FCC PART 90

TEST AND MEASUREMENT REPORT

For

Teltronic S.A.U.

Poligono Malpica, Calle F Oeste, Parcela 12,

50016 Zaragoza, Spain

FCC ID: WT7PTHTT500760B
Model: HTT-500 763-870 MHz

Report Type: Original Report	**Product Type:** Digital Handheld Terminal

Prepared By: Ning Ma

Report Number: R1212273-90

Report Date: 2013-04-02

Reviewed By: Quinn Jiang, Test Engineer

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1212273-90	Original Report	2013-04-02

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Teltronic S.A.U.* and their product FCC ID: WT7PTHTT500760B, model: HTT-500 763-870 MHz, which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a digital handheld terminal with GPS receiver

Specifications	
Frequency Band	C4FM: 769-775 MHz/799-805 MHz D-LMR: 769-775 MHz/799-805 MHz; 806-824 MHz/851-869 MHz TETRA: 809-824 MHz/854-869 MHz FM: 806-824 MHz/851-869 MHz
Modulation Type	C4FM FM D-LMR: π/4-DQPSK, TDMA 4 slots TETRA: π/4-DQPSK, TDMA 4 slots
Emission Designator	C4FM: 8K10F1E, 8K10F1D, 8K10F1W FM: 14K0F3E, 16K0F3E D-LMR: 20K0D7W, 20K0D7E, 20K0D7D, 20K0Q7W, 20K0Q7E, 20K0Q7D TETRA: 22K0D7W, 22K0D7E, 22K0D7D, 22K0Q7W, 22K0Q7E, 22K0Q7D
RF Output Power	TETRA, D-LMR, C4FM, FM: 1 Watt (High Power) TETRA, D-LMR : 0.03 Watt (Low Power) C4FM, FM: 0.3 Watt (Low Power)
Channel Spacing	C4FM: 12.5 kHz FM: 20 kHz, 25 kHz D-LMR, TETRA: 25 kHz
Necessary /authorized Bandwidth	C4FM: 8.1 kHz (Necessary BW) / 11.25 kHz (Authorized BW) FM: 14 kHz (Necessary BW)/20 kHz (Authorized BW) 16 kHz (Necessary BW)/20 kHz (Authorized BW) D-LMR: 20 kHz TETRA: 22 kHz
Power Supply	7.4 Vdc Li-Pol Battery

RF Channel Spacing for D-LMR and TETRA: 25 kHz (Spectrum Efficiency 6.25 kHz)
Note: TDMA access scheme with 4 physical channels per carrier. The channel bandwidth is 25 kHz. As a result, the equipment meets the narrowbanding spectrum efficiency standard of one voice channel per 6.25 kHz of channel bandwidth. Modulation is π/4-DQPSK with 18 Ksym/sec. This modulation is based on transmitting two bits per symbol, so the data rate for each physical channel is 9000 bits per second (higher than narrowbanding standard of 4800 bps per 6.25 kHz of channel bandwidth).

1.2 Mechanical Description

The EUT measures approximately 16cm (L) x 6cm (W) x 4cm (H) and weighs 397.5g with battery, 297.5g without battery.

The test data gathered are from production sample. Serial number: 000127031179030 *provided by Teltronic S.A.U.*

1.3 Objective

This type approval report is prepared on behalf of *Teltronic S.A.U.* in accordance with Part 90 and Rule & Order 12-114 of the Federal Communication Commissions rules.

The objective was to determine the RF Output Power, Modulation Characteristics, Occupied Bandwidth, Transmitter Spurious Emissions, Emission Mask, Adjacent Channel Power and Frequency Stability are in compliance with the FCC rules.

1.4 Related Submittal(s)/Grant(s)

None

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 individual parts:

Part 90 – Private Land Mobile Radio Service

Applicable Standards:TIA603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories 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 CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from $\pm$2.0 dB for Conducted Emissions tests and $\pm$4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility and Accreditation

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 C63.4-2003, 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 EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software used was TDriver.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturers	Descriptions	Models	Serial Numbers
Teltronic S.A.U.	Main Board	F072001	-
Teltronic S.A.U.	MMI Board	F072002	-
Teltronic S.A.U.	GPS Board	F072004	-

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
Dell	Laptop	PP05L	7T390 A02

2.6 Power Supply

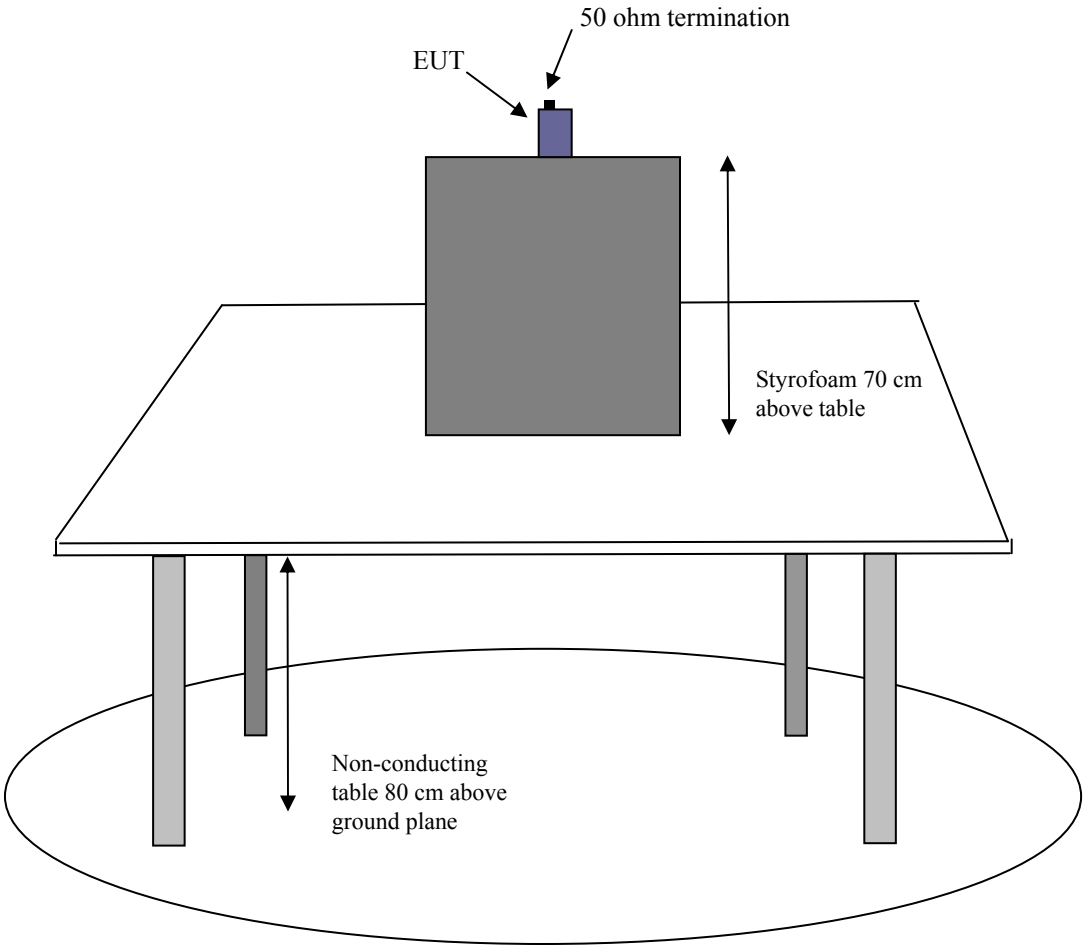
Manufacturer	Description	Model	Serial Number
Sunny	Switching Adapter	SYS1308-2412-W2	-

2.7 External I/O Cabling List and Details

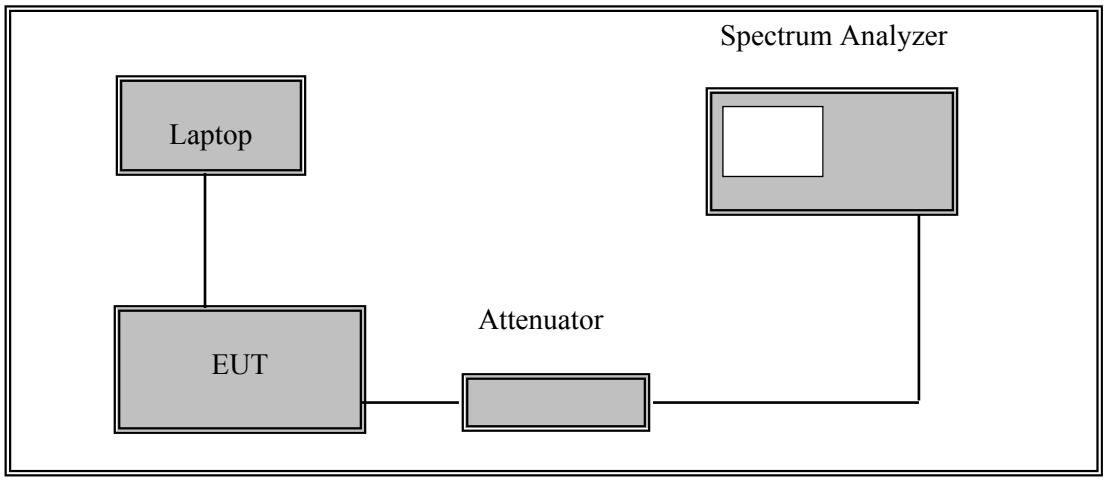
Cable Description	Length (m)	From	To
Serial cable	>1.0	Laptop Serial port	EUT Serial Port
RF cable	>1.0	EUT Output	PSA

2.8 Test Setup Block Diagram

Radiated Test



Conducted Test



3 Summary of Test Results

FCC Rules	Description of Tests	Results
FCC §1.1310, §2.1093	RF Exposure	Compliant
FCC §2.1046, §90.205	RF Output Power	Compliant
FCC §2.1047, §90.207	Modulation Characteristics, Audio Frequency Response and Audio Filter Response	Compliant[1]
FCC §2.1049, §90.209, §90.210	Occupied Bandwidth and Emission Mask	Compliant
FCC §2.1051, §90.210 §90.221	Spurious Emissions at Antenna Terminals	Compliant
FCC §2.1055, §90.213 §90.539	Frequency Stability	Compliant
FCC§2.1053, §90.210 §90.221, §90.543 (f)	Field Strength of Spurious Radiation 1559-1610 MHz Radiated Emissions (GNSS)	Compliant
FCC §90.214	Transient Frequency Behavior	N/A
FCC §2.1049, §90.221 §90.543	Adjacent Channel Power	Compliant

N/A: Not applicable.
Note 1: This test was completed by Teltronic S.A.U with test report.
Modulation Characteristics: D370000_RG95ed0100_Laboratory_Measurements_Reference_Guide

4 FCC §2.1093 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1093

4.2 Test Result

Compliant: Please refer SAR report: R1212273-FCC-SAR.

5 FCC §2.1046 & §90.205 - RF Output Power

5.1 Applicable Standard

According to FCC §2.1046, and §90.205. The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b) and (c) of §90.635.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

5.2 Test Procedure

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

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	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:	21 °C
Relative Humidity:	43 %
ATM Pressure:	101.1 kPa

The testing was performed by Ning Ma on 2013-02-04 at the RF site.

5.5 Test Results

763-806 MHz

Test Mode: 25 kHz Channel Spacing, D-LMR

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
769-775	769.1	15.95	0.039	30.79	1.199
	772	15.42	0.035	30.63	1.156
	774.9	15.62	0.036	30.78	1.197
799-805	799.1	15.48	0.035	29.89	0.975
	802	15.88	0.039	30.39	1.094
	804.9	15.91	0.039	30.84	1.213

Note: Manufacturer's rated power is 0.03-1.0 Watt

Test Mode: 12.5 kHz Channel Spacing, C4FM

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
769-775	769.1	24.52	0.283	30.60	1.148
	772	25.43	0.349	30.14	1.033
	774.9	25.89	0.388	30.62	1.153
799-805	799.1	25.53	0.357	30.54	1.132
	802	24.45	0.279	30.79	1.199
	804.9	25.22	0.333	29.77	0.948

Note: Manufacturer's rated power is 0.3-1.0 Watts

806-870 MHz

Test Mode: 25 kHz Channel Spacing TETRA

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
809-824	809.1	15.57	0.036	30.24	1.057
	815	15.71	0.037	30.64	1.159
	823.9	15.54	0.036	29.94	0.986
854-869	854.1	15.65	0.037	30.56	1.138
	860	15.68	0.037	30.73	1.183
	868.9	15.45	0.035	30.44	1.107

Note: Manufacturer's rated power is 0.03-1.0 Watt

Test Mode: 25 kHz Channel Spacing, D-LMR

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
806-824	806.1	15.32	0.034	29.38	0.867
	815	15.83	0.038	30.00	1.000
	823.9	15.40	0.035	29.19	0.830
851-869	851.1	15.56	0.036	30.18	1.042
	860	14.15	0.026	29.27	0.845
	868.9	15.35	0.034	30.13	1.030

Note: Manufacturer's rated power is 0.03-1.0 Watt

Test Mode: 20 KHz Channel Spacing, FM

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
806-824	806.1	25.08	0.322	30.37	1.089
	815	25.13	0.326	30.40	1.096
	823.9	25.02	0.318	30.36	1.086
851-869	851.1	25.11	0.324	30.51	1.125
	860	25.09	0.323	30.46	1.112
	868.9	25.06	0.321	30.42	1.102

Note: Manufacturer's rated power is 0.3-1.0 Watt

Testing Mode: 25 kHz channel spacing, FM

FCC Band (MHz)	Frequency (MHz)	Low Output Power (dBm)	Low Output Power (Watt)	High Output Power (dBm)	High Output Power (Watt)
806-824	806.1	25.00	0.316	30.34	1.081
	815	24.93	0.311	30.28	1.067
	823.9	24.94	0.312	30.29	1.069
851-869	851.1	25.01	0.317	30.40	1.096
	860	24.99	0.316	30.40	1.096
	868.9	24.97	0.314	30.26	1.062

Note: Manufacturer's rated power is 0.3-1.0 Watt

6 FCC §2.1047 & §90.207 – Modulation Characteristic

6.1 Applicable Standard

FCC §2.1047 & §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. For equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

6.2 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
AGILENT	RF Generator	E4438C	MY45093571	2012-03-12	2 years
ROHDE&SCHWARZ	Radiocommunication Service Monitor	CMS54	846393/018	2012-02-18	2 years
XANTREX	Power Supply	XFR 100-28	E00132443	2012-02-18	3 years

6.3 Test Environmental Conditions

Temperature:	25.1ºC
Relative Humidity:	37.2%
ATM Pressure:	102.6 kPa

The testing was performed by Denny Soto on 2012-11-07 at Teltronic S.A.U.

6.4 Test Results

TETRA and D-LMR Transmitter Low Pass Filter

Type of Emission:

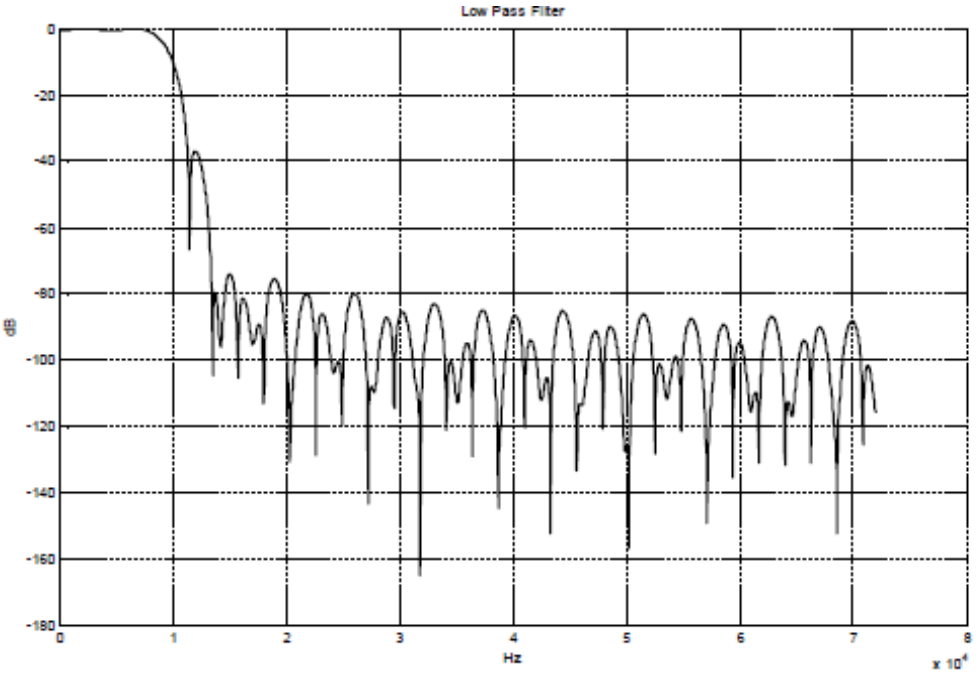
TETRA: 22K0Q7E, 22K0Q7D, 22K0Q7W, 22K0D7E, 22K0D7D, 22K0D7W
D-LMR: 20K0Q7E, 20K0Q7D, 20K0Q7W, 20K0D7E, 20K0D7D, 20K0D7W

The modulation used is π/4-shifted Differential Quaternary Phase Shift Keying (π/4-DQPSK), with a modulation rate of 18k symbol/sec. (36k bit/sec).

A root-raised-cosine filter (RRC) is used as transmitting and receiving filter in this digital communication system to perform matched filtering.
The combined response of two such filters is that of the raised-cosine filter.
The raised-cosine filter is a filter frequently used for pulse-shaping in digital modulation known for its ability to minimize intersymbol interference (ISI).

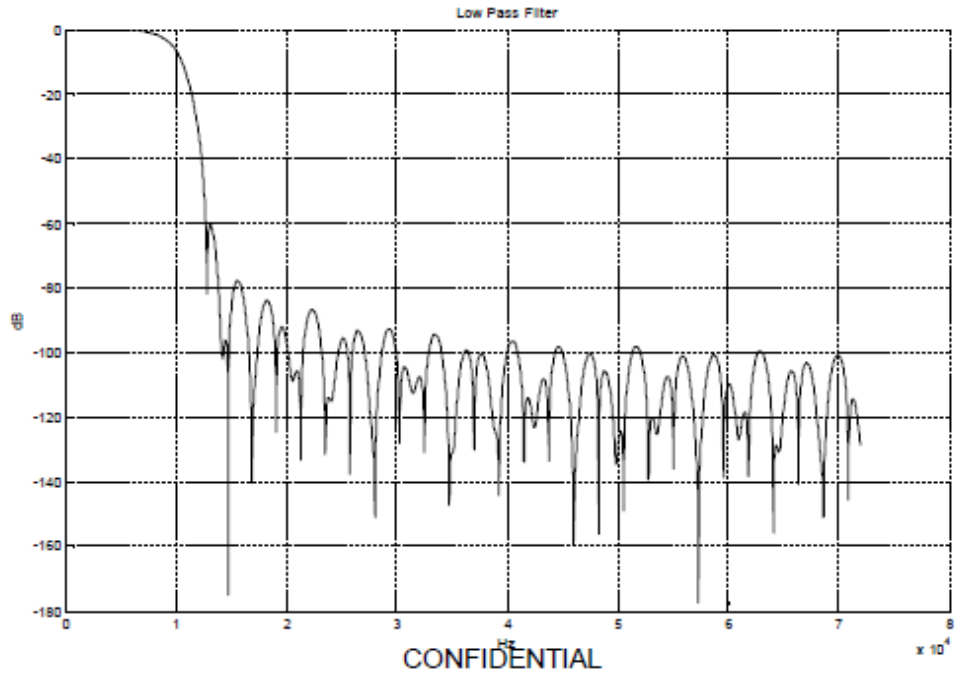
The access scheme is TDMA with 4 physical channels per carrier.

The following graph is the transfer function of the aforementioned filter for D-LMR modulation.



Note: Plot was provided by the manufacturer

The following graph is the transfer function of the aforementioned filter for TETRA modulation.



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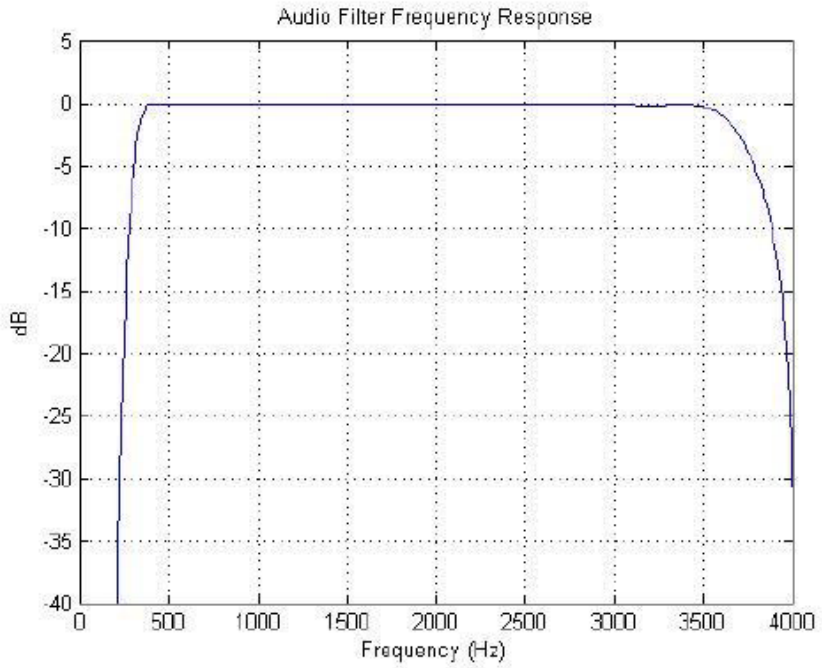
Note: Plot was provided by the manufacturer

Audio Low Pass Filter

The modulation is limited by data characteristics and its filters.

In the previous section, the phase and quadrature branches (I and Q) are filtered with a root-raised-cosine filter (RRC) with a symbol rate of 18k symbol/sec. After that, the signal is pi/4 DQPSK modulated (see the plot in the previous section) for D-LMR and TETRA modulations.

The signal processing is carried out using a digital filter implemented in the OMAP processor. The next picture shows its frequency response, which is valid for all modulations.

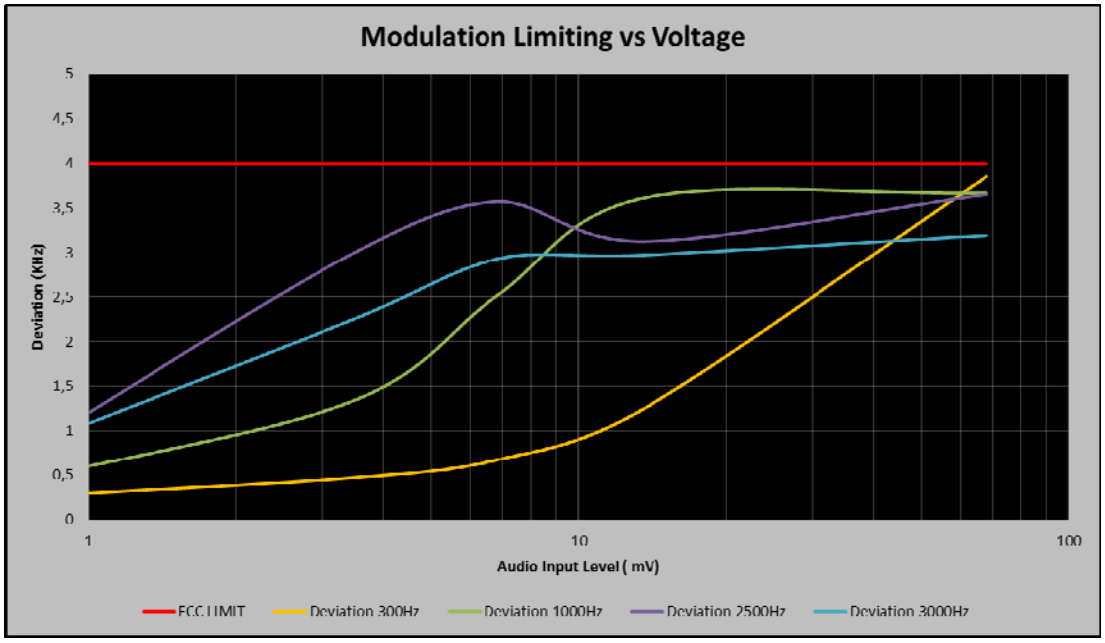


Note: Plot was provided by manufacturer.

FM Modulation Limiting vs. Voltage

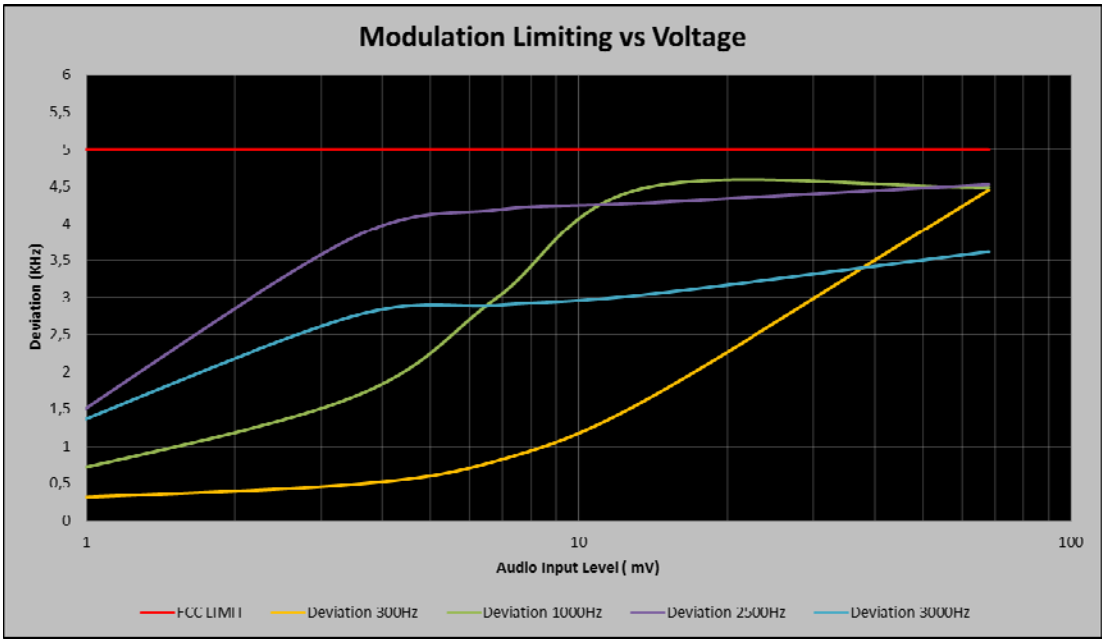
806-824 MHz, FM (20 kHz)

Middle Channel



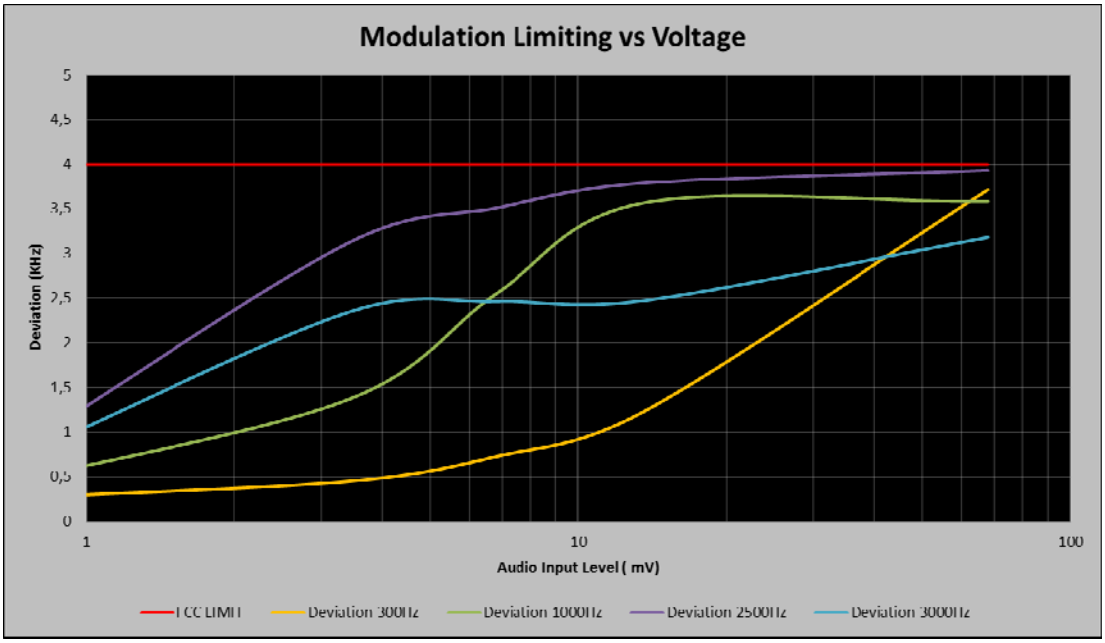
806-824 MHz, FM (25 kHz)

