KTL Test Report:	9R02023
Applicant:	WiLAN Inc. 300-801 Manning Road, NE Calgary, Alberta T2E 8J5
Equipment Under Test: (E.U.T.)	OFDM 300-24
In Accordance With:	**FCC Part 15, Subpart C** Direct Sequence Transmitters 2400-2483.5 MHz
Tested By:	KTL Ottawa Inc. 3325 River Road, R.R. 5 Ottawa, Ontario K1V 1H2
Authorized By:	
	K. Carr, Technologist
Date:	
Total Number of Pages:	34

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Section 1. Summary Of Test Results

Manufacturer: WiLAN Inc.

Model No.: W-OFDM 300-24

Serial No.: W700007

Date Received In Laboratory: December 2, 1999

KTL Identification No.: Item #1

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 15, Subpart C, Paragraph 15.247 for Direct Sequence Spread Spectrum devices.

☒	New Submission	☒	Production Unit
☐	Class II Permissive Change	☐	Pre-Production Unit
☐☐☐	Equipment Code	☐	Family Listing

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: 100351-0

TESTED BY: _____ DATE: _____
Glen Westwell, Technologist

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	RESULT
Powerline Conducted Emissions	15.207 (a)	48 dBμV	Complies
Occupied Bandwidth	15.247 (a)(2)	≥500 kHz	Complies
Peak Power Output	15.247 (b)	1 watt	Complies
Spurious Emissions (Antenna Conducted)	15.247 (c)	-20 dBc	Complies
Spurious Emissions (Radiated)	15.247 (c)	Table 15.209 (a)	Complies
Transmitter Power Density	15.247 (d)	≤ +8 dBm	Complies
Processing Gain	15.247 (e)	≥ 10 dB	To Be Supplied By Customer

Footnotes For N/A's:

Test Conditions:

Indoor Temperature: 20 °C
Humidity: 25 %

Outdoor Temperature: 5.5 °C
Humidity: 31 %

Section 2. General Equipment Specification

Transmitter

Power Input:	120 VAC/60 Hz, 240 VAC/50 Hz
Frequency Range:	2415 – 2465 MHz
Tunable Bands:	1
Number of Channels:	3
6 dB Bandwidth:	14.3 MHz
Type of Modulation	Combined Direct Sequence Spread Spectrum & Wide Band Orthogonal Frequency Division Multiplexing (W-OFDM)
Data Rate:	30 Mbps
Internal / External Data Source:	Internal
Emissions Designator:	23M2F1D
Output Impedance:	50 ohms
RF Power Output (Rated):	20 dBm
Power Output Adjustment Capability:	None

Theory of Operation

The I.WILL 300-24 Access Point (300-24) is the first Wi-LAN product based on the Wide-Band Orthogonal Frequency Division Multiplexing (W-OFMD) technology. With a peak data rate of 30 Mbps in 25 MHz of bandwidth. The Dynamic Time Allocation technique allocates variable time slots to busy stations when needed. Valuable bandwidth is not wasted allocated time to idle stations.

The 300-24 operates in the 2.4 – 2.4835 GHz license-exempt ISM band allowing you to provide wireless networking connectivity at a fraction of the wire, cable or fibre networking costs. The user can manager, configure and monitor the entire wireless network through the RS-232 management port, SNMP or telnet.

The I.WILL 300-24 Access Point (300-24) is a multi-point product that allows wireless connection of remote computers or LAN segments at signaling rates up to 30 Mbps. The unit is self-contained and easy to use. You do not need installation disks or software drivers to get started. The user connects the 300-24 to each LAN segment.

W-OFDM

Wide-band Orthogonal Frequency Division Multiplexing. A transmission scheme that encodes data inside a radio frequency signal. OFDM sends a high-speed signal concurrently on different frequencies. This allows for very efficient use of bandwidth and provides for robust communications that can transmit through interference such as occurring noise and stray and reflecting signals, that can encumber radio communications.

Section 3. Powerline Conducted Emissions

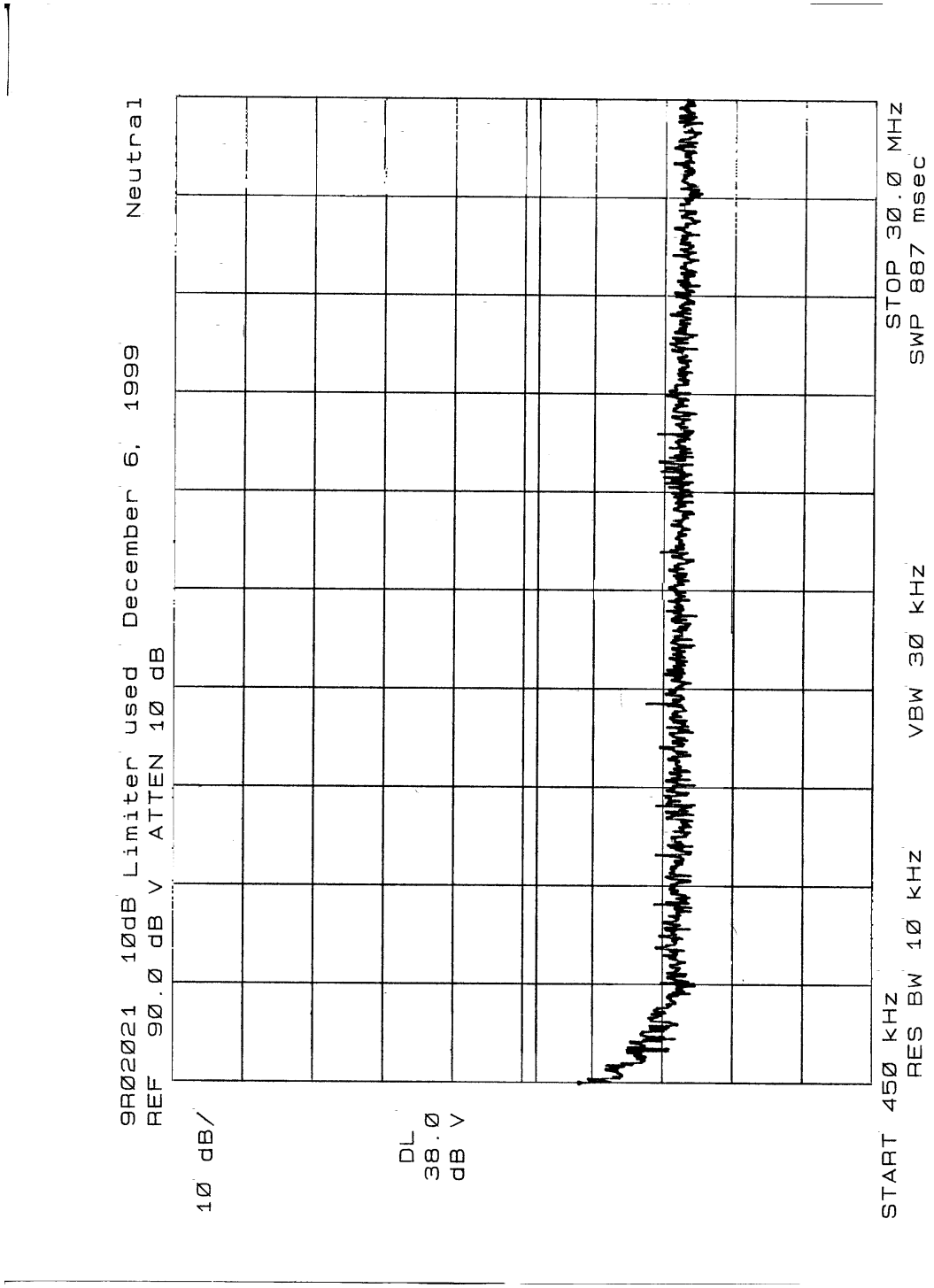
NAME OF TEST: Powerline Conducted Emissions	PARA. NO.: 15.207(a)
TESTED BY: Glen Westwell	DATE: December 6, 1999

