Excellence in Compliance Testing

# Certification Test Report

## FCC ID: SDBIDTB004
## IC: 2220A-IDTB004

## FCC Rule Part: CFR 47 Part 24 Subpart D, Part 101 Subpart C
## IC Radio Standards Specification: RSS 119, RSS 134

## ACS Report Number: 12-2108.W06.1A

Applicant: Sensus Metering Systems, Inc.
Model: IDTB004

Test Begin Date: September 15, 2012
Test End Date: October 11, 2012

Report Issue Date: October 16, 2012

For The Scope of Accreditation Under Certificate Number AT-1533

For The Scope of Accreditation Under Lab Code 200612-0

This report must not be used by the client to claim product certification, approval, or endorsement by ACLASS, NVLAP, ANSI, or any agency of the Federal Government.

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**This report contains 49 pages**

# Table of Content

# 1.0 GENERAL

## 1.1 Purpose

The purpose of this report is to demonstrate compliance with Part 2 Subpart J, Part 24 Subpart D and Part 101 Subpart C of the FCC's Code of Federal Regulations, and Industry Canada Radio Standards Specifications RSS-119 and RSS-134 for a modular approval.

## 1.2 Product Description

The Sensus Integrated Display Transceiver Board, Model IDTB004, is a wireless module with meter display circuitry. The device mounts into the Sensus iCon electric meter. The device acts as the "Integrated Communications Device" and provides the RF functionality for the meter.

The IDTB monitors meter reading and diagnostic information which is transmitted via the Sensus fixed wireless telemetry network to the utility provider.

Manufacturer Information:
Sensus Metering Systems, Inc.
639 Davis Drive
Morrisville, NC 27560

Test Sample Serial Numbers: 211411049062820, 211511049062852

Test Sample Condition: The unit was in good operating conditions with no physical damages.

## 1.3 Test Methodology

### 1.3.1 Configurations and Justification

The IDTB004 was tested for RF conducted and radiated emissions while powered with a 26VDC power source.

The RF conducted measurements were performed using a sample with a temporary sma connector at the antenna port. The radiated emissions evaluations were performed up to the 10$^{th}$ harmonic with the unit set in the orientation of typical installation.

The evaluation for unintentional emission is documented separately in a verification report.

### 1.3.2 In-Band Testing Methodology

The EUT is designed to operate in multiple bands under the requirements of CFR 47 Parts 24 and 101. The following is a list of the frequency bands of operation sorted based on the FCC rule parts in which the band is associated.

| CFR Title 47 Rule Part | Frequency Band of Operation (MHz) |
|---|---|
| 24D | 901.0 - 902.0 |
| 24D | 930.0 - 931.0 |
| 24D | 940.0 - 941.0 |
| 101 | 928.85 - 929.0 |
| 101 | 932.0 - 932.5 |
| 101 | 941.0 - 941.5 |
| 101 | 952.0 – 953.0 |
| 101 | 959.85 - 960.0 |

Based on the requirements set forth in accordance 47 CFR 2.1046-2.1057 as stated above, the methodology in selecting the places to test in the available bands of operation is outlined in the following table.

| CFR Title 47 Rule Part | Frequency Band of Operation (MHz) | Location in the Range of Operation | Approx. Test Freq. |
|---|---|---|---|
| 24D | 901.0 - 902.0 | Middle | 901.5000 |
| 101 | 928.85 - 929.0 | Middle | 928.9250 |
| 24D | 930.0 - 931.0 | Middle | 930.5000 |
| 101 | 932.0 - 932.5 | Middle | 932.2500 |
| 24D | 940.0 - 941.0 | 1 near top and 1 near bottom | 940.0125 |
| 101 | 941.0 - 941.5 | | 941.4875 |
| 101 | 952.0 – 953.0 | Middle | 952.5000 |
| 101 | 959.85 – 960.0 | Middle | 959.9250 |

### 1.4 Emission Designators

The IDTB004 transmitter produces six distinct modulation formats. The emissions designators for the modulation types used by the IDTB004 transmitter are as follows:

EMISSIONS DESIGNATORS:

Normal Mode: 9K60F2D (7-FSK)
Double Density Mode: 9K60F2D (13-FSK)
C&I Mode (Half-Baud): 4K80F2D (7-FSK)
Priority Mode: 4K80F2D (13-FSK)
MPass Mode (5 kbps): 5K90F1D (2-GFSK)
MPass Mode (10 kbps): 11K8F1D (2-GFSK)

## 2.0 TEST FACILITIES

### 2.1 Location

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

**Site 1**
Advanced Compliance Solutions, Inc.
3998 FAU Blvd, Suite 310
Boca Raton, Florida 33431
Phone: (561) 961-5585
Fax: (561) 961-5587
www.acstestlab.com

**Site 2**
Advanced Compliance Solutions, Inc.
5015 B.U. Bowman Drive
Buford GA 30518
Phone: (770) 831-8048
Fax: (770) 831-8598
www.acstestlab.com

### 2.2 Laboratory Accreditations/Recognitions/Certifications

**Site 1**
ACS, Boca Raton, Florida, is accredited to ISO/IEC 17025 by ANSI-ASQ National Accreditation Board under their ACLASS program and has been issued certificate number AT-1533 in recognition of this accreditation.

**Site 2**
ACS, Buford, GA is accredited to ISO/IEC 17025 by the National Institute of Standards and Technology under their National Voluntary Laboratory Accreditation Program (NVLAP).

Unless otherwise specified, all test methods described within this report are covered under the respective test site ISO/IEC 17025 scope of accreditation.

## 2.3 Radiated & Conducted Emissions Test Site Description

### 2.3.1 Semi-Anechoic Chamber Test Site

The EMC radiated test facility consists of an RF-shielded enclosure. The interior dimensions of the indoor semi-anechoic chamber are approximately 48 feet (14.6 m) long by 36 feet (10.8 m) wide by 24 feet (7.3 m) high and consist of rigid, 1/8 inch (0.32 cm) steel-clad, wood core modular panels with steel framing. In the shielded enclosure, the faces of the panels are galvanized and the chamber is self-supporting. 8-foot RF absorbing cones are installed on 4 walls and the ceiling. The steel-clad ground plane is covered with vinyl floor.

The turntable is driven by pneumatic motor, which is capable of supporting a 2000 lb. load. The turntable is flushed with the chamber floor which it is connected to, around its circumference, with metallic loaded springs. An EMCO Model 1051 Multi-device Controller controls the turntable position.

A pneumatic motor is used to control antenna polarizations and height relative to the ground. The height information is displayed on the control unit EMCO Model 1050.

The control room is an RF shielded enclosure attached to the semi-anechoic chamber with two bulkhead panels for connecting RF, and control cables. The dimension of the room is 7.3 m x 4.9 m x 3 m high and the entrance doors of both control and conducted rooms are 3 feet (0.91 m) by 7 feet (2.13 m).

A diagram of the Semi-Anechoic Chamber Test Site is shown in Figure 2.3.1-1 below:

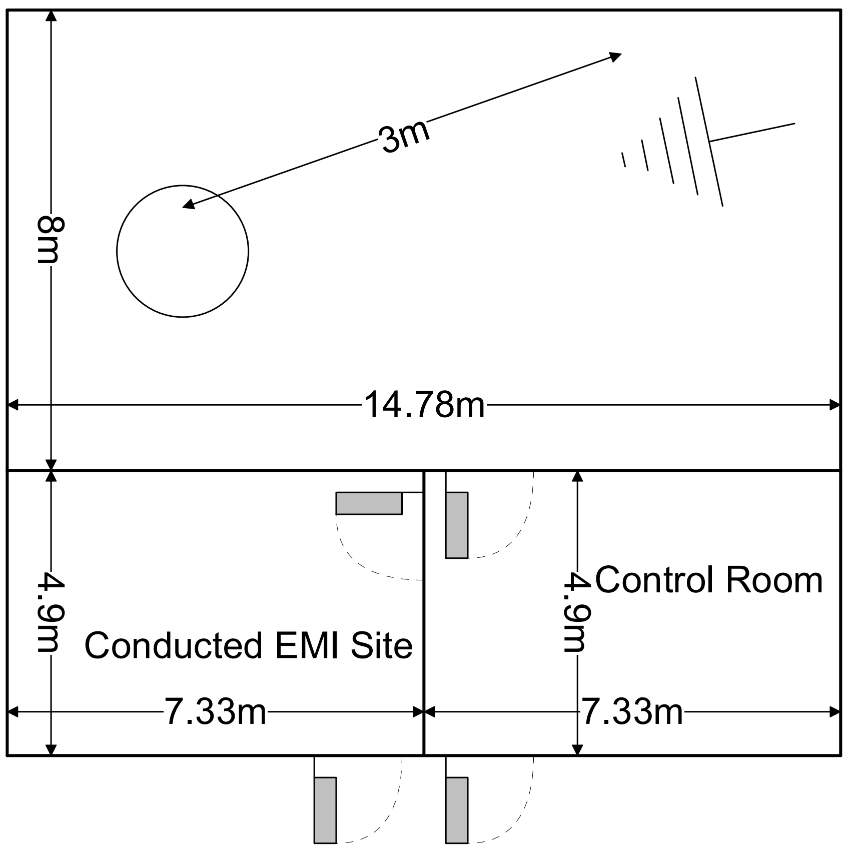


**Figure 2.3.1-1: Semi-Anechoic Chamber Test Site**

### 2.3.2 Conducted Emissions Test Site Description

The dimensions of the shielded conducted room are 7.3 x 4.9 x 3 $m^3$. As per ANSI C63.4 2003 requirements, the data were taken using two LISNs; a Solar Model 8028-50 50 Ω/50 μH and an EMCO Model 3825, which are installed as shown in Photograph 3. For 220 V, 50 Hz, a Polarad LISN (S/N 879341/048) is used in conjunction with a 1 kVA, 50 Hz/220 V EDGAR variable frequency generator, Model 1001B, to filter conducted noise from the generator.

A diagram of the room is shown below in figure 2.3.2-1:

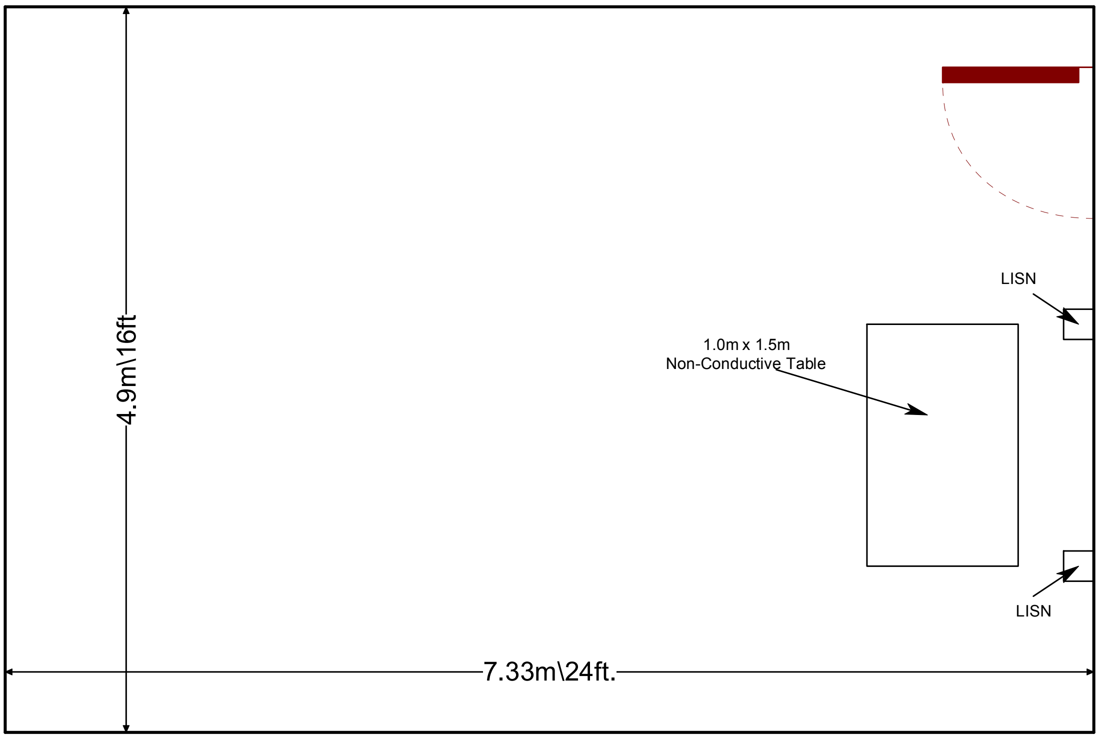


**Figure 2.3.2-1: AC Mains Conducted EMI Site**

## 3.0 APPLICABLE STANDARD REFERENCES

The following standards were used:

1 - ANSI C63.4-2003: Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the 9 kHz to 40GHz - 2003
2 - US Code of Federal Regulations (CFR): Title 47, Part 2, Subpart J: Equipment Authorization Procedures - 2012
3 - US Code of Federal Regulations (CFR): Title 47, Part 24, Subpart D: Personal Communications Services – 2012
4 - US Code of Federal Regulations (CFR): Title 47, Part 101, Subpart C: Fixed Microwave Services - 2012
5 – TIA-603-C: Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards – 2004
6 – Industry Canada Radio Standards Specification: RSS-119 - Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz, Issue 11, June 2011
7 – Industry Canada Radio Standards Specification: RSS-134 - 900 MHz Narrow Band Personal Communication Service, Issue 1, March 2000

## 4.0 LIST OF TEST EQUIPMENT

The calibration interval of test equipment is annually or the manufacturer's recommendations. Where the calibration interval deviates from the annual cycle based on the instrument manufacturer's recommendations, it shall be stated below.

