Nemko Test Report:	1L0136RUS1
Applicant:	ActionTec 760 N. Mary Avenue Sunnyvale. CA 94086
Equipment Under Test: (E.U.T.)	802MIP and 802MIP-W Wireless LAN Combo
In Accordance With:	**FCC Part 15, Subpart C, 15.247** Direct Sequence Spread Spectrum Transmitters
Tested By:	Nemko Dallas Inc. 802 N. Kealy Lewisville, Texas 75057-3136
Authorized By:	Tom Tidwell, RF Group Manager
Date:	4/25/01
Total Number of Pages:	44

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Section 1. Summary of Test Results

Manufacturer: Action Tek

Model No.: 802MIP Wireless LAN

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 Part 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices. Radiated tests were conducted is 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

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Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
Powerline Conducted Emissions	15.207(a)	48 dBµV	< 48 dBµV	Complies
Minimum 6 dB Bandwidth	15.247(a)(2)	500 kHz	9.42 MHz	Complies
Maximum Peak Power Output	15.247(b)(1)	1 Watt	.048 Watts	Complies
Spurious Emissions (Antenna Conducted)	15.247(c)	-20 dBc/100kHz	< -20 dBc	Complies
Spurious Emissions (Restricted Bands)	15.247(c)	Table 15.209(a)	< -54 dBµV/m	Complies
Peak Power Spectral Density	15.247(d)	+8 dBm/3kHz	< +8 dBm/3 kHz	Complies
Processing Gain	15.247(e)	10 dB	> 10 dB	Complies

Footnotes:

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: 5 MHz

User Frequency Adjustment: Software controlled

Family List Rational

There are two models in this family of products:

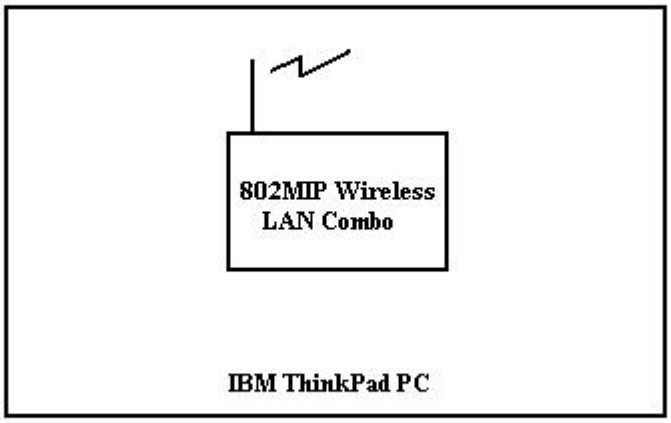
1.) 802 MIP
A combination wireless LAN and wired V.90 modem

2.) 802 MIP-W
The same card as the 802 MIP above with V.90 components removed

Description of Operation

The EUT is a combination wired V.90 and wireless 802.11b modem. The wireless transmission is in the 2.4 – 2.4835 GHz band. The radio uses Direct Sequence Spread Spectrum modulation techniques. The antenna is embedded in the lid of a laptop computer and is therefore non-detachable.

System Diagram



Section 3. Powerline Conducted Emissions

NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: David Light	DATE:4/16/01

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 0.7 dB

Test Data – Powerline Conducted Emissions

Test Plot: Powerline Conducted Emissions

Page 1 of 2

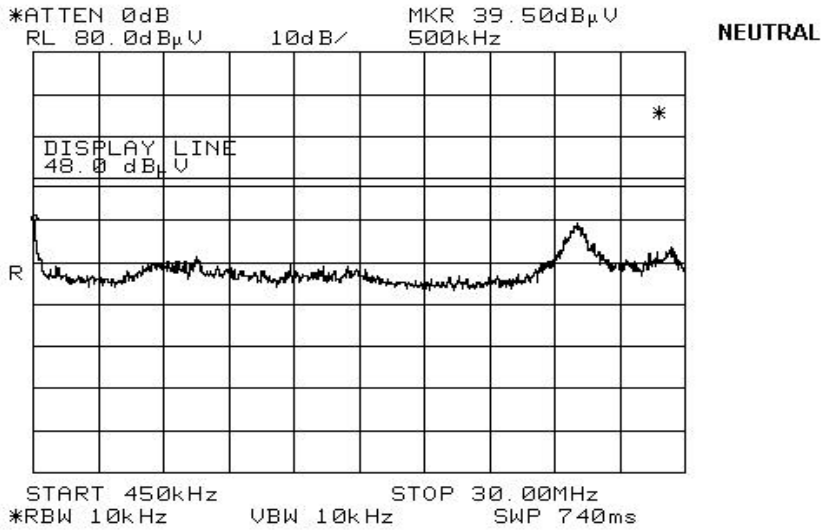
Job No.:	1L0136R	Date:	04/16/01
Specification:	15.207	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Continuous transmit - Installed in IBM Laptop PC		
Serial Number:	None		
Location:	Shielded Enclosure	RBW:	10 kHz
Detector Type:	Peak	VBW:	10 kHz

Test Equipment Used

Antenna:	#N/A	Directional Coupler:	#N/A
Pre-Amp:	#N/A	Cable #1:	1527
Filter:	704	Cable #2:	1038
Receiver:	1464	L.I.S.N.	969
Attenuator #1	#N/A	Cable #4:	#N/A
Attenuator #2:	#N/A	Mixer:	#N/A

Additional equipment used:

