

KTL Test Report: 0L0065RUS3

Applicant: Nera
660 N. Central Expressway Suite #250
Plano, TX 75074

Equipment Under Test: BASE UNIT HDT

FCC ID: PAMBSHDT

In Accordance With: **FCC Part 15, Subpart C, 15.247**
Direct Sequence Spread Spectrum Transmitters

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

Authorized By:



Tom Tidwell, RF Group Manager

Date: 10/9/00

Total Number of Pages: 44

Table of Contents

Section 1. Summary of Test Results	3
Section 2. Equipment Under Test (E.U.T.)	5
Section 3. Powerline Conducted Emissions	8
Section 4. Minimum 6 dB Bandwidth.....	9
Section 5. Maximum Peak Output Power	13
Section 6. RF Exposure.....	14
Section 7. Spurious Emissions (conducted)	15
Section 8. Spurious Emissions (radiated).....	18
Section 9. Peak Power Spectral Density	24
Section 10. Minimum Processing Gain	28
Section 11. Test Equipment List	30
ANNEX A - TEST DETAILS	31
ANNEX B - TEST DIAGRAMS.....	41

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 1. Summary of Test Results

Manufacturer: NERA Telecommunications, Inc.

Model No.: HDT

Sample No.: S07

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 Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted in accordance with ANSI C63.4-1992. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

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

KTL 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. KTL 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: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB μ V	NA
Minimum 6 dB Bandwidth	15.247(a)(2)	500 kHz	COMPLIES
Maximum Peak Power Output	15.247(b)(1)	1 Watt	COMPLIES
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc/100kHz	COMPLIES
Spurious Emissions (Restricted Bands)	15.247(c)	Table 15.209(a)	COMPLIES
Peak Power Spectral Density	15.247(d)	+8 dBm/3kHz	COMPLIES
Processing Gain	15.247(e)	10 dB	COMPLIES

Footnotes: The equipment operates on 48 Vdc CO power only.

Section 2. Equipment Under Test (E.U.T.)

General Equipment Information

Frequency Band: 902 – 928 MHz
 2400 – 2483.5 MHz
 5725 – 5850 MHz

Channel Spacing: 3.5 MHz

Type of System: Direct Sequence Spread Spectrum

User Frequency Adjustment: Software controlled.

User Power Adjustment: Not adjustable by user.

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Description of Modifications

ONE RF CAN WAS ADDED TO THE BACK OF THE PCB ON THE RF SECTION
OPPOSITE THE COMPONENT SIDE OF THE PCB.

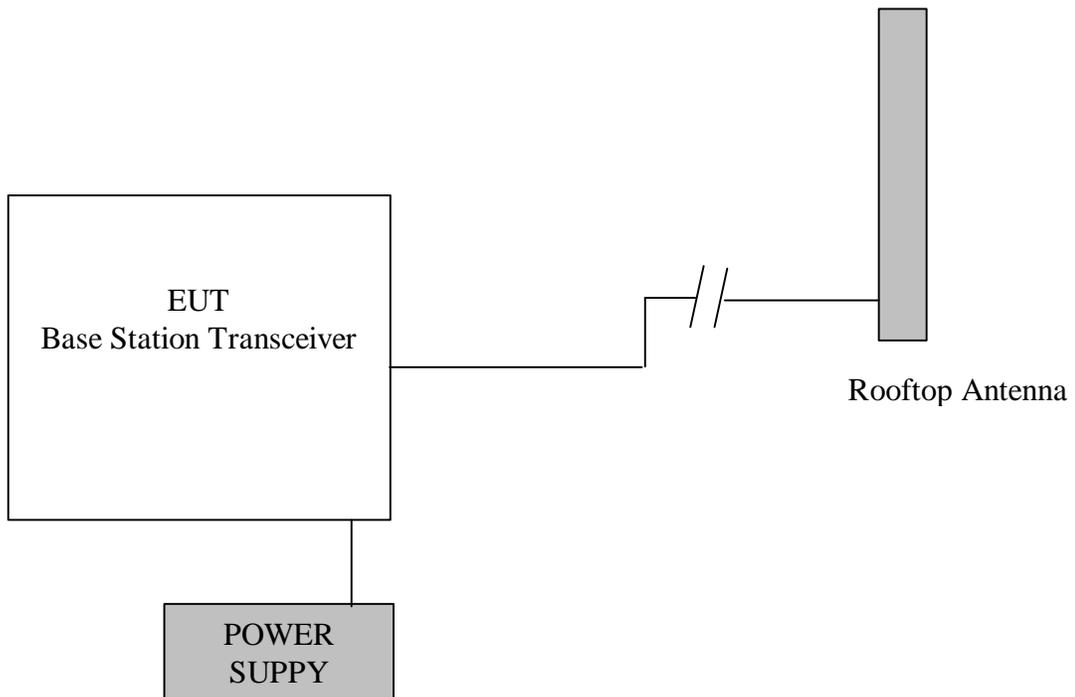
GASKETING WAS ADDED TO THE REAR OF THE EUT

COPPER FINGER STOCK WAS ADDED TO THE RIGHT HAND SIDE OF THE EUT
(INTERNAL)

Decription of Operation

The EUT is a point to multi-point 2.4Ghz data and voice transceiver.

System Diagram



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY:	DATE:

Test Results: Compliant

Measurement Date: See attached plots.

NOT APPLICABLE

Equipment Used:

Measurement Uncertainty: +/- ____ dB

Temperature: °C

Relative Humidity: %

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 4. Minimum 6 dB Bandwidth

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Kevin Rose	DATE: Aug 2, 2000

Test Results: **Complies.**

Measurement Data: See 6 dB BW plots
Measured 6 dB bandwidth: **2.244 MHz**
Channel Separation: **3.5 MHz**

