Nemko Test Report No.:	1L0581RUS1
Applicant:	Communications Components 89 Leuning Street South Hackensack, NJ 07606 Tel: 201-342-3338 Fax: 201-342-3339 Email: sales@cciproducts.com
Equipment Under Test:	GSM Amplifier DAB1819
In Accordance With:	**FCC Part 24, Subpart E** Broadband PCS Repeaters
Tested By:	Nemko Dallas Inc. 802 N. Kealy Lewisville, Texas 75057-3136
Authorized By:	Tom Tidwell, RF Group Manager
Date:	11/1/01
Total Number of Pages:	37

Table of Contents

Section 1. Summary of Test Results

Manufacturer: Communications Components

Model No.: DAB1819

Serial No.: 160

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	☒	Production Unit
☐	Class II Permissive Change	☐	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 LAB CODE: 100426-0

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPECIFIED LIMT	RESULT
RF Power Output	24.232	100W	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Complies

Footnotes:

(1) Modulation characteristics were not tested since the E.U.T. processes but does not produce a modulated waveform.

Measurement uncertainty for each test configuration is expressed to 95% probability.

Section 2. General Equipment Specification

Supply Voltage Input:		28 Vdc 10A
Frequency Bands:	**Downlink:**	☒ Block A : 1930 – 1945 MHz ☒ Block D : 1945 – 1950 MHz ☒ Block B : 1950 – 1965 MHz ☒ Block E : 1965 – 1970 MHz ☒ Block F : 1970 – 1975 MHz ☒ Block C : 1975 – 1990 MHz
Frequency Bands:	**Uplink:**	Not Applicable. The equipment is directly connected to the BTS via coaxial cable.
		CDMA (G7W) ☐ **GSM (GXW)** ☒ **NADC (DXW)** ☐
Output Impedance:		50 ohms
Max Input:		5 dBm
		Highest Channel: 5.01 W Per channel: 55 W Lowest Channel: 5.01 W The power output must be lowered on the first and last channels of each frequency block.
		F1-F1 ☒ **F1-F2** ☐ **N/A** ☐
		Software ☐ **Duplexer** ☐ **Fullband** ☒

Description of Modifications For Class II Permissive Change

Not Applicable

Modifications Made During Testing

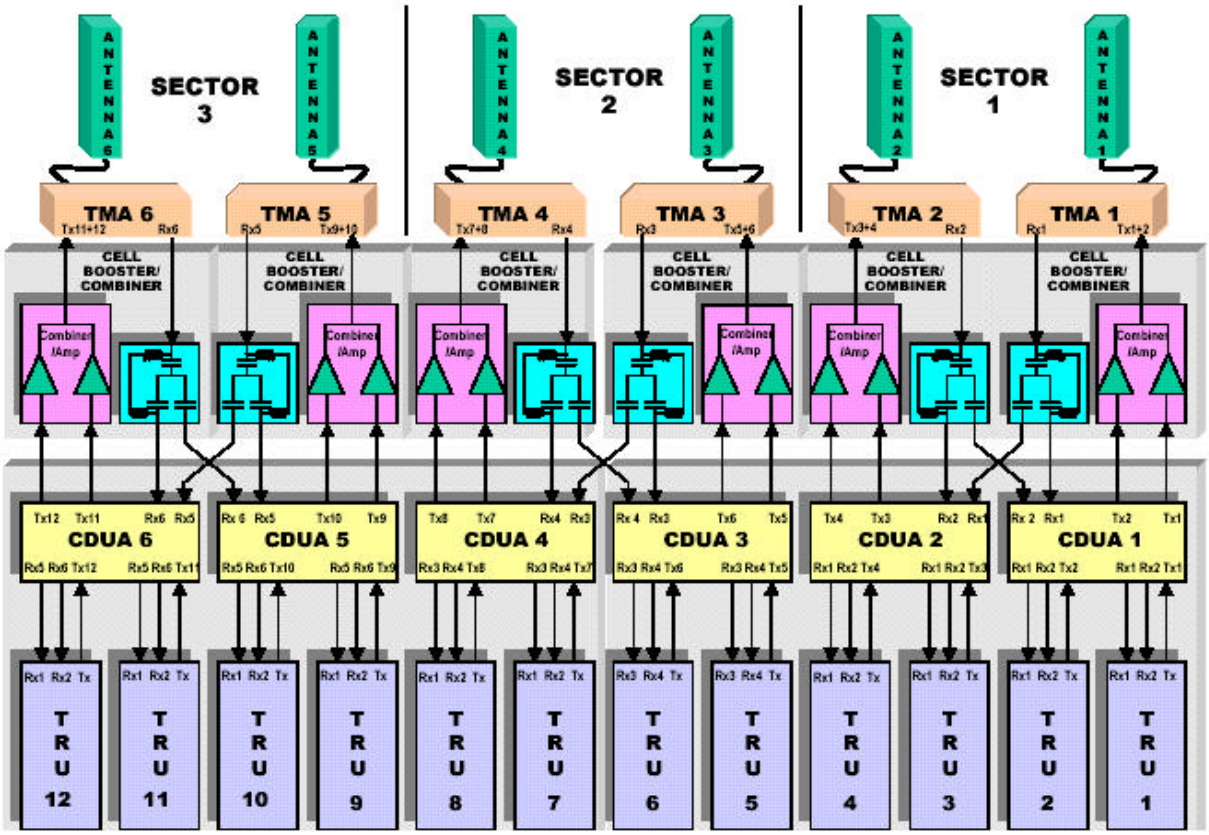
Not Applicable

Description of Operation

The PCS Cell Booster was specifically designed to integrate with compact GSM base stations without any need for retrofitting the original equipment. The system consists of a 5U 19” rack mount tray that can accommodate up to five individual modules. The modules include a Dual Amplifier-Booster Module, a Dual Amplifier-Combiner Module, a Triple Duplexer Module, and a Power Supply Unit (PSU). The Cell Booster system can be configured with any combination of the above modules in order to achieve the desired performance results.

The Dual Amplifier-Booster Module (DAB) consists of two linear power amplifiers with intermodulation level control circuitry, each capable of generating a 55 Watt GSM signal.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Lance Walker	DATE: October 22, 2001

Test Results: Complies.

Channel	Per Channel Output Power (dBm)	Composite Output Power (dBm)	Composite Output Power (W)
High (1989.8 MHz)	37	37	5.01
Mid (1960 MHz)	47	47.4	55
Low (1930.2 MHz)	37	37	5.01

It is necessary to lower rf power to 5 watts on the first and last channels of each frequency block in order to satisfy spurious emission limits on the band edges. For the purposes of this testing the first and last channels are considered to be centered at 200 kHz above the block edge and 200 kHz below the upper block edge respectively.