Measurement Uncertainty: #N/A



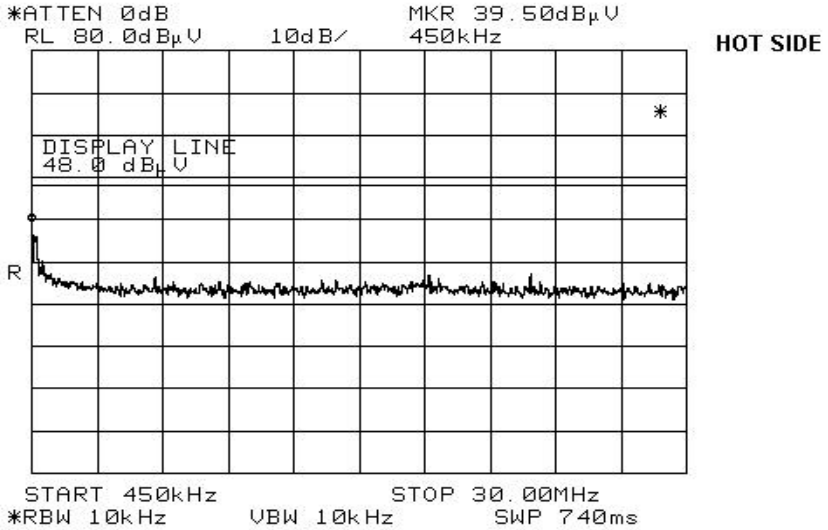
Notes: **NEUTRAL SIDE**

Test Data – Powerline Conducted Emissions

Test Plot: Powerline Conducted Emissions

Page 2 of 2

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.2	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Continuous transmit - Installed in IBM Laptop PC		



Notes: **HOT SIDE**

Photographs – Powerline Conducted Emissions

Section 4. Minimum 6 dB Bandwidth

NAME OF TEST: Minimum 6 dB Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: David Light	DATE: 4/16/01

Test Results: Complies.

Measurement Data: See 6 dB BW plot
Measured 6 dB bandwidth: 9.42 MHz Minimum
Channel Separation: 5 MHz

Measurement Uncertainty: +/- 0.7 dB
+/- 1 X 10^{-7} ppm

Test Data – 6 dB Bandwidth

Data Plot 6 dB Bandwidth

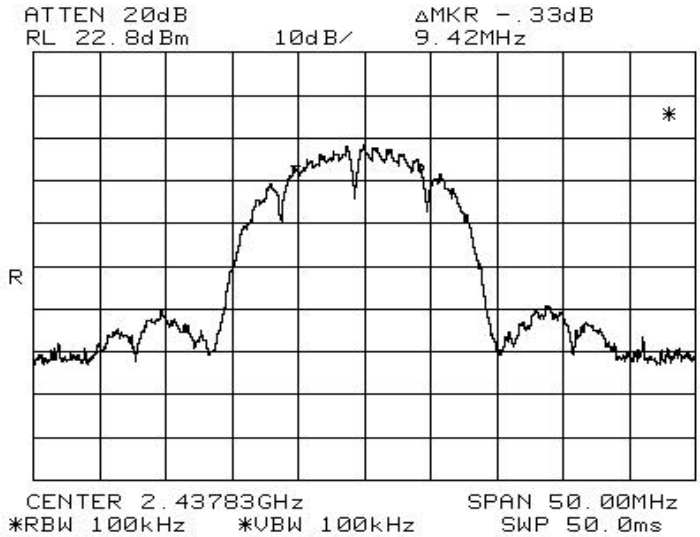
Page 1 of 3 | Complete X | Preliminary

Job No.: 1L0136R | Date: 4/16/01
Specification: 15.247 | Temperature(°C): 22
Tested By: David Light | Relative Humidity(%) 50
E.U.T.: 802MIP Wireless LAN Combo
Configuration: Transmit continuous Data
Sample Number: S01
Location: Lab 2 | RBW: 100 kHz | Measurement
Detector Type: Peak | VBW: 100 kHz | Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1	1469	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-3.6 dB



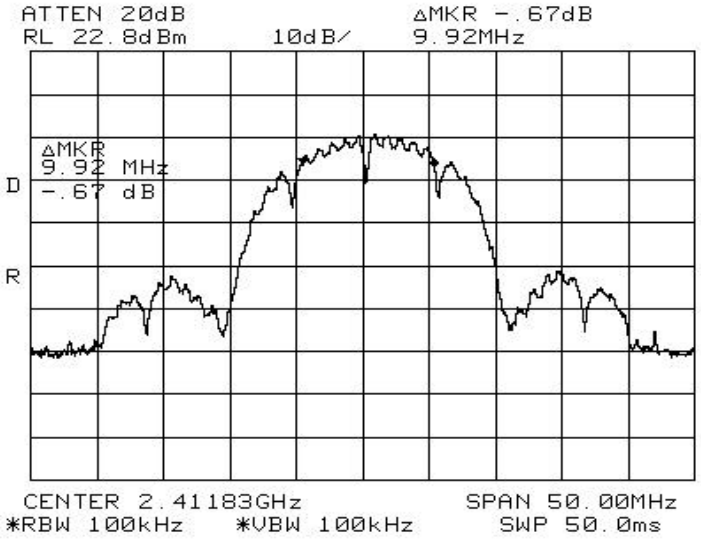
Notes: **transmit Mid Band**

Test Data – 6 dB Bandwidth

Data Plot 6 dB Bandwidth

Page 2 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.2	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Transmit continuous Data		