Middle Channel



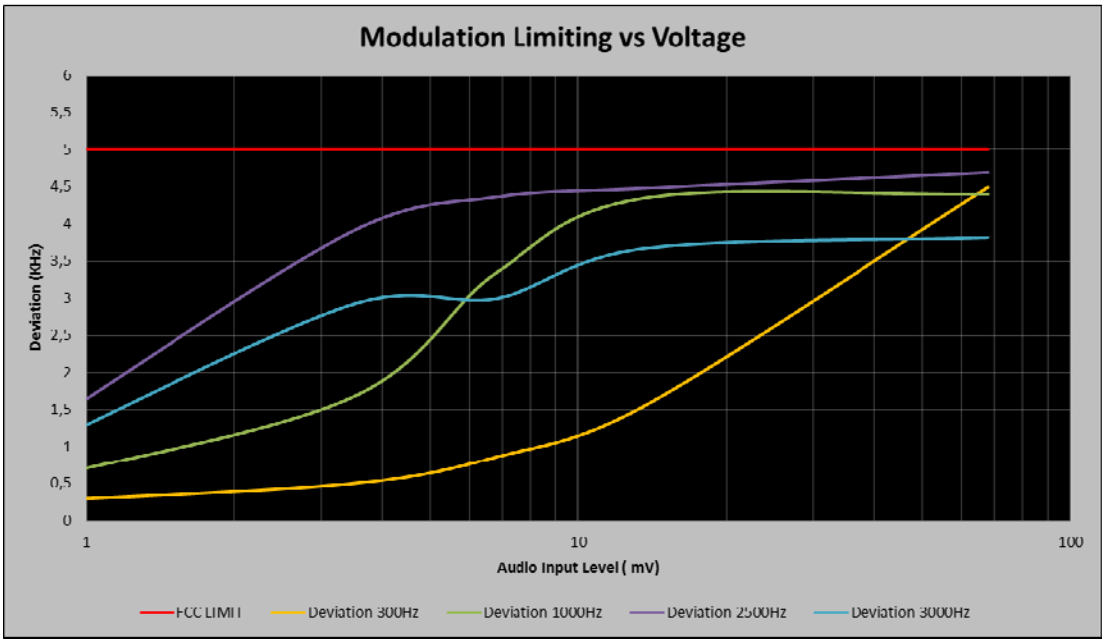
851-869 MHz, FM (20 kHz)

Middle Channel



851-869 MHz, FM (25 kHz)

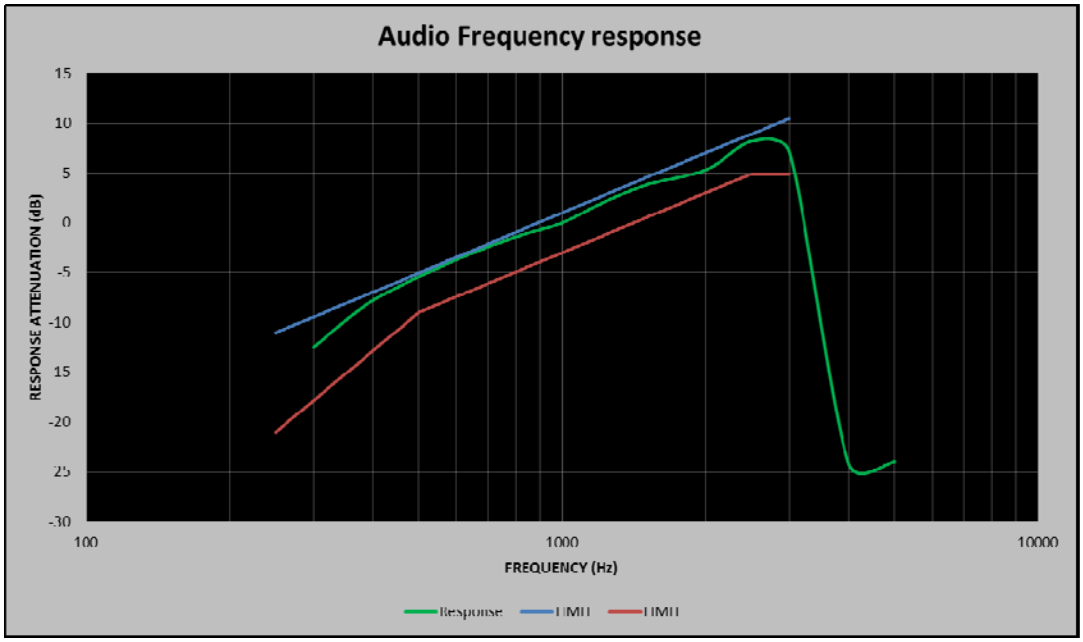
Middle Channel



FM Audio Frequency Response

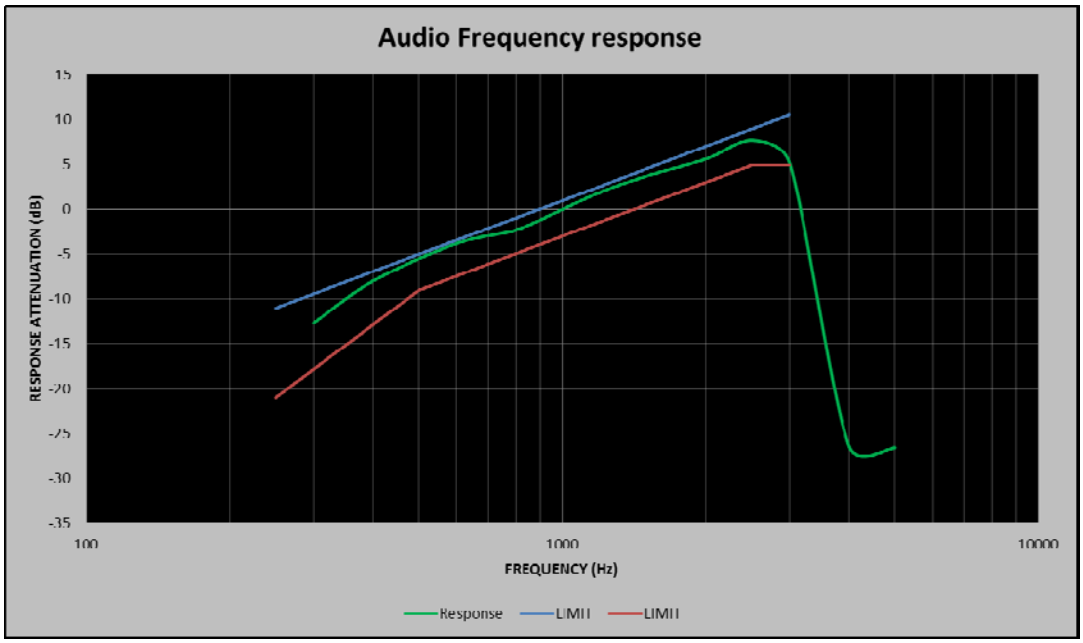
806-824 MHz, FM (20 kHz)

Middle Channel



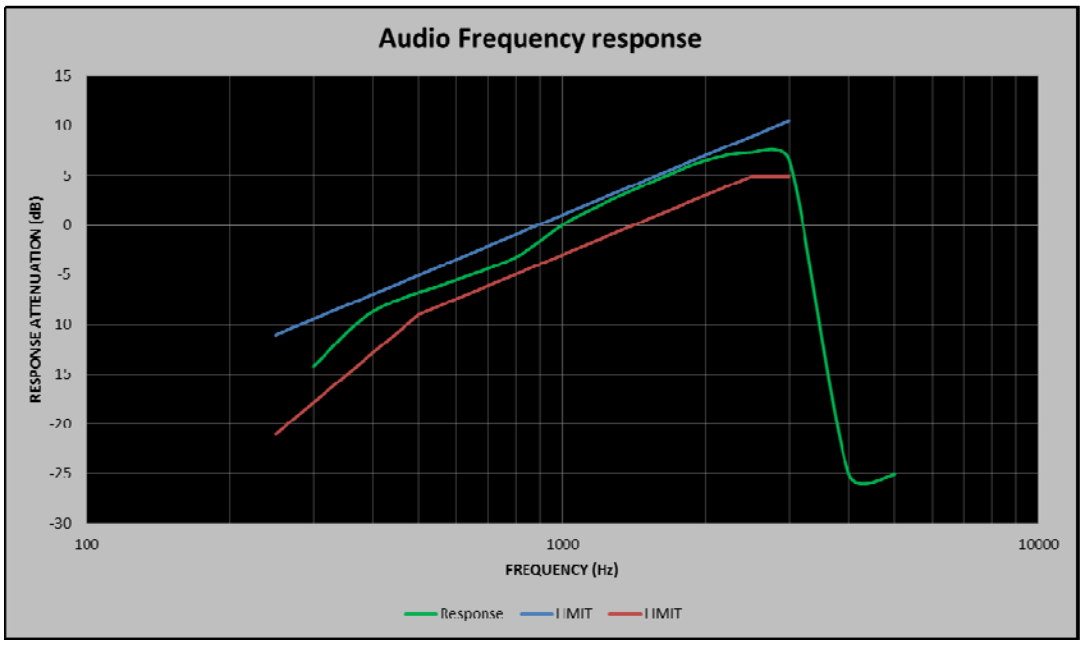
806-824 MHz, FM (25 kHz)

Middle Channel



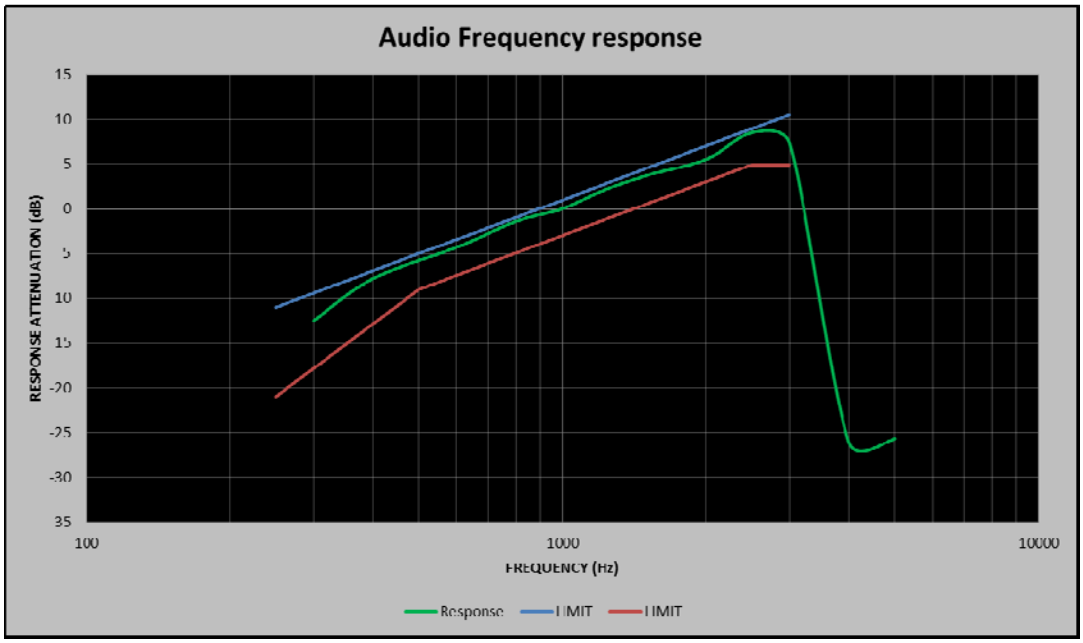
851-869 MHz, FM (20 kHz)

Middle Channel



851-869 MHz, FM (25 kHz)

Middle Channel



7 FCC §2.1049, §90.209 & §90.210 – Occupied Bandwidth & Emission Mask

7.1 Applicable Standard

According to FCC §90.210:

Frequency band (MHz)	Mask for equipment with Audio low pass filter	Mask for equipment without audio low pass filter
Below 25 [1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174 [2]	B, D, or E	C, D, or E
150 Paging-only	B	C
220-222	F	F
421-512 [2]	B, D, or E	C, D, or E
450 Paging-only	B	G
806-809/851-854	B	H
809-824/854-869 [3]	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990 MHz	L or M	L or M.
5850-5925 [4]		
All other bands	B	C

1 Equipment using single sideband J3E emission must the requirements of Emission Mask A. Equipment using other emissions must meet the requirements of Emission Mask B or C, as applicable.

2 Equipment designed to operate with a 25 kHz channel bandwidth must meet the requirements of Emission Mask B or C, as applicable. Equipment designed to operate with a 12.5 kHz channel bandwidth must meet the requirements of Emission Mask D, and equipment designed to operate with a 6.25 kHz channel bandwidth Must meet the requirements of Emission Mask E.

3 Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of § 90.691.

4 DSRCS Roadside Units equipment in the 5850-5925 MHz band is governed under subpart M of this part.

5 Equipment may alternatively meet the Adjacent Channel Power limits of § 90.221, where applicable.

Emission Mask B:

For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

(1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.

(2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.

(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Emission Mask EA:

(a) Out-of-band emission requirement shall apply only to the ‘‘outer’’ channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee’s frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log10(f/6.1) decibels or 50 + 10 Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

(2) For any frequency removed from the EA licensee’s frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log10(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

7.2 Test Procedure

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

Occupied Bandwidth:

- ...C4FM: The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ±15 KHz from the carrier frequency
- ...FM: The resolution bandwidth of the spectrum analyzer was set at 200 Hz and the spectrum was recorded in the frequency band ±25 KHz from the carrier frequency.
- ...D-LMR, TETRA: The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±25 KHz from the carrier frequency.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	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:	23 °C
Relative Humidity:	48.1 %
ATM Pressure:	101.1 kPa

The testing was performed by Ning Ma on 2013-02-06 in the RF Site.

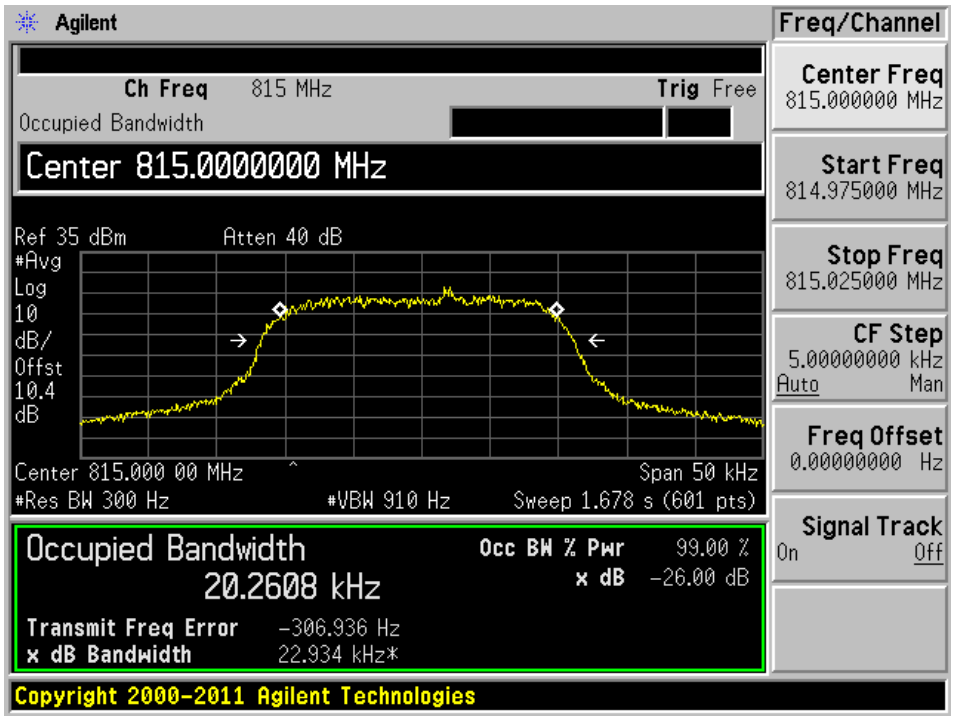
7.5 Test Results

Please refer to the following plots.

Occupied Bandwidth (High Power)

