Certelecom Laboratories Inc.
Safety - EMI - Telecom - ISO Guide 25

CLASS II MODIFICATION

ENGINEERING TEST REPORT

ON:
THE ALLEN TELECOM GROUP, SYSTEMS DIVISION "PMR722CC1 CHANNEL SELECTIVE REPEATER"

FCC ID: BCR9GBPMR722

IN ACCORDANCE WITH:
FCC PART 24, SUBPART E
BROADBAND PCS REPEATERS

PROJECT NO.: 8R00293

TESTED FOR:

ALLEN TELECOM GROUP, SYSTEMS DIVISION
30500 BRUCE INDUSTRAIL PARKWAY
CLEVELAND, OHIO 44139-3996

TESTED BY:

CERTELECOM LABORATORIES INC.
3325 RIVER ROAD, R.R. 5
OTTAWA, ONTARIO K1V 1H2

NVLAP

NVLAP LAB CODE: 100351-0

MAY 1998

This document contains 63 pages including this one.

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Section 1. Summary of Test Results

Manufacturer: Allen Telecom

Model No.: PMR722

Serial No.: None

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 24, Subpart E.

☐ New Submission

☒ Class II Permissive Change

☒ Production Unit

☐ Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

NVLAP

NVLAP LAB CODE: 100351-0

TESTED BY: _____ DATE: 12 May 1998
Tom Tidwell, Senior Technologist

APPROVED BY: _____ DATE: 13 May 1998
W. Waterhouse, RF Engineering Lab Manager

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	2W	Complies
Occupied Bandwidth (CDMA)	24.238	Input/Output	Plot	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	Plot	Complies
Occupied Bandwidth (NADC)	24.238	Input/Output	Plot	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	<-16 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	N/A	N/A
Frequency Stability	24.235		N/A	N/A

Footnotes For N/A's: Since there was no hardware modification, only the tests noted above were performed.

Test Conditions: Temperature: 22 °C
Humidity: 42 %

Section 2. General Equipment Specification

Supply Voltage Input:		120 VAC, 60 Hz
Frequency Range:	**Downlink:**	1930 - 1990 MHz
Frequency Range:	**Uplink:**	1850 - 1910 MHz
20 dB Bandwidth:		5.62 MHz

Type of Modulation and Designator:

CDMA (F9W)	GSM (GXW)	NADC (DXW)
☒	☒	☒

AGC Threshold:		+32 dBm
Output Impedance:		50 ohms
Gain:		55 - 85 dB selected in 2 dB steps
Max Input Power:		N/A
RF Output (Rated):	**Single:**	+33 dBm (1 watt)
	Composite:	+31.1 dBm (NADC)
	Note:	The system is a single channel system except for NADC signals.

Frequency Translation:

F1-F1	F1-F2	N/A
☒	☐	☐

Band Selection:

Software	Duplexer Change	Fullband Coverage
☒	☒	☐

Description of Modifications For Class II Permissive Change

The E.U.T. was modified to extend the frequency operating capability by a change of duplexers which are passive devices. There were no changes to the active circuitry of the device.

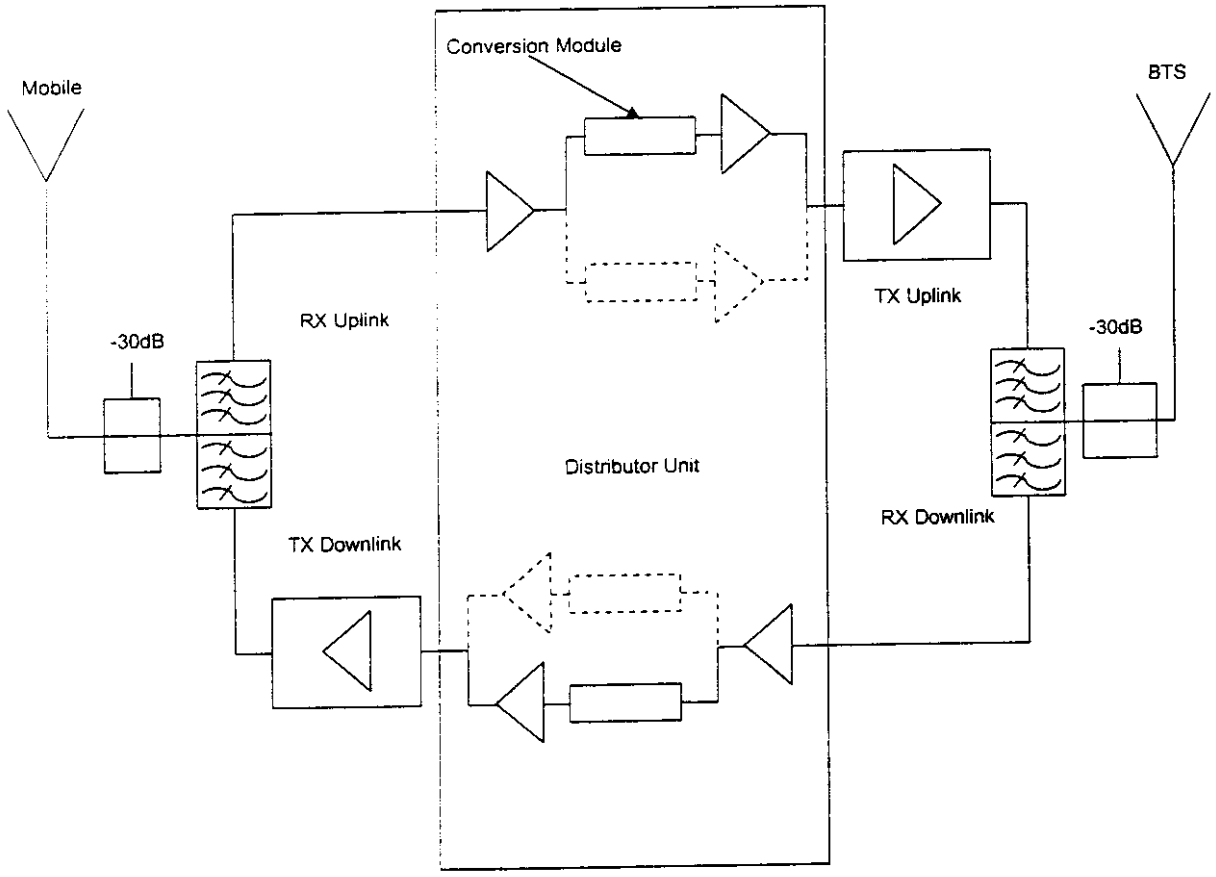
Modifications Made During Testing

Theory of Operation

The repeater consists of two amplifier paths, each of them intended to receive radio signals from an antenna, amplify them and transmit them to another antenna. The conversion modules amplify the received signal and convert them to an intermediate frequency. The signals are then filtered through a highly selective filter state and then sent through a digitally controllable attenuator.

The signal is finally up converted from the IF to the input frequency using the same oscillator as was used for data conversion.

System Diagram



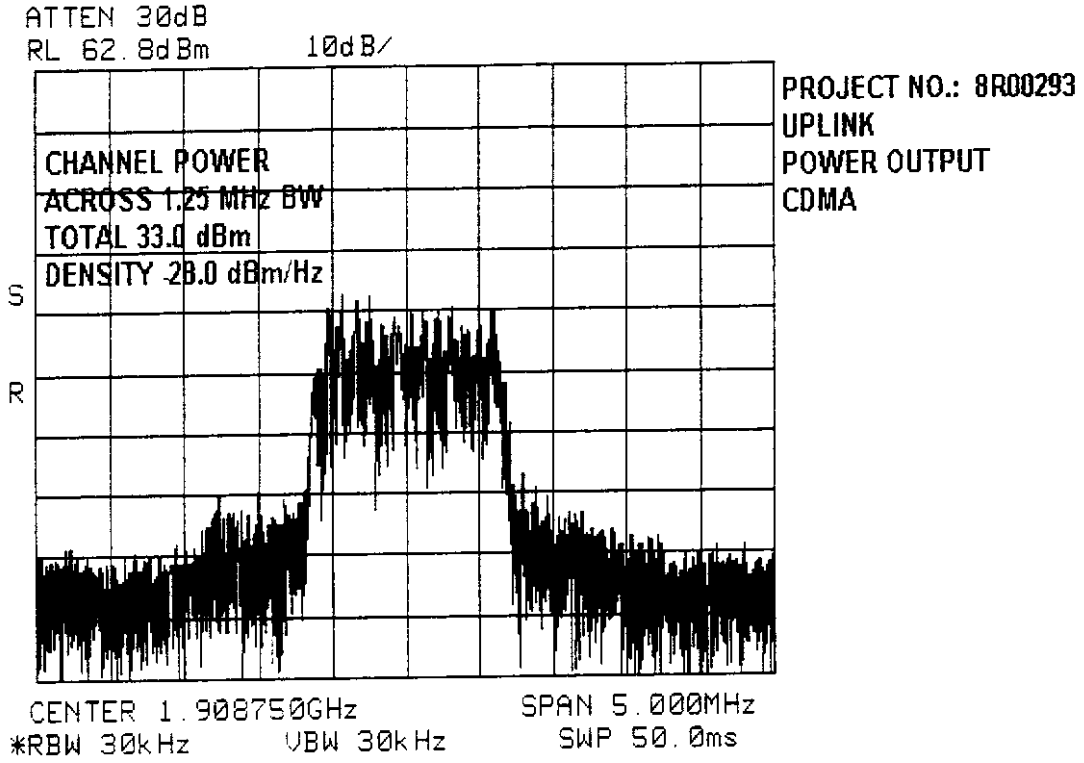
Section 3. RF Power Output

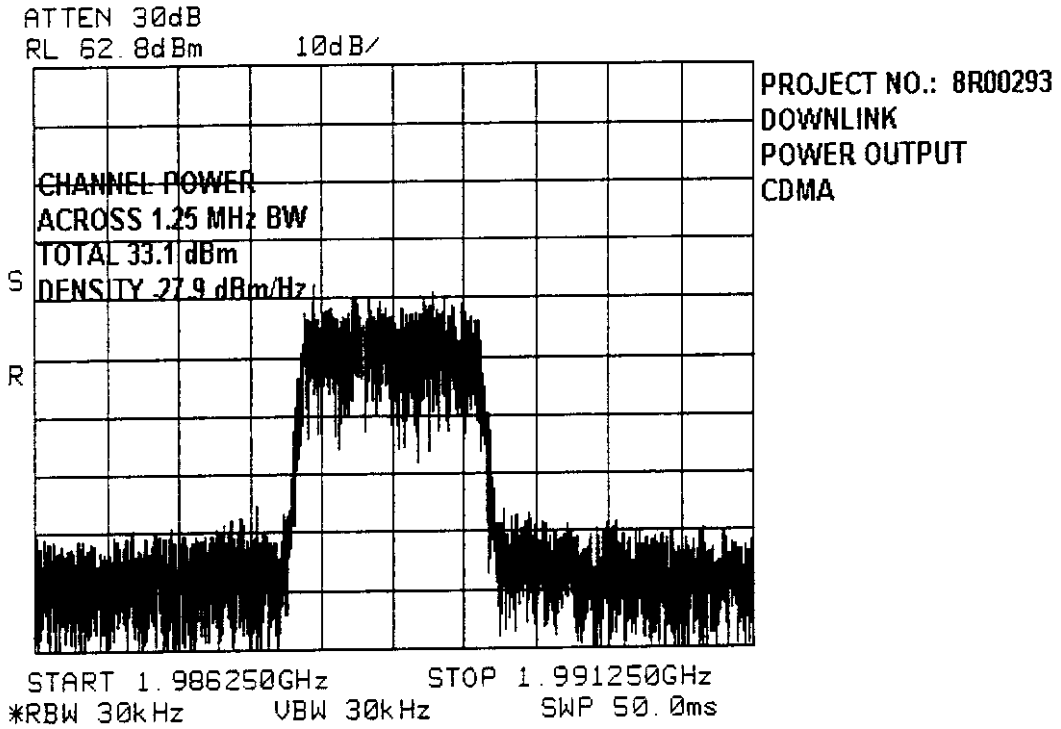
NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Tom Tidwell	DATE: May 1, 1998

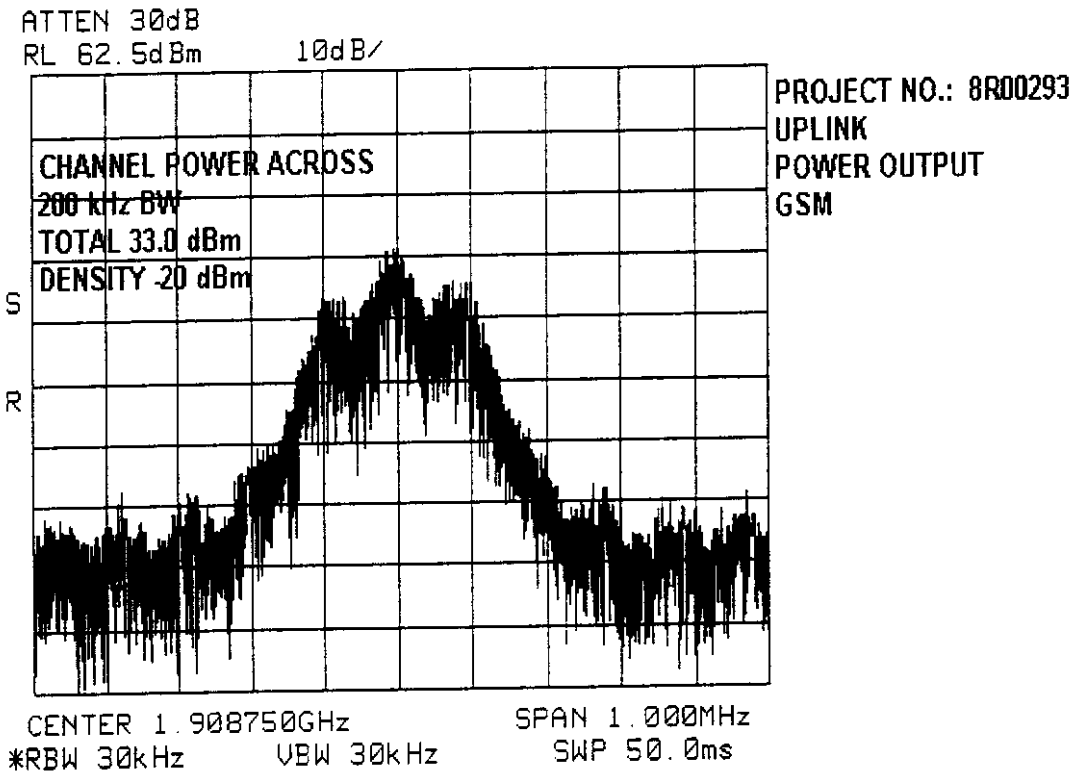
Test Results: Complies.

