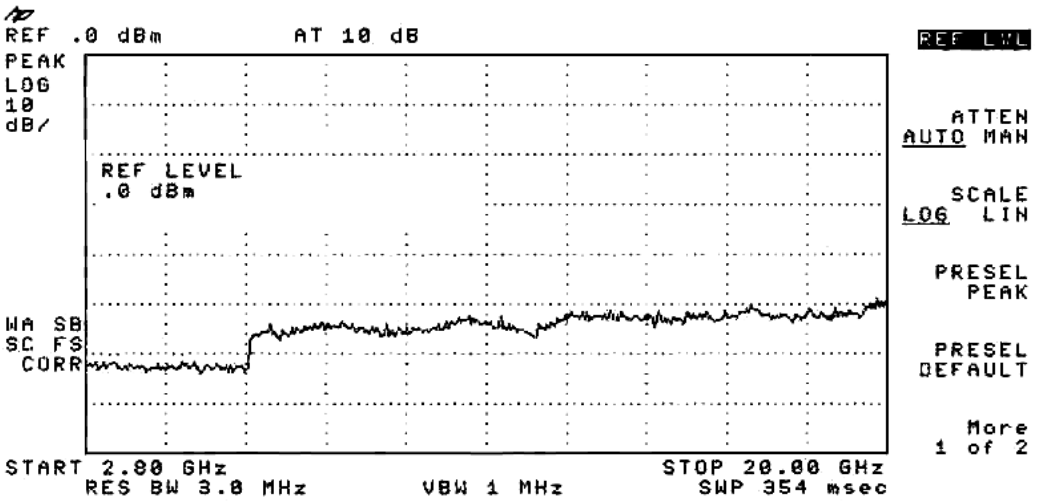
Plot 44 Downlink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 0 - 2.9 GHz



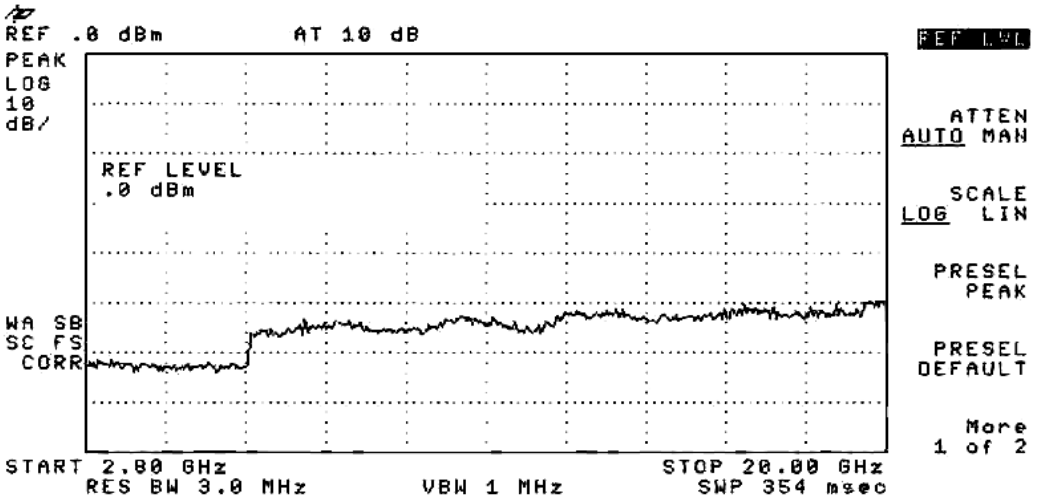
Plot 45 Downlink Radiated Spurious – AMPS Modulation

Input Level = -56 dBm Modulation = 1KHz FM
Deviation = 12KHz Span = 2.8 - 20 GHz



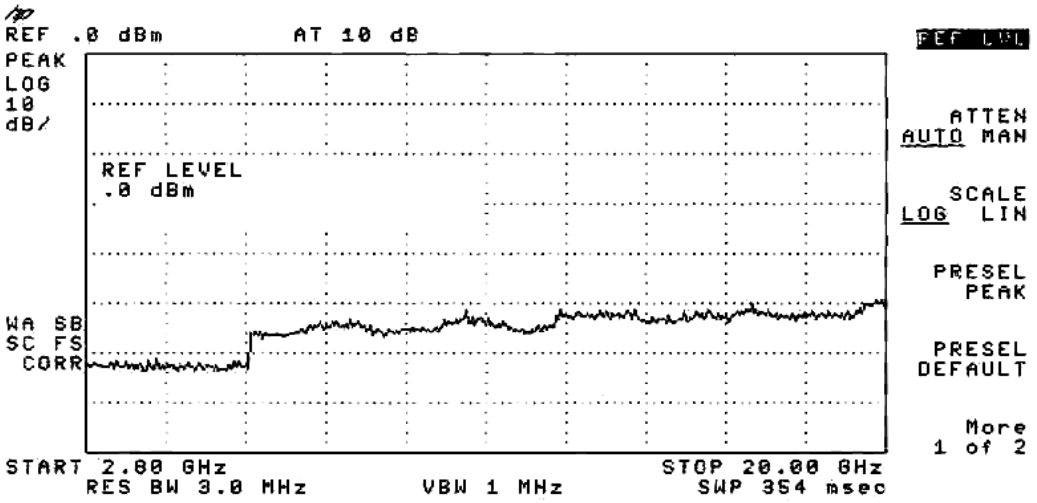
Plot 46 Downlink Radiated Spurious – NADC Modulation