**Table 4-1: Test Equipment**

| AssetID | Manufacturer | Model # | Equipment Type | Serial # | Last Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|---|
| 283 | Rohde & Schwarz | FSP40 | Spectrum Analyzers | 1000033 | 8/1/2012 | 8/1/2013 |
| 339 | Aeroflex/Weinschel | AS-18 | Attenuators | 7142 | 6/4/2012 | 6/4/2013 |
| 426 | Thermotron | S-8 Mini Max | Environmental Chamber | 25-2888-10 | 8/2/2012 | 8/2/2013 |
| 523 | Agilent | E7405 | Spectrum Analyzers | MY45103293 | 1/5/2011 | 1/5/2013 |
| 524 | Chase | CBL6111 | Antennas | 1138 | 1/7/2011 | 1/7/2013 |
| 562 | United Microwave Products, Inc. | AA-190-00.48.0 | Cables | 562 | 7/31/2012 | 7/31/2013 |
| 2006 | EMCO | 3115 | Antennas | 2573 | 3/2/2011 | 3/2/2013 |
| 2007 | EMCO | 3115 | Antennas | 2419 | 1/18/2012 | 1/18/2014 |
| 2011 | Hewlett-Packard | HP 8447D | Amplifiers | 2443A03952 | 1/2/2012 | 1/2/2013 |
| 2037 | ACS Boca | Chamber EMI Cable Set | Cable Set | 2037 | 1/2/2012 | 1/2/2013 |
| 2071 | Trilithic, Inc. | 4HC1400-1-KK | Filter | 9643263 | 1/19/2012 | 1/19/2013 |
| 2075 | Hewlett Packard | 8495B | Attenuators | 2626A11012 | 1/2/2012 | 1/2/2013 |
| 2078 | ACS Boca | Substitution Cable Set | Cable Set | 2078 | 1/12/2012 | 1/12/2013 |
| 2082 | Teledyne Storm Products | 90-010-048 | Cables | 2082 | 5/31/2012 | 5/31/2013 |
| 2089 | Agilent Technologies, Inc. | 83017A | Amplifiers | 3123A00214 | 12/22/2011 | 12/22/2012 |
| 2091 | Agilent Technologies, Inc. | 8573A | Spectrum Analyzers | 2407A03233 | 12/12/2011 | 12/12/2013 |
| RE563 | Hewlett Packard | 8673D | Signal Generators | 3034A01078 | 2/22/2011 | 2/22/2013 |
| RE587 | Fairview Microwave Inc. | SA3N511-15 | Attenuators | RE587 | 4/18/2012 | 4/18/2013 |

**NCR=No Calibration Required**

## 5.0 SUPPORT EQUIPMENT

**Table 5-1: Support Equipment**

| Diagram # | Manufacturer | Equipment Type | Model Number | Serial Number |
|---|---|---|---|---|
| 1 | Lambda | DC Power Supply | LPD-422A-FM | A82600 |
| | TryGon Electronics | DC Power Supply | DL40-1 | 489512 |

## 6.0 EQUIPMENT UNDER TEST SETUP AND BLOCK DIAGRAM

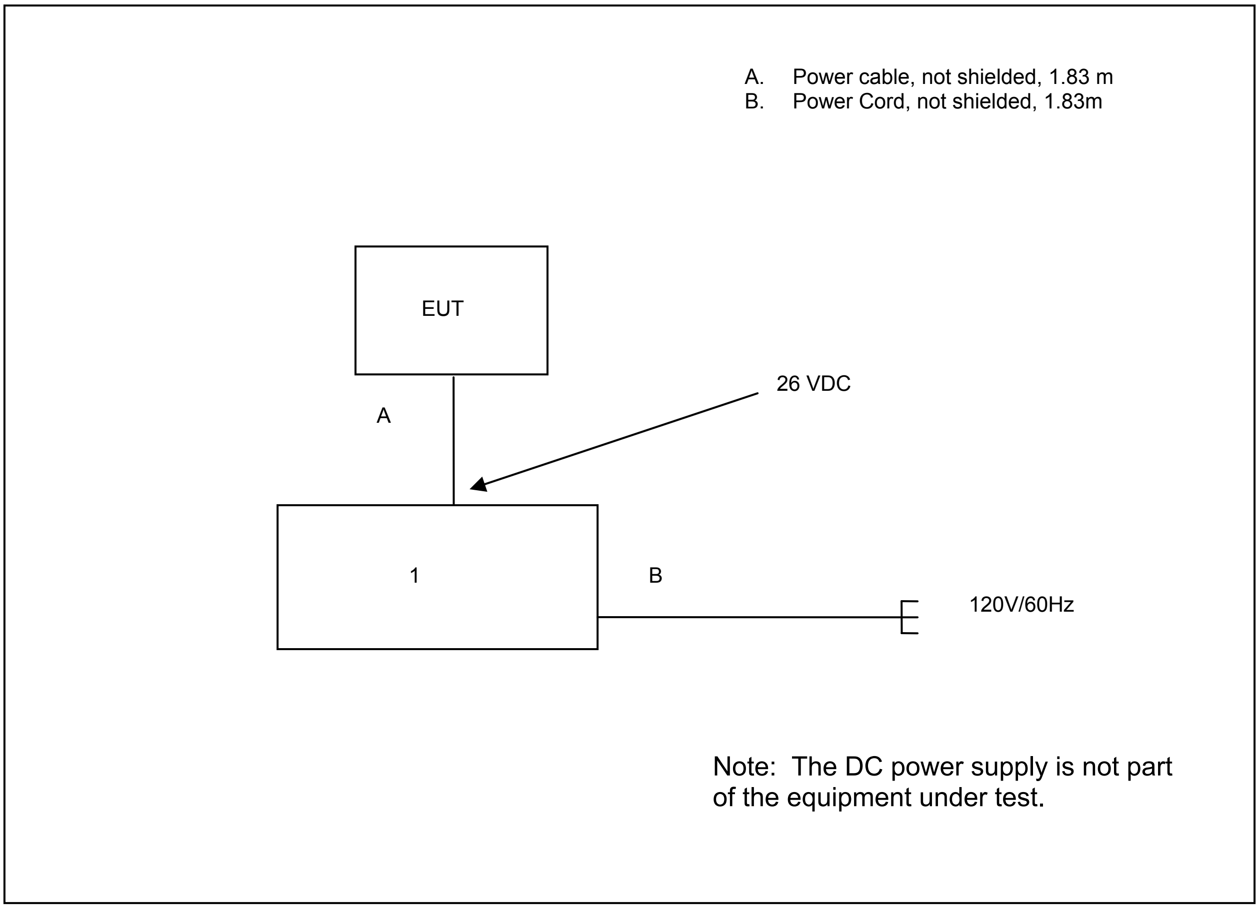


**Figure 6-1: EUT Test Setup**

## 7.0 SUMMARY OF TESTS

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

**Table 7-1: Test Results Summary**

| Test Parameter | Test Site | Test Summary |
|---|---|---|
| RF Power Output | 1 | Pass |
| Occupied Bandwidth (Emissions Limits) | 1 | Pass |
| Spurious Emissions at Antenna Terminals | 1 | Pass |
| Field Strength of Spurious Emissions | 1 | Pass |
| Frequency Stability | 2 | Pass |

## 7.1 RF Power Output

### 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 35 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.

### 7.1.2 Measurement Results

**Table 7.1.2-1: Peak Output Power**

| Frequency (MHz) | FCC Rule Part | Output Power (dBm) |
|---|---|---|
| 901.5000 | 24D | 30.91 |
| 930.5000 | 24D | 30.97 |
| 940.0125 | 24D | 30.92 |
| 928.9250 | 101 | 31.06 |
| 932.2500 | 101 | 31.00 |
| 941.4875 | 101 | 30.92 |
| 952.5000 | 101 | 30.76 |
| 959.9250 | 101 | 30.57 |

