FCC Part 101
Multiple Address System
Transmitter Certification

Test Report

FCC ID: P2SMTX950

FCC Rule Part: CFR 47 Part 101 Subpart C

ACS Report Number: 05-0025-101

Manufacturer: Neptune Technology Group, Inc.
Equipment Type: Mobile Drive-by Data Collector
Model: MTX950

Test Begin Date: January 19, 2005
Test End Date: March 24, 2005

Report Issue Date: March 24, 2005

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.

This report contains **20** pages

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1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J and Part 101 Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

The MTX950 is a mobile drive-by data collector used exclusively inside a motor vehicle. It receives RF messages (910-920 MHz) sent by End Devices attached to utility meters (electric, water, gas) which are equipped with compatible radio transmitters. Some of these End Devices require a wake up signal to start their transmission. This function is provided by the MTX950, which has a transmitter capable of working in the 952-960 MHz band and transmits continuously, when activated, a tone modulated carrier, amplitude modulated, with appropriate tone frequency to wake up the End Devices.

The architecture of the MTX950 consists of three primary components: RF transmitter, RF receiver, and a laptop computer. The PPC or portable personal computer, which serves as interface to the host software of the mobile system, controls the collection process, stores the data, and provides diagnostic to the user.

The generation of wake up signals, including channel frequency and tone frequency are controlled by the PPC. When a Route contains End Devices requiring this signal, the tone and channel information is contained in the host file and is automatically set in the hardware when the reading process begins.

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

1.3 EUT Test Setup and Configuration

For End devices supported by the MTX950, which must be awakened by a RF transmission from the MTX950, the carrier is modulated by one of 15 tones from 24.752 Hz to 57.471 Hz. The carrier signal is 100% (minimum 95%) Amplitude Modulated (DSB). The default tone of 32.468 Hz was used for all testing.

For radiated measurements on the transmitter the EUT was loaded with a 50 Ohm 100W termination. The antenna was connected for measurements of unintentional emissions according to CFR 47 Part 15. For conducted measurements the EUT was coupled directly to the Spectrum Analyzer via a 30dB in-line attenuator.

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:

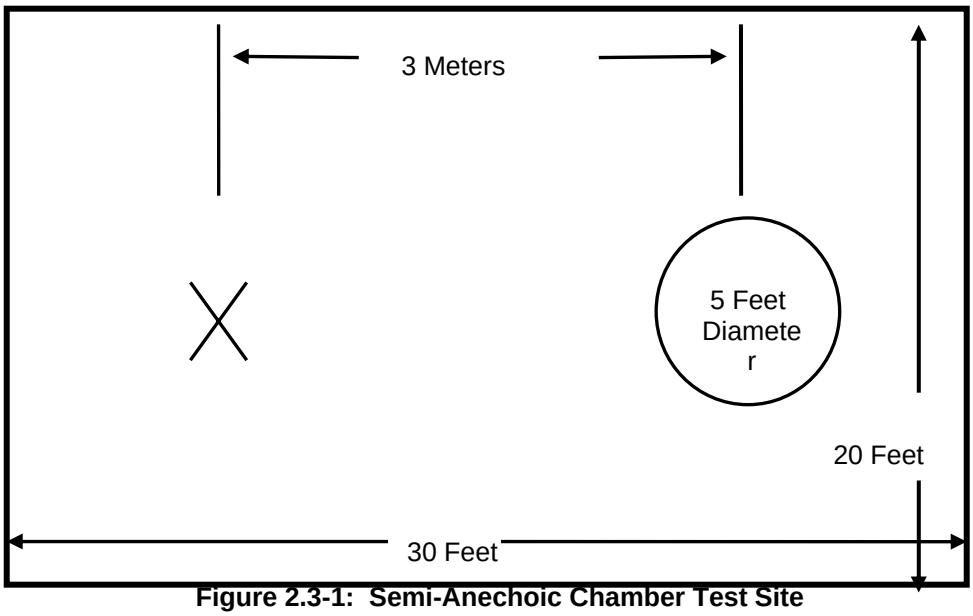

Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

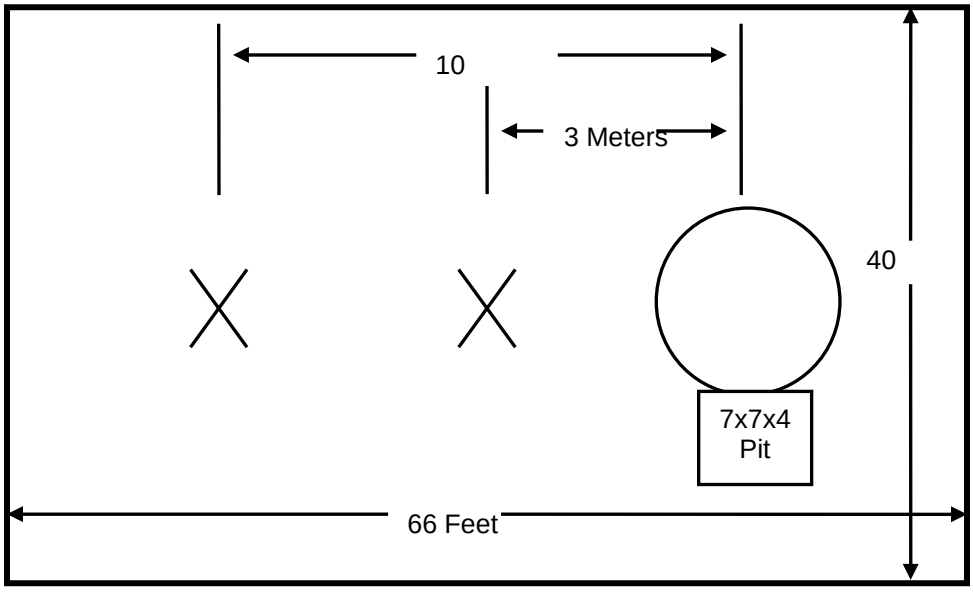

Figure 2.3-2: Open Area Test Site

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:

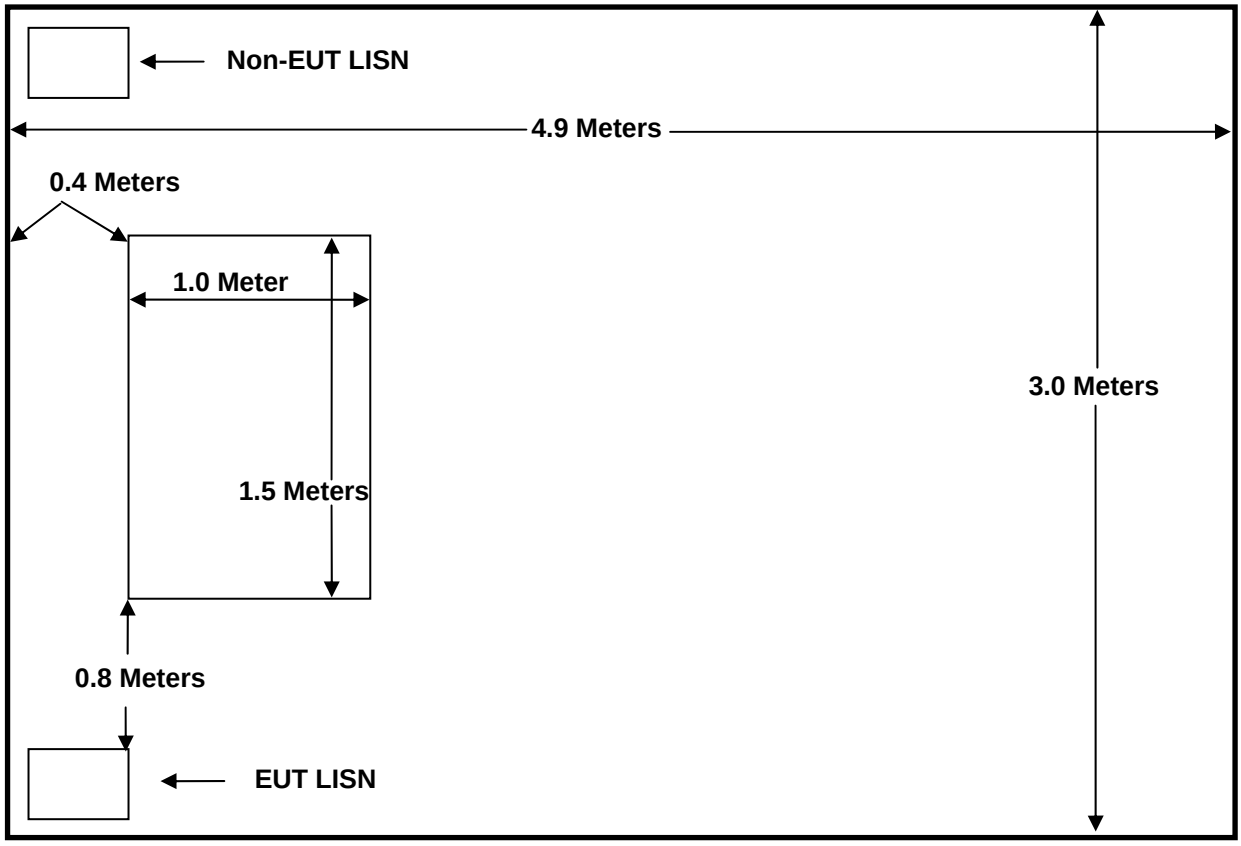

Figure 2.4-1: AC Mains Conducted EMI Site

3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-1992: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9KHz to 40GHz

2 - US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures (October 2003)

3 - US Code of Federal Regulations (CFR): Title 47, Part 15, Subpart B: Radio Frequency Devices, Unintentional Radiators (October 2003)

4 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Personal Communication Service, Narrowband PCS (October 2003)

5 - 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 4-1: Test Equipment

Equipment Calibration Information					
ACS#	**Mfg.**	**Eq. type**	**Model**	**S/N**	**Cal. Due**
26	Chase	Bi-Log Antenna	CBL6111	1044	10/05/05
152	EMCO	LISN	3825/2	9111-1905	01/18/06
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	05/12/05
73	Agilent	Pre-Amplifier	8447D	272A05624	04/30/05
30	Spectrum Technologies	Horn Antenna	DRH-0118	970102	05/08/05
105	Microwave Circuits	High Pass Filter	H1G810G1	2123-01 DC0225	06/09/05
209	Microwave Circuits	High Pass Filters	H3G020G2	4382-01 DC0421	06/09/05
1	Rohde & Schwarz	Receiver	804.8932.52	833771/007	02/26/06
2	Rohde & Schwarz	Receiver	1032.5640.53	839587/003	02/26/06
3	Rohde & Schwarz	ESMI Receiver	804.8932.52	839379/011	12/15/05
4	Rohde & Schwarz	ESMI Receiver	1032.5640.53	833827/003	12/15/05
213	Test Equipment Corp.	Pre-Amplifier	PA-102	44927	06/28/05
211	Eagle	Band Reject Filter	C7RFM3NFNM	n/a	06/28/05
168	Hewlett Packard	Pulse Limiter	11947A	3107A02268	04/30/05
93	Chase	EM Clamp	CIC 8101	65	01/06/06
204	ACS	Cable	RG8	204	12/29/05
169	Solar Electronics	LISN	9117-5-TS-50-N	031032	04/12/05
6	Harbour Industries	HF RF Cable	LL-335	00006	03/16/06
7	Harbour Industries	HF RF Cable	LL-335	00007	03/16/06
208	n/a	HF RF Cable	n/a	00208	06/14/05
5	ChaseRF Current Probe	Current Probe	CSP-8441	19	01/06/06
237	Gigatronics	Signal Generator	900	282706	01/03/06
176	Weinschel	30 dB Attenuator	46-30-34	BN4922	1/10/2006
N/A	Termaline	Coaxial Resistor 100W	8164	7655	N/A
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 5-1: Support Equipment

Diagram #	Manufacturer	Equipment Type	Model Number	Serial Number	FCC ID
1	Neptune	EUT	MXT950 Data Collector	None	P2SMTX950
2	Termaline	Coaxial Resistor 100W	8164	7655	None
3	Sorenson	DC Power Supply	DSC 60-50	0024B1130	None

6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

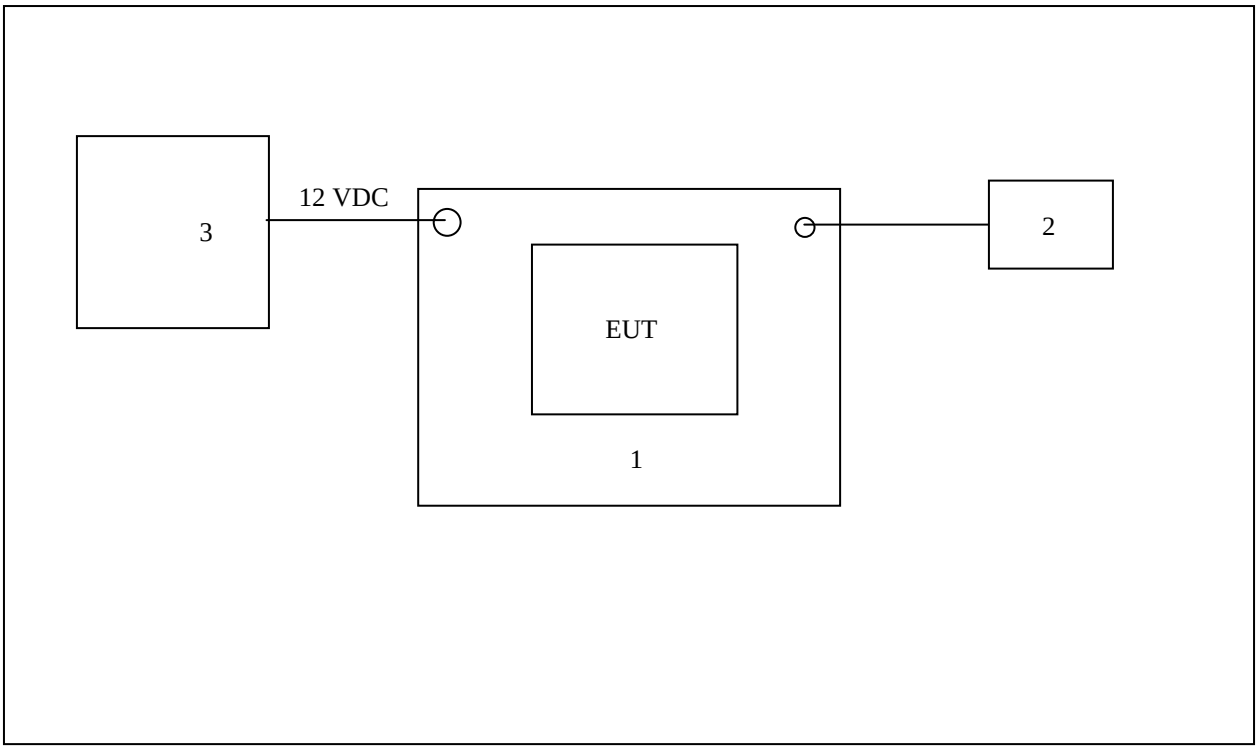

Figure 6-1: EUT Test Setup

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 RF Power Output - FCC Section 2.1046, 101.113

7.1.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The resolution and video bandwidths of the spectrum analyzer were set at sufficient levels, >> signal bandwidth, to produce accurate results. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results are shown below in Table 7.1.1-1 and Figure 7.1.1-1 through 7.1.1-3.

7.1.2 Measurement Results

Table 7.1.1-1: Peak Output Power

Frequency (MHz)	Channel	Output Power (dBm)	Output Power (W)
952.00625	161	40.33	10.79
956.00000	800	40.46	11.12
959.99375	1439	40.31	10.74

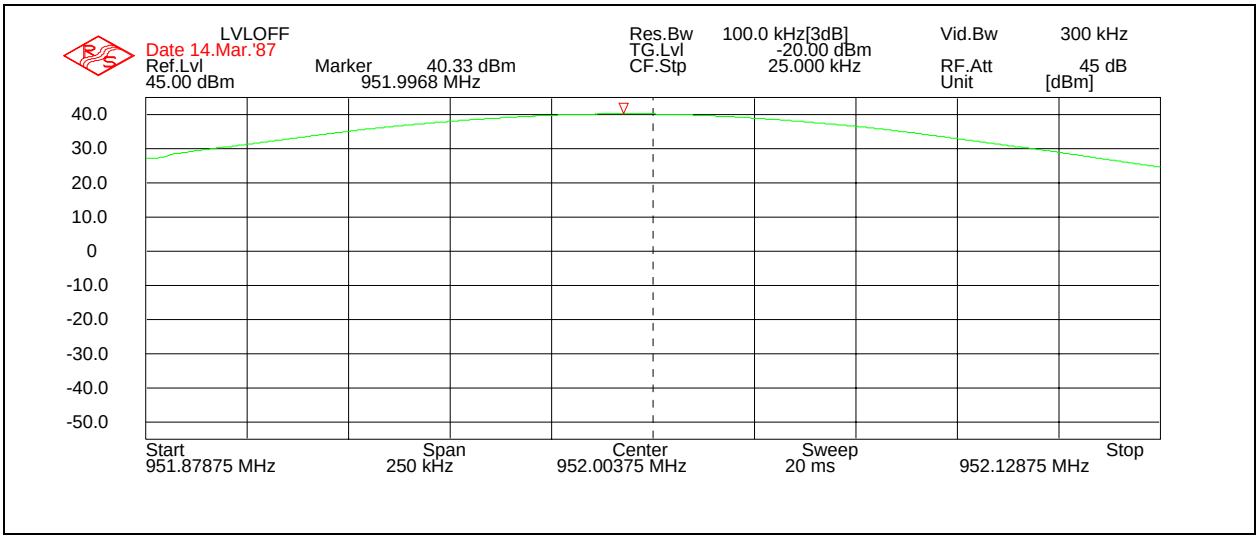

Figure 7.1.2-1: Peak Output Power 952.00625 MHz

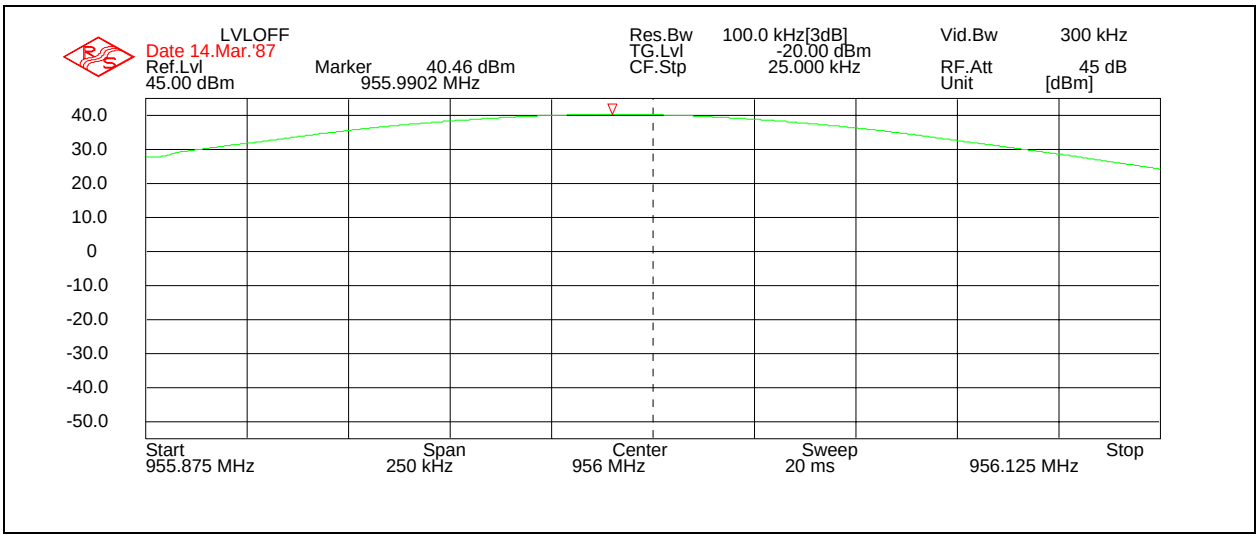

Figure 7.1.2-2: Peak Output Power 956.00000 MHz

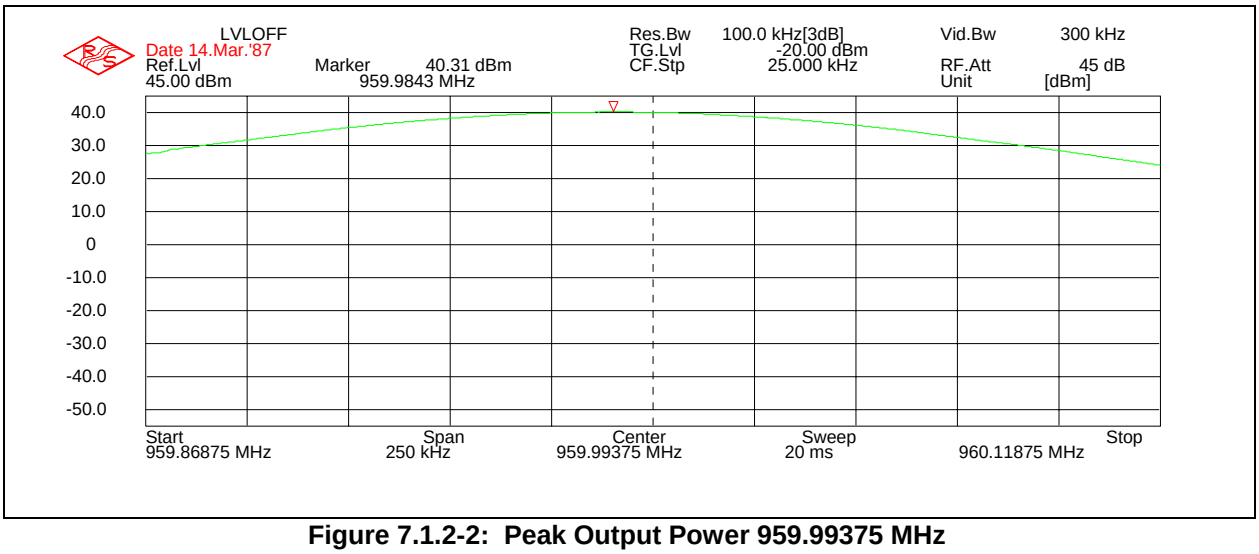

Figure 7.1.2-2: Peak Output Power 959.99375 MHz

7.2 Occupied Bandwidth (Emission Limits) - FCC Section 2.1049, 101.111 a(1)

7.2.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. Results of the test are shown below in Figure 7.2.2-1 through 7.2.2-3.

7.2.2 Measurement Results

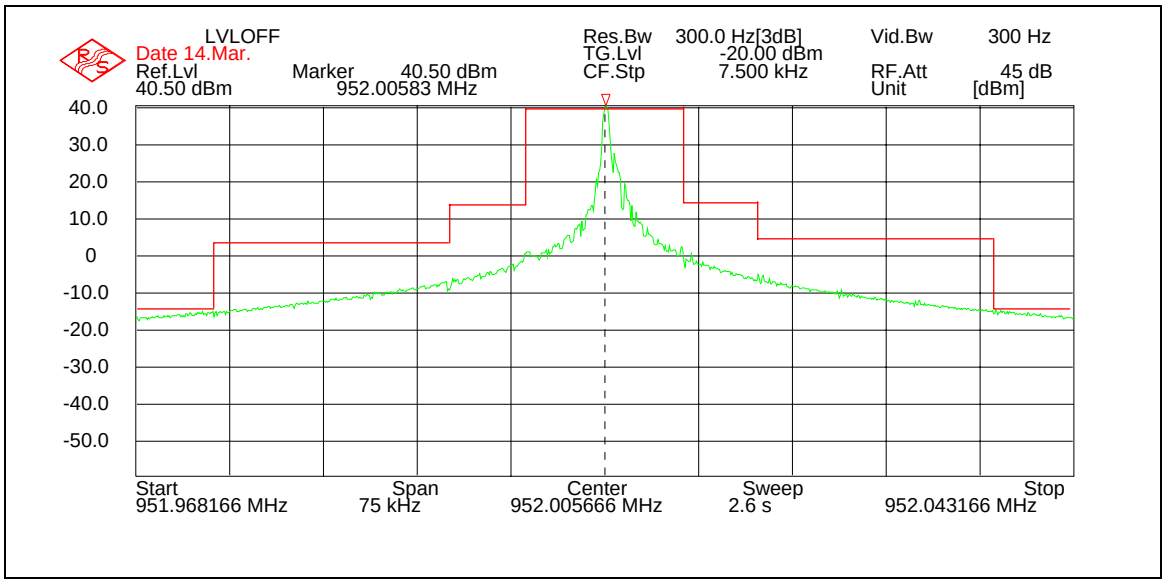

Figure 7.2.2-1: Occupied Bandwidth– 952.00625 MHz

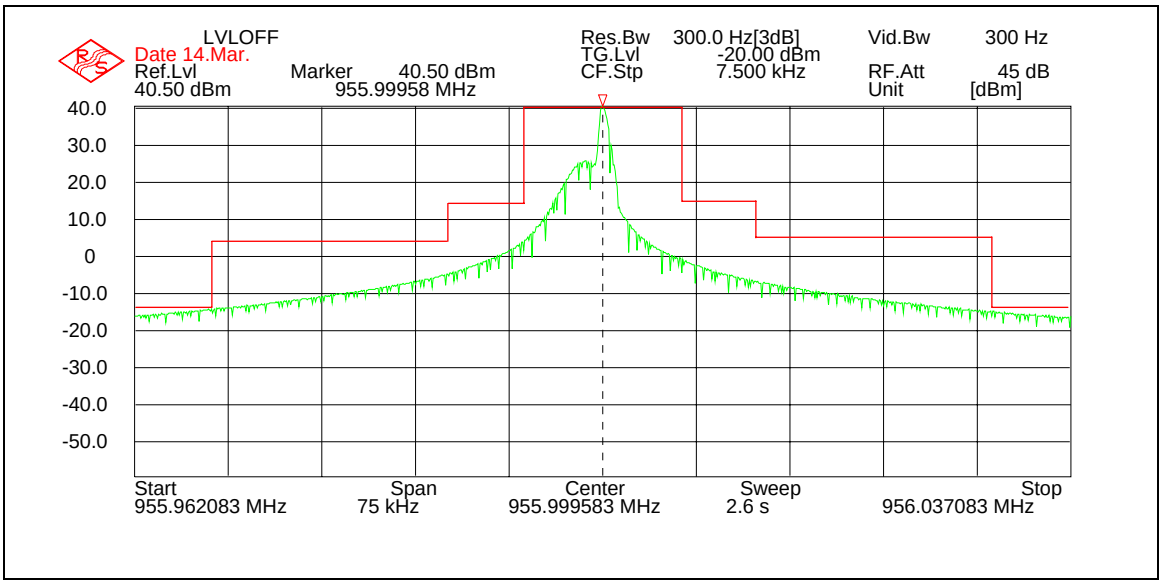

Figure 7.2.2-2: Occupied Bandwidth– 956.00000 MHz

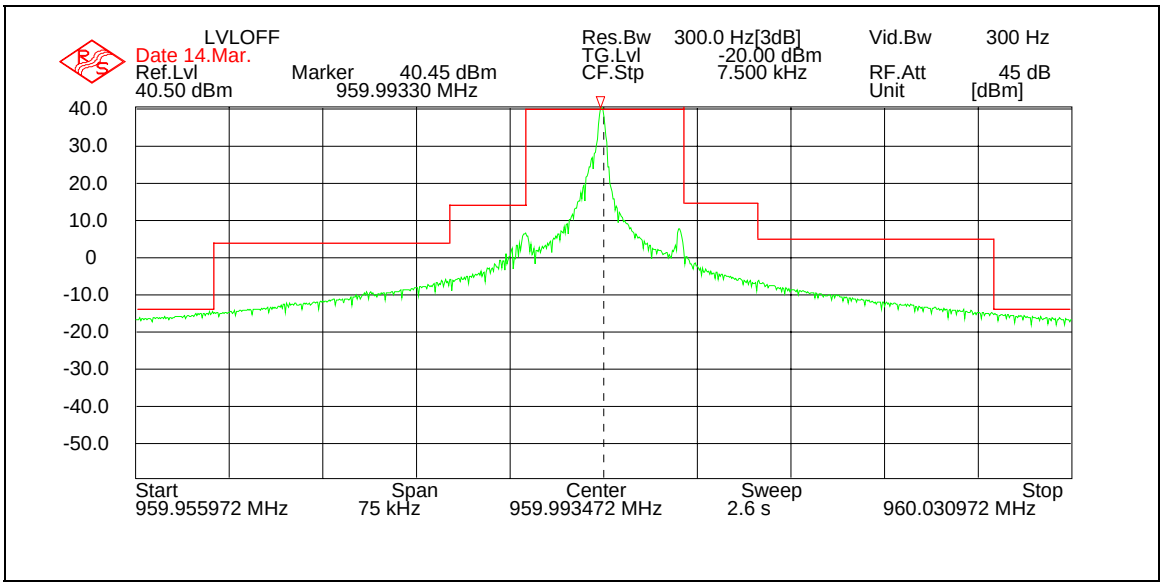

Figure 7.2.2-3: Occupied Bandwidth– 959.99375 MHz

7.3 Spurious Emissions at Antenna Terminals - FCC Section 2.1051, 101.111 (a)(1)(iii)

7.3.1 Measurement Procedure

The RF output of the equipment under test was directly connected to the input of the Spectrum Analyzer through a 30 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 10 kHz / 30 kHz below 1000 MHz and 1 MHz / 1 MHz above 1000 MHz according to TIA 603-A-2001. The internal correction factors of the spectrum analyzer were employed to correct for any cable or attenuator losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057.

7.3.2 Measurement Results

The magnitude of all spurious emissions were attenuated more than 20 dB below the permissible value. Results of the test are shown below in Figure 7.3.2-1 through 7.3.2-6.

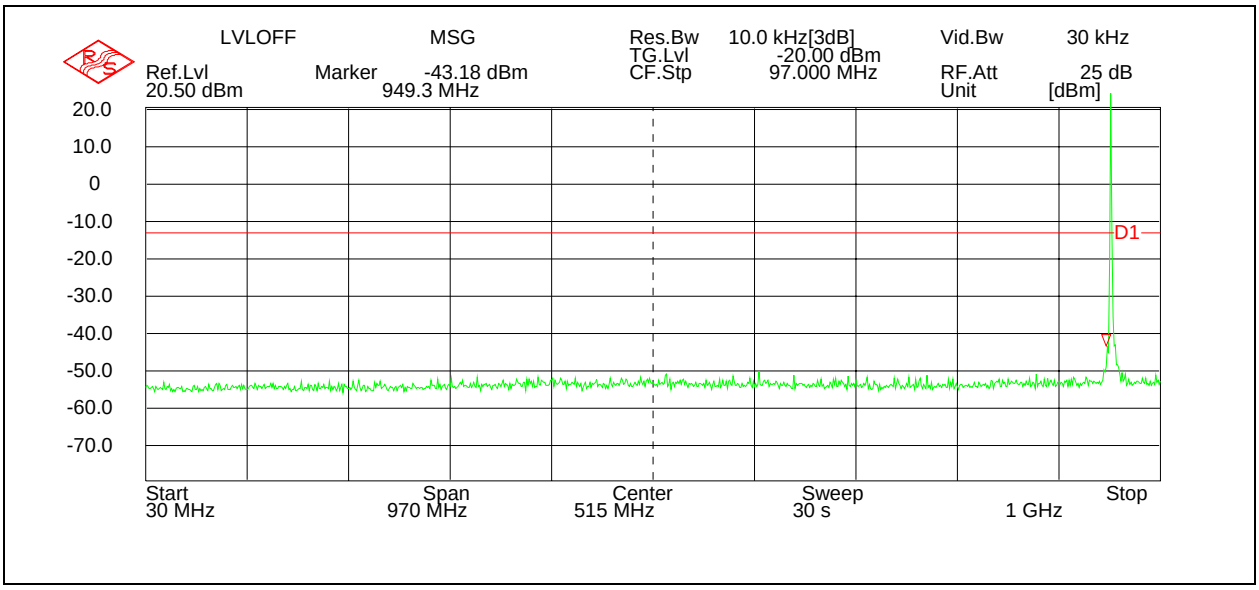

Figure 7.3.2-1: Spurious Emissions –952.00625 MHz

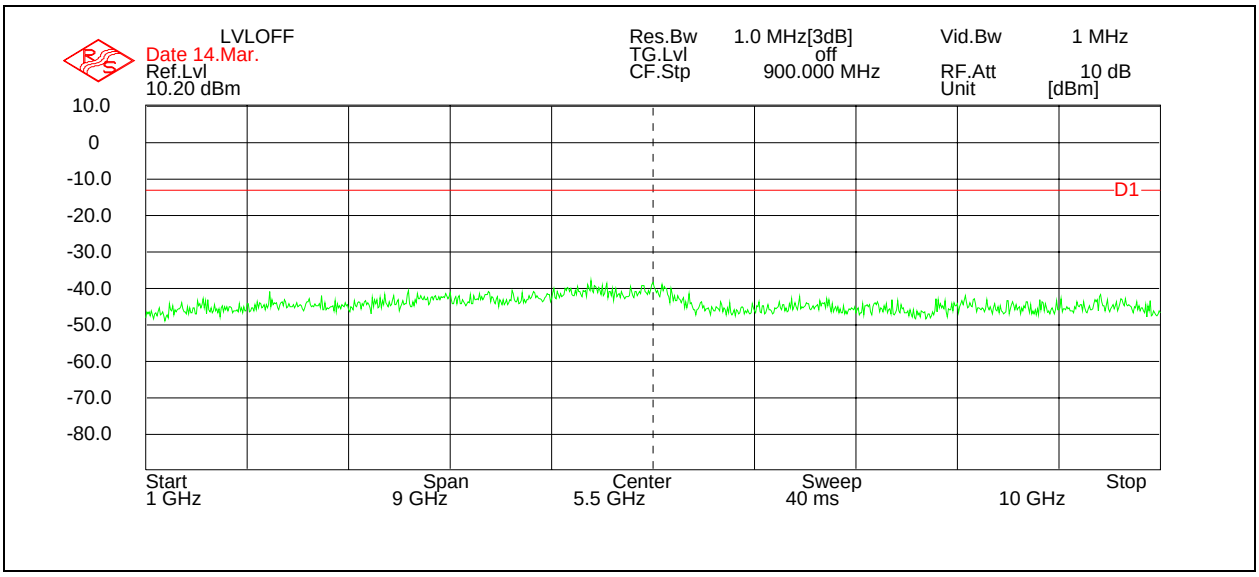

Figure 7.3.2-2: Spurious Emissions –952.00625 MHz

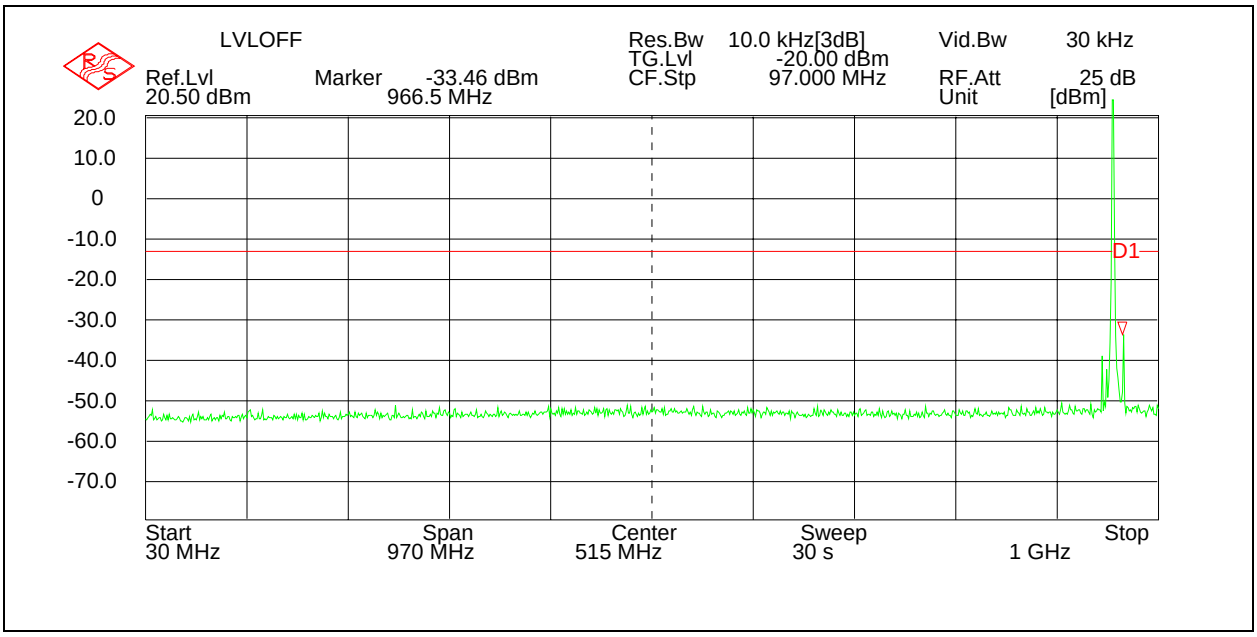

Figure 7.3.2-3: Spurious Emissions –956.00000 MHz

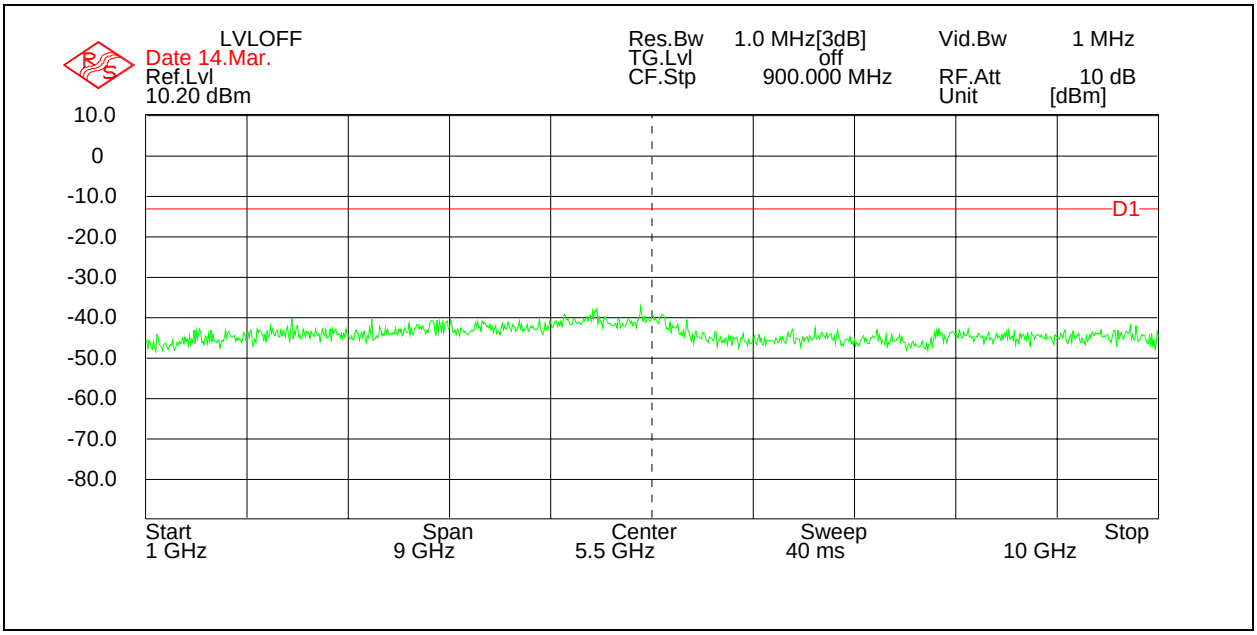

Figure 7.3.2-4: Spurious Emissions –956.00000 MHz

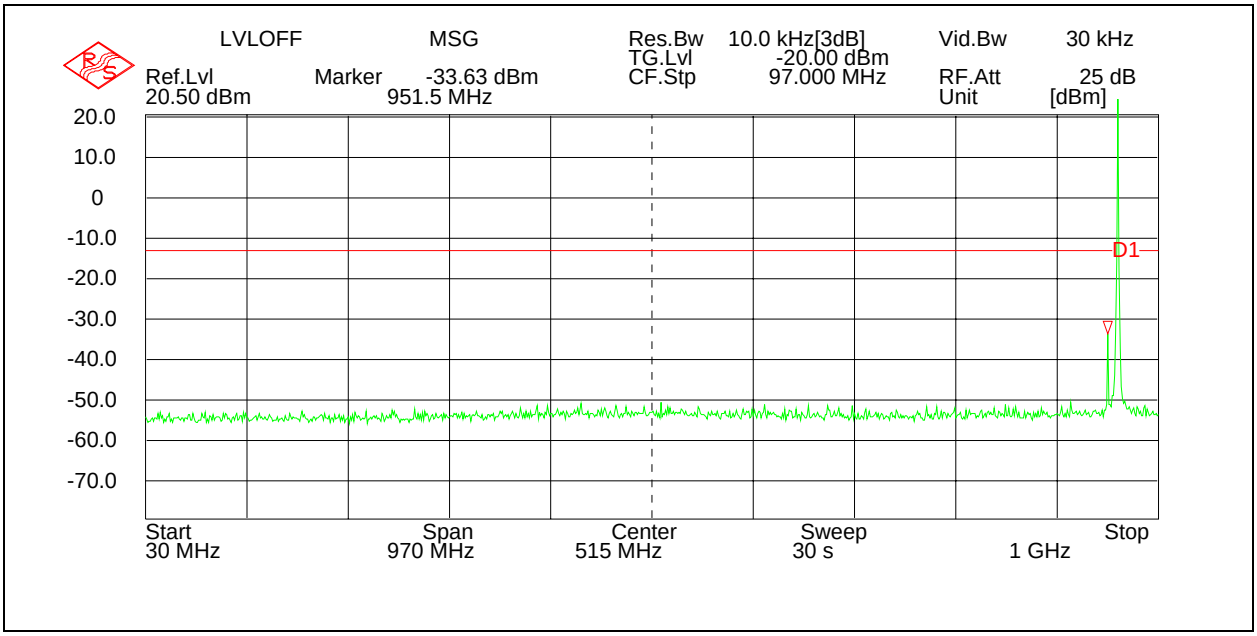

Figure 7.3.2-5: Spurious Emissions –959.99375 MHz

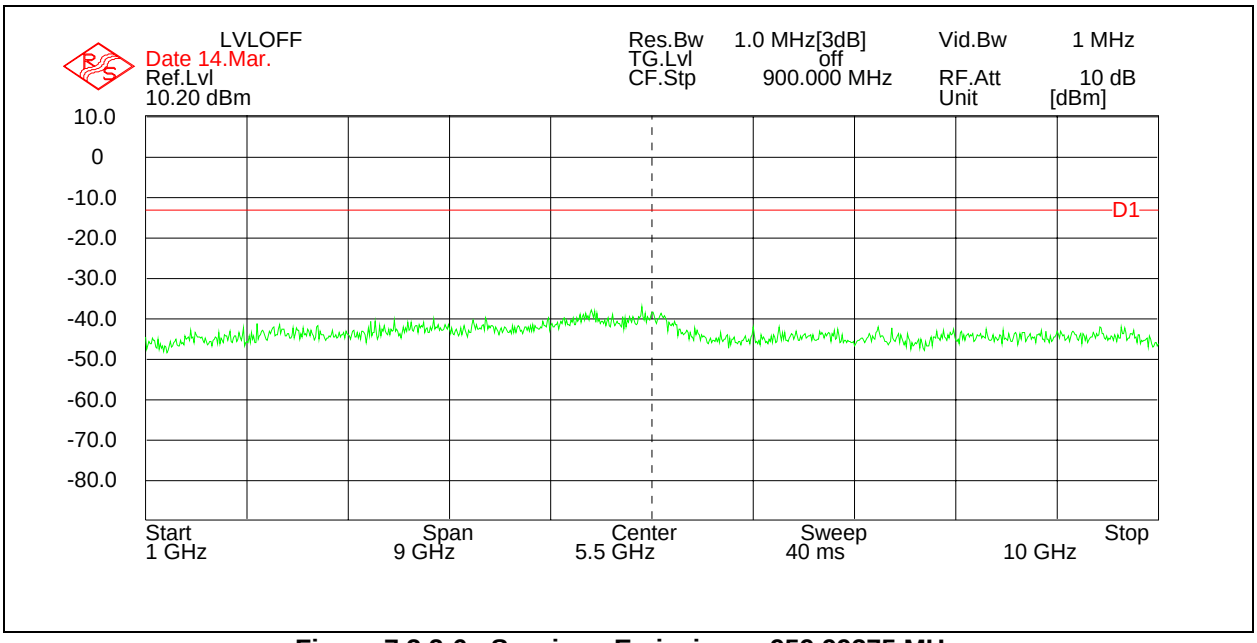

Figure 7.3.2-6: Spurious Emissions –959.99375 MHz

7.4 Field Strength of Spurious Emissions - FCC Section 2.1053, 101.111(a)(1)(iii)

7.4.1 Measurement Procedure

The equipment under test is placed on the Open Area Test Site (described in section 2.1) on a wooden table at the turntable center. For each spurious emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º and the maximum reading on the spectrum analyzer is recorded. This repeated for both horizontal and vertical polarizations of the receive antenna.

The equipment under test is then replaced with a substitution antenna fed by a signal generator. The signal generator's frequency is set to that of the spurious emission recorded from the equipment under test. The antenna mast is raised and lowered from one (1) to four (4) meters to obtain a maximum reading on the spectrum analyzer. The output of the signal generator is then adjusted until the reading on the spectrum analyzer matches that obtained from the equipment under test. The signal generator level is recorded.

The ERP in dBm of each spurious emission is calculated by correcting the signal generator level for the cable loss and gain of the substitution antenna referenced to a dipole. The spectrum was investigated in accordance to CFR 47 Part 2.1057.

Results of the test are shown below in Table 7.4.2-1 through 7.4.2-3.

7.4.2 Measurement Results

Table 7.4.2-1: Field Strength of Spurious Emissions – 952.00625 MHz

Frequency (GHz)	Uncorrected Radiated Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factor (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1.9040	-40.69	-39	H	4.56	-34.44	-13	21.44
1.9040	-35.94	-35	V	4.56	-30.44	-13	17.44
2.8560	-50.57	-51	H	5.68	-45.32	-13	32.32
2.8560	-52.60	-50	V	5.68	-44.32	-13	31.32
3.8080	-55.85	-51	H	6.18	-44.82	-13	31.82
3.8080	-55.06	-51	V	6.18	-44.82	-13	31.82
4.7600	-57.07	-54	H	6.51	-47.49	-13	34.49
4.7600	-56.18	-53	V	6.51	-46.49	-13	33.49

Table 7.4.2-2: Field Strength of Spurious Emissions – 956.00000 MHz

Frequency (GHz)	Uncorrected Radiated Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factor (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1.9120	-39.55	-38	H	4.55	-33.45	-13	20.45
1.9120	-40.31	-41	V	4.55	-36.45	-13	23.45
2.8680	-51.79	-51	H	5.69	-45.31	-13	32.31
2.8680	-55.85	-53	V	5.69	-47.31	-13	34.31
3.8240	-56.97	-53	H	6.17	-46.83	-13	33.83
3.8240	-56.71	-55	V	6.17	-48.83	-13	35.83
4.7800	-57.68	-55	H	6.47	-48.53	-13	35.53
4.7800	-55.6	-48	V	6.47	-41.53	-13	28.53

Table 7.4.2-3: Field Strength of Spurious Emissions – 959.99375 MHz

Frequency (GHz)	Uncorrected Radiated Level (dBm)	Generator Level (dBm)	Antenna Polarity (H/V)	Correction Factor (dB)	Corrected Reading (dBm)	Limit (dBm)	Margin (dB)
1.9200	-37.34	-36	H	4.53	-31.47	-13	18.47
1.9200	-36.58	-35	V	4.53	-30.47	-13	17.47
2.8800	-52.19	-52	H	5.70	-46.30	-13	33.30
2.8800	-53.79	-53	V	5.70	-47.30	-13	34.30
3.8400	-55.65	-51	H	6.16	-44.84	-13	31.84
3.8400	-57.27	-54	V	6.16	-47.84	-13	34.84
4.8000	-56.79	-52	H	6.43	-45.57	-13	32.57
4.8000	-57.25	-53	V	6.43	-46.57	-13	33.57

7.5 Frequency Stability - FCC Section 2.1055, 101.107(a)

7.5.1 Measurement Procedure

The equipment under test is placed inside an environmental chamber. The RF output is directly coupled to the input of the measurement equipment via a 30dB attenuator and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range 0º C to +50º C and at intervals of 10º C at normal supply voltage. A period of time sufficient to stabilize all components of the equipment was allowed at each frequency measurement. At a temperature 20º C the supply voltage was varied from 85% to 115% from the normal. The maximum variation of frequency was recorded.

The temperature control system of the MTX950 has two sensors; one monitoring the temperature high inside the MTX950 and one monitoring the low inside the MTX950. The high temperature sensor is located near the power amplifier and the low temperature sensor is located in the transmitter board. Should any of these sensors detect an out of range condition (below 0º C or above 50º C), all power supplies are turned off, except the transmitter control circuitry, the fans and the supply to the PC.

The EUT was tested at the middle channel with an unmodulated carrier.

Results of the test are shown below in Table 7.5.2-1 and Figure 7.5.2-1.

7.5.2 Measurement Results

Table 7.5.2-1: Frequency Stability

Temperature ºC	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
0 C	956.000690	**0.722**	100%	12.00
10 C	956.000480	**0.502**	100%	12.00
20 C	956.000000	**0.000**	100%	12.00
30 C	955.999450	**-0.575**	100%	12.00
40 C	955.998740	**-1.318**	100%	12.00
50 C	955.999410	**-0.617**	100%	12.00
20 C	955.999960	**-0.042**	85%	10.20
20 C	955.999950	**-0.052**	100%	13.80

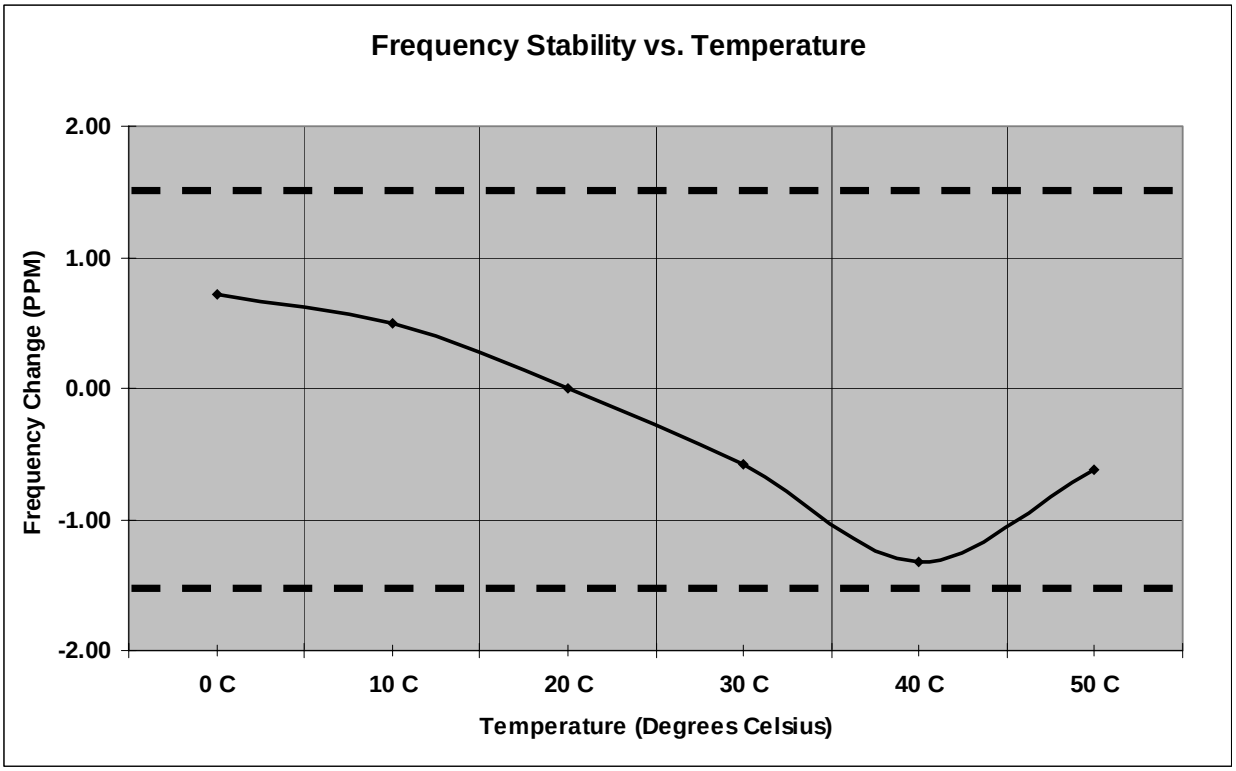

Figure 7.5.2-1: Frequency Stability – 956.00000 MHz

7.6 Radiated Emissions (Unintentional Radiators) - FCC Section 15.109

7.6.1 Measurement Procedure

The equipment under test is placed on the Open Area Test Site (described in section 2.1) on a wooden table at the turntable center. For each radiated emission, the antenna mast is raised and lowered from one (1) to four (4) meters and the turntable is rotated 360º to obtain a maximum peak reading on the spectrum analyzer. The radiated emissions are then measured using an EMI receiver employing a CISPR quasi-peak detector for frequencies below 1000 MHz and an Average detector function for frequencies above 1000 MHz. This repeated for both horizontal and vertical polarizations of the receive antenna. Measurements were taken from 30 MHz to 5000 MHz.

The field strength of each radiated emission is calculated by correcting the EMI receiver level for cable loss, amplifier gain, and antenna correction factors.

Field Strength (dBuV/m) = EMI Receiver Level (dBuV) + Cable Loss (dB) – Amplifier Gain (dB) + Antenna Correction Factor (1/m)

Results of the test are shown below in Table 7.6.2-1.

7.6.2 Measurement Results

Table 7.6.2-1: Radiated Emissions Tabulated Data

Frequency (MHz)	Antenna Polarity (H/V)	Antenna Position (cm)	Turntable Position (°)	Corrected Reading (dBµV)	Limit (dBµV)	Margin (dB)
30.00	V	107	168	17.7	40.0	22.3
40.16	V	100	69	22.1	40.0	17.9
55.28	V	100	278	30.8	40.0	9.2
106.08	V	99	119	41.3	43.5	2.2
174.16	H	130	175	36.5	43.5	7.0
276.48	H	99	42	39.0	46.0	7.0
302.00	H	100	352	37.5	46.0	8.5
400.88	V	131	113	38.8	46.0	7.2
956.96	V	100	113	43.6	46.0	2.4

7.7 Power Line Conducted Emissions - FCC Section 15.107

The MTX950 unit is power from the 12V battery of a car and therefore Power Line Conducted Emissions is not required.

8.0 CONCLUSION

In the opinion of ACS, Inc. the MTX950, manufactured by Neptune Technology Group, Inc., meets the requirements of FCC Part 15 subpart B and FCC Part 101 subpart C.