



## **Class 2 Permissive Change Certification Report for the M/A-COM MASTRIII 800 MHz Base Station FCC Part 90 & RSS-119**

**Document Number:** KP001197-CR-RAD-03-01

**Release Date:** February 8, 2006

**Prepared for:** M/A-COM, Inc.  
221 Jefferson Ridge Parkway  
Lynchburg, Virginia  
U.S.A., 24501

**Author:** Denis Lalonde  
Radio Compliance Discipline Leader

**Solectron EMS Canada Inc.**  
**Design & Engineering Kanata (SDE)**  
21 Richardson Side Road  
Kanata, Ontario, K2K 2C1  
<http://www.solectron.com/services/prod.htm>

---

© Copyright Solectron EMS Inc. February 8, 2006

The information disclosed herein is proprietary to Solectron and is not to be used by or disclosed to unauthorized persons without the written consent of Solectron EMS Canada Inc. The recipient of this document shall respect the security status of the information.

The master of this document is stored on an electronic database and is "write-protected" and may be altered only by authorized persons at Solectron. Viewing of the master document electronically on SDE electronic database ensures access to the current issue. Any other copies are regarded as uncontrolled copies.

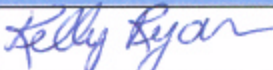
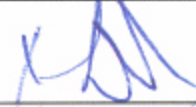
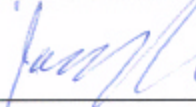
---

## Release Control Record

This document is based on CEI document template KG000347-TR-EMC-03.

Release no.	Reason for change	Date released
01	Original Release	February 8, 2006

## Approvals

Function	Name	Job title	Signature and Date
Document Release Approval	Steve Tippet	Manager, Product Engineering and Verification	 FOR STEVE TIPPET 8-FEB-06
Author	Denis Lalonde	Radio Compliance Discipline Leader	 Feb 7, 2006
Technical Reviewer	Jacques Rollin	EMC Advisor	 Feb. 8, 2006

## Accreditations

Solelectron EMS Canada test facilities are accredited by the Standards Council of Canada (SCC) in accordance with the scope of accreditation outlined at the following web site [http://palcan.scc.ca/specs/pdf/95\\_e.pdf](http://palcan.scc.ca/specs/pdf/95_e.pdf) [1]. The SCC is a member of the APLAC [14] and ILAC [15] organizations which, through mutual recognition arrangements, provide accreditation of test facilities in the member countries.



The Solelectron Design and Engineering 10-meter Ambient Free Chamber (AFC) complies with the Industry Canada (IC) requirements for Test Facilities and Test Methods [16] under reference file number 4180. Through IC MRAs, EMC measurements are accepted in the following countries: USA, Australia, Singapore, Chinese Taipei (Taiwan), and the Republic of Korea. Further information can be found at the IC Certification and Engineering Bureau web site <http://strategis.ic.gc.ca/epic/internet/inceb-bhst.nsf/en/Home> under the "conformity assessment bodies" link.

The VCCI [13] lab registration numbers associated with our test facilities are: R-1641, C-1749, C-1750, T-148, and T-149.

Solelectron EMS Canada is ISO 9001:2000 and ISO-IEC 17025 certified and its processes are documented in the Solelectron EMS Canada Quality Manual [2] and Lab Operations Manual [3].

# Table of Contents

<b>RELEASE CONTROL RECORD.....</b>	<b>2</b>
<b>APPROVALS .....</b>	<b>2</b>
<b>ACCREDITATIONS .....</b>	<b>2</b>
<b>TABLE OF CONTENTS.....</b>	<b>3</b>
<b>LIST OF FIGURES .....</b>	<b>4</b>
<b>LIST OF TABLES .....</b>	<b>5</b>
<b>1. EXECUTIVE SUMMARY.....</b>	<b>7</b>
<b>2. COMPLIANCE SUMMARY.....</b>	<b>8</b>
<b>3. EQUIPMENT UNDER TEST (EUT) .....</b>	<b>9</b>
3.1 PRODUCT FUNCTIONAL DESCRIPTION .....	9
3.2 MANUFACTURER INFORMATION.....	9
3.3 TRANSMITTER SPECIFICATIONS .....	9
3.4 EQUIPMENT MODIFICATION .....	10
3.5 SYSTEM COMPONENTS .....	10
3.6 SUPPORT EQUIPMENT .....	10
3.7 SYSTEM SET-UP AND TEST CONFIGURATIONS .....	10
3.8 EUT INTERFACES AND CABLES .....	11
3.9 SYSTEM MODIFICATIONS .....	12
<b>4. GENERAL TEST CONDITIONS .....</b>	<b>13</b>
4.1 TEST FACILITY .....	13
4.2 MEASUREMENT INSTRUMENTATION.....	13
<b>5. DETAILED TEST RESULTS.....</b>	<b>14</b>
5.1 RF POWER .....	14
5.1.1 Test Specification .....	14
5.1.1.1 Limits .....	14
5.1.2 Test Facility Information .....	14
5.1.3 Test Procedure .....	14
5.1.4 Test Results.....	15
5.1.5 Test Conclusion .....	15
5.1.6 Test Equipment List.....	15
5.2 CONDUCTED SPURIOUS EMISSIONS .....	15
5.2.1 Test Specification .....	15
5.2.1.1 Limits .....	16
5.2.2 Test Facility Information.....	16
5.2.3 Test Procedure .....	16

5.2.4	Test Results.....	16
5.2.5	Test Conclusion .....	17
5.2.6	Test Equipment List.....	17
5.3	EMISSION MASK.....	17
5.3.1	Test Specification .....	17
5.3.1.1	Limits .....	17
5.3.2	Test Facility Information.....	18
5.3.3	Test Procedure .....	18
5.3.4	Test Results.....	18
5.3.5	Test Conclusion .....	19
5.3.6	Test Equipment List.....	19
5.4	FIELD STRENGTH OF SPURIOUS EMISSIONS .....	19
5.4.1	Test Specification .....	19
5.4.1.1	Limits .....	19
5.4.2	Test Facility Information.....	20
5.4.3	Test Procedure .....	20
5.4.4	Test Results.....	21
5.4.5	Test Conclusion .....	22
5.4.6	Test Equipment List.....	22
5.5	OCCUPIED BANDWIDTH.....	22
5.5.1	Test Specification .....	22
5.5.2	Test Facility Information.....	23
5.5.3	Test Procedure .....	23
5.5.4	Test Results.....	23
5.5.5	Test Equipment List.....	24
6.	REFERENCES .....	25
7.	APPENDICES.....	26
7.1	APPENDIX A: GLOSSARY .....	26
7.2	APPENDIX B: TEST SET-UP PHOTOGRAPHS .....	27
7.3	APPENDIX C: CONDUCTED SPURIOUS EMISSIONS PLOTS .....	28
7.4	APPENDIX D: EMISSION MASK PLOTS.....	34
7.5	APPENDIX E: FIELD STRENGTH OF SPURIOUS EMISSIONS PLOTS.....	36
7.6	APPENDIX F: OCCUPIED BANDWIDTH PLOTS .....	38

## List of Figures

FIGURE 3-1	PRODUCT DESCRIPTION.....	9
FIGURE 3-2:	MODULE CONFIGURATION .....	11
FIGURE 3-3:	SYSTEM CONFIGURATION .....	11
FIGURE 7-1:	M/A-COM MASTRIII 800 MHz BASE STATION RADIATED EMISSIONS SET-UP .....	27

FIGURE 7-2: TX AT 851.0125 MHz, 100 W POWER, 30 MHz TO 1 GHz.....	28
FIGURE 7-3: TX AT 851.0125 MHz, 100 W POWER, 1 GHz TO 2.75 GHz .....	28
FIGURE 7-4: TX AT 851.0125 MHz, 100 W POWER, 2.75 GHz TO 8.7 GHz .....	29
FIGURE 7-5: TX AT 851.0125 MHz, 10 W POWER, 30 MHz TO 1 GHz.....	29
FIGURE 7-6: TX AT 851.0125 MHz, 10 W POWER, 1 GHz TO 2.75 GHz .....	30
FIGURE 7-7: TX AT 851.0125 MHz, 10 W POWER, 2.75 GHz TO 8.7 GHz .....	30
FIGURE 7-8: TX AT 869.9875 MHz, 100 W POWER, 30 MHz TO 1 GHz.....	31
FIGURE 7-9: TX AT 869.9875 MHz, 100 W POWER, 1 GHz TO 2.75 GHz .....	31
FIGURE 7-10: TX AT 869.9875 MHz, 100 W POWER, 2.75 GHz TO 8.7 GHz .....	32
FIGURE 7-11: TX AT 869.9875 MHz, 10 W POWER, 30 MHz TO 1 GHz.....	32
FIGURE 7-12: TX AT 869.9875 MHz, 10 W POWER, 1 GHz TO 2.75 GHz .....	33
FIGURE 7-13: TX AT 869.9875 MHz, 10 W POWER, 2.75 GHz TO 8.7 GHz .....	33
FIGURE 7-14: 2500 HZ AUDIO SIGNAL .....	34
FIGURE 7-15: 2 LEVEL 9600 BAUD SIGNAL WITH 3 KHz DEVIATION .....	34
FIGURE 7-16: NPSPAC (9600 BAUD) SIGNAL.....	35
FIGURE 7-17: NPSPAC (ANALOG) SIGNAL .....	35
FIGURE 7-18: FIELD STRENGTH WITH 100 W Tx, 30 MHz TO 1 GHz .....	36
FIGURE 7-19: FIELD STRENGTH WITH 100 W Tx, 1 GHz TO 9 GHz .....	37
FIGURE 7-20: 2500 HZ AUDIO SIGNAL .....	38
FIGURE 7-21: 2 LEVEL 9600 BAUD SIGNAL WITH 3 KHz DEVIATION .....	38
FIGURE 7-22: NPSPAC (9600 BAUD) SIGNAL.....	39
FIGURE 7-23: NPSPAC (ANALOG) SIGNAL.....	39

## List of Tables

TABLE 2-1: COMPLIANCE RESULTS SUMMARY .....	8
TABLE 3-1: TRANSMITTER SPECIFICATIONS .....	9
TABLE 3-2: MASTRIII 800 MHZ BTS COMPONENTS .....	10
TABLE 3-3: SUPPORT EQUIPMENT .....	10
TABLE 3-4: SYSTEM CABLES .....	12
TABLE 5-1: RF POWER REQUIREMENTS.....	14
TABLE 5-2: RF POWER LIMIT .....	14
TABLE 5-3: RF POWER LEVELS .....	15
TABLE 5-4: TEST EQUIPMENT USED FOR RF POWER .....	15
TABLE 5-5: CONDUCTED SPURIOUS EMISSIONS REQUIREMENT .....	15

---

TABLE 5-6: CONDUCTED SPURIOUS EMISSION LIMIT .....	16
TABLE 5-7: CONDUCTED SPURIOUS EMISSIONS .....	16
TABLE 5-8: TEST EQUIPMENT USED FOR CONDUCTED SPURIOUS EMISSIONS .....	17
TABLE 5-9: EMISSION MASK REQUIREMENT .....	17
TABLE 5-10: EMISSION MASK LIMITS .....	18
TABLE 5-11: EMISSION MASK RESULTS .....	19
TABLE 5-12: TEST EQUIPMENT USED FOR EMISSION MASK .....	19
TABLE 5-13: FIELD STRENGTH OF SPURIOUS EMISSIONS REQUIREMENT .....	19
TABLE 5-14: FIELD STRENGTH OF SPURIOUS EMISSIONS LIMIT .....	19
TABLE 5-15: FIELD STRENGTH OF SPURIOUS EMISSIONS .....	21
TABLE 5-16: TEST EQUIPMENT USED FOR FIELD STRENGTH OF SPURIOUS EMISSIONS .....	22
TABLE 5-17: OCCUPIED BANDWIDTH .....	23
TABLE 5-18: OCCUPIED BANDWIDTH VALUES .....	24
TABLE 5-19: TEST EQUIPMENT USED FOR OCCUPIED BANDWIDTH .....	24

# 1. Executive Summary

This test report documents the measurements performed on the M/A-COM MASTRIII 800 MHz Base Station as part of a Class 2 Permissive Change Equipment Certification for its FCC Part 90 and Industry Canada RSS-119 certifications. The equipment modification is the change of supplier for 2 obsolete power amplifier transistors (see Section 3.4).

On the basis of measurements performed in January 2006, the M/A-COM MASTRIII 800 MHz Base Station is verified to remain compliant with FCC Part 90 and Industry Canada RSS-119 requirements. The test data included in this report apply to the product titled above manufactured by M/A-COM, Inc.

The frequency of the band of operation is 851 to 870 MHz.

The FCCID and Industry Canada certification numbers for this equipment are the following:

- FCCID: OWDTR-329-A2
- CANADA: 3636194215

A detailed summary of compliance results is found in Table 2-1: Compliance Results Summary on page 8.

## 2. Compliance Summary

This section summarizes all the measurements performed on the M/A-COM MASTRIII 800 MHz Base Station and its compliance to FCC Part 90, and Industry Canada RSS-119.