**Part 24.132 / RSS-134 5.4(a)**

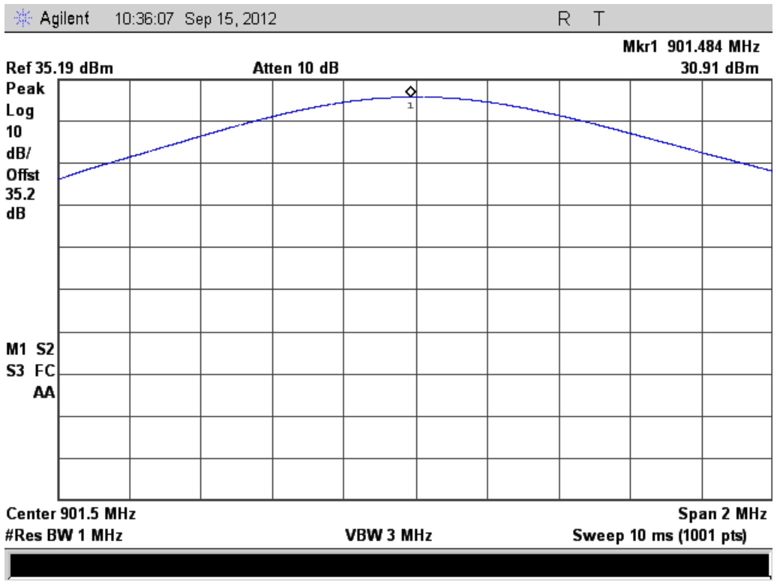


**Figure 7.1.2-1: Peak Output Power 901.5 MHz**

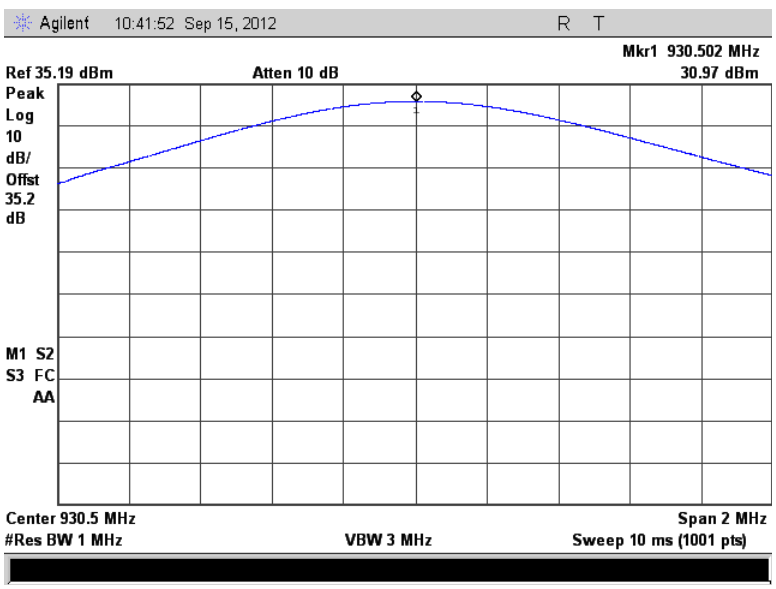


**Figure 7.1.2-2: Peak Output Power 930.5 MHz**

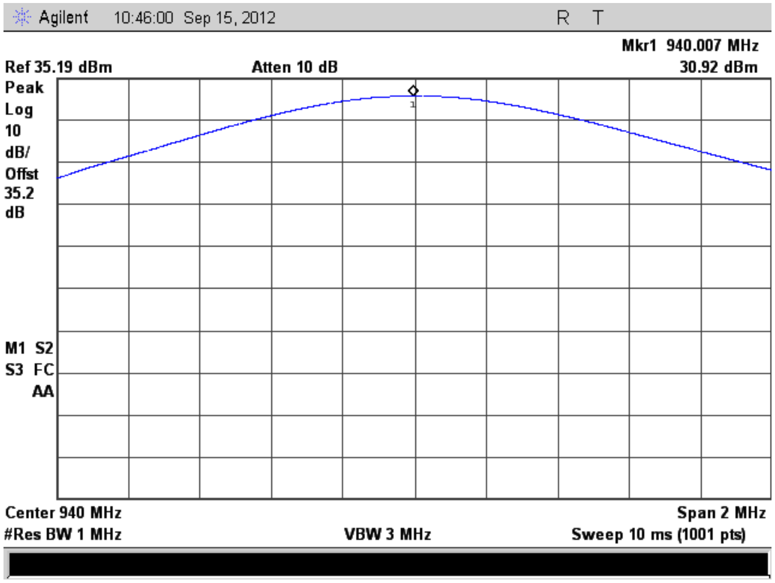


**Figure 7.1.2-3: Peak Output Power 940.0125 MHz**

## Part 101.113(a) / RSS-119 5.41

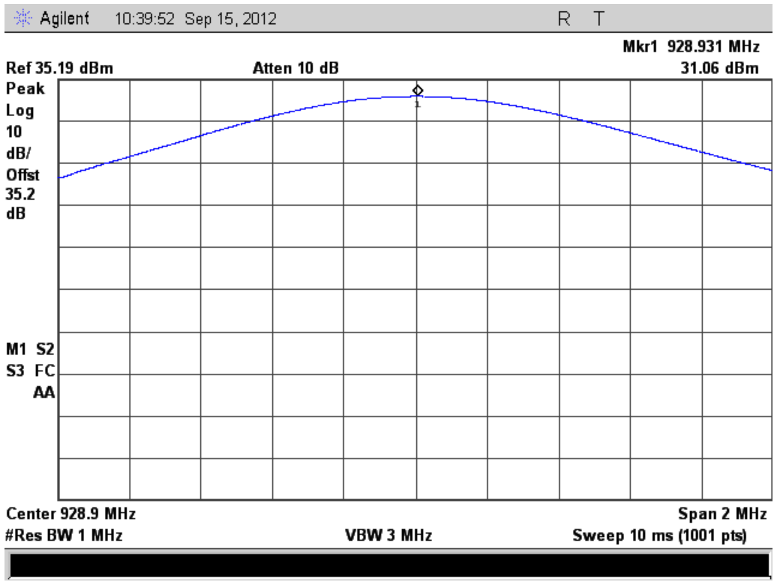


Figure 7.1.2-4: Peak Output Power 928.925 MHz

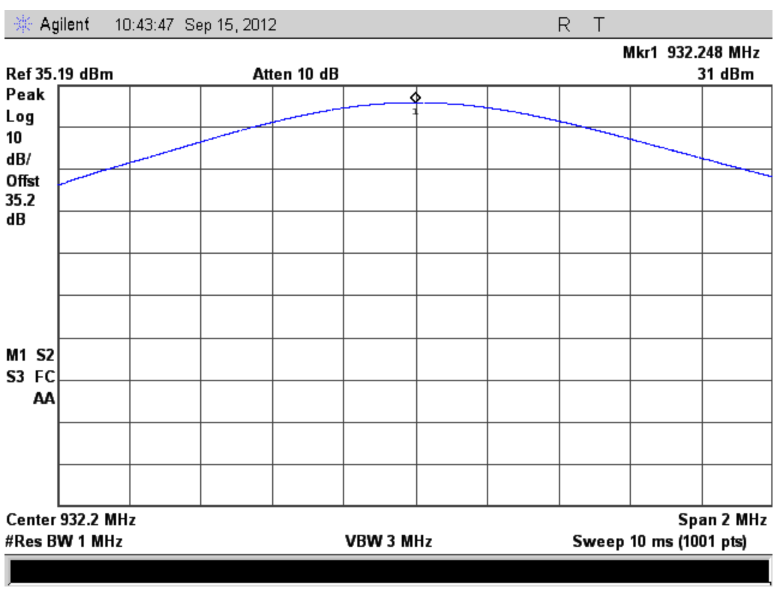


Figure 7.1.2-5: Peak Output Power 932.25 MHz

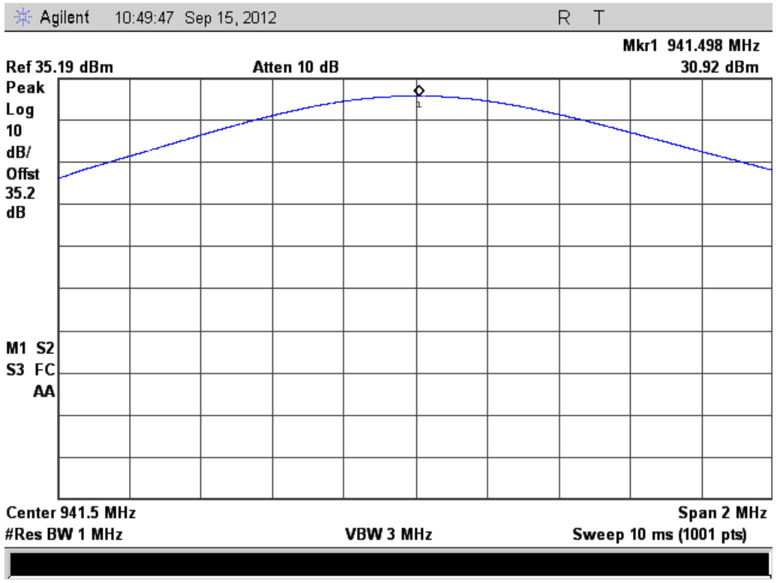


**Figure 7.1.2-6: Peak Output Power 941.4875 MHz**

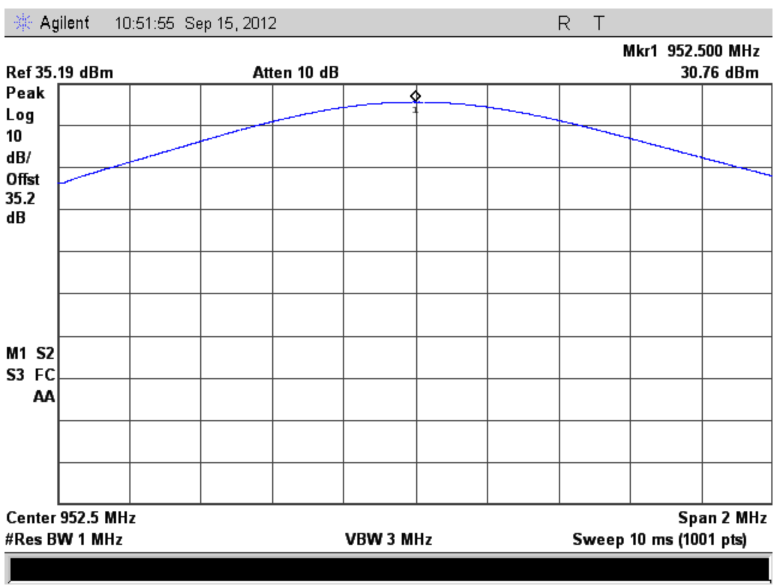


**Figure 7.1.2-7: Peak Output Power 952.5 MHz**

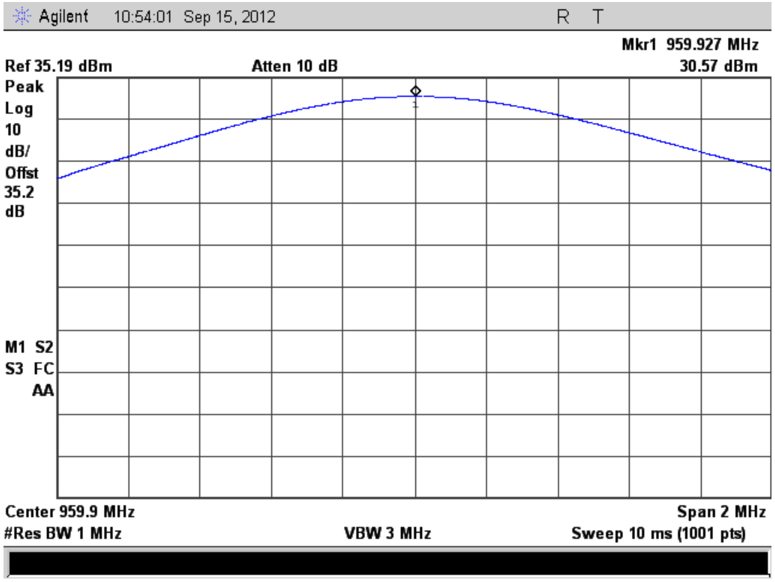


**Figure 7.1.2-8: Peak Output Power 959.925 MHz**

## 7.2 Occupied Bandwidth (Emission Limits)

### 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 35 dB passive attenuator. The spectrum analyzer resolution and video bandwidths were set to 300 Hz and 3000 Hz respectively. 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 for all modes of operation.