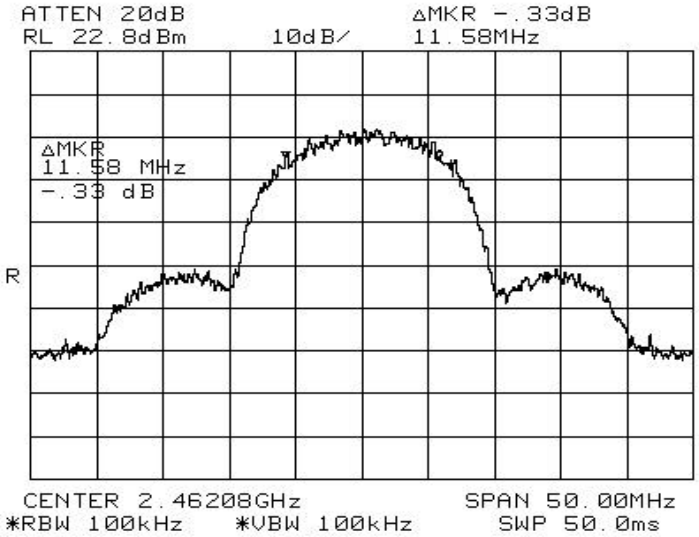
Notes: **Lowest Channel (Channel 1)**

Test Data – 6 dB Bandwidth

Data Plot 6 dB Bandwidth

Page 3 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.247	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Transmit continuous Data		



Notes: **Highest Channel (Channel 11)**

Section 5. Maximum Peak Output Power

NAME OF TEST: Maximum Peak Output power	PARA. NO.: 15.247(b)(1)
TESTED BY: David Light	DATE:4/16/01

Test Results: Complies.

Measurement Data:

Antennas: **Integral**

Note: Special arrangement was made to remove the antenna for testing. The TX output port was 50 ohms.

Frequency (GHz)	Power Output Conducted (dBm)	Antenna Gain (dBi)	E.I.R.P. (dBm)
2.413	16.8	3	19.8
2.437	16.8	3	19.8
2.463	16.7	3	19.7

Measurement Uncertainty: +/- 0.7 dB

Section 6. RF Exposure

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

Test Results: Complies.

Measurement Data: See next page

The predicted power density level at 3 cm is 0.838 mW/cm^2. This is below the uncontrolled exposure limit of 1mW/cm^2 at 2400 MHz.

This radio is intended to be installed in laptop PC only and is thus classed as mobile equipment.

MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{PG}{4pR^2}$$

where: S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal:	17.00	(dBm)
Maximum peak output power at antenna input terminal:	47.5	(mW)
Antenna gain(typical):	3	(dBi)
Maximum antenna gain:	1.995262	(numeric)
Prediction distance:	3	(cm)
Prediction frequency:	2400	(MHz)
MPE limit for uncontrolled exposure at prediction frequency:	1.0	(mW/cm^2)
Power density at prediction frequency:	0.837995	(mW/cm^2)
Maximum allowable antenna gain:	3.767588	(dBi)

Section 7. Spurious Emissions (conducted)

NAME OF TEST: Spurious Emissions (conducted)	PARA. NO.: 15.247(c)
TESTED BY: David Light	DATE:4/16/01

Test Results: Complies.

Measurement Data: See attached plots.

Measurement Uncertainty: +/- 0.7 dB

Test Data – Spurious Emissions Conducted

Data Plot Antenna Port Spurious Emissions

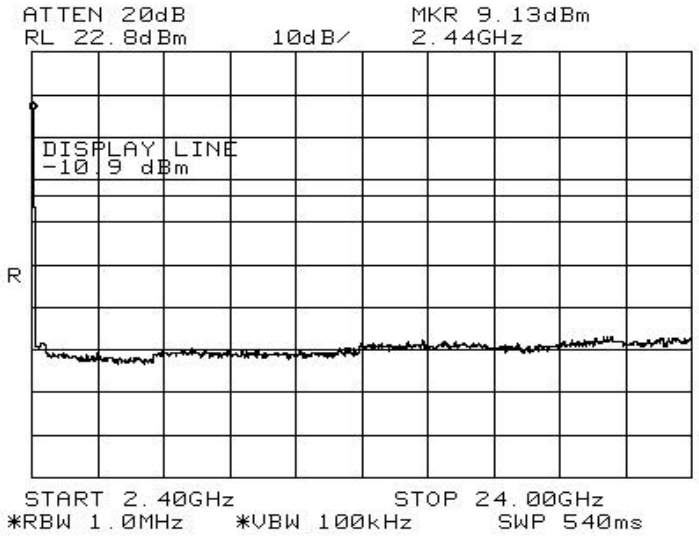
Page 1 of 3 | Complete X | Preliminary

Job No.: 1L0136R | Date: 4/16/01
Specification: 15.247 | Temperature(°C): 22
Tested By: David Light | Relative Humidity(%) 50
E.U.T.: 802MIP Wireless LAN Combo
Configuration: Tx Continuous data
Sample Number: S01
Location: Lab 2 | RBW: Refer to plots | Measurement
Detector Type: Peak | VBW: Refer to plots | Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1	1469	Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-3.6 dB