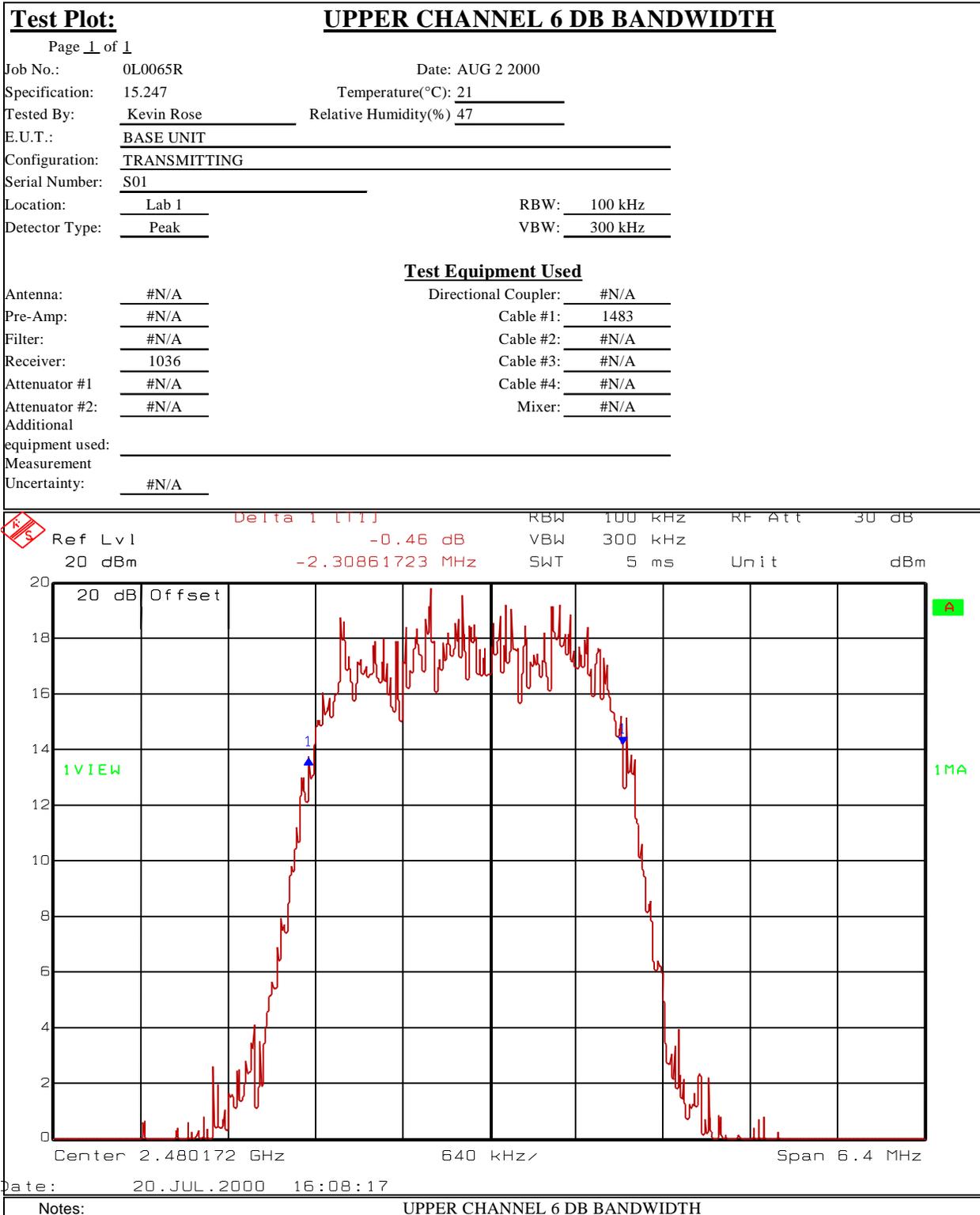
Measurement Uncertainty: +/- **0.7** dB

Temperature: **21** °C

Relative Humidity: **46** %

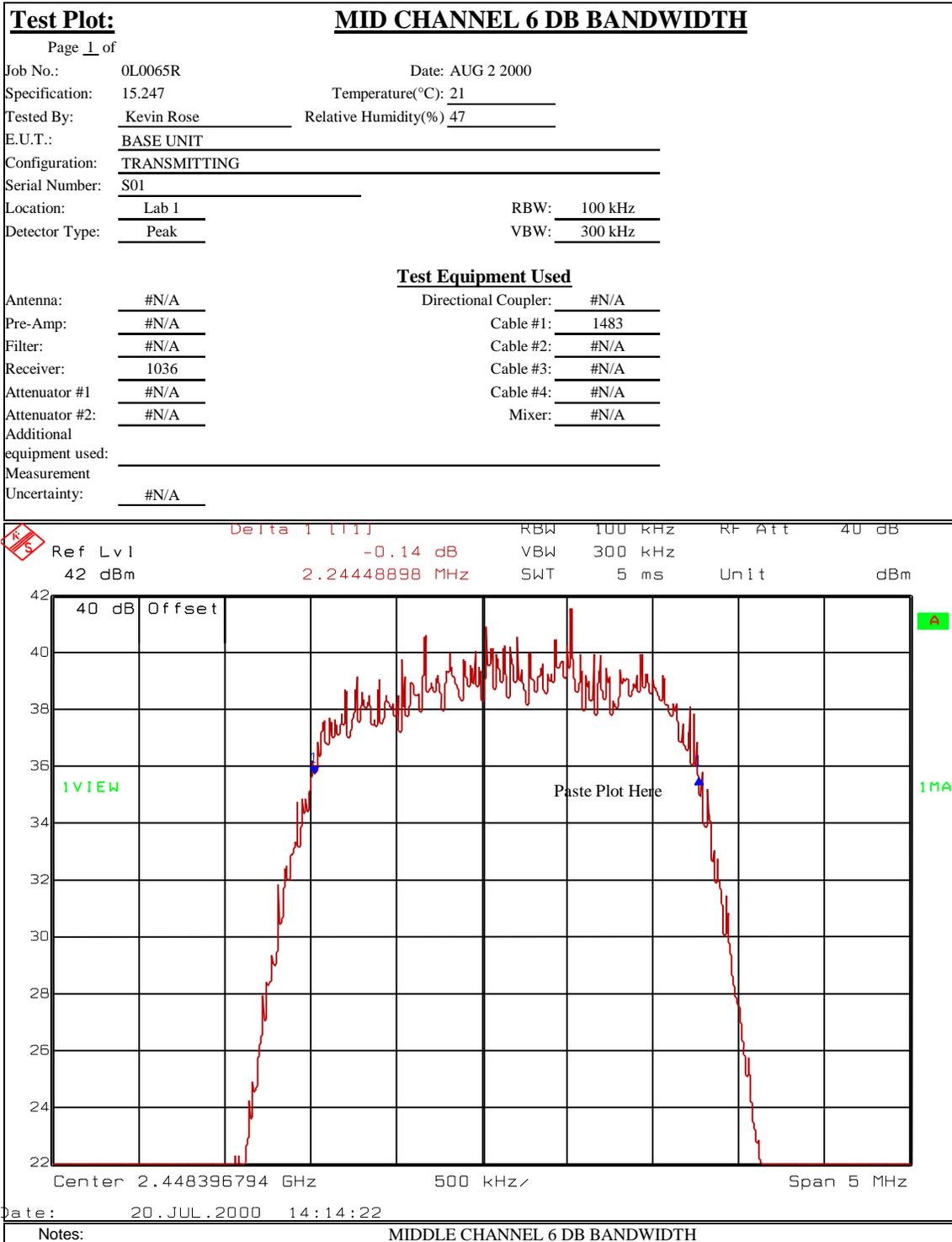
EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

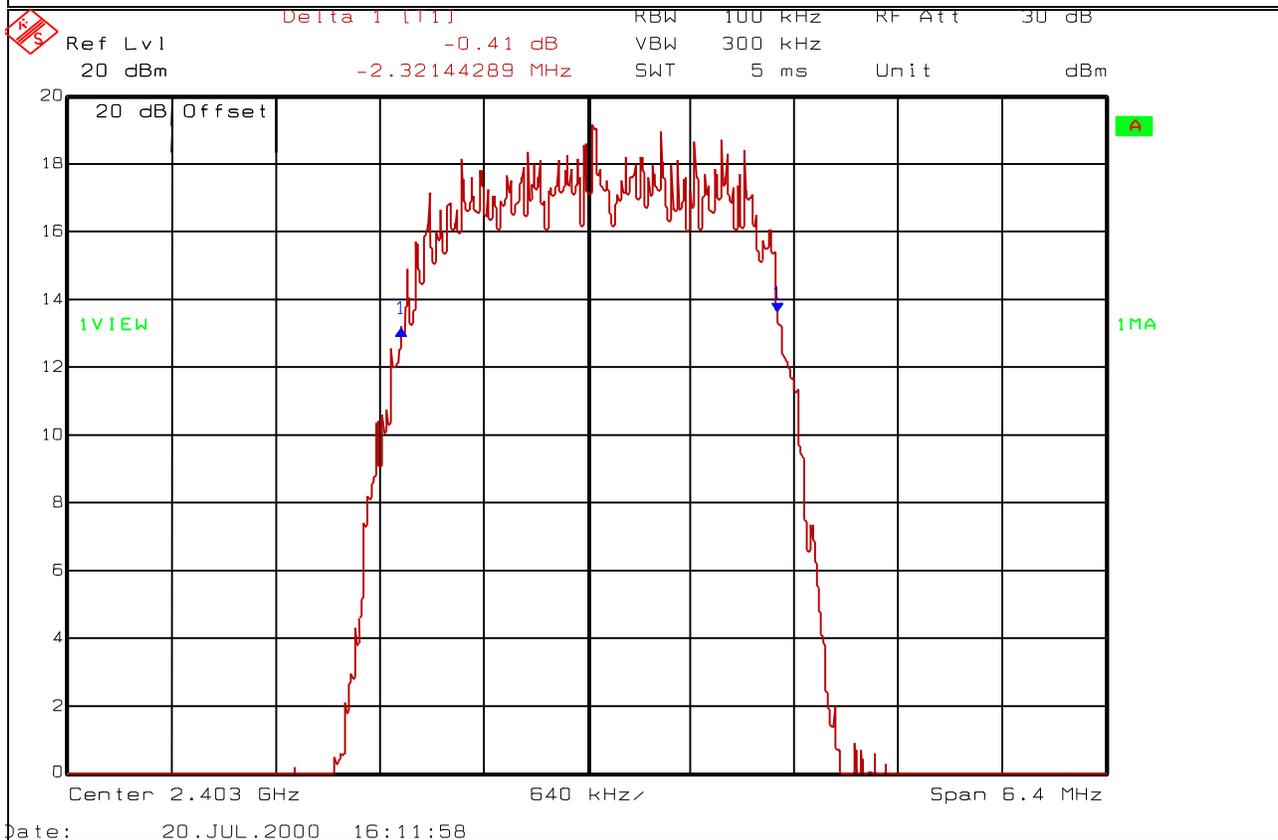
Test Plot:

LOWER CHANNEL 6 DB BANDWIDTH

Page 1 of 1
 Job No.: 0L0065R Date: AUG 2 2000
 Specification: 15.247 Temperature(°C): 21
 Tested By: Kevin Rose Relative Humidity(%) 47
 E.U.T.: BASE UNIT
 Configuration: TRANSMITTING
 Serial Number: S01
 Location: Lab 1 RBW: 100 kHz
 Detector Type: Peak VBW: 300 kHz

Test Equipment Used

Antenna:	#N/A	Directional Coupler:	#N/A
Pre-Amp:	#N/A	Cable #1:	1483
Filter:	#N/A	Cable #2:	#N/A
Receiver:	1036	Cable #3:	#N/A
Attenuator #1:	#N/A	Cable #4:	#N/A
Attenuator #2:	#N/A	Mixer:	#N/A
Additional equipment used:	_____		
Measurement Uncertainty:	#N/A		



Notes: LOWER CHANNEL 6 DB BANDWIDTH

EQUIPMENT: BASE UNIT HDT

PROJECT NO.: 0L0065RUS3

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: Kevin Rose	DATE: Aug. 5, 2000

Test Results: Complies.

Measurement Data: +35.8 dBm e.i.r.p.

Antennas:

Model	Type	Manufacturer	Gain (dBi)	E.I.R.P. (dBm)
TA-2304-2	120 DEGREE SECTOR	TIL-TEK	14.5	+35.8
Peak power output at antenna port(dBm): +21.3 dBm				

Equipment Used: 1029, 1030

Measurement Uncertainty: +/- 0.63 dB

Temperature: 21 °C

Relative Humidity: 46 %

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 6. RF Exposure

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
	DATE: Oct. 9, 2000

Test Results: Complies.

Measurement Data: Does not require special warnings or instructions to ensure compliance according to OET Bulletin 65 Supplement C, Table 1.

Maximum e.i.r.p.: 3.8 W

Antenna location: The antenna is mounted on the rooftop of a building. Separation distance from persons is expected to exceed 1 meter.

Professional installation: The system must be professionally installed.

Application: The application of the device is to transport broadband data from a single point to multiple user sites. The base station is professionally installed with the antenna mounted on the roof of a commercial building.

Installation: The base station is installed with a specific roof-top antenna. Specific instructions are given in the installation manual to insure that the 4 W e.i.r.p. limit is not exceeded.

Marketing: The device is marketed through authorized distributors only. The cost of the system is such that it could not be considered a normal consumer device. The system would be advertised in specific trade magazines and at specific trade show events.

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 7. Spurious Emissions (conducted)

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.247(c)
TESTED BY: Kevin Rose	DATE: Aug. 5, 2000

Test Results: **Complies.**

Measurement Data: See attached plots.

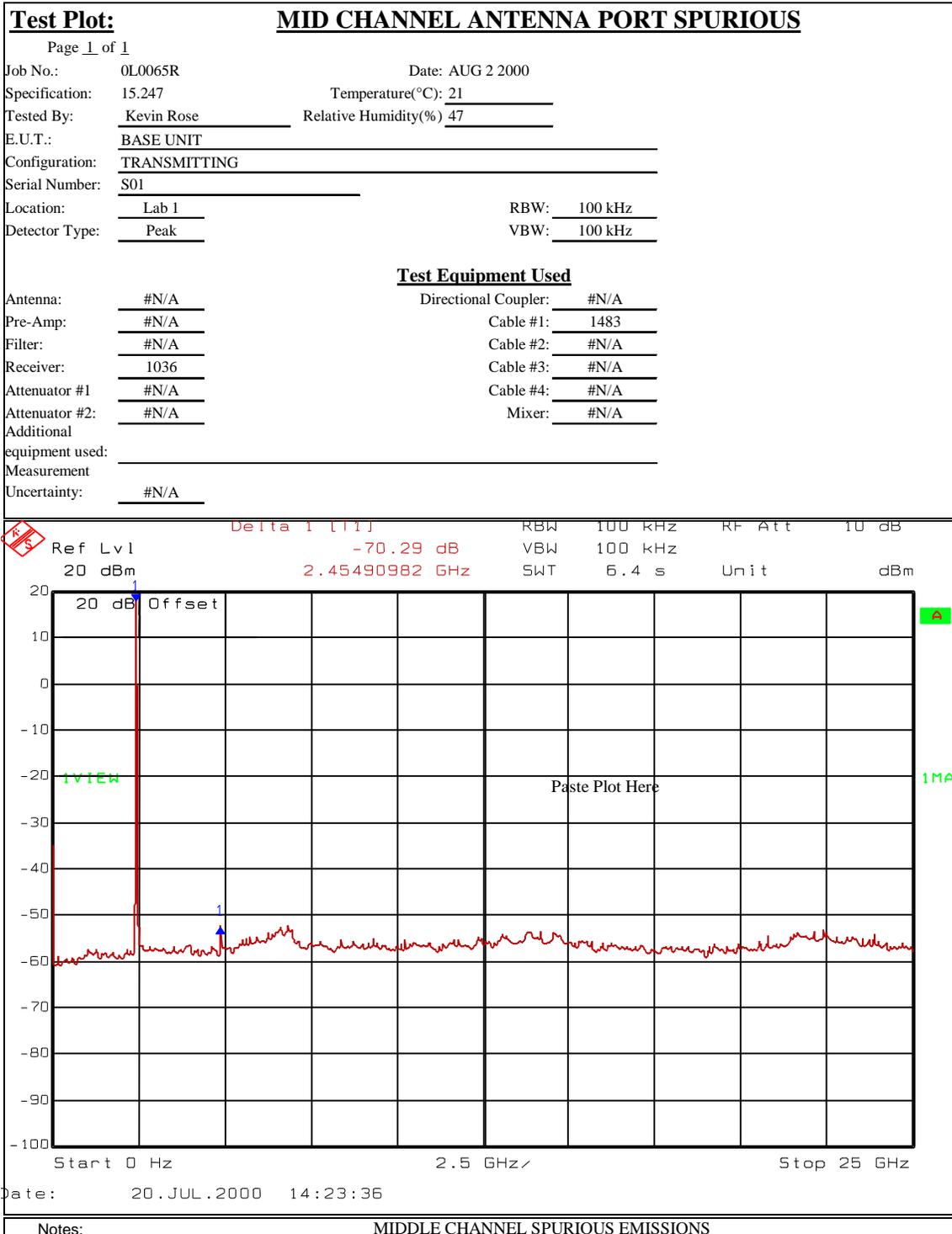
Measurement Uncertainty: +/- 1.7 dB

Temperature: **21** °C

Relative Humidity: **47** %

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Test Plot:		UPPER CHANNEL ANTENNA PORT SPURIOUS	
Page 1 of 1			
Job No.:	0L0065R	Date:	AUG 2 2000
Specification:	15.247	Temperature(°C):	21
Tested By:	Kevin Rose	Relative Humidity(%):	47
E.U.T.:	BASE UNIT		
Configuration:	TRANSMITTING		
Serial Number:	S01		
Location:	Lab 1	RBW:	100 kHz
Detector Type:	Peak	VBW:	100 kHz
Test Equipment Used			
Antenna:	#N/A	Directional Coupler:	#N/A
Pre-Amp:	#N/A	Cable #1:	1483
Filter:	#N/A	Cable #2:	#N/A
Receiver:	1036	Cable #3:	#N/A
Attenuator #1:	#N/A	Cable #4:	#N/A
Attenuator #2:	#N/A	Mixer:	#N/A
Additional equipment used:			
Measurement Uncertainty:	#N/A		