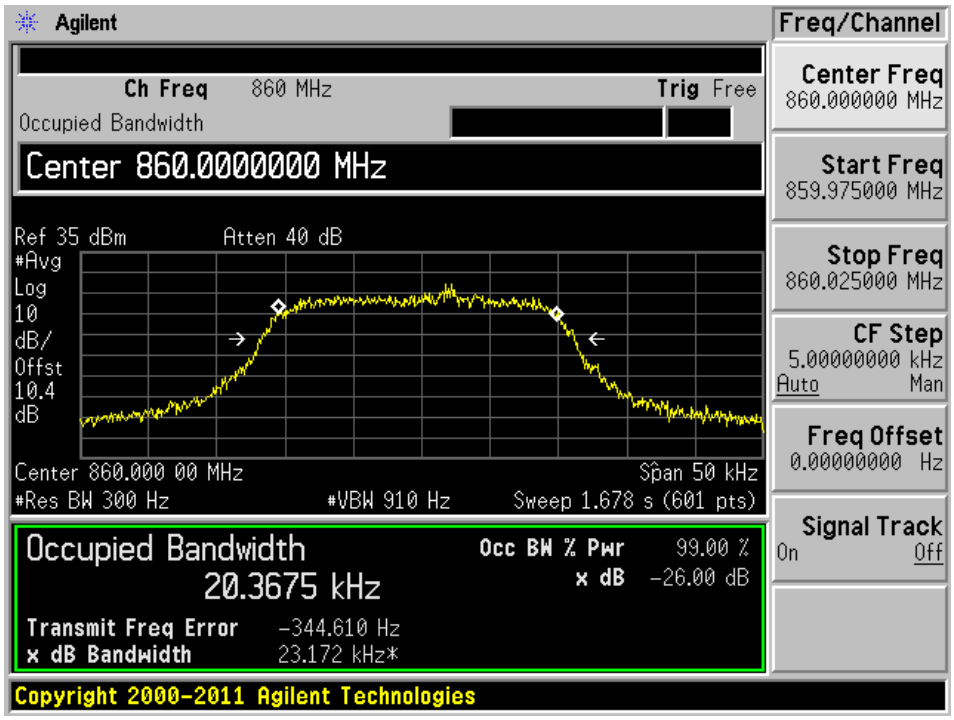
TETRA: 809 MHz – 824 MHz

Middle Channel – 815 MHz



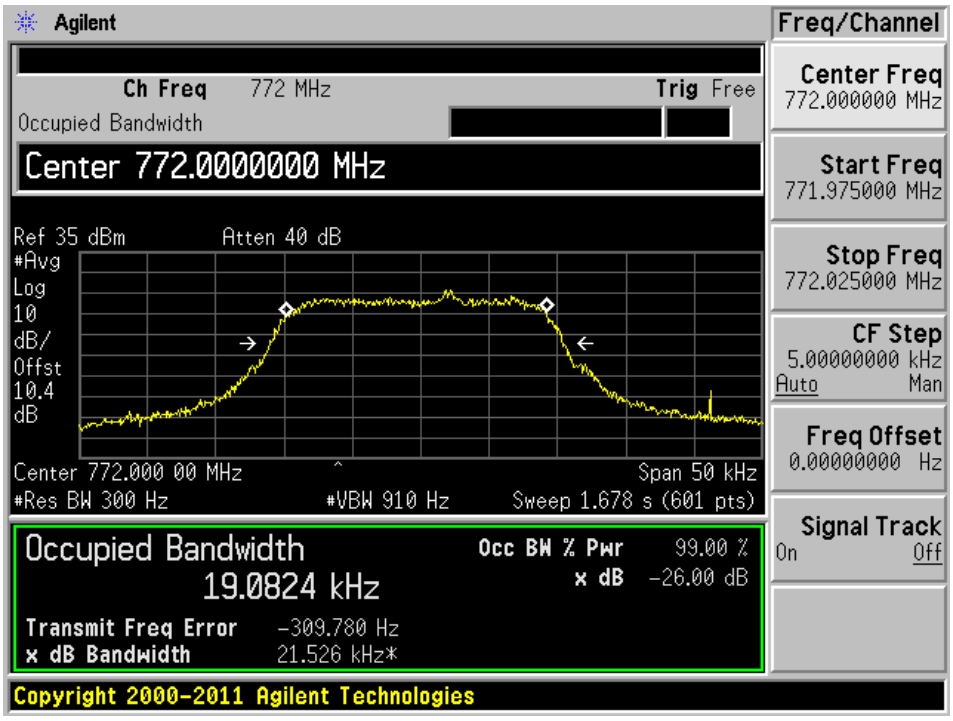
TETRA: 854 MHz - 869 MHz

Middle Channel – 860 MHz



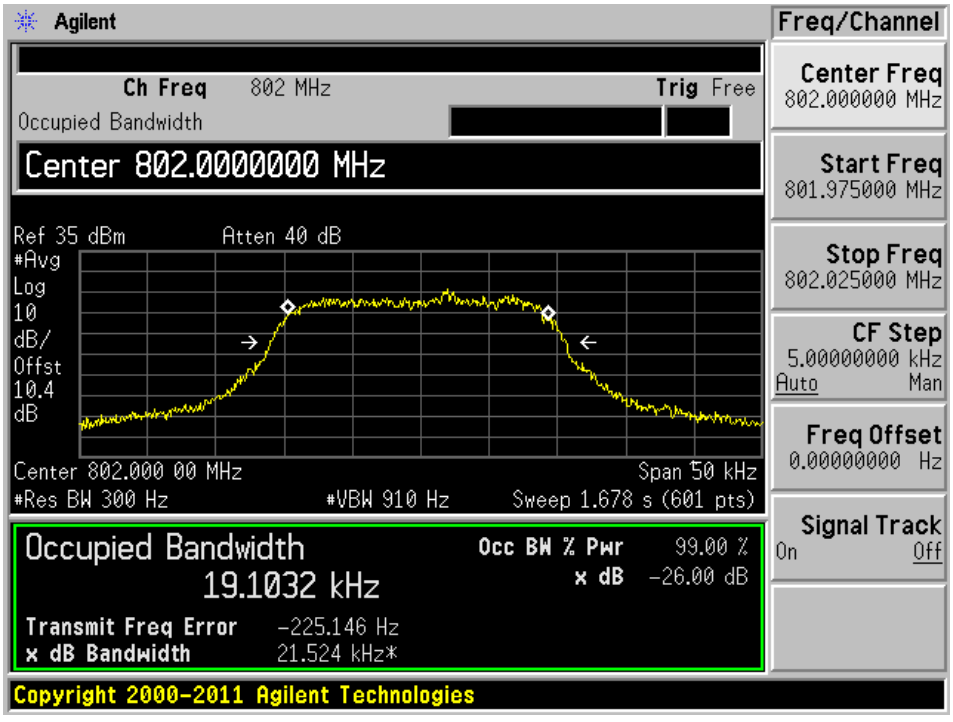
D-LMR: 769 MHz – 775 MHz

Middle Channel – 772 MHz



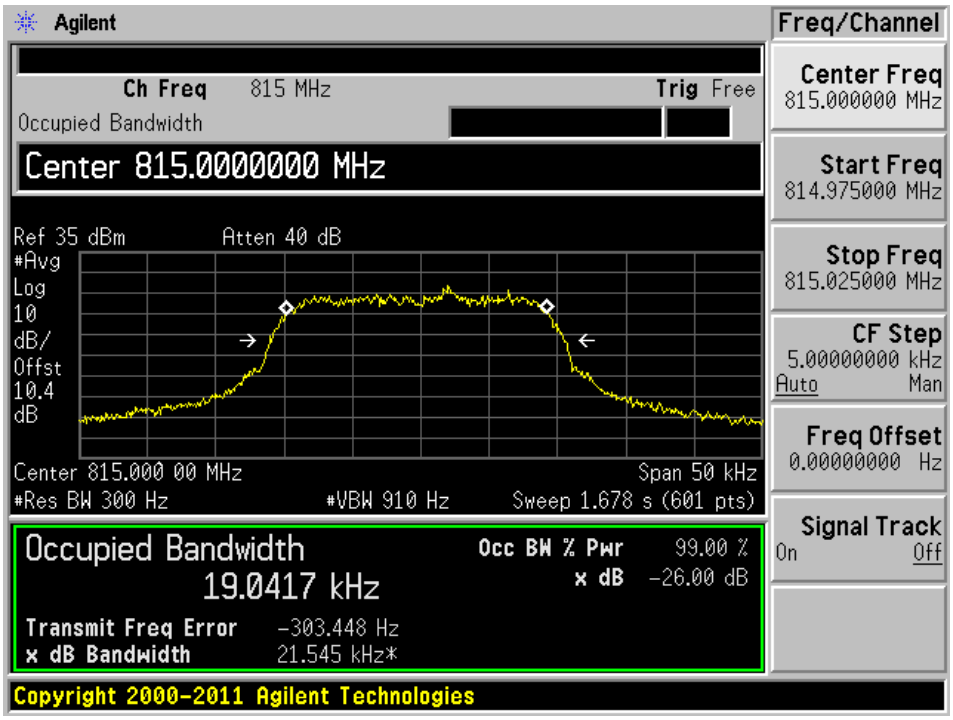
D-LMR: 799 MHz – 805 MHz

Middle Channel – 802 MHz



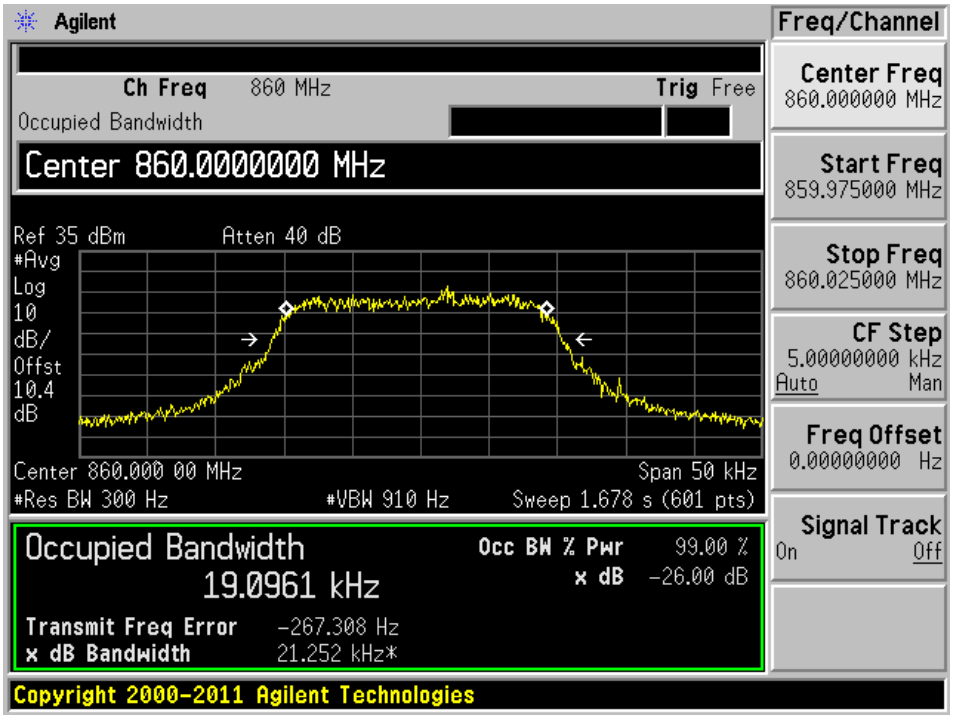
D-LMR: 806 MHz – 824 MHz

Middle Channel – 815 MHz



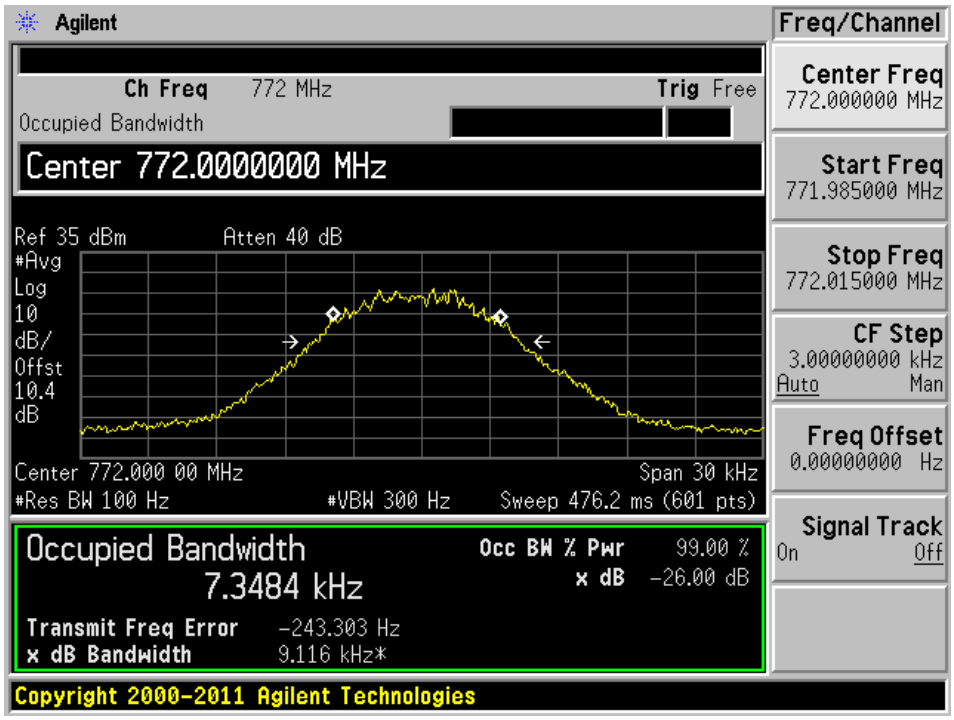
D-LMR: 851 MHz – 869 MHz

Middle Channel – 860 MHz



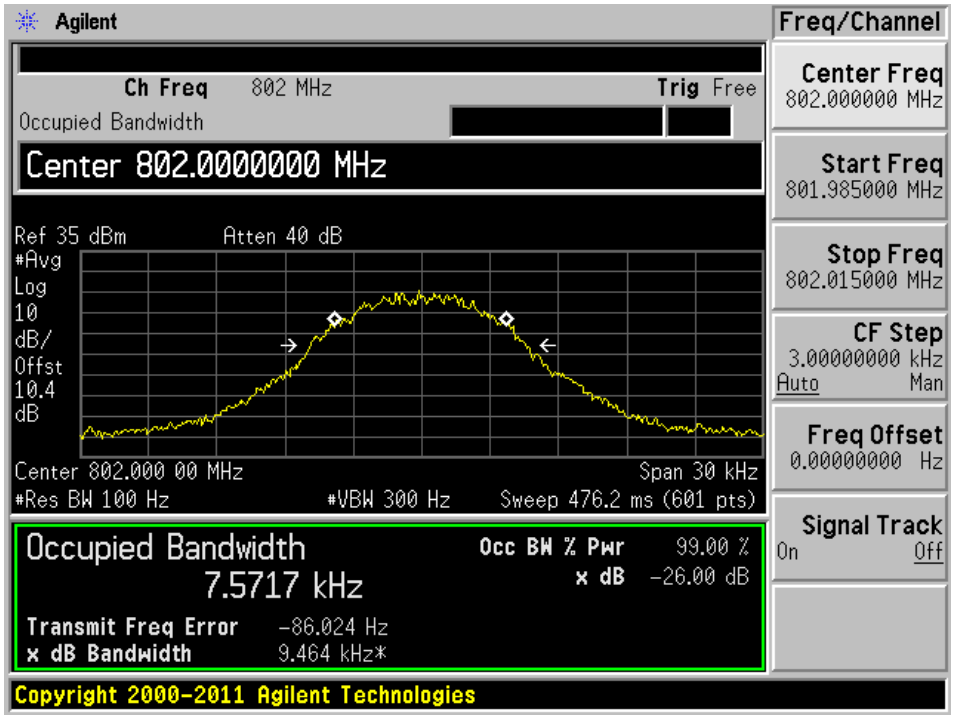
C4FM: 769 MHz – 775 MHz

Middle Channel – 772 MHz



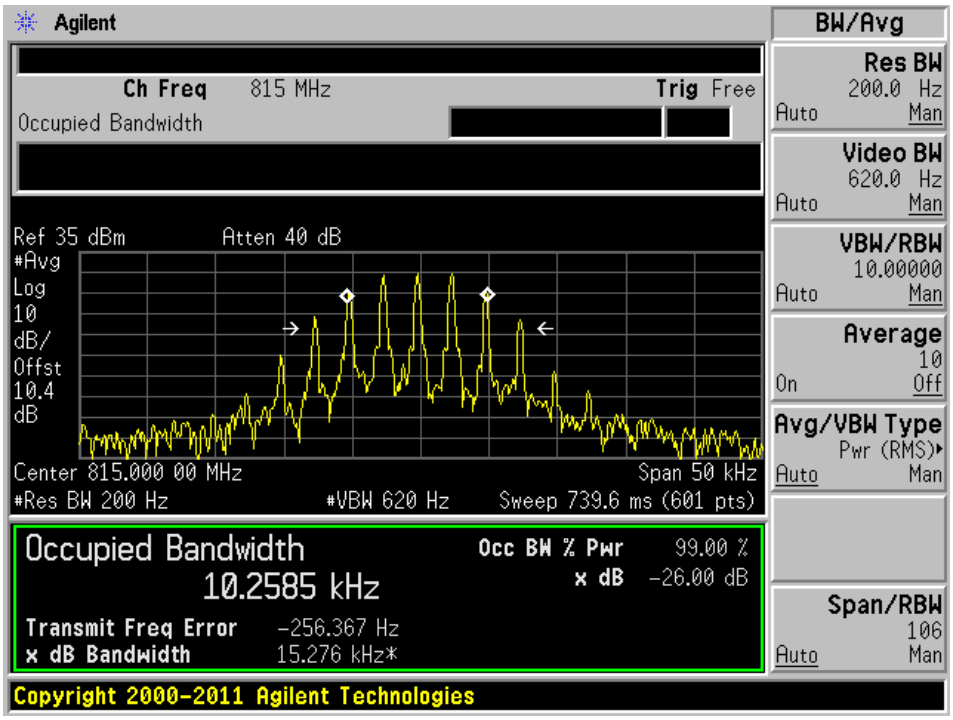
C4FM: 799 MHz – 805 MHz

Middle Channel – 802 MHz



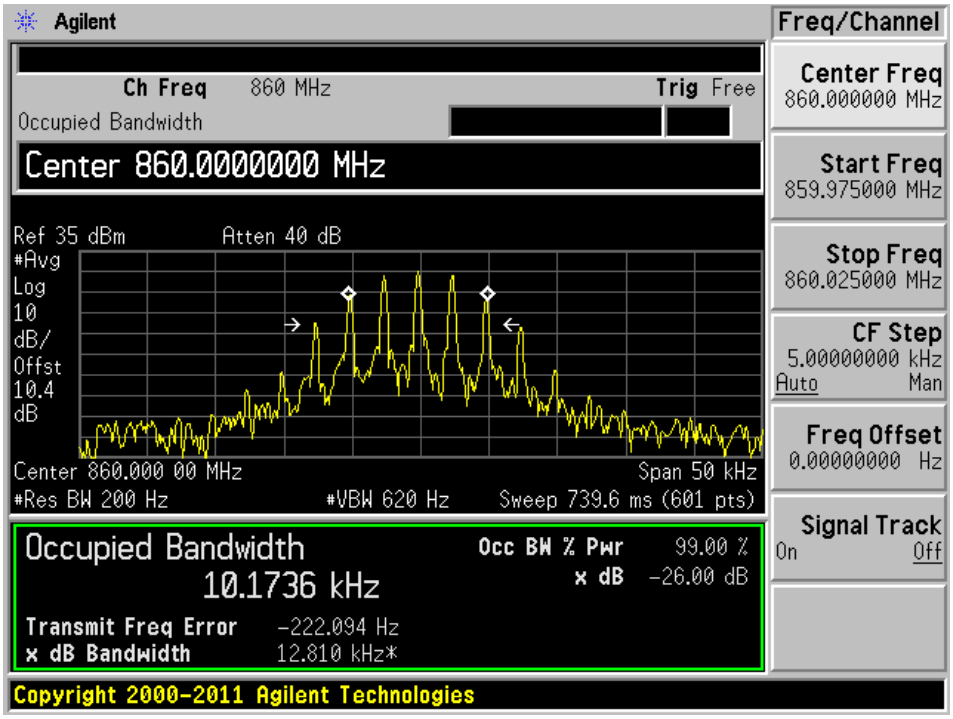
FM: 806 MHz – 824 MHz 20 kHz Channel spacing

Middle Channel – 815 MHz



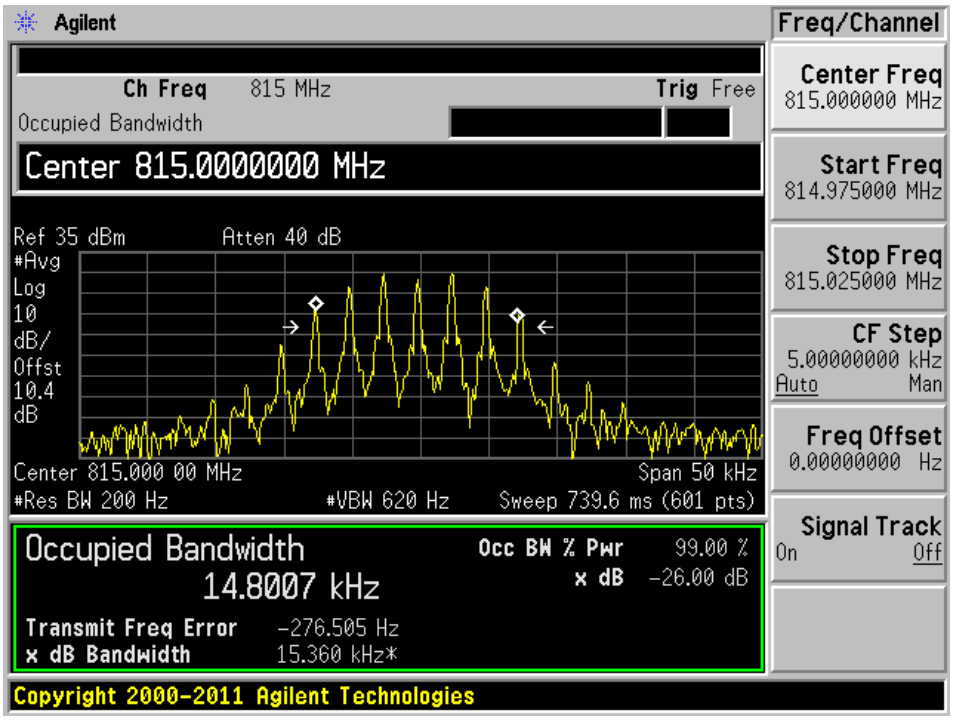
FM: 851 MHz – 869 MHz 20 kHz Channel spacing

Middle Channel – 860 MHz



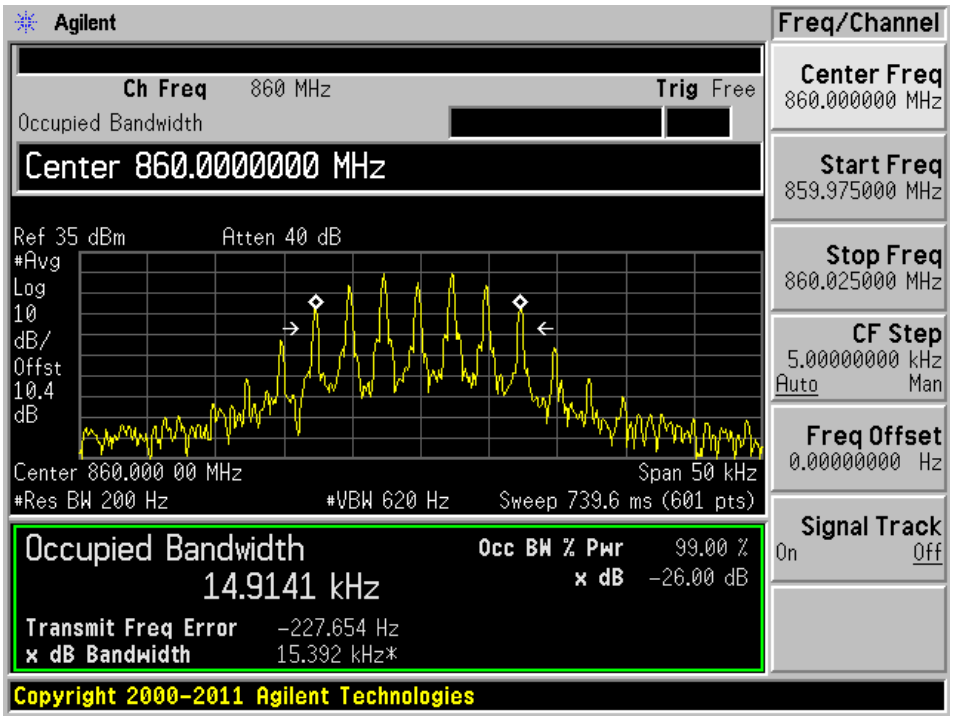
FM: 806 MHz – 824 MHz 25 kHz Channel spacing

Middle Channel – 815 MHz



FM: 851 MHz – 869 MHz 25 kHz Channel spacing

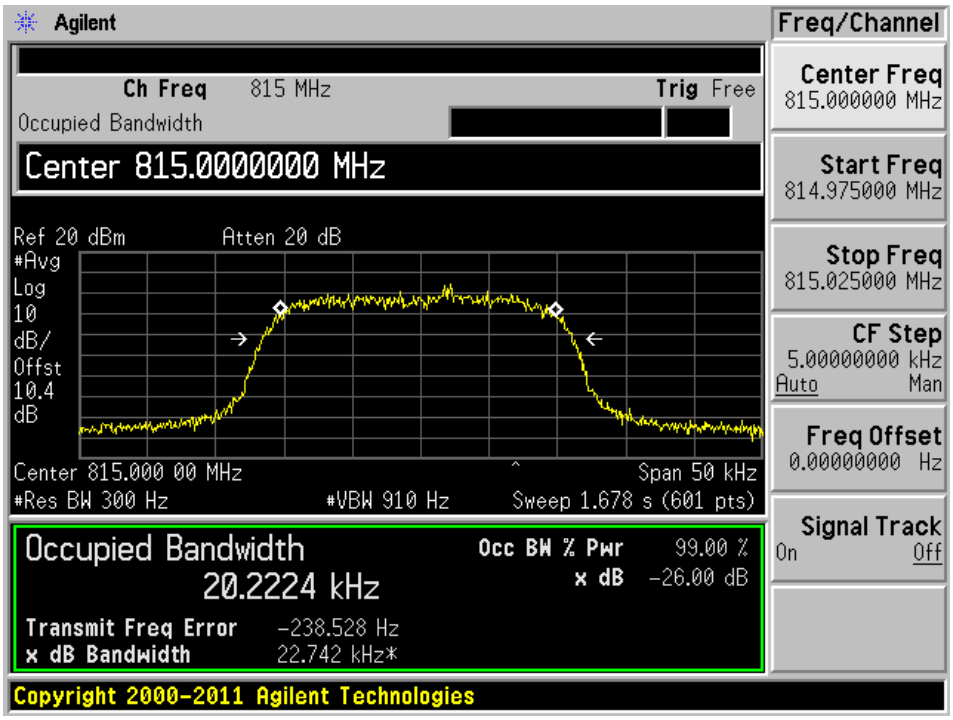
Middle Channel – 860 MHz



Occupied Bandwidth (Low Power)

