Lab Code: 200167-0

# FCC PART 27 AND 90

# INDUSTRY CANADA RSS-119

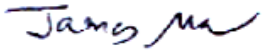
# MEASUREMENT AND TEST REPORT

For

## LGC WIRELESS, INC. – AN ADC COMPANY

2540 Junction Avenue, San Jose, CA 95134, USA

**FCC ID: NOOUNS-PS70-1**
**IC: 3077-UNSPS701**

| **Report Type:** ☒ Original Report | | **Product Type:** Wireless Networking System |
|---|---|---|
| **Test Engineer:** | Dan Coronia |  |
| **Report Number:** | R0711271 | |
| **Report Date:** | 2007-12-13 | |
| **Reviewed By:** | James Ma, Test Engineer |  |
| **Prepared By: (dc)** | Bay Area Compliance Laboratories Corp.<br>1274 Anvilwood Ave.<br>Sunnyvale, CA 94089, USA<br>Tel: (408) 732-9162<br>Fax: (408) 732 9164 | |

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# 1 GENERAL INFORMATION

## 1.1 Product Description for Equipment under Test (EUT)

The *LGC Wireless, Inc. – An ADC Company*, product: *InterReach Fusion System* model: UNSPS701 which includes: *Remote Access Unit (FR220AJQ), Main Hub (UNS-1-MH 2) & Expansion Hub (UNS-EH-1)* or the "EUT" as referred to in this report is a Wireless Networking System that operates on both C4FM, CQPSK, WCDMA, CDMA and IDEN 700 MHz bands. The EUT is designed for mid-sized to large edifices containing dense, high-traffic data environments such as convention centers, sporting arenas and airports. The EUT is a system comprised of three unit types: A Main Hub, a base station or a repeater and up to 4- Expansion Hubs that connect to the Main Hub via Single-mode or Multi-Mode fiber optics; and up to 32- Remote Access Units (RAUs) that connect to the Expansion Hub via CATV cabling. Each RAU sends and receives RF signals to wireless devices located within its coverage area. For the purposes of the tests and results recorded herein, the EUT comprised of one Base Station, one Main Hub, and one Expansion Hub tested together as a system.

**EUT Photos**

**Model: UNSPS701**

FR220AJQ (*Remote Access Unit)*

UNS-1-MH 2 *(Main Hub)*

UNS-EH-1 (*Expansion Hub)*

*EUT detail photos in exhibit C*

## 1.2 Mechanical Description

Each component of the EUT system was housed within separate chassis. The Remote Unit measured 44 mm H x 305 mm L x 158 mm W, Main Hub measured 44.5 mm H x 438 mm L x 305 mm W and the Expansion Hub measured 89 mm H x 438 mm L x 305 mm W.

** The test data gathered are from production samples provided by the manufacturer, serial numbers: Remote Unit FR220AJQ, Main Hub: F0100J21, Expansion Hub: P0100TSQ.*

## 1.3 Objective

This type approval report is prepared on behalf of *LGC Wireless, Inc. – An ADC Company* in accordance with Part 2, Subpart J, Part 90 Subpart I, and Part 27 Subpart E of the Federal Communication Commissions rules and Industry Canada RSS-119, Issue 9, June 2007.

The objective is to determine compliance with FCC rules for RF output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation, frequency stability, band edge, and conducted and radiated margin.

## 1.4 Related Submittal(s)/Grant(s)

No Related Submittals

## 1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 90 Subparts I – Private Land Mobile Radio Services
Part 27 Subpart E – WCS – Miscellaneous Wireless Communication Services

and

IC RSS-119: Land Mobile and Fixed Radio Transmitters and Receivers Operating in the Frequency Range 27.41-960 MHz.

Applicable Standards: TIA EIA 98-C, TIA/EIA603-C, ANSI C63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## 1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

## 1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: C-2463 and R-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at http://ts.nist.gov/Standards/scopes/2001670.htm

# 2 SYSTEM TEST CONFIGURATION

## 2.1 Justification

The EUT was configured for testing according to TIA/EIA-603 C.

The final qualification test was performed with the EUT operating at normal mode.

## 2.2 Equipment Modifications

No modifications were made to the EUT.

## 2.3 Power Supply and Line Filters

### 2.3.1 Expansion Hub

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Digital Power Corp | Switching P/S | ef0306-14B | 0605103 |
| Digital Power Corp | Switching P/S | ef0306-14B | 0605082 |
| The Power Solution | AC-DC Power supply | AM-120UR-T211-145 REV. X2 | NA |
| Schaffner | EMI Power Filter | FN9222+0-06 | NA |

### 2.3.2 Main Hub

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| The Power Solution | AC-DC Power supply | AM-120UR-T211-145 REV. X2 | NA |
| Schaffner | EMI Power Filter | FN9222+0-06 | NA |

## 2.4 Local Support Equipment List and Details

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Rohde & Schwartz | Signal Generator | SMIQ03 | 849192/0085 2006-10-18 |
| Agilent | Signal Generator | E4438C | MY45092500 |
| LGC Wireless | Main Hub | FSN-1-MH-1 | FR1014RA |
| LGC Wireless | Expansion Hub | FSN-1-EH-2 | FR220AHN |

## 2.5 Interface Ports and Cabling

| Cable Description | Length (M) | From | To |
|---|---|---|---|
| RF cable | 0.2 | Signal Generator | Main Hub |
| RF cable | 0.2 | Expansion Hub | Remote Unit (EUT) |

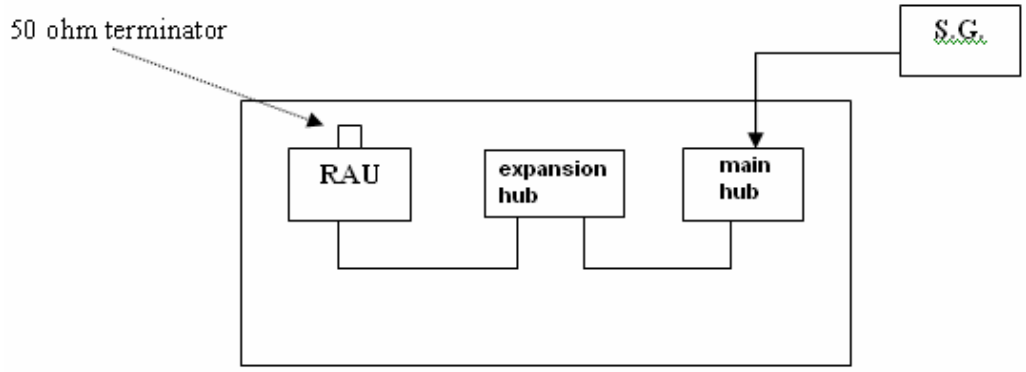
## Mode of Operation

Uplink mode: Simulation signal is being generated from Signal Generator then feed into Antenna port of RAU. Output is monitored by Spectrum analyzer through Hub's uplink port.

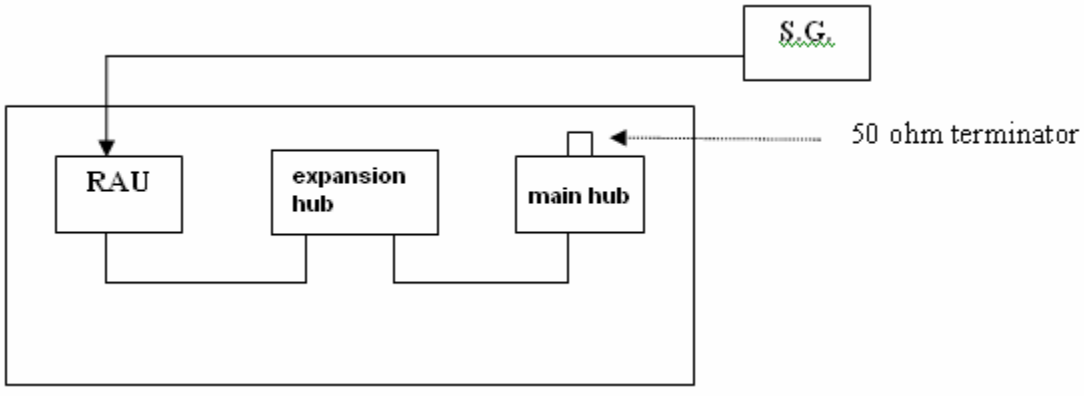
Downlink Mode: Simulation signal is being generated from Signal Generator then feed into downlink port of main hub. Output is monitored by Spectrum analyzer through RAU Antenna port.

## 2.6 Test Setup Block Diagram

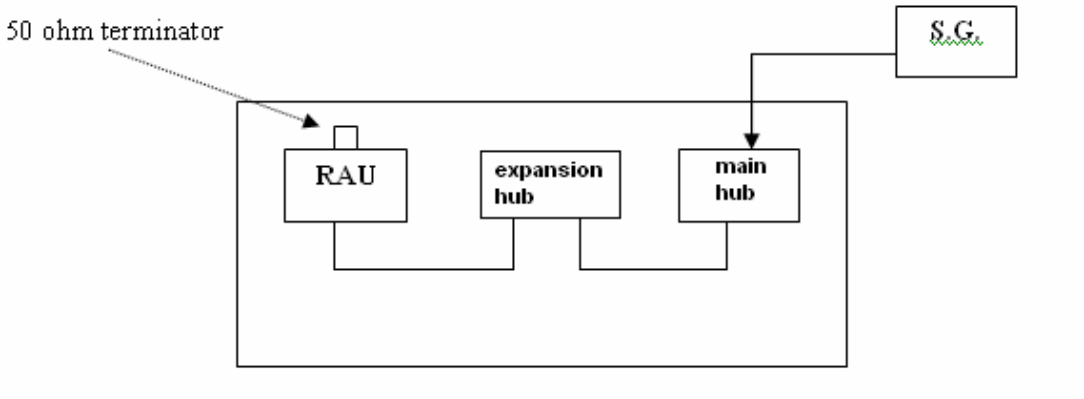
### 2.6.1 Radiated Emission – Downlink



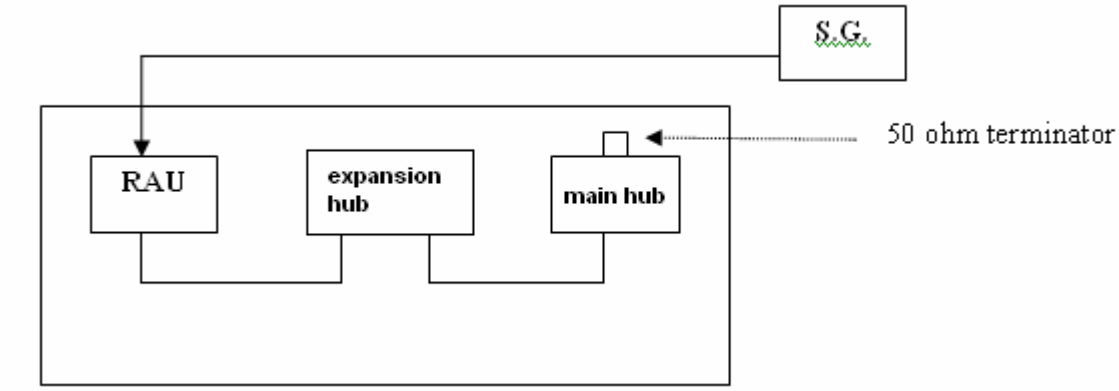

### 2.6.2 Radiated Emission – Uplink



### 2.6.3 Conducted Emission – Downlink




### 2.6.4 Conducted Emission – Uplink



# 3 SUMMARY OF TEST RESULTS

**FCC Part 27 / 90 & RSS-119**

| FCC/IC Rules | Description of Test | Result | Note |
|---|---|---|---|
| § 2.1047 & RSS-119 §5.2 | Modulation Characteristics | Compliant | - |
| § 2.1053, RSS-119 5.8 | Field Strength of Spurious Radiation | Compliant | - |
| §2.1091 & RSS-GEN §5.5 & RSS-102 | RF Exposure | Compliant | - |
| § 2.1046,§ 27.50 § 90.541 & RSS-119 § 5.4.5 | RF Output Power | Compliant | - |
| § 2.1049,§ 27.53 § 90.543 & RSS-119 §5.8.10.2, | Out of Band Emissions, Occupied Bandwidth | Compliant | - |
| § 2.1051,§ 27.53 § 90.210 §90.543 & RSS-GEN §7.2 | Spurious Emissions at Antenna Terminals | Compliant | - |
| § 2.1055 & RSS-119 §5.3 | Frequency stability vs. temperature<br>Frequency stability vs. voltage | Compliant | - |

| FCC/IC Rules | Description of Test | Result |
|---|---|---|
| § 15.109 & ICES-003 §5 | Conducted Emission | Compliant |
| § 15.107 & ICES-003 §6 | Radiated Emission | Compliant |

# 4 §2.1047 & RSS-119 §5.2 - MODULATION CHARACTERISTIC

## 4.1 4.1 Applicable Standard

According to FCC § 2.1047(d), part 27 and part 90, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

According to RSS-119 §5.2:

> **5.2 Types of Modulation**
>
> Equipment that operates in frequency bands other than 764-770 MHz and 794-800 MHz may employ any type of modulation.
>
> Equipment that operates in the bands 764-770 MHz and 794-800 MHz must use digital modulation. Mobile and portable transmitters may have analogue modulation capability only as a secondary mode in addition to their primary digital mode. Mobile and portable transmitters that only operate on the low-power channel as defined in SRSP-511 may employ any type of modulation.

**Results:** EUT satisfies the requirement, it employs digital modulation technique.

# 5 §2.1053, & RSS-119 5.8 - SPURIOUS RADIATED EMISSIONS

## 5.1 Applicable Standard

Requirements: CFR 47, § 2.1053.

For C4FM, CQPSK, CDMA 2000, WCDMA and iDEN.

RSS-119 5.8.

## 5.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious attenuation limit in dB = 43 + 10 $\text{Log}_{10}$ (power out in Watts)

### 5.2.1 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 5.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2007-04-26 |
| HP | Amplifier, Pre | 8447D | 2944A10198 | 2007-01-08 |
| A. H. Systems | Antenna, Horn, DRG | SAS-200/571 | 261 | 2007-06-07 |
| HP | Generator, Signal | 83650B | 3614A00276 | 2007-05-18 |
| A.R.A. | Antenna, Horn | DRG-118/A | 1132 | 2007-06-18 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 5.4 Test Result

***C4FM: Middle Channel***

| Indicated | | Table Azimuth Degrees | Test Antenna | | Substituted | | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Amp. (dBuV) | | Height (m) | Polar. (H/V) | Freq. (MHz) | Level (dBm) | Ant. Gain Correction (dBi) | Cable Loss (dB) | | | |
| 1539.00 | 59.99 | 170 | 1.5 | v | 1539.00 | -50.50 | 8.97 | 1.20 | -42.73 | -13.00 | -29.73 |
| 1539.00 | 59.06 | 165 | 1.4 | h | 1539.00 | -50.00 | 8.97 | 1.20 | -42.23 | -13.00 | -29.23 |
| 2308.50 | 58.83 | 205 | 1.8 | v | 2308.50 | -49.00 | 9.94 | 1.50 | -40.56 | -13.00 | -27.56 |
| 2308.50 | 58.26 | 200 | 1.7 | h | 2308.50 | -49.50 | 9.94 | 1.50 | -41.06 | -13.00 | -28.06 |
| 3078.00 | 49.42 | 130 | 1.7 | h | 3078.00 | -57.00 | 9.91 | 1.85 | -48.94 | -13.00 | -35.94 |
| 3078.00 | 48.65 | 140 | 1.6 | h | 3078.00 | -57.80 | 9.91 | 1.85 | -49.74 | -13.00 | -36.74 |

***CQPSK: Middle Channel***

| Indicated | | Table Azimuth Degrees | Test Antenna | | Substituted | | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Amp. (dBuV) | | Height (m) | Polar. (H/V) | Freq. (MHz) | Level (dBm) | Ant. Gain Correction (dBi) | Cable Loss (dB) | | | |
| 1539.00 | 59.20 | 160 | 1.4 | v | 1539.00 | -50.30 | 8.97 | 1.20 | -42.53 | -13.00 | -29.53 |
| 1539.00 | 59.00 | 163 | 1.6 | h | 1539.00 | -50.00 | 8.97 | 1.20 | -42.23 | -13.00 | -29.23 |
| 2308.50 | 58.35 | 200 | 1.9 | v | 2308.50 | -49.40 | 9.94 | 1.50 | -40.96 | -13.00 | -27.96 |
| 2308.50 | 57.90 | 180 | 2.0 | h | 2308.50 | -49.80 | 9.94 | 1.50 | -41.36 | -13.00 | -28.36 |
| 3078.00 | 47.80 | 100 | 1.0 | h | 3078.00 | -58.10 | 9.91 | 1.85 | -50.04 | -13.00 | -37.04 |
| 3078.00 | 47.00 | 120 | 1.2 | h | 3078.00 | -59.50 | 9.91 | 1.85 | -51.44 | -13.00 | -38.44 |

***WCDMA*: Middle Channel**

| Indicated | | Table Azimuth Degrees | Test Antenna | | Substituted | | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Amp. (dBuV) | | Height (m) | Polar. (H/V) | Freq. (MHz) | Level (dBm) | Ant. Gain Correction (dBi) | Cable Loss (dB) | | | |
| 1539.00 | 60.00 | 175 | 1.6 | v | 1539.00 | -50.10 | 8.97 | 1.20 | -42.33 | -13.00 | -29.33 |
| 1539.00 | 59.60 | 190 | 1.4 | h | 1539.00 | -50.20 | 8.97 | 1.20 | -42.43 | -13.00 | -29.43 |
| 2308.50 | 58.90 | 190 | 1.7 | v | 2308.50 | -49.60 | 9.94 | 1.50 | -41.16 | -13.00 | -28.16 |
| 2308.50 | 58.00 | 210 | 1.5 | h | 2308.50 | -49.70 | 9.94 | 1.50 | -41.26 | -13.00 | -28.26 |
| 3078.00 | 49.50 | 130 | 1.1 | h | 3078.00 | -57.10 | 9.91 | 1.85 | -49.04 | -13.00 | -36.04 |
| 3078.00 | 49.00 | 120 | 1.4 | h | 3078.00 | -57.30 | 9.91 | 1.85 | -49.24 | -13.00 | -36.24 |

***CDMA2000: Middle Channel***

| Indicated | | Table Azimuth Degrees | Test Antenna | | Substituted | | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Amp. (dBuV) | | Height (m) | Polar. (H/V) | Freq. (MHz) | Level (dBm) | Ant. Gain Correction (dBi) | Cable Loss (dB) | | | |
| 1539.00 | 59.80 | 175 | 1.6 | v | 1539.00 | -50.40 | 8.97 | 1.20 | -42.63 | -13.00 | -29.63 |
| 1539.00 | 59.00 | 180 | 1.4 | h | 1539.00 | -50.10 | 8.97 | 1.20 | -42.33 | -13.00 | -29.33 |
| 2308.50 | 58.70 | 200 | 1.9 | v | 2308.50 | -49.10 | 9.94 | 1.50 | -40.66 | -13.00 | -27.66 |
| 2308.50 | 58.20 | 190 | 1.8 | h | 2308.50 | -49.40 | 9.94 | 1.50 | -40.96 | -13.00 | -27.96 |
| 3078.00 | 49.10 | 100 | 2.0 | h | 3078.00 | -57.20 | 9.91 | 1.85 | -49.14 | -13.00 | -36.14 |
| 3078.00 | 48.35 | 130 | 1.9 | h | 3078.00 | -57.60 | 9.91 | 1.85 | -49.54 | -13.00 | -36.54 |

***IDEN: Middle Channel***

| Indicated | | Table Azimuth Degrees | Test Antenna | | Substituted | | | | Absolute Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Freq. (MHz) | Amp. (dBuV) | | Height (m) | Polar. (H/V) | Freq. (MHz) | Level (dBm) | Ant. Gain Correction (dBi) | Cable Loss (dB) | | | |
| 1539.00 | 59.50 | 180 | 1.6 | v | 1539.00 | -50.40 | 8.97 | 1.20 | -42.63 | -13.00 | -29.63 |
| 1539.00 | 58.80 | 160 | 1.4 | h | 1539.00 | -49.90 | 8.97 | 1.20 | -42.13 | -13.00 | -29.13 |
| 2308.50 | 58.45 | 175 | 1.9 | v | 2308.50 | -49.70 | 9.94 | 1.50 | -41.26 | -13.00 | -28.26 |
| 2308.50 | 58.10 | 180 | 1.3 | h | 2308.50 | -49.60 | 9.94 | 1.50 | -41.16 | -13.00 | -28.16 |
| 3078.00 | 48.70 | 100 | 1.5 | h | 3078.00 | -58.10 | 9.91 | 1.85 | -50.04 | -13.00 | -37.04 |
| 3078.00 | 48.50 | 110 | 1.7 | h | 3078.00 | -57.85 | 9.91 | 1.85 | -49.79 | -13.00 | -36.79 |

# 6 §2.1091 & RSS- GEN 5.5 and RSS-102 – RF EXPOSURE

## 6.1 Applicability

According to §1.1307(b)(1) and §1.1307(b)(2), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

**Limits for General Population/Uncontrolled Exposure**

| Limits for General Population/Uncontrolled Exposure | | | | |
|---|---|---|---|---|
| **Frequency Range (MHz)** | **Electric Field Strength (V/m)** | **Magnetic Field Strength (A/m)** | **Power Density ($mW/cm^2$)** | **Averaging Time (minutes)** |
| 0.3-1.34 | 614 | 1.63 | *(100) | 30 |
| 1.34-30 | 824/f | 2.19/f | *($180/f^2$) | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | / | / | f/1500 | 30 |
| 1500-100,000 | / | / | 1.0 | 30 |

f = frequency in MHz
* = Plane-wave equivalent power density

## 6.2 MPE Prediction

**C4FM (763-775MHz Downlink, 793-805MHz Uplink)**

MPE Limit Calculation:@ 763-775MHz; highest conducted power=17.72dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 7.72dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 17.72 |
| Maximum peak output power at antenna input terminal (mW): | 59.16 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 769.50 |
| Maximum Antenna Gain, typical (dBi): | 7.72 |
| Maximum Antenna Gain (numeric): | 5.92 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.0697 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 0.513 |

**CQPSK Band (763-775MHz Downlink, 793-805MHz Uplink)**

MPE Limit Calculation:@ 763MHz - 775MHz; highest conducted power=17.78dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 17.78 |
| Maximum peak output power at antenna input terminal (mW): | 59.98 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 769.5 |
| Maximum Antenna Gain, typical (dBi): | 8.39 |
| Maximum Antenna Gain (numeric): | 6.902 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.4997 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 0.513 |

**WCDMA Band (763-775MHz Downlink, 793-805MHz Uplink)**

MPE Limit Calculation:@ 763MHz-775MHz; highest conducted power=15.93dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 15.93 |
| Maximum peak output power at antenna input terminal (mW): | 39.17 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 769.5 |
| Maximum Antenna Gain, typical (dBi): | 8.39 |
| Maximum Antenna Gain (numeric): | 6.902 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.4997 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 0.513 |

**CDMA2000 Band (763-775MHz Downlink, 793-805MHz Uplink)**

MPE Limit Calculation:@ 763MHz-775MHz; highest conducted power=16.49dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 16.49 |
| Maximum peak output power at antenna input terminal (mW): | 44.57 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 769.5 |
| Maximum Antenna Gain, typical (dBi): | 8.39 |
| Maximum Antenna Gain (numeric): | 6.902 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.4997 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 0.513 |

**IDEN Band (763-775MHz Downlink, 793-805MHz Uplink)**

MPE Limit Calculation:@ 763MHz-775MHz; highest conducted power=17.72dBm

EUT maximum EIRP per users manual=2500mW (34.0dBm), therefore the maximum antenna gain in this band= 8.39dBi

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

| | |
|---|---|
| Maximum peak output power at antenna input terminal (dBm): | 17.72 |
| Maximum peak output power at antenna input terminal (mW): | 59.16 |
| Prediction distance (cm): | 20 |
| Prediction frequency (MHz): | 769.5 |
| Maximum Antenna Gain, typical (dBi): | 8.39 |
| Maximum Antenna Gain (numeric): | 6.902 |
| Power density of prediction frequency at 20.0 cm ($mW/cm^2$): | 0.4997 |
| MPE limit for uncontrolled exposure at prediction frequency ($mW/cm^2$): | 0.513 |

**Note:** Please refer to the Users manual.

# 7 §2.1046, §27.50, & §90.541 & RSS-119 §5.4 – RF OUTPUT POWER

## 7.1 Applicable Standard

According to FCC §2.1046, §27.50, §90.541 And RSS-119 §5.4.

## 7.2 7.2 Test Procedure

*Conducted:*

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

### 7.2.1 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 7.3 7.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2007-04-26 |
| Rohde & Schwartz | Signal Generator | SMIQ03 | 849192/0085 | 2007-12-03 |
| Agilent | Vector Signal Generator | ESG44 | US44300386 | 2007-10-10 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 7.4 Test Results

**C4FM (Downlink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) |
|---|---|---|---|
| LOW | 763.00 | 13.96 | 0.025 |
| MID | 769.50 | 17.72 | 0.059 |
| HIGH | 775.00 | 15.65 | 0.037 |

**C4FM (Uplink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| LOW | 793.00 | -27.58 | 0.002 |
| MID | 799.50 | -25.49 | 0.003 |
| HIGH | 805.00 | -26.65 | 0.002 |

**CQPSK (Downlink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) |
|---|---|---|---|
| LOW | 763.00 | 14.10 | 0.026 |
| MID | 769.50 | 17.78 | 0.060 |
| HIGH | 775.00 | 15.81 | 0.038 |

**CQPSK (Uplink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| LOW | 793.00 | -27.09 | 0.002 |
| MID | 799.50 | -25.12 | 0.003 |
| HIGH | 805.00 | -26.17 | 0.002 |

**WCDMA (Downlink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) |
|---|---|---|---|
| LOW | 763.00 | 12.29 | 0.017 |
| MID | 769.50 | 15.93 | 0.039 |
| HIGH | 775.00 | 13.98 | 0.025 |

**WCDMA (Uplink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| LOW | 793.00 | -28.12 | 0.001 |
| MID | 799.50 | -25.86 | 0.003 |
| HIGH | 805.00 | -26.75 | 0.002 |

**CDMA2000 (Downlink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) |
|---|---|---|---|
| LOW | 763.00 | 16.62 | 0.046 |
| MID | 769.50 | 16.49 | 0.045 |
| HIGH | 775.00 | 15.96 | 0.039 |

**CDMA2000 (Uplink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| LOW | 793.00 | -26.83 | 0.002 |
| MID | 799.50 | -24.51 | 0.004 |
| HIGH | 805.00 | -25.02 | 0.003 |

**IDEN (Downlink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (Watt) |
|---|---|---|---|
| LOW | 763.00 | 14.20 | 0.026 |
| MID | 769.50 | 17.72 | 0.059 |
| HIGH | 775.00 | 15.85 | 0.038 |

**IDEN (Uplink)**

| Channel | Frequency (MHz) | Output Power (dBm) | Output Power (mW) |
|---|---|---|---|
| LOW | 793.00 | -27.52 | 0.002 |
| MID | 799.50 | -25.10 | 0.003 |
| HIGH | 805.00 | -26.19 | 0.002 |

# 8 §2.1049, §27.53, & §90.543 & RSS-119 §5.5 - OCCUPIED BANDWIDTH

## 8.1 Applicable Standard

Requirements: CFR 47 §2.1049, §27.53, & §90.543.

RSS-119 §5.5

## 8.2 Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

### 8.2.1 Environmental Conditions

| | |
|---|---|
| Temperature: | 20 °C |
| Relative Humidity: | 58 % |
| ATM Pressure: | 101.8 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 8.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2007-04-26 |
| Rohde & Schwartz | Signal Generator | SMIQ03 | 849192/0085 | 2007-12-03 |
| Agilent | Vector Signal Generator | ESG44 | US44300386 | 2007-10-10 |

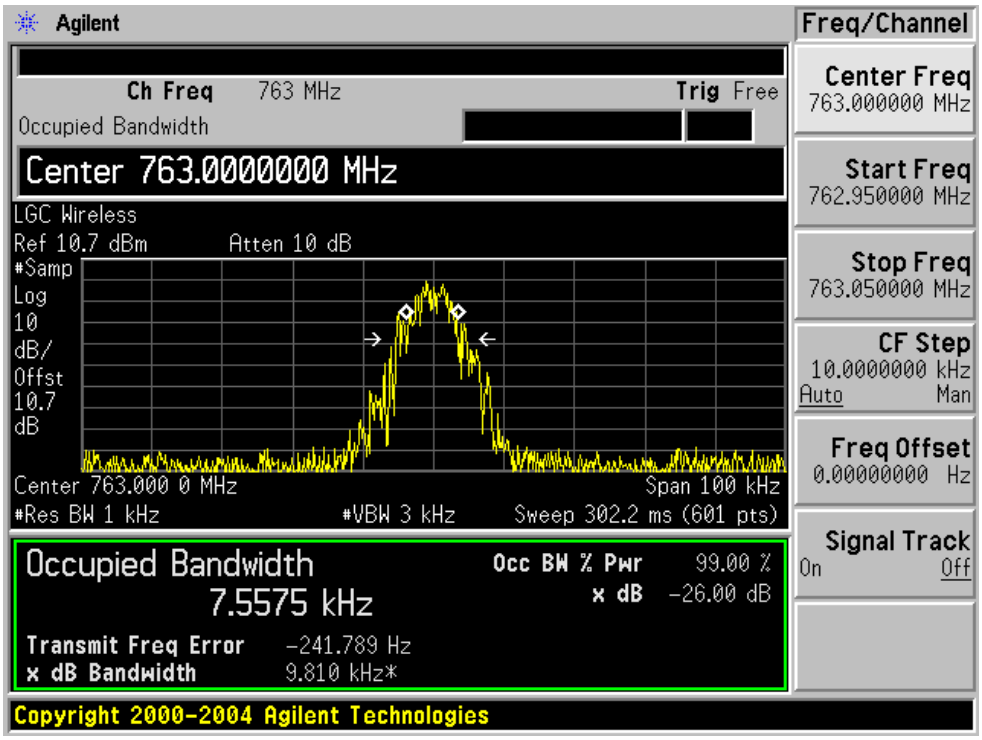
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 8.4 Test Results

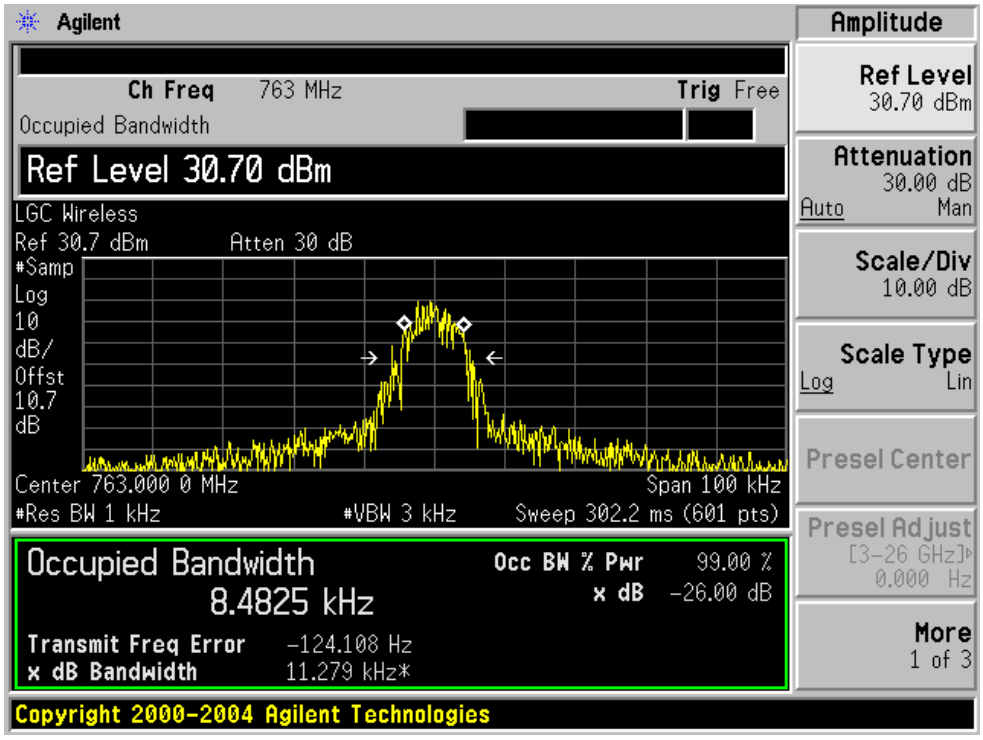
Please refer to the following plots.