Input Level = -56 dBm Modulation = NADC
Span = 2.8 - 20 GHz



Plot 47 Downlink Radiated Spurious – GSM Modulation

Input Level = -56 dBm Modulation = GSM
Span = 2.8 – 20 GHz



Plot 48 Downlink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 - 20 GHz

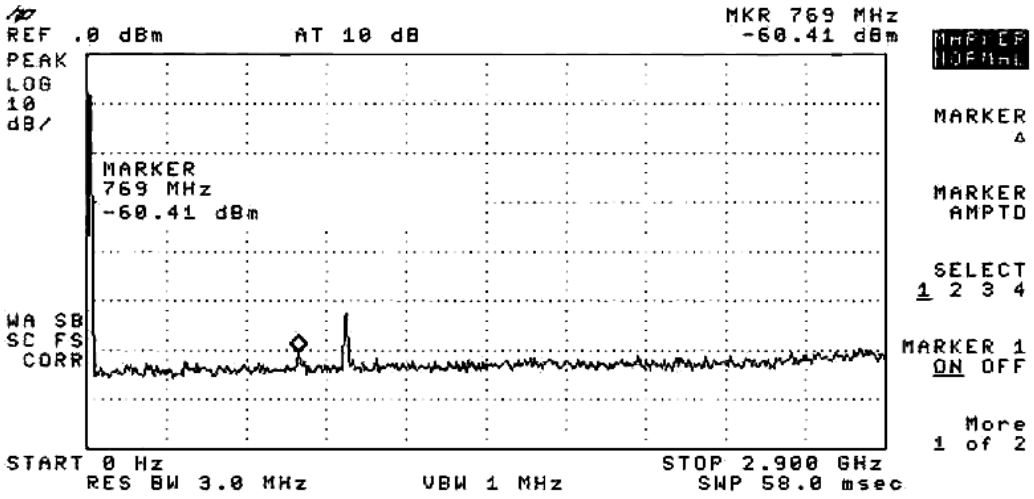
The results in Plots 33 through 48 above show no measurable spurious above the background noise measured in Plots 31 and 32. The test demonstrates that radiated emissions are well below the required level.

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.

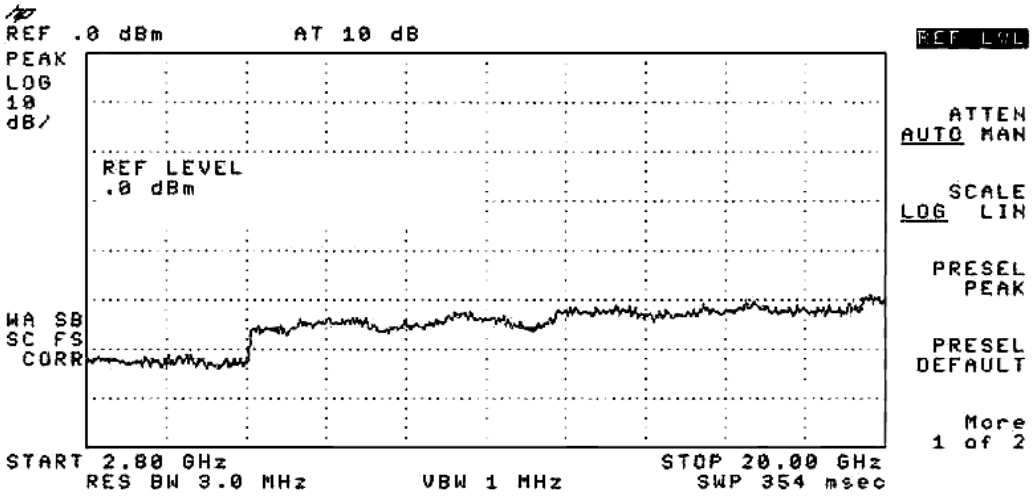
The orientation of the terminated enclosure was varied in order to find the highest radiated signals.

Uplink results are shown in plots 49 and 50 that follow. Downlink results are shown in plots 51 and 52 that follow.



