

**Ultratech's
Accreditations:**



0685



31040/SIT



C-1376



46390-2049



200093-0



SL2-IN-E-1119R

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

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Apr. 24, 2007

TIMCO ENGINEERING INC.

P.O. Box 370
849 N.W. State Road 45
Newberry, Florida
USA 32669

Subject: FCC Class II Permissive Change Authorization Application under
FCC Part 15, Subpart C, Sec. 15.247 - Digital Modulation
Transmitters operating in the frequency band 5725 - 5850 MHz.

Product: Broadband Wireless System (20 MHz Channel Bandwidth)
Model No.: AN-80i
FCC ID: QC8-AN80I

Dear Sir/Madam

As appointed agent for **Redline Communications Inc.**, we would like to submit this application for FCC Class II Permissive Change Authorization of the above product. Please review all required documents uploaded to TIMCO Upload Web Site.

Class II Permissive Changes:

Additional Antennas as specified in the test report are included in the certification for Point-to-Multipoint application. The Model AN-80i and it's antennas are required to be professionally installed.

Remark: These additional Point-to Multipoint antennas are performed only for operation with 20 MHz Bandwidth. Other operation with bandwidths of 10 MHz and 40 MHz will allowed to be used with these Point-to-Point antennas.

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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Apr. 24, 2007

Redline Communications Inc.

302 Town Centre Blvd.
Markham, Ontario
Canada, L3R 0E8

Attn.: Mr. Medhat Fawzy, P.Eng.

Subject: FCC Class II Permissive Change Authorization Application Testing under FCC Part 15, Subpart C, Sec. 15.247 - Digital Modulation Transmitters operating in the frequency band 5725 - 5850 MHz.

Product: Broadband Wireless System (20 MHz Channel Bandwidth)
Model No.: AN-80i
FCC ID: QC8-AN80I

Dear Mr. Fawzy,

The product sample, as provided by you, has been tested and found to comply with **FCC Part 15, Subpart C, Sec. 15.247 - Digital Modulation Transmitters operating in the frequency band 5725 - 5850 MHz.**

Class II Permissive Changes:

Additional Antennas as specified in the test report are included in the certification for Point-to-Multipoint application. The Model AN-80i and it's antennas are required to be professionally installed.

Remark: These additional Point-to Multipoint antennas are performed only for operation with 20 MHz Bandwidth. Other operation with bandwidths of 10 MHz and 40 MHz will allowed to be used with these Point-to-Point antennas.

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

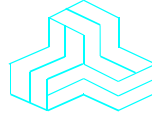
Yours truly,



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

Encl.

ENGINEERING TEST REPORT



Broadband Wireless System (20 MHz Channel Bandwidth) Model No.: AN-80i

FCC ID: QC8-AN80I

Applicant: **Redline Communications Inc.**
302 Town Centre Blvd.
Markham, Ontario
Canada, L3R 0E8

In Accordance With

**FEDERAL COMMUNICATIONS COMMISSION (FCC)
PART 15, SUBPART C, SEC. 15.247
Digital Modulation Transmitters operating in the frequency
band 5725 - 5850 MHz**

UltraTech's File No.: RCI174FCC15C

This Test report is Issued under the Authority of
Tri M. Luu, Professional Engineer,
Vice President of Engineering
UltraTech Group of Labs



Date: Apr. 24, 2007

Report Prepared by: Mr. Tri Luu, P.Eng.

Tested by: Mr. Hung Trinh, RFI Technologist

Issued Date: Apr. 24, 2007

Test Dates: Test Dates: Apr. 19-23, 2007

- *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

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EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title	Telecommunication - Code of Federal Regulations, CFR 47, Part 15
Purpose of this Class II Permissive Change Application:	To gain FCC Class II Permissive Change Authorization for Digital Modulation Transmitters operating in the Frequency Band 5725 - 5850 MHz : Additional Antennas as specified in the test report are included in the certification for Point-to-Multipoint application. The Model AN-80i and it's antennas are required to be professionally installed. Remark: These additional Point-to Multipoint antennas are performed only for operation with 20 MHz Bandwidth. Other operation with bandwidths of 10 MHz and 40 MHz will allowed to be used with these Point-to-Point antennas.
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:	<ul style="list-style-type: none"> • Light-industry, Commercial • Industry

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

None

1.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	2005	Code of Federal Regulations – Telecommunication
ANSI C63.4	2004	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 +A1 EN 55022	2003-04-10 2004-10-14 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
CISPR 16-2-3	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Radiated disturbance measurement
FCC Test Procedures	Mar. 23, 2005	Measurement of Digital Transmission Systems. Operating under Section 15.247
FCC Public	2000	Part 15 Unlicensed Modular Transmitter Approval

ULTRATECH GROUP OF LABS

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File #: RCI174FCC15C
 Apr. 24, 2007

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

Notice DA 00-1407		
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File #: RCI174FCC15C
Apr. 24, 2007

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 1. PERFORMANCE ASSESSMENT

1.1. CLIENT INFORMATION

APPLICANT:	
Name:	Redline Communications Inc.
Address:	302 Town Centre Blvd. Markham, Ontario Canada, L3R 0E8
Contact Person:	Mr. Medhat Fawzy, P.Eng. Phone #: 905-479-8344 (ext. 443) Fax #: 905-479-5331 Email Address: mfawzy@redlinecommunications.com

MANUFACTURER:	
Name:	Redline Communications Inc.
Address:	302 Town Centre Blvd. Markham, Ontario Canada, L3R 0E8
Contact Person:	Mr. Sherwyn Welshman Phone #: 905-479-8344 (ext. 362) Fax #: 905-479-5331 Email Address: swelshman@redlinecommunications.com

1.2. 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	Broadband Wireless System
Model Name or Number	AN-80i
Serial Number	N/A
Type of Equipment	Digital Modulation Transmitters
Input Power Supply Type	48 Vdc from an external power PoE (power over the Ethernet Port), made by Cincon Electronics, Model TR60A-POE-L (SN: 002204), AC IN: 100-240 V, 50/60 Hz
Primary User Functions of EUT:	Provide data communication link through air

1.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	<ul style="list-style-type: none"> ▪ Base station (fixed use)
Intended Operating Environment:	<ul style="list-style-type: none"> ▪ Commercial, light industry & heavy industry
Power Supply Requirement:	48 Vdc from an external power PoE (power over the Ethernet Port), made by Cincon Electronics, Model TR60A-POE-L (SN: 002204), AC IN: 100-240 V, 50/60 Hz
Maximum RF Output Power Rating (Conducted):	
<ul style="list-style-type: none"> • (Channel BW: 20 MHz): 	<ul style="list-style-type: none"> • 23.3 dBm or 214 mWatts @ 5735 – 5840 MHz
Operating Frequency Range:	
<ul style="list-style-type: none"> • (Channel BW: 20 MHz): 	<ul style="list-style-type: none"> • 5735 – 5840 MHz
RF Output Impedance:	50 Ohms
Duty Cycle:	100% maximum
6 dB Bandwidth:	
<ul style="list-style-type: none"> • (Channel BW: 20 MHz): 	<ul style="list-style-type: none"> • 16.5 MHz
Modulation Type:	
<ul style="list-style-type: none"> • (Channel BW: 20 MHz): • 	<ul style="list-style-type: none"> • BPSK @ 9Mb/s, QPSK @ 18 Mb/s 16QAM @ 36 Mb/s and 64QAM @ 54 Mb/s
Emission Designation:	
<ul style="list-style-type: none"> • (Channel BW: 20 MHz): • 	<ul style="list-style-type: none"> • 16M5GXW •
Antenna Connector Type:	Female N connector (Professional Installation). Please refer to the User's manual for detailed instruction of Antenna installation and RF Exposure Warning.
Temperature Rating:	-40°C to + 60 °C

RECEIVER	
Operating Frequency Range:	5725 - 5850 MHz
RF Input Impedance:	50 Ohms

List of Additional Antennas vs. Conducted Peak Power Ratings

Redline Part Number	Manufacturers Part Number	Antenna Description	Antenna Frequency (GHz)	Gain (dBi)	Beamwidth Az/EI (Degrees)	Channel Frequency (MHz)	Tx Peak Conducted Power (dBm)	GUI Settings	Maximum EIRP (dBm)
48-00014-00	MT-484026/NV-R (MTI Wireless Edge)	ANTENNA, 60 DEG, 16dBi, 5.150-5.875 GHz, BS, 1.43x0.82 FT (436x250 mm) SECTOR FP REDLINE LABELED	5.150 - 5.875	16	60/10	5735.0 5787.5 5840.0	18.6 18.3 18.5	9	34.6 34.3 34.5
48-00017-00	MT-484027/NV-R (MTI Wireless Edge)	ANTENNA, 90 DEG, 14dBi, 5.150-5.875 GHz, BS, 1.43x0.82 FT (436x250 mm) SECTOR FP	5.150 - 5.875	14	90/10	5735.0 5787.5 5840.0	20.3 20.5 19.8	11	34.3 34.5 33.8
48-00028-00	SEC-55V-60-17 (Radiowaves)	ANTENNA, 60 DEG, 17dBi, 5.250-5.850 GHz, BS, 2.13x0.7 FT (650x216 mm), SECTOR FP	5.250 - 5.850	17	60/8	5735.0 5787.5 5840.0	17.2 17.3 16.8	8	34.2 34.3 33.8
48-00029-00	SEC-55V-90-16 (Radiowaves)	ANTENNA, 90 DEG, 16dBi, 5.250-5.850 GHz, BS, 2.13x0.7 FT (650x216 mm), SECTOR FP	5.250 - 5.850	16	90/8	5735.0 5787.5 5840.0	18.6 18.3 18.5	9	34.6 34.3 34.5
48-00047-00	MT-484034/NV-A (MTI Wireless Edge)	ANTENNA, 120 DEG, 15dBi, 5.15-5.875 GHz, BS, FP (550x250 mm)	5.150 - 5.875	15	120/6	5735.0 5787.5 5840.0	19.4 20.1 18.7	10	34.4 35.1 33.7
48-00065-00	SA15-120-5.5/9503/RLC (European Antennas)	ANTENNA, 120 DEG, 15dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	15	120/6.5	5735.0 5787.5 5840.0	19.4 20.1 18.7	10	34.4 35.1 33.7
48-00067-00 (*)	SA17-60-5.5/9501/RLC (European Antennas)	ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	17.5	62/6.5	5735.0 5787.5 5840.0	15.1 14.9 14.2	5	32.6 32.4 31.7
48-00066-00	SA16-90-5.5/9502/RLC (European Antennas)	ANTENNA, 90 DEG, 16.6dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	16.6	90/6.5	5735.0 5787.5 5840.0	17.2 17.3 16.8	8	34.7 34.8 34.3
48-00048-01 (*)	ECO9-5500 (Mobile Mark)	ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI	5 - 6	9	360/14	5735.0 5787.5 5840.0	19.4 20.8 20.3	13	28.4 29.8 29.3

(*) These antennas are chosen to test for worst cases. Test are not required for other antennas since they are the same type of the antennas certified in original certification with less antenna gain.

1.1. LIST OF ACCESSORIES

Index Number	Parts Description	Parts Number/ Model Number	Serial Number
1	Cincon Power Supply	TR60A-POE-L	N/A
2	Ethernet Cable	CAT 5e Outdoor	N/A
3	RF Cable	LMR 240	N/A
4	Antennas	See attached	N/A

1.2. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)	Is cable length restricted to be < 3 meters?
1	RF Port	1	N-Type	RF Shielded Coax	Yes
2	Ethernet Port	1	RJ-45	CAT 5e (Shielded)	No

1.3. 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:	Laptop Computer
Brand name:	Dell
Model Name or Number:	PA6
FCC Class II Permissive Change Authorization	FCC DoC
Serial Number:	N/A
Connected to EUT's Port:	Ethernet Port <ul style="list-style-type: none"> • Non-shielded RJ-45 cable from Laptop PC to AC/DC Power Adaptor • Shielded RJ-45 cable from AC/DC Power Adaptor to EUT

1.4. TEST SETUP BLOCK DIAGRAM

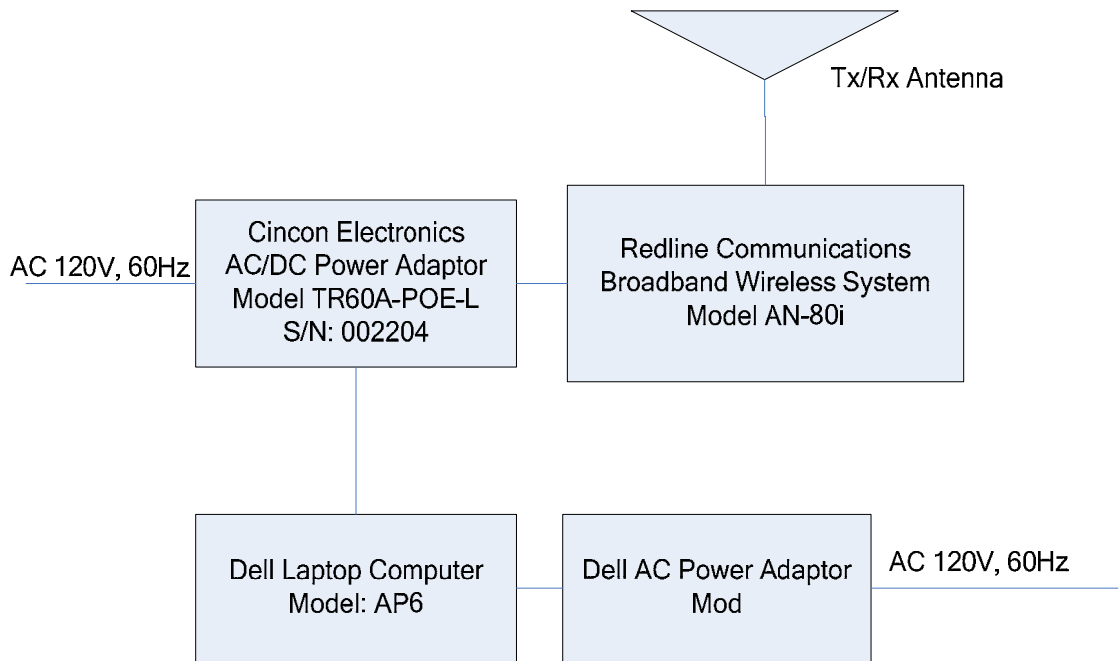


EXHIBIT 2. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

2.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	48 Vdc from an external power PoE (power over the Ethernet Port), made by Cincon Electronics, Model TR60A-POE-L (SN: 002204), AC IN: 100-240 V, 50/60 Hz

2.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	<ul style="list-style-type: none"> ▪ Each of lowest, middle and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in normal Direct Sequence mode for occupancy duration, and frequency separation.
Special Test Software:	<ul style="list-style-type: none"> ▪ Special software is provided by the Applicant to select and operate the EUT at each channel frequency continuously. For example, the transmitter will be operated at each of lowest, middle and highest frequencies individually continuously during testing.
Special Hardware Used:	N/A
Transmitter Test Antenna:	The EUT was tested with the highest gain Antenna in each family of Antennas listed in Sec. 1.3 of this test report.

Transmitter Test Signals:	
Frequencies:	Lowest, middle and highest channel frequencies tested:
<ul style="list-style-type: none"> ▪ 5735 - 5840 MHz band: 	
Transmitter Wanted Output Test Signals:	
<ul style="list-style-type: none"> • RF Power Output (measured maximum output power): • Normal Test Modulation • Modulating signal source: 	<ul style="list-style-type: none"> • 23.3 dBm or 214 mWatts @ 5735 – 5840 MHz (Channel BW: 20 MHz) • BPSK, QPSK 16QAM and 64QAM • Internal

EXHIBIT 3. SUMMARY OF TEST RESULTS

3.1. 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 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site 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 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: June. 20, 2006.

3.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
Public Notice DA 00-1407	Part 15 Unlicensed Modular Transmitter Approval	N/A for this Class II Permissive Change
15.107 & 15.207	Class B - AC Power Conducted Emissions on Tx, Rx and standby modes	N/A for this Class II Permissive Change
15.247(a)(2)	6dB Bandwidth of a Digital Modulation System	N/A for this Class II Permissive Change
15.247(b) & (c)	Maximum Peak Power (Conducted)	Yes
15.247(i) & 1.1307, 1.1310, 2.1091 & 2.1093	RF Exposure Limit	Yes
15.247(d)	RF Conducted Spurious Emissions at the Transmitter Antenna Terminal	N/A for this Class II Permissive Change
15.247(e)	Transmitted Power Density of a Digital Modulation System	N/A for this Class II Permissive Change
15.247(d), 15.209 & 15.205	Transmitter Radiated Emissions	Yes
FCC Part 15, Sub. B, Sec. 15.109	Class B Radiated Emissions	N/A for this Class II Permissive Change

3.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None

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File #: RCI174FCC15C
 Apr. 24, 2007

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

EXHIBIT 4. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS

4.1. TEST PROCEDURES

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4, "FCC Measurement of Digital Transmission Systems Operating under Section 15.247 - March 23, 2005", ULTR-P001-2004, ULTR-P002-2004 and ULTR-P003-2004.

4.2. MEASUREMENT UNCERTAINTIES

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

4.3. MEASUREMENT EQUIPMENT USED:

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1.

4.4. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	
15.203	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> • The application (or intended use) of the EUT • The installation requirements of the EUT • The method by which the EUT will be marketed 	The Antenna connector is standard “N” type connector. The device and it’s Antenna are required to be professionally installed.
15.204	<p>Provided the information for every Antenna proposed for use with the EUT:</p> <p>(a) type (e.g. Yagi, patch, grid, dish, etc...), (b) manufacturer and model number (c) gain with reference to an isotropic radiator</p>	Please refer to the Antenna list below

4.5. OUTPUT POWER (CONDUCTED) @ FCC 15.247(B)&(C)

4.5.1. Limits

FCC 15.247(b):

- (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all Antennas and Antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all Antennas and Antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.
- (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of Antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting Antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the Antenna exceeds 6 dBi.

FCC 15.247(c): Operation with directional Antenna gains greater than 6 dBi.

- (1) Fixed point-to-point operation:
 - (i) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting Antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

- (iii) Fixed, point-to-point operation, as used in paragraphs (c)(4)(i) and (c)(4)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

4.5.2. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Power Meter	Hewlett Packard	8900D	2131A01044	9 kHz – 40 GHz

4.5.3. Method of Measurements

Refer to “FCC Measurement of Digital Transmission Systems Operating under Section 15.247 - March 23, 2005”

This is an RF conducted test. Use a direct connection between the Antenna port of the transmitter and the spectrum analyzer, through suitable attenuation. Power Output Option 1 is a peak measurement. Power Output Option 2 is the same procedure used for UNII output power measurements. Either option can be used for DTS devices.

Power Output Option 1:

The total peak power was measured using peak power meter

4.5.4. Test Data

Remark: These additional Point-to Multipoint antennas are performed only for operation with 20 MHz Bandwidth. Other operation with bandwidths of 10 MHz and 40 MHz will allowed to be used with these Point-to-Point antennas.

Conducted Peak Power & EIRP wrt. Antenna Gains

Redline Part Number	Manufacturers Part Number	Antenna Description	Antenna Frequency (GHz)	Gain (dBi)	Beamwidth Az/EI (Degrees)	Channel Frequency (MHz)	Tx Peak Conducted Power (dBm)	GUI Settings	Maximum EIRP (dBm)
48-00014-00	MT-484026/NV-R (MTI Wireless Edge)	ANTENNA, 60 DEG, 16dBi, 5.150-5.875 GHz, BS, 1.43x0.82 FT (436x250 mm) SECTOR FP REDLINE LABELED	5.150 - 5.875	16	60/10	5735.0 5787.5 5840.0	18.6 18.3 18.5	9	34.6 34.3 34.5
48-00017-00	MT-484027/NV-R (MTI Wireless Edge)	ANTENNA, 90 DEG, 14dBi, 5.150-5.875 GHz, BS, 1.43x0.82 FT (436x250 mm) SECTOR FP	5.150 - 5.875	14	90/10	5735.0 5787.5 5840.0	20.3 20.5 19.8	11	34.3 34.5 33.8
48-00028-00	SEC-55V-60-17 (Radiowaves)	ANTENNA, 60 DEG, 17dBi, 5.250-5.850 GHz, BS, 2.13x0.7 FT (650x216 mm), SECTOR FP	5.250 - 5.850	17	60/8	5735.0 5787.5 5840.0	17.2 17.3 16.8	8	34.2 34.3 33.8
48-00029-00	SEC-55V-90-16 (Radiowaves)	ANTENNA, 90 DEG, 16dBi, 5.250-5.850 GHz, BS, 2.13x0.7 FT (650x216 mm), SECTOR FP	5.250 - 5.850	16	90/8	5735.0 5787.5 5840.0	18.6 18.3 18.5	9	34.6 34.3 34.5
48-00047-00	MT-484034/NV-A (MTI Wireless Edge)	ANTENNA, 120 DEG, 15dBi, 5.15-5.875 GHz, BS, FP (550x250 mm)	5.150 - 5.875	15	120/6	5735.0 5787.5 5840.0	19.4 20.1 18.7	10	34.4 35.1 33.7
48-00065-00	SA15-120-5.5/9503/RLC (European Antennas)	ANTENNA, 120 DEG, 15dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	15	120/6.5	5735.0 5787.5 5840.0	19.4 20.1 18.7	10	34.4 35.1 33.7
48-00067-00 (*)	SA17-60-5.5/9501/RLC (European Antennas)	ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	17.5	62/6.5	5735.0 5787.5 5840.0	15.1 14.9 14.2	5	32.6 32.4 31.7
48-00066-00	SA16-90-5.5/9502/RLC (European Antennas)	ANTENNA, 90 DEG, 16.6dBi, 4.9-5.9 GHz, SECTOR FP	4.9 - 5.9	16.6	90/6.5	5735.0 5787.5 5840.0	17.2 17.3 16.8	8	34.7 34.8 34.3
48-00048-01 (*)	ECO9-5500 (Mobile Mark)	ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI	5 - 6	9	360/14	5735.0 5787.5 5840.0	19.4 20.8 20.3	13	28.4 29.8 29.3

(*) These power measurements were performed by Ultratech Eng. Labs Inc. The others were performed by the manufacturer (Redline Communications Inc.)

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- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

4.1. RF EXPOSURE REQUIRMENTS @ FCC 15.247(I), 1.1307(B)(1)

4.1.1. Limits

- **FCC 15.247(i):** Systems operating under provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission’s guidelines. See @ 1.1307(b)(1).
- **FCC 1.1310:-** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
1500-100,000	5	6
(B) Limits for General Population/Uncontrolled Exposure				
1500-100,000	1.0	30

F = Frequency in MHz

4.1.2. Method of Measurements

Refer to FCC @ 1.1310, 2.1091

- Spread spectrum transmitters operating under section 15.247 are categorically from routine environmental evaluation to demonstrating RF exposure compliance with respect to MPE and/or SAR limits. These devices are not exempted from compliance (As indicated in Section 15.247(b)(5), these transmitters are required to operate in a manner that ensures that exposure to public users and nearby persons) does not exceed the Commission’s RF exposure guidelines (see Section 1.1307 and 2.1093). Unless a device operates at substantially low power levels, with a low gain Antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its Antenna(s) in order to determine compliance with the RF exposure guidelines.
- In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:
 - (1) Calculation that estimates the minimum separation distance (20 cm or more) between an Antenna and persons required to satisfy power density limits defined for free space.
 - (2) Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement
 - (3) Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits
 - (4) Any other RF exposure related issues that may affect MPE compliance

Calculation Method of RF Safety Distance:

$$S = PG/4\pi r^2 = EIRP/4\pi r^2$$

Where: P: power input to the Antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm²
G: numeric gain of Antenna relative to isotropic radiator
r: distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the Antenna of this device

$$r = \sqrt{PG/4\pi S}$$

FCC radio frequency exposure limits may not be exceeded at distances closer than r cm from the Antenna of this device

- For portable transmitters (see Section 2.1093), or devices designed to operate next to a person's body, compliance is determined with respect to the SAR limit (define in the body tissues) for near-field exposure conditions. If the maximum average output power, operating condition configurations and exposure conditions are comparable to those of existing cellular and PCS phones., an SAR evaluation may be required in order to determine if such a device complies with SAR limit. When SAR evaluation data is not available, and the additional supporting information cannot assure compliance, the Commission may request that a SAR evaluation be performed, as provided for in Section 1.1307(d)

- All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

4.1.3. Test Data

Frequency Range (MHz)	Maximum Conducted Peak Power at the Antenna Terminal (dBm)	Maximum Antenna Gain (dBi)	Maximum Allowable EIRP (dBm)	Laboratory's Recommended Minimum RF Safety Distance r (cm)
5375 - 5840	Refer to Sec. 4.5.4	Refer to Sec. 4.5.4	36.0	17.8

Note 1: RF EXPOSURE DISTANCE LIMITS: $r = (PG/4\Pi S)^{1/2} = (EIRP/4\Pi S)^{1/2}$
 Limits for General Population/Uncontrolled Exposure: $S = 1.0 \text{ mW/cm}^2$

Evaluation of RF Exposure Compliance Requirements	
RF Exposure Requirements	Compliance with FCC Rules
Minimum calculated separation distance between Antenna and persons required: 17.8 meters	Manufacturer' instruction for separation distance between Antenna and persons required: 20 cm.
Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement	Antenna is required to be professionally installed

4.2. TRANSMITTER BAND-EDGE & SPURIOUS EMISSIONS (RADIATED @ 3 METERS), FCC CFR 47, PARA. 15.247(D), 15.209 & 15.205

4.2.1. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

Remarks:

- Applies to harmonics/spurious emissions that fall in the restricted bands listed in Section 15.205. The maximum permitted average field strength is listed in Section 15.209.
- @ FCC CFR 47, Para. 15.237(c) - The emission limits as specified above are based on measurement instrument employing an average detector. The provisions in @15.35 for limiting peak emissions apply.

FCC CFR 47, Part 15, Subpart C, 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 C, 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

4.2.2. Method of Measurements

Refer to “FCC Measurement of Digital Transmission Systems Operating under Section 15.247 - March 23, 2005” and Ultratech Test Procedures, File # ULTR P003-2004 and ANSI C63.4 for measurement methods

Radiated emission test: Applies to harmonics/spurs 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 possibly a high-pass filter) is necessary for this measurement. For measurements above 1 GHz, set RBW = 1MHz, VBW = 10 Hz, Sweep: Auto. If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation. See Section 15.35(b) and (c).

4.2.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
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

4.2.4. Photographs of Test Setup

Refer to the Photographs #1 to #4 in Annex 1 for setup and arrangement of equipment under tests and its ancillary equipment.

4.2.5. Test Data

Notes:

The Radiated Band-edge and Spurious Emissions were performed on with the following antennas:

- (1) ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas)
- (2) ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark)

Test are not required be required for other antennas since they are the same type of the antennas certified in original certification with less antenna gain and less rf output power for Point to Multi-point application.

4.2.5.1. Transmitter Radiated Band-edge Spurious Emissions

Conforms. Please refer to Plots # 1((a),(b),(c)&(d) to # 2((a),(b),(c)&(d) for detailed measurements of band-edge radiated emissions.

4.2.5.2. Transmitter Radiated Spurious Emissions

- 4.2.5.2.1.1. Test Configuration #1: ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas) – Channel Spacing: 20 MHz, GUI Setting: 5 dBm (Maximum Peak Power = 15.1 dBm), Modulation: 64QAM @54 Mb/s

4.2.5.2.1.1.1. Carrier Frequency of 5735 MHz (Lowest)

Frequency (MHz)	RF Peak Level (dBμV/m)	RF AVG Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

*Frequency in restricted frequency band.

4.2.5.2.1.1.2. Carrier Frequency of 5787.5 MHz (Middle)

Frequency (MHz)	RF Peak Level (dBμV/m)	RF AVG Level (dBμV/m)	Antenna Plane (H/V)	Limit 15.209 (dBμV/m)	Limit 15.247 (dBμV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

*Frequency in restricted frequency band.

4.2.5.2.1.1.3. Carrier Frequency of 5840 MHz (Highest)

Frequency (MHz)	RF Peak Level (dBµV/m)	RF AVG Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

*Frequency in restricted frequency band.

4.2.5.2.1.2. Test Configuration #2: ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark) – Channel Spacing: 20 MHz, GUI Setting: 13 dBm (Maximum Peak Power = 20.8 dBm), Modulation: 64QAM @54 Mb/s

4.2.5.2.1.2.1. Carrier Frequency of 5735 MHz (Lowest)

Frequency (MHz)	RF Peak Level (dBµV/m)	RF AVG Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

*Frequency in restricted frequency band.

4.2.5.2.1.2.2. Carrier Frequency of 5787.5 MHz (Middle)

Frequency (MHz)	RF Peak Level (dBµV/m)	RF AVG Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

*Frequency in restricted frequency band.

4.2.5.2.1.2.3. Carrier Frequency of 5840 MHz (Highest)

Frequency (MHz)	RF Peak Level (dBµV/m)	RF AVG Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/Fail
30 – 40,000	**	**	H	54.0	68.2	**	Pass
** The radiated emissions from the transmitter were scanned from 30 MHz to 40 GHz and no significant emissions were found in this band (all spurious an harmonic emissions form the transmitter were more than 20 dB below the FCC Limits 15.209 or 15.247 whatever it is applicable)							

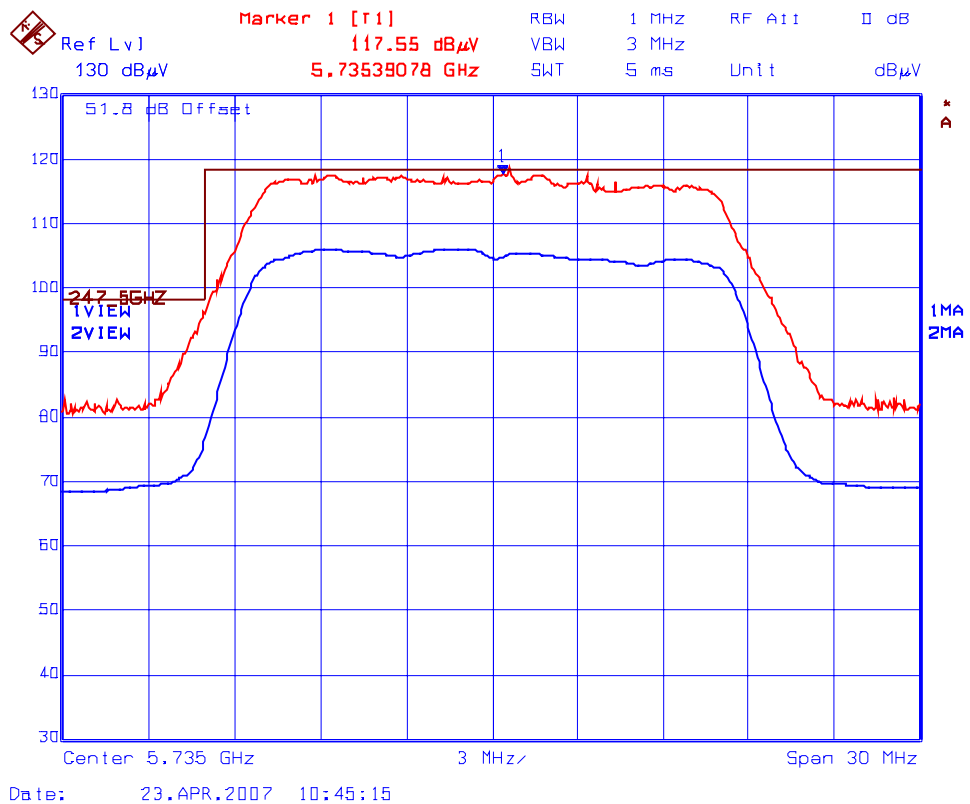
*Frequency in restricted frequency band.

Plot #1(a): Lower Band-Edge Radiated Emissions Horizontal Polarization

Test Configuration #1: ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline
P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas) –
Channel Frequency: 5735 MHz, Channel Spacing: 20 MHz, GUI Setting: 5 dBm (Maximum
Peak Power = 15.1 dBm), Modulation: 64QAM @54 Mb/s

Trace 1: RBW= 1 MHz, VBW= 3 MHz

Trace 2: RBW= 1 MHz, VBW= 10 Hz

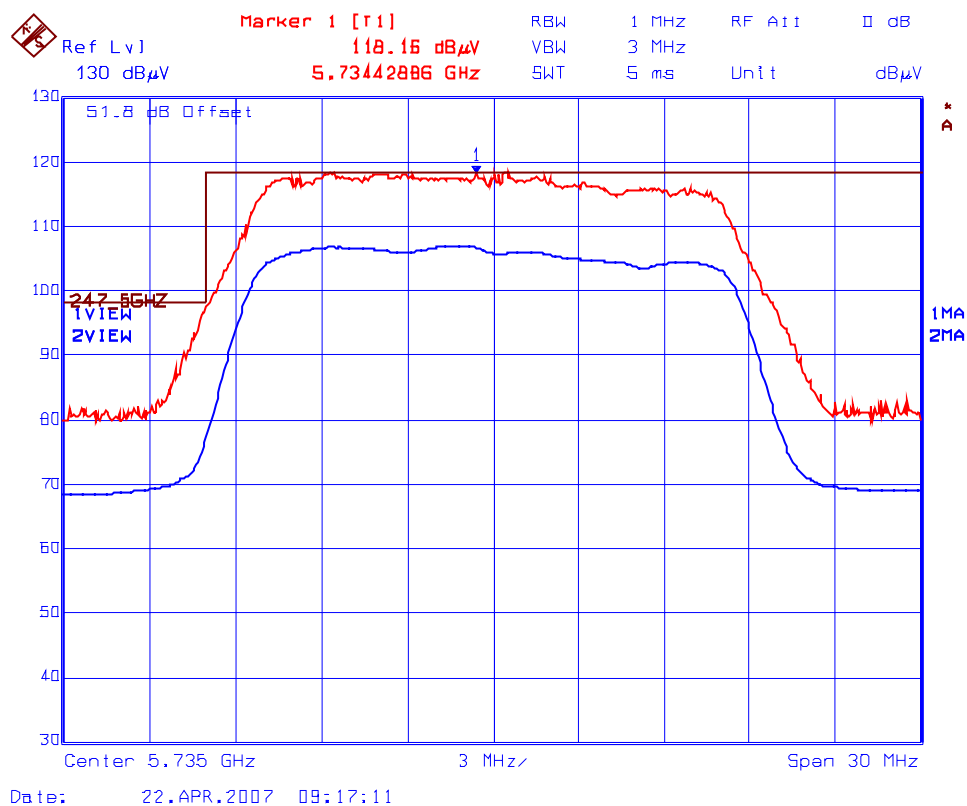


Plot #1(b): Lower Band-Edge Radiated Emissions Vertical Polarization

Test Configuration #1: ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline
P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas) –
Channel Frequency: 5735 MHz, Channel Spacing: 20 MHz, GUI Setting: 5 dBm (Maximum
Peak Power = 15.1 dBm), Modulation: 64QAM @54 Mb/s

Trace 1: RBW= 1 MHz, VBW= 3 MHz

Trace 2: RBW= 1 MHz, VBW= 10 Hz

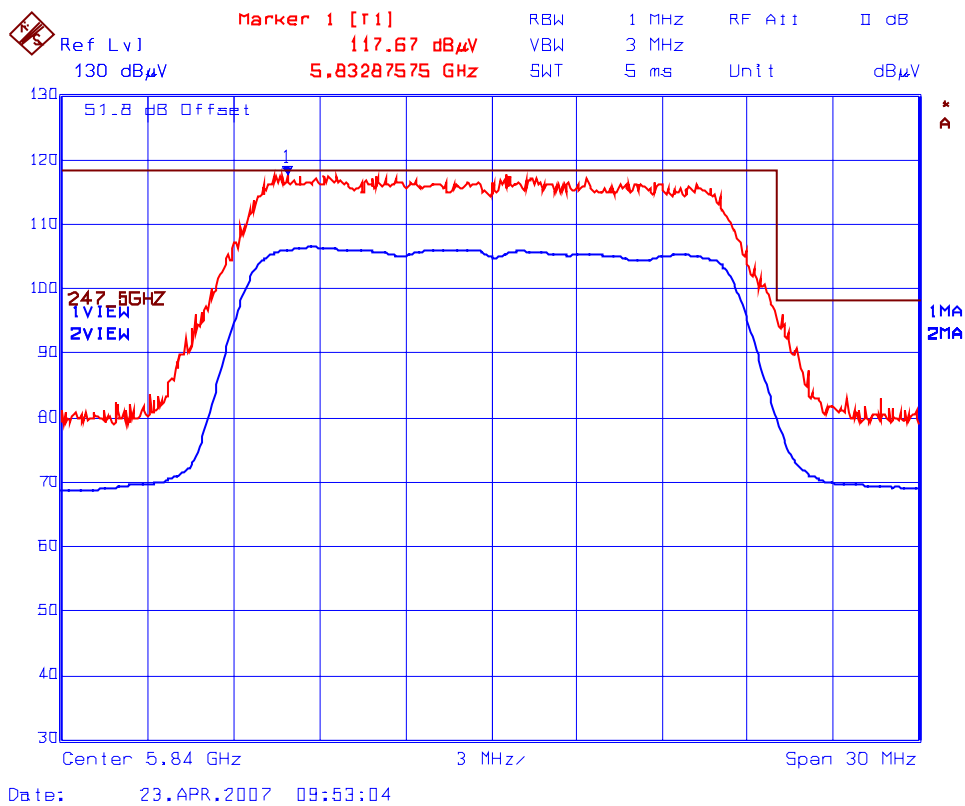


Plot #1(c): Lower Band-Edge Radiated Emissions Horizontal Polarization

Test Configuration #1: ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline
P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas) –
Channel Frequency: 5840 MHz, Channel Spacing: 20 MHz, GUI Setting: 5 dBm (Maximum
Peak Power = 14.2 dBm), Modulation: 64QAM @54 Mb/s

Trace 1: RBW= 1 MHz, VBW= 3 MHz

Trace 2: RBW= 1 MHz, VBW= 10 Hz



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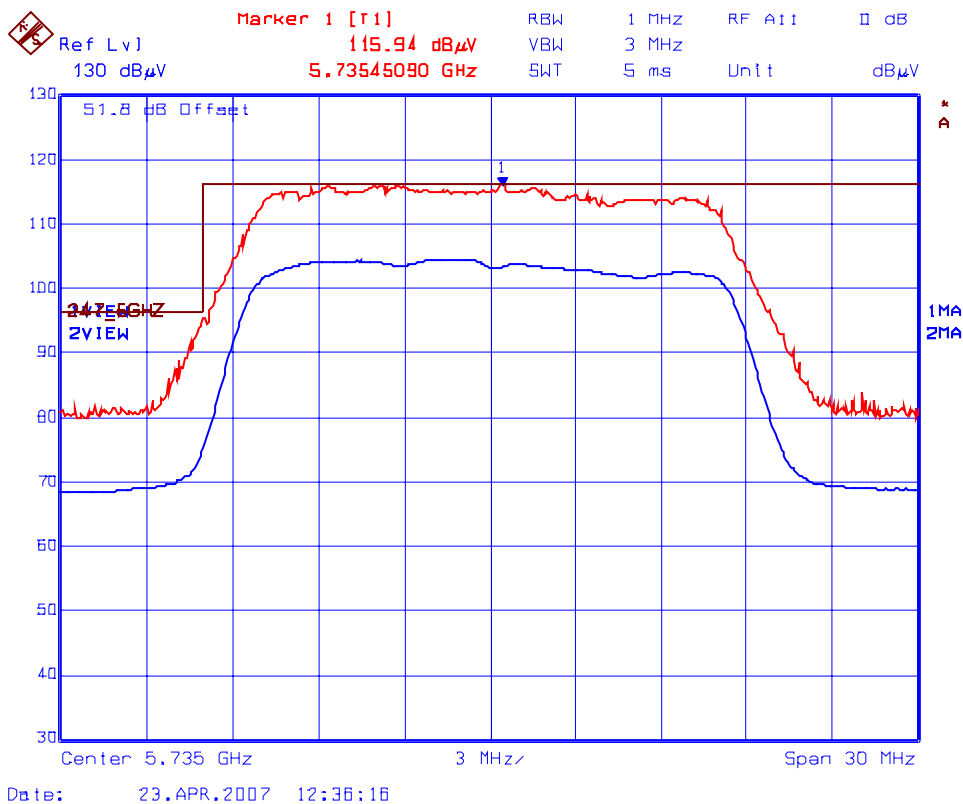
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Plot #1(d): Lower Band-Edge Radiated Emissions Vertical Polarization