Block	Channel Center Frequency(MHz)	Maximum rf Input (dBm)	Maximum rf Output (Watts)
A	1930.2	-5.4	5
A	1930.4 - 1944.6	+5.0	55
A	1944.8	-5.4	5
D	1945.2	-5.4	5
D	1945.4 - 1949.6	+5.0	55
D	1949.8	-5.4	5
B	1950.2	-5.4	5
B	1950.4 - 1964.6	+5.0	55
B	1964.8	-5.4	5
E	1965.2	-5.4	5
E	1965.4 - 1969.6	+5.0	55
E	1969.8	-5.4	5
F	1970.2	-5.4	5
F	1970.4 - 1974.6	+5.0	55
F	1974.8	-5.4	5
C	1975.2	-5.4	5
C	1975.4 - 1989.6	+5.0	55
C	1989.8	-5.4	5

Equipment Used: 1036, 1082, 1628, 1604, and 1055

Measurement Uncertainty: +/- 0.6 dB

Temperature: 22 °C

Relative Humidity: 50 %

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: Lance Walker	DATE: October 23, 2001

Test Results: Complies.

Test Data: See attached plot(s).

Measurement Uncertainty: +/- 1.7 dB

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Tel: (972) 436-9600
Fax: (972) 436-2667

Nemko Dallas, Inc.

Data Plot — Occupied BW

Page 1 of 2 Complete X

Job No.: 1L0581R Date: 10/22/2001 Preliminary

Specification: Temperature(°C): 22

Tested By: Lance Walker Relative Humidity(%) 50

E.U.T.: Cell Band Repeater

Configuration: Normal

Sample Number: S01

Location: Lab 1 RBW: Refer to plots Measurement

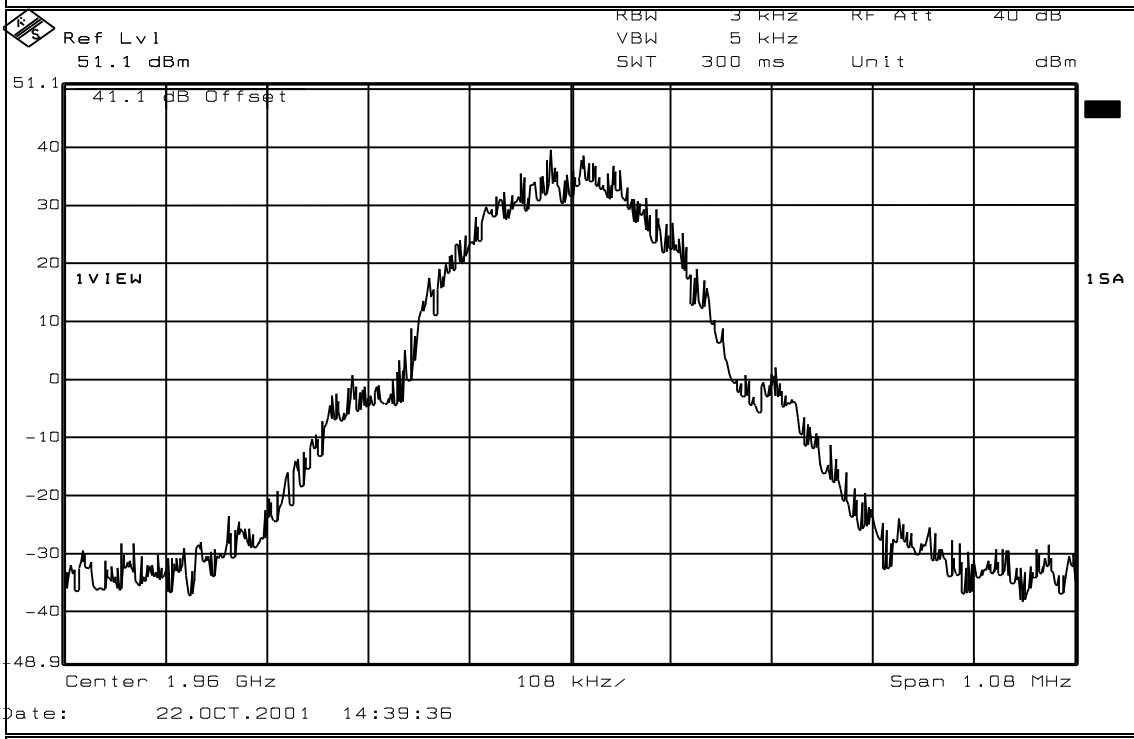
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	1055
Pre-Amp:		Cable #1:	1082
Filter:		Cable #2:	1628
Receiver:	1036	Cable #3:	
Attenuator #1	1604	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used: 1048

Measurement Uncertainty: +/-1.7 dB



Notes: **Mid Channel Full Power Output**

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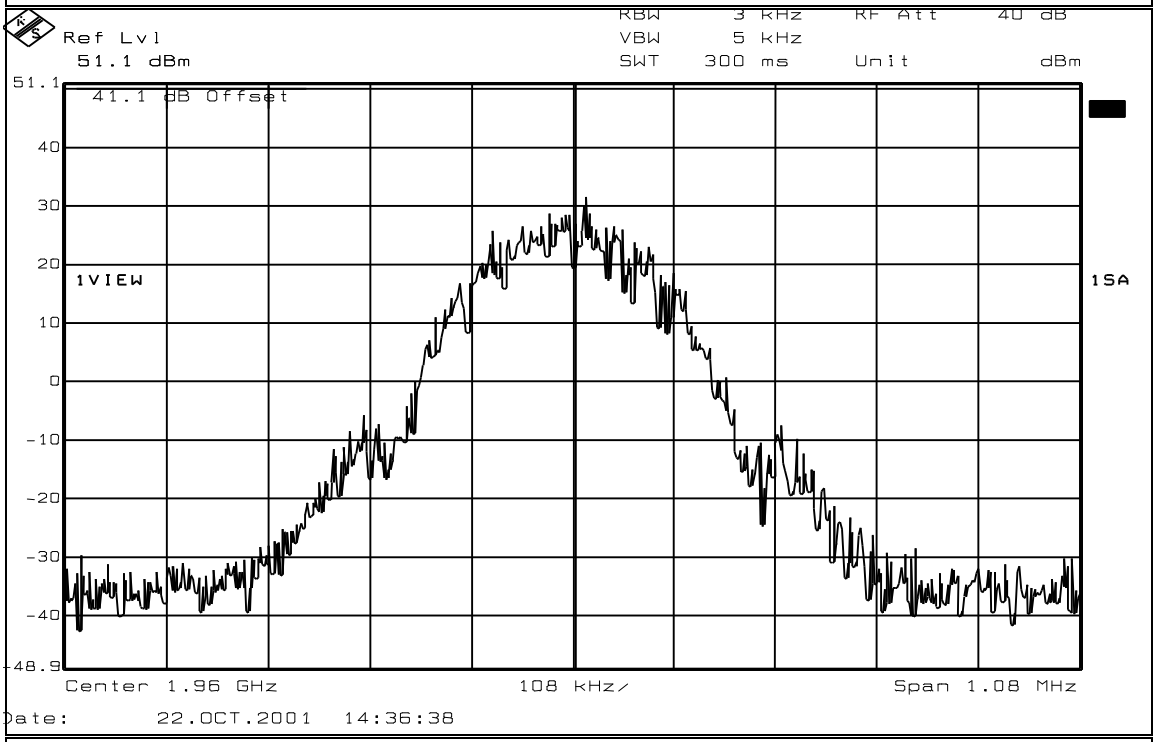
Data Plot — Occupied BW

Page 2 of 2

Job No.:	1L0581R	Date:	10/22/2001
Specification:		Temperature(°C):	22
Tested By:	Lance Walker	Relative Humidity(%)	50
E.U.T.:	Cell Band Repeater		
Configuration:	Normal		