**C4FM Band: Downlink**

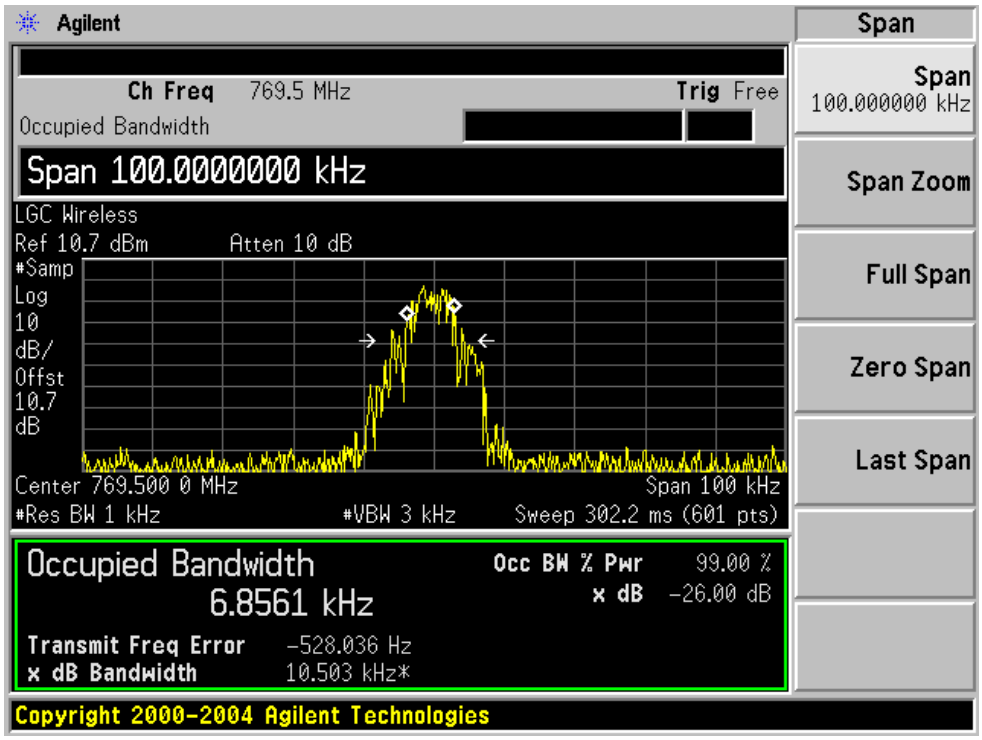
**Low Channel (Input)**



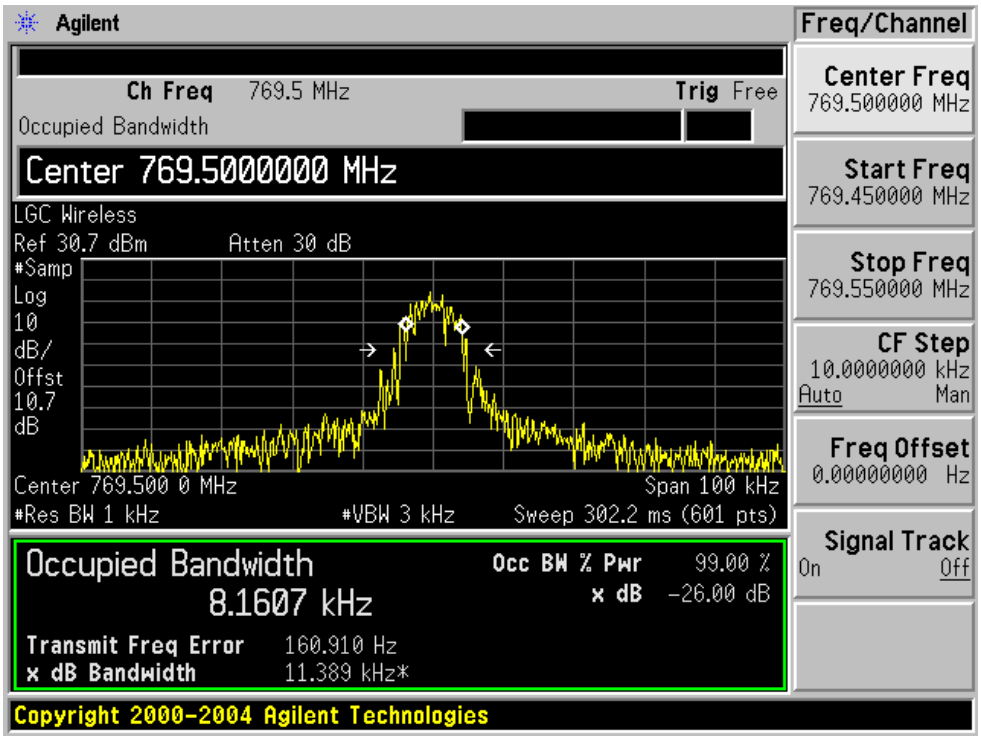

**Low Channel (Output)**



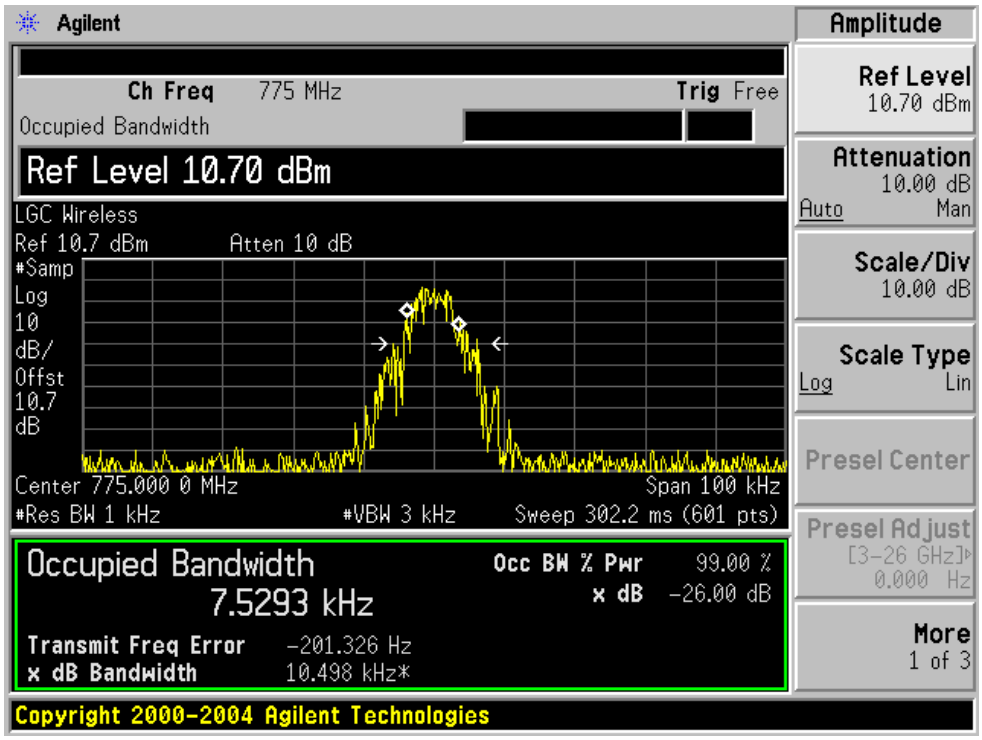
**Middle Channel (Input)**



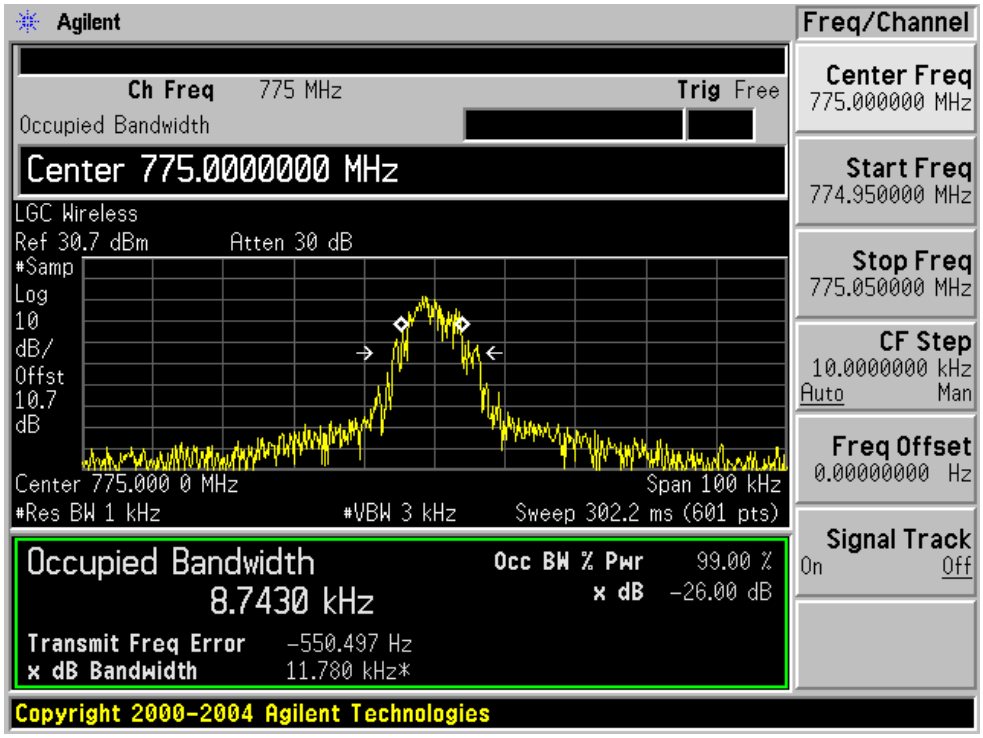

**Middle Channel (Output)**



**High Channel (Input)**

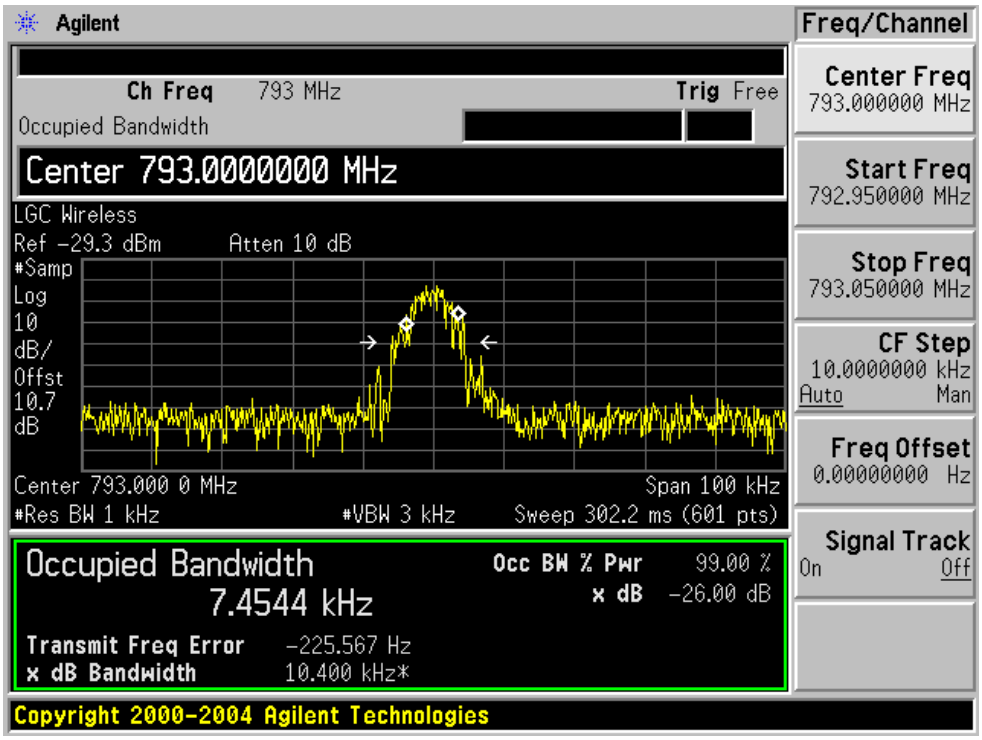



**High Channel (Output)**

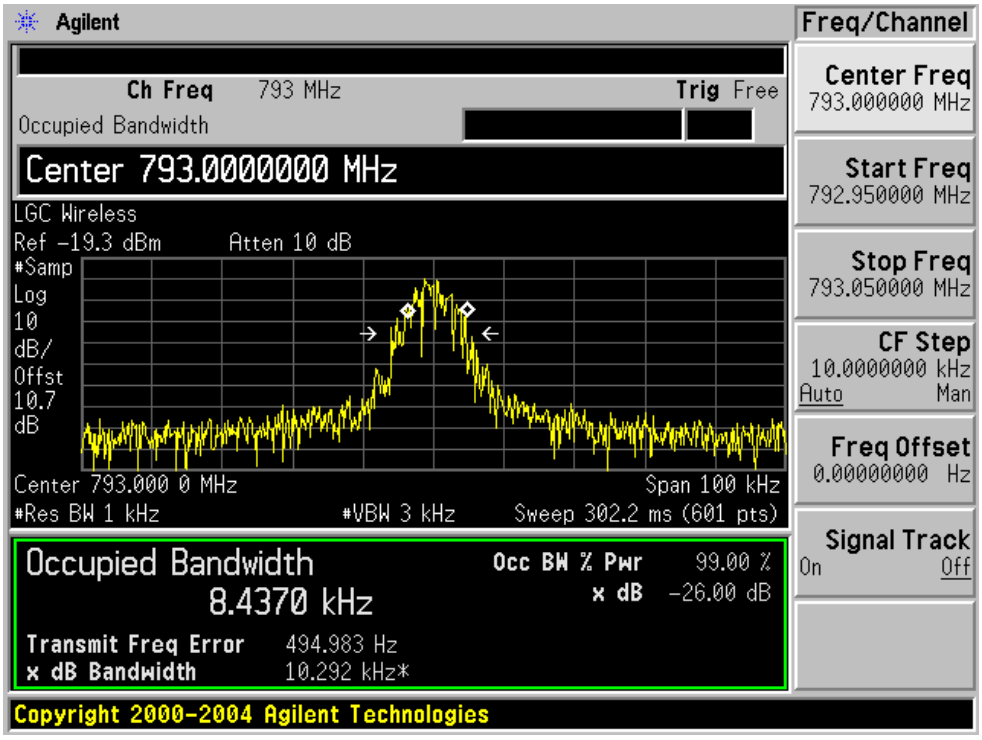


**C4FM Band: Uplink**

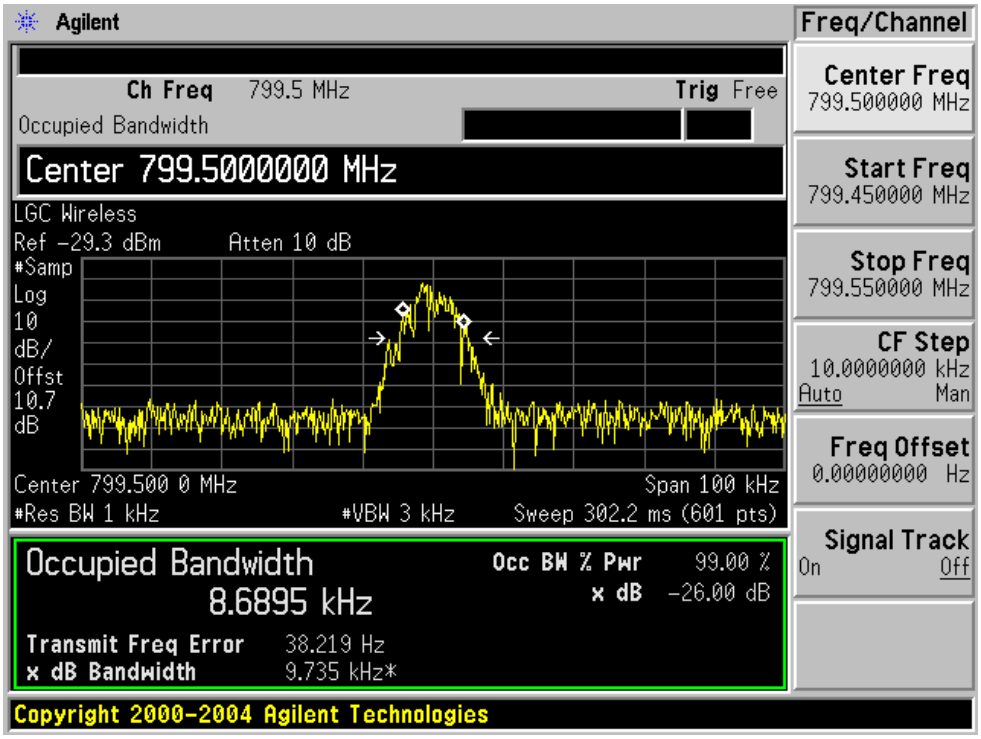
**Low Channel (Input)**



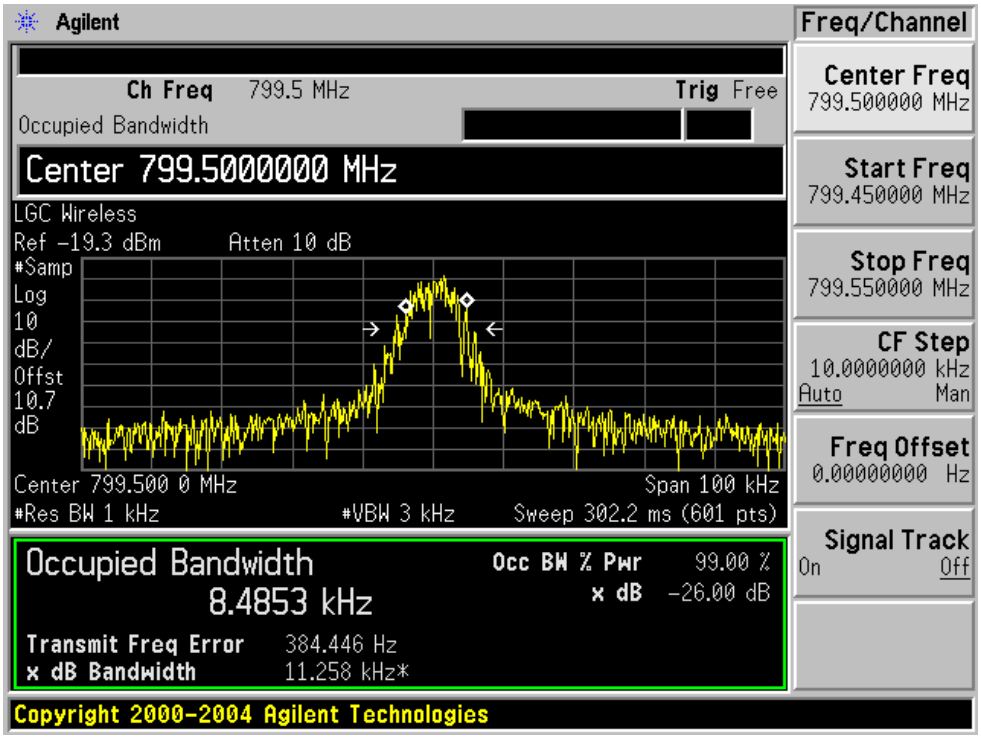

**Low Channel (Output)**



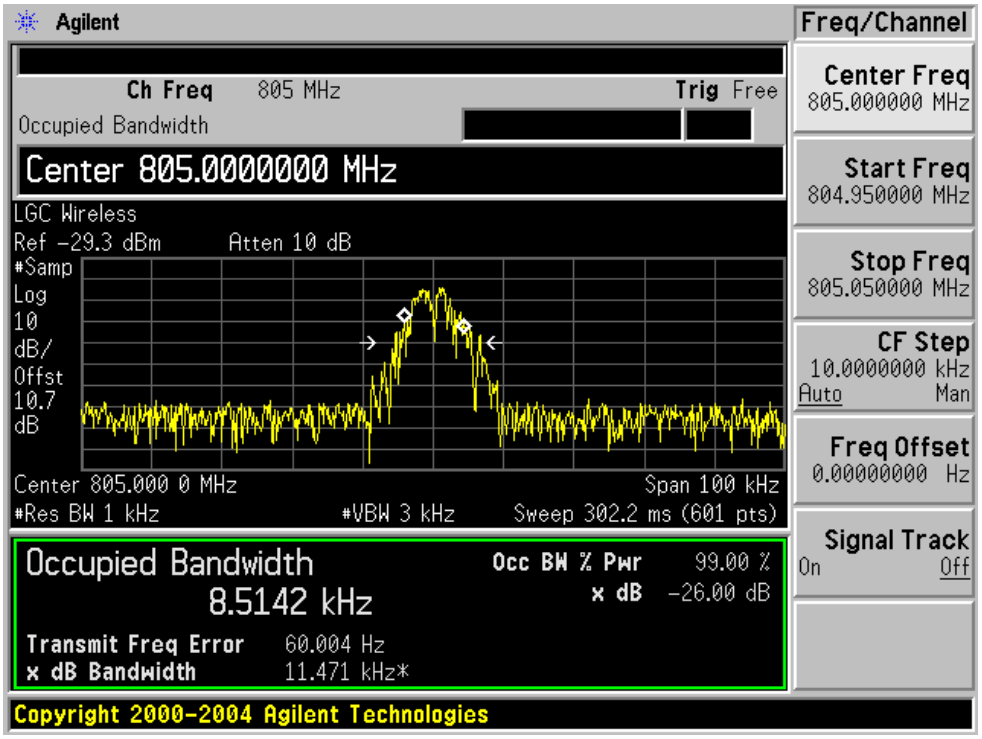
**Middle Channel (Input)**



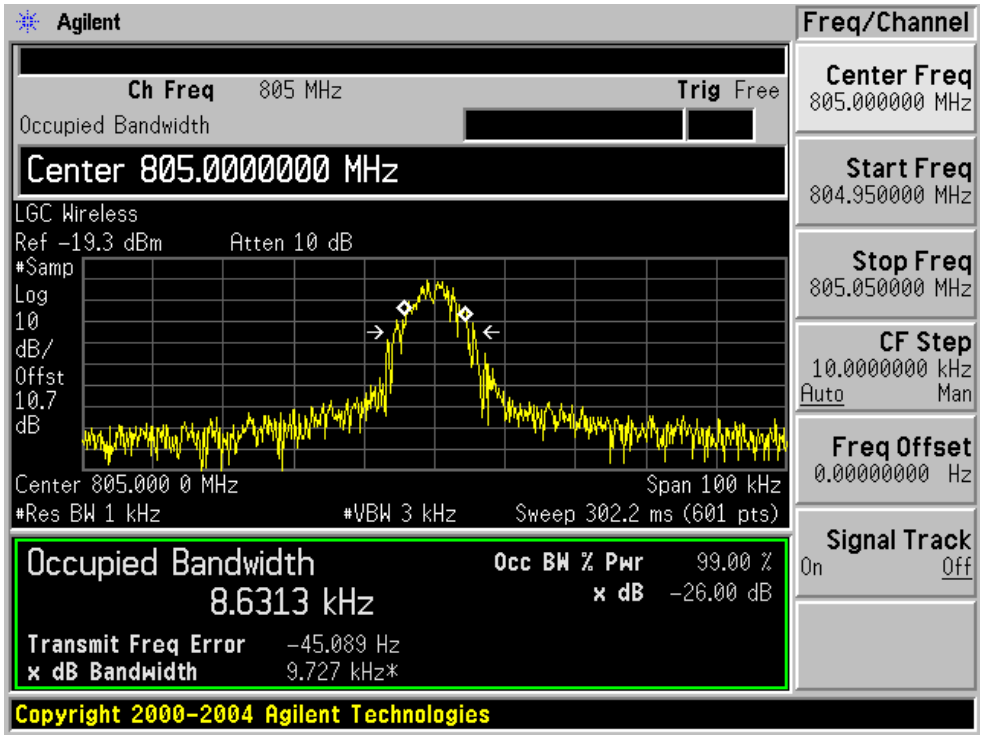

**Middle Channel (Output)**



**High Channel (Input)**

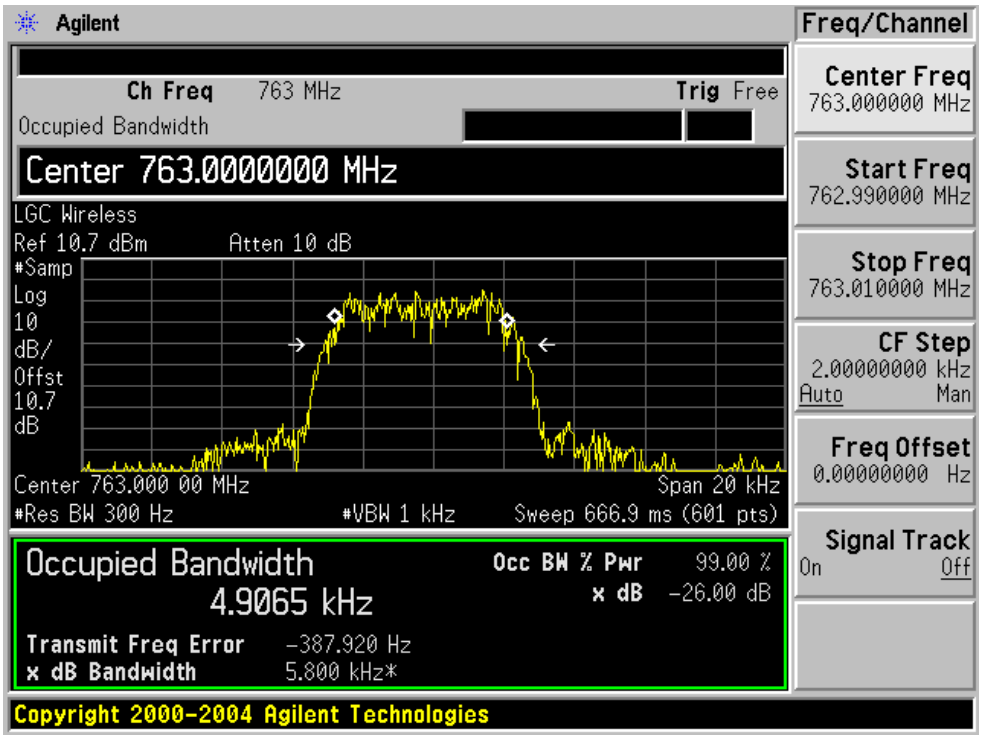



**High Channel (Output)**

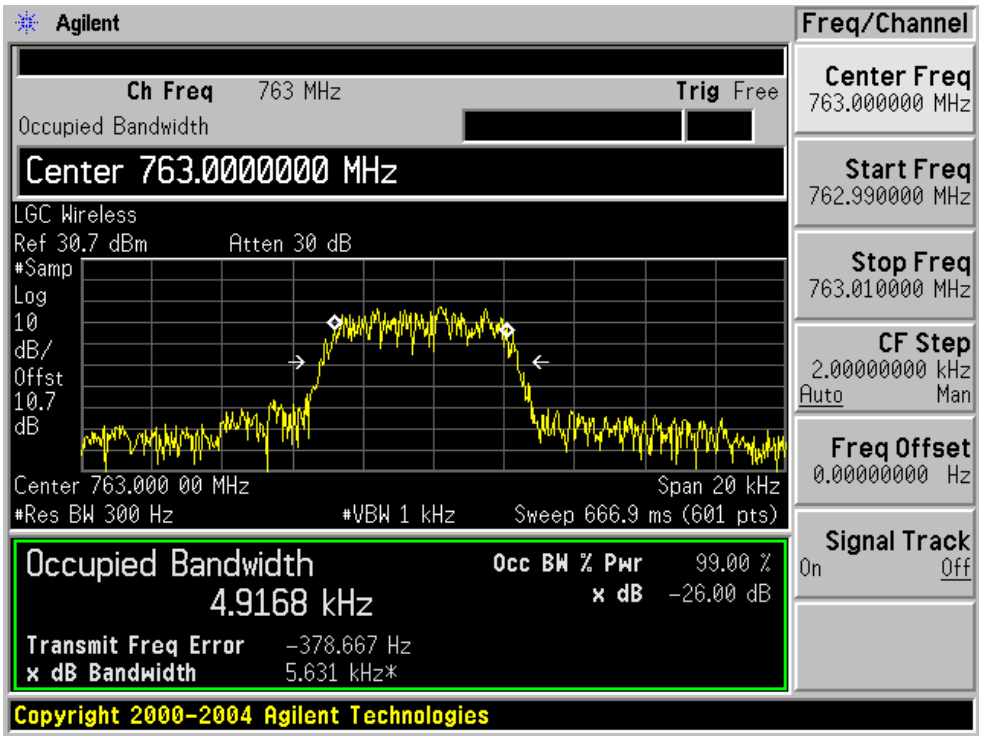


**CQPSK Band: Downlink**

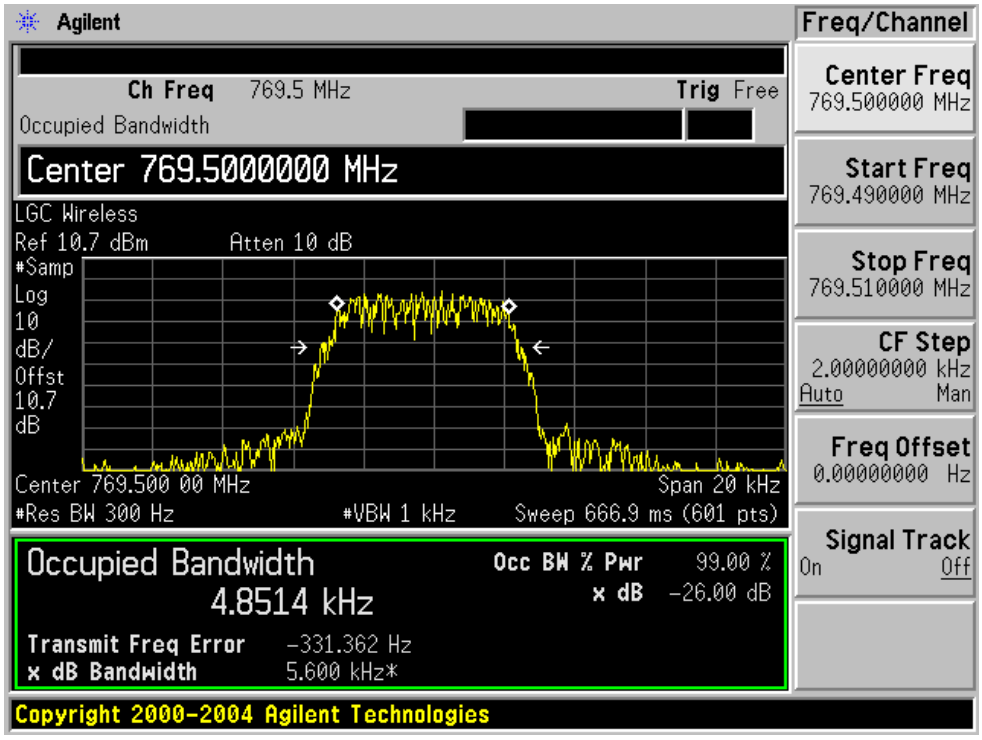
**Low Channel (Input)**



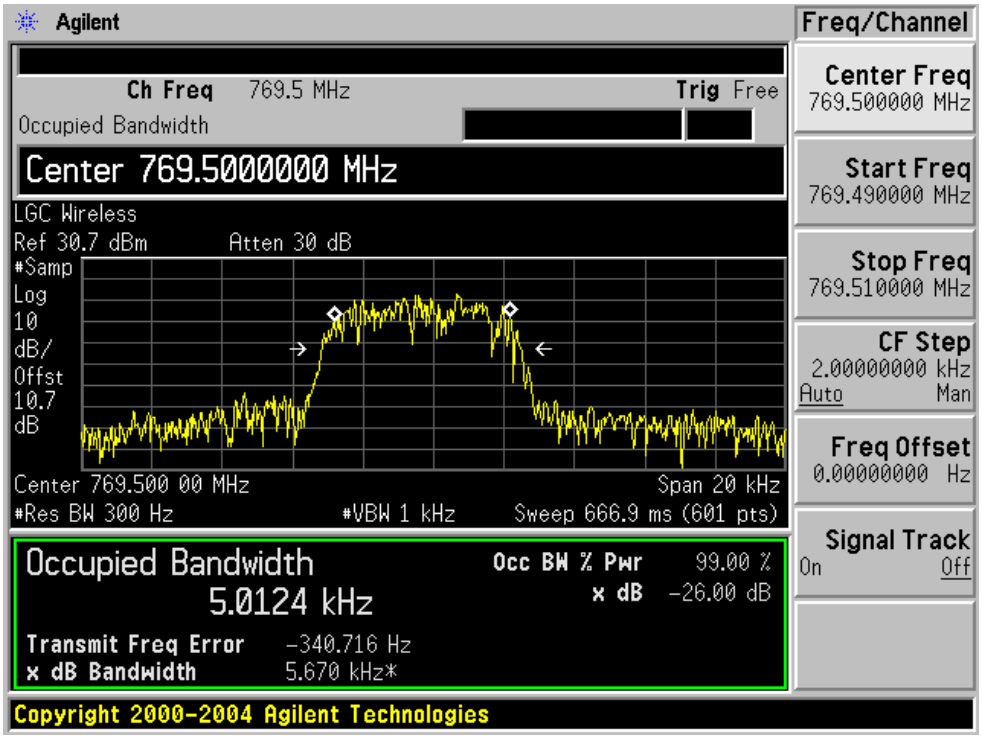

**Low Channel (Output)**



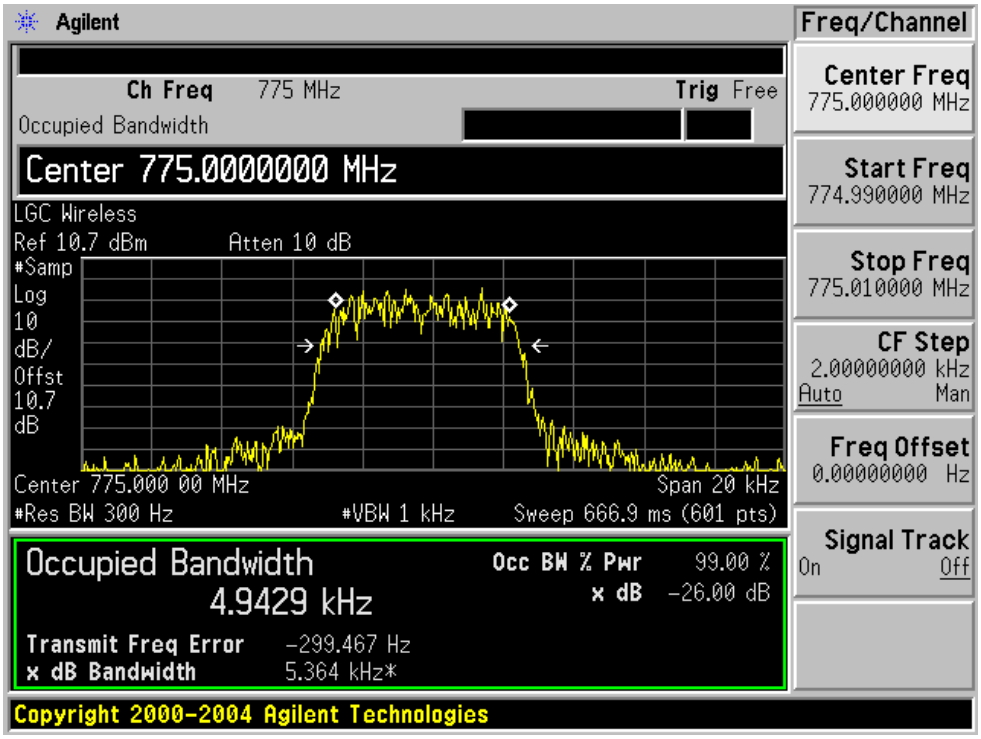
**Middle Channel Input)**



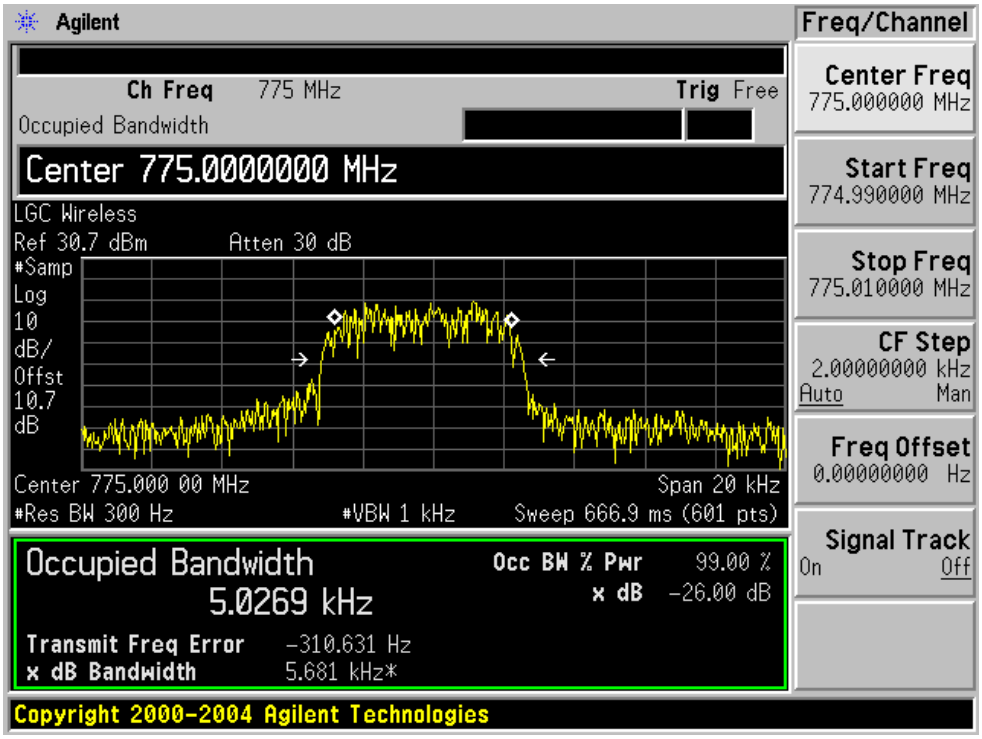

**Middle Channel (Output)**



**High Channel (Input)**

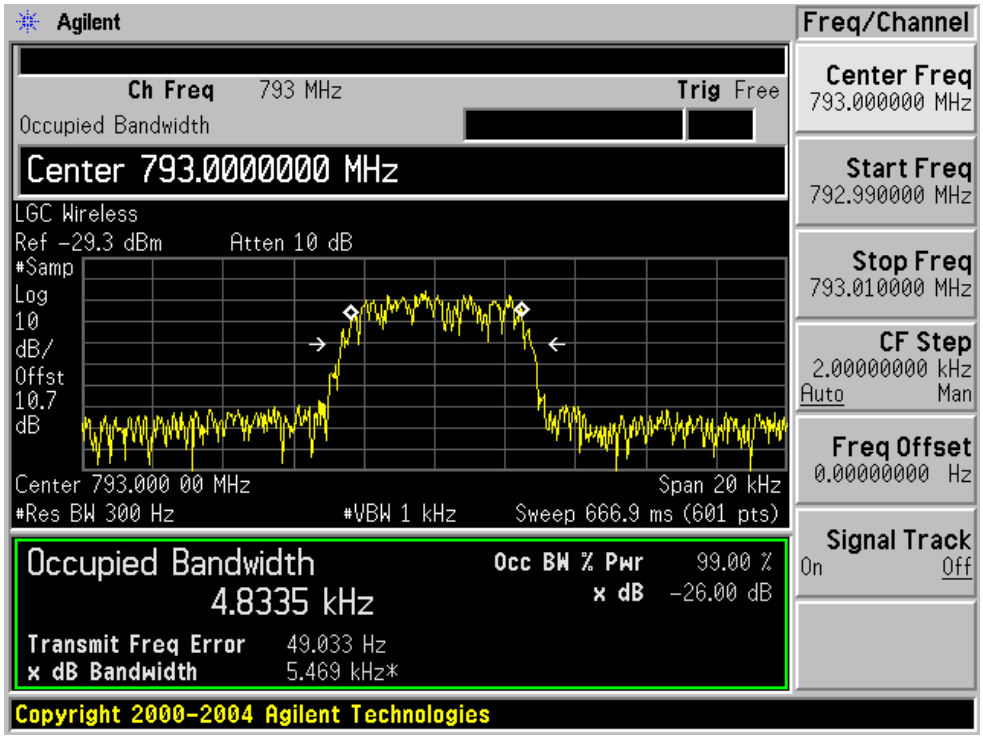



**High Channel (Output)**

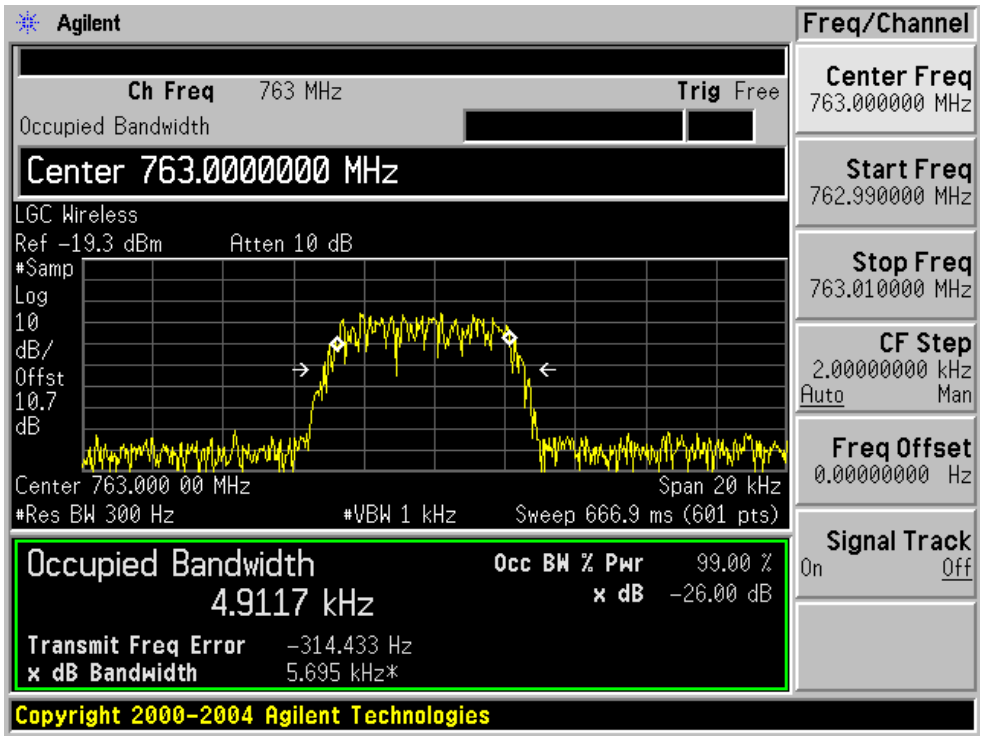


**CQPSK Band: Uplink**

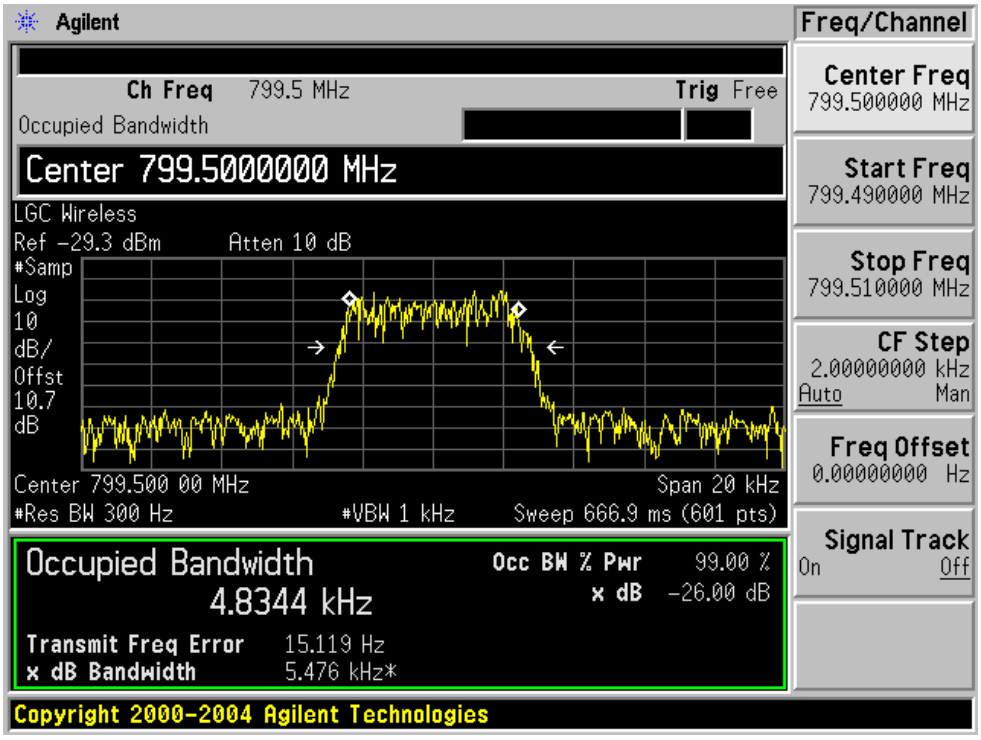
**Low Channel (Input)**



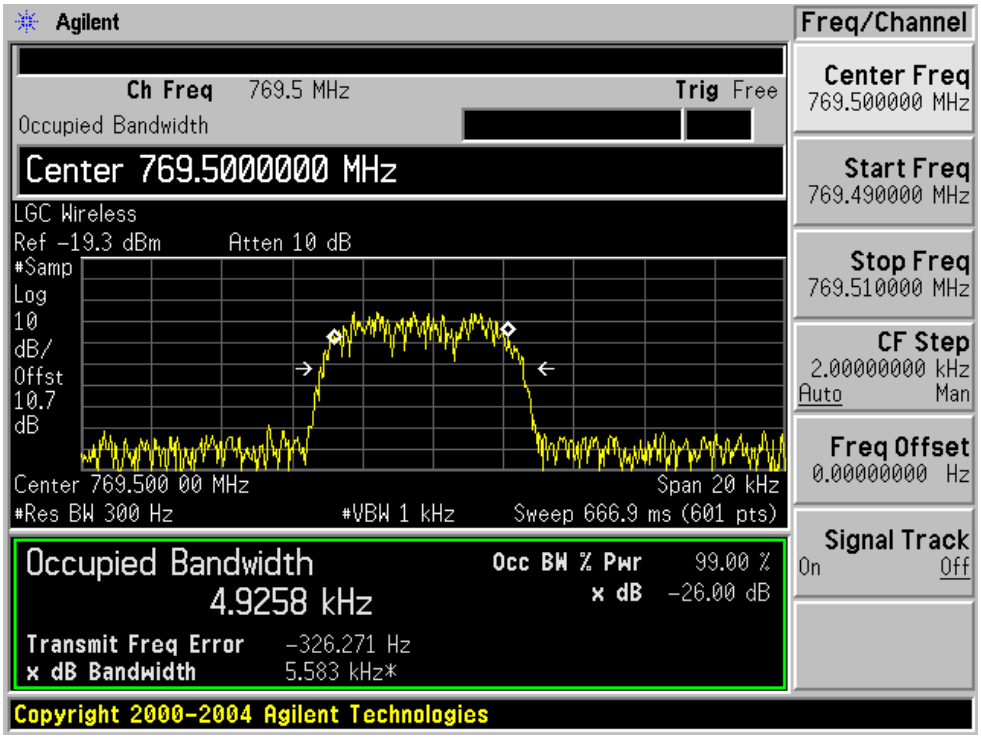

**Low Channel (Output)**



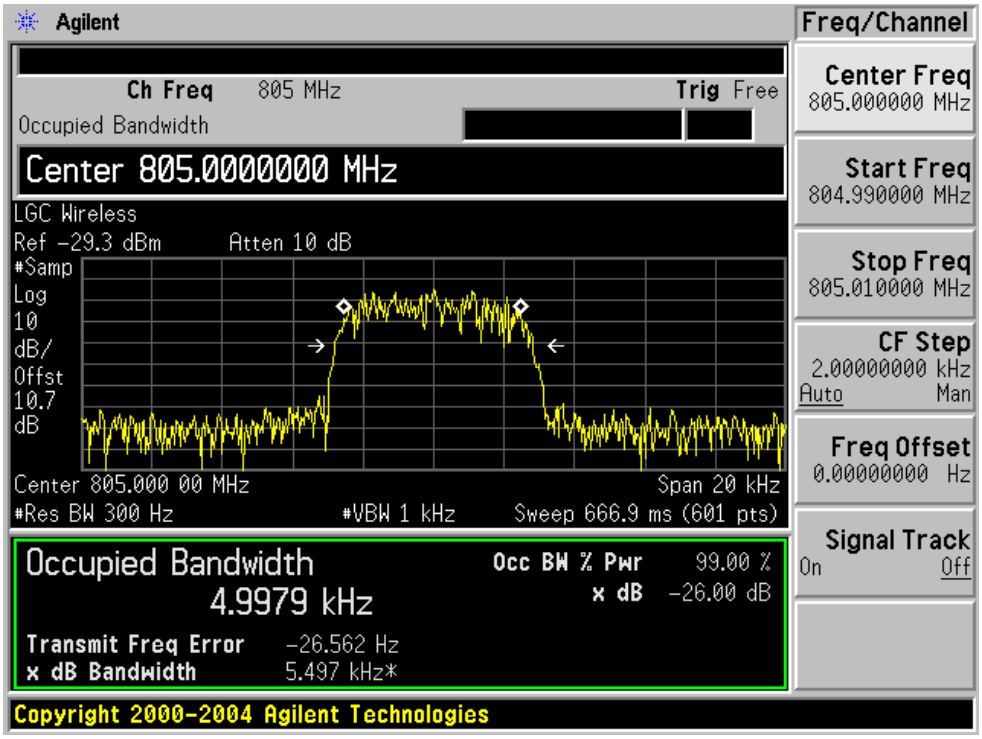
**Middle Channel (Input)**



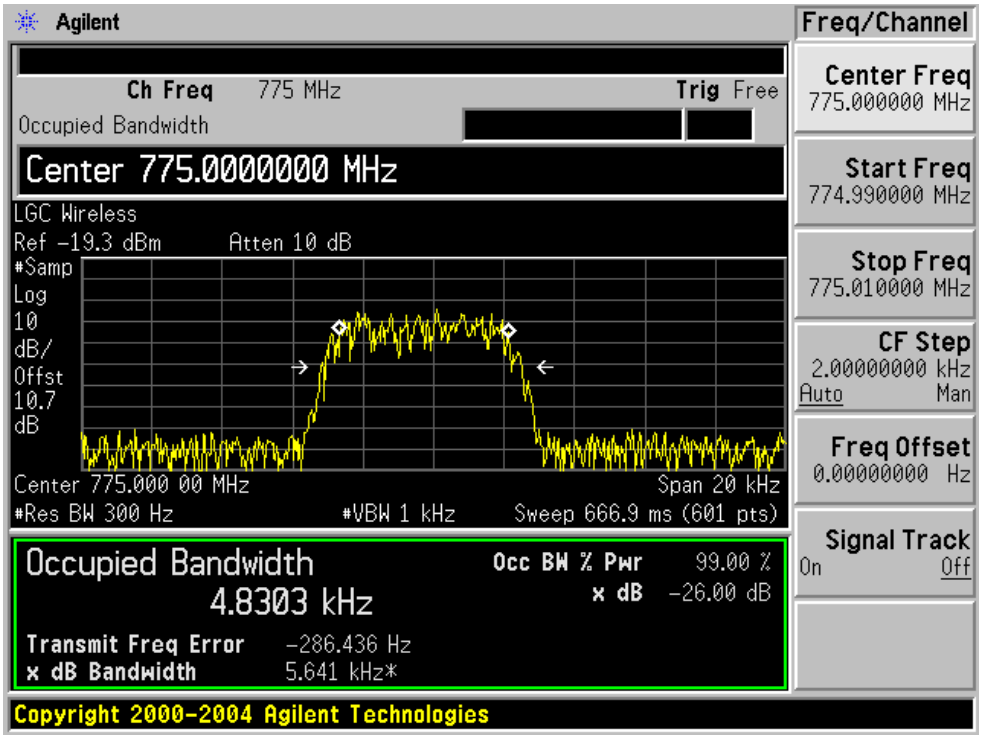

**Middle Channel (Output)**



**High Channel (Input)**

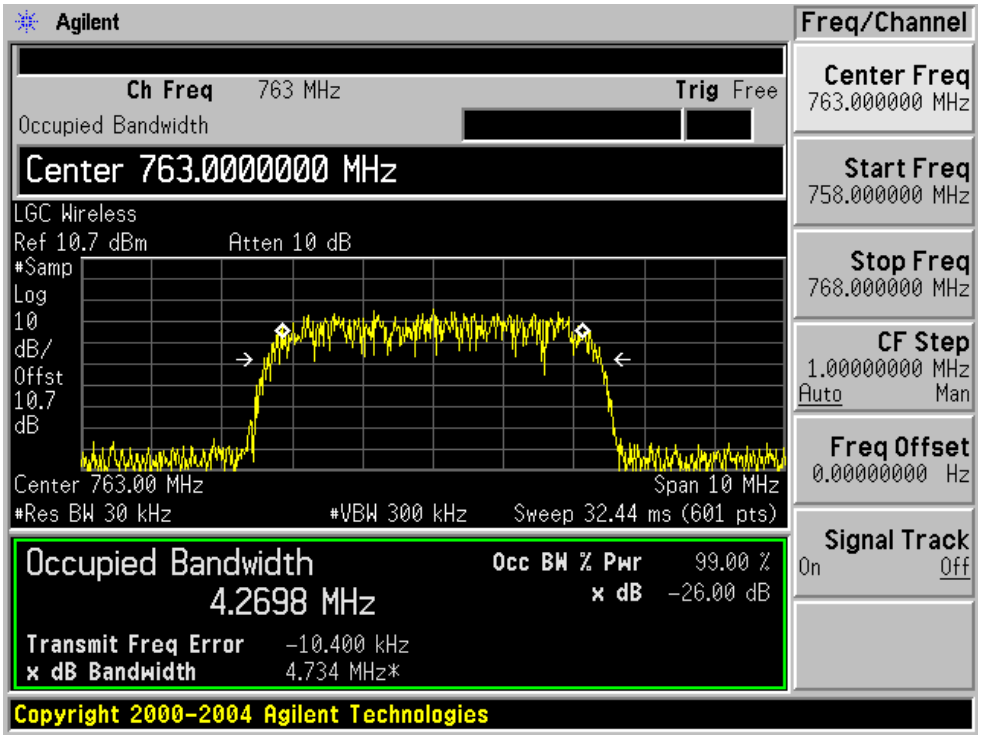



