UltraTech
Group of Labs

31040/SIT

C-1376

Canada
46390-2049

200093-0

00-034

3000 Bristol Circle,
Oakville, Ontario,
Canada L6H 6G4

Tel.: (905) 829-1570
Fax: (905) 829-8050

Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

June 10, 2002

TIMCO ENGINEERING INC.
P O BOX 370
849 N.W. STATE ROAD 45
NEWBERRY, FLORIDA
USA 32669

Subject: FCC Certification Authorization Application under FCC PART 15, Subpart E - Unlicensed National Information Infrastructure Devices operating in the frequency band 5.725-5.825 GHz.

Product: ACCESS NODE
Model No.: AN-50
FCC ID: QC8-AN50

Dear Sir/Madam

As appointed agent for REDLINE COMMUNICATIONS INC., we would like to submit the application to FCC for certification of the above product. Please review all necessary files uploaded to TIMCO UPLOAD SITE site for detailed information.

Grant Limitation: This device requires professional installation. The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P. Eng.,
V.P., Engineering

Encl

UltraTech
Group of Labs

31040/SIT

C-1376

46390-2049

200093-0

00-034

3000 Bristol Circle,
Oakville, Ontario,
Canada L6H 6G4

Tel.: (905) 829-1570
Fax.: (905) 829-8050

Website: www.ultratech-labs.com
Email: vic@ultratech-labs.com

June 10, 2002

REDLINE COMMUNICATIONS INC.
90 Tiverton Court, Suite 102
Markham, Ontario
Canada, L3R 9V2

Attn.: Mr. Marin Stan

Subject: FCC Certification Application Testing under FCC PART 15, Subpart E - Unlicensed National Information Infrastructure Devices operating in the frequency band 5.725-5.825 GHz.

Product: ACCESS NODE
Model No.: AN-50
FCC ID: QC8-AN50

Dear Mr. Stan,

The product sample, as provided by you, has been tested and found to comply with **FCC PART 15, Subpart E - Unlicensed National Information Infrastructure Devices operating in the frequency band 5.725-5.825 GHz.**

Grant Limitation: This device requires professional installation. The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Enclosed you will find copies of the engineering report. If you have any queries, please do not hesitate to contact us.

Yours truly,

Tri Minh Luu, P. Eng.,
V.P., Engineering

Encl

ENGINEERING TEST REPORT

ACCESS NODE
Model No.: AN-50

FCC ID: QC8-AN50

Applicant: **REDLINE COMMUNICATIONS INC.**
90 Tiverton Court, Suite 102
Markham, Ontario
Canada, L3R 9V2

In Accordance With

FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART E
Unlicensed National Information Infrastructure Devices
operating in: 5.725-5.825 GHz

UltraTech's File No.: RCI-002FCC15E

This Test report is Issued under the Authority of Tri M. Luu, Professional Engineer, Vice President of Engineering UltraTech Group of Labs Date: June 03, 2002	
Report Prepared by: Tri M. Luu Issued Date: June 10, 2002	Tested by: Hung Trinh, RFI Technician Test Dates: May 28-June 10, 2002

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- *This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

UltraTech

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4
Tel.: (905) 829-1570 Fax.: (905) 829-8050
Website: www.ultratech-labs.com Email: vic@ultratech-labs.com, Email: tri.luu@sympatico.ca