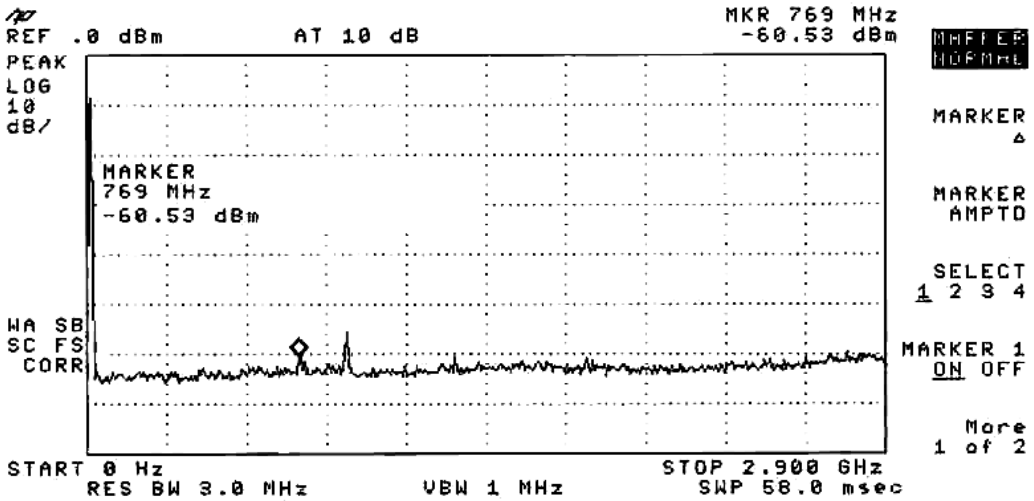
Plot 49 Uplink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 0 – 2.9 GHz



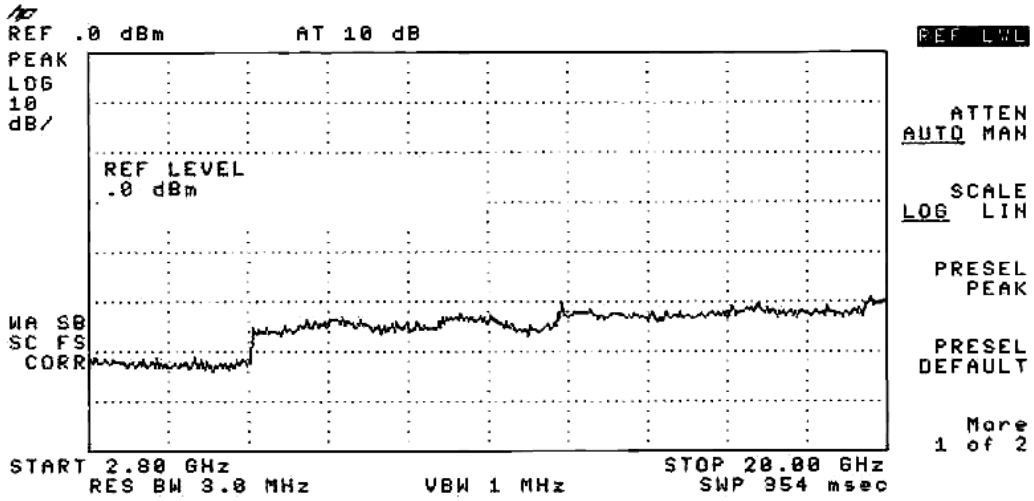
Plot 50 Uplink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 - 20 GHz



Plot 51 Downlink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 0 – 2.9 GHz



Plot 52 Downlink Radiated Spurious – CDMA Modulation

Input Level = -56 dBm Modulation = CDMA
Span = 2.8 - 20 GHz

The highest spurious signal was found to be in Plot 49 at 769 MHz with a level of –60.4 dBm. Any other spurious is below this level.

3.0 TEST EQUIPMENT LIST

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

REFERENCE	PART NUMBER	MANUFACTURER	SERIAL NUMBER	DESCRIPTION
DUT	001-0280-002	P. G. Electronics	100111	R280C-A 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	FWP10012	Elpac		Power Supply (12VDC, 8.3A)
Combiner	2089-6406-00	M/A-COM	--------	Power Divider/Combiner
SMA Terminator	ANNE-50	Mini-Circuits	--------	50 Ohm SMA Terminator
N Terminator	405-1	MECA	--------	50 Ohm N Terminator
10 dB Attn.	771-10	Narda	--------	10dB Attenuator
20 dB Attn.	605-20-1	MECA	--------	20dB Attenuator
53 dB Attn.	5080	Wavetek	17101	Step Attenuator (Set to 53 dB)
Horn Antenna	SAS-299/571	AH Systems	289	Horn Antenna
Tx Antenna	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 previously been granted equipment authorization by the FCC for various units. The most recent unit was the Model R307B Repeater (FCC ID: P6T803).

All tests described herein were performed in the same company laboratory using the similar test arrangements as shown. The test equipment used is listed in section 3.0.

4.0 CONCLUSIONS

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