# FCC PART 27

# TEST AND MEASUREMENT REPORT

For

## Intelibs Inc.

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Florham Park, NJ 07932, USA

## FCC ID: Z69D01T4X3

| Report Type: | Product Type: |
|---|---|
| Original Report | Distributed Antenna Systems Remote Unit |

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## DOCUMENT REVISION HISTORY

| Revision Number | Report Number | Description of Revision | Date of Revision |
|---|---|---|---|
| 0 | R1311257-27 | Original Report | 2014-01-16 |

# 1 General Description

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

The *Intelibs, Inc.* product, model: *DBC-RU-10W-AWS*, FCC ID: Z69D01T4X3 or the "EUT" as referred to in this report, is an Remote Unit for AWS is a part of the Distributed Antenna System (DAS) to clear RF shadows, to fill coverage gaps existing among the adjacent cells and to enhance the quality of service of extending coverage of 2100 MHz AWS band.

## 1.2 Mechanical Description

The EUT dimension is approximately "30.48"cm (L) x "26.34"cm (W) x "47.17"cm (H) and weighs approximately "26" kilograms.

*The test data gathered are from production sample. Serial number: RU0AWS139001, provided by the manufacturer.*

## 1.3 Objective

This type approval report is prepared on behalf of *Intelibs, Inc.* in accordance with Part 2, Subpart J, and part 27 Subpart C of the Federal Communication Commission rules.

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, RF exposure and KDB 935210 D02.

## 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 20.21 - Signal Booster
Part 27 Subpart C – Miscellaneous Wireless Communications Services
KDB 935210 D02

Applicable Standards: TIA EIA 98-C, TIA/EIA 603-C, ANSI C63.4-2009.

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 CISPR16-4-2:2011, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

## 1.7 Test Facility

Bay Area Compliance Laboratories Corp. (BACL) is:

1- An independent Commercial Test Laboratory accredited to **ISO 17025: 2005** by **A2LA**, in the fields of: Electromagnetic Compatibility & Telecommunications covering Emissions, Immunity, Radio, RF Exposure, Safety and Telecom. This includes NEBS (Network Equipment Building System), Wireless RF, Telecommunications Terminal Equipment (TTE); Network Equipment; Information Technology Equipment (ITE); Medical Electrical Equipment; Industrial, Commercial, and Medical Test Equipment; Professional Audio and Video Equipment; Electronic (Digital) Products; Industrial and Scientific Instruments; Cabled Distribution Systems and Energy Efficiency Lighting.

2- An ENERGY STAR Recognized Laboratory, for the LM80 Testing, a wide variety of Luminares and Computers.

3- A NIST Designated Phase-I and Phase-II CAB including: ACMA (Australian Communication and Media Authority), BSMI (Bureau of Standards, Metrology and Inspection of Taiwan), IDA (Infocomm Development Authority of Singapore), IC(Industry Canada), Korea ( Ministry of Communications Radio Research Laboratory), NCC (Formerly DGT; Directorate General of Telecommunication of Chinese Taipei) OFTA (Office of the Telecommunications Authority of Hong Kong), Vietnam, VCCI - Voluntary Control Council for Interference of Japan and a designated EU CAB (Conformity Assessment Body) (Notified Body) for the EMC and R&TTE Directives.

4- A Product Certification Body accredited to **ISO Guide 65: 1996** by **A2LA** to certify:
1- Unlicensed, Licensed radio frequency devices and Telephone Terminal Equipment for the FCC. Scope A1, A2, A3, A4, B1, B2, B3, B4 & C.
2. Radio Standards Specifications (RSS) in the Category I Equipment Standards List and All Broadcasting Technical Standards (BETS) in Category I Equipment Standards List for Industry Canada.
3. Radio Communication Equipment for Singapore.
4. Radio Equipment Specifications, GMDSS Marine Radio Equipment Specifications, and Fixed Network Equipment Specifications for Hong Kong.
5. Japan MIC Telecommunication Business Law (A1, A2) and Radio Law (B1, B2 and B3).
6. Audio/Video, Battery Charging Systems, Computers, Displays, Enterprise Servers, Imaging Equipment, Set-Top Boxes, Telephony, Televisions, Ceiling Fans, CFLs (Including GU24s),Decorative Light Strings, Integral LED Lamps, Luminaires, Residential Ventilating Fans.

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 site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have 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 test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2009, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for Laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

# 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 EUT Exercise Software

The software used Cherry ver.0.1.0.7 provided by Client and was verified by Glenn Escano and Bo Li to comply with the standard requirements being tested against.

"signal was sent through EUT using a signal generator; device was set to normal operating mode."

## 2.3 Equipment Modifications

No modifications were made to the EUT.

## 2.4 Special Equipment

No special equipment used during testing.

## 2.5 Local Support Equipment

| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| Lenovo | Laptop | G560 | - |
| Intelibs | Master Hub Unit | DBC-MHU-10W | MHU000138001 |

## 2.6 External I/O Cabling List and Details

| Cable Description | Length (m) | From | To |
|---|---|---|---|
| Fiber Optic Cable | > 1 | EUT | MHU |
| RS232-USB | 1 | MHU | Laptop |

## 2.7 EUT Internal Configuration Details

| Manufacturers | Descriptions | Models | Serial Numbers |
|---|---|---|---|
| KJ COMTECH | AWS RF MUX | DX00393 | - |
| KJ COMTECH | AWS RRCOM | DX00392 | - |
| Intelibs, Inc. | RFBS0_AWS | VDAWCFRU | - |
| Intelibs, Inc. | RFBS1_AWS | VDAWCFRU | - |
| Intelibs, Inc. | RRBS0_AWS | - | - |
| Intelibs, Inc. | RRBS1_AWS | - | - |
| Kisan Telecom | AWS SOU | - | - |
| Intelibs, Inc. | FSK Modem | HM-374T/311R | - |
| Intelibs, Inc. | HPA_AWS | SMD076 | 0020 |
| Intelibs, Inc. | FE_DUPLEX_AWS | VDAWDP21 | - |
| Intelibs, Inc. | PSU | VDAUPSUA | - |
| Intelibs, Inc. | NMS_Controller | VDAWRUNM | - |
| Intelibs, Inc. | NMS_Controller(CPU) | NEO-2510 V0.0 | - |
| Intelibs, Inc. | NMS_Controller(IO) | KST-PWDucl_RU | - |
| KJ COMTECH | 3WAY | PD00488 | - |
| KJ COMTECH | 10dB Coupler | DC00255 | - |

# 3 Summary of Test Results

| FCC Rules | Description of Tests | Results |
|---|---|---|
| §2.1046<br>§27.50(d), (3) | RF Output Power | Compliant |
| §2.1047 | Modulation Characteristics | N/A* |
| §2.1049<br>§27.53 | Occupied Bandwidth | Compliant |
| §2.1053<br>§27.53 (g) | Spurious Radiated Emissions | Compliant |
| §2.1051<br>§27.53 (h) | Spurious Emissions at Antenna Terminals<br>Out of Band Rejection | Compliant |
| §27.53 (8) | Band Edge | Compliant |
| §2.1055<br>§27.54 | Frequency Stability | N/A |
| §2.1091<br>§27.52 | RF Exposure Information | Compliant |

Note: N/A*, the device is a booster.

# 4 FCC §2.1046 & §27.50 (d) (3) – RF Output Power

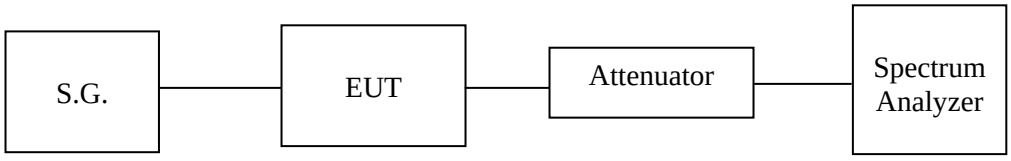
## 4.1 Applicable Standard

According to FCC §27.50 (d), (3), the maximum equivalent isotropically radiated power (EIRP) of fixed and base station must not exceed 1640 Watts.

## 4.2 Test Procedure

*Conducted:*

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




## 4.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | PSA, Series Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 2 years |
| Agilent | Generator, Signal | E4438C | MY45091309 | 2013-05-30 | 1 year |

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 4.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 22 ºC |
| **Relative Humidity:** | 35 % |
| **ATM Pressure:** | 101.69 kPa |

*The testing was performed by Glenn Escano from 2013-12-12 at RF Site.*

## 4.5 Test Results

Note: Worst case measurement is AGC Off, the rated output power at each port is 10 Watts (40 dBm).

WCDMA/HSPA, Chain J0

| Mode | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mW) | Limit (Watts) |
|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | 2112.4 | 0 | 37.51 | 38.68 | 5636.38 | 7379.04 | 1640 |
| | 2132.4 | 0 | 37.67 | 39.17 | 5847.90 | 8260.38 | 1640 |
| | 2152.6 | 0 | 37.52 | 38.87 | 5649.37 | 7709.03 | 1640 |

WCDMA/HSPA, Chain J1

| Mode | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mW) | Limit (Watts) |
|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | 2112.4 | 0 | 38.63 | 39.22 | 7294.58 | 8356.03 | 1640 |
| | 2132.4 | 0 | 38.96 | 39.58 | 7870.46 | 9078.21 | 1640 |
| | 2152.6 | 0 | 38.61 | 39.38 | 7261.06 | 8669.62 | 1640 |

2100 MHz -LTE – Downlink Chain J0

| Mode | Modulation | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mw) | Limit (Watt) |
|---|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | QPSK (1.4 MHz) | 2111 | 0 | 37.74 | 38.76 | 5942.92 | 7516.23 | 1640 |
| | QPSK (1.4 MHz) | 2132 | 0 | 37.23 | 39.27 | 5284.45 | 8452.79 | 1640 |
| | QPSK (1.4 MHz) | 2154 | 0 | 36.45 | 38.89 | 4415.70 | 7744.62 | 1640 |
| | 16QAM (1.4 MHz) | 2111 | 0 | 36.3 | 38.97 | 4265.80 | 7888.60 | 1640 |
| | 16QAM (1.4 MHz) | 2132 | 0 | 36.74 | 39.06 | 4720.63 | 8053.78 | 1640 |
| | 16QAM (1.4 MHz) | 2154 | 0 | 35.91 | 39.07 | 3899.42 | 8072.35 | 1640 |
| | 64QAM (1.4 MHz) | 2111 | 0 | 36.53 | 39 | 4497.80 | 7943.28 | 1640 |
| | 64QAM (1.4 MHz) | 2132 | 0 | 37.19 | 39.27 | 5236.00 | 8452.79 | 1640 |
| | 64QAM (1.4 MHz) | 2154 | 0 | 36.02 | 39.09 | 3999.45 | 8109.61 | 1640 |
| | QPSK (3 MHz) | 2112 | 0 | 37.32 | 39.06 | 5395.11 | 8053.78 | 1640 |
| | QPSK (3 MHz) | 2132 | 0 | 37.62 | 39.29 | 5780.96 | 8491.80 | 1640 |
| | QPSK (3 MHz) | 2153 | 0 | 37.26 | 39 | 5321.08 | 7943.28 | 1640 |
| | 16QAM (3 MHz) | 2112 | 0 | 36.69 | 38.97 | 4666.59 | 7888.60 | 1640 |
| | 16QAM (3 MHz) | 2132 | 0 | 37.06 | 39.37 | 5081.59 | 8649.68 | 1640 |
| | 16QAM (3 MHz) | 2153 | 0 | 36.16 | 39.03 | 4130.48 | 7998.34 | 1640 |
| | 64QAM (3 MHz) | 2112 | 0 | 36.62 | 38.91 | 4591.98 | 7780.37 | 1640 |
| | 64QAM (3 MHz) | 2132 | 0 | 36.71 | 39.39 | 4688.13 | 8689.60 | 1640 |
| | 64QAM (3 MHz) | 2153 | 0 | 36.35 | 39.05 | 4315.19 | 8035.26 | 1640 |
| | QPSK (5 MHz) | 2113 | 0 | 37.31 | 39.32 | 5382.70 | 8550.67 | 1640 |
| | QPSK (5 MHz) | 2132 | 0 | 37.23 | 39.45 | 5284.45 | 8810.49 | 1640 |
| | QPSK (5 MHz) | 2152 | 0 | 36.71 | 39.41 | 4688.13 | 8729.71 | 1640 |
| | 16QAM (5 MHz) | 2113 | 0 | 36.85 | 39.47 | 4841.72 | 8851.16 | 1640 |
| | 16QAM (5 MHz) | 2132 | 0 | 37.09 | 39.42 | 5116.82 | 8749.84 | 1640 |
| | 16QAM (5 MHz) | 2152 | 0 | 37.23 | 39.53 | 5284.45 | 8974.29 | 1640 |
| | 64QAM (5 MHz) | 2113 | 0 | 36.95 | 39.35 | 4954.50 | 8609.94 | 1640 |
| | 64QAM (5 MHz) | 2132 | 0 | 37.13 | 39.67 | 5164.16 | 9268.30 | 1640 |
| | 64QAM (5 MHz) | 2152 | 0 | 36.78 | 39.26 | 4764.31 | 8433.35 | 1640 |
| | QPSK (10 MHz) | 2115 | 0 | 37.27 | 39.44 | 5333.35 | 8790.23 | 1640 |
| | QPSK (10 MHz) | 2132 | 0 | 37.17 | 39.54 | 5211.95 | 8994.98 | 1640 |
| | QPSK (10 MHz) | 2150 | 0 | 37.36 | 39.47 | 5445.03 | 8851.16 | 1640 |
| | 16QAM (10 MHz) | 2115 | 0 | 37.1 | 39.44 | 5128.61 | 8790.23 | 1640 |
| | 16QAM (10 MHz) | 2132 | 0 | 37.14 | 39.56 | 5176.07 | 9036.49 | 1640 |
| | 16QAM (10 MHz) | 2150 | 0 | 37.64 | 39.38 | 5807.64 | 8669.62 | 1640 |
| | 64QAM (10 MHz) | 2115 | 0 | 37.33 | 39.48 | 5407.54 | 8871.56 | 1640 |
| | 64QAM (10 MHz) | 2132 | 0 | 37.27 | 39.52 | 5333.35 | 8953.65 | 1640 |
| | 64QAM (10 MHz) | 2150 | 0 | 37.1 | 39.2 | 5128.61 | 8317.64 | 1640 |

2100 MHz -LTE – Downlink Chain J0
(Continued)

| Mode | Modulation | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mw) | Limit (Watt) |
|---|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | QPSK (15 MHz) | 2117.6 | 0 | 36.89 | 39.54 | 4886.52 | 8994.98 | 1640 |
| | QPSK (15 MHz) | 2147.4 | 0 | 37.35 | 39.6 | 5432.50 | 9120.11 | 1640 |
| | 16QAM (15 MHz) | 2117.6 | 0 | 37.14 | 39.41 | 5176.07 | 8729.71 | 1640 |
| | 16QAM (15 MHz) | 2147.4 | 0 | 37.35 | 39.63 | 5432.50 | 9183.33 | 1640 |
| | 64QAM (15 MHz) | 2117.6 | 0 | 37.11 | 39.24 | 5140.44 | 8394.60 | 1640 |
| | 64QAM (15 MHz) | 2147.4 | 0 | 37.5 | 39.49 | 5623.41 | 8892.01 | 1640 |
| | QPSK (20 MHz) | 2120 | 0 | 36.99 | 39.17 | 5000.35 | 8260.38 | 1640 |
| | QPSK (20 MHz) | 2145 | 0 | 37.4 | 39.57 | 5495.41 | 9057.33 | 1640 |
| | 16QAM (20 MHz) | 2120 | 0 | 36.55 | 39.16 | 4518.56 | 8241.38 | 1640 |
| | 16QAM (20 MHz) | 2145 | 0 | 37.28 | 39.56 | 5345.64 | 9036.49 | 1640 |
| | 64QAM (20 MHz) | 2120 | 0 | 36.69 | 39.2 | 4666.59 | 8317.64 | 1640 |
| | 64QAM (20 MHz) | 2145 | 0 | 37.15 | 39.53 | 5188.00 | 8974.29 | 1640 |

2100 MHz -LTE – Downlink Chain J1

| Mode | Modulation | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mw) | Limit (Watt) |
|---|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | QPSK (1.4 MHz) | 2111 | 0 | 38.76 | 39.49 | 7516.229 | 8892.011 | 1640 |
| | QPSK (1.4 MHz) | 2132 | 0 | 38.77 | 39.53 | 7533.556 | 8974.288 | 1640 |
| | QPSK (1.4 MHz) | 2154 | 0 | 38.22 | 39.28 | 6637.431 | 8472.274 | 1640 |
| | 16QAM (1.4 MHz) | 2111 | 0 | 38.74 | 39.45 | 7481.695 | 8810.489 | 1640 |
| | 16QAM (1.4 MHz) | 2132 | 0 | 38.94 | 39.45 | 7834.296 | 8810.489 | 1640 |
| | 16QAM (1.4 MHz) | 2154 | 0 | 38.41 | 39.44 | 6934.258 | 8790.225 | 1640 |
| | 64QAM (1.4 MHz) | 2111 | 0 | 38.71 | 39.37 | 7430.191 | 8649.679 | 1640 |
| | 64QAM (1.4 MHz) | 2132 | 0 | 39 | 39.36 | 7943.282 | 8629.785 | 1640 |
| | 64QAM (1.4 MHz) | 2154 | 0 | 38.28 | 39.36 | 6729.767 | 8629.785 | 1640 |
| | QPSK (3 MHz) | 2112 | 0 | 38.63 | 39.67 | 7294.575 | 9268.298 | 1640 |
| | QPSK (3 MHz) | 2132 | 0 | 38.84 | 39.49 | 7655.966 | 8892.011 | 1640 |
| | QPSK (3 MHz) | 2153 | 0 | 38.46 | 39.27 | 7014.553 | 8452.788 | 1640 |
| | 16QAM (3 MHz) | 2112 | 0 | 38.54 | 39.57 | 7144.963 | 9057.326 | 1640 |
| | 16QAM (3 MHz) | 2132 | 0 | 38.4 | 39.74 | 6918.31 | 9418.896 | 1640 |
| | 16QAM (3 MHz) | 2153 | 0 | 38.54 | 39.64 | 7144.963 | 9204.496 | 1640 |
| | 64QAM (3 MHz) | 2112 | 0 | 38.67 | 39.28 | 7362.071 | 8472.274 | 1640 |
| | 64QAM (3 MHz) | 2132 | 0 | 38.45 | 39.66 | 6998.42 | 9246.982 | 1640 |
| | 64QAM (3 MHz) | 2153 | 0 | 38.35 | 39.11 | 6839.116 | 8147.043 | 1640 |

2100 MHz -LTE – Downlink Chain J1
(Continued)

| Mode | Modulation | Frequency (MHz) | Input Power (dBm) | AGC-On Output Power (dBm) | AGC-Off Output Power (dBm) | AGC-On Output Power (mW) | AGC-Off Output Power (mw) | Limit (Watt) |
|---|---|---|---|---|---|---|---|---|
| Downlink 2110-2155 MHz | QPSK (5 MHz) | 2113 | 0 | 38.35 | 39.27 | 6839.116 | 8452.788 | 1640 |
| | QPSK (5 MHz) | 2132 | 0 | 38.9 | 39.53 | 7762.471 | 8974.288 | 1640 |
| | QPSK (5 MHz) | 2152 | 0 | 38.51 | 39.16 | 7095.778 | 8241.381 | 1640 |
| | 16QAM (5 MHz) | 2113 | 0 | 38.35 | 39.45 | 6839.116 | 8810.489 | 1640 |
| | 16QAM (5 MHz) | 2132 | 0 | 38.96 | 39.56 | 7870.458 | 9036.495 | 1640 |
| | 16QAM (5 MHz) | 2152 | 0 | 38.69 | 39.68 | 7396.053 | 9289.664 | 1640 |
| | 64QAM (5 MHz) | 2113 | 0 | 38.65 | 39.47 | 7328.245 | 8851.156 | 1640 |
| | 64QAM (5 MHz) | 2132 | 0 | 38.85 | 39.33 | 7673.615 | 8570.378 | 1640 |
| | 64QAM (5 MHz) | 2152 | 0 | 38.58 | 39.29 | 7211.075 | 8491.805 | 1640 |
| | QPSK (10 MHz) | 2115 | 0 | 38.51 | 39.71 | 7095.778 | 9354.057 | 1640 |
| | QPSK (10 MHz) | 2132 | 0 | 38.65 | 39.76 | 7328.245 | 9462.372 | 1640 |
| | QPSK (10 MHz) | 2150 | 0 | 38.43 | 39.51 | 6966.265 | 8933.055 | 1640 |
| | 16QAM (10 MHz) | 2115 | 0 | 38.59 | 39.68 | 7227.698 | 9289.664 | 1640 |
| | 16QAM (10 MHz) | 2132 | 0 | 38.87 | 39.46 | 7709.035 | 8830.799 | 1640 |
| | 16QAM (10 MHz) | 2150 | 0 | 38.45 | 39.48 | 6998.42 | 8871.56 | 1640 |
| | 64QAM (10 MHz) | 2115 | 0 | 38.61 | 39.61 | 7261.06 | 9141.132 | 1640 |
| | 64QAM (10 MHz) | 2132 | 0 | 39.07 | 39.53 | 8072.35 | 8974.288 | 1640 |
| | 64QAM (10 MHz) | 2150 | 0 | 38.58 | 39.64 | 7211.075 | 9204.496 | 1640 |
| | QPSK (15 MHz) | 2117.6 | 0 | 38.54 | 39.66 | 7144.963 | 9246.982 | 1640 |
| | QPSK (15 MHz) | 2147.4 | 0 | 38.77 | 39.48 | 7533.556 | 8871.56 | 1640 |
| | 16QAM (15 MHz) | 2117.6 | 0 | 38.51 | 39.67 | 7095.778 | 9268.298 | 1640 |
| | 16QAM (15 MHz) | 2147.4 | 0 | 38.67 | 39.41 | 7362.071 | 8729.714 | 1640 |
| | 64QAM (15 MHz) | 2117.6 | 0 | 38.68 | 39.5 | 7379.042 | 8912.509 | 1640 |
| | 64QAM (15 MHz) | 2147.4 | 0 | 38.41 | 39.71 | 6934.258 | 9354.057 | 1640 |
| | QPSK (20 MHz) | 2120 | 0 | 38.42 | 39.59 | 6950.243 | 9099.133 | 1640 |
| | QPSK (20 MHz) | 2145 | 0 | 38.99 | 39.85 | 7925.013 | 9660.509 | 1640 |
| | 16QAM (20 MHz) | 2120 | 0 | 38.7 | 39.6 | 7413.102 | 9120.108 | 1640 |
| | 16QAM (20 MHz) | 2145 | 0 | 38.59 | 39.83 | 7227.698 | 9616.123 | 1640 |
| | 64QAM (20 MHz) | 2120 | 0 | 38.62 | 39.62 | 7277.798 | 9162.205 | 1640 |
| | 64QAM (20 MHz) | 2145 | 0 | 38.46 | 39.4 | 7014.553 | 8709.636 | 1640 |

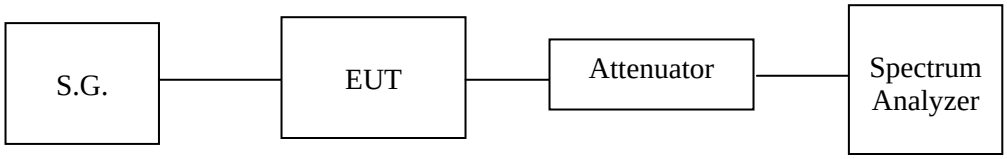
# 5 FCC §2.1049 & §27.53 – Occupied Bandwidth

## 5.1 Applicable Standard

Requirements: FCC §2.1049 and §27.53.

## 5.2 Test Procedure

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




## 5.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | PSA, Series Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 2 years |
| Agilent | Generator, Signal | E4438C | MY45091309 | 2013-05-30 | 1 year |

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 5.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 ºC |
| **Relative Humidity:** | 30 % |
| **ATM Pressure:** | 101.79 kPa |

*The testing was performed by Glenn Escano from 2013-12-13 at RF Site.*

## 5.5 Test Results

Please refer to the following tables and plots.

**Occupied Bandwidth:**

2100 MHz WCDMA/HSPA - Downlink

| Mode | Frequency (MHz) | Emission Bandwidth Input (MHz) | Emission Bandwidth Output (MHz) | |
|---|---|---|---|---|
| | | | Chain J0 | Chain J1 |
| WCDMA/HSPA | 2132.4 | 4.1795 | 4.1609 | 4.1657 |

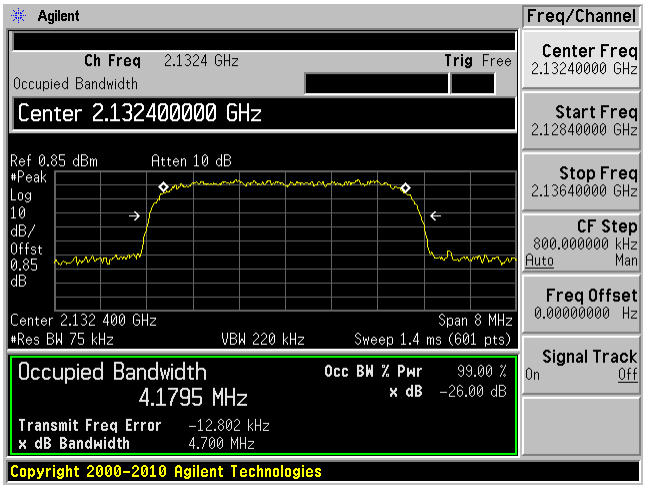
2100 MHz -LTE - Downlink

| Mode | Modulation | Frequency (MHz) | Emission Bandwidth Input (MHz) | Emission Bandwidth Output (MHz) | |
|---|---|---|---|---|---|
| | | | | Chain J0 | Chain J1 |
| Downlink 2110-2155 MHz | QPSK (1.4 MHz) | 2132 | 1.1018 | 1.1110 | 1.1092 |
| | 16QAM (1.4 MHz) | 2132 | 1.0958 | 1.1111 | 1.0981 |
| | 64QAM (1.4 MHz) | 2132 | 1.0936 | 1.1009 | 1.1021 |
| | QPSK (3 MHz) | 2132 | 2.6984 | 2.7046 | 2.7028 |
| | 16QAM (3 MHz) | 2132 | 2.6903 | 2.7030 | 2.7040 |
| | 64QAM (3 MHz) | 2132 | 2.6954 | 2.7051 | 2.7083 |
| | QPSK (5 MHz) | 2132 | 4.4880 | 4.4948 | 4.4874 |
| | 16QAM (5 MHz) | 2132 | 4.4747 | 4.4935 | 4.4785 |
| | 64QAM (5 MHz) | 2132 | 4.4862 | 4.4864 | 4.4808 |
| | QPSK (10 MHz) | 2132 | 8.9347 | 8.9626 | 8.9572 |
| | 16QAM (10 MHz) | 2132 | 8.9322 | 8.9544 | 8.9607 |
| | 64QAM (10 MHz) | 2132 | 8.9476 | 8.9712 | 8.9653 |
| | QPSK (15 MHz) | 2147 | 13.3979 | 13.3974 | 13.4167 |
| | 16QAM (15 MHz) | 2147 | 13.3916 | 13.4060 | 13.4124 |
| | 64QAM (15 MHz) | 2147 | 13.4172 | 13.3782 | 13.4071 |
| | QPSK (20 MHz) | 2145 | 17.8916 | 17.8543 | 17.8821 |
| | 16QAM (20 MHz) | 2145 | 17.8591 | 17.1987 | 17.8768 |
| | 64QAM (20 MHz) | 2145 | 17.8550 | 17.7976 | 17.8768 |

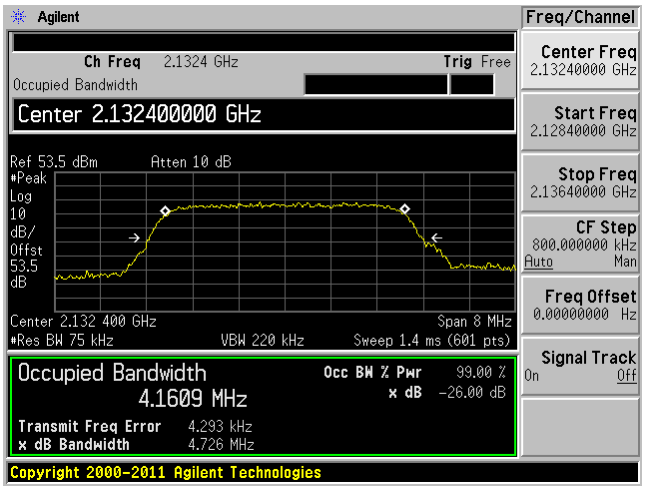
**WCDMA/HSPA; DL: 2110-2155 MHz**

"Middle" Channel ("2132.4" MHz)

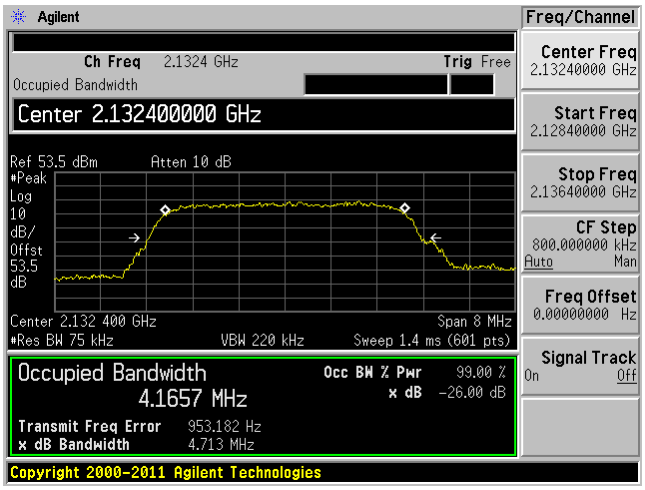
Input




Output, Chain J0



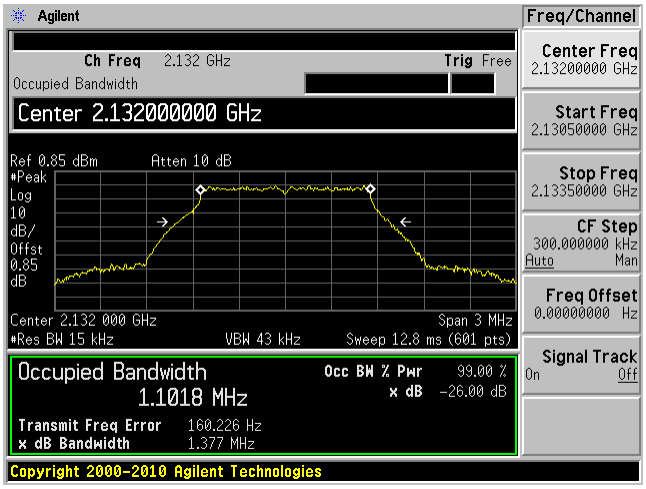

Output, Chain J1



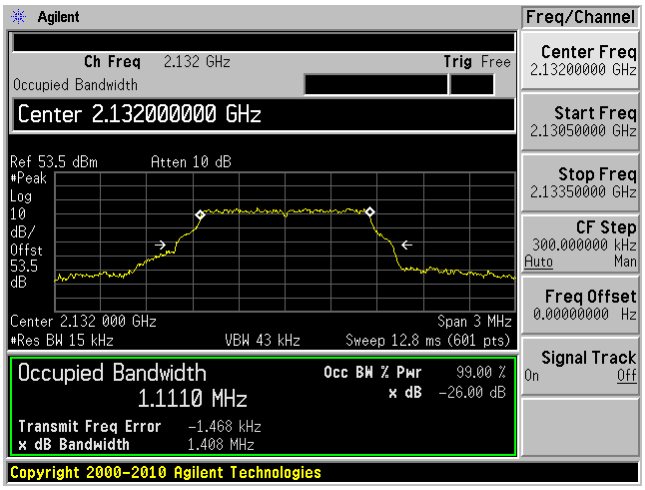
**LTE; DL: 2110-2155 MHz**

QPSK (1.4 MHz), (Middle Channel)

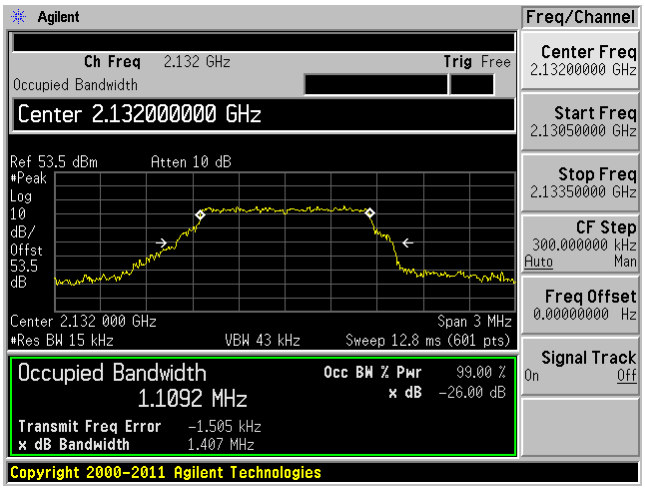
Input




Output, Chain J0

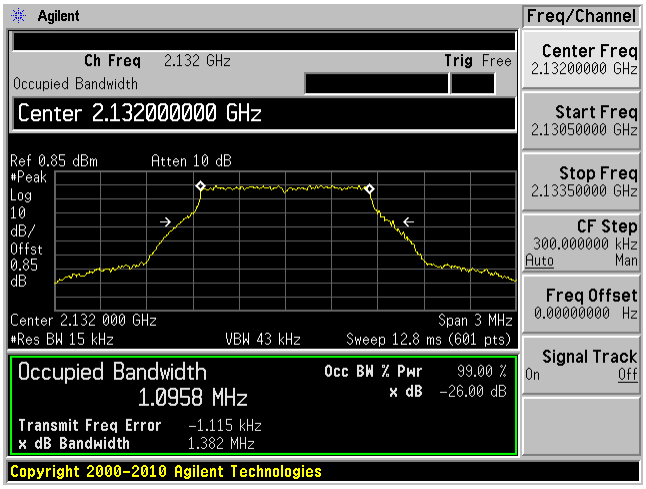



Output, Chain J1

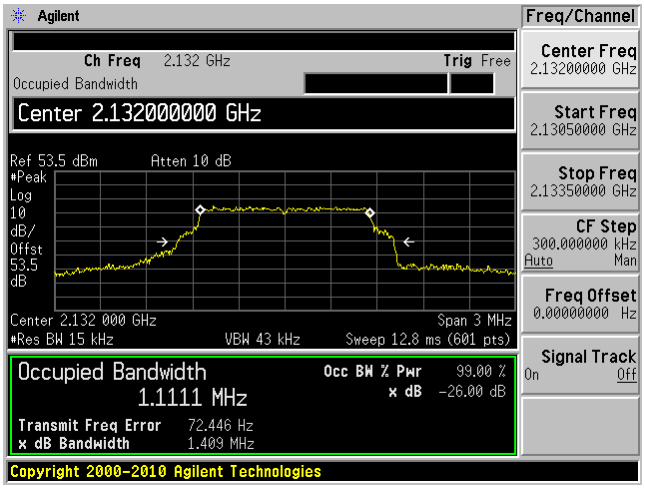


16QAM (1.4 MHz), (Middle Channel)

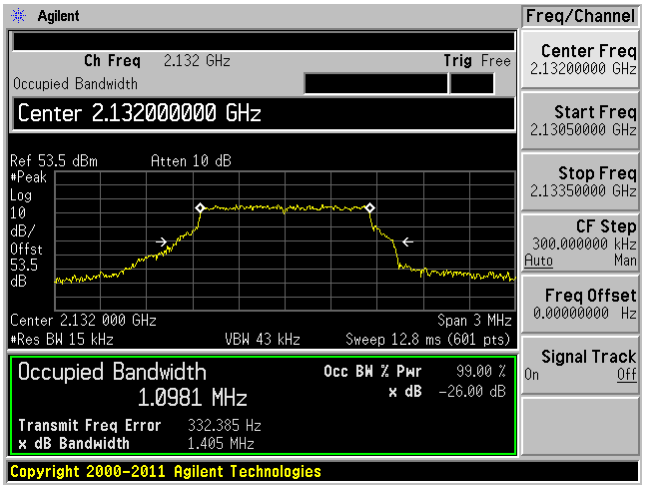
Input




Output, Chain J0

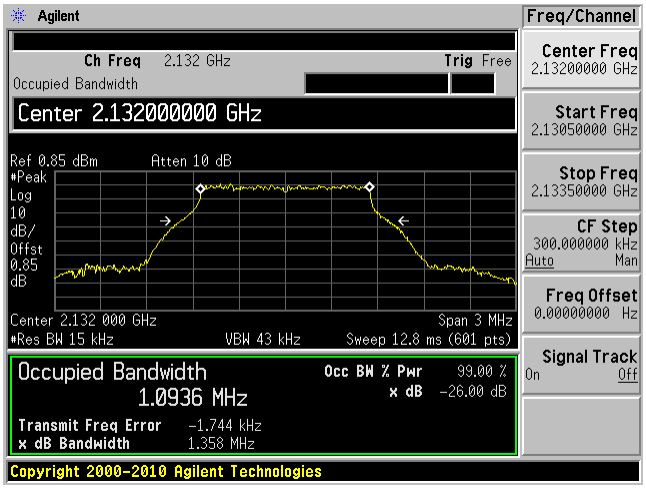



Output, Chain J1

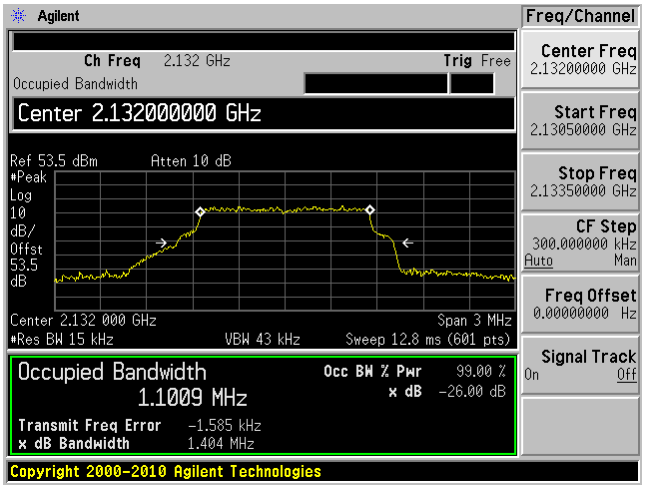


64QAM (1.4 MHz), (Middle Channel)

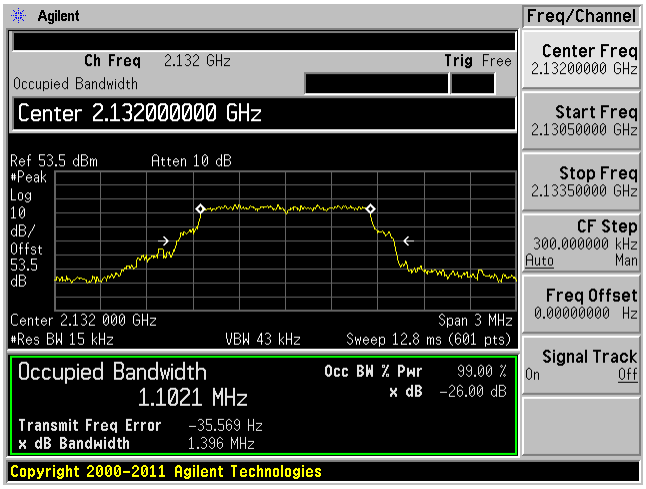
Input




Output, Chain J0

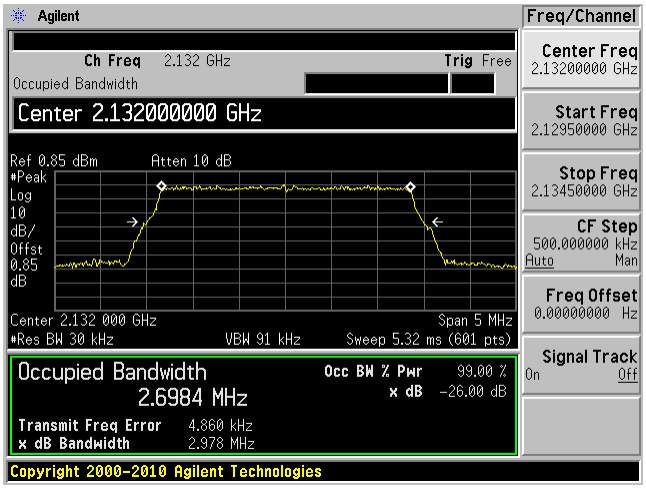



Output, Chain J1

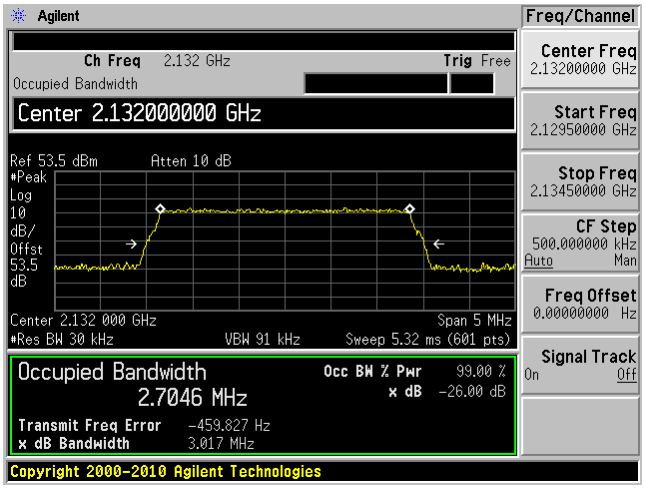


QPSK (3 MHz), (Middle Channel)

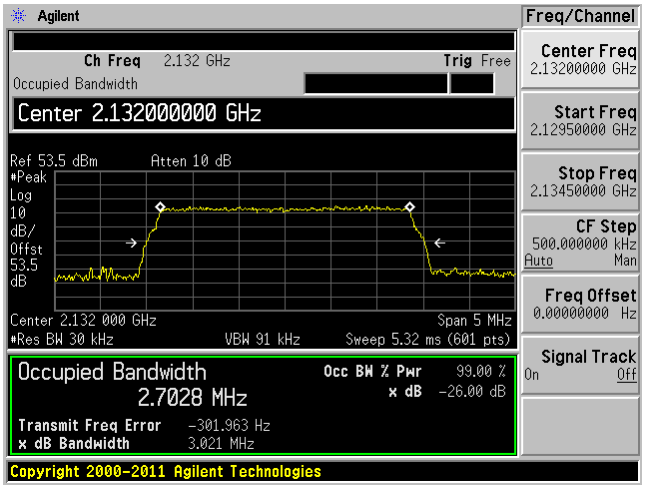
Input




Output, Chain J0

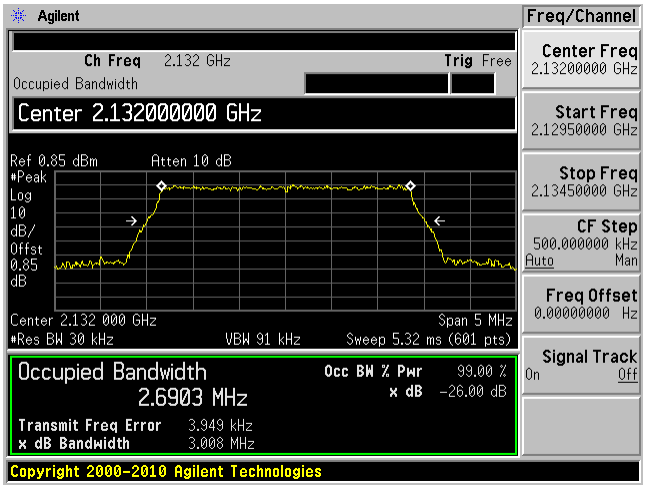



Output, Chain J1

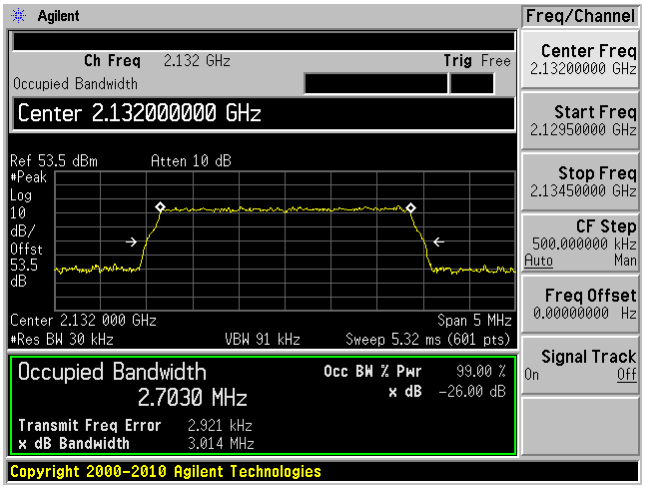


16QAM (3 MHz), (Middle Channel)

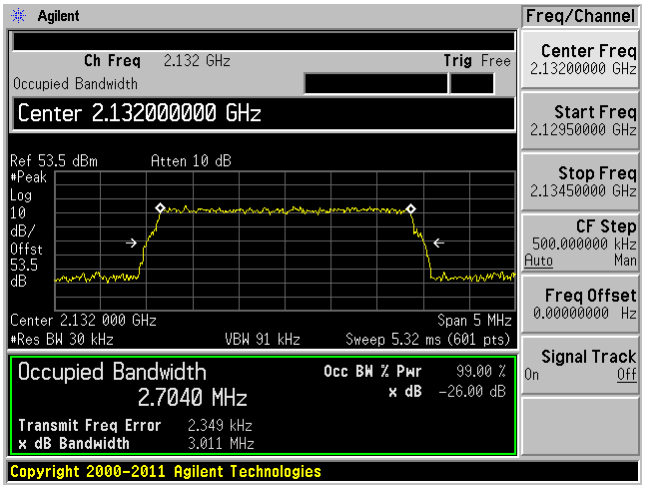
Input




Output, Chain J0

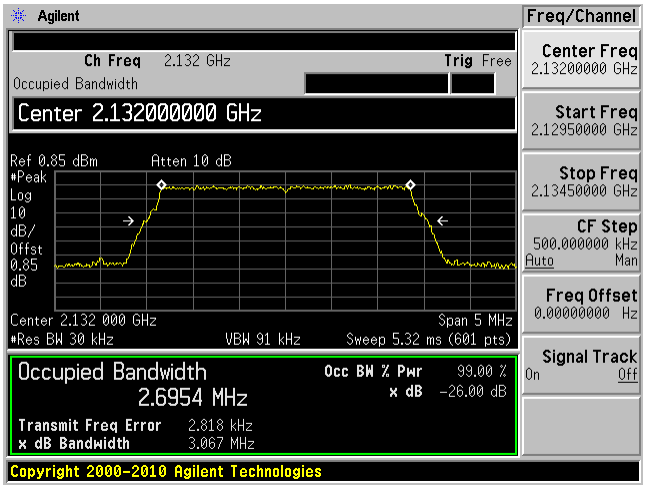



Output, Chain J1

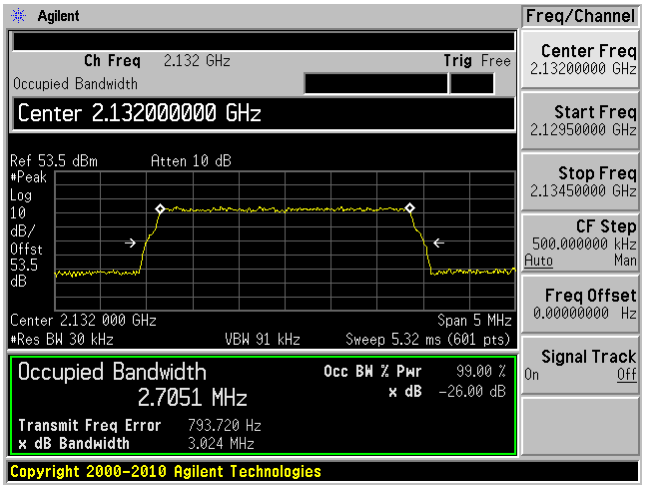


64QAM (3MHz), (Middle Channel)

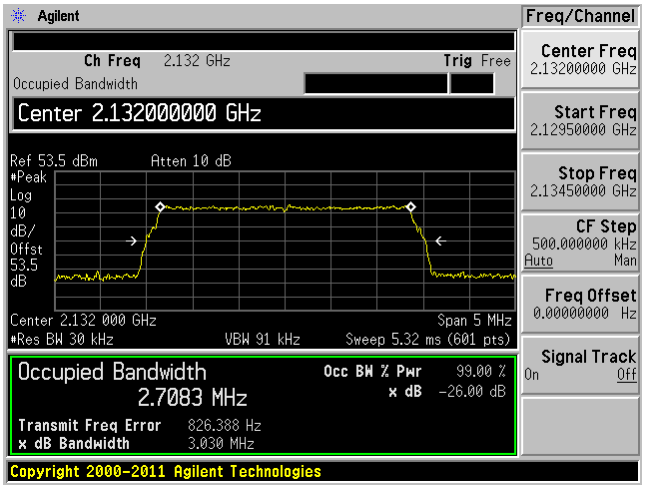
Input




Output, Chain J0

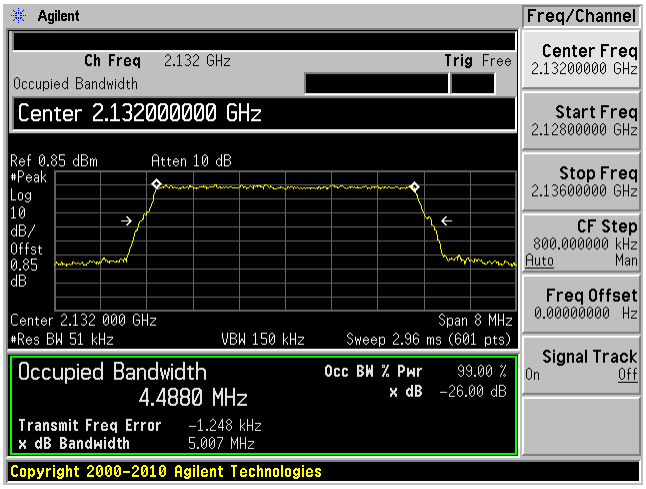



Output, Chain J1

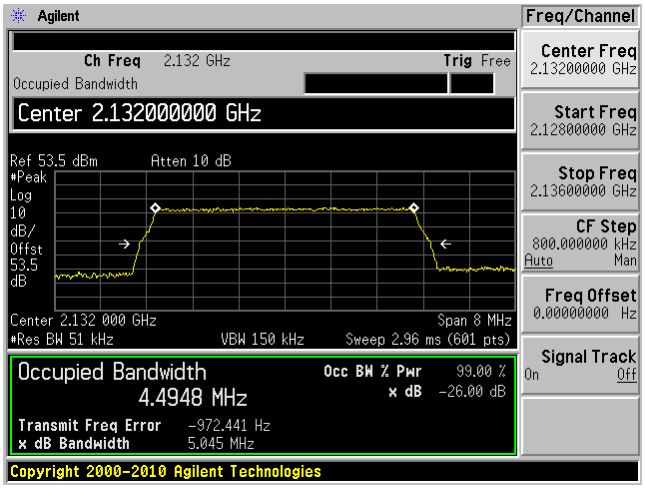


QPSK (5 MHz), (Middle Channel)

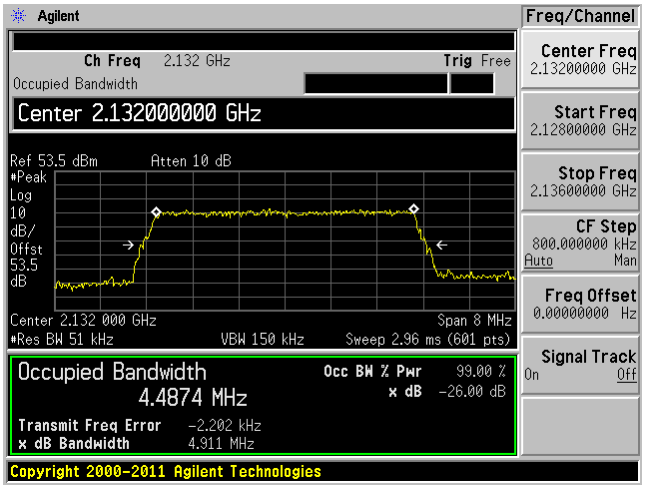
Input




Output, Chain J0

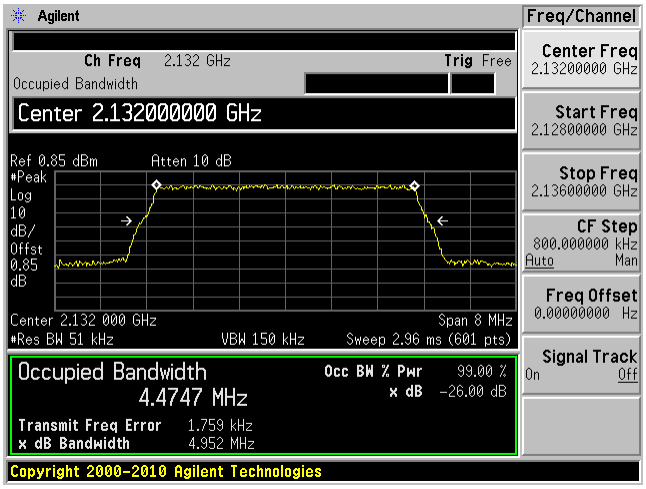



Output, Chain J1

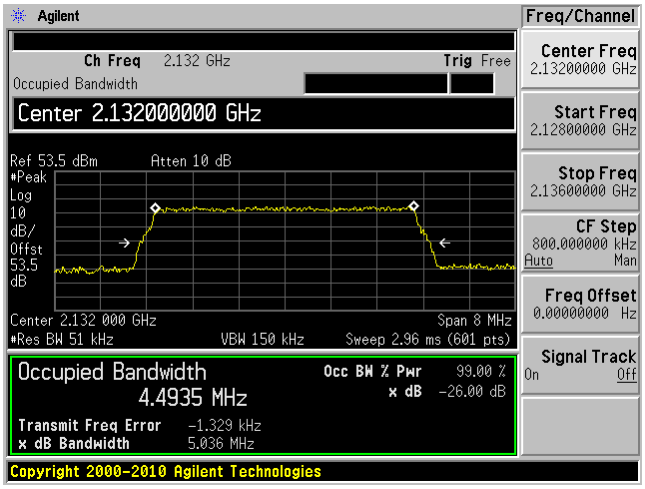


16QAM (5 MHz), (Middle Channel)

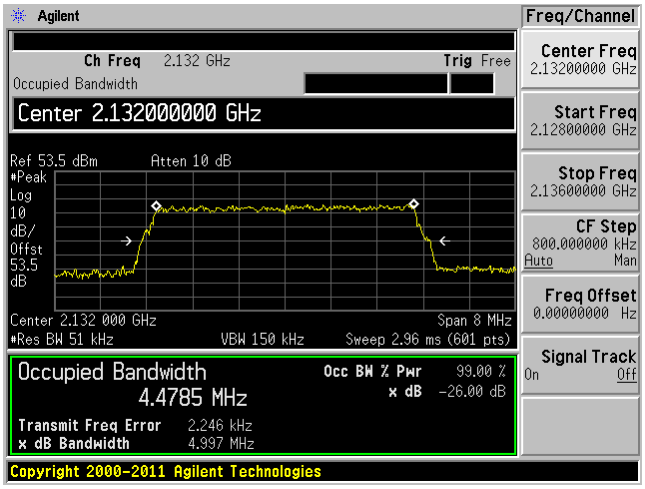
Input




Output, Chain J0

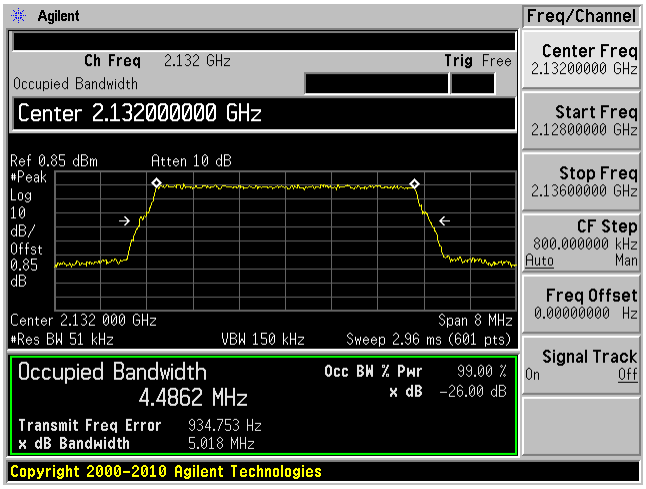



Output, Chain J1

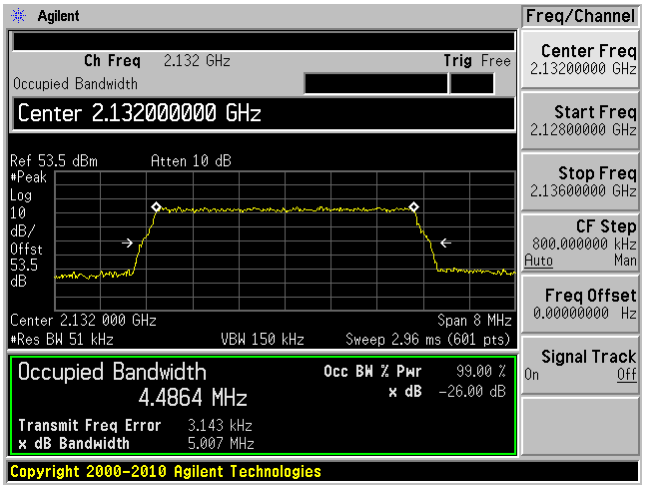


64QAM (5MHz), (Middle Channel)

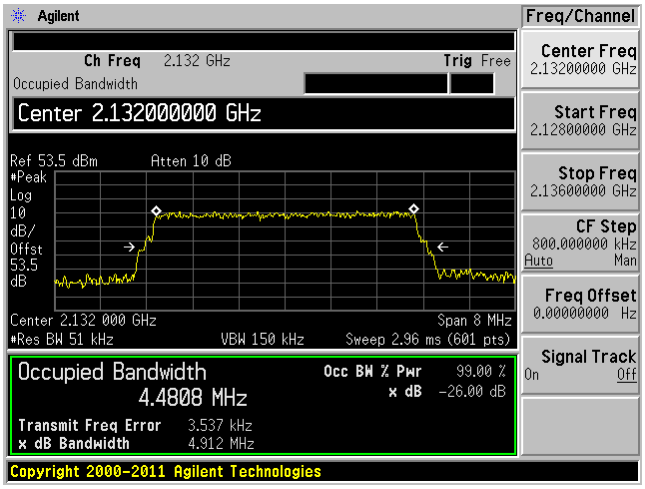
Input




Output, Chain J0

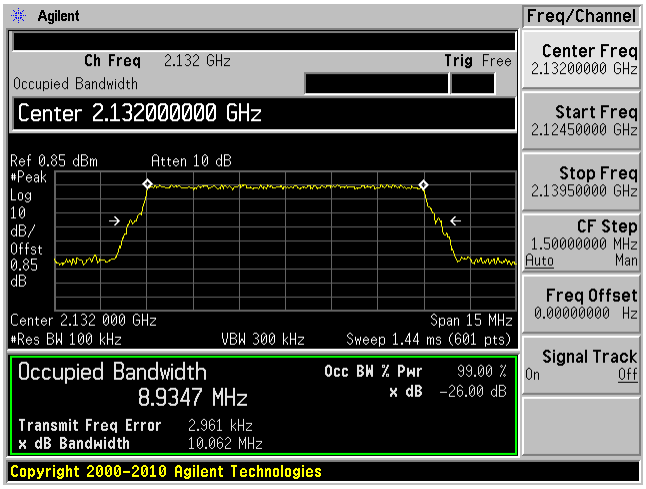



Output, Chain J1

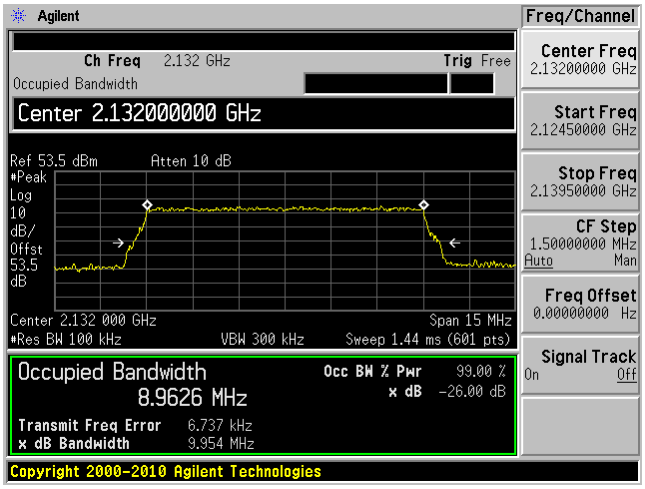


QPSK (10 MHz), (Middle Channel)

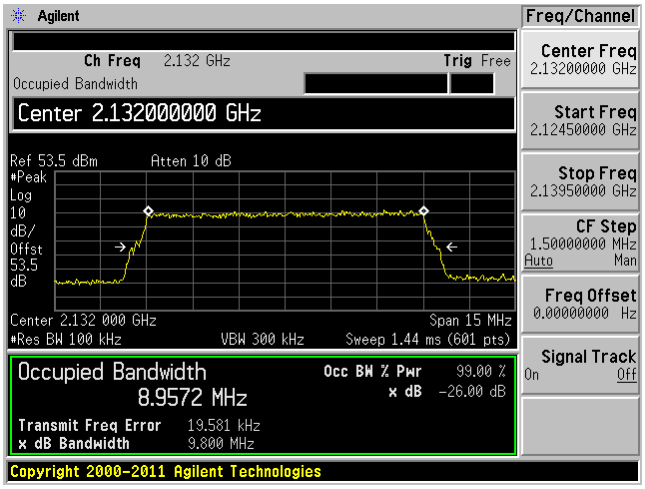
Input




Output, Chain J0

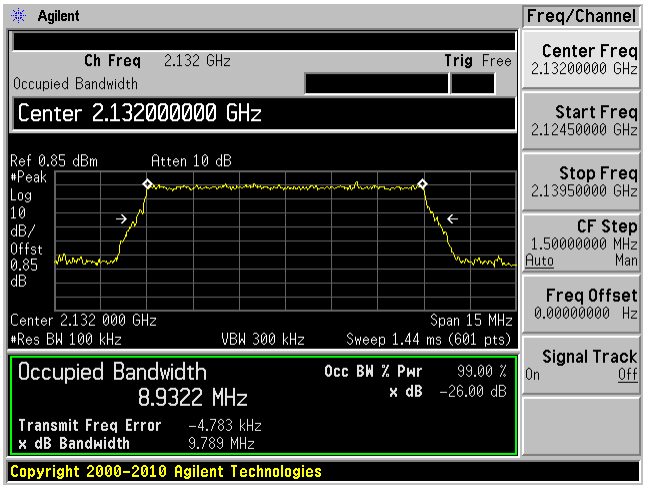



Output, Chain J1

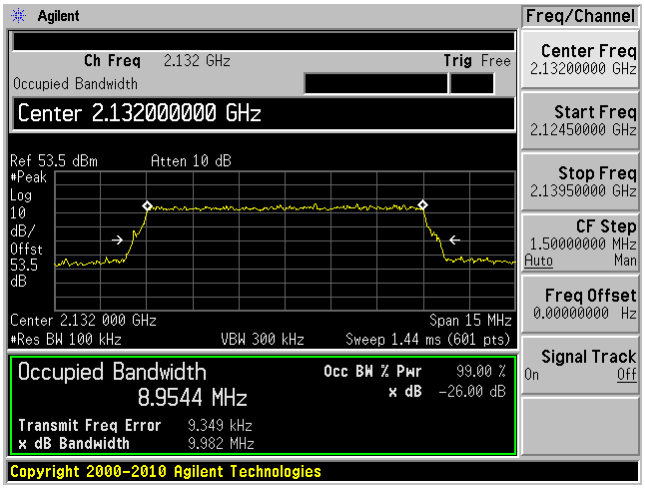


16QAM (10 MHz), (Middle Channel)