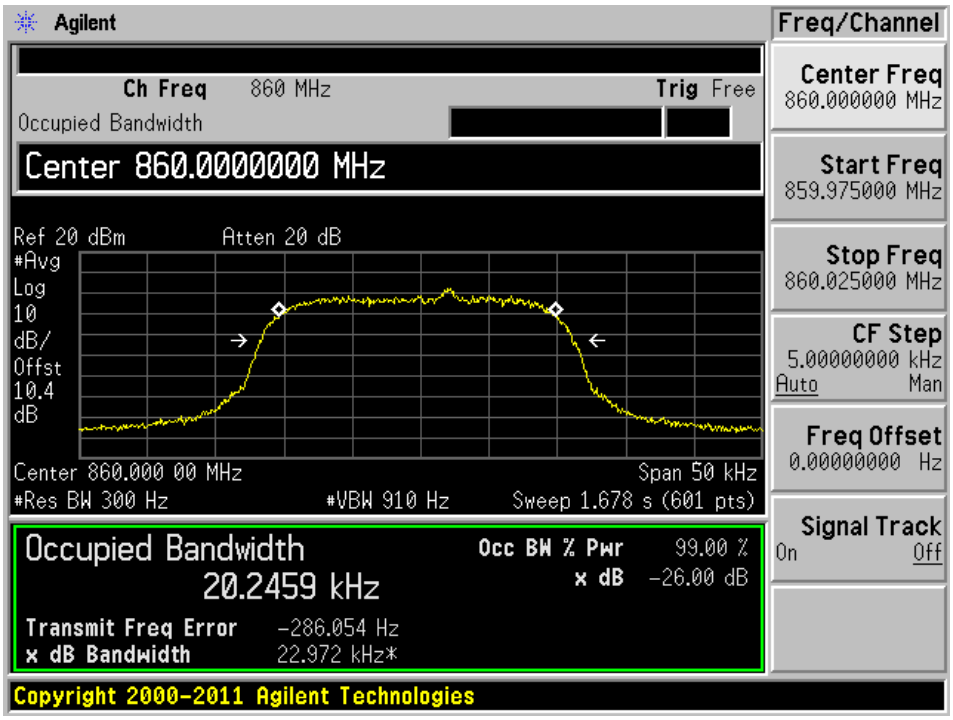
TETRA: 809 MHz – 824 MHz

Middle Channel – 815 MHz



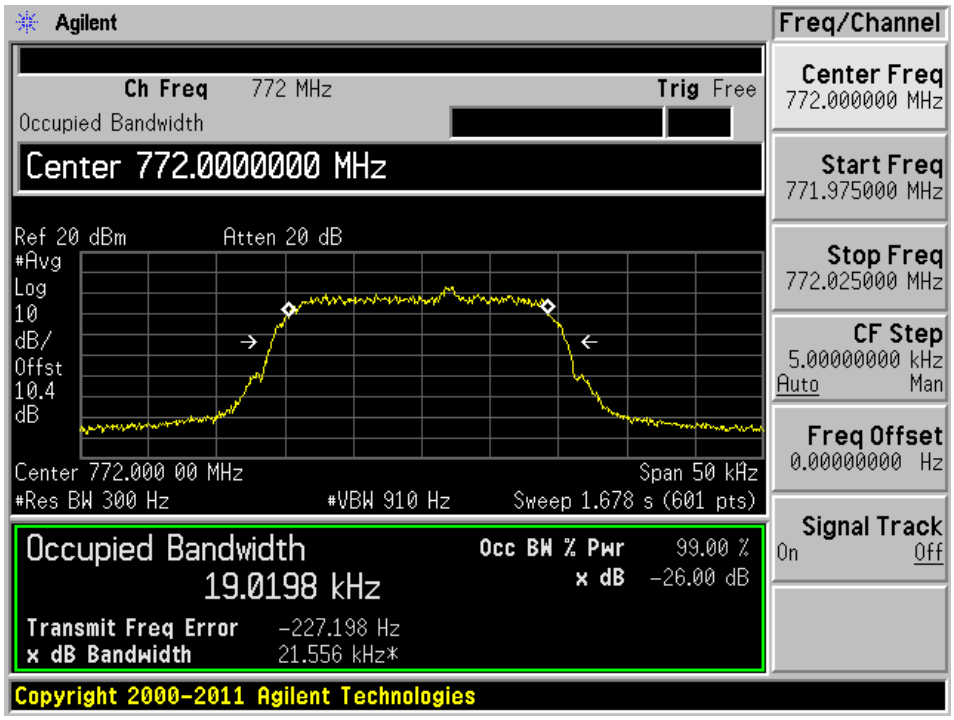
TETRA: 854 MHz - 869 MHz

Middle Channel – 860 MHz



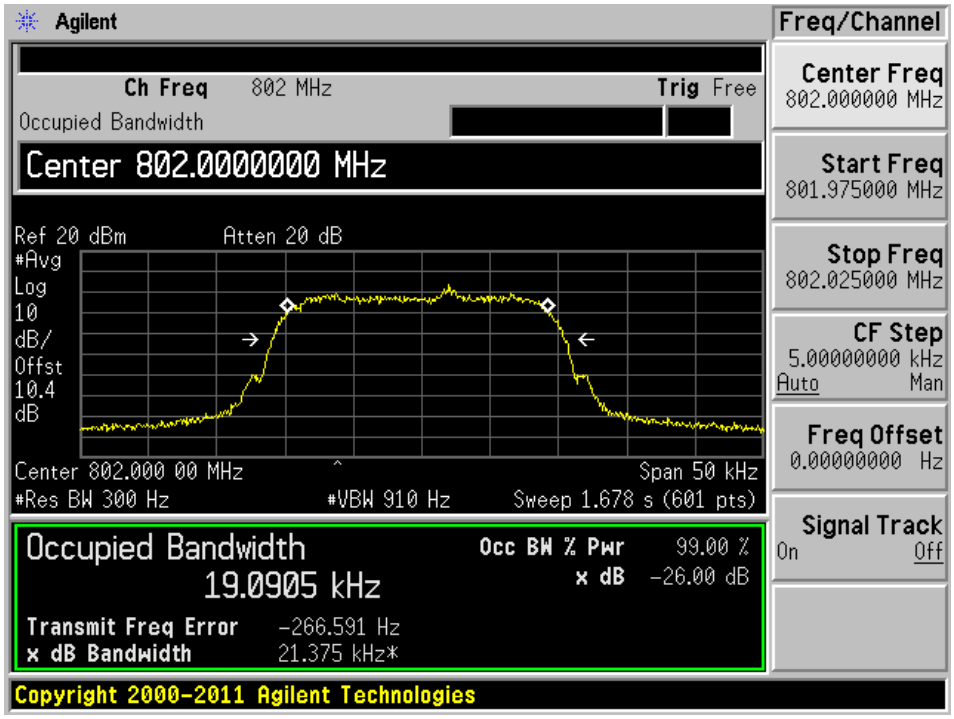
D-LMR: 769 MHz – 775 MHz

Middle Channel – 772 MHz



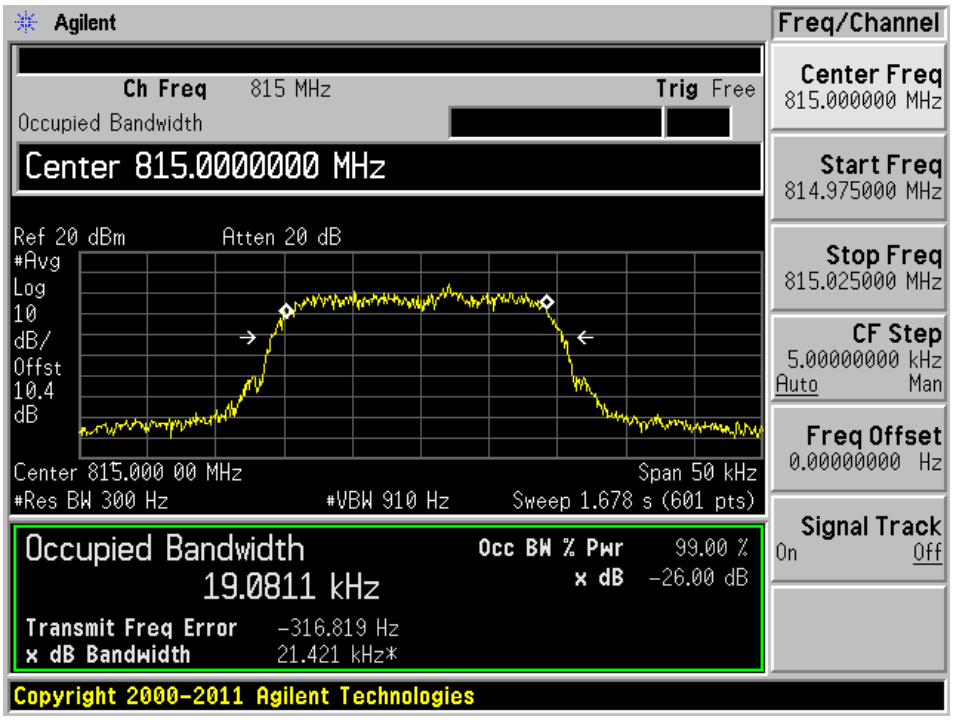
D-LMR: 799 MHz – 805 MHz

Middle Channel – 802 MHz



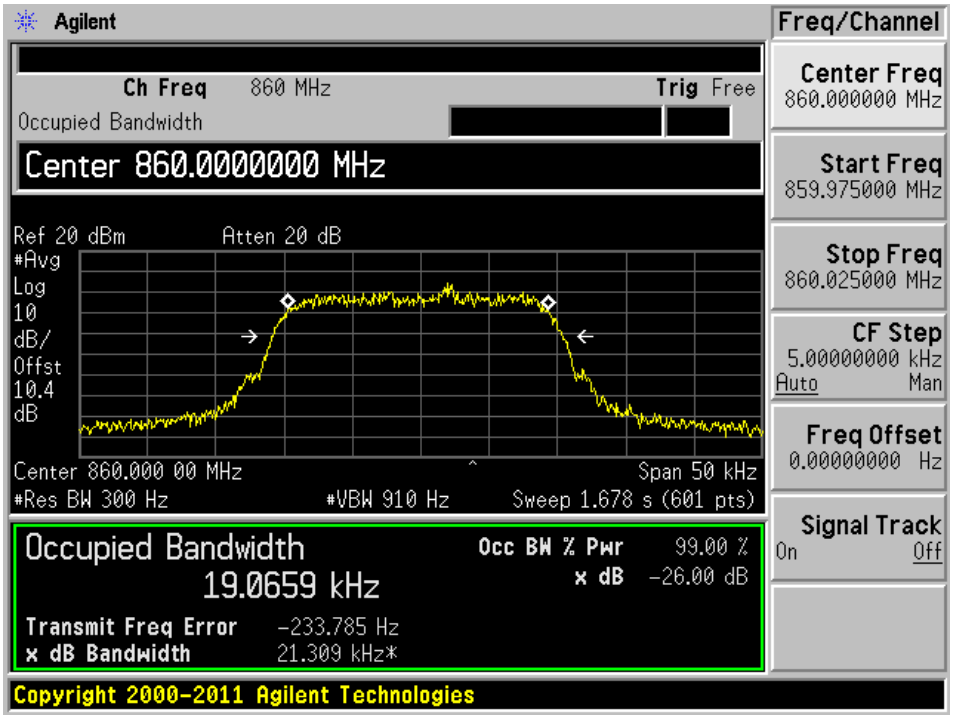
D-LMR: 806 MHz – 824 MHz

Middle Channel – 815 MHz



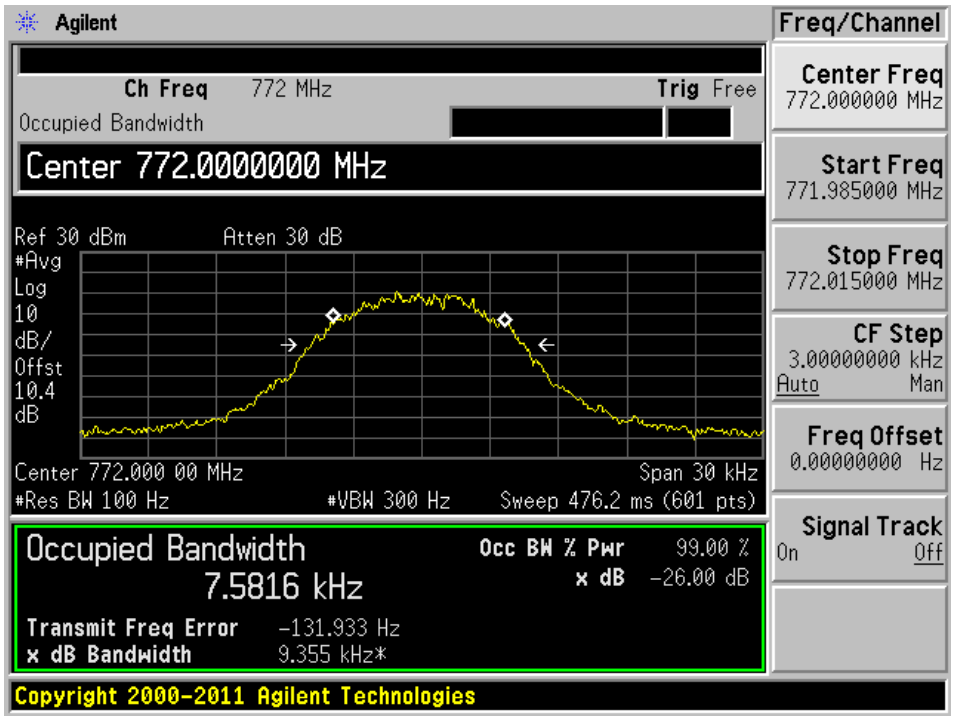
D-LMR: 851 MHz – 869 MHz

Middle Channel – 860 MHz



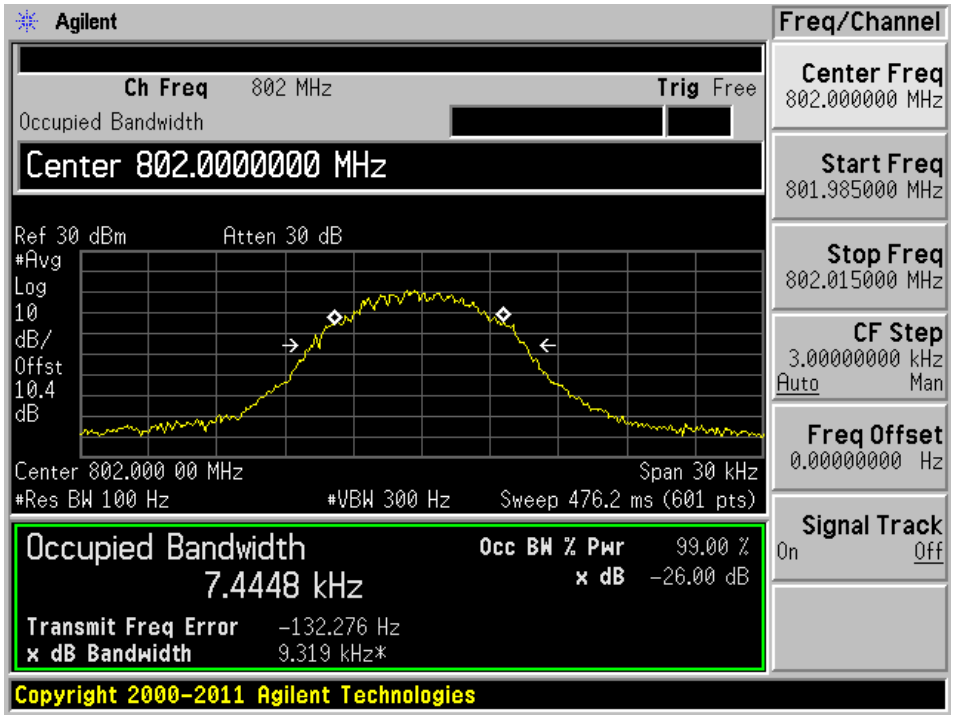
C4FM: 769 MHz – 775 MHz

Middle Channel – 772 MHz



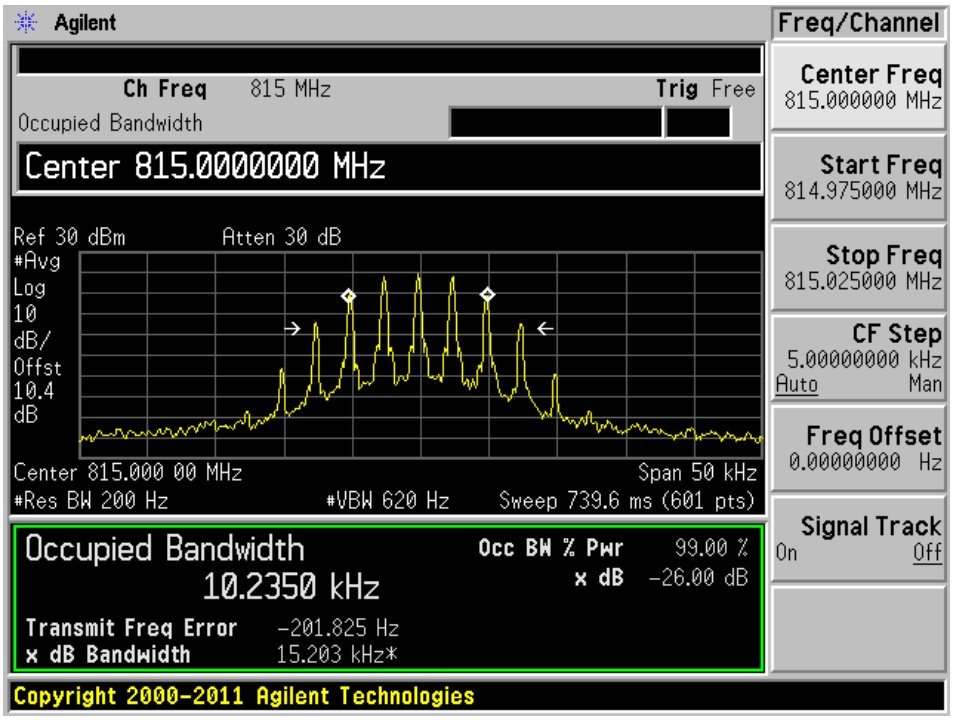
C4FM: 799 MHz – 805 MHz

Middle Channel – 802 MHz



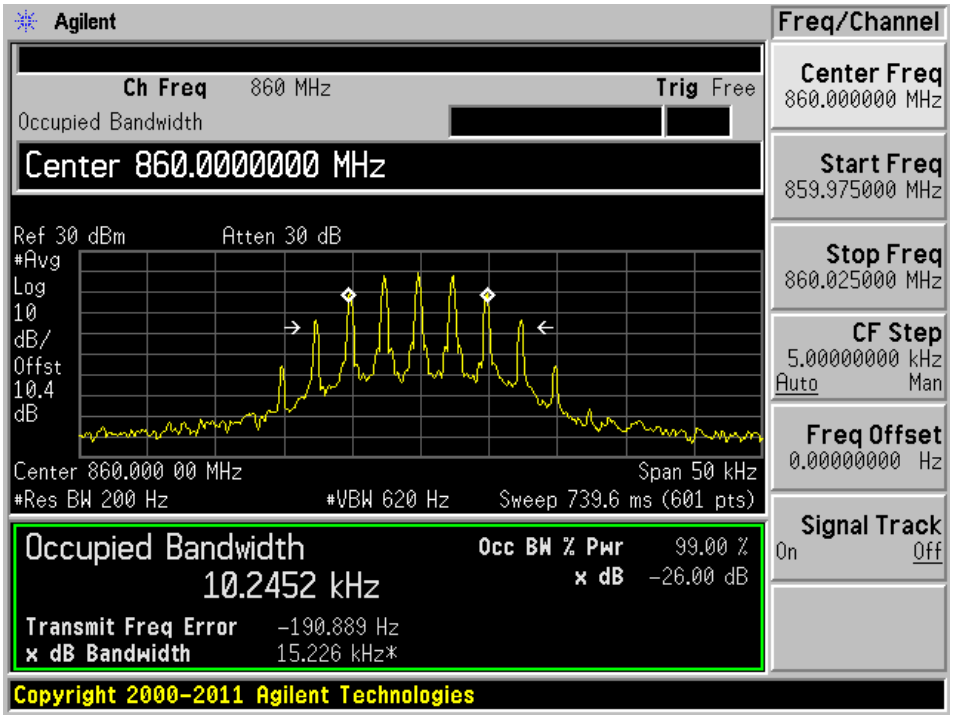
FM: 806 MHz – 824 MHz, 20 kHz Channel Spacing

Middle Channel – 815 MHz



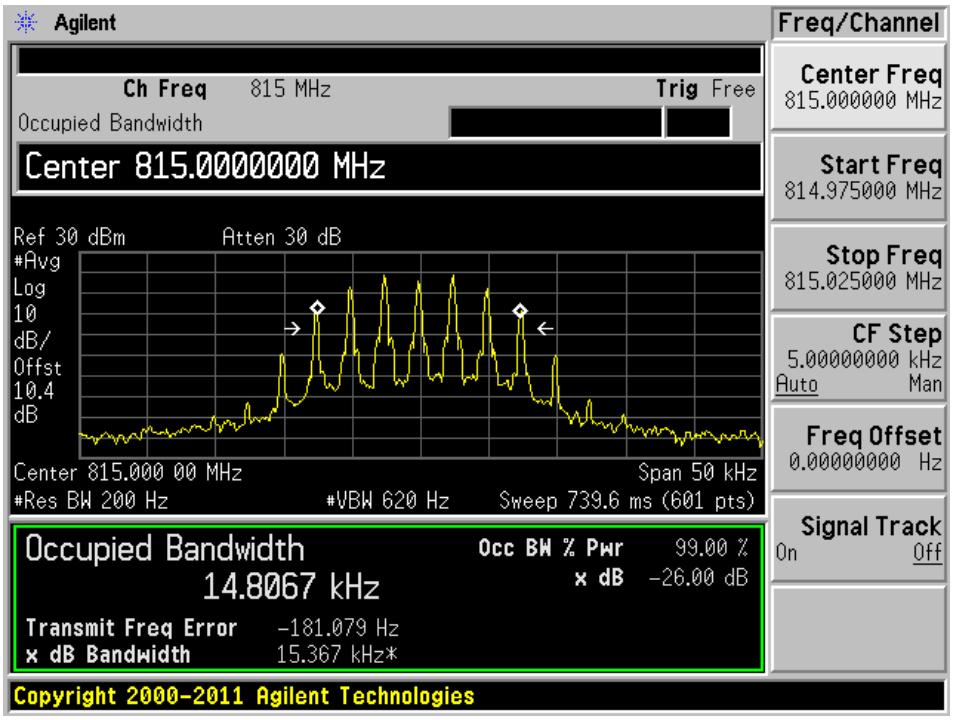
FM: 851 MHz – 869 MHz, 20 kHz Channel Spacing

Middle Channel – 860 MHz



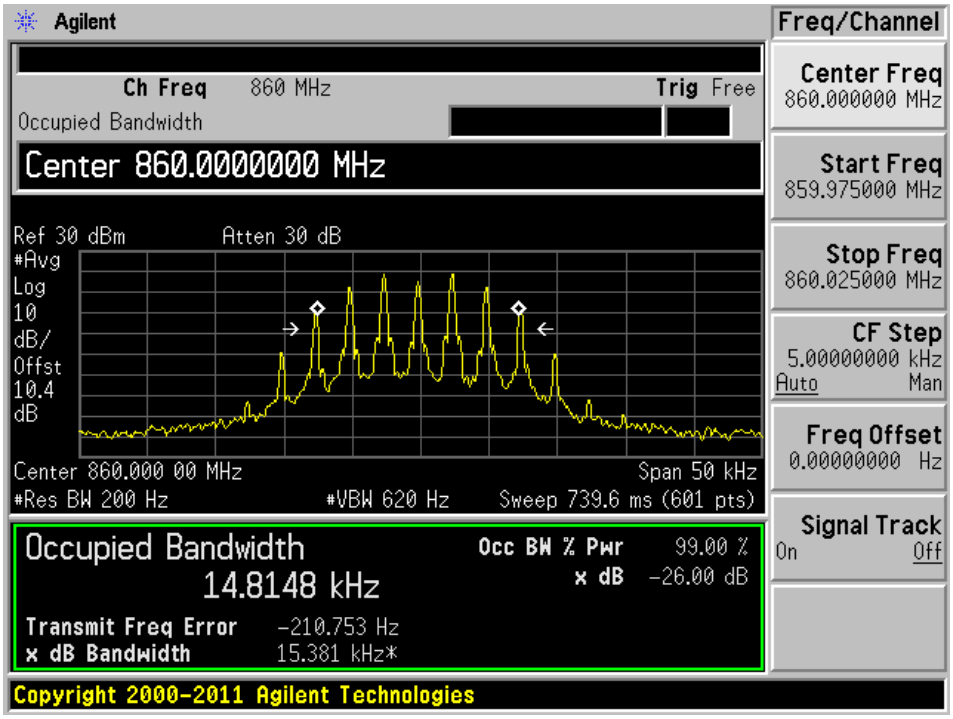
FM: 806 MHz – 824 MHz, 25 kHz Channel Spacing

Middle Channel – 815 MHz



FM: 851 MHz – 869 MHz, 25 kHz Channel Spacing

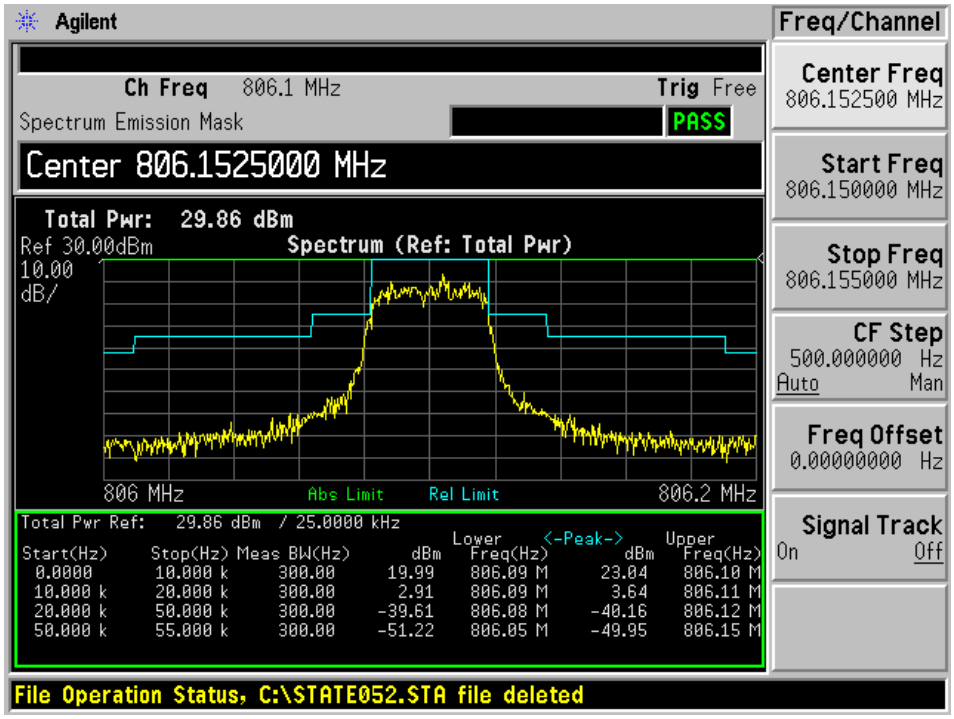
Middle Channel – 860 MHz



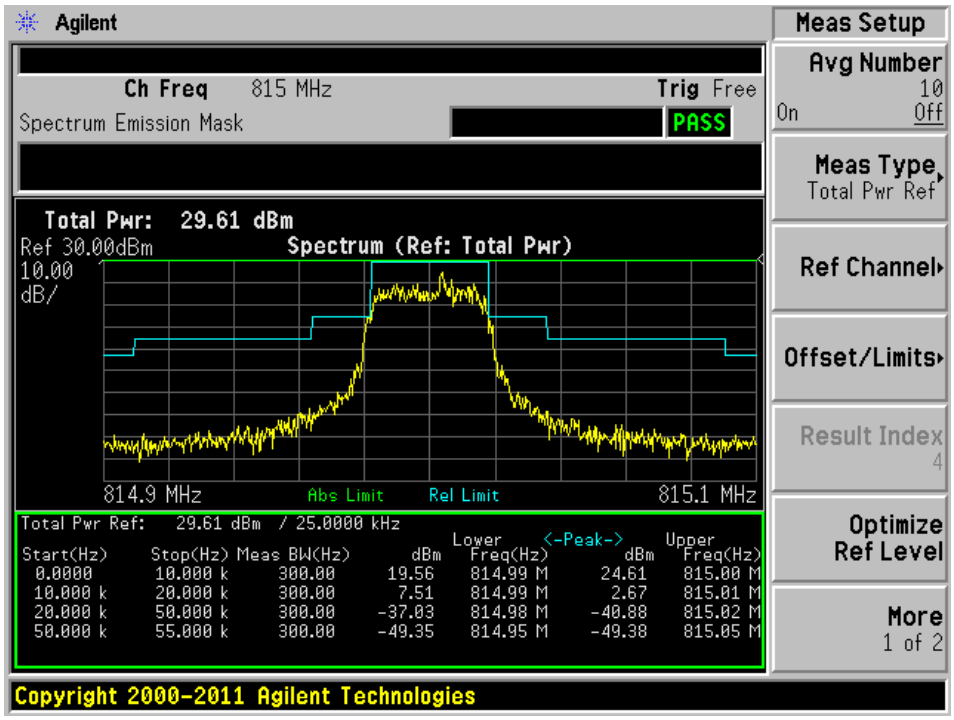
Emission Mask B (High Power)

D-LMR: 806 MHz – 824 MHz

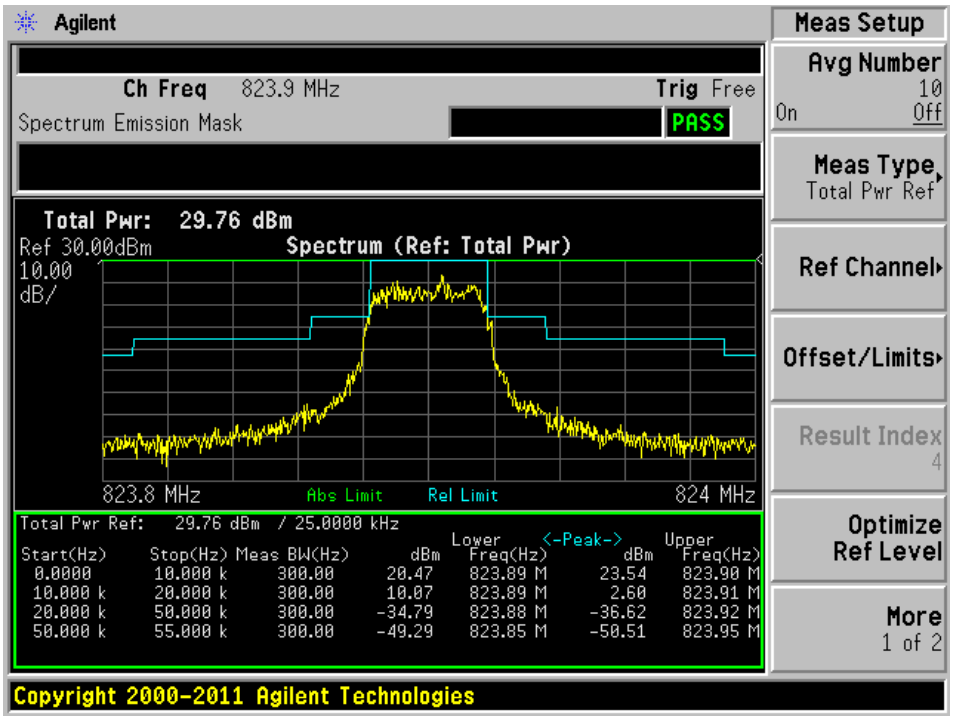
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

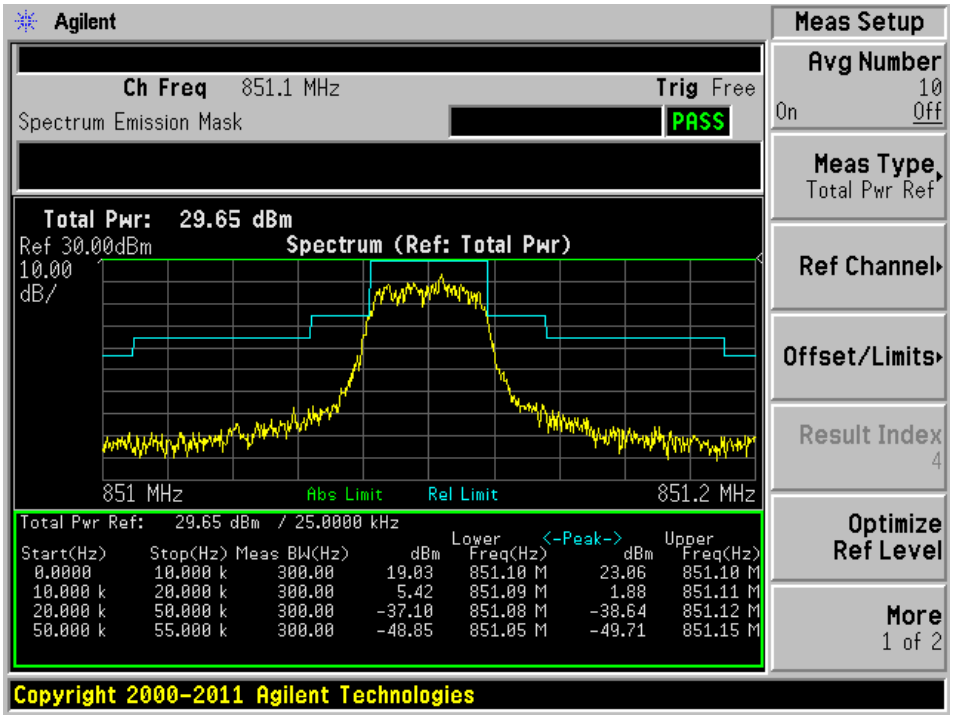


High Channel – 823.9 MHz

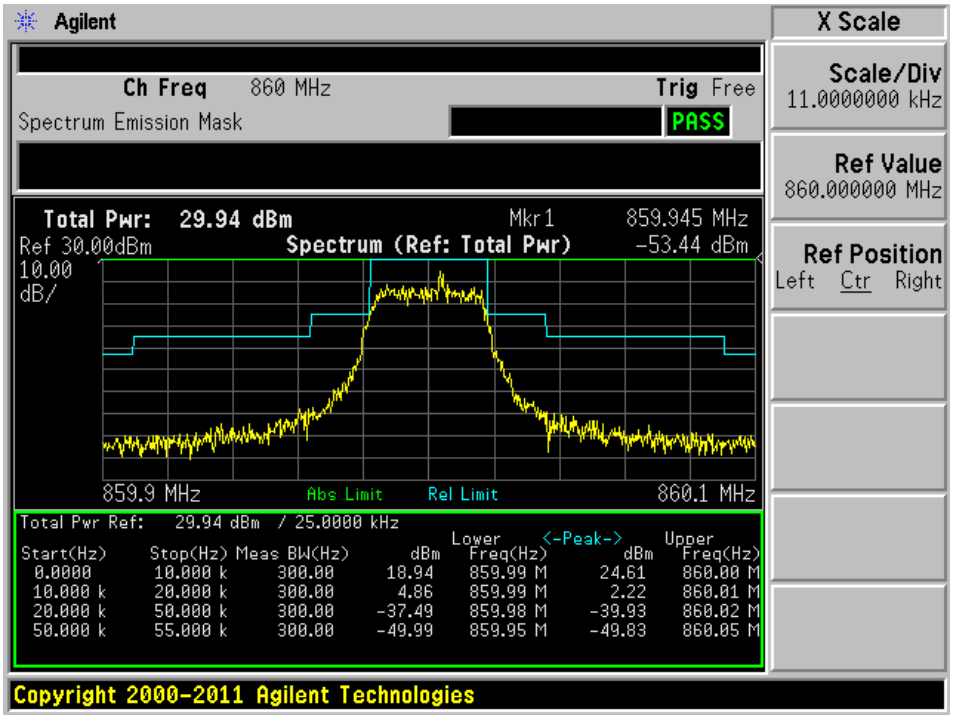


D-LMR: 851 MHz – 869 MHz

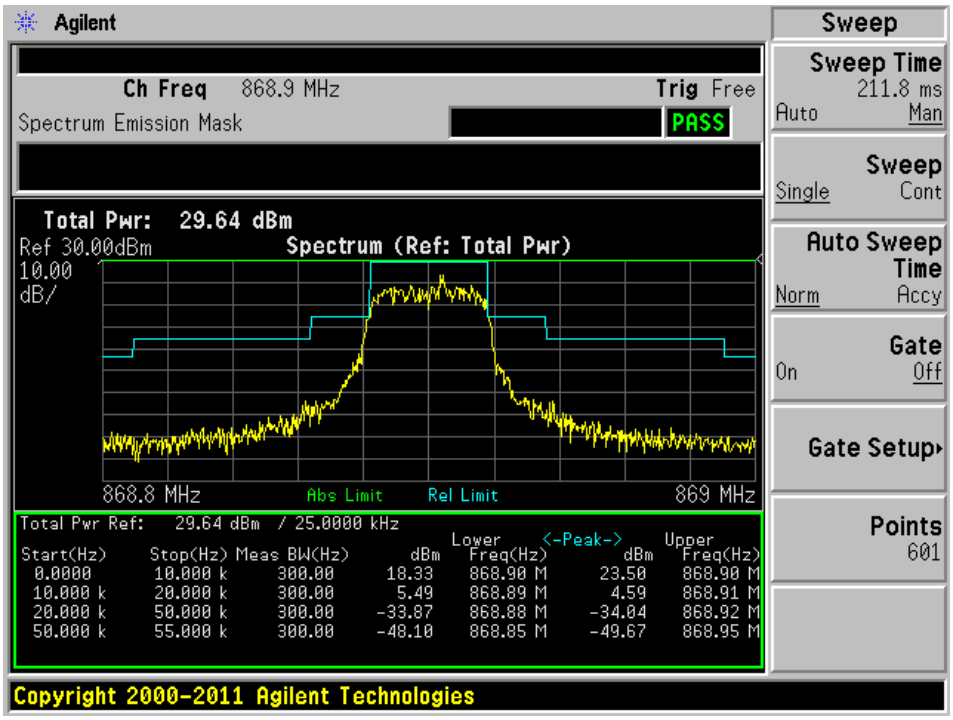
Low Channel – 851.1 MHz



Middle Channel – 860 MHz

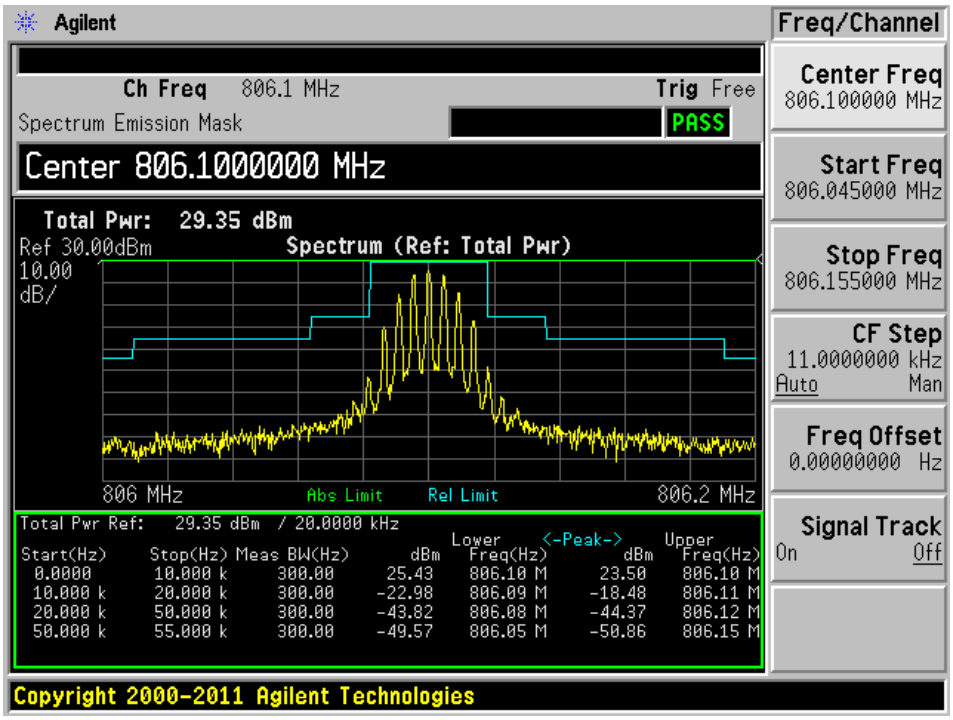


High Channel – 868.9 MHz

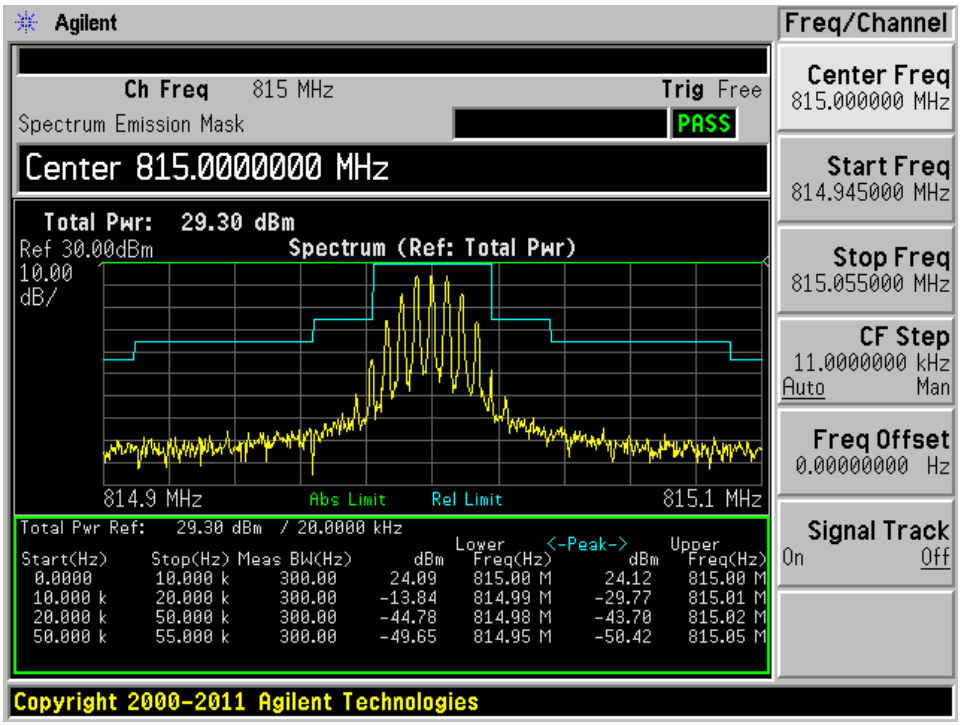


FM: 806 MHz – 824 MHz, 20 kHz Channel Spacing

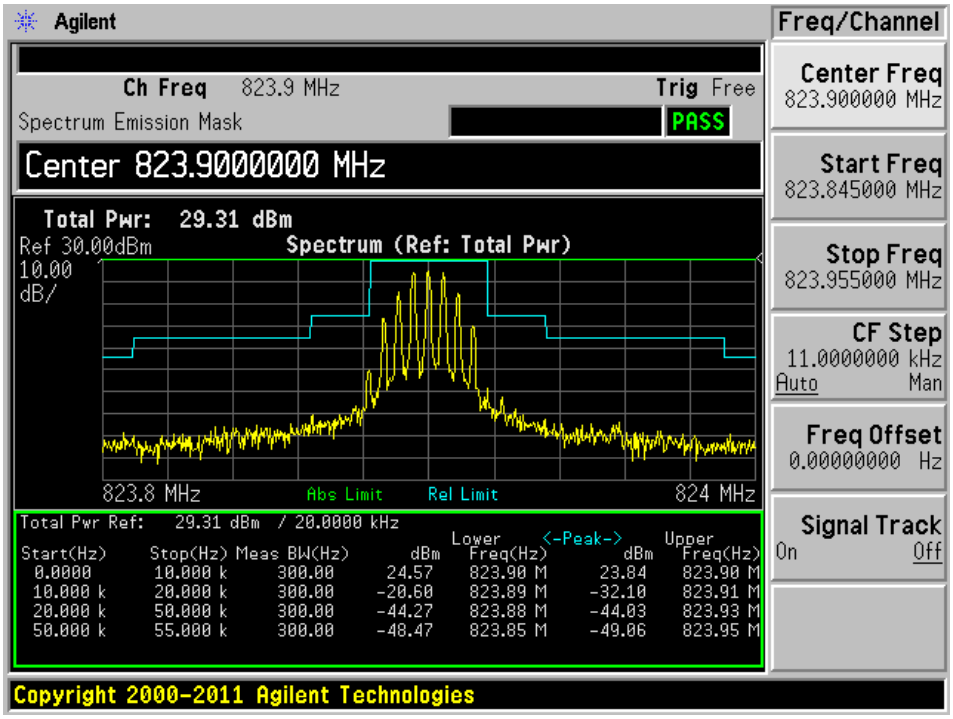
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