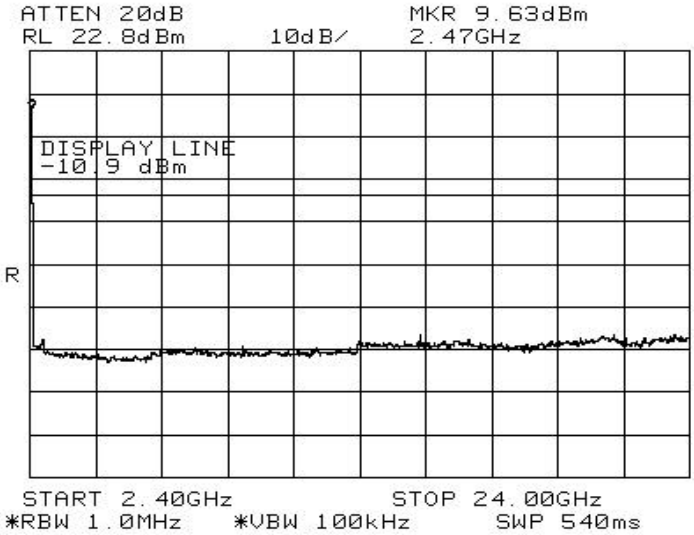
Notes: **Highest channel (Channel 11)**

Test Data – Spurious Emissions Conducted

Data Plot **Antenna Port Spurious Emissions**

Page 2 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.2	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Tx Continuous data		



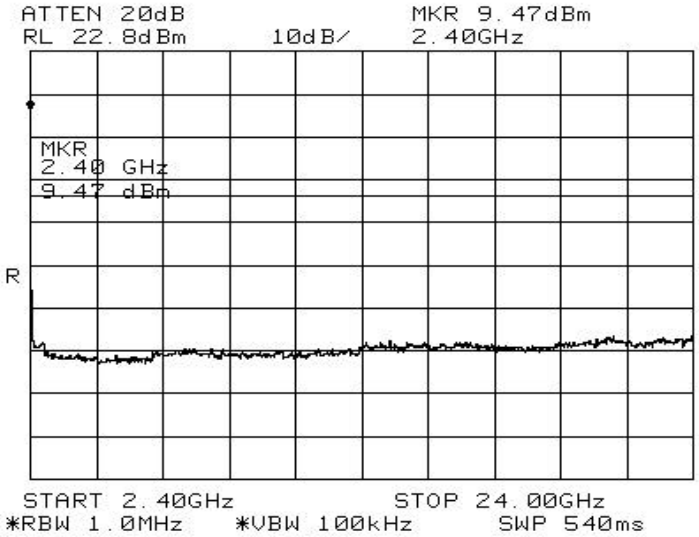
Notes: **Mid Channel (Channel 6)**

Test Data – Spurious Emissions Conducted

Data Plot **Antenna Port Spurious Emissions**

Page 3 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.247	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Tx Continuous data		



Notes: **Lowest Channel (Channel 1)**

Section 8. Spurious Emissions (radiated)

NAME OF TEST: Spurious Emissions (radiated)	PARA. NO.: 15.247 (c)
TESTED BY: David Light	DATE: 4/16/01

Test Results: Complies.

Measurement Data: See attached table.

Duty Cycle Calculation: No duty cycle was factored into the readings.

Duty Cycle correction factor(dB) = 20 log (rf_{ON} in ms/100ms)

Measurement Uncertainty: +/- 3.2 dB

Test Data – Spurious Emissions Radiated (Restricted Bands)

Radiated Emissions

Page 1 of 1

Job No.: 1L0136R — Date: 4/16/01
Specification: CFR 47, Part 15.247 — Temperature(°C): 22
Tested By: David Light — Relative Humidity(%) 50
E.U.T.: 802MIP Wireles LAN Combo
Configuration: Transmit Continuous data
Sample Number: S01
Location: AC 3 — RBW: 1 MHz
Detector Type: Peak — VBW: 30 kHz

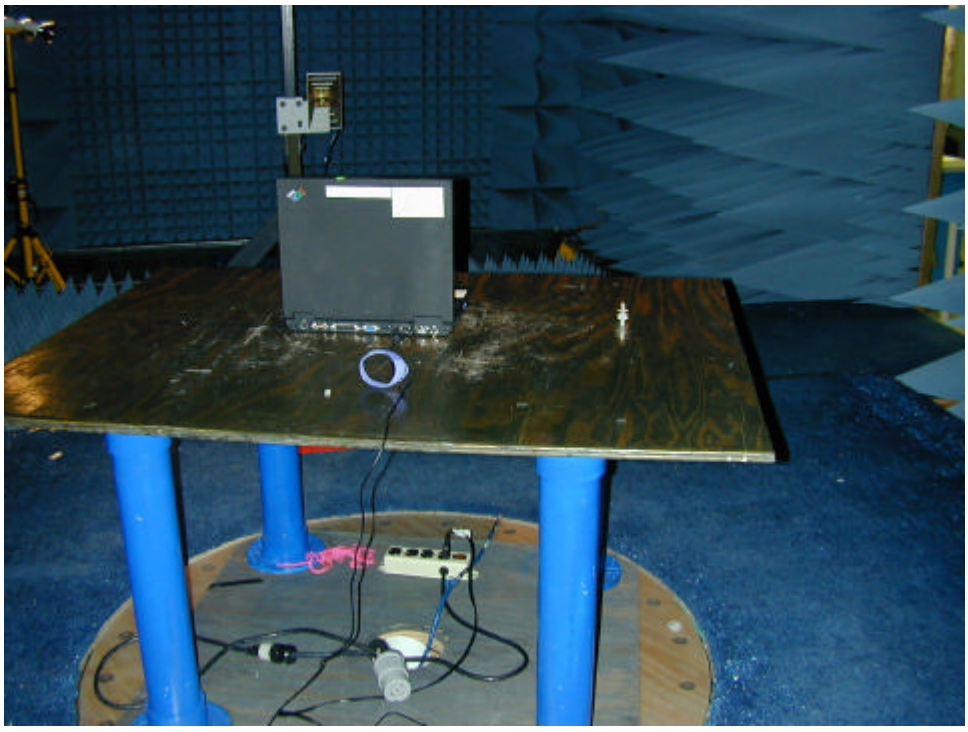
Test Equipment Used

Antenna: #N/A — Directional Coupler: #N/A
Pre-Amp: 1016 — Cable #1: 1484
Filter: 1482 — Cable #2: 1485
Receiver: 1464 — Cable #3: #N/A
Attenuator #1 #N/A — Cable #4: #N/A
Attenuator #2: #N/A — Mixer: #N/A
Measurement Uncertainty: #N/A