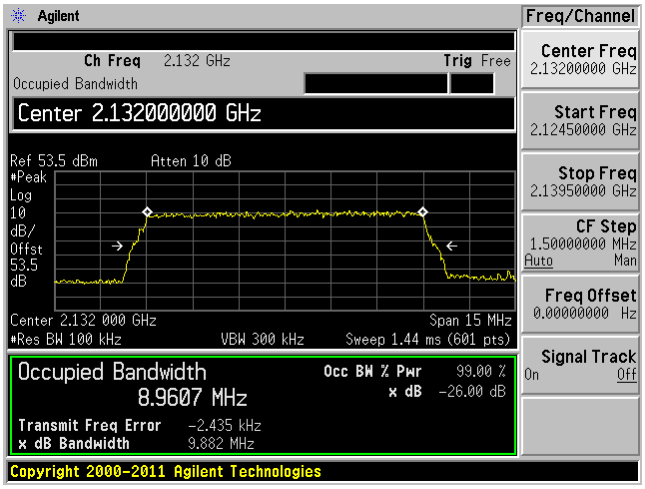
Input




Output, Chain J0

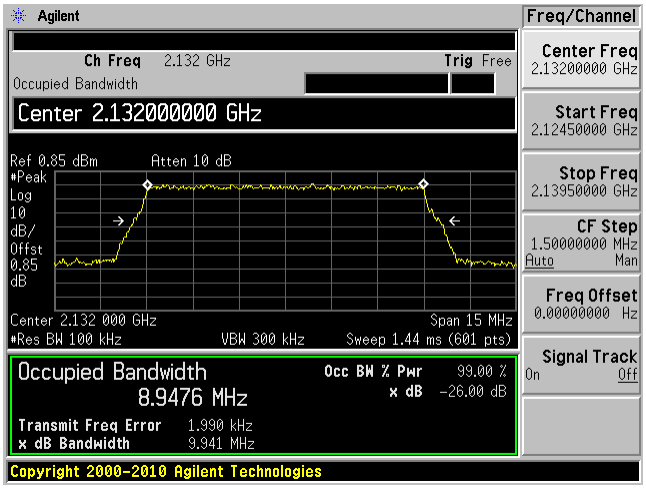



Output, Chain J1

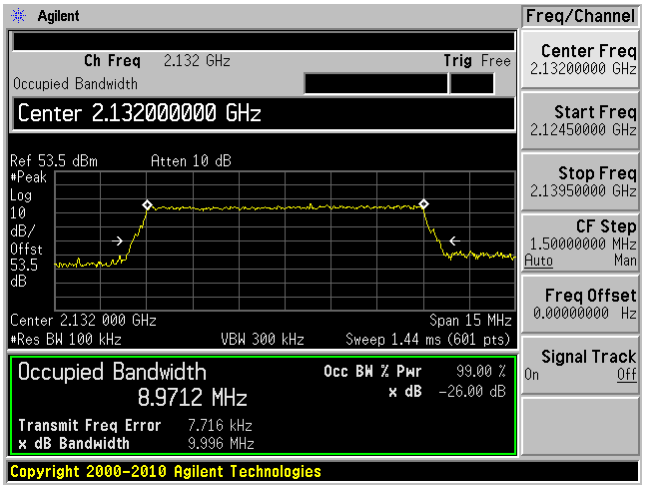


64QAM (10 MHz), (Middle Channel)

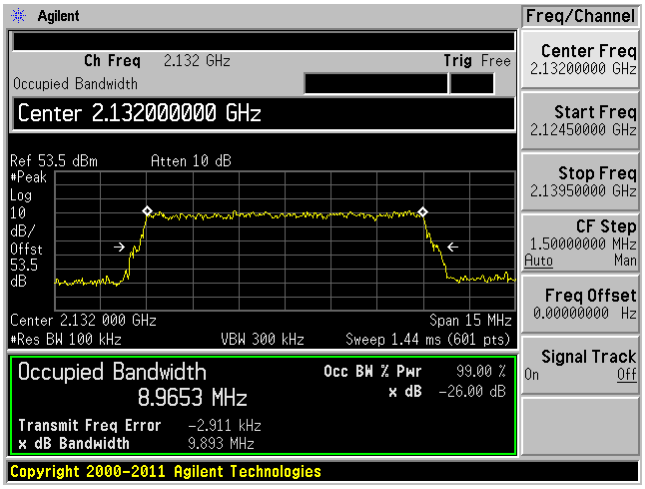
Input




Output, Chain J0

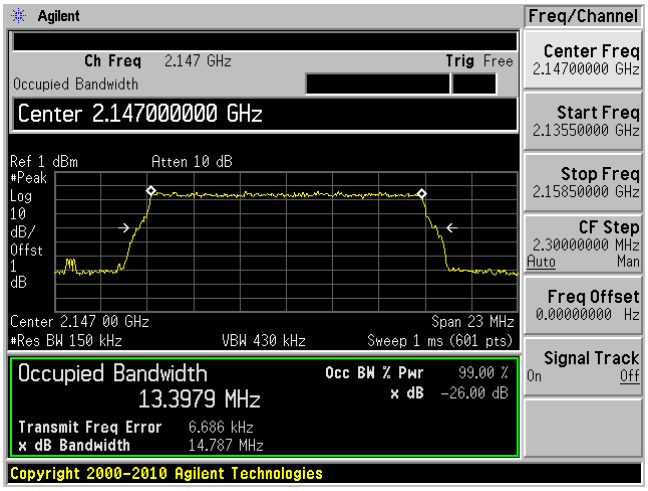



Output, Chain J1

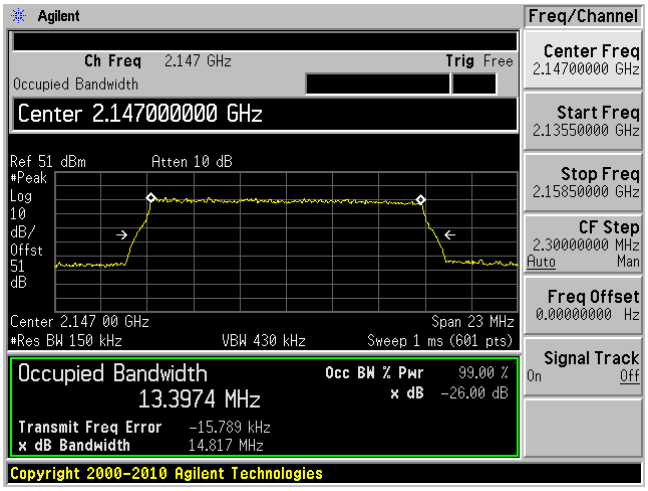


QPSK (15 MHz), (High Channel)

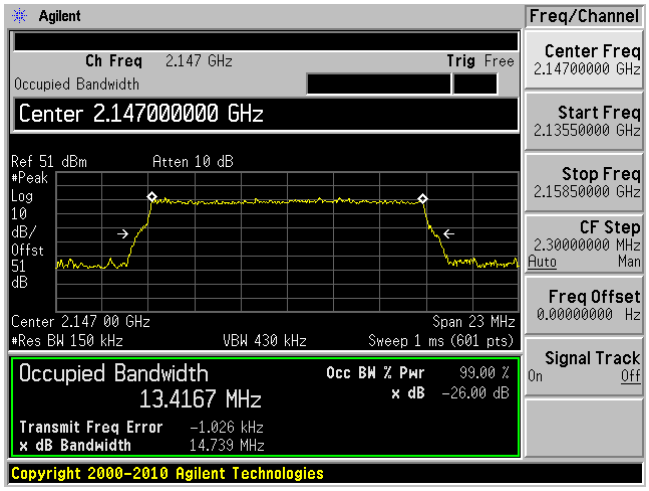
Input




Output, Chain J0

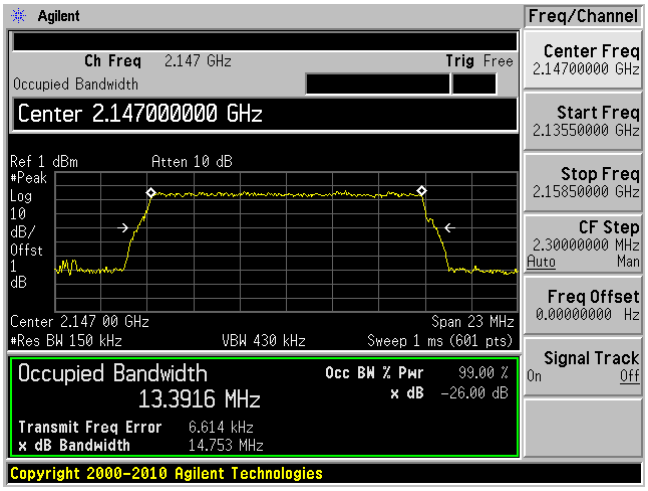



Output, Chain J1

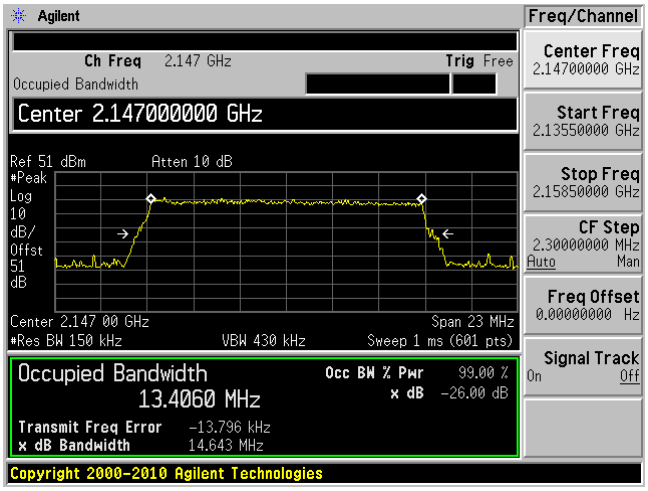


16QAM (15 MHz), (High Channel)

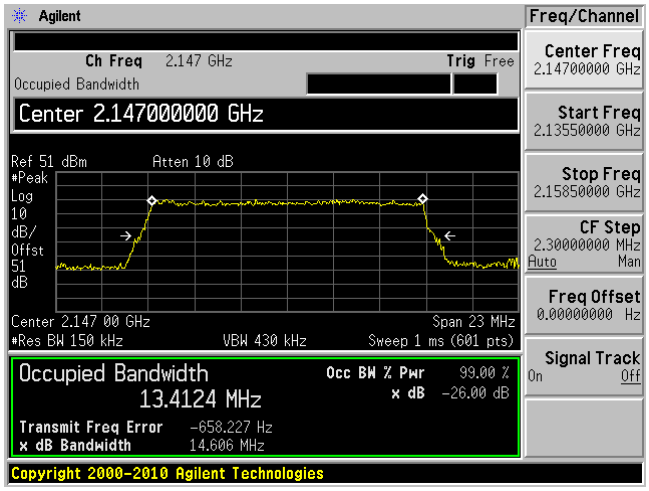
Input




Output, Chain J0

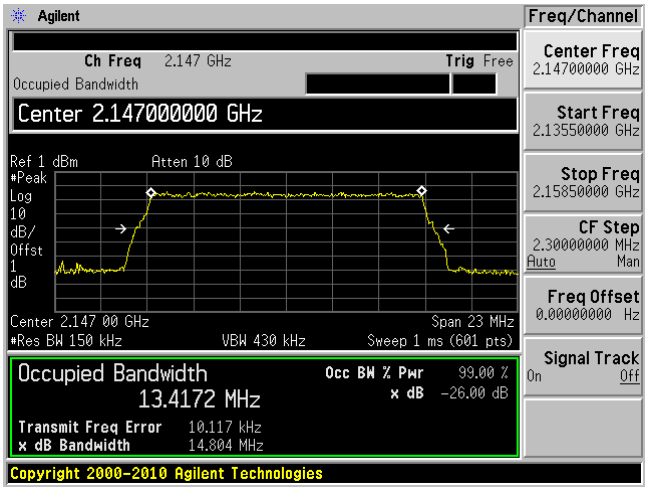



Output, Chain J1

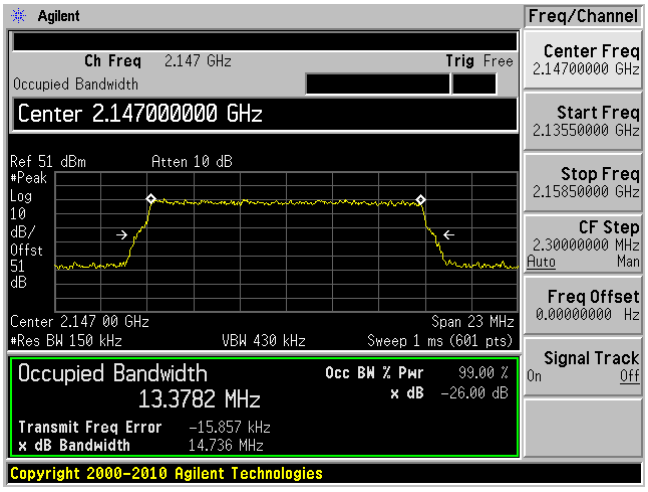


64QAM (15 MHz), (High Channel)

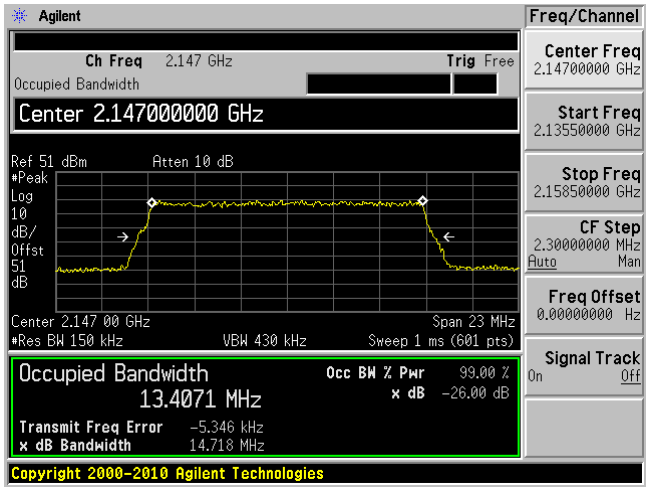
Input




Output, Chain J0

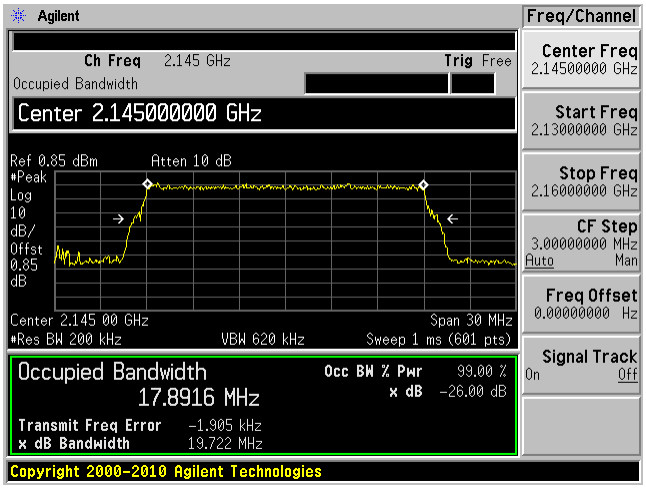



Output, Chain J1

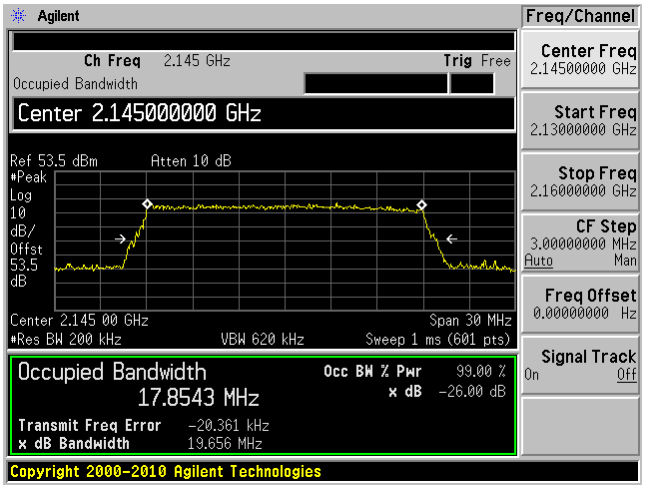


QPSK (20 MHz), (High Channel)

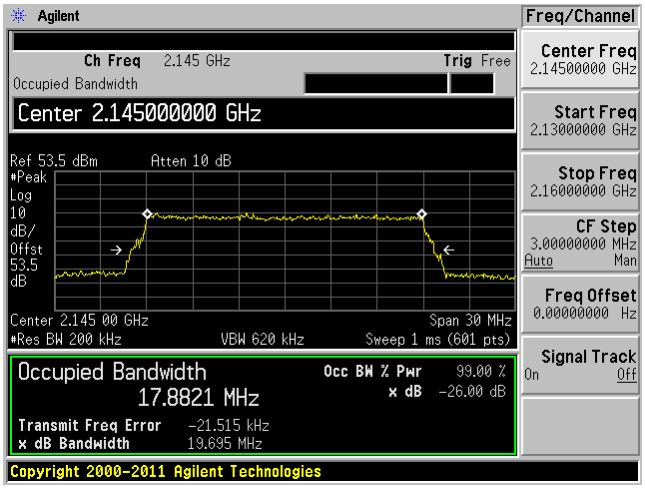
Input




Output, Chain J0

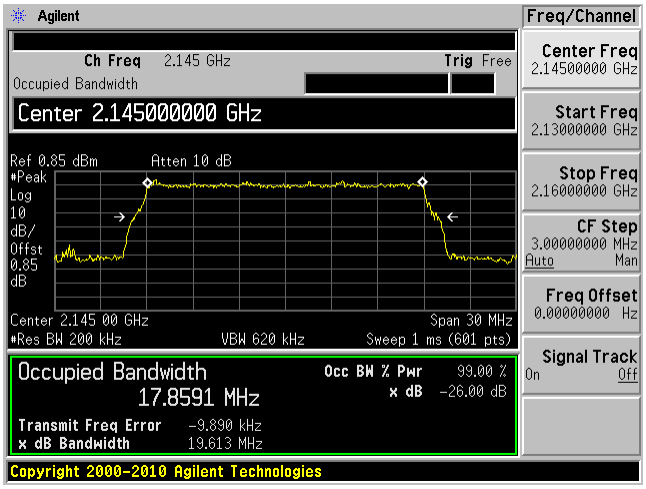



Output, Chain J1

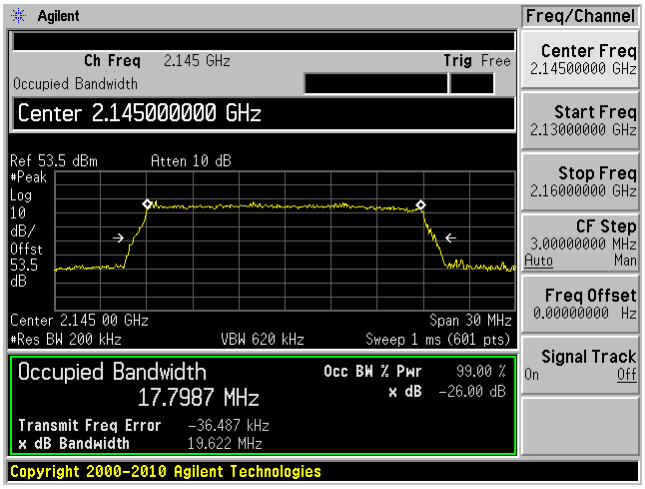


16QAM (20 MHz), (High Channel)

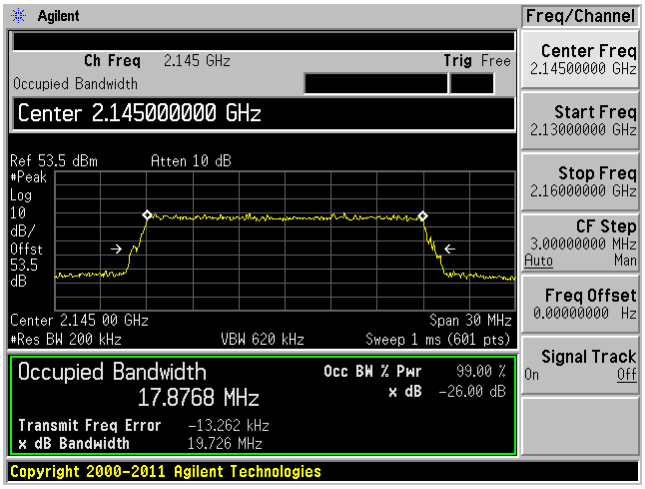
Input




Output, Chain J0

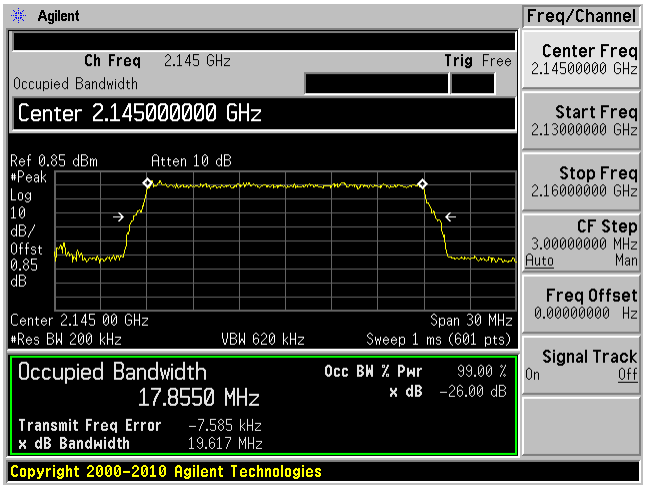



Output, Chain J1

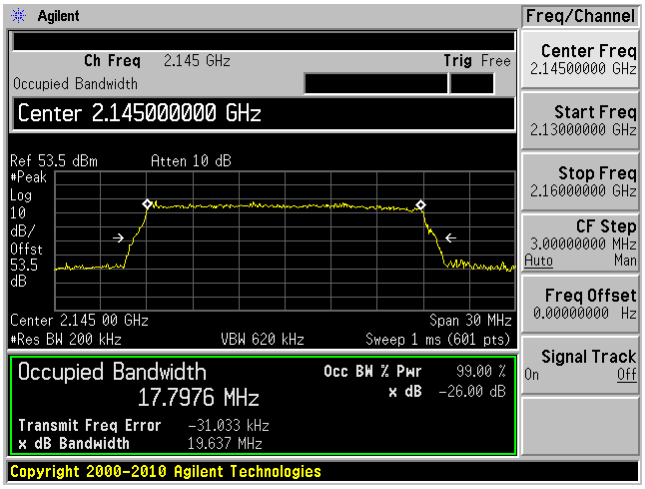


64QAM (20 MHz), (Middle Channel)

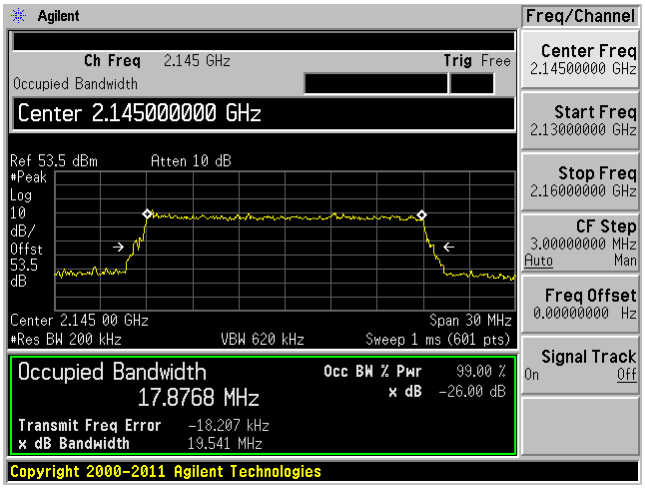
Input




Output, Chain J0




Output, Chain J1



# 6 FCC §2.1053 & §27.53(g) - Spurious Radiated Emissions

## 6.1 Applicable Standard

Requirements: FCC §2.1053 and §27.53(g)

## 6.2 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 emissions in dB = 10 log (TX Power in Watts/0.001) – the absolute level
Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts)

## 6.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Hewlett & Packard | Amplifier, Pre | 8447D | 2944A10187 | 2013-03-08 | 1 year |
| Sunol Sciences Corp | Antenna, Biconical Log | JB3 | A020106-3 | 2013-07-11 | 1 year |
| Sunol Sciences Corp | System Controller | SC99V | 011003-1 | N/R | N/R |
| Agilent | Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 2 years |
| A.R.A. | Horn Antenna | DRG-118/A | 1132 | 2013-01-29 | 1 year |
| Sunol Sciences Corp | Horn Antenna | DRH-118 | A052704 | 2013-03-07 | 1 year |
| Mini-Circuits | Pre-Amplifier | ZVA-183-S | 570400946 | 2013-05-09 | 1 year |
| Agilent | Generator, Signal | E4438C | MY45091309 | 2013-05-30 | 1 year |

***Statement of Traceability**: BACL Corp. attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

## 6.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 ºC |
| **Relative Humidity:** | 32 % |
| **ATM Pressure:** | 101.87 kPa |

*The testing was performed by Glenn Escano from 2013-12-26 in 5m chamber 2.*

## 6.5 Test Results

AWS Band, Downlink, Input frequency = "2132"MHz

| Indicated | | Turntable Azimuth (degree) | Test Antenna | | Substituted | | | | | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | S.A. Amp. (dBuV) | | Height (m) | Polarity (H/V) | Frequency (MHz) | Level (dBm) | Ant. Cord. (dB) | Cable Loss (dB) | Absolute Level (dBm) | | |
| 708 | 47.1 | 213 | 100 | V | 708 | -64.28 | 0 | 0.92 | -65.2 | -13 | -52.2 |
| 708 | 45.64 | 160 | 100 | H | 708 | -67.11 | 0 | 0.92 | -68.03 | -13 | -55.03 |
| 901 | 41.23 | 272 | 142 | V | 901 | -66.9 | 0 | 1.04 | -67.94 | -13 | -54.94 |
| 901 | 38.84 | 127 | 137 | H | 901 | -70.08 | 0 | 1.04 | -71.12 | -13 | -58.12 |
| 988 | 38.4 | 0 | 100 | V | 988 | -68.73 | 0 | 1.1 | -69.83 | -13 | -56.83 |
| 988 | 39.23 | 131 | 128 | H | 988 | -69 | 0 | 1.1 | -70.1 | -13 | -57.1 |
| 1585 | 53.27 | 86 | 142 | V | 1585 | -59.93 | 8.675 | 2.17 | -53.425 | -13 | -40.425 |
| 1585 | 56.13 | 132 | 149 | H | 1585 | -55.21 | 8.675 | 2.17 | -48.705 | -13 | -35.705 |
| 2496 | 48.62 | 124 | 161 | V | 2496 | -60.3 | 8.924 | 3.04 | -54.416 | -13 | -41.416 |
| 2496 | 42.87 | 311 | 194 | H | 2496 | -65.56 | 8.924 | 3.04 | -59.676 | -13 | -46.676 |

*Note: - All spurious emissions are on the noise floor level*

# 7 FCC §2.1051 & §27.53(h) - Spurious Emissions at Antenna Terminals

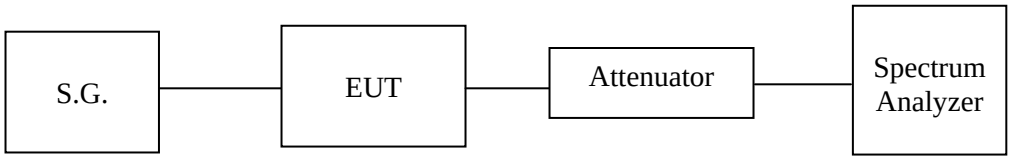
## 7.1 Applicable Standard

Requirements: FCC §2.1051 and §27.53(h).

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

## 7.2 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.




## 7.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | PSA, Series Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 2 years |
| Agilent | Generator, Signal | E4438C | MY45091309 | 2013-05-30 | 1 year |

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 7.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 ºC |
| **Relative Humidity:** | 37 % |
| **ATM Pressure:** | 101.92 kPa |

*The testing was performed by Glenn Escano from 2013-12-17 at RF Site.*

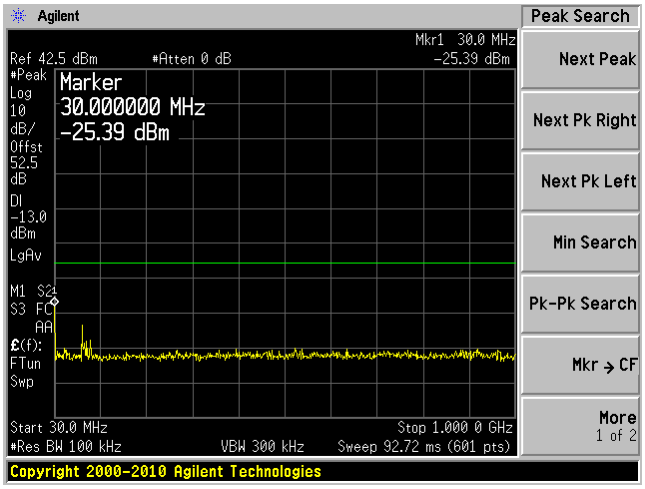
## 7.5 Test Results

Please refer to the following plots.

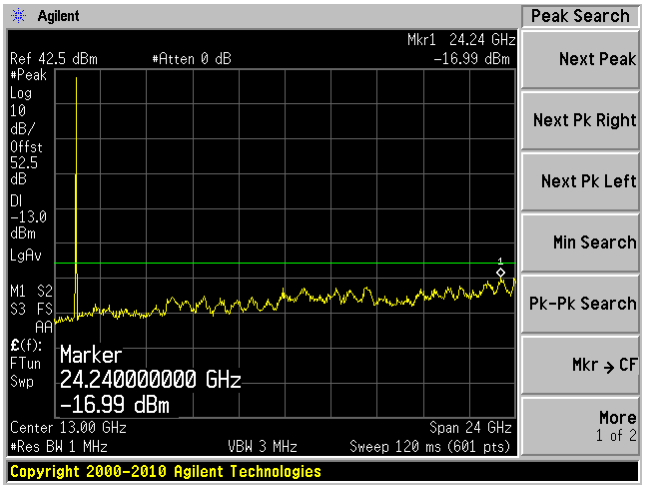
## (A) Spurious Emissions at Antenna Port

WCDMA/HSPA, Downlink: Low Channel (“2112.4” MHz)

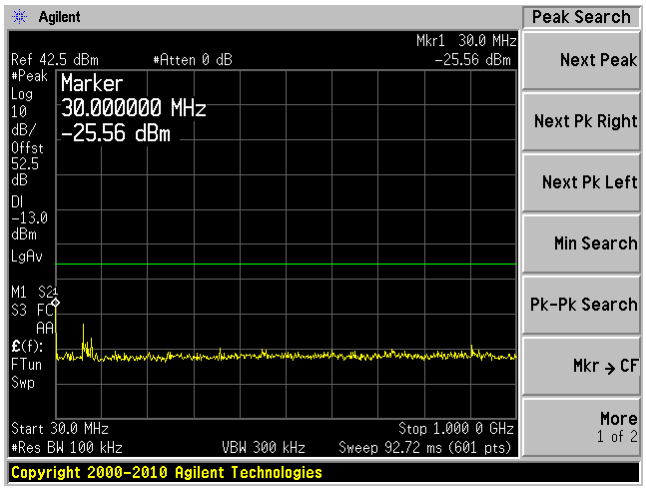
Plot 1: 30 MHz to 1 GHz, Chain J0



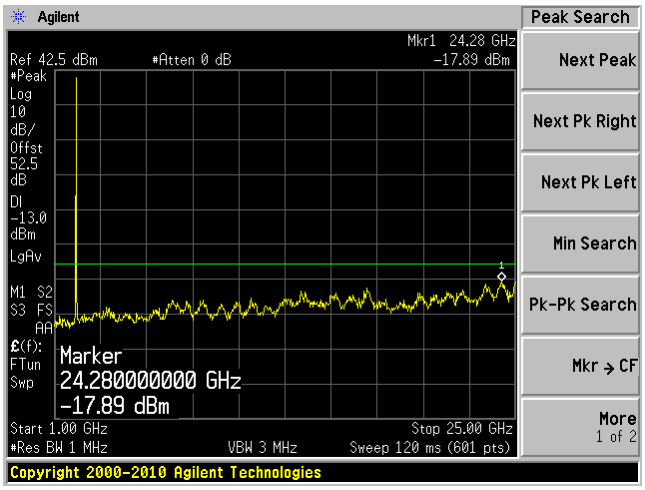

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

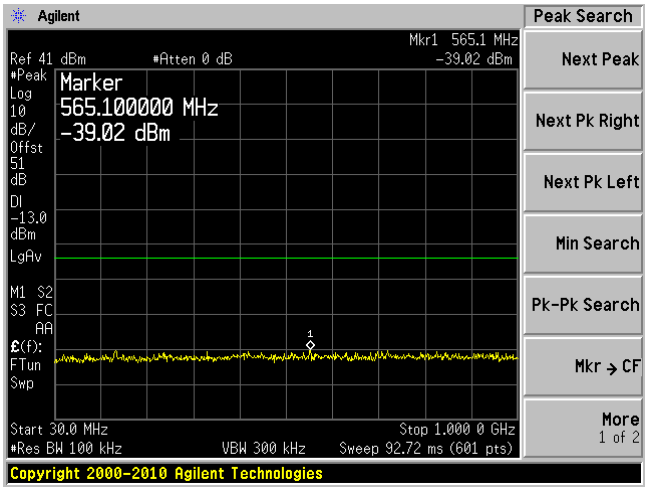



Plot 2: 1 GHz to 25 GHz, Chain J1

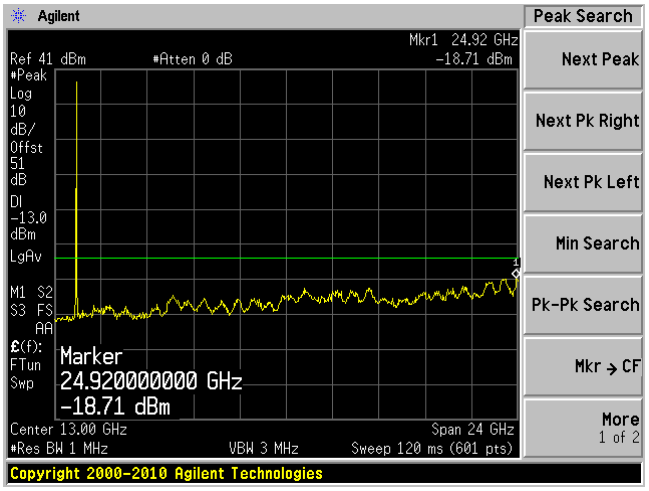


WCDMA/HSPA, Downlink: Middle Channel (“2132.4” MHz)

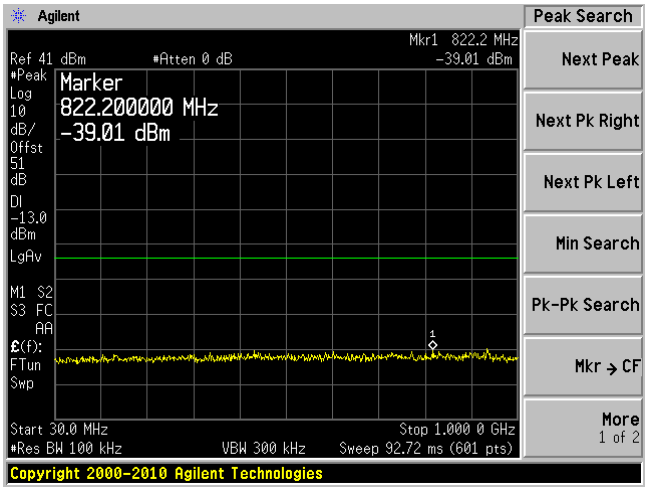
Plot 1: 30 MHz to 1 GHz, Chain J0



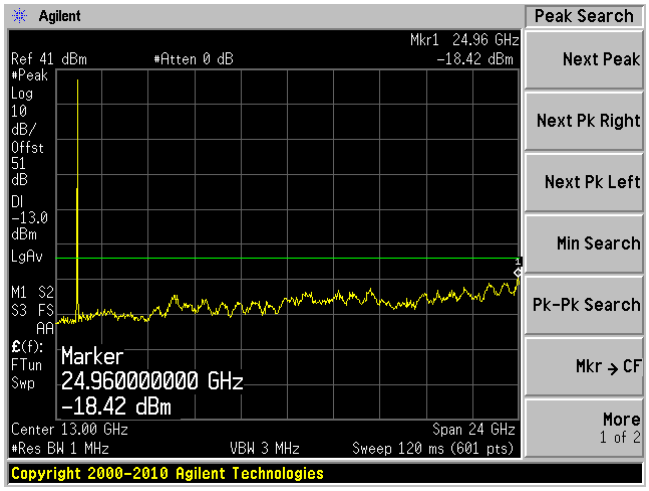

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

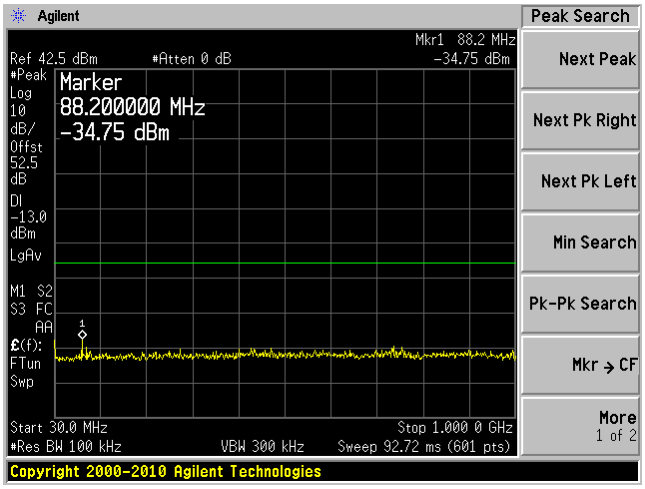



Plot 2: 1 GHz to 25 GHz, Chain J1

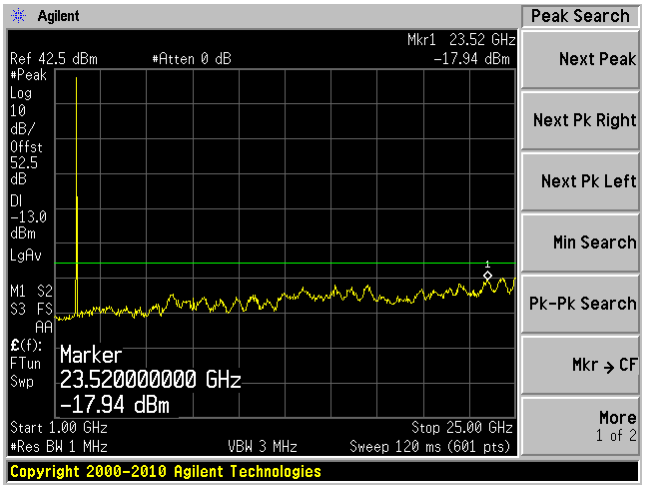


WCDMA/HSPA, Downlink: High Channel (“2152.6” MHz)

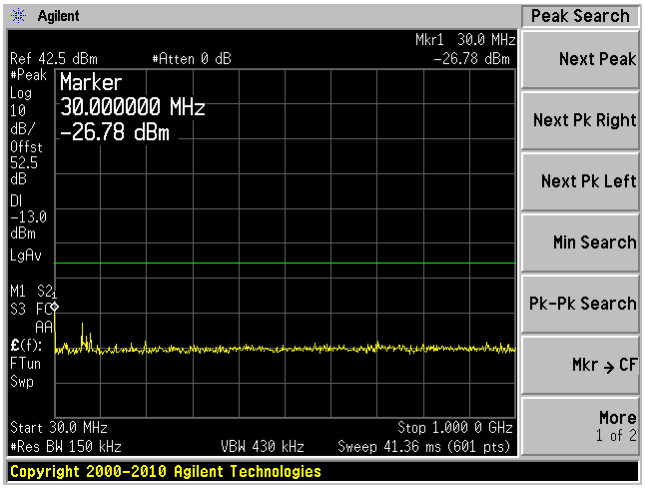
Plot 1: 30 MHz to 1 GHz, Chain J0



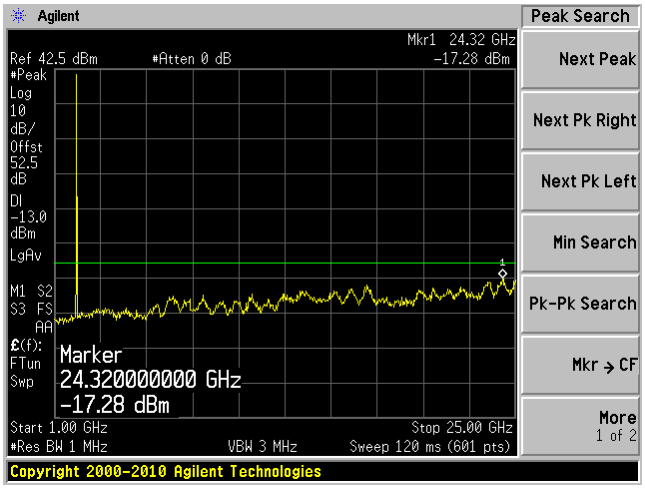

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

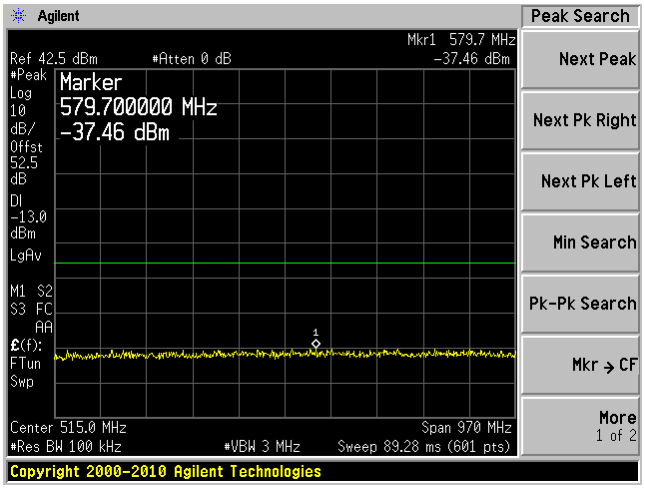



Plot 2: 1 GHz to 25 GHz, Chain J1

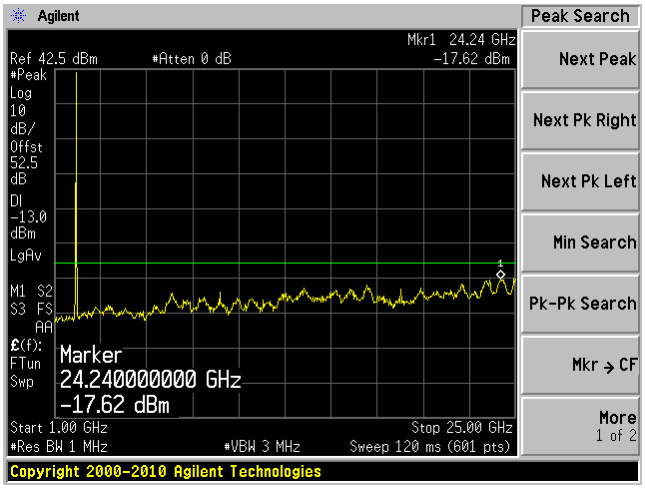


LTE, QPSK (1.4 MHz) Downlink: Low Channel (“2111” MHz)

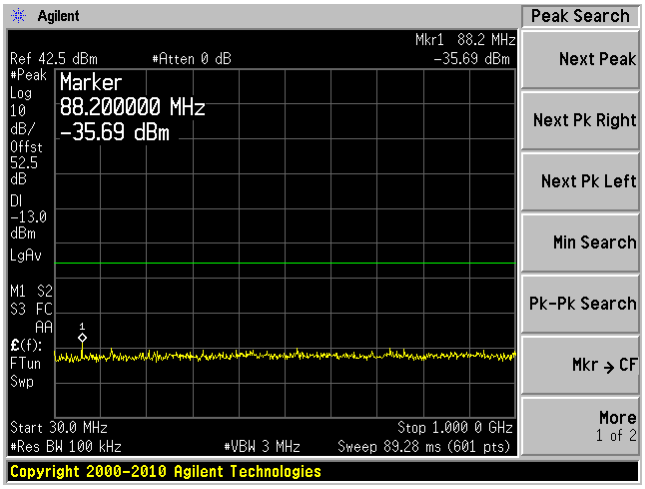
Plot 1: 30 MHz to 1 GHz, Chain J0



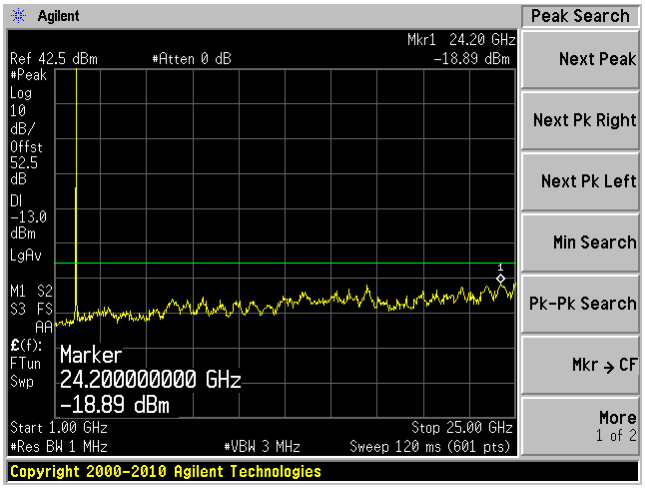

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

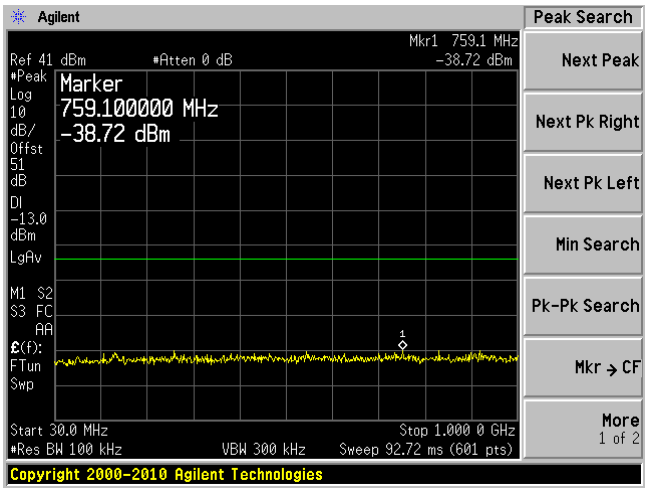



Plot 2: 1 GHz to 25 GHz, Chain J1

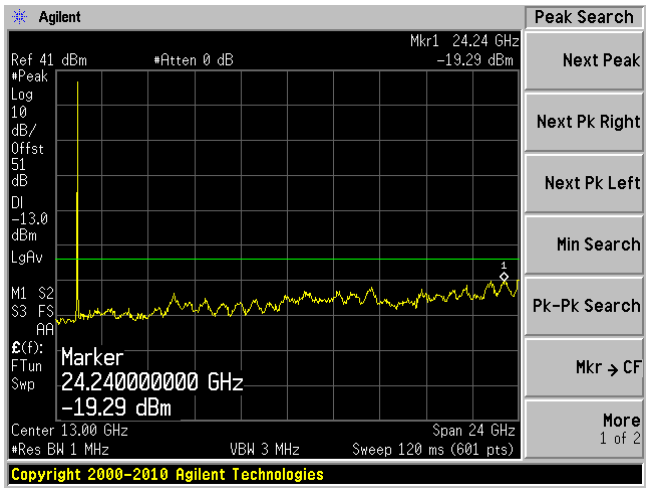


LTE, QPSK (1.4 MHz) Downlink: Middle Channel (“2132” MHz)

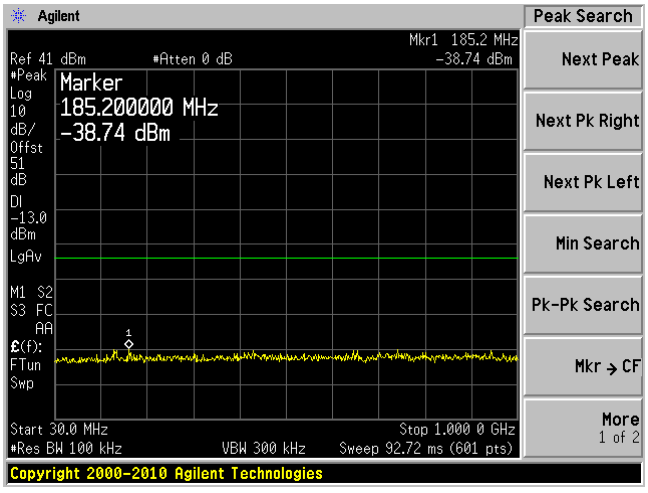
Plot 1: 30 MHz to 1 GHz, Chain J0



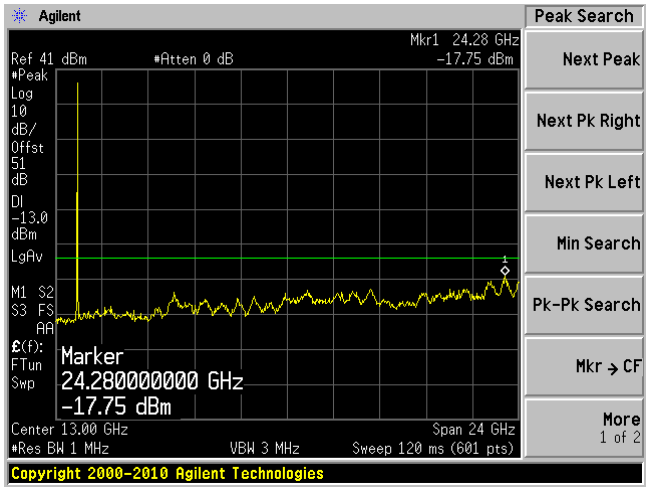

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

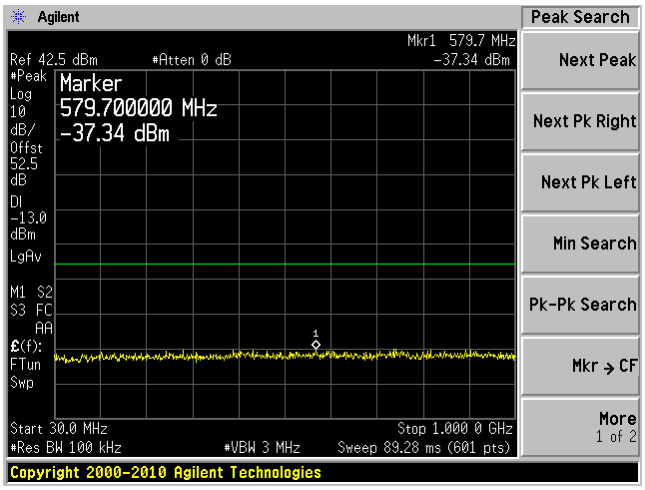



Plot 2: 1 GHz to 25 GHz, Chain J1

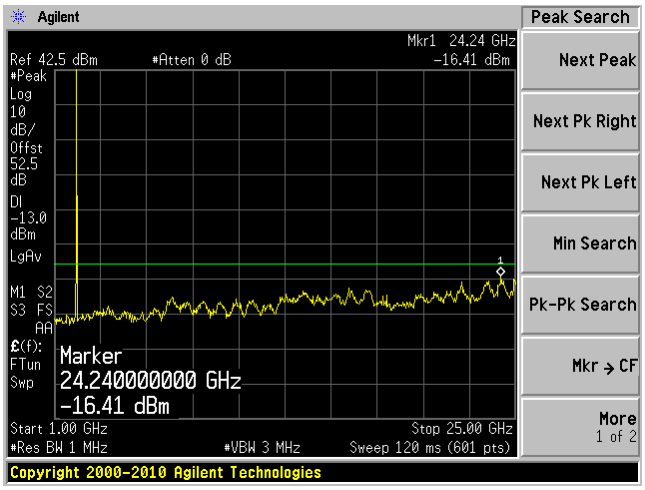


LTE, QPSK (1.4 MHz) Downlink: High Channel (“2154” MHz)

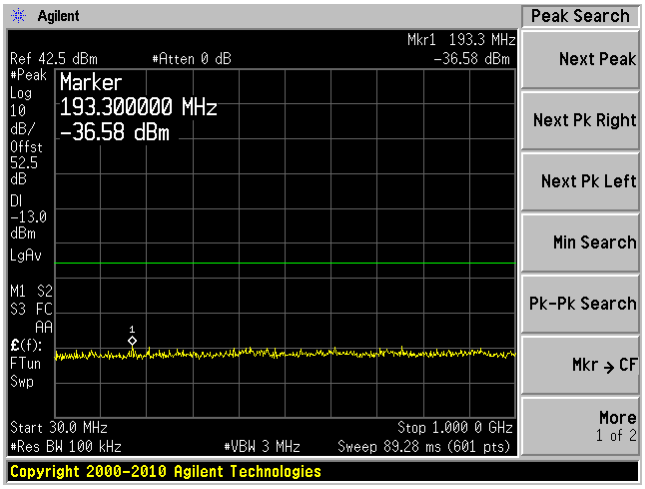
Plot 1: 30 MHz to 1 GHz, Chain J0



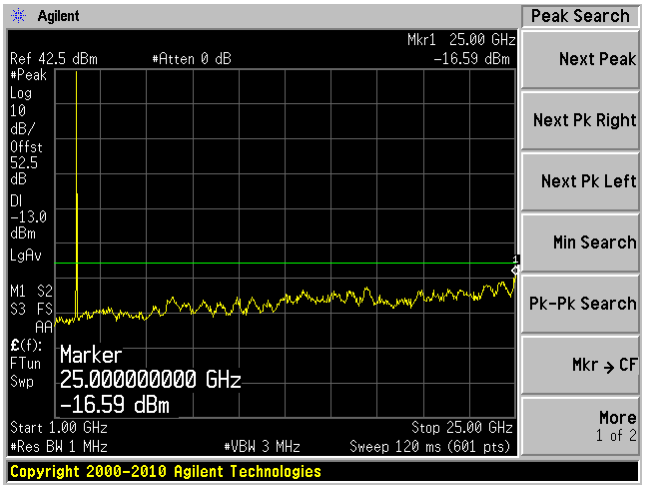

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

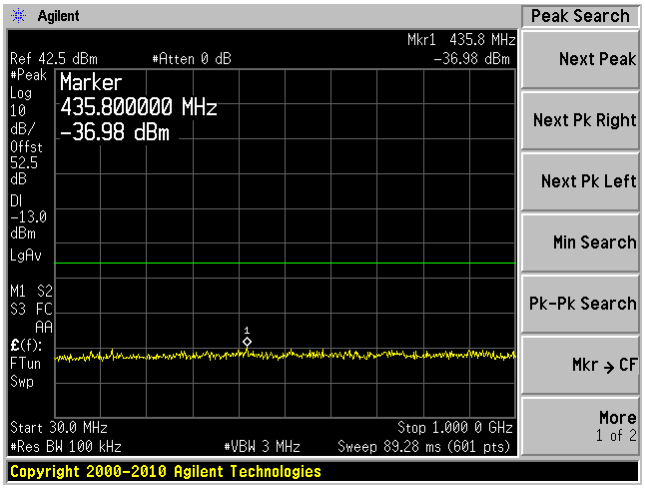



Plot 2: 1 GHz to 25 GHz, Chain J1

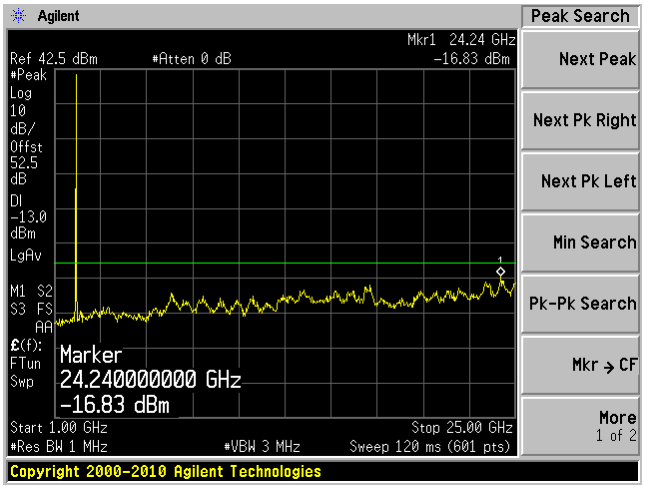


LTE, 16QAM (1.4 MHz) Downlink: Low Channel (“2111” MHz)

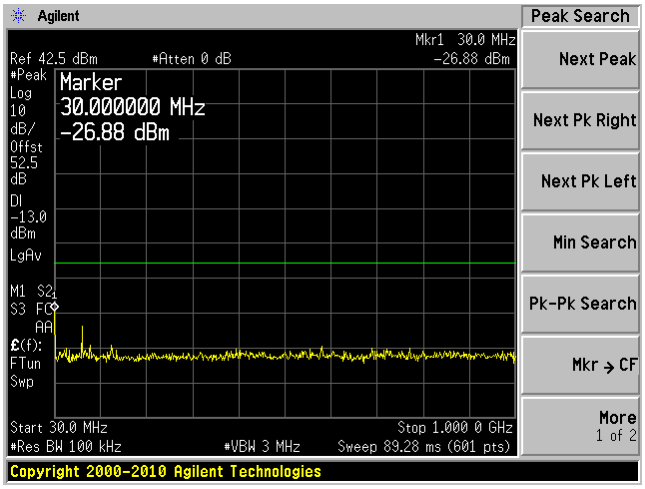
Plot 1: 30 MHz to 1 GHz, Chain J0



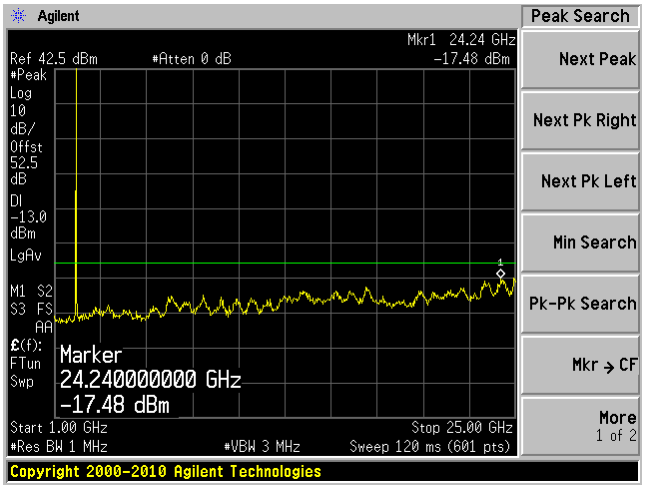

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

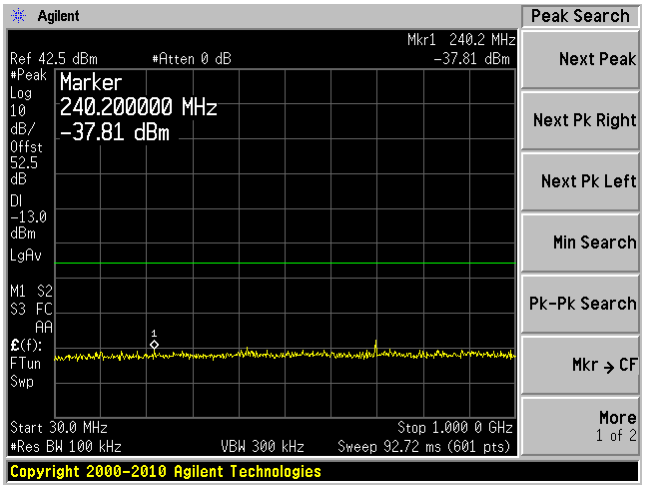



Plot 2: 1 GHz to 25 GHz, Chain J1

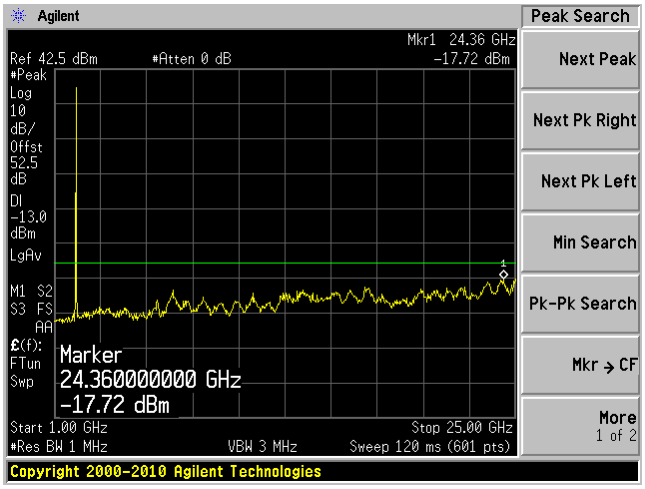


LTE, 16QAM (1.4 MHz) Downlink: Middle Channel (“2132” MHz)

