

**Nemko Test Report:** 2L0071RUS1Rev1

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

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

**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

*EQUIPMENT: 2.6 GHz BTS Rel1*

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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.

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".

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This report applies only to the items tested.

*EQUIPMENT: 2.6 GHz BTS Rel1*

**Summary Of Test Data**

<b>NAME OF TEST</b>	<b>PARA. NO.</b>	<b>SPEC.</b>	<b>RESULT</b>
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

<b>Type(s) of Modulation:</b>	<b>F3E (Voice)</b>	<b>F1D</b>	<b>F2D</b>	<b>D7W (QAM)</b>	<b>DQPSK (F9W)</b>
	<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

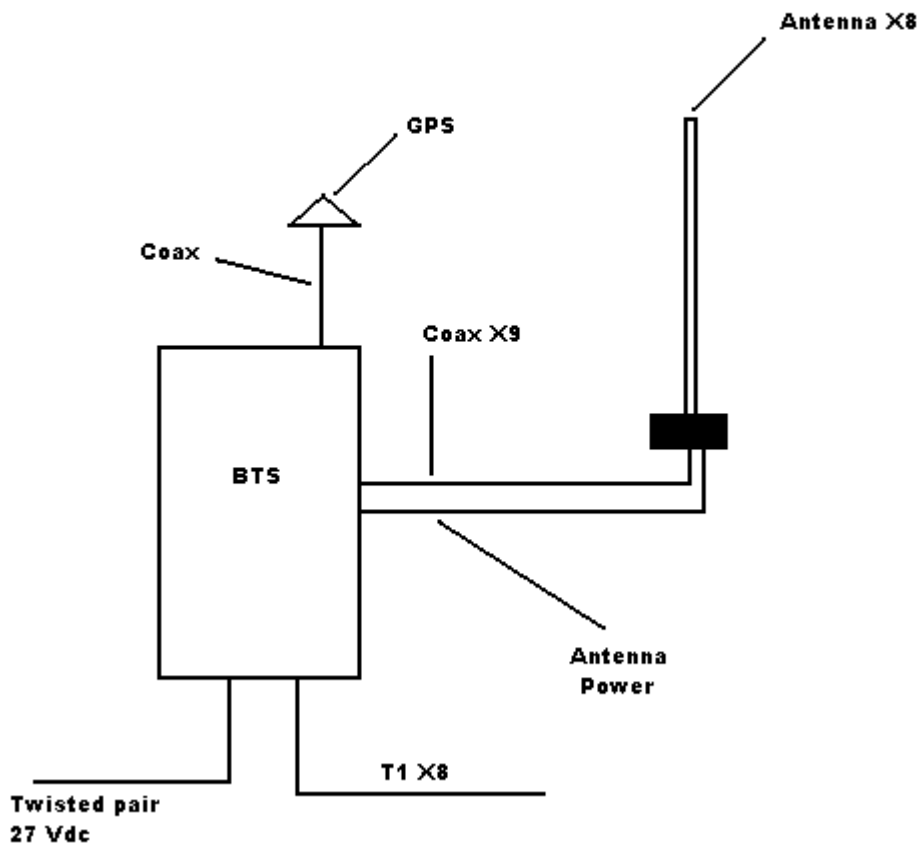
**Power Output Adjustment  
Capability:** Software controlled

*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**



*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).

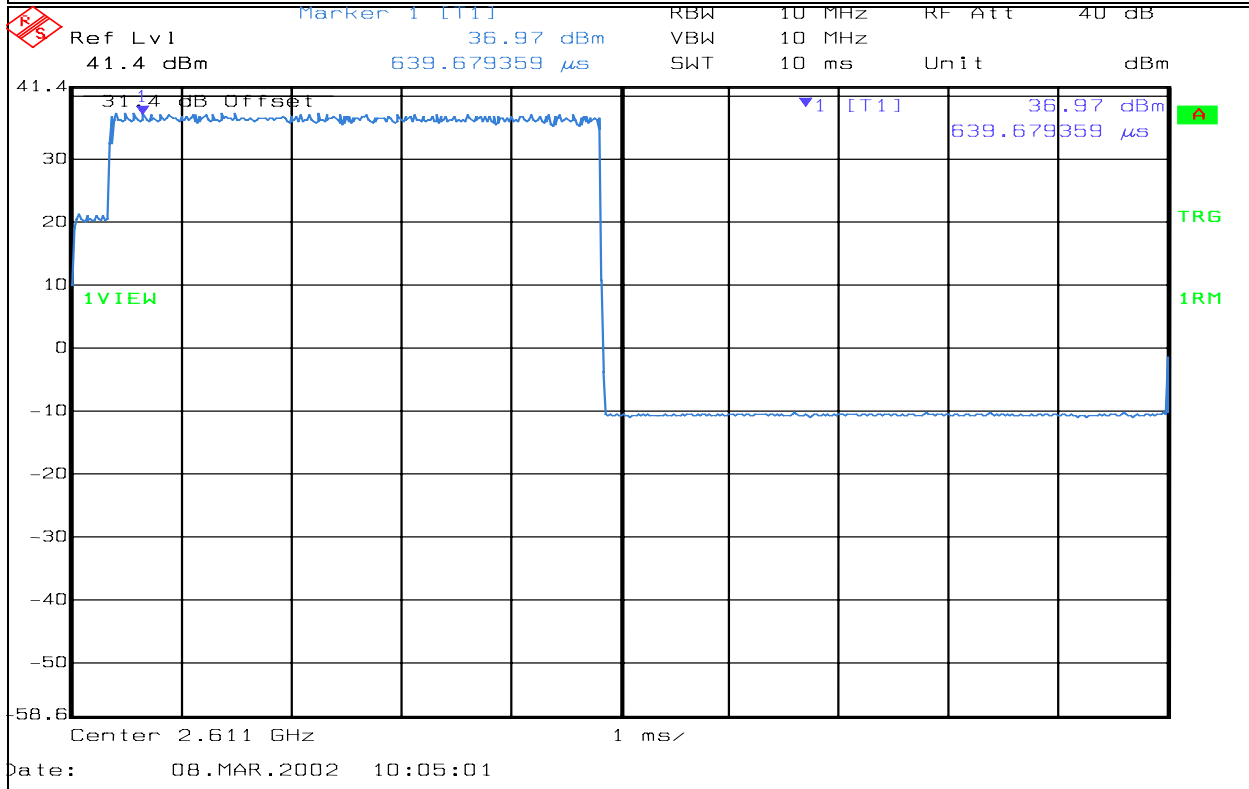
EQUIPMENT: 2.6 GHz BTS Rel1  
 Tests Data – RF Power Output



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

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Data Plot		RF Power Output		Complete <u>  X  </u>	
Page <u>  1  </u> of <u>  1  </u>				Preliminary: <u>          </u>	
Job No.:	<u>  2L0071R  </u>	Date:	<u>  2/28/2002  </u>		
Specification:	<u>  PT 21  </u>	Temperature(°C):	<u>  20  </u>		
Tested By:	<u>  David Light  </u>	Relative Humidity(%):	<u>  50  </u>		
E.U.T.:	<u>  2.6 GHz BTS  </u>				
Configuration:	<u>  TX TDD SIGNAL  </u>				
Sample Number:	<u>  1  </u>				
Location:	<u>  Lab 1  </u>	RBW:	<u>  10 MHz  </u>	Measurement	
Detector Type:	<u>  Rms  </u>	VBW:	<u>  10 MHz  </u>	Distance:	<u>  N/A  </u> m
<b>Test Equipment Used</b>					
Antenna:	<u>          </u>	Directional Coupler:	<u>  1055  </u>		
Pre-Amp:	<u>          </u>	Cable #1:	<u>  1628  </u>		
Filter:	<u>          </u>	Cable #2:	<u>          </u>		
Receiver:	<u>  1036  </u>	Cable #3:	<u>          </u>		
Attenuator #1	<u>  1471  </u>	Cable #4:	<u>          </u>		
Attenuator #2:	<u>          </u>	Mixer:	<u>          </u>		
Additional equipment used:	<u>                                  </u>				
Measurement Uncertainty:	<u>  +/-1.7 dB  </u>				



Notes: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_



*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.