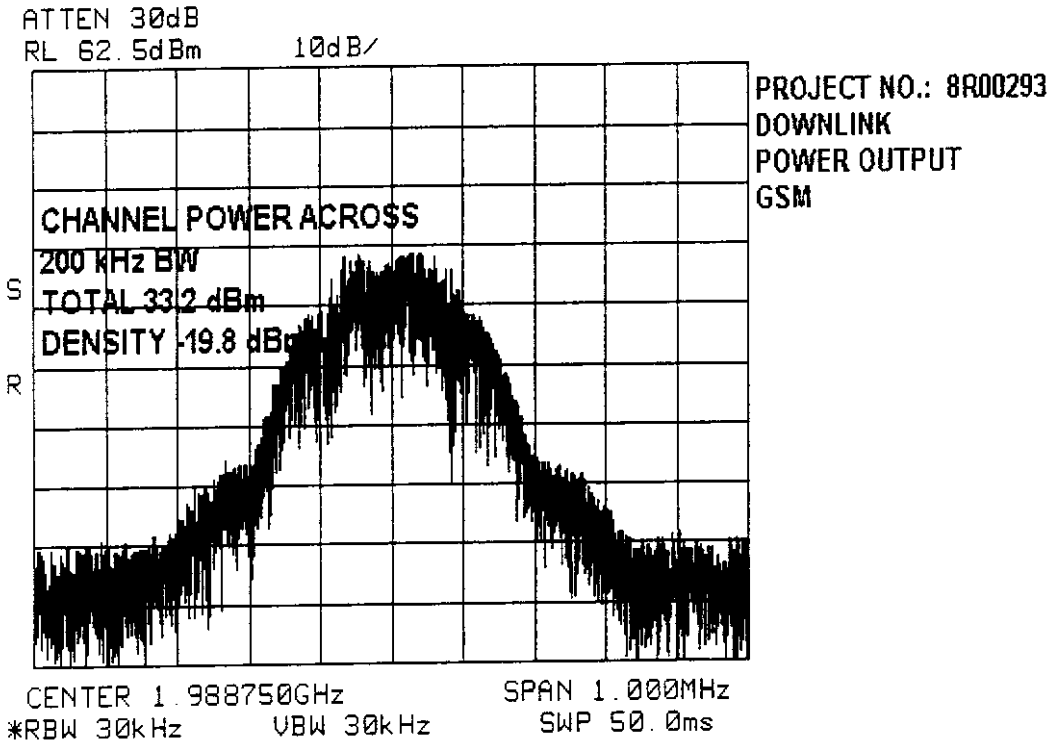
Measurement Data:

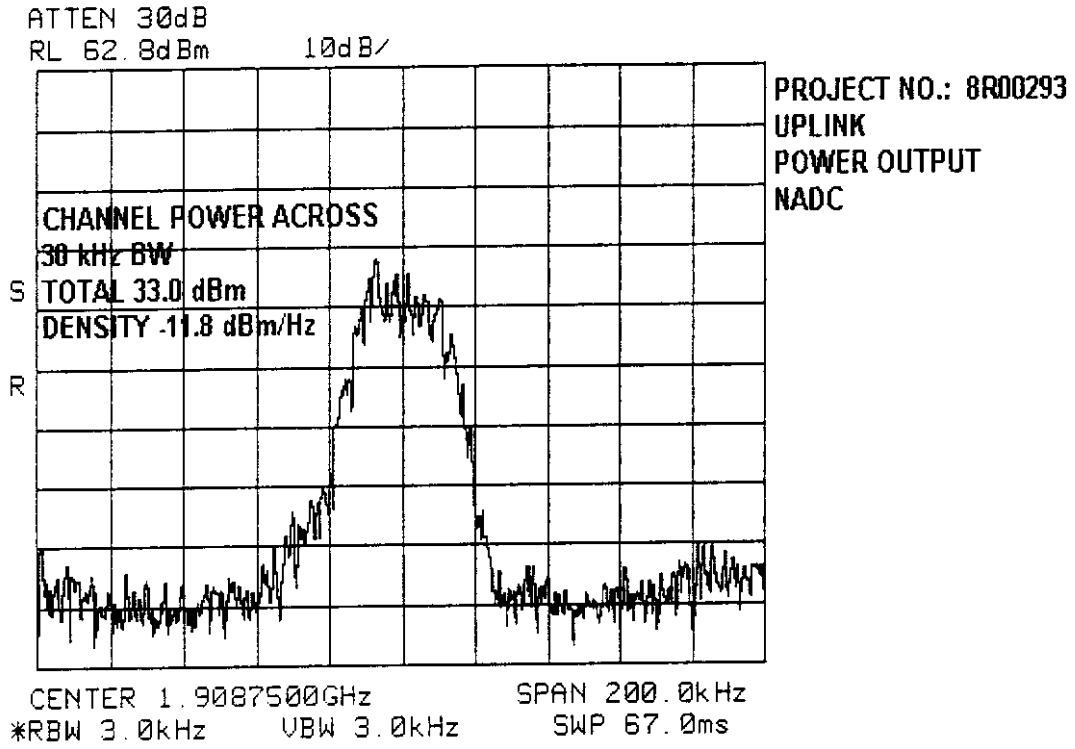
	Modulation Type	Per Channel Output Power (dBm)	Composite Output Power (dBm)
Uplink	CDMA	+33.0	N/A
Downlink	CDMA	+33.1	N/A
Uplink	GSM	+33.0	N/A
Downlink	GSM	+33.2	N/A
Uplink	NADC	+33.0	+31.0
Downlink	NADC	+33.1	+31.1

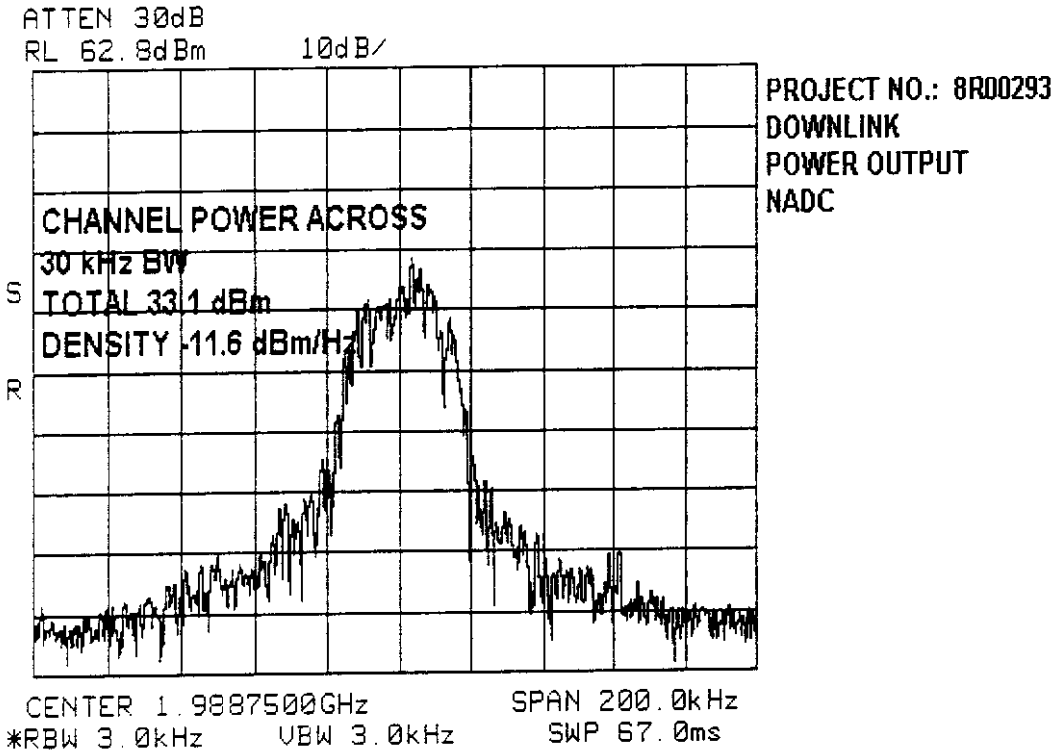

ATTEN 30dB
RL 62.8dBm
10dB/
CHANNEL POWER
ACROSS 1.25 MHz BW
TOTAL 33.0 dBm
DENSITY -28.0 dBm/Hz
S
R
PROJECT NO.: 8R00293
UPLINK
POWER OUTPUT
CDMA
CENTER 1.908750GHz
SPAN 5.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

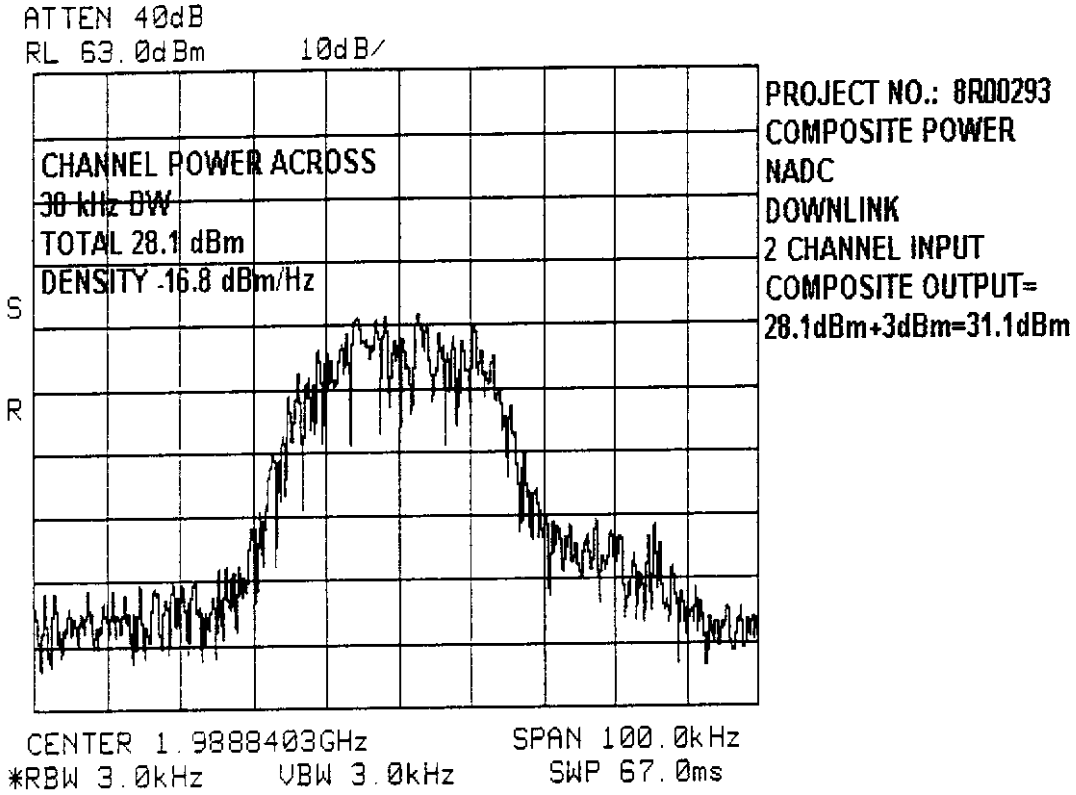

ATTEN 30dB
RL 62.8dBm
10dB/
PROJECT NO.: 8R00293
DOWNLINK
POWER OUTPUT
CDMA
CHANNEL POWER
ACROSS 1.25 MHz BW
TOTAL 33.1 dBm
DENSITY 27.9 dBm/Hz
S
R
START 1.986250GHz
STOP 1.991250GHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 62.5dBm
10dB/
CHANNEL POWER ACROSS
200 kHz BW
TOTAL 33.0 dBm
DENSITY -20 dBm
S
R
PROJECT NO.: 8R00293
UPLINK
POWER OUTPUT
GSM
CENTER 1.908750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 62.5dBm
10dB/
CHANNEL POWER ACROSS
200 kHz BW
TOTAL 33.2 dBm
DENSITY -19.8 dBm
S
R
PROJECT NO.: 8R00293
DOWNLINK
POWER OUTPUT
GSM
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 30dB
RL 62.8dBm
10dB/
CHANNEL POWER ACROSS
30 kHz BW
TOTAL 33.0 dBm
DENSITY -11.8 dBm/Hz
S
R
PROJECT NO.: 8R00293
UPLINK
POWER OUTPUT
NADC
CENTER 1.9087500GHz
SPAN 200.0kHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 67.0ms


ATTEN 30dB
RL 62.8dBm
10dB/
CHANNEL POWER ACROSS
30 kHz BW
TOTAL 33.1 dBm
DENSITY -11.6 dBm/Hz
S
R
CENTER 1.9887500GHz
SPAN 200.0kHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 67.0ms
PROJECT NO.: 8R00293
DOWNLINK
POWER OUTPUT
NADC

