

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

Table of Contents

Section 1.	Summary of Test Results	3
Section 2.	General Equipment Specification	5
Section 3.	RF Power Output	7
Section 4.	Occupied Bandwidth.....	9
Section 5.	Spurious Emissions at Antenna Terminals	12
Section 6.	Field Strength of Spurious	14
Section 7.	Frequency Stability	18
Section 8.	Test Equipment List.....	28
Section 9.	Test Details	29
Section 10.	Test Diagrams	35

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”.

Nemko Dallas Inc. authorizes the above named company to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Dallas Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

This report applies only to the items tested.

*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:	F3E (Voice)	F1D	F2D	D7W (QAM)	DQPSK (F9W)
	☐	☐	☐	☐	☒

Emission Designator: 5M00F9W

Output Impedance: 50 ohms

RF Power Output Rated: +37 dBm (5 watts)

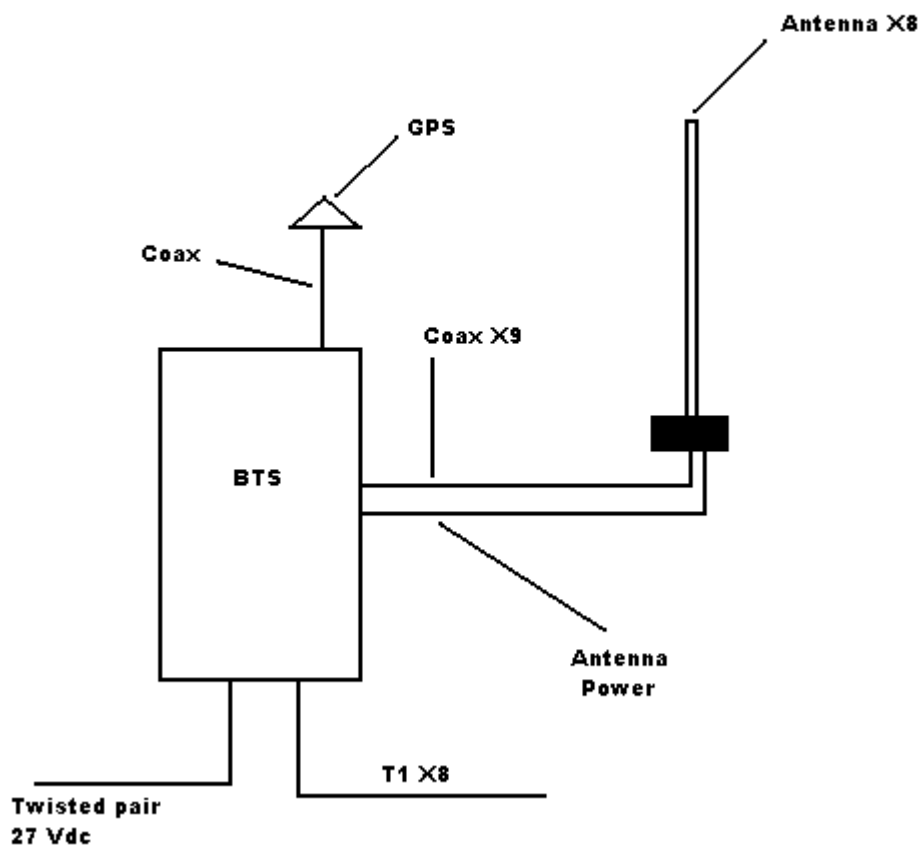
Duty Cycle: 50% TDD

**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



Dallas Headquarters:

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

Nemko Dallas, Inc.

Data Plot		RF Power Output															
Page 1 of 1				Complete <u> X </u>													
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:	1036	Cable #3:															
Attenuator #1	1471	Cable #4:															
Attenuator #2:		Mixer:															
Additional equipment used:																	
Measurement Uncertainty:	+/-1.7 dB																
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>RBW</td> <td>10 MHz</td> <td>RF Att</td> <td>40 dB</td> </tr> <tr> <td>VBW</td> <td>10 MHz</td> <td>Unit</td> <td>dBm</td> </tr> <tr> <td>SWT</td> <td>10 ms</td> <td></td> <td></td> </tr> </table>						RBW	10 MHz	RF Att	40 dB	VBW	10 MHz	Unit	dBm	SWT	10 ms		
RBW	10 MHz	RF Att	40 dB														
VBW	10 MHz	Unit	dBm														
SWT	10 ms																
Ref Lvl 41.4 dBm Marker 1 [T1] 36.97 dBm 31.4 dB Offset 639.679359 μs 36.97 dBm 639.679359 μs TRG 1RM																	
Date: 08.MAR.2002 10:05:01 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



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

Nemko Dallas, Inc.

Data		Occupied Bandwidth / Emission	
Page 1 of 2		Complete ☒ 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	Measurement Distance: N/A m	
Detector Type: Rms	VBW: 500 kHz		
Test Equipment			
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			
Ref Lvl 16.7 dBm Marker 1 [11] 16.72 dBm 2.61029359 GHz RBW 50 kHz VBW 500 kHz SWT 15 s Unit dBm 31.4 dB Offset 1VIEW 1RM Center 2.611 GHz 1.5 MHz Span 15 MHz			
Date: 08.MAR.2002 09:58:22			
Notes: OUTPUT POWER = 37 dBm (5.0 Watts)			

EQUIPMENT: 2.6 GHz BTS Rel1

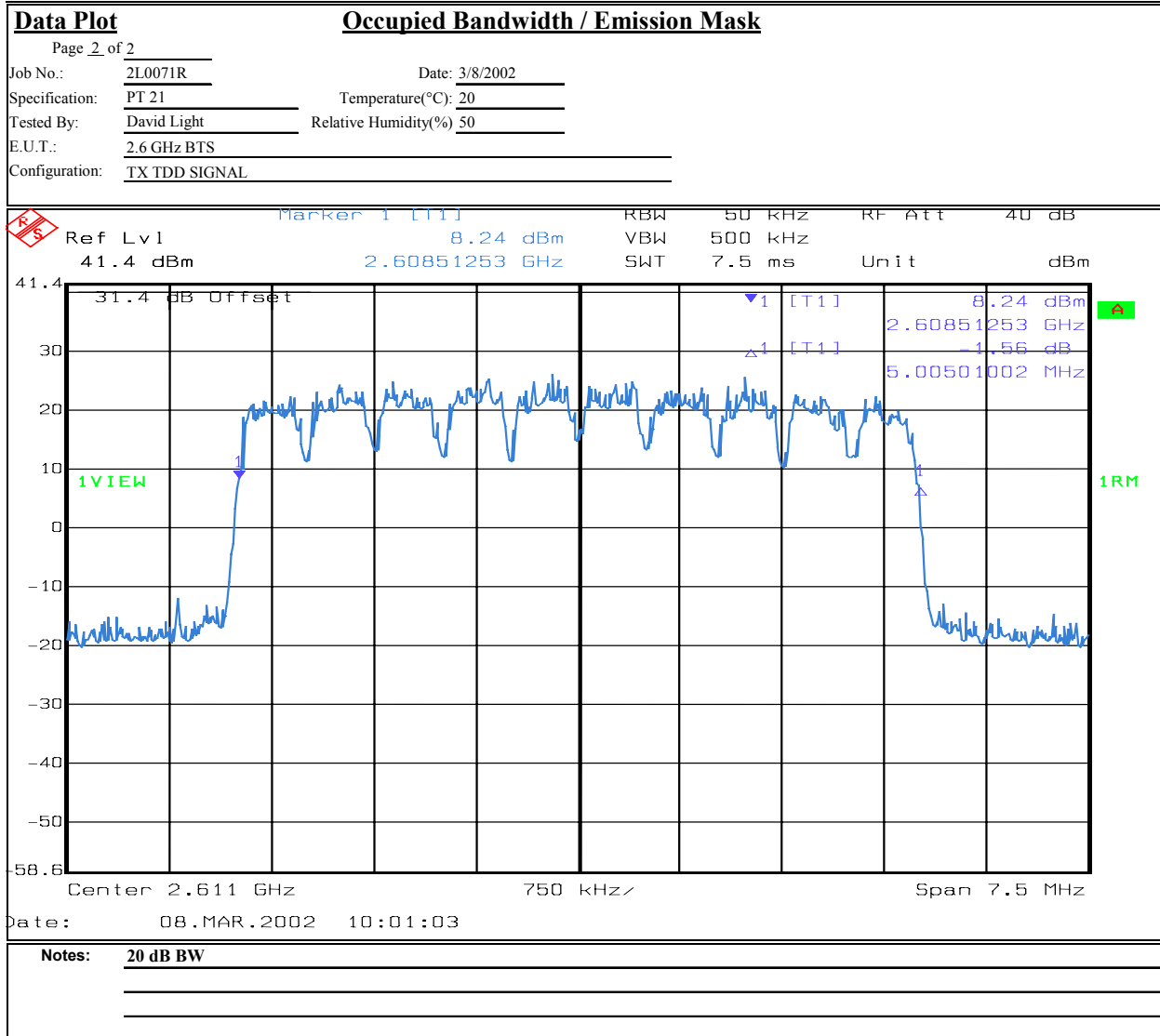
Test Data – Occupied Bandwidth



Dallas Headquarters:

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

Nemko Dallas, Inc.



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



Dallas Headquarters:

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

Nemko Dallas, Inc.

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
Test Equipment Used			
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



Dallas Headquarters:

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

Field Strength of Spurious Emissions

Page 1 of 1

Job No.: 2L0071R Date: 3/6/2002 Complete X
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

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

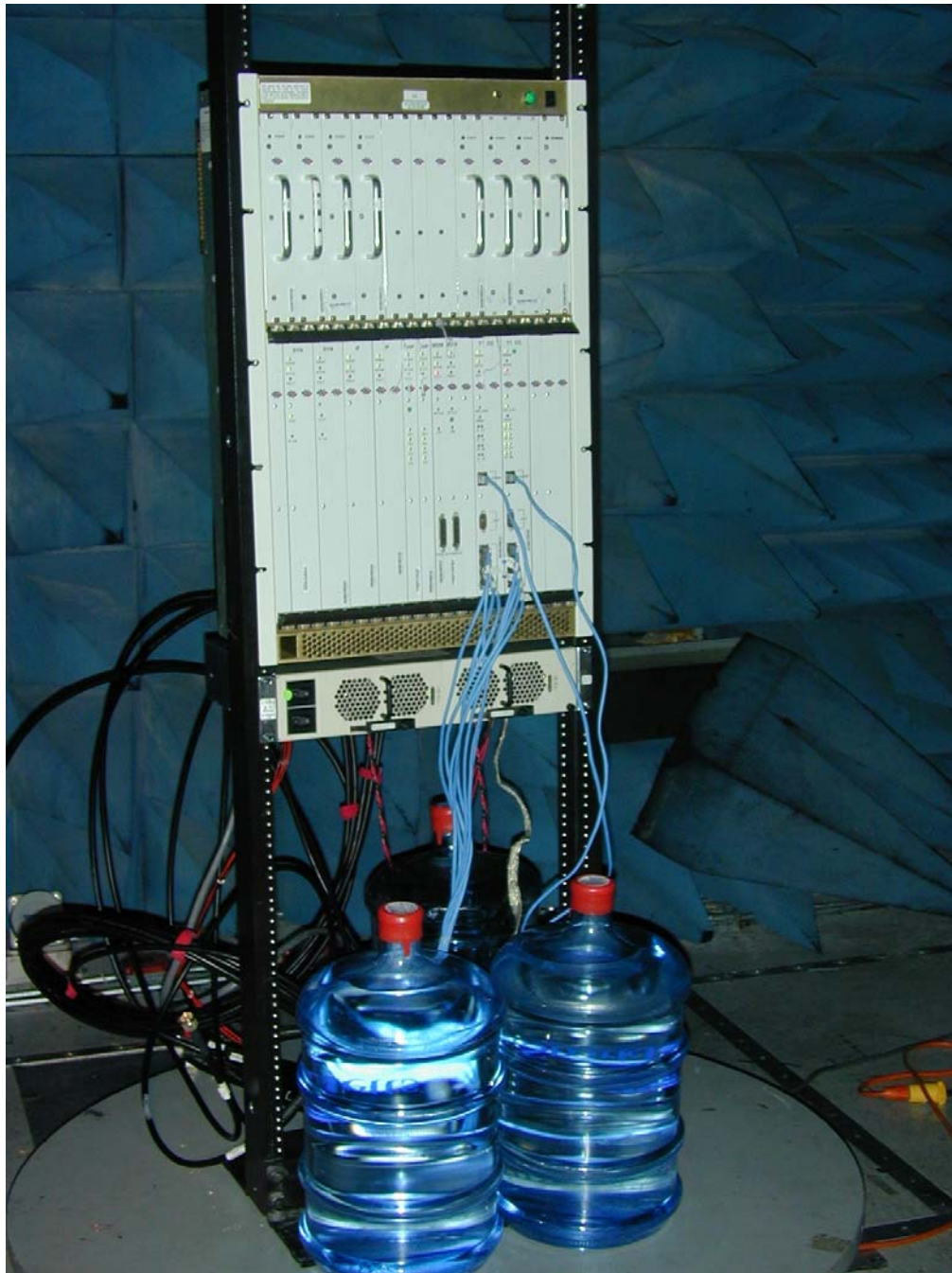
Notes: The spectrum was searched to the 10th harmonic

No emissions (other than 2nd harmonic) were detected above the noise floor which was greater than 6 dB below the spec limit

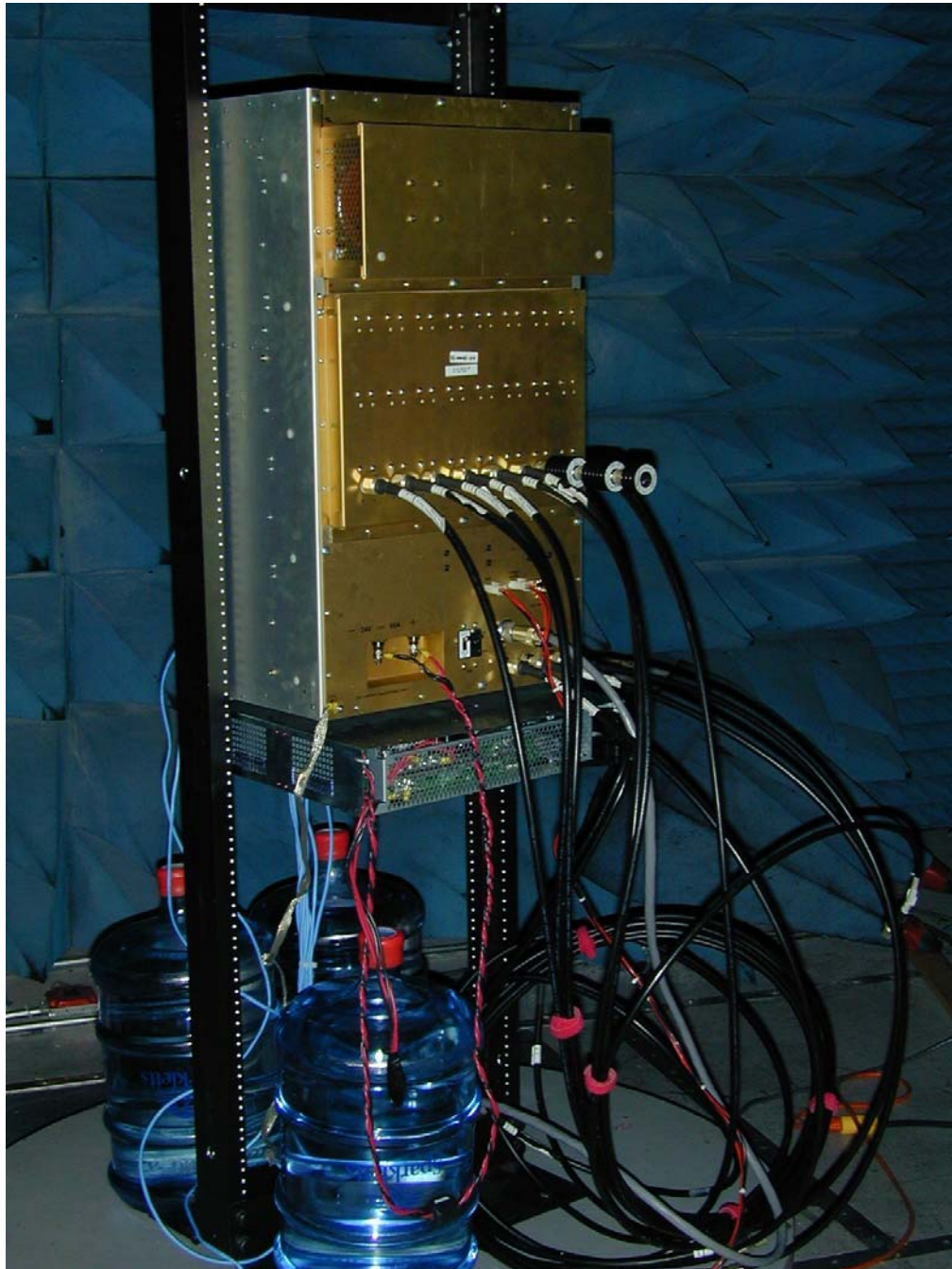
EQUIPMENT: 2.6 GHz BTS Rel1

Photos – Field Strength of Spurious Emissions

Front



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.

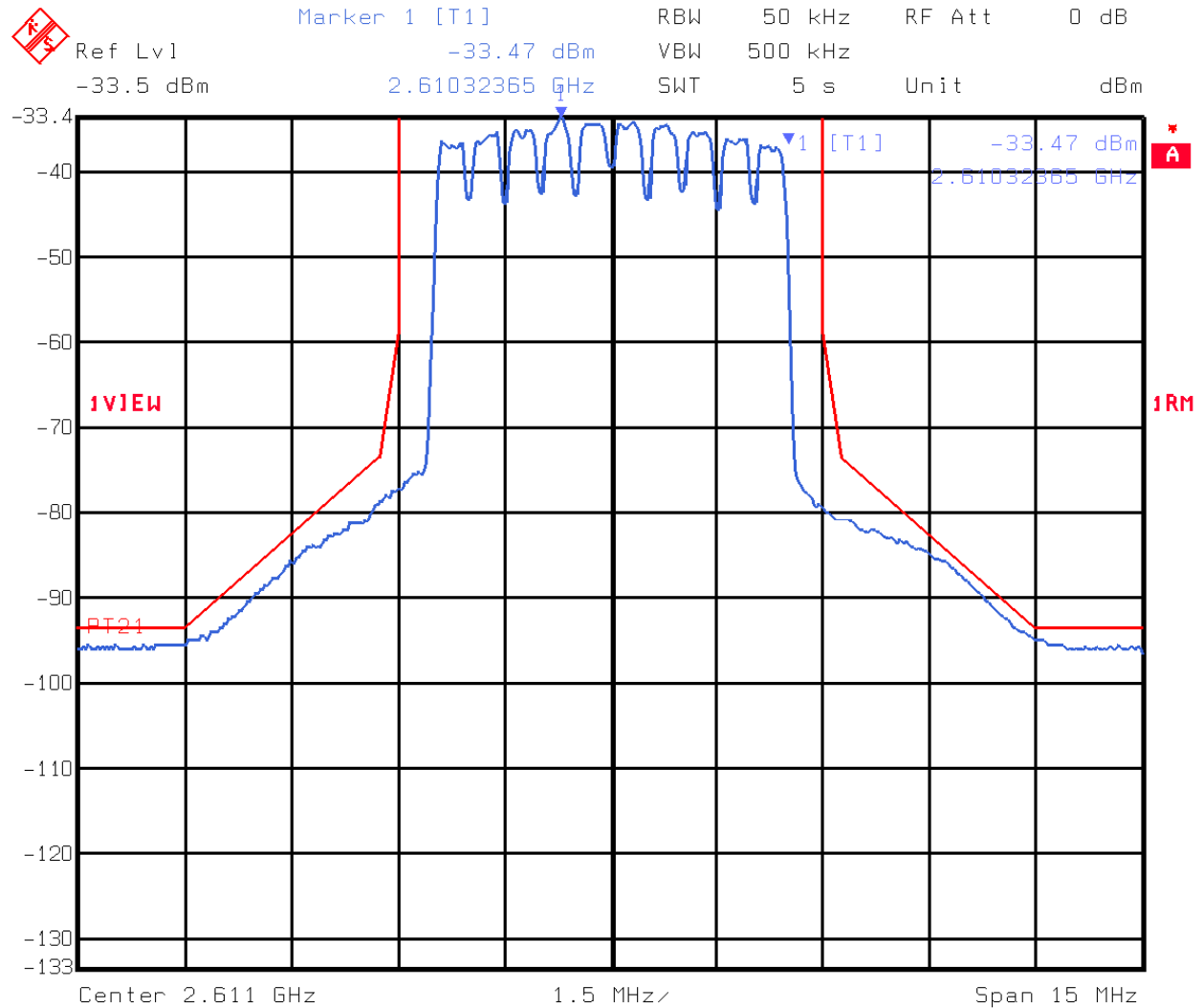
EQUIPMENT: 2.6 GHz BTS Rel1

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

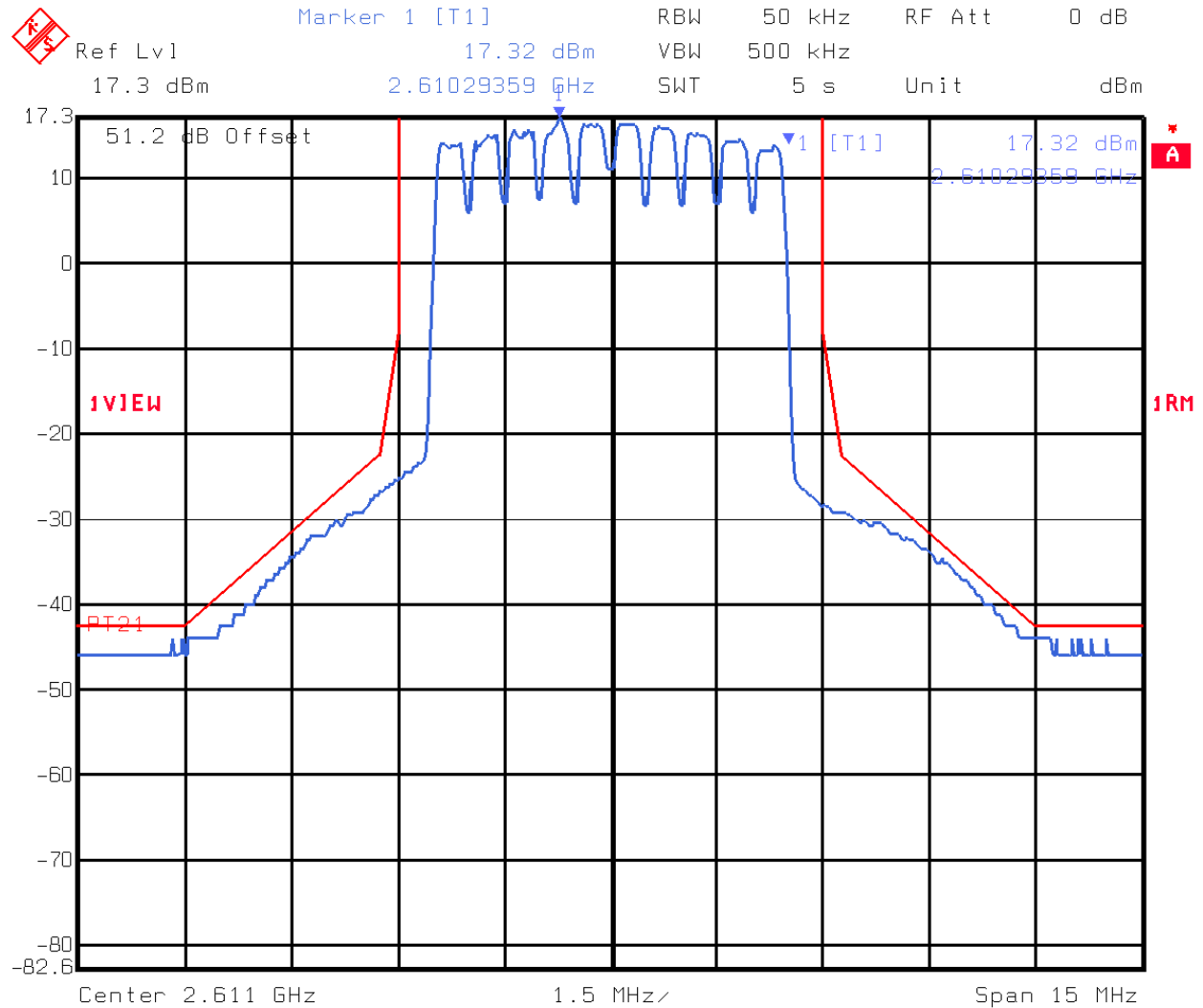
Test Data – Frequency Stability



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

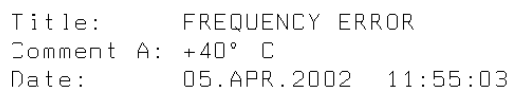
EQUIPMENT: 2.6 GHz BTS Rel1

Test Data – Frequency Stability



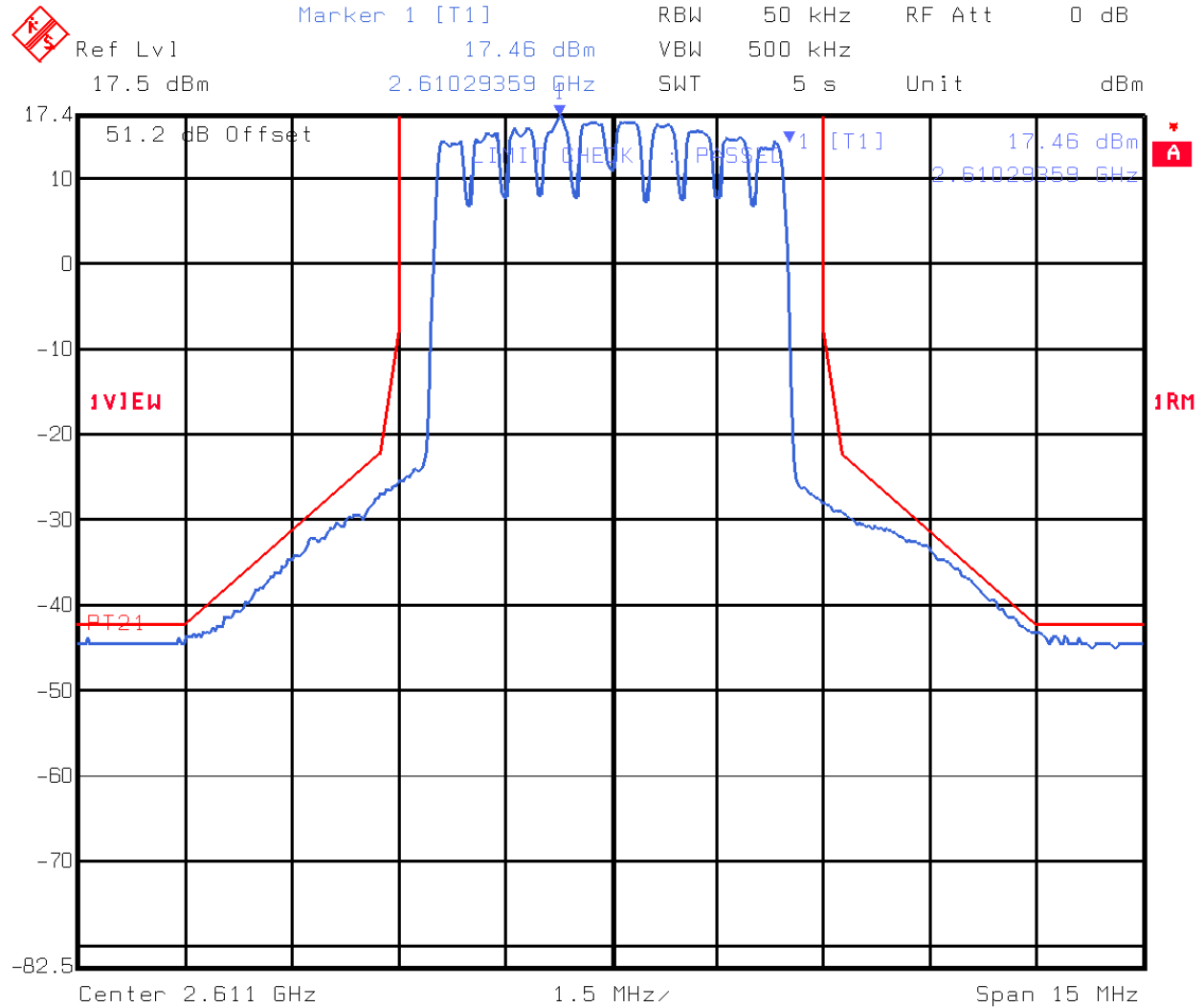
Title: FREQUENCY ERROR
Comment A: +50° C
Date: 05.APR.2002 11:34:43

Test Data – Frequency Stability



EQUIPMENT: 2.6 GHz BTS Rel1

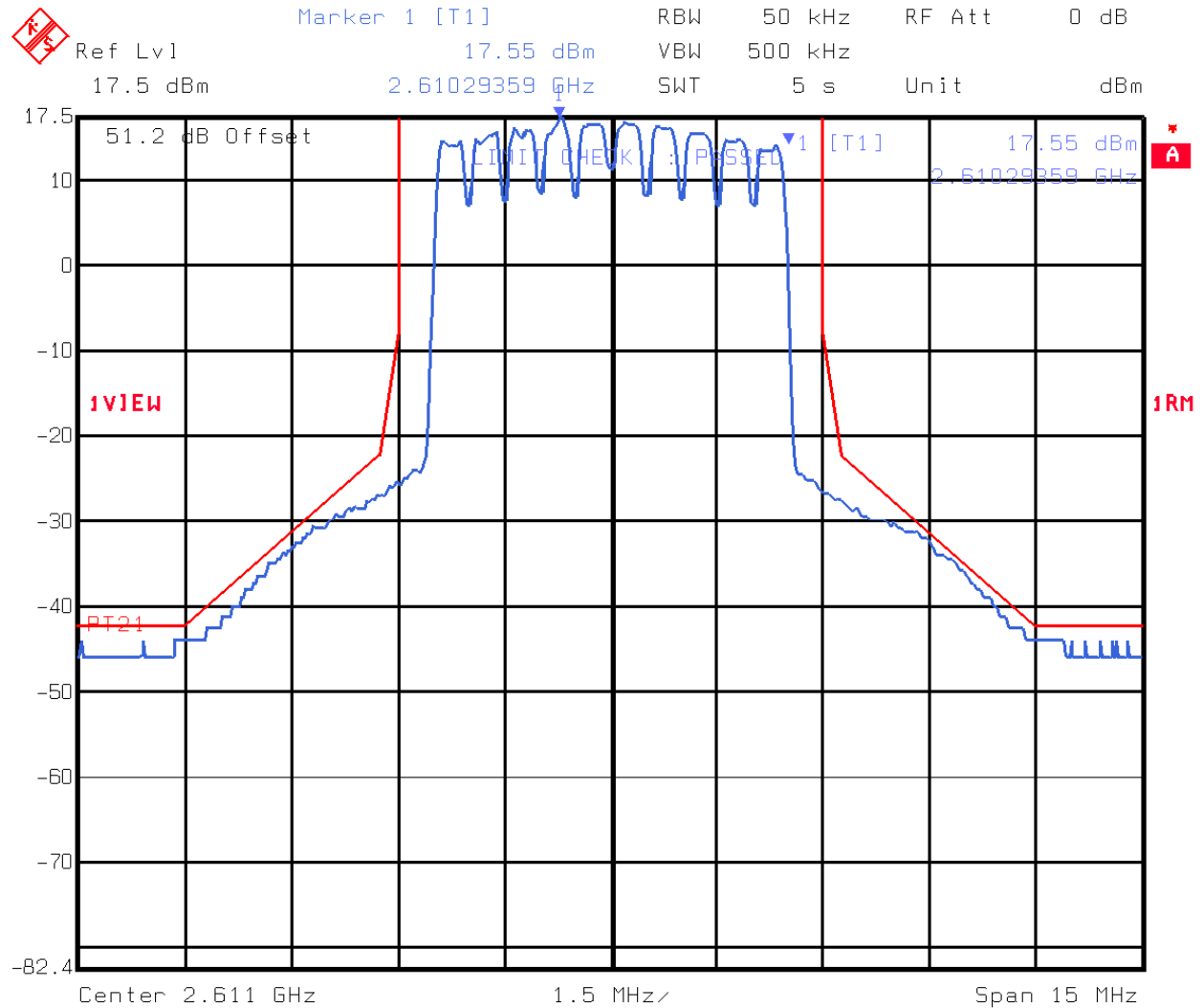
Test Data – Frequency Stability



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

EQUIPMENT: 2.6 GHz BTS Rel1

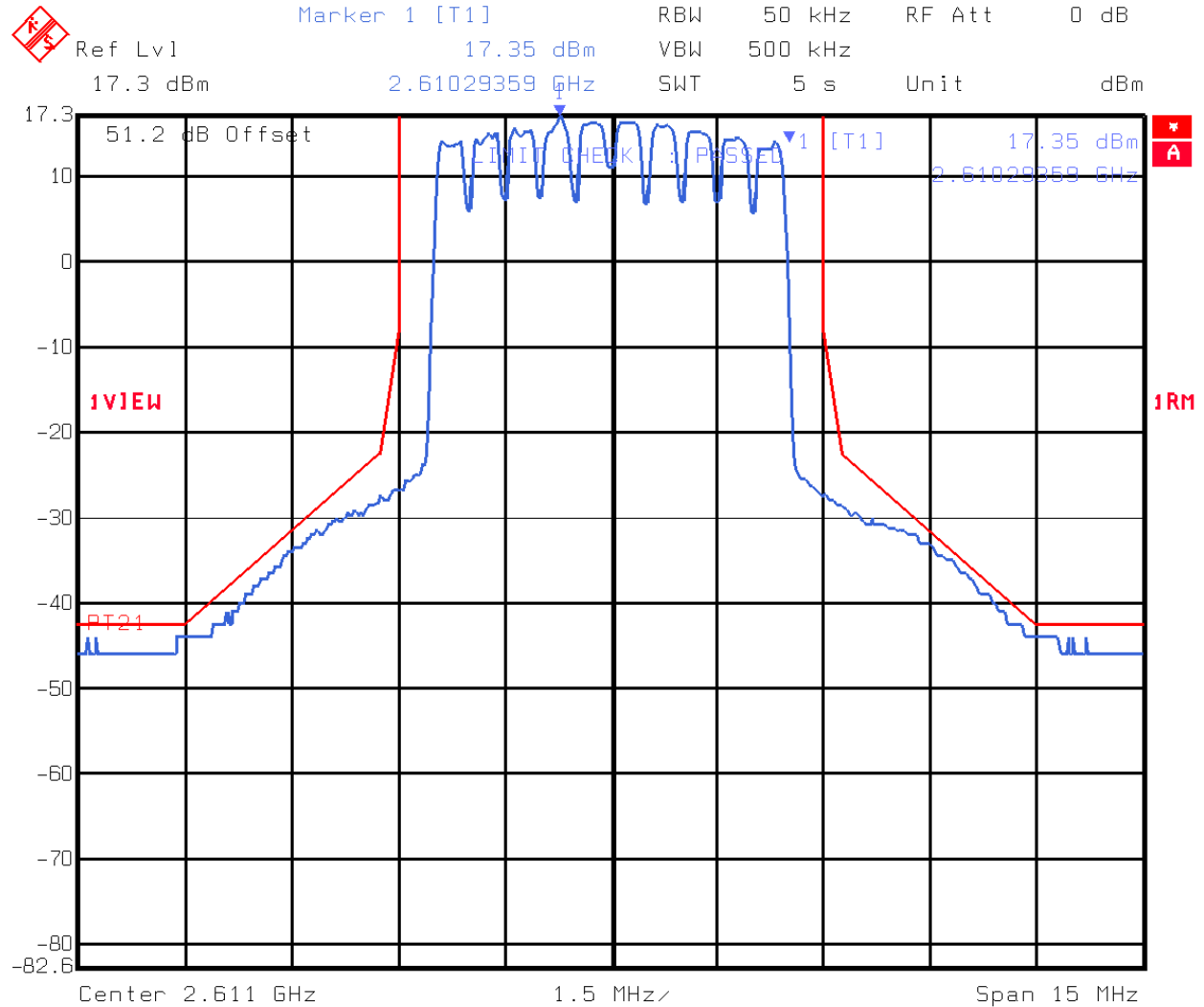
Test Data – Frequency Stability



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

EQUIPMENT: 2.6 GHz BTS Rel1

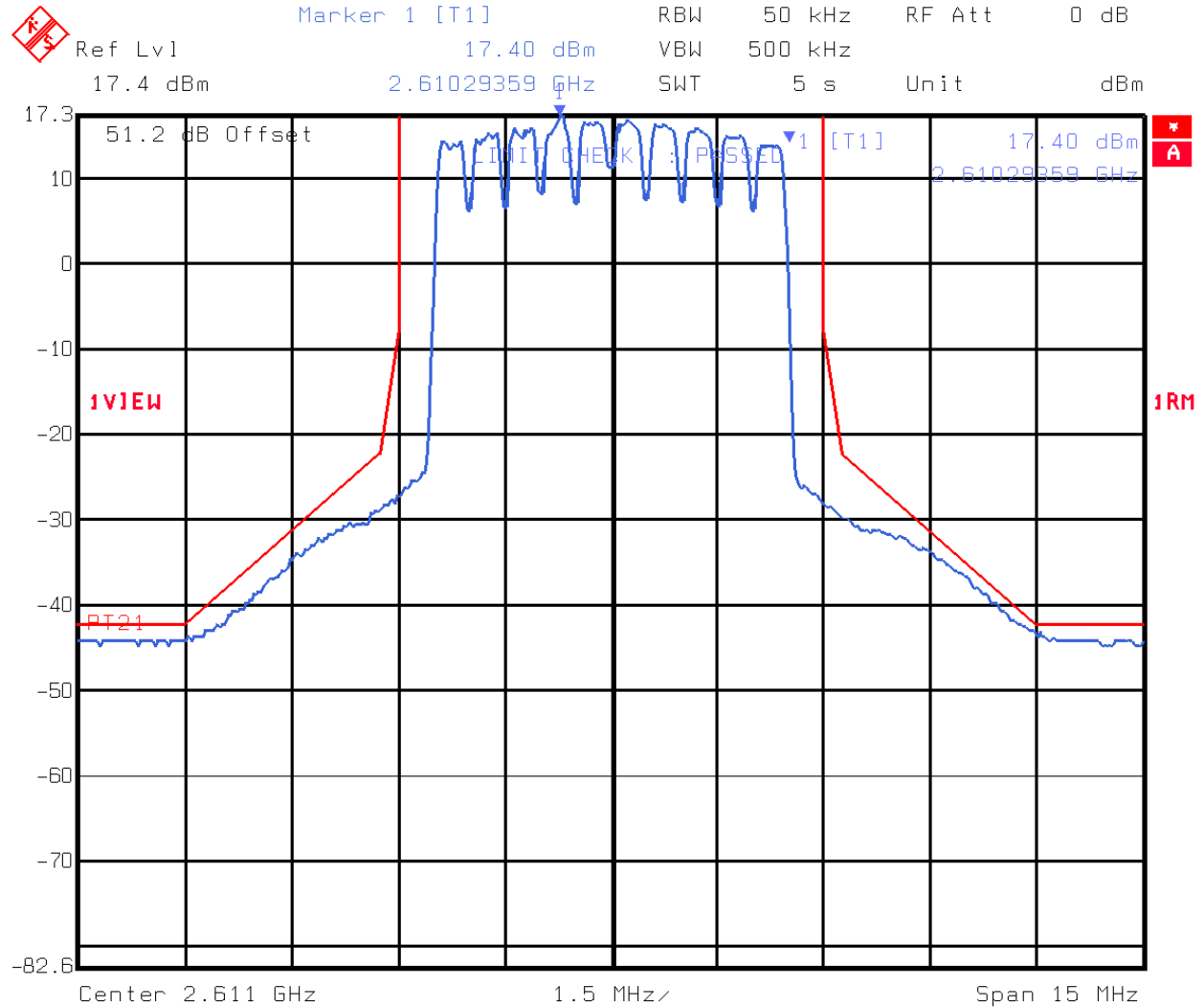
Test Data – Frequency Stability



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

EQUIPMENT: 2.6 GHz BTS Rel1

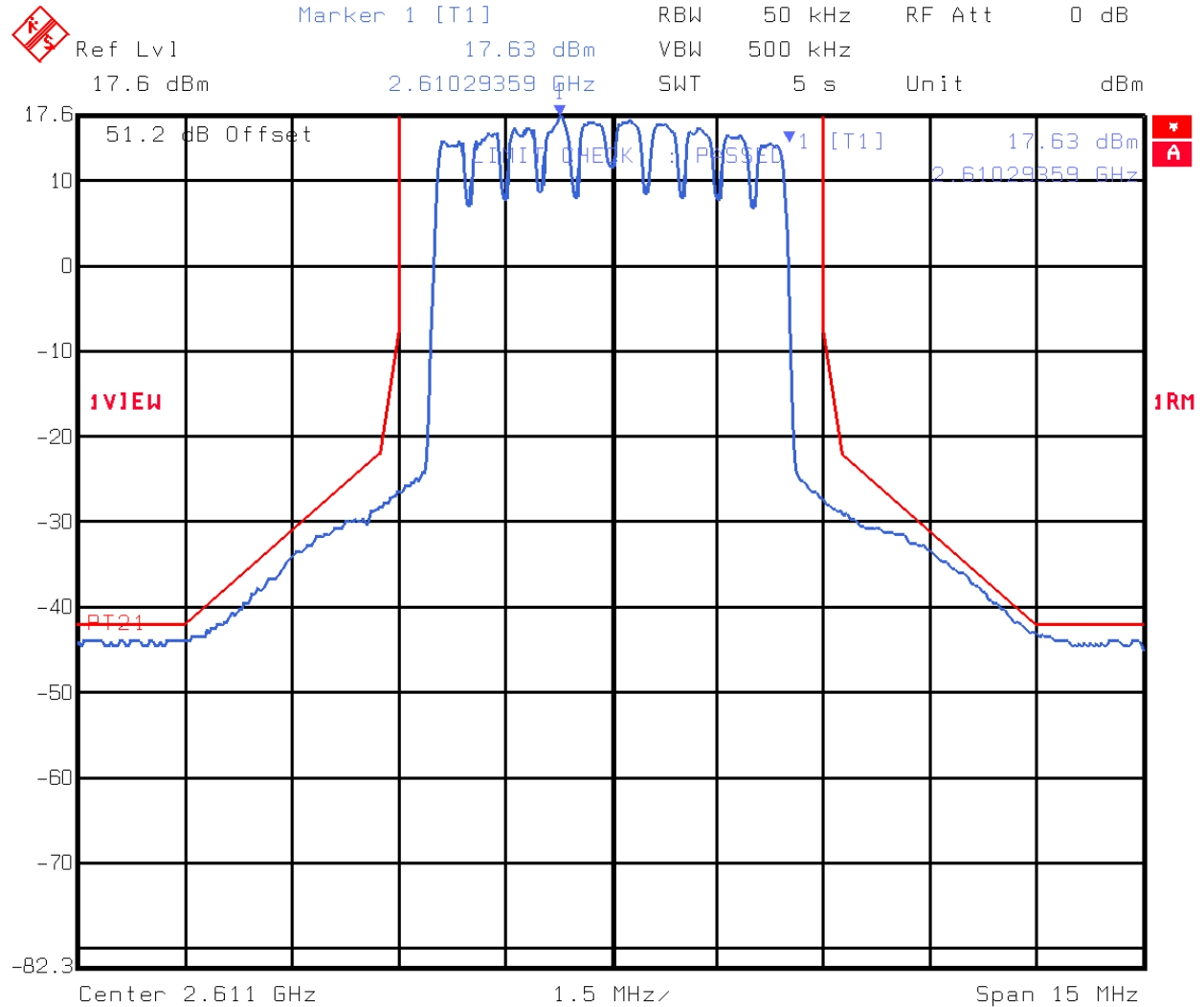
Test Data – Frequency Stability



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

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

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

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

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.

EQUIPMENT: 2.6 GHz BTS Rel1