Test Results: Complies. See attached graph.

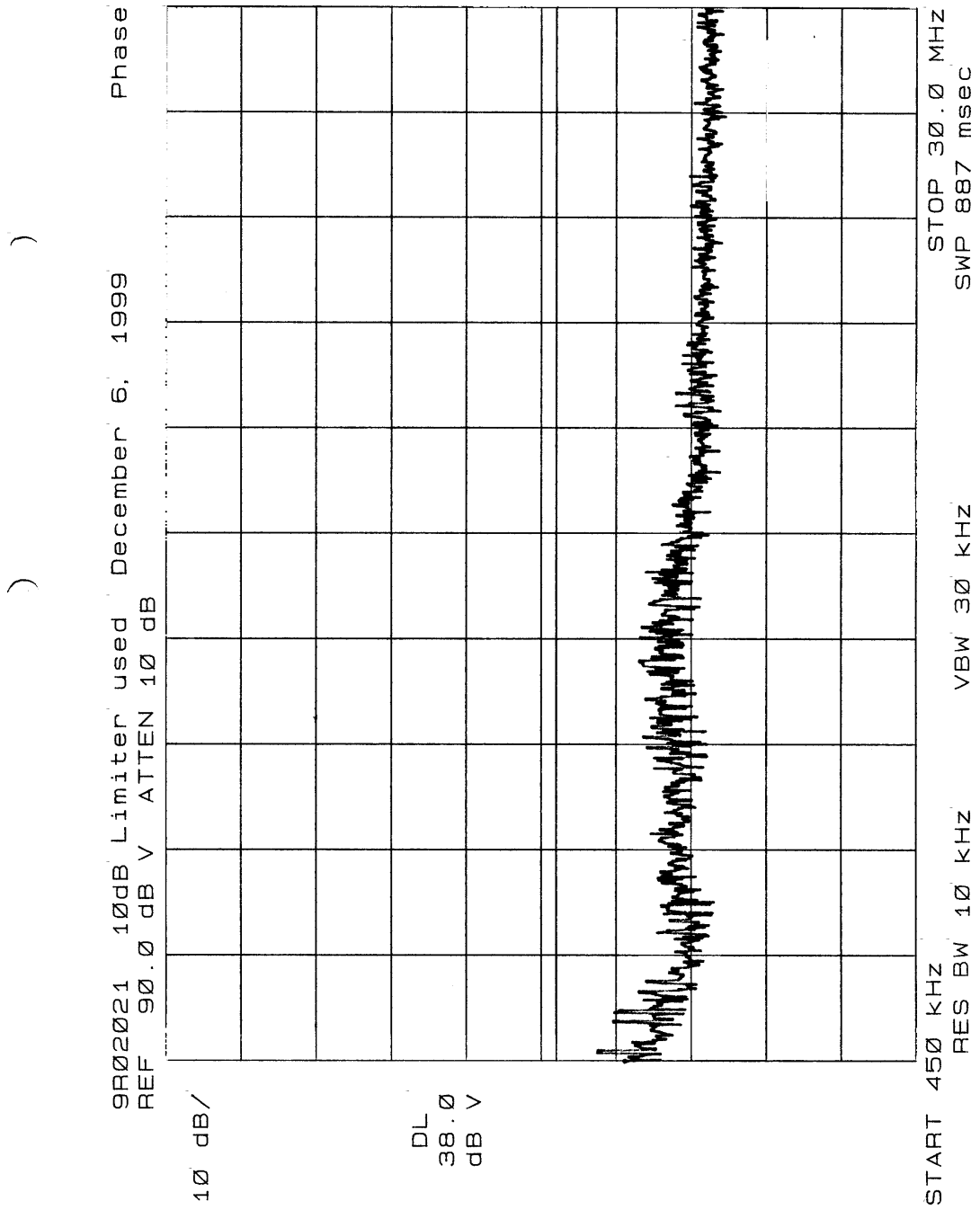
Measurement Data: See attached graph.

Conductor	Frequency (MHz)	CISPR (dBµV)	Average (dBµV)
Neutral	0.450	37.2	36.3
Phase	0.675	32.4	31.2
	1.54	29.6	24.4
	1.84	31.8	28.1

Neutral


9R02021 10dB Limiter used December 6, 1999 Neutral
REF 90.0 dB V ATTEN 10 dB
10 dB/
DL
38.0
dB V
START 450 kHz
RES BW 10 kHz
VBW 30 kHz
STOP 30.0 MHz
SWP 887 msec

