# Nortel BWA Type Acceptance Radio Transceiver Test Report

| | |
|---|---|
| **Product Description:** | 28 GHz Customer Premise Radio Transceiver (CTR) |
| **Model**: | CTR 2800 |
| **Nortel BWA File #** | OHOCTR2807NT |

**CHARLIE BISHOP PI ENGINEER**

**DATE MAY 12, 1999**

WINNIPEG,

**DECLARATION BY Nortel Networks BWA**

The tests were performed from Feb 5 through Mar 26,1999 at the Nortel Networks BWA's EMC Laboratory in Winnipeg.

The following personnel collaborated to this project:

Mitch Hebert, Tech.
Charlie Bishop, PI Engineer

Testing was performed and supervised by the undersigned. The test supervisor attests to the accuracy of the test data recorded in this report.

| | |
|---|---|
| Performed by: Mitch Hebert | Date March 26, 1999 |
| Supervised by: Charlie Bishop | Date March 26, 1999 |



Total number of pages: 47.

The results presented in this report refer only to the product(s) described in section 1.

All equipment and instrumentation used during this test have been verified and/or calibrated. All calibration certificates are traceable to the National Research Council of Canada (CNRC) and/or to the American National Institute of Standards and Technology (NIST) standards and can be provided on request.

**Nortel BWA is registered ISO 9002:1998, certificate # 766.2.**

# TABLE OF CONTENTS

Page

# 1. INTRODUCTION

## Object

This test report is being submitted for type acceptance of the Nortel Networks BWA Reunion Radios operating in the LMDS Band 29.1 to 29.25 GHz. The ReUnion radios are designed to provide wide-band multi-carrier point-to-multi-point subscriber services in an efficient and cost effective manner. The adherence to the rules for LMDS radios in these bands are demonstrated in the following pages. Nortel Networks BWA is currently seeking type approval on this product.

## Equipment Under Test Description

The Nortel Networks BWA 28 GHz radio product is of wide band design. The power amplifiers and the LNA are designed to provide gain over the entire 27.5 to 29.25 GHz band. The CTR are of a single conversion design and use a single DRO to serve both transmit and receive paths. The CTR provides a maximum power output of 0.5 watt for a single un-modulated tone. Thus the power limitation requirement of FCC part 101 section 101.113 is satisfied. The following tables identify the EUTs:

| Model # | Description | Manufacturer | Part # |
|---|---|---|---|
| CTR2800 | Customer Premise Transceiver | Nortel BWA | NTVG16AG |

| Model # | Order Code | uW Tx (GHz) | uW Rx (GHz) | RF Rx (MHz) | RF Tx (MHz) | BW | Separation |
|---|---|---|---|---|---|---|---|
| CTR2800 | NTVG16AG | 28.2-28.35 | 29.1-29.25 | 250-400 | 500-650 | 150 | 900 |

## Antennae

The antenna used by the Customer Premise transceiver can be identified by the saucer-like top which encapsulates the antenna.

| Nortel Part Number | Spread (degrees) | Isotropic Gain (dBi) |
|---|---|---|
| NTVG13BA | 2.5 | 35.5 min |
| NTVG13EA | 1.7 | 35.5 min |

## General

Tests were performed on a production sample(s) of the CTR, according to standards and directives.  All measurements were performed in accordance to the measurement procedures outlined in these standards or detailed in this report..  The customer transceiver (CTR) is intended to fall into the 27500 to 28350MHz range of the Part 101.109 table  The BTR is intended to fall into the 29100 to 29250MHz range and will be documented under CTVG14AG and FCC ID OHOBTR2807NT.

## Results

The following table summarizes the EUT test results of the testing described in this report:

| Standard | Test Description | Para. No. | Results |
|---|---|---|---|
| FCC part  101.111(a) | Spectral Mask | (2)(ii) | Compliant |
| FCC part  101.111(a) | Conducted Emissions  except mask region | (2)(iii) | Compliant |
| FCC part  101.111(a) | Radiated Emissions except mask region | (2)(iii) | Compliant |
| FCC part 101, sec 101.113 | Transmit Power Limitation | C2 | Compliant |
| FCC part 101, sec 101.113 | Antenna azimuth limitation | C3 | Compliant |
| FCC part 2, Section 2.995 (a) (1), (b) and FCC part 101 section 101.107 | Frequency Stability Over Temperature | 4 | Compliant |

## Test Facilities Description

The Nortel Network BWA EMC facility is a shielded 3m room The room is provided with input voltage of 120 and 240 V ac, which is filtered through Corcom filters before entry. Due to lab construction, the radiated measurements were performed in an open lab environment. A reference sweep was taken to demonstrate the ambient conditions.

## Test Equipment

The following is a list of test equipment used to perform all tests described in this report.

| Equipment | Manufacturer | Model | Serial or Asset # | Cal due (Y/M/D) |
|---|---|---|---|---|
| Spectrum Analyzer | Hewlett Packard | HP 8665E | 02940 | 09/99 |
| Spectrum Analyzer | Hewlett Packard | HP 8663E | 3611A05001 | 08/99 |
| Synthesized Sig. Gen. | Anritsu | 69369A | 981807 | 06/99 |
| Power Meter<br>Power Sensor | Anritsu<br>Anritsu | ML2438A<br>MA2475A | 97400074 | 06/99<br>06/99 |
| Mixer Assembly 40 to 60 GHz | Millitech/Nortel BWA | MHB-19-RD3A0 | MS-118086 | 7/99 |

| Equipment | Manufacturer | Model | Serial or Asset # | Cal due (Y/M/D) |
|---|---|---|---|---|
| Mixer Assembly 60 to 90 GHZ | Millitech/Nortel BWA | MHB-12-RD3A0 | MS-118101 | 7/99 |
| Mixer Assembly 90 to 140 GHz | Millitech/Nortel BWA | MHB-08-RD3A0 | MS-118090 | 7/99 |
| Power Supply | Hewlett Packard | 6544A | US36390168 | ----- |
| Power Supply | Hewlett Packard | 6554A | US36340233 | ----- |
| Frequency Counter | XL microwave | 3460 | 980338143 | 03/99 |
| Antenna Bilog 30 to 1000 MHz | Shaffner-Chase | CBL6111B | 2261 | 08/99 |
| Horn Antenna 1 to 18 GHz | EMCO | 3115 | 9711-5345 | 11/99 |
| Horn Antenna 14 to 40 GHz | Shaffner-Chase | BBHA 9170 | 9046 | 3/99 |

## 2. CONDUCTED EMISSIONS

| | |
|---|---|
| Tested by: | Charlie Bishop and Mitch Hebert |
| Date: | Mar 9 through Mar 15,1998 |

**Test Conditions**

| | |
|---|---|
| Temperature | 22 to 25C, |
| Primary Voltage | +18 V dc |

**Test Results**

The EUT does comply with the specification referenced in the previous paragraph.

**Measurement Data**

See on Appendix A for test results and setup photographs.

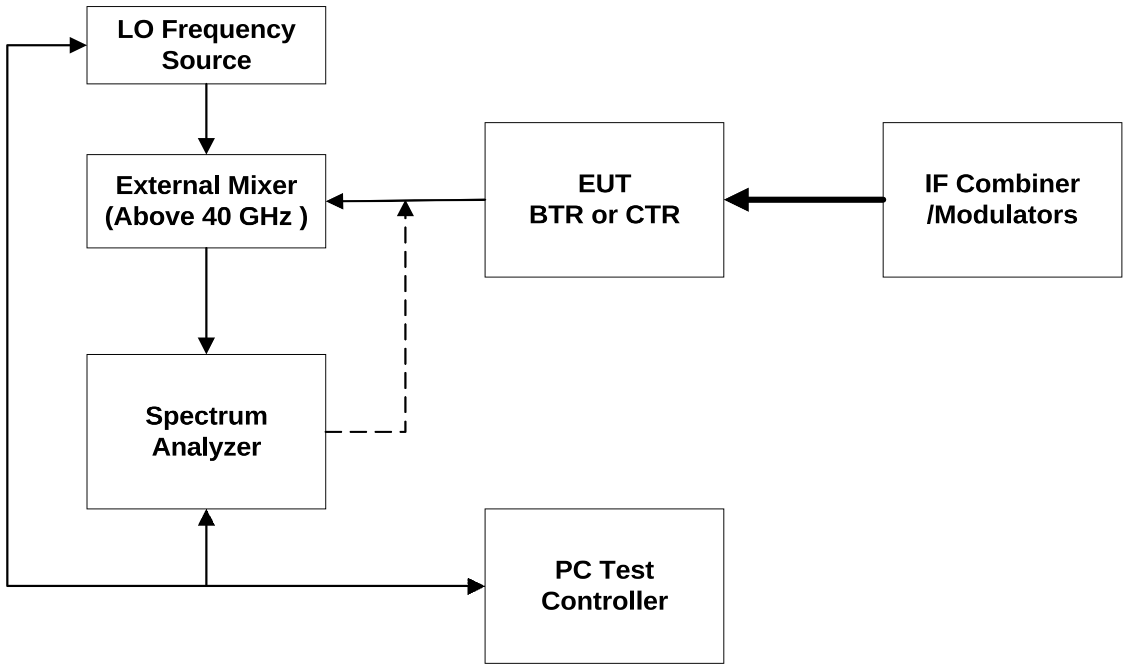
**Test Method**

Nortel processing equipment stimulated the CTR with digitally modulated 16 QAM signal. The modulator output signals are then combined, through a passive combiner, and fed into the input to the CTR. The output is examined directly by a spectrum analyzer for up to frequencies of 40GHz. External mixers are used for frequencies greater than 40GHz. A synthesized frequency generator stimulates the external mixer's local oscillator input. The spectrum analyzer, synthesized generator and all calculations are administered by a Labview software application on a PC.

**Test System Test Configuration**

Figure 1.0 presents a simplified block diagram of the conducted emissions test set-up. For measurements above 40GHz, a PC controlled a synthesized generator programming the LO frequency input to the external mixer, so that the difference frequency between what is measured and the LO frequency is 100MHz. Below 40GHz, the output of the EUT was directly connected to the input of the spectrum analyzer.

A reference passband response is recorded, of two 16 QAM modulated carriers, occupied bandwidth of 20MHz for CTR. The measured reference is used to determine the out of band emissions, by measuring the relative differences between the reference and the measured emission.


LO Frequency Source
External Mixer (Above 40 GHz )
EUT BTR or CTR
IF Combiner /Modulators
Spectrum Analyzer
PC Test Controller

## 3. RADIATED EMISSIONS

| | |
|---|---|
| Tested by: | Charlie Bishop and Mitch Hebert |
| Date: | Mar 9 through Mar 15, 1998 |

### Test Conditions

| | |
|---|---|
| Temperature | 20-25C, |
| Primary Voltage | +18 V dc |

### Test Results

The EUT does comply with the specification referenced in the previous paragraph

### Measurement Data

See on Appendix B for test results and setup photographs.

### Test Method

Nortel processing equipment stimulated the CTR with digitally modulated 16 QAM signal. The modulator output signals are then combined, through a passive combiner, and fed into the input to the CTR. The output is examined directly by a spectrum analyzer for up to frequencies of 40GHz. External mixers are used for frequencies greater than 40GHz. A synthesized frequency generator stimulates the external mixer's local oscillator input. The spectrum analyzer, synthesized generator and all calculations are administered by a Labview software application on a PC.

**Test System Configuration**

Figure 2.0 presents a simplified block diagram of the radiated emissions test set-up. For measurements above 40GHz, the antennae is positioned 30cm from the EUT; a PC controlled a synthesized generator programming the LO frequency input to the external mixer, so that the difference frequency between what is measured and the LO frequency is 100 MHz. External mixers are connected to Millitech horn antennae, covering the band 40 to 60GHz, 60 to 90GHz and 90 to 140GHz. Below 40 GHz, the antennae is positioned 1m from the EUT; the input to the spectrum analyzer was connected to various antenna a Chase 30 to 1000MHz bilog, EMCO 1 to 18GHz horn, and Chase 14 to 40GHz horn.

A reference passband response is recorded, of two 16 QAM modulated carriers, occupied bandwidth of 20 MHz for the CTR. The test antennae and the EUT antenna are positioned at a given distance, to produce a maximum amplitude response of the passband. The antennae are held in this position during the entire testing of up to 110 GHz. The measured reference is used to determine the out of band emissions, by measuring the relative differences between it and the measured emission.

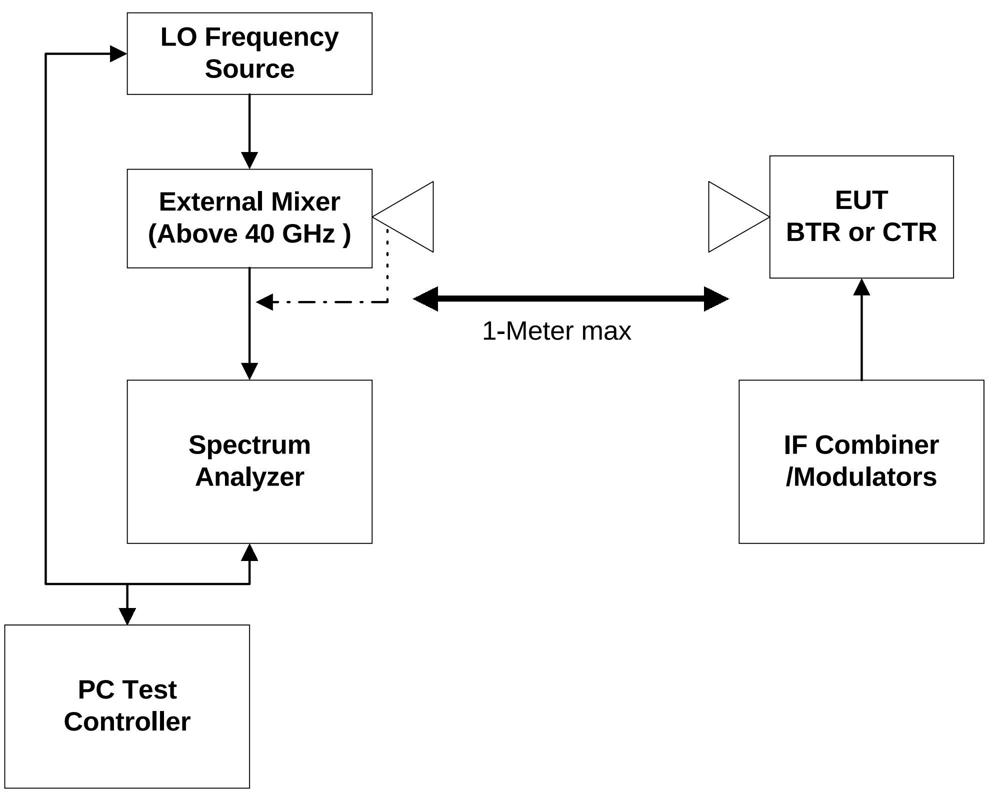



**Figure 2.0: Test Setup Configuration for Radiated Emissions**

## 4. TEMPERATURE STABILITY TESTS

| | |
|---|---|
| Tested by: | Charlie Bishop and Mitch Hebert |
| Date: | Mar 8, 1998 |

Test was performed to the validate the requirement of part 101, section

### Test Conditions

| | |
|---|---|
| Temperature | -40C to +50C, |
| Primary Voltage | +18 V dc |

### Specifications

Requirement specified in FCC part 101, section 101.107, frequency tolerance of ±0.03%

### Test Results

The CTR complies with the specifications stated in specification paragraph

### Measurement Data

See on Appendix C for test setup and photographs.