Ref Lvl	-65.19 dB	RBW	100 kHz	RF Att	10 dB
20 dBm	2.50501002 GHz	VBW	100 kHz	SWT	6.4 s
				Unit	dBm

Center 12.5 GHz 2.5 GHz Span 25 GHz

Date: 20.JUL.2000 16:23:48

Notes: **HIGH CHANNEL SPURIOUS EMISSIONS**

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 8. Spurious Emissions (radiated)

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (c)
TESTED BY: Kevin Rose	DATE: Aug. 2, 2000

Test Results: **Complies.**

Measurement Data: See attached table.

Measurement Uncertainty: +/- 3.4 dB

Temperature: **21** °C

Relative Humidity: **46** %

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

<u>Radiated Emissions</u>								
Page <u>1</u> of <u>1</u>								
Job No.:	<u>0L0065R</u>	Date:	<u>8/12/00</u>					
Specification:	<u>CFR 47, Part 15</u>	Temperature(°F):	<u>72</u>					
Tested By:	<u>Kevin Rose</u>	Relative Humidity(%):	<u>49</u>					
E.U.T.:	<u>BASE UNIT</u>							
Configuration:	<u>TRANSMIT 2.403Ghz</u>							
Sample Number:								
Location:	<u>AC 3</u>	RBW:	<u>1 MHz</u>					
Detector Type:	<u>Peak</u>	VBW:	<u>1 MHz</u>					
<u>Test Equipment Used</u>								
Antenna:	<u>759</u>	Directional Coupler:	<u>#N/A</u>					
Pre-Amp:	<u>1016</u>	Cable #1:	<u>1043</u>					
Filter:	<u>1482</u>	Cable #2:	<u>1484</u>					
Receiver:	<u>1464</u>	Cable #3:	<u>1485</u>					
Attenuator #1:	<u>#N/A</u>	Cable #4:	<u>#N/A</u>					
Attenuator #2:	<u>#N/A</u>	Mixer:	<u>#N/A</u>					
Additional equipment used: _____								
Measurement Uncertainty: <u>+/- .7 dB</u>								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
4.8	37.7	32.4	5.3	33.2	42.2	54	-11.8	H NF
7.209	36.8	35.8	6.4	33	46.0	54	-8.0	H NF
9.612	37	37	7.8	36	45.8	54	-8.2	H NF
12.015	37.7	39.6	8.57	36.6	49.3	54	-4.7	H NF
4.8	37.3	32.4	5.3	33.2	41.8	54	-12.2	V NF
7.209	36.7	35.8	6.4	33	45.9	54	-8.1	V NF
9.612	36.7	37	7.8	36	45.5	54	-8.5	V NF
12.015	37.7	39.6	8.57	36.6	49.3	54	-4.7	V NF
Notes: <u>SCANNED TO THE 10TH HARMONIC</u>								

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

<u>Radiated Emissions</u>								
Page <u>1</u> of <u>1</u>								
Job No.: 0L0065R			Date: 8/12/00					
Specification: CFR 47, Part 15			Temperature(°F): <u>72</u>					
Tested By: <u>Kevin Rose</u>			Relative Humidity(%) <u>49</u>					
E.U.T.: <u>BASE UNIT</u>								
Configuration: <u>TRANSMIT 2.4485Ghz</u>								
Sample Number: _____								
Location: <u>AC 3</u>			RBW: <u>1 MHz</u>					
Detector Type: <u>Peak</u>			VBW: <u>1 MHz</u>					
<u>Test Equipment Used</u>								
Antenna: <u>759</u>			Directional Coupler: <u>#N/A</u>					
Pre-Amp: <u>1016</u>			Cable #1: <u>1043</u>					
Filter: <u>1482</u>			Cable #2: <u>1484</u>					
Receiver: <u>1464</u>			Cable #3: <u>1485</u>					
Attenuator #1: <u>#N/A</u>			Cable #4: <u>#N/A</u>					
Attenuator #2: <u>#N/A</u>			Mixer: <u>#N/A</u>					
Additional equipment used: _____								
Measurement Uncertainty: <u>+/- .7 dB</u>								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
4.897	48.3	32.4	5.3	33.2	52.8	54	-1.2	H
4.897	35.3	32.4	5.3	33.2	39.8	54	-14.2	H AVG 10HZ VBW
7.3455	36.3	35.8	6.4	33	45.5	54	-8.5	H NF
9.794	37.3	37	7.8	36	46.1	54	-7.9	H NF
12.2425	37	39.6	8.57	36.6	48.6	54	-5.4	H NF
4.897	48.3	32.4	5.3	33.2	52.8	54	-1.2	V
4.897	35.2	32.4	5.3	33.2	39.7	54	-14.3	V AVG 10HZ VBW
7.3455	36.3	35.8	6.4	33	45.5	54	-8.5	V NF
9.794	37.5	37	7.8	36	46.3	54	-7.7	V NF
12.2425	37.8	39.6	8.57	36.6	49.4	54	-4.6	V NF
Notes: <u>SCANNED TO THE 10TH HARMONIC</u>								

EQUIPMENT: BASE UNIT HDT

PROJECT NO.: 0L0065RUS3

<u>Radiated Emissions</u>								
Page <u>1</u> of <u>1</u>								
Job No.: 0L0065R			Date: 8/12/00					
Specification: CFR 47, Part 15			Temperature(°F): <u>72</u>					
Tested By: <u>Kevin Rose</u>			Relative Humidity(%) <u>49</u>					
E.U.T.: <u>BASE UNIT</u>								
Configuration: <u>TRANSMIT 2.48Ghz</u>								
Sample Number: _____								
Location: <u>AC 3</u>			RBW: <u>1 MHz</u>					
Detector Type: <u>Peak</u>			VBW: <u>1 MHz</u>					
<u>Test Equipment Used</u>								
Antenna: <u>759</u>			Directional Coupler: <u>#N/A</u>					
Pre-Amp: <u>1016</u>			Cable #1: <u>1043</u>					
Filter: <u>1482</u>			Cable #2: <u>1484</u>					
Receiver: <u>1464</u>			Cable #3: <u>1485</u>					
Attenuator #1: <u>#N/A</u>			Cable #4: <u>#N/A</u>					
Attenuator #2: <u>#N/A</u>			Mixer: <u>#N/A</u>					
Additional equipment used: _____								
Measurement Uncertainty: <u>+/- .7 dB</u>								
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Delta (dB)	Comment
4.96	38.2	32.4	5.3	33.2	42.7	54	-11.3	H NF
7.44	35.3	35.8	6.4	33	44.5	54	-9.5	H NF
9.92	35.7	37	7.8	36	44.5	54	-9.5	H NF
12.4	34.7	39.6	8.57	36.6	46.3	54	-7.7	H NF
4.96	37.3	32.4	5.3	33.2	41.8	54	-12.2	V NF
7.44	37.7	35.8	6.4	33	46.9	54	-7.1	V NF
9.92	37.8	37	7.8	36	46.6	54	-7.4	V NF
12.4	37.2	39.6	8.57	36.6	48.8	54	-5.2	V NF
2.4835	12.1	28.5	3.4		44.0	54	-10.0	RESTRICTED BAND
2.4835	12.2	28.5	3.4		44.1	54	-9.9	RESTRICTED BAND
Notes: <u>SCANNED TO THE 10TH HARMONIC</u>								

Radiated Photographs (Worst Case Configuration)
FRONT VIEW



REAR VIEW



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 9. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: Kevin Rose	DATE: Aug. 8, 2000

Test Results: Complies.