Notes: **Mid Channel Full Power Input**

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Data Plot

Bandedges

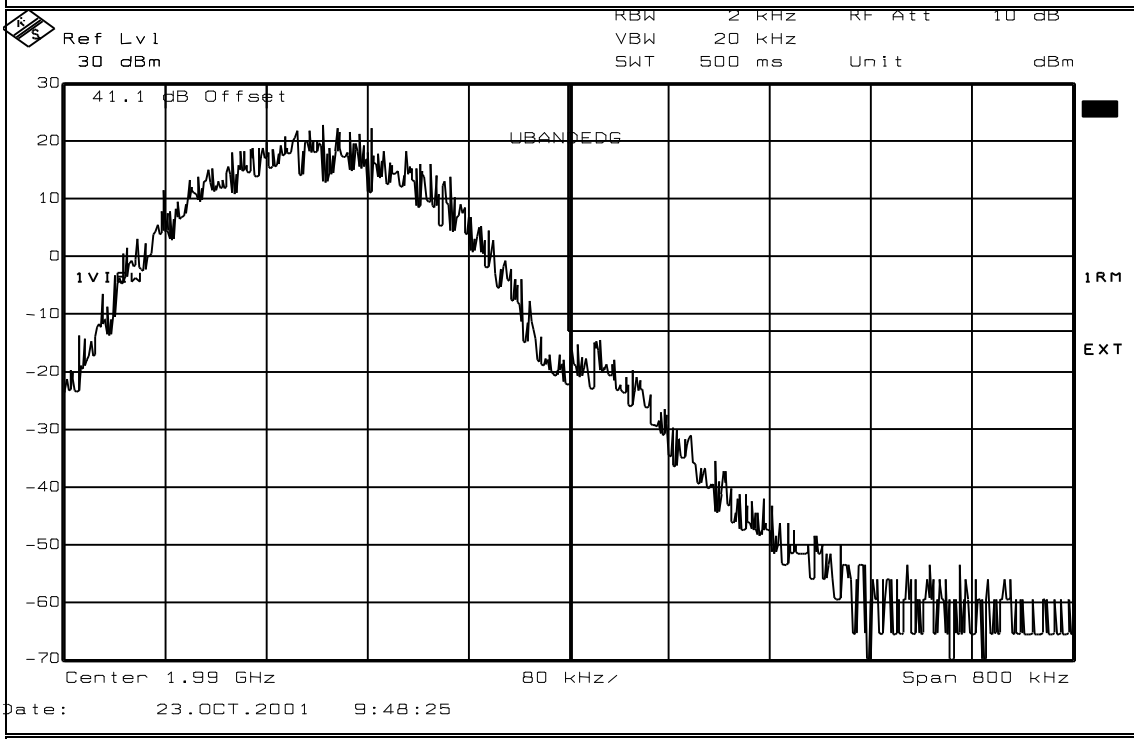
Page 1 of 4

Complete X
Preliminary

Job No.: 1L0581R Date: 10/21/2001
Specification: Part 24 Subpart E Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: Repeater
Configuration: Normal
Sample Number: S01
Location: Lab 1 RBW: Refer to plots Measurement
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:
Pre-Amp:
Filter:
Receiver: 1464
Attenuator #1 1604
Attenuator #2:
Directional Coupler: 1055
Cable #1: 1082
Cable #2: 1628
Cable #3:
Cable #4:
Mixer:
Additional equipment used:
Measurement Uncertainty: +/- 1.7 dB



Notes: **Had to lower output to 5.01 W in order to get signal humps under limit**

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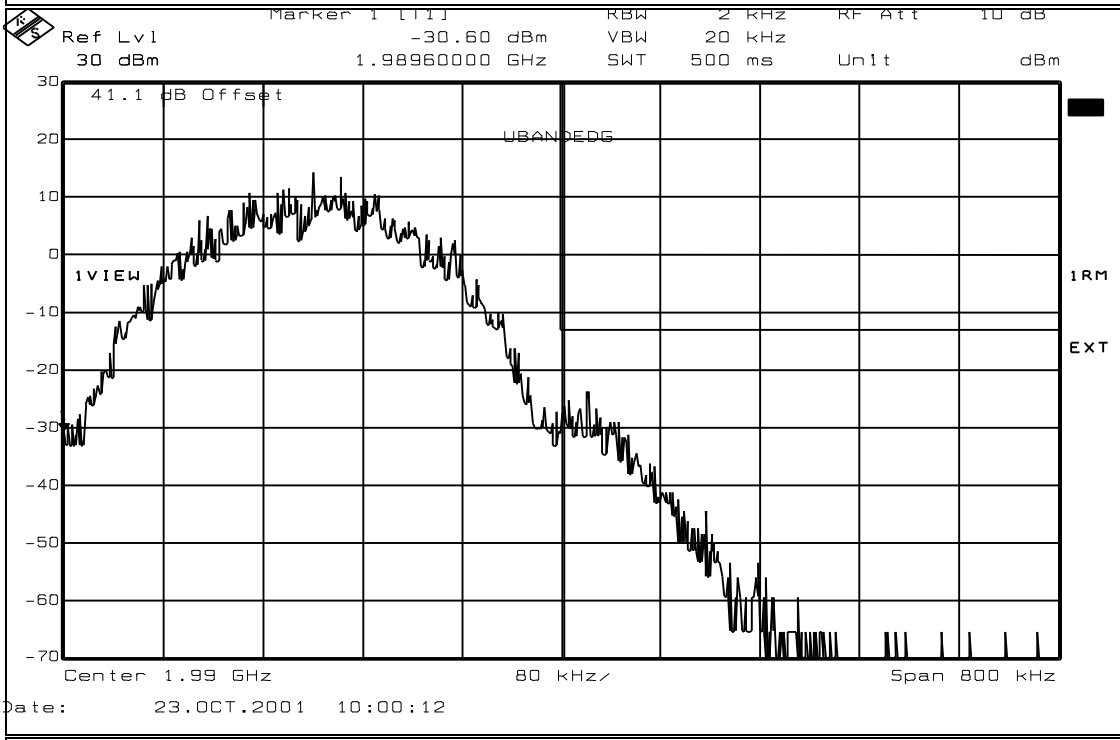
Test Plot: **Bandedges**

Page 4 of 4

Job No.: 1L0581R Date: 10/21/2001
Specification: Part 24 Subpart E Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: Repeater
Configuration: Normal



