# Class 2 Permissive Change Certification Report for the M/A-COM MASTRIII 800 MHz Base Station

# FCC Part 90 & RSS-119


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# Release Control Record

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# Approvals

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# Accreditations

Solectron 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 [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 Solectron 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.

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

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# 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-0036-E
- CANADA: 3636B-0036

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: | the M/A-COM MASTRIII 800 MHz Base Station | Project Leader: | Denis Lalonde |
| Product Code: | TR-0036 | Measurements by : | Denis Lalonde |
| Product Status: | | Date: | January 29, 2006 |

| **Test Cases** | | | | | |
|---|---|---|---|---|---|
| **Performed** | **Description** | **Specification** | **Test Results** | | **Notes** |
| | | | Pass | Fail | |
| ■ | RF Power | FCC Part 90.205 and 2.1046<br>RSS-119 sect. 5.4 | ■ | □ | |
| ■ | Conducted Spurious Emissions | FCC Part 90.210 & 2.1051<br>RSS-119 sect. 6.3 | ■ | □ | |
| ■ | Emission Mask | FCC Part 90.210 & 2.1049<br>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<br>RSS-119 sect. 7 | □ | □ | Note 1 |
| □ | Audio Frequency Response | FCC 2.1047 | □ | □ | Note 1 |
| □ | Audio Low Pass Filter | FCC 2.1047<br>RSS-119 sect. 6.6 | □ | □ | Note 1 |
| □ | Modulation Limiting | FCC 2.1047 | □ | □ | Note 1 |
| ■ | Occupied Bandwidth | FCC 2.202<br>RSP 100 sect. 7.2 | ■ | □ | |
| □ | RF Exposure | FCC 1.1310<br>RSS-119 sect. 9.0 | □ | □ | To be evaluated during licensing of equipment |
| □ | Conducted Emissions Rx port | RSS-119 sect. 8<br>FCC 15.111 | □ | □ | Note 1 |

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

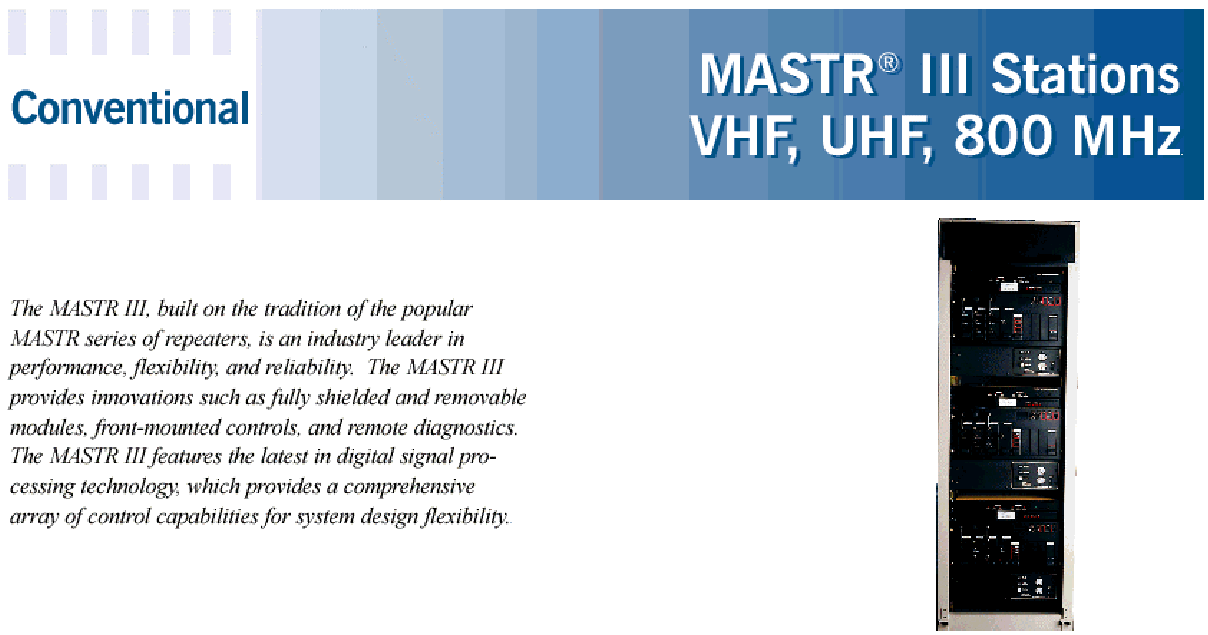
# 3. Equipment Under Test (EUT)

## 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<br>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 | EA101685V5 | SLR 04111439 |
| Rx Synthesizer module | EA101684V5 | SLR 04111322 |
| Rx Front End module | 19D902782G5 | SLR 03182064 |
| IF module | EA101794V1 | SLR 03190963 |
| System module | 19D902590G6 | SLR 02512492 |
| DSP module | EA101800V1 | SLR 03084077 |
| Power module | 19D902589G2 | CKA 01390368 |
| 12 V Battery | Dynasty TEL 12-125 | NR |
| Switching Power supply | PS103010V120 | QG12659 |
| 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**

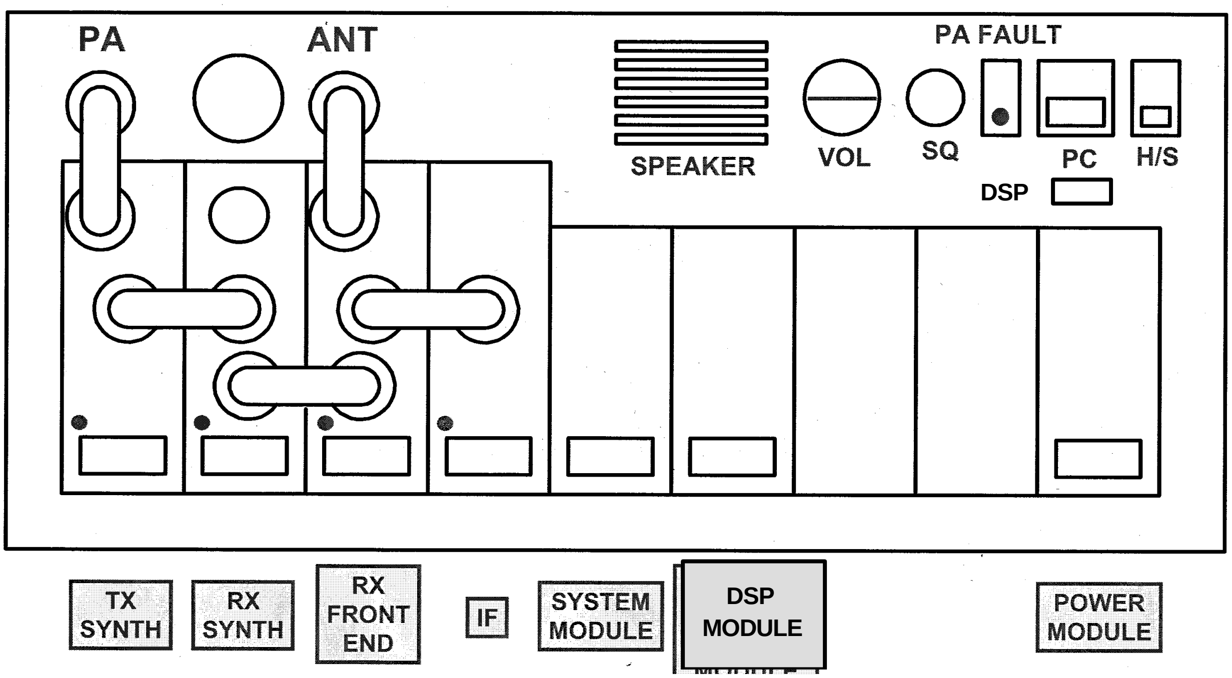
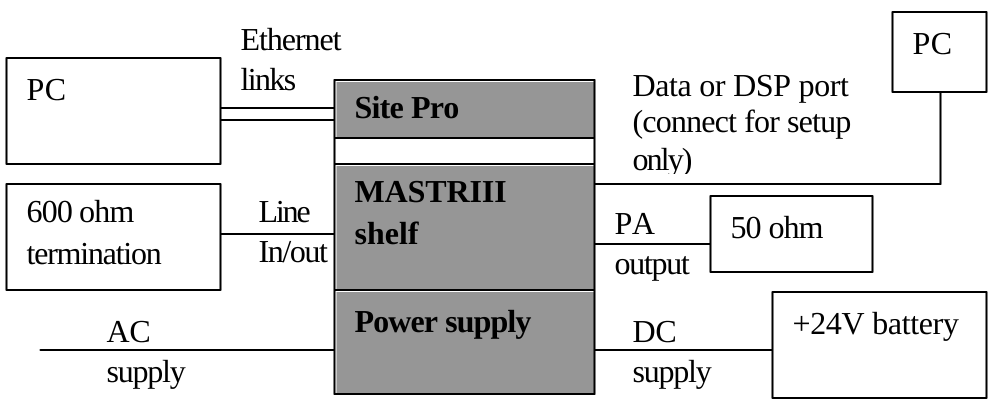



**Figure 3-3: System Configuration**




A photograph of the test setup used in this test report is presented in Appendix B: Test Set-up Photographs, on page 28.

