

KTL Test Report: 0L0065RUS2

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

**Equipment Under Test:
(E.U.T.)** SUBSCRIBER UNIT CPI

FCC ID: PAMRUCPI

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:



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.....	11
Section 5. Maximum Peak Output Power	15
Section 6. RF Exposure.....	17
Section 7. Spurious Emissions (conducted)	18
Section 8. Spurious Emissions (radiated).....	19
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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

Section 1. Summary of Test Results

Manufacturer: NERA

Model No.: CPI

Serial 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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dB μ V	COMPLIES
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	NA
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 transceiver has an integral, non-detachable antenna.

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](#)

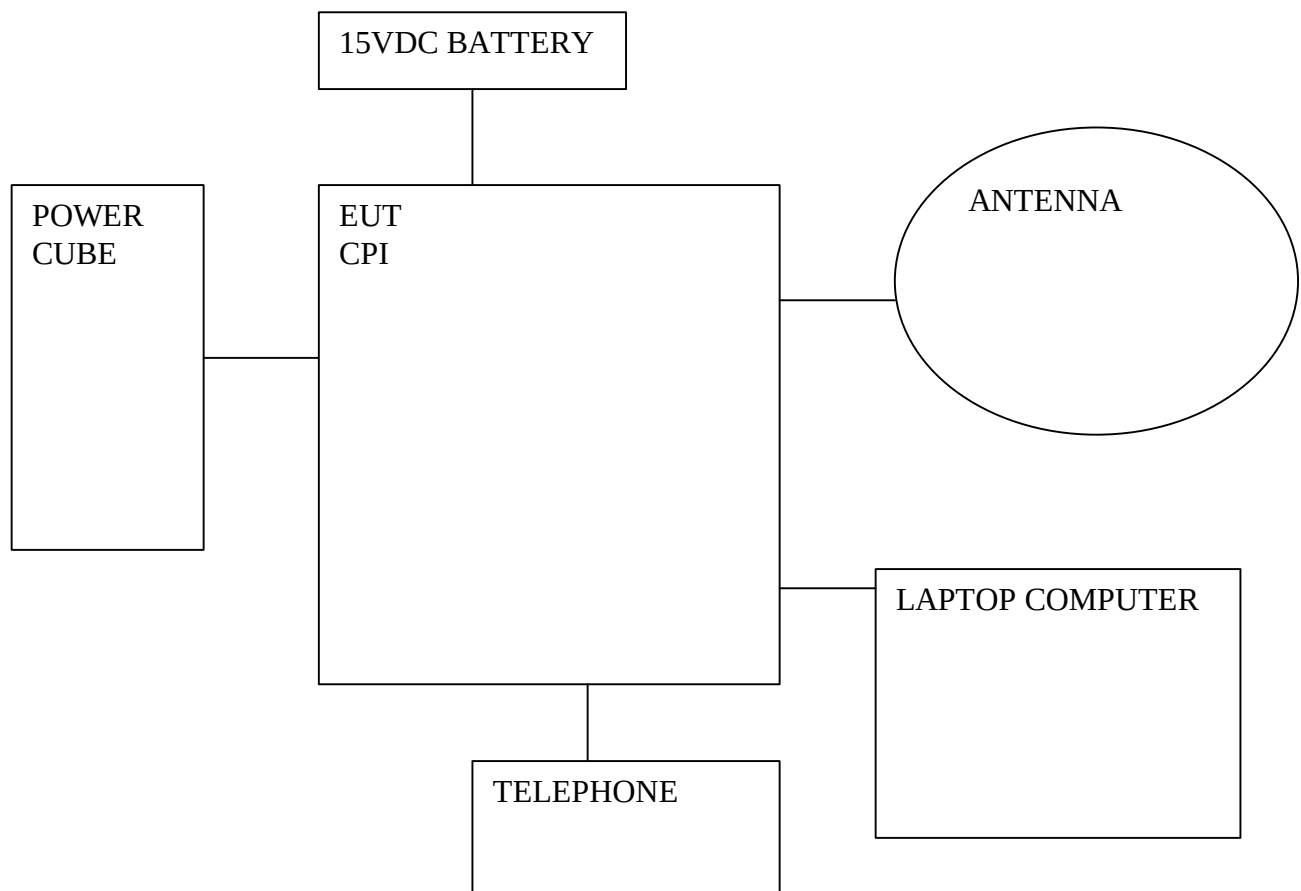
Description of Modification for Modification Filing

A METAL PLATE WAS ADDED TO THE SOLDER SIDE OF THE PCB OPPOSITE TO THE RF CAN ON THE COMPONENT SIDE OF THE PCB.