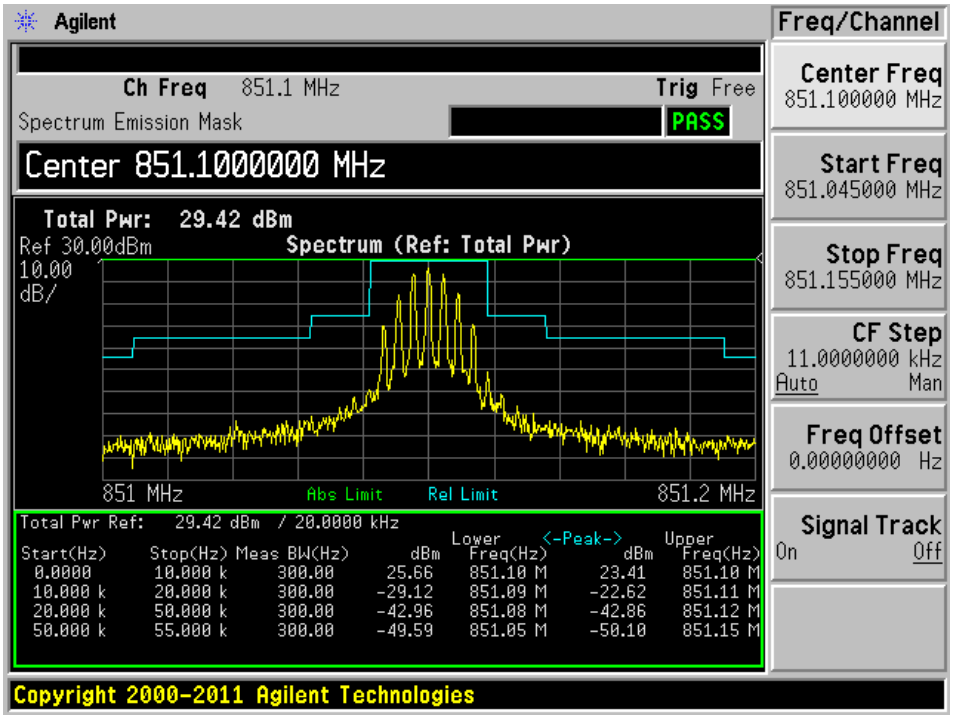


High Channel – 823.9 MHz

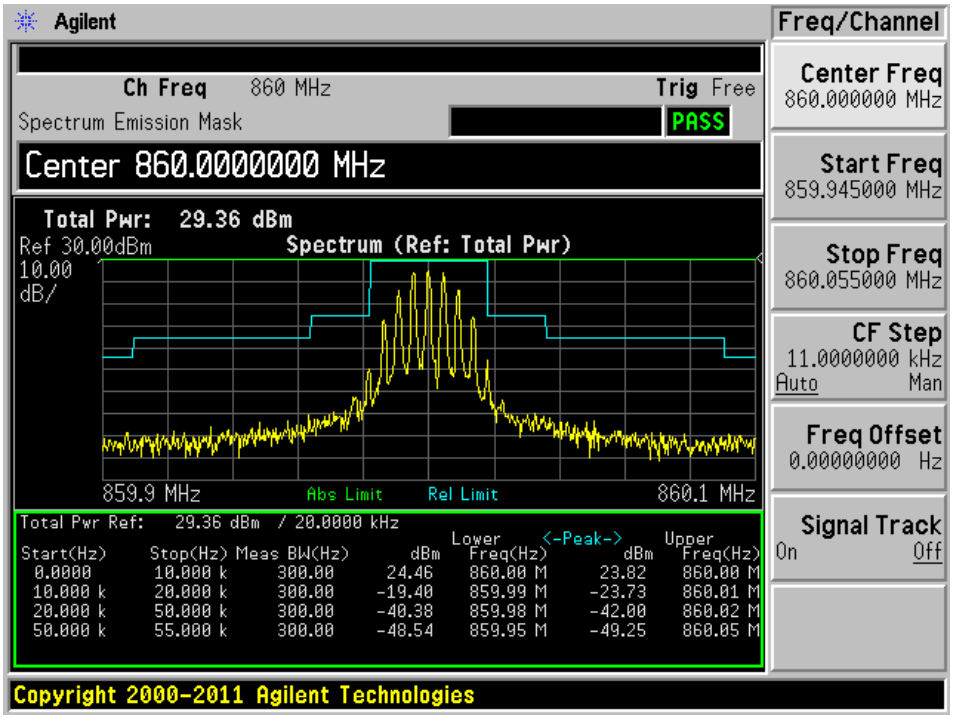


FM: 851 MHz – 869 MHz, 20 kHz Channel Spacing

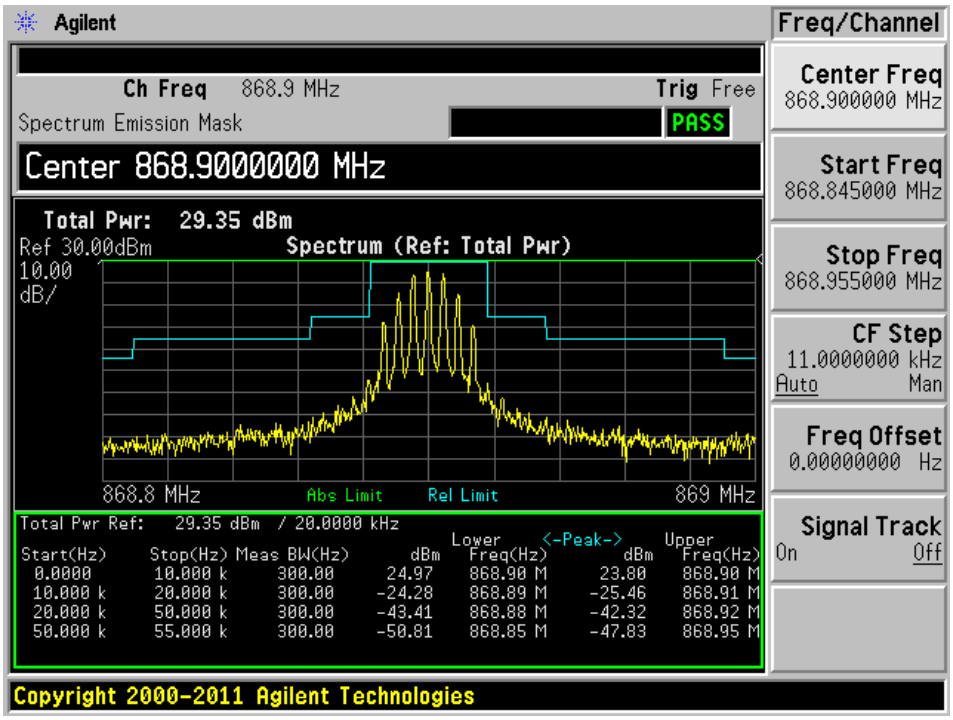
Low Channel – 851.1 MHz



Middle Channel – 860 MHz

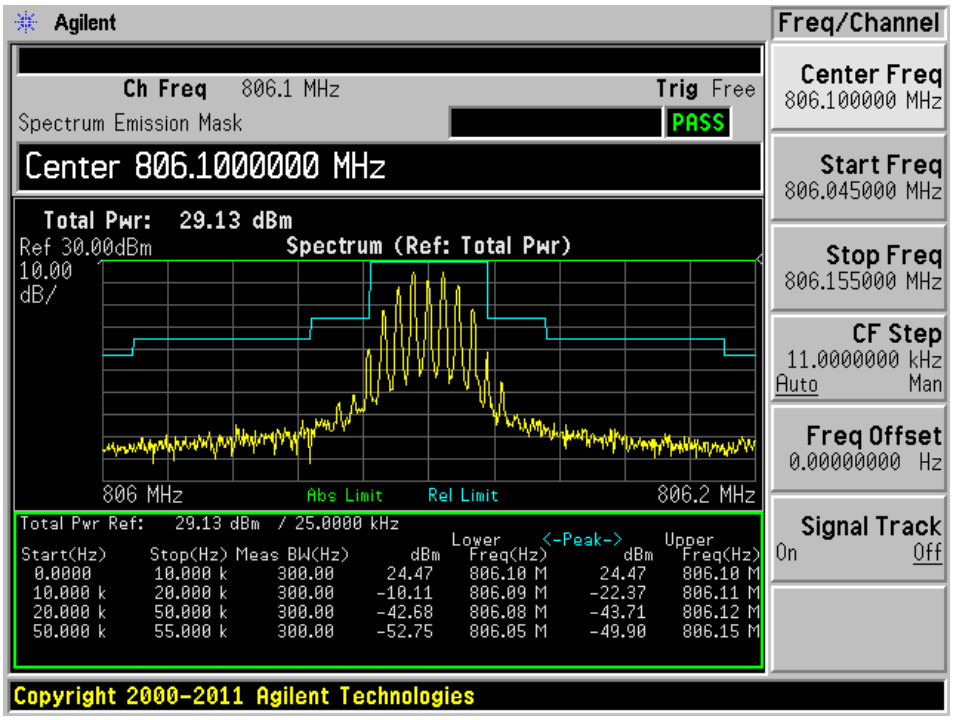


High Channel – 868.9 MHz

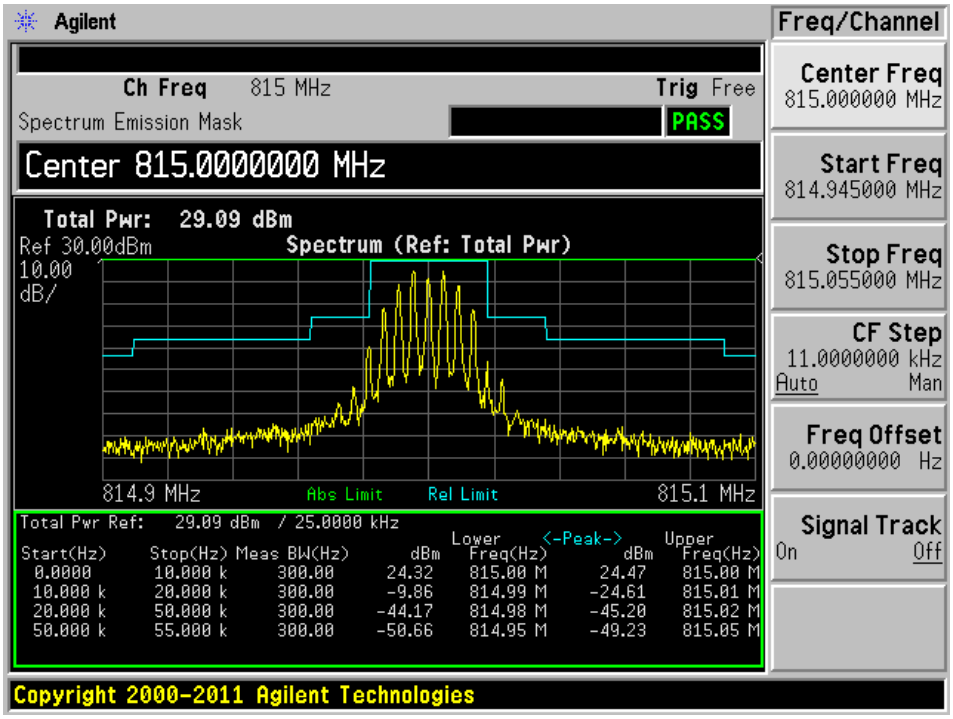


FM: 806 MHz – 824 MHz, 25 kHz Channel Spacing

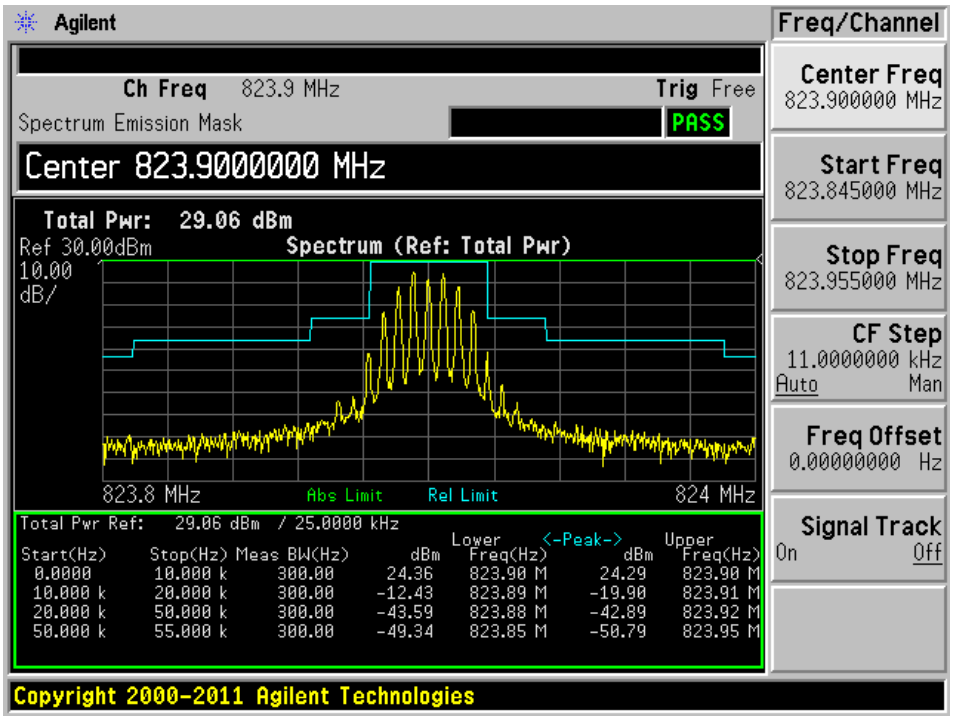
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

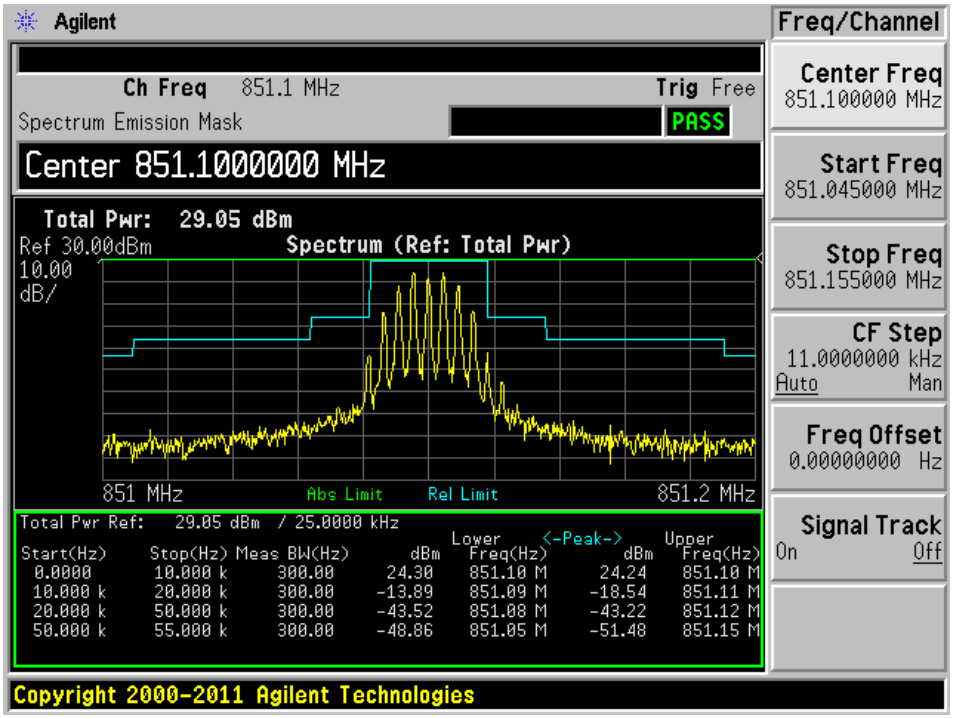


High Channel – 823.9 MHz

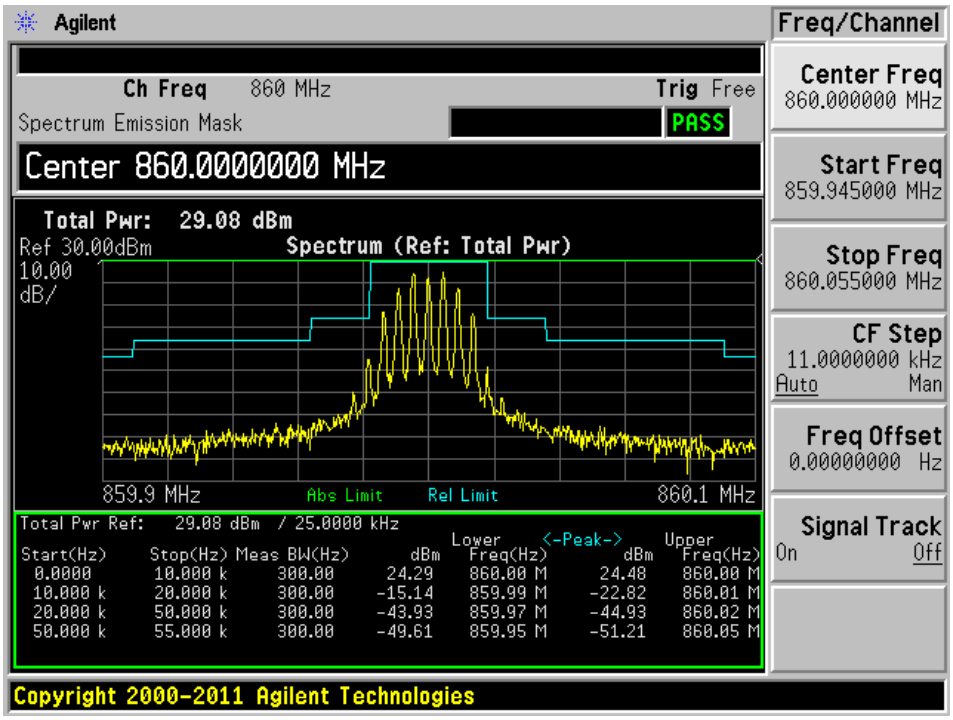


FM: 851 MHz – 869 MHz, 25 kHz Channel Spacing

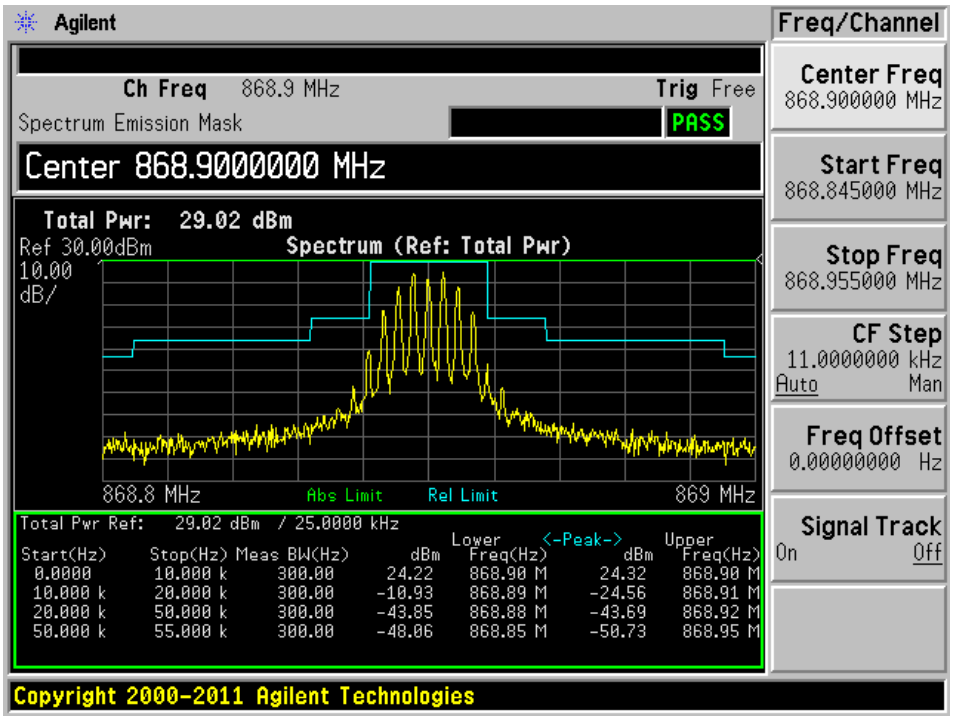
Low Channel – 851.1 MHz



Middle Channel – 860 MHz



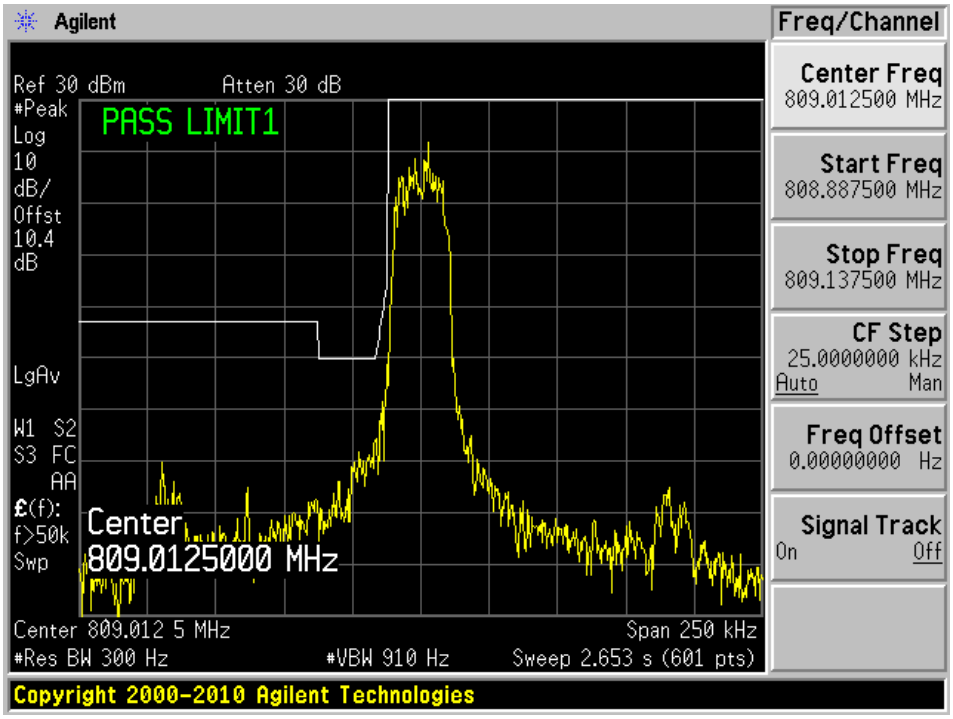
High Channel – 868.9 MHz



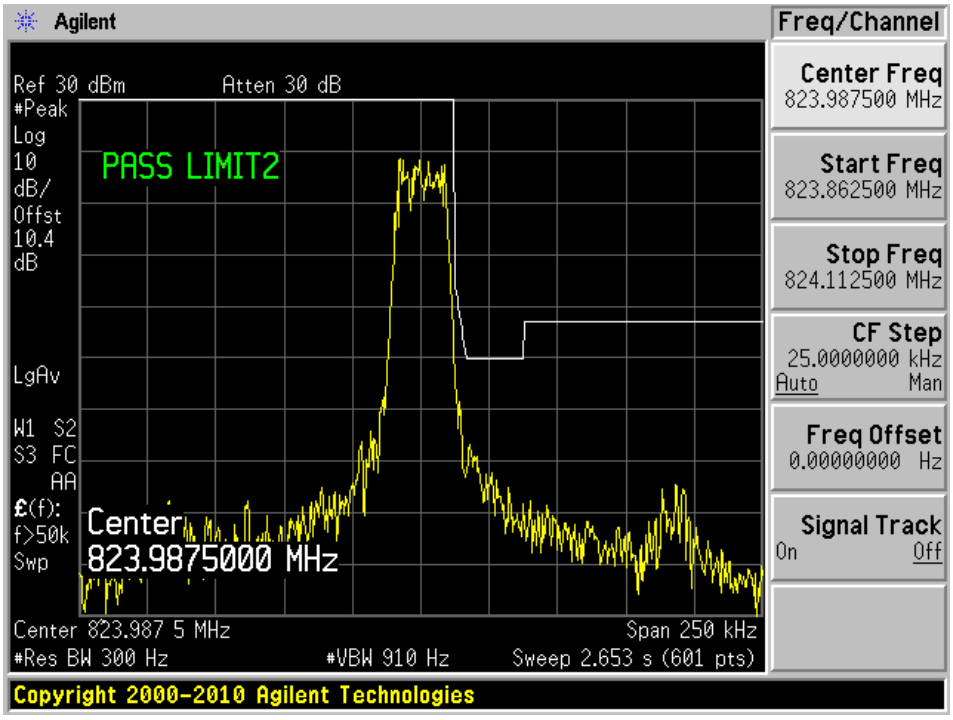
EA Mask (High Power)