FC	VCCI	Canada	NVLAP	IT	UL	entela
31040/SIT	C-1376	46390-2049	200093-0	00-034		

TABLE OF CONTENTS

EXHIBIT 1. SUBMITTAL CHECK LIST

Annex No.	Exhibit Type	Description of Contents	Quality Check (OK)
	Test Report	• Exhibit 1: Submittal check lists • Exhibit 2: Introduction • Exhibit 3: Performance Assessment • Exhibit 4: EUT Operation and Configuration during Tests • Exhibit 5: Summary of test Results • Exhibit 6: Measurement Data • Exhibit 7: Measurement Uncertainty • Exhibit 8: Measurement Methods	OK
1	Test Report - Plots of Measurement Data	Plots # 1 to 121	OK
2	Test Setup Photos	Photos # 1 to 2	OK
3	External Photos of EUT	Photos # 1 to 10	OK
4	Internal Photos of EUT	Photos of 1 to 16	OK
5	Cover Letters	• Letter from Ultratech for Certification Request	OK
6	Attestation Statements	• Manufacturer's Declaration for Equipment Specifications, Installation (if it is professionally installed) and Production Quality Production Assurance. • Request for Confidentiality Filing • Authority to act as an Agent	OK OK OK
7	ID Label/Location Info	• ID Label • Location of ID Label	OK OK
8	Block Diagrams	Block Diagrams	OK
9	Schematic Diagrams	Schematic Diagrams	OK
10	Parts List/Tune Up Info	Parts List/Tune Up Info	OK
11	Operational Description	Operational Description	OK
12	RF Exposure Info	RF Exposure Info	OK
13	Users Manual	Information/instructions that will be intended in the installation/operation pertains to: • Correct output power settings required for compliance operation for every antenna proposed for use with EUT • Point-to-point operational requirements and responsibilities • RF exposure compliance requirements, if any	 OK OK OK

EXHIBIT 2. INTRODUCTION

2.1. SCOPE

Reference:	FCC Part 15, Subpart E - Unlicensed National Information Infrastructure Devices
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15, Subpart E
Purpose of Test:	This report is covered test results for Certification compliance with FCC regulations for Unlicensed National Information Infrastructure (U-NII) devices operating in the 5.725-5.825 GHz bands.
Definition:	U-NII devices. Intentional radiators operating in the frequency bands 5.725-5.825 GHz that use wideband digital modulation techniques and provide a wide array of high data rate mobile and fixed communications for individuals, businesses, and institutions
Test Procedures	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
Environmental Classification:	• Light-industry, Commercial • Industry
Grant Limitation:	**This device requires professional installation. The antenna(s) used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 1.5 meters from all persons during normal operation. Users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.**

2.2. RELATED SUBMITAL(S)/GRANT(S)

None

2.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	2001	Code of Federal Regulations – Telecommunication
ANSI C63.4	1992	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
CISPR 22 & EN 55022	1997 1998	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1		Specification for Radio Disturbance and Immunity measuring apparatus and methods
FCC Public Notice DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval

EXHIBIT 3. PERFORMANCE ASSESSMENT

3.1. CLIENT INFORMATION

APPLICANT:	
Name:	REDLINE COMMUNICATIONS INC.
Address:	90 Tiverton Court, Suite 102 Markham, Ontario Canada, L3R 9V2
Contact Person:	Mr. Marin Stan Phone #: 905-479-8344 (x336) Fax #: 905-479-7432 Email Address: mstan@redlinecommunications.com

MANUFACTURER:	
Name:	REDLINE COMMUNICATIONS
Address:	90 Tiverton Court, Suite 102 Markham, Ontario Canada, L3R 9V2
Contact Person:	Mr. Marin Stan Phone #: 905-479-8344 (x336) Fax #: 905-479-7432 Email Address: mstan@redlinecommunications.com

3.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name	REDLINE COMMUNICATIONS INC.
Product Name	ACCESS NODE
Model Name or Number	AN-50
Serial Number	Preproduction
Type of Equipment	Unlicensed National Information Infrastructure Devices
Input Power Supply Type	AC Mains
Primary User Functions of EUT:	Fixed, Point-to-Point application wireless access. Please refer to attached Technical Description for details.

3.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	▪ Base station (fixed , point to point)
Intended Operating Environment:	▪ Commercial, light industry & heavy industry
Power Supply Requirement:	120V 60Hz
RF Peak Transmit Power Rating: *Note: Please refer to the following Tables and Chart in Section 6.7 of this test report for detailed variation of the maximum peak transmit power with respect to channel number/frequency*	• Minimum Rating: -18.6 dBm (0.014 mWatts) for all channels • Maximum Ratings: +20.5 dBm (112.2 mwatts) varied with different channels.
RF Peak Power Spectral Density: *Note: Please refer to the following Tables and Chart in Section 6.7 of this test report for detailed variation of the maximum peak transmit power with respect to channel number/frequency*	• Minimum Rating: -27.8 dBm/MHz to all channels • Maximum Ratings: +16.4 dBm/MHz and varied with different channels
Operating Frequency Range:	5.735-5.815 GHz
RF Output Impedance:	50 Ohms
Total number of Channels:	9
Channel Spacing:	10 MHz
Duty Cycle:	Continuous (as worst case)
26 dB Bandwidth:	19.6 MHz Max.
Modulation Type (Maximum Data Rate):	• 64 QAM (54 Mb/s maximum) • 16 QAM (36 Mb/s maximum) • QPSK (18 Mb/s maximum) • BPSK (9 Mb/s maximum)
Environmental Temperature:	• Indoor Unit: 0°C to +55°C • Outdoor Unit: -40°C to +60°C
Antenna Connector Type:	• Standard SMA connector (transmitter side) and N connector (antenna side). Professional Installation is required by the manufacturer. Please refer to the User's manual for detailed instruction of antenna installation and RF Exposure Warning.
Antenna Description:	1. MTI, Planar Array Antenna, Model: MT-486001, Frequency Range: 5.25-5.82 GHz, In/Out Impedance: 50 Ohms, Gain: 28 dBi min, Connector Type: Standard "N" (Alternative) 2. MTI, Planar Array Antenna, Model: MT-485002, Frequency Range: 5.725-5.875 GHz, In/Out Impedance: 50 Ohms, Gain: 23 dBi min, Connector Type: Standard "N"