Measurement Data: See attached plots.

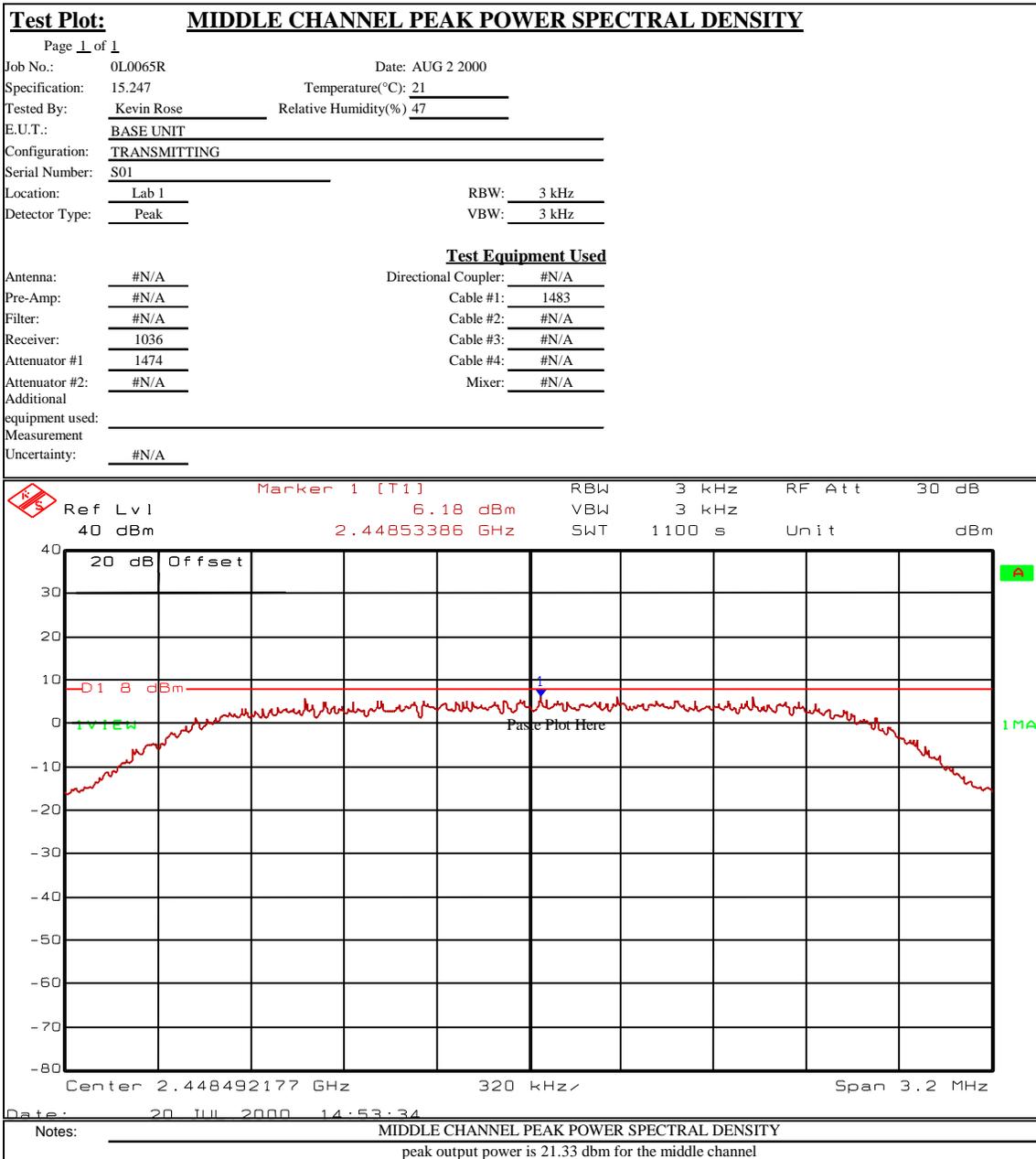
Measurement Uncertainty: +/- 0.7 dB

Temperature: 21 °C

Relative Humidity: 46 %

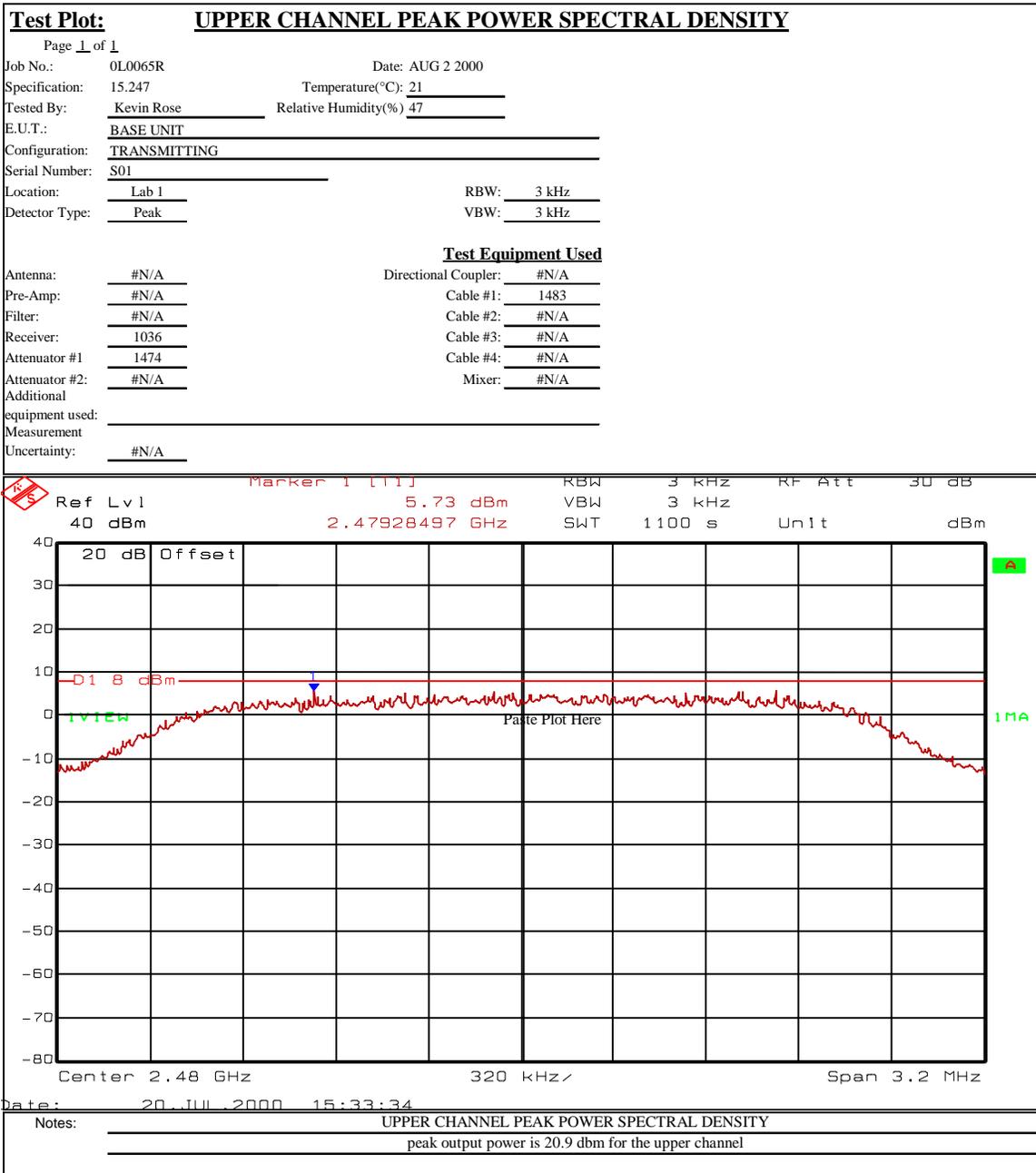
EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