Notes: **Input Upper Band Edge**

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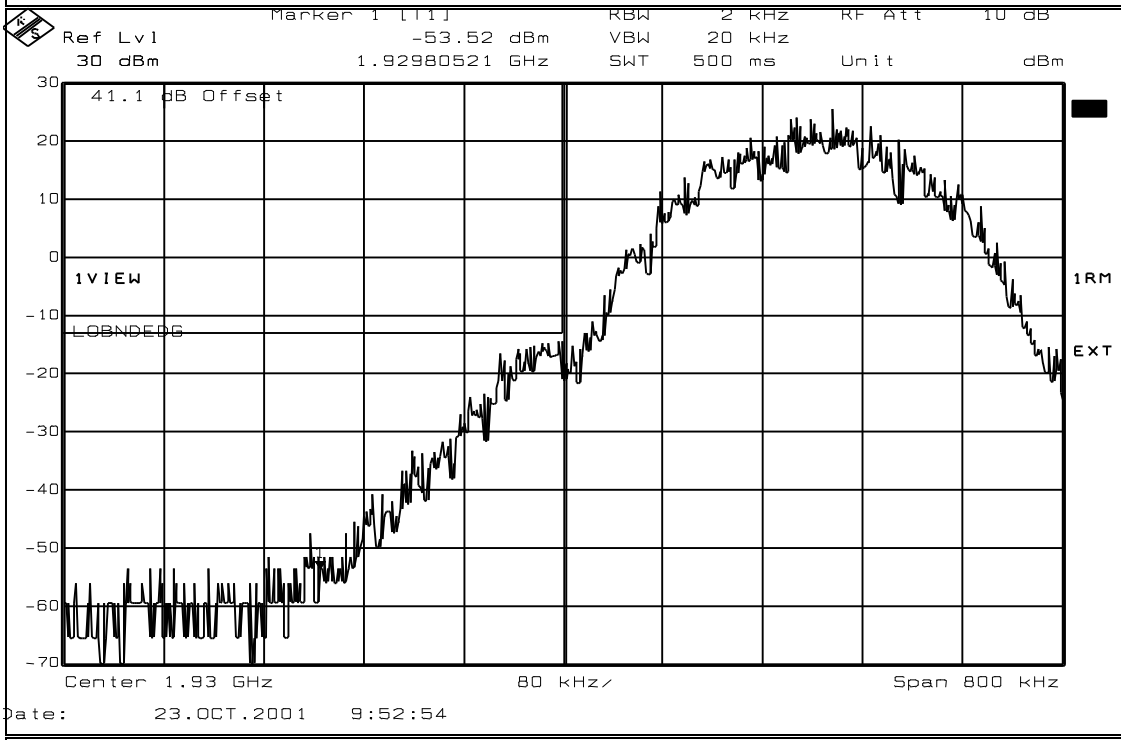
Data Plot — Bandedges

Page 2 of 4

Job No.: 1L0581R
Part 24
Specification: Subpart E
Tested By: Lance Walker
E.U.T.: Repeater
Configuration: Normal

Date: 10/21/2001
Temperature(°C): 22
Relative Humidity(%) 50



Notes: **Same as upper Bandedge lowered output**

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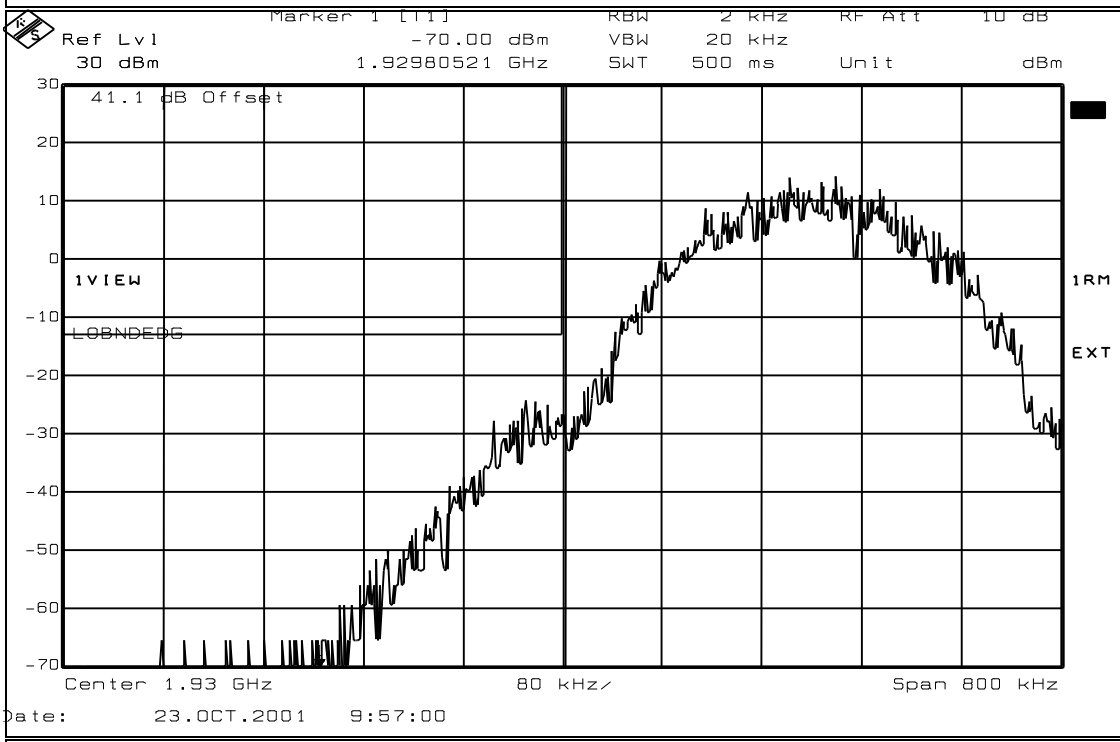
Data Plot — Bandedges

Page 3 of 4

Job No.: 1L0581R Date: 10/21/2001
Specification: Part 24 Subpart E Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: Repeater
Configuration: Normal



Notes: **Input Lower Bandedge**

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Data Plot — Intermodulation Characteristics