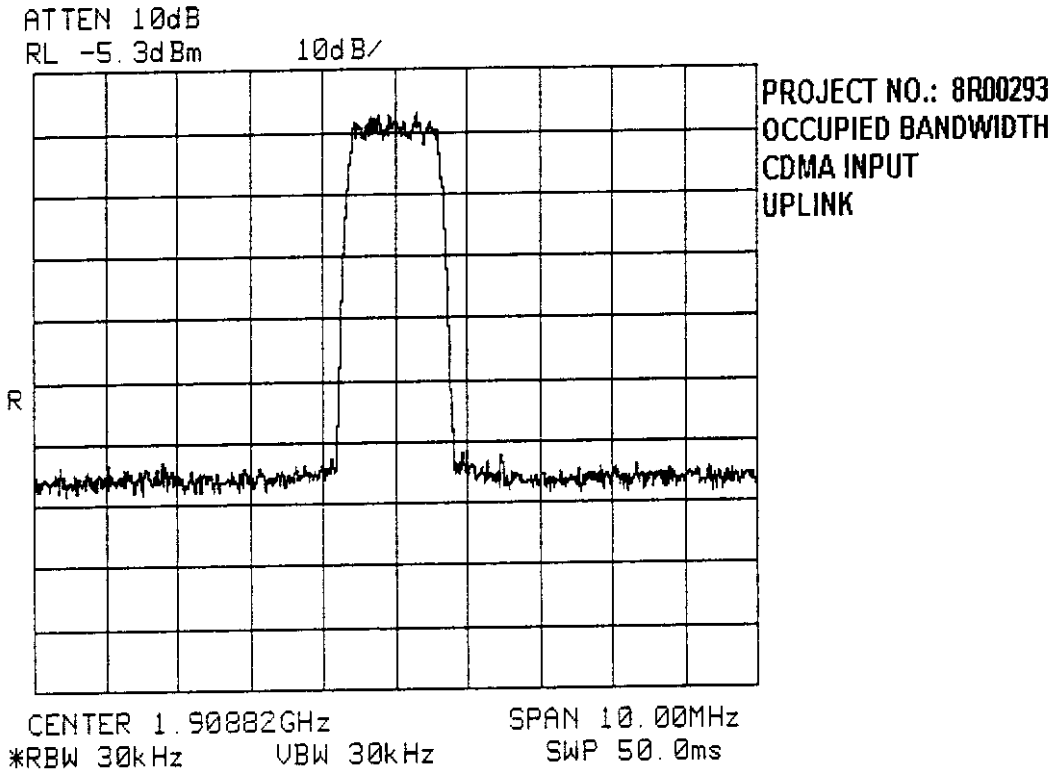

ATTEN 40dB
RL 63.0dBm
10dB/
CHANNEL POWER ACROSS
30 kHz BW
TOTAL 28.1 dBm
DENSITY -16.8 dBm/Hz
S
R
PROJECT NO.: 8R00293
COMPOSITE POWER
NADC
DOWNLINK
2 CHANNEL INPUT
COMPOSITE OUTPUT=
28.1dBm+3dBm=31.1dBm
CENTER 1.9888403GHz
SPAN 100.0kHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 67.0ms

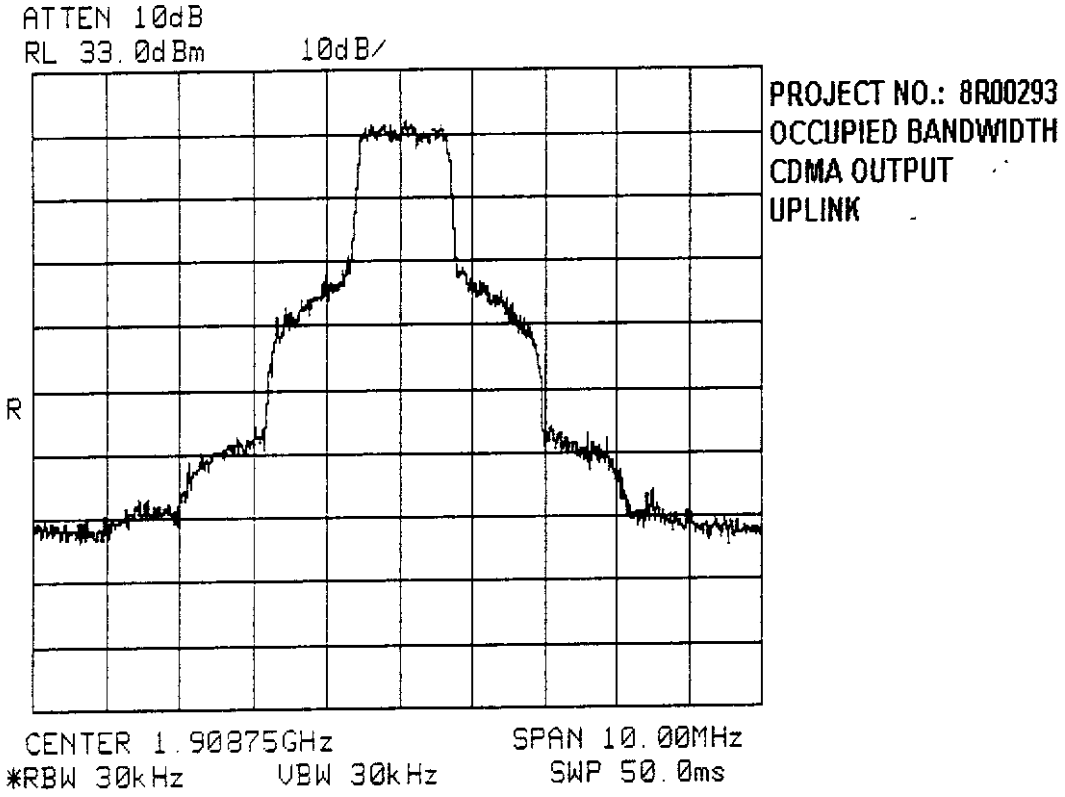
Section 4. Occupied Bandwidth

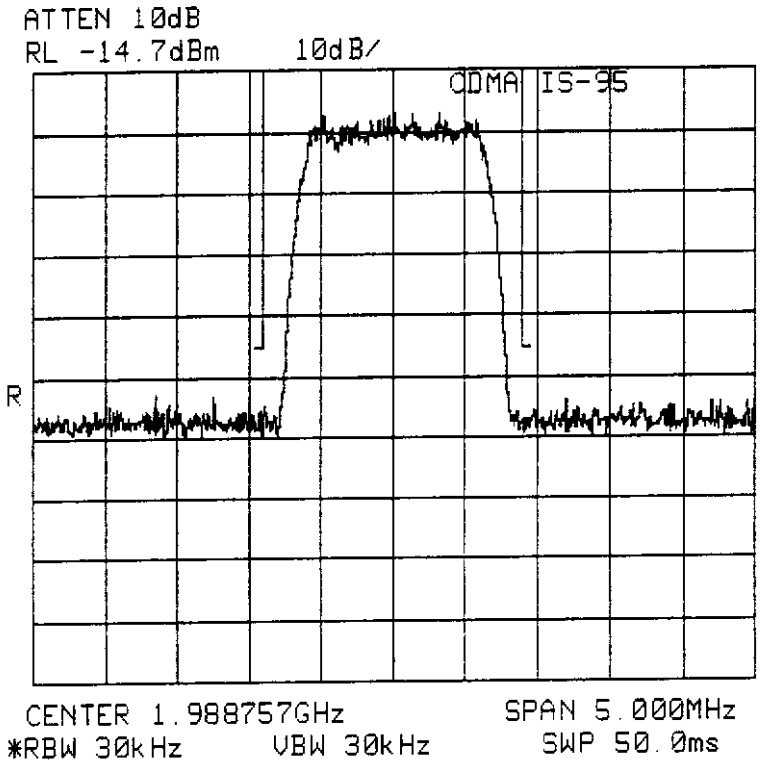
NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.917(c)
TESTED BY: Tom Tidwell	DATE: May 1, 1998

Test Results: Complies.

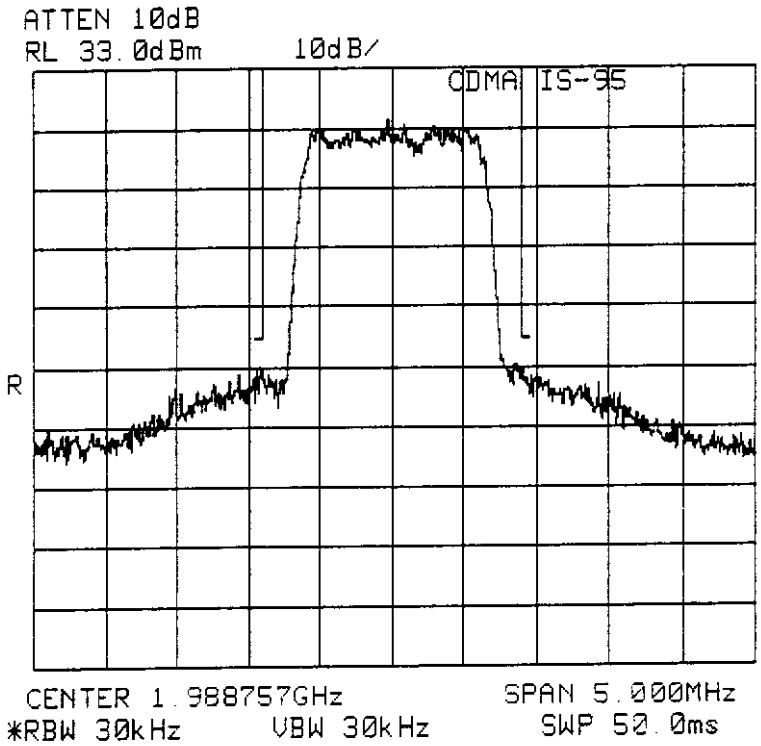
Test Data: See attached graph(s).


ATTEN 10dB
RL -5.3dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
CDMA INPUT
UPLINK
CENTER 1.90882GHz
SPAN 10.00MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 10dB
RL 33.0dBm
10dB/
R
CENTER 1.90875GHz
SPAN 10.00MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
CDMA OUTPUT
UPLINK



PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
CDMA INPUT
DOWNLINK

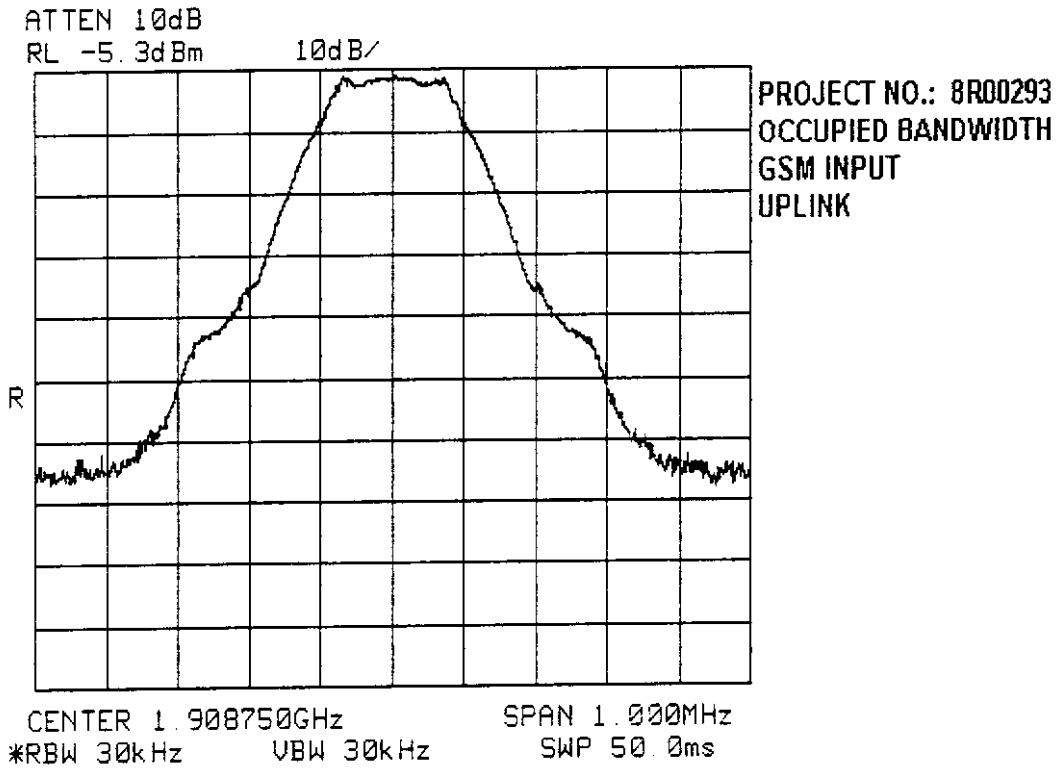


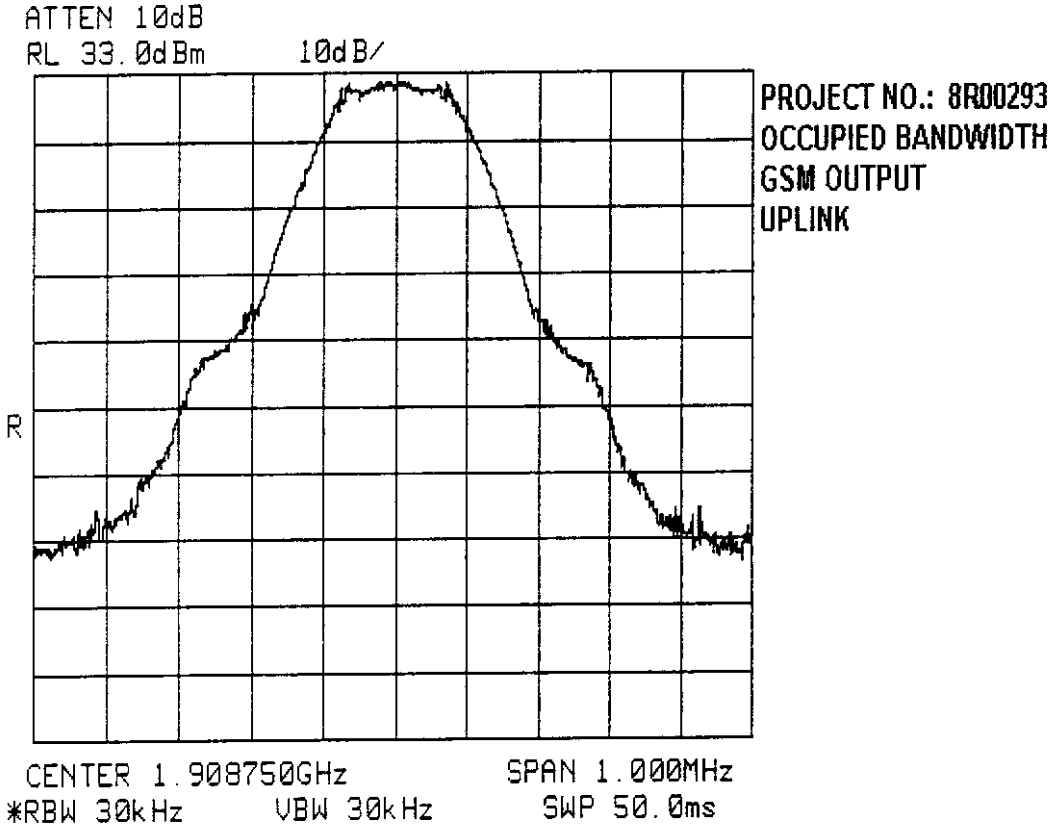
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
CDMA OUTPUT
DOWNLINK

