

***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 6 for an  
Intentional Radiator on the  
Trimble Navigation  
Model: Trimble SPS850, SPS750, SPS550  
Part Numbers: 55800-90***

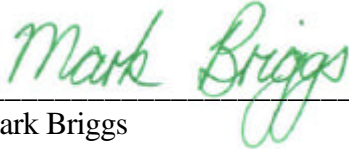
FCC ID: JUP-5580090  
UPN: 1756A-5580090

GRANTEE: Trimble Navigation  
935 Stewart Drive  
Sunnyvale, CA 94088

TEST SITE: Elliott Laboratories, Inc.  
684 W. Maude Avenue  
Sunnyvale, CA 94086

REPORT DATE: November 9, 2005

FINAL TEST DATE: October 31, November 1 and November 2, 2005

AUTHORIZED SIGNATORY:   
Mark Briggs  
Principal Engineer



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**DECLARATIONS OF COMPLIANCE**

Equipment Name and Model:  
55800-90


Manufacturer:  
Trimble Navigation  
935 Stewart Drive  
Sunnyvale, CA 94088

Tested to applicable standards:  
RSS-210, Issue 6, September 2005, "General Requirements and Information for the Certification of Radiocommunication Equipment"  
FCC Part 15.247 (DTS)

Measurement Facility Description Filed With Department of Industry:

Departmental Acknowledgement Number: IC2845 SV2 Dated August 16, 2007

I declare that the testing was performed or supervised by me; that the test measurements were made in accordance with the above mentioned departmental standards (through the use of ANSI C63.4:2003 as detailed in section 5.3 of RSS-210, Issue 6); and that the equipment performed in accordance with the data submitted in this report.

Signature	
Name	Mark Briggs
Title	Principal Engineer
Company	Elliott Laboratories Inc.
Address	684 W. Maude Ave Sunnyvale, CA 94086 USA

Date: November 9, 2005

Maintenance of compliance with the above standards is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

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## SCOPE

An electromagnetic emissions test has been performed on the Trimble Navigation model 55800-90 pursuant to the following rules:

Industry Canada RSS-Gen Issue 1

RSS 210 Issue 6 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment” (To cover Bluetooth transceiver and 900MHz FHSS transceiver)

RSS 310 Issue 1 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment” (To cover the GPS receiver)

FCC Part 15 Subpart B (Receivers – to cover the 900 MHz FHSS transceiver)

FCC Part 15, Subpart C requirements for FHSS devices

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in Elliott Laboratories test procedures:

ANSI C63.4:2003

RSS-212 Issue 1 Test Facilities and Test Methods for Radio Equipment

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada 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 55800-90 and therefore apply only to the tested sample. The sample was selected and prepared by Gerardo Torres of Trimble Navigation

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**OBJECTIVE**

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules, RSS 310 Issue 1 and RSS-210 Issue 6 for license-exempt low power devices for the radiated and conducted emissions of intentional radiators and receivers. Certification of these devices is required as a prerequisite to marketing as defined in Part 2 the FCC Rules.

Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units that are subsequently manufactured.

**STATEMENT OF COMPLIANCE**

The tested sample of the Trimble Navigation model 55800-90 complied with the requirements of the following regulations:

- Industry Canada RSS-Gen Issue 1
- RSS 210 Issue 6 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment”
- RSS 310 Issue 1 “Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment”
- FCC Part 15 Subpart B (Receivers)
- FCC Part 15, Subpart C requirements for FHSS devices

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

**SUMMARY OF RESULTS****FREQUENCY HOPPING SPREAD SPECTRUM (902 – 928 MHz, 50 channels or more)**

FCC Part 15 Reference	RSS Reference	Description	Measured Value / Comments	Limit / Requirement	Result
	RSS 210	99% Bandwidth	630kHz	Information only	Complies
	RSS 210 A8.1 (1)	20dB Bandwidth	440 kHz	Channel spacing > 20dB bandwidth / 25kHz	Complies
	RSS 210 A8.1 (2)	Channel Separation	508.25 kHz		Complies
	RSS 210 A8.1 (3)	Number of Channels	50	50 or more	Complies
	RSS 210 A8.1 (3)	Channel Dwell Time	< 0.4 seconds per 20 seconds	<0.4 second within a 20 second period	Complies
	RSS 210 A8.1 (1)	Channel Utilization	All channels are used equally - refer to the operational description for full explanation	All channels shall, on average, be used equally	Complies
15.247 (b) (3)	RSS 210 A8.4 (1)	Output Power	29.5 dBm (0.895 Watts) EIRP = 2.83W <sup>Note 1</sup>	1Watt, EIRP < 4 Watts	Complies
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions 30MHz – 9.28 GHz	All spurious emissions < -20dBc	< -20dBc	Complies
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 9.28 GHz (Note 2)	53.5dB $\mu$ V/m (474.8 $\mu$ V/m) @ 2708.0MHz	15.207 in restricted bands, all others < -20dBc	Complies (-0.5dB)
15.247	RSS 210 A8.1(2)	Receiver bandwidth	Refer to operational description	Shall match the channel bandwidth	Complies

Note 1: EIRP calculated using antenna gain of 5 dBi for the highest EIRP multi-point system.

Note 2: Radiated spurious emissions performed with the long whip, short whip and rubber ducky antennas. The worst case emission was with the long whip connected.

**GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS**

FCC Part 15 Section	RSS 210 Section	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Bluetooth antenna integrated into the system. 900 MHz FHSS antenna uses reverse TNC.	Unique or integral antenna connection	Complies
15.109	RSS GEN 7.2.3 Table 1	900 MHz FHSS, GPS Receiver and Bluetooth Receiver spurious emissions	32.4 dB $\mu$ V/m (45.2 $\mu$ V/m) @ 1400.0MHz	Table 1 / 15.209	Complies (-20.9dB)
15.207	RSS GEN Table 2	AC Conducted Emissions	31.3dB $\mu$ V @ 0.500MHz	Refer to standard	Complies (-14.7dB)
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in Exhibit 11, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies

**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 UKAS document LAB 34.

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

**EQUIPMENT UNDER TEST (EUT) DETAILS****GENERAL**

The Trimble Navigation models Trimble SPS850, SPS750, SPS550 and SPS550H are a GPS receiver with integrated Bluetooth transceiver. The various models share identical hardware with the differences being in the software-enabled options in the various models to allow access to features such as different GPS bands, data logging capabilities and CMR (GPS data packet) input and output.

The SPS850 has all functions and options enabled. The lower numbers (SPS750, SPS550, etc.) have some options disabled compared to the SPS850. The model SPS550 consists of the base unit only and does not include the 900MHz TRx or UHF TRx options.

The base units of all models (except the SPS550H) can also house one of two radio modules, either a 450MHz band transceiver radio or a 900MHz band FHSS transceiver radio. This test report covers the base unit and base unit with UHF transceiver option.

Since the EUT would be mounted on a tripod during normal operation it was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the AC-DC power adapter is 100-250 V, 56/60 Hz, 0.5 A-0.3 A with a dc output rating of 16 V, 1.56 A.

The sample was received on October 26, 2005 and tested on October 31, November 1 and November 2, 2005. The EUT consisted of the following component(s):

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble Navigation	SPS850	GPS/Bluetooth/900MHz	WAMEL00071	
Trimble	29148-10	AC adapter	-	



**OTHER EUT DETAILS**

The SPS850, SPS750, SPS550 and SPS550H can be powered from either an internal battery or an external AC adapter. All base models contain a GPS receiver and a Bluetooth transceiver. The Bluetooth transceiver has FCC modular approval.

The SPS850, SPS750, SPS550, and SPS550H with 900 MHz Radio will be sold under P/N 55800-90.

The SPS850, SPS750, SPS550, and SPS550H with 450 MHz (UHF) Radio will be sold under P/Ns 55800-62, 55800-64, and 55800-66. The difference between the -62, -64 and -66 versions is in the operating band for the UHF radio. The UHF radio has a modular approval from both FCC (FCC ID E5MDS-TRM450) and Industry Canada (3738A-TRM450). Only the -62 and -66 versions are available in Canada.

**ENCLOSURE**

The EUT enclosure is primarily constructed of cast aluminum. It measures approximately 12 cm wide by 23 cm deep by 6 cm high.

**MODIFICATIONS**

The EUT required the following modifications in order to comply with the specifications:

Mod. #	Test	Date	Modification
-	CE	10/27/2005	Change the power adpater from the FRIWO unit to a Trimble 29148-10 unit.

**SUPPORT EQUIPMENT**

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

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble Navigation	Spirit	GPS Antenna	-	-
Dell	Latitude CP	Laptop		DoC

No remote support equipment was used during testing.

**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)
Ethernet on block	Laptop	Cat 5	Unshielded	4.0
Pwr/Serial Data	AC adapter/ Data unterminated	2 wire	Unshielded	2.0
Pwr/Data	USB/Pwr/Ethernet block	Multiwire	Shielded	0.2
GPS Ant	GPS antenna	Coax	Shielded	1.5
Transceiver Antenna	Terminated	-	-	-
USB on block	Laptop	Multiwire with ferrite	Shielded	3.0

Note: The unit can be powered through two different ports. The Pwr/Serial Data port was connected to the charging adapter for all testing. The power port on the block was not connected.

The device is not intended for use with a PC, rather the USB port is provided to interface with data loggers and hand-held computers so the minimum system configuration requirements of ANSI C63.4 for a PC peripheral were not applied. The laptop was used to allow control of the transceivers.

**EUT OPERATION DURING TESTING**

When measuring the emissions and transmitter-related parameters for the 900 MHz FHSS radio, the FHSS radio was configured to continuously transmit on the channel specified in the test data, with the exception of the measurements related to channel occupancy and number of channels where the radio was configured in a continuous hopping mode.

Radiated emissions tests against the requirements for a digital device were performed on a sample with the 900 MHz FHSS options and on a sample with the UHF transceiver installed.

Tests specific to the intentional radiator requirements for the Bluetooth module to support the application for Industry Canada certification are included in a separate test report..

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**ANTENNA REQUIREMENTS**

The Bluetooth antenna is integral to the Bluetooth device installed inside the unit.

The 900MHz antenna connects to the EUT via a non-standard reverse TNC antenna connector, thereby meeting the requirements of FCC 15.203. The 900 MHz antennas available are

- long whip: 5 dBi, P/N 32318,
- medium whip: 3 dBi, P/N 32316 ,
- short whip: 0 dBi, P/N 32317,
- rubber ducky: 0 dBi

The UHF radio is licensed and uses a standard TNC connector. It has modular approval from both Industry Canada and FCC.

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## TEST SITE

### GENERAL INFORMATION

Final test measurements were taken on October 31, November 1 and November 2, 2005 at 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 6 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 C63.4:2003. 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 C63.4:2003 guidelines.

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## **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. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak 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, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

### **INSTRUMENT CONTROL COMPUTER**

The receivers utilize either a Rohde & 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.

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**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 or incorporated into the test software.

**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 C63.4:2003 and RSS 212 specify 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.

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## 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 C63.4:2003, 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.

