Transmitter Certification

Test Report

FCC ID: SDBAMDS1000TR-1

FCC Rule Part: CFR 47 Part 24 Subpart D, Part 90 Subpart I, Part 101 Subpart C

ACS Report Number: 05-0052-LD

Manufacturer: AMDS.
Equipment Type: Electricity Meter Transmitter
Model: AMDS-1000TR-1

Test Dates (1): June 1, 2004 - August 11, 2004
Test Dates (2): February 9, 2005 – April 4, 2005

Report Issue Date: April 12, 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 **32** pages

Table of Contents

Additional Exhibits Included In Filing

Internal Photographs
Test Setup Photographs
RF Exposure – MPE Calculations
System Block Diagram
Parts List
External Photographs
Product Labeling
Installation/Users Guide
Theory of Operation
Schematics

1.0 GENERAL

1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J, Part 24 Subpart D, Part 90 Subpart I, and Part 101 Subpart C of the FCC's Code of Federal Regulations.

1.2 Product Description

The AMDS-1000TR iCon Transceiver is a printed circuit board that provides wireless communication capability to the Invensys™ iCon family of electric utility meters.

The device mounts into existing iCon meters and acts as the "Integrated Communications Device". The device monitors meter reading and diagnostic information via an UI 1203 serial interface to the iCon display board. Power failures are detected via a Power Failure active low signal also from the iCon display board. The device communicates via the AMDS fixed wireless telemetry network to provide electric meter readings and diagnostic data from the meter to the utility provider via a two-way radio link.

The AMDS-1000TR transceiver utilizes a printed antenna. The transceiver antenna has a VSWR bandwidth of 50 MHz, enough to cover the transmitter and receiver operating frequency range. The antenna is a printed monopole with a gain of 0 dBi.

The AMDS-100TR operates on 901-902 MHz, 930-931 MHz, and 940-941 MHz in accordance to Part 24 Narrowband PCS; on 896-901 MHz and 935-940 MHz in accordance to Part 90; and on 932-932.5 MHz and 941-941.5 MHz in accordance to Part 101.

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

1.3 Emission Designators

The AMDS iCon Transceiver produces four distinct modulation formats. They are described as Normal mode, Half-Baud Rate Mode, Boost mode, and MPass mode.

The emissions designators for the four modulation types used by the AMDS iCon Transceiver are as follows:

Normal Mode:	9K60F2D
Half-Baud Rate Mode:	4K80F2D
Boost Mode:	1K10F2D
MPass Mode:	5K90F1D

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:

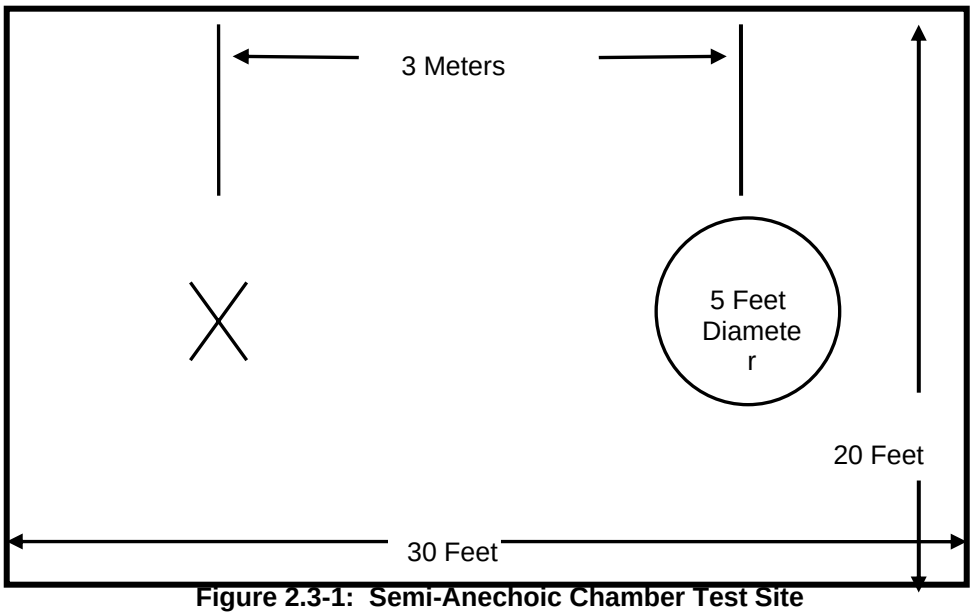


Figure 2.3-1: Semi-Anechoic Chamber Test Site

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:

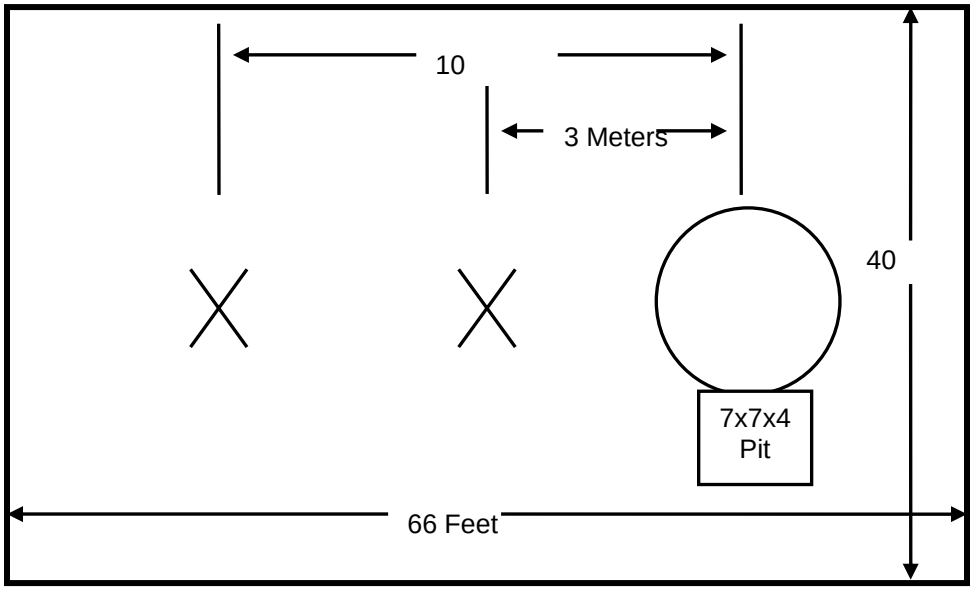


Figure 2.3-2: Open Area Test Site

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:

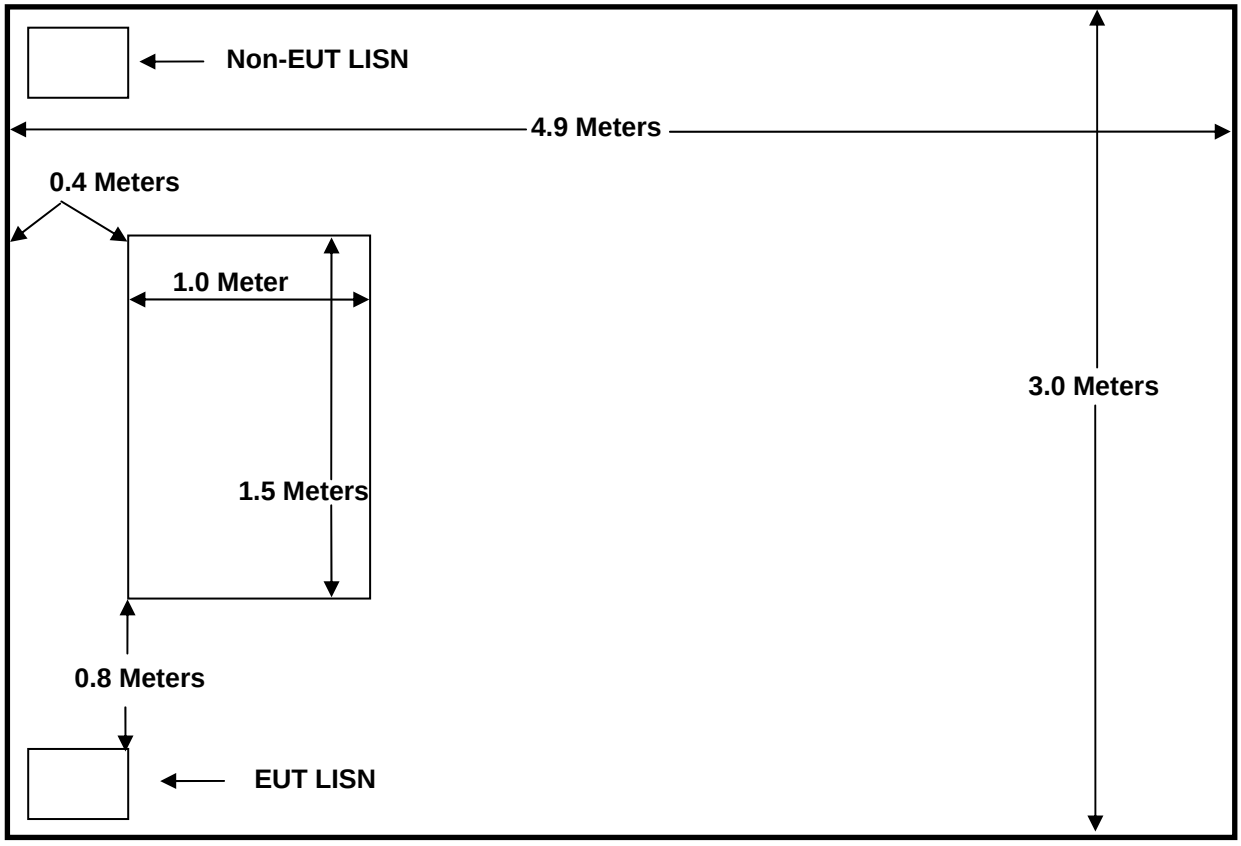


Figure 2.4-1: AC Mains Conducted EMI Site

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 2004)

3 - US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communication Service (October 2004)

4 - US Code of Federal Regulations (CFR): Title 47, Part 90, Subpart I: Private Land Mobile Radio Services (October 2004)

5 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services (October 2004)

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	AMDS	EUT	AMDS-1000TR-1 iCon Transceiver	None	SDBAMDS1000TR-1
2	Sorenson	DC Power Supply	DSC 60-50	0024B1130	None
3	OK Industries	DC Power Supply	PS73C	36095	None
4	Dell	Laptop PC	Think Pad	78-TFN16 96/12	ANOGCF2704AT

6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

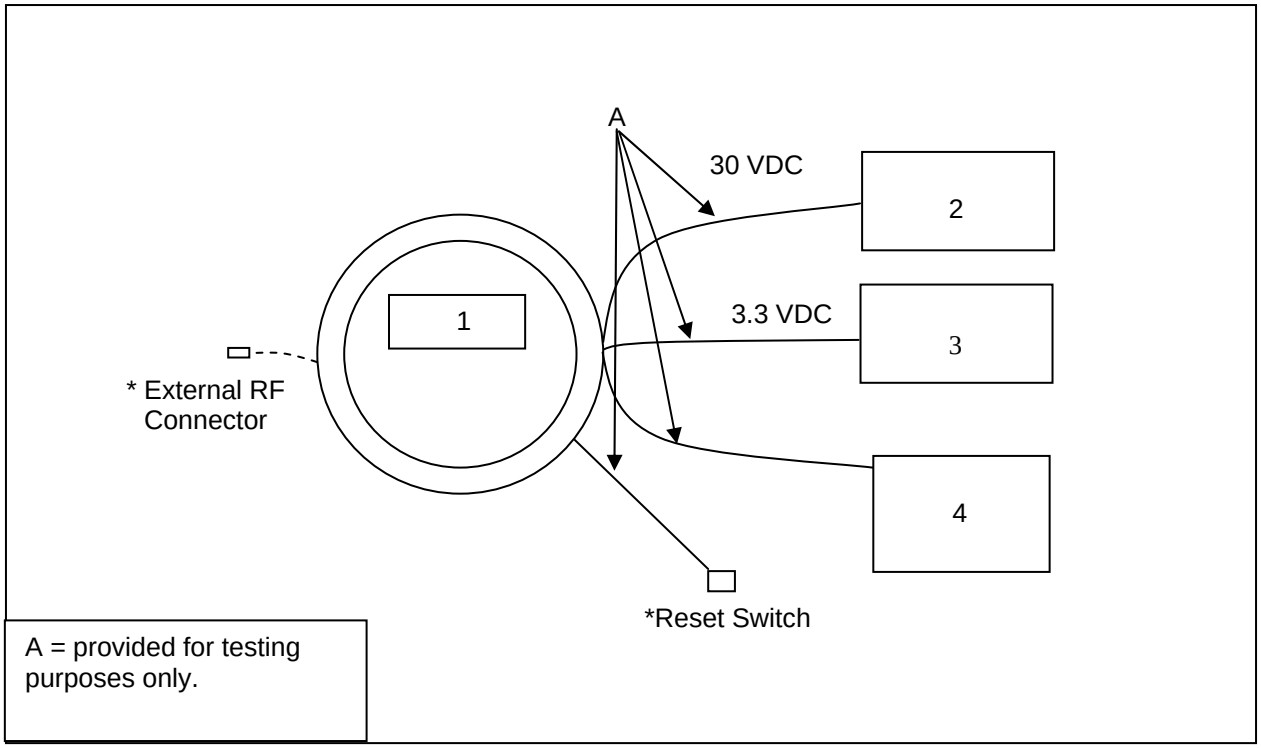


Figure 6-1: EUT Test Setup

The EUT was power by two external DC power supplies as shown above. The DB9 connector was used to connect to a PC for programming the EUT test modes. The PC was removed prior to testing.

* For RF conducted measurements the AMDS iCon Transceiver was modified with an external RF connector to the PCB. The AMDS iCon Transceiver utilizes a printed antenna integral to the transceiver PCB for normal operation but for testing purposes a 50-Ohm test point (TP2) is available on the bottom of the PCB. The test point provides proper power level measurements only when the antenna is disconnected and a 50-Ohm test cable is soldered (with the appropriate ground connection) to TP2.

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

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 10 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 7.1.1-2 and Figure 7.1.1-1 through 7.1.1-9.

7.1.2 Measurement Results

Table 7.1.1-1: Peak Output Power

Frequency (MHz)	FCC Rule Part	Output Power (dBm)
896.0500	90	30.00
900.9875	90	29.85
935.0125	90	29.03
939.9875	90	29.03
901.1125	24	29.87
930.1125	24	29.19
940.1125	24	29.03
932.23125	101	29.16
941.23125	101	29.03

Part 90

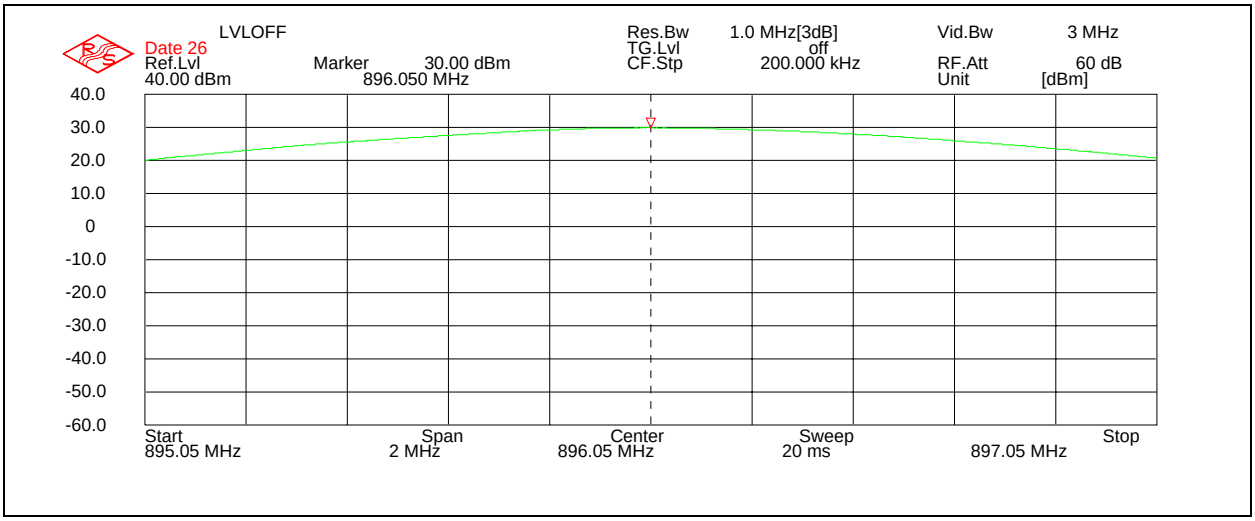


Figure 7.1.2-1: Peak Output Power 896.0500 MHz

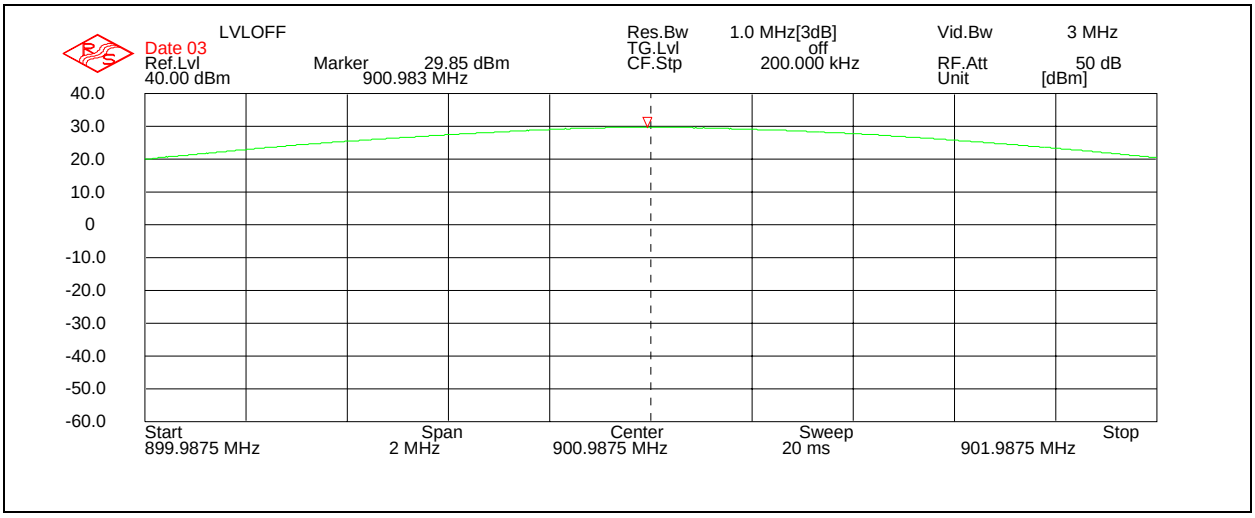


Figure 7.1.2-2: Peak Output Power 900.9875 MHz

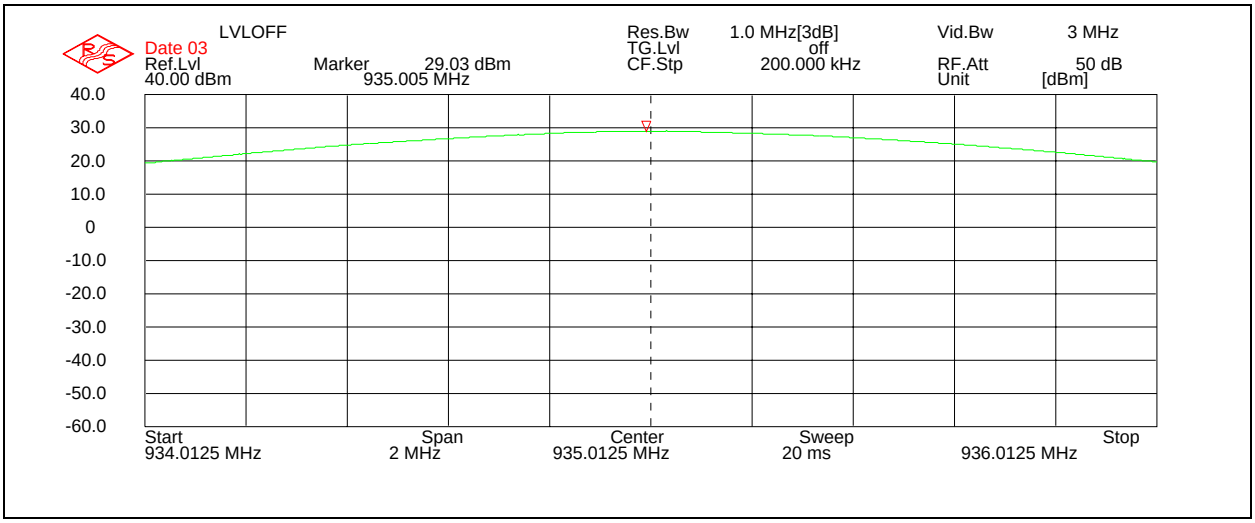


Figure 7.1.2-3: Peak Output Power 935.0125 MHz

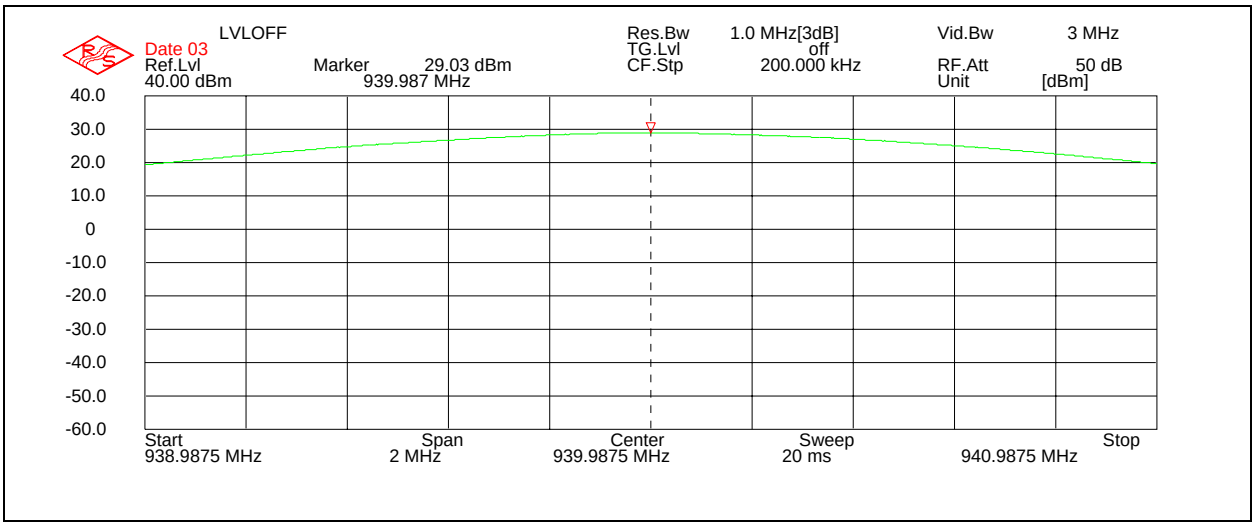


Figure 7.1.2-4: Peak Output Power 939.9875 MHz

Part 24

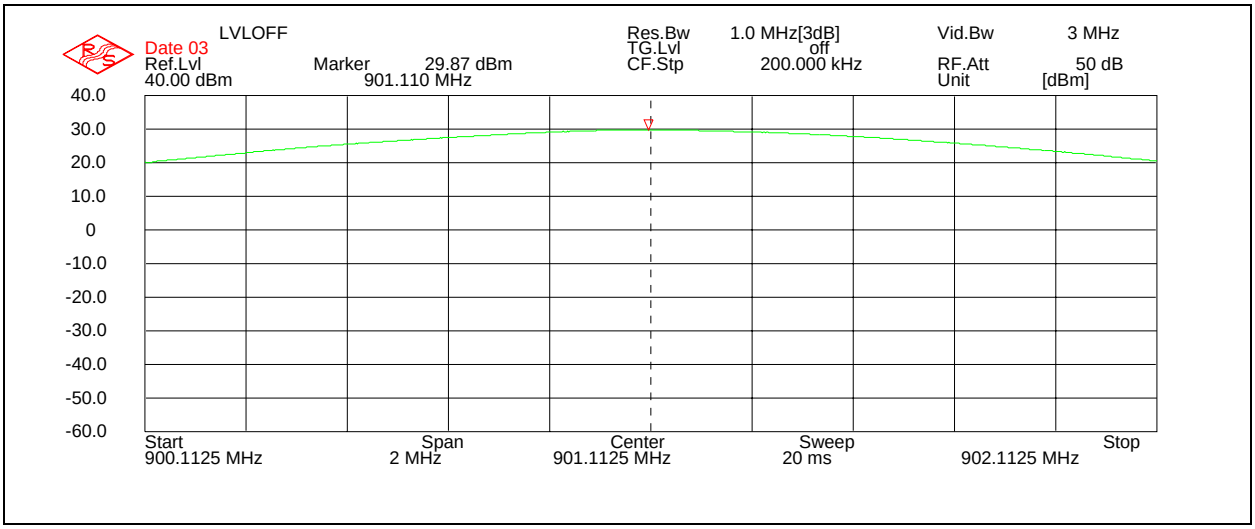


Figure 7.1.2-5: Peak Output Power 901.1125 MHz

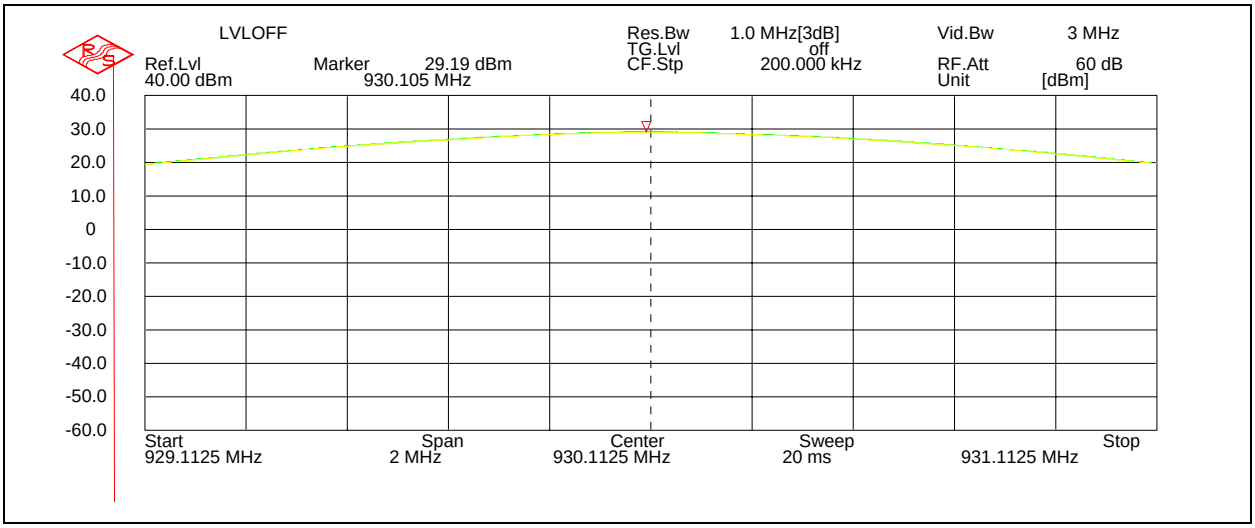


Figure 7.1.2-6: Peak Output Power 930.1125 MHz

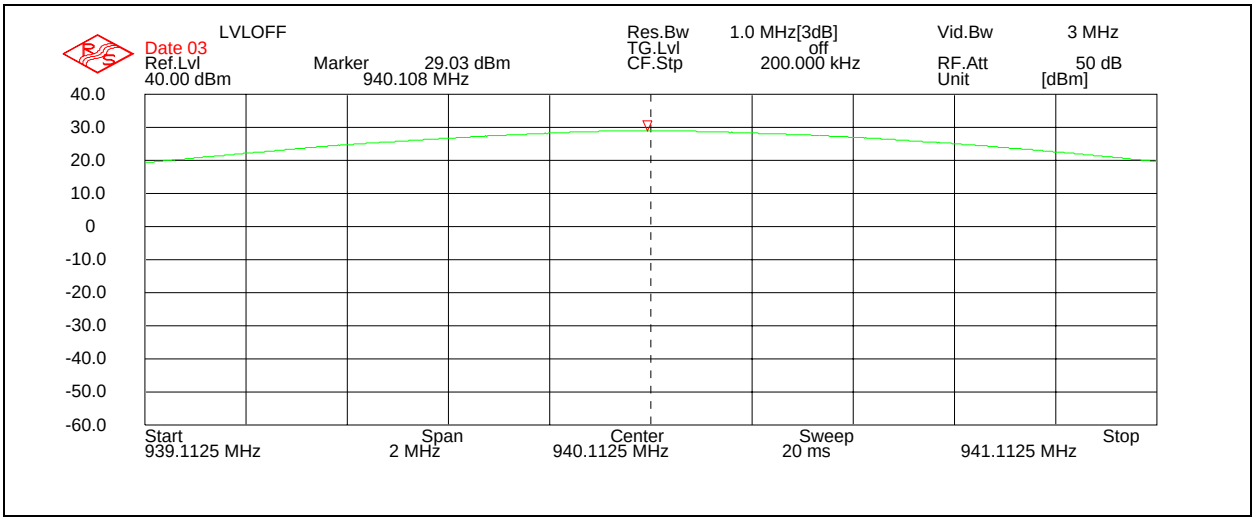


Figure 7.1.2-7: Peak Output Power 940.1125 MHz

Part 101

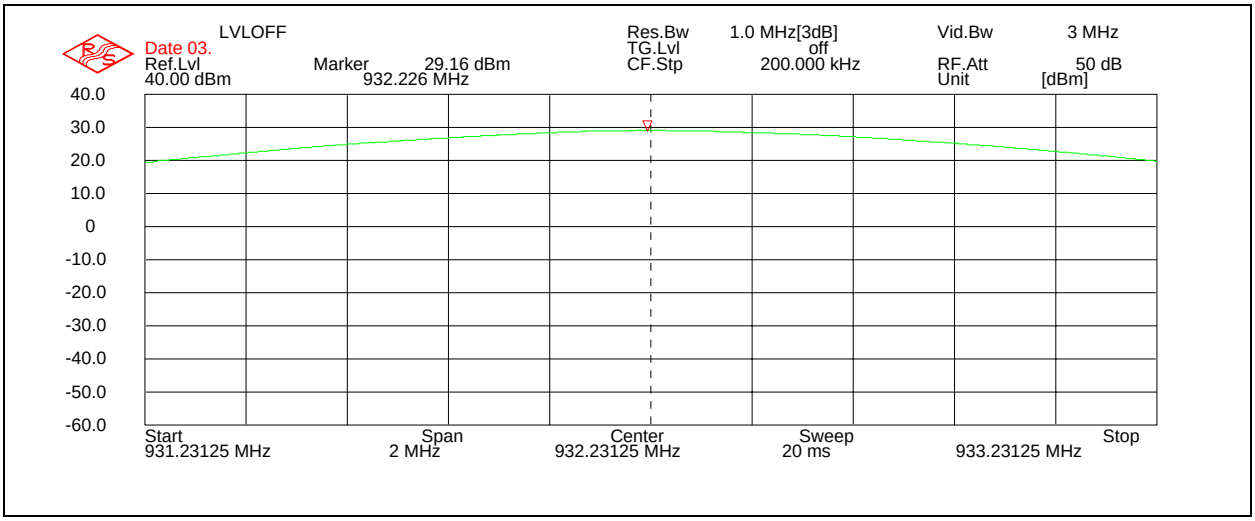


Figure 7.1.2-8: Peak Output Power 932.23125 MHz

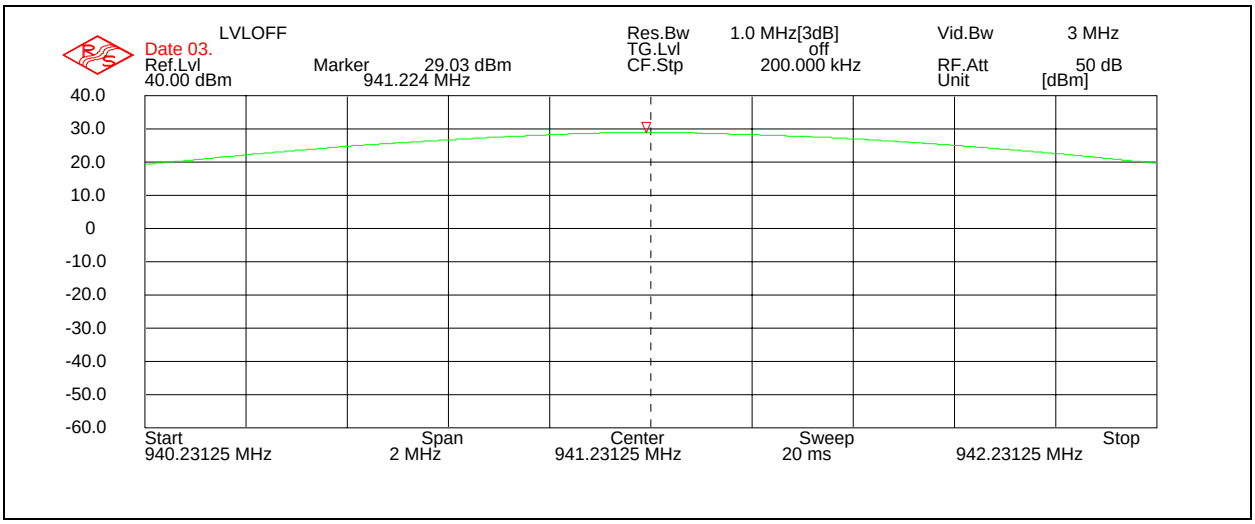


Figure 7.1.2-9: Peak Output Power 941.23125 MHz

7.2 Occupied Bandwidth (Emission Limits) - FCC Section 2.1049

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 10 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 for all modes of operation.

7.2.2 Measurement Results – Part 24.133 a(1), a(2)

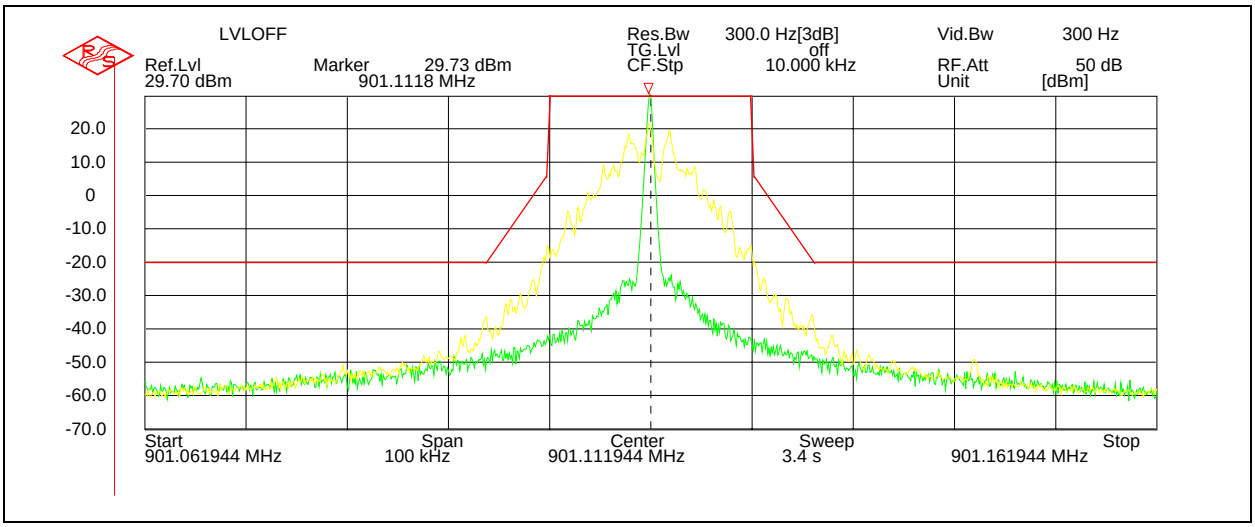


Figure 7.2.2-1: Normal Mode – 901.1125 MHz – 25 kHz Channel

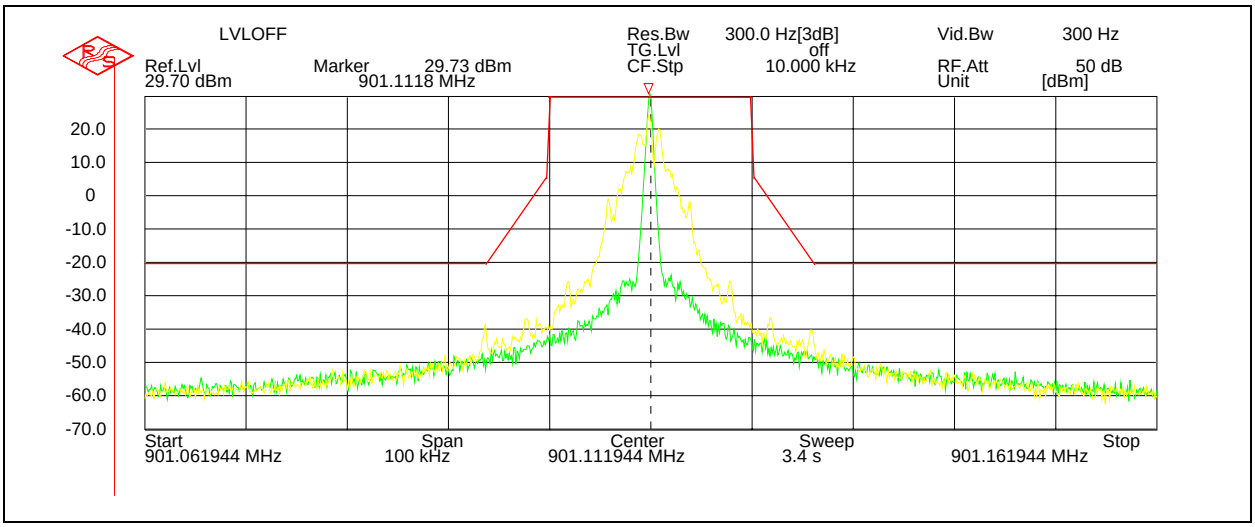


Figure 7.2.2-2: Half-Baud Rate Mode – 901.1125 MHz – 25 kHz Channel

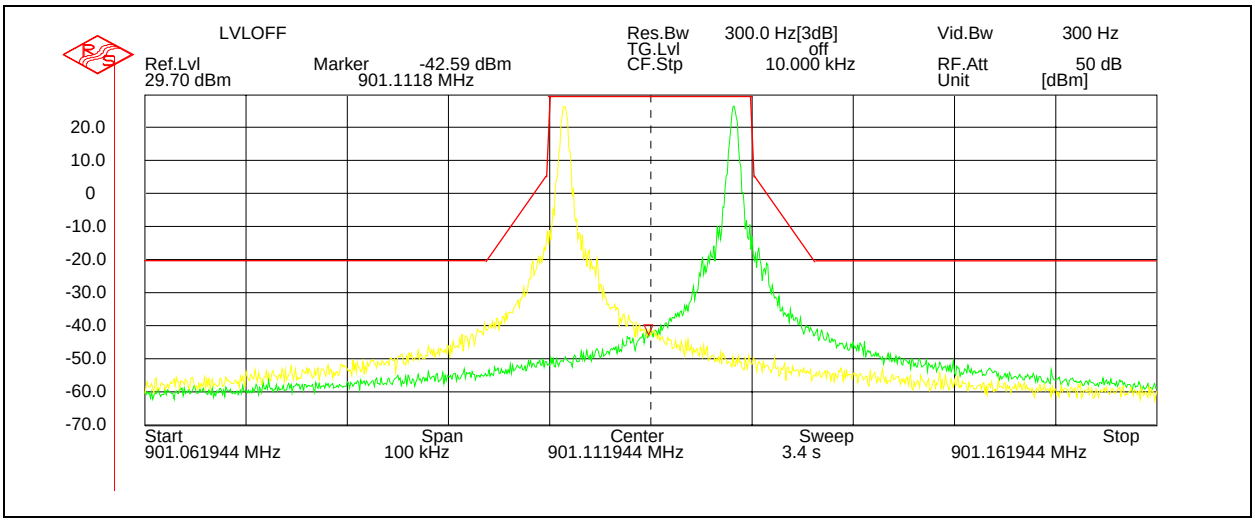


Figure 7.2.2-3: Boost Mode – 901.1125 MHz – 25 kHz Channel
Offset Channel of +/- 14 (+/- 8400 Hz)

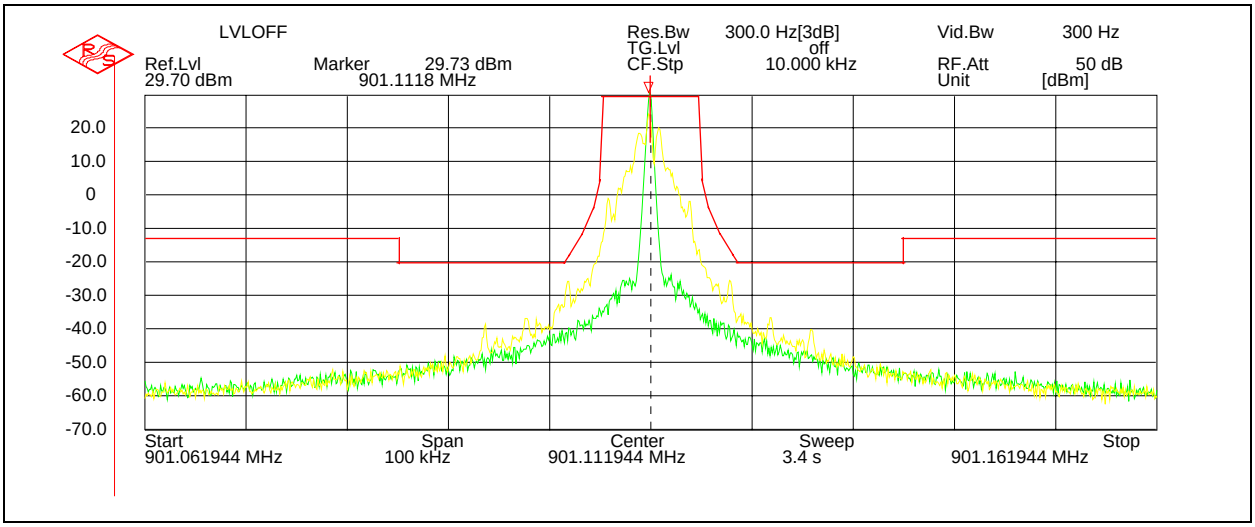


Figure 7.2.2-4: Half-Baud Rate – 901.1125 MHz – 12.5 kHz Channel

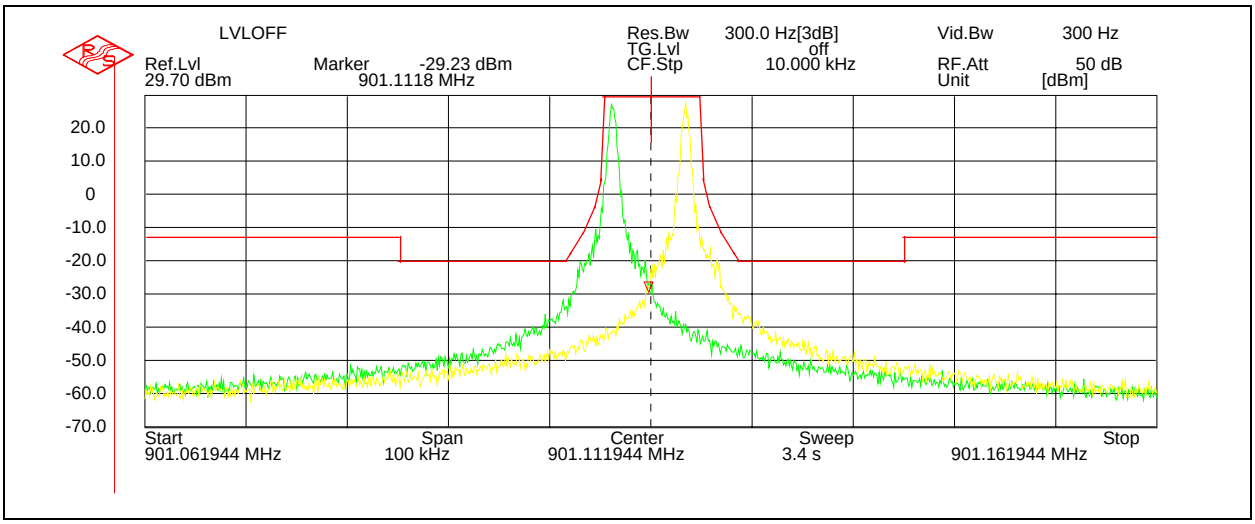


Figure 7.2.2-5: Boost Mode – 901.1125 MHz – 12.5 kHz Channel
Offset Channel of +/- 6 (+/- 3600 Hz)

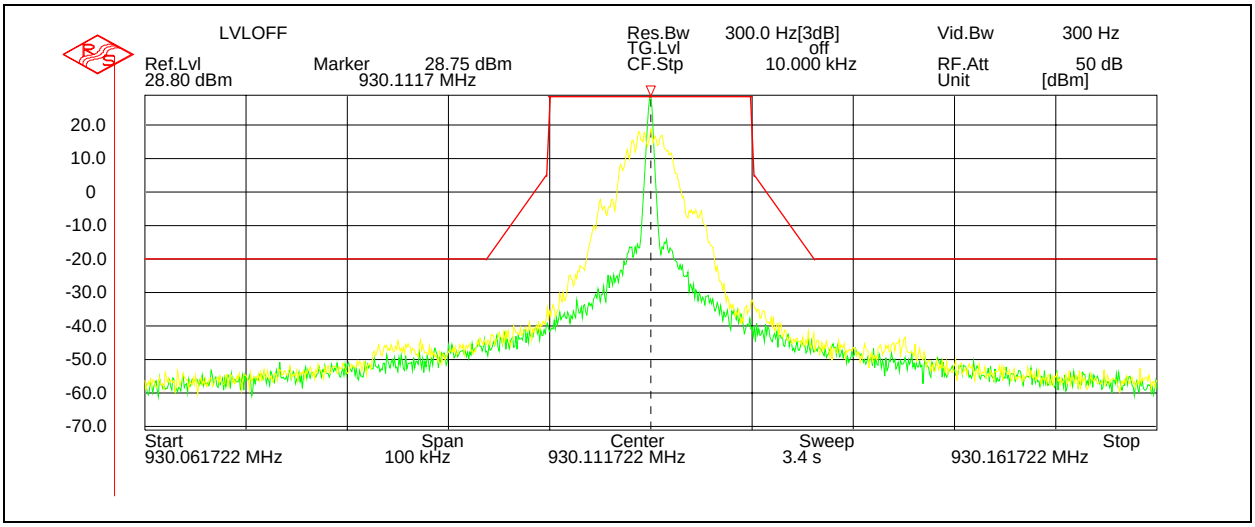


Figure 7.2.2-6: MPass Mode – 930.1125 MHz – 25 kHz Channel

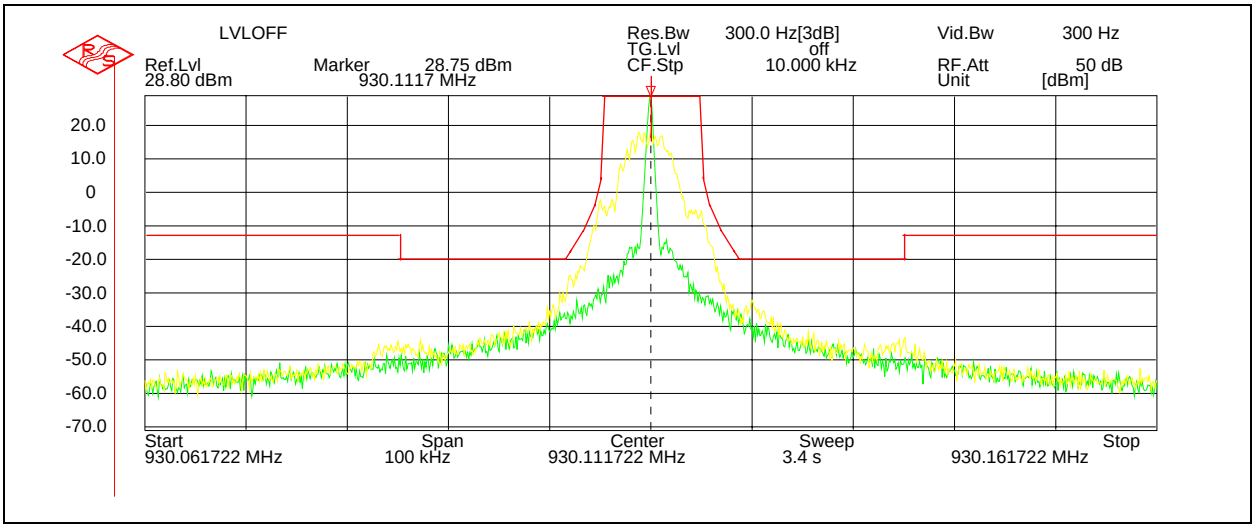


Figure 7.2.2-7: MPass Mode – 930.1125 MHz – 12.5 kHz Channel

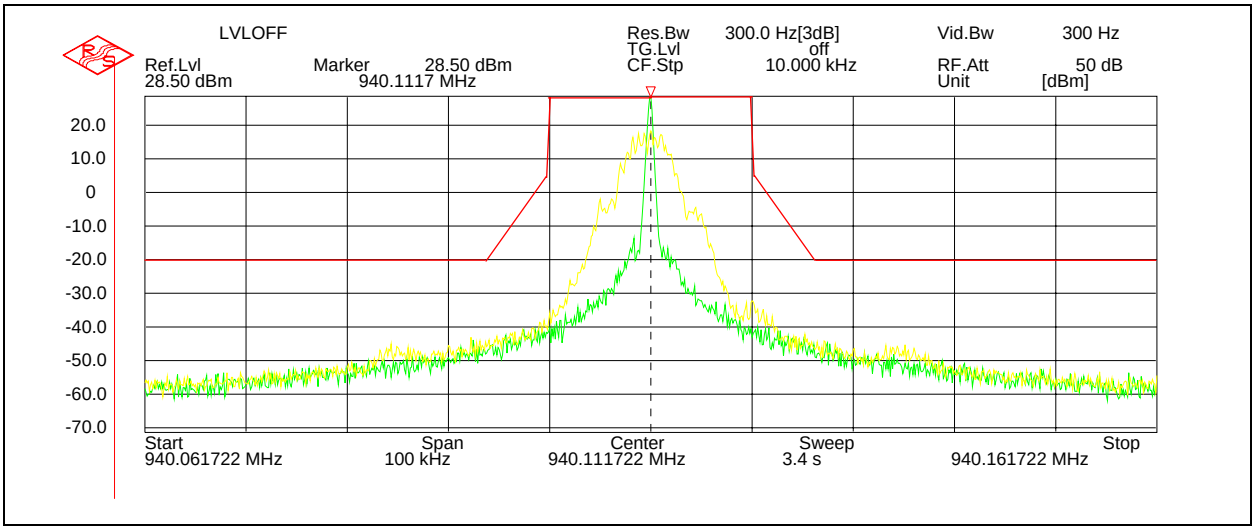


Figure 7.2.2-8: MPass Mode – 940.1125 MHz – 25 kHz Channel

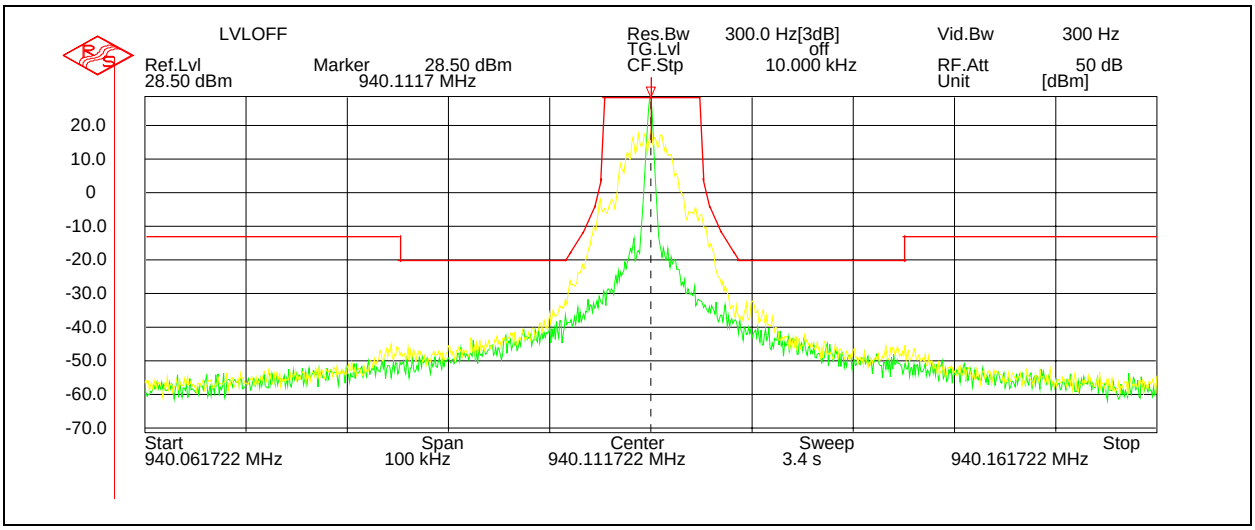


Figure 7.2.2-9: MPass Mode – 940.1125 MHz – 12.5 kHz Channel

7.2.3 Measurement Results – Part 90.210 (j)

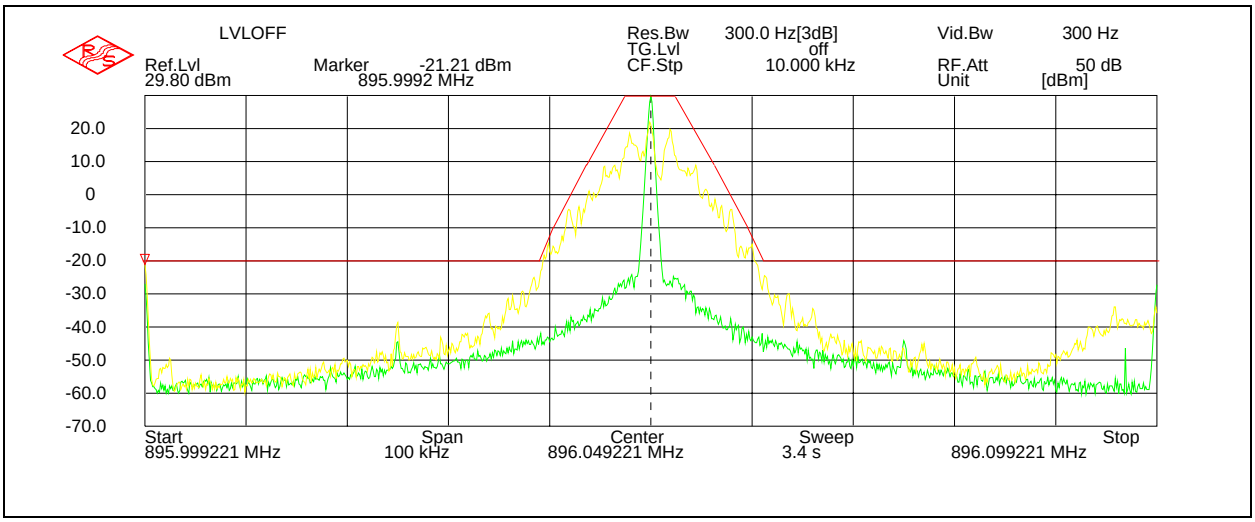


Figure 7.2.3-1: Normal Mode – 896.0500 MHz

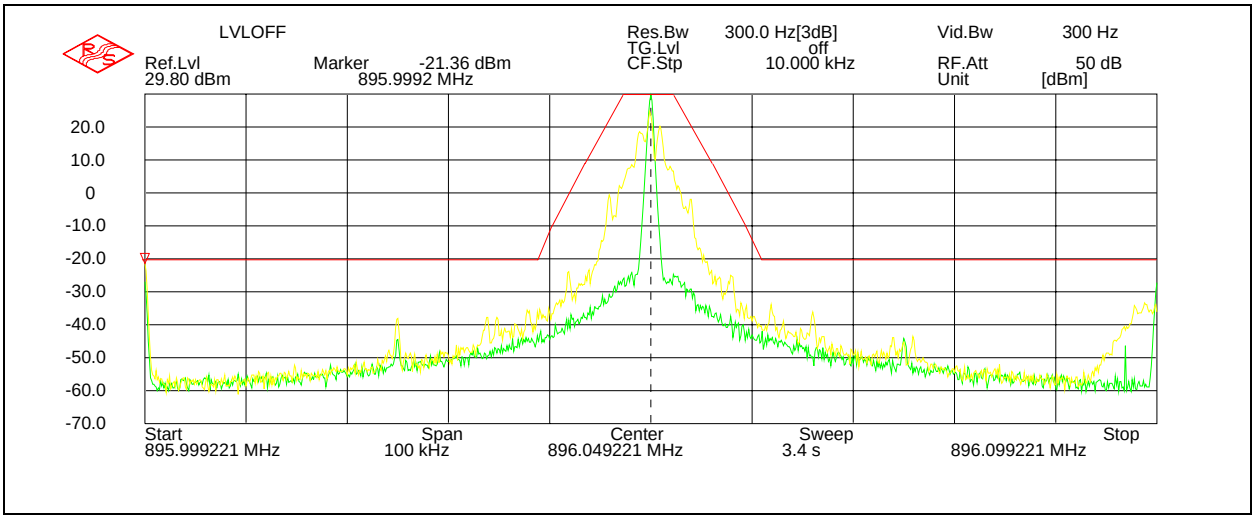


Figure 7.2.3-2: Half-Baud Rate Mode – 896.0500 MHz

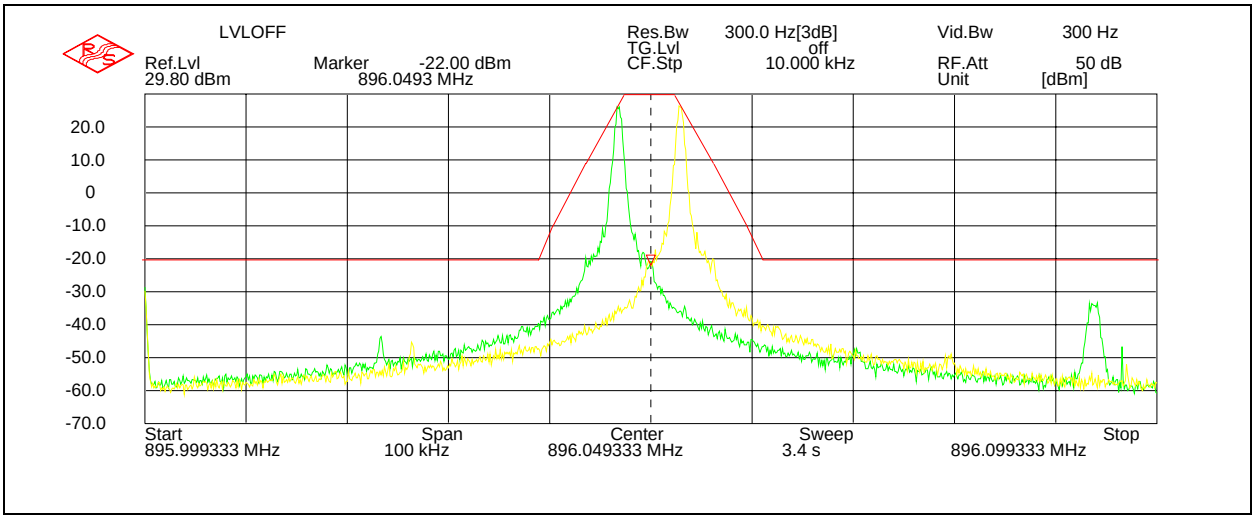


Figure 7.2.3-3: Boost Mode – 896.0500 MHz
Offset Channel of +/- 5 (+/- 3000 Hz)

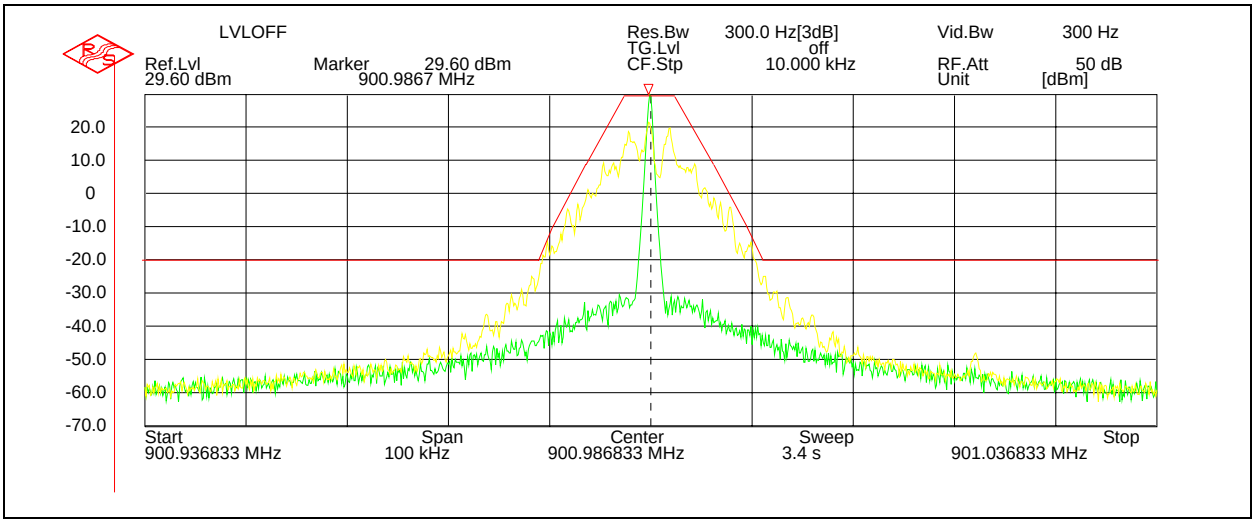


Figure 7.2.3-4: Normal Mode – 900.9875 MHz

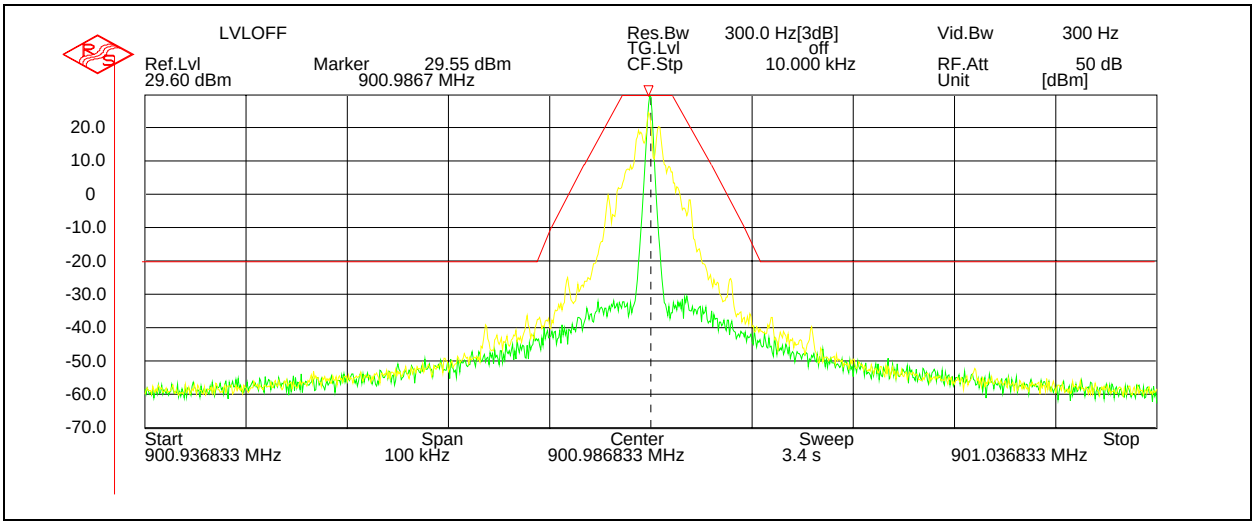


Figure 7.2.3-5: Half-Baud Rate Mode – 900.9875 MHz

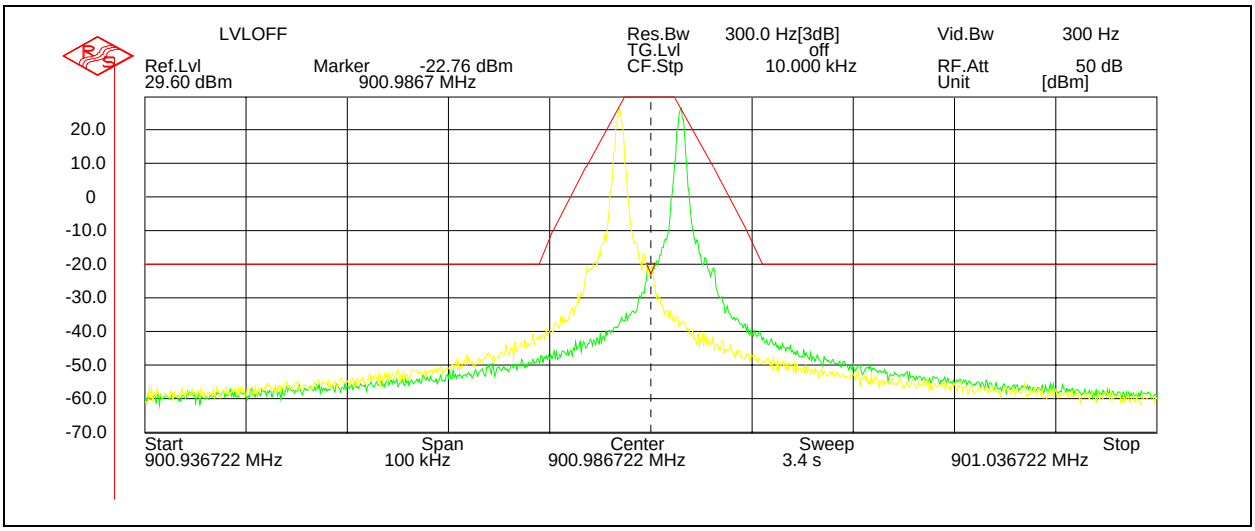


Figure 7.2.3-6: Boost Mode – 900.9875 MHz
Offset Channel of +/- 5 (+/- 3000 Hz)

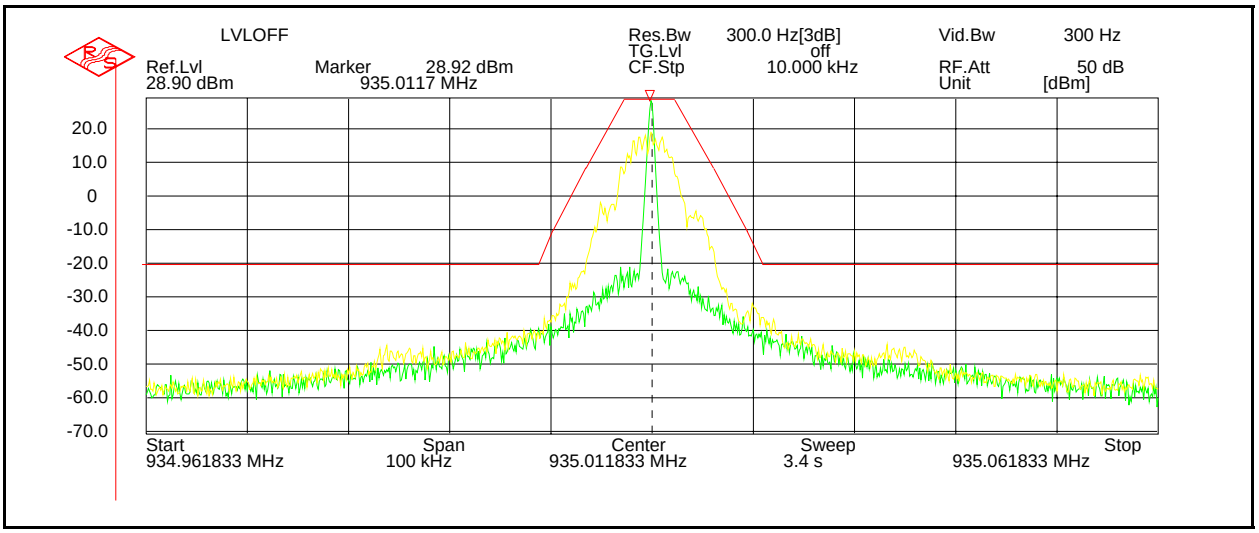


Figure 7.2.3-7: Mpass Mode – 935.0125 MHz

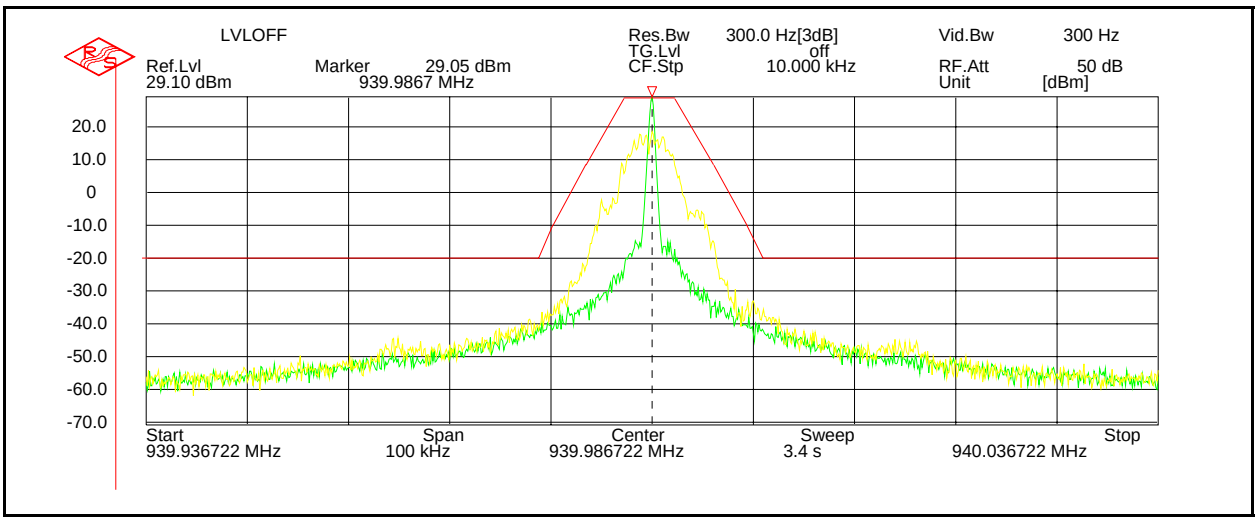


Figure 7.2.3-8: Mpass Mode – 939.9875 MHz

7.2.4 Measurement Results – Part 101.111 a(6)

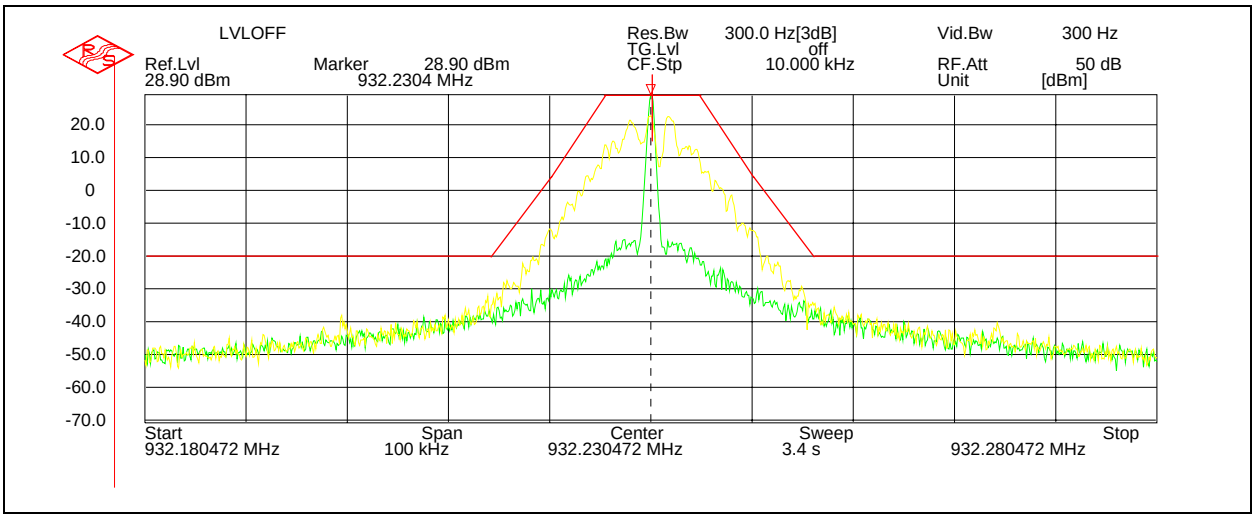


Figure 7.2.4-1: Normal Mode – 932.23125 MHz

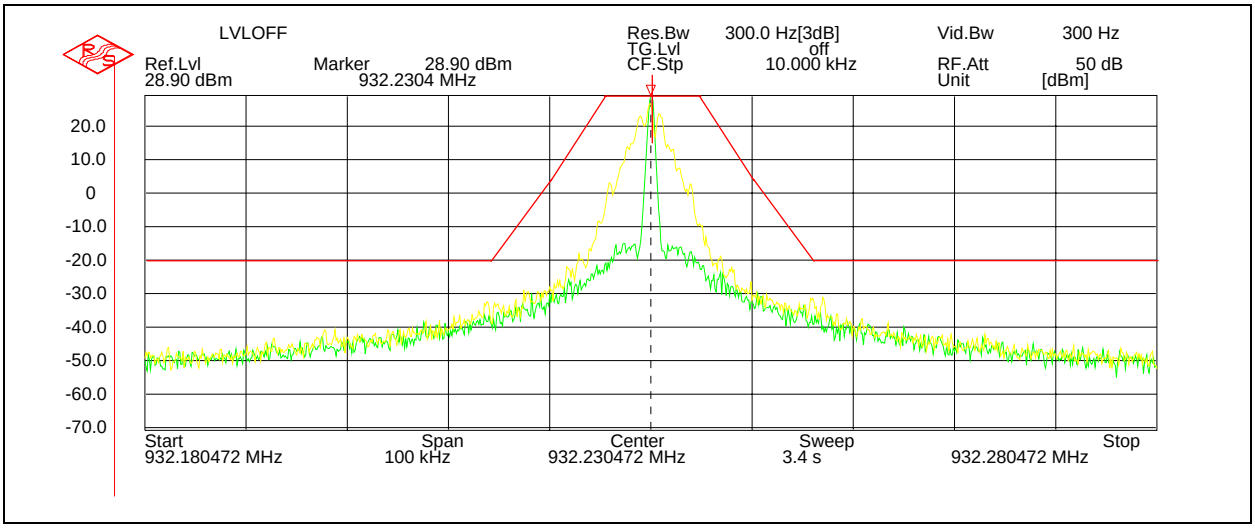


Figure 7.2.4-2: Half-Baud Rate Mode – 932.23125 MHz

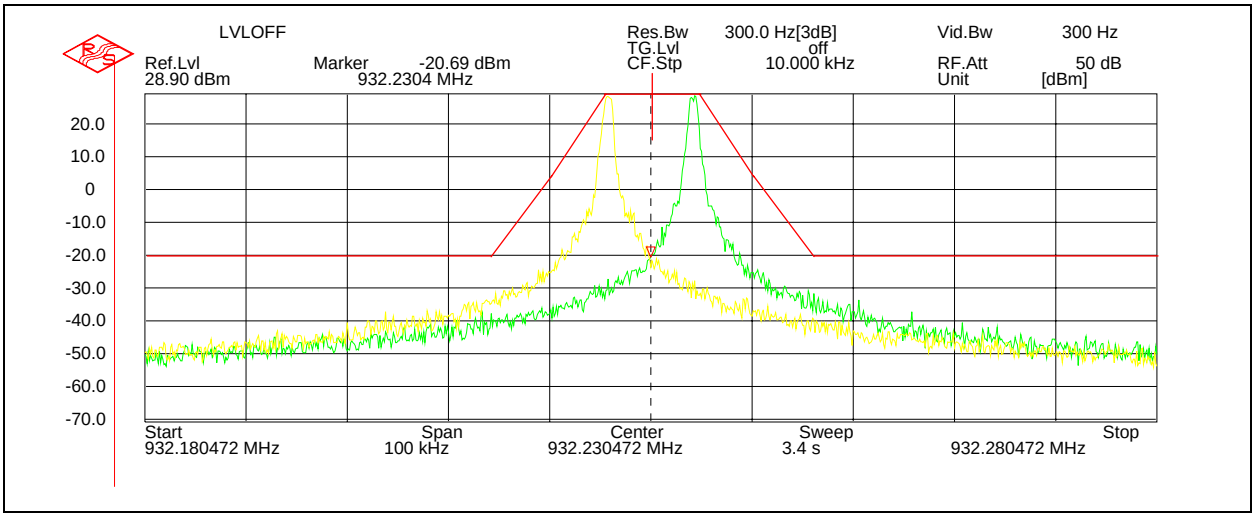


Figure 7.2.4-3: Boost Mode – 932.23125 MHz
Offset Channel of +/- 7 (+/- 4200 Hz)

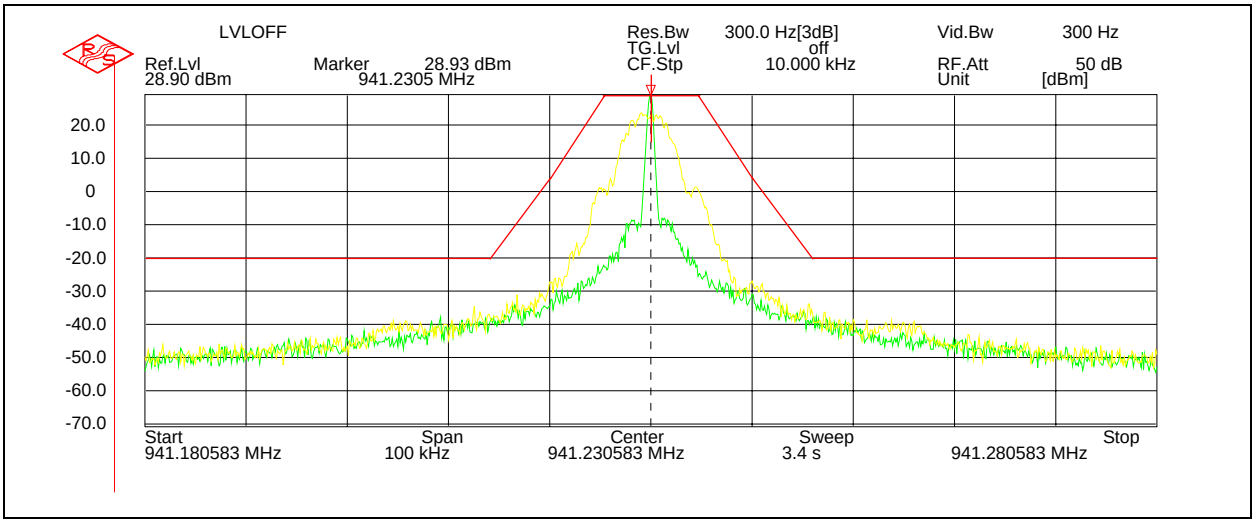


Figure 7.2.4-4: Mpass Mode – 941.23125 MHz

7.3 Spurious Emissions at Antenna Terminals - FCC Section 2.1051, 101.111 a (6)

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 20 dB passive attenuator. The spectrum analyzer resolution bandwidth was set to 30 kHz below 1000 MHz and 1 MHz above 1000 MHz. 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 and therefore not specified in this report (2.1051). Data was collected at the low, middle, and high end of the operating range of the device in the mode that produced the worst case emissions. Plots are supplied in Figure 7.3.2-1 through 7.3.2.6.

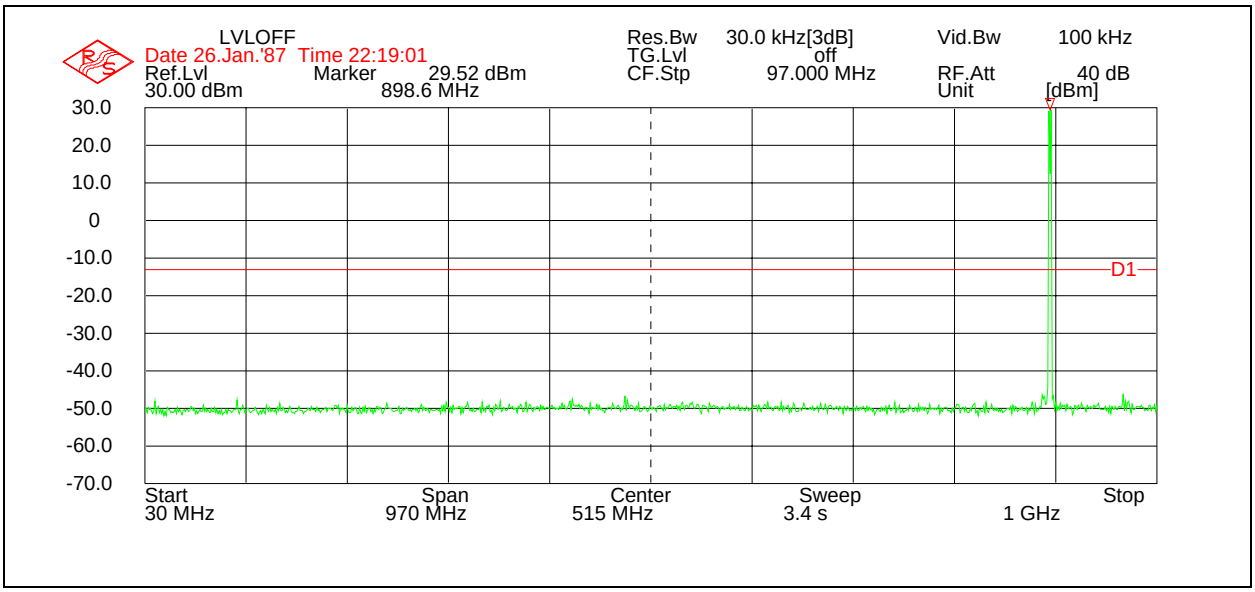


Figure 7.3.2-1: Normal Mode – 896.0500 MHz

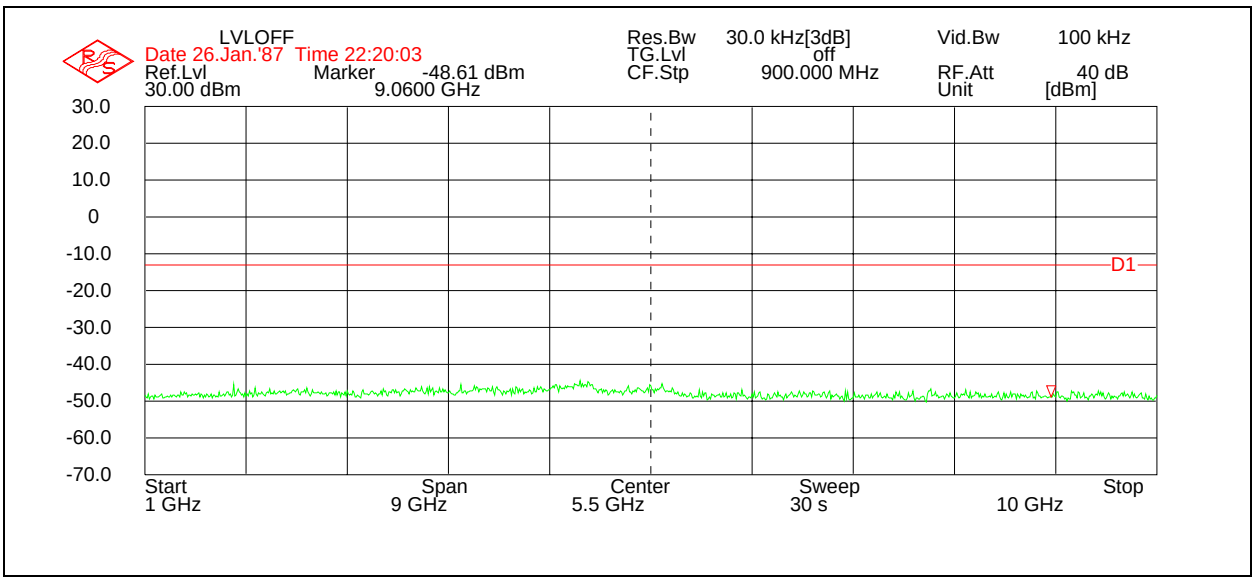


Figure 7.3.2-2: Normal Mode – 896.0500 MHz

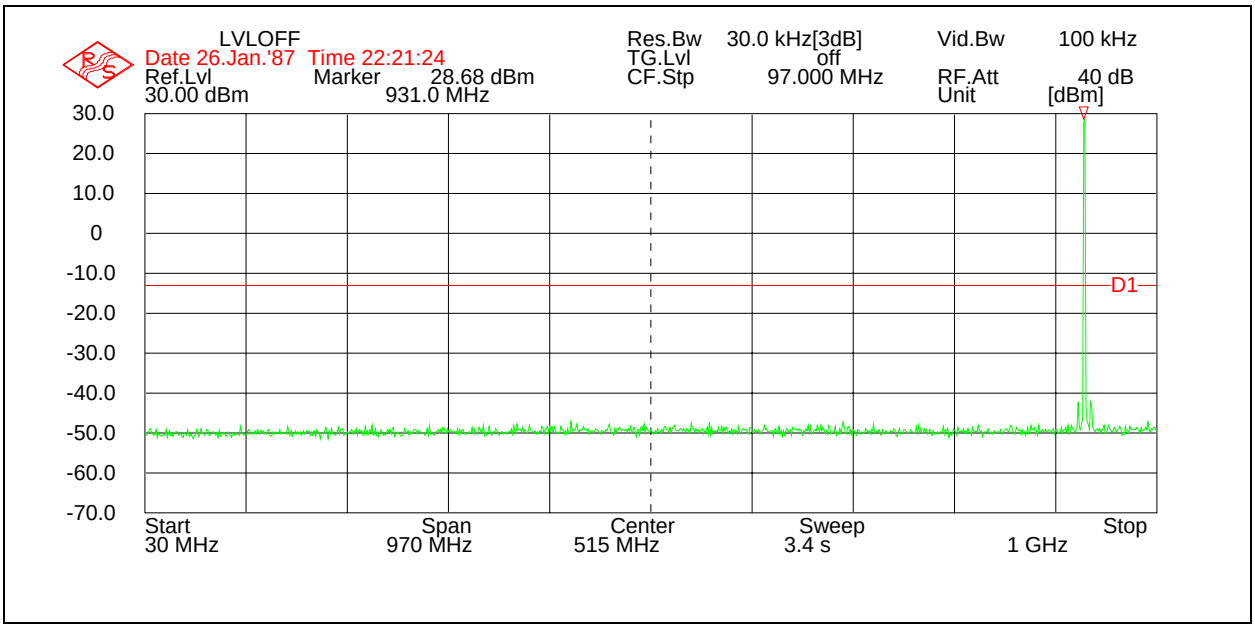


Figure 7.3.2-3: Normal Mode – 930.1125 MHz

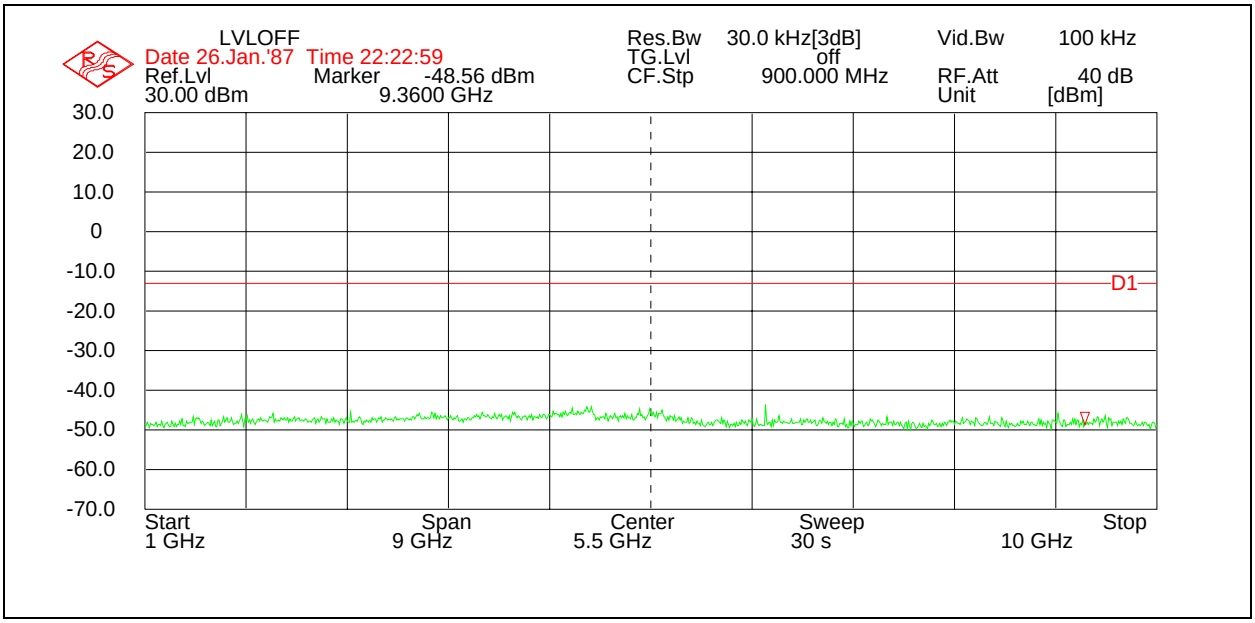


Figure 7.3.2-4: Normal Mode – 930.1125 MHz

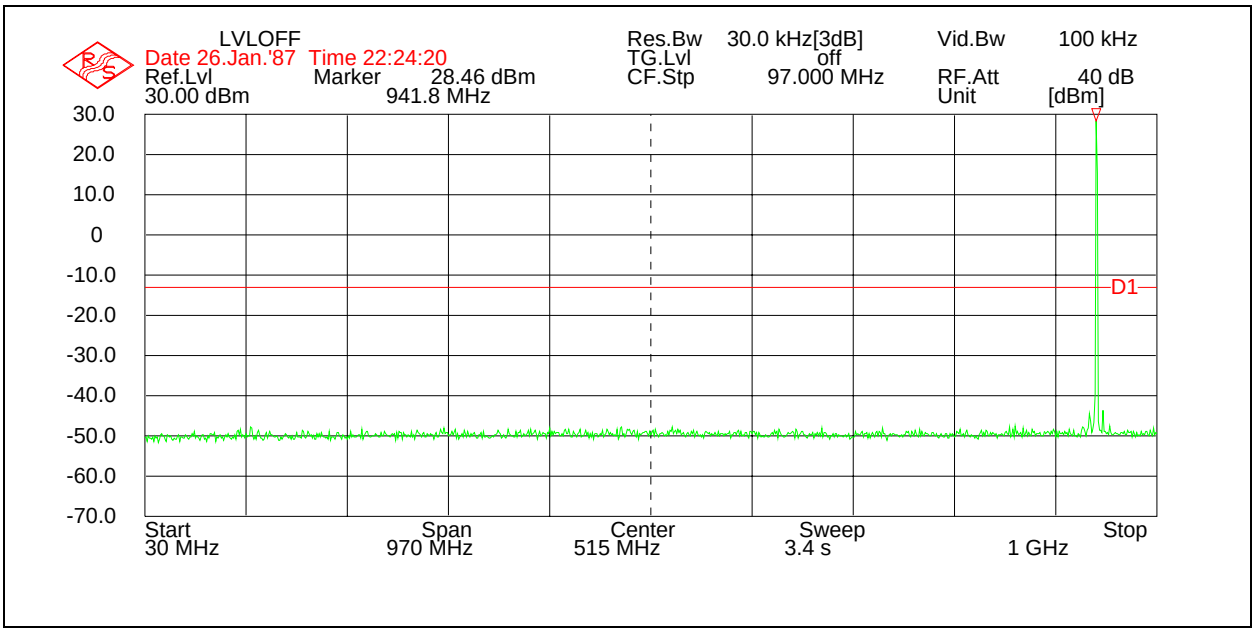


Figure 7.3.2-5: Normal Mode – 941.23125 MHz

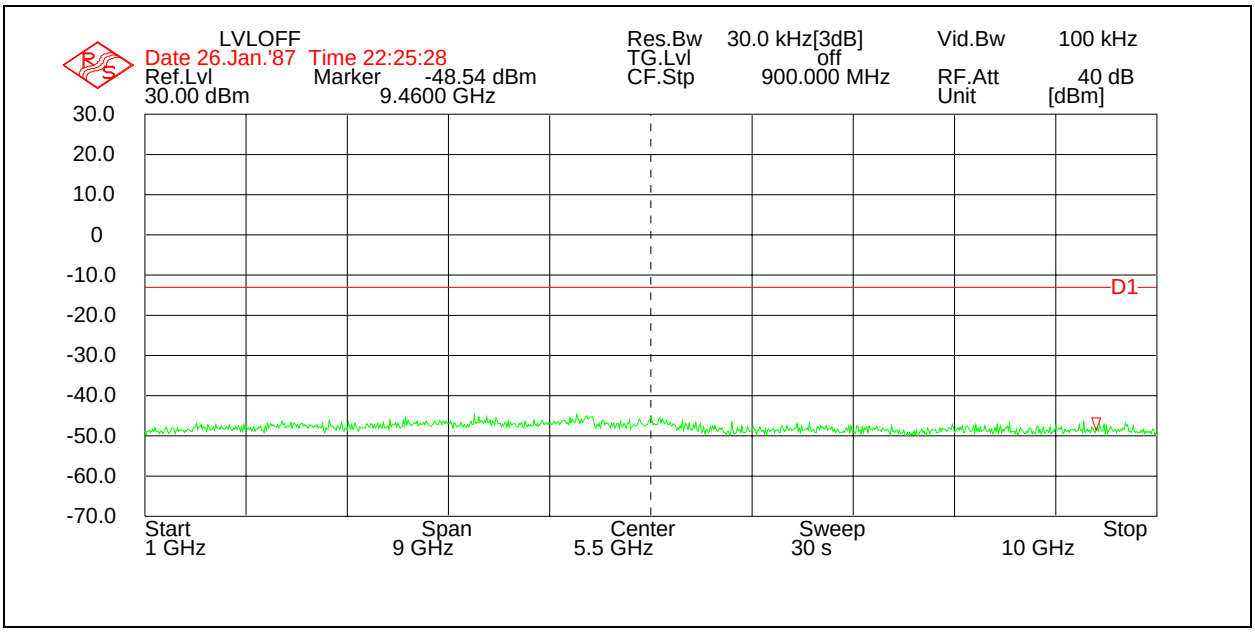


Figure 7.3.2-6: Normal Mode – 941.23125 MHz

7.4 Field Strength of Spurious Emissions - FCC Section 2.1053, 24.133, 90.210, and 101.111

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 power 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.

Data was collected at the low and high end of the operating range of the device. Results of the test are shown below in Table 7.4.2-1 and 7.4.2-2. The magnitude of all spurious emissions not reported were attenuated below the noise floor of the measurement system and therefore not specified in this report.

7.4.2 Measurement Results

Table 7.4.2-1: Field Strength of Spurious Emissions – Low Channel

Frequency (GHz)	Uncorrected Radiated Level (dBuV)	Generator Level (dBm)	Cable Attenuation (dB)	Antenna Gain (dBd)	Corrected Reading (dBm)	Substitution Field Strength (dBc)	Limit (dBc)	Margin (dB)
Horizontal								
1802.2	76.08	-33.00	0.72	5.25	-28.47	-58.34	-42.87	15.47
2703.3	63.28	-45.00	0.88	6.55	-39.33	-69.20	-42.87	26.33
3604.5	59.63	-44.00	1.04	7.25	-37.79	-67.66	-42.87	24.79
4505.6	60.62	-42.00	1.19	7.95	-35.24	-65.11	-42.87	22.24
Vertical								
1802.2	75.45	-33.00	1.48	8.55	-25.93	-55.80	-42.87	12.93
2703.3	63.54	-43.00	1.53	8.45	-36.08	-65.95	-42.87	23.08
3604.5	57.17	-47.00	1.56	8.85	-39.71	-69.58	-42.87	26.71
4505.6	60.06	-42.00	1.68	9.15	-34.53	-64.40	-42.87	21.53

Table 7.4.2-2: Field Strength of Spurious Emissions – High Channel

Frequency (GHz)	Uncorrected Radiated Level (dBuV)	Generator Level (dBm)	Cable Attenuation (dB)	Antenna Gain (dBd)	Corrected Reading (dBm)	Substitution Field Strength (dBc)	Limit (dBc)	Margin (dB)
Horizontal								
1864.5	66.08	-41.00	0.72	5.25	-36.47	-65.63	-42.16	23.47
2796.7	60.54	-47.00	0.88	6.55	-41.33	-70.49	-42.16	28.33
3728.9	52.6	-52.00	1.04	7.25	-45.79	-74.95	-42.16	32.79
4661.2	61.38	-39.00	1.19	7.95	-32.24	-61.40	-42.16	19.24
Vertical								
1864.5	66.39	-40.00	1.48	8.55	-32.93	-62.09	-42.16	19.93
2796.7	59.86	-46.00	1.53	8.45	-39.08	-68.24	-42.16	26.08
3728.9	53.41	-50.00	1.56	8.85	-42.71	-71.87	-42.16	29.71
4661.2	59.35	-41.00	1.68	9.15	-33.53	-62.69	-42.16	20.53

7.5 Frequency Stability - FCC Section 2.1055, 24.135, 90.213, 101.107

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 and a power supply is attached to the primary supply voltage.

Frequency measurements were made at the extremes of the of temperature range -30º 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.

Data was collected at the low and high end of the operating range of the device. Results of the test are shown below in Table 7.5.2-1 through 7.5.2-2 for all modes of operation.

7.5.2 Measurement Results

Table 7.5.2-1: Frequency Stability

Frequency Stability

Frequency (MHz): 901.1125
Deviation Limit (PPM): 1.0 ppm

Temperature C	Frequency MHz	Frequency Error (PPM)	Voltage (%)	Voltage (VDC)
-30 C	**901.111730**	**-0.854**	100%	30
-20 C	**901.112210**	**-0.322**	100%	30
-10 C	**901.112110**	**-0.433**	100%	30
0 C	**901.112280**	**-0.244**	100%	30
10 C	**901.112360**	**-0.155**	100%	30
20 C	**901.112190**	**-0.344**	100%, 85%, 115%	30, 25.5, 34.5
30 C	**901.112010**	**-0.544**	100%	30
40 C	**901.111660**	**-0.932**	100%	30
50 C	**901.111650**	**-0.943**	100%	30

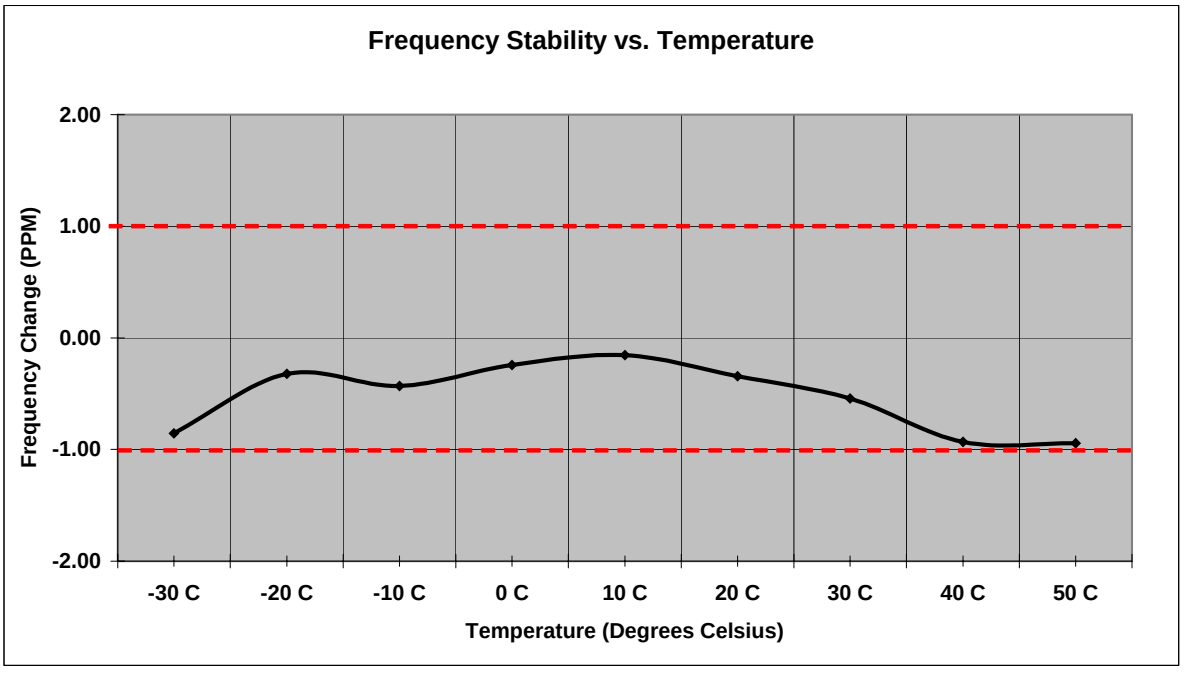
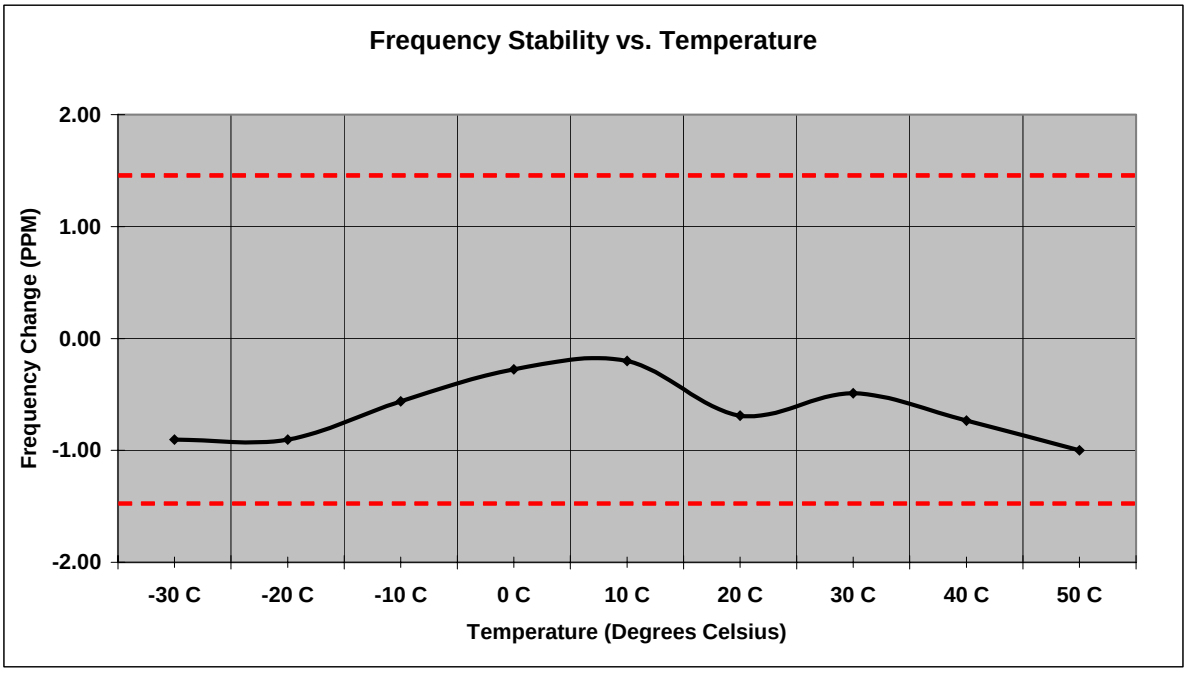


Table 7.5.2-2: Frequency Stability

Frequency Stability

Frequency (MHz): 941.23125
Deviation Limit (PPM): 1.5 ppm

Temperature	Frequency	Frequency Error	Voltage	Voltage
C	MHz	(PPM)	(%)	(VDC)
-30 C	**941.230400**	**-0.903**	100%	30
-20 C	**941.230400**	**-0.903**	100%	30
-10 C	**941.230720**	**-0.563**	100%	30
0 C	**941.230990**	**-0.276**	100%	30
10 C	**941.231060**	**-0.202**	100%	30
20 C	**941.230600**	**-0.691**	100%, 85%, 115%	30, 25.5, 34.5
30 C	**941.230790**	**-0.489**	100%	30
40 C	**941.230560**	**-0.733**	100%	30
50 C	**941.230310**	**-0.999**	100%	30



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.

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)	Uncorrected Reading (dBµV)	Antenna Polarity (H/V)	Antenna Height (cm)	Turntable Position (°)	Total Correction Factor (dB)	Corrected Reading (dBµV)	Limit (dBµV)	Margin (dB)	Results
77.42	20.18	v	100	0	8.17	28.35	40	11.7	**Pass**
80.65	19.75	v	100	0	8.51	28.26	40	11.7	**Pass**
82.81	19.93	v	100	0	8.86	28.79	40	11.2	**Pass**
125.92	22.13	v	100	0	13.22	35.35	43.5	8.2	**Pass**
278.96	28.25	h	100	240	-8.59	19.66	46	26.3	**Pass**
291.9	28.23	h	100	247	-8.35	19.88	46	26.1	**Pass**
304.83	27.34	v	100	270	-8.27	19.07	46	26.9	**Pass**
922.4	22.51	h	100	0	6.00	28.51	46	17.5	**Pass**
69.78	18.25	v	100	0	7.38	25.63	40	14.4	**Pass**
34.31	14.97	h	100	0	17.83	32.80	40	7.2	**Pass**

7.7 Power Line Conducted Emissions - FCC Section 15.107

7.7.1 Measurement Procedure

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 = Corrected Reading – Applicable Limit

Results of the test are shown below in and Tables 7.7.2-1 through 7.7.2-4 and Figure 7.7.2-1 through 7.7.2-2

7.7.2 Measurement Results

Table 7.7.2-1: Line 1 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.456	37.6	9.5	56.7	19.1	L1	GND
0.606	39.3	9.5	56	16.6	L1	GND
0.756	38	9.5	56	17.9	L1	GND
1.056	35.7	9.6	56	20.2	L1	GND
1.362	36.1	9.5	56	19.8	L1	GND
1.662	35.1	9.5	56	20.8	L1	GND
3.486	19.8	9.5	56	36.1	L1	GND
4.182	18.8	9.6	56	37.1	L1	GND
4.716	15.1	9.7	56	40.9	L1	GND
18.57	31.6	10	60	28.3	L1	GND

Table 7.7.2-2: Line 1 Conducted EMI Results (Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.456	26.1	9.5	46.7	20.6	L1	GND
0.606	27.8	9.5	46	18.1	L1	GND
0.756	26.6	9.5	46	19.3	L1	GND
1.056	24.7	9.6	46	21.2	L1	GND
1.362	25.6	9.5	46	20.3	L1	GND
1.662	24.6	9.5	46	21.3	L1	GND
3.552	8.1	9.5	46	37.8	L1	GND
4.176	8.3	9.6	46	37.6	L1	GND
4.746	7.1	9.7	46	38.8	L1	GND
18.57	14.6	10	50	35.3	L1	GND

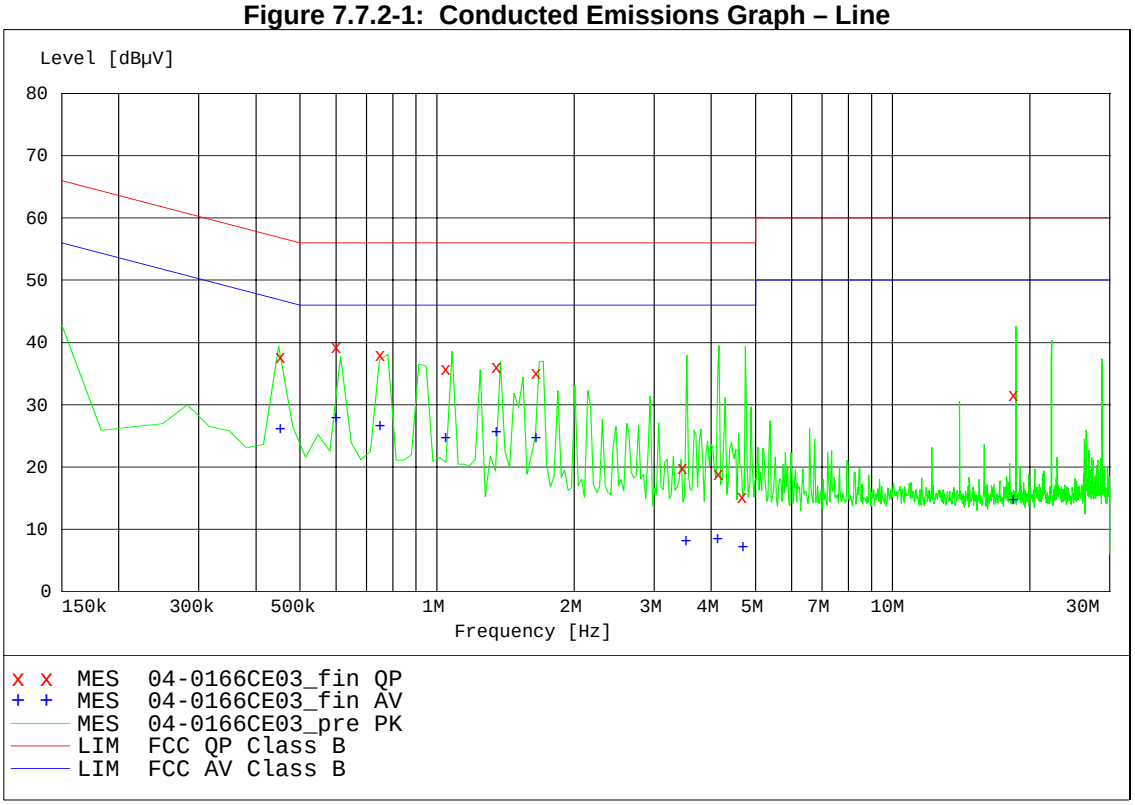
Table 7.7.2-3: Line 2 Conducted EMI Results (Quasi-Peak)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.606	41.9	9.5	56	14	L2	GND
0.756	52.8	9.5	56	3.1	L2	GND
1.968	35.1	9.6	56	20.8	L2	GND
2.13	16.9	9.5	56	39	L2	GND
2.646	15.9	9.5	56	40	L2	GND
3.432	19.3	9.5	56	36.6	L2	GND
3.888	21.4	9.6	56	34.6	L2	GND
4.038	21.6	9.5	56	34.3	L2	GND
4.494	21.1	9.7	56	34.8	L2	GND
4.662	20.7	9.7	56	35.2	L2	GND

Table 7.7.2-4: Line 2 Conducted EMI Results(Average)

Frequency MHz	Level dBµV	Transducer dB	Limit dBµV	Margin dB	Line	PE
0.606	40.8	9.5	46	5.1	L2	GND
0.756	39.7	9.5	46	6.2	L2	GND
1.968	34	9.6	46	11.9	L2	GND
2.13	12.4	9.5	46	33.5	L2	GND
2.64	10.3	9.5	46	35.6	L2	GND
3.426	12.6	9.5	46	33.3	L2	GND
3.888	13	9.6	46	32.9	L2	GND
4.032	12.9	9.5	46	33	L2	GND
4.482	11.8	9.7	46	34.1	L2	GND
4.656	11.4	9.7	46	34.5	L2	GND

Figure 7.7.2-1: Conducted Emissions Graph – Line



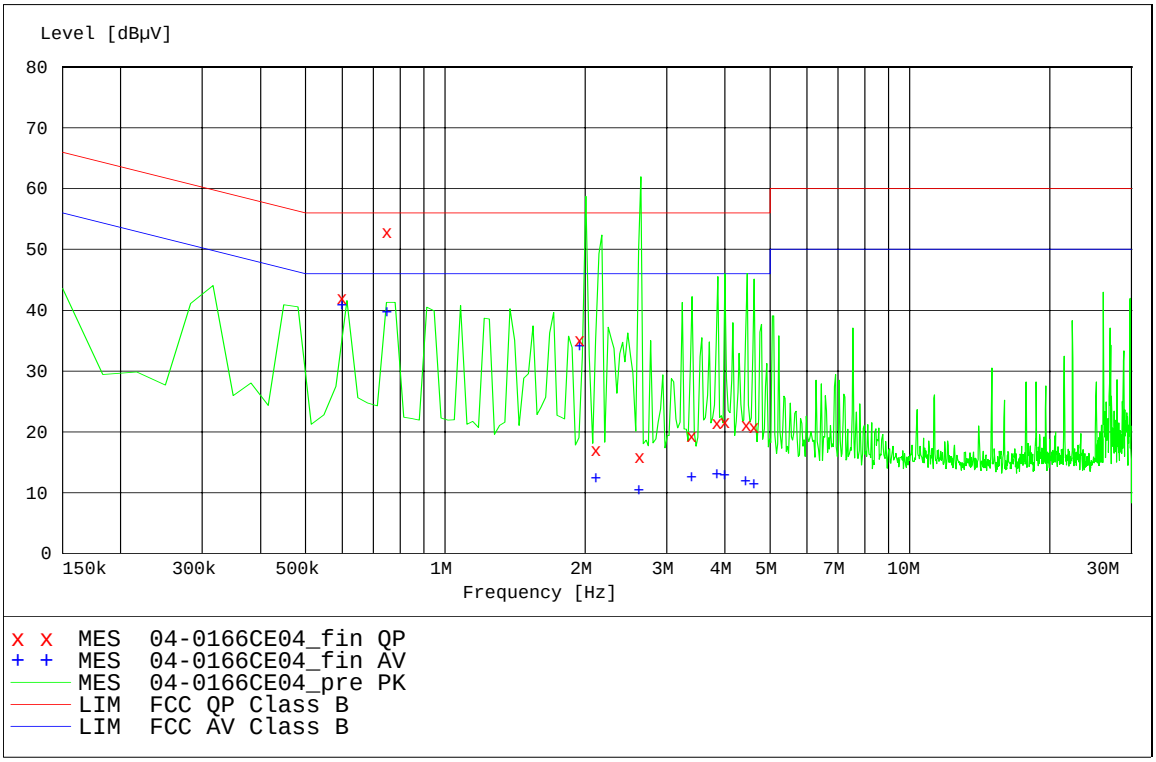


Figure 7.7.2-2: Conducted Emissions Graph – Line 2

End Report