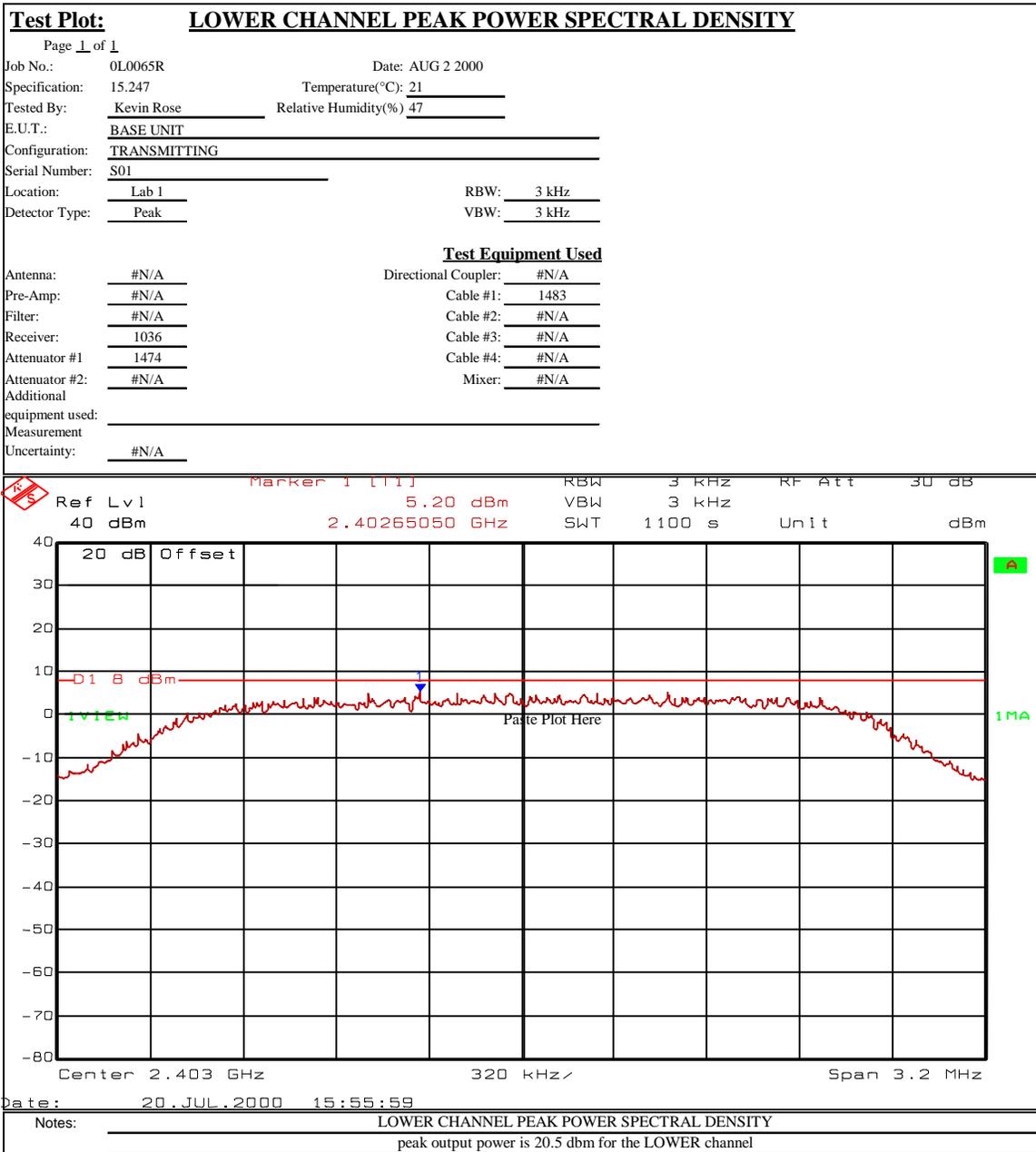
EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**



EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Section 10. Minimum Processing Gain

NAME OF TEST: Minimum Processing Gain	PARA. NO.: 15.247(e)
TESTED BY: Tom Tidwell / Kevin Rose	DATE: Sept. 29, 2000

Test Results: Complies. The processing gain of the system is 16.2 dB.

Measurement Data: See attached data.

BER: 1×10^{-5}
S/N_{out}: 17.0 dB
J/S Ratio: -2.3 dB
L_{sys}: 2 dB

Measurement Uncertainty: +/- 0.7 dB

Temperature: 24 °C

Relative Humidity: 30 %

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

Test : Processing Gain			
Job No.:	0L0065R	Date:	09/29/00
Specification:	CFR 47, Part 15.247	Temperature(°C):	24
Tested By:	T. Tidwell/K.Rose	Relative Humidity(%)	30
E.U.T.:	_____		
Configuration:	BER		
Serial Number:	4		
Location:	Nera, Plano TX		
BER:	0.0001	Worst-case J/S:	-2.8 dB
S/N:	17.0343864 $\ln(\text{BER}/.5)^{-2}$	Processing Gain:	16.23 dB
$G_p = S/N + J_m + 2\text{dB}(\text{system losses})$			
Test Equipment Used			
Power meter	1029	Power Sensor:	1030
Coupler	1055	Preamp:	1016
Attenuator	1470	Cable #1:	1081
Receiver:	_____	Cable #2:	1082
Combiner	1095	Cable #3:	1083
Additional equipment used: _____			
CW Interferer Frequency (MHz)	CW Interferer Amplitude (dBm)	Intended Signal Amplitude (dBm)	J/S
2447.500	-66.4	-68.7	2.3
2447.550	-66.9	-68.7	1.8
2447.600	-66.5	-68.7	2.2
2447.650	-68.0	-68.7	0.7
2447.700	-69.0	-68.7	-0.3
2447.750	-68.5	-68.7	0.2
2447.800	-68.8	-68.7	-0.1
2447.850	-69.0	-68.7	-0.3
2447.900	-67.5	-68.7	1.2
2447.950	-69.3	-68.7	-0.6
2448.000	-69.0	-68.7	-0.3
2448.050	-68.5	-68.7	0.2
2448.100	-69.0	-68.7	-0.3
2448.150	-70.7	-68.7	-2
2448.200	-71.7	-68.7	-3
2448.250	-73.5	-68.7	-4.8
2448.300	-72.6	-68.7	-3.9
2448.350	-72.4	-68.7	-3.7
2448.400	-71.0	-68.7	-2.3
2448.450	-70.8	-68.7	-2.1
2448.500	-66.8	-68.7	1.9
2448.550	-71.5	-68.7	-2.8
2448.600	-71.5	-68.7	-2.8
2448.650	-72.0	-68.7	-3.3
2448.700	-72.0	-68.7	-3.3
2448.750	-73.0	-68.7	-4.3
2448.800	-72.0	-68.7	-3.3
2448.850	-70.5	-68.7	-1.8
2448.900	-70.0	-68.7	-1.3
2448.950	-70.0	-68.7	-1.3
2449.000	-70.5	-68.7	-1.8
2449.050	-69.3	-68.7	-0.6
2449.100	-67.5	-68.7	1.2
2449.150	-68.9	-68.7	-0.2
2449.200	-69.4	-68.7	-0.7
2449.250	-69.4	-68.7	-0.7
2449.300	-69.4	-68.7	-0.7
2449.350	-69.4	-68.7	-0.7

EQUIPMENT: **BASE UNIT HDT**PROJECT NO.: **0L0065RUS3****Section 11. Test Equipment List**

KTL ID	Description	Manufacturer Model Number	Serial Number	Calibration Due
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/01
1483	Cable 4m	Storm PR90-010-144	N/A	05/23/01
1029	PEAK POWER METER	HP 8900D	3303U0012	02/17/01
1474	20db Attenuator DC 18 GHz	MCL Inc. BW-S20W2	NONE	CBU
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/26/01
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/01
1482	High-Pass Filter	K & L 11SH10-4000/T12000-0/0	2	CBU
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	11/03/00
1043	Flexible cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	09/30/00
1484	Cable 2.0-18.0 GHz	Storm PR90-010-072	N/A	05/25/01
1485	Cable 2.0-18.0 GHz	Storm PR90-010-216	N/A	05/25/01
1055	DIRECTIONAL COUPLER	NARDA 3022	73393	Cal Not Req
1470	10 db Attenuator DC 18 GHz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU
1095	COMBINER	MINI-CIRCUITS ZA3PD-4	NONE	CBU
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	02/17/01
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/01
1082	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/01
1083	Cable 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/01

ANNEX A - TEST DETAILS

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

NAME OF TEST: Powerline Conducted Emissions

PARA. NO.: 15.207(a)

Minimum Standard:

The R.F. that is conducted back onto the AC power line on any frequency within the band 0.45 to 30 MHz shall not exceed 250 μ V (48 dB μ V) across 50 ohms.