809-824 MHz, D-LMR

Low Channel – 809.0125 MHz

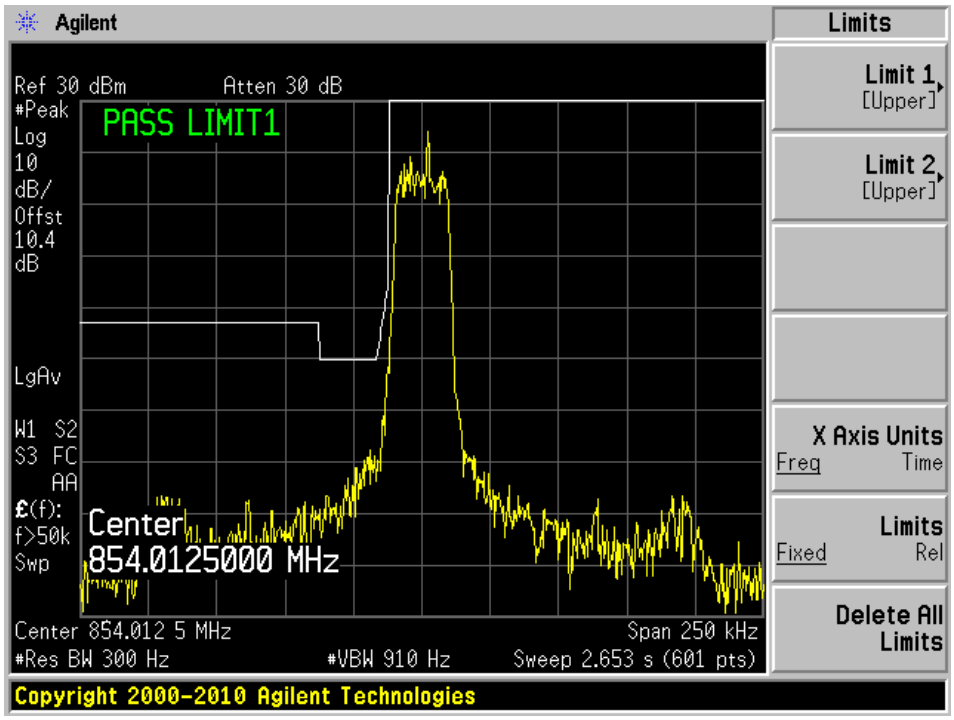


High Channel – 823.9875 MHz

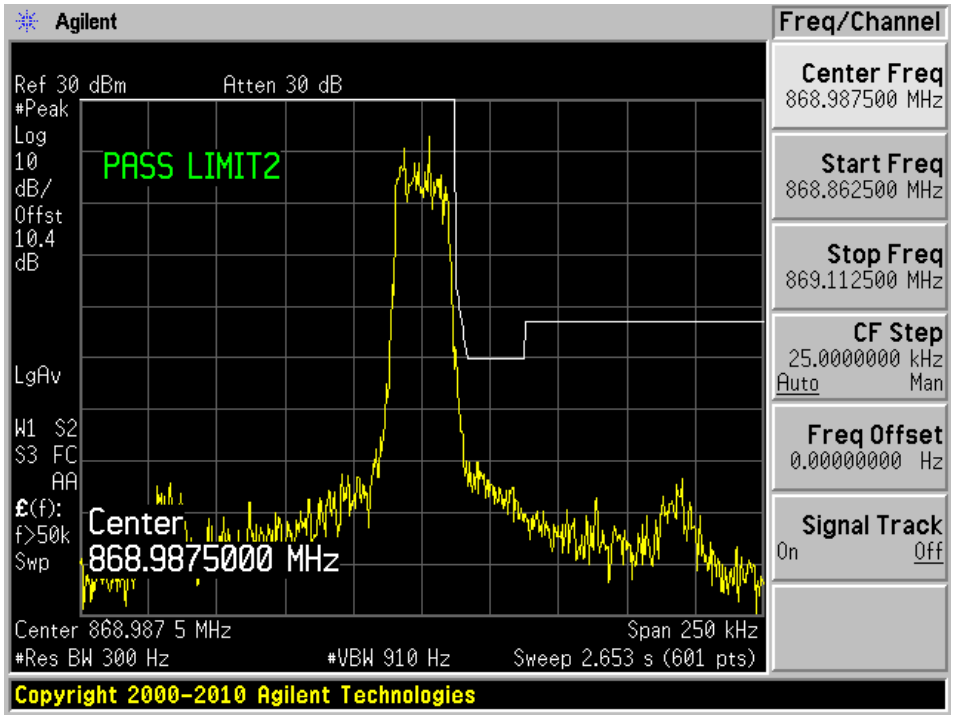


854-869 MHz, D-LMR

Low Channel – 854.0125 MHz

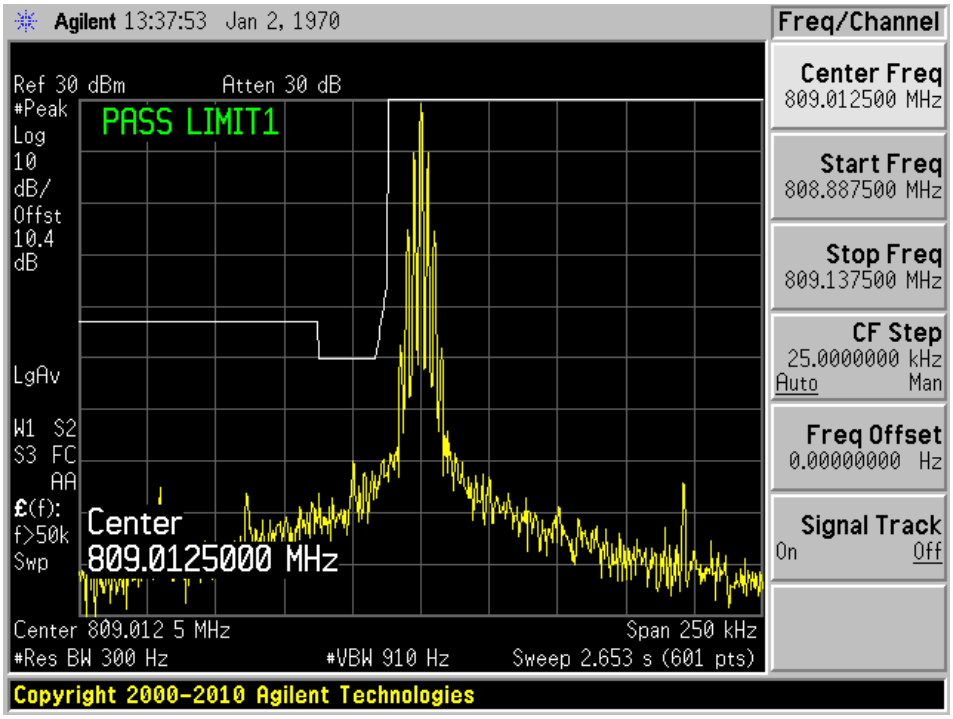


High Channel – 868.9875 MHz

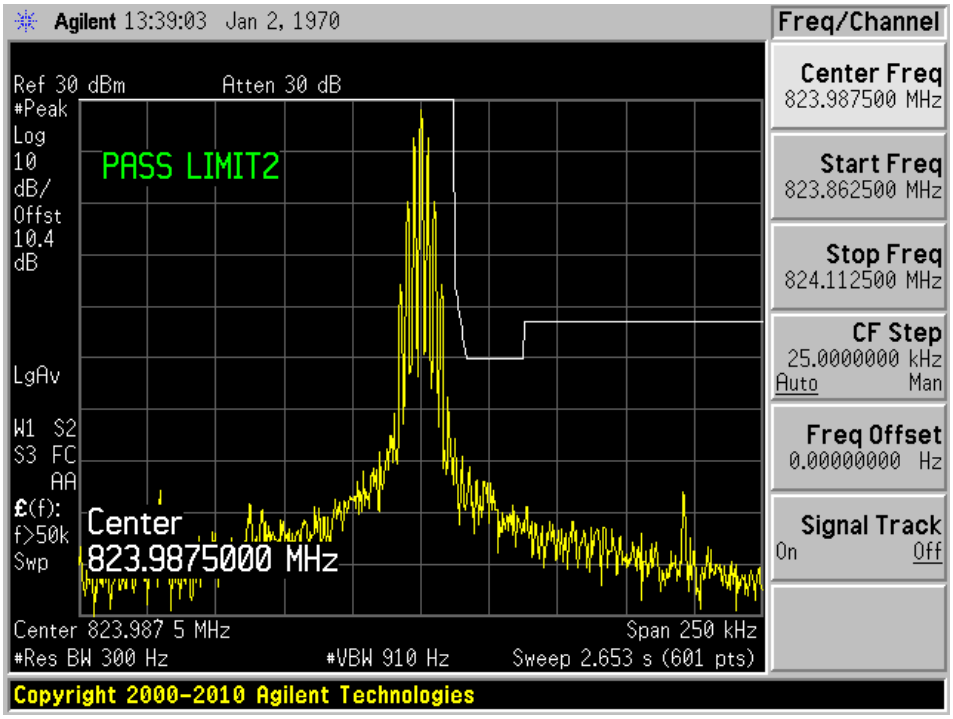


809-824 MHz, FM (20 kHz CS)

Low Channel – 809.0125 MHz

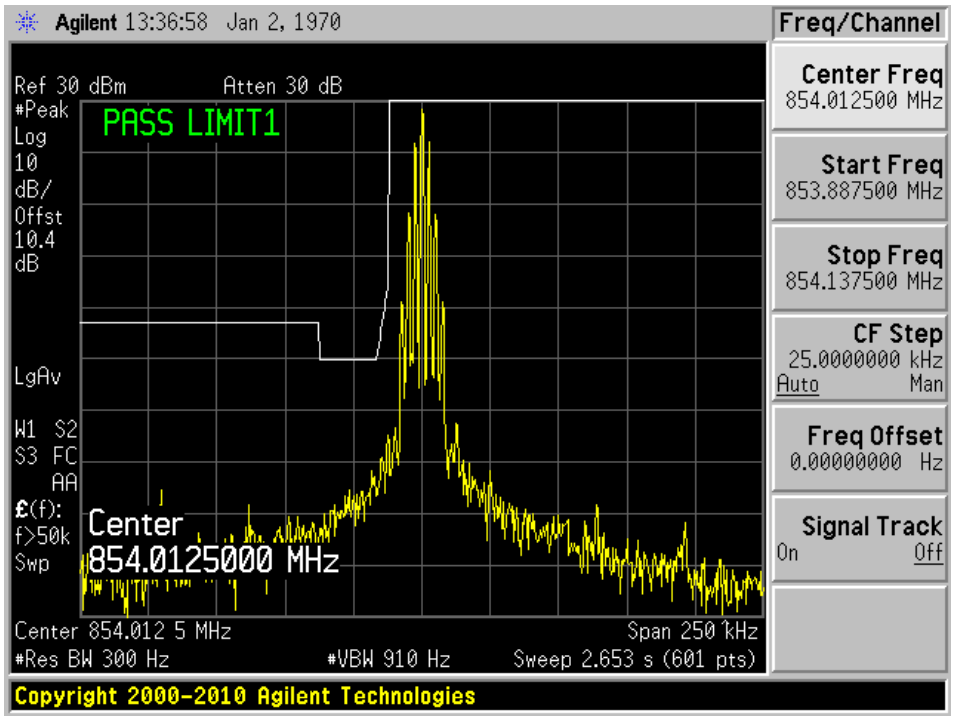


High Channel – 823.9875 MHz

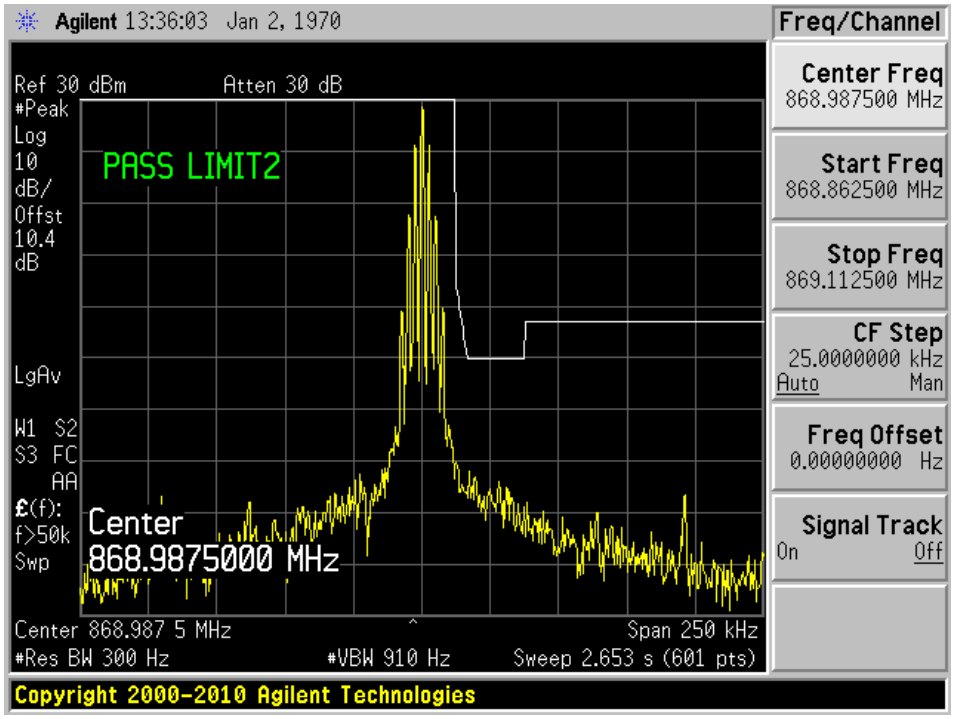


854-869 MHz, FM (20 kHz CS)

Low Channel – 854.0125 MHz

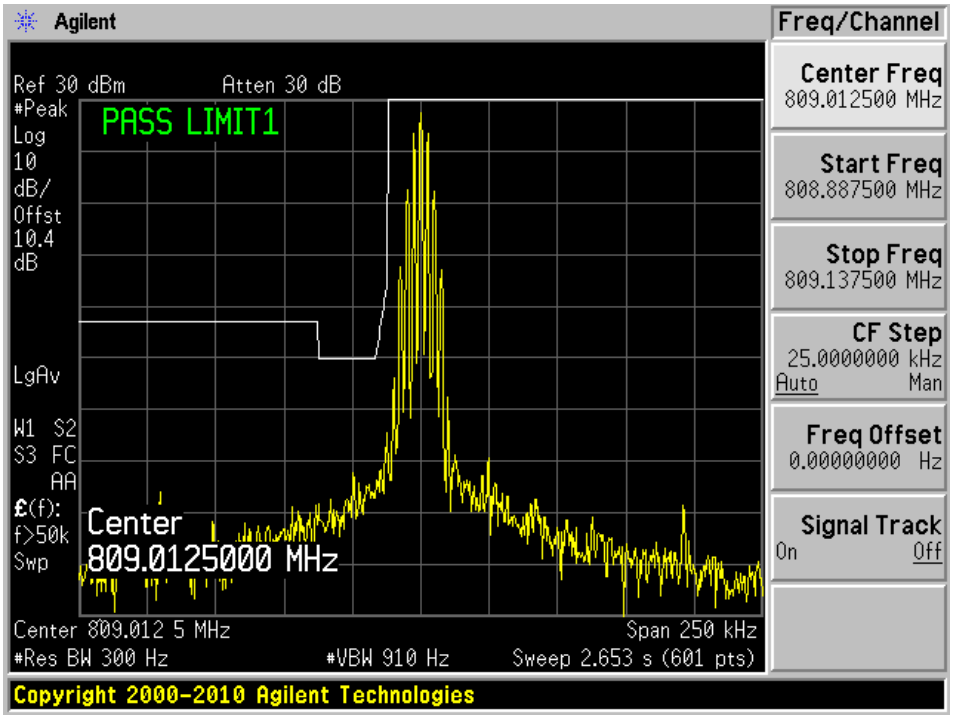


High Channel – 868.9875 MHz

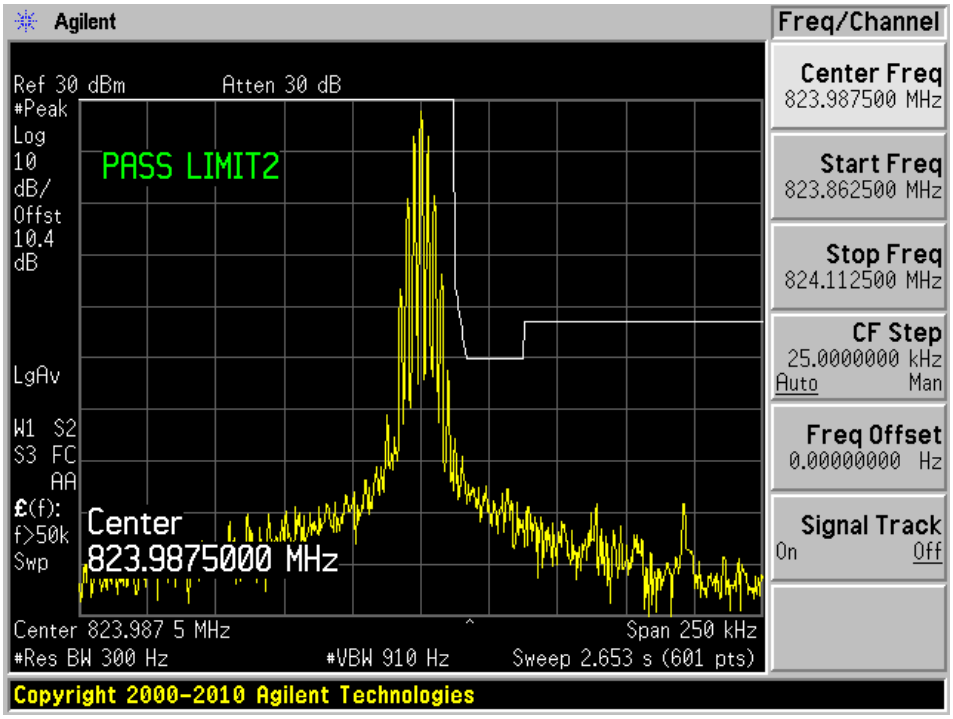


809-824 MHz, FM (25 kHz CS)

Low Channel – 809.0125 MHz

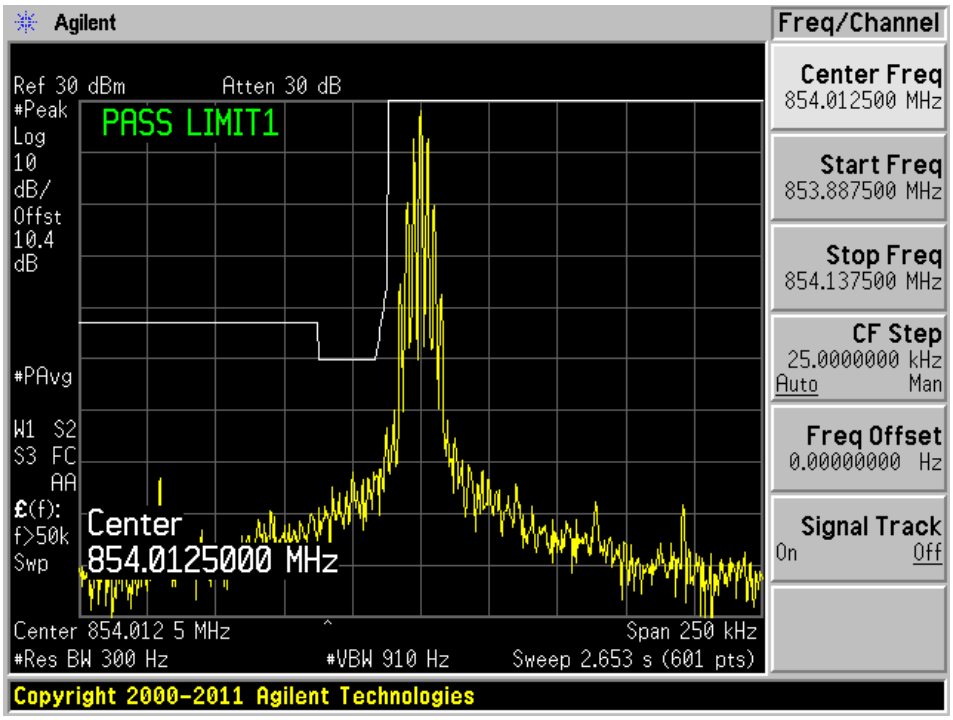


High Channel – 823.9875 MHz

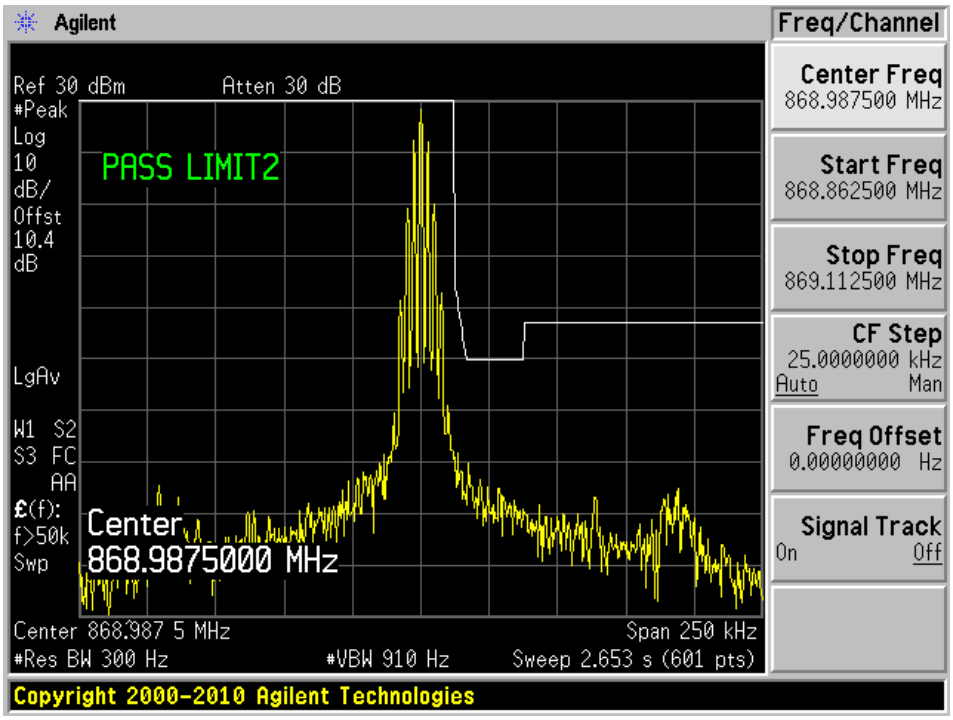


854-869 MHz, FM (25 kHz CS)

Low Channel – 854.0125 MHz



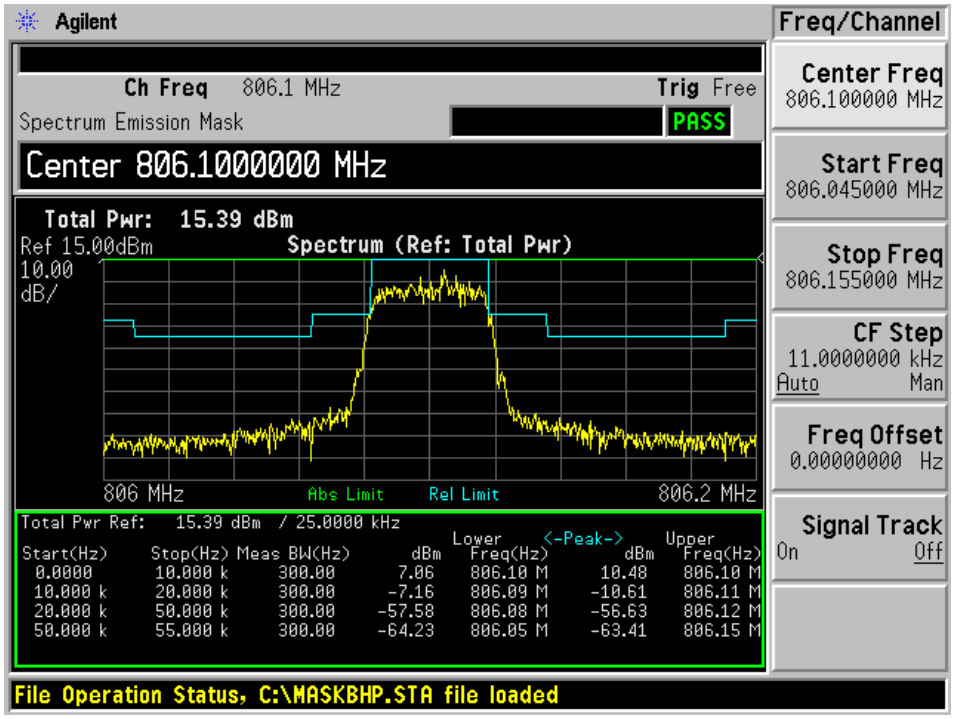
High Channel – 868.9875 MHz



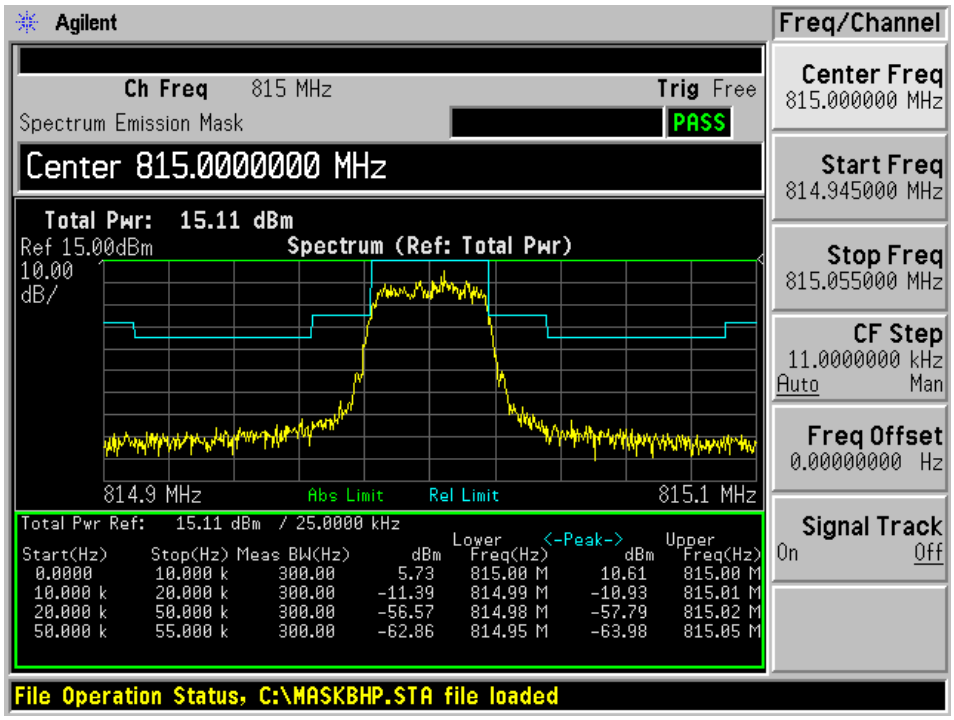
Emission Mask B (Low Power)

D-LMR: 806 MHz – 824 MHz

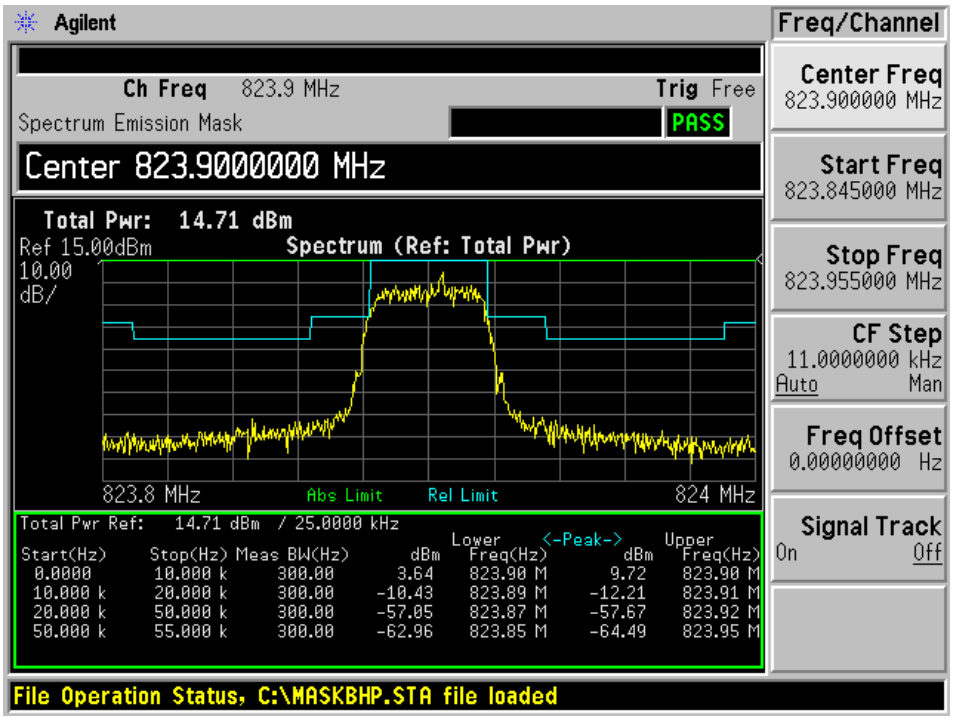
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

