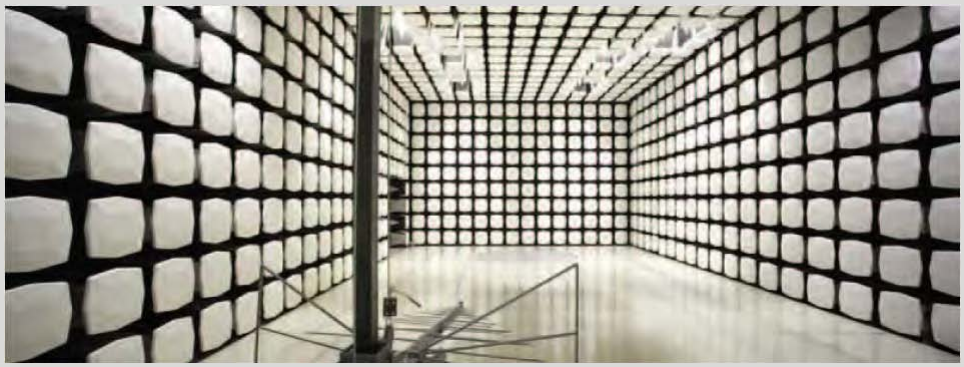
Trimble Navigation Limited MCS

Ranger/TSC3

FCC 15.247:2012

FCC 15.207:2012

Report #: TRPO0081



Report Prepared By Northwest EMC Inc.

NORTHWEST EMC – (888) 364-2378 – www.nwemc.com

California – Minnesota – Oregon – New York – Washington

CERTIFICATE OF TEST

WTD 12.5.23

Last Date of Test: November 27, 2012
Trimble Navigation Limited MCS
Model: Ranger/TSC3

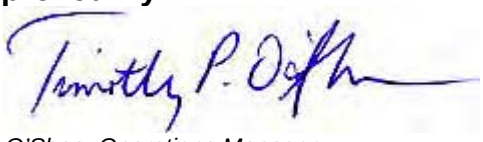
Emissions

Test Description	Specification	Test Method	Pass/Fail
Spurious Radiated Emissions	FCC 15.247:2012	ANSI C63.10:2009	Pass
AC Powerline Conducted Emissions	FCC 15.207:2012	ANSI C63.10:2009	Pass

Deviations From Test Standards

None

Approved By:



Tim O'Shea, Operations Manager

NVLAP Lab Code: 200630-0

Test Facility

The measurement facility used to collect the data is located at:

Northwest EMC, Inc.
22975 NW Evergreen Parkway, Suite 400
Hillsboro, OR 97124

Phone: (503) 844-4066 Fax: 844-3826

This site has been fully described in a report filed with and accepted by the FCC (Federal Communications Commission) and Industry Canada (Site filing #2834D-1).

This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government of the United States of America.

Product compliance is the responsibility of the client, therefore the tests and equipment modes of operation represented in this report were agreed upon by the client, prior to testing. This Report may only be duplicated in its entirety. The results of this test pertain only to the sample(s) tested. The specific description is noted in each of the individual sections of the test report supporting this certificate of test.

REVISION HISTORY

REV 2012.08.02

Revision Number	Description	Date	Page Number
00	None		

Barometric Pressure

The recorded barometric pressure has been normalized to sea level.

NORTHWEST EMC

REV 2012.05.24

ACCREDITATIONS AND AUTHORIZATIONS

United States

FCC - Designated by the FCC as a Telecommunications Certification Body (TCB). Certification chambers, Open Area Test Sites, and conducted measurement facilities are listed with the FCC.

A2LA - Accredited by A2LA to ISO / IEC Guide 65 as a product certifier. This allows Northwest EMC to certify transmitters to FCC and IC specifications.

NVLAP - Each laboratory is accredited by NVLAP to ISO 17025

Canada

IC - Recognized by Industry Canada as a Certification Body (CB). Certification chambers and Open Area Test Sites are filed with IC.

European Union

European Commission – Validated by the European Commission as a Conformity Assessment Body (CAB) under the EMC directive and as a Notified Body under the R&TTE Directive.

Australia/New Zealand

ACMA - Recognized by ACMA as a CAB for the acceptance of test data.

Korea

KCC / RRA - Recognized by KCC's RRA as a CAB for the acceptance of test data.

Japan

VCCI - Associate Member of the VCCI. Conducted and radiated measurement facilities are registered.

Taiwan

BSMI – Recognized by BSMI as a CAB for the acceptance of test data.

NCC - Recognized by NCC as a CAB for the acceptance of test data.

Singapore

IDA – Recognized by IDA as a CAB for the acceptance of test data.

Hong Kong

OFTA – Recognized by OFTA as a CAB for the acceptance of test data.

Vietnam

MIC – Recognized by MIC as a CAB for the acceptance of test data.

Russia

GOST – Accredited by Certinform VNIINMASH, CERTINFO, SAMTES, and Federal CHEC to perform EMC and Hygienic testing for Information Technology products to GOST standards.

SCOPE

For details on the Scopes of our Accreditations, please visit:
http://www.nwemc.com/accreditations/

NORTHWEST EMC
REV 2012.08.15

MEASUREMENT PARAMETERS

Measurement Uncertainty

When a measurement is made, the result will be different from the true or theoretically correct value. The difference is the result of tolerances in the measurement system that cannot be completely eliminated. To the extent that technology allows us, it has been our aim to minimize this error. Measurement uncertainty is a statistical expression of measurement error qualified by a probability distribution.

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty (K=2) can be found included as part of the applicable test description page. Our measurement data meets or exceeds the measurement uncertainty requirements of the applicable specification; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for estimating measurement uncertainty are based upon ETSI TR 100 028 (or CISPR 16-4-1 as applicable), and are available upon request.

Measurement Bandwidths

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

Sample Calculations

Radiated Emissions:

Field Strength		Measured Level		Antenna Factor		Cable Factor		Amplifier Gain		Distance Adjustment Factor		External Attenuation
33.5	=	42.6	+	28.6	+	3.1	-	40.8	+	0.0	+	0.0

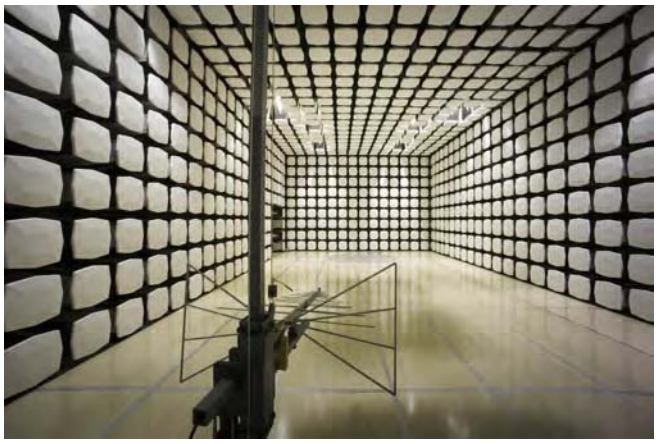
Conducted Emissions:

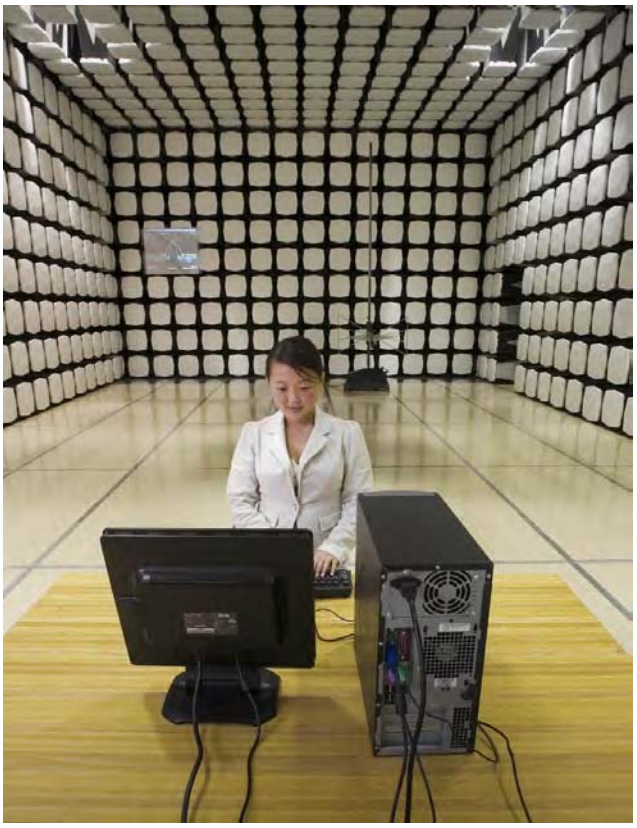
Adjusted Level		Measured Level		Transducer Factor		Cable Factor		External Attenuation
47.1	=	26.7	+	0.3	+	0.1	+	20.0

LOCATIONS

REV 2012.08.03

Oregon	California	New York	Minnesota	Washington
Labs EV01-EV12 22975 NW Evergreen Pkwy, #400 Hillsboro, OR 97124 (503) 844-4066	Labs OC01-OC13 41 Tesla Irvine, CA 92618 (949) 861-8918	Labs WA01-WA04 4939 Jordan Rd. Elbridge, NY 13060 (315) 685-0796	Labs MN01-MN08 9349 W Broadway Ave. Brooklyn Park, MN 55445 (763) 425-2281	Labs SU01-SU07 14128 339th Ave. SE Sultan, WA 98294 (360) 793-8675
VCCI				
A-0108	A-0029		A-0109	A-0110
Industry Canada				
2834D-1, 2834D-*2*	2834B-1, 2834B-2, 2834B-3		2834E-1	2834C-1





PRODUCT DESCRIPTION

WTD 12.5.23

Trimble Navigation Limited MCSClient and Equipment Under Test (EUT) Information

Company Name:	Trimble Navigation Limited MCS
Address:	345 SW Avery Ave
City, State, Zip:	Corvallis, OR 97333
Test Requested By:	Bob Grant
Model:	Ranger/TSC3
First Date of Test:	November 21, 2012
Last Date of Test:	November 27, 2012
Receipt Date of Samples:	November 20, 2012
Equipment Design Stage:	Production
Equipment Condition:	No Damage

Information Provided by the Party Requesting the Test

Functional Description of the EUT (Equipment Under Test):
FHSS radio module tested in Trimble's Yuma 2 tablet computer.

Testing Objective:
To demonstrate compliance to FCC 15.247 requirements

CONFIGURATIONS

Configuration TRPO0081- 2

EUT			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
Tablet Computer	Trimble Navigation Limited MCS	Ranger/TSC3	W2410M4G-I-417006

Peripherals in test setup boundary			
Description	**Manufacturer**	**Model/Part Number**	**Serial Number**
AC adapter	LITEON	PA-1061-0	L21225043024
Mouse (wireless)	Logitech	M505	None
USB Mouse	Logitech	M-BE58	LZE02357693
USB Keyboard	Lenovo	KU-0225	0758502

Cables					
Cable Type	**Shield**	**Length (m)**	**Ferrite**	**Connection 1**	**Connection 2**
AC power	No	1.8m	No	AC adapter	AC Mains
DCpower	PA	1.4m	Yes	AC adapter	Tablet Computer
USB	Yes	1.8m	No	USB Mouse	Tablet Computer
USB	Yes	1.9m	No	USB Keyboard	Tablet Computer
HDMI	Yes	4.5m	No	Tablet Computer	Unterminated
Audio	No	2.4m	No	Tablet Computer	Unterminated
PA = Cable is permanently attached to the device. Shielding and/or presence of ferrite may be unknown.					

MODIFICATIONS

WTD 12.5.23

Equipment Modifications

Item	Date	Test	Modification	Note	Disposition of EUT
1	11/21/2012	Spurious Radiated Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	EUT remained at Northwest EMC following the test.
2	11/27/2012	AC Powerline Conducted Emissions	Tested as delivered to Test Station.	No EMI suppression devices were added or modified during this test.	Scheduled testing was completed.

SPURIOUS RADIATED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data. The test data represents the configuration / operating mode/ model that produced the highest emission levels as compared to the specification limit.