**High Channel (Output)**

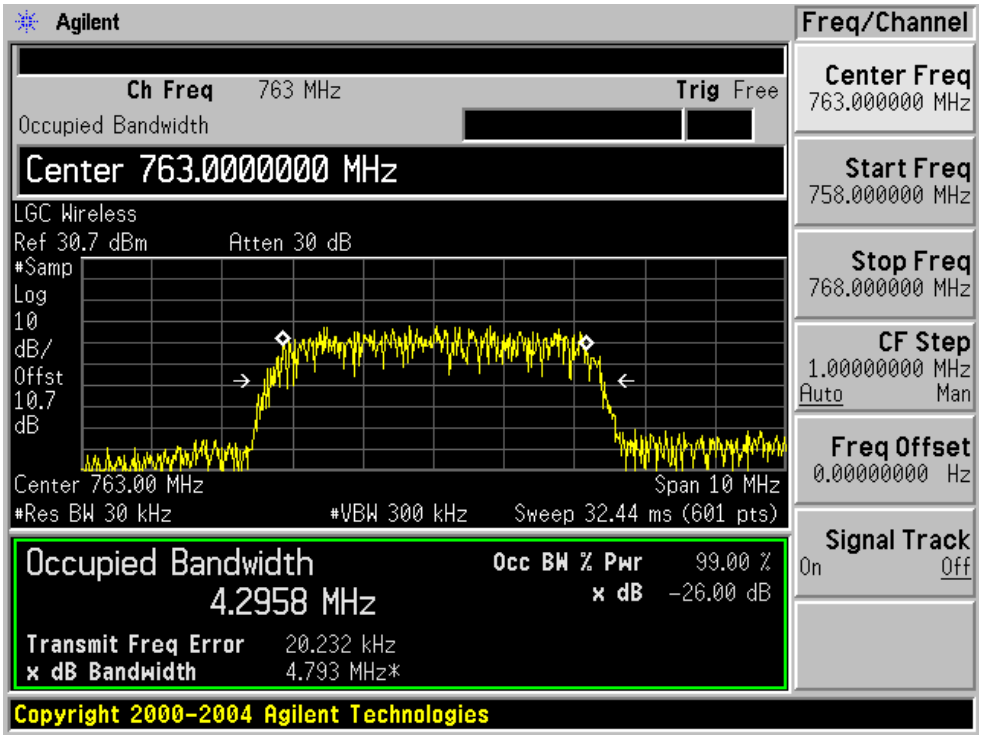


**WCDMA Band: Downlink**

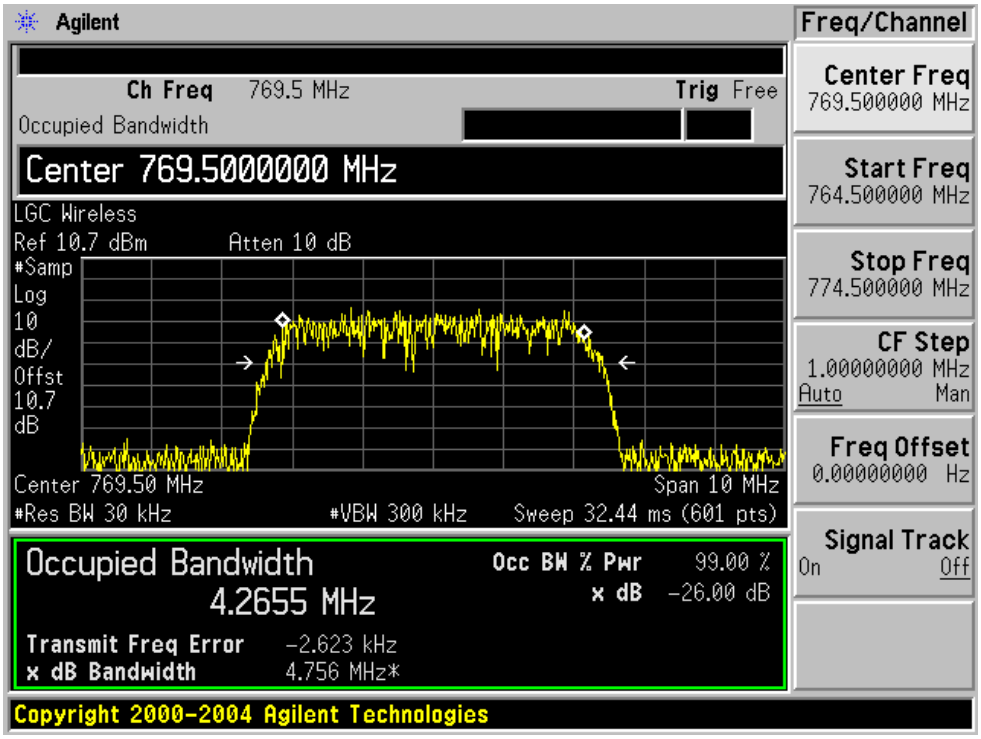
**Low Channel (Input)**



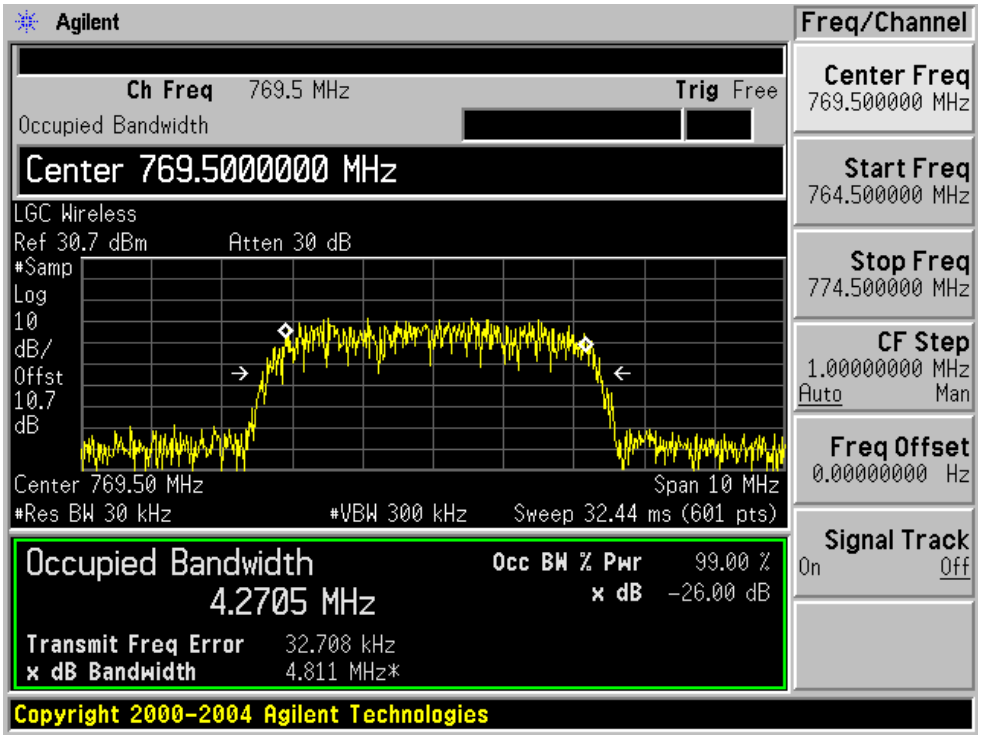

**Low Channel (Output)**



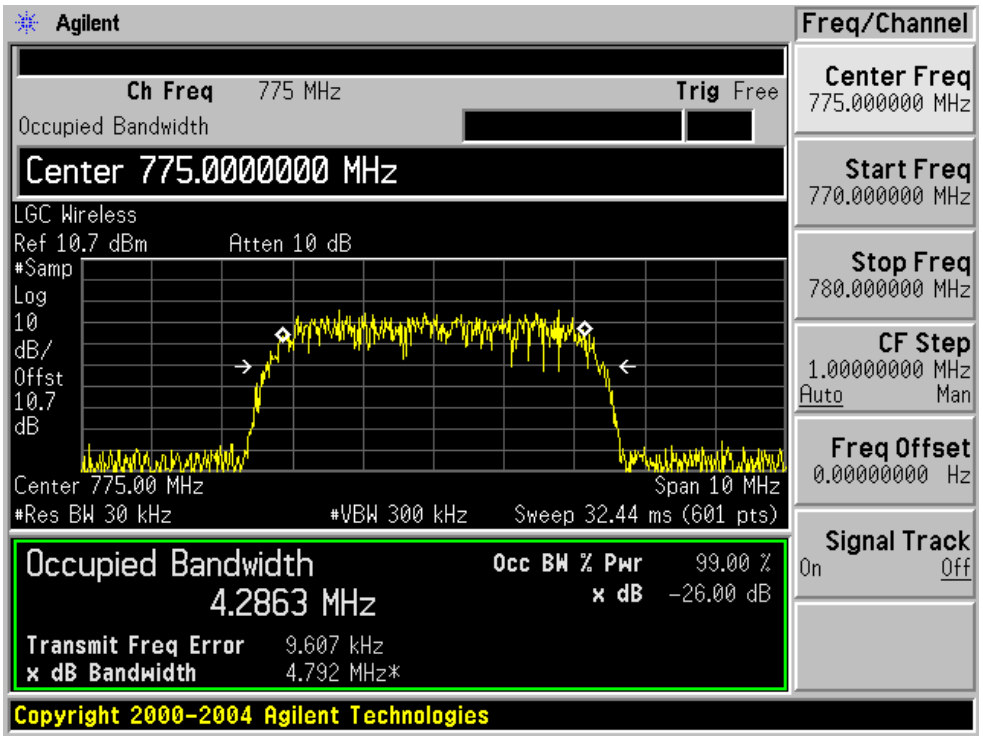
**Middle Channel (Input)**



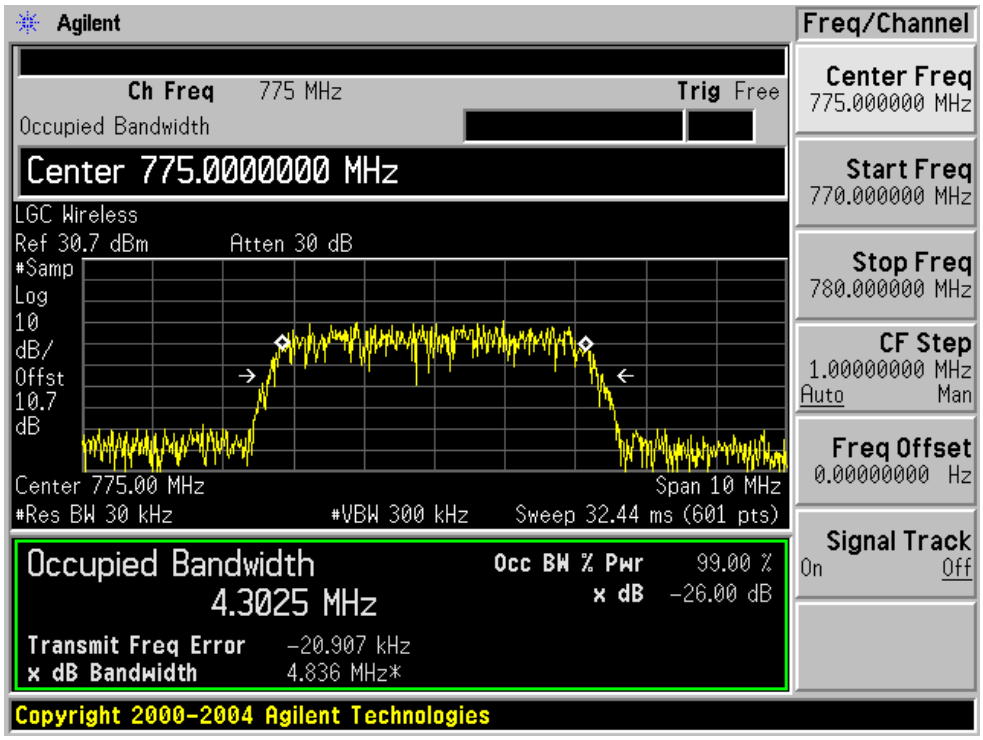

**Middle Channel (Output)**



**High Channel (Input)**

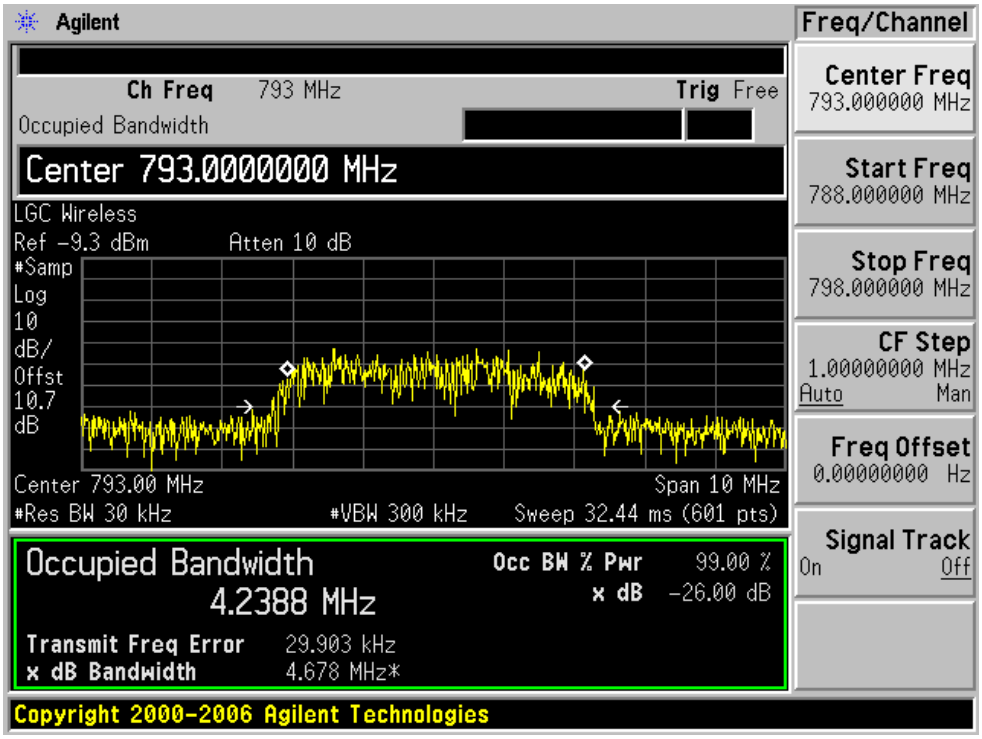



**High Channel (Output)**

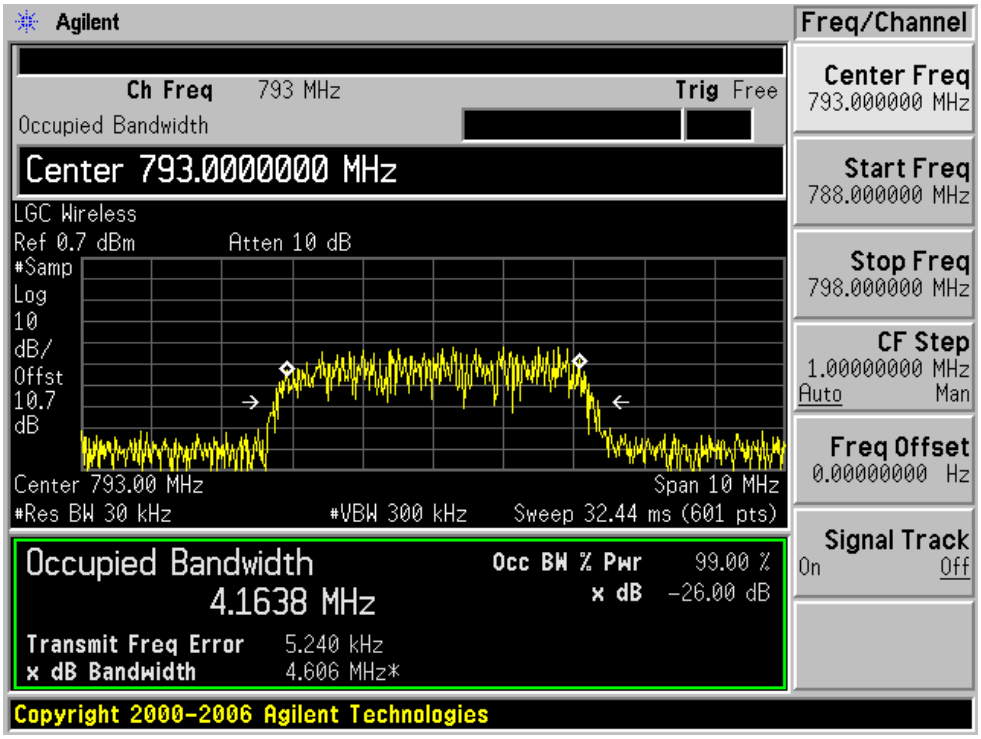


**WCDMA Band: Uplink**

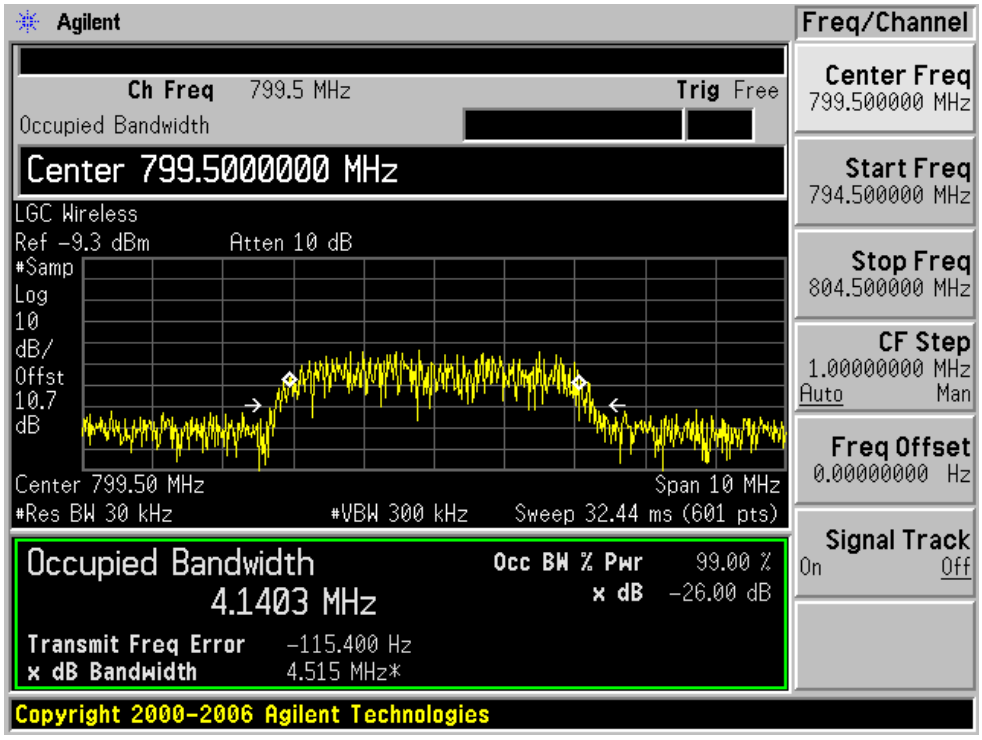
**Low Channel (Input)**



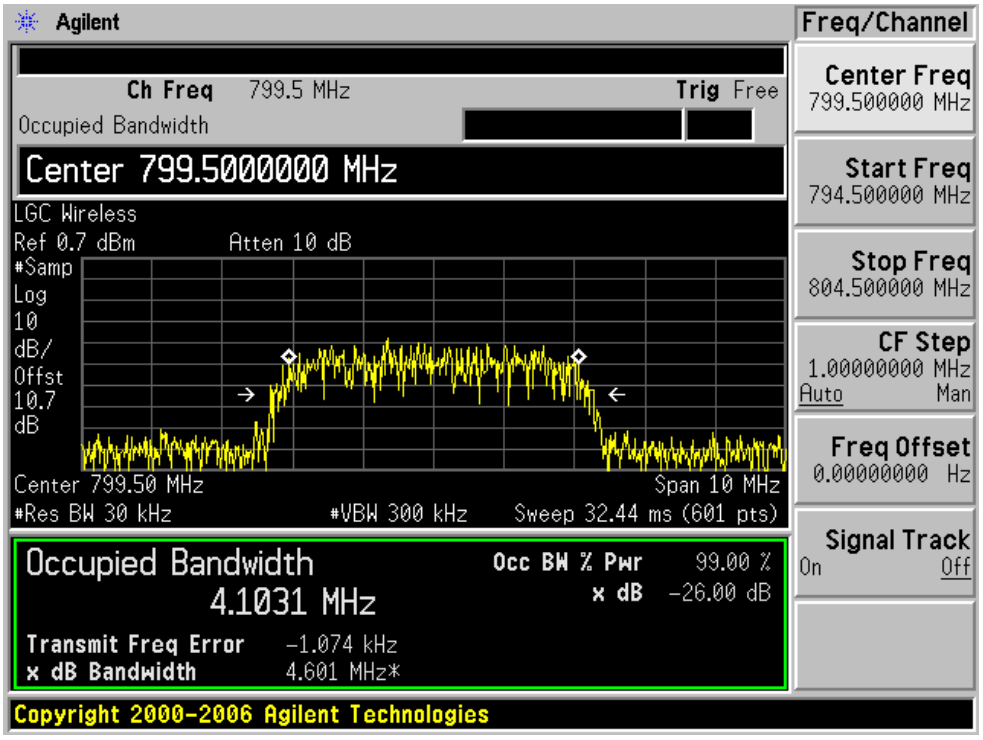

**Low Channel (Output)**



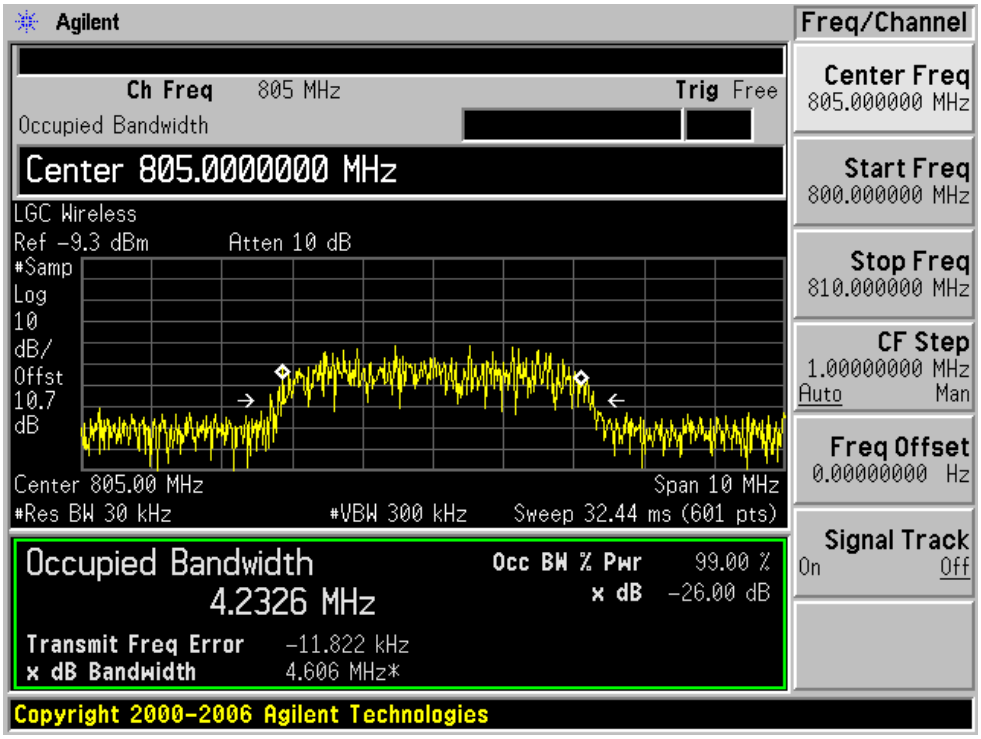
**Middle Channel (Input)**



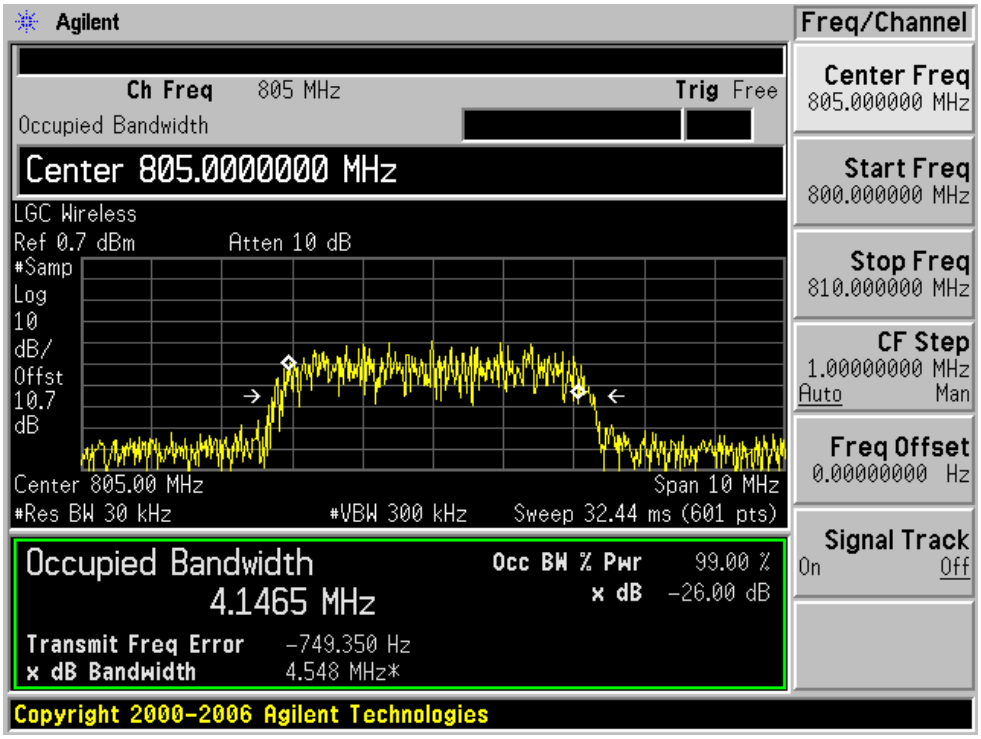

**Middle Channel (Output)**



**High Channel (Input)**

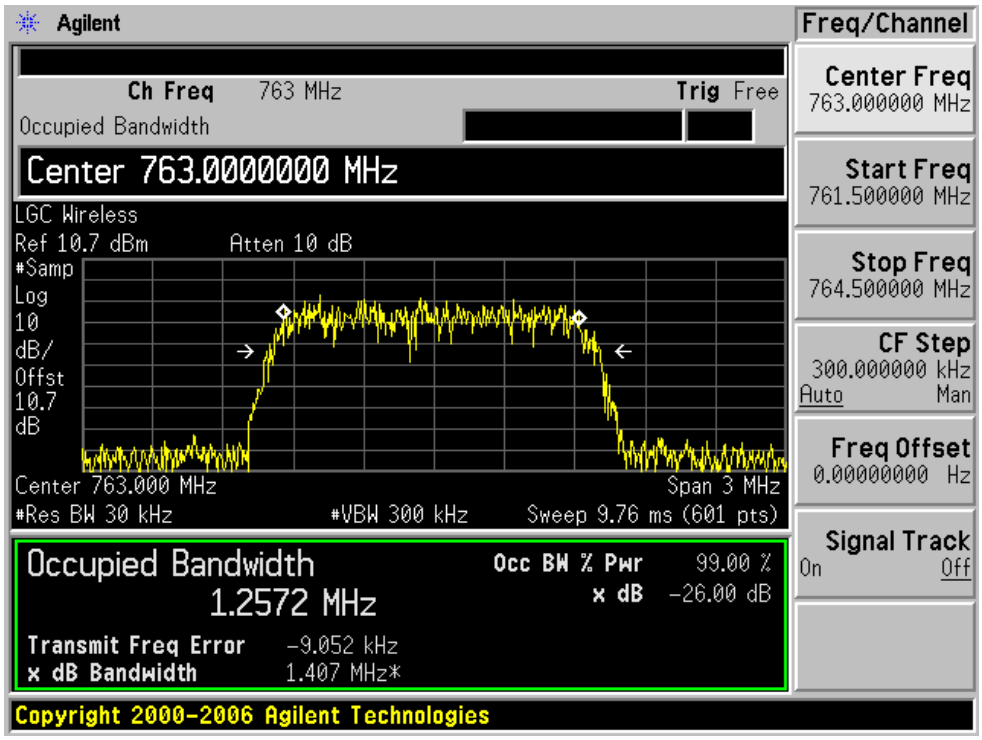



**High Channel (Output)**

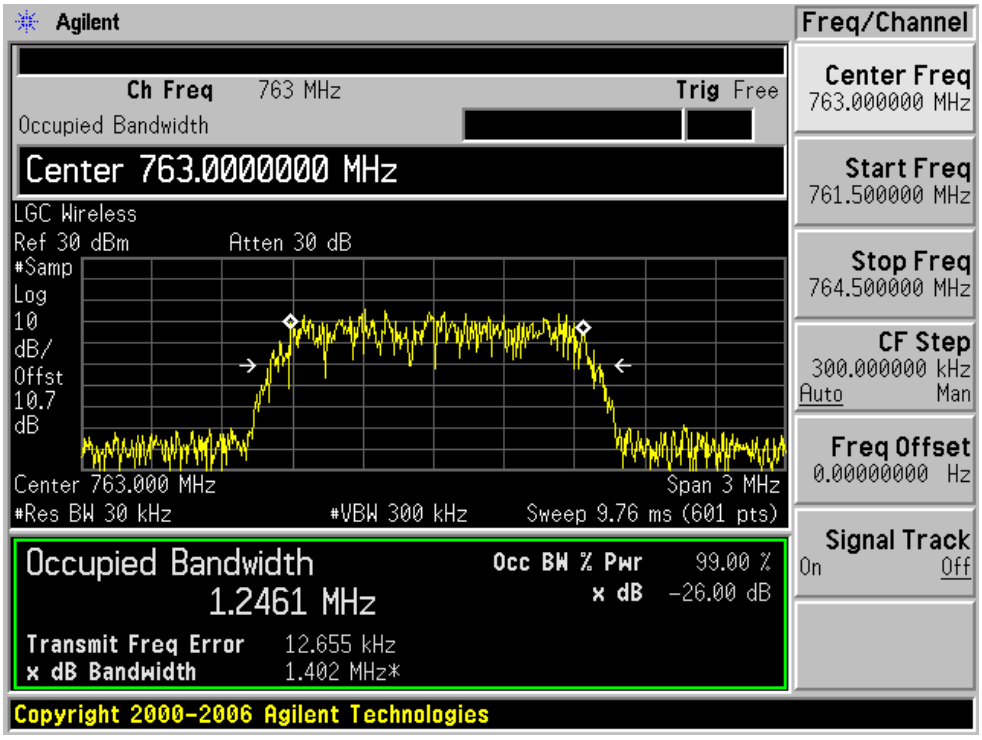


**CDMA2000 Band: Downlink**

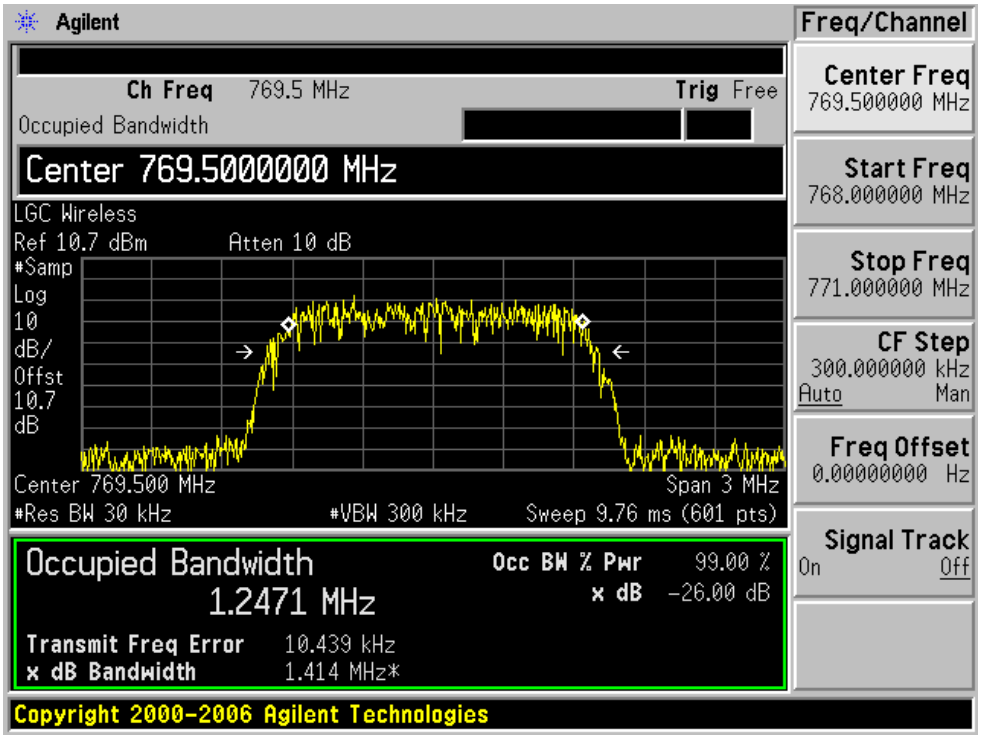
**Low Channel (Input)**



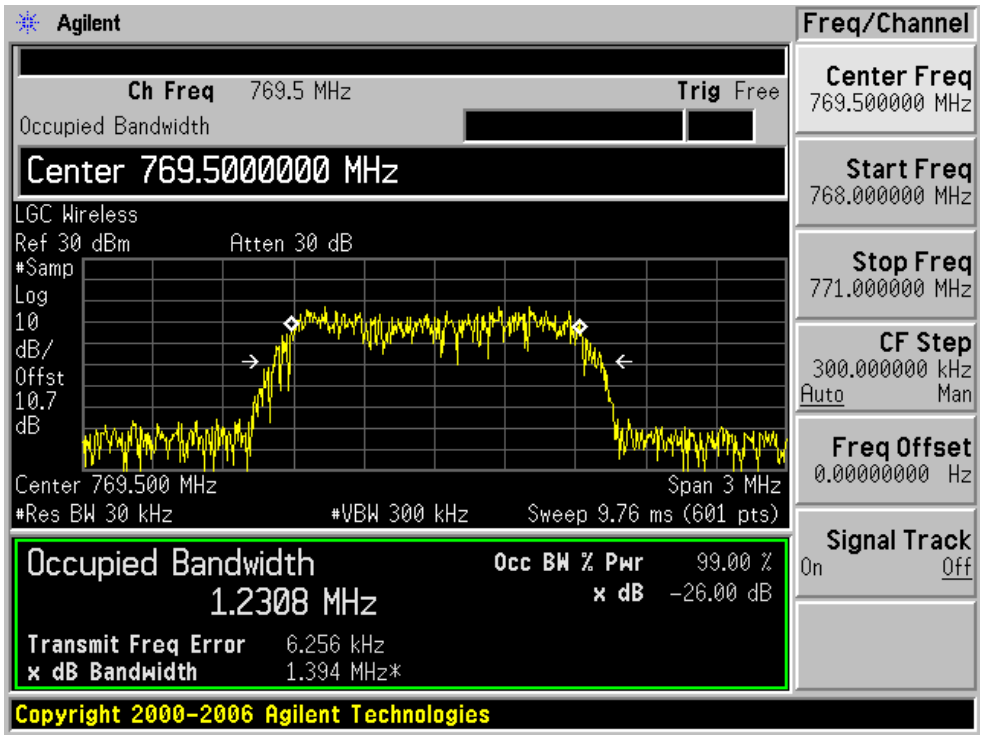

**Low Channel (Output)**



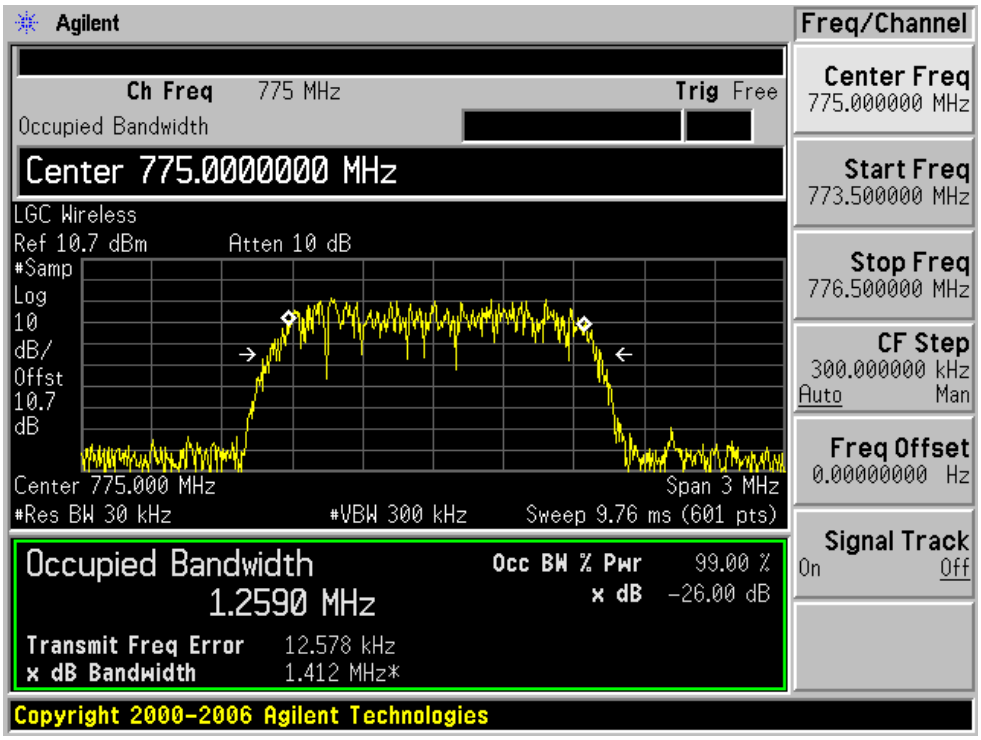
**Middle Channel (input)**



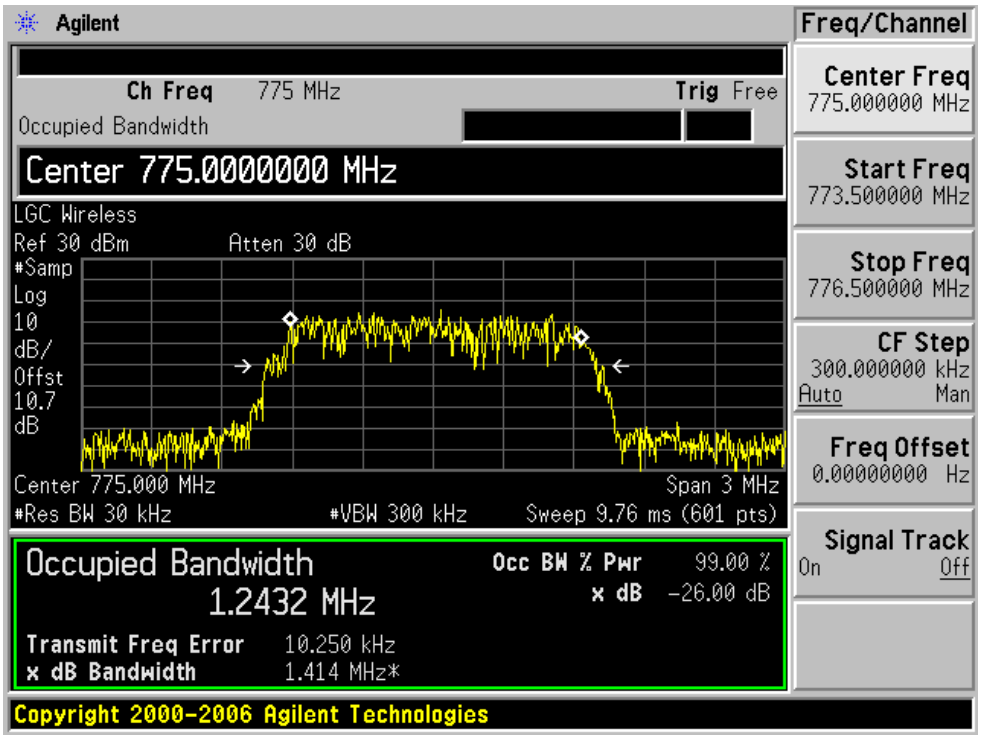

**Middle Channel (Output)**



**High Channel (Input)**

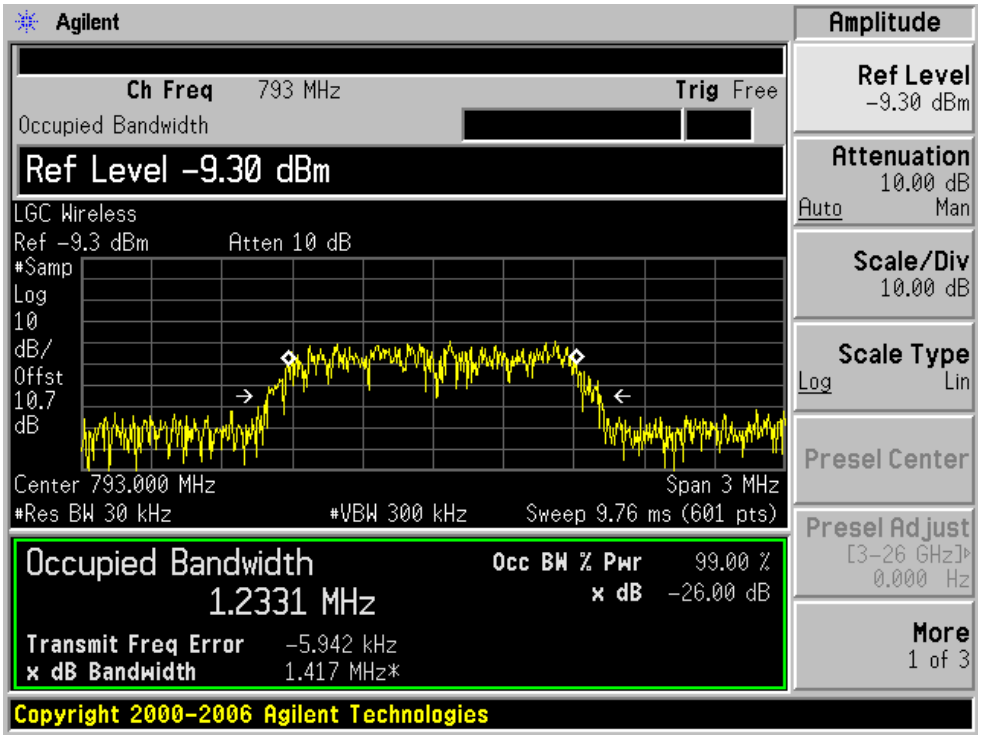



**High Channel (Output)**

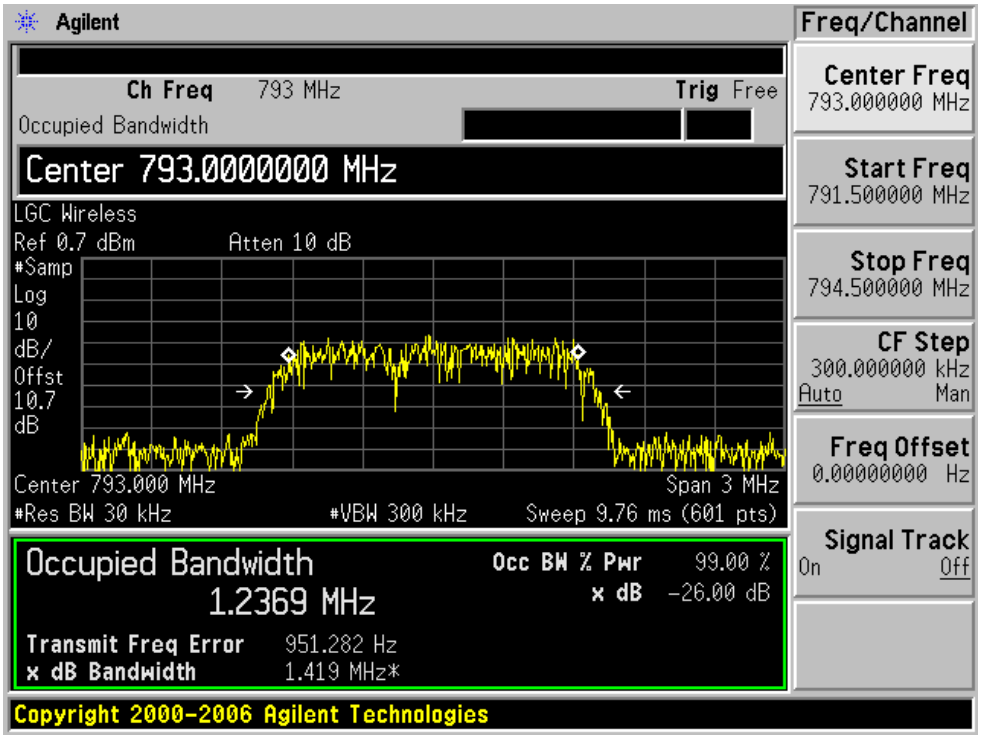


**CDMA2000 Band: Uplink**

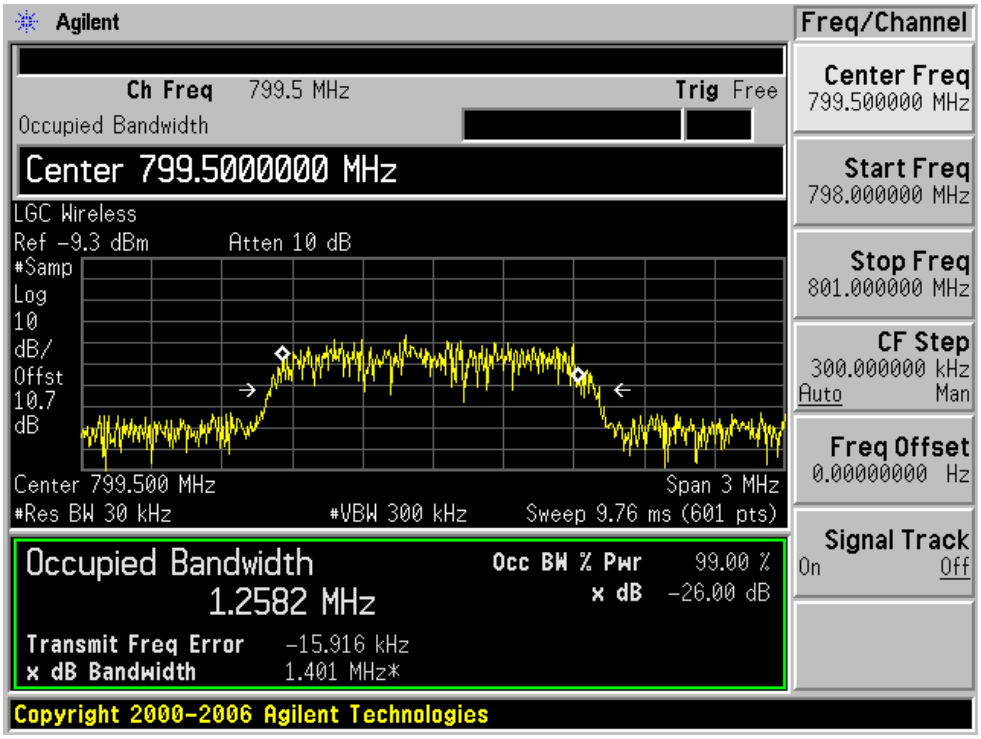
**Low Channel (Input)**



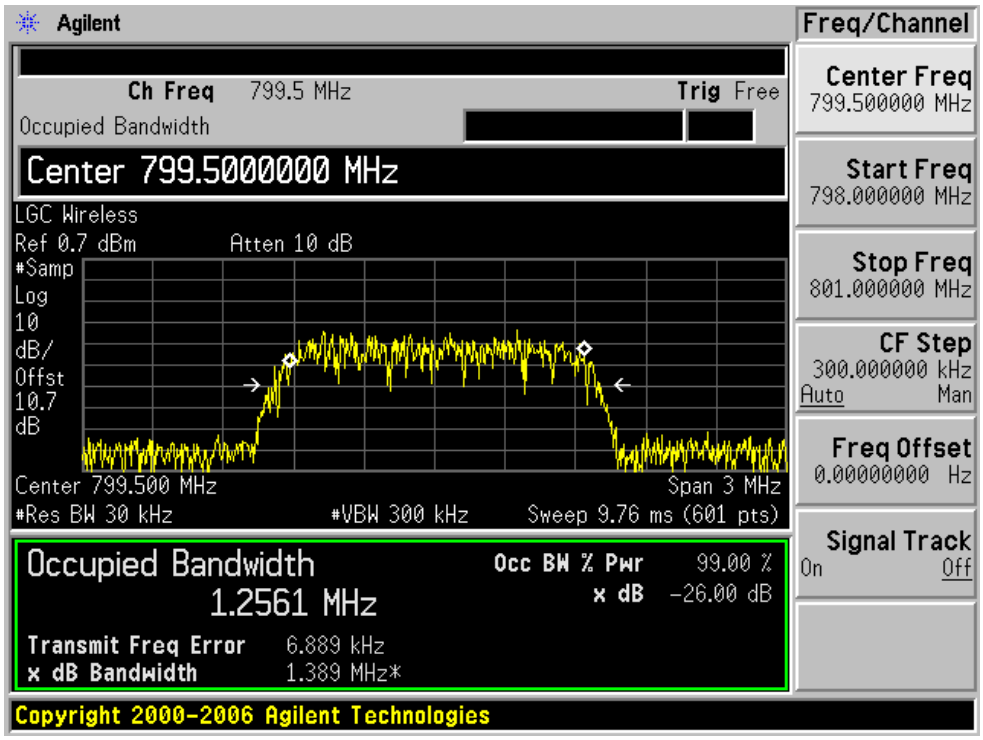

**Low Channel (Output)**



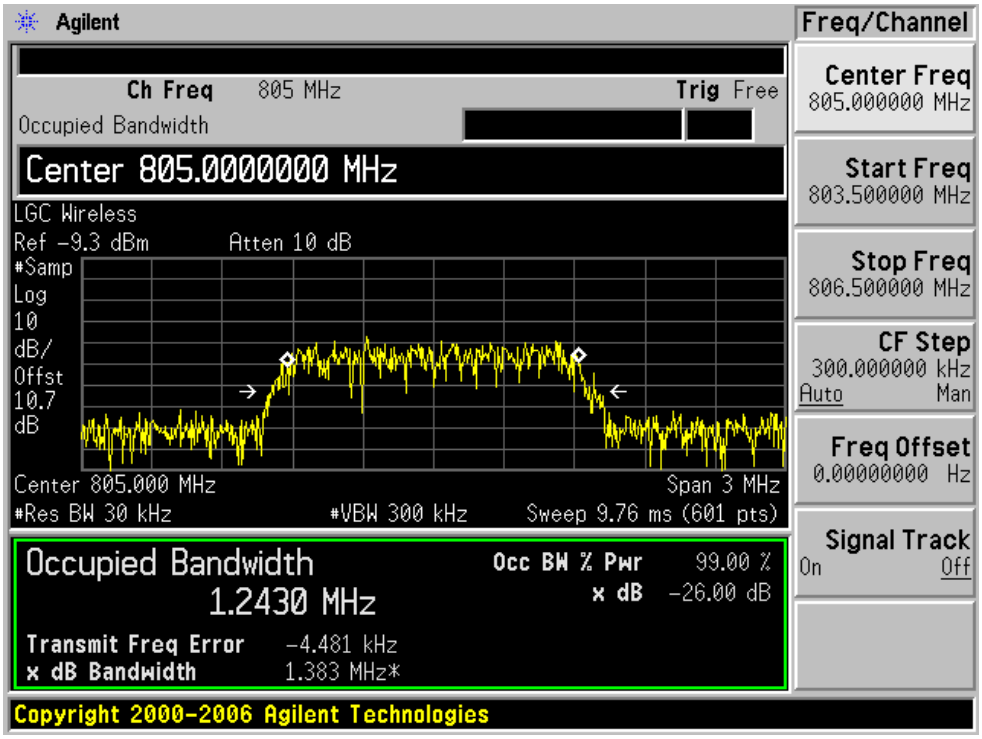
**Middle Channel (Input)**



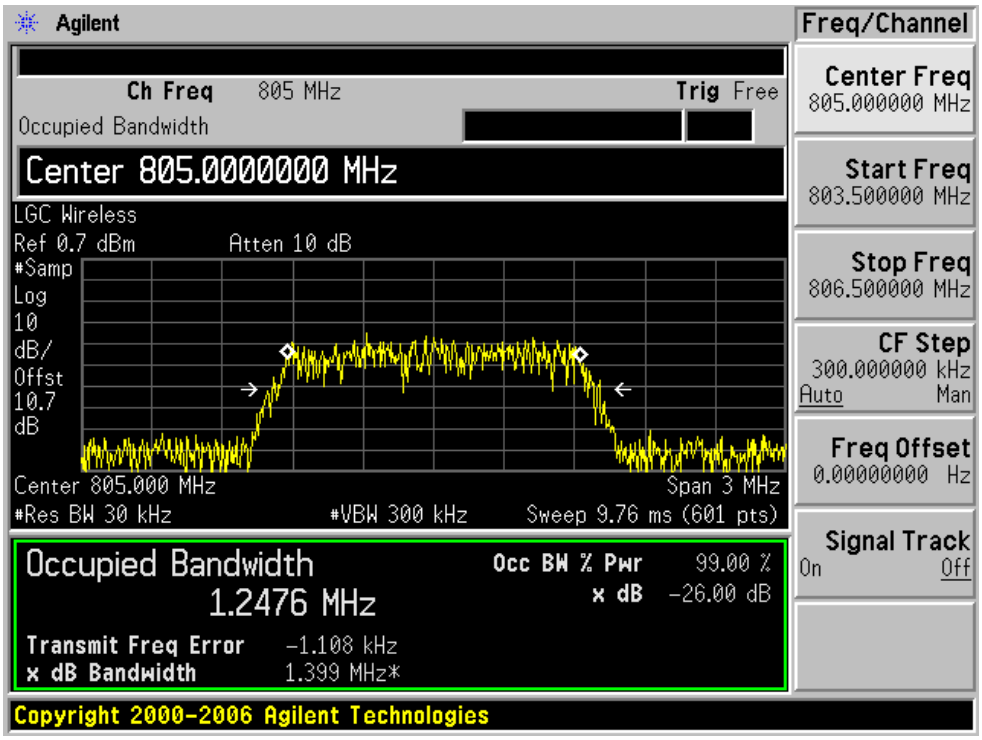

**Middle Channel (Output)**



**High Channel (Input)**

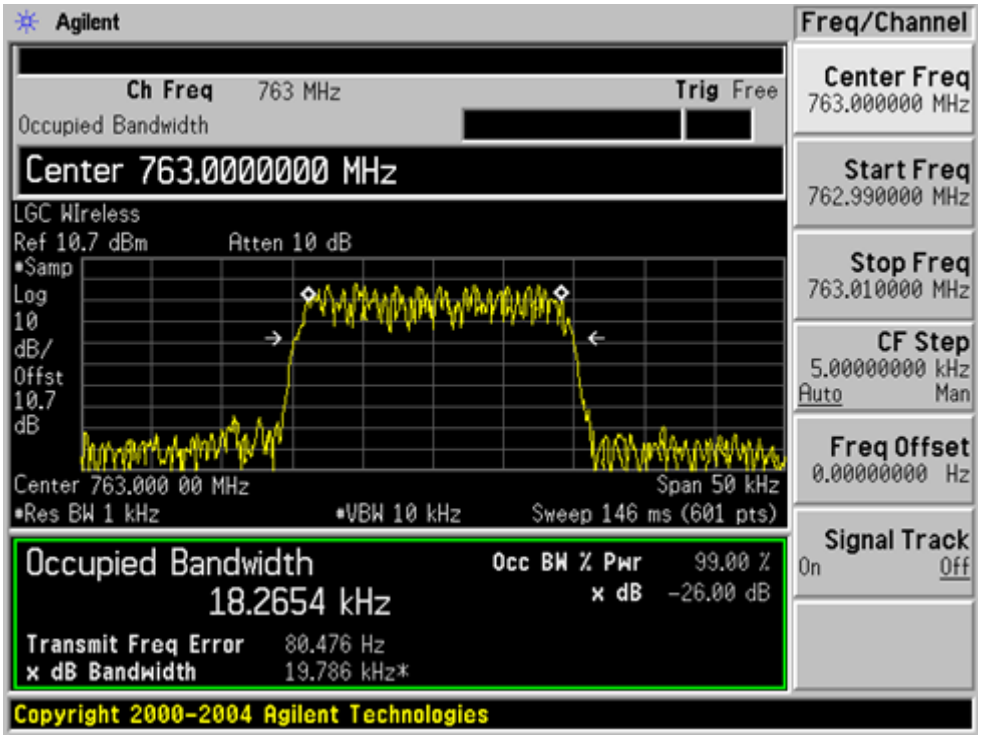