KTL Dallas

FCC PART 15, SUBPART C
DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

NAME OF TEST: Minimum 6 dB bandwidth

PARA. NO.: 15.247(a)(2)

Minimum Standard: The minimum 6 dB bandwidth shall be at least 500 kHz

EQUIPMENT: **BASE UNIT HDT**PROJECT NO.: **0L0065RUS3**

NAME OF TEST: Maximum Peak Output Power

PARA. NO.: 15.247(b)(1)

Minimum Standard: The maximum peak output power shall not exceed 1 watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point to point operation may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceed 6 dBi.

Systems operating in the 5725 – 5850 MHz band that are used exclusively for fixed, point-to-point operation may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter peak output power.

Direct Measurement Method For Detachable Antennas:

If the antenna is detachable, a peak power meter is used to measure the power output with the transmitter operating into a 50 ohm load. The dBi gain of the antenna(s) employed shall be reported.

Calculation Of EIRP For 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

The RBW of the spectrum analyzer shall be set to a value greater than the measured 6 dB occupied bandwidth of the E.U.T.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

NAME OF TEST: RF Exposure

PARA. NO.: 15.247(b)(4)

Minimum Standard:

Systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines stipulated in 1.1307(b)(1) of CFR 47.

EQUIPMENT: BASE UNIT HDT

PROJECT NO.: 0L0065RUS3

NAME OF TEST: Spurious Emissions(conducted)	PARA. NO.: 15.247(c)
---	----------------------

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits. Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (mV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM IS SEARCHED TO THE 10th HARMONIC OF THE HIGHEST FREQUENCY GENERATED IN THE EUT.

Method Of Measurement:

30 MHz - 10th harmonic plot

- RBW: 100 kHz
- VBW: 300 kHz
- Sweep: Auto
- Display line: -20 dBc

Lower Band Edge

- RBW: At least 1% of span/div.
- VBW: >RBW
- Span: As necessary to display any spurious at band edge.
- Sweep: Auto
- Center Frequency: 902 MHz, 2400 MHz, or 5725 MHz
- Marker: Peak of fundamental emission
- Marker Δ: Peak of highest spurious level below center frequency.

Upper Band Edge

- RBW: At least 1% of span/div.
- VBW: >RBW
- Span: As necessary to display any spurious at band edge.
- Sweep: Auto
- Center Frequency: 928 MHz, 2483.5 MHz, or 5850 MHz
- Marker: Peak of fundamental emission
- Marker Δ: Peak of highest spurious level above center frequency.

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: BASE UNIT HDT

PROJECT NO.: 0L0065RUS3

NAME OF TEST: Radiated Spurious Emissions	PARA. NO.: 15.247(c)
---	----------------------

Minimum Standard: In any 100kHz bandwidth outside the frequency band in which the transmitter is operating, emissions shall be at least 20 dB below the fundamental emission or shall not exceed the following field strength limits:

Emissions falling in the restricted bands of 15.205 shall not exceed the following field strength limits:

Frequency (MHz)	Field Strength (mV/m @ 3m)	Field Strength (dB @ 3m)
30 - 88	100	40.0
88 - 216	150	43.5
216 - 960	200	46.0
Above 960	500	54.0

THE SPECTRUM WAS SEARCHED TO THE 10th HARMONIC

15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.09-0.11	16.42-16.423	399.9-410	4.5-5.25
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.125-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41	1718		

Number of channels tested:

Tuning range	Number of channels tested	Channel location in band
1 MHz or less	1	middle
1 to 10 MHz	2	top and bottom
more than 10 MHz	3	top, middle, bottom

EQUIPMENT: **BASE UNIT HDT**

PROJECT NO.: **0L0065RUS3**

NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
---	----------------------

Minimum Standard: The transmitted power density averaged over any 1 second interval shall not be greater than +8 dBm in any 3 kHz bandwidth.

Method Of Measurement: The spectrum analyzer is set as follows:

- RBW: 3 kHz
- VBW: >3 kHz
- Span: => measured 6 dB bandwidth
- Sweep: Span(kHz)/3 (i.e. for a span of 1.5 MHz the sweep rate is 1500/3 = 500 sec.
- LOG dB/div.: 2 dB

Note: For devices with spectrum line spacing =< 3 kHz, the RBW of the analyzer is reduced until the spectral lines are resolved. The measurement data is normalized to 3 kHz by summing the power of all the individual spectral lines within a 3 kHz band in linear power units.

For Devices With Integral Antenna:

For devices with non-detachable antennas, the received field strength is peaked and the spectrum analyzer is set as above. The peak emission level is then measured and converted to a field strength by adding the appropriate antenna factor and cable loss. This field strength is then converted to an equivalent isotropic radiated power using the same method as described for Peak Power output.

Number of channels tested:

Tuning Range	Number Of Channels Tested	Channel Location In Band
1 MHz or Less	1	Middle
1 to 10 MHz	2	Top And Bottom
More Than 10 MHz	3	Top, Middle, Bottom

EQUIPMENT: **BASE UNIT HDT**PROJECT NO.: **0L0065RUS3**

NAME OF TEST: Processing Gain

PARA. NO.: 15.247(e)

Minimum Standard: The processing gain shall be at least 10 dB.**Method Of Measurement:** The CW jamming margin method was used to determine the processing gain. A CW signal generator is stepped across the passband of the receiver in 50 kHz increments. At each point the signal generator level required to obtain the recommended bit error rate is recorded. The jammer to signal ratio (J/S) is then calculated. The worst 20% of the J/S points is discarded. The lowest remaining J/S ratio is used to calculate the processing gain.**Calculation Of Processing Gain:**

The processing gain was determined by measuring the jamming margin of the E.U.T. and using the following formula:

$$\text{Jamming Margin} = G_p - (S/N)_{\text{out}} - L_{\text{sys}}$$

For a receiver using non-coherent detection the value $(S/N)_{\text{out}}$ is calculated using the formula:

$P_e = (1/2)\text{EXP}\{-E/2N_o\}$ where P_e is the probability of error (minimum Bit Error Rate required for proper operation).