MODES OF OPERATION

Transmitting single channel, 5% duty cycle

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

TRPO0081 - 2

FREQUENCY RANGE INVESTIGATED

Start Frequency	30 MHz	Stop Frequency	26500 MHz

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Spectrum Analyzer	Agilent	E4446A	AAQ	2/7/2012	12 mo
Cable	ESM Cable Corp.	KMKM-72	EVY	9/11/2012	12 mo
Pre-Amplifier	Miteq	AMF-6F-18002650-25-10P	AVU	9/11/2012	12 mo
Antenna, Horn	ETS Lindgren	3160-09	AIV	NCR	0 mo
EV01 Cables	N/A	Standard Gain Horns Cables	EVF	2/28/2012	12 mo
Pre-Amplifier	Miteq	AMF-6F-08001200-30-10P	AVC	2/28/2012	12 mo
Antenna, Horn	ETS	3160-07	AHU	NCR	0 mo
Pre-Amplifier	Miteq	AMF-6F-12001800-30-10P	AVD	2/28/2012	12 mo
Antenna, Horn	ETS	3160-08	AHV	NCR	0 mo
EV01 Cables	N/A	Double Ridge Horn Cables	EVB	6/27/2012	12 mo
Pre-Amplifier	Miteq	AMF-4D-010100-24-10P	APW	6/27/2012	12 mo
Antenna, Horn	ETS	3115	AIZ	1/24/2011	24 mo
EV01 Cables	N/A	Bilog Cables	EVA	6/26/2012	12 mo
Pre-Amplifier	Miteq	AM-1616-1000	AOL	6/26/2012	12 mo
Antenna, Biconilog	EMCO	3141	AXG	4/10/2012	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

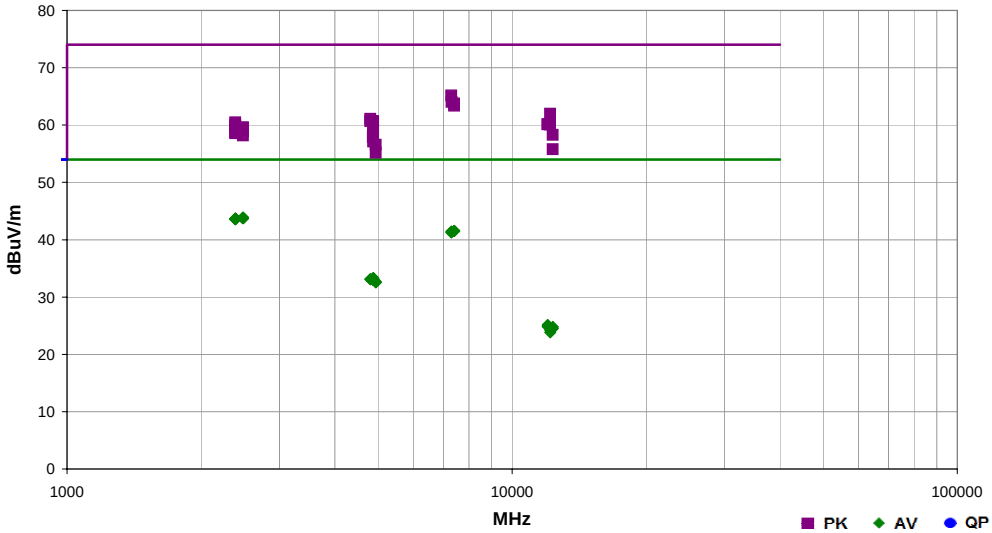
The highest gain of each type of antenna to be used with the EUT was tested. The EUT was configured for low, mid, and high band transmit frequencies. For each configuration, the spectrum was scanned throughout the specified range. In addition, measurements were made in the restricted bands to verify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

SPURIOUS RADIATED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/21/12		
Project:	None	**Temperature:**	21.1 °C		
Job Site:	EV01	**Humidity:**	43% RH		
Serial Number:	W2410M4G-I-417006	**Barometric Pres.:**	1013.5 mbar	**Tested by:**	Dan Haas
EUT:	Ranger/TSC3				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle				
Deviations:	None				
Comments:	See comments for Channel and EUT orientation.				

