UltraTech
Group of Labs

31040/SIT

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Canada
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entela

3000 Bristol Circle,
Oakville, Ontario,
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Nov. 19, 2002

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

Subject: FCC Certification Authorization Application for Class II Permissive Change 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.

The following modifications were applied to the Outdoor Unit of the Model AN-50:

(1) The heat-sink was changed to a new type as shown in the external photographs
(2) The SMA connector was changed to "N" type connector. Please note that this product is certified with Professional Antenna Installation.

Since the above modifications have no affect on the transmitter parameters, only radiated emissions from its enclosure needs to be conducted to enclosure the compliance per FCC 15.407(a), 15.209 and 15.205.

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

Yours truly,

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

Encl

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Email: vic@ultratech-labs.com

Nov. 19, 2002

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

Attn.: Mr. Marin Stan

Subject: FCC Certification Authorization Application for Class II Permissive Change 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.**

The following modifications were applied to the Outdoor Unit of the Model AN-50:

(3) The heat-sink was changed to a new type as shown in the external photographs
(4) The SMA connector was changed to "N" type connector. Please note that this product is certified with Professional Antenna Installation.

Since the above modifications have no affect on the transmitter parameters, only radiated emissions from its enclosure needs to be conducted to enclosure the compliance per FCC 15.407(a), 15.209 and 15.205.

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-011FCC15E

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: Nov. 19, 2002	Tested by: Hung Trinh, RFI Technician Test Dates: Nov. 15 & 18, 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

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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		

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EXHIBIT 1. INTRODUCTION

1.1. 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 covered test results for Certification compliance (Class II Permissive Change) 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.**
Modifications applied to the original certified product:	The following modifications were applied to the Outdoor Unit of the Model AN-50: **(1)** The heat-sink was changed to a new type as shown in the external photographs. **(2)** The SMA connector was changed to "N" type connector. Please note that this product is certified with Professional Antenna Installation

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

None

1.3. 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 2. PERFORMANCE ASSESSMENT

2.1. 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

2.2. 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.

2.3. 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 N 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"

2.4. 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

2.5. 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.

2.6. 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 N-to-N cable.

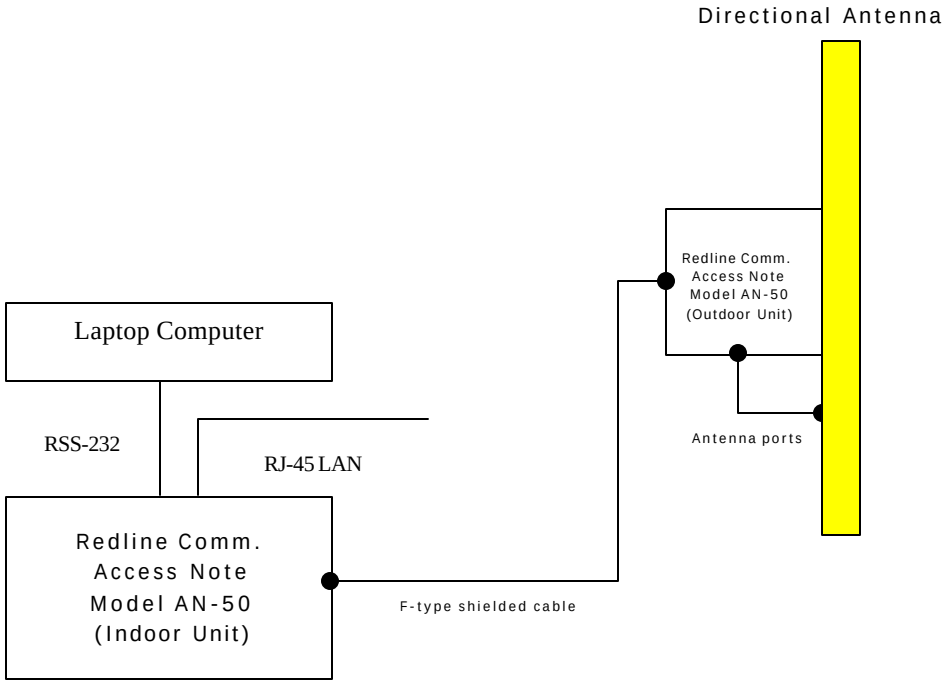


EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. 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

3.2. 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 4. SUMMARY OF TEST RESULTS

4.1. 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.

4.2. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

4.3. 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.	Note (1)
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	Note 1
15.407(a)	Power Limits & 26 dB Bandwidth	Note 1
15.407(f), 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Note 1
15.407(b)	Band-edge & Undesired Emissions (Conducted)	Note 1
15.407(b), 15.205 & 15.209	Undesired Emissions (Radiated)	Yes
15.107 & 15.207	Class B - AC Power Conducted Emissions on Tx, Rx and standby modes	Note 1
15.109(b)	Class A - Radiated Emissions from Unintentional Radiators	Note 1

Note (1): Since the changes of the external heat-sink and RF connector type applied to the Outdoor Unit of the AN-50 have no affect on the transmitter parameters, only radiated emissions from its enclosure needs to be conducted to enclosure the compliance per FCC 15.407(a), 15.209 and 15.205.

EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

5.1. 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

5.2. 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.

5.3. 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.

5.4. 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.

5.5. 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 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"

5.6. UNDESIRED EMISSIONS (RADIATED @ 3 METERS), FCC 15.407(B)

5.6.1. Limits

Undesirable emission limits: the PEAK emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(3) For transmitters operating in the 5.725-5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27 dBm/MHz.

(4) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Sec. 15.209.

(6) The provisions of Sec. 15.205 apply to intentional radiators operating under this section. (7) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Remarks:

FCC CFR 47, Part 15, Subpart E, Para. 15.205(a) - Restricted Frequency Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 - 2300	9000 - 9200	

FCC CFR 47, Part 15, Subpart E, Para. 15.209(a)
-- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	DISTANCE (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.6.2. Method of Measurements

Refer to Exhibit 8, Sec. 8.4 of this test report and **ANSI 63.4-1992, Para. 8** for detailed radiated emissions measurement procedures.

The following measurement procedures were also applied:

- Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.
- For measurement below 1 GHz, set RBW = 100 KHz, VBW $\geq$ 100 KHz, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz (Peak), SWEEP=AUTO.

5.6.3. Test Arrangement

Please refer to Test Arrangement in Sec. 5.5.3 for details of test setup for emission measurements.

5.6.4. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Advantest	R3271	15050203	100 Hz to 32 GHz with external mixer for frequency above 32 GHz
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz
Horn Antenna	EMCO	3160-09	..	18 GHz – 26.5 GHz
Horn Antenna	EMCO	3160-10	..	26.5 GHz – 40 GHz
Mixer	Tektronix	118-0098-00	..	18 GHz – 26.5 GHz
Mixer	Tektronix	119-0098-00	..	26.5 GHz – 40 GHz

5.6.5. Photographs of Test Setup

Refer to photos # 1 and 2 in Annex 2 for photos of test setup.

5.6.6. Test Data

Theory of Conversion From EIRP Limits to E-Field Limits:

FCC specifies the limit of an EIRP of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, and an EIRP of -27 dBm/MHz. For other emissions outside 5.725 GHz - 10 MHz and 5.825 GHz + 10 MHz. In addition, the FCC E-Field Limits @ 15.209 in dBuV/m are applied for spurious and harmonic emissions which fall in the restricted band specified in FCC 15.205. In order to uniform our measurements, all EIRP limits (dBm/MHz) converted into E-Field Limits [dB(uV/m)/MHz} as follows:

$P = (Ed)^2/30G$
$EIRP = PG = (Ed)^2/30$
$E = (30*EIRP)^{0.5}/d$

Where:
P: Conducted power at the antenna in Watts
G: Transmitter's isotropic gain in numeric
EIRP: Equivalent isotropic radiated power in Watts
E: Electric Field in uV/m
D: Distance in meters (3 meters)

$10^6*E_{V/m}/10^6 = [30*EIRP_W*10^3/10^3]^{0.5}/d$
$20*\log[10^6*E_{V/m}/10^6] = 20*\log\{[30*EIRP_W*10^3/10^3]^{0.5}/d\}$
$20*\log[E_{uV/m}] - 20*\log[10^6] = 10*\log[EIRP_{mW}] + 10*\log[30] + 10*\log[10^{-3}] - 20*\log(d)$
$E_{dBuV/m} = EIRP_{dBm} + 14.77 - 30 - 9.54 + 120$

$E_{dBuV/m} = EIRP_{dBm} + 95.25$ dB

The FCC Equivalent E-Field Limits are:

-17 dB/MHz ⇐=> 78.24 dB(uV/m)/MHz
-27 dBm/MHz ⇐=> 68.24 dB(uV/m)/MHz

5.6.6.1. TRANSMITTER SPURIOUS & HARMONIC RADIATED EMISSIONS

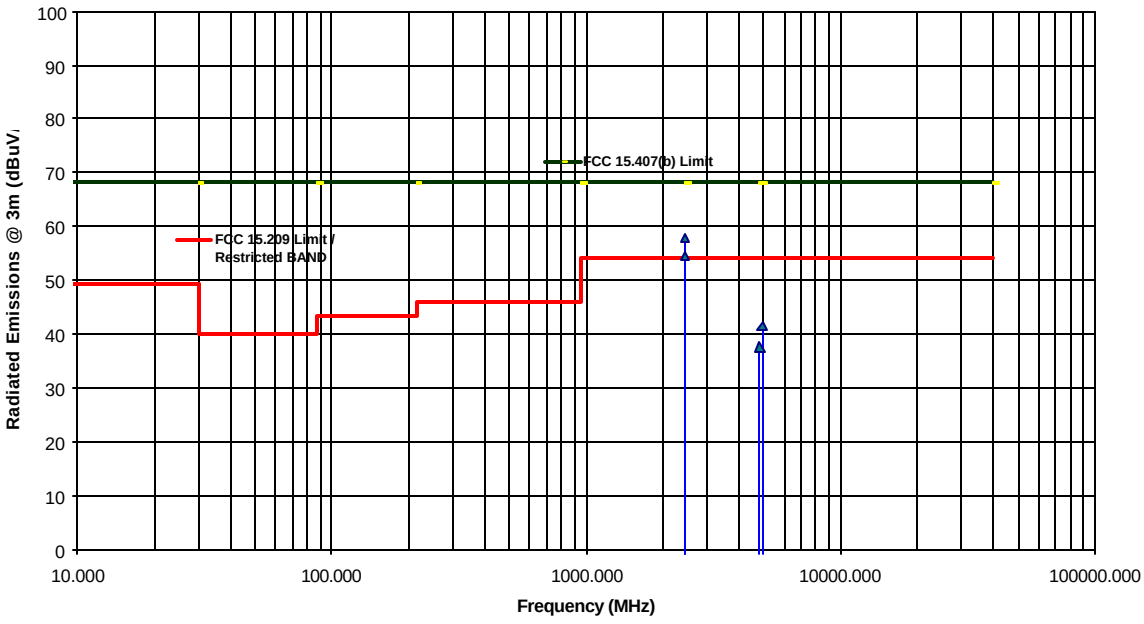
Remarks: Since there is no difference power and signal spectrum among modulations (64QAM, 16QAM, QPSK and PBSK), the transmitter was set with 64 QAM at maximum data rate of 54 Mb/s at its maximum rf output power, and the test results will represent for all other modulation operation.

5.6.6.1.1. Lowest Frequency (5.735 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting), Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2460.00	59.0	57.9	V	54.0	68.2	-10.3	PASS
2460.00	56.3	54.5	H	54.0	68.2	-13.7	PASS
4920.00	50.5	41.6	V	54.0	68.2	-12.4	PASS
4820.00	49.0	37.7	H	54.0	68.2	-16.3	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 3 and 4 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.735 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

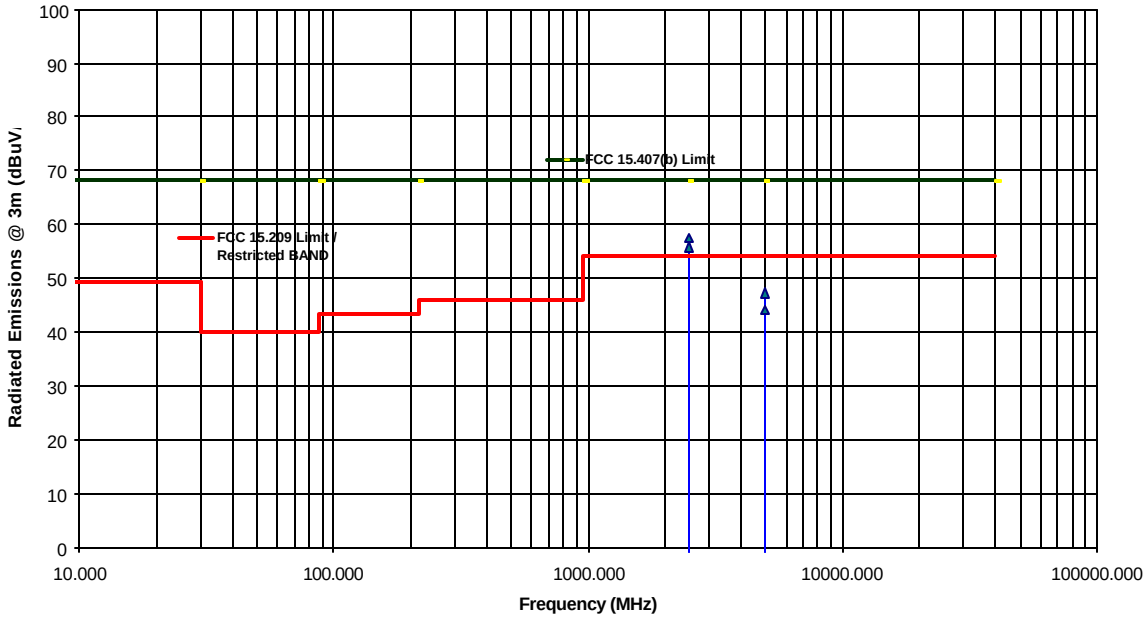


5.6.6.1.2. Middle Frequency (5.775 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting)), Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2480.00	59.1	57.6	V	54.0	68.2	-10.6	PASS
2480.00	57.5	55.9	H	54.0	68.2	-12.3	PASS
4960.00	52.8	47.3	V	54.0	68.2	-6.7	PASS
4960.00	51.3	44.2	H	54.0	68.2	-9.8	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 3 and 4 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.775 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

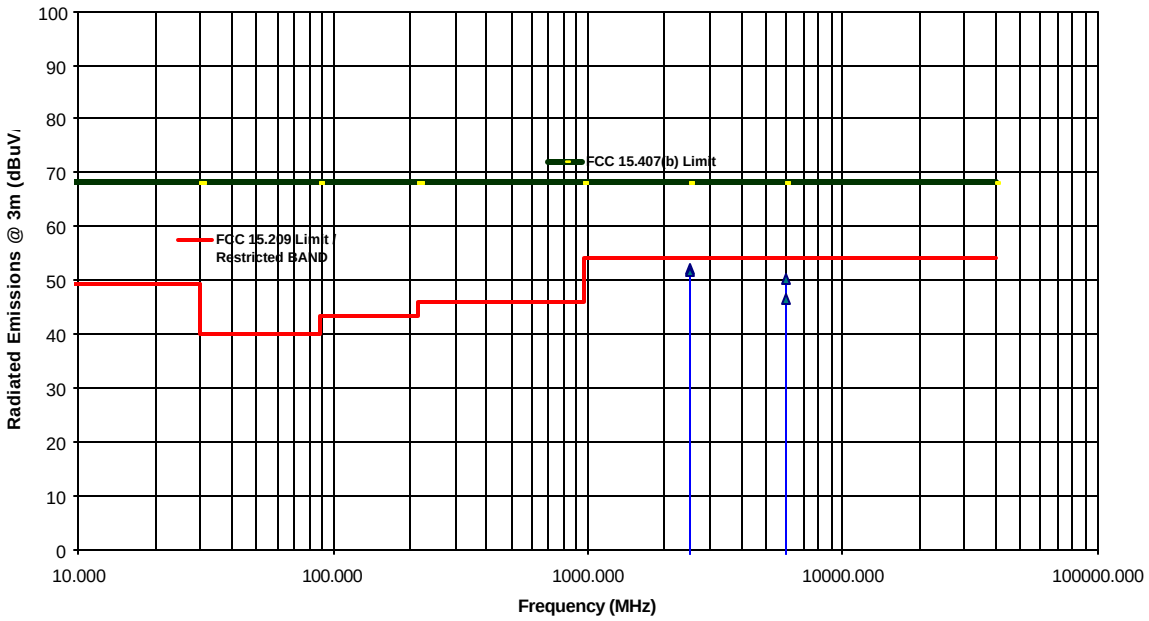


5.6.6.1.3. Highest Frequency (5.815 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting)), Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2500.00	54.3	52.2	V	54.0	68.2	-1.8	PASS
2500.00	53.9	51.7	H	54.0	68.2	-2.3	PASS
6000.00	52.4	46.6	V	54.0	68.2	-21.6	PASS
6000.00	55.1	50.3	H	54.0	68.2	-17.9	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 3 and 4 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.815 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-485002, Gain 23 dBi

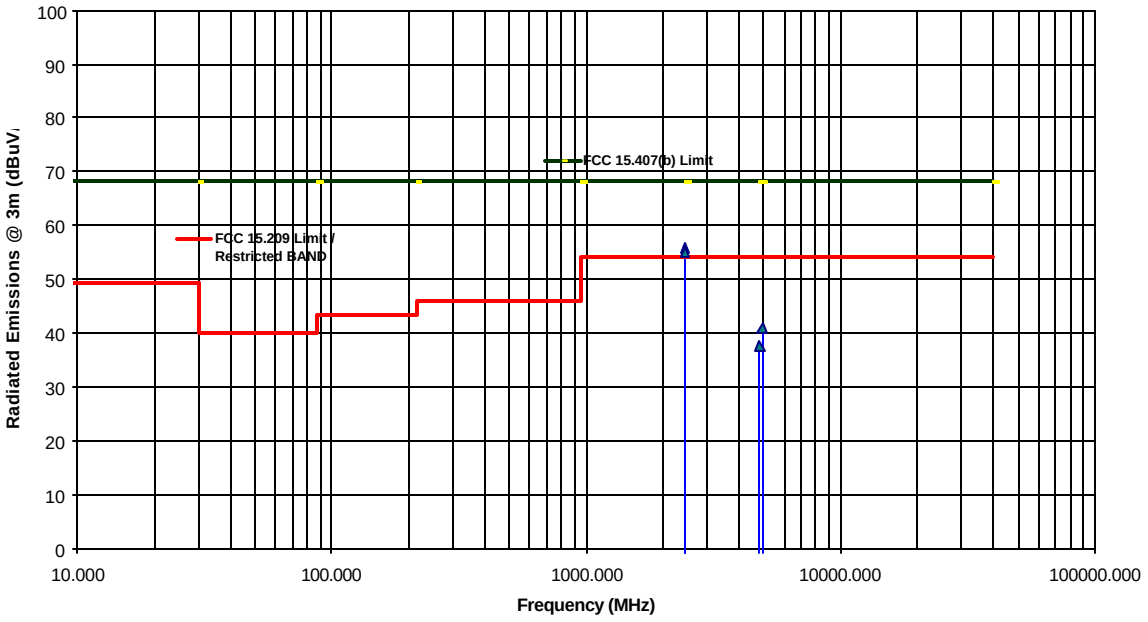


5.6.6.1.4. Lowest Frequency (5.735 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting), Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain 28 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2460.00	58.9	55.9	V	54.0	68.2	-12.3	PASS
2460.00	57.0	55.1	H	54.0	68.2	-13.1	PASS
4920.00	49.6	41.0	V	54.0	68.2	-13.0	PASS
4820.00	48.7	37.7	H	54.0	68.2	-16.3	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 1 and 2 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.735 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain: 28 dBi

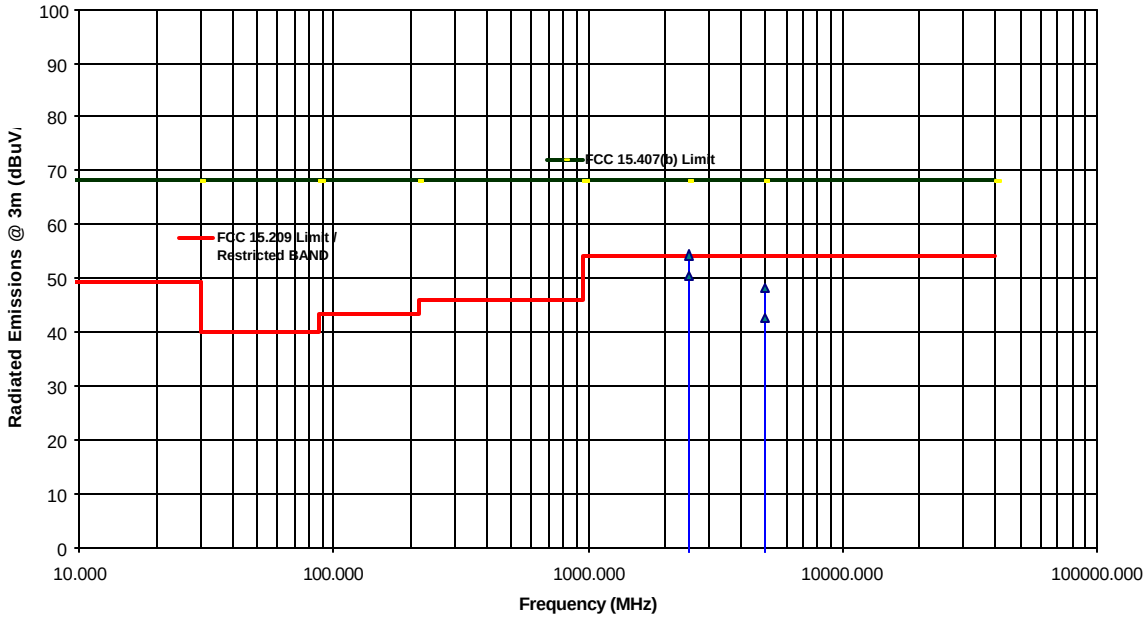


5.6.6.1.5. Middle Frequency (5.775 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting))), Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain 28 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2480.00	57.6	54.3	V	54.0	68.2	-13.9	PASS
2480.00	52.9	50.5	H	54.0	68.2	-17.7	PASS
4960.00	52.9	48.2	V	54.0	68.2	-5.8	PASS
4960.00	50.2	42.7	H	54.0	68.2	-11.3	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 1 and 2 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.775 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain: 28 dBi



5.6.6.1.6. Highest Frequency (5.815 GHz, Modulation 64QAM with 54 Mb/s Data Rate, Power Output: Maximum Setting))), Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain 28 dBi

FREQUENCY (MHz)	RF PEAK LEVEL (dBuV/m)	RF AVG LEVEL (dBuV/m)	ANTENNA PLANE (H/V)	LIMIT 15.209 (dBuV/m)	LIMIT 15.407(b) dB(uV/m)/MHz	MARGIN (dB)	PASS/ FAIL
2500.00	53.9	51.4	V	54.0	68.2	-2.6	PASS
2500.00	52.5	49.8	H	54.0	68.2	-4.2	PASS
6000.00	56.8	53.7	V	54.0	68.2	-14.5	PASS
6000.00	53.3	48.4	H	54.0	68.2	-19.8	PASS

- The emissions were scanned from 10 MHz to 40 GHz and all emissions less 20 dB below the limits were recorded.
- Refer to Photos # 3 and 4 in Annex for photos of test setup

Transmitter Radiated Emissions Measurements at 3 Meter OFTS
Redline Comnunications Inc.
Access Node, Model AN-50, Tx Freq.: 5.815 GHz, RF Ouptut Power: Maximum
Tx Antenna: MTI Planar Array Antenna, Model MT-486001, Gain: 28 dBi

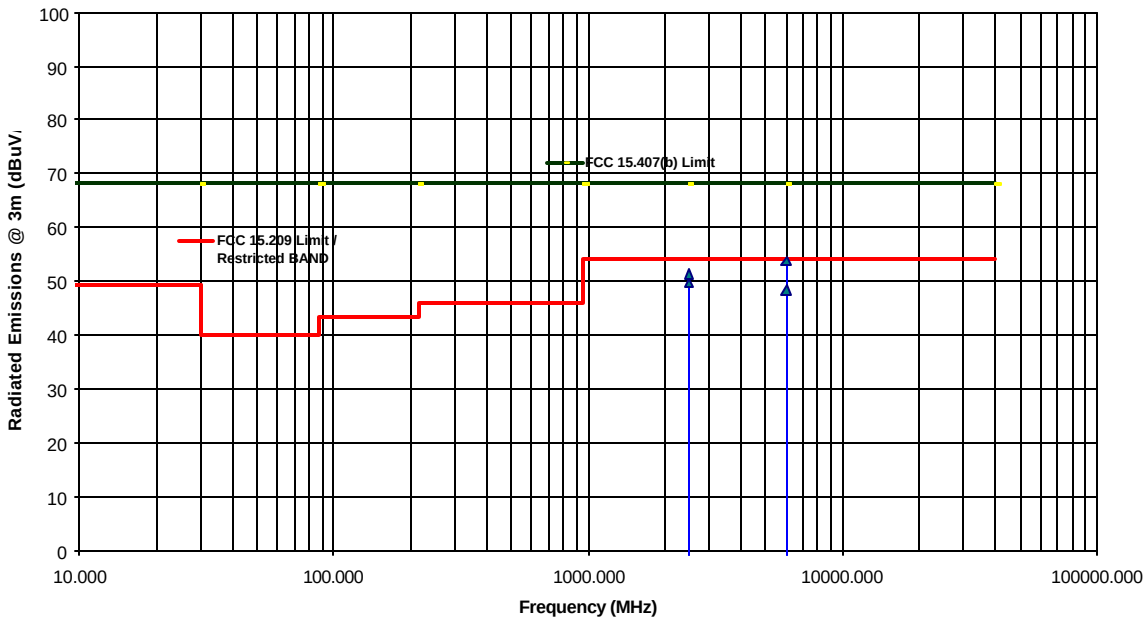


EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and NIS 81 (1994)

6.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (± dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	±1.0	±1.0
Cable Loss Calibration	Normal (k=2)	±0.3	±0.5
EMI Receiver specification	Rectangular	±1.5	±1.5
Antenna Directivit	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	±2.0	±0.5
Antenna phase center variation	Rectangular	0.0	±0.2
Antenna factor frequency interpolation	Rectangular	±0.25	±0.25
Measurement distance variation	Rectangular	±0.6	±0.4
Site imperfections	Rectangular	±2.0	±2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67$(Bi) 0.3 (Lp) Uncertainty limits 20Log(1±$\Gamma_1\Gamma_R$)	U-Shaped	+1.1 -1.25	±0.5
System repeatability	Std. Deviation	±0.5	±0.5
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k=2 is used:

$U = 2u_c(y) = 2x(+2.19) = +4.38$ dB And $U = 2u_c(y) = 2x(-2.21) = -4.42$ dB

EXHIBIT 7. MEASUREMENT METHODS

7.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

7.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

7.1.2. Normal power source

7.1.2.1. MAINS VOLTAGE

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

7.1.2.2. BATTERY POWER SOURCE.

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

7.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency

- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

7.2. SPURIOUS EMISSIONS (CONDUCTED & RADIATED)

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10th harmonic of the highest frequency generated by the EUT.

7.2.1. Band-edge and Spurious Emissions (Conducted)

Band-edge Compliance of RF Conducted Emissions:

Use the following spectrum analyzer settings:

- The radio was connected to the measuring equipment via a suitable attenuator.
- Span = wide enough to capture the peak level of the emission operating on the channel closest to the band-edge, as well as any modulation products which fall outside of the authorized band of operation.
- RBW = 1 % of the span
- VBW = RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize
- Set the marker on the emission at the band-edge, or on the highest modulation product outside of the band, if this level is greater than that at the band-edge
- Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission.
- The marker-delta value now displayed must comply with the limit specified
- Submit this plot

Spurious RF Conducted Emissions:

Use the following spectrum analyzer settings:

- The radio was connected to the measuring equipment via a suitable attenuator.
- Span = wide enough to capture the peak level of the in-band-emission and all spurious emissions (e.g. harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, sevral plots are required to cover this entire span.
- RBW = 100 kHz
- VBW = RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Allow the trace to stabilize
- Set the marker on the any spurious emission recorded. The level displayed must comply with the limit specified in this Section.
- Submit this plot

7.2.2. Spurious Emissions (Radiated)

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.

- Radiated emissions measurements were made using the following test instruments:

1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
3. The test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

   - RBW = 100 kHz for f < 1GHz and RBW = 1 MHz for f ≥ 1 GHz
   - VBW = RBW
   - Sweep = auto
   - Detector function = peak
   - Trace = max hold
   - Follows the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc.. A pre-amp and highpass filter are required for this test, in order to provide the measuring system with sufficient sensitivity.
   - Allow the trace to stabilize.
   - The peak reading of the emission, after being corrected by the antenna correction factor, cable loss, pre-amp gain, etc…. is the peak field strength which comply with the limit specified in Section 15.35(b)

   Calculation of Field Strength:

   The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

   FS = RA + AF + CF - AG

Where FS = Field Strength
RA = Receiver/Analyzer Reading
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:
Field Level = 60 + 7.0 + 1.0 - 30 = 38.0 dBuV/m.
Field Level = $10^{(38/20)}$ = 79.43 uV/m.

- Submit this test data
- Now set the VBW to 10Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time of the each channel is less than 100ms, then the reading obtained may be further adjusted by a “duty cycle correction factor”, derived from 10log(dwell time/100mS) in an effort to demonstrate compliance with the 15.209.
- Submit test data

Maximizing The Radiated Emissions:

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.

Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.

Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.

Step4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.

Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.

Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.

Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

7.2.3. Peak Power Measurements

Calculate the transmitter's peak power using the following equation:

$E = (30PG)^{0.5}/d$
$P = (Ed)^2/30G$

Where:

- E: measured maximum fundamental field strength in V/m. Utilizing a RBW, the 20 dB bandwidth of the emission VBW >RBW, peak detector function. Follow the procedures in C63.4-1992 with respect to maximizing the emission
- G is numeric gain of the transmitting antenna with reference to an isotropic radiator
- D is the distance in meters from which the field strength was measured
- P is Conducted Power at the antenna port

7.2.4. Spurious RF Conducted Emissions

The demonstrate compliance with the spurious RF conducted emission requirement of Section 15.407©, use the following spectrum analyzer settings:

- Span = wide enough to fully capture the emission being measured
- RBW = 100 kHz for $f \leq 1$ GHz and RBW = 1 MHz for $f \geq 1$GHz
- VBW > RBW
- Sweep = auto
- Detector function = peak
- Trace = max hold
- Measure the field strength of both the fundamental and all spurious emissions with these settings.