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

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**

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****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:

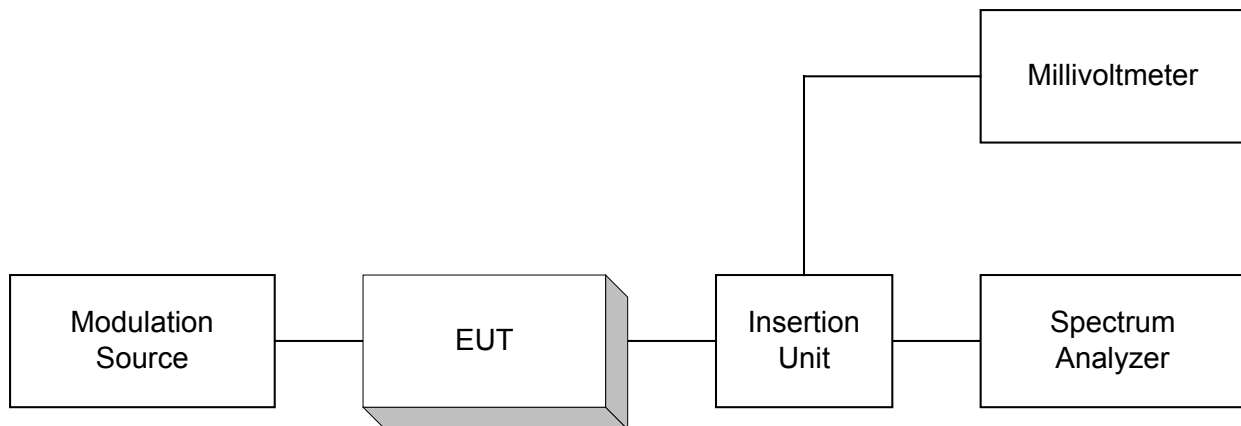
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency is measured in 30 second intervals for a period of 5 minutes.

EQUIPMENT:
FCC ID:

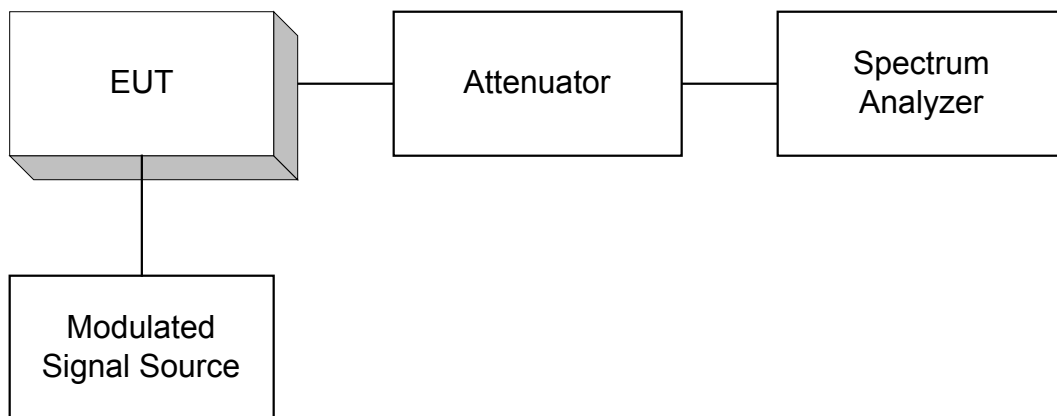
Section 10. Test Diagrams

EQUIPMENT:
FCC ID:

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

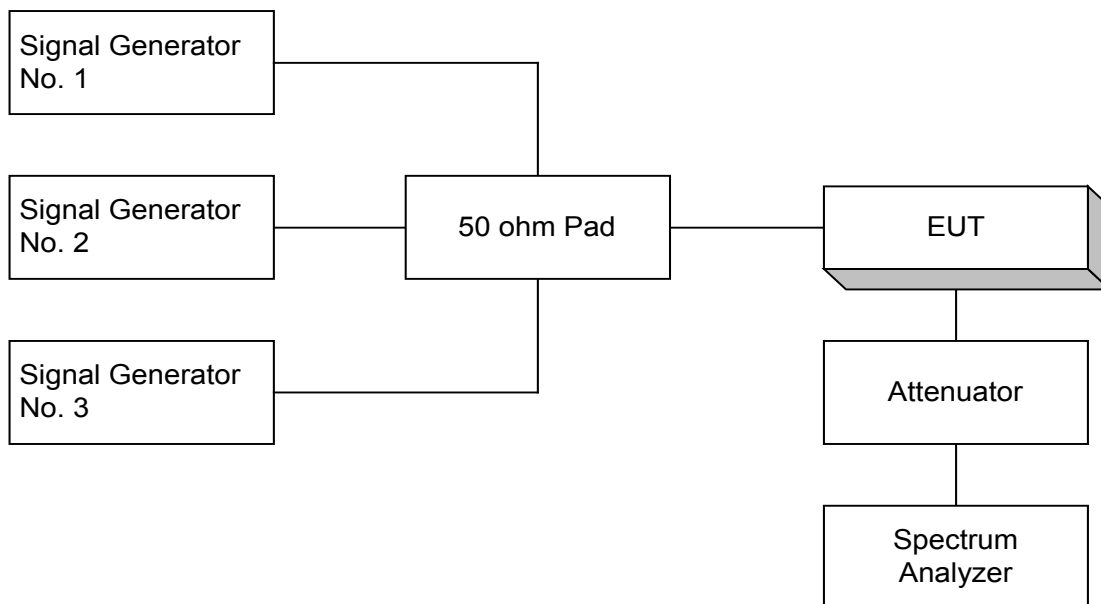
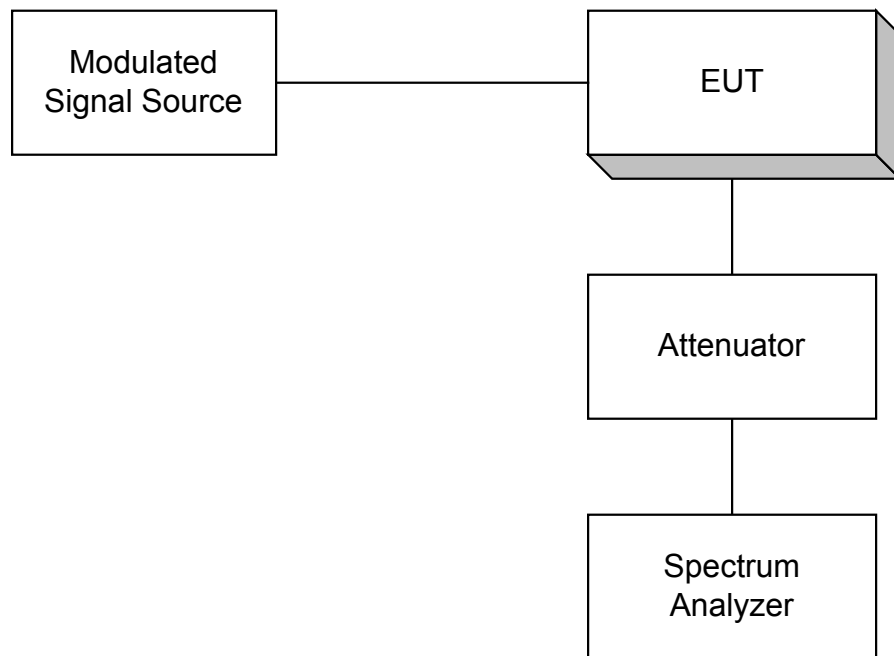


Para. No. 2.1049 - Occupied Bandwidth



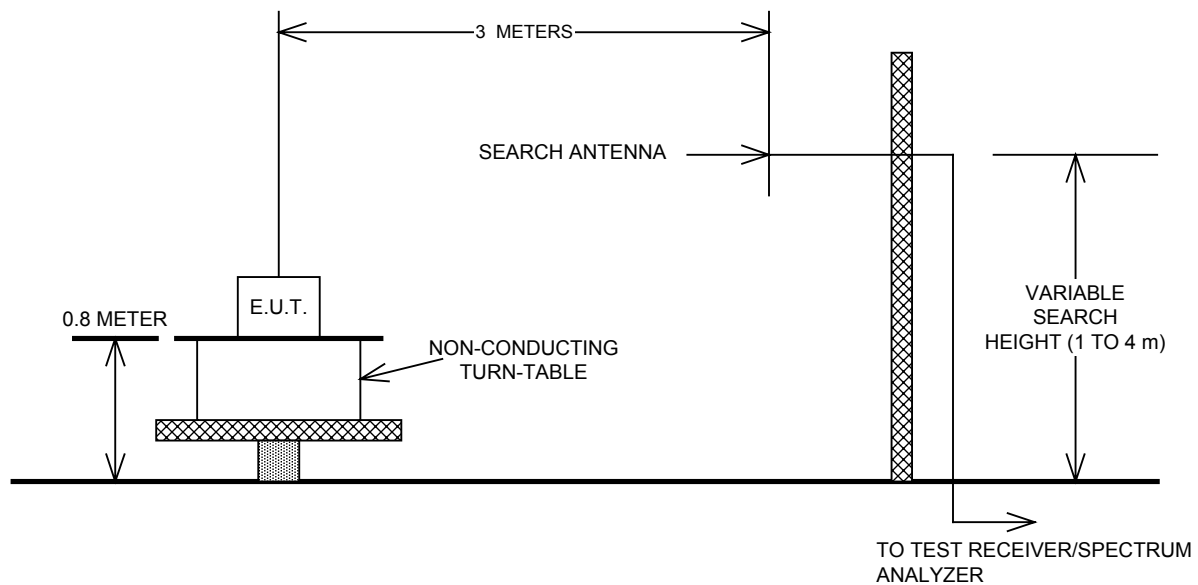
EQUIPMENT:
FCC ID:

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