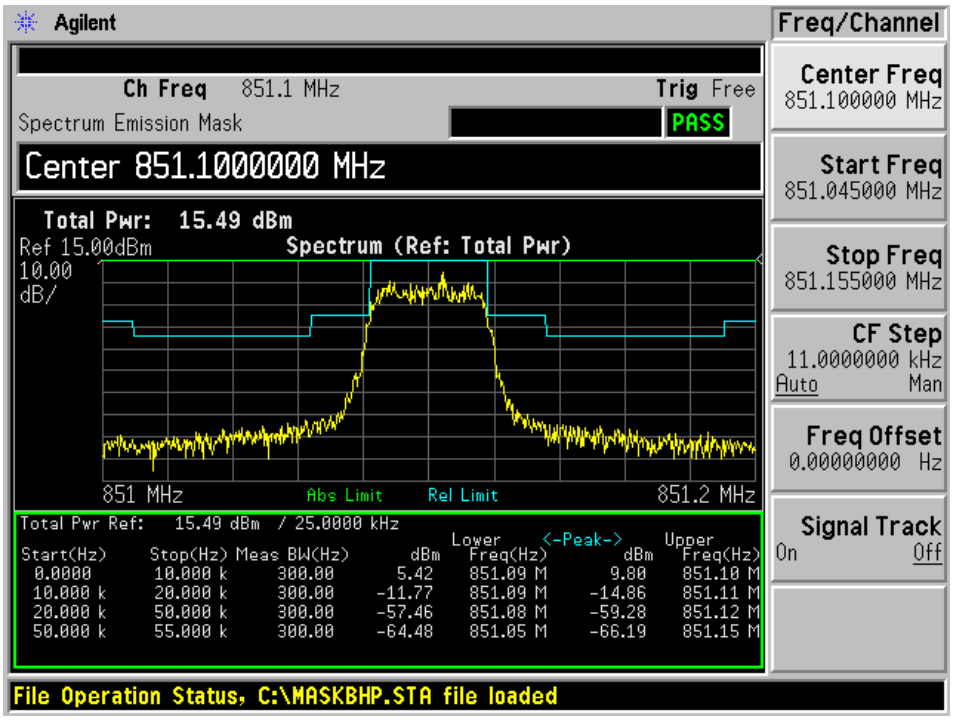


High Channel – 823.9 MHz

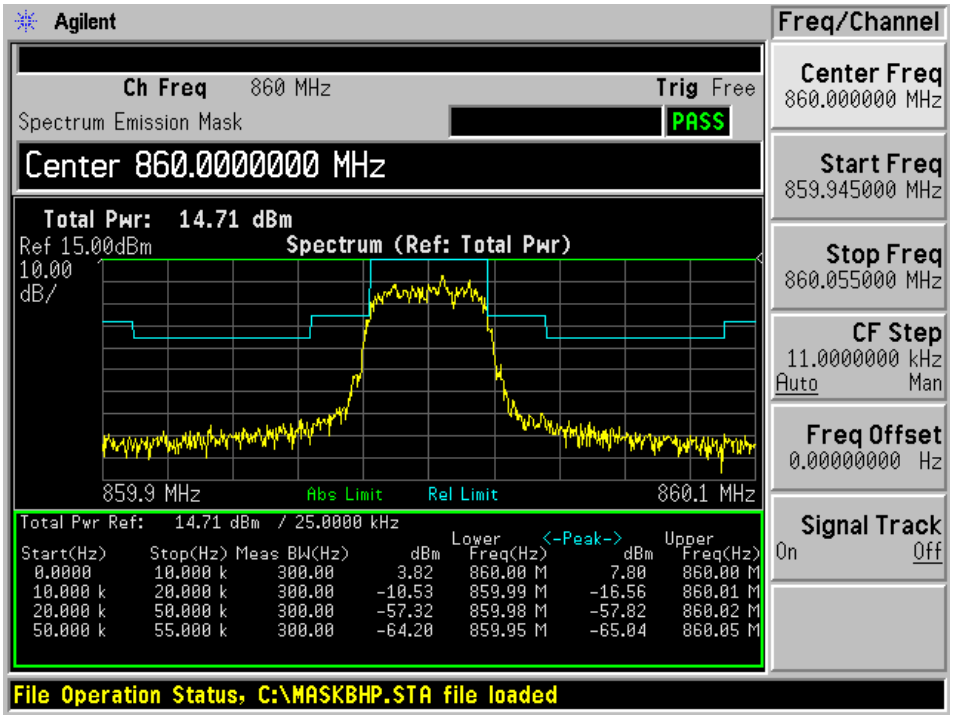


D-LMR: 851 MHz – 869 MHz

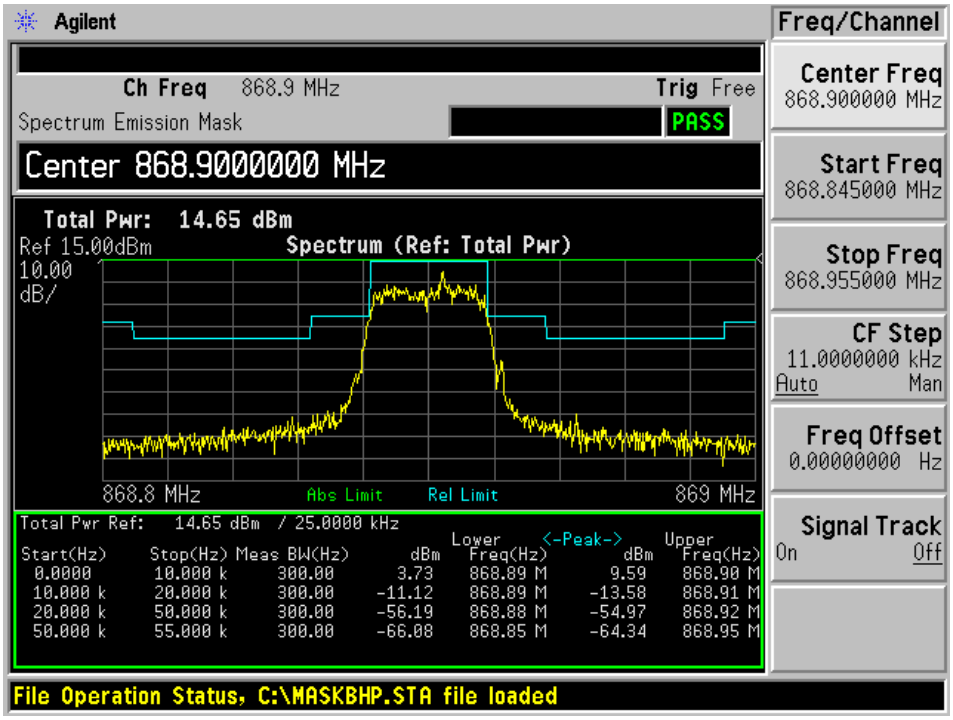
Low Channel – 851.1 MHz



Middle Channel – 860 MHz

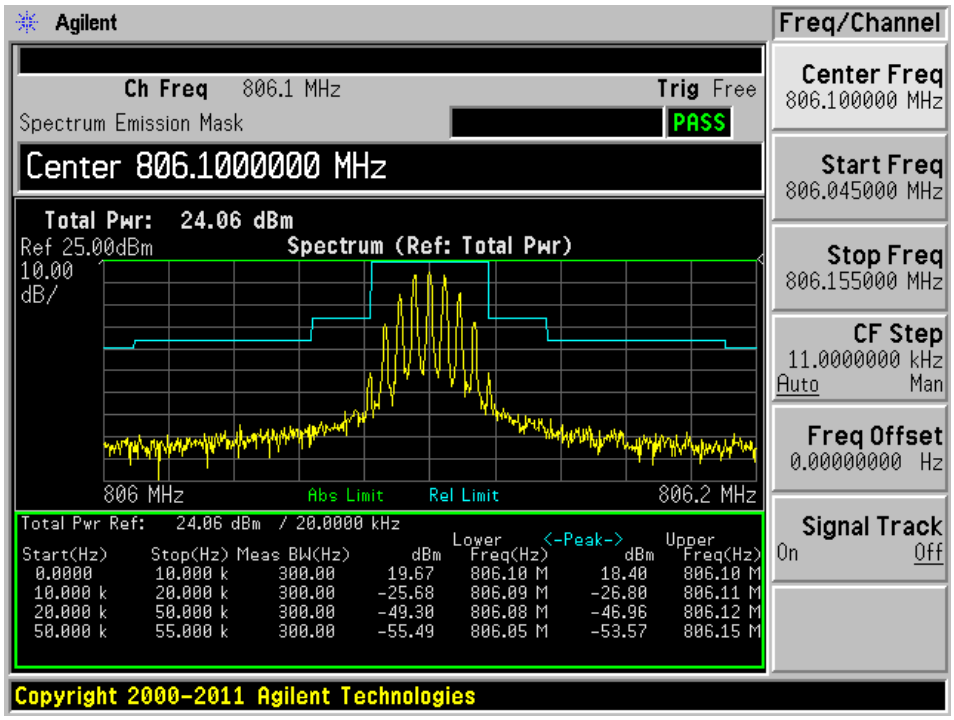


High Channel – 868.9 MHz

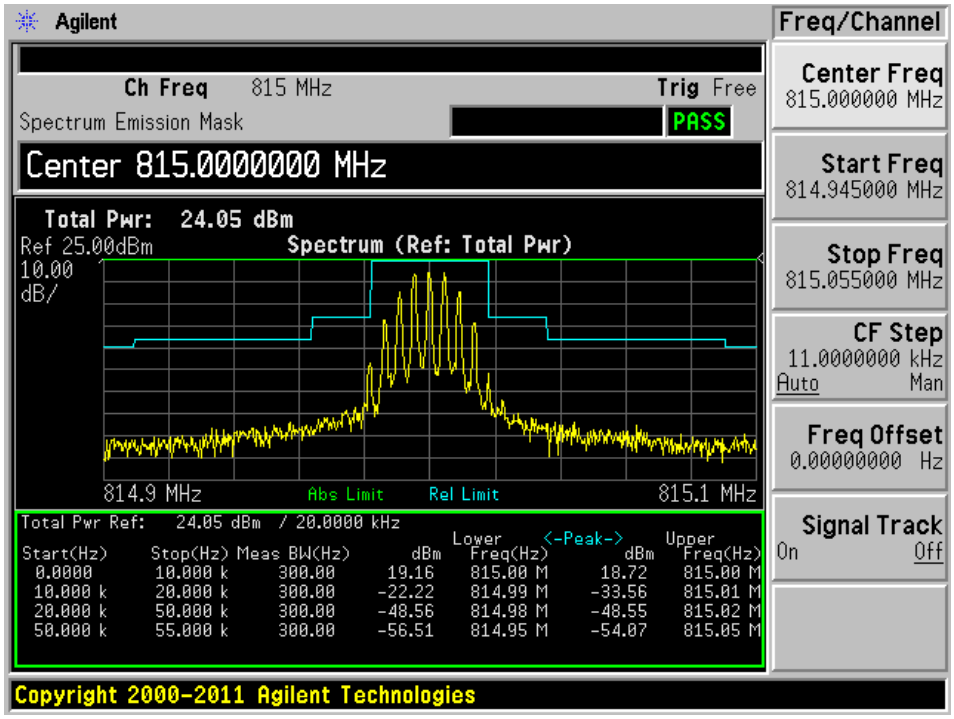


FM: 806 MHz – 824 MHz, 20 kHz Channel Spacing

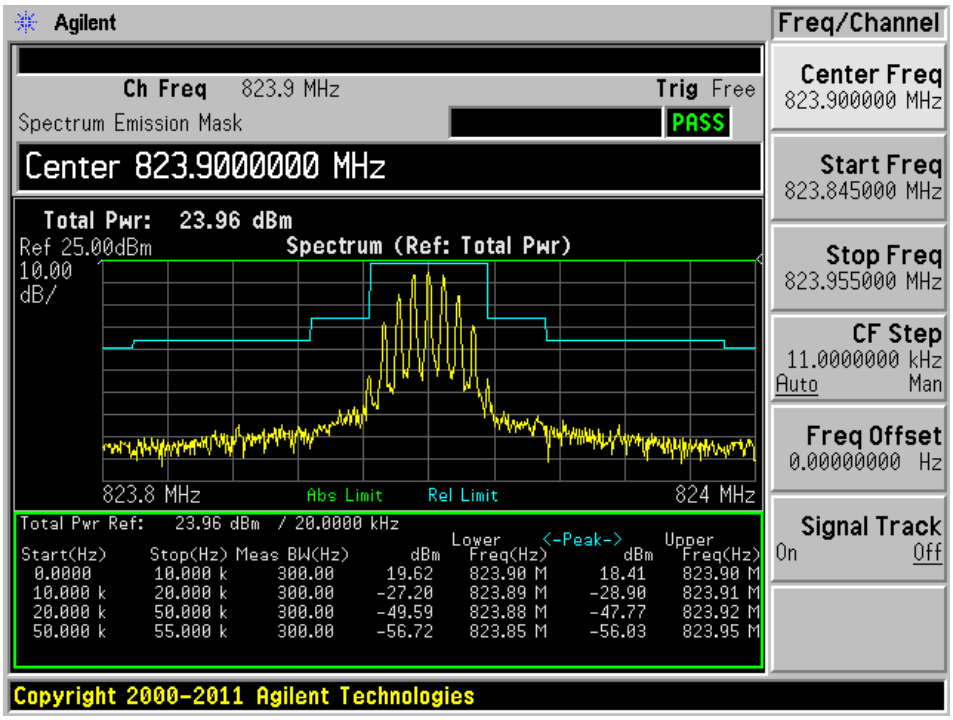
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