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
4.876	37.1	29	3.1	33.3	35.9	54	-18.1	Vertical - NF
7.314	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.19	38	39.6	7.3	36.7	48.2	54	-5.8	NF
4.876	37.1	29	3.1	33.3	35.9	54	-18.1	Horizontal - NF
7.314	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.19	38	39.6	7.3	36.7	48.2	54	-5.8	NF
2.4835	32	29	3.1	33.3	30.8	54	-23.2	Horizontal - NF - Bandedge
4.926	37.1	29	3.1	33.3	35.9	54	-18.1	NF
7.389	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.315	38	39.6	7.3	36.7	48.2	54	-5.8	NF
2.4835	42	29	3.1	33.3	40.8	54	-13.2	Vertical - NF - Bandedge
4.926	37.1	29	3.1	33.3	35.9	54	-18.1	NF
7.389	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.315	38	39.6	7.3	36.7	48.2	54	-5.8	NF
4.824	37.1	29	3.1	33.3	35.9	54	-18.1	Vertical - NF
7.24	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.06	38	39.6	7.3	36.7	48.2	54	-5.8	NF
4.824	37.1	29	3.1	33.3	35.9	54	-18.1	Horizontal - NF
7.24	36.5	35.9	5.3	33	44.7	54	-9.3	NF
12.06	38	39.6	7.3	36.7	48.2	54	-5.8	NF

Notes: No spurious emissions detected above noise floor

Photographs – Radiated Emissions



Section 9. Peak Power Spectral Density

NAME OF TEST: Peak Power Spectral Density	PARA. NO.: 15.247(d)
TESTED BY: David Light	DATE:4/16/01

Test Results: Complies.

Measurement Uncertainty: +/- 0.7 dB

Test Data – Peak Power Spectral Density

Data Plot **Peak Power Spectral density**

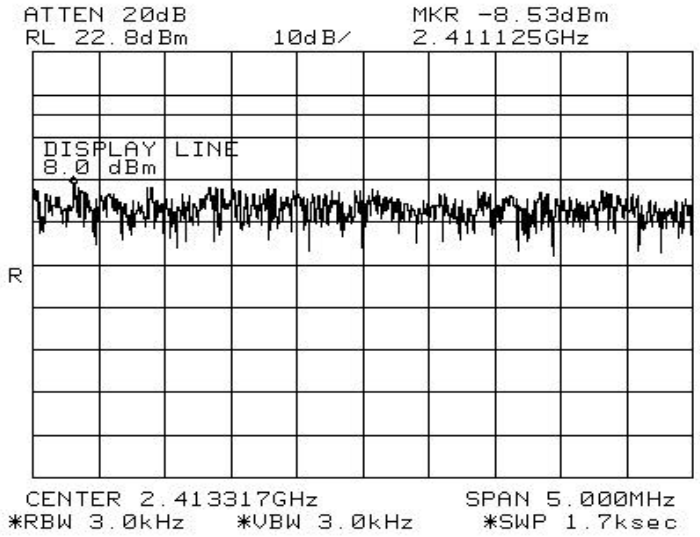
Page 1 of 3 | Complete X | Preliminary

Job No.: 1L0136R | Date: 4/16/01
Specification: 15.247 | Temperature(°C): 22
Tested By: David Light | Relative Humidity(%) 50
E.U.T.: 802MIP Wireless LAN Combo
Configuration: Tx Continuous Data
Sample Number: S01
Location: Lab 1 | RBW: 3 kHz | Measurement
Detector Type: Peak | VBW: 3 kHz | Distance: N/A m

Test Equipment Used

Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	1043
Filter:		Cable #2:	
Receiver:	1464	Cable #3:	
Attenuator #1		Cable #4:	
Attenuator #2:		Mixer:	

Additional equipment used:
Measurement Uncertainty: +/-3.6 dB



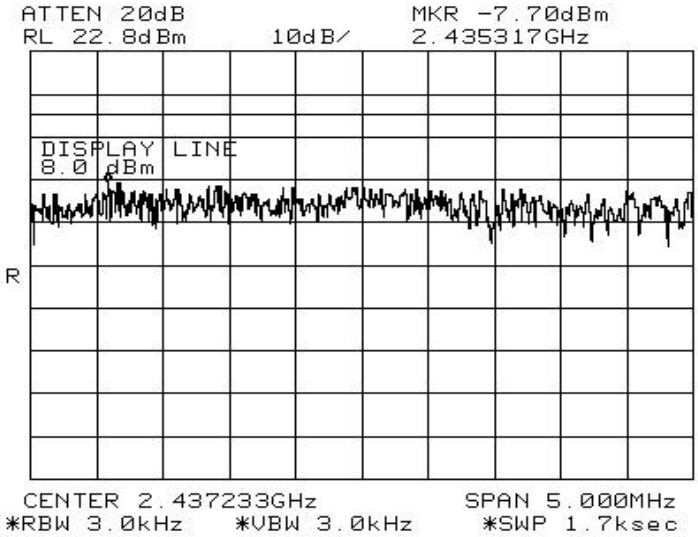
Notes: **Low Channel (Channel 1)**

Test Data – Peak Power Spectral Density

Data Plot Peak Power Spectral density

Page 2 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.2	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Tx Continuous Data		



