

**TEST REPORT**

Report Number: 3099245ATL-001

November 8, 2006

**Product Designation: SR390**

Standard: CFR Title 47 Part 90  
RSS-119, Issue 6, March 25, 2000

**Tested by:**

Intertek Testing Services NA Inc.  
1950 Evergreen Blvd., Suite 100  
Duluth, GA 30096

**Client:**

Temco Communications Inc  
Silver Palace Honancho 1F, 2-12-26,  
Honan, Suginami-Ku, Tokyo, Japan  
Contact: Brian Murakami

**Tests performed by:**



Richard Bianco  
EMC Engineer

**Report reviewed by:**



David J. Schramm  
EMC Department Manager

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## 1.0 Introduction and Conclusion

The tests indicated in section 2.0 were performed on the product constructed as described in section 3.0. The remaining test sections are the verbatim text from the actual data sheets used during the investigation. These test sections include the test name, the specified test Method, a list of the actual Test Equipment Used, documentation Photos, Results and raw Data. No additions, deviations, or exclusions have been made from the standard(s) unless specifically noted.

Based on the results of our investigation, we have concluded the product tested complies with the requirements of the standard(s) indicated. The results obtained in this test report pertain only to the item(s) tested.

## 2.0 Test Summary

| Section | Test Full Name                                                                                                       | Test Date  | Result |
|---------|----------------------------------------------------------------------------------------------------------------------|------------|--------|
| 4.0     | System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup) |            |        |
| 5.0     | Transmitter Information (Transmitter Info - Licensed)                                                                | 07/31/2006 |        |
| 6.0     | RF Output Power (Conducted) (FCC Part 2.1046 Cond)                                                                   | 07/20/2006 | PASS   |
| 7.0     | Audio Low Pass Filter (Voice Input) (FCC Part 2.1047 alp)                                                            | 09/27/2006 | PASS   |
| 8.0     | Audio Frequency Response (FCC Part 2.1047 afr)                                                                       | 07/30/2006 | PASS   |
| 9.0     | Modulation Limiting (FCC Part 2.1047 ml)                                                                             | 09/28/2006 | PASS   |
| 10.0    | Occupied Bandwidth (FCC Part 2.1049)                                                                                 | 11/07/2006 | PASS   |
| 11.0    | Spurious emissions at antenna terminals (FCC Part 2.1051)                                                            | 07/25/2006 | PASS   |
| 12.0    | Field strength of spurious radiation (FCC Part 2.1053)                                                               | 07/28/2006 | PASS   |
| 13.0    | Measurement of frequency stability (Frequency Stability)                                                             | 07/26/2006 | PASS   |
| 14.0    | Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)                              | 09/28/2006 | PASS   |

### 3.0 Description of Equipment Under Test

| Equipment Under Test |              |              |               |
|----------------------|--------------|--------------|---------------|
| Description          | Manufacturer | Model Number | Sample Number |
| FM Radio             | Temco        | SR390        | 1-3           |

|                        |            |
|------------------------|------------|
| EUT receive date:      | 07-18-2006 |
| EUT receive condition: | Good       |

Description of EUT provided by Client:

The SR390 is a two-way radio communication device that is designed to operate on 15 channels between the frequency range of 380MHz and 446MHz. The transmitter output can be set to 200mW for low power or 2W for high power. It has a high sensitive built-in VOX that detects only human voice sounds and a noise cancellation feature utilizing real time digital processing.

Description of EUT exercising:

The EUT was equipped with a new set of batteries and switched to the on position and places the transceiver in a continuous receive mode of operation. All the stand-by testing was performed in this configuration. For all other testing the transmit button was pressed and the device was placed in a continuous transmit state. When modulation was required to perform a test there was a signal applied to the microphone input port.

#### 4.0 System setup including cable interconnection details, support equipment and simplified block diagram. (System Setup)

**Method:**

Record the details of EUT cabling, document the support equipment, and show the interconnections in a block diagram.

**Data:**

| EUT Cabling |              |        |           |          |            |                       |
|-------------|--------------|--------|-----------|----------|------------|-----------------------|
| ID          | Description  | Length | Shielding | Ferrites | Connection |                       |
|             |              |        |           |          | From       | To                    |
| A           | AF Connector | 1m     | No        | No       | EUT        | Microphone/Voiceducer |

| Support Equipment |              |              |               |
|-------------------|--------------|--------------|---------------|
| Description       | Manufacturer | Model Number | Serial Number |
| Microphone        | Temco        | RSM220       | NA            |
| Voiceducer        | Temco        | EM7B-05      | NA            |

## 5.0 Transmitter Information (Transmitter Info - Licensed)

## Method:

## Data:

| FCC Rule Part |                                                       |                                                                       |
|---------------|-------------------------------------------------------|-----------------------------------------------------------------------|
| 2.1033(c)(1)  | Applicant                                             | Company Name: Temco Communications Inc.                               |
|               |                                                       | Address: 13 Chipping Campden, S. Barrington, Il                       |
|               |                                                       | Phone: 847-359-3277                                                   |
|               |                                                       | Fax: 847-359-3743                                                     |
|               |                                                       | Contact Name: Brian Murakami                                          |
|               |                                                       | Email: <a href="mailto:bmurakami@temcom.net">bmurakami@temcom.net</a> |
|               | Manufacturer                                          | Company Name: Temco Communications Inc.                               |
|               |                                                       | Address: 13 Chipping Campden, S. Barrington, Il                       |
|               |                                                       | Phone: 847-359-3277                                                   |
|               |                                                       | Fax: 847-359-3743                                                     |
|               |                                                       | Contact Name: Brian Murakami                                          |
|               |                                                       | Email: <a href="mailto:bmurakami@temcom.net">bmurakami@temcom.net</a> |
| 2.1033(c)(2)  | Equipment                                             | FCC ID:                                                               |
|               |                                                       | EUT Model Number: SR390                                               |
|               |                                                       | EUT Serial Number: Engineering Samples 1-3                            |
| 2.1033(c)(3)  |                                                       | User Manual Attach as separate exhibit.                               |
| 2.1033(c)(4)  | Frequency Range                                       | 380 to 446 MHz                                                        |
|               |                                                       |                                                                       |
| 2.1033(c)(5)  | Type(s) of Emission                                   |                                                                       |
| 2.1033(c)(6)  | Range of operating power and means for variation      |                                                                       |
| 2.1033(c)(7)  | Maximum power rating                                  |                                                                       |
| 2.1033(c)(8)  | DC voltage and current into final RF stages of device |                                                                       |
| 2.1033(c)(9)  | Tune up procedure                                     |                                                                       |
| 2.1033(c)(10) | Schematics                                            |                                                                       |

## 6.0 RF Output Power (Conducted) (FCC Part 2.1046 Cond)

### Method:

Connect the transmitter output to a calibrated coaxial attenuator. Connect the other end of the attenuator to a power meter. Transmitter output was read off the power meter in dBm.

Performed the test at three frequencies (low, middle, and high channels) and on the highest power levels, which can be setup on the transmitter.

Canada typically requires this test to be repeated at +60° C and at -30° C.

### Test Equipment Used:

| Description:                                       | Manufacturer:  | Model:    | Asset Number: | Cal Date:  | Cal Due:   |
|----------------------------------------------------|----------------|-----------|---------------|------------|------------|
| Attenuator, 03 dB                                  | Weinschel Corp | 2         | 200003        | 07/18/2006 | 07/18/2007 |
| Attenuator, 20 dB                                  | Weinschel Corp | 2         | 200008        | 07/18/2006 | 07/18/2007 |
| Power Meter                                        | Boonton        | 4232A     | 200063        | 10/25/2005 | 10/25/2006 |
| Power Sensor, Dual Diode, 10kHz to 8GHz,<br>20 dBm | Boonton        | 51011-EMC | 200064        | 10/25/2005 | 10/25/2006 |

**Results: The sample tested was found to Comply.**

### Photos:



**6.0 RF Output Power (Conducted) (FCC Part 2.1046 Cond)****Data:**

| EUT Mode   | Frequency<br>MHz | Channel | Measured Power |       |       |
|------------|------------------|---------|----------------|-------|-------|
|            |                  |         | dBm            |       |       |
|            |                  |         | +60°C          | +20°C | -30°C |
| Low Power  | 380              | 1       | 22.8           | 22.93 | 22.83 |
|            | 413              | 8       | 22.67          | 22.83 | 22.56 |
|            | 446              | 15      | 22.83          | 22.89 | 22.68 |
| High Power | 380              | 1       | 32.86          | 32.92 | 32.72 |
|            | 413              | 8       | 32.76          | 32.91 | 32.62 |
|            | 446              | 15      | 32.89          | 32.88 | 32.55 |

## 7.0 Audio Low Pass Filter (Voice Input) (FCC Part 2.1047 alp)

### Method:

Guide: ANSI/TIA-603-C 2004

- 1) Setup the EUT and test equipment such that the audio input is connected at the input to the modulation limiter at the modulation stage.
- 2) Connect the audio output to the modulated stage.

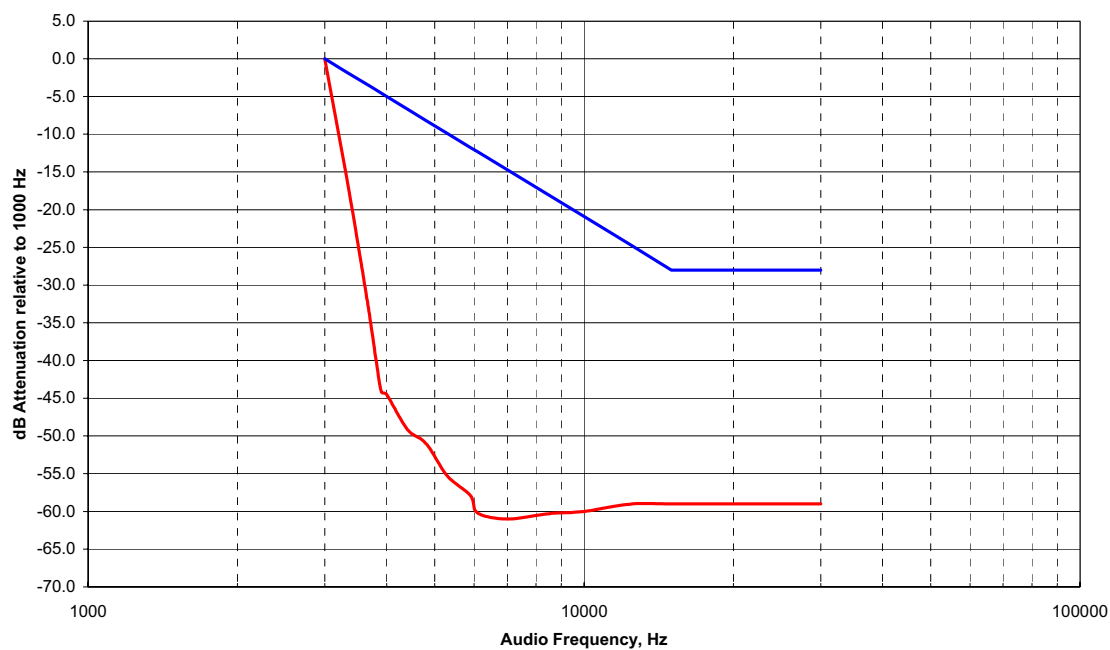
### Test Equipment Used:

| Description:        | Manufacturer:   | Model:  | Asset Number: | Cal Date:  | Cal Due:   |
|---------------------|-----------------|---------|---------------|------------|------------|
| Attenuator, 10 dB   | Weinschel Corp  | 2       | 200009        | 07/18/2006 | 07/18/2007 |
| Attenuator, 20 dB   | Weinschel Corp  | 2       | 200008        | 07/18/2006 | 07/18/2007 |
| Audio Analyzer      | Hewlett Packard | 8903B   | NYM-EMC-65    | 07/17/2006 | 07/17/2007 |
| Modulation Analyzer | Hewlett Packard | 8901A   | 213050        | 12/12/2005 | 12/12/2006 |
| Power Supply        | Tektronix       | PS2510G | 211678        | 04/17/2006 | 04/17/2007 |

**Results: The sample tested was found to Comply.**

### Plots:

**Transmitter Audio Response Characteristic  
Modulation Level vs. Audio Frequency**



Test Plot



**7.0 Audio Low Pass Filter (Voice Input) (FCC Part 2.1047 alp)****Data:**

## 8.0 Audio Frequency Response (FCC Part 2.1047 afr)

### Method:

Guide: ANSI/TIA-603-C 2004

- 1) Connect the audio signal generator to the input of the post limiter low pass filter and the dB meter to the output of the post limiter low pass filter.
- 2) Apply a 1000 Hz tone from the audio signal generator and adjust the level per manufacturer's specifications. Record the dB level of the 1000 Hz tone as LEVREF.
- 3) Set the audio signal generator to the desired test frequency between 3000 Hz and the upper low pass filter limit. Record the dB level at the test frequency as LEVFREQ.
- 4) Calculate the audio frequency response at the test frequency as: low pass filter response = LEVFREQ - LEVREF

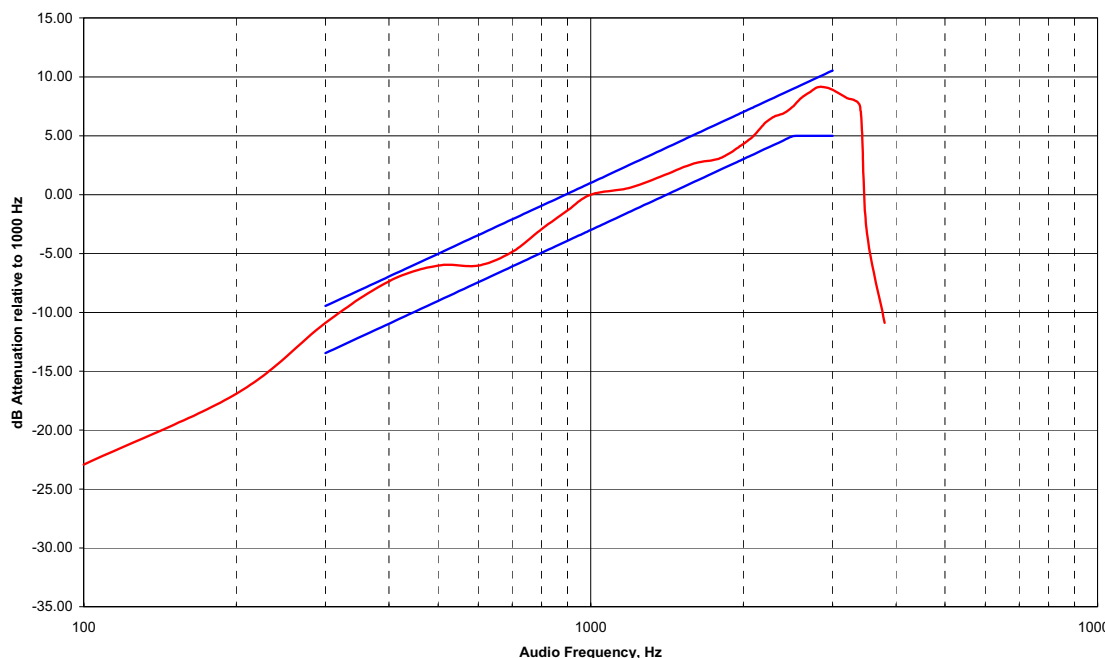
### Test Equipment Used:

| Description:        | Manufacturer:   | Model:  | Asset Number: | Cal Date:  | Cal Due:   |
|---------------------|-----------------|---------|---------------|------------|------------|
| Attenuator, 10 dB   | Weinschel Corp  | 2       | 200009        | 07/18/2006 | 07/18/2007 |
| Attenuator, 20 dB   | Weinschel Corp  | 2       | 200008        | 07/18/2006 | 07/18/2007 |
| Audio Analyzer      | Hewlett Packard | 8903B   | NYM-EMC-65    | 07/17/2006 | 07/17/2007 |
| Modulation Analyzer | Hewlett Packard | 8901A   | 213050        | 12/12/2005 | 12/12/2006 |
| Power Supply        | Tektronix       | PS2510G | 211678        | 04/17/2006 | 04/17/2007 |

**Results: The sample tested was found to Comply.**

### Plots:

**Transmitter Audio Response Characteristic  
Modulation Level vs. Audio Frequency**



Transmitter Audio Response

## **8.0 Audio Frequency Response (FCC Part 2.1047 afr)**

**Data:**

## 9.0 Modulation Limiting (FCC Part 2.1047 ml)

### Method:

Guide: ANSI/TIA-603-C 2004

- 1) Setup the test equipment as follows: Audio source to EUT. EUT to modulation meter through appropriate attenuation.
- 2) Set the frequency of the audio signal generator to 300Hz and adjust the level from -20 to +20 dB relative to the level required to achieve 60% modulation at 1 kHz.
- 3) Record the maximum value of plus or minus peak frequency deviation.
- 4) Repeat the above procedure with frequency 1000Hz & 3000Hz.

