FCC Part 15.247
Transmitter Certification

Frequency Hopping Spread Spectrum Transmitter

<u>Test Report</u>

FCC ID: P2SNTGSRFE01

FCC Rule Part: 15.247

ACS Report Number: 05-0356-15C

Manufacturer: Neptune Technology Group, Inc.
Model: R900E

Test Begin Date: October 06, 2005
Test End Date: October 26, 2005

Report Issue Date: January 05, 2006

FOR THE SCOPE OF ACCREDITATION UNDER LAB Code 200612

Prepared by: ______________________
J. Kirby Munroe
Manager Wireless Certifications
ACS, Inc.

Reviewed by: ______________________
R. Sam Wismer
Engineering Manager
ACS, Inc.

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 15, Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

1.2.1 General

The R900E is a Spread Spectrum frequency hoping one-way transmitter that is designed to work with the Landis+Gyr Solid State Focus Meter. This is an AMR radio used to report customer kWh usage. .

Detailed photographs of the EUT are filed separately with this filing.

1.2.2 Intended Use

The R900E will be a transmit-only meter module that collects and transmits metering data over the 902 - 928 MHz Industrial, Scientific and Medical (ISM) RF band for collection by electric utility companies.

2.0 TEST FACILITIES

2.1 Location

The radiated and conducted emissions test sites are located at the following address:

Advanced Compliance Solutions
5015 B.U. Bowman Drive
Buford, GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598

2.2 Laboratory Accreditations/Recognitions/Certifications

The Semi-Anechoic Chamber Test Site, Open Area Test Site (OATS) and Conducted Emissions Site have been fully described, submitted to, and accepted by the FCC, Industry Canada and the Japanese Voluntary Control Council for Interference by information technology equipment. In addition, ACS is compliant to ISO 17025 as certified by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program. The following certification numbers have been issued in recognition of these accreditations and certifications:

FCC Registration Number: 89450
Industry Canada Lab Code: IC 4175
VCCI Member Number: 1831

- VCCI OATS Registration Number R-1526
- VCCI Conducted Emissions Site Registration Number: C-1608

NVLAP Lab Code: 200612

2.3 Radiated Emissions Test Site Description

2.3.1 Semi-Anechoic Chamber Test Site

The Semi-Anechoic Chamber Test Site consists of a 20' x 30' x 18' shielded enclosure. The chamber is lined with Toyo Ferrite Grid Absorber, model number FFG-1000. The ferrite tile grid is 101 x 101 x 19mm thick and weighs approximately 550 grams. These tiles are mounted on steel panels and installed directly on the inner walls of the chamber.

The turntable is 150cm in diameter and is located 160cm from the back wall of the chamber. The chamber is grounded via 1 - 8' copper ground rod, installed at the center of the back wall, it is bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is all steel, flush mounted table installed in an all steel frame. The table is remotely operated from inside the control room located 25' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Behind the turntable is a 3' x 6' x 4' deep shielded pit used for support equipment if necessary. The pit is equipped with 1 - 4" PVC chases from the turntable to the pit that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit.

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3-1 below:

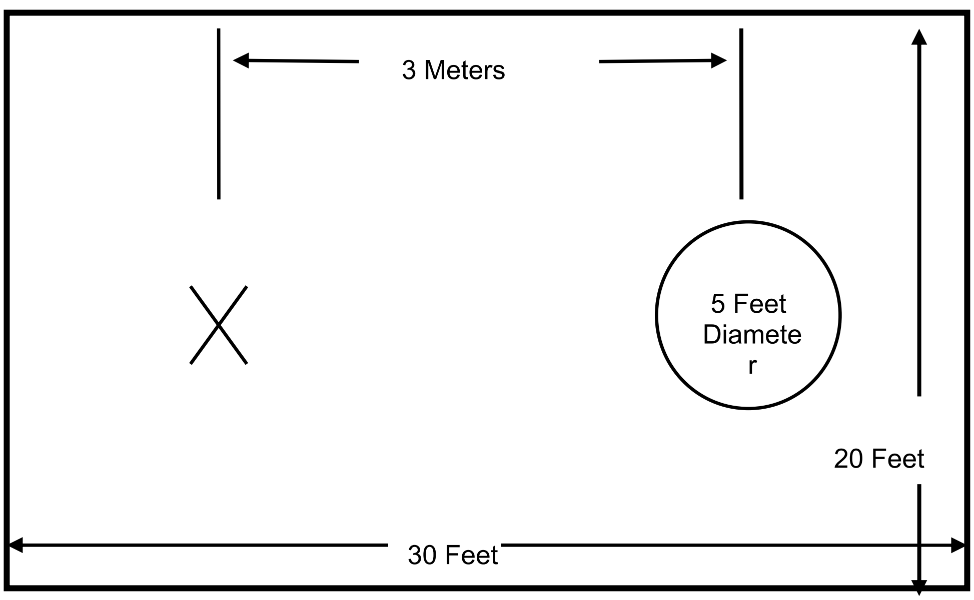

Figure 2.3-1: Semi-Anechoic Chamber Test Site

2.3.2 Open Area Tests Site (OATS)

The open area test site consists of a 40' x 66' concrete pad covered with a perforated electro-plated galvanized sheet metal. The perforations in the sheet metal are 1/8" holes that are staggered every 3/16". The individual sheets are placed to overlap each other by 1/4" and are riveted together to provide a continuous seam. Rivets are spaced every 3" in a 3 x 20 meter perimeter around the antenna mast and EUT area. Rivets in the remaining area are spaced as necessary to properly secure the ground plane and maintain the electrical continuity.

The entire ground plane extends 12' beyond the turntable edge and 16' beyond the antenna mast when set to a 10 meter measurement distance. The ground plane is grounded via 4 - 8' copper ground rods, each installed at a corner of the ground plane and bound to the ground plane using 3/4" stainless steel braided cable.

The turntable is an all aluminum 10' flush mounted table installed in an all aluminum frame. The table is remotely operated from inside the control room located 40' from the range. The turntable is electrically bonded to the surrounding ground plane via steel fingers installed on the edge of the turn table. The steel fingers make constant contact with the ground plane during operation.

Adjacent to the turntable is a 7' x 7' square and 4' deep concrete pit used for support equipment if necessary. The pit is equipped with 5 - 4" PVC chases from the pit to the control room that allow for cabling to the EUT if necessary. The underside of the turntable can be accessed from the pit so cables can be supplied to the EUT from the pit. The pit is covered with 2 sheets of 1/4" diamond style re-enforced steel sheets. The sheets are painted to match the perforated steel ground plane; however the underside edges have been masked off to maintain the electrical continuity of the ground plane. All reflecting objects are located outside of the ellipse defined in ANSI C63.4.

A diagram of the Open Area Test Site is shown in Figure 2.3-2 below:

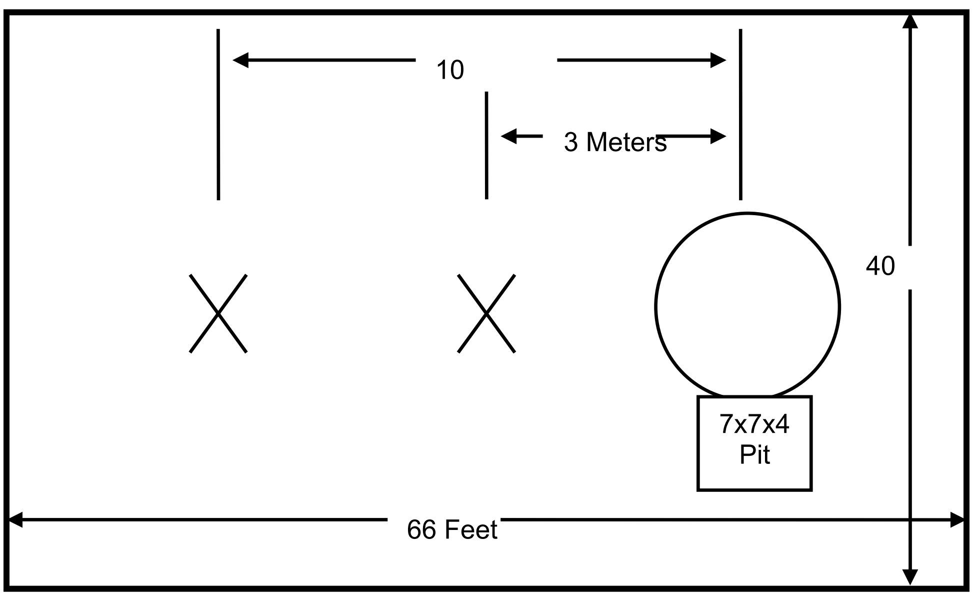

Figure 2.3-2: Open Area Test Site

2.4 Conducted Emissions Test Site Description

The AC mains conducted EMI site is a shielded room with the following dimensions:

- Height: 3.0 Meters
- Width: 3.6 Meters
- Length: 4.9 Meters

The room is manufactured by Rayproof Corporation and installed by Panashield, Inc. Earth ground is provided to the room via an 8' copper ground rod. Each panel of the room is connected electrically at intervals of 4".

Power to the room is filtered to prevent ambient noise from coupling to the EUT and measurement equipment. Filters are models 1B42-60P manufactured by Rayproof Corporation.

The room is of sufficient size to test table top and floor standing equipment in accordance with section 6.1.4 of ANSI C63.4.

A diagram of the room is shown below in figure 2.4-1:

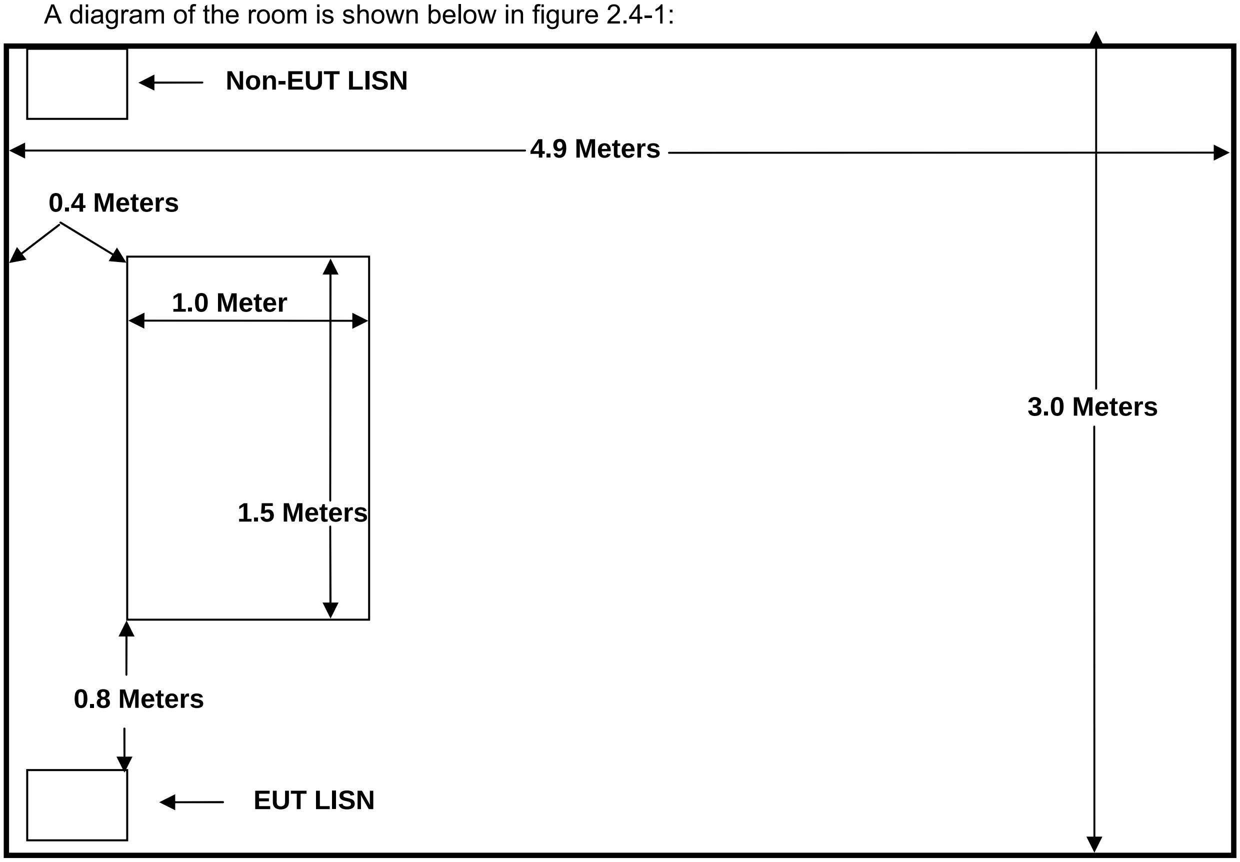

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

- ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz
- US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures (October 2004)
- US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart C: Radio Frequency Devices, Intentional Radiators (October 2004)
- FCC OET Bulletin 65 Appendix C - Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

4.0 LIST OF TEST EQUIPMENT

All test equipment used for regulatory testing is calibrated yearly or according to manufacturer's specifications.

Table 4.0-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
☒ 26	Chase	Bi-Log Antenna	CBL6111	1044	10/15/05
☒ 153	EMCO	LISN	3825/2	9411-2268	12/20/05
☒ 193	ACS	OATS Cable Set	RG8	193	01/07/06
☒ 225	Andrew	OATS RF cable	Heliax	225	01/06/06
☒ 165	ACS	Conducted EMI Cable Set	RG8	165	01/06/06
☒ 22	Agilent	Pre-Amplifier	8449B	3008A00526	05/06/06
☒ 73	Agilent	Pre-Amplifier	8447D	272A05624	05/18/06
☒ 30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	05/09/06
☒ 105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	06/09/06
☒ 1	Rohde & Schwarz	Receiver Display	804.8932.52	833771/007	03/07/06
☒ 2	Rohde & Schwarz	ESMI Receiver	1032.5640.53	839587/003	03/07/06
☒ 3	Rohde & Schwarz	Receiver Display	804.8932.52	839379/011	12/15/05
☒ 4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
☒ ---	Agilent	Spectrum Analyzer	E7402A	US41110277	11/10/05
☒ 168	Hewlett Packard	Pulse Limiter	11947A	3107A02268	01/06/06
☒ 6	Harbour Industries	HF RF Cable	LL-335	00006	03/16/06
☒ 7	Harbour Industries	HF RF Cable	LL-335	00007	03/16/06
☒ 167	ACS	Chamber EMI Cable Set	RG6	167	12/29/05
☒ 204	ACS	Chamber EMI RF cable	RG8	204	01/07/06

5.0 SUPPORT EQUIPMENT

Table 5-3: Support Equipment

Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
	EUT Was Self Supporting			

6.0 EQUIPMENT UNDER TEST SETUP BLOCK DIAGRAM

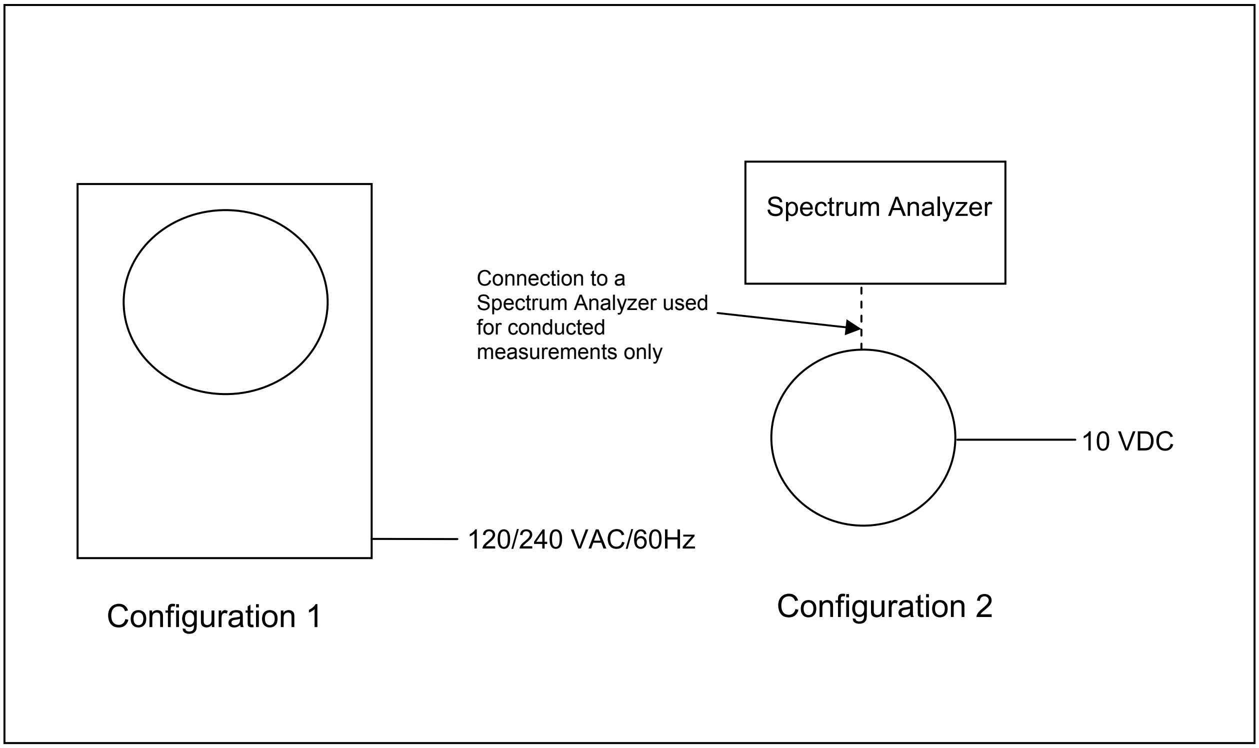

Figure 6-1: EUT Test Setup

Configuration 1: Used for unintentional radiated emissions and AC power line conducted emissions.
Configuration 2: Used for transmitter radiated and conducted measurements. The EUT was configured with a 50 Ohm temporary RF output port for conducted measurements to facilitate a direct connection to a spectrum analyzer.

Note: The radio module can be installed in both 120V and 240V meter bases. Testing performed on both meter housing for AC powerline conducted emissions. Radiated emissions from the transmitter was performed.

7.0 SUMMARY OF TESTS

Along with the tabular data shown below, plots were taken of all signals deemed important enough to document.

7.1 Antenna Requirement - FCC Section 15.203

The EUT employs a -5dBi integrated antenna that cannot be modified without damaging the device.

7.2 Power Line Conducted Emissions - FCC Section 15.207

7.2.1 Test Methodology

ANSI C63.4 sections 6 and 7 were the guiding documents for this evaluation. Conducted emissions were performed from 150kHz to 30MHz with the spectrum analyzer's resolution bandwidth set to 9kHz and the video bandwidth set to 30kHz. The calculation for the conducted emissions is as follows:

Corrected Reading = Analyzer Reading + LISN Loss + Cable Loss
Margin = Applicable Limit - Corrected Reading

7.2.2 Test Results

Results of the test are shown below in and Tables 7.2-1 through 7.2-8 and Figure 7.2-1 through 7.2-4.

<u>120V Configuration:</u>

Table 7.2-1: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.294	22.0	9.9	60.4	38.3	L1	GND
0.402	28.2	10.0	57.8	29.5	L1	GND
0.540	28.5	9.9	56	27.4	L1	GND
0.780	12.3	10.0	56	43.6	L1	GND
2.400	10.8	10.0	56	45.1	L1	GND
3.690	11.1	10.0	56	44.8	L1	GND
19.254	11.9	10.2	60	48.0	L1	GND
19.662	25.1	10.2	60	34.8	L1	GND
25.806	12.2	10.4	60	47.7	L1	GND
26.214	26.7	10.3	60	33.2	L1	GND

Table 7.2-2: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.288	12.7	9.9	50.5	37.8	L1	GND
0.372	11.9	9.9	48.4	36.5	L1	GND
0.576	13.9	9.9	46	32.0	L1	GND
0.780	8.2	10.0	46	37.7	L1	GND
2.370	7.4	10.0	46	38.5	L1	GND
3.684	7.7	10.0	46	38.2	L1	GND
19.248	7.6	10.2	50	42.3	L1	GND
19.662	24.6	10.2	50	25.3	L1	GND
25.806	8.9	10.4	50	41.0	L1	GND
26.214	25.0	10.3	50	24.9	L1	GND

Table 7.2-3: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.240	20.8	9.9	62	41.2	L2	GND
0.372	22.9	9.9	58.4	35.5	L2	GND
0.402	18.4	10.0	57.8	39.3	L2	GND
0.774	15.4	10.0	56	40.5	L2	GND
1.458	11.8	10.0	56	44.1	L2	GND
2.502	11.3	10.0	56	44.6	L2	GND
4.680	10.4	10.0	56	45.5	L2	GND
8.814	10.8	10.1	60	49.1	L2	GND
16.326	10.8	10.2	60	49.1	L2	GND
26.214	20.5	10.3	60	39.4	L2	GND

Table 7.2-4: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.288	11.8	9.9	50.5	38.7	L2	GND
0.372	11.4	9.9	48.4	36.9	L2	GND
0.492	8.0	9.9	46.1	38.1	L2	GND
0.780	9.0	10.0	46	36.9	L2	GND
1.458	8.1	10.0	46	37.8	L2	GND
2.472	7.6	10.0	46	38.3	L2	GND
4.680	7.0	10.0	46	38.9	L2	GND
8.784	7.2	10.1	50	42.7	L2	GND
16.308	7.4	10.2	50	42.5	L2	GND
26.214	18.7	10.3	50	31.2	L2	GND

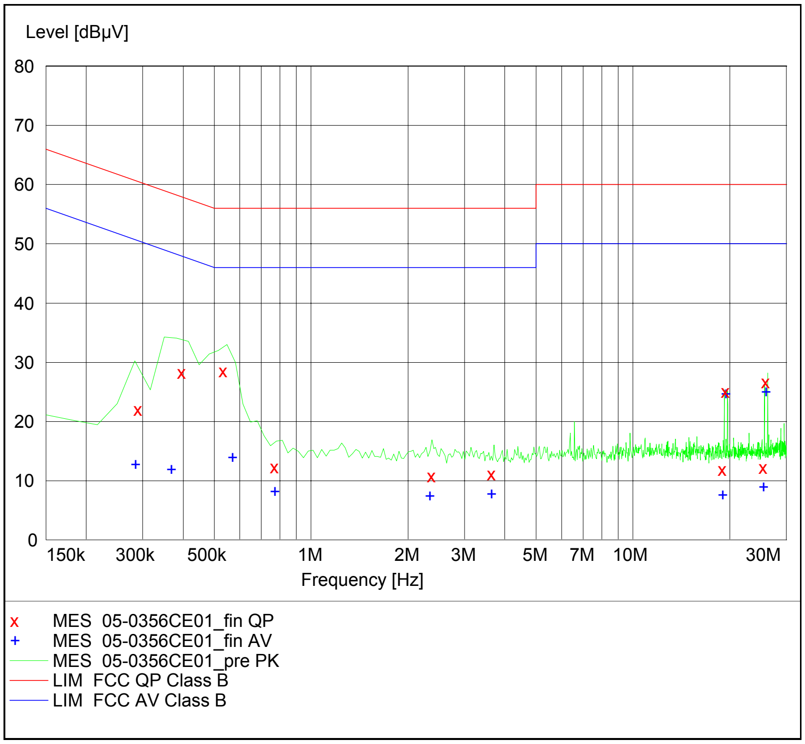

Figure 7.2-1: Conducted Emissions Graph – Line 1

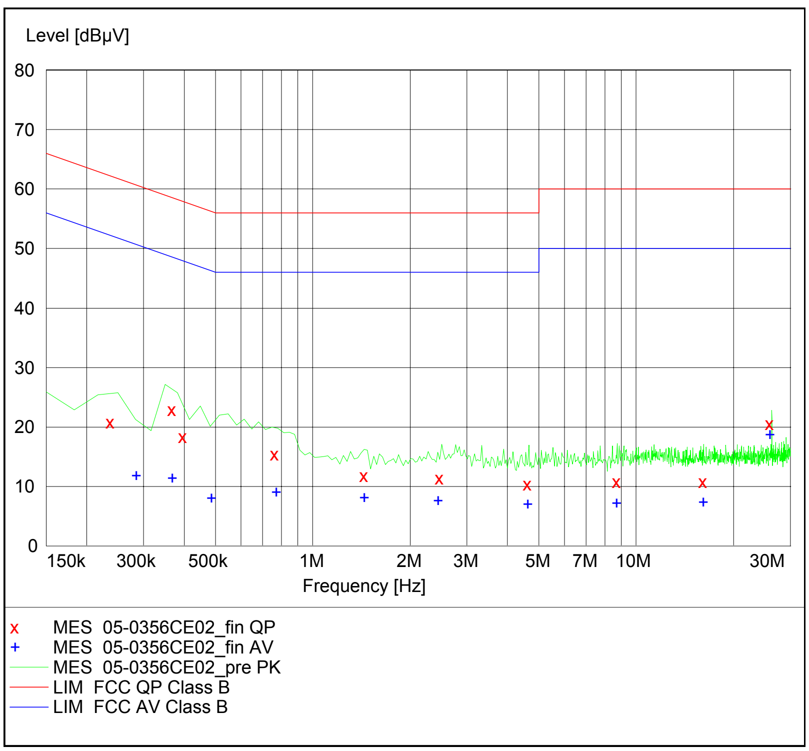

Figure 7.2-2: Conducted Emissions Graph – Line 2

240V Configuration:

Table 7.2-5: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.294	22.0	9.9	60.4	38.3	L1	GND
0.402	28.2	10.0	57.8	29.5	L1	GND
0.540	28.5	9.9	56	27.4	L1	GND
0.780	12.3	10.0	56	43.6	L1	GND
2.400	10.8	10.0	56	45.1	L1	GND
3.690	11.1	10.0	56	44.8	L1	GND
19.254	11.9	10.2	60	48.0	L1	GND
19.662	25.1	10.2	60	34.8	L1	GND
25.806	12.2	10.4	60	47.7	L1	GND
26.214	26.7	10.3	60	33.2	L1	GND

Table 7.2-6: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.288	12.7	9.9	50.5	37.8	L1	GND
0.372	11.9	9.9	48.4	36.5	L1	GND
0.576	13.9	9.9	46	32.0	L1	GND
0.780	8.2	10.0	46	37.7	L1	GND
2.370	7.4	10.0	46	38.5	L1	GND
3.684	7.7	10.0	46	38.2	L1	GND
19.248	7.6	10.2	50	42.3	L1	GND
19.662	24.6	10.2	50	25.3	L1	GND
25.806	8.9	10.4	50	41.0	L1	GND
26.214	25.0	10.3	50	24.9	L1	GND

Table 7.2-7: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.150	17.8	10.0	66	48.1	L2	GND
0.396	28.4	9.9	57.9	29.4	L2	GND
0.534	28.8	9.9	56	27.1	L2	GND
0.708	13.6	9.9	56	42.3	L2	GND
2.118	11.0	10.0	56	44.9	L2	GND
3.222	10.4	10.0	56	45.6	L2	GND
4.398	9.8	10.0	56	46.1	L2	GND
13.110	16.0	10.2	60	43.9	L2	GND
26.214	26.8	10.3	60	33.1	L2	GND
29.496	18.0	10.4	60	41.9	L2	GND

Table 7.2-8: Line 2 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.168	11.8	9.9	55	43.2	L2	GND
0.372	11.8	9.9	48.4	36.6	L2	GND
0.576	14.4	9.9	46	31.5	L2	GND
0.708	9.1	9.9	46	36.8	L2	GND
2.100	7.3	10.0	46	38.6	L2	GND
3.270	6.9	10.0	46	39.0	L2	GND
4.338	6.6	10.0	46	39.3	L2	GND
13.110	13.4	10.2	50	36.5	L2	GND
26.214	25.6	10.3	50	24.3	L2	GND
29.496	15.9	10.4	50	34.0	L2	GND

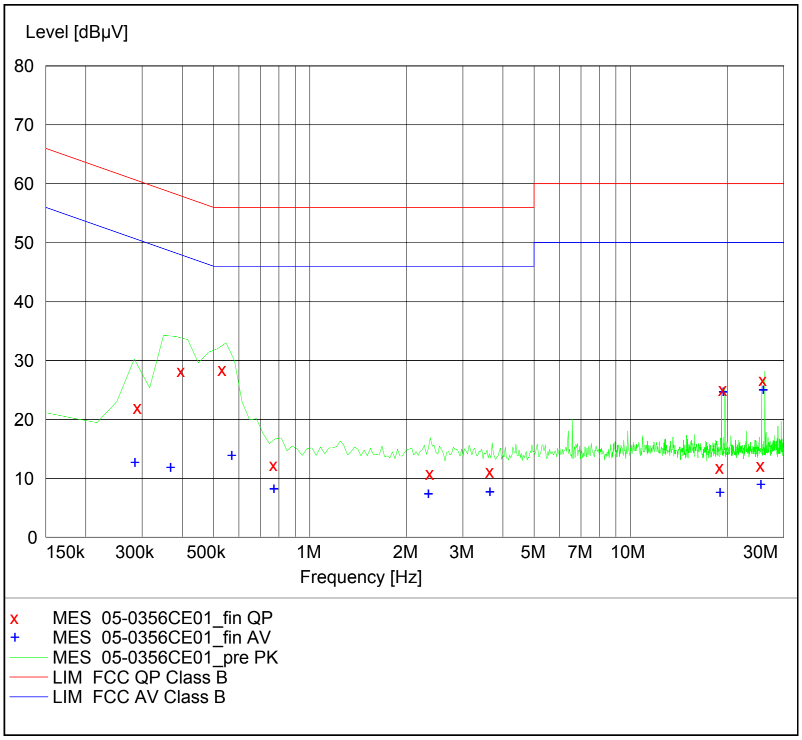

Figure 7.2-3: Conducted Emissions Graph – Line 1

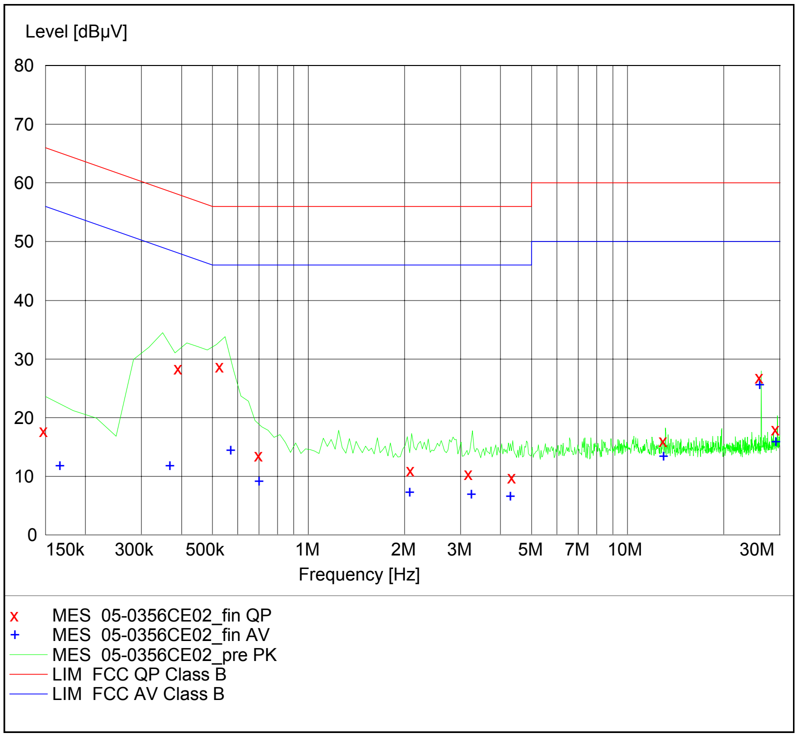

Figure 7.2-4: Conducted Emissions Graph – Line 2

7.3 Radiated Emissions - FCC Section 15.109(Unintentional Radiation)

7.3.1 Test Methodology

Radiated emissions tests were performed over the frequency range of 30MHz to 1 GHz. Measurements of the radiated field strength were made at a distance of 3m from the boundary of the equipment under test (EUT) and the receiving antenna. The antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. Radiated measurements were made with the Spectrum Analyzer's resolution bandwidth set to 120 KHz for measurements above 30MHz. Average measurements are taken with the RBW and VBW were set to 1MHz and 10 Hz respectively for measurements above 1000MHz.

7.3.2 Test Results

Results of the test are given in Table 7.3-1 below:

Table 7.3-1: Radiated Emissions Tabulated Data

Frequency **(MHz)**	Polarization	Height **(cm)**	Azimuth **(deg)**	Level **(dBµV/m)**	Limit **(dBµV/m)**	Margin **(dB)**
30.00	HORIZONTAL	138	67	12.4	40	27.6
171.68	VERTICAL	170	249	8.4	43.5	35.1
267.20	VERTICAL	104	315	15.3	46	30.7
286.40	VERTICAL	110	55	16.5	46	29.5
295.68	VERTICAL	190	0	16.6	46	29.4
484.08	VERTICAL	150	0	17.5	46	28.5
687.04	HORIZONTAL	229	155	22.5	46	23.5
944.64	VERTICAL	299	15	35.2	46	10.8

* Note: All emissions above 944.64 MHz were attenuated below the permissible limit.

7.4 Peak Output Power – FCC Section 15.247(b)(2)

7.4.1 Test Methodology (Conducted Method)

The 20dB bandwidth of the EUT was within the resolution bandwidth of spectrum analyzer, therefore the power measurement was made using the spectrum analyzer method. The resolution and video bandwidth were set to > 20 dB bandwidth of the emission measured. The device employs >50 channels therefore the power is limited to 1 Watt.

7.4.2 Test Results

Results are shown below in table 7.4-1 and the worst case was plotted and shown in figure 7.4-1 to 7.4-3 below:

Table 7.4-1: RF Output Power

Frequency [MHz]	Level [dBm]
911.092	17.57
915.0	17.78
919.072	17.93

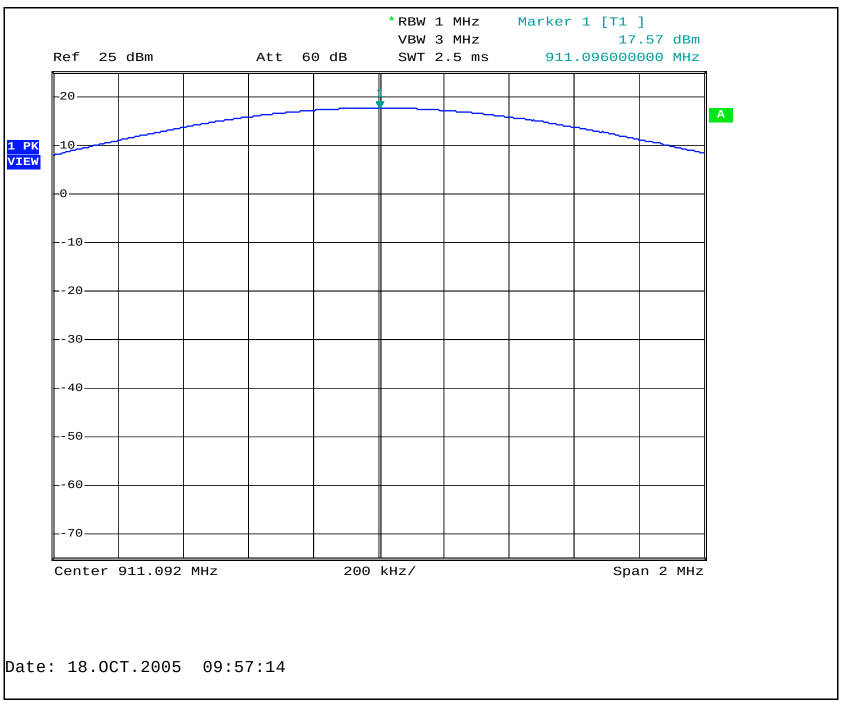

Figure 7.4-1: Output power – Low Channel

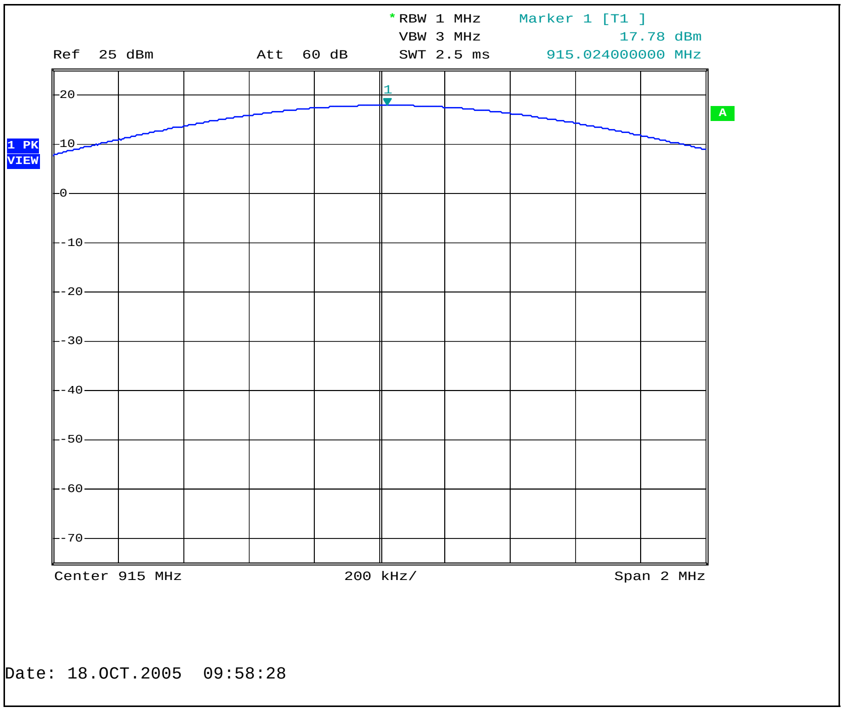

Figure 7.4-2: Output power – Mid Channel

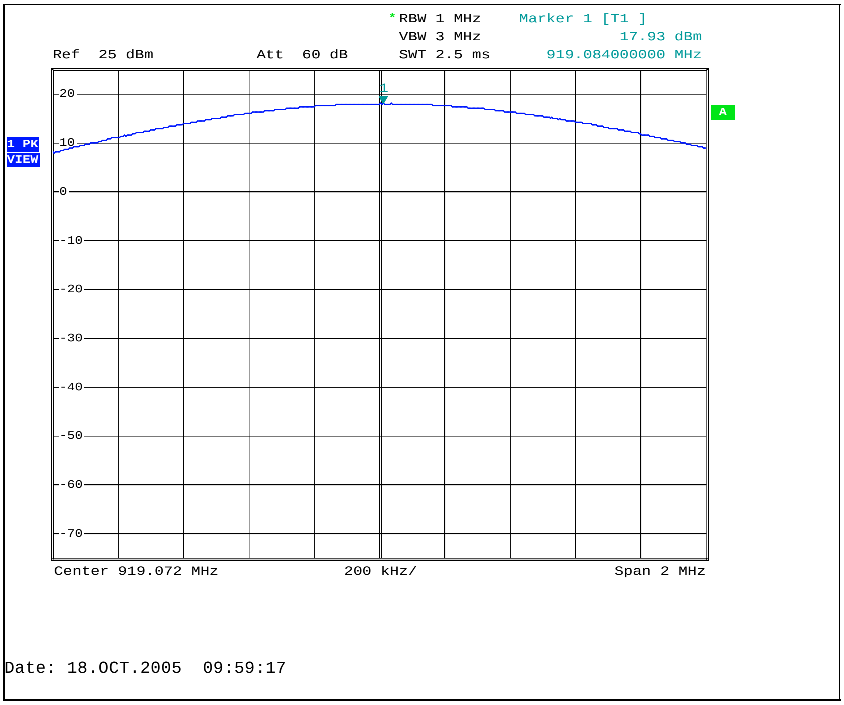

Figure 7.4-3: Output power – High Channel

7.5 Channel Usage Requirements - FCC Section 15.247(a) (1)

15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

15.247(a) (1) (i): For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

7.5.1 Carrier Frequency Separation

7.5.1.1 Test Methodology
The span of the spectrum analyzer was set wide enough to capture two adjacent peaks and the RBW and VBW were set to ≥ 1% of the span.

7.5.1.2 Test Results
The maximum 20dB bandwidth of the hopping channel was measured to be 125.4 kHz (See figure 7.5.4-1 to 7.5.4-3 below). The adjacent channel separation was measured to be 131.5 kHz. Results are shown in figure 7.5.1-1 below:

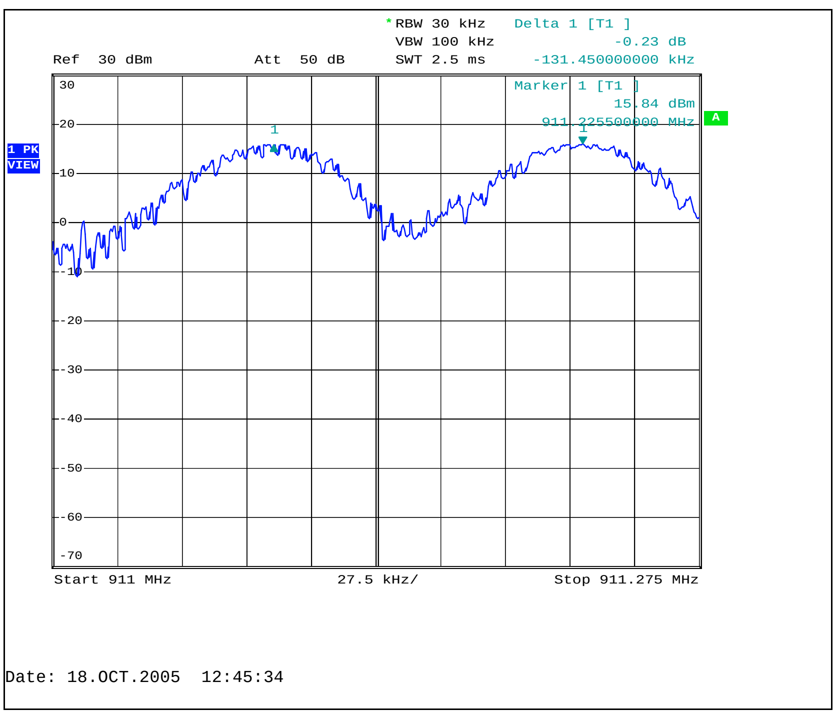

Figure 7.5.1-1: Carrier Frequency Separation

7.5.2 Number of Hopping Channels

The 20dB bandwidth of the device is less than 250 kHz. The device employs 50 hopping channels as required. Results are shown in Figure 7.5.2-1 below:

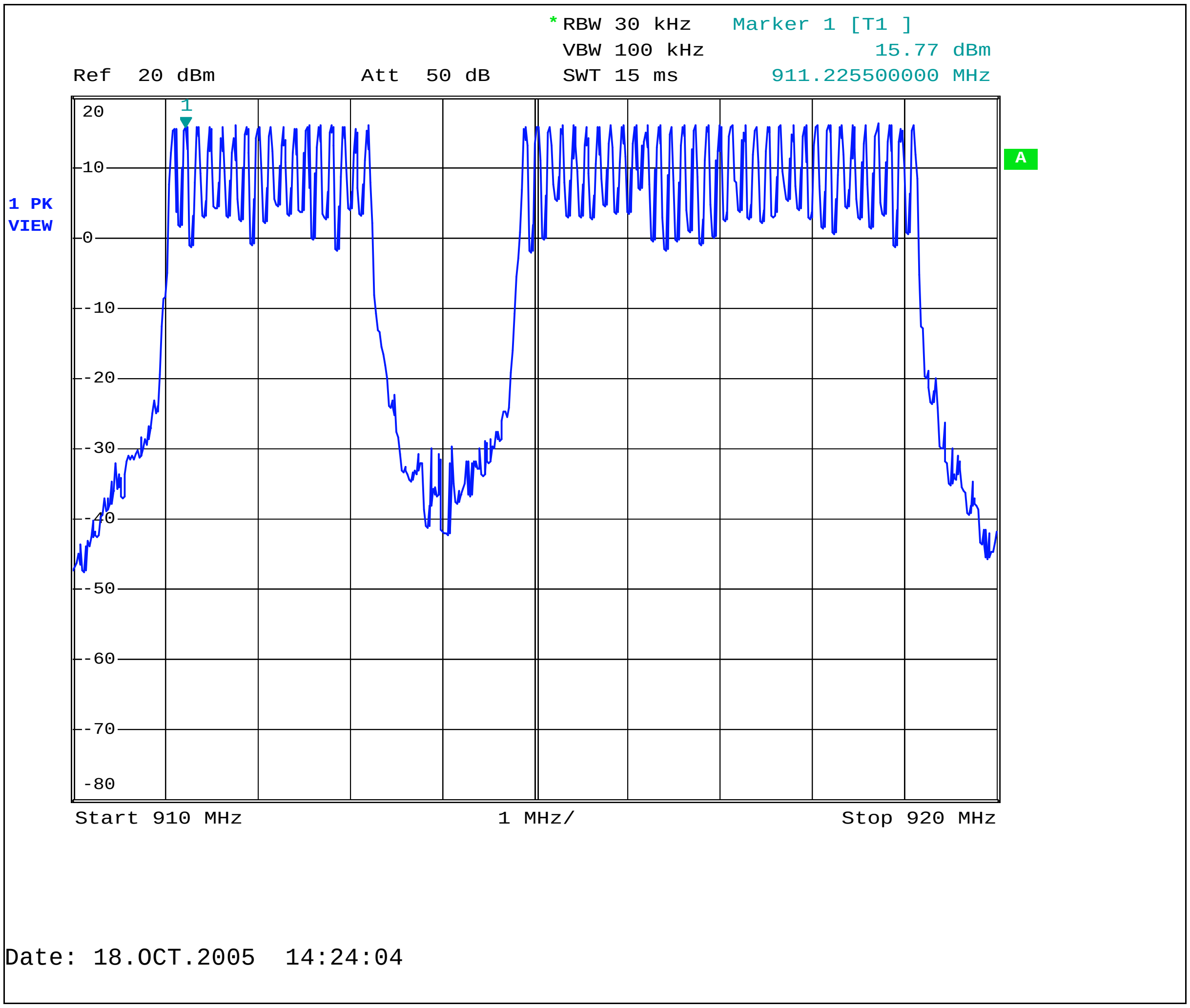

Figure 7.5.2-1: Number of Hopping Channels

7.5.3 Channel Dwell Time

7.5.3.1 Test Methodology

The emission measured centered on the analyzer and the span set to 0 Hz. The RBW was set to 1 MHz and the VBW to 3 MHz. Sweep time was set to 20 ms to capture the burst duration of the emission. The marker –delta function of the analyzer was employed to measure the burst duration.

7.5.3.2 Test Results

The duration of the RF transmission is 7.05 ms. There is a minimum 10 second rest period in which the device hops to another channel according to the pseudorandom frequency table before transmitting another 7.05mS burst. Therefore the average time of occupancy on any channel in a 20 second period is 7.05mS. A single transmission is shown in figure 7.5.3-1 below:

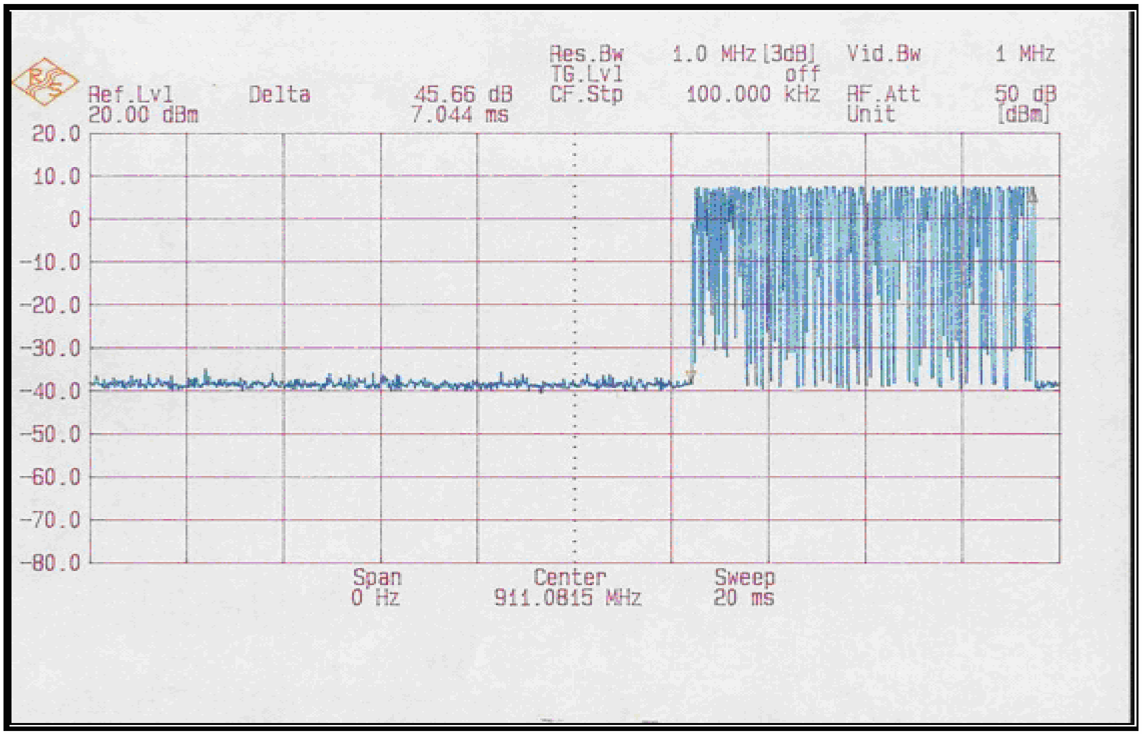

Figure 7.5.3-1: Channel Dwell Time

7.5.4 20dB Bandwidth

7.5.4.1 Test Methodology

The spectrum analyzer span was set to 2 to 3 times the estimated 20 dB bandwidth of the emission. The RBW was to ≥ 1% of the estimated 20 dB bandwidth. The trace was set to max hold with a peak detector active. The N-dB Down function of the analyzer was utilized to determine the 20 dB bandwidth of the emission. The span and RBW were examined and re-adjusted if necessary to meet the requirements of 2 to 3 time the 20 bandwidth for the span and ≥ 1% of the 20 dB bandwidth for the RBW.

7.5.4.2 Test Results

The maximum 20dB bandwidth was found to be approximately 113.33 kHz. Results are shown below in Figure 7.5.4-1 through 7.5.4-3.

Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	911.092	105.0
Mid	915.0	125.4
High	919.072	120.6

Figure 7.5.4-1: 20dB Bandwidth Low Channel

Figure 7.5.4-2: 20dB Bandwidth Mid Channel

Figure 7.5.4-3: 20dB Bandwidth High Channel

7.6 Band-Edge Compliance and Spurious Emissions - FCC Section 15.247(c)

7.6.1 Band-Edge Compliance of RF Conducted Emissions

7.6.1.1 Test Methodology

The EUT was investigated at the lowest and highest channel available to determine band-edge compliance. For each measurement the spectrum analyzer's RBW was set to 300 kHz, which is ≥ 1% of the span, and the VBW was set to 1 MHz.

7.6.1.2 Test Results

In a 100 kHz bandwidth at the lower and upper band-edge, the radio frequency power that was produced by the EUT is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Band-edge compliance is displayed in Figures 7.6.1-1 and 7.6.2-2

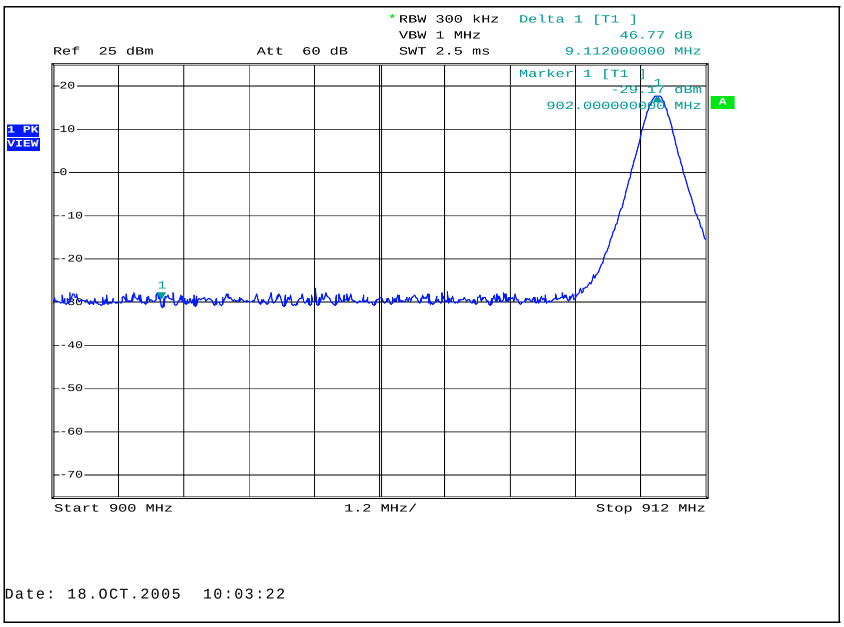

Figure 7.6.1-1: Lower Band-edge

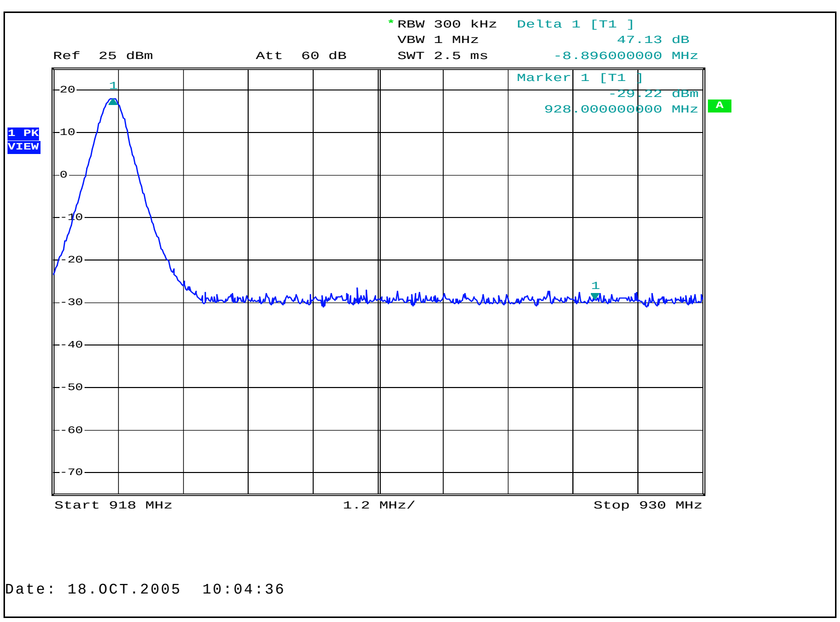

Figure 7.6.1-2: Upper Band-edge

7.6.2 RF Conducted Spurious Emissions

7.6.2.1 Test Methodology

The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was investigated for conducted spurious emissions from 30MHz to 10GHz, 10 times the highest fundamental frequency. Measurements were made at the low, center and high channels of the EUT. For each measurement, the spectrum analyzer's VBW was set to 100kHz and the RBW was set to 1MHz. A peak detector function was used with the trace set to max hold.

7.6.2.1 Test Results

All emission found were greater than 20dB down from the fundamental carrier. The RF conducted spurious emissions were measured in the band of 30MHz to 10GHz. Results are shown below in Figure 7.6.2-1 through 7.6.2-6.

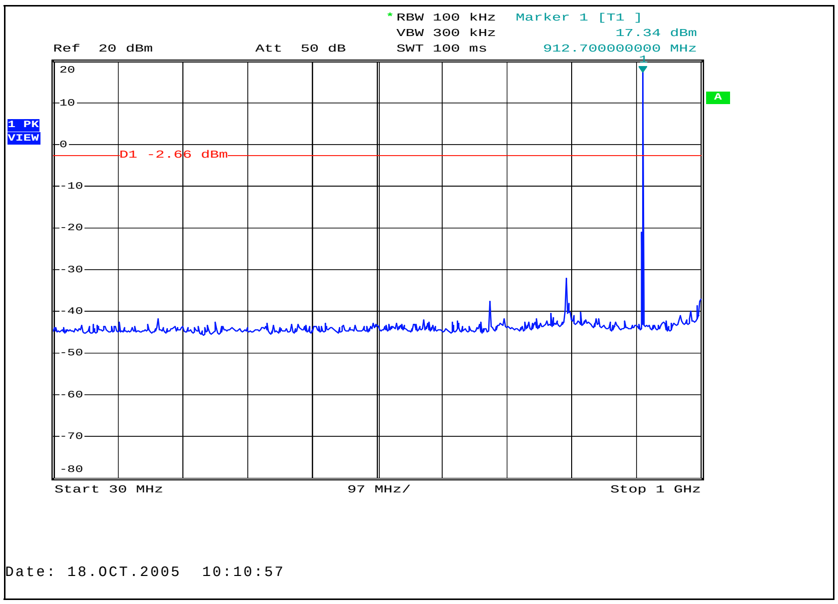

Figure 7.6.2-1 RF Conducted Spurious Emissions – Low Channel

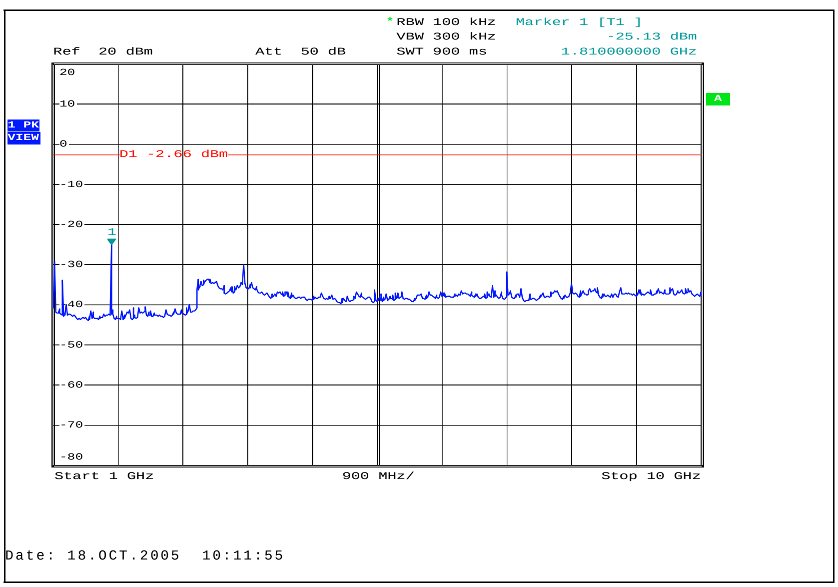

Figure 7.6.2-2 RF Conducted Spurious Emissions – Low Channel

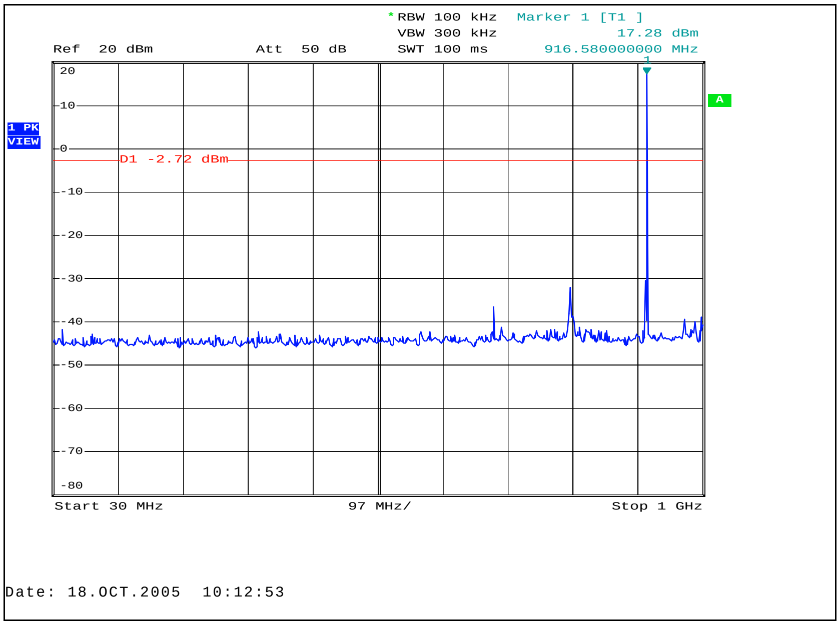

Figure 7.6.2-3 RF Conducted Spurious Emissions – Mid Channel

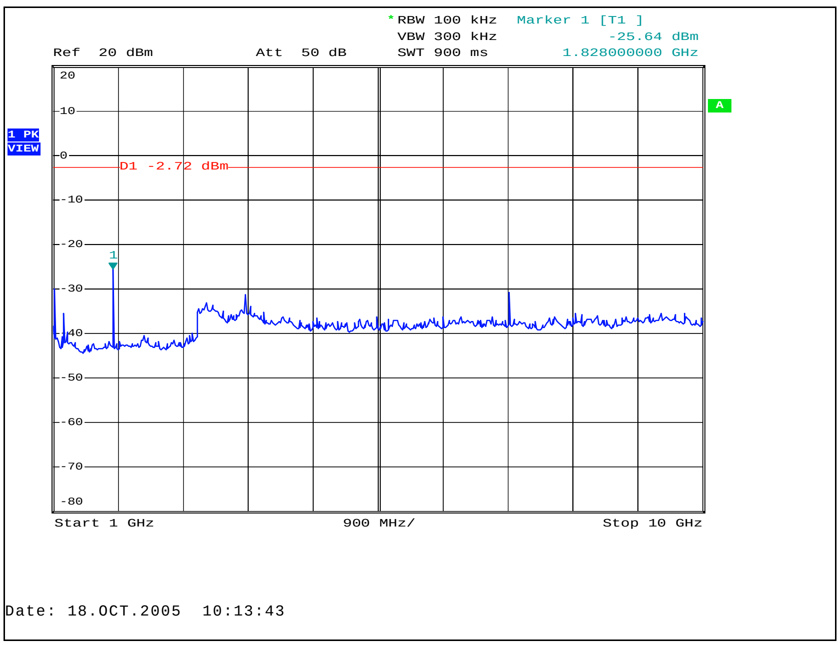

Figure 7.6.2-4 RF Conducted Spurious Emissions – Mid Channel

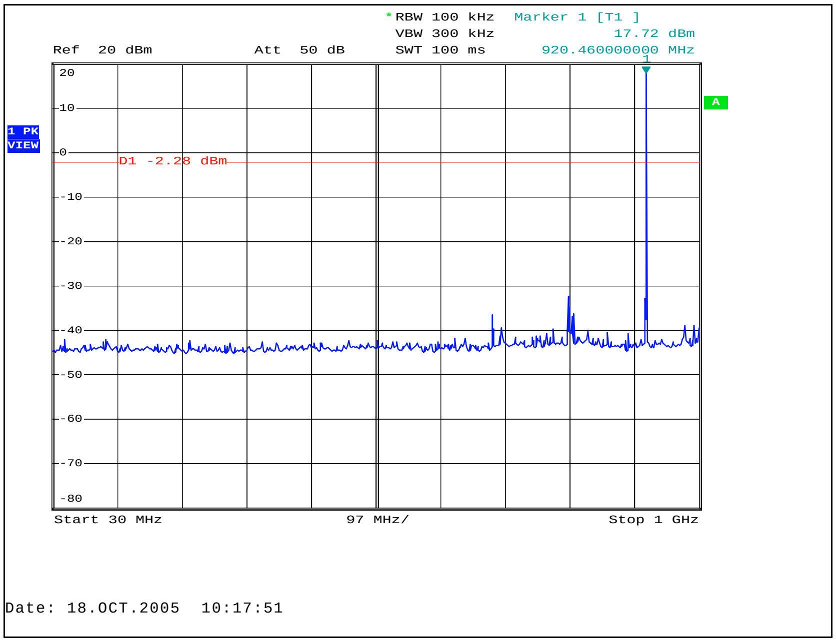

Figure 7.6.2-5 RF Conducted Spurious Emissions – High Channel

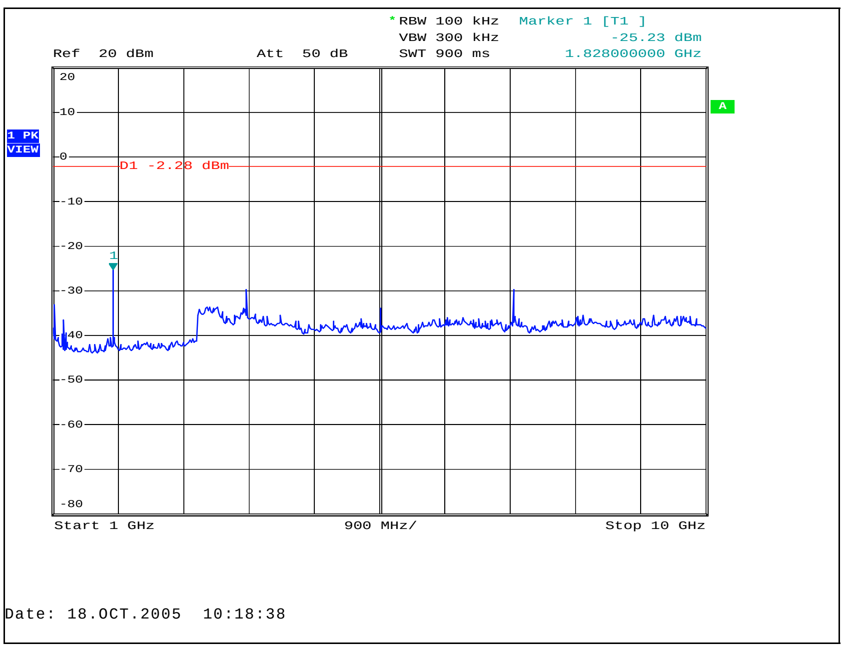

Figure 7.6.2-6 RF Conducted Spurious Emissions – High Channel

7.6.3 Radiated Spurious Emissions (Restricted Bands) - FCC Section 15.205

7.6.3.1 Test Methodology

Radiated emissions tests were made over the frequency range of 30MHz to 10GHz, 10 times the highest fundamental frequency.

The EUT was rotated through 360° and the receive antenna height was varied from 1m to 4m so that the maximum radiated emissions level would be detected. For frequencies below 1000MHz, quasi-peak measurements were made using a resolution bandwidth (RBW) of 120 kHz and a video bandwidth (VBW) of 300 kHz. For frequencies above 1000MHz, average measurements were made using an RBW of 1 MHz and a VBW of 10 Hz and peak measurements were made with RBW of 1 MHz and a VBW of 1 MHz.

The EUT was caused to generate a continuous carrier signal on the hopping channel.

7.6.3.2 Duty Cycle Correction

For average radiated measurements, the measured level was reduced by a factor 23dB to account for the duty cycle of the EUT. The EUT transmits for 7.05mS on a channel followed by a minimum 10 second rest period before hopping to the next channel. The EUT does not return to the same channel for over 500 seconds. Therefore the duty cycle is 7.05%. The duty cycle correction factor is determined using the formula: 20log (.0705)=-23dB.

7.6.3.3 Test Results

Radiated spurious emissions found in the band of 30MHz to 10GHz are reported in Table 7.6.3-1. Each emission found to be in a restricted band as defined by section 15.205, was compared to the radiated emission limits as defined in section 15.209.

Table 7.6.3-1: Radiated Spurious Emissions

Frequency (MHz)	Level (dBuV) pk	Level (dBuV) avg	Antenna Polarity (H/V)	Correction Factors (dB)	Corrected Level (dBuV/m) pk	Corrected Level (dBuV/m) avg	Limit (dBuV/m) pk	Limit (dBuV/m) avg	Margin (dB) pk	Margin (dB) avg
Low Channel										
2733	53.05	50.03	H	2.33	55.38	29.26	74	54	18.62	24.74
2733	51.53	42.46	V	2.33	53.86	21.69	74	54	20.14	32.31
3644	59.05	39.60	H	5.81	64.86	22.31	74	54	9.14	31.69
3644	61.76	41.70	V	5.81	67.57	24.41	74	54	6.43	29.59
4555	52.80	36.37	H	7.84	60.64	21.11	74	54	13.36	32.89
4555	51.61	36.52	V	7.84	59.45	21.26	74	54	14.55	32.74
7288	51.76	34.14	H	15.67	67.43	26.71	74	54	6.57	27.29
7288	51.35	34.16	V	15.67	67.02	26.73	74	54	6.98	27.27
8199	47.09	32.26	H	16.51	63.60	25.67	74	54	10.40	28.33
8199	45.74	30.76	V	16.51	62.25	24.17	74	54	11.75	29.83
Mid Channel										
2745	53.83	49.69	H	2.37	56.20	28.96	74	54	17.80	25.04
2745	49.32	41.80	V	2.37	51.69	21.07	74	54	22.31	32.93
3660	59.81	39.63	H	5.87	65.68	22.40	74	54	8.32	31.60
3660	58.89	38.92	V	5.87	64.76	21.69	74	54	9.24	32.31
4575	52.41	36.56	H	7.93	60.34	21.39	74	54	13.66	32.61
4575	49.38	34.22	V	7.93	57.31	19.05	74	54	16.69	34.95
7320	51.08	34.13	H	15.70	66.78	26.73	74	54	7.22	27.27
7320	48.30	32.60	V	15.70	64.00	25.20	74	54	10.00	28.80
8235	45.51	30.52	H	16.55	62.06	23.97	74	54	11.94	30.03
8235	44	29.64	V	16.55	60.55	23.09	74	54	13.45	30.91
High Channel										
2757	52.32	48.65	H	2.40	54.72	27.96	74	54	19.28	26.04
2757	48.51	41.18	V	2.40	50.91	20.49	74	54	23.09	33.51
3676	58.85	38.89	H	5.93	64.78	21.72	74	54	9.22	32.28
3676	57.41	38.04	V	5.93	63.34	20.87	74	54	10.66	33.13
4595	49.56	34.69	H	8.01	57.57	19.61	74	54	16.43	34.39
4595	47.31	32.76	V	8.01	55.32	17.68	74	54	18.68	36.32
7352	47.44	32.03	H	15.73	63.17	24.66	74	54	10.83	29.34
7352	45.59	30.89	V	15.73	61.32	23.52	74	54	12.68	30.48

***** The magnitude of all emissions not reported were below the noise floor of the measurement system.

7.6.3.3 Sample Calculation:

$R_C = R_U + CF_T$

Where:

CF_T	=	Total Correction Factor (AF+CA+AG)-DC (Average Measurements Only)
R_U	=	Uncorrected Reading
R_C	=	Corrected Level
AF	=	Antenna Factor
CA	=	Cable Attenuation
AG	=	Amplifier Gain
DC	=	Duty Cycle Correction Factor

Example Calculation

PEAK:
Corrected Level: 53.05 + 2.33 = 55.38 dBuV
Margin: 74dBuV – 55.38 dBuV = 18.62 dB

AVERAGE:
Corrected Level: 50.03 + 2.33 -23 = 29.26 dBuV
Margin: 54dBuV – 29.26 dBuV = 24.74 dB

8.0 CONCLUSION

In the opinion of ACS, Inc. the R900E, manufactured by Neptune Technology Group, Inc., meets the requirements of FCC Part 15 subpart C.