Test Configuration #1: ANTENNA, 62 DEG, 17.5dBi, 4.9-5.9 GHz, SECTOR FP, Redline P/N: 48-00067-00, Manufacturer P/N: SA17-60-5.5/9501/RLC (European Antennas) – Channel Frequency: 5840 MHz, Channel Spacing: 20 MHz, GUI Setting: 5 dBm (Maximum Peak Power = 14.2 dBm), Modulation: 64QAM @54 Mb/s

Trace 1: RBW= 1 MHz, VBW= 3 MHz

Trace 2: RBW= 1 MHz, VBW= 10 Hz



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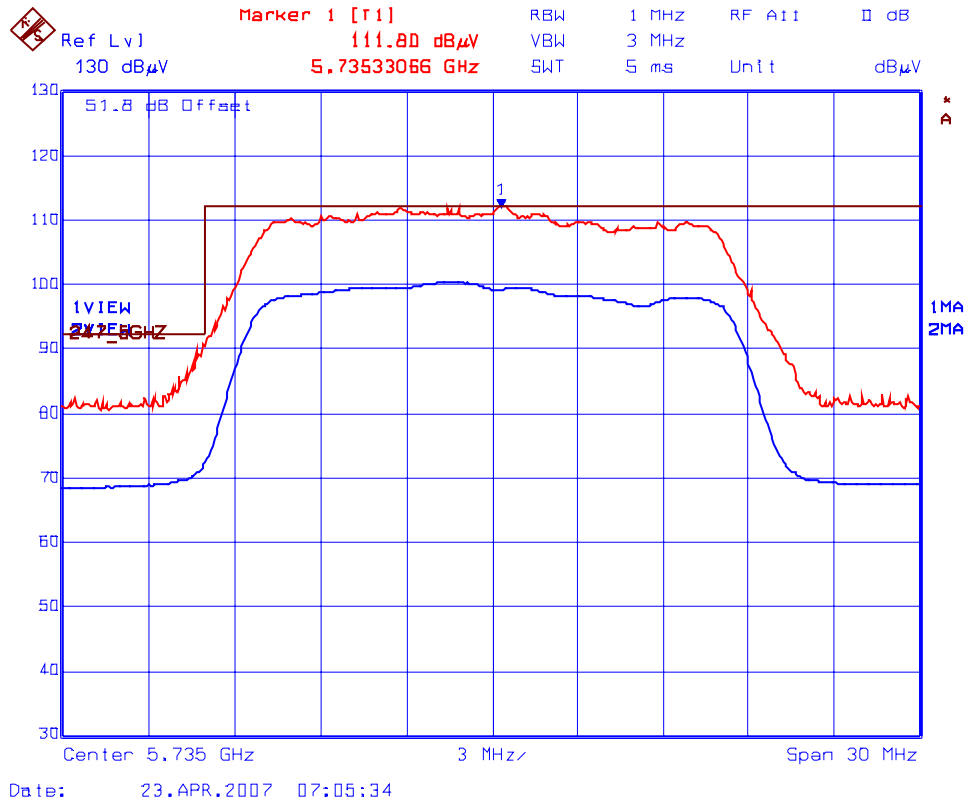
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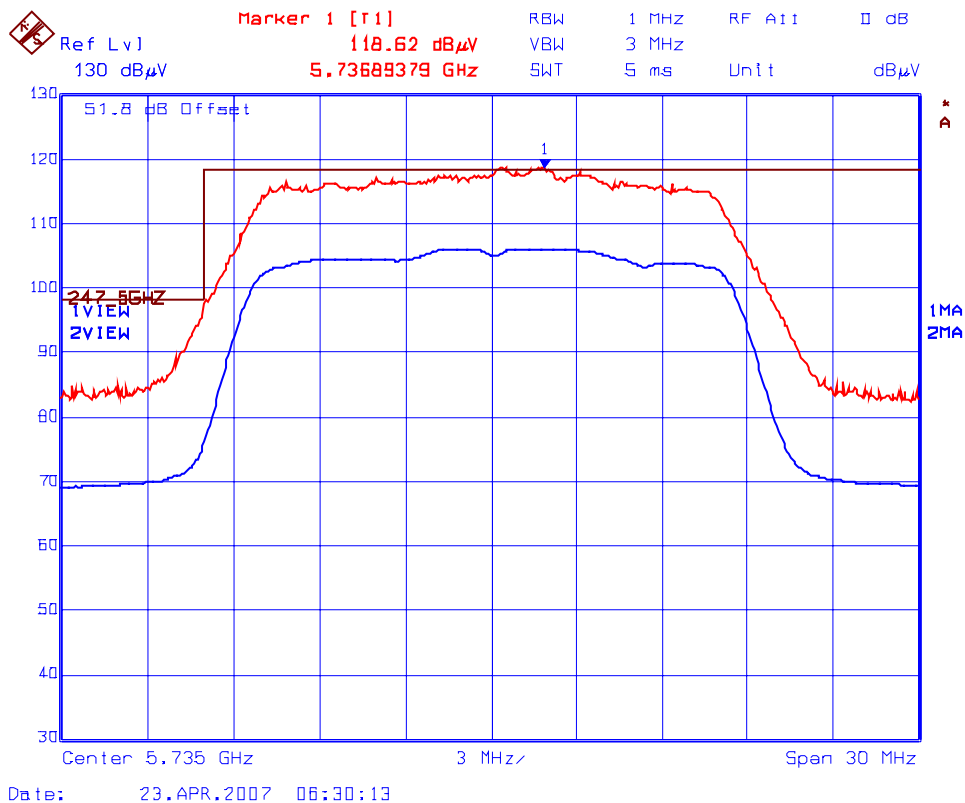
Plot #2(a): Lower Band-Edge Radiated Emissions Horizontal Polarization

Test Configuration #2: ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark) – Channel Frequency: 5735 MHz, Channel Spacing: 20 MHz, GUI Setting: 13 dBm (Maximum Peak Power = 19.4 dBm), Modulation: 64QAM @54 Mb/s



Plot #2(b): Lower Band-Edge Radiated Emissions Vertical Polarization

Test Configuration #2: ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark) – Channel Frequency: 5735 MHz, Channel Spacing: 20 MHz, GUI Setting: 13 dBm (Maximum Peak Power = 19.4 dBm), Modulation: 64QAM @54 Mb/s



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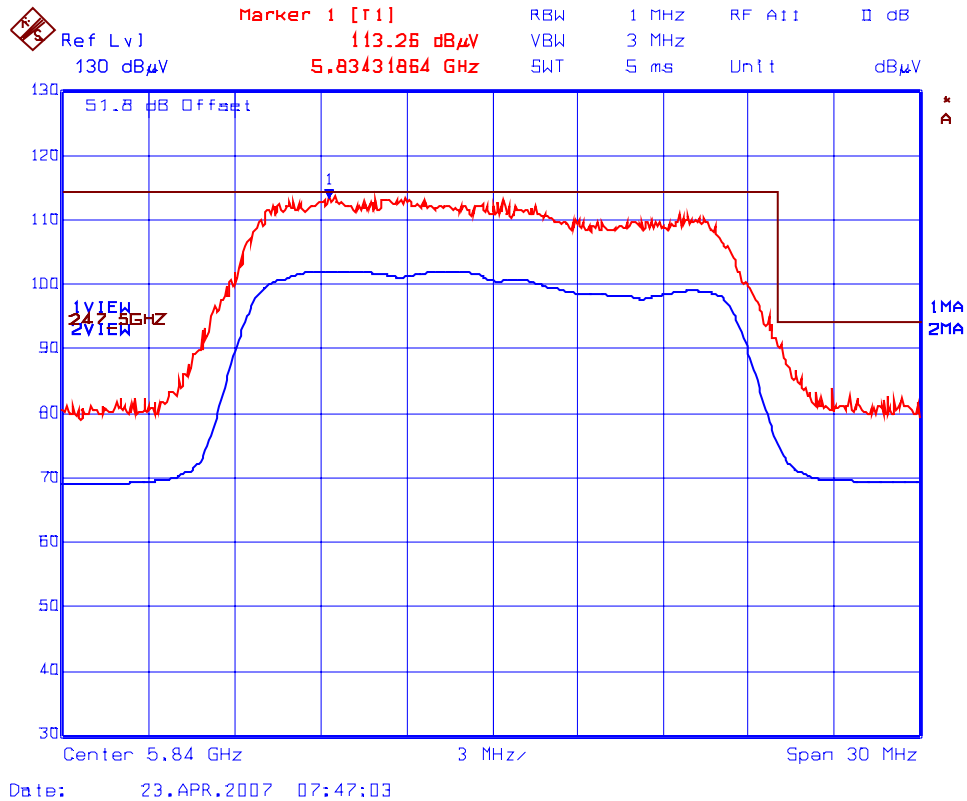
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4
Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: <http://www.ultratech-labs.com>

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Plot #2(a): Lower Band-Edge Radiated Emissions Horizontal Polarization

Test Configuration #2: ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark) – Channel Frequency: 5840 MHz, Channel Spacing: 20 MHz, GUI Setting: 13 dBm (Maximum Peak Power = 20.3 dBm), Modulation: 64QAM @54 Mb/s



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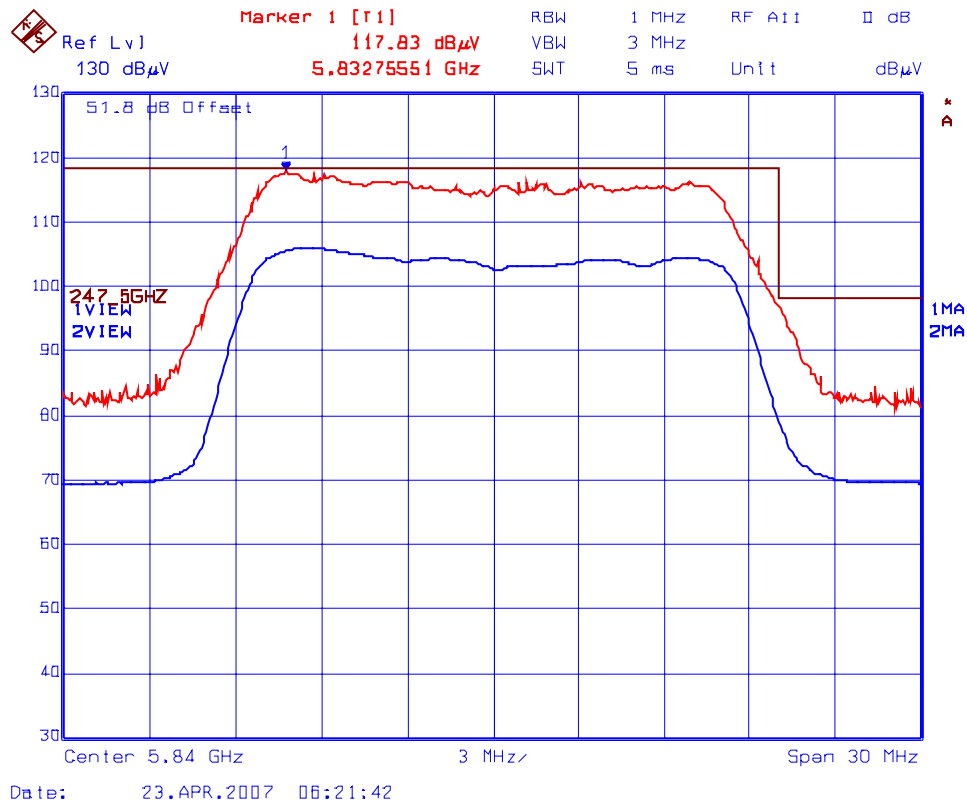
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Tel. #: 905-829-1570, Fax. #: 905-829-8050, Email: vic@ultratech-labs.com, Website: http://www.ultratech-labs.com

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Plot #2(b): Lower Band-Edge Radiated Emissions Vertical Polarization

Test Configuration #2: ANTENNA, 360 DEG, 9dBi, 5 - 6 GHz, OMNI, Redline P/N: 48-00048-01, Manufacturer P/N: ECO9-5500 (Mobile Mark) – Channel Frequency: 5840 MHz, Channel Spacing: 20 MHz, GUI Setting: 13 dBm (Maximum Peak Power = 20.3 dBm), Modulation: 64QAM @54 Mb/s



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EXHIBIT 5. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

5.1. 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 Directivity	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 $\Gamma_R = 0.67(\text{Bi}) 0.3 (\text{Lp})$ Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$	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:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$