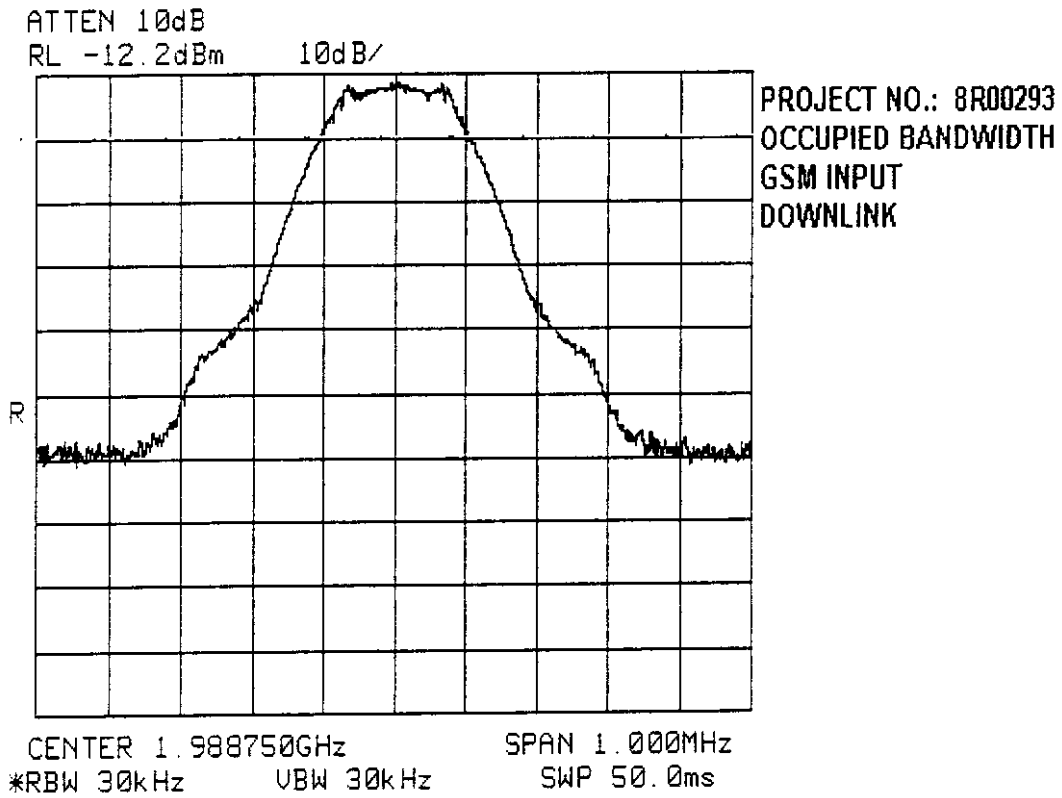
NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.917(c)
TESTED BY: Tom Tidwell	DATE: May 1, 1998

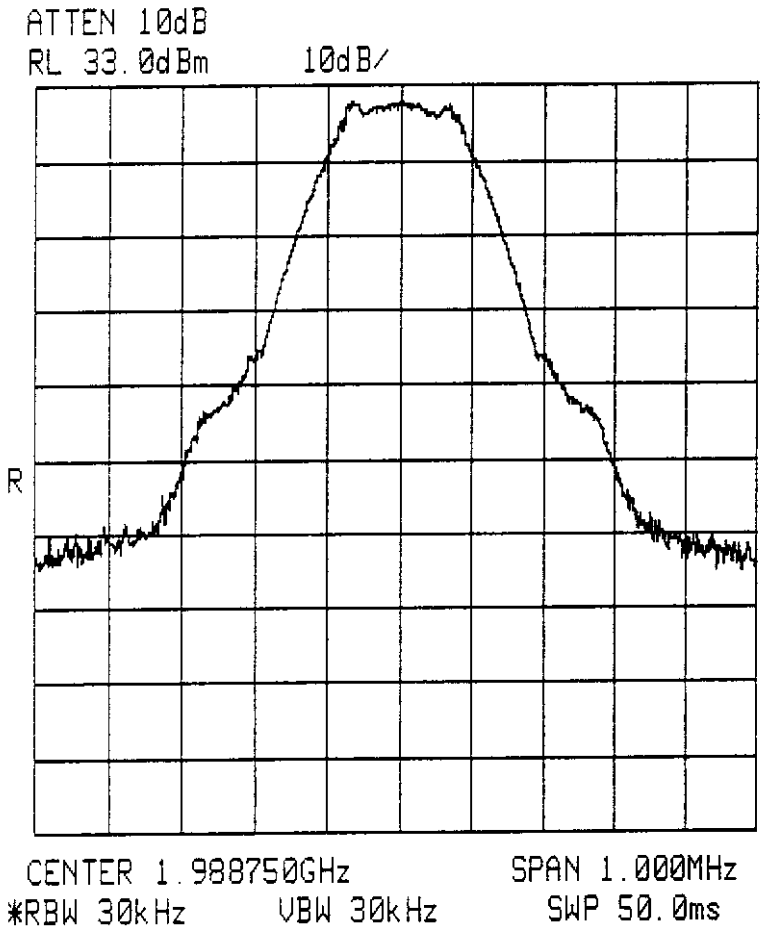
Test Results: Complies.

Test Data: See attached graph(s).


ATTEN 10dB
RL -5.3dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
GSM INPUT
UPLINK
CENTER 1.908750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 10dB
RL 33.0dBm
10dB/
R
CENTER 1.908750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
GSM OUTPUT
UPLINK

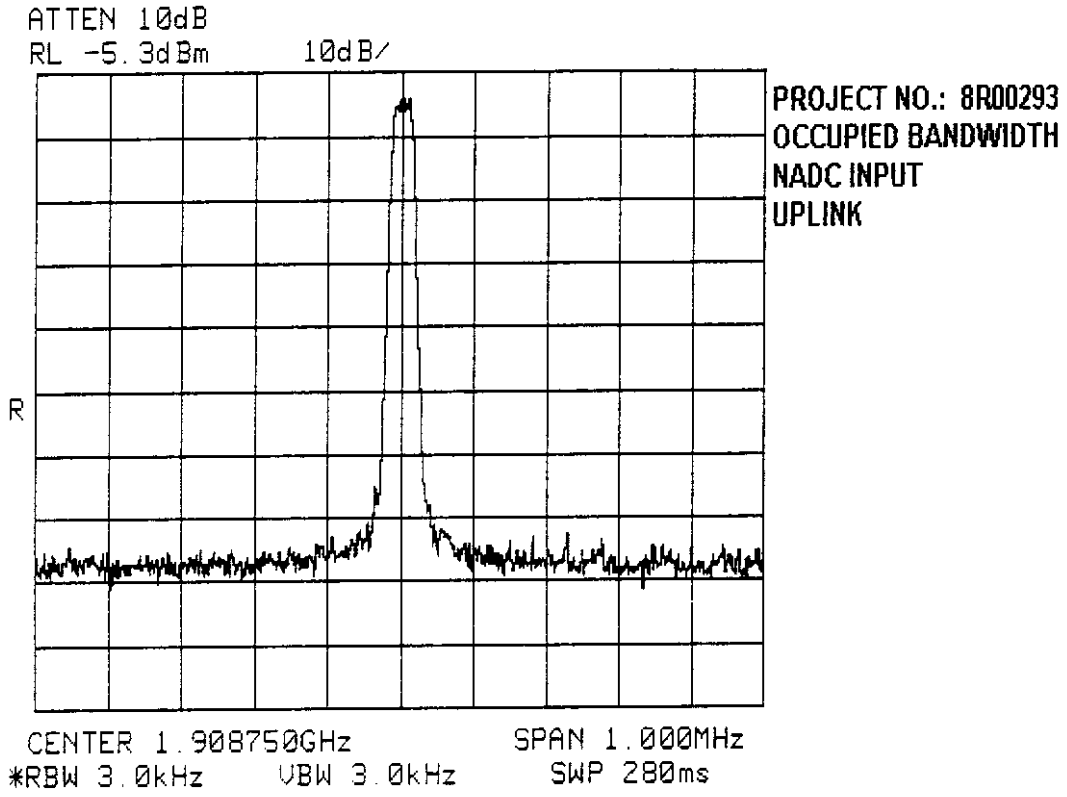

ATTEN 10dB
RL -12.2dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
GSM INPUT
DOWNLINK
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

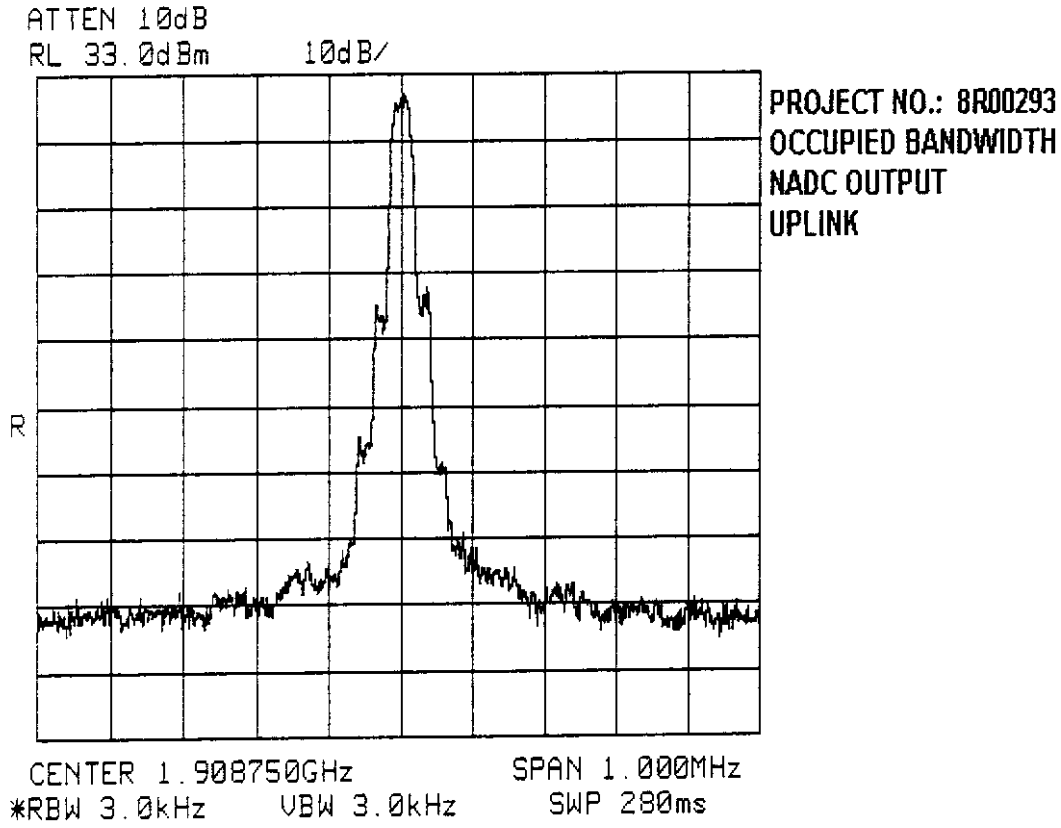

ATTEN 10dB
RL 33.0dBm
10dB/
R
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
GSM OUTPUT
DOWNLINK

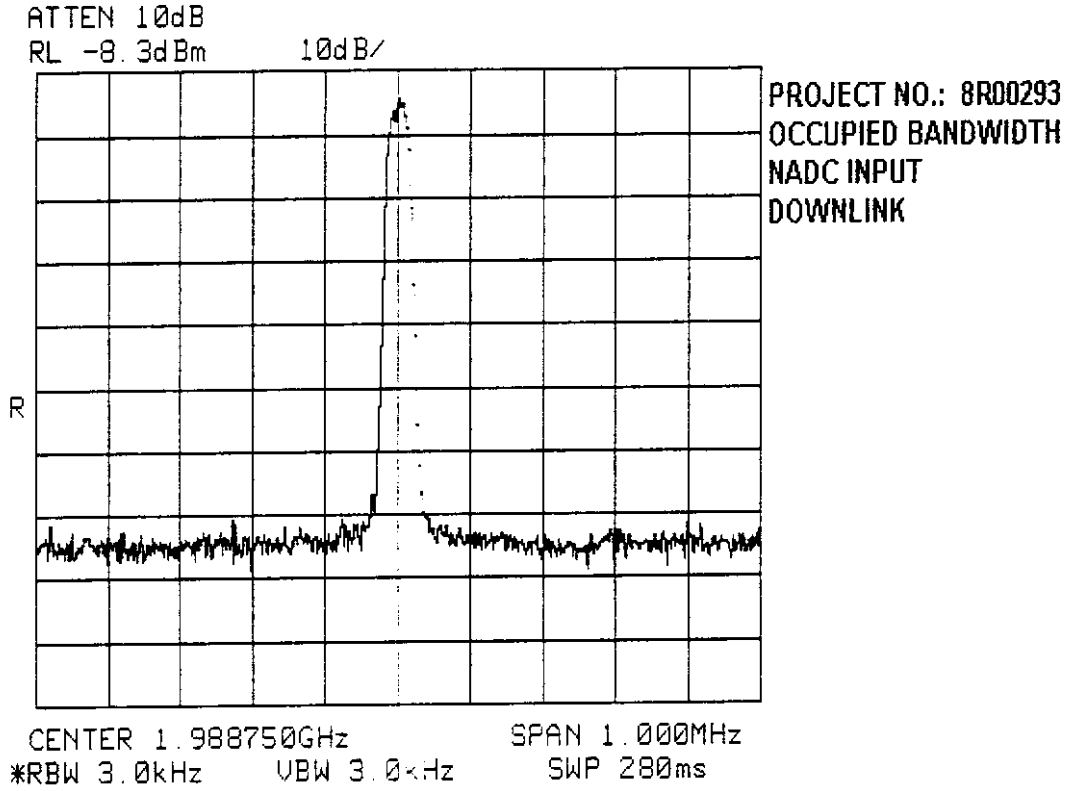
NAME OF TEST: Occupied Bandwidth (NADC)	PARA. NO.: 2.917(c)
TESTED BY: Tom Tidwell	DATE: May 1, 1998