## 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 |
| DC Mains (only on the new version of the supply) | Battery connector of power supply | 2 wire battery cable | unshielded | 6 feet | 1 |
| Ethernet link | SitePro Ethernet 0 and 1 ports | Category 5 twisted pairs | unshielded | 50 feet | 2 |
| 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:** Solectron 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 | 40.0 | 50.0 |
| 869.9875 | 40.2 | 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:** Solectron Design and Engineering Lab 1

**Date tested:** January 27, 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 C4FM signal (+/-2826 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 | -34.7 dBm | -24.8 dBm | Figure 7-2 to Figure 7-7 |
| 869.9875 | -34.8 dBm | -25.2 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 | Wainwrigth 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:** Solectron Design and Engineering Lab 1

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

**Tested by:** Denis Lalonde

### 5.3.3 Test Procedure

Four emission mask measurements were performed at 860 MHz and two at 869.9875 MHz. The six 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. 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 +/- 1.9 kHz deviation. Tested at 860 MHz.
4. C4FM modulation: the power amplifier output was modulated with a C4FM pseudo-random signal which had the level required for a maximum of +/- 2826 Hz deviation. Tested at 860 MHz.
5. 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.
6. 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 |
| 2 level 9600 baud / 1.9 KHz deviation | Pass | Figure 7-16 |
| C4FM | Pass | Figure 7-17 |
| NPSPAC (9600 baud) | Pass | Figure 7-18 |
| NPSPAC (analog) | Pass | Figure 7-19 |

### 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).

Attenuation = 43 + 10 log (P) dB
= 43 + 10 log (100)
= 63 dB

ERP limit = 10 log (100 W) – 63 dB
= -13 dBm

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

### 5.4.2 Test Facility Information

**Location:** Solectron Design and Engineering 10m Ambient Free Chamber

**Date tested:** January 29, 2006

**Tested by:** K. Sivaratnam 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:

**ERP = Signal generator level – Cable losses + Antenna gain (dBi) – Gain of tuned dipole (dBi)**

**Margin = Limit – 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 | -29.1 | 8.4 | 1.5 | -24.4 | 11.4 | Figure 7-20 to Figure 7-21 |
| 2153.53 | -28.3 | 8.8 | 1.8 | -23.5 | 10.5 | Figure 7-20 to Figure 7-21 |
| 2580 | -35.2 | 9.6 | 1.9 | -29.7 | 16.7 | Figure 7-20 to Figure 7-21 |
| 3440 | -40 | 9.8 | 2.2 | -34.6 | 21.6 | Figure 7-20 to Figure 7-21 |
| 4300 | -36.5 | 10.4 | 2.5 | -30.8 | 17.8 | Figure 7-20 to Figure 7-21 |
| 5160 | -42.6 | 10.7 | 2.6 | -36.7 | 23.7 | Figure 7-20 to Figure 7-21 |
| 6020 | -31 | 11.3 | 2.7 | -24.6 | 11.6 | Figure 7-20 to Figure 7-21 |
| 7740 | -38 | 11.3 | 3.2 | -32.1 | 19.1 | Figure 7-20 to Figure 7-21 |
| 8600 | -42.9 | 11.5 | 3.3 | -36.9 | 23.9 | Figure 7-20 to Figure 7-21 |

### 5.4.5 Test Conclusion

The test results meet the requirements 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 | Huber & Suhner | 106A | SSG012453 | 2/9/2006 |

| Description | Make | Model Number | Asset Number | Cal. Due |
|---|---|---|---|---|
| Cable | | | | |
| 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:** Solectron Design and Engineering Lab 1

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

**Tested by:** Denis Lalonde

### 5.5.3 Test Procedure

Four occupied bandwidth measurements were performed at 860 MHz and two at 869.9875 MHz. The six 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. 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 +/- 1.9 kHz deviation. Tested at 860 MHz.
4. C4FM modulation: the power amplifier output was modulated with a C4FM pseudo-random signal which had the level required for a maximum of +/- 2826 Hz deviation. Tested at 860 MHz.
5. 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.
6. 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<br>Max. deviation (D) = 5 kHz<br>K = 1<br>Bn = 2M + 2DK<br>Bn = 16 kHz | 10.7 kHz<br>Figure 7-22<br>(measured with 2.5 kHz tone) | 16K0F3E |
| 2 level 9600 baud / 3 KHz deviation | Max. modulation (B) = 9.6 kHz<br>Max. deviation (D) = 3 kHz<br>K = 1<br>Bn = B + 2DK<br>Bn = 15.6 kHz | 11.0 kHz<br>Figure 7-23 | 10K8F1D<br>10K8F1E |
| 2 level 9600 baud / 1.9 KHz deviation | Max. modulation (B) = 9.6 kHz<br>Max. deviation (D) = 1.9 kHz<br>K = 1<br>Bn = B + 2DK<br>Bn = 13.44 kHz | 9.2 kHz<br>Figure 7-24 | 8K2F1D<br>8K2F1E |
| C4FM | Max. modulation (B) = 4.8 kHz<br>Max. deviation (D) = 2.826 kHz<br>K = 1<br>Bn = B + 2DK<br>Bn = 10.452 kHz | 6.8 kHz<br>Figure 7-25 | 7K8F1D<br>7K8F1D |

| Type of signal | Calculation | Measurement (kHz) | Currently Used Emission Designators |
|---|---|---|---|
| NPSPAC (9600 baud) | Max. modulation (B) = 9.6 kHz<br>Max. deviation (D) = 2.4 kHz<br>K = 1<br>Bn = B + 2DK<br>Bn = 14.4 kHz | 10.4 kHz<br>Figure 7-26 | 10K5F1D<br>10K5F1E |
| NPSPAC (analog) | Max. modulation (M) = 3 kHz<br>Max. deviation (D) = 4 kHz<br>K = 1<br>Bn = 2M + 2DK<br>Bn = 14 kHz | 10.1 kHz<br>Figure 7-27<br>(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 Solectron EMS Canada Inc. outlined at the following web site http://palcan.scc.ca/specs/pdf/95_e.pdf.
2. Solectron EMS Canada Inc. Quality Manual, K0000608-QD-QM-01-07, 2004.
3. Solectron 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. Solectron EMS Canada Inc., EMC General Lab Test Procedure, KP000270-LP-EMC-01-06, April 20th, 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 10th, 2004): http://www.aplac.org.
15. ILAC, International Laboratory Accreditation Cooperation, Website (February 10th, 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

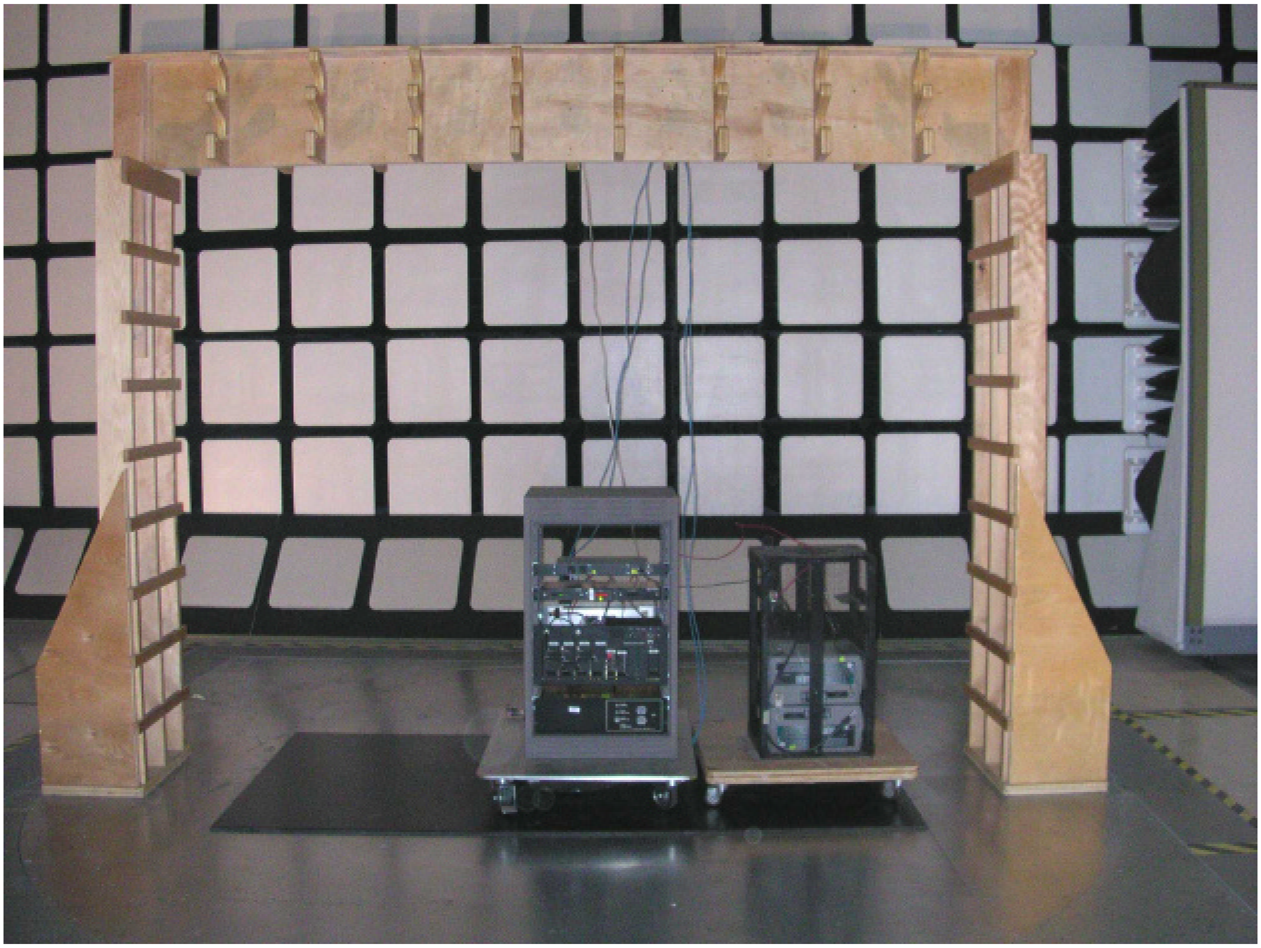
## 7.1 Appendix A: Glossary

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: the 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**