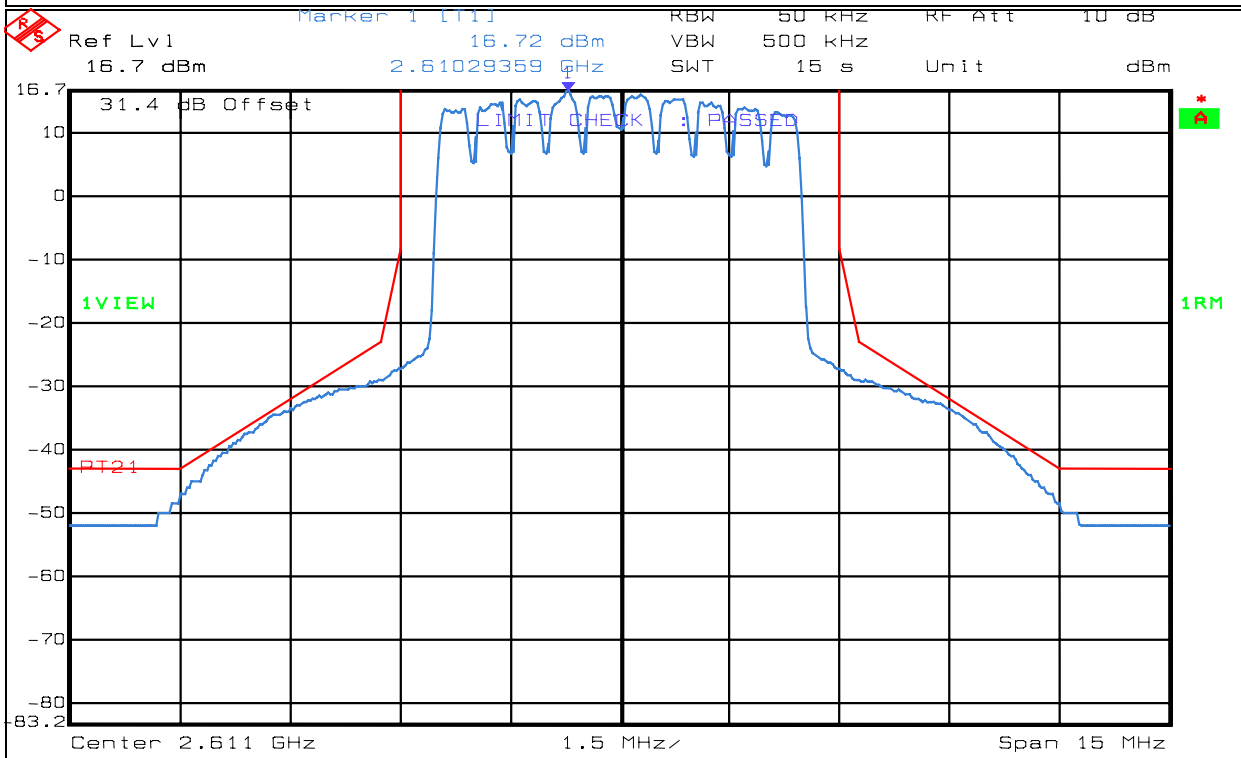
EQUIPMENT: 2.6 GHz BTS Rel1  
Test data – Emission Mask



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Data		Occupied Bandwidth / Emission	
Page 1 of 2		Complete <u>X</u>	
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
<b>Test Equipment</b>			
Antenna:		Directional Coupler:	1055
Pre-Amp:		Cable #1:	1628
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1471	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-1.7 dB		



Date: 08.MAR.2002 09:58:22

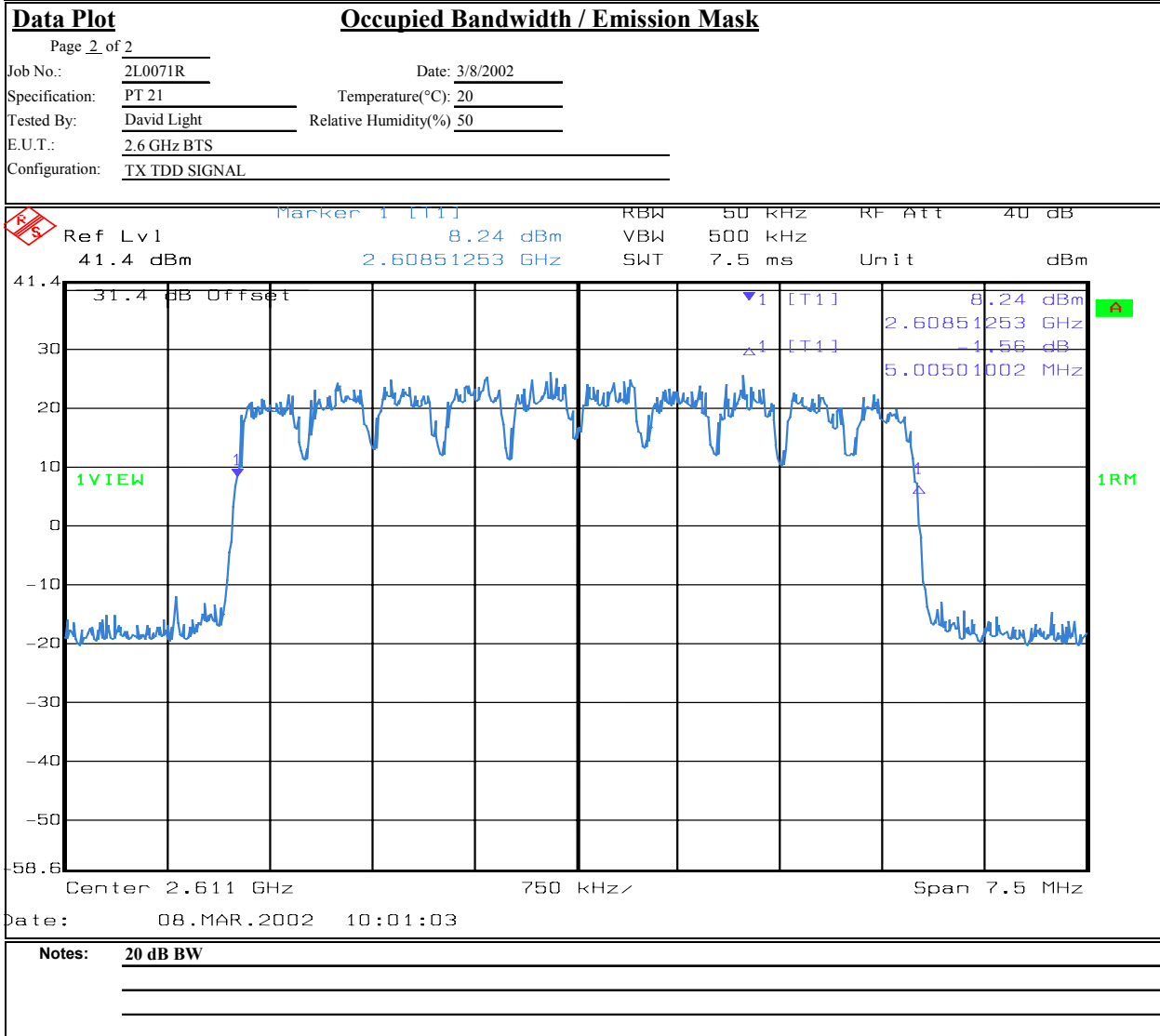
Notes: **OUTPUT POWER = 37 dBm (5.0 Watts)**

EQUIPMENT: 2.6 GHz BTS Rel1  
 Test Data – Occupied Bandwidth



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*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

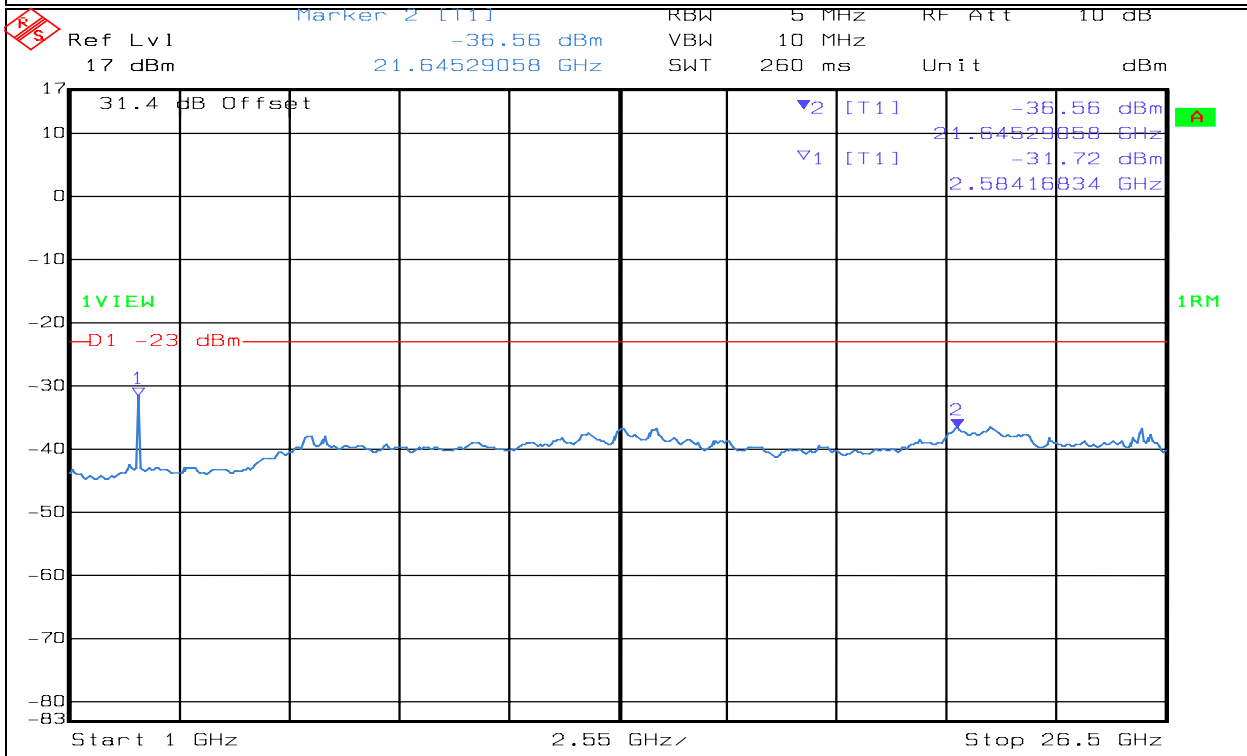
Test Data – Spurious Emissions at Antenna Terminals



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Data Plot		Spurious Emissions at Antenna Terminals	
Page 1 of 1		Complete <u>  X  </u>	
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
<b>Test Equipment Used</b>			
Antenna:		Directional Coupler:	1055
Pre-Amp:		Cable #1:	1627
Filter:		Cable #2:	
Receiver:	1036	Cable #3:	
Attenuator #1:	1471	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	+/-1.7 dB		



Date: 08.MAR.2002 10:19:33

Notes: MARKER 1 = CARRIER (NOTCHED) / MARKER 2 = HIGHEST EMISSION  
 DISPLAY LINE - -23 dBm (-60dBc FROM CARRIER POWER)

*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



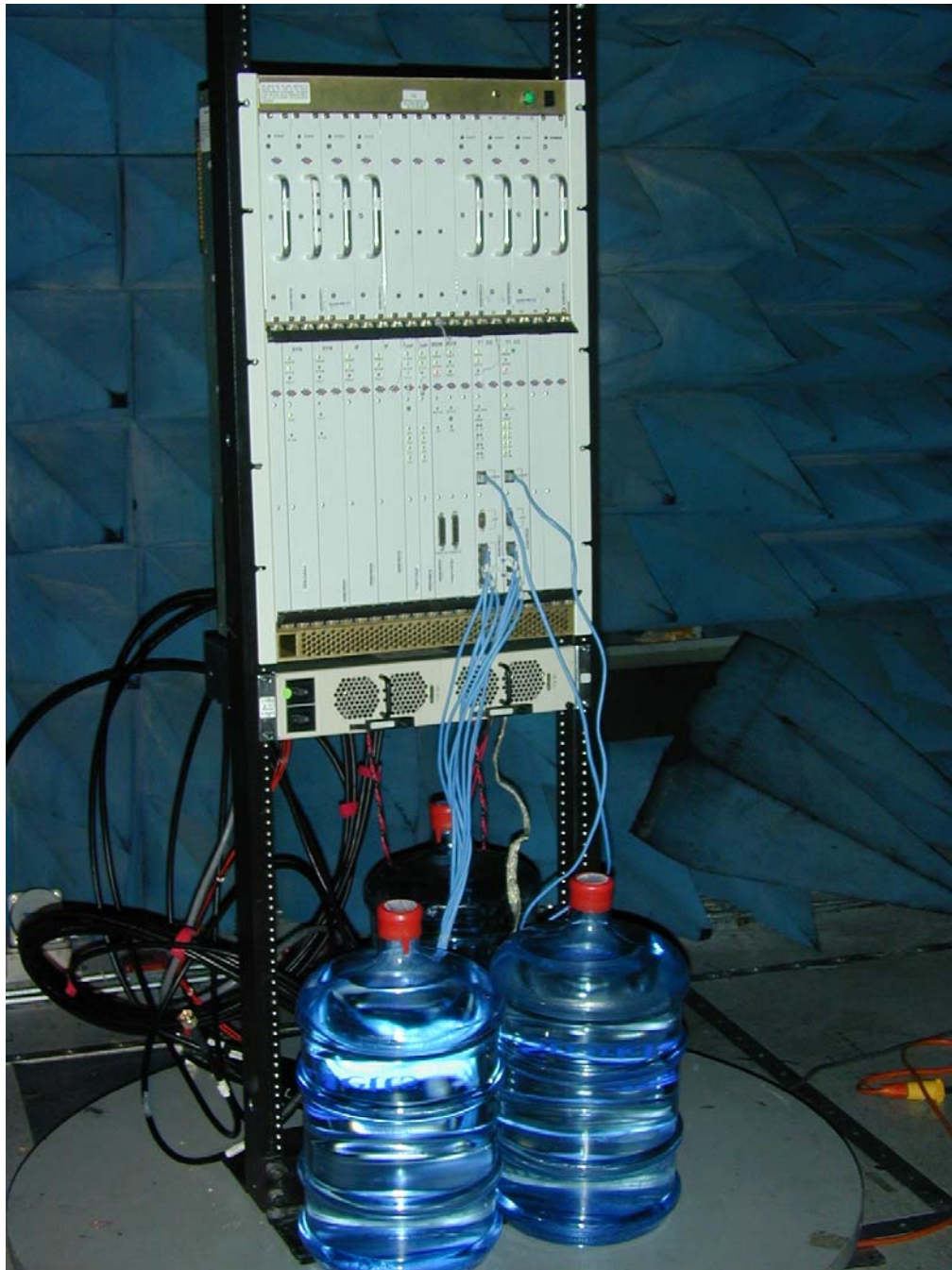
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<u>Field Strength of Spurious Emissions</u>											
Page 1 of 1									Complete	<u>X</u>	
Job No.:	2L0071R		Date:		3/6/2002		Preliminary				
Specification:	PT 21		Temperature(°C):		22						
Tested By:	David Light		Relative Humidity(%)		50						
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		
<b>Test Equipment Used</b>											
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	
<b>Notes:</b> 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*

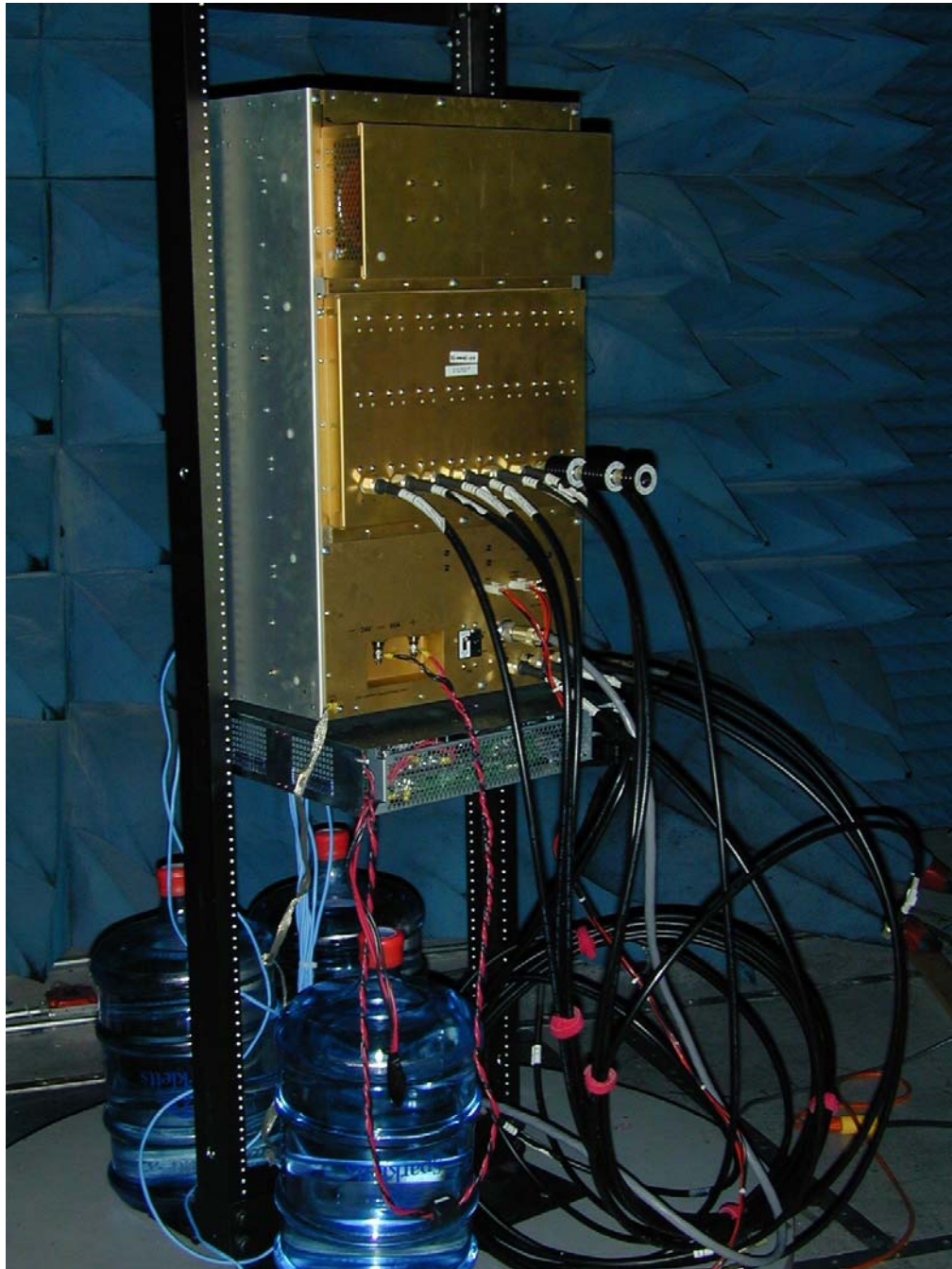
**Photos – Field Strength of Spurious Emissions**

**Front**





*EQUIPMENT: 2.6 GHz BTS Rel1*  
**Rear**



*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.**


*EQUIPMENT: 2.6 GHz BTS Rel1*

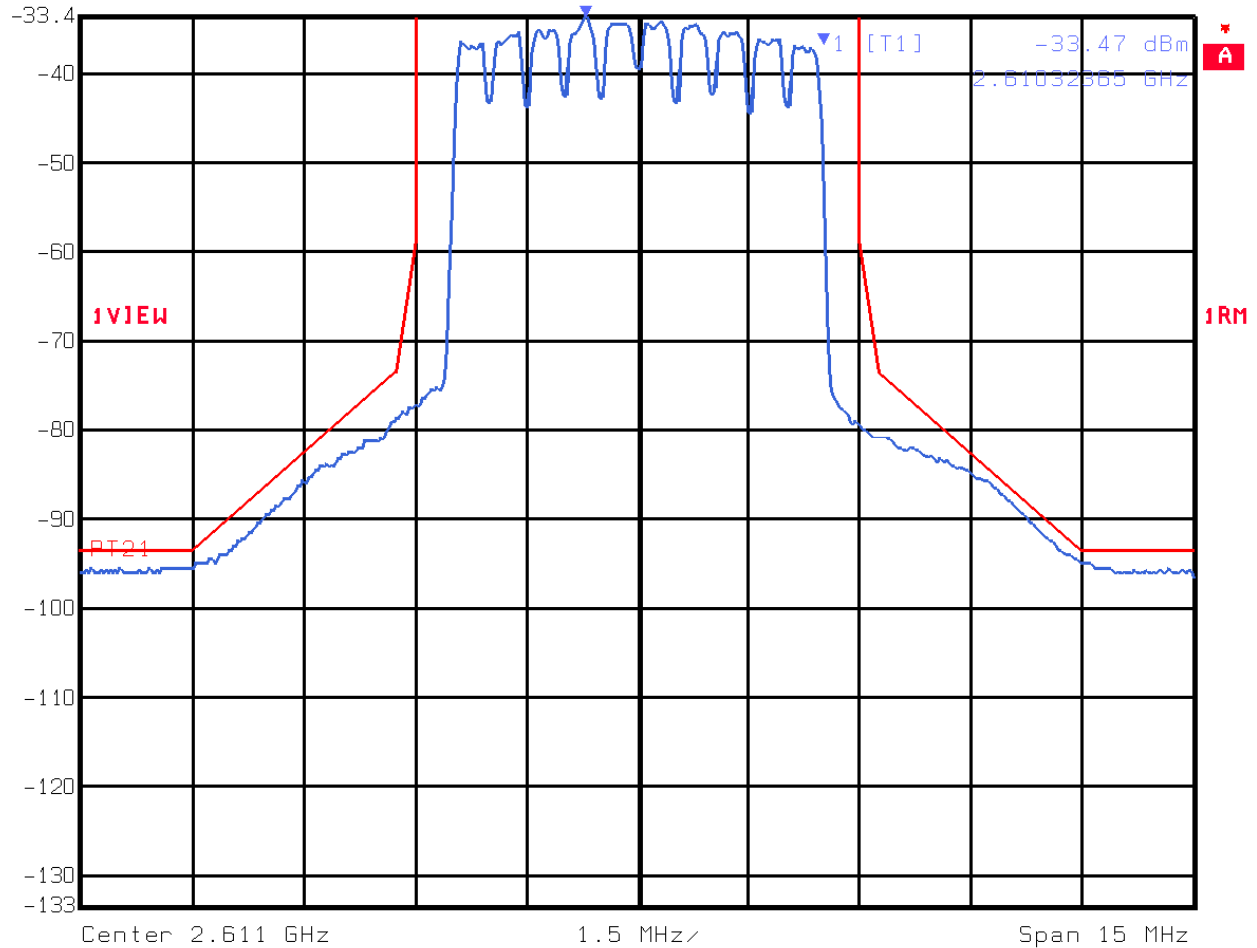
Temperature (°C)	Measured Frequency (MHz)	Frequency Error (kHz)	Frequency Error (%)
0	2610.293590	30.06	.001
+10	2610.293590	30.06	.001
+20	2610.323650	0	0
+30	2610.293590	30.06	.001
+40	2610.293590	30.06	.001
+50	2610.293590	30.06	.001

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

 Ref Lvl -33.5 dBm      Marker 1 [T1] -33.47 dBm      RBW 50 kHz      RF Att 0 dB  
-33.5 dBm      2.61032365 GHz      VBW 500 kHz  
SWT 5 s      Unit dBm

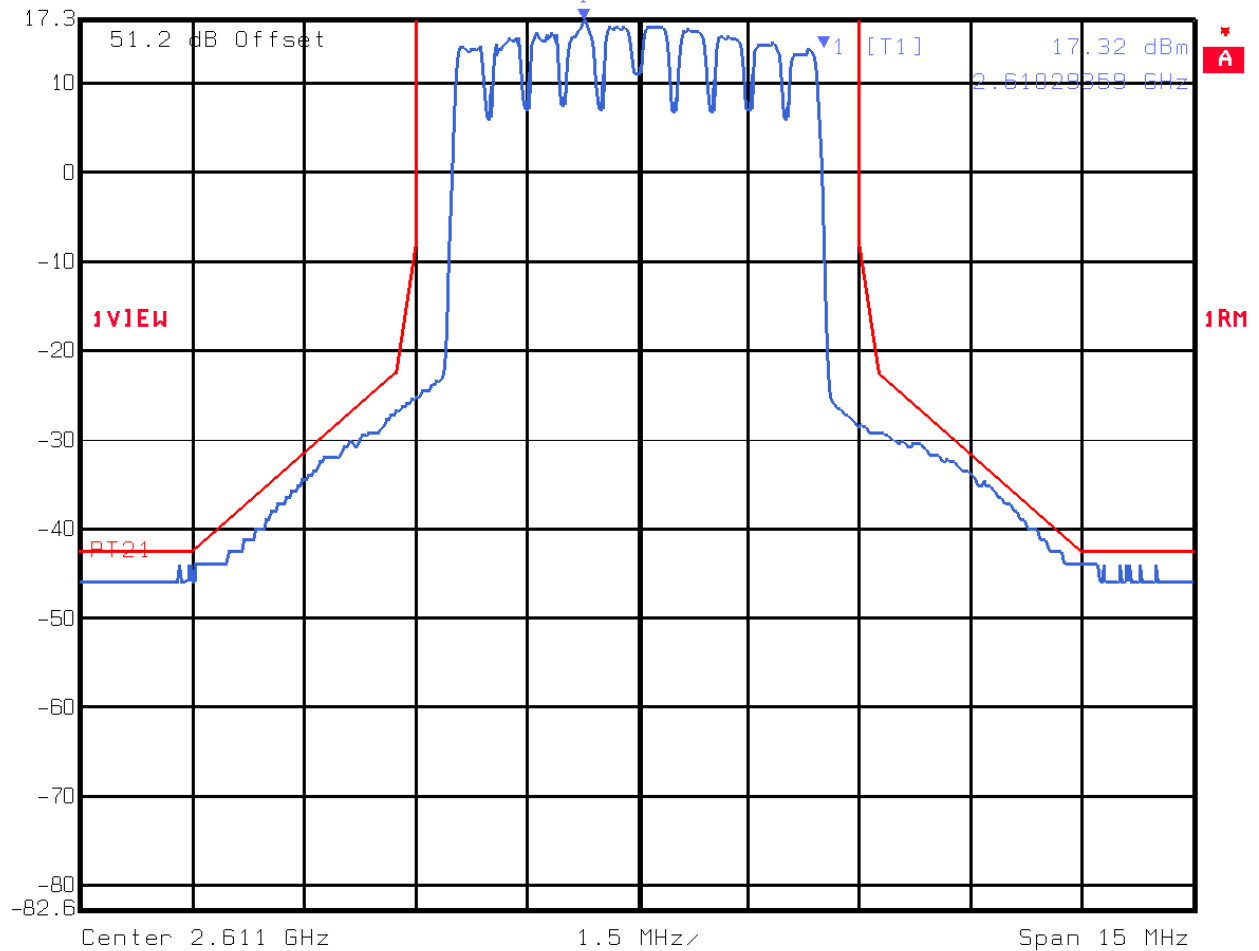


Title: FREQUENCY ERROR  
Comment A: AMBIENT  
Date: 05.APR.2002 10:47:27

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability


Ref Lvl 17.3 dBm  
Marker 1 [T1] 17.32 dBm  
2.61029359 GHz  
RBW 50 kHz RF Att 0 dB  
VBW 500 kHz  
SWT 5 s Unit dBm

