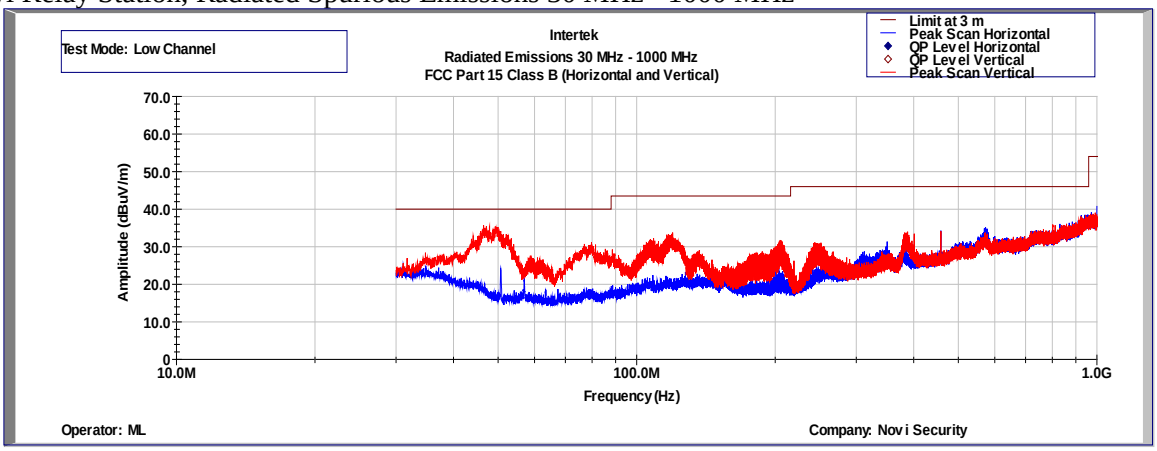
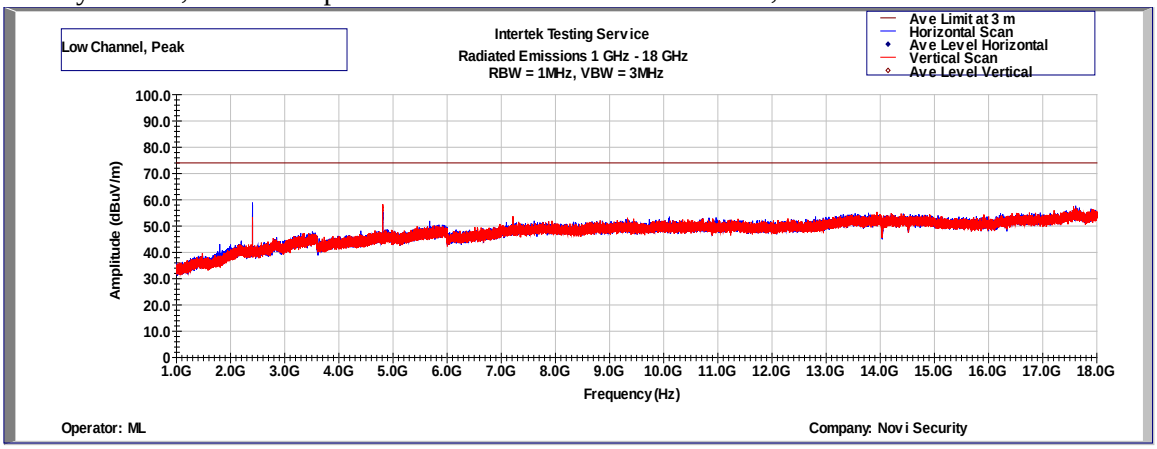
Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2405MHz

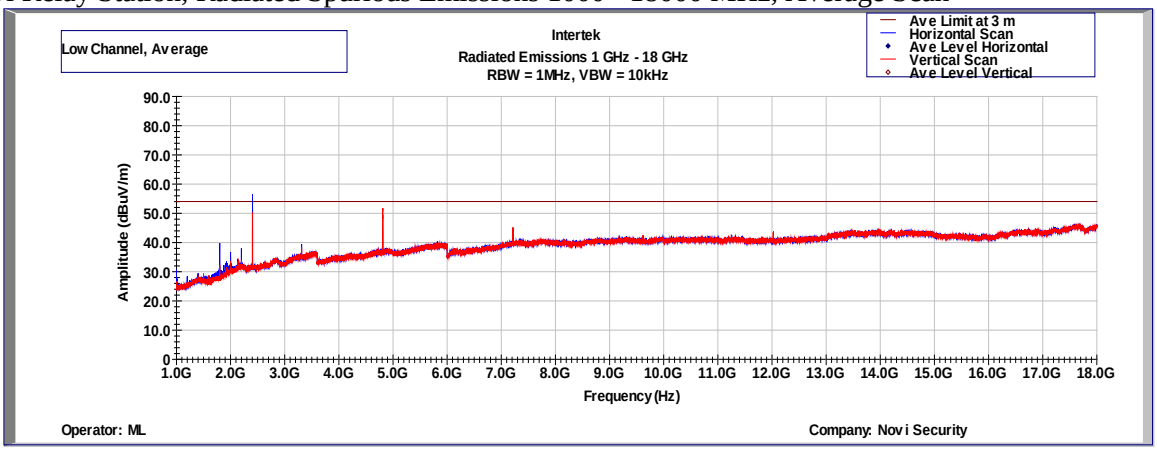
Novi Relay Station, Radiated Spurious Emissions 30 MHz - 1000 MHz



Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



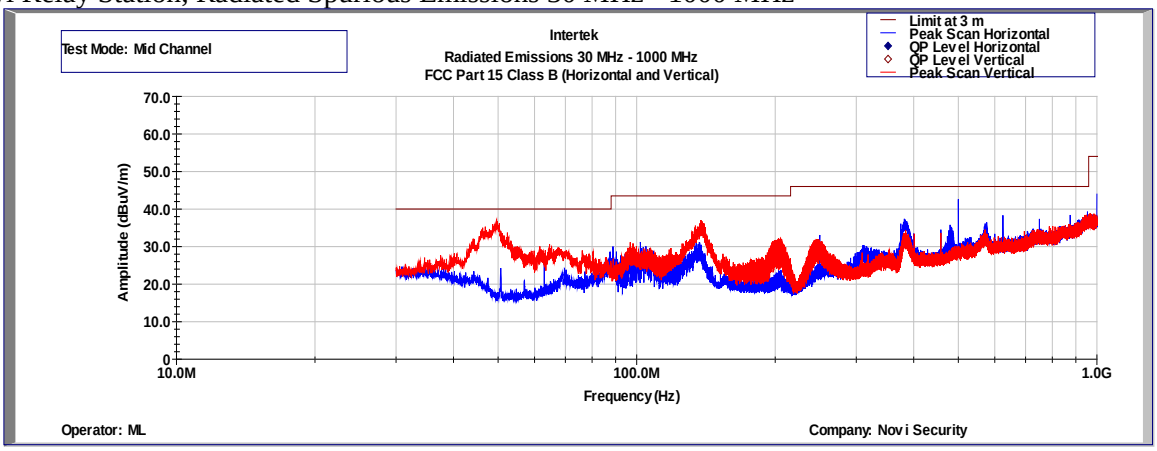
Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



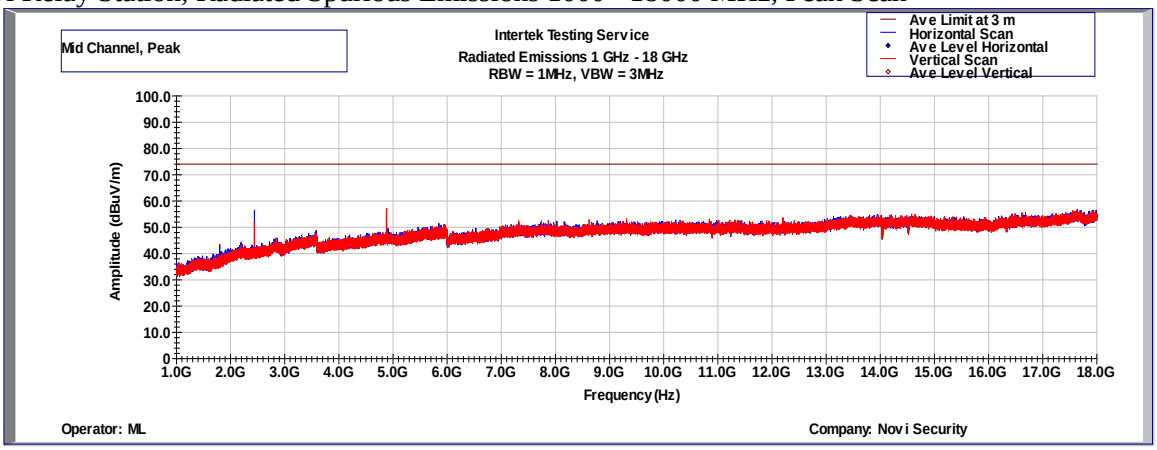
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Test Results: 15.209 Radiated Spurious Emissions Mid Channel, Tx at 2440MHz

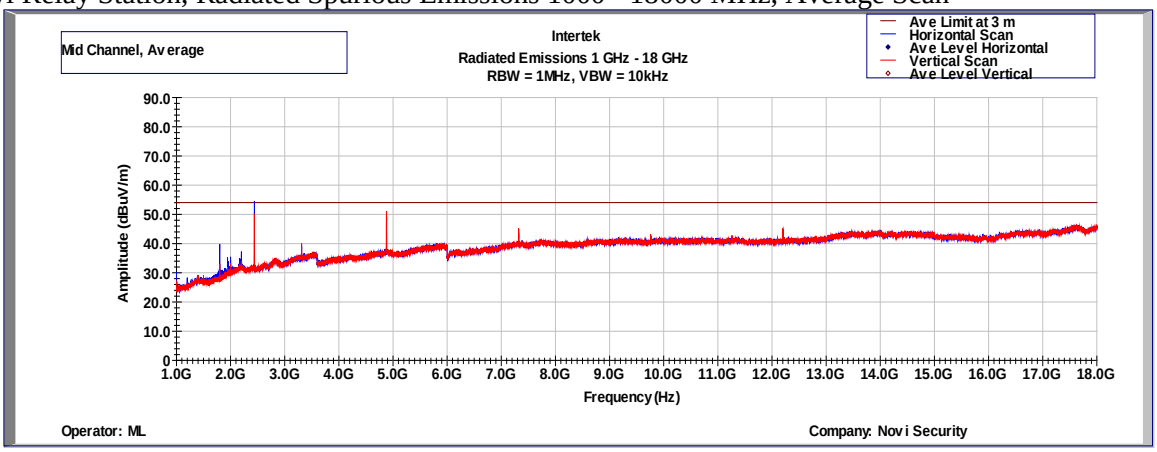
Novi Relay Station, Radiated Spurious Emissions 30 MHz - 1000 MHz



Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



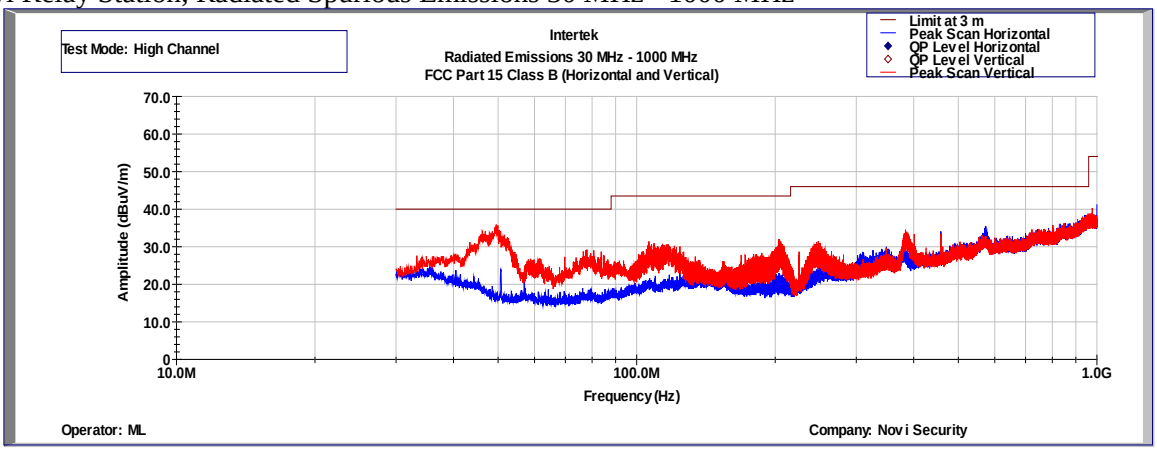
Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



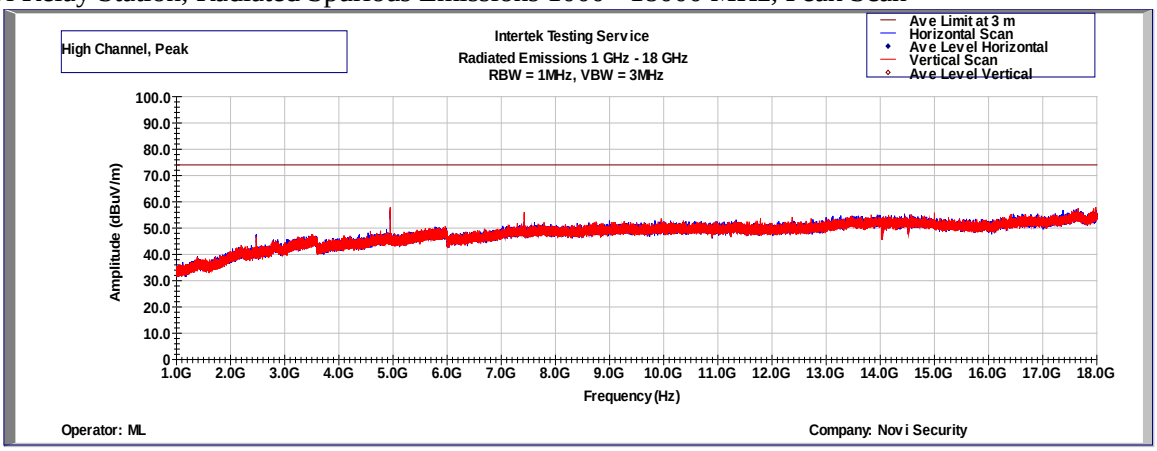
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Test Results: 15.209 Radiated Spurious Emissions High Channel, Tx at 2475MHz

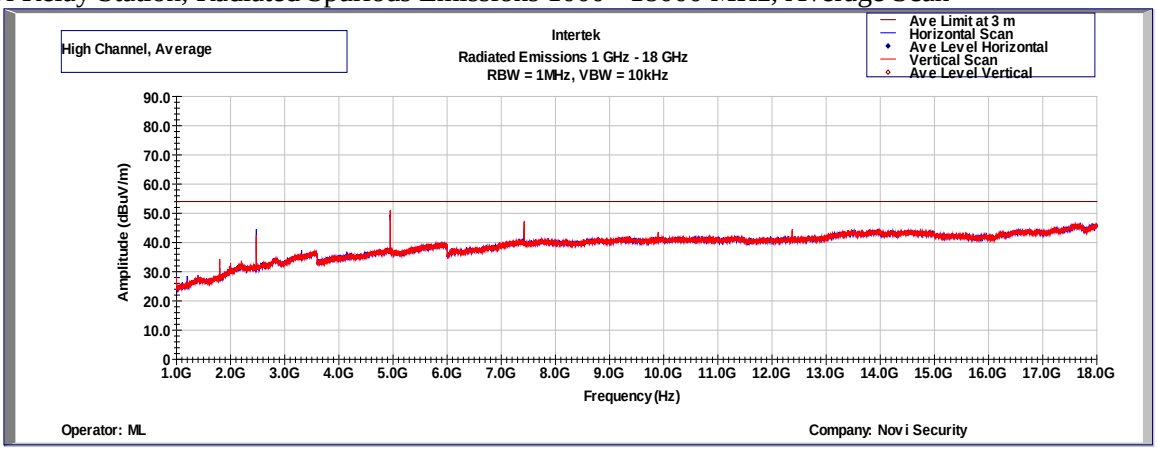
Novi Relay Station, Radiated Spurious Emissions 30 MHz - 1000 MHz



Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



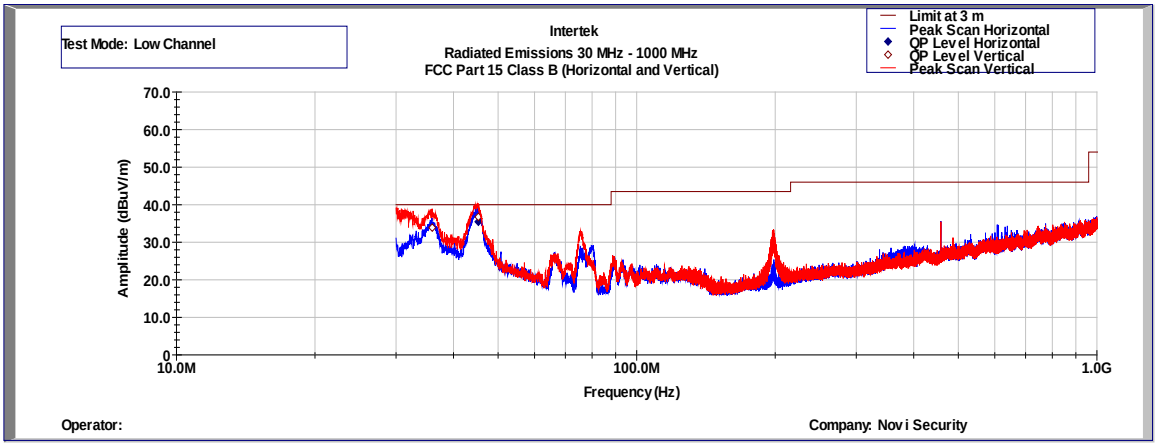
Novi Relay Station, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2405MHz

Novi Sensor, Radiated Spurious Emissions 30 MHz - 1000 MHz



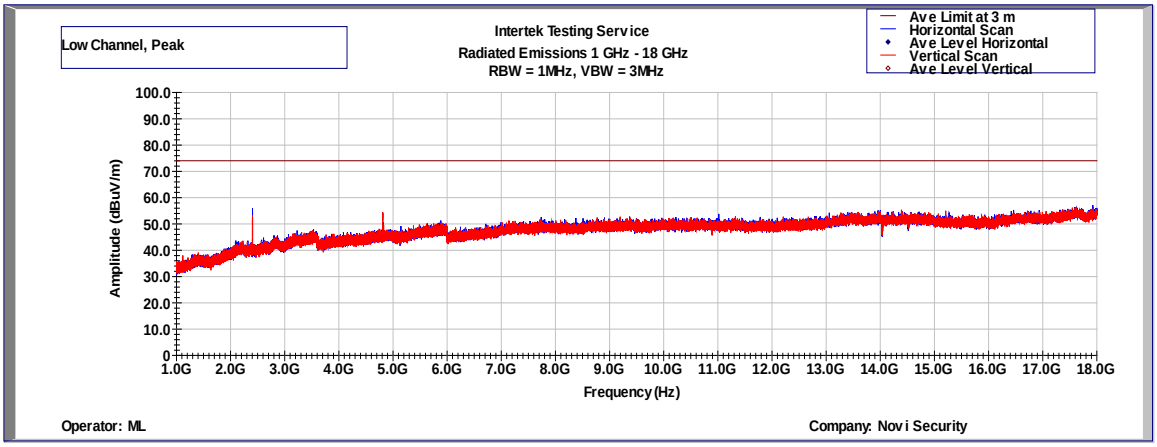
Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz

Operator: ML

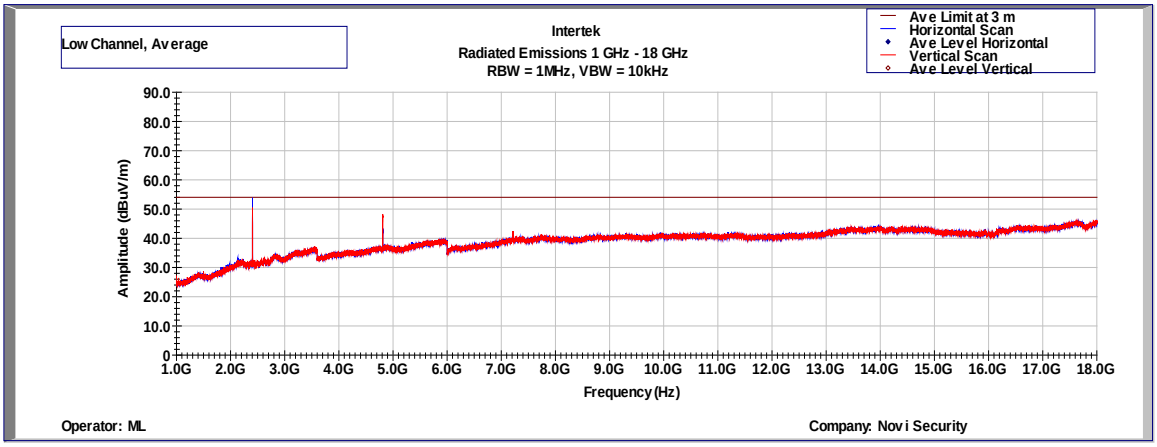
Model Number: NS-2415-P
Company: Novi Security, Inc

FCC Part 15 Class B (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
35.960	33.9	40.0	-6.1	39.2	0.7	34.2	10.5	17.7	0.0	208.0
45.300	36.8	40.0	-3.2	43.4	0.8	34.2	10.5	16.3	300.0	100.0
FCC Part 15 Class B (QP-Horizontal)										
45.300	35.5	40.0	-4.5	42.1	0.8	34.2	10.5	16.3	0.0	100.0

Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



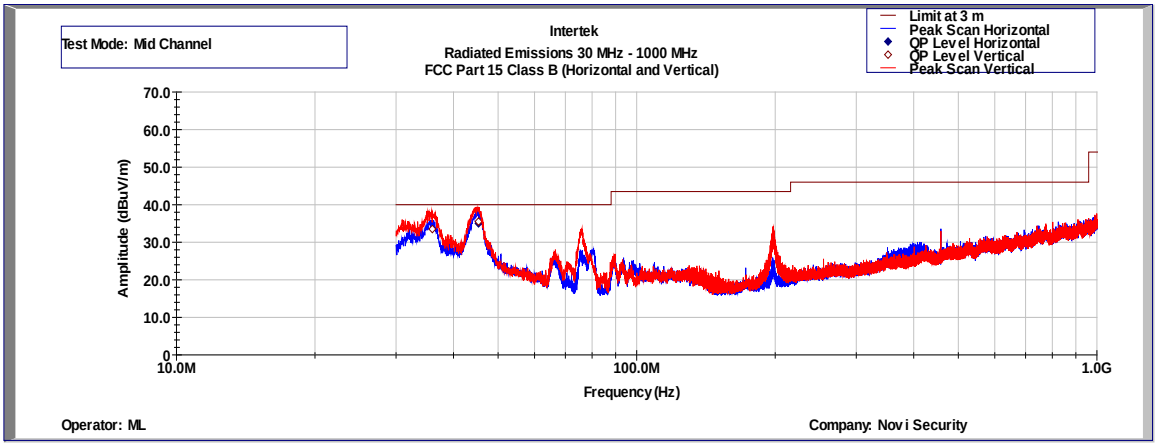
Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2440MHz