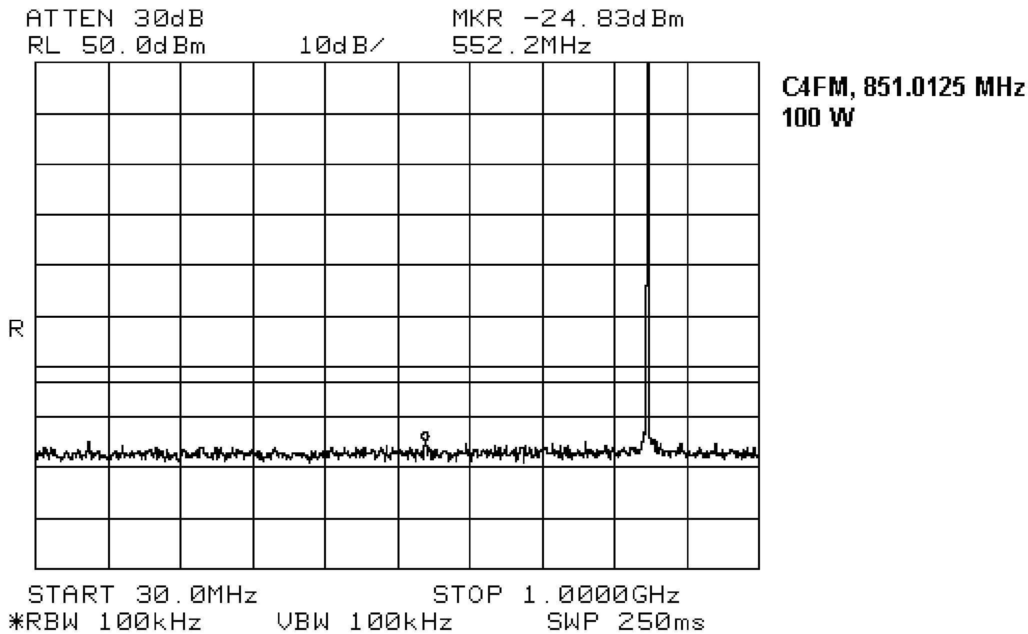



**Figure 7-3: Tx at 851.0125 MHz, 100 W Power, 1 GHz to 2.75 GHz**

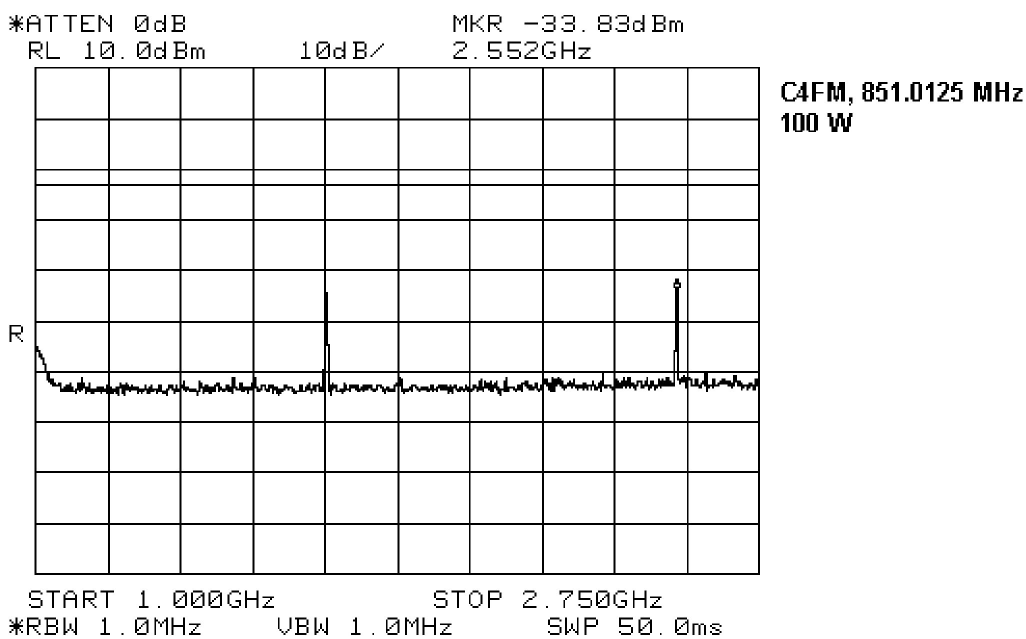


**Figure 7-4: Tx at 851.0125 MHz, 100 W Power, 2.75 GHz to 8.7 GHz**

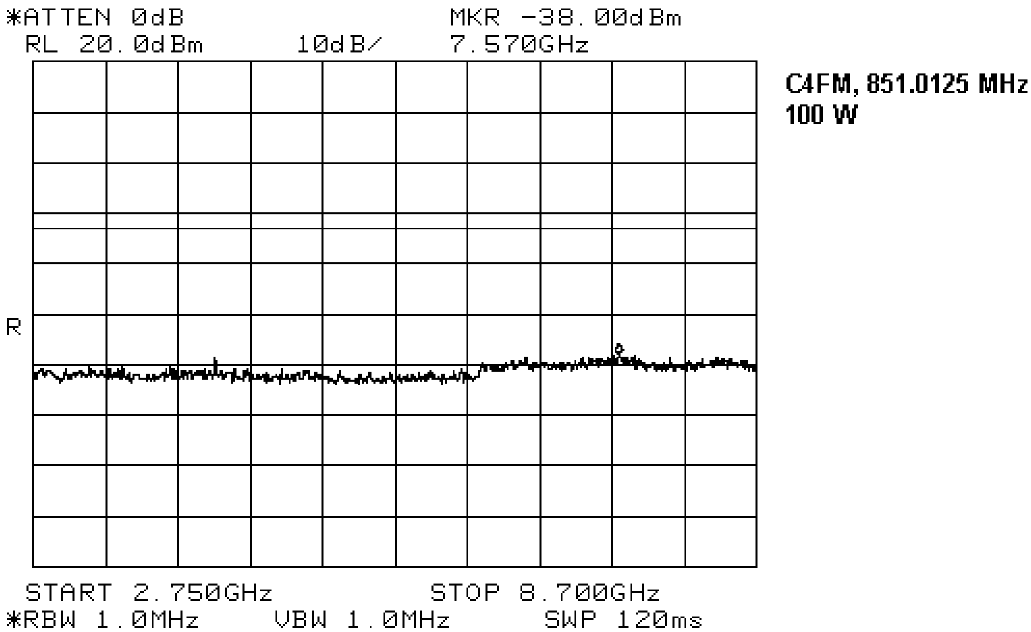



**Figure 7-5: Tx at 851.0125 MHz, 10 W Power, 30 MHz to 1 GHz**

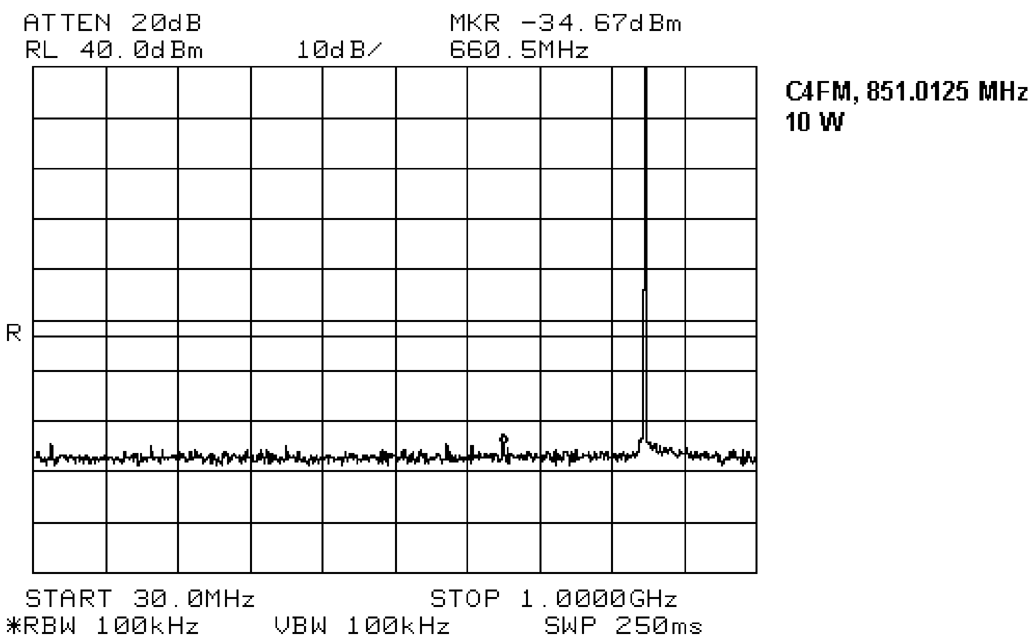


**Figure 7-6: Tx at 851.0125 MHz, 10 W Power, 1 GHz to 2.75 GHz**

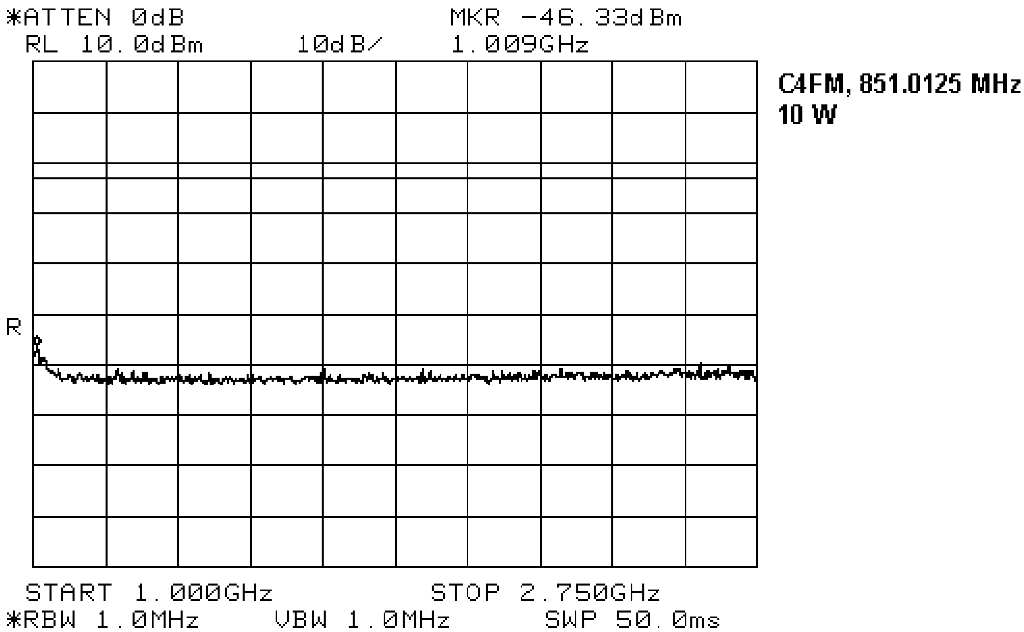