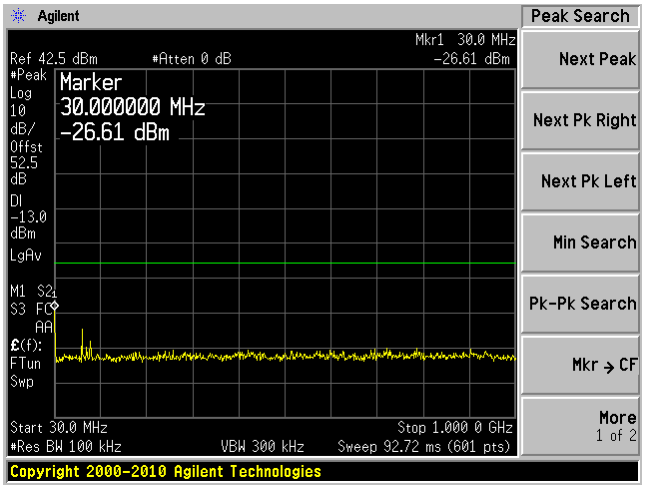
Plot 1: 30 MHz to 1 GHz, Chain J0



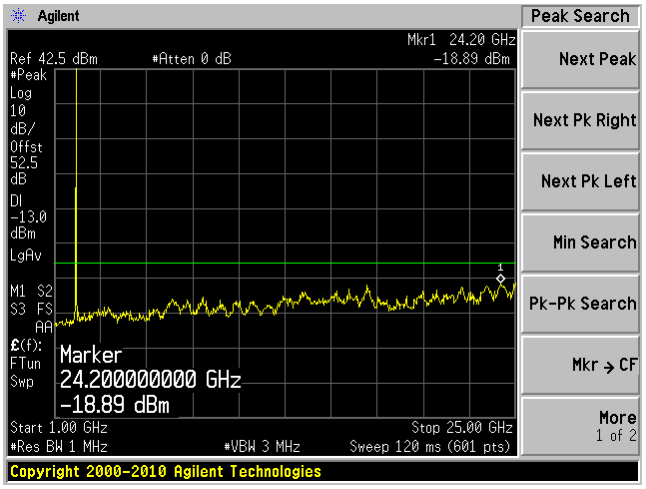

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

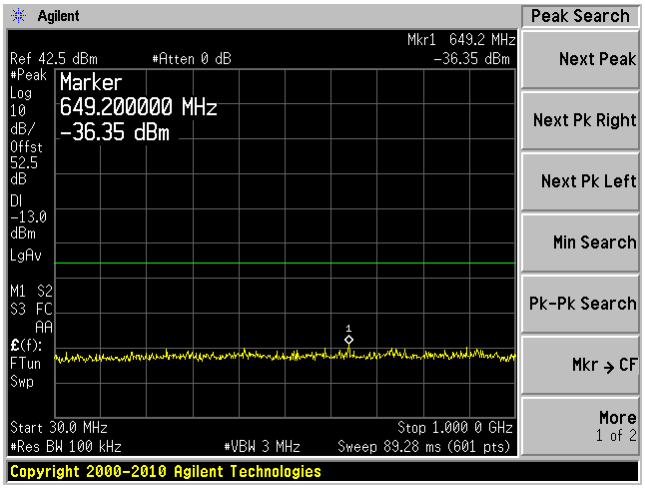



Plot 2: 1 GHz to 25 GHz, Chain J1

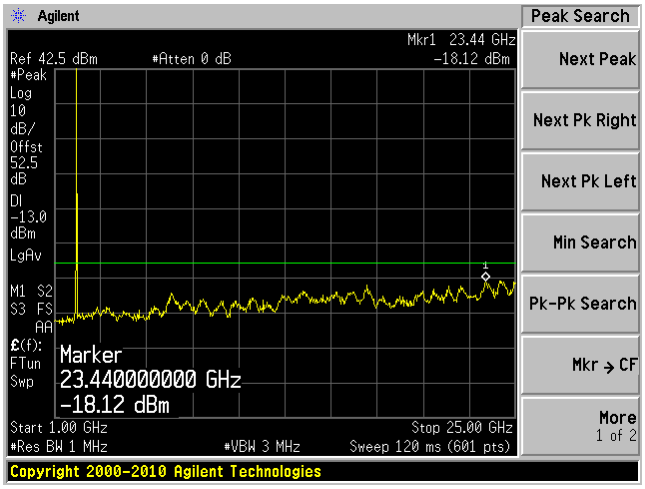


LTE, 16QAM (1.4 MHz) Downlink: High Channel (“2154” MHz)

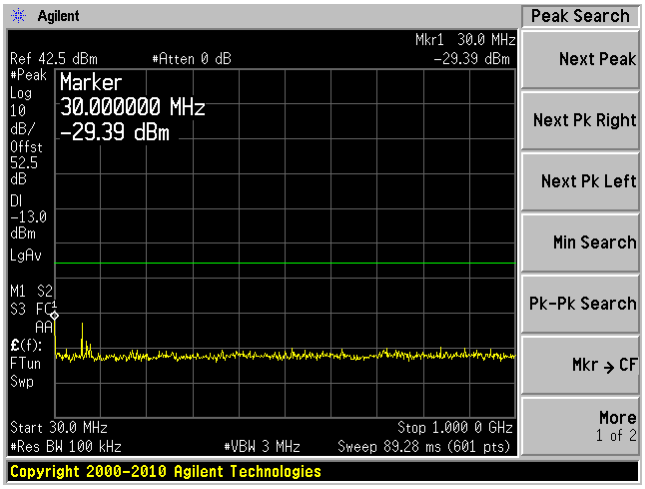
Plot 1: 30 MHz to 1 GHz, Chain J0



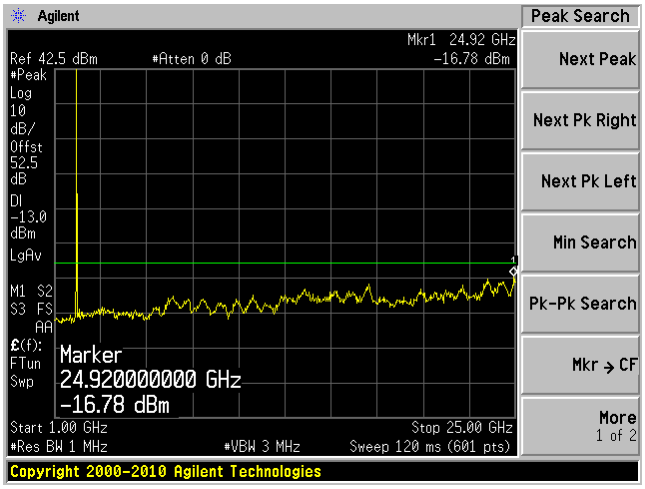

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

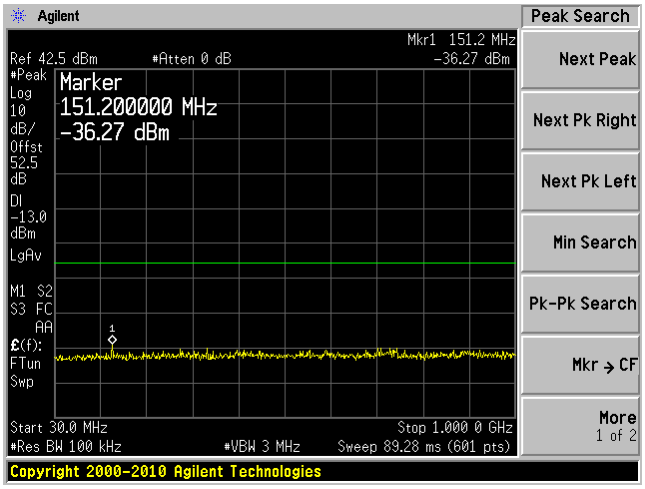



Plot 2: 1 GHz to 25 GHz, Chain J1

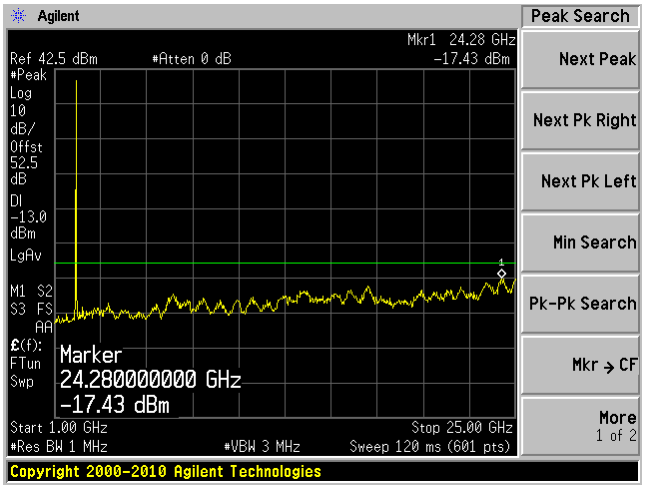


LTE, 64QAM (1.4 MHz) Downlink: Low Channel (“2111” MHz)

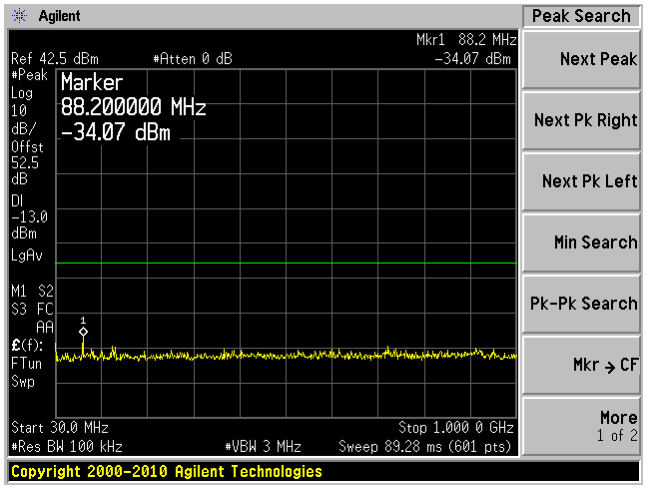
Plot 1: 30 MHz to 1 GHz, Chain J0



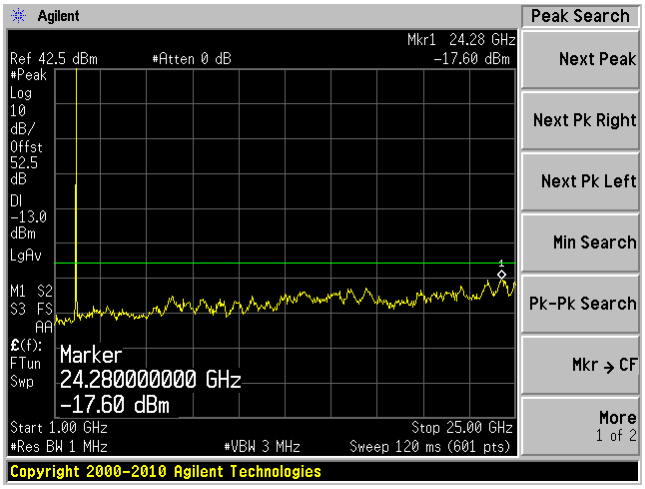

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

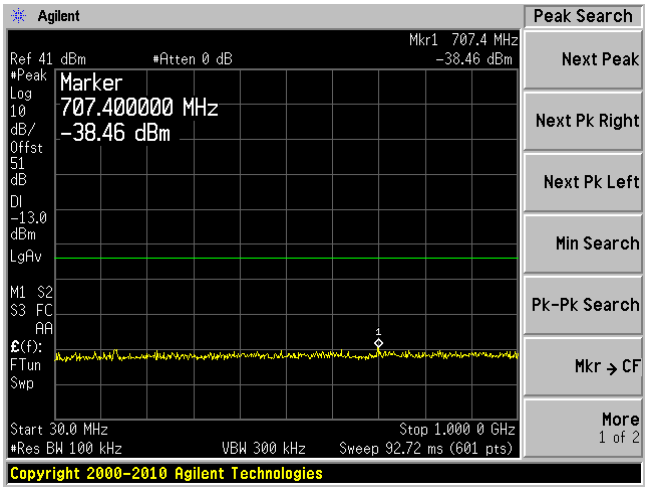



Plot 2: 1 GHz to 25 GHz, Chain J1

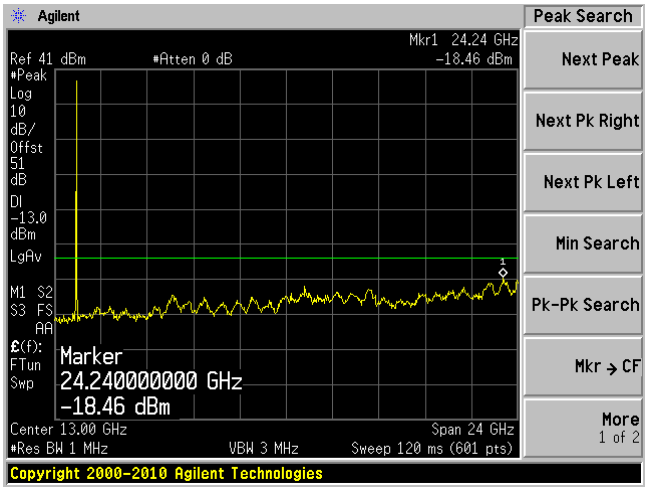


LTE, 64QAM (1.4 MHz) Downlink: Middle Channel (“2132” MHz)

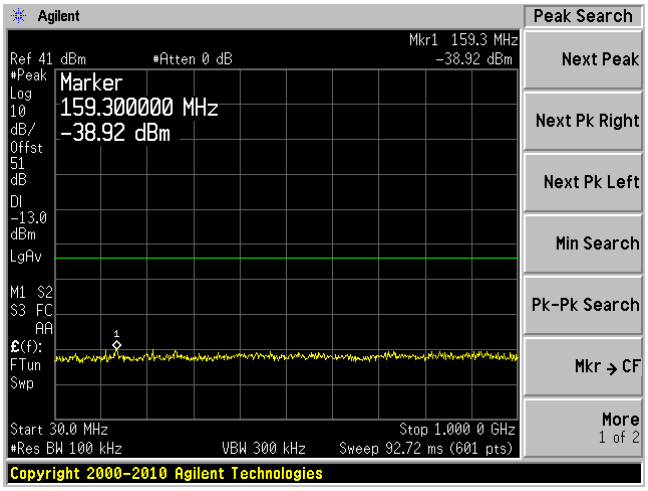
Plot 1: 30 MHz to 1 GHz, Chain J0



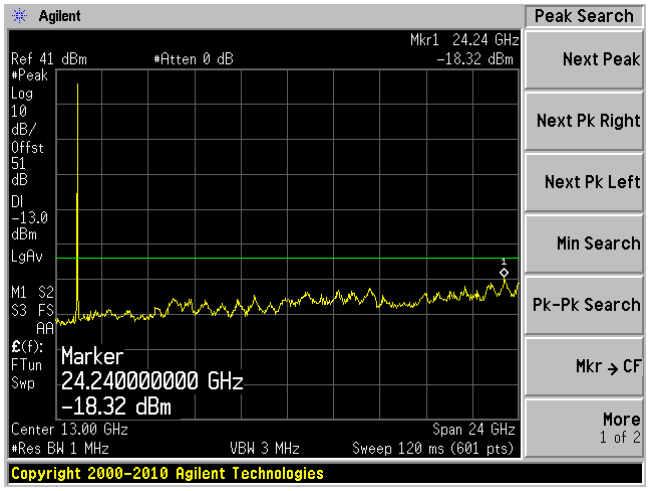

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

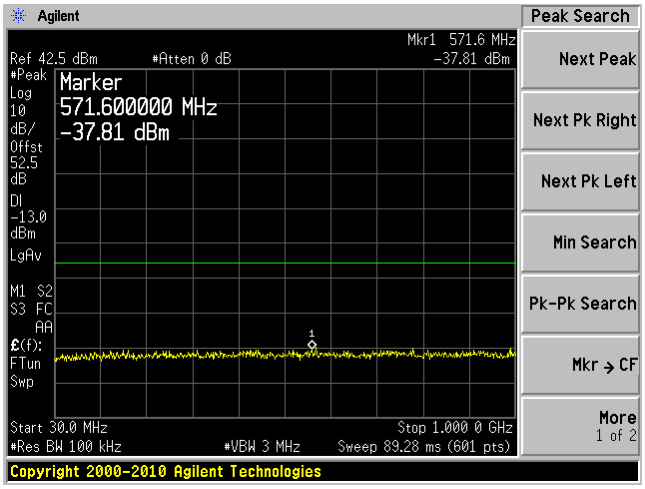



Plot 2: 1 GHz to 25 GHz, Chain J1

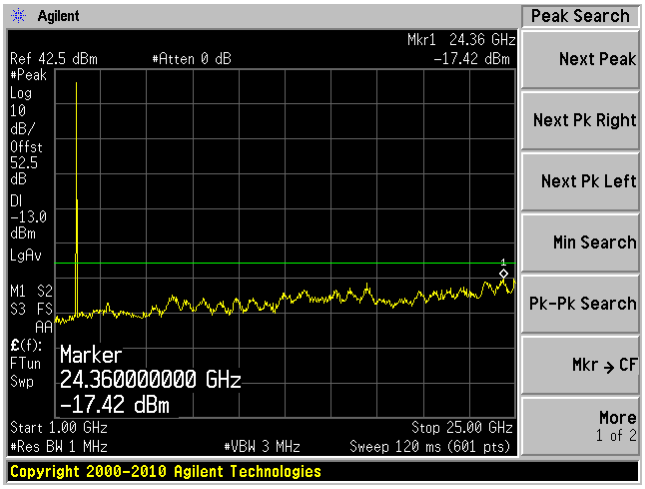


LTE, 64QAM (1.4 MHz) Downlink: High Channel (“2154” MHz)

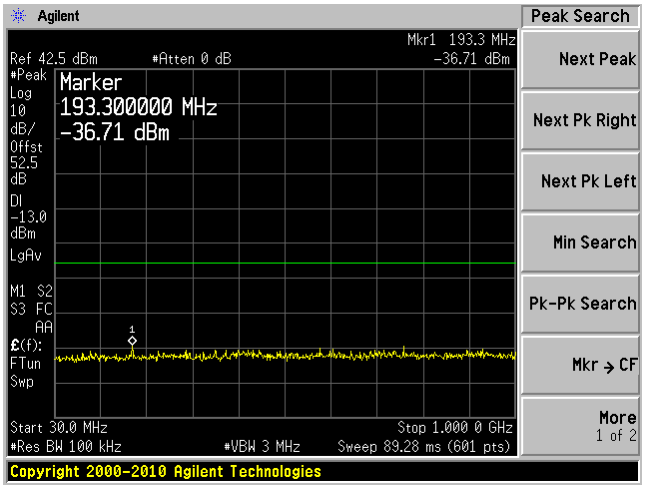
Plot 1: 30 MHz to 1 GHz, Chain J0



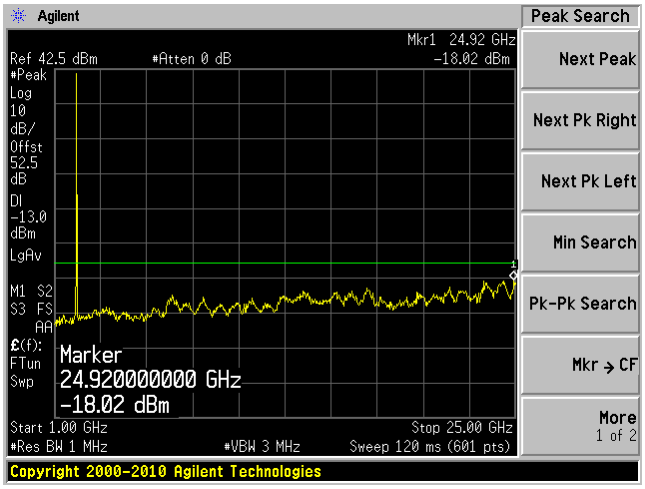

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

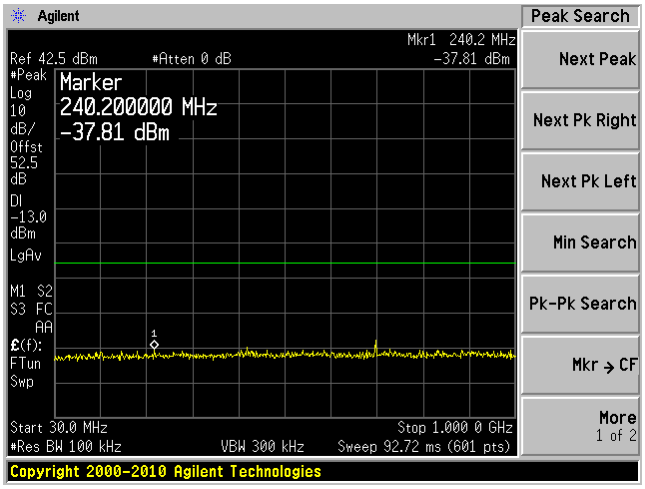



Plot 2: 1 GHz to 25 GHz, Chain J1

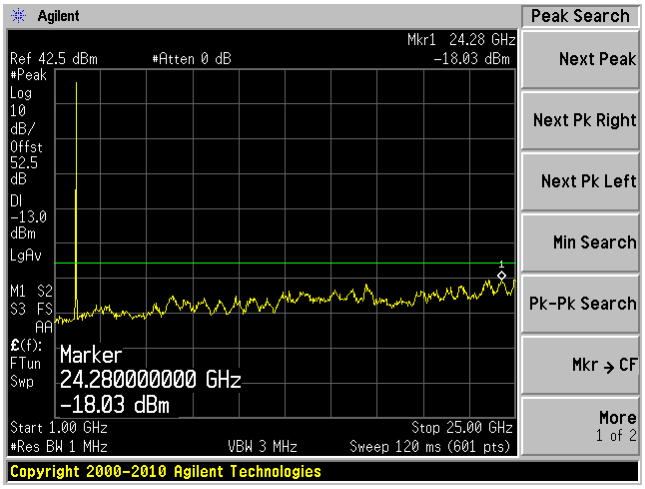


LTE, QPSK (3 MHz) Downlink: Low Channel (“2112” MHz)

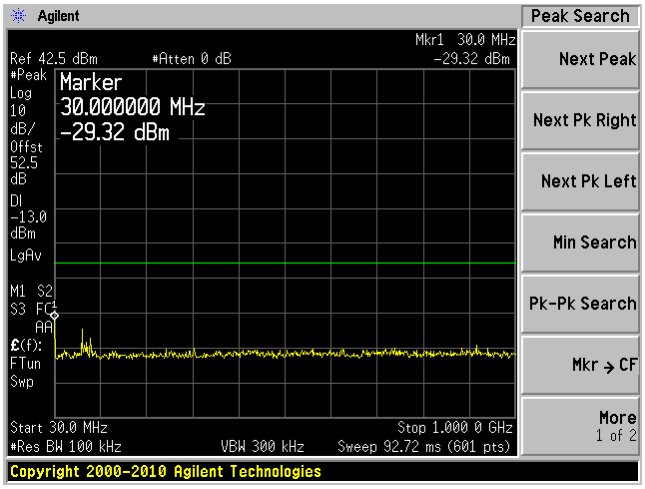
Plot 1: 30 MHz to 1 GHz, Chain J0



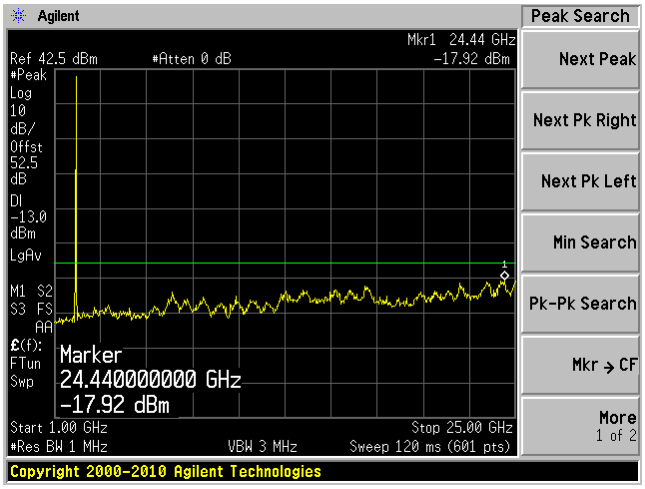

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

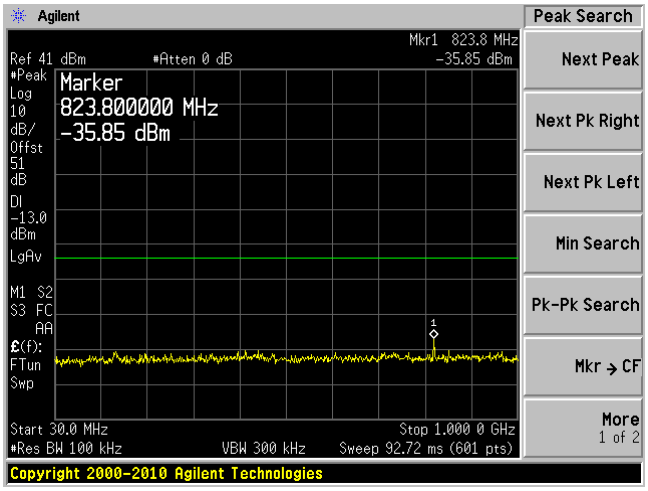



Plot 2: 1 GHz to 25 GHz, Chain J1

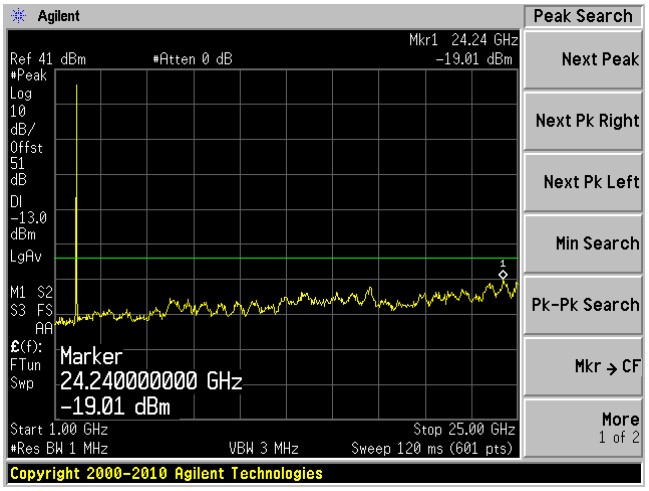


LTE, QPSK (3 MHz) Downlink: Middle Channel (“2132” MHz)

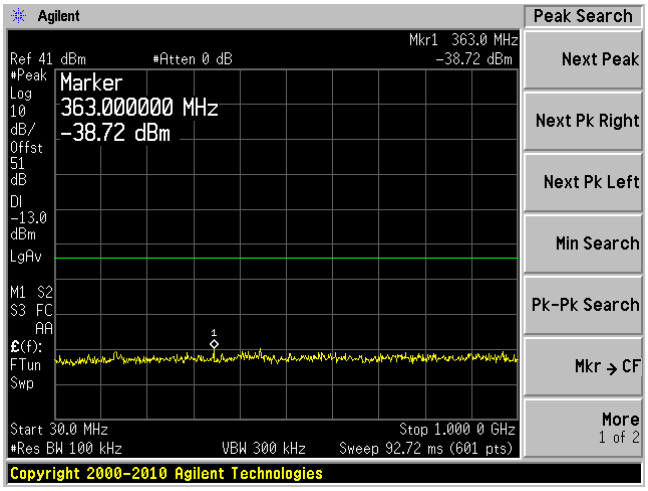
Plot 1: 30 MHz to 1 GHz, Chain J0



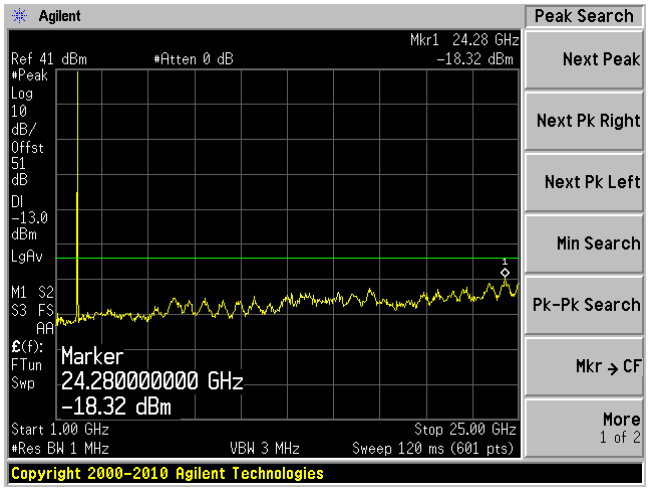

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

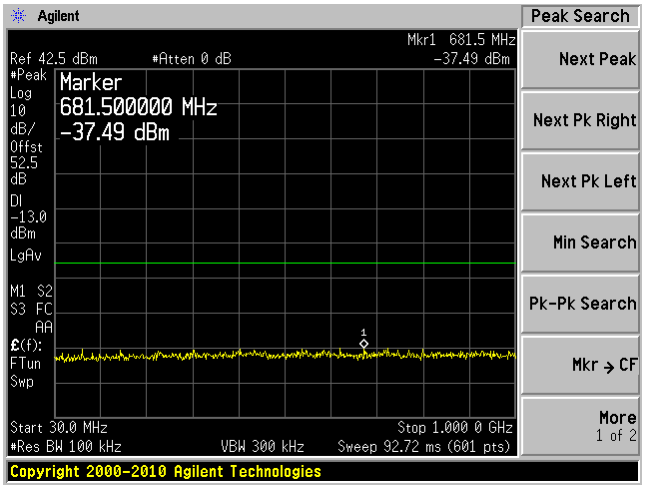



Plot 2: 1 GHz to 25 GHz, Chain J1

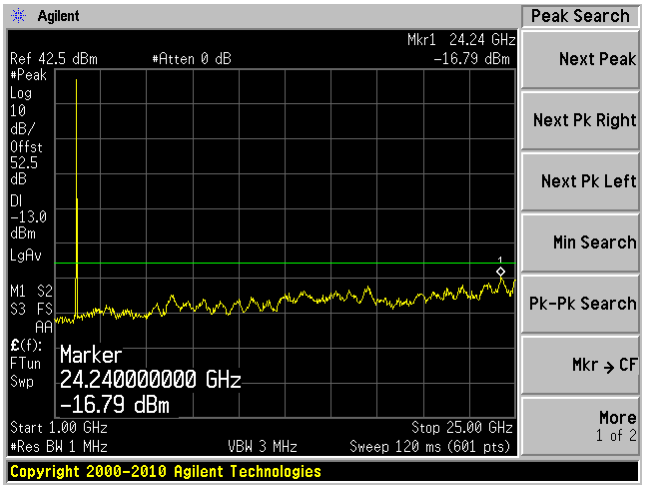


LTE, QPSK (3 MHz) Downlink: High Channel (“2153” MHz)

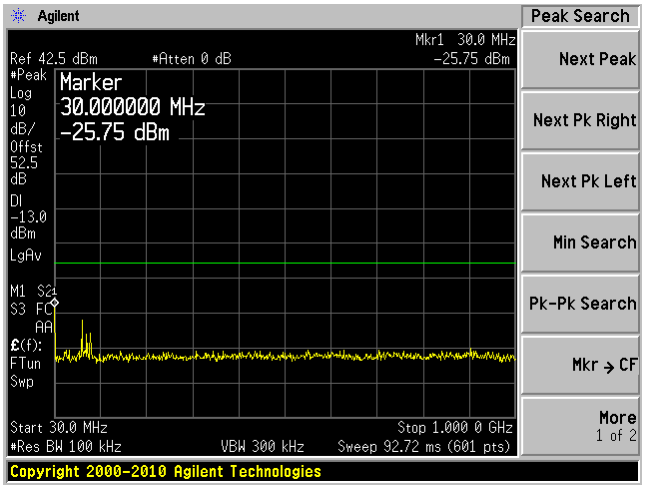
Plot 1: 30 MHz to 1 GHz, Chain J0



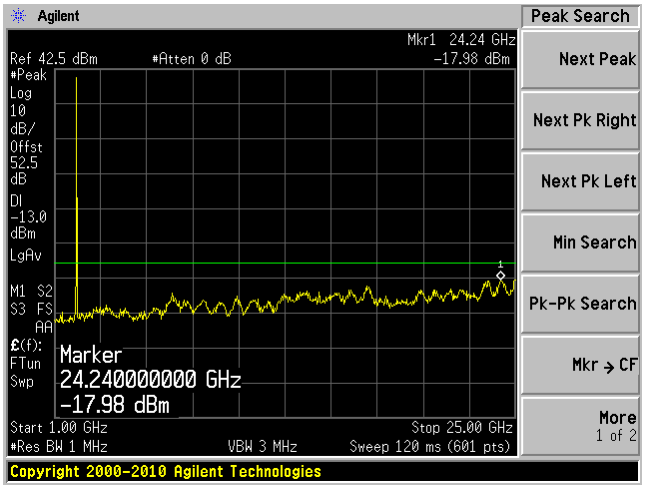

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

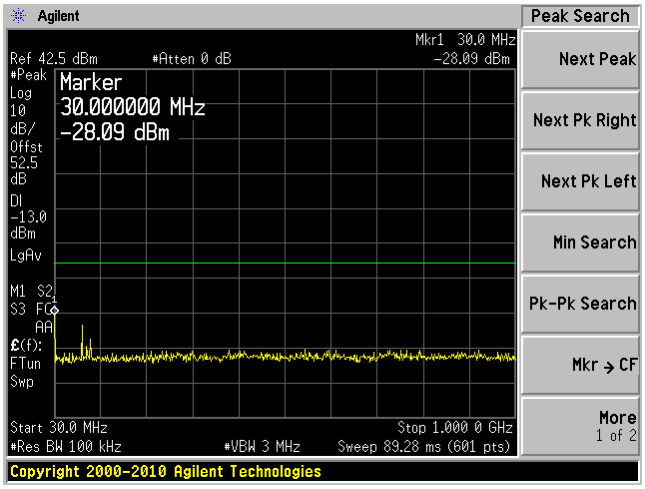



Plot 2: 1 GHz to 25 GHz, Chain J1

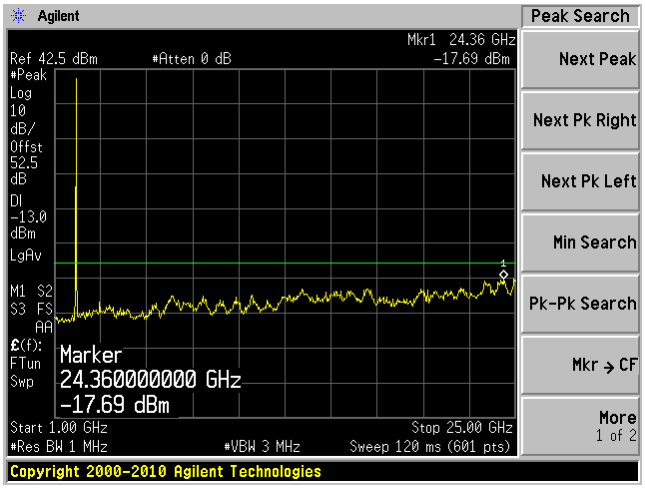


LTE, 16QAM (3 MHz) Downlink: Low Channel (“2112” MHz)

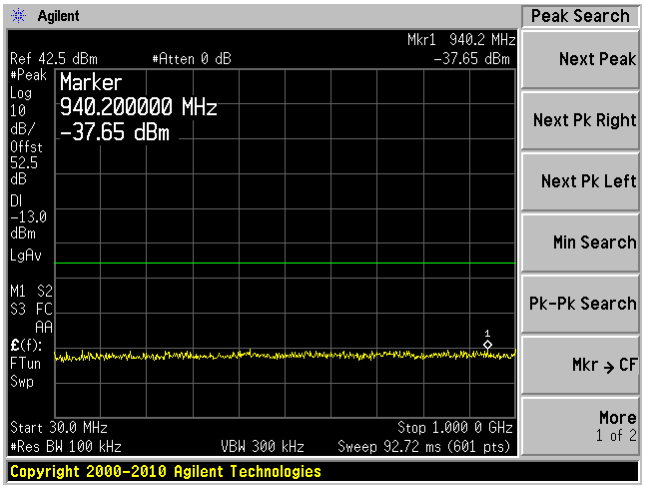
Plot 1: 30 MHz to 1 GHz, Chain J0



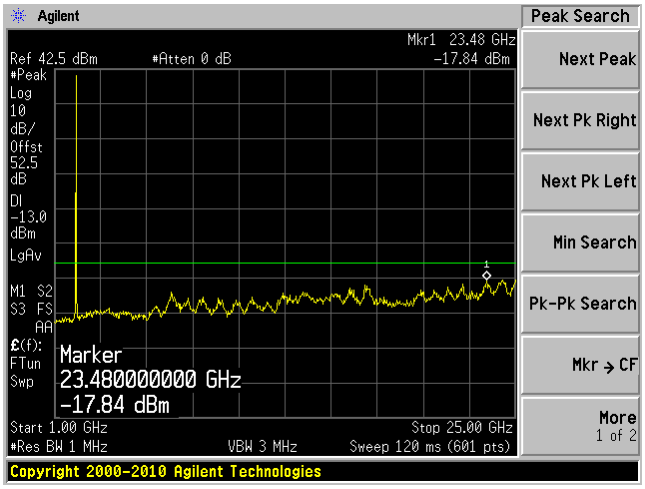

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

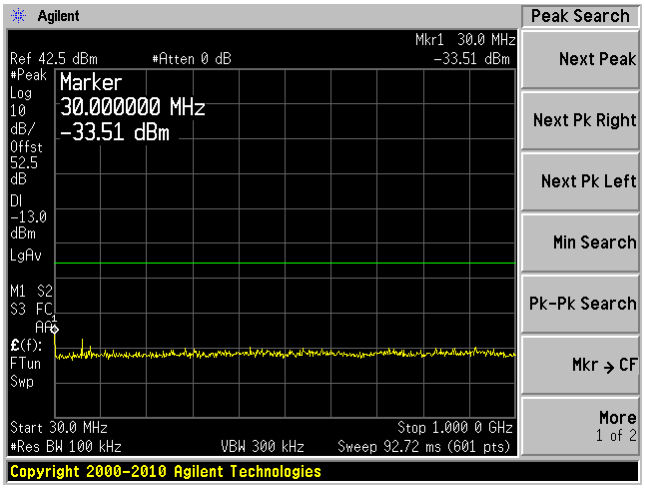



Plot 2: 1 GHz to 25 GHz, Chain J1

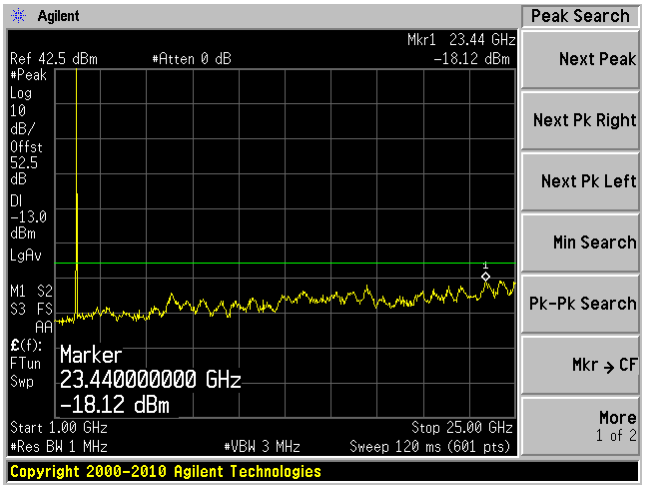


LTE, 16QAM (3 MHz) Downlink: Middle Channel (“2132” MHz)

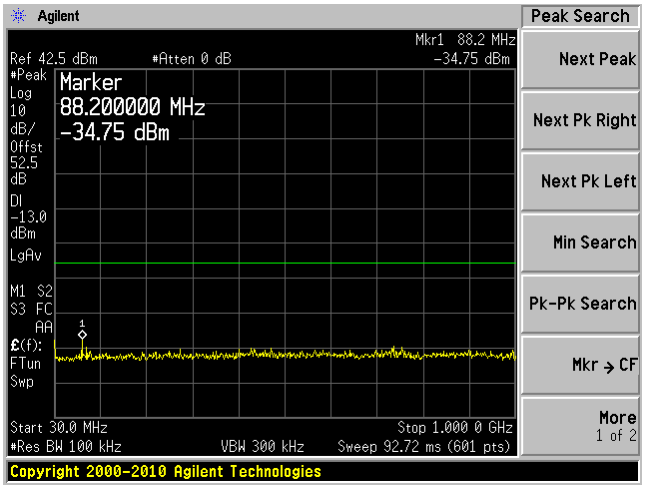
Plot 1: 30 MHz to 1 GHz, Chain J0



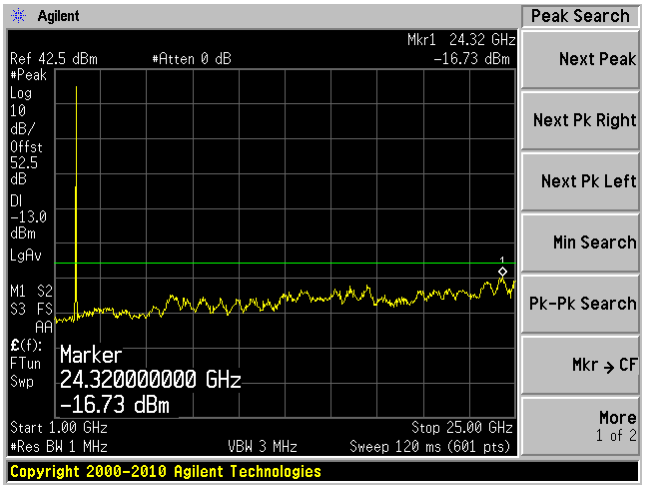

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

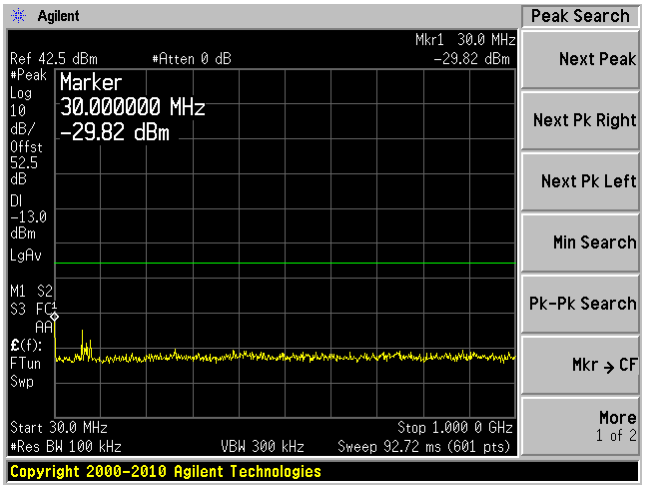



Plot 2: 1 GHz to 25 GHz, Chain J1

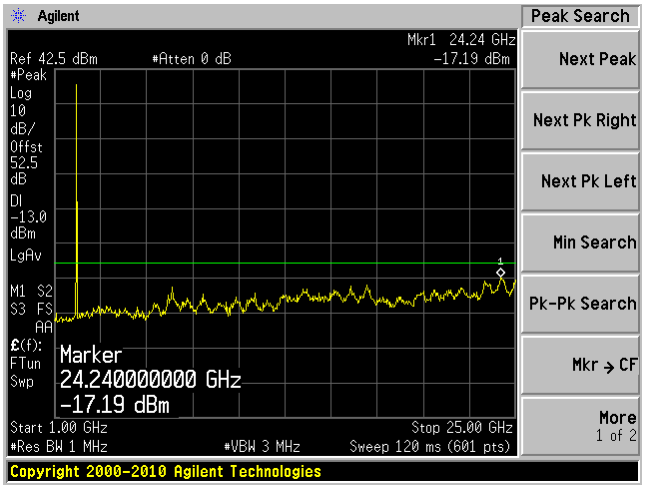


LTE, 16QAM (3 MHz) Downlink: High Channel (“2153” MHz)

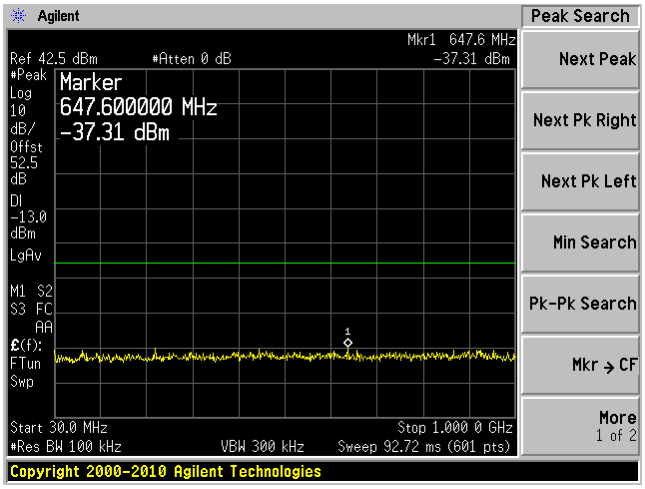
Plot 1: 30 MHz to 1 GHz, Chain J0



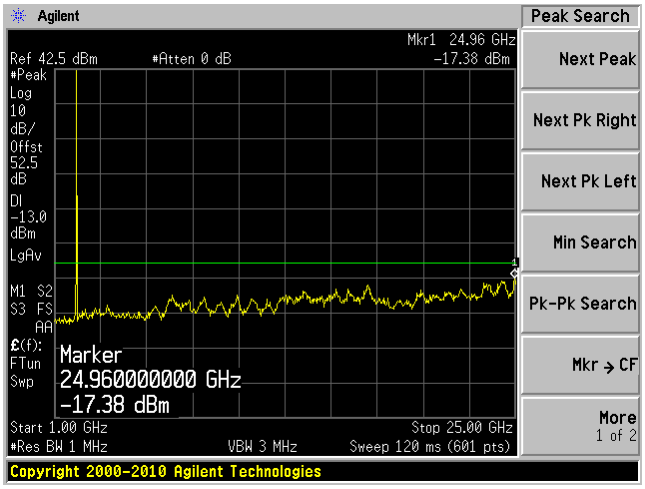

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

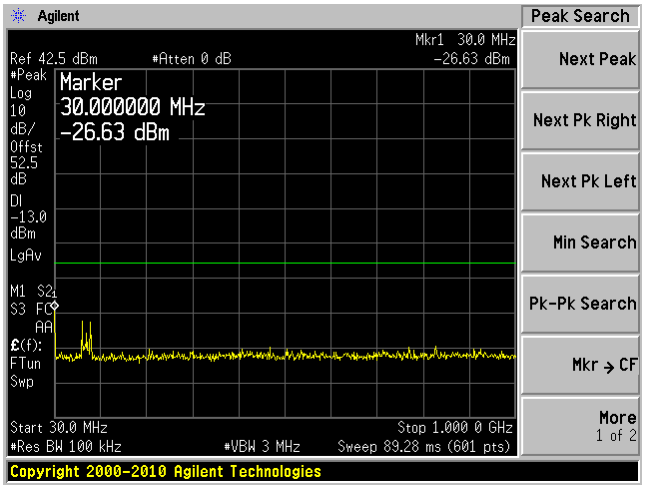



Plot 2: 1 GHz to 25 GHz, Chain J1

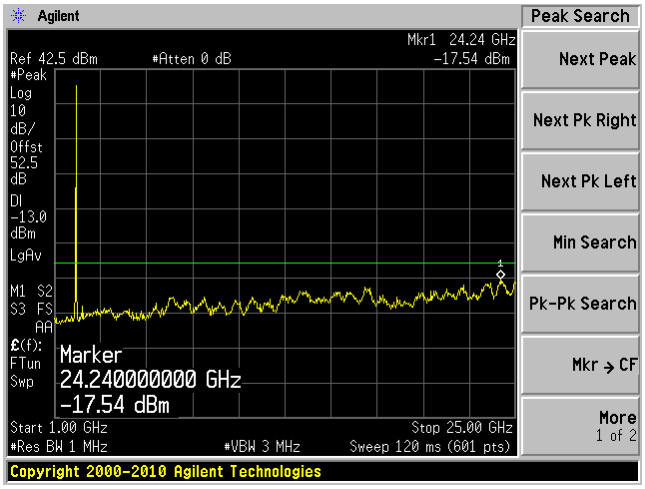


LTE, 64QAM (3 MHz) Downlink: Low Channel (“2112” MHz)

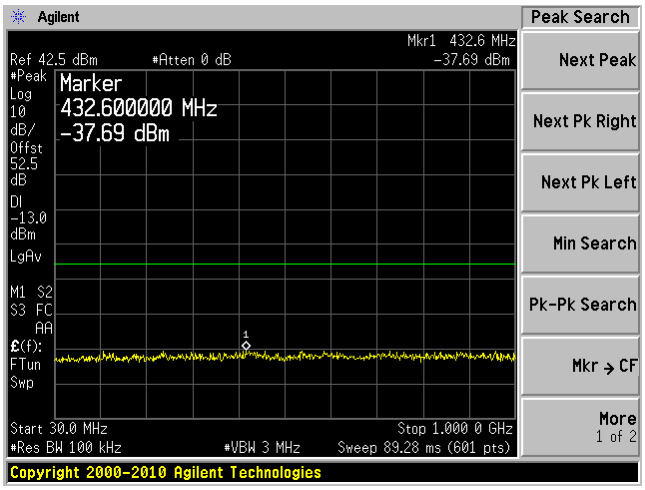
Plot 1: 30 MHz to 1 GHz, Chain J0



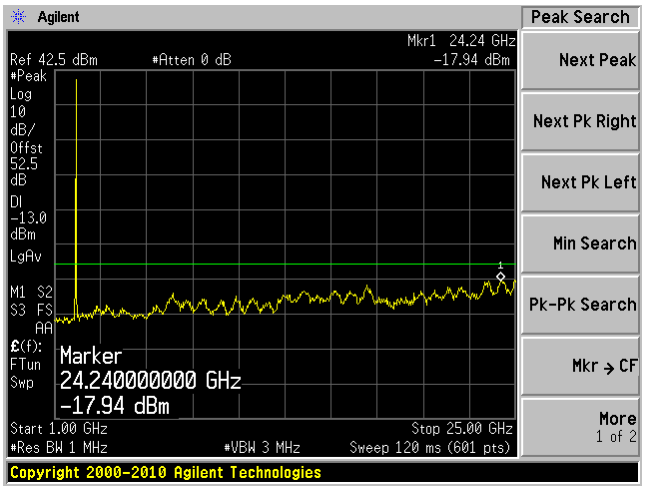

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

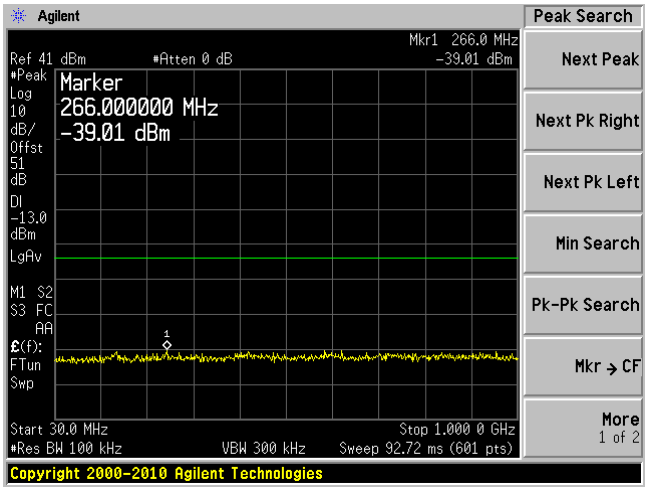



Plot 2: 1 GHz to 25 GHz, Chain J1

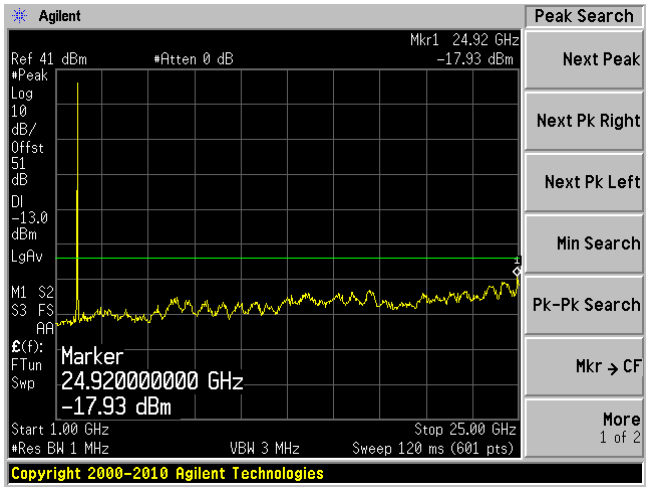


LTE, 64QAM (3 MHz) Downlink: Middle Channel (“2132” MHz)

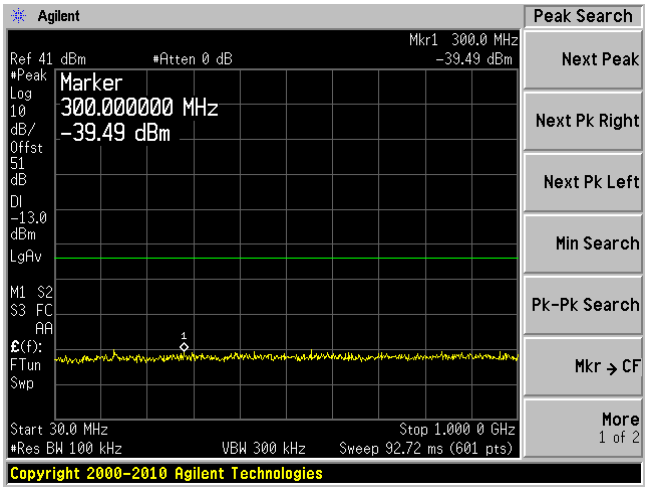
Plot 1: 30 MHz to 1 GHz, Chain J0



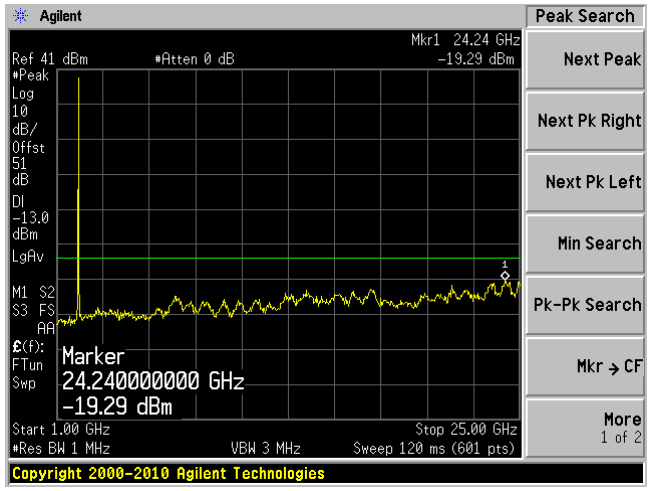

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

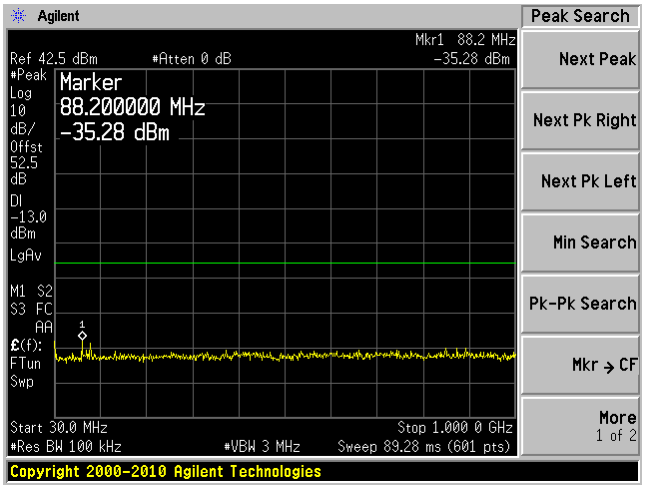



Plot 2: 1 GHz to 25 GHz, Chain J1

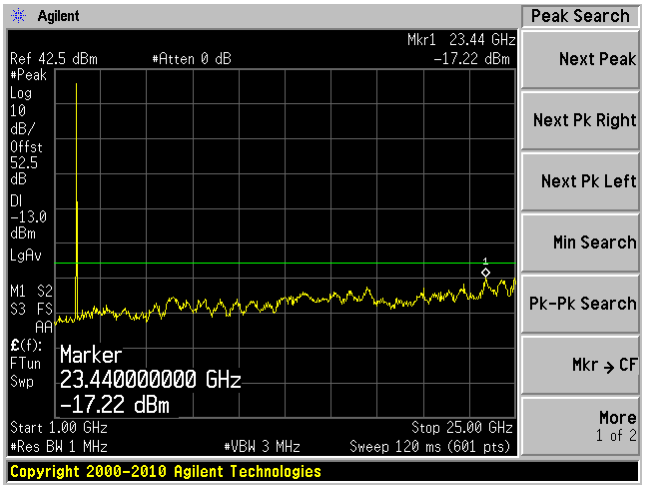


LTE, 64QAM (3 MHz) Downlink: High Channel (“2153” MHz)

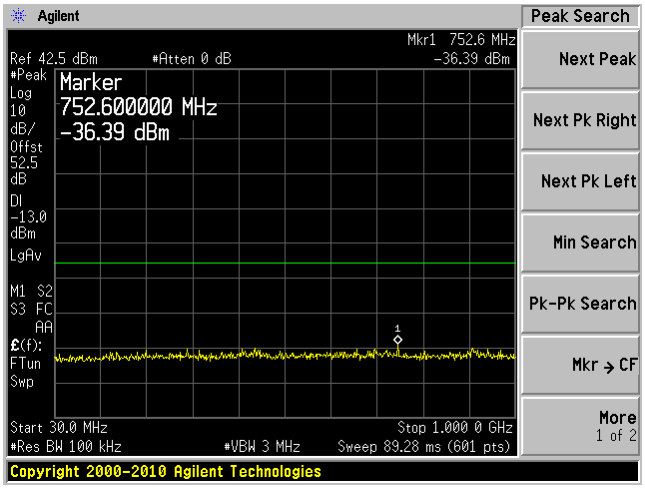
Plot 1: 30 MHz to 1 GHz, Chain J0



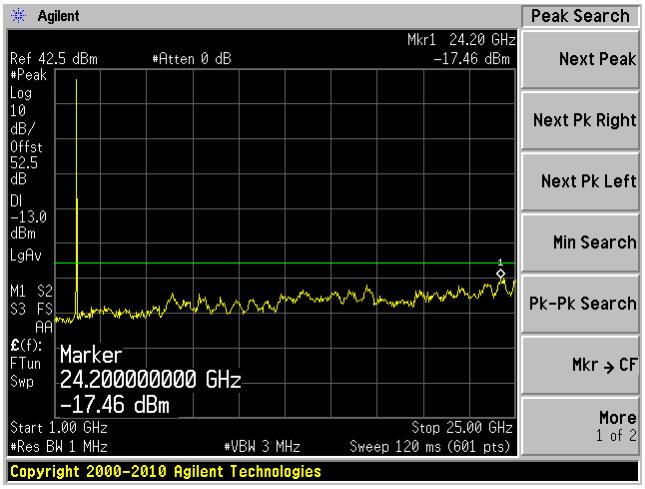

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

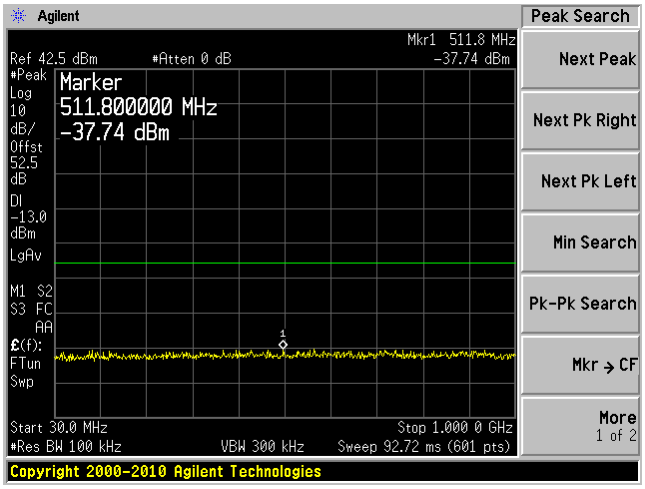



Plot 2: 1 GHz to 25 GHz, Chain J1

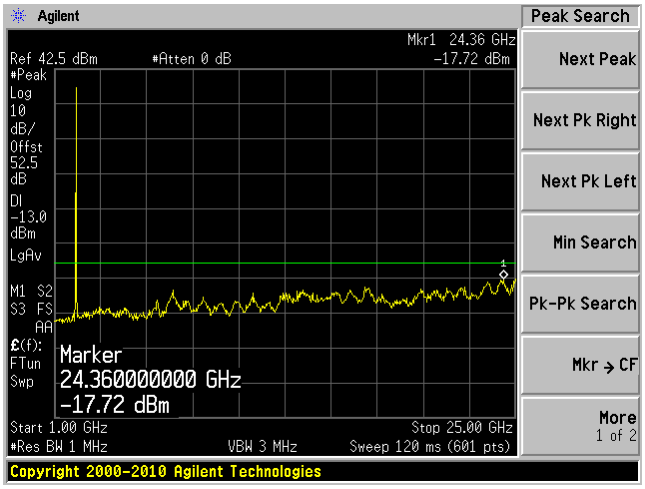


LTE, QPSK (5 MHz) Downlink: Low Channel (“2113” MHz)