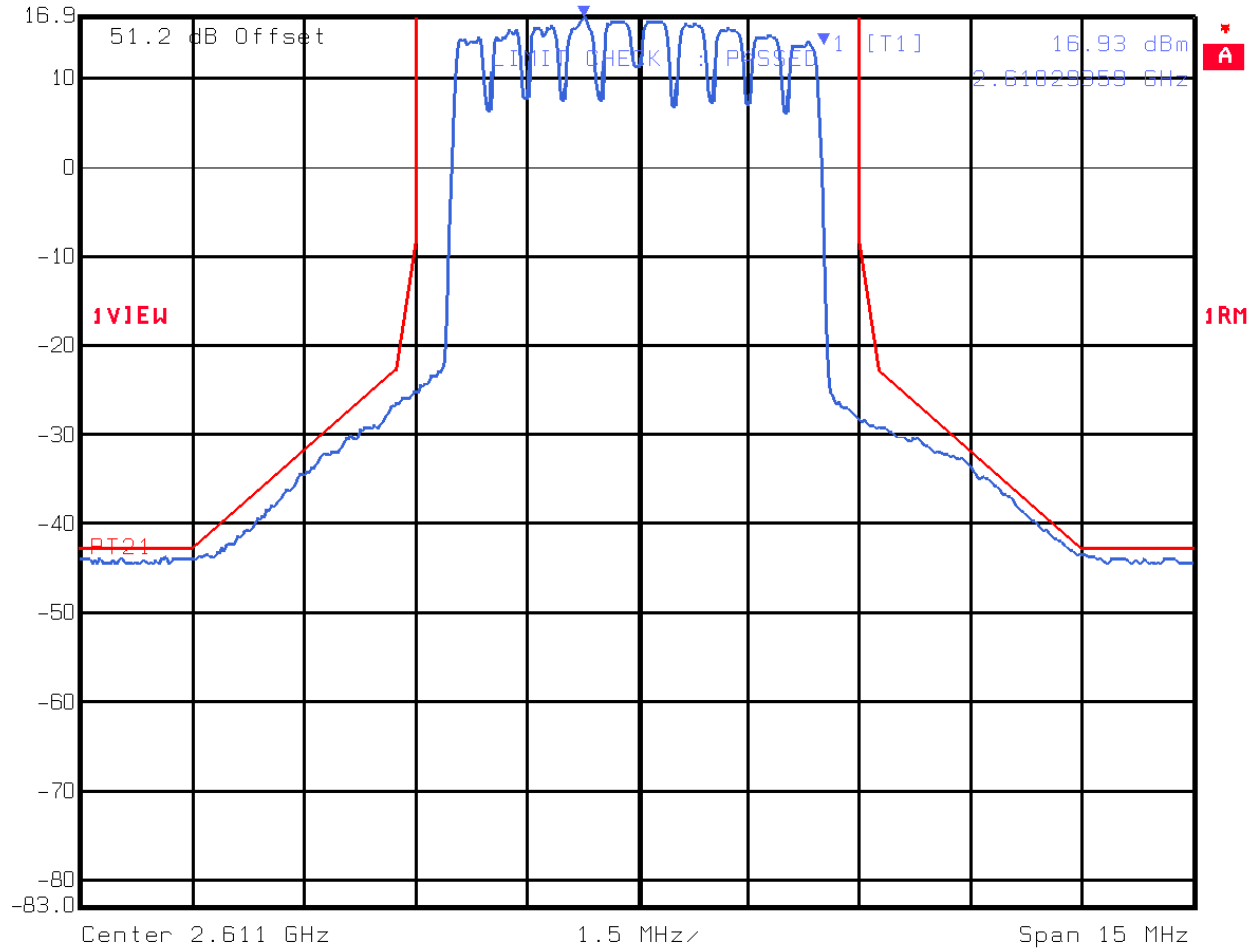


Title: FREQUENCY ERROR  
Comment A: +50° C  
Date: 05.APR.2002 11:34:43

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability


 Marker 1 [T1]      RBW 50 kHz      RF Att 0 dB  
 Ref Lvl 16.93 dBm      VBW 500 kHz  
 16.9 dBm      2.61029359 GHz      SWT 5 s      Unit dBm

