Radioframe Networks, Inc.

DH2

Test Report

January 15, 2003

Report No. RAFN0023

Report Prepared By:

NORTHWEST EMC

1-888-EMI-CERT

NORTHWEST EMC

22975 NW Evergreen Parkway
Suite 400
Hillsboro, Oregon 97124

Certificate of Test

Issue Date: July 01, 2003
Radioframe Networks, Inc.
Model : DH2

Emissions

Description	Pass	Fail
FCC 15.247, Power Spectral Density	☒	☐
FCC 15.247, Spurious RF Conducted Emissions	☒	☐
FCC 15.247, Band Edge Compliance	☒	☐
FCC 15.247, Peak Output Power	☒	☐
FCC 15.247, Occupied Bandwidth	☒	☐
FCC 15.247, Spurious Radiated Emissions	☒	☐
FCC 15.207, AC Power Line Conducted Emissions	☒	☐

The equipment was tested in the configuration and mode(s) of operation provided by the client. The specific tests and test levels were specified by the client. Any additional tests, or product configurations that should be tested are the responsibility of the client. Product compliance is the responsibility of the client.

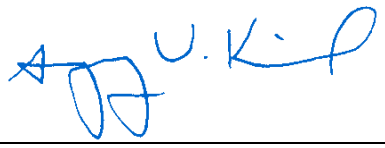
Modifications made to the product

- No EMI suppression devices were added or modified. The EUT was tested as delivered.

Deviations to the test standard

- No deviations were made to the test standard

Approved By:



Greg Kiemel, Director of Engineering

This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested, the specific description is noted in each of the individual sections of the test report supporting this certificate of test.

Revision Number	Description	Date	Page Number
00	None		

FCC: The Open Area Test Sites, and conducted measurement facilities, have been fully described in reports filed with the FCC and accepted by the FCC in letters maintained in our files.

TCB: Northwest EMC has been accredited by ANSI to ISO/IEC Guide 65 as a product certifier. We have been designated by the FCC as a Telecommunications Certification Body (TCB). This allows Northwest EMC to certify transmitters to FCC specifications in accordance with 47 CFR 2.960 and 2.962.

A2LA: Accreditation has been granted to Northwest EMC, Inc. to perform the Electromagnetic Compatibility (EMC) tests described in the Scope of Accreditation. Assessment performed to ISO/IEC 17025.
Certificate Number: 1936-01, Certificate Number: 1936-02, Certificate Number 1936-03

Australia/New Zealand: The National Association of Testing Authorities (NATA), Australia has been appointed by the ACA as an accreditation body to accredit test laboratories and competent bodies for EMC standards. Accredited test reports or assessments by competent bodies must carry the NATA logo. Test reports made by an overseas laboratory that has been accredited for the relevant standards by an overseas accreditation body that has a Mutual Recognition Agreement (MRA) with NATA are also accepted as technical grounds for product conformity. The report should be endorsed with the respective logo of the accreditation body. (A2LA)

TÜV Product Service: Included in TUV Product Service Group's Listing of Recognized Laboratories. It qualifies in connection with the TUV Certification after Recognition of Agent's Testing Program for the product categories and/or standards shown in TUV's current Listing of CARAT Laboratories available from TUV. A certificate was issued to represent that this laboratory continues to meet TUV's CARAT Program requirements.
Certificate No. USA0302C

TÜV Rheinland: Authorized to carryout EMC tests by order and under supervision of TÜV Rheinland. This authorization is based on "Conditions for EMC-Subcontractors" of November 1992.

Accreditations and Authorizations

NEMKO: Assessed and accredited by NEMKO (Norwegian testing and certification body) for European emissions and immunity testing. As a result of NEMKO's laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification (Authorization No. ELA 119).

Technology International: Assessed in accordance with ISO Guide 25 defining the general international requirements for the competence of calibration and testing laboratories and with ITI assessment criteria LACO196. Based upon that assessment Interference Technology International, Ltd., has granted approval for specifications implementing the EU Directive on EMC (89/336/EEC and amendments). The scope of the approval was provided on a Schedule of Assessment supplied with the certificate and is available upon request.

Industry Canada: Accredited by Industry Canada for performance of radiated measurements. Our open area test sites comply with RSP 100, Issue 7, section 3.3.

VCCI: Accepted as an Associate Member to the VCCI, Acceptance No. 564. Conducted and radiated measurement facilities have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. *(Registration Nos. - Evergreen: C-1071 and R-1025, Trails End: C-694 and R-677, Sultan: C-905, R-871 and R-1172, North Sioux City C-1246, R-1185 and R-1217)*

BSMI: Northwest EMC has been designated by NIST and validated by C-Taipei (BSMI) as a CAB to conduct tests as described in the APEC Mutual Recognition Agreement. License No.SL2-IN-E-1017.

CAB: Designated by NIST and validated by the European Commission as a Conformity Assessment Body (CAB) to conduct tests and approve products to the EMC directive and transmitters to the R&TTE directive, as described in the U.S. - EU Mutual Recognition Agreement

GOST: Northwest EMC, Inc. has been assessed and accredited by the Russian Certification bodies Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC, to perform EMC and Hygienic testing for Information Technology Products. As a result of their laboratory assessment, they will accept test results from Northwest EMC, Inc. for product certification

Northwest EMC

Scope of Accreditations

Revision 06/24/03

	FCC	NIST	TUV PS	TUV Rheinland	Nemko	Technology International	Industry Canada	BSMI	VCCI	GOST	NATA
IEC 1000-4-2			✓	✓	✓	✓					
IEC 1000-4-3			✓	✓	✓	✓					
IEC 1000-4-4			✓	✓	✓	✓					
IEC 1000-4-5			✓	✓	✓	✓					
IEC 1000-4-6			✓	✓	✓	✓					
IEC 1000-4-8			✓	✓	✓	✓					
IEC 1000-4-11			✓	✓	✓	✓					
IEC 1000-3-2			✓	✓	✓	✓					
IEC 1000-3-3			✓	✓	✓	✓					
AS/NZS 3548											✓
CNS 13438								✓			
ISO/IEC Guide 25			✓	✓	✓	✓		✓			
ISO/IEC17025			✓	✓	✓	✓					
Radiated Emissions			✓	✓	✓	✓	✓	✓	✓	✓	
Conducted Emissions			✓	✓	✓	✓	✓	✓	✓	✓	
OATS Sites	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Hillsboro 5-Meter Chamber (EV01)	✓		✓	✓	✓	✓	✓	✓	✓	✓	
TCB for Licensed Transmitters	✓										
TCB for un-Licensed Transmitters	✓										
Cab for R&TTE		✓									
CAB for EMC		✓									

SCOPE OF ACCREDITATION TO ISO/IEC 17025-1999

NORTHWEST EMC
Evergreen Facility
22975 NW Evergreen Pkwy #400
Hillsboro, OR 97124
David Tolman Phone: 503 844 4066

ELECTRICAL (EMC)

Valid until: July 31, 2004 Certificate Number: 1936-01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following Electromagnetic Compatibility (EMC) tests:

EMC Standards	Title
Radiated & Conducted Emissions	
CFR 47, FCC Part 15 using ANSI C63.4	American National Standard for methods of measurement of radio-noise emissions for low-voltage electrical and electronic equipment in the range of 9 kHz to 40GHz.
CISPR 22	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
CNS 13438	Limits and methods of measurement of radio interference characteristics of information technology equipment.
EN 55022	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
Canada ICES-003	Digital apparatus
AS/NZS 3548	Australian/New Zealand Standard Limits and methods of measurement of radio disturbance characteristics of information technology equipment
Canada ICES-001	Industrial, scientific and medical radio frequency generators
CNS 13803	Industrial, Scientific and Medical Instrument

AS/NZS 2064	Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
EN 61000-6-3	Electromagnetic capability – Generic emission standard. Part 1: Residential, commercial and light industry. (I.S.)
EN 61000-6-4	Electromagnetic compatibility – Generic emission standard. Part 2: Industrial environment
VCCI V-3/99.05	Technical Requirements
VCCI V-4/99.05	Instruction for Test Conditions for Requirement under Test
CISPR 11	Limits and methods of measurement of electromagnetic disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
EN 55011	Limits and methods of measurement of radio disturbance characteristics of industrial, scientific and medical (ISM) radio-frequency equipment.
EN 55103-1	Electromagnetic Compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 1: Emission
EN 61000-3-2	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: Limits for harmonic current emissions
EN 61000-3-3	Electromagnetic compatibility (EMC). Part 3: Limits Section 2: Limitation of voltage fluctuations and flicker in low-voltage supply systems.
GR-1089 Section 3 (excluding analog voice band)	Bellcore electromagnetic compatibility and electrical safety – Generic criteria for network telecommunications equipment.
Immunity	
EN 61000-4-2 AS/NZS 61000-4-2	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 2: Electrostatic discharge immunity test – Basic EMC Publication
EN 61000-4-3 AS/NZS 61000-4-3	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 3: Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4 AS/NZS 61000-4-4	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 4: Electrical fast transient/burst immunity test – Basic EMC publication

EN 61000-4-5 AS/NZS 61000-4-5	Electromagnetic compatibility (EMC) Part 4: Testing and measurement techniques. Section 5: Surge immunity test.
EN 61000-4-6 AS/NZS 61000-4-6	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 6: Immunity to conducted disturbances, induce by radio-frequency fields.
EN 61000-4-8	Electromagnetic compatibility (EMC). Part 4: Testing and measurement techniques. Section 8: Power frequency magnetic field immunity test.
EN 61000-4-11	Electromagnetic Compatibility (EMC) Part 4: Testing and measurement techniques. Section 11: Voltage dips, short interruptions and voltage. Variations immunity tests.
EN 61000-6-1	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 1: Immunity for residential, commercial and light-industrial environments
EN 61000-6-2	Electromagnetic Compatibility (EMC)- Part 6: Generic standards- Section 2: Immunity for industrial environments
IEEE/ANSI C62.41	IEEE recommended practice on surge voltages in low-voltage AC power circuits

Product Standards

GR-1089 Section 3 (excluding voice band)	Bellcore electromagnetic compatibility and electrical safety – Generic criteria for network telecommunications equipment.
EN 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 60601-1-2	Medical electrical equipment Part 1: general requirements for safety Section 2: Collateral standard: Electromagnetic compatibility – requirements and tests
EN 50130-4	Alarm Systems. Part 4: Electromagnetic compatibility. Product family standard: Immunity requirements for components of fire, intruder and social alarm systems.
EN 55103-2	Electromagnetic Compatibility – Product family standard for audio, video, audio-visual and entertainment lighting control professional use. Part 2: Immunity
EN 55024	Immunity Requirements for Information Technology Equipment – ITE Immunity

Other Standards

ETS 300 220	Electromagnetic compatibility and Radio spectrum matters (ERM); Short range devices; Technical characteristics and test methods for radio equipment to be used in the 25 MHZ to 1000 MHZ frequency range with power levels ranging up to 500 mW; Part 1: Parameters intended for regulatory purposes; Part 2: Supplementary parameters not intended for regulatory Purposes
ETS 300 224	Electro Magnetic Compatability and Radio Spectrum Matters; Paging Services; Technical characteristics and test methods for on site paging service devices.
ETS 300 328	Radio Equipment and Systems (RES); Wideband transmission systems; Technical characteristics and test conditions for data transmission equipment operating in the 2,4 GHz ISM band and using spread spectrum modulation techniques
ETS 300 489-1	Electro Magnetic Compatability and Radio Spectrum Matters; Common Technical Requirements
ETS 300 489-2	Specific conditions for radio paging equipment
ETS 300 489-3	Specific conditions for Short Range Devices (SRD) operating on frequencies between 9 kHz and 40 GHz
Canadian RSS-102	Evaluation Procedure for Mobile and Portable Radio Transmitters with respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields
Canadian RSS-119	Land Mobile and Fixed Radio Transmitters and Receivers, 27.41 to 960 MHz
Canadian RSS-123	Low Power Licensed Radiocommunication Devices
Canadian RSS-139	Licensed Radiocommunications Devices in the Band 2400- 2483.5 MHz
Canadian RSS-210	Industry Canada – Low power license-exempt radio communication devices
SAE J1113-41	Radiated and conducted emissions.
SAE J1113-21	Radiated immunity absorber lined chamber (200 MHz – 1 GHz)
SAE J1113-23	Radiated immunity stripline method (only 10 kHz – 200 MHz @ 80 V/m)

SAE J1113-4 (only substitution method)	Conducted immunity Bulk Current Injection
SAE J1113-13	ESD
FCC 47 Parts 22 (Cellular), 24, 25, 26 & 27	TCB Scope B1 (Excluding SAR testing)
FCC 47 Parts 22 (Non-Cellular), 73,74,90,95 & 97	TCB Scope B2 (Excluding SAR testing)
FCC 47 Parts 80 & 87	TCB Scope B3 (Excluding SAR testing)
FCC 47 Parts 21, 74, 101	TCB Scope B4 (Excluding SAR testing)
Onsite Testing	
EN61000-6-2	Generic Immunity Standard for Industrial Applications
EN61000-6-4	Generic Emissions Standard for Industrial Applications

What is measurement uncertainty?

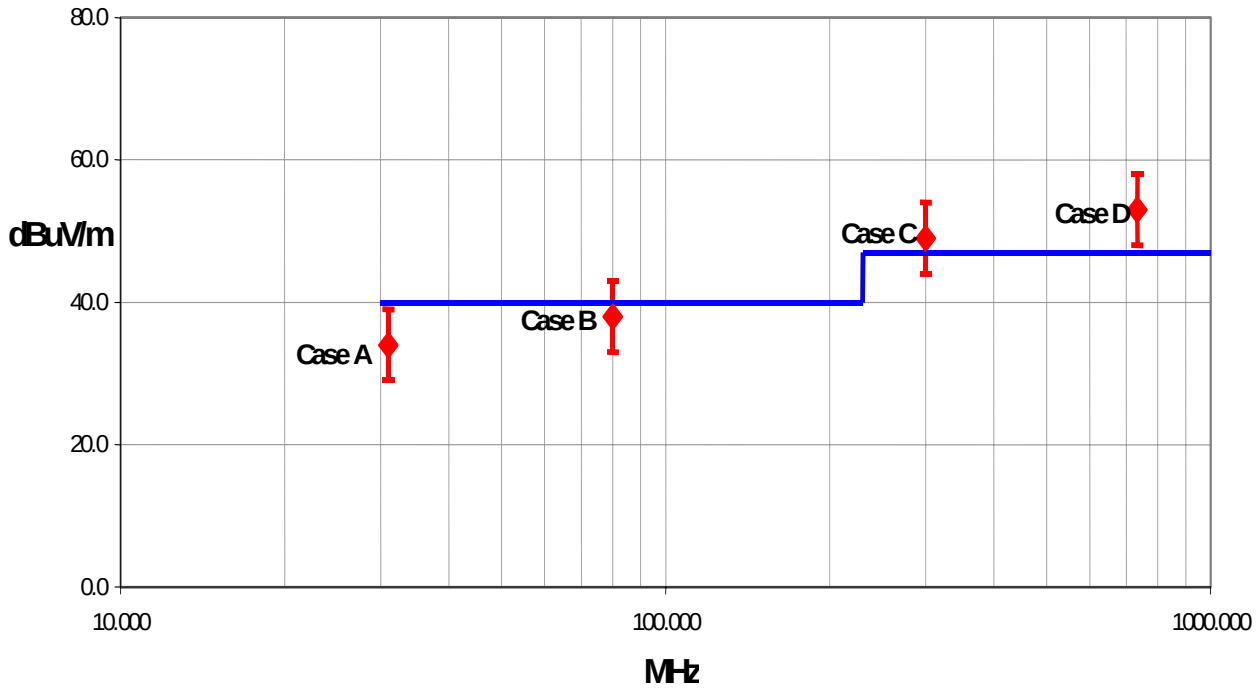
When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. The following statement of measurement uncertainty is used to reflect the accuracy of the measured result as compared with its "true" value. In the case of transient tests (ESD, EFT, Surge, Voltage Dips and Interruptions), the test equipment has been demonstrated by calibration to provide at least a 95% confidence that it complies with the test specification requirements.

The following documents were the basis for determining the uncertainty levels of our measurements:

- "ISO Guide to the Expression of Uncertainty in Measurements", October 1993
- "NIS81: The Treatment of Uncertainty in EMC Measurements", May 1994
- "IEC CISPR 16-3 A1 f1 Ed.1: Radio-interference measurements and statistical techniques", December 2000

How might measurement uncertainty be applied to test results?

If the diamond marks the measured value for the test and the vertical bars bracket the range of + and – measurement uncertainty, then test results can be interpreted from the diagram below.



Test Result Scenarios:
Case A: Product complies.
Case B: Product conditionally complies. It is not possible to say with 95% confidence that the product complies.
Case C: Product conditionally does not comply. It is not possible to say with 95% confidence that the product does not comply.
Case D: Product does not comply.

Radiated Emissions ≤ 1 GHz

Value (dB)

Test Distance	Probability Distribution	Biconical Antenna 3m	Biconical Antenna 10m	Log Periodic Antenna 3m	Log Periodic Antenna 10m	Dipole Antenna 3m	Dipole Antenna 10m
Combined standard uncertainty $u_c(y)$	normal	+ 1.86 - 1.88	+ 1.82 - 1.87	+ 2.23 - 1.41	+ 1.29 - 1.26	+ 1.31 - 1.27	+ 1.25 - 1.25
Expanded uncertainty ***U*** (level of confidence ≈ 95%)	normal (k=2)	+ 3.72 - 3.77	+ 3.64 - 3.73	+ 4.46 -2.81	+ 2.59 - 2.52	+ 2.61 - 2.55	+ 2.49 - 2.49

Radiated Emissions > 1 GHz

Value (dB)

	Probability Distribution	Without High Pass Filter	With High Pass Filter
Combined standard uncertainty $u_c(y)$	normal	+ 1.29 - 1.25	+ 1.38 - 1.35
Expanded uncertainty ***U*** (level of confidence ≈ 95%)	normal (k=2)	+ 2.57 - 2.51	+ 2.76 - -2.70

Conducted Emissions

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.48
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.97

Radiated Immunity

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.11

Conducted Immunity

	Probability Distribution	Value (+/- dB)
Combined standard uncertainty ***uc(y)***	normal	1.05
Expanded uncertainty ***U*** (level of confidence ≈ 95 %)	normal (k = 2)	2.10

Legend

$u_c(y)$ = square root of the sum of squares of the individual standard uncertainties

U = combined standard uncertainty multiplied by the coverage factor: **k**. This defines an interval about the measured result that will encompass the true value with a confidence level of approximately 95%. If a higher level of confidence is required, then k=3 (CL of 99.7%) can be used. Please note that with a coverage factor of one, uc(y) yields a confidence level of only 68%.

California

Orange County Facility

41 Tesla Ave.
Irvine, CA 92618
(888) 364-2378
FAX (503) 844-3826

Oregon

Evergreen Facility

22975 NW Evergreen Pkwy.,
Suite 400
Hillsboro, OR 97124
(503) 844-4066
FAX (503) 844-3826

Oregon

Trails End Facility

30475 NE Trails End Lane
Newberg, OR 97132
(503) 844-4066
FAX (503) 537-0735

South Dakota

North Sioux City Facility

745 N. Derby Lane
P.O. Box 217
North Sioux City, SD 57049
(605) 232-5267
FAX (605) 232-3873

Washington

Sultan Facility

14128 339th Ave. SE
Sultan, WA 98294
(888) 364-2378
FAX (360) 793-2536

Party Requesting the Test

Company Name:	Radioframe Networks, Inc.
Address:	1120 112th Ave. NE, Suite 600
City, State, Zip:	Bellevue, WA 98004
Test Requested By:	Steven Peters
Model:	DH2
First Date of Test:	December 19, 2002
Last Date of Test:	January 15, 2003
Receipt Date of Samples:	December 19, 2002
Equipment Design Stage:	Production
Equipment Condition:	No visual damage.

Information Provided by the Party Requesting the Test

Clocks/Oscillators:	Information not available at time of test
I/O Ports:	Radio blade interface to back plane of RFU unit. No external I/O.

Functional Description of the EUT (Equipment Under Test):

802.11(b) radio blade

Client Justification for EUT Selection:

Representative of production unit

Client Justification for Test Selection

To demonstrate compliance of radio to FCC 15.247 requirements

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
-48VDC

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	32596-0004
Chassis Unit	Radio Frame Networks	1230500-00	None
PC	Dell	Inspiron 4100	N/A

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	3m	No	Chassis Unit	Test Fixture
Ethernet	No	3.0	No	PC	Chassis Unit

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

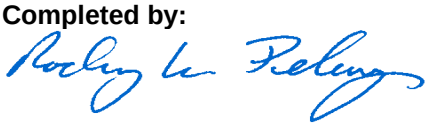
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	24 mo

Test Description

Requirement: Per 47 CFR 15.247(a)(2), the 6 dB bandwidth of a system using digital modulation techniques must be at least 500kHz. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The occupied bandwidth was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation.

Completed by:



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(a)(2)	Year:	Most Current	Method:	FCC97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The minumum 6dB bandwidth is 500KHz

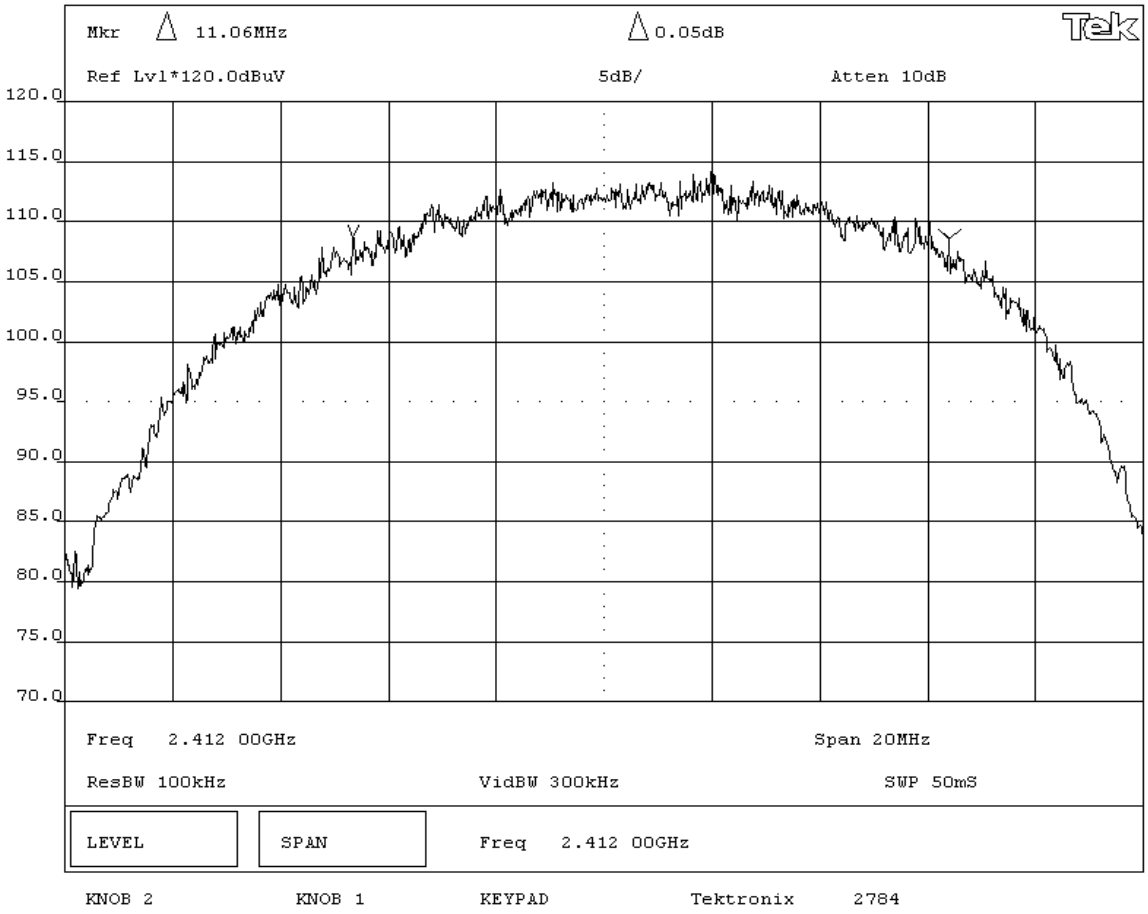
RESULTS	BANDWIDTH
Pass	11.06MHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth - Low Channel



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters

Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS							
Specification:	47 CFR 15.247(a)(2)	Year:	Most Current	Method:	FCC97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The minumum 6dB bandwidth is 500KHz

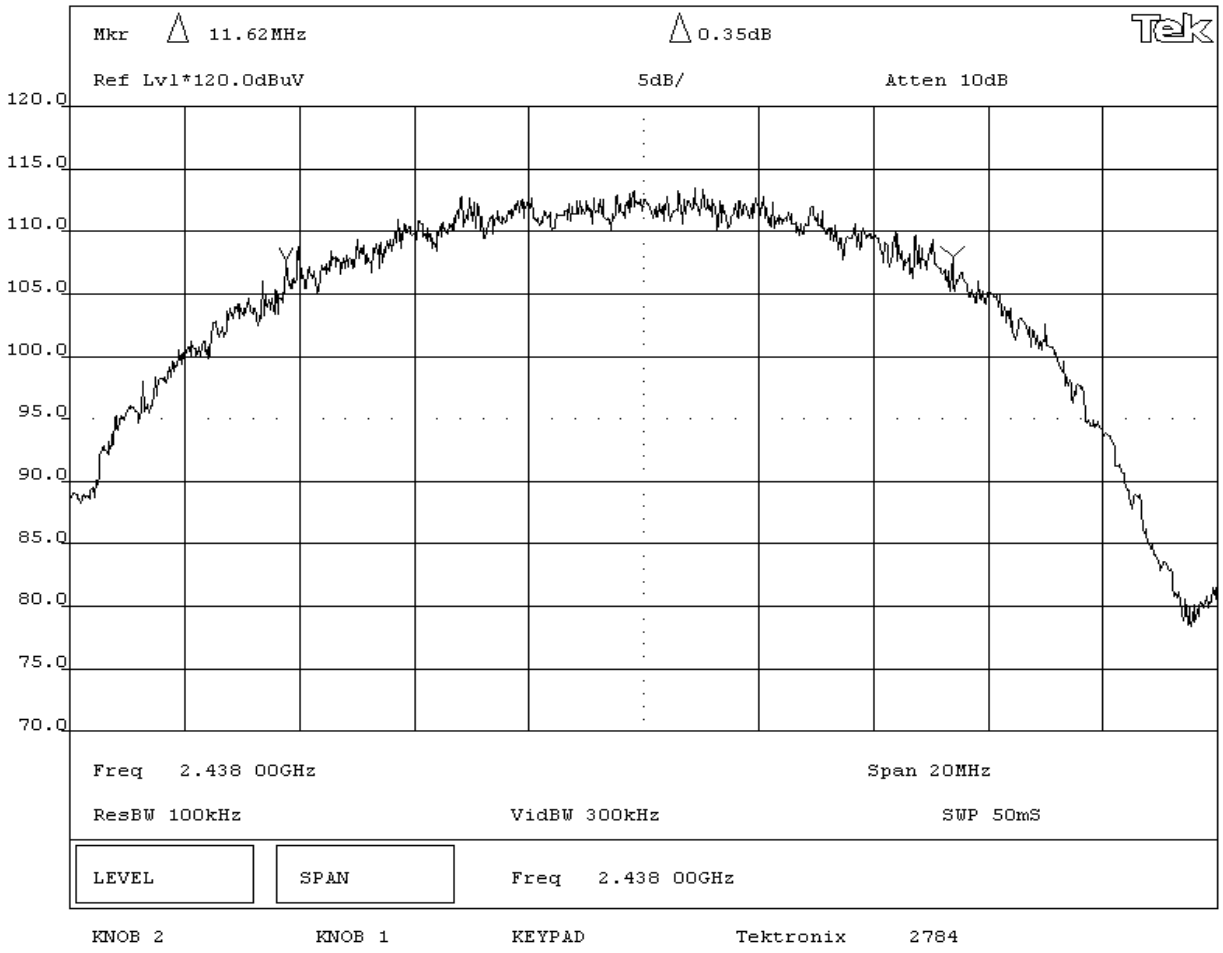
RESULTS	BANDWIDTH
Pass	11.62MHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Occupied Bandwidth - Mid Channel



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters

Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(a)(2)	Year: Most Current	Method:	FCC97-114, ANSI C63.4	Year: 1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

The minumum 6dB bandwidth is 500KHz

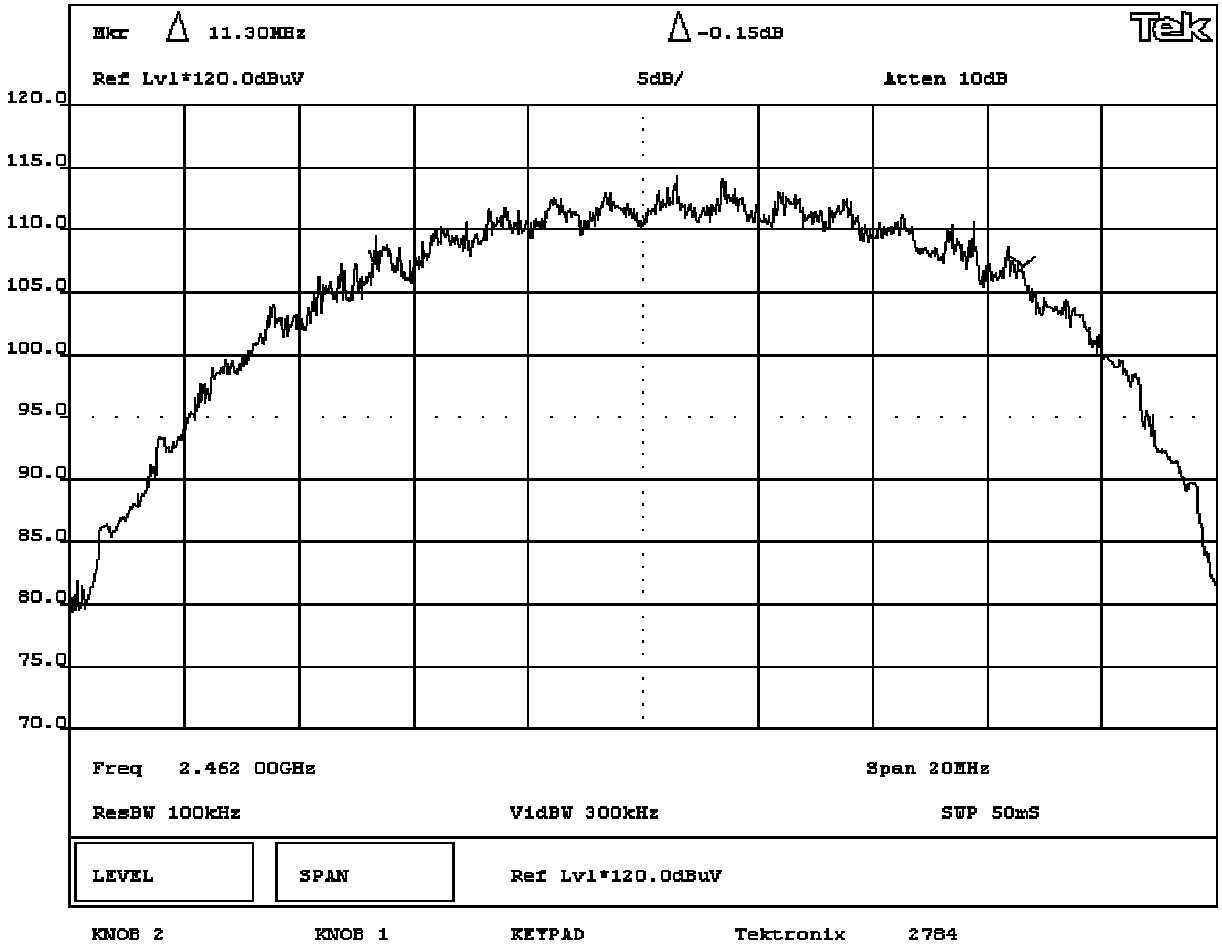
RESULTS	BANDWIDTH
Pass	11.3MHz

SIGNATURE

Tested By: Rodney La Peloquin

DESCRIPTION OF TEST

Occupied Bandwidth - High Channel



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
-48VDC

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	32596-0004
Chassis Unit	Radio Frame Networks	1230500-00	None
PC	Dell	Inspiron 4100	N/A

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	3m	No	Chassis Unit	Test Fixture
Ethernet	No	3.0	No	PC	Chassis Unit

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett Packard	8593E	AAP	10/23/2002	12 mo

Test Description

Requirement: Per 47 CFR 15.247(b)(1), the maximum peak output power must not exceed 1 Watt. The measurement is made using either a peak power meter, or a spectrum analyzer.

If a spectrum analyzer is used, the resolution bandwidth must be set to greater than the 6 dB bandwidth of the modulated carrier, and the video bandwidth set to greater than or equal to the resolution bandwidth. If the largest resolution bandwidth is less than the 6 dB bandwidth of the modulated carrier, the analyzer band power function can be used with these settings:

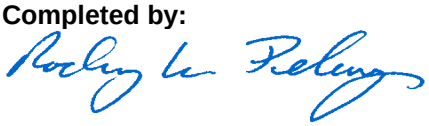
- Set RBW = VBW = Max
- Set Channel Bandwidth = Bandwidth of modulated carrier plus the resolution bandwidth
- Set Frequency Span just large enough to capture emission
- User peak detector only – set to max hold

(This alternate method was presented by Joe Dichoso of the FCC's OET Division at an FCC Workshop for TCBs, Feb 14, 2002)

Configuration: The peak output power was measured with the EUT set to low, medium, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and a spectrum analyzer. The EUT was transmitting at its maximum data rate and maximum output power.

De Facto EIRP Limit: Per 47 CFR 15.247 (b)(1-3), the EUT meets the de facto EIRP limit of +36dBm.

Completed by:



NORTHWEST EMC

EMISSIONS DATA SHEET

Output Power

Transmitters

Rev df11/15/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(b)(1)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt

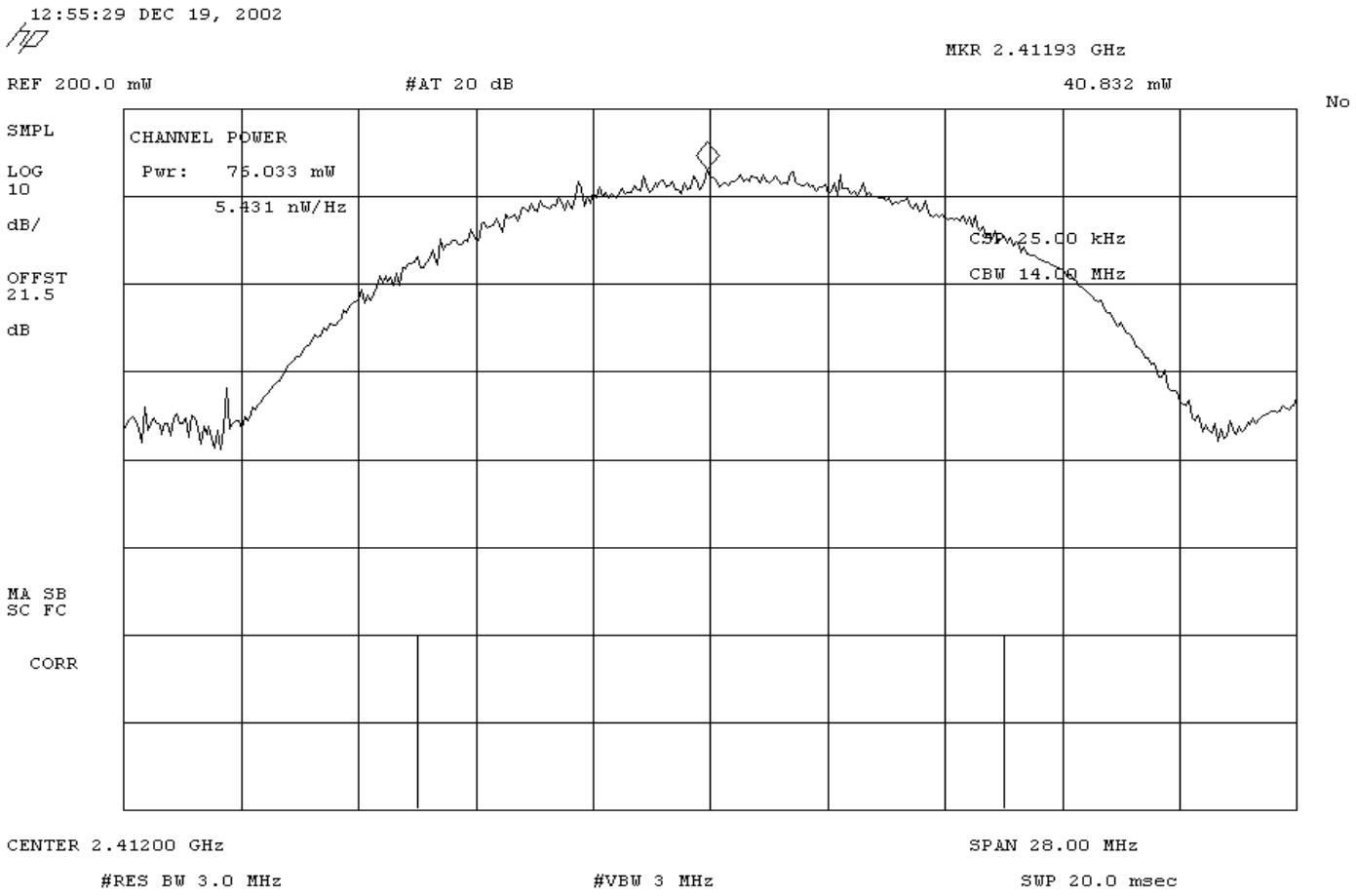
RESULTS	AMPLITUDE
Pass	76mW

SIGNATURE

Tested By:

DESCRIPTION OF TEST

Low Channel



NORTHWEST EMC

EMISSIONS DATA SHEET

Output Power

Transmitters

Rev df11/15/02

EUT:	DH2	Work Order:	RAFN0023
Serial Number:	none	Date:	12/19/02
Customer:	Radio Frame Networks	Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd	Humidity:	34%
Customer Ref. No.:	None	Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power: 120 V, 60 Hz	Job Site: EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(b)(1)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt

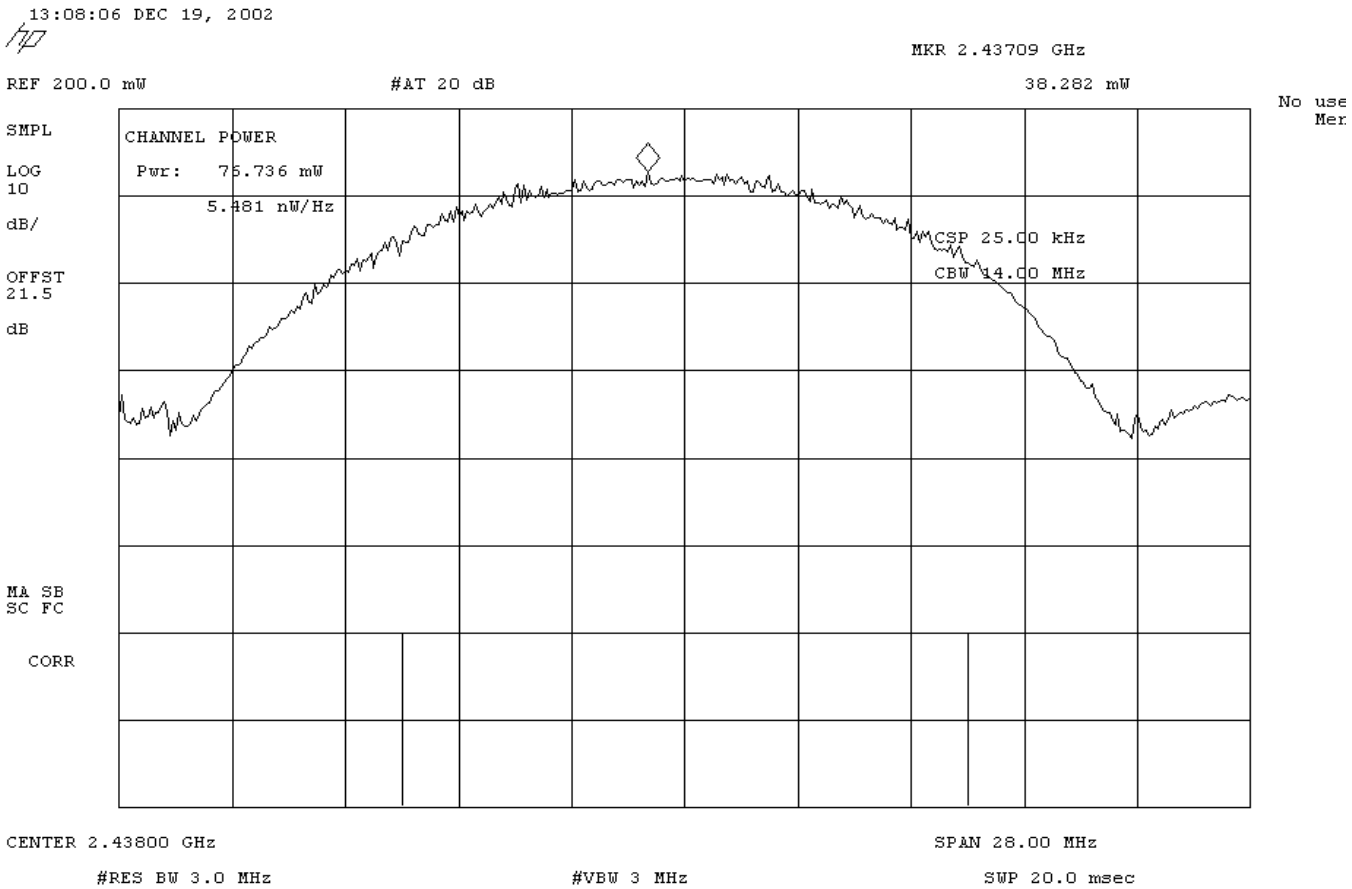
RESULTS	AMPLITUDE
Pass	76.7mW

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Mid Channel



NORTHWEST EMC

EMISSIONS DATA SHEET

Output Power

Transmitters

Rev df11/15/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(b)(1)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak conducted output power does not exceed 1 Watt

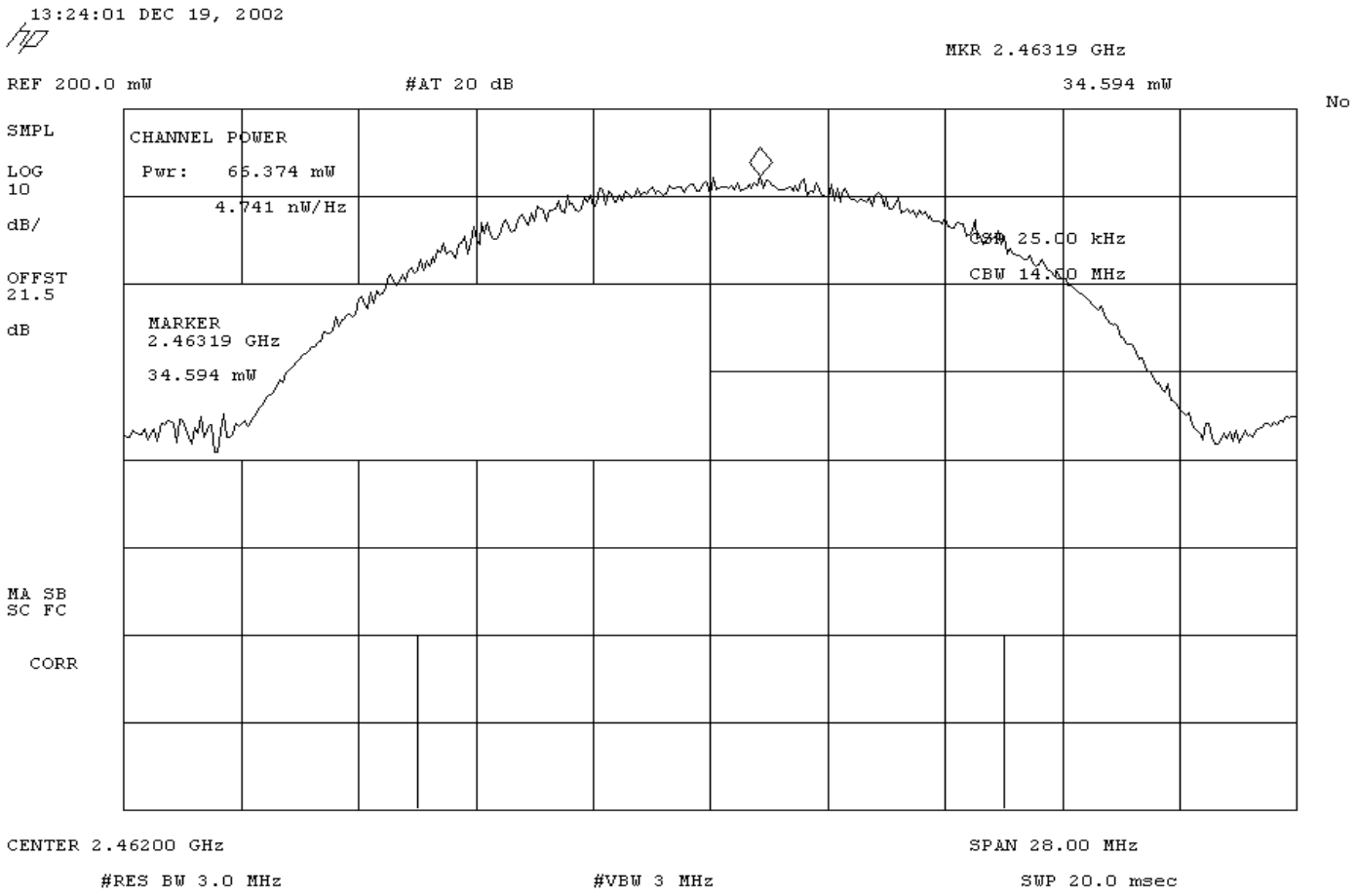
RESULTS	AMPLITUDE
Pass	66.37mW

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

High Channel



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
-48VDC

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	32596-0004
Chassis Unit	Radio Frame Networks	1230500-00	None
PC	Dell	Inspiron 4100	N/A

Band Edge Compliance of RF Conducted Emissions

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	3m	No	Chassis Unit	Test Fixture
Ethernet	No	3.0	No	PC	Chassis Unit

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

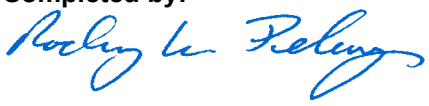
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	24 mo

Test Description

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions at the edges of the authorized band were measured with the EUT set to low and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. The channels closest to the band edges were selected. The spectrum was scanned across each band edge from 5 MHz below the band edge to 5 MHz above the band edge.

Completed by:



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters

Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission at the edge of the authorized band is 20dB down from the fundamental

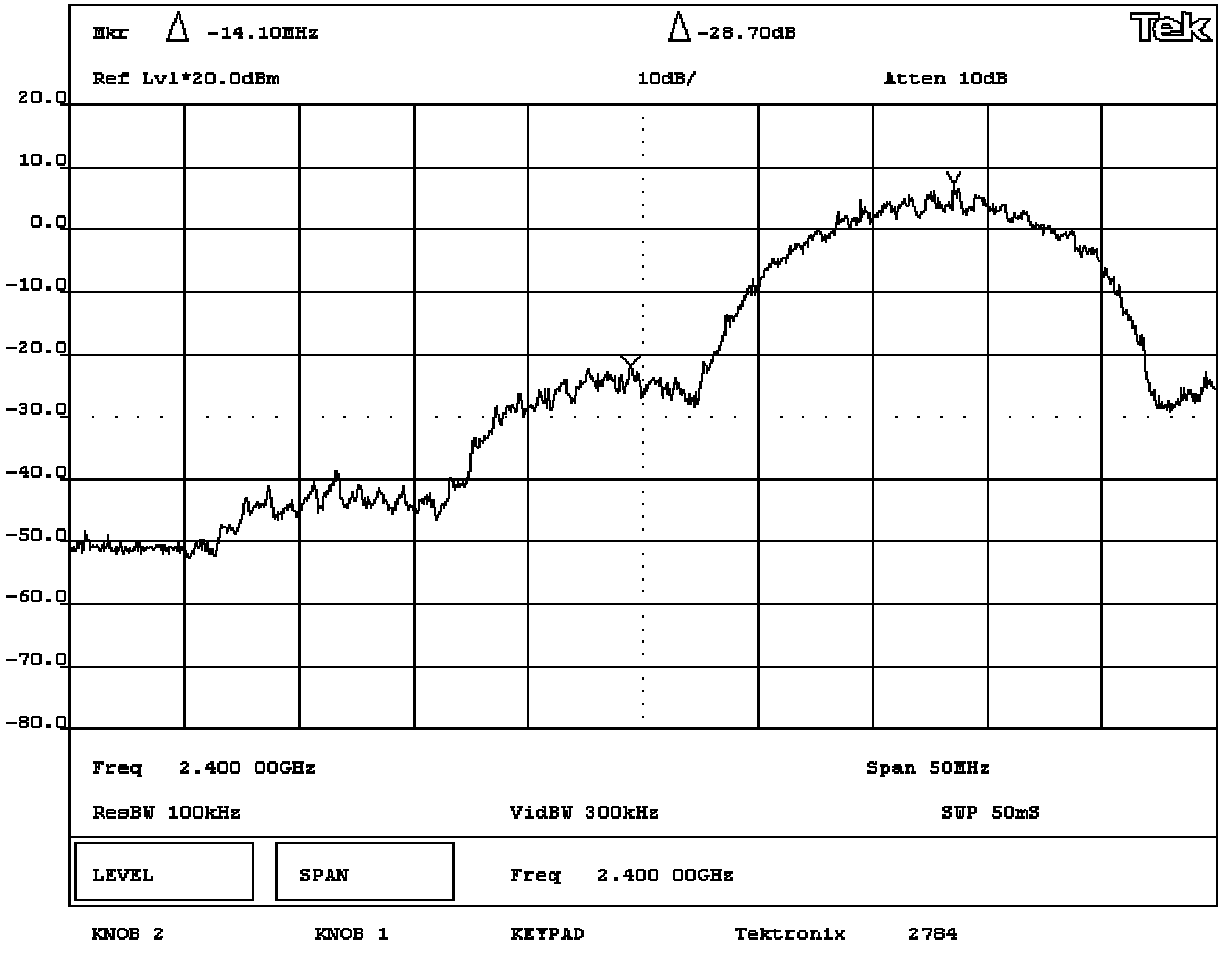
RESULTS	AMPLITUDE
Pass	-28.7dB

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Band Edge Compliance - Low Channel



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters

Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission at the edge of the authorized band is 20dB down from the fundamental

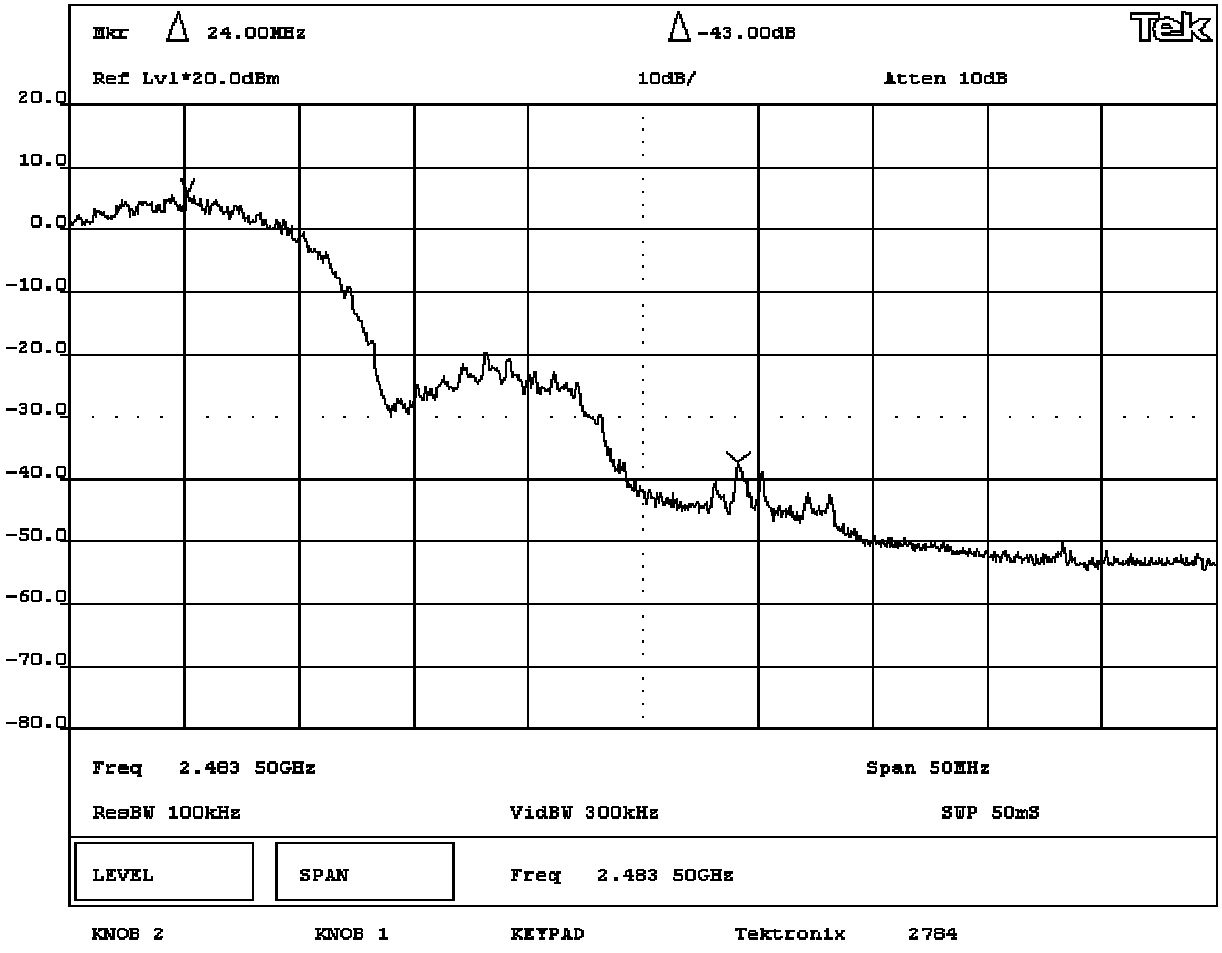
RESULTS	AMPLITUDE
Pass	-43dB

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Band Edge Compliance - High Channel



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
-48VDC

Frequency Range Investigated			
Start Frequency	30 MHz	Stop Frequency	25 GHz

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	32596-0004
Chassis Unit	Radio Frame Networks	1230500-00	None
PC	Dell	Inspiron 4100	N/A

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	3m	No	Chassis Unit	Test Fixture
Ethernet	No	3.0	No	PC	Chassis Unit

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

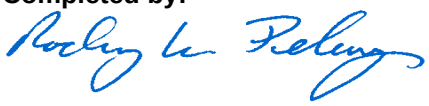
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	24 mo

Test Description

Requirement: Per 47 CFR 15.247(c), in any 100 kHz bandwidth outside the authorized band, the maximum level of radio frequency power must be at least 20dB down from the highest emission level within the authorized band. The measurement is made with the spectrum analyzer's resolution bandwidth set to 100 kHz, and the video bandwidth set to greater than or equal to the resolution bandwidth.

Configuration: The spurious RF conducted emissions were measured with the EUT set to low, medium, and high transmit frequencies. The measurements were made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. For each transmit frequency, the spectrum was scanned throughout the specified frequency range.

Completed by:



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

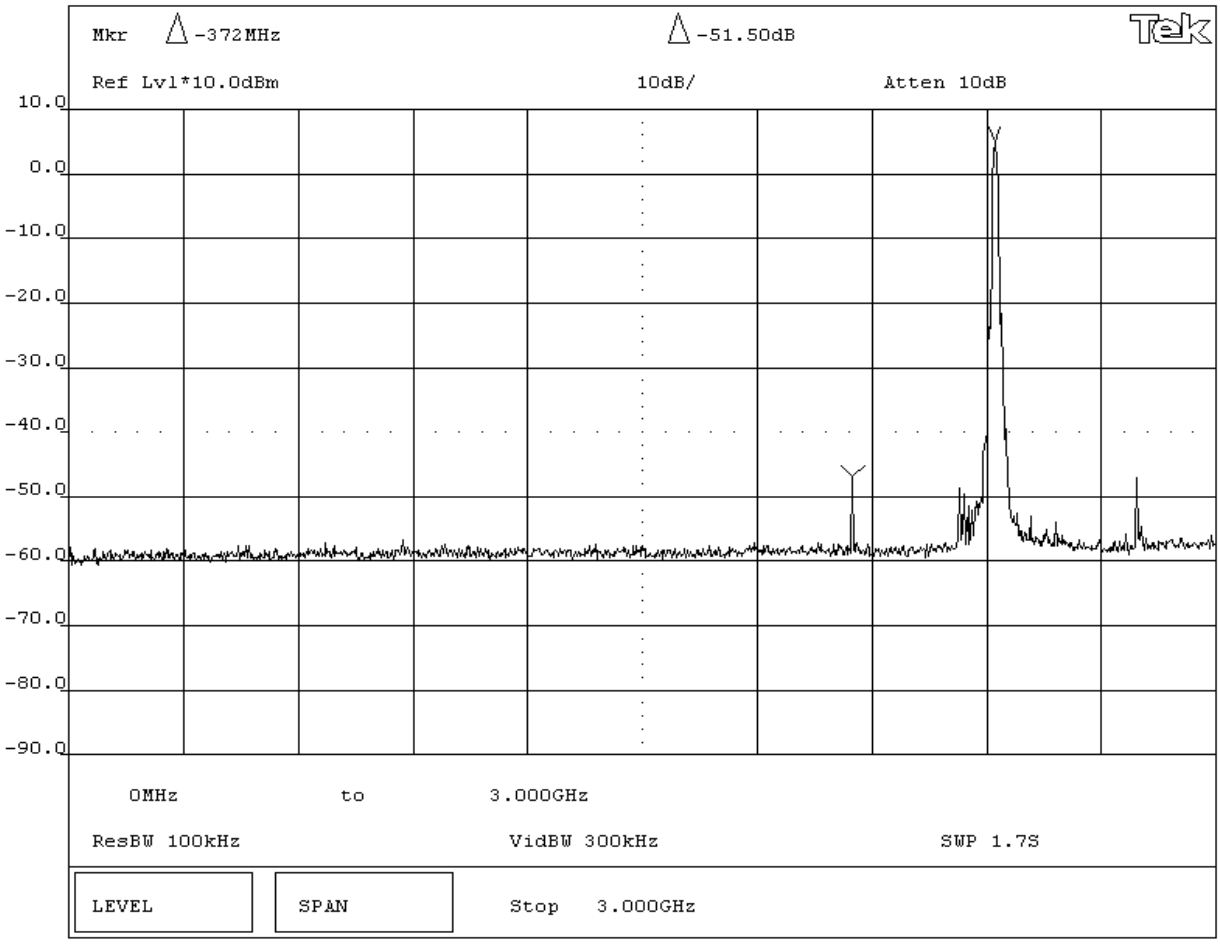
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 0MHz-3GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, low channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

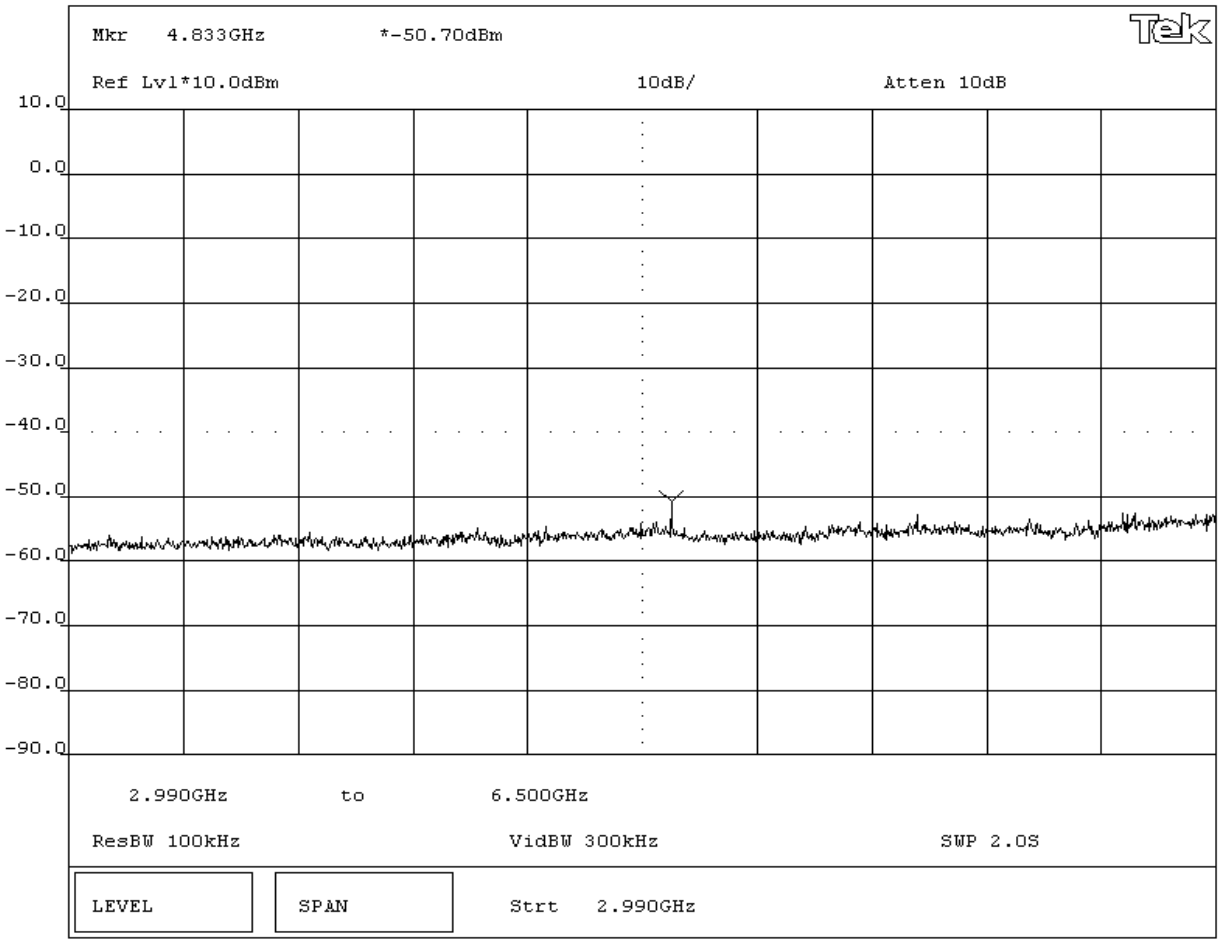
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 3GHz-6.5GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, low channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

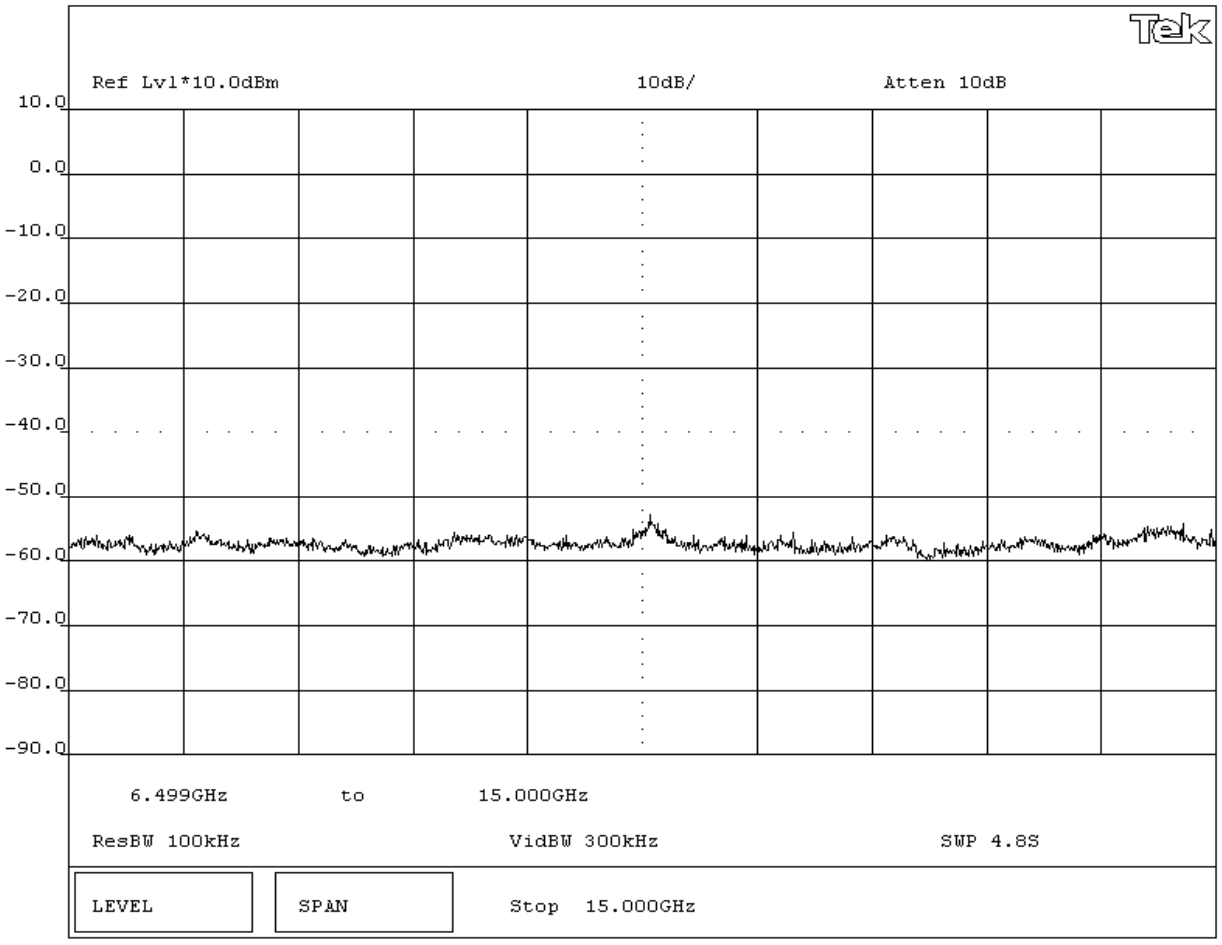
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 6.5GHz-15GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS							
Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, low channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

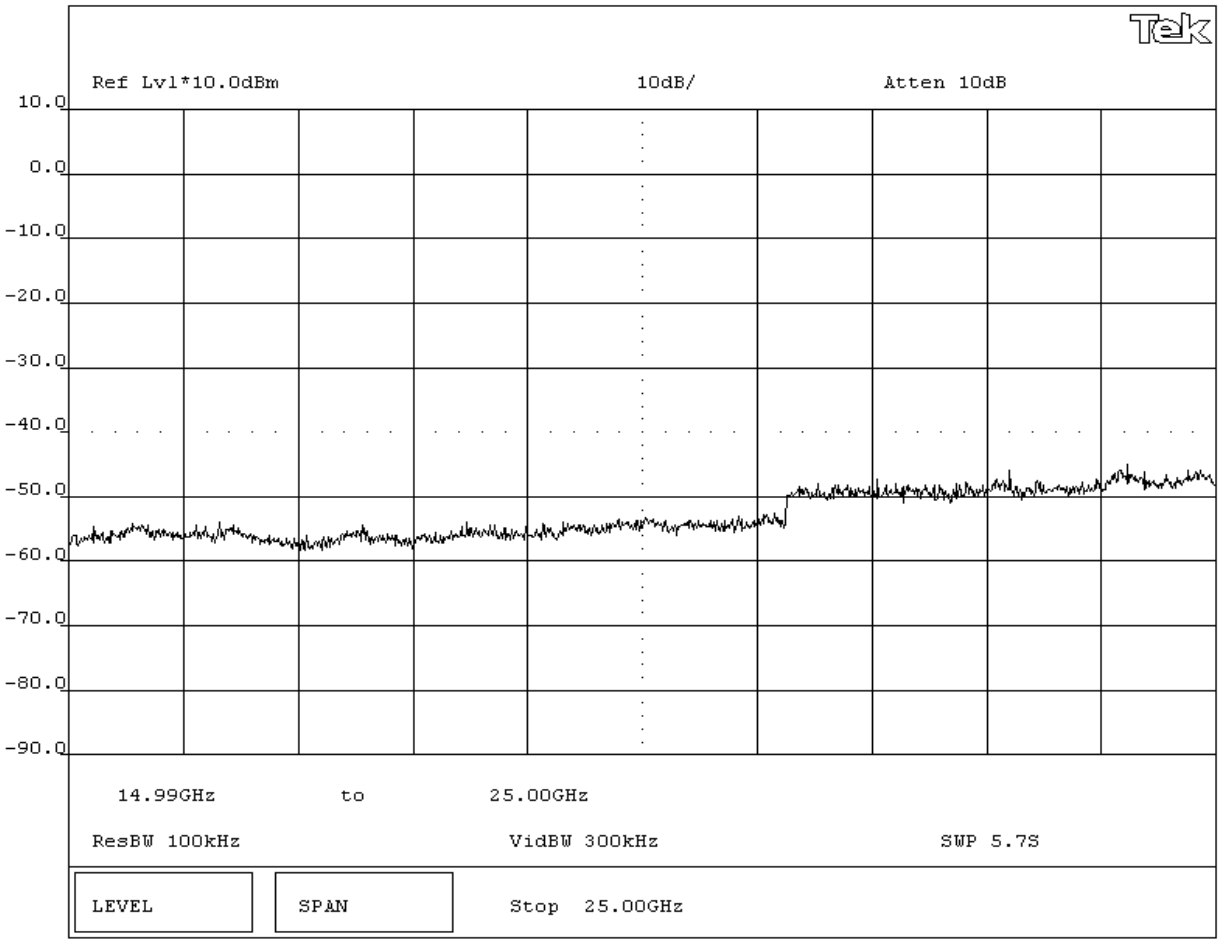
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Low Channel 15GHz-25GHz



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

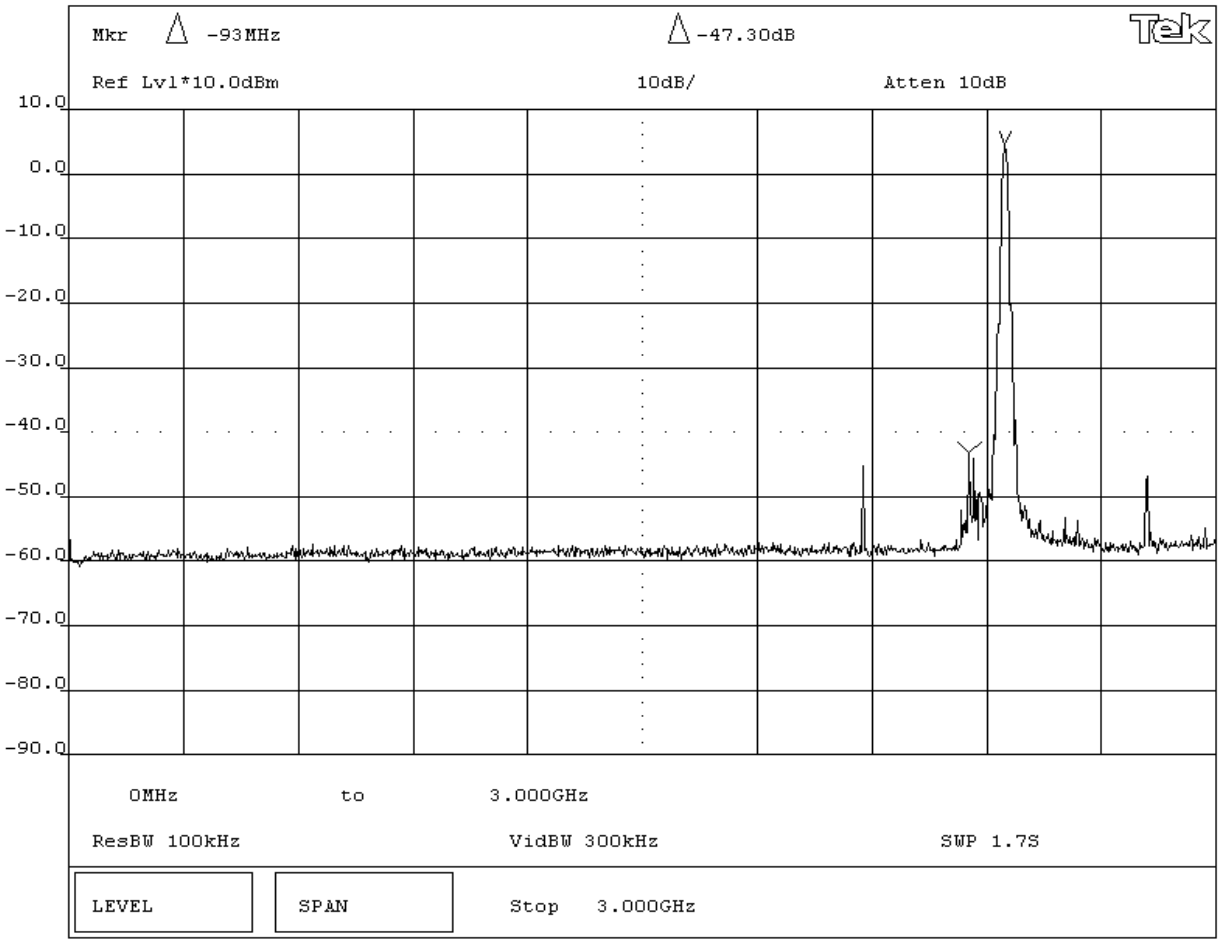
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Mid Channel 0MHz-3GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			**Work Order:**	RAFN0023
Serial Number:	none			**Date:**	12/19/02
Customer:	Radio Frame Networks			**Temperature:**	21 °C
Attendees:	Dean Busch, Kevin Boyd			**Humidity:**	34%
Customer Ref. No.:	None			**Bar. Pressure:**	30.02
Tested by:	Rod Peloquin	**Power:**	120 V, 60 Hz	**Job Site:**	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	**Year:**	Most Current	**Method:**	FCC 97-114, ANSI C63.4	**Year:**	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, mid channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

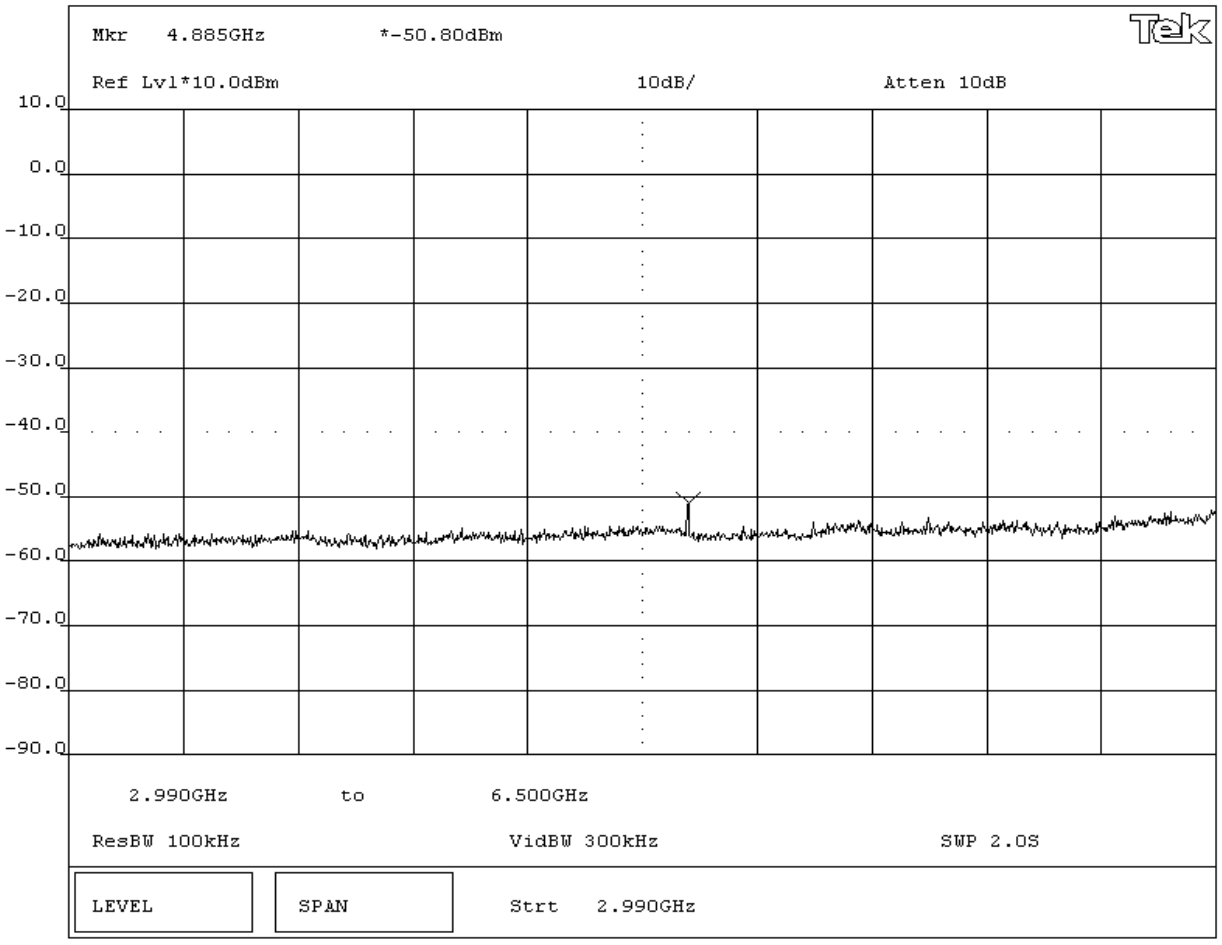
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Mid Channel 3GHz-6.5GHz



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters
Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, mid channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

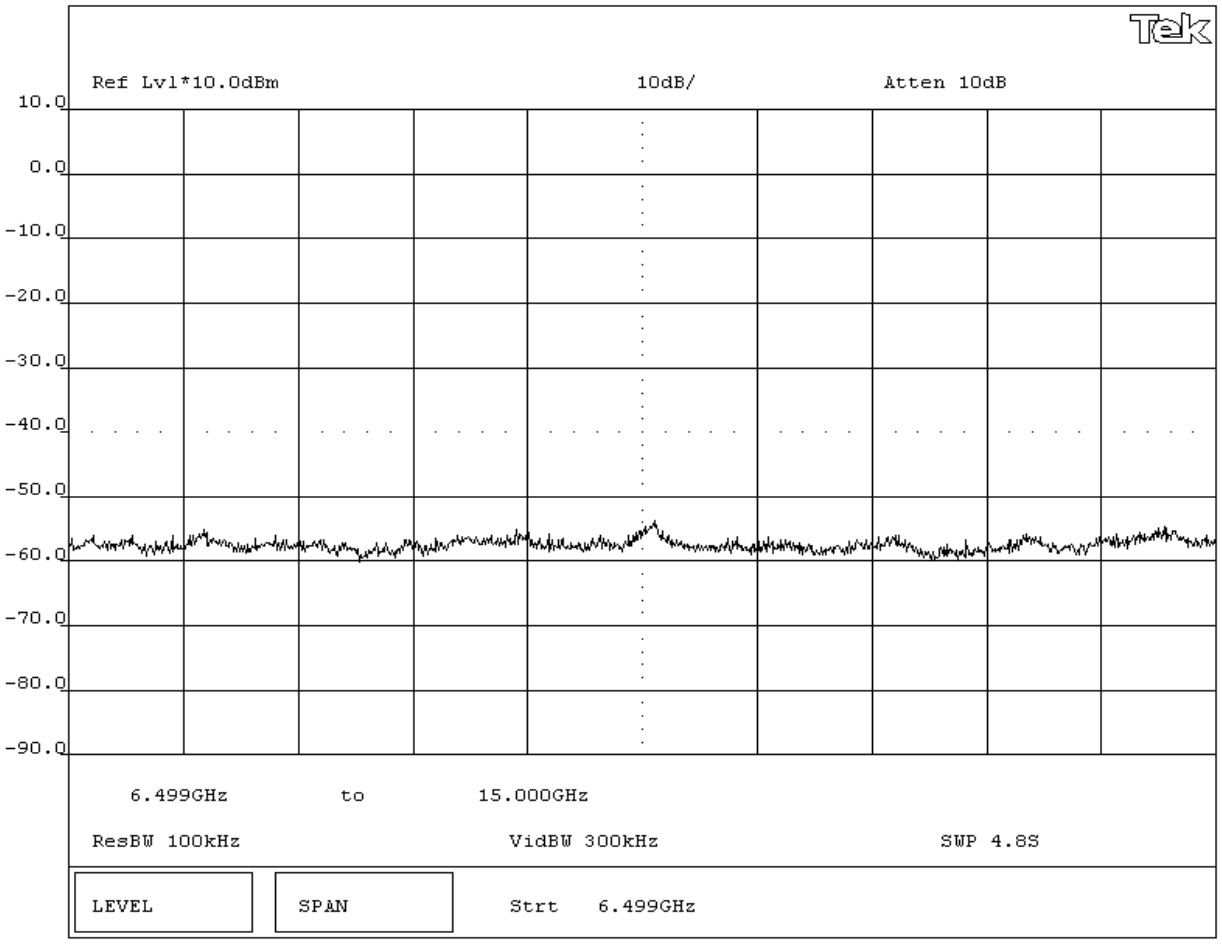
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Mid Channel 6.5GHz-15GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, mid channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

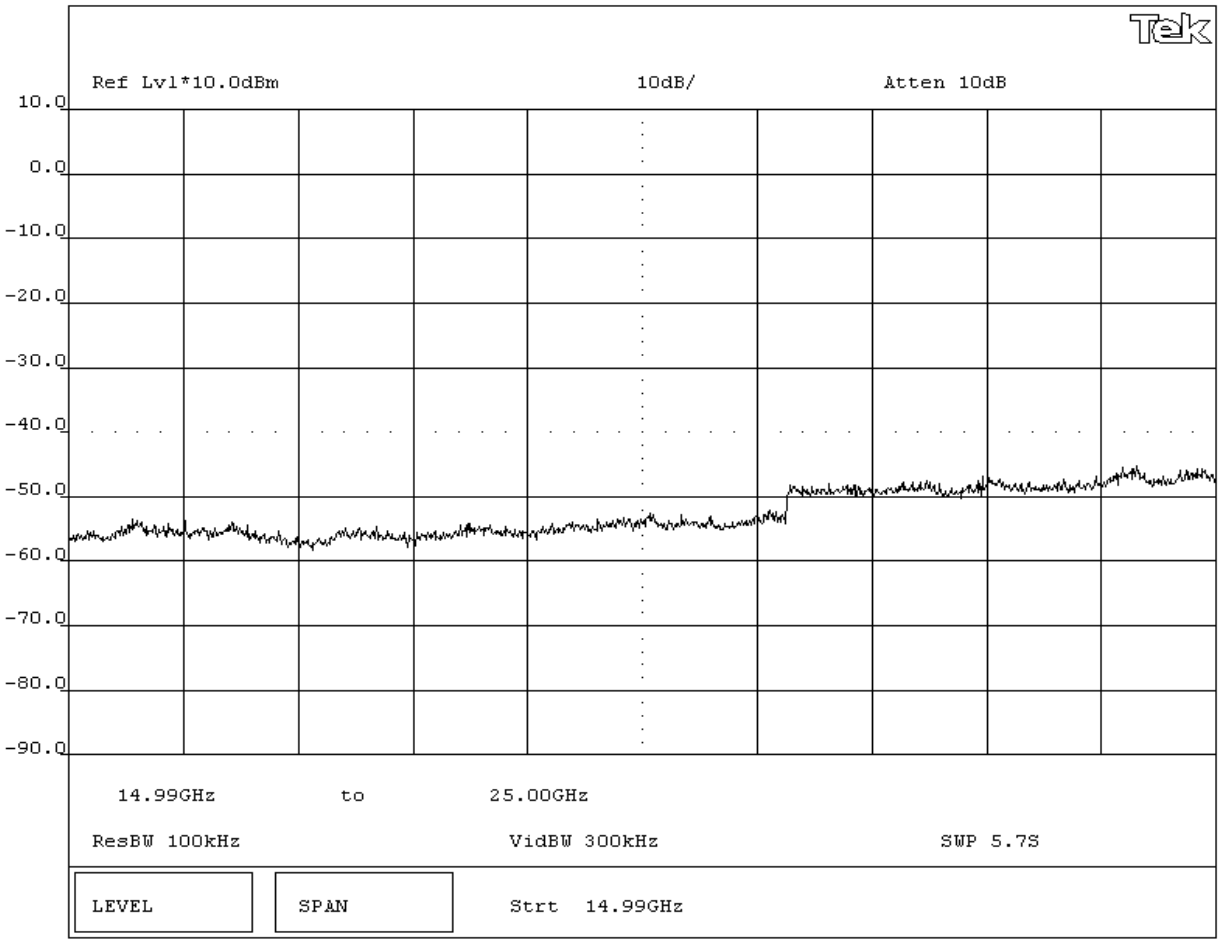
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - Mid Channel 15GHz-25GHz



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters
Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, high channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

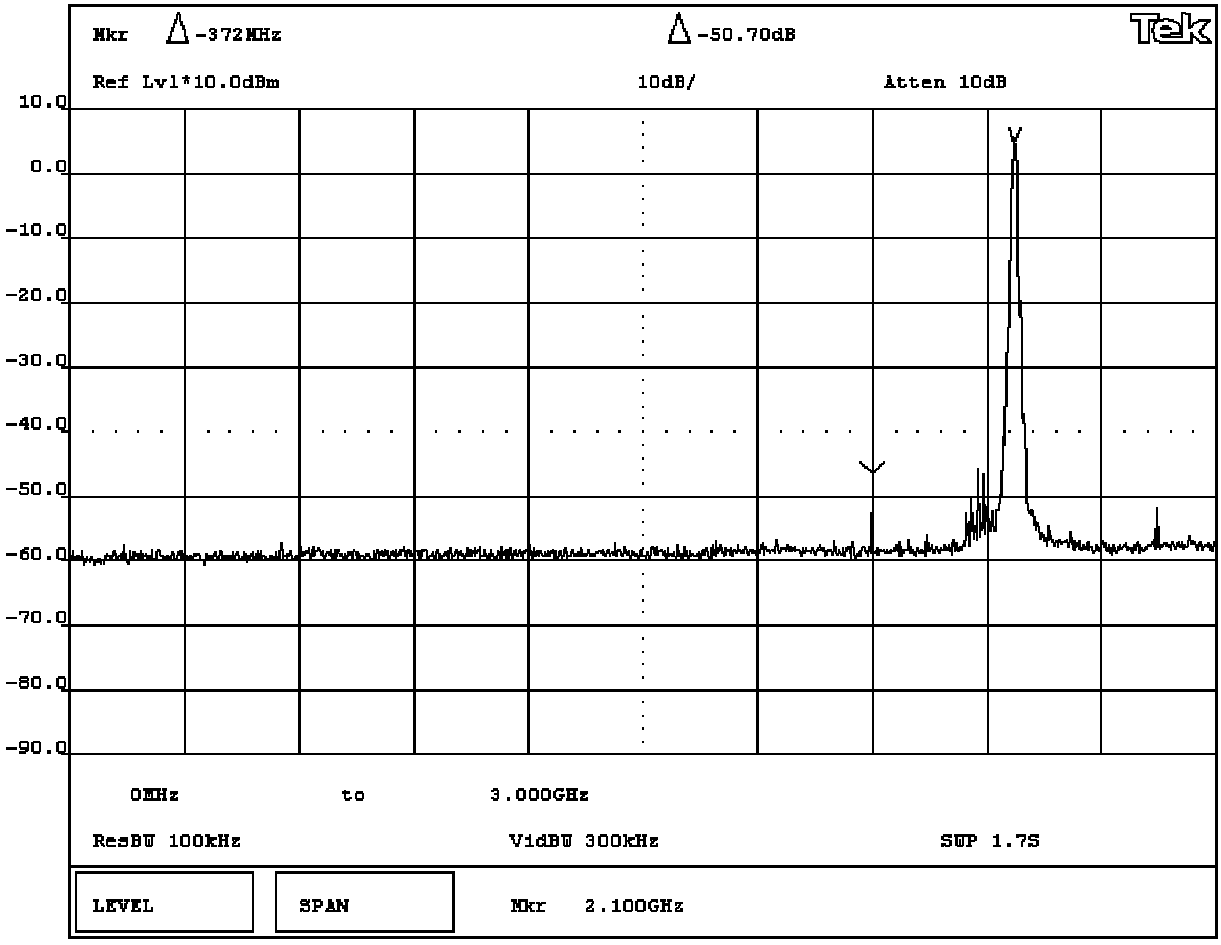
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - High Channel 0MHz-3GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, high channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

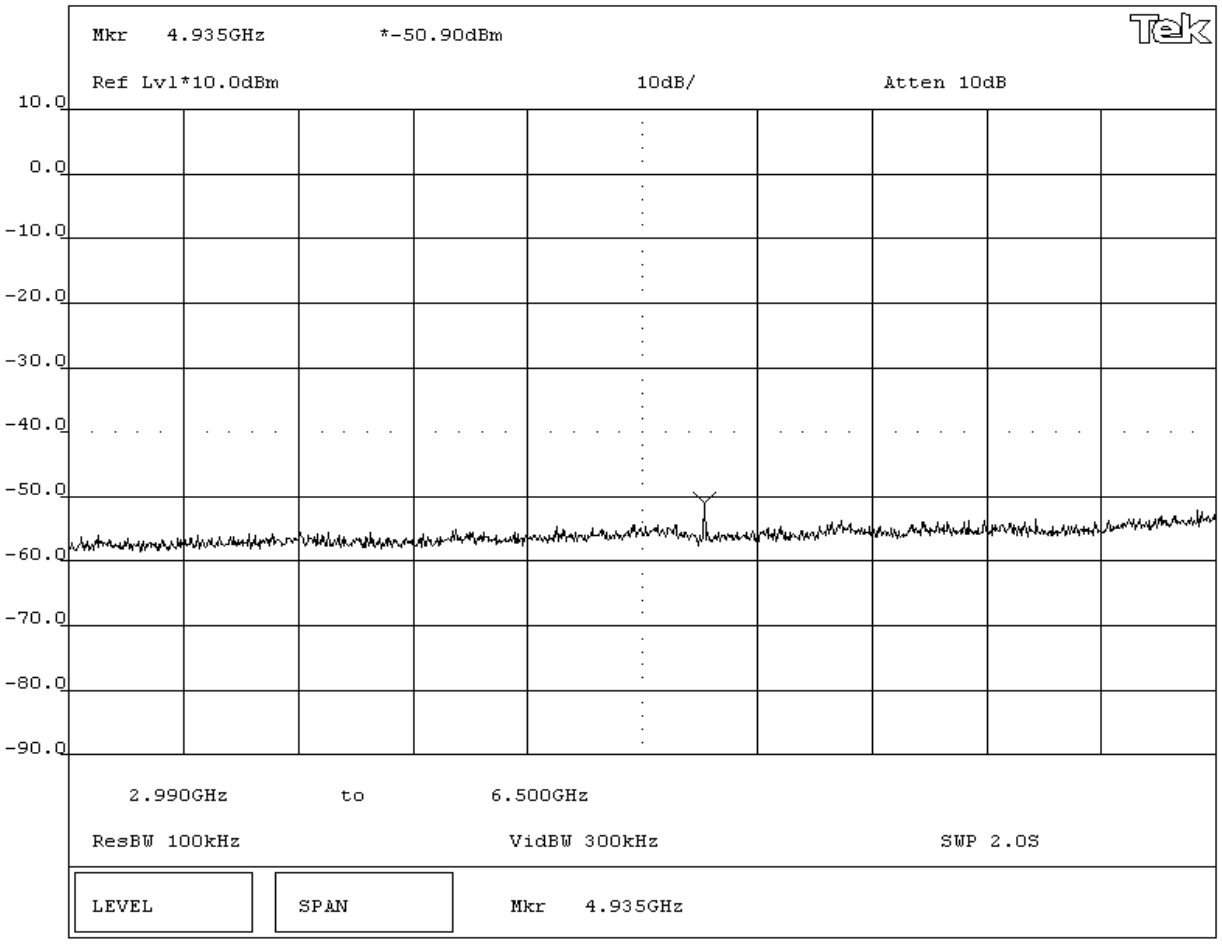
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - High Channel 3GHz-6.5GHz



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, high channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

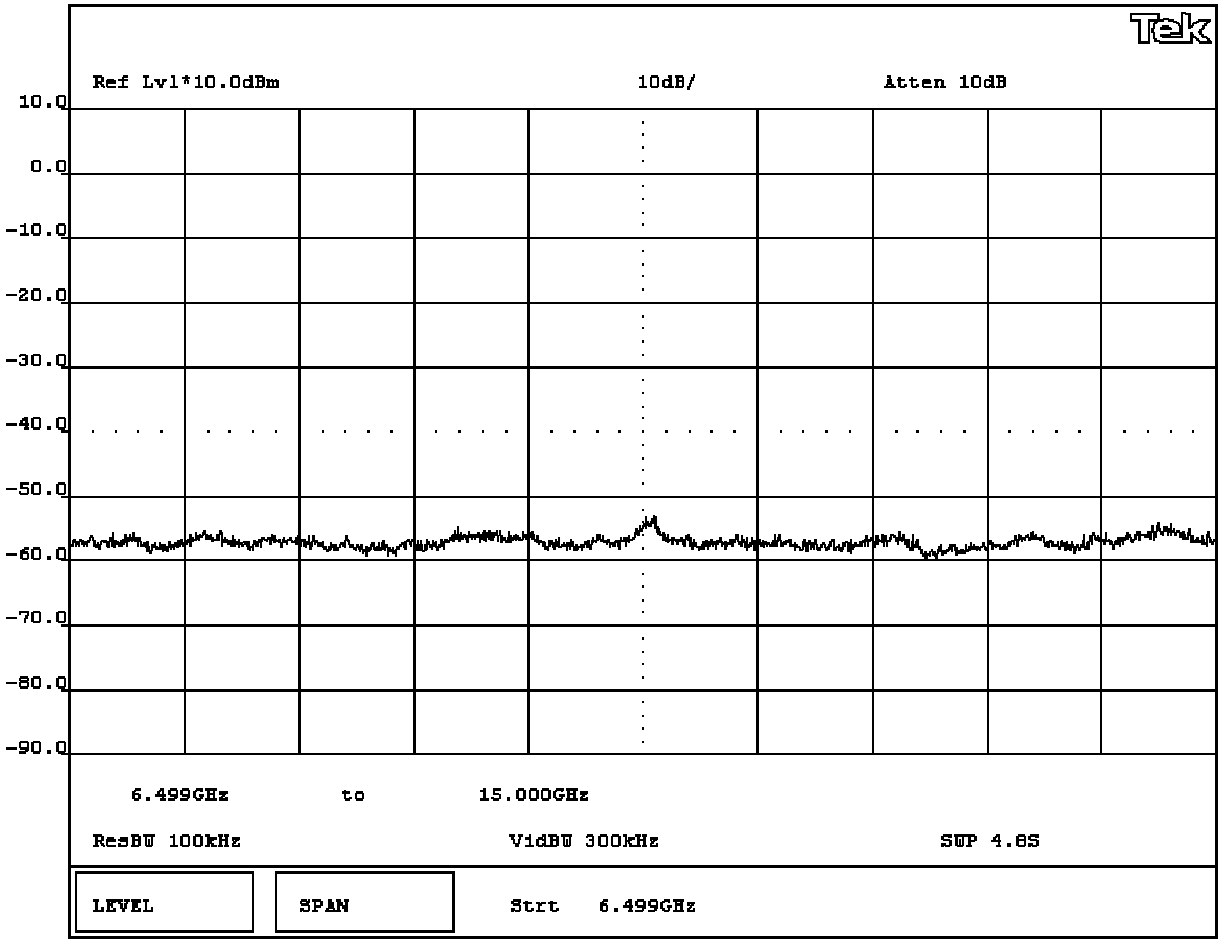
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - High Channel 6.5GHz-15GHz



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS

Specification:	47 CFR 15.247(c)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

COMMENTS

None

EUT OPERATING MODES

modulation, high channel

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum level of any spurious emission outside of the authorized band is 20 dB down from the fundamental

RESULTS

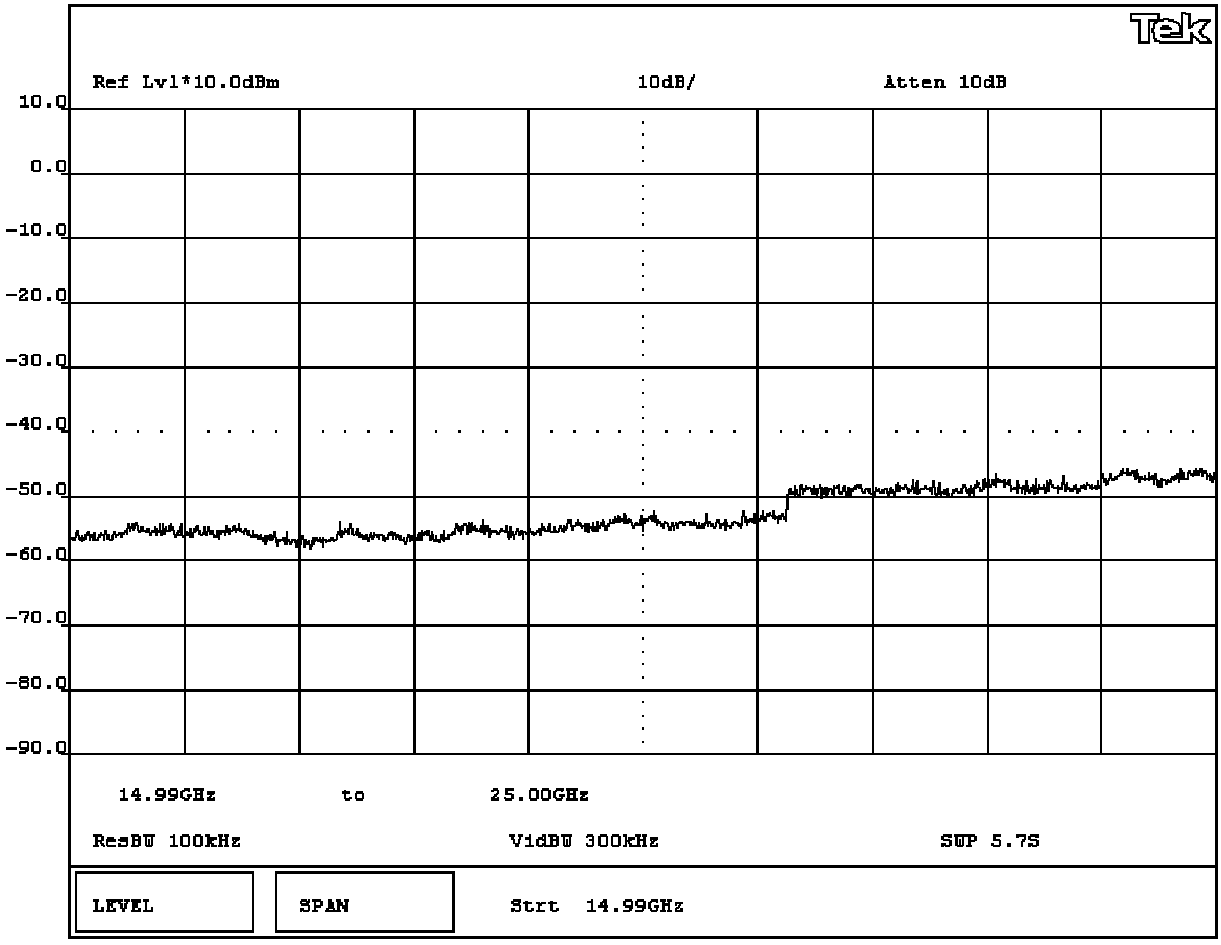
Pass

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Antenna Conducted Spurious Emissions - High Channel 15GHz-25GHz



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
Maximum

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
-48VDC from Chassis Unit

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	32596-0004
Chassis Unit	Radio Frame Networks	1230500-00	None
PC	Dell	Inspiron 4100	N/A

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	3m	No	Chassis Unit	Test Fixture
Ethernet	No	3.0	No	PC	Chassis Unit

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	24 mo

Test Description

Requirement: Per 47 CFR 15.247(d), the peak power spectral density conducted from the antenna port of a direct sequence transmitter must not be greater than +8 dBm in any 3 kHz band during any time interval of continuous transmission.

Configuration: The peak power spectral density measurements were measured with the EUT set to low, mid, and high transmit frequencies. The measurement was made using a direct connection between the RF output of the EUT and the spectrum analyzer. The EUT was transmitting at its maximum data rate using direct sequence modulation. Per the procedure outlined in FCC 97-114, the spectrum analyzer was used as follows:

> The emission peak(s) were located and zoom in on within the passband. The resolution bandwidth was set to 3 kHz, the video bandwidth was set to greater than or equal to the resolution bandwidth. The sweep speed was set equal to the span divided by 3 kHz (sweep = (SPAN/3 kHz)). For example, given a span of 1.5 MHz, the sweep should be $1.5 \times 10^6 \div 3 \times 10^3 =$ 500 seconds. External attenuation was used and added to the reading. The following FCC procedure was used for modifying the power spectral density measurements:

"If the spectrum line spacing cannot be resolved on the available spectrum analyzer, the noise density function on most modern conventional spectrum analyzers will directly measure the noise power density normalized to a 1 Hz noise power bandwidth. Add 34.7 dB for correction to 3 kHz."

Completed by:

NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters
Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(d)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.
Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.
Bandwidth Correction Factor = 10*log(3 kHz / 1 Hz) = 34.7 dB

COMMENTS

EUT OPERATING MODES

Maximum output power at maximum data rate

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

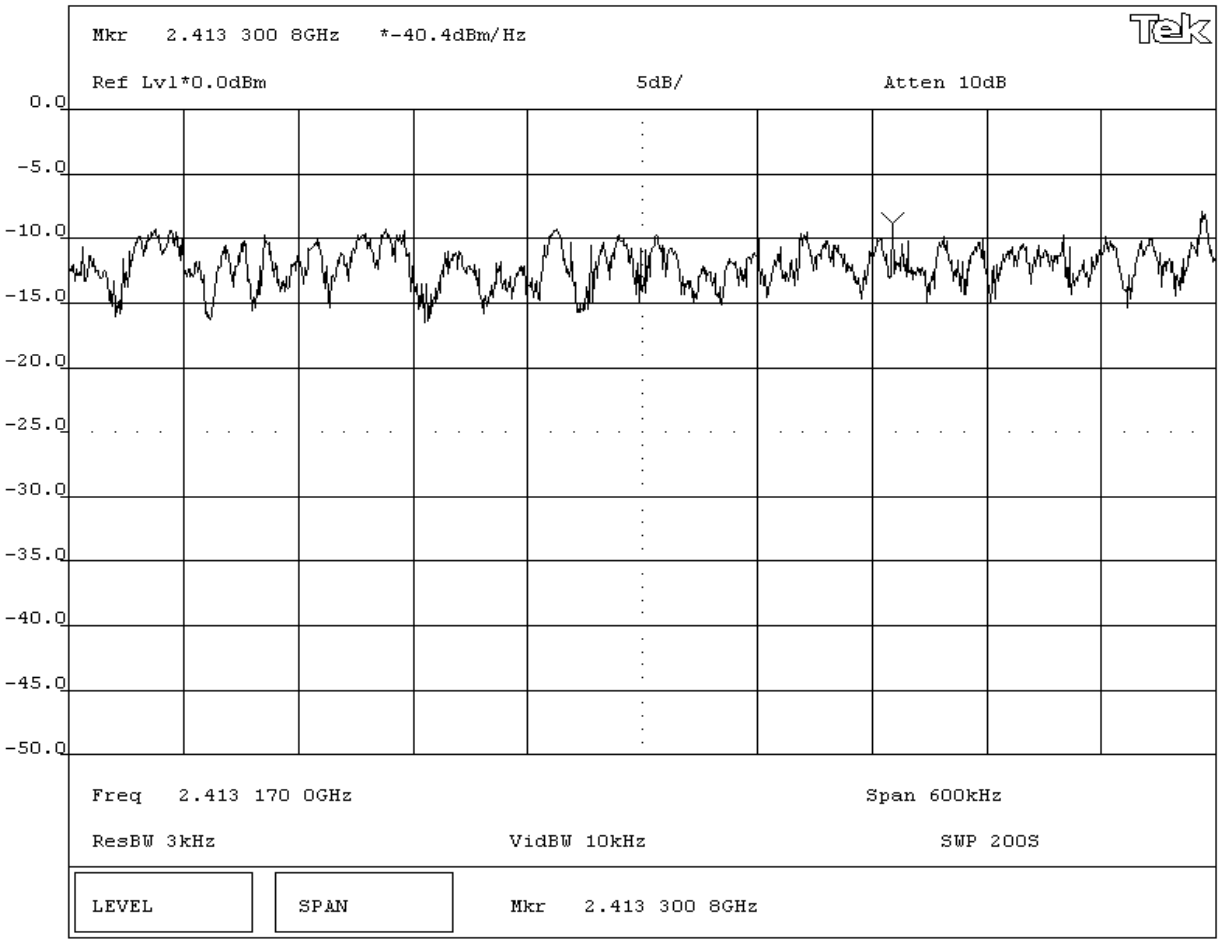
RESULTS	AMPLITUDE
Pass	-5.7dBm / 3KHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Power Spectral Density - Low Channel



NORTHWEST
EMC

EMISSIONS DATA SHEET

Transmitters
Rev
df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(d)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.
Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.
Bandwidth Correction Factor = 10*log(3 kHz / 1 Hz) = 34.7 dB

COMMENTS

None

EUT OPERATING MODES

modulated

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

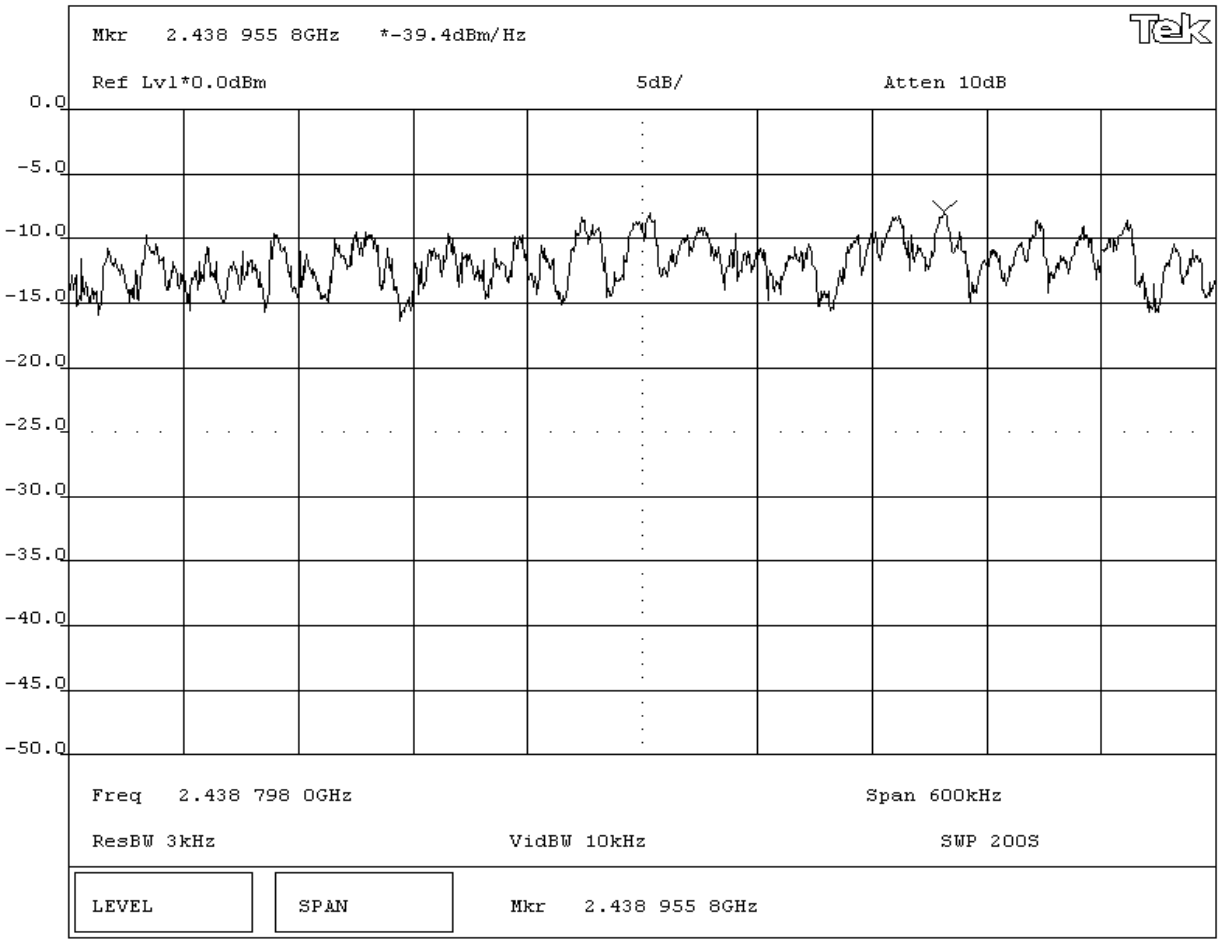
RESULTS	AMPLITUDE
Pass	-4.7dBm / 3KHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Power Spectral Density - Mid Channel



NORTHWEST EMC

EMISSIONS DATA SHEET

Transmitters
Rev df11/13/02

EUT:	DH2			Work Order:	RAFN0023
Serial Number:	none			Date:	12/19/02
Customer:	Radio Frame Networks			Temperature:	21 °C
Attendees:	Dean Busch, Kevin Boyd			Humidity:	34%
Customer Ref. No.:	None			Bar. Pressure:	30.02
Tested by:	Rod Peloquin	Power:	120 V, 60 Hz	Job Site:	EV06

TEST SPECIFICATIONS					
Specification:	47 CFR 15.247(d)	Year:	Most Current	Method:	FCC 97-114, ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Meter reading on spectrum analyzer is internally compensated for cable loss and external attenuation.
Power Spectral Density per 3kHz bandwidth = Power Spectral Density per 1 Hz bandwidth + Bandwidth Correction Factor.
Bandwidth Correction Factor = 10*log(3 kHz / 1 Hz) = 34.7 dB

COMMENTS

None

EUT OPERATING MODES

modulated

DEVIATIONS FROM TEST STANDARD

None

REQUIREMENTS

Maximum peak power spectral density conducted from a DSSS transmitter does not exceed 8 dBm in any 3 kHz band

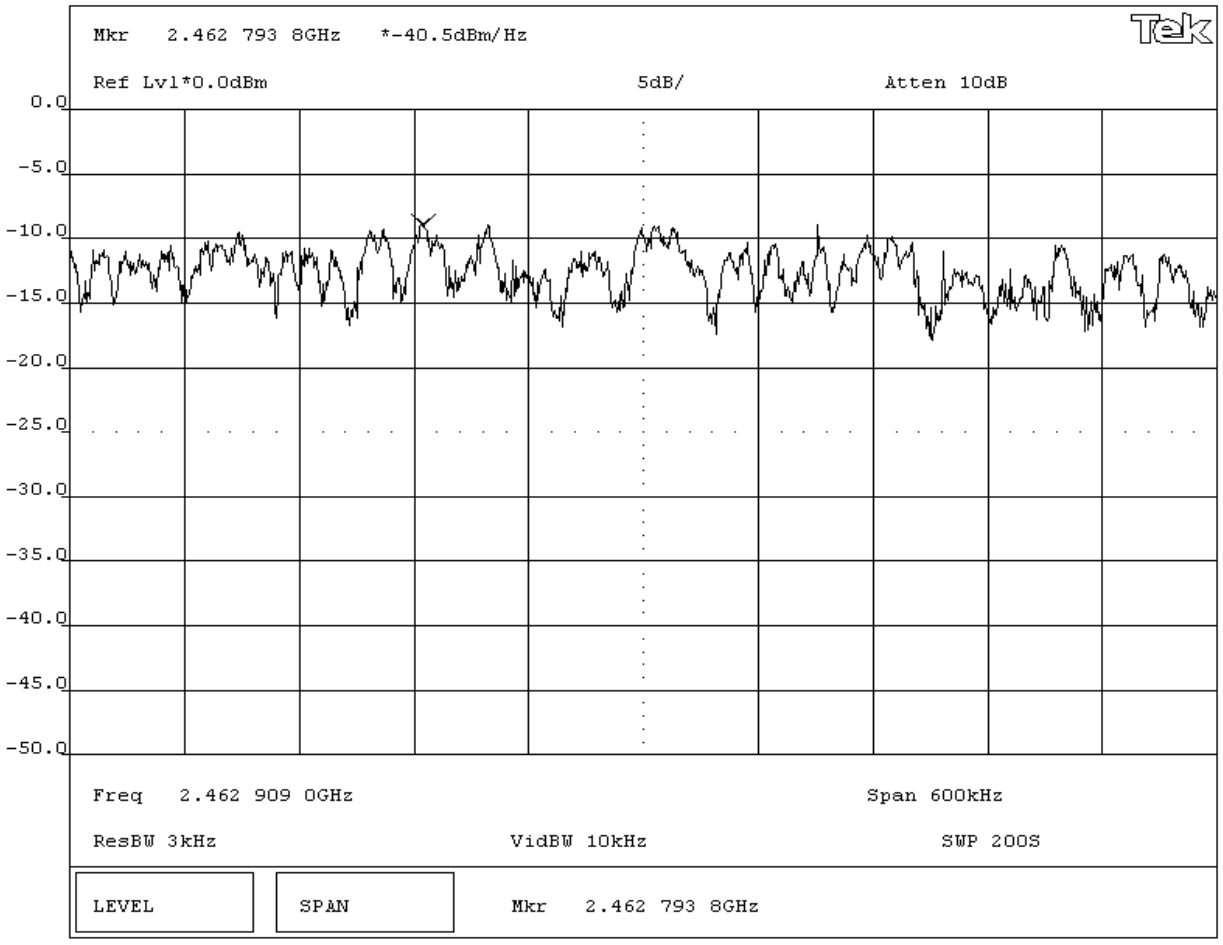
RESULTS	AMPLITUDE
Pass	-5.8dBm / 3KHz

SIGNATURE

Tested By: _____

DESCRIPTION OF TEST

Power Spectral Density - High Channel



Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Antennas Investigated:
LINX ANT-2.4-RCT-SS

Data Rates Investigated:
5.5Mbps (Maximum)

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
120 VAC, 60 Hz.

Frequency Range Investigated			
Start Frequency	30 MHz	Stop Frequency	26 GHz

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	02102500005R
Chassis Unit	Radio Frame Networks	1230500-00	FCC Engineering unit

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	1.5m	No	Chassis Unit	Test Fixture

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	01/07/2003	12 mo
Spectrum Analyzer Display	Hewlett Packard	85662A	AALD	01/07/2003	12 mo
Pre-Amplifier	Amplifier Research	LN1000A	APS	12/03/2001	14 mo
Antenna, Biconilog	EMCO	3141	AXE	12/31/2001	36 mo
Pre-Amplifier	Miteq	AMF-4D-005180-24-10P	APJ	01/06/2003	12 mo
Antenna, Horn	EMCO	3115	AHC	08/12/2002	12 mo
Antenna, Horn	EMCO	3160-09	AHG	01/15/2000	39 mo
Pre-Amplifier	Miteq	JSD4-18002600-26-8P	APU	01/17/2000	39 mo
High Pass Filter	RLC Electronics	F-100-4000-5-R	HFF	05/01/2002	12 mo
Spectrum Analyzer	Tektronix	2784	AAO	03/08/2001	24 mo

Test Description

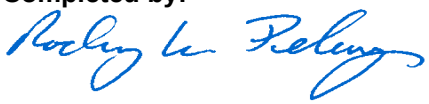
Requirement: The field strength of any spurious emissions or modulation products that fall in a restricted band, as defined in 47 CFR 15.205, is measured. The peak level must comply with the limits specified in 47 CFR 15.35(b). The average level (taken with a 10Hz VBW) must comply with the limits specified in 15.209.

Configuration: The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify compliance. While scanning, emissions from the EUT were maximized by rotating the EUT on a turntable, adjusting the position of the EUT and EUT antenna in three orthogonal axis, and adjusting the measurement antenna height and polarization (per ANSI C63.4:1992). A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

Bandwidths Used for Measurements

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 – 0.15	1.0	0.2	0.2
0.15 – 30.0	10.0	9.0	9.0
30.0 – 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0
Measurements were made using the bandwidths and detectors specified. No video filter was used.			

Completed by:



NORTHWEST EMC

OATS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	power from E-net	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.247(c)	Year:	2001
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Low channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

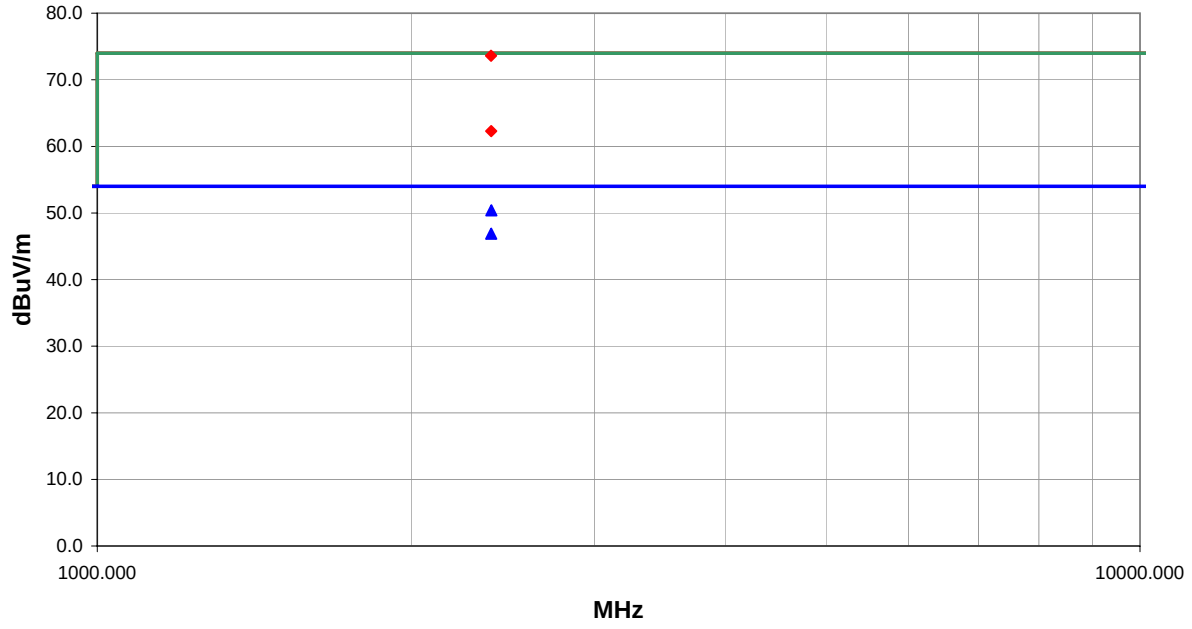
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Test Distance (m)	Run #
Pass		9

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2387.400	31.6	-1.2	11.0	1.2	3.0	20.0	V-Horn	AV	0.0	50.4	54.0	-3.6
2387.000	28.1	-1.2	66.0	1.3	3.0	20.0	H-Horn	AV	0.0	46.9	54.0	-7.1
2385.913	54.8	-1.2	0.0	1.2	3.0	20.0	V-Horn	PK	0.0	73.6	74.0	-0.4
2386.500	43.5	-1.2	66.0	1.3	3.0	20.0	H-Horn	PK	0.0	62.3	74.0	-11.7

NORTHWEST EMC

OATS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	power from E-net	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.247(c)	Year:	2001
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Mid channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

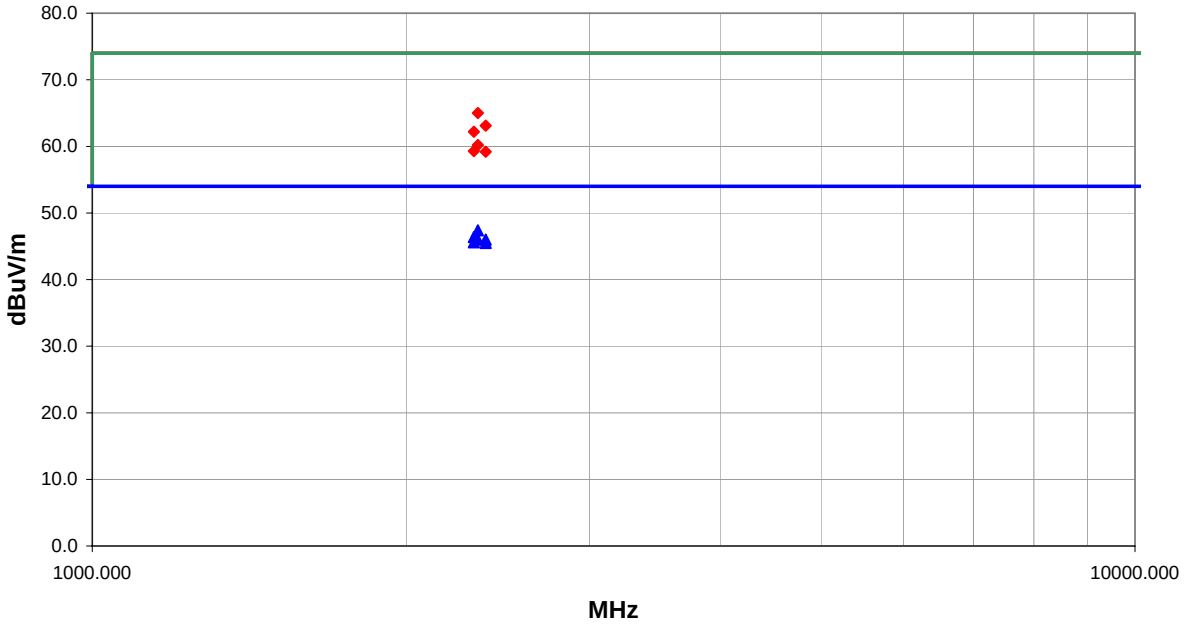
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Test Distance (m)	Run #
Pass		11

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)
2343.000	28.7	-1.3	60.0	1.2	3.0	20.0	V-Horn	AV	0.0	47.4	54.0	-6.6
2322.400	27.8	-1.4	63.0	1.2	3.0	20.0	V-Horn	AV	0.0	46.4	54.0	-7.6
2343.000	27.3	-1.3	48.0	1.3	3.0	20.0	H-Horn	AV	0.0	46.0	54.0	-8.0
2384.000	27.2	-1.2	6.0	1.2	3.0	20.0	V-Horn	AV	0.0	46.0	54.0	-8.0
2322.400	27.0	-1.4	44.0	1.3	3.0	20.0	H-Horn	AV	0.0	45.6	54.0	-8.4
2384.000	26.7	-1.2	309.0	1.3	3.0	20.0	H-Horn	AV	0.0	45.5	54.0	-8.5
2343.000	46.3	-1.3	60.0	1.2	3.0	20.0	V-Horn	PK	0.0	65.0	74.0	-9.0
2384.000	44.3	-1.2	6.0	1.2	3.0	20.0	V-Horn	PK	0.0	63.1	74.0	-10.9
2322.400	43.6	-1.4	63.0	1.2	3.0	20.0	V-Horn	PK	0.0	62.2	74.0	-11.8
2343.000	41.5	-1.3	48.0	1.3	3.0	20.0	H-Horn	PK	0.0	60.2	74.0	-13.8
2322.400	40.7	-1.4	44.0	1.3	3.0	20.0	H-Horn	PK	0.0	59.3	74.0	-14.7
2384.000	40.4	-1.2	309.0	1.3	3.0	20.0	H-Horn	PK	0.0	59.2	74.0	-14.8

NORTHWEST EMC

OATS DATA SHEET

REV df3.03 12/16/2002

EUT:	DH2			Work Order:	RAFN0026
Serial Number:	None			Date:	01/31/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	46%
Cust. Ref. No.:				Barometric Pressure	29.98
Tested by:	Greg Kiemel	Power:	120 VAC/ 60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.247(c)	Year:	2001
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

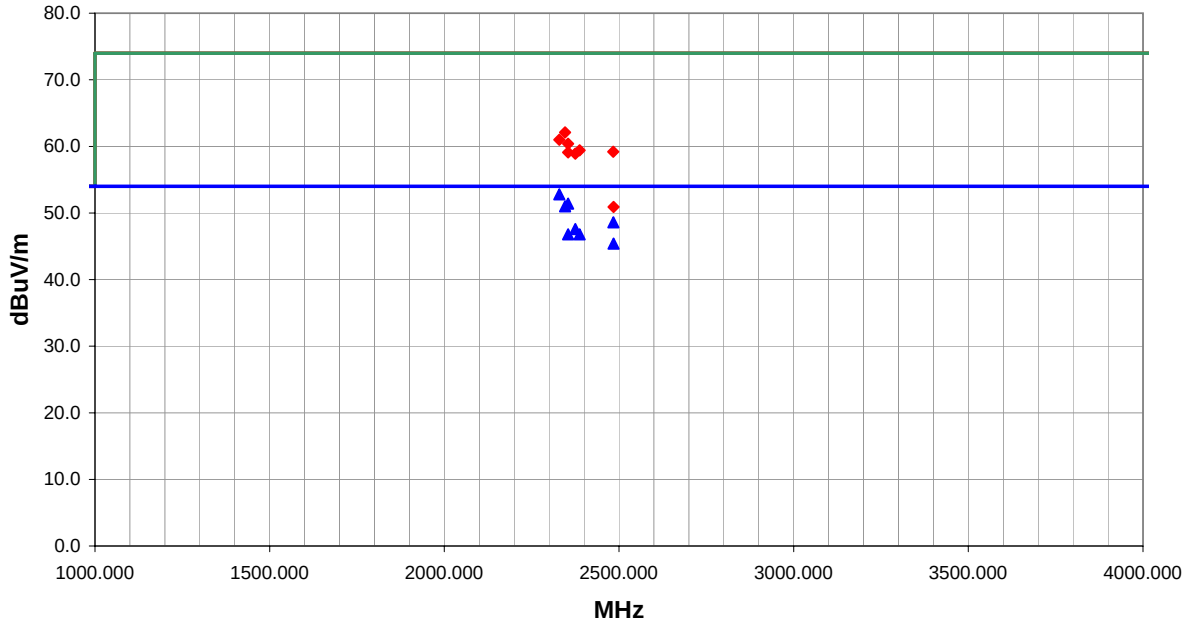
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Test Distance (m)	Run #
Pass		2

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Azimuth (degrees)	Height (meters)	Distance (meters)	External Attenuation (dB)	Polarity	Detector	Distance Adjustment (dB)	Adjusted dBuV/m	Spec. Limit dBuV/m	Compared to Spec. (dB)	Comments
2329.280	34.2	-1.4	14.0	1.0	3.0	20.0	V-Horn	AV	0.0	52.8	54.0	-1.2	"Mid Channel"
2354.318	32.7	-1.3	360.0	1.0	3.0	20.0	V-Horn	AV	0.0	51.4	54.0	-2.6	"High Channel"
2345.600	32.3	-1.3	13.0	1.0	3.0	20.0	V-Horn	AV	0.0	51.0	54.0	-3.0	"Low Channel"
2483.902	29.5	-0.9	240.0	1.2	3.0	20.0	V-Horn	AV	0.0	48.6	54.0	-5.4	"High Channel"
2375.120	28.8	-1.2	75.0	1.1	3.0	20.0	H-Horn	AV	0.0	47.6	54.0	-6.4	"Mid Channel"
2354.400	28.1	-1.3	6.0	1.0	3.0	20.0	H-Horn	AV	0.0	46.8	54.0	-7.2	"High Channel"
2387.420	28.0	-1.2	17.0	1.1	3.0	20.0	H-Horn	AV	0.0	46.8	54.0	-7.2	"Low Channel"
2484.457	26.3	-0.9	0.0	1.2	3.0	20.0	H-Horn	AV	0.0	45.4	54.0	-8.6	"High Channel"
2345.600	43.4	-1.3	13.0	1.0	3.0	20.0	V-Horn	PK	0.0	62.1	74.0	-11.9	"Low Channel"
2329.280	42.4	-1.4	14.0	1.0	3.0	20.0	V-Horn	PK	0.0	61.0	74.0	-13.0	"Mid Channel"
2354.318	41.7	-1.3	360.0	1.0	3.0	20.0	V-Horn	PK	0.0	60.4	74.0	-13.6	"High Channel"
2387.420	40.6	-1.2	17.0	1.1	3.0	20.0	H-Horn	PK	0.0	59.4	74.0	-14.6	"Low Channel"
2483.550	40.1	-0.9	240.0	1.2	3.0	20.0	V-Horn	PK	0.0	59.2	74.0	-14.8	"High Channel"
2354.400	40.4	-1.3	6.0	1.0	3.0	20.0	H-Horn	PK	0.0	59.1	74.0	-14.9	"High Channel"
2375.120	40.1	-1.2	75.0	1.1	3.0	20.0	H-Horn	PK	0.0	58.9	74.0	-15.1	"Mid Channel"
2484.457	31.8	-0.9	0.0	1.2	3.0	20.0	H-Horn	PK	0.0	50.9	74.0	-23.1	"High Channel"

Justification

The individuals and/or the organization requesting the test provided the modes, configurations and settings available to evaluate. While scanning the radiated emissions, all of the EUT parameters listed below were investigated. This includes, but may not be limited to, antennas, tuned transmit frequency ranges, operating modes, and data rates.

Channels in Specified Band Investigated:
Low
Mid
High

Operating Modes Investigated:
Typical

Data Rates Investigated:
5.5Mbps

Output Power Setting(s) Investigated:
Maximum

Power Input Settings Investigated:
120 VAC, 60 Hz.

Frequency Range Investigated			
Start Frequency	150KHz	Stop Frequency	30MHz

Software\Firmware Applied During Test			
Exercise software	EtherPeek	Version	4.02
Description			
The system was tested using standard operating production software to exercise the functions of the device during the testing. The EtherPeek software was used to transfer data packets at the maximum data rate.			

Equipment Modifications

No EMI suppression devices were added or modified. The EUT was tested as delivered.

EUT and Peripherals

Description	Manufacturer	Model/Part Number	Serial Number
EUT	Radio Frame Networks	DH2	None
Test Fixture	Radio Frame Networks	ASY-0525-010010224	02102500005R
Chassis Unit	Radio Frame Networks	1230500-00	FCC Engineerin

Cables

Cable Type	Shield	Length (m)	Ferrite	Connection 1	Connection 2
Data/Power	No	1.5m	No	Chassis Unit	Test Fixture

PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.

Measurement Equipment

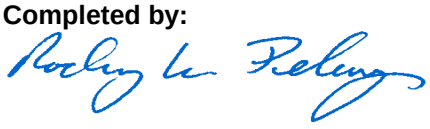
Description	Manufacturer	Model	Identifier	Last Cal	Interval
Spectrum Analyzer	Hewlett-Packard	8566B	AAL	01/07/2003	12 mo
Quasi-Peak Adapter	Hewlett-Packard	85650A	AQF	01/07/2003	12 mo
High Pass Filter	TTE	H97-100k-50-720B	HFC	01/02/2003	12 mo
LISN	Solar	9252-50-R-24-BNC	LIP	12/12/2002	12 mo

Test Description

Requirement: Per 47 15.207(d), if the EUT is connected to the AC power line indirectly, obtaining its power from another device that is connected to the AC power line, then it should be tested to demonstrate compliance with the conducted limits of 15.207.

Configuration: The EUT will be powered from a host 'Chassis Unit' that could be connected to the AC power line. Therefore, the measurements were made on the host 'Chassis Unit' used to power the EUT. The AC power line conducted emissions were measured with the EUT operating at the lowest, the highest, and a middle channel in the operational band. The EUT was transmitting at its maximum data rate (5.5Mbps). For each mode, the spectrum was scanned from 150 kHz to 30 MHz. The test setup and procedures were in accordance with ANSI C63.4-1992.

Completed by:



NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2	Work Order:	RAFN0025
Serial Number:	None	Date:	01/15/03
Customer:	Radio Frame Networks	Temperature:	73
Attendees:	Dean Busch	Humidity:	34%
Cust. Ref. No.:	None	Barometric Pressure	30.34
Tested by:	Rod Peloquin Power: 120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Low channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

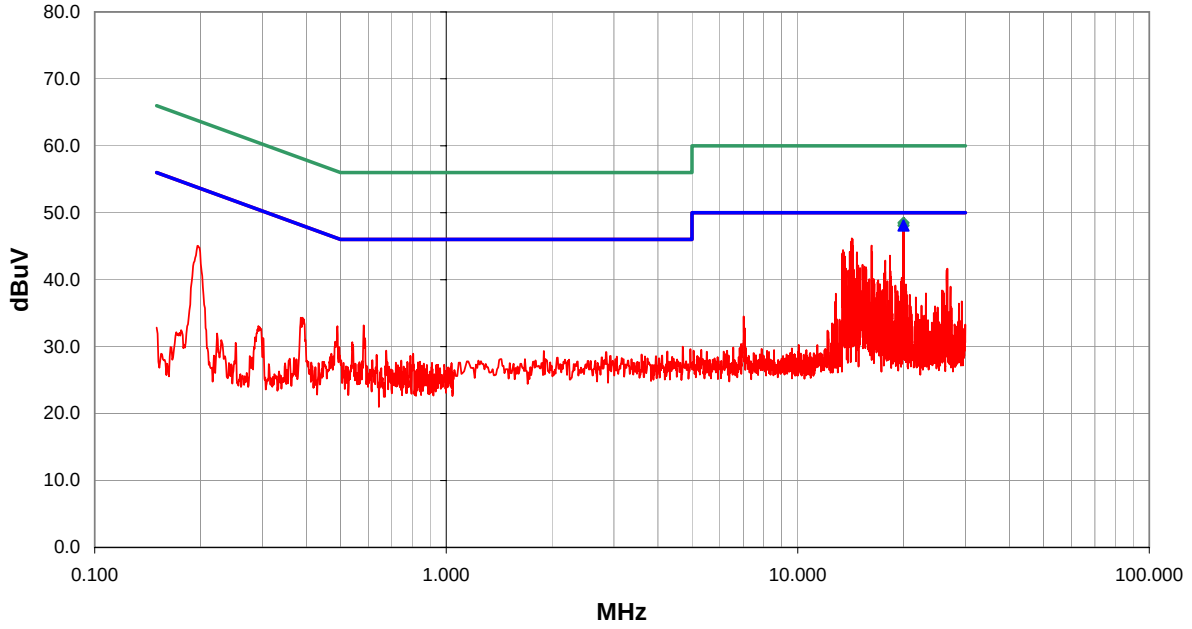
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	1

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.002	26.7			0.0	1.4	20.0		AV		48.1	50.0	-1.9
20.002	27.1			0.0	1.4	20.0		QP		48.5	60.0	-11.5
20.052	27.8			0.0	1.4	20.0				49.2	50.0	-0.8
20.012	27.8			0.0	1.4	20.0				49.2	50.0	-0.8
20.040	27.5			0.0	1.4	20.0				48.9	50.0	-1.1
20.001	27.3			0.0	1.4	20.0				48.7	50.0	-1.3
20.064	27.0			0.0	1.4	20.0				48.4	50.0	-1.6
20.023	25.7			0.0	1.4	20.0				47.1	50.0	-2.9
14.244	25.1			0.0	1.1	20.0				46.2	50.0	-3.8
14.304	25.0			0.0	1.1	20.0				46.1	50.0	-3.9
14.184	24.6			0.0	1.1	20.0				45.7	50.0	-4.3
16.224	23.9			0.0	1.2	20.0				45.1	50.0	-4.9
14.364	23.9			0.0	1.1	20.0				45.0	50.0	-5.0
13.452	23.4			0.0	1.0	20.0				44.4	50.0	-5.6
14.064	23.1			0.0	1.1	20.0				44.2	50.0	-5.8
13.512	23.1			0.0	1.0	20.0				44.1	50.0	-5.9
14.736	23.0			0.0	1.1	20.0				44.1	50.0	-5.9
16.272	22.9			0.0	1.2	20.0				44.1	50.0	-5.9
13.392	22.9			0.0	1.0	20.0				43.9	50.0	-6.1
18.288	22.3			0.0	1.3	20.0				43.6	50.0	-6.4

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Low channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

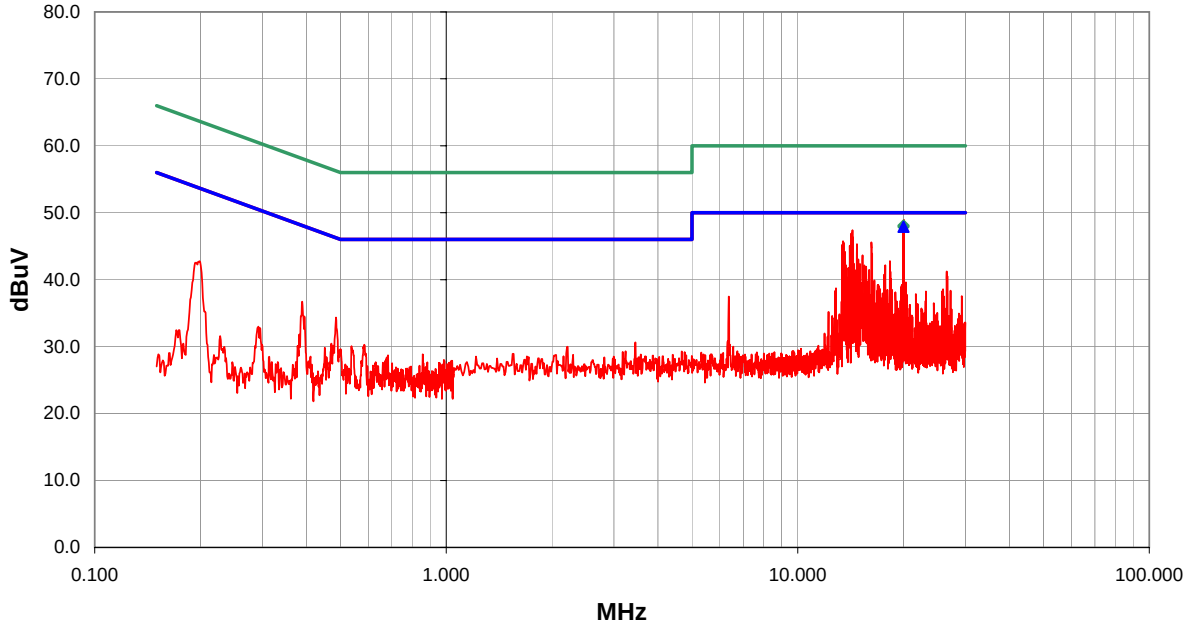
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	2

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.000	26.5			0.0	1.4	20.0		AV		47.9	50.0	-2.1
20.000	26.7			0.0	1.4	20.0		QP		48.1	60.0	-11.9
20.052	27.5			0.0	1.4	20.0				48.9	50.0	-1.1
20.012	27.4			0.0	1.4	20.0				48.8	50.0	-1.2
20.001	27.4			0.0	1.4	20.0				48.8	50.0	-1.2
20.064	26.9			0.0	1.4	20.0				48.3	50.0	-1.7
14.304	26.3			0.0	1.1	20.0				47.4	50.0	-2.6
20.040	25.8			0.0	1.4	20.0				47.2	50.0	-2.8
14.244	25.9			0.0	1.1	20.0				47.0	50.0	-3.0
14.184	25.8			0.0	1.1	20.0				46.9	50.0	-3.1
20.023	25.4			0.0	1.4	20.0				46.8	50.0	-3.2
14.364	25.2			0.0	1.1	20.0				46.3	50.0	-3.7
13.452	24.7			0.0	1.0	20.0				45.7	50.0	-4.3
16.200	24.4			0.0	1.2	20.0				45.6	50.0	-4.4
13.512	24.5			0.0	1.0	20.0				45.5	50.0	-4.5
14.736	24.2			0.0	1.1	20.0				45.3	50.0	-4.7
13.392	24.2			0.0	1.0	20.0				45.2	50.0	-4.8
14.064	24.0			0.0	1.1	20.0				45.1	50.0	-4.9
13.632	23.1			0.0	1.1	20.0				44.2	50.0	-5.8
16.272	22.7			0.0	1.2	20.0				43.9	50.0	-6.1

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Mid channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

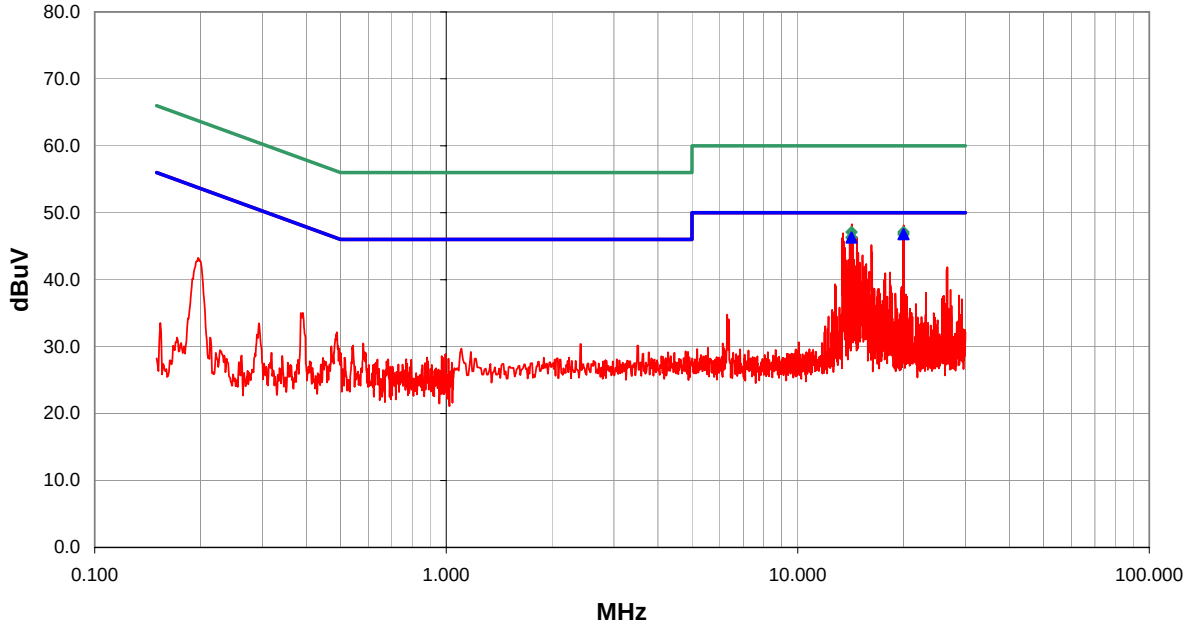
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	3

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.000	25.4			0.0	1.4	20.0		AV		46.8	50.0	-3.2
14.215	25.2			0.0	1.1	20.0		AV		46.3	50.0	-3.7
20.000	25.7			0.0	1.4	20.0		QP		47.1	60.0	-12.9
14.215	26.0			0.0	1.1	20.0		QP		47.1	60.0	-12.9
14.244	27.2			0.0	1.1	20.0				48.3	50.0	-1.7
20.012	26.7			0.0	1.4	20.0				48.1	50.0	-1.9
14.184	26.7			0.0	1.1	20.0				47.8	50.0	-2.2
14.304	26.6			0.0	1.1	20.0				47.7	50.0	-2.3
20.052	26.3			0.0	1.4	20.0				47.7	50.0	-2.3
20.001	26.0			0.0	1.4	20.0				47.4	50.0	-2.6
13.452	25.9			0.0	1.0	20.0				46.9	50.0	-3.1
14.364	25.8			0.0	1.1	20.0				46.9	50.0	-3.1
20.040	25.0			0.0	1.4	20.0				46.4	50.0	-3.6
14.736	25.2			0.0	1.1	20.0				46.3	50.0	-3.7
20.023	24.9			0.0	1.4	20.0				46.3	50.0	-3.7
13.392	25.2			0.0	1.0	20.0				46.2	50.0	-3.8
20.064	24.8			0.0	1.4	20.0				46.2	50.0	-3.8
14.064	25.1			0.0	1.1	20.0				46.2	50.0	-3.8
13.512	24.7			0.0	1.0	20.0				45.7	50.0	-4.3
16.200	24.0			0.0	1.2	20.0				45.2	50.0	-4.8

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

Mid channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

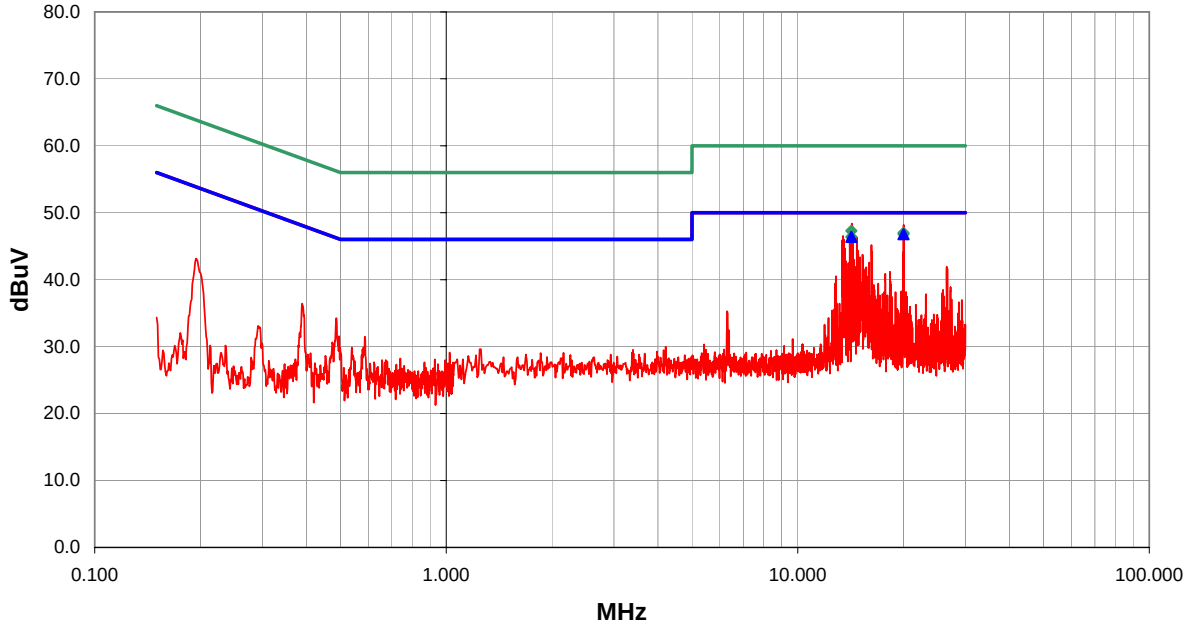
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	4

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.000	25.4			0.0	1.4	20.0		AV		46.8	50.0	-3.2
14.211	25.3			0.0	1.1	20.0		AV		46.4	50.0	-3.6
14.211	26.2			0.0	1.1	20.0		QP		47.3	60.0	-12.7
20.000	25.6			0.0	1.4	20.0		QP		47.0	60.0	-13.0
14.244	27.3			0.0	1.1	20.0				48.4	50.0	-1.6
20.004	26.8			0.0	1.4	20.0				48.2	50.0	-1.8
20.052	26.6			0.0	1.4	20.0				48.0	50.0	-2.0
14.304	26.8			0.0	1.1	20.0				47.9	50.0	-2.1
14.184	26.3			0.0	1.1	20.0				47.4	50.0	-2.6
20.064	25.7			0.0	1.4	20.0				47.1	50.0	-2.9
14.364	25.8			0.0	1.1	20.0				46.9	50.0	-3.1
13.452	25.5			0.0	1.0	20.0				46.5	50.0	-3.5
20.040	25.1			0.0	1.4	20.0				46.5	50.0	-3.5
14.736	25.2			0.0	1.1	20.0				46.3	50.0	-3.7
13.512	25.0			0.0	1.0	20.0				46.0	50.0	-4.0
13.392	24.9			0.0	1.0	20.0				45.9	50.0	-4.1
14.064	24.8			0.0	1.1	20.0				45.9	50.0	-4.1
16.212	24.0			0.0	1.2	20.0				45.2	50.0	-4.8
13.632	23.6			0.0	1.1	20.0				44.7	50.0	-5.3
14.796	23.3			0.0	1.1	20.0				44.4	50.0	-5.6

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

High channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

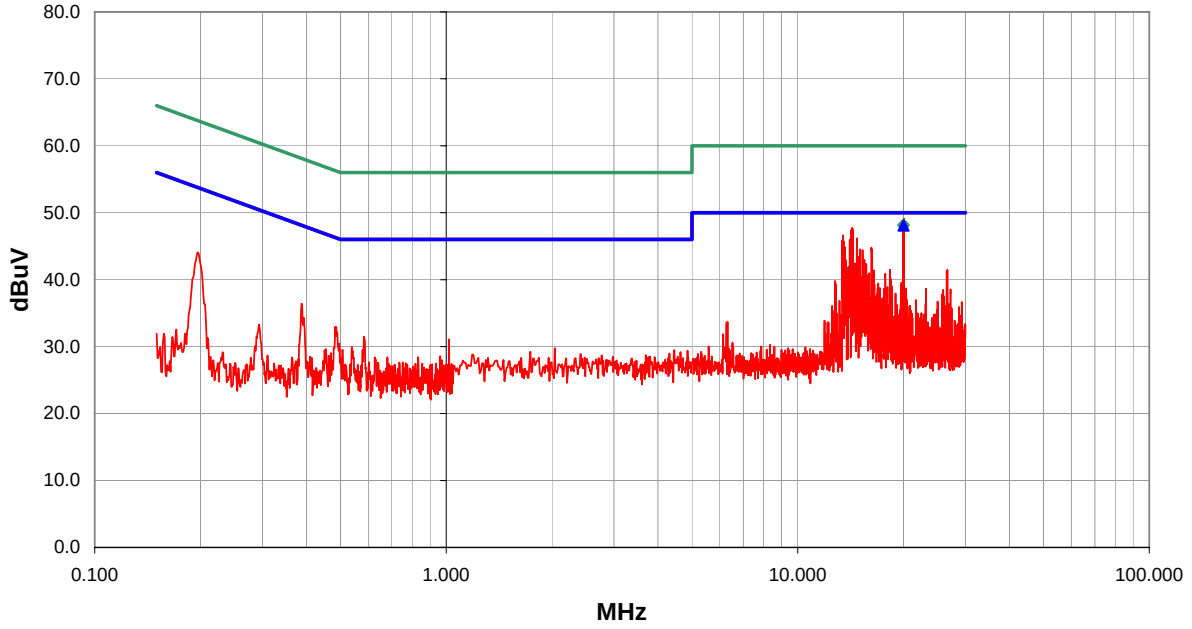
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	L1	5

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.000	26.7			0.0	1.4	20.0		AV		48.1	50.0	-1.9
20.000	26.8			0.0	1.4	20.0		QP		48.2	60.0	-11.8
20.052	27.7			0.0	1.4	20.0				49.1	50.0	-0.9
20.012	27.5			0.0	1.4	20.0				48.9	50.0	-1.1
20.064	27.2			0.0	1.4	20.0				48.6	50.0	-1.4
20.001	27.2			0.0	1.4	20.0				48.6	50.0	-1.4
20.040	26.9			0.0	1.4	20.0				48.3	50.0	-1.7
14.316	26.6			0.0	1.1	20.0				47.7	50.0	-2.3
14.256	26.6			0.0	1.1	20.0				47.7	50.0	-2.3
14.184	26.3			0.0	1.1	20.0				47.4	50.0	-2.6
14.364	26.2			0.0	1.1	20.0				47.3	50.0	-2.7
13.452	25.6			0.0	1.0	20.0				46.6	50.0	-3.4
14.736	25.1			0.0	1.1	20.0				46.2	50.0	-3.8
14.064	24.9			0.0	1.1	20.0				46.0	50.0	-4.0
13.380	24.8			0.0	1.0	20.0				45.8	50.0	-4.2
13.512	24.7			0.0	1.0	20.0				45.7	50.0	-4.3
20.023	24.2			0.0	1.4	20.0				45.6	50.0	-4.4
13.632	23.8			0.0	1.1	20.0				44.9	50.0	-5.1
16.200	23.6			0.0	1.2	20.0				44.8	50.0	-5.2

NORTHWEST EMC

CONDUCTED EMISSIONS DATA SHEET

REV df3.02 10/23/2002

EUT:	DH2			Work Order:	RAFN0025
Serial Number:	None			Date:	01/15/03
Customer:	Radio Frame Networks			Temperature:	73
Attendees:	Dean Busch			Humidity:	34%
Cust. Ref. No.:	None			Barometric Pressure	30.34
Tested by:	Rod Peloquin	Power:	120VAC/60Hz	Job Site:	EV01

TEST SPECIFICATIONS

Specification:	FCC Part 15.207	Year:	2003
Method:	ANSI C63.4	Year:	1992

SAMPLE CALCULATIONS

Radiated Emissions: Field Strength = Measured Level + Antenna Factor + Cable Factor - Amplifier Gain + Distance Adjustment Factor + External Attenuation

Conducted Emissions: Adjusted Level = Measured Level + Transducer Factor + Cable Attenuation Factor + External Attenuator

COMMENTS

High channel, LINX ANT-2.4-RCT-SS antenna

EUT OPERATING MODES

Maximum output power at 5.5Mbps data rate

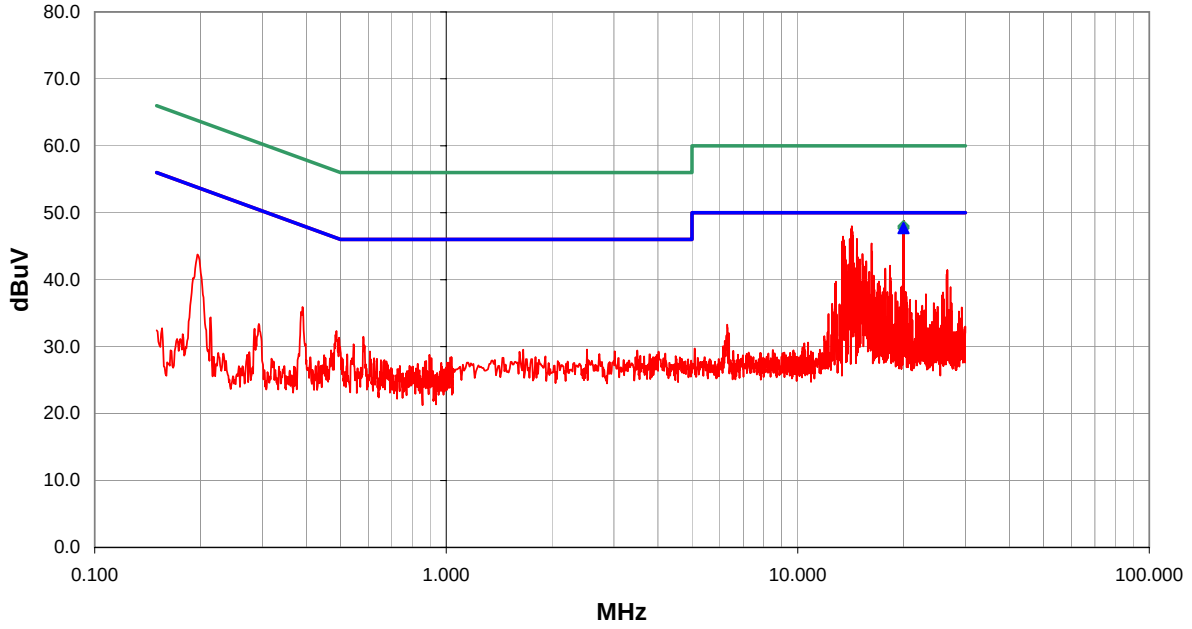
DEVIATIONS FROM TEST STANDARD

No deviations.

RESULTS	Line	Run #
Pass	N	6

Other

Tested By:



Freq (MHz)	Amplitude (dBuV)			Transducer (dB)	Cable (dB)	External Attenuation (dB)		Detector (blank equal peaks [PK] from scan)		Adjusted dBuV	Spec. Limit dBuV	Compared to Spec. (dB)
20.000	26.3			0.0	1.4	20.0		AV		47.7	50.0	-2.3
20.000	26.6			0.0	1.4	20.0		QP		48.0	60.0	-12.0
20.052	27.4			0.0	1.4	20.0				48.8	50.0	-1.2
20.012	27.3			0.0	1.4	20.0				48.7	50.0	-1.3
20.001	27.1			0.0	1.4	20.0				48.5	50.0	-1.5
20.064	26.9			0.0	1.4	20.0				48.3	50.0	-1.7
14.244	26.9			0.0	1.1	20.0				48.0	50.0	-2.0
14.184	26.5			0.0	1.1	20.0				47.6	50.0	-2.4
14.304	26.1			0.0	1.1	20.0				47.2	50.0	-2.8
20.023	25.8			0.0	1.4	20.0				47.2	50.0	-2.8
20.040	25.5			0.0	1.4	20.0				46.9	50.0	-3.1
14.364	25.4			0.0	1.1	20.0				46.5	50.0	-3.5
13.452	25.4			0.0	1.0	20.0				46.4	50.0	-3.6
14.736	25.0			0.0	1.1	20.0				46.1	50.0	-3.9
14.064	25.0			0.0	1.1	20.0				46.1	50.0	-3.9
13.512	24.9			0.0	1.0	20.0				45.9	50.0	-4.1
13.392	24.7			0.0	1.0	20.0				45.7	50.0	-4.3
16.224	24.2			0.0	1.2	20.0				45.4	50.0	-4.6
13.632	23.9			0.0	1.1	20.0				45.0	50.0	-5.0
16.272	23.0			0.0	1.2	20.0				44.2	50.0	-5.8