3.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	Serial Port	1	DB9	Shielded
2	IF Out Port	1	F	Shielded
3	Sync Out Port	1	BNC	Shielded
4	Sync In Port	1	BNC	Shielded
5	Ethernet Port	1	RJ-45	Nonsielded

3.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	ThinkPad Laptop
Brand name:	IBM
Model Name or Number:	2625
FCC ID:	ANOKAJIPENCP
Serial Number:	78-WWM4A
Connected to EUT's Port:	RS-232
Notes:	This laptop computer is used for technical services only; therefore, and it is used for control purpose only but not for testing.

3.6. BLOCK DIAGRAM OF TEST SETUP

The equipment under test is arranged as intended set up for normal operation. The Indoor AN-50 Unit is located indoor and connect to the Outdoor AN-50 (transmitter) Unit using a minimum 100 foot, F-type shielded cable. The Outdoor AN-50 (Transmitter) is mounted on the antenna and its RF output port is connected to the antenna using a short SMA-to-N cable.

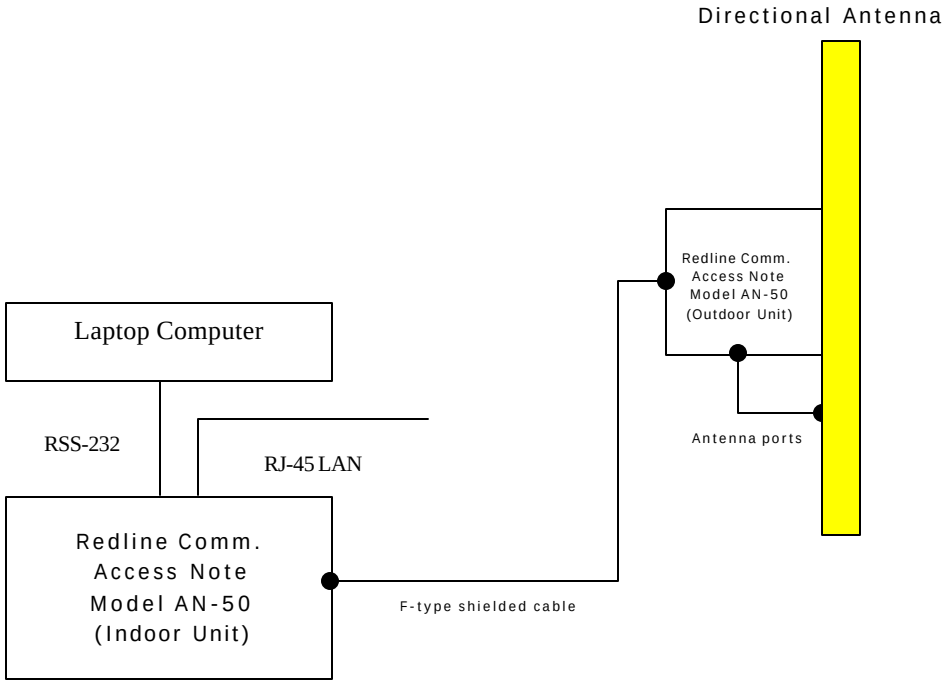


EXHIBIT 4. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

4.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	120V 60Hz

4.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each channel from the transmitter is tested for worst case emissions since the maximum power rating of each channel is different. The transmitter is transmitted continuously in a test mode configuration for worst case and convenience of measurements
Special Test Software:	▪ Special software is provided by the Applicant to select and operate the EUT at each channel frequency continuously.
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as a non-integral antenna equipment. The professional installation is required field installation and operation

Transmitter Test Signals:	
Frequencies: ▪ 5.735-5.815 GHz	• All channel swill be tested since they have different maximum output power ratings.
Transmitter Wanted Output Test Signals: ▪ RF Power Output: ▪ Normal Test Modulation ▪ Modulating signal source:	 ▪ 20.5 dB maximum and -18.6 dBm minimum ▪ 64QAM, 16QAM, QPSK & BPSK

EXHIBIT 5. SUMMARY OF TEST RESULTS

5.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 16'(L) by 12'(W) by 12'(H).

- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.

  The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Aug. 08, 2001.

5.2. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

5.3. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.407(c)	The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.	Yes. Please refer to Technical Description for details of explanation.
15.407(g)	Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual	Yes.
15.407(a)	Power Limits & 26 dB Bandwidth	Yes
15.407(f), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.407(b)	Band-edge & Undesired Emissions (Conducted)	Yes
15.407(b), 15.205 & 15.209	Band-edge & Undesired Emissions (Radiated)	Yes
15.107 & 15.207	Class B - AC Power Conducted Emissions on Tx, Rx and standby modes	Yes
15.109(b)	Class A - Radiated Emissions from Unintentional Radiators	Yes. A separate test report will be provided upon request.

EXHIBIT 6. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

6.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in Exhibit 8 of this report and ANSI C63-4:1992

6.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Exhibit 7 for Measurement Uncertainties.

6.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C64-3:1992, FCC 15.407 and CISPR 16-1.

6.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUACTURER:

The essential function of the EUT is to correctly communicate data to and from radios over RF link.

6.5. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	
15.407(d) & 15.203	Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT. The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed: • The application (or intended use) of the EUT • The installation requirements of the EUT • The method by which the EUT will be marketed	Standard SMA and N connectors Professional installation is required
15.204	Provided the information for every antenna proposed for use with the EUT: (a) type (e.g. Yagi, patch, grid, dish, etc…), (b) manufacturer and model number (c) gain with reference to an isotropic radiator	1. Manufacturer: MTI Type: Planar Array Model: MT-486001 Frequency Range: 5.25-5.82 GHz In/Out Impedance: 50 Ohms Gain: 28 dBi min Connector Type: Standard "N" (Alternative) 2. Manufacturer: MTI Type: Planar Array Model: MT-485002 Frequency Range: 5.725-5.875 GHz In/Out Impedance: 50 Ohms Gain: 23 dBi min Connector Type: Standard "N"

6.6. DISCONTINUATION OF TRANSMISSION @ FCC 15.407(C)

6.6.1. Limits

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signalling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

6.6.2. Analysis

Please refer to the description of how the device is automatically discontinue transmission in case of either absence of information to transmit or operational failure in the letter provided by the applicant in the Technical/Operational Description folder.

6.7. FREQUENCY STABILITY @ FCC 15.407(G)

6.7.1. Limits

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

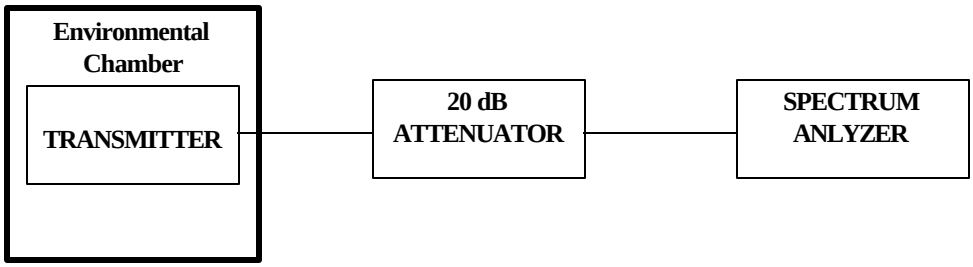
6.7.2. Method of Measurements

Refer to Exhibit 8, § 8.5 of this report for measurement details

6.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Attenuator(s)	Bird	..	…	DC – 22 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60 ° C range

6.7.4. Test Arrangement



6.7.5. Test Data

Temperature Ratings by Manufacturer:	Indoor Unit: 0°C to +60°C Indoor Unit: -40°C to +60°C
Center Frequency:	Lowest (5.735 GHz) and Highest (5.815 GHz). Note 1
Full Power Level:	-7.4 dBm as maximum ratings at 5.735 GHz and 5.815 GHz
Frequency Tolerance Limit:	Emission is maintained within the band of operation 5.725-5.825 GHz
Test Results:	Emissions were found ti be maintained within the band of operation 5.725-5.825 GHz at all temperature measured below.
Input Voltage Rating:	120V 60 Hz

Notes:

1. Tests were conducted at lowest and highest channel frequencies, and their maximum rf output power as worst cases to ensure that they do not drift outside of the permitted band (5.725-5.825 GHz)
2. Tests were performed with the modulation since the EUT can not transmit unmodulated carrier per requirement 15.407(c); therefore, the accurate frequency errors could not be measured. Only visual check for out-of-band drifts were observed. Please refer to Plots # 109 to 121 in Annex 1 show the signal spectrum at lowest and highest channel frequencies at normal temperatures (+20°C) and extreme temperatures (-40°C for outdoor unit, 0°C for indoor unit and +60°C for both outdoor and indoor units).

CENTER FREQUENCY & RF POWER OUTPUT VARIATION				
Ambient Temperature (°C)	**Supply Voltage (Nominal) 120 Volts**	**Supply Voltage (85% of Nominal) 102 Volts**	**Supply Voltage (115% of Nominal) 138 Volts**	**Test Configurations**
-40	Pass	N/A	N/A	• The Indoor unit was maintained at 20°C • The outdoor unit was maintained at -40°C
-30	Pass	N/A	N/A	• The Indoor unit was maintained at 20°C • The outdoor unit was maintained at -30°C
-20	Pass	N/A	N/A	• The Indoor unit was maintained at 20°C • The outdoor unit was maintained at -20°C
-10	Pass	N/A	N/A	• The Indoor unit was maintained at 20°C • The outdoor unit was maintained at -10°C
0	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C
+10	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C
+20	Pass	Pass	Pass	Both indoor and outdoor units were maintained at -0°C
+30	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C
+40	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C
+50	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C
+60	Pass	N/A	N/A	Both indoor and outdoor units were maintained at -0°C

6.8. POWER LIMITS & 26 DB BANDWIDTH @ FCC 15.407(A)

6.8.1. Limits

(a) Power limits:

(3) For the band 5.725-5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10logB, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density. For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omni directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations. Note to paragraph (a)(3): The Commission strongly recommends that parties employing U-NII devices to provide critical communications services should determine if there are any nearby Government radar systems that could affect their operation.

6.8.2. Method of Measurements

@ FCC 15.407(a):

(4) The peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement conforming to the definitions in this paragraph for the emission in question.

(5) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

(6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified in this paragraph) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

6.8.2.1. GUIDELINES FOR EMISSION BANDWIDTH "B"

Emission Bandwidth "B" MHz can be measured using a spectrum analyzer with the following setting:

- Use a RBW = 1% of the emission bandwidth.
- Set the VBW > RBW
- Use a peak detector.
- Do not use the Max Hold function. Rather, use the view button to capture the emission.
- Measure the widest width of the emission that is 26 dB down from the peak of the emission.

6.8.2.2. GUIDELINES FOR PEAK CONDUCTED TRANSMIT OUTPUT POWER:

Peak output power shall be measured with the following setting:

- **Method #1**: Use a peak power meter applicable for the transmission pulse duration. Any low-pass filtering in the meter must comply with the VBW requirement, above.

- **Method #2**: Use a peak diode detection method applicable for the transmission pulse duration. The test procedure is described in Section 8.3 of this test report

- **Method #3**: For Broadband emissions where the available analyzer bandwidth is less than emission bandwidth, set:
  - RBW = 1 MHz , no video averaging and VBW is greater than or equal to the larger of:
    - EBW/(2*pi*30), where EBW is the 26-dB emission bandwidth
    - 1/(2*pi*T), where T is the transmission pulse duration over which the transmission is continuous and average symbol envelope power is constant.
  - Use peak detector and max hold settings with no averaging.
  - The analyzer should be in linear (rather than log) display mode.
  - Compute power by integrating the spectrum across the 26-dB EBW or apply a bandwidth correction factor of 10 log(EBW/1 MHz) to the spectral peak of the emission. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1-MHz band in linear power terms. The 1-MHz band power levels to be summed can be obtained by averaging, in linear power terms, the peak-detected, max-hold power levels in each frequency bin across the 1 MHz.

6.8.2.3. GUIDELINES FOR PEAK CONDUCTED POWER SPECTRAL DENSITY (PPSD)

Compliance with any of the three methods is acceptable (subject to the restrictions of method #2).

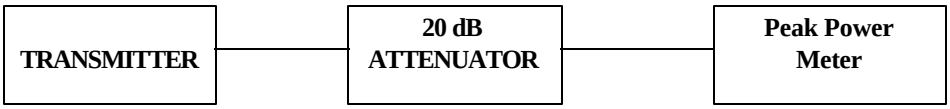
- Use a peak detector and max hold.
- Set RBW= 1MHz and VBW > 1 MHz.
- The PPSD is the highest level found across the emission in any 1-MHz band.
- Use Power averaging (not video averaging) mode. Set RBW= 1 MHz, VBW > 1 MHz. The PPSD is the highest level found across the emission in any 1-MHz band after 100 sweeps of averaging. This method is permitted only if the transmission pulse or sequence of pulses remains at maximum transmit power for each of the 100 sweeps of averaging (e.g., 100 sweeps occur during one transmission, or each sweep gated to occur during a transmission).
  * When the emission bandwidth is less than 1 MHz, use a measurement bandwidth equal to the emission bandwidth, in accordance with Section 15.407(a)5.
  * It is permissible to use a bandwidth less than the measurement bandwidth provided the measured power is integrated to show total power over the measurement bandwidth. The integration can be performed using the spectrum analyzer's band power measurement function with band limits set equal to the measurement band edges or by summing power levels in each band in linear power terms.

6.8.2.4. GUIDELINES FOR PEAK EXCURSION MEASUREMENTS

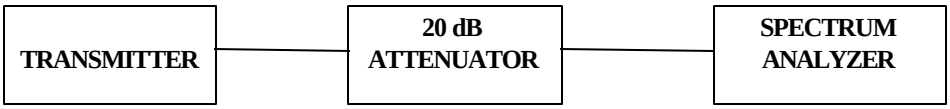
- Set the spectrum analyzer span to view the entire emission bandwidth. The largest difference between the following two traces in any 1 MHz band on any frequency across the emission cannot be greater than 13 dB. Submit a plot
  * 1st Trace. Use a RBW=VBW=1MHz with peak detector and max-hold settings.
  * 2nd Trace. Use a RBW=1MHz and VBW as used for the peak power measurement
  * Use peak detector and max-hold settings.
  * If the peak power measurement was performed with VBW $\geq$ 1 MHz and no other averaging, the peak excursion test is not required. When no test is required, indicate so. List the VBW used for the peak power measurement and indicate how the VBW was determined.

6.8.3. Test Arrangement

Peak Conducted Transmit Power using Peak Power Meter Measurements:



Peak Conducted Power Spectral Density (PPSD) & Peak Excursion Measurements:



6.8.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8546A	…	9 kHz to 5.6 GHz with built-in 30 dB Gain Pre-selector, QP, Average & Peak Detectors.
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3155	9911-5955	1 GHz – 18 GHz
RF Signal Generator	Hewlett Packard	HP 83752B	3610A00457	0.01 – 20 GHz
67297 RF Detector (Diode Detector)	Herotex	DZ122-553	63400	..
Storage Oscilloscope	Philips	PM3320A	ST9907959	--

6.8.5. Test Data

6.8.5.1. 26 DB BANDWIDTH & CALCULATION OF POWER LIMITS

CHANNEL FREQUENCY	(1) MEASURED 26 dB BANDWIDTH [B] - (MHz)				PPSD LIMIT	(3) PEAK TRANSMIT POWER LIMIT
(MHz)	64QAM (54 Mb/s)	16QAM (36 Mb/s)	QPSK (18 Mb/s)	BPSK (9 Mb/s)	(dBm/MHz)	(dBm)
5735	19.5	19.2	19.0	19.4	17.0	29.9
5775	19.5	19.4	19.1	19.5	17.0	29.9
5815	19.5	19.2	19.0	19.6	17.0	29.9
Refer to Plots # 1 to 12 in Annex 1 for detailed measurements of 26 dB BW						

Notes:
(1) The 26 dB BW was measured with each modulation at its maximum data rate. For example 64QAM @ 54Mb/s, 16QAM @ 36 Mb/s, QPSK @ 18 Mb/s and BPSK @ 9 Mb/s.
(2) Refer to Plots # 1 to 12 in Annex 1 for detailed Measurements.
(3) Lesser of 30 dBm (1000 mW) or 17 dBm + 10log[B]. The minimum 26 dB bandwidth of the above measurement (19.0 MHz) will be used for calculation of the WORST CASE limit of the peak transmit power.

Peak Transmit Power = 17 + 10*log (19.0) = 29.9 dBm

6.8.5.2. PEAK POWER SPECTRAL DENSITY (PPSD) IN 1 MHZ BW

6.8.5.2.1. Minimum PPSD

REMARK: Since the minimum RF Output Power Ratings are the same for all channels and modulations, the minimum PPSD will be tested at lowest, middle and highest channel frequencies.

		PPSD [2] (dBm/MHz)				
Transmitter Channel	Frequency (MHz)	64QAM (54 Mb/s)	16QAM (36 Mb/s)	QPSK (18 Mb/s)	BPSK (9 Mb/s)	Limit (dBm/MHz)
1	5.735	-26.44	(1)	(1)	(1)	17.0
5	5.775	-25.94	(1)	(1)	(1)	17.0
9	5.815	-27.81	(1)	(1)	(1)	17.0

Refer to Plots # 13 to 15 in Annex 1 for detailed measurement

Notes:

(1) Since there were no significant differences in power density with different modulations and the PPSD is very low at its lowest power setting, the PPSD measurements for different modulations were not necessary to be repeated (Prescan did show no significant differences in PPSD measurements with different modulations at different channels).

(2) The PPSD was measured in with the spectrum analyzer set and RBW = 1 MHz, VBW = 3 MHz and "MAX-HOLD" and the results were found to be below the limit of 17 dBm. Therefore, The Power Average Readings over 100 Sweeps measurements are not necessary to be performed.

(3) The transmitter was measured at stable temperature after 1 hour warn-up on transmit mode.

6.8.5.2.2. Maximum PPSD

REMARK: Since the Maximum RF Output Power Ratings (set by the manufacturer) are different to meet the band-edge of the permitted band from 5.725-5.825 GHz, the maximum PPSD will be measured at each channel frequency.

		PPSD [2] (dBm/MHz)				
Transmitter Channel	Frequency (MHz)	64QAM (54 Mb/s)	16QAM (36 Mb/s)	QPSK (18 Mb/s)	BPSK (9 Mb/s)	Limit (dBm/MHz)
1	5.735	-11.25	(1)	(1)	(1)	17.0
2	5.745	9.19	(1)	(1)	(1)	17.0
3	5.755	10.41	(1)	(1)	(1)	17.0
4	5.765	15.38	(1)	(1)	(1)	17.0
5	5.775	16.44	15.59	16.16	15.06	17.0
6	5.785	15.03	(1)	(1)	(1)	17.0
7	5.795	9.81	(1)	(1)	(1)	17.0
8	5.805	8.50	(1)	(1)	(1)	17.0
9	5.815	-12.47	(1)	(1)	(1)	17.0

Refer to Plots # 16 to 27 in Annex 1 for detailed measurement

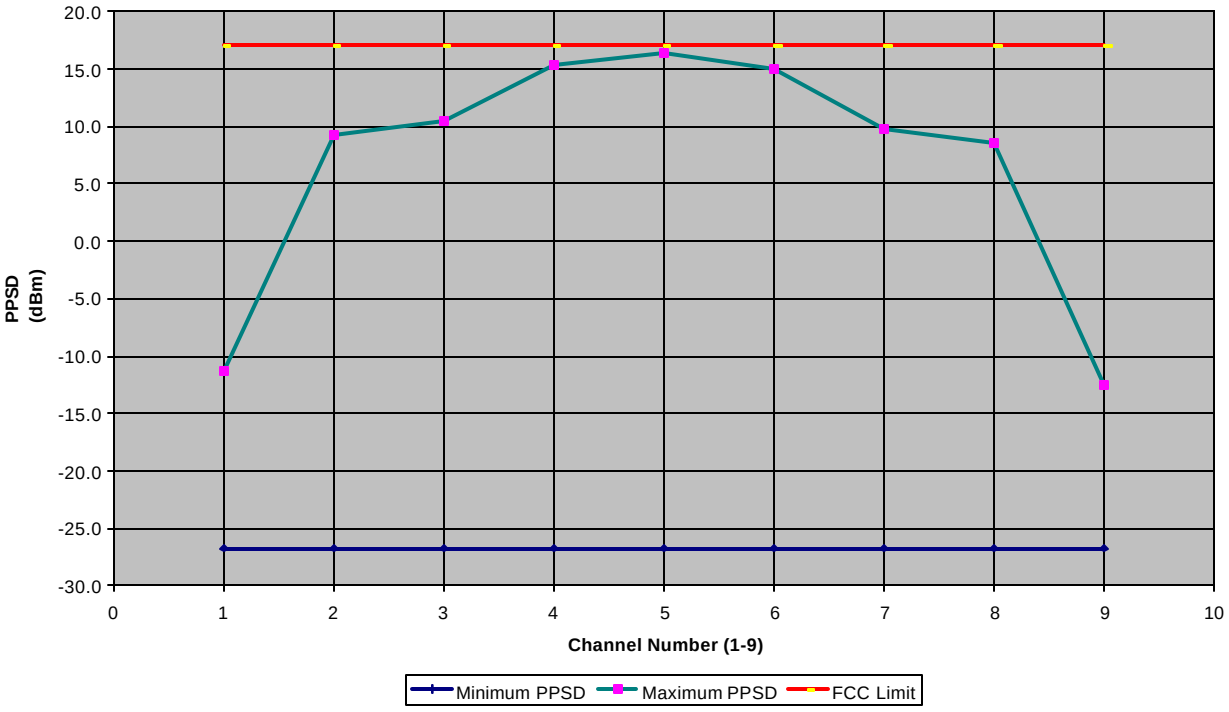
Notes

(1) Since there were no differences in PPSDs with different modulations when the PPSD was measured at the highest power setting at Channel # 5, the PPSD measurements with different modulations for other channels with lower power settings were not necessary.

(2) The PPSD was measured in with the spectrum analyzer set and RBW = 1 MHz, VBW = 3 MHz and "MAX-HOLD" and the results were well below the limit of 17 dBm. Therefore, The Power Average Readings over 100 Sweeps measurements were not necessary to be performed.

(3) The transmitter was measured at stable temperature after 1 hour warn-up on transmit mode.

Peak Power Spectral Density
Redline Communications Inc.
Access Node, Model AN-50



6.8.5.3. PEAK EXCURSION

Since the Peak Power Spectral Density is measured using the VBW = 3 MHz, the peak excursion measurement is not required. However, for additional information , the Peak Excursion was measured in the middle channel (Channel #5) and it was found to be 1.28 dB. The same results are expected for all channels and modulations since the rf output signal characteristic is always the same. Please refer to Plots # 28 and 29 for detailed measurements.

6.8.5.4. PEAK CONDUCTED TRANSMIT POWER (FULL BANDWIDTH)

PEAK TRANSMIT POWER LIMIT (Conducted): Lesser of 30 dBm (1000 mW) or 17 dBm + 10log[B]. The minimum 26 dB bandwidth of 19.0 MHz was used for calculation of the WORST CASE limit of the peak transmit power as follows: **Peak Transmit Power = 17 + 10*log (19.0) = 29.9 dBm**

6.8.5.4.1. Minimum Peak Transmit Power

		PEAK TRANSMIT POWER (Measured a Peak Power Meter) (dBm)				
Transmitter Channel	Frequency (MHz)	64QAM (54 Mb/s)	16QAM (36 Mb/s)	QPSK (18 Mb/s)	BPSK (9 Mb/s)	Limit (dBm)
1	5.735	-18.6	-18.6	-18.6	-18.6	29.9
2	5.745	-18.6	-18.6	-18.6	-18.6	29.9
3	5.755	-18.6	-18.6	-18.6	-18.6	29.9
4	5.765	-18.6	-18.6	-18.6	-18.6	29.9
5	5.775	-18.6	-18.6	-18.6	-18.6	29.9
6	5.785	-18.6	-18.6	-18.6	-18.6	29.9
7	5.795	-18.6	-18.6	-18.6	-18.6	29.9
8	5.805	-18.6	-18.6	-18.6	-18.6	29.9
9	5.815	-18.6	-18.6	-18.6	-18.6	29.9
Note: The transmitter was measured at stable temperature after 1 hour warn-up on transmit mode.						