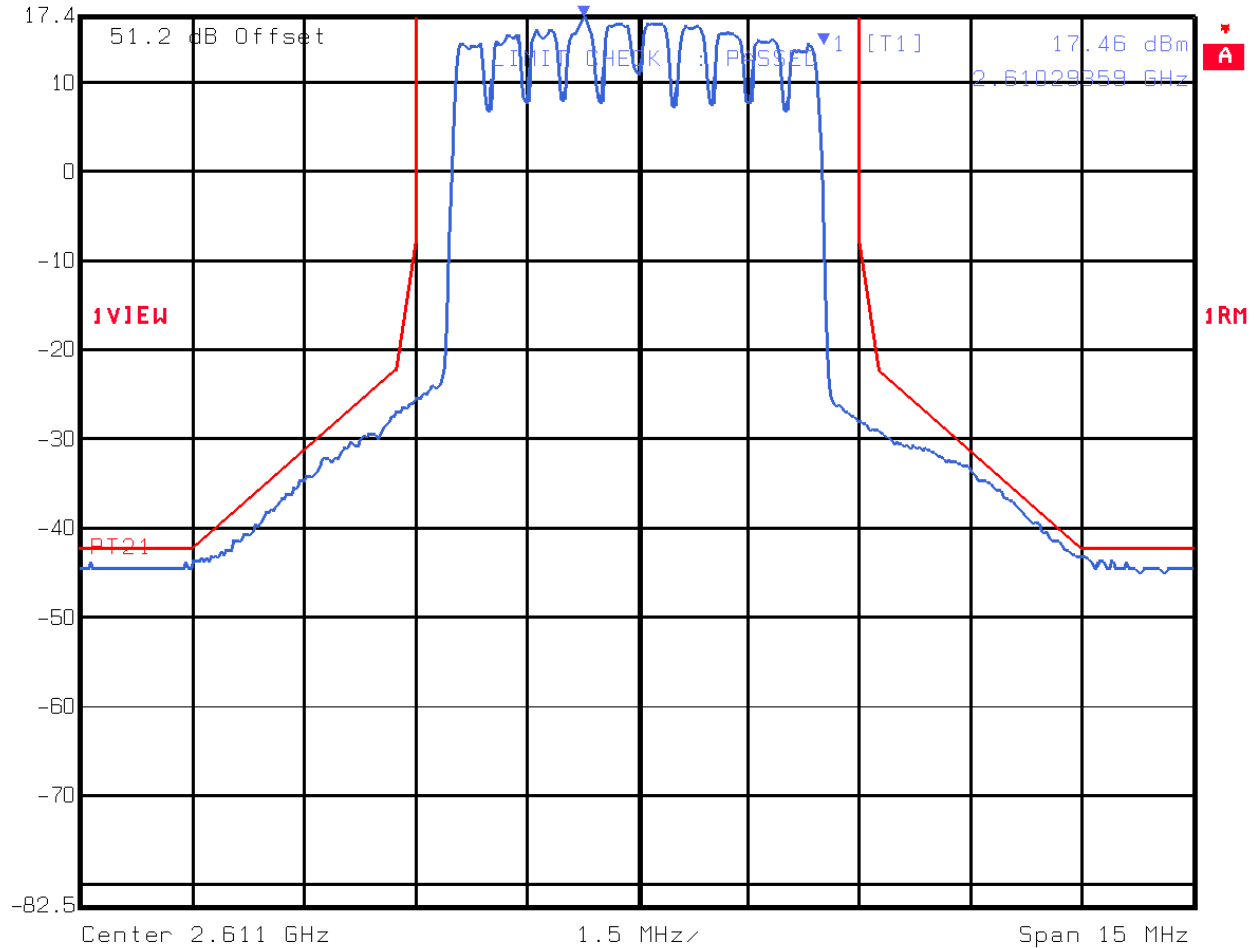


Title: FREQUENCY ERROR  
 Comment A: +40° C  
 Date: 05.APR.2002 11:55:03

EQUIPMENT: 2.6 GHz BTS Rel1


Test Data – Frequency Stability

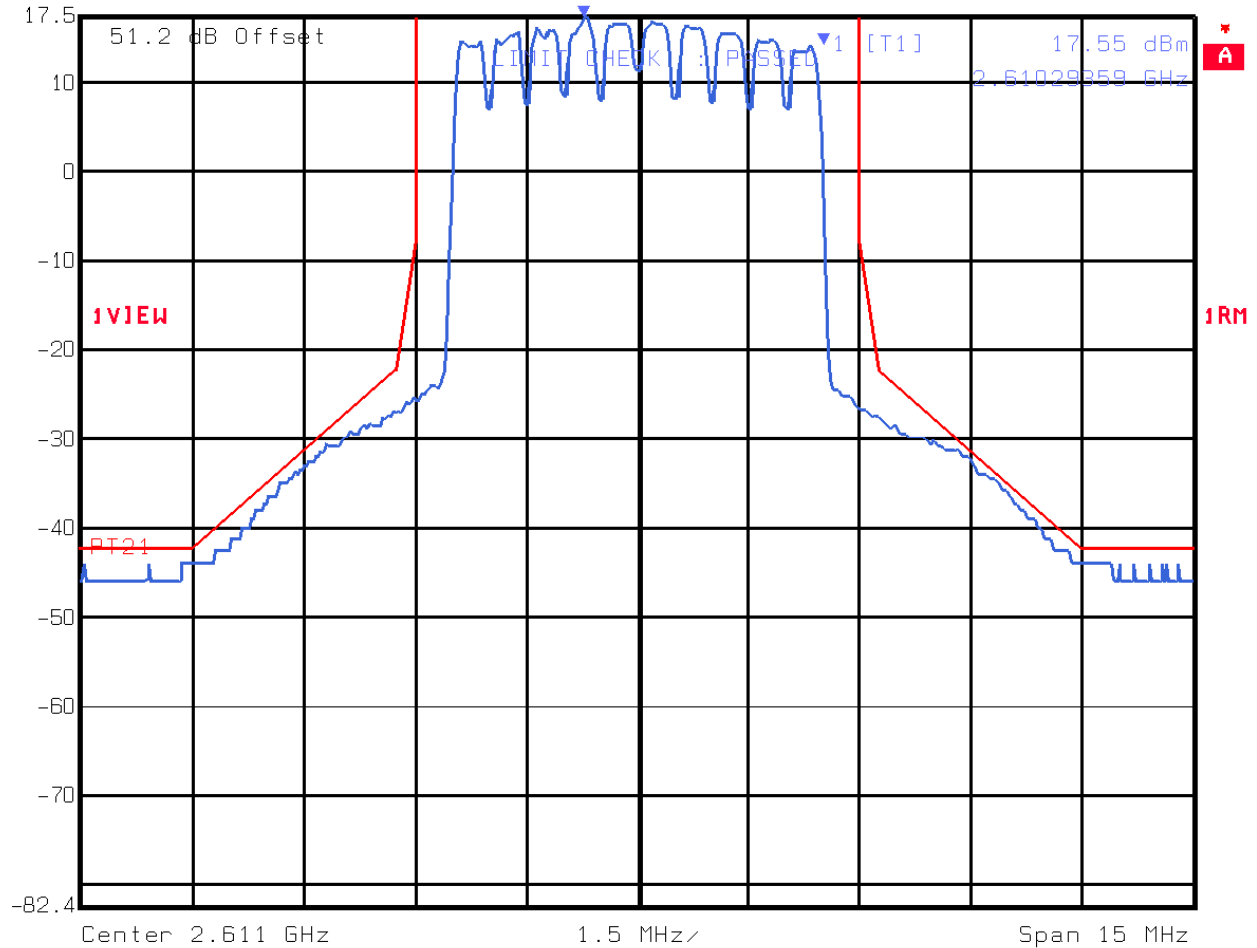
Ref Lvl 17.5 dBm  
Marker 1 [T1] 17.46 dBm  
2.61029359 GHz  
RBW 50 kHz  
RF Att 0 dB  
VBW 500 kHz  
SWT 5 s  
Unit dBm



Title: FREQUENCY ERROR  
Comment A: +30° C  
Date: 05.APR.2002 12:07:33

EQUIPMENT: 2.6 GHz BTS Rel1  
**Test Data – Frequency Stability**


 Marker 1 [T1]      RBW 50 kHz      RF Att 0 dB  
 Ref Lvl 17.55 dBm      VBW 500 kHz  
 17.5 dBm      2.61029359 GHz      SWT 5 s      Unit dBm



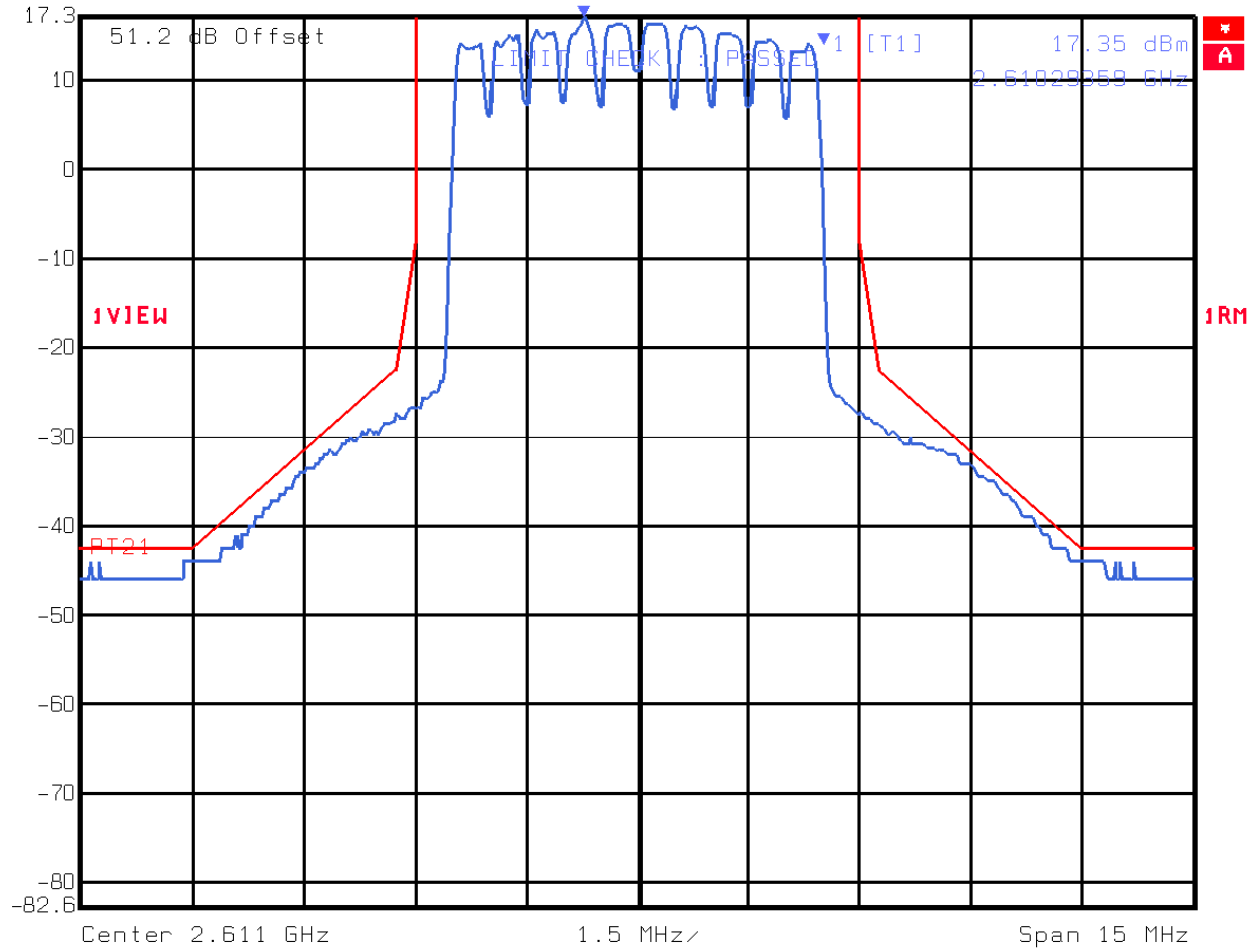
Title: FREQUENCY ERROR  
 Comment A: +10° C  
 Date: 05.APR.2002 13:29:40



EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability


Ref Lvl 17.3 dBm  
Marker 1 [T1] 17.35 dBm  
2.61029359 GHz  
RBW 50 kHz RF Att 0 dB  
VBW 500 kHz  
SWT 5 s Unit dBm

