TEST REPORT

Report Number: 101386112MPK-001
Project Number: G101386112
November 26, 2013

Testing performed on the
Metropolitan Beacon System
Model Number: 100-0013-01
FCC ID: A4P-100-0013-01

to

FCC Part 90
FCC Part 15, Subpart B

for

NextNav, LLC

Test Performed by:	**Test Authorized by:**
Intertek	NextNav, LLC
1365 Adams Court	484 Oakmead Pkwy
Menlo Park, CA 94025	Sunnyvale, CA 94085, USA

Prepared by:  **Date:** November 26, 2013
Minh Ly

Reviewed by:  **Date:** November 26, 2013
Krishna K Vemuri

Report No. 101386112MPK-001

Equipment Under Test:	Metropolitan Beacon System (MBS)
Trade Name:	NEXTNAV
Model No.:	100-0013-01
FCC ID:	A4P-100-0013-01
Serial No.:	1013- 0001
Applicant:	NextNav, LLC
Contact:	Arun Narayan
Address:	484 Oakmead Parkway Sunnyvale, CA 94085
Country	USA
Tel. Number:	(408) 206-4575
Email:	anarayan@nextnav.com
Applicable Regulation:	FCC Part 90 FCC Part 15 Subpart B
Test Site Location:	Intertek 1365 Adams Drive Menlo Park, CA 94025
Date of Test:	October 29 to November 08, 2013

We attest to the accuracy of this report:

Minh Ly
EMC Project Engineer

Krishna K Vemuri
EMC Senior Staff Engineer

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The NextNav MBS beacon is a broadcast beacon that wirelessly transmits signals from fixed installations (typically co-located with other transmitters such as cellular transmitters) to help with determination of user location. In a given geographical area, several Box beacons are installed to provide the coverage and the geometry that is required for the 3D positioning trilateration by a MBS receiver. The NextNav beacons operate within the licensed ISM band (919.75-927.25 MHz) amongst themselves by transmitting the MBS signal in allocated time slots for a given frequency channel. The time slots are in 100ms multiples within one second. There are three various temporal modes of transmission:

1. Single transmission of 2.046 MHz Channel at center frequency of 926.227 MHz for 100 msec every 1 sec
2. Dual band, Mode A transmission of 2.046 MHz Channel (at 920.773 MHz) and 5.115 MHz Channel (at 924.692 MHz) interleaved every 2nd sec (transmit also for 100 msec)
3. Dual band, Mode B transmission of 2.046 MHz Channel (at 926.227 MHz) and 5.115 MHz Channel (at 924.692 MHz) interleaved every 2nd sec (transmit also for 100 msec)

Radio Specifications	
Applicant	NextNav, LLC
Model No.	100-0013-01
Use of Product	Commercial deployment (MBS – Metropolitan Beacon System) to provide enhanced 3D positioning indoors, and outdoors in dense urban , semi-urban environment
Rated RF Output Power	30 Watts
Frequency Ranges	920.773 MHz and 926.227 MHz: Two channels only with 2.046 MHz Channel Bandwidth 924.692 MHz: One channel only with 5.115 MHz Channel Bandwidth
Type of Modulation	BPSK, CDMA, TDMA
Channel Bandwidth and Maximum Data Rate	2.046 MHz and 5.115 MHz, data rate: 1000 bps
Antenna & Gain	Commscope DB586-Y, Gain = 6.0 dBd Amphenol BCD-8707, Gain = 6.5 dBd Sinclair SC433-HF6LDF, Gain = 2.5 dBd Laird OD9-5, Gain = 2.9 dBd
Detachable Antenna	Yes
Manufacture Name & Address	NextNav, LLC 484 Oakmead Pkwy, Sunnyvale, CA 94085

EUT receive date:	October 28, 2013
EUT receive condition:	The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date:	October 29, 2013
Test completion date:	November 08, 2013

1.2 Summary of Test Results

FCC Rule	Description of Test	Result
2.1046	RF Power Output	Complies
90.205(l)	ERP	Complies
2.1047	Modulation Characteristics	Not Applicable*
2.1049, 90.209	Occupied Bandwidth	Complies
90.210	Emission Masks	Complies
2.1051, 90.210	Out of Band Emissions at Antenna Terminals	Complies
2.1053, 90.210	Spurious Radiation	Complies
2.1055, 90.213	Frequency Stability vs. Temperature and Voltage	Complies
2.1091	RF Exposure evaluation	Complies
15.107, 15.109	Emissions from Digital Parts and Receiver	Complies

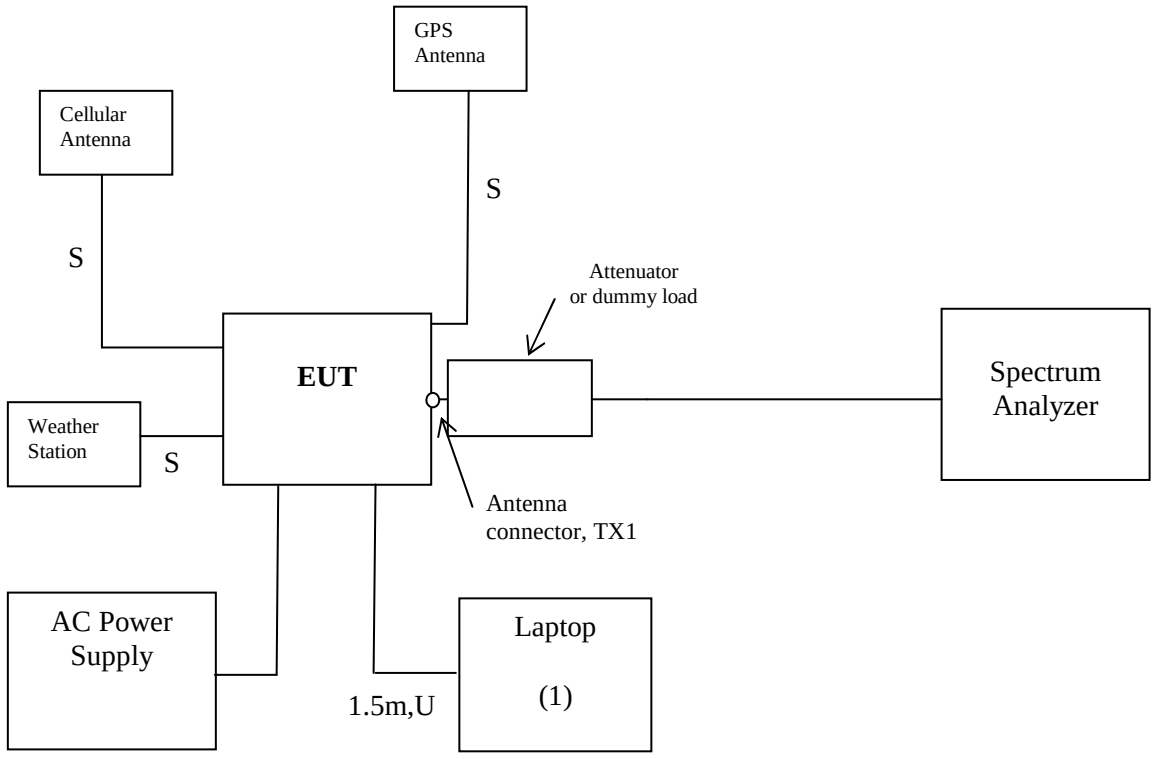
*Radio transmission is for data only.

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Dell Laptop	Latitude E6420	203P3R1

1.3.2 Block Diagram of Test Setup



S = Shielded	**F** = With Ferrite
U = Unshielded	**m** = Length in Meters

During testing, the EUT was connected to a Laptop through an Ethernet cable. Test software loaded on the computer was adjusted to exercise the EUT with different mode and Tx gain.

1.4 Related Submittal(s) Grants

None

2.0 RF Power Output
FCC 2.1046

2.1 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit continuously the maximum power.

The spectrum analyzer was setup to measure the peak power. The attenuation and cable loss were added to the spectrum analyzer reading by using OFFSET function.

Measurements were performed at Single Channel mode (2MHz channel at 926.227MHz) and Dual Band Mode A (2MHz channel at 920.773MHz & 5MHz channel at 924.692MHz). For dual band mode, a trigger is setup to measure the 2.046MHz and 5.115MHz channel respectively.

2.2 Test Equipment

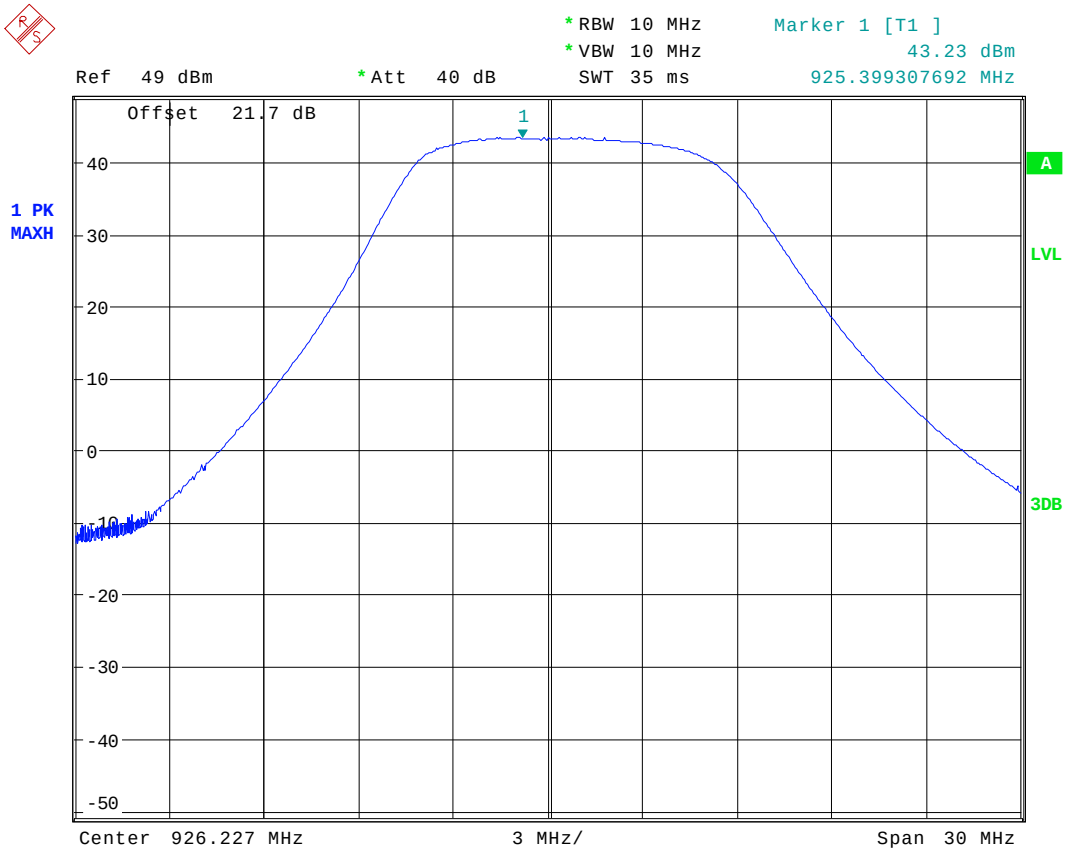
Rohde & Schwarz FSU26 Spectrum Analyzer.

2.3 Test Results

Mode	Bandwidth (MHz)	Frequency (MHz)	Measured Output Power (dBm)	Measured Output Power (Watt)	Graph
Single Channel	2.046	926.227	43.23	21.08	2.1
Dual Band Mode A	2.046	920.773	41.56	14.36	2.2
	5.115	924.692	41.33	13.61	2.3

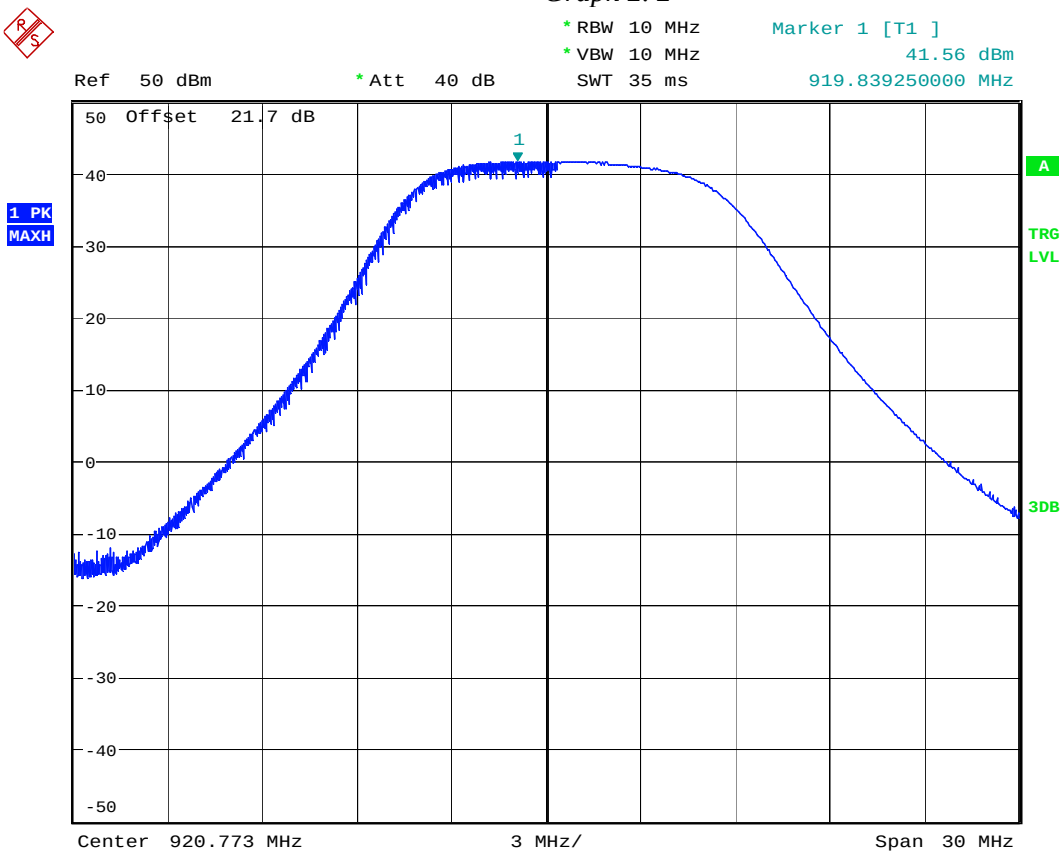
Refer to the attached graphs.
Note: Dual band Mode B transmission of 2.046 MHz Channel (at 926.227 MHz) and 5.115 MHz Channel (at 924.692 MHz), has the same 2.046 MHz and 5.115 MHz Channel powers as Dual Band Mode A.

Graph 2. 1


*RBW 10 MHz
*VBW 10 MHz
SWT 35 ms
Marker 1 [T1]
43.23 dBm
925.399307692 MHz
Ref 49 dBm
*Att 40 dB
Offset 21.7 dB
1 PK
MAXH
A
LVL
3DB
40
30
20
10
0
-10
-20
-30
-40
-50
Center 926.227 MHz
3 MHz/
Span 30 MHz

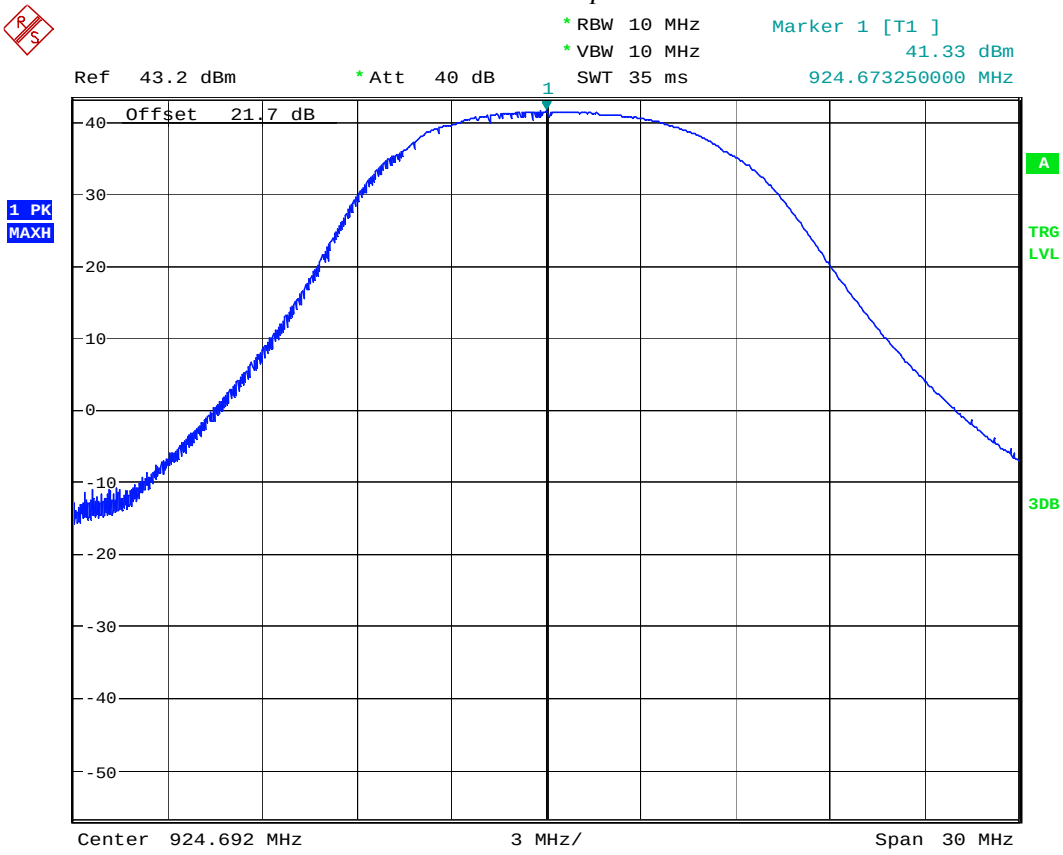
OP

Graph 2. 2


*RBW 10 MHz
*VBW 10 MHz
SWT 35 ms
Marker 1 [T1]
41.56 dBm
919.839250000 MHz
Ref 50 dBm
*Att 40 dB
50 Offset 21.7 dB
1 PK
MAXH
A
TRG
LVL
3DB
40
30
20
10
0
-10
-20
-30
-40
-50
Center 920.773 MHz
3 MHz/
Span 30 MHz

OP

Graph 2. 3



OP-5MHz

3.0 Radiated Power

3.1 Requirement

FCC 90.205(l)

The maximum Effective Radiated Power (ERP) is 30 Watts or 44.76dBm.

3.2 Test Procedure

The ERP was calculated by adding the antenna gain to the output power in dBm.

$ERP = P_{max} + G_{dBd}$

3.3 Test Equipment

None.

3.4 Test Results

According to the antenna list provided, the lowest antenna gain used with the EUT is 2.5dBd; according to manufacturer, maximum antenna gain with cable loss is 1.45dBd; therefore, the maximum calculated peak radiated power is:

Mode	Bandwidth (MHz)	Frequency (MHz)	Measured Output Power (dBm)	Antenna Gain (dBd)	ERP (dBm)
Single Channel	2.046	926.227	43.23	1.45	44.68
Dual Band Mode A	2.046	920.773	41.56	1.45	43.01
	5.115	924.692	41.33	1.45	42.78

Note: Dual band Mode B transmission of 2.046 MHz Channel (at 926.227 MHz) and 5.115 MHz Channel (at 924.692 MHz), has the same 2.046 MHz and 5.115 MHz Channel powers as Dual Band Mode A.

Result	Complies

4.0 Occupied Bandwidth

FCC 2.1049, 90.209(b)(5)

4.1 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power. For dual band mode, a trigger is setup to measure the 2.046MHz and 5.115MHz channel respectively.

The spectrum analyzer was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth). The Occupied Bandwidth was measured for all modes and authorized bandwidths.

4.2 Test Equipment

Rohde & Schwarz FSU26 Spectrum Analyzer

4.3 Test Results

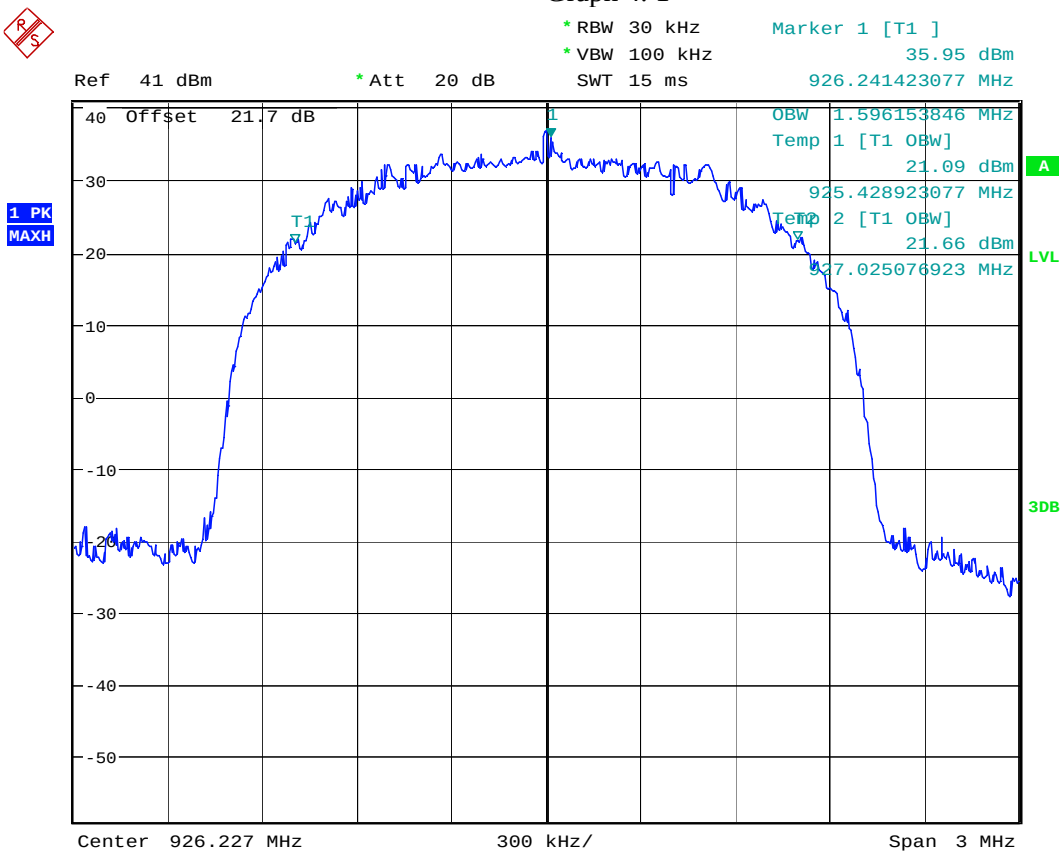
Mode	Channel Bandwidth (MHz)	Frequency (MHz)	Measured Occupied Bandwidth (MHz)	Graph
Single Channel	2.046	926.227	1.59	4.1
Dual Band Mode A	2.046	920.773	1.59	4.2
	5.115	924.692	3.93	4.3

Refer to the following Graphs

Note: Dual band Mode B transmission of 2.046 MHz Channel (at 926.227 MHz) and 5.115 MHz Channel (at 924.692 MHz), has the same 2.046 MHz and 5.115 MHz Channel powers as Dual Band Mode A.

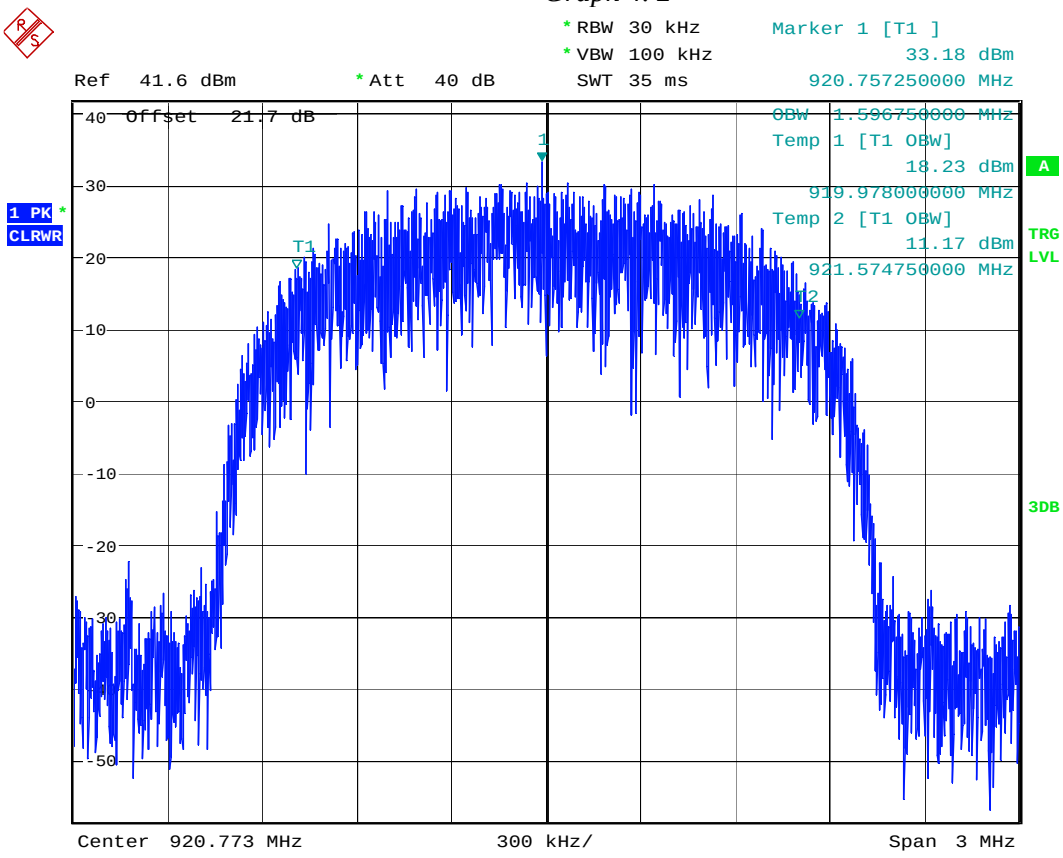
Result	Complies

Graph 4. 1



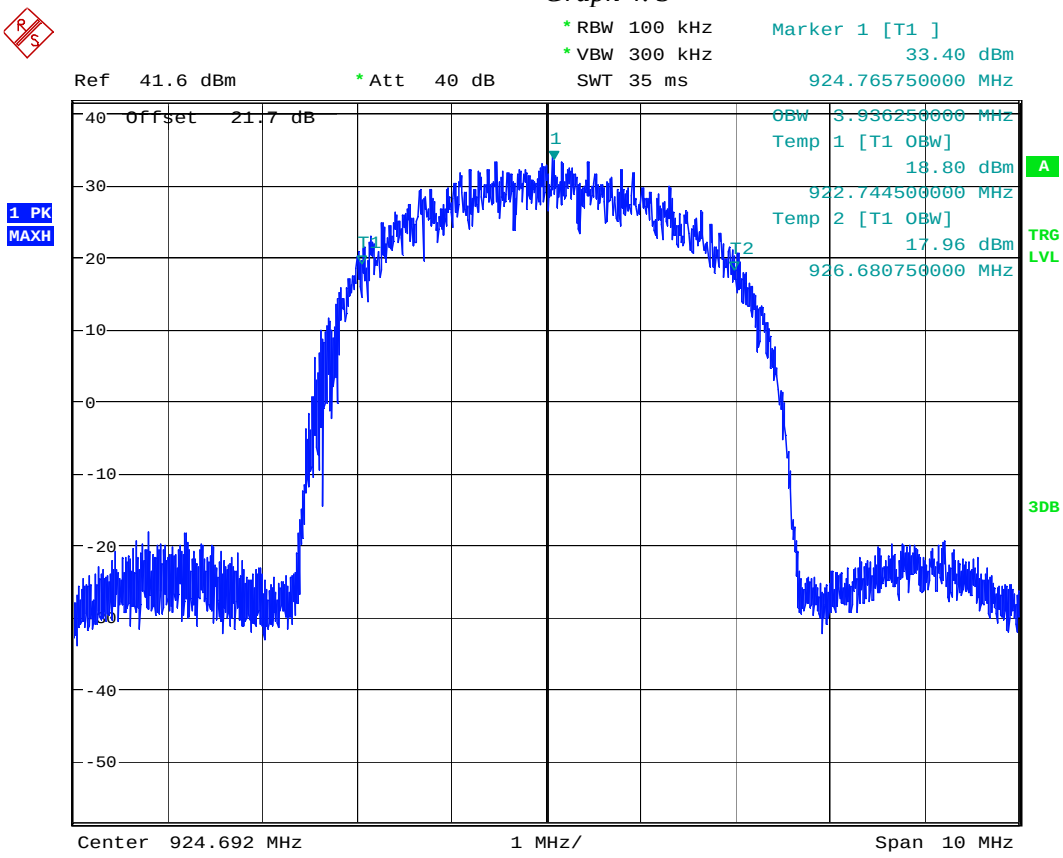
Occupied Bandwidth

Graph 4. 2


*RBW 30 kHz
*VBW 100 kHz
SWT 35 ms
Marker 1 [T1]
33.18 dBm
920.757250000 MHz
Ref 41.6 dBm
*Att 40 dB
Offset 21.7 dB
OBW 1.596750000 MHz
Temp 1 [T1 OBW]
18.23 dBm
919.978000000 MHz
Temp 2 [T1 OBW]
11.17 dBm
921.574750000 MHz
1 PK
CLRWR
TRG
LVL
A
3DB
40
30
20
10
0
-10
-20
-30
-50
Center 920.773 MHz
300 kHz/
Span 3 MHz

OCB

Graph 4. 3


*RBW 100 kHz
*VBW 300 kHz
SWT 35 ms
Marker 1 [T1]
33.40 dBm
924.765750000 MHz
Ref 41.6 dBm
*Att 40 dB
Offset 21.7 dB
OBW 3.936250000 MHz
Temp 1 [T1 OBW]
18.80 dBm
922.744500000 MHz
Temp 2 [T1 OBW]
17.96 dBm
926.680750000 MHz
1 PK
MAXH
A
TRG
LVL
3DB
40
30
20
10
0
-10
-20
-30
-40
-50
Center 924.692 MHz
1 MHz/
Span 10 MHz

OCB

5.0 Emission Mask

FCC 90.210

5.1 Requirement

Equipment designed to operate in the frequency range 902MHz – 928MHz must meet the requirements of Emission Mask K as defined in FCC Part 90.210.

5.2 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power in each mode.

The equation A = 16 + 0.4 (D-50) + 10logB (where B is the authorized bandwidth) was used to calculate the mask and entered into the spectrum analyzer. The maximum conducted power was used to set the reference level of the spectrum analyzer or the top of the mask.

Note: Dual Band Mode B (5MHz at 924.692MHz and 2MHz channel at 926.227MHz) has the same frequencies as the other two modes.

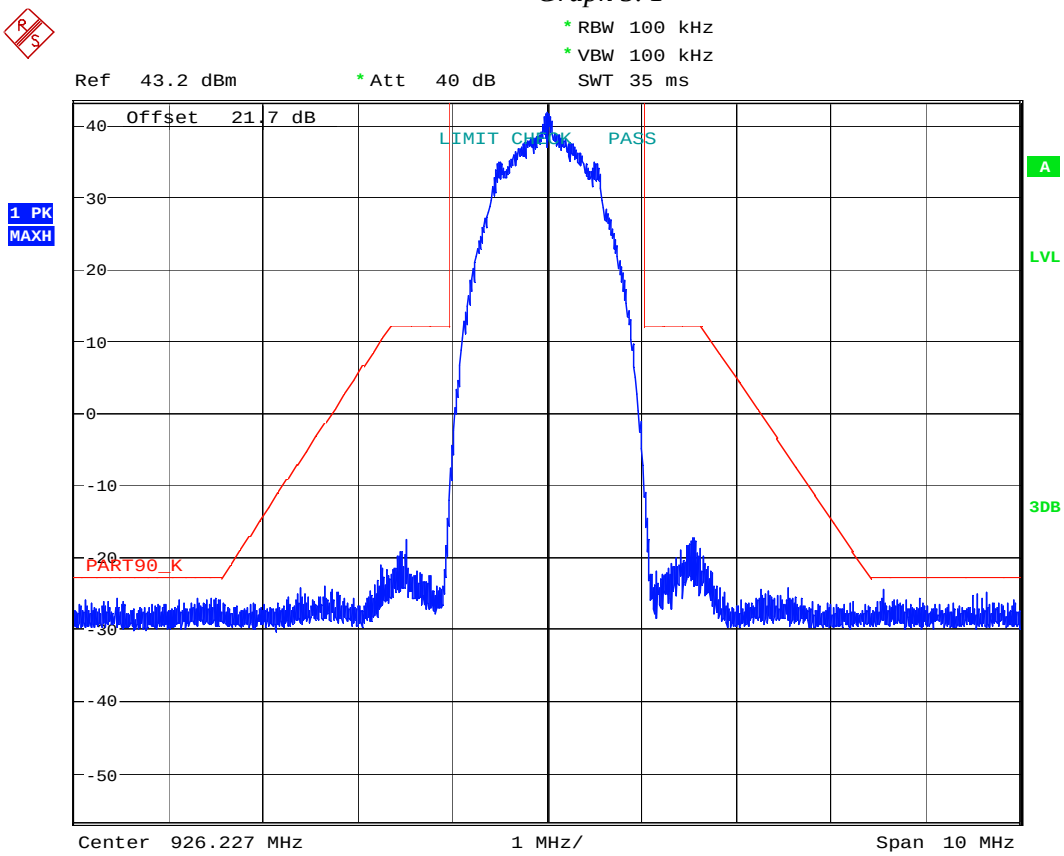
5.3 Test Equipment

Rohde & Schwarz FSU26 Spectrum Analyzer

5.4 Test Results

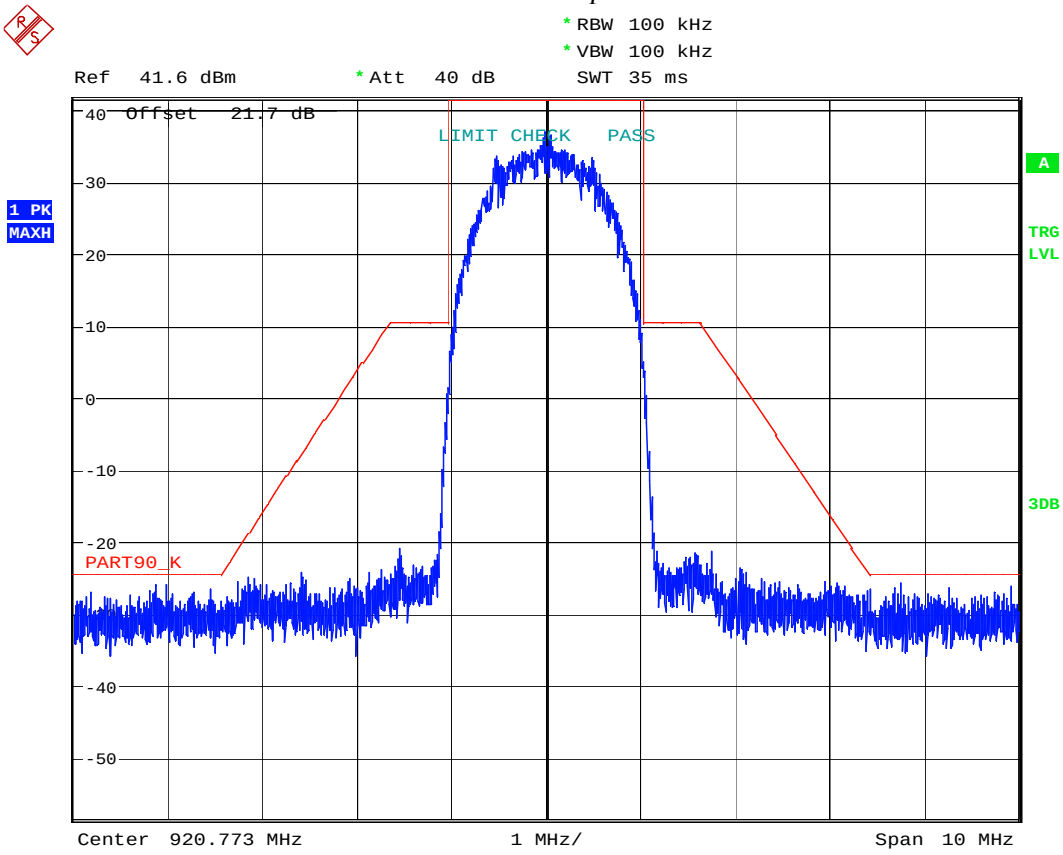
Complies	Refer to the following Graphs

Graph 5. 1



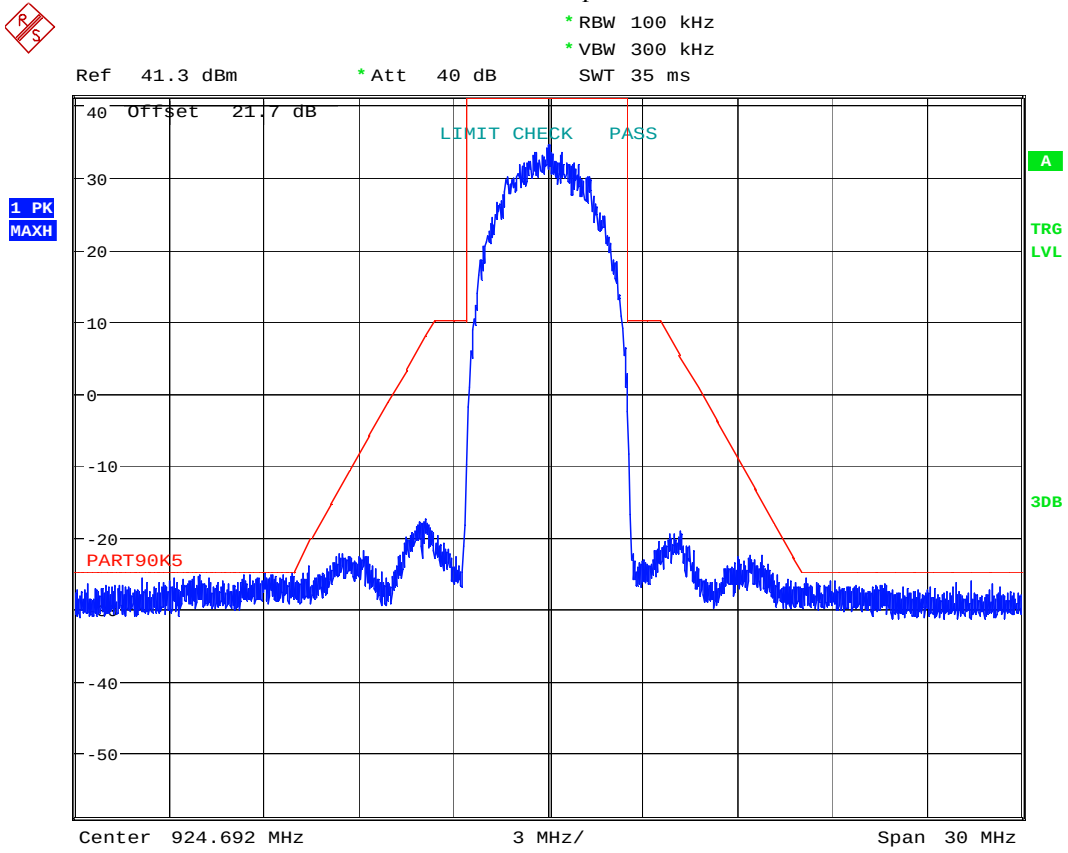
Emission Mask

Graph 5. 2



Emission Mask

Graph 5. 3



Emission Mask

6.0 Spurious Emissions at Antenna Terminals

FCC 2.1051, 90.210

6.1 Requirement

Emission Mask K

The power of any emissions shall be attenuated below the transmitter output power, as specified in the equation: A = 16 + 0.4 (D-50) + 10logB (attenuation greater than 66dB is not required).

Note:
1/ Single Channel Mode: attenuation of 66 dB corresponds to the level of -22.77 dBm for any out-of-band and spurious emissions.
2/ Dual Band Mode A: attenuation of 66dB corresponds to the level of -24.67 dBm for any out-of-band and spurious emissions. This worse-case limit was used for all conducted spurious emission measurements.

6.2 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power.

For conducted measurements, the spectrum analyzer resolution bandwidth was set to 100 kHz. Peak detector is used for these measurements.

Sufficient scans were taken to show the spurious emissions up to 10th harmonic.