E/N_o is $(S/N)_{\text{out}}$

for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

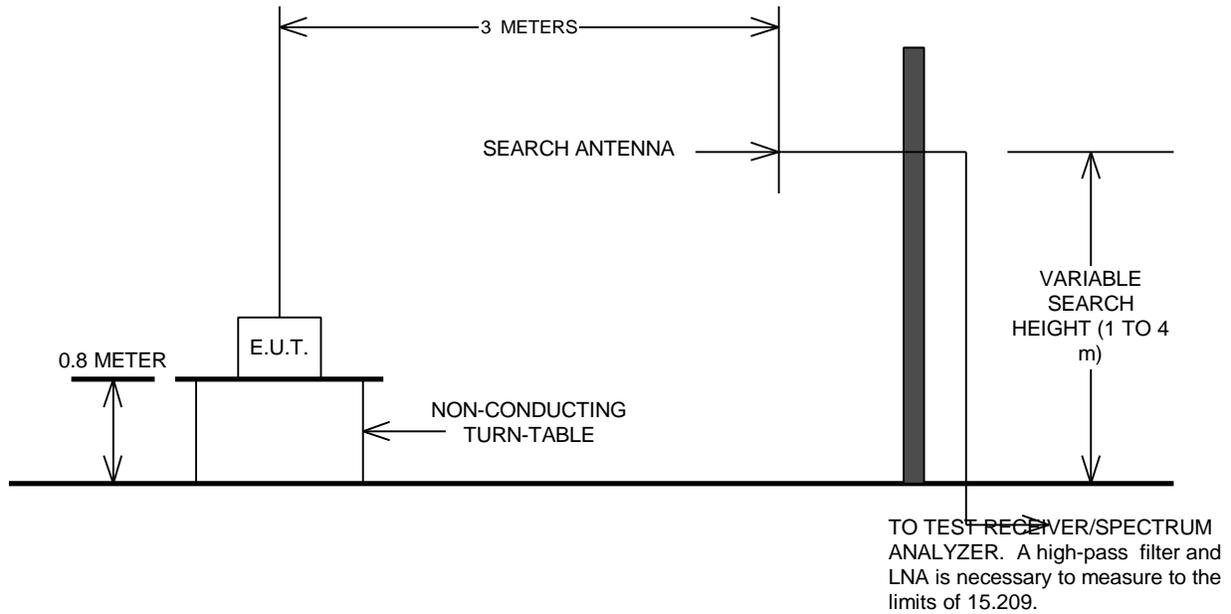
L_{sys} (system losses) is assumed to be 2 dB.

Therefore $G_p = M_j + (S/N)_{\text{out}} + L_{\text{sys}}$

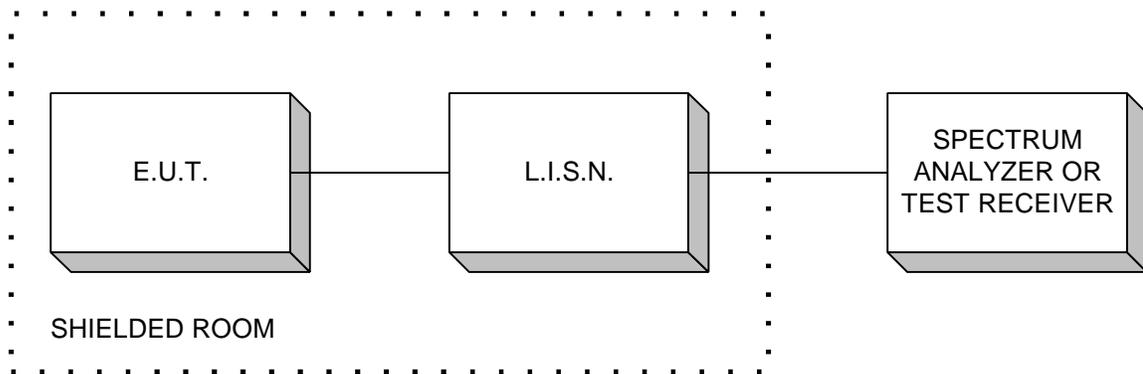
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

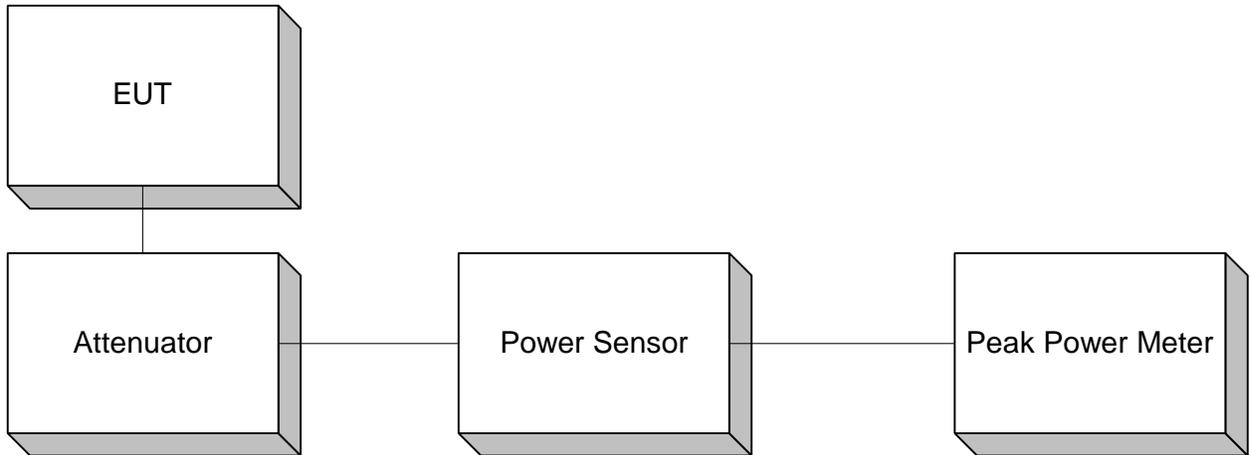
Test Site For Radiated Emissions



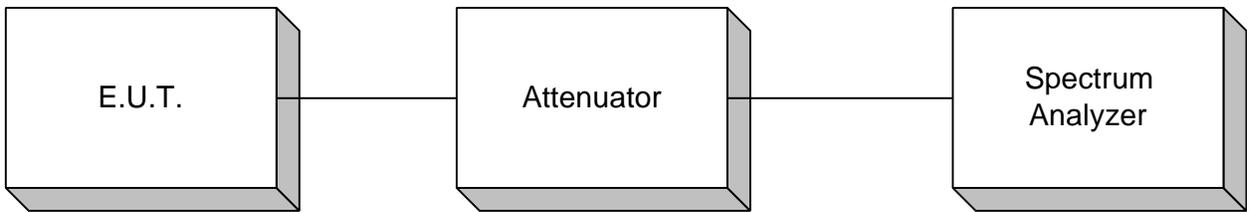
Conducted Emissions



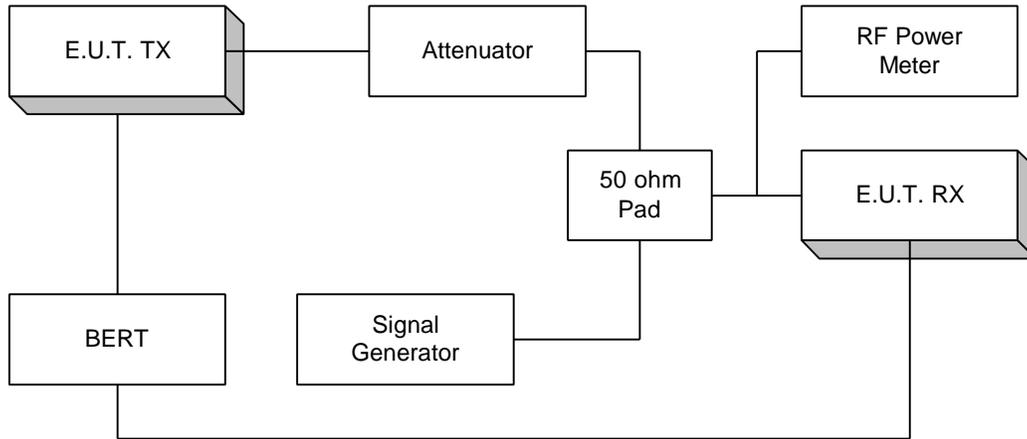
Peak Power At Antenna Terminals



**Minimum 6 dB Bandwidth
Peak Power Spectral Density
Spurious Emissions (conducted)**



Processing Gain



NOTE: This is a typical setup. The setup may vary slightly since many devices have BER test functions built into the device.