

Nemko Test Report: 2L0071RUS1Rev1

Applicant: Navini Networks
2240 Campbell Creek Blvd. Suite 110
Richardson, TX 75082

Equipment Under Test: 2.6 GHz BTS Rel1
(E.U.T.)

In Accordance With: **FCC PART 21, Subpart K**
Multipoint Distribution Service

Tested By: Nemko Dallas Inc.
802 N. Kealy
Lewisville, Texas 75057-3136

Authorized By:



Tom Tidwell, EMC/Wireless Group Manager

Date: 4/22/02

Total Number of Pages: 38

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EQUIPMENT: 2.6 GHz BTS Rel1

Section 1. Summary of Test Results

Manufacturer: Navini Networks

Model No.: 2.6 GHz BTS Rel1

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 21, Subpart K.

<input checked="" type="checkbox"/> New Submission	<input type="checkbox"/> Production Unit
<input type="checkbox"/> Class II Permissive Change	<input checked="" type="checkbox"/> 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".

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This report applies only to the items tested.

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
RF Power Output	2.1046	33dBW EIRP	Complies
Occupied Bandwidth	2.1049	21.908 (b) Mask	Complies
Spurious Emissions @ Antenna Terminals	2.1051	-60 dBc	Complies
Field Strength of Spurious Radiation	2.1053	-60 dBc	Complies
Frequency Stability	2.1055	Mask	Complies

Footnotes:

EQUIPMENT: 2.6 GHz BTS Rel1

Section 2. General Equipment Specification

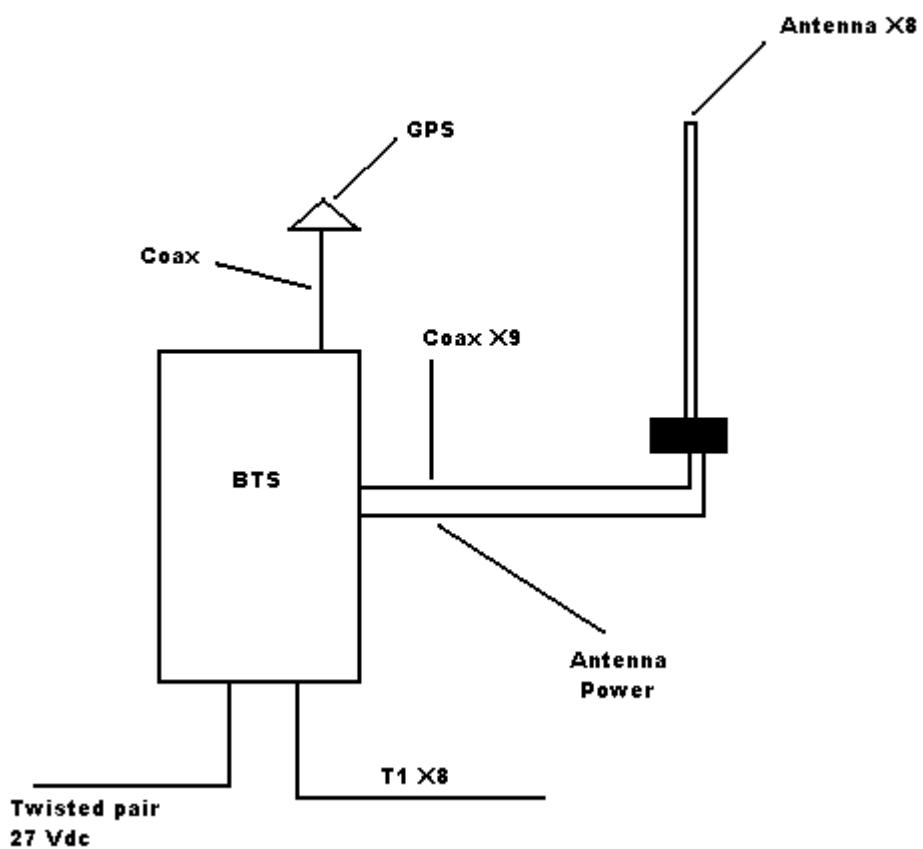
Supply Power:	24 Vdc														
Frequency Range:	2596 MHz to 2644 MHz														
Type(s) of Modulation:	<table><tr><td>F3E (Voice)</td><td>F1D</td><td>F2D</td><td>D7W (QAM)</td><td>DQPSK (F9W)</td></tr><tr><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input type="checkbox"/></td><td><input checked="" type="checkbox"/></td></tr></table>					F3E (Voice)	F1D	F2D	D7W (QAM)	DQPSK (F9W)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
F3E (Voice)	F1D	F2D	D7W (QAM)	DQPSK (F9W)											
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>											
Emission Designator:	5M00F9W														
Output Impedance:	50 ohms														
RF Power Output Rated:	+37 dBm (5 watts)														
Duty Cycle:	50% TDD														
Operator Selection Of Operating Frequency:	Software controlled														
Power Output Adjustment Capability:	Software controlled														

EQUIPMENT: 2.6 GHz BTS Rel1

Description Of EUT

The EUT is a licensed, non-broadcast base station transmitter for use in the MMDS services. The EUT is intended to deliver broadband data services to Customer Premise Equipment transceiver units.

System Diagram



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MULTIPOINT DISTRIBUTION SERVICE
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EQUIPMENT: 2.6 GHz BTS Rel1

Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: David Light	DATE: 2/28/2002

Test Results: Complies

Measurement Data: See attached data sheets.

The following plot shows the rf output power during one TDD cycle (TX-RX).

EQUIPMENT: 2.6 GHz BTS Rel1
Tests Data – RF Power Output

Nemko Dallas, Inc.

Dallas Headquarters:

802 N. Kealy
Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667

Data Plot		RF Power Output				
Page <u>1</u> of 1				Complete <input checked="" type="checkbox"/> X		
Job No.:	2L0071R	Date:	2/28/2002	Preliminary:		
Specification:	PT 21	Temperature(°C):	20			
Tested By:	David Light	Relative Humidity(%)	50			
E.U.T.:	2.6 GHz BTS					
Configuration:	TX TDD SIGNAL					
Sample Number:	1					
Location:	Lab 1	RBW:	10 MHz	Measurement		
Detector Type:	Rms	VBW:	10 MHz	Distance: N/A m		
Test Equipment Used						
Antenna:	Directional Coupler: 1055					
Pre-Amp:	Cable #1: 1628					
Filter:	Cable #2:					
Receiver:	Cable #3:					
Attenuator #1	1036	Cable #4:				
Attenuator #2:	1471	Mixer:				
Additional equipment used:						
Measurement Uncertainty: +/-1.7 dB						
Ref Lvl 41.4 dBm Marker 1 [T1] 36.97 dBm 639.679359 μs RBW 10 MHz VBW 10 MHz SWT 10 ms RF Att Unit dBm 1VIEW 1RM A TRG						
Date: 08.MAR.2002 10:05:01						
Notes:						

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MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Section 4. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
TESTED BY: David Light	DATE:3/8/2002

Test Results: Complies

Measurement Data: See attached data sheets.

EQUIPMENT: 2.6 GHz BTS Rel1

Test data – Emission Mask



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Data		Occupied Bandwidth / Emission	
Page 1 of 2		Complete <input checked="" type="checkbox"/> Preliminary: _____	
Job No.:	2L0071R	Date:	3/8/2002
Specification:	PT 21	Temperature(°C):	20
Tested By:	David Light	Relative Humidity(%):	50
E.U.T.:	2.6 GHz BTS		
Configuration:	TX TDD SIGNAL		
Sample Number:	1		
Location:	Lab 1	RBW:	50 kHz
Detector Type:	Rms	VBW:	500 kHz
		Measurement	
		Distance: N/A m	
Test Equipment			
Antenna:	Directional Coupler: 1055		
Pre-Amp:	Cable #1: 1628		
Filter:	Cable #2: _____		
Receiver:	Cable #3: _____		
Attenuator #1	Cable #4: _____		
Attenuator #2:	Mixer: _____		
Additional equipment used: _____			
Measurement Uncertainty: +/-1.7 dB			
Ref Lvl 1 16.7 dBm Marker I 16.72 dBm 2.61029359 GHz RBW 50 kHz VBW 500 kHz SWT 15 s RF Att Unit dBm			
31.4 dB Offset Center 2.611 GHz Span 15 MHz			
Date: 08.MAR.2002 09:58:22 Notes: OUTPUT POWER = 37 dBm (5.0 Watts)			