Page 1 of

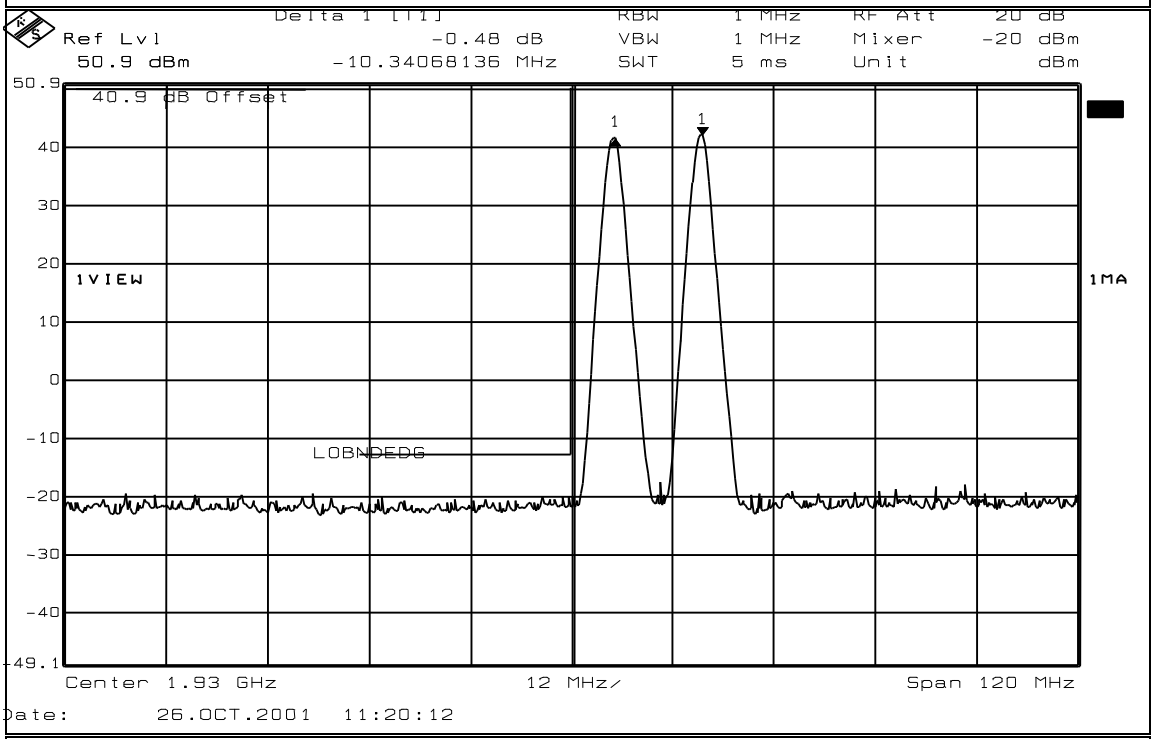
Complete X
Preliminary

Job No.: 1L0581R Date: 10/26/2001
Specification: Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: GSM Repeater
Configuration: Normal
Sample Number:
Location: Lab 1 RBW: Refer to plots Measurement
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	1055
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	1626
Receiver:	1036	Cable #3:	
Attenuator #1	1064	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-1.7 dB



Notes: **Marker 1 at top of signal at 1945.5 MHz and Delta being the other input signal, no significant spurious emissions were found.**

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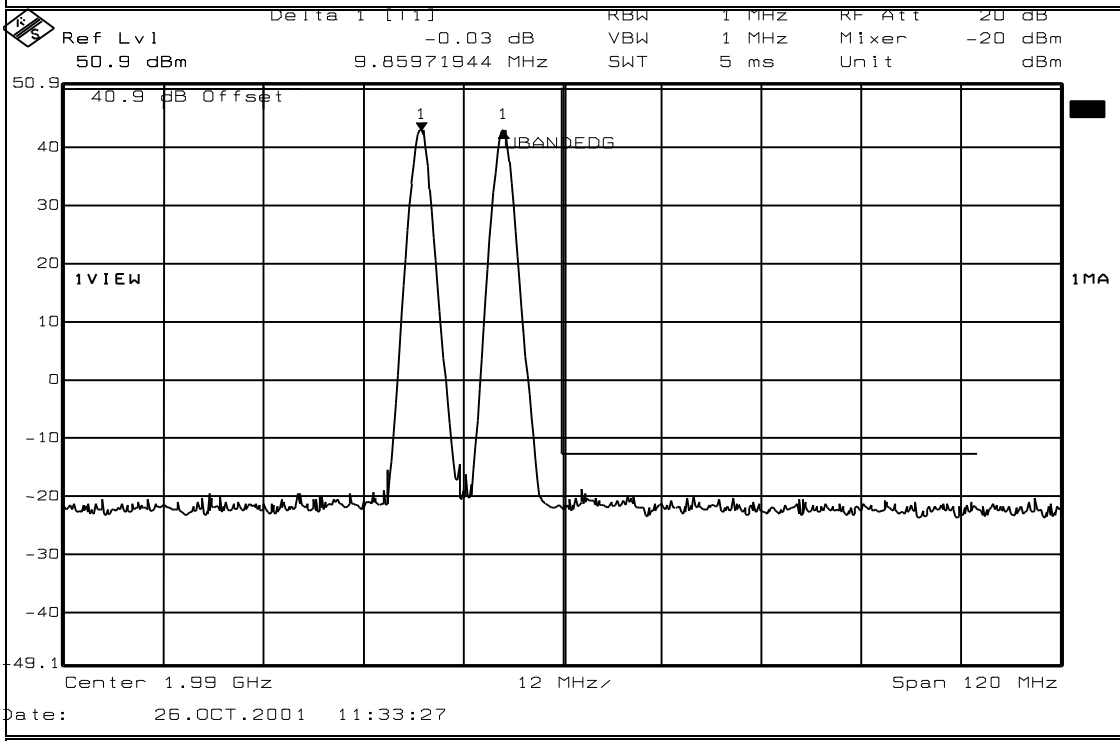
Data Plot — Intermodulation Characteristics

Page 2 of

Job No.: 1L0581R Date: 10/26/2001
Specification: Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: GSM Repeater
Configuration: Normal



Notes: **Marker 1 is set at 1.973 MHz with the delta on the upper edge**

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: Lance Walker	DATE: October 22, 2001

Test Results: Complies.

Test Data: See attached plot(s).

Measurement Uncertainty: +/- 1.6 dB

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Data Plot — Antenna Port Spurious Emissions

Page 1 of 4 Complete X

Job No.: 1l0581r Date: 10/22/2001 Preliminary

Specification: FCC Part 24 Temperature(°C): 22

Tested By: David Light Relative Humidity(%) 50

E.U.T.: Repeater

Configuration: Normal

Sample Number: 1

Location: Lab 1 RBW: Refer to plots Measurement

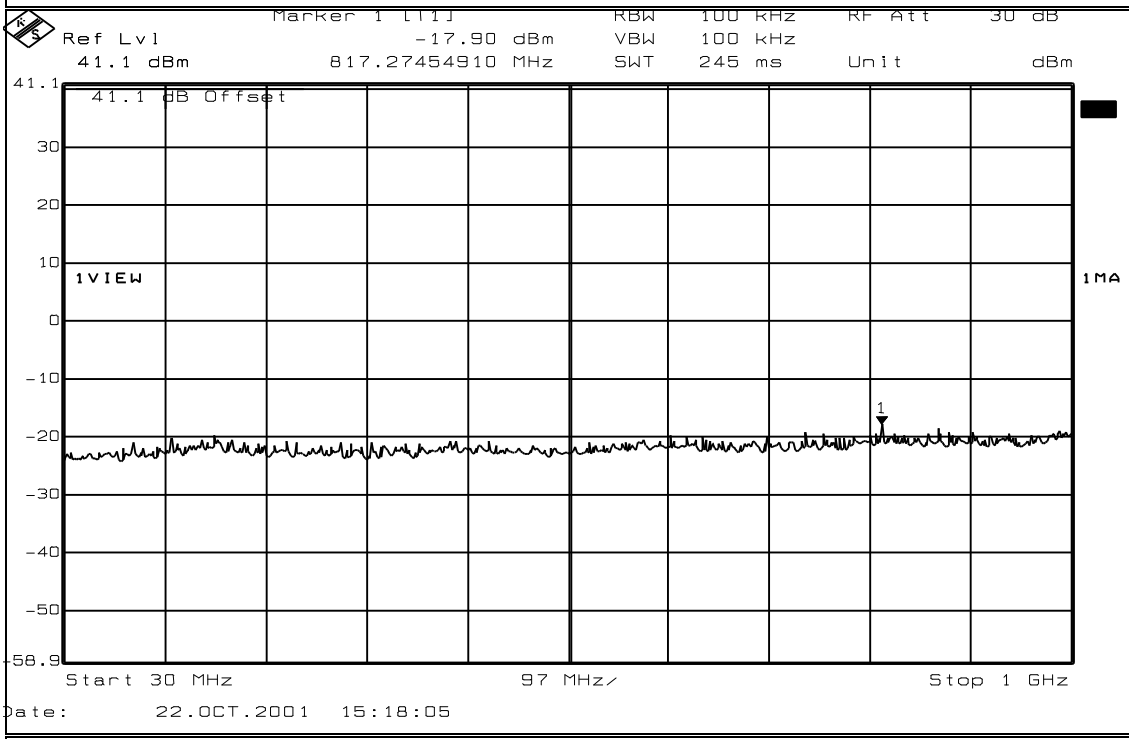
Detector Type: Peak VBW: Refer to plots Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	1055
Pre-Amp:		Cable #1:	1082
Filter:		Cable #2:	1628
Receiver:	1036	Cable #3:	
Attenuator #1	1604	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used: 1059