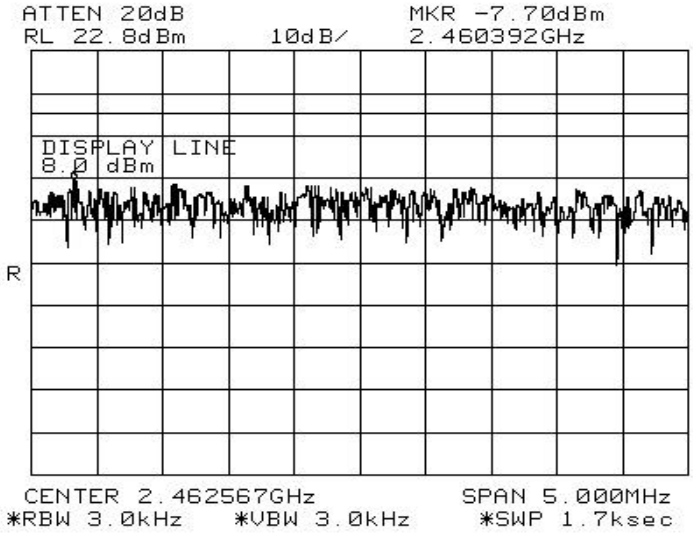
Notes: **Mid Band (Channel 6)**

Test Data – Peak Power Spectral Density

Data Plot Peak Power Spectral density

Page 3 of 3

Job No.:	1L0136R	Date:	4/16/01
Specification:	15.247	Temperature(°C):	22
Tested By:	David Light	Relative Humidity(%)	50
E.U.T.:	802MIP Wireless LAN Combo		
Configuration:	Tx Continuous Data		



Notes: **Highest Channel (Channel 11)**

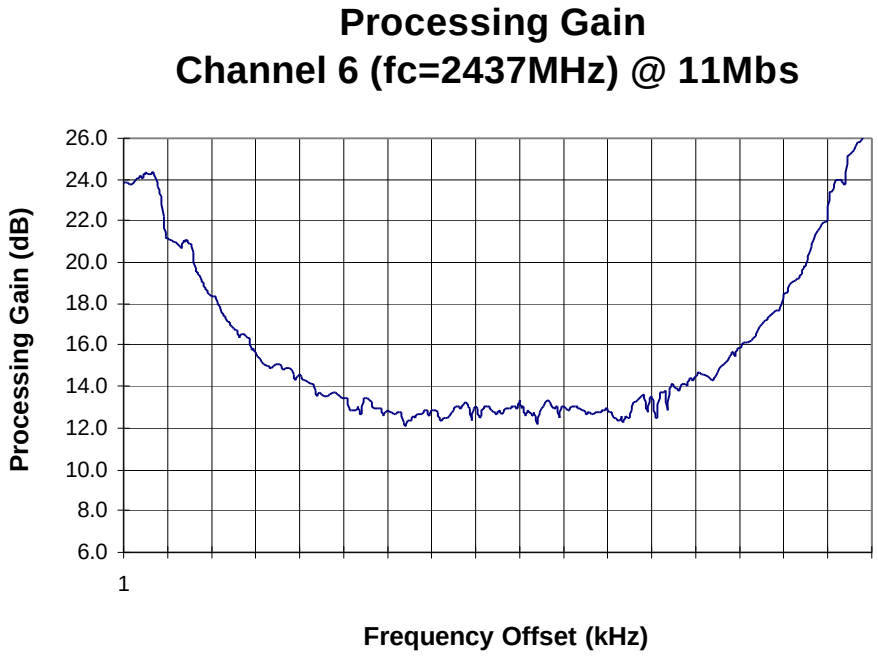
Section 10. Minimum Processing Gain

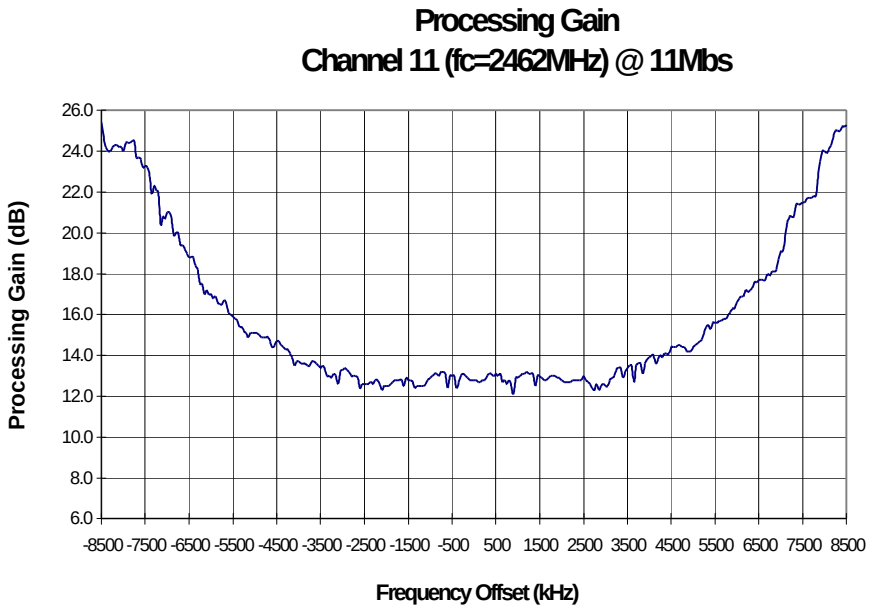
NAME OF TEST: Minimum Processing Gain	PARA. NO.: 15.247(e)
TESTED BY: Provided by client	DATE:

Test Results: Complies. The processing gain of the system is 12.6 dB.

Measurement Data: See attached data.

Processing Gain Graphs





Section 11. Test Equipment List

ASSET	Description	Manufacturer Model Number	Serial Number	Cal. Date	Cal. Due
1029	PEAK POWER METER	HP 8900D	3303U0012	03/12/01	03/12/02
1030	PEAK POWER SENSOR	HP 84811A	2539A03573	03/12/01	03/12/02
1464	Spectrum analyzer	Hewlett Packard 8563E	3551A04428	01/02/01	01/02/02
1043	Flexable cable 1m	Astrolab Inc. 32027-2-29094K-1M	0	01/29/01	01/29/02
1469	10 db Attenuator DC 18 Ghz	MCL Inc. BW-S10W2 10db-2WDC	NONE	CBU	N/A
704	FILTER, HIGH PASS, 5 KHz	SOLAR 7930-5.0	933126	11/04/00	11/04/01
1527	CABLE, 2.7M	KTL RG223	NA	08/30/00	08/30/01
1038	CABLE, .5m	KTL RG223	N/A	05/18/00	05/18/01
969	lisn	Schwarzbeck 8120	8120281	07/01/00	07/01/01
1016	AMPLIFIER	HEWLETT PACKARD 8449A	2749A00159	05/24/00	05/24/01
1482	Band Pass Filter	K & L 11SH10-4000/T12000-0/0	2	Cal B4 Use	N/A
1484	Cable 2.0-18.0 Ghz	Storm PR90-010-072	N/A	05/25/00	05/25/01
1485	Cable 2.0-18.0 Ghz	Storm PR90-010-216	N/A	05/25/00	05/25/01

ANNEX A - TEST DETAILS

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 250µV (48 dBµV) across 50 ohms.

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:

$$P = \frac{E^2R^2}{30G} = \frac{E^2 3^2}{30G}$$

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

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.

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

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

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:

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

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

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

E/N_o is $(S/N)_{out}$
for example, for a bit error rate of 10^{-4} a S/N ratio of 12.3 dB is required.

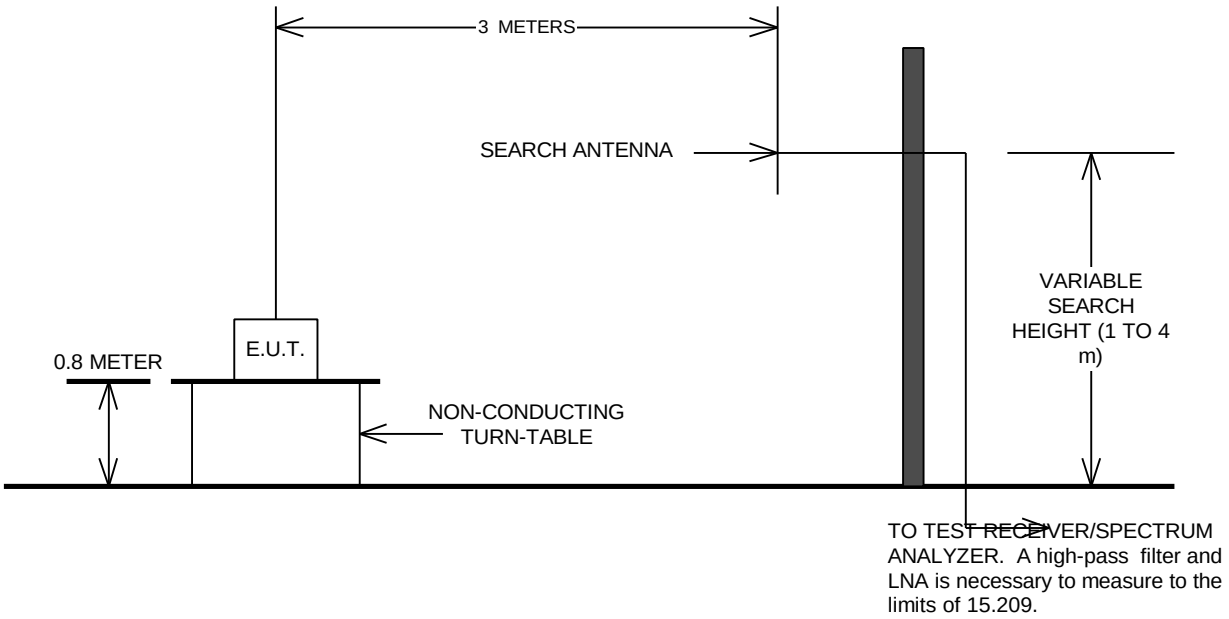
$L_{sys\ (system\ losses)}$ is assumed to be 2 dB.

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

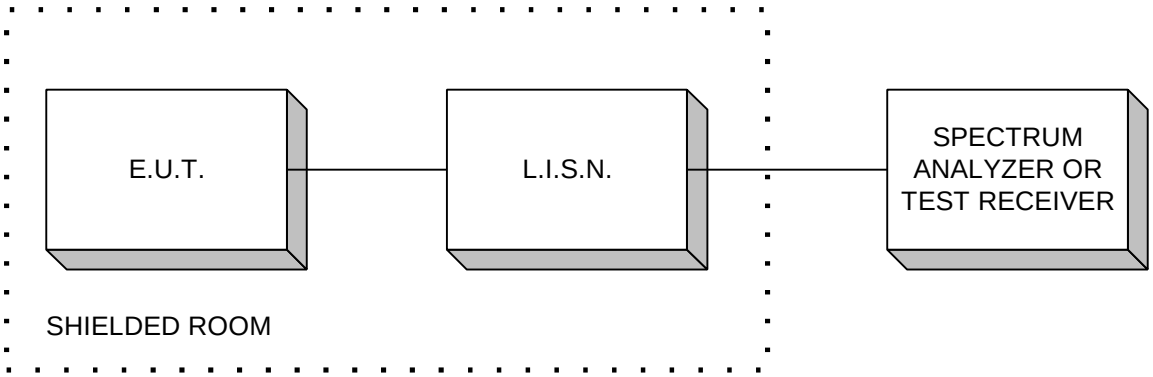
Measurement performed at a channel in the center of the operating band of the EUT.

ANNEX B - TEST DIAGRAMS

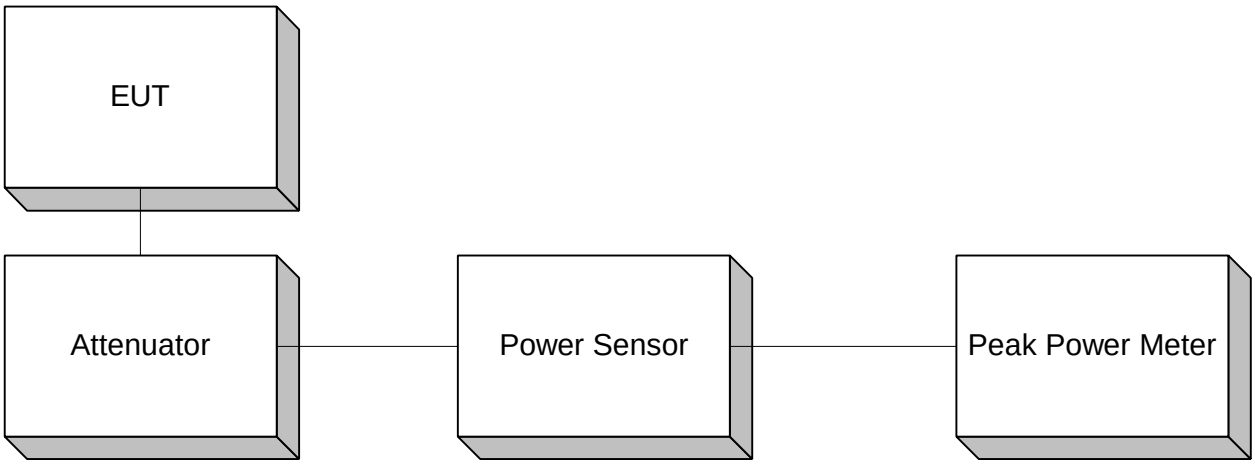
Test Site For Radiated Emissions



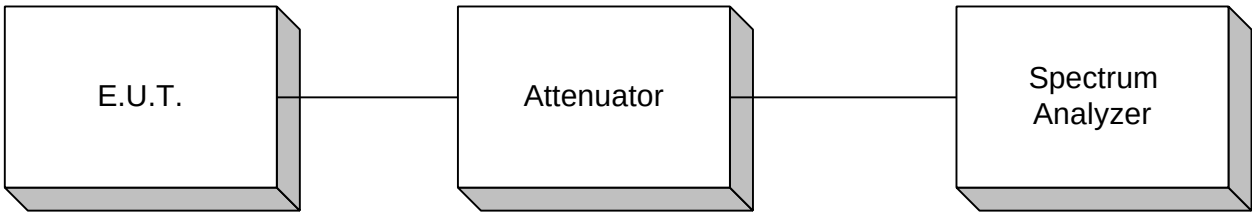
Conducted Emissions



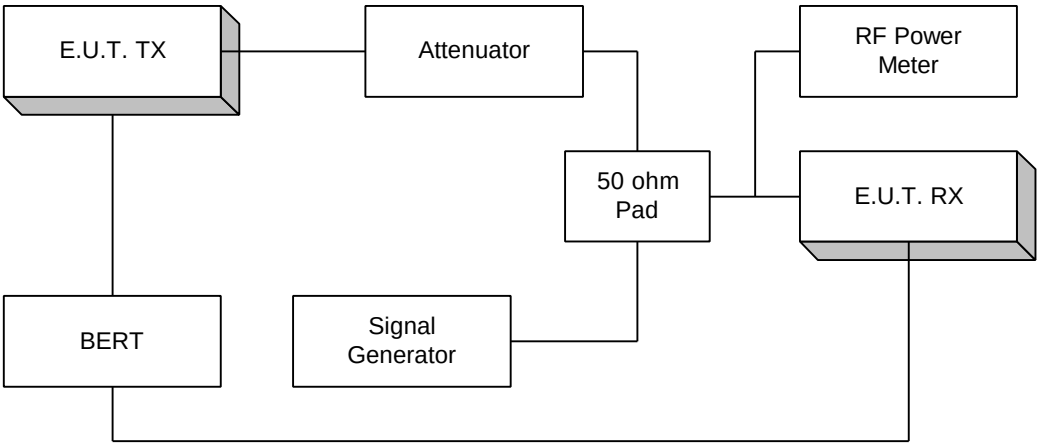
Peak Power At Antenna Terminals



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.