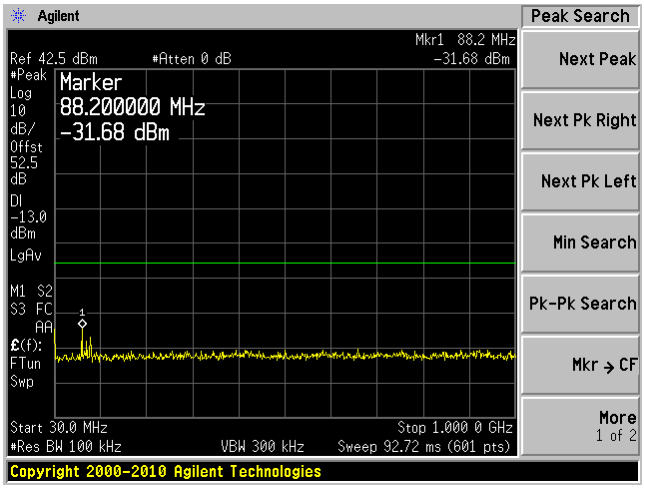
Plot 1: 30 MHz to 1 GHz, Chain J0



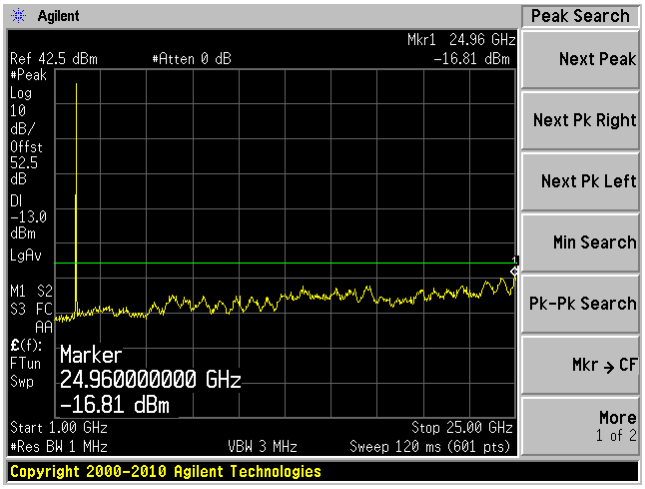

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

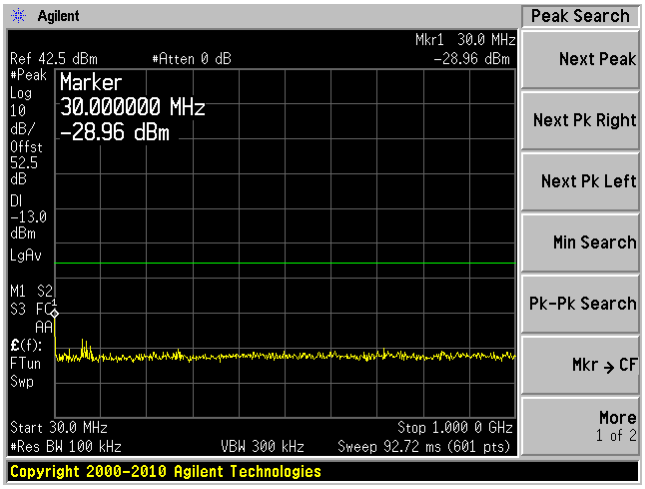



Plot 2: 1 GHz to 25 GHz, Chain J1

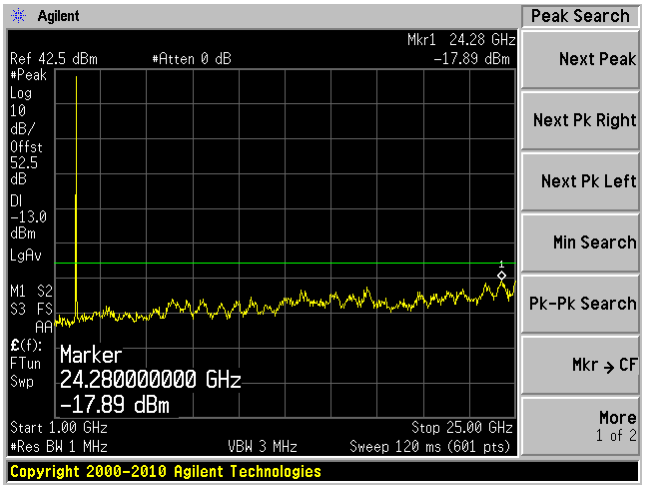


LTE, QPSK (5 MHz) Downlink: Middle Channel (“2132” MHz)

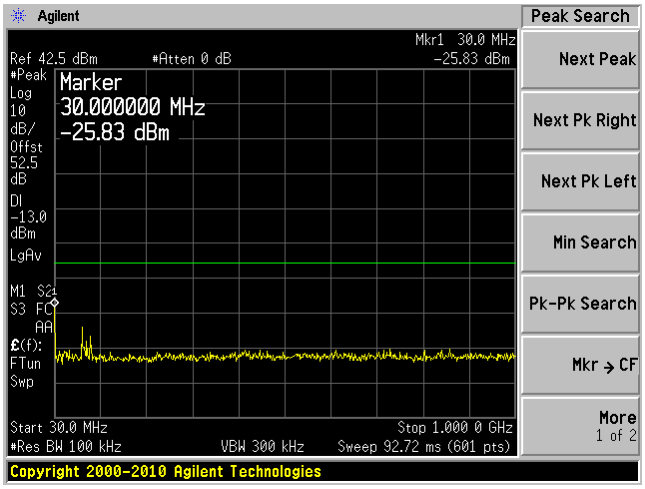
Plot 1: 30 MHz to 1 GHz, Chain J0



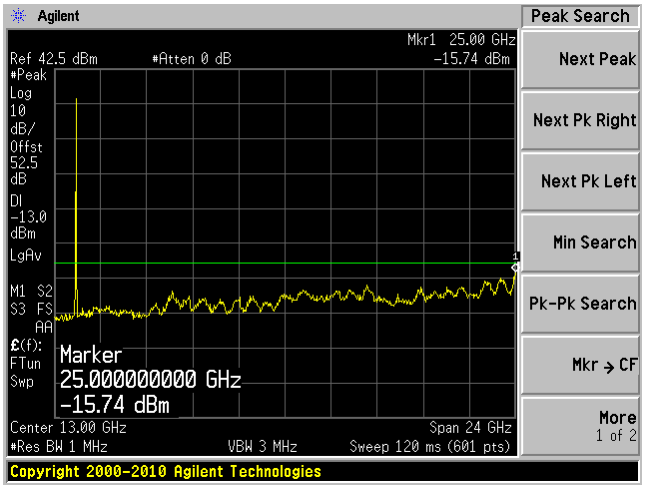

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

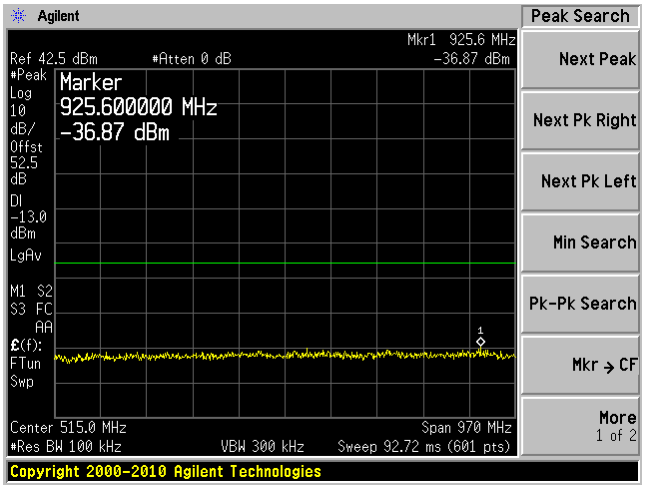



Plot 2: 1 GHz to 25 GHz, Chain J1

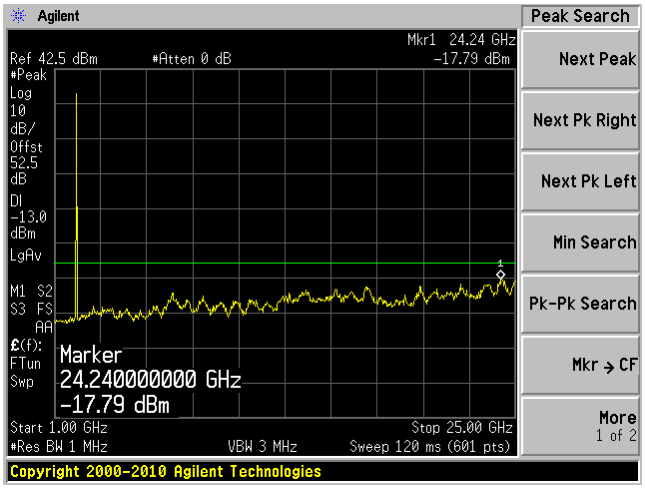


LTE, QPSK (5 MHz) Downlink: High Channel (“2152” MHz)

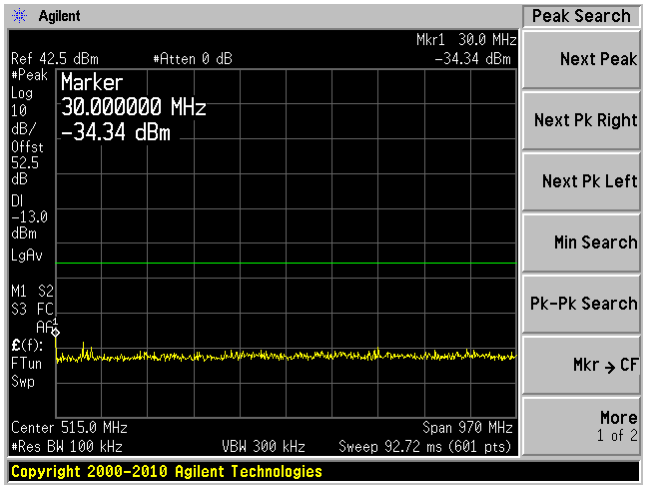
Plot 1: 30 MHz to 1 GHz, Chain J0



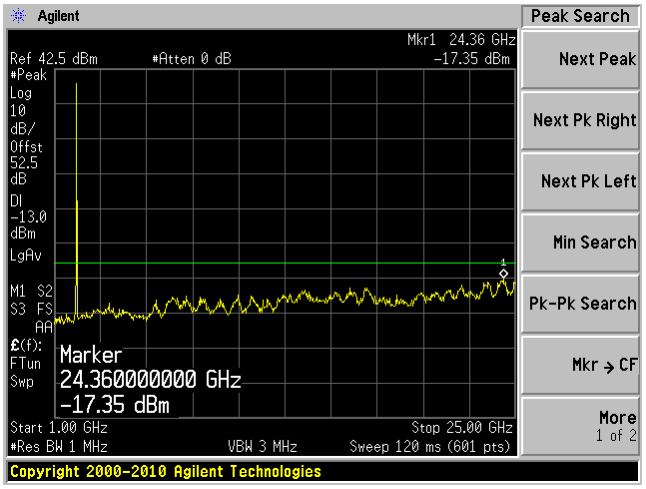

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

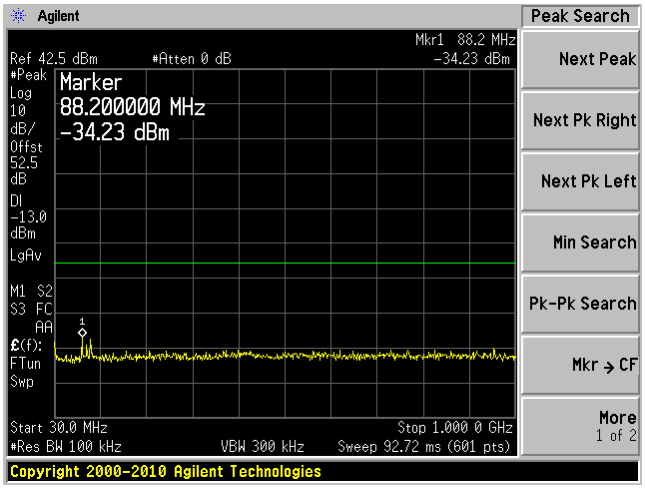



Plot 2: 1 GHz to 25 GHz, Chain J1

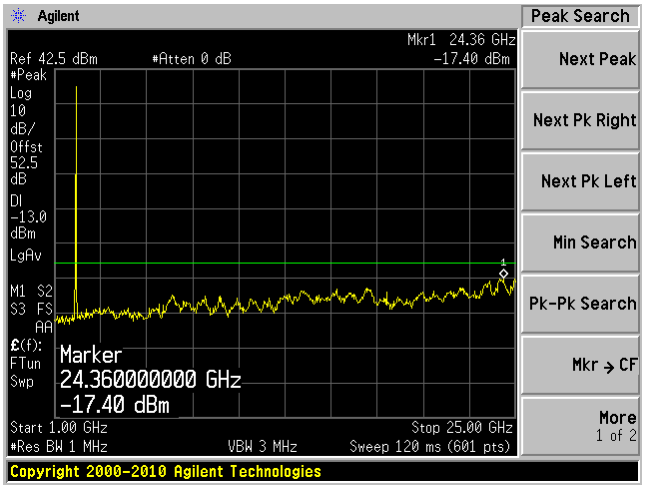


LTE, 16QAM (5 MHz) Downlink: Low Channel (“2113” MHz)

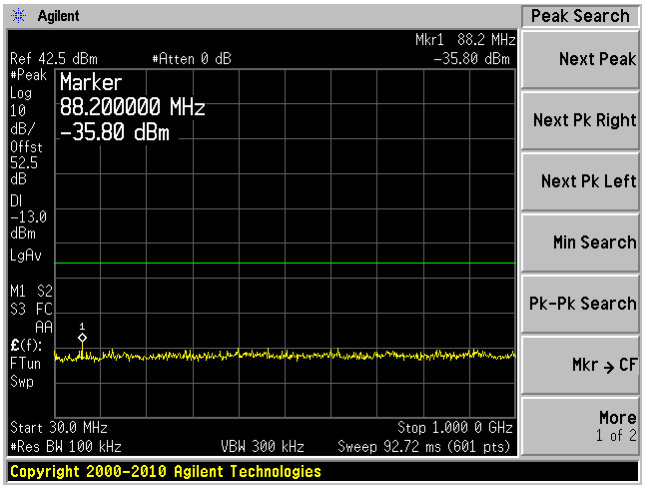
Plot 1: 30 MHz to 1 GHz, Chain J0



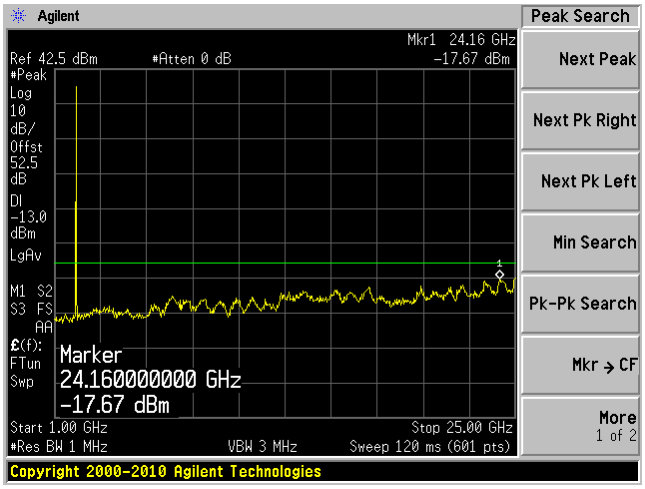

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

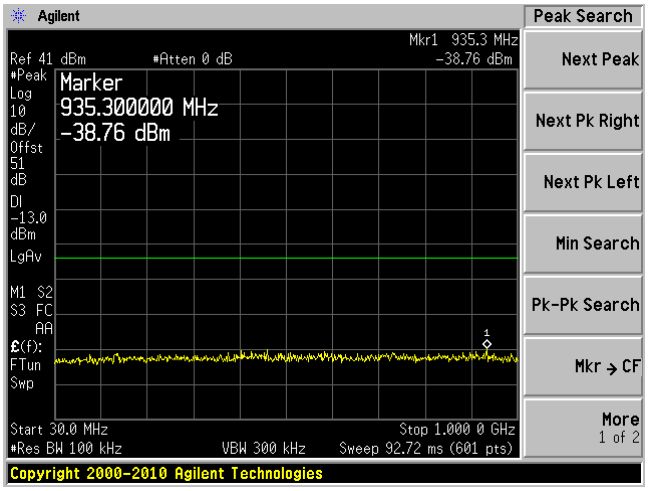



Plot 2: 1 GHz to 25 GHz, Chain J1

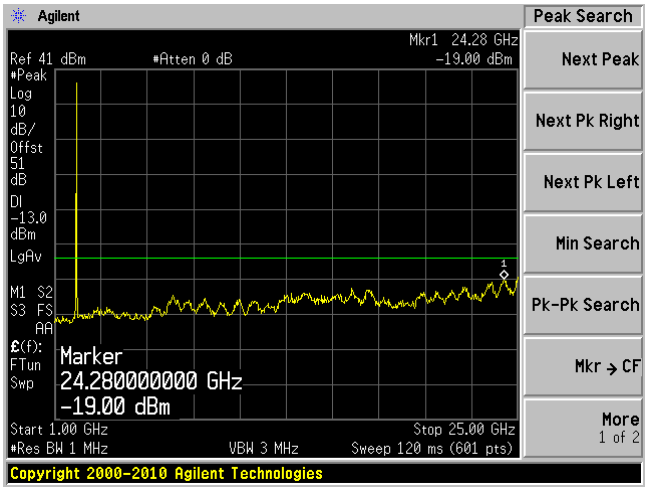


LTE, 16QAM (5 MHz) Downlink: Middle Channel (“2132” MHz)

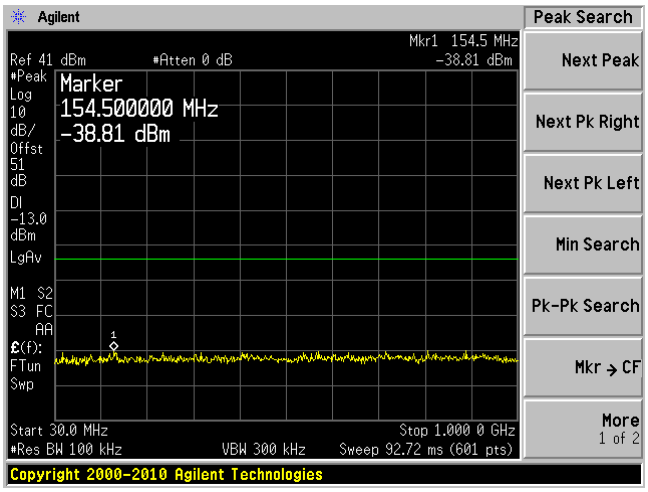
Plot 1: 30 MHz to 1 GHz, Chain J0



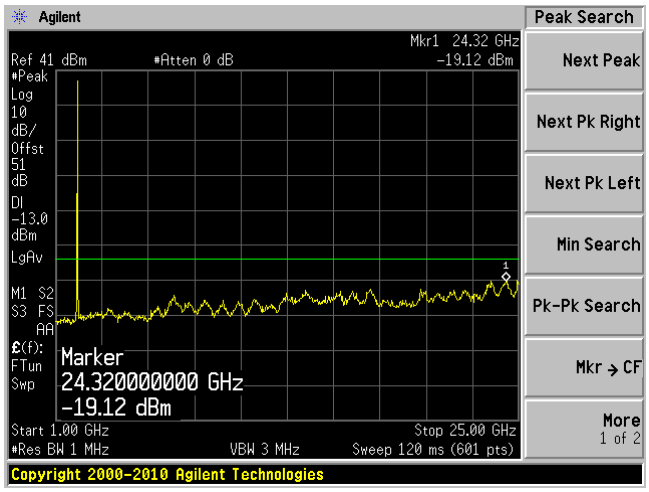

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

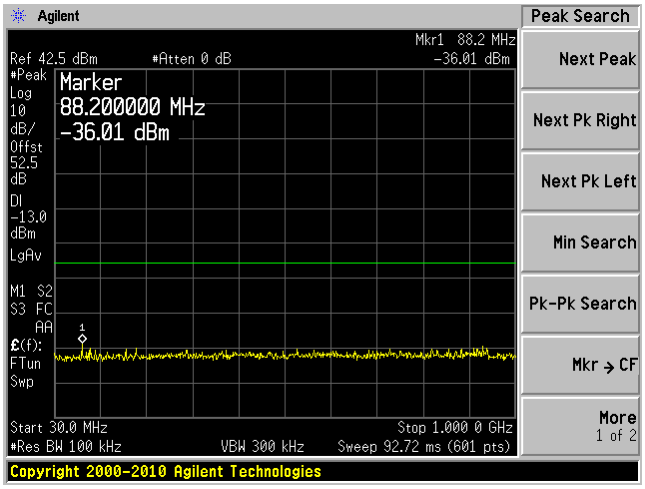



Plot 2: 1 GHz to 25 GHz, Chain J1

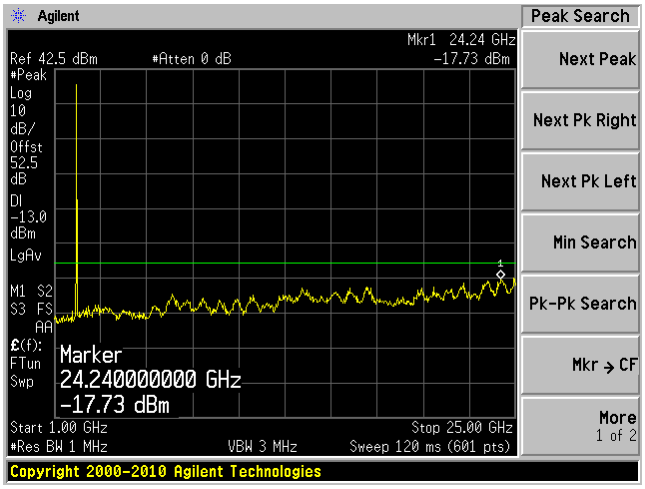


LTE, 16QAM (5 MHz) Downlink: High Channel (“2152” MHz)

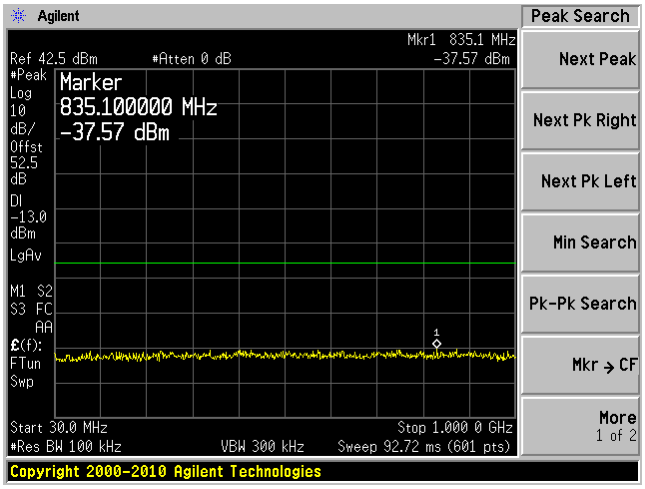
Plot 1: 30 MHz to 1 GHz, Chain J0



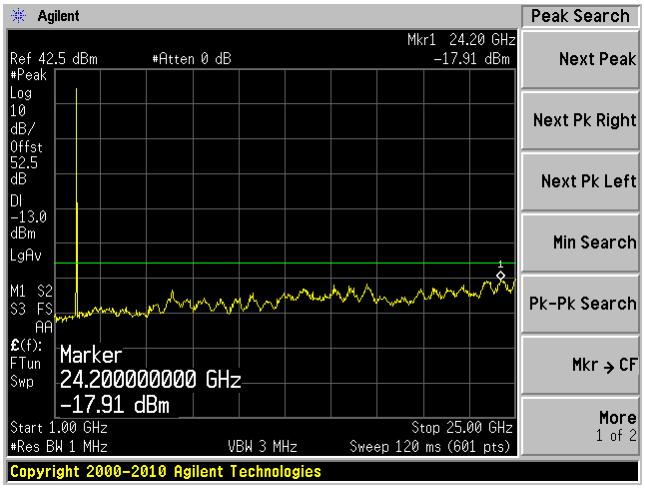

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

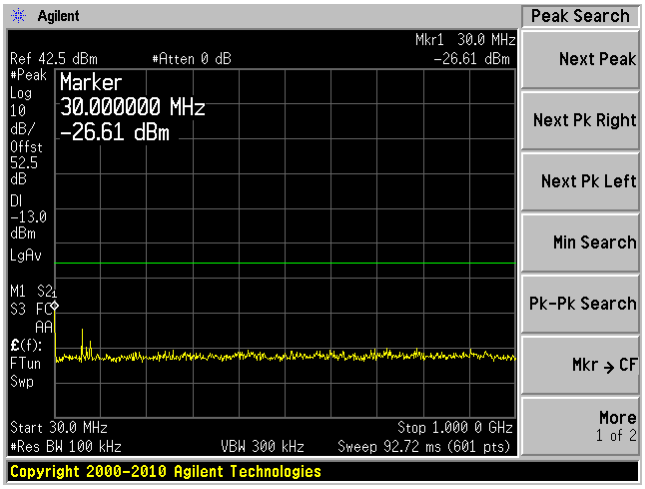



Plot 2: 1 GHz to 25 GHz, Chain J1

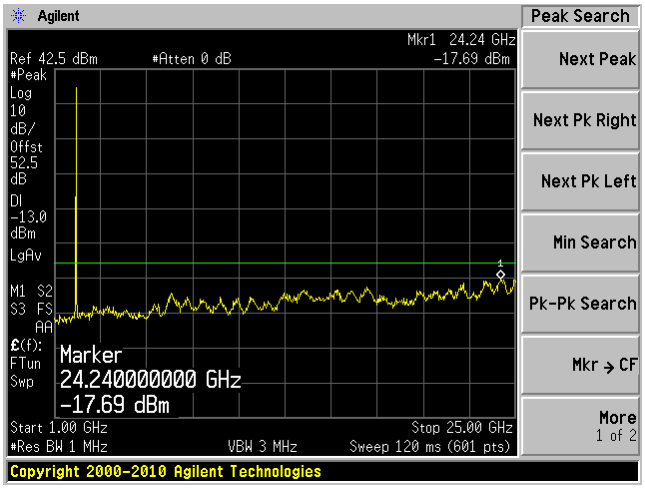


LTE, 64QAM (5 MHz) Downlink: Low Channel (“2113” MHz)

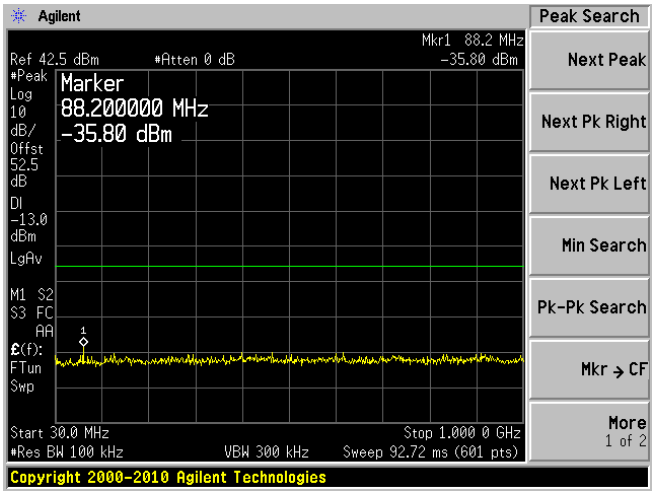
Plot 1: 30 MHz to 1 GHz, Chain J0



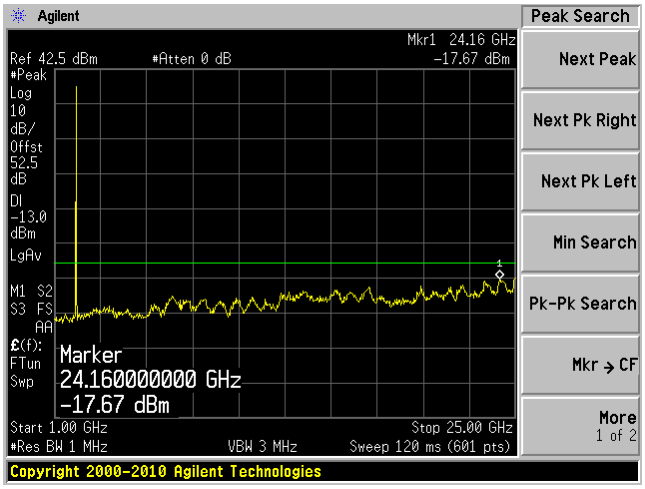

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

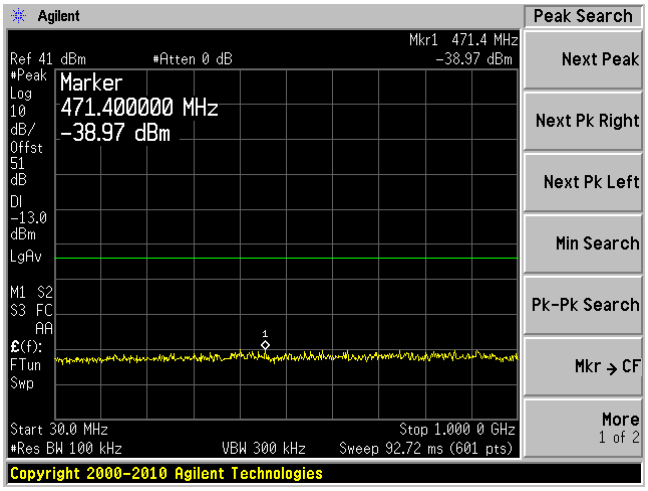



Plot 2: 1 GHz to 25 GHz, Chain J1

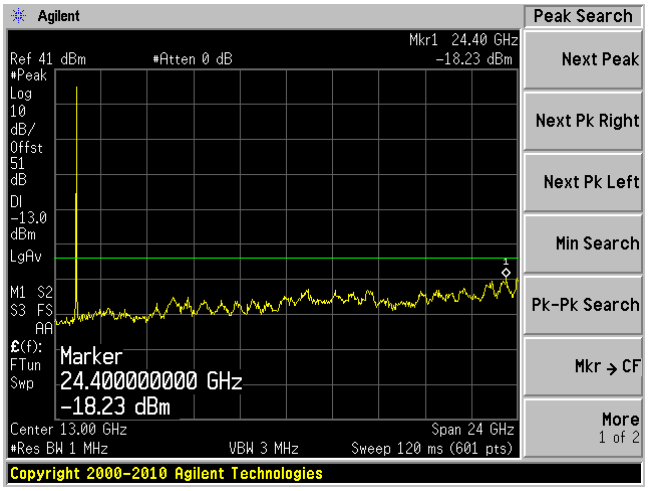


LTE, 64QAM (5 MHz) Downlink: Middle Channel (“2132” MHz)

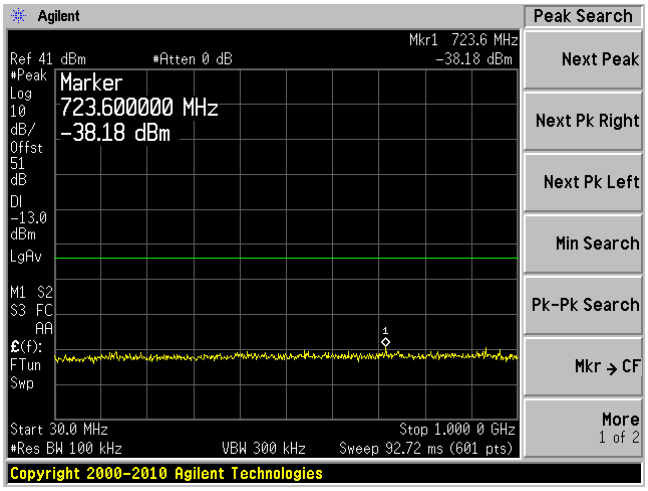
Plot 1: 30 MHz to 1 GHz, Chain J0



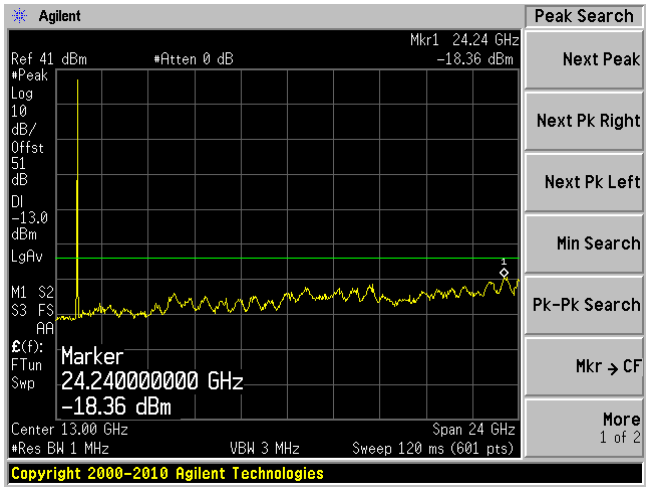

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

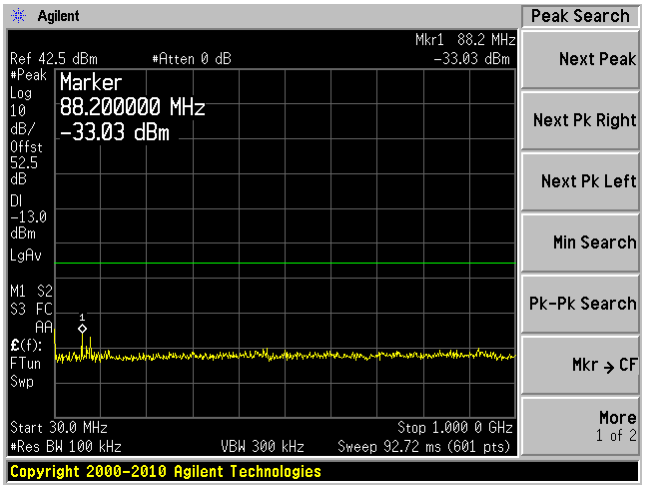



Plot 2: 1 GHz to 25 GHz, Chain J1

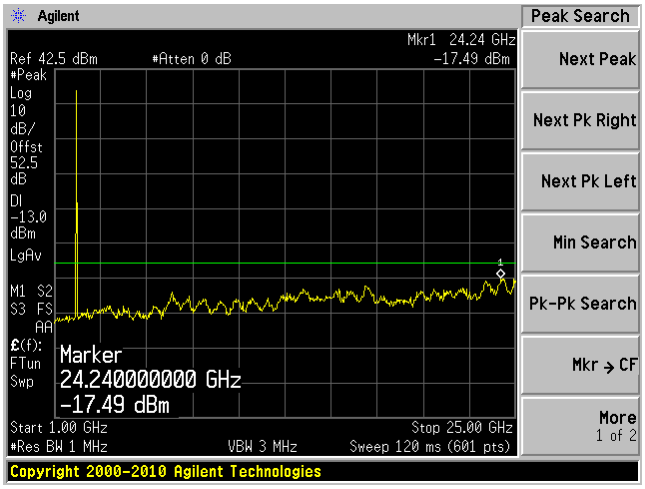


LTE, 64QAM (5 MHz) Downlink: High Channel (“2152” MHz)

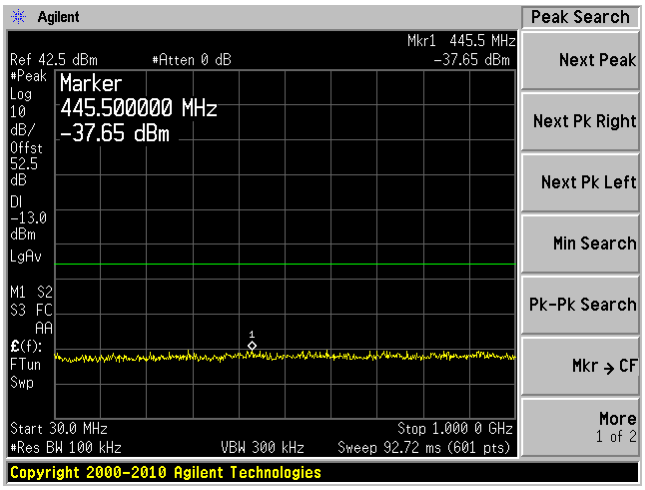
Plot 1: 30 MHz to 1 GHz, Chain J0



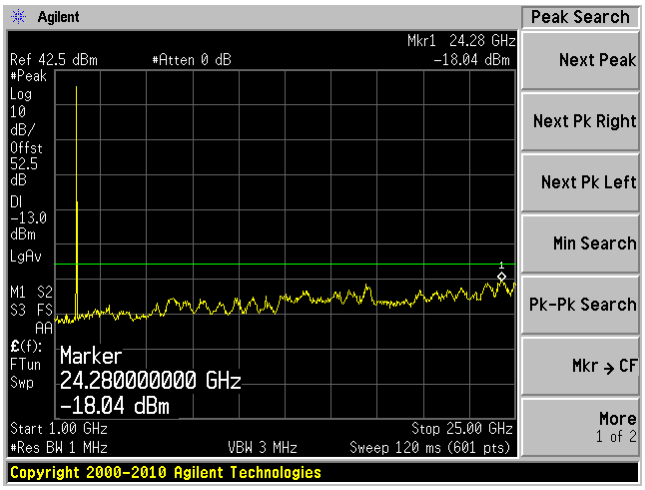

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

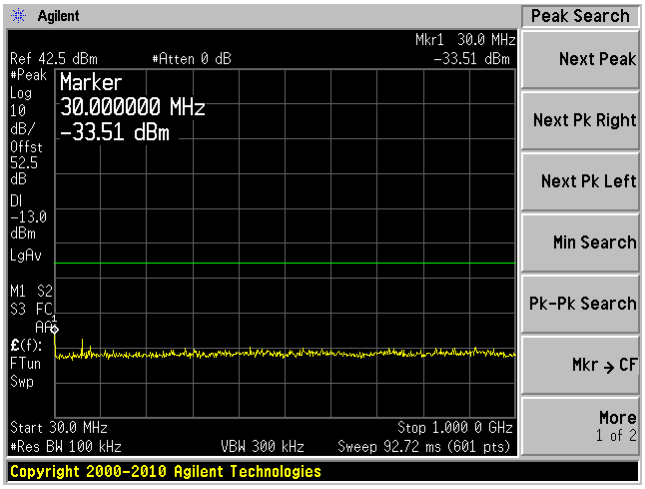



Plot 2: 1 GHz to 25 GHz, Chain J1

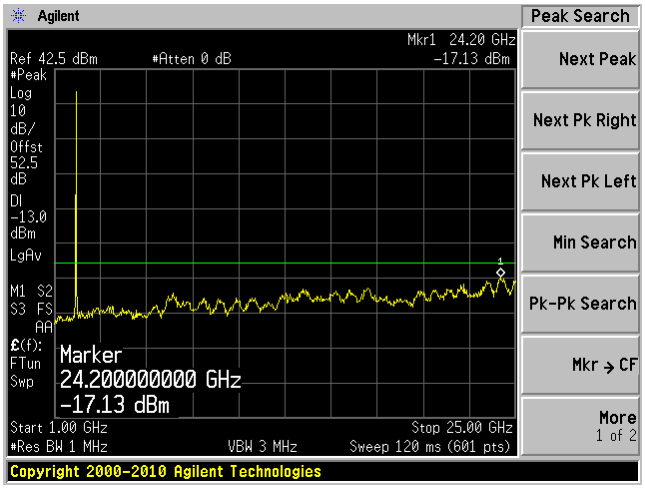


LTE, QPSK (10 MHz) Downlink: Low Channel (“2115” MHz)

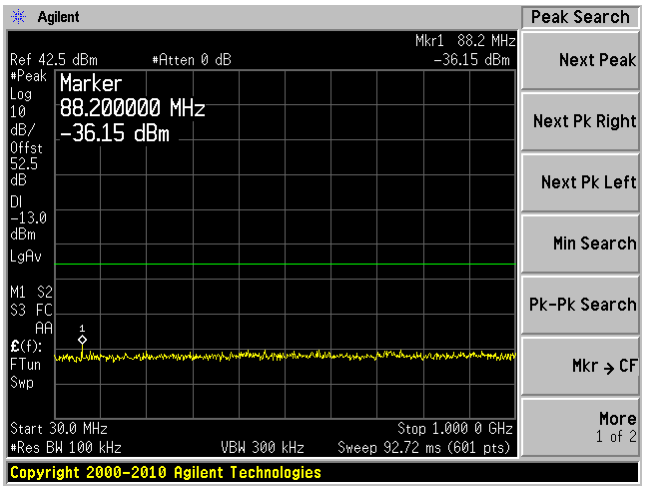
Plot 1: 30 MHz to 1 GHz, Chain J0



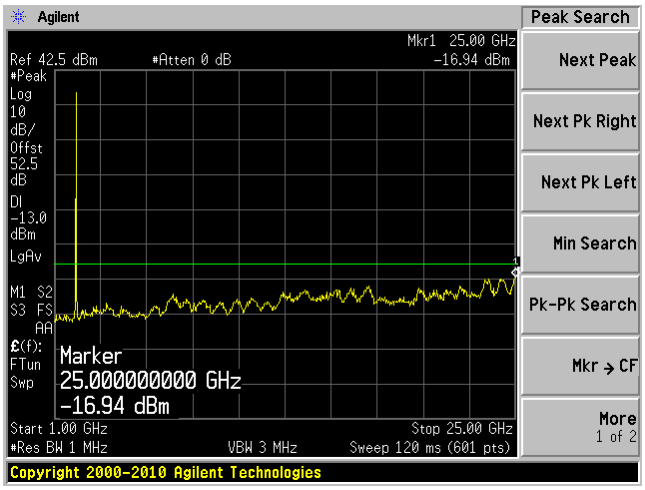

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

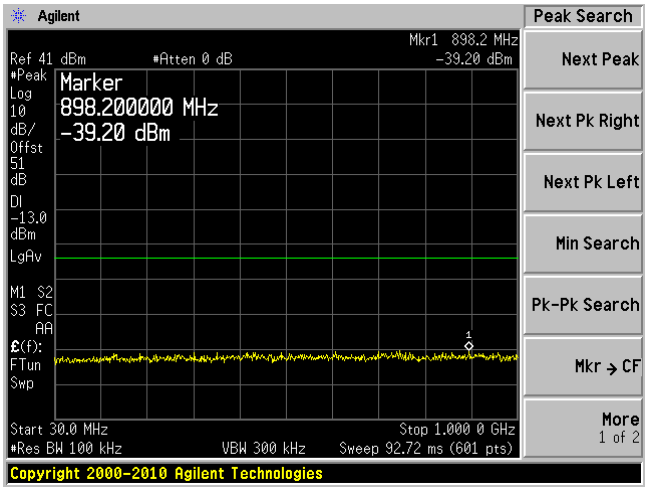



Plot 2: 1 GHz to 25 GHz, Chain J1

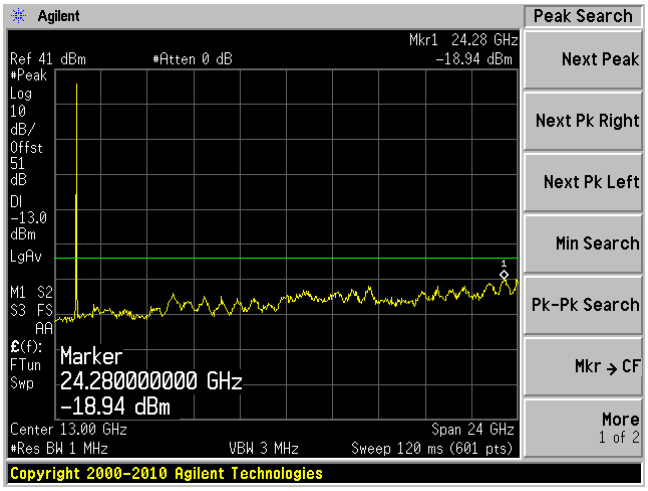


LTE, QPSK (10 MHz) Downlink: Middle Channel (“2132” MHz)

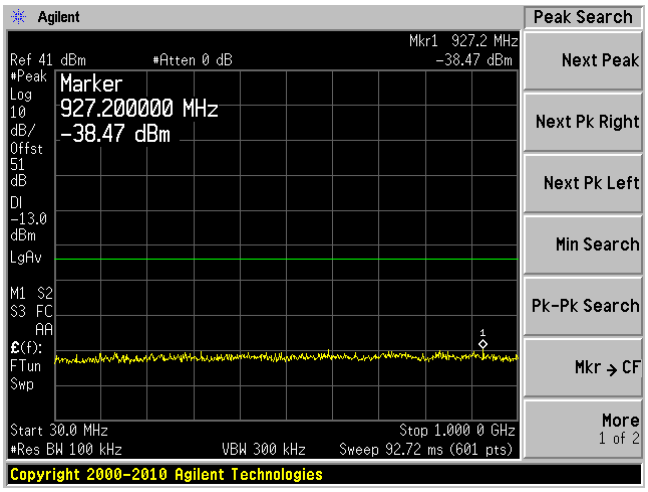
Plot 1: 30 MHz to 1 GHz, Chain J0



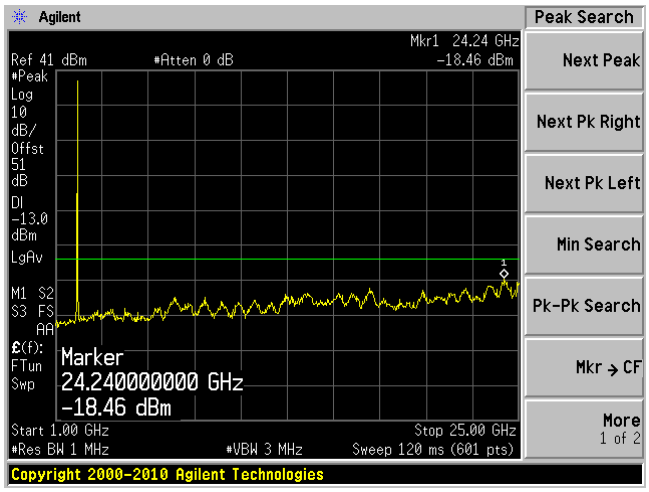

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

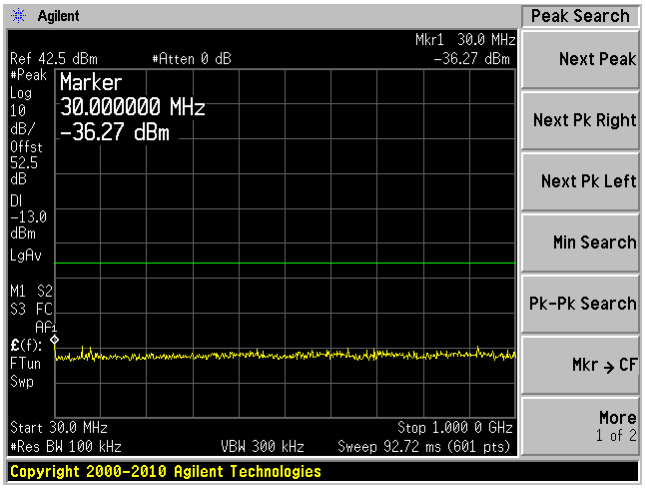



Plot 2: 1 GHz to 25 GHz, Chain J1

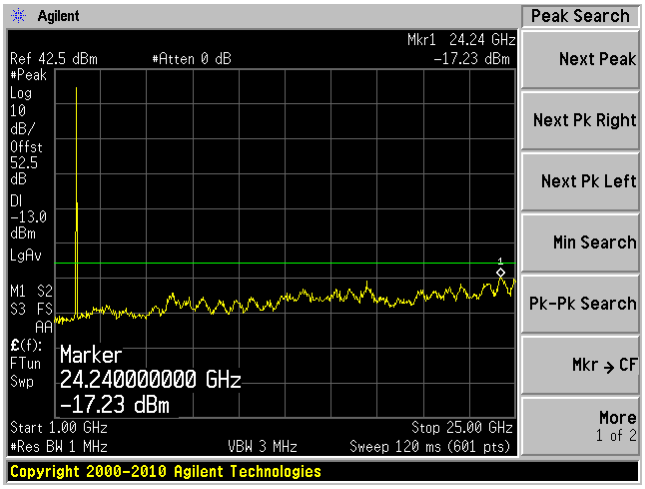


LTE, QPSK (10 MHz) Downlink: High Channel (“2150” MHz)

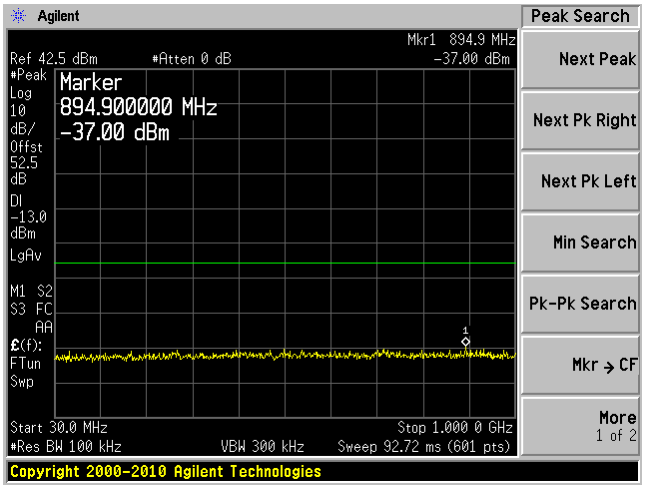
Plot 1: 30 MHz to 1 GHz, Chain J0



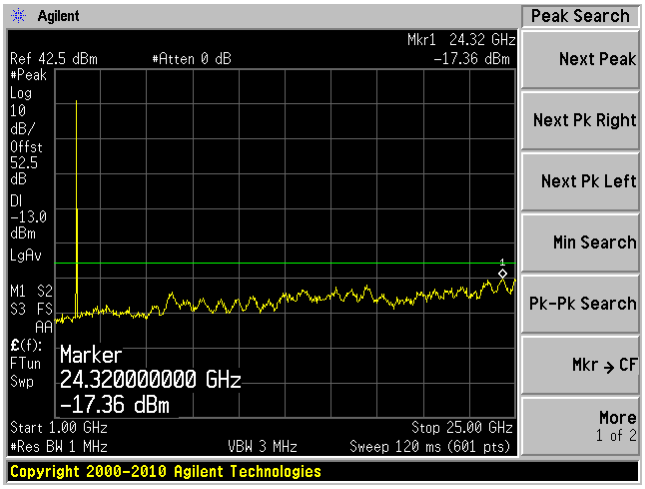

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

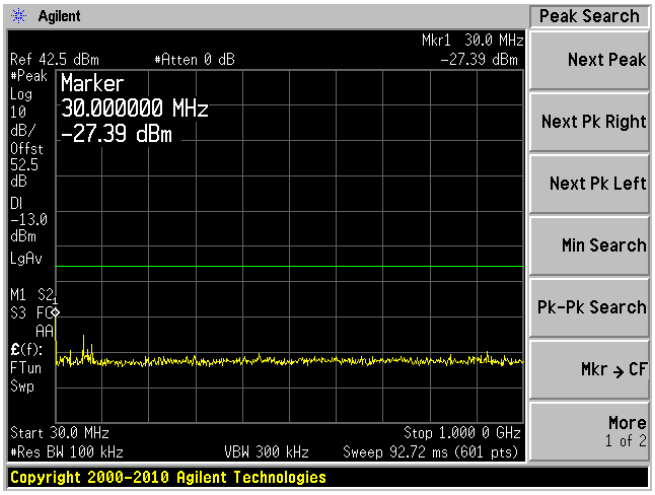



Plot 2: 1 GHz to 25 GHz, Chain J1

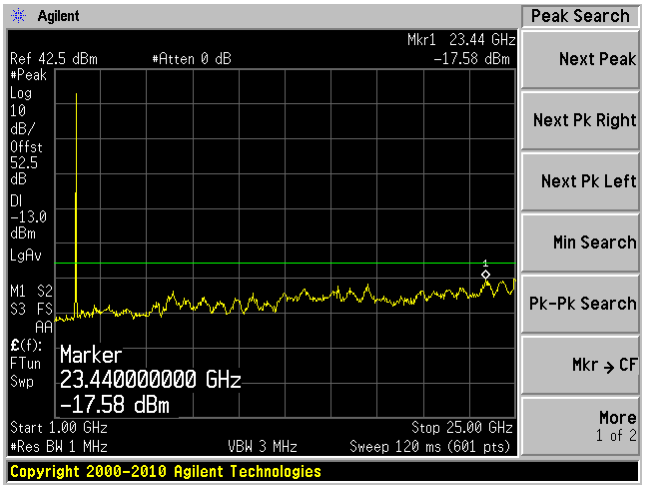


LTE, 16QAM (10 MHz) Downlink: Low Channel (“2115” MHz)

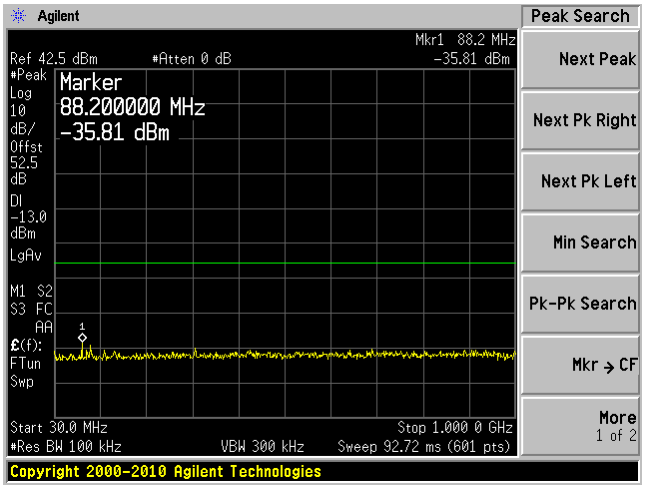
Plot 1: 30 MHz to 1 GHz, Chain J0



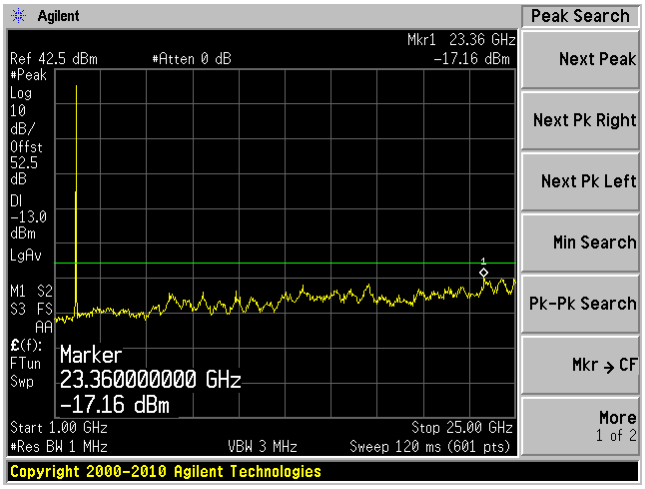

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

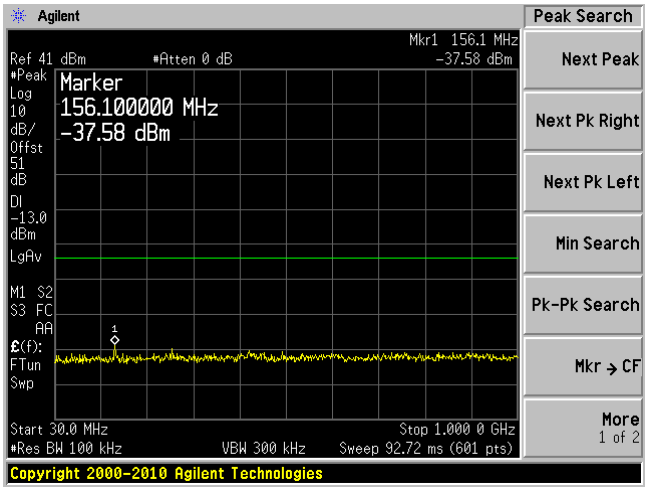



Plot 2: 1 GHz to 25 GHz, Chain J1

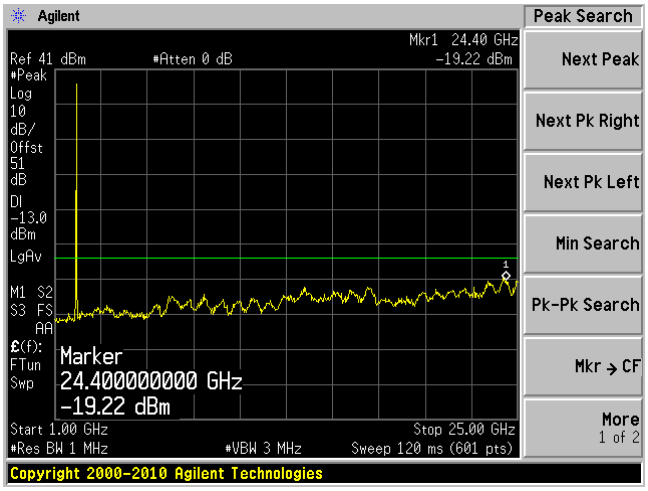


LTE, 16QAM (10 MHz) Downlink: Middle Channel (“2132” MHz)

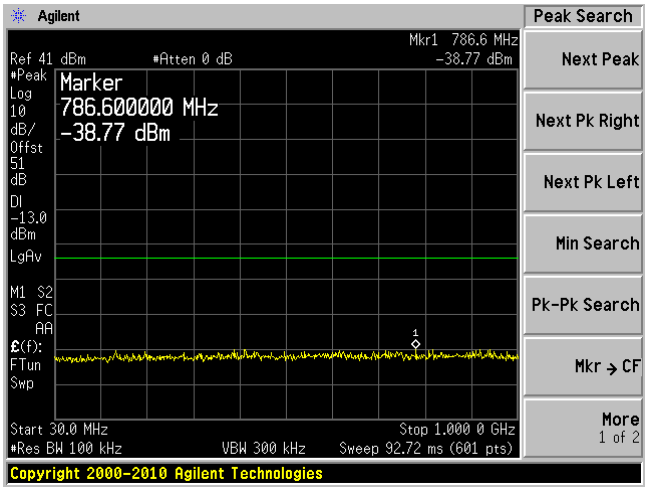
Plot 1: 30 MHz to 1 GHz, Chain J0



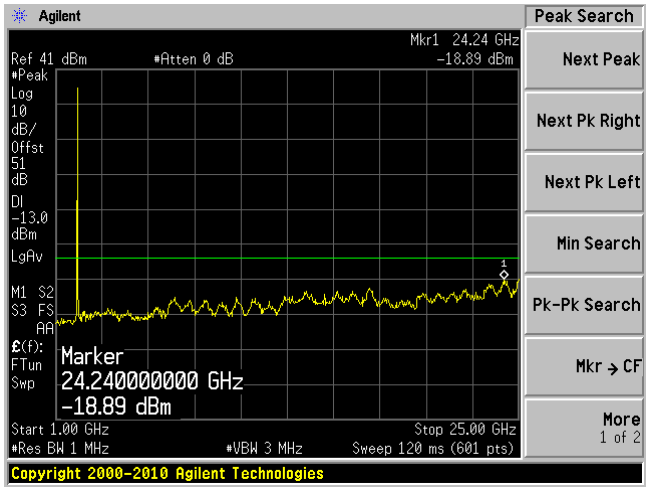

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

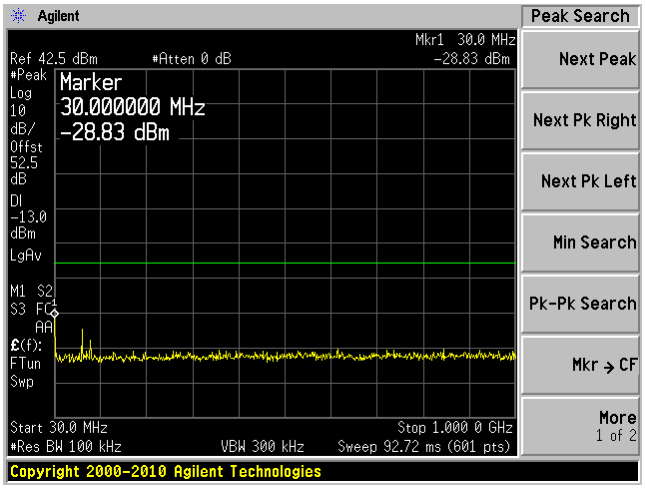



Plot 2: 1 GHz to 25 GHz, Chain J1

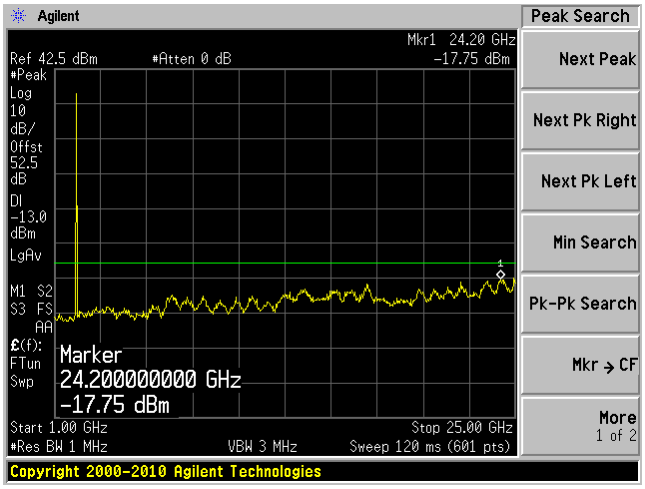


LTE, 16QAM (10 MHz) Downlink: High Channel (“2150” MHz**)**

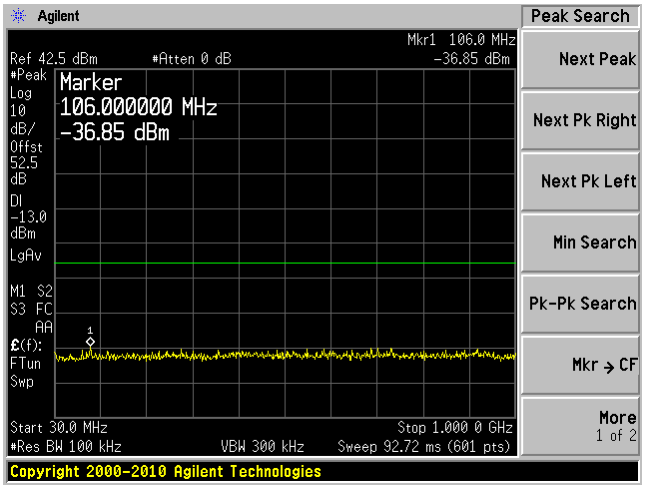
Plot 1: 30 MHz to 1 GHz, Chain J0



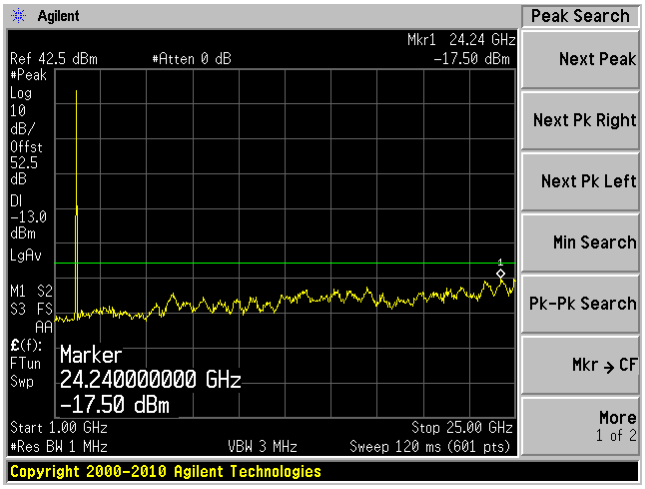

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

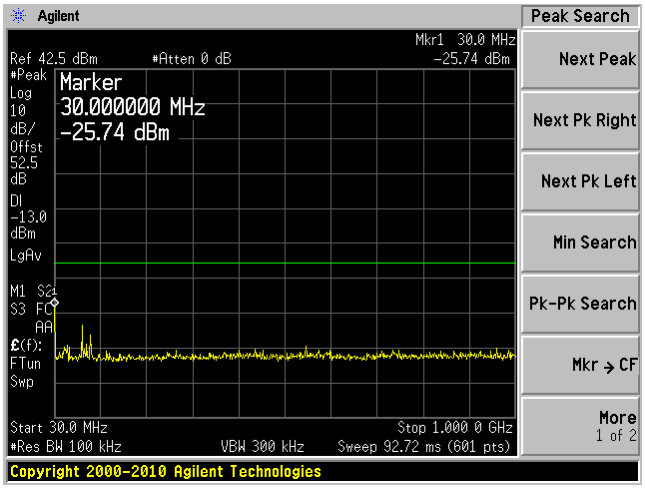



Plot 2: 1 GHz to 25 GHz, Chain J1

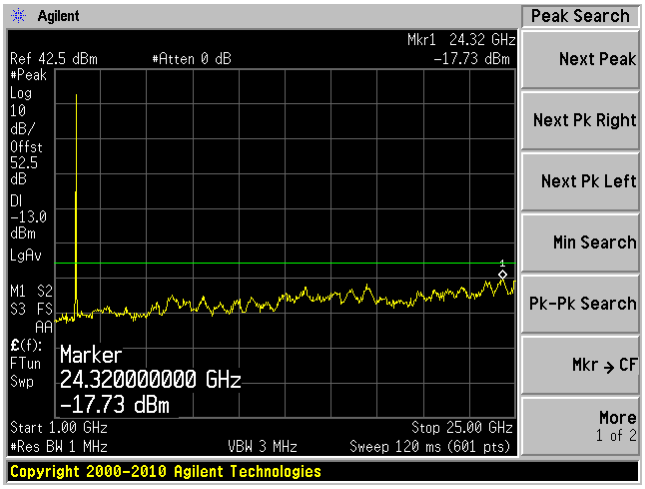


LTE, 64QAM (10 MHz) Downlink: Low Channel (“2115” MHz)