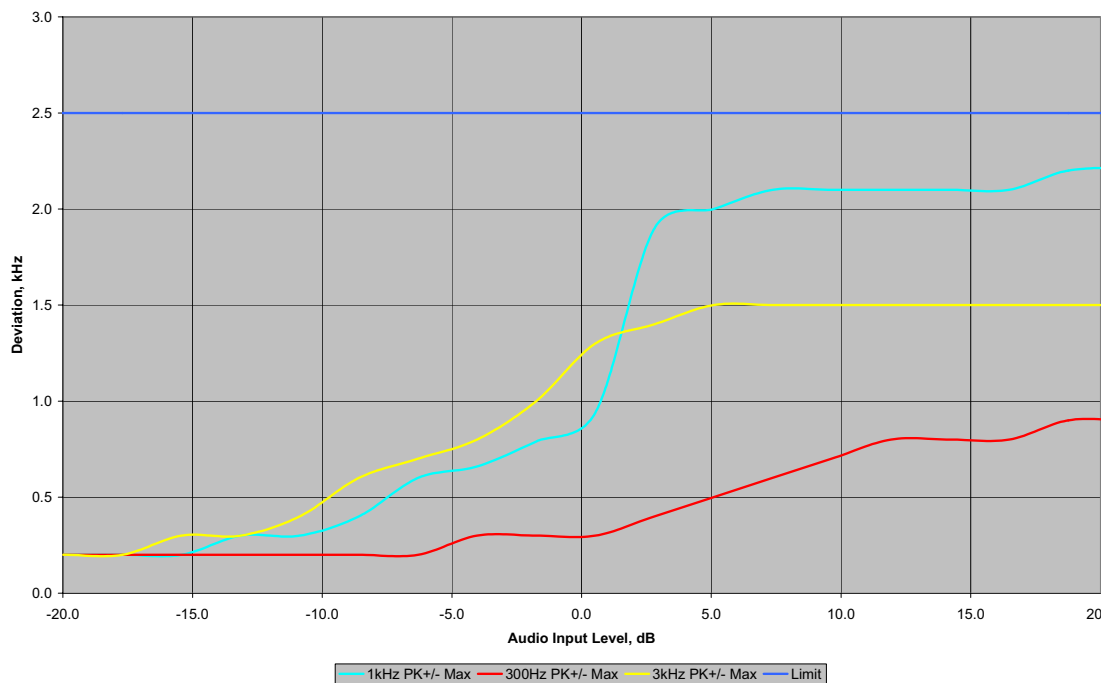
### Test Equipment Used:

| Description:              | Manufacturer:   | Model: | Asset Number: | Cal Date:  | Cal Due:   |
|---------------------------|-----------------|--------|---------------|------------|------------|
| Audio Analyzer            | Hewlett Packard | 8903B  | NYM-EMC-65    | 07/17/2006 | 07/17/2007 |
| Modulation Analyzer       | Hewlett Packard | 8901A  | 213050        | 12/12/2005 | 12/12/2006 |
| Multifunction Synthesizer | Hewlett Packard | 8904A  | 213214        | 09/19/2006 | 09/19/2007 |
| Spectrum Analyzer         | Hewlett Packard | 8595E  | 213060        | 03/06/2006 | 03/06/2007 |

**Results: The sample tested was found to Comply.**

### Plots:

**Modulation Limiting: Voice**



Modulation Limiting Plot

## **9.0 Modulation Limiting (FCC Part 2.1047 ml)**

**Data:**

## 10.0 Occupied Bandwidth (FCC Part 2.1049)

### Method:

Connect an audio source to the EUT. Connect the EUT to the receiver / spectrum analyzer.

Set the level of audio signal generator to obtain 16 dB greater than required for 50% modulation.

The occupied bandwidth is measured with the spectrum analyzer set at 2.5kHz/div scan and 10dB/div.

For amplifiers, the output bandwidth should be same as the input bandwidth.

### Test Equipment Used:

| Description:                       | Manufacturer:   | Model: | Asset Number: | Cal Date:  | Cal Due:   |
|------------------------------------|-----------------|--------|---------------|------------|------------|
| Attenuator, 20 dB                  | Weinschel Corp  | 2      | 200008        | 07/18/2006 | 07/18/2007 |
| Spectrum Analyzer, 20 Hz to 40 GHz | Rohde & Schwarz | FSEK30 | 200062        | 01/12/2006 | 01/12/2007 |

**Results: The sample tested was found to Comply.**

### Photos:



Delta 1 [T1]

RBW 300 Hz RF Att 40 dB

Ref Lvl

0.76 dB

VBW 300 Hz

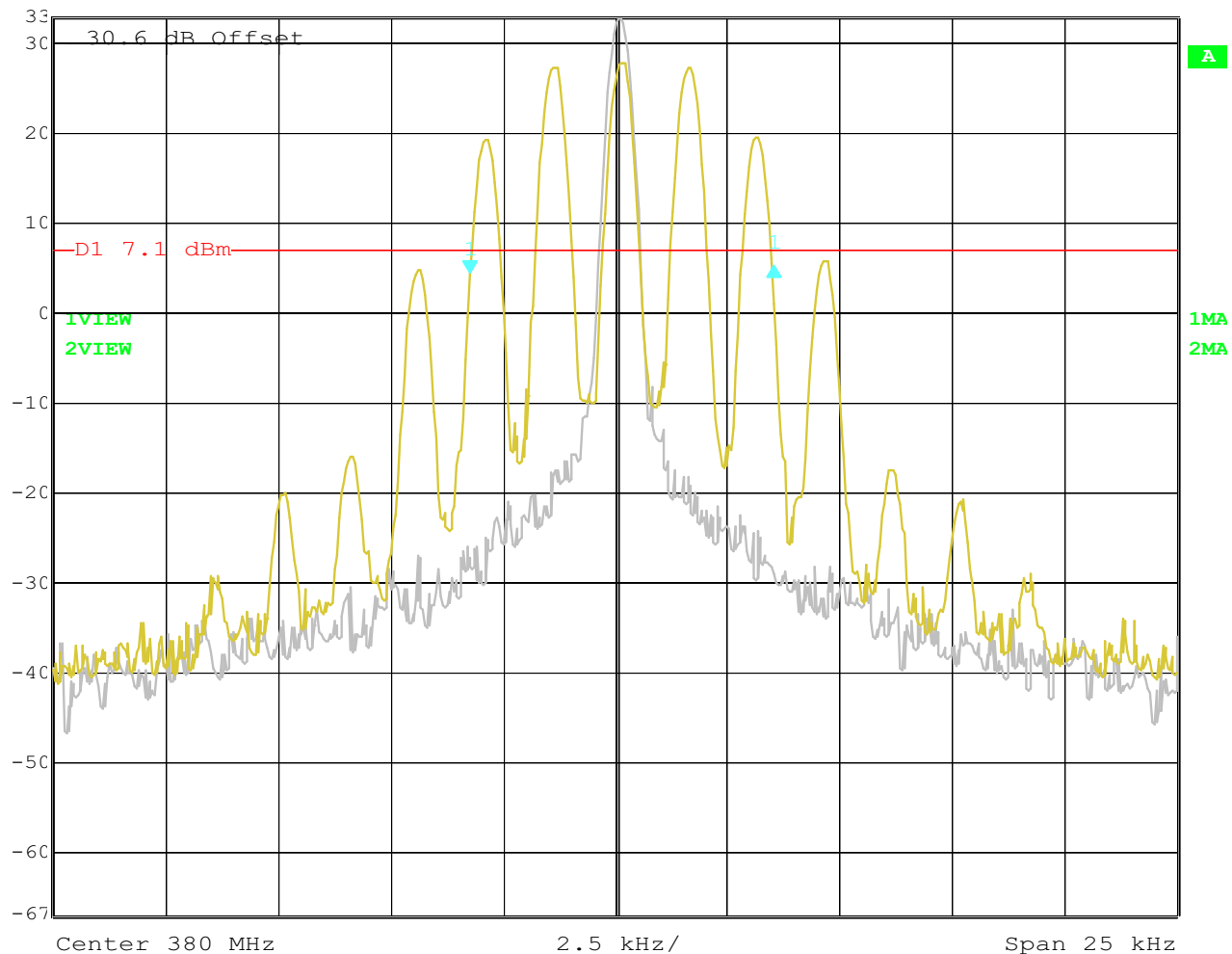
33 dBm

6.76352705 kHz

SWT 1.4 s

Unit

dBm



Date: 7.NOV.2006 21:53:31

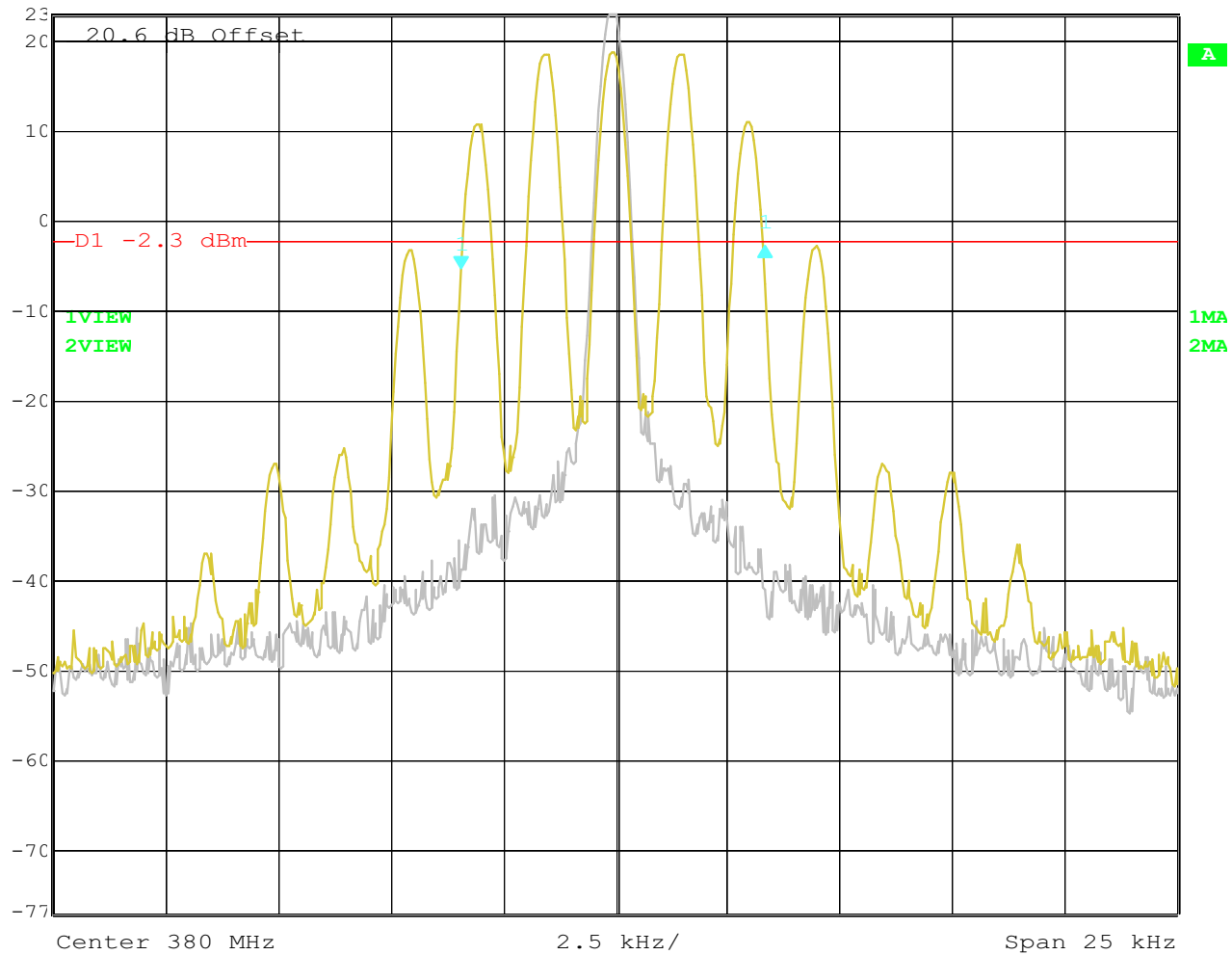
Occupied Bandwidth - High Power - 380 MHz

## 10.0 Occupied Bandwidth (FCC Part 2.1049)

## Photos:



Delta 1 [T1] RBW 300 Hz RF Att 40 dB  
Ref Lvl 2.47 dB VBW 300 Hz  
23 dBm 6.76352705 kHz SWT 1.4 s Unit dBm



Date: 7.NOV.2006 21:41:48

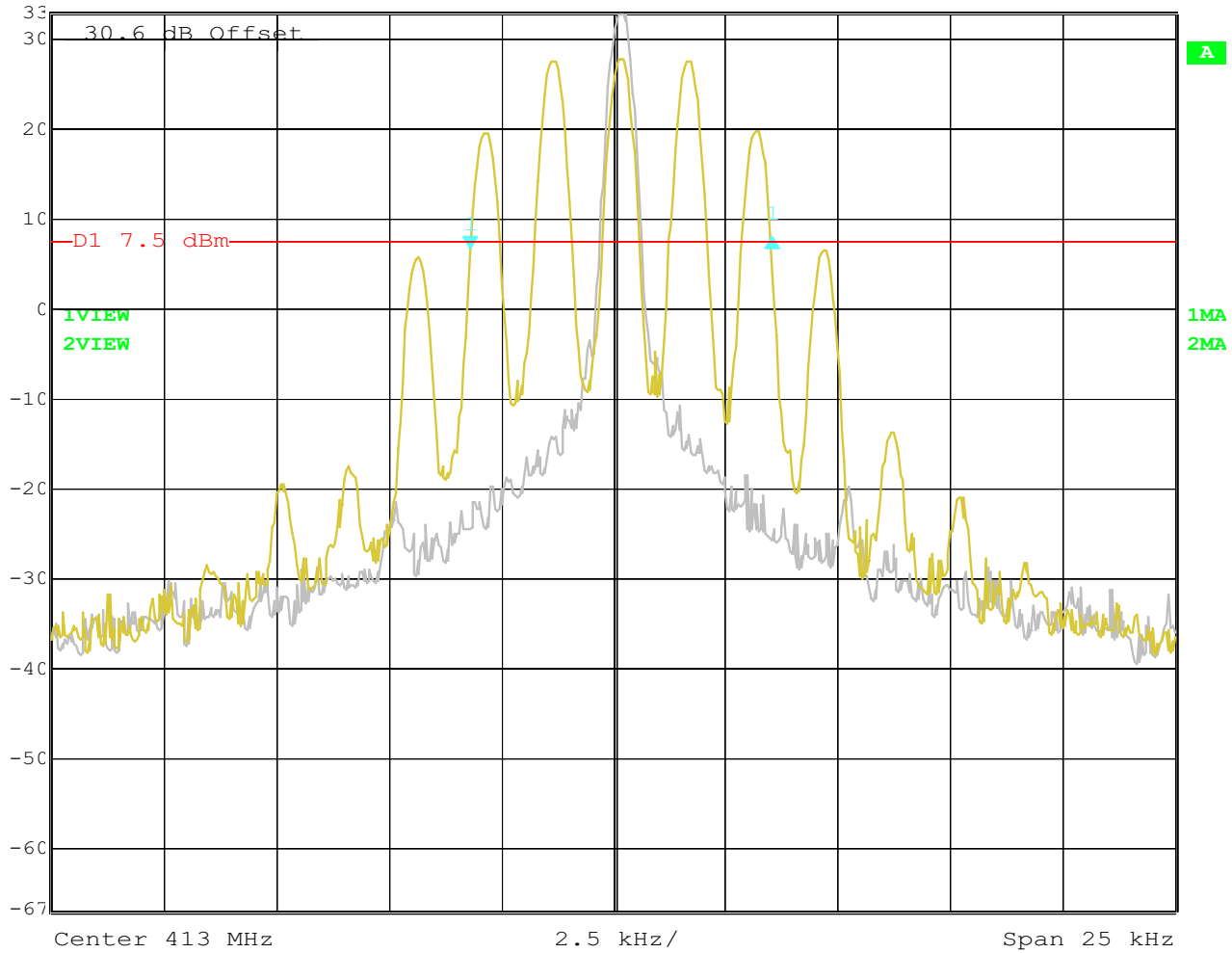
Occupied Bandwidth - Low Power - 380 MHz

# 10.0 Occupied Bandwidth (FCC Part 2.1049)

## Photos:



Delta 1 [T1] RBW 300 Hz RF Att 40 dB  
 Ref Lvl 1.26 dB VBW 300 Hz  
 33 dBm 6.71342685 kHz SWT 1.4 s Unit dBm



Date: 7.NOV.2006 21:57:45

Occupied Bandwidth - High Power - 413 MHz

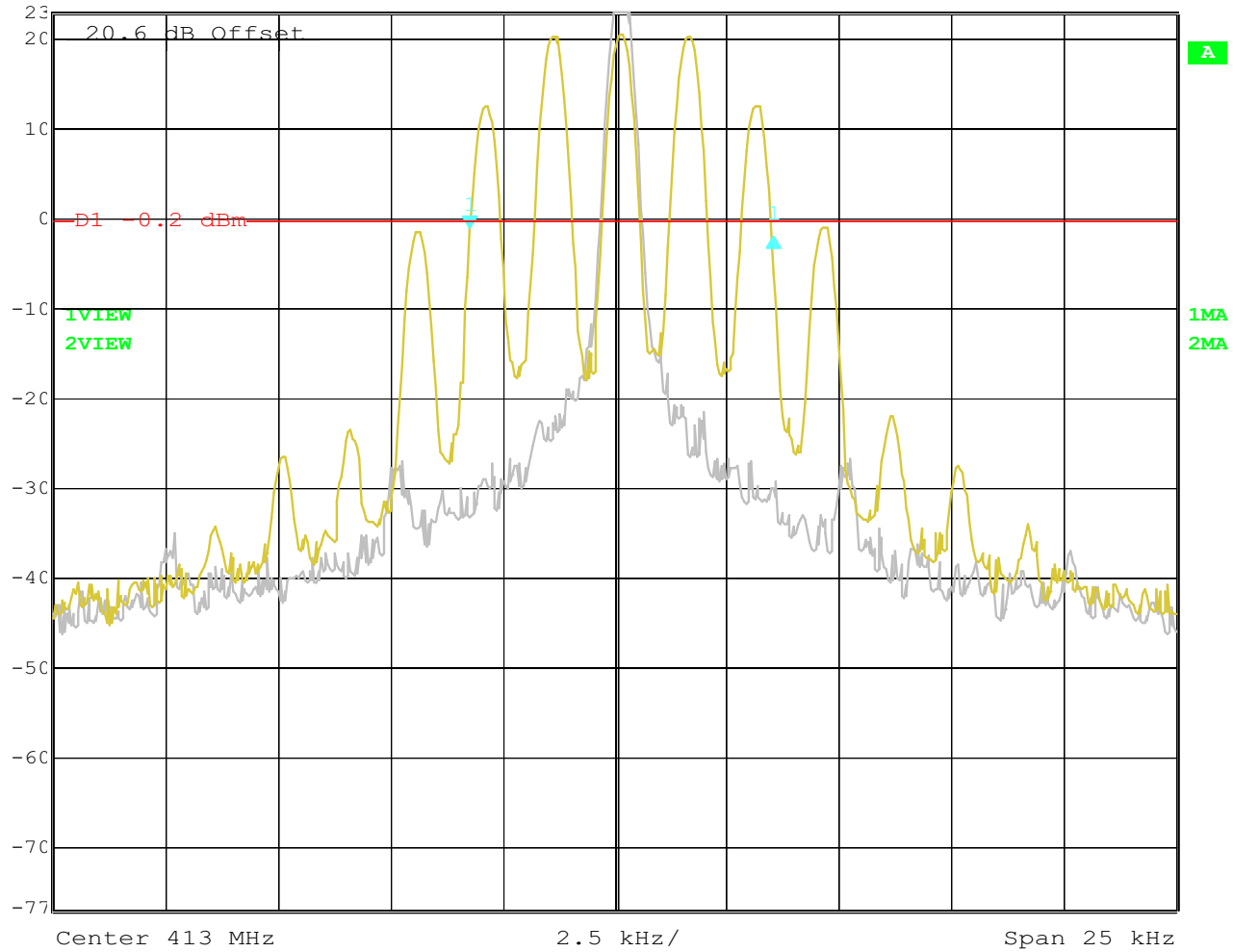


# 10.0 Occupied Bandwidth (FCC Part 2.1049)

## Photos:



Delta 1 [T1] RBW 300 Hz RF Att 40 dB  
 Ref Lvl -1.01 dB VBW 300 Hz  
 23 dBm 6.76352705 kHz SWT 1.4 s Unit dBm



Date: 7.NOV.2006 22:03:07

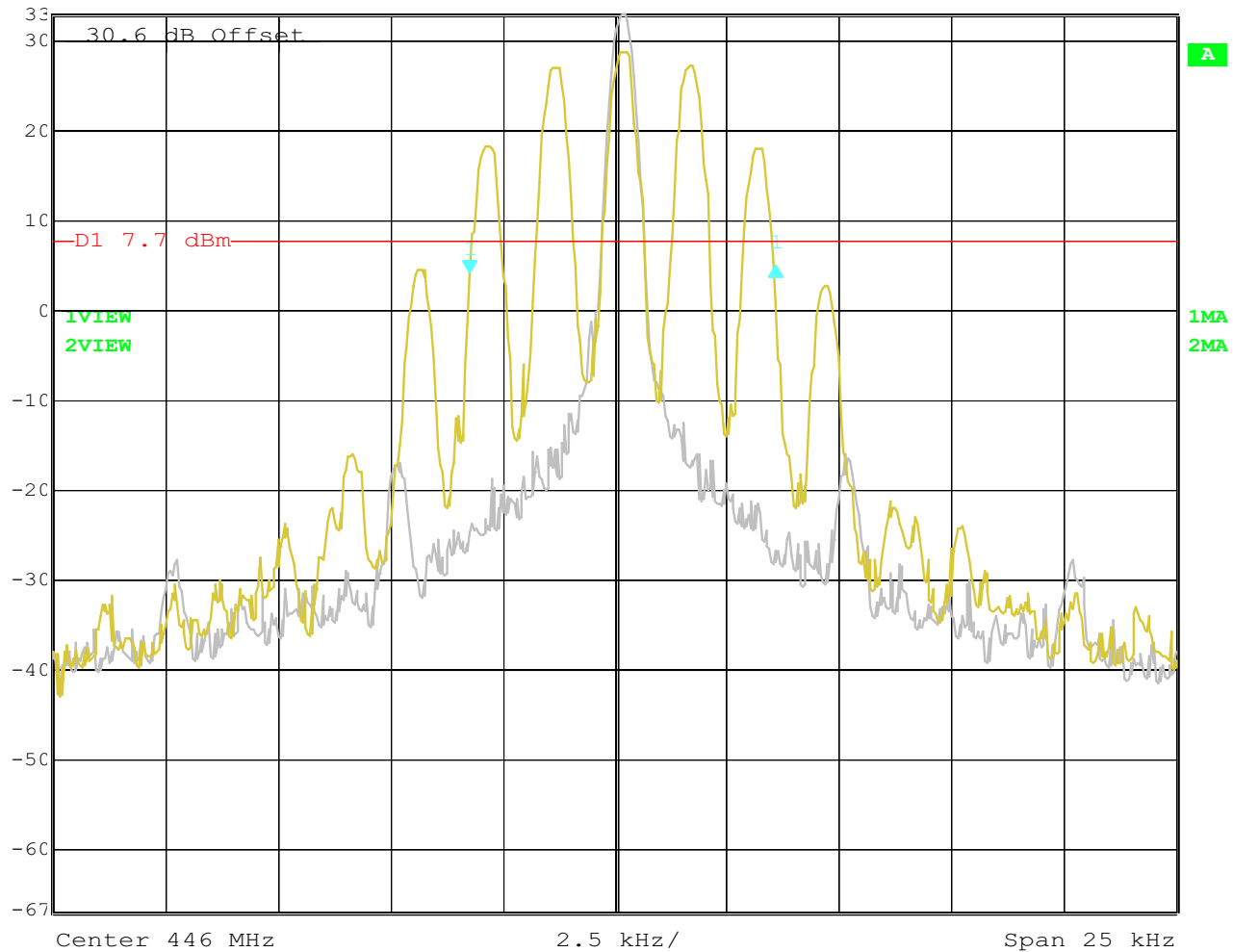
Occupied Bandwidth - Low Power - 413 MHz

## 10.0 Occupied Bandwidth (FCC Part 2.1049)

## Photos:



Delta 1 [T1] RBW 300 Hz RF Att 40 dB  
Ref Lvl 0.85 dB VBW 300 Hz  
33 dBm 6.81362725 kHz SWT 1.4 s Unit dBm



Date: 7.NOV.2006 22:00:12

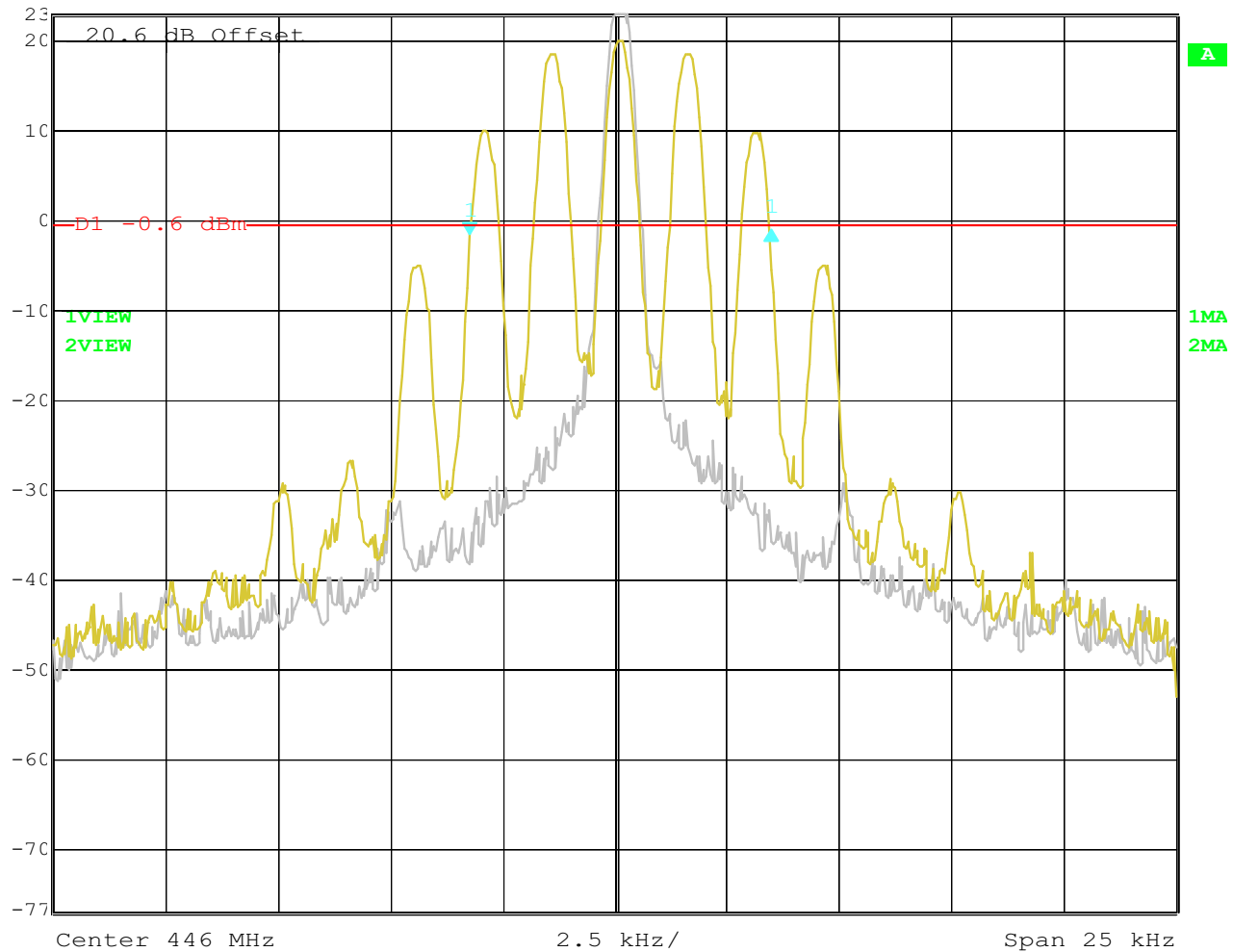
Occupied Bandwidth - High Power - 446 MHz

## 10.0 Occupied Bandwidth (FCC Part 2.1049)

## Photos:



Delta 1 [T1] RBW 300 Hz RF Att 40 dB  
Ref Lvl 0.60 dB VBW 300 Hz  
23 dBm 6.71342685 kHz SWT 1.4 s Unit dBm



Date: 7.NOV.2006 22:06:33

Occupied Bandwidth - Low Power - 446 MHz

**10.0 Occupied Bandwidth (FCC Part 2.1049)****Data:**

| <b>Mode</b> | <b>Frequency<br/>MHz</b> | <b>Resolution<br/>Bandwidth (1)</b> | <b>Video<br/>Bandwidth</b> | <b>Sweep time<br/>Seconds</b> | <b>Measured<br/>Bandwidth<br/>kHz</b> |
|-------------|--------------------------|-------------------------------------|----------------------------|-------------------------------|---------------------------------------|
| High Power  | 380                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.76                                  |
| Low Power   | 380                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.76                                  |
| High Power  | 413                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.71                                  |
| Low Power   | 413                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.76                                  |
| High Power  | 446                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.81                                  |
| Low Power   | 446                      | 300 Hz                              | 300 Hz                     | 1.4                           | 6.71                                  |

Note (1): Greater or equal to 1% of emission bandwidth.

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

### Method:

FCC §2.1049, FCC §2.1051, §22.917(a), FCC §24.238(a)

Out of Band Emissions: The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for the Cellular band and 1 MHz or greater in the PCS band. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

Connect the RF output of the EUT to a spectrum analyzer through appropriate attenuation. Set the EUT to transmit at its maximum power level. Sufficient scans were taken to show the out of band Emissions if any up to 10th harmonic.

For Amplifiers, an intermodulation test is also performed. Test all modulations types [TDMA, CDMA, and FM (covers GSM and F1D)].

- CW signal rather than typical signal is acceptable (for FM).
- At maximum drive level, for each modulation: one test with three tones, or two tests (high-, low-band edge) with two tones
- Limit usually is -13dBm conducted.
- Not needed for Single Channel systems.
- Combination of modulation types not needed.

### Test Equipment Used:

| Description:        | Manufacturer:   | Model: | Asset Number: | Cal Date:  | Cal Due:   |
|---------------------|-----------------|--------|---------------|------------|------------|
| Attenuator, 03 dB   | Weinschel Corp  | 2      | 200003        | 07/18/2006 | 07/18/2007 |
| Attenuator, 20 dB   | Weinschel Corp  | 2      | 200008        | 07/18/2006 | 07/18/2007 |
| Audio Analyzer      | Hewlett Packard | 8903B  | NYM-EMC-65    | 07/17/2006 | 07/17/2007 |
| Modulation Analyzer | Hewlett Packard | 8901A  | 213050        | 12/12/2005 | 12/12/2006 |
| Spectrum Analyzer   | Hewlett Packard | 8595E  | 213060        | 03/06/2006 | 03/06/2007 |

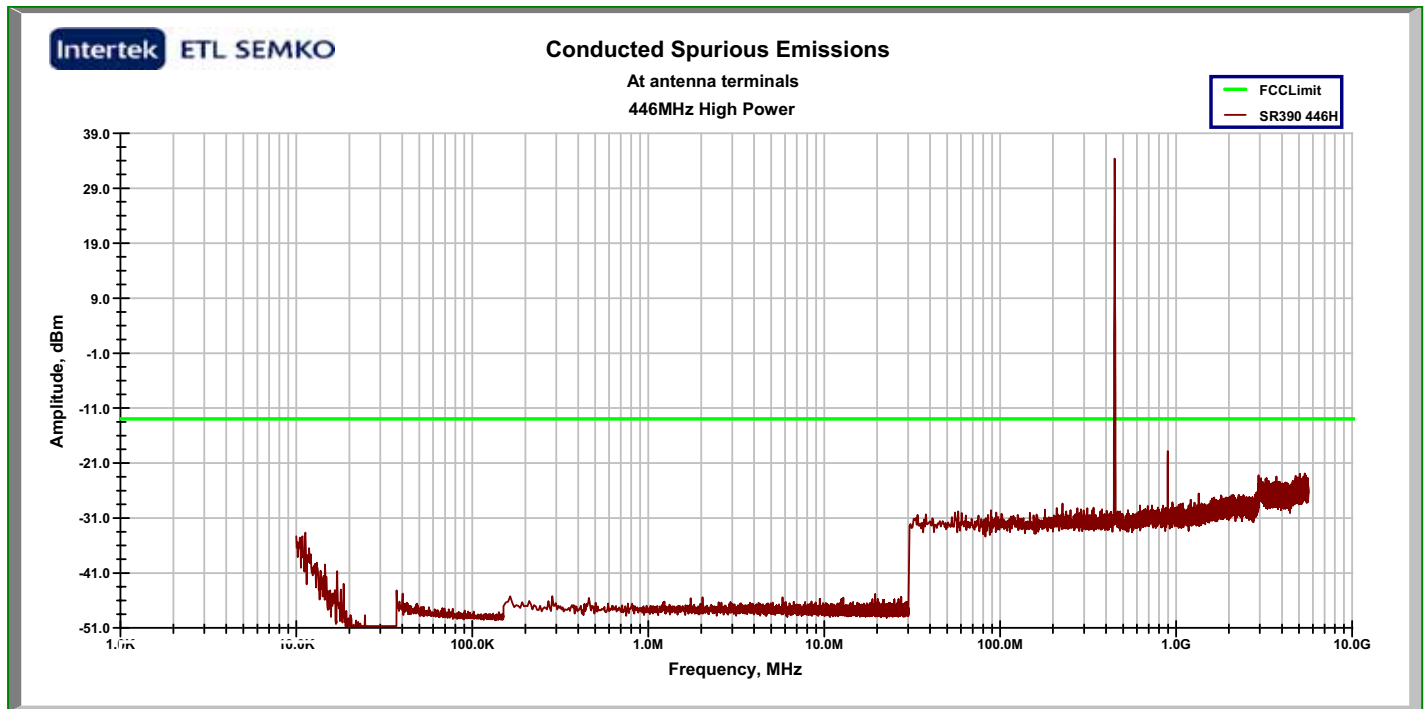
**Results: The sample tested was found to Comply.**

**11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)****Photos:**

Conducted Spurious Emissions

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

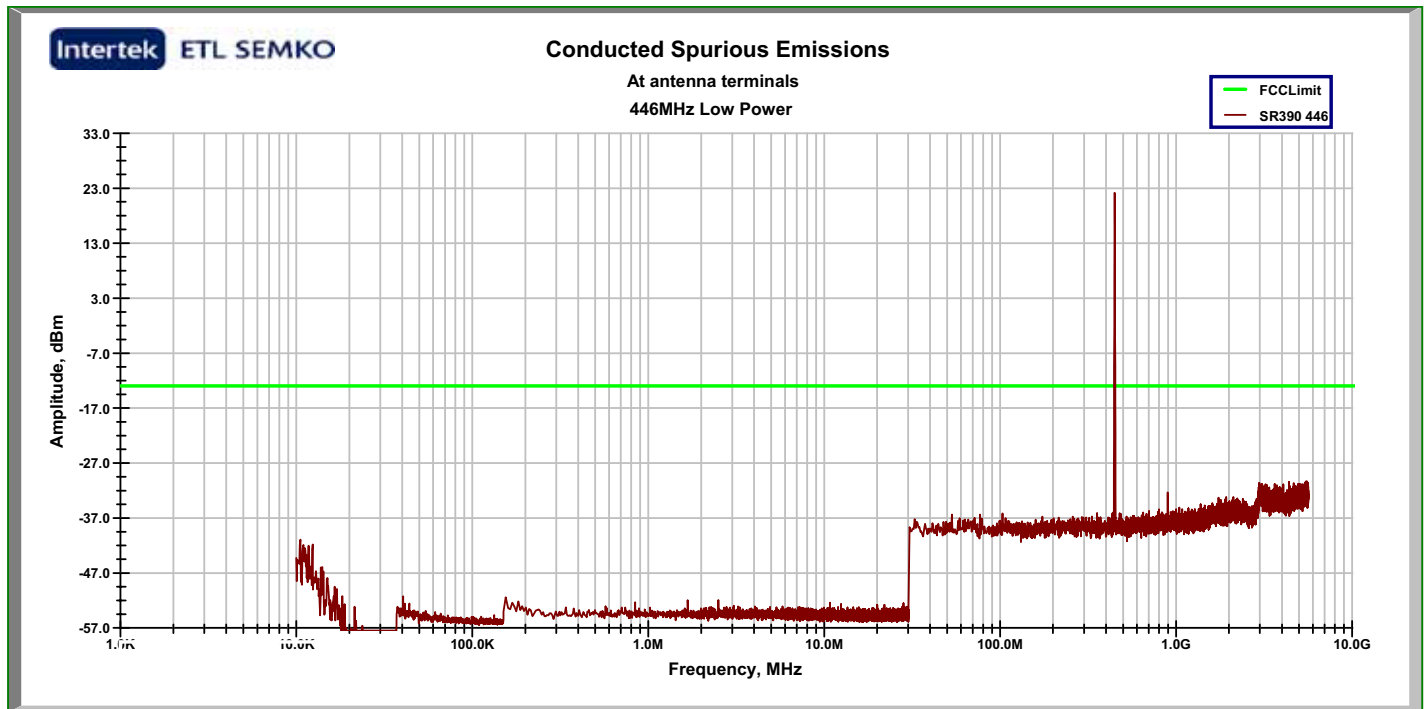
### Plots:



Spurious Emissions - High Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

### Plots:

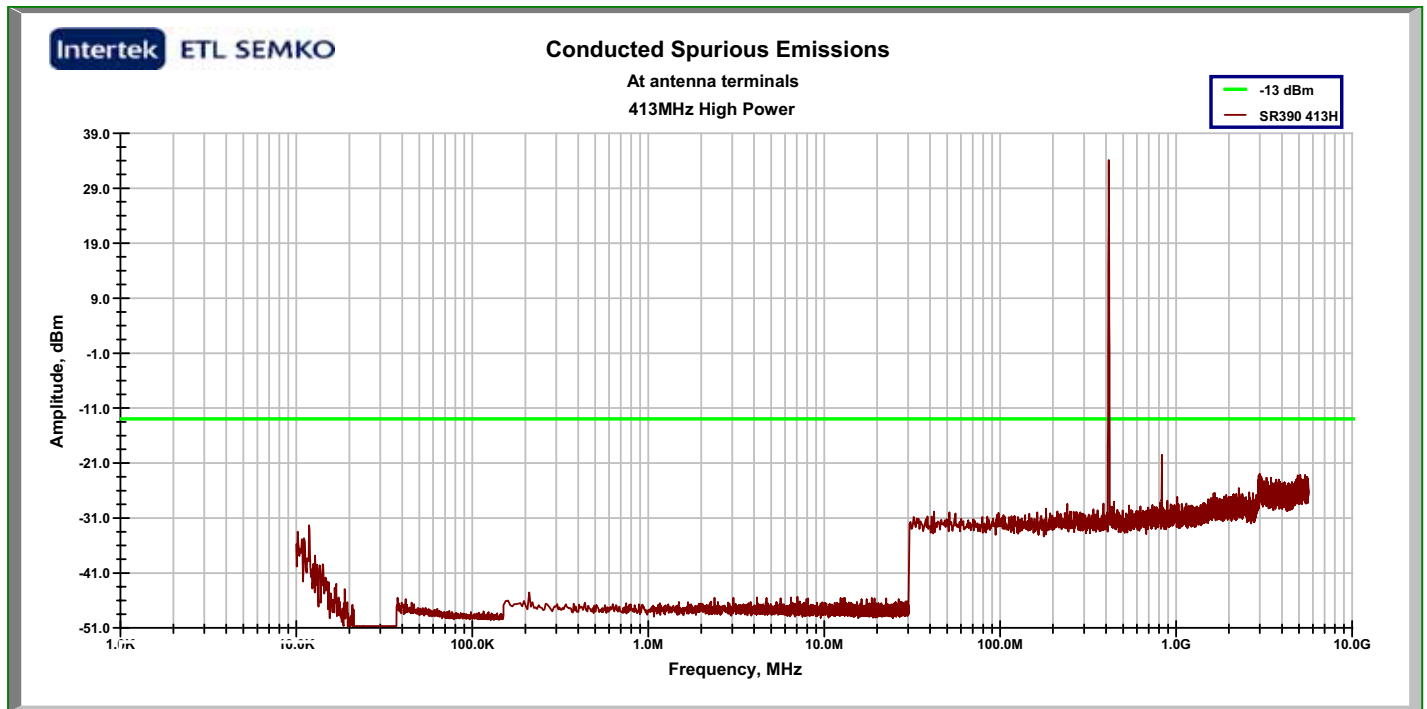


Spurious Emissions - High Channel, Low Power



## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

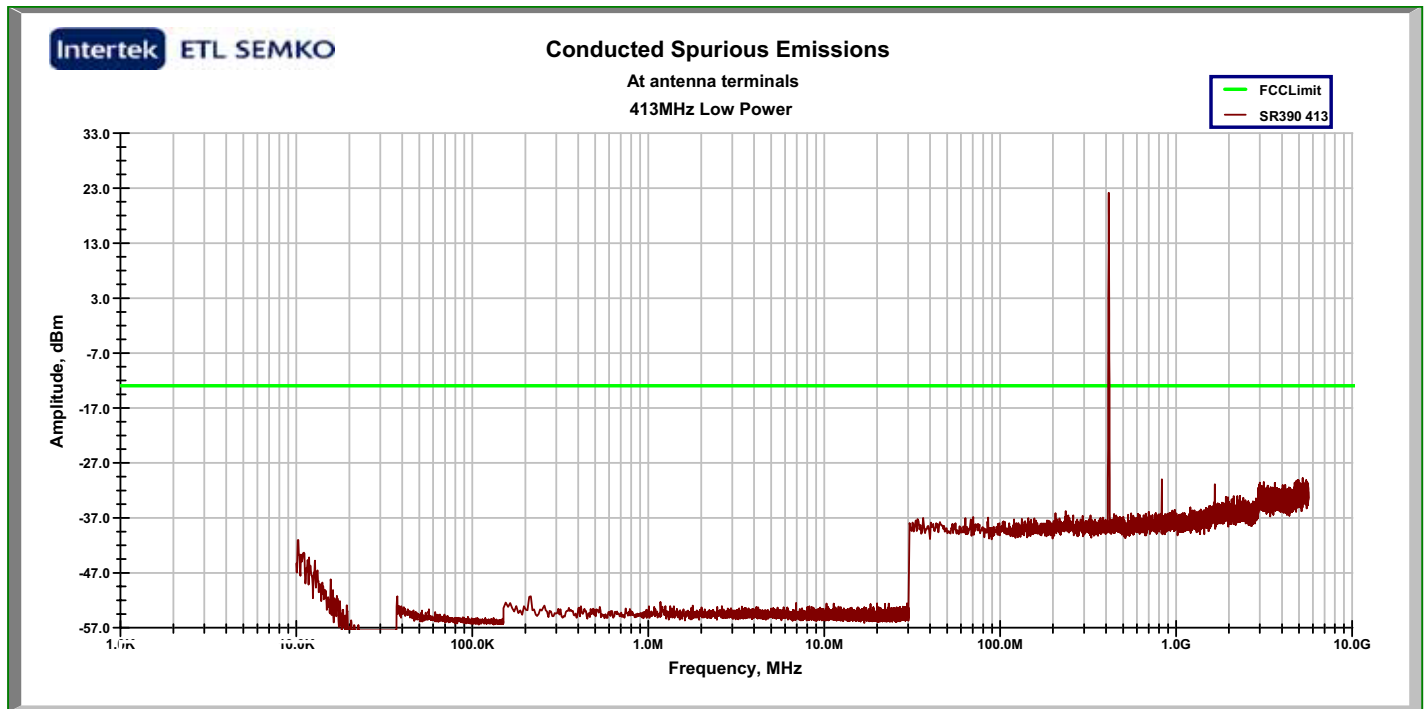
### Plots:



Spurious Emissions - Mid Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

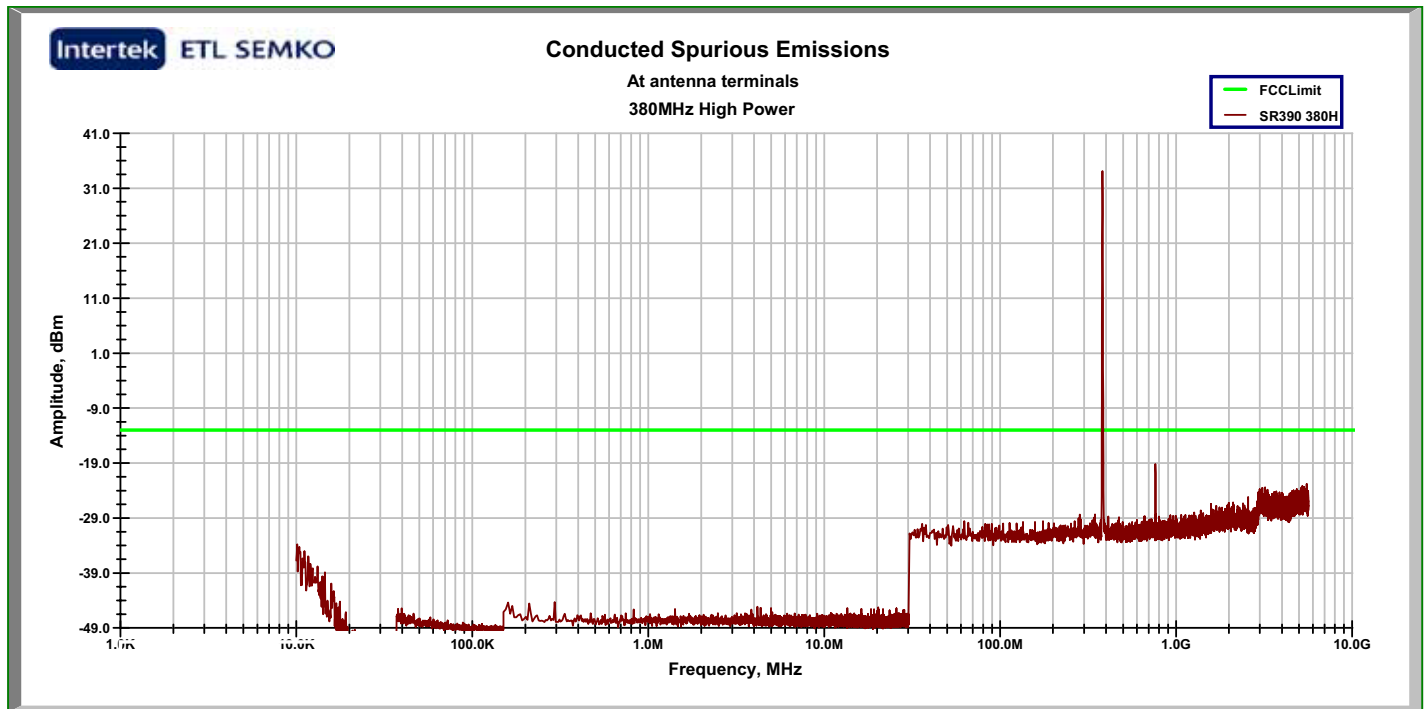
### Plots:



Spurious Emissions - Mid Channel, Low Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

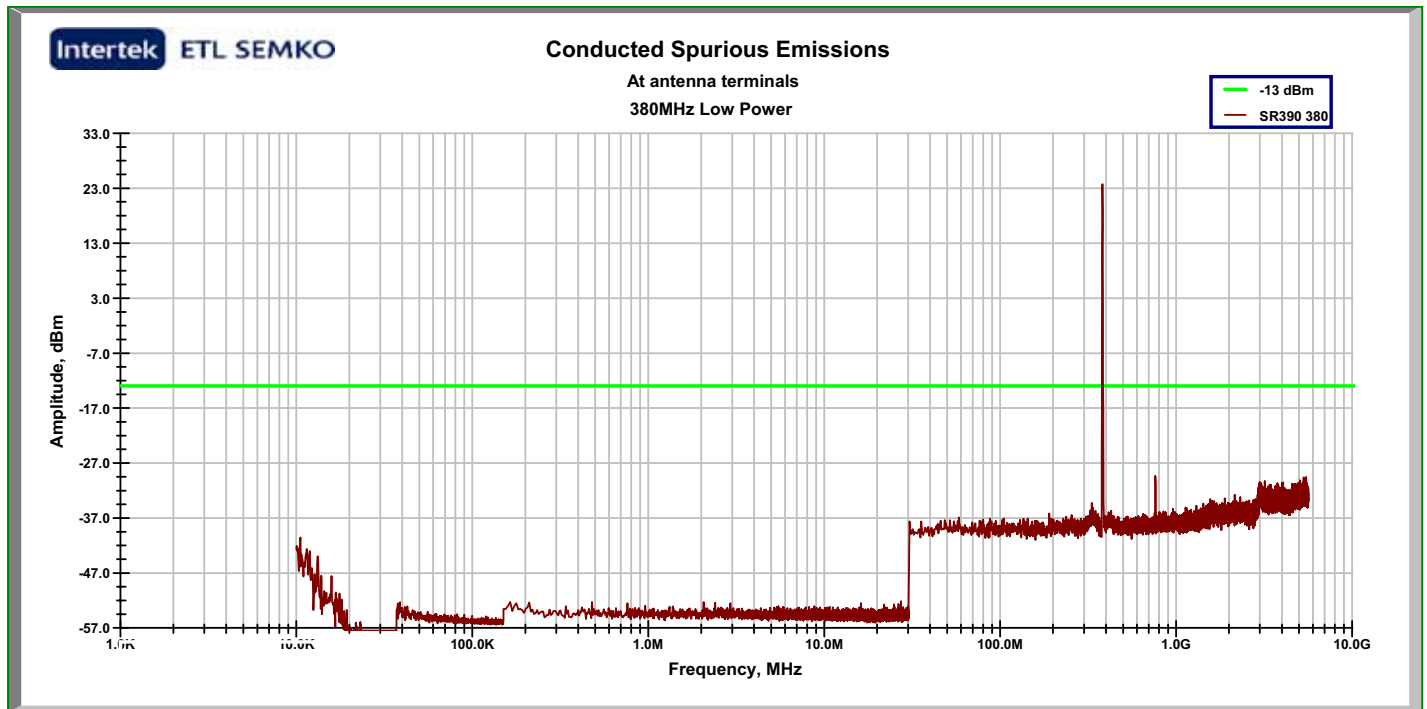
### Plots:



Spurious Emissions - Low Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

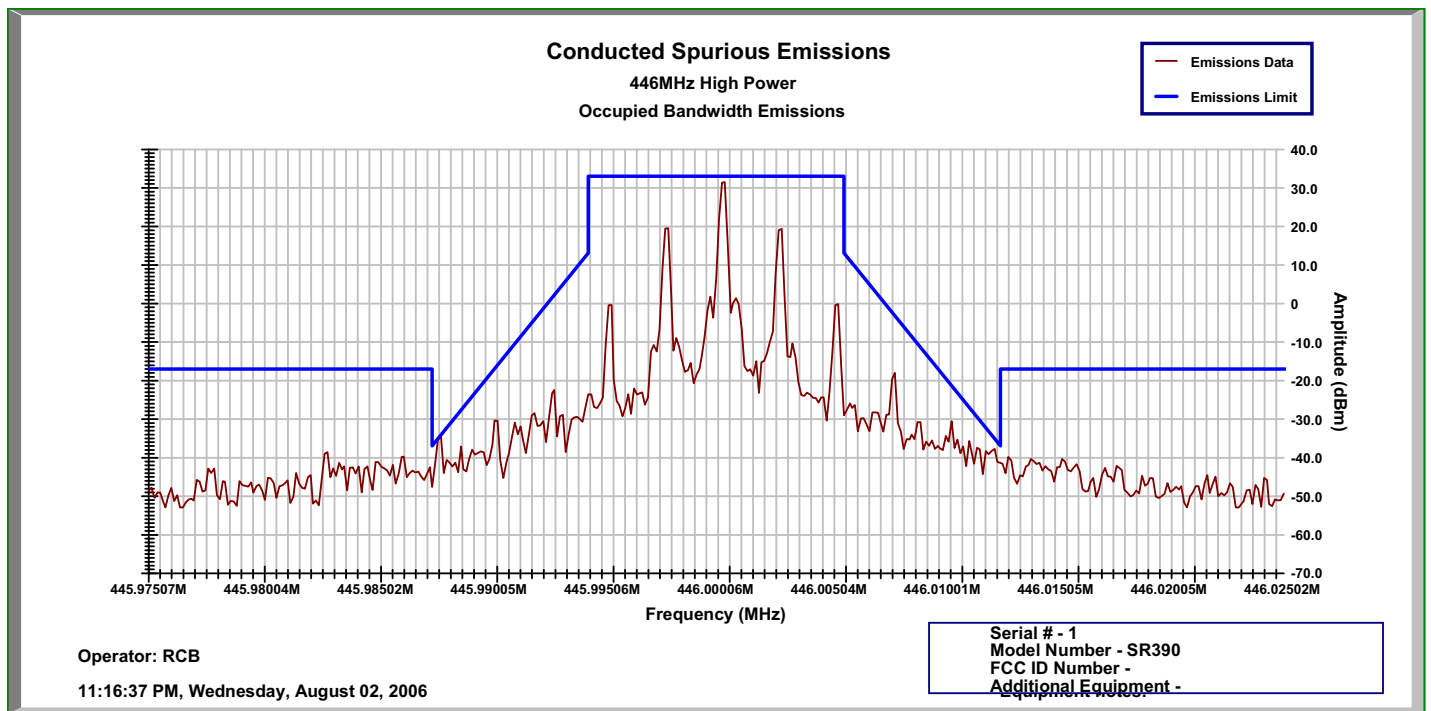
### Plots:



Spurious Emissions - Low Channel, Low Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

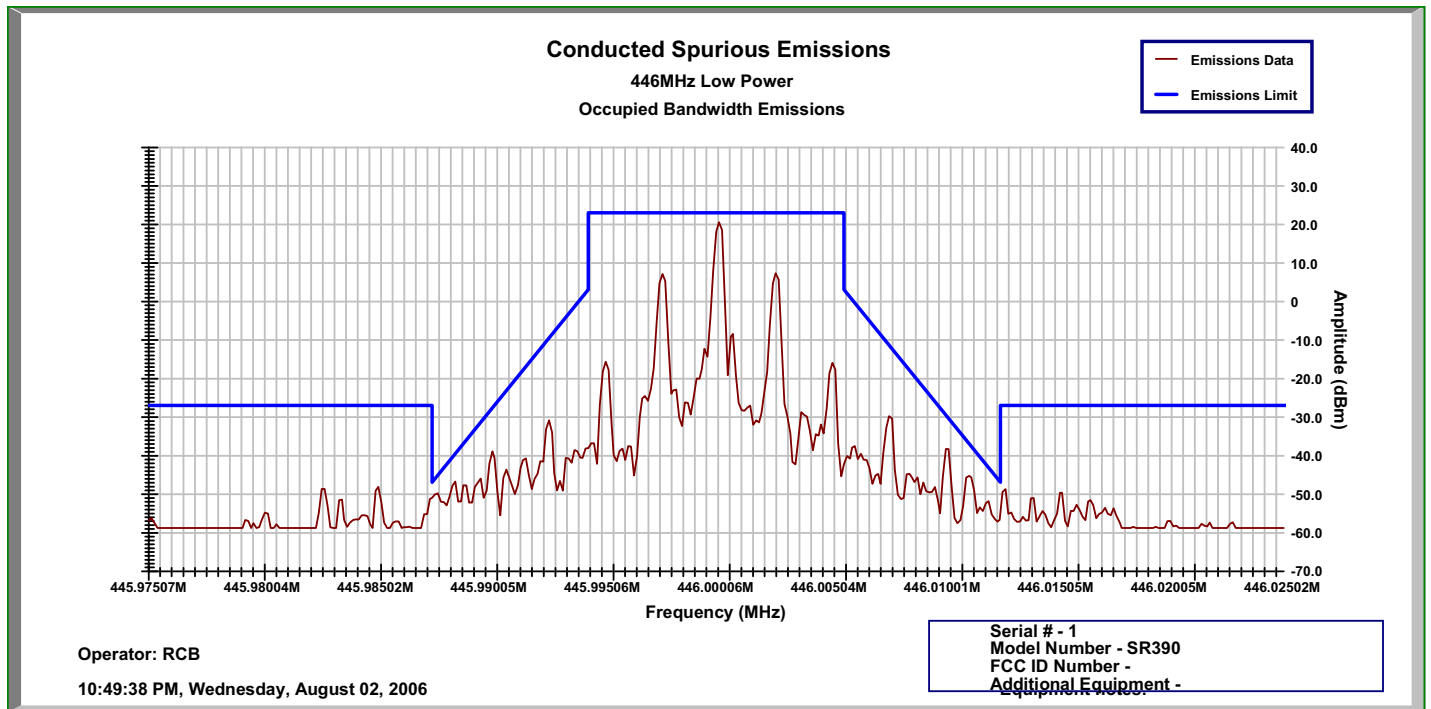
## Plots:



Emission Mask - High Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

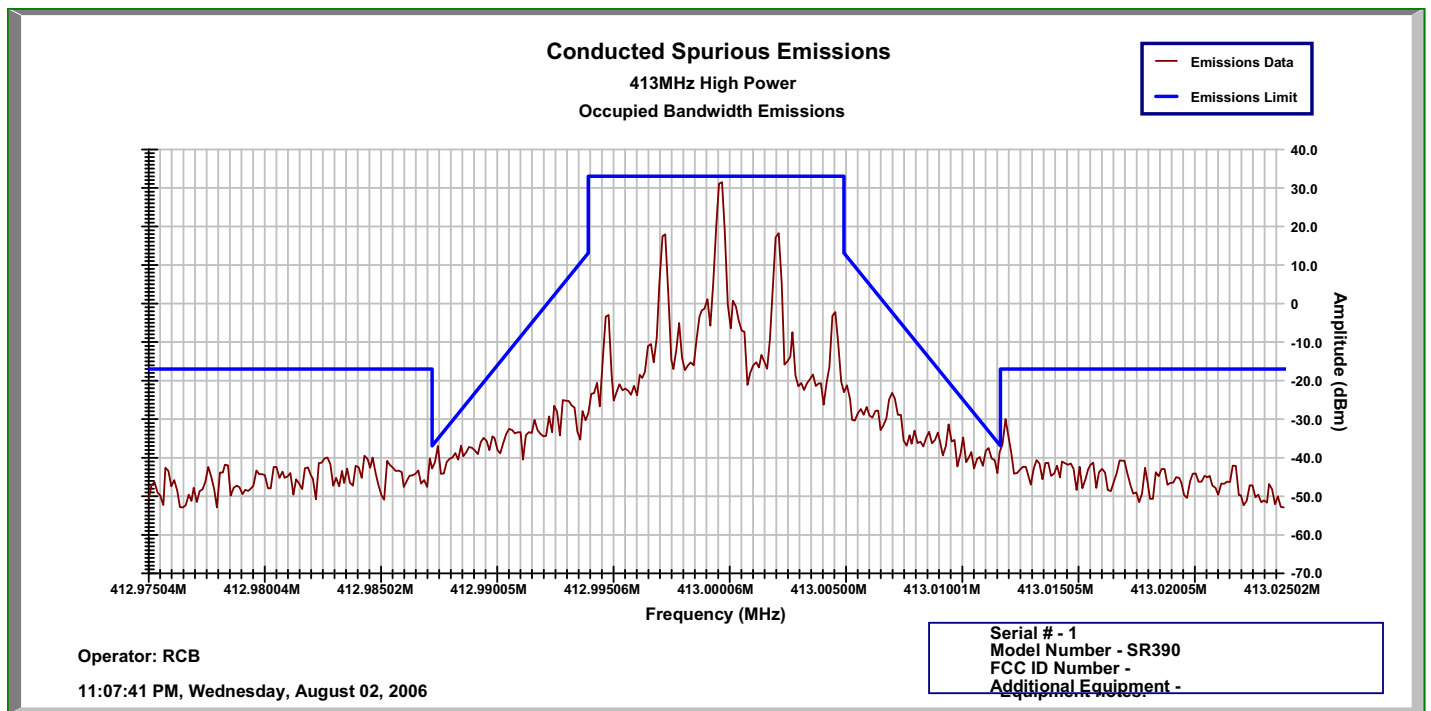
### Plots:



Emission Mask - High Channel, Low Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

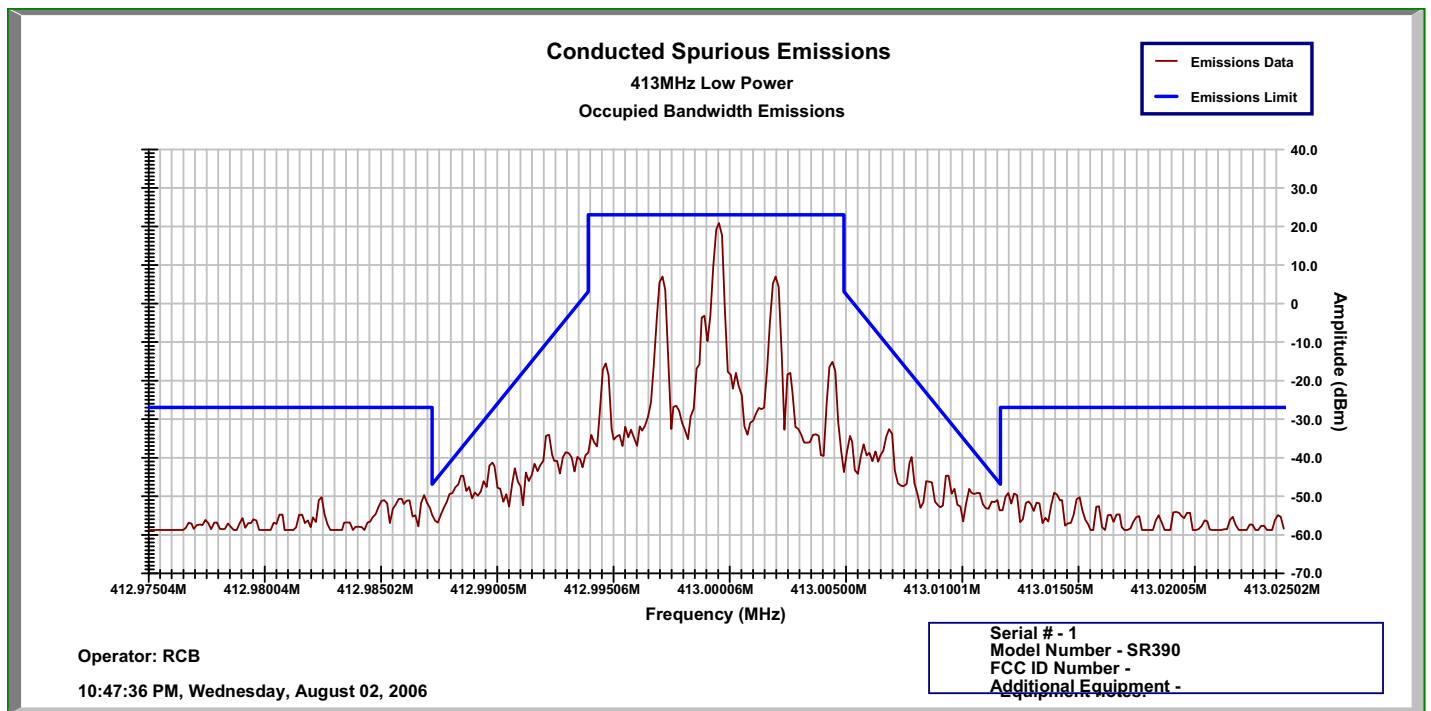
## Plots:



Emission Mask - Mid Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

## Plots:

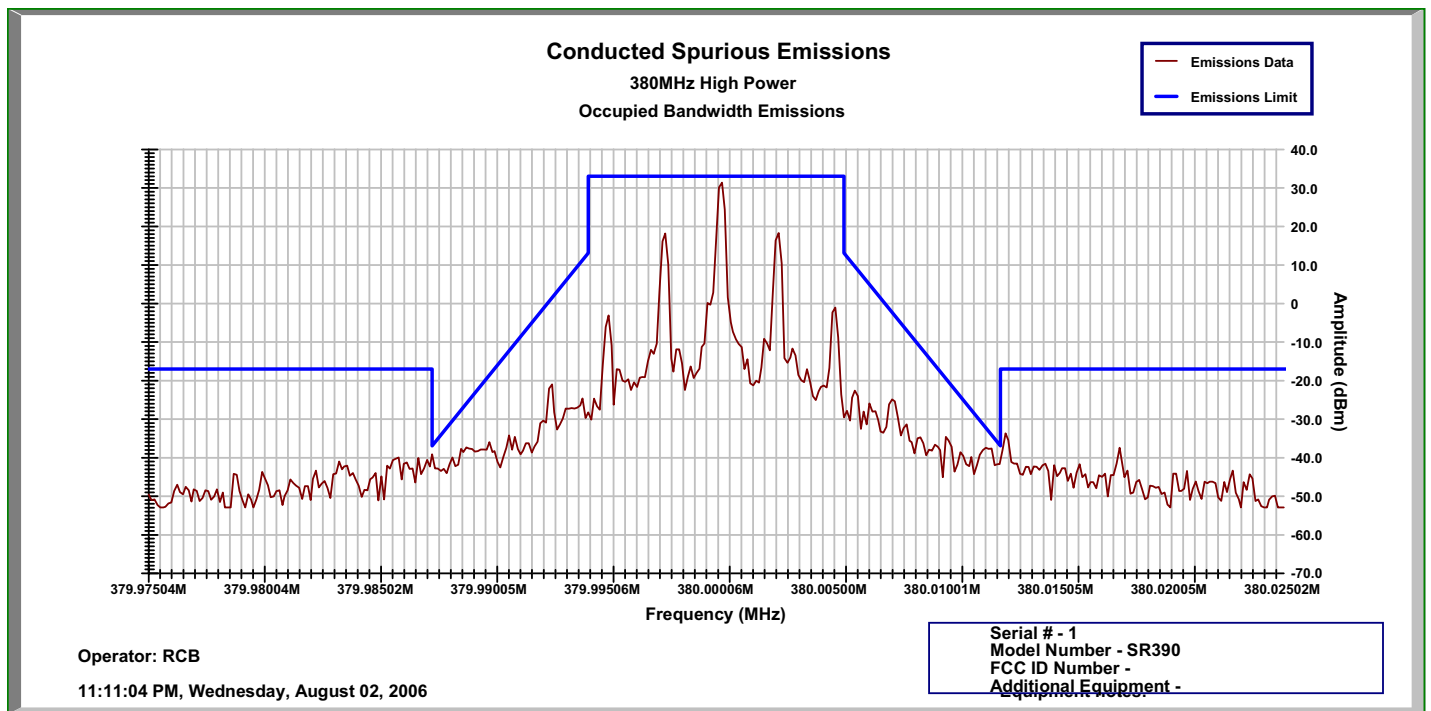


Emission Mask - Mid Channel, Low Power



## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

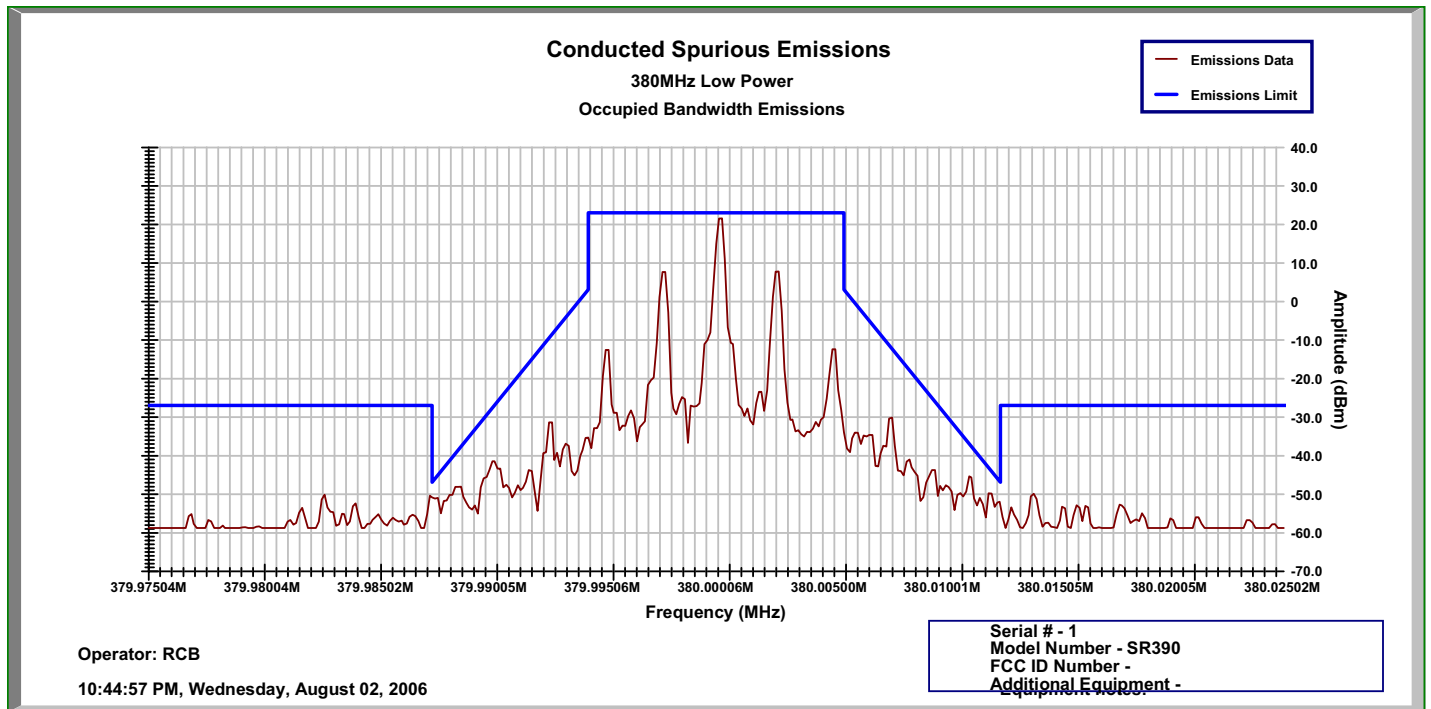
## Plots:



Emission Mask - Low Channel, High Power

## 11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)

### Plots:



Emission Mask - Low Channel, Low Power

**11.0 Spurious emissions at antenna terminals (FCC Part 2.1051)****Data:**

| <b>Mode</b> | <b>Frequency<br/>MHz</b> | <b>RBW/VBW</b>  | <b>Peak EUT<br/>Emission<br/>dBm</b> | <b>Limit<br/>dBm</b> | <b>Margin<br/>dB</b> |
|-------------|--------------------------|-----------------|--------------------------------------|----------------------|----------------------|
| TX 380      | 759.9875                 | 100 kHz / 1 MHz | -21.31                               | -13                  | -8.31                |
| TX 413      | 825.9825                 | 100 kHz / 1 MHz | -21.29                               | -13                  | -8.29                |
| TX 413      | 1652.0025                | 1 MHz / 3 MHz   | -22.48                               | -13                  | -9.48                |
| TX 446      | 891.999                  | 100 kHz / 1 MHz | -21.09                               | -13                  | -8.09                |

## 12.0 Field strength of spurious radiation (FCC Part 2.1053)

### Method:

Applies to the following Standards:

TIA-603-C (land mobile)

FCC 47 CFR Part 90 (land mobile)

RSS-119 (land mobile/fixed)

### PROCEDURE

- A) Connect the equipment as illustrated. Place the transmitter to be tested on the turntable in the test site, in its normal operating position. If the transmitter is intended to be hand held, the testing must be repeated with the transmitter in three orthogonal orientations.
- B) Attach a non-radiating standard load to the antenna port, using the shortest possible interconnecting shielded cable. For devices with integral, antennas, run the test with the integral antenna operating.
- C) Select the larger test distance consistent with the site noise floor; use 10m if possible, 3m if ambient noise requires a shorter distance.
- D) Typical spectrum analyzer settings are given below. Refer to the table above, and the specific standard, for correct settings.
  - 1) RBW = 10 kHz below 1 GHz, 1 MHz above 1 GHz.
  - 2) VBW = 300 kHz below 1 GHz, 3 MHz above 1 GHz.
  - 3) Sweep speed sufficiently slow to maintain calibration.
  - 4) detector mode = positive peak.
- E) Place the test antenna in its vertical polarization position; use an attenuator with 6 - 10 dB loss (A) as a matching pad between the test antenna and its cable.
- F) The spectrum is to be scanned from the lowest RF frequency generated in the equipment to the 10th harmonic of the carrier, excepting the occupied bandwidth. Specific standards may require a different maximum frequency.
- G) For each spurious emission detected, raise and lower the test antenna from 1 to 4m with the transmitter facing the test antenna, and record the highest received signal from the transmitter in dBmR. Rotate the turntable through 360 degrees to find the maximum emission value at that frequency.
- H) Rotate the test antenna to its horizontal polarization position. Repeat steps g) and h).
- I) Replace the transmitter under test with a substitution antenna whose gain above that of a half-wave dipole is known to be G(dBd). Refer to the illustration below.
- J) Place the center of the substitution antenna at the same location on the table as the transmitter under test, using vertical polarization for both substitution and test antennas. Connect the substitution antenna to the signal generator, using a cable with known signal loss LC. Use an attenuator with loss S as a matching pad between the substitution antenna and its cable.
- K) Raise the test antenna from 1m to 4m to maximize the analyzer display from the substitution antenna. At the maximum display value for each spurious frequency, adjust the signal level dBmT so that the spectrum analyzer displays the maximum signal observed in steps g) - h) above.
- L) Calculate the output power of the transmitter in ERP according to:  

$$\text{spurious power in (dBm)} = \text{dBmT} - \text{LC} - \text{S} + \text{dBd}$$
- M) Repeat steps k) - l) for both antennas horizontally polarized. Record the spurious power separately for the vertical and horizontal polarizations.

NOTE: For FCC purposes, emissions > 20 dB below the regulatory spurious limit do not have to be determined by the substitution method. The regulatory limit for many licensed transmitters is -13 dBm (50 ?W) or 84.4 dBuV/m at 3m.

### MEASUREMENT UNCERTAINTY

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes. The values given are the measurement uncertainty values with an expanded uncertainty of k=2.

+/- 3.85 dB

### Test Equipment Used:

| Description:                                 | Manufacturer:     | Model:          | Asset Number: | Cal Date:  | Cal Due:   |
|----------------------------------------------|-------------------|-----------------|---------------|------------|------------|
| Antenna, Bilog (20MHz to 2GHz)               | Chase             | CBL6112B        | 211386        | 08/31/2005 | 08/31/2006 |
| Antenna, Horn, 0.7 - 18 GHz                  | A.H. Systems      | SAS-200/571     | 213058a       | 02/27/2006 | 02/27/2007 |
| Antenna, Horn, 1-18 GHz                      | EMCO              | 3115            | 213061        | 03/28/2006 | 03/28/2007 |
| Antenna, Roberts Tunable Dipole (set)        | Compliance Design | A100            | 213157        | 01/05/2006 | 01/05/2007 |
| Cable E01 (Formerly PE7000N-N2 or N2)        | Pasternack        | RG214/U         | E01           | 05/11/2006 | 05/11/2007 |
| Cable E05 (Formerly HS 1500 N-N)             | Huber-Suhner      | Sucoflex 104PEA | E05           | 05/11/2006 | 05/11/2007 |
| Cable E06 (Formerly HS 1500 N-SMA)           | Huber-Suhner      | Sucoflex 104PEA | E06 211268    | 05/11/2006 | 05/11/2007 |
| Cable E11 (Formerly HS 7000 N-SMA)           | Huber-Suhner      | Sucoflex 104PEA | E11 211266    | 05/11/2006 | 05/11/2007 |
| Cable, 18 GHz, N, 394 inches                 | Megaphase         | G919-NKNK-394   | MP3           | 05/11/2006 | 05/11/2007 |
| EMI Receiver                                 | Hewlett Packard   | 8546A           | 211505        | 02/13/2006 | 02/13/2007 |
| EMI Receiver, Preselector section            | Hewlett Packard   | 85460A          | 211506        | 02/13/2006 | 02/13/2007 |
| High Pass Filter, 1 GHz                      | Filtek            | HP12/1000-5AB   | 213156a       | 03/06/2006 | 03/06/2007 |
| Preamplifier, 10 MHz to 2000 MHz, 27 dB gain | Mini-Circuits     | ZKL-2           | 200074        | 01/24/2006 | 01/24/2007 |
| Preamplifier, 1-26 GHz                       | Hewlett Packard   | 8449B           | 213191        | 05/04/2006 | 05/04/2007 |
| Signal Generator / Sweeper (20 GHz)          | Hewlett Packard   | 83620B          | 213166        | 04/12/2006 | 04/12/2007 |

**12.0 Field strength of spurious radiation (FCC Part 2.1053)****Results: The sample tested was found to Comply.****Photos:**

Radiated Spurious Emissions - EUT Front Setup

**12.0 Field strength of spurious radiation (FCC Part 2.1053)****Photos:**

Radiated Spurious Emissions - EUT Rear Setup

**12.0 Field strength of spurious radiation (FCC Part 2.1053)****Photos:**

Radiated Spurious Emissions - Substitution Method

## 12.0 Field strength of spurious radiation (FCC Part 2.1053)

### Data:

| Date: 07-28-2006               |               |               |           |           | Limit: -13dBm                          |           |           |
|--------------------------------|---------------|---------------|-----------|-----------|----------------------------------------|-----------|-----------|
| Frequency Range (MHz): 30-5500 |               |               |           |           | Test Distance (m): 3                   |           |           |
| Input power: 9Vdc              |               |               |           |           | Modifications for compliance (y/n): No |           |           |
| A                              | B             | G             | H         | I         | G                                      | H         | I         |
| Ant. Pol. (V/H)                | Frequency MHz | Power Net dBm | Limit dBm | Margin dB | Power Net dBm                          | Limit dBm | Margin dB |
| Low Channel                    |               |               |           |           | High Power                             |           |           |
| V                              | 760.000       | -32.7         | -13.0     | -19.7     | -32.5                                  | -13.0     | -19.5     |
| V                              | 1140.000      | -31.5         | -13.0     | -18.5     | -29.0                                  | -13.0     | -16.0     |
| V                              | 1520.000      | -30.9         | -13.0     | -17.9     | -29.0                                  | -13.0     | -16.0     |
| V                              | 1900.000      | -32.4         | -13.0     | -19.4     | -29.8                                  | -13.0     | -16.8     |
| V                              | 2280.000      | -32.7         | -13.0     | -19.7     | -28.5                                  | -13.0     | -15.5     |
| V                              | 2660.000      | -32.8         | -13.0     | -19.8     | -28.8                                  | -13.0     | -15.8     |
| V                              | 3040.000      | -29.9         | -13.0     | -16.9     | -24.7                                  | -13.0     | -11.7     |
| H                              | 760.000       | -33.5         | -13.0     | -20.5     | -32.1                                  | -13.0     | -19.1     |
| H                              | 1140.000      | -31.3         | -13.0     | -18.3     | -31.1                                  | -13.0     | -18.1     |
| H                              | 1520.000      | -31.4         | -13.0     | -18.4     | -30.6                                  | -13.0     | -17.6     |
| H                              | 1900.000      | -33.9         | -13.0     | -20.9     | -31.0                                  | -13.0     | -18.0     |
| H                              | 2280.000      | -33.0         | -13.0     | -20.0     | -29.6                                  | -13.0     | -16.6     |
| H                              | 2660.000      | -34.3         | -13.0     | -21.3     | -30.3                                  | -13.0     | -17.3     |
| H                              | 3040.000      | -31.8         | -13.0     | -18.8     | -28.2                                  | -13.0     | -15.2     |
| Mid Channel                    |               |               |           |           | High Power                             |           |           |
| V                              | 826.000       | -32.0         | -13.0     | -19.0     | -31.5                                  | -13.0     | -18.5     |
| V                              | 1239.000      | -32.0         | -13.0     | -19.0     | -29.1                                  | -13.0     | -16.1     |
| V                              | 1652.000      | -28.6         | -13.0     | -15.6     | -27.2                                  | -13.0     | -14.2     |
| V                              | 2065.000      | -35.2         | -13.0     | -22.2     | -32.3                                  | -13.0     | -19.3     |
| V                              | 2478.000      | -33.7         | -13.0     | -20.7     | -28.7                                  | -13.0     | -15.7     |
| V                              | 2891.000      | -33.3         | -13.0     | -20.3     | -27.8                                  | -13.0     | -14.8     |
| V                              | 3304.000      | -31.7         | -13.0     | -18.7     | -26.8                                  | -13.0     | -13.8     |
| H                              | 826.000       | -31.2         | -13.0     | -18.2     | -31.4                                  | -13.0     | -18.4     |
| H                              | 1239.000      | -32.5         | -13.0     | -19.5     | -30.9                                  | -13.0     | -17.9     |
| H                              | 1652.000      | -29.1         | -13.0     | -16.1     | -28.6                                  | -13.0     | -15.6     |
| H                              | 2065.000      | -35.1         | -13.0     | -22.1     | -32.7                                  | -13.0     | -19.7     |
| H                              | 2478.000      | -33.1         | -13.0     | -20.1     | -30.4                                  | -13.0     | -17.4     |
| H                              | 2891.000      | -33.1         | -13.0     | -20.1     | -29.7                                  | -13.0     | -16.7     |
| H                              | 3304.000      | -32.6         | -13.0     | -19.6     | -28.5                                  | -13.0     | -15.5     |
| High Channel                   |               |               |           |           | High Power                             |           |           |
| V                              | 892.000       | -31.7         | -13.0     | -18.7     | -31.0                                  | -13.0     | -18.0     |
| V                              | 1338.000      | -32.5         | -13.0     | -19.5     | -32.2                                  | -13.0     | -19.2     |
| V                              | 1784.000      | -30.7         | -13.0     | -17.7     | -28.5                                  | -13.0     | -15.5     |
| V                              | 2230.000      | -30.5         | -13.0     | -17.5     | -28.3                                  | -13.0     | -15.3     |
| V                              | 2676.000      | -31.9         | -13.0     | -18.9     | -30.7                                  | -13.0     | -17.7     |
| V                              | 3122.000      | -31.6         | -13.0     | -18.6     | -30.6                                  | -13.0     | -17.6     |
| V                              | 3568.000      | -29.7         | -13.0     | -16.7     | -29.2                                  | -13.0     | -16.2     |
| H                              | 892.000       | -31.6         | -13.0     | -18.6     | -31.2                                  | -13.0     | -18.2     |
| H                              | 1338.000      | -32.1         | -13.0     | -19.1     | -32.8                                  | -13.0     | -19.8     |
| H                              | 1784.000      | -30.1         | -13.0     | -17.1     | -29.9                                  | -13.0     | -16.9     |
| H                              | 2230.000      | -31.3         | -13.0     | -18.3     | -28.7                                  | -13.0     | -15.7     |
| H                              | 2676.000      | -32.9         | -13.0     | -19.9     | -30.8                                  | -13.0     | -17.8     |
| H                              | 3122.000      | -32.6         | -13.0     | -19.6     | -31.4                                  | -13.0     | -18.4     |
| H                              | 3568.000      | -30.9         | -13.0     | -17.9     | -29.3                                  | -13.0     | -16.3     |



### 13.0 Measurement of frequency stability (Frequency Stability)

#### Method:

Measure in accordance with Intertek Test Procedure "Procedure Frequency Stability."

#### Stability with Respect to Ambient Temperature

- (1) Place the de-energized EUT in the environmental temperature test chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber. Supply the EUT with nominal AC voltage or install a new or fully charged battery in the EUT. An antenna should be connected to the antenna output connector of the EUT if possible. Use of a dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable-length antenna, it should be fully extended.
- (2) Turn the EUT on and couple its output to a frequency counter or other frequency-measuring device of sufficient accuracy, considering the frequency tolerance with which the EUT must comply. Tune the EUT to one of the number of the test frequencies. Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT).
- (3) Turn the EUT off and set the environmental chamber to the highest temperature specified by the procuring or regulatory agency. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.
- (4) Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and measure the EUT operating frequency at startup, and two, five, and ten minutes after startup. Four measurements in total are made.
- (5) If the EUT operates only at one operating frequency, proceed to step 6; otherwise, successively tune the EUT to each of the additional operating frequencies required and repeat step 4.
- (6) Set the temperature chamber to the lowest temperature specified by the procuring or regulatory agency. Be sure to allow the environmental chamber temperature to stabilize before performing these measurements.
- (7) Repeat Steps 4 and 5
- (8) Prepare the final test report in accordance with clause 10 of ANSI C63.4.

#### Stability with Respect to Input Voltage

- (1) This test may be made at ambient room temperature if it is within the range +15° to +25 °C; otherwise, an environmental temperature test chamber set for a temperature of +20 °C shall be used. If possible, connect an antenna to the output terminals of the EUT because use of a dummy load could affect the output frequency of the EUT. If the EUT is equipped with or uses an adjustable-length antenna, it should be fully extended.
- (2) Supply the EUT with nominal AC voltage or install a new or fully charged battery in the EUT. Turn on the EUT and couple its output to a frequency counter.
- (3) Tune the EUT to any one of the test frequencies. Adjust the location of the measurement antenna and the controls on the measuring instrument to obtain a suitable signal level (i.e., a level that will not overload the measuring instrument, but is strong enough to allow measurement of the operating or fundamental frequency of the EUT). Turn the EUT off and place it inside an environmental chamber. Allow sufficient time (approximately 30 min) for the chamber to stabilize at +20 °C before proceeding. Turn the EUT on and measure the EUT operating frequency at startup, and two, five, and ten minutes after startup. Four measurements in total are made.
- (4) If measurements on only one operating frequency is required, proceed to step 5; otherwise, successively tune the EUT to each of the additional operating frequencies and repeat step 3.
- (5) If the EUT is powered from the AC powerlines, supply it with 85% nominal AC voltage and repeat steps 3 and 4 before proceeding to step 6. If the EUT is battery powered, proceed to step 7.
- (6) If the EUT is powered from the AC powerlines, supply it with 115% nominal AC voltage and repeat steps 3 and 4 before proceeding to step 7.

#### Test Equipment Used:

| Description:                    | Manufacturer:   | Model:  | Asset Number: | Cal Date:  | Cal Due:   |
|---------------------------------|-----------------|---------|---------------|------------|------------|
| Attenuator, 03 dB               | Weinschel Corp  | 2       | 200003        | 07/18/2006 | 07/18/2007 |
| Attenuator, 20 dB               | Weinschel Corp  | 2       | 200008        | 07/18/2006 | 07/18/2007 |
| Cable, 7m Ferrite (Formerly N8) | Belden          | RG-58   | E13           | 05/12/2006 | 05/12/2007 |
| ENVIRONMENTAL CHAMBER           | Thermotron      | SM32C   | 013848        | 04/17/2006 | 04/17/2007 |
| Modulation Analyzer             | Hewlett Packard | 8901A   | 213050        | 12/12/2005 | 12/12/2006 |
| Power Supply                    | Tektronix       | PS2510G | 211678        | 04/17/2006 | 04/17/2007 |
| Spectrum Analyzer               | Hewlett Packard | 8595E   | 213060        | 03/06/2006 | 03/06/2007 |

**Results: The sample tested was found to Comply.**

**13.0 Measurement of frequency stability (Frequency Stability)****Data:**

Frequency Stability Measurements Temco RS390

Limit: 2.50ppm = 1030Hz

Worst Case: 0.56ppm = 230Hz

Frequency measurements in 412MHz

Nominal Voltage: 9Vdc

| >1 min     |         | Voltage (percentage of nominal) |         |      |
|------------|---------|---------------------------------|---------|------|
| Temp. (°C) |         | 85%                             | 100%    | 115% |
| 60         |         |                                 |         |      |
| 50         | 0.99983 | 0.99983                         | 0.99983 |      |
| 40         |         |                                 | 0.99991 |      |
| 30         |         |                                 | 0.99996 |      |
| 20         | 0.99996 | 0.99996                         | 0.99996 |      |
| 10         |         |                                 | 0.99996 |      |
| 0          |         |                                 | 0.99994 |      |
| -10        |         |                                 | 0.99989 |      |
| -20        |         |                                 | 0.99981 |      |
| -30        | 0.99977 | 0.99977                         | 0.99977 |      |

Frequency measurements in 412MHz

Nominal Voltage: 9Vdc

| 2 Min      |         | Voltage (percentage of nominal) |         |      |
|------------|---------|---------------------------------|---------|------|
| Temp. (°C) |         | 85%                             | 100%    | 115% |
| 60         |         |                                 |         |      |
| 50         | 0.99982 | 0.99982                         | 0.99982 |      |
| 40         |         |                                 | 0.9999  |      |
| 30         |         |                                 | 0.99996 |      |
| 20         | 0.99996 | 0.99996                         | 0.99996 |      |
| 10         |         |                                 | 0.99996 |      |
| 0          |         |                                 | 0.99992 |      |
| -10        |         |                                 | 0.99989 |      |
| -20        |         |                                 | 0.9998  |      |
| -30        | 0.99977 | 0.99977                         | 0.99977 |      |

Frequency measurements in 412MHz

Nominal Voltage: 9Vdc

| 5 Min      |         | Voltage (percentage of nominal) |         |      |
|------------|---------|---------------------------------|---------|------|
| Temp. (°C) |         | 85%                             | 100%    | 115% |
| 60         |         |                                 |         |      |
| 50         | 0.99981 | 0.99981                         | 0.99981 |      |
| 40         |         |                                 | 0.9999  |      |
| 30         |         |                                 | 0.99996 |      |
| 20         | 0.99996 | 0.99996                         | 0.99996 |      |
| 10         |         |                                 | 0.99996 |      |
| 0          |         |                                 | 0.99992 |      |
| -10        |         |                                 | 0.99988 |      |
| -20        |         |                                 | 0.9998  |      |
| -30        | 0.99977 | 0.99977                         | 0.99977 |      |

Frequency measurements in 412MHz

Nominal Voltage: 9Vdc

| 10 Min     |         | Voltage (percentage of nominal) |         |      |
|------------|---------|---------------------------------|---------|------|
| Temp. (°C) |         | 85%                             | 100%    | 115% |
| 60         |         |                                 |         |      |
| 50         | 0.99981 | 0.99981                         | 0.99981 |      |
| 40         |         |                                 | 0.99989 |      |
| 30         |         |                                 | 0.99996 |      |
| 20         | 0.99996 | 0.99996                         | 0.99996 |      |
| 10         |         |                                 | 0.99996 |      |
| 0          |         |                                 | 0.99992 |      |
| -10        |         |                                 | 0.99988 |      |
| -20        |         |                                 | 0.99979 |      |
| -30        | 0.99977 | 0.99977                         | 0.99977 |      |

## 14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)

### Method:

Measure in accordance with Intertek Test Procedure "TFB-1 Transient frequency behavior" or "TFB-2 Transient frequency behavior."

Applies to the following Standards:

TIA-603-C (land mobile)  
FCC 47 CFR Part 90 (land mobile)  
RSS-119 (land mobile and fixed)

### PROCEDURE

- A) Connect the equipment as illustrated.
- B) Connect the test receiver FM output (rear panel) to the vertical input channel of the storage oscilloscope. Connect the output of the RF peak detector to the external trigger on the storage oscilloscope. Connect the output of the RF combiner to the RF power meter.
- C) Set the test receiver to measure FM deviation with the audio bandwidth set at < 50 Hz to >15,000 Hz, and tune the RF frequency to the transmitter assigned frequency.
- D) Set the signal generator to the assigned transmitter frequency and modulate it with a 1 kHz tone at +/- 25 kHz deviation (using the test receiver to adjust the deviation) and set its output level to 100 dBm.
- E) Key the transmitter.
- F) Supply sufficient attenuation via the RF attenuator to provide an input level to the test receiver that is 40 dB below (or - 10 dBm) the test receiver maximum allowed input power (30 dBm) when the transmitter is operating at its rated power level. Note this power level on the RF power meter.
- G) Unkey the transmitter.
- G) Adjust the RF level of the signal generator to provide RF power into the RF power meter equal to the level noted in step f). This signal generator RF level shall be maintained throughout the rest of the measurement.
- I) Disconnect the RF power meter and connect the output of the RF combiner network to the input of the test receiver.
- J) Set the horizontal sweep rate on the storage oscilloscope to 10 milliseconds per division and adjust the display to continuously view the 1000 Hz tone from the FM output. Adjust the vertical amplitude control of the oscilloscope to display the 1000 Hz at +/- 4 divisions, vertically centered on the display.
- K) Adjust the oscilloscope so it will trigger on an increasing magnitude from the RF peak detector at 1 division from the left side of the display, when the transmitter is turned on. Set the controls to store the display.
- L) Reduce the attenuation of the RF attenuator so the input to the RF peak detector and the RF combiner is increased by 30 dB when the transmitter is turned on.
- M) Key the transmitter and observe the stored display. The signal at the FM output, due to the change in the ratio of power between the signal generator input power and the transmitter output power will, because of the capture effect of the test receiver, produce a change in display: For the first part of the sweep it will show the 1 kHz test signal. Then once the receiver's demodulator has been captured by the transmitter power, the display will show the frequency difference from the assigned frequency to the actual transmitter frequency versus time. The instant when the 1 kHz test signal is completely suppressed (including any capture time due to phasing) is considered to be on. The trace should be maintained within the allowed divisions during the period t1 and t2. Refer to the standard requirements in section 4.0 of this procedure, and to the sample following.
- N) During the time from the end of t2 to the beginning of t3 the frequency difference should not exceed the limits in section 4.0 of this procedure. The allowed limit is equal to the transmitter frequency times its regulatory frequency tolerance times ? 4 display divisions divided by 25 kHz. For example, at a transmitter assigned frequency of 500 MHz and a frequency tolerance of 5 ppm, this would be 500 MHz times 5 ppm times ?4 divisions divided by 25 kHz. This equals ± 0.4 divisions in this example. Greater vertical sensitivity may be required to view this accurately.
- O) Key the transmitter and observe the stored display. The trace should be maintained within the allowed divisions after the end of t2 and remain within it until the end of the trace.
- P) To test the transient frequency behavior during the period t3, the transmitter shall be keyed.
- Q) Adjust the oscilloscope trigger controls so it will trigger on a decreasing magnitude from the RF peak detector, at 1 division from the right side of the display, when the transmitter is turned off. Set the controls to store the display. The moment when the 1 kHz test signal starts to rise is considered to provide toff.
- R) The transmitter shall be unkeyed.
- S) Observe the display. The trace should remain within the allowed divisions during the period t3. Refer to the sample following.

### MEASUREMENT UNCERTAINTY

Compliance of the product is based on the measured value. However, the measurement uncertainty is included for informational purposes. The values given are the measurement uncertainty values with an expanded uncertainty of k=2.

+/- 5.17%

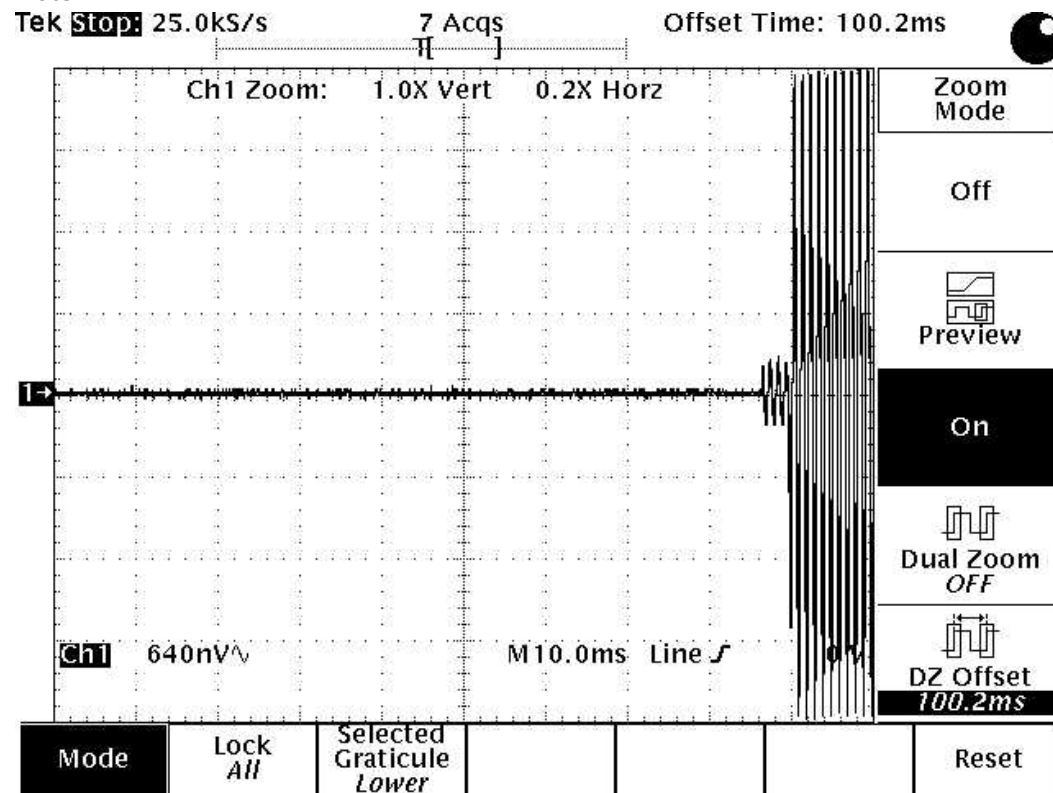
### Test Equipment Used:

| Description:                           | Manufacturer:   | Model:     | Asset Number: | Cal Date:  | Cal Due:   |
|----------------------------------------|-----------------|------------|---------------|------------|------------|
| Digital Real-Time Oscilloscope         | Tektronix       | TDS680C    | 213288        | 06/21/2006 | 06/21/2007 |
| Modulation Analyzer                    | Hewlett Packard | 8901A      | 213050        | 12/12/2005 | 12/12/2006 |
| Power Splitter, 50-Ohm, DC to 2000 MHz | Mini-Circuits   | 2FRSC-2050 | 213157a       | 10/29/2005 | 10/29/2006 |
| Signal Generator                       | Hewlett Packard | 8656B      | LEX-1016      | 03/27/2006 | 03/27/2007 |

**Results: The sample tested was found to Comply.**

## 14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)

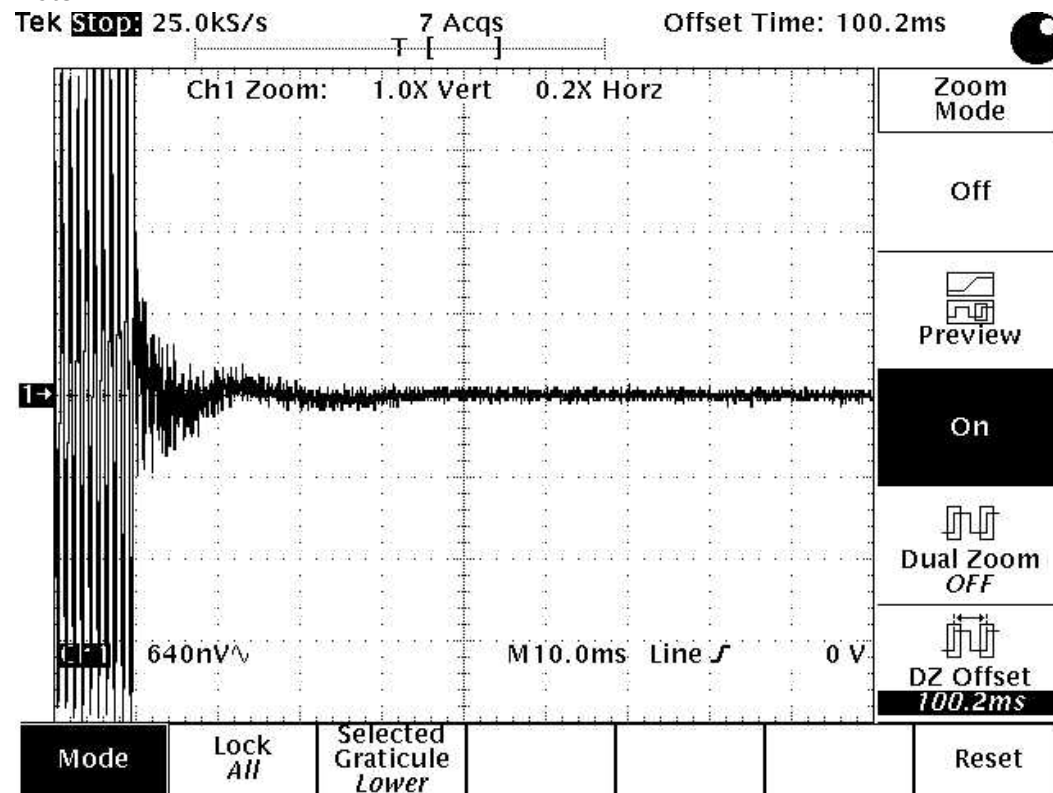
### Plots:



Turn Off Transient in High Power

## 14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)

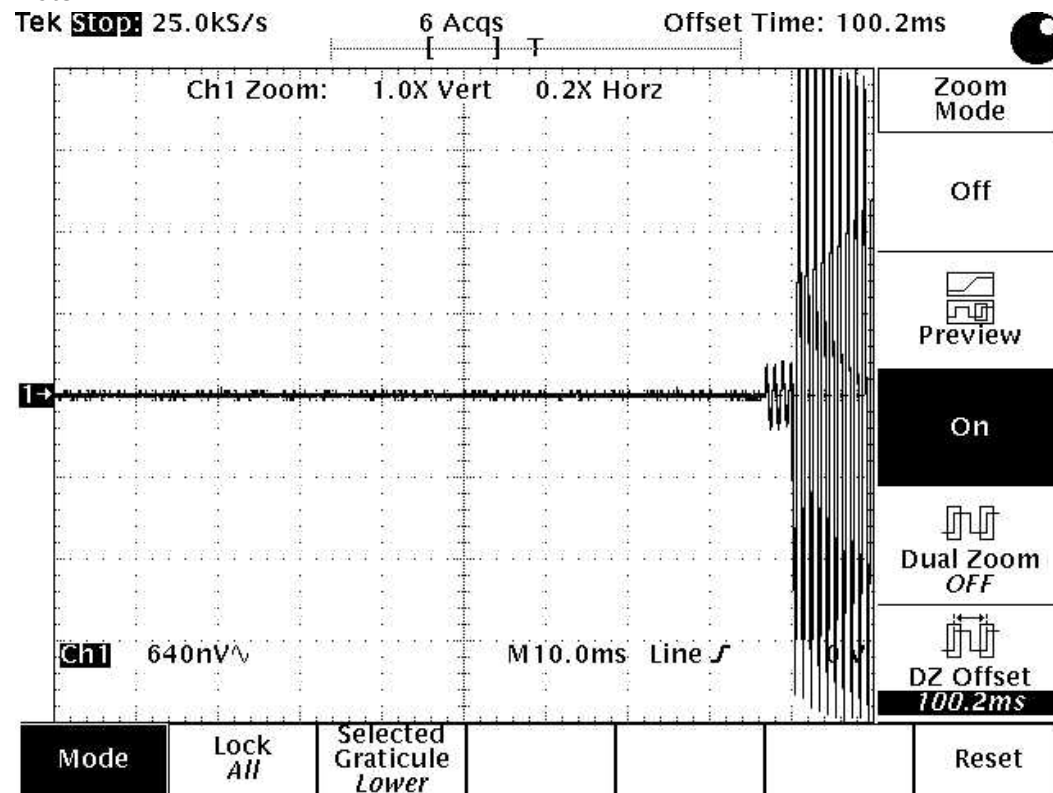
## Plots:



Turn On Transient in High Power

## 14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)

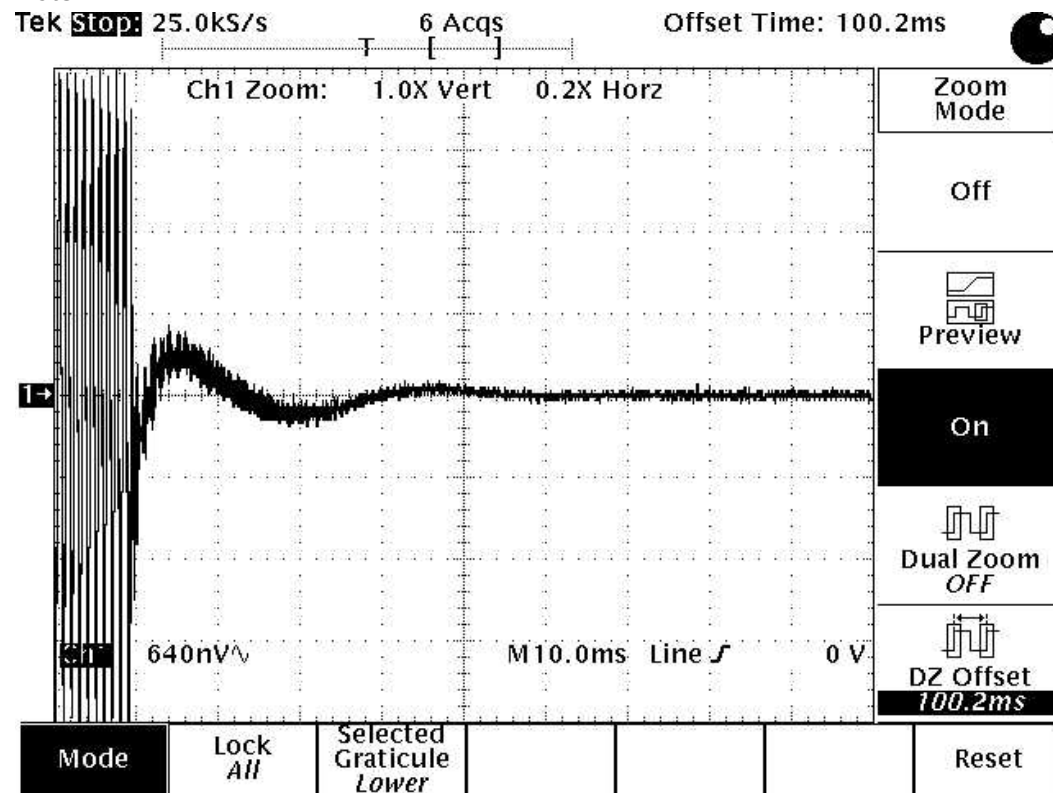
### Plots:



Turn Off Transient in Low Power

## 14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)

## Plots:



Turn On Transient in Low Power

**14.0 Measurement of transmitter transient frequency behavior (Transient Frequency Behaviour)****Data:**