Measurement Uncertainty: +/-1.7 dB



Notes: **MID CHANNEL 30 - 1 GHz**

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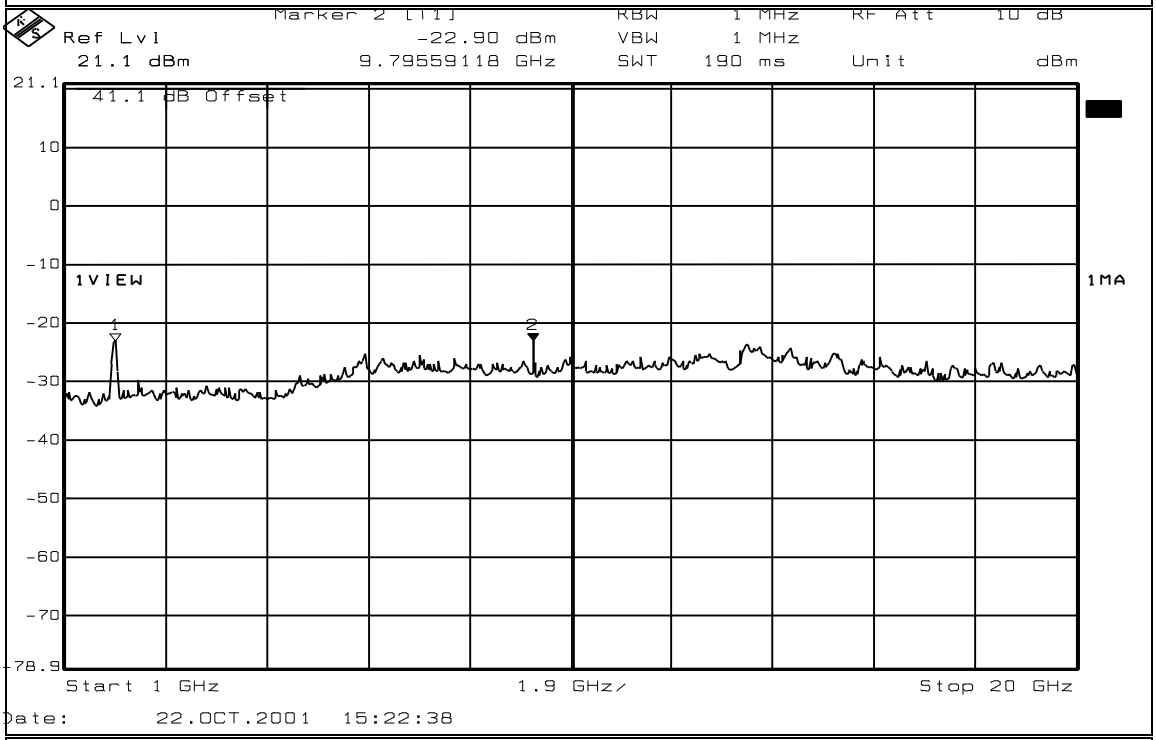
Data Plot — Antenna Port Spurious Emissions

Page 2 of 4

Job No.:	1l0581r	Date:	10/22/2001
Specification:	FCC Part 24	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	Repeater		
Configuration:	Normal		



Notes: **CARRIER NOTCHED**

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1051
TESTED BY: Lance Walker	DATE: 10/22/01

Test Results: Complies.

Test Data: See attached table.

Measurement Uncertainty: +/- 3.6 dB

Test Data - Radiated Emissions

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Field Strength of Spurious Emissions

Page 1 of 1 Complete X
Job No.: 1L0581R Date: 10/22/2001 Preliminary
Specification: Part 24 Subpart R Temperature(°C): 22
Tested By: Lance Walker Relative Humidity(%) 50
E.U.T.: Repeater
Configuration: Normal
Sample No: S01
Location: AC 3 RBW: 1 MHz Measurement
Detector Type: Peak VBW: 1 MHz Distance: 3 m

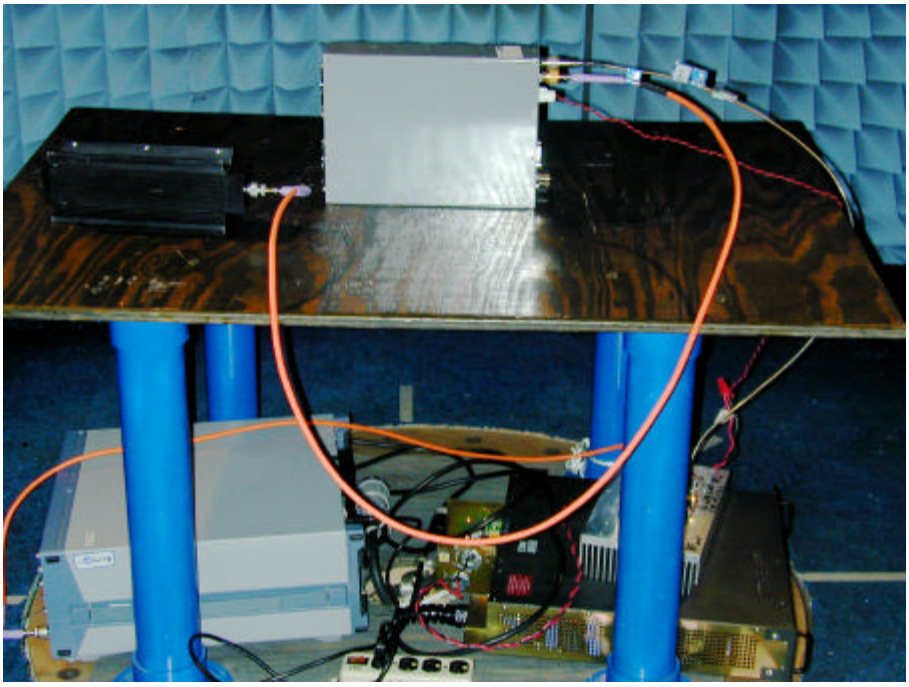
Test Equipment Used

Antenna: 993 Directional Coupler:
Pre-Amp: 1016 Cable #1: 1484
Filter: Cable #2: 1485
Receiver: 1464 Cable #3: 1043
Attenuator #1 Cable #4:
Attenuator #2: Mixer:
Additional equipment used:
Measurement Uncertainty: +/-1.7 dB

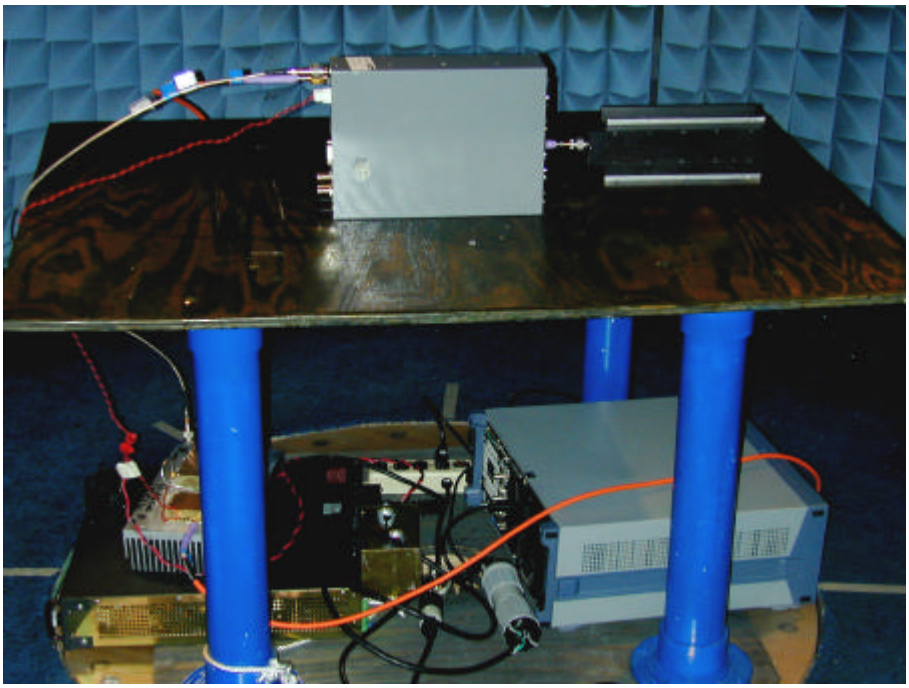
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)		Pre-Amp Gain (dB)	Substitution Antenna Gain (dBd)	Limit (dBm)	ERP (dBm)	ERP (mW)	Polarity	Comments
3920	-35.7	34.3		33.3	8.0	-13	-26.7	0.002153	H	-31.7 without filter
5880	-37.8	36.0		32.7	9.1	-13	-25.4	0.002858	H	
7840	-40.3	39.8		33.3	9.4	-13	-24.4	0.003648	H	
9800	-46.5	42.6		36	10.5	-13	-29.4	0.001153	H	
11760	-59.0	46.0		35.5	11.0	-13	-37.5	0.000179	H	
13720	-57.3	50.8		33.3	10.4	-13	-29.4	0.001161	H	
15680	-67.5	44.0		33.2	13.6	-13	-43.1	0.000049	H	
17640	-69.0	53.6		34	8.7	-13	-40.7	0.000085	H	Noise Floor
3920	-33.5	40.4		33.3	8.0	-13	-18.4	0.014388	V	
5880	-37.2	38.5		32.7	9.1	-13	-22.3	0.005834	V	
7840	-41.3	40.4		33.3	9.4	-13	-24.7	0.003357	V	
9800	-45.4	40.4		36	10.5	-13	-30.5	0.000899	V	
11760	-57.7	49.3		35.5	11.0	-13	-32.9	0.000516	V	
13720	-59.5	47.6		33.3	10.4	-13	-34.8	0.000334	V	
15680	-67.5	43.2		33.2	13.6	-13	-43.9	0.000041	V	
17640	-69.0	51.0		34	8.7	-13	-43.3	0.000047	V	Noise Floor

Photographs of Test Setup

FRONT VIEW



REAR VIEW



Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY:	DATE:

Test Results: Compliance.

Measurement Data: See attached table.

Standard Test Frequency: MHz
Standard Test Voltage:

Equipment Used:

Measurement Uncertainty: +/- 1.6 dB

Lab Temperature: °C

Relative Humidity: %

Section 8. Test Equipment List

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	09/17/01
1604	ATTENUATOR	NARDA 776B-20	NONE	09/13/01
1059	TUNABLE NOTCH FILTER	K&L 3TNF-1000/2000-N/N	144	CBU
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/99
1064	ATTENUATOR	NARDA 776B-20	NONE	09/13/01
1055	DUAL DIRECTIONAL COUPLER	NARDA 3022	73393	Cal Not Req
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	06/01/01
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	CBU
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	06/01/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	06/01/01
1043	Flexable cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	01/29/01
1626	CABLE, 5 ft	MEGAPHASE 10311 1GVT4	N/A	CBU

ANNEX A - TEST DETAILS

NAME OF TEST: RF Power Output **PARA. NO.: 2.1046**

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:

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

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.: 2.1047**

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.: 2.1051

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.: 2.1053

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.

Test Method: TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting erp is the signal level fed to the reference antenna corrected for gain referenced to a dipole.

NAME OF TEST: Frequency Stability **PARA. NO.: 2.1055**

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

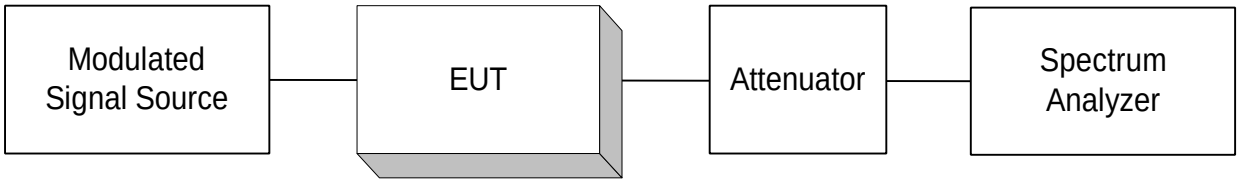
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. The frequency counter and signal generator are phase locked with the same 10 MHz reference frequency by connecting the 10 MHz ref. out of the counter to the 10 MHz ref, in of the 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

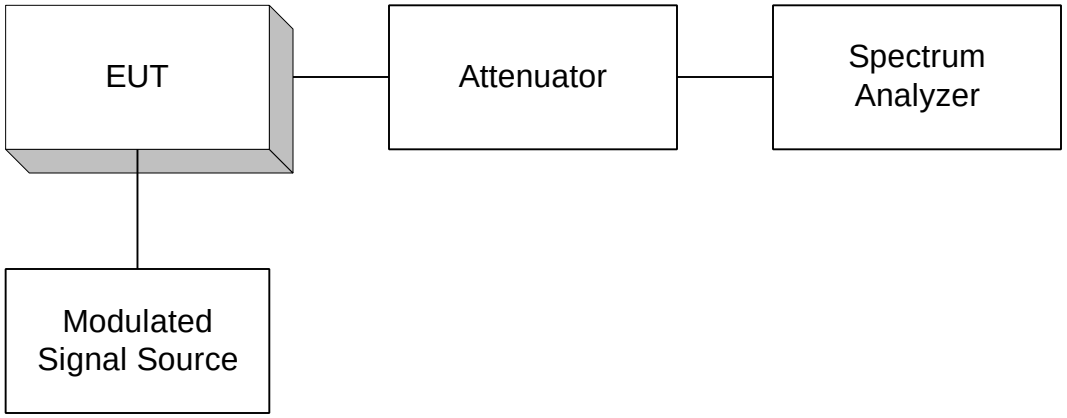
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