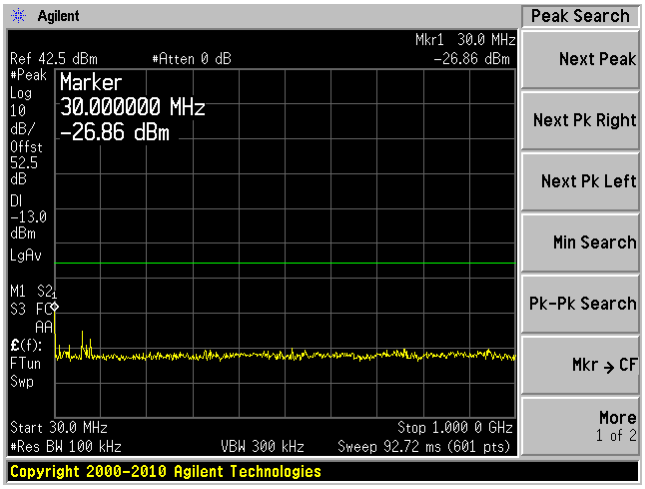
Plot 1: 30 MHz to 1 GHz, Chain J0



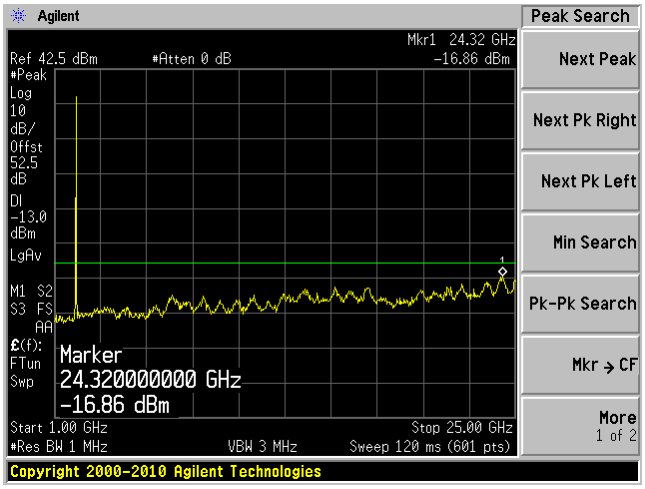

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

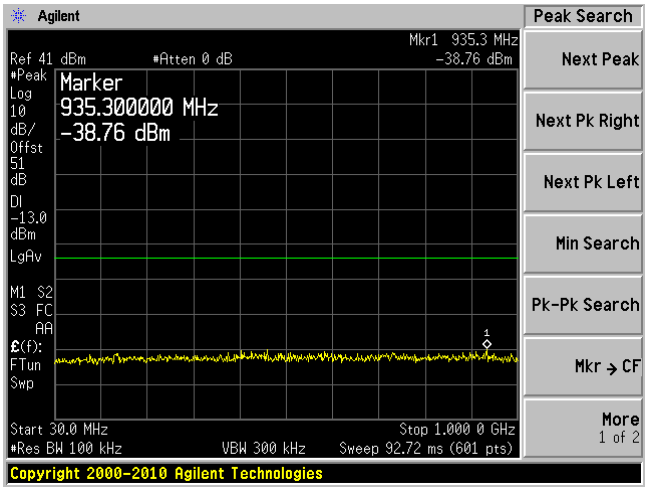



Plot 2: 1 GHz to 25 GHz, Chain J1

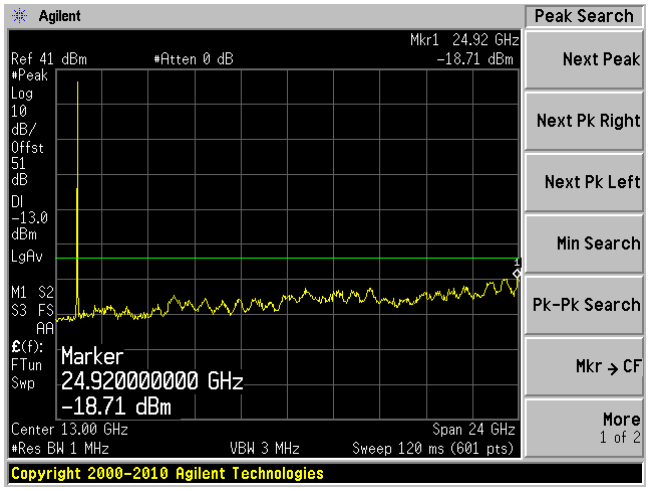


LTE, 64QAM (10 MHz) Downlink: Middle Channel (“2132” MHz)

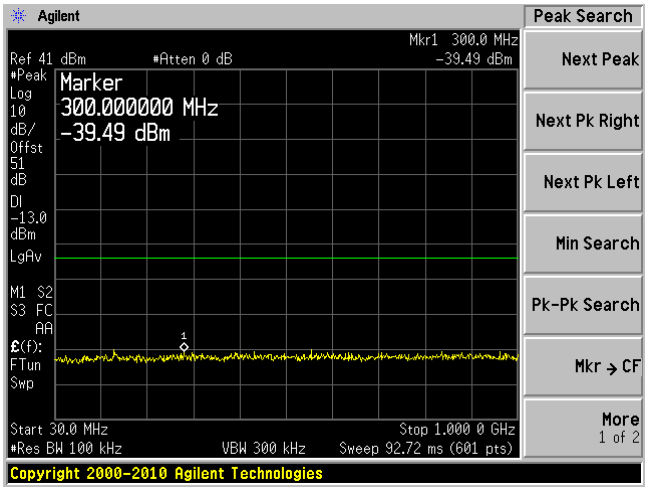
Plot 1: 30 MHz to 1 GHz, Chain J0



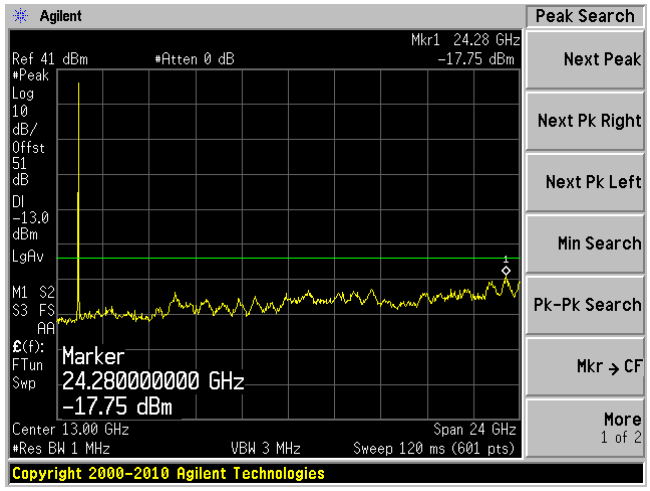

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

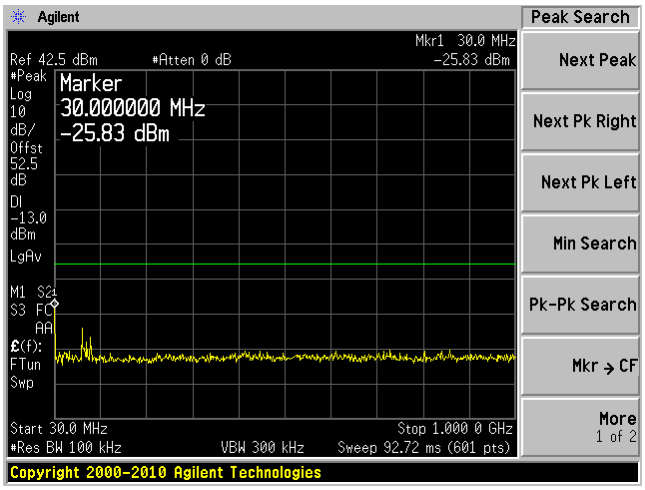



Plot 2: 1 GHz to 25 GHz, Chain J1

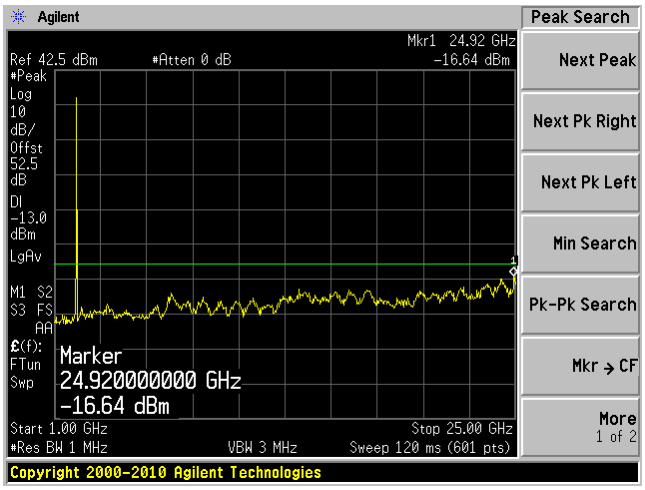


LTE, 64QAM (10 MHz) Downlink: High Channel (“2150” MHz)

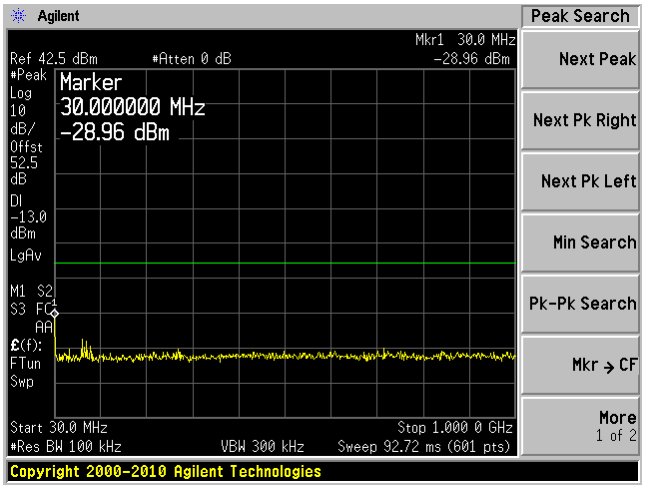
Plot 1: 30 MHz to 1 GHz, Chain J0



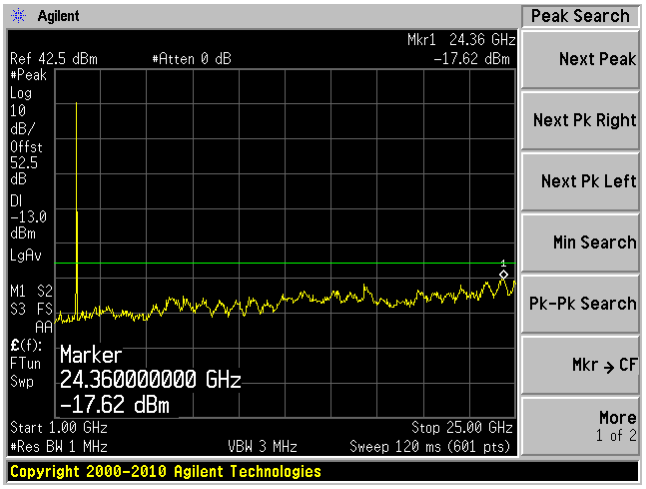

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

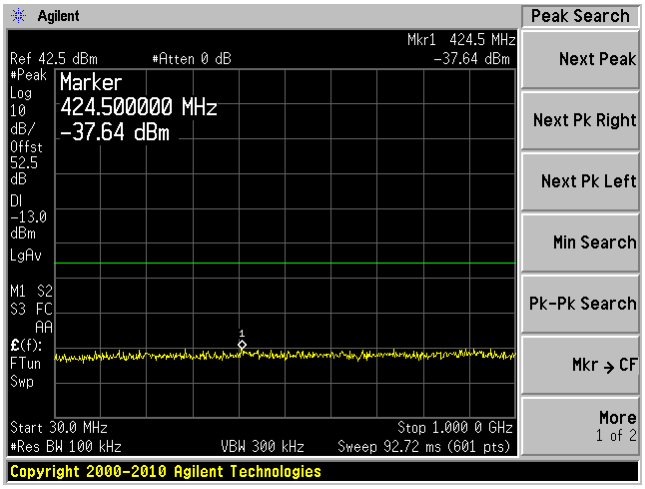



Plot 2: 1 GHz to 25 GHz, Chain J1

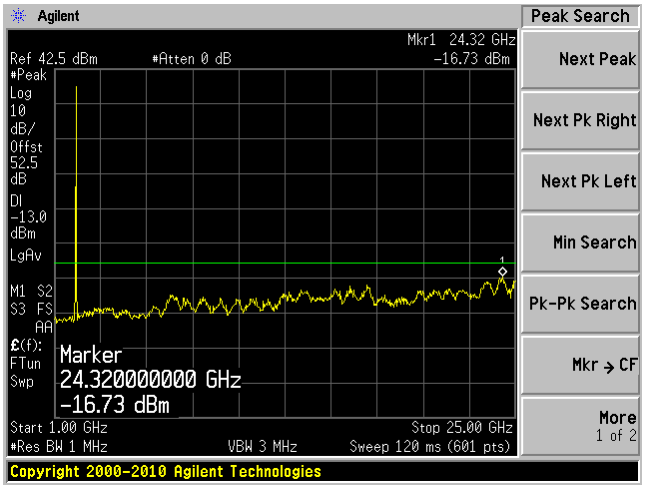


LTE, QPSK (15 MHz) Downlink: Low Channel (“2118” MHz)

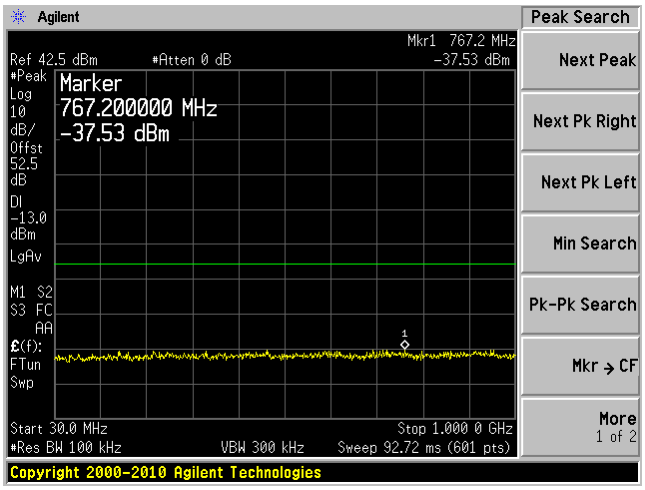
Plot 1: 30 MHz to 1 GHz, Chain J0



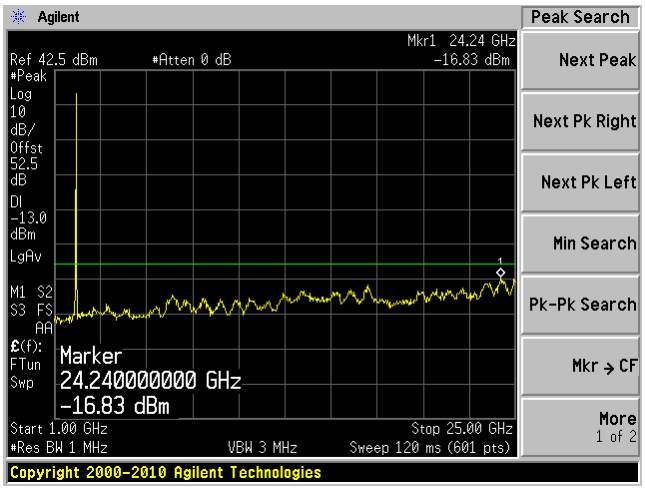

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

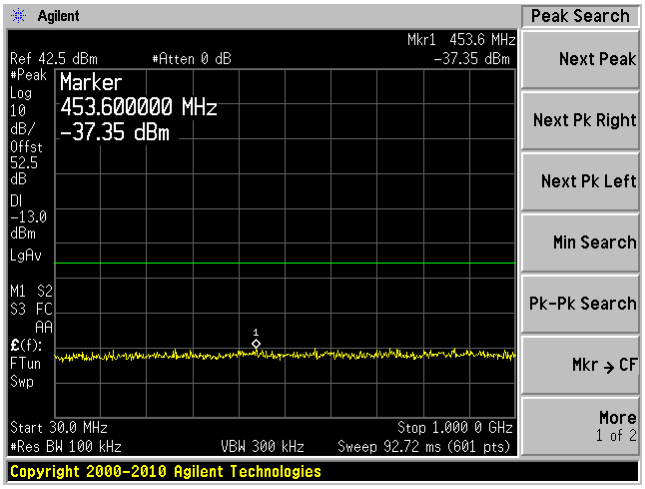



Plot 2: 1 GHz to 25 GHz, Chain J1

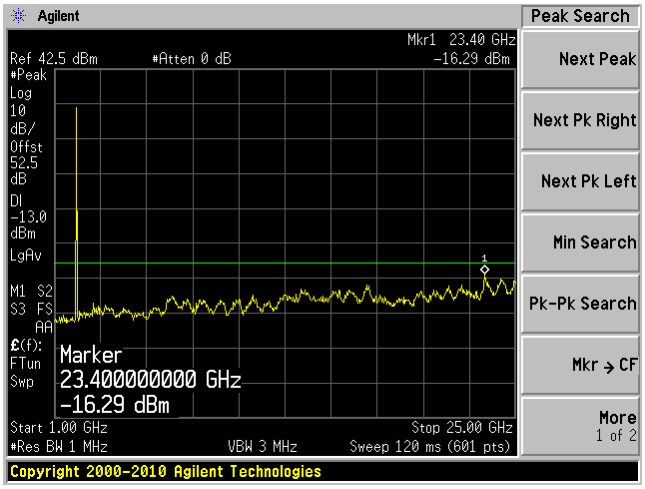


LTE, QPSK (15 MHz) Downlink: High Channel (“2147” MHz)

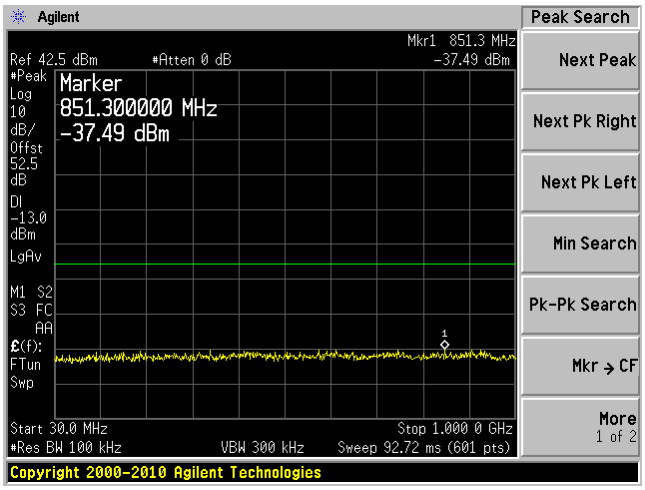
Plot 1: 30 MHz to 1 GHz, Chain J0



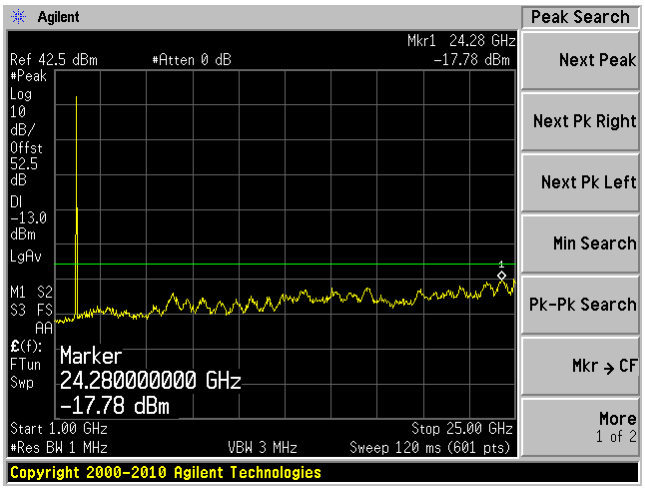

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

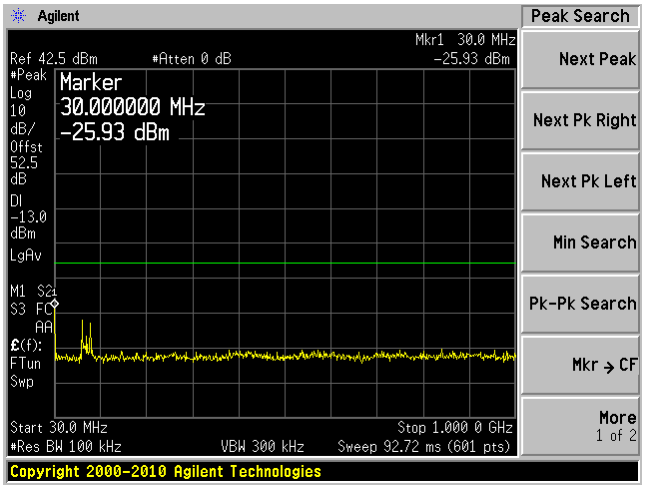



Plot 2: 1 GHz to 25 GHz, Chain J1

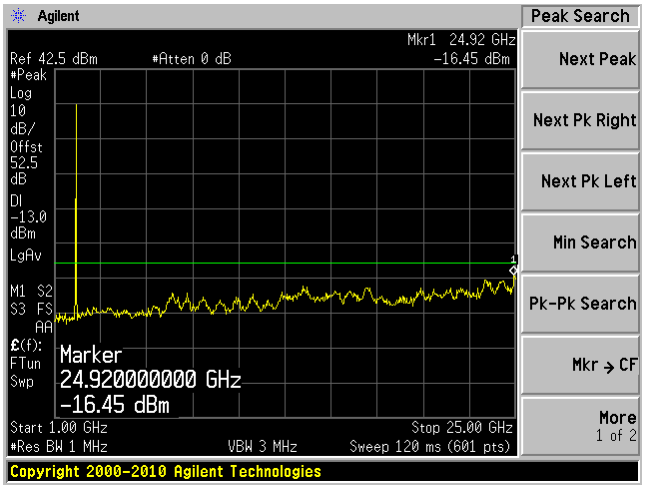


LTE, 16QAM (15 MHz) Downlink: Low Channel (“2118” MHz)

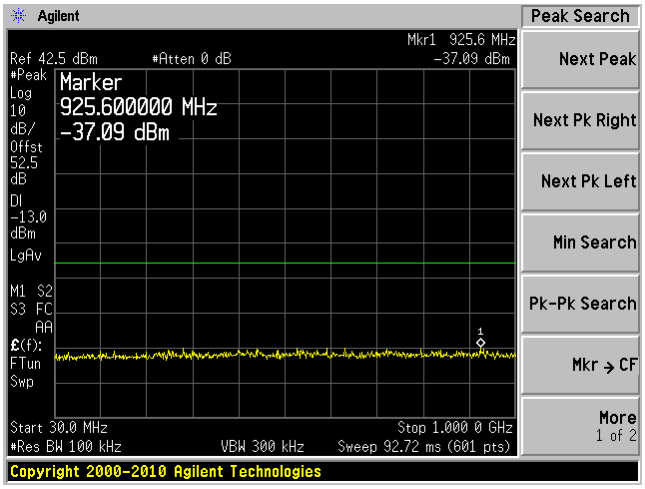
Plot 1: 30 MHz to 1 GHz, Chain J0



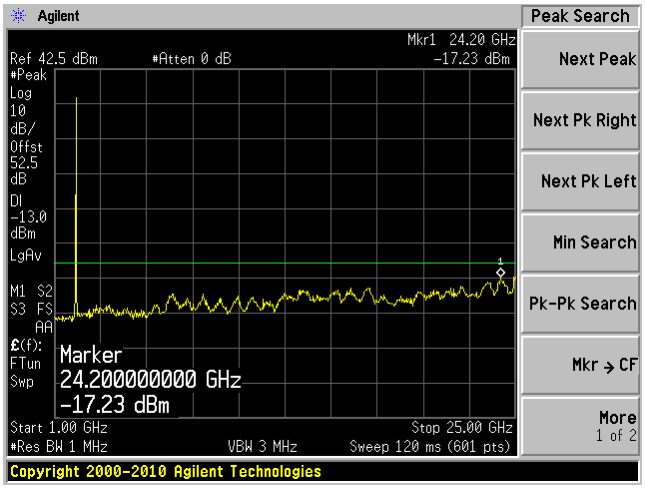

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

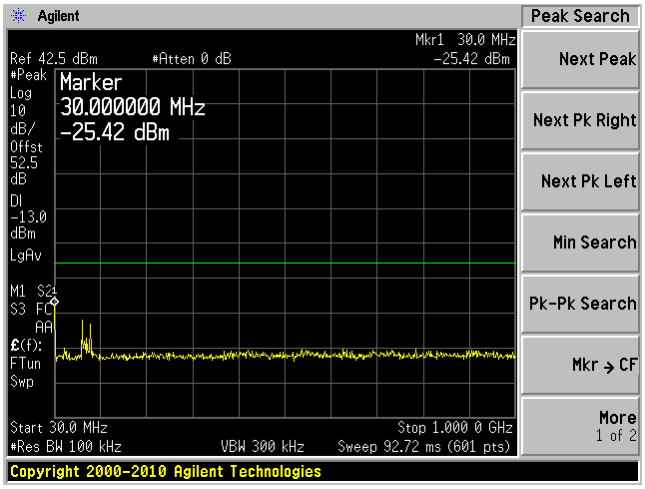



Plot 2: 1 GHz to 25 GHz, Chain J1

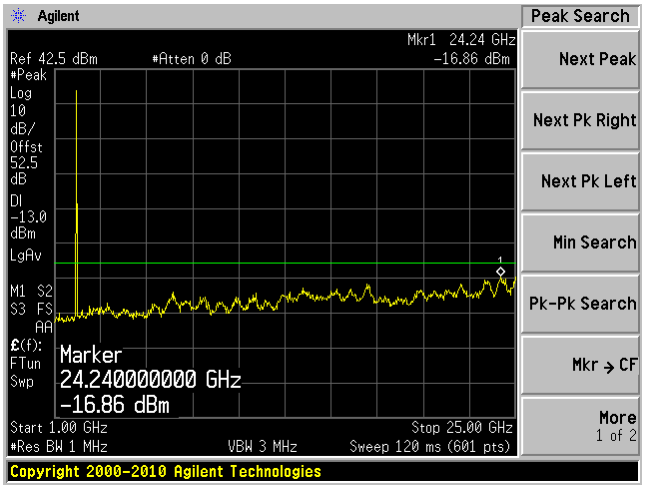


LTE, 16QAM (15 MHz) Downlink: High Channel (“2147” MHz)

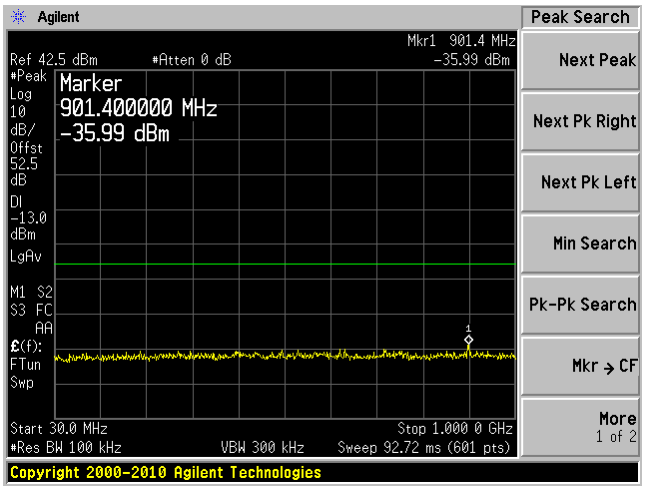
Plot 1: 30 MHz to 1 GHz, Chain J0



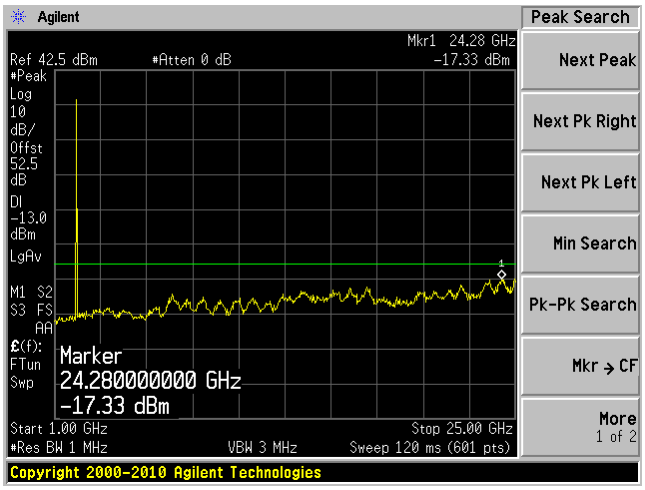

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

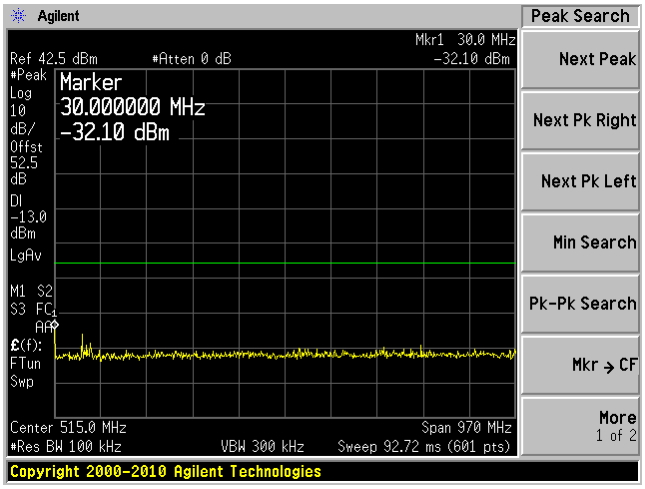



Plot 2: 1 GHz to 25 GHz, Chain J1

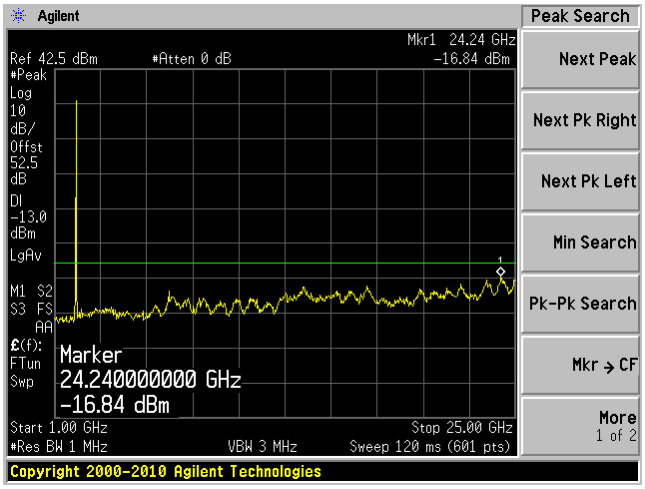


LTE, 64QAM (15 MHz) Downlink: Low Channel (“2118” MHz)

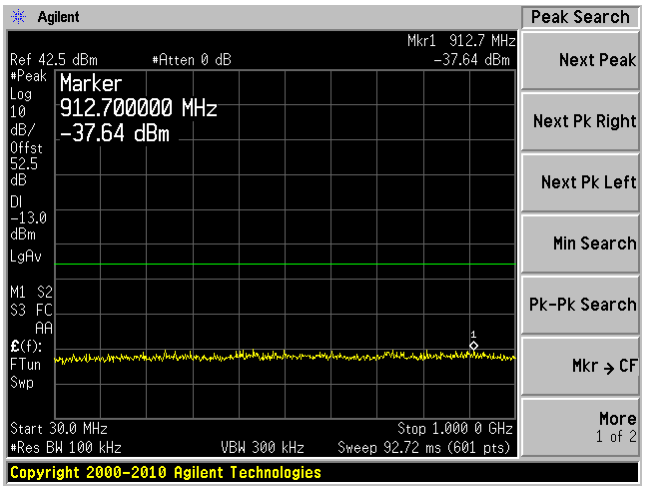
Plot 1: 30 MHz to 1 GHz, Chain J0



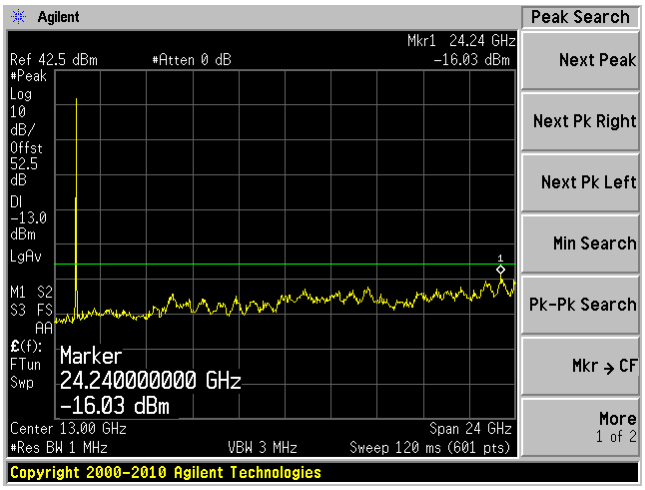

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

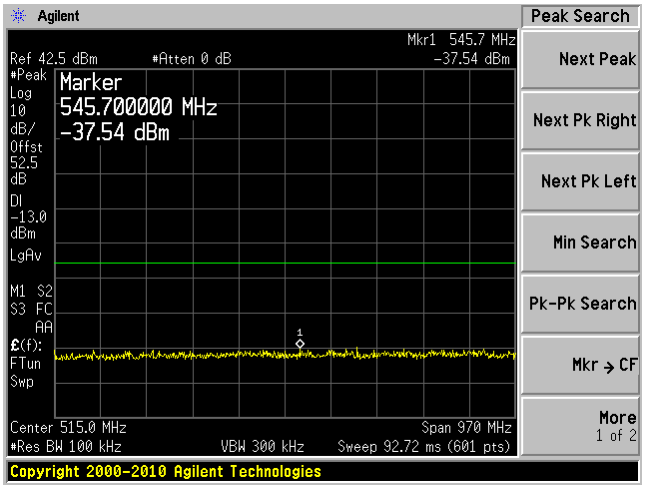



Plot 2: 1 GHz to 25 GHz, Chain J1

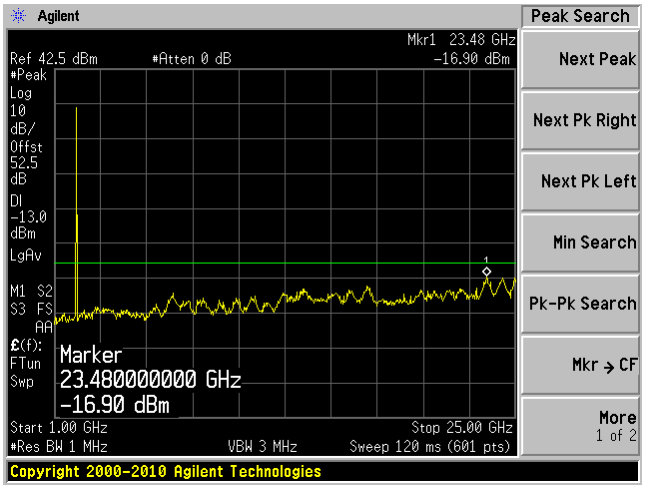


LTE, 64QAM (15 MHz) Downlink: High Channel (“2147” MHz)

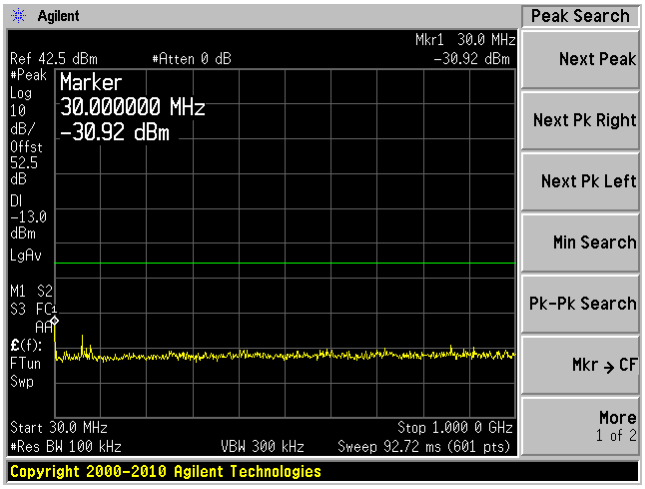
Plot 1: 30 MHz to 1 GHz, Chain J0



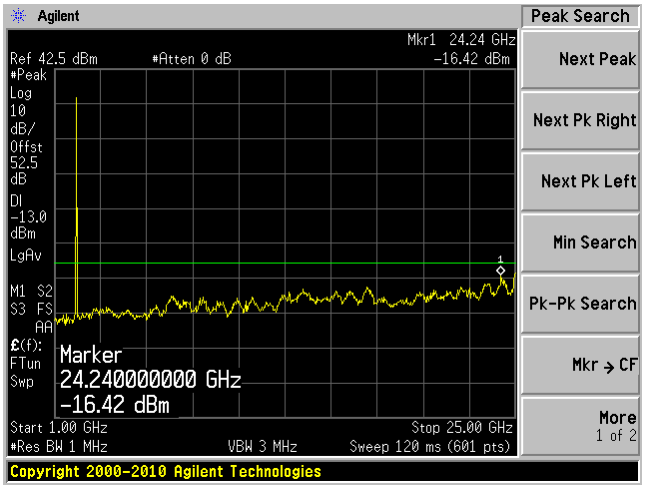

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

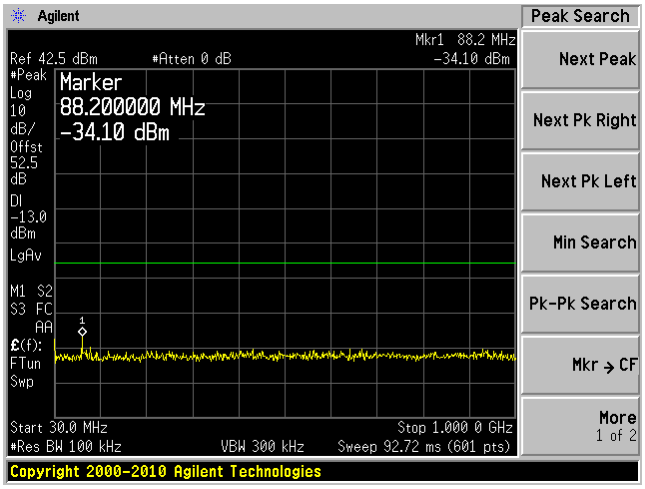



Plot 2: 1 GHz to 25 GHz, Chain J1

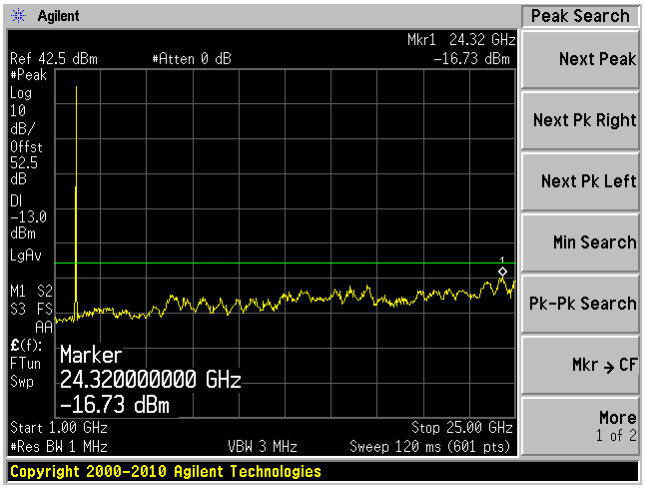


LTE, QPSK (20 MHz) Downlink: Low Channel (“2120” MHz)

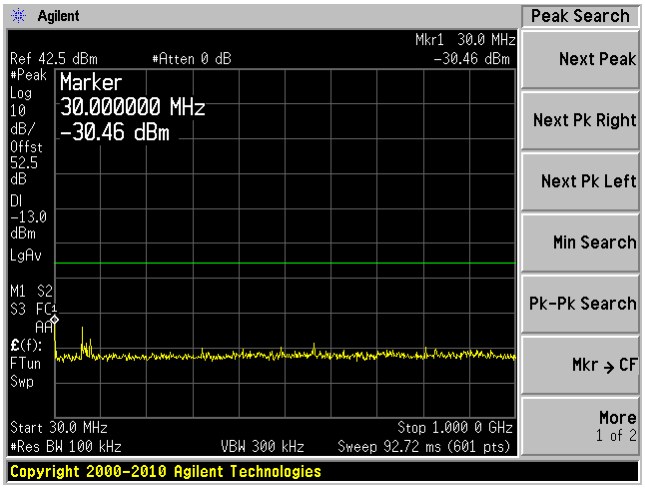
Plot 1: 30 MHz to 1 GHz, Chain J0



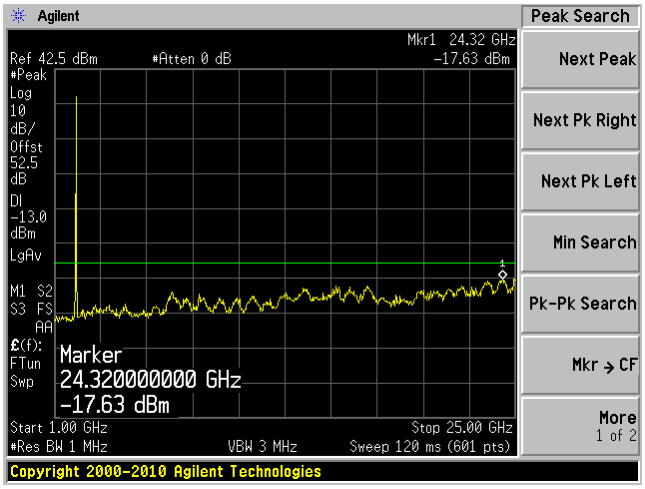

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

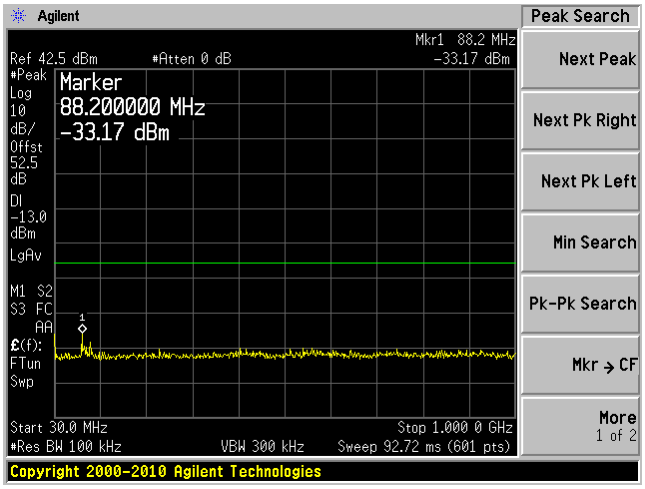



Plot 2: 1 GHz to 25 GHz, Chain J1

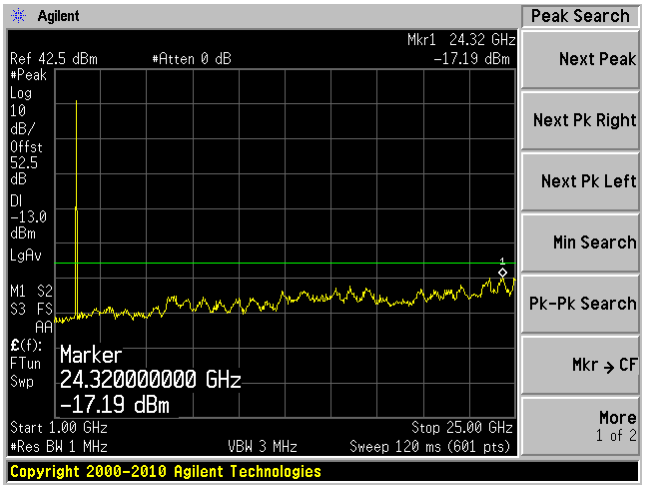


LTE, QPSK (20 MHz) Downlink: High Channel (“2145” MHz)

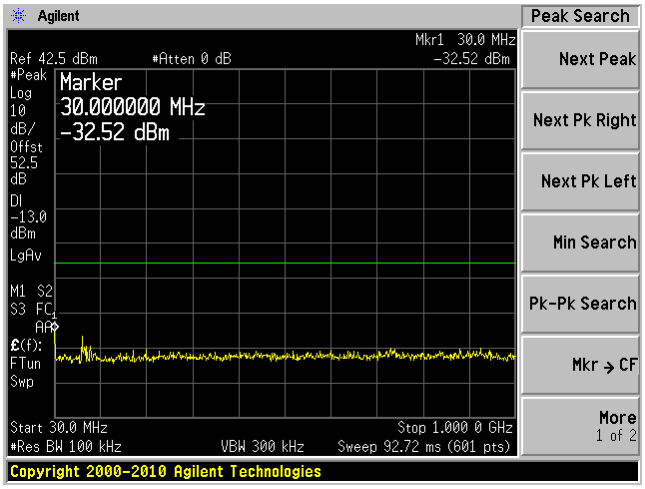
Plot 1: 30 MHz to 1 GHz, Chain J0



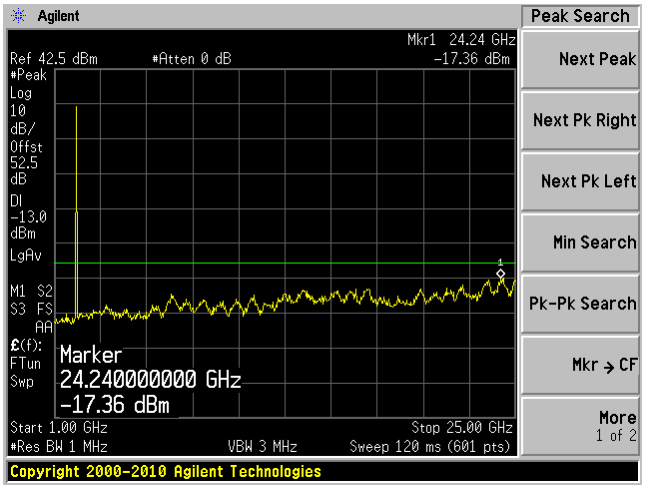

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

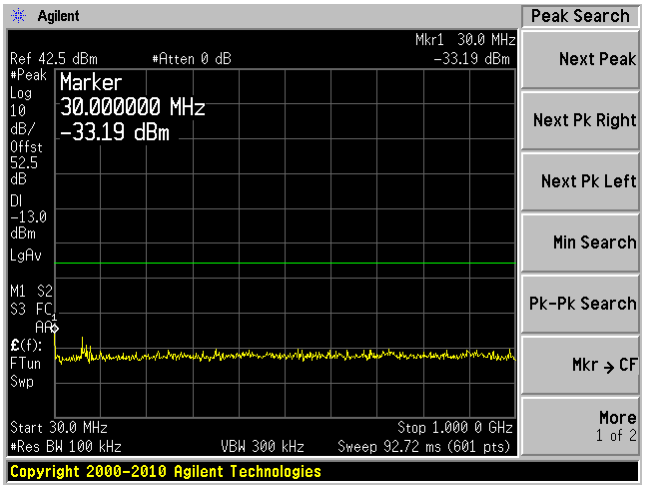



Plot 2: 1 GHz to 25 GHz, Chain J1

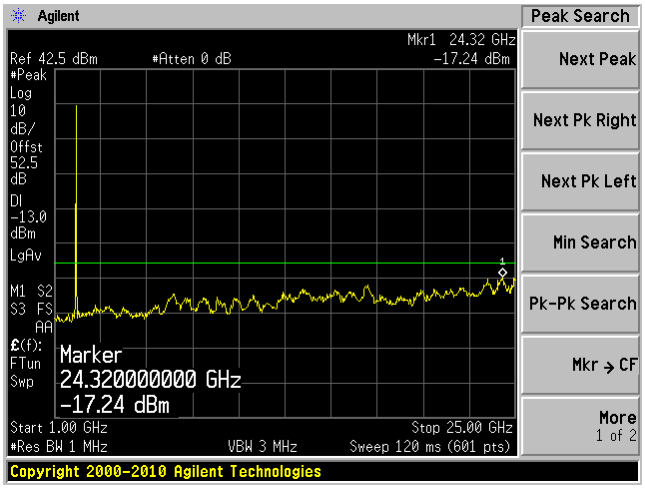


LTE, 16QAM (20 MHz) Downlink: Low Channel (“2120” MHz)

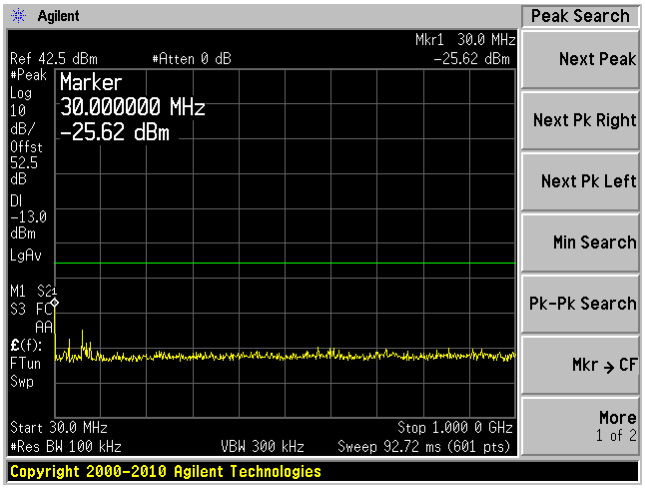
Plot 1: 30 MHz to 1 GHz, Chain J0



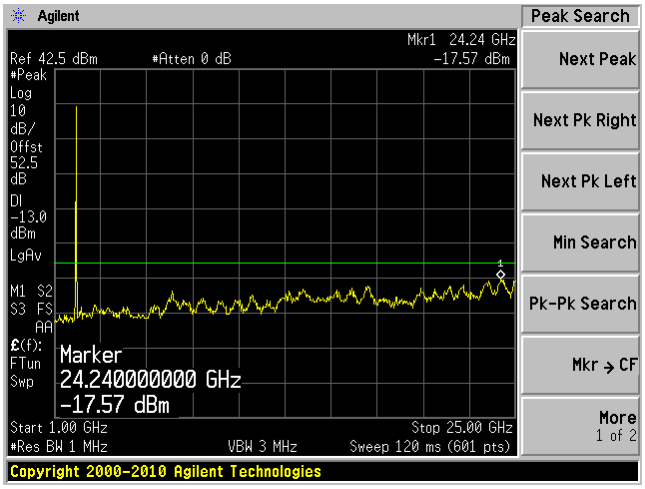

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

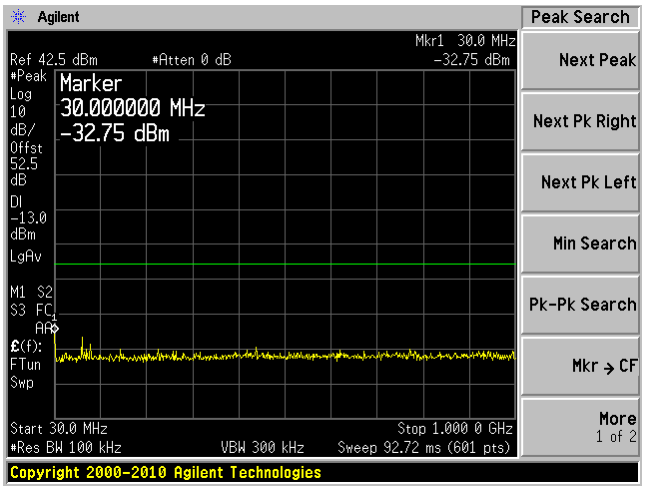



Plot 2: 1 GHz to 25 GHz, Chain J1

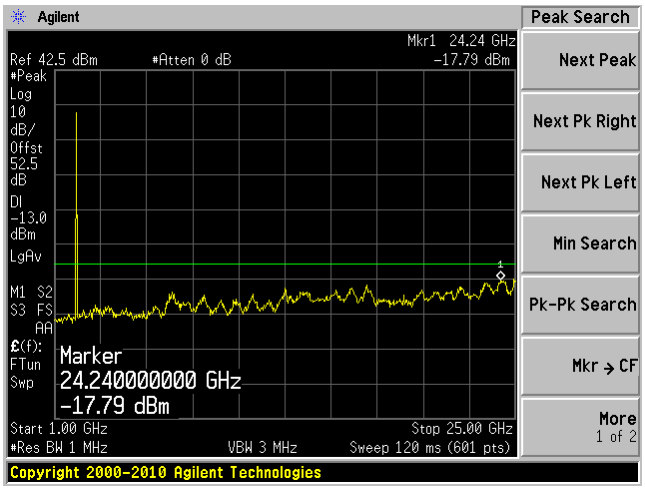


LTE, 16QAM (20 MHz) Downlink: High Channel (“2145” MHz)

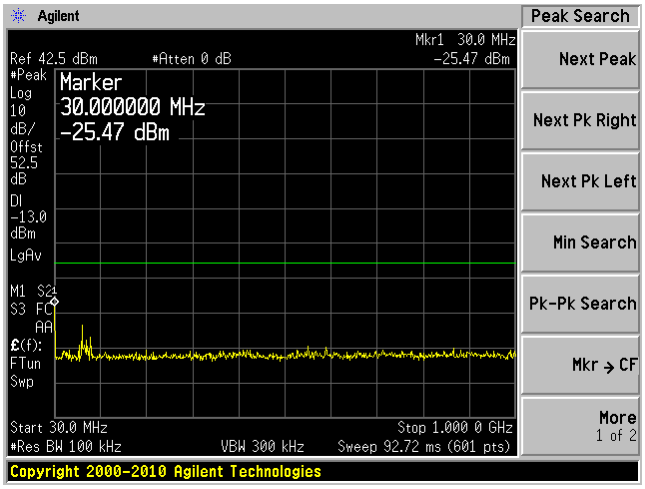
Plot 1: 30 MHz to 1 GHz, Chain J0



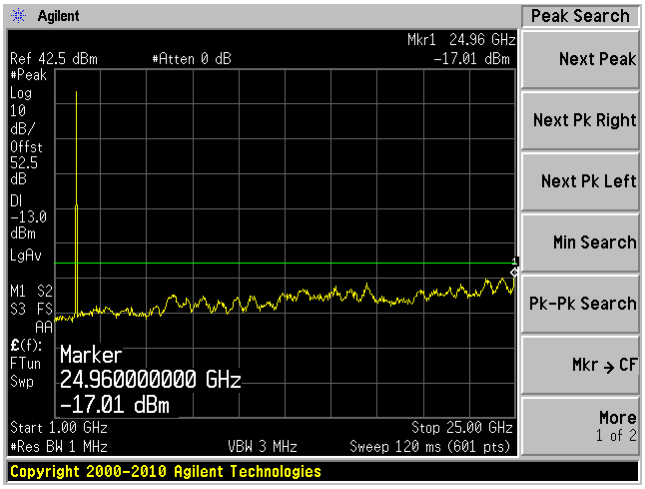

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

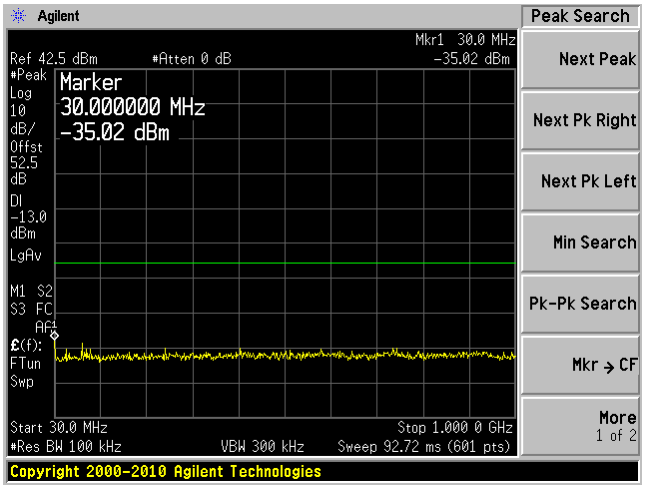



Plot 2: 1 GHz to 25 GHz, Chain J1

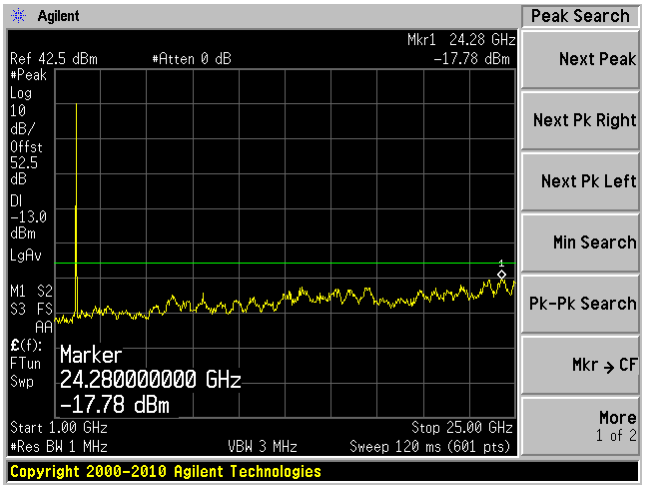


LTE, 64QAM (20 MHz) Downlink: Low Channel (“2120” MHz)

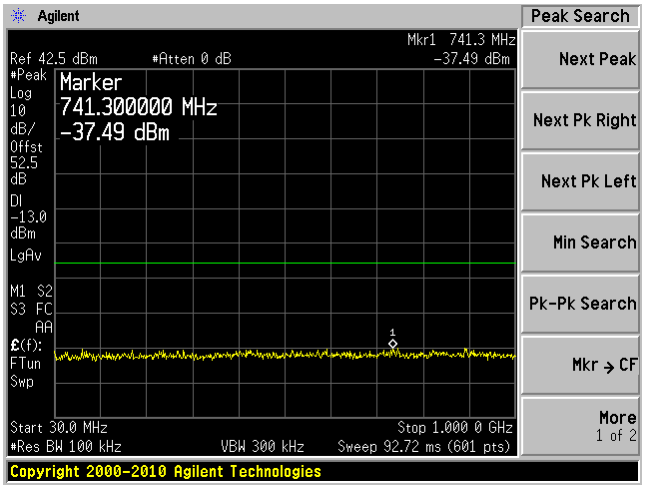
Plot 1: 30 MHz to 1 GHz, Chain J0



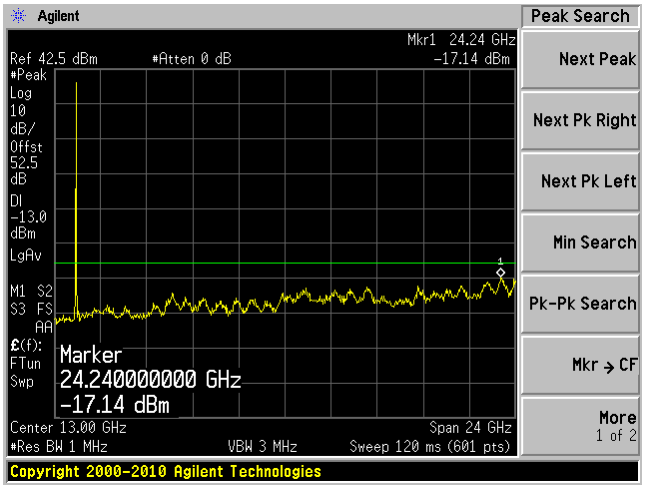

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1

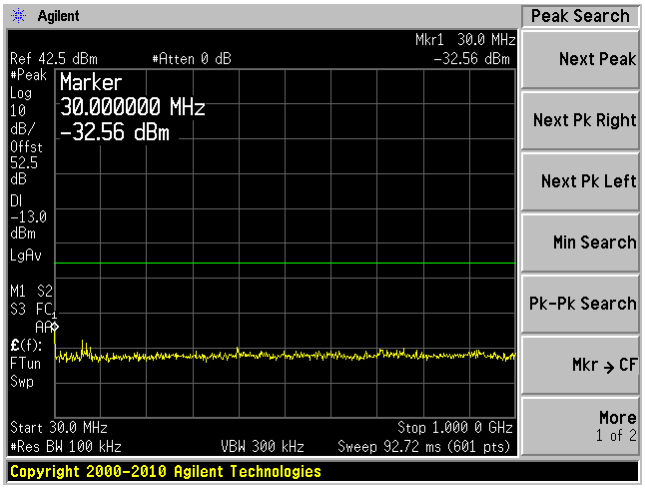



Plot 2: 1 GHz to 25 GHz, Chain J1

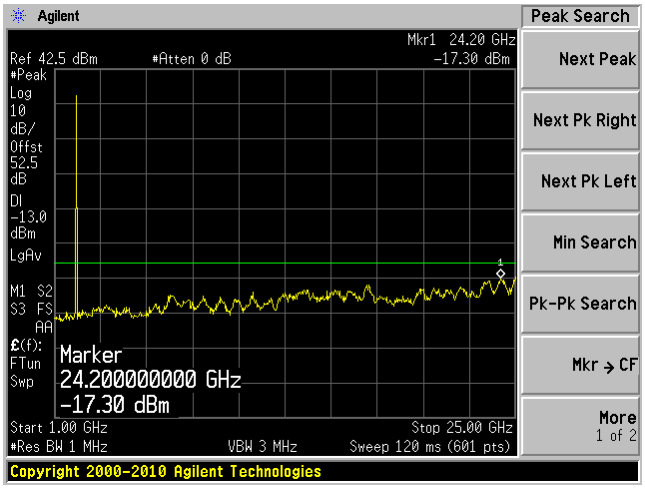


LTE, 64QAM (20 MHz) Downlink: High Channel (“2145” MHz)

