# Certification Test Report

# CFR 47 FCC Part 24, Subpart E
# CFR 47 FCC Part 2, Subpart J
# Industry Canada RSS 133

# Star Solutions iCell 1XRTT +DOrA Macro BSS 1900MHz

## FCC ID # S52-5-02-01-00-1
## IC ID # 8076A-50201001

## Project Code CG-1148

**(Report CG-1148-RA-1-2)**
**Revision: 2**

**(This report supersedes CG-1148-RA-1-1)**

**July 14, 2009**

| | |
|---|---|
| **Prepared for**: | Star Solutions |
| **Author:** | Daryl Therens<br>Senior Test Specialist |
| **Approved by:** | Nick Kobrosly<br>Director of Canadian Operations |

## Report Summary

| | |
|---|---|
| **Test Facility:** | **National Technical Systems, Canada**<br>Product Integrity Laboratory<br>5151-47th Street, NE<br>Calgary Alberta T3J 3R2 |
| **Accreditation Numbers:** | 0214.22 Electrical<br>0214.23 Mechanical<br>Accredited by A2LA<br>The American Association for Laboratory Accreditation<br><br>CLIENTS SERVED: All interested parties<br>FIELDS OF TESTING: Electrical/Electronic, Mechanical/Physical<br>ACCREDITATION DATE:: May 14, 2009 VALID TO: December 31, 2009 |
| **Applicant:** | Star Solutions<br>120 – 4600 Jacombs Road<br>Richmond, BC, Canada<br>V6V 3B1 |
| **Customer Representative:** | Name: Azadeh Farzin<br>Phone #: (604) 276-0055, x244<br>Email Address: azadeh.farzin@starsolutions.com |

## EUT Description[1]

| EUT Description | Manufacturer | Model | Revision | Serial Number |
|---|---|---|---|---|
| iCell 1X + DOrA Macro BSS, 2F/3S 1900MHz | Star Solutions | NA | NA | 16ZWY4SJ1LC1 |

[1] See section 2.1 for more detail.

## Test Summary

| Appendix | Test/Requirement Description | Deviations* from: | | | Pass / Fail | Applicable FCC Rule Parts | Applicable Industry Canada Rule Parts |
|---|---|---|---|---|---|---|---|
| | | Base Standard | Test Basis | NTS Procedure | | | |
| A | RF Power Output | No | No | No | PASS | FCC -24.232 | RSS 133 6.4 |
| B | Occupied Bandwidth (26dB emission bandwidth) | No | No | No | PASS | FCC -24.238 | N/A |
| B | Occupied Bandwidth (99% emission bandwidth) | No | No | No | PASS | N/A | RSS 133 6.5 |
| C | Conducted Spurious Emissions Band Edge | No | No | No | PASS | FCC -24.238 | RSS 133 6.5 |
| C | Conducted Spurious Emissions | No | No | No | PASS | FCC -24.238 | RSS 133 6.5 |
| D | TX Frequency Stability | No | No | No | PASS | FCC -24.235 | RSS 133 6.3 |
| E | Peak to Average Power | No | No | No | PASS | FCC -24.232 | RSS 133 6.4 |
| F | Tx / Rx Radiated Spurious Emissions | No | No | No | PASS | FCC -24.238 | RSS 133 6.3<br>RSS 133 6.6<br>RSS-Gen |

Test Result: The product presented for testing complied with test requirements as shown above.

Prepared By: _____
Daryl Therens
Senior Test Specialist

Glen Moore
2009.07.14
15:38:17 -06'00'

Reviewed By: _____
Glen Moore
Wireless/EMC Manager

Alex Mathews
2009.07.14
15:44:48 -06'00'

Approved By: _____
Alex Mathews
Quality Management Representative

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## Register of Revisions

| Revision | Date | Description of Revisions |
|---|---|---|
| 1 | July 13, 2009 | Initial release for review |
| 2 | July 14, 2009 | Changes after customer review |

# 1.0 INTRODUCTION

## 1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the iCell 1XRTT + DOrA Macro BSS 1900 MHz from Star Solutions to FCC Part 24 Subpart E, FCC Part 2 Subpart J, and equivalent sections of Industry Canada's RSS 133.

The configuration tested is the worst case combination of radio and power amplifier equipment and covers off all product configurations.

# 2.0 EUT DESCRIPTION

## 2.1 CONFIGURATION

| | Name | Model | Revision | Serial Number |
|---|---|---|---|---|
| **EUT** | iCell 1X + DOrA Macro BSS, 2F/3S 1900MHz, which contains the below items; | | | |
| | iCell 1x BTS Assembly, Macro 1900MHz, with GPS Receiver, Dual PS, -48Vdc | 24242379GS | B7 | 1664Y4SJ1LCG |
| | iCell DOrA BTS Assembly, Macro 1900MHz, Dual PS, -48Vdc | 24244245GS | A8 | 17HGY4TJ1LD0 |
| | iCell ACS, Macro 2F 1900MHz for SCPA, -48Vdc | 24242416GS | B3 | 165XY4SJ1LC9<br>165XY4SJ1LCA<br>165XY4SJ1LCB |
| | iCell SCPA, Macro 1900MHz, -48Vdc | 24245143GS | A8 | 17HFY4TJ1LCQ<br>17HFY4TJ1LCR<br>17HFY4TJ1LCS<br>17HFY4TJ1LCT<br>17HFY4TJ1LCU<br>17HFY4TJ1LCV |
| **Classification** | Base-station | | | |
| **Modulation** | 1XRTT, EVDO (8PSK, QPSK, 16QAM) | | | |
| **Frequency Range** | 1850 – 1990 MHz | | | |
| **Size** | 89"H x 33"W x 54"D (shipping dimensions) | | | |
| **Weight** | 600-800 lbs (shipping weight) | | | |

| | |
|---|---|
| **General Functional Description** | The Macro BSS is a part of Star Solutions end-to-end all IP-based wireless communication solution providing the mobility and media in a packet-based environment.<br>The Macro BSS is built in a standard rack dimensioned to customer specified network requirements. It consists following sub components:<br>• Base Station Controller (BSC)<br>• Base Transceiver Station (BTS) - 1XRTT<br>• Base Transceiver Station (BTS) - EVDO<br>• Ethernet switch<br>• Circuit breakers<br>• Alarm and Control Module (ACM)<br>• Carrier Power Amplifier (SCPA) and Antenna Combining System (ACS) |

### 2.2 EUT POWER

| | |
|---|---|
| Voltage | -48 Vdc |
| Number of Feeds | 1 |
| Gauge of cable | #4 AWG minimum |
| Current Draw | 45A |

### 2.3 EUT CABLING

| Item | Routing | | Description | Length |
|---|---|---|---|---|
| | From | To | | |
| 1 | EUT | Attenuator/ Load | Sucoflex RF Cable for Main Ant. Port (1XRTT) | 3m |
| 2 | EUT | Attenuator/ Load | Sucoflex RF Cable for Diversity Ant. Port (EVDO) | 3m |
| 3 | EUT | GPS Splitter | LMR400 RF Cable for GPS Port | 8m |
| 4 | EUT | Variable DC Power Supply | #2 AWG DC Power Cables | 10m |

### 2.4 FREQUENCIES

| Module | Signal | Frequency (MHz) |
|---|---|---|
| Macro BSS | Transmit | 1930-1990 |
| | Receive | 1850-1910 |

## 3.0 TEST ENVIRONMENT

### 3.1 NORMAL TEST CONDITIONS

Temperature: 20 – 23 °C
Relative Humidity: 28 – 35 %
Atmospheric pressure: 883 – 890 mbar
Nominal test voltage: -48Vdc

# APPENDICES

# APPENDIX A: POWER OUTPUT

## A.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 24.232; IC RSS 133 6.4 |
| **Test Basis** | FCC 2.1046 |
| **Test Method** | TIA/EIA 603 |

## A.2. Specifications

### FCC Part 2.1046

*(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune -up procedure to give the values of current and voltage on the circuit elements specified in 2.983(d)(5). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.*

## A.3. FCC Limit (Part 24.232)

*The maximum RF power from a base station must not exceed 100 Watts.*

## A.4. Deviations

| Deviation Number | Time & Date | Description and Justification of Deviation | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| none | | | | | | |

## A.5. Test Method

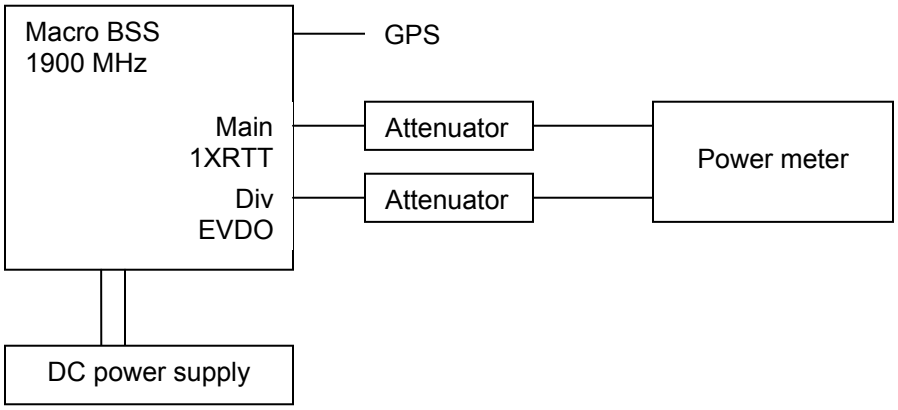
The EUT was setup via a PC and Star Solutions software to transmit at maximum power in both 1XRTT and EVDO modes. EVDO measurements were made in at different modulation types and data rates. The RF output power was measured using the power meter with an average power sensor.

The Macro BSS utilizes a full band duplexer. Power measurements were made at the low, middle, and high ends of the frequency band.

## A.6. Test Setup

The set-up used for the RF output power test is illustrated below. RF output power measurements were referenced to the Sector 1 main antenna port for 1XRTT measurements, and to the Sector 1 diversity antenna port for EVDO measurements. Sector 2 and 3 main / diversity antenna ports were terminated into 50Ω loads.

**Figure 1: Power Output Setup**




## A.7. Test Results[2]

**Table 1: RF Power Output of Macro BSS 1900 MHz, 1XRTT Mode**

| Channel Number (Block) | Modulation | Frequency (MHz) | Measured RF Output Power (dBm) | Typical Maximum Rated Power (dBm) | FCC Limit (dBm) |
|---|---|---|---|---|---|
| 25 (A) | 1XRTT | 1931.25 | 42.0 | 43 | 50 |
| 600 (B) | 1XRTT | 1960.00 | 41.9 | 43 | 50 |
| 1175 (C) | 1XRTT | 1988.75 | 41.9 | 43 | 50 |

**Table 2: RF Power Output of Macro BSS 1900 MHz, EVDO Mode**

| Channel Numbers (Block) | Modulation | Frequency (MHz) | Measured RF Output Power (dBm) | Typical Maximum Rated Power (dBm) | FCC Limit (dBm) |
|---|---|---|---|---|---|
| 600 (B) | 8PSK, 1843.2 kbps 1 slot | 1960.00 | 42.4 | 43 | 50 |
| 600 (B) | 8PSK, 921.6 kbps 2 slots | 1960.00 | 42.5 | 43 | 50 |
| 600 (B) | QPSK, 38.4 kbps, 16 slots | 1960.00 | 42.4 | 43 | 50 |
| 600 (B) | QPSK, 1228.8 kbps, 1 slot | 1960.00 | 42.5 | 43 | 50 |
| 600 (B) | 16QAM, 2457.6 kbps 1slot | 1960.00 | 42.4 | 43 | 50 |
| 600 (B) | 16QAM, 1536 kbps 2 slots | 1960.00 | 42.4 | 43 | 50 |

[2] The Macro BSS utilizes a full band duplexer. Power measurements were made at the low, middle, and high ends of the frequency band.

| Channel Numbers (Block) | Modulation | Frequency (MHz) | Measured RF Output Power (dBm) | Typical Maximum Rated Power (dBm) | FCC Limit (dBm) |
|---|---|---|---|---|---|
| 25 (A) | QPSK, 1228.8 kbps, 1 slot | 1931.25 | 42.8 | 43 | 50 |
| 1175 (C) | QPSK, 1228.8 kbps, 1 slot | 1988.75 | 42.9 | 43 | 50 |

### A.8. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Daryl Therens
Senior Test Specialist

### A.9. Test Dates

Test Start: June 16, 2009
Test Complete: June 17, 2009

# APPENDIX B: OCCUPIED BANDWIDTH

## B.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 24.238; IC RSS 133 6.5 |
| **Test Basis** | FCC PART 2.1049 |
| **Test Method** | FCC PART 2.1049/24.238 |

## B.2. Specifications

### FCC Part 2.1049

*The OBW, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:*

*(g) Transmitter in which the modulating baseband comprises not more than three independent channels - when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.*

*(h) Transmitters employing digital modulation techniques - when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at discretion of the user.*

## B.3. Deviations

| Deviation Number | Time & Date | Description and Justification of Deviation | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| none | | | | | | |

## B.4. Test Method

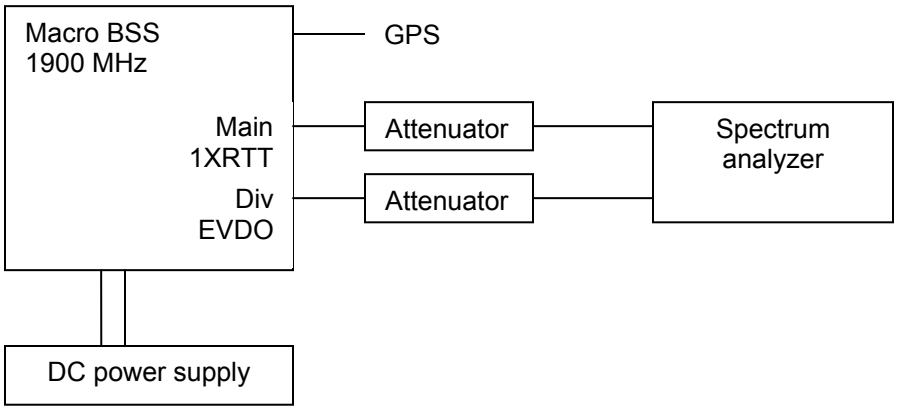
The EUT was setup via a PC and Star Solutions software to transmit at maximum power in both 1XRTT and EVDO modes. EVDO measurements were made in at different modulation types and data rates. The occupied bandwidth was measured both using the 99% channel power feature and the 26dB down

feature of the spectrum analyzer. Occupied bandwidth measurements were performed on Sector 1 main antenna port for 1XRTT measurements, and on Sector 1 diversity antenna port for EVDO measurements. Sector 2 and 3 main / diversity antenna ports were terminated into 50Ω loads.

### B.5. Test Setup

The test setup for Occupied BW is as illustrated below.

**Figure 2: Occupied BW Setup**




### B.6. Test Results

**Table 3: Occupied BW, Macro BSS 1900 MHz, 1XRTT Mode**

| Channel Number (Block) | Modulation | Frequency (MHz) | IC 99% Measured Occupied BW (MHz) | FCC 26dB Measured Occupied BW (MHz) |
|---|---|---|---|---|
| 25 (A) | 1XRTT | 1931.25 | 1.28056112 | 1.45490982 |
| 600 (B) | 1XRTT | 1960.00 | 1.28056112 | 1.45490982 |
| 1175 (C) | 1XRTT | 1988.75 | 1.28657315 | 1.45490982 |

**Table 4: Occupied BW, Macro BSS 1900 MHz, EVDO Mode**

| Channel Number (Block) | Modulation | Frequency (MHz) | IC 99%Measured Occupied BW (MHz) | FCC 26dB Measured Occupied BW (MHz) |
|---|---|---|---|---|
| 25 (A) | 8PSK, 1843.2 kbps 1 slot | 1931.25 | 1.28657315 | 1.45490982 |
| 600 (B) | 8PSK, 1843.2 kbps 1 slot | 1960.00 | 1.28657315 | 1.44889780 |
| 1175 (C) | 8PSK, 1843.2 kbps 1 slot | 1988.75 | 1.28657315 | 1.44889780 |
| 25 (A) | QPSK, 1228.8 kbps, 1 slot | 1931.25 | 1.28657315 | 1.45490982 |

| Channel Number (Block) | Modulation | Frequency (MHz) | IC 99%Measured Occupied BW (MHz) | FCC 26dB Measured Occupied BW (MHz) |
|---|---|---|---|---|
| 600 (B) | QPSK, 1228.8 kbps, 1 slot | 1960.00 | 1.28056112 | 1.45490982 |
| 1175 (C) | QPSK, 1228.8 kbps, 1 slot | 1988.75 | 1.28056112 | 1.44889780 |
| 25 (A) | 16QAM, 2457.6 kbps 1slot | 1931.25 | 1.28657315 | 1.44889780 |
| 600 (B) | 16QAM, 2457.6 kbps 1slot | 1960.00 | 1.28056112 | 1.45490982 |
| 1175 (C) | 16QAM, 2457.6 kbps 1slot | 1988.75 | 1.28657315 | 1.44889780 |

**Figure 3: IC 99% Occupied BW, Channel 25, 1XRTT Mode**

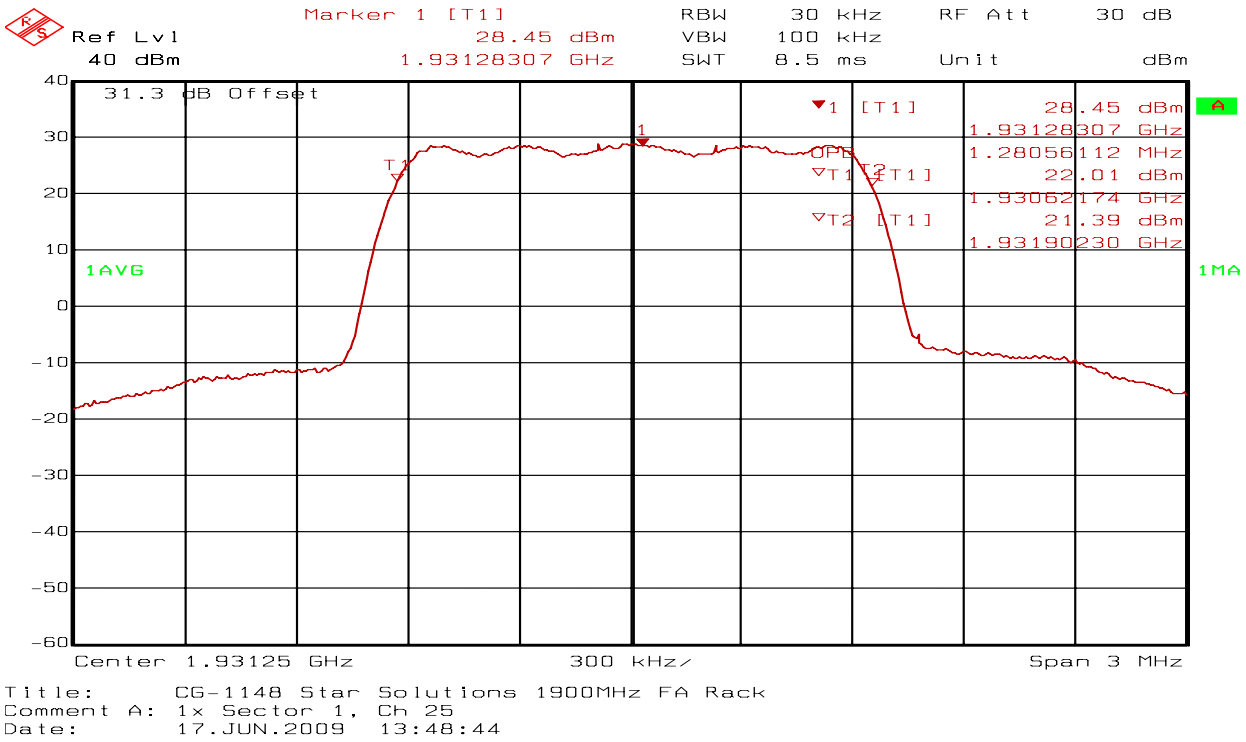


**Figure 4: FCC 26dB Occupied BW, Channel 25, 1XRTT Mode**

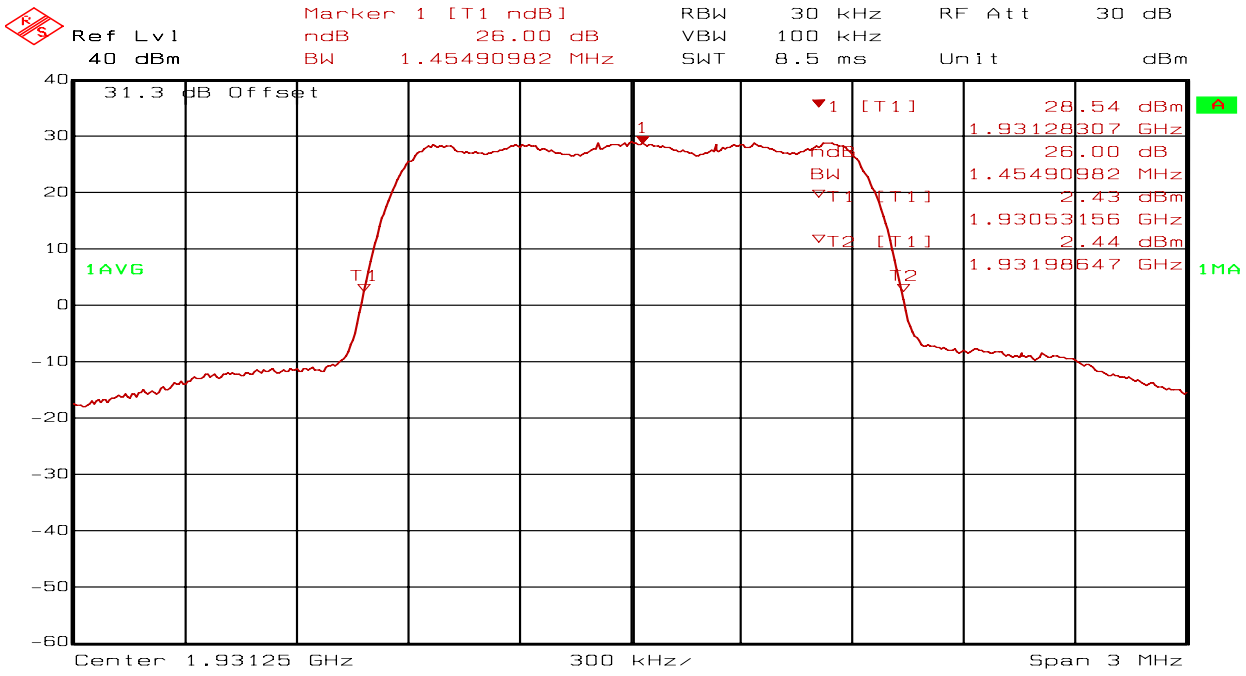



**Figure 5: IC 99% Occupied BW, Channel 1175, 1XRTT Mode**

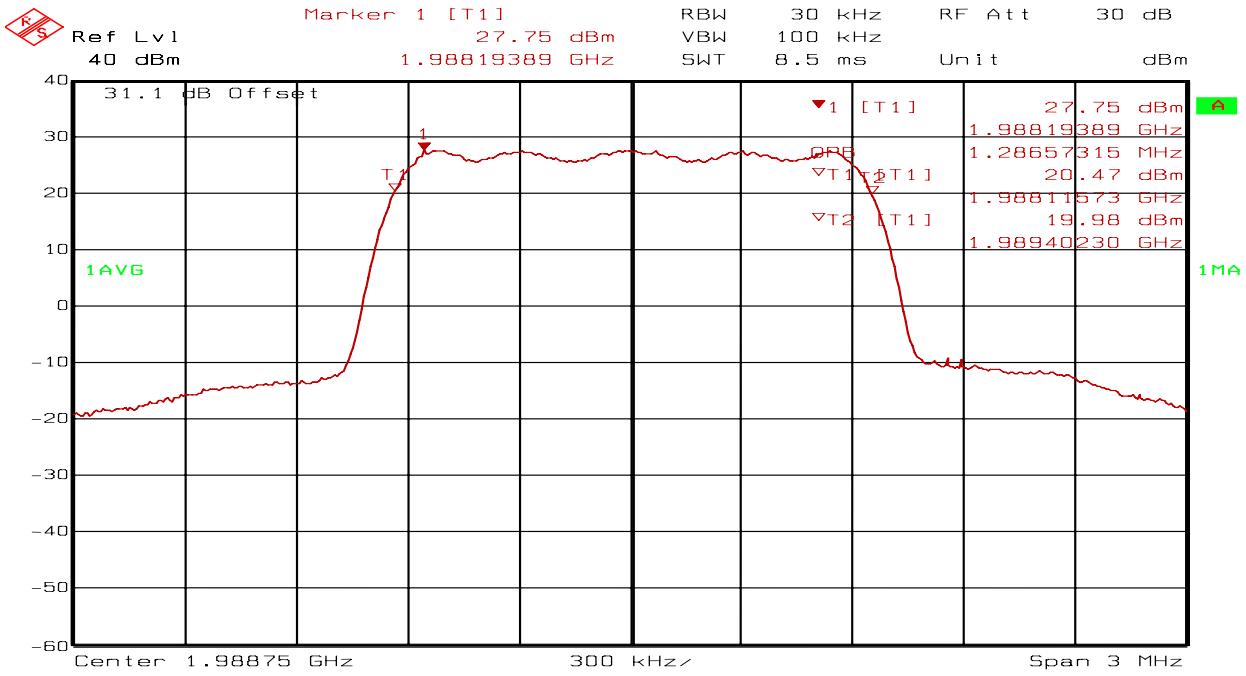


**Figure 6: FCC 26dB Occupied BW, Channel 1175, 1XRTT Mode**

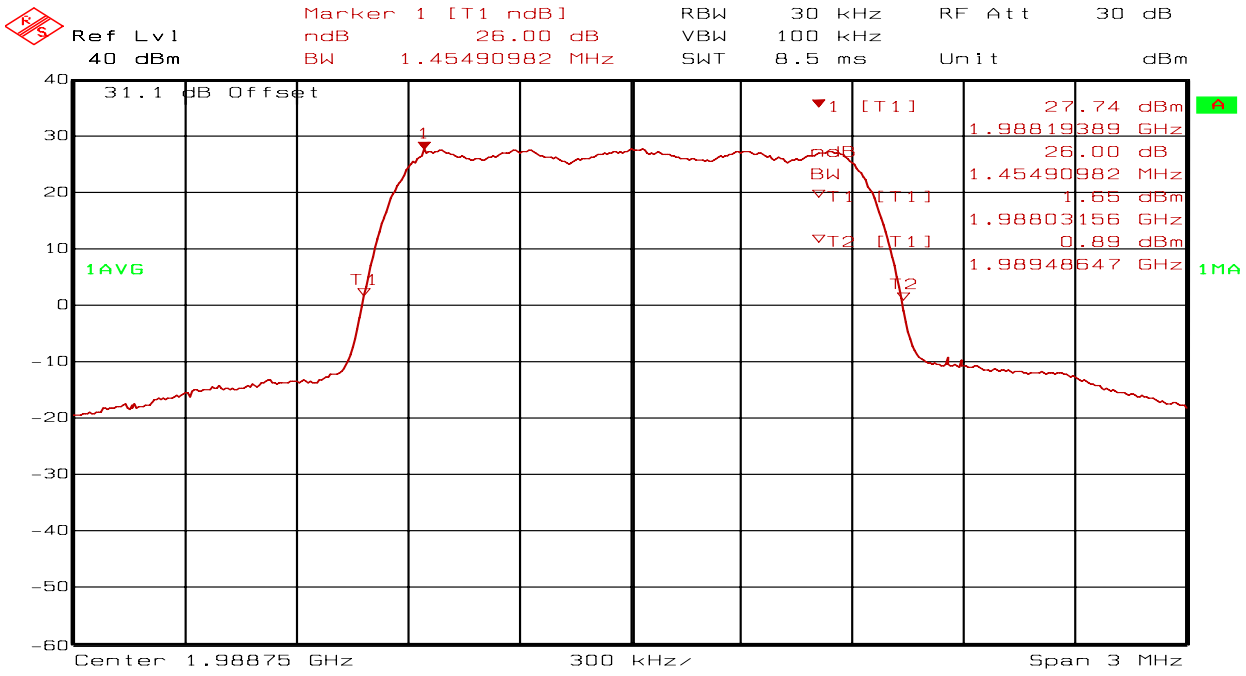



**Figure 7: IC 99% Occupied BW, Channel 25, EVDO Mode, 8PSK**

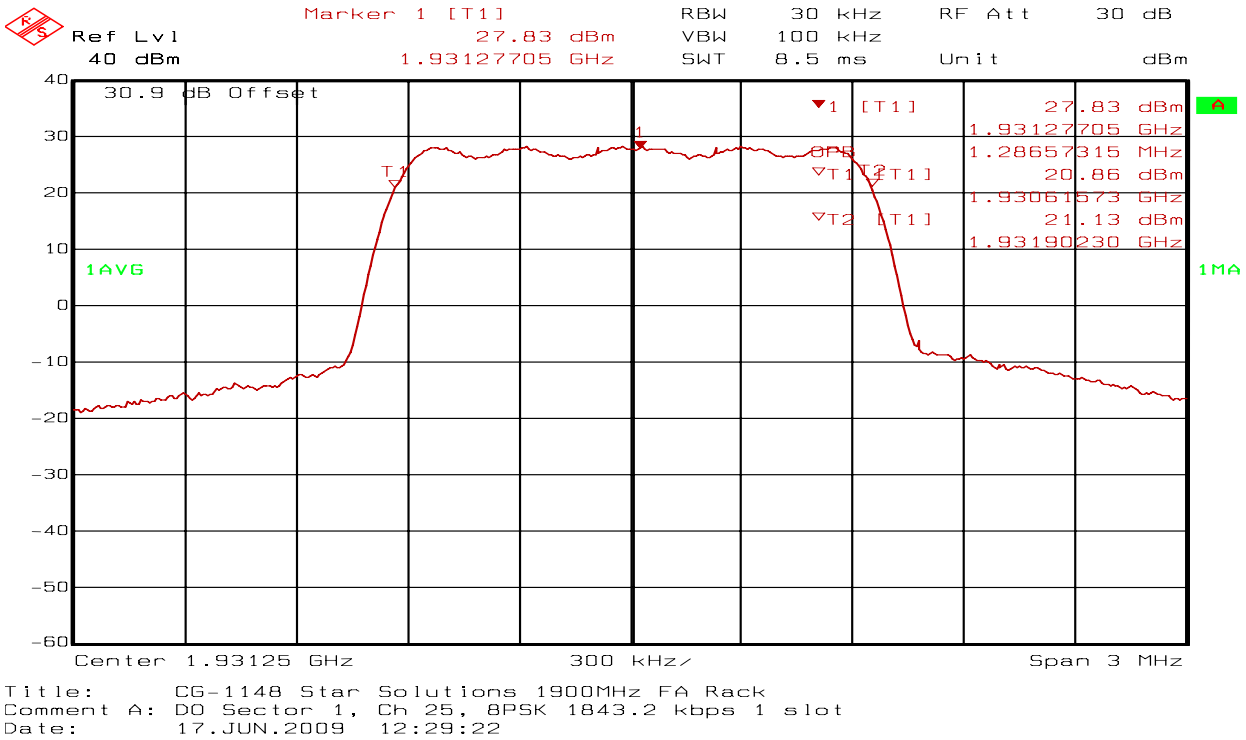


**Figure 8: FCC 26dB Occupied BW, Channel 25, EVDO Mode, 8PSK**

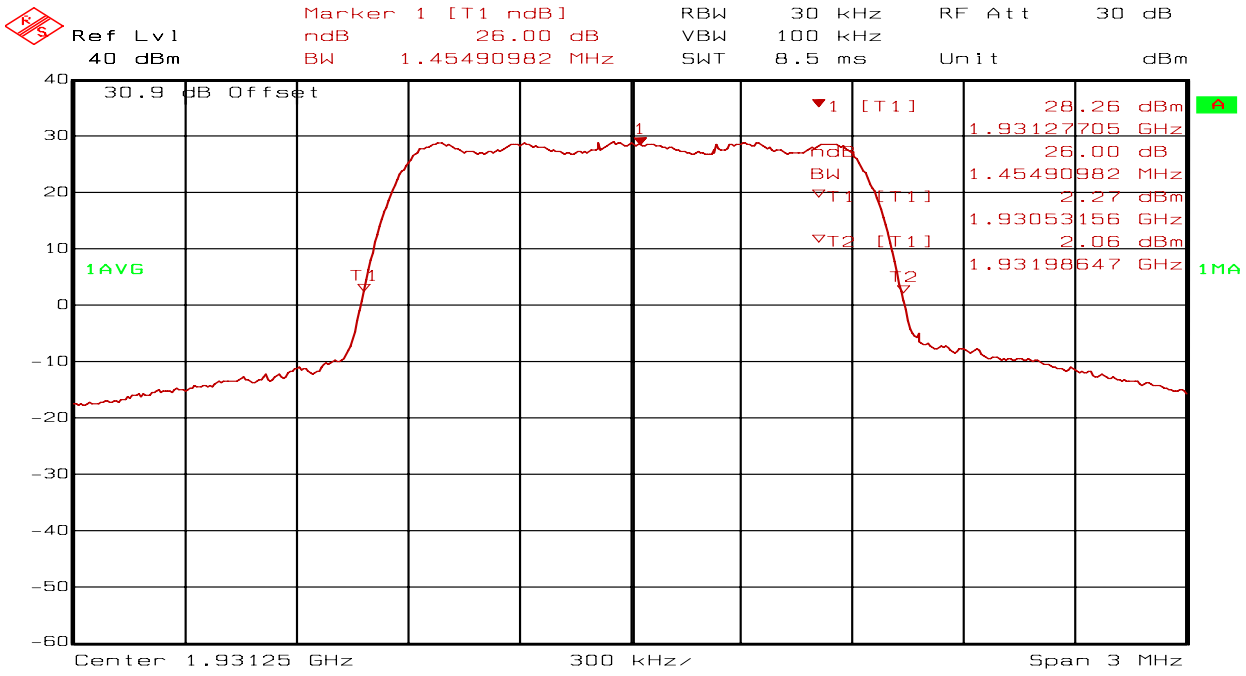



**Figure 9: IC 99% Occupied BW, Channel 25, EVDO Mode, QPSK**

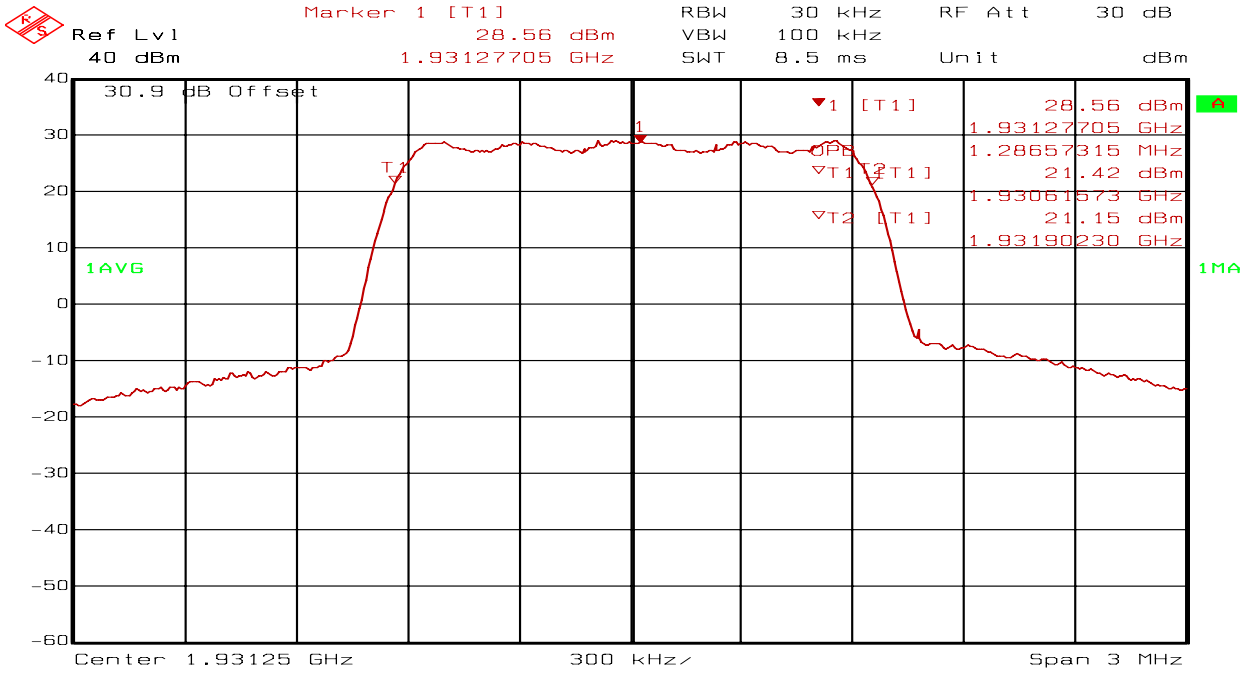


**Figure 10: FCC 26dB Occupied BW, Channel 25, EVDO Mode, QPSK**

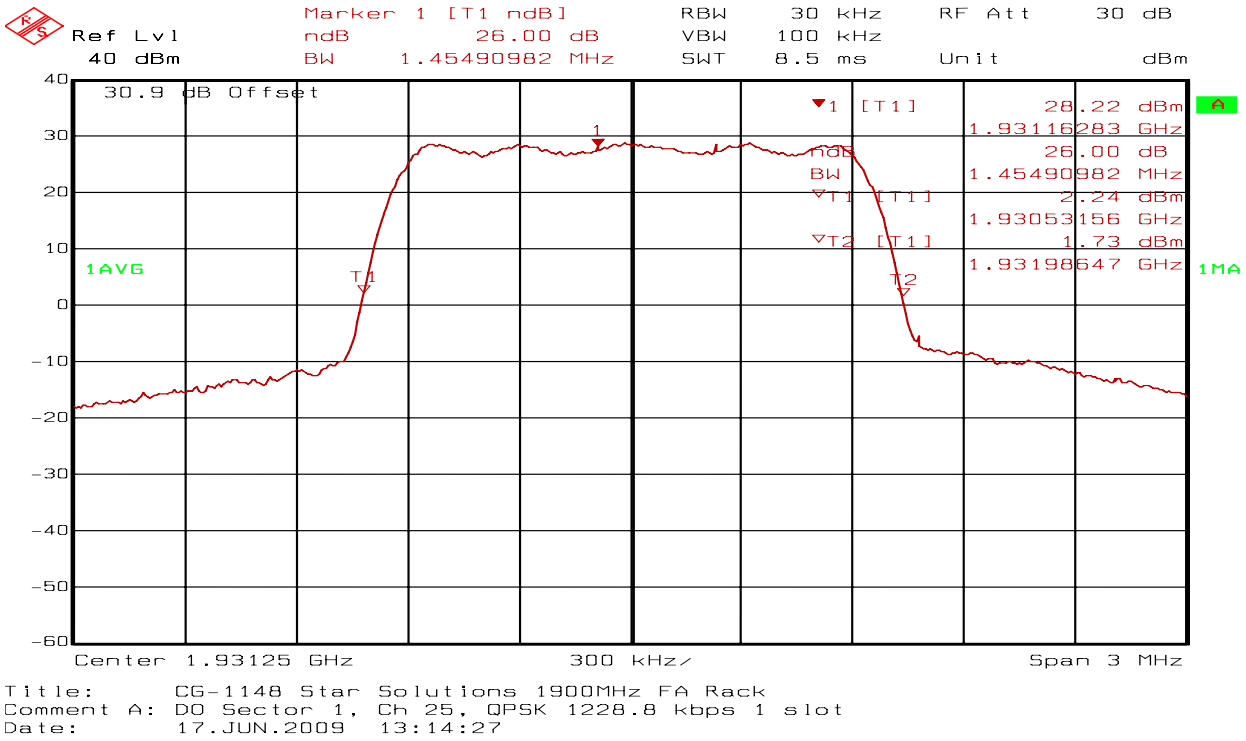



**Figure 11: IC 99% Occupied BW, Channel 25, EVDO Mode, 16QAM**

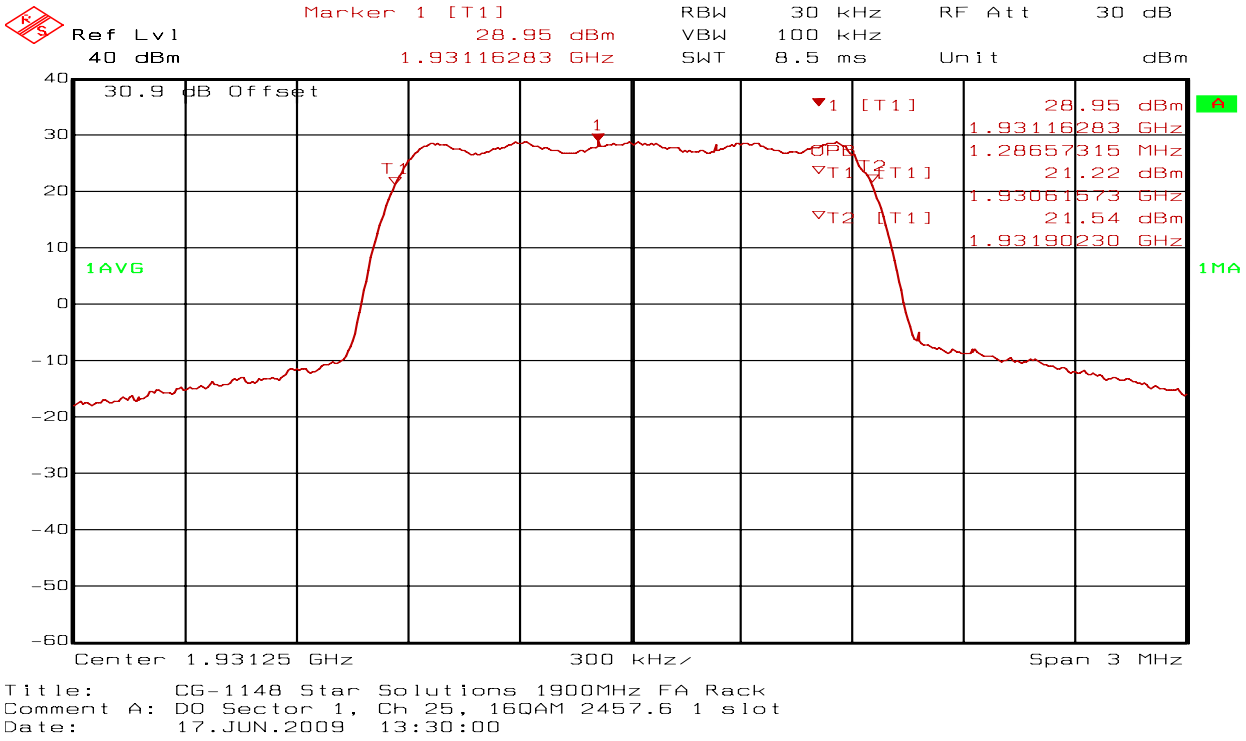


**Figure 12: FCC 26dB Occupied BW, Channel 25, EVDO Mode, 16QAM**

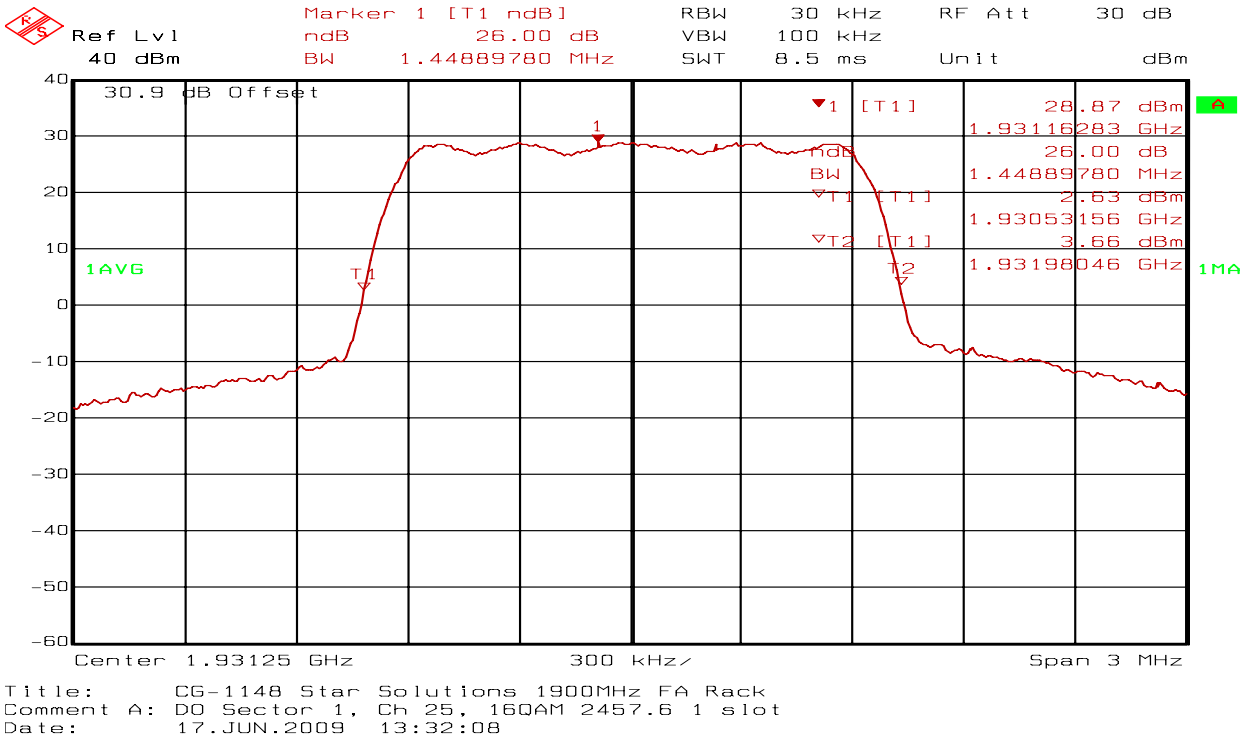



**Figure 13: IC 99% Occupied BW, Channel 1175, EVDO Mode, 8PSK**

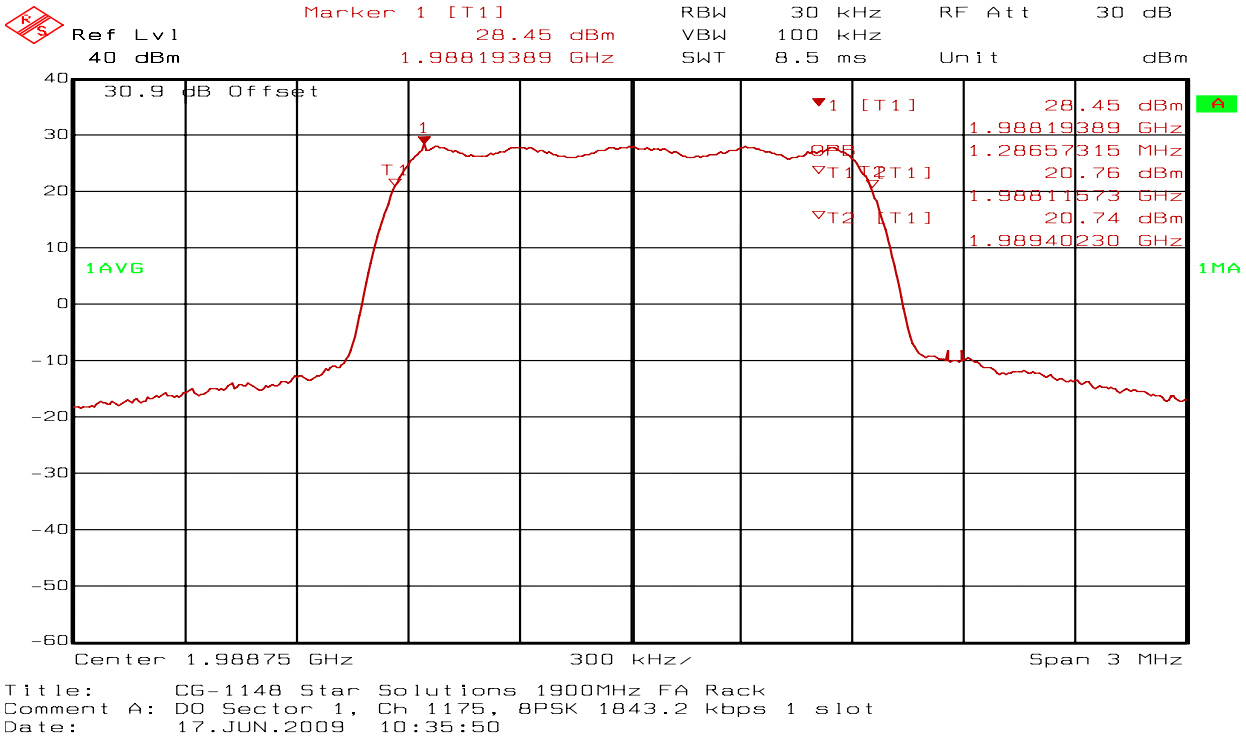


**Figure 14: FCC 26dB Occupied BW, Channel 1175, EVDO Mode, 8PSK**

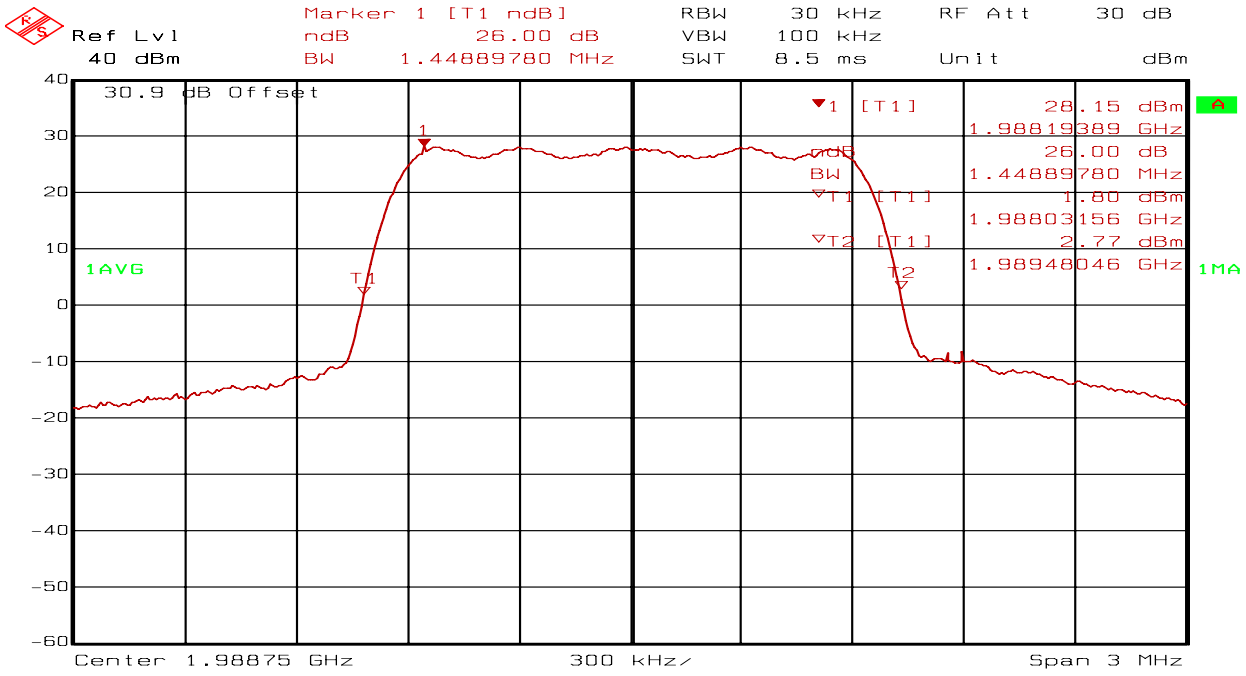



**Figure 15: IC 99% Occupied BW, Channel 1175, EVDO Mode, QPSK**

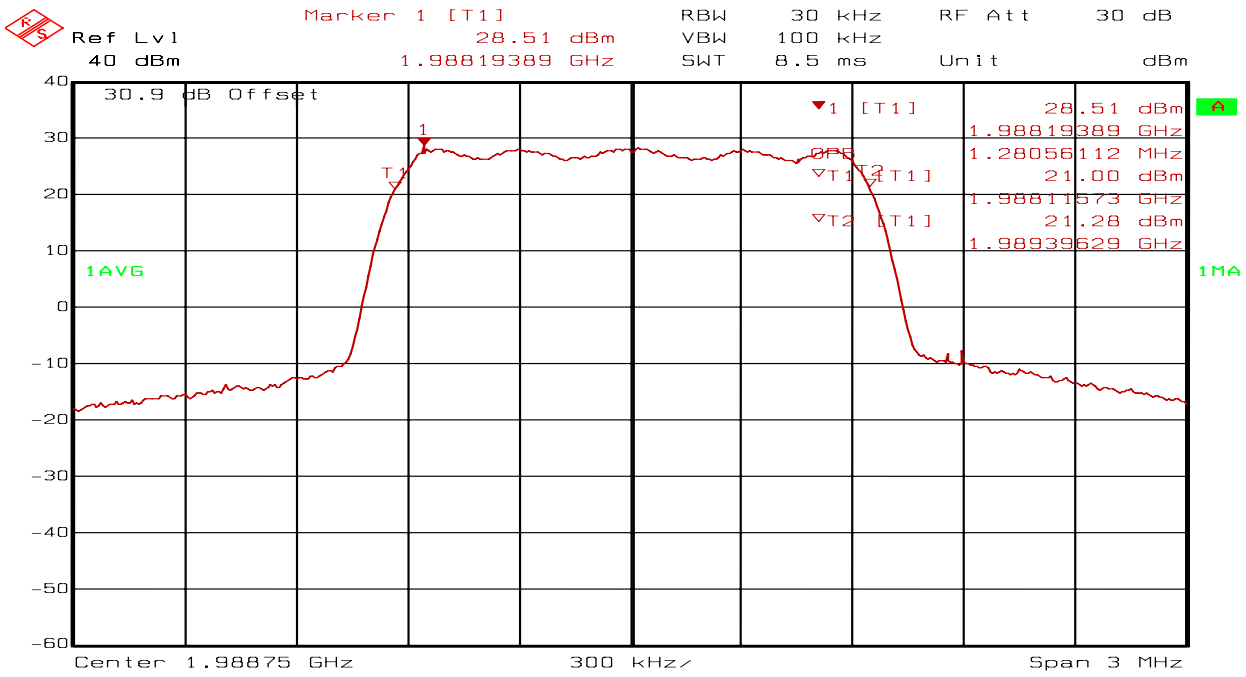


**Figure 16: FCC 26dB Occupied BW, Channel 1175, EVDO Mode, QPSK**

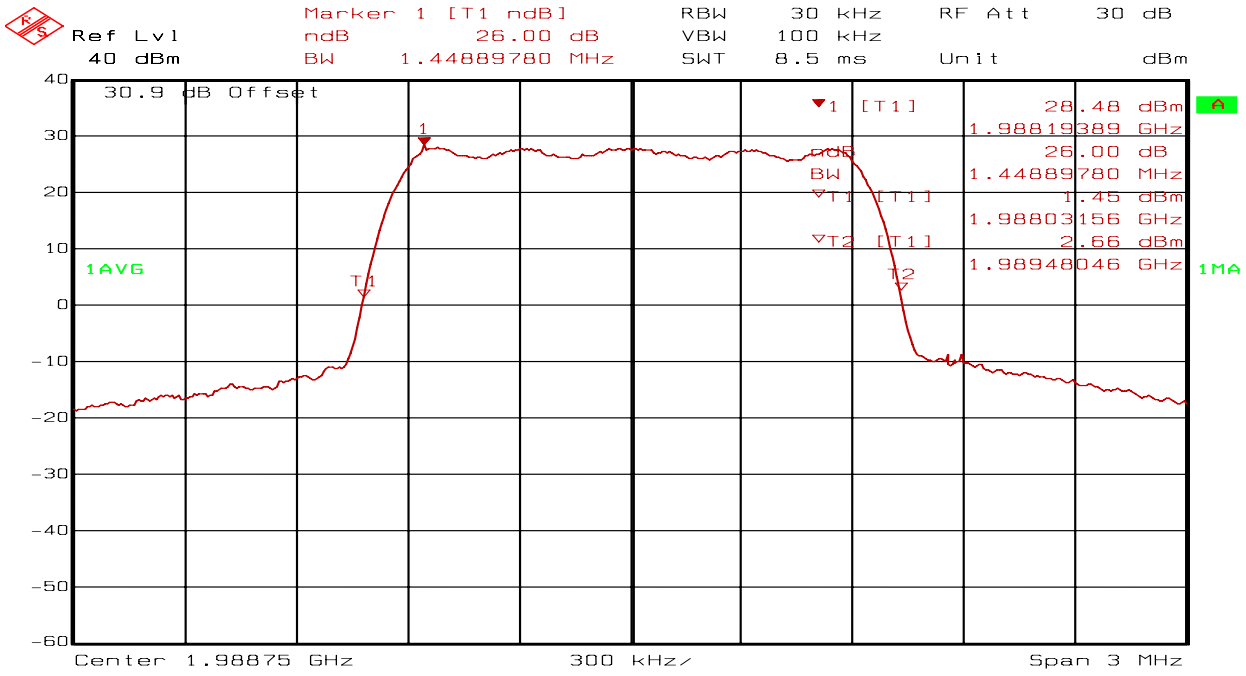



**Figure 17: IC 99% Occupied BW, Channel 1175, EVDO Mode, 16QAM**

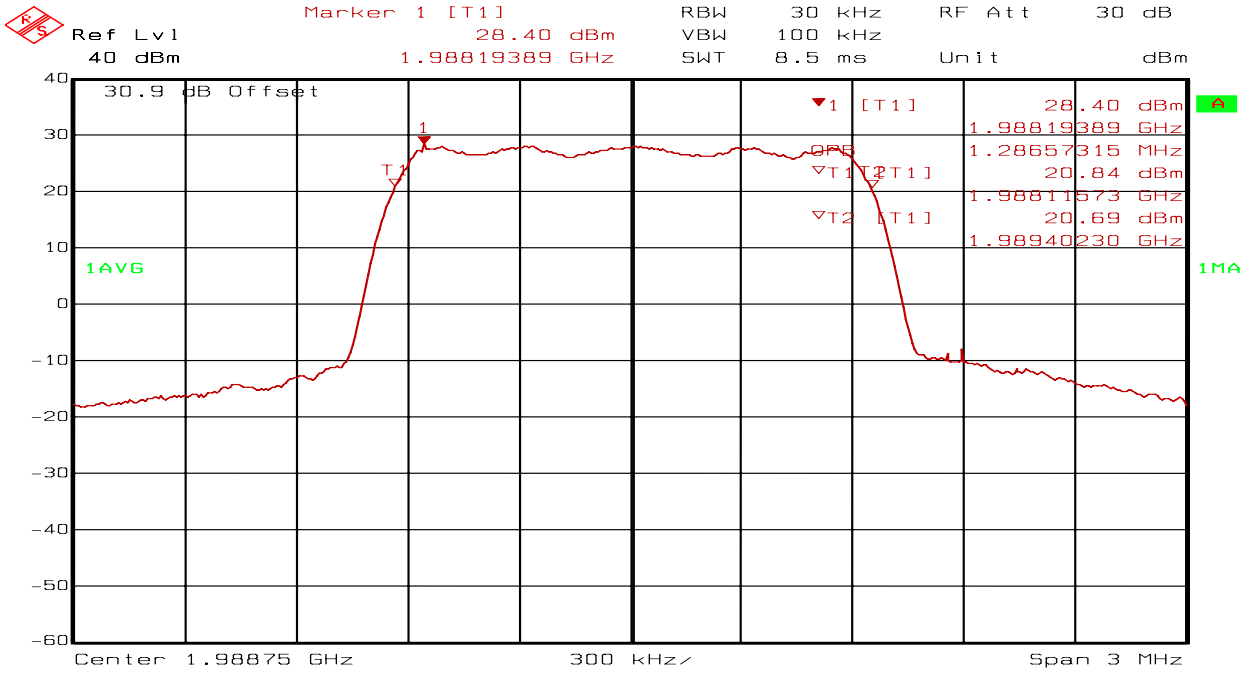
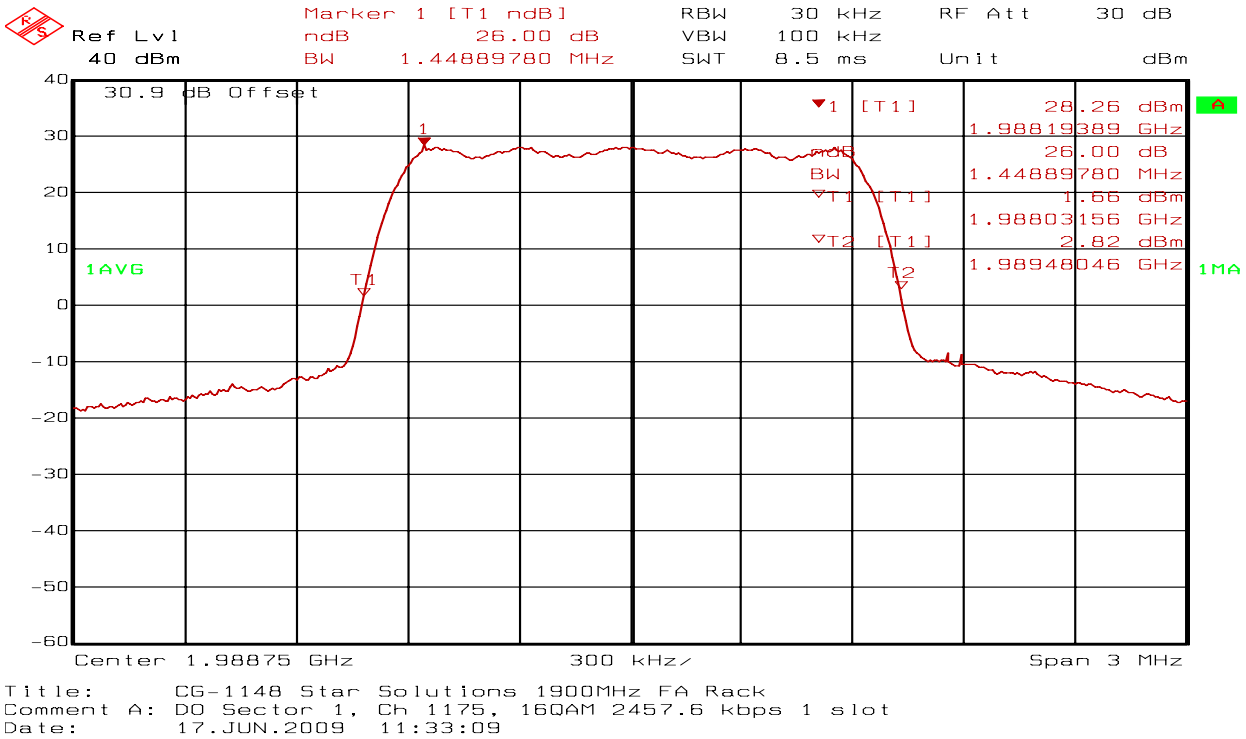


**Figure 18: FCC 26dB Occupied BW, Channel 1175, EVDO Mode, 16QAM**




## B.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Daryl Therens
Senior Test Specialist

## B.8. Test Dates

Test Start: June 17, 2009
Test Complete: June 17, 2009

# APPENDIX C: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## C.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 24.238; IC RSS 133 6.5 |
| **Test Basis** | FCC 2.1051 |
| **Test Method** | FCC 2.1051 |

## C.2. Specifications

**FCC Part 2.1051**

*The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.*

**FCC Part 2.1057 - Frequency Spectrum to be investigated**

*(a) In all of the measurements set forth in §§2.1051 and 2.1053, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the frequency shown below:(1) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.*

*(2) If the equipment operates at or above 10 GHz and below 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 100 GHz, whichever is lower.*

*(3) If the equipment operates at or above 30 GHz: to the fifth harmonic of the highest fundamental frequency or to 200 GHz, whichever is lower.*

*(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.*

*(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.*

*(d) Unless otherwise specified, measurements above 40 GHz shall be performed using a minimum resolution bandwidth of 1 MHz.*

**FCC Part 24.238 Limit**

*The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.*

*(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.*

*(b) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, 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. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.*

*(c) Alternative out of band emission limit. Licensees in this service may establish an alternative out of band emission limit to be used at specified band edge(s) in specified geographical areas, in lieu of that set forth in this section, pursuant to a private contractual arrangement of all affected licensees and applicants. In this event, each party to such contract shall maintain a copy of the contract in their station files and disclose it to prospective assignees or transferees and, upon request, to the FCC.*

*(d) Interference caused by out of band emissions. If any emission from a transmitter operating in this service results in interference to users of another radio service, the FCC may require a greater attenuation of that emission than specified in this section.*

### C.3. Deviations

| Deviation Number | Time & Date | Description and Justification of Deviation | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| none | | | | | | |

### C.4. Test Procedure

The EUT was setup via a PC and Star Solutions software to transmit at maximum power in both 1XRTT and EVDO modes. Measurements were made in both 1XRTT and EVDO modes (different modulation types and data rates) at the bottom and top of the licensed sub-bands. Spurious emission measurements were performed on Sector 1 main antenna port for 1XRTT measurements, and on Sector 1 diversity antenna port for EVDO measurements. Sector 2 and 3 main / diversity antenna ports were terminated into 50Ω loads.

Measurements were made at all Block Edges, and in all modulation types / data rates for EVDO mode, and all were compliant.

The following spectrum analyzer settings were used for the measurement of the antenna port spurious emissions:

**Band-edge to indicated cellular band (Upper and Lower)**

Resolution Bandwidth: 20 kHz
Video Bandwidth: 100 kHz
Video Average: 200 Averages
Span: 5 MHz

Attenuation: 30 dB
Ref. Level: 30 dBm
Ref. Level Offset: Set according to cable/attenuator loss
All spectrum analyzer settings were coupled as per the manufacturer's recommendations to improve measurement time, without compromising data.

**All other Spurious Emissions up to 20 GHz**

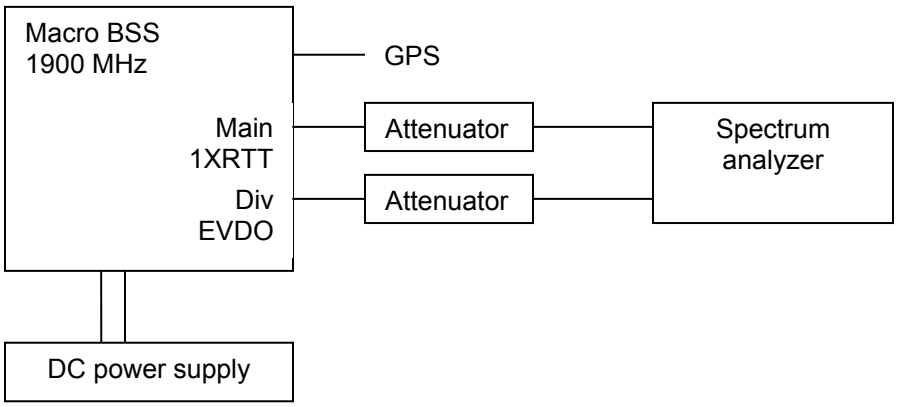
Resolution Bandwidth: 1 MHz
Video Bandwidth: 3 MHz
Detector: Peak maximum
Span: Auto-coupled
Attenuation: Auto-coupled
Ref. Level: Auto-coupled
Ref. Level Offset: Auto-coupled

Calibrated cables and attenuators were used (losses to 20GHz). The calibrated loss is the reference level offset on the spectrum analyzer.

### C.5. Test Setup

The test setup for conducted spurious emissions is as shown in the figure below.

**Figure 19: Conducted Spurious Emission Setup**




### C.6. Test Results

The frequency spectrum from 4 MHz to 20 GHz was scanned for emissions using the spectrum analyzer settings outlined in the test method (Section 4.4.2). The Macro BSS complies with the limit of -13 dBm.

The table below shows the spurious emissions at the antenna port of the Macro BSS for both 1XRTT and EVDO carrier modes. To reduce the number of Figures only band-edge (not block-edge) plots are shown. For EVDO operation, all modulation types and data rates were tested.

**Table 5: Spurious Emissions at the Macro BSS 1900 MHz Antenna Ports[3]**

| Channel | Mode | Note | Emission Frequency (GHz) | Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 25 | 1XRTT | Lower band edge | 1.929999 | -19.05 | -13 | 6.05 |
| 1175 | 1XRTT | Upper band edge | 1.9900001 | -18.21 | -13 | 5.21 |
| 25 | EVDO, 8PSK, 921.6 kbps | Lower band edge | 1.929999 | -21.83 | -13 | 8.83 |
| 25 | EVDO, 8PSK, 1843.6 kbps | Lower band edge | 1.929999 | -22.19 | -13 | 9.19 |
| 25 | EVDO, QPSK, 38.4 kbps | Lower band edge | 1.929999 | -20.55 | -13 | 7.55 |
| 25 | EVDO, QPSK, 1228.8 kbps | Lower band edge | 1.929999 | -20.56 | -13 | 7.56 |
| 25 | EVDO, 16QAM, 1536 kbps | Lower band edge | 1.929999 | -22.28 | -13 | 9.28 |
| 25 | EVDO, 16QAM, 2457.6 kbps | Lower band edge | 1.929999 | -21.19 | -13 | 8.19 |
| 1175 | EVDO, 8PSK, 921.6 kbps | Upper band edge | 1.9900001 | -19.91 | -13 | 6.91 |
| 1175 | EVDO, 8PSK, 1843.6 kbps | Upper band edge | 1.9900001 | -20.13 | -13 | 7.13 |
| 1175 | EVDO, QPSK, 38.4 kbps | Upper band edge | 1.9900001 | -19.4 | -13 | 6.4 |
| 1175 | EVDO, QPSK, 1228.8kbps | Upper band edge | 1.9900001 | -19.33 | -13 | 6.33 |
| 1175 | EVDO, 16QAM, 1536 kbps | Upper band edge | 1.9900001 | -19.77 | -13 | 6.77 |
| 1175 | EVDO, 16QAM, 2457.6 kbps | Upper band edge | 1.9900001 | -22.83 | -13 | 9.83 |
| 1175 | 1XRTT | Measurement noise floor | 0.004 - 3 | -31.39 | -13 | 18.39 |
| 1175 | 1XRTT | 2nd harmonic | 3.9775 | -26.97 | -13 | 13.97 |
| 1175 | 1XRTT | 3rd harmonic | 5.96625 | -32.83 | -13 | 19.83 |
| 1175 | EVDO, 8PSK, 921.6 kbps | Measurement noise floor | 0.004 - 3 | -32.32 | -13 | 19.32 |
| 1175 | EVDO, 8PSK, 921.6 kbps | 2nd harmonic | 3.9775 | -37.59 | -13 | 24.59 |
| 1175 | EVDO, 8PSK, 921.6 kbps | 3rd harmonic | 5.96625 | -29.2 | -13 | 16.2 |

[3] Measurements were made at all Block Edges, and in all modulation types / data rates for EVDO mode, and all were compliant.

**Figure 20: Band-edge, Channel 25, 1XRTT Mode**

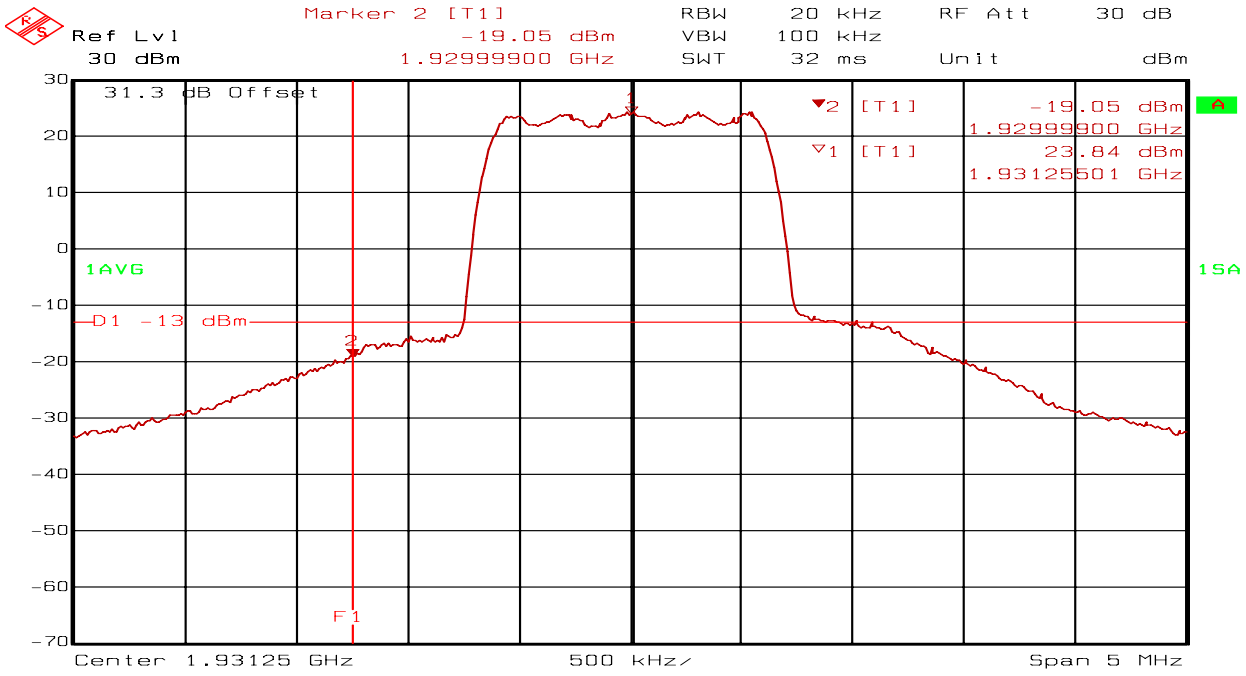



**Figure 21: Band-edge, Channel 1175, 1XRTT Mode**

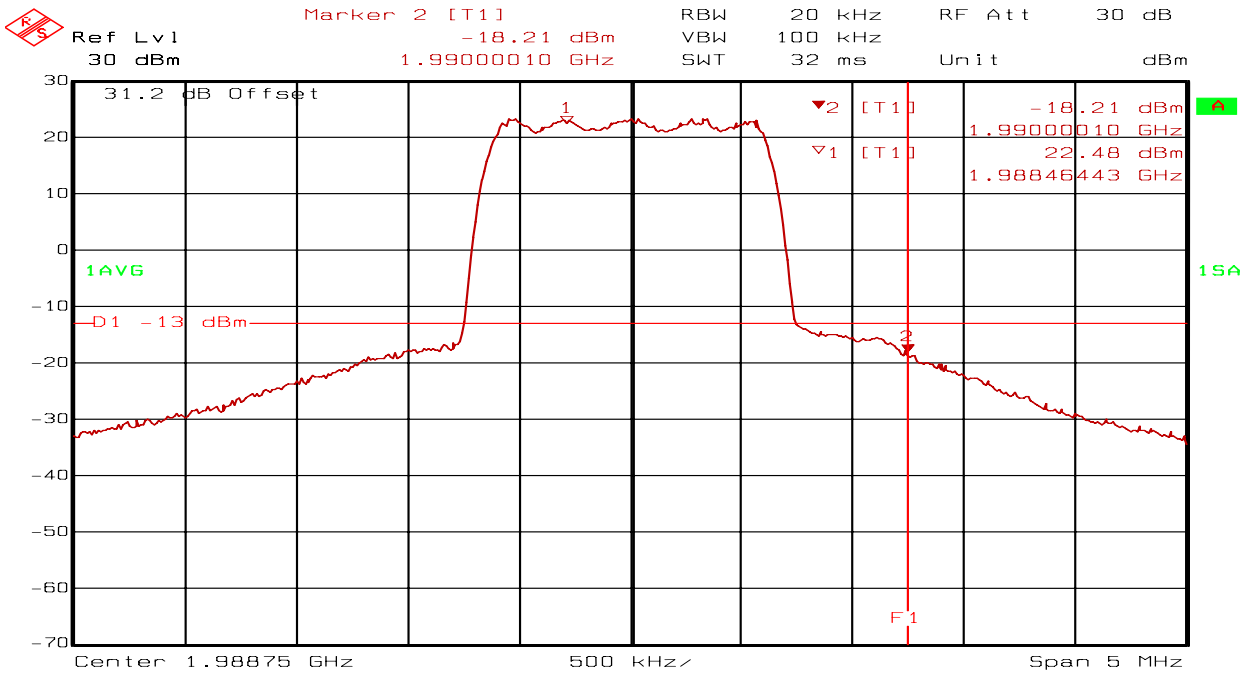


**Figure 22: Band-edge, Channel 25, EVDO Mode, 8PSK, 921.6kbps**

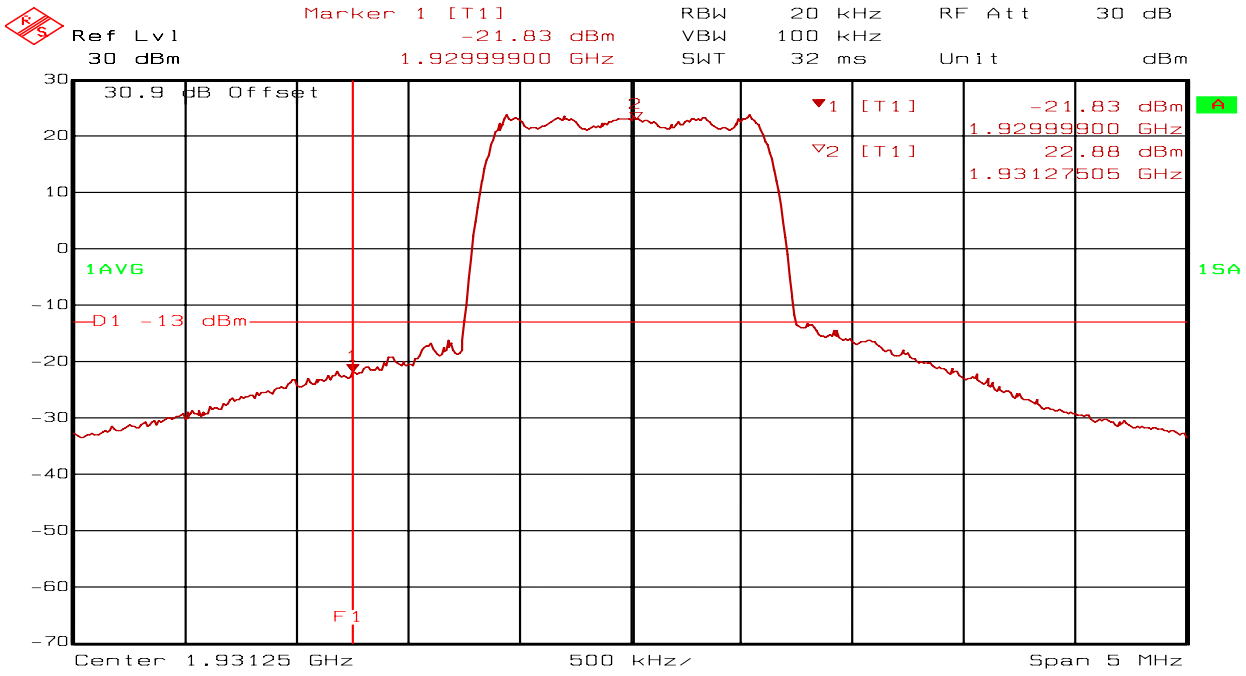



**Figure 23: Band-edge, Channel 25, EVDO Mode, 8PSK, 1843.6kbps**

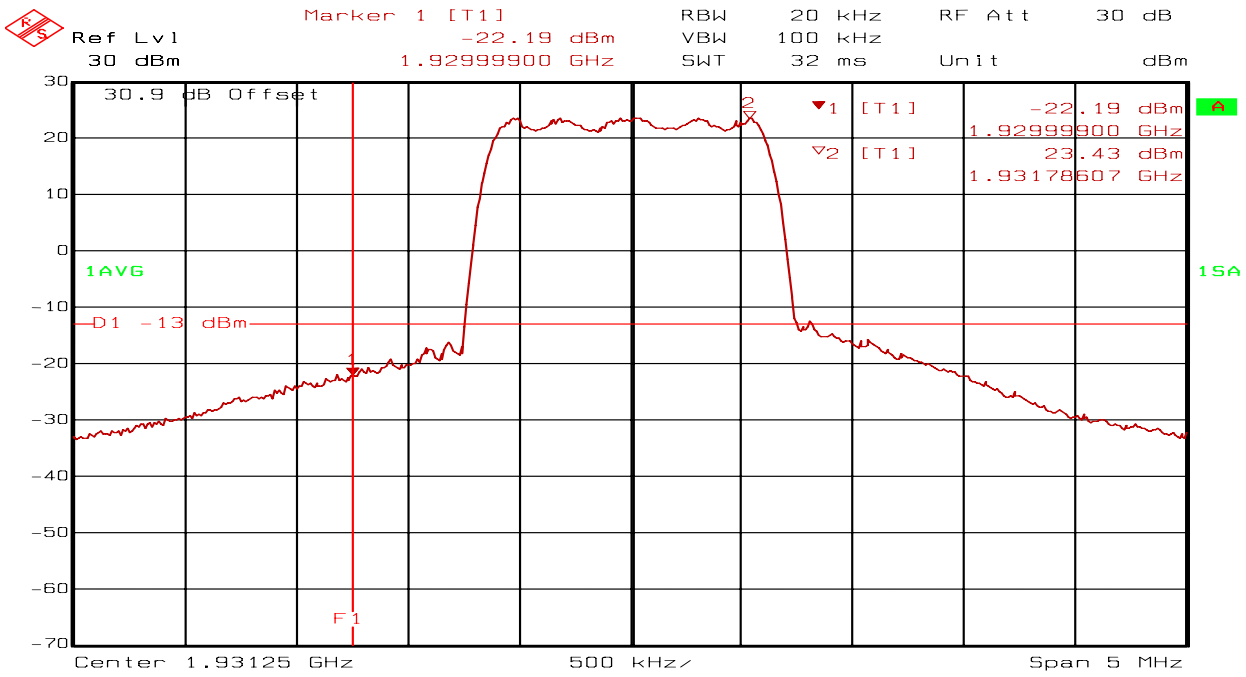
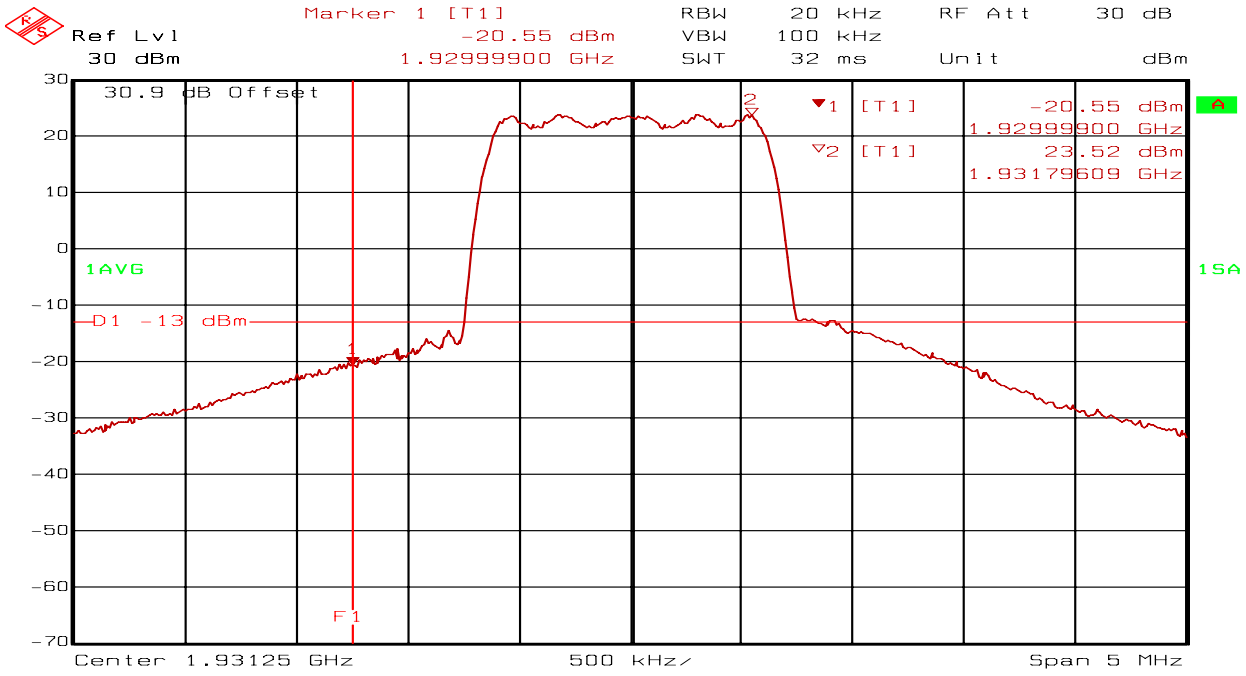
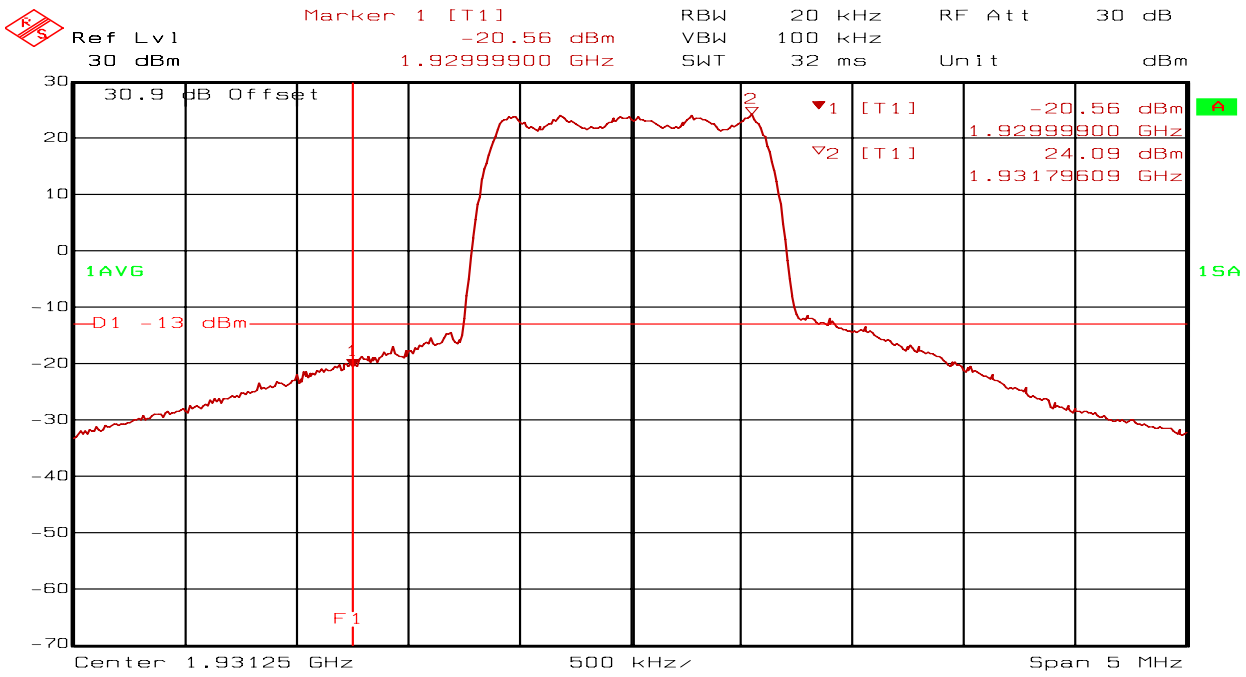


**Figure 24: Band-edge, Channel 25, EVDO Mode, QPSK, 38.4kbps**




Title: CG-1148 Star Solutions 1900MHz FA Rack
Comment A: DO Sector 1, Ch25, QPSK 38.4kbps, 16slots
Date: 11.JUN.2009 16:14:33

**Figure 25: Band-edge, Channel 25, EVDO Mode, QPSK, 1228.8kbps**




Title: CG-1148 Star Solutions 1900 MHz FA Rack
Comment A: DO Sector 1 Ch 25 QPSK 1228.8kbps 1 slots
Date: 12.JUN.2009 8:50:06

**Figure 26: Band-edge, Channel 25, EVDO Mode, 16QAM, 1536kbps**

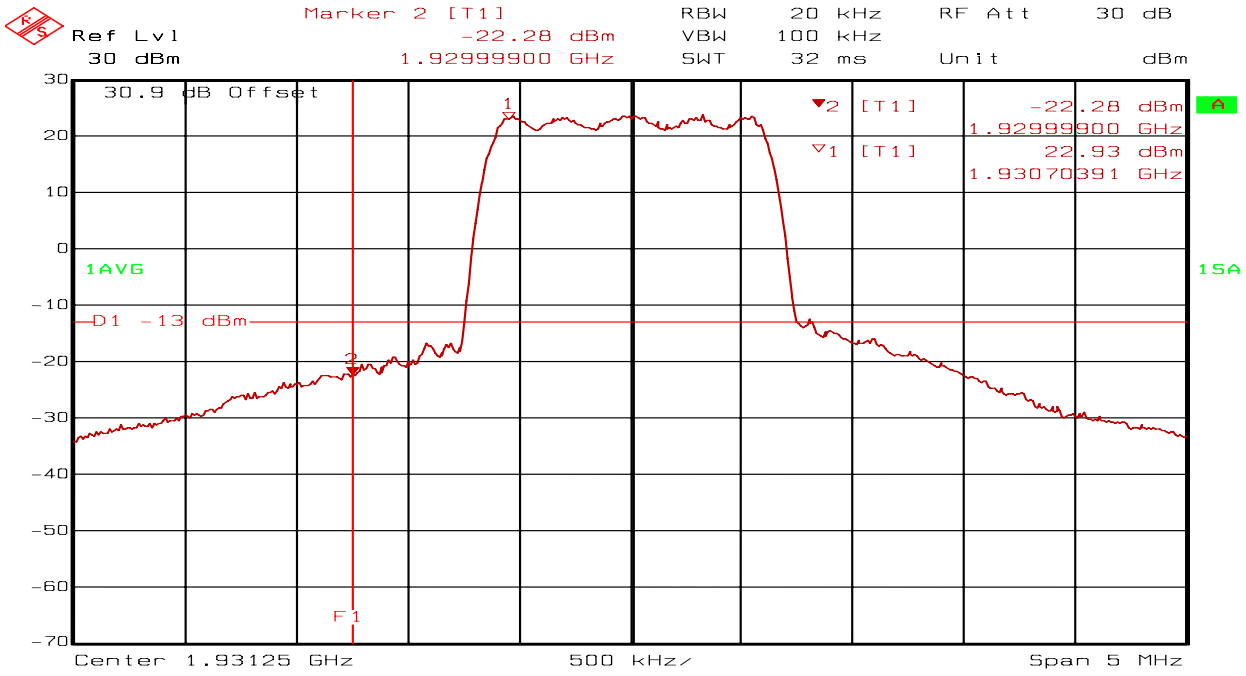



**Figure 27: Band-edge, Channel 25, EVDO Mode, 16QAM, 2457.6kbps**

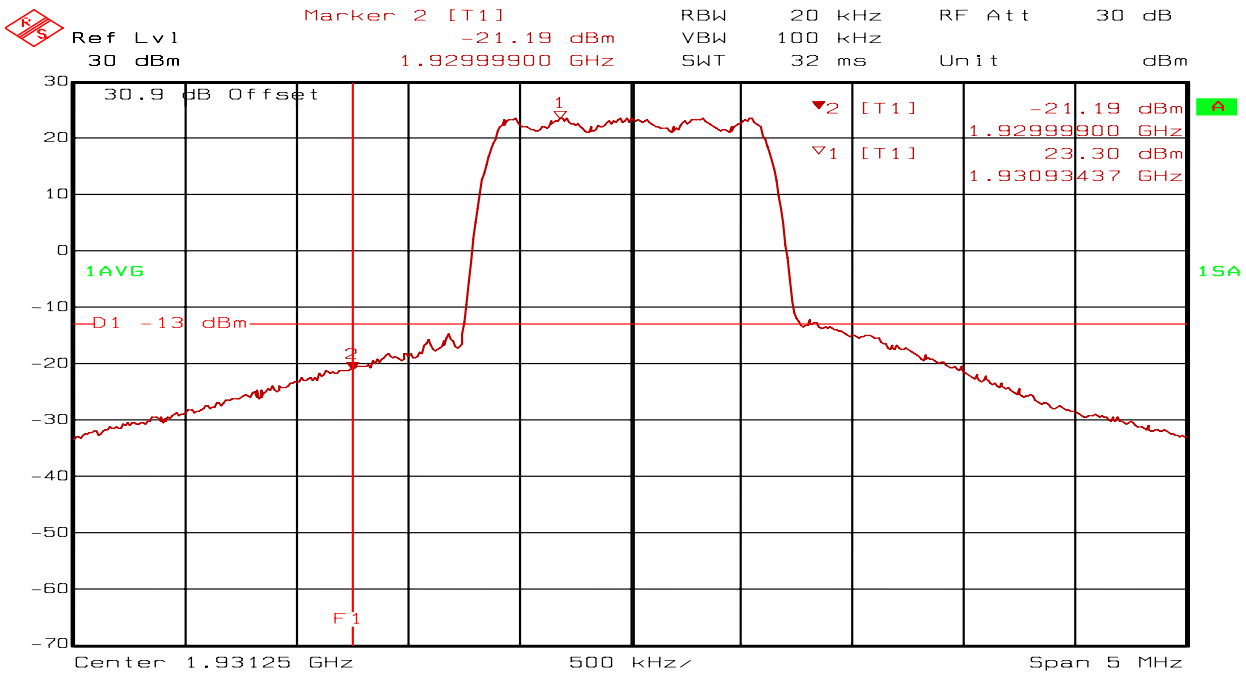


**Figure 28: Band-edge, Channel 1175, EVDO Mode, 8PSK, 921.6kbps**

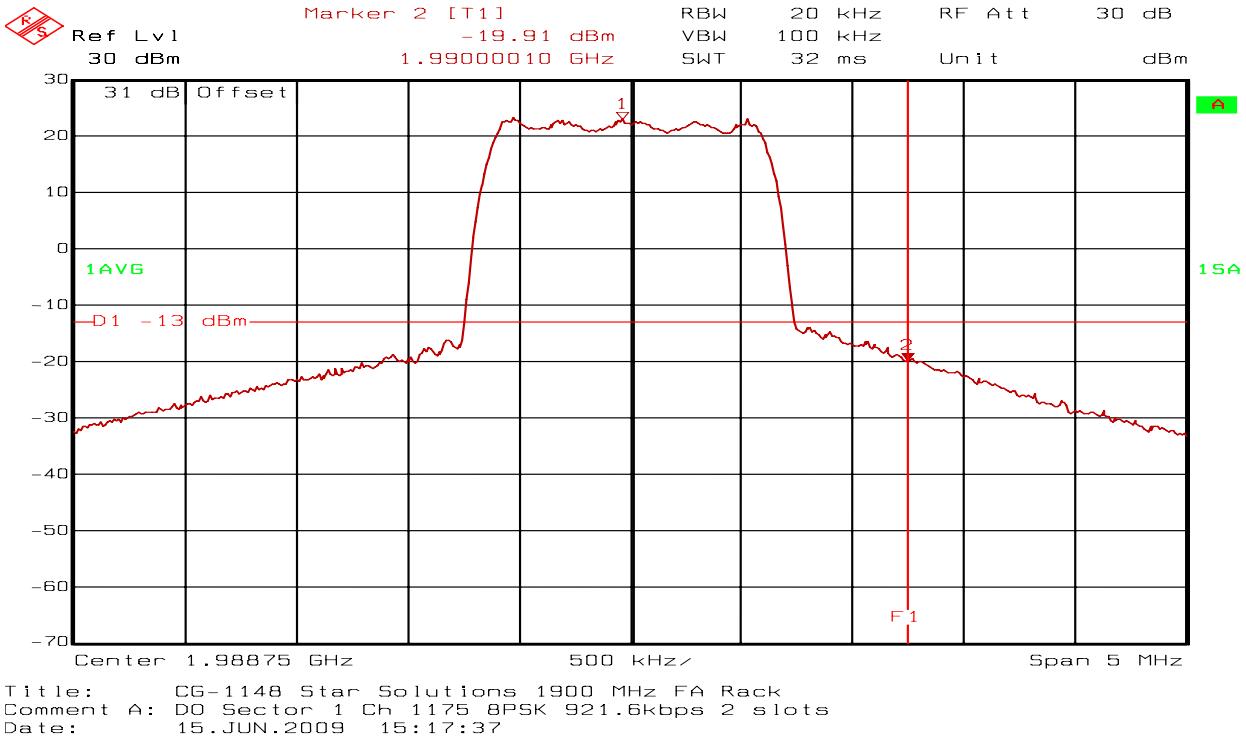



**Figure 29: Band-edge, Channel 1175, EVDO Mode, 8PSK, 1843.6kbps**

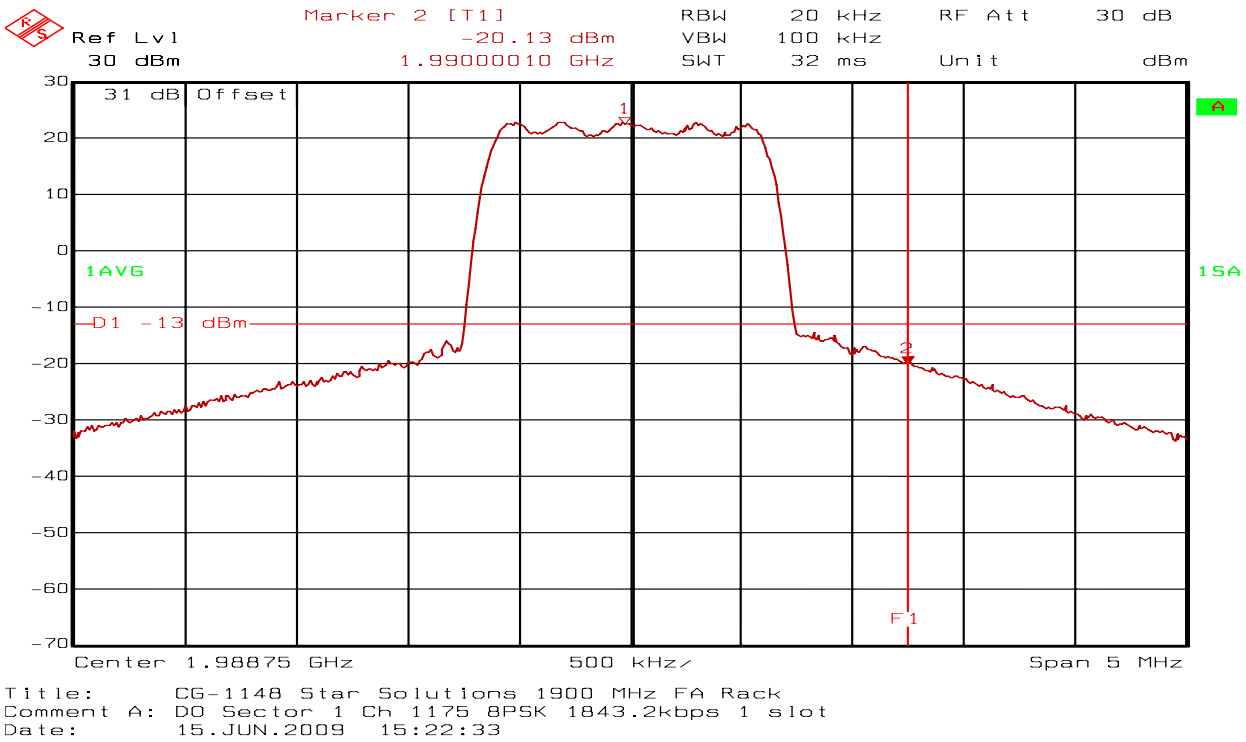


**Figure 30: Band-edge, Channel 1175, EVDO Mode, QPSK, 38.4kbps**

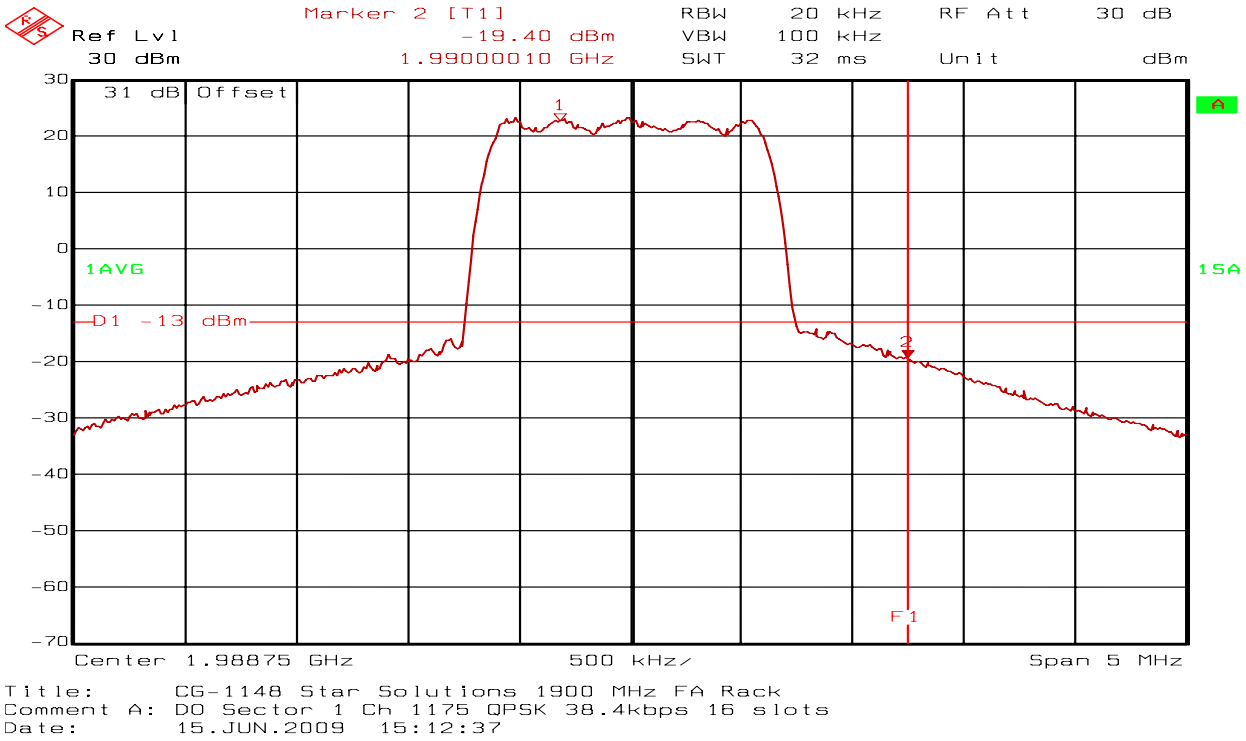



**Figure 31: Band-edge, Channel 1175, EVDO Mode, QPSK, 1228.8kbps**

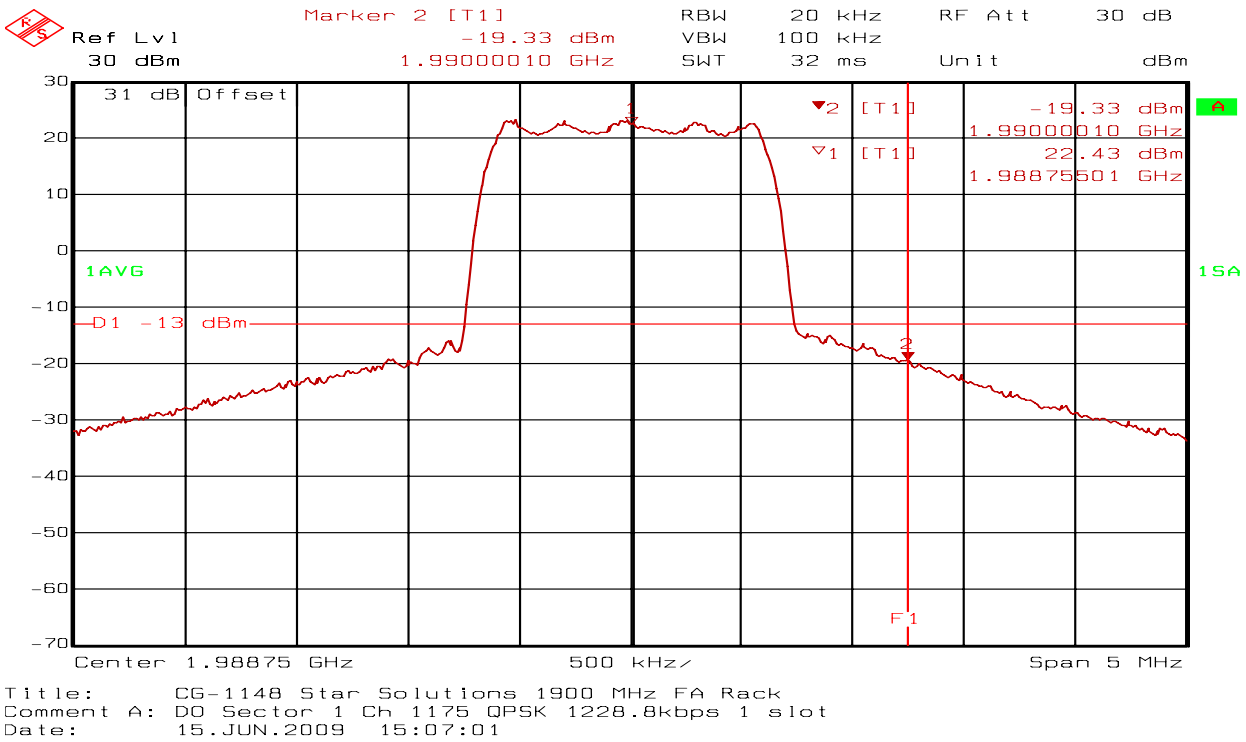


**Figure 32: Band-edge, Channel 1175, EVDO Mode, 16QAM, 1536kbps**

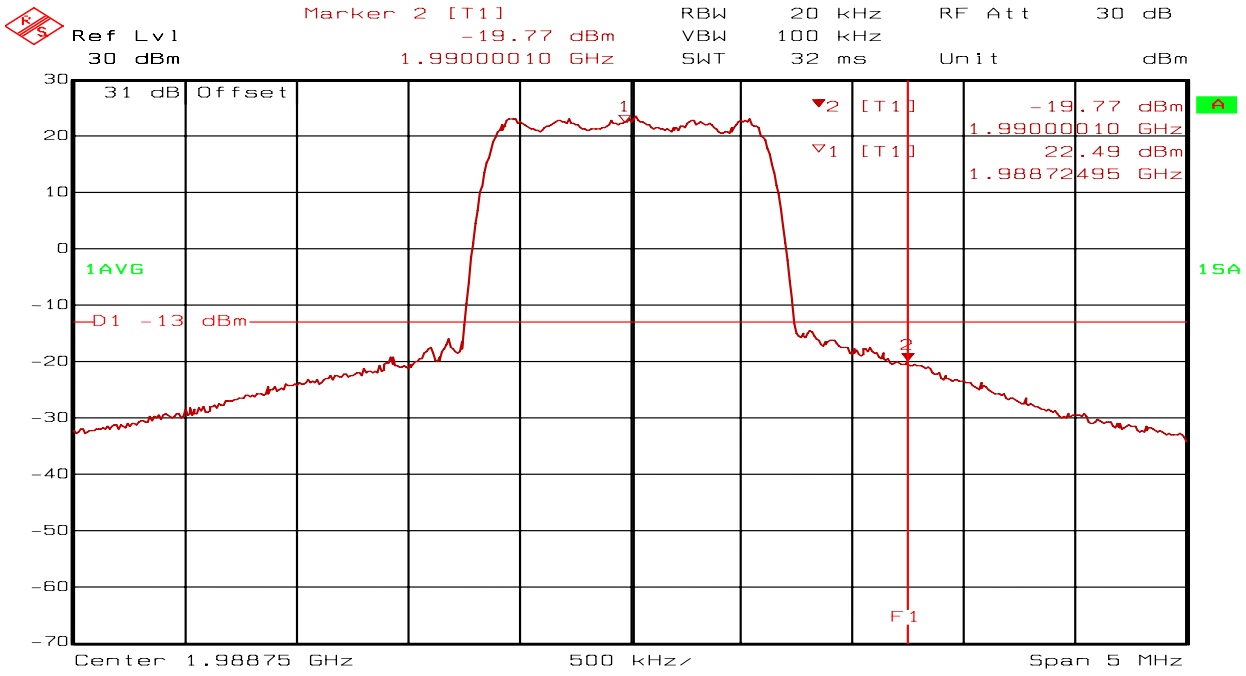



**Figure 33: Band-edge, Channel 1175, EVDO Mode, 16QAM, 2457.6kbps**

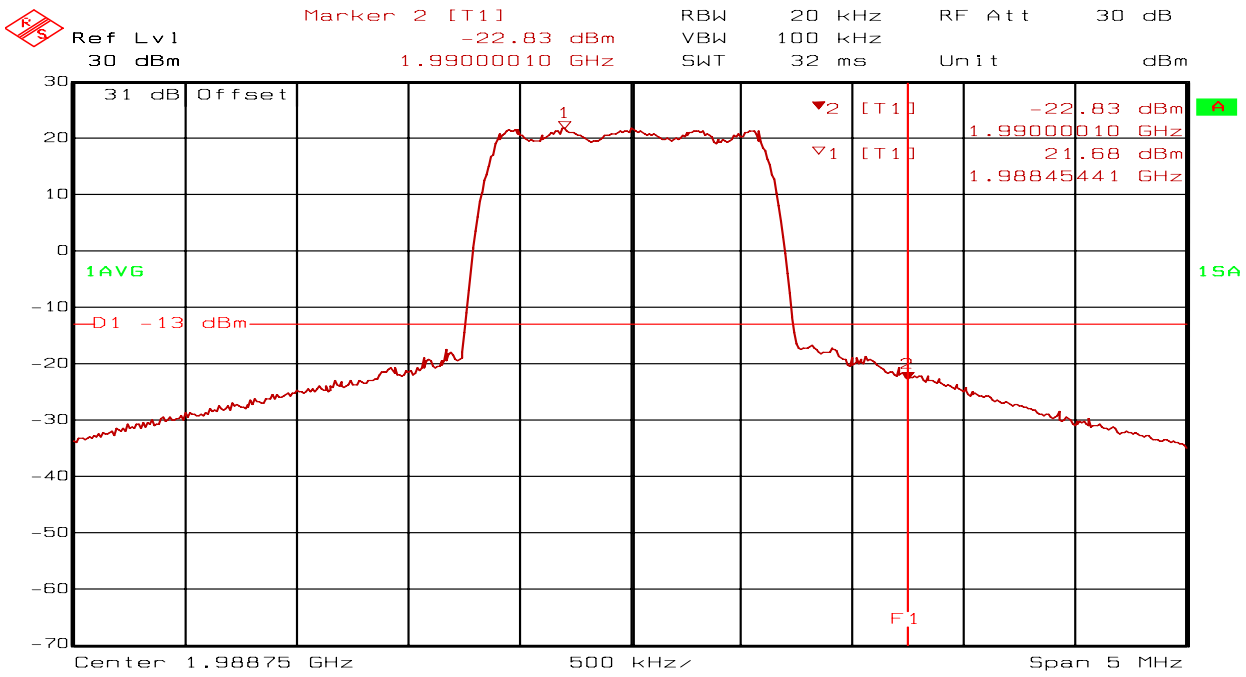
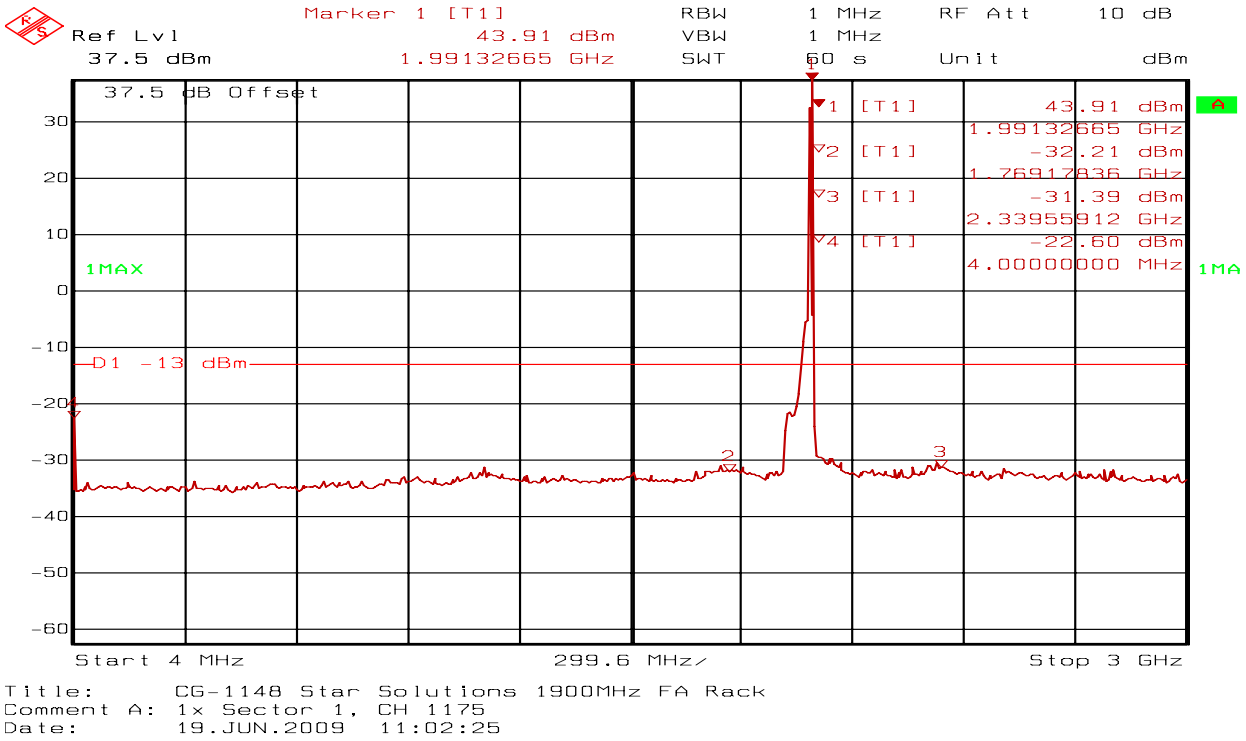
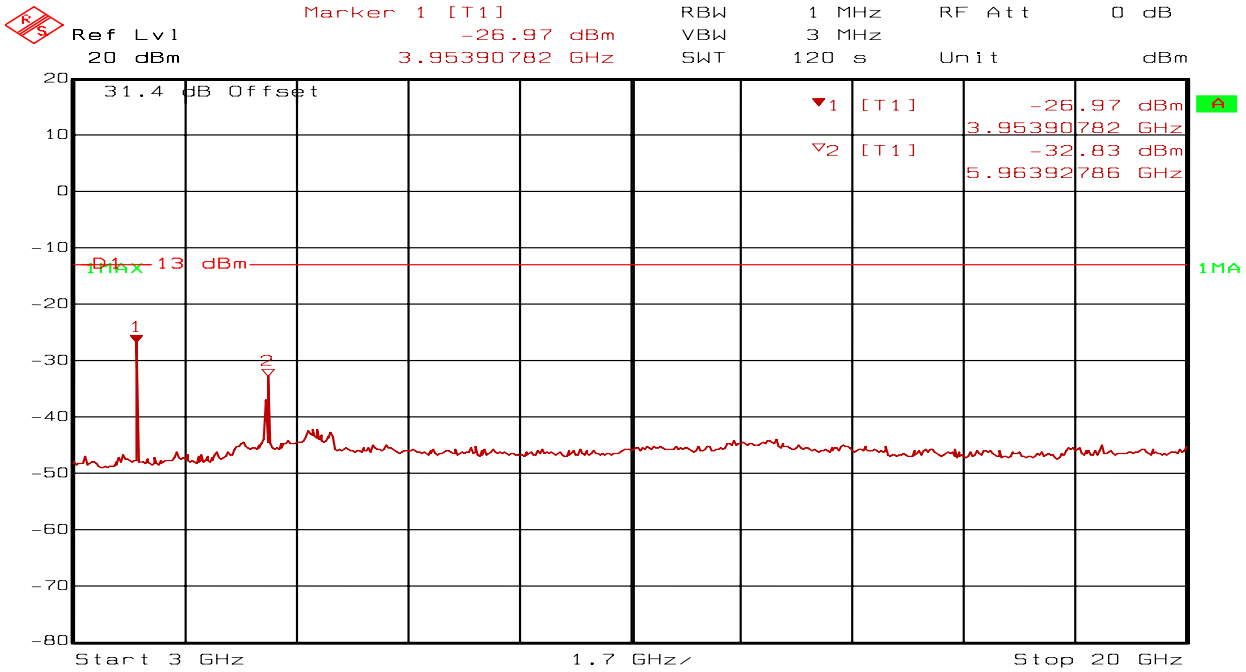


**Figure 34: 4MHz – 3GHz, Channel 1175, 1XRTT Mode**




Title: CG-1148 Star Solutions 1900MHz FA Rack
Comment A: 1x Sector 1, CH 1175
Date: 19.JUN.2009 11:02:25

**Figure 35: 3GHz – 20GHz, Channel 1175, 1XRTT Mode**




Title: CG-1148 Star Solutions 1900MHz FA Rack
Comment A: 1x Sector 1, CH 1175
Date: 18.JUN.2009 11:36:00

**Figure 36: 4MHz – 3GHz, Channel 1175, EVDO Mode, 8PSK, 921.6kbps**

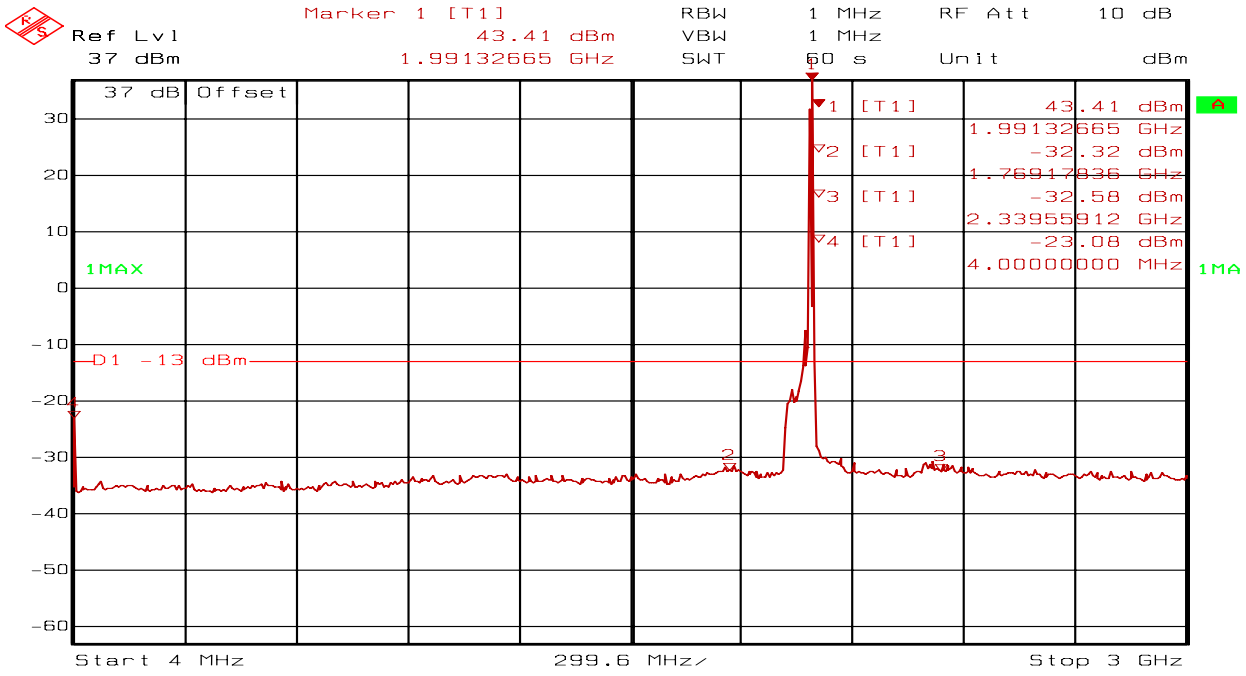
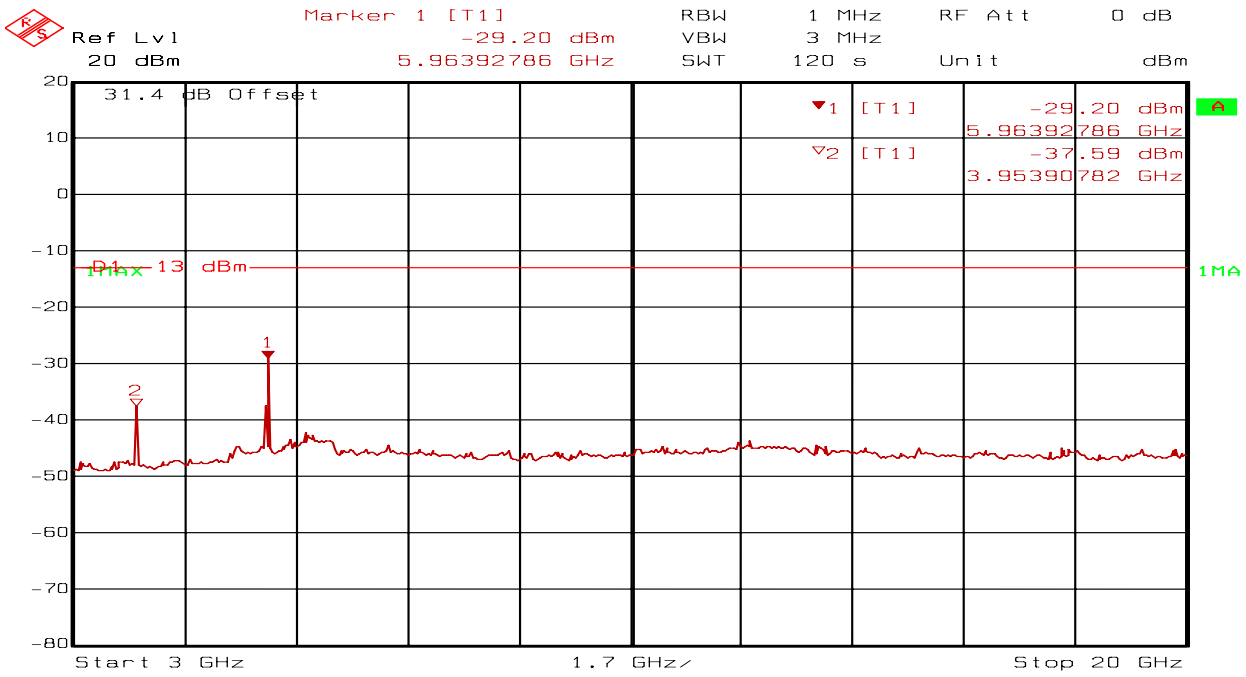



**Figure 37: 3GHz – 20GHz, Channel 1175, EVDO Mode, 8PSK, 921.6kbps**



### C.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Daryl Therens
Senior Test Specialist

### C.8. Test Dates

Test Start: June 11, 2009
Test Complete: June 19, 2009

# APPENDIX D: FREQUENCY STABILITY

## D.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC 24.235; IC RSS 133 6.3 |
| **Test Basis** | FCC Part 2.1055 |
| **Test Method** | FCC Part 2.1055/EIA/TIA 603 |

## D.2. FCC Part 2.1055

*(a) The frequency stability shall be measured with variation of ambient temperature as follows:*
*(1) From -30 to +50 centigrade for all equipment except that specified in subparagraphs (2) and (3) of this paragraph.*

*(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.*

*(d) The frequency stability shall be measured with variation of primary supply voltage as follows:*

*(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.*
*(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.*
*(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.*

*(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equip*ment.)

## FCC Part 24.235 Limit

*The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.*

### D.3. Deviations

| Deviation Number | Time & Date | Description and Justification of Deviation | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| none | | | | | | |

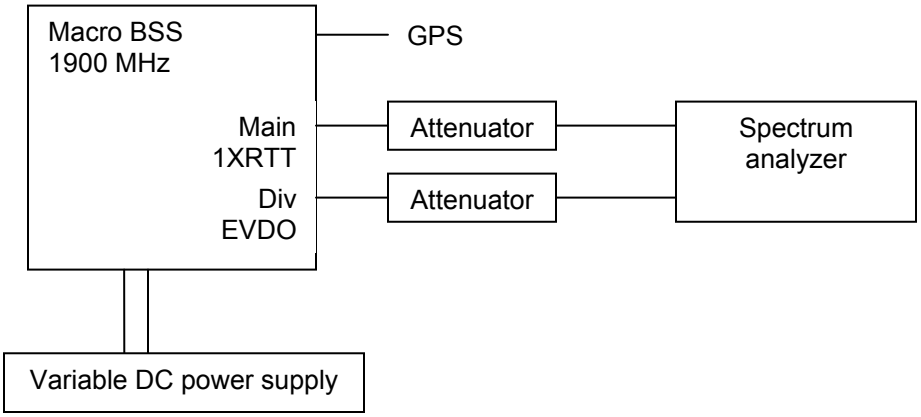
### D.4. Test Method

The EUT was setup via a PC and Star Solutions software to transmit at maximum power in both 1XRTT and EVDO modes. Frequency stability measurements were performed on Sector 1 main antenna port for 1XRTT measurements, and on Sector 1 diversity antenna port for EVDO measurements. Sector 2 and 3 main / diversity antenna ports were terminated into 50Ω loads.

To verify the stability of the frequency determining components the 1XRTT and EVDO carriers were set to transmit in CW mode. An external GPS reference was connected to the Macro BSS during test. Measurements were taken at startup and at 1 minute intervals for 10 minutes. Note that only the maximum frequency error reading is listed in Tables 6 and 7.

### D.5. Test Set Up

**Figure 38: Frequency Stability Setup**




### D.6. Test Results

Complies. In 1XRTT Mode, the maximum frequency drift is +186 Hz. In EVDO Mode, the maximum frequency drift is +285 Hz. This is sufficient to ensure the fundamental stays within the assigned PCS block.

**Table 6: 1XRTT Mode Frequency Stability Data**

| Channel / Frequency | Operating conditions | Frequency Drift in Hz[4] |
|---|---|---|
| CH 25, 1931.25 MHz | 50°C and -48Vdc | +174 |
| | 40°C and -48Vdc | +171 |
| | 30°C and -48Vdc | +170 |
| | 20°C and -48Vdc | +175 |
| | 20°C and -55.2Vdc | +172 |
| | 20°C and -40.8Vdc | +176 |
| | 10°C and -48Vdc | +174 |
| | 0°C and -48Vdc | +186 |
| | -10°C and -48Vdc | +175 |
| | -15°C and -48Vdc | +168 |
| | -20°C and -48Vdc | Transmitter would not key on |
| | -30°C and -48Vdc | Transmitter would not key on |

**Table 7: EVDO Mode Frequency Stability Data**

| Channel / Frequency | Operating conditions | Frequency Drift in Hz[5] |
|---|---|---|
| CH 1175, 1988.75 MHz | 50°C and -48Vdc | +176 |
| | 40°C and -48Vdc | +223 |
| | 30°C and -48Vdc | +198 |
| | 20°C and -48Vdc | +276 |
| | 20°C and -55.2Vdc | +285 |
| | 20°C and -40.8Vdc | +281 |
| | 10°C and -48Vdc | +179 |
| | 0°C and -48Vdc | +181 |
| | -10°C and -48Vdc | +175 |
| | -15°C and -48Vdc | +183 |
| | -20°C and -48Vdc | Transmitter would not key on |
| | -30°C and -48Vdc | Transmitter would not key on |

### D.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.

Name: Daryl Therens
Senior Test Specialist

### D.8. Test Dates

Test Start: June 22, 2009
Test Complete: June 26, 2009

[4] Maximum frequency error of the 10 readings taken over a 10 minute period.
[5] Maximum frequency error of the 10 readings taken over a 10 minute period.

# APPENDIX E: PEAK-TO-AVERAGE POWER RATIO

## E.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | FCC Part 24.232; IC RSS 133 6.4 |
| **Test Basis** | FCC 2.1046 |
| **Test Method** | TIA/EIA 603 |

## E.2. FCC Part 24.232

### FCC Limit

*The peak-to-average ratio of the power shall not exceed 12dB.*

## E.3. Deviations

| Deviation Number | Time & Date | Description and Justification of Deviation | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| none | | | | | | |

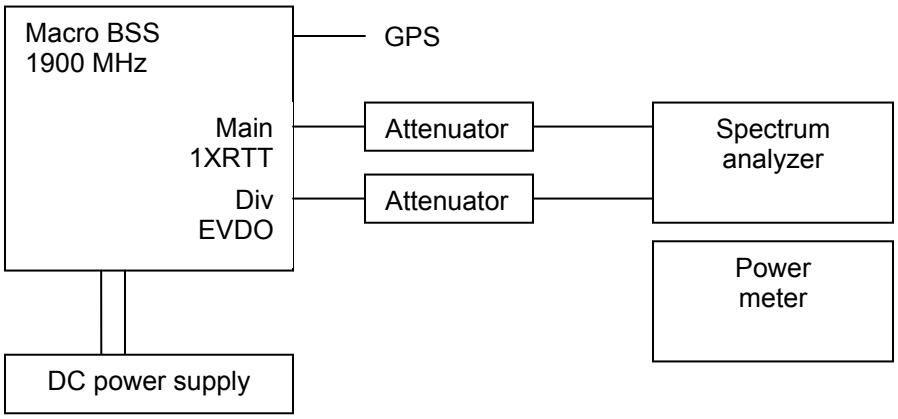
## E.4. Test Method

The EUT was setup via a PC and Star Solutions software to transmit at maximum power in both 1XRTT and EVDO modes. Peak-to-average power ratio measurements were performed on Sector 1 main antenna port for 1XRTT measurements, and on Sector 1 diversity antenna port for EVDO measurements. Sector 2 and 3 main / diversity antenna ports were terminated into 50Ω loads.

The spectrum analyzer was used for peak power measurements. The power meter with an average power sensor was used for average power measurements.

## E.5. Test Set Up

**Figure 39: Peak-to-Average Power Setup**



### E.6. Test Results

Complies. In 1XRTT Mode, the peak-to-average ratio of the power was 10.5dB. In EVDO Mode, the worst case peak-to-average ratio of the power was 10.6dB.

**Table 8: 1XRTT and EVDO Mode Peak-to-Average Power Ratio Data**

| Channel / Frequency | Operating Mode | Peak-to-Average Power Ratio in dB |
|---|---|---|
| CH 600, 1960.00 MHz | 1XRTT | 10.5 |
| | EVDO, 16QAM, 2457.6kbps, 1slot | 10.6 |
| | EVDO, QPSK, 1228.8kbps, 1slot | 9.7 |
| | EVDO, 8PSK, 1843.2kbps, 1slot | 10.3 |

### E.7. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation, table 1; Quality Manual.
Name: Daryl Therens
Senior Test Specialist

### E.8. Test Dates

Test Start: June 26, 2009
Test Complete: June 26, 2009

# APPENDIX F: RADIATED E-FIELD EMISSIONS; TX / RX SPURIOUS EMISSIONS – 30MHZ TO 20GHZ

## F.1. Base Standard & Test Basis

| | |
|---|---|
| **Base Standard** | CFR Title 47 – Telecommunications, Chapter I, Subchapter B,<br>FCC Part 24 – Personal Communication Services<br>IC RSS 133 6.3, IC RSS 133 6.6, RSS-Gen |
| **Test Basis** | EIA/TIA 603 C |
| **Test Method** | • NTS Emission Test Methods CAG EMC 02<br>• NTS Emission Verification Test Methods CAG EMC 01 |

## F.2. Specifications

| Frequency (MHz) | 47 CFR FCC Part 24 | |
|---|---|---|
| | Theoretical Peak @ 3m[1] dBµV/m | ERP[2] dBm |
| 1000 - 20000 | 84.3 | -13 |

Note 1: Calculated using: Pd-(43 + 10 log(Pw)
where Pd is the EUT power in dBm and Pw is the EUT power in watts
Note 2: Calculated using: 120+20log(SQRT(49.2*Pw)/3)
where Pw is the EUT power in watts

## F.3. Measurement Uncertainty

| Radiated Emissions | Measurement Uncertainty (dB) | Expanded Uncertainty (K=2) |
|---|---|---|
| 30 MHz – 1 GHz | +2.32/-2.36 | +4.65/-4.72 |
| 1 GHz – 20 GHz | +3.48/-3.51 | +6.96/-7.02 |

## F.4. Deviations

| Deviation Number | Time & Date | Descriptions | Deviation Reference | | | Approval |
|---|---|---|---|---|---|---|
| | | | Base Standard | Test Basis | NTS Procedure | |
| None | | | | | | |

## F.5. Special Considerations

None

## F.6. Operating Mode During Test

The EUT was tested to determine worst case operating modes to produce maximum peak spurious emissions for the different modulation types. The following modes produced the highest power levels and spurious levels. The system cannot be simultaneously set to the same RF channels in 1XRTT and EVDO modes.

1XRTT Mode, Channel 25

EVDO Mode, Channel 1175, 8PSK, 921.6kbps

### F.7. Tx Test Results

**Table 9: Compliance Scan Summary: 30MHz to 1GHz**

There were no FCC Part 24 related emissions detected in this frequency range.

**Table 10: Compliance Scan Summary: 1GHz to 20GHz**

| Polarization | Frequency (MHz) | Measured Level / Noise Floor (dBuV/m) | Substitution Signal Generator Level (dBm) | Substitution Antenna Gain (dBi) | Cable Loss (dB) | EIRP Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| Horizontal | 3862.5 | 73.35 | -29.81 | 9.97 | 2.05 | -21.89 | -13 | 8.89 |
| Horizontal | 3977.5 | 73.84 | -29.27 | 9.96 | 2.09 | -21.40 | -13 | 8.40 |
| Vertical | 3977.5 | 73.22 | -29.89 | 9.96 | 2.09 | -22.02 | -13 | 9.02 |

### F.8. Rx Spurious Emissions

No Rx spurious emissions were detected.

### F.9. Observations

None.

### F.10. Sample Calculation

3m Limit = 10m Limit – 20 * log (3/10)
Emission Level = Measured Level + Correction Factors
Margin = Limit – Emission Level
ERP Limit (dBm) = Pd-(43 + 10 log(Pw)
where Pd is the EUT power in dBm and Pw is the EUT power in watts
Theoretical ERP Limit (dBuV/m) 120+20log(SQRT(49.2*Pw)/3)
where Pw is the EUT power in watts

### F.11. Tested By

This testing was conducted in accordance with the ISO 17025:2005 scope of accreditation table 1; Quality Manual.

Name: Lixin Wang
EMC Specialist

### F.12. Test Dates

Test Start: June 9, 2009
Test Complete: June 10, 2009

# APPENDIX G: TEST EQUIPMENT LIST

## G.1. Test Equipment

| Descriptions | Manufacturer | Type/Model | Serial # | Cal Due | Cal Date |
|---|---|---|---|---|---|
| Test Receiver | Rohde & Schwarz | ESAI | CG0433/ 0434 | 4-MAY-10 | 4-MAY-09 |
| Bilog Antenna | Teseq | CBL 6112D | CG1177 | 10OCT09 | 10OCT07 |
| Digital Barometer / Thermometer | Cole-Parmer | 1870 | CG0728 | 30JUN09 | 19JUN07 |
| Horn Antenna (Rx) 1 GHz – 18 GHz | EMCO | 3115 | CG0368 | 23AUG09 | 23AUG07 |
| High pass filter | MicroTronics | | CG0951 | N/A | N/A |
| LNA 1 GHz - 18 GHz | Miteq | JSD00121 | CG0317 | 01DEC10 | 01DEC08 |
| Spectrum Analyzer 9 kHz – 40 GHz | Rohde & Schwarz | FSEK-20 | CG0118 | 01-JUL-09 | 01-JUL-08 |
| Power Meter | Agilent | E4418B | CG0119 | 29-JUL-09 | 29-JUL-08 |
| Power Meter Sensor | Agilent | 8481A | CG0264 | 29-JUL-09 | 29-JUL-08 |
| Spectrum Analyzer 30Hz – 40 GHz | HP | 8564E | CG0352 | 30-AUG-09 | 30-AUG-08 |
| Attenuator | Weinschel | 30dB 150W | #4 | N/A | N/A |
| Attenuator | Weinschel | 30dB 150W | CG0752 | N/A | N/A |
| RF cable | Sucoflex | 104 | 9338 | N/A | N/A |
| RF cable | Sucoflex | 104 | 9341 | N/A | N/A |
| RF cable | Sucoflex | 104 | 115771-4 | N/A | N/A |
| Multi-meter | Fluke | 87 | CG0384 | 1-OCT-09 | 1-OCT-08 |

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