**Table 2-1: Compliance Results Summary**

Product Summary					
Product Name:	M/A-COM MASTRIII 800 MHz Base Station	Project Leader:		Denis Lalonde	
Product Code:	TR-329	Measurements by :		Denis Lalonde	
Product Status:		Date:		January 31, 2006	
Test Cases					
Performed	Description	Specification	Test Results		Notes
			Pass	Fail	
■	RF Power	FCC Part 90.205 and 2.1046 RSS-119 sect. 5.4	■	□	
■	Conducted Spurious Emissions	FCC Part 90.210 & 2.1051 RSS-119 sect. 6.3	■	□	
■	Emission Mask	FCC Part 90.210 & 2.1049 RSS-119 sect. 6.4	■	□	
■	Field Strength of Spurious Emissions	FCC Part 90.210 & 2.1053	■	□	
□	Frequency Stability	FCC Part 90.213 and 2.1055 RSS-119 sect. 7	□	□	Note 1
□	Audio Frequency Response	FCC 2.1047	□	□	Note 1
□	Audio Low Pass Filter	FCC 2.1047 RSS-119 sect. 6.6	□	□	Note 1
□	Modulation Limiting	FCC 2.1047	□	□	Note 1
■	Occupied Bandwidth	FCC 2.202 RSP 100 sect. 7.2	■	□	
□	RF Exposure	FCC 1.1310 RSS-119 sect. 9.0	□	□	To be evaluated during licensing of equipment
□	Conducted Emissions Rx port	RSS-119 sect. 8 FCC 15.111	□	□	Note 1

Note 1: these characteristics are not affected by the design change (see Section 3.4)



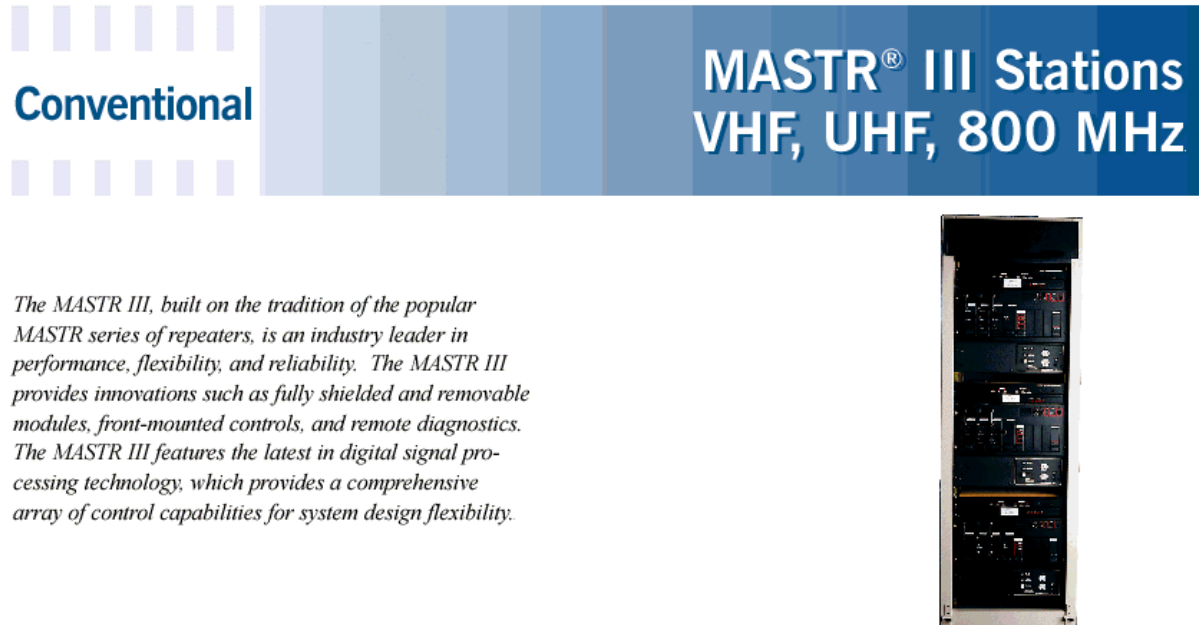
### 3. Equipment Under Test (EUT)

#### 3.1 Product Functional Description

The product trade name of the unit tested is the “M/A-COM MASTRIII 800 MHz Base Station”.

Figure 3-1 provides a brief description of the tested product.

Figure 3-1 Product Description



#### 3.2 Manufacturer Information

Company Name	M/A-COM, Inc.
Mailing Address	221 Jefferson Ridge Parkway, Lynchburg, Virginia, U.S.A., 24501
Product Name	the M/A-COM MASTRIII 800 MHz Base Station

#### 3.3 Transmitter Specifications

Table 3-1 lists the specifications of the transmitter under test

Table 3-1: Transmitter Specifications

Circuit Pack	Fundamental Frequencies (MHz)
Tx power	10 to 100 W
Tx frequency	851 to 870 MHz
Channel spacing	851 – 866 MHz: 25 kHz 866 – 869 MHz: 12.5 kHz (NPSPAC)

### 3.4 Equipment Modification

The final LDMOS transistors of the power amplifier (Q1 in the Final Pallet assembly, used twice per unit) have been changed from MRF184 (Motorola) to SD57060 (ST Microelectronics). No PCB artwork have been changed and no schematic changes have been made; the parts list is updated with the new device.

### 3.5 System Components

The system tested consists of the following units, as shown in Table 3-2.

**Table 3-2: MASTRIII 800 MHZ BTS Components**

Component		Model	Serial Number
MASTRIII shelf		19D902839G2	NR
Tx Synthesizer module		19D902780G5	SLR 02090631
Rx Synthesizer module		19D902781G5	SLR 03102203
Rx Front End module		19D902782G5	SLR 03182064
IF module		19D902783G5	SLR04110636
System module		19D902590G6	SLR 02512492
Power module		19D902589G2	CKA 01390368
Linear Power supply		19A149979P1	31725690
SitePro shelf		EA101209V1 R1B	SLR 02190892
	SSI	CB101869V1/R1A	NR
	Controller board	CB101069V2 P3A	NR
	Analog board	CB10170V1 R6A	NR
RF Power Amplifier		EA101292V1 rev PB	Prototype 2

NR: Not required

### 3.6 Support Equipment

The support equipment used for operation and monitoring of the EUT is described in Table 3-3.

**Table 3-3: Support Equipment**

Description	Model Number
IBM Thinkpad PC	600E

### 3.7 System Set-up and Test Configurations

The system configuration used for all test cases is presented in Figure 3-2 and Figure 3-3.

Figure 3-2: Module Configuration

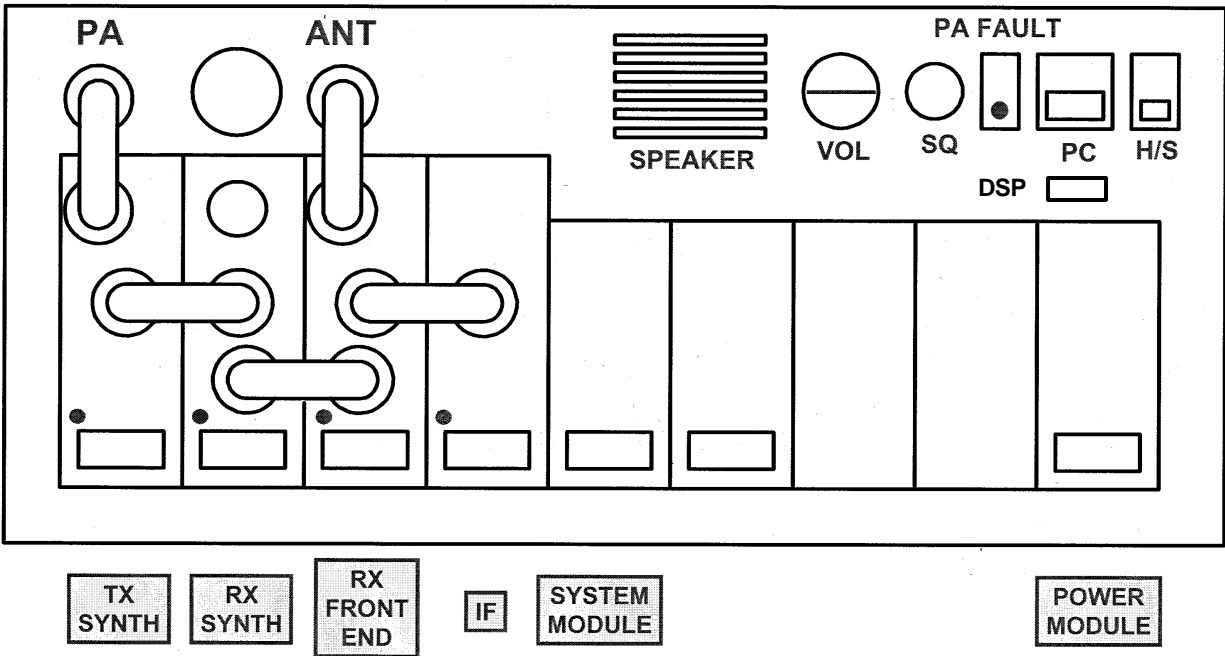
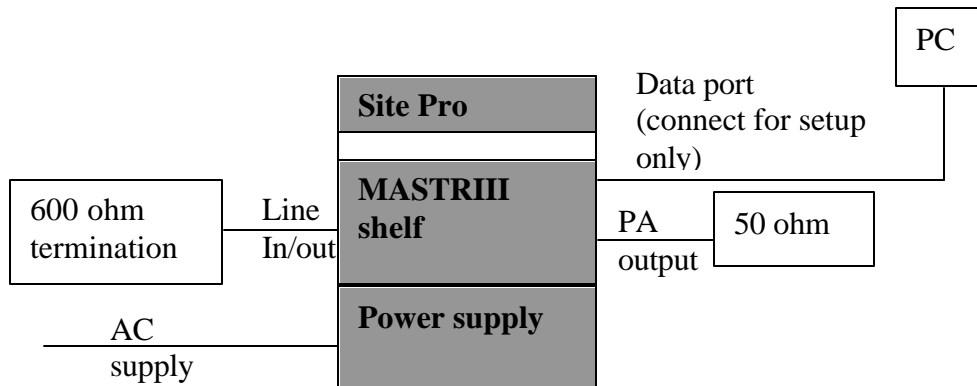


Figure 3-3: System Configuration



A photograph of the test setup used in this test report is presented in Appendix B: Test Set-up Photographs, on page 27.

### 3.8 EUT Interfaces and Cables

The system contains the following interfaces, as shown in Table 3-4.

**Table 3-4: System Cables**

Interface Type	EUT Connection	Description	Type	Length	Qty
AC Mains	AC power supply	3 wire AC cord	unshielded	6 feet	1
Telephone line in/out	MASTRIII shelf	2 twisted pair	unshielded	6 feet	1

### 3.9 System Modifications

No modifications were required to pass the requirements.

## 4. General Test Conditions

### 4.1 Test Facility

Radiated emissions testing was performed in a 10-meter Ambient Free Chamber (AFC) located at 21 Richardson Side road, Kanata, Ontario, Canada. The AFC consists of a shielded room lined with ferrite tiles and anechoic material.

These test facilities are accredited by the Standards Council of Canada (SCC) [1]. Through a Mutual Recognition Agreement (MRA) between the National Voluntary Laboratory Accreditation Program (NVLAP) and SCC, the accreditation status of the AFC facility is valid for the U.S.

### 4.2 Measurement Instrumentation

The measurement instrumentation conforms to ANSI C63.2 [5] and CISPR 16 [6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

## 5. Detailed Test Results

### 5.1 RF Power

#### 5.1.1 Test Specification

The system was tested to the requirements listed in Table 5-1:

**Table 5-1: RF Power Requirements**

Requirement	Part / Section
FCC	90.205, 2.1046
RSS-119	5.4

##### 5.1.1.1 Limits

The system was tested to the rated power of the EUT, listed in Table 5-2.

**Table 5-2: RF Power Limit**

Rated power
10 to 100 W

#### 5.1.2 Test Facility Information

**Location:** Soletron Design and Engineering Lab 1  
**Date tested:** January 26, 2006  
**Tested by:** Denis Lalonde

#### 5.1.3 Test Procedure

The output of the power amplifier was connected to a power meter using a calibrated RF attenuator and cable.

The unmodulated RF signal was set at the bottom, middle, and top of the frequency band. The lowest and highest possible power levels were evaluated.

## 5.1.4 Test Results

Test results are shown in Table 5-3.

Table 5-3: RF Power Levels

Channel (MHz)	Low Power (dBm)	Hi Power (dBm)
851.0125	40.0	50.0
860.0	40.2	50.0
869.9875	40.1	50.0

## 5.1.5 Test Conclusion

The test results meet the requirements defined in Table 5-1: RF Power Requirements.