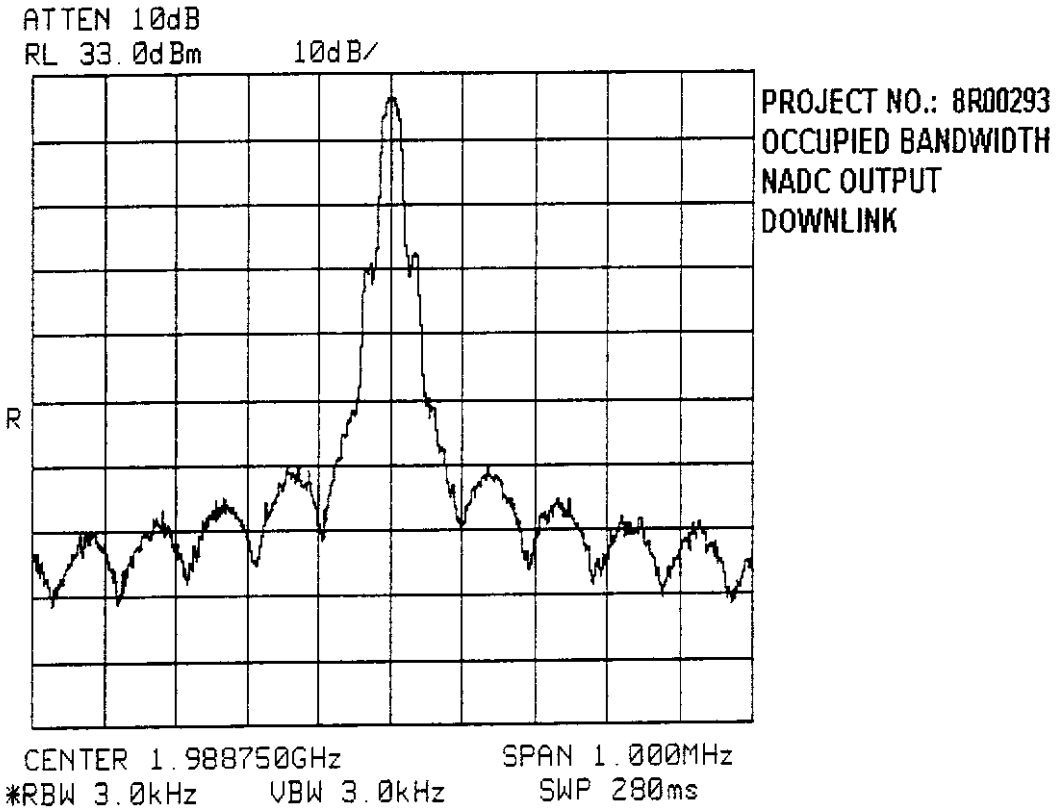
Test Results: Complies.

Test Data: See attached graph(s).


ATTEN 10dB
RL -5.3dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
NADC INPUT
UPLINK
CENTER 1.908750GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL 33.0dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
NADC OUTPUT
UPLINK
CENTER 1.908750GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL -8.3dBm
10dB/
R
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
NADC INPUT
DOWNLINK
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL 33.0dBm
10dB/
R
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms
PROJECT NO.: 8R00293
OCCUPIED BANDWIDTH
NADC OUTPUT
DOWNLINK

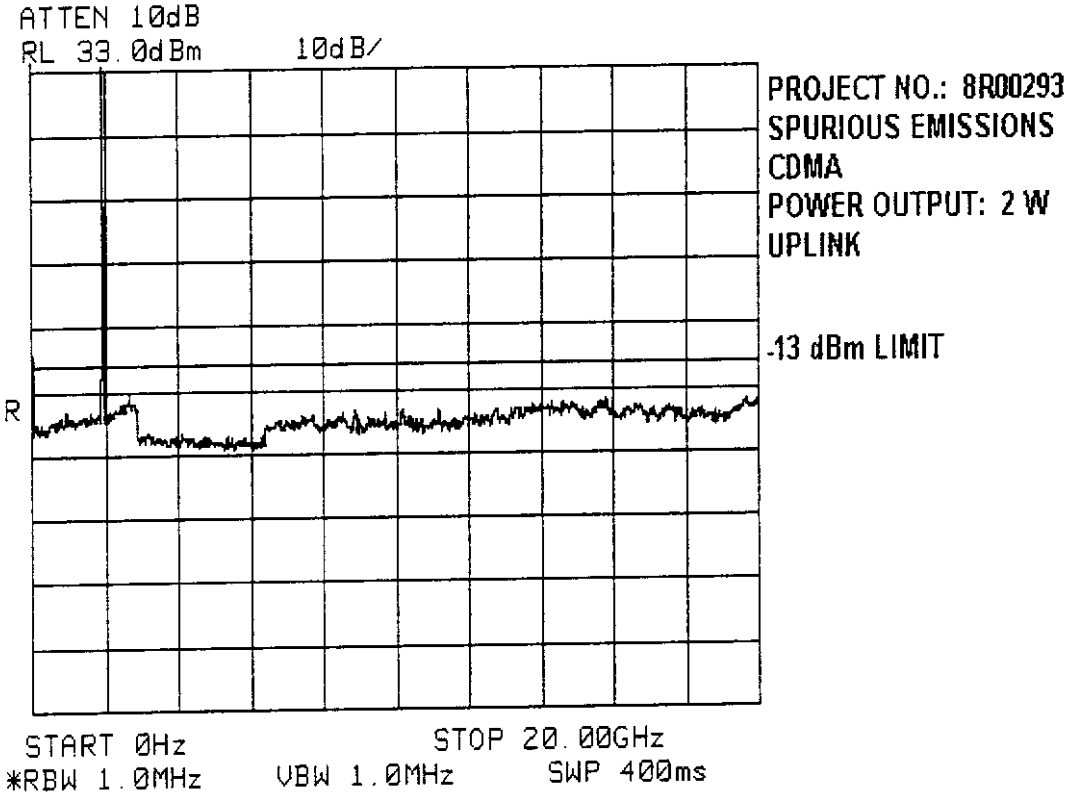
Section 5. Spurious Emissions at Antenna Terminals

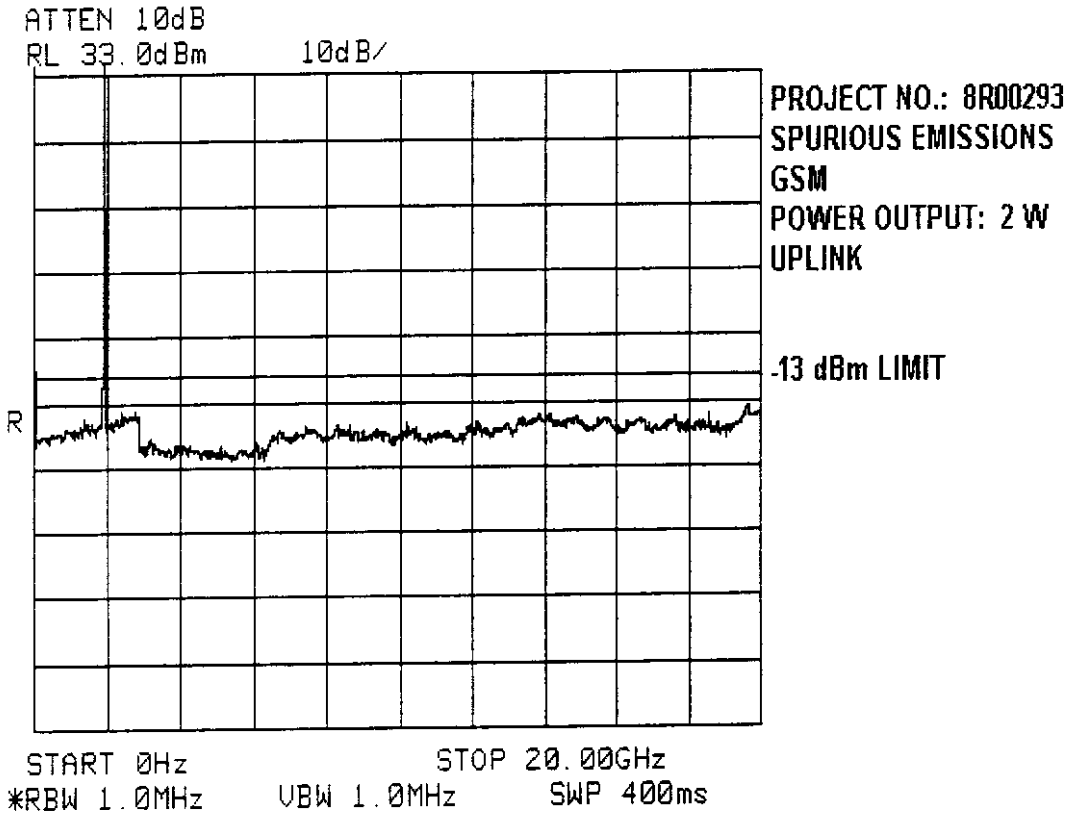
NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Tom Tidwell	DATE: May 4, 1998

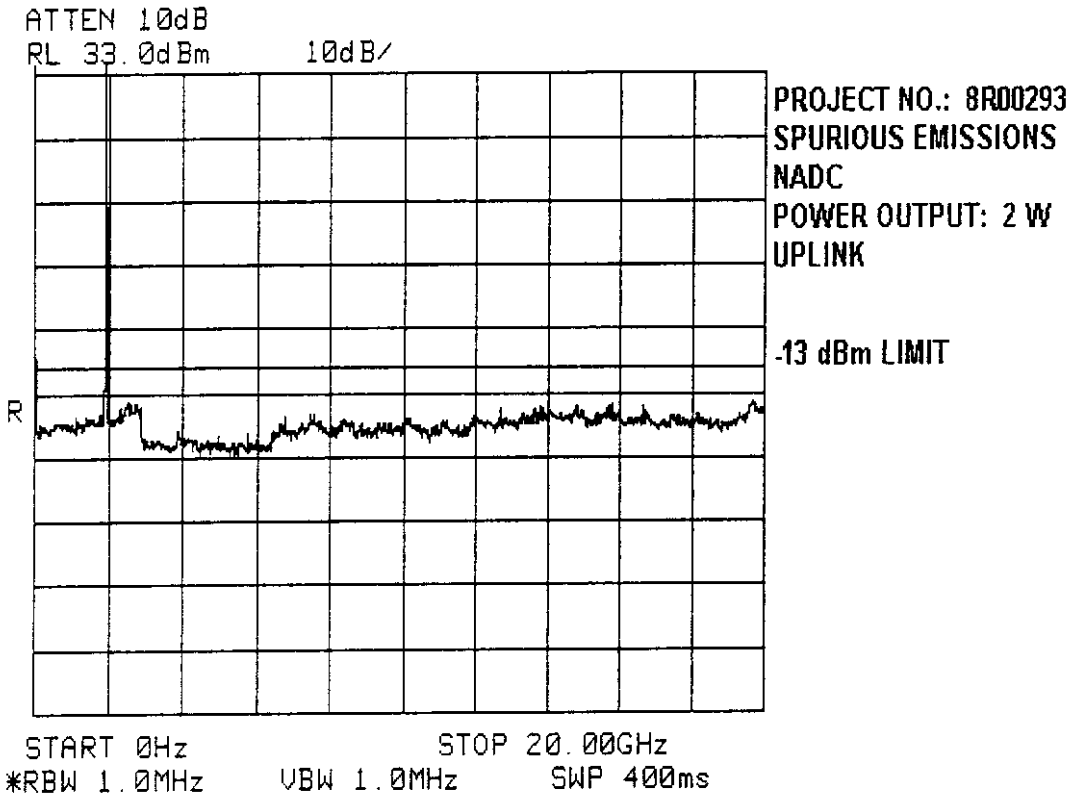
Test Results: Complies.