**High Channel (Output)**

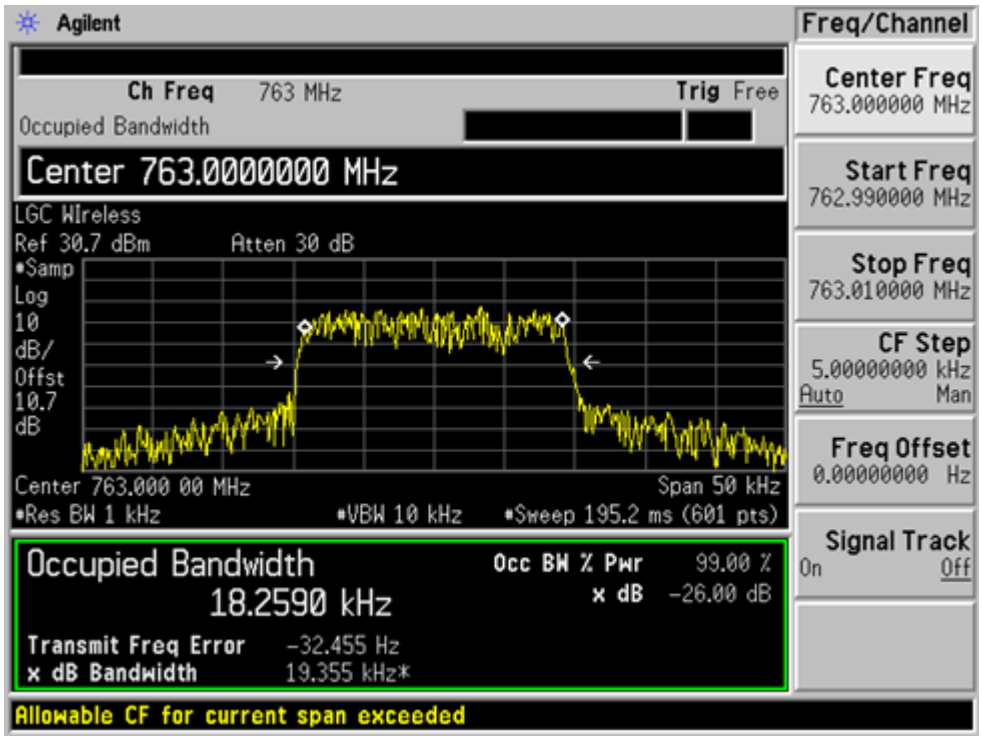


**IDEN Band: Downlink**

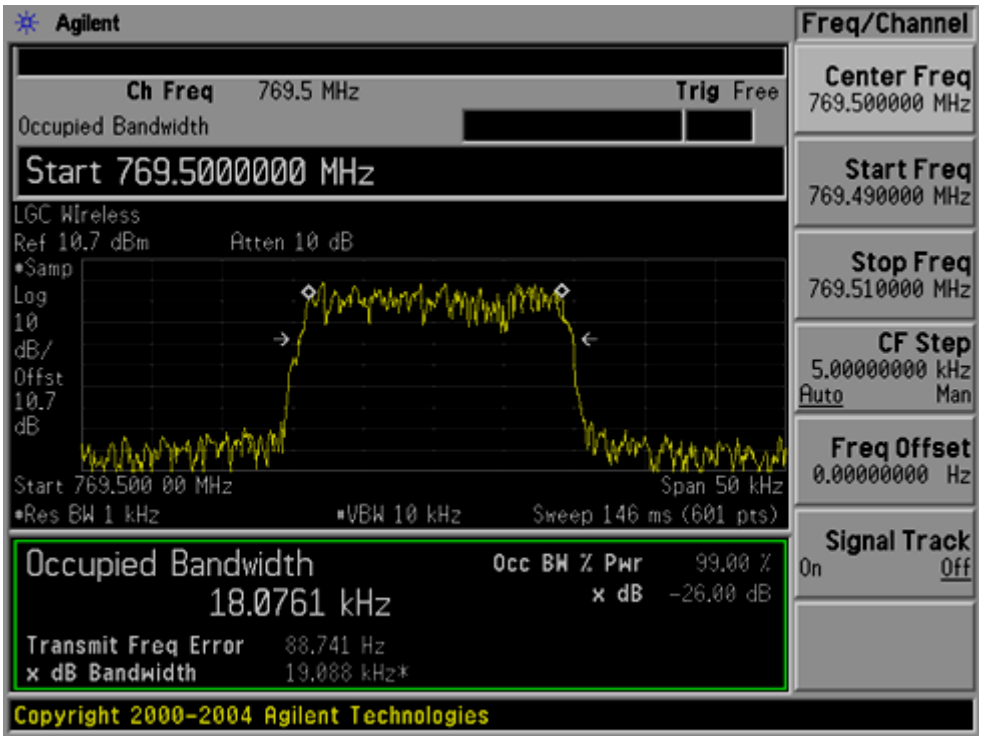
**Low Channel (Input)**



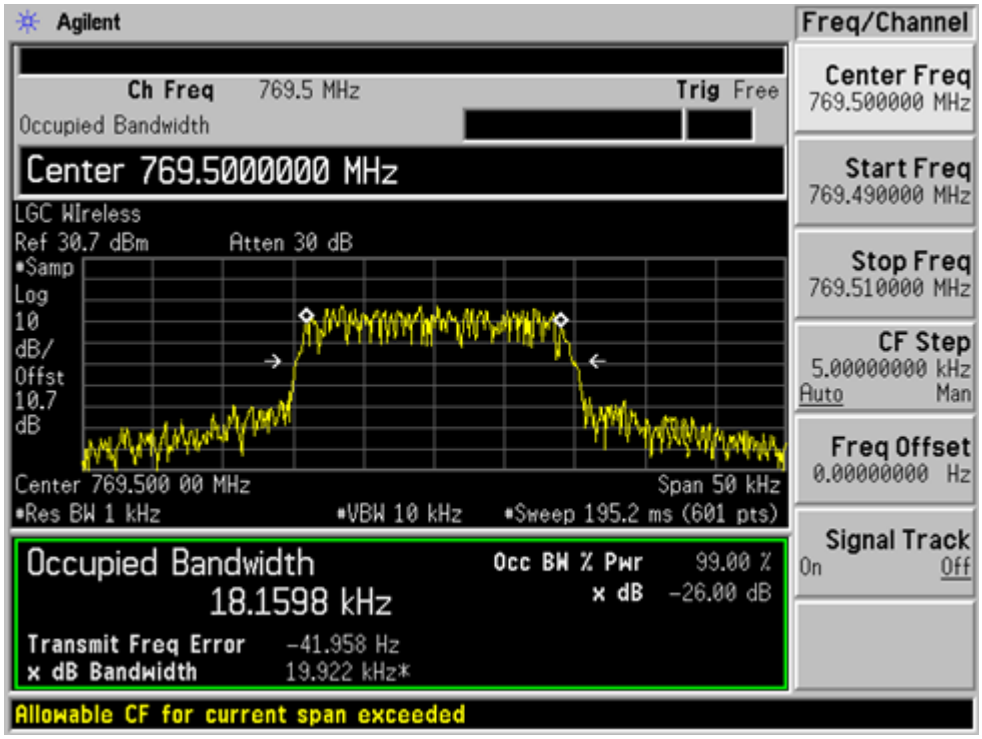

**Low Channel (Output)**



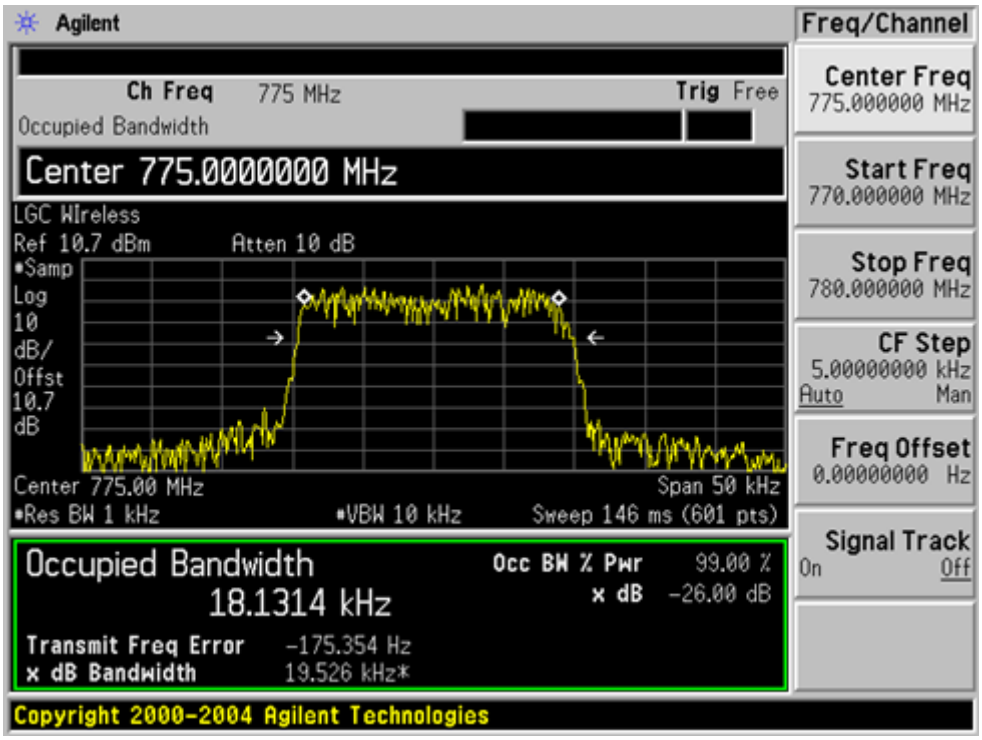
**Middle Channel (Input)**



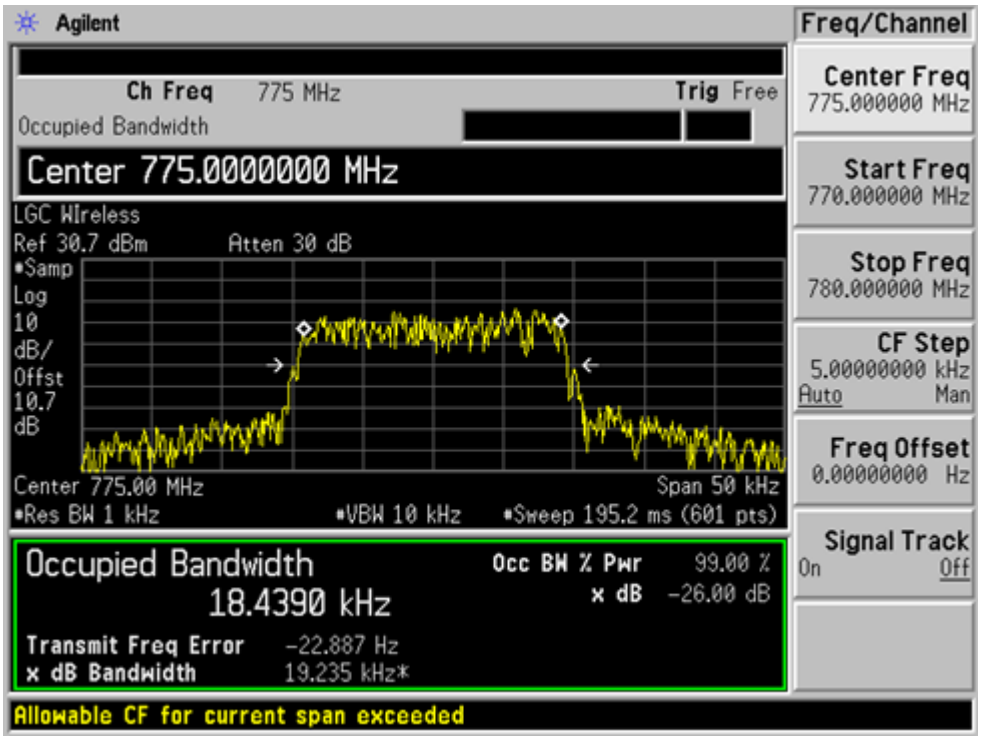

**Middle Channel (Output)**



**High Channel (Input)**

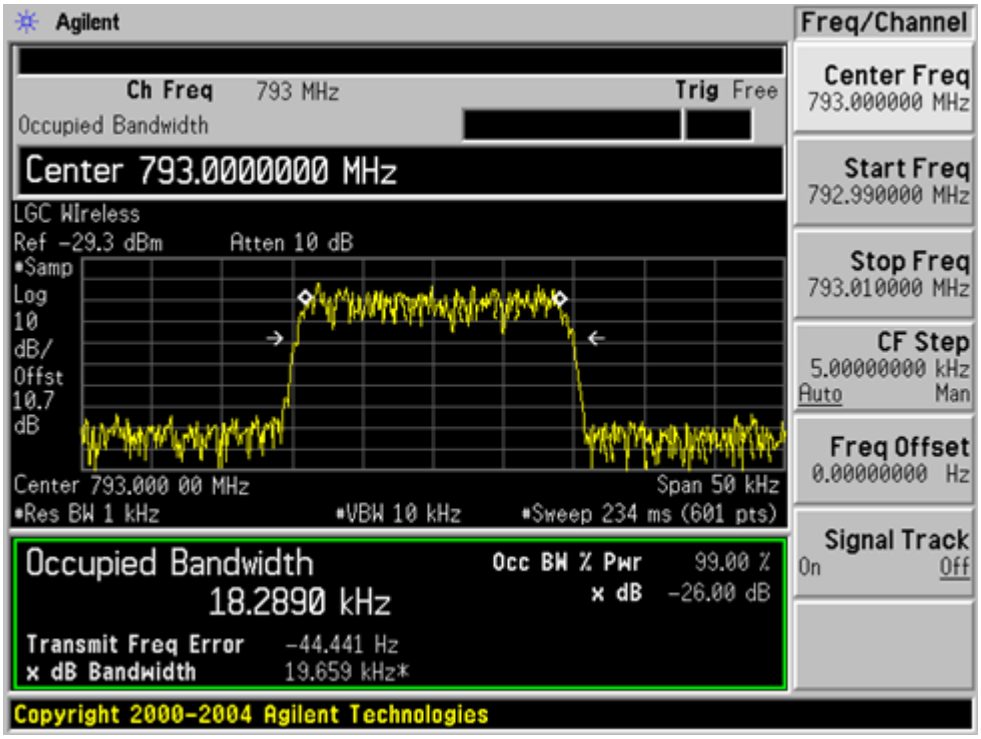



**High Channel (Output)**

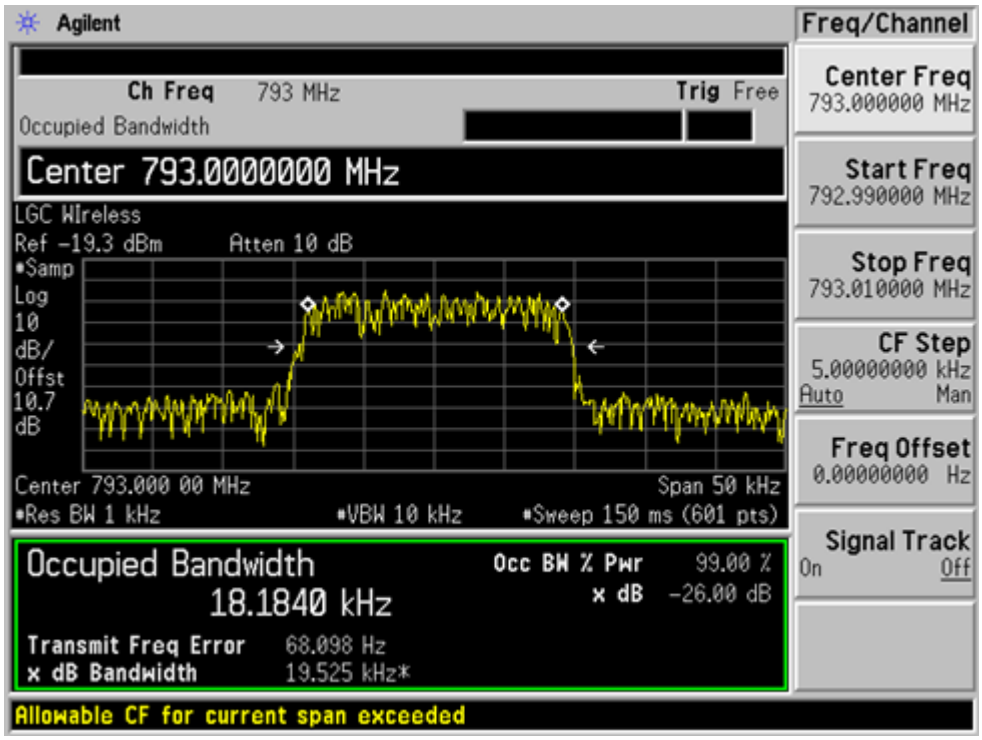


**IDEN: Uplink**

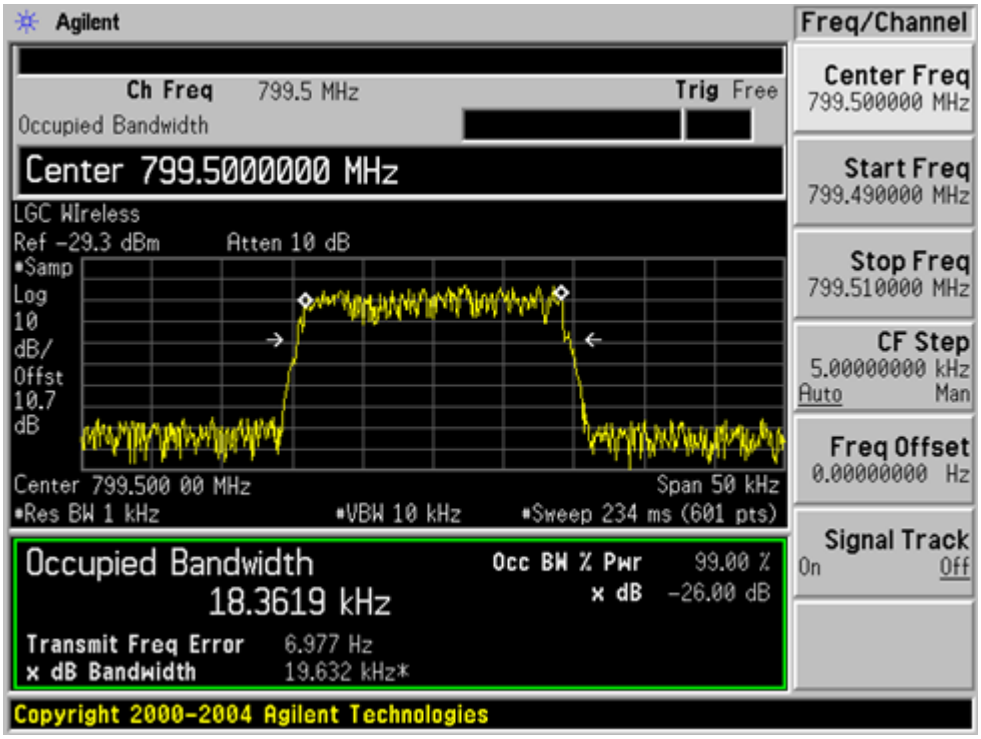
**Low Channel (Input)**



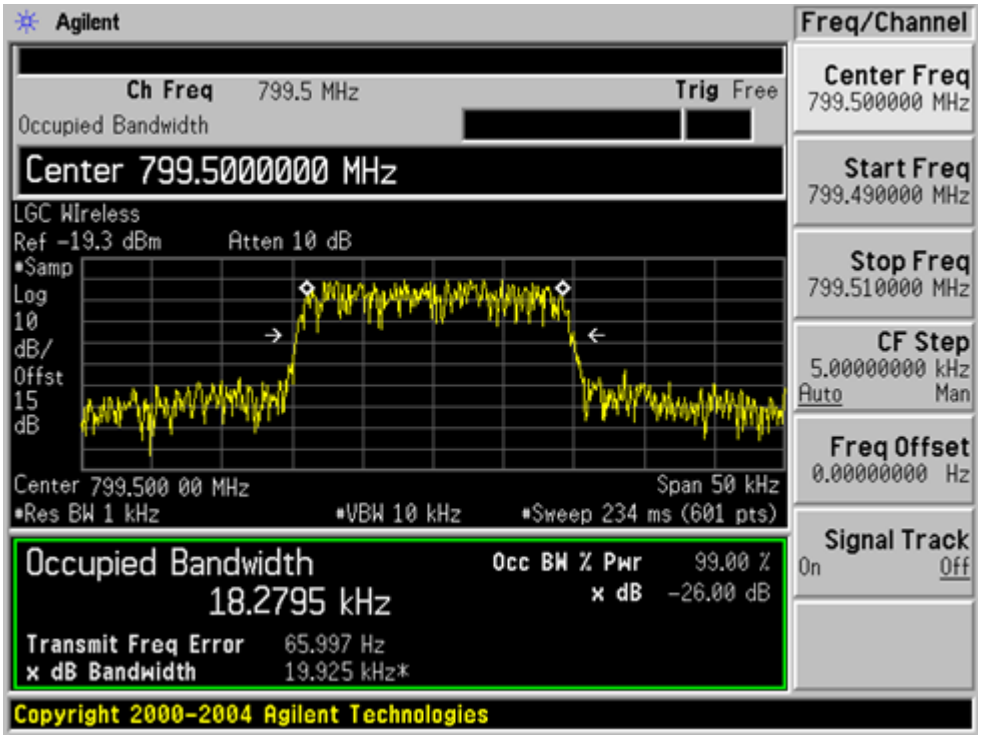

**Low Channel (Output)**



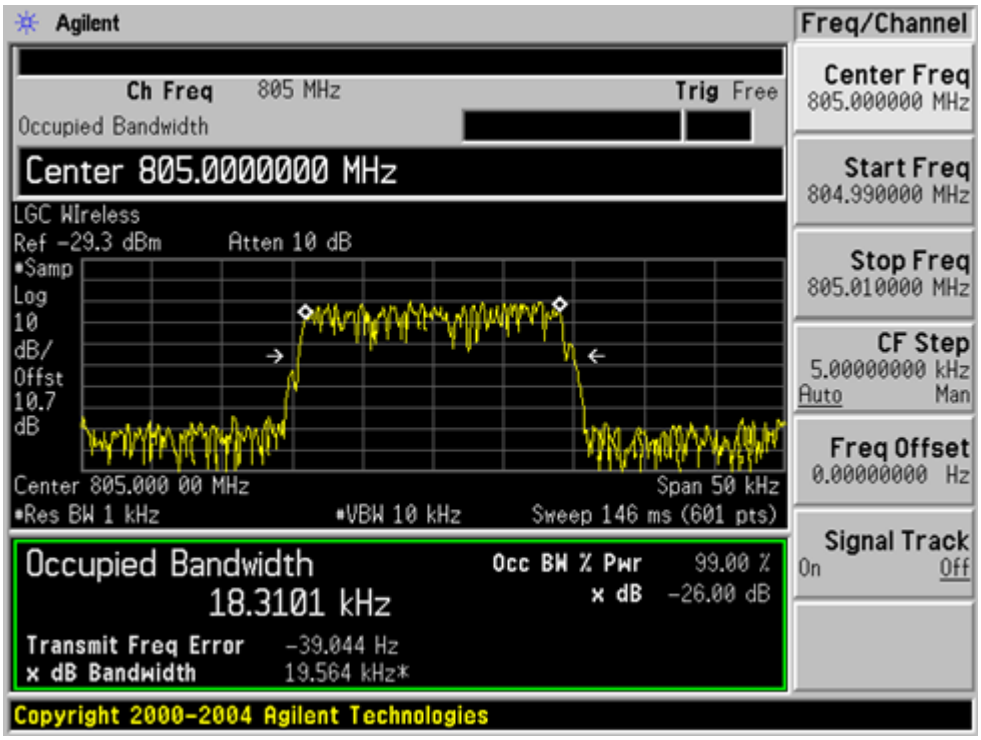
**Middle Channel (Input)**



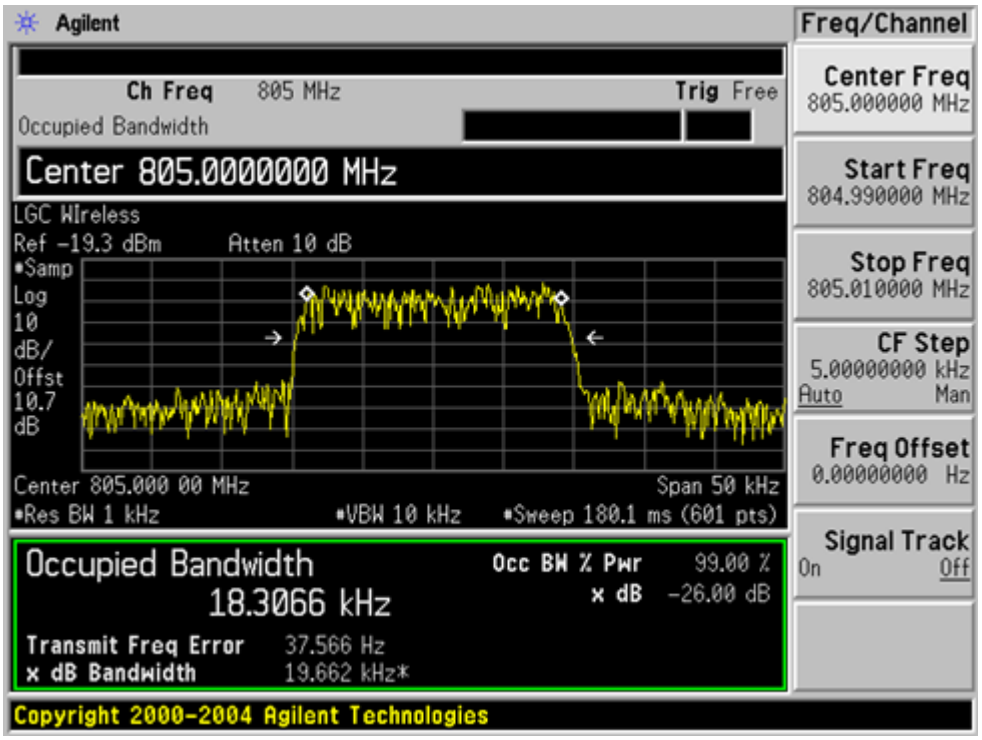

**Middle Channel (Output)**



**High Channel (Input)**




**High Channel (Output)**



# 9 §2.1051 §27.53 & § 90.543 & RSS-119 §5.8 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

## 9.1 Applicable Standard

Requirements: CFR 47 § 2.1051, §27.53, § 90.210, § 90.543 & RSS-119 §5.8.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

## 9.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10$^{th}$ harmonic.

### 9.2.1 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 9.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| HP | Analyzer, Spectrum | 8565EC | 3946A00131 | 2007-01-24 |
| Rohde & Schwartz | Signal Generator | SMIQ03 | 849192/0085 | 2007-12-03 |
| Agilent | Vector Signal Generator | ESG44 | US44300386 | 2007-10-10 |

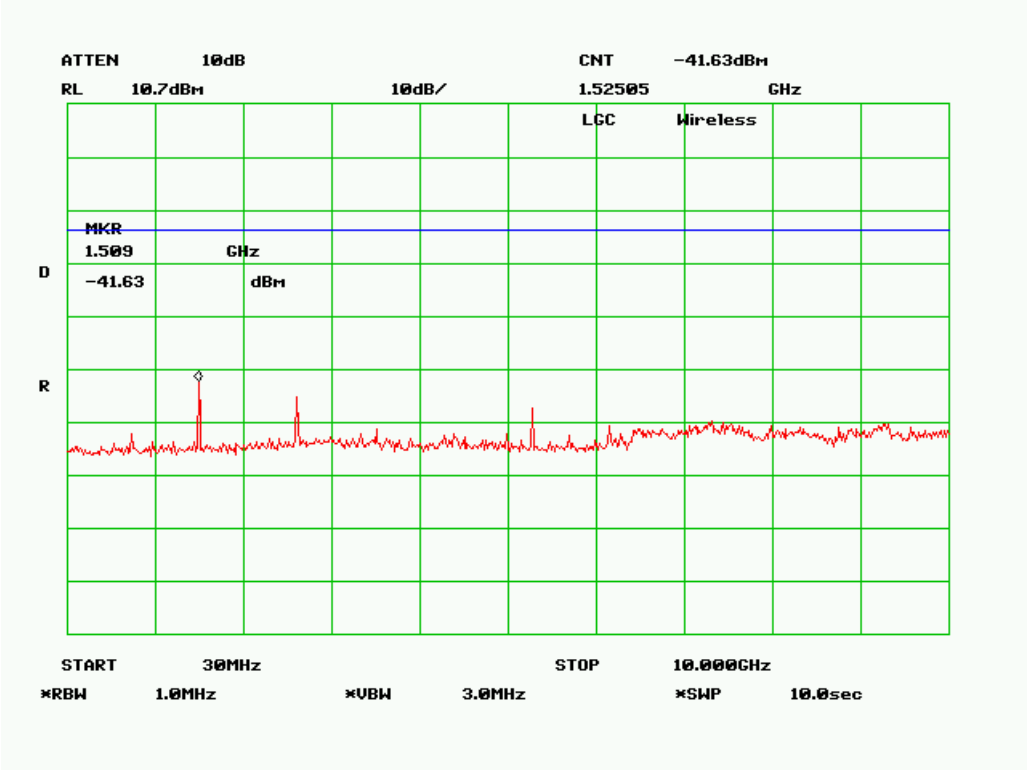
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 9.4 Test Results

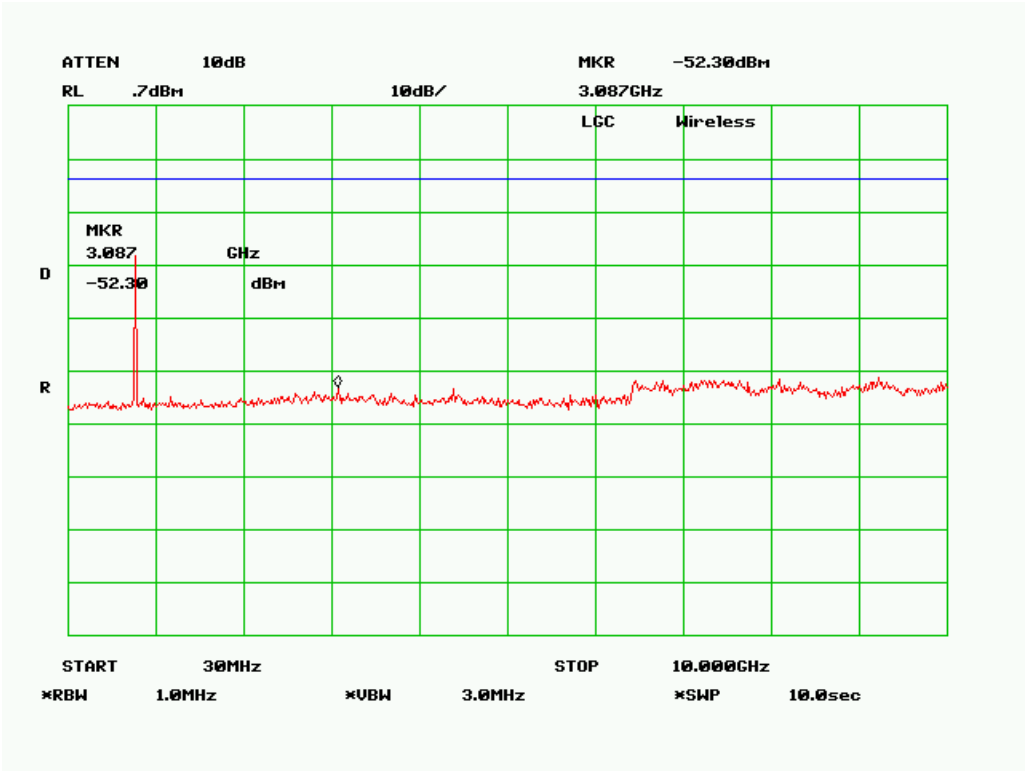
Please refer to the hereinafter plots.