## 5.1.6 Test Equipment List

Table 5-4: Test Equipment Used for RF Power

Category	Manufacture	Model Number	Description	Serial Number	Cal. Due
Attenuator	Weinschel	53-20-33	20 dB, 500 W	SSG012589	22-Apr-2006
Attenuator	Weinschel	6070-10	10 dB, 25 W	SSG012140	23-Sep-2006
Power meter	Anritsu	M2438A	Power meter	SSG012588	19-Apr-2006
Power sensor	Anritsu	M2424A	Power sensor	SSG012587	22-Apr-2006

The measurement instrumentation conforms to ANSI C63.2[5] and CISPR 16 [6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

## 5.2 Conducted Spurious Emissions

### 5.2.1 Test Specification

The system was tested to the limits of the requirements listed in Table 5-5:

Table 5-5: Conducted Spurious Emissions Requirement

Requirement	Part / Section
FCC	90.210, 2.1051
RSS-119	6.3

### 5.2.1.1 Limits

The following specification levels are applicable to this test:

**Table 5-6: Conducted Spurious Emission Limit**

Frequency Range (MHz)	Limit (dBm)
30 to 8700	-13 dBm

The limit is calculated in section 5.4.

### 5.2.2 Test Facility Information

**Location:** Soletron Design and Engineering Lab 1  
**Date tested:** January 27 and 30, 2006  
**Tested by:** Denis Lalonde

### 5.2.3 Test Procedure

Conducted spurious emissions were measured at the bottom and top of the 851 to 870 MHz frequency band. The measurement was repeated while the power amplifier was operating at 10 W and 100 W.

The signal used for measurements at 851.0125 MHz was a pseudo-random signal (9600 baud with +/-3000 Hz deviation). The signal used at 869.9875 MHz was a NPSPAC pseudo-random signal (2 level, 9600 baud with +/-2400 Hz deviation).

The measurement was separated in 3 frequency bands;

1. 30 MHz to 1 GHz: the power amplifier output is connected to the spectrum analyzer through a 10 dB and a 20 dB attenuator.
2. 1 GHz to 2.75 GHz: the power amplifier output is connected to the spectrum analyzer through a 10 dB attenuator and a notch filter.
3. 2.75 GHz to 8.7 GHz: the power amplifier output is connected to the spectrum analyzer through a 10 dB attenuator and a high-pass filter.

### 5.2.4 Test Results

The test result are shown in Table 5-7.

**Table 5-7: Conducted Spurious Emissions**

Channel (MHz)	Highest Emission Low Power Mode (dBm)	Highest Emission Hi Power Mode (dBm)	Reference
851.0125	-33.8 dBm	-24.8 dBm	Figure 7-2 to Figure 7-7
869.9875	-34.5 dBm	-24.7 dBm	Figure 7-8 to Figure 7-13



## 5.2.5 Test Conclusion

The test results meet the requirements defined in Table 5-5: Conducted Spurious Emissions Requirement.

## 5.2.6 Test Equipment List

**Table 5-8: Test Equipment used for Conducted Spurious Emissions**

Category	Manufacture	Model Number	Description	Serial Number	Cal. Due
Attenuator	Weinschel	53-20-33	20 dB, 500 W	SSG012589	22-Apr-2006
Attenuator	Weinschel	6070-10	10 dB, 25 W	SSG012140	23-Sep-2006
Spectrum analyzer	HP	8564A	40 GHz	SSG012069	21-Apr-2006
High Pass filter	FSY Microwave	HR2380-11XNXN	2.5 GHz high pass	002	NR
Notch filter	Wainwright Instruments	WRCAS915/960-0.2/40-6EE	Tunable notch filter	1	NR
Signal generator	Anritsu	69369A	40 GHz	SSG012138	21-Sep-2006

NR: not required, these units were calibrated using the Signal Generator and the Spectrum Analyzer

The measurement instrumentation conforms to ANSI C63.2[5] and CISPR 16 [6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

## 5.3 Emission Mask

### 5.3.1 Test Specification

The system was tested to the limits of the requirements listed in Table 5-9:

**Table 5-9: Emission Mask Requirement**

Requirement	Part / Section
FCC	90.210, 2.1049
RSS-119	6.4

#### 5.3.1.1 Limits

The specification levels in Table 5-10 were used.

**Table 5-10: Emission Mask Limits**

Frequency Range (MHz)	Audio modulation	2 level/9600 baud modulation, C4FM modulation, NPSPAC modulation
851 to 866	Mask B	Mask G
866 to 869	Mask B	Mask H

### 5.3.2 Test Facility Information

**Location:** Solelectron Design and Engineering Lab 1

**Date tested:** January 26 and 27, 2006

**Tested by:** Denis Lalonde

### 5.3.3 Test Procedure

Two emission mask measurements were performed at 860 MHz and two at 869.9875 MHz. The four different modulated signals were evaluated as follows:

1. Analog signal: the power amplifier output was modulated with a 2500 Hz signal which had a level 16 dB higher than what was required to produce a deviation of 50% of rated system deviation (5 kHz) at 1 kHz. Tested at 860 MHz.
2. Two level/9600 baud modulation: the power amplifier output was modulated with a 2 level 9600 baud pseudo-random signal which had the level required for +/- 3 kHz deviation. Tested at 860 MHz.
3. NPSPAC modulation (9600 baud): the power amplifier output was modulated with a 2 level 9600 baud pseudo-random signal which had the level required for +/- 2.4 kHz deviation. Tested at 869.9875 MHz.
4. NPSPAC modulation (analog) : the power amplifier output was modulated with a 2500 Hz signal which had a level 16 dB higher than what was required to produce a deviation of 50% of rated system deviation (4 kHz) at 1 kHz. Tested at 869.9875 MHz.

For all of these measurements, the power amplifier output was connected to the spectrum analyzer through a 10 dB and a 20 dB attenuator.

### 5.3.4 Test Results

Table 5-11 lists the modulation modes measured:

**Table 5-11: Emission Mask Results**

Type of signal	Test result	Reference
2500 Hz Audio	Pass	Figure 7-14
2 level 9600 baud / 3 KHz deviation	Pass	Figure 7-15
NPSPAC (9600 baud)	Pass	Figure 7-16
NPSPAC (analog)	Pass	Figure 7-17

### 5.3.5 Test Conclusion

The test results meet the requirements defined in Table 5-9: Emission Mask Requirement.

### 5.3.6 Test Equipment List

**Table 5-12: Test Equipment used for Emission Mask**

Category	Manufacture	Model	Description	Serial Number	Cal. Due
Attenuator	Weinschel	53-20-33	20 dB, 500 W	SSG012589	22-Apr-2006
Attenuator	Weinschel	6070-10	10 dB, 25 W	SSG012140	23-Sep-2006
Spectrum analyzer	HP	8564A	40 GHz	SSG012069	21-Apr-2006

The measurement instrumentation conforms to ANSI C63.2[5]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

## 5.4 Field Strength of Spurious Emissions

### 5.4.1 Test Specification

The system was tested to the limits of the following requirements:

**Table 5-13: Field Strength of Spurious Emissions Requirement**

Requirement	Part / Section
FCC	90.210, 2.1053

#### 5.4.1.1 Limits

The following specification levels are worst-case limits taken from all test specifications.

**Table 5-14: Field Strength of Spurious Emissions Limit**

Frequency Range (MHz)	ERP Limit (dBm)
30 to 8700	-13

The ERP limit was calculated using the minimum attenuation requirement of FCC 90.210 d)3).

$$\begin{aligned}\text{Attenuation} &= 43 + 10 \log (P) \text{ dB} \\ &= 43 + 10 \log (100) \\ &= 63 \text{ dB}\end{aligned}$$

$$\begin{aligned}\text{ERP limit} &= 10 \log (100 \text{ W}) - 63 \text{ dB} \\ &= -13 \text{ dBm}\end{aligned}$$

When operating at 10 W, the ERP limit for spurious emissions is also – 13 dBm.

## 5.4.2 Test Facility Information

**Location:** Soletron Design and Engineering 10m Ambient Free Chamber  
**Date tested:** January 31, 2006  
**Tested by:** W. Kwong and D. Lalonde

## 5.4.3 Test Procedure

Verifications of the test equipment and AFC were performed prior to the installation of the EUT in accordance with the quality assurance procedures in KP000270-LP-EMC-01-06 [7]. The test was performed as per the relevant test procedures in ANSI C63.4 [4]:

The system was tested in the following manner:

- The EUT was placed on a turntable inside the AFC and it was configured as in normal operation. The system and its cables were separated from the ground plane by an insulating support 10 mm in height. The system was grounded in accordance with its normal installation specifications. No additional grounding connections are allowed.
- For tests between 30 MHz and 1 GHz a broadband bilog antenna was placed at a 10 m distance; a horn antenna, placed also at 10 m distance from the EUT, was used for measurements between 1 GHz and 9 GHz.
- A pre-scan was performed to find emissions (frequencies) requiring detail measurement. The pre-scan (using a peak detector) was performed by rotating the system 360 degrees while recording all emissions (frequency and amplitude). This procedure was repeated for antenna heights of 1 to 4 meters, in steps of 1 meter, and for horizontal and vertical polarizations of the receiving antenna (for measurements above 30 MHz).
- Prescan optimization was performed based on the pre-scan data. All frequencies, having emission levels within 10 dB of the specification(s) limits, were optimized. For each such frequency, the EUT was rotated in azimuth over 360 degrees and the direction of maximum emission was noted. Antenna height was then varied from 1 to 4 meters at this azimuth to obtain maximum emissions. The procedure was repeated for both horizontal and vertical polarizations of the search antenna. Then the maximum level measured was recorded.

- The frequency range investigated was 30 MHz to 9 GHz.
- Between 30 MHz and 1 GHz, a resolution bandwidth of 120 kHz was used.
- Above 1 GHz, a 1 MHz resolution bandwidth was used.
- The highest emissions were evaluated using the substitution method. This is accomplished by replacing the EUT by a calibrated antenna, cable and signal generator. This equipment is used to transmit a signal that will generate a RF meter reading level identical to the one recorded when the EUT was present. The signal generator power level, the calibration data of the cable and antenna is then used to evaluate the Effective Radiated Power (ERP) of the EUT. The following formula is used:

$$\text{ERP} = \text{Signal generator level} - \text{Cable losses} + \text{Antenna gain (dBi)} - \text{Gain of tuned dipole (dBi)}$$

$$\text{Margin} = \text{Limit} - \text{ERP}$$

The measurement was performed while the power amplifier was operating at 10 W and 100 W. A 9600 baud 2 level digital signal at 860 MHz was used for this test. A 50 ohm load was connected to the power amplifier output.

#### 5.4.4 Test Results

Table 5-15 lists the highest emissions measured while the transmitter was set to 100 W, all other emissions had more than 20 dB margin. The levels of measurements performed at 10 W were all lower than recorded in Table 5-15.

**Table 5-15: Field Strength of Spurious Emissions**

Freq. of Emission (MHz)	Signal Generator Level Hi Power (dBm)	Antenna Gain (dBi)	Cable losses (dB)	ERP Hi Power (dBm)	Margin (dB)	Reference
1720	-29.4	8.4	1.5	-24.7	11.7	Figure 7-18 to Figure 7-19
2153.53	-25.3	8.8	1.8	-20.5	7.5	Figure 7-18 to Figure 7-19
2580	-28.3	9.6	1.9	-22.8	9.8	Figure 7-18 to Figure 7-19
3440	-48.7	9.8	2.2	-43.3	30.3	Figure 7-18 to Figure 7-19
4300	-35.3	10.4	2.5	-29.6	16.6	Figure 7-18 to Figure 7-19
5160	-40.1	10.7	2.6	-34.2	21.2	Figure 7-18 to Figure 7-19
6020	-29.7	11.3	2.7	-23.3	10.3	Figure 7-18 to Figure 7-19
7740	-38.3	11.3	3.2	-32.4	19.4	Figure 7-18 to Figure 7-19
8600	-42.1	11.5	3.3	-36.1	23.1	Figure 7-18 to Figure 7-19

## 5.4.5 Test Conclusion

The test results met the requirement as defined in Table 5-13: Field Strength of Spurious Emissions Requirement.

## 5.4.6 Test Equipment List

**Table 5-16: Test Equipment used for Field Strength of Spurious Emissions**

Description	Make	Model Number	Asset Number	Cal. Due
Bilog Antenna	Antenna Research	LPB 2520A	SSG012299	1/3/2007
Spectrum Analyzer, HP8566B, (AFC #1)	HP	8566B	SSG012521	4/21/2006
Spec. A, RF PreSelector, HP85685A (AFC #1)	HP	85685A	SSG012010	4/21/2006
EMC Cable # 25, Sucotest Cable	Huber + Suhner	ST18/Nm/Nm/36	SSG012788	2/8/2006
Double Ridged Horn	Emco	3115	SSG012508	12/21/2006
Power Supply	HP	6216A	SSG013063	2/11/2007
Pre-Amplifier	BNR	LNA	SSG012360	2/10/2006
Quasi-Peak Adapter, HP85650A, (EMI # 2)	HP	85650A	SSG013046	9/22/2006
RF Amplifier, HP8447 # 2	HP	8447D	SSG012405	2/8/2006
EMC Cable # 5, Sucoflex Cable	Huber & Suhner	104PEA	SSG012359	2/10/2006
EMC Cable # 3, Sucoflex Cable	Huber & Suhner	106A	SSG012455	2/9/2006
EMC Cable # 2, Sucoflex Cable	Huber & Suhner	106A	SSG012453	2/9/2006
EMC Cable # 4, Utiflex Cable	Micro-Coax	UFA 147B-1-0300-70X70	SSG012309	9/22/2006
Spectrum Analyzer Display, HP 85662A	HP	85662A	SSG012433	4/21/2006

The measurement instrumentation conforms to ANSI C63.2[5] and CISPR 16 [6]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.