### 7.2.2 Measurement Results

**Part 24.133 a(1), a(2), IC RSS-134 6.3(i), (ii)**

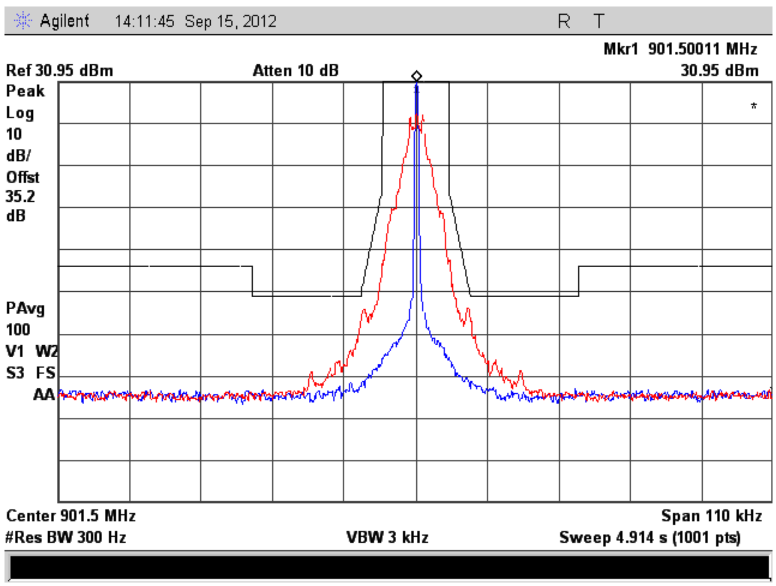


Figure 7.2.2-1: 901.5 MHz – 12.5 kHz Channel Spacing – C&I Mode

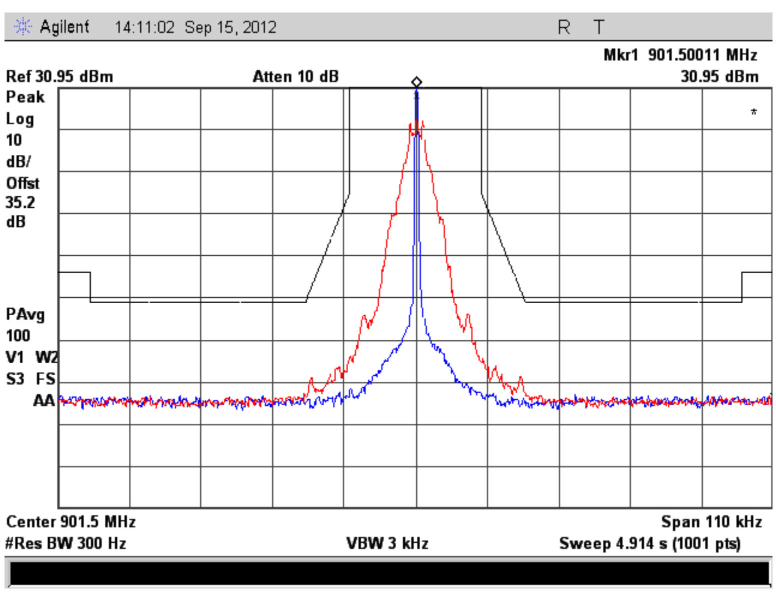


Figure 7.2.2-2: 901.5 MHz – 25 kHz Channel Spacing – C&I Mode

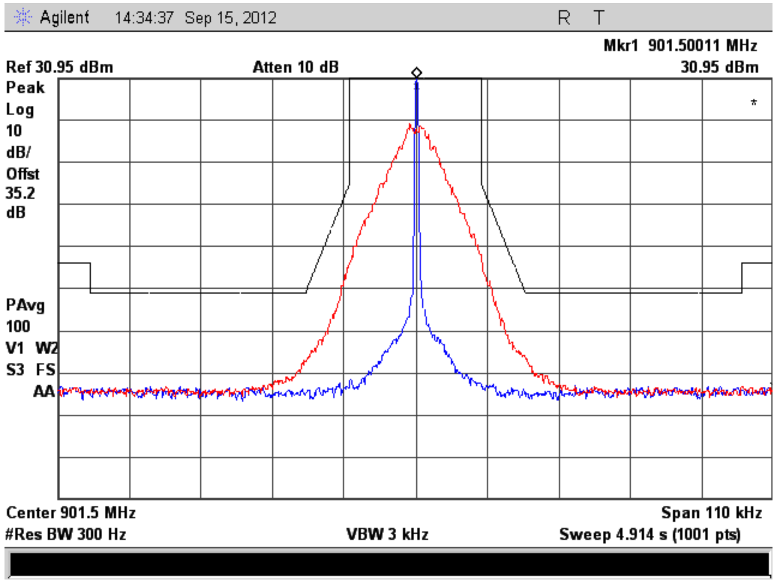


Figure 7.2.2-3: 901.5 MHz – 25 kHz Channel Spacing – Double Density Mode

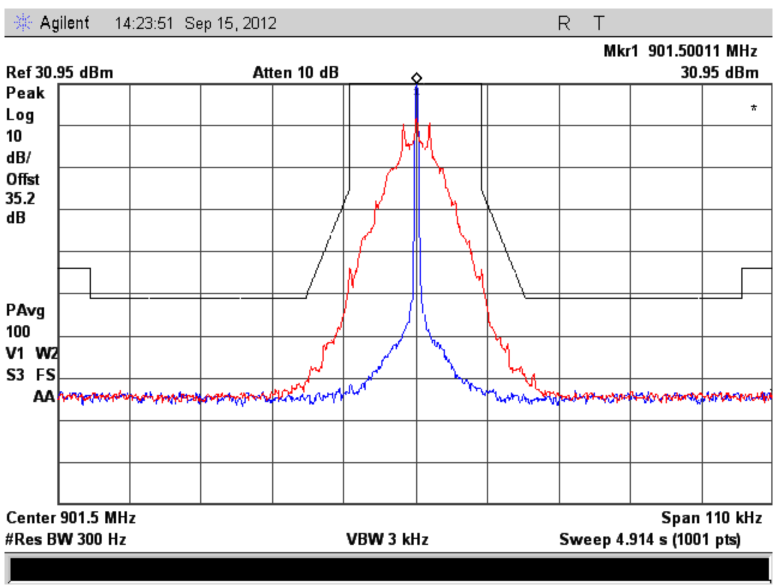


Figure 7.2.2-4: 901.5 MHz – 25 kHz Channel Spacing – Normal Mode

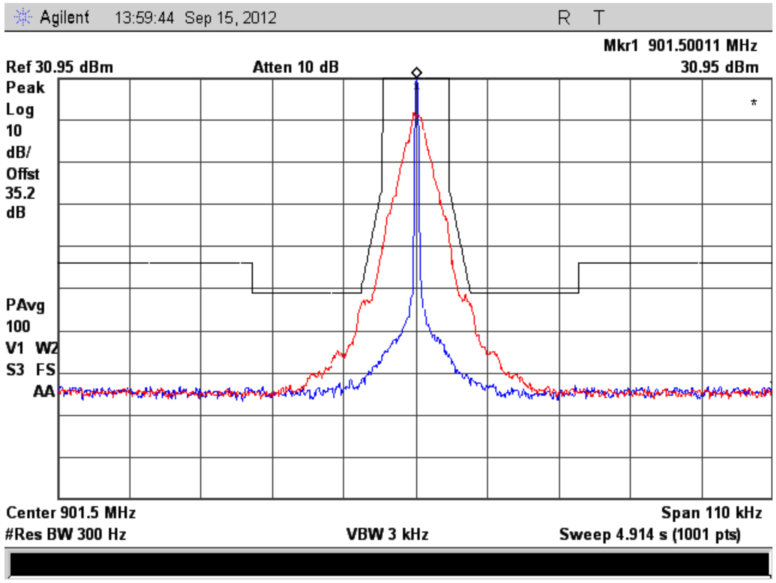


**Figure 7.2.2-5: 901.5 MHz – 12.5 kHz Channel Spacing – Priority Mode**

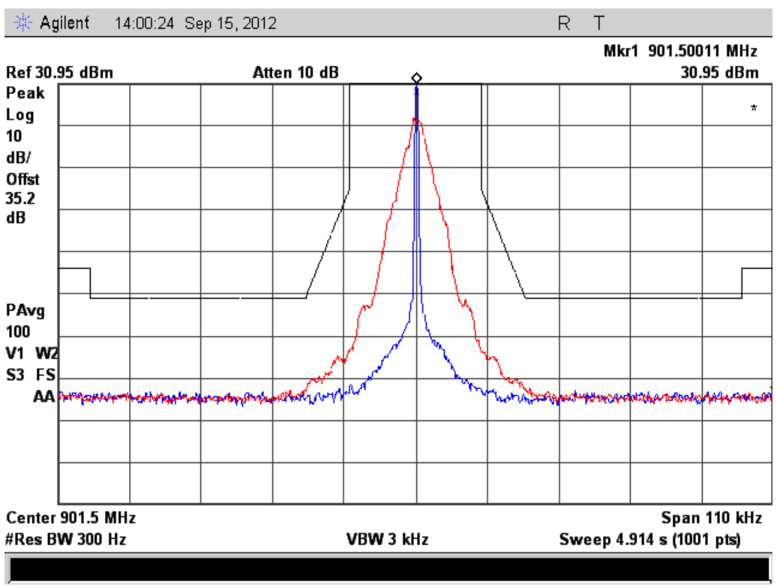


**Figure 7.2.2-6: 901.5 MHz – 25 kHz Channel Spacing – Priority Mode**

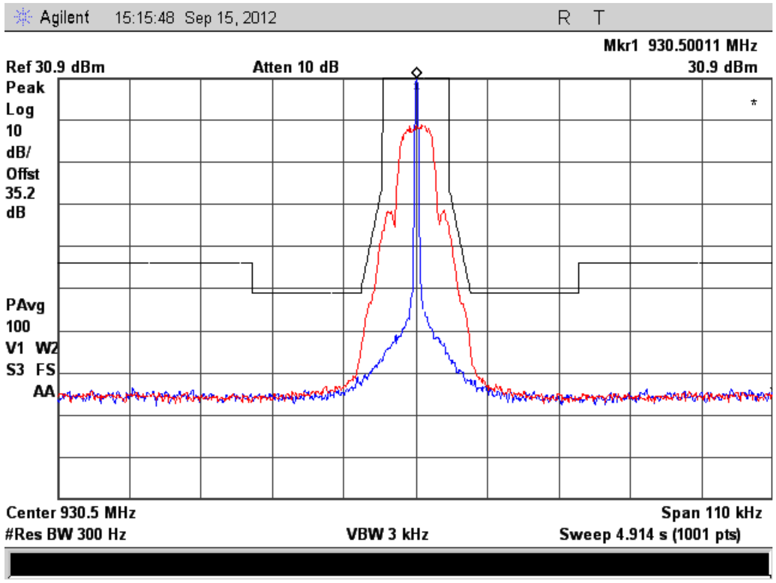


**Figure 7.2.2-7: 930.5 MHz – 12.5 kHz Channel Spacing – mPass 5k Mode**

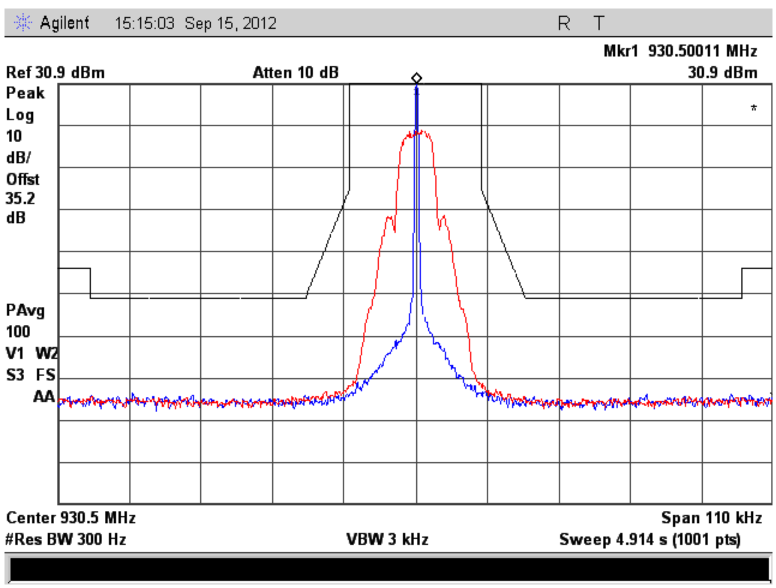


**Figure 7.2.2-8: 930.5 MHz – 25 kHz Channel Spacing – mPass 5k Mode**

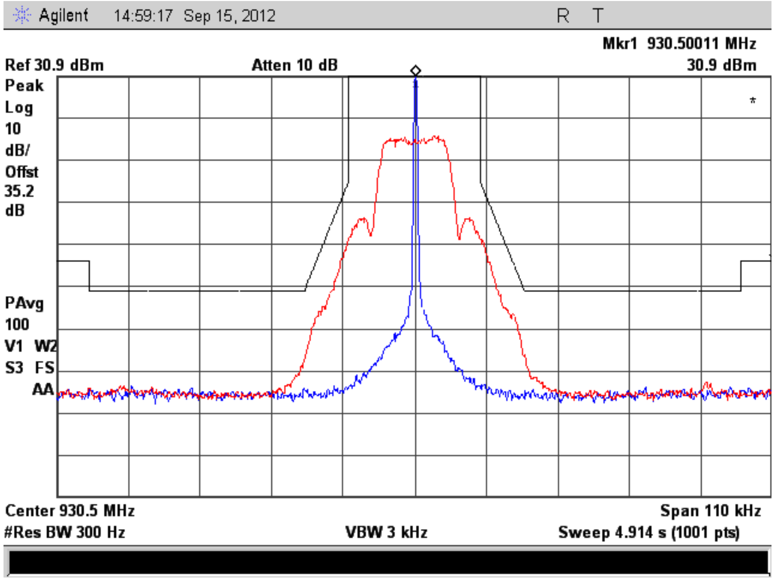


**Figure 7.2.2-9: 930.5 MHz – 25 kHz Channel Spacing – mPass 10k Mode**

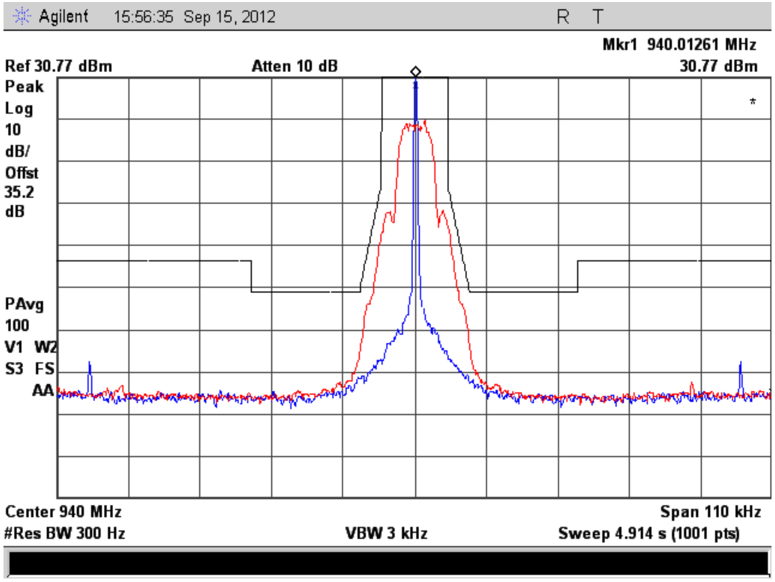


**Figure 7.2.2-10: 940.0125 MHz – 12.5 kHz Channel Spacing – mPass 5k Mode**

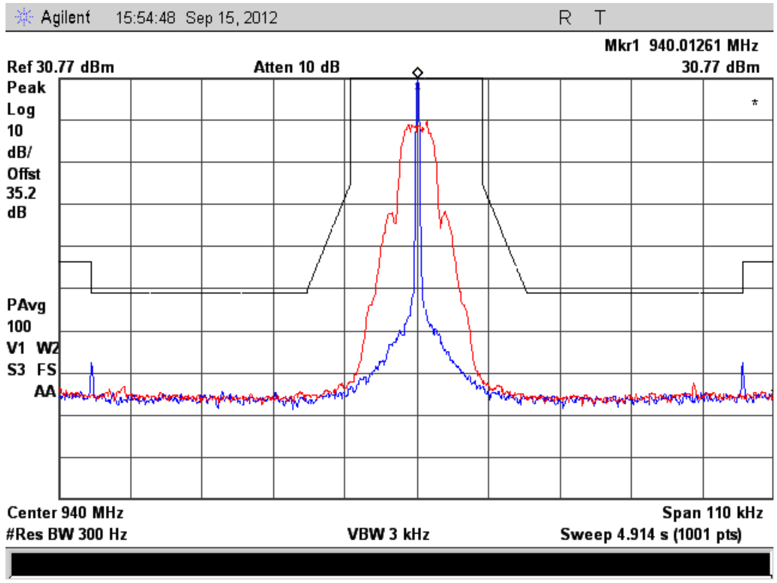


**Figure 7.2.2-11: 940.0125 MHz – 25 kHz Channel Spacing – mPass 5k Mode**

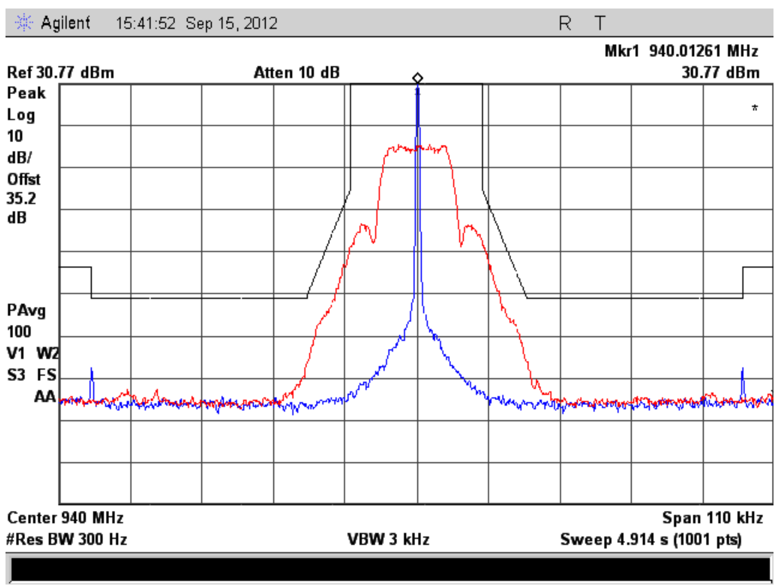


**Figure 7.2.2-12: 940.0125 MHz – 25 kHz Channel Spacing – mPass 10k Mode**

**Part 101.111 a(6), RSS-119 5.8.6 (FCC Part 101.11a(6) provides worst case)**

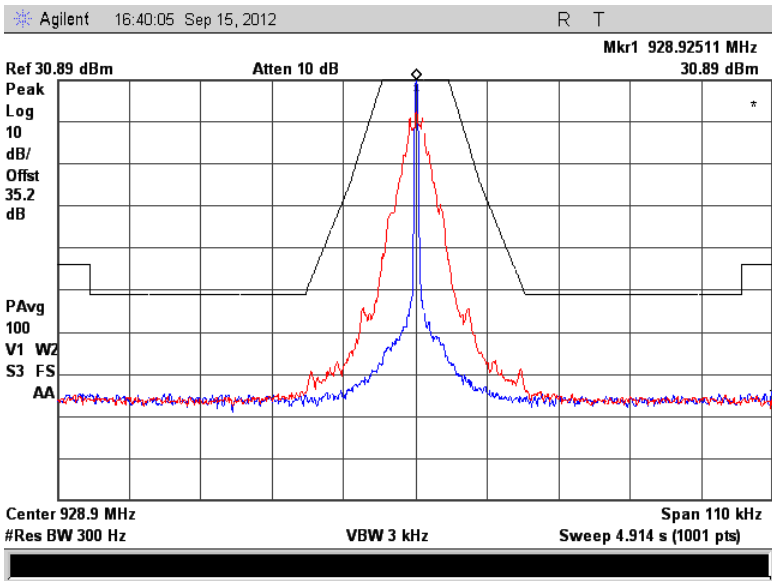


**Figure 7.2.2-13: 928.925 MHz – C&I Mode**

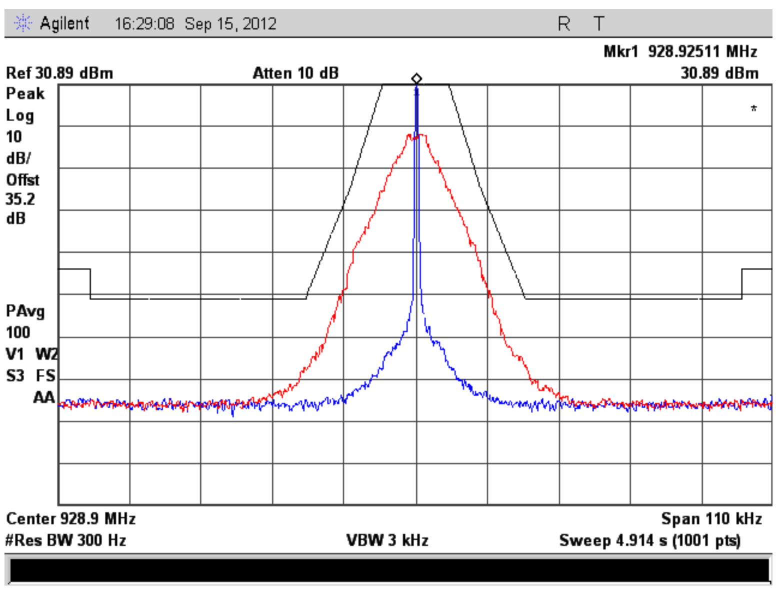