***C4FM***

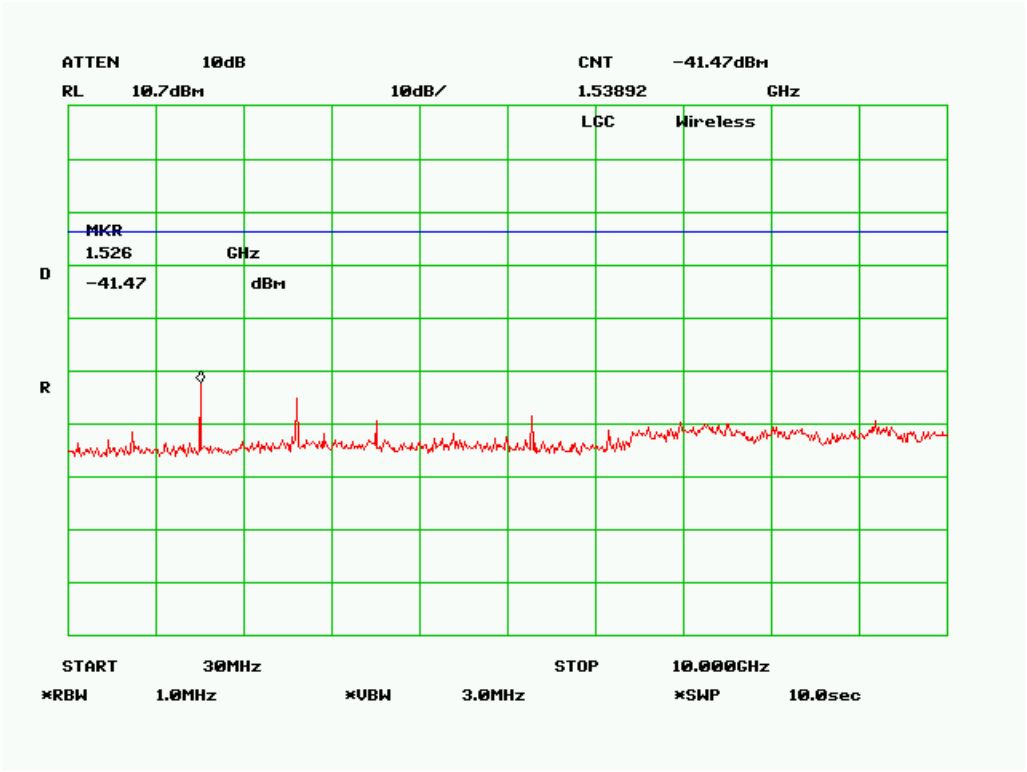
**Low Channel (Downlink)**



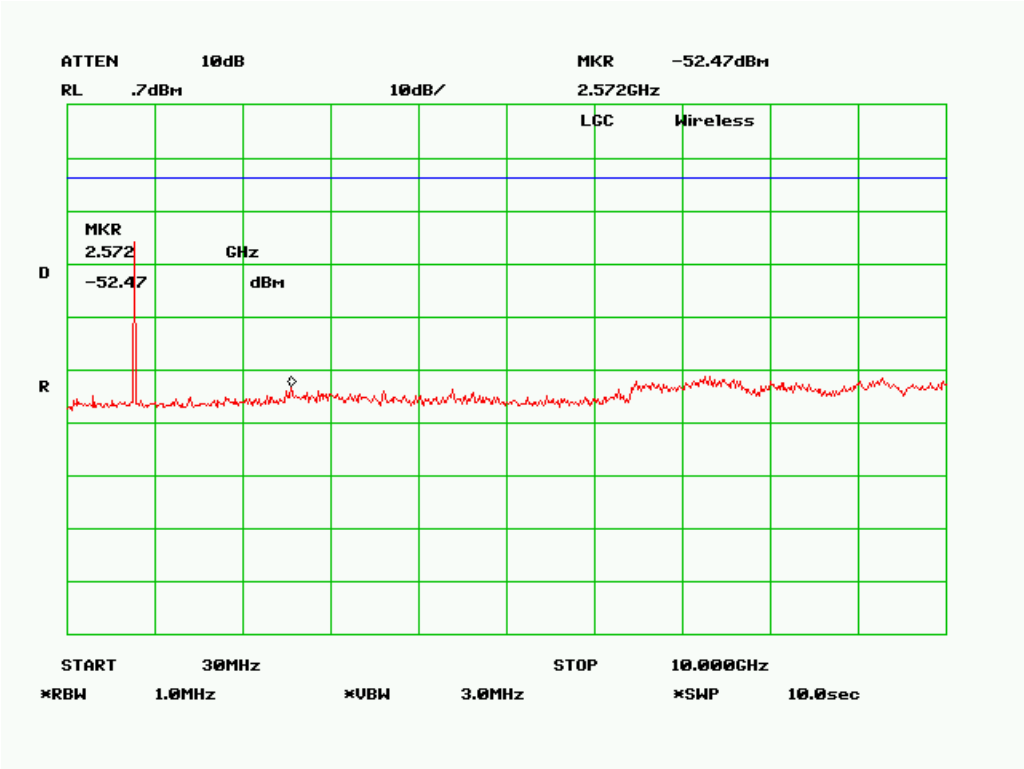

**Low Channel (Uplink)**



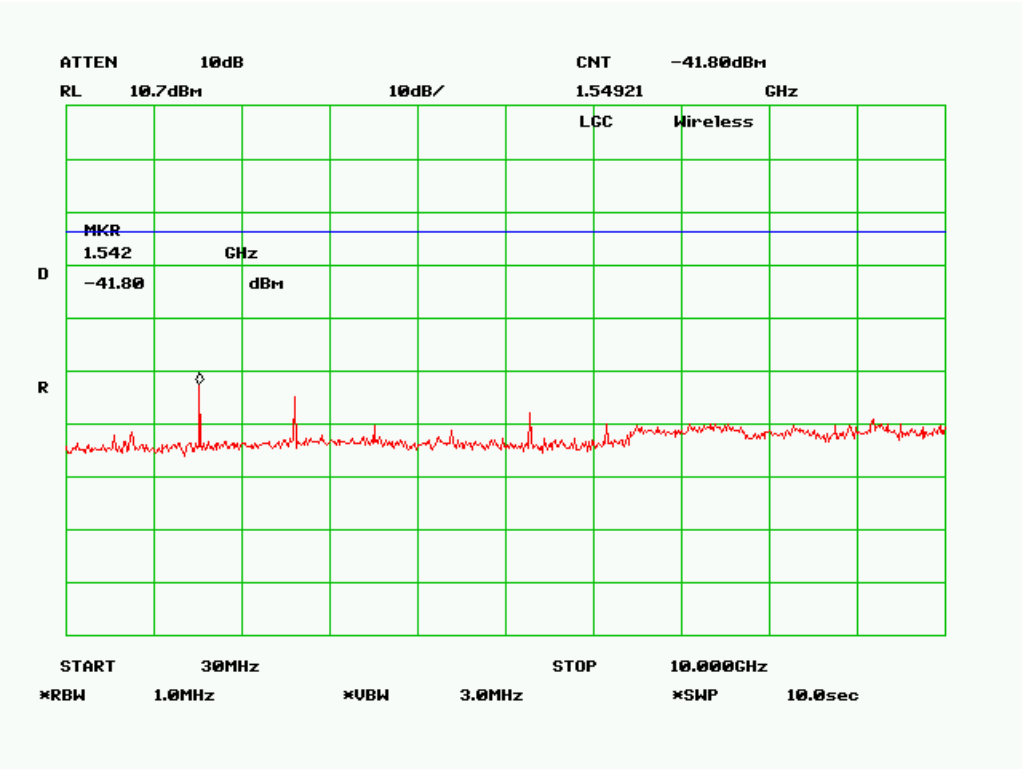
**Middle Channel (Downlink)**



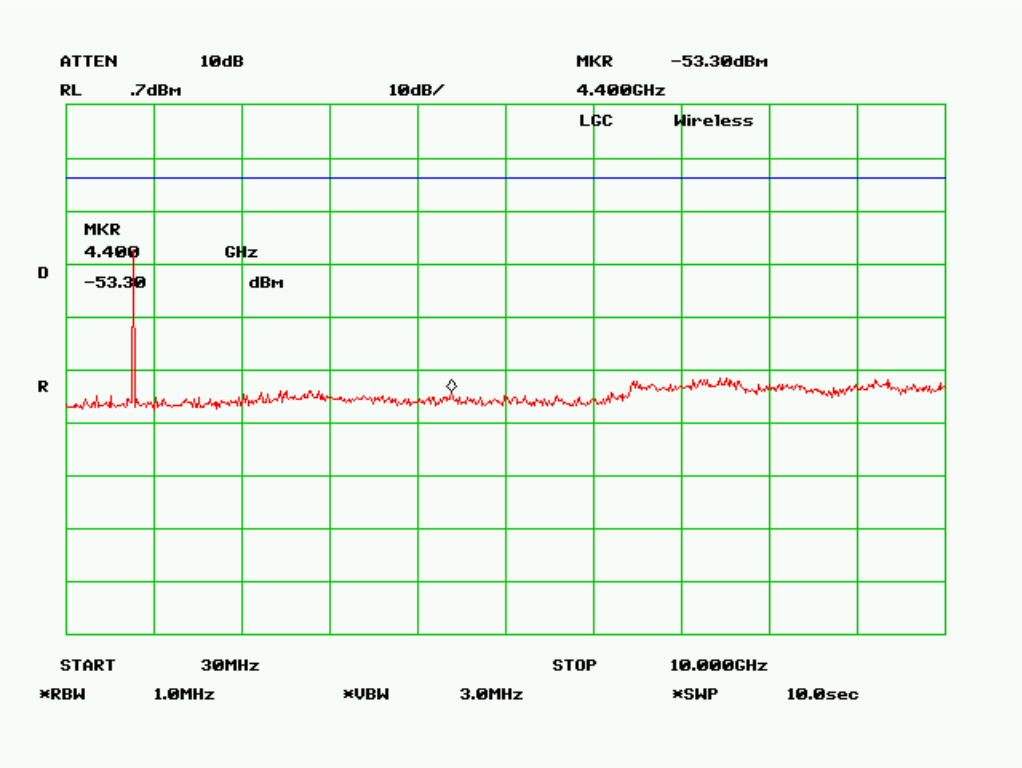

**Middle Channel (Uplink)**



**High Channel (Downlink)**

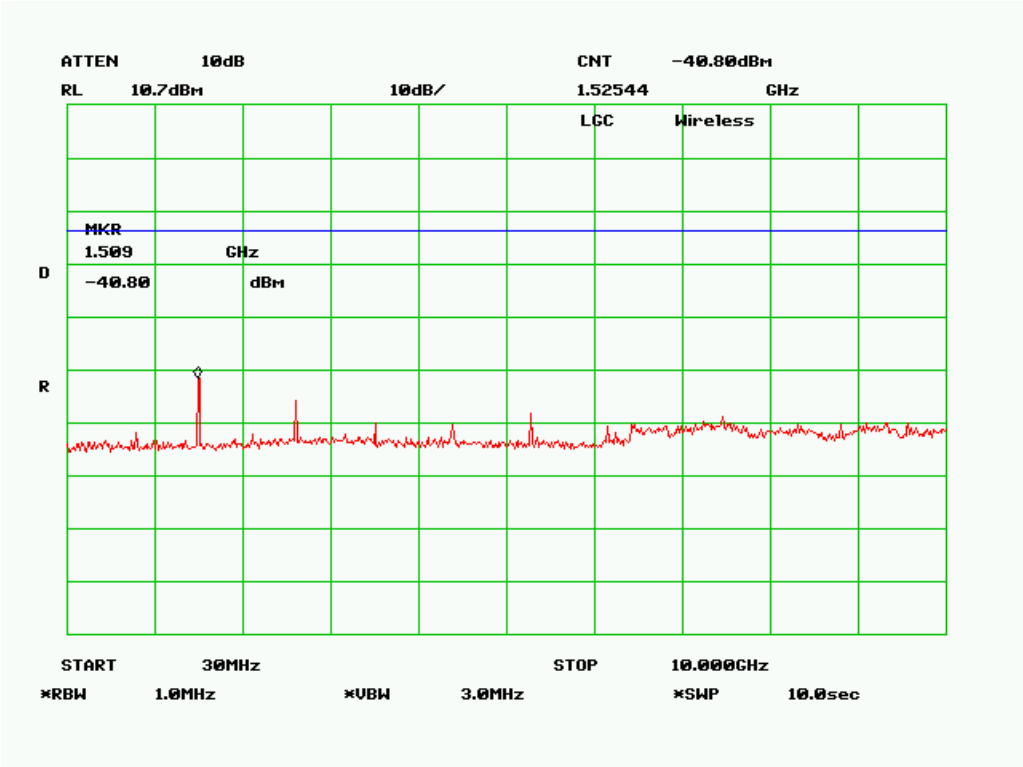



**High Channel (Uplink)**

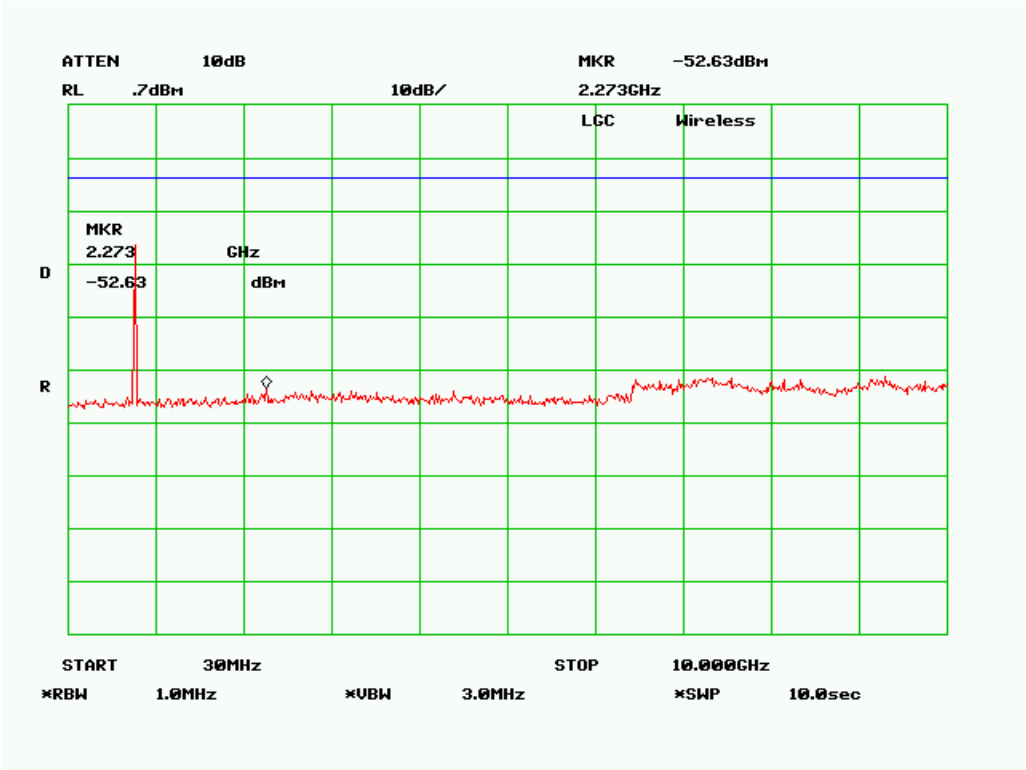


**CQPSK**

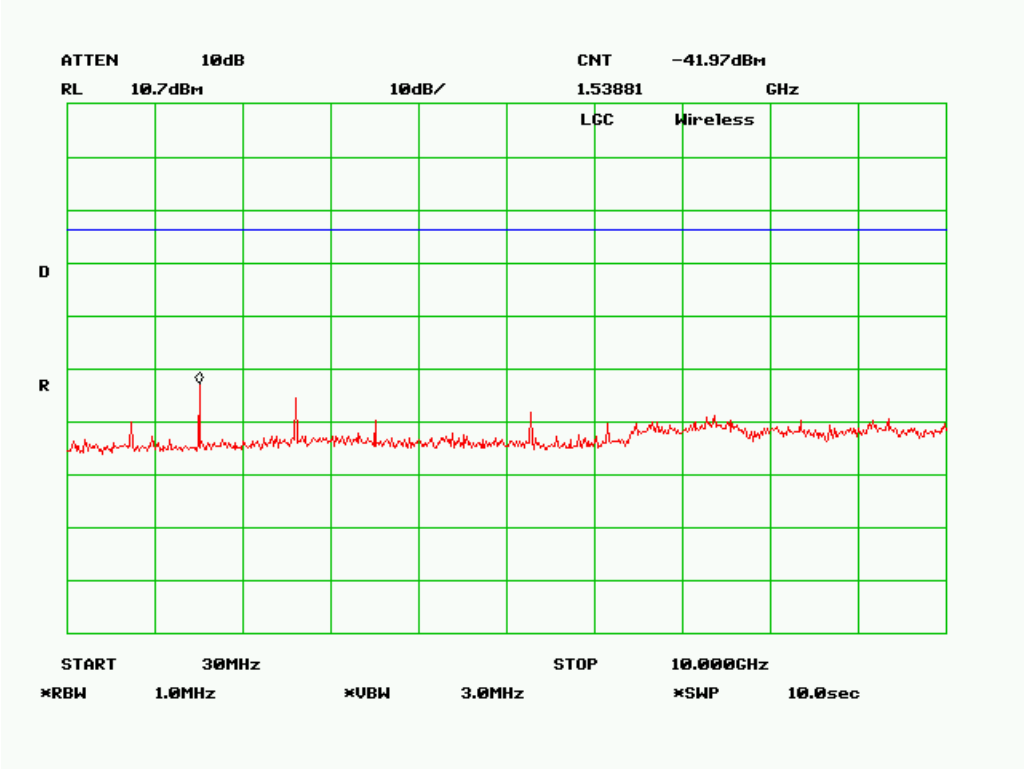
**Low Channel (Downlink)**



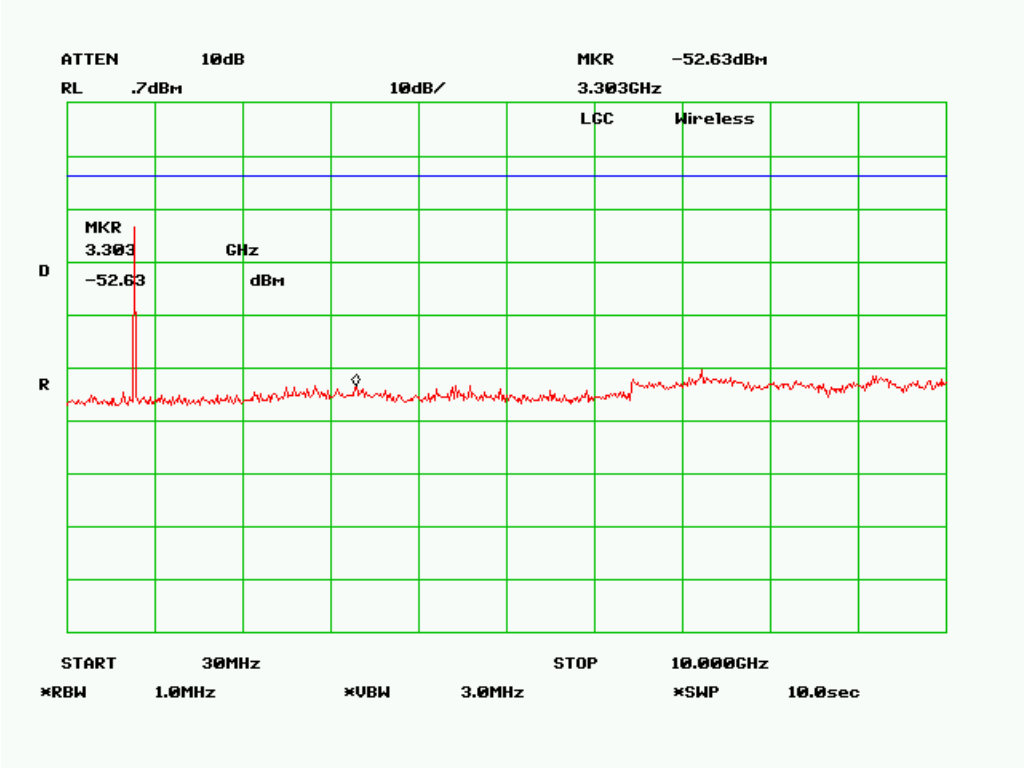

**Low Channel (Uplink)**



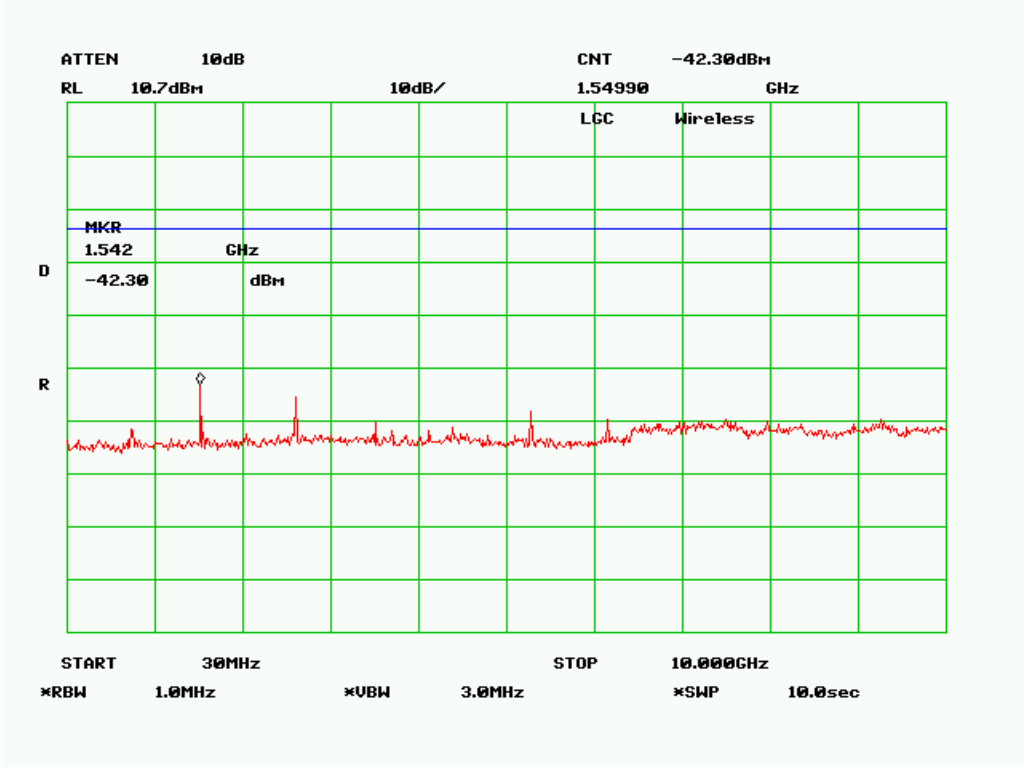
**Middle Channel (Downlink)**



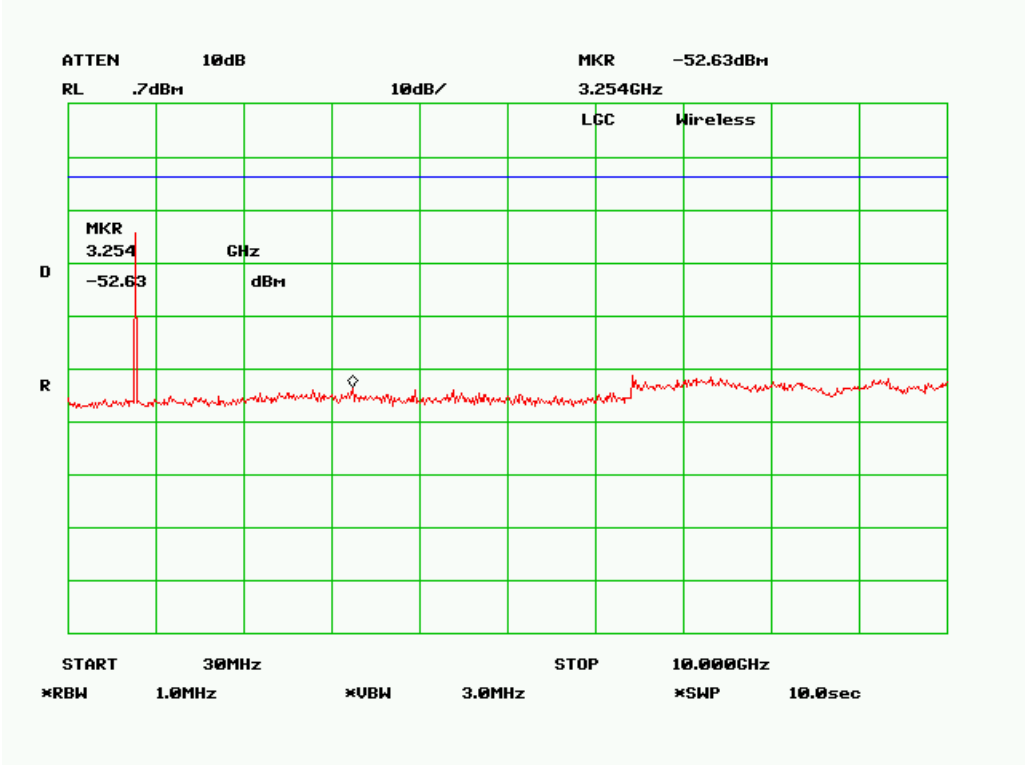

**Middle Channel (Uplink)**



## High Channel (Downlink)

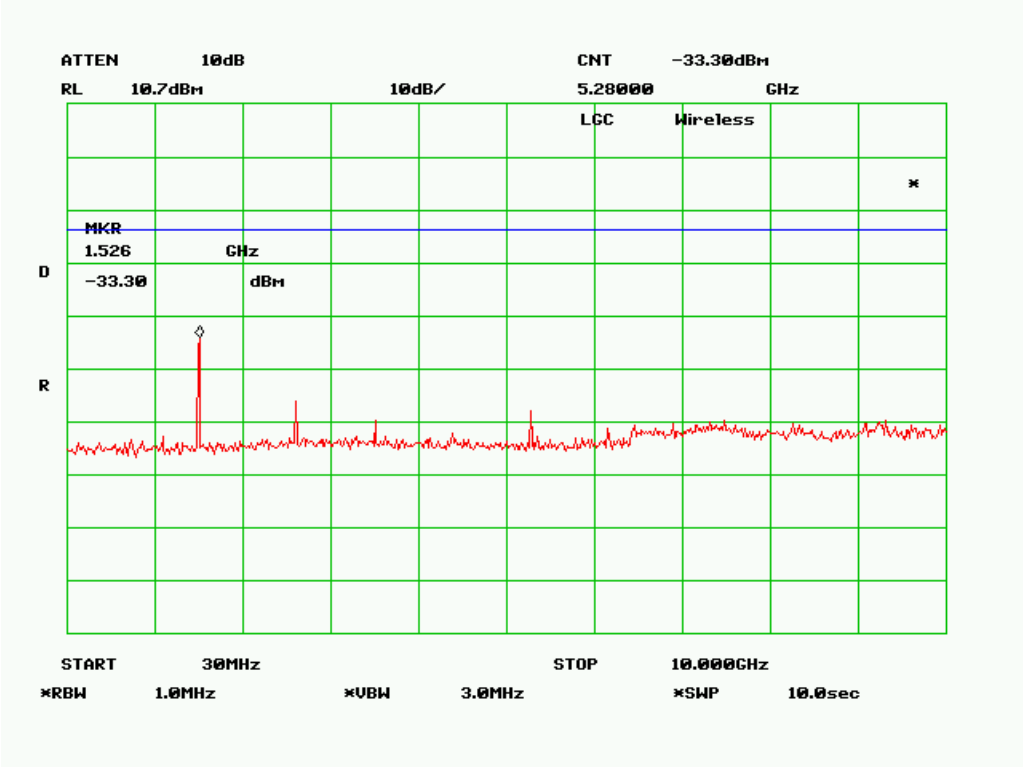



## High Channel (Uplink)

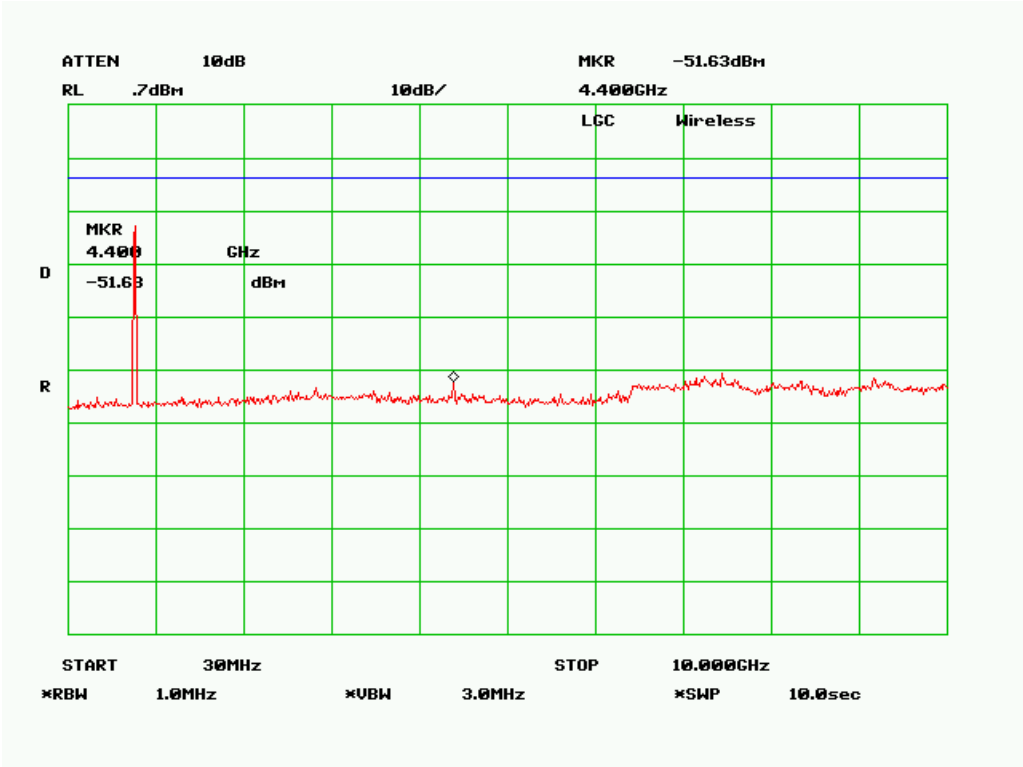


## WCDMA

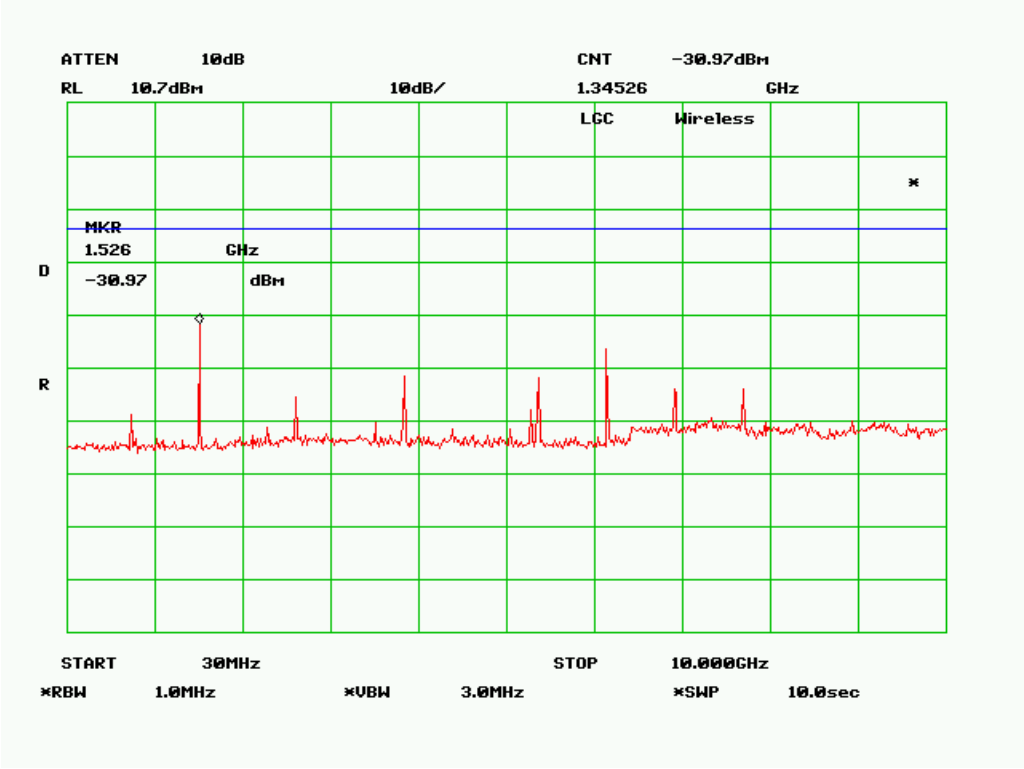
### Low Channel (Downlink)



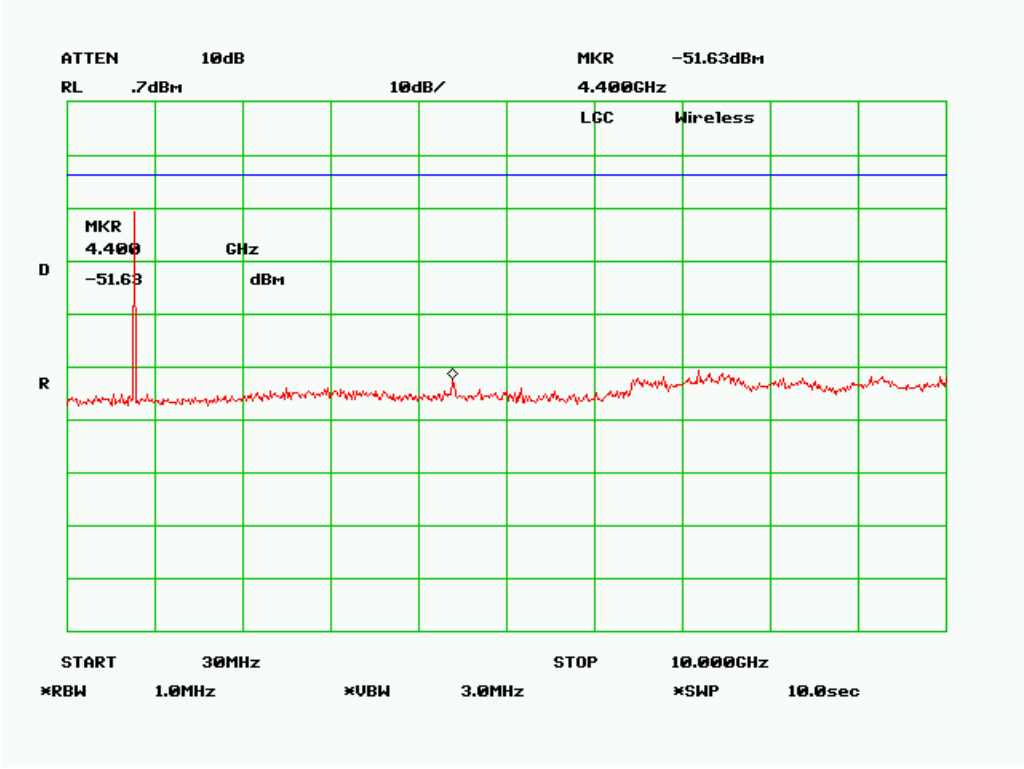

### Low Channel (Uplink)



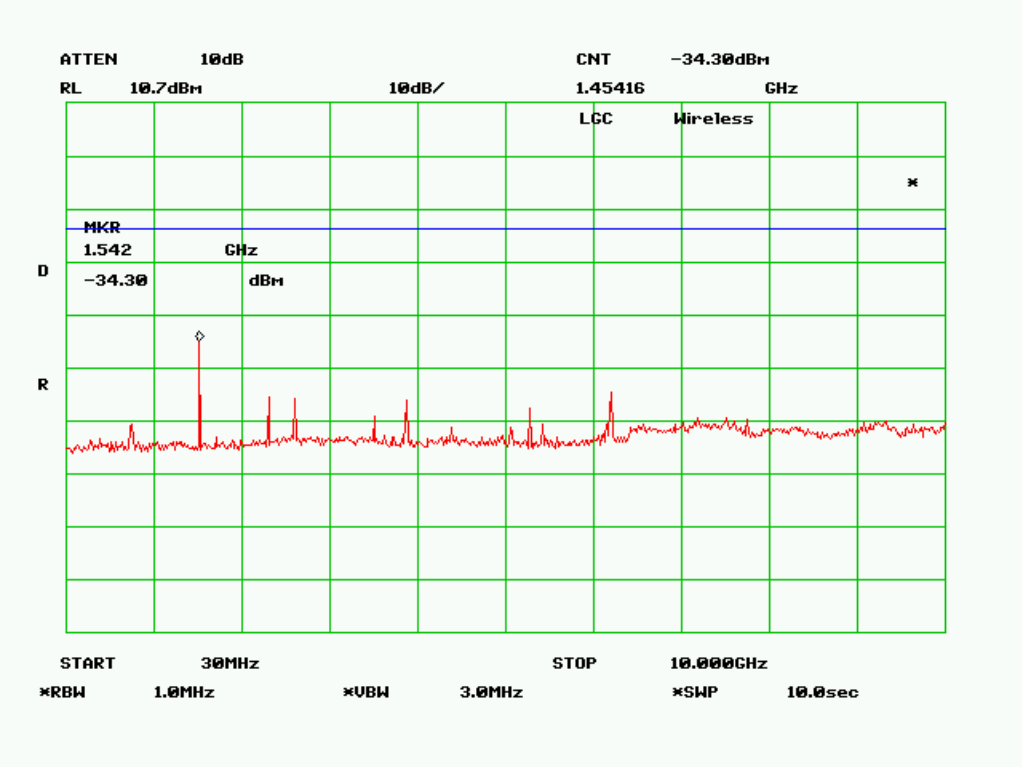
## Middle Channel (Downlink)



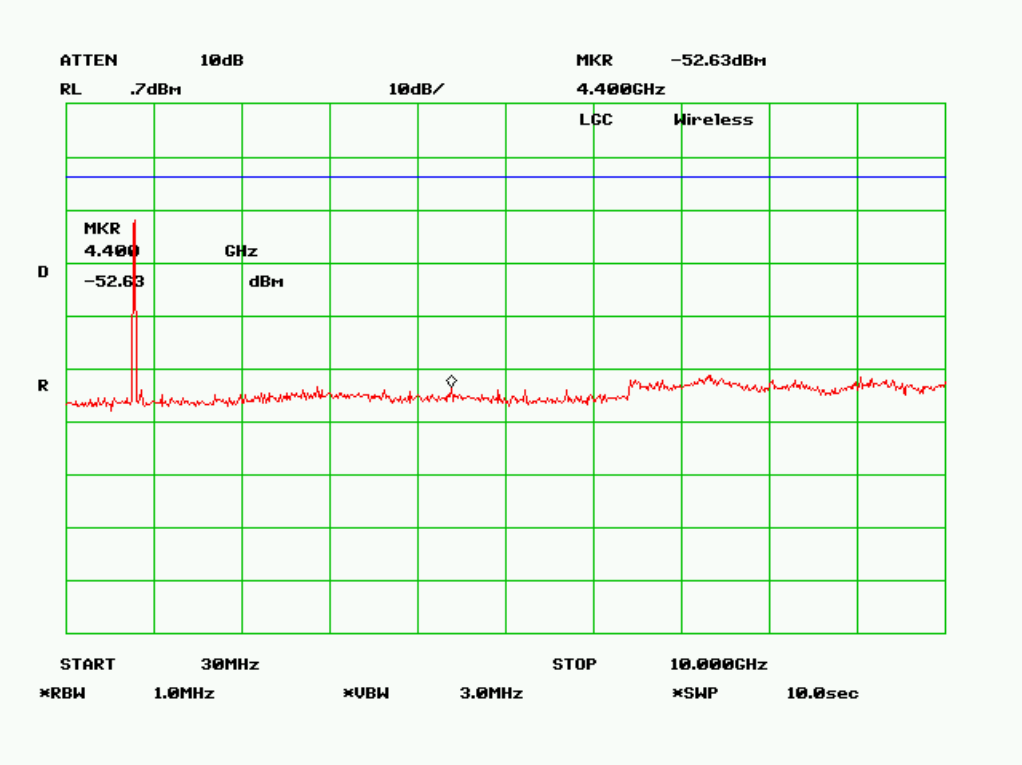

## Middle Channel (Uplink)



**High Channel (Downlink)**

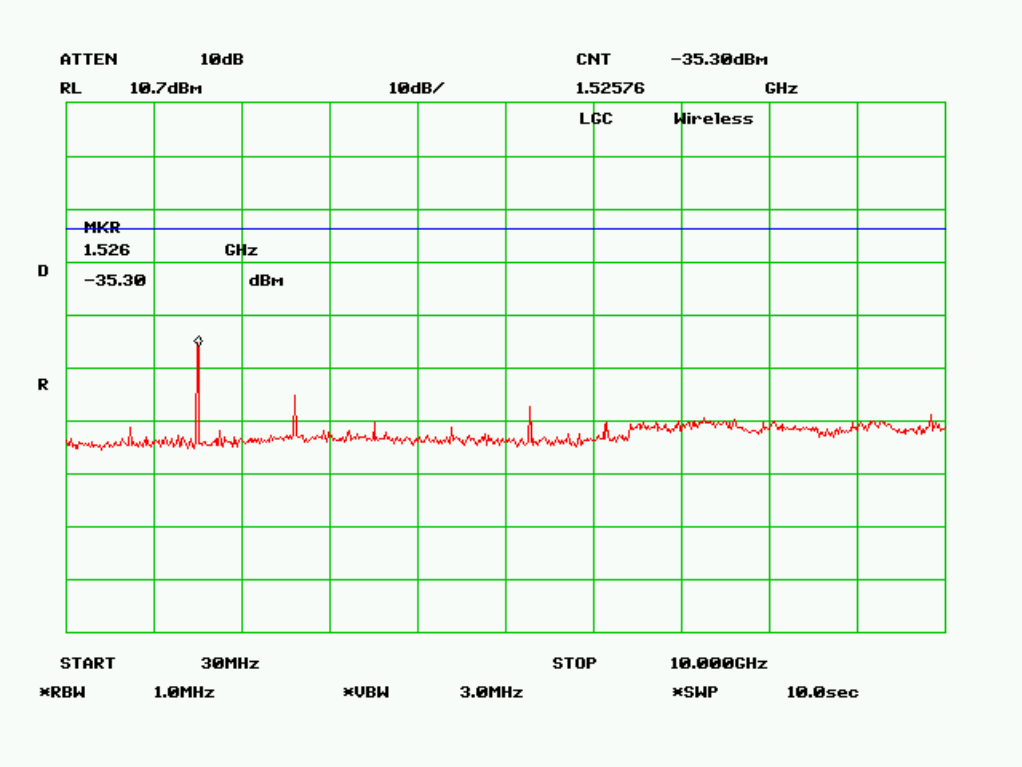



**High Channel (Uplink)**

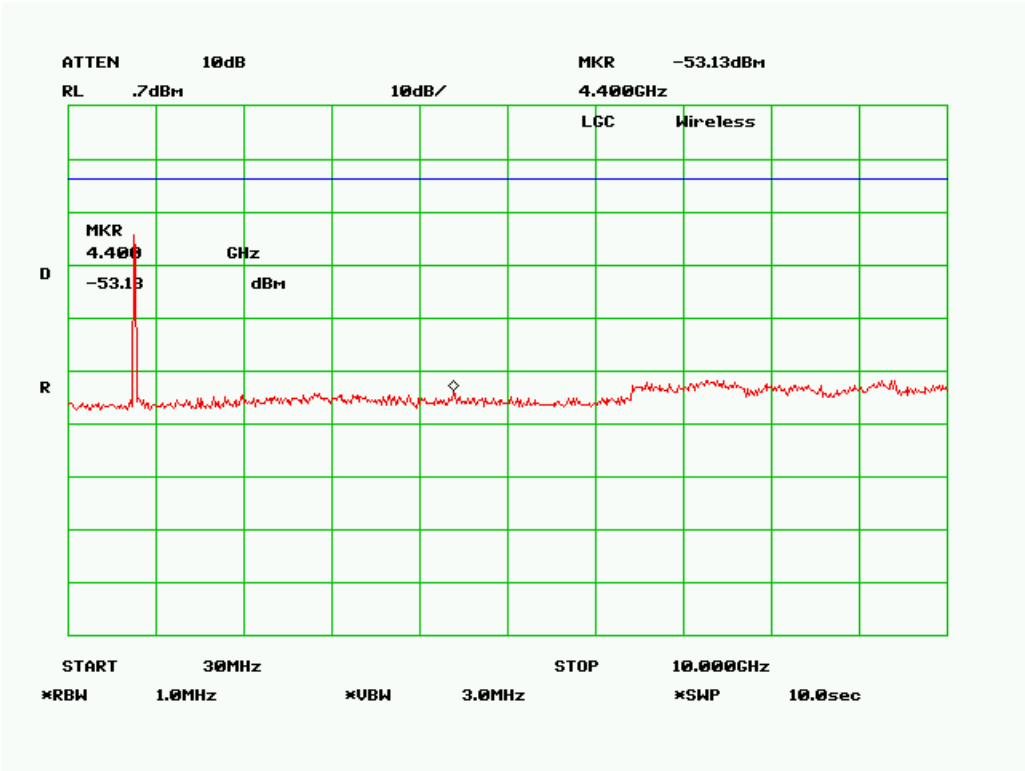


**CDMA2000 Band**

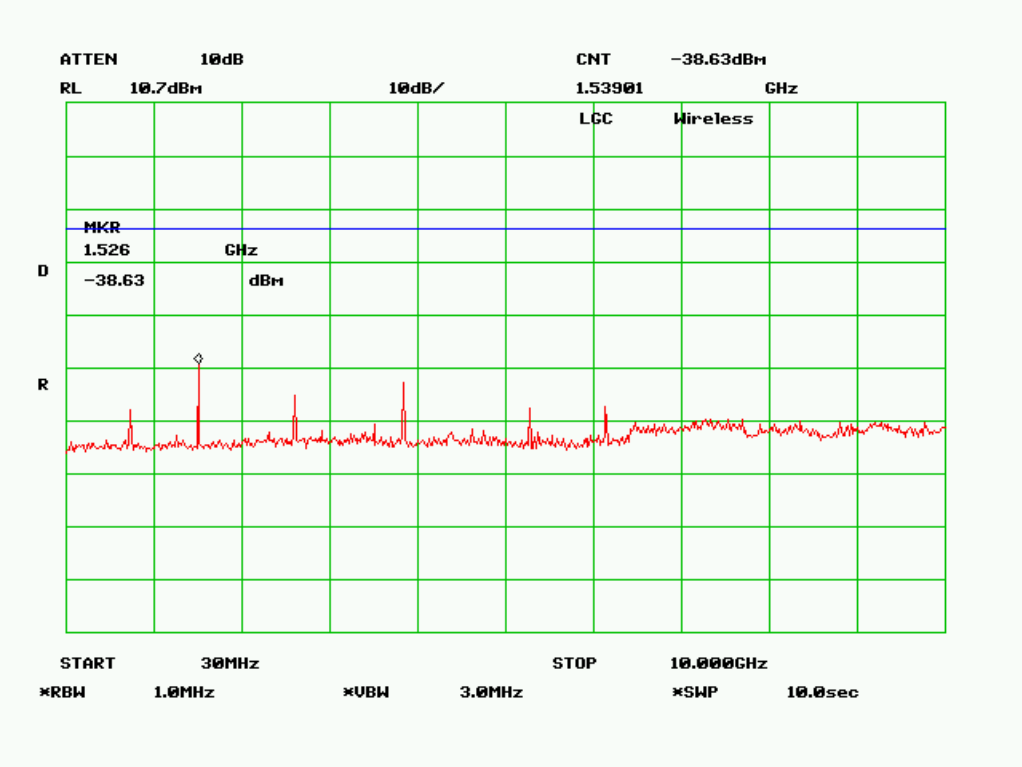
**Low Channel (Downlink)**



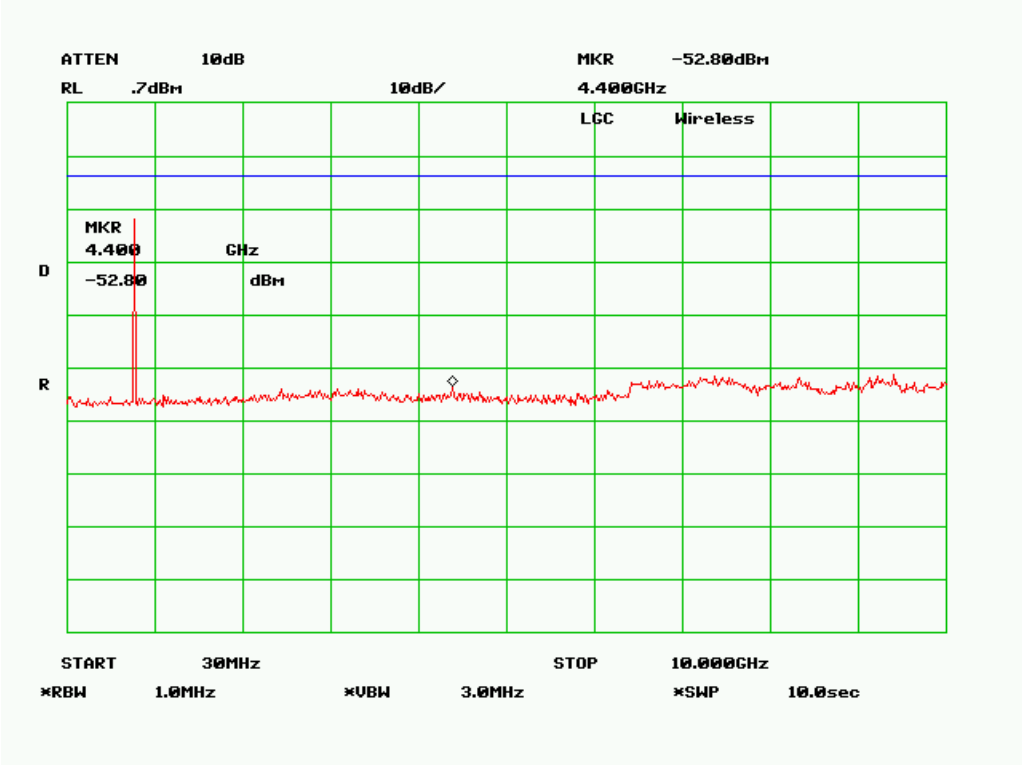

**Low Channel (Uplink)**



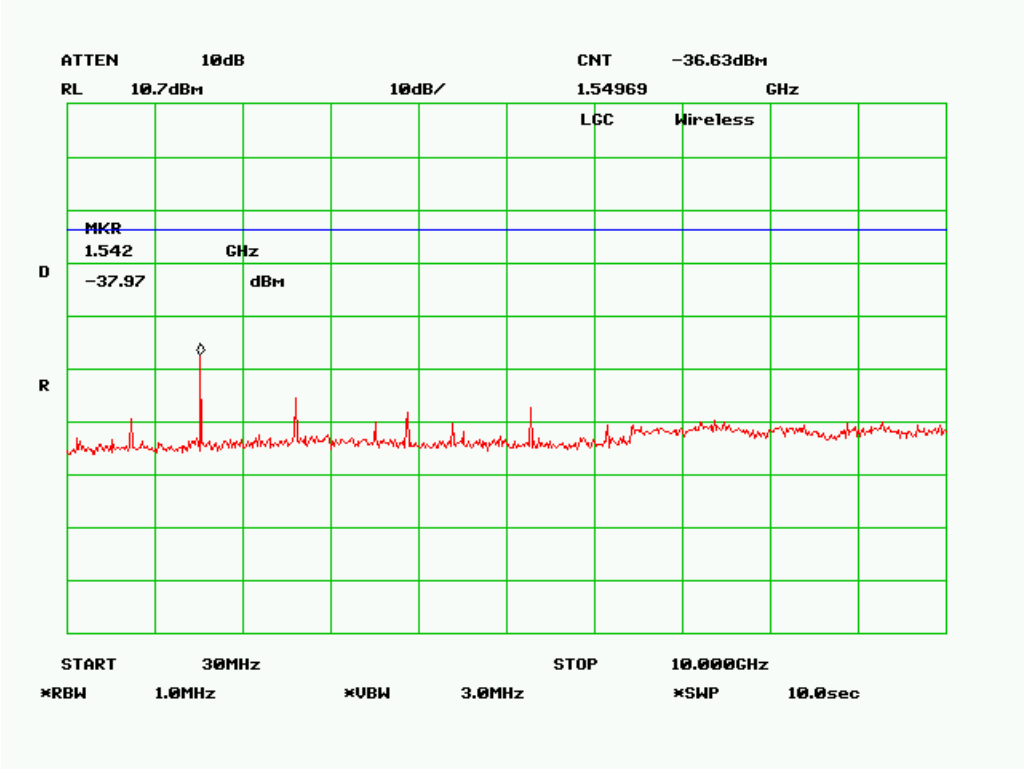
**Middle Channel (Downlink)**



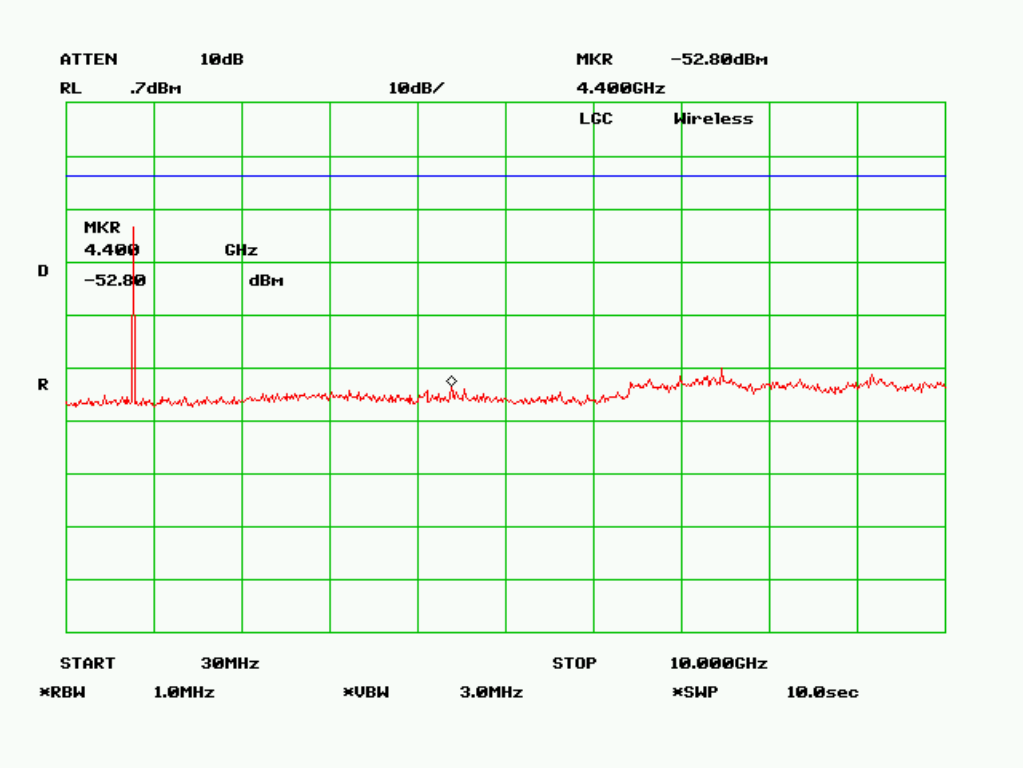

**Middle Channel (Uplink)**



**High Channel (Downlink)**

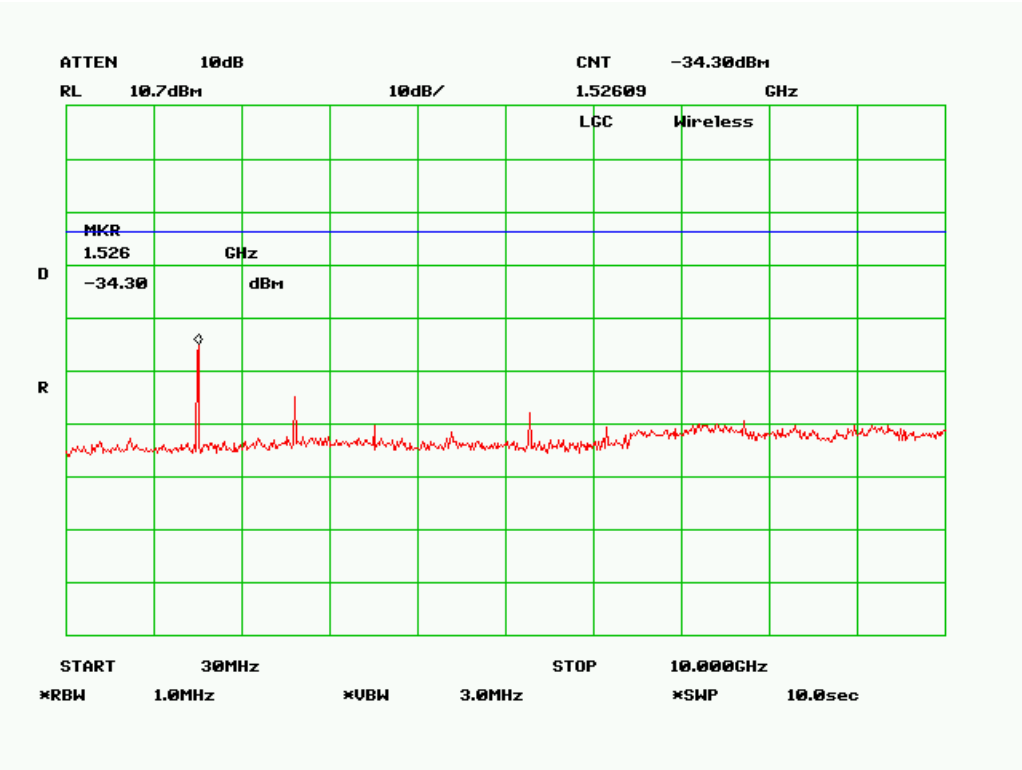



**High Channel (Uplink)**

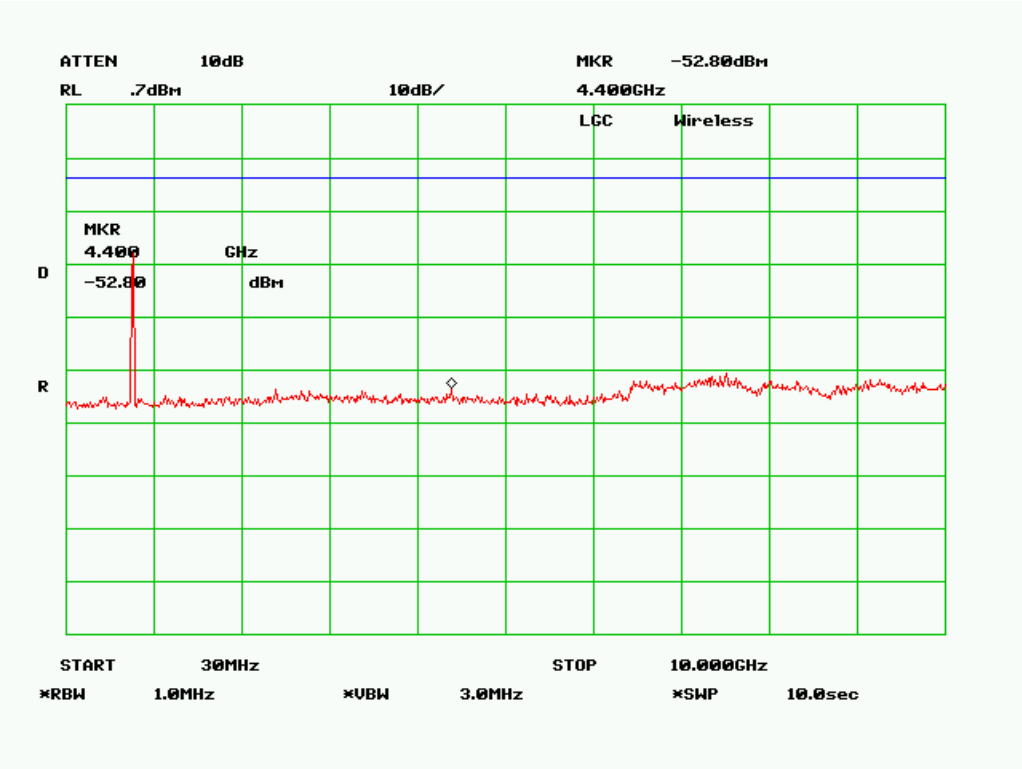


## IDEN Band

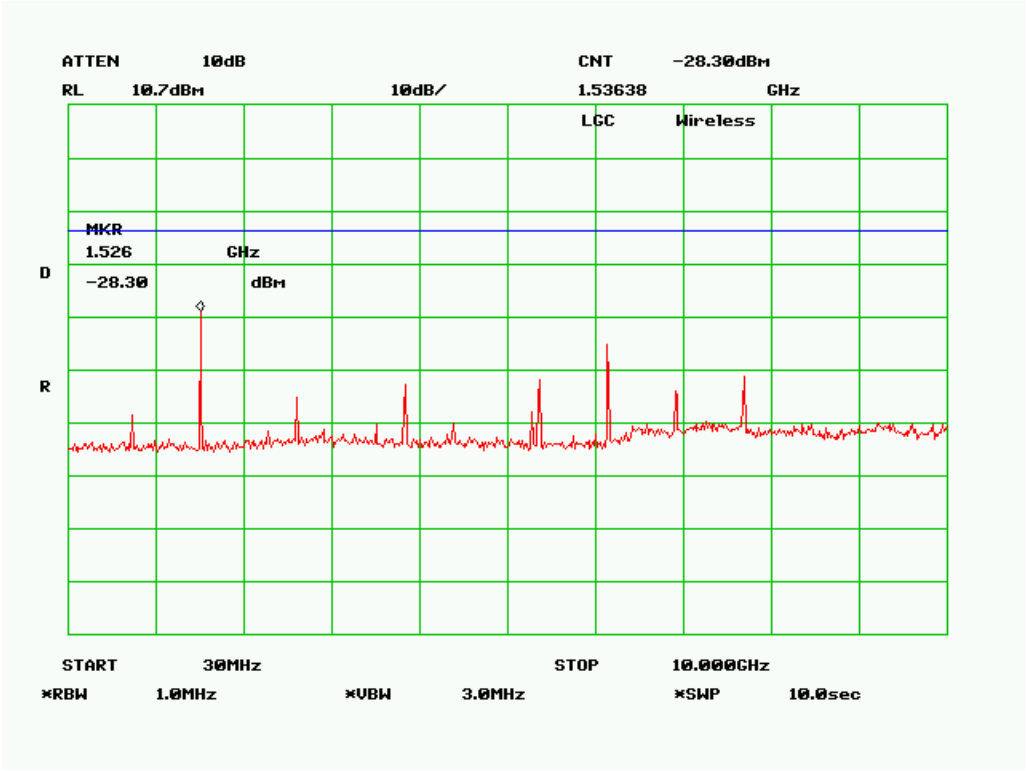
### Low Channel (Downlink)



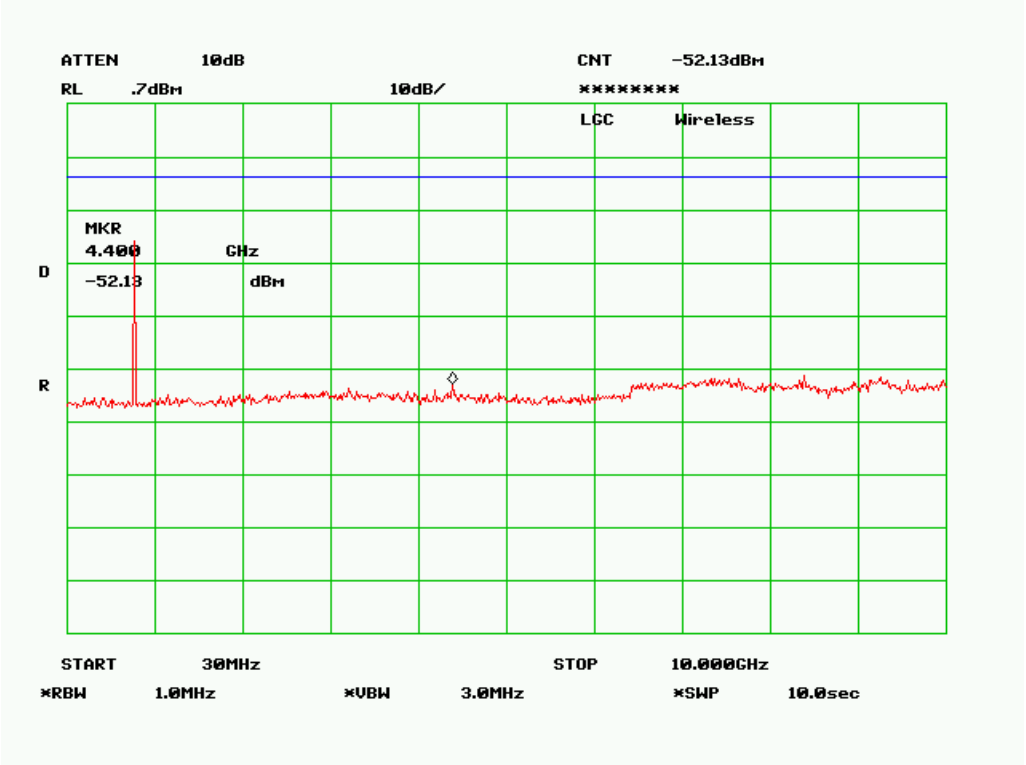

### Low Channel (Uplink)



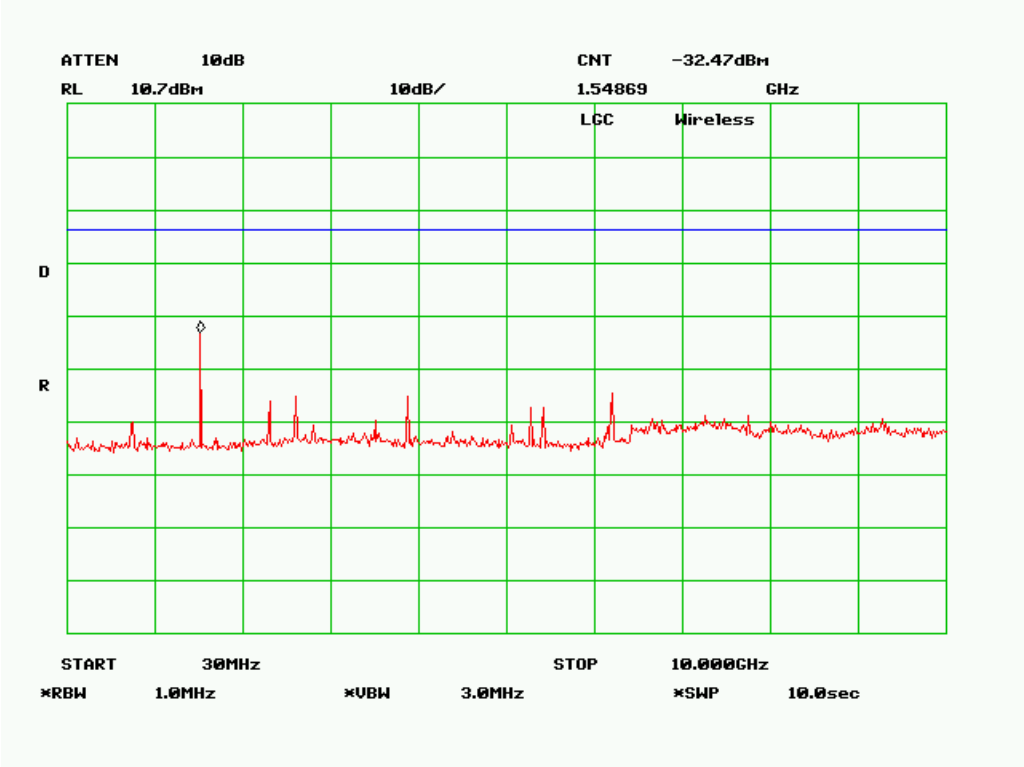
**Middle Channel (Downlink)**



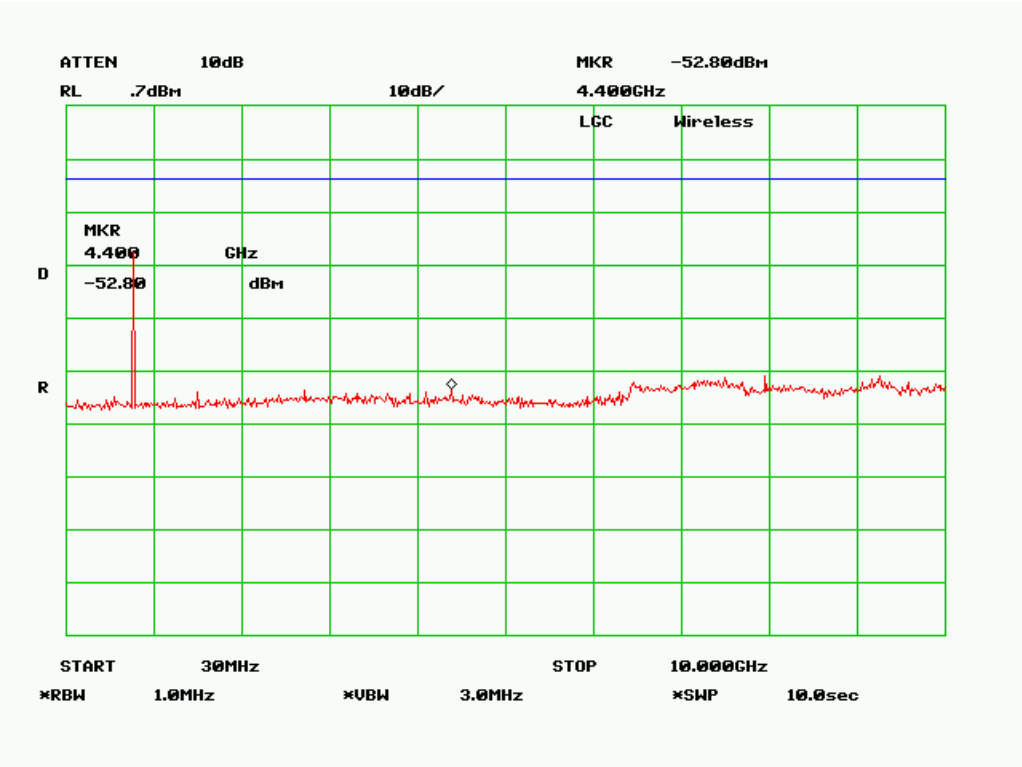

**Middle Channel (Uplink)**



**High Channel (Downlink)**

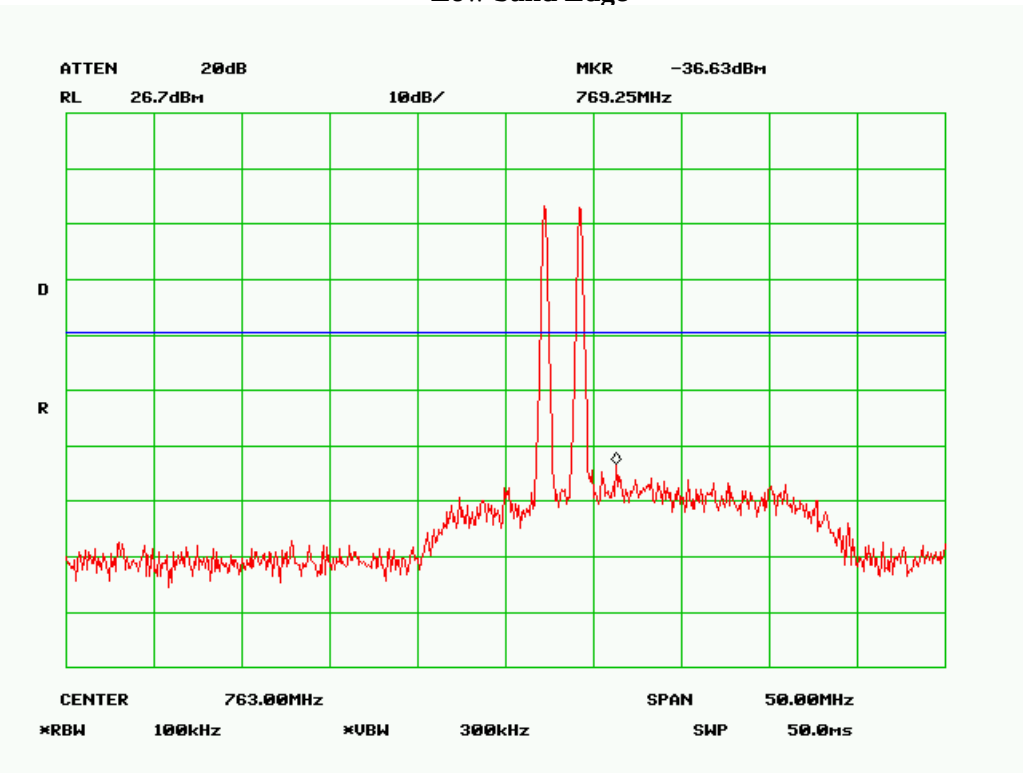



**High Channel (Uplink)**

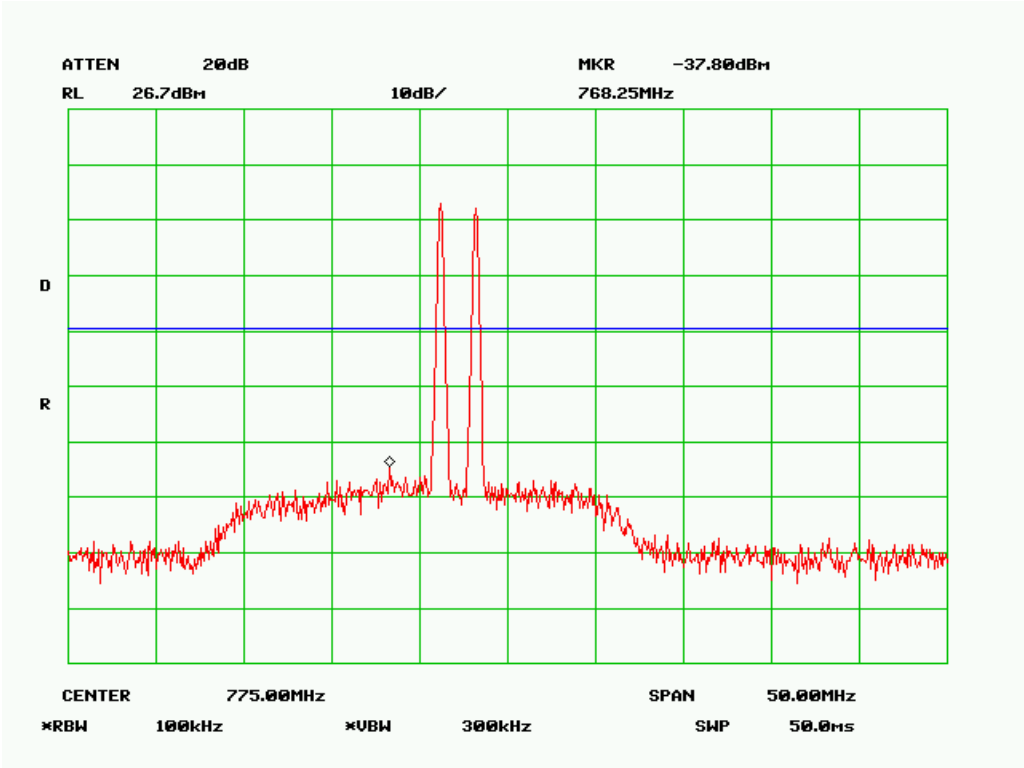


**Plots of Inter-modulation Spurious Emission for C4FM Band: Downlink**

**Low band Edge**

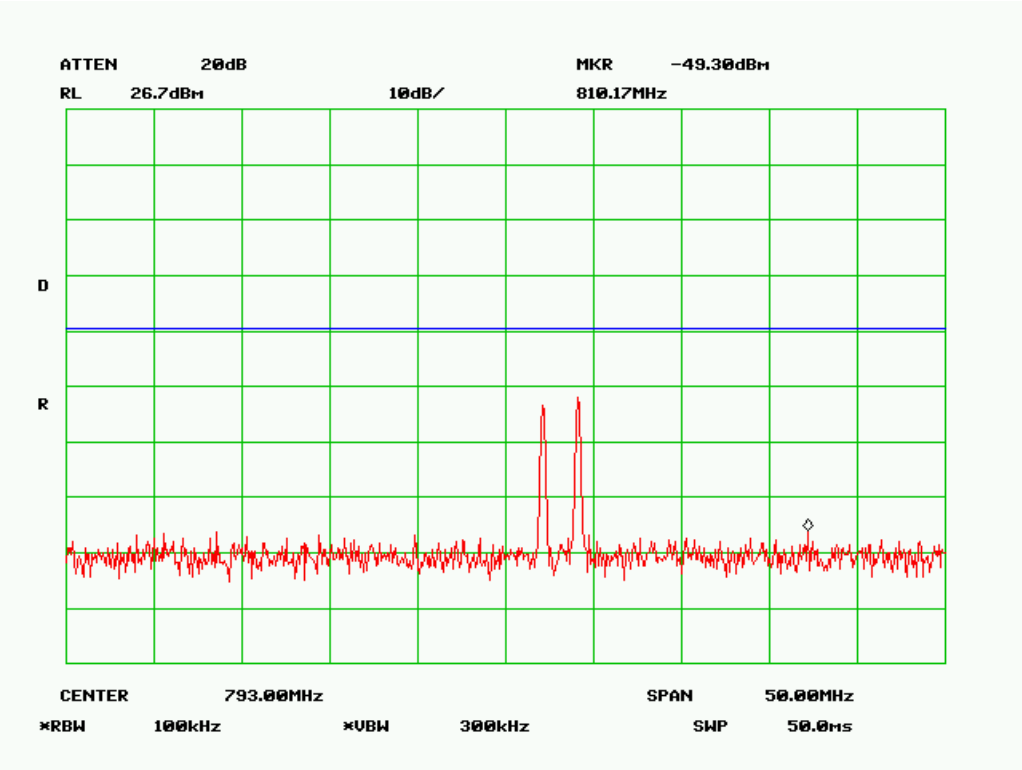



**High Band Edge**

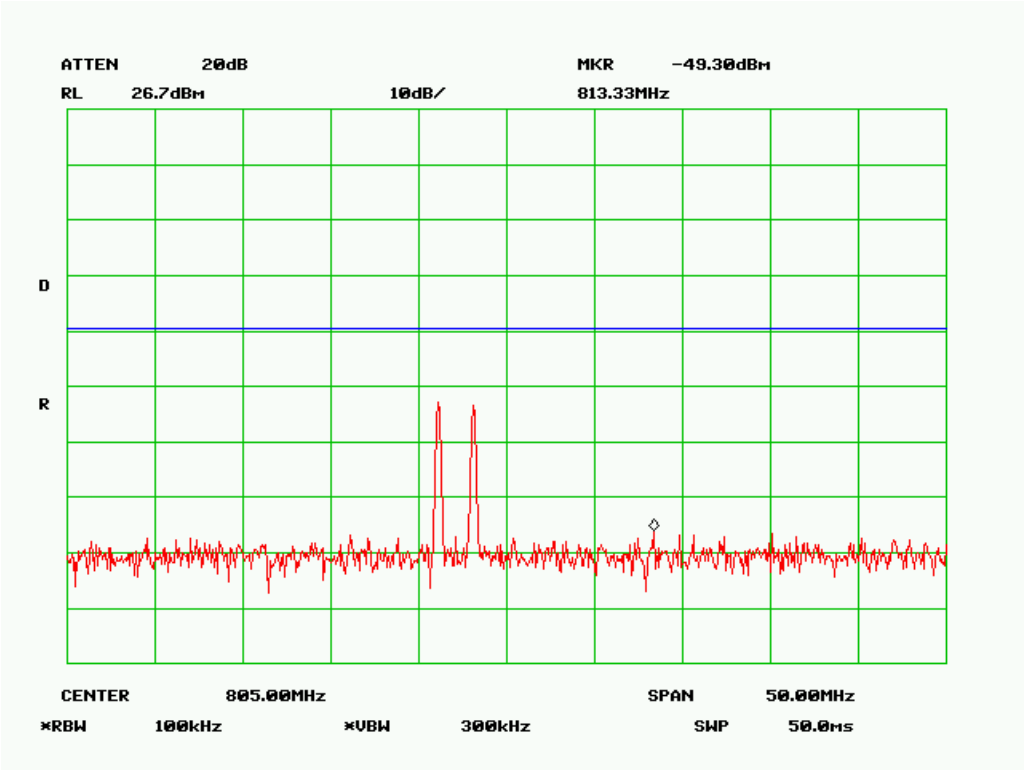


**C4FM (Uplink)**

**Low Band Edge**

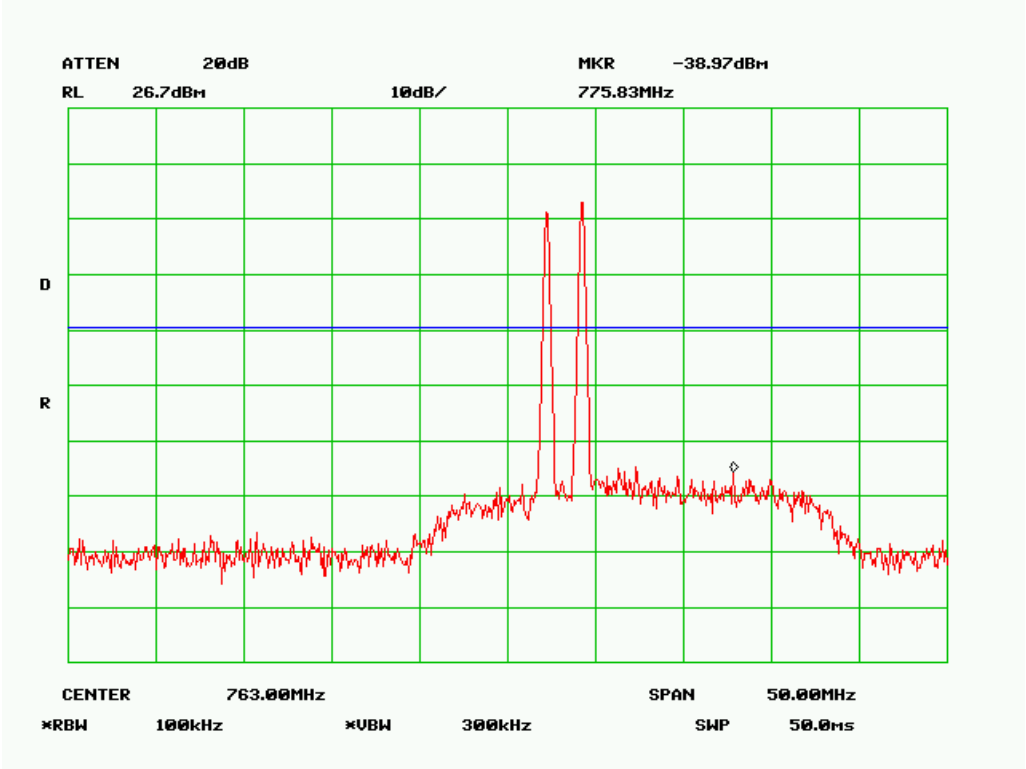



**High Band Edge**

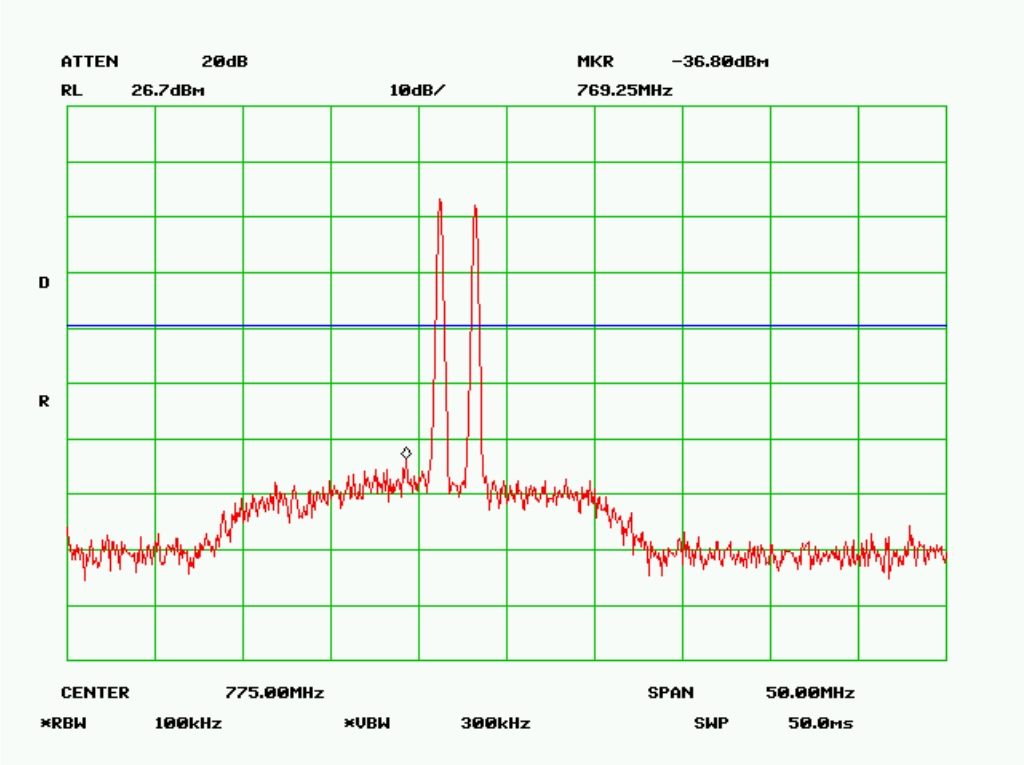


**CQPSK (Downlink)**

**Low Band Edge**

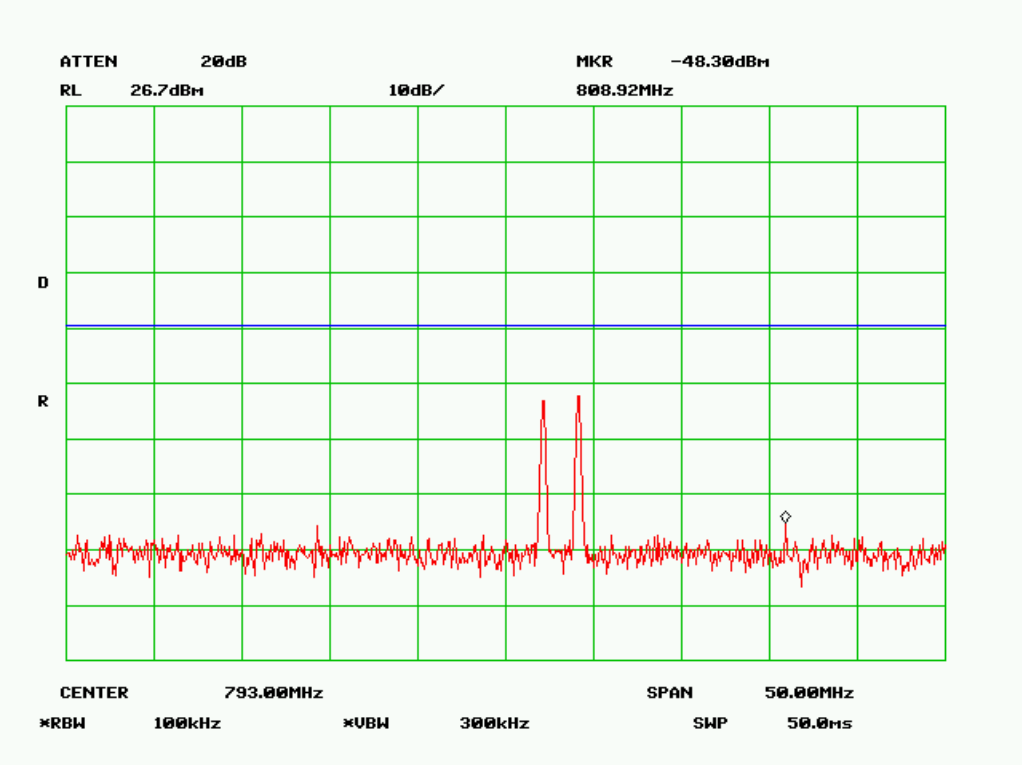



**High Band Edge**

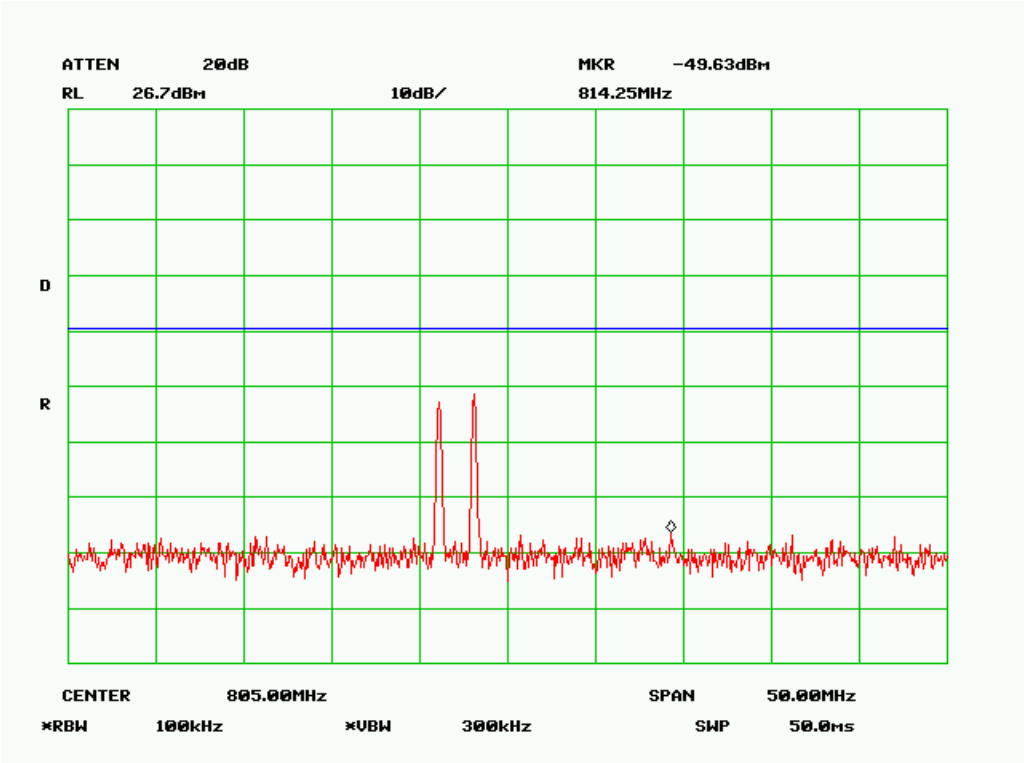


**CQPSK (Uplink)**

**Low Band Edge**

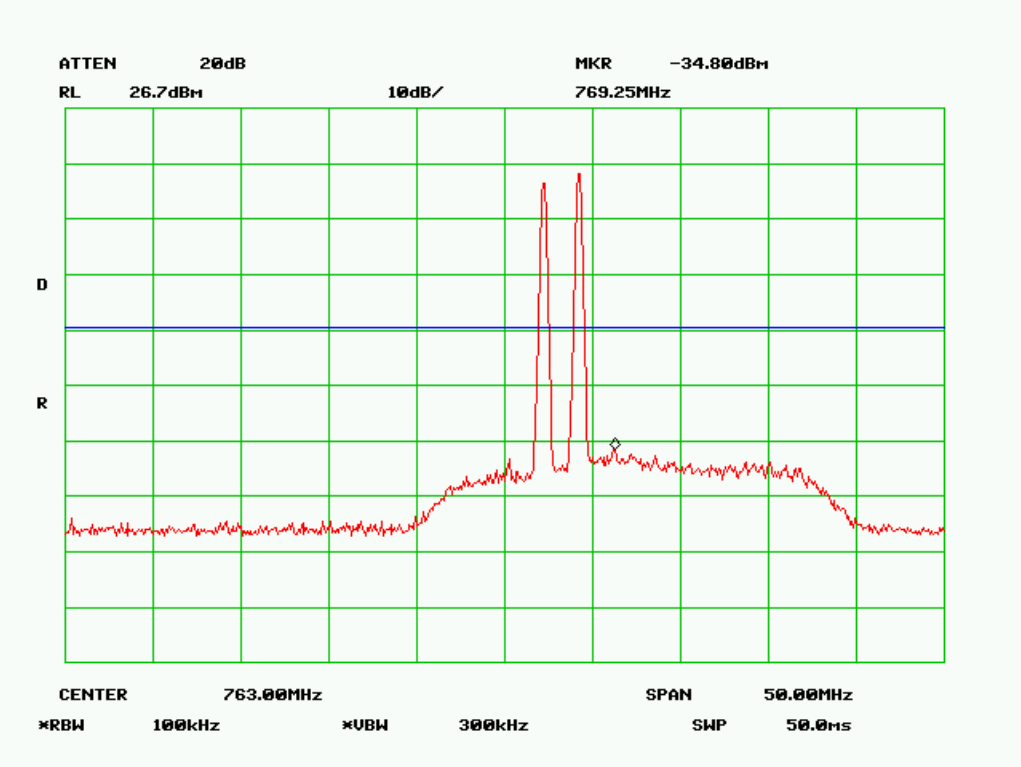



**High Band Edge**

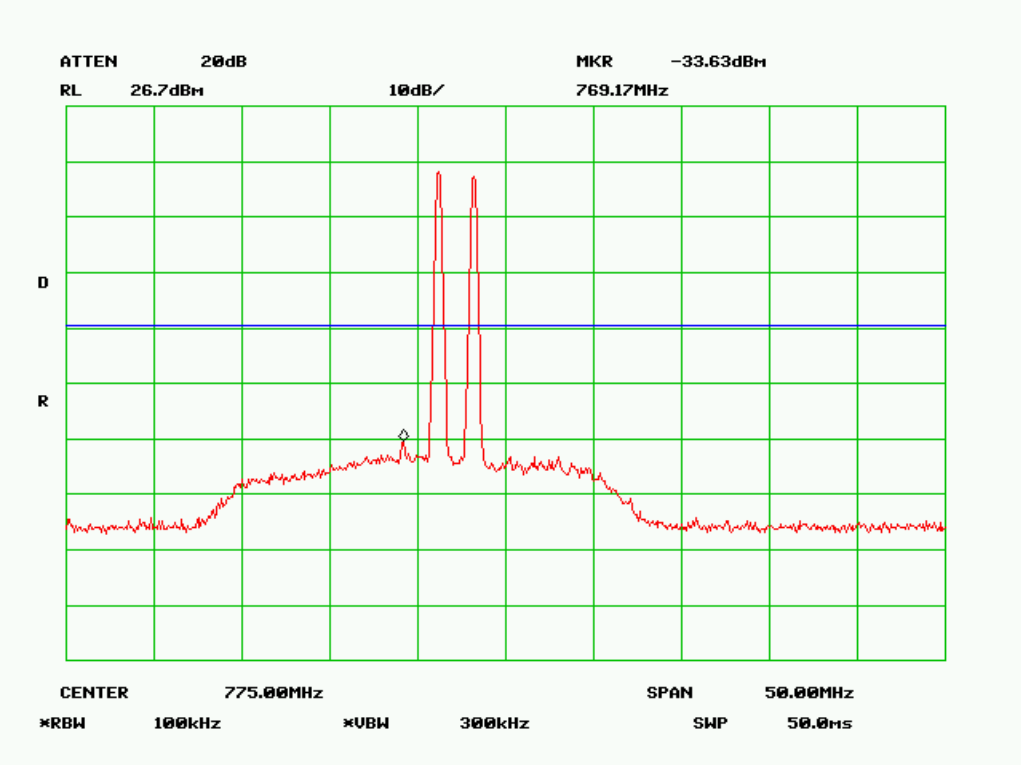


**WCDMA (Downlink)**

**Low Band Edge**

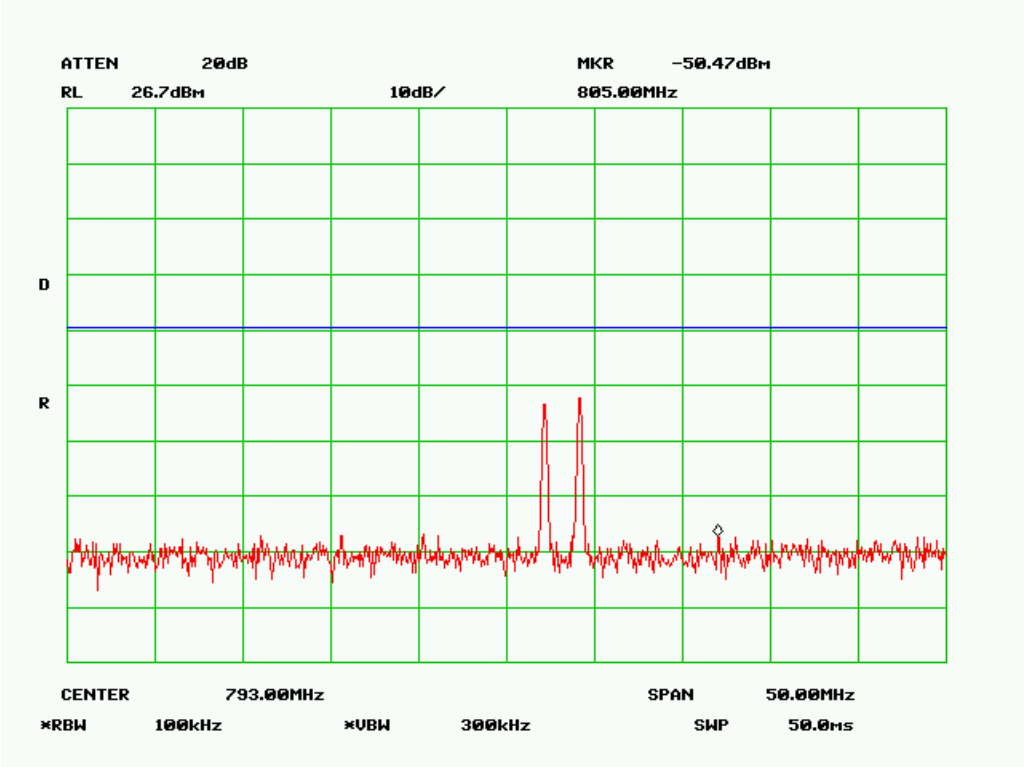



**High Band Edge**

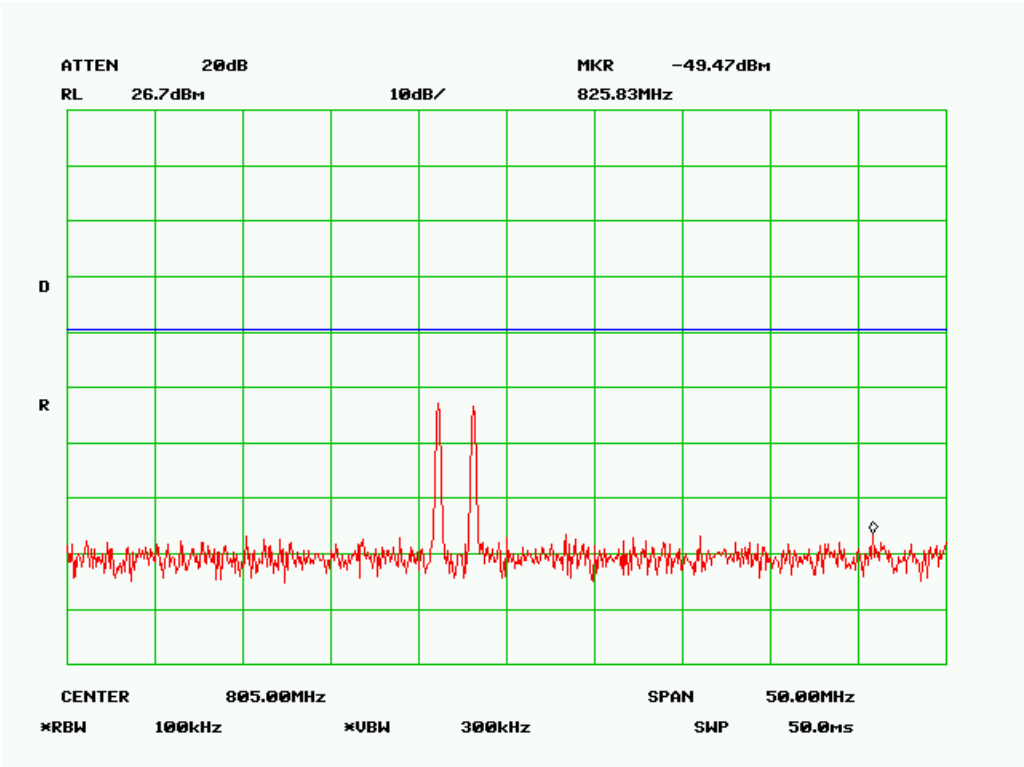


**WCDMA (Uplink)**

**Low Band Edge**

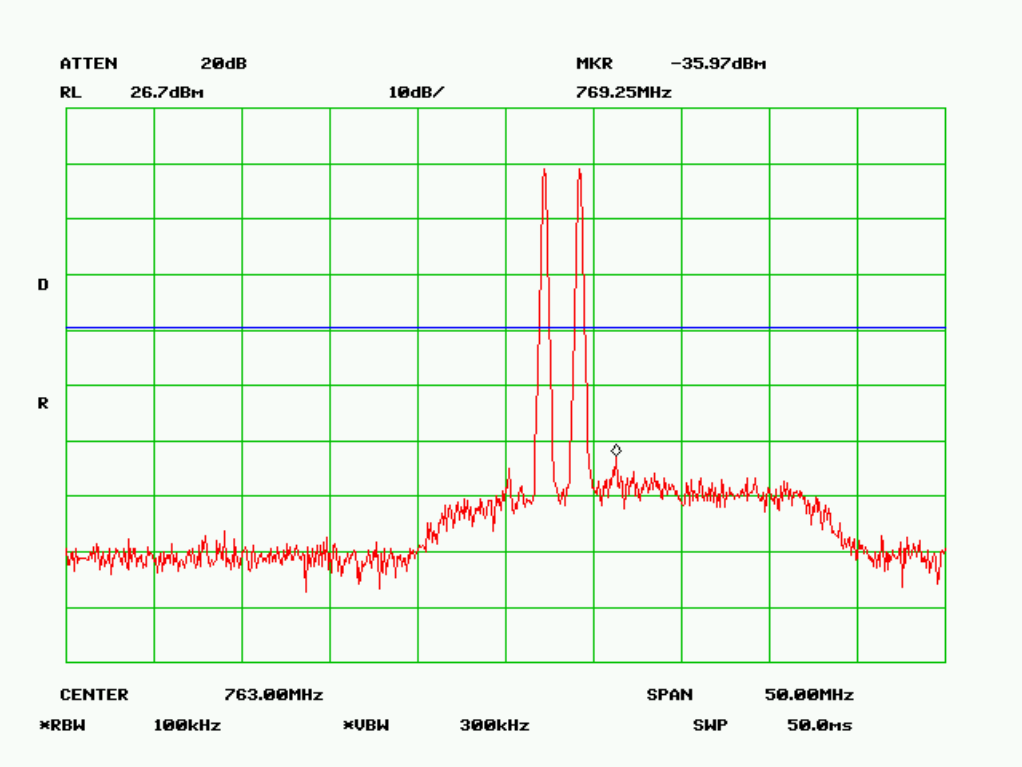



**High Band Edge**

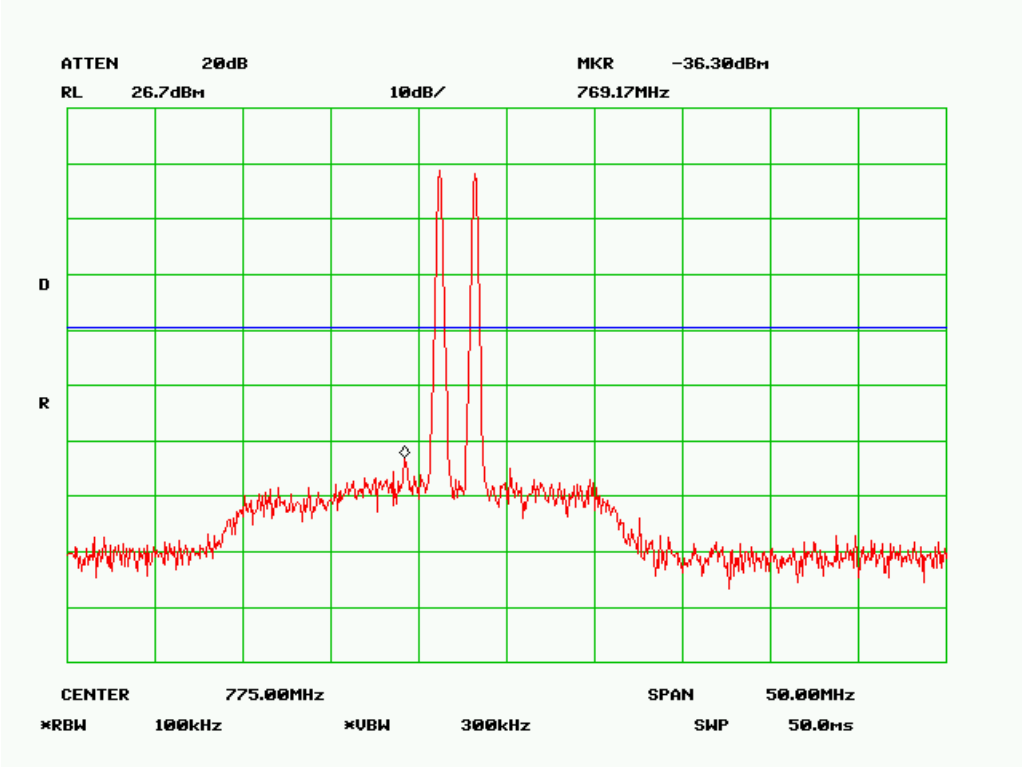


**CDMA2000 Bands (Downlink)**

**Low Band Edge**

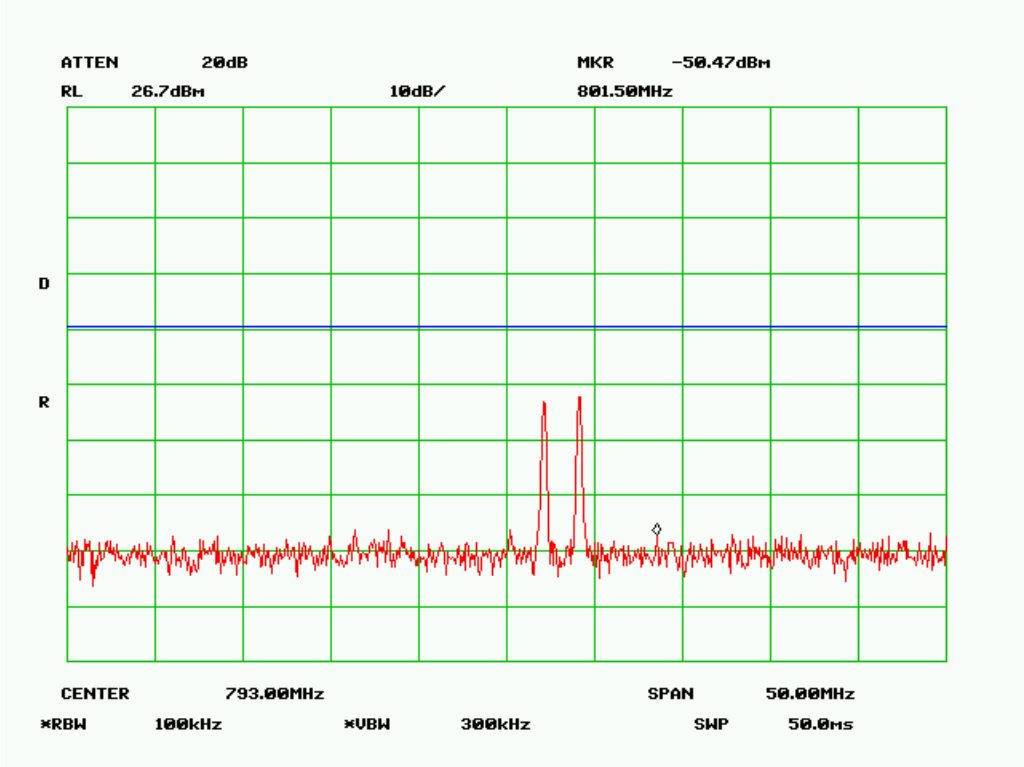



**High Band Edge**

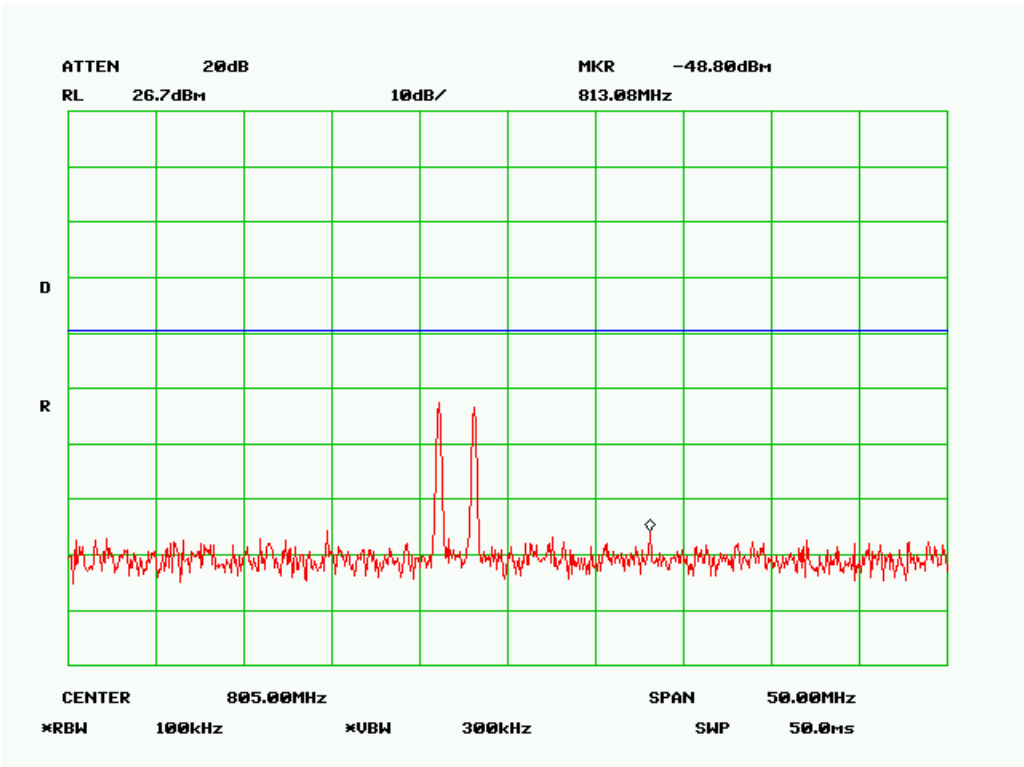


## CDMA2000 Bands (Uplink)

### Low Band Edge

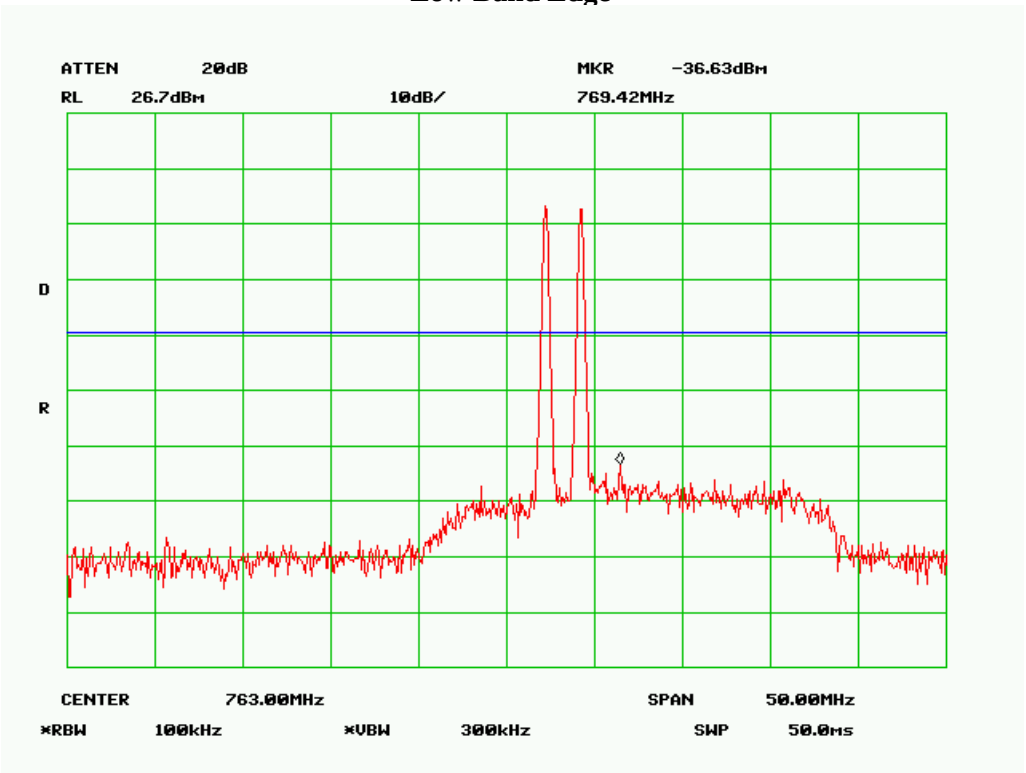



### High Band Edge

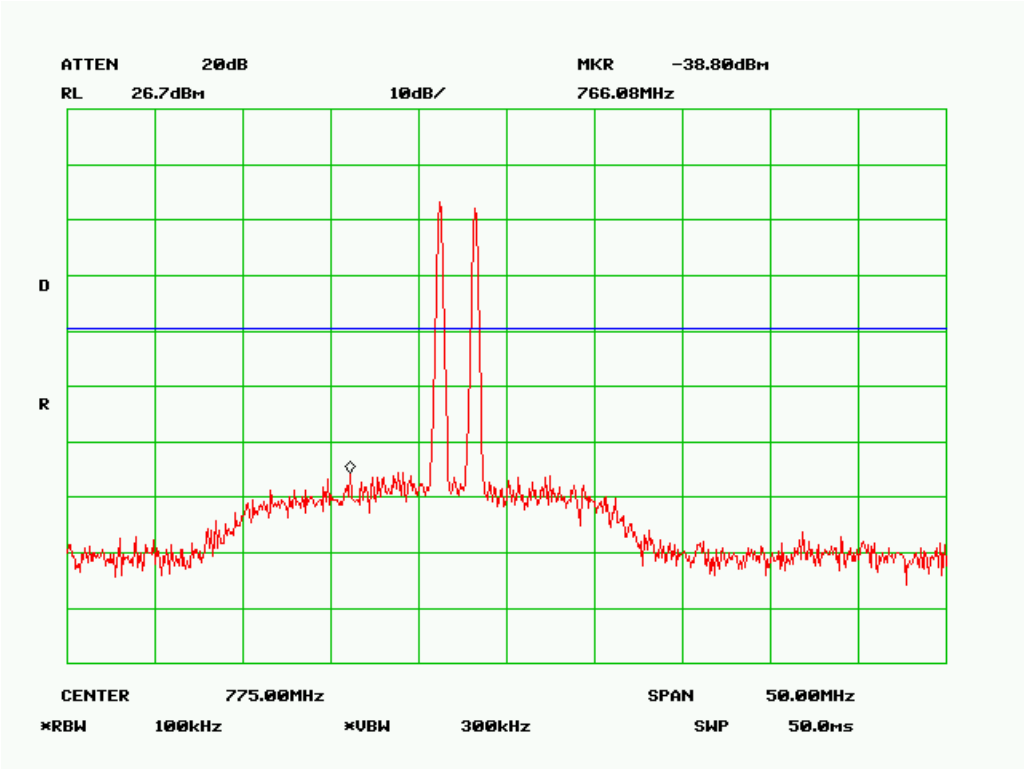


## IDEN Bands (Downlink)

### Low Band Edge

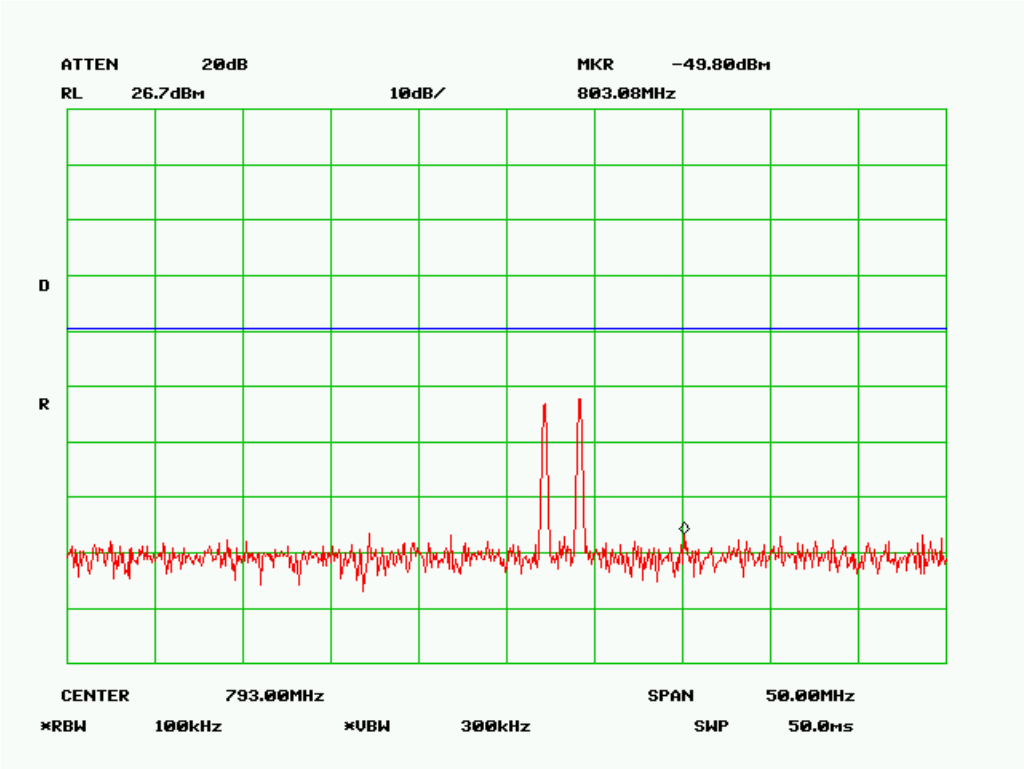



### High Band Edge

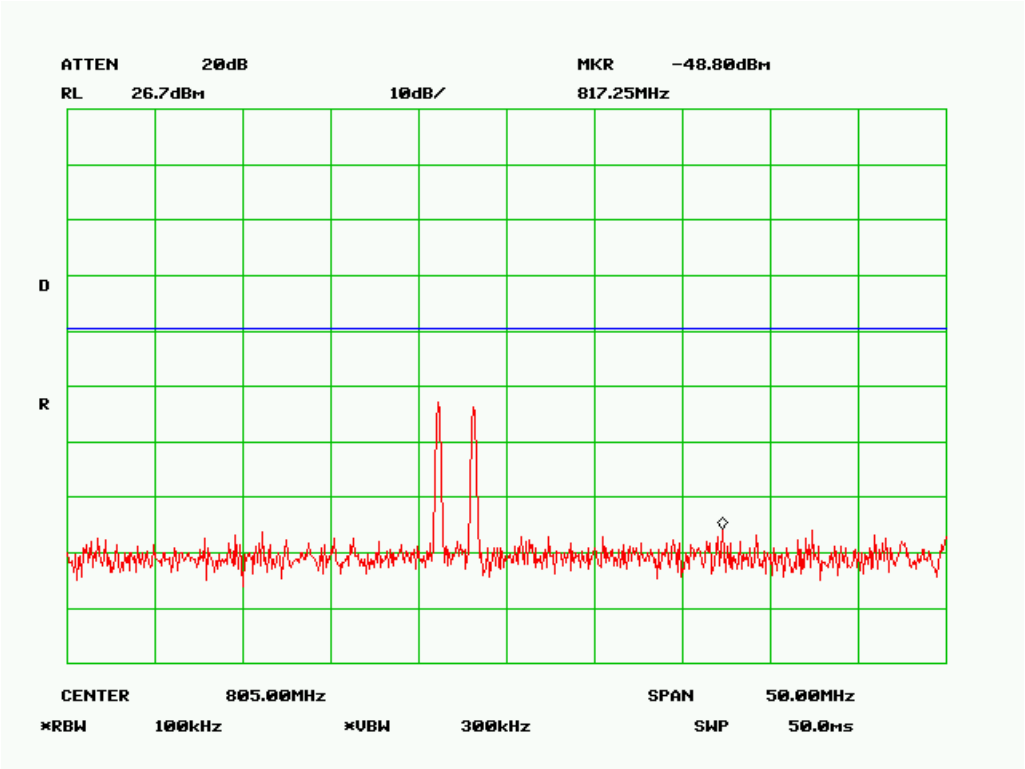


**IDEN Bands (Uplink)**

**Low Band Edge**




**High Band Edge**



# 10 §2.1055 & RSS-119 5.3 – FREQUENCY STABILITY

## 10.1 Applicable Standard

Requirements: FCC § 2.1055, RSS-119 §5.3.

## 10.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

### 10.2.1 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 10.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Cal. Date |
|---|---|---|---|---|
| Agilent | Analyzer, Spectrum | E4446A | US44300386 | 2007-04-26 |
| Tenney | Oven, Temperature | VersaTenn | 12.222-193 | 2007-06-21 |

*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

## 10.4 Test Results

*Frequency Stability versus Temperature*

| Reference Frequency: 769.5 MHz, Limit: 1.0 ppm | | | |
|---|---|---|---|
| Environment Temperature (°C) | Power Supplied (VAC) | Frequency Measure with Time Elapsed | |
| | | Measured Frequency (MHz) | Error (ppm) |
| 50 | 120 | 769.500071 | 0.092268 |
| 40 | 120 | 769.500076 | 0.098765 |
| 30 | 120 | 769.500052 | 0.067576 |
| 20 | 120 | 769.500081 | 0.105263 |
| 10 | 120 | 769.500091 | 0.118259 |
| 0 | 120 | 769.500085 | 0.110461 |
| -10 | 120 | 769.499908 | -0.120078 |
| -20 | 120 | 769.499990 | -0.012865 |
| -30 | 120 | 769.499925 | -0.097466 |

*Frequency Stability versus Voltage*

| Reference Frequency: 769.5 MHz, Limit: 1.0 ppm | | | |
|---|---|---|---|
| Power Supplied (VAC) | Environment Temperature (°C) | Measured Frequency (MHz) | Error (ppm) |
| 102 | 20 | 769.500095 | 0.123457 |

# 11 FCC §15.107, ICES-003 §5 – CONDUCTED EMISSIONS

## 11.1 Applicable Standard

**As per FCC §15.107: Conducted Limits**

(b) For a Class A digital device that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms LISN. Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

| Frequency of Emission (MHz) | Conducted Limit (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15-0.5 | 79 | 66 |
| 0.5-30 | 73 | 60 |

## 11.2 EUT Setup

The conducted emissions tests were performed in the 10-meter chamber, using the setup in accordance with ANSI C63.4-2003 measurement procedures. The specifications used were in accordance with FCC Part 15 Standard, Class A limits.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to a 120 V, 60 Hz AC line power source.

## 11.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| Solar Electronics Company | Line Impedance Network | TYPE 252-50-R-24-N | 0511205 | 2007-07-07 |
| Rohde & Schwarz | EMI Test Receiver | ESCI 3 | 100337 | 2007-02-24 |

****Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to NVLAP requirements, traceable to the NIST.

## 11.4 Test Procedure

During conducted emissions testing, the power cord of the EUT was connected to the main outlet of the LISN-1.

Maximizing procedure was performed on the six (6) highest emission readings from the EUT.

All data was recorded in the peak detection mode, quasi-peak and average. Average readings are labeled "AV," and Quasi-peak readings are labeled "QP," in the test data hereinafter.

## 11.5 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

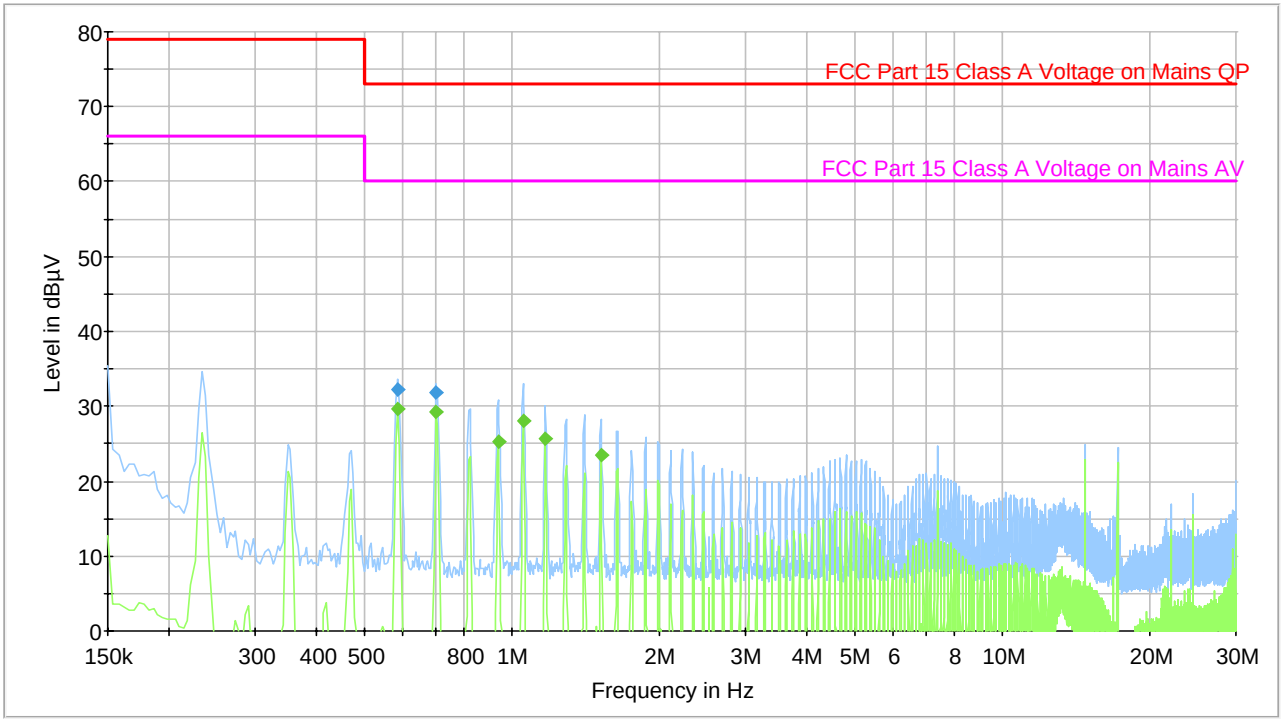
** The testing was performed by Dan Coronia on 2007-12-13.*

## 11.6 Summary of Test Results

According to the recorded data, the EUT complied with FCC §15.107 ICES-003 §5 Standard, Class A limits. Please refer to the following tables and plots.

## 11.7 Conducted Emissions Test Plots and Data

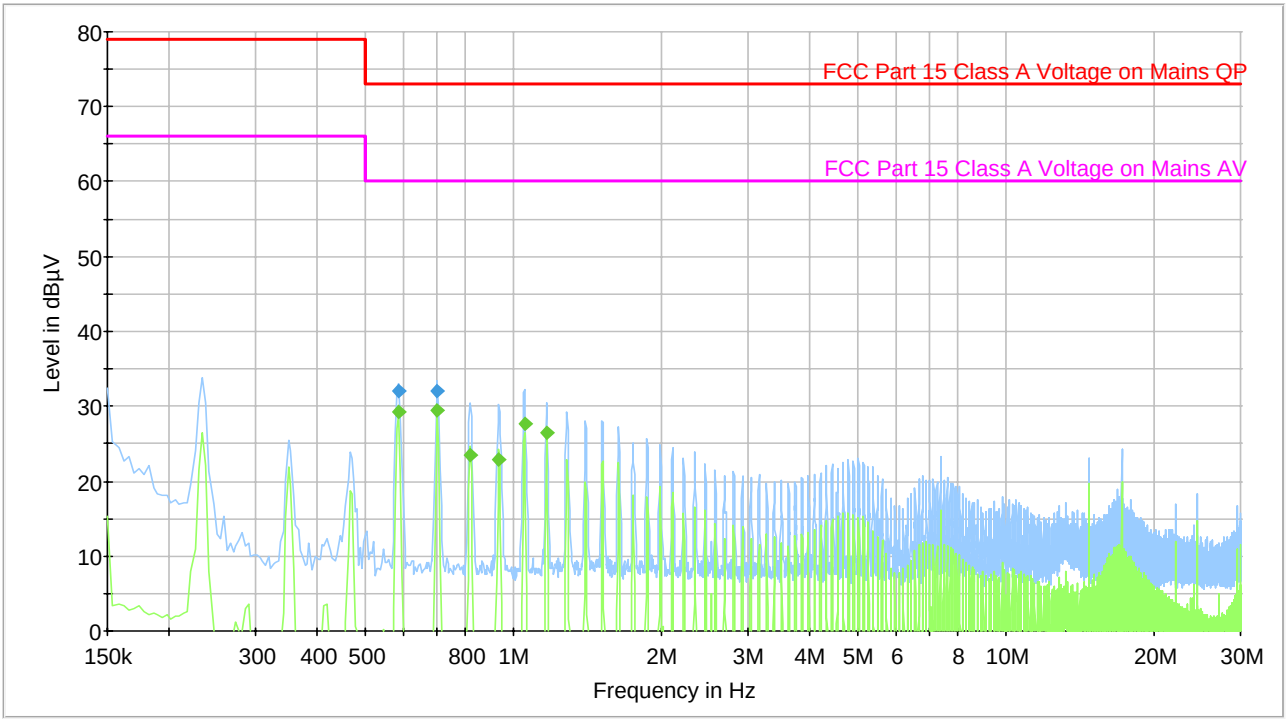
### 11.7.1 120 V, 60 Hz - Hot (Main Hub)




**Average Measurements**

| Frequency (MHz) | Average (dBµV) | Conductor (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.586000 | 29.6 | H | 66.0 | -30.4 |
| 0.702000 | 29.3 | H | 66.0 | -30.7 |
| 0.938000 | 25.3 | H | 66.0 | -34.7 |