Description of Operation

The device tested is a direct sequence spread spectrum radio transceiver. The inputs are two POTS lines with voice over data.

System Diagram



Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Kevin Rose	DATE: Aug. 10, 2000

Test Results: [Complies.](#)

Measurement Data: [See attached plots.](#)

Measurement Uncertainty: +/- [0.67](#) dB

Temperature: [21](#) °C

Relative Humidity: [47](#) %



EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

Conducted Emissions Data
(CISPR Quasi-Peak Detector)
FCC (CFR 47)Complete x
Preliminary Page 1 of 1 Client: NERA W.O.#: 0L0065R Date: AUG 10 2000 EUT: 2.4 GHZ SUBSCRIBER EUT S/N: S07 Specification: FCC B conducted Tech: Kevin Rose Test #: Lab: 4 Photo ID: 0L0065 Equipment Used: subscriber EUT Configuration: EUT was tested in transmit and standby. Standby was the worst case IF Bandwidth: 10Khz Video Bandwidth: 10Khz Detector: Peak X CISPRAmbient Temperature: 20 C EUT Power: X 115 V.A.C. X 60 Hz X 1 Phase
Relative Humidity: 46 % 230 V.A.C. 50 Hz 3 Phase
 Other

Freq. (MHz)	Meter Reading (dBuV)	Attn. (dB)	Cable Loss (dB)	Probe Factor (dB)	Corrected Reading (dBuV)	Spec.limit (dBuV)	Pol.	Comments:
0.45	50	0	0	0	50	48	Phase	QP
0.45	10	0	0	0	10	48	Phase	AVG
0.45	37	0	0	0	37	48	Phase	13 dB relaxation per 15.107 (d)
0.5	49	0	0	0	49	48	Phase	QP
0.5	9	0	0	0	9	48	Phase	AVG
0.5	36	0	0	0	36	48	Phase	13 dB relaxation per 15.107 (d)
0.6	41	0	0	0	41	48	Phase	QP
0.8	37	0	0	0	37	48	Phase	QP
1.11	29	0	0	0	29	48	Phase	QP
27.64	33	0	0	0	33	48	Phase	QP
0.45	49	0	0	0	49	48	N	QP
0.45	9	0	0	0	9	48	N	AVG
0.45	36	0	0	0	36	48	N	13 dB relaxation per 15.107 (d)
0.5	47.6	0	0	0	47.6	48	N	QP
0.5	9	0	0	0	9	48	N	AVG
0.5	34.6	0	0	0	34.6	48	N	13 dB relaxation per 15.107 (d)
0.6	40	0	0	0	40	48	N	QP
0.8	34	0	0	0	34	48	N	QP
1.11	27	0	0	0	27	48	N	QP
27.64	34	0	0	0	34	48	N	QP

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

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. 8, 2000

Test Results: Complies.**Measurement Data:** See 6 dB BW plot

Measured 6 dB bandwidth: 2.132 MHz

Channel Separation: 3.5 MHz

Measurement Uncertainty: +/- 1.7 dB**Temperature:** 20 °C**Relative Humidity:** 46 %

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

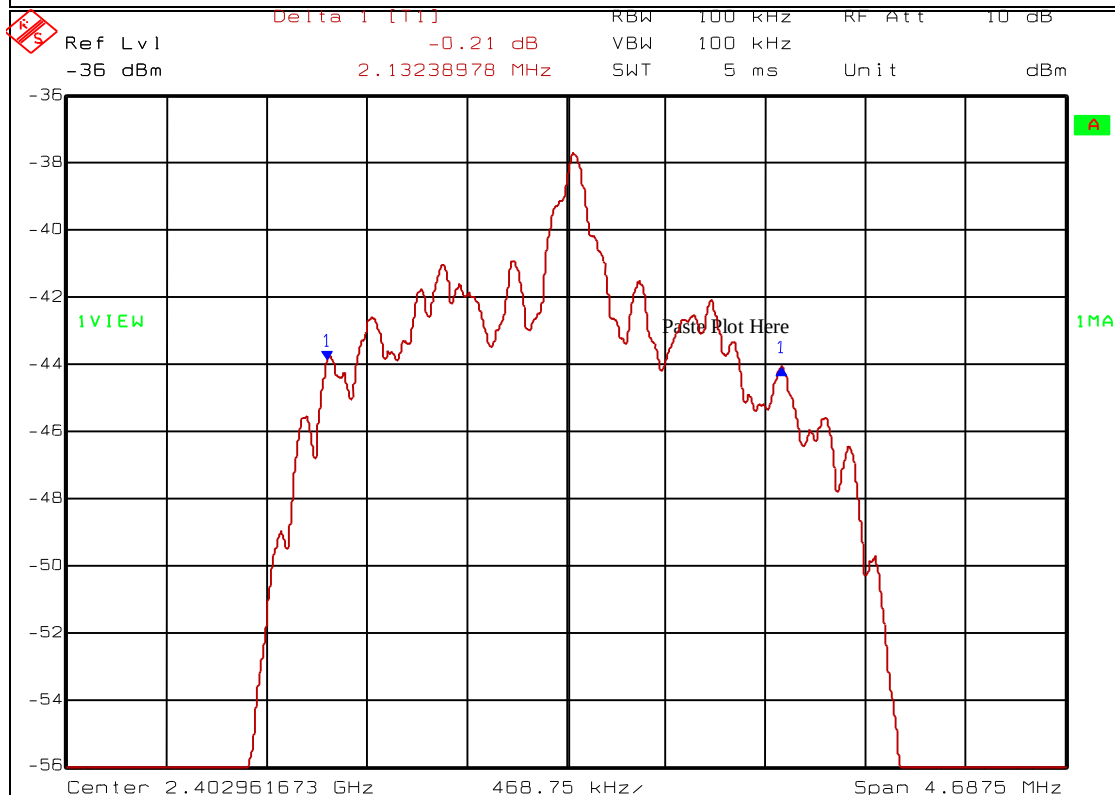
Test Plot: 6 dB Bandwidth

Page 1 of 1

Job No.:	0I0065r	Date:	August 7 2000
Specification:	15.247	Temperature(°C):	20
Tested By:	Kevin Rose	Relative Humidity(%)	46
E.U.T.:	subscriber EUT		
Configuration:	transmitting		
Serial Number:			
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:	1081
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:	near field probes		
Measurement Uncertainty:	#N/A		



Date: 7.AUG.2000 13:12:55

Notes: low channel 6 db bandwidth

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

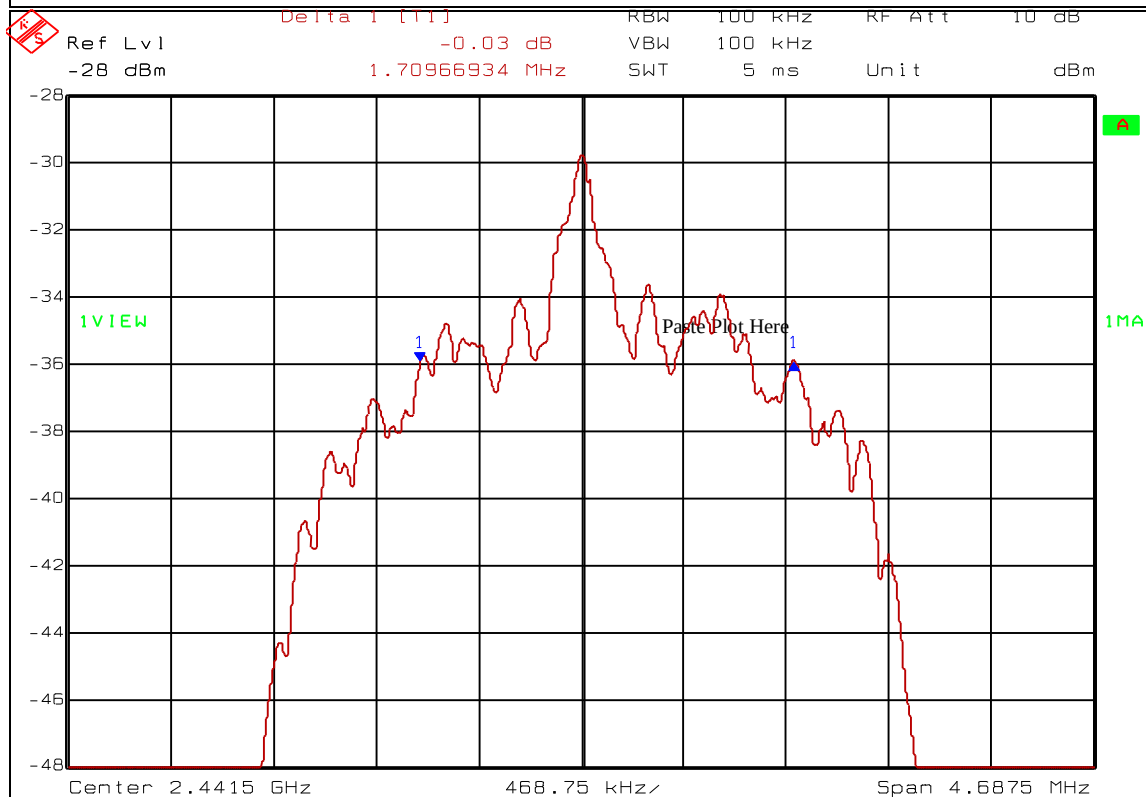
Test Plot: 6 dB Bandwidth

Page 1 of 1

Job No.:	0I0065r	Date:	August 7 2000
Specification:	15.247	Temperature(°C):	20
Tested By:	Kevin Rose	Relative Humidity(%)	46
E.U.T.:	subscriber EUT		
Configuration:	transmitting		
Serial Number:			
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:	1081
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:	near field probes		
Measurement Uncertainty:	#N/A		



Date: 7.AUG.2000 13:20:27

Notes: mid channel 6 db bandwidth

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

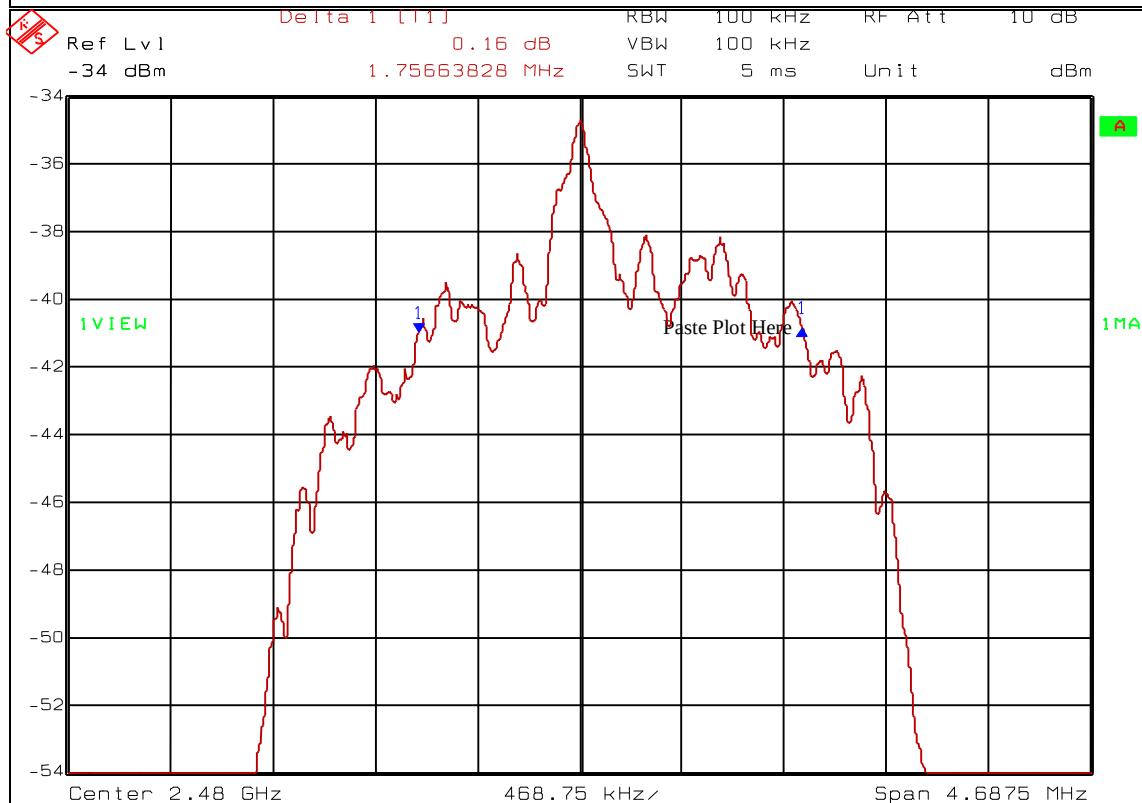
Test Plot: 6 dB Bandwidth

Page 1 of 1

Job No.:	0I0065r	Date:	August 7 2000
Specification:	15.247	Temperature(°C):	20
Tested By:	Kevin Rose	Relative Humidity(%)	46
E.U.T.:	subscriber EUT		
Configuration:	transmitting		
Serial Number:			
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:	1081
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:	near field probes		
Measurement Uncertainty:	#N/A		



Date: 7.AUG.2000 13:29:08

Notes: upper channel 6 db bandwidth

EQUIPMENT: [SUBSCRIBER UNIT CPI](#)PROJECT NO.: [0L0065RUS2](#)

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. 8, 2000

Test Results: [Complies. The measured peak output power at the antenna rf output terminal is +13.8 dBm. The antenna gain is 12 dBi. Therefore, the peak e.i.r.p. is +25.8 dBm \(0.380 watts\).](#)

Measurement Data: [See attached table.](#)

Measurement Uncertainty: +/- [3.6](#) dB

Temperature: [21](#) °C

Relative Humidity: [43](#) %

Section 6. RF Exposure

NAME OF TEST: RF Exposure	PARA. NO.: 15.247(b)(4)
	DATE:

Test Results: Complies.

Measurement Data:

Maximum e.i.r.p.: 380 mW

Antenna location: The antenna/radio unit is intended to be mounted on the exterior wall of the residence or on a pole. Separation distance from persons is expected to exceed 1 meter. See page 2 of the RU installation manual.

Professional installation: The system must be professionally installed.

Application: The application of the device is to transport broadband data to a base station site. The base station is also professionally installed with the antenna mounted on the roof of a commercial building.

Installation: The RU is installed with a specific exterior wall-mount or pole-mount antenna. Specific instructions are given in the installation manual. The RU/CPI is not a "plug-and-play" system. Installation would be performed by the service provider.

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.

Section 7. Spurious Emissions (conducted)NAME OF TEST: Spurious Emissions (conducted) FCC NO.: 15.247(c)

TESTED BY:

Test Results: See attached plots

Measurement Data: See attached plots.**Equipment Used:****Measurement Uncertainty:** +/- ____ dB**Temperature:** °C**Relative Humidity:** %

EQUIPMENT: SUBSCRIBER UNIT CPIPROJECT NO.: 0L0065RUS2

Section 8. Spurious Emissions (radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247 (c)
TESTED BY: Kevin Rose	DATE: 9\6\2000

Test Results: [Complies.](#)**Measurement Data:** [See attached table.](#)**Measurement Uncertainty:** +/- 3.6 dB**Temperature:** 21 °C**Relative Humidity:** 50 %

Page 20 of 44

Page 21 of 44

PROJECT NO.: 0L0065RUS2

Page 22 of 44

Radiated Photographs (Worst Case Configuration)



EQUIPMENT: SUBSCRIBER UNIT CPIPROJECT NO.: 0L0065RUS2

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. The maximum measured peak power density at the antenna terminal is +1.1 dBm.

Measurement Data: See attached plots.

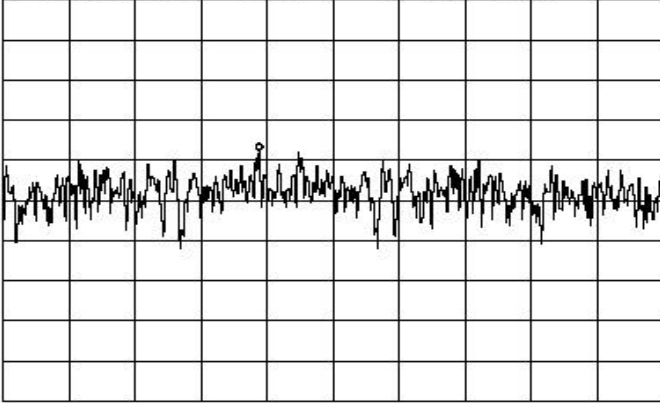
Measurement Uncertainty: +/- 3.6 dB

Temperature: 21 °C

Relative Humidity: 43 %

EQUIPMENT: SUBSCRIBER UNIT CPI

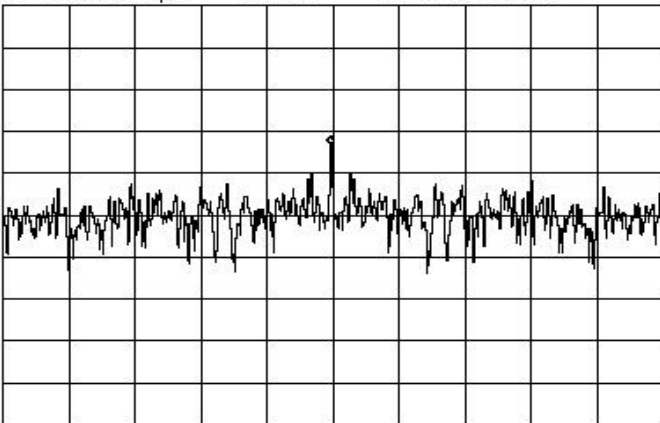
PROJECT NO.: 0L0065RUS2

Peak power spectral density										
Page 1 of 1							Complete <u>X</u>			
Job No.: 010065r		Date: AUG 8 2000					Preliminary <u> </u>			
Specification:		Temperature(°C): 21								
Tested By: Kevin Rose		Relative Humidity(%): 43								
E.U.T.: subscriber EUT										
Configuration: transmitting							Peak rf power output(dBm): -5.9			
Sample Number:										
Location: Lab 3		RBW: 3 kHz					Measurement			
Detector Type: Peak		VBW: 3 kHz					Distance 3 m			
Test Equipment Used										
Antenna: 759		Directional Coupler: #N/A								
Pre-Amp: #N/A		Cable #1: 1484								
Filter: #N/A		Cable #2: 1485								
Receiver: 1464		Cable #3: #N/A								
Attenuator #1: #N/A		Cable #4: #N/A								
Attenuator #2: #N/A		Mixer: #N/A								
Additional equipment used:										
Measurement Uncertainty: +/- 3.6 dB										
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak rf output (W)	Peak rf output (dBm)	dBc	Polarity	Comments
2.403	69.3	28.5	3.4		101	0.000257	-5.90		H	
ATTEN 10dB RL 107.0dBμV 10dB/ MKR 69.33dBμV 2.402943GHz  LOW CHANNEL PEAK POWER SPEC. DENSITY. PEAK 69.3dBuV CENTER 2.403167GHz *RBW 3.0kHz VBW 3.0kHz SPAN 2.000MHz *SWP 670sec										
Notes: FLAT PANEL ANTENNA HAS A GAIN OF 12dBi THEREFORE NUMERIC GAIN OF 15.4 IS USED TO CALCULATED EIRP										

Page 26 of 44

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

Peak power spectral density										
Page 1 of 1						Complete <u>X</u>				
Job No.: 00065r		Date: AUG 8 2000				Preliminary _____				
Specification:		Temperature(°C): 21								
Tested By: Kevin Rose		Relative Humidity(%) 43								
E.U.T.: subscriber EUT						Peak rf power output(dBm): -1.4 (@ ant. Terminal)				
Configuration: transmitting										
Sample Number:										
Location: Lab 3		RBW: 3 kHz		Measurement Distance: 3 m						
Detector Type: Peak		VBW: 3 kHz								
Test Equipment Used										
Antenna: 759		Directional Coupler: #N/A								
Pre-Amp: #N/A		Cable #1: 1484								
Filter: #N/A		Cable #2: 1485								
Receiver: 1464		Cable #3: #N/A								
Attenuator #1: #N/A		Cable #4: #N/A								
Attenuator #2: #N/A		Mixer: #N/A								
Additional equipment used: _____										
Measurement Uncertainty: +/- 3.6 dB										
Frequency (GHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-Amp Gain (dB)	Corrected Reading (dBuV/m)	Peak rf output (W)	Peak rf output (dBm)		Polarity	Comments
2.480	73.8	28.5	3.4		106	0.000724	-1.40		H	
ATTEN 10dB RL 107.0dBμV 10dB/ MKR 73.83dBμV 2.480002GHz  HIGH CHANNEL PEAK POWER SPEC. DENSITY. 73.8dBuV CENTER 2.480008GHz *RBW 3.0kHz VBW 3.0kHz SPAN 2.000MHz *SWP 670sec										
Notes: FLAT PANEL ANTENNA HAS A GAIN OF 12dBi THEREFORE NUMERIC GAIN OF 15.4 IS USED TO CALCULATED EIRP										

EQUIPMENT: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

Section 10. Minimum Processing Gain

NAME OF TEST: Minimum Processing Gain	PARA. NO.: 15.247(e)
TESTED BY:	DATE:

Test Results: Complies. The processing gain of the system is ____ 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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

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: [SUBSCRIBER UNIT CPI](#)PROJECT NO.: [0L0065RUS2](#)**Section 11. Test Equipment List**

KTL ID	Description	Manufacturer Model Number	Serial Number	Calibration Due Date
759	ANTENNA, LOG PERIODIC	A.H. SYSTEMS SAS-200/510	556	02/26/01
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	11/03/00
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
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/01
1482	High Pass Filter	K & L 11SH10-4000/T12000-0/0	2	CBU
1043	Flexible cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	09/30/00
1036	SPECTRUM ANALYZER	ROHDE & SCHWARZ FSEK30	830844/006	06/14/01
1081	CABLE 2m	Astrolab 32027-2-29094-72TC	N/A	05/23/01
993	Horn antenna	A.H. Systems SAS-200/571	XXX	07/16/01
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/01
1008	RECEIVER (9 kHz-30 MHz)	ROHDE & SCHWARZ ESH 3	860318/012	05/05/01
785	ANALYZER, SPECTRUM	HP 8591E	3412A02996	02/26/01
1523	LIMITER	FISCHER FCC-450-1.25-N	446	02/17/01
545	LISN	Schwarz Beck 8120	8120350	02/18/01
1552	CABLE 1.1m	KTL RG223	N/A	12/20/00
1555	Filter high pass 5KHz	Solar Electronics 7930-5.0	933125	11/23/00
1114	CABLE, 7m	KTL RG223	N/A	12/21/00

ANNEX A - TEST DETAILS

EQUIPMENT: [SUBSCRIBER UNIT CPI](#)

PROJECT NO.: [0L0065RUS2](#)

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.

EQUIPMENT: [SUBSCRIBER UNIT CPI](#)

PROJECT NO.: [0L0065RUS2](#)

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

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: [SUBSCRIBER UNIT CPI](#)

PROJECT NO.: [0L0065RUS2](#)

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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

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: SUBSCRIBER UNIT CPI

PROJECT NO.: 0L0065RUS2

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

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.

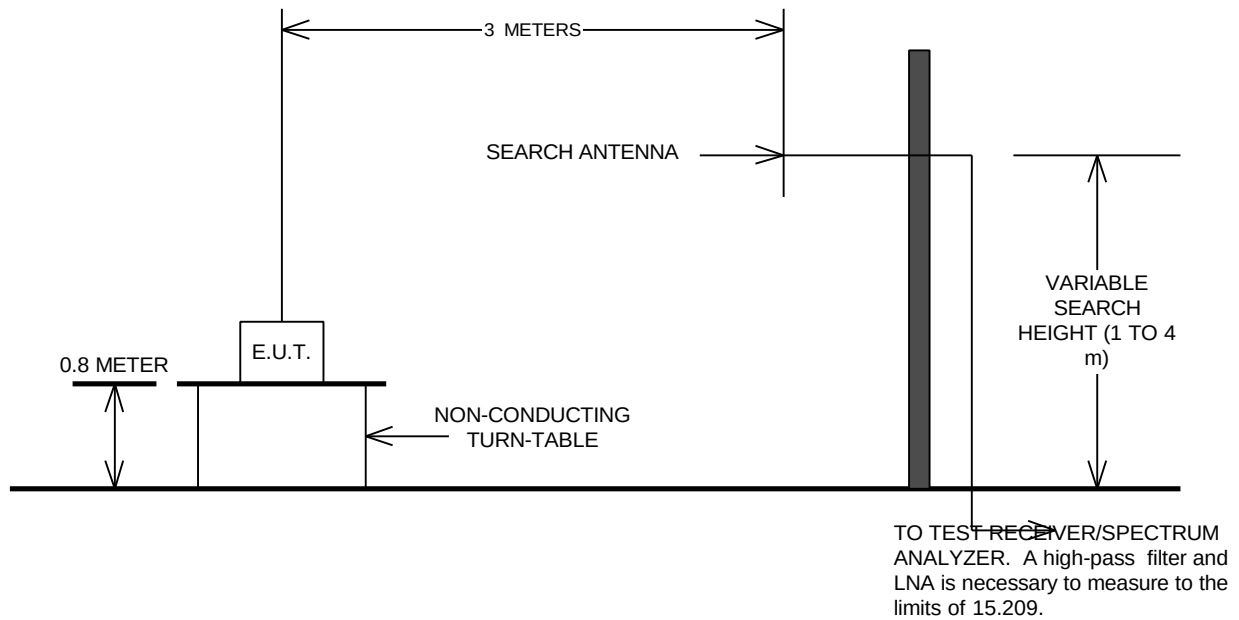
L_{sys} (system losses) is assumed to be 2 dB.

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

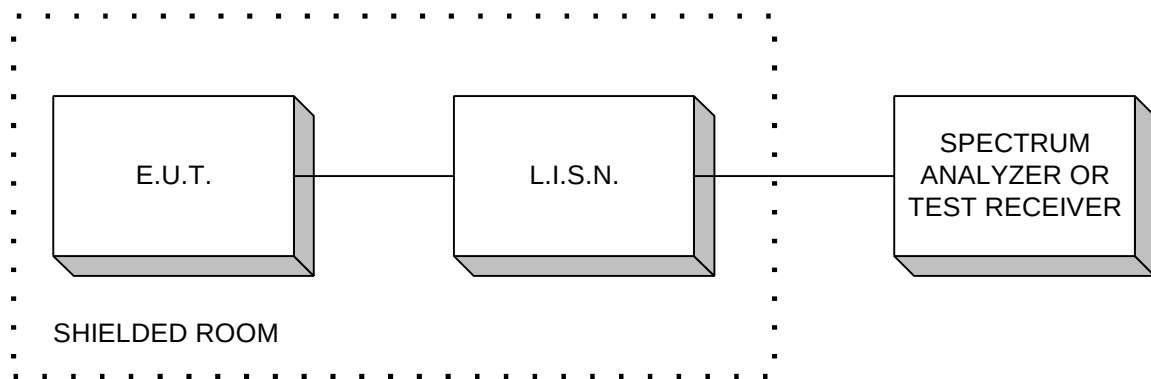
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