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**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 are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. 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.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

**CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN**

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

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

**GENERAL RADIATED EMISSIONS SPECIFICATION LIMITS**

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands<sup>1</sup> (with the exception of transmitters operating under FCC Part 15 Subpart D) and the limits for all emissions for a low power device operating under the general rules of RSS 310, RSS 210, FCC Part 15 Subpart C.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	2400/F <sub>KHz</sub> @ 300m	67.6-20*log <sub>10</sub> (F <sub>KHz</sub> ) @ 300m
0.490-1.705	24000/F <sub>KHz</sub> @ 30m	87.6-20*log <sub>10</sub> (F <sub>KHz</sub> ) @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

**RECEIVER SPURIOUS EMISSIONS SPECIFICATION LIMITS**

The table below shows the limits for emissions from the receiver as detailed in FCC Part 15.109, RSS 210 table 2, RSS GEN table 1 and RSS 310.

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

<sup>1</sup> The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

**OUTPUT POWER LIMITS - FHSS SYSTEMS**

The table below shows the limits for output power based on the number of channels available for the hopping system.

Operating Frequency (MHz)	Number of Channels	Output Power
902 – 928	≥ 50	1 Watt (30 dBm)
902 – 928	25 to 49	0.25 Watts (24 dBm)
2400 – 2483.5	≥ 75	1 Watt (30 dBm)
2400 – 2483.5	< 75	0.125 Watts (21 dBm)
5725 – 5850	75	1 Watt (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.

**TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS - FHSS and DTS SYSTEMS**

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

**SAMPLE CALCULATIONS - CONDUCTED EMISSIONS**

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

$$R_r - S = M$$

where:

$R_r$  = Receiver Reading in dBuV

$S$  = Specification Limit in dBuV

$M$  = Margin to Specification in +/- dB

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**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 above 30MHz, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

$F_d$  = Distance Factor in dB

$D_m$  = Measurement Distance in meters

$D_s$  = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40 * \text{LOG}_{10} (D_m/D_s)$$

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.

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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:

$$R_r = \text{Receiver Reading in dBuV/m}$$

$$F_d = \text{Distance Factor in dB}$$

$$R_c = \text{Corrected Reading in dBuV/m}$$

$$L_s = \text{Specification Limit in dBuV/m}$$

$$M = \text{Margin in dB Relative to Spec}$$

#### **SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION**

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of 3m from the equipment under test:

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

where P is the eirp (Watts)

***EXHIBIT 1: Test Equipment Calibration Data***

1 Page

**Radiated Emissions, 30 - 6,500 MHz, 26-Oct-05****Engineer: Juan Martinez**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	13-May-06
Hewlett Packard	EMC Spectrum Analyzer 9kHz - 6.5GHz	8595EM	787	17-Dec-05
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-06
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	955	31-Mar-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	30-Mar-07
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06
EMCO	Biconical Antenna, 30-300 MHz	3110B	1497	15-Jun-06

**Conducted and Radiated Emissions, 27-Oct-05****Engineer: dbare**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	08-Jul-06
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	13-Jan-06
Solar Electronics	LISN	8028-50-TS-24-BNC support	904	08-Jul-06
Filtek	High Pass Filter, 1GHz	HP12/1000-5BA	955	31-Mar-06
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	19-Oct-06
Hewlett Packard	EMC Spectrum Analyzer, 9KHz - 22GHz	8593EM	1319	28-Mar-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1321	30-Mar-07
Rohde & Schwarz	Test Receiver, 0.009-2750 MHz	ESN	1332	23-May-06
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1398	11-Feb-06
EMCO	Biconical Antenna, 30-300 MHz	3110B	1497	15-Jun-06

**Radiated Emissions, 30 - 10,000 MHz, 31-Oct-05****Engineer: Mehran Birgani**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	26-Apr-06
Hewlett Packard	EMC Spectrum Analyzer 30Hz - 40GHz, Sunnyvale (SA40)	8564E (84125C)	1148	09-Sep-06
Hewlett Packard	High Pass filter, 1.5GHz	P/N 84300-80037 (84125C)	1154	09-Jun-06
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	1242	19-Oct-06
Rohde & Schwarz	Test Receiver, 9kHz-2750MHz	ESCS 30	1337	12-Jan-06
EMCO	Log Periodic Antenna, 0.2-2 GHz	3148	1347	03-Nov-05

**Radiated Emissions (short whip/rubber duck antenna), Power, Bandwidth, 02-Nov-05****Engineer: Mark Briggs**

<u>Manufacturer</u>	<u>Description</u>	<u>Model #</u>	<u>Asset #</u>	<u>Cal Due</u>
EMCO	Horn Antenna, D. Ridge 1-18GHz	3115	487	13-May-06
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	26-Apr-06
Hewlett Packard	EMC Spectrum Analyzer, 9KHz-26.5GHz	8593EM	1141	10-Jun-06

***EXHIBIT 2: Test Data Log Sheets***

***ELECTROMAGNETIC EMISSIONS***

***TEST LOG SHEETS***

***AND***

***MEASUREMENT DATA***

T 61593 32 Pages





## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	Test-Log Number:	T61593
		Project Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Emissions Spec:	EN55022/FCC 15.24/RSS210	Class:	B
Immunity Spec:	-	Environment:	-

# EMC Test Data

For The

## Trimble Navigation

Model

### Trimble SPSx50

Date of Last Test: 11/2/2005



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	Test-Log Number:	T61593
		Project Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Emissions Spec:	EN55022/FCC 15.24/RSS210	Class:	B
Immunity Spec:	-	Environment:	-

### EUT INFORMATION

#### General Description

The EUT is a GPS receiver with integrated Bluetooth transceiver that can also house either an internal 450MHz band transceiver radio or 900MHz band transceiver radio. It is designed to provide GPS location data for a professional user. Since the EUT would be mounted on a tripod during normal operation it was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the AC-DC power adapter is: Input at 100-250 V, 56/60 Hz, 0.5 A-0.3 A., and output at 16 V, 1.56 A.

#### Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble Navigation	SPS850	GPS/Bluetooth/900MHz	WAMEL00062	
Trimble Navigation	SPS850	GPS/Bluetooth/UHF	WAMEL00065	
Trimble Navigation	SPS850	GPS/Bluetooth/UHF	WAMEL00067	
Trimble Navigation	SPS850	GPS/Bluetooth/900MHz	WAMEL00071	
Trimble Navigation	29148-10	AC adapter	-	
Friwo	48800-00	AC adapter	-	

Note - Friwo adapter did not comply with the AC conducted emissions requirements.

#### Other EUT Details

The SPS850 can be powered from either an internal battery or an external AC adapter. It contains a GPS receiver and a Bluetooth transceiver. The Bluetooth transceiver has FCC modular approval.

The SPS850, SPS750, SPS550, and SPS550H with 900 MHz Radio will be sold under P/N 55800-90.

The SPS850, SPS750, SPS550, and SPS550H with 450 MHz (UHF) Radio will be sold under P/Ns 55800-62, 55800-64, and 55800-66. The difference between P/Ns 55800-62/64/66 is the center frequency of the Local Oscillator in the UHF radio. (the UHF radio uses a module with FCC and Industry Canada modular approval). Only the -62 and -66 versions are available in Canada.

Serial numbers WAMEL00062 and WAMEL00067 were used during preliminary radiated emission tests, final radiated and conducted emissions measurements were performed with serial number WAMEL00065 and WAMEL00071 that did not have the USB on board filter.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	Test-Log Number:	T61593
		Project Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Emissions Spec:	EN55022/FCC 15.24/RSS210	Class:	B
Immunity Spec:	-	Environment:	-

### EUT Antenna (Intentional Radiators Only)

The Bluetooth antenna is integral to the Bluetooth device installed inside the unit.

The 900MHz antenna connects to the EUT via a non-standard reverse TNC antenna connector, thereby meeting the requirements of FCC 15.203. The UHF radio is licensed and uses a standard TNC connector.

The 900 MHz antennas available are:

long whip, 5 dBi, P/N 32318

medium whip: 3 dBi, P/N 32316

short whip: 0 dBi, P/N 32317

rubber ducky: 0 dBi

Radiated spurious emissions were evaluated with the long and short whip antennas and the rubber ducky antenna.

### EUT Enclosure

The EUT enclosure is primarily constructed of cast aluminum. It measures approximately 12 cm wide by 23 cm deep by 6 cm high.

### Modification History

Mod. #	Test	Date	Modification
1	RE	10/27/2005	The samples were changed to ones without the on-board USB filter.
2	CE	10/27/2005	Change the power adapter from the FRIWO unit to a Trimble 29148-10 unit.

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



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Project Manager:	Nesha Lambert
Emissions Spec:	EN55022/FCC 15.24/RSS210	Class:	B
Immunity Spec:	-	Environment:	-

### Test Configuration #2

*The following information was collected during the test sessions(s).*

#### Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Trimble Navigation	Spirit	GPS Antenna	-	-
Dell	Latitude CP	Laptop		DoC

#### 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)
Ethernet on block	Laptop	Cat 5	Unshielded	4.0
Pwr/Serial Data	AC adapter/ Data unterminated	2 wire	Unshielded	2.0
Pwr/Data	USB/Pwr/Ethernet block	Multiwire	Shielded	0.2
GPS Ant	GPS antenna	Coax	Shielded	1.5
Transceiver Antenna	Terminated	-	-	-
USB on block	Laptop	Multiwire with ferrite	Shielded	3.0

Note: The unit can be powered through two different ports. The Pwr/Serial Data port was connected to the charging adapter for all testing. The power port on the block was not connected.

The device is not intended for use with a PC, rather the USB port is provided to interface with data loggers and hand-held computers so the minimum system configuration requirements of ANSI C63.4 for a PC peripheral were not applied. The laptop was used to allow control of the transceivers.

#### EUT Operation During Emissions Tests

During Digital / Rx mode emissions testing the EUT was in GPS and Bluetooth receive mode with the UHF or 900MHz also in receive mode on the center channel (note that preliminary measurements did not show any new emissions when the receiving channel was changed).

During transmitter-related measurements for output power and spurious emissions on the 900MHz transceiver the device was set to continuously transmit a modulated signal on the specified channel. Channel occupancy and separation measurements were made with the transceiver transmitting a modulated signal in a hopping mode.



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
		Account Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Spec:	EN55022/FCC 15.24/RSS210	Class:	B

**Digital Device/Receiver Radiated Emissions**  
*Sample WAMEL00071, base unit w/900 MHz TRx module & Friwo supply*  
*Sample WAMEL00065, base unit w/UHF TRx module, Friwo and Trimble supply*

### 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: 10/27/2005	Config. Used: 2
Test Engineer: David Bare	Config Change: None
Test Location: SVOATS #2	EUT Voltage: 230V/50Hz

### General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated emissions testing. The test distance and extrapolation factor (if used) are detailed under each run description. 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.

<b>Ambient Conditions:</b>	Temperature:	10/26/2005	10/27/2005
	Rel. Humidity:	15 °C	19.5 °C
		67 %	40 %

### Summary of Results

Run #	Test Performed	Limit	Result	Margin
1,3	RE, 30 - 1000MHz, Maximized Emissions	Class B	Pass	35.0dBµV/m @ 240.000MHz (-2.0dB)
2,4	RE, 1000 - 7500 MHz, Maximized Emissions	FCC B	Pass	33.1dBµV/m @ 1400.0MHz (-20.9dB)

### Modifications Made During Testing:

Note that samples tested did not contain an on-board USB filter.

### Deviations From The Standard

No deviations were made from the requirements of the standard.



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	B

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

Sample WAMEL00071, base unit w/900 MHz TRx module, Friwo power supply

Frequency	Level	Pol	EN55022 B		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
240.000	35.0	v	37.0	-2.0	QP	250	1.0	
60.220	27.0	v	30.0	-3.0	QP	0	1.0	
36.000	25.5	v	30.0	-4.5	QP	240	1.0	
72.000	24.7	v	30.0	-5.3	QP	240	1.0	
32.000	24.3	v	30.0	-5.7	QP	280	1.0	
108.770	23.4	v	30.0	-6.6	QP	240	1.0	
62.200	23.3	v	30.0	-6.7	QP	30	1.0	

## Run #2: Maximized Radiated Emissions, 1000 - 7500 MHz

Sample WAMEL00071, base unit w/900 MHz TRx module, Friwo power supply

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1400.000	33.1	v	54.0	-20.9	Avg	0	1.3	
1400.000	44.6	v	74.0	-29.4	Pk	0	1.3	



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	B

### Run #3: Maximized Readings From Run #1

Sample WAMEL00065, base unit w/UHF TRx module, Friwo Power Supply

Frequency	Level	Pol	EN55022 B		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
240.000	35.0	v	37.0	-2.0	QP	50	1.2	
60.000	26.4	v	30.0	-3.6	QP	160	1.0	
33.290	25.8	v	30.0	-4.2	QP	280	1.0	
38.900	25.6	v	30.0	-4.4	QP	0	1.0	
43.700	21.7	v	30.0	-8.3	QP	180	1.0	
66.360	21.2	v	30.0	-8.8	QP	320	1.0	
180.000	17.8	v	30.0	-12.2	QP	0	1.0	
166.000	16.8	v	30.0	-13.2	QP	0	1.0	

Changed the adapter from Friwo to Trimble (Ault) unit:

Frequency	Level	Pol	EN 55022 B		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
240.000	35.0	v	37.0	-2.0	QP	50	1.2	
60.000	26.4	v	30.0	-3.6	QP	160	1.0	
33.290	25.8	v	30.0	-4.2	QP	280	1.0	
38.900	25.6	v	30.0	-4.4	QP	0	1.0	
132.900	23.6	v	30.0	-6.4	QP	40	1.0	
70.900	21.8	v	30.0	-8.2	QP	0	1.0	
43.700	21.7	v	30.0	-8.3	QP	180	1.0	
66.360	21.2	v	30.0	-8.8	QP	320	1.0	
180.000	17.8	v	30.0	-12.2	QP	0	1.0	
166.000	16.8	v	30.0	-13.2	QP	0	1.0	

### Run #4: Maximized readings, 1000 - 7500 MHz

Sample WAMEL00065, base unit w/UHF TRx module, Friwo Power Supply

Frequency	Level	Pol	FCC Class B		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1400.000	32.4	v	54.0	-21.6	Avg	0	1.3	
1400.000	44.0	v	74.0	-30.0	Pk	0	1.3	

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
		Account Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Spec:	EN55022/FCC 15.24/RSS210	Class:	B

## AC Power Port Conducted Emissions

*Base unit with 900MHz TRx and Trimble Power Supply*  
*Base unit with UHF TRx and Trimble Power Supply*

### 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: 10/27/2005	Config. Used: 2
Test Engineer: David Bare	Config Change: None
Test Location: SVOATS #2	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. A second LISN was used for all local support equipment.

**Ambient Conditions:**            Temperature:            18 °C  
    Rel. Humidity:            48 %

### Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 230V/50Hz, Trimble 29148-10 PS	EN 55022 B	Pass	33.7dBµV @ 0.500MHz (-12.3dB)
2	CE, AC Power, 120V/60Hz, Trimble 29148-10 PS	EN 55022 B	Pass	31.3dBµV @ 0.500MHz (-14.7dB)
3	CE, AC Power, 230V/50Hz, Trimble 29148-10 PS	EN 55022 B EN 301 489	Pass	33.5dBµV @ 0.466MHz (-13.1dB)
4	CE, AC Power, 120V/60Hz, Trimble 29148-10 PS	FCC 15.107, FCC 15.207, RSS 210	Pass	34.8dBµV @ 16.188MHz (-15.2dB)

### Modifications Made During Testing:

The following modifications were made to the EUT during testing in order to comply with the requirements of the standard:  
 The power adapter was changed after Run #1 to a Trimble 29148-10 type.

### Deviations From The Standard

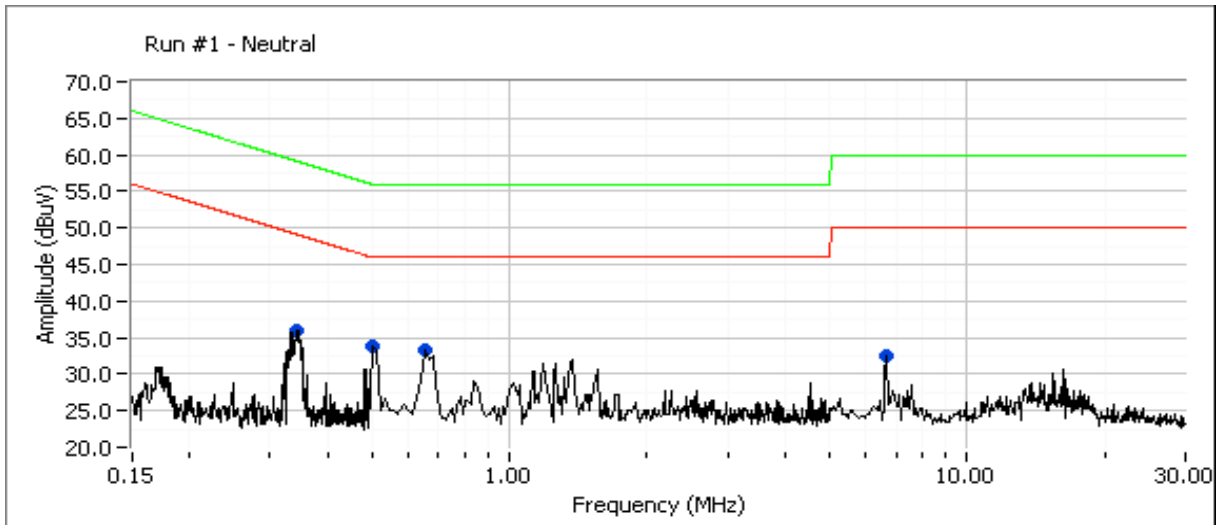
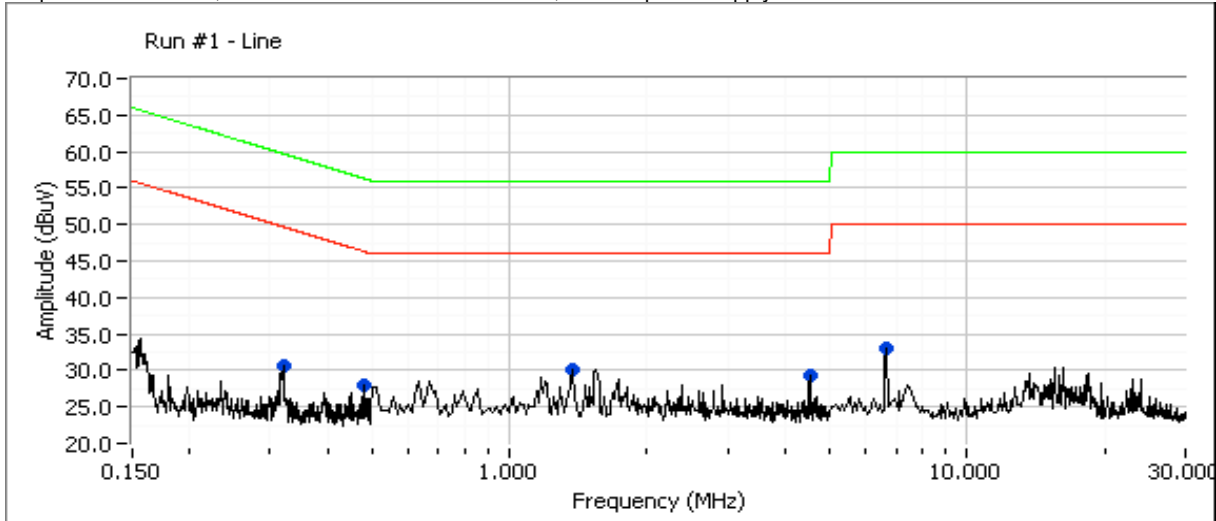
No deviations were made from the requirements of the standard.



Client: Trimble Navigation	Job Number: J61557
Model: Trimble SPSx50	T-Log Number: T61593
Contact: Gerardo Torres	Account Manager: Nesha Lambert
Spec: EN55022/FCC 15.24/RSS210	Class: B

**Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz, Trimble 29148-10 power adapter**

Sample WAMEL00071, base unit w/900 MHz TRx module, Trimble power supply

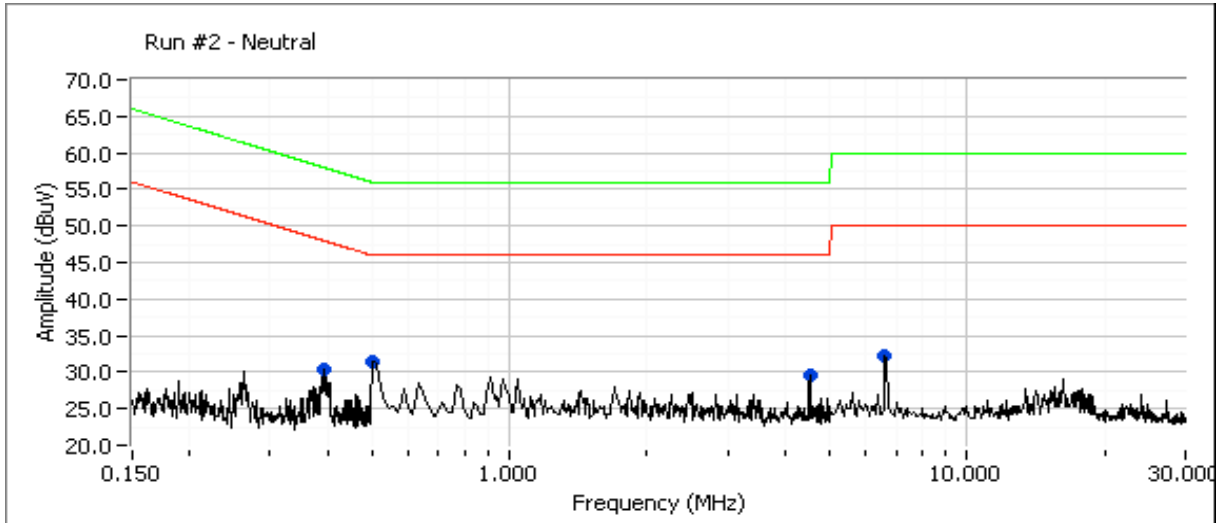
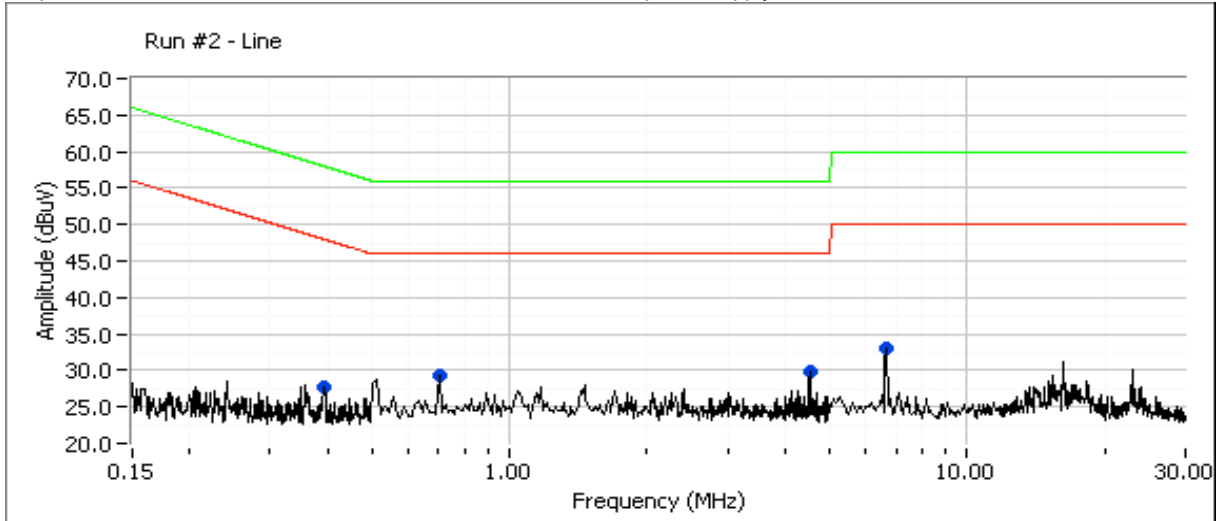