Test Specifications	**Test Method**
FCC 15.247:2012	ANSI C63.10:2009

Run #	13	**Test Distance (m)**	3	**Antenna Height(s)**	1-4m	**Results**	Pass



Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
7306.867	46.2	18.9	1.4	283.0	3.0	0.0	Horz	PK	0.0	65.1	74.0	-8.9	Mid Channel (37), EUT on side
7307.533	45.1	18.9	1.3	186.0	3.0	0.0	Vert	PK	0.0	64.0	74.0	-10.0	Mid Channel (37), EUT on side
2485.880	22.0	1.9	1.1	184.0	3.0	20.0	Horz	AV	0.0	43.9	54.0	-10.1	2. High Channel (74), EUT vertical. 10Hz Video Average.
2486.420	21.9	1.9	2.1	248.0	3.0	20.0	Horz	AV	0.0	43.8	54.0	-10.2	2. High Channel (74), EUT on side. 10Hz Video Average.
2486.175	21.9	1.9	1.1	40.0	3.0	20.0	Horz	AV	0.0	43.8	54.0	-10.2	2. High Channel (74), EUT horizontal. 10Hz Video Average.
2485.925	21.9	1.9	1.3	349.0	3.0	20.0	Vert	AV	0.0	43.8	54.0	-10.2	2. High Channel (74), EUT horizontal. 10Hz Video Average.
2485.335	21.9	1.9	1.1	197.0	3.0	20.0	Vert	AV	0.0	43.8	54.0	-10.2	2. High Channel (74), EUT on side. 10Hz Video Average.
2484.910	21.9	1.9	1.4	172.0	3.0	20.0	Vert	AV	0.0	43.8	54.0	-10.2	2. High Channel (74), EUT vertical. 10Hz Video Average.
7409.123	44.4	19.4	1.3	175.0	3.0	0.0	Vert	PK	0.0	63.8	74.0	-10.2	High Channel (74), EUT on side
2388.590	22.1	1.6	1.1	225.0	3.0	20.0	Vert	AV	0.0	43.7	54.0	-10.3	2. Low Channel (0), EUT horizontal. 10Hz Video Average.
2388.515	22.1	1.6	1.1	73.0	3.0	20.0	Vert	AV	0.0	43.7	54.0	-10.3	2. Low Channel (0), EUT on side. 10Hz Video Average.
2388.805	22.1	1.6	1.0	165.0	3.0	20.0	Horz	AV	0.0	43.7	54.0	-10.3	2. Low Channel (0), EUT horizontal. 10Hz Video Average.
2389.180	22.1	1.5	1.1	42.0	3.0	20.0	Vert	AV	0.0	43.6	54.0	-10.4	2. Low Channel (0), EUT vertical. 10Hz Video Average.
2389.970	22.1	1.5	1.1	113.0	3.0	20.0	Horz	AV	0.0	43.6	54.0	-10.4	2. Low Channel (0), EUT on side. 10Hz Video Average.
2389.700	22.0	1.5	1.1	24.0	3.0	20.0	Horz	AV	0.0	43.5	54.0	-10.5	2. Low Channel (0), EUT vertical. 10Hz Video Average.
7409.097	44.0	19.4	1.3	192.0	3.0	0.0	Horz	PK	0.0	63.4	74.0	-10.6	High Channel (74), EUT on side
12178.000	66.3	-4.4	1.1	232.0	3.0	0.0	Horz	PK	0.0	61.9	74.0	-12.1	Mid Channel (37), EUT on side
7409.643	22.2	19.4	1.3	192.0	3.0	0.0	Horz	AV	0.0	41.6	54.0	-12.4	2. High Channel (74), EUT on side. 10Hz Video Average.
7409.523	22.2	19.4	1.3	175.0	3.0	0.0	Vert	AV	0.0	41.6	54.0	-12.4	2. High Channel (74), EUT on side. 10Hz Video Average.
7307.213	22.5	18.9	1.4	283.0	3.0	0.0	Horz	AV	0.0	41.4	54.0	-12.6	2. Mid Channel (37), EUT on side. 10Hz Video Average.
7307.227	22.3	18.9	1.3	186.0	3.0	0.0	Vert	AV	0.0	41.2	54.0	-12.8	2. Mid Channel (37), EUT on side. 10Hz Video Average.
4803.047	50.9	10.2	1.2	307.0	3.0	0.0	Vert	PK	0.0	61.1	74.0	-12.9	Low Channel (0), EUT on side
4871.240	50.3	10.4	1.3	23.0	3.0	0.0	Horz	PK	0.0	60.7	74.0	-13.3	Mid Channel (37), EUT on side
4803.080	50.5	10.2	1.2	290.0	3.0	0.0	Horz	PK	0.0	60.7	74.0	-13.3	Low Channel (0), EUT on side
2389.860	38.9	1.5	1.1	24.0	3.0	20.0	Horz	PK	0.0	60.4	74.0	-13.6	Low Channel (0), EUT vertical
4871.453	49.8	10.4	1.2	296.0	3.0	0.0	Vert	PK	0.0	60.2	74.0	-13.8	Mid Channel (37), EUT on side
12007.640	65.6	-5.5	1.1	229.0	3.0	0.0	Vert	PK	0.0	60.1	74.0	-13.9	Low Channel (0), EUT on side
12007.480	65.6	-5.5	1.1	267.0	3.0	0.0	Horz	PK	0.0	60.1	74.0	-13.9	Low Channel (0), EUT on side
12177.970	64.4	-4.4	1.1	231.0	3.0	0.0	Vert	PK	0.0	60.0	74.0	-14.0	Mid Channel (37), EUT on side
2388.245	38.4	1.6	1.0	165.0	3.0	20.0	Horz	PK	0.0	60.0	74.0	-14.0	Low Channel (0), EUT horizontal
2389.105	38.4	1.5	1.1	113.0	3.0	20.0	Horz	PK	0.0	59.9	74.0	-14.1	Low Channel (0), EUT on side
2484.650	37.7	1.9	1.1	184.0	3.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	High Channel (74), EUT vertical
2483.850	37.7	1.9	2.1	248.0	3.0	20.0	Horz	PK	0.0	59.6	74.0	-14.4	High Channel (74), EUT on side
2387.610	37.9	1.6	1.1	73.0	3.0	20.0	Vert	PK	0.0	59.5	74.0	-14.5	Low Channel (0), EUT on side
4871.327	48.7	10.4	1.1	285.0	3.0	0.0	Horz	PK	0.0	59.1	74.0	-14.9	Mid Channel (37), EUT vertical
2486.005	37.2	1.9	1.3	349.0	3.0	20.0	Vert	PK	0.0	59.1	74.0	-14.9	High Channel (74), EUT horizontal
2486.280	37.1	1.9	1.4	172.0	3.0	20.0	Vert	PK	0.0	59.0	74.0	-15.0	High Channel (74), EUT vertical
2485.695	37.0	1.9	1.1	40.0	3.0	20.0	Horz	PK	0.0	58.9	74.0	-15.1	High Channel (74), EUT horizontal
2387.390	37.2	1.6	1.1	225.0	3.0	20.0	Vert	PK	0.0	58.8	74.0	-15.2	Low Channel (0), EUT horizontal
2389.815	37.0	1.5	1.1	42.0	3.0	20.0	Vert	PK	0.0	58.5	74.0	-15.5	Low Channel (0), EUT vertical

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Antenna Height (meters)	Azimuth (degrees)	Test Distance (meters)	External Attenuation (dB)	Polarity/ Transducer Type	Detector	Distance Adjustment (dB)	Adjusted (dBuV/m)	Spec. Limit (dBuV/m)	Compared to Spec. (dB)	Comments
4871.787	48.0	10.4	1.0	191.0	3.0	0.0	Vert	PK	0.0	58.4	74.0	-15.6	Mid Channel (37), EUT horizontal
12348.340	61.5	-3.2	1.1	312.0	3.0	0.0	Horz	PK	0.0	58.3	74.0	-15.7	High Channel (74), EUT on side
2484.425	36.3	1.9	1.1	197.0	3.0	20.0	Vert	PK	0.0	58.2	74.0	-15.8	High Channel (74), EUT on side
4871.120	47.5	10.4	1.0	163.0	3.0	0.0	Horz	PK	0.0	57.9	74.0	-16.1	Mid Channel (37), EUT horizontal
4871.273	46.7	10.4	1.0	34.0	3.0	0.0	Vert	PK	0.0	57.1	74.0	-16.9	Mid Channel (37), EUT vertical
4939.620	45.9	10.7	1.0	7.0	3.0	0.0	Horz	PK	0.0	56.6	74.0	-17.4	High Channel (74), EUT on side
12348.500	59.0	-3.2	1.3	227.0	3.0	0.0	Vert	PK	0.0	55.8	74.0	-18.2	High Channel (74), EUT on side
4940.113	44.5	10.7	1.0	274.0	3.0	0.0	Vert	PK	0.0	55.2	74.0	-18.8	High Channel (74), EUT on side
4871.373	22.9	10.4	1.3	23.0	3.0	0.0	Horz	AV	0.0	33.3	54.0	-20.7	2. Mid Channel (37), EUT on side. 10Hz Video Average.
4871.407	22.8	10.4	1.2	296.0	3.0	0.0	Vert	AV	0.0	33.2	54.0	-20.8	2. Mid Channel (37), EUT on side. 10Hz Video Average.
4871.633	22.7	10.4	1.0	191.0	3.0	0.0	Vert	AV	0.0	33.1	54.0	-20.9	2. Mid Channel (37), EUT horizontal. 10Hz Video Average
4871.553	22.7	10.4	1.1	285.0	3.0	0.0	Horz	AV	0.0	33.1	54.0	-20.9	2. Mid Channel (37), EUT vertical. 10Hz Video Average
4803.233	22.9	10.2	1.2	290.0	3.0	0.0	Horz	AV	0.0	33.1	54.0	-20.9	2. Low Channel (0), EUT on side. 10Hz Video Average.
4803.180	22.9	10.2	1.2	307.0	3.0	0.0	Vert	AV	0.0	33.1	54.0	-20.9	2. Low Channel (0), EUT on side. 10Hz Video Average.
4871.447	22.6	10.4	1.0	34.0	3.0	0.0	Vert	AV	0.0	33.0	54.0	-21.0	2. Mid Channel (37), EUT vertical. 10Hz Video Average
4871.420	22.6	10.4	1.0	163.0	3.0	0.0	Horz	AV	0.0	33.0	54.0	-21.0	2. Mid Channel (37), EUT horizontal. 10Hz Video Average
4939.660	22.0	10.7	1.0	7.0	3.0	0.0	Horz	AV	0.0	32.7	54.0	-21.3	2. High Channel (74), EUT on side. 10Hz Video Average.
4939.567	21.9	10.7	1.0	274.0	3.0	0.0	Vert	AV	0.0	32.6	54.0	-21.4	2. High Channel (74), EUT on side. 10Hz Video Average.
12008.240	30.6	-5.5	1.1	267.0	3.0	0.0	Horz	AV	0.0	25.1	54.0	-28.9	2. Low Channel (0), EUT on side. 10Hz Video Average.
12008.150	30.3	-5.5	1.1	229.0	3.0	0.0	Vert	AV	0.0	24.8	54.0	-29.2	2. Low Channel (0), EUT on side. 10Hz Video Average.
12349.060	28.0	-3.2	1.1	312.0	3.0	0.0	Horz	AV	0.0	24.8	54.0	-29.2	2. High Channel (74), EUT on side. 10Hz Video Average.
12349.120	27.7	-3.2	1.3	227.0	3.0	0.0	Vert	AV	0.0	24.5	54.0	-29.5	2. High Channel (74), EUT on side. 10Hz Video Average.
12178.660	28.6	-4.3	1.1	232.0	3.0	0.0	Horz	AV	0.0	24.3	54.0	-29.7	2. Mid Channel (37), EUT on side. 10Hz Video Average.
12178.590	28.2	-4.3	1.1	231.0	3.0	0.0	Vert	AV	0.0	23.9	54.0	-30.1	2. Mid Channel (37), EUT on side. 10Hz Video Average.

AC POWERLINE CONDUCTED EMISSIONS

Testing was performed using the mode(s) of operation and configuration(s) noted within the report. The individuals and/or the organization requesting the test provided the modes, configurations and settings used to complete the evaluation. The actual test parameters are specified in the test data, this includes items such as investigated frequency range (scanned) and test levels. The testing methods and performance specifications, as well as the test site used for the evaluation are indicated in the test data.

MODES OF OPERATION

Transmitting single channel, 5% duty cycle, High channel
Transmitting single channel, 5% duty cycle, Mid channel
Transmitting single channel, 5% duty cycle, Low channel

POWER SETTINGS INVESTIGATED

110VAC/60Hz

CONFIGURATIONS INVESTIGATED

TRPO0081 - 2

SAMPLE CALCULATIONS

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

TEST EQUIPMENT

Description	Manufacturer	Model	ID	Last Cal.	Interval
Receiver	Rohde & Schwarz	ESCI	ARH	3/29/2012	12 mo
High Pass Filter	TTE	H97-100K-50-720B	HHD	2/1/2012	24 mo
Attenuator	Coaxicom	66702 2910-20	RBR	8/7/2012	12 mo
EV07 Cables	N/A	Conducted Cables	EVG	4/27/2012	12 mo
LISN	Solar	9252-50-R-24-BNC	LIN	4/16/2012	12 mo

MEASUREMENT BANDWIDTHS

Frequency Range (MHz)	Peak Data (kHz)	Quasi-Peak Data (kHz)	Average Data (kHz)
0.01 - 0.15	1.0	0.2	0.2
0.15 - 30.0	10.0	9.0	9.0
30.0 - 1000	100.0	120.0	120.0
Above 1000	1000.0	N/A	1000.0

Measurements were made using the bandwidths and detectors specified. No video filter was used.

MEASUREMENT UNCERTAINTY

A measurement uncertainty estimation has been performed for each test per our internal quality document WP 342. The estimation is used to compare the measured result with its "true" or theoretically correct value. The expanded measurement uncertainty for radiated emissions measurements is less than +/- 4 dB, and for conducted emissions measurements is less than +/- 2.7 dB. Our measurement data meets or exceeds the measurement uncertainty requirements of CISPR 16-4; therefore, the test data can be compared directly to the specification limit to determine compliance. The calculations for measurement uncertainty are available upon request.

TEST DESCRIPTION

Using the mode of operation and configuration noted within this report, conducted emissions tests were performed. The frequency range investigated (scanned), is also noted in this report. Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with power cords that are normally used or that have electrical or shielding characteristics that are the same as those cords normally used. Typically those measurements are made using a LISN (Line Impedance Stabilization Network), the 50ohm measuring port is terminated by a 50ohm EMI meter or a 50ohm resistive load. All 50ohm measuring ports of the LISN are terminated by 50ohm.

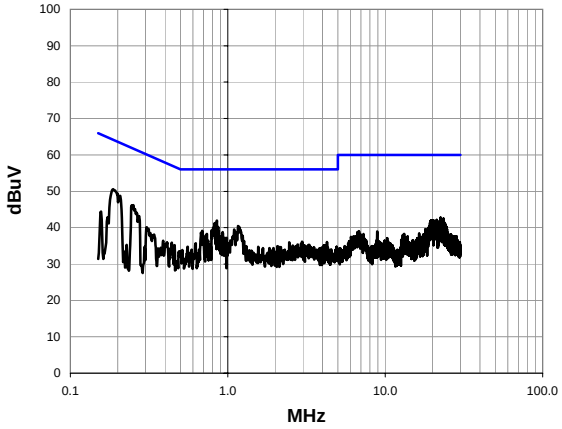
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	W2410M4G-I-417006	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	Ranger/TSC3				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, Low channel				
Deviations:	None				
Comments:	None				

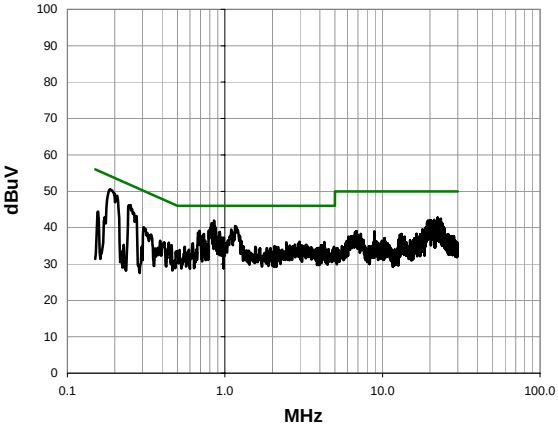
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	1	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.187	30.2	20.3	50.5	64.2	-13.6
0.852	21.6	20.4	42.0	56.0	-14.0
0.842	20.9	20.4	41.3	56.0	-14.7
0.825	20.9	20.3	41.2	56.0	-14.8
1.160	20.1	20.4	40.5	56.0	-15.5
0.245	25.8	20.3	46.1	61.9	-15.8
0.867	19.8	20.4	40.2	56.0	-15.8
1.096	19.1	20.4	39.5	56.0	-16.5
0.689	18.8	20.3	39.1	56.0	-16.9
0.927	18.4	20.4	38.8	56.0	-17.2
22.430	21.0	21.7	42.7	60.0	-17.3
0.675	18.3	20.3	38.6	56.0	-17.4
23.410	20.7	21.8	42.5	60.0	-17.5
23.370	20.5	21.8	42.3	60.0	-17.7
22.760	20.5	21.8	42.3	60.0	-17.7
0.736	17.9	20.3	38.2	56.0	-17.8
21.230	20.5	21.7	42.2	60.0	-17.8
20.200	20.4	21.7	42.1	60.0	-17.9
20.030	20.4	21.7	42.1	60.0	-17.9
22.350	20.3	21.7	42.0	60.0	-18.0

Peak Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.187	30.2	20.3	50.5	54.2	-3.6
0.852	21.6	20.4	42.0	46.0	-4.0
0.842	20.9	20.4	41.3	46.0	-4.7
0.825	20.9	20.3	41.2	46.0	-4.8
1.160	20.1	20.4	40.5	46.0	-5.5
0.245	25.8	20.3	46.1	51.9	-5.8
0.867	19.8	20.4	40.2	46.0	-5.8
1.096	19.1	20.4	39.5	46.0	-6.5
0.689	18.8	20.3	39.1	46.0	-6.9
0.927	18.4	20.4	38.8	46.0	-7.2
22.430	21.0	21.7	42.7	50.0	-7.3
0.675	18.3	20.3	38.6	46.0	-7.4
23.410	20.7	21.8	42.5	50.0	-7.5
23.370	20.5	21.8	42.3	50.0	-7.7
22.760	20.5	21.8	42.3	50.0	-7.7
0.736	17.9	20.3	38.2	46.0	-7.8
21.230	20.5	21.7	42.2	50.0	-7.8
20.200	20.4	21.7	42.1	50.0	-7.9
20.030	20.4	21.7	42.1	50.0	-7.9
22.350	20.3	21.7	42.0	50.0	-8.0

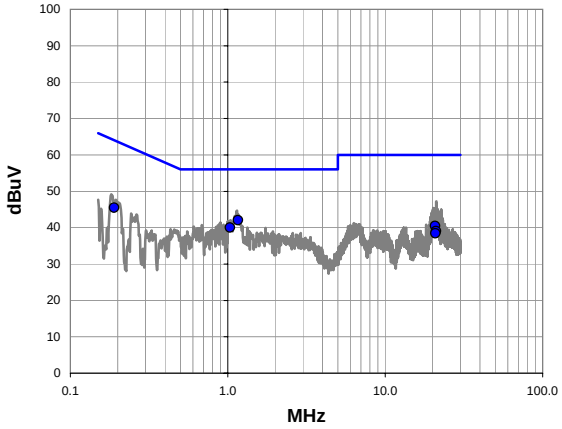
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	W2410M4G-I-417006	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	Ranger/TSC3				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, Low channel				
Deviations:	None				
Comments:	None				

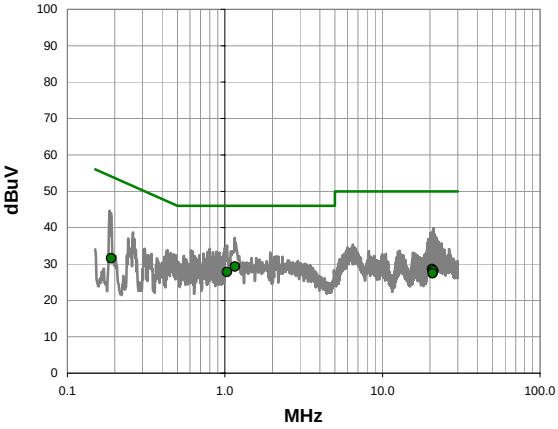
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	2	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.160	21.6	20.4	42.0	56.0	-14.0
1.032	19.6	20.4	40.0	56.0	-16.0
0.190	25.1	20.4	45.5	64.0	-18.6
20.718	18.8	21.7	40.5	60.0	-19.5
21.082	17.4	21.7	39.1	60.0	-20.9
20.892	16.8	21.7	38.5	60.0	-21.5

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.160	8.9	20.4	29.3	46.0	-16.7
1.032	7.4	20.4	27.8	46.0	-18.2
20.718	6.9	21.7	28.6	50.0	-21.4
21.082	6.5	21.7	28.2	50.0	-21.8
0.190	11.2	20.4	31.6	54.0	-22.5
20.892	5.8	21.7	27.5	50.0	-22.5

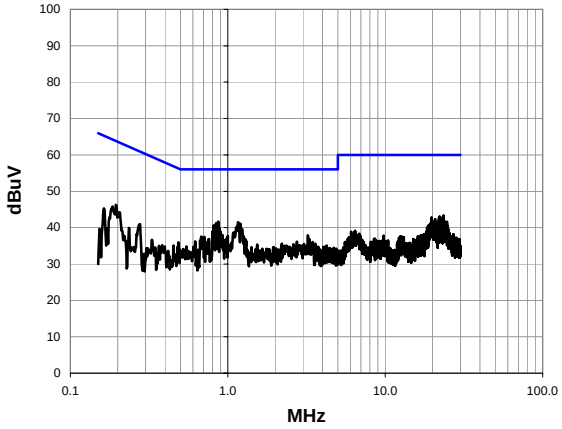
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	0360-003899	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	RT71G				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, Mid channel				
Deviations:	None				
Comments:	None				

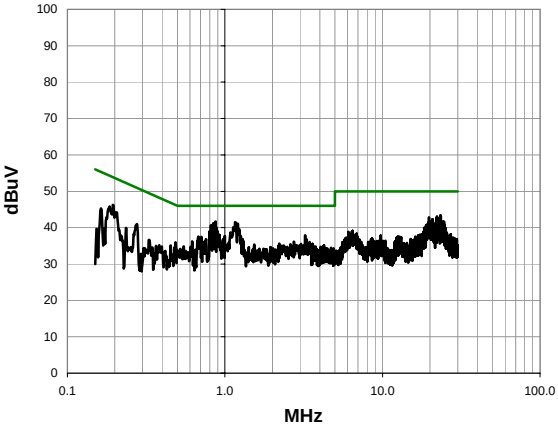
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	3	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.871	21.3	20.4	41.7	56.0	-14.3
1.160	21.1	20.4	41.5	56.0	-14.5
0.850	20.9	20.4	41.3	56.0	-14.7
1.200	20.7	20.4	41.1	56.0	-14.9
0.815	20.3	20.3	40.6	56.0	-15.4
0.883	19.7	20.4	40.1	56.0	-15.9
23.390	21.5	21.8	43.3	60.0	-16.7
23.410	21.3	21.8	43.1	60.0	-16.9
22.140	21.3	21.7	43.0	60.0	-17.0
0.799	18.6	20.3	38.9	56.0	-17.1
23.230	21.1	21.8	42.9	60.0	-17.1
19.700	21.1	21.7	42.8	60.0	-17.2
21.940	21.0	21.7	42.7	60.0	-17.3
22.710	20.8	21.8	42.6	60.0	-17.4
0.194	25.9	20.4	46.3	63.9	-17.6
22.430	20.6	21.7	42.3	60.0	-17.7
20.770	20.6	21.7	42.3	60.0	-17.7
22.980	20.4	21.8	42.2	60.0	-17.8
22.890	20.4	21.8	42.2	60.0	-17.8
22.250	20.4	21.7	42.1	60.0	-17.9

Peak Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
0.871	21.3	20.4	41.7	46.0	-4.3
1.160	21.1	20.4	41.5	46.0	-4.5
0.850	20.9	20.4	41.3	46.0	-4.7
1.200	20.7	20.4	41.1	46.0	-4.9
0.815	20.3	20.3	40.6	46.0	-5.4
0.883	19.7	20.4	40.1	46.0	-5.9
23.390	21.5	21.8	43.3	50.0	-6.7
23.410	21.3	21.8	43.1	50.0	-6.9
22.140	21.3	21.7	43.0	50.0	-7.0
0.799	18.6	20.3	38.9	46.0	-7.1
23.230	21.1	21.8	42.9	50.0	-7.1
19.700	21.1	21.7	42.8	50.0	-7.2
21.940	21.0	21.7	42.7	50.0	-7.3
22.710	20.8	21.8	42.6	50.0	-7.4
0.194	25.9	20.4	46.3	53.9	-7.6
22.430	20.6	21.7	42.3	50.0	-7.7
20.770	20.6	21.7	42.3	50.0	-7.7
22.980	20.4	21.8	42.2	50.0	-7.8
22.890	20.4	21.8	42.2	50.0	-7.8
22.250	20.4	21.7	42.1	50.0	-7.9

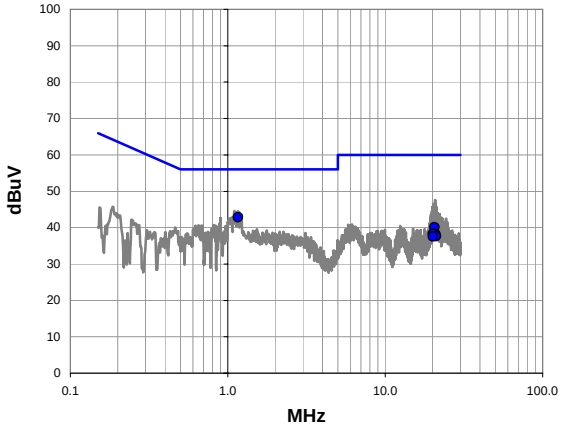
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	0360-003899	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	RT71G				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, Mid channel				
Deviations:	None				
Comments:	None				

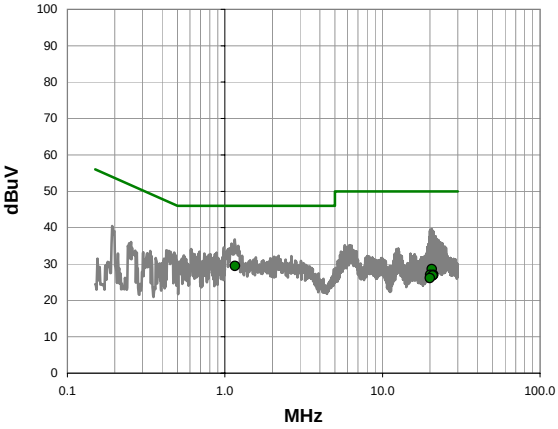
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	4	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.160	22.4	20.4	42.8	56.0	-13.2
20.564	18.4	21.7	40.1	60.0	-19.9
20.872	16.6	21.7	38.3	60.0	-21.7
20.090	16.6	21.7	38.3	60.0	-21.7
21.058	16.0	21.7	37.7	60.0	-22.3
20.046	15.9	21.7	37.6	60.0	-22.4

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.160	9.1	20.4	29.5	46.0	-16.5
20.564	6.9	21.7	28.6	50.0	-21.4
21.058	5.3	21.7	27.0	50.0	-23.0
20.090	5.3	21.7	27.0	50.0	-23.0
20.872	5.2	21.7	26.9	50.0	-23.1
20.046	4.5	21.7	26.2	50.0	-23.8

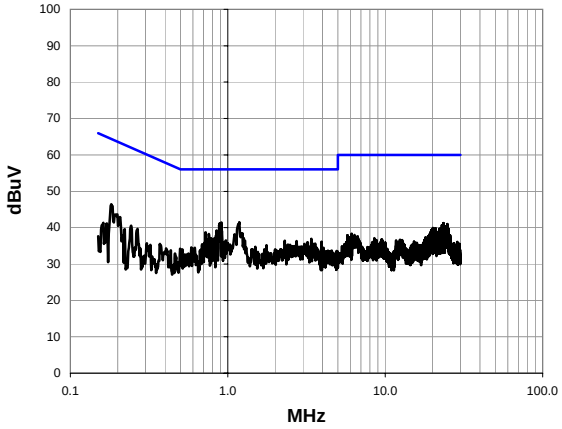
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	0360-003899	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	RT71G				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, High channel				
Deviations:	None				
Comments:	None				

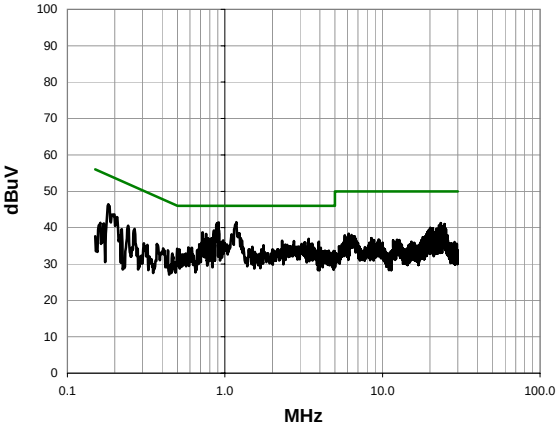
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	5	**Line:**	High Line	**Ext. Attenuation:**	20	**Results**	Pass

Peak Data - vs - Quasi Peak Limit



Peak Data - vs - Average Limit



Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.184	21.1	20.4	41.5	56.0	-14.5
0.912	21.1	20.4	41.5	56.0	-14.5
0.896	20.9	20.4	41.3	56.0	-14.7
0.889	20.8	20.4	41.2	56.0	-14.8
0.850	18.9	20.4	39.3	56.0	-16.7
0.723	18.4	20.3	38.7	56.0	-17.3
0.760	17.9	20.3	38.2	56.0	-17.8
0.182	26.1	20.3	46.4	64.4	-17.9
23.480	19.4	21.8	41.2	60.0	-18.8
0.784	16.8	20.3	37.1	56.0	-18.9
0.823	16.7	20.3	37.0	56.0	-19.0
24.790	19.0	22.0	41.0	60.0	-19.1
3.400	16.4	20.5	36.9	56.0	-19.1
0.738	16.4	20.3	36.7	56.0	-19.3
23.360	18.9	21.8	40.7	60.0	-19.3
22.870	18.9	21.8	40.7	60.0	-19.3
0.974	16.1	20.4	36.5	56.0	-19.5
2.304	15.9	20.5	36.4	56.0	-19.6
2.736	15.8	20.5	36.3	56.0	-19.7
24.010	18.4	21.9	40.3	60.0	-19.7

Peak Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.184	21.1	20.4	41.5	46.0	-4.5
0.912	21.1	20.4	41.5	46.0	-4.5
0.896	20.9	20.4	41.3	46.0	-4.7
0.889	20.8	20.4	41.2	46.0	-4.8
0.850	18.9	20.4	39.3	46.0	-6.7
0.723	18.4	20.3	38.7	46.0	-7.3
0.760	17.9	20.3	38.2	46.0	-7.8
0.182	26.1	20.3	46.4	54.4	-7.9
23.480	19.4	21.8	41.2	50.0	-8.8
0.784	16.8	20.3	37.1	46.0	-8.9
0.823	16.7	20.3	37.0	46.0	-9.0
24.790	19.0	22.0	41.0	50.0	-9.1
3.400	16.4	20.5	36.9	46.0	-9.1
0.738	16.4	20.3	36.7	46.0	-9.3
23.360	18.9	21.8	40.7	50.0	-9.3
22.870	18.9	21.8	40.7	50.0	-9.3
0.974	16.1	20.4	36.5	46.0	-9.5
2.304	15.9	20.5	36.4	46.0	-9.6
2.736	15.8	20.5	36.3	46.0	-9.7
24.010	18.4	21.9	40.3	50.0	-9.7

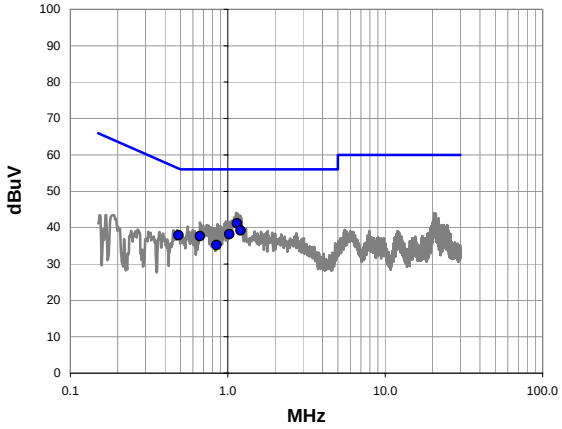
AC POWERLINE CONDUCTED EMISSIONS

Work Order:	TRPO0081	**Date:**	11/27/12		
Project:	None	**Temperature:**	20.8 °C		
Job Site:	EV07	**Humidity:**	33.2% RH		
Serial Number:	W2410M4G-I-417006	**Barometric Pres.:**	1014.9 mbar	**Tested by:**	Dan Haas
EUT:	Ranger/TSC3				
Configuration:	2				
Customer:	Trimble Navigation Limited MCS				
Attendees:	None				
EUT Power:	110VAC/60Hz				
Operating Mode:	Transmitting single channel, 5% duty cycle, High channel				
Deviations:	None				
Comments:	None				

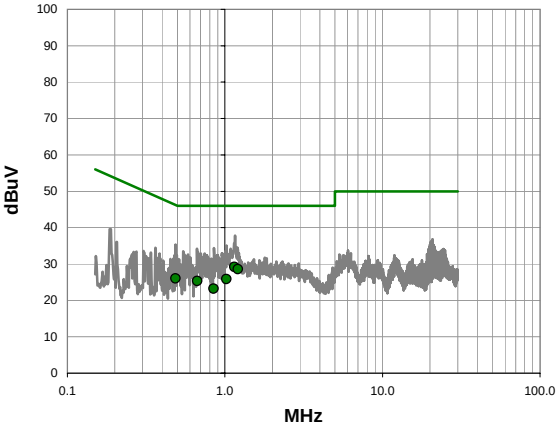
Test Specifications	**Test Method**
FCC 15.207:2012	ANSI C63.10:2009

Run #	6	**Line:**	Neutral	**Ext. Attenuation:**	20	**Results**	Pass

Quasi Peak Data - vs - Quasi Peak Limit



Average Data - vs - Average Limit



Quasi Peak Data - vs - Quasi Peak Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.148	20.8	20.4	41.2	56.0	-14.8
1.208	18.8	20.4	39.2	56.0	-16.8
1.024	17.8	20.4	38.2	56.0	-17.8
0.487	17.6	20.3	37.9	56.2	-18.3
0.667	17.3	20.3	37.6	56.0	-18.4
0.848	14.8	20.4	35.2	56.0	-20.8

Average Data - vs - Average Limit

Freq (MHz)	Amplitude (dBuV)	Factor (dB)	Adjusted (dBuV)	Spec. Limit (dBuV)	Compared to Spec. (dB)
1.148	8.8	20.4	29.2	46.0	-16.8
1.208	8.2	20.4	28.6	46.0	-17.4
1.024	5.5	20.4	25.9	46.0	-20.1
0.487	5.7	20.3	26.0	46.2	-20.2
0.667	5.0	20.3	25.3	46.0	-20.7
0.848	2.9	20.4	23.3	46.0	-22.7