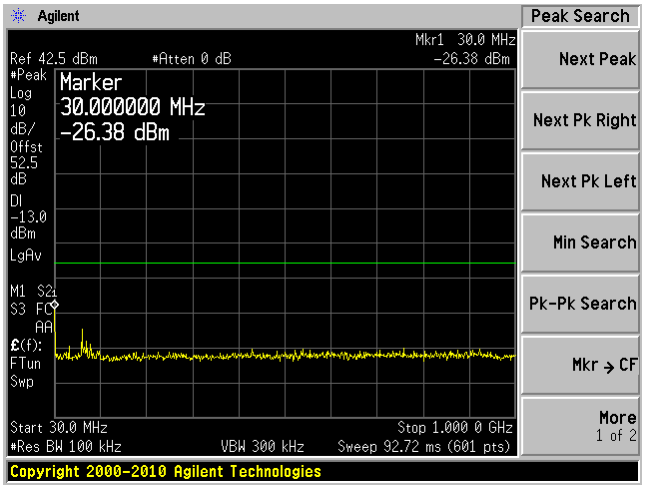
Plot 1: 30 MHz to 1 GHz, Chain J0



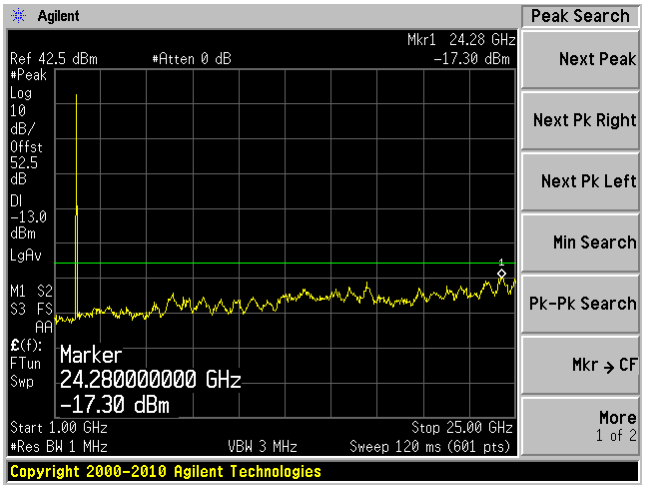

Plot 2: 1 GHz to 25 GHz, Chain J0




Plot 1: 30 MHz to 1 GHz, Chain J1



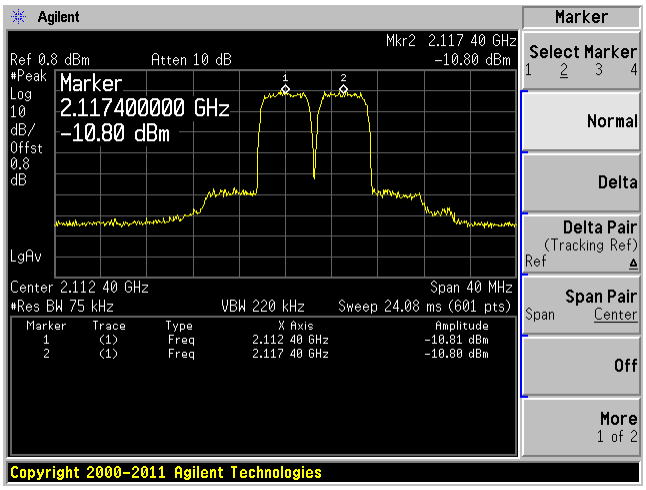

Plot 2: 1 GHz to 25 GHz, Chain J1



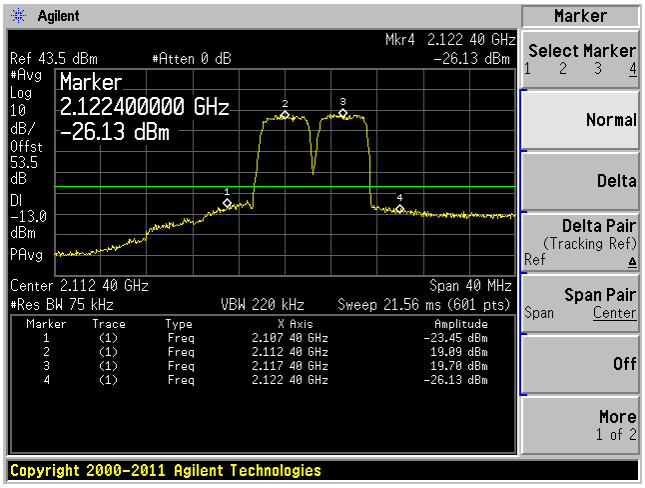
## (B) Intermodulation

WCDMA/HSPA, Low Channel “2112.4” MHz

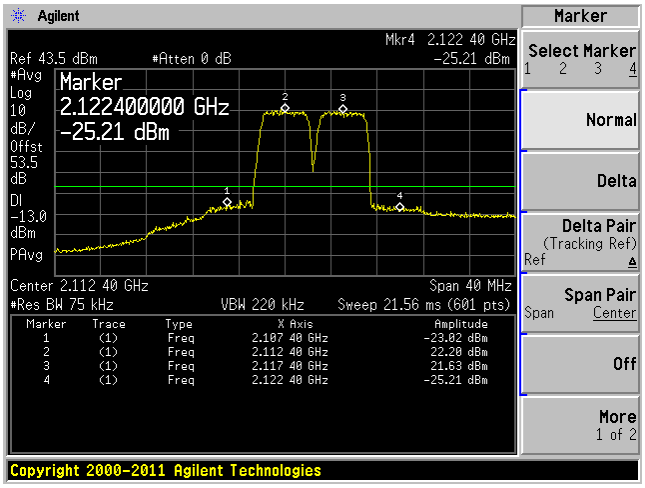
Input




Output, Chain J0

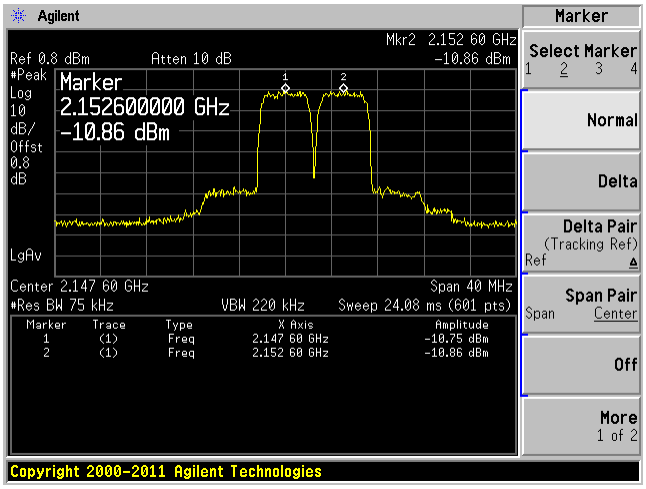



Output, Chain J1

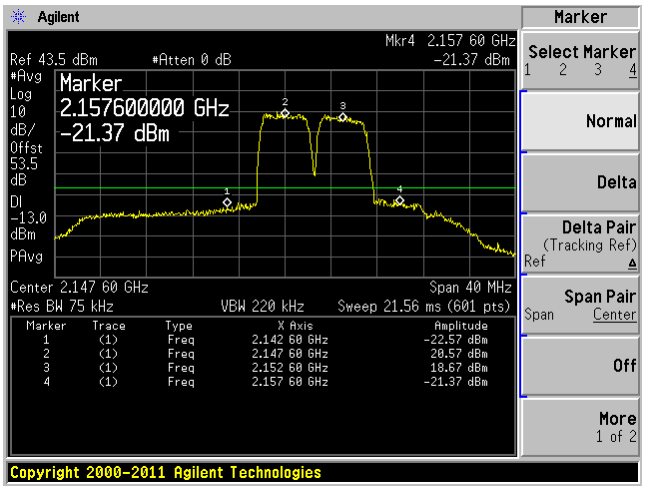


WCDMA/HSPA, High Channel “2152.6” MHz

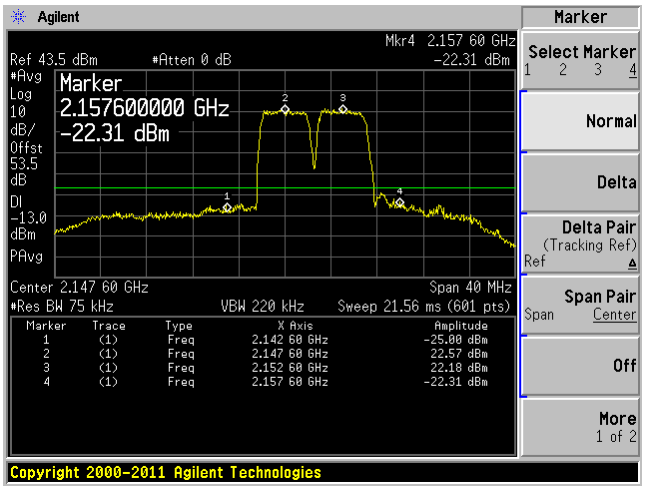
Input




Output, Chain J0

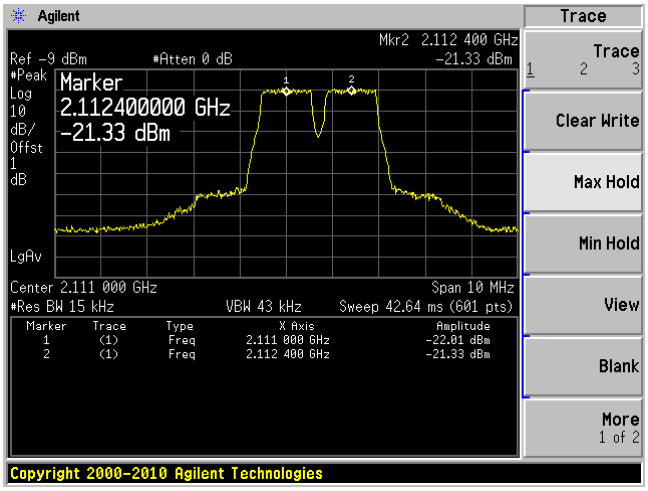



Output, Chain J1

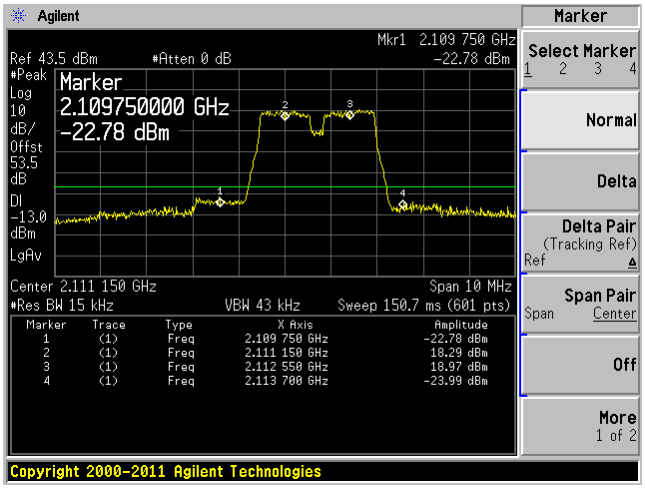


LTE, QPSK (1.4 MHz), Low Channel “2111” MHz

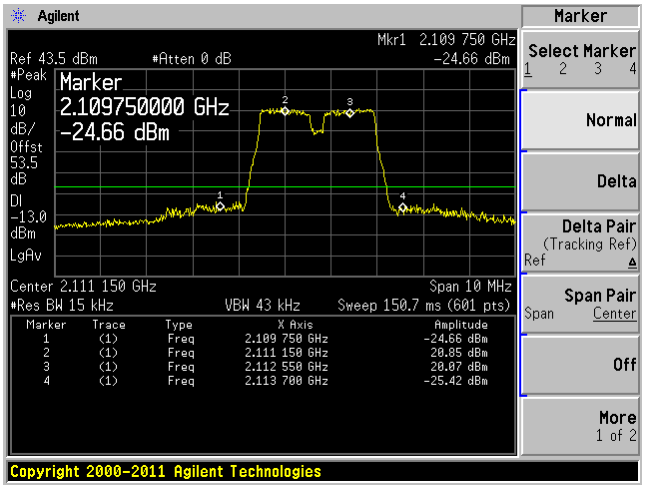
Input




Output, Chain J0

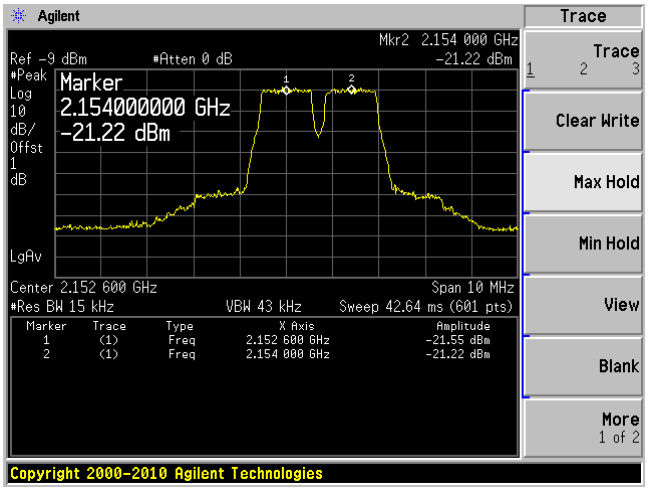



Output, Chain J1

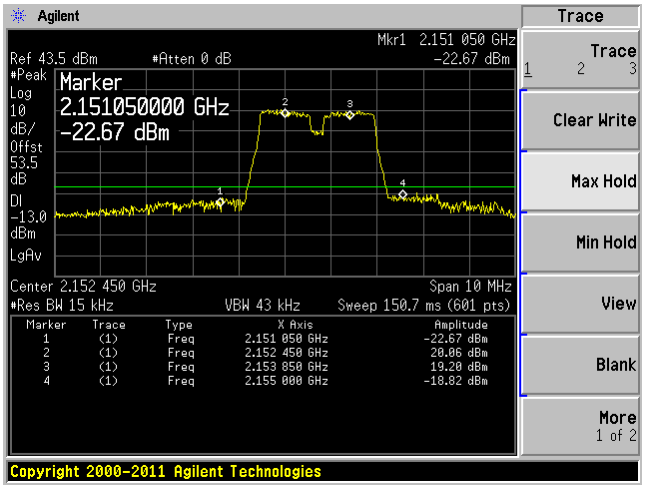


LTE, QPSK (1.4 MHz), High Channel “2154” MHz

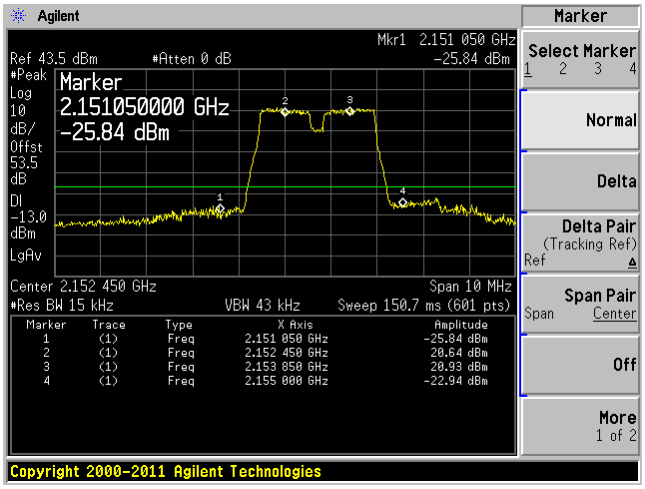
Input




Output, Chain J0

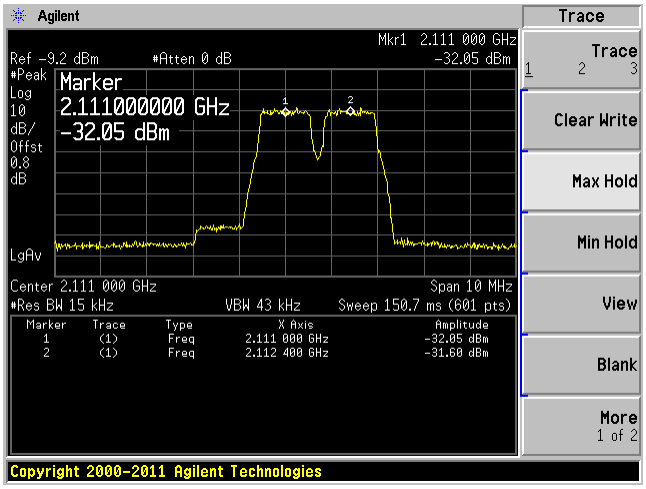



Output, Chain J1

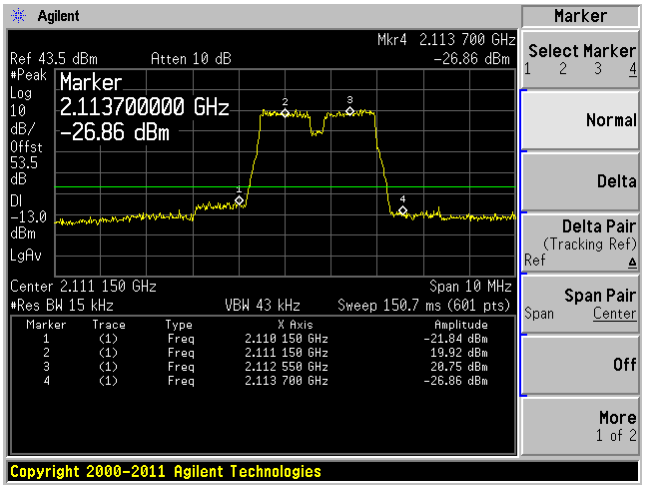


LTE, 16QAM (1.4 MHz), Low Channel “2111” MHz

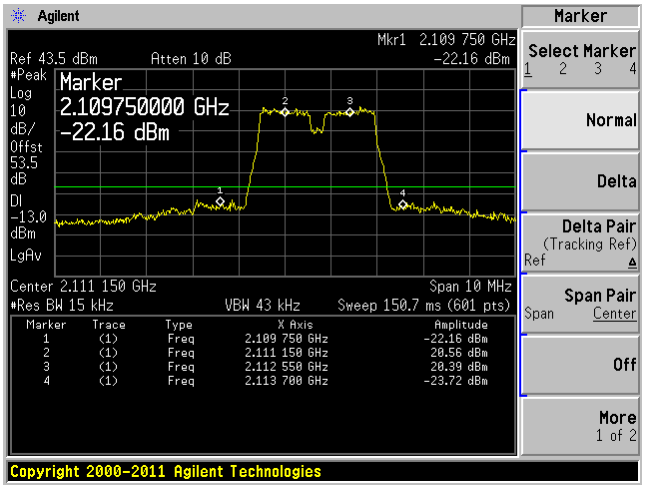
Input




Output, Chain J0

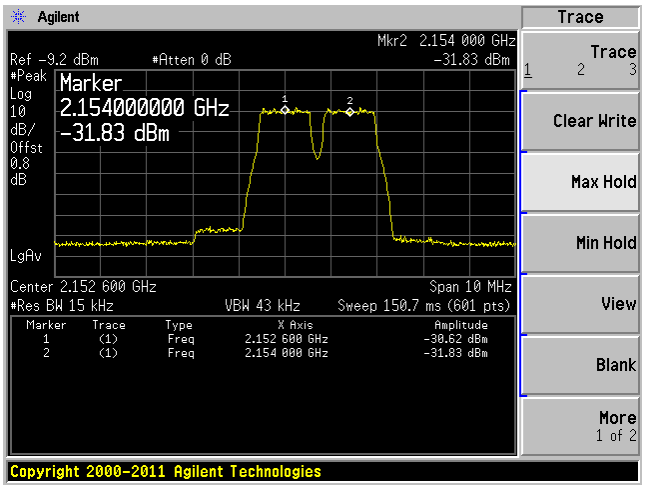



Output, Chain J1

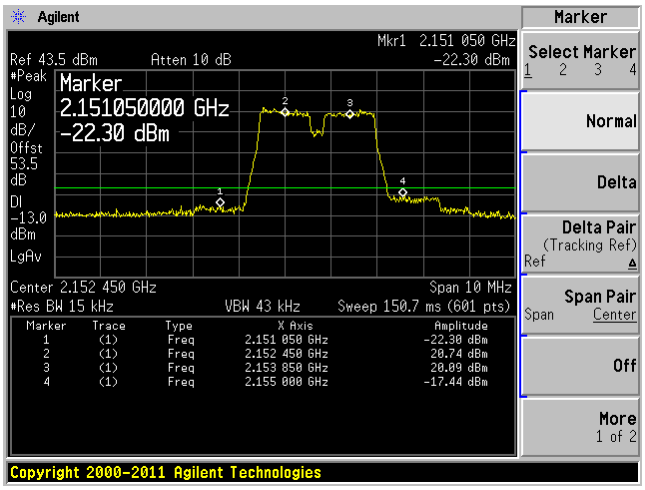


LTE, 16QAM (1.4 MHz), High Channel “2154” MHz

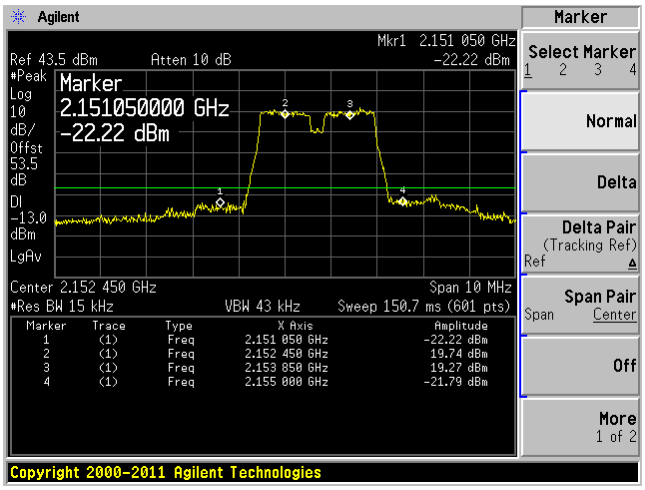
Input




Output, Chain J0

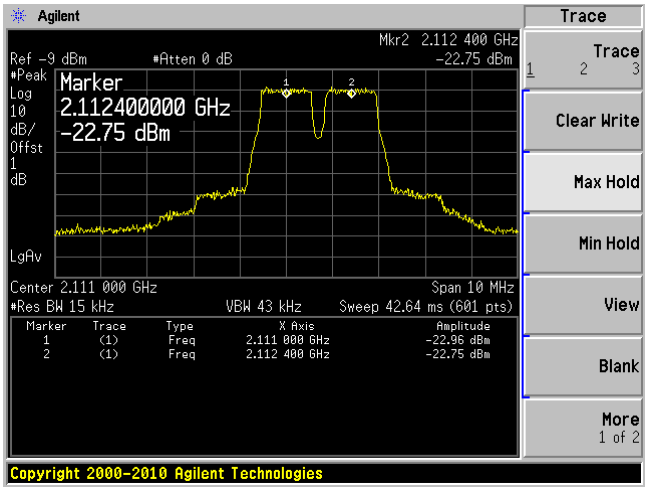



Output, Chain J1

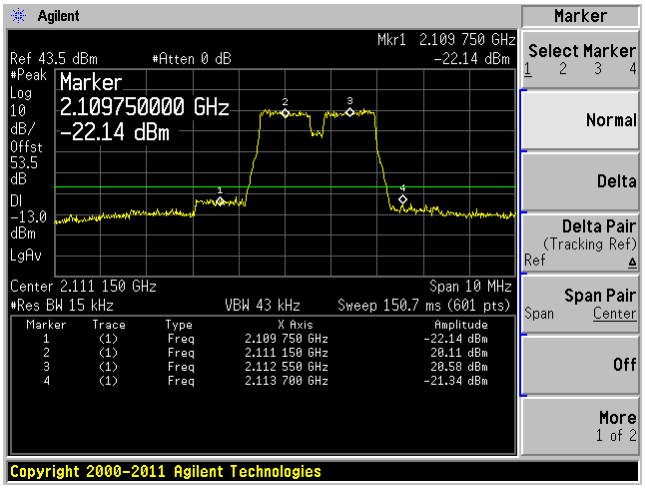


LTE, 64QAM (1.4 MHz), Low Channel “2111” MHz

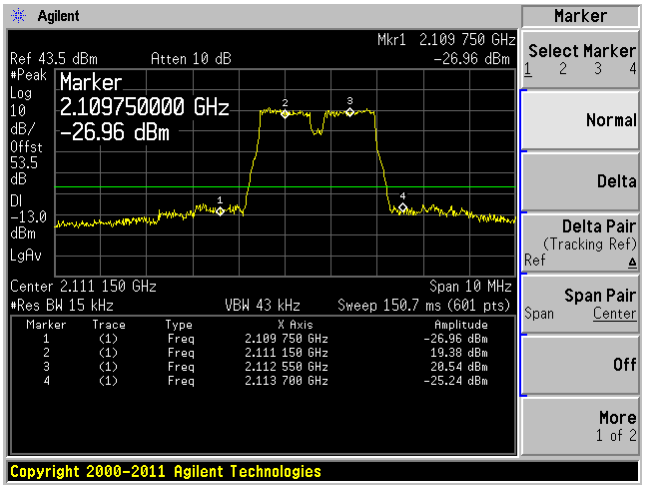
Input




Output, Chain J0

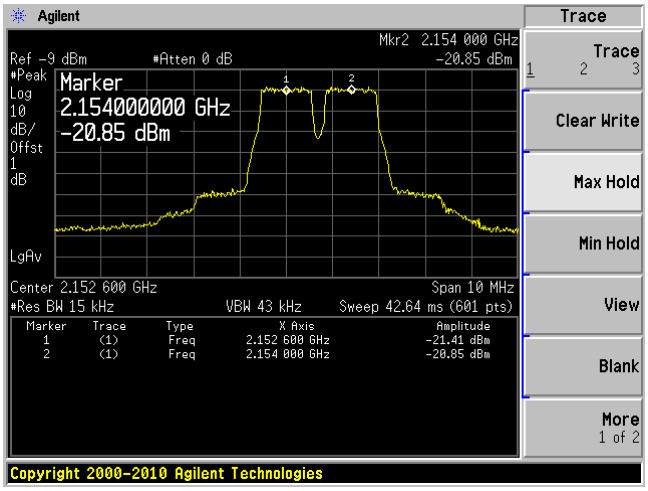



Output, Chain J1

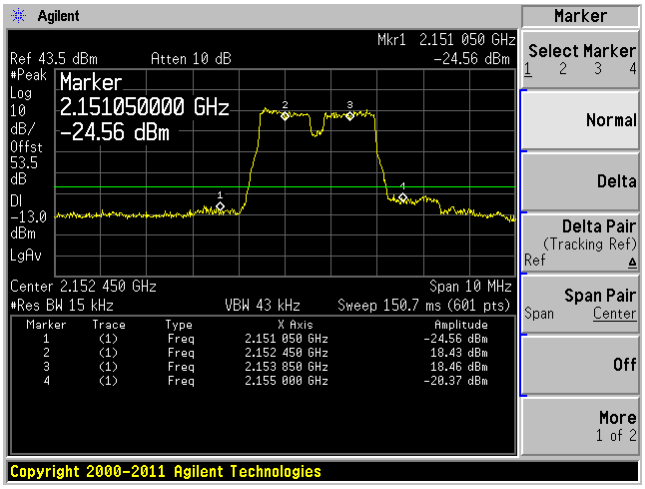


LTE, 64QAM (1.4 MHz), High Channel “2154” MHz

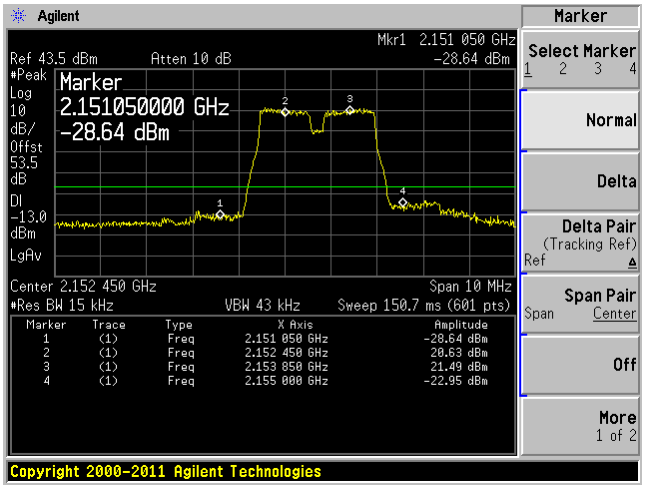
Input




Output, Chain J0

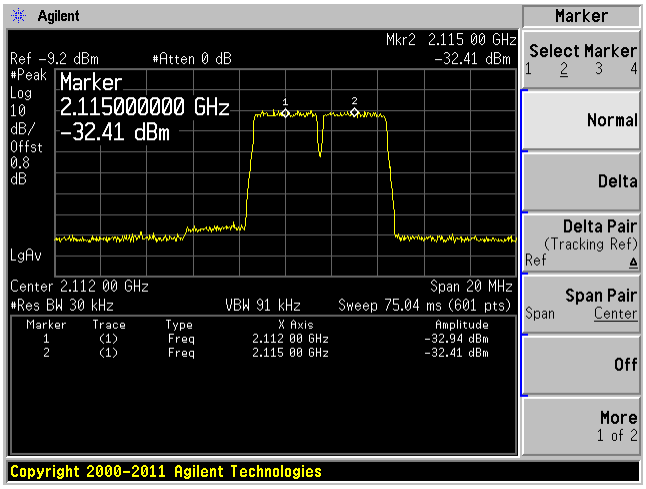



Output, Chain J1

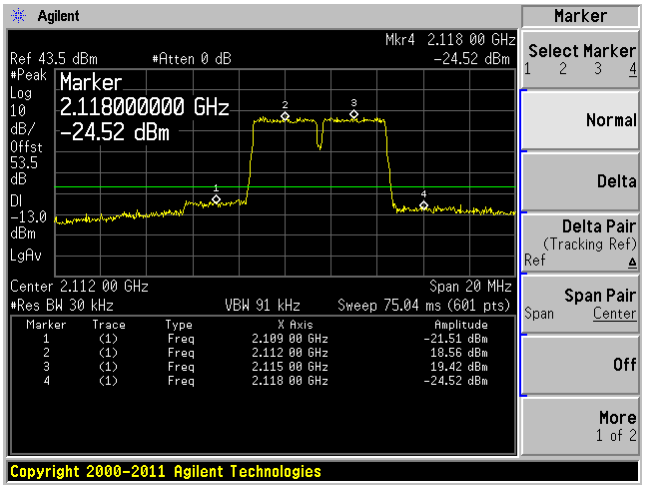


LTE, QPSK (3 MHz), Low Channel “2112” MHz

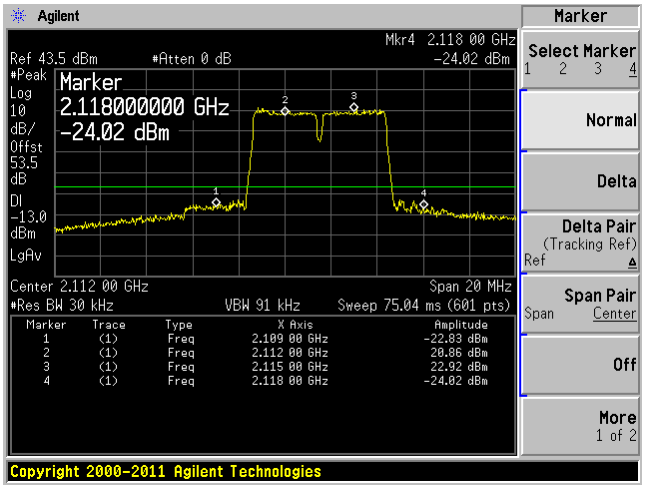
Input




Output, Chain J0

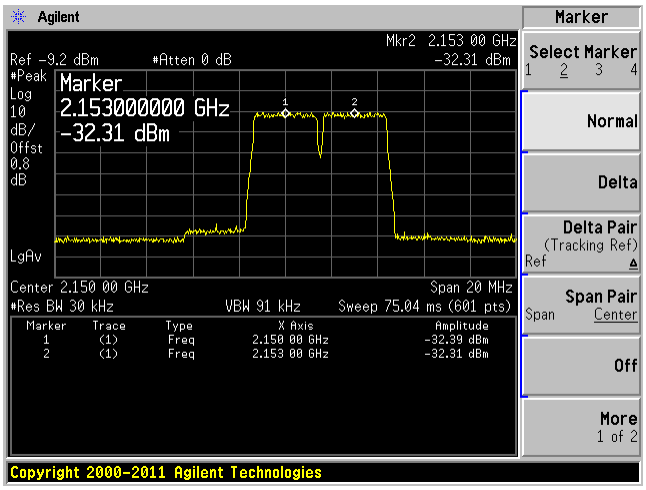



Output, Chain J1

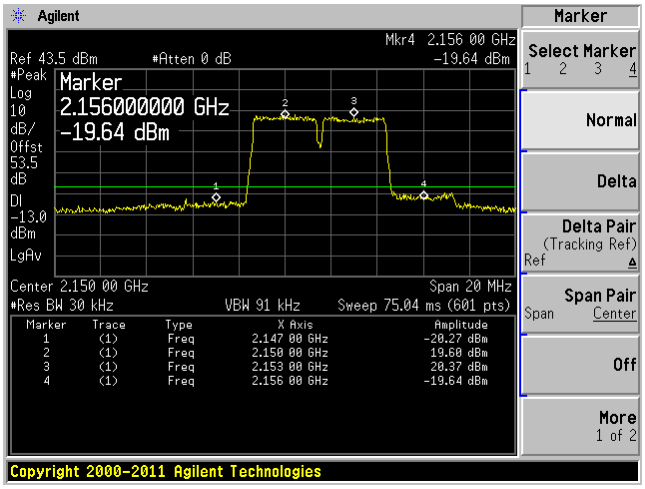


LTE, QPSK (3 MHz), High Channel “2153” MHz

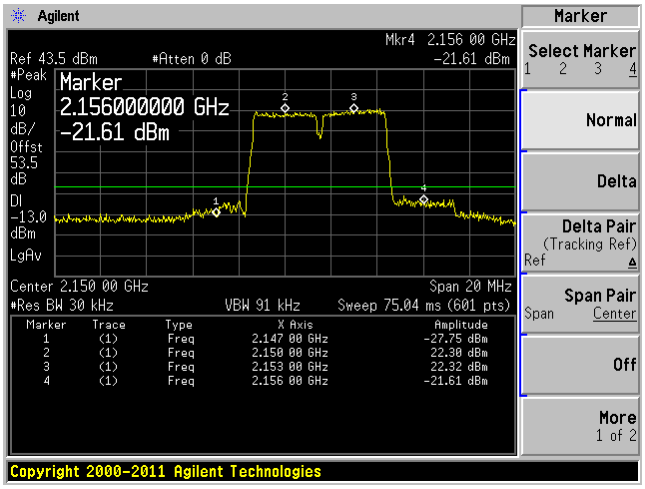
Input




Output, Chain J0

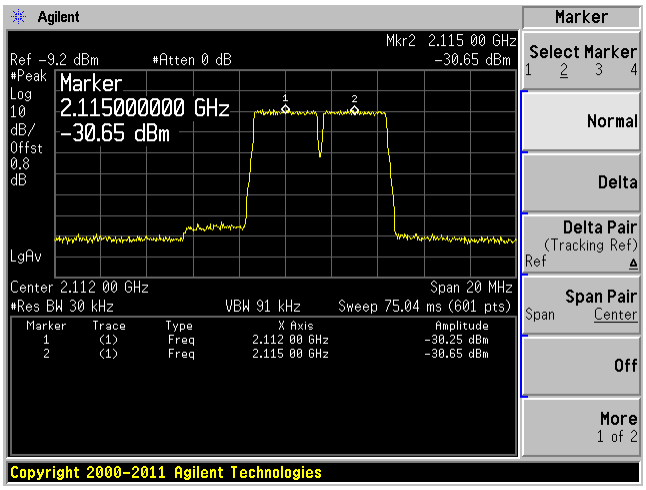



Output, Chain J1

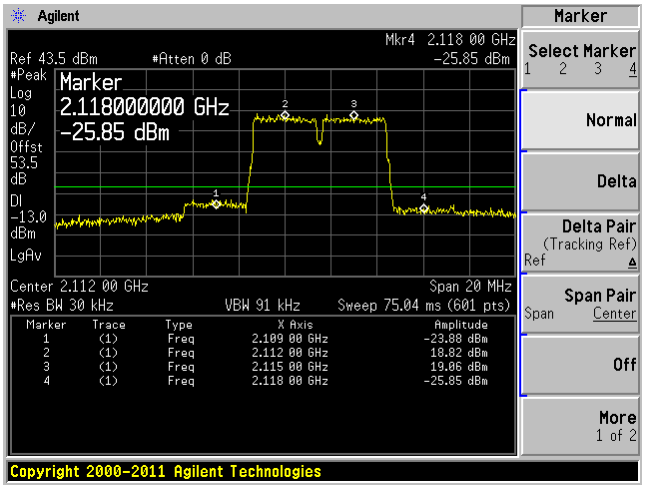


LTE, 16QAM (3 MHz), Low Channel “2112” MHz

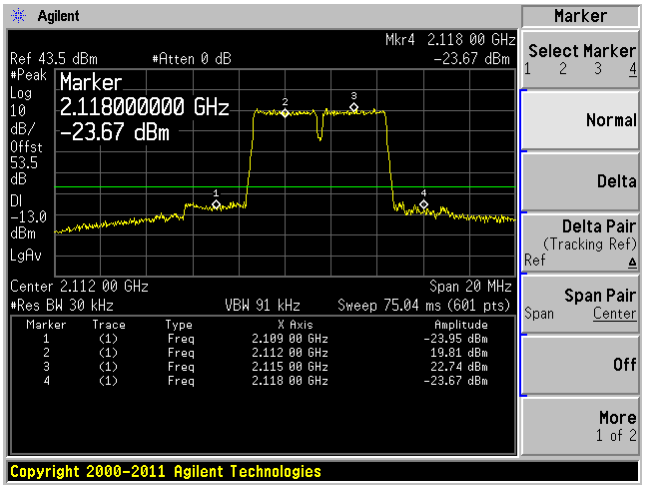
Input




Output, Chain J0

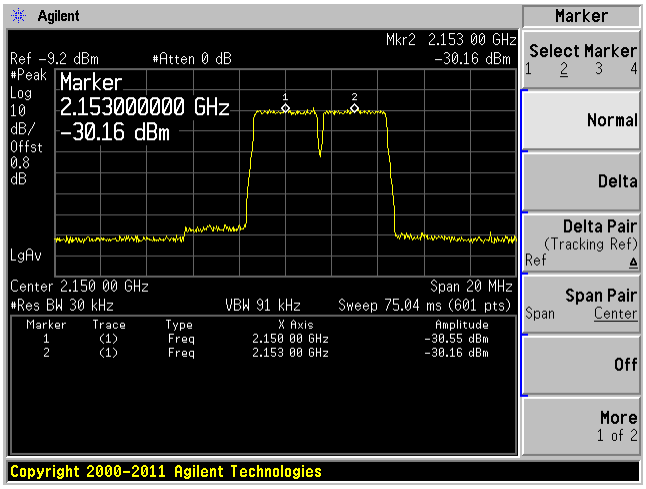



Output, Chain J1

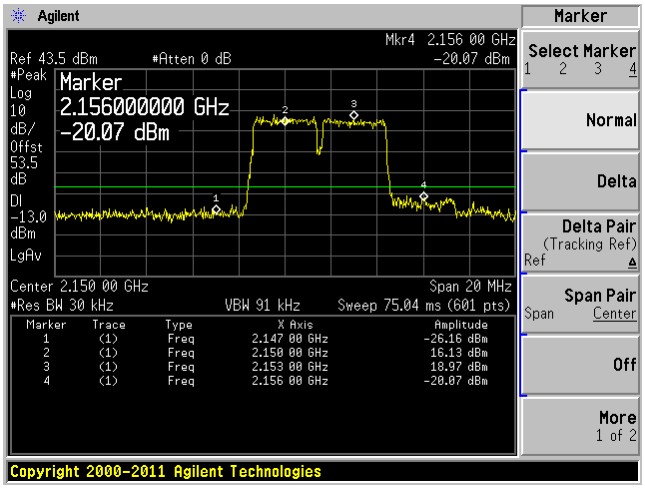


LTE, 16QAM (3 MHz), High Channel “2153” MHz

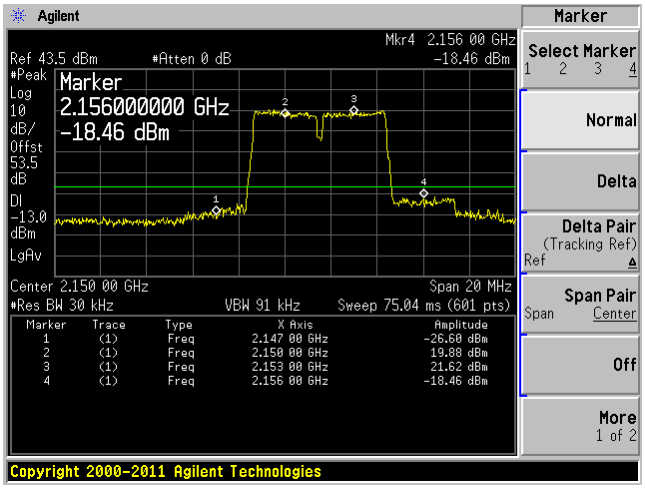
Input




Output, Chain J0

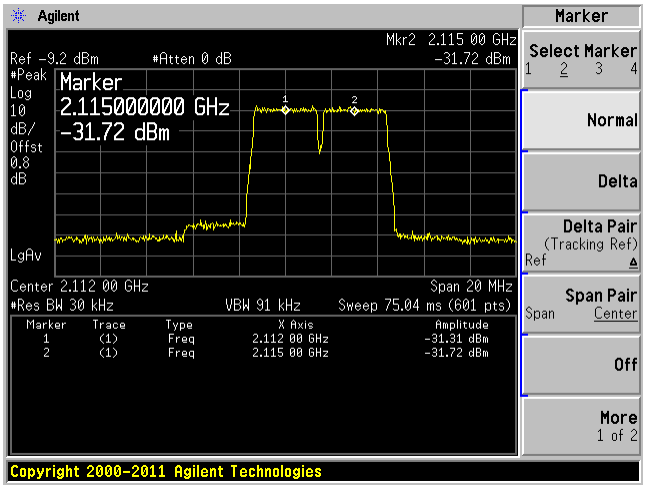



Output, Chain J1

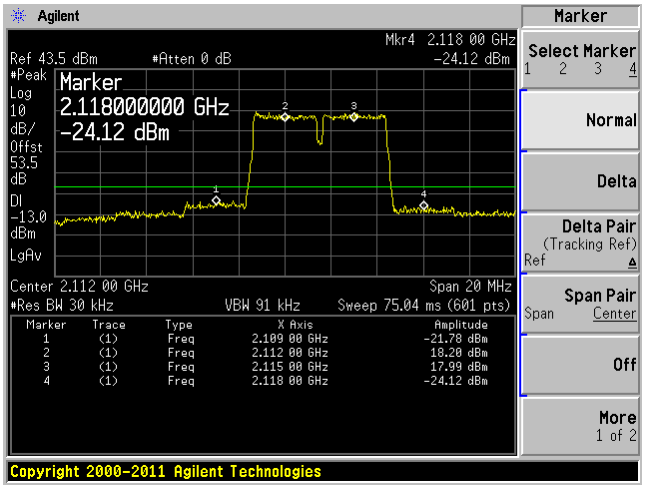


LTE, 64QAM (3 MHz), Low Channel “2112” MHz

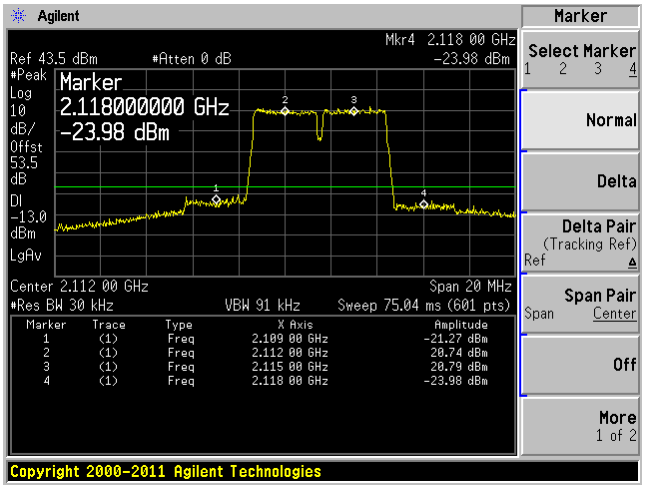
Input




Output, Chain J0

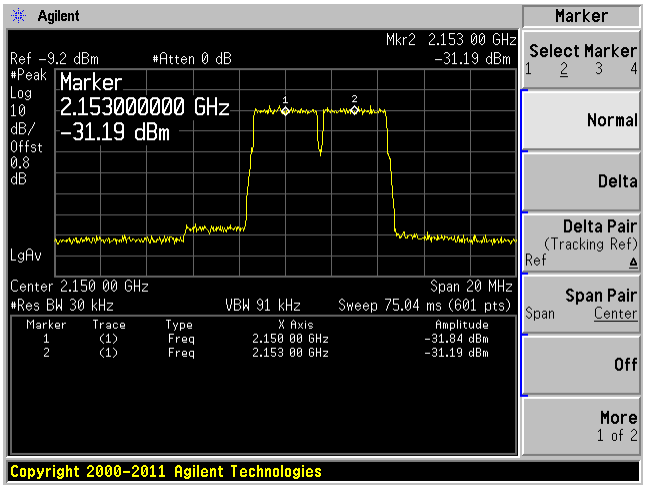



Output, Chain J1

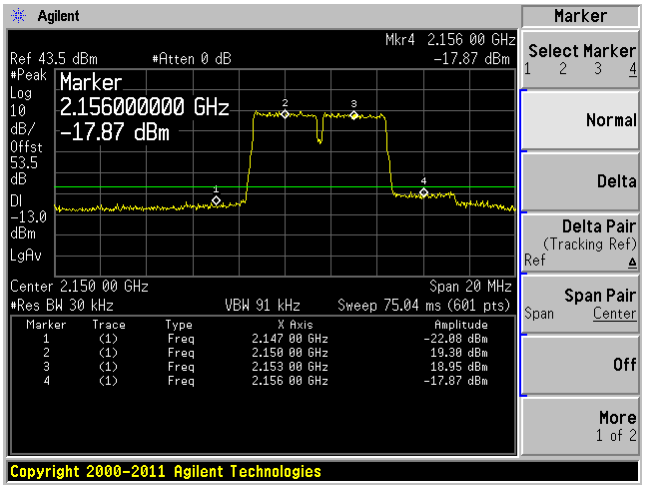


LTE, 64QAM (3 MHz), High Channel “2153” MHz

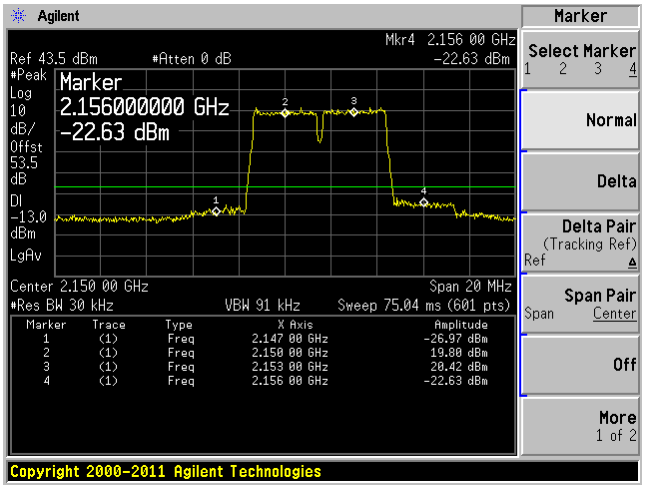
Input




Output, Chain J0

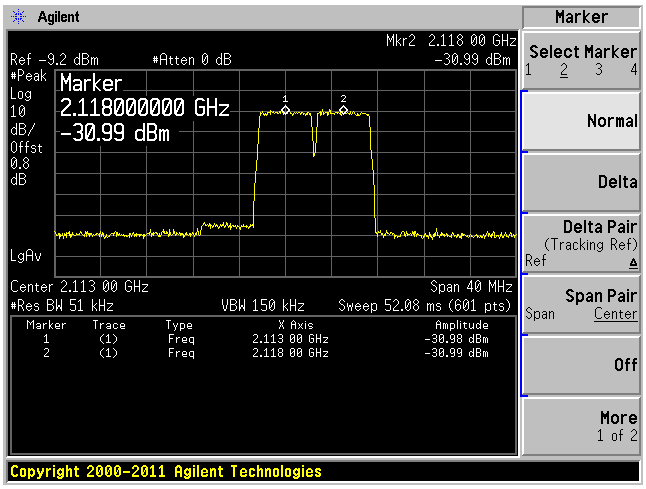



Output, Chain J1

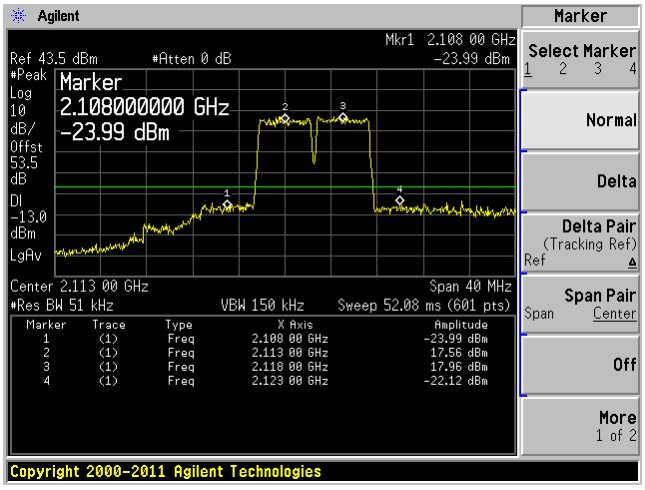


LTE, QPSK (5 MHz), Low Channel “2113” MHz

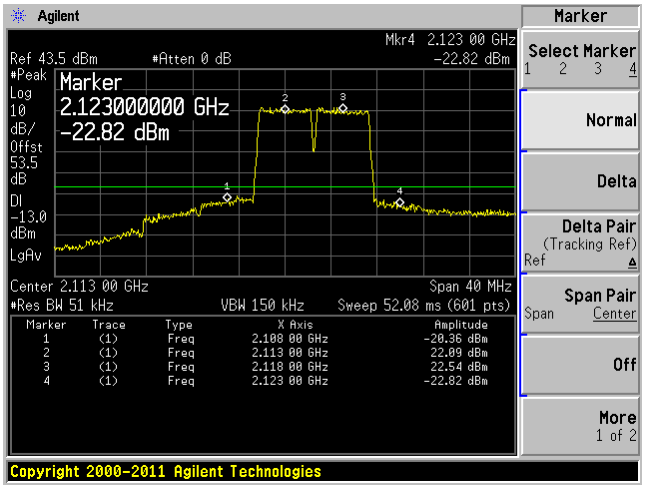
Input




Output, Chain J0

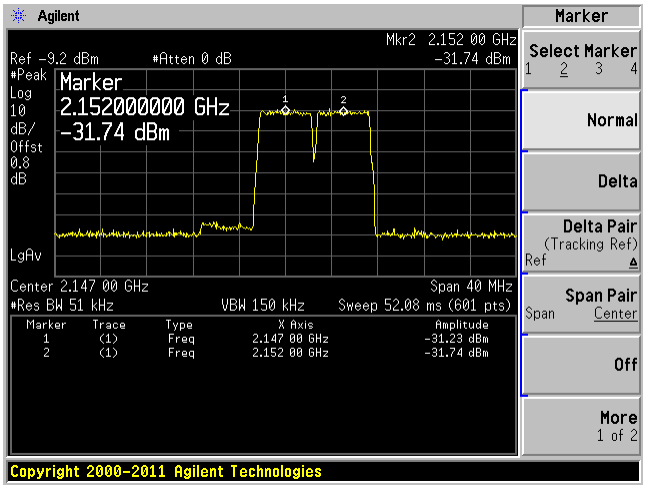



Output, Chain J1

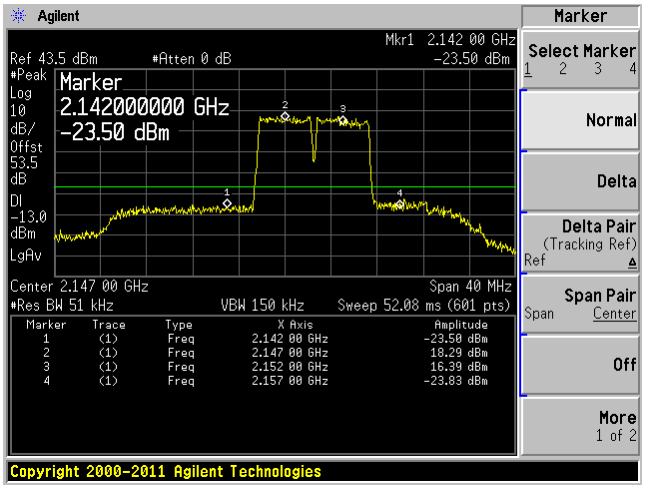


LTE, QPSK (5 MHz), High Channel “2152” MHz

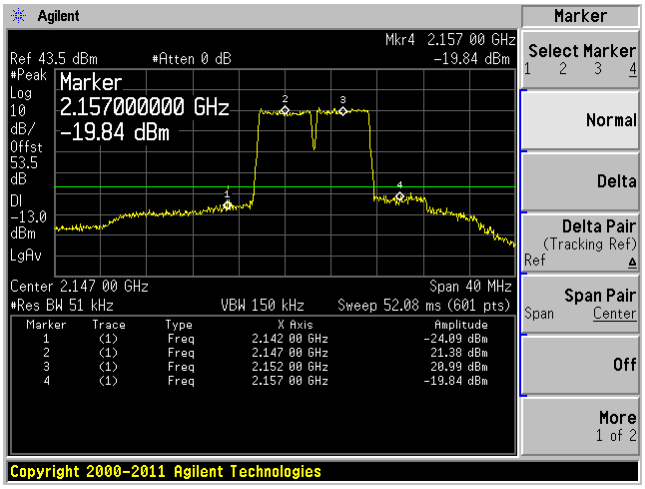
Input




Output, Chain J0

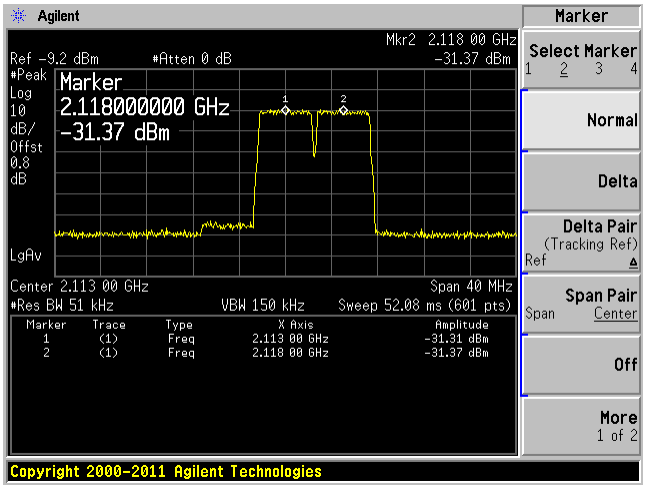



Output, Chain J1

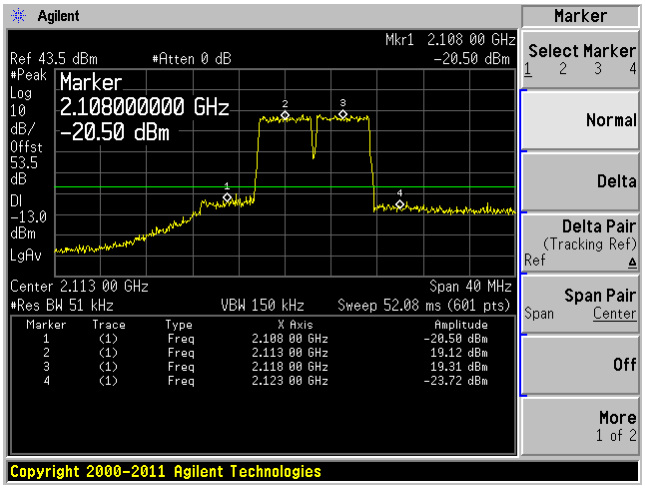


LTE, 16QAM (5 MHz), Low Channel “2113” MHz

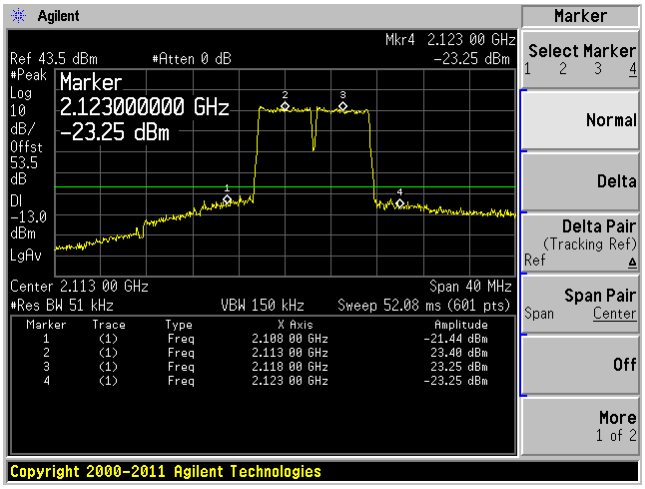
Input




Output, Chain J0

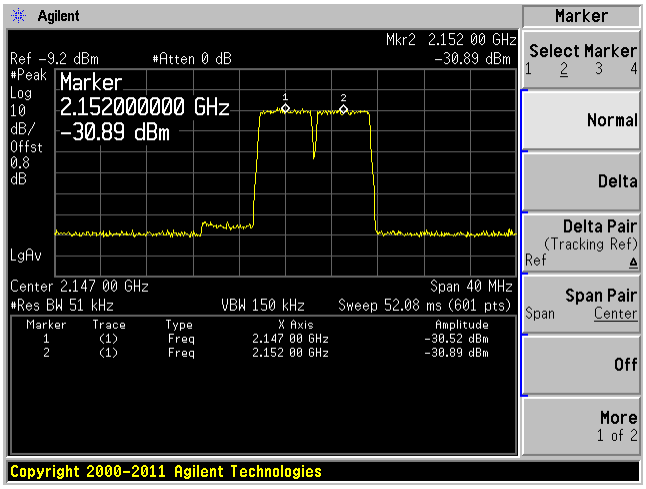



Output, Chain J1

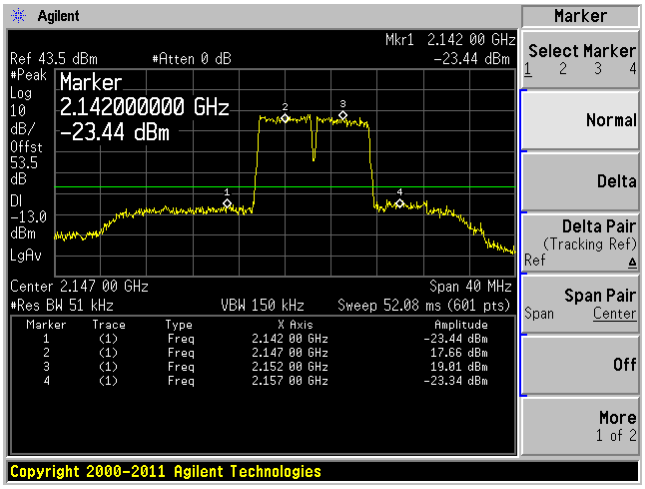


LTE, 16QAM (5 MHz), High Channel “2152” MHz

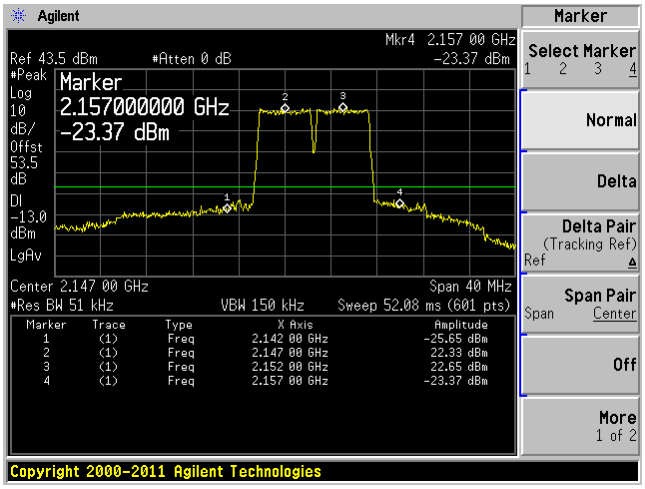
Input




Output, Chain J0

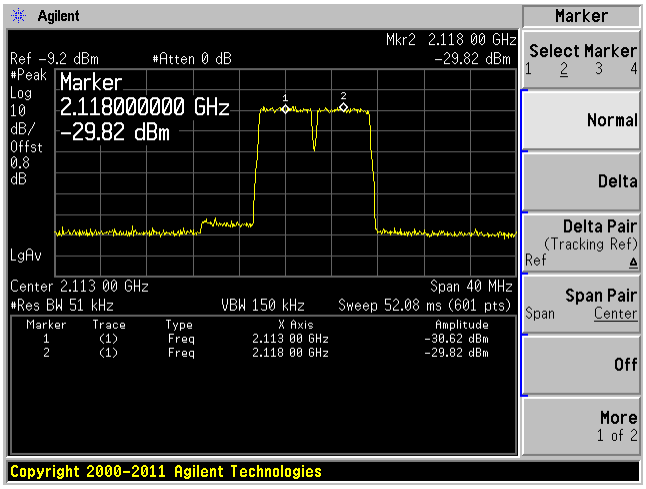



Output, Chain J1

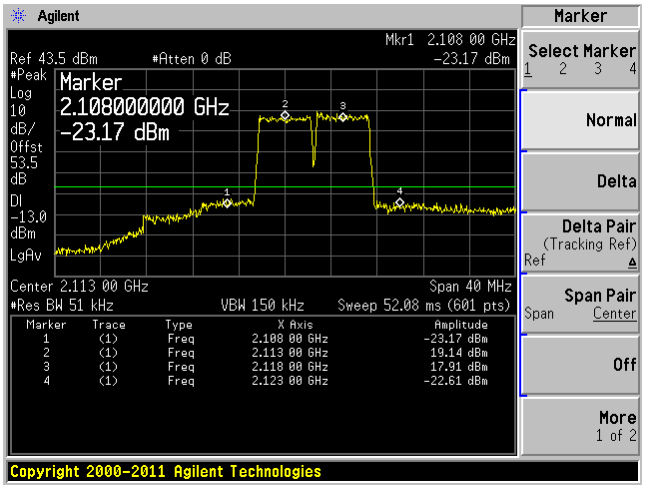


LTE, 64QAM (5 MHz), Low Channel “2113” MHz

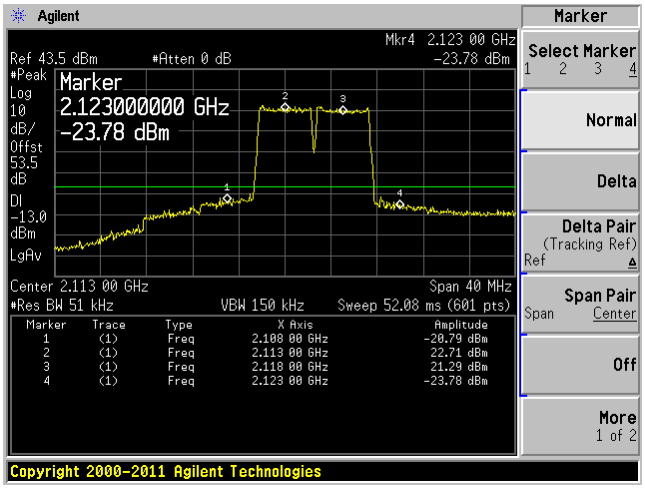
Input




Output, Chain J0

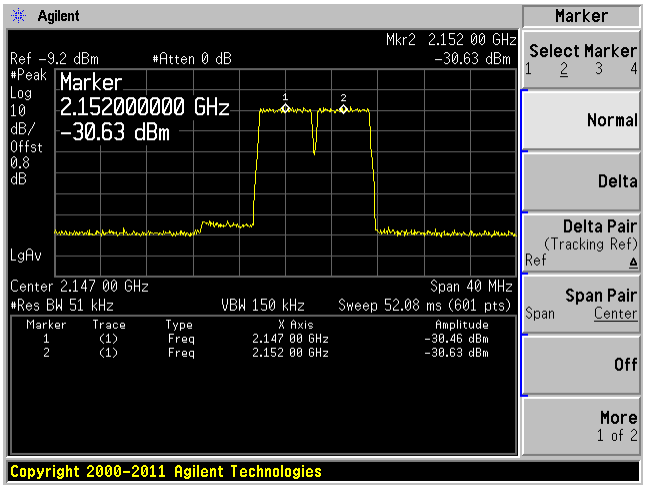



Output, Chain J1

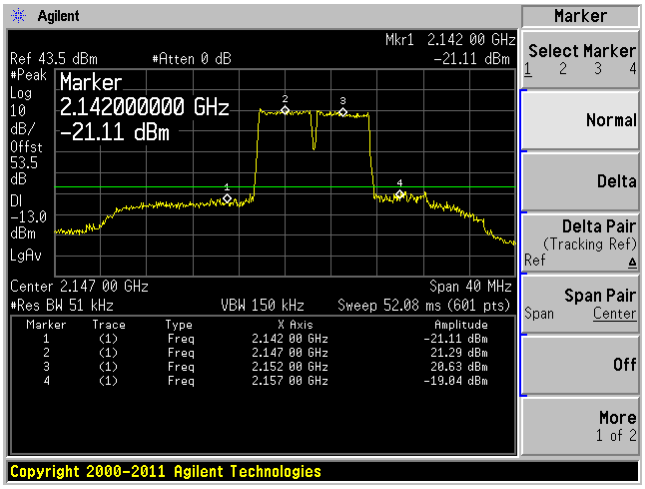


LTE, 64QAM (5 MHz), High Channel “2152” MHz

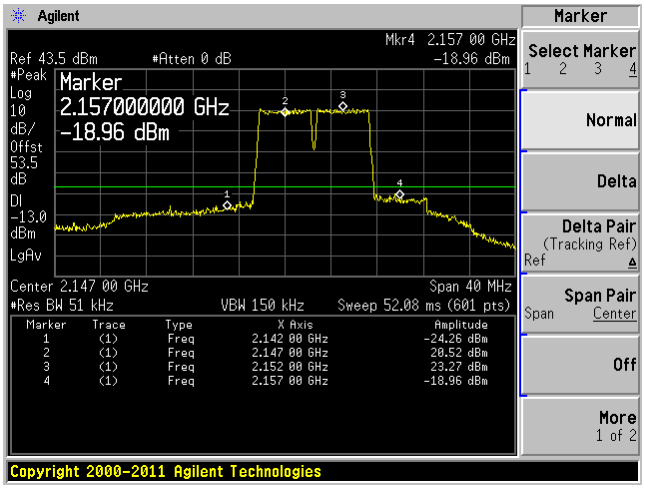
Input




Output, Chain J0

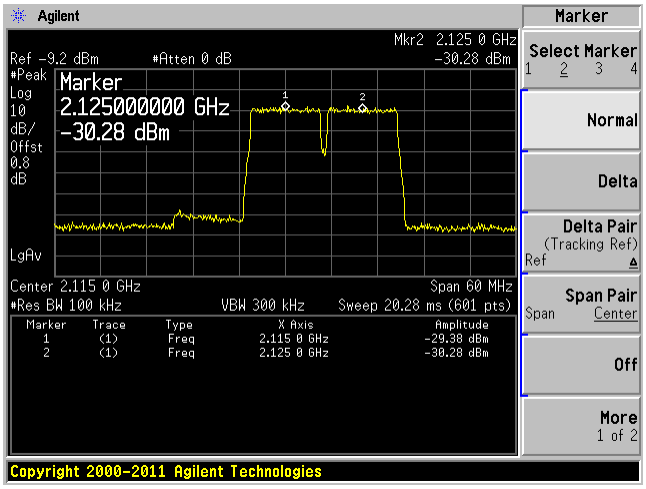



Output, Chain J1