**Figure 7.2.2-14: 928.925 MHz – Double Density Mode**

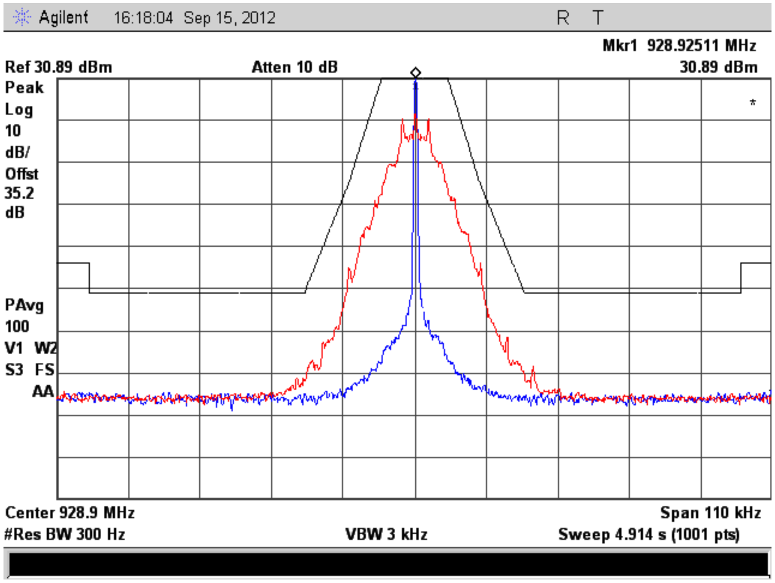


Figure 7.2.2-15: 928.925 MHz – Normal Mode

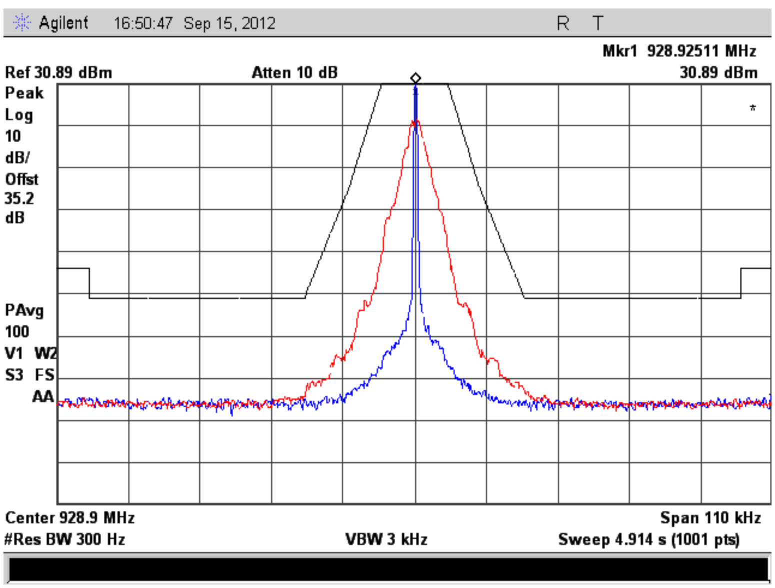


Figure 7.2.2-16: 928.925 MHz –– Priority Mode

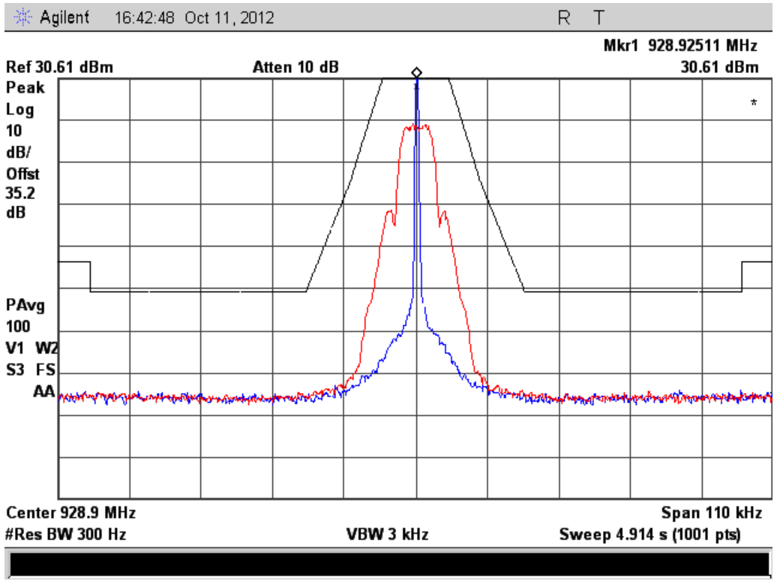


**Figure 7.2.2-17: 928.925 MHz – mPass 5k Mode**

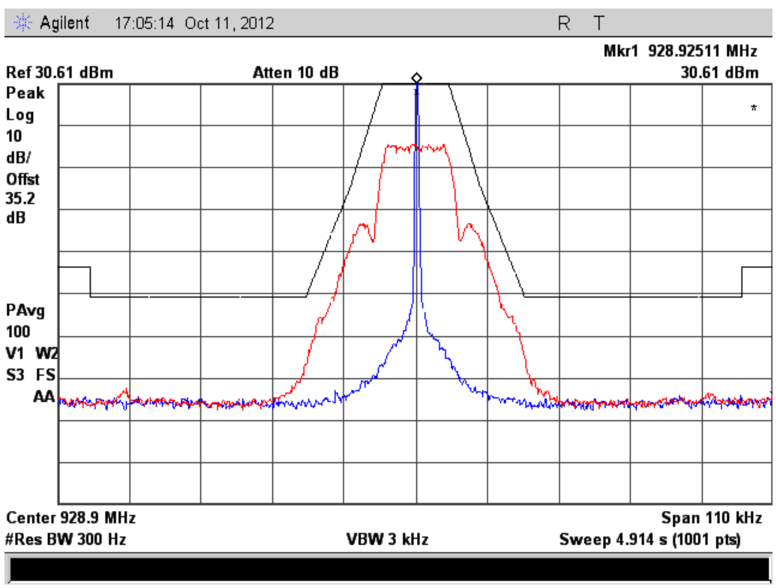


**Figure 7.2.2-18: 928.925 MHz –– mPass 10k Mode**

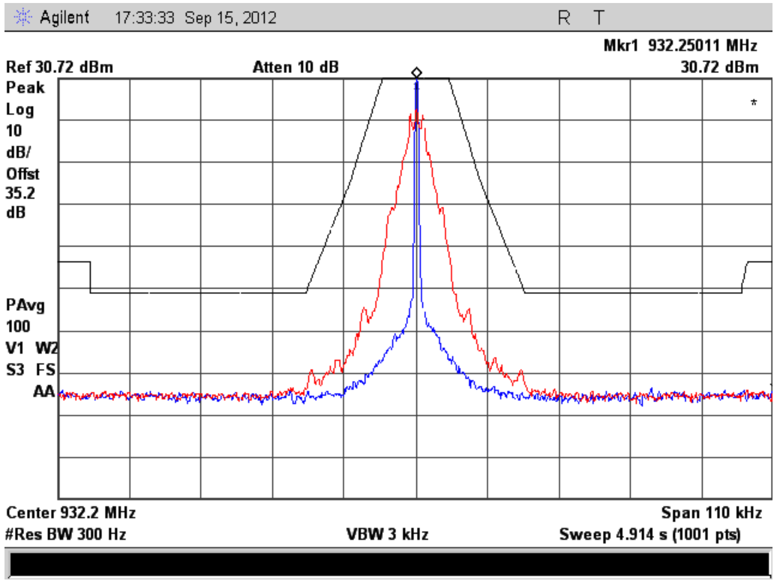


Figure 7.2.2-19: 932.25 MHz – C&I Mode

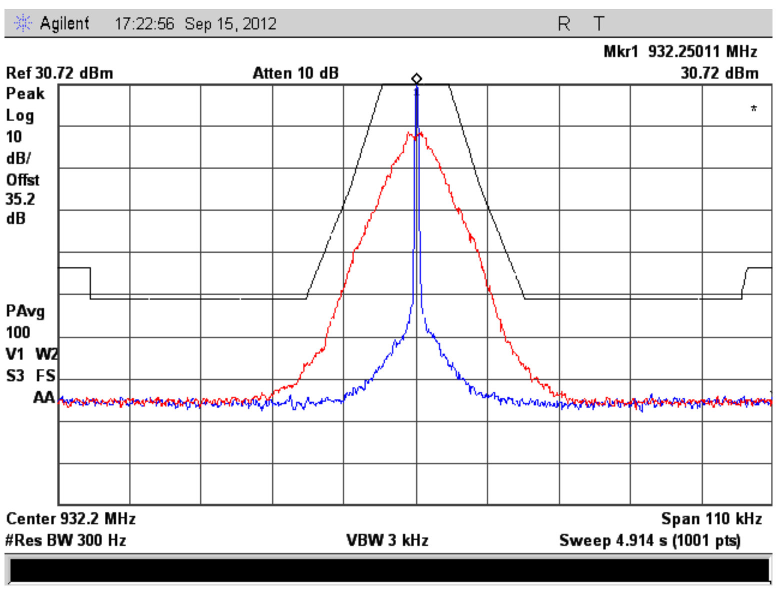


Figure 7.2.2-20: 932.25 MHz – Double Density Mode

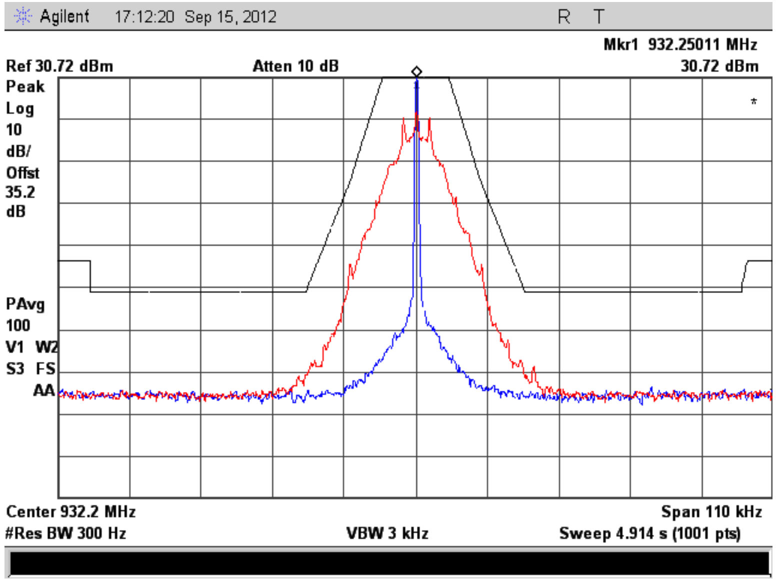


**Figure 7.2.2-21: 932.25 MHz – Normal Mode**

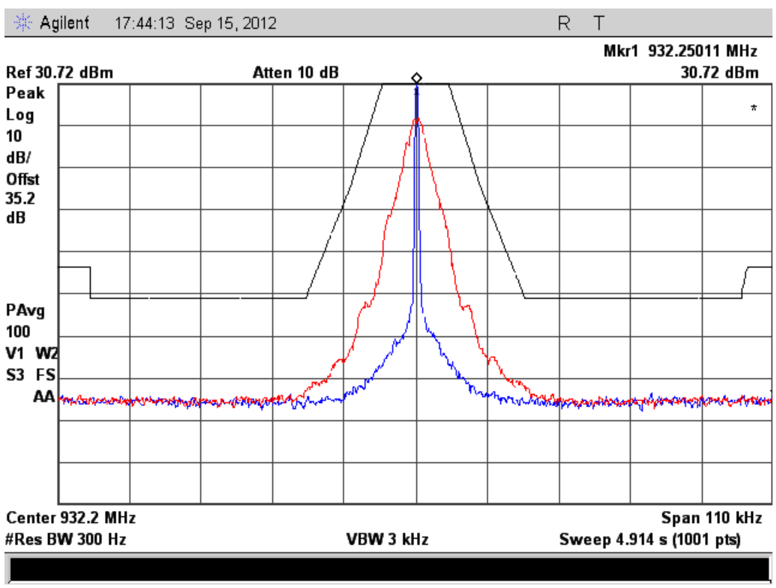


**Figure 7.2.2-22: 932.25 MHz –– Priority Mode**

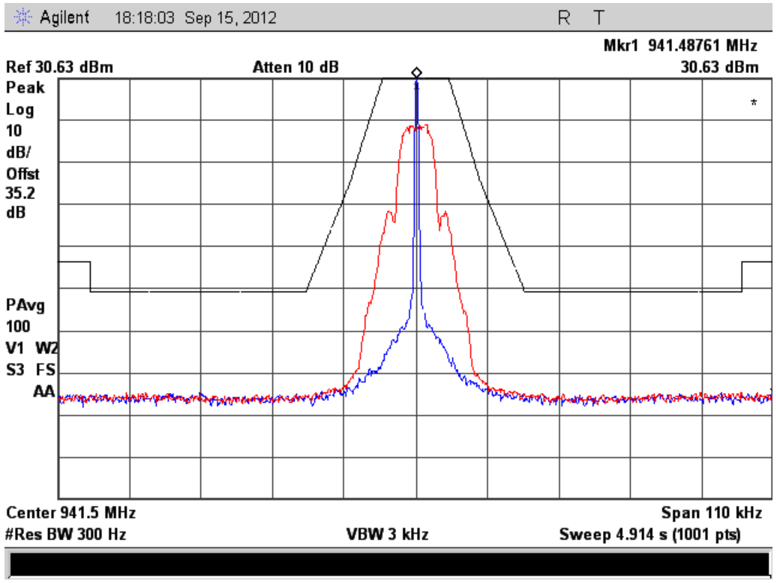


**Figure 7.2.2-23: 941.4875 MHz – mPass 5k Mode**

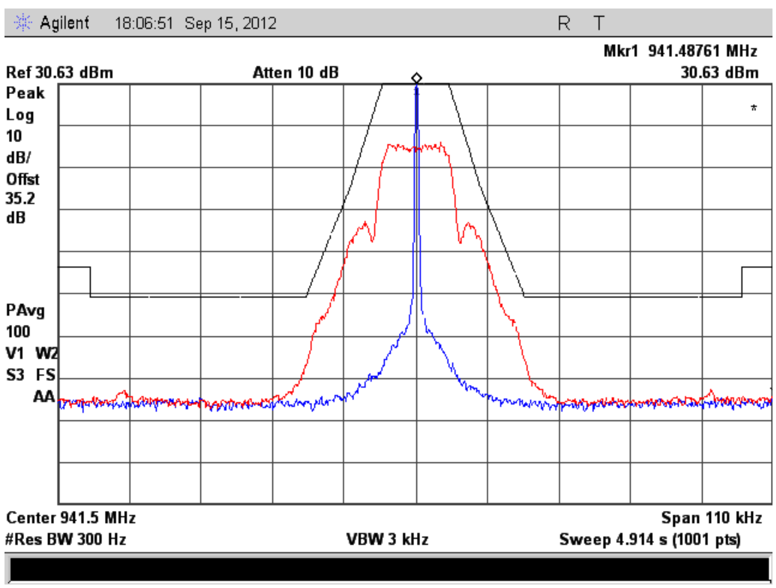


**Figure 7.2.2-24: 941.4875 MHz – mPass 10k Mode**

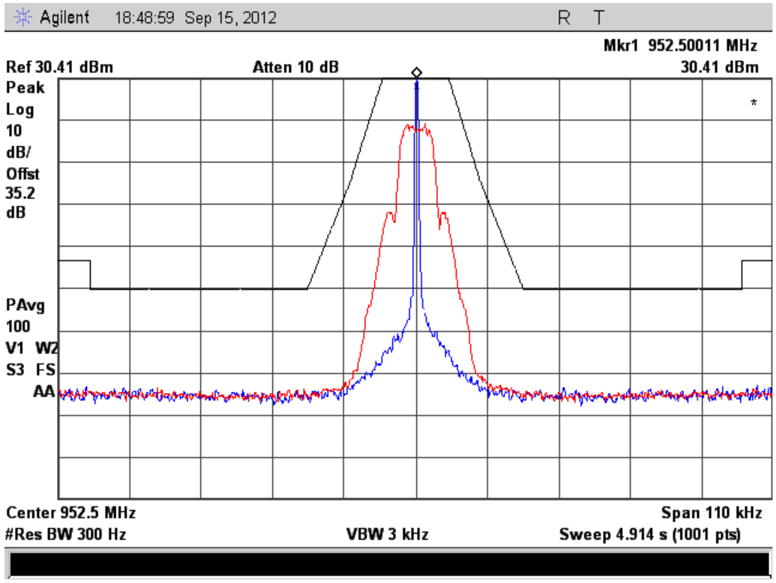


Figure 7.2.2-25: 952.5 MHz – mPass 5k Mode

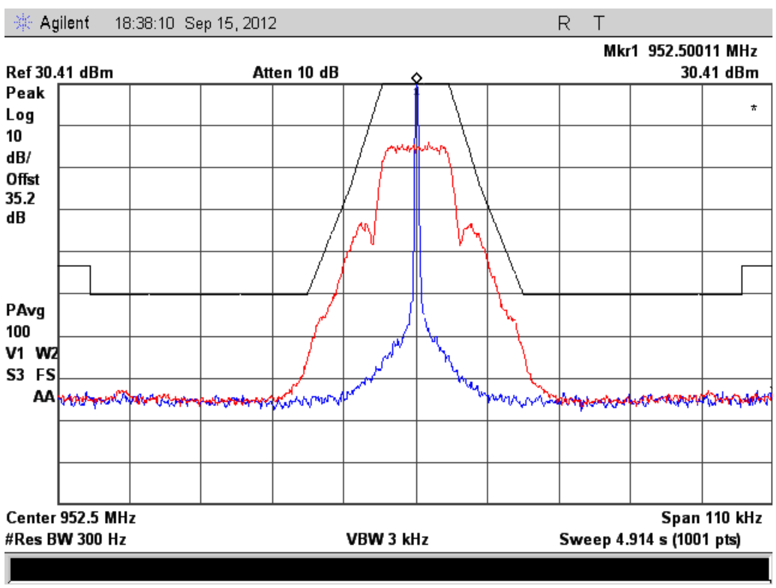


Figure 7.2.2-26: 952.5 MHz – mPass 10k Mode

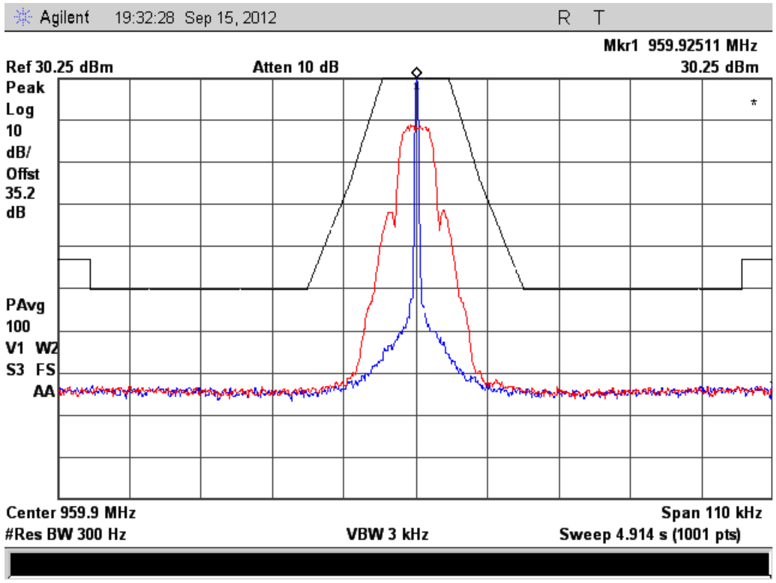


**Figure 7.2.2-27: 959.925 MHz – mPass 5k Mode**

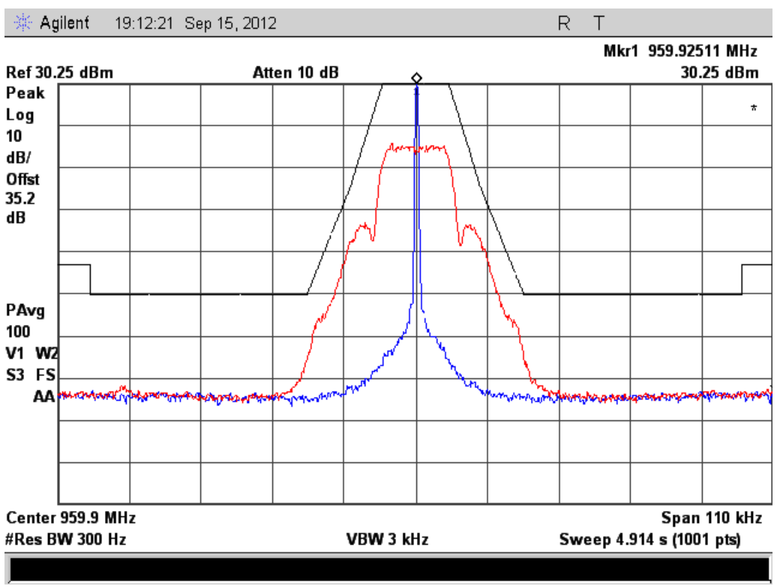


**Figure 7.2.2-28: 959.925 MHz – mPass 10k Mode**

### 7.3 Spurious Emissions at Antenna Terminals

#### 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 35 dB passive attenuator. The spectrum analyzer resolution bandwidth was set to 100 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, attenuator or filter losses. The spectrum was investigated in accordance to CFR 47 Part 2.1057. Results are shown below.