### Test Method

Tests were performed on a CTR, these units were placed into a temperature chamber, and the temperature profile used for temperature is referenced in FCC part 2, section. A base line frequency measurement is made at first ambient temperature. With the power not applied to the EUT, the temperature is then decreased by the programmed interval (10C) and allowed to “soak” for a period time specified by the user.(20min) This time allows the internal component temperature to stabilize. Once the plateau has been achieved, the power is applied to the EUT and the frequency is measured to 6 significant digits.

**Test System Configuration**

Figure 3.0 presents a simplified block diagram of the temperature stability test set-up. The PC controls the temperature profile of the temperature chamber. The specified temperature profile is –40°C to +50°C.

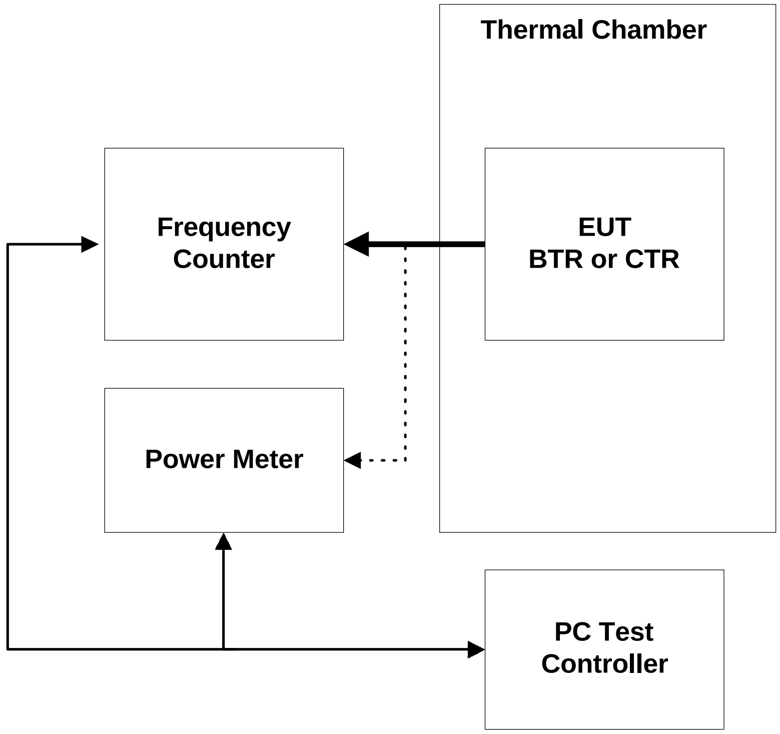


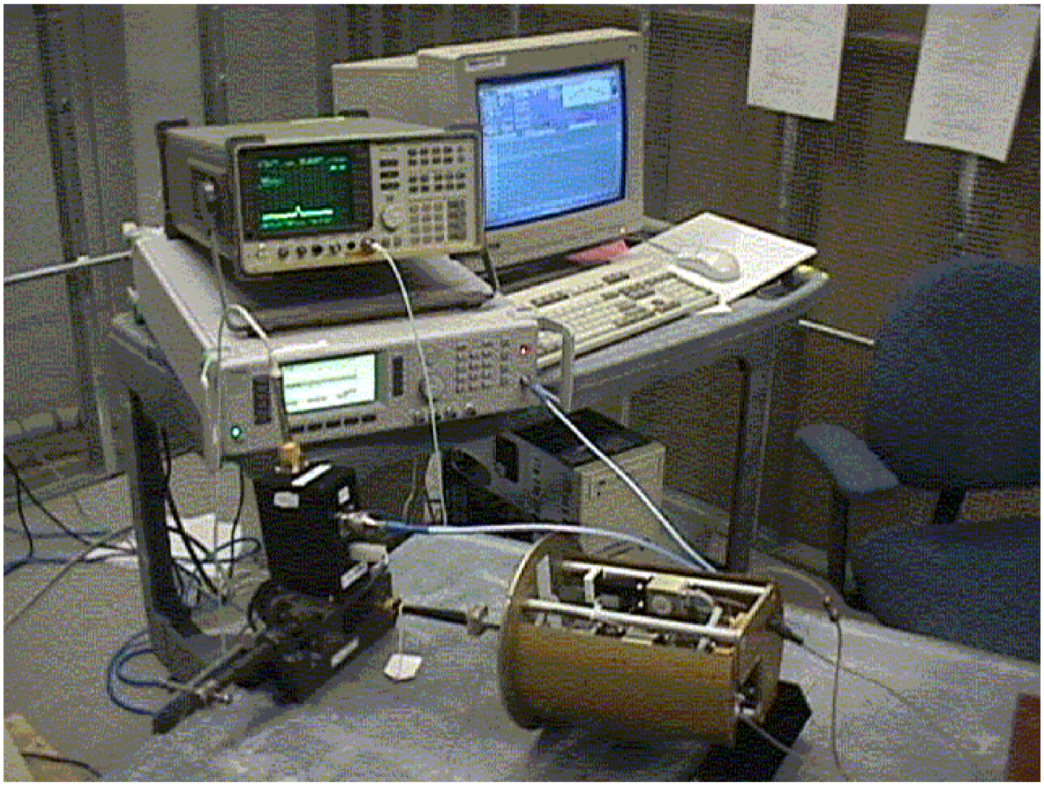

**Figure 3.0: Test Setup Configuration for Temperature Stability Tests**

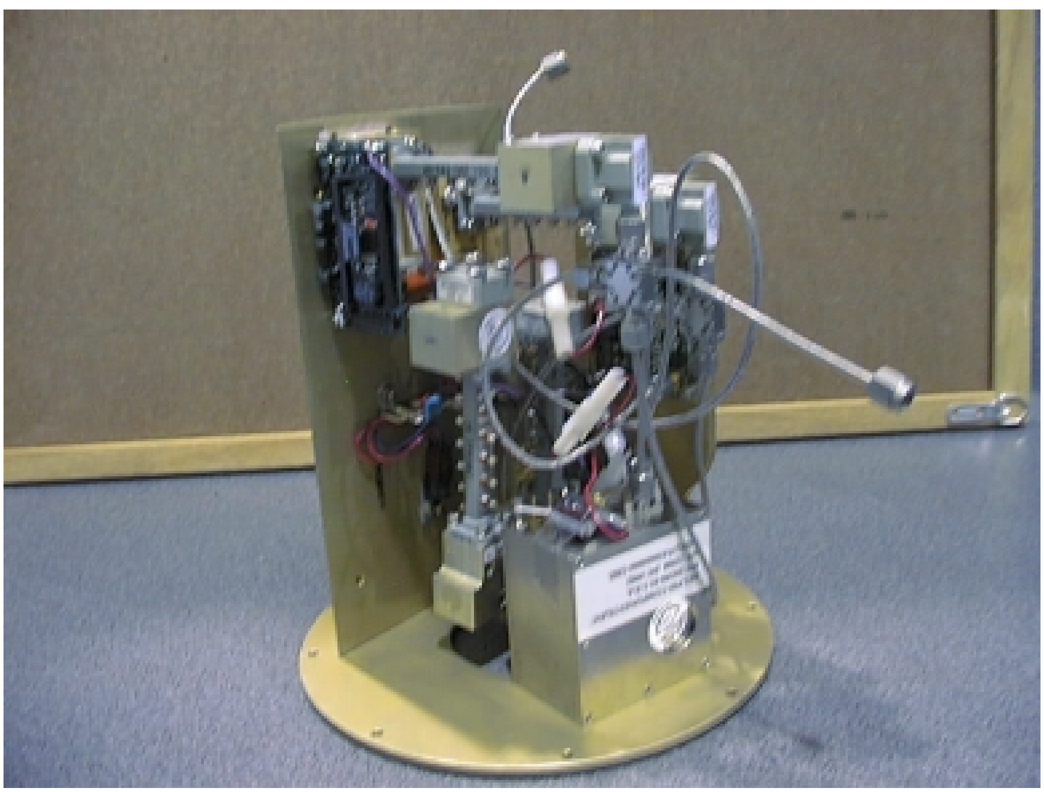
# APPENDIX A

## Conducted Emissions Measurement Results

## 5. CONDUCTED EMISSIONS MEASUREMENT RESULTS

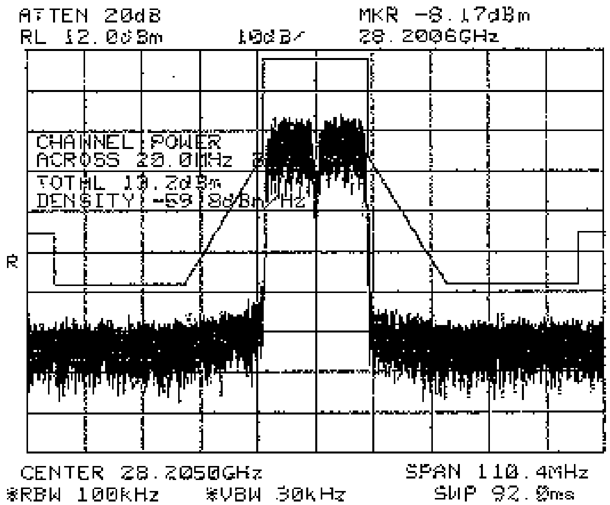
CTR connected in the laboratory for conducted measurements

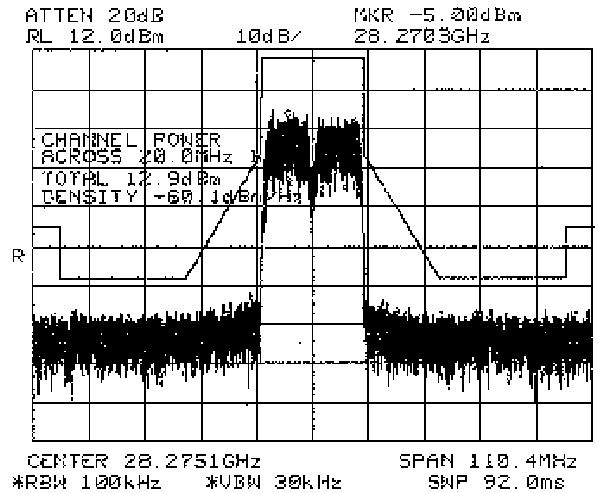


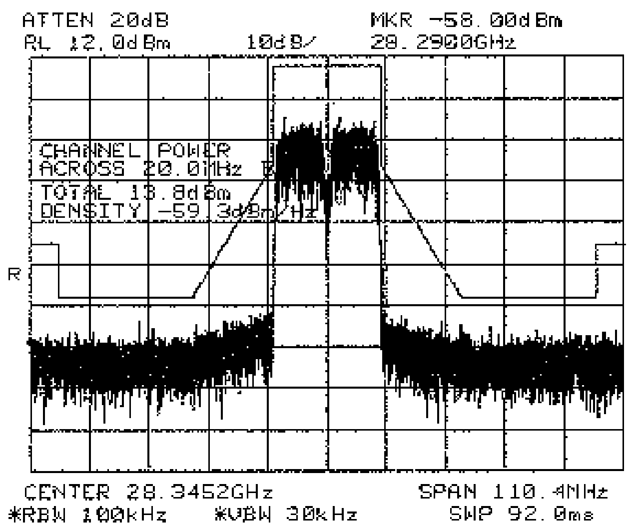


CTR with the case removed

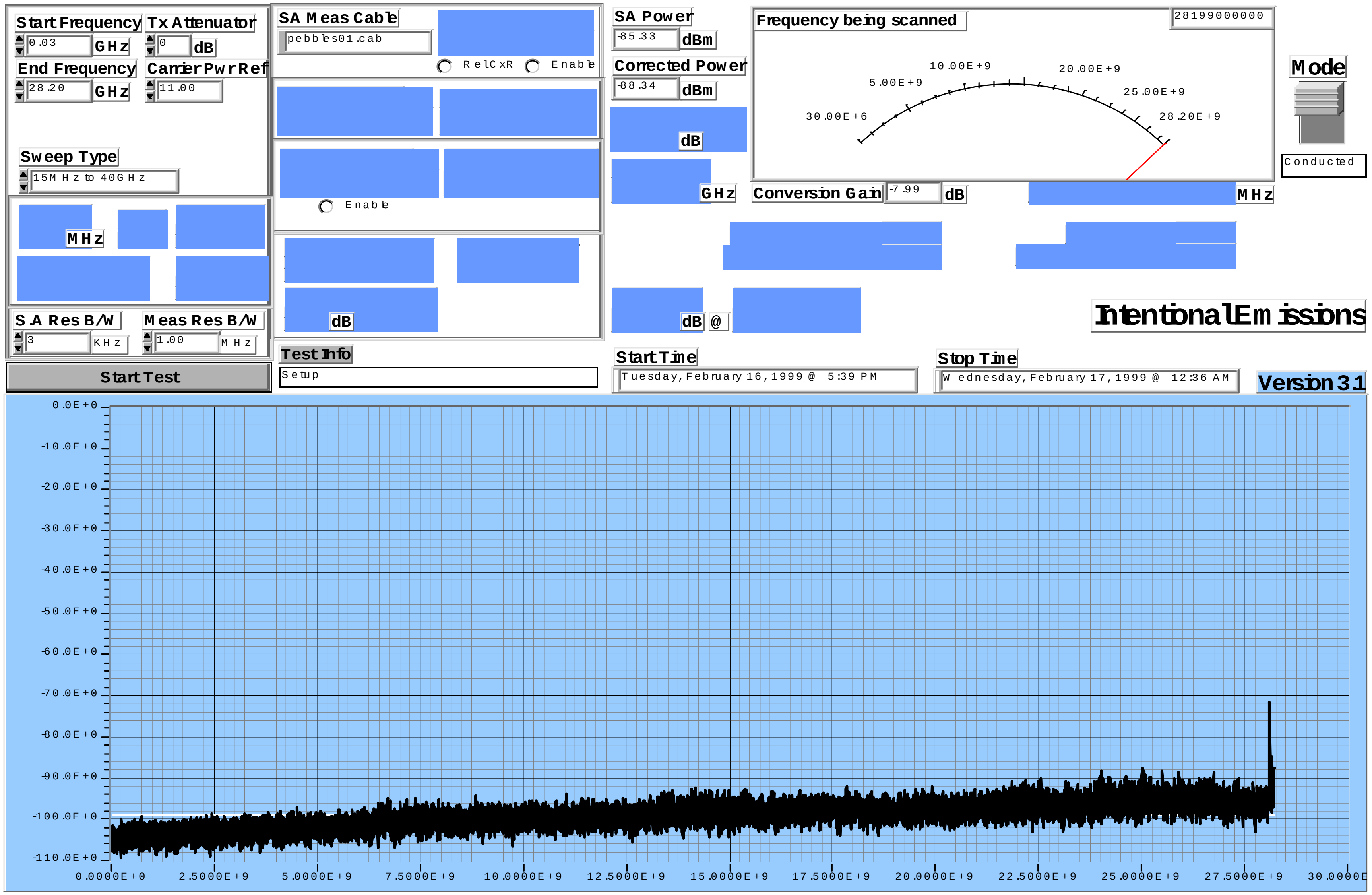
The following pictures show 2 – 10MHz carriers across the minimum, maximum and middle of the 150MHz band at a channel power of 13dBm.