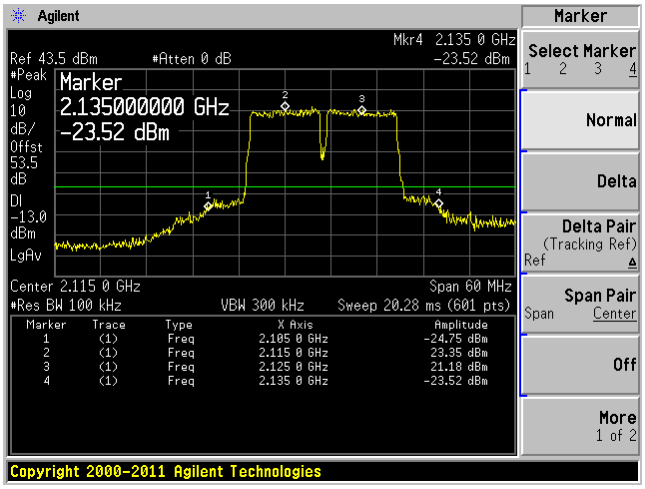


LTE, QPSK (10 MHz), Low Channel “2115” MHz

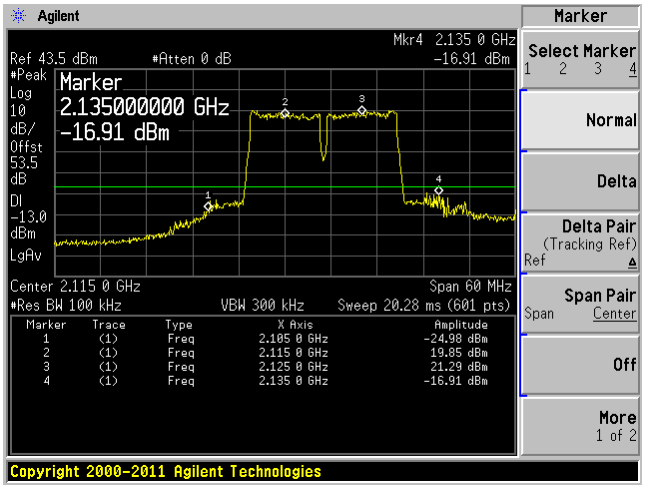
Input




Output, Chain J0

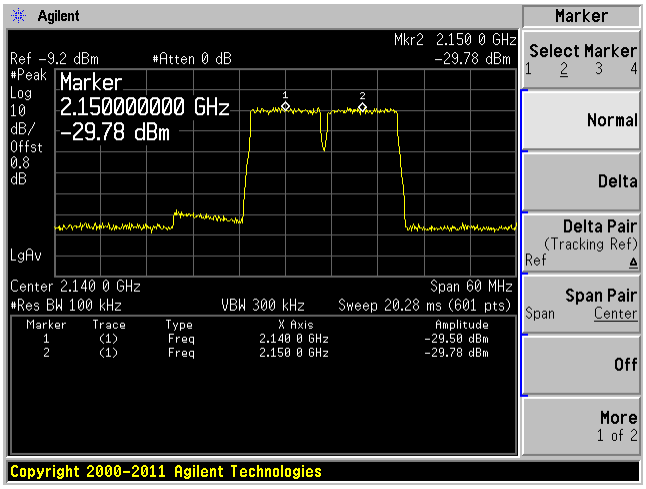



Output, Chain J1

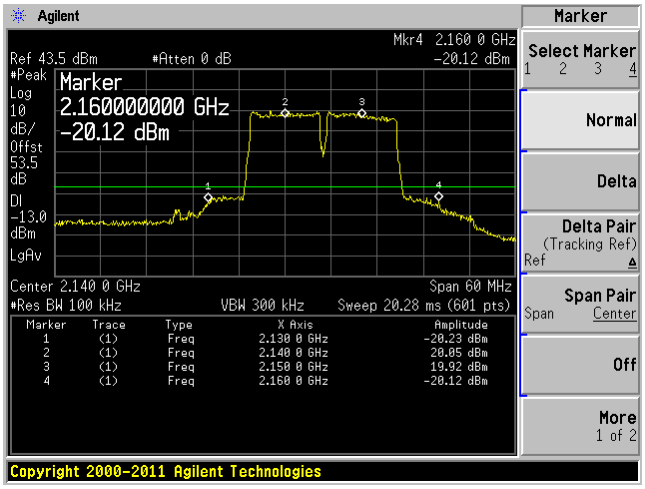


LTE, QPSK (10 MHz), High Channel “2150” MHz

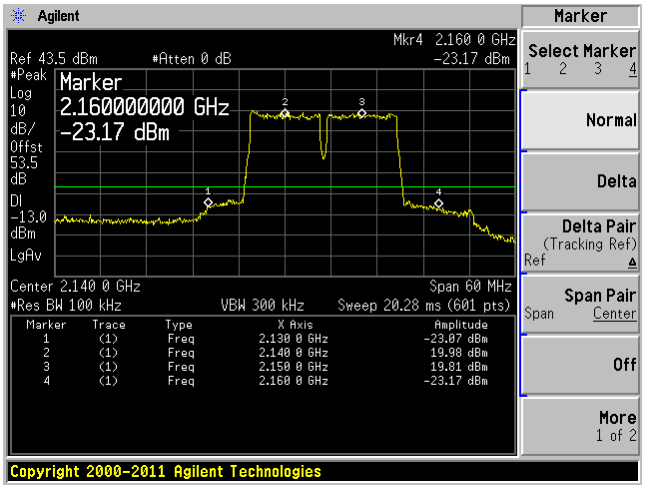
Input




Output, Chain J0

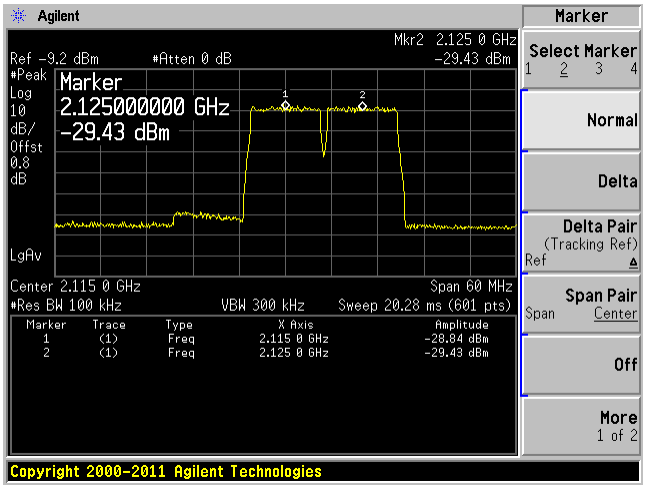



Output, Chain J1

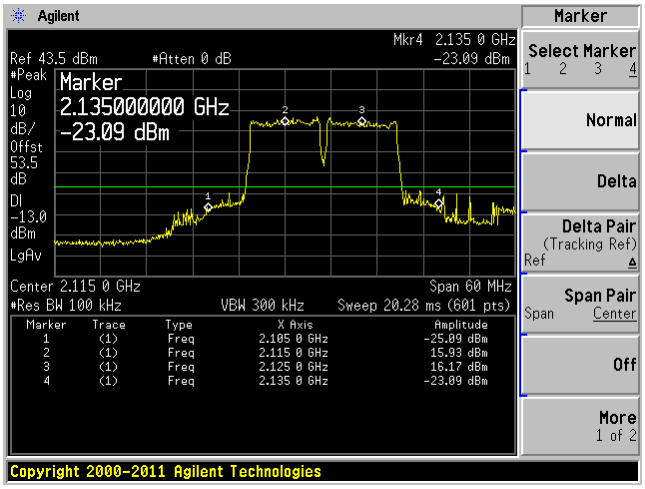


LTE, 16QAM (10 MHz), Low Channel “2115” MHz

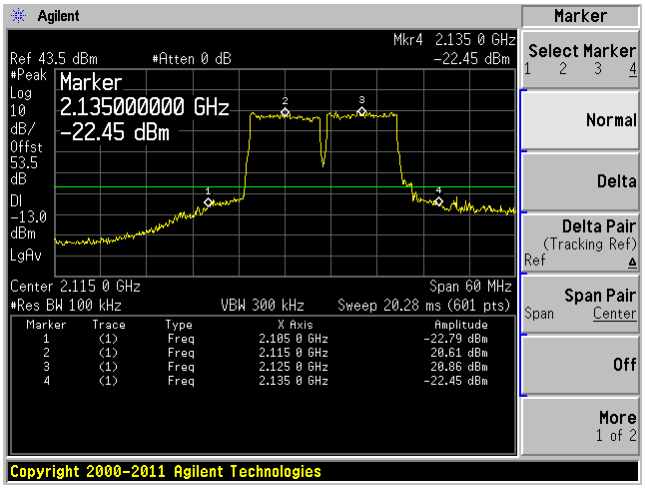
Input




Output, Chain J0

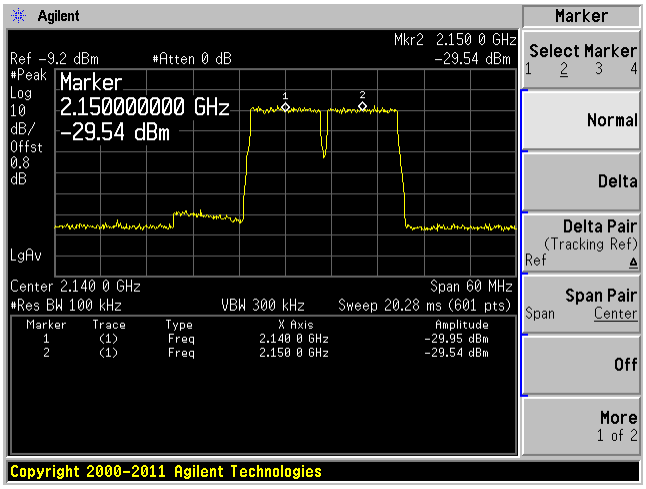



Output, Chain J1

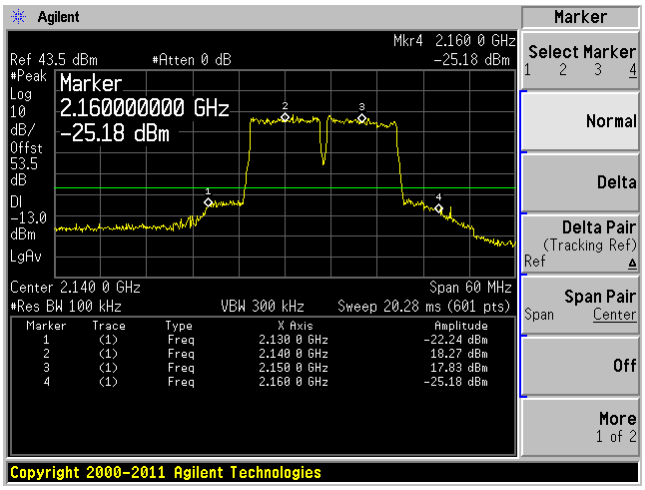


LTE, 16QAM (10 MHz), High Channel “2150” MHz

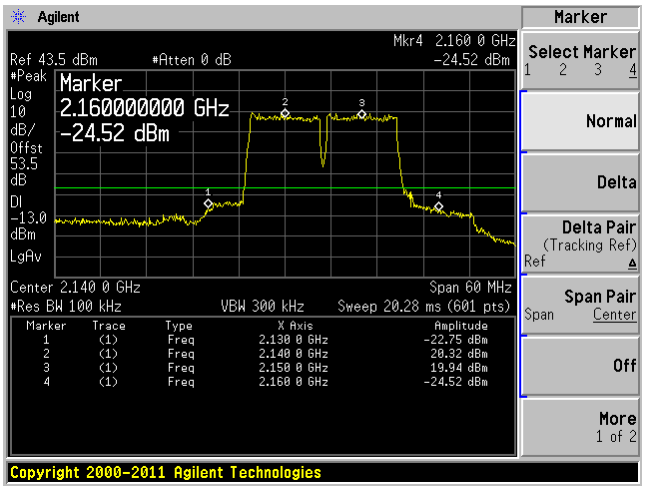
Input




Output, Chain J0

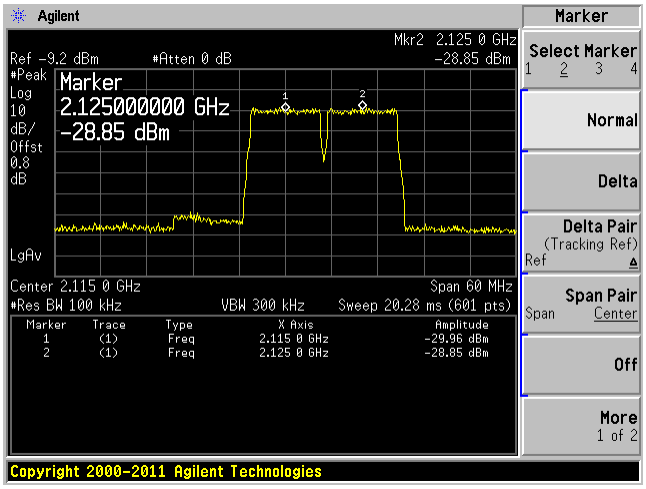



Output, Chain J1

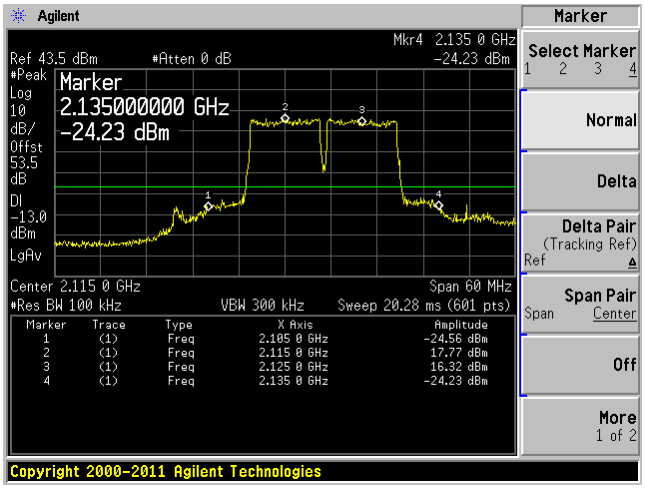


LTE, 64QAM (10 MHz), Low Channel “2115” MHz

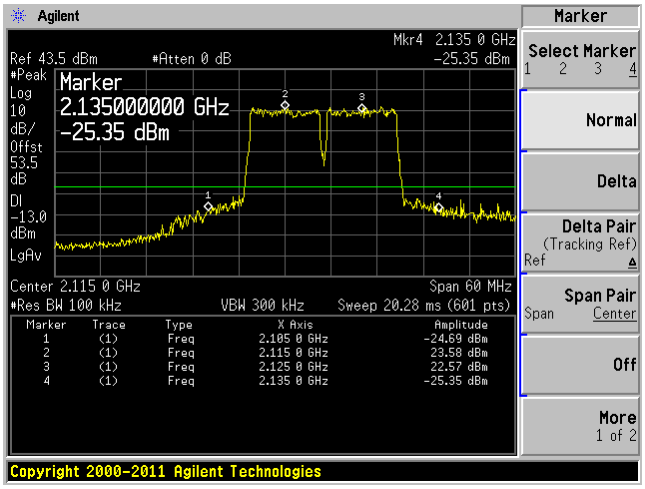
Input




Output, Chain J0

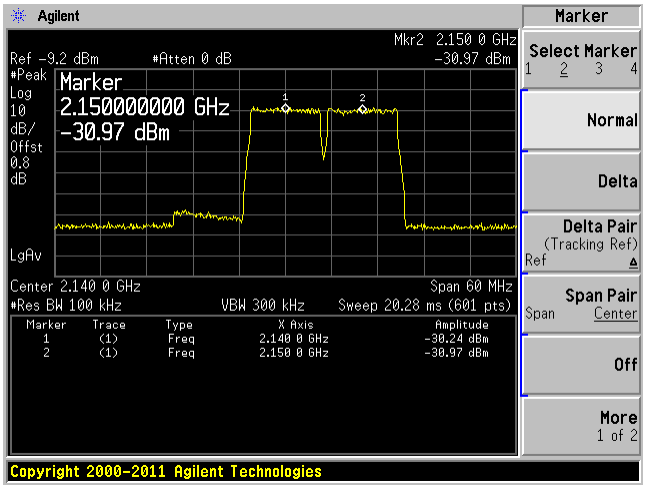



Output, Chain J1

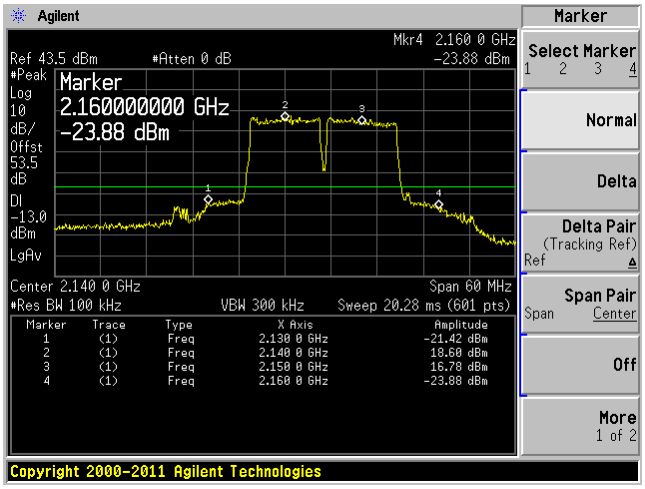


LTE, 64QAM (10 MHz), High Channel “2150” MHz

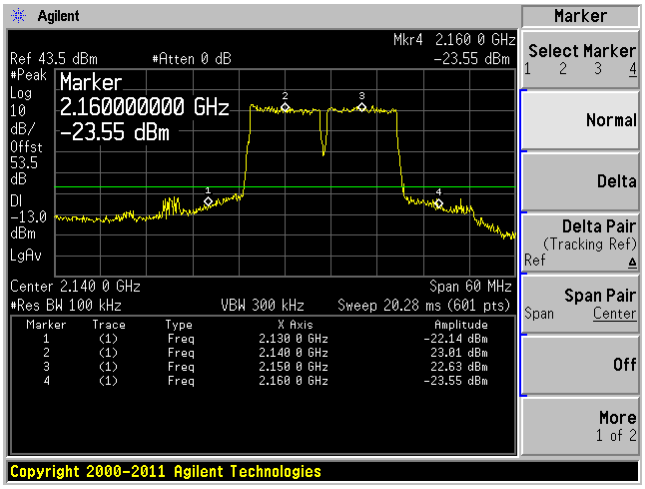
Input




Output, Chain J0



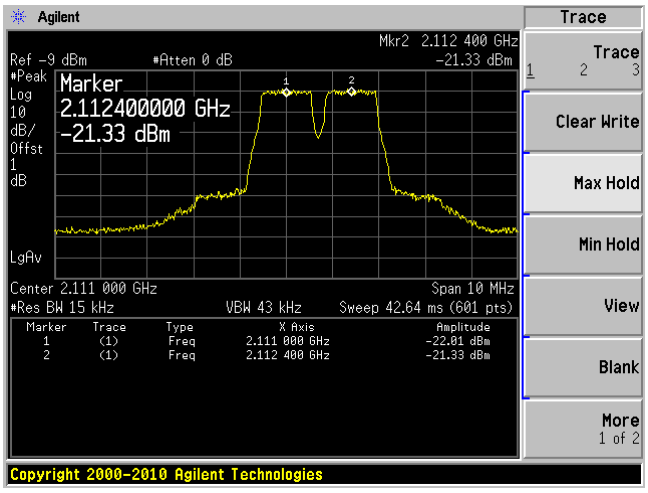

Output, Chain J1



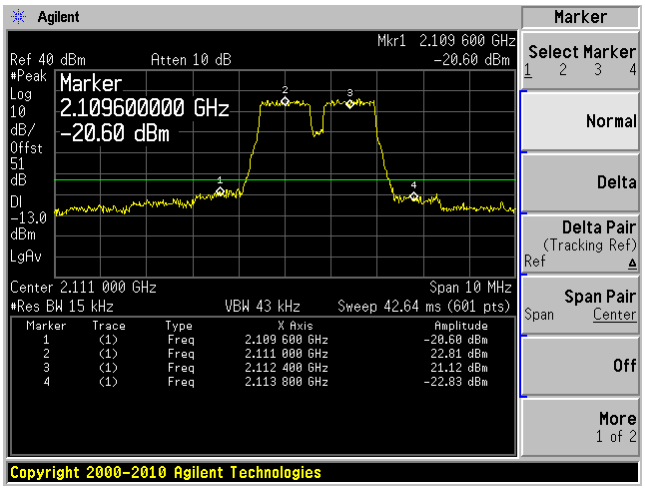
Note: Worst case intermodulation is at 1.4 MHz Channel bandwidth with AGC enabled. Per KDB 935210 D02, data was taken for worst case with AGC disabled.

LTE, (QPSK 1.4 MHz) Low Channel “2111” MHz

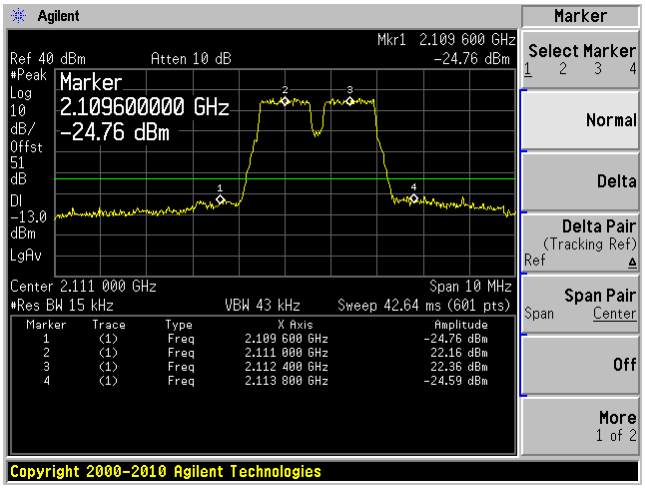
Input




Output, Chain J0

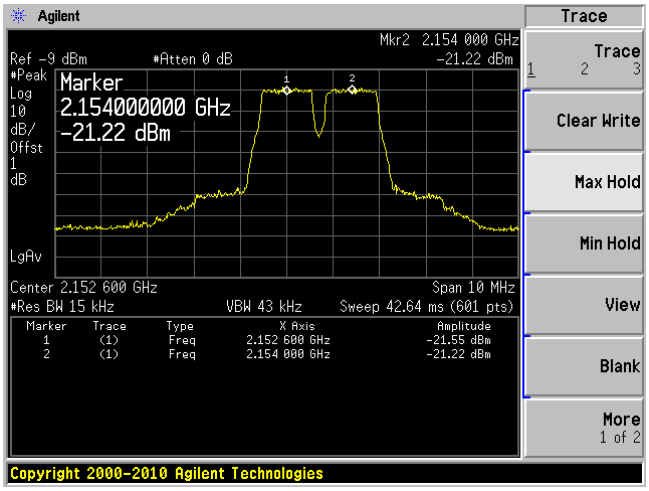



Output, Chain J1

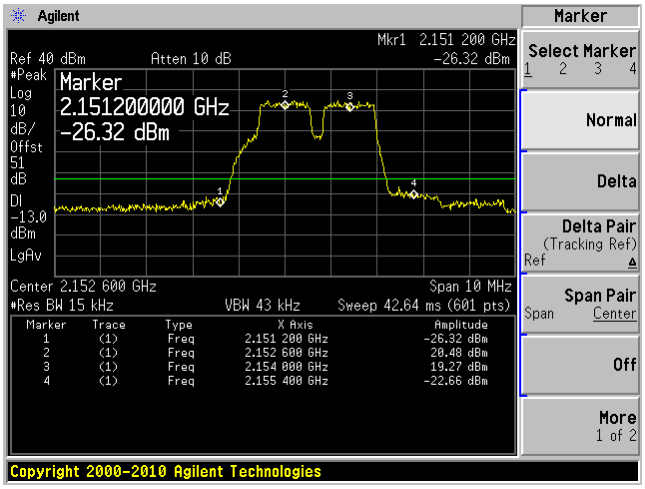


LTE, (QPSK 1.4 MHz) High Channel “2154” MHz

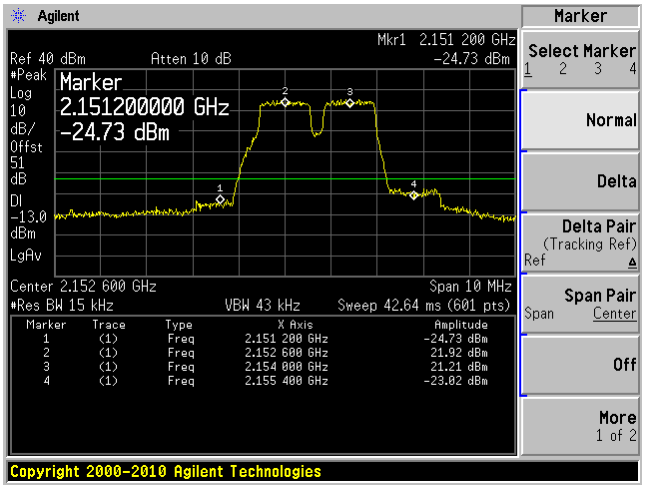
Input




Output, Chain J0

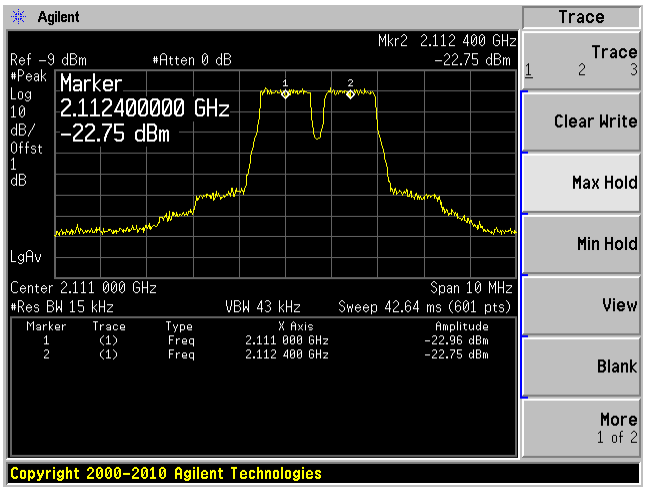



Output, Chain J1

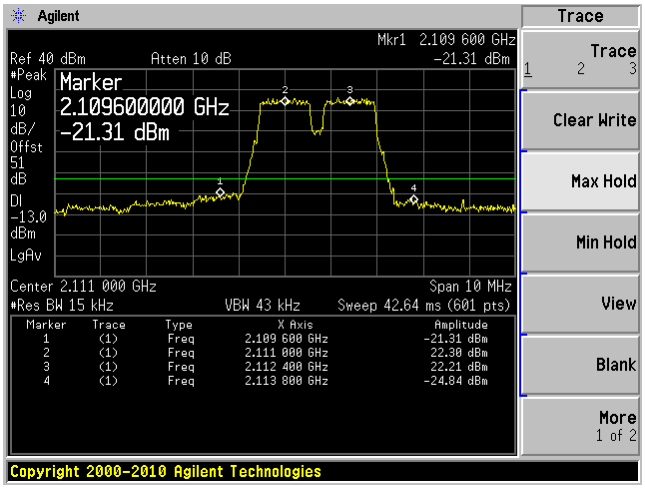


LTE, (64QAM 1.4 MHz) Low Channel “2111” MHz

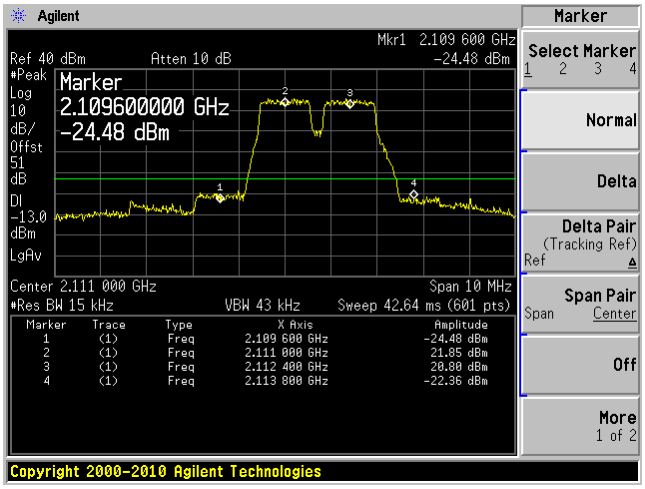
Input




Output, Chain J0

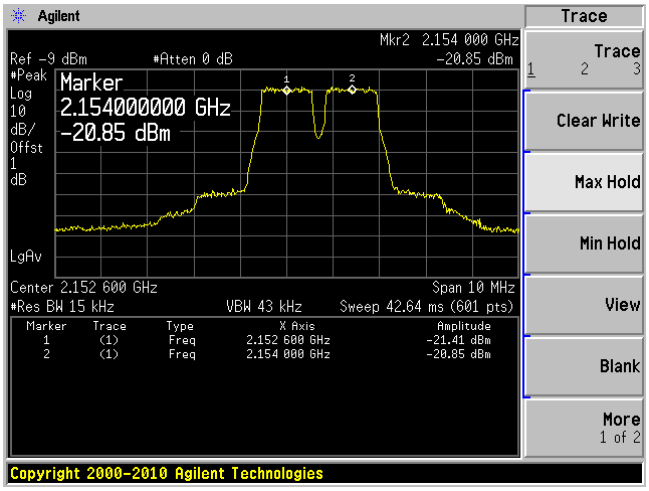



Output, Chain J1

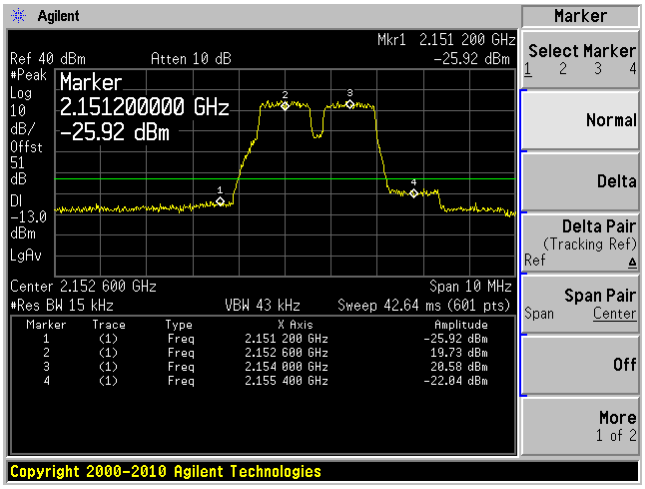


LTE, (64QAM 1.4 MHz) High Channel “2154” MHz

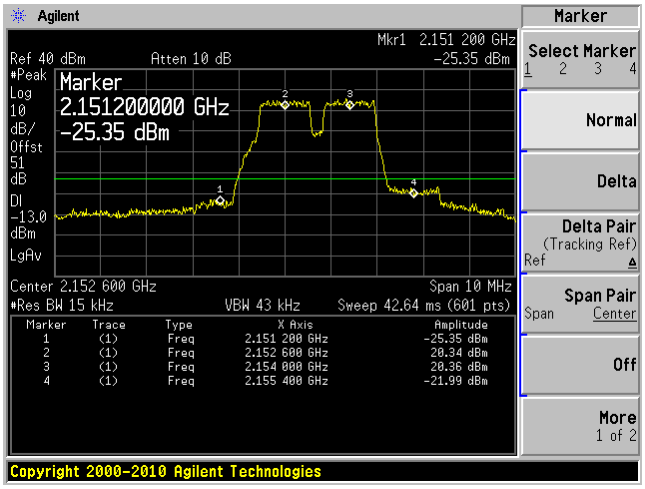
Input




Output, Chain J0

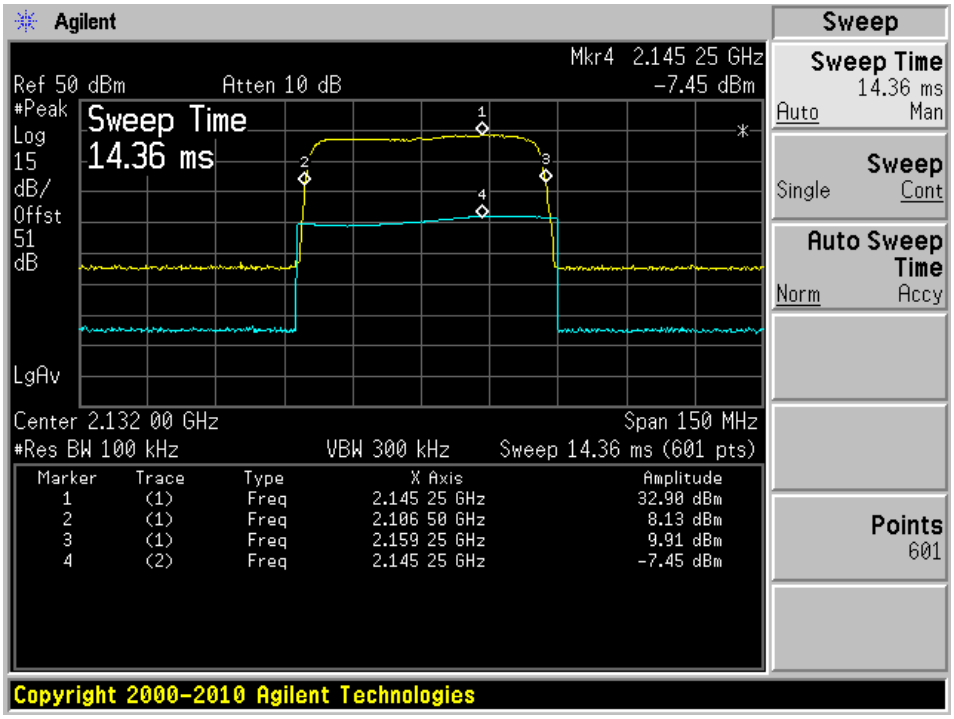



Output, Chain J1

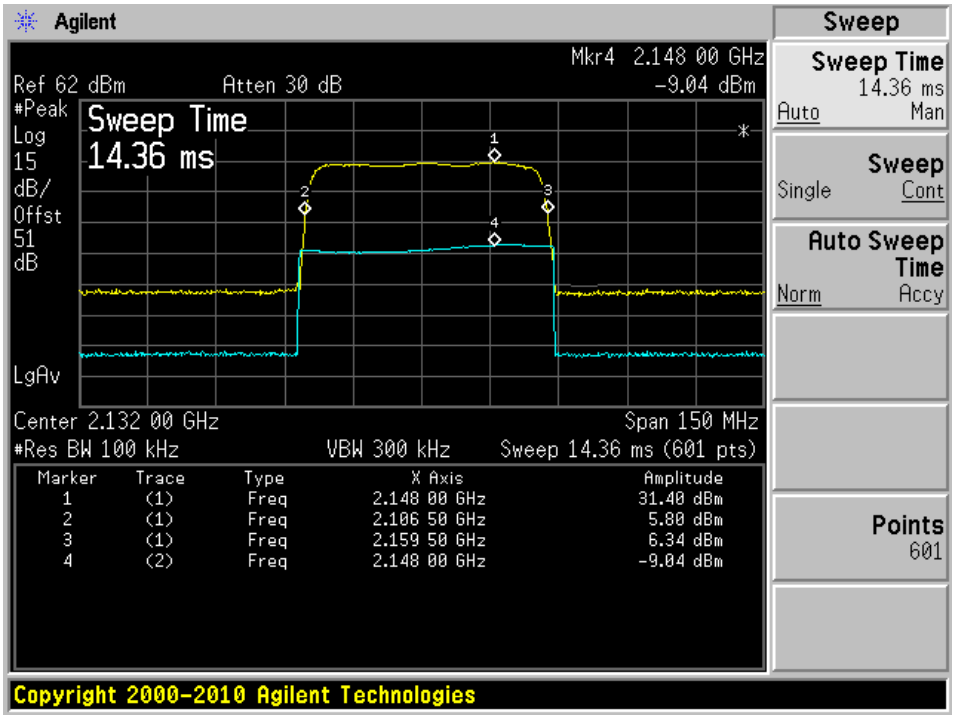


## (C) Out of Band Rejection

Chain J0




Chain J1



# 8 FCC §27.53 (8) – Band Edge

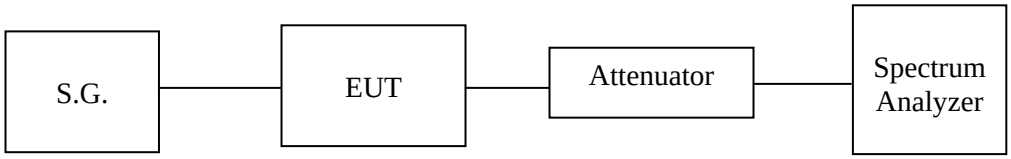
## 8.1 Applicable Standard

According to FCC §27.53 (h), the power of any emissions 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.

## 8.2 Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency.




## 8.3 Test Equipment List and Details

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Interval |
|---|---|---|---|---|---|
| Agilent | PSA, Series Spectrum Analyzer | E4440A | US45303156 | 2012-08-22 | 2 years |
| Agilent | Generator, Signal | E4438C | MY45091309 | 2013-05-30 | 1 year |

***Statement of Traceability*:** BACL Corp. attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

## 8.4 Test Environmental Conditions

| | |
|---|---|
| **Temperature:** | 26 ºC |
| **Relative Humidity:** | 33 % |
| **ATM Pressure:** | 101.85 kPa |

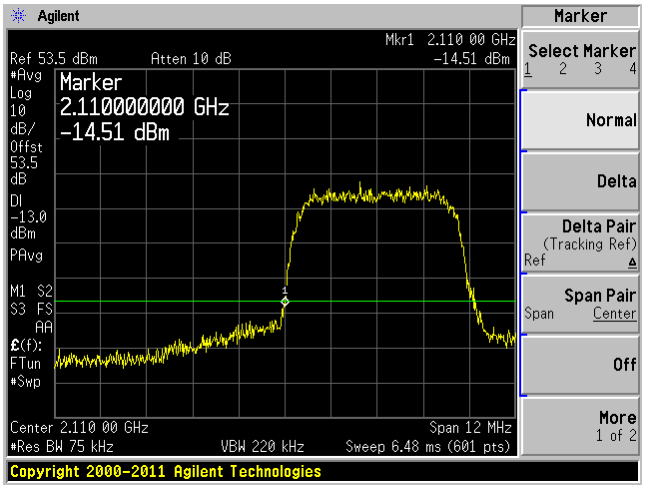
*The testing was performed by Glenn Escano from 2013-12-17 at RF Site.*

## 8.5 Test Results

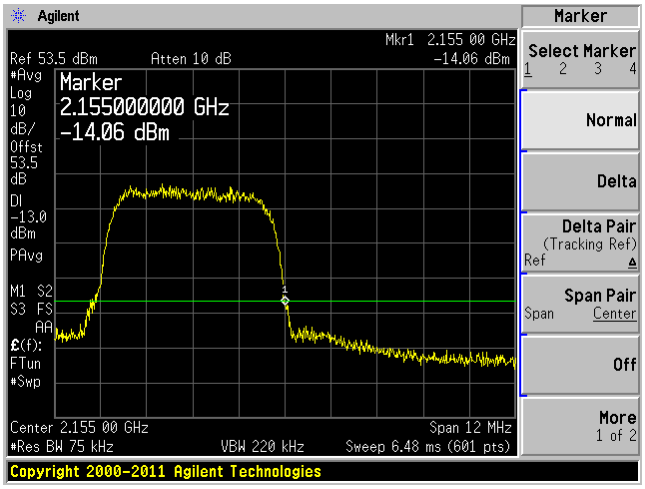
Please refer to the following plots.

**WCDMA/HSPA; DL: 2110-2155 MHz**

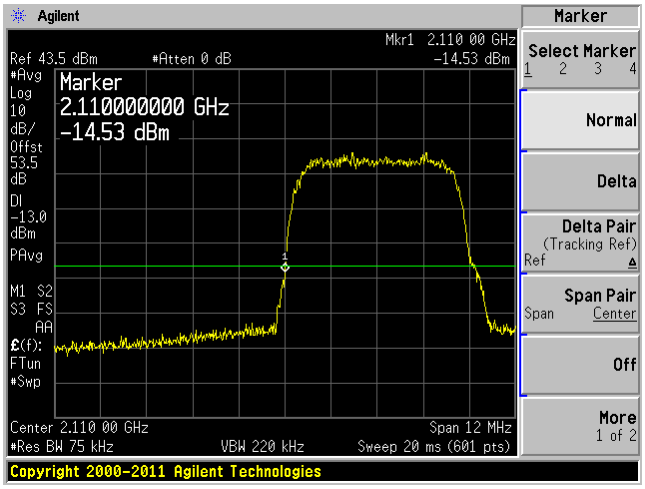
Low Channel, Chain J0



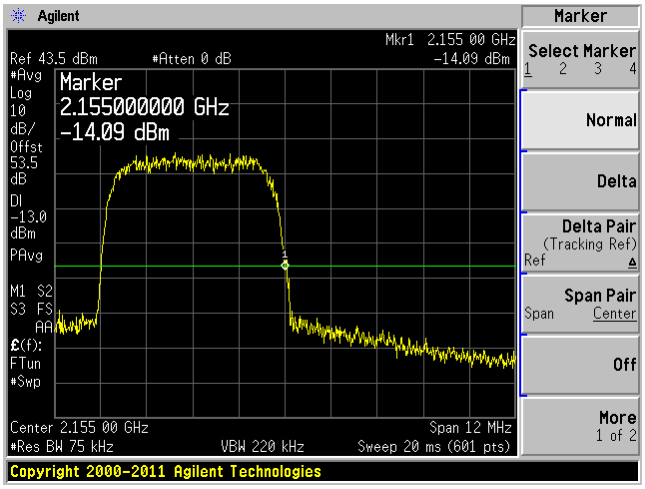

High Channel, Chain J0




Low Channel, Chain J1



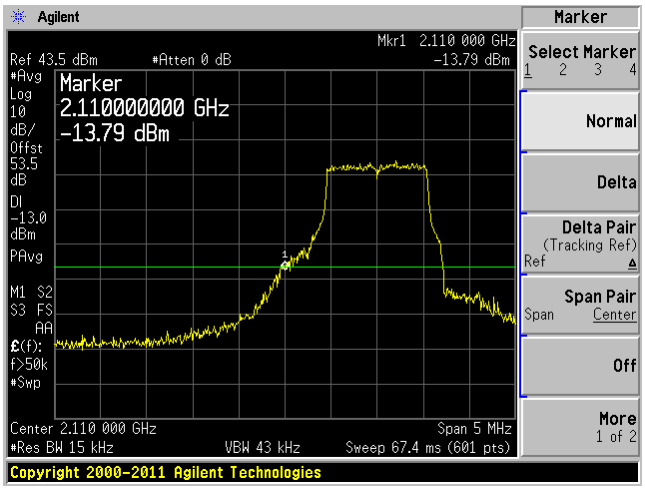

High Channel, Chain J1



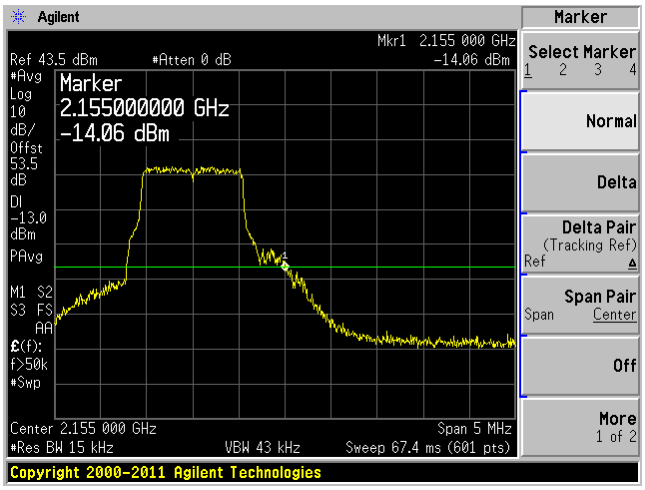
**LTE; DL: 2110-2155 MHz**

QPSK (1.4 MHz)

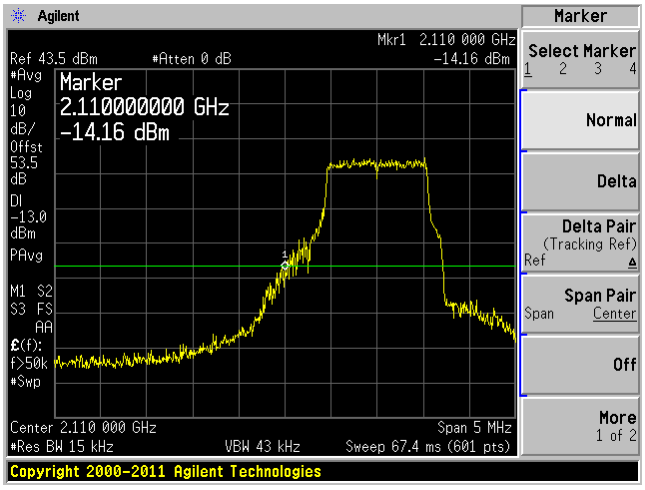
Low Channel, Chain J0



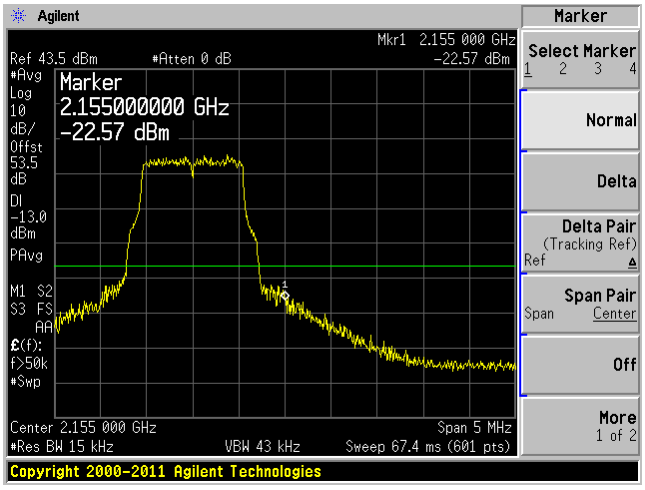

High Channel, Chain J0




Low Channel, Chain J1

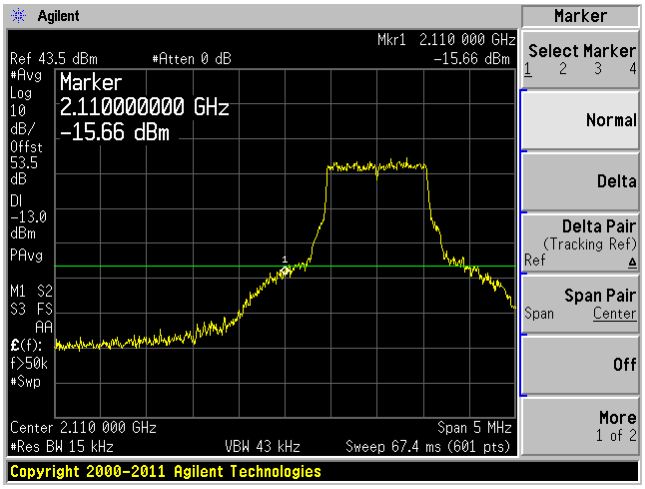



High Channel, Chain J1

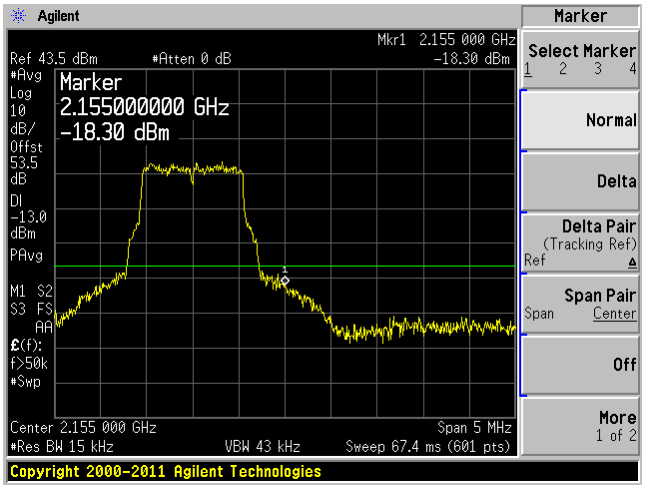


16QAM (1.4 MHz)

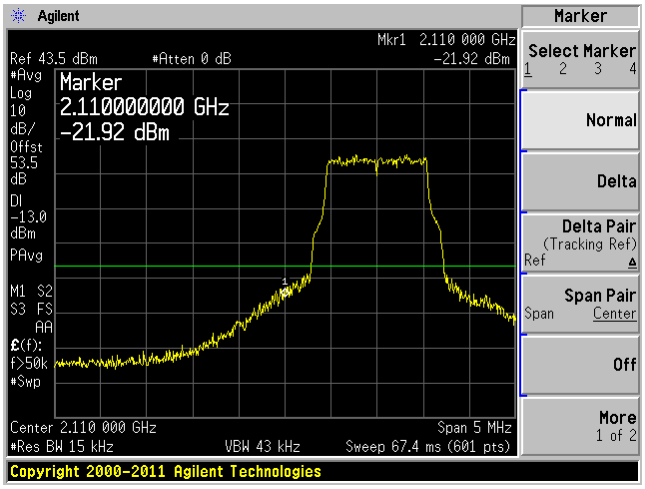
Low Channel, Chain J0



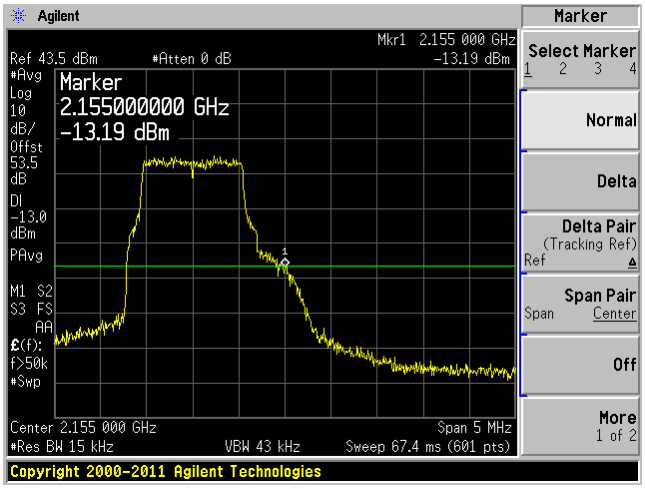

High Channel, Chain J0




Low Channel, Chain J1

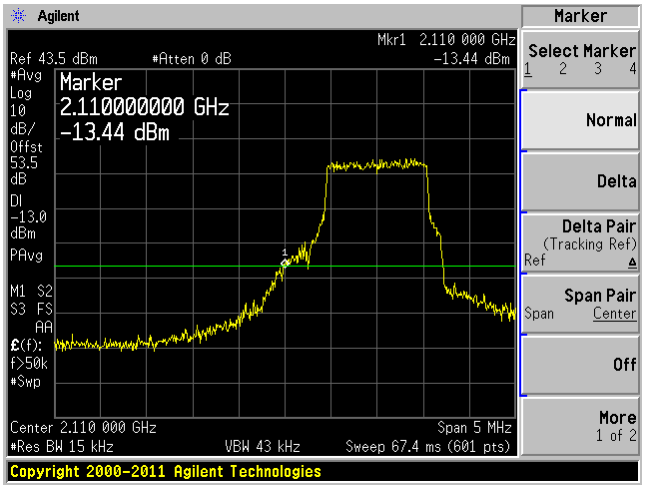



High Channel, Chain J1

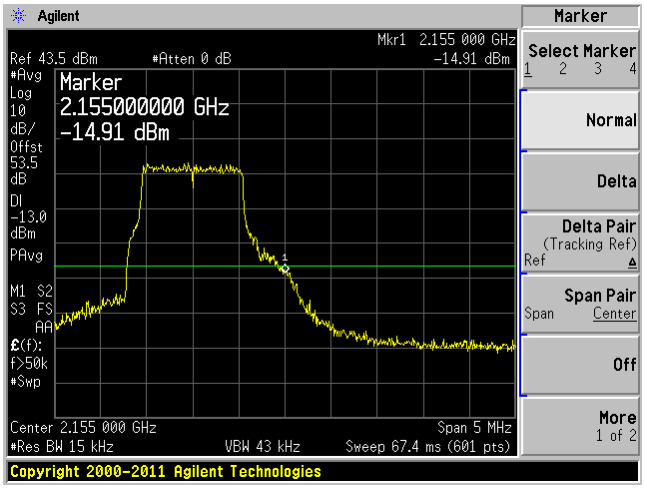


64QAM (1.4 MHz)

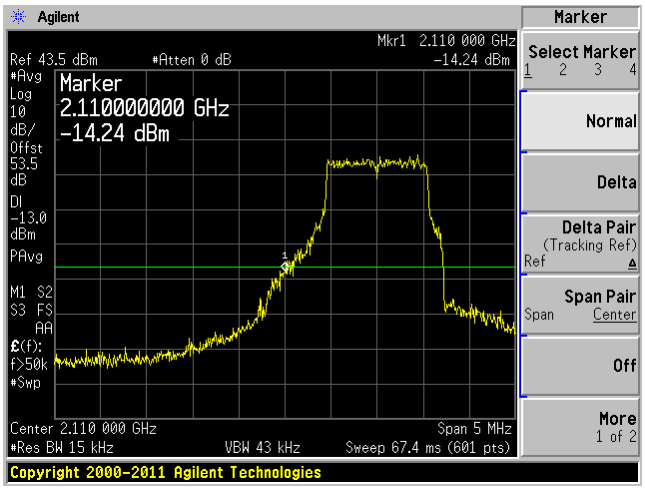
Low Channel, Chain J0



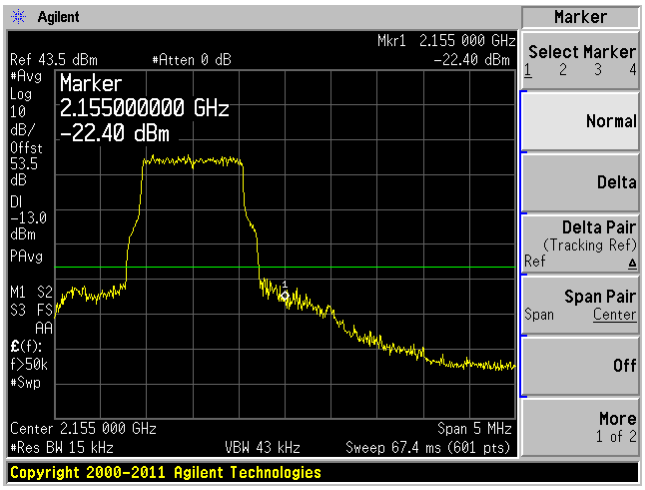

High Channel, Chain J0




Low Channel, Chain J1

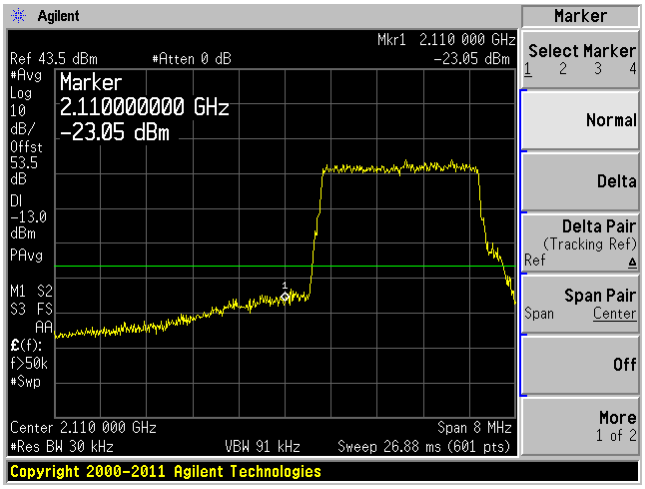



High Channel, Chain J1

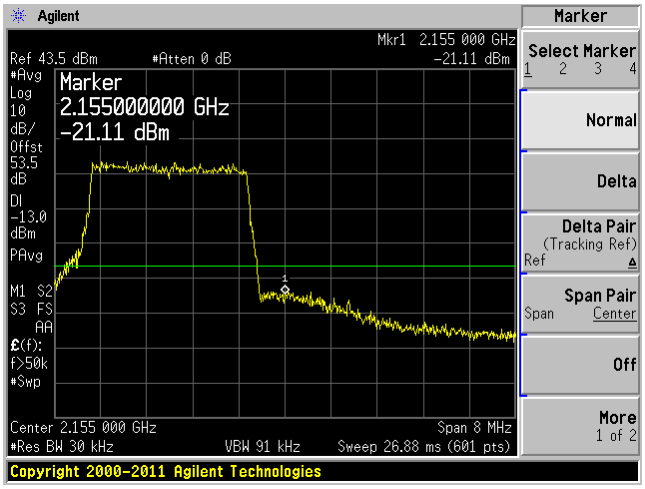


QPSK (3 MHz)