## 5.5 Occupied Bandwidth

### 5.5.1 Test Specification

The system occupied bandwidth was evaluated according to the specifications listed in Table 5-17:

**Table 5-17: Occupied Bandwidth**

Requirement	Part / Section
FCC	2.202
RSP-100	7.2

### 5.5.2 Test Facility Information

**Location:** Soletron Design and Engineering Lab 1  
**Date tested:** January 26 and 27, 2006  
**Tested by:** Denis Lalonde

### 5.5.3 Test Procedure

Two occupied bandwidth measurements were performed at 860 MHz and two at 869.9875 MHz. The four different modulated signals were evaluated as follows:

1. Analog signal: the power amplifier output was modulated with a 2500 Hz signal which had a level 16 dB higher than what was required to produce a deviation of 50% of rated system deviation (5 kHz) at 1 kHz. Tested at 860 MHz.
2. Two level/9600 baud modulation: the power amplifier output was modulated with a 2 level 9600 baud pseudo-random signal which had the level required for +/- 3 kHz deviation. Tested at 860 MHz.
3. NPSPAC modulation (9600 baud): the power amplifier output was modulated with a 2 level 9600 baud pseudo-random signal which had the level required for +/- 2.4 kHz deviation. Tested at 869.9875 MHz.
4. NPSPAC modulation (analog) : the power amplifier output was modulated with a 2500 Hz signal which had a level 16 dB higher than what was required to produce a deviation of 50% of rated system deviation (4 kHz) at 1 kHz. Tested at 869.9875 MHz.

For all of these measurements, the power amplifier output was connected to the spectrum analyzer through a 10 dB and a 20 dB attenuator.

The occupied bandwidth was measured using the 99% bandwidth measuring feature of the spectrum analyzer.

### 5.5.4 Test Results

The table below lists the calculated and measured occupied bandwidth.

**Table 5-18: Occupied bandwidth values**

Type of signal	Calculation	Measurement (kHz)	Currently Used Emission Designators
Audio	Max. modulation (M) = 3 kHz Max. deviation (D) = 5 kHz K = 1 $B_n = 2M + 2DK$ Bn = 16 kHz	10.7 kHz Figure 7-20 (measured with 2.5 kHz tone)	16K0F3E
2 level 9600 baud / 3 KHz deviation	Max. modulation (B) = 9.6 kHz Max. deviation (D) = 3 kHz K = 1 $B_n = B + 2DK$ Bn = 15.6 kHz	11.0 kHz Figure 7-21	16K0F1D 16K0F1E
NPSPAC (9600 baud)	Max. modulation (B) = 9.6 kHz Max. deviation (D) = 2.4 kHz K = 1 $B_n = B + 2DK$ Bn = 14.4 kHz	10.8 kHz Figure 7-22	15K0F1D 15K0F1E
NPSPAC (analog)	Max. modulation (M) = 3 kHz Max. deviation (D) = 4 kHz K = 1 $B_n = 2M + 2DK$ Bn = 14 kHz	10.5 kHz Figure 7-23 (measured with 2.5 kHz tone)	14K0F3E

## 5.5.5 Test Equipment List

**Table 5-19: Test Equipment used for Occupied bandwidth**

Category	Manufacture	Model	Description	Serial Number	Cal. Due
Attenuator	Weinschel	53-20-33	20 dB, 500 W	SSG012589	22-Apr-2006
Attenuator	Weinschel	6070-10	10 dB, 25 W	SSG012140	23-Sep-2006
Spectrum analyzer	HP	8564A	40 GHz	SSG012069	21-Apr-2006

The measurement instrumentation conforms to ANSI C63.2[5]. Calibration of the measurement instrumentation is maintained in accordance with the supplier's recommendations, or as necessary to ensure its accuracy.



## 6. References

1. Standards Council of Canada, Scope of Accreditation for Solelectron EMS Canada Inc. outlined at the following web site [http://palcan.scc.ca/specs/pdf/95\\_e.pdf](http://palcan.scc.ca/specs/pdf/95_e.pdf).
2. Solelectron EMS Canada Inc. Quality Manual, K0000608-QD-QM-01-07, 2004.
3. Solelectron EMS Canada Inc. Lab Operations Manual KG000347-QD-LAB-01-05, 2004.
4. ANSI C63.4-2001, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz, 17 June 2001.
5. ANSI C63.2-1996, American National Standard for Electromagnetic Noise and Field Strength Instrumentation, 10 Hz to 40 GHz – Specifications.
6. CISPR 16-1, Specification for Radio Disturbance and Immunity Measuring Apparatus and Methods - Part 1: Radio Disturbance and Immunity Measuring Apparatus, Edition 2.0, 1999-10.
7. Solelectron EMS Canada Inc., EMC General Lab Test Procedure, KP000270-LP-EMC-01-06, April 20<sup>th</sup>, 2005.
8. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 2, U.S. Federal Communications Commission.
9. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 22, U.S. Federal Communications Commission.
10. FCC Rules for Radio Frequency Devices, Title 47 of the Code of Federal Regulations), Part 90, U.S. Federal Communications Commission.
11. RSS-119, Issue 6, “Land Mobile and Fixed Radio, Transmitters and Receivers, 27.41 to 960 MHz” March 25, 2000.
12. ANSI/TIA-603-B-2002, “Land Mobile FM or PM Communications Equipment Measurement and Performance Standards”, November 7, 2002
13. VCCI, V-3/02.04 16th edition, April 2002. Title: AGREEMENT OF VOLUNTARY CONTROL COUNCIL FOR INTERFERENCE BY INFORMATION TECHNOLOGY EQUIPMENT
14. APLAC, Asia Pacific Laboratory Accreditation Cooperation, Website (February 10<sup>th</sup>, 2004): <http://www.aplac.org>.
15. ILAC, International Laboratory Accreditation Cooperation, Website (February 10<sup>th</sup>, 2004): <http://www.ilac.org/>
16. Industry Canada, RSS 212, Test Facilities and Test Methods for Radio Equipment, Issue 1 (Provisional), February 27, 1999.

## 7. Appendices

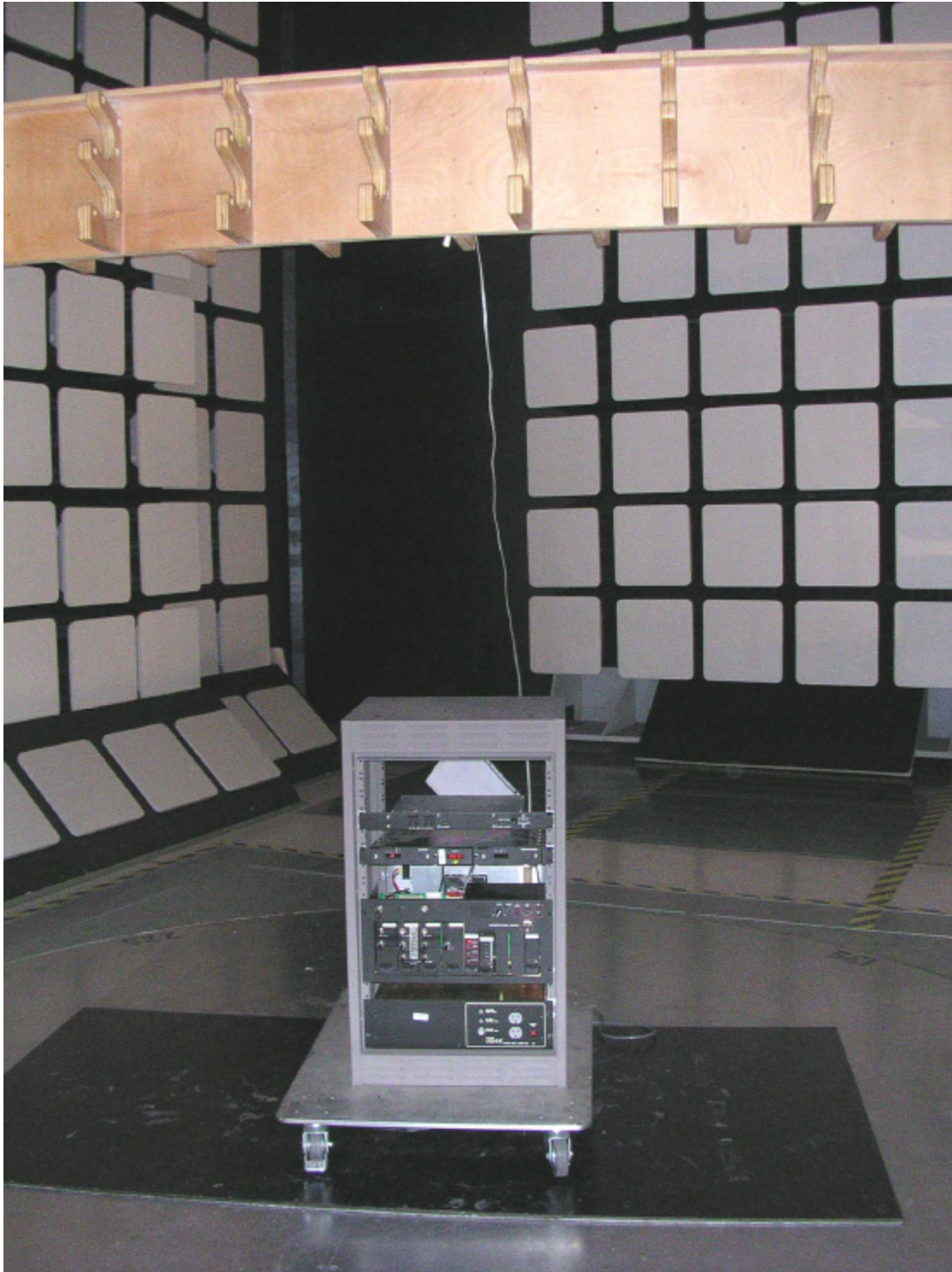
### 7.1 Appendix A: Glossary

Included below are definitions and abbreviations of terms used in this document.

Term	Definition
AC	Alternating Current
AFC	Ambient Free Chamber
AM	Amplitude modulation
ANSI	American National Standards Institute
AVG	Average detector
CISPR	Comité International Spécial Perturbation Radioélectrique (International Special Committee on Radio Interference)
Class A	Class A Limits for typical commercial establishments
Class B	Class B Limits for typical domestic and residential establishments
dB	Decibel
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Normative
EUT	Equipment Under Test
FCC	Federal Communications Commission, USA
GND	Ground
IC	Industry Canada
PA	Broadband Power Amplifier
RBW	Resolution Bandwidth
RF	Radio-Frequency
RFI	Radio-Frequency Interference
SCC	Standards Council of Canada

## 7.2 Appendix B: Test Set-up Photographs

Figure 7-1: M/A-COM MASTRIII 800 MHz Base Station Radiated Emissions Set-up



## 7.3 Appendix C: Conducted Spurious Emissions Plots

Figure 7-2: Tx at 851.0125 MHz, 100 W Power, 30 MHz to 1 GHz

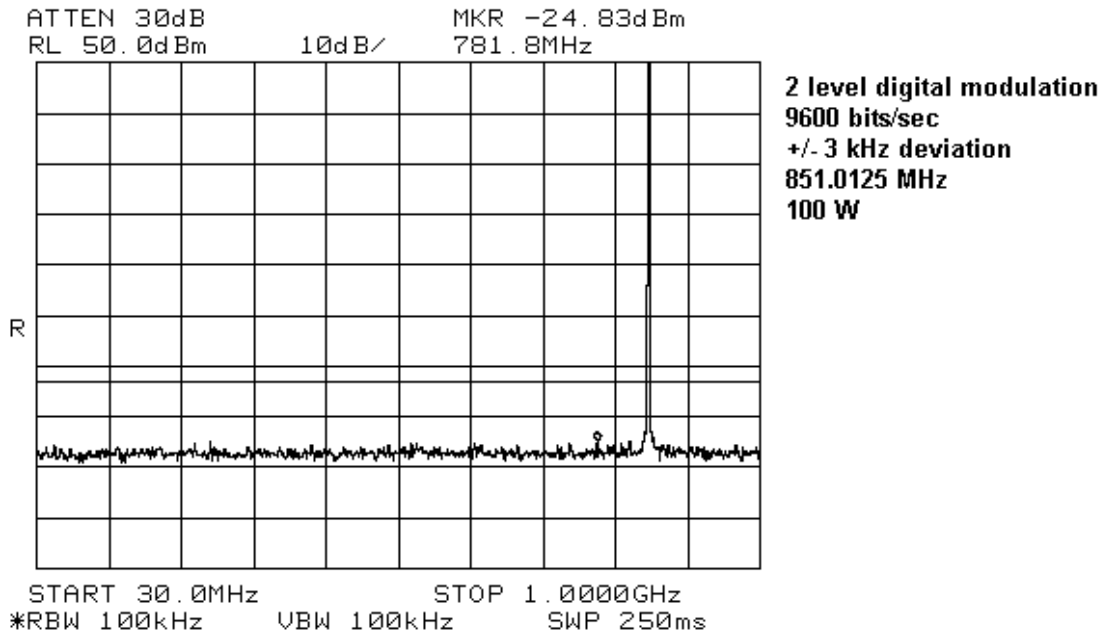
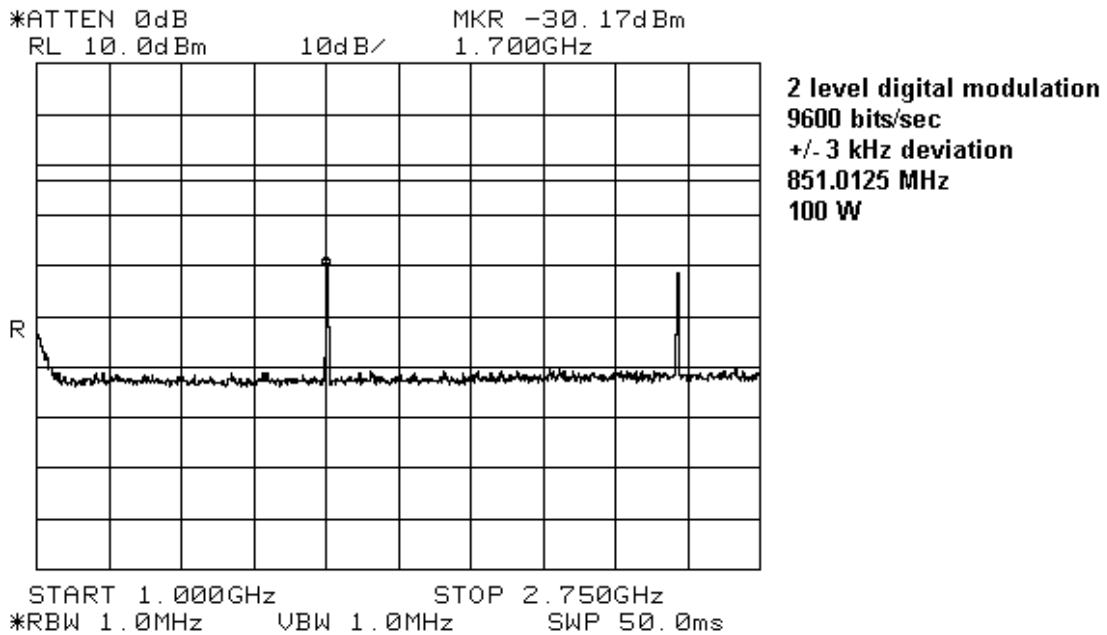


Figure 7-3: Tx at 851.0125 MHz, 100 W Power, 1 GHz to 2.75 GHz



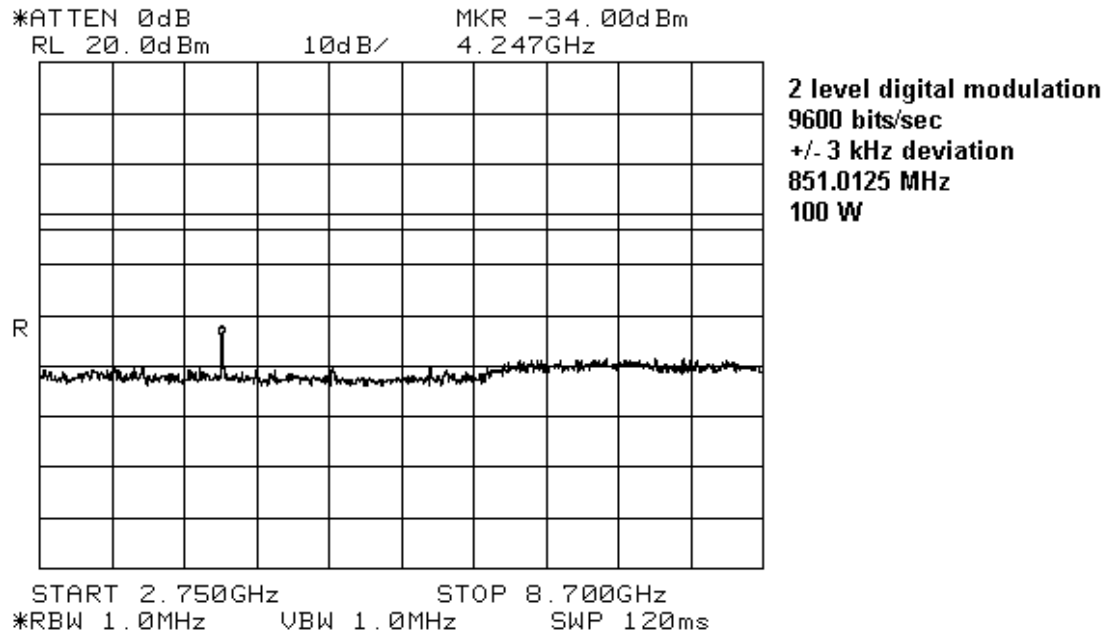
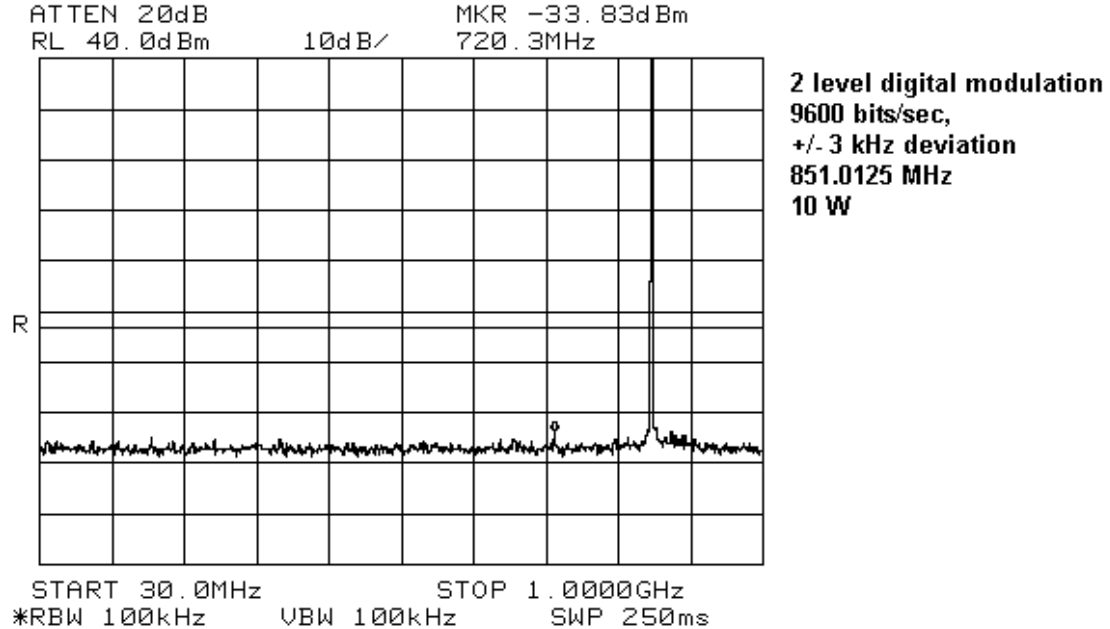
**Figure 7-4: Tx at 851.0125 MHz, 100 W Power, 2.75 GHz to 8.7 GHz****Figure 7-5: Tx at 851.0125 MHz, 10 W Power, 30 MHz to 1 GHz**

Figure 7-6: Tx at 851.0125 MHz, 10 W Power, 1 GHz to 2.75 GHz

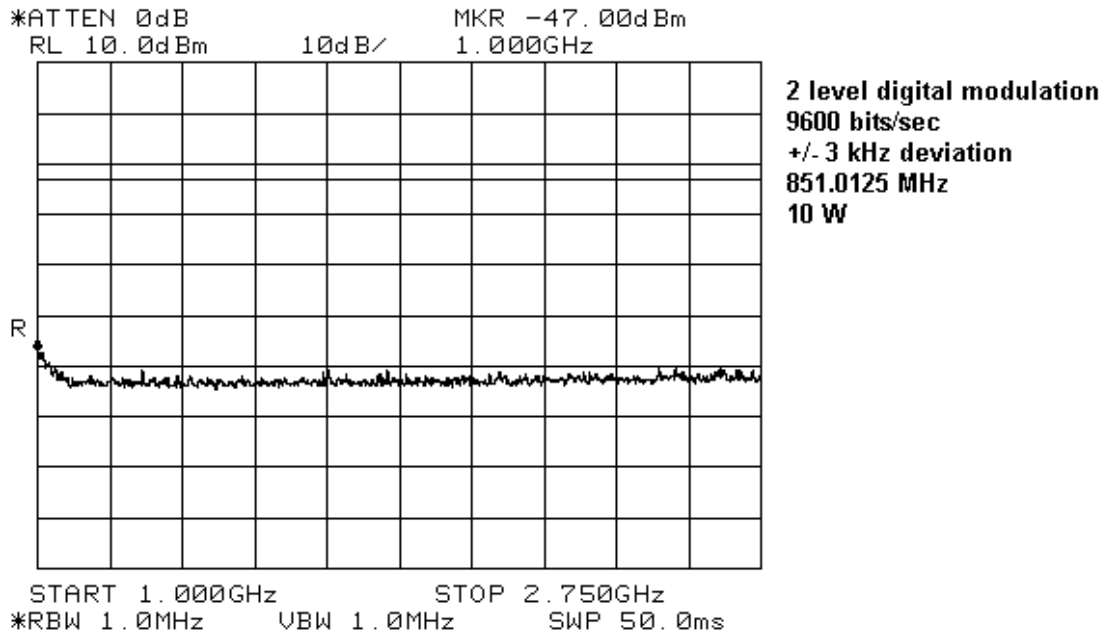


Figure 7-7: Tx at 851.0125 MHz, 10 W Power, 2.75 GHz to 8.7 GHz

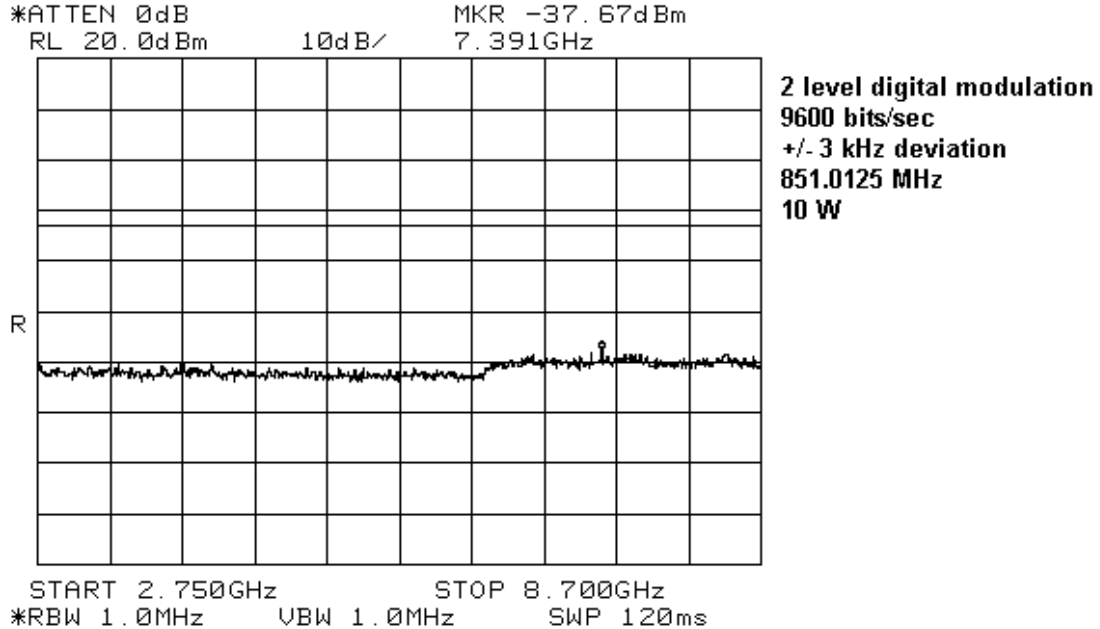


Figure 7-8: Tx at 869.9875 MHz, 100 W Power, 30 MHz to 1 GHz

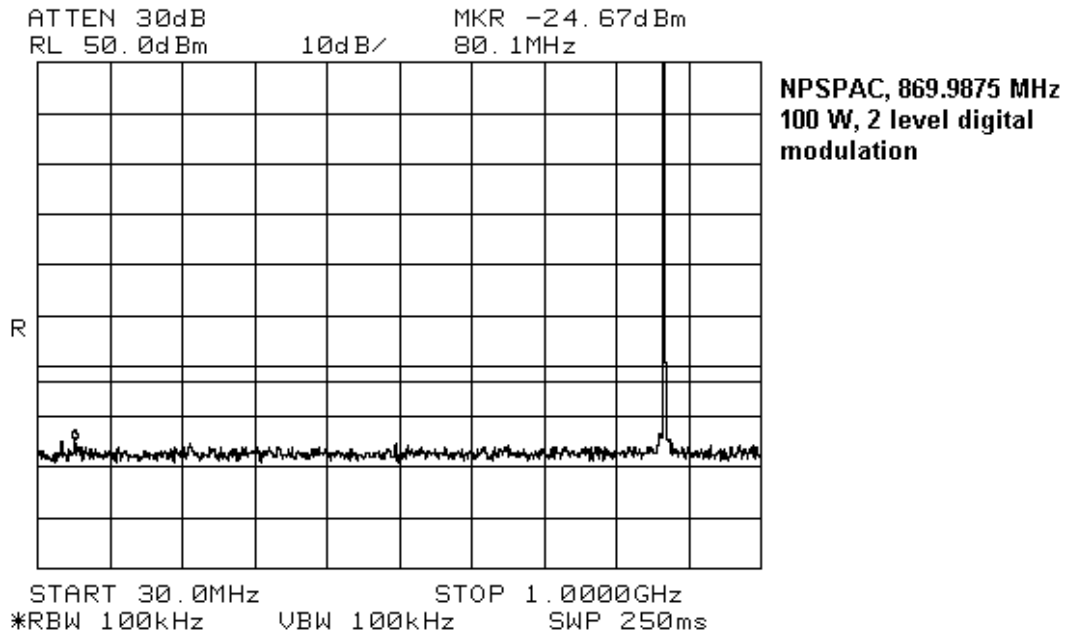


Figure 7-9: Tx at 869.9875 MHz, 100 W Power, 1 GHz to 2.75 GHz

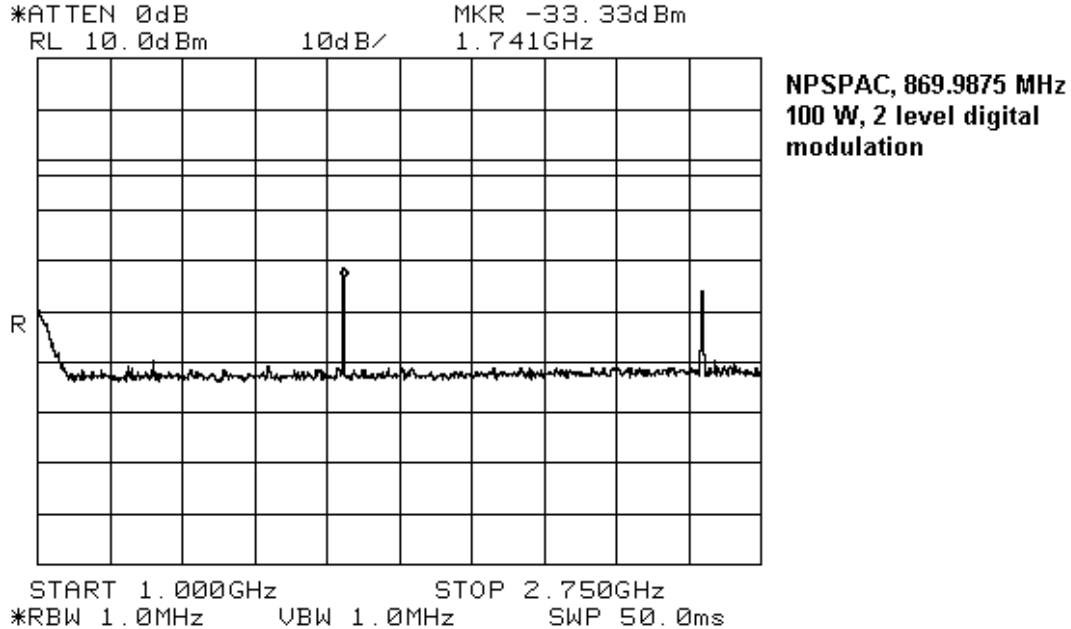


Figure 7-10: Tx at 869.9875 MHz, 100 W Power, 2.75 GHz to 8.7 GHz

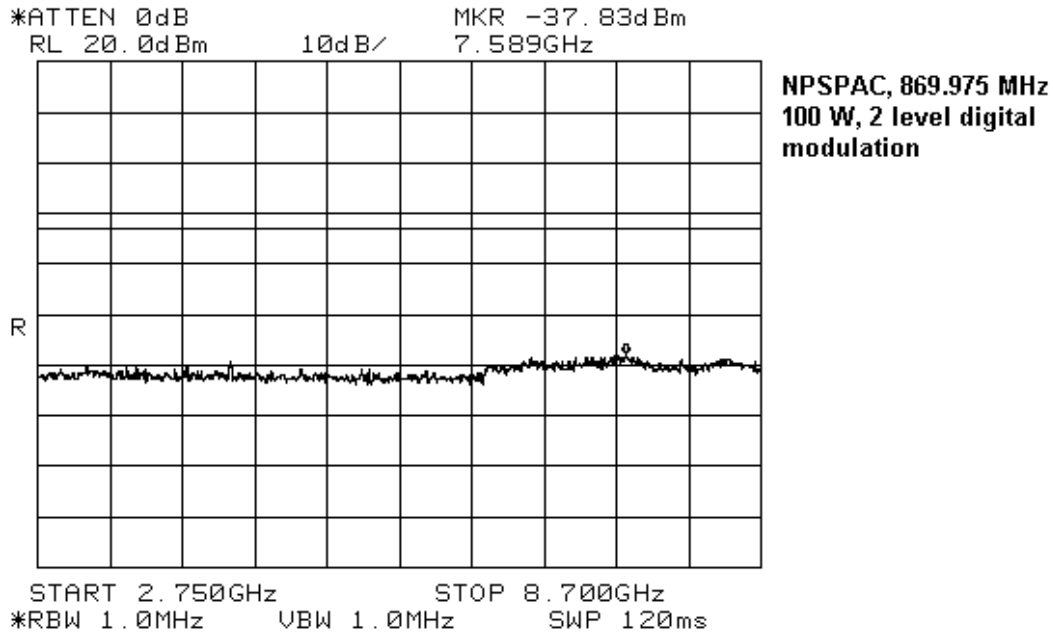


Figure 7-11: Tx at 869.9875 MHz, 10 W Power, 30 MHz to 1 GHz

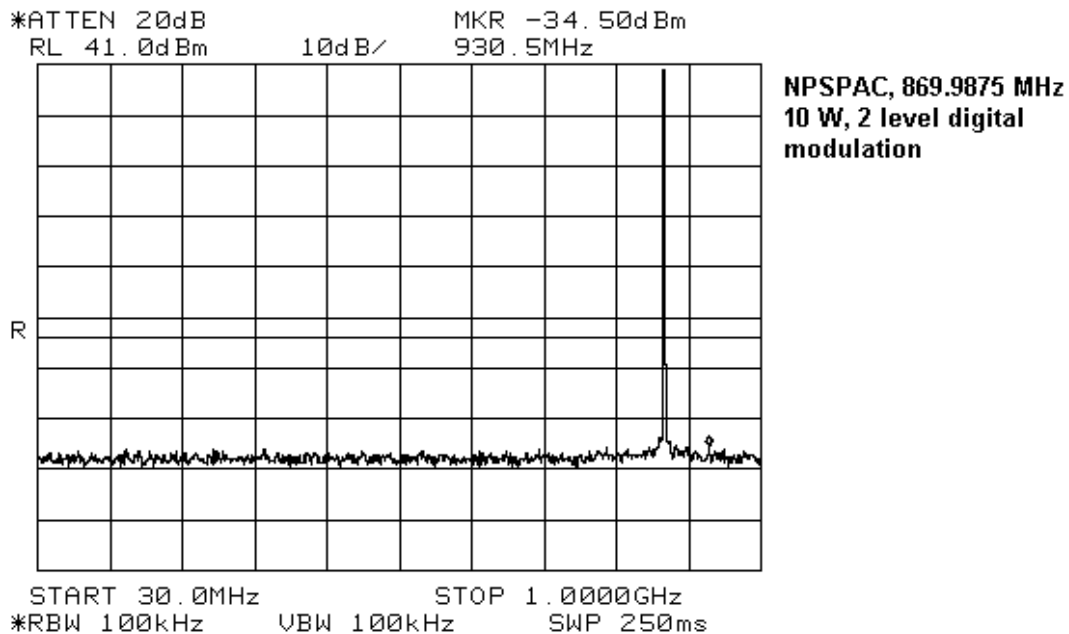




Figure 7-12: Tx at 869.9875 MHz, 10 W Power, 1 GHz to 2.75 GHz

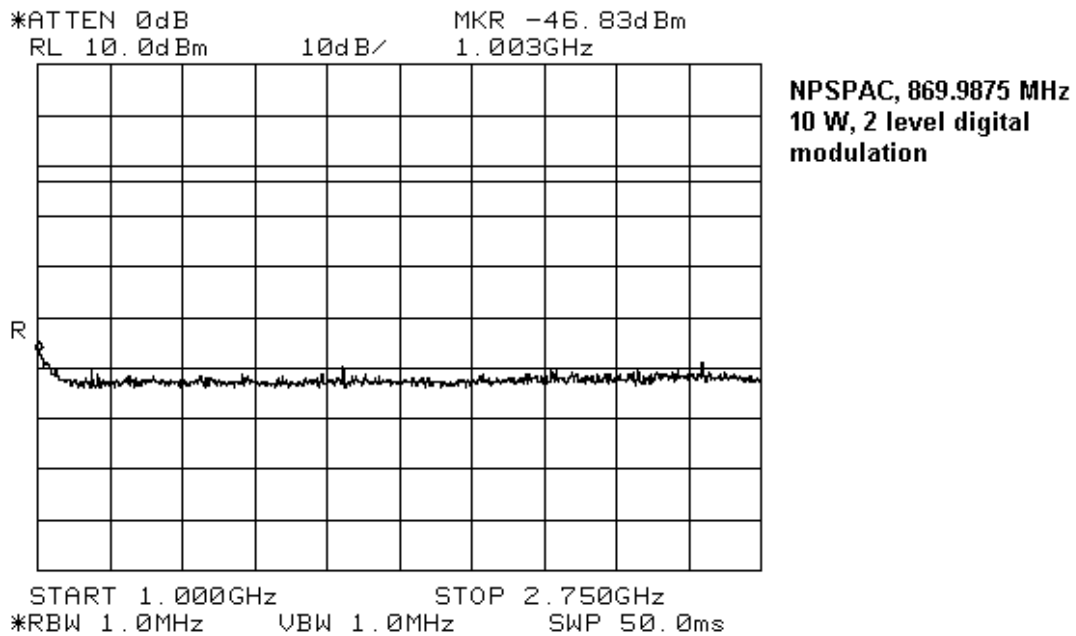
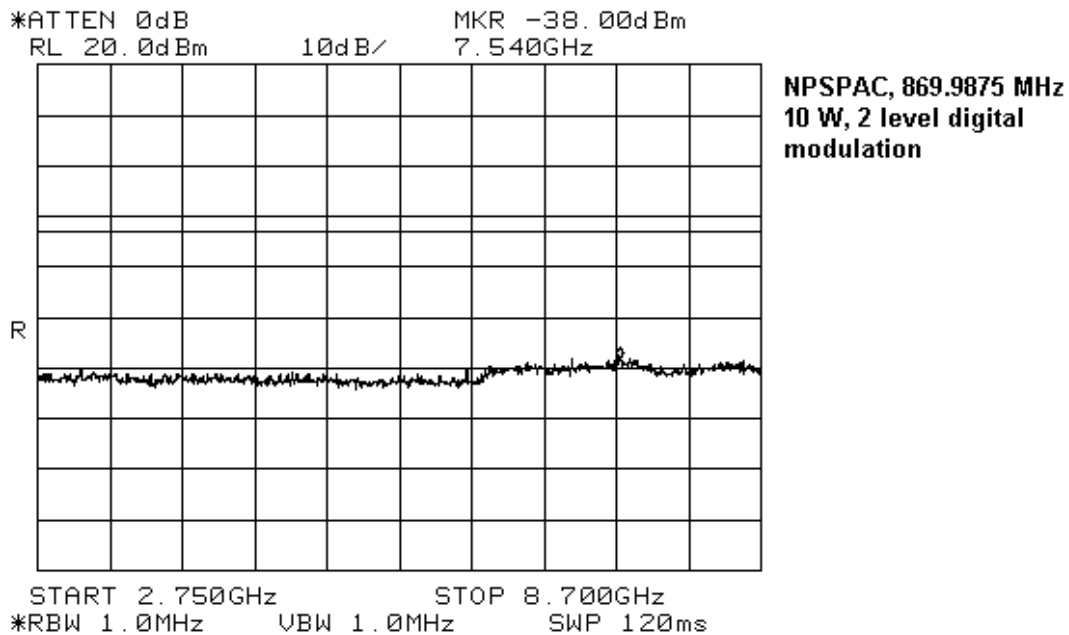


Figure 7-13: Tx at 869.9875 MHz, 10 W Power, 2.75 GHz to 8.7 GHz



## 7.4 Appendix D: Emission Mask Plots

This appendix presents all emission mask plots for the test cases measured.

Figure 7-14: 2500 Hz Audio Signal

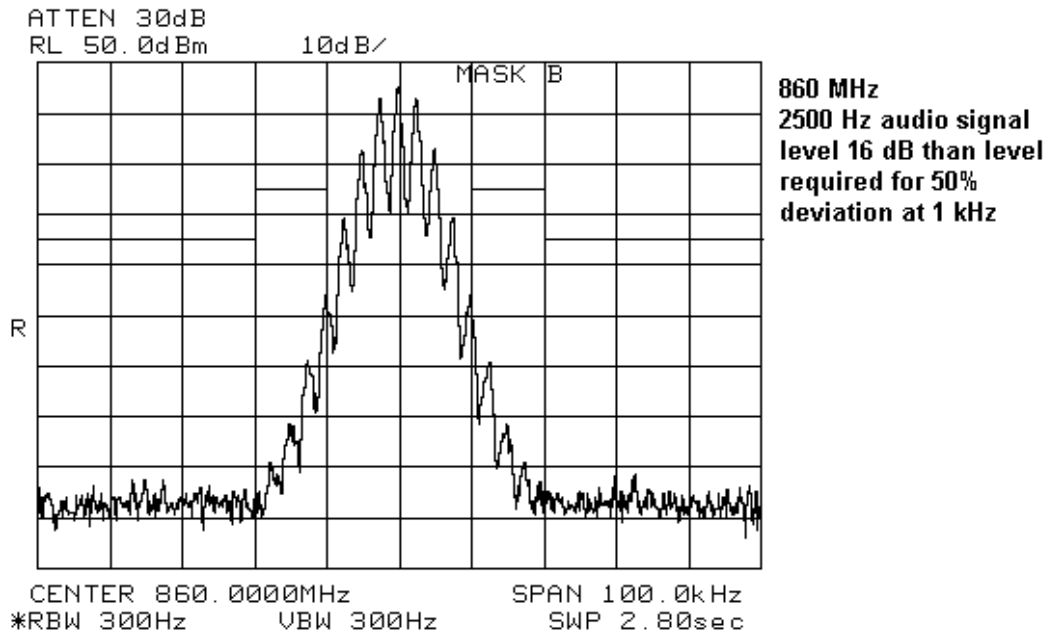


Figure 7-15: 2 level 9600 baud Signal With 3 kHz Deviation

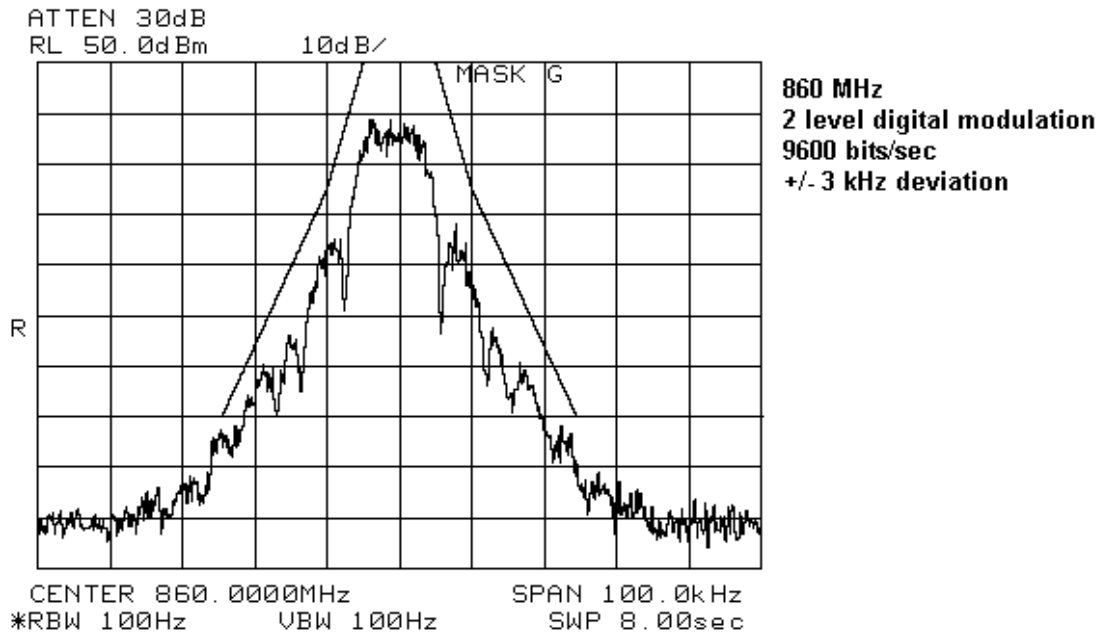


Figure 7-16: NPSPAC (9600 baud) Signal

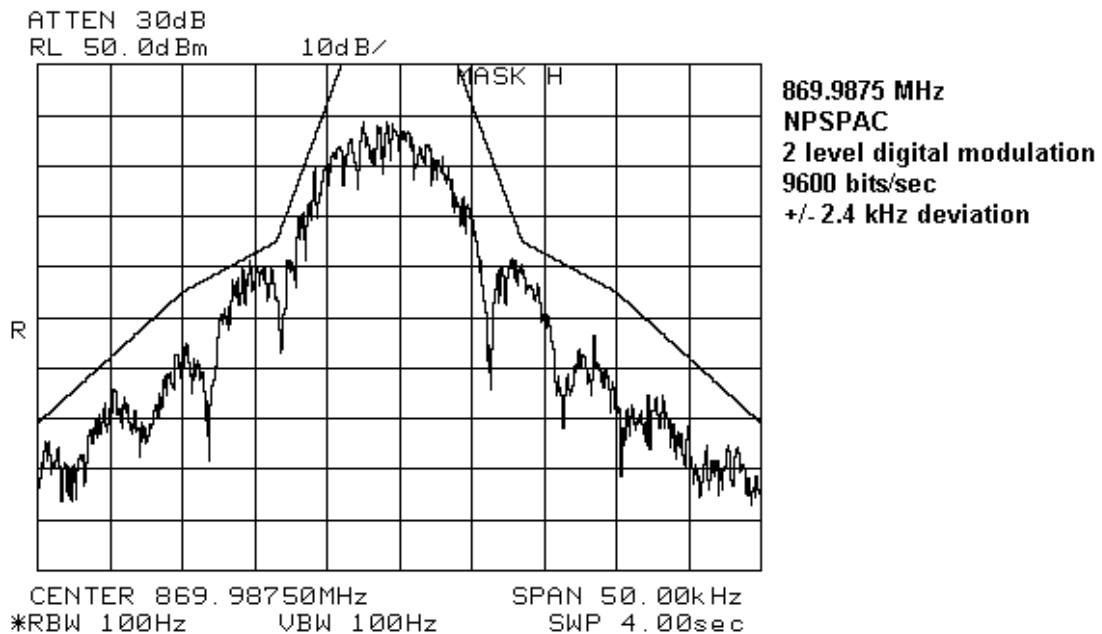
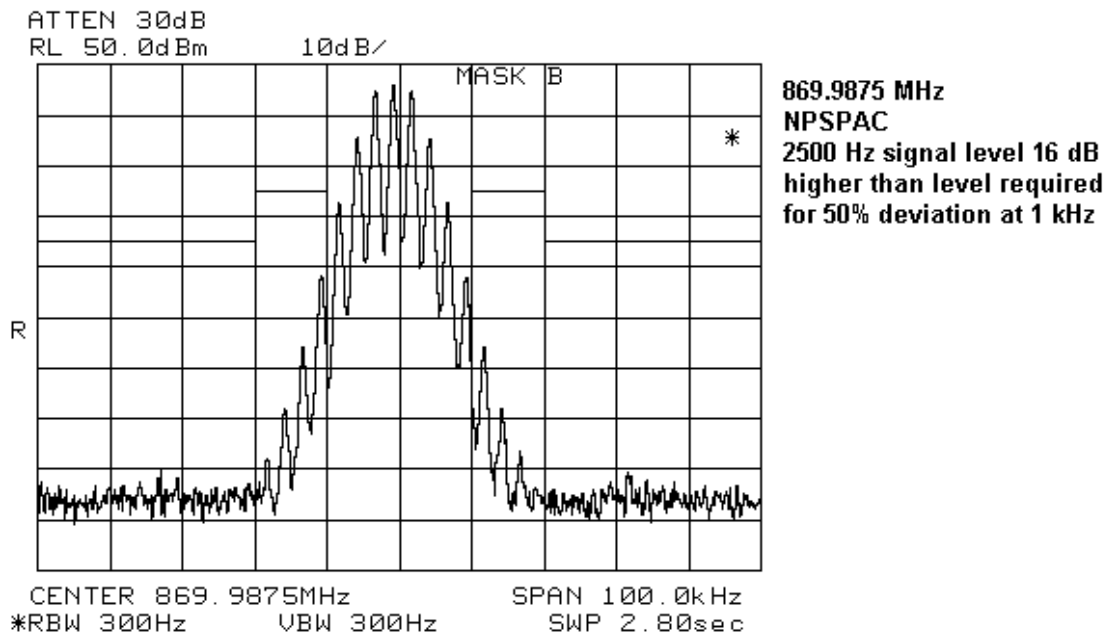


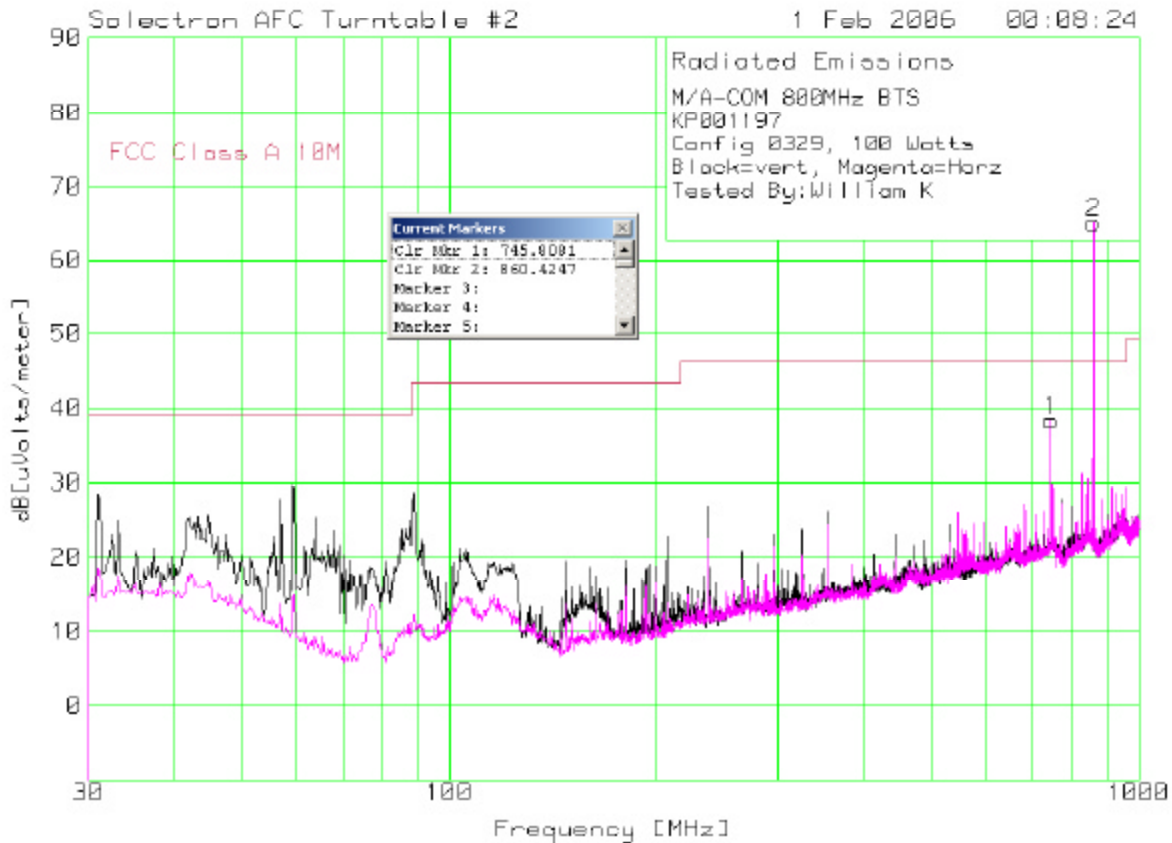
Figure 7-17: NPSPAC (Analog) signal



## 7.5 Appendix E: Field Strength of Spurious Emissions Plots

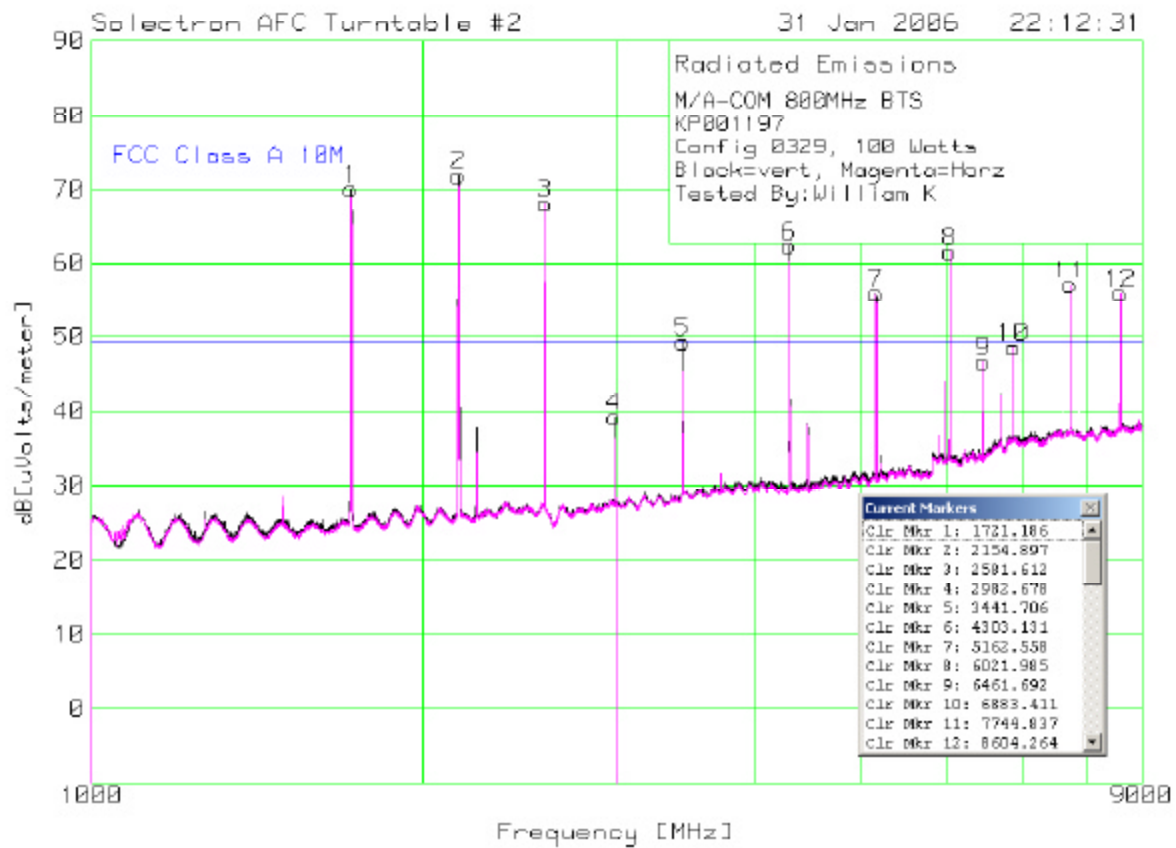
This appendix presents all field strength plots for the test cases measured.

Figure 7-18: Field Strength With 100 W Tx, 30 MHz to 1 GHz



Note: the emissions at 860 MHz is leakage of the transmitted signal

Figure 7-19: Field Strength With 100 W Tx, 1 GHz to 9 GHz



## 7.6 Appendix F: Occupied Bandwidth Plots

This appendix presents all the occupied bandwidth plots for the test cases measured.

Figure 7-20: 2500 Hz Audio Signal

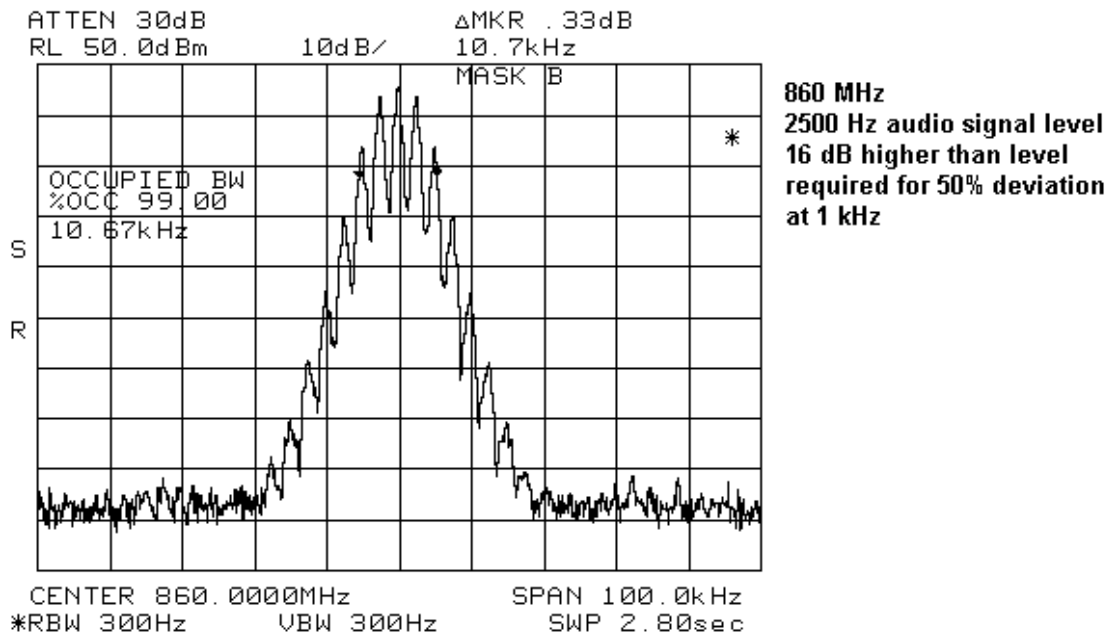


Figure 7-21: 2 Level 9600 baud Signal With 3 kHz Deviation

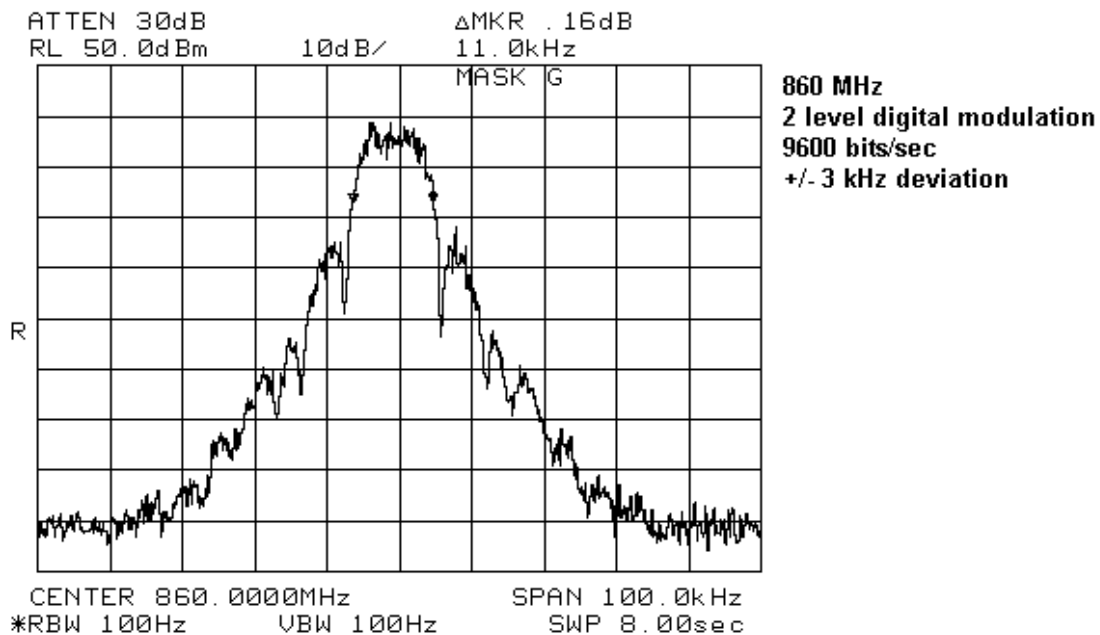


Figure 7-22: NPSPAC (9600 baud) Signal

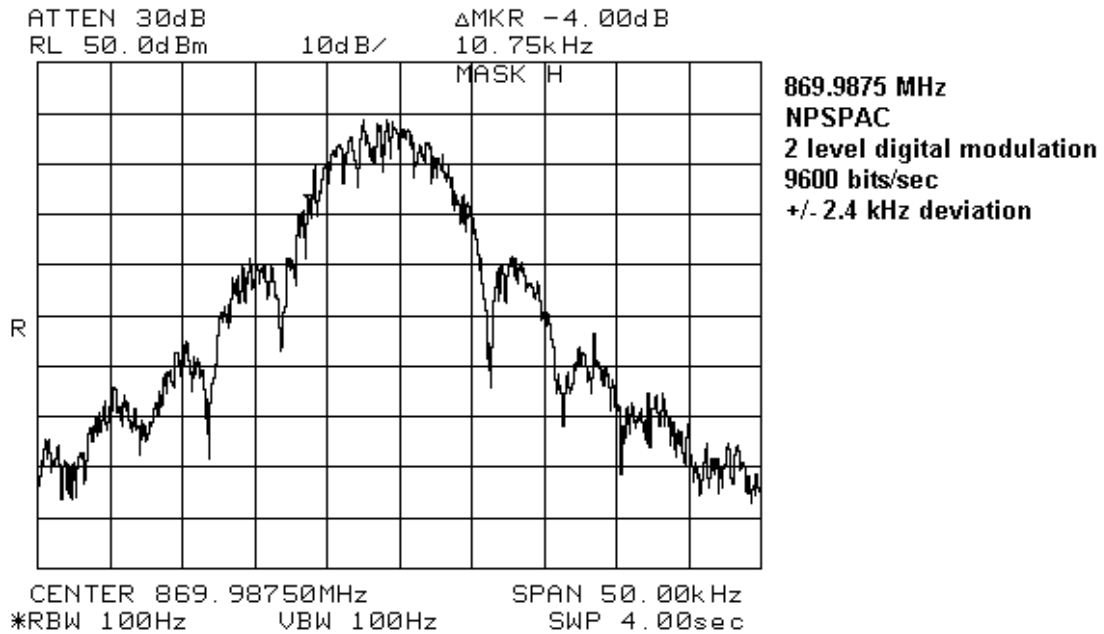
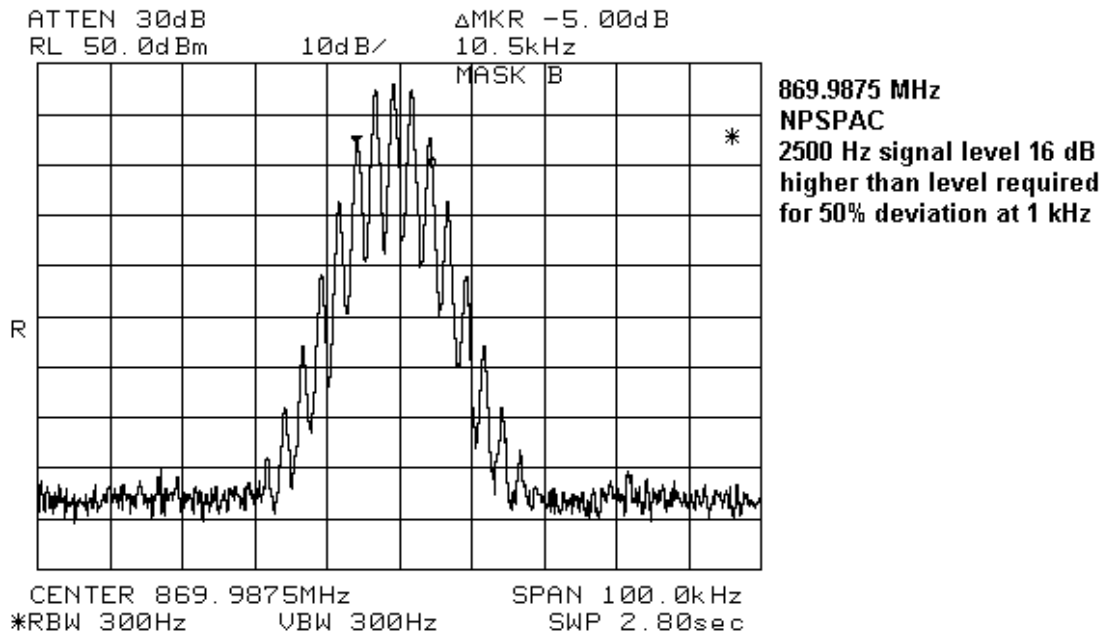


Figure 7-23: NPSPAC (Analog) Signal



## **Solelectron EMS Canada Inc. Design and Engineering**

### **Class 2 Permissive Change Certification Report for the M/A-COM MASTRIII 800 MHz Base Station FCC Part 90 & RSS-119**

### **End of Document**

---

© Copyright Solelectron EMS Inc. February 8, 2006

The information disclosed herein is proprietary to Solelectron and is not to be used by or disclosed to unauthorized persons without the written consent of Solelectron EMS Canada Inc. The recipient of this document shall respect the security status of the information.

The master of this document is stored on an electronic database and is "write-protected" and may be altered only by authorized persons at Solelectron. Viewing of the master document electronically on SDE electronic database ensures access to the current issue. Any other copies are regarded as uncontrolled copies.

---