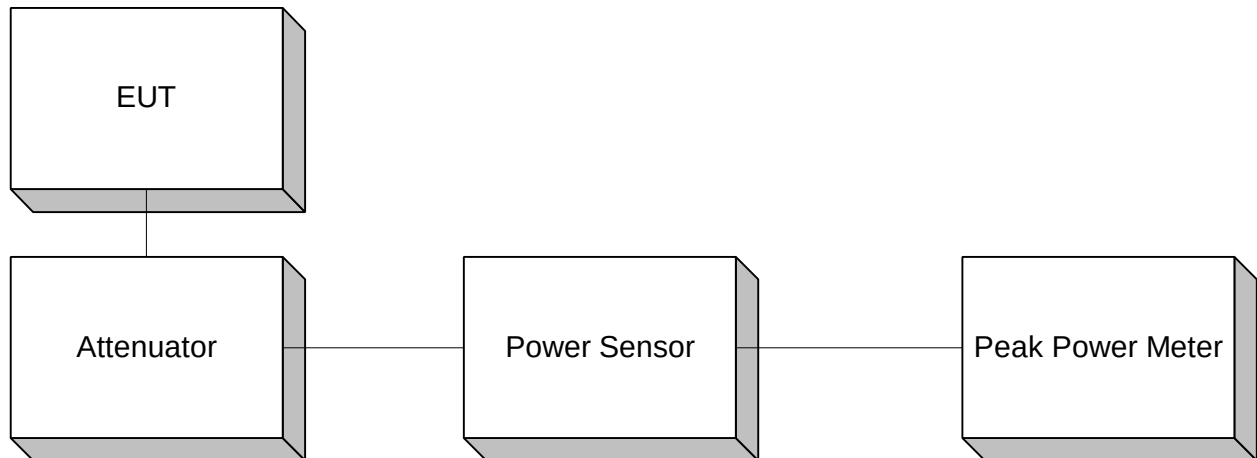
Test Site For Radiated Emissions



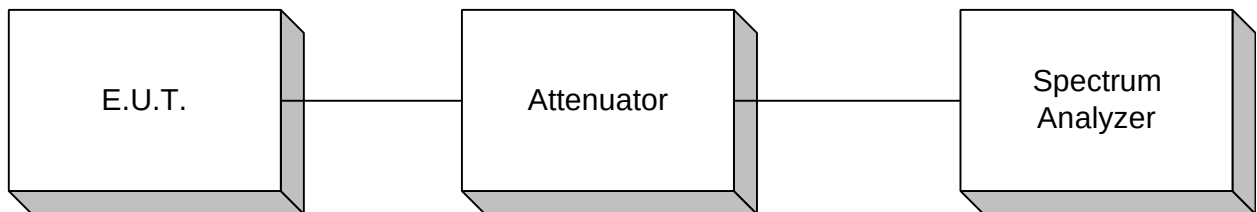
Conducted Emissions

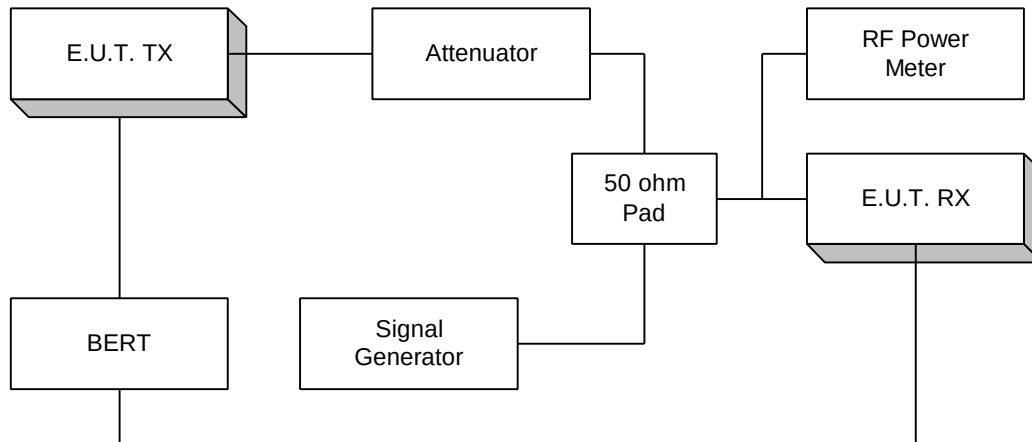


Peak Power At Antenna Terminals



**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.