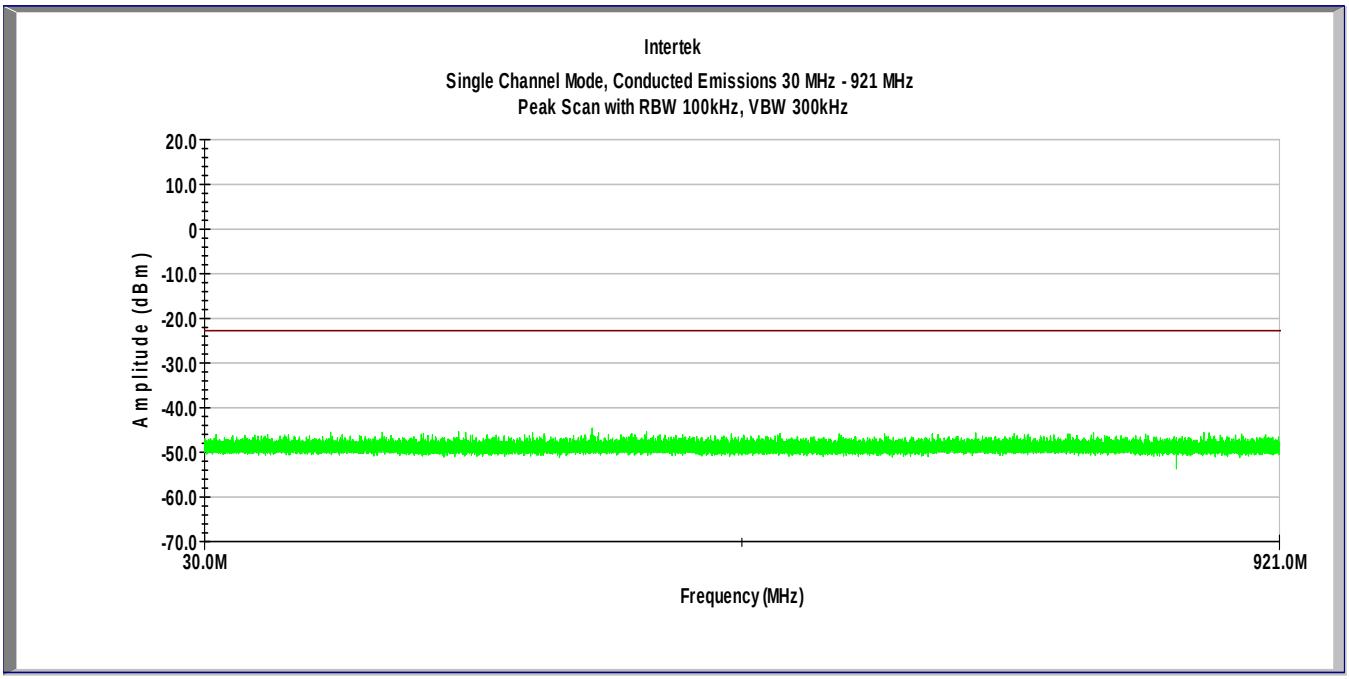
6.3 Test Equipment

Rohde & Schwarz FSU26 Spectrum Analyzer

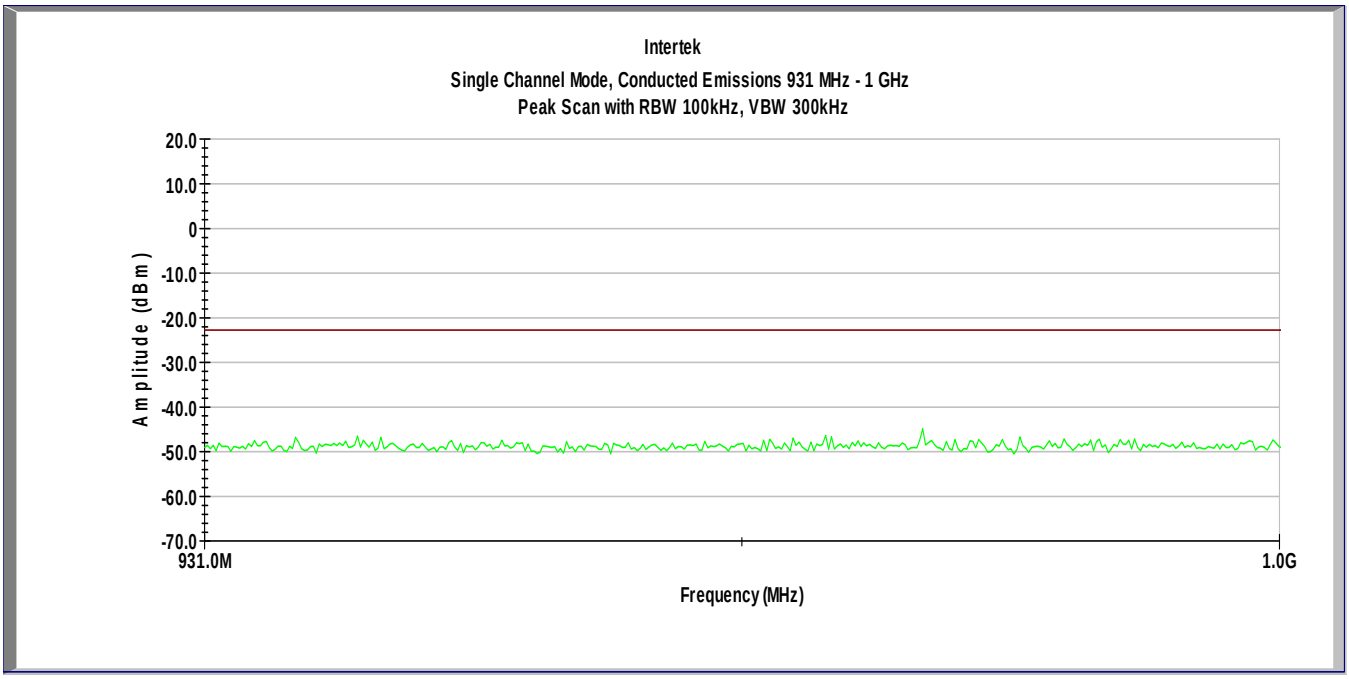
6.4 Test Results

Complies	Refer to the following Graphs

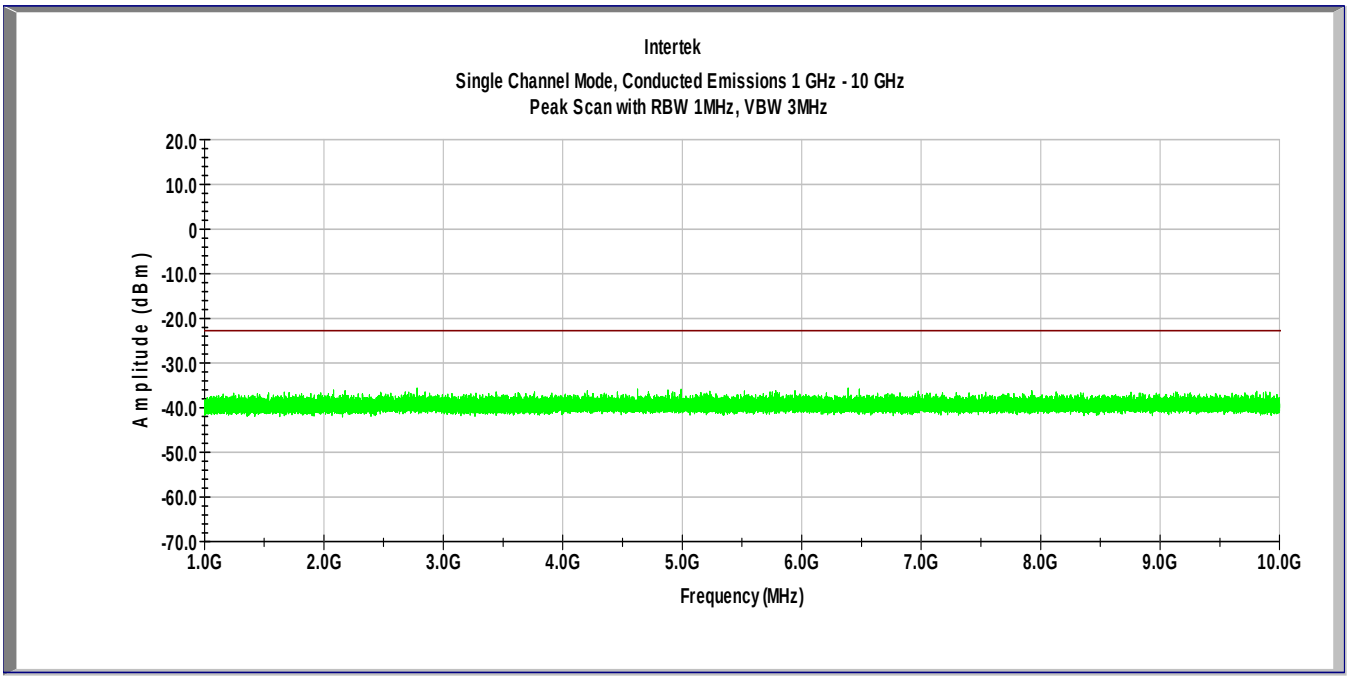
Graph 6. 1



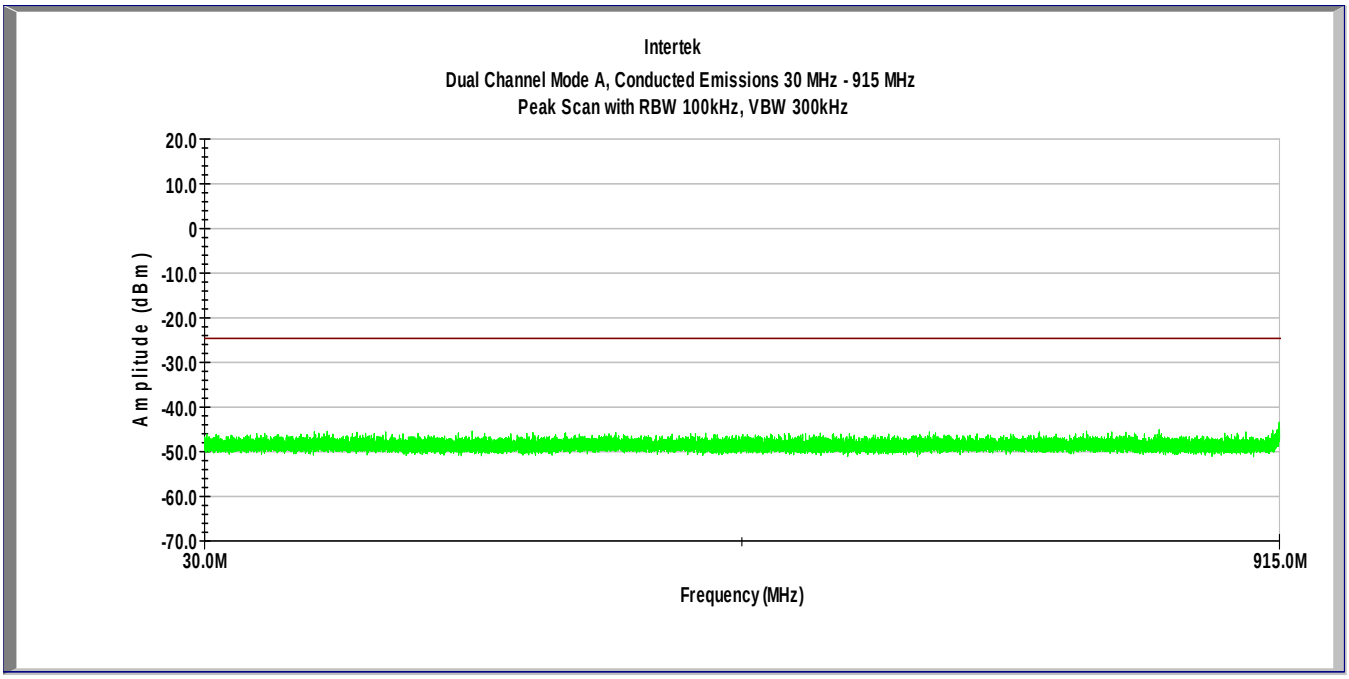
Graph 6. 2



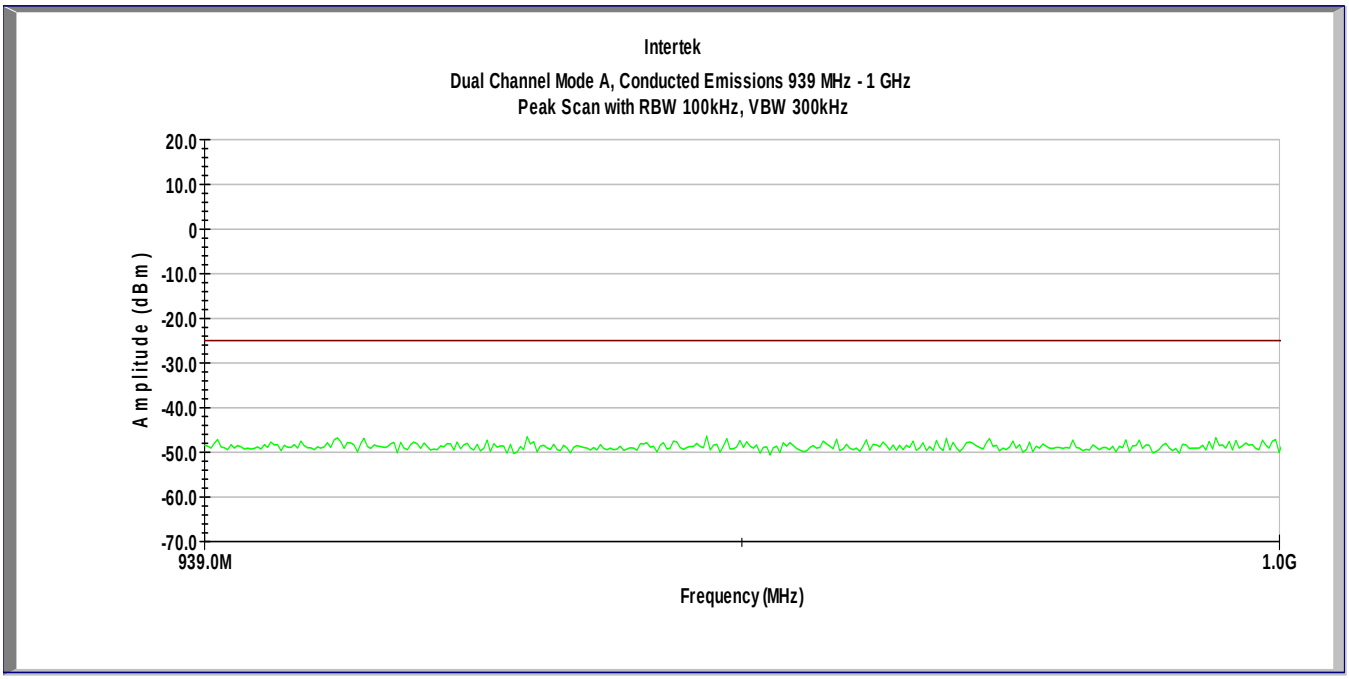
Graph 6. 3



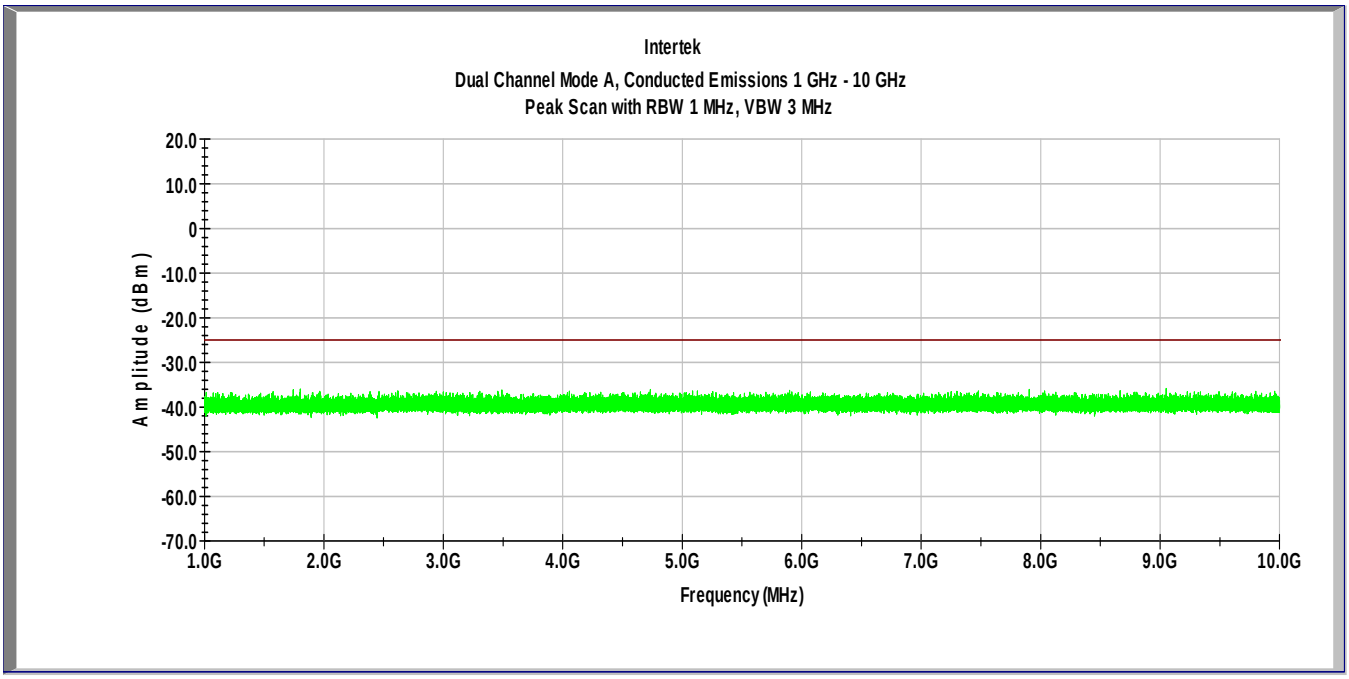
Graph 6. 4



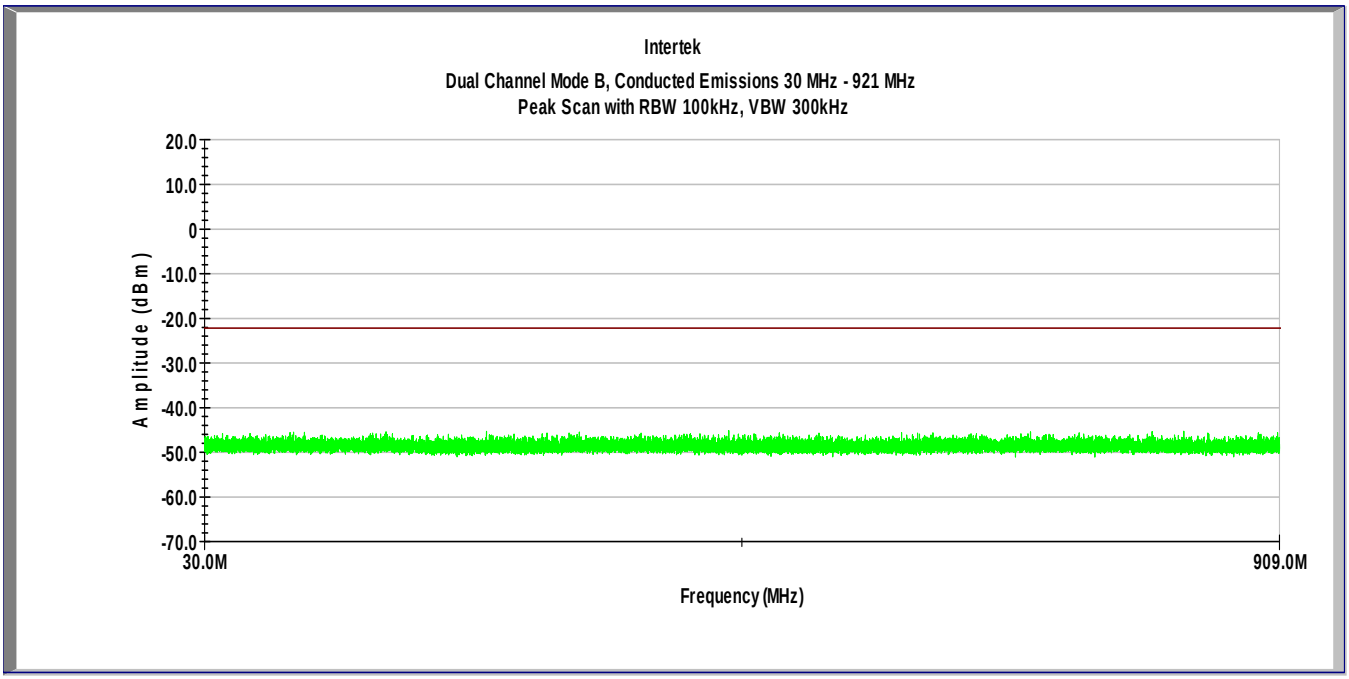
Graph 6. 5



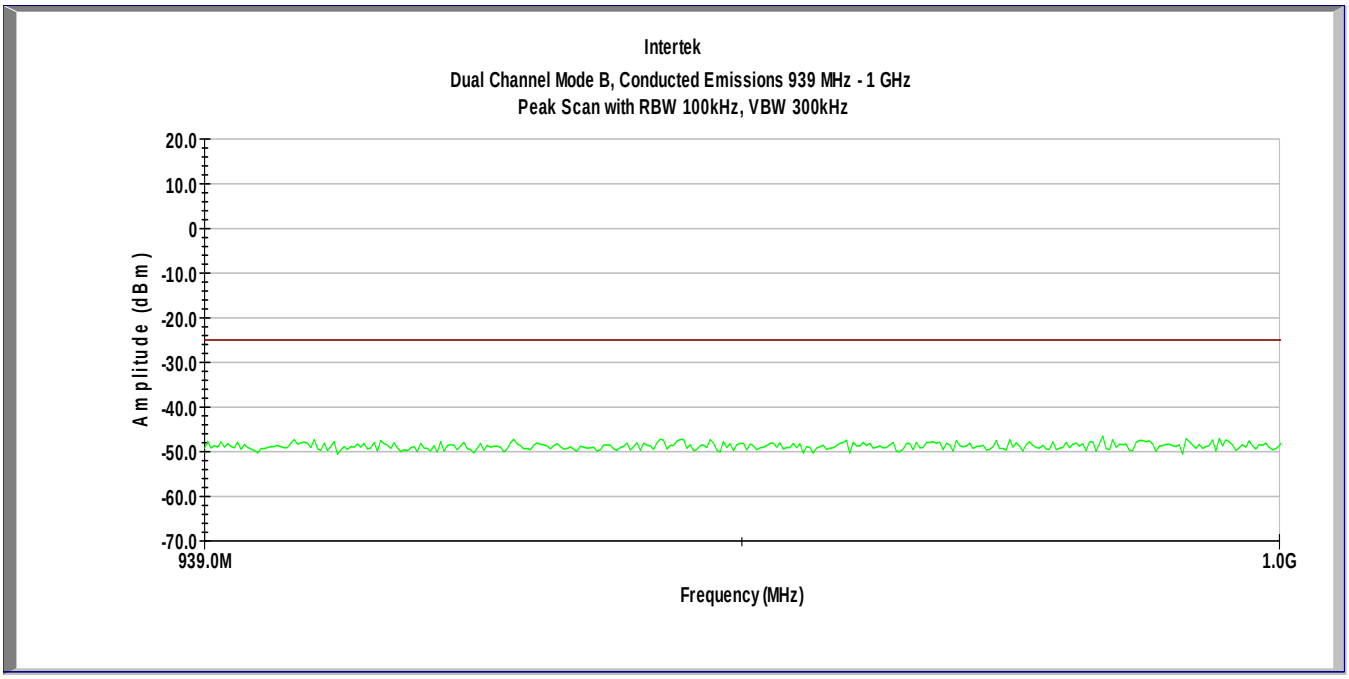
Graph 6. 6



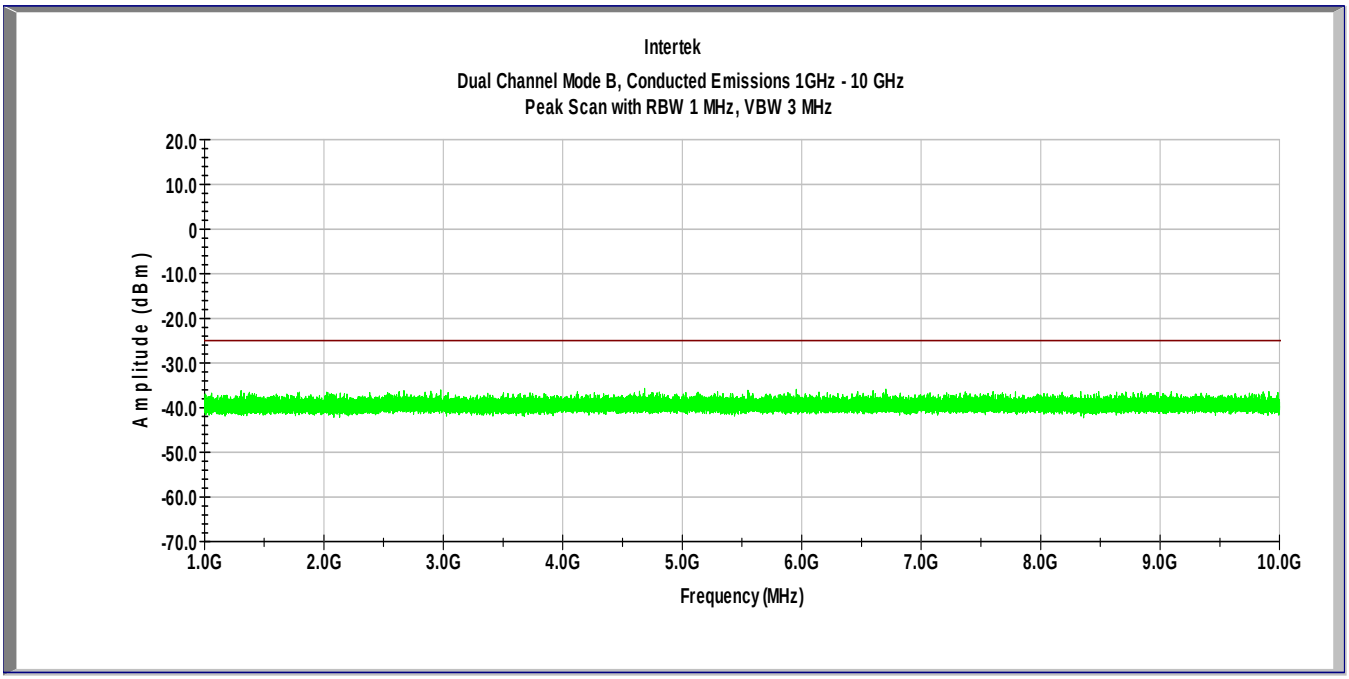
Graph 6. 7



Graph 6. 8



Graph 6. 9


Intertek
Dual Channel Mode B, Conducted Emissions 1GHz - 10 GHz
Peak Scan with RBW 1 MHz, VBW 3 MHz
Amplitude (dBm)
20.0
10.0
0
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
1.0G
2.0G
3.0G
4.0G
5.0G
6.0G
7.0G
8.0G
9.0G
10.0G
Frequency (MHz)

7.0 Spurious Radiation

FCC 2.1053, 90.210

7.1 Requirement

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency outside the frequency band by 66 dB.

Note:
1/ Single Channel Mode: attenuation of 66 dB corresponds to the level of -22.77 dBm (Limit = Max power – 66) for any out-of-band and spurious emissions.
2/ Dual Band Mode: attenuation of 66dB corresponds to the level of -24.44dBm (Limit = Max power – 66) for 2MHz channel signal and -24.67 dBm (5MHz channel) for any out-of-band and spurious emissions.
The worse-case limit of -24.67 was used for all dual band spurious emission measurements.

7.2 Test Procedure

The measurement antenna was placed at a distance of 10 meters for 30MHz – 1GHz and 3 meters for 1-10GHz from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to 10th harmonic was investigated. The worst case of emissions were reported.

During the spurious emission measurement, the antenna port of the EUT was terminated by 50ohms load. For spurious emissions attenuation, the limit was calculated and converted from dBm to dBuV/m to determine the worse-case margin. The substitution method was used to investigate at the highest peak in each frequency range (30MHz – 1GHz and 1GHz – 10GHz). The EUT was substituted by a reference antenna (Biconical antenna for 30MHz – 200MHz, log-periodic for 200MHz – 1GHz, or Horn antenna - above 1GHz), connected to a signal generator. The signal generator output level ($\mathbf{V_g}$ in dBm) was adjusted to obtain the same reading as from EUT. The ERP at the spurious emissions frequency was calculated as follows.

$$ERP_{(dBm)} = \mathbf{V_g} + \mathbf{G}_{(dBd)} + \mathbf{CF}_{(dB)}$$

The spurious emissions attenuation is the difference between the ERP level at the fundamental frequency (see report section 3) and the level of the spurious emissions.

7.3 Test Equipment

Biconical Antenna
EMCO 3115 Horn Antennas
Rohde & Schwarz FSU26 Spectrum Analyzer
50ohm load

7.4 Test Results

Spurious Radiated Emissions
Single Channel Mode, 2MHz

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Vertical							
	Single Channel Mode, 2MHz							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
37.28	47.3	72.4	-25.11	51	0.7	32.1	10.5	17.2
42.93	45.6	72.4	-26.81	49.9	0.8	32.1	10.5	16.5
110.83	57.4	72.4	-15.01	66.9	1.2	32.1	10.5	10.9
127.81	53	72.4	-19.41	61.6	1.3	32	10.5	11.6
143.98	45.5	72.4	-26.91	57.1	1.4	32	10.5	8.5
190.86	43.3	72.4	-29.11	53.5	1.6	32	10.5	9.7
626.55	35.8	72.4	-36.61	35.6	3	32.3	10.5	19
1199.74	42.9	72.4	-29.51	49.5	2.9	34.4	0	24.9
1888.16	45.5	72.4	-26.91	49.6	3.8	34.3	0	26.4
1927.35	42.7	72.4	-29.71	46.1	3.9	34.3	0	27
1997.08	46.4	72.4	-26.01	48.3	3.9	34.3	0	28.5
3415.27	47.4	72.4	-25.01	45.2	5.9	34.3	0	30.6
9523.92	57.1	72.4	-15.31	39.7	11.9	32.1	0	37.6

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Horizontal							
	Single Channel Mode, 2MHz							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
32.43	36.6	72.4	-35.8	40.1	0.7	32.1	10.5	17.4
40.51	35.7	72.4	-36.7	39.8	0.7	32.1	10.5	16.8
110.83	40.8	72.4	-31.6	50.3	1.2	32.1	10.5	10.9
128.62	39.8	72.4	-32.6	48.4	1.3	32	10.5	11.6
253.10	43.4	72.4	-29	50.8	1.9	32	10.5	12.2
626.55	38.7	72.4	-33.7	38.5	3	32.3	10.5	19
1200.01	42.7	72.4	-29.7	49.3	2.9	34.4	0	24.9
1350.02	39.5	72.4	-32.9	45.2	3.1	34.3	0	25.5
1438.94	39	72.4	-33.4	44.6	3.2	34.3	0	25.5
1800.31	40.6	72.4	-31.8	45.5	3.7	34.3	0	25.7
1997.62	43.4	72.4	-29	45.3	3.9	34.3	0	28.5

Spurious Radiated Emissions
Dual Channel, A Mode

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Vertical							
	Dual Channel, A Mode							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
42.93	45.7	70.2	-24.5	50	0.8	32.1	10.5	16.5
110.83	57.6	70.2	-12.6	67.1	1.2	32.1	10.5	10.9
128.62	51.5	70.2	-18.7	60.1	1.3	32	10.5	11.6
143.17	45.4	70.2	-24.8	57	1.4	32	10.5	8.5
253.10	45.1	70.2	-25.1	52.5	1.9	32	10.5	12.2
751.03	32.9	70.2	-37.3	31	3.3	32.3	10.5	20.4
1200.25	40.7	70.2	-29.5	47.3	2.9	34.4	0	24.9
1864.00	43.5	70.2	-26.7	47.8	3.8	34.3	0	26.2
1996.75	44.4	70.2	-25.8	46.3	3.9	34.3	0	28.5
3428.88	47.9	70.2	-22.3	45.7	5.9	34.3	0	30.6
3740.50	51.9	70.2	-18.3	48.5	6	34	0	31.4

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Horizontal							
	Dual Channel, A Mode							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
30.81	46.4	70.2	-23.8	49.8	0.6	32.1	10.5	17.6
120.53	38.2	70.2	-32	46.7	1.3	32	10.5	11.7
128.62	40.1	70.2	-30.1	48.7	1.3	32	10.5	11.6
195.71	40.5	70.2	-29.7	50.8	1.6	32	10.5	9.6
253.10	44.1	70.2	-26.1	51.5	1.9	32	10.5	12.2
626.55	39	70.2	-31.2	38.8	3	32.3	10.5	19
1199.12	42.2	70.2	-28	48.8	2.9	34.4	0	24.9
1349.87	38.9	70.2	-31.3	44.6	3.1	34.3	0	25.5
1662.63	41.2	70.2	-29	46.5	3.5	34.2	0	25.4
1799.87	41.5	70.2	-28.7	46.4	3.7	34.3	0	25.7
1993.37	45.5	70.2	-24.7	47.5	3.9	34.3	0	28.4
9562.38	57.2	70.2	-13	40.2	11.6	32.1	0	37.5

Spurious Radiated Emissions
Dual Channel, B Mode

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Vertical							
	Dual Channel, B Mode							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
42.93	45.1	70.2	-25.1	49.4	0.8	32.1	10.5	16.5
110.83	58	70.2	-12.2	67.5	1.2	32.1	10.5	10.9
127.81	52.9	70.2	-17.3	61.5	1.3	32	10.5	11.6
143.17	45.7	70.2	-24.5	57.3	1.4	32	10.5	8.5
185.20	43.5	70.2	-26.7	53.9	1.6	32	10.5	9.5
626.55	35.9	70.2	-34.3	35.7	3	32.3	10.5	19
1832.50	46.6	70.2	-23.6	51.3	3.7	34.3	0	25.9
1870.75	49.3	70.2	-20.9	53.6	3.8	34.3	0	26.2
1875.25	52.8	70.2	-17.4	57	3.8	34.3	0	26.3
1977.62	47.2	70.2	-23	49.5	3.9	34.3	0	28.1
1993.37	47.8	70.2	-22.4	49.8	3.9	34.3	0	28.4
9517.38	57.4	70.2	-12.8	40	11.9	32.1	0	37.6

	Intertek Testing Services							
	Radiated Spurious Emissions 30 MHz - 10000 MHz, Horizontal							
	Dual Channel, B Mode							
Operator: ML					Model Number: 100-0013-01			
October 29, 2013					Company: NextNav LLC			
Frequency (MHz)	**Peak FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**DCF dB**	**AF dB(1/m)**
42.93	44.7	70.2	-25.5	49	0.8	32.1	10.5	16.5
110.83	57.6	70.2	-12.6	67.1	1.2	32.1	10.5	10.9
133.47	50.6	70.2	-19.6	59.9	1.3	32	10.5	10.9
252.29	44.4	70.2	-25.8	51.9	1.9	32	10.5	12.1
700.92	33.2	70.2	-37	32.2	3.1	32.3	10.5	19.7
751.03	37.2	70.2	-33	35.3	3.3	32.3	10.5	20.4
1747.00	40.8	70.2	-29.4	45.9	3.7	34.2	0	25.5
1864.00	44.8	70.2	-25.4	49.2	3.8	34.3	0	26.2
1914.63	43.8	70.2	-26.4	47.5	3.8	34.3	0	26.8
2074.38	44.6	70.2	-25.6	45.9	4.1	34.4	0	29
3484.00	47.4	70.2	-22.8	45.2	5.8	34.3	0	30.7
9376.75	57.1	70.2	-13.1	40.6	11	32.1	0	37.6

Spurious Radiated Emissions
Substitution Method

Frequency	Peak FS	Signal Generator Output	Substitute Antenna Gain	CF	ERP*	ERP Limit	ERP Margin
MHz	**dB(uV/m)**	**V_g dBm**	**dBd**	**dB**	**dBm**	**dBm**	**dB**
Single Channel Mode							
110.83	57.4	-45	-4.4	-0.36	-49.76	-22.77	-26.99
9523.92	57.1	-71	9.9	-4.03	-65.13	-22.77	-42.36
Dual Channel, Mode A							
30.81	46.4	-39	-21.1	-0.2	-60.3	-24.44	-35.86
9562.38	57.2	-69	10.0	-4.03	-63.03	-24.44	-38.59

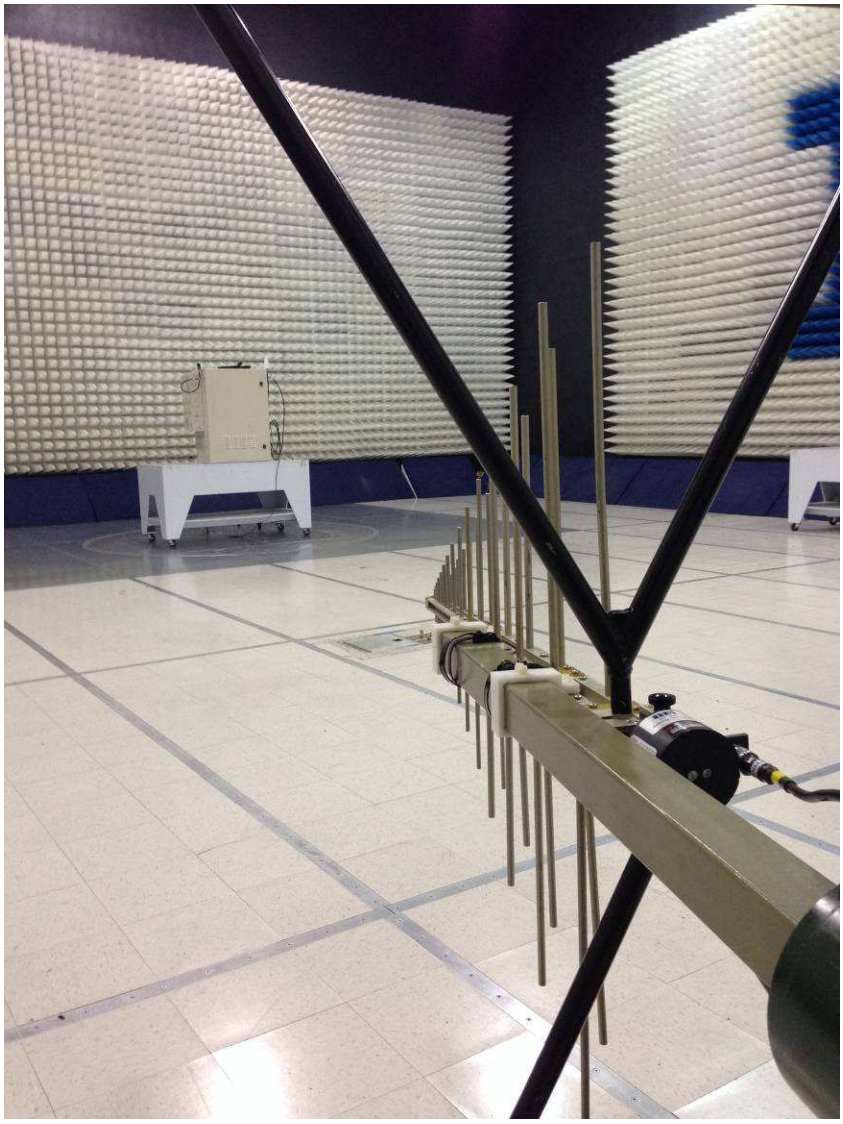
* ERP is calculated as: $ERP_{(dBm)} = \mathbf{V_{g(dBm)} + G_{(dBd)}} + \mathbf{CF}$ (dB)

NOTE: The highest amplitude and frequency of Dual Channel Mode B is identical to Dual Channel Mode A.

Result	Complies

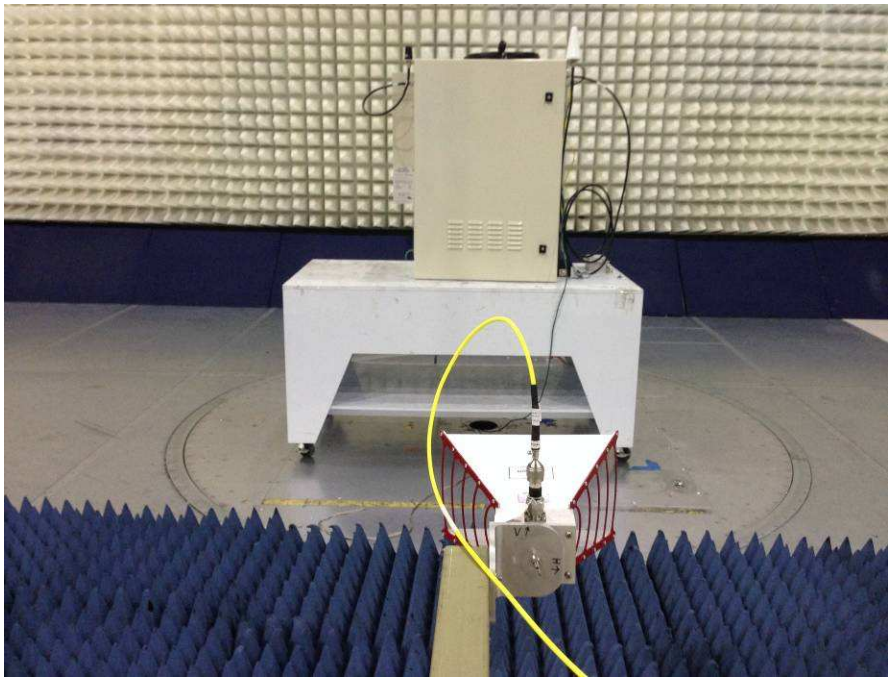
7.5 Test Setup Photographs

Radiated Emission Test Setup



7.5 Test setup photographs

Radiated Emission Test Setup



8.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055, 90.213

8.1 Requirement

In the 902-928 MHz band, fixed and base stations must have a frequency stability of 2.5 ppm.

8.2 Test Procedure

The EUT was placed inside the temperature chamber. The RF power output was connected to frequency counter. The EUT was setup to transmit the maximum power. The EUT was set to transmit with CW signal.

After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured by the frequency counter and recorded.

At the room temperature, the frequency was measured when the EUT was powered with the nominal voltage and with 85% and 115% of the nominal voltage.

8.3 Test Equipment

Temperature Chamber
Spectrum Analyzer

8.4 Test Results

Nominal frequency: 926.227 MHz

Temperature (°C)	Frequency at nominal voltage (MHz)	Maximum deviation from frequency at 20°C, ppm
Nominal Frequency: 926.227 MHz		
-30	926.227084	0.128
-20	926.227083	0.130
-10	926.227083	0.130
0	926.227081	0.132
10	926.227201	0.002
20	926.227203	0.000
30	926.227203	0.000
40	926.227406	0.219
50	926.227407	0.220

Note: No change in carrier frequency was observed when the EUT voltage was varied.

9.0 Emission from Digital Parts and Receiver

9.1 Radiated Emissions
FCC 15.109

9.1.1 Test Limit

Radiated Emission Limit for FCC Part 15 Subpart B and ICES 003

Radiated Emission Limits for Class A at 10 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	39.1
88 to 216	43.5
216 to 960	46.4
960 and up	49.5
Radiated Emission Limits for Class B at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

9.1.2 Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2003).

Example Field Strength Calculation
The field strength is calculated by adding the Antenna Factor and Cable Factor. Then by subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

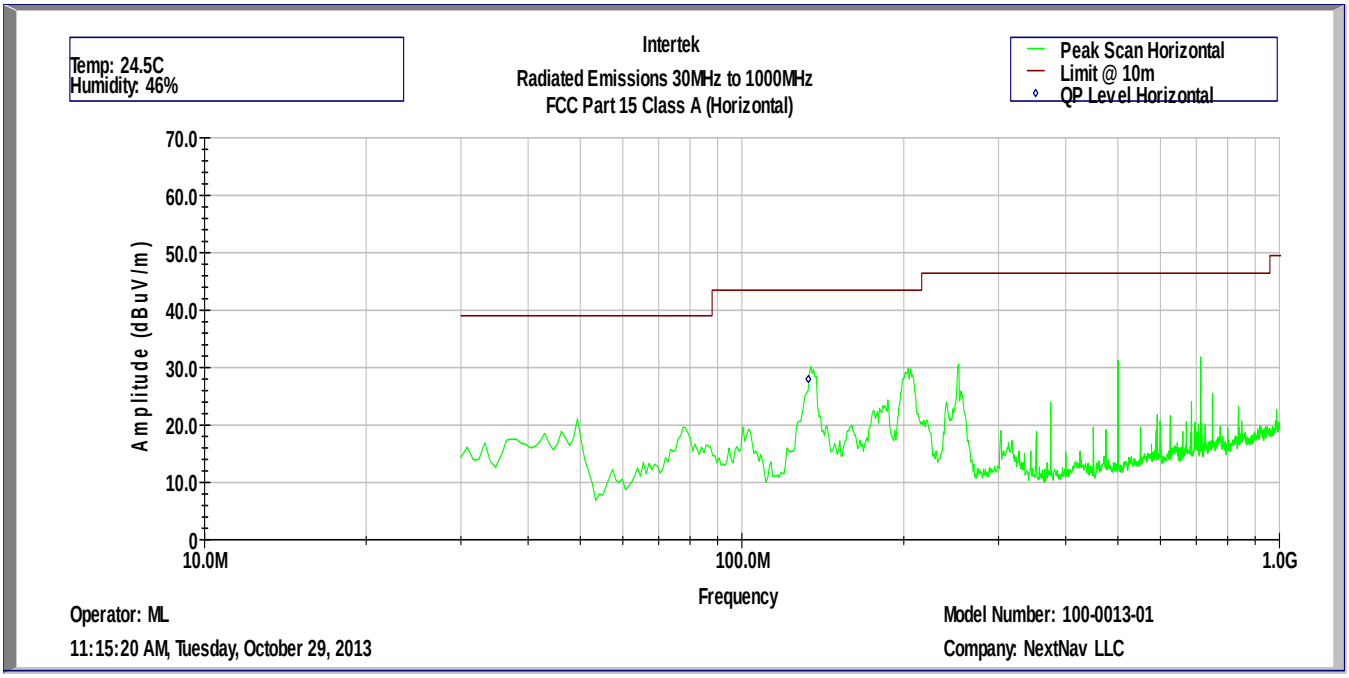
FS = RA + AF + CF – PA
Where FS = Field Strength in dB (µV/m)
RA = Receiver Amplitude (including preamplifier) in dB (µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
PA= Preamplifier Factor in dB

Assume a receiver reading of 52.0 dB (µV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB (µV/m).

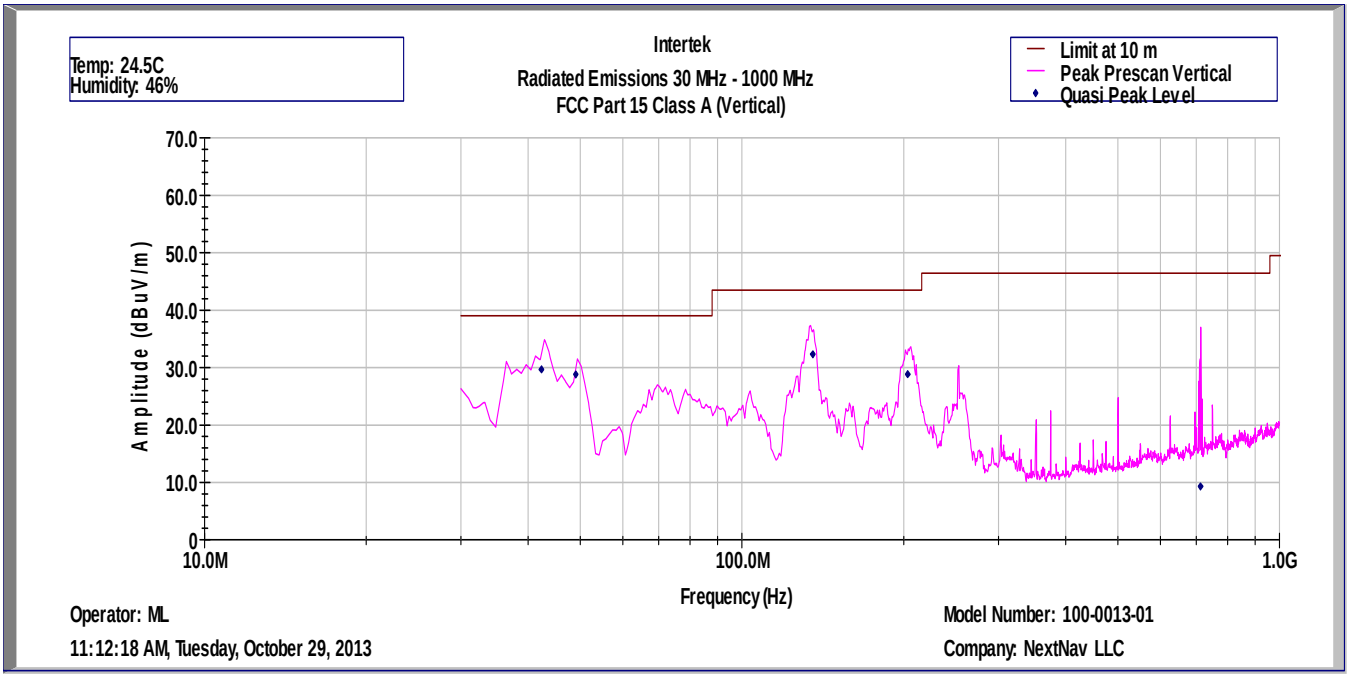
RA = 52.0 dB (µV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
PA = 29.0 dB
FS = RF + AF + CF – PA
FS = 52.0 + 7.4 + 1.6 – 29.0
FS = 32 dB (µV/m)

9.1.3 Test Results

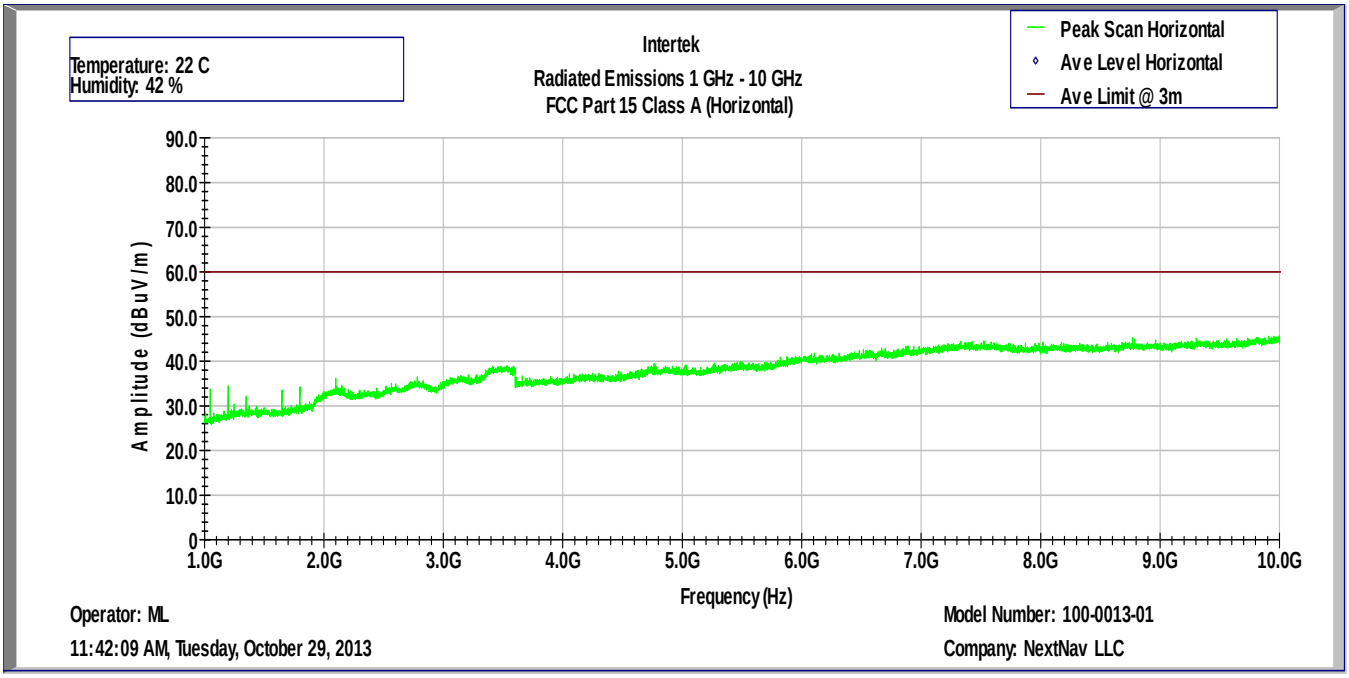
Result	Complies by 9.3 dB

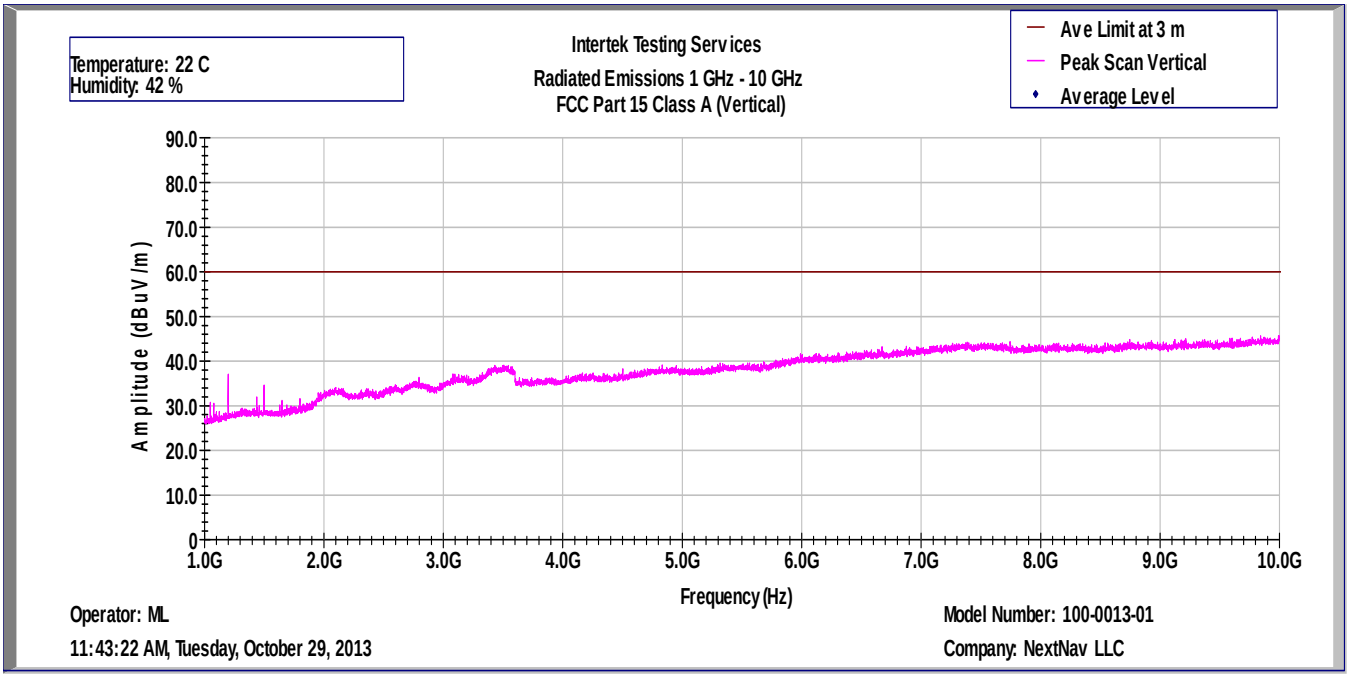


Intertek Testing Services							
Radiated Emissions 30 MHz - 1000 MHz							
FCC Part 15 Class A (QP-Horizontal)							
Operator: ML				Model Number: 100-0013-01			
October 29, 2013				Company: NextNav LLC			
Frequency (MHz)	**Quasi Pk FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**AF dB(1/m)**
132.92	28.6	43.5	-14.9	48.3	1.3	32	11
Mode: Normal mode Temp: 23.5 C, Humidity: 46.7%							



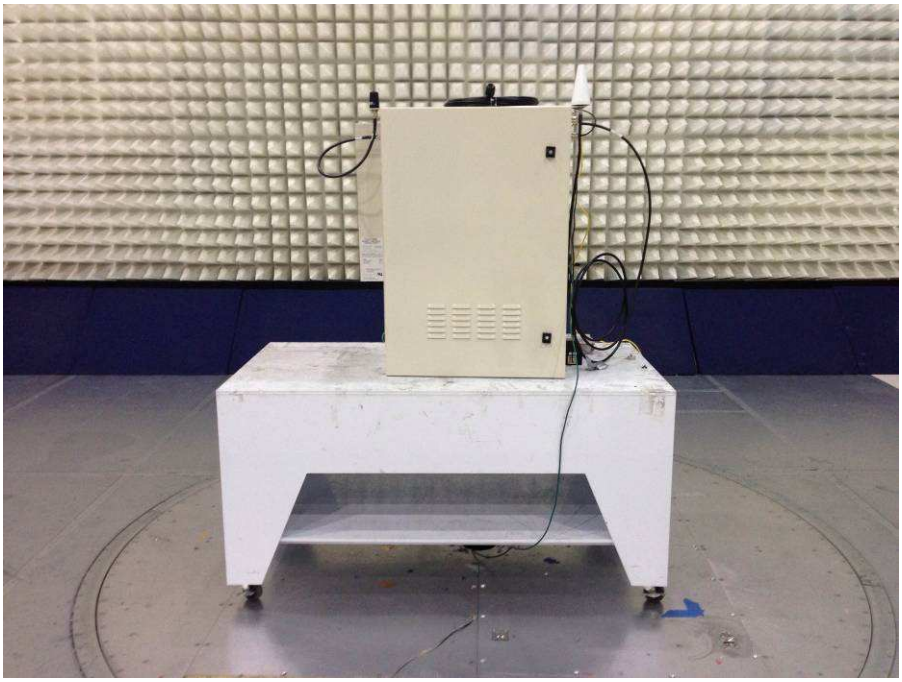
Intertek Testing Services							
Radiated Emissions 30 MHz - 1000 MHz							
FCC Part 15 Class A (QP-Vertical)							
Operator: ML				Model Number: 100-0013-01			
October 29, 2013				Company: NextNav LLC			
Frequency (MHz)	**Quasi Pk FS dB(uV/m)**	**Limit@3m dB(uV/m)**	**Margin dB**	**RA dB(uV)**	**CF dB**	**AG dB**	**AF dB(1/m)**
42.36	29.7	39.0	-9.3	44.9	0.7	32.1	16.5
49.08	28.8	39.0	-10.2	45.5	0.8	32.1	15
135.46	32.3	43.5	-11.2	53.3	1.3	32	10.4
203.42	28.8	43.5	-14.7	50	1.7	32	10
712.90	9.3	46.4	-37.1	20.8	3.2	32.3	19.2
Mode: Normal mode Temp: 23.5 C, Humidity: 46.7%							


Temperature: 22 C
Humidity: 42 %
Intertek
Radiated Emissions 1 GHz - 10 GHz
FCC Part 15 Class A (Horizontal)
Peak Scan Horizontal
Ave Level Horizontal
Ave Limit @ 3m
Amplitude (dBuV/m)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
1.0G
2.0G
3.0G
4.0G
5.0G
6.0G
7.0G
8.0G
9.0G
10.0G
Frequency (Hz)
Operator: ML
11:42:09 AM, Tuesday, October 29, 2013
Model Number: 100-0013-01
Company: NextNav LLC


Temperature: 22 C
Humidity: 42 %
Intertek Testing Services
Radiated Emissions 1 GHz - 10 GHz
FCC Part 15 Class A (Vertical)
Ave Limit at 3 m
Peak Scan Vertical
Average Level
Amplitude (dBuV/m)
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
1.0G
2.0G
3.0G
4.0G
5.0G
6.0G
7.0G
8.0G
9.0G
10.0G
Frequency (Hz)
Operator: ML
11:43:22 AM, Tuesday, October 29, 2013
Model Number: 100-0013-01
Company: NextNav LLC

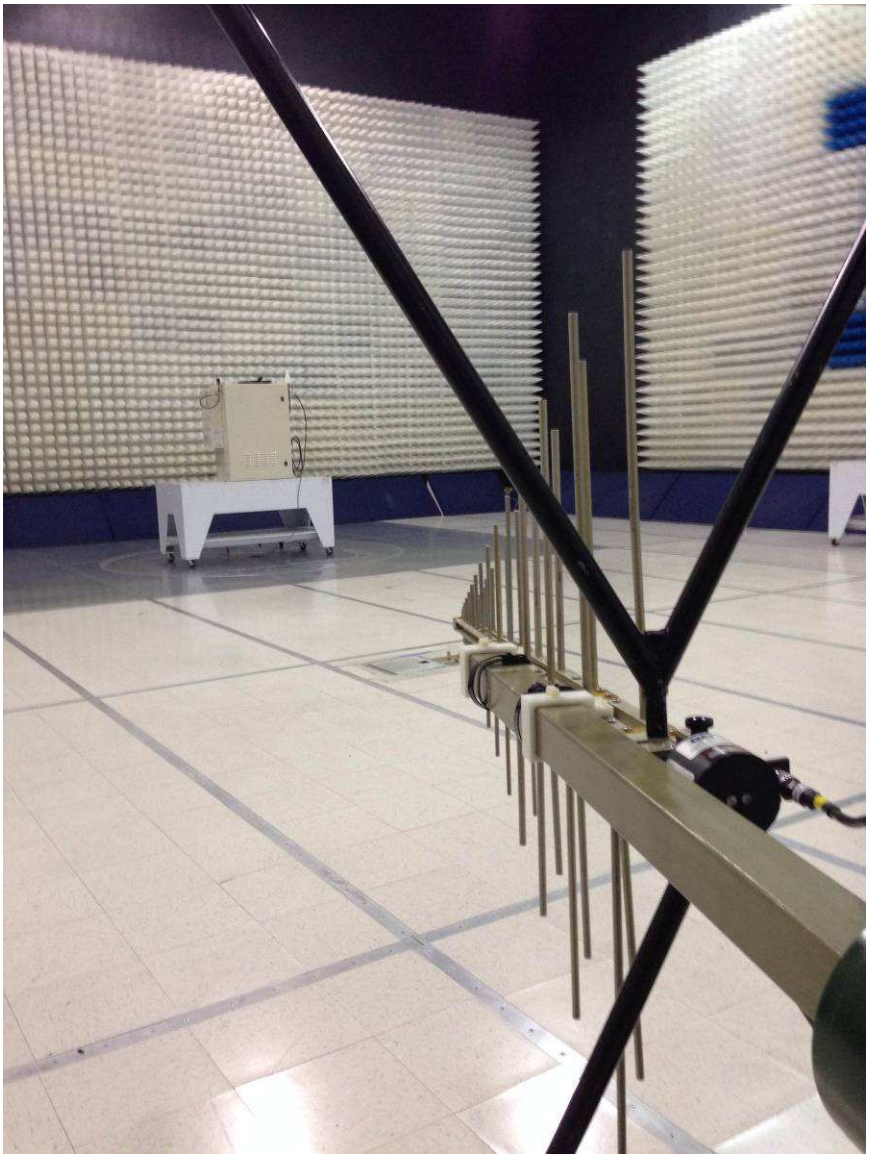
9.1.4 Test Setup Photographs

Radiated Emission Test Setup

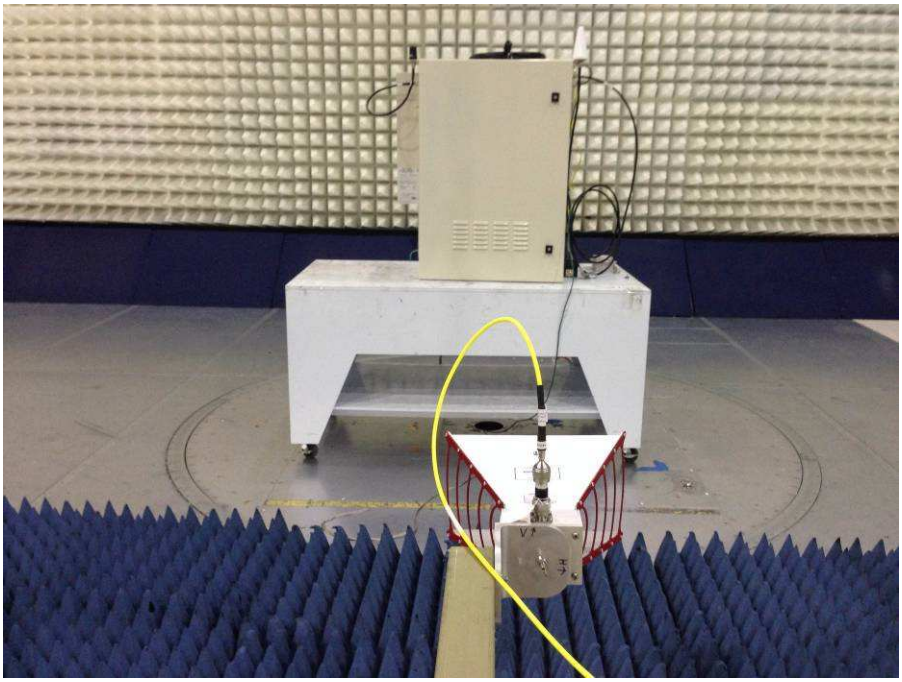


9.1.4 Test Setup Photographs

Radiated Emission Test Setup



Radiated Emission Test Setup



9.2 Line Conducted Emissions
FCC Rules: 15.107

9.2.1 Requirements

Frequency Band MHz	Class B Limit dB(µV)		Class A Limit dB(µV)	
	Quasi-Peak	Average	Quasi-Peak	Average
0.15-0.50	66 to 56 *	56 to 46 *	79	66
0.50-5.00	56	46	73	60
5.00-30.00	60	50	73	60

*Note: *Decreases linearly with the logarithm of the frequency*
At the transition frequency the lower limit applies.

9.2.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

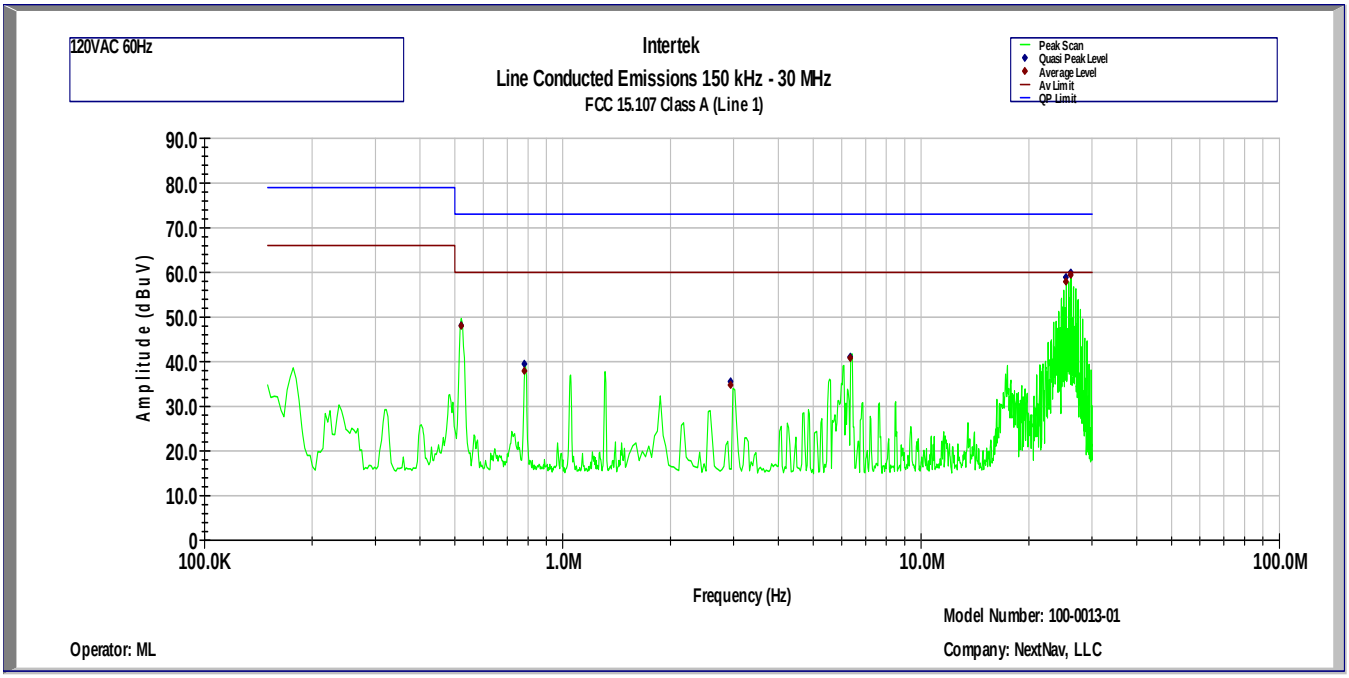
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

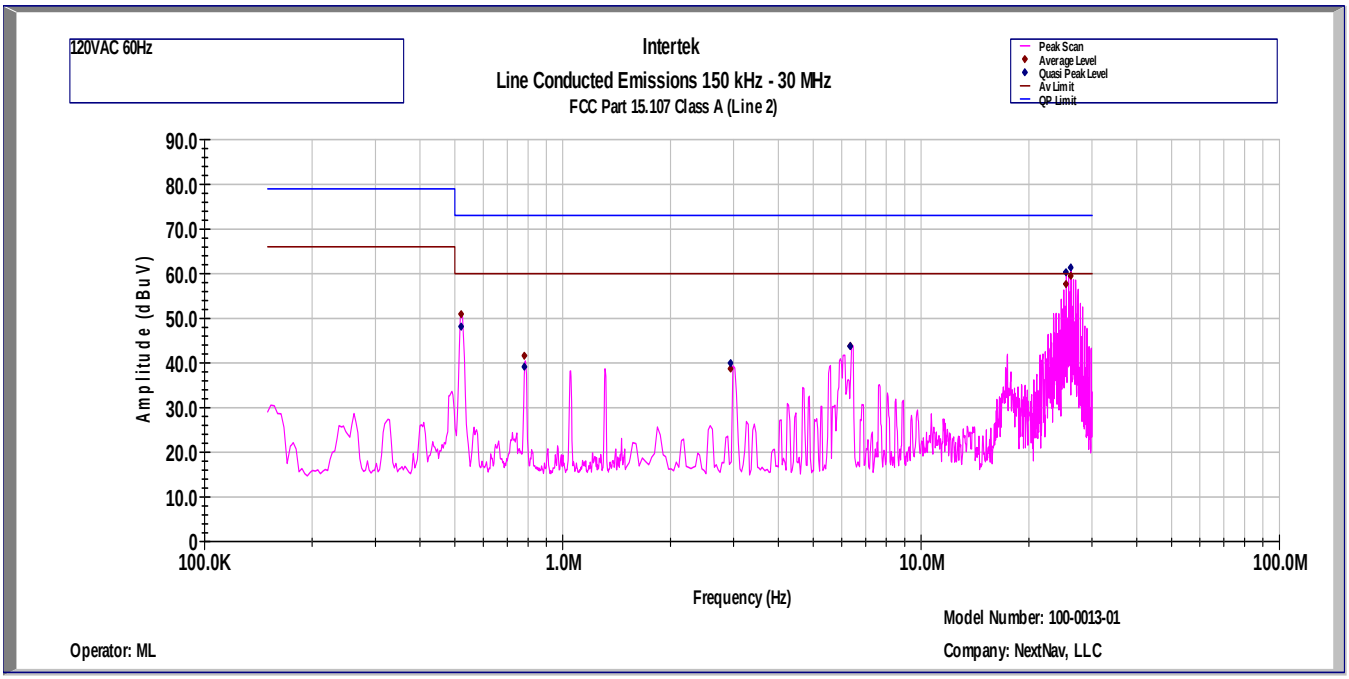
9.2.3 Test Result

AC Line Conducted Emission Data



Intertek Testing Services						
Line Conducted Emissions 150 kHz - 30 MHz						
FCC Part 15 Class A, Line 1						
Operator: ML				Model Number: 100-0013-01		
October 29, 2013				Company: NextNav LLC		
Frequency (MHz)	**Av Level dBuV**	**QP Level dBuV**	**Av Limit dBuV**	**QP Limit dBuV**	**Av Margin dB**	**QP Margin dB**
0.52	48	48.1	60	73	-12	-24.9
0.78	37.9	39.5	60	73	-22.1	-33.5
2.94	34.8	35.5	60	73	-25.2	-37.5
6.34	40.8	41.1	60	73	-19.2	-31.9
25.35	57.9	58.9	60	73	-2.1	-14.1
26.15	59.4	59.9	60	73	-0.6	-13.1
Mode: Normal Mode at 120V 60Hz						

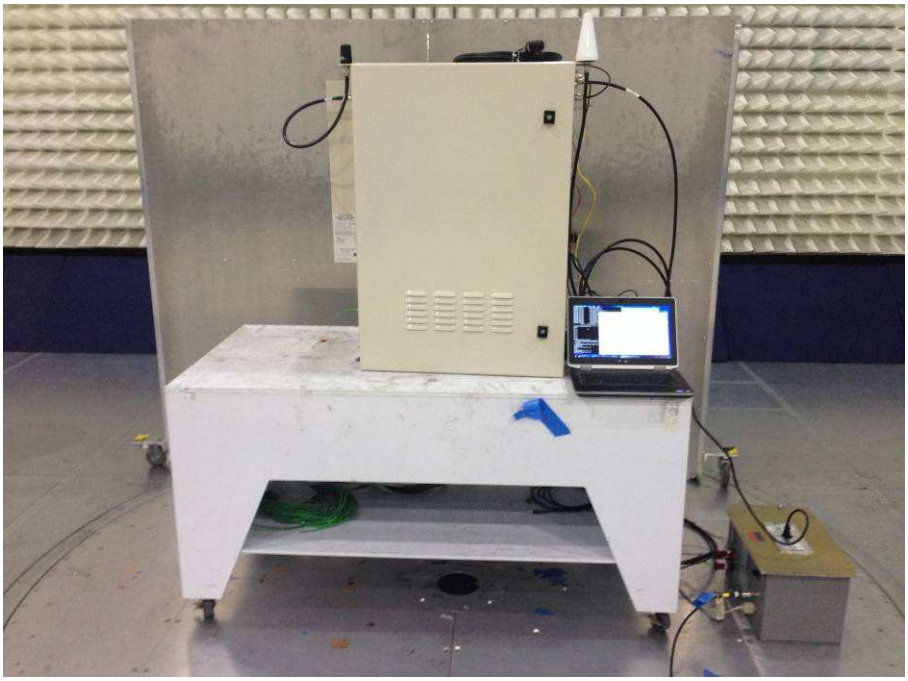
AC Line Conducted Emission Data



Intertek Testing Services						
Line Conducted Emissions 150 kHz - 30 MHz						
FCC Part 15 Class A						
Operator: ML				Model Number: 100-0013-01		
October 29, 2013				Company: NextNav LLC		
Frequency (MHz)	**Av Level dBuV**	**QP Level dBuV**	**Av Limit dBuV**	**QP Limit dBuV**	**Av Margin dB**	**QP Margin dB**
0.52	50.9	48.1	60	73	-9.1	-24.9
0.78	41.6	39.1	60	73	-18.4	-33.9
2.94	38.7	40	60	73	-21.3	-33
6.34	43.8	43.7	60	73	-16.2	-29.3
25.35	57.7	60.3	60	73	-2.3	-12.7
26.15	59.5	61.4	60	73	-0.5	-11.6
Mode: Normal Mode at 120V 60Hz						

Results	**Complies** by 0.5 dB

9.2.4 Test Setup Photographs



10.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/12/14
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/12/14
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	04/05/14
BI-Log Antenna	ARA	LPB-2513/A	1154	12	08/01/14
Horn Antenna	EMCO	3115	9107-3712	12	11/15/13
Signal Generator	Rohde & Schwarz	SMR40	100445	12	08/30/14
Horn Antenna	EMCO	3115	9107-3712	12	12/06/13
Preamp	Sonoma	310N	185634	12	12/12/13
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	799159	12	09/27/14
Biconical Antenna	Electro-Metrics	EM-6912	565	12	05/15/14
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	02/28/14

11.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G101386112	ML	November 15, 2013	Original document