ANNEX B - TEST DIAGRAMS

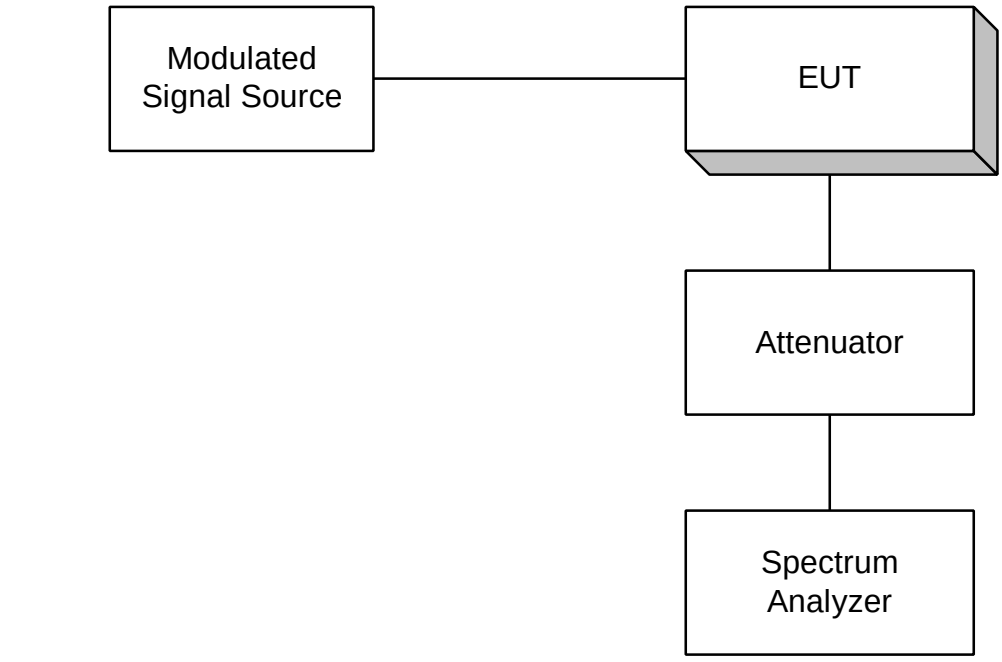
Para. No. 2.985 - R.F. Power Output

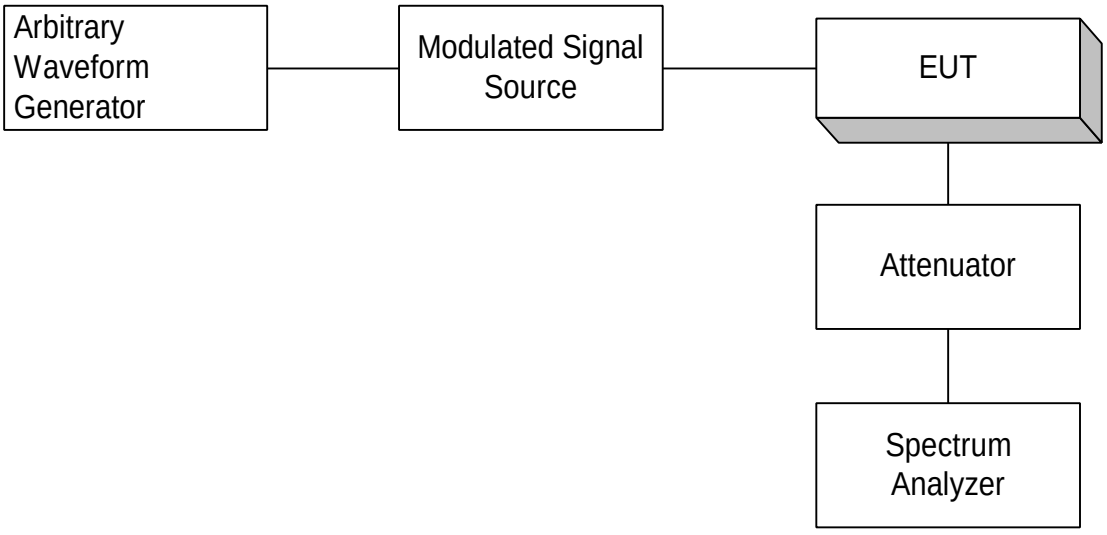


Para. No. 2.989 - Occupied Bandwidth

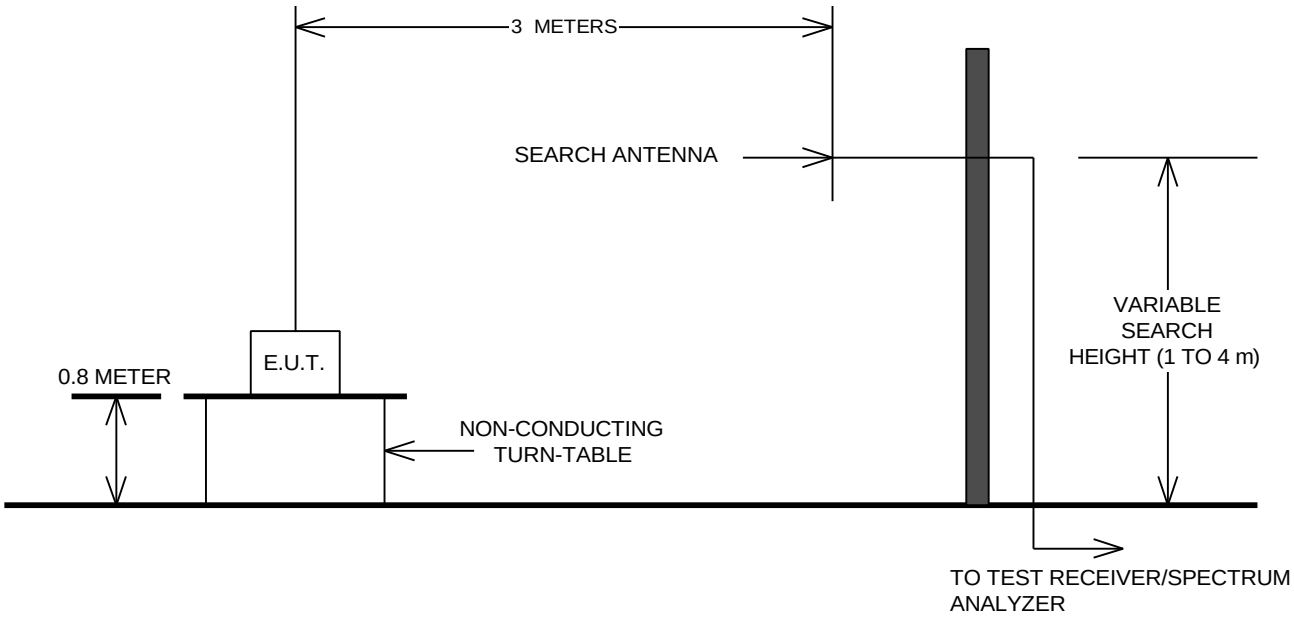


Para. No. 2.991 Spurious Emissions at Antenna Terminals





Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability