KTL Test Report:	8R01087
Applicant:	Communication Components Inc. 299 Forest Avenue Paramus, NJ 07652
Equipment Under Test: **(E.U.T.)**	PCS Signal Enhancer
FCC ID:	NT3CE-1819-20
In Accordance With:	**FCC Part 24, Subpart E** Broadband PCS Repeaters
Tested By:	KTL Ottawa Inc. 3325 River Road, R.R. 5 Ottawa, Ontario K1V 1H2
Authorized By:	
	_____ W. Waterhouse, RF Engineering Lab Manager
Date:	_____
Total Number of Pages:	43

Table of Contents

Table of Contents, continued

Section 1. Summary of Test Results

Manufacturer: Communication Components Inc.

Model No.: CE-1819-20

Serial No.: 2380

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

☐☐☐ Equipment Code

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: 100351-0

TESTED BY: _____ DATE: _____
Kevin Carr, Technologist

TECHNICAL REVIEW: _____ DATE: _____
Tom Tidwell, Wireless Group Manager

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	24.232	100W	20W	Complies
Occupied Bandwidth (GSM)	24.238	Input/Output	Plot	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	-13 dBm	-13.33	Complies
Field Strength of Spurious Emissions	24.238(a)	-13 dBm E.I.R.P.	Table	Complies
Frequency Stability	24.235	N/A	N/A	N/A

Footnotes For N/A's: F1-F1

Test Conditions: Temperature: 20 °C
Humidity: 25 %

Section 2. General Equipment Specification

Supply Voltage Input:		120 VAC, 60 Hz
Frequency Range:	**Downlink:**	B-Band, 1950 / 1964.95 MHz A/D-Band, 1930 / 1949.95 MHz
Frequency Range:	**Uplink:**	Not Applicable
20 dB Bandwidth:		Not Applicable

Type of Modulation and Designator:	**CDMA (F9W)**	**GSM (GXW)**	**NADC (DXW)**
	☐	☒	☐

AGC Threshold:	Not Applicable
Output Impedance:	50 ohm
Gain:	13 dB Nominal
Max Input Power:	+30 dBm
RF Output (Rated): **Single:**	43.0 dBm

Frequency Translation:	**F1-F1**	**F1-F2**	**N/A**
	☒	☐	☐

Band Selection:	**Software**	**Duplexer Change**	**Fullband Coverage**
	☐	☒	☐

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

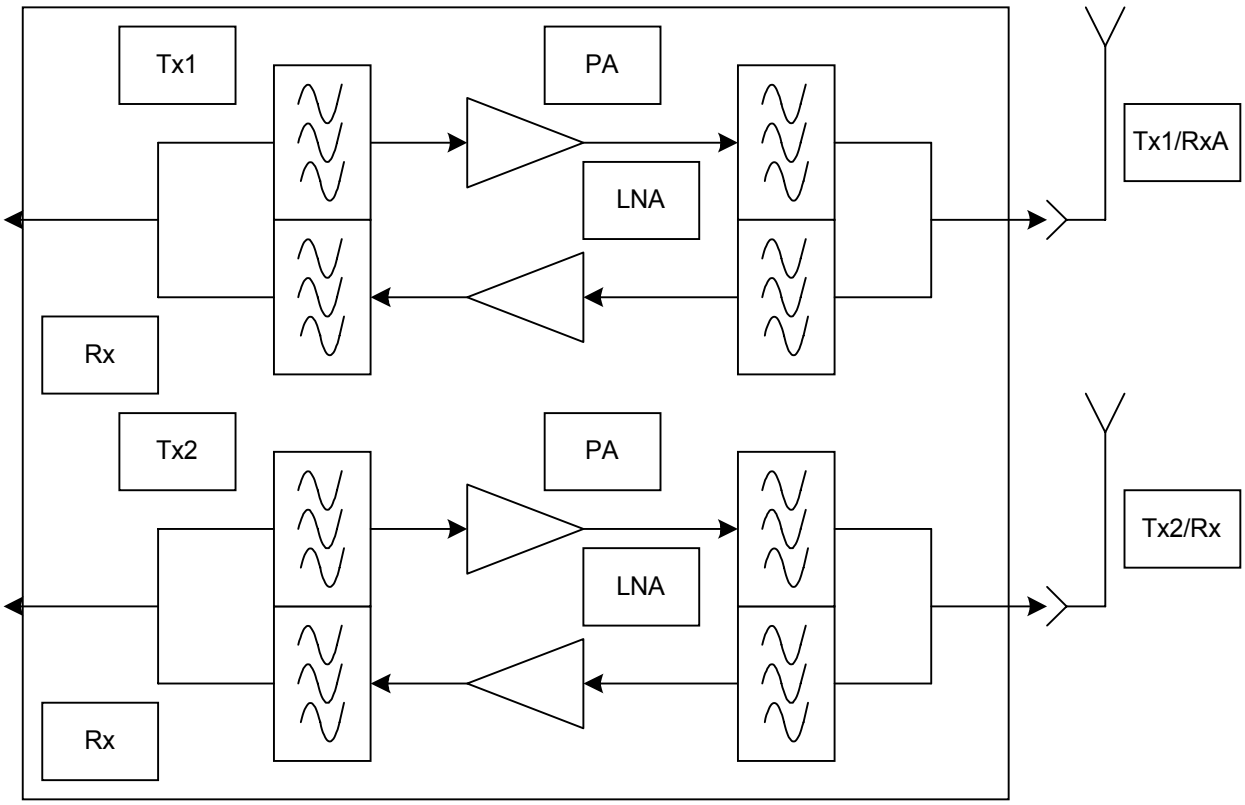
Modifications Made During Testing

NOT APPLICABLE

Theory of Operation

The CE-1819-20 is a bi-directional amplifier that can be mounted on the same mounting structure directly underneath the micro-based station. The cell extender is specifically designed for compatibility with the Ericsson RBS 2301 base station. The E.U.T. is designed to boost both low power transceivers (both cells) provided with RBS 2301. The unit contains redundant low noise amps, and higher power amps, it also contains an integrated power supply and alarm/control circuitry to monitor the unit. The uplink direction is hard wired to the base station.

System Diagram



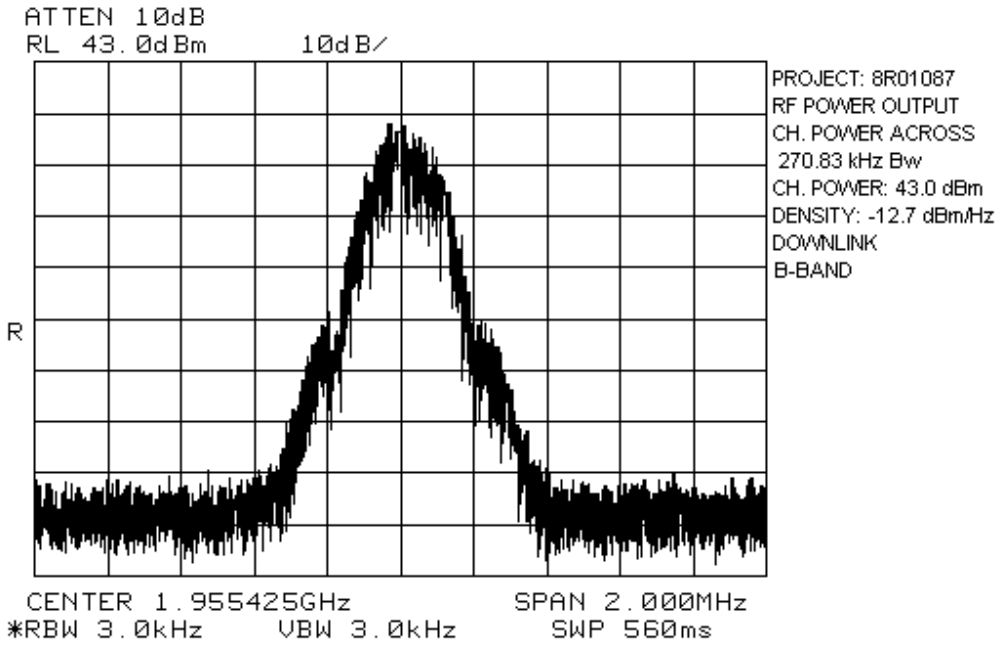
Section 3. RF Power Output

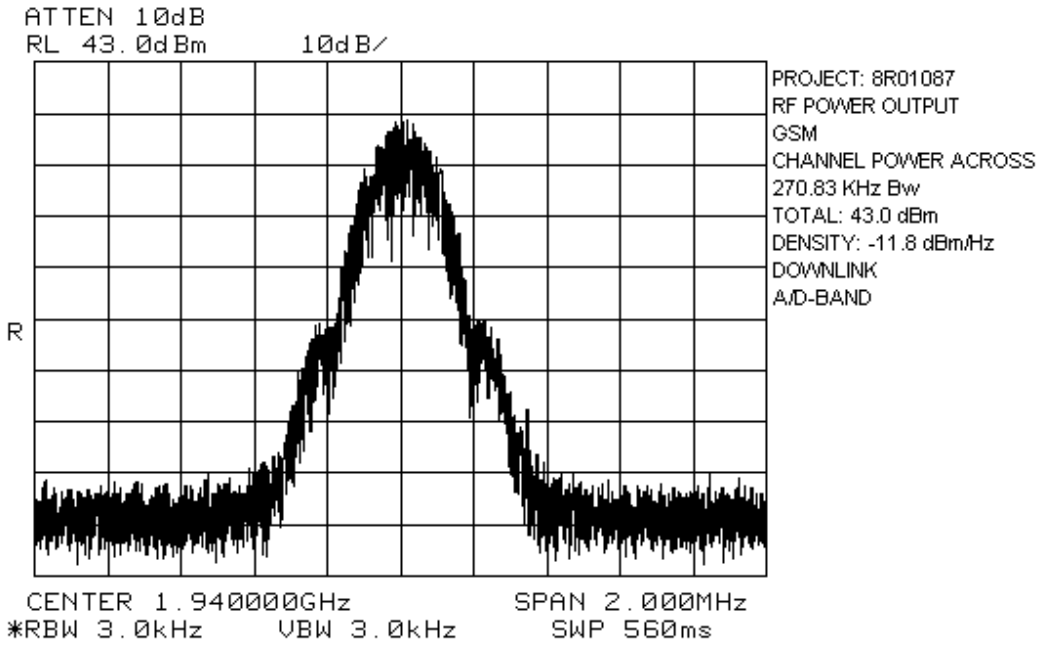
NAME OF TEST: RF Power Output	PARA. NO.: 2.985
TESTED BY: Kevin Carr	DATE: January 18, 1999

Test Results: Complies.

Measurement Data:

	Modulation Type	Per Channel Output Power (dBm)
Downlink	GSM	43.0


ATTEN 10dB
RL 43.0dBm
10dB/
R
PROJECT: 8R01087
RF POWER OUTPUT
CH. POWER ACROSS
270.83 kHz Bw
CH. POWER: 43.0 dBm
DENSITY: -12.7 dBm/Hz
DOWNLINK
B-BAND
CENTER 1.955425GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


ATTEN 10dB
RL 43.0dBm
10dB/
R
PROJECT: 8R01087
RF POWER OUTPUT
GSM
CHANNEL POWER ACROSS
270.83 KHz Bw
TOTAL: 43.0 dBm
DENSITY: -11.8 dBm/Hz
DOWNLINK
A/D-BAND
CENTER 1.940000GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth (CDMA)	PARA. NO.: 2.917(c)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

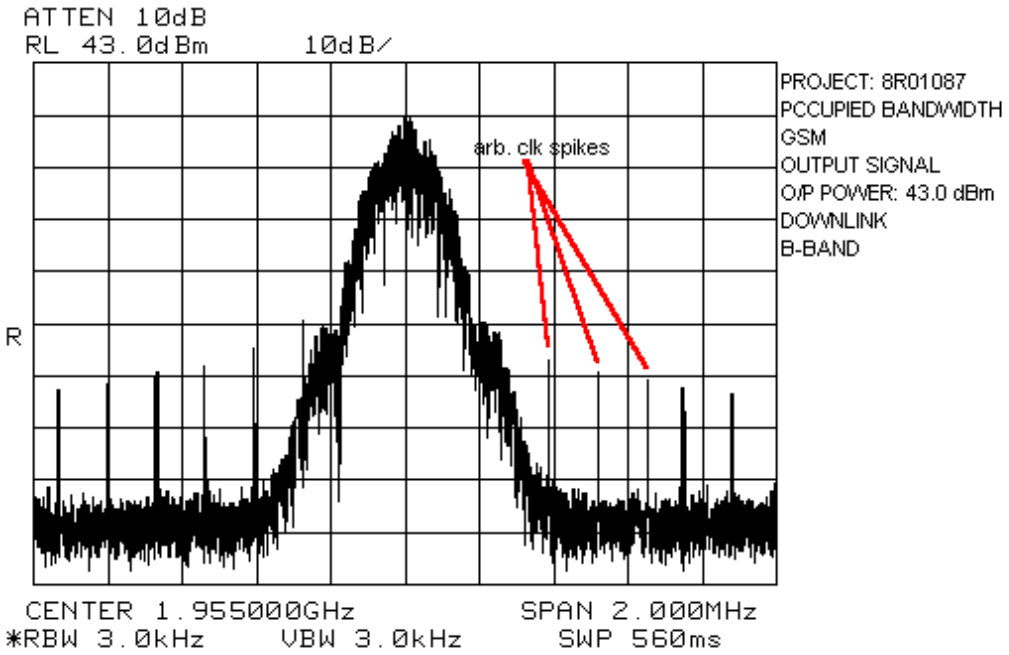
Test Data: See attached graph(s).

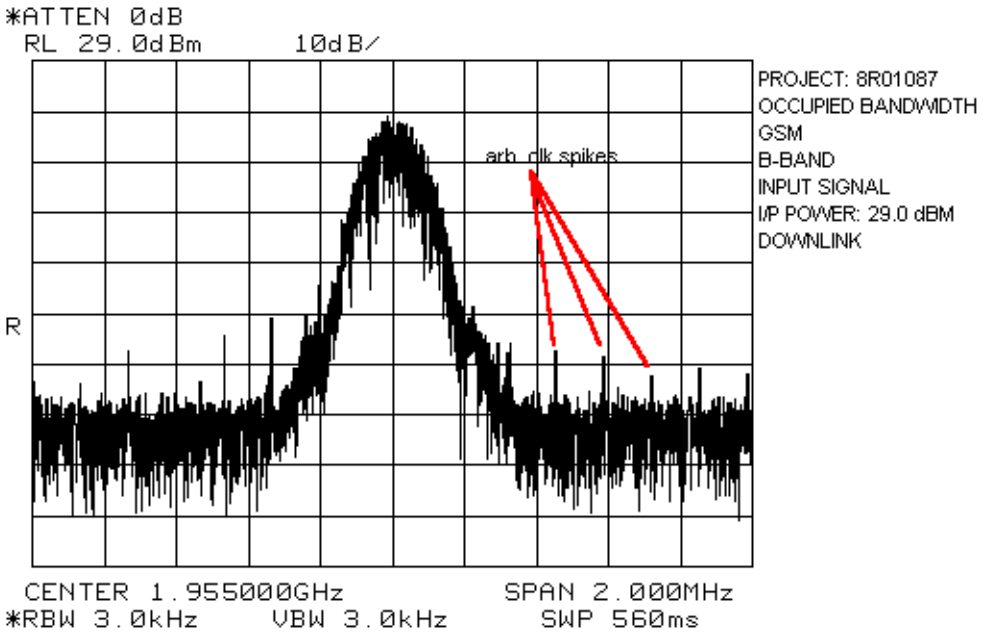
NOT APPLICABLE

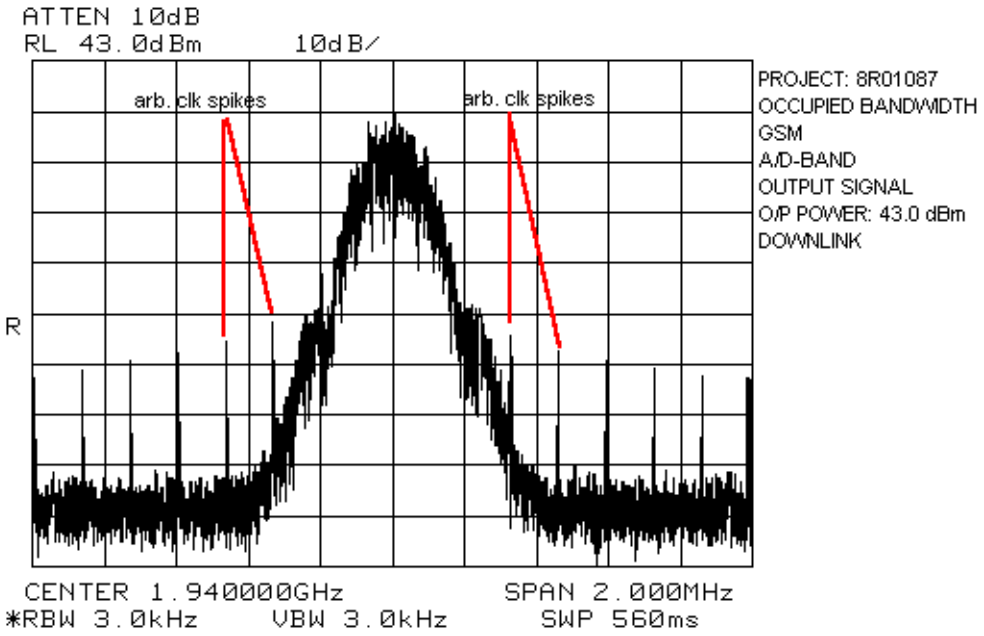
NAME OF TEST: Occupied Bandwidth (GSM)	PARA. NO.: 2.917(c)
TESTED BY: Kevin Carr	DATE: January 19, 1999

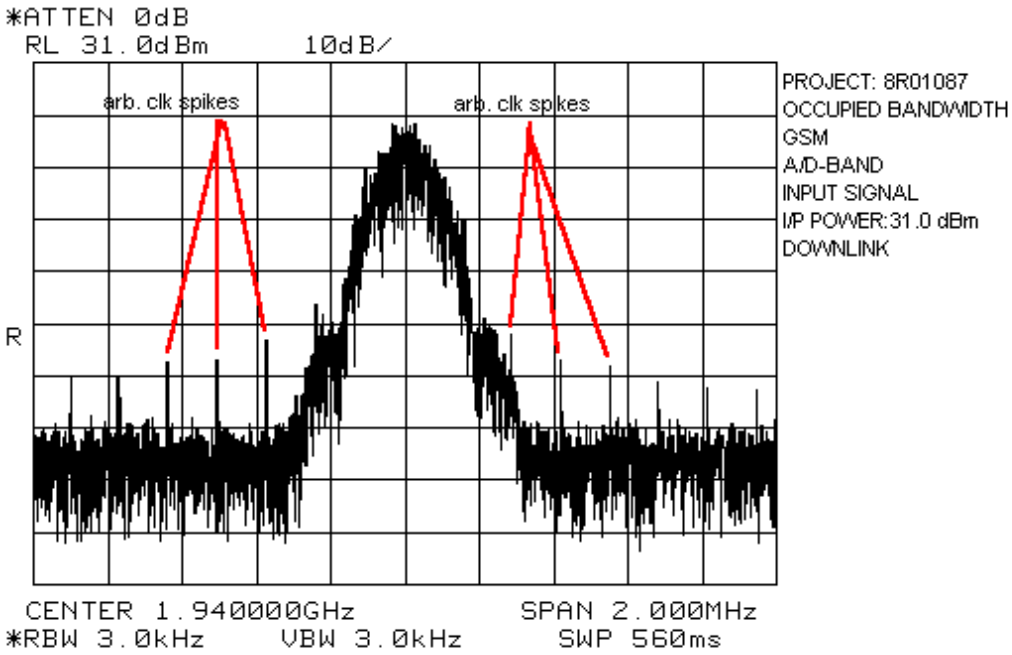
Test Results: Complies.

Test Data: See attached graph(s).


ATTEN 10dB
RL 43.0dBm
10dB/
arb. clk spikes
PROJECT: 8R01087
PCCUPIED BANDWIDTH
GSM
OUTPUT SIGNAL
O/P POWER: 43.0 dBm
DOWNLINK
B-BAND
R
CENTER 1.955000GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


*ATTEN 0dB
RL 29.0dBm
10dB/
arb. clk spikes
PROJECT: 8R01087
OCCUPIED BANDWIDTH
GSM
B-BAND
INPUT SIGNAL
I/P POWER: 29.0 dBM
DOWNLINK
R
CENTER 1.955000GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


ATTEN 10dB
RL 43.0dBm
10dB/
arb. clk spikes
arb. clk spikes
R
PROJECT: 8R01087
OCCUPIED BANDWIDTH
GSM
A/D-BAND
OUTPUT SIGNAL
O/P POWER: 43.0 dBm
DOWNLINK
CENTER 1.940000GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms


*ATTEN 0dB
RL 31.0dBm
10dB/
arb. clk spikes
arb. clk spikes
PROJECT: 8R01087
OCCUPIED BANDWIDTH
GSM
A/D-BAND
INPUT SIGNAL
I/P POWER:31.0 dBm
DOWNLINK
R
CENTER 1.940000GHz
SPAN 2.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 560ms

NAME OF TEST: Occupied Bandwidth (NADC)	PARA. NO.: 2.917(c)
TESTED BY:	DATE:

Test Results: Complies/Does Not Comply.

Test Data: See attached graph(s).

NOT APPLICABLE

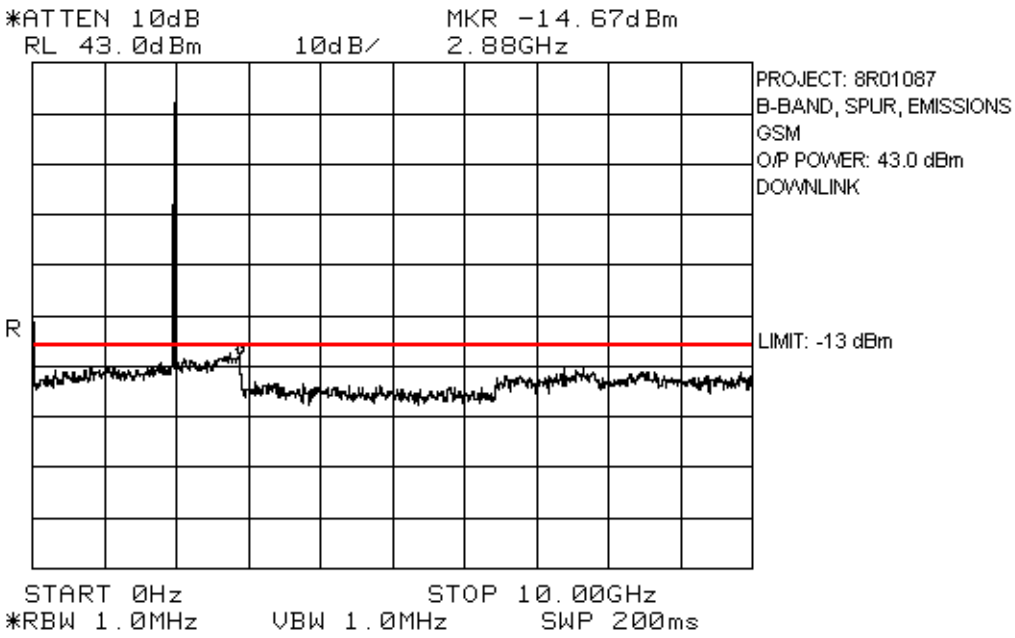
Section 5. Spurious Emissions at Antenna Terminals

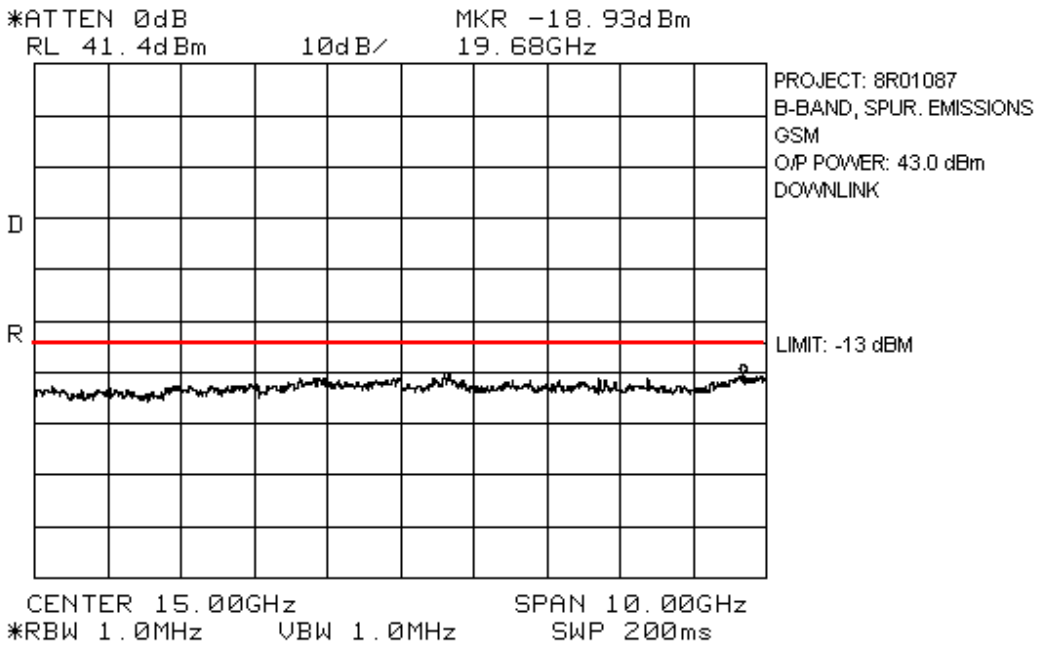
NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Kevin Carr	DATE: January 18, 1999

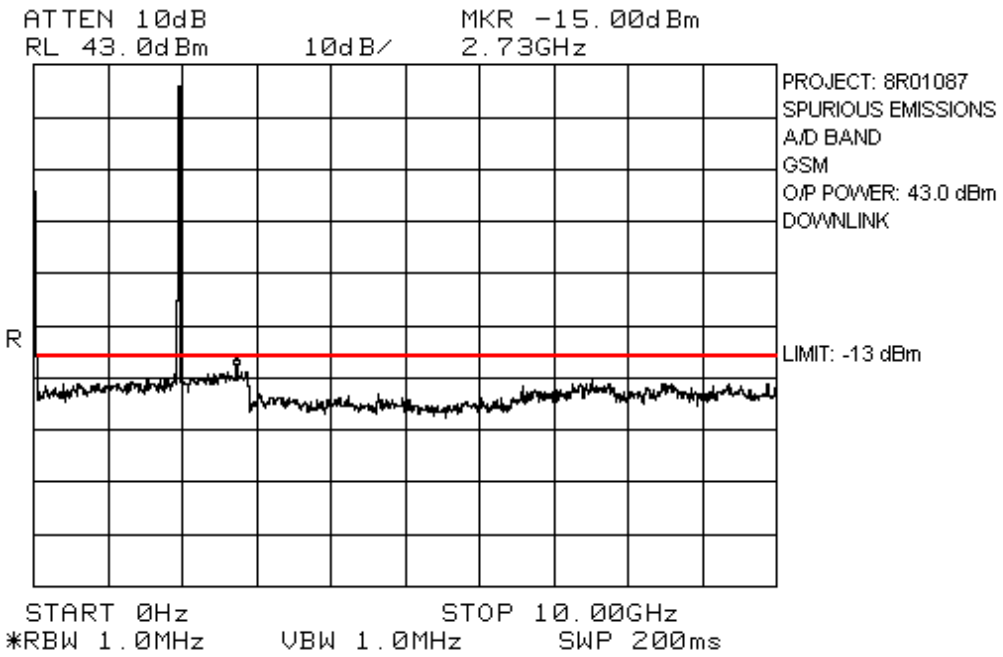
Test Results: Complies.

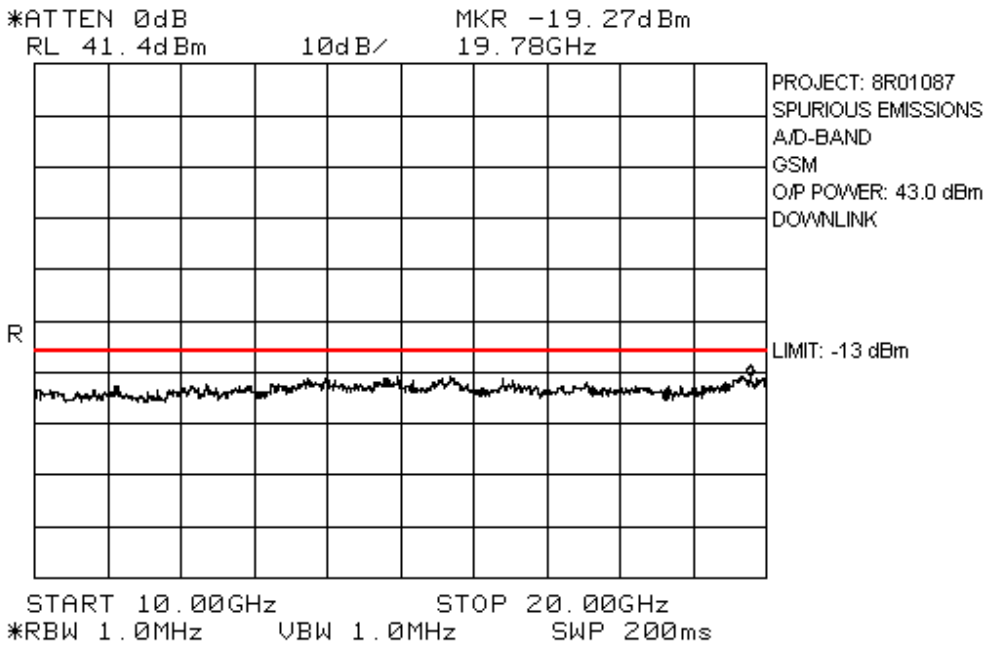
Test Data:

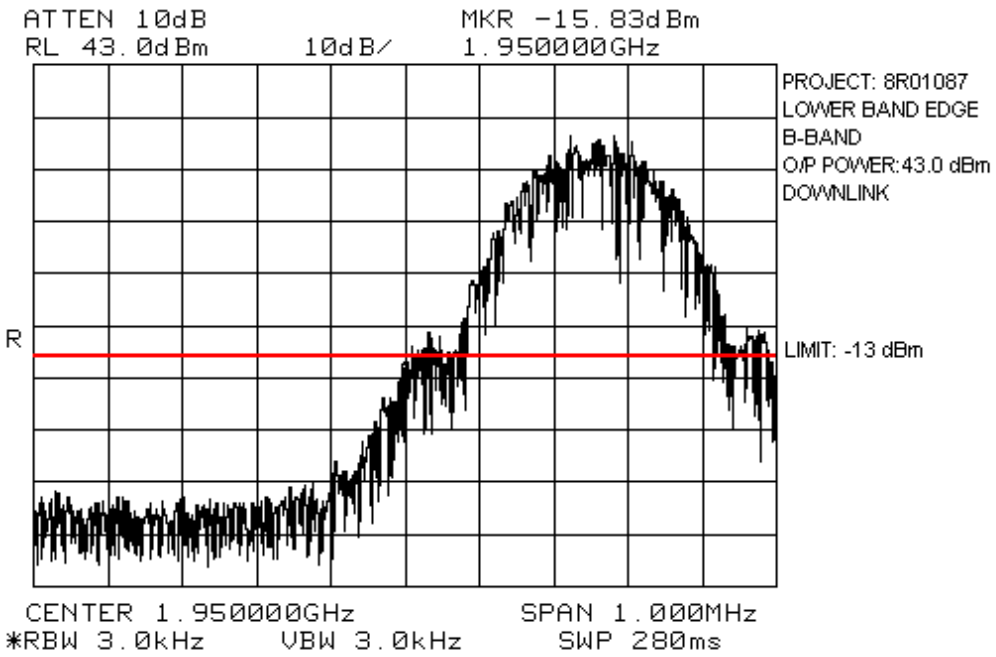
NAME OF TEST	WORST-CASE SPURIOUS LEVEL(dBm)
0 to 20 GHz spurious (Downlink)	-14.67
Lower band edge spurious (Downlink)	-15.17
Upper band edge spurious (Downlink)	-13.33

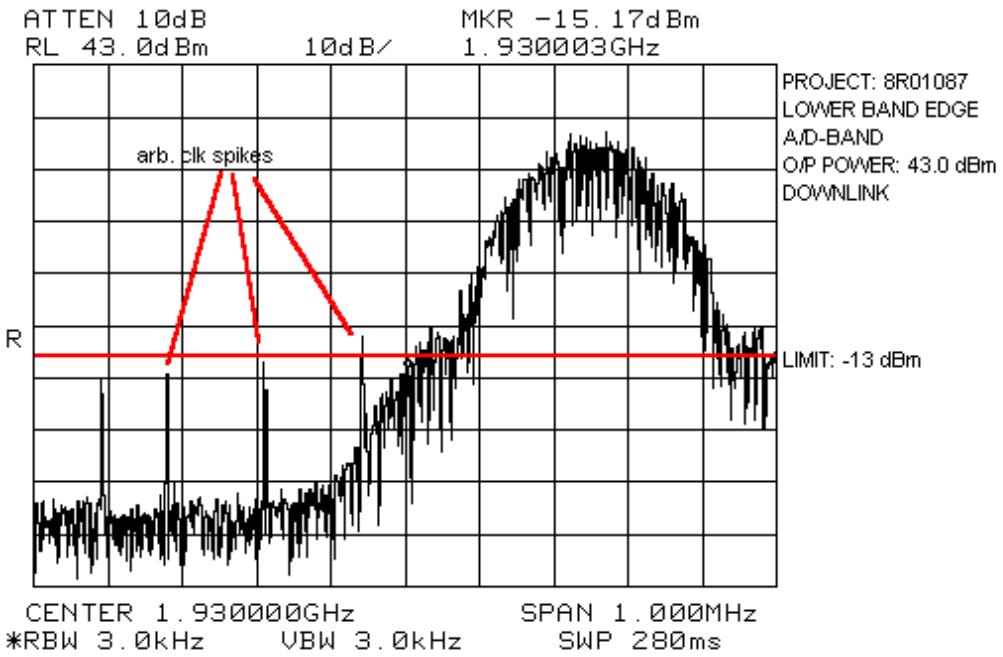

*ATTEN 10dB
MKR -14.67dBm
RL 43.0dBm
10dB/
2.88GHz
PROJECT: 8R01087
B-BAND, SPUR, EMISSIONS
GSM
O/P POWER: 43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
START 0Hz
STOP 10.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 200ms

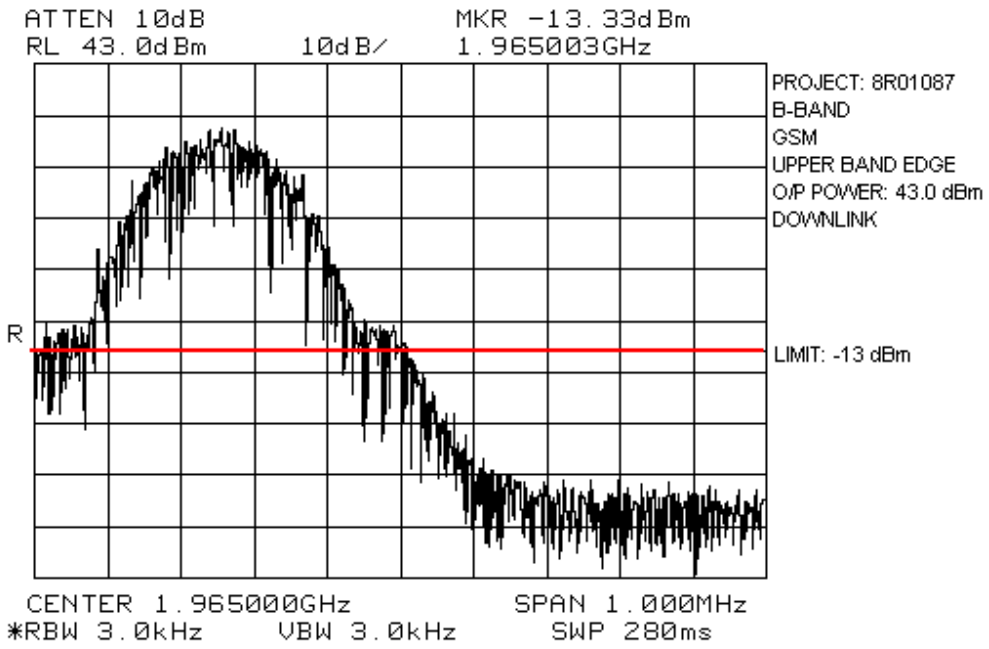

*ATTEN 0dB
MKR -18.93dBm
RL 41.4dBm
10dB/
19.68GHz
PROJECT: 8R01087
B-BAND, SPUR. EMISSIONS
GSM
O/P POWER: 43.0 dBm
DOWNLINK
D
R
LIMIT: -13 dBM
CENTER 15.00GHz
SPAN 10.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 200ms

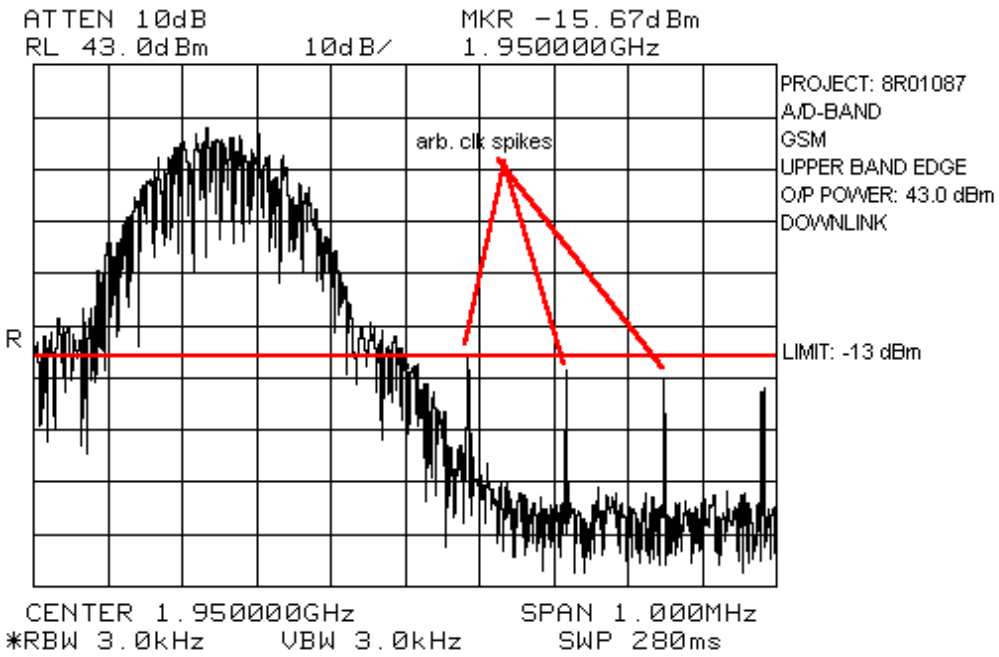

ATTEN 10dB
RL 43.0dBm
10dB/
MKR -15.00dBm
2.73GHz
PROJECT: 8R01087
SPURIOUS EMISSIONS
A/D BAND
GSM
O/P POWER: 43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
START 0Hz
STOP 10.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 200ms


*ATTEN 0dB
MKR -19.27dBm
RL 41.4dBm
10dB/
19.78GHz
PROJECT: 8R01087
SPURIOUS EMISSIONS
A/D-BAND
GSM
O/P POWER: 43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
START 10.00GHz
STOP 20.00GHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 200ms


ATTEN 10dB
RL 43.0dBm
10dB/
MKR -15.83dBm
1.950000GHz
PROJECT: 8R01087
LOWER BAND EDGE
B-BAND
O/P POWER:43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
CENTER 1.950000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL 43.0dBm
10dB/
MKR -15.17dBm
1.930003GHz
arb. clk spikes
R
PROJECT: 8R01087
LOWER BAND EDGE
A/D-BAND
O/P POWER: 43.0 dBm
DOWNLINK
LIMIT: -13 dBm
CENTER 1.930000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL 43.0dBm
10dB/
MKR -13.33dBm
1.965003GHz
PROJECT: 8R01087
B-BAND
GSM
UPPER BAND EDGE
O/P POWER: 43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
CENTER 1.965000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms


ATTEN 10dB
RL 43.0dBm
10dB/
MKR -15.67dBm
1.950000GHz
arb. clk spikes
PROJECT: 8R01087
A/D-BAND
GSM
UPPER BAND EDGE
O/P POWER: 43.0 dBm
DOWNLINK
R
LIMIT: -13 dBm
CENTER 1.950000GHz
SPAN 1.000MHz
*RBW 3.0kHz
VBW 3.0kHz
SWP 280ms

Section 6. Field Strength of Spurious

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.917(e)
TESTED BY: Kevin Carr	DATE: January 20, 1999

Test Results: Complies.
The maximum field strength is 68.6 dBμV/m @ 3m.

Test Data:

Test Data - Radiated Emissions - Downlink

Test Distance (meters) : 3		Range: A Tower		Receiver: HP 8566B		RBW(1 MHz) VBW (3 MHz)		Detector: Peak			
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)
3916.0	Hrn2	V			68.4	36.0	-42.6		61.8	82.3	20.5
3916.0	Hrn2	H			70.2	36.0	-42.6		63.6	82.3	18.7
5874.0	Hrn2	V			60.4	41.8	-44.5		57.7	82.3	24.6
5874.0	Hrn2	H			55.6	41.8	-44.5		52.9	82.3	29.4
7832.0	Hrn2	V			37.9	45.6	-43.7		39.8	82.3	42.5
7832.0	Hrn2	H			36.5	45.6	-43.7		38.4	82.3	43.9
9790.0	Hrn2	V			38.4	51.6	-44.4		45.6	82.3	36.7
9790.0	Hrn2	H			35.8	51.6	-44.4		43.0	82.3	39.3
11748.0	Hrn2	V			28.8	41.3		-9.5	60.6	82.3	21.7
11748.0	Hrn2	H			27.6	41.3		-9.5	59.4	82.3	22.9
13706.0	Hrn2	V			31.5	41.5		-9.5	63.5	82.3	18.8
13706.0	Hrn2	H			32.7	41.5		-9.5	64.7	82.3	17.6
15664.0	Hrn2	V			32.2	42.3		-9.5	65.0	82.3	17.3
15664.0	Hrn2	H			33.8	42.3		-9.5	66.6	82.3	15.7
17622.0	Hrn2	V			32.0	45.0		-9.5	67.5	82.3	14.8
17622.0	Hrn2	H			32.5	45.0		-9.5	68.0	82.3	14.3
19580.0	SH50-1	V			36.6	40.5		-9.5	67.6	82.3	14.7
19580.0	SH50-1	H			37.6	40.5		-9.5	68.6	82.3	13.7

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.

Note: Measurements incorporating distance correction where taken at 1 meter.

Photographs of Test Setup

FRONT VIEW

REAR VIEW

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 20/98	May 20/99	
1 Year	Spectrum Analyzer-**2**	Hewlett Packard	8566B	1950A00400	July 22/98	July 22/99	
1 Year	Spectrum Analyzer Display-**2**	Hewlett Packard	85662A	1950A01177	July 22/98	July 22/99	
1 Year	Quasi Peak Adaptor-**2**	Hewlett Packard	85650A	2251A00620	July 22/98	July 22/99	
	Power Supply	Astron	VS-50M	8405071	NCR	NCR	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9704	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9709	July 24/98	July 24/99	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/98	July 23/99	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/98	July 23/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Aug. 4/98	Aug. 4/99	
1 Year	Low Noise Amplifier	DBS Microwave	DWT-13035	9623	Aug. 4/98	Aug. 4/99	
1 Year	Signal Generator	Rohde & Schwarz	SM1Q03	1084-8004-03	July 23/98	July 23/99	
3 Year	Standard Gain Horn	Electro-Metrics	SH-50/60-1	FA000479	July 29/97	July 29/00	
1 Year	Arbitrary Waveform Gen.	Sony/Tektronix	AWG2021	J310495	NCR	NCR	

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:

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

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.: 2.989**

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)

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

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

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.

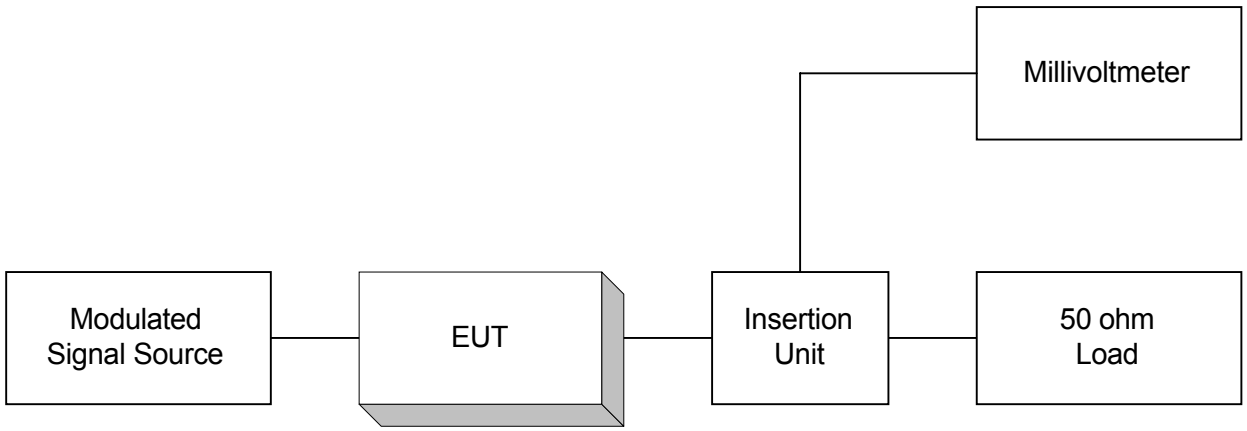
Frequency Stability With Temperature Variation

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.

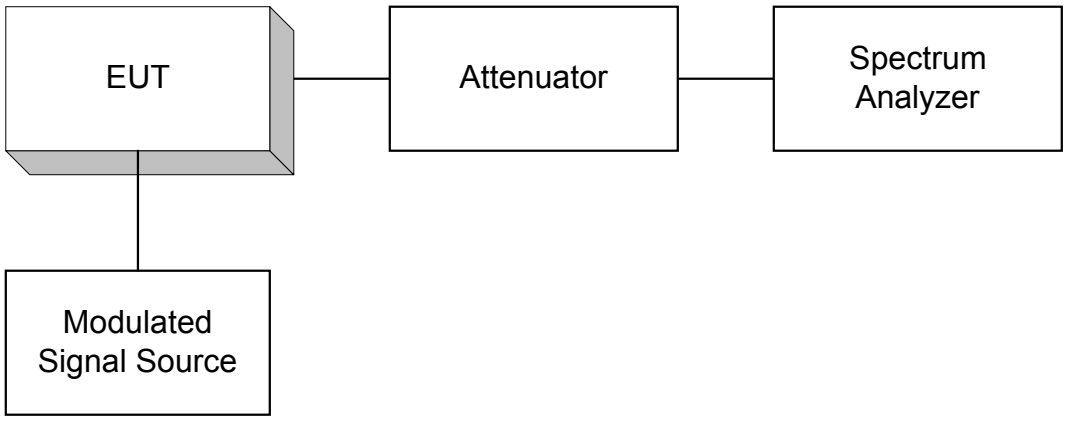
ANNEX B

TEST DIAGRAMS

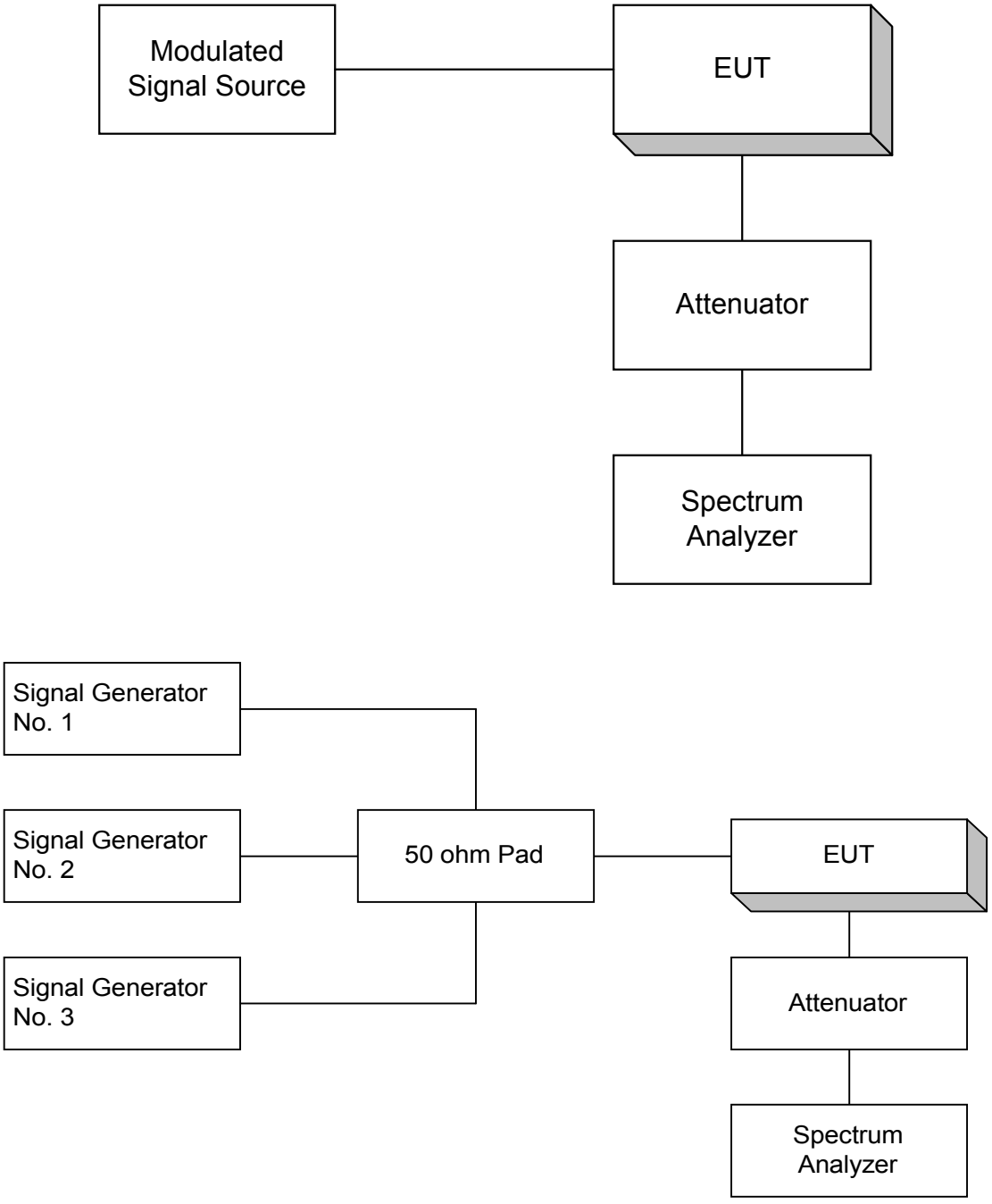
Para. No. 2.985 - R.F. Power Output



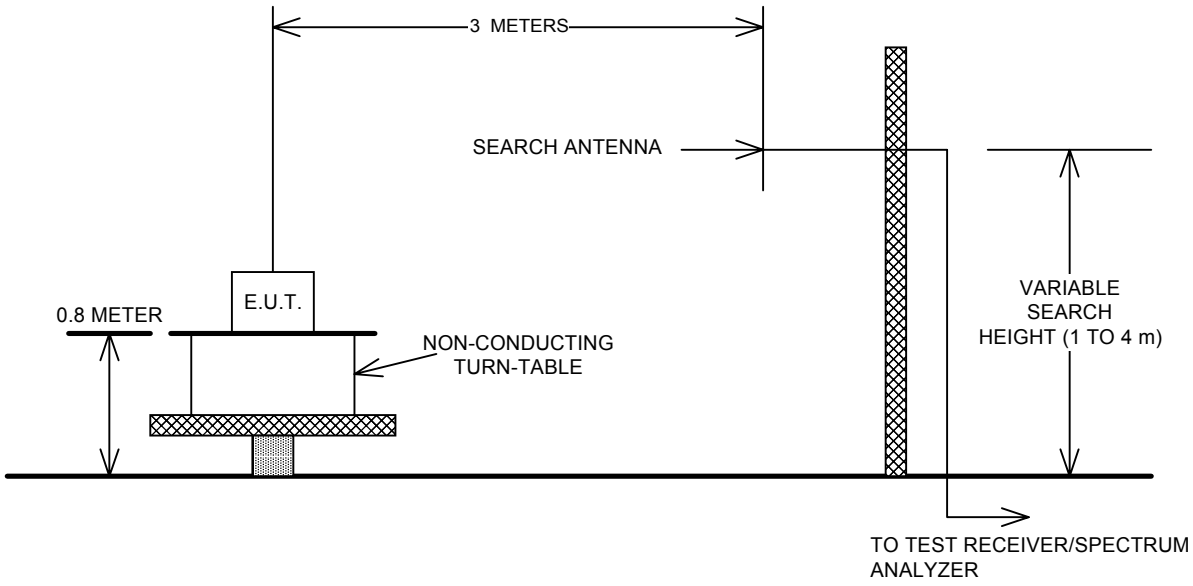
Para. No. 2.989 - Occupied Bandwidth



Para. No. 2.991 Spurious Emissions at Antenna Terminals



Para. No. 2.993 - Field Strength of Spurious Radiation



Para. No. 2.995 - Frequency Stability