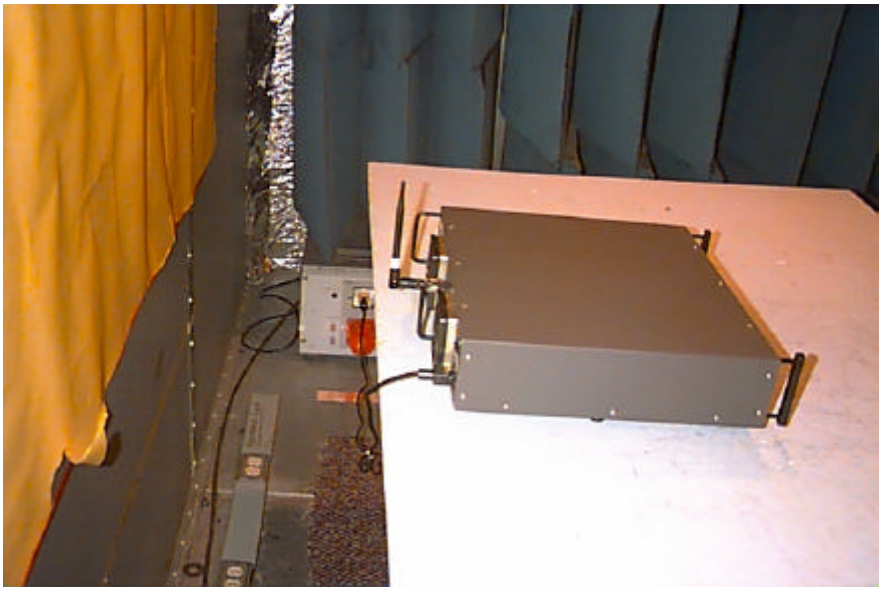
Phase


Phase
9R02021 10dB Limiter used December 6, 1999
REF 90.0 dB V ATTEN 10 dB
10 dB/
DL
38.0
dB V
START 450 kHz
RES BW 10 kHz
VBW 30 kHz
STOP 30.0 MHz
SWP 887 msec

Conducted Photographs

Front View

Side View

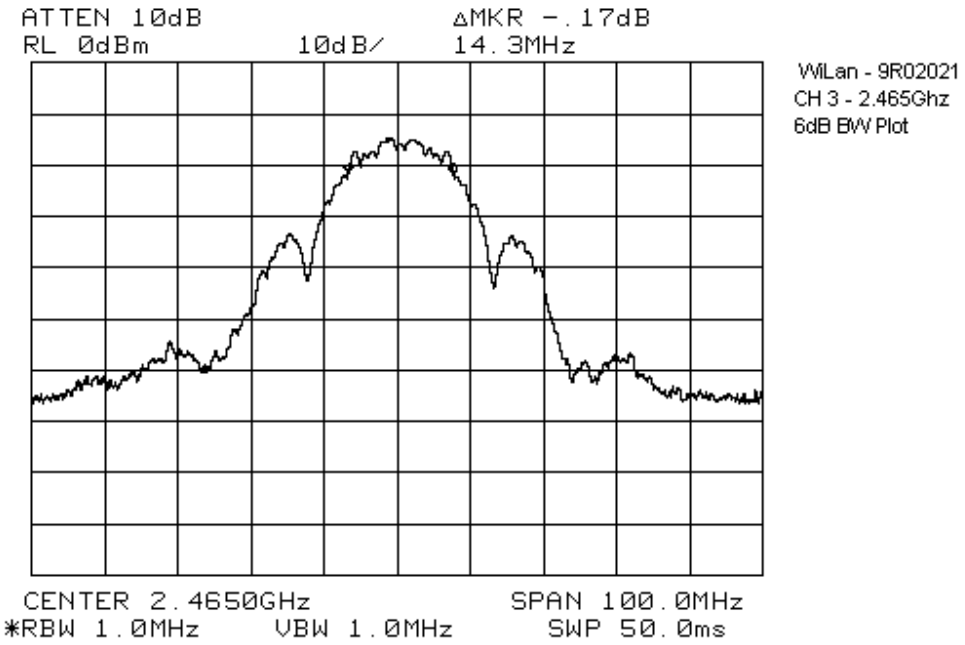


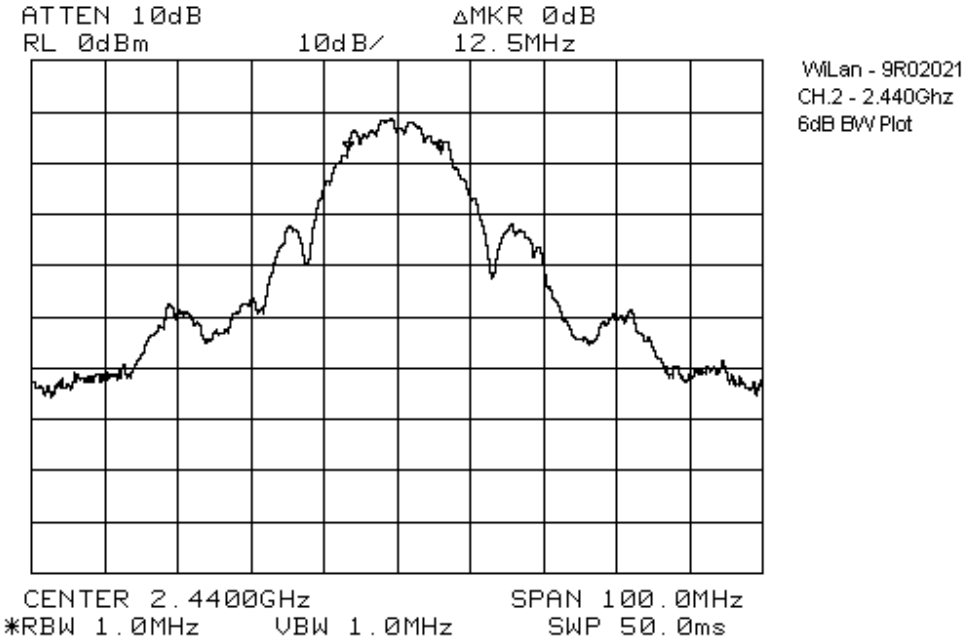
Section 4. Occupied Bandwidth

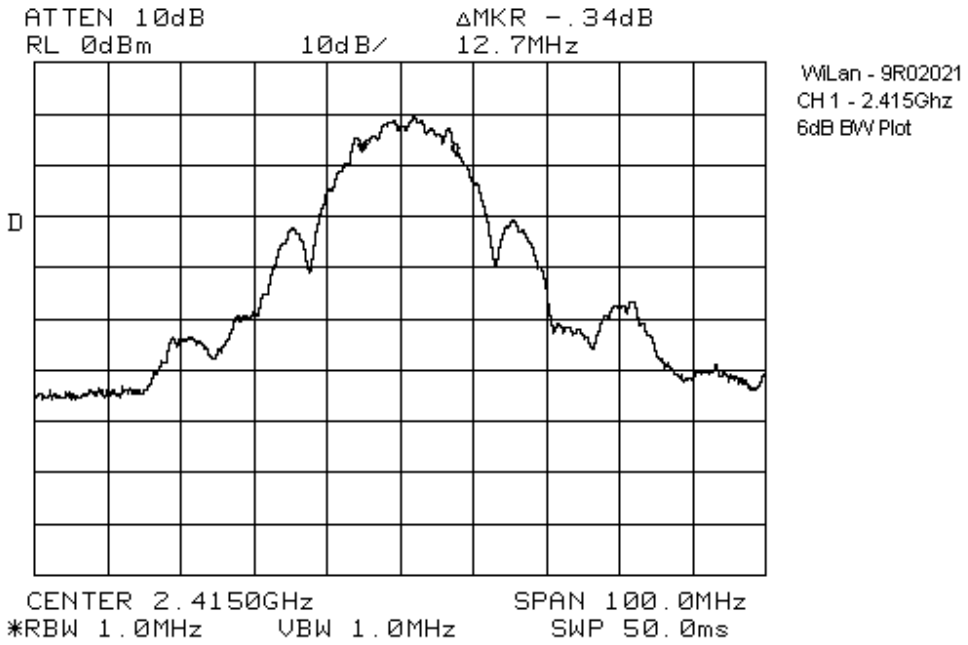
NAME OF TEST: Occupied Bandwidth	PARA. NO.: 15.247(a)(2)
TESTED BY: Glen Westwell	DATE: December 3, 1999

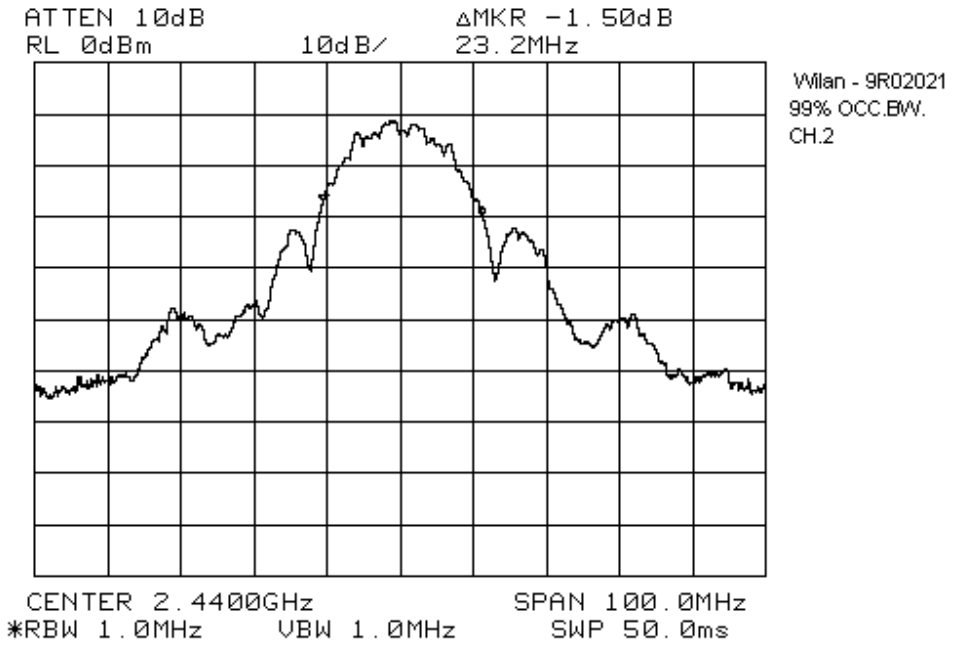
Test Results: Complies. The 6 dB bandwidth is 14.3 MHz.
See attached graph.

Measurement Data: See attached graph.


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -.17dB
14.3MHz
WiLan - 9R02021
CH 3 - 2.465Ghz
6dB BW Plot
CENTER 2.4650GHz
SPAN 100.0MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR 0dB
12.5MHz
WiLan - 9R02021
CH.2 - 2.440Ghz
6dB BW Plot
CENTER 2.4400GHz
SPAN 100.0MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -.34dB
12.7MHz
D
CENTER 2.4150GHz
SPAN 100.0MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms
WiLan - 9R02021
CH 1 - 2.415Ghz
6dB BW Plot

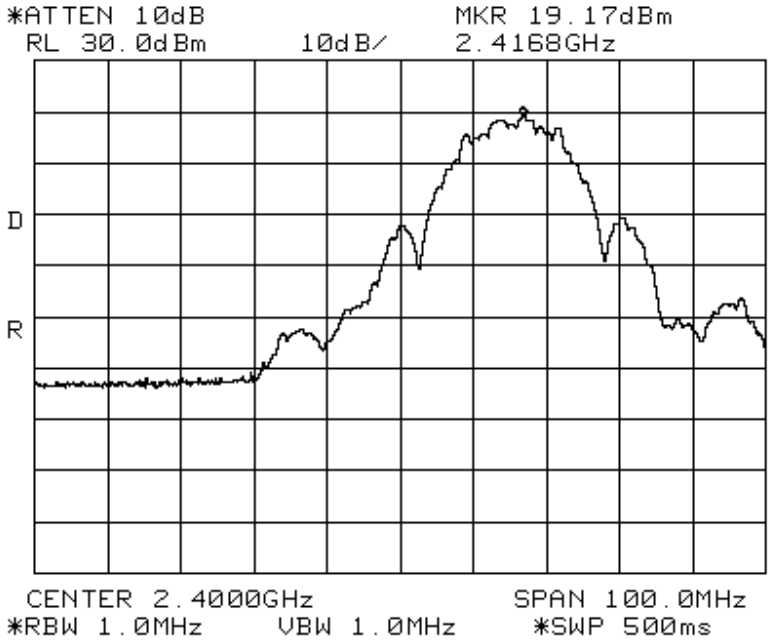

ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -1.50dB
23.2MHz
Wlan - 9R02021
99% OCC.BW.
CH.2
CENTER 2.4400GHz
SPAN 100.0MHz
*RBW 1.0MHz
VBW 1.0MHz
SWP 50.0ms

Section 5. Peak Power Output

NAME OF TEST: Peak Power Output	PARA. NO.: 15.247 (b)
TESTED BY: Glen Westwell	DATE: December 3, 1999

Test Results: Complies. The maximum peak power output of the transmitter is 0.082 watts

Measurement Data: Detachable antenna? ☒ Yes ☐ No
If yes, state the type of non-standard connector used at the antenna port: N-Type

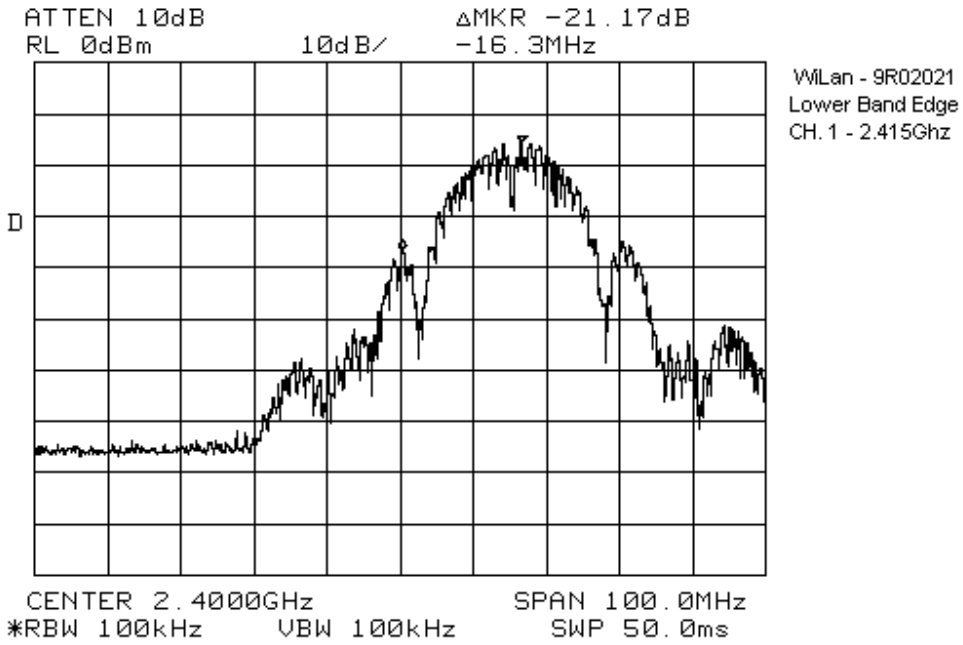

*ATTEN 10dB
MKR 19.17dBm
RL 30.0dBm
10dB/
2.4168GHz
D
R
CENTER 2.4000GHz
SPAN 100.0MHz
*RBW 1.0MHz
VBW 1.0MHz
*SWP 500ms

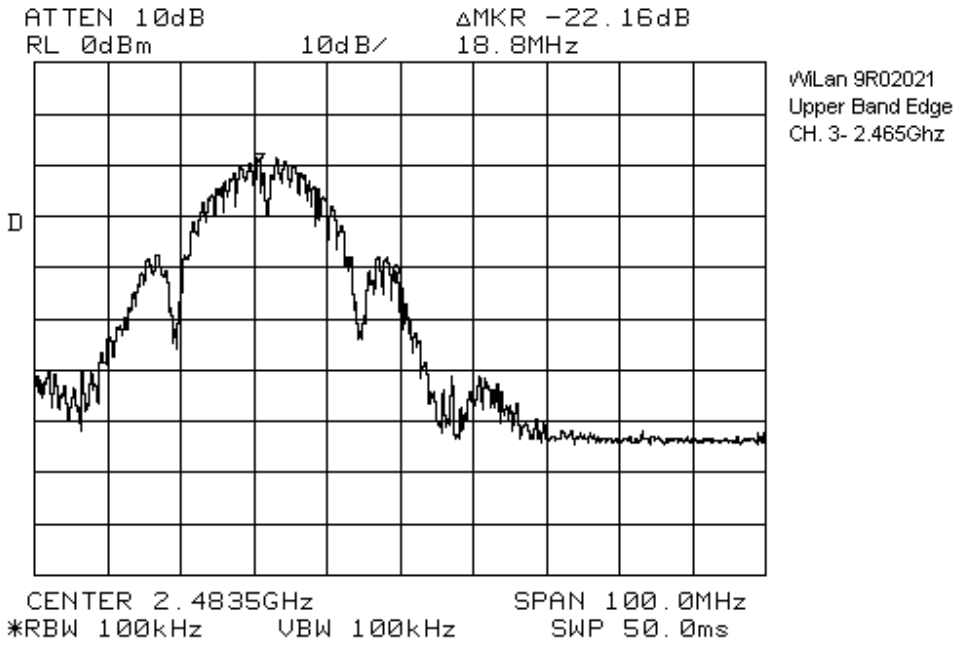
Section 6. Spurious Emissions (Antenna Conducted)

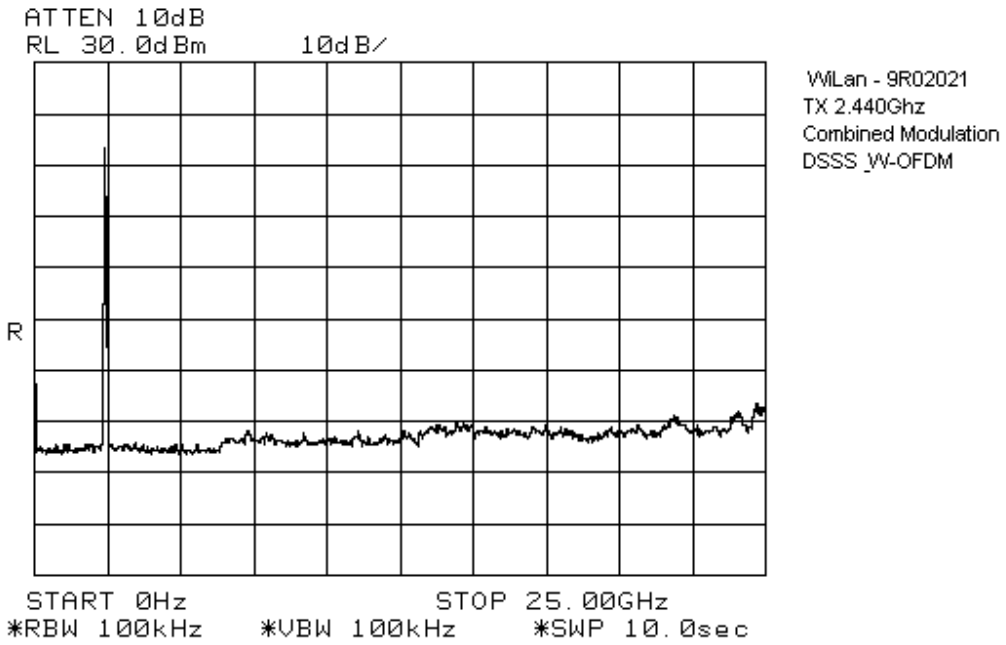
NAME OF TEST: Spurious Emissions (Antenna Conducted)	PARA. NO.: 15.247(c)
TESTED BY: Glen Westwell	DATE: December 3, 1999

Test Results: Complies.

Measurement Data: See attached graphs.


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -21.17dB
-16.3MHz
WiLan - 9R02021
Lower Band Edge
CH. 1 - 2.415Ghz
D
CENTER 2.4000GHz
SPAN 100.0MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms


ATTEN 10dB
RL 0dBm
10dB/
ΔMKR -22.16dB
18.8MHz
D
CENTER 2.4835GHz
SPAN 100.0MHz
*RBW 100kHz
VBW 100kHz
SWP 50.0ms
WiLan 9R02021
Upper Band Edge
CH. 3- 2.465Ghz


ATTEN 10dB
RL 30.0dBm
10dB/
R
START 0Hz
STOP 25.00GHz
*RBW 100kHz
*VBW 100kHz
*SWP 10.0sec
WiLan - 9R02021
TX 2.440Ghz
Combined Modulation
DSSS _W-OFDM

Section 7. Spurious Emissions (Radiated)

NAME OF TEST: Spurious Emissions (Radiated)	PARA. NO.: 15.247(c)
TESTED BY: Glen Westwell	DATE: December 7, 1999

Test Results: Complies. The worst-case emission level is 49.7 dBµV/m @ 3m at 7320MHz. This is 4.3 dB below the specification limit.

Measurement Data: See attached graphs.

Test Data - Radiated Emissions (PEAK)

Test Distance (meters) : 3		Range: A Tower		Receiver: 8564		RBW 1 MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle Corr.	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Channel 1: Fundamental											
2415		V			81.8	31.4			113.2	131.0	17.8
2415		H			86.0	31.4			117.4	131.0	13.6
Channel 1: Harmonics											
4830		V			60.1	38.5	-44.1		54.5	74.0	19.5
4830		H			62.4	38.5	-44.1		56.8	74.0	17.2
7245		V			59.2	44.6	-42.3		61.5	74.0	12.5
7245		H			61.3	44.6	-42.3		63.6	74.0	10.4
Channel 2: Fundamental											
2440		V			76.2	31.3			107.5	131.0	23.5
2440		H			85.8	31.3			117.1	131.0	13.9
Channel 2: Harmonics											
4880		V			62.3	38.7	-44.3		56.7	74.0	17.3
4880		H			61.3	38.7	-44.3		55.7	74.0	18.3
7350		V			64.9	44.8	-42.2		67.5	74.0	6.5
7350		H			60.3	44.8	-42.2		62.9	74.0	11.1
Channel 3: Fundamental											
2465		V			72.3	31.4			103.7	131.0	27.3
2465		H			82.3	31.4			113.7	131.0	17.3
Channel 3: Harmonics											
4930		V			56.8	38.9	-44.4		51.3	74.0	22.7
4930		H			63.0	38.9	-44.4		57.5	74.0	16.5
7395		V			49.2	44.9	-42.1		52.0	74.0	22.0
7395		H			51.8	44.9	-42.1		54.6	74.0	19.4

Notes:
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.
No emissions detected above 7395 MHz. The spectrum analyzer noise floor was 20 dB below the limit.

Test Data - Radiated Emissions (AVERAGE)

Test Distance (meters) : 3		Range: A Tower		Receiver: 8564		RBW 1 MHz		Detector: Peak			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Duty Cycle Corr.	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Channel 1: Harmonics – Restricted Bands											
4830		V			42.8	38.5	-44.1		37.2	54.0	16.8
4830		H			44.2	38.5	-44.1		38.6	54.0	15.4
Channel 2: Harmonics – Restricted Bands											
4880		V			46.2	38.7	-44.3		40.6	54.0	13.4
4880		H			47.8	38.7	-44.3		42.2	54.0	11.8
7320		V			47.1	44.8	-42.2		49.7	54.0	4.3
7320		H			41.3	44.8	-42.2		43.9	54.0	10.1
Channel 3: Harmonics – Restricted Bands											
4930		V			41.2	38.9	-44.4		35.7	54.0	18.3
4930		H			47.3	38.9	-44.4		41.8	54.0	12.2
7395		V			35.0	44.9	-42.2		37.8	54.0	16.2
7395		H			38.2	44.9	-42.2		41.0	54.0	13.0

Notes:
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Re-measured using dipole antenna.
** Includes cable loss when amplifier is not used.
*** Includes cable loss.
( ) Denotes failing emission level.
No emissions detected above 7395 MHz. The spectrum analyzer noise floor was >20 dB below the limit.

Radiated Photographs

Front View

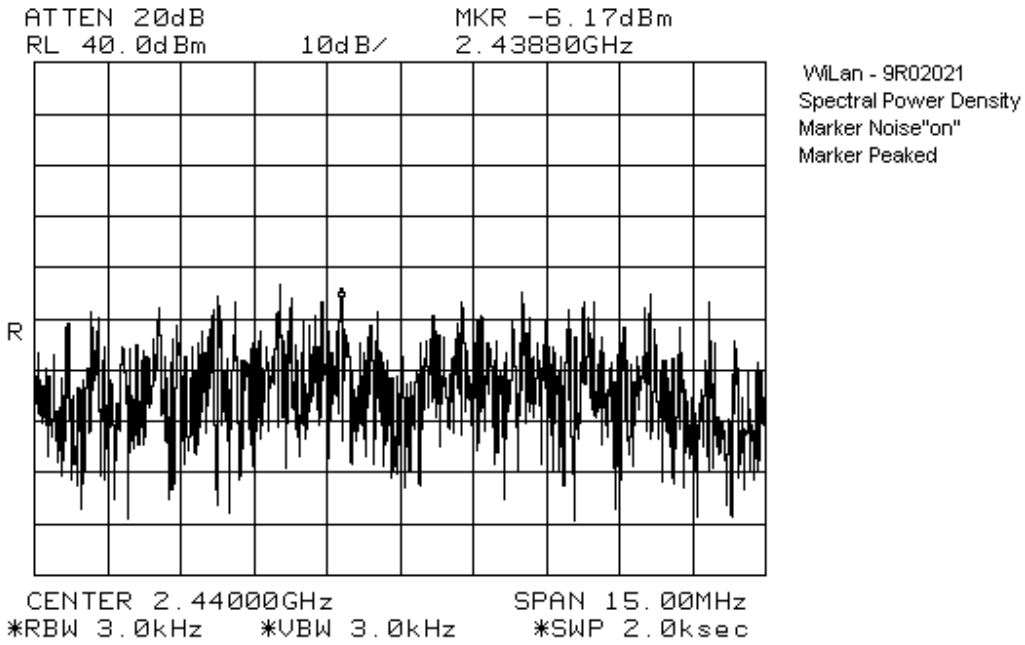
Side View

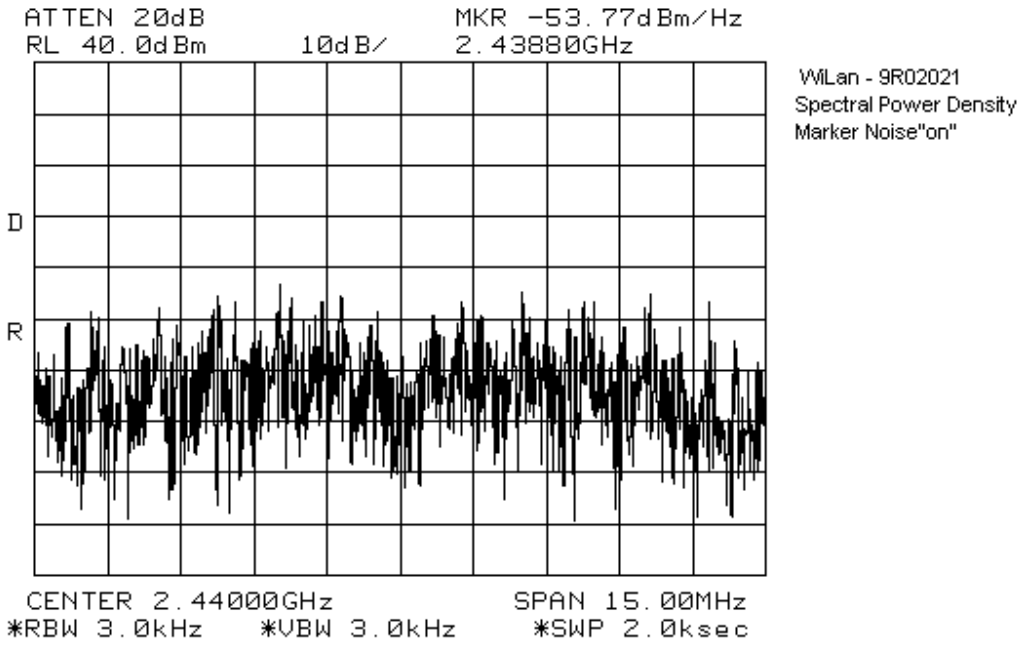
Section 8. Transmitter Power Density

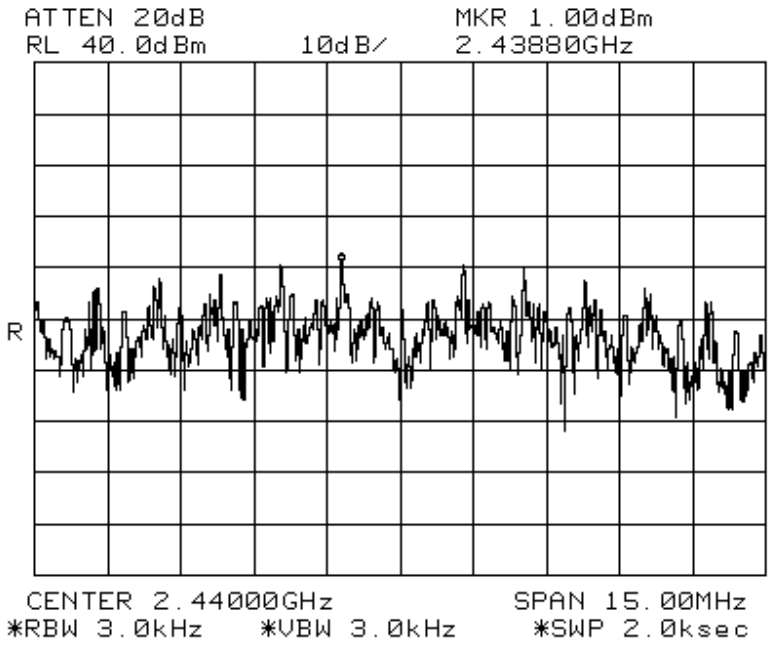
NAME OF TEST: Transmitter Power Density	PARA. NO.: 15.247(d)
TESTED BY: Glen Westwell	DATE: December 6, 1999

Test Results: Complies.

Measurement Data: See attached graphs.


ATTEN 20dB
RL 40.0dBm
10dB/
MKR -6.17dBm
2.43880GHz
R
CENTER 2.44000GHz
SPAN 15.00MHz
*RBW 3.0kHz
*VBW 3.0kHz
*SWP 2.0ksec
WiLan - 9R02021
Spectral Power Density
Marker Noise"on"
Marker Peaked


ATTEN 20dB
RL 40.0dBm
10dB/
MKR -53.77dBm/Hz
2.43880GHz
D
R
CENTER 2.44000GHz
SPAN 15.00MHz
*RBW 3.0kHz
*VBW 3.0kHz
*SWP 2.0ksec
WiLan - 9R02021
Spectral Power Density
Marker Noise"on"



WiLan - 9R02021
Power Spectral Density
30dB Attenuation TX to S/A

Section 9. Processing Gain

NAME OF TEST: Processing Gain	PARA. NO.: 15.247(e)
TESTED BY: To Be Supplied By Customer	DATE:

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

Measurement Data: See attached data.

BER:
S/N_{out}:
J/S Ratio:
L_{sys}:

Section 10. Test Equipment List

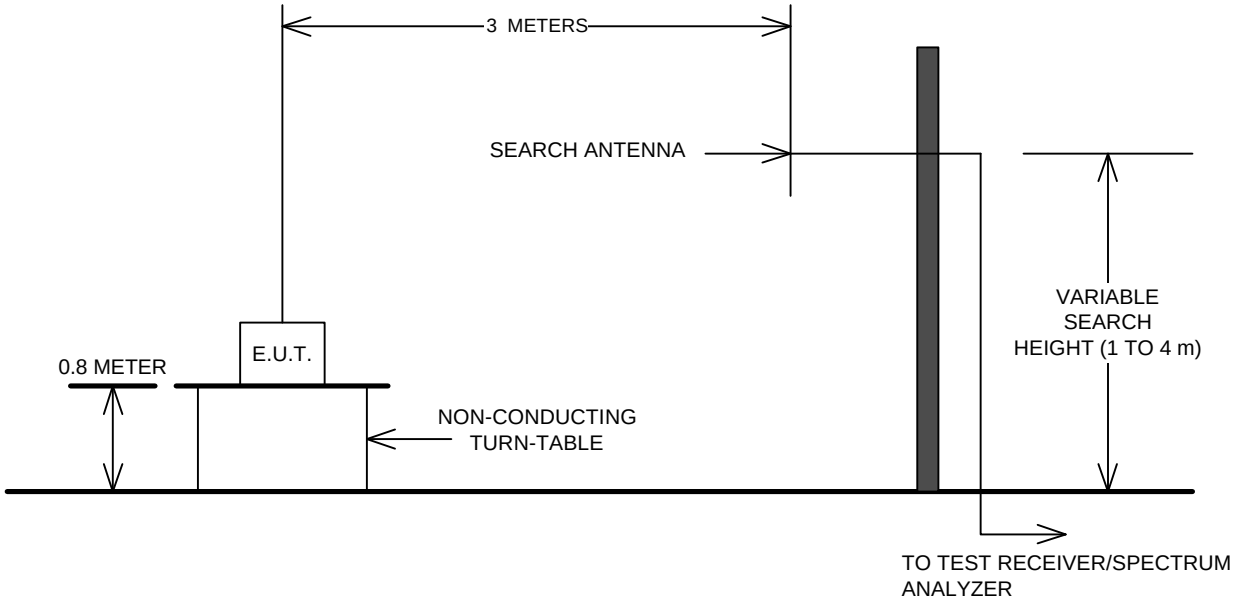
CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.
1 Year	Spectrum Analyzer	Hewlett Packard	8564E	3846A01407	May 31/99	May 31/00
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	June 16/99	June 16/00
1 Year	Spectrum Analyzer-**1**	Hewlett Packard	8566B	2311A02238	Nov. 6/99	Nov. 6/00
1 Year	Spectrum Analyzer Display-**1**	Hewlett Packard	8566B	2314A04759	Nov. 6/99	Nov. 6/00
1 Year	Quasi-peak adapter-**1**	Hewlett-Packard	85650A	2043A00302	Nov. 11/99	Nov. 11/00
1 Year	Attenuator	Narda	768-10	9709	Oct. 8/99	Oct. 8/00
1 Year	Attenuator	Narda	776B-20	FA001400	Oct. 15/99	Oct. 15/00
1 Year	LISN	Rohde & Schwarz	ESH2-Z5	890485/017	Aug. 24/99	Aug. 24/00
1 Year	Receiver	Rohde & Schwarz	ESH3	872079/053	Oct. 5/99	Oct. 5/00
2 Year	Horn Antenna	EMCO #2	3115	4336	Nov. 11/99	Nov. 11/00
1 Year	Low Noise Amplifier	Avantek	AWT-8035	1005	Sept. 20/99	Sept. 20/00
1 Year	Plotter	Hewlett Packard	7550A	FA001129	NCR	NCR

NA: Not Applicable
NCR: No Cal Required
COU: CAL On Use

ANNEX A

BLOCK DIAGRAMS

Test Site For Radiated Emissions

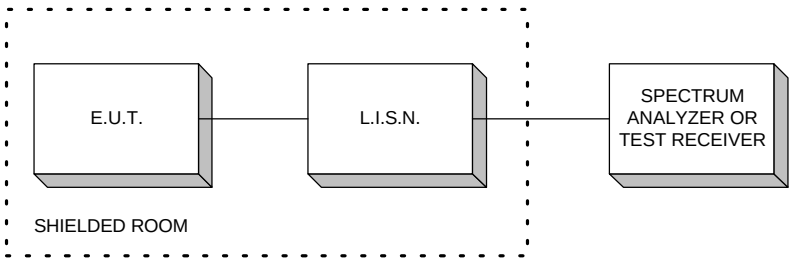


Below 1 GHz
Peak detector.
RBW = 100 kHz

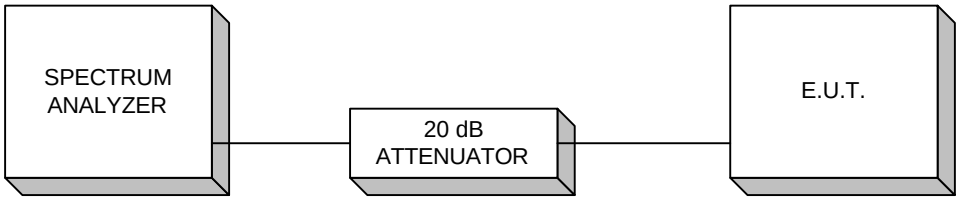
Above 1 GHz For Peak Emission Levels
Peak detector
RBW = 1 MHz
VBW = >RBW

Above 1 GHz For Average Emission Levels
Peak detector
RBW = 1 MHz
VBW = 10 Hz

Conducted Emissions

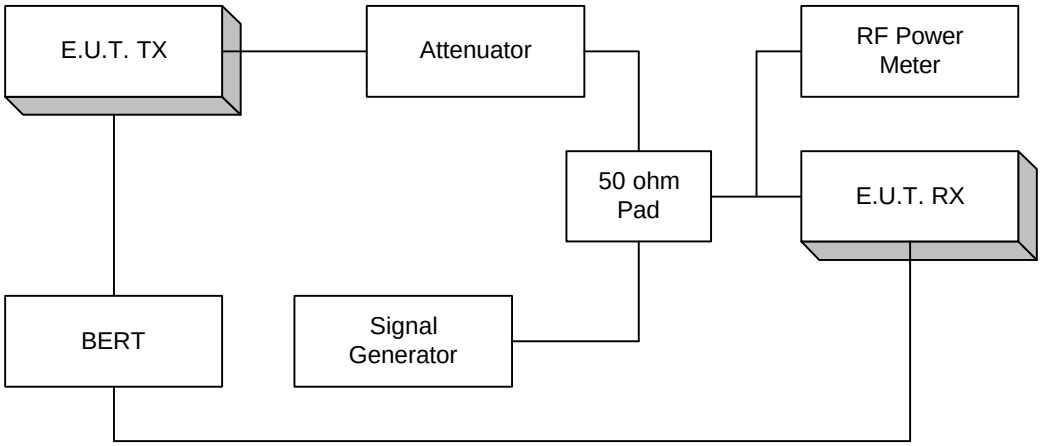


Transmitter Power Density & Peak Power At Antenna Terminals



If the E.U.T. has an integral (non-detachable) antenna, the above test is performed as a radiated measurement and the result is reported as EIRP.

Processing Gain



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