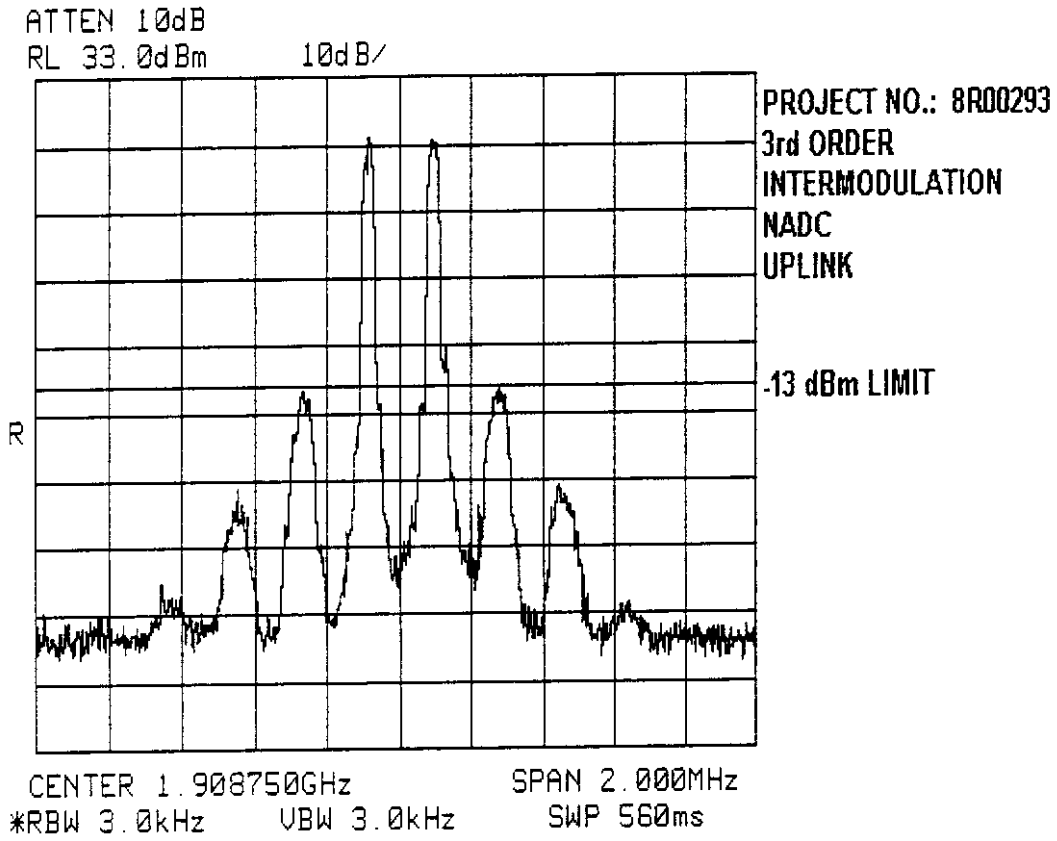
Test Data:

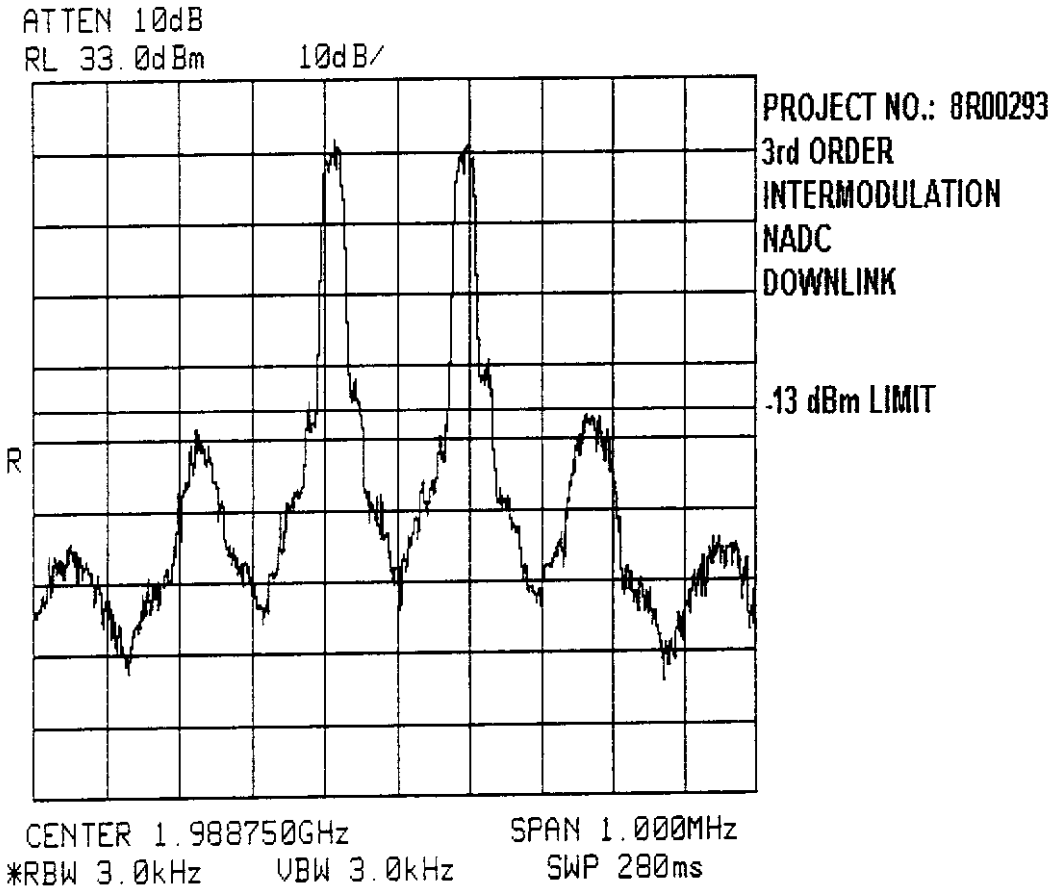
NAME OF TEST	WORST-CASE SPURIOUS LEVEL(dBm)
0 to 20 GHz spurious (Uplink)	<-16
0 to 20 GHz spurious (Downlink)	<-16
3 - signal intermodulation (Uplink)	<-16 (NADC)
3 - signal intermodulation (Downlink)	<-16 (NADC)
Lower band edge spurious (Uplink)	<-16
Lower band edge spurious (Downlink)	<-16.3
Upper band edge spurious (Uplink)	-18.17
Upper band edge spurious (Downlink)	-28.5

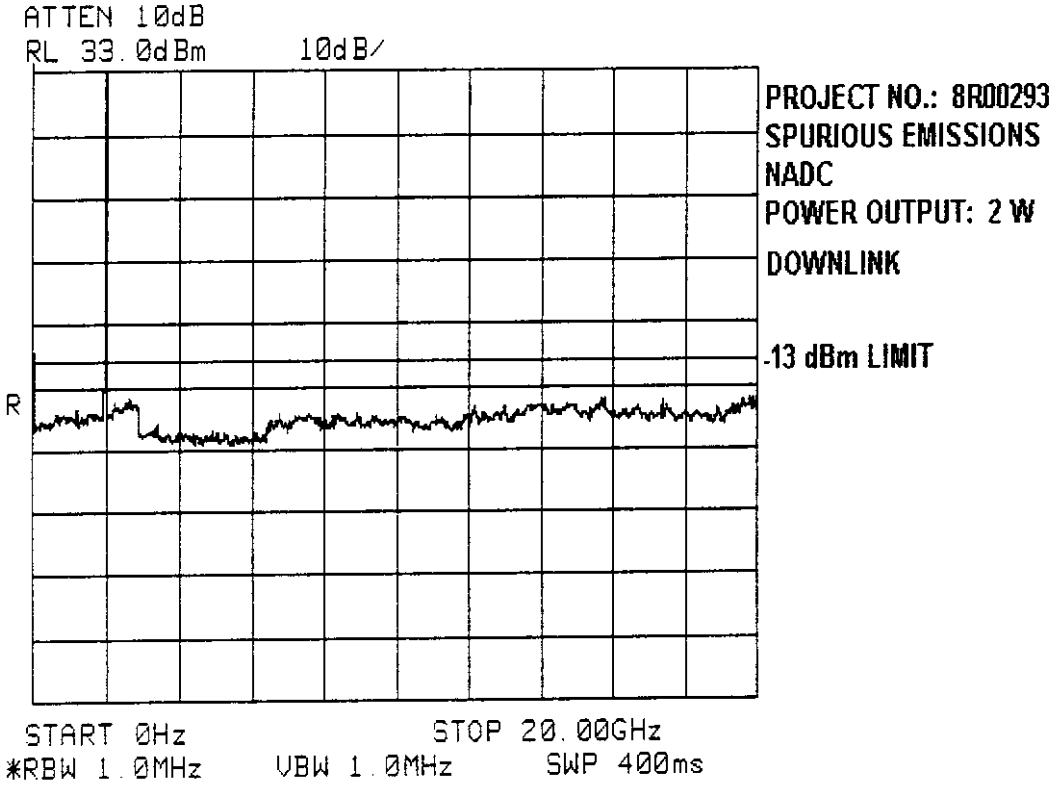

ATTEN 10dB
RL 33.0dBm
10dB/
R
START 0Hz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms
PROJECT NO.: 8R00293
SPURIOUS EMISSIONS
CDMA
POWER OUTPUT: 2 W
UPLINK
-13 dBm LIMIT

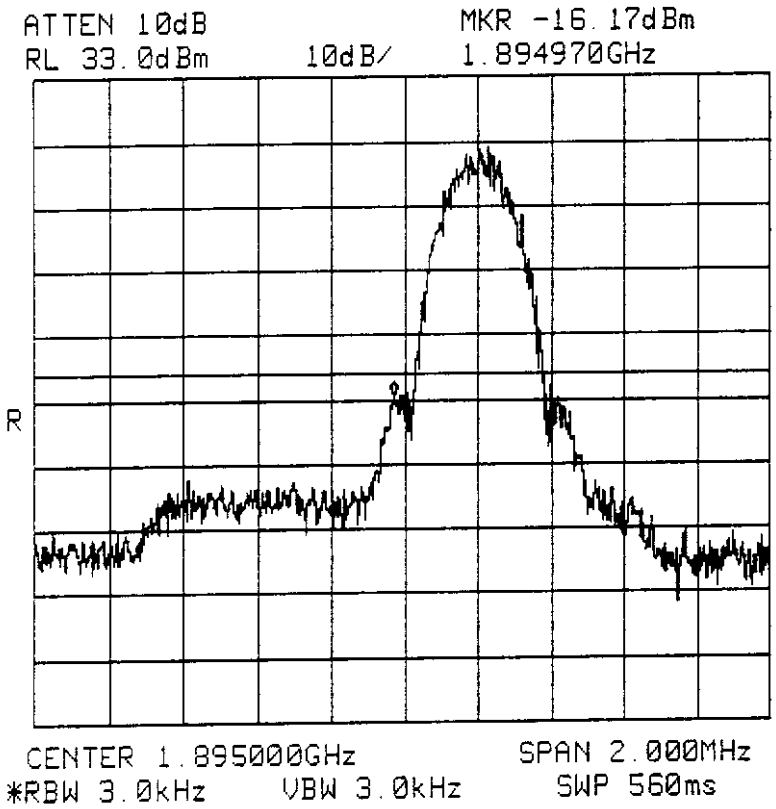

ATTEN 10dB
RL 33.0dBm
10dB/
R
START 0Hz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms
PROJECT NO.: 8R00293
SPURIOUS EMISSIONS
GSM
POWER OUTPUT: 2 W
UPLINK
-13 dBm LIMIT


ATTEN 10dB
RL 33.0dBm
10dB/
R
PROJECT NO.: 8R00293
SPURIOUS EMISSIONS
NADC
POWER OUTPUT: 2 W
UPLINK
-13 dBm LIMIT
START 0Hz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms

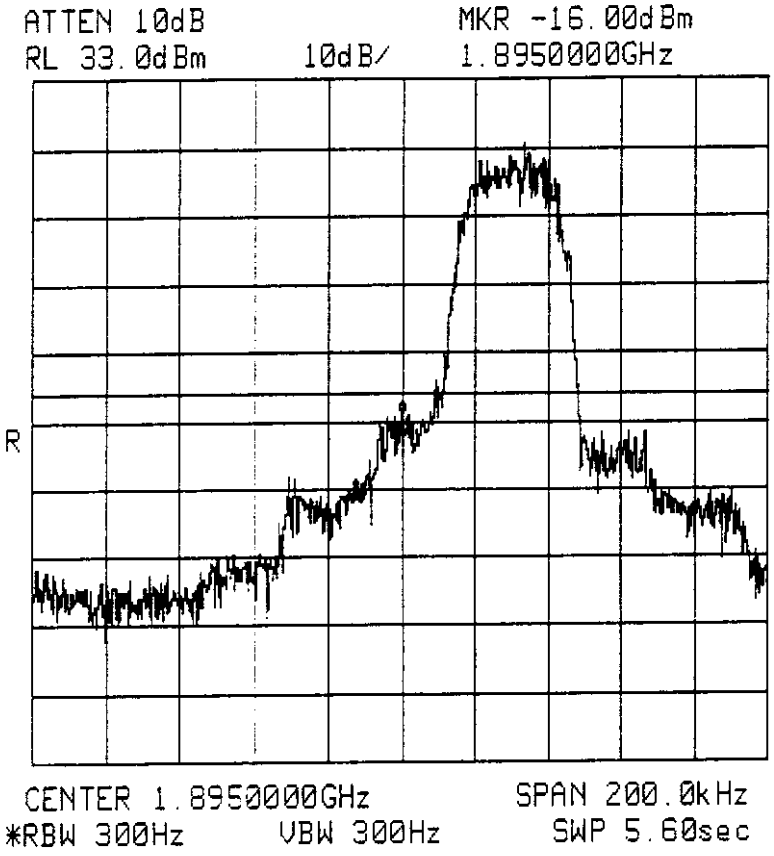

ATTEN 10dB
RL 33.0dBm
10dB/
R
PROJECT NO.: 8R00293
3rd ORDER
INTERMODULATION
NADC
UPLINK
-13 dBm LIMIT
CENTER 1.908750GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms

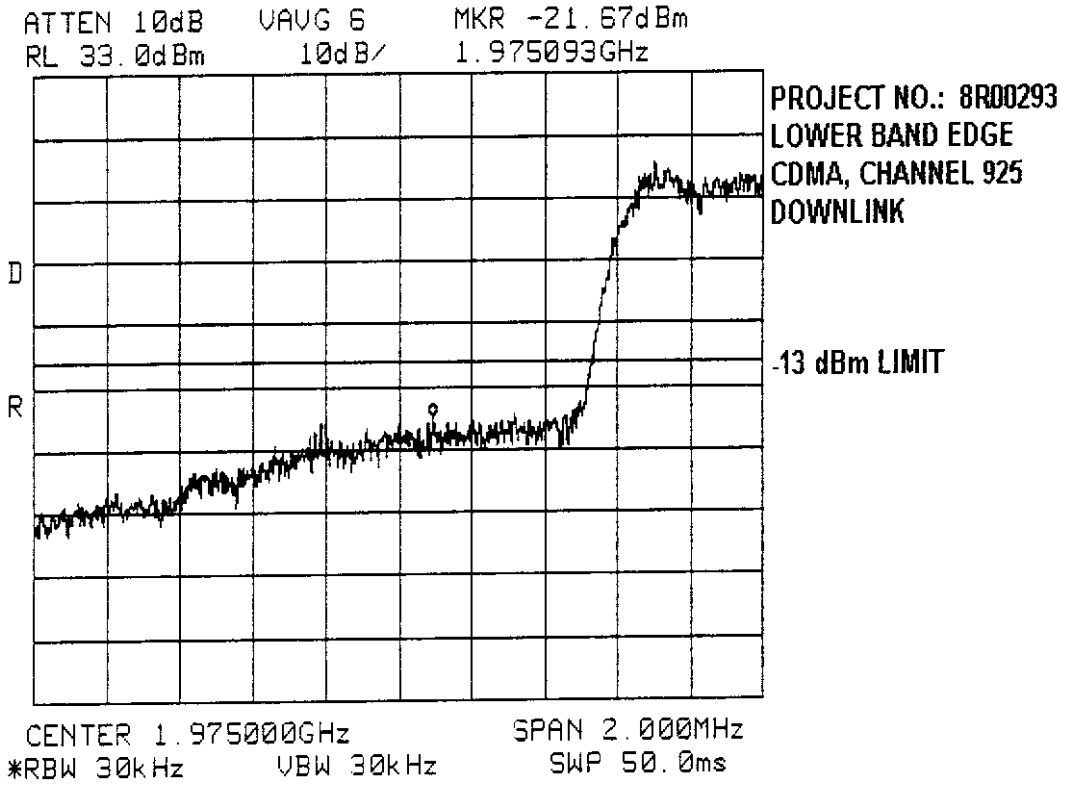

ATTEN 10dB
RL 33.0dBm
10dB/
R
PROJECT NO.: 8R00293
3rd ORDER
INTERMODULATION
NADC
DOWNLINK
-13 dBm LIMIT
CENTER 1.988750GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms

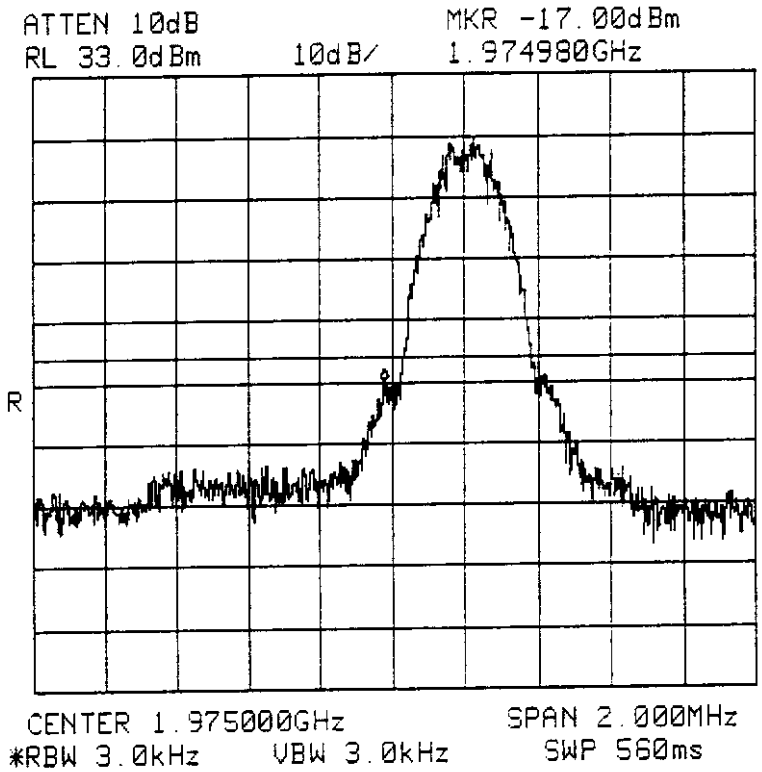

ATTEN 10dB
RL 33.0dBm
10dB/
R
PROJECT NO.: 8R00293
SPURIOUS EMISSIONS
NADC
POWER OUTPUT: 2 W
DOWNLINK
-13 dBm LIMIT
START 0Hz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 400ms



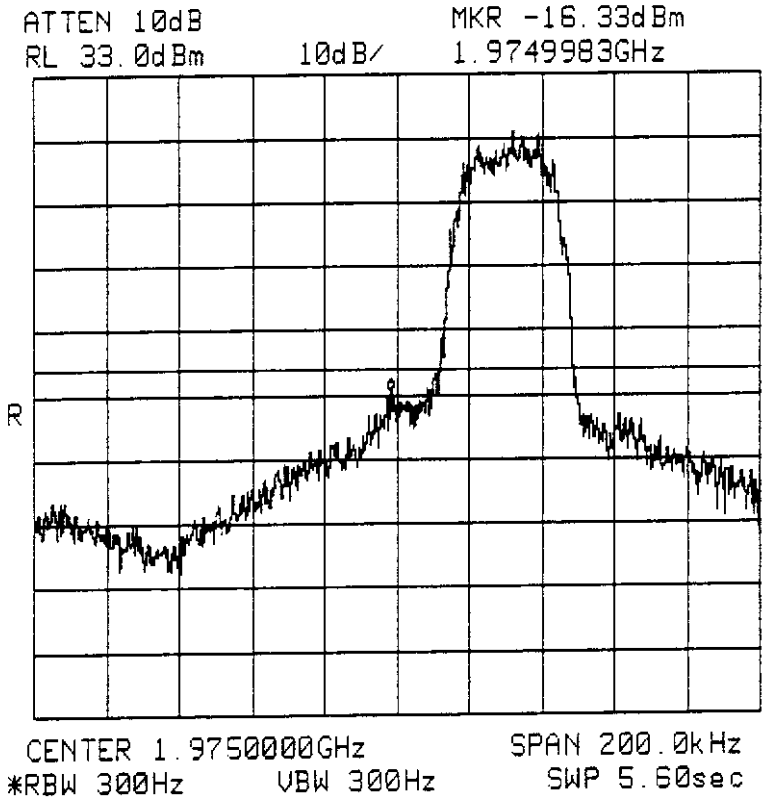
PROJECT NO.: 8R00293
LOWER BAND EDGE
GSM, 200 kHz FROM
EDGE OF FREQ. BLOCK
UPLINK


ATTEN 10dB
RL 33.0dBm
10dB/
MKR -16.00dBm
1.8950000GHz
R
CENTER 1.8950000GHz
SPAN 200.0kHz
*RBW 300Hz
VBW 300Hz
SWP 5.60sec
PROJECT NO.: 8R00293
LOWER BAND EDGE
NADC, 30 kHz FROM
EDGE OF FREQ. BLOCK
UPLINK

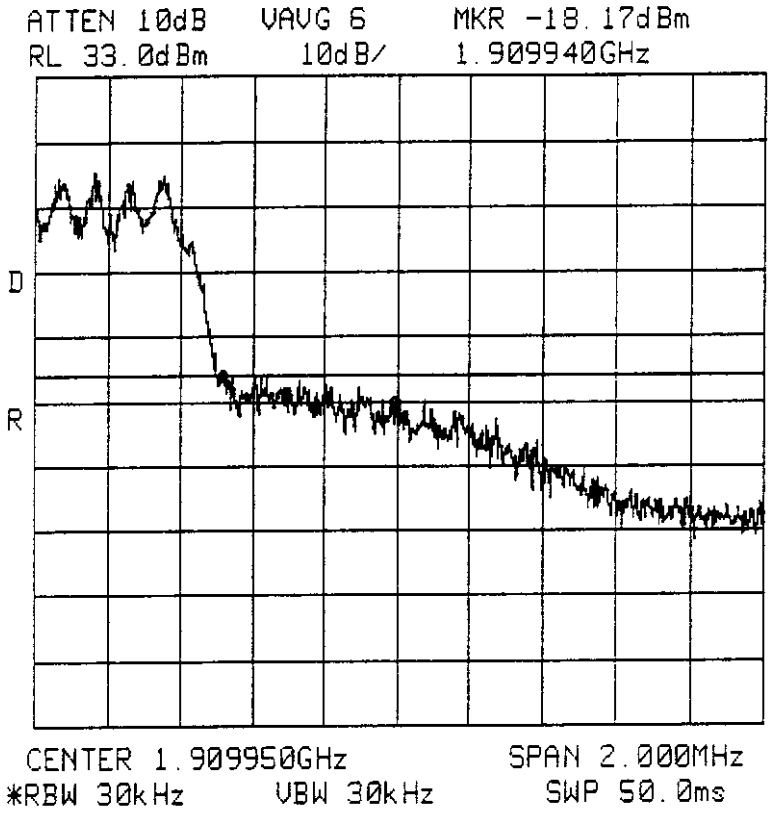

ATTEN 10dB
RL 33.0dBm
VAVG 6
10dB/
MKR -21.67dBm
1.975093GHz
D
R
PROJECT NO.: 8R00293
LOWER BAND EDGE
CDMA, CHANNEL 925
DOWNLINK
-13 dBm LIMIT
CENTER 1.975000GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

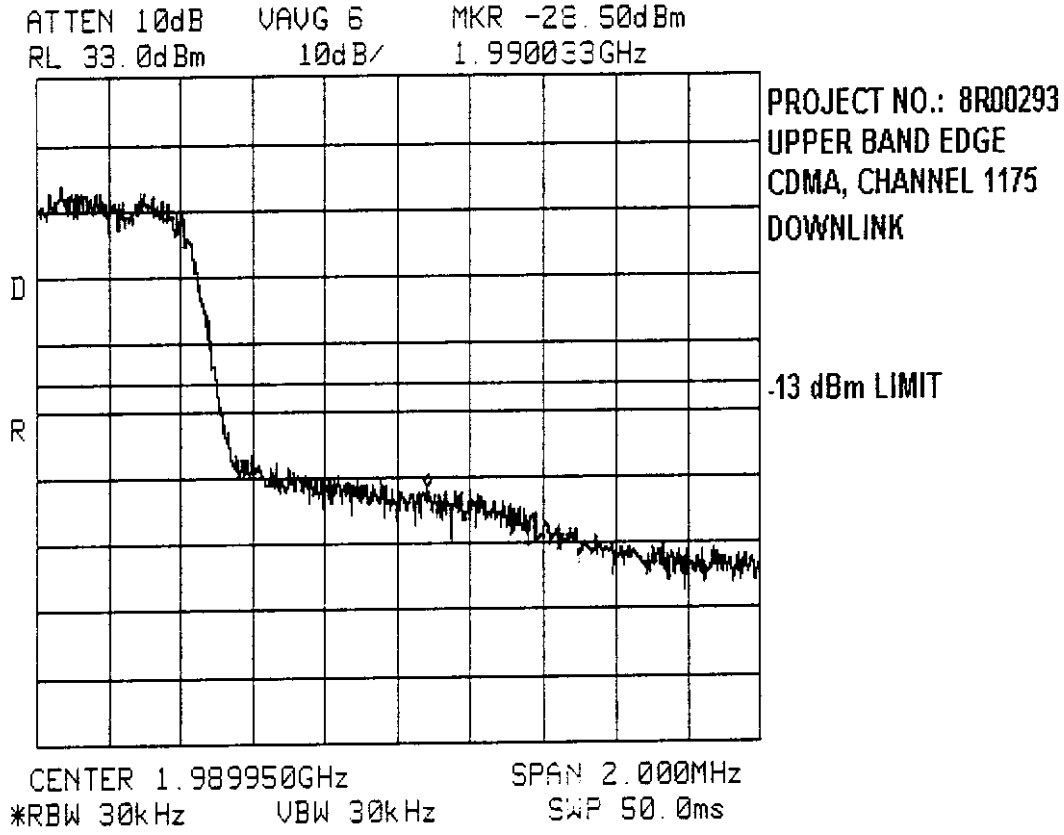


PROJECT NO.: 8R00293
LOWER BAND EDGE
GSM, 200 kHz FROM
EDGE OF FREQ. BLOCK
DOWNLINK



PROJECT NO.: 8R00293
LOWER BAND EDGE
NADC, 30 kHz FROM
EDGE OF FREQ. BLOCK
DOWNLINK


ATTEN 10dB
VAVG 6
MKR -18.17dBm
RL 33.0dBm
10dB/
1.909940GHz
D
R
CENTER 1.909950GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms


ATTEN 10dB
RL 33.0dBm
VAVG 6
10dB/
MKR -28.50dBm
1.990033GHz
PROJECT NO.: 8R00293
UPPER BAND EDGE
CDMA, CHANNEL 1175
DOWNLINK
D
R
-13 dBm LIMIT
CENTER 1.989950GHz
SPAN 2.000MHz
*RBW 30kHz
VBW 30kHz
SWP 50.0ms

Section 6. Field Strength of Spurious

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.
The maximum field strength is ____ dBμV/m @ 3m.

Test Data:

Test Data - Radiated Emissions - Uplink

Test Distance (meters) : 3		Range:		Receiver:		RBW(1 MHz):		Detector:			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBμV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)

NOT APPLICABLE

Notes:
The spectrum was search up to the 10th harmonic of the fundamental frequency.
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Includes cable loss when amplifier is not used.
** Includes cable loss.
( ) Denotes failing emission level.

Test Data - Radiated Emissions - Downlink

Test Distance (meters) : 3		Range:		Receiver:		RBW(1 MHz):		Detector:			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBμV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)

NOT APPLICABLE

Notes:
The spectrum was search up to the 10th harmonic of the fundamental frequency.
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Includes cable loss when amplifier is not used.
** Includes cable loss.
( ) Denotes failing emission level.