#### 7.3.2 Measurement Results

**Part 24.133 a(1), a(2), IC RSS-134 6.3(i), (ii)**

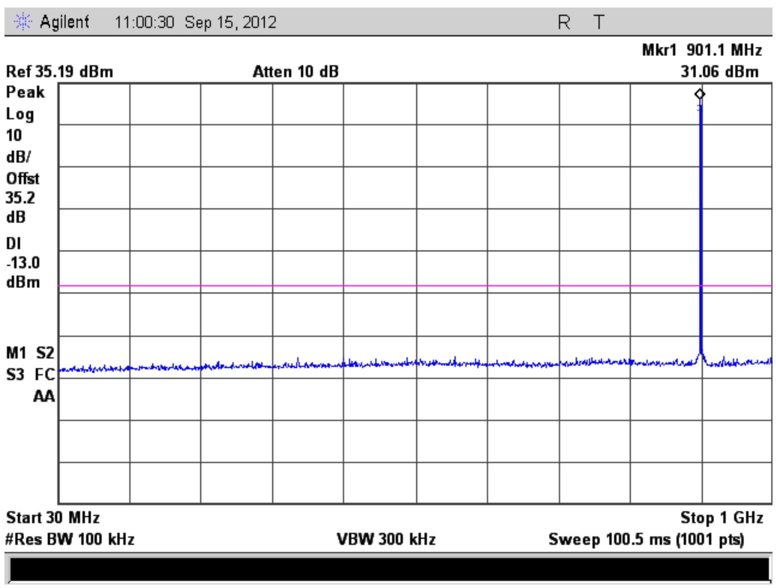


**Figure 7.3.2-1: 901.5 MHz – 30MHz to 1GHz**

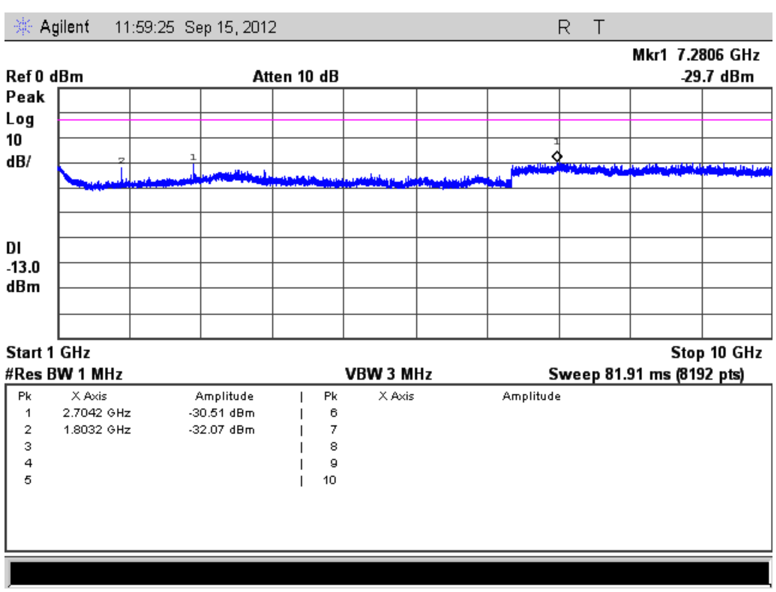


**Figure 7.3.2-2: 901.5 MHz – 1GHz to 10GHz**

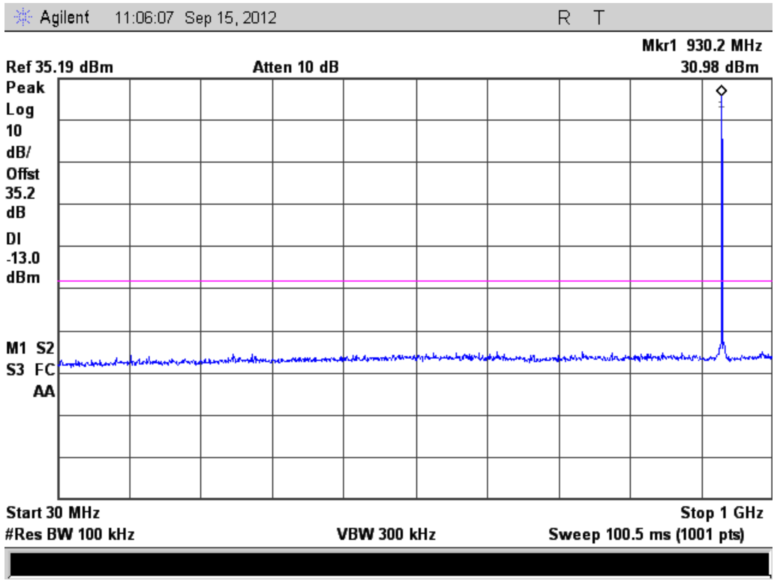


Figure 7.3.2-3: 930.5 MHz – 30MHz to 1GHz

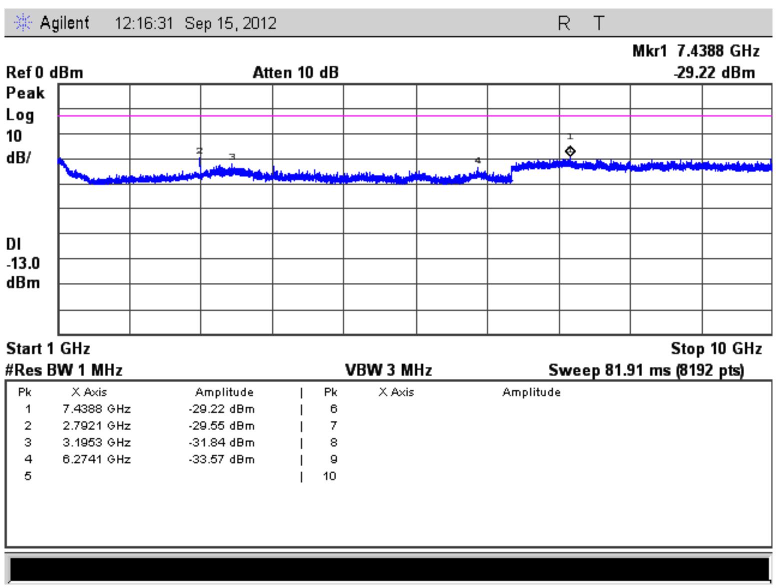


Figure 7.3.2-4: 930.5 MHz – 1GHz to 10GHz

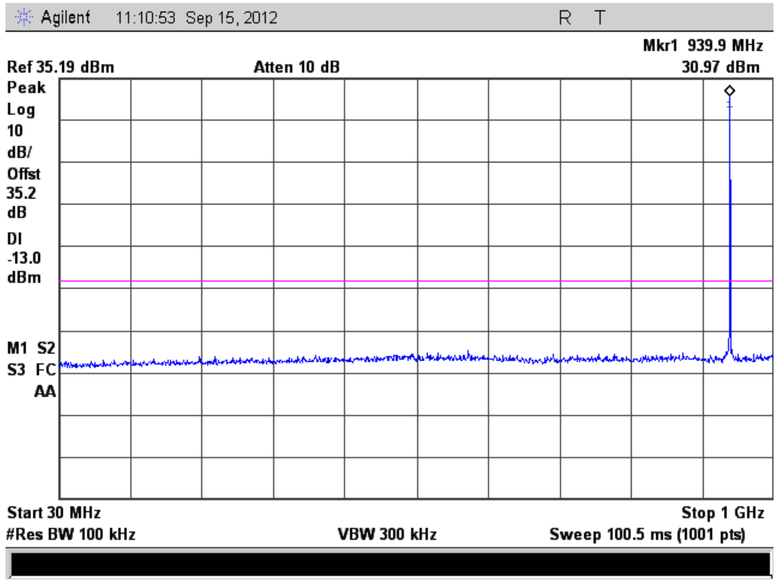


**Figure 7.3.2-5:  940.0125 MHz – 30MHz to 1GHz**

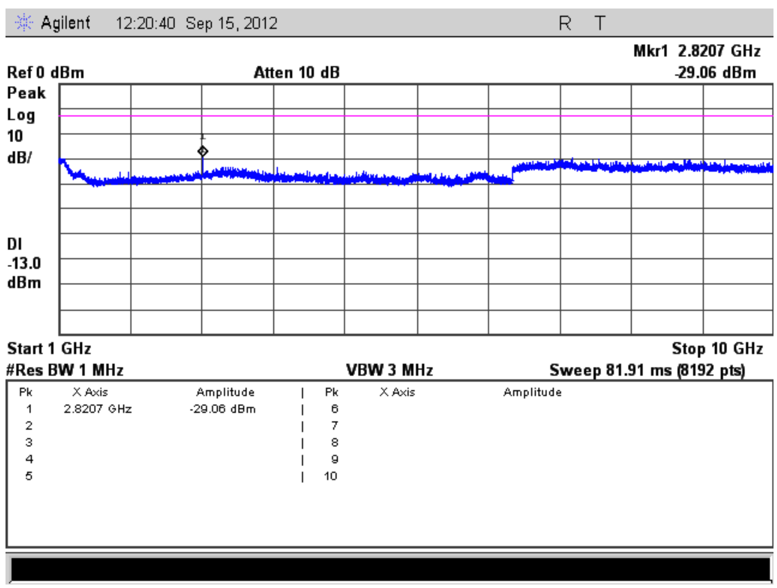


**Figure 7.3.2-6:  940.0125 MHz – 1GHz to 10GHz**

## Part 101.111 a(6), RSS-119 5.8.6

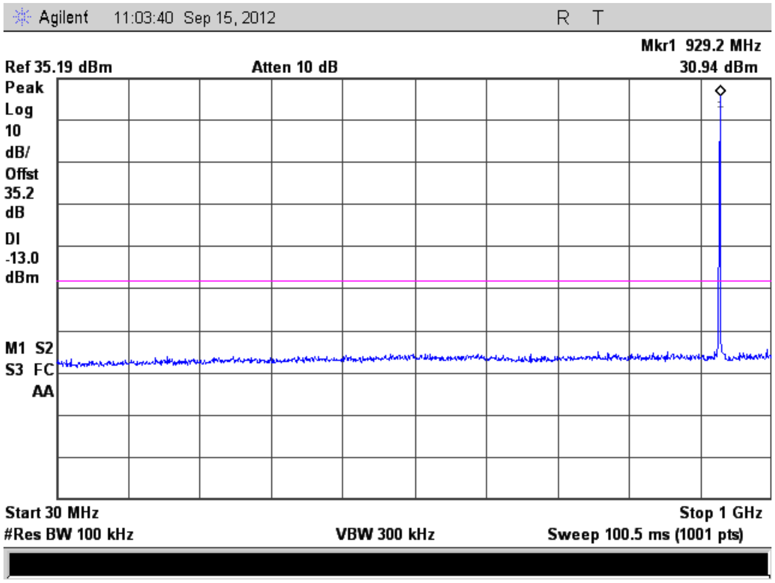


Figure 7.3.2-7: 928.925 MHz – 30MHz to 1GHz

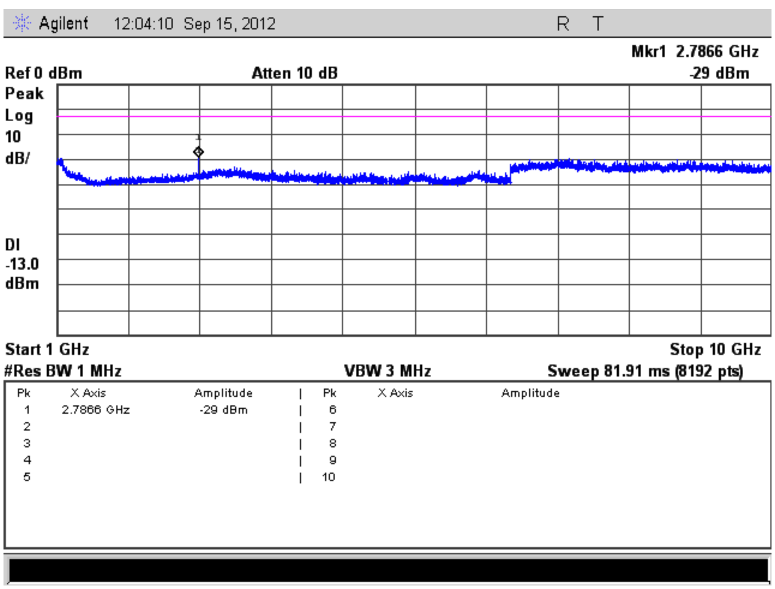


Figure 7.3.2-8: 928.925 MHz – 1GHz to 10GHz

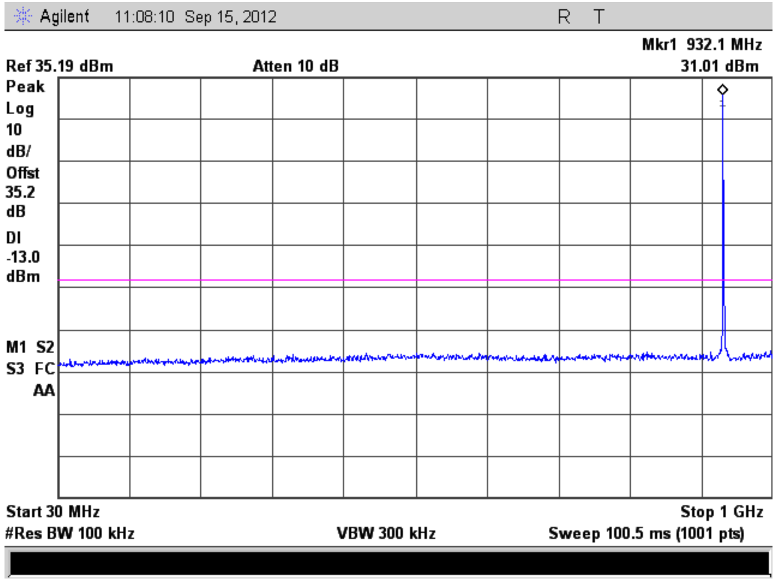


Figure 7.3.2-9: 932.25 MHz – 30MHz to 1GHz

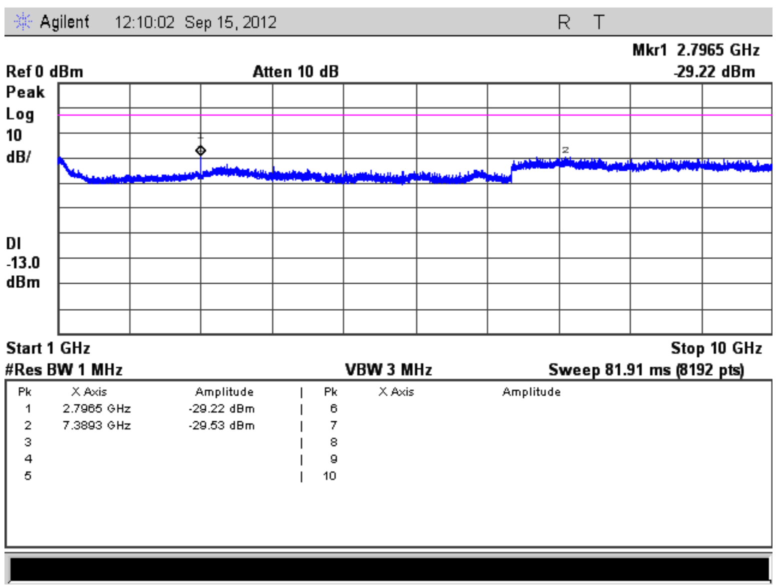


Figure 7.3.2-10: 932.25 MHz – 1GHz to 10GHz

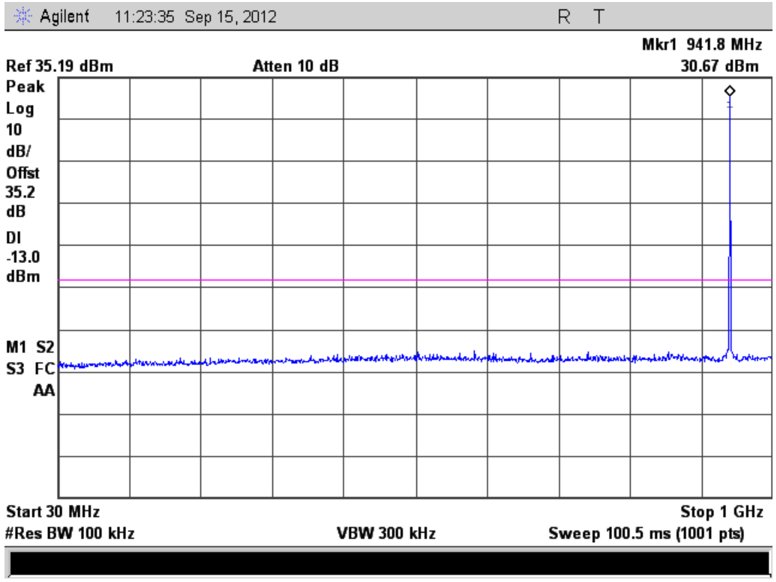


**Figure 7.3.2-11: 941.4875 MHz – 30MHz to 1GHz**

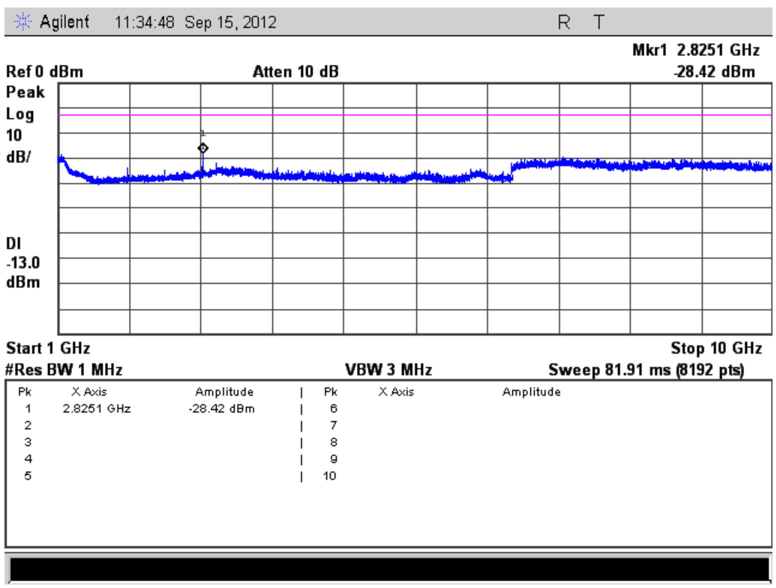


**Figure 7.3.2-12: 941.4875 MHz – 1GHz to 10GHz**

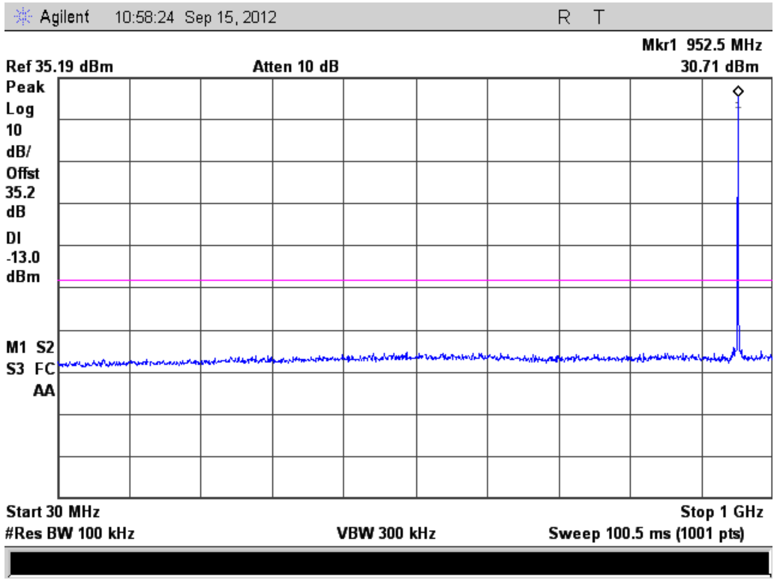


Figure 7.3.2-13: 952.5 MHz – 30MHz to 1GHz

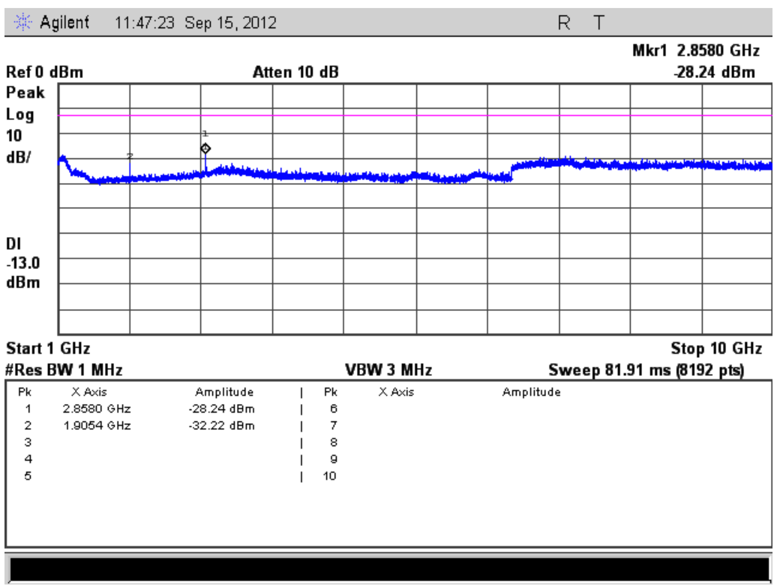


Figure 7.3.2-14: 952.5 MHz – 1GHz to 10GHz

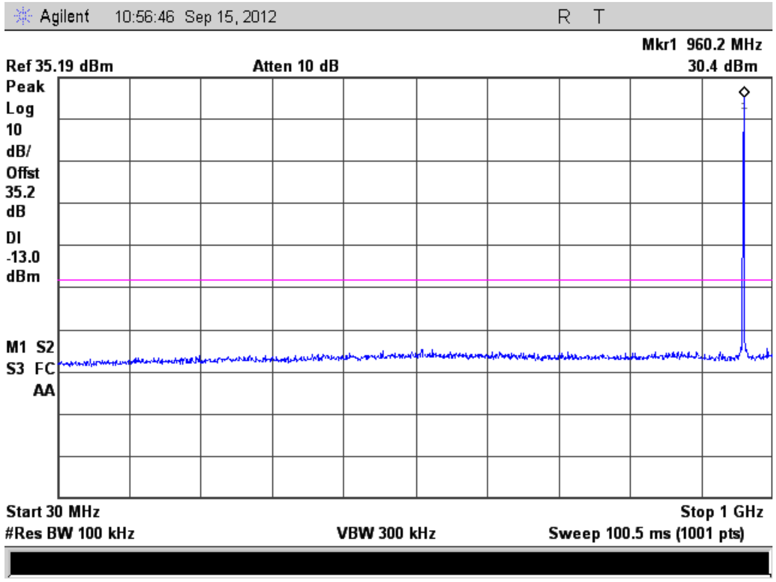


Figure 7.3.2-15: 959.925 MHz – 30MHz to 1GHz

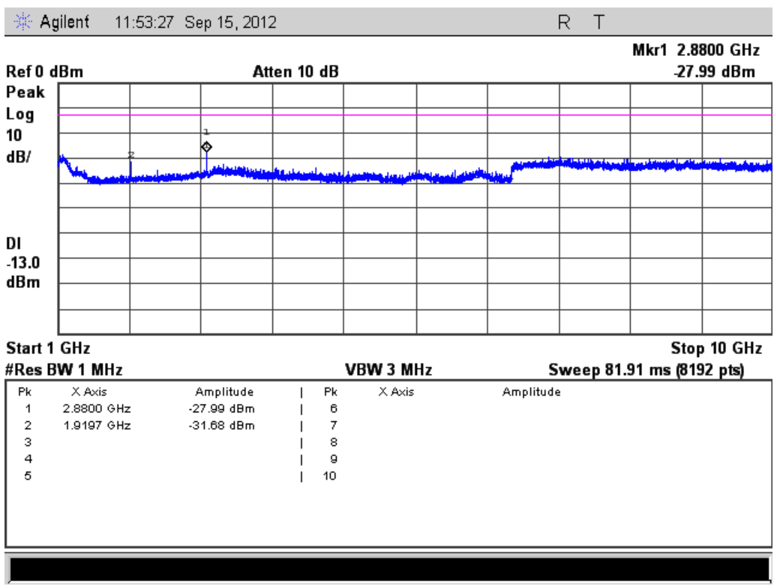


Figure 7.3.2-16: 959.925 MHz – 1GHz to 10GHz

## 7.4 Field Strength of Spurious Emissions

### 7.4.1 Measurement Procedure

The equipment under test is placed in the Semi-Anechoic Chamber (described in section 2.3.1) 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 was 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.

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. Results are shown below.

### 7.4.2 Measurement Results

**Part 24.133 a(1), a(2), RSS-134 6.3(i), (ii)**

**Table 7.4.2-1: Field Strength of Spurious Emissions – 901.5 MHz – Normal Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1803 | -41.00 | H | -39.27 | -13.00 | 26.27 |
| 2704.5 | -49.60 | H | -46.87 | -13.00 | 33.87 |
| 3606 | -55.55 | H | -49.57 | -13.00 | 36.57 |
| 4507.5 | -59.95 | H | -56.14 | -13.00 | 43.14 |
| 5409 | -58.80 | H | -45.50 | -13.00 | 32.50 |
| | | | | | |
| 1803 | -41.05 | V | -39.47 | -13.00 | 26.47 |
| 2704.5 | -41.95 | V | -36.92 | -13.00 | 23.92 |
| 3606 | -55.75 | V | -48.27 | -13.00 | 35.27 |
| 4507.5 | -59.50 | V | -54.49 | -13.00 | 41.49 |
| 5409 | -59.10 | V | -58.15 | -13.00 | 45.15 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-2: Field Strength of Spurious Emissions – 930.5 MHz – MPass 5k Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1861 | -45.85 | H | -43.52 | -13.00 | 30.52 |
| 2791.5 | -52.85 | H | -50.07 | -13.00 | 37.07 |
| 3722 | -56.85 | H | -50.69 | -13.00 | 37.69 |
| 5583 | -57.30 | H | -42.43 | -13.00 | 29.43 |
| | | | | | |
| 1861 | -43.55 | V | -40.72 | -13.00 | 27.72 |
| 2791.5 | -43.20 | V | -35.62 | -13.00 | 22.62 |
| 3722 | -57.15 | V | -50.09 | -13.00 | 37.09 |
| 4652.5 | -59.90 | V | -53.96 | -13.00 | 40.96 |
| 5583 | -60.15 | V | -49.83 | -13.00 | 36.83 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-3: Field Strength of Spurious Emissions – 940.0125 MHz – MPass 5k Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1880.025 | -44.65 | H | -42.07 | -13.00 | 29.07 |
| 2820.0375 | -53.80 | H | -51.29 | -13.00 | 38.29 |
| 3760.05 | -57.20 | H | -52.34 | -13.00 | 39.34 |
| 4700.0625 | -59.65 | H | -56.37 | -13.00 | 43.37 |
| 5640.075 | -58.15 | H | -44.58 | -13.00 | 31.58 |
| | | | | | |
| 1880.025 | -42.50 | V | -40.72 | -13.00 | 27.72 |
| 2820.0375 | -43.20 | V | -35.84 | -13.00 | 22.84 |
| 3760.05 | -58.00 | V | -53.34 | -13.00 | 40.34 |
| 4700.0625 | -59.85 | V | -58.17 | -13.00 | 45.17 |
| 5640.075 | -60.30 | V | -51.13 | -13.00 | 38.13 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Part 101.111 a(6), RSS-119 5.8.6**

**Table 7.4.2-4: Field Strength of Spurious Emissions – 928.925 MHz – Normal Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1857.85 | -46.10 | H | -43.87 | -13.00 | 30.87 |
| 2786.775 | -51.20 | H | -46.67 | -13.00 | 33.67 |
| 3715.7 | -57.75 | H | -52.29 | -13.00 | 39.29 |
| 4644.625 | -60.95 | H | -56.36 | -13.00 | 43.36 |
| 5573.55 | -57.80 | H | -44.43 | -13.00 | 31.43 |
| | | | | | |
| 1857.85 | -42.50 | V | -39.52 | -13.00 | 26.52 |
| 2786.775 | -44.20 | V | -36.32 | -13.00 | 23.32 |
| 3715.7 | -58.05 | V | -50.09 | -13.00 | 37.09 |
| 4644.625 | -59.75 | V | -54.01 | -13.00 | 41.01 |
| 5573.55 | -59.90 | V | -48.88 | -13.00 | 35.88 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-5: Field Strength of Spurious Emissions – 932.25 MHz – Normal Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenn a Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1864.5 | -45.15 | H | -42.67 | -13.00 | 29.67 |
| 2796.75 | -52.15 | H | -48.42 | -13.00 | 35.42 |
| 3729 | -56.65 | H | -50.84 | -13.00 | 37.84 |
| 5593.5 | -57.90 | H | -44.18 | -13.00 | 31.18 |
| | | | | | |
| 1864.5 | -43.25 | V | -40.77 | -13.00 | 27.77 |
| 2796.75 | -43.55 | V | -35.17 | -13.00 | 22.17 |
| 3729 | -57.60 | V | -50.99 | -13.00 | 37.99 |
| 4661.25 | -59.85 | V | -54.21 | -13.00 | 41.21 |
| 5593.5 | -59.60 | V | -47.88 | -13.00 | 34.88 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-6: Field Strength of Spurious Emissions – 941.4875 MHz – MPass 5k Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1882.975 | -45.45 | H | -42.37 | -13.00 | 29.37 |
| 2824.4625 | -54.75 | H | -51.39 | -13.00 | 38.39 |
| 3765.95 | -58.40 | H | -55.34 | -13.00 | 42.34 |
| 4707.4375 | -61.00 | H | -58.22 | -13.00 | 45.22 |
| 5648.925 | -58.70 | H | -45.43 | -13.00 | 32.43 |
| | | | | | |
| 1882.975 | -42.65 | V | -39.92 | -13.00 | 26.92 |
| 2824.4625 | -44.75 | V | -36.59 | -13.00 | 23.59 |
| 3765.95 | -58.65 | V | -53.69 | -13.00 | 40.69 |
| 4707.4375 | -60.60 | V | -56.62 | -13.00 | 43.62 |
| 5648.925 | -61.15 | V | -52.73 | -13.00 | 39.73 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-7: Field Strength of Spurious Emissions – 952.5 MHz – MPass 5k Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenna Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1905 | -42.45 | H | -39.59 | -13.00 | 26.59 |
| 2857.5 | -53.85 | H | -51.79 | -13.00 | 38.79 |
| 3810 | -58.70 | H | -54.73 | -13.00 | 41.73 |
| 4762.5 | -60.80 | H | -55.87 | -13.00 | 42.87 |
| 5715 | -59.50 | H | -46.57 | -13.00 | 33.57 |
| | | | | | |
| 1905 | -41.45 | V | -39.09 | -13.00 | 26.09 |
| 2857.5 | -44.30 | V | -37.29 | -13.00 | 24.29 |
| 3810 | -59.30 | V | -55.78 | -13.00 | 42.78 |
| 4762.5 | -60.80 | V | -56.32 | -13.00 | 43.32 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

**Table 7.4.2-8: Field Strength of Spurious Emissions – 959.925 MHz – MPass 5k Mode**

| Frequency (MHz) | Spectrum Analyzer Level (dBm) | Antenn a Polarity (H/V) | Spurious ERP (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|
| 1919.85 | -40.95 | H | -37.49 | -13.00 | 24.49 |
| 2879.775 | -53.20 | H | -50.29 | -13.00 | 37.29 |
| 3839.7 | -59.55 | H | -55.28 | -13.00 | 42.28 |
| 5759.55 | -60.55 | H | -49.27 | -13.00 | 36.27 |
| | | | | | |
| 1919.85 | -41.40 | V | -38.49 | -13.00 | 25.49 |
| 2879.775 | -45.70 | V | -39.24 | -13.00 | 26.24 |
| 3839.7 | -60.20 | V | -56.33 | -13.00 | 43.33 |
| 4799.625 | -61.20 | V | -58.32 | -13.00 | 45.32 |
| 5759.55 | -62.00 | V | -57.32 | -13.00 | 44.32 |

NOTE: All frequencies not listed were below the noise floor of the spectrum analyzer.

## 7.5 Frequency Stability

### 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 measurements were performed at +/- 15% of the EUT nominal voltage. The maximum variation of frequency was recorded.

Results of the test are shown below.

### 7.5.2 Measurement Results

**Part 24.135, RSS-134 (7)**

## Frequency Stability

**Frequency (MHz):** 901.5
**Deviation Limit (PPM):** 1ppm

| Temperature | Frequency | Frequency Error | Voltage | Voltage |
|---|---|---|---|---|
| C | MHz | (PPM) | (%) | (VDC) |
| | | | | |
| -30 C | **901.500055** | **0.061** | 100% | 26.00 |
| -20 C | **901.500088** | **0.098** | 100% | 26.00 |
| -10 C | **901.500183** | **0.203** | 100% | 26.00 |
| 0 C | **901.500214** | **0.237** | 100% | 26.00 |
| 10 C | **901.500238** | **0.264** | 100% | 26.00 |
| 20 C | **901.500236** | **0.262** | 100% | 26.00 |
| 30 C | **901.500144** | **0.160** | 100% | 26.00 |
| 40 C | **901.500079** | **0.088** | 100% | 26.00 |
| 50 C | **901.500093** | **0.103** | 100% | 26.00 |
| | | | | |
| 20 C | **901.500232** | **0.257** | 85% | 22.10 |
| 20 C | **901.500231** | **0.256** | 115% | 29.90 |

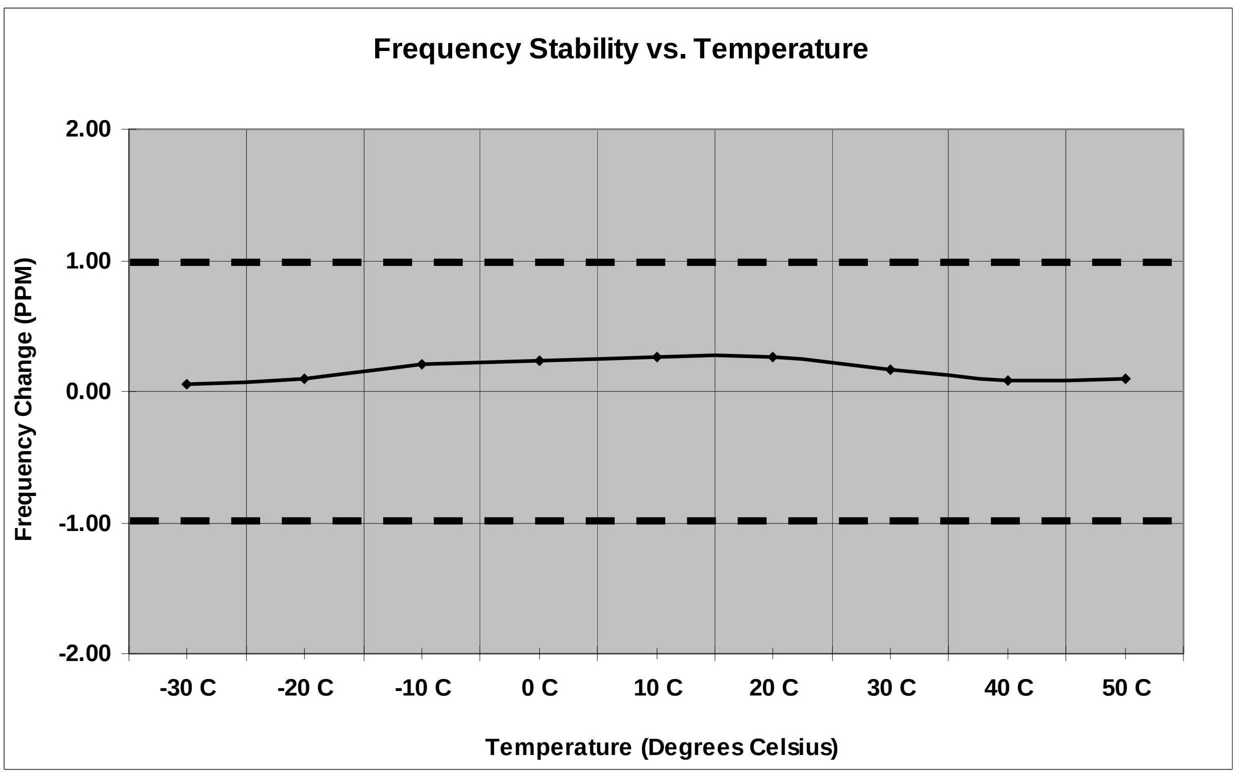


**Figure 7.5.2-1: Frequency Stability – 901.5 MHz**

**Part 24.135, RSS-134 (7)**

# Frequency Stability

**Frequency (MHz):** 930.5
**Deviation Limit (PPM):** 1ppm

| Temperature C | Frequency MHz | Frequency Error (PPM) | Voltage (%) | Voltage (VDC) |
|---|---|---|---|---|
| | | | | |
| -30 C | 930.500041 | 0.044 | 100% | 26.00 |
| -20 C | 930.500086 | 0.092 | 100% | 26.00 |
| -10 C | 930.500182 | 0.196 | 100% | 26.00 |
| 0 C | 930.500220 | 0.236 | 100% | 26.00 |
| 10 C | 930.500239 | 0.257 | 100% | 26.00 |
| 20 C | 930.500238 | 0.256 | 100% | 26.00 |
| 30 C | 930.500142 | 0.153 | 100% | 26.00 |
| 40 C | 930.500081 | 0.087 | 100% | 26.00 |
| 50 C | 930.500089 | 0.096 | 100% | 26.00 |
| | | | | |
| 20 C | 930.500237 | 0.255 | 85% | 22.10 |
| 20 C | 930.500234 | 0.251 | 115% | 29.90 |

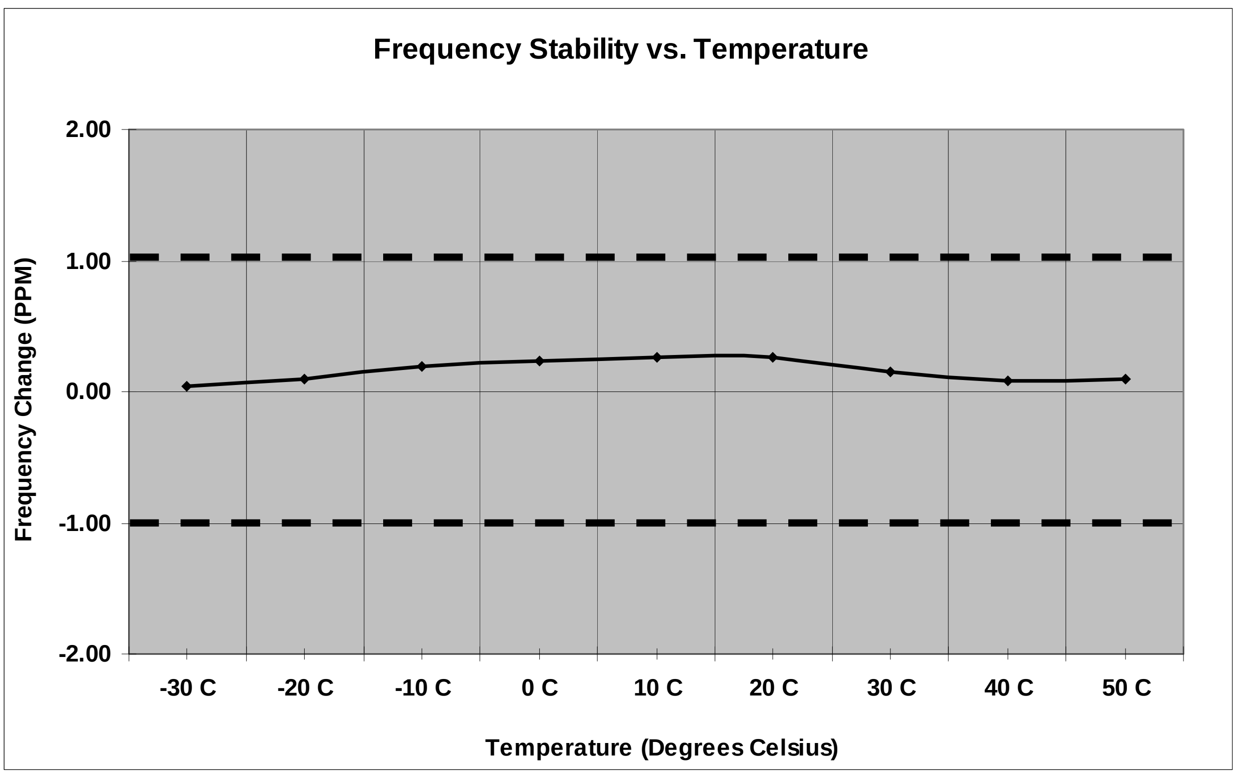


**Figure 7.5.2-2: Frequency Stability – 930.5 MHz**

**Part 101.107, RSS-119 5.3**

# Frequency Stability

**Frequency (MHz):** 959.925
**Deviation Limit (PPM):** 1ppm

| Temperature | Frequency | Frequency Error | Voltage | Voltage |
|---|---|---|---|---|
| C | MHz | (PPM) | (%) | (VDC) |
| | | | | |
| -30 C | **959.925046** | **0.048** | 100% | 26.00 |
| -20 C | **959.925091** | **0.095** | 100% | 26.00 |
| -10 C | **959.925181** | **0.189** | 100% | 26.00 |
| 0 C | **959.925227** | **0.236** | 100% | 26.00 |
| 10 C | **959.925242** | **0.252** | 100% | 26.00 |
| 20 C | **959.925236** | **0.246** | 100% | 26.00 |
| 30 C | **959.925139** | **0.145** | 100% | 26.00 |
| 40 C | **959.925084** | **0.088** | 100% | 26.00 |
| 50 C | **959.925093** | **0.097** | 100% | 26.00 |
| | | | | |
| 20 C | **959.925239** | **0.249** | 85% | 22.10 |
| 20 C | **959.925231** | **0.241** | 115% | 29.90 |

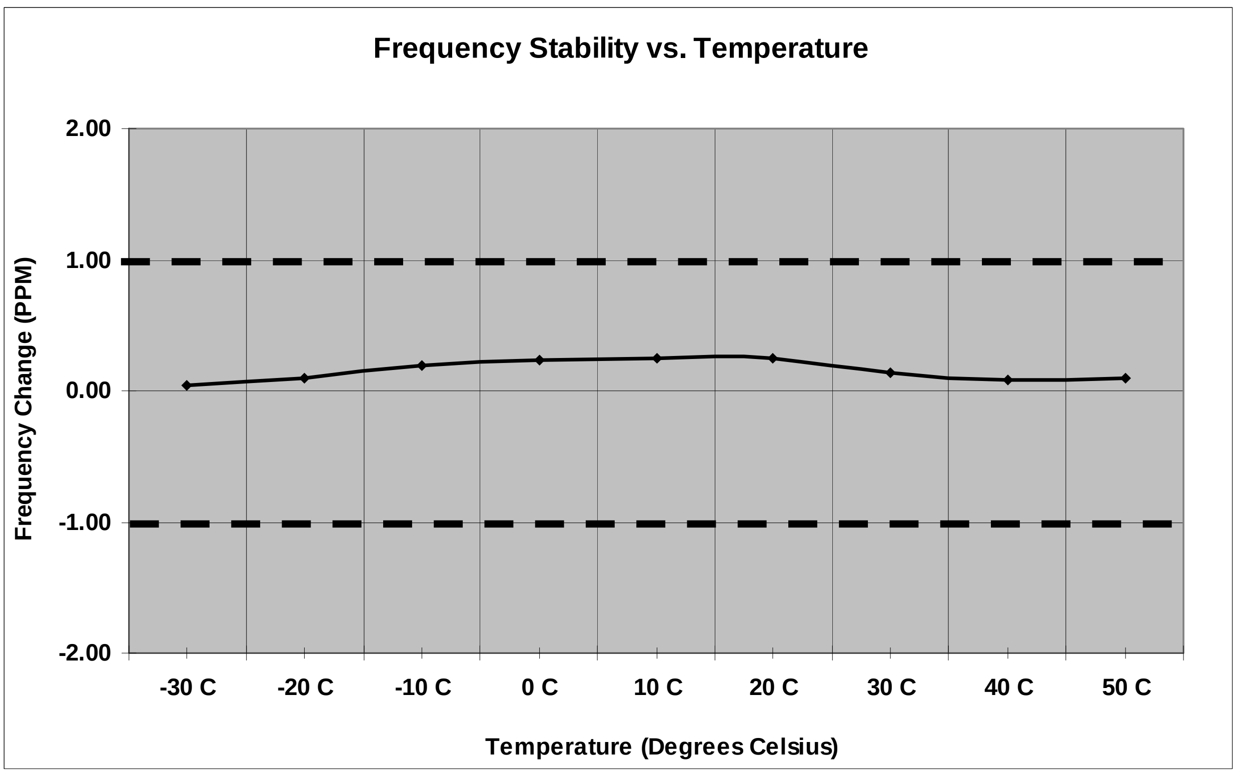


**Figure 7.5.2-3: Frequency Stability – 959.925 MHz**

**8.0 CONCLUSION**

In the opinion of ACS, Inc. the model IDTB004, manufactured by Sensus Metering Systems, Inc., meets all the requirements of FCC Part 24D and Part 101 as well as Industry Canada RSS-119 and RSS-134 were applicable.

End Report