Novi Sensor, Radiated Spurious Emissions 30 MHz - 1000 MHz

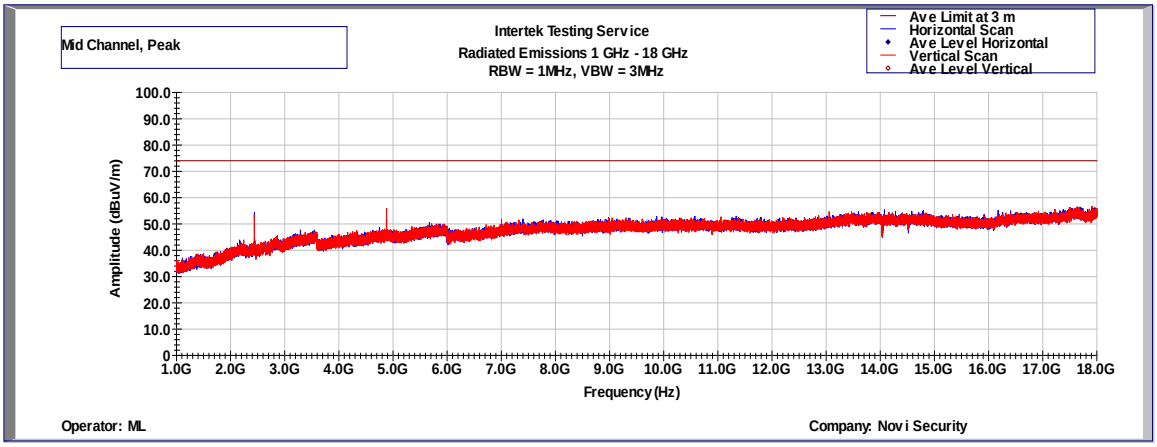


Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
Operator: ML

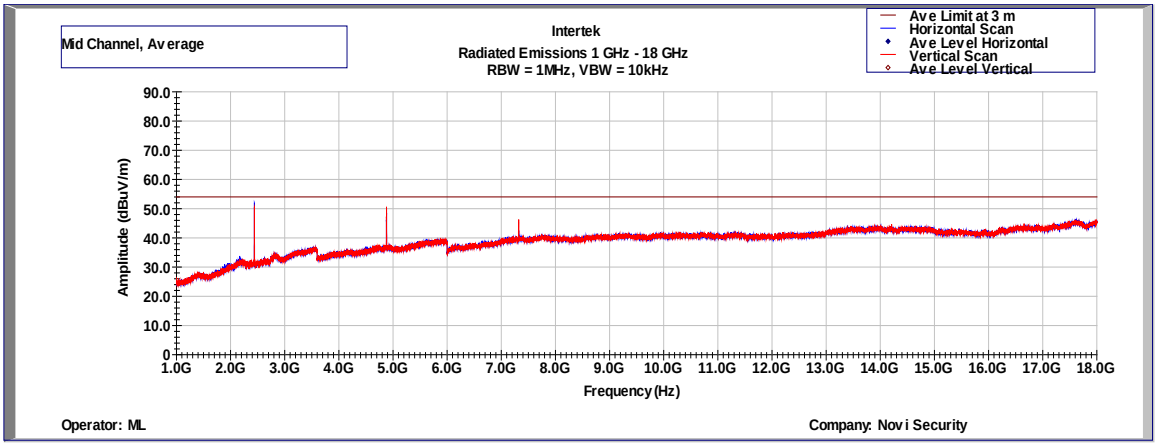
Model Number: NS-2415-P
Company: Novi Security, Inc

FCC Part 15 Class B (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
35.978	33.5	40.0	-6.5	38.8	0.7	34.2	10.5	17.7	0.0	209.0
45.330	35.5	40.0	-4.5	42.2	0.8	34.2	10.5	16.3	302.0	100.0
FCC Part 15 Class B (QP-Horizontal)										
45.341	35.0	40.0	-5.0	41.7	0.8	34.2	10.5	16.3	360.0	100.0

Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



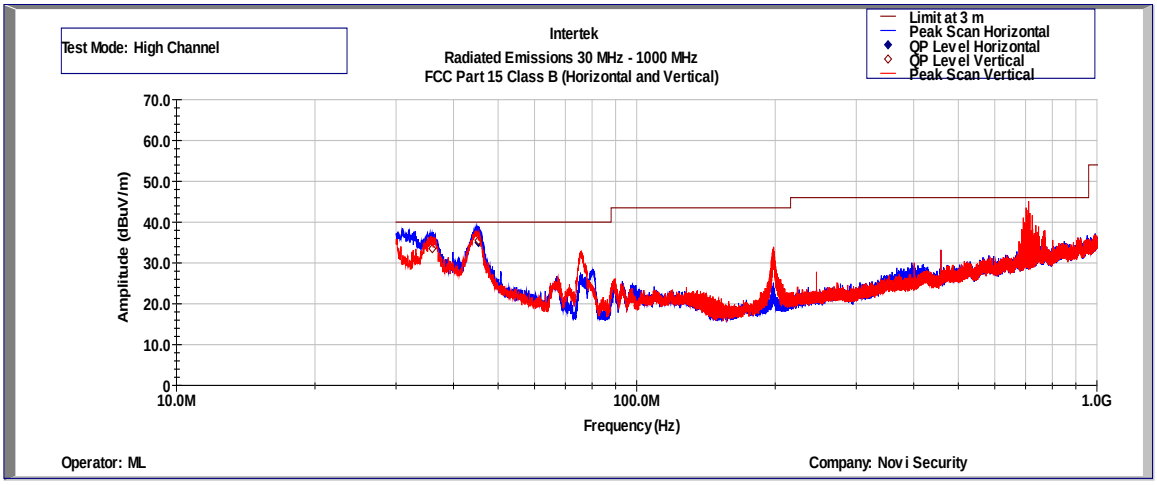
Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Test Results: 15.209 Radiated Spurious Emissions Low Channel, Tx at 2475MHz

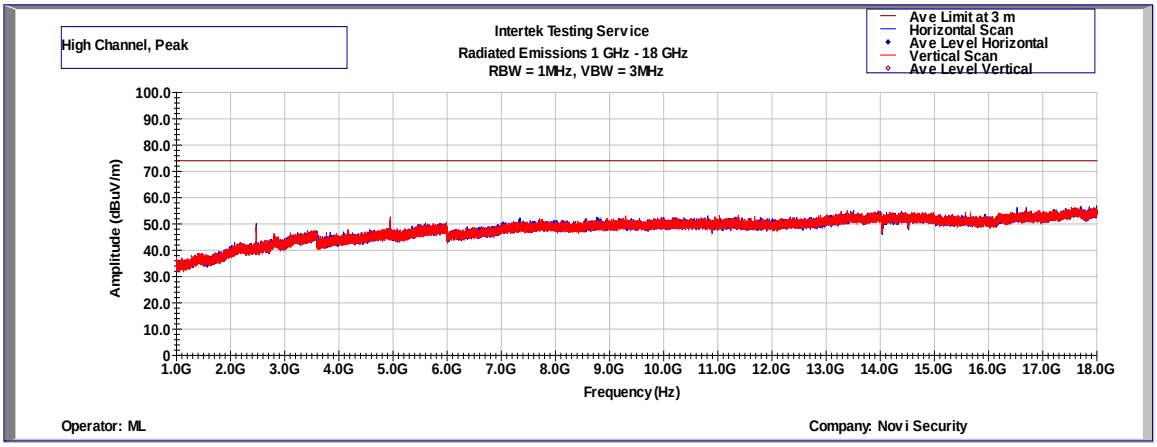
Novi Sensor, Radiated Spurious Emissions 30 MHz - 1000 MHz



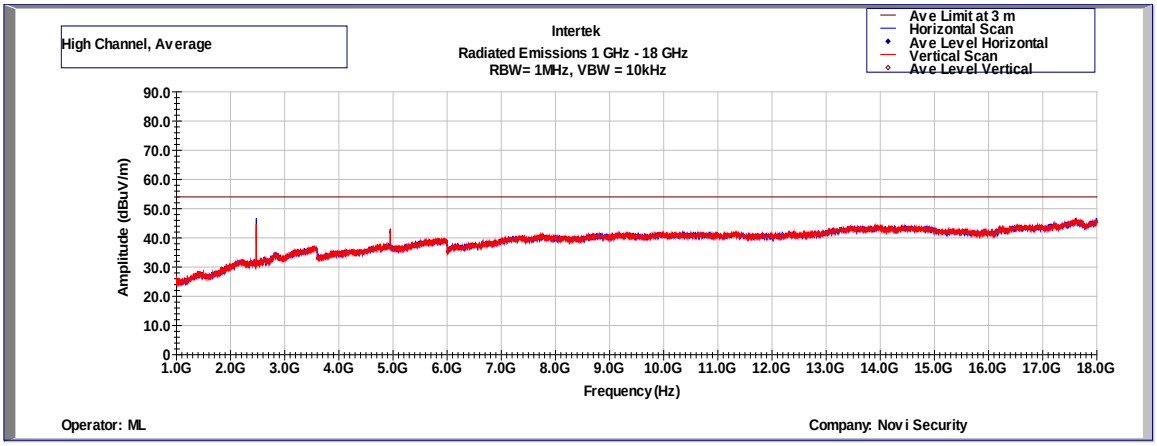
Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
Operator: ML
Model Number: NS-2415-P
Company: Novi Security, Inc

FCC Part 15 Class B (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
35.960	33.8	40.0	-6.2	39.1	0.7	34.2	10.5	17.7	0.0	200.0
45.290	35.9	40.0	-4.1	42.5	0.8	34.2	10.5	16.3	300.0	112.0
FCC Part 15 Class B (QP-Horizontal)										
45.370	35.2	40.0	-4.8	41.9	0.8	34.2	10.5	16.3	0.0	100.0

Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Peak Scan



Novi Sensor, Radiated Spurious Emissions 1000 - 18000 MHz, Average Scan



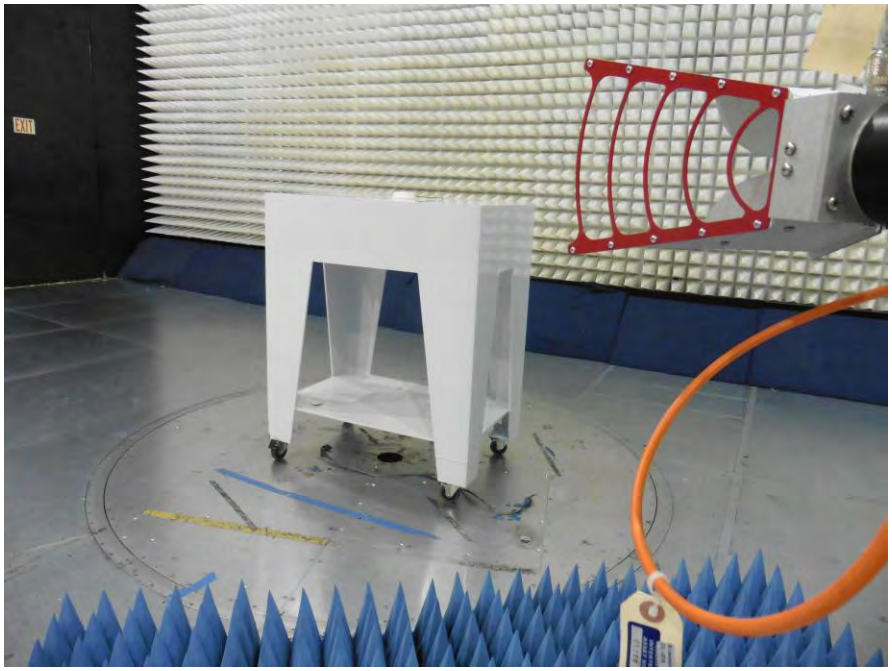
Note: Radiated emission measurements were performed up to 25GHz. No Emissions were identified when scanned from 18-25 GHz

Results	**Complies**

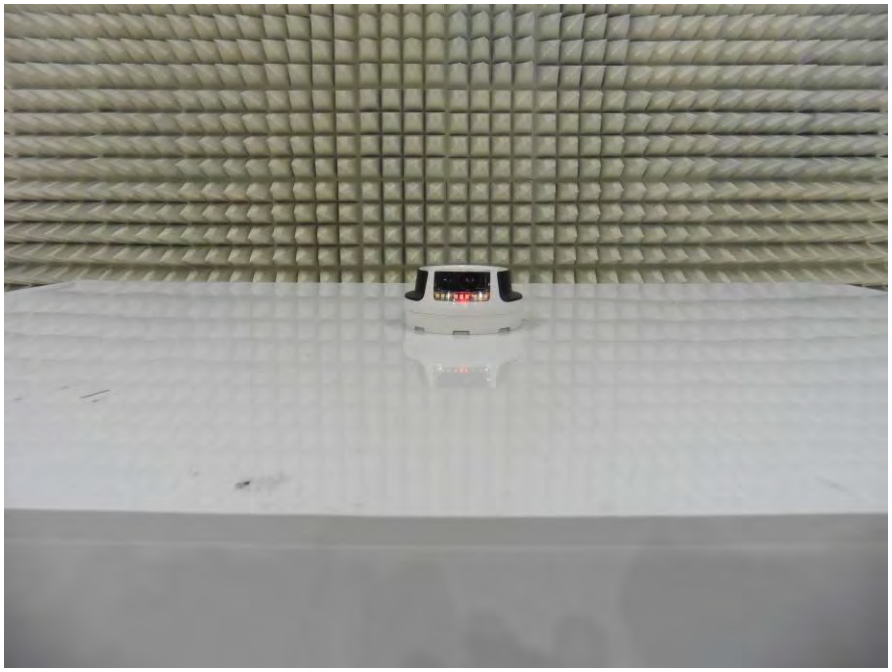
4.5.5 Test setup photographs

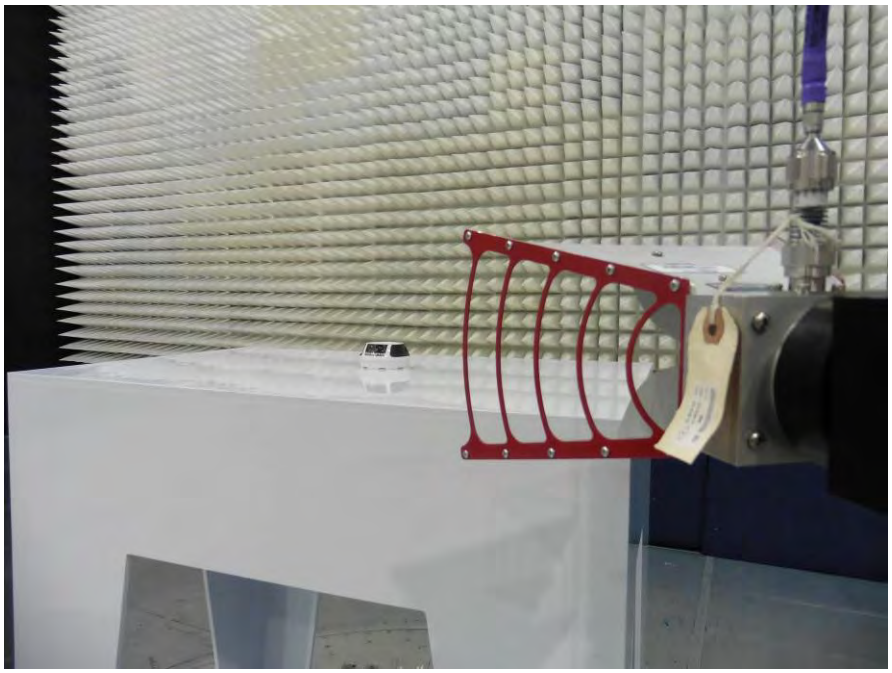
The following photographs show the testing configurations used.

Novi Relay Station



Novi Sensor





4.6 Radiated Emissions

FCC Ref: 15.109, ICES 003

4.6.1 Requirement

Limits for Electromagnetic Radiated Emissions FCC Section 15.109(b), ICES 003*, RSS GEN

Frequency (MHz)	**Class A at 10m dB(µV/m)**	**Class B at 3m dB(µV/m)**
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.6.2 Procedures

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 EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material.

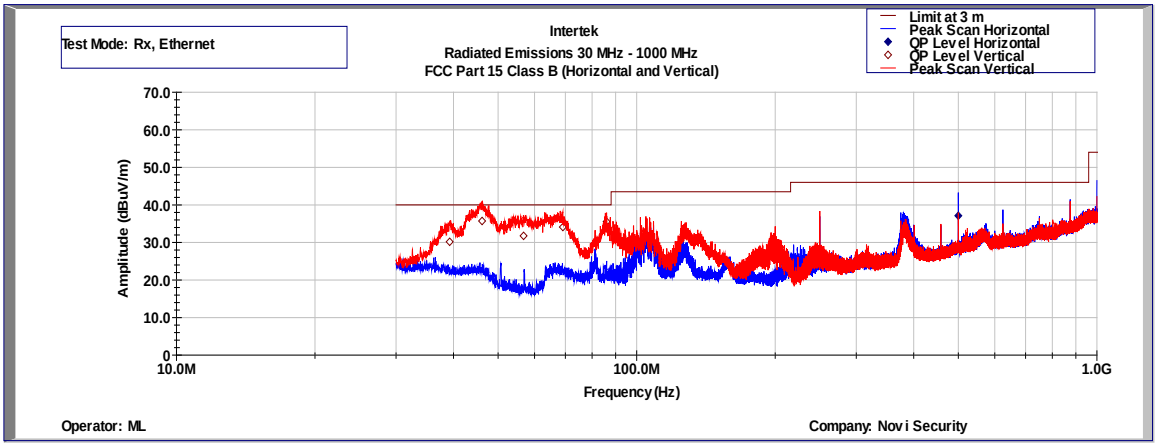
Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 and EN 55022.

4.6.3 Test Results

The highest clock frequency used in the EUT is 16 MHz; therefor testing for Radiated Emissions need be tested up to 1 GHz for FCC 15B. Radiated emission measurements were performed from 30 MHz to 1000 MHz. The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

Test Results: Novi Relay Station, with Power Supply PA1008-090DU100

Radiated Emissions 30 MHz – 1000MHz.



Intertek Testing Services

Radiated Emissions 30 MHz - 1000 MHz

Operator: ML

Model Number: NR-2415-P

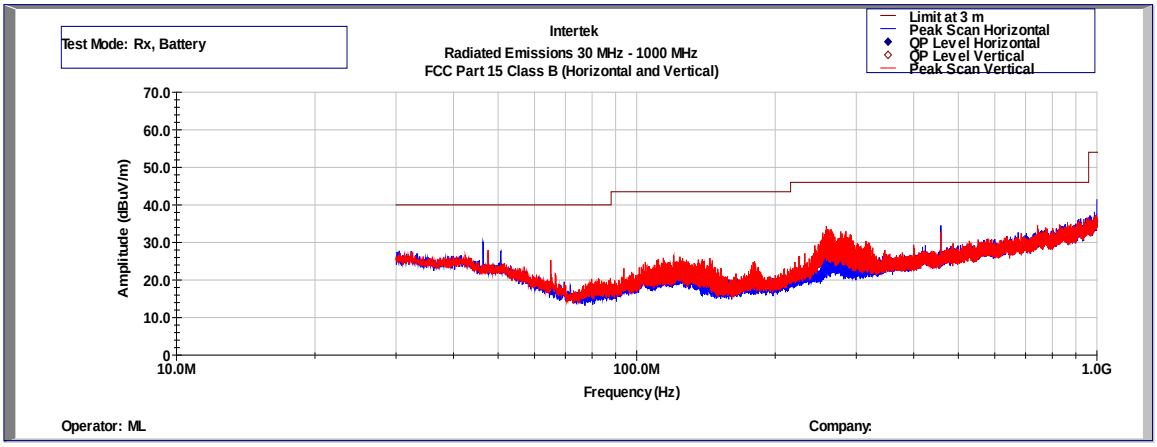
Company: Novi Security, Inc

FCC Part 15 Class B (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
39.240	30.2	40.0	-9.8	37.1	0.7	32.1	10.5	13.9	71.0	209.0
46.150	35.7	40.0	-4.3	46.1	0.8	32.1	10.5	10.4	266.0	100.0
56.790	31.7	40.0	-8.3	46.2	0.9	32.1	10.5	6.2	205.0	100.0
69.123	34.1	40.0	-5.9	47.8	1.0	32.1	10.5	6.9	85.0	215.0
86.040	35.5	40.0	-4.5	47.9	1.1	32.1	10.5	8.1	338.0	163.0
FCC Part 15 Class B (QP-Horizontal)										
500.000	37.1	46.0	-8.9	38.5	2.5	32.1	10.5	17.7	175.0	226.0

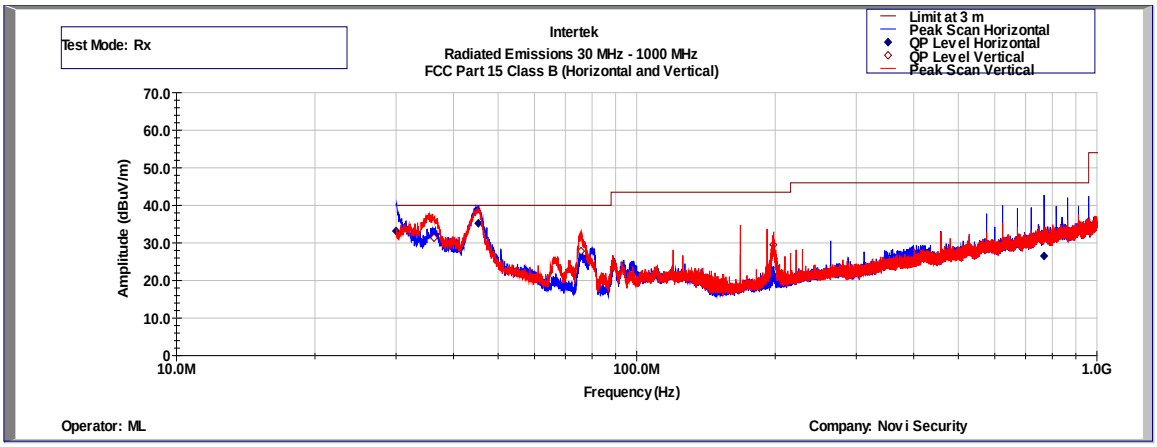
Result: **Complies** by 4.3 dB

Test Results: Novi Relay Station, Battery Mode

Radiated Emissions 30 MHz – 1000MHz.



Test Results: Novi Sensor, Radiated Emissions 30 MHz – 1000MHz.



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz

Operator: ML

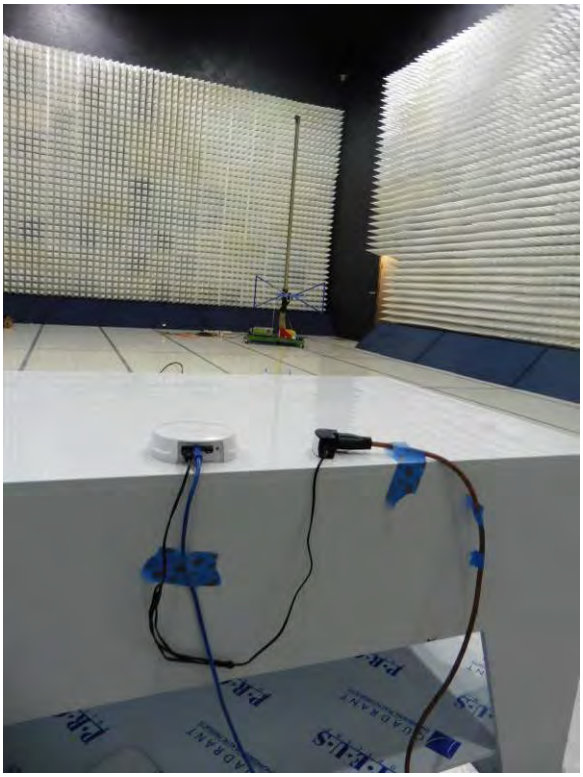
Model Number: NS-2415-P
Company: Novi Security, Inc

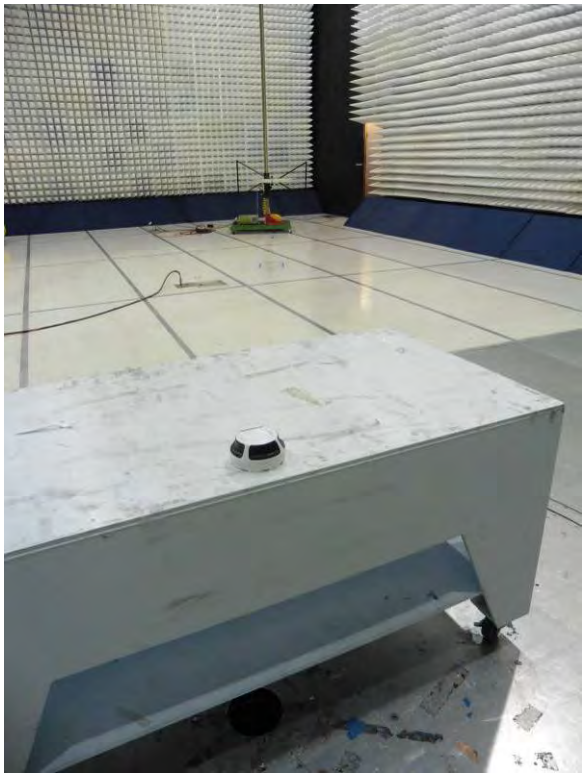
FCC Part 15 Class B (QP-Vertical)										
Frequency	Quasi Pk FS	Limit@3m	Margin	RA	Cable	AG	DCF	AF	Azimuth	Height
MHz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB	dB(1/m)	deg	cm
36.280	31.4	40.0	-8.6	36.7	0.7	34.2	10.5	17.7	360.0	166.0
75.700	27.8	40.0	-12.2	43.6	1.0	34.2	10.5	6.9	0.0	100.0
198.150	29.5	43.5	-14.0	42.4	1.2	34.2	10.5	9.6	88.0	100.0
FCC Part 15 Class B (QP-Horizontal)										
30.000	33.1	40.0	-6.9	38.2	0.6	34.2	10.5	18.0	0.0	100.0
45.300	35.2	40.0	-4.8	41.8	0.8	34.2	10.5	16.3	172.0	100.0
768.000	26.5	46.0	-19.5	25.1	3.2	33.0	10.5	20.6	0.0	100.0

Result: **Complies** by 4.8dB

4.6.4 Test Configuration Photographs

The following photographs show the testing configurations used.





4.7 AC Line Conducted Emission
FCC: 15.207, 15.107; RSS-GEN;

4.7.1 Requirement

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.

4.7.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a 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.

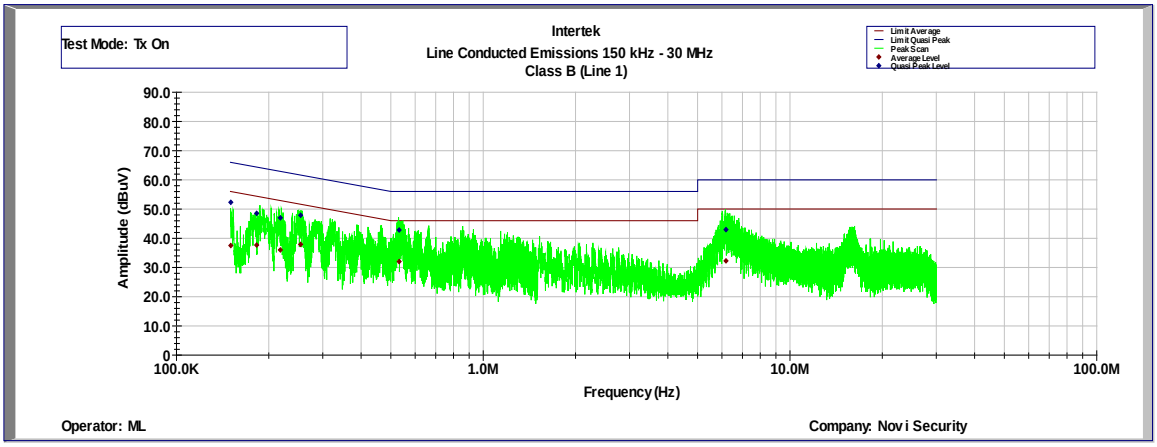
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground 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.

4.7.3 Test Result

AC Line Conducted Emission Data, EUT in transmitting mode



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 1)

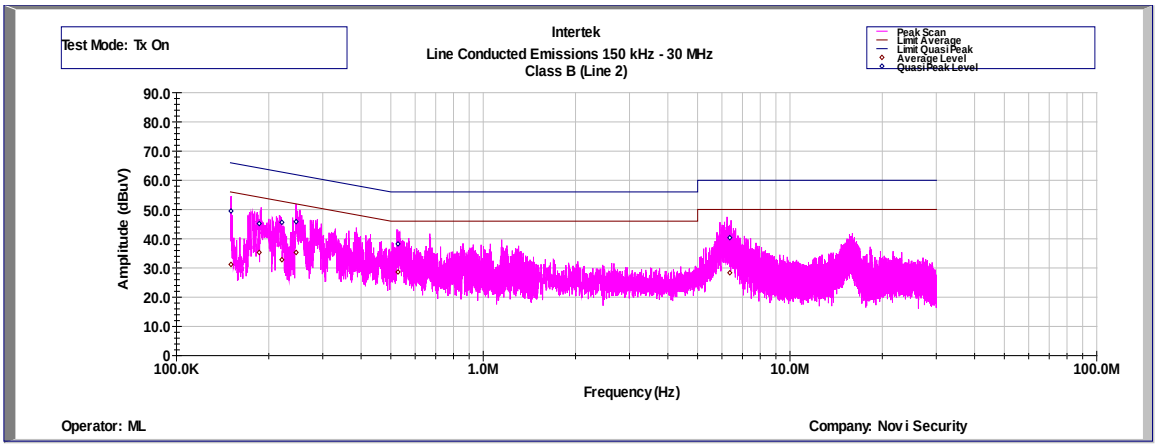
Operator: ML
October 05, 2015

Model Number: NR-2415-P
Company: Novi Security, Inc

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.150	37.5	52.3	56.0	66.0	-18.5	-13.7
0.183	37.7	48.5	55.1	65.1	-17.4	-16.5
0.218	36.0	47.0	54.1	64.1	-18.1	-17.1
0.254	37.9	47.9	53.0	63.0	-15.1	-15.2
0.532	32.0	42.8	46.0	56.0	-14.0	-13.2
6.181	32.2	42.9	50.0	60.0	-17.8	-17.1

Test Mode: Tx On, 120V 60Hz
Temp.: 20C
Humidity: 49.7%

AC Line Conducted Emission Data, EUT in transmitting mode



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 2)

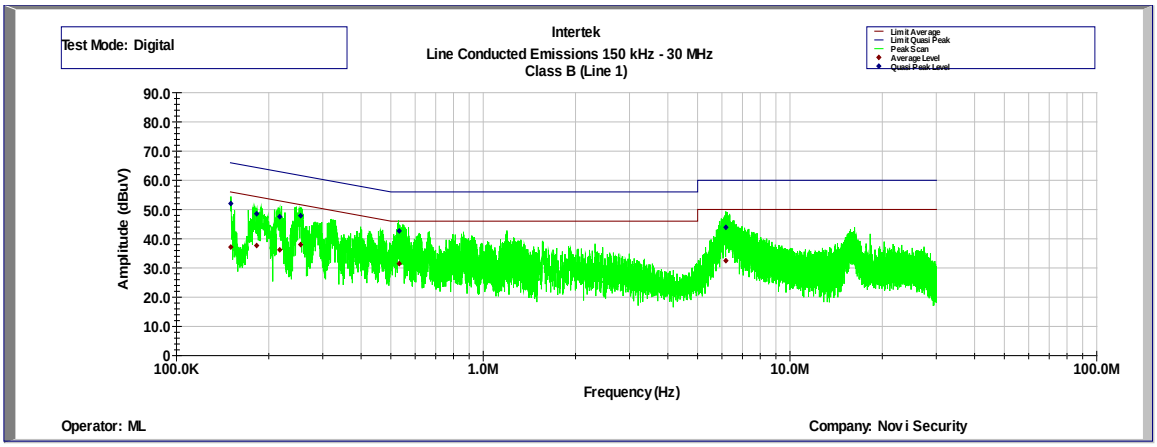
Operator: ML
October 05, 2015

Model Number: NR-2415-P
Company: Novi Security, Inc

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.151	31.2	49.5	56.0	66.0	-24.8	-16.5
0.186	35.3	45.2	55.1	65.1	-19.8	-19.9
0.221	32.8	45.6	54.1	64.1	-21.3	-18.5
0.246	35.3	45.8	53.0	63.0	-17.7	-17.2
0.528	28.6	38.2	46.0	56.0	-17.4	-17.8
6.362	28.3	40.3	50.0	60.0	-21.7	-19.7

Test Mode: Tx On, 120V 60Hz
Temp.: 20C
Humidity: 49.7%

AC Line Conducted Emission Data, Digital Parts Emissions



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 1)

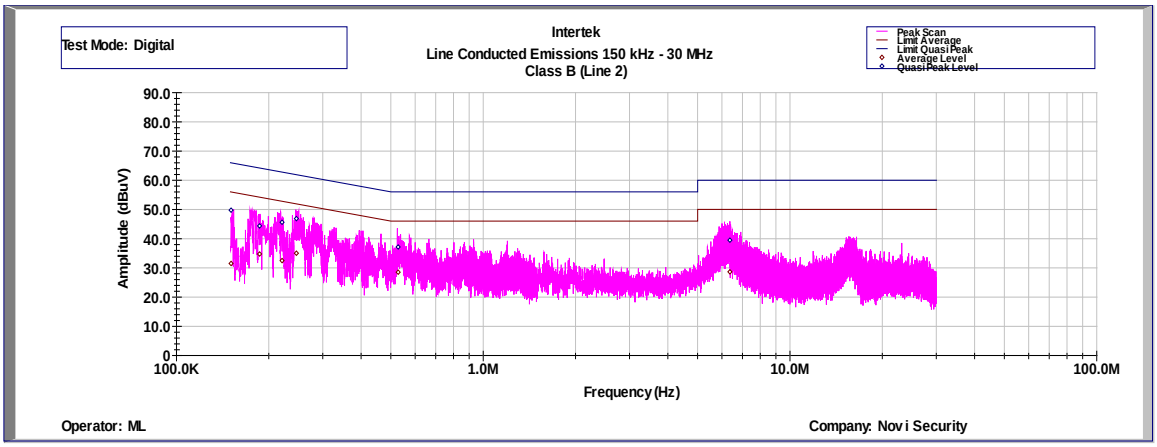
Operator: ML
October 05, 2015

Model Number: NR-2415-P
Company: Novi Security, Inc

Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.150	37.1	52.0	56.0	66.0	-18.9	-14.0
0.183	37.7	48.5	55.1	65.1	-17.4	-16.5
0.217	36.2	47.6	54.1	64.1	-17.9	-16.5
0.254	38.0	47.9	53.0	63.0	-15.0	-15.2
0.532	31.5	42.7	46.0	56.0	-14.5	-13.3
6.177	32.5	43.9	50.0	60.0	-17.5	-16.1

Test Mode: Digital, 120V 60Hz
Temp.: 20C
Humidity: 49.7%

AC Line Conducted Emission Data, Digital Parts Emissions



Intertek Testing Services
Line Conducted Emissions 150 kHz - 30 MHz
FCC Class B (Line 2)

Operator: ML
October 05, 2015

Model Number: NR-2415-P
Company: Novi Security, Inc

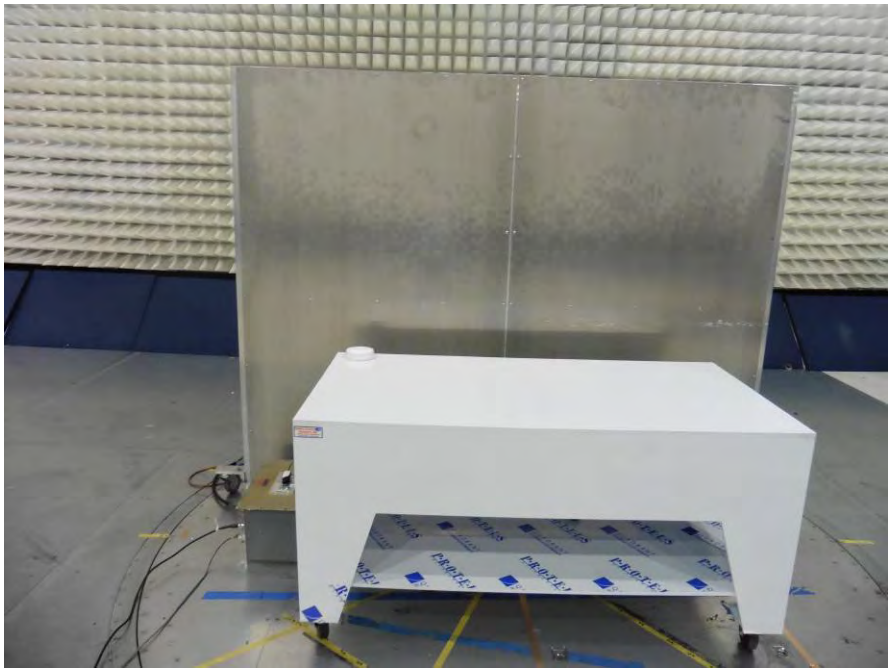
Frequency	Av Level	QP Level	Av Limit	QP Limit	Av Margin	QP Margin
MHz	dBuV	dBuV	dBuV	dBuV	dB	dB
0.151	31.5	49.7	56.0	66.0	-24.5	-16.3
0.187	34.7	44.4	55.1	65.1	-20.4	-20.7
0.221	32.5	45.6	54.1	64.1	-21.6	-18.5
0.246	35.0	46.8	53.0	63.0	-18.0	-16.2
0.528	28.5	37.2	46.0	56.0	-17.5	-18.8
6.368	28.6	39.5	50.0	60.0	-21.4	-20.5

Test Mode: Transmitter On, 120V 60Hz
Temp.: 20C
Humidity: 49.7%

Results	**Complies** by 13.3 dB

4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



5.0 RF Exposure Evaluation

MPE Evaluation (Relay Station)

The EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons.

The maximum Peak EIRP calculated is +17.34 dBm or 54.3 mW; therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

It is considered that 20 cm is the minimum distance that user can go closest to the EUT.

At 20 cm, S =0.108 W/m^2, which is below the MPE Limit of 10 W/m^2

MPE Evaluation (Sensor)

The EUT is a wireless device used in a mobile application, at least 20 cm from any body part of the user or nearby persons.

The maximum Peak EIRP calculated is +16.70 dBm or 46.77 mW; therefore, to comply with RF Exposure Requirement, the MPE is calculated.

The Power Density can be calculated using the formula

$$S = EIRP/ 4\pi D^2$$

Where: S is Power Density in W/m^2
D is the distance from the antenna.

It is considered that 20 cm is the minimum distance that user can go closest to the EUT.

At 20 cm, S =0.093 W/m^2, which is below the MPE Limit of 10 W/m^2

6.0 List of Test Equipment

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

Equipment	Manufacturer	Model/Type	Asset #	Cal Int	Cal Due
Spectrum Analyzer	Rohde and Schwarz	FSU	ITS00913	12	12/16/15
EMI Receiver	Rohde and Schwarz	ESU	ITS 00961	12	06/02/16
BI-Log Antenna	Teseq	CBL 6111D	ITS 01058	12	11/21/15
Pyramidal Horn Antenna	EMCO	3160-09	ITS00571	#	#
Pre-Amplifier	Sonoma Instrument	310N	ITS 00942	12	11/26/15
Pre-Amplifier (1-18GHz)	Miteq	AMF-4D-001180-24-10P	ITS 00526	12	10/06/16
Pre-Amplifier (18-40GHz)	Miteq	JSD44-18004000-305P	ITS 00921	12	06/18/16
Horn Antenna	ETS Lindgren	3115	ITS 00982	12	11/21/15
LISN	FCC	FCC-LISN-50-50-M-H	ITS 00552	12	05/05/16

No Calibration required

7.0 Document History

Revision/ Job Number	Writer Initials	Reviewers Initials	Date	Change
1.0 / G102195685	ML	KV	October 15, 2015	Original document