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Electromagnetic Emissions Test Report and Application for Grant of Equipment Authorization pursuant to FCC Part 15, Subpart C (15.247) FHSS Specifications and Industry Canada RSS 210 Issue 5 for an Intentional Radiator on the Trimble Navigation Model: SNB900

FCC ID:	JUP-48480-SNB900
UPN:	1756A-48480
GRANTEE:	Trimble Navigation 645 North Mary Avenue Sunnyvale, CA 94088-3642
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	July 2, 2004
FINAL TEST DATE:	June 28, 2004
AUTHORIZED SIGNATORY:	Mark Briggs Vice President of Engineering

ACCREDITED

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SCOPE

An electromagnetic emissions test has been performed on the Trimble Navigation model SNB900 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 Trimble Navigation model SNB900 and therefore apply only to the tested sample. The sample was selected and prepared by Terence Choy of Trimble Navigation

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

Note – remove references in the table below that do not apply to the radio tested

FCC Part 15 Section	RSS 210 Section	Description	Measured Value	Comments	Result
15.247	6.2.2(o)(a)	20dB Bandwidth	392 kHz	The channel spacing shall be greater than the 20dB bandwidth	Complies
15.247	6.2.2(o)(a)	Channel Separation	510 kHz		Complies
15.247	6.2.2(o)(a)	Number of Channels	50	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	400ms per 20s (refer to operational description)		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	29.2 dBm (0.832 Watts) EIRP = 2.63 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)	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	All spurious emissions < -20dBc.	Complies
15.247(c) / 15.209		Radiated Spurious Emissions 30MHz – 25GHz	63.1 dBuV/m 2746.1MHz (-10.9dB) (Peak)	Emissions in restricted bands must meet the radiated emissions limits detailed in 15.207. All others must be < -20dBc	Complies
		Receiver Spurious Emissions 30MHz – 12GHz	N/A	>20dB margin for all receiver-spurious emissions	Complies
15.207		AC Conducted Emissions	47.0 dBuV @ 0.208MHz (-6.3dB)		Complies
	6.6	AC Conducted Emissions	37.6dBuV @ 0.5206 MHz (-10.4dB)		Complies
15.247 (b) (5)		RF Exposure Requirements	FCC /IC limits of power density not exceeded provided antenna is located a minimum of 21 cm from persons	Refer to MPE calculation for 21cm derivation. Refer to User's Guide for installation instructions requiring a 21cm separation	Complies
15.203		RF Connector	RF connector is a reverse TNC that connects to a reverse TNC to reverse-gender N.	Integral antenna or specialized connector required	Complies

EIRP calculated using antenna gain of 5dBi 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 Trimble Navigation model SNB900 is a radio modem that uses frequency hopping spread spectrum in the 900MHz unlicensed band. The device also incorporates a pre-approved Bluetooth module. During test, the EUT was located on an 80cm high table with all local support equipment. The antenna was mounted on a mount and base. The electrical rating of the EUT is 120/240 V, 50/60 Hz, 0.7 Amps.

The sample was received on June 28, 2004 and tested on June 28, 2004.

The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number
Trimble	SNB900	GPS Receiver/ Transmitter	
Trimble	SNB900	0 dBi antenna	ENG-FCC
Trimble	SNB900	5 dBi antenna	ENG-FCC

OTHER EUT DETAILS

The EUT receives its supply power from an AC adapter via the lemo connector port.

ENCLOSURE

The EUT enclosure is primarily constructed of metal with black rubber protective bumpers on both ends. It measures approximately 13cm long, 13cm wide and 5cm thick.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for Radiated Emissions:

Manufacturer	Model	Description	Serial Number	FCC ID
Tripod Data Systems	Ranger	Hand Held Computer	15488	DoC
FRIWO	SDA5518	AC Adapter	-	-
Trimble		10/100ethernet extender hub	-	-
AtWork Computers		handheld computer	-	-
X TEND-T/T	X TEND-T/T	extender	-	-

The following equipment was used as local support equipment for Conducted Emissions:

Manufacturer	Model	Description	Serial Number	FCC ID
Versa	PC-470-1552	Laptop PC	4X004117	A3DP52S
FRIWO	SDA5518	AC Adapter	-	DOC
D-Link	DE-805TP	10/100ethernet extender hub	AC68100022	DOC

No remote support equipment was used during testing.

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
serial	handheld computer	2 wire	Shielded	2
DC In	AC adapter	2 wire	Shielded	2
serial	ethernet hub	DB9	Shielded	2
RF I/O	antenna	coax	Shielded	1

*The DC output of the AC adapter connects first to the computer and then to the EUT

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
serial	Laptop PC / AC-DC adapter	2 wire	Shielded	2
ethernet	ethernet hub	DB9	Shielded	2
RF I/O	antenna	coax	Shielded	1

*The DC output of the AC adapter connects to the EUT via a special input connector on the laptop end of the serial cable.

EUT OPERATION

For digital device emissions the EUT was operating in a Receive-only mode. For transmitter-related tests the EUT was continuously transmitting a modulated signal at the specified channel.

ANTENNA REQUIREMENTS

The antenna port uses a reverse polarity TNC connector, meeting the requirements of FCC 15.203. During the certification test and normal usage, the EUT connects via a 5m cable (reverse polarity TNC to reverse gender N) to either a 5dBi or 0dBi whip antenna.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on June 28, 2004at the Elliott Laboratories Open Area Test Site #4 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)
2400 – 2483.5	>= 75	1 W (30 dBm)
2400 – 2483.5	>= 75	0.125 W (21 dBm)
5725 – 5850	>=75	1 W (30 dBm)

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

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

T 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:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

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

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Radiated Emissions, 30 - 1,000 MHz, 25-Jun-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Test Receiver, 20-1300MHz	ESVP	213	03-Dec-04
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	25-Mar-05
EMCO	Biconical Antenna, 30-300 MHz	3110B	1497	29-May-05

Radiated Emissions, 30 - 6,500 MHz, 25-Jun-04
Engineer: Juan Martinez

Manufacturer	Description	Model #	Asset #	Cal Due
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	786	29-Oct-04
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	10-Dec-04
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	12-Jan-05
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	956	11-Mar-05

Transmitter Spurious Emissions, Bandwidth, Output Power, 28-Jun-04
Engineer: Yu Chien Ho

Manufacturer	Description	Model #	Asset #	Cal Due
Hewlett Packard	Microwave EMI test system (SA40, 30Hz - 40GHz), Sunnyvale	84125C	1149	02-Jun-05
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1404	17-Nov-04
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1422	11-Sep-04
Rohde & Schwarz	Peak Power Sensor 100uW - 2 Watts	NRV-Z32	1423	18-Mar-05

Conducted Emissions - AC Power Ports, 29-Jun-04
Engineer: Adam LaCourse

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Test Receiver, 0.009-30 MHz	ESH3	274	21-Jan-05
Solar Electronics	Support Equipment LISN, 0.150-30.0 MHz	8012-50-R-24-BNC	305	08-Apr-05
Fischer Custom Comm.	LISN, Freq. 0.9 -30 MHz,16 Amp	FCC-LISN-50/250-16-2	1079	01-Jul-04

Radio Antenna Port (Power and Spurious Emissions), 07-Jul-04
Engineer: David Bare

Manufacturer	Description	Model #	Asset #	Cal Due
Rohde & Schwarz	Peak Power Sensor 100uW - 2 Watts	NRV-Z32	1423	18-Mar-05
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1534	18-Mar-05

EXHIBIT 2: Test Data Log Sheets

ELECTROMAGNETIC EMISSIONS

TEST LOG SHEETS

AND

MEASUREMENT DATA

T55873 26 Pages

Elliott

EMC Test Data

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	
Contact:	Dennis Connor		
Emissions Spec:	EN55022 / FCC	Class:	B
Immunity Spec:		Environment:	-

EMC Test Data

For The

Trimble Navigation

Model

SNB900

Date of Last Test: 9/24/2004

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	
Contact:	Dennis Connor		
Emissions Spec:	EN55022 / FCC	Class:	B
Immunity Spec:	Enter immunity spec on cover	Environment:	-

EUT INFORMATION

General Description

The EUT is a 900MHz frequency hopping transmitter / receiver radio with an incorporated Bluetooth module. During test, the EUT was located on an 80cm high table with all local support equipment. The antenna was mounted on a mount and base. The electrical rating of the EUT is 120/240 V, 50/60 Hz, 0.7 Amps.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble	SNB900	GPS Receiver/ Transmitter		-
Trimble	SNB900	0 dBi antenna	ENG-FCC	-
Trimble	SNB900	5 dBi antenna	ENG-FCC	-

Other EUT Details

The EUT receives its supply power from an AC adapter via the lemo connector port. The antenna port uses a reverse polarity TNC connector, meeting the requirements of FCC 15.203. During the certification test and normal usage, the EUT connects via a 5m cable (reverse polarity TNC to reverse polarity N) to an antenna. The antenna comes with either a 0dBi or 5 dBi tip.

EUT Enclosure

The EUT enclosure is primarily constructed of metal with black rubber protective bumpers on both ends. It measures approximately 13cm long, 13cm wide and 5cm thick.

Modification History

Mod. #	Test	Date	Modification
1	Power	7/7/2004	The power amp gain was re-tuned to lower the total output power.

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

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	
Contact:	Dennis Connor		
Emissions Spec:	EN55022 / FCC	Class:	B
Immunity Spec:	Enter immunity spec on cover	Environment:	-

Test Configuration #1

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
FRIWO	SDA5518	AC Adapter	-	-
Trimble	-	Multiport Adapter	-	-
Trimble	-	Antenna	-	-

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
D-Link	DE-805TP	10/100ethernet extender hub	AC68100022	DoC
Tripod Data Systems	Ranger	Handheld data collector	15488	DoC

The handheld computer was not powered on for the testing and used to provide an electrical termination to the RS232 interface.

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
serial	handheld computer	2 wire	Shielded	2
DC In	AC adapter	2 wire	Shielded	2
10/100 Base-T	ethernet hub	Cat 5	Unshielded	2
RF I/O	antenna	coax	Shielded	1

* The DC output of the AC adapter connects first to the computer and then to the EUT

EUT Operation During Emissions

For digital device emissions the EUT was operating in a Receive-only mode. For transmitter-related tests the EUT was continuously transmitting a modulated signal at the specified channel. For all tests the Bluetooth transceiver was operating in receive mode.

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	
Contact:	Dennis Connor		
Emissions Spec:	EN55022 / FCC	Class:	B
Immunity Spec:	Enter immunity spec on cover	Environment:	-

Test Configuration #2

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Versa	PC-470-1552	Laptop PC	4X004117	A3DP52S
FRIWO	SDA5518	AC Adapter	-	DOC
D-Link	DE-805TP	10/100ethernet extender hub	AC68100022	DOC

The computer is not normally used, but was needed to configure the radio for different channels

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
None				

Interface Cabling and Ports

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
serial	Laptop PC / AC-DC adapter	2 wire	Shielded	2
Ethernet	ethernet hub	DB9	Shielded	2
RF I/O	antenna	coax	Shielded	1

* The DC output of the AC adapter connects to the EUT via a special input connector on the laptop end of the serial cable.

EUT Operation During Emissions

For digital device emissions the EUT was operating in a Receive-only mode. For transmitter-related tests the EUT was continuously transmitting a modulated signal at the specified channel. For all tests the Bluetooth transceiver was operating in receive mode.

EUT Operation During Conducted Emissions

For Conducted Emissions the EUT was hopping on the center channel every 400msec and SW logged the status on the laptop computer.

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

Radiated Emissions

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: 6/25/2004
Test Engineer: Juan Martinez
Test Location: SVOATS #2
Config. Used: 1
Config Change: None
EUT Voltage: 230V/50Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing. Remote support equipment was located on the floor

Unless otherwise specified, the measurement antenna was located 10 meters from the EUT for the measurement range 30 - 1000 MHz and 3m from the EUT for the frequency range 1 - 6.5 GHz.

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.

Note, for testing above 1 GHz, the FCC specifies the limit as an average measurement. In addition, the FCC states that the peak reading of any emission above 1 GHz, can not exceed the average limit by more than 20 dB.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
2	RE, 30 - 1000MHz, Maximized Emissions	EN55022 B	Pass	-1.8dB @ 160.000MHz
3	RE, 1000 - 6500 MHz, Maximized Emissions	FCC B	Pass	-24.8dB @ 1096 MHz

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:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

Run #1: Preliminary Radiated Emissions, 30-1000 MHz

Frequency	Level	Pol	EN55022 B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
160.000	28.2	v	30.0	-1.8	QP	124	1.0	
160.000	26.4	h	30.0	-3.6	QP	250	3.2	
160.950	16.0	v	30.0	-14.0	QP	261	1.0	
541.000	22.8	h	37.0	-14.2	QP	0	1.5	
30.675	15.2	v	30.0	-14.8	QP	173	1.0	
601.000	21.8	h	37.0	-15.2	QP	360	1.5	
241.012	21.1	v	37.0	-15.9	QP	0	1.0	
161.000	12.5	h	30.0	-17.5	QP	0	1.8	
241.016	19.3	h	37.0	-17.7	QP	360	3.3	
601.000	18.2	v	37.0	-18.8	QP	10	1.0	
541.000	16.9	v	37.0	-20.1	QP	360	1.0	
281.110	16.5	v	37.0	-20.5	QP	360	1.0	
361.000	12.5	v	37.0	-24.5	QP	1	1.0	
321.000	12.2	h	37.0	-24.8	QP	340	1.5	
361.000	10.9	h	37.0	-26.1	QP	10	1.5	
321.000	10.2	v	37.0	-26.8	QP	2	1.0	

Run #2: Maximized Readings From Run #1

Frequency	Level	Pol	EN55022 B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
160.000	28.2	v	30.0	-1.8	QP	124	1.0	
160.000	26.4	h	30.0	-3.6	QP	250	3.2	
160.950	16.0	v	30.0	-14.0	QP	261	1.0	
541.000	22.8	h	37.0	-14.2	QP	0	1.5	
30.675	15.2	v	30.0	-14.8	QP	173	1.0	
601.000	21.8	h	37.0	-15.2	QP	360	1.5	

Elliott

EMC Test Data

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

Run #3: Maximized readings, 1000 - 6500 MHz

Measurements made at 3m per FCC requirements.

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1096.000	44.5	v	74.0	-29.5	Pk	360	1.0	
1096.000	27.4	v	54.0	-26.6	Avg	360	1.0	
2471.000	39.1	v	74.0	-34.9	Pk	0	1.0	
2471.000	25.7	v	54.0	-28.3	Avg	0	1.0	
1096.000	45.5	h	74.0	-28.5	Pk	360	1.0	
1096.000	29.2	h	54.0	-24.8	Avg	360	1.0	
2471.000	38.1	h	74.0	-35.9	Pk	0	1.0	
2471.000	24.5	h	54.0	-29.5	Avg	0	1.0	

Note 1:	No significant signals observed from 6.5GHz to 12 GHz with the device in receive mode (i.e > 20dB margin)

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

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: 6/29/2004
Test Engineer: Adam LaCourse
Test Location: SVOATS #3
Config. Used: 2
Config Change: none
EUT Voltage: 230V/50Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment.

Ambient Conditions:

Temperature: 20 °C
Rel. Humidity: 60 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 230V/50Hz	EN55022 B	Pass	-4.4dB @ 0.384MHz
2	CE, AC Power,120V/60Hz	EN55022 B	Pass	-6.3dB @ 0.208MHz

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:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

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

Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.3838	43.8	Line1	48.2	-4.4	AV	
0.4796	41.1	Line1	46.3	-5.2	AV	
0.5275	40.7	Line1	46	-5.3	AV	
0.3838	42.8	Neutral	48.2	-5.4	AV	
0.3838	42.8	Neutral	48.2	-5.4	AV	
0.4797	40.5	Neutral	46.3	-5.8	AV	
0.192	47.7	Neutral	53.8	-6.2	PK	
0.5278	39.2	Neutral	46	-6.8	AV	
0.2078	46.3	Line1	53.2	-6.9	AV	
0.2085	46.2	Neutral	53.2	-7	AV	
0.5756	37.4	Line1	46	-8.6	AV	
0.6236	37.2	Line1	46	-8.8	AV	
0.5233	37	Line1	46	-9	AV	
0.6237	37	Neutral	46	-9	AV	
0.2078	53.8	Line1	63.2	-9.4	QP	
0.5756	36.6	Neutral	46	-9.4	AV	
0.4172	47.4	Line1	57.4	-10	QP	
0.6715	35.9	Neutral	46	-10.1	AV	
0.2085	53	Neutral	63.2	-10.2	QP	
0.312	49.4	Line1	59.8	-10.5	QP	
0.3838	47.6	Line1	58.2	-10.6	QP	
0.3126	49.3	Neutral	59.8	-10.6	QP	
0.192	42.4	Neutral	53.8	-11.5	AV	
0.3838	46.5	Neutral	58.2	-11.7	QP	
0.3838	46.5	Neutral	58.2	-11.7	QP	
0.4172	35.3	Line1	47.4	-12.1	AV	
0.4796	44	Line1	56.3	-12.3	QP	
0.4213	45	Neutral	57.3	-12.3	QP	
0.312	36.9	Line1	49.8	-13	AV	
0.5275	42.9	Line1	56	-13.1	QP	
0.3126	36.6	Neutral	49.8	-13.3	AV	
0.7194	32.7	Neutral	46	-13.3	AV	
0.4797	42.8	Neutral	56.3	-13.5	QP	
0.4213	33.7	Neutral	47.3	-13.6	AV	
0.5278	41.9	Neutral	56	-14.1	QP	
0.6236	41	Line1	56	-15	QP	
0.5756	40.9	Line1	56	-15.1	QP	
0.5233	40.6	Line1	56	-15.4	QP	
0.6237	40.6	Neutral	56	-15.4	QP	
0.5756	40	Neutral	56	-16	QP	

Elliott

EMC Test Data

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	B

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

Frequency	Level	AC	EN55022 B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.2083	47	Line 1	53.3	-6.3	Average	
0.2083	46.7	Neutral	53.3	-6.6	Average	
0.3835	38.9	Line 1	48.2	-9.3	Average	
0.2083	53.5	Line 1	63.3	-9.8	QP	
0.2083	52.3	Neutral	63.3	-11.0	QP	
0.3835	47.2	Line 1	58.2	-11.0	QP	
0.3124	45.6	Line 1	59.9	-14.3	QP	
0.3122	44.3	Neutral	59.9	-15.6	QP	
0.3124	32.2	Line 1	49.9	-17.7	Average	
0.1516	48	Neutral	65.9	-17.9	QP	
0.5206	37.6	Line 1	56.0	-18.4	QP	
0.5276	37.5	Neutral	56.0	-18.5	QP	
0.5276	27.1	Neutral	46.0	-18.9	Average	
0.4165	38.3	Neutral	57.5	-19.2	QP	
0.4164	38.2	Neutral	57.5	-19.3	QP	
0.3122	30.4	Neutral	49.9	-19.5	Average	
0.4165	37.9	Neutral	57.5	-19.6	QP	
0.5206	25	Line 1	46.0	-21.0	Average	
0.4165	25.4	Neutral	47.5	-22.1	Average	
0.4164	25	Neutral	47.5	-22.5	Average	
0.4165	24.6	Neutral	47.5	-22.9	Average	
0.1516	27.7	Neutral	55.9	-28.2	Average	

Frequency	Level	AC	R210		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.5206	37.6	Line 1	48.0	-10.4	QP	
0.5276	37.5	Neutral	48.0	-10.5	QP	

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Radiated Emissions

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: 6/28/2004
Test Engineer: Yu-Chien Ho
Test Location: SVOATS #4
Config. Used: 2
Config Change: No
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

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.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 25.6 °C
Rel. Humidity: 55 %

Summary of Results

Run #	Test Performed	Limit	Result	Details
1	Antenna Port Emissions, 30 - 9280 MHz	FCC Part 15.209 / 15.247(c)	Pass	All emissions > -20dBc
2	Radiated Spurious Emissions, 30 - 9280 MHz - Long Whip	FCC Part 15.209 / 15.247(c)	Pass	-10.9dB @ 2746.1MHz
3	Radiated Spurious Emissions, 30 - 9280 MHz - Short Whip	FCC Part 15.209 / 15.247(c)	Pass	-18.6dB @ 2708.0MHz
4	20dB Bandwidth	15.247(a)	Pass	392 kHz
5	Output Power	15.247(b)	Pass	0.832 W
6	Channel Occupancy / Separation	15.247(a)	Pass	Channel separation = 510kHz. Time of occupancy as per operational description
6	Number of Channels	15.247(a)	Pass	50 Channels

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Modifications Made During Testing:

The power amp gain was re-tuned to lower the total output power prior to the test on 7-7-04.

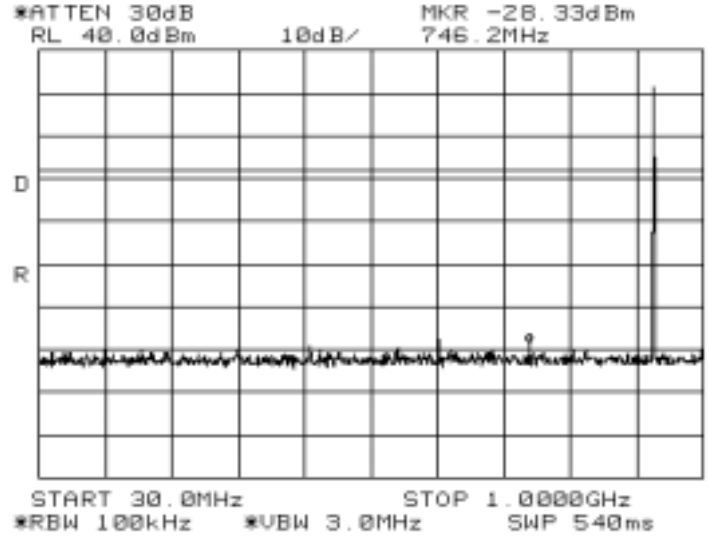
Deviations From The Standard

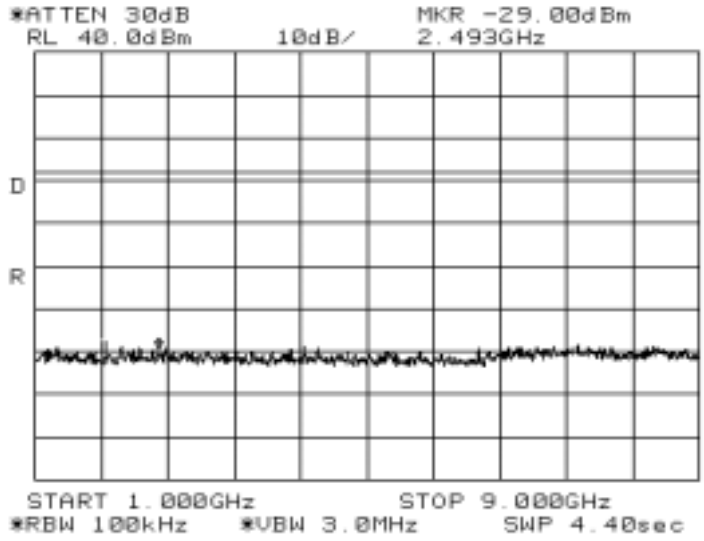
No deviations were made from the requirements of the standard.

Run #1: Antenna Port Spurious Emissions, 30 - 9300 MHz

All spurious emissions were more than 20dB below the fundamental signal level on the antenna port.

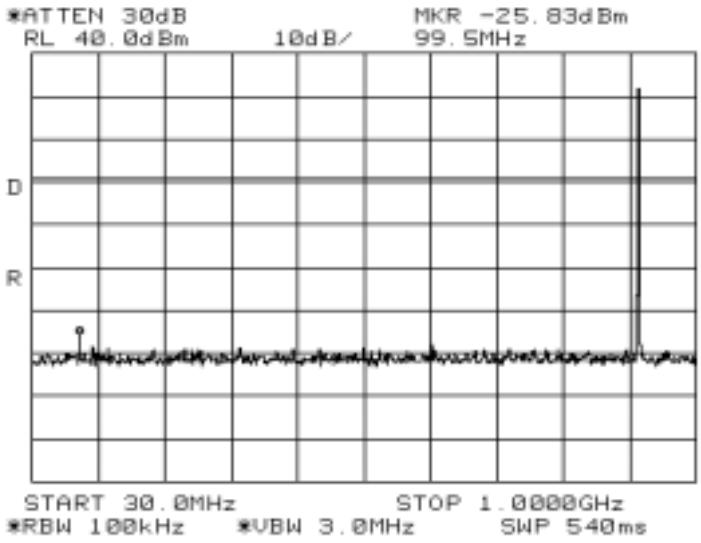
902.6

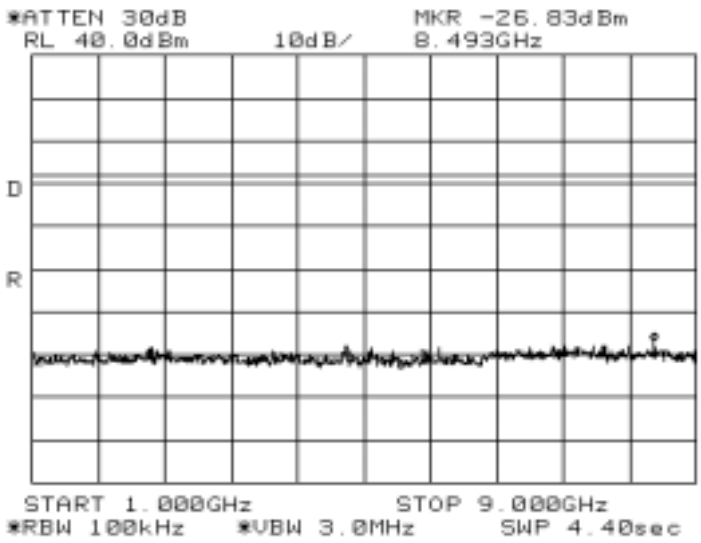




Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

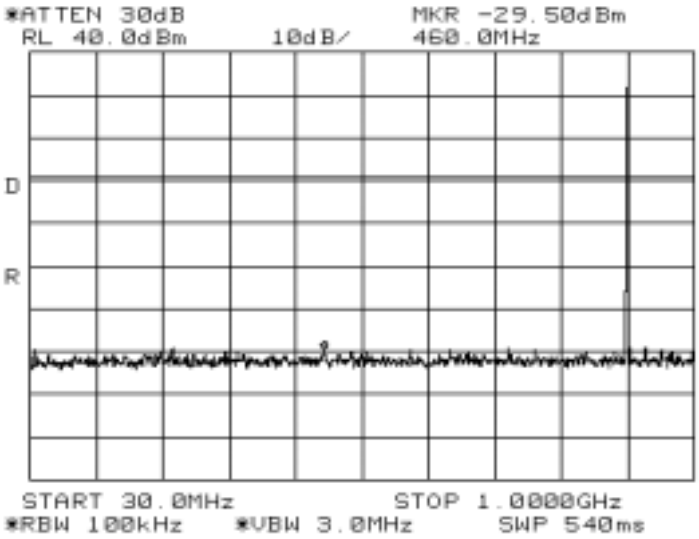
915.4

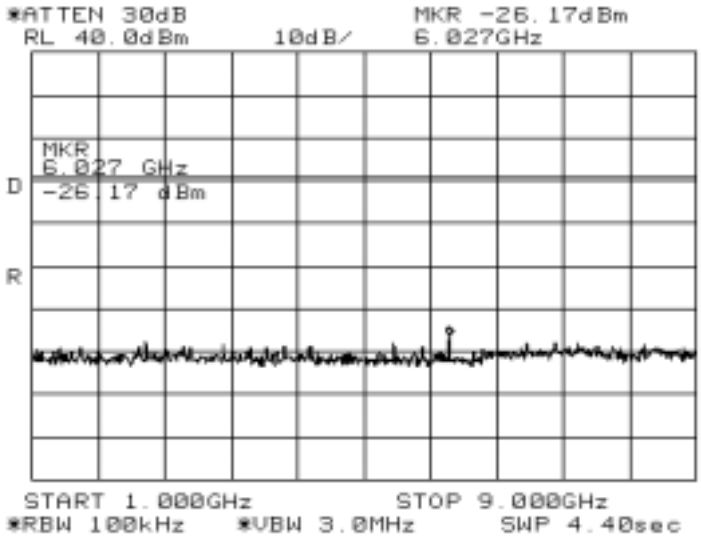




Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

927.6





Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Run #2a: Radiated Spurious Emissions, 30 - 9300 MHz. Low Channel @ 902.6 MHz, High Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		132.6
Limit for emissions outside of restricted bands:	112.6 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	
2707.863	34.7	V	54.0	-19.3	AVG	251	1.1	Low Channel
2707.863	33.1	H	54.0	-20.9	AVG	80	1.0	Low Channel
2707.863	43.4	V	74.0	-30.6	PK	251	1.1	Low Channel
2707.863	42.5	H	74.0	-31.5	PK	80	1.0	Low Channel
1805.233	60.1	V	112.6	-52.5	PK	1	1.1	Low Channel
1805.236	54.4	H	112.6	-58.2	PK	318	1.2	Low Channel

Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No emissions observed in the 960MHz restricted band.

Run #2b: Radiated Spurious Emissions, 30 - 9300 MHz. Middle Channel @ 915.4 MHz, High Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		131.2
Limit for emissions outside of restricted bands:	111.2 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	
2746.078	63.1	H	74.0	-10.9	PK	86	1.1	EUT plus ambient
2746.078	32.7	H	54.0	-21.3	AVG	86	1.1	Center channel
2745.010	31.4	V	54.0	-22.6	AVG	-1	1.0	Center channel
2745.010	40.1	V	74.0	-33.9	PK	-1	1.0	Center channel
1830.720	58.5	V	111.2	-52.7	PK	0	1.0	Center channel
1830.701	54.5	H	111.2	-56.7	PK	87	1.2	Center channel

Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No emissions observed in the 960MHz restricted band.

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Run #2c: Radiated Spurious Emissions, 30 - 9300 MHz. High Channel @ 927.6 MHz, High Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		131.7
Limit for emissions outside of restricted bands:	111.7 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	
2782.773	34.6	V	54.0	-19.4	AVG	250	1.0	High Channel
2782.773	53.6	V	74.0	-20.4	PK	250	1.0	High Channel
2782.765	30.9	H	54.0	-23.1	AVG	259	1.0	High Channel
2782.765	44.9	H	74.0	-29.1	PK	259	1.0	High Channel
1855.200	57.2	V	111.7	-54.5	Pk	359	1.0	High Channel
1855.188	54.5	H	111.7	-57.2	Pk	255	1.0	High Channel

Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No emissions observed in the 960MHz restricted band.

Run #3a: Radiated Spurious Emissions, 30 - 9300 MHz. Low Channel @ 902.6 MHz, Low Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		129.44
Limit for emissions outside of restricted bands:	109.44 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	
2707.955	35.4	V	54.0	-18.6	AVG	0	1.6	Low Channel
2707.955	45.8	V	74.0	-28.2	PK	0	1.6	Low Channel
1805.256	52.0	V	109.4	-57.4	PK	10	1.5	Low Channel

Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No significant signals observed above 3GHz

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Run #3b: Radiated Spurious Emissions, 30 - 9300 MHz. Middle Channel @ 915.4 MHz, Low Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		127.45
Limit for emissions outside of restricted bands:	107.45 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	
2746.205	29.8	V	54.0	-24.2	AVG	133	1.7	Center channel
1830.741	54.8	V	87.5	-32.6	PK	9	1.0	Center channel
2746.205	40.2	V	74.0	-33.8	PK	133	1.7	Center channel

Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No significant signals observed above 3GHz. All signals were higher in amplitude for vertical polarization.

Run #3c: Radiated Spurious Emissions, 30 - 9300 MHz. High Channel @ 927.6 MHz, Low Gain Whip Antenna

	H	V
Fundamental emission level @ 3m in 100kHz RBW:		129.45
Limit for emissions outside of restricted bands:	109.45 dBµV/m	

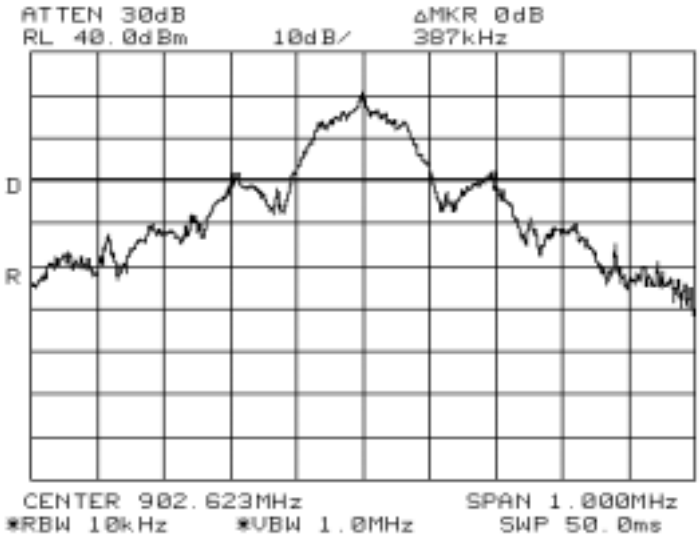
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2783.575	31.6	V	54.0	-22.4	AVG	251	1.0	High Channel
2783.575	49.0	V	74.0	-25.0	PK	251	1.0	High Channel
1855.201	48.7	V	89.5	-40.8	PK	86	1.0	High Channel

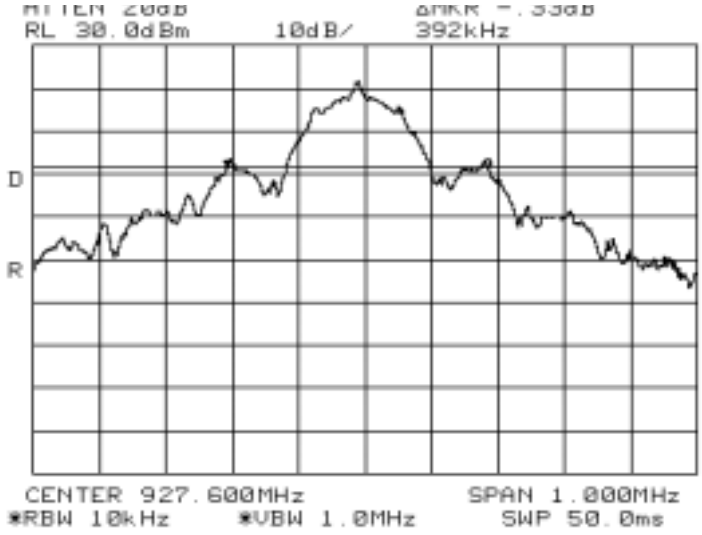
Note 1:	For emissions in restricted bands, the limit of 15.209 was used - measurements were made with RB=1MHz and VB=10Hz (average) or VB=1MHz (peak). For all other emissions, the limit was set 20dB below the level of the fundamental and measurements wre made with RB=VB=100kHz.
Note 2:	No significant signals observed above 3GHz. No signals observed in 960-1280MHz restricted band.

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

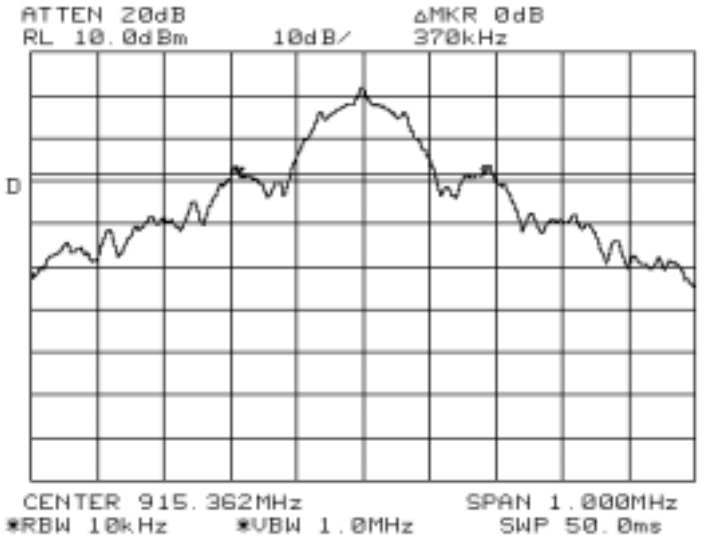
Run #4: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth
Low	902.6	10 kHz	387 kHz
Mid	915.4	10 kHz	370 kHz
High	927.6	10 kHz	392 kHz





Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A



Run #5: Output Power, measured on July 7, 2004 by David Bare

Power measured on June 28 exceeded the limit by approximately 1 dB. The client re-tuned the power amp for lower gain to comply with the 1 watt limit. This will only reduce the spurious emissions and would not change the bandwidth, so these were not remeasured.

Channel	Frequency (MHz)	Res BW	Output Power	CL Note 2	Power Note 3	
					dBm	W
Low	902.6	Note 1	30.9	1.7	29.2	0.832
Mid	915.4	Note 1	30.8	1.7	29.1	0.813
High	927.6	Note 1	30.6	1.7	28.9	0.776

Note 1:	Measured using power meter with peak power sensor.
Note 2:	EUT antenna port connects to antenna via a cable. The minimum length of the cable is five meters with a minimum loss of 1.7 dB. CL is the minimum loss of this cable.
Note 3:	Output power into the cable. For a 50 channel system the power minus the cable loss cannot exceed 1 Watt.

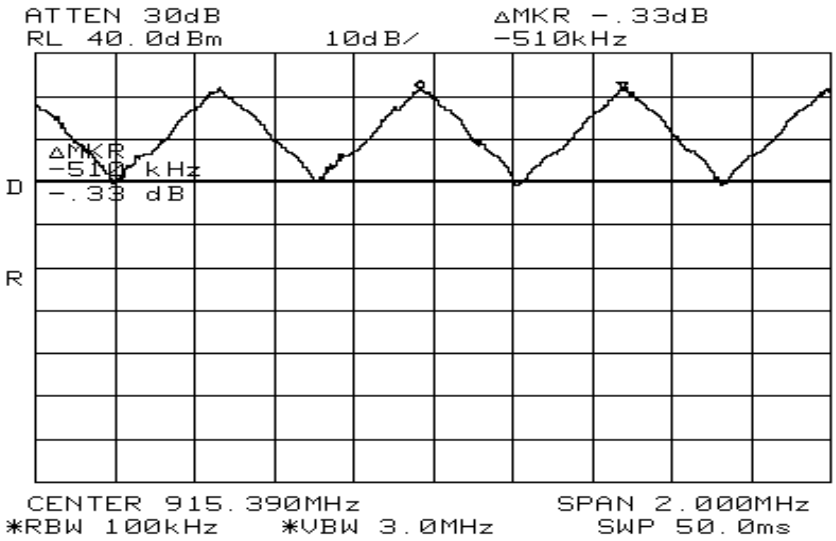
With a 5dBi antenna the EIRP is 34.2dBm (2.63 Watts).

Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Run #6: Channel Occupancy And Spacing

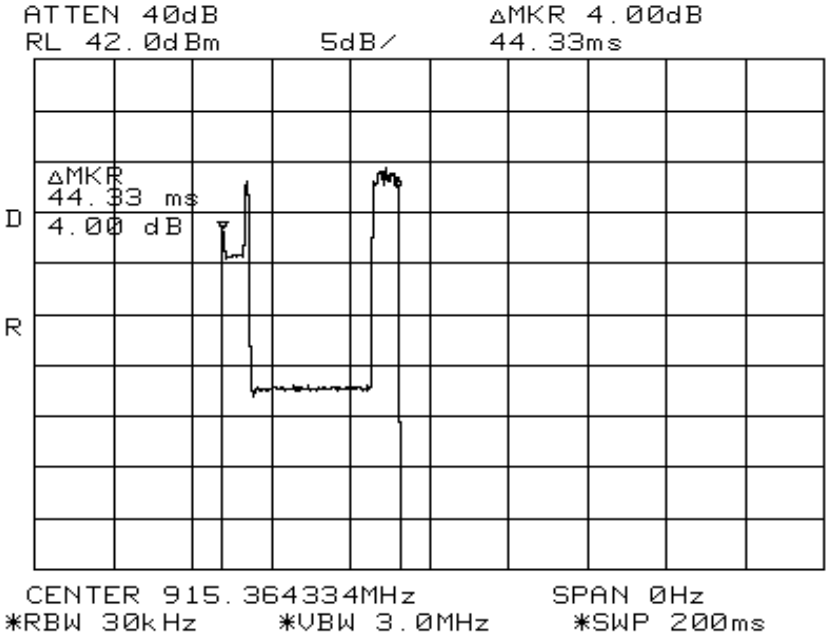
The channel occupancy was measured with the radio transmitting normally (i.e. In hopping mode)

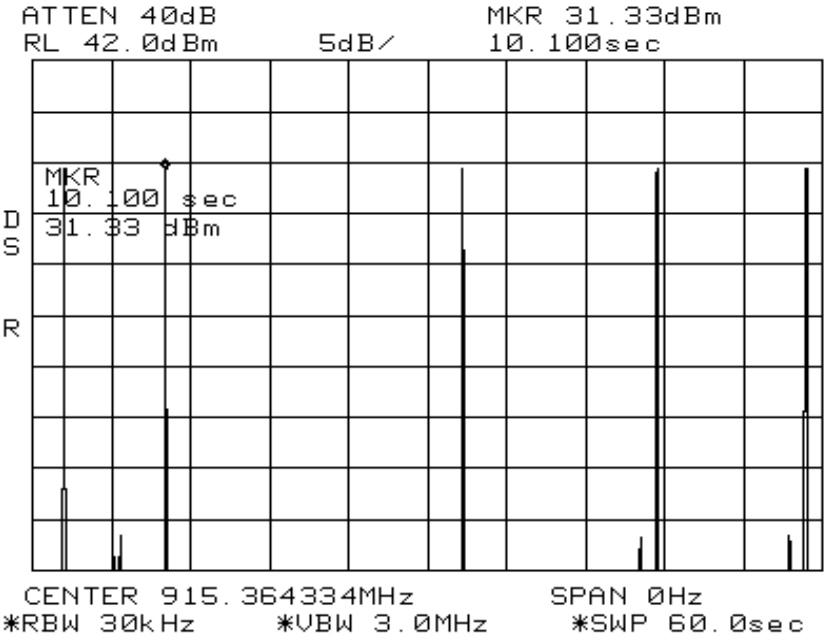
The channel spacing was: 510 kHz



Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

The frequency hopping algorithm ensures occupancy of less than 400ms per 20s per channel (refer to operational description). The plots below show the transmit time per channel (~ 43ms) and a channel being used 5 times in a 60 second period.



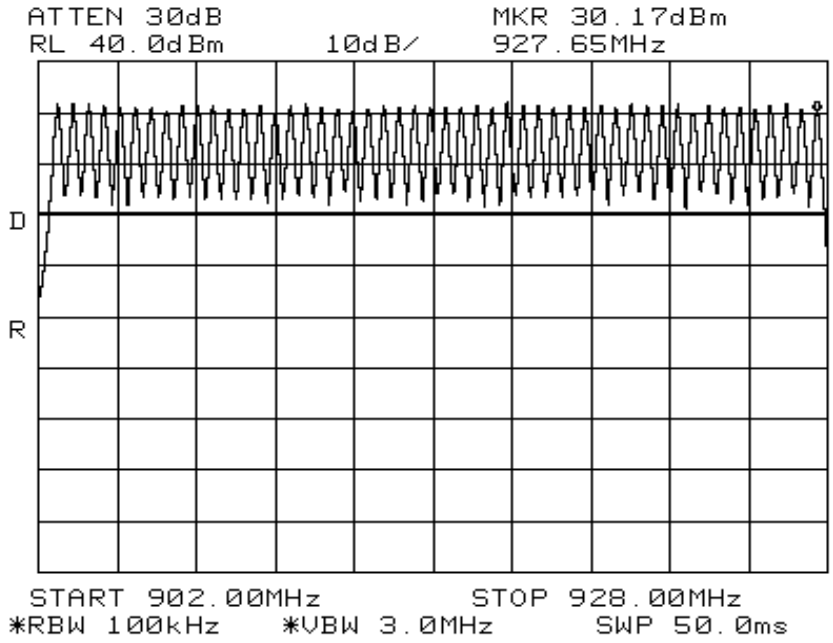


Client:	Trimble Navigation	Job Number:	J55805
Model:	SNB900	T-Log Number:	T55873
		Account Manager:	-
Contact:	Dennis Connor		
Spec:	EN55022 / FCC	Class:	N/A

Run #7: Number of Channels

The number of channels was verified with the radio transmitting normally (i.e. In hopping mode)

The number of channels was: 50

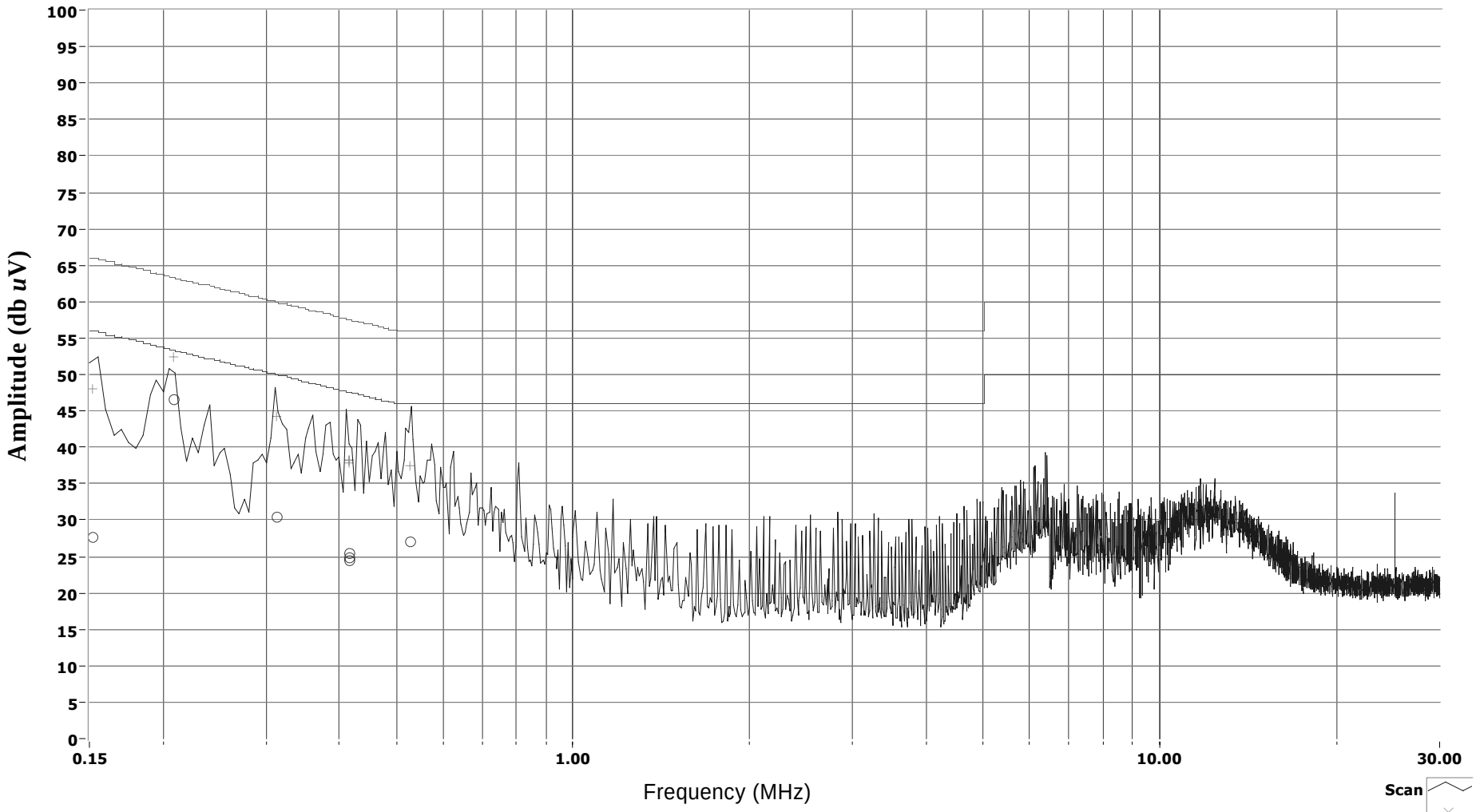


OATS#3: Trimble Navigation SNB900 GPS Transmitter/Receiver

Spec: EN55022B

Mains Lead Neutral

J55805/T55873



120V Neutral

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

6/29/2004

Adam LaCourse

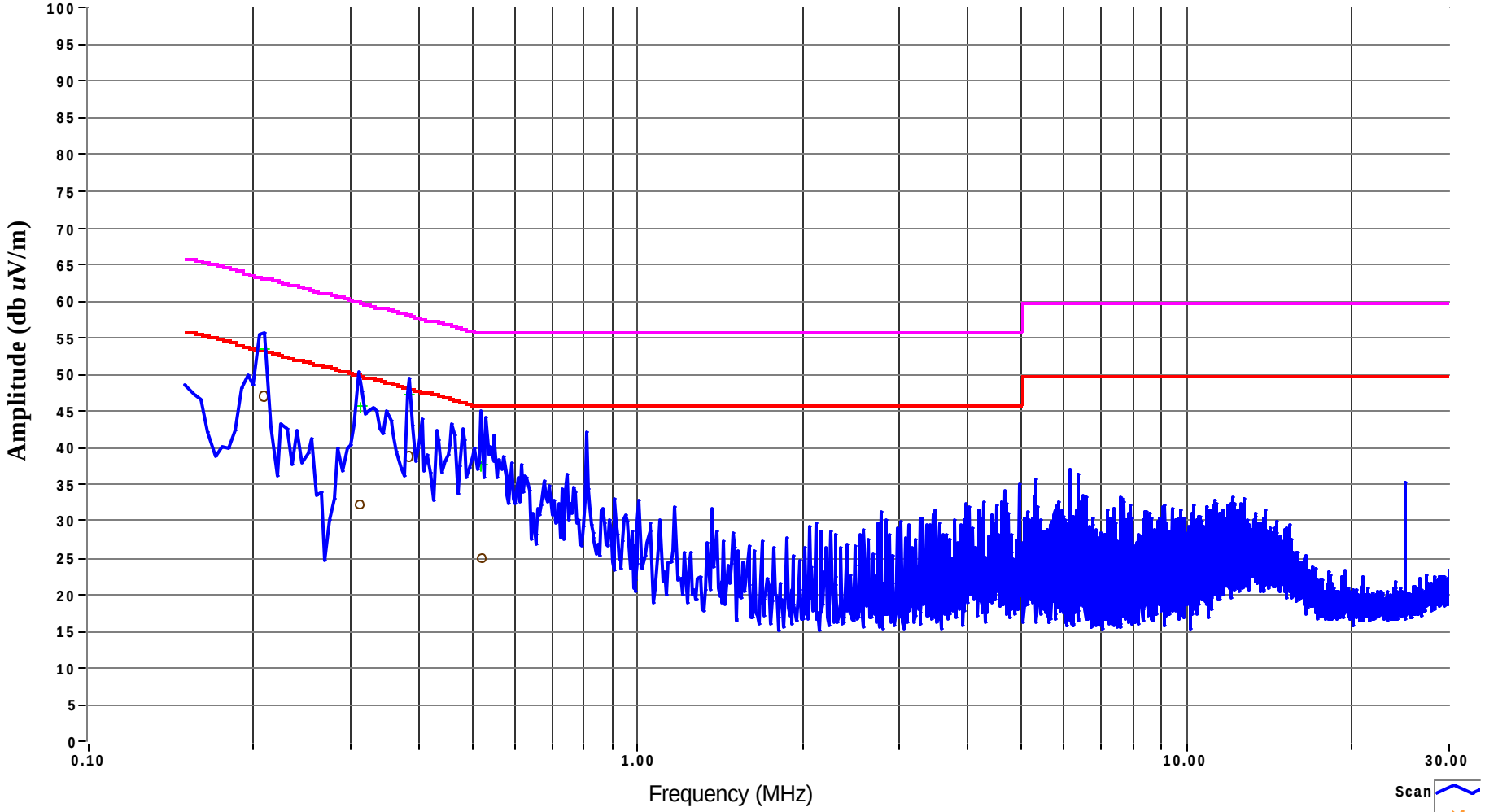
OATS#3: Trimble Navigation SNB900 GPS Transmitter/Receiver

Spec:

J55805/T55873

Mains Lead

Line 1



120VLine1

Scan

Peak

Quasi-peak

Average

Average Limit

QuasiPeak Limit

9/28/2004

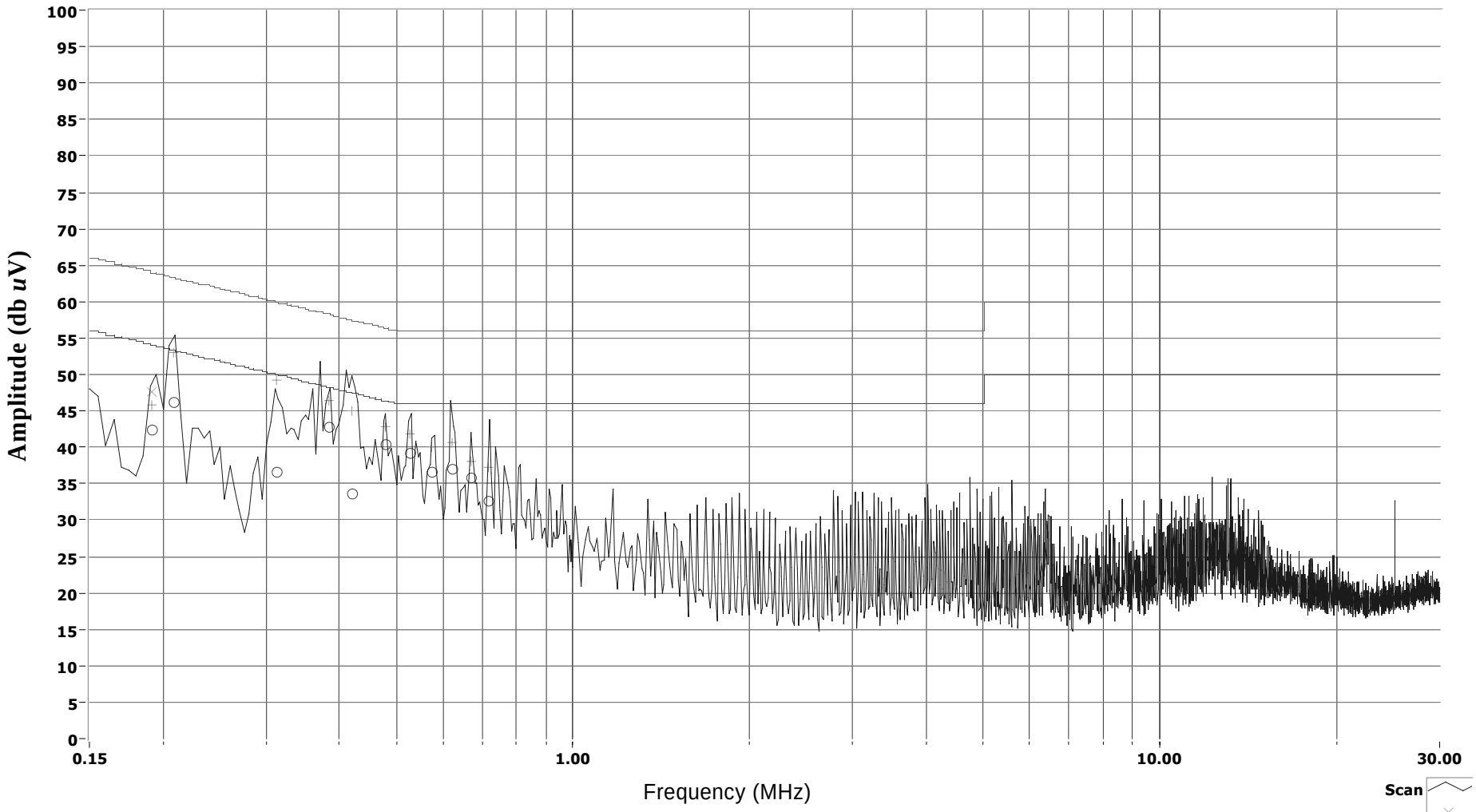
Adam LaCourse

OATS#3: Trimble Navigation SNB900 GPS Transmitter/Receiver

Spec:
EN55022B

J55805/T55873

Mains Lead
Neutral



230V Neutral

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

6/29/2004

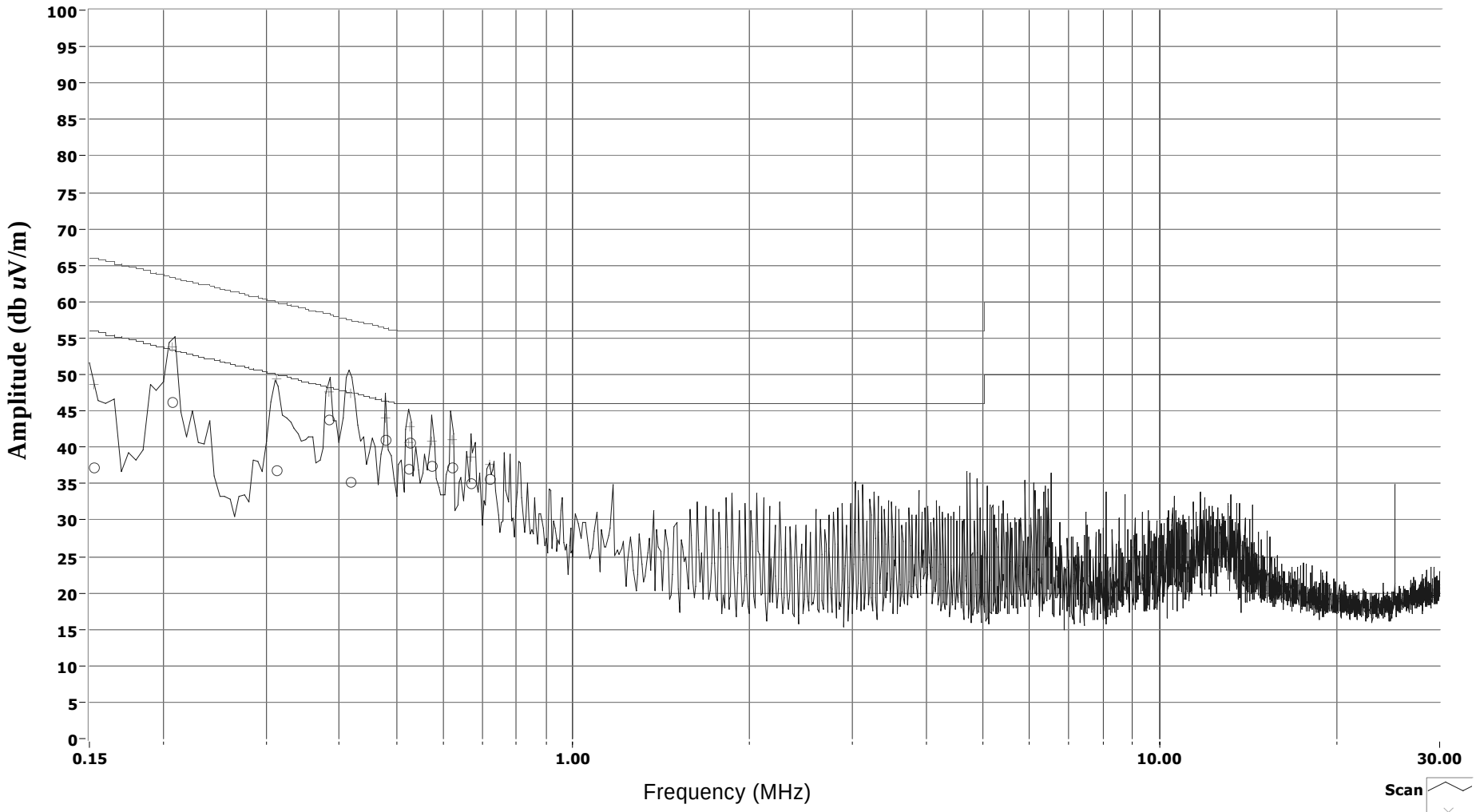
Adam LaCourse

OATS#3: Trimble Navigation SNB900 GPS Transmitter/Receiver

Spec:
EN55022B

Mains Lead
Line 1

J55805/T55873



230V Line1

Scan
Peak
Quasi-peak
Average
Average Limit
QuasiPeak Limit

6/29/2004

Adam LaCourse