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PROJECT NO.:2L0071RUS1Rev1

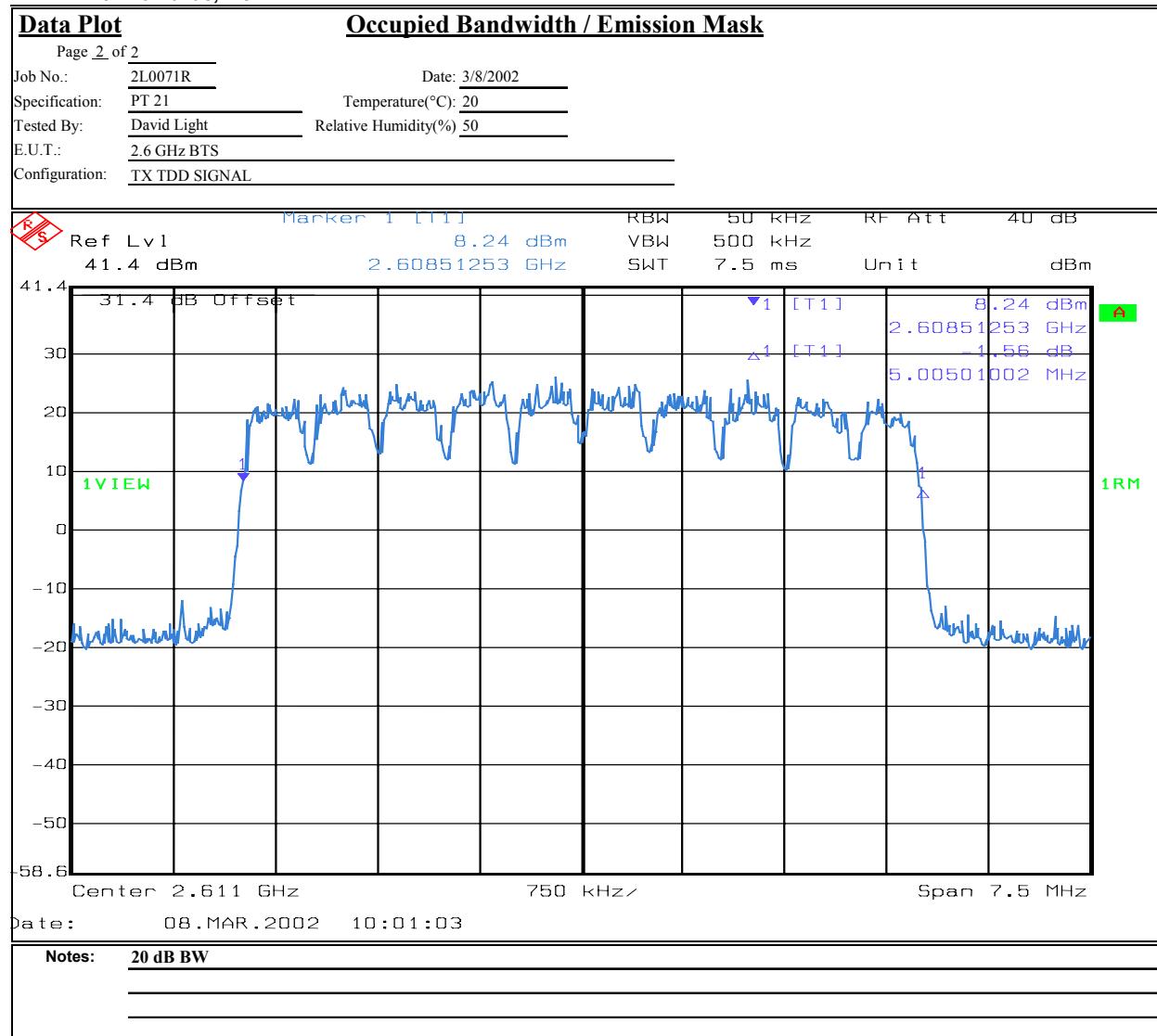
EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Occupied Bandwidth



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Lewisville, TX 75057
Tel: (972) 436-9600
Fax: (972) 436-2667



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MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Section 5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: David Light	DATE: 2/28/2002

Test Results: Complies

Measurement Data: See attached data sheets.

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Spurious Emissions at Antenna Terminals



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Dallas Headquarters:

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 Tel: (972) 436-9600
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Data Plot		Spurious Emissions at Antenna Terminals					
Page 1 of 1							
Job No.:	2L0071R	Date:	2/28/2002				
Specification:	PT 21	Temperature(°C):	20				
Tested By:	David Light	Relative Humidity(%):	50				
E.U.T.:	2.6 GHz BTS						
Configuration:	TX TDD SIGNAL						
Sample Number:	1						
Location:	Lab 1	RBW:	10 MHz				
Detector Type:	Rms	VBW:	10 MHz				
		Measurement					
		Distance: N/A m					
Test Equipment Used							
Antenna:	Directional Coupler: 1055						
Pre-Amp:	Cable #1: 1627						
Filter:	Cable #2:						
Receiver:	Cable #3:						
Attenuator #1	Cable #4:						
Attenuator #2:	Mixer:						
Additional equipment used:							
Measurement Uncertainty: +/-1.7 dB							
Notes: MARKER 1 = CARRIER (NOTCHED) / MARKER 2 = HIGHEST EMISSION DISPLAY LINE --23 dBm (-60dBc FROM CARRIER POWER)							

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EQUIPMENT: 2.6 GHz BTS Rel1

Section 6. Field Strength of Spurious

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1053
TESTED BY: David Light	DATE:3/6/2002

Test Results: Complies

Measurement Data: See attached table.

*EQUIPMENT: 2.6 GHz BTS Rel1***Test Data - Radiated Emissions**

Nemko Dallas, Inc.

Dallas Headquarters:

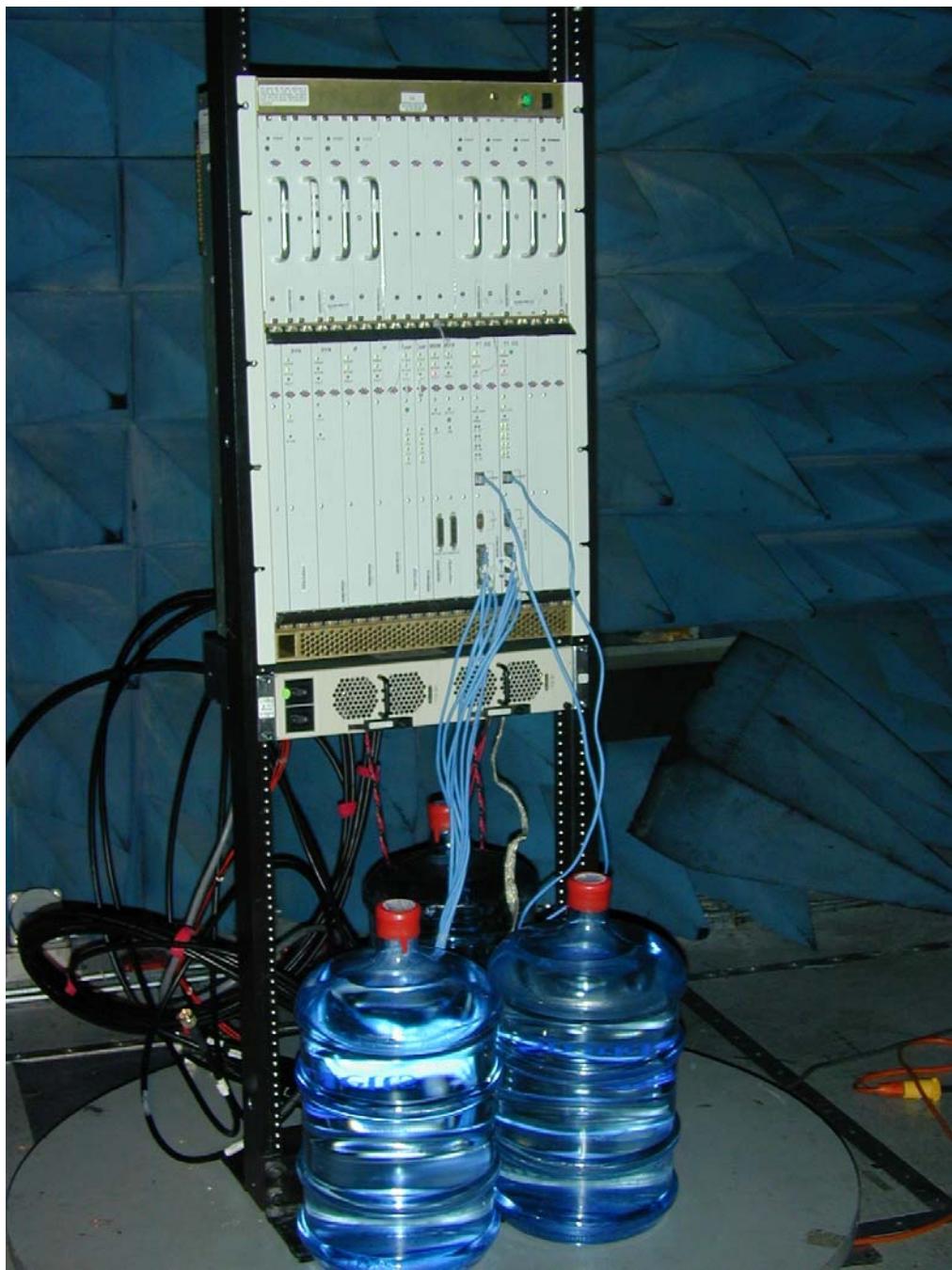
802 N. Kealy
 Lewisville, TX 75057
 Tel: (972) 436-9600
 Fax: (972) 436-2667

Field Strength of Spurious Emissions										
Page <u>1</u> of <u>1</u>										
Job No.:	2L0071R			Date:	3/6/2002			Complete	<input checked="" type="checkbox"/>	
Specification:	PT 21			Temperature(°C):	22			Preliminary	<input type="checkbox"/>	
Tested By:	David Light			Relative Humidity(%)	50					
E.U.T.:	2.6 GHz BTS									
Configuration:	TX INTO DUMMY LOAD									
Sample No:	1									
Location:	AC 1			RBW:	1 MHz			Measurement		
Detector Type:	Peak			VBW:	1 MHz			Distance:	3 m	
Test Equipment Used										
Antenna:				Directional Coupler:						
Pre-Amp:	1016			Cable #1:	1972					
Filter:				Cable #2:	1067					
Receiver:	1464			Cable #3:						
Attenuator #1				Cable #4:						
Attenuator #2:				Mixer:						
Additional equipment used:										
Measurement Uncertainty: +/-3.6 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
5222	-73.9	8.5		0	8.2	-23	-57.2	0.0000	H	
5222	-72.7	8.2		0	8.2	-23	-56.3	0.0000	V	
										Limit is -60 dBc
Notes: The spectrum was searched to the 10th harmonic No emissions (other than 2nd harmonic) were detected above the noise floor which was greater than 6 dB below the spec limit										

EQUIPMENT: 2.6 GHz BTS Rel1

Photos – Field Strength of Spurious Emissions

Front

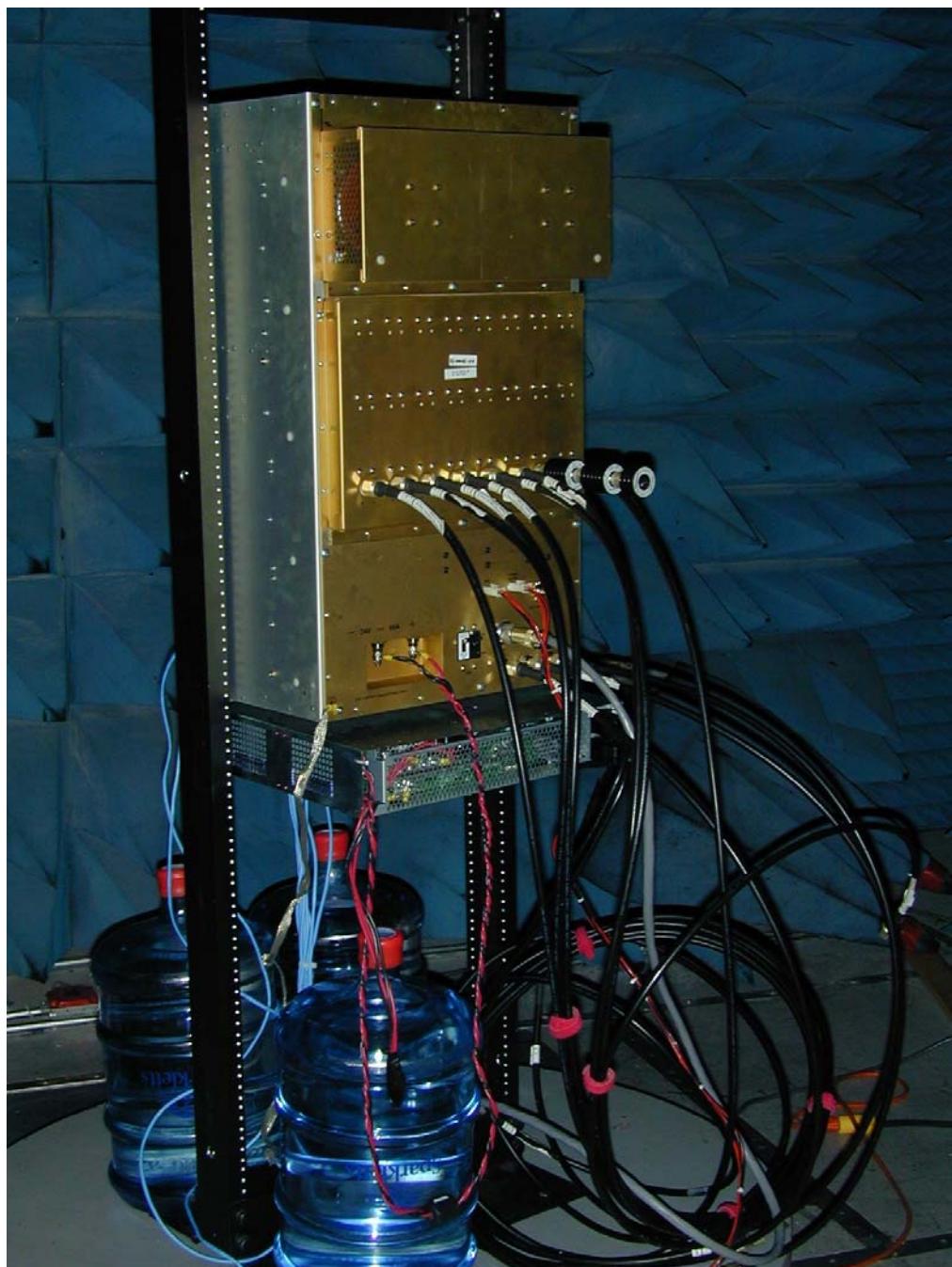


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PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Rear



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PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Section 7. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: David Light	DATE:4/5/2002

Test Results: Complies

Measurement Data: See attached data sheets.

The following plots show that the transmitted signal stays within the required emission mask when the equipment is subjected to temperature variations.

Note – The device ceased operation below 0°C. The EUT is not designed to operate below 0°C and has a function that causes it to cease operation under these conditions.

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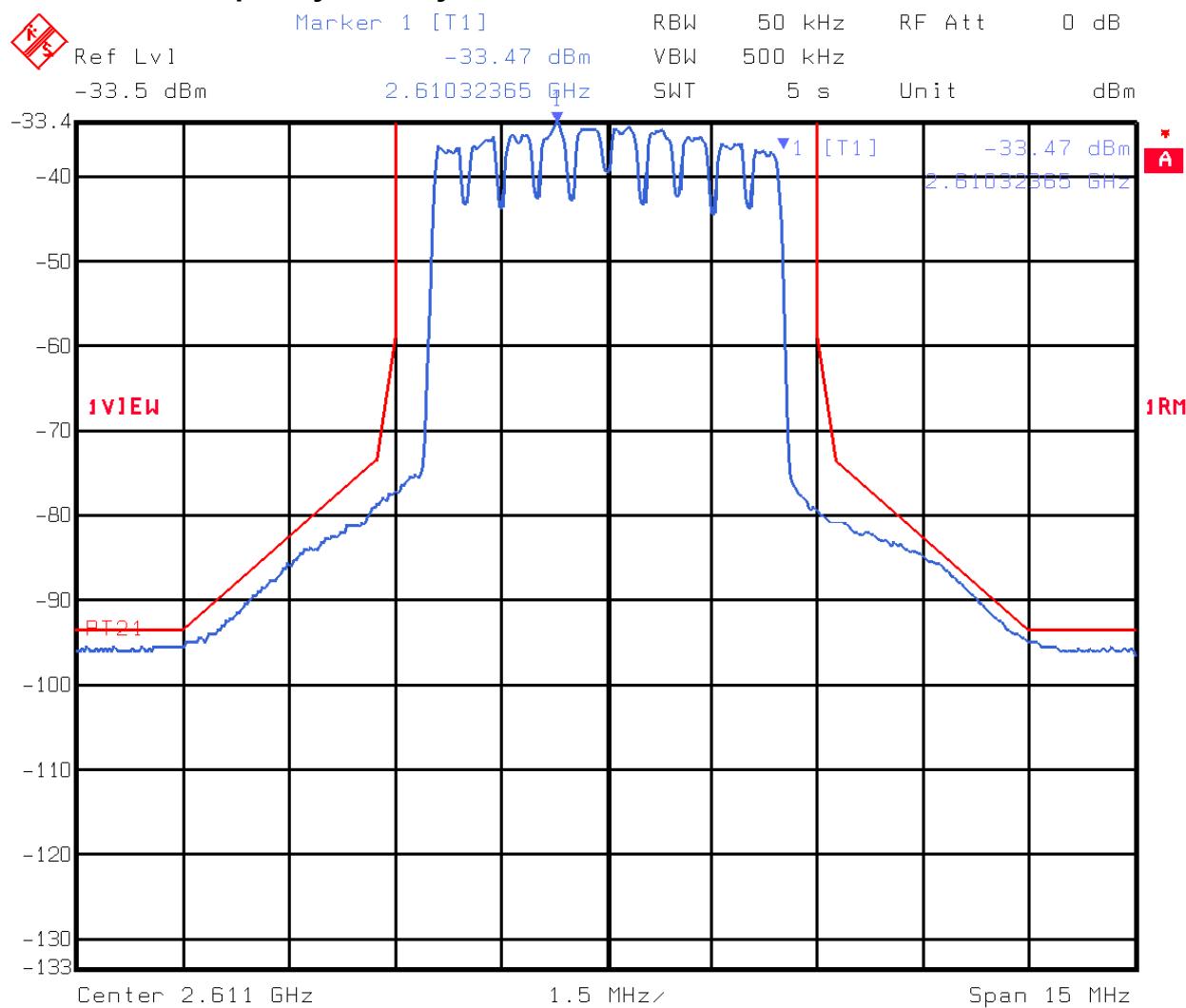
EQUIPMENT: 2.6 GHz BTS Rel1

Temperature (°C)	Measured Frequency (MHz)	Frequency Error (kHz)	Frequency Error (%)
0	2610.293590	30.06	.001
+10	2610.293590	30.06	.001
+20	2610.323650	0	0
+30	2610.293590	30.06	.001
+40	2610.293590	30.06	.001
+50	2610.293590	30.06	.001

Temp. (°C)	Voltage (Vdc)	Measured Frequency (MHz)	Frequency Error (kHz)	Frequency Error (%)
+20	20.4	2610.293590	30.06	.001
+20	24.0	2610.323650	0	0
+20	27.6	2610.293590	30.06	.001

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



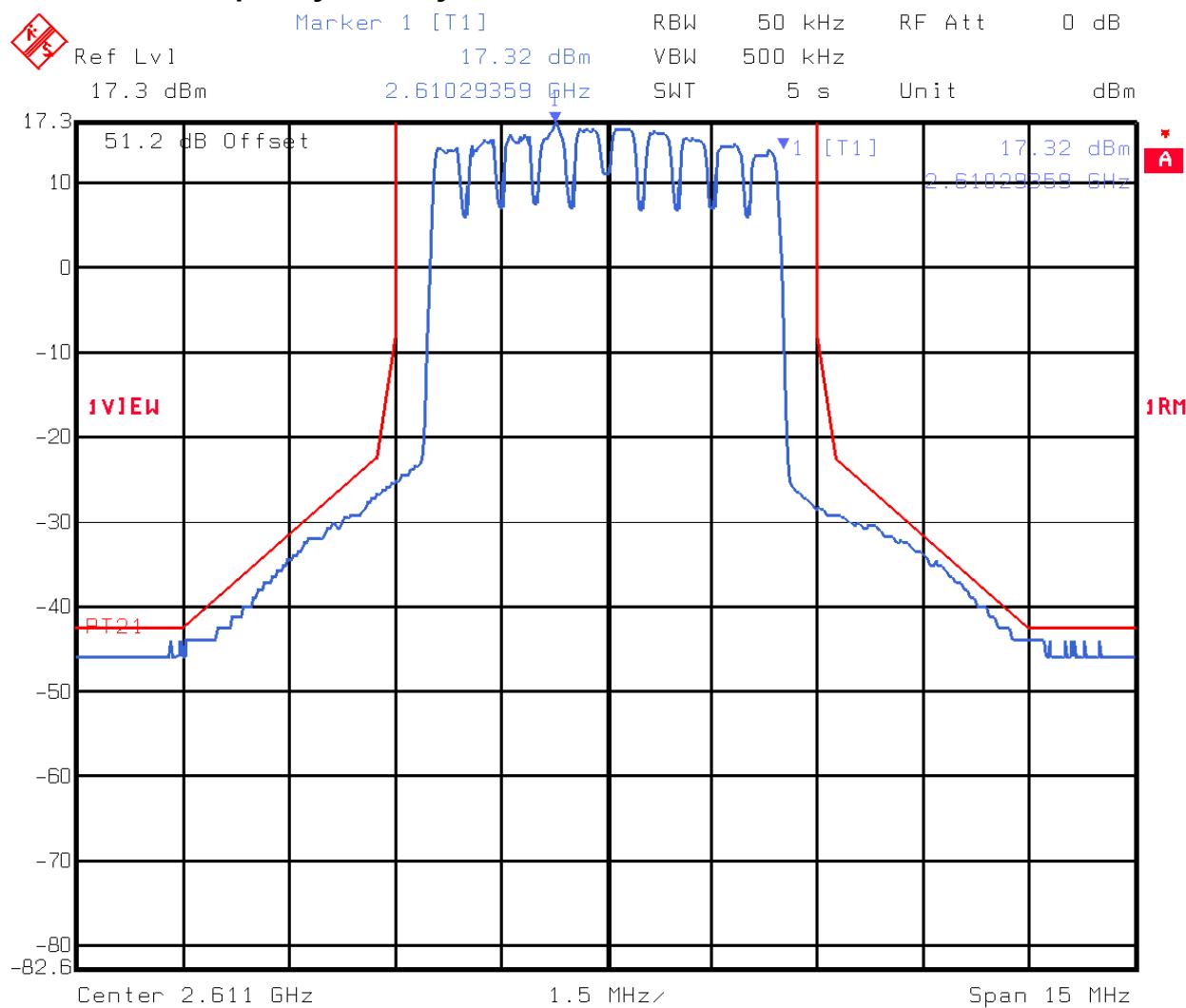
Title: FREQUENCY ERROR

Comment A: AMBIENT

Date: 05.APR.2002 10:47:27

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



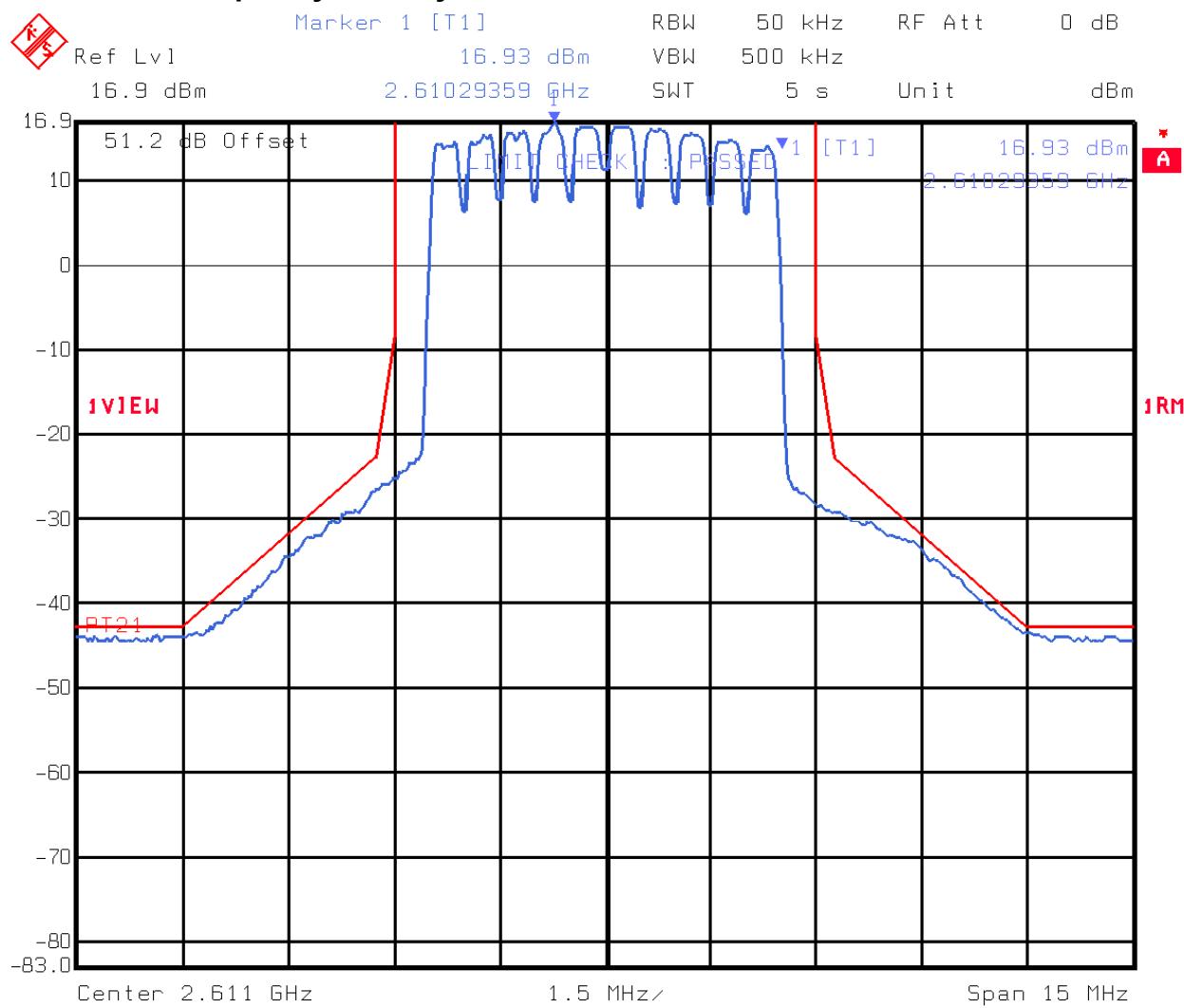
Title: FREQUENCY ERROR

Comment A: +50° C

Date: 05.APR.2002 11:34:43

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



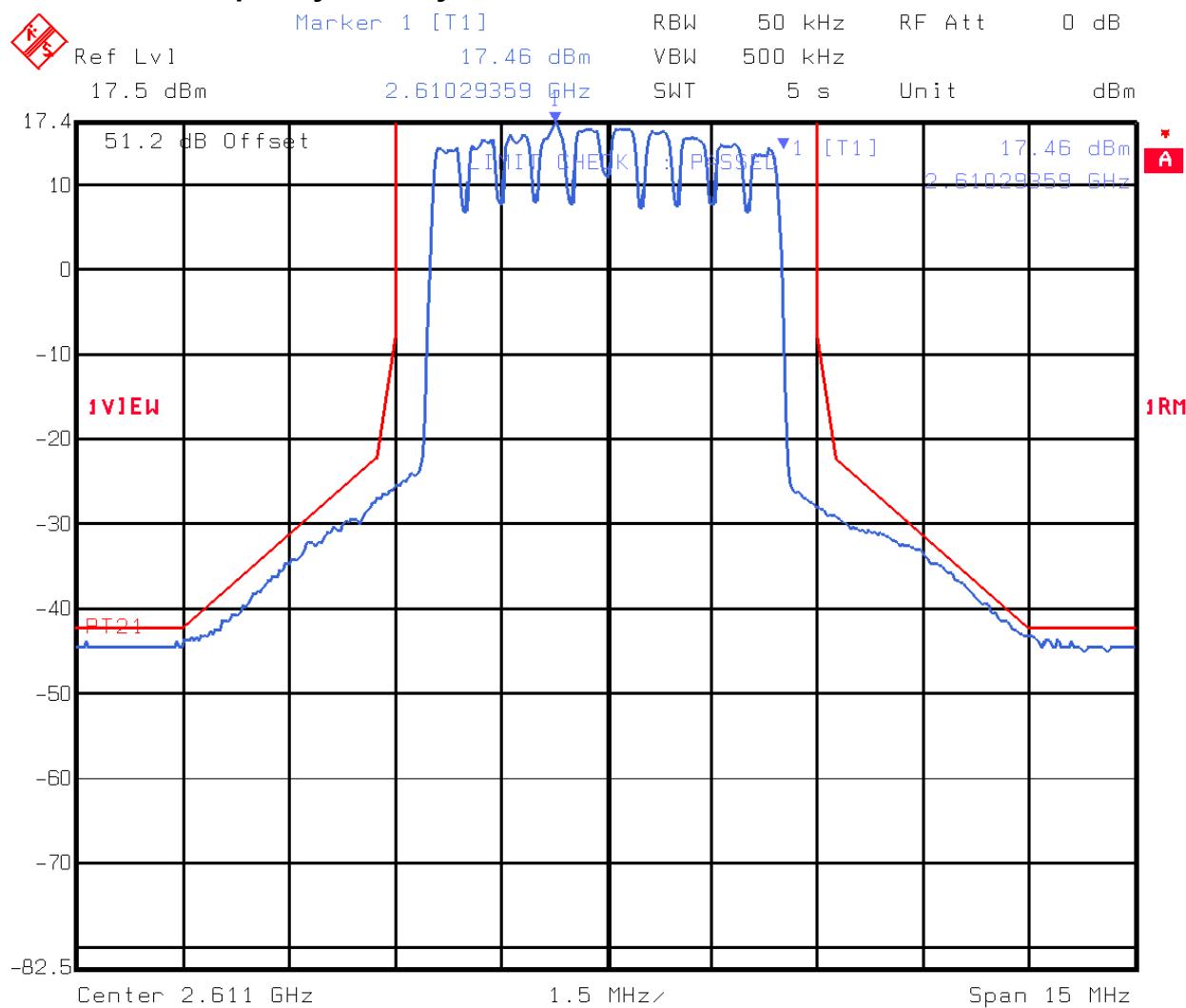
Title: FREQUENCY ERROR

Comment A: +40° C

Date: 05.APR.2002 11:55:03

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



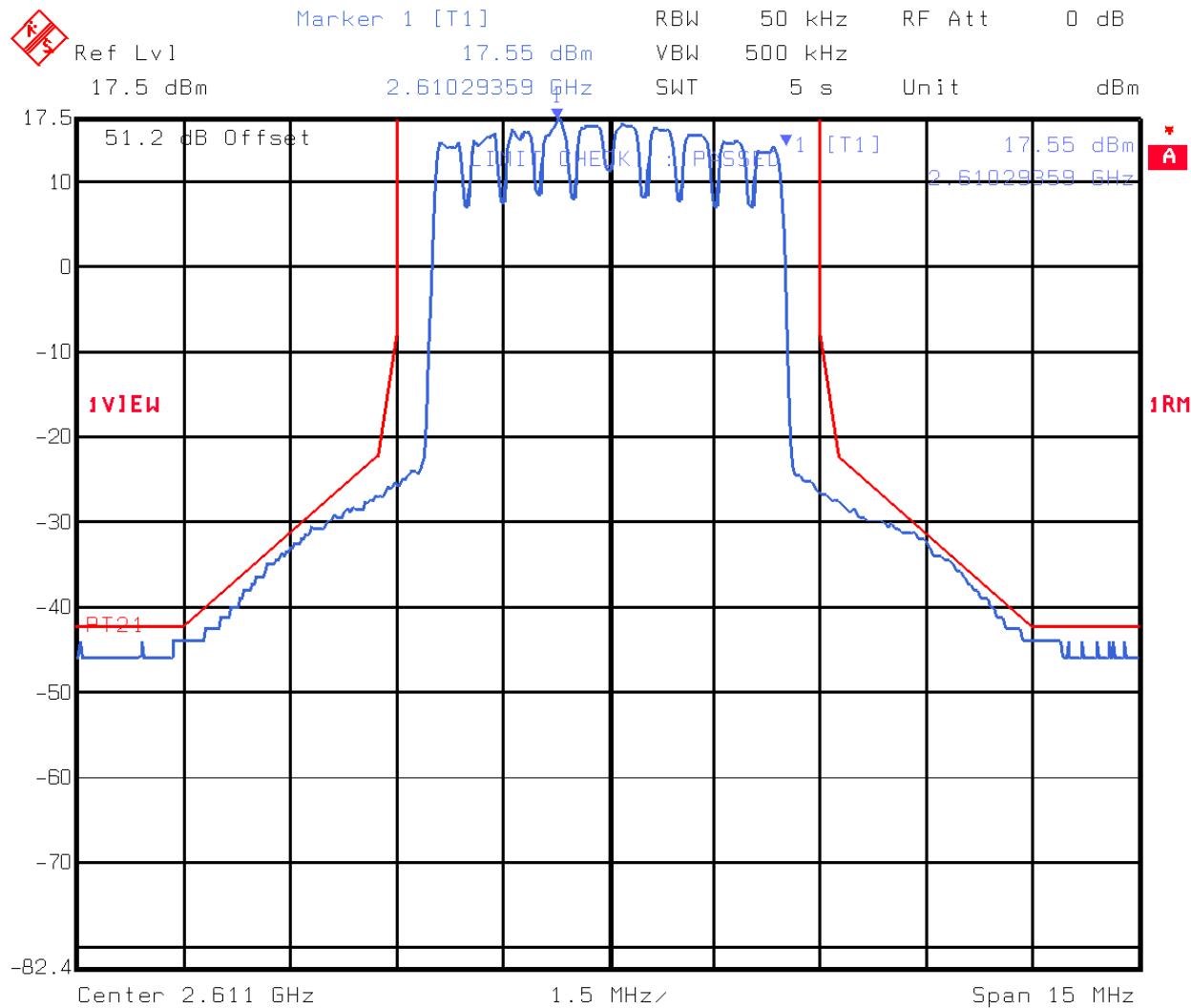
Title: FREQUENCY ERROR

Comment A: +30° C

Date: 05.APR.2002 12:07:33

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



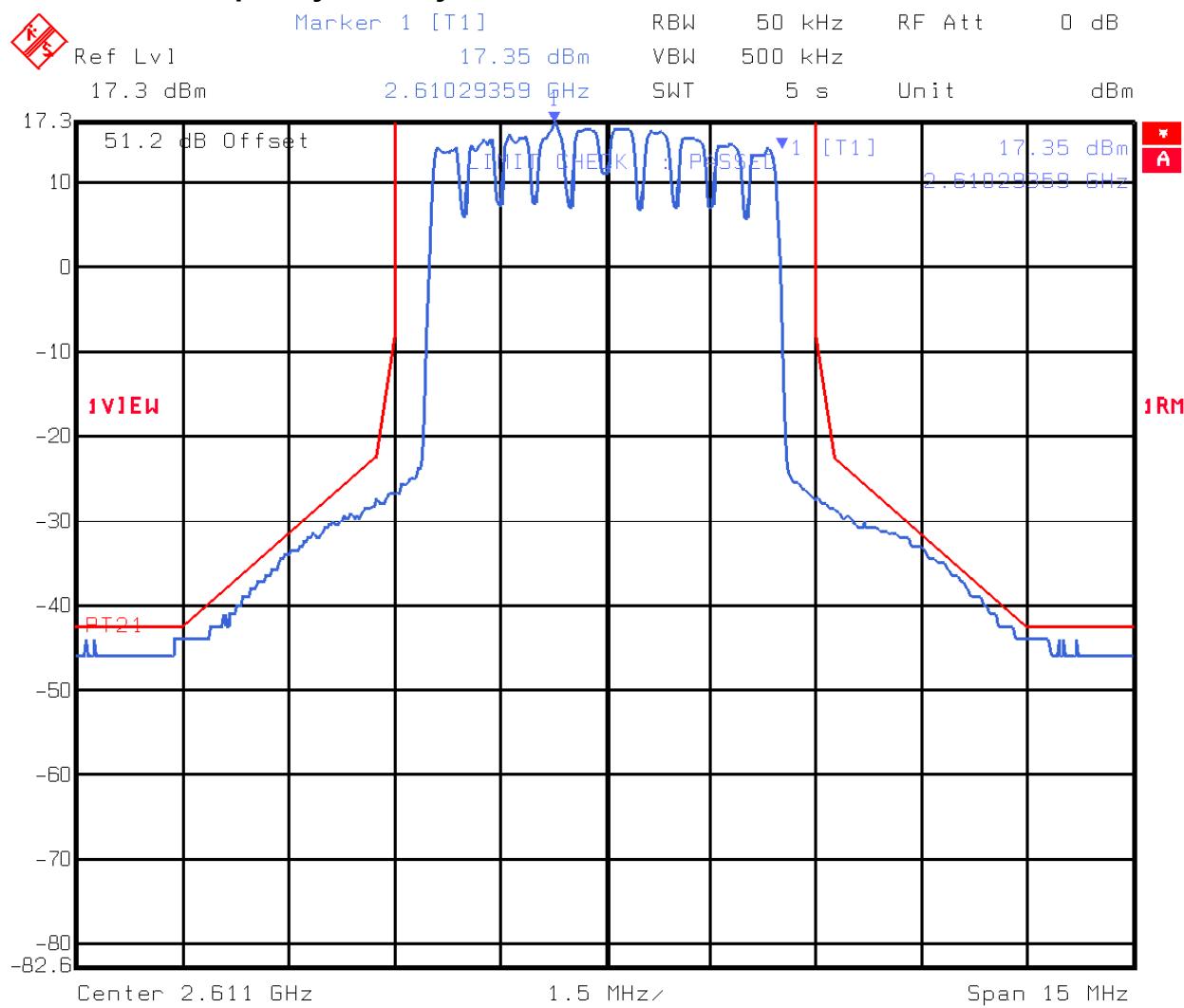
Title: FREQUENCY ERRORS

Comment A: +10° C

Date: 05/APR/2002 13:29:40

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



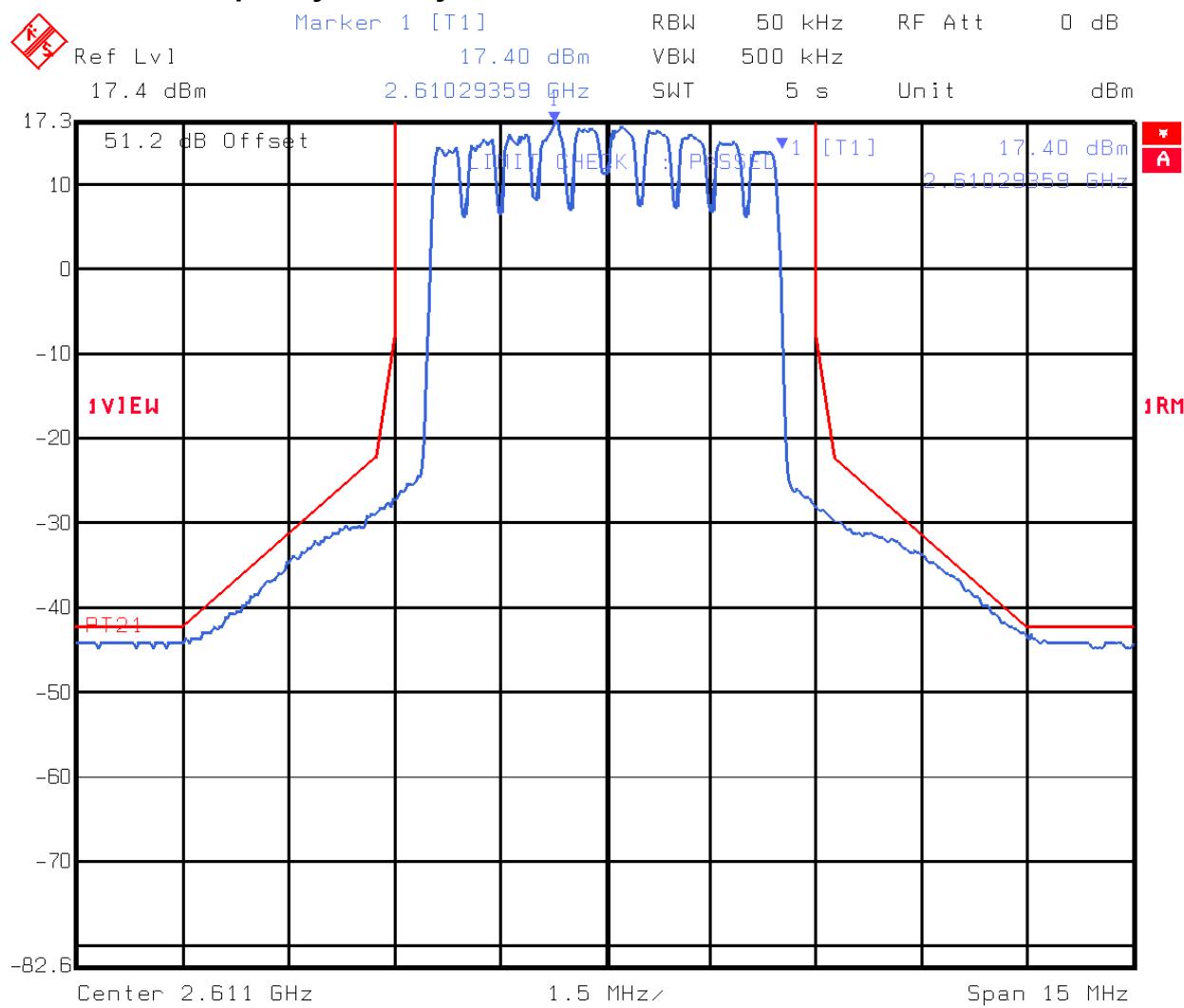
Title: FREQUENCY ERROR

Comment A: 0° C

Date: 05.APR.2002 13:49:12

EQUIPMENT: 2.6 GHz BTS Rel1

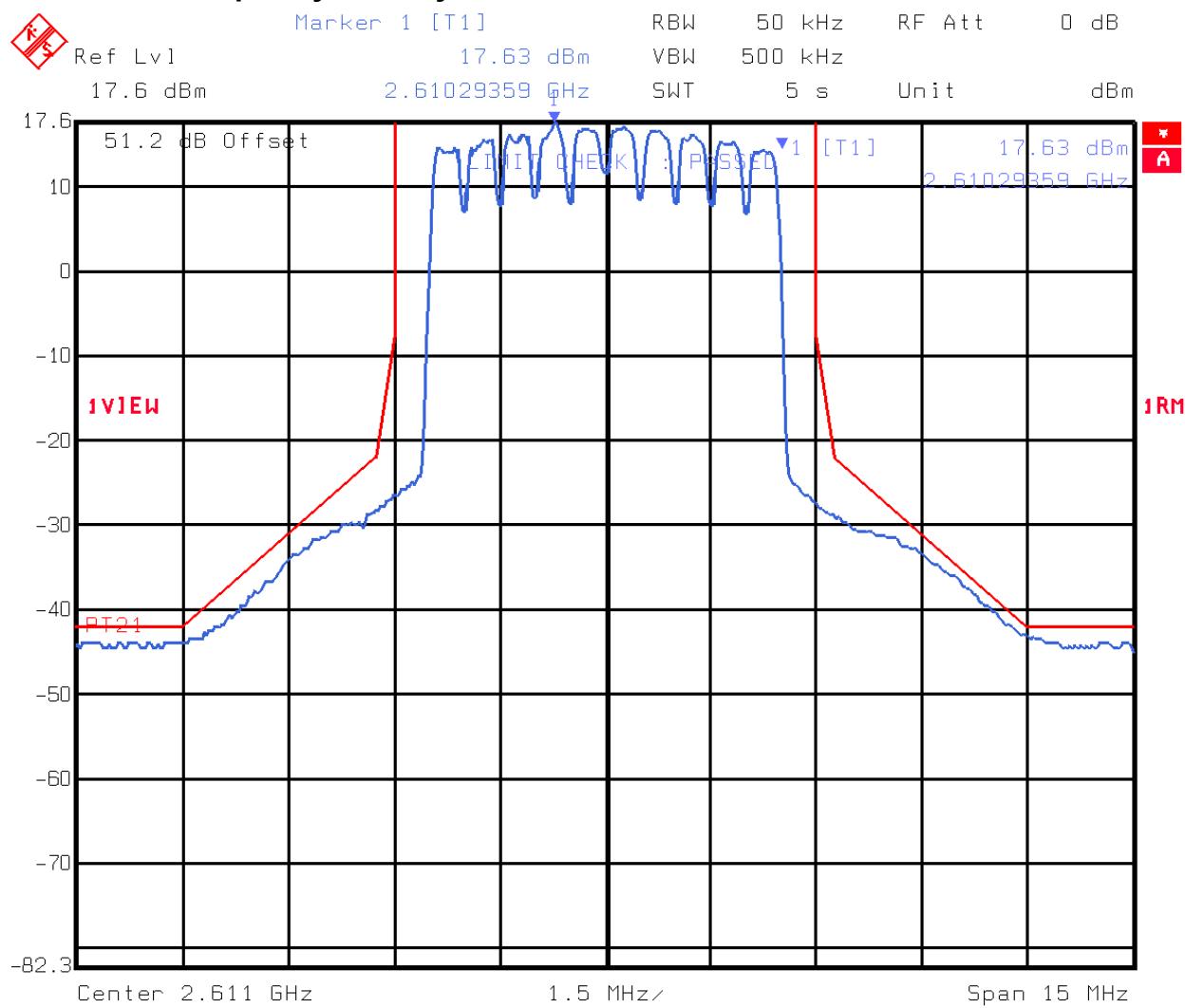
Test Data – Frequency Stability



Title: FREQUENCY ERROR
 Comment A: AMBIENT 27.6 Vdc
 Date: 05.APR.2002 14:38:04

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



Title: FREQUENCY ERROR
Comment A: AMBIENT 20.4 Vdc
Date: 05.APR.2002 14:35:02

*EQUIPMENT: 2.6 GHz BTS Rel1***Section 8. Test Equipment List**

Nemko ID	Description	Manufacturer Model Number	Serial Number	Calibration Date
993	Horn antenna	A.H. Systems SAS-200/571	XXX	01/08/02
1972	CABLE, 1.2m	KTL Semi-Flex	N/A	06/06/01
1067	Blue cable 4m	Storm PR90-010-144	0	06/06/01
1016	Pre-Amp	HEWLETT PACKARD 8449A	2749A00159	05/30/01
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	12/18/01
1471	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU
1055	DUAL DIRECTIONAL COUPLER	NARDA 3022	73393	Cal Not Req
1628	CABLE, 6 ft	MEGAPHASE TM26 S1S5 72	N/A	CBU
1629	CABLE, 6 ft	MEGAPHASE 10311 1GVT4	N/A	CBU

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

Section 9. Test Details

EQUIPMENT: 2.6 GHz BTS Rel1

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
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Method Of Measurement:**Antenna Conducted:**

The peak power at antenna terminals is measured using a Spectrum Analyzer or Power Meter. Power output is measured with the maximum rated input level.

E.I.R.P.:

If the antenna is not detachable from the circuit then the EIRP is measured using the substitution antenna method of measurement as described in EIA/TIA 630. The field strength of the fundamental emission is measured using a RBW setting on the spectrum analyzer greater than the 20 dB bandwidth of the transmitted waveform. The EUT is then replaced with an antenna with known gain relative to either a dipole or an isotropic radiator. A signal generator is used to feed the substitution antenna until the previously measured field strength level is obtained. The level of signal needed to drive the substitution antenna to obtain the previously measured field strength is the erp or eirp after correction for substitution antenna gain.

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EQUIPMENT: 2.6 GHz BTS Rel1

NAME OF TEST: Occupied Bandwidth

PARA. NO.: 2.1049

Method Of Measurement:

A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of at least 1% of the bandwidth of the transmitted signal. The resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform.

The appropriate bandwidth mask is applied to the output waveform to verify compliance.

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PROJECT NO.:2L0071RUS1Rev1

EQUIPMENT: 2.6 GHz BTS Rel1

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.1051
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Antenna Conducted:

A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of 1 MHz for emissions above 1 GHz. Below 1 GHz the resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform.

The appropriate limit line is applied to the output waveform to verify compliance.

EQUIPMENT: 2.6 GHz BTS Rel1

NAME OF TEST: Field Strength of Spurious Radiation	PARA. NO.: 2.1053
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If the antenna is detachable from the transmitter, it is removed and replaced with a 50 ohm load. Emissions are measured up to the 10th harmonic of the highest transmit frequency that the transmitter is capable of producing.

If the antenna is not detachable from the transmitter, emissions are measured radiated only.

E.R.P.:

If the antenna is detachable from the circuit then the antenna is replaced with a 50 ohm load for this test.. The ERP is measured using the substitution antenna method of measurement as described in EIA/TIA 630. The field strength of the emission is measured using a RBW setting on the spectrum analyzer greater than the 20 dB bandwidth of the transmitted waveform. The EUT is then replaced with an antenna with known gain relative to either a dipole or an isotropic radiator. A signal generator is used to feed the substitution antenna until the previously measured field strength level is obtained. The level of signal needed to drive the substitution antenna to obtain the previously measured field strength is the erp or eirp after correction for substitution antenna gain.

EQUIPMENT: 2.6 GHz BTS Rel1

NAME OF TEST: Frequency Stability	2.1055
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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.

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FCC PART 21, SUBPART K
MULTIPOINT DISTRIBUTION SERVICE
PROJECT NO.:
ANNEX B

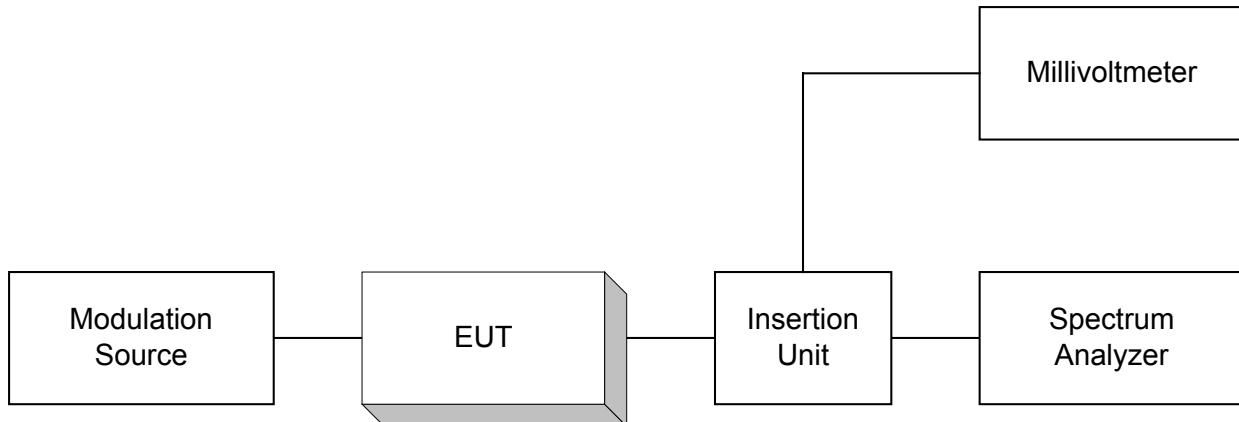
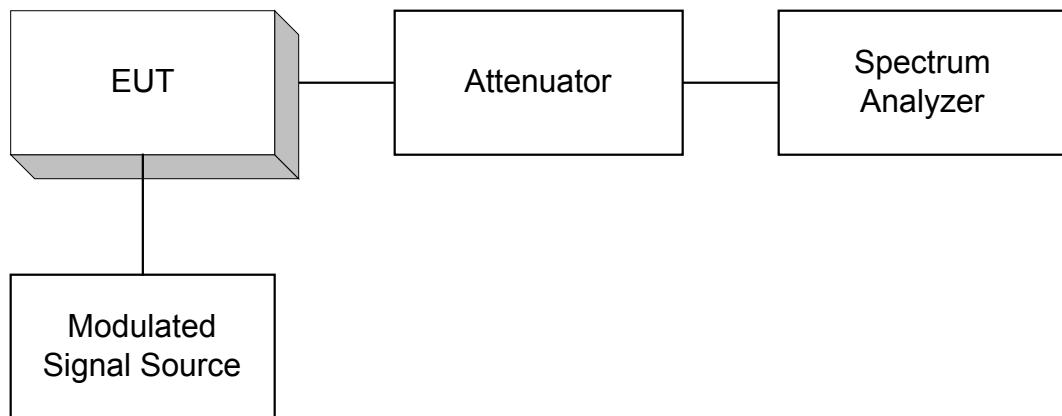
EQUIPMENT:

FCC ID:

Section 10.

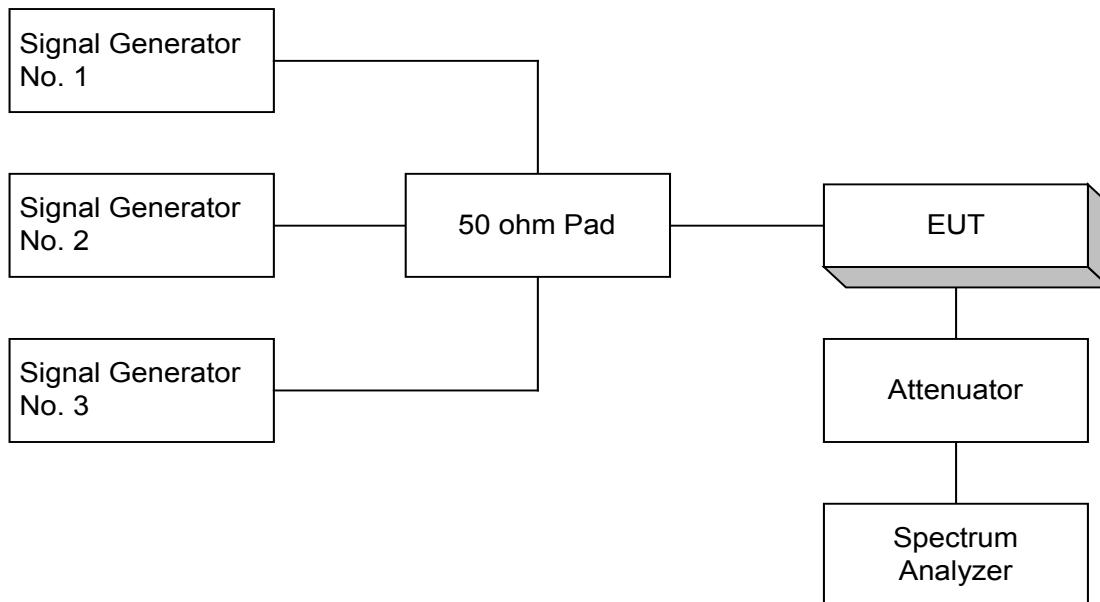
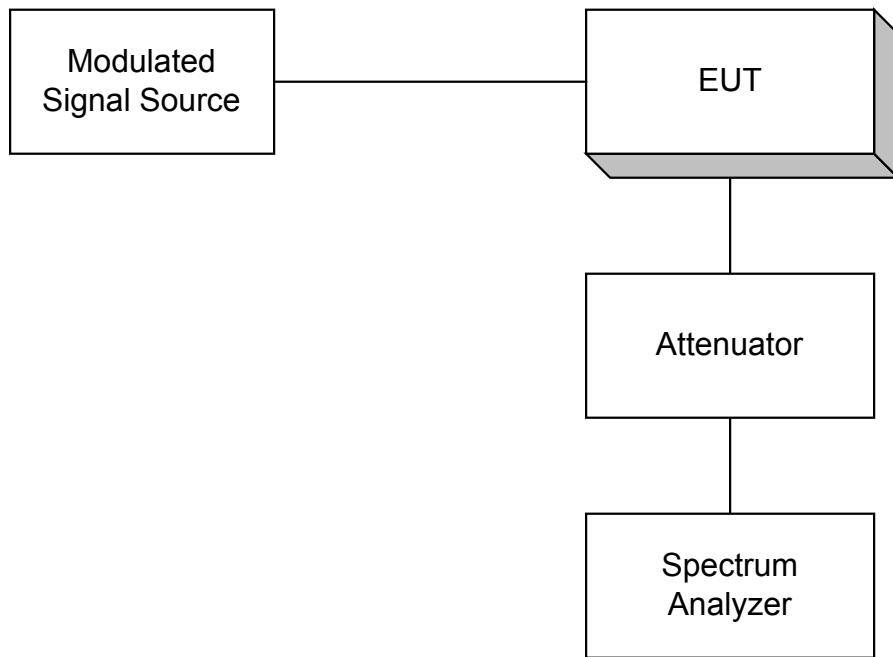
Test Diagrams

EQUIPMENT:
FCC ID:

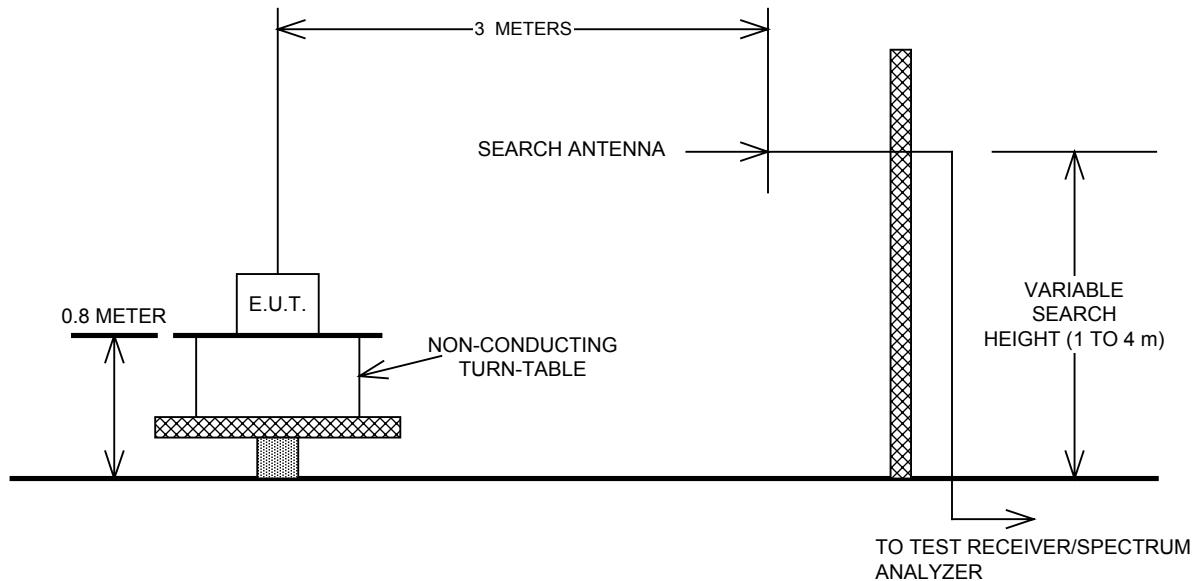
Para. No. 2.1046 - R.F. Power Output**Para. No. 2.1049 - Occupied Bandwidth**

EQUIPMENT:
FCC ID:

Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



EQUIPMENT:
FCC ID:

Para. No. 2.1053 - Field Strength of Radiation**Para. No. 2.1055 - Frequency Stability**