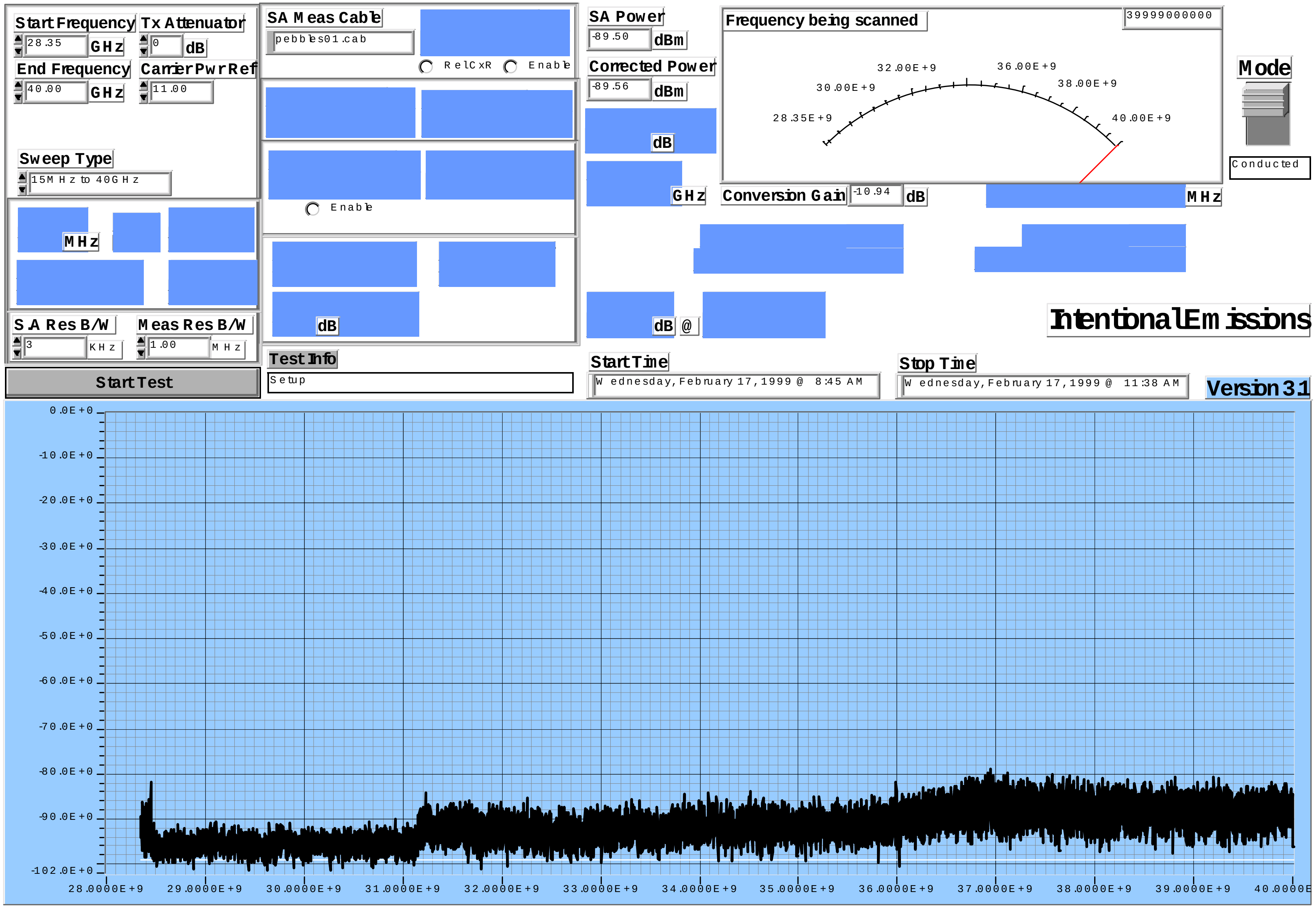



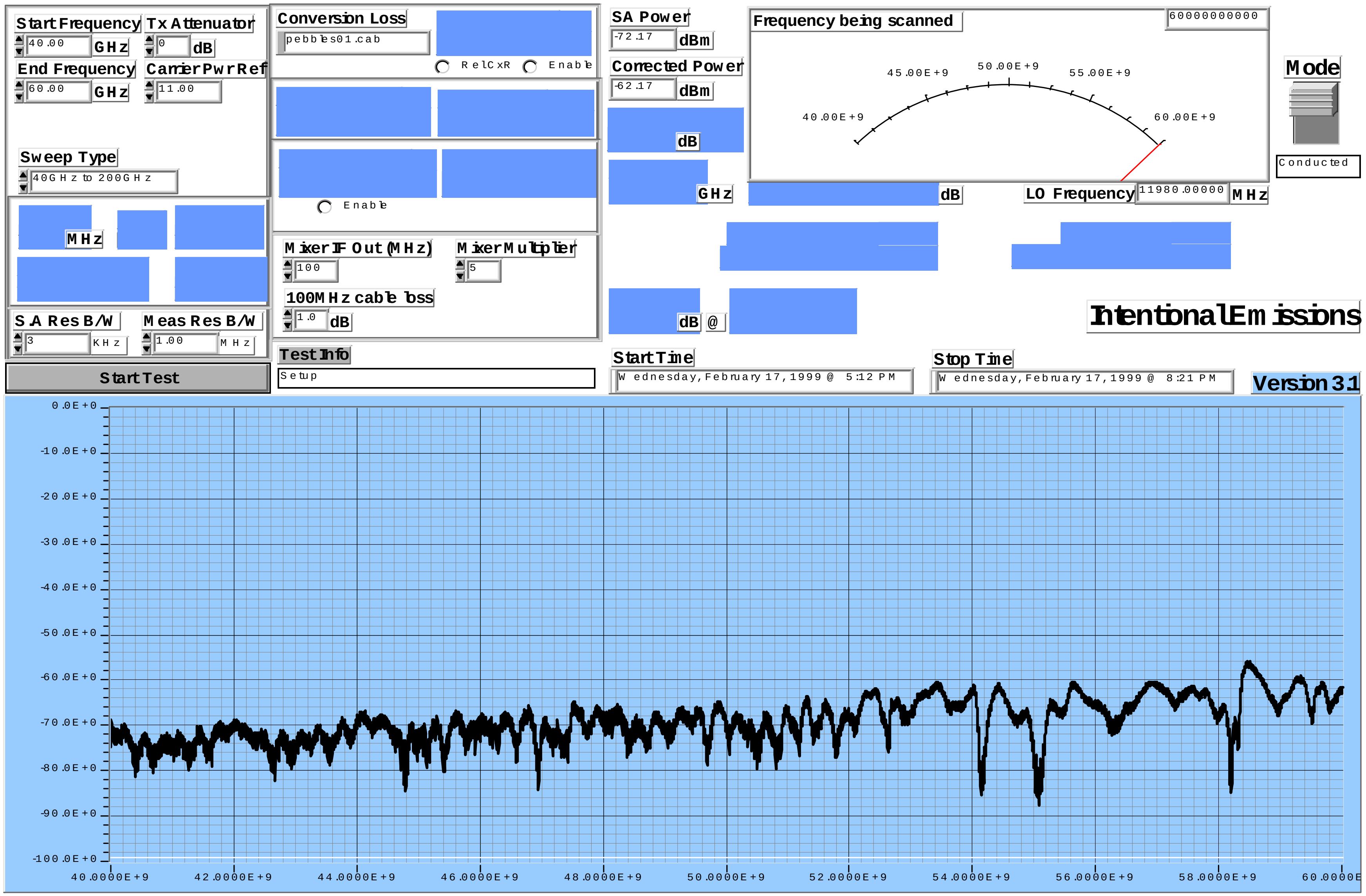
CTR 2800, 2 carrier QAM 64 modulated. – 30MHz to edge of carriers



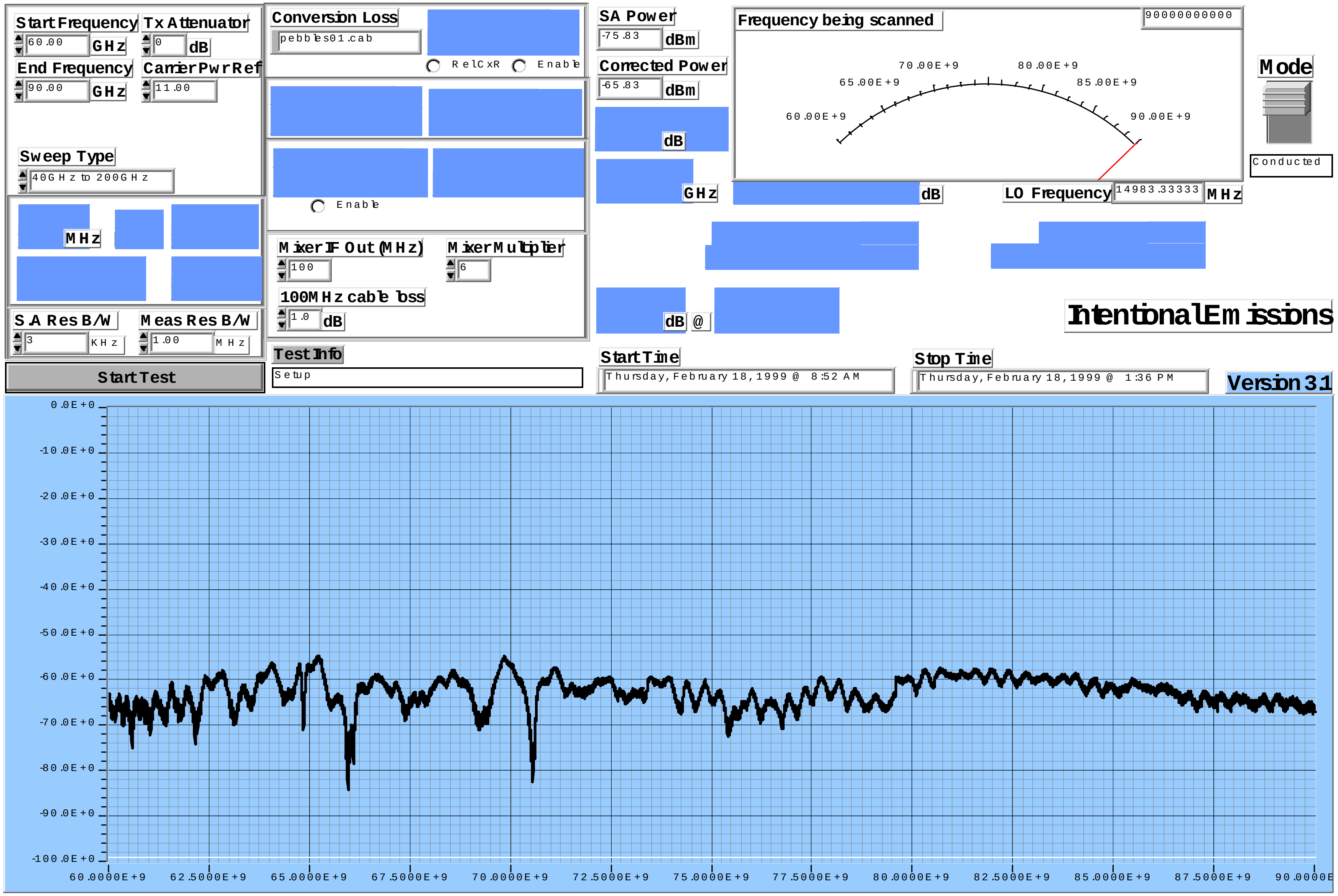
CTR 2800, 2 carrier QAM 64 modulated. – edge of carriers to 40GHz