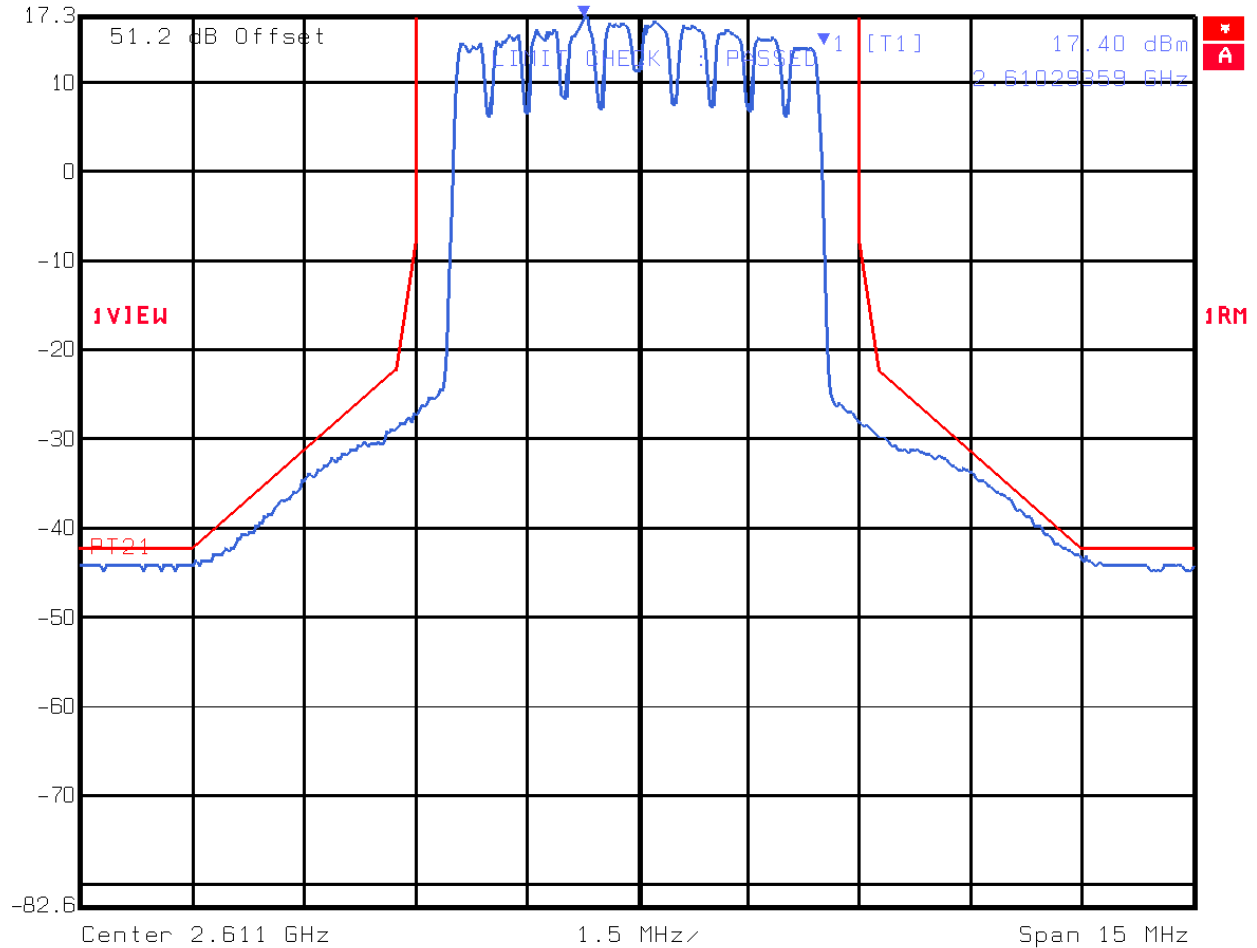


Title: FREQUENCY ERROR  
Comment A: 0° C  
Date: 05.APR.2002 13:49:12

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability


 Marker 1 [T1]      RBW 50 kHz      RF Att 0 dB  
 Ref Lvl 17.4 dBm      VBW 500 kHz  
 17.4 dBm      2.61029359 GHz      SWT 5 s      Unit dBm

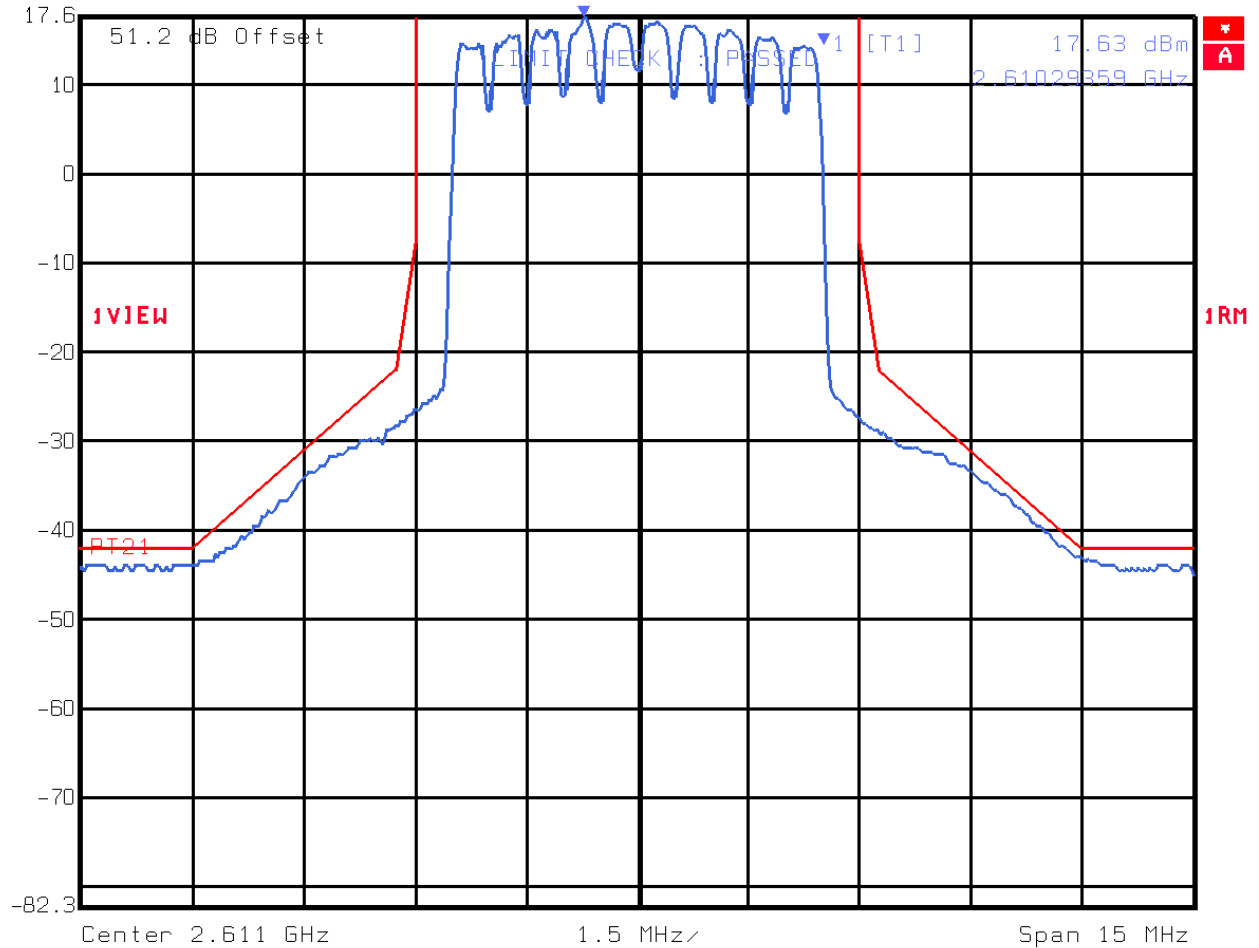


Title: FREQUENCY ERROR  
 Comment A: AMBIENT 27.6 Vdc  
 Date: 05.APR.2002 14:38:04

EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability

Ref Lvl 17.6 dBm  
Marker 1 [T1] 17.63 dBm  
2.61029359 GHz  
RBW 50 kHz  
RF Att 0 dB  
VBW 500 kHz  
SWT 5 s  
Unit dBm



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

**Nemko Dallas**

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*

<b>NAME OF TEST: RF Power Output</b>	<b>PARA. NO.: 2.1046</b>
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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.

*EQUIPMENT: 2.6 GHz BTS Rel1*

<b>NAME OF TEST: Occupied Bandwidth</b>
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<b>PARA. NO.: 2.1049</b>
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**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.

*EQUIPMENT: 2.6 GHz BTS Rel1*

<b>NAME OF TEST: Spurious Emission at Antenna Terminals</b>	<b>PARA. NO.: 2.1051</b>
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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*

<b>NAME OF TEST: Field Strength of Spurious Radiation</b>	<b>PARA. NO.: 2.1053</b>
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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 10<sup>th</sup> 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*

<b>NAME OF TEST: Frequency Stability</b>	<b>2.1055</b>
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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.

*EQUIPMENT:*  
*FCC ID:*

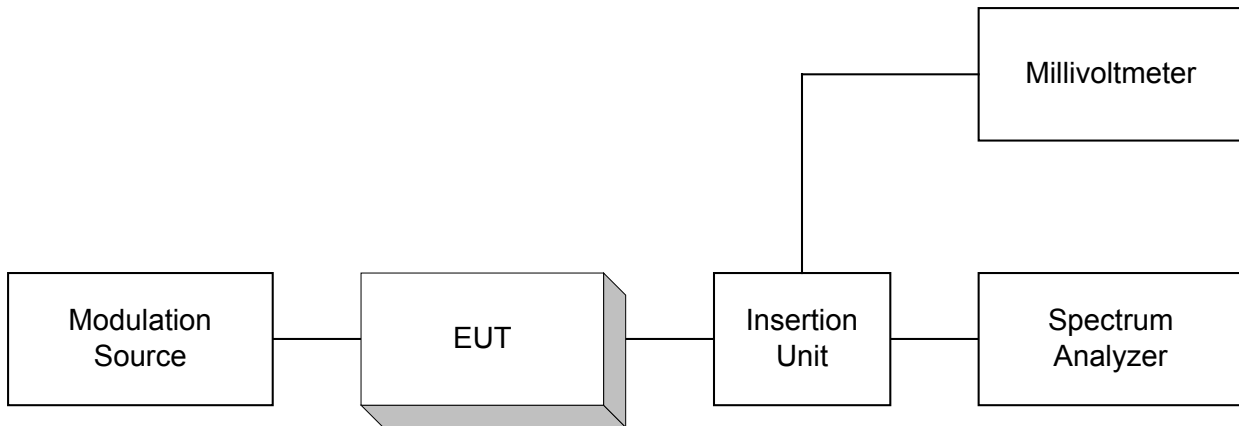
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**Section 10.                      Test Diagrams**

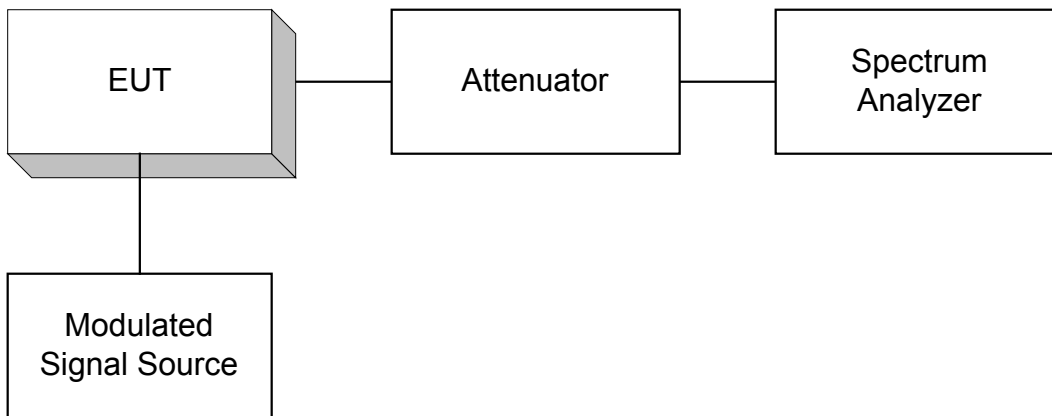
EQUIPMENT:  
FCC ID:

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**Para. No. 2.1046 - R.F. Power Output**



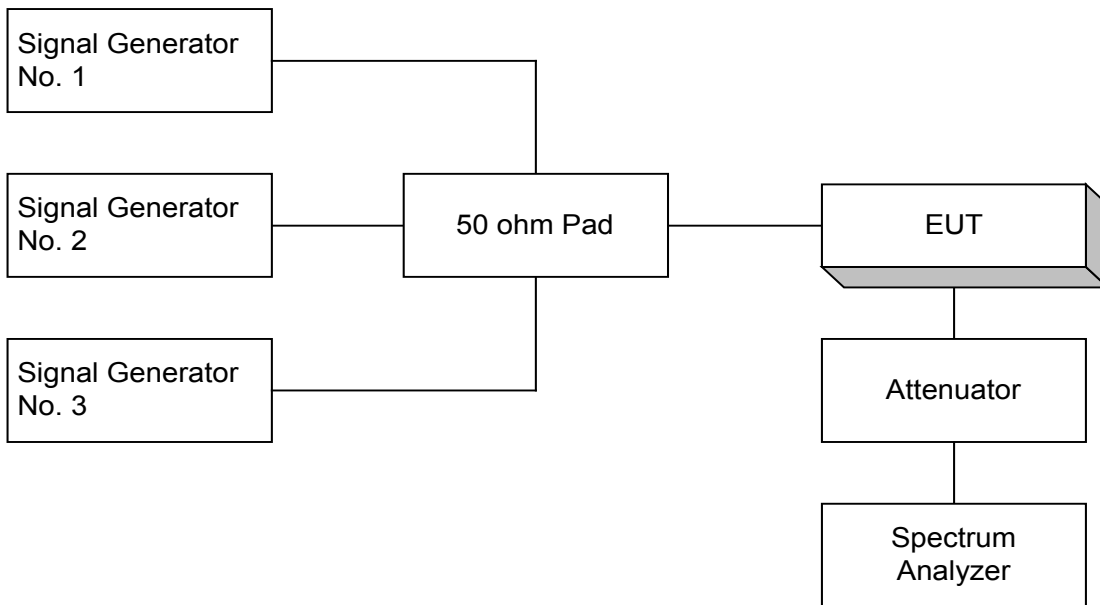
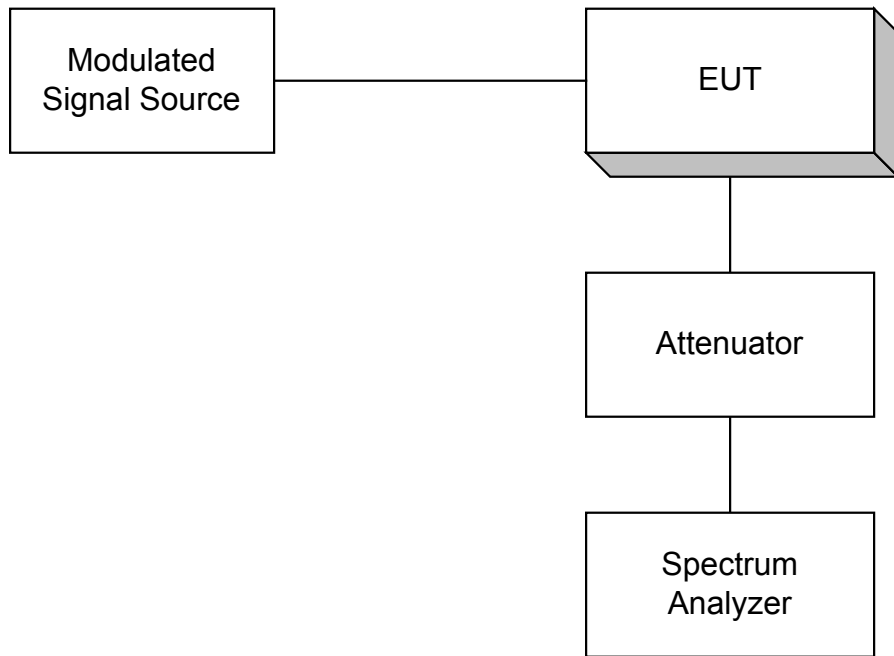
**Para. No. 2.1049 - Occupied Bandwidth**



EQUIPMENT:  
FCC ID:

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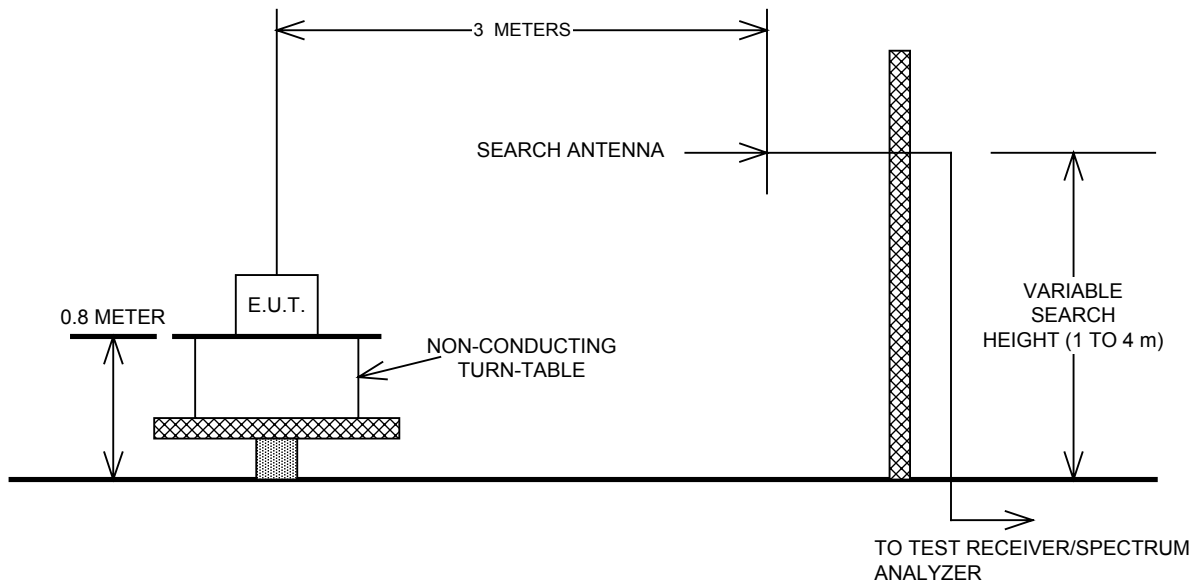
**Para. No. 2.1051 - Spurious Emissions at Antenna Terminals**



EQUIPMENT:  
FCC ID:

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**Para. No. 2.1053 - Field Strength of Radiation**



**Para. No. 2.1055 - Frequency Stability**