Photographs of Test Setup

FRONT VIEW

REAR VIEW

Pre-Scan Data

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 24.235
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Measurement Data: Standard Test Frequency: _____ MHz
Standard Test Voltage: _____ Vdc

NOT APPLICABLE

Section 8. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 9/97	May 9/98	
1 Year	Multimeter	Fluke	29	67902059	June 1/97	Jun 1/98	
1 Year	Attenuator	Narda	768-20	9507	July 23/97	July 23/98	
1 Year	Attenuator	Narda	768-10	9704	Oct. 1/97	Oct. 1/98	
1 Year	Attenuator	Narda	768-10	9709	Oct. 1/97	Oct. 1/98	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/97	July 23/98	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/97	July 23/98	
	50 Ω Termination	Wiltron	26N50	605248	N/A	N/A	
1 Year	50 ohm Combiner Pad	Mini Circuits	ZA3PD-2	9746	Dec. 12/97	Dec. 12/98	
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	1084-8004-03	Sept. 18/97	Sept. 18/98	
1 Year	Arbitrary Waveform Gen.	Sony Tektronix	AWG2021	J310495	May 15/97	May 15/98	

NA: Not Applicable
NCR: No Cal Required

ANNEX A

TEST METHODOLOGIES

NAME OF TEST: RF Power Output	**PARA. NO.: 2.985**

Test Conditions: Standard Temperature & Humidity
Standard Test Voltage

Minimum Standard: Para. No.24.232. Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Method Of Measurement:

Detachable Antenna:
The peak power at antenna terminals is measured using an in-line peak power meter. Power output is measured with the maximum rated input level.

Integral Antenna:
If the antenna is not detachable from the circuit then the Peak Power Output is derived from the peak radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts
E = the maximum measured field strength in V/m
R = the measurement range (3 meters)
G = the numeric gain of the transmit antenna in relation to an isotropic radiator

NAME OF TEST: Occupied Bandwidth **PARA. NO.: 2.989**

Test Conditions: Standard Temperature & Humidity
Standard Test Voltage

Minimum Standard: Para. No. 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 26 dB.

Method Of Measurement:

CDMA

Spectrum analyzer settings:
RBW: 30 kHz
VBW: ≥ RBW
Span: 5 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

GSM

RBW: 3 kHz
VBW: ≥ RBW
Span: 2 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

NADC

RBW: 1 kHz
VBW: ≥ RBW
Span: 1 MHz
Sweep: Auto
Mask: Set markers to -26 dB from peak of CW.

NAME OF TEST: Spurious Emission at Antenna Terminals PARA. NO.: 2.991

Test Conditions: Standard Temperature & Humidity
Standard Test Voltage

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least 43 + 10 log (P) dB.

Method Of Measurement:

Spectrum analyzer settings:

CDMA

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 30 kHz (< 1MHz from Band Edge)
VBW: ≥ RBW
Sweep: Auto
Video Avg: 6 Sweeps

GSM

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: ≥ RBW
Sweep: Auto
Video Avg: Disabled

NADC

RBW: 1 MHz (> 1 MHz from Band Edge)
RBW: 3 kHz (< 1 MHz from Band Edge)
VBW: ≥ RBW
Sweep: Auto
Video Avg: Disabled

To demonstrate compliance at band edges the frequency of the input signal is set to the lowest and highest assigned channel and the center frequency of the spectrum analyzer is set to the upper and lower edges of the appropriate frequency block.

NAME OF TEST: Field Strength of Spurious Radiation **PARA. NO.: 2.993**

Test Conditions: Outdoor Range
Standard Test Voltage

Minimum Standard: Para. No.24.238(a). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least 43 + 10 log (P) dB.

Calculation Of Field Strength Limit

An example of attenuation requirement of 43 + 10 Log P is equivalent to -13 dBm (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$GP/4\pi R^2 = E^2/120\pi$

For emissions ≤ 1 GHz:

G = 1.64 (Dipole Gain)
P = 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R}$$

$$E = \frac{\sqrt{30 \times 1.64 \times 5 \times 10^{-5}}}{3} = 0.016533 \text{ V / m} = 84.4 \text{ dB}\mu\text{V / m}$$

For emissions > 1 GHz:

G = 1 (Isotropic Gain)
P = 1×10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = 84.4 - 20Log\sqrt{1.64} = 82.3 dB\mu V / m@3m$$

NAME OF TEST: Frequency Stability	**PARA. NO.: 2.995**

Test Conditions: As per measurement data.

Minimum Standard: Para. No. 24.235. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:

Frequency Stability With Voltage Variation

The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the signal generator. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency is measured in 30 second intervals for a period of 5 minutes. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

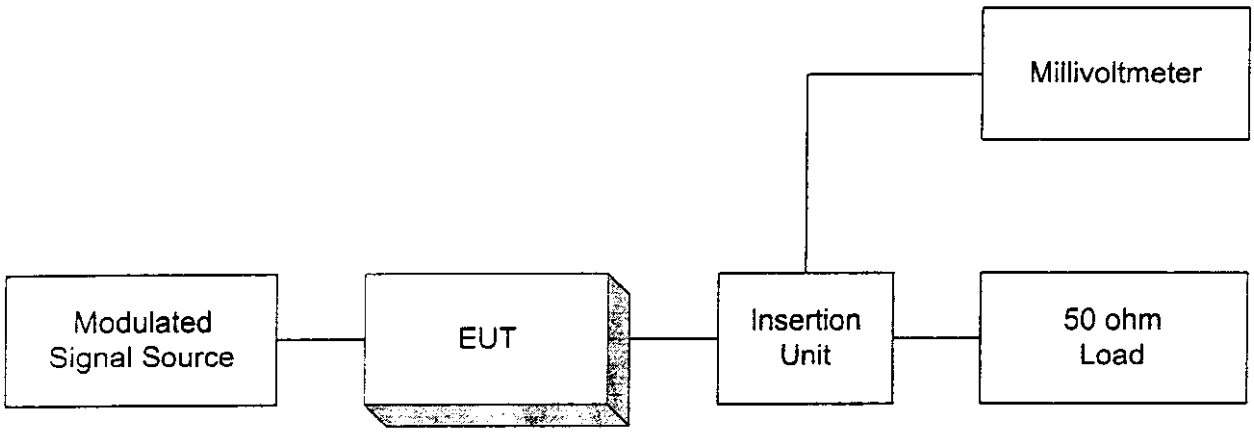
Frequency Stability With Temperature Variation

The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

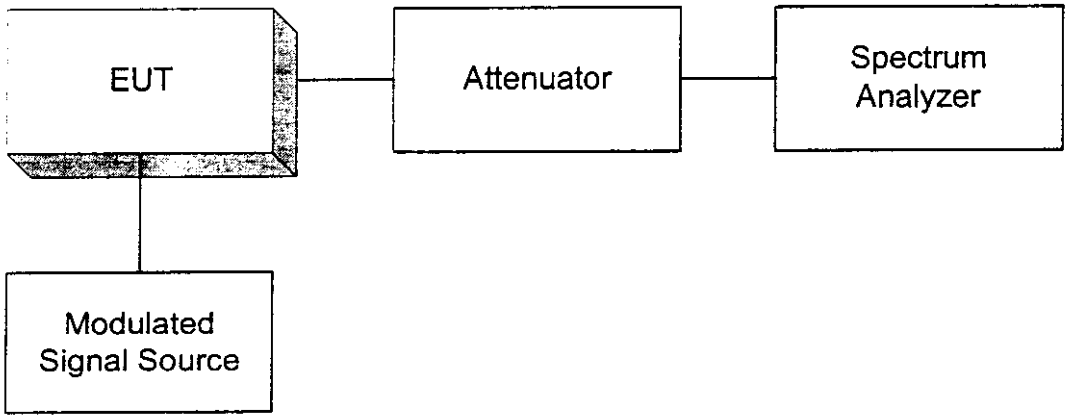
ANNEX B

TEST DIAGRAMS

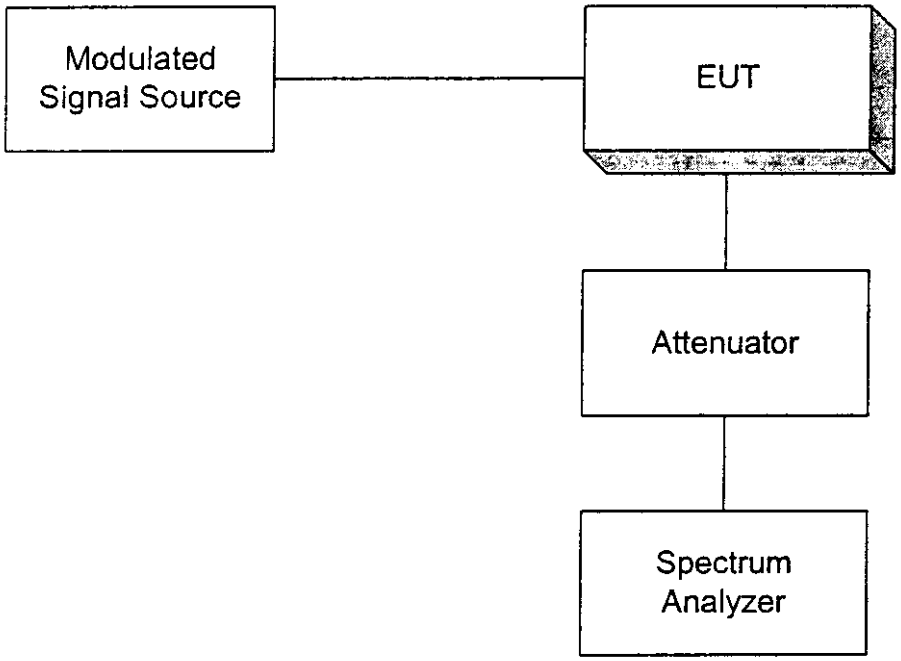
Para. No. 2.985 - R.F. Power Output

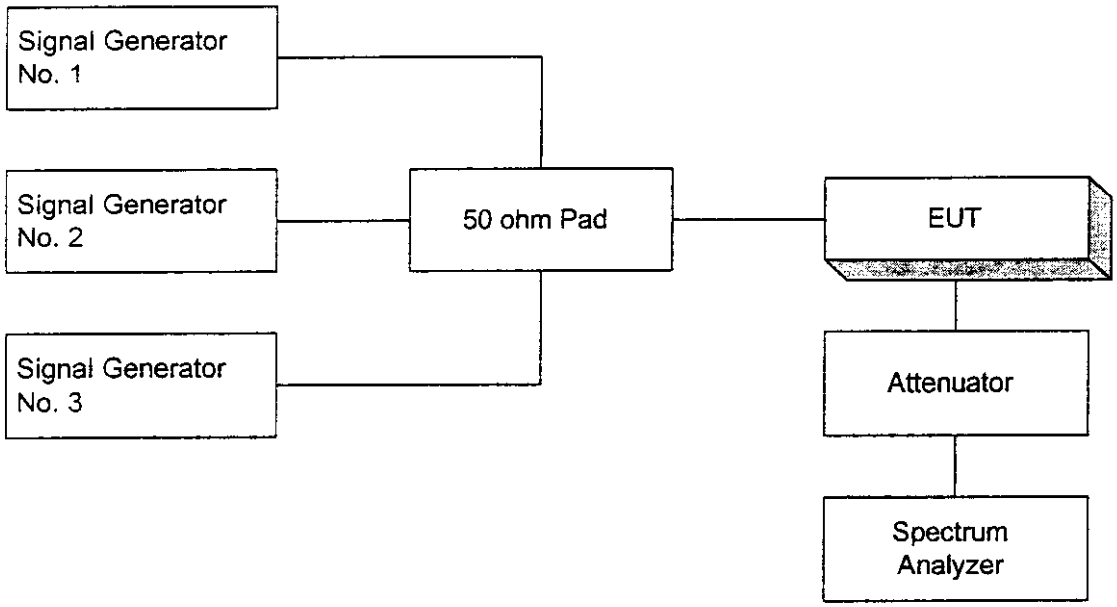


Para. No. 2.989 - Occupied Bandwidth

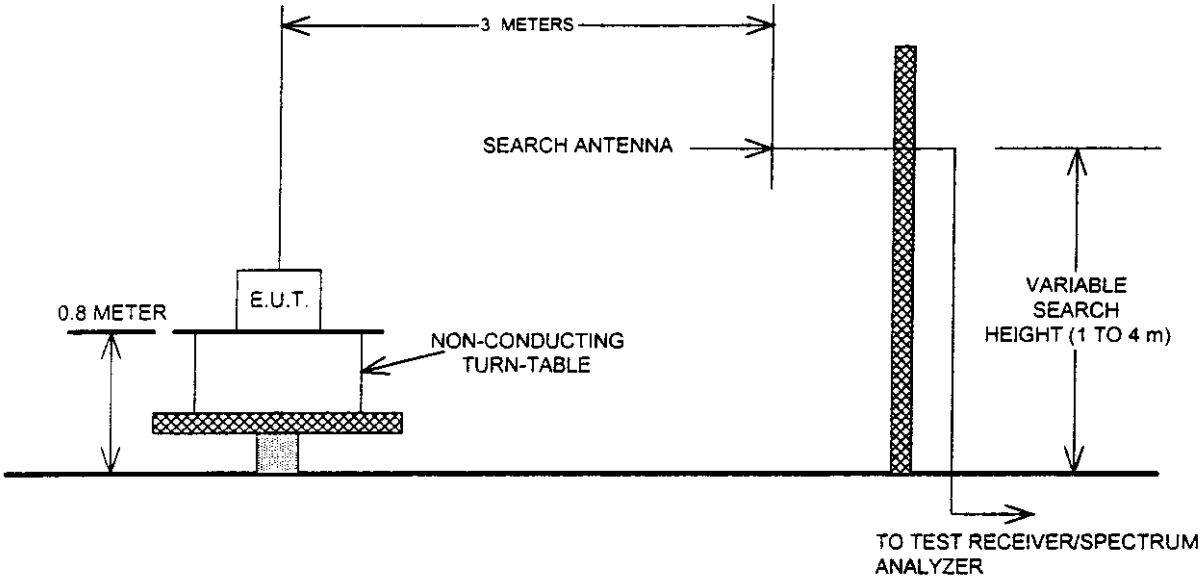


Para. No. 2.991 Spurious Emissions at Antenna Terminals





Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability