Elliott Laboratories Inc.
www.elliottlabs.com
684 West Maude Avenue
Sunnyvale, CA 94086-3518
408-245-7800 Phone
408-245-3499 Fax

Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Nova Engineering Model: NovaRoam EH900

FCC ID:	OOSNREH900
UPN:	4826A-NREH900
GRANTEE:	Nova Engineering 5 Circle Freeway Drive Cincinnati, OH 45246
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	January 6, 2004
FINAL TEST DATE:	December 24, 2003
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Nova Engineering, Inc. model NovaRoam EH900 pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators and RSS-210 Issue 5 for licence-exempt low power devices. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in ANSI C63.4-1992 as outlined in Elliott Laboratories test procedures.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Nova Engineering, Inc. model NovaRoam EH900 and therefore apply only to the tested sample. The sample was selected and prepared by Barry Carlin of Nova Engineering

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules and RSS-210 Issue 5 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a grant of equipment authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units that are subsequently manufactured.

SUMMARY OF RESULTS

101.5 kB/s Data Rate

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247	6.2.2(o)(a)	20dB Bandwidth	124.5 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247	6.2.2(o)(a)	Channel Separation	125 kHz		Complies
15.247	6.2.2(o)(a)	Number of Channels	207 @ low data rate	At least 50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period.	Complies
15.247	6.2.2(o)(a)	Channel Dwell Time	0.176 seconds per 20 seconds		Complies
15.247	6.2.2(o)(a)	Channel Utilization	All channels are used equally	Refer to Theory of Operations for detailed description of the hopping algorithm	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 902 -928MHz	28 dBm (0.63 Watts) EIRP = 2.52 W	Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2(o)(e1)	Tx Spurious Emissions – 30MHz – 10 GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Tx Spurious Emissions – 30MHz – 10 GHz	51.2 dBuV/m @ 2783.6MHz (-2.8dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.109	Section 7 Table 3	Rx Spurious Emissions – 30MHz – 3 GHz	40.1 dBuV/m @ 805 MHz (-5.9dB)	Spurious emissions from the receiver must meet 15.109 and RSS 210 Table 3	Complies
15.207		AC Conducted Emissions	42.1dBuV @ 3.364MHz (-13.9dB)		Complies
	6.6	AC Conducted Emissions	42.1dBuV @ 3.364MHz (-5.9dB dB)		Complies
15.247 (b) (5)		RF Exposure Requirements	FCC /IC limits of power density not exceeded provided antenna is located a minimum of 30 cm from persons	Refer to MPE calculation. Refer to User's Guide and Installation Guide for instructions requiring adequate separation	Complies
15.203		RF Connector	TNC	Professional installation required	Complies

Note 1 – Antenna plus cable assembly have a gain that does not exceed 6dBi. EIRP calculated using antenna gain – cable loss of 6dBi for the highest EIRP point-to-multipoint system.

406 kB/s Data Rate

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247 (a) (1)	6.2.2(o)(a)	20dB Bandwidth	498 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247 (a) (1)	6.2.2(o)(a)	Channel Separation	500 kHz		Complies
15.247 (a) (1)	6.2.2(o)(a)	Number of Channels	51	At least 50 hopping frequencies: average time of occupancy <0.4 second within a 20 second period.	Complies
15.247 (a) (1)	6.2.2(o)(a)	Channel Dwell Time	0.392 seconds per 20 seconds		Complies
15.247 (a) (1)	6.2.2(o)(a)	Channel Utilization	All channels are used equally	Refer to Theory of Operations for detailed description of the hopping algorithm	Complies
15.247 (b) (3)	6.2.2(o)(a)	Output Power, 902 -928MHz	28.6 dBm (0.73 Watts) EIRP = 2.92 W	Maximum permitted is 1Watt, with EIRP limited to 4 Watts for a 50-channel system.	Complies
15.247(c)	6.2.2(o)(e1)	Tx Spurious Emissions – 30MHz – 10 GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Tx Spurious Emissions – 30MHz – 10 GHz	2781.4MHz 51.0 dBuV/m @ 2781.4MHz (- 3.0 dB)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
15.109	Section 7 Table 3	Rx Spurious Emissions – 30MHz – 3 GHz	40.1 dBuV/m @ 805 MHz (-5.9dB)	Spurious emissions from the receiver must meet 15.109 and RSS 210 Table 3	Complies
15.207		AC Conducted Emissions	42.1dBuV @ 3.364MHz (-13.9dB)		Complies
	6.6	AC Conducted Emissions	42.1dBuV @ 3.364MHz (-5.9dB dB)		Complies
15.247 (b) (5)		RF Exposure Requirements	FCC /IC limits of power density not exceeded provided antenna is located a minimum of 20 cm from persons	Refer to MPE calculation for 20cm derivation. Refer to User's Guide for installation instructions requiring a 20cm separation	Complies
15.203		RF Connector	TNC	Professional installation required	Complies

Note 1 – Antenna plus cable assembly have a gain that does not exceed 6dBi. EIRP calculated using antenna gain – cable loss of 6dBi for the highest EIRP point-to-multipoint system.

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with NAMAS document NIS 81.

Measurement Type	Frequency Range (MHz)	Calculated Uncertainty (dB)
Conducted Emissions	0.15 to 30	± 2.4
Radiated Emissions	30 to 1000	± 3.6

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Nova Engineering, Inc. model NovaRoam EH900 is a frequency-hopping radio which is designed for commercial/industrial and military applications. The device can operate at two data rates, one using a 207-channel hopping sequence with channel spacing of 125kHz and data rate of 101.5kB/s, the other uses 51 channels with a 500 kHz spacing and a data rate of 406 kb/s.

Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/240 V, 50/60 Hz (via external AC-DC adapter) 10 Watts. In addition, the NovaRoam EH900 will accept DC input power at any voltage between +10 and +18V.

The sample was received on October 28, 2003 and tested on December 24, 2003. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	Proposed FCC ID #
Nova Engineering NovaRoam EH900 Frequency-Hopping Radio	67	TBD
Antenex YB8966 Yagi Antenna		
Antenex FG9026 Omni Antenna	-	-

ENCLOSURE

The EUT enclosure is primarily constructed of extruded aluminum. It measures approximately 13.2 cm wide by 16 cm deep by 3.3 cm high.

MODIFICATIONS

The EUT did not require modifications during testing in order to comply with the emission specifications.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
None	-	-

The following equipment was used as remote support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
Toshiba Satellite Laptop computer	-	-

EUT INTERFACE PORTS

The I/O cabling configuration during emissions testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length (m)
RJ 45	Laptop	CAT5	Unshielded	30
RS232	NOT CONNECTED	See note below		
Antenna	Antenna	LMR 400	Shielded	See note
DC power	DC Adapter	2-wire	Unshielded	1.5

Note: The Monitor ports was not connected as the manufacturer stated that it is for configuration purpose and therefore would not normally be connected.
The Yagi antenna was connected to the EUT via a 135' LMR-400 cable. The Omni antenna was connected via a 60' cable. These cable lengths are the minimum lengths that can be used with respective antennas. The length of cable ensures the maximum EIRP of 4 Watts allowed by RSS 210 and FCC Part 15.247 is not exceeded.

EUT OPERATION DURING TESTING

Radiated spurious emissions measurements were made with the EUT continuously transmitting on a single channel with a duty cycle of ~ 95%. The signal was on for approximately 140ms and off for approximately 10ms.

Direct measurements of hopping parameters were made with the device set to hop across all channels. Bandwidth and power measurements were made with the device on single channels detailed for radiated spurious emissions.

ANTENNA REQUIREMENTS

The antenna port is a standard, TNC connector, which is permitted as the system is intended to be professionally installed. The system can be used with the following antenna assemblies:

Antenna Model	Type	Gain (dBi)	Minimum Cable Loss (dB)	Net Gain (dBi)
Antenex YB8966	Yagi	11.2	5.2	6
Antenna Specialists	Yagi	10.2	4.2	6
Antenex FG9026	Omni	8.2	2.2	6
Antenna Specialists ASPG1894T	Omni	5.2	0	5.2
Nearson S467TC-915S	Omni	2.2	0	2.2
Antenex TRAB9023	Low Profile Omni	3	0	3

The highest gain omni antenna and highest gain Yagi antenna were tested with the system for radiated spurious emissions in both transmit and receive modes. Additional measurements made with the antenna replaced with a non-radiating load indicated that the emissions at harmonics of the fundamental transmitted signal were from the enclosure and not from the antenna.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on December 24, 2003at the Elliott Laboratories Open Area Test Site #1&2 located at 684 West Maude Avenue, Sunnyvale, California. The test site contains separate areas for radiated and conducted emissions testing. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Federal Communications Commission. In accordance with Industry Canada rules detailed in RSS 210 Issue 5 and RSS-212, construction, calibration, and equipment data for the test sites have been filed with the Federal Communications Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4-1992. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde and Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and peak power sensor are used for all direct output power measurements from transmitters as they provide a broadband indication of the power output.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the entire 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used. The antenna calibration factors are included in site factors programmed into the test receivers.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 MHz up to the frequency required by the regulation specified on page 1. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

Measurement bandwidths (video and resolution) are set in accordance with FCC procedures for the type of radio being tested.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions from the AC power port are given in units of microvolts, the limits for radiated electric field emissions are given in units of microvolts per meter at a specified test distance and the output power limits are given in temrs of Watts, milliwatts or dBm. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp) the following formula is used to determine the field strength limit in terms of microvolts per meter at a distance of 3m from the equipment under test:

$$E = \frac{1000000 \text{ v } 30\ P}{3} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For reference, converting the voltage and electric field strength specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. Conversion of power specification limits from linear units (in milliwatts) to decibel form (in dBm) is accomplished by taking the base ten logarithm, then multiplying by 10.

FCC 15.407 (a)and RSS 210 (o) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Number Of Channels	Output Power
902 – 928	>=50	1 W (30 dBm)
902 – 928	< 50	0.25 W (24 dBm)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi.

RSS 210 (o) AND FCC 15.247 SPURIOUS RADIATED EMISSIONS LIMITS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands detailed in Part 15.205 and for all spurious emissions from the receiver are:

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level.

FCC AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in FCC Part 15.207.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

RSS-210 SECTION 6.6 AC POWER PORT CONDUCTED EMISSIONS LIMITS

The table below shows the limits for emissions on the AC power line as detailed in Industry Canada RSS-210 section 6.6.

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EXHIBIT 1: Test Equipment Calibration Data

1 Page

AC Conducted Emissions, 24-Dec-03
Engineer: Mark Briggs

Manufacturer	Description	Model #	Assett #	Cal Due
Elliott Laboratories	FCC / CISPR LISN	LISN-4, OATS	362	01-Jul-04
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	1316	15-Dec-04
Rohde& Schwarz	Pulse Limiter	ESH3 Z2	1398	10-Jan-04

Radiated Emissions, 30 - 10,000 MHz, 24-Dec-03
Engineer: Mark Briggs

Manufacturer	Description	Model #	Assett #	Cal Due
Narda West	High Pass Filter 1.9 GHz	HPF-161	248	26-Mar-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	24-Jan-04
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	20-Nov-04
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	31-Mar-04
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	24-Jul-04
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	09-Oct-04

Antenna Conducted Measurements (Power, Bandwidth, Occupancy), 24-Dec-03
Engineer: Mark Briggs

Manufacturer	Description	Model #	Assett #	Cal Due
Hewlett Packard	EMC Spectrum Analyzer, Opt. 026 □9 KHz - 26.5GHz	8593EM	1141	19-Mar-04

Radiated Emissions, 30 - 6,500 MHz, 07-Jan-04
Engineer: Rod Wong

Manufacturer	Description	Model #	Assett #	Cal Due
Elliott Laboratories	Biconical Antenna, 30-300 MHz	EL30.300	773	18-Mar-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	24-Jan-04
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	09-Oct-04
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	20-Nov-04
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	31-Mar-04
Rohde & Schwarz	Test Receiver, 0.009-2000 MHz	ESN	1332	24-Jul-04

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T53238 34 Pages

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Emissions Spec:	FCC	Class:	A
Immunity Spec:	n/a	Environment:	n/a

EMC Test Data

For The

Nova Engineering

Model

NovaRoam EH900

Date of Last Test: 1/9/2004

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Emissions Spec:	FCC	Class:	A
Immunity Spec:	n/a	Environment:	n/a

EUT INFORMATION

General Description

The EUT is a frequency-hopping radio which is designed for commercial/industrial and military applications. The device can operate at two data rates, one using a 207-channel hopping sequence with channel spacing of 125kHz and data rate of 101.5kB/s, the other uses 51 channels with a 500 kHz spacing and a data rate of 406 kb/s.

Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120/240 V, 50/60 Hz (via external AC-DC adapter) 10 Watts. In addition, the NovaRoam EH900 will accept DC input power at any voltage between +10 and +18V.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Nova Engineering	NovaRoam EH900	Frequency-Hopping Radio	67	TBD
Antenex	YB8966	Yagi Antenna	-	
Antenex	FG9026	Omni Antenna	-	

Other EUT Details

The EUT has a standard TNC antenna connector. It can be used with the following antennas:

+11.2dBi Yagi
+10.2dBi Yagi
+8.2dBi omni
+5.2dBi magnetic mount collinear
+2.2dBi flexible whip
low profile magnetic mount.

The cable lengths supplied with each antenna ensure that their effective gain (actual gain - cable loss) does not exceed 6dBi.

EUT Enclosure

The EUT enclosure is primarily constructed of extruded aluminum. It measures approximately 13.2 cm wide by 16 cm deep by 3.3 cm high.

Modification History

Mod. #	Test	Date	Modification
1	-	-	None

Modifications applied are assumed to be used on subsequent tests unless otherwise stated as a further modification.

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Emissions Spec:	FCC	Class:	A
Immunity Spec:	n/a	Environment:	n/a

Test Configuration #1

Local Support Equipment

None used.

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Toshiba	Satellite	Laptop computer		

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
RJ 45	Laptop	CAT5	Unshielded	30
RS232	NOT CONNECTED	See note below		
Antenna	Antenna	LMR 400	Shielded	See note
DC power	DC Adapter	2-wire	Unshielded	1.5

Note: The Monitor ports was not connected as the manufacturer stated that it is for configuration purpose and therefore would not normally be connected.
The Yagi antenna was connected to the EUT via a 130'm cable. The Omni antenna was connected via a 60' cable. These cable lengths are the minimum lengths that can be used with respective antennas. The length of cable ensures the maximum EIRP of 4 Watts allowed by RSS 210 and FCC Part 15.247 is not exceeded.

EUT Operation During Emissions (Digital Device/Receiver)

Communication was established with the EUT via a ping program running in the remote laptop while the EUT was set to receive on the specified channel.

EUT Operation During Emissions (Transmitter)

Radiated spurious emissions measurements were made with the EUT continuously transmitting on a single channel with a duty cycle of ~ 95%. The signal was on for approximately 140ms and off for approximately 10ms.
Direct measurements of hopping parameters were made with the device set to hop across all channels. Bandwidth and power measurements were made with the device on a single channel as detailed for radiated spurious emissions.

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Radiated Emissions - Digital Device

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 1/7/2004
Test Engineer: Rod Wong
Test Location: SVOATS #2

Config. Used: #1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing. Remote support equipment was located approximately 30 meters from the test area with all I/O connections routed overhead.

Unless otherwise specified, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz.

Note, **preliminary** testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. **Maximized** testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 12.8 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz, Maximized Emissions, Digital testing	FCC Class A	Pass	-9.4dB @ 250.000MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Run #1: Preliminary Radiated Emissions, 30-1000 MHz
Omni antenna
sn #67

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
250.000	36.8	V	46.4	-9.6	QP	67	1.0	
41.446	23.0	V	39.1	-16.1	QP	0	1.0	
150.000	26.1	V	43.5	-17.4	QP	221	1.0	
805.000	24.5	V	46.4	-21.9	QP	163	1.0	
500.000	23.4	V	46.4	-23.0	QP	213	1.0	
150.000	18.7	H	43.5	-24.8	QP	0	3.6	
41.446	12.2	H	39.1	-26.9	QP	89	2.0	
30.000	10.4	V	39.1	-28.7	QP	0	1.0	

Run #2: Maximized Readings From Run #1
Omni antenna
sn #67

Frequency	Level	Pol	FCC Class A		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
250.000	37.0	V	46.4	-9.4	QP	67	1.0	
41.446	23.0	V	39.1	-16.1	QP	0	1.0	
150.000	26.1	V	43.5	-17.4	QP	221	1.0	
805.000	24.6	V	46.4	-21.8	QP	163	1.0	
500.000	23.4	V	46.4	-23.0	QP	213	1.0	
150.000	18.7	H	43.5	-24.8	QP	0	3.6	

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Conducted Emissions - Power Ports

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 12/24/2003
Test Engineer: Mark Briggs
Test Location: SVOATS #1
Config. Used: #1
Config Change: None
EUT Voltage: Refer to individual run

General Test Configuration

The EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. Remote support equipment was located approximately 30 meters from the test area. All I/O connections were routed overhead.

Ambient Conditions:

Temperature: 14 °C
Rel. Humidity: 74 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 230V/50Hz	EN 55022 B / 15.207	Pass	-10.0dB @ 0.398MHz
2	CE, AC Power,120V/60Hz	FCC 15.207	Pass	-13.9dB @ 3.364MHz
2	CE, AC Power,120V/60Hz	RSS 210	Pass	-5.9dB @ 3.364MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

All conducted measurements were made with the device operating a telnet session to the laptop and transmitting continuously on the center channel.

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz

Frequency	Level	AC	FCC 15.207/15.107		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.398	37.8	Line 1	47.8	-10.0	AV	
3.181	44.1	Neutral	56.0	-11.9	QP	
0.398	45.0	Line 1	57.8	-12.8	QP	
3.319	42.6	Line 1	56.0	-13.4	QP	
0.641	41.6	Line 1	56.0	-14.4	QP	
0.535	41.5	Line 1	56.0	-14.5	QP	
2.174	40.3	Line 1	56.0	-15.7	QP	
1.326	40.2	Line 1	56.0	-15.8	QP	
0.641	30.1	Line 1	46.0	-15.9	AV	
0.527	39.5	Neutral	56.0	-16.5	QP	
0.639	38.9	Neutral	56.0	-17.1	QP	
0.535	28.0	Line 1	46.0	-18.0	AV	
3.181	27.6	Neutral	46.0	-18.4	AV	
3.319	27.4	Line 1	46.0	-18.6	AV	
0.527	27.1	Neutral	46.0	-18.9	AV	
0.639	25.4	Neutral	46.0	-20.6	AV	
1.677	34.9	Neutral	56.0	-21.1	QP	
1.326	23.7	Line 1	46.0	-22.3	AV	
2.174	22.2	Line 1	46.0	-23.8	AV	
1.677	17.9	Neutral	46.0	-28.1	AV	

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

Frequency	Level	AC	FCC 15.207/15.107		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
3.364	42.1	Line 1	56.0	-13.9	QP	
0.642	41.4	Line 1	56.0	-14.6	QP	
3.401	41.1	Neutral	56.0	-14.9	QP	
1.065	39.1	Line 1	56.0	-16.9	QP	
0.659	38.5	Neutral	56.0	-17.5	QP	
0.642	27.9	Line 1	46.0	-18.1	AV	
0.659	25.8	Neutral	46.0	-20.2	AV	
1.994	35.3	Neutral	56.0	-20.7	QP	
3.364	25.3	Line 1	46.0	-20.7	AV	
1.065	23.6	Line 1	46.0	-22.4	AV	
3.401	21.6	Neutral	46.0	-24.4	AV	
1.994	19.4	Neutral	46.0	-26.6	AV	

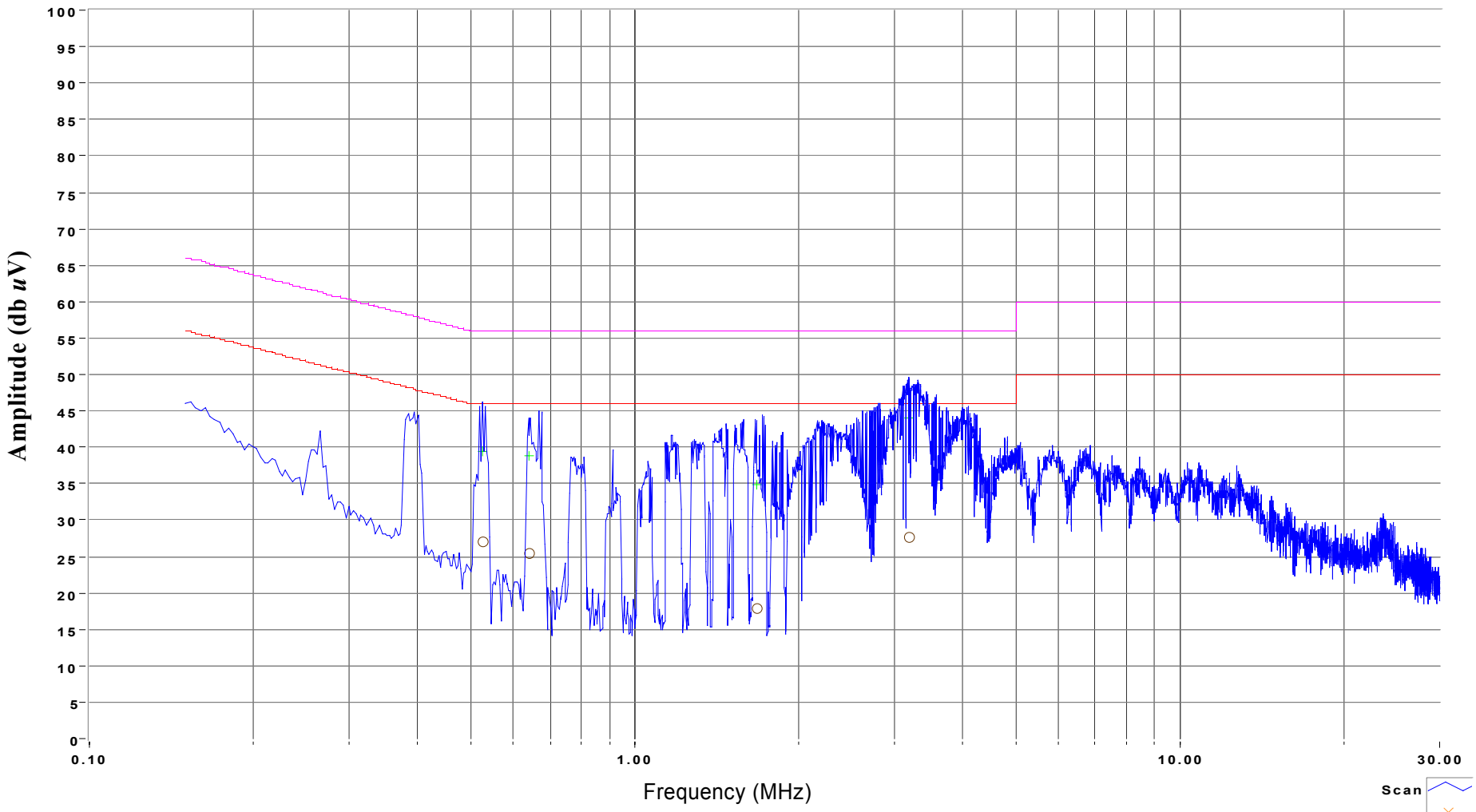
Frequency	Level	AC	RSS 210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
3.364	42.1	Line 1	48.0	-5.9	QP	
0.642	41.4	Line 1	48.0	-6.6	QP	
3.401	41.1	Neutral	48.0	-6.9	QP	
1.065	39.1	Line 1	48.0	-8.9	QP	
0.659	38.5	Neutral	48.0	-9.5	QP	
1.994	35.3	Neutral	48.0	-12.7	QP	

SV #1: Nova NovaRoam NR-EH900 (NR2) Run 1

Spec:
EN55022B

Mains Lead
Neutral

ACConducted Emissions



Run #1, 230V/50Hz, Neutral

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

12/24/03

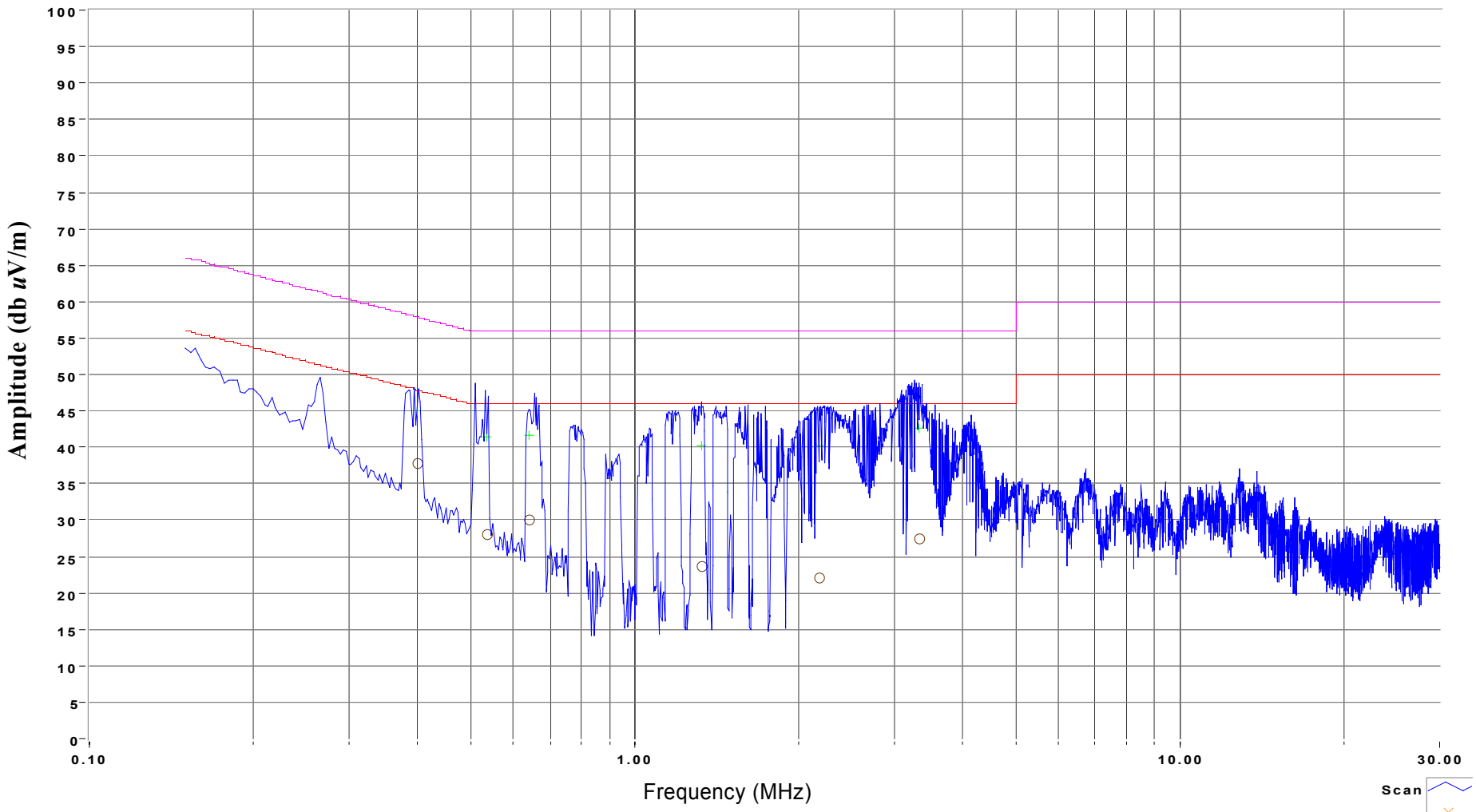
Mark Briggs

SV #1: Nova NovaRoam NR-EH900 (NR2) Run 1

Spec:
EN55022B

Mains Lead
Line 1

ACConducted Emissions



Run #1, 230V/50Hz, Line

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

12/24/03

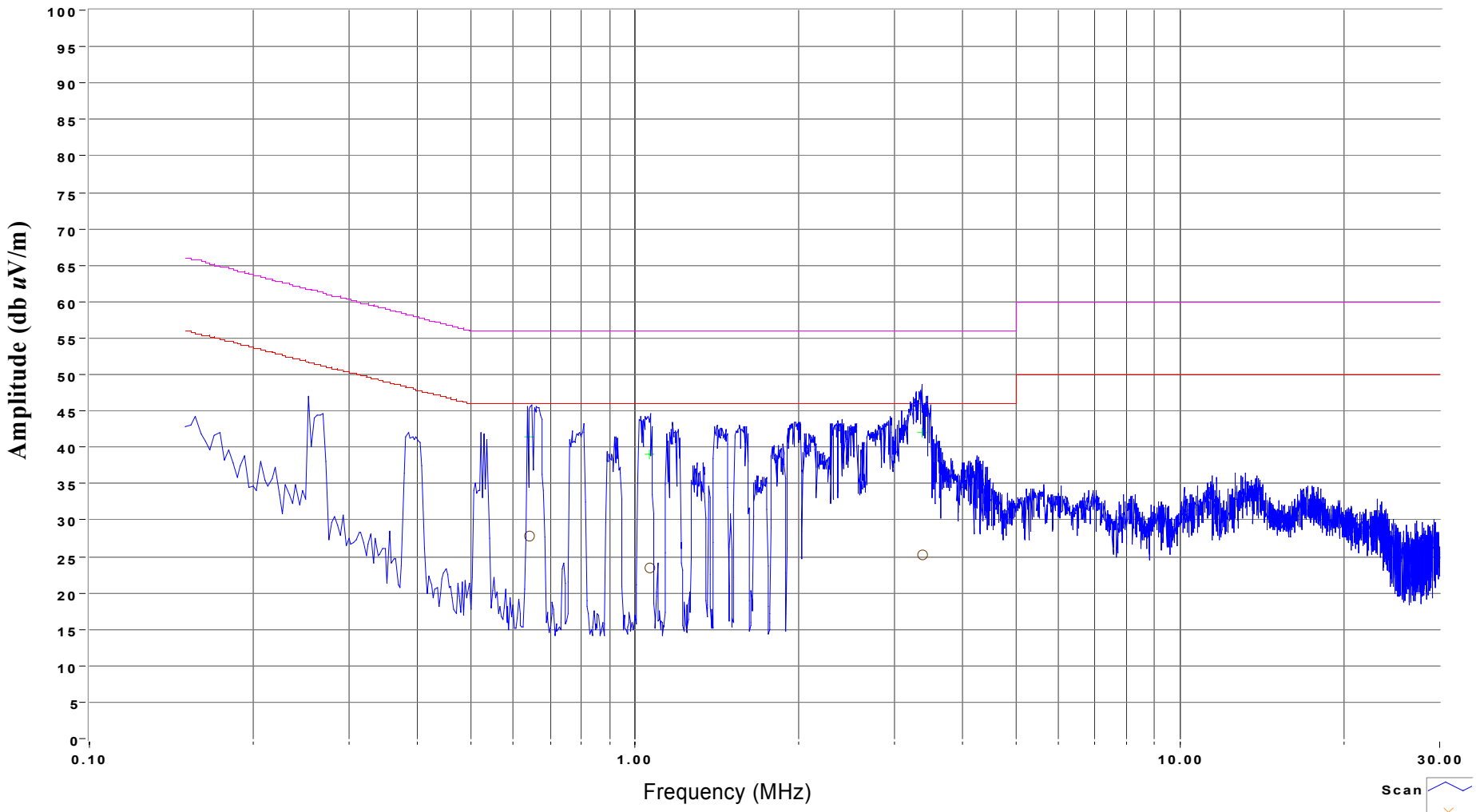
Mark Briggs

SV #1: Nova NovaRoam NR-EH900 (NR2) Run 2

Spec:
EN55022B

Mains Lead
Line 1

ACConducted Emissions



Run #2, 120V/60Hz, Line

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

12/24/03

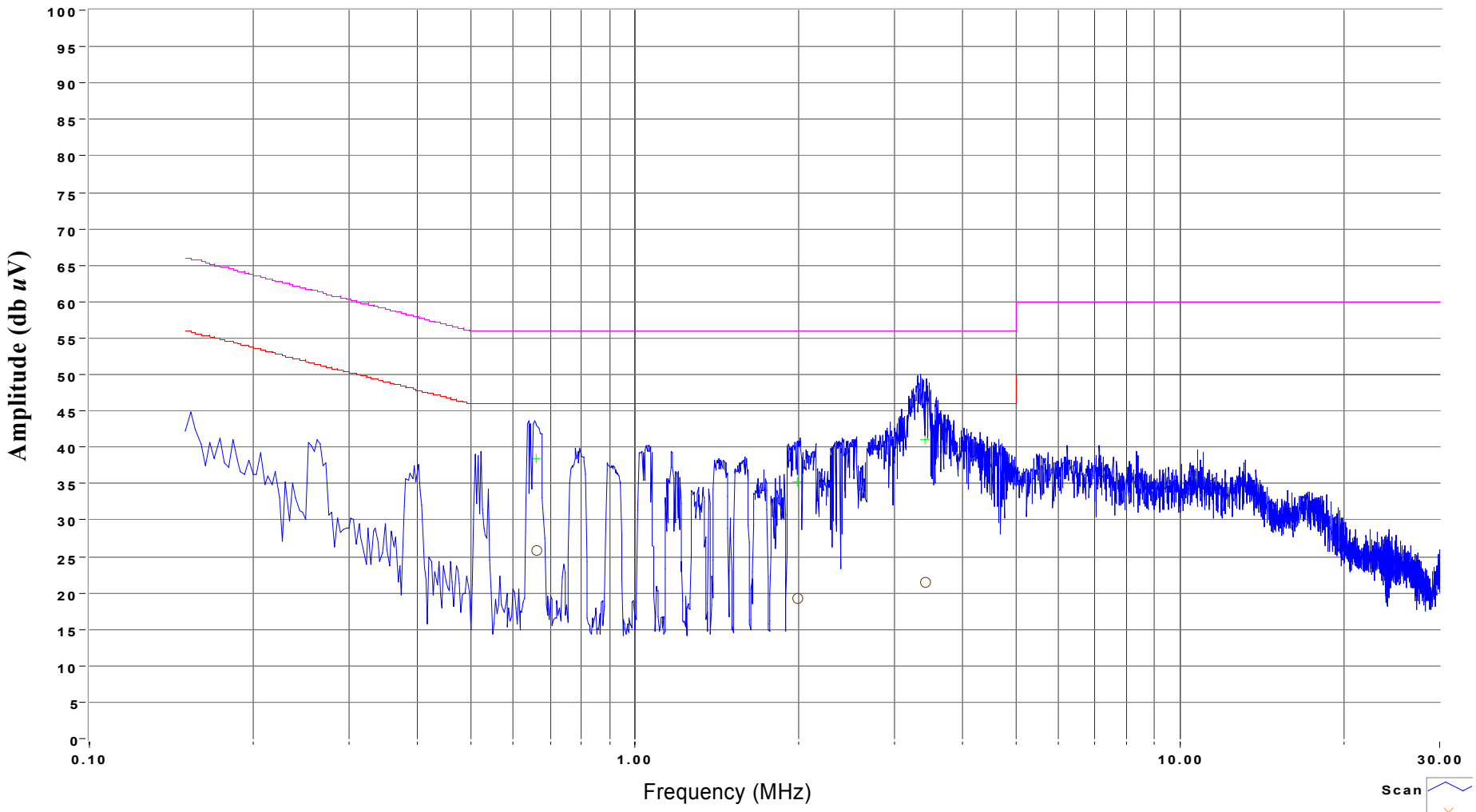
Mark Briggs

SV #1: Nova NovaRoam NR-EH900 (NR2) Run 2

Spec:
EN55022B

Mains Lead
Neutral

ACConducted Emissions



Run #2, 120V/60Hz, Neutral

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

12/24/03

Mark Briggs

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Radiated Emissions - Receiver

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 12/18/2003
Test Engineer: Joseph Cadigal
Test Location: SVOATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 12 °C
Rel. Humidity: 75 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, Rx Spurious Emissions (Omni Antenna)	FCC Part 15.209, RSS 210 Table 3	Pass	-5.9dB @ 805.000MHz
2	RE, Rx Spurious Emissions (Yagi Antenna)	FCC Part 15.209, RSS 210 Table 3	Pass	-10.8dB @ 805.000MHz

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Run #1a: Radiated Spurious Emissions, Rx Low Channel LO @ 792.375 MHz
Omni antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1584.683	45.9	H	54.0	-8.1	Avg	305	1.1	2nd LO, Noise Floor
792.375	37.2	H	46.0	-8.8	QP	150	1.1	LO
792.375	33.5	V	46.0	-12.5	QP	10	1.2	LO
2377.110	36.5	H	54.0	-17.5	AVG	0	1.4	3rd LO
2377.170	35.4	V	54.0	-18.6	Avg	186	2.0	3rd LO
1584.683	48.6	H	74.0	-25.4	Pk	305	1.1	2nd LO, Noise Floor
2377.170	42.7	V	74.0	-31.3	Pk	186	2.0	3rd LO
2377.110	42.1	H	74.0	-31.9	PK	0	1.4	3rd LO

Run #1b: Radiated Spurious Emissions, RX Center Channel LO A90@ 805 MHz
Omni antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
805.000	40.1	H	46.0	-5.9	QP	159	1.0	LO
1610.030	46.8	H	54.0	-7.2	AVG	306	1.1	2nd LO, Noise Floor
805.000	35.3	V	46.0	-10.7	QP	91	1.0	LO
2415.000	35.4	H	54.0	-18.6	AVG	0	1.0	3rd LO
2414.933	34.6	V	54.0	-19.4	AVG	183	1.0	3rd LO
1610.030	49.7	H	74.0	-24.3	PK	306	1.1	2nd LO, Noise Floor
2414.933	43.2	V	74.0	-30.8	PK	183	1.0	3rd LO
2415.000	41.7	H	74.0	-32.3	PK	0	1.0	3rd LO

Run #1c: Radiated Spurious Emissions, Rx High Channel LO @ 818.125 MHz
Omni antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
818.125	39.9	H	46.0	-6.1	QP	168	1.0	LO
1636.158	46.7	H	54.0	-7.3	Avg	305	1.0	2nd LO, Noise Floor
818.125	33.9	V	46.0	-12.1	QP	0	1.1	LO
2454.360	37.1	V	54.0	-16.9	Avg	348	1.0	3rd LO
2454.473	36.6	H	54.0	-17.4	Avg	0	1.0	3rd LO
1636.158	49.5	H	74.0	-24.5	Pk	305	1.0	2nd LO, Noise Floor
2454.360	44.3	V	74.0	-29.7	Pk	348	1.0	3rd LO
2454.473	42.6	H	74.0	-31.4	Pk	0	1.0	3rd LO

Elliott

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	A

Run #2a: Radiated Spurious Emissions, Rx Low Channel LO @ 792.375 MHz
Yagi antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
792.375	32.1	H	46.0	-13.9	QP	164	1.0	LO
792.375	30.4	V	46.0	-15.6	QP	115	1.0	LO
2377.150	38.2	V	54.0	-15.8	Avg	167	1.0	3rd LO
2377.150	44.1	V	74.0	-29.9	Pk	167	1.0	3rd LO

Run #2b: Radiated Spurious Emissions, RX Center Channel LO @ 805 MHz
Yagi antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
805.000	35.2	H	46.0	-10.8	QP	161	1.0	LO
805.000	30.1	V	46.0	-15.9	QP	236	1.0	LO
2414.918	37.5	V	54.0	-16.5	AVG	342	1.0	3rd LO
2414.918	43.6	V	74.0	-30.4	PK	342	1.0	3rd LO

Run #2c: Radiated Spurious Emissions, Rx High Channel LO @ 818.125 MHz
Yagi antenna
sn #67

Frequency	Level	Pol	FCC 15.109 / RSS210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
818.125	35.0	H	46.0	-11.0	QP	167	1.7	LO
818.125	30.6	V	46.0	-15.4	QP	239	1.0	LO

All other harmonics of the LO were more than 20dB below the limit.

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Transmiter Tests - Low Data Rate

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 12/24/2003
Test Engineer: Mark Briggs
Test Location: SVOATS #2

Config. Used: #1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the ground plane or routed in overhead in the GR-1089 test configuration.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 14 °C
Rel. Humidity: 74 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 10000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-2.8dB @ 2783.6MHz
2	20dB Bandwidth	15.247(a)	Pass	124.5kHz
3	Output Power	15.247(b)	Pass	28.0 dBm (0.63 W)
4	Channel Occupancy / Separation	15.247(a)	Pass	Separation 125kHz, Occupancy 0.17s / 20s
4	Number of Channels	15.247(a)	Pass	207 Channels

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

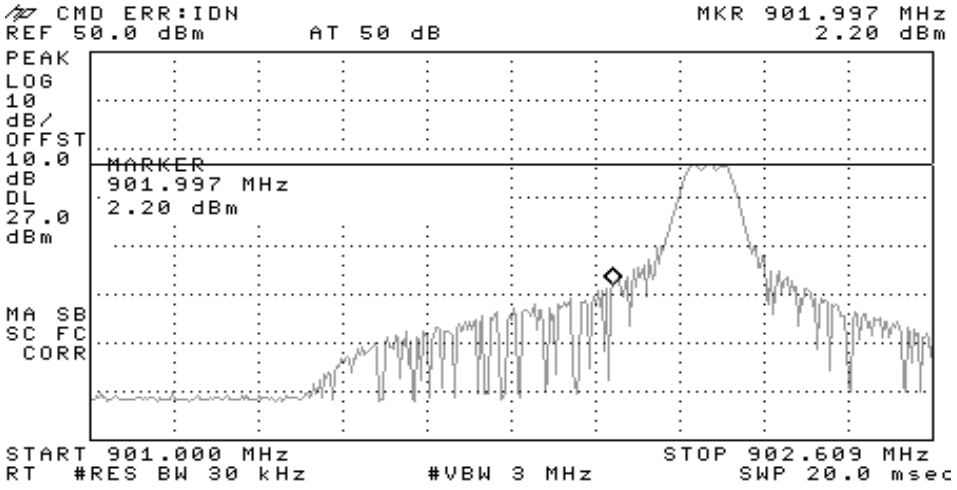
Run #1: Transmitter Radiated Spurious Emissions, 30 MHz - 10000 MHz, Three Channels, Omni Antenna (runs (a)-(c), Yagi Antenna (runs (d)-(f)

The system was tested at both data rates with the omni antenna connected. As the higher data data rate (406kb/s) produced lower emissions than the lower data rate (101.5kb/s) the system configured with the Yagi antenna was tested at the lower data rate only.

There were no significant out-of-band signals in the 960 MHz restricted band. Emissions close to the 902 - 928 MHz band edges were more than 20dB below the highest in-band signals, refer to the plots made with the analyzer connected directly to the antenna port of the device.

Run #1a: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.175 MHz, Omni Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		120.6
Limit for emissions outside of restricted bands:	100.6 dBµV/m	



Plot of 902 MHz Band-Edge Showing -24.8 dBc at 902MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2706.525	48.9	h	54.0	-5.1	Avg	246	1.2	Restricted Band Signal, Note 3
2706.525	48.4	v	54.0	-5.6	Avg	210	1.0	Restricted Band Signal, Note 3
4510.830	44.6	v/h	54.0	-9.4	Avg	-	-	Restricted Band Signal (note 2)
3608.650	43.0	v/h	54.0	-11.0	Avg	-	-	Restricted Band Signal (note 2)
2706.525	56.9	h	74.0	-17.2	Pk	246	1.2	Restricted Band Signal
4510.830	56.5	v/h	74.0	-17.5	Pk	-	-	Restricted Band Signal (note 2)
2706.525	56.4	v	74.0	-17.6	Pk	210	1.0	Restricted Band Signal
3608.650	55.4	v/h	74.0	-18.6	Pk	-	-	Restricted Band Signal (note 2)
1804.350	45.0	v	100.6	-55.6	Pk	230	1.0	Not in restricted band
1804.350	39.2	h	100.6	-61.4	Pk	180	1.0	Not in restricted band

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 914.8 MHz, Omni Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		120.6
Limit for emissions outside of restricted bands:	100.6 dBµV/m	

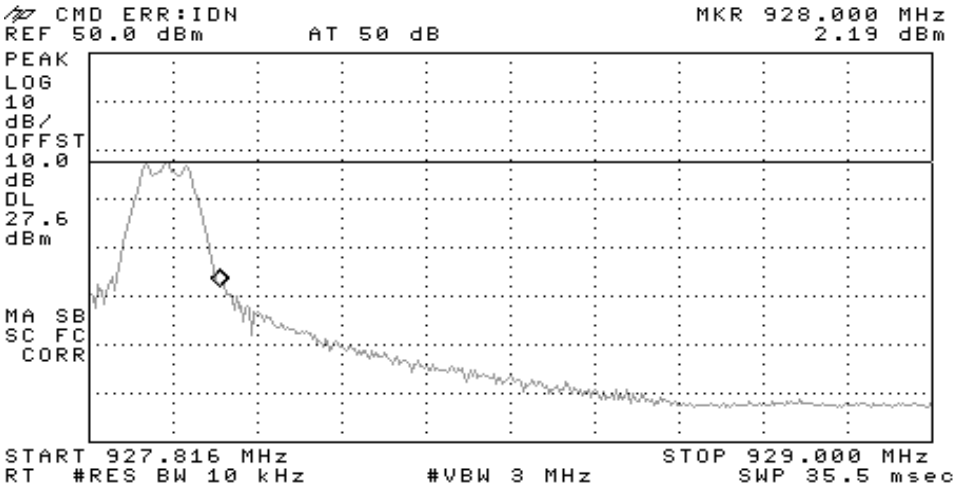
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2744.400	45.8	v	54.0	-8.2	Avg	165	1.1	Restricted Band Signal, Note 3
2744.400	44.0	h	54.0	-10.0	Avg	195	1.0	Restricted Band Signal, Note 3
4574.000	44.0	v/h	54.0	-10.0	Avg	-	-	Restricted Band Signal (note 2)
3659.000	43.3	v/h	54.0	-10.7	Avg	-	-	Restricted Band Signal (note 2)
4574.000	56.8	v/h	74.0	-17.2	Pk	-	-	Restricted Band Signal (note 2)
3659.000	56.3	v/h	74.0	-17.7	Pk	-	-	Restricted Band Signal (note 2)
2744.400	53.8	v	74.0	-20.2	Pk	165	1.1	Restricted Band Signal
2744.400	52.0	h	74.0	-22.0	Pk	195	1.0	Restricted Band Signal
1829.538	51.6	v	100.6	-49.0	Pk	190	1.0	Not in restricted band
1829.538	42.4	h	100.6	-58.2	Pk	180	1.3	Not in restricted band

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.925 MHz, Omni Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		121
Limit for emissions outside of restricted bands:	101 dBµV/m	



Plot of 928 MHz Band-Edge Showing -25.2 dBc at 928MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2783.590	51.2	v	54.0	-2.8	Avg	207	1.0	Restricted Band Signal, Note 3
2783.590	49.6	h	54.0	-4.4	Avg	170	1.4	Restricted Band Signal, Note 3
2783.590	59.2	v	74.0	-14.8	Pk	207	1.0	Restricted Band Signal
2783.590	57.6	h	74.0	-16.4	Pk	170	1.4	Restricted Band Signal
1855.795	52.2	v	101.0	-48.8	Pk	350	1.1	Not in restricted band
1855.795	47.0	h	101.0	-54.0	Pk	250	1.3	Not in restricted band

Note 1:	For emissions in restricted bands, the limit of 15.209 was used and measurements were made with a 1MHz bandwidth above 1GHz, 120kHz bandwidth below 1GHz. For all other emissions, the limit was set 20dB below the level of the fundamental and the measurement was made using a 100kHz measurement bandwidth.
Note 2:	Signal below the noise floor of the measurement instrumentation
Note 3:	Average reading calculated from the peak reading by subtracting an 8dB correction factor based on a duty cycle of 40% in any 100ms period.

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #1d: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.175 MHz, Yagi Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	110	
Limit for emissions outside of restricted bands:	90 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2706.525	50.3	v	54.0	-3.7	Avg	215	1.4	Restricted Band Signal, Note 3
2706.525	48.8	h	54.0	-5.2	Avg	162	2.0	Restricted Band Signal, Note 3
2706.525	58.3	v	74.0	-15.7	Pk	215	1.4	Restricted Band Signal
2706.525	56.8	h	74.0	-17.2	Pk	162	2.0	Restricted Band Signal
1804.350	44.4	v	90.0	-45.6	Pk	230	1.0	Not in restricted band
1804.350	43.6	h	90.0	-46.4	Pk	224	1.0	Not in restricted band

Run #1e: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 914.8 MHz, Yagi Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	111.8	
Limit for emissions outside of restricted bands:	91.8 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2744.400	50.5	h	54.0	-3.5	Avg	200	2.0	Restricted Band Signal, Note 3
2744.400	48.6	v	54.0	-5.4	Avg	220	1.4	Restricted Band Signal, Note 3
2744.400	58.5	h	74.0	-15.5	Pk	200	2.0	Restricted Band Signal
2744.400	56.6	v	74.0	-17.4	Pk	220	1.4	Restricted Band Signal
1829.538	49.9	v	91.8	-41.9	Pk	227	1.0	Not in restricted band
1829.538	47.6	h	91.8	-44.2	Pk	232	1.0	Not in restricted band

EMC Test Data

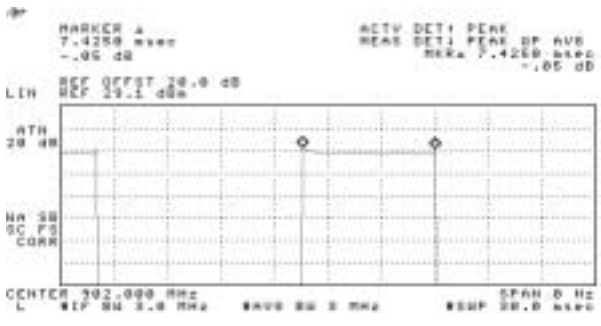
Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

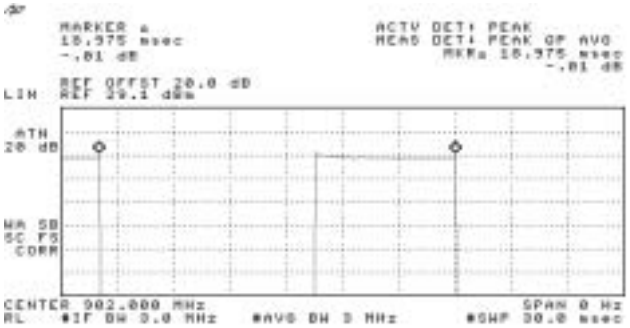
Run #1f: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.925 MHz, Yagi Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	112.1	
Limit for emissions outside of restricted bands:	92.1 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2783.590	51.1	h	54.0	-2.9	Avg	226	2.0	Restricted Band Signal, Note 3
2783.590	51.0	v	54.0	-3.0	Avg	217	1.4	Restricted Band Signal, Note 3
2783.590	59.1	h	74.0	-14.9	Pk	226	2.0	Restricted Band Signal
2783.590	59.0	v	74.0	-15.0	Pk	217	1.4	Restricted Band Signal
1855.795	51.3	v	92.1	-40.8	Pk	223	1.0	Not in restricted band
1855.795	49.4	h	92.1	-42.7	Pk	234	1.0	Not in restricted band

Note 1:	For emissions in restricted bands, the limit of 15.209 was used and measurements were made with a 1MHz bandwidth above 1GHz, 120kHz bandwidth below 1GHz. For all other emissions, the limit was set 20dB below the level of the fundamental and the measurement was made using a 100kHz measurement bandwidth.
Note 2:	Signal below the noise floor of the measurement instrumentation
Note 3:	Average reading calculated from the peak reading by subtracting an 8dB correction factor based on a duty cycle of 40% in any 100ms period. Plot at end of data tables shows 7.4ms Tx time per 19ms period which is 39% (-8.21dB Average correction factor)

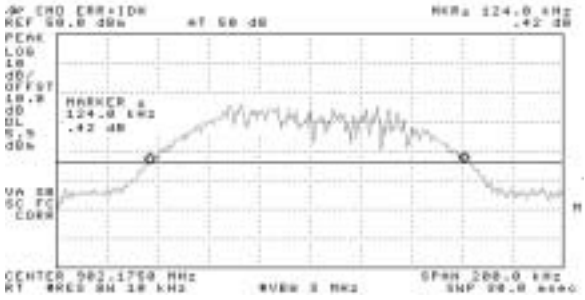


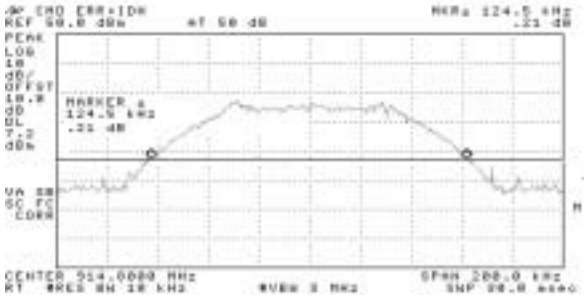


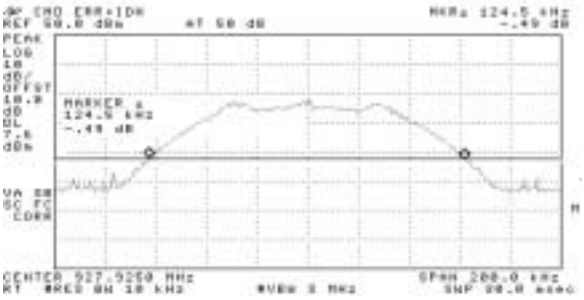
Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth
Low	902.175	10 kHz	124.0 kHz
Mid	914.8	10 kHz	124.5 kHz
High	927.925	10 kHz	124.5 kHz







Note 1:	Bandwidth used to measure the signal bandwidth was at least 5% of the measured bandwidth

Run #2: Output Power

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)
Low	902.175	3MHz	27.7	0.59
Mid	914.8	3MHz	28.0	0.63
High	927.925	3MHz	27.9	0.62

Note 1:	Output power measured with the spectrum analyzer and RBW=VBW=3MHz

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

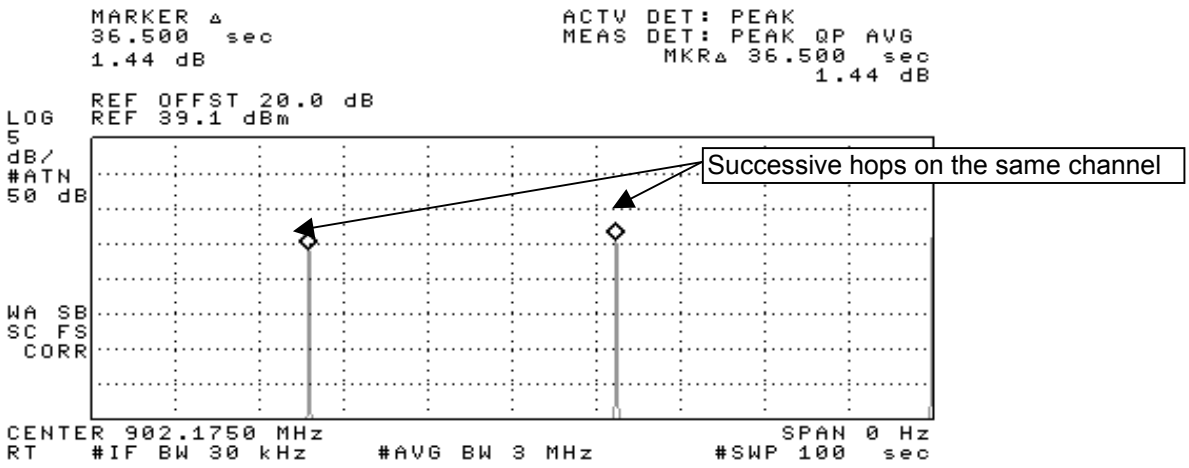
Run #4: Channel Occupancy And Spacing

The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

Frequency of lowest channel:	902.175	MHz
Frequency of highest channel:	927.925	MHz
The number of channels was:	207	
The channel spacing was:	125	kHz
Delay between successive hops on the same channel:	36500	ms
Dwell time per channel was:	176.3285	ms
Dwell time per 20 seconds (calculated):	176.3285	ms

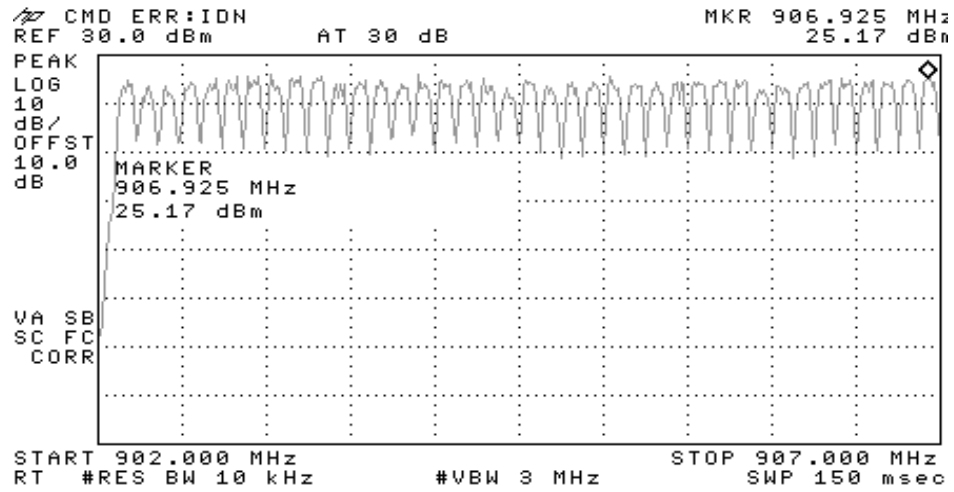
All channels are used, on average, equally. The NovaRoam EH900 network maintains a system clock that synchronizes the hop timing. The particular channels that are selected to relay packets are derived from these time epochs. As a result, there is an equal likelihood of accessing any particular RF channel for sending information and, therefore, transmissions are distributed equally across all available channels in the case of both long-duration and short-duration transmissions.
The channel spacing was greater than the 20dB signal bandwidth.
The dwell time per 20 seconds was less than 0.4 seconds per channel.

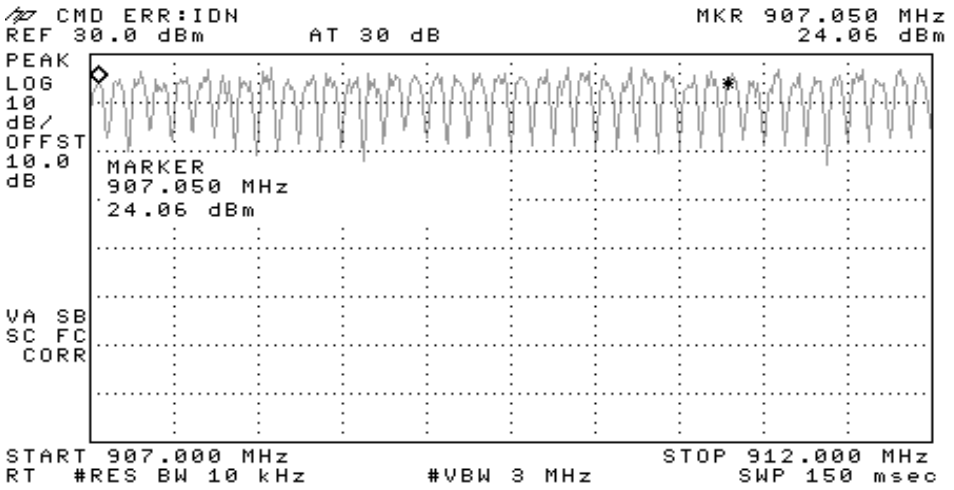
Plot showing time between successive hops on the same channel



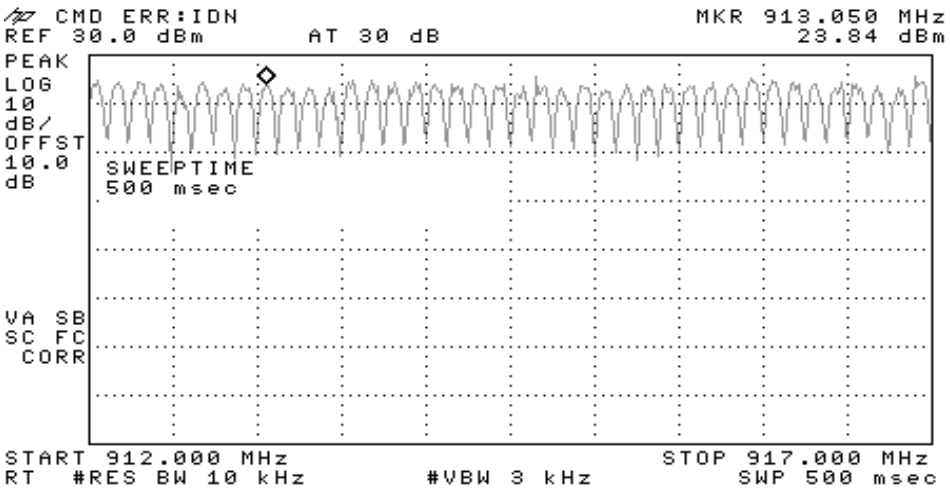
Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

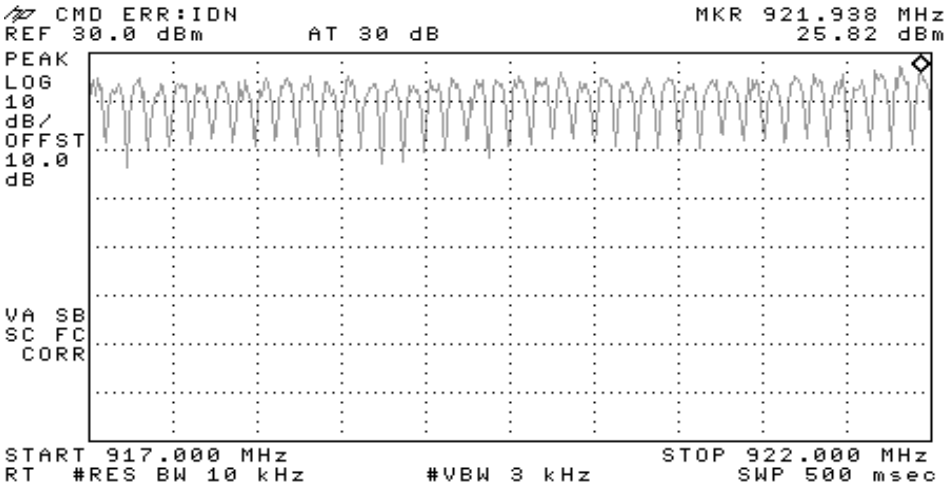
Plots showing number of channels



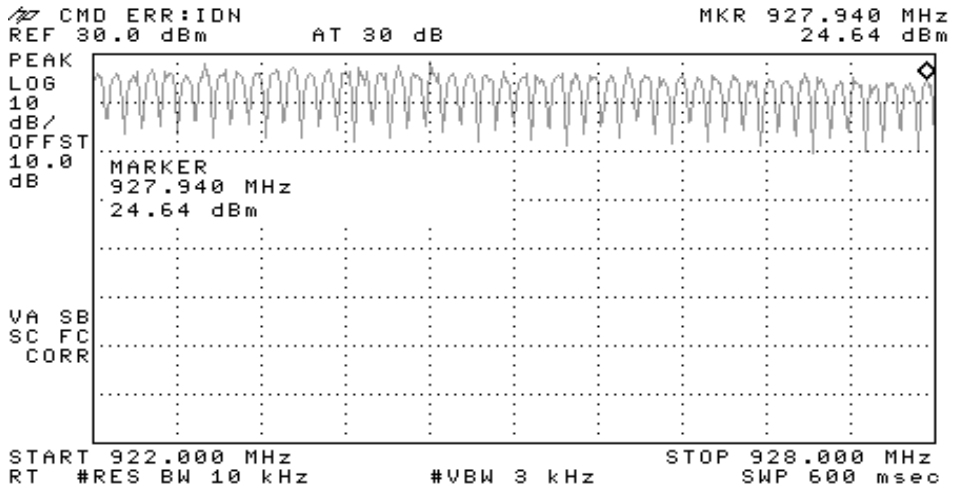


Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A





Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A



39 channels from 902.175 - 906.925 MHz
40 channels from 907 - 912 MHz
40 channels from 912 - 917 MHz
40 channels from 917 - 922 MHz
48 channels from 922 - 928 MHz
Total: 207

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Transmiter Tests - High Data Rate

Test Specifics

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 12/24/2003
Test Engineer: Mark Briggs
Test Location: SVOATS #2

Config. Used: #1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the ground plane or routed in overhead in the GR-1089 test configuration.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

When measuring the conducted emissions from the EUT's antenna port, the antenna port of the EUT was connected to the spectrum analyzer or power meter via a suitable attenuator to prevent overloading the measurement system. All measurements are corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 14 °C
Rel. Humidity: 74 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	RE, 30 - 10000 MHz - Spurious Emissions	FCC Part 15.209 / 15.247(c)	Pass	-3.0dB @ 2781.4MHz
2	20dB Bandwidth	15.247(a)	Pass	495 kHz
3	Output Power	15.247(b)	Pass	28.6dBm (0.73 W)
4	Channel Occupancy / Separation	15.247(a)	Pass	Separation is 500kHz, Occupancy 0.39s / 20s
4	Number of Channels	15.247(a)	Pass	51 Channels

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

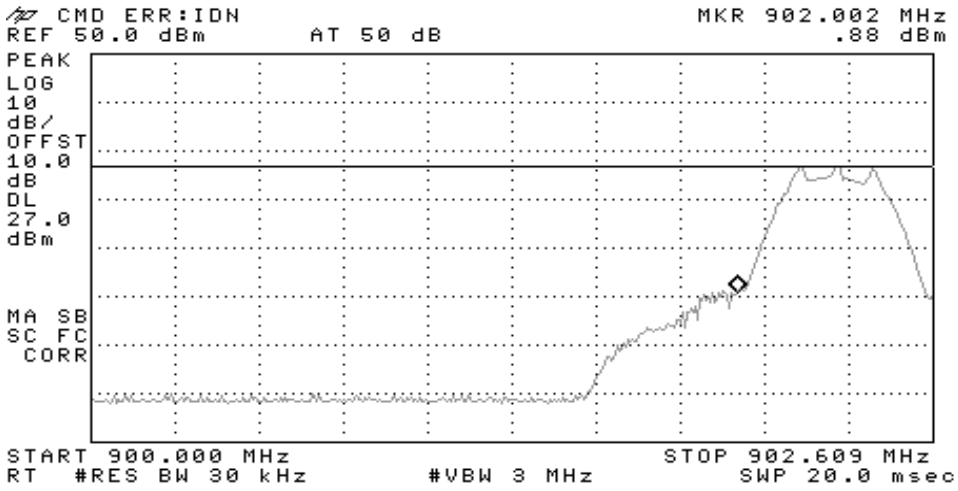
Run #1: Transmitter Radiated Spurious Emissions, 30 MHz - 10000 MHz, Three Channels, Omni Antenna

The system was tested at both data rates with the omni antenna connected. As this data rate (406kb/s) produced lower emissions than the lower data rate (101.5kb/s) the Yagi antenna was tested at the lower data rate only.

There were no significant out-of-band signals in the 960 MHz restricted band. Emissions close to the 902 - 928 MHz band edges were more than 20dB below the highest in-band signals, refer to refer to the plots made with the analyzer connected directly to the antenna port of the device.

Run #1a: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.3 MHz, Omni Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		120.6
Limit for emissions outside of restricted bands:	100.6 dBµV/m	



Plot of 902 MHz Band-Edge Showing -26.12 dBc at 902MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2706.705	49.3	v	54.0	-4.7	Avg	200	1.1	Restricted Band Signal, Note 3
2706.705	46.3	h	54.0	-7.7	Avg	246	1.2	Restricted Band Signal, Note 3
4511.200	44.6	v/h	54.0	-9.4	Avg	-	-	Restricted Band Signal (note 2)
3609.000	42.9	v/h	54.0	-11.1	Avg	-	-	Restricted Band Signal (note 2)
2706.705	57.3	v	74.0	-16.7	Pk	200	1.1	Restricted Band Signal
4511.200	57.3	v/h	74.0	-16.7	Pk	-	-	Restricted Band Signal (note 2)
3609.000	55.5	v/h	74.0	-18.5	Pk	-	-	Restricted Band Signal (note 2)
2706.705	54.3	h	74.0	-19.7	Pk	246	1.2	Restricted Band Signal
1804.300	37.2	h	101	-63.4	Pk	220	1.2	Not in restricted band
1804.300	35.9	v	100.6	-64.7	Pk	122	1.1	Not in restricted band

EMC Test Data

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #1b: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 914.8 MHz, Omni Antenna

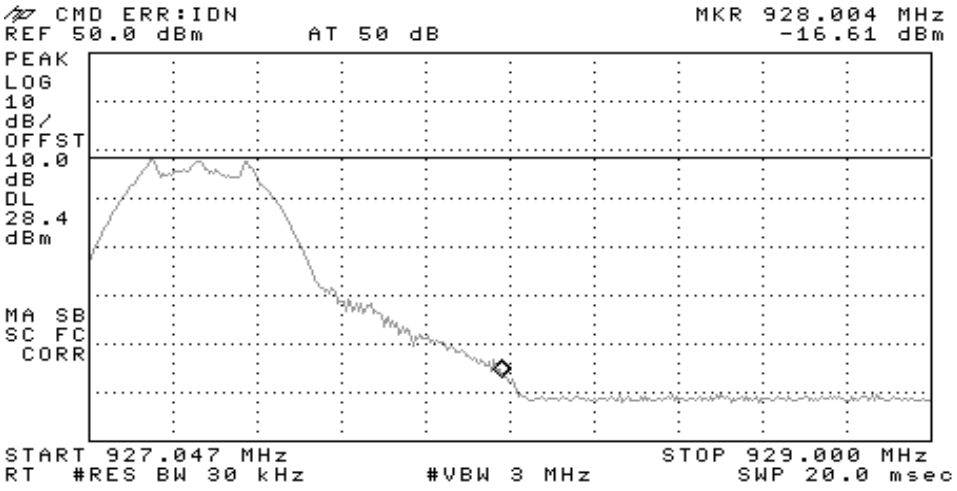
	H	V
Fundamental emission level @ 3m in 100kHz RBW:		120.7
Limit for emissions outside of restricted bands:	100.7 dBµV/m	

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2744.000	48.4	h	54.0	-5.6	Avg	213	1.3	Restricted Band Signal, Note 3
2744.000	47.0	v	54.0	-7.0	Avg	170	1.1	Restricted Band Signal, Note 3
4574.000	45.1	v/h	54.0	-8.9	Avg	-	-	Restricted Band Signal (note 2)
3659.000	43.3	v/h	54.0	-10.7	Avg	-	-	Restricted Band Signal (note 2)
4574.000	57.5	v/h	74.0	-16.5	Pk	-	-	Restricted Band Signal (note 2)
3659.000	56.0	v/h	74.0	-18.0	Pk	-	-	Restricted Band Signal (note 2)
2744.000	55.0	v	74.0	-19.0	Pk	170	1.1	Restricted Band Signal
2744.000	52.4	h	74.0	-21.6	Pk	213	1.3	Restricted Band Signal
1829.600	45.6	v	100.7	-55.1	Pk	107	1.8	Not in restricted band
1829.600	45.0	h	100.7	-55.7	Pk	252	1.3	Not in restricted band

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #1c: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.3 MHz, Omni Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		120
Limit for emissions outside of restricted bands:	100 dBµV/m	

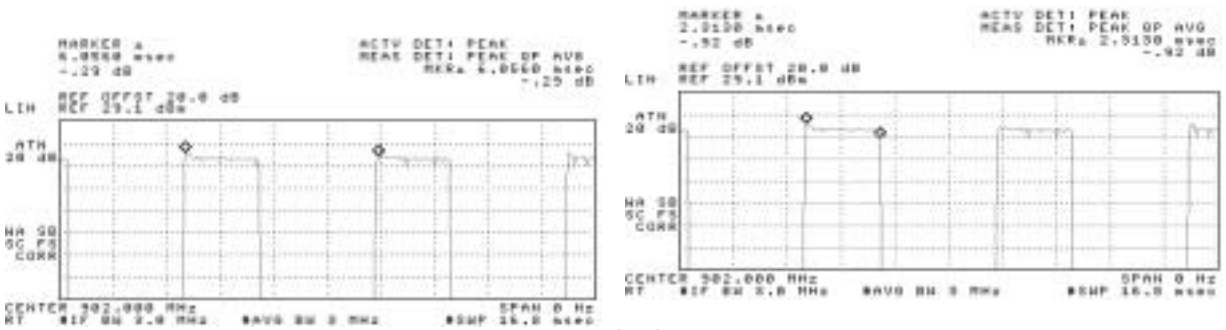


Plot of 928 MHz Band-Edge Showing -45 dBc at 928MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
3709.200	55.3	v/h	74.0	-18.7	Pk	-	-	Restricted Band Signal (note 2)
3709.200	42.9	v/h	54.0	-11.1	Avg	-	-	Restricted Band Signal (note 2)
4636.000	58.3	v/h	74.0	-15.7	Pk	-	-	Restricted Band Signal (note 2)
4636.000	45.3	v/h	54.0	-8.7	Avg	-	-	Restricted Band Signal (note 2)
1854.348	56.0	v	100.0	-44.0	Pk	220	1.0	Not in restricted band
2781.385	59.0	v	74.0	-15.0	Pk	206	1.0	Restricted Band Signal
2781.385	51.0	v	54.0	-3.0	Avg			Restricted Band Signal, Note 3
1854.348	48.8	h	100.0	-51.2	Pk	252	1.3	Not in restricted band
2781.385	58.1	h	74.0	-16.0	Pk		1.1	Restricted Band Signal
2781.385	50.1	h	54.0	-3.9	Avg		1.1	Restricted Band Signal, Note 3

Note 1:	For emissions in restricted bands, the limit of 15.209 was used and measurements were made with a 1MHz bandwidth above 1GHz, 120kHz bandwidth below 1GHz. For all other emissions, the limit was set 20dB below the level of the fundamental and the measurement was made using a 100kHz measurement bandwidth.
Note 2:	Signal below the noise floor of the measurement instrumentation, average measurement made using average detector.
Note 3:	Average reading calculated from the peak reading by subtracting an 8dB correction factor based on a duty cycle of 40% in any 100ms period (-8.0 dB Average correction factor). Plots on following page show 2.3ms Tx time per 6ms period which is 38%

Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

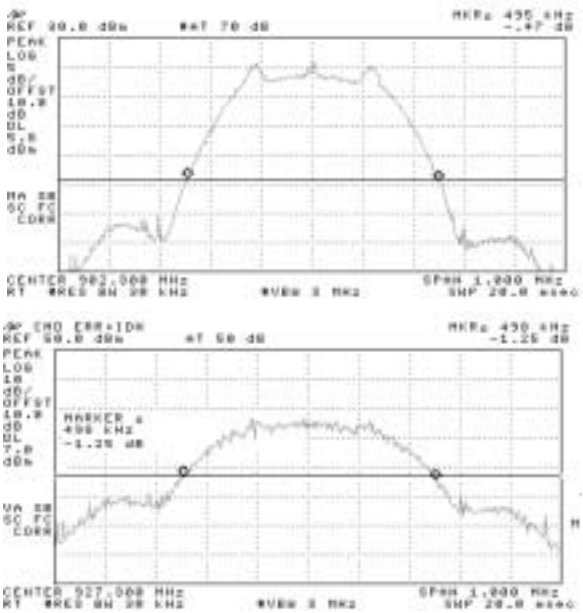


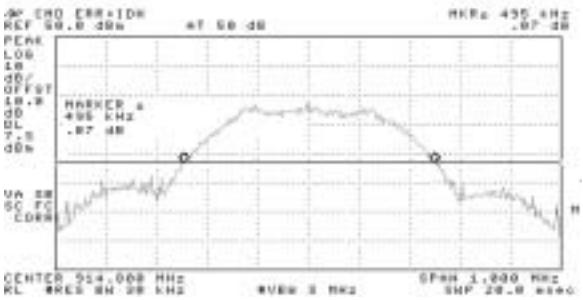
Duty Cycle Plots

Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth
Low	902.3	30 kHz	495 kHz
Mid	914.8	30 kHz	495 kHz
High	927.3	30 kHz	498 kHz

Note 1:	Bandwidth used to measure the signal bandwidth was at least 5% of the measured bandwidth



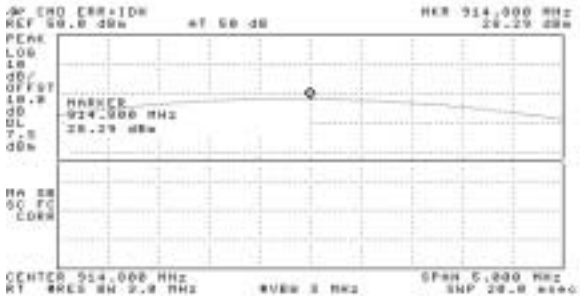


Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #2: Output Power

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)
Low	902.3	3MHz	27.8	0.60
Mid	914.8	3MHz	28.3	0.67
High	927.3	3MHz	28.6	0.73

Note 1:	Output power measured with the spectrum analyzer and RBW=VBW=3MHz - see sample plot below

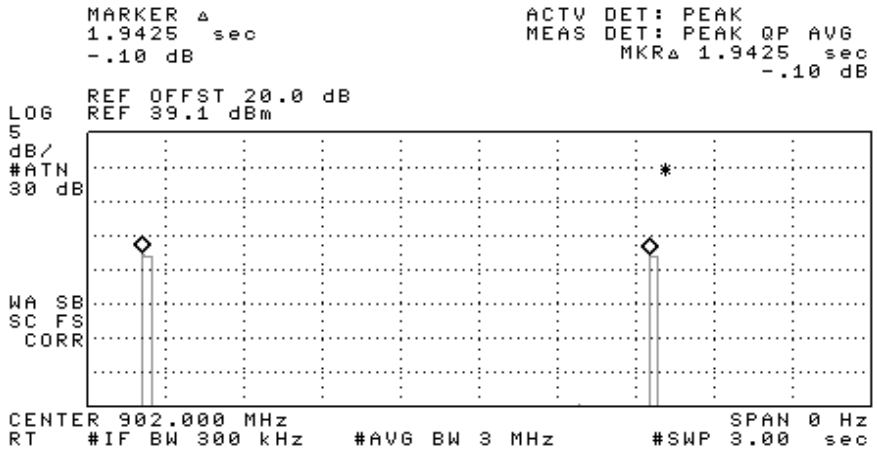


Client:	Nova Engineering	Job Number:	J52762
Model:	NovaRoam EH900	T-Log Number:	T53238
		Account Manager:	Danni Olivas
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Run #3: Channel Occupancy And Spacing

Frequency of lowest channel:	902.3	MHz
Frequency of highest channel:	927.3	MHz
The number of channels was:	51	
The channel spacing was:	500	kHz
Delay between successive hops on the same channel:	1942.5	ms
Dwell time per channel was:	38.08824	ms
Dwell time per 20 seconds (calculated):	392.1569	ms

All channels are used, on average, equally. The NovaRoam EH900 network maintains a system clock that synchronizes the hop timing. The particular channels that are selected to relay packets are derived from these time epochs. As a result, there is an equal likelihood of accessing any particular RF channel for sending information and, therefore, transmissions are distributed equally across all available channels in the case of both long-duration and short-duration transmissions.
The channel spacing was greater than the 20dB signal bandwidth.
The dwell time per 20 seconds was less than 0.4 seconds per channel.



Plot showing time between successive hops on the same channel

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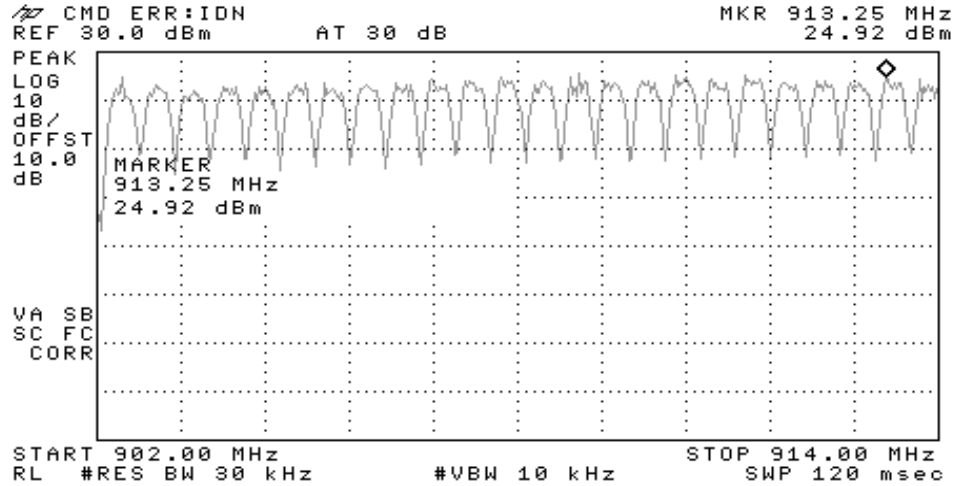
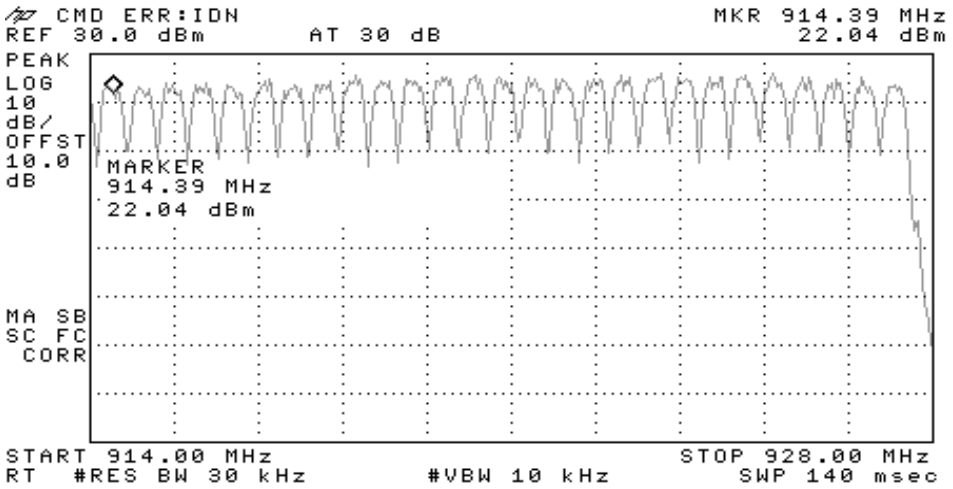
Contact:	Barry Carlin		
Spec:	FCC	Class:	N/A

Plots showing number of channels





24 channels from 902.3 - 914 MHz, 27 channels from 914 - 927 MHz, total = 51 channels

EXHIBIT 3: Test Configuration Photographs

4 Pages

EXHIBIT 4: Proposed FCC ID Label & Label Location

EXHIBIT 5: Detailed Photographs of Nova Engineering Model NovaRoam EH900Construction

5 Pages

EXHIBIT 6: Operator's Manual for Nova Engineering Model NovaRoam EH900

78 Pages

EXHIBIT 7: Block Diagram of Nova Engineering Model NovaRoam EH900

2 Pages

EXHIBIT 8: Schematic Diagrams for Nova Engineering Model NovaRoam EH900

Schematics	15 Pages
Antennas	9 Pages
Omni Antenna 5.2dBi	1 Page

EXHIBIT 9: Theory of Operation for Nova Engineering Model NovaRoam EH900

6 Pages

EXHIBIT 10: Advertising Literature

2 Pages

EXHIBIT 11: RF Exposure – MPE Calculation

2 Pages