| 1.054000 | 28.0 | H | 66.0 | -32.0 |
| 1.170000 | 25.6 | H | 66.0 | -34.4 |
| 1.522000 | 23.5 | H | 66.0 | -36.5 |

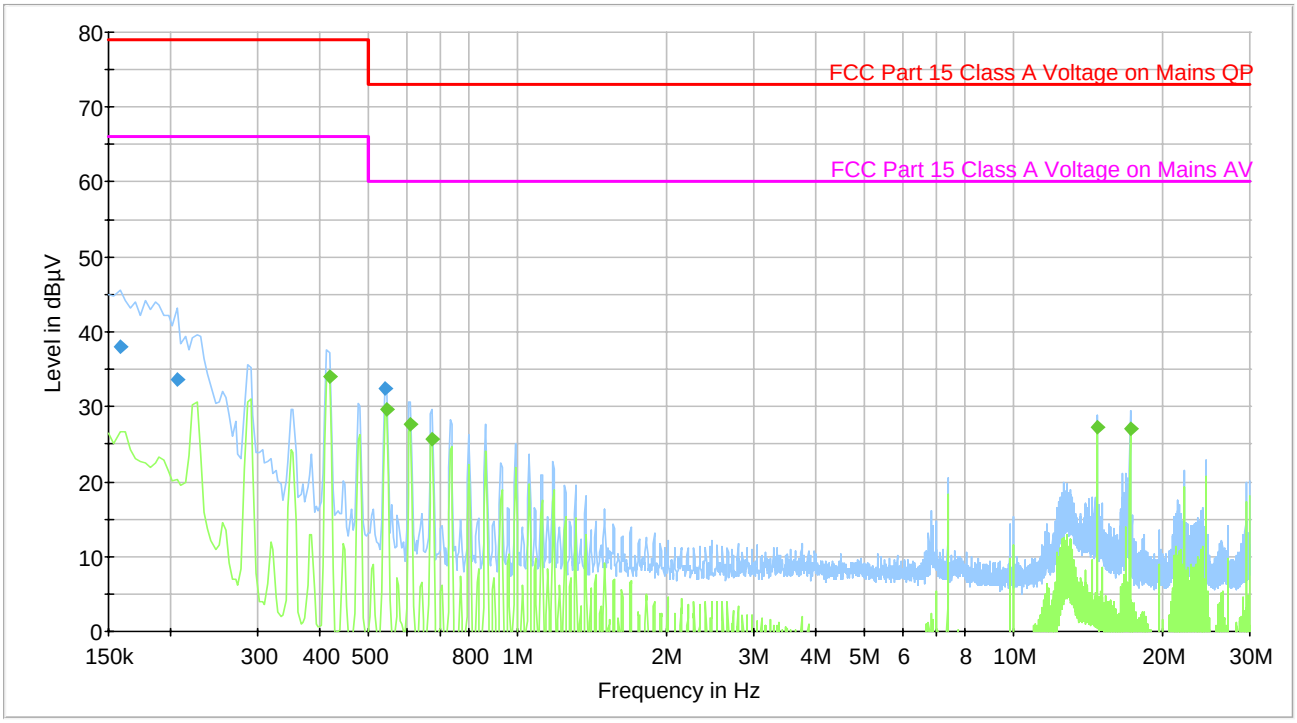
### 11.7.2 120 V, 60 Hz - Neutral (Main Hub)




**Average Measurements**

| Frequency (MHz) | Average (dBµV) | Conductor (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.586000 | 29.2 | N | 66.0 | -30.8 |
| 0.702000 | 29.5 | N | 66.0 | -30.5 |
| 0.818000 | 23.5 | N | 66.0 | -36.5 |
| 0.934000 | 22.8 | N | 66.0 | -37.2 |
| 1.054000 | 27.6 | N | 66.0 | -32.4 |
| 1.170000 | 26.5 | N | 66.0 | -33.5 |

### 11.7.3 120 V, 60 Hz - Hot (Expansion Hub)



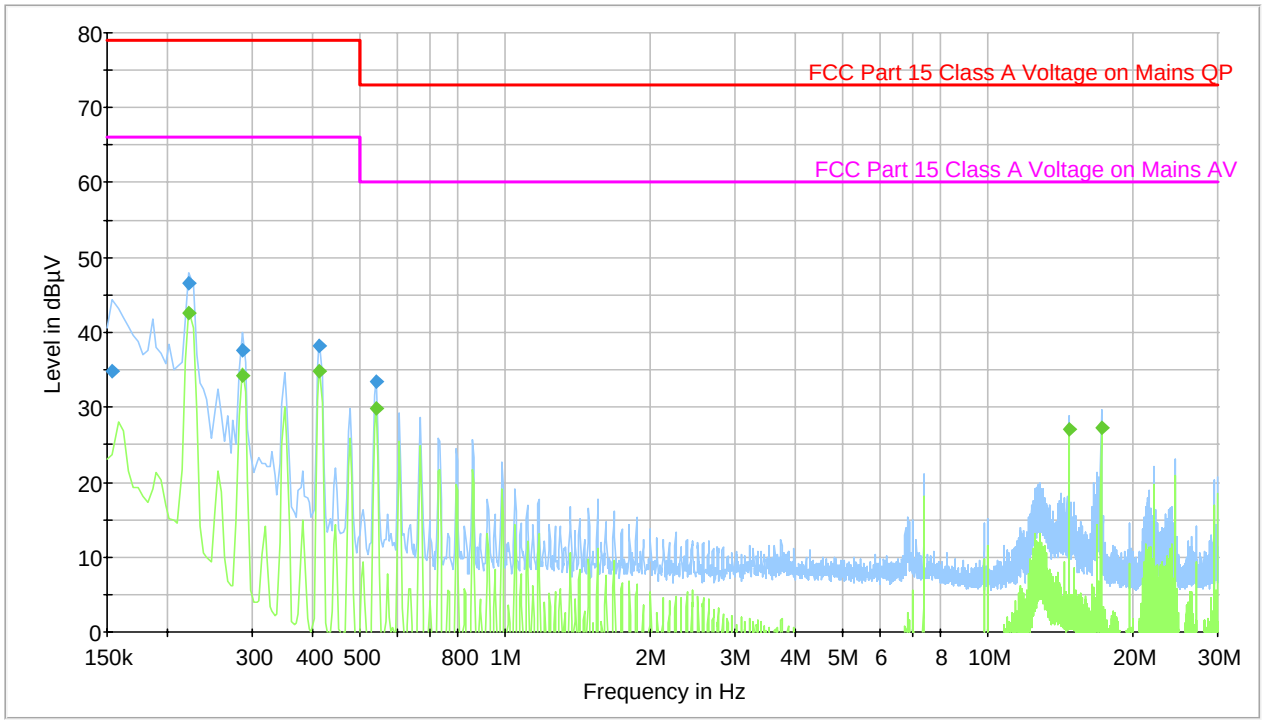

**QP Measurements**

| Frequency (MHz) | Quasi-Peak (dBµV) | Line (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.158000 | 38.1 | H | 79.0 | -40.9 |
| 0.206000 | 33.6 | H | 79.0 | -45.4 |
| 0.542000 | 32.5 | H | 79.0 | -40.5 |
| 0.542000 | 32.5 | H | 79.0 | -40.5 |

**Average Measurements**

| Frequency (MHz) | Average (dBµV) | Line (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.418000 | 34.1 | H | 66.0 | -31.9 |
| 0.546000 | 29.6 | H | 66.0 | -30.4 |
| 0.610000 | 27.6 | H | 66.0 | -32.4 |
| 0.674000 | 25.7 | H | 66.0 | -34.3 |
| 14.746000 | 27.3 | H | 66.0 | -32.7 |
| 17.206000 | 27.1 | H | 60.0 | -32.9 |

### 11.7.4 120 V, 60 Hz – Neutral (Expansion Hub)




**QP Measurements**

| Frequency (MHz) | Quasi-Peak (dBµV) | Line (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.154000 | 34.8 | N | 79.0 | -44.2 |
| 0.222000 | 46.5 | N | 79.0 | -32.5 |
| 0.286000 | 37.6 | N | 79.0 | -41.4 |
| 0.414000 | 38.3 | N | 79.0 | -40.7 |
| 0.542000 | 33.4 | N | 73.0 | -39.6 |

**Average Measurements**

| Frequency (MHz) | Average (dBµV) | Line (H/N) | Limit (dBµV) | Margin (dB) |
|---|---|---|---|---|
| 0.222000 | 42.6 | N | 66.0 | -23.4 |
| 0.286000 | 34.2 | N | 66.0 | -31.8 |
| 0.414000 | 34.7 | N | 60.0 | -31.3 |
| 0.542000 | 29.8 | N | 60.0 | -30.2 |
| 14.746000 | 27.0 | N | 60.0 | -33.0 |
| 17.206000 | 27.3 | N | 60.0 | -32.7 |

# 12 FCC §15.109 & ICES-003 §5– RADIATED EMISSIONS

## 12.1 Applicable Standard

As per FCC §15.109: Radiated Emission Limits

(a) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

| Frequency of Emission (MHz) | Field Strength (µV/m) |
|---|---|
| 30-88 | 90 |
| 88-216 | 150 |
| 216-960 | 210 |
| Above 960 | 300 |

(g) As an alternative to the radiated emission limits shown in paragraphs (a) and (b) of this section, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement."

*Note: The CISPR 22 §6 Standard, Class A limits are applied to the test data hereinafter.*

## 12.2 Test Setup

The radiated emissions tests were performed in the 10-meter test chamber, using the setup in accordance with CISPR 22 Ed. 5.2 b: 2006 measurement procedures. The specifications used were in accordance with CISPR 22 Ed. 5.2 b: 2006 Standard, Class A limits for measurements up to 1 GHz and FCC Part 15 Rules, Class A limits for frequencies above 1 GHz.

The spacing between the peripherals was 10 cm.

The external I/O cables were draped along the test table and bundled as required.

The EUT was connected to a 110 AC Power Source.

## 12.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date |
|---|---|---|---|---|
| Sonama Instrument | Pre- Amplifier | 317 | 260407 | N/R |
| Sunol Science | Broadband Antenna | JB3 Antenna | A020106-2 | 2007-04-05 |
| Rohde & Schwarz | EMI Test Receiver | ESCI 3 | 100337 | 2007-03-08 |
| Sunol Science | System Controller | SC99V | 011003-1 | N/R |

***Statement of Traceability:* BACL Corp.** attests that all calibrations have been performed according to NVLAP requirements, traceable to the NIST.

## 12.4 Test Procedure

Maximization procedure was performed on the six (6) highest emissions readings to ensure the EUT is compliant with all installation combinations.

All data was recorded in the peak detection mode. Quasi-peak readings were performed only when an emission was found to be marginal (within -4 dB of specification limits).

## 12.5 Environmental Conditions

| | |
|---|---|
| Temperature: | 20.3 º C |
| Relative Humidity: | 38.3 % |
| ATM Pressure: | 102.5 kPa |

** The testing was performed by Dan Coronia on 2007-12-13.*

## 12.6 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor, and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corrected Amplitude = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class A. The equation for margin calculation is as follows:

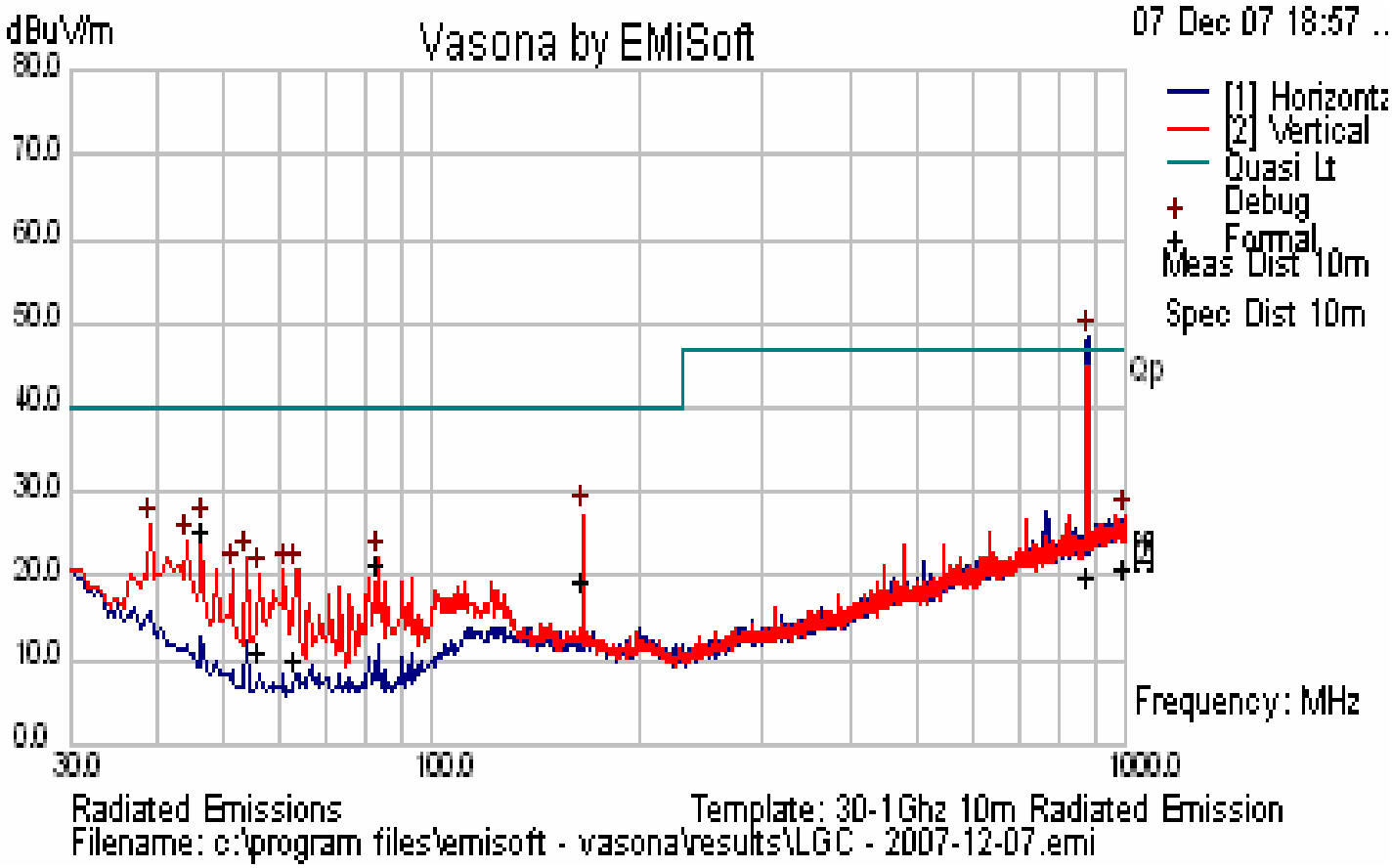
Margin = Corrected Amplitude - Class A Limit

## 12.7 Summary of Test Results

According to the recorded data, the EUT complied with CISPR 22 Standard, Class A limits, and had the worst margin readings (when calculated using CISPR 22 Standard, Class A limits) of:

| **Mode: Receiving** | | | |
|---|---|---|---|
| **Margin (dB)** | **Frequency (MHz)** | **Polarization (Horizontal/Vertical)** | **Range (MHz)** |
| -16.94 | 48.689 | Horizontal | 30 to 1000 MHz |

**Test Data**




| Frequency (MHz) | Quasi-Peak (dBµV/m) | Antenna Height (cm) | Polarity (H/V) | Turntable Position (deg) | Limit (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 46.689 | 23.06 | 283 | V | 283 | 40 | -16.94 |
| 83.584 | 19.16 | 166 | V | 166 | 40 | -20.84 |
| 164.998 | 16.94 | 98 | V | 98 | 40 | -23.06 |
| 996.942 | 18.57 | 315 | V | 315 | 47 | -28.43 |
| 880.891 | 17.37 | 400 | H | 400 | 47 | -29.63 |
| 56.409 | 8.78 | 357 | V | 357 | 40 | -31.22 |
| 63.26 | 7.6 | 169 | V | 169 | 40 | -32.40 |