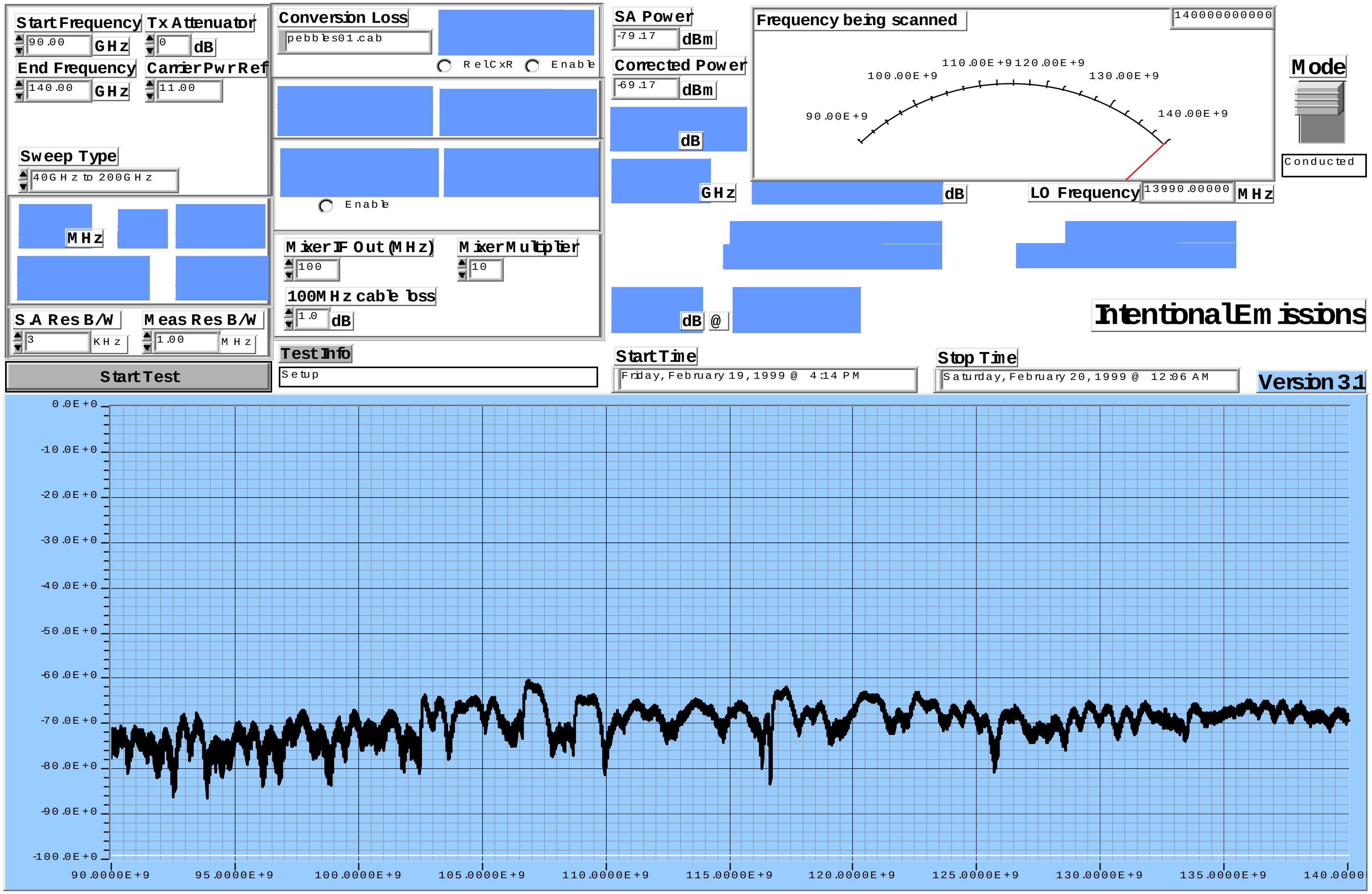
CTR 2800, 2 carrier QAM 64 modulated. – 40-60GHz



CTR 2800, 2 carrier QAM 64 modulated. –60-90GHz



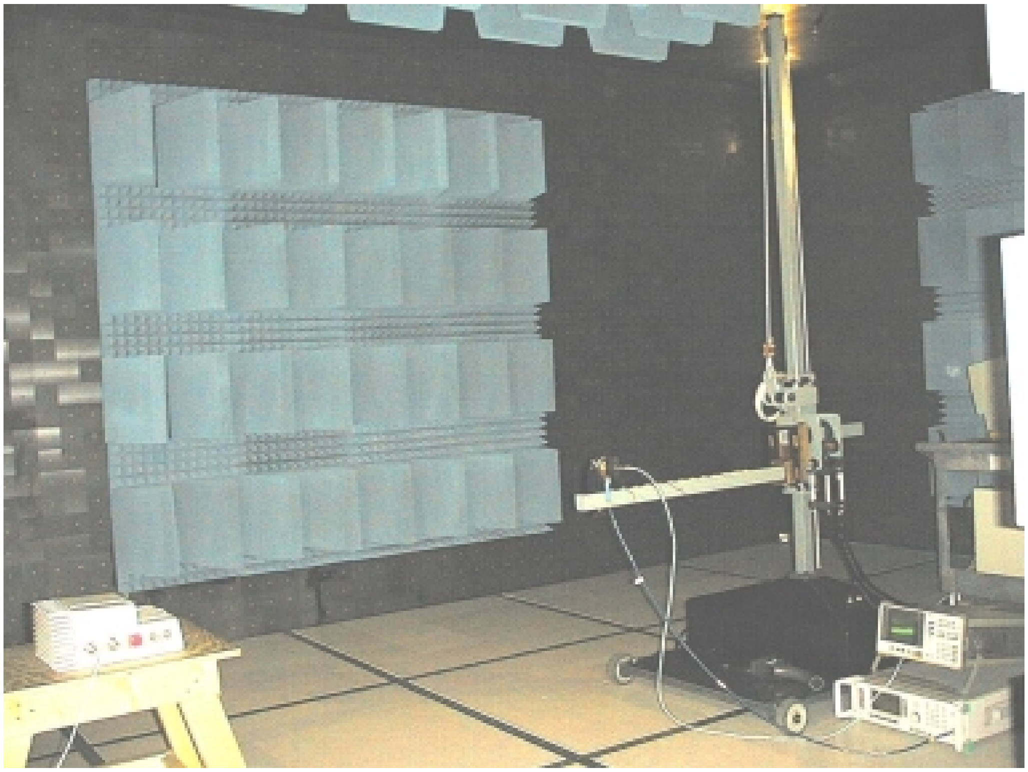
CTR 2800, 2 carrier QAM 64 modulated. –90-110GHz

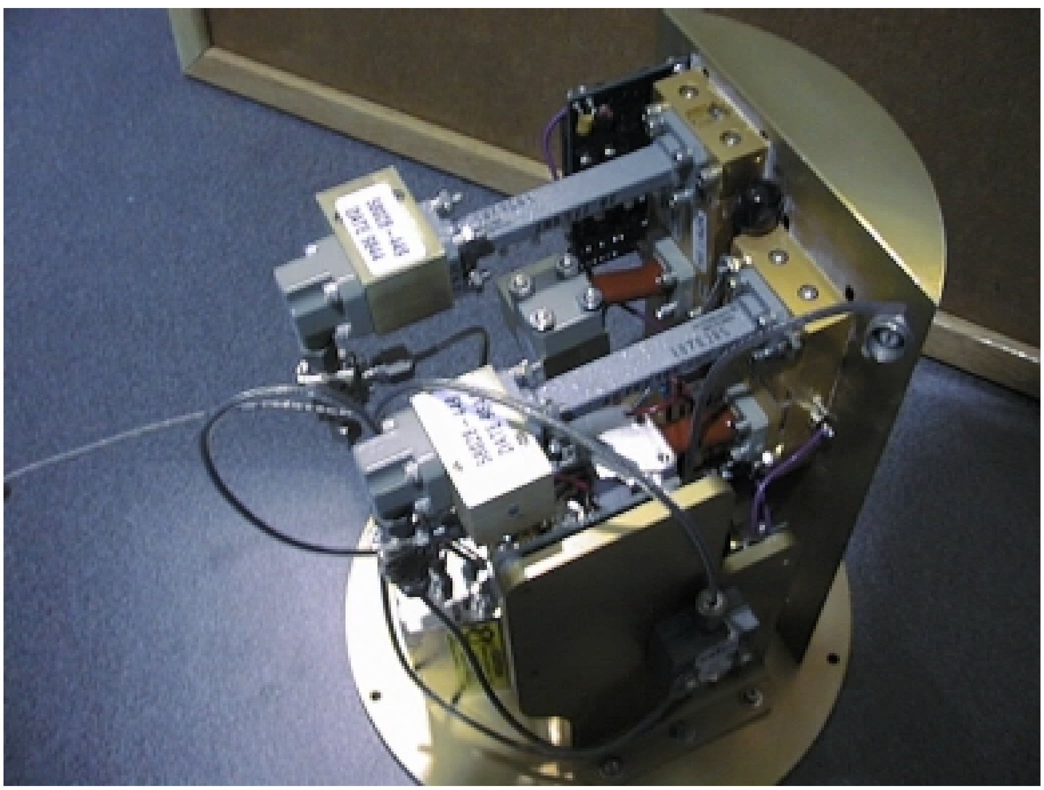


# APPENDIX B

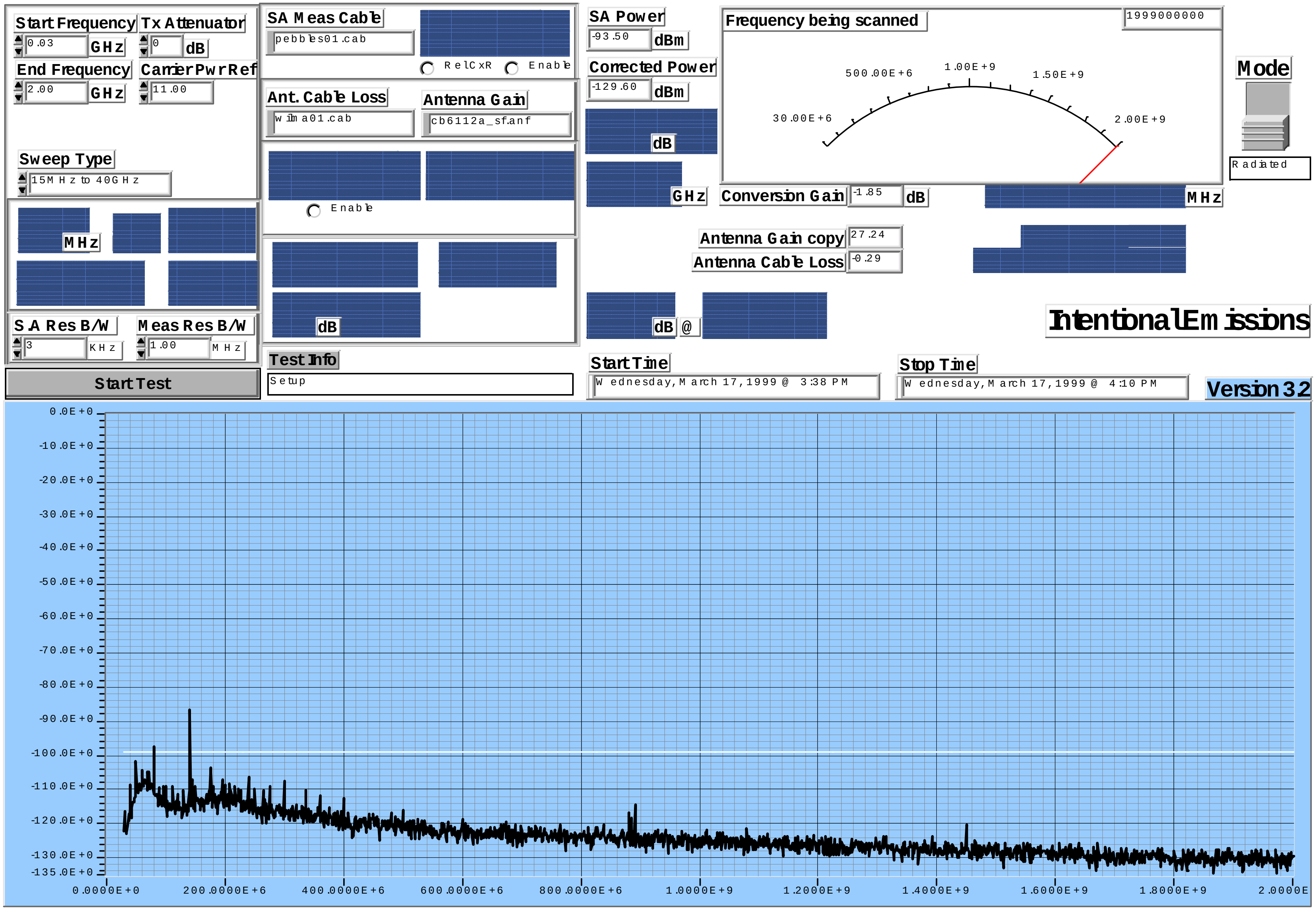
## Radiated Emissions Measurement Results

## 6. RADIATED EMISSIONS MEASUREMENT RESULTS

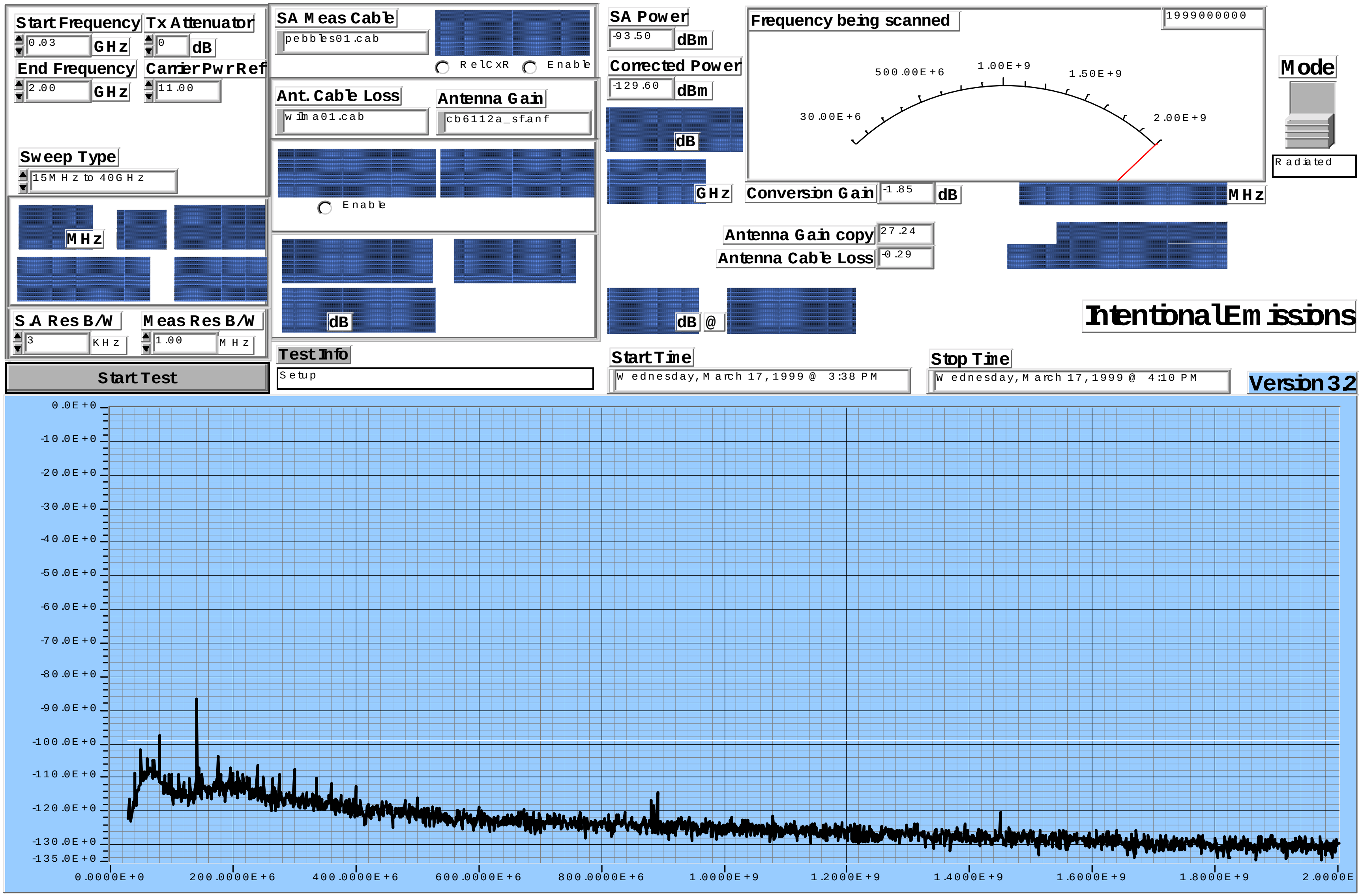




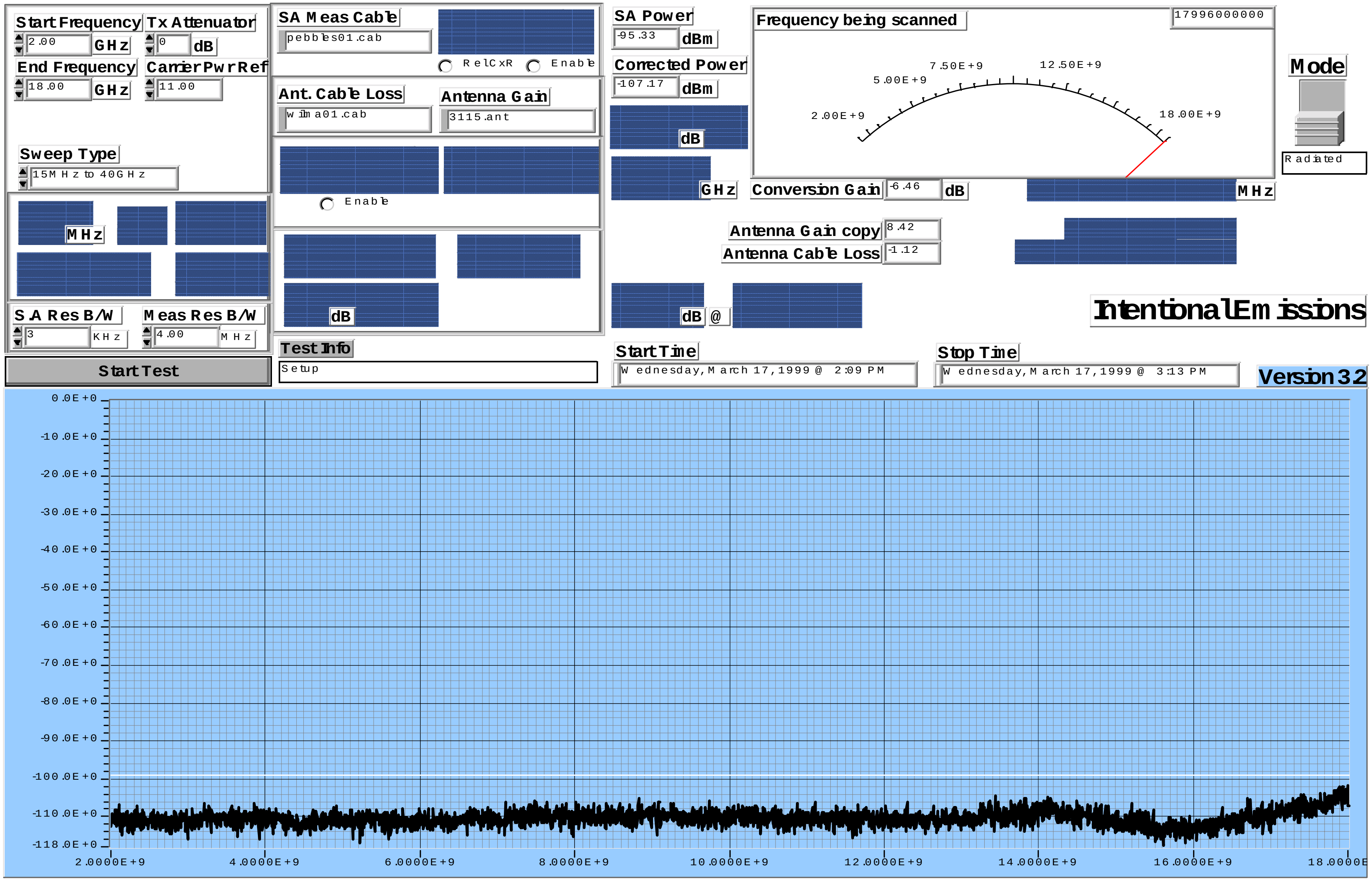
CTR 2800, 2 carrier QAM 64 modulated. – 30MHz to 2GHz – Horizontal



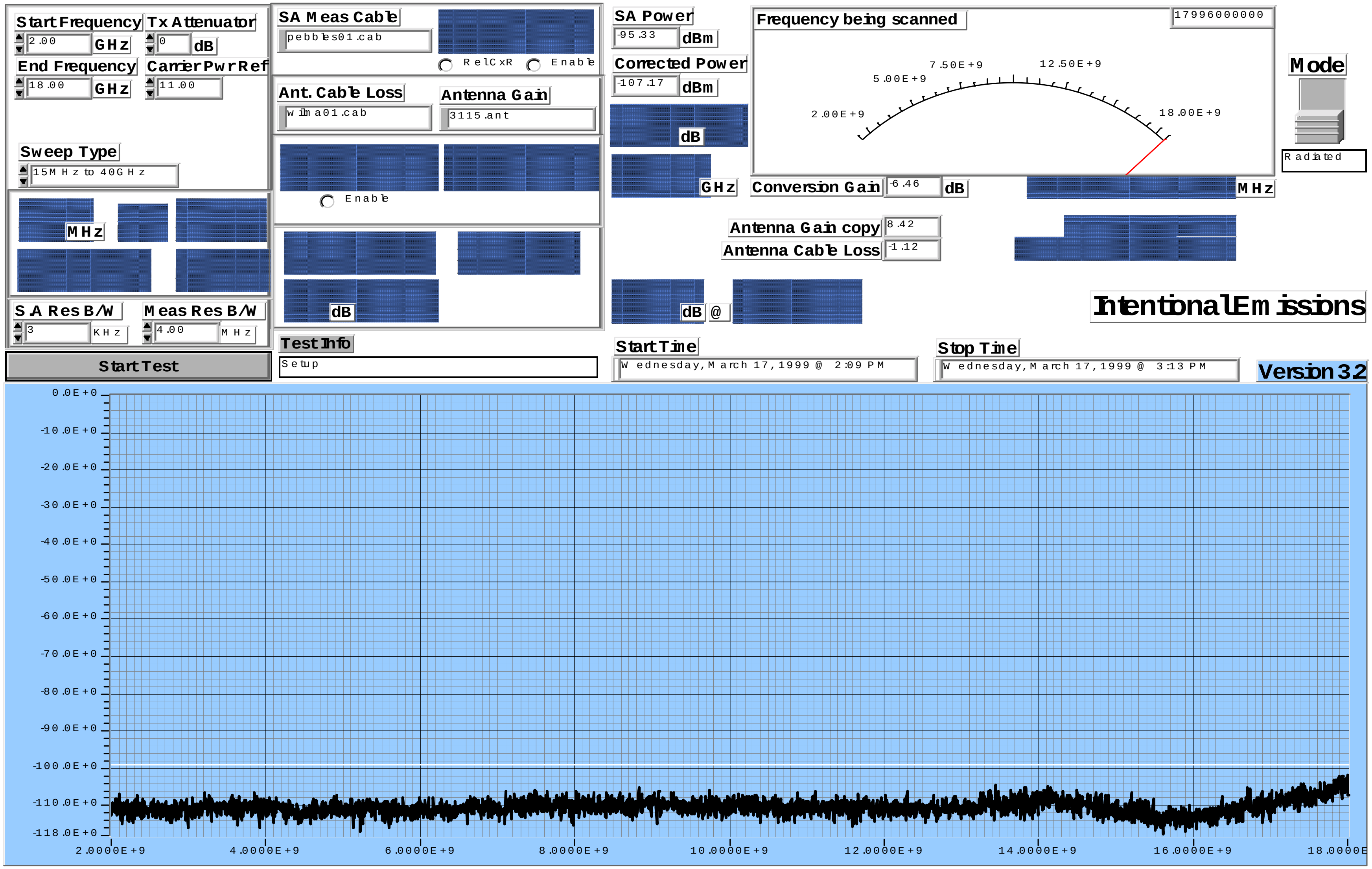
CTR 2800, 2 carrier QAM 64 modulated. – 30MHz to 2GHz – Vertical



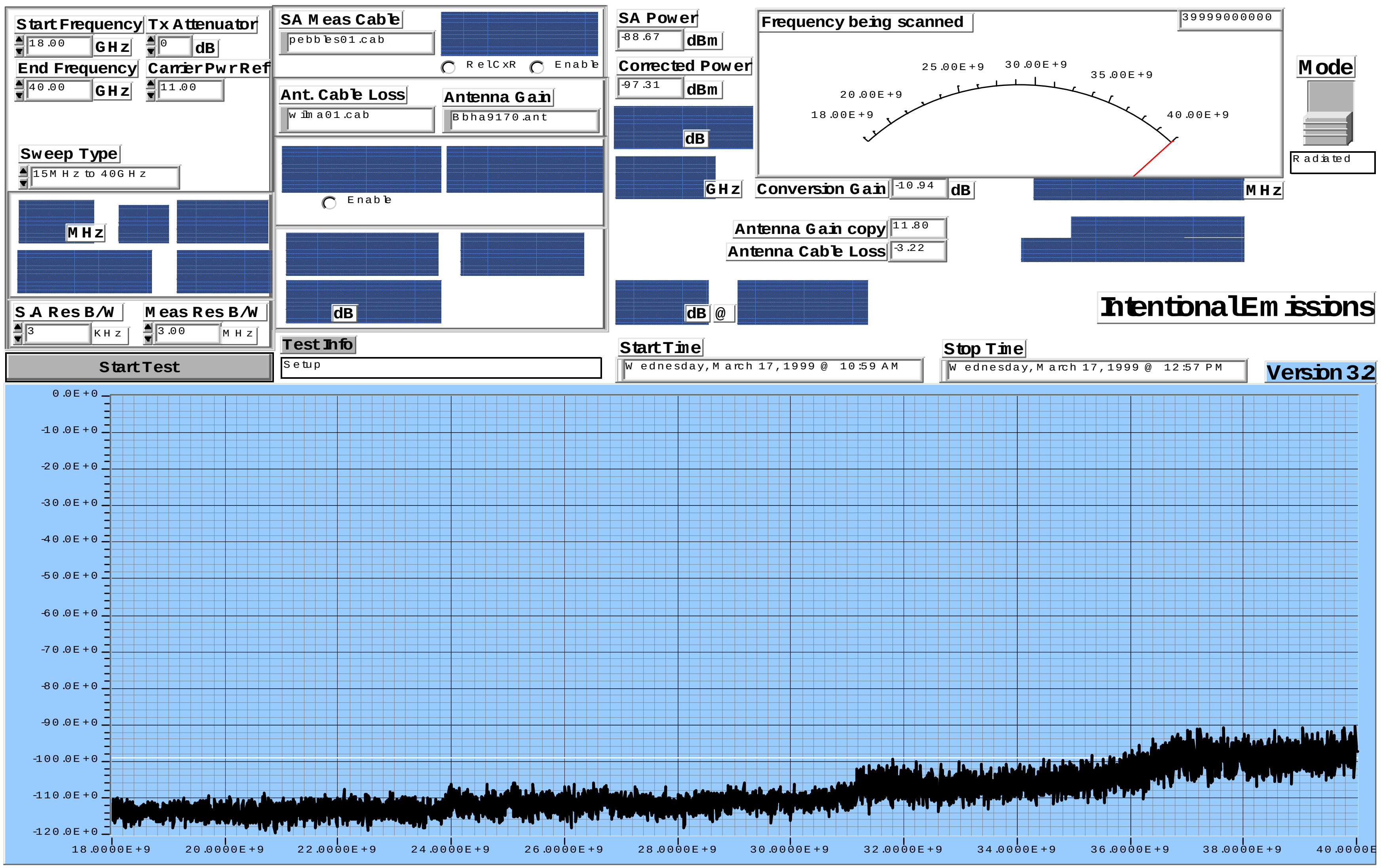
CTR 2800, 2 carrier QAM 64 modulated. – 1GHz to 18GHz - Horizontal



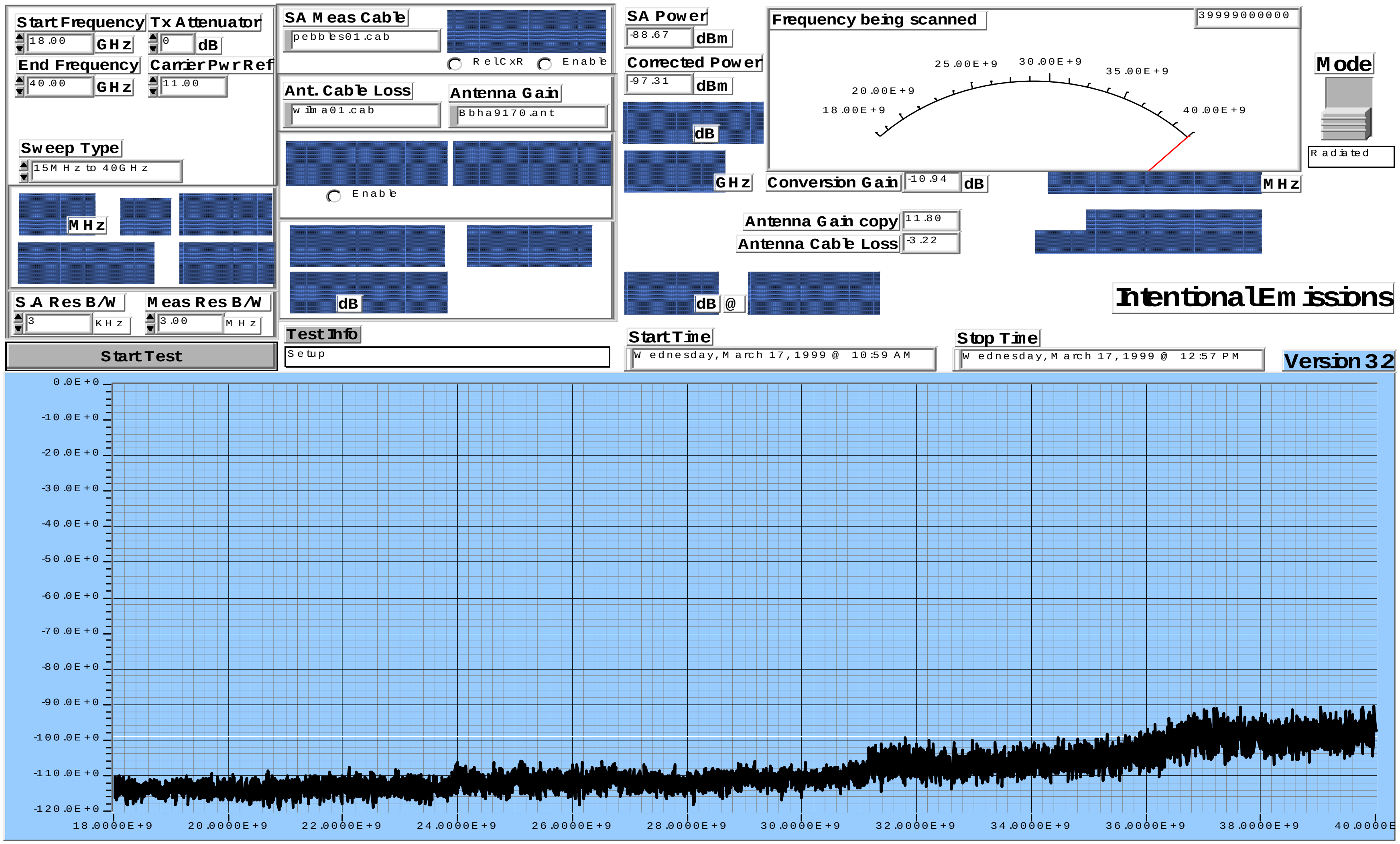
CTR 2800, 2 carrier QAM 64 modulated. – 1GHz to 18GHz - Vertical



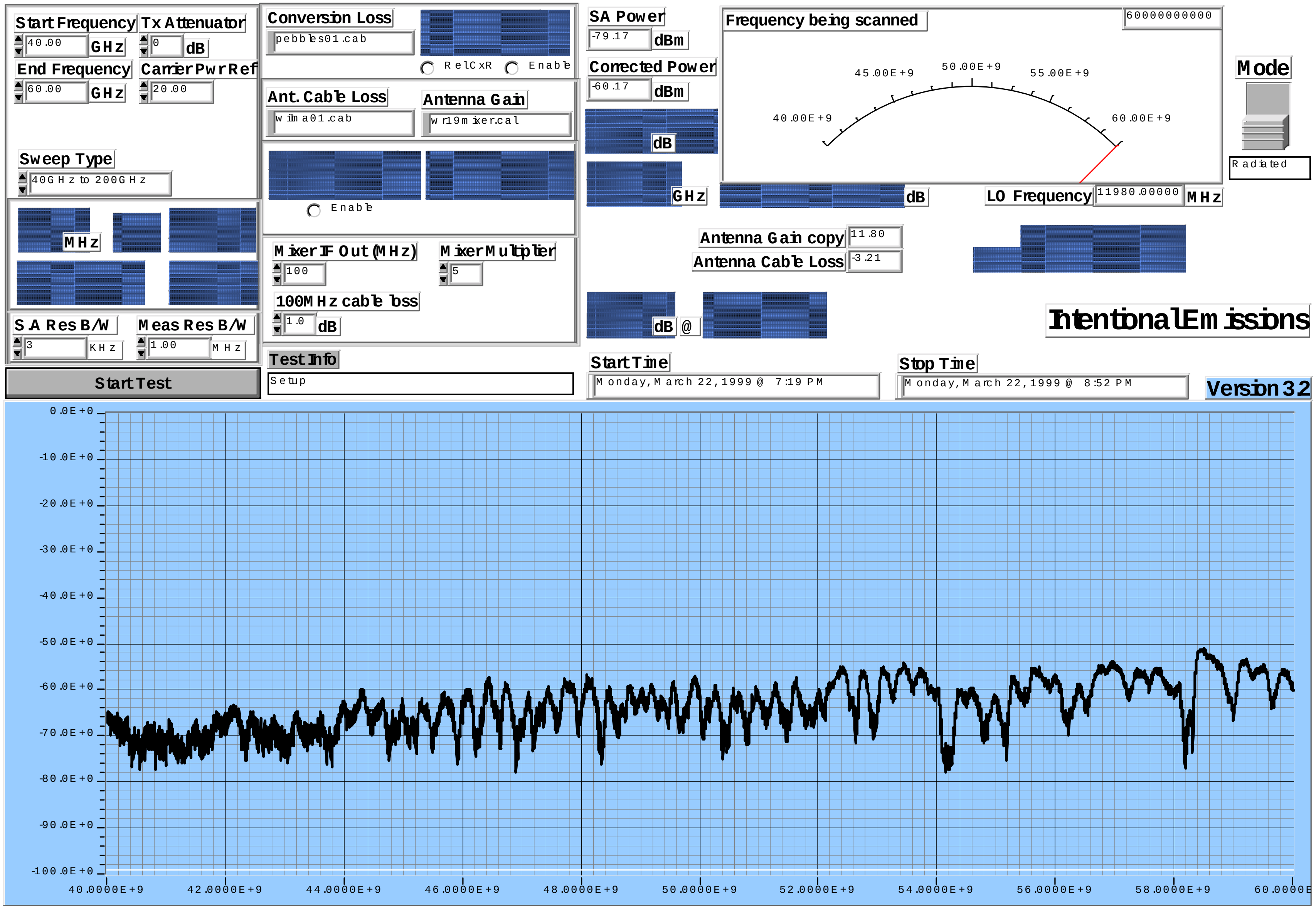
CTR 2800, 2 carrier QAM 64 modulated. –18GHz to 40GHz - Horizontal



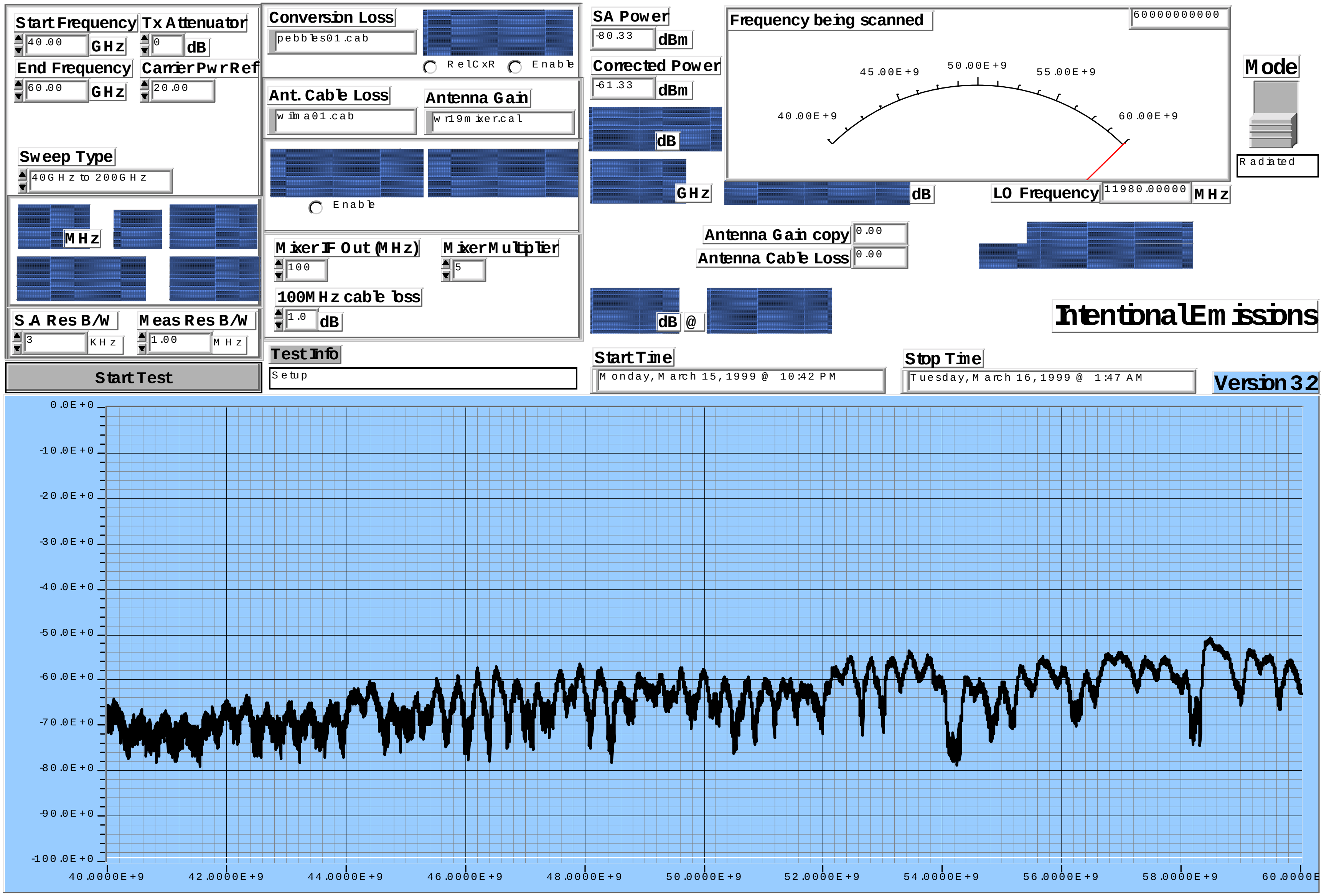
CTR 2800, 2 carrier QAM 64 modulated. –18GHz to 40GHz - Vertical



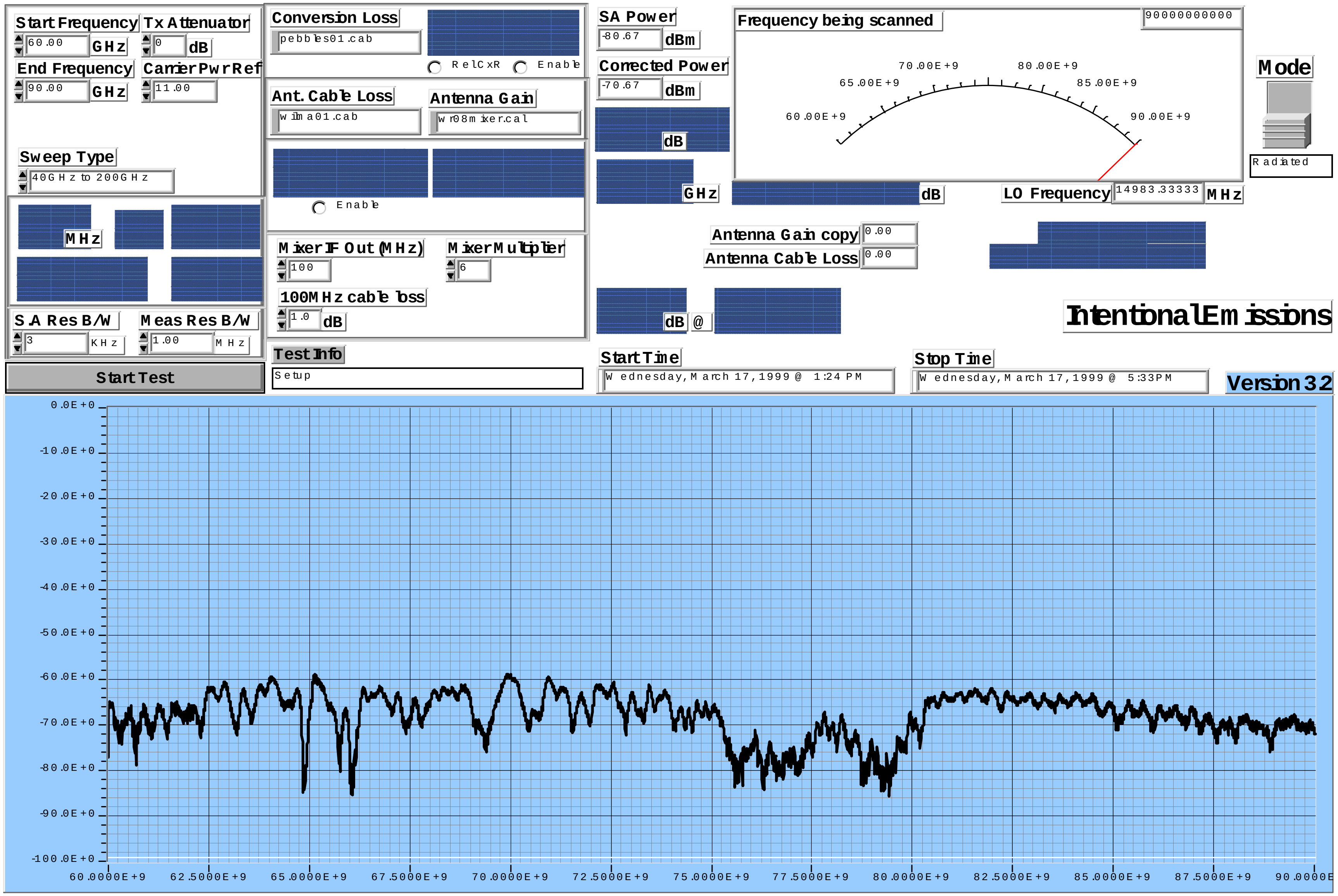
CTR 2800, 2 carrier QAM 64 modulated. –40GHz to 60GHz - Horizontal



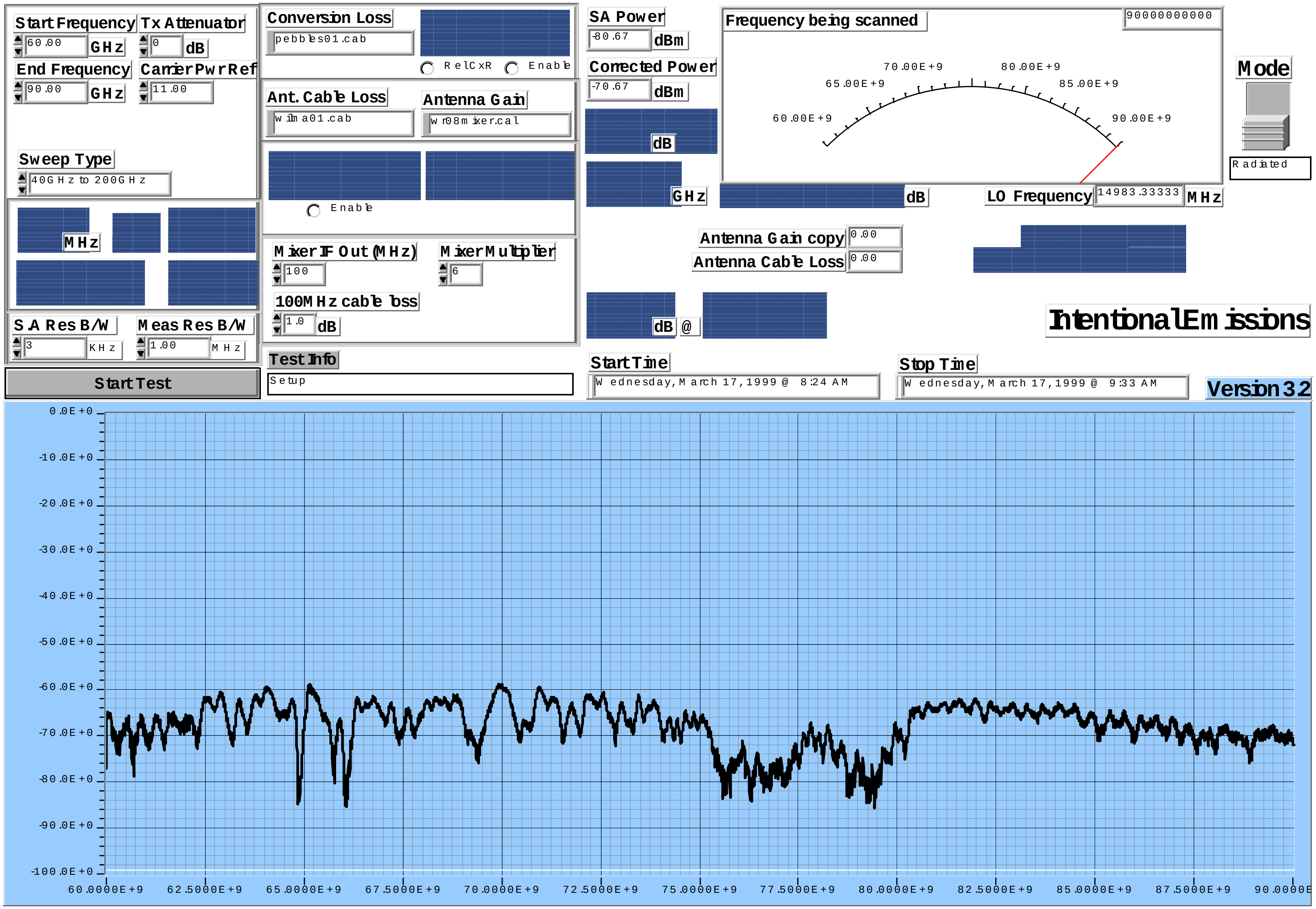
CTR 2800, 2 carrier QAM 64 modulated. –40GHz to 60GHz - Vertical



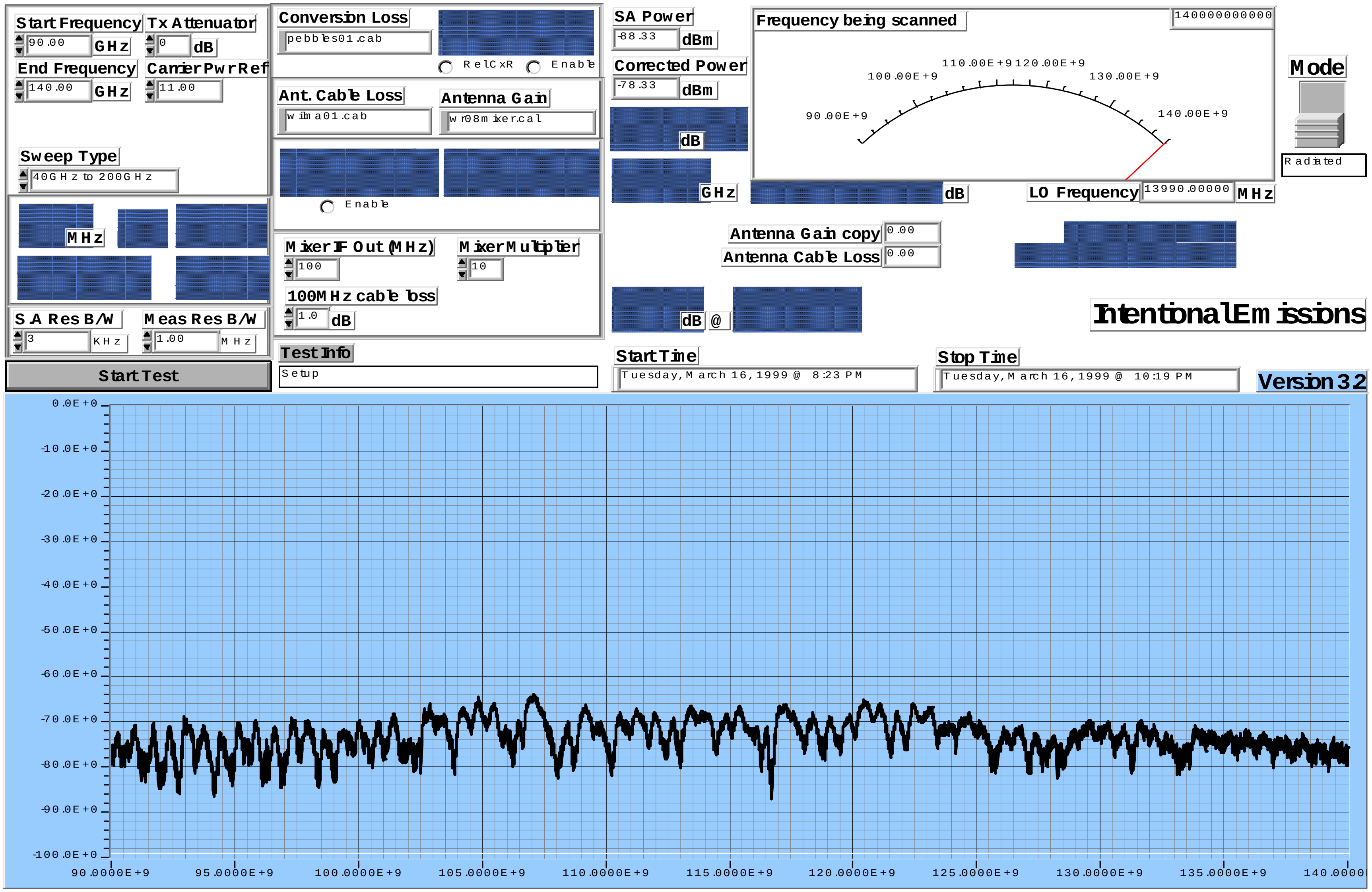
CTR 2800, 2 carrier QAM 64 modulated. –60GHz to 90GHz - Horizontal



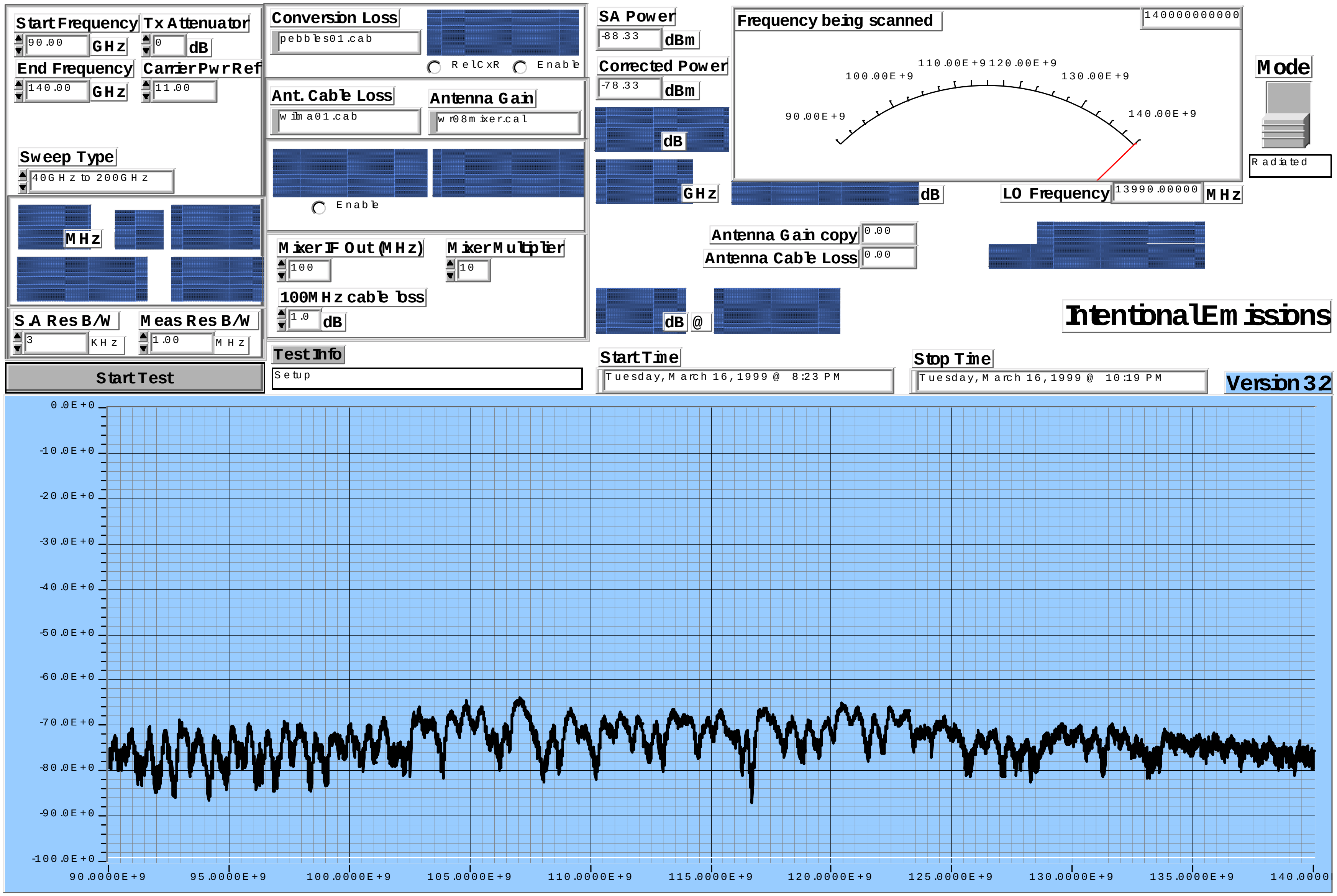
CTR 2800, 2 carrier QAM 64 modulated. –60GHz to 90GHz - Vertical



CTR 2800, 2 carrier QAM 64 modulated. –90GHz to 140GHz - Horizontal



CTR 2800, 2 carrier QAM 64 modulated. –90GHz to 140GHz - Vertical

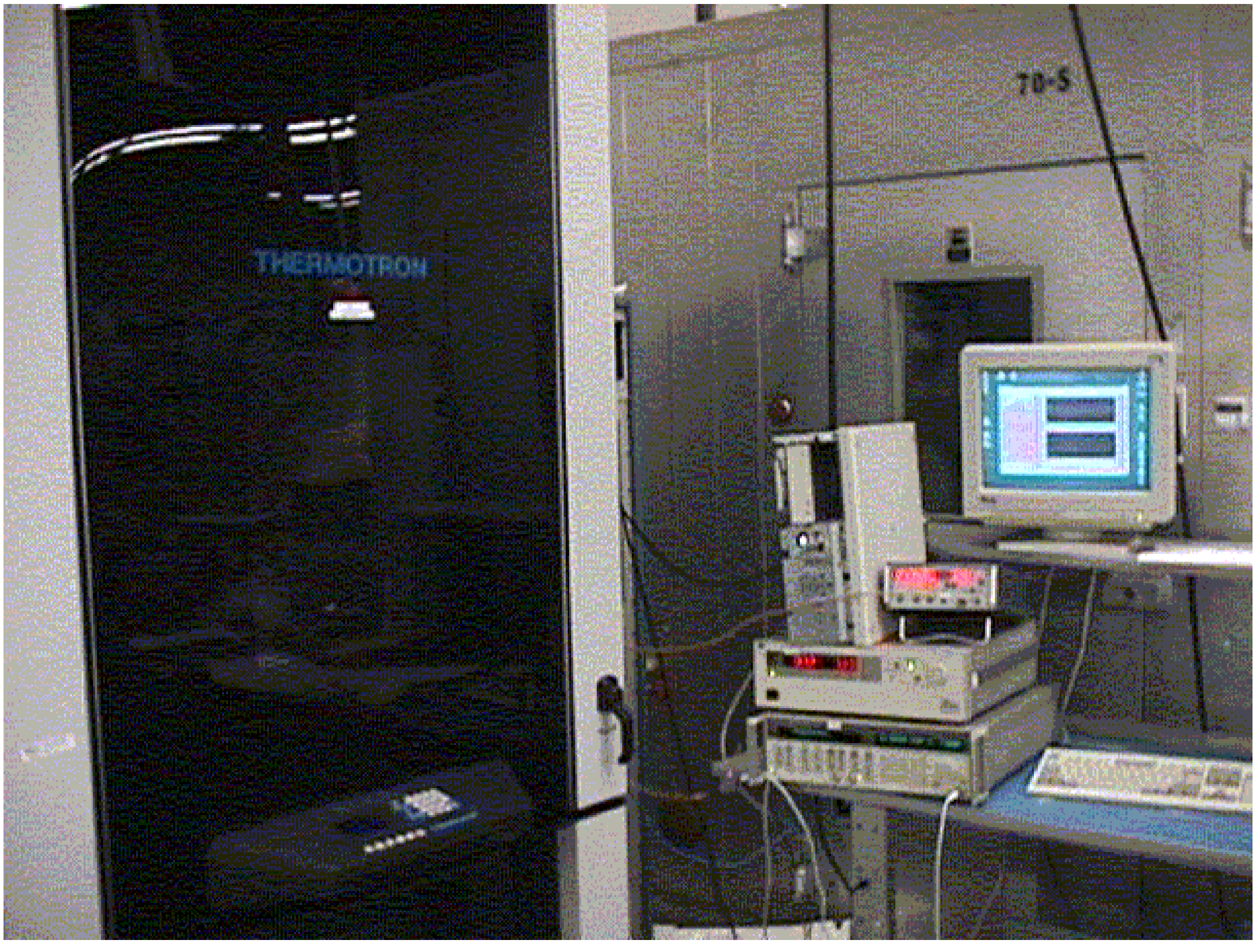


# APPENDIX C

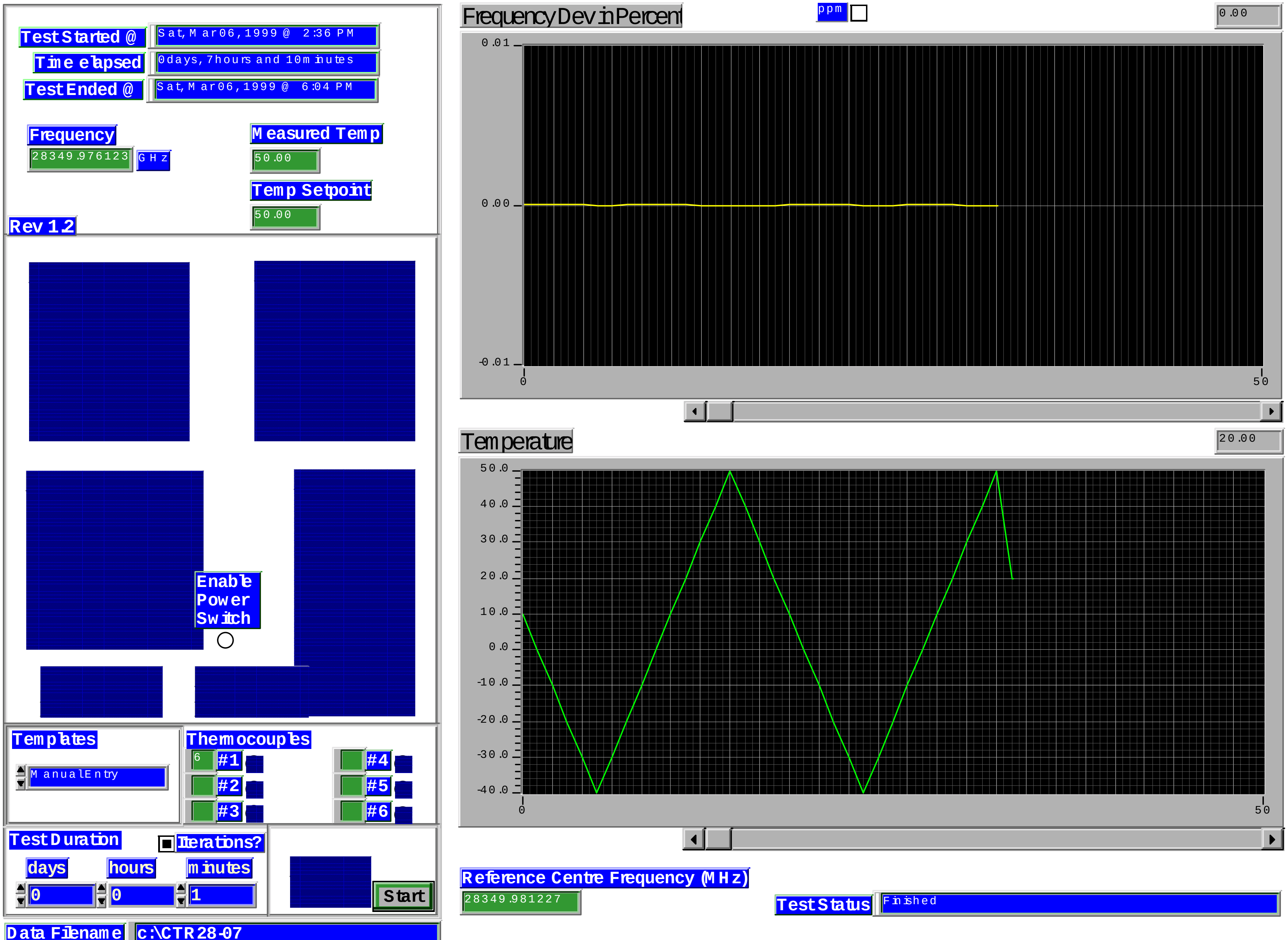
# Temperature Stability Measurements Results

## 7. TEMPERATURE STABILITY MEASUREMENTS RESULTS

Frequency Stability Test Setup



## CTR Frequency Stability



| Date and Time | | | Frequency | Temp | Deviation |
|---|---|---|---|---|---|
| Sat | Mar 06 | 1999 @ 2:47 PM | 28349.982318 | 10.0 | 0.000004 |
| Sat | Mar 06 | 1999 @ 2:59 PM | 28349.983326 | 0.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 3:13 PM | 28349.983705 | -10.0 | 0.000009 |
| Sat | Mar 06 | 1999 @ 3:27 PM | 28349.983266 | -20.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 3:41 PM | 28349.982303 | -30.0 | 0.000004 |
| Sat | Mar 06 | 1999 @ 3:55 PM | 28349.979945 | -40.0 | -0.000005 |
| Sat | Mar 06 | 1999 @ 4:09 PM | 28349.979937 | -30.0 | -0.000005 |
| Sat | Mar 06 | 1999 @ 4:20 PM | 28349.981277 | -20.0 | 0.000000 |
| Sat | Mar 06 | 1999 @ 4:32 PM | 28349.982322 | -10.0 | 0.000004 |
| Sat | Mar 06 | 1999 @ 4:44 PM | 28349.982972 | 0.0 | 0.000006 |
| Sat | Mar 06 | 1999 @ 4:56 PM | 28349.983086 | 10.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 5:08 PM | 28349.982624 | 20.0 | 0.000005 |
| Sat | Mar 06 | 1999 @ 5:20 PM | 28349.981028 | 30.0 | -0.000001 |
| Sat | Mar 06 | 1999 @ 5:35 PM | 28349.978784 | 40.0 | -0.000009 |
| Sat | Mar 06 | 1999 @ 5:49 PM | 28349.975842 | 50.0 | -0.000019 |
| Sat | Mar 06 | 1999 @ 6:04 PM | 28349.976447 | 40.0 | -0.000017 |
| Sat | Mar 06 | 1999 @ 6:16 PM | 28349.978139 | 30.0 | -0.000011 |
| Sat | Mar 06 | 1999 @ 6:28 PM | 28349.980213 | 20.0 | -0.000004 |
| Sat | Mar 06 | 1999 @ 6:42 PM | 28349.982028 | 10.0 | 0.000003 |
| Sat | Mar 06 | 1999 @ 6:56 PM | 28349.983258 | 0.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 7:10 PM | 28349.983670 | -10.0 | 0.000009 |
| Sat | Mar 06 | 1999 @ 7:24 PM | 28349.983325 | -20.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 7:38 PM | 28349.982134 | -30.0 | 0.000003 |
| Sat | Mar 06 | 1999 @ 7:52 PM | 28349.979825 | -40.0 | -0.000005 |
| Sat | Mar 06 | 1999 @ 8:06 PM | 28349.980026 | -30.0 | -0.000004 |
| Sat | Mar 06 | 1999 @ 8:18 PM | 28349.981167 | -20.0 | -0.000000 |
| Sat | Mar 06 | 1999 @ 8:30 PM | 28349.982257 | -10.0 | 0.000004 |
| Sat | Mar 06 | 1999 @ 8:41 PM | 28349.982956 | 0.0 | 0.000006 |
| Sat | Mar 06 | 1999 @ 8:53 PM | 28349.983092 | 10.0 | 0.000007 |
| Sat | Mar 06 | 1999 @ 9:06 PM | 28349.982394 | 20.0 | 0.000004 |
| Sat | Mar 06 | 1999 @ 9:20 PM | 28349.981157 | 30.0 | -0.000000 |
| Sat | Mar 06 | 1999 @ 9:32 PM | 28349.978976 | 40.0 | -0.000008 |
| Sat | Mar 06 | 1999 @ 9:47 PM | 28349.976123 | 50.0 | -0.000018 |

# APPENDIX D

## Spectral Mask Limit Calculations

SPECTRAL MASK CALCULATIONS

| | | | | |
|---|---|---|---|---|
| **Number of CXR** | 2 | **Center Freq. (MHz)** | 28206.1 | CTR - low side mask |
| **Symbol rate (Msps)** | 8 | | | |
| **Authorized BW (MHz)** | 20 | | | |
| **O/P Channel Power (dBm)** | 20 | 0.1 | **Watts** | |

| % Removed | FCC Spec | Delta BW | Lower Band | Upper Band |
|---|---|---|---|---|
| **0** | **0** | **0** | **28205** | **28205** |
| **50** | **0** | **10** | **28195** | **28215** |
| **50.5** | **-24.2103** | **10.1** | **28194.9** | **28215.1** |
| 51 | -24.4103 | 10.2 | 28194.8 | 28215.2 |
| 55 | -26.0103 | 11 | 28194 | 28216 |
| 60 | -28.0103 | 12 | 28193 | 28217 |
| 75 | -34.0103 | 15 | 28190 | 28220 |
| 100 | -44.0103 | 20 | 28185 | 28225 |
| 101 | -44.4103 | 20.2 | 28184.8 | 28225.2 |
| 102 | -44.8103 | 20.4 | 28184.6 | 28225.4 |
| 105 | -46.0103 | 21 | 28184 | 28226 |
| 106 | -46.4103 | 21.2 | 28183.8 | 28226.2 |
| 107 | -46.8103 | 21.4 | 28183.6 | 28226.4 |
| 107.45 | -46.9903 | 21.49 | 28183.51 | 28226.49 |
| 115 | -50.0103 | 23 | 28182 | 28228 |
| 120 | -52.0103 | 24 | 28181 | 28229 |
| **125** | **-56** | **25** | **28180** | **28230** |
| 150 | -56 | 30 | 28175 | 28235 |
| 175 | -56 | 35 | 28170 | 28240 |
| 200 | -56 | 40 | 28165 | 28245 |
| **250** | **-56** | **50** | **28155** | **28255** |
| **250.1** | **-43** | **50.02** | **28154.98** | **28255.02** |
| 300 | -43 | 60 | 28145 | 28265 |
| 500 | -43 | 100 | 28105 | 28305 |
| 1000 | -43 | 200 | 28005 | 28405 |
| 1100 | -43 | 440 | 27765 | 28645 |
| 1200 | -43 | 250 | 27955 | 28455 |
| 1250 | -43 | 250 | 27955 | 28455 |
| 1300 | -43 | 260 | 27945 | 28465 |
| **1500** | **-43** | **300** | **27905** | **28505** |

| | | | | |
|---|---|---|---|---|
| **Number of CXR** | 2 | **Center Freq. (MHz)** | 28345.2 | CTR - midpoint mask |

| | | | | |
|---|---|---|---|---|
| **Symbol rate (Msps)** | 8 | | | |
| **Authorized BW (MHz)** | 20 | | | |
| **O/P Channel Power (dBm)** | 20 | 0.1 | **Watts** | |
| **% Removed** | **FCC Spec** | **Delta BW** | **Lower Band** | **Upper Band** |
| **0** | **0** | **0** | **28345.2** | **28345.2** |
| **50** | **0** | **10** | **28335.2** | **28355.2** |
| **50.5** | **-24.2103** | **10.1** | **28335.1** | **28355.3** |
| 51 | -24.4103 | 10.2 | 28335 | 28355.4 |
| 55 | -26.0103 | 11 | 28334.2 | 28356.2 |
| 60 | -28.0103 | 12 | 28333.2 | 28357.2 |
| 75 | -34.0103 | 15 | 28330.2 | 28360.2 |
| 100 | -44.0103 | 20 | 28325.2 | 28365.2 |
| 101 | -44.4103 | 20.2 | 28325 | 28365.4 |
| 102 | -44.8103 | 20.4 | 28324.8 | 28365.6 |
| 105 | -46.0103 | 21 | 28324.2 | 28366.2 |
| 106 | -46.4103 | 21.2 | 28324 | 28366.4 |
| 107 | -46.8103 | 21.4 | 28323.8 | 28366.6 |
| 107.45 | -46.9903 | 21.49 | 28323.71 | 28366.69 |
| 115 | -50.0103 | 23 | 28322.2 | 28368.2 |
| 120 | -52.0103 | 24 | 28321.2 | 28369.2 |
| **125** | **-56** | **25** | **28320.2** | **28370.2** |
| 150 | -56 | 30 | 28315.2 | 28375.2 |
| 175 | -56 | 35 | 28310.2 | 28380.2 |
| 200 | -56 | 40 | 28305.2 | 28385.2 |
| **250** | **-56** | **50** | **28295.2** | **28395.2** |
| **250.1** | **-43** | **50.02** | **28295.18** | **28395.22** |
| 300 | -43 | 60 | 28285.2 | 28405.2 |
| 500 | -43 | 100 | 28245.2 | 28445.2 |
| 1000 | -43 | 200 | 28145.2 | 28545.2 |
| 1100 | -43 | 440 | 27905.2 | 28785.2 |
| 1200 | -43 | 250 | 28095.2 | 28595.2 |
| 1250 | -43 | 250 | 28095.2 | 28595.2 |
| 1300 | -43 | 260 | 28085.2 | 28605.2 |
| **1500** | **-43** | **300** | **28045.2** | **28645.2** |

| | | | | |
|---|---|---|---|---|
| **Number of CXR** | 2 | **Center Freq. (MHz)** | 28.2751 | CTR - high side mask |
| **Symbol rate (Msps)** | 8 | | | |

| Authorized BW (MHz) | 20 | | | |
|---|---|---|---|---|
| O/P Channel Power (dBm) | 20 | 0.1 | Watts | |
| **% Removed** | **FCC Spec** | **Delta BW** | **Lower Band** | **Upper Band** |
| **0** | **0** | **0** | **28275.1** | **28275.1** |
| **50** | **0** | **10** | **28265.1** | **28285.1** |
| **50.5** | **-24.2103** | **10.1** | **28265** | **28285.2** |
| 51 | -24.4103 | 10.2 | 28264.9 | 28285.3 |
| 55 | -26.0103 | 11 | 28264.1 | 28286.1 |
| 60 | -28.0103 | 12 | 28263.1 | 28287.1 |
| 75 | -34.0103 | 15 | 28260.1 | 28290.1 |
| 100 | -44.0103 | 20 | 28255.1 | 28295.1 |
| 101 | -44.4103 | 20.2 | 28254.9 | 28295.3 |
| 102 | -44.8103 | 20.4 | 28254.7 | 28295.5 |
| 105 | -46.0103 | 21 | 28254.1 | 28296.1 |
| 106 | -46.4103 | 21.2 | 28253.9 | 28296.3 |
| 107 | -46.8103 | 21.4 | 28253.7 | 28296.5 |
| 107.45 | -46.9903 | 21.49 | 28253.61 | 28296.59 |
| 115 | -50.0103 | 23 | 28252.1 | 28298.1 |
| 120 | -52.0103 | 24 | 28251.1 | 28299.1 |
| **125** | **-56** | **25** | **28250.1** | **28300.1** |
| 150 | -56 | 30 | 28245.1 | 28305.1 |
| 175 | -56 | 35 | 28240.1 | 28310.1 |
| 200 | -56 | 40 | 28235.1 | 28315.1 |
| **250** | **-56** | **50** | **28225.1** | **28325.1** |
| **250.1** | **-43** | **50.02** | **28225.08** | **28325.12** |
| 300 | -43 | 60 | 28215.1 | 28335.1 |
| 500 | -43 | 100 | 28175.1 | 28375.1 |
| 1000 | -43 | 200 | 28075.1 | 28475.1 |
| 1100 | -43 | 440 | 27835.1 | 28715.1 |
| 1200 | -43 | 250 | 28025.1 | 28525.1 |
| 1250 | -43 | 250 | 28025.1 | 28525.1 |
| 1300 | -43 | 260 | 28015.1 | 28535.1 |

## 8. FCC ID LABEL AND LOCATION