**Figure 7-7: Tx at 851.0125 MHz, 10 W Power, 2.75 GHz to 8.7 GHz**

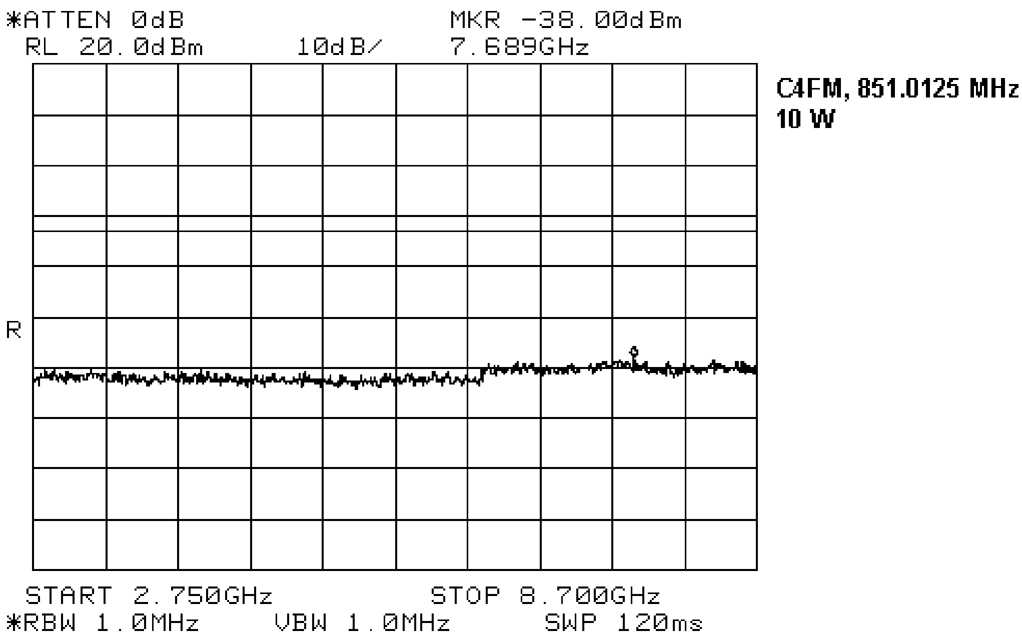


**Figure 7-8: Tx at 869.9875 MHz, 100 W Power, 30 MHz to 1 GHz**

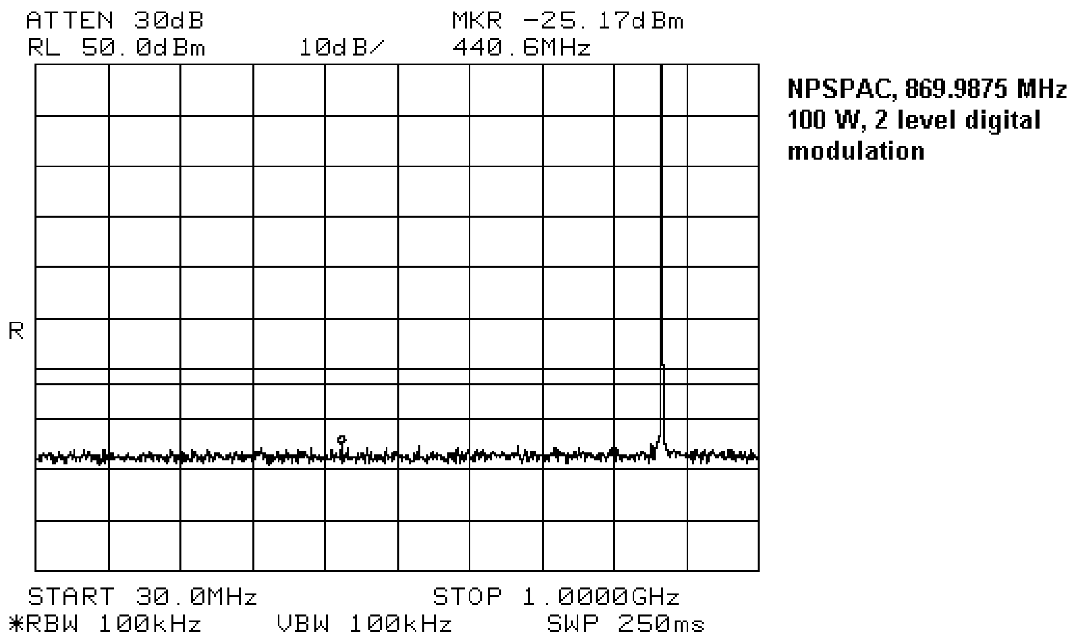



**Figure 7-9: Tx at 869.9875 MHz, 100 W Power, 1 GHz to 2.75 GHz**

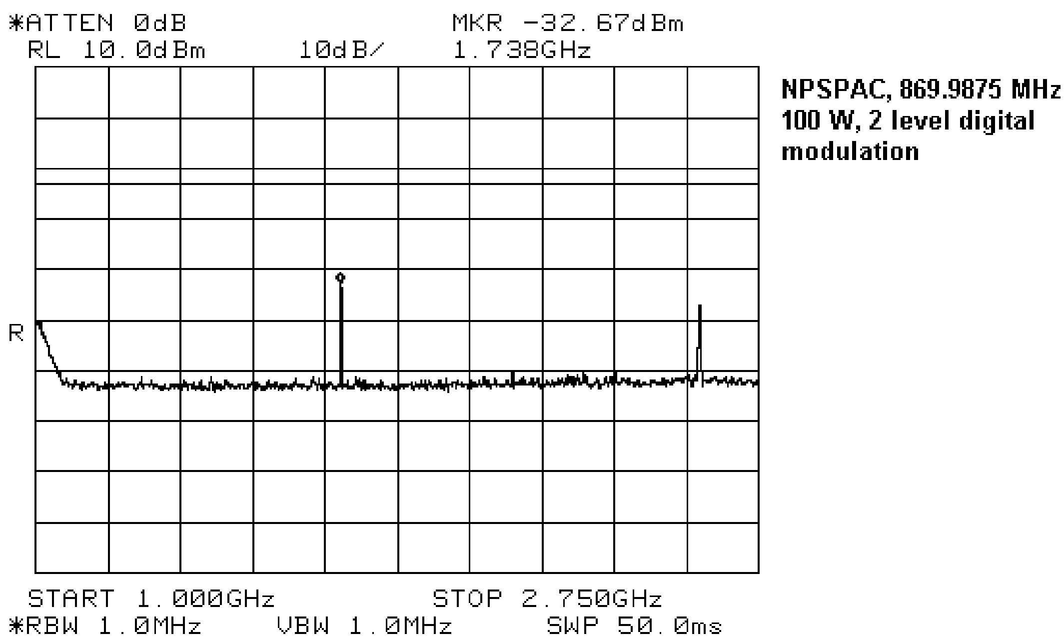


**Figure 7-10: Tx at 869.9875 MHz, 100 W Power, 2.75 GHz to 8.7 GHz**

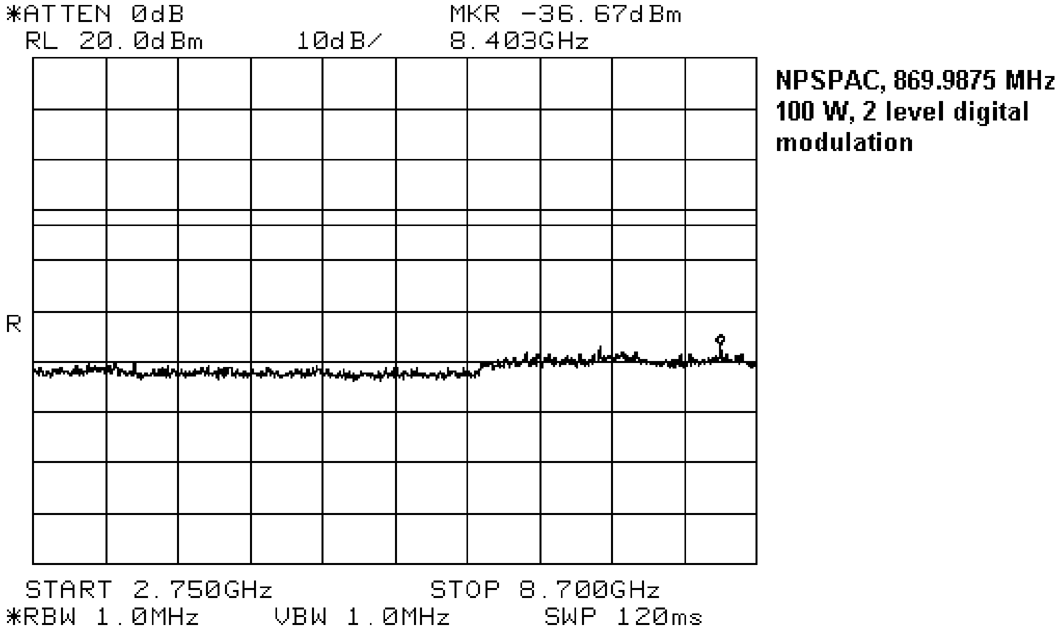



**Figure 7-11: Tx at 869.9875 MHz, 10 W Power, 30 MHz to 1 GHz**

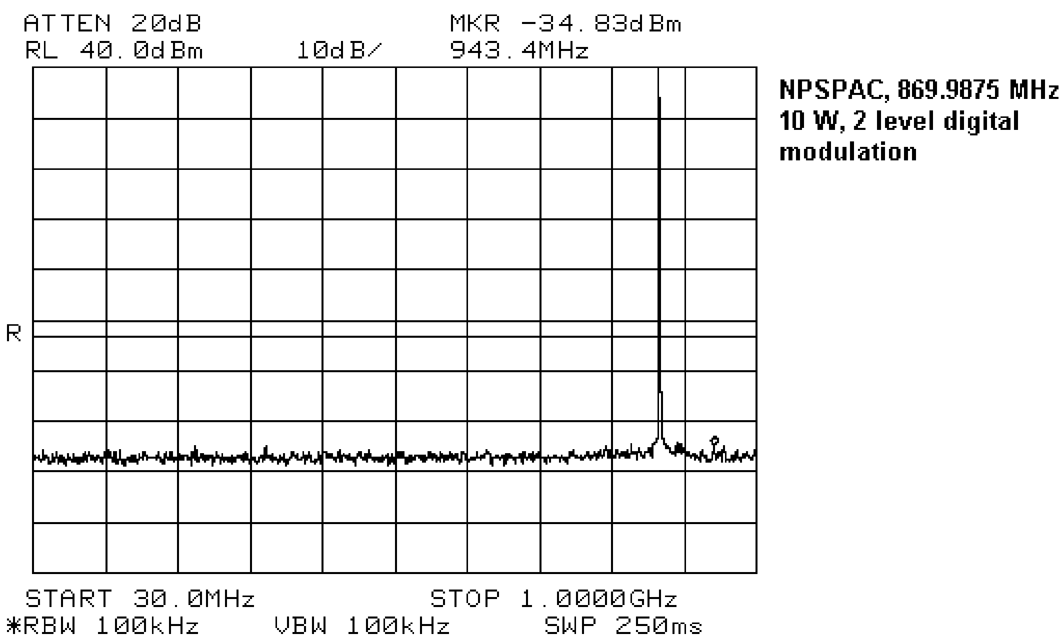


**Figure 7-12: Tx at 869.9875 MHz, 10 W Power, 1 GHz to 2.75 GHz**

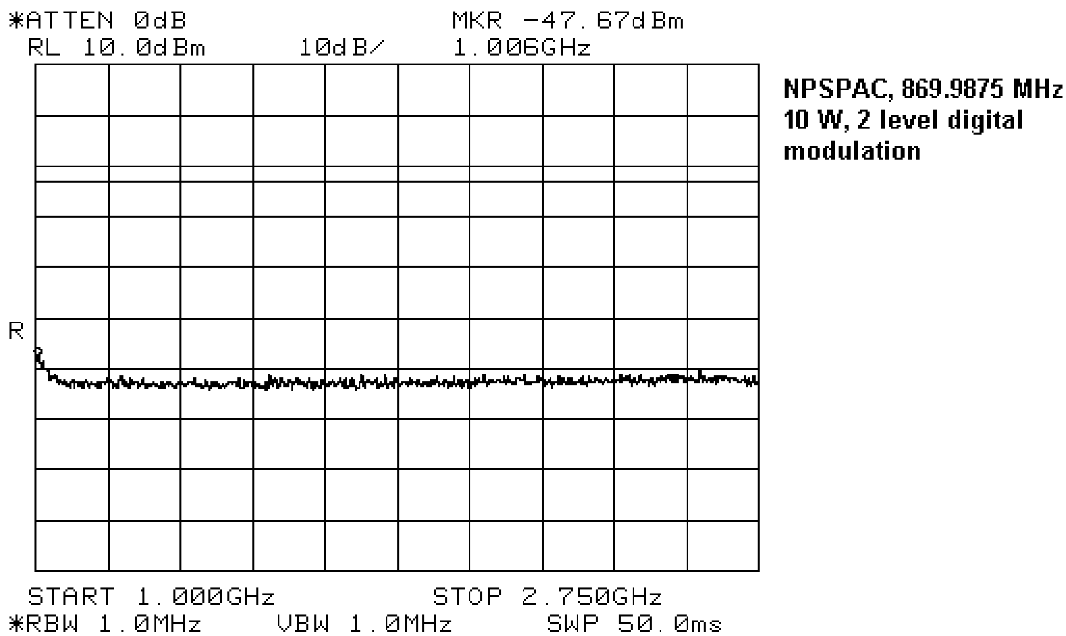
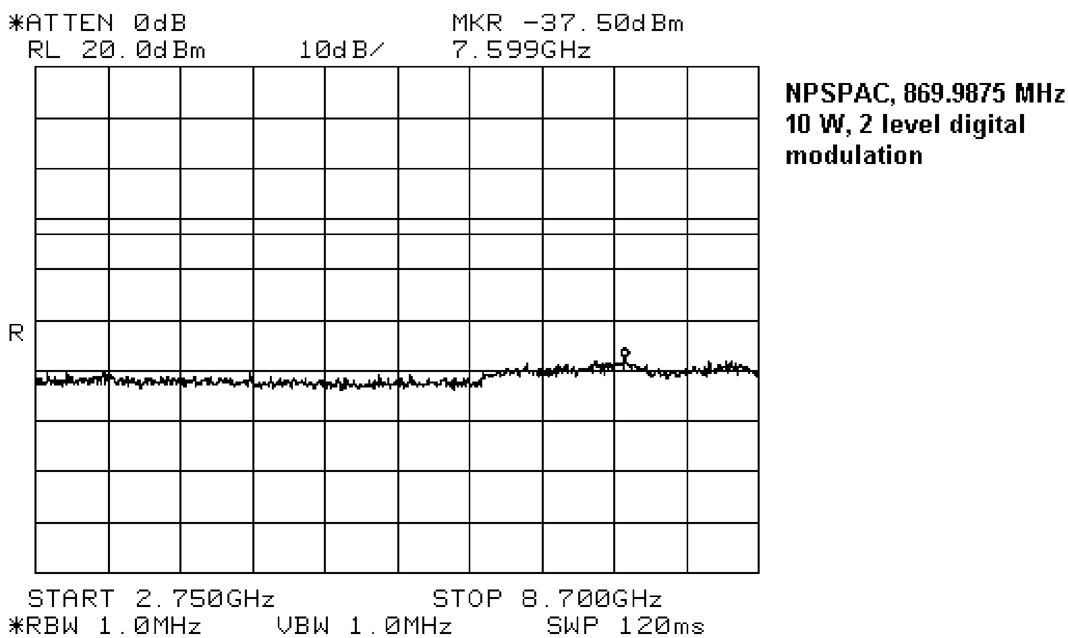


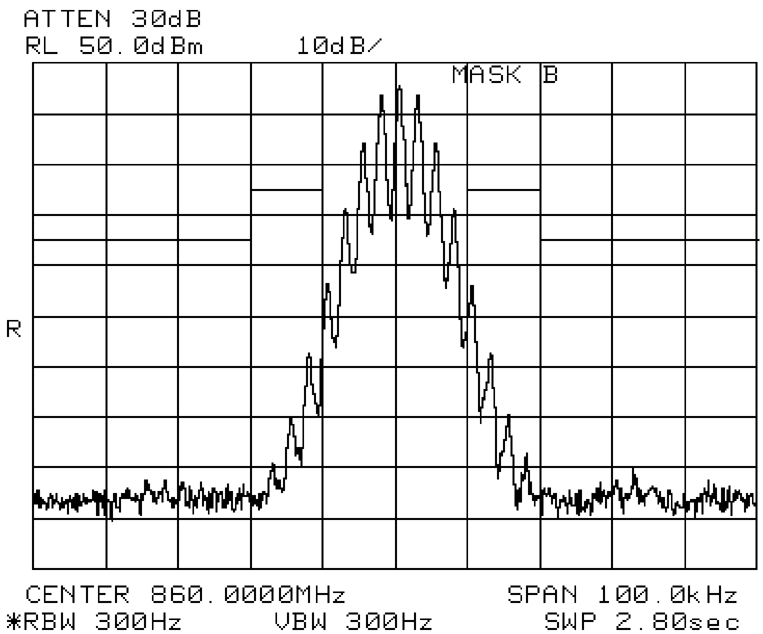

**Figure 7-13: Tx at 869.9875 MHz, 10 W Power, 2.75 GHz to 8.7 GHz**



## 7.4 Appendix D: Emission Mask Plots

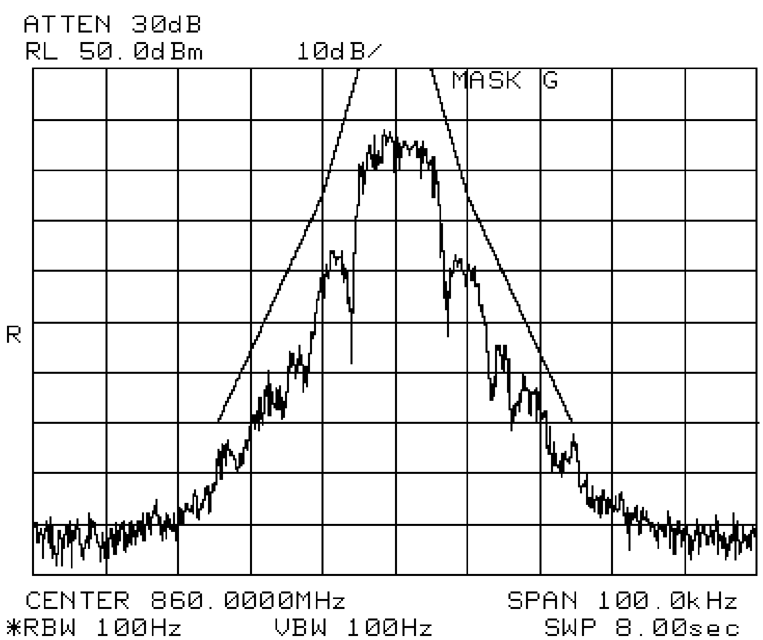
This appendix presents all emission mask plots for the test cases measured.

**Figure 7-14: 2500 Hz Audio Signal**




**860 MHz**
**2500 Hz signal level 16 dB higher than required for 50% deviation at 1 kHz**

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




**860 MHz**
**2 level digital modulation**
**9600 bit/sec**
**+/- 3 kHz deviation**

**Figure 7-16: 2 level 9600 baud Signal With 1.9 kHz Deviation**

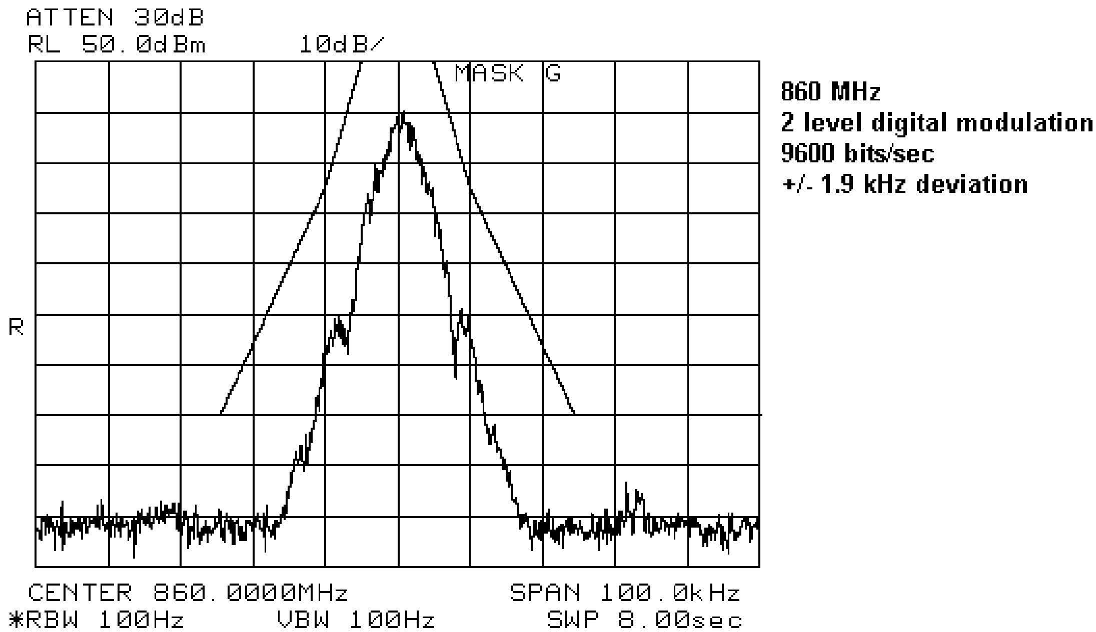



**Figure 7-17: C4FM Signal**

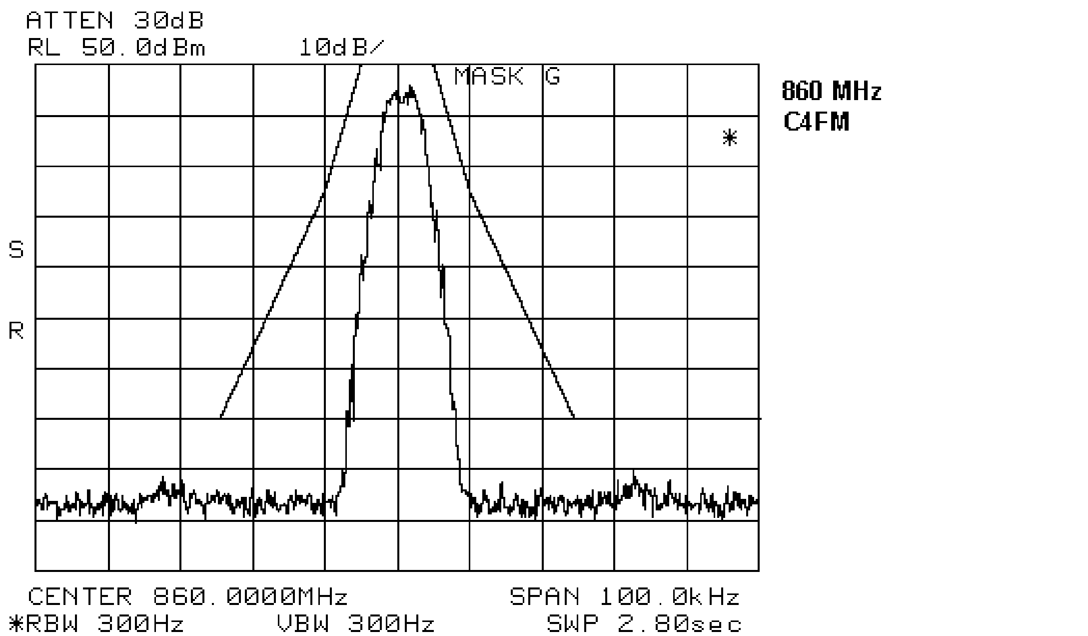


**Figure 7-18: NPSPAC (9600 baud) Signal**

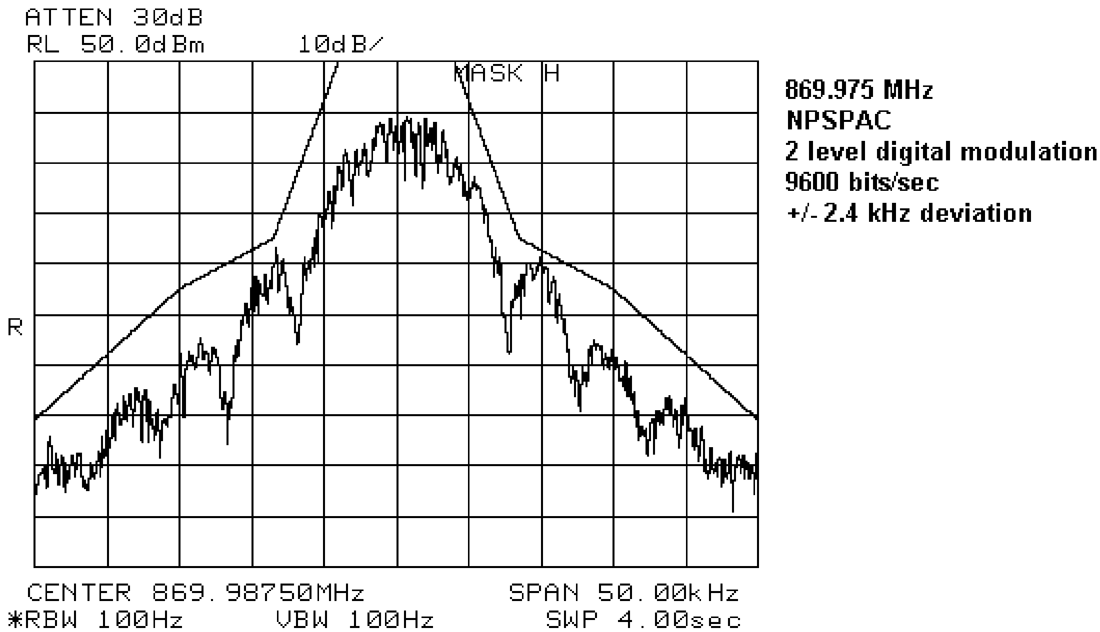
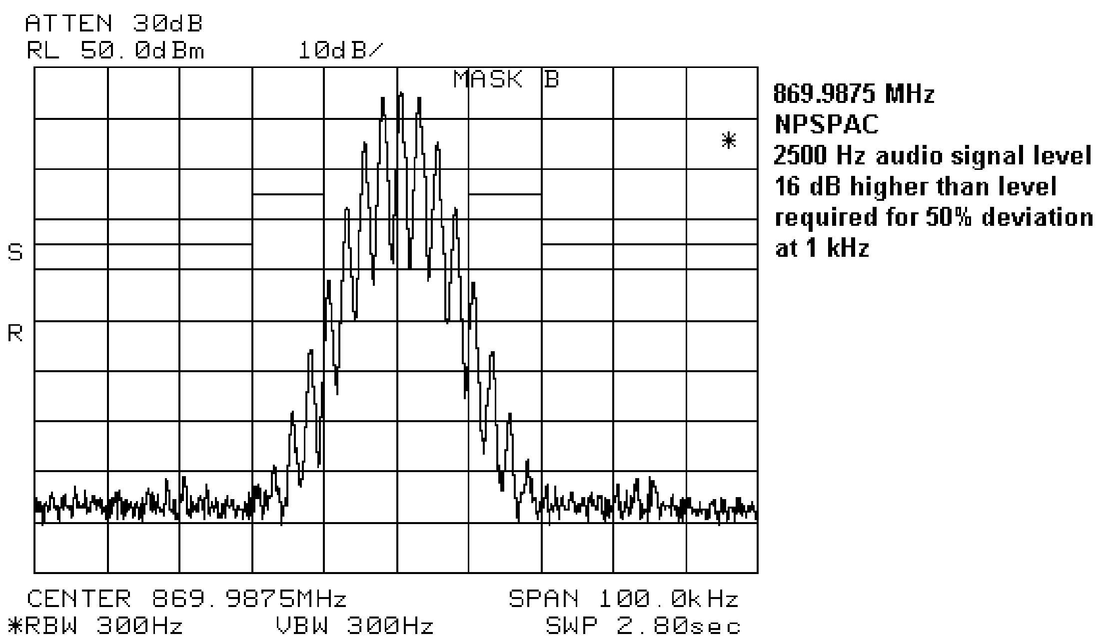


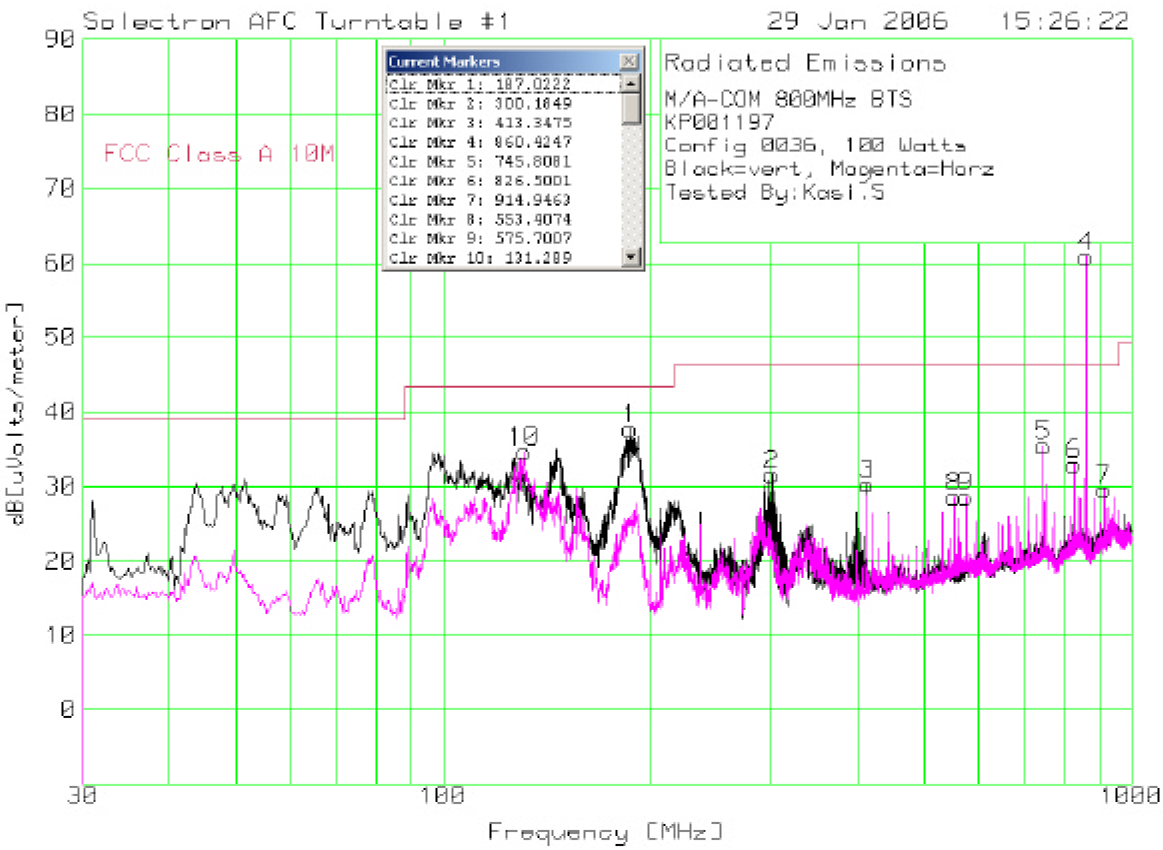

**Figure 7-19: NPSPAC (Analog) signal**



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

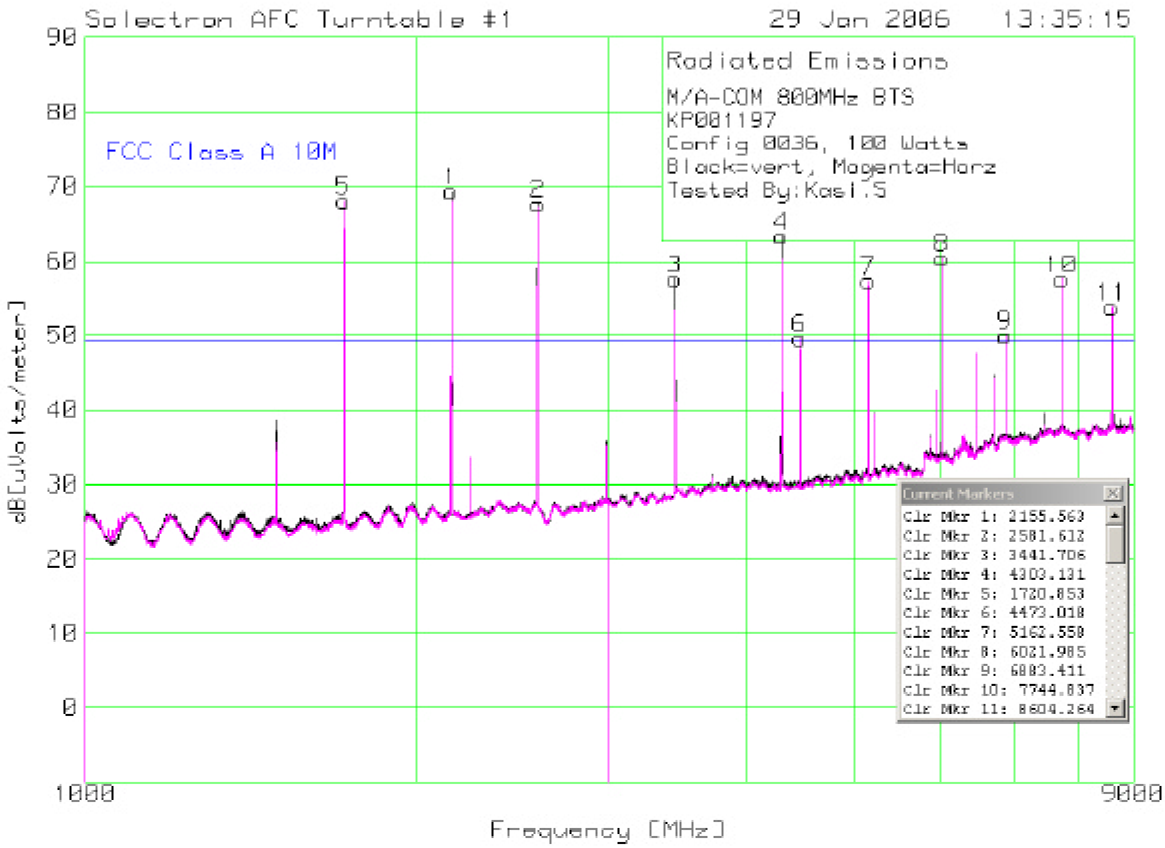
This appendix presents all field strength plots for the test cases measured.

**Figure 7-20: Field Strength With 100 W Tx, 30 MHz to 1 GHz**




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

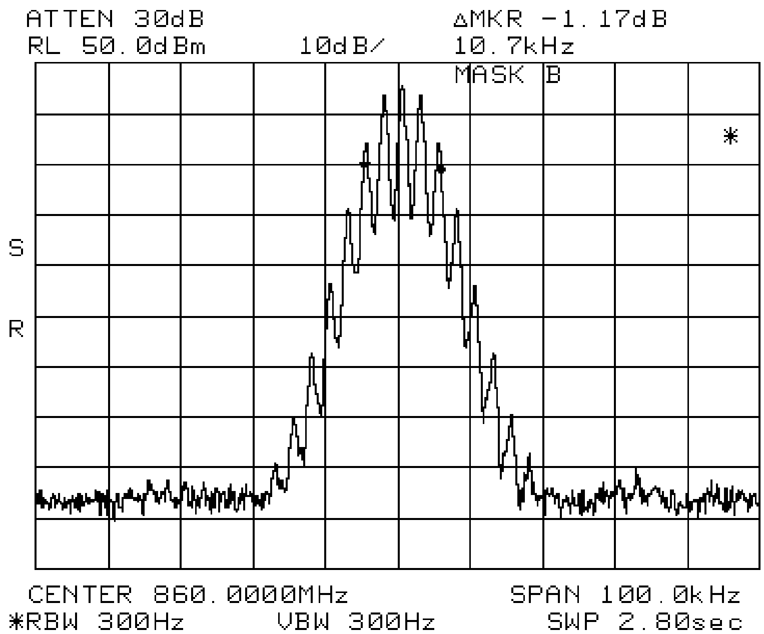
**Figure 7-21: Field Strength With 100 W Tx, 1 GHz to 9 GHz**



# 7.6 Appendix F: Occupied Bandwidth Plots

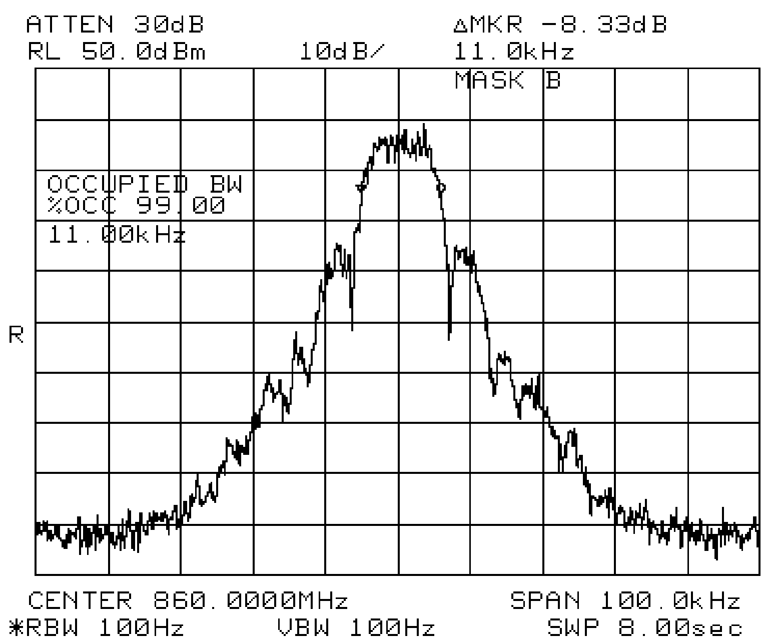
This appendix presents all the occupied bandwidth plots for the test cases measured.

**Figure 7-22: 2500 Hz Audio Signal**




**860 MHz**
**2500 Hz signal level 16 dB higher than level required for 50% deviation at 1 KHz**

**Figure 7-23: 2 Level 9600 baud Signal With 3 kHz Deviation**




**860 MHz**
**2 level modulation**
**9600 bits/sec**
**+/- 3 kHz deviation**

**Figure 7-24: 2 Level 9600 baud Signal With 1.9 kHz Deviation**

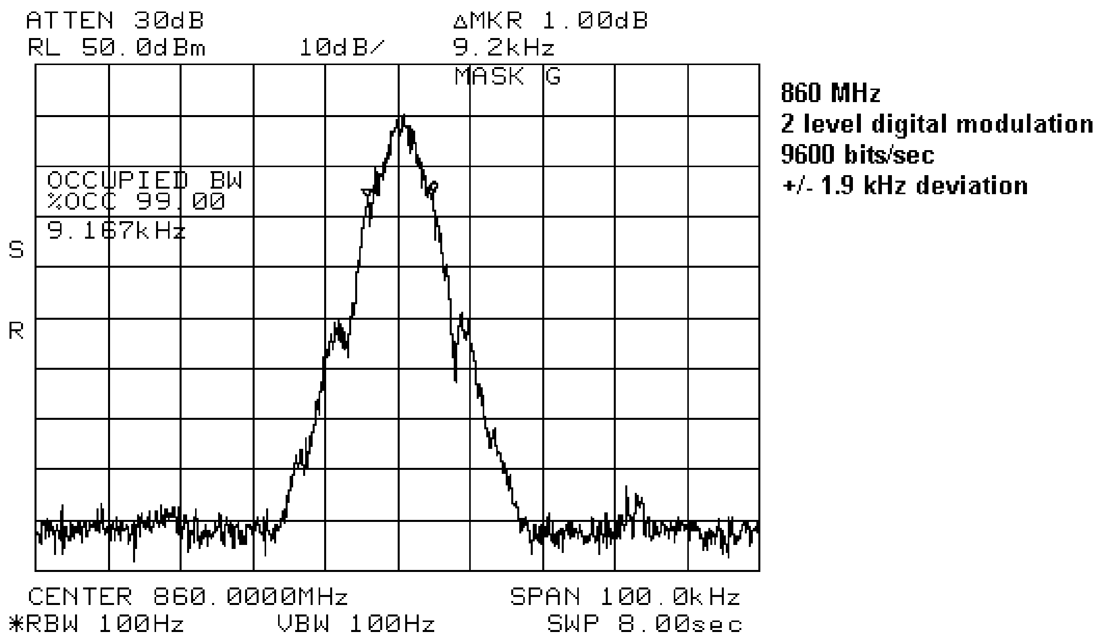



**Figure 7-25: C4FM Signal**

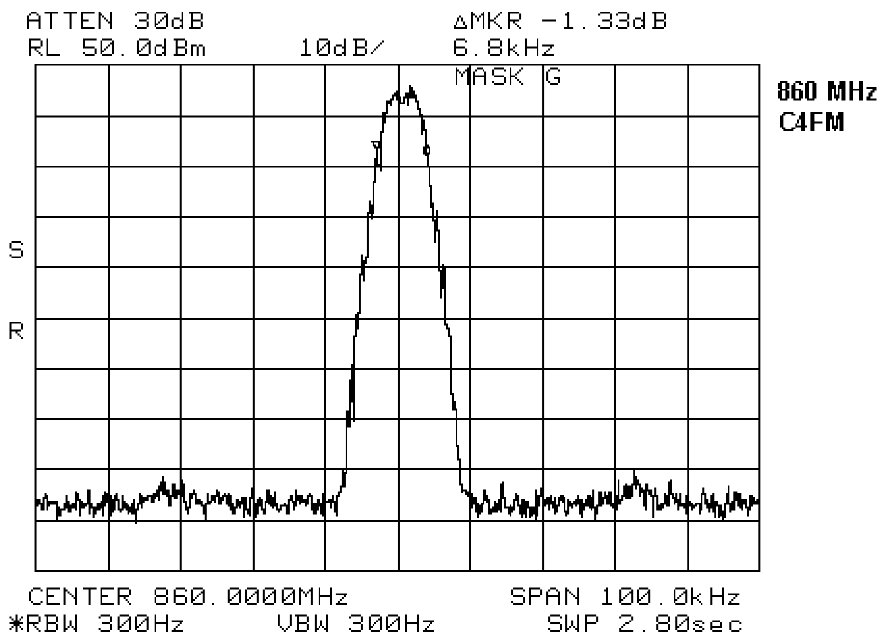


**Figure 7-26: NPSPAC (9600 baud) Signal**

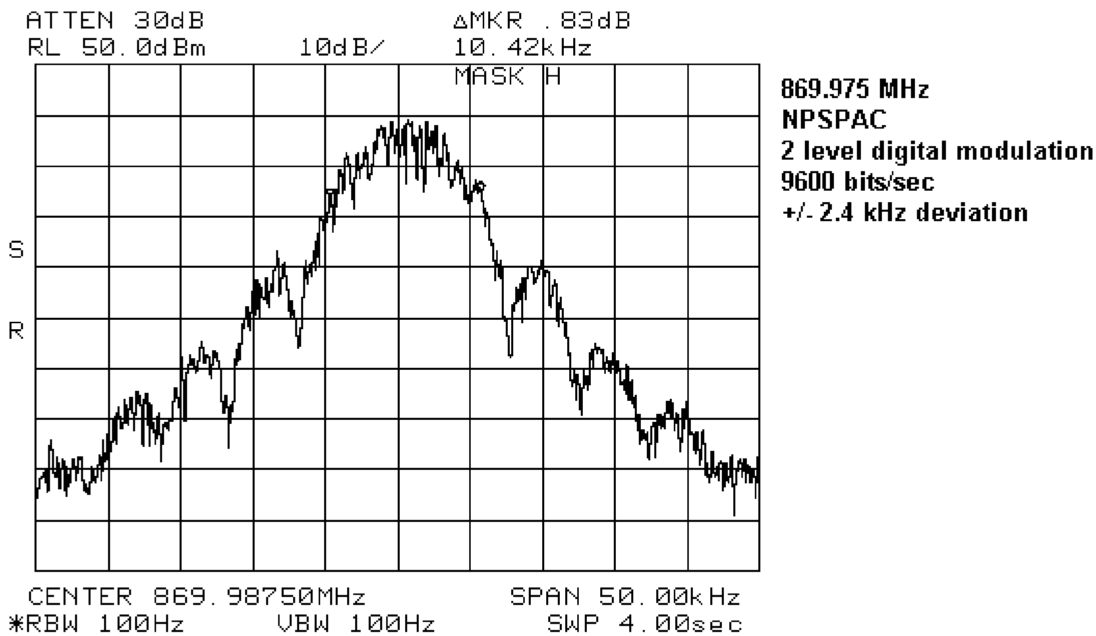
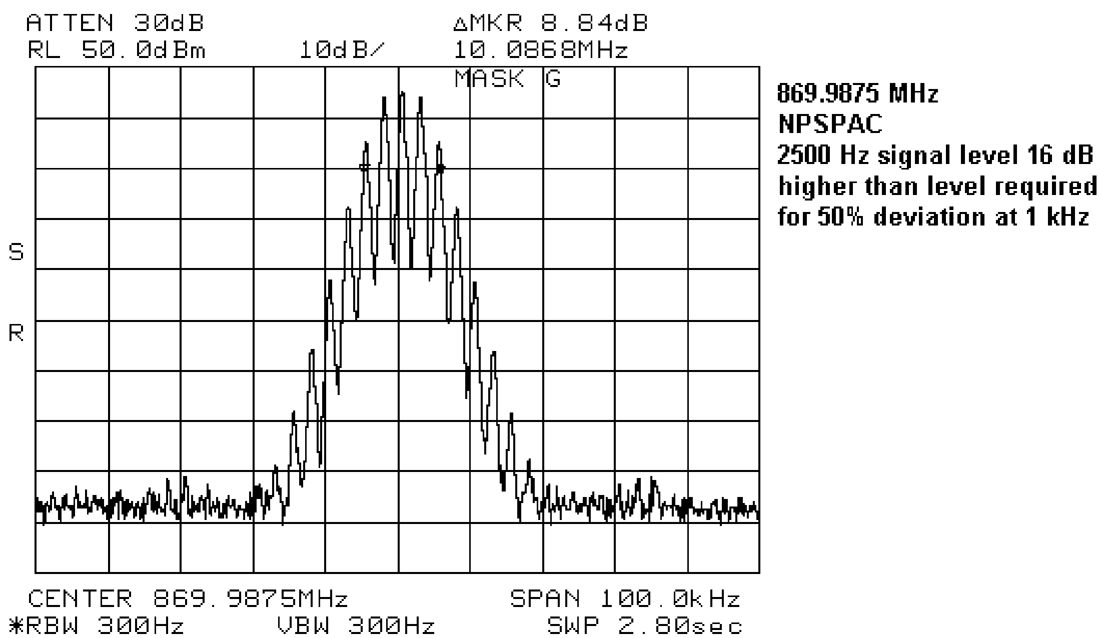



**Figure 7-27: NPSPAC (Analog) Signal**



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# Solectron 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