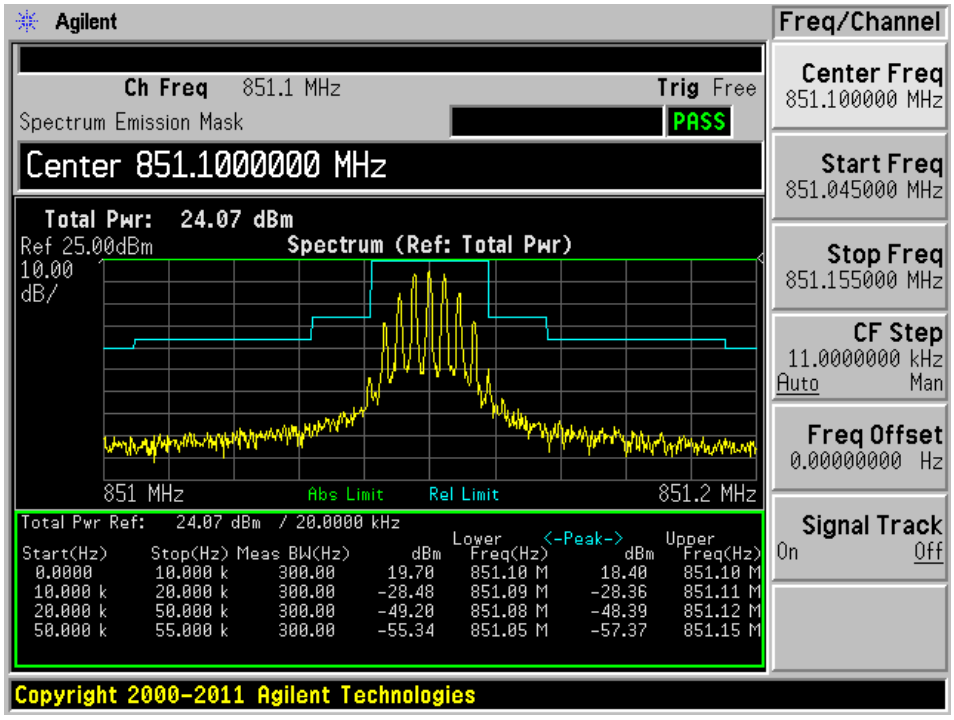


High Channel – 823.9 MHz

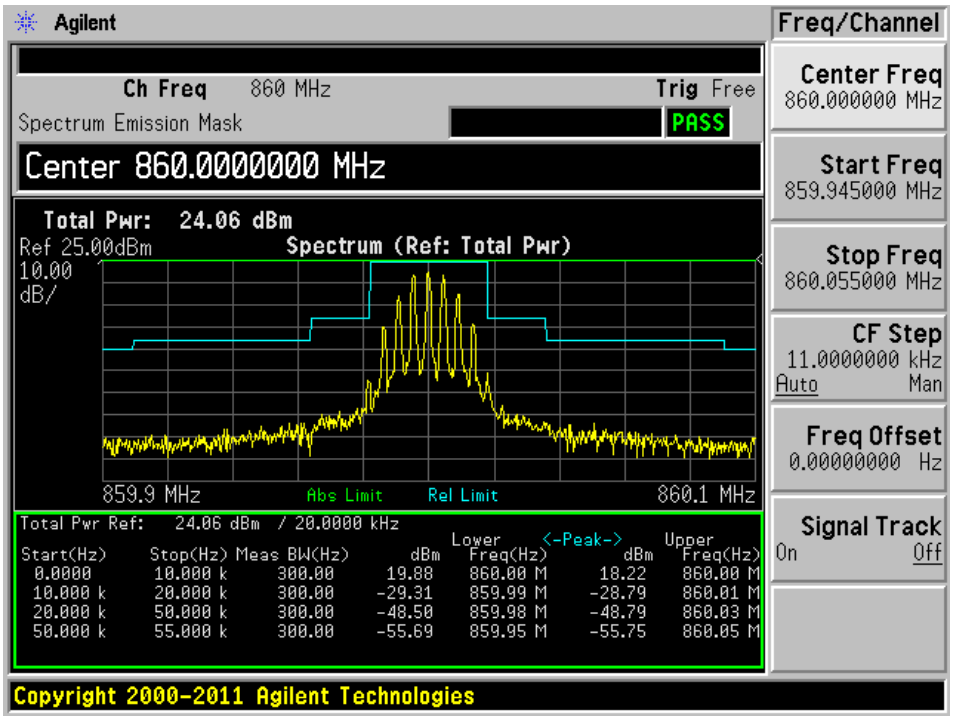


FM: 851 MHz – 869 MHz, 20 kHz Channel Spacing

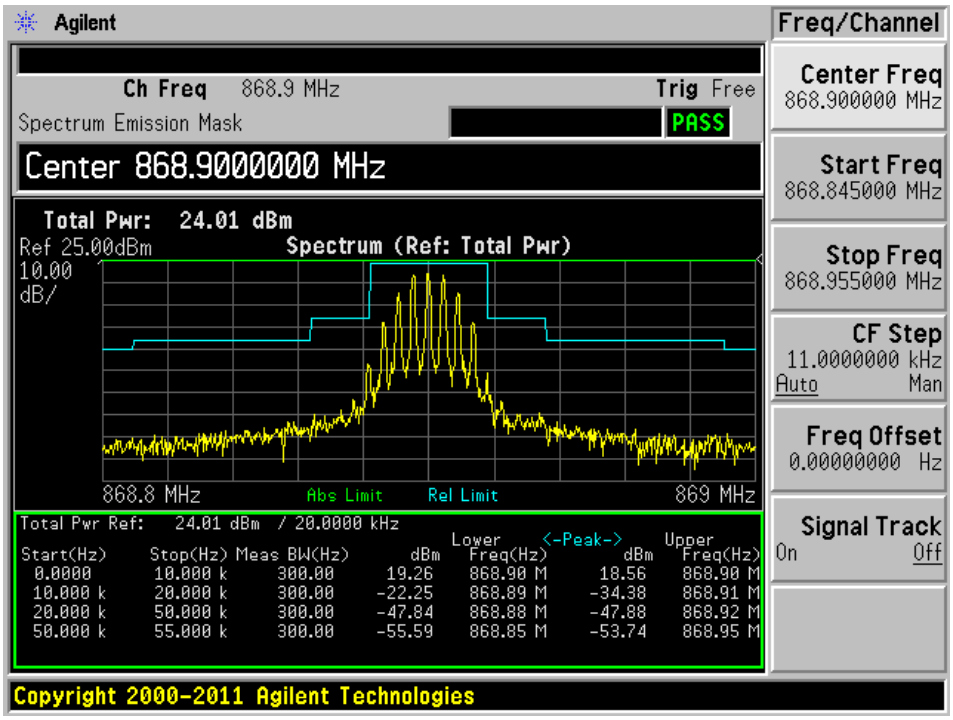
Low Channel – 851.1 MHz



Middle Channel – 860 MHz

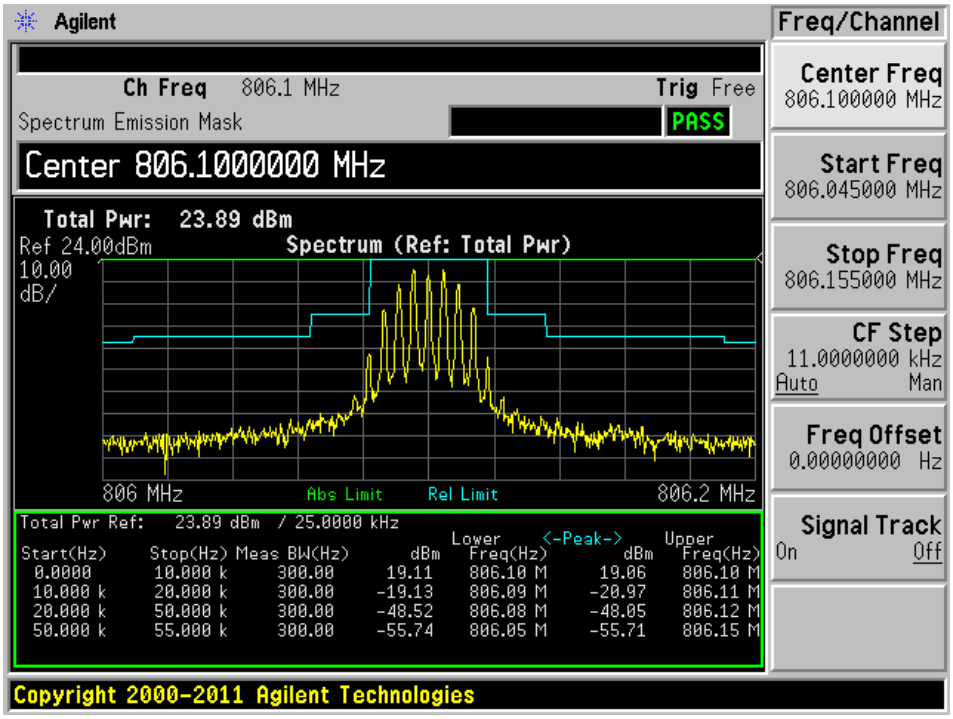


High Channel – 868.9 MHz

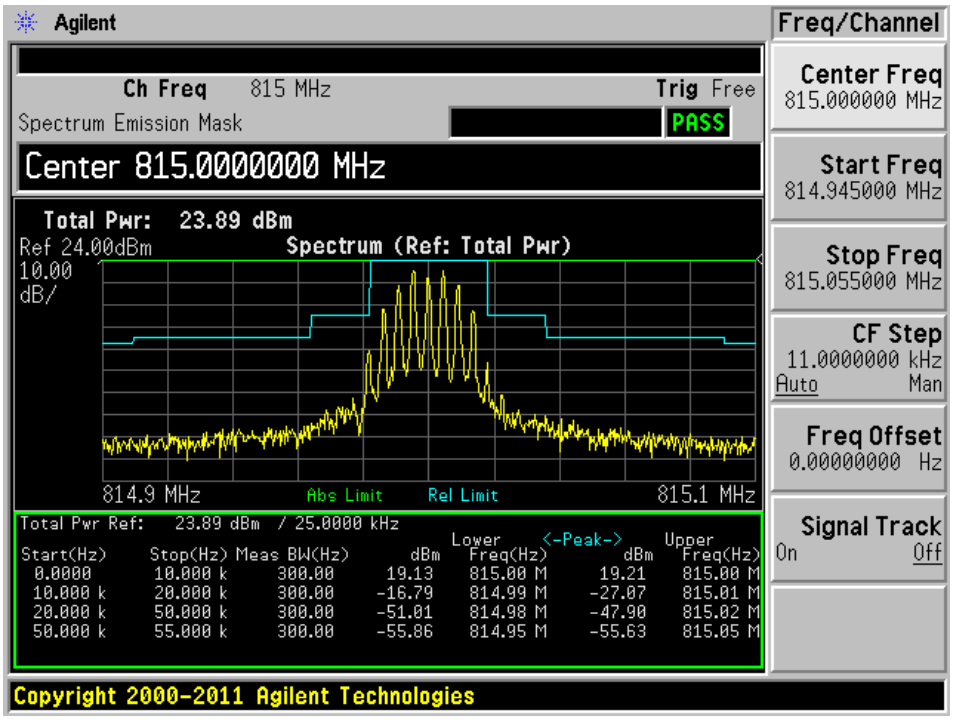


FM: 806 MHz – 824 MHz, 25 kHz Channel Spacing

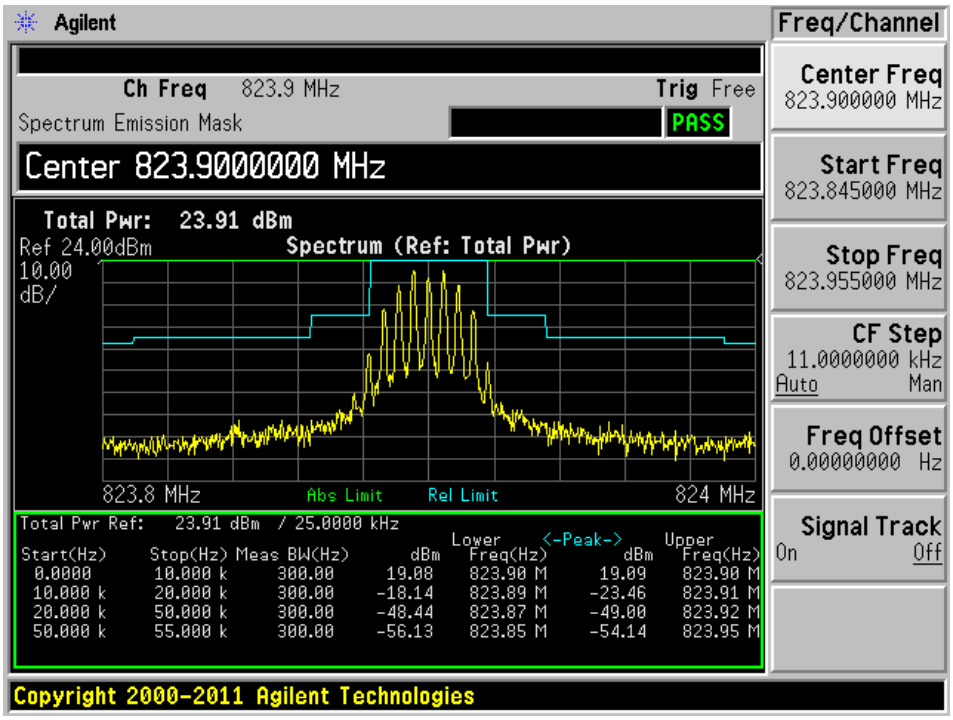
Low Channel – 806.1 MHz



Middle Channel – 815 MHz

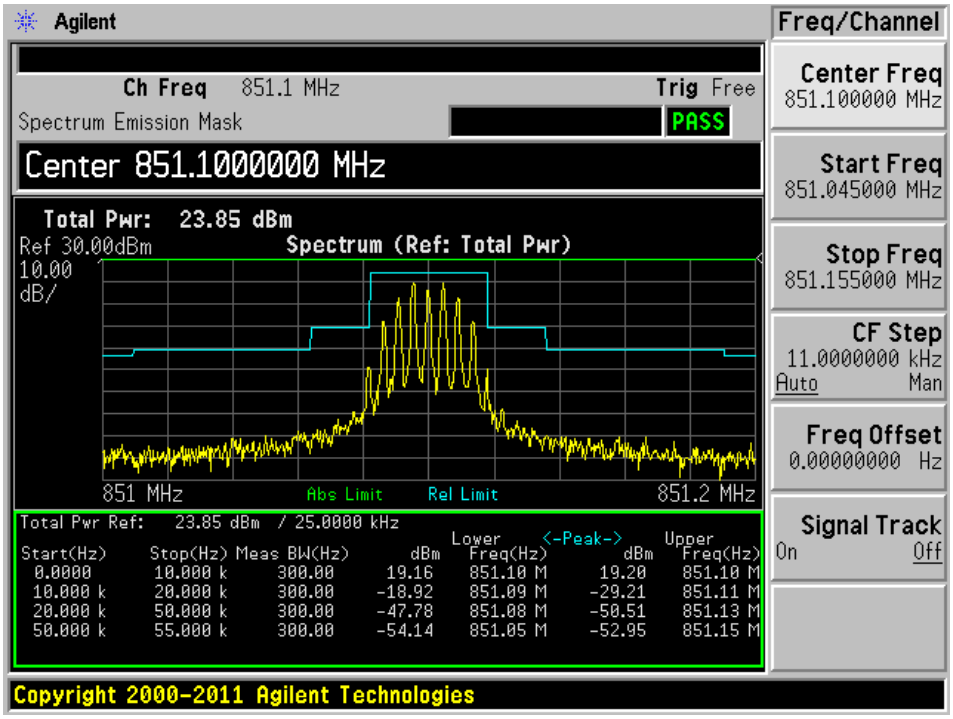


High Channel – 823.9 MHz

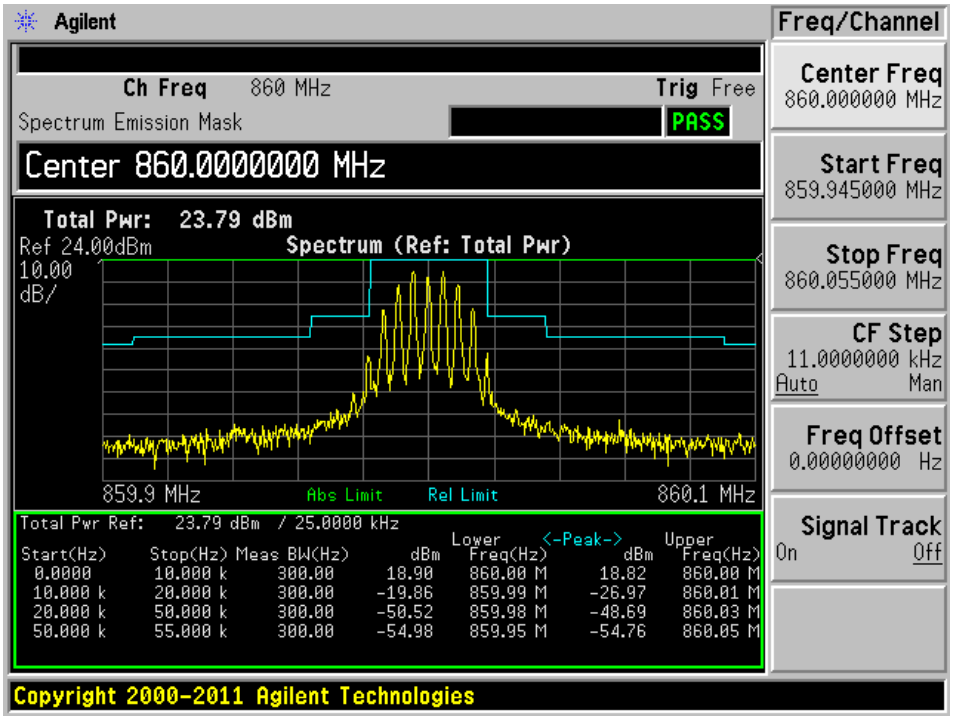


FM: 851 MHz – 869 MHz, 25 kHz Channel Spacing

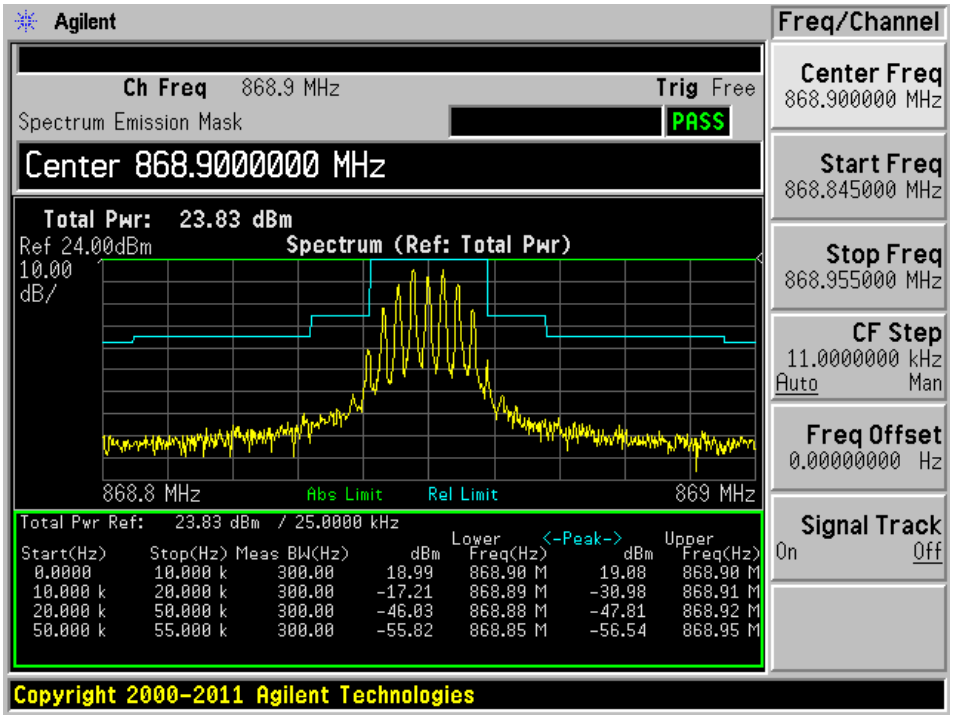
Low Channel – 851.1 MHz



Middle Channel – 860 MHz



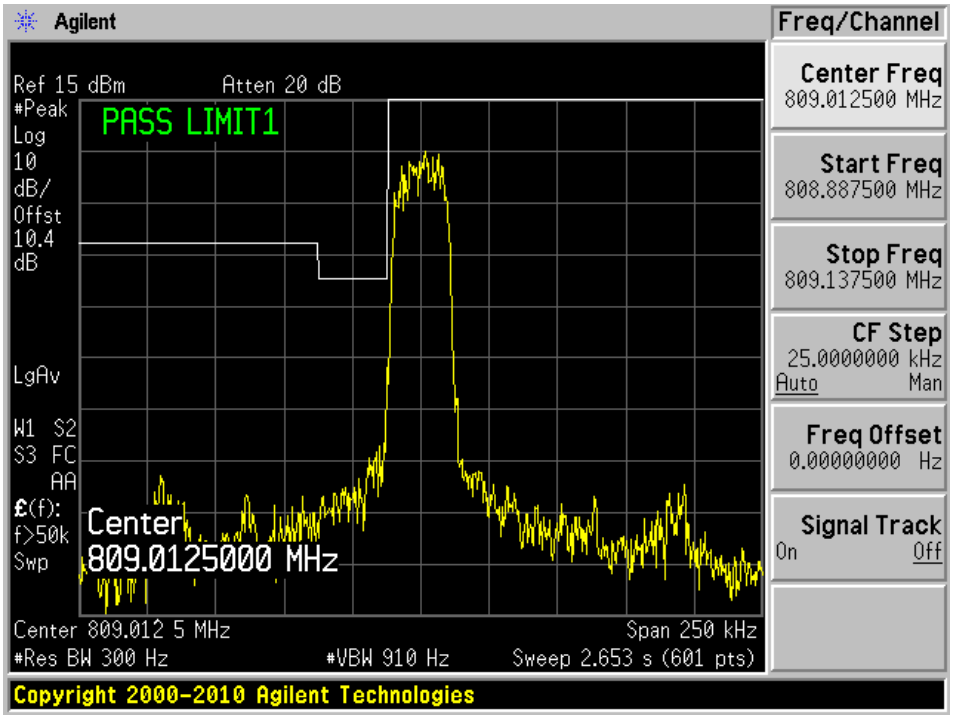
High Channel – 868.9 MHz



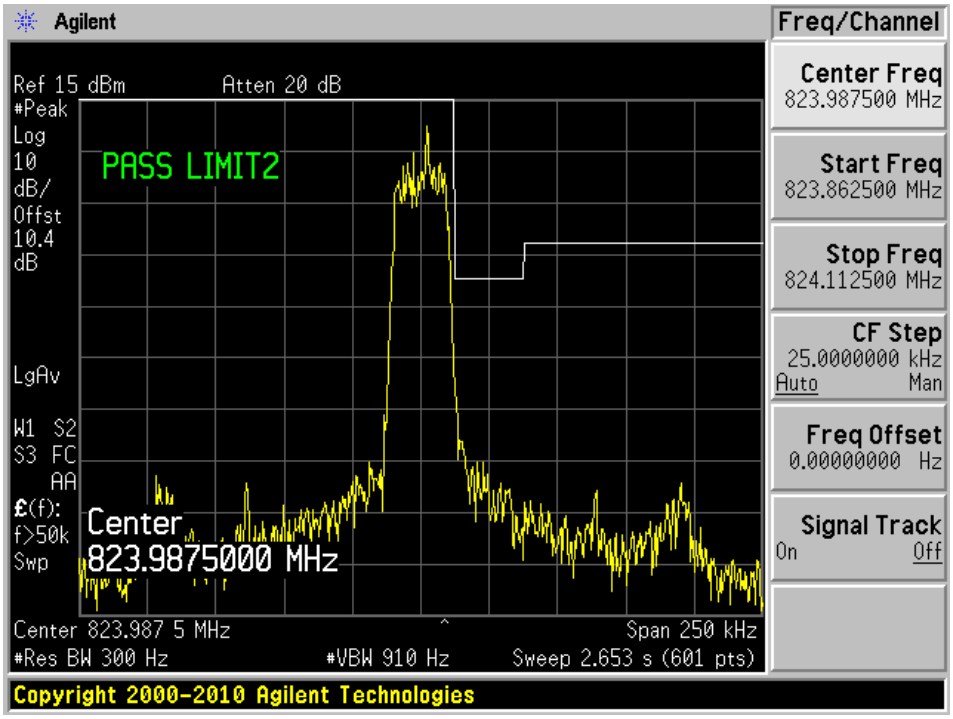
EA Mask (Low Power)

809-824 MHz, D-LMR

Low Channel – 809.0125 MHz

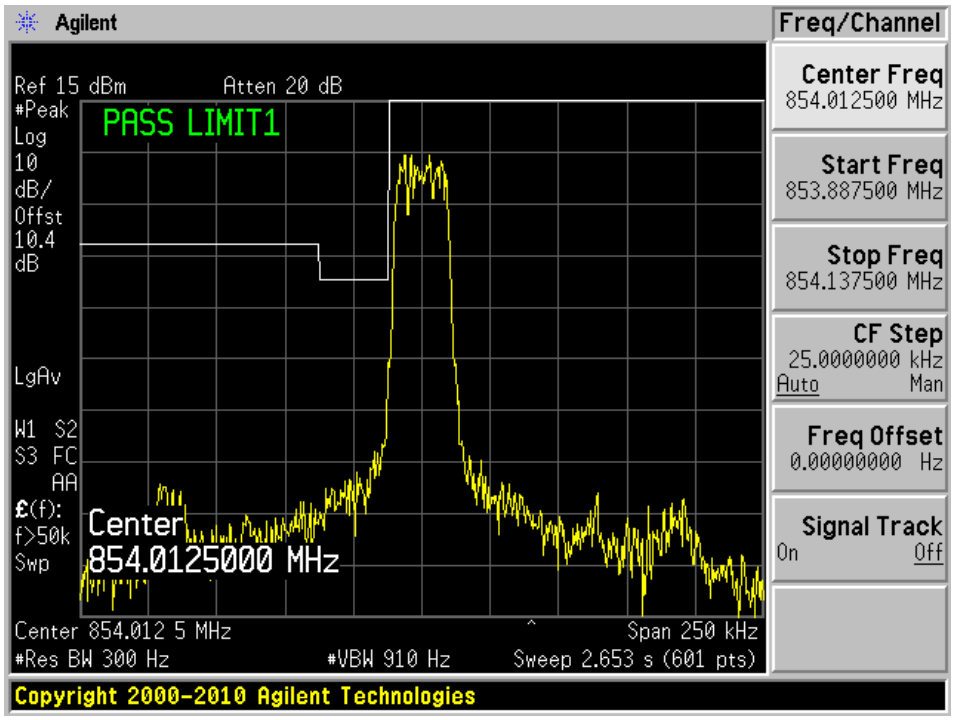


High Channel – 823.9875 MHz

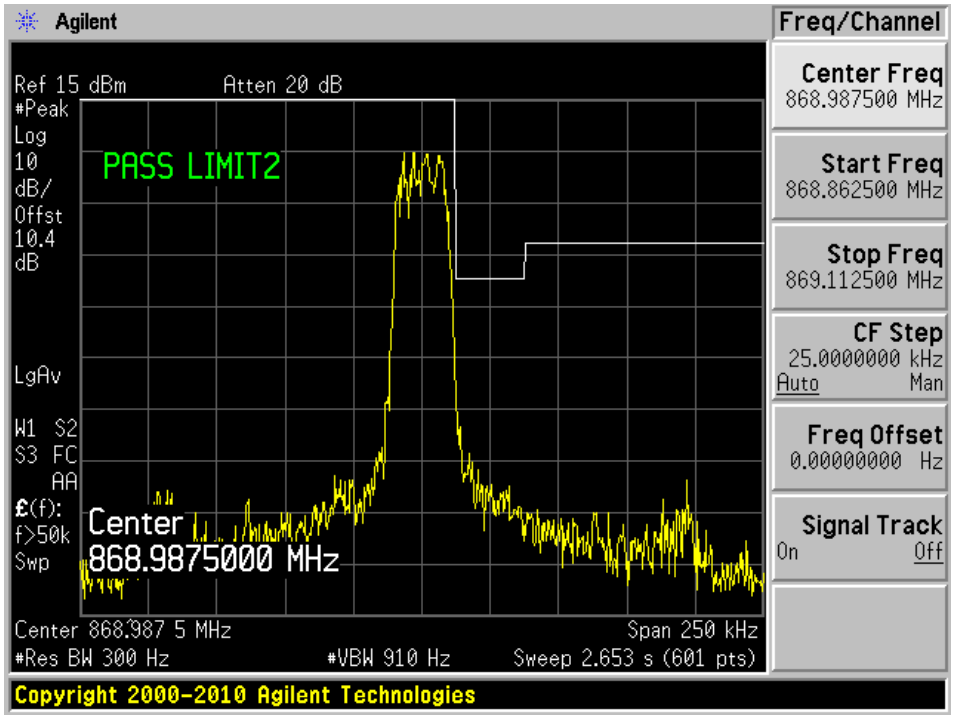


854-869 MHz, D-LMR

Low Channel – 854.0125 MHz

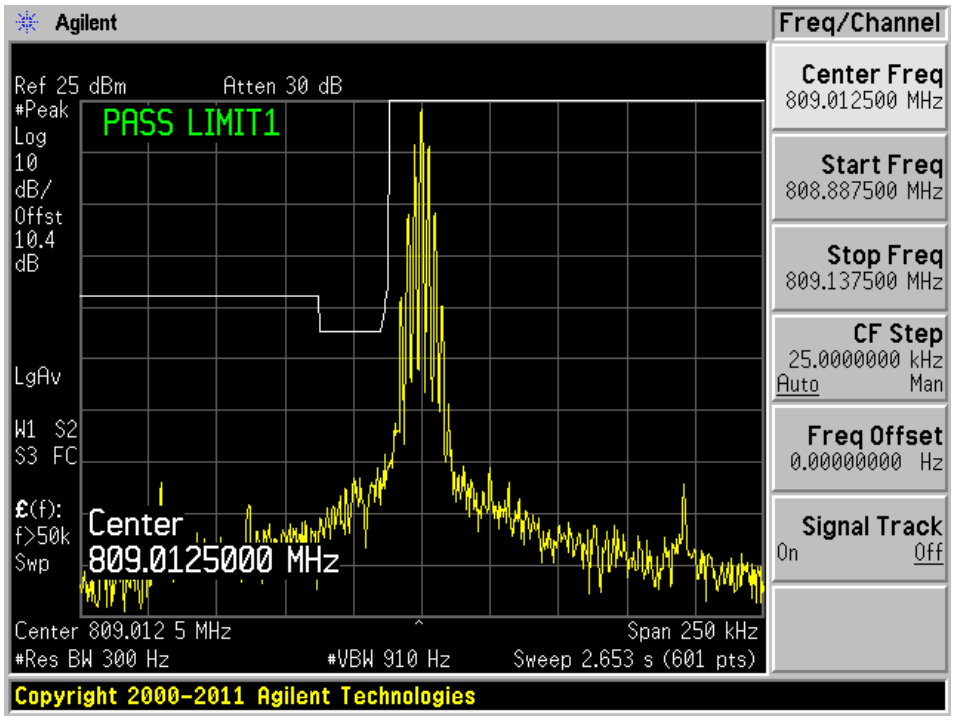


High Channel – 868.9875 MHz

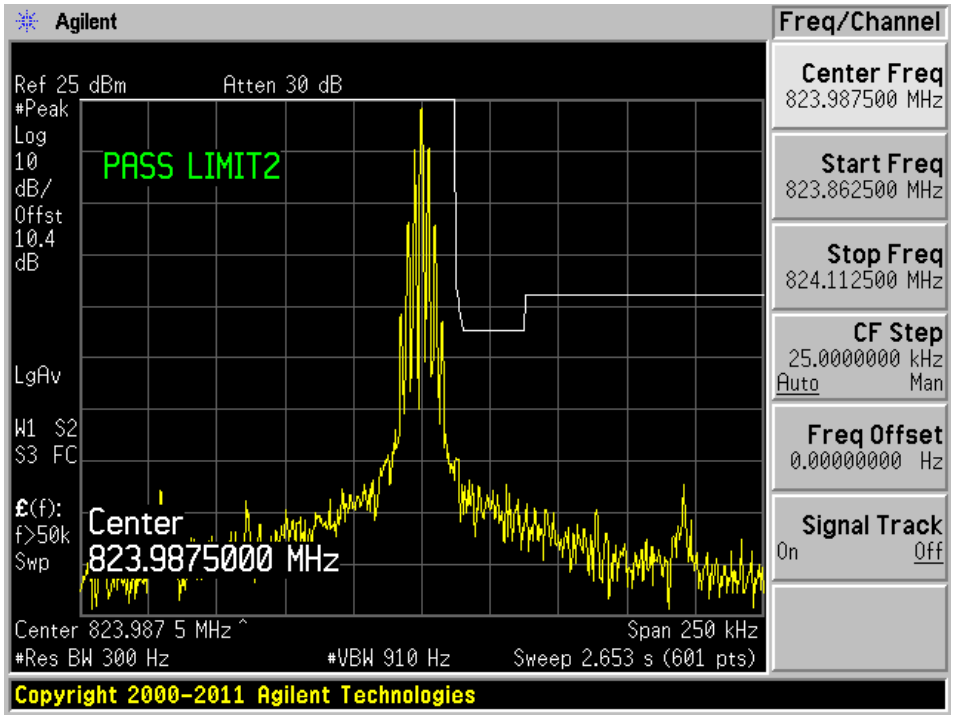


809-824 MHz, FM (20 kHz CS)

Low Channel – 809.0125 MHz

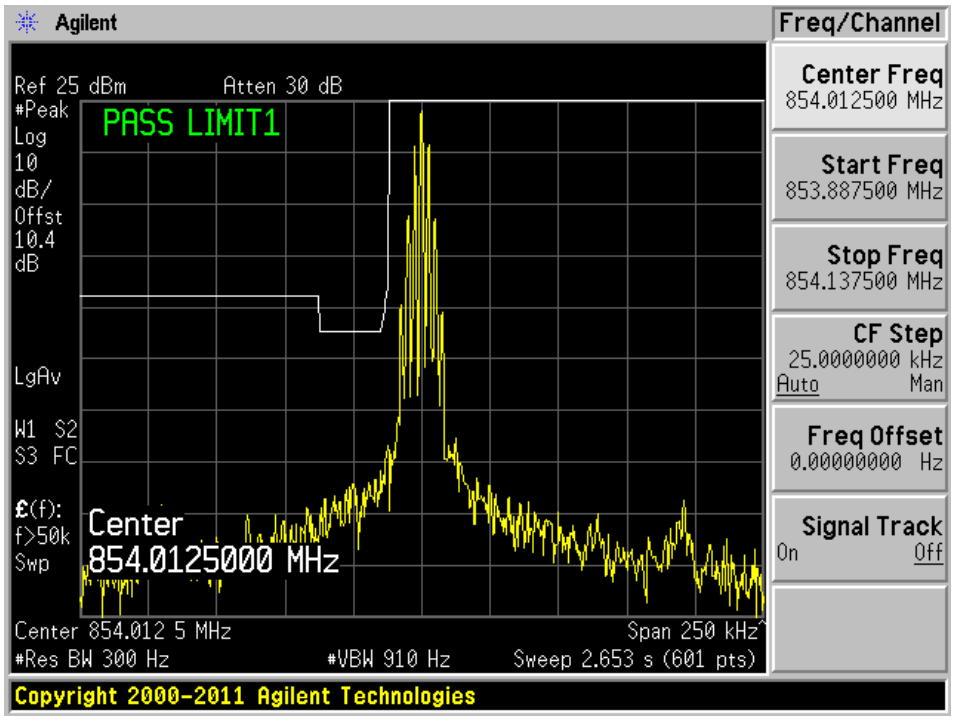


High Channel – 823.9875 MHz

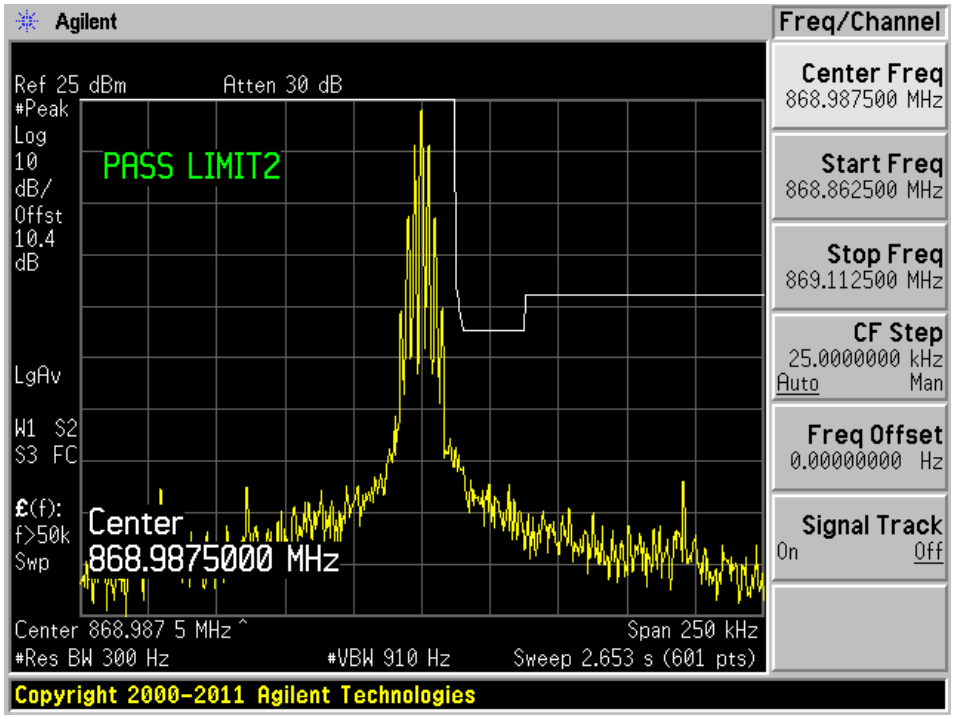


854-869 MHz, FM (20 kHz CS)

Low Channel – 854.0125 MHz

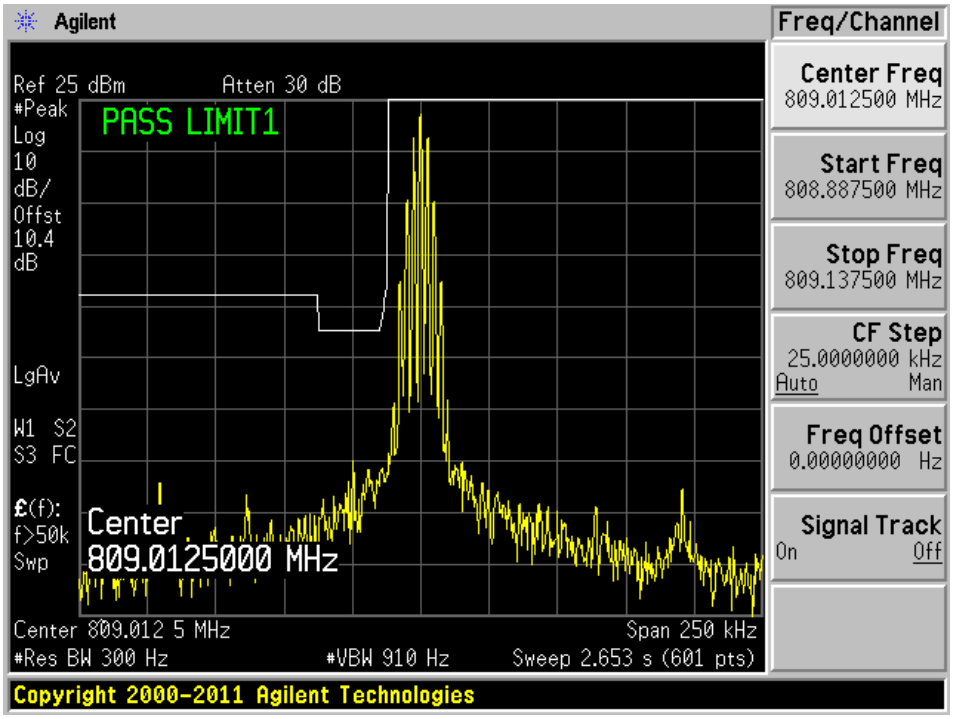


High Channel – 868.9875 MHz

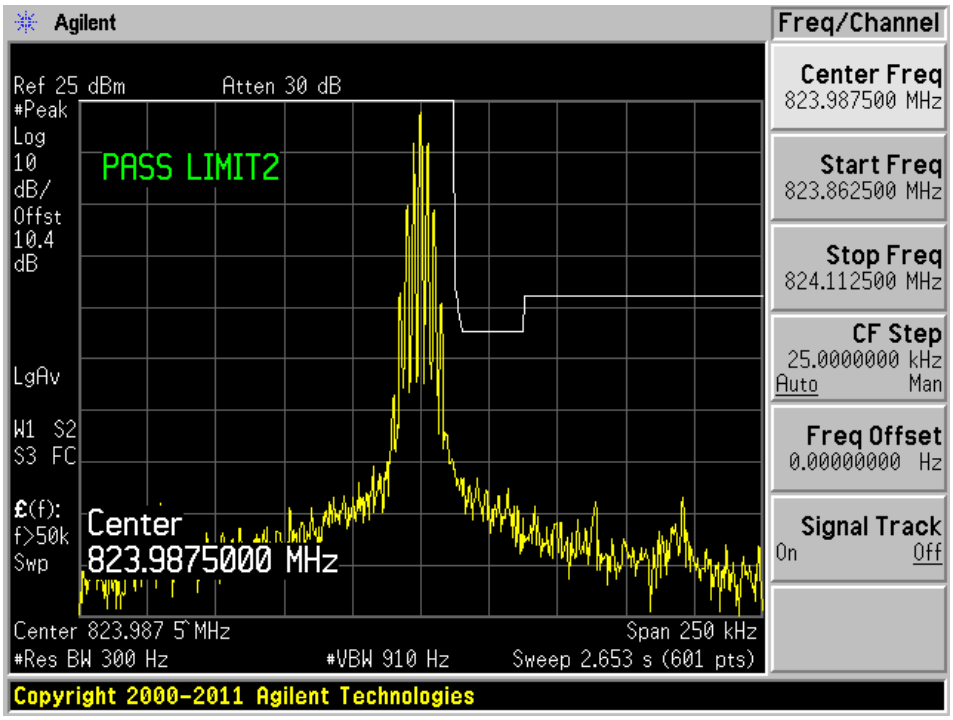


809-824 MHz, FM (25 kHz CS)

Low Channel – 809.0125 MHz

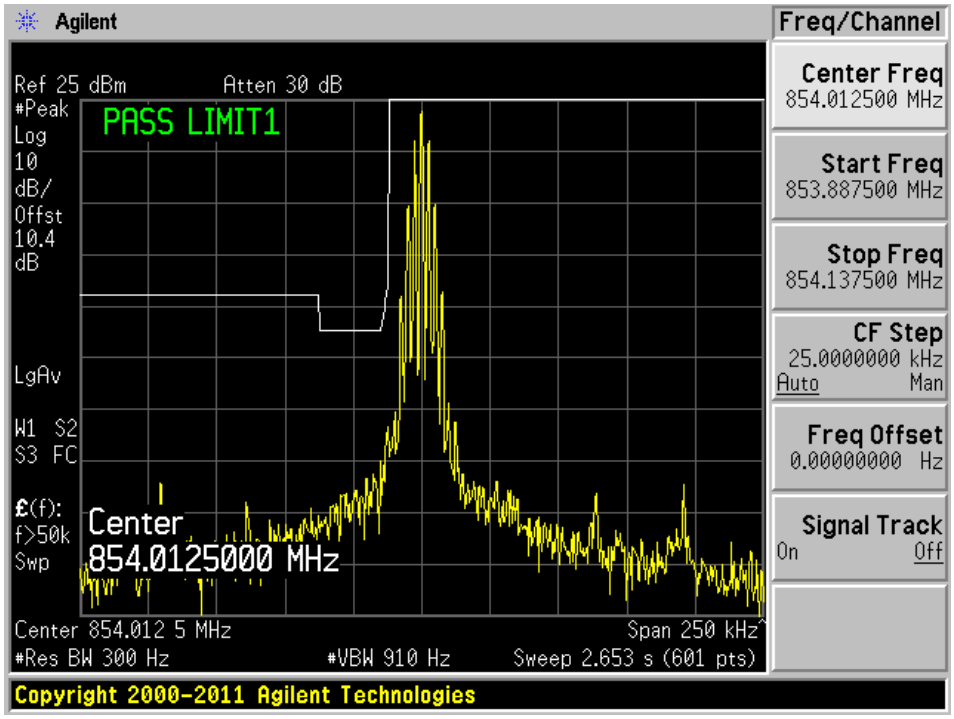


High Channel – 823.9875 MHz