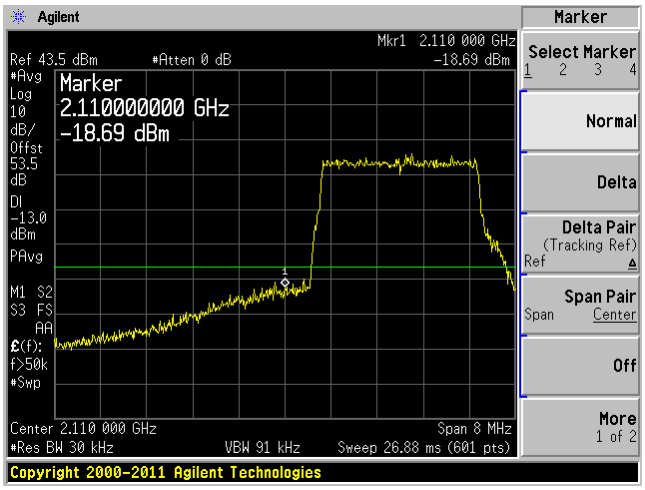
Low Channel, Chain J0



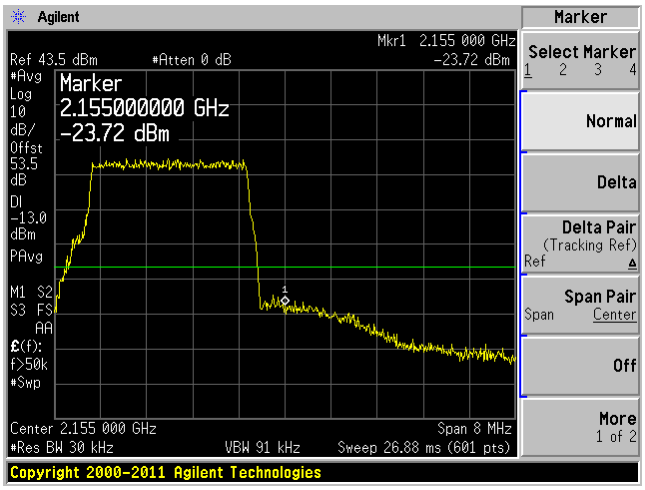

High Channel, Chain J0




Low Channel, Chain J1

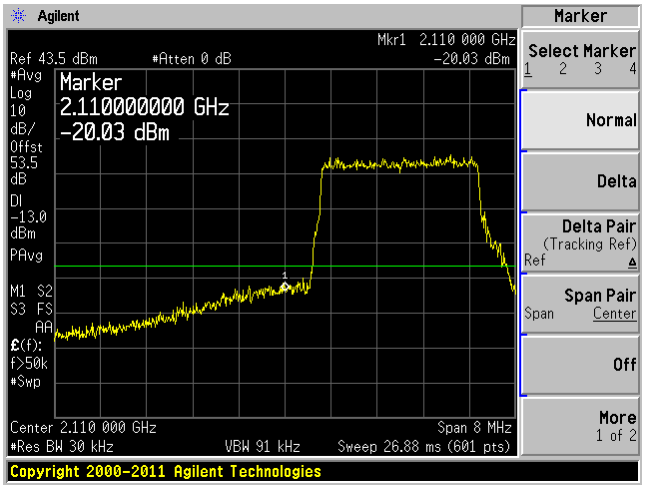



High Channel, Chain J1

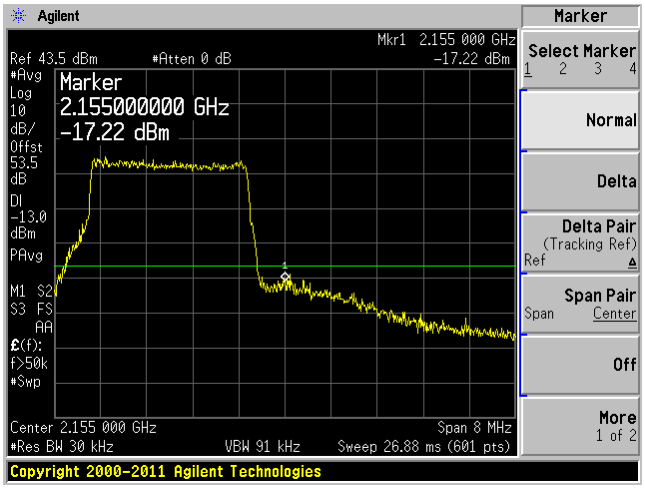


16QAM (3 MHz)

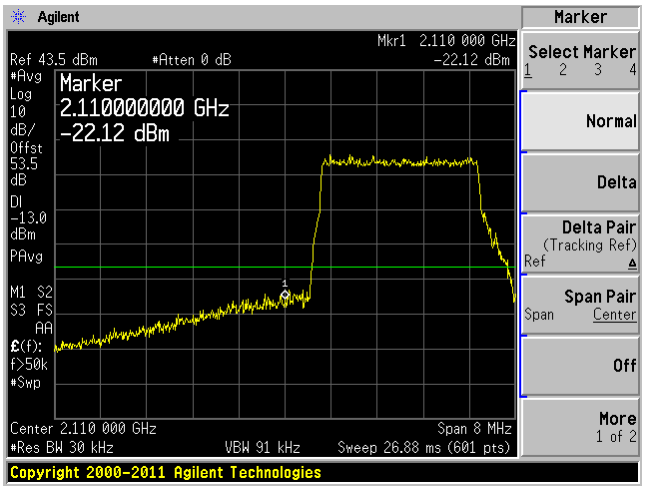
Low Channel, Chain J0



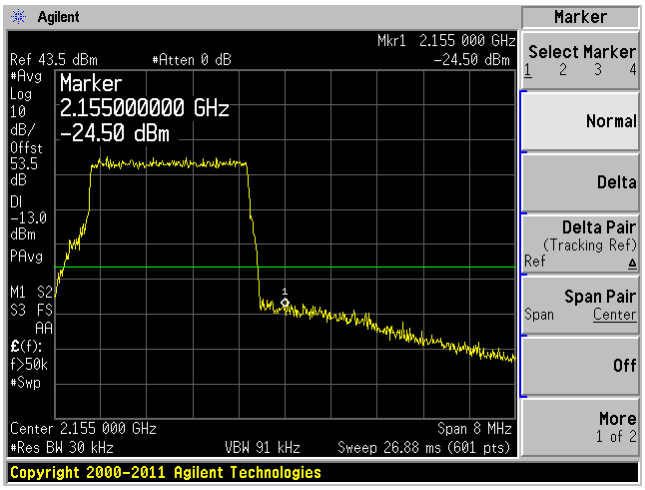

High Channel, Chain J0




Low Channel, Chain J1

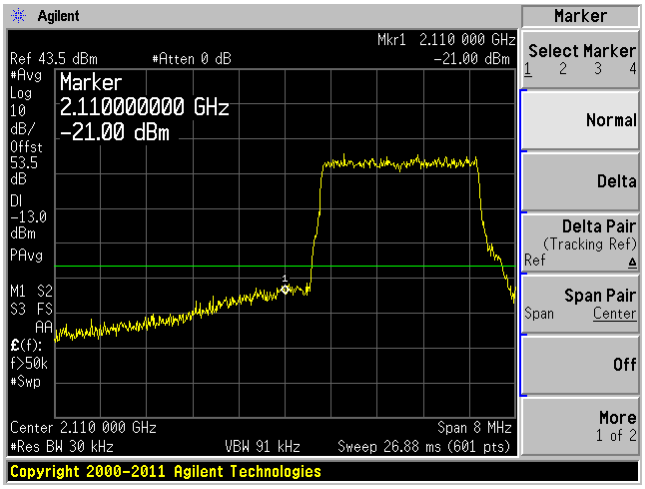



High Channel, Chain J1

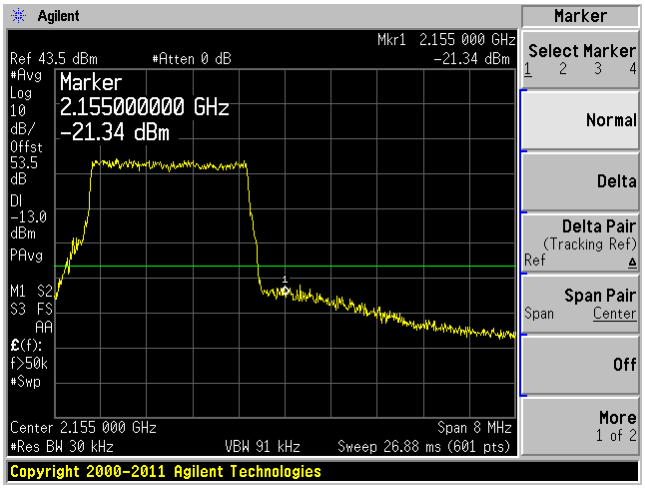


64QAM (3 MHz)

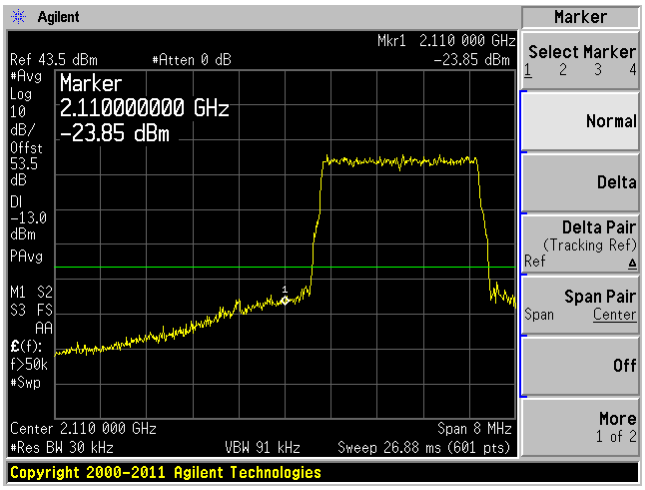
Low Channel, Chain J0



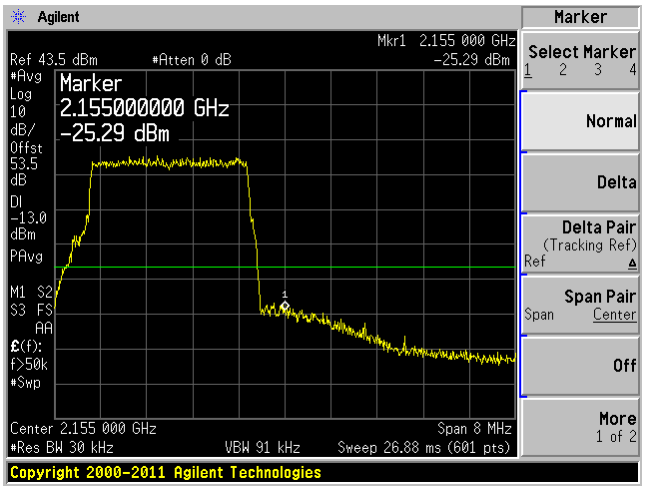

High Channel, Chain J0




Low Channel, Chain J1

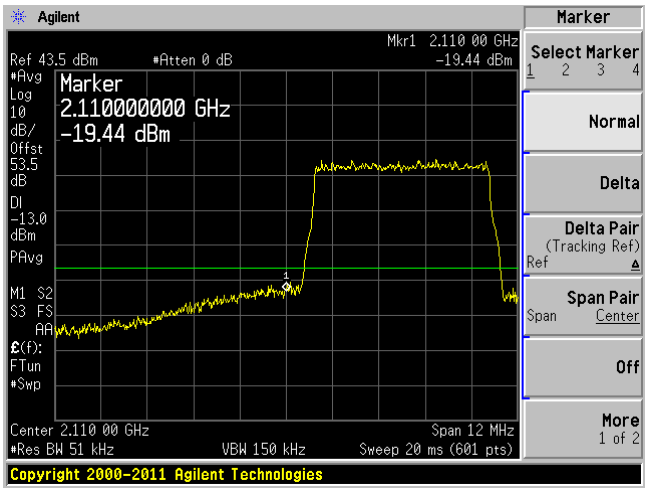



High Channel, Chain J1

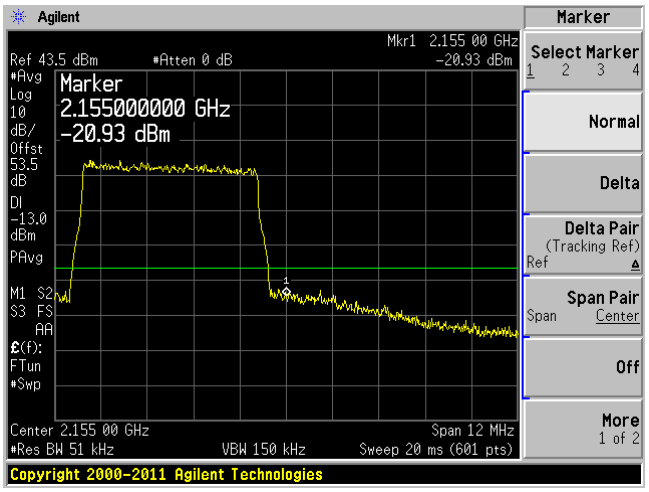


QPSK (5 MHz)

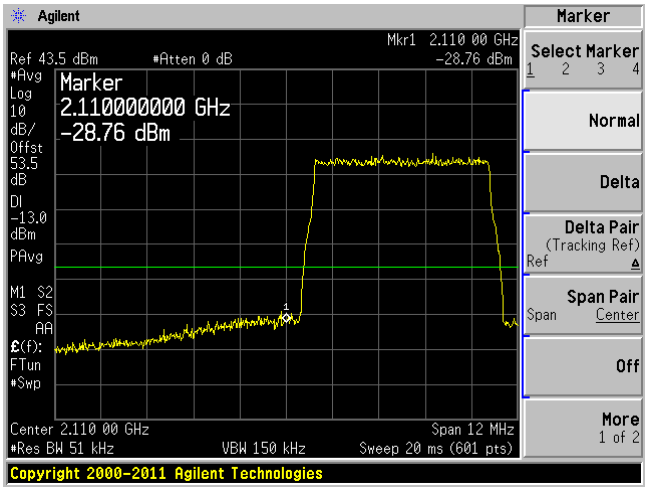
Low Channel, Chain J0



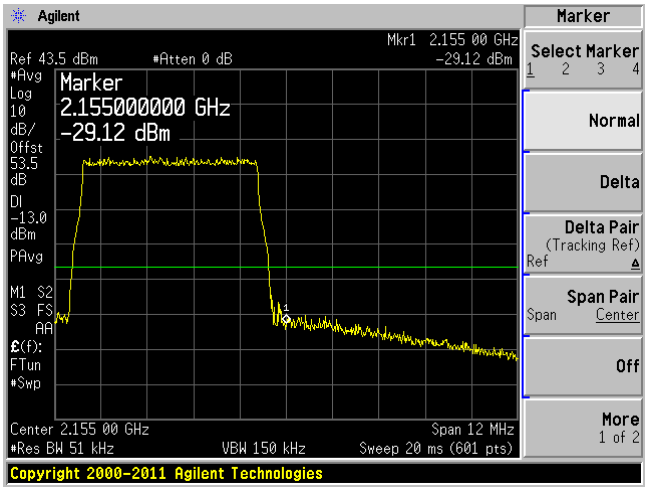

High Channel, Chain J0




Low Channel, Chain J1

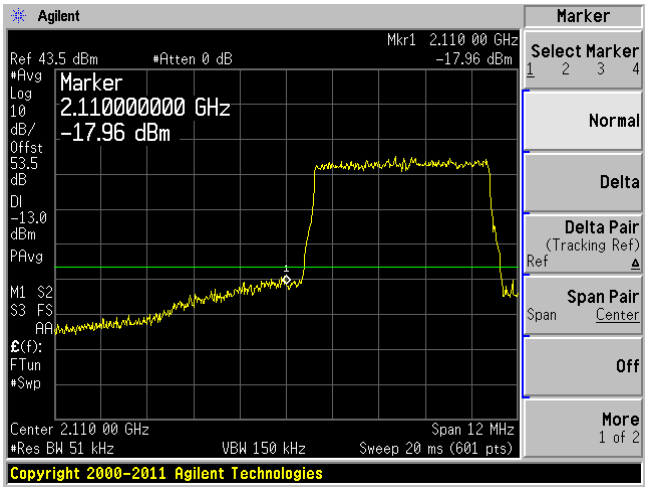



High Channel, Chain J1

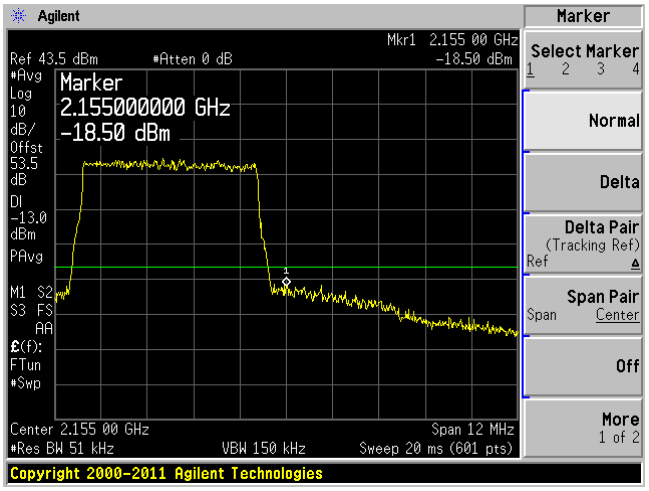


16QAM (5 MHz)

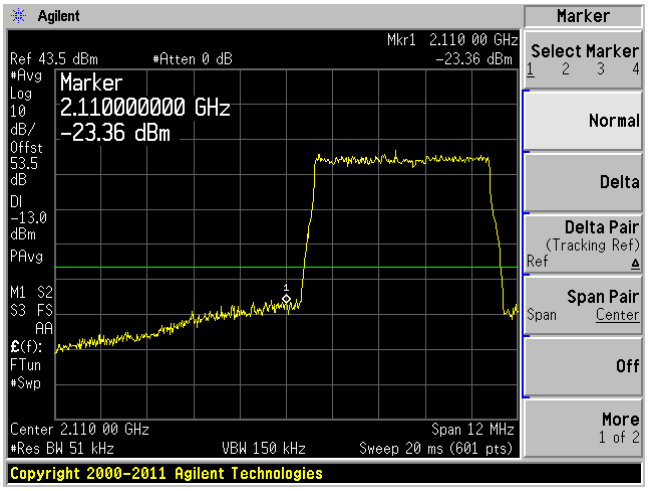
Low Channel, Chain J0



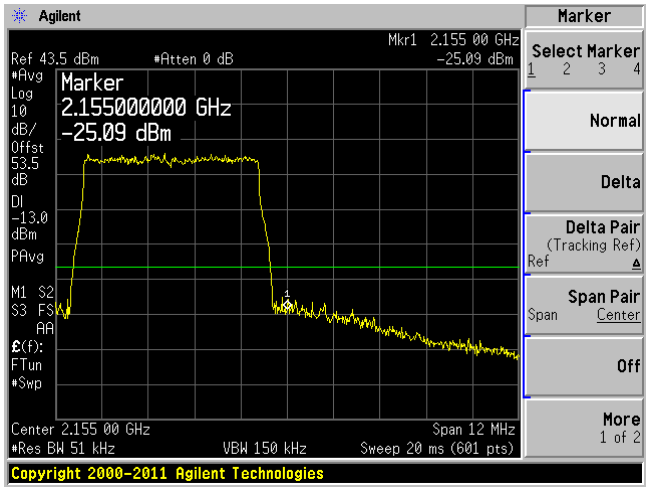

High Channel, Chain J0




Low Channel, Chain J1

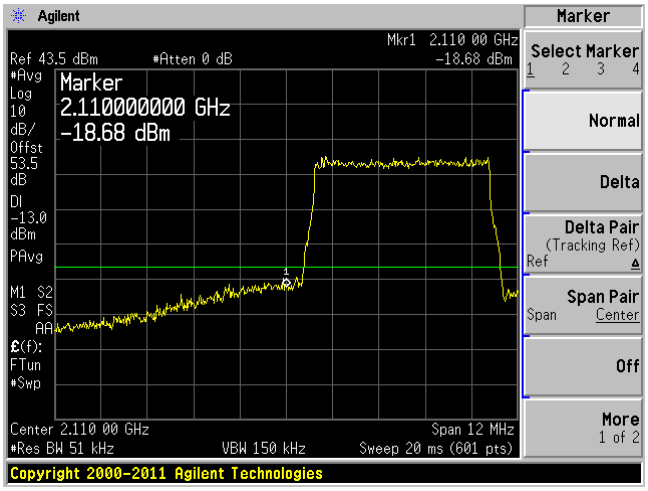



High Channel, Chain J1



64QAM (5 MHz)

Low Channel, Chain J0

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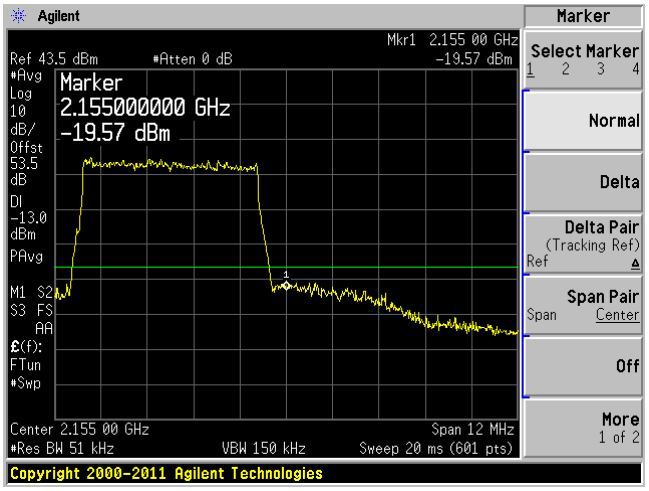
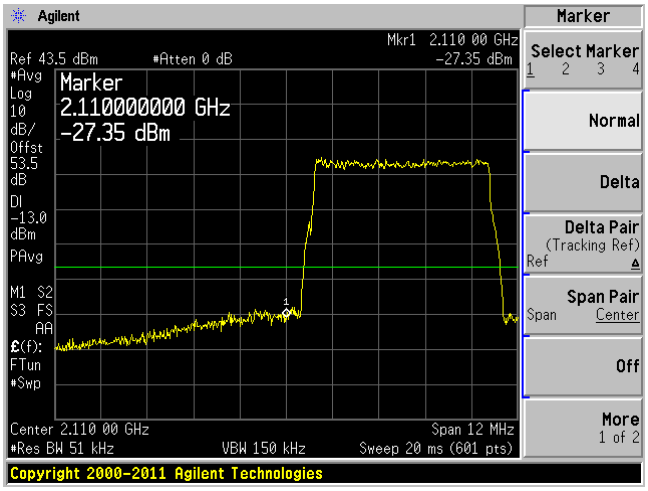
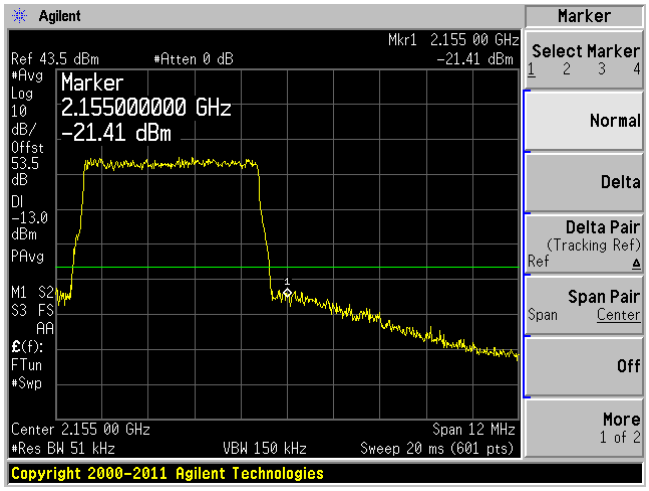



Low Channel, Chain J1

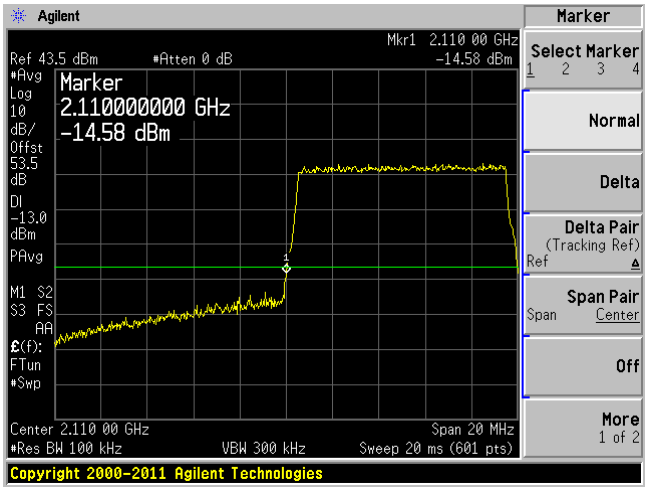



High Channel, Chain J1

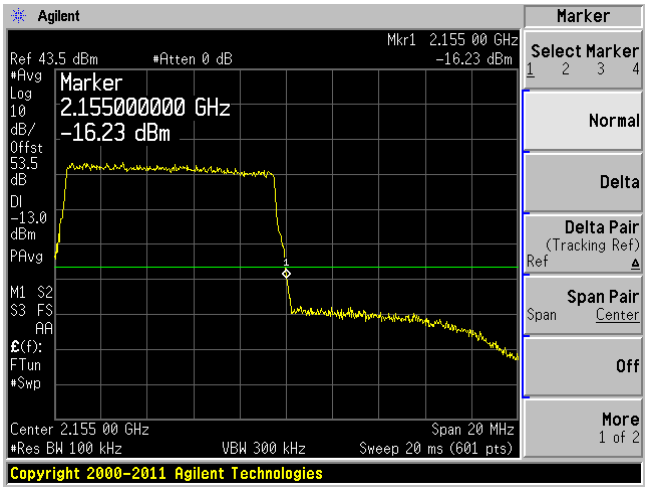


QPSK (10 MHz)

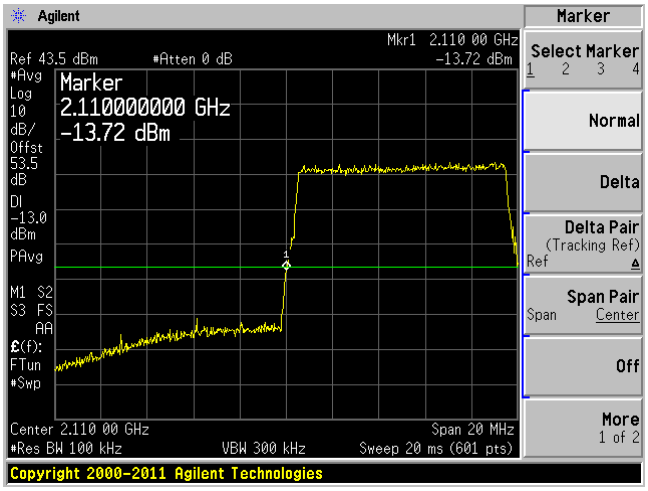
Low Channel, Chain J0



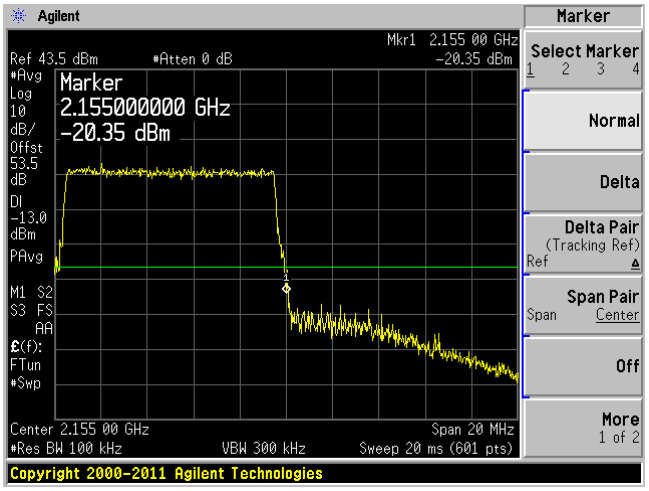

High Channel, Chain J0




Low Channel, Chain J1

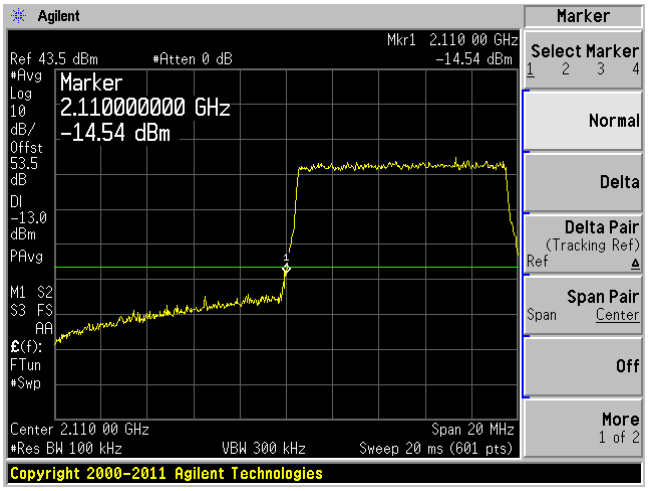



High Channel, Chain J1

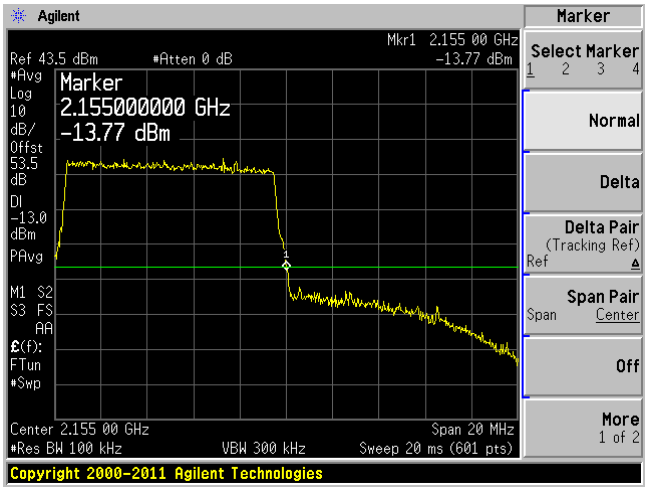


16QAM (10 MHz)

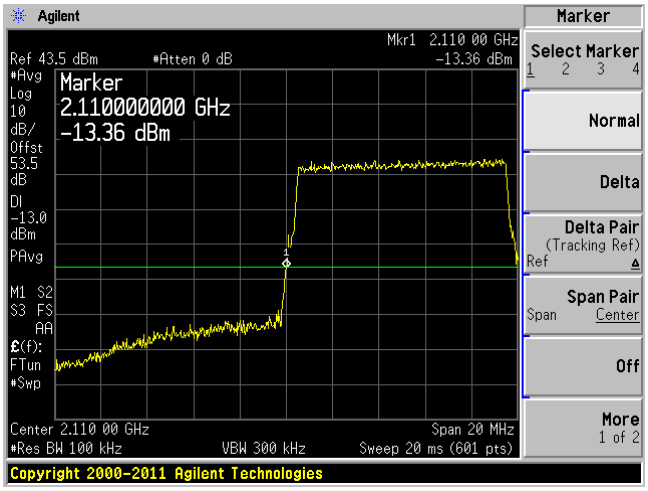
Low Channel, Chain J0



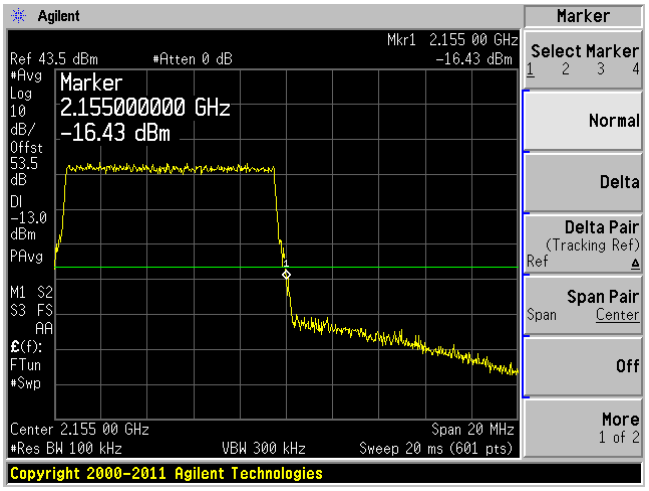

High Channel, Chain J0




Low Channel, Chain J1

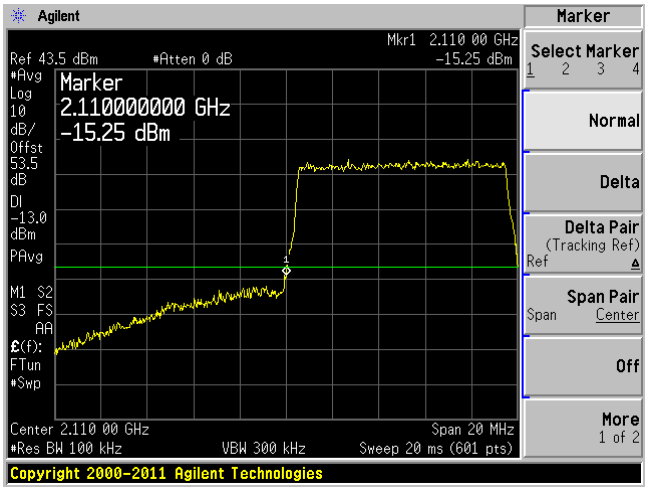



High Channel, Chain J1

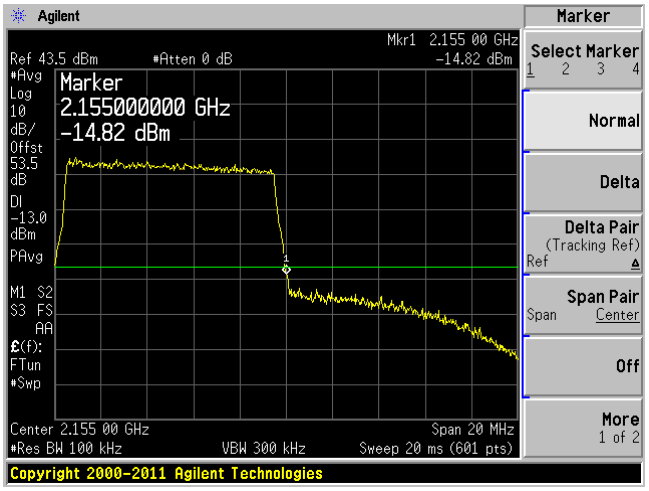


64QAM (10 MHz)

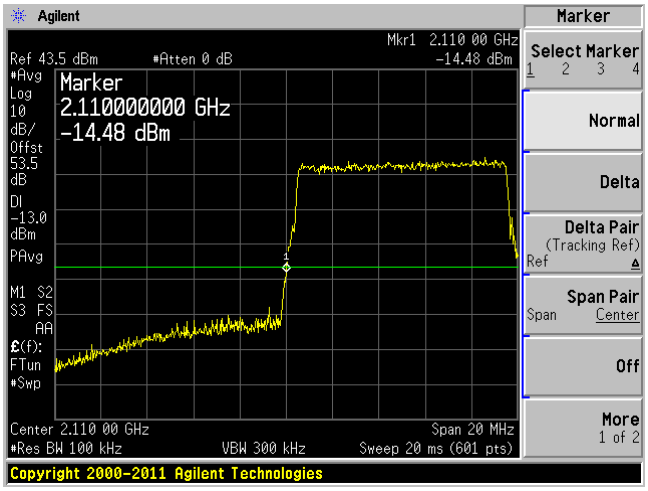
Low Channel, Chain J0



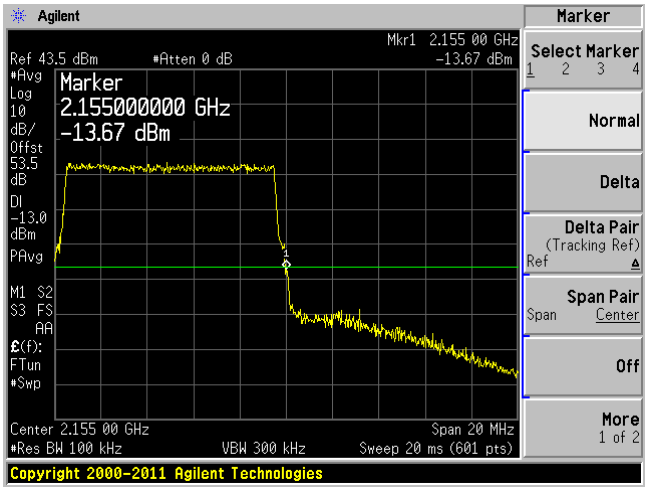

High Channel, Chain J0




Low Channel, Chain J1

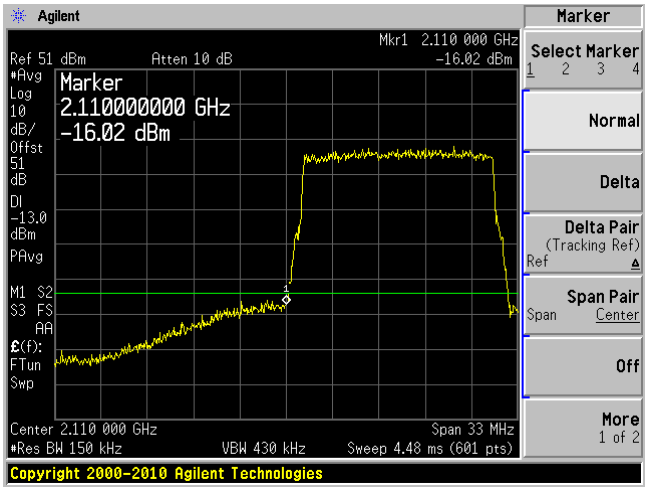



High Channel, Chain J1

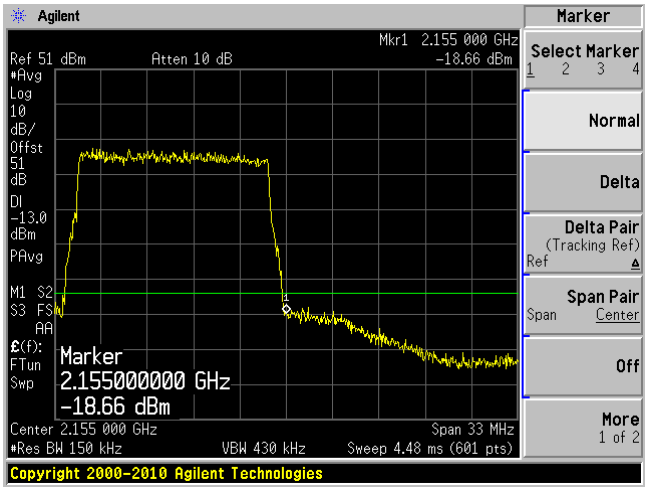


QPSK (15 MHz)

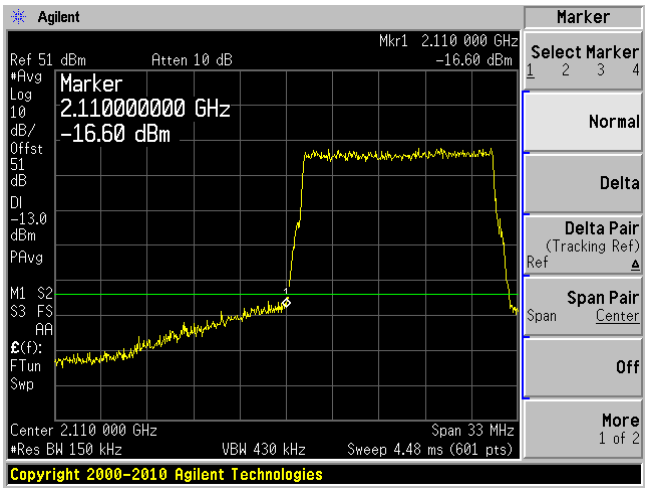
Low Channel, Chain J0



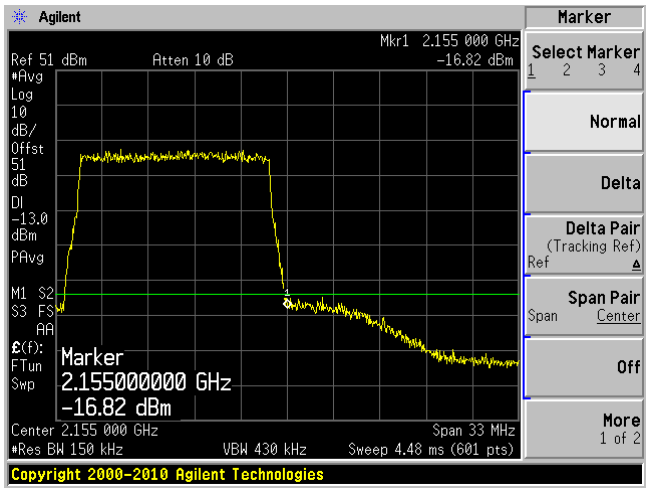

High Channel, Chain J0




Low Channel, Chain J1

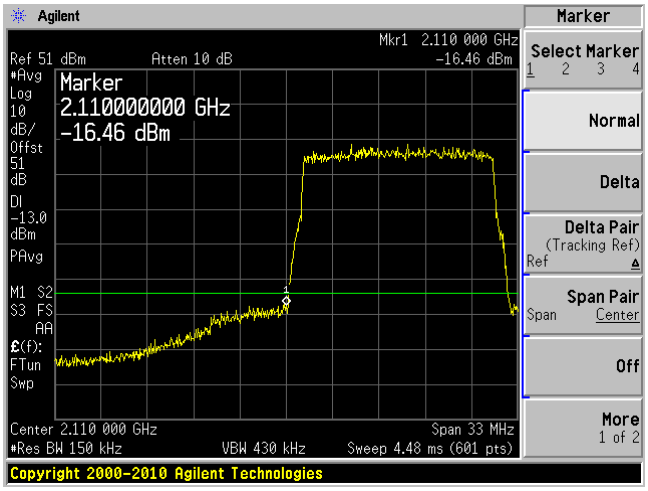



High Channel, Chain J1

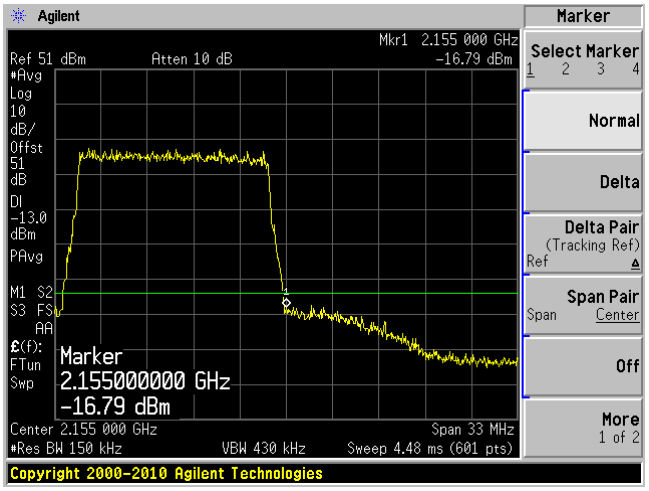


16QAM (15 MHz)

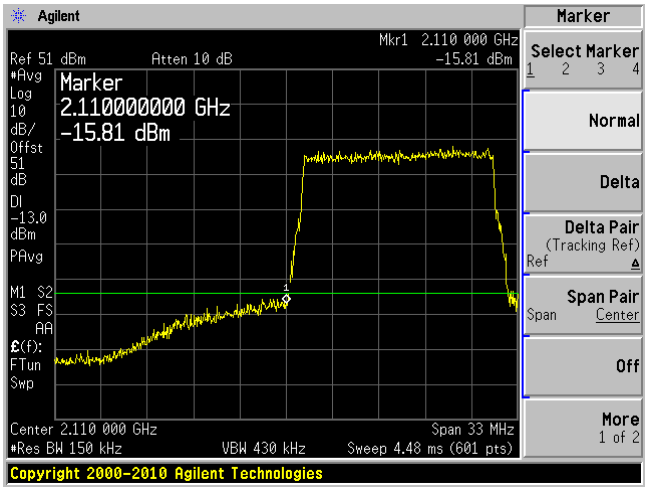
Low Channel, Chain J0



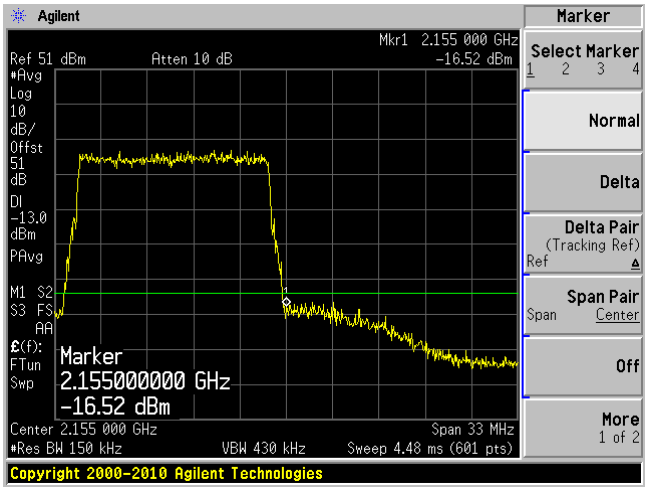

High Channel, Chain J0




Low Channel, Chain J1

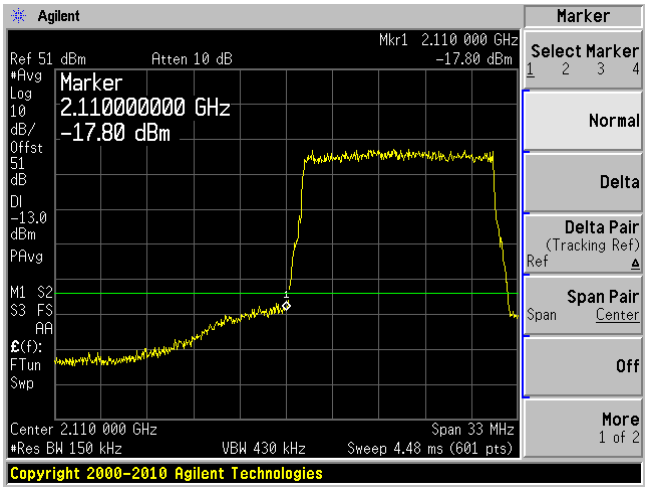



High Channel, Chain J1

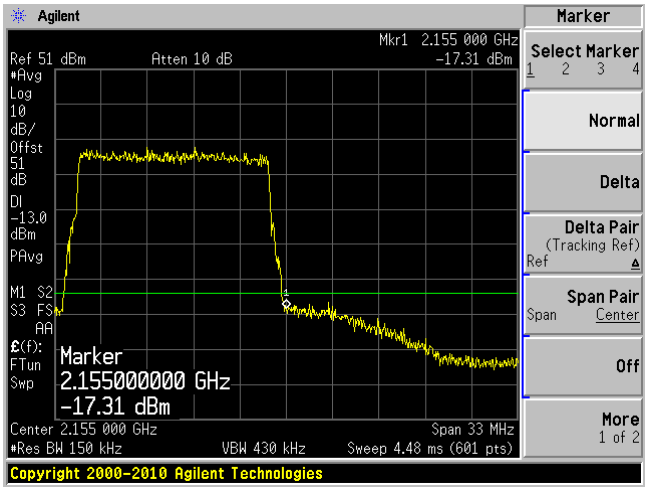


64QAM (15 MHz)

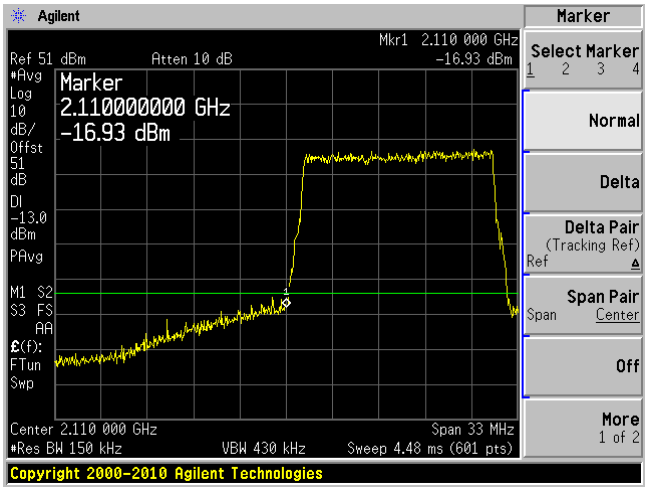
Low Channel, Chain J0



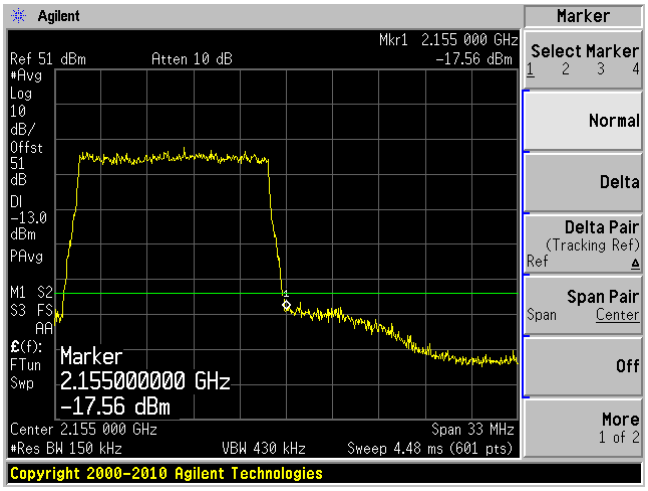

High Channel, Chain J0




Low Channel, Chain J1

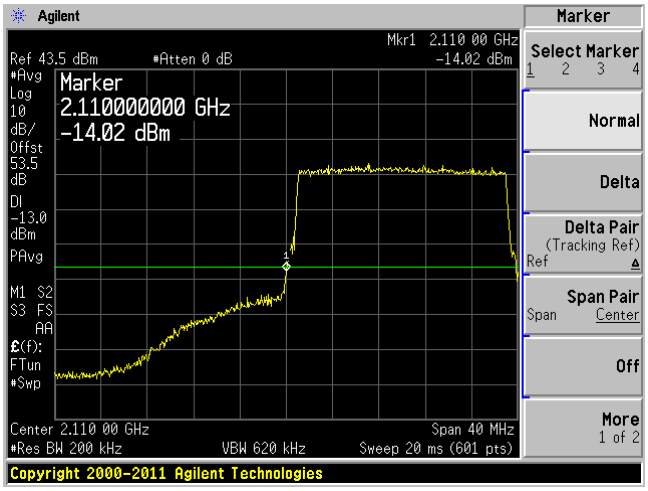



High Channel, Chain J1

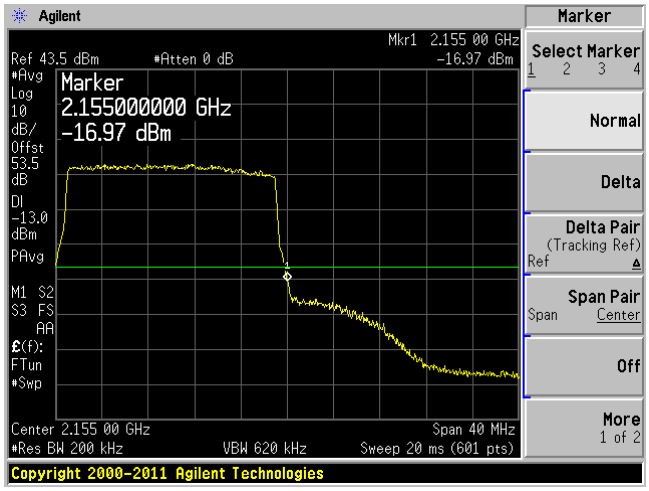


QPSK (20 MHz)

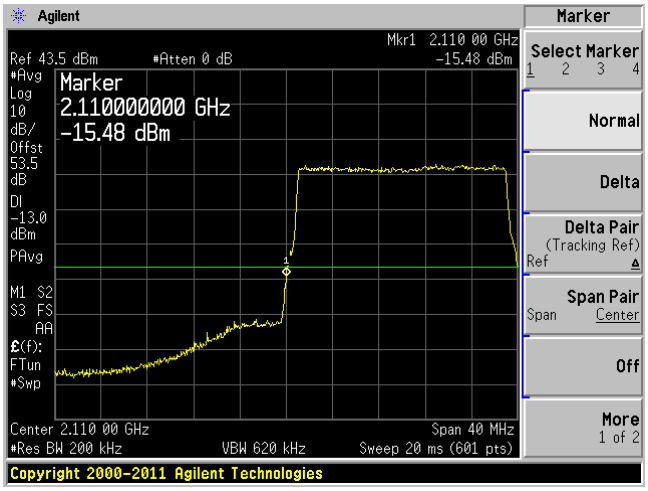
Low Channel, Chain J0



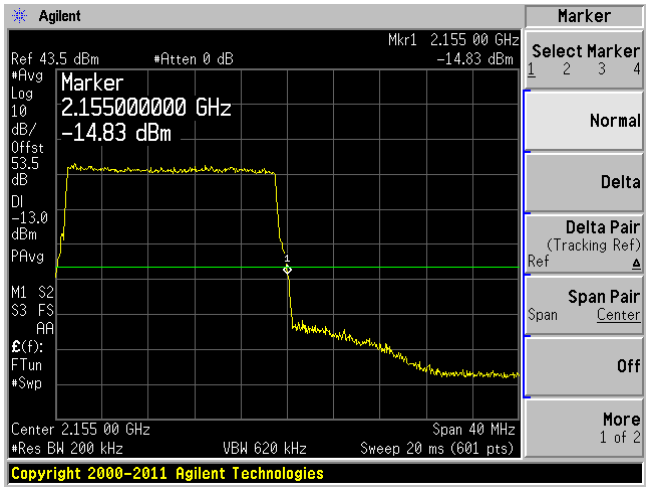

High Channel, Chain J0




Low Channel, Chain J1

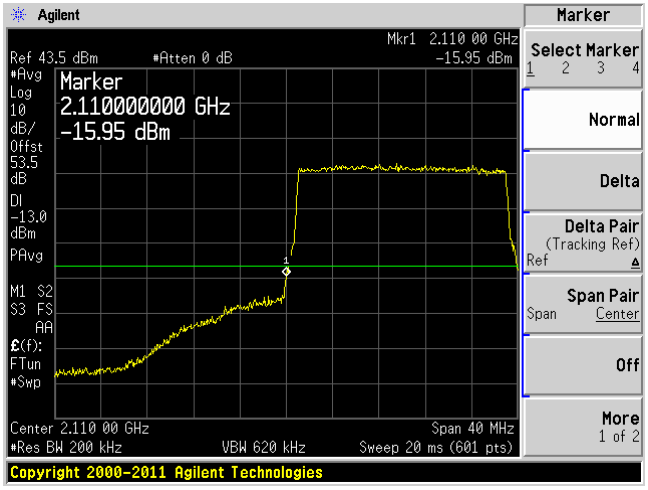



High Channel, Chain J1

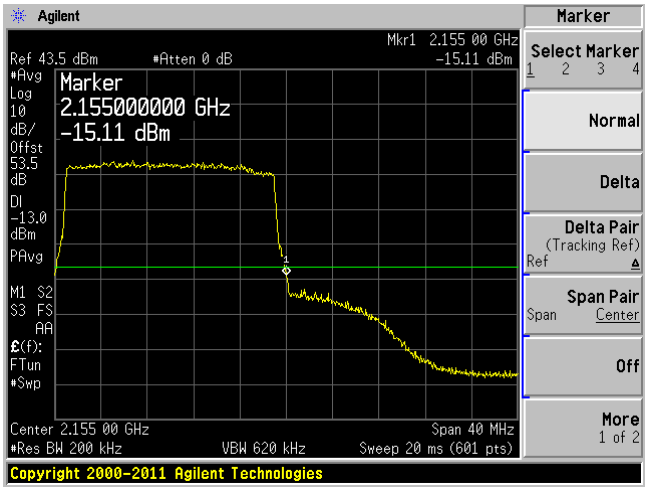


16QAM (20 MHz)

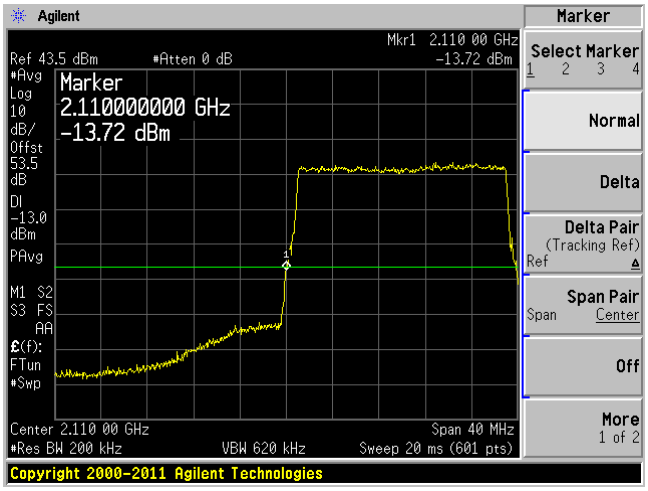
Low Channel, Chain J0



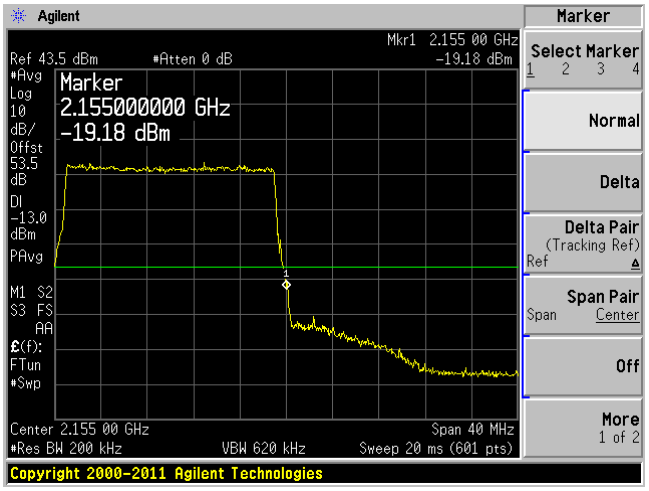

High Channel, Chain J0




Low Channel, Chain J1

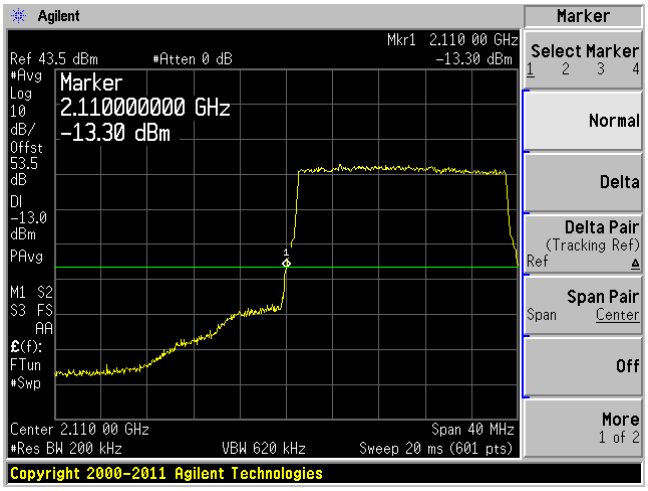



High Channel, Chain J1

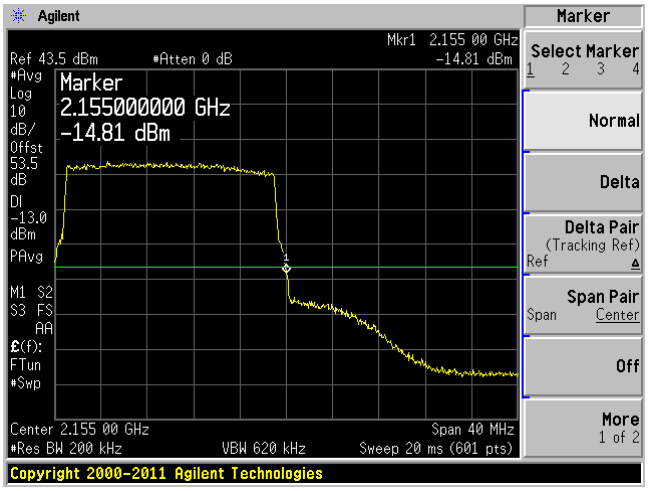


64QAM (20 MHz)

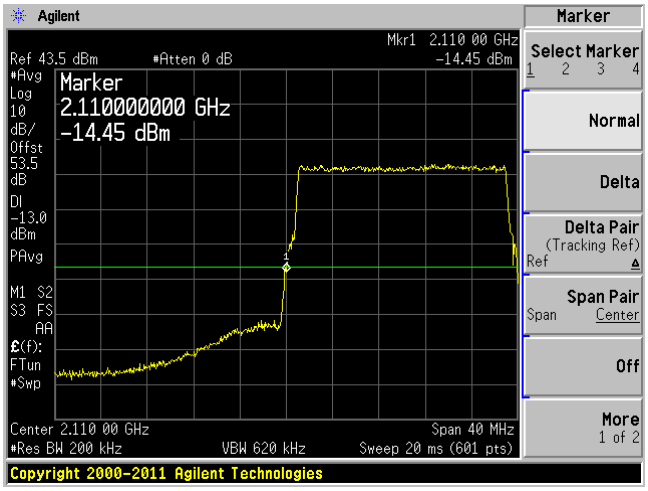
Low Channel, Chain J0



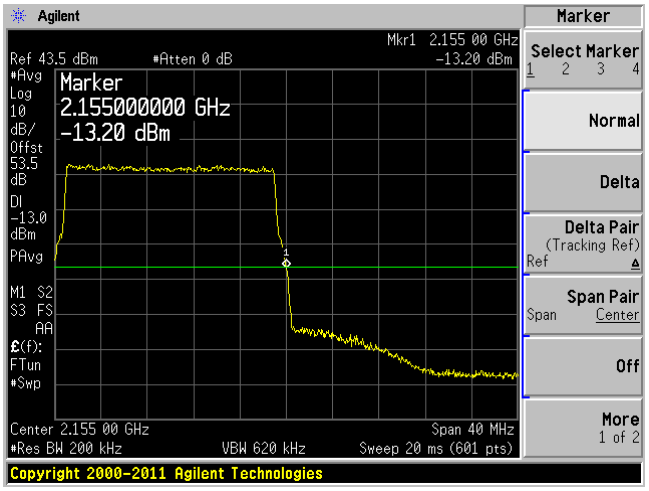

High Channel, Chain J0




Low Channel, Chain J1




High Channel, Chain J1



# 9 FCC §1.1307(b)(1) & §2.1091 – RF Exposure Information

## 9.1 Applicable Standard

According to FCC §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

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 (minute) |
|---|---|---|---|---|
| **Limits for General Population/Uncontrolled Exposure** | | | | |
| 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 |

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

## 9.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from 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): | 39.98 |
| Maximum peak output power at antenna input terminal (mW): | 9954.05 |
| Prediction distance (cm): | 40 |
| Prediction frequency (MHz): | 2118 |
| Antenna Gain, typical (dBi): | 5.0 |
| Cable Loss (dB): | 2.0 |
| Power density at predication frequency and distance ($mW/cm^2$): | 0.991 |
| MPE limit for uncontrolled exposure at predication frequency ($mW/cm^2$): | 1.0 |

To meet FCC MPE for the general population/uncontrolled environment, the minimum safety distance should be 40 cm from the device. RF exposure compliance is addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-locating requirements of FCC §1.1307(b)(3).