Frequency MHz	Level dB $\mu$ V	AC Line	EN55022 B		Detector QP/Ave	Comments
			Limit	Margin		
0.500	33.7	Neutral	46.0	-12.3	Peak	Peak reading average limit
0.658	33.3	Neutral	46.0	-12.7	Peak	Peak reading average limit
0.343	35.9	Neutral	49.1	-13.2	Peak	Peak reading average limit
1.378	30.2	Line 1	46.0	-15.8	Peak	Peak reading average limit
4.528	29.4	Line 1	46.0	-16.6	Peak	Peak reading average limit
6.688	33.0	Line 1	50.0	-17.0	Peak	Peak reading average limit
6.688	32.6	Neutral	50.0	-17.5	Peak	Peak reading average limit
0.482	28.1	Line 1	46.3	-18.2	Peak	Peak reading average limit
0.322	30.6	Line 1	49.7	-19.1	Peak	Peak reading average limit

Client: Trimble Navigation	Job Number: J61557
Model: Trimble SPSx50	T-Log Number: T61593
Contact: Gerardo Torres	Account Manager: Nesha Lambert
Spec: EN55022/FCC 15.24/RSS210	Class: B

**Run #2: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz, Trimble 29148-10 power adapter**

Sample WAMEL00071, base unit w/900 MHz TRx module, Trimble power supply

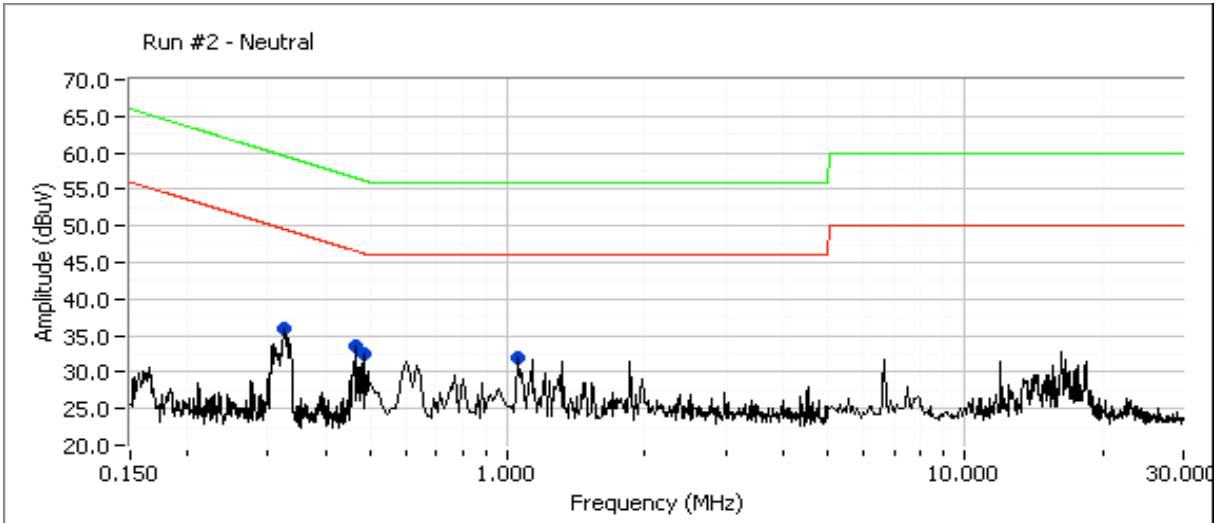
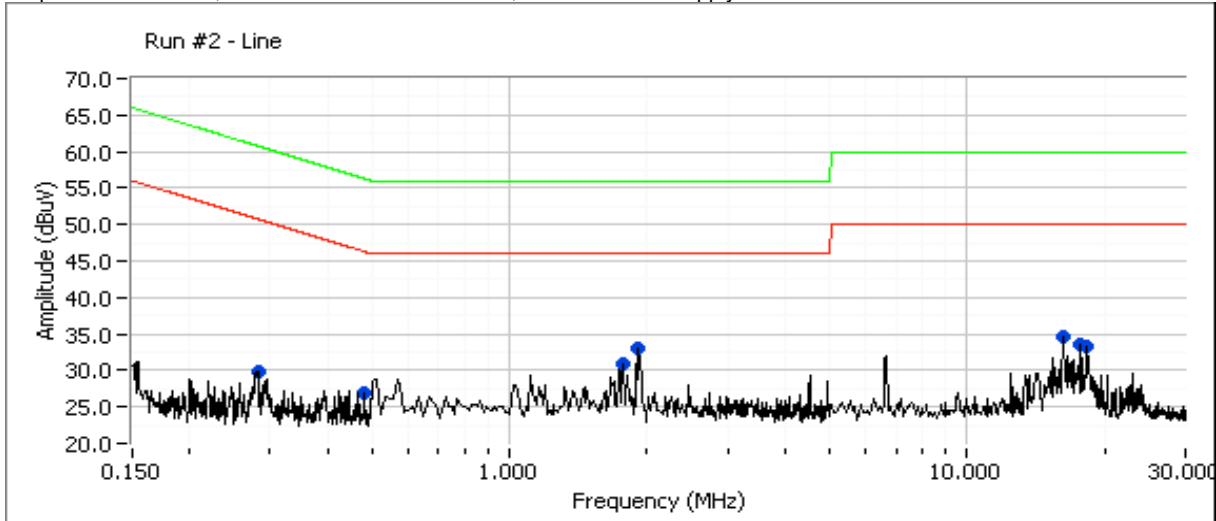


Frequency MHz	Level dB $\mu$ V	AC Line	EN55022 B		Detector QP/Ave	Comments
			Limit	Margin		
0.500	31.3	Neutral	46.0	-14.7	Peak	Peak reading average limit
4.528	29.8	Line 1	46.0	-16.2	Peak	Peak reading average limit
4.528	29.7	Neutral	46.0	-16.3	Peak	Peak reading average limit
0.703	29.2	Line 1	46.0	-16.8	Peak	Peak reading average limit
6.688	32.9	Line 1	50.0	-17.1	Peak	Peak reading average limit
0.392	30.4	Neutral	48.0	-17.7	Peak	Peak reading average limit
6.625	32.3	Neutral	50.0	-17.7	Peak	Peak reading average limit
0.392	27.7	Line 1	48.0	-20.3	Peak	Peak reading average limit

Client: Trimble Navigation	Job Number: J61557
Model: Trimble SPSx50	T-Log Number: T61593
Contact: Gerardo Torres	Account Manager: Nesha Lambert
Spec: EN55022/FCC 15.24/RSS210	Class: B

**Run #3: AC Power Port Conducted Emissions, 0.15 - 30MHz, 230V/50Hz, Trimble 29148-10 power adapter**

Sample WAMEL00065, base unit w/UHF TRx module, Trimble Power Supply

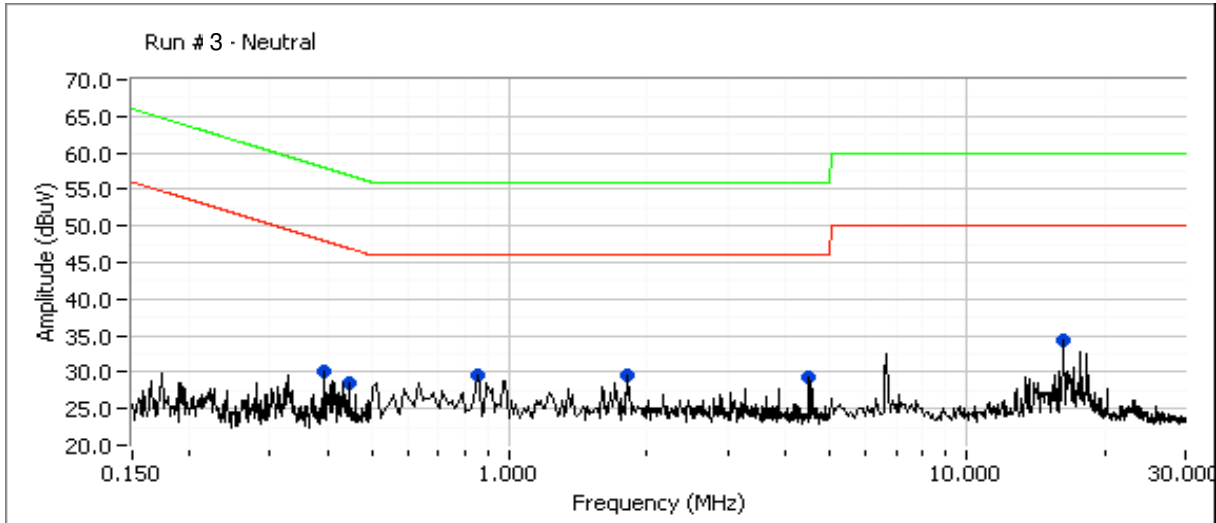
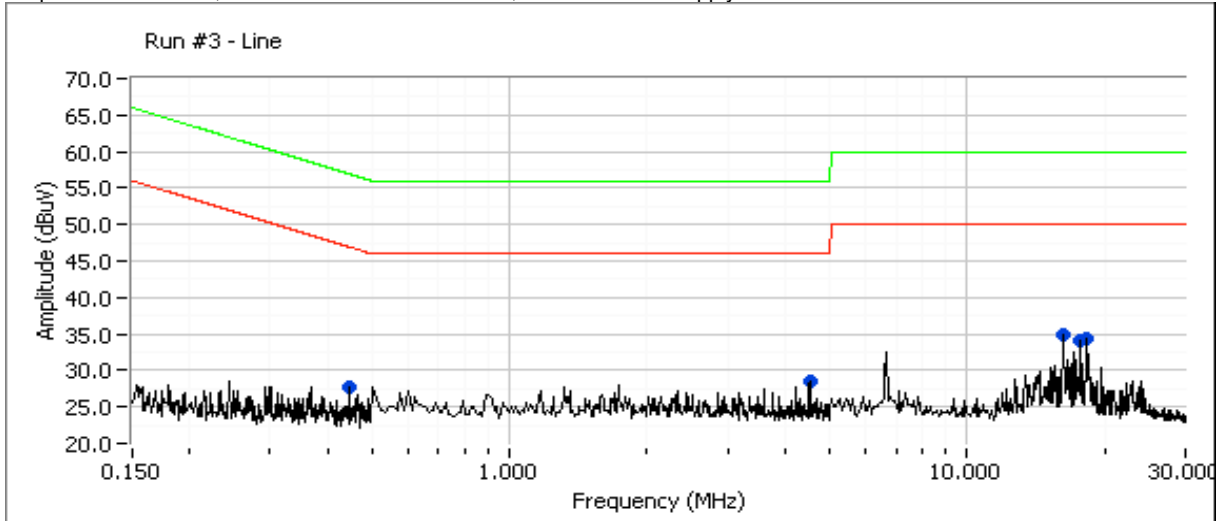


Frequency MHz	Level dB $\mu$ V	AC Line	EN 55022 B		Detector QP/Ave	Comments
			Limit	Margin		
0.466	33.5	Neutral	46.6	-13.1	Peak	Peak reading average limit
1.918	32.9	Line 1	46.0	-13.1	Peak	Peak reading average limit
0.325	36.0	Neutral	49.6	-13.6	Peak	Peak reading average limit
0.487	32.5	Neutral	46.2	-13.8	Peak	Peak reading average limit
1.051	32.0	Neutral	46.0	-14.0	Peak	Peak reading average limit
1.771	30.8	Line 1	46.0	-15.2	Peak	Peak reading average limit
16.250	34.7	Line 1	50.0	-15.3	Peak	Peak reading average limit
17.688	33.6	Line 1	50.0	-16.4	Peak	Peak reading average limit
18.250	33.2	Line 1	50.0	-16.8	Peak	Peak reading average limit
0.483	26.9	Line 1	46.3	-19.4	Peak	Peak reading average limit
0.282	29.9	Line 1	50.8	-20.8	Peak	Peak reading average limit

Client: Trimble Navigation	Job Number: J61557
Model: Trimble SPSx50	T-Log Number: T61593
Contact: Gerardo Torres	Account Manager: Nesha Lambert
Spec: EN55022/FCC 15.24/RSS210	Class: B

**Run #3: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz, Trimble 29148-10 power adapter**

Sample WAMEL00065, base unit w/UHF TRx module, Trimble Power Supply



Frequency MHz	Level dB $\mu$ V	AC Line	EN55022 B		Detector QP/Ave	Comments
			Limit	Margin		
16.188	34.8	Line 1	50.0	-15.2	Peak	Peak reading average limit
18.250	34.4	Line 1	50.0	-15.6	Peak	Peak reading average limit
16.250	34.3	Neutral	50.0	-15.8	Peak	Peak reading average limit
17.688	34.1	Line 1	50.0	-15.9	Peak	Peak reading average limit
0.849	29.6	Neutral	46.0	-16.4	Peak	Peak reading average limit
1.816	29.5	Neutral	46.0	-16.5	Peak	Peak reading average limit
4.516	29.3	Neutral	46.0	-16.7	Peak	Peak reading average limit
4.528	28.6	Line 1	46.0	-17.4	Peak	Peak reading average limit
0.395	30.1	Neutral	48.0	-17.9	Peak	Peak reading average limit
0.447	28.6	Neutral	46.9	-18.4	Peak	Peak reading average limit
0.447	27.7	Line 1	46.9	-19.3	Peak	Peak reading average limit



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
		Account Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

## FCC 15.247 Spurious Emissions (long whip antenna) Power, Bandwidth and Channel Occupancy

### 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: 10/31/2005; 11/2/2005  
 Test Engineer: Mehran Birgani; M Briggs  
 Test Location: SVOATS #1

Config. Used: 2  
 Config Change: None  
 EUT Voltage: 230V/50Hz

### 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.

**Ambient Conditions:**            Temperature: 16.7-22.2 °C  
    Rel. Humidity: 55-59 %

### Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 30 - 10000 MHz - Spurious Emissions In Restricted Bands	FCC Part 15.209 / 15.247( c)	Pass	53.5dBµV/m (474.8µV/m) @ 2708.0MHz (-0.5dB)
2	Bandwidth	15.247(a)	Pass	20dB: 439kHz 99%: 630kHz
3	Output Power	15.247(b)	Pass	29.52dBm
4	Channel Occupancy / Separation	15.247(a)	Pass	Separation: 508.25kHz Occupancy 400ms/20s
4	Number of Channels	15.247(a)	Pass	50 channels



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### 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.

### Run #1a: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.6 MHz

**Fundamental Signal Field Strength:** Peak and average values measured in 1 MHz, and peak value measured in 100kHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
902.647	125.7	V	-	-	Avg	63	1.4	RB = 1MHz, VB = 10Hz
902.647	129.6	V	-	-	Pk	63	1.4	RB = VB = 1MHz
902.624	129.7	V	-	-	Pk	63	1.4	RB = VB = 100kHz
902.614	110.7	H	-	-	Avg	294	1.0	RB = 1MHz, VB = 10Hz
902.614	114.6	H	-	-	Pk	294	1.0	RB = VB = 1MHz
902.614	114.7	H	-	-	Pk	294	1.0	RB = VB = 100kHz

	H	V
Fundamental emission level @ 3m in 100kHz RBW:	114.7	129.7
Limit for emissions outside of restricted bands:	109.7 dB $\mu$ V/m	

### Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2707.955	53.5	V	54.0	-0.5	AVG	191	1.4	
2707.885	52.1	H	54.0	-1.9	AVG	142	1.5	
2707.955	58.5	V	74.0	-15.5	PK	191	1.4	
3609.683	38.0	V	54.0	-16.0	AVG	142	1.0	
2707.885	56.6	H	74.0	-17.4	PK	142	1.5	
4513.183	36.3	V	54.0	-17.7	AVG	201	1.0	
960.040	35.3	V	54.0	-18.7	QP	45	1.0	
960.040	34.3	H	54.0	-19.7	QP	360	1.0	
3609.683	50.1	V	74.0	-23.9	PK	142	1.0	
4513.183	46.9	V	74.0	-27.1	PK	201	1.0	

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #1b: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 915.4 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2746.090	50.8	V	54.0	-3.2	AVG	153	1.4	
2746.167	47.1	H	54.0	-6.9	AVG	140	1.0	
3660.767	38.3	V	54.0	-15.8	AVG	102	1.0	
4576.500	35.9	V	54.0	-18.1	AVG	100	1.0	
2746.090	55.7	V	74.0	-18.3	PK	153	1.4	
2746.167	54.7	H	74.0	-19.3	PK	140	1.0	
3660.767	50.2	V	74.0	-23.8	PK	102	1.0	
4576.500	46.9	V	74.0	-27.1	PK	100	1.0	

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

### Run #1c: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.6 MHz

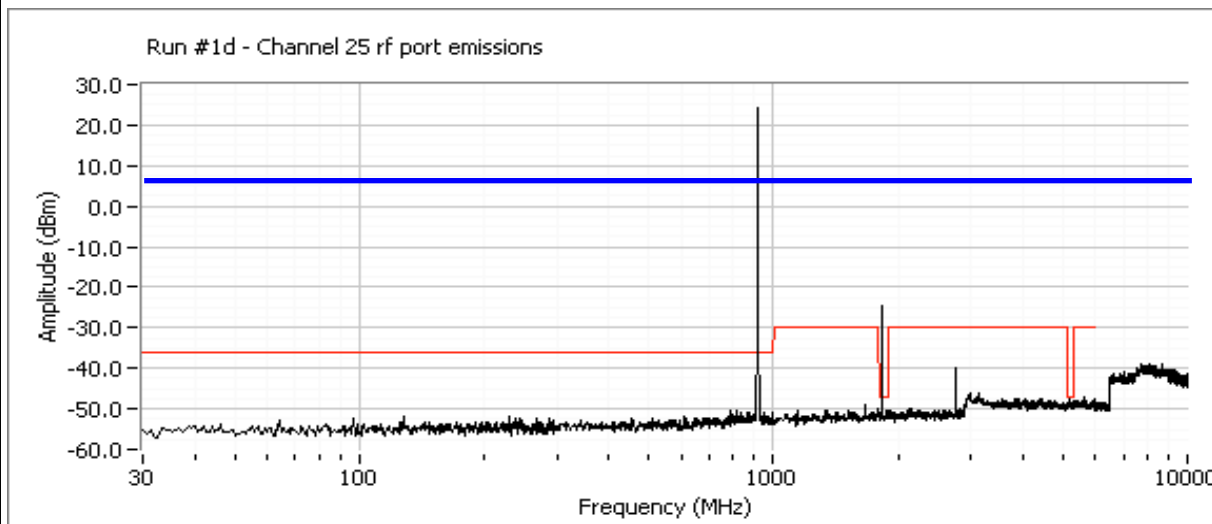
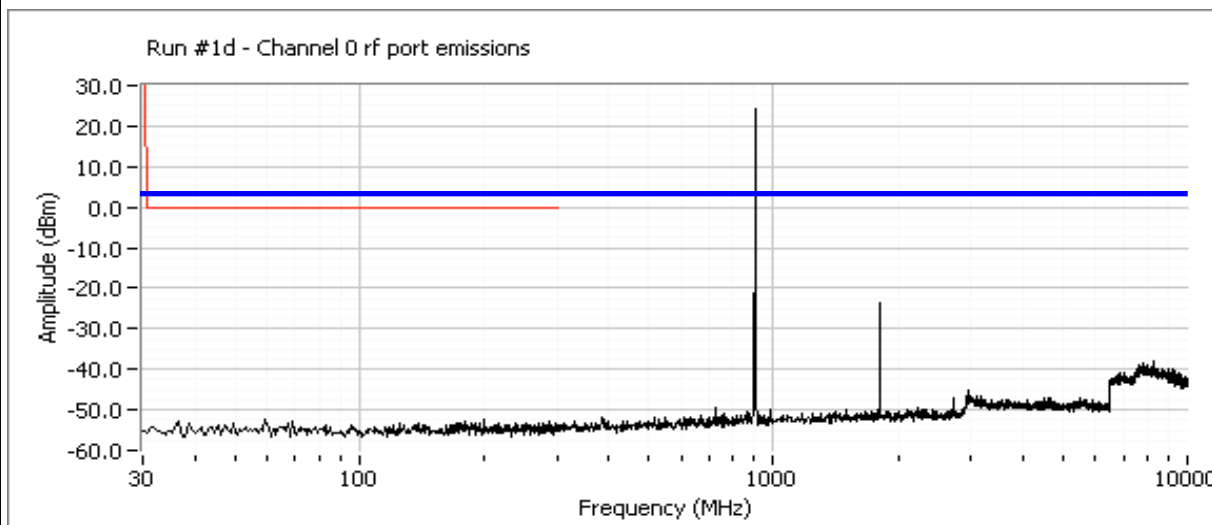
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB $\mu$ V/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2782.765	50.1	V	54.0	-3.9	AVG	174	1.5	
2782.765	45.8	H	54.0	-8.2	AVG	146	1.4	
4637.534	38.5	V	54.0	-15.5	AVG	181	1.0	
3708.817	38.3	V	54.0	-15.8	AVG	181	1.0	
2782.765	55.4	V	74.0	-18.7	PK	174	1.5	
960.040	35.3	V	54.0	-18.7	QP	45	1.0	
960.040	34.3	H	54.0	-19.7	QP	360	1.0	
2782.765	53.3	H	74.0	-20.7	PK	146	1.4	
3708.817	49.9	V	74.0	-24.1	PK	181	1.0	
4637.534	49.6	V	74.0	-24.4	PK	181	1.0	

Note 1: For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 20dB below the level of the fundamental.

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

**Run #1d: Antenna Conducted Spurious Emissions, 30 - 10,000 MHz.**

Refer to plots below. Scans made using RBW=VB=100 KHz with the limit line (blue line) set at 20dB below the highest in-band signal level. All emissions more than 20dB below the in-band signal level. Red limit line on the graphs should be ignored.

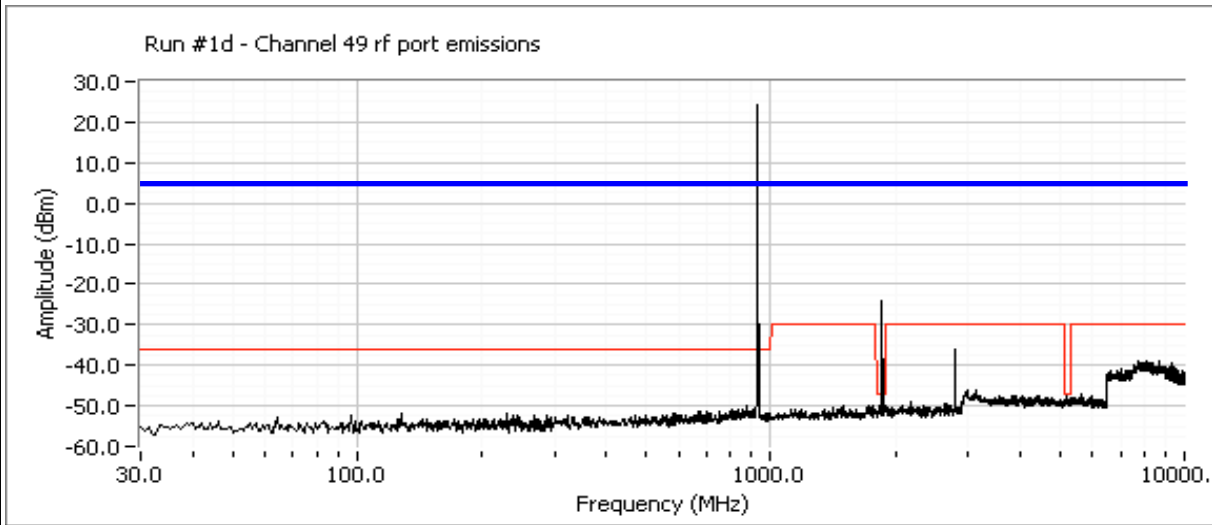






# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A





## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #2: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	99% Bandwidth
Low	902.7	30kHz	439kHz	630kHz
Mid	915.4	30kHz	434kHz	570kHz
High	927.6	30kHz	434kHz	510kHz

Note 1: 20dB and 99% bandwidth measured with RB=10kHz, VB=1MHz, no averaging (RB based on 5% of the nominal 500kHz spacing)

Note 2: Plots showing bandwidth start on the next page.

### Run #3: Output Power

For frequency hopping systems operating in the 902-928 MHz band the maximum power is 1 watt for systems employing at least 50 hopping channels.

Maximum antenna gain: 5 dBi

Channel	Frequency (MHz)	Res BW	Output Power (dBm)	Output Power (W)	EIRP (W)
Low	902.7	1MHz	29.52	0.895	2.831
Mid	915.4	1MHz	29.42	0.875	2.767
High	927.6	1MHz	29.14	0.820	2.594



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A



**Analyzer Settings**  
HP8593EM  
CF: 902.7 MHz  
SPAN: 2.0 MHz  
RB 30 kHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.00  
Sweep Time 20.0ms  
Ref Lvl: 36.00DBM

**Comments**  
20dB Bandwidth:  
439kHz

Cursor 1	902.842	29.30	+	-	+	-
Cursor 2	902.403	9.30	+	-	+	-

Delta Freq. 0.4 MHz  
Delta Amplitude 20.00



**Analyzer Settings**  
HP8593EM  
CF: 902.7 MHz  
SPAN: 2.0 MHz  
RB 30 kHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.00  
Sweep Time 20.0ms  
Ref Lvl: 36.00DBM

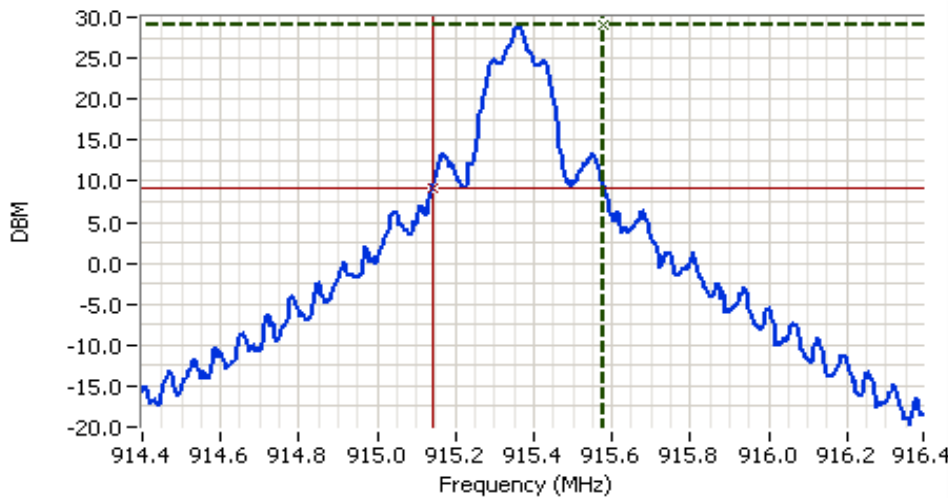
**Comments**  
99% power bandwidth:  
0.630 MHz

Cursor 1	902.308	29.30	+	-	+	-
Cursor 2	902.938	3.30	+	-	+	-

Delta Freq. 0.6 MHz  
Delta Amplitude 26.00



Client: Trimble Navigation	Job Number: J61557
Model: Trimble SPSx50	T-Log Number: T61593
Contact: Gerardo Torres	Account Manager: Nesha Lambert
Spec: EN55022/FCC 15.24/RSS210	Class: N/A

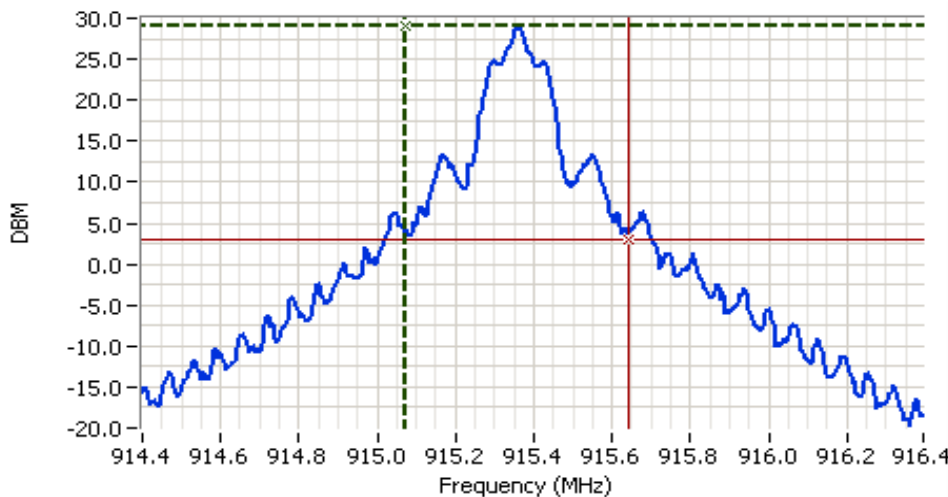


**Analyzer Settings**  
 HP8593EM  
 CF: 915.4 MHz  
 SPAN: 2.0 MHz  
 RB 30 kHz  
 VB 3.0 MHz  
 Detector POS  
 Att 40  
 RL Offset 6.00  
 Sweep Time 20.0ms  
 Ref Lvl: 36.00DBM

**Comments**  
 20dB bandwidth:  
 0.434 MHz

Cursor 1	915.577	29.05	
Cursor 2	915.143	9.05	

Delta Freq. 0.4 MHz  
 Delta Amplitude 20.00



**Analyzer Settings**  
 HP8593EM  
 CF: 915.4 MHz  
 SPAN: 2.0 MHz  
 RB 30 kHz  
 VB 3.0 MHz  
 Detector POS  
 Att 40  
 RL Offset 6.00  
 Sweep Time 20.0ms  
 Ref Lvl: 36.00DBM

**Comments**  
 99% power bandwidth:  
 0.570 MHz

Cursor 1	915.073	29.05	
Cursor 2	915.643	3.05	

Delta Freq. 0.6 MHz  
 Delta Amplitude 26.00





# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A



**Analyzer Settings**  
HP8593EM  
CF: 927.6 MHz  
SPAN: 2.0 MHz  
RB 30 kHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.00  
Sweep Time 20.0ms  
Ref Lvl: 36.00DBM

**Comments**  
20dB bandwidth:  
0.434MHz

Cursor 1	927.807	28.95	
Cursor 2	927.373	8.95	

Delta Freq. 0.4 MHz  
Delta Amplitude 20.00



**Analyzer Settings**  
HP8593EM  
CF: 927.6 MHz  
SPAN: 2.0 MHz  
RB 30 kHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.00  
Sweep Time 20.0ms  
Ref Lvl: 36.00DBM

**Comments**  
99% power bandwidth:  
0.510 MHz

Cursor 1	927.333	28.95	
Cursor 2	927.843	2.95	

Delta Freq. 0.5 MHz  
Delta Amplitude 26.00

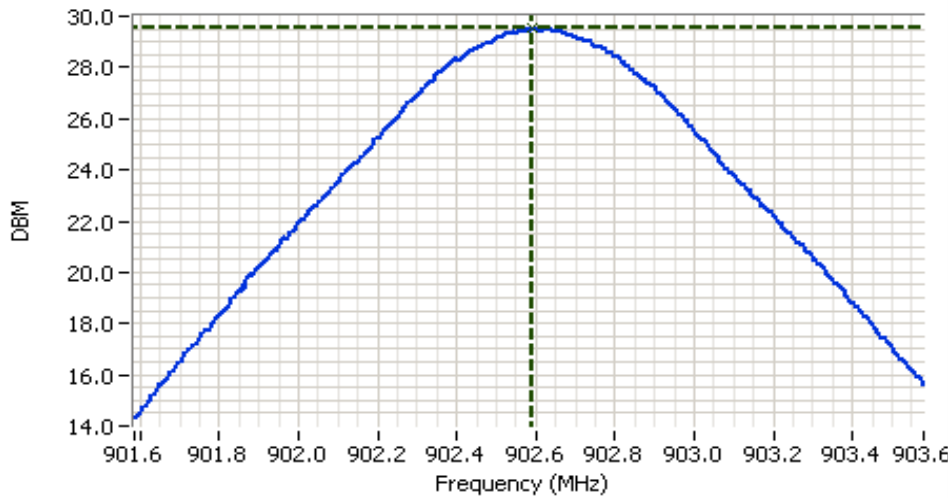




# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

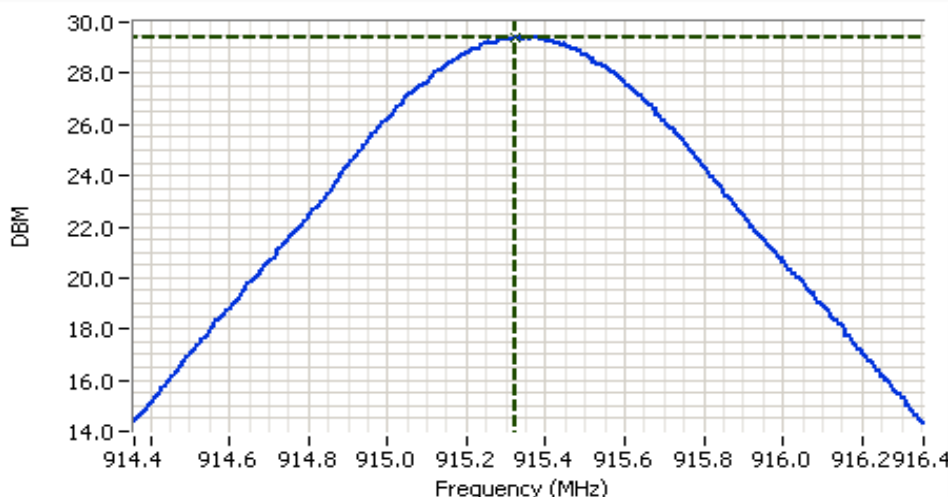
## Power Plots



**Analyzer Settings**  
HP8593EM  
CF: 902.6 MHz  
SPAN: 2.0 MHz  
RB 1.0 MHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.33  
Sweep Time 20.0ms  
Ref Lvl: 36.00dBm

**Comments**  
Peak power: 29.52dBm

Cursor 1 902.593 29.52  
0.000 0.00



**Analyzer Settings**  
HP8593EM  
CF: 915.4 MHz  
SPAN: 2.0 MHz  
RB 1.0 MHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.33  
Sweep Time 20.0ms  
Ref Lvl: 36.00dBm

**Comments**  
Peak power: 29.42dBm

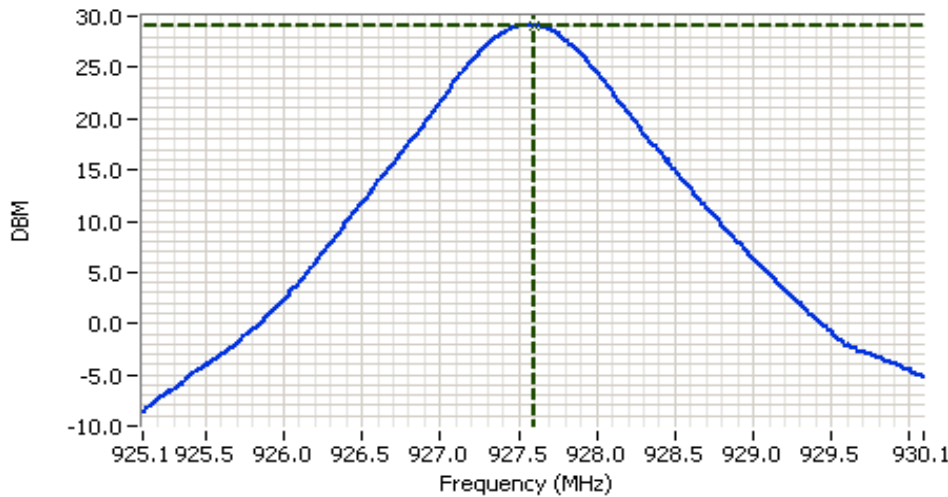
Cursor 1 915.323 29.42  
0.000 0.00





# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A



**Analyzer Settings**  
HP8593EM

CF: 927.6 MHz  
SPAN: 5.0 MHz  
RB 1.0 MHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.33  
Sweep Time 20.0ms  
Ref Lvl: 36.00dBm

**Comments**  
Peak power: 29.14dBm

Cursor 1 927.594 29.14

0.000 0.00





# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #4: Channel Occupancy, Spacing and Number of Channels

For frequency hopping systems operating in the **902-928 MHz** band:

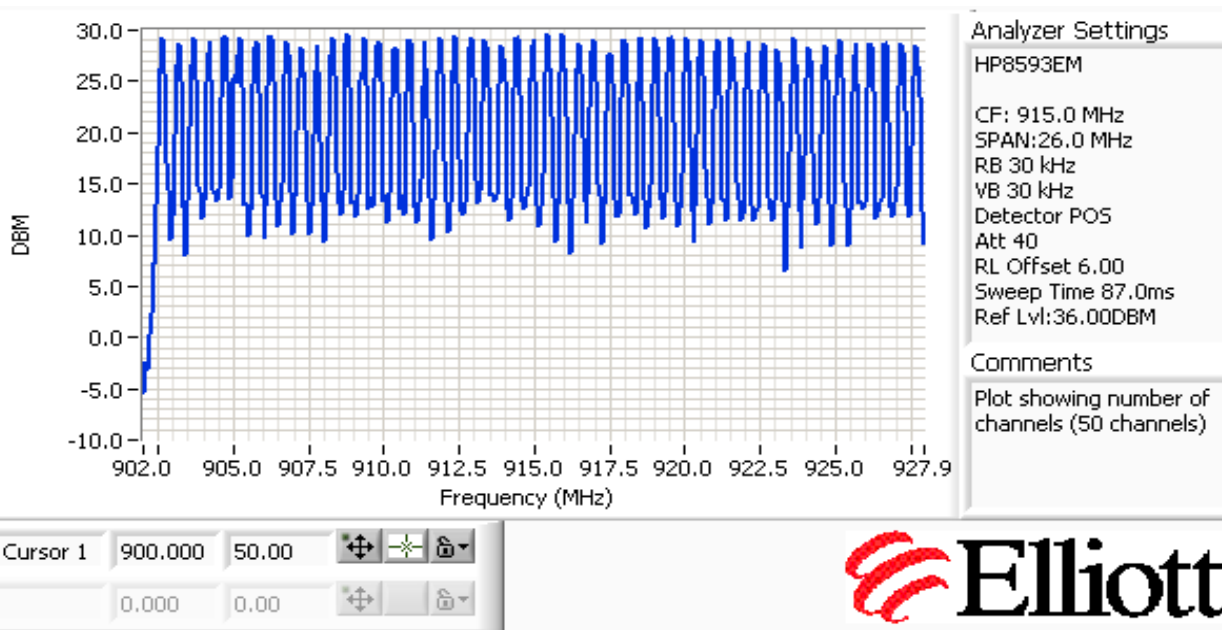
If the system uses at least 50 hopping frequencies then the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period.

The device uses an adaptive hopping algorithm (refer to operational description). A plot of the center channel shows it being used a total of 12 times in a 100 second period. Transmit time per channel = 47.5ms, so the channel was used for (47.5 x 12) ms in a 100 second period. The average time per 20 seconds is  $20 \times (47.5 \times 12) / 100$

Maximum 20dB bandwidth:	439 kHz	
Channel spacing:	508.25 kHz	Pass (operation description: 509.524kHz)
Transmission time per hop:	47.46 ms	
The time between successive hops on a channel:	- ms	
Number of channels (N):	50	Pass
Channel dwell time in 20 seconds:	113.904 ms	Pass

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

Channel spacing based on measurement of (916.377 - 914.344)MHz between 5 channels, giving a channel spacing of 2.033MHz/4, or 508.25kHz.

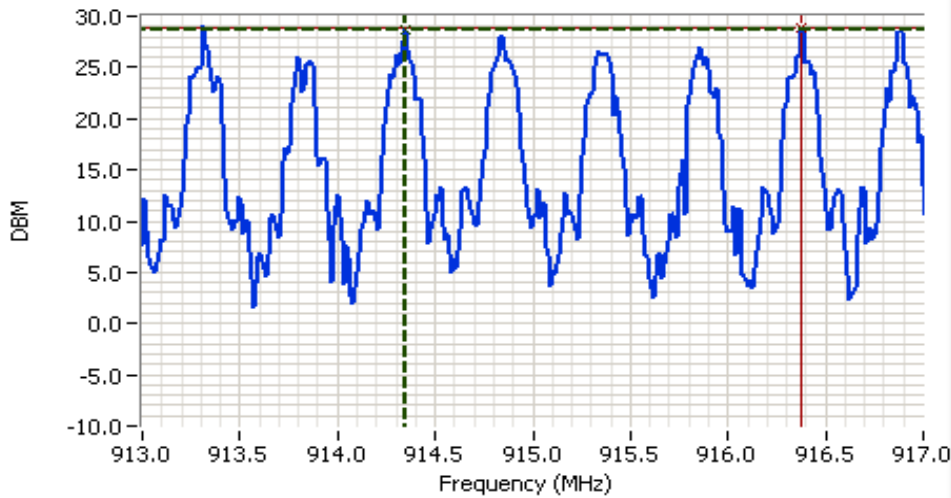


Plot showing all 50 channels





Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A



### Analyzer Settings

HP8593EM  
 CF: 915.4 MHz  
 SPAN: 5.0 MHz  
 RB 30 kHz  
 VB 3.0 MHz  
 Detector POS  
 Att 40  
 RL Offset 6.00  
 Sweep Time 20.0ms  
 Ref Lvl: 36.00DBM

### Comments

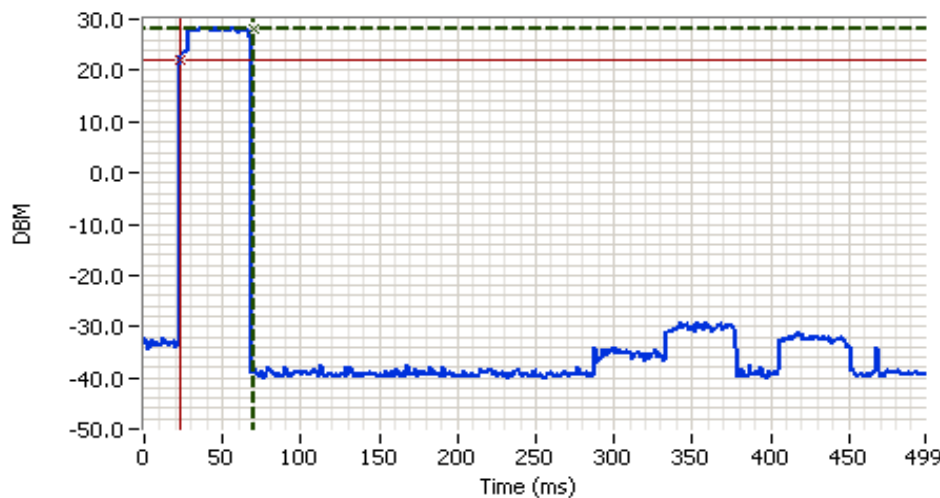
Plot showing channel spacing = 500kHz (5 channels in 2MHz)

Cursor 1	914.344	28.69	
Cursor 2	916.377	28.84	

Delta Freq. 2.0 MHz  
 Delta Amplitude 0.15



Plot showing spacing of 2.33MHz between 5 channels



### Analyzer Settings

HP8593EM  
 CF: 915.4 MHz  
 SPAN: 0.0 MHz  
 RB 30 kHz  
 VB 3.0 MHz  
 Detector POS  
 Att 40  
 RL Offset 6.00  
 Sweep Time 0.5s  
 Ref Lvl: 36.00DBM

### Comments

Plot showing transmit time on one channel for a single transmission

Cursor 1	69.906	28.14	
Cursor 2	22.444	22.14	

Delta Time (ms) 47.46  
 Delta Amplitude 6.00

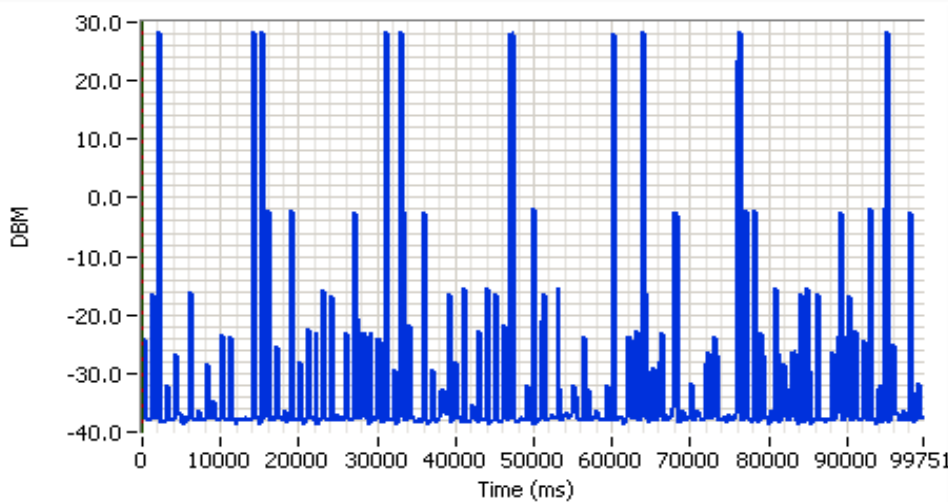


Plot showing the duration of a single transmission (Operational description states 42ms)



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A



**Analyzer Settings**  
HP8593EM  
CF: 915.4 MHz  
SPAN:0.0 MHz  
RB 30 kHz  
VB 3.0 MHz  
Detector POS  
Att 40  
RL Offset 6.00  
Sweep Time 100.0s  
Ref Lvl:36.00DBM

**Comments**  
Plot showing a total of 12 transmissions on the center channel over a 100 second period.

Cursor 1 -10.000 50.00 [Icons]  
Cursor 2 -10.000 50.00 [Icons]

Delta Time (ms) 0.00  
Delta Amplitude 0.00



Plot showing transmissions on the center channel in a 100 second period



# EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
		Account Manager:	Nesha Lambert
Contact:	Gerardo Torres		
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

## FCC 15.247 - Spurious Emissions Rubber Duck and 0dBi Antenna

### 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: 11/1/2005	Config. Used: 2
Test Engineer: Juan Martinez	Config Change: -
Test Location: SVOATS #2	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.

**Ambient Conditions:**

Temperature:	22.2 °C
Rel. Humidity:	55 %

### Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	RE, 30 - 10000 MHz - Spurious Emissions (Rubber Duck)	FCC Part 15.209 / 15.247( c)	Pass	45.2dBµV/m (182.8µV/m) @ 2707.8MHz (-8.8dB)
2	RE, 30 - 10000 MHz - Spurious Emissions (0dBi Whip)	FCC Part 15.209 / 15.247( c)	Pass	50.1dBµV/m (319.2µV/m) @ 2707.8MHz (-3.9dB)

### 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:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #1a: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.6 MHz

Frequency MHz	Level dB $\mu$ V/m	Pol v/h	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
2707.823	45.2	V	54.0	-8.8	AVG	46	1.4	
5416.418	41.9	V	54.0	-12.1	AVG	358	1.0	
5414.955	41.8	H	54.0	-12.2	AVG	103	1.0	
2707.875	39.5	H	54.0	-14.5	AVG	216	1.0	
4512.257	39.3	V	54.0	-14.7	AVG	-1	1.0	
4514.410	39.2	H	54.0	-14.8	AVG	147	1.0	
3610.303	37.4	V	54.0	-16.7	AVG	360	1.0	
3609.028	37.3	H	54.0	-16.7	AVG	304	1.0	
5414.955	53.0	H	74.0	-21.1	PK	103	1.0	
5416.418	52.8	V	74.0	-21.2	PK	358	1.0	
4512.257	50.8	V	74.0	-23.2	PK	-1	1.0	
2707.823	50.7	V	74.0	-23.3	PK	46	1.4	
4514.410	49.8	H	74.0	-24.2	PK	147	1.0	
3610.303	48.3	V	74.0	-25.7	PK	360	1.0	
3609.028	48.0	H	74.0	-26.0	PK	304	1.0	
2707.875	46.8	H	74.0	-27.2	PK	216	1.0	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #1b: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 915.4 MHz

Frequency MHz	Level dBµV/m	Pol v/h	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
2746.187	42.6	V	54.0	-11.4	AVG	44	1.0	
5491.577	42.3	V	54.0	-11.7	AVG	130	1.0	
5491.577	39.7	H	54.0	-14.3	AVG	121	1.7	
4577.420	39.5	V	54.0	-14.5	AVG	360	1.0	
3659.902	37.5	H	54.0	-16.5	AVG	263	1.0	
4577.420	37.5	H	54.0	-16.5	AVG	-1	1.0	
3661.845	37.4	V	54.0	-16.6	AVG	232	1.0	
1830.673	36.6	V	54.0	-17.4	AVG	319	1.0	
5491.577	54.2	V	74.0	-19.8	PK	130	1.0	
1830.838	32.9	H	54.0	-21.1	AVG	52	1.0	
4577.420	50.9	V	74.0	-23.2	PK	360	1.0	
5491.577	50.5	H	74.0	-23.5	PK	121	1.7	
2746.187	49.1	V	74.0	-24.9	PK	44	1.0	
4577.420	48.7	H	74.0	-25.3	PK	-1	1.0	
3659.902	48.5	H	74.0	-25.5	PK	263	1.0	
3661.845	48.1	V	74.0	-26.0	PK	232	1.0	
1830.673	43.9	V	74.0	-30.1	PK	319	1.0	
1830.838	42.4	H	74.0	-31.6	PK	52	1.0	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #1c: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.6 MHz

Frequency MHz	Level dBμV/m	Pol V/H	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
960.000	37.0	v	46.0	-9.0	QP	400	1.0	
5564.288	42.0	H	54.0	-12.0	AVG	322	1.0	
5565.188	41.9	V	54.0	-12.1	AVG	111	1.0	
2782.753	40.4	V	54.0	-13.6	AVG	132	1.0	
2782.650	39.6	H	54.0	-14.4	AVG	130	1.2	
4636.733	39.2	H	54.0	-14.8	AVG	0	1.0	
4638.833	39.2	V	54.0	-14.8	AVG	304	1.0	
960.000	31.0	h	46.0	-15.0	QP	0	1.0	
3709.313	37.8	H	54.0	-16.2	AVG	45	1.0	
3709.733	37.7	V	54.0	-16.3	AVG	357	1.0	
5565.188	53.2	V	74.0	-20.8	PK	111	1.0	
5564.288	52.7	H	74.0	-21.3	PK	322	1.0	
4636.733	50.7	H	74.0	-23.3	PK	0	1.0	
4638.833	49.9	V	74.0	-24.1	PK	304	1.0	
3709.733	49.1	V	74.0	-24.9	PK	357	1.0	
3709.313	48.7	H	74.0	-25.3	PK	45	1.0	
2782.753	47.7	V	74.0	-26.3	PK	132	1.0	
2782.650	47.2	H	74.0	-26.8	PK	130	1.2	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #2a: Radiated Spurious Emissions, 30 - 10000 MHz. Low Channel @ 902.6 MHz

Frequency MHz	Level dB $\mu$ V/m	Pol v/h	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
2707.845	50.1	V	54.0	-3.9	AVG	95	2.0	
2707.845	47.5	H	54.0	-6.5	AVG	95	2.0	
5416.635	41.2	H	54.0	-12.9	AVG	342	1.0	
5415.188	41.1	V	54.0	-12.9	AVG	313	1.0	
4513.757	38.7	V	54.0	-15.3	AVG	361	1.0	
4514.125	38.7	H	54.0	-15.3	AVG	358	1.0	
2707.845	53.1	V	74.0	-20.9	PK	95	2.0	
5415.188	52.4	V	74.0	-21.6	PK	313	1.0	
5416.635	51.6	H	74.0	-22.4	PK	342	1.0	
2707.845	51.2	H	74.0	-22.8	PK	95	2.0	
4514.125	50.1	H	74.0	-23.9	PK	358	1.0	
4513.757	49.4	V	74.0	-24.6	PK	361	1.0	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.

### Run #2b: Radiated Spurious Emissions, 30 - 10000 MHz. Center Channel @ 915.4 MHz

Frequency MHz	Level dB $\mu$ V/m	Pol v/h	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
2746.090	48.5	V	54.0	-5.5	AVG	100	1.4	
2746.167	45.2	H	54.0	-8.8	AVG	110	1.0	
3660.767	37.5	V	54.0	-16.5	AVG	78	1.0	
4576.500	34.5	V	54.0	-19.5	AVG	100	1.0	
2746.090	53.5	V	74.0	-20.5	PK	100	1.4	
2746.167	52.4	H	74.0	-21.6	PK	110	1.0	
3660.767	48.5	V	74.0	-25.5	PK	78	1.0	
4576.500	45.1	V	74.0	-28.9	PK	100	1.0	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.



## EMC Test Data

Client:	Trimble Navigation	Job Number:	J61557
Model:	Trimble SPSx50	T-Log Number:	T61593
Contact:	Gerardo Torres	Account Manager:	Nesha Lambert
Spec:	EN55022/FCC 15.24/RSS210	Class:	N/A

### Run #2c: Radiated Spurious Emissions, 30 - 10000 MHz. High Channel @ 927.6 MHz

Frequency MHz	Level dB $\mu$ V/m	Pol V/H	15.209 / 15.247		Detector Pk/QP/Avg	Azimuth degrees	Height meters	Comments
			Limit	Margin				
2782.765	48.5	V	54.0	-5.5	AVG	100	1.0	
2782.765	44.2	H	54.0	-9.8	AVG	180	1.2	
960.000	34.1	v	46.0	-11.9	QP	150	1.5	
960.000	32.8	h	46.0	-13.2	QP	0	1.0	
3708.817	37.4	V	54.0	-16.6	AVG	150	1.0	
4637.534	35.8	V	54.0	-18.2	AVG	171	1.0	
2782.765	53.2	V	74.0	-20.8	PK	100	1.0	
2782.765	51.2	H	74.0	-22.8	PK	180	1.2	
3708.817	48.5	V	74.0	-25.5	PK	171	1.0	
4637.534	47.5	V	74.0	-26.5	PK	150	1.0	

Note 1: The limits for restricted bands (15.209) was used for all emissions. The relaxed -20dBc limit for signals not in restricted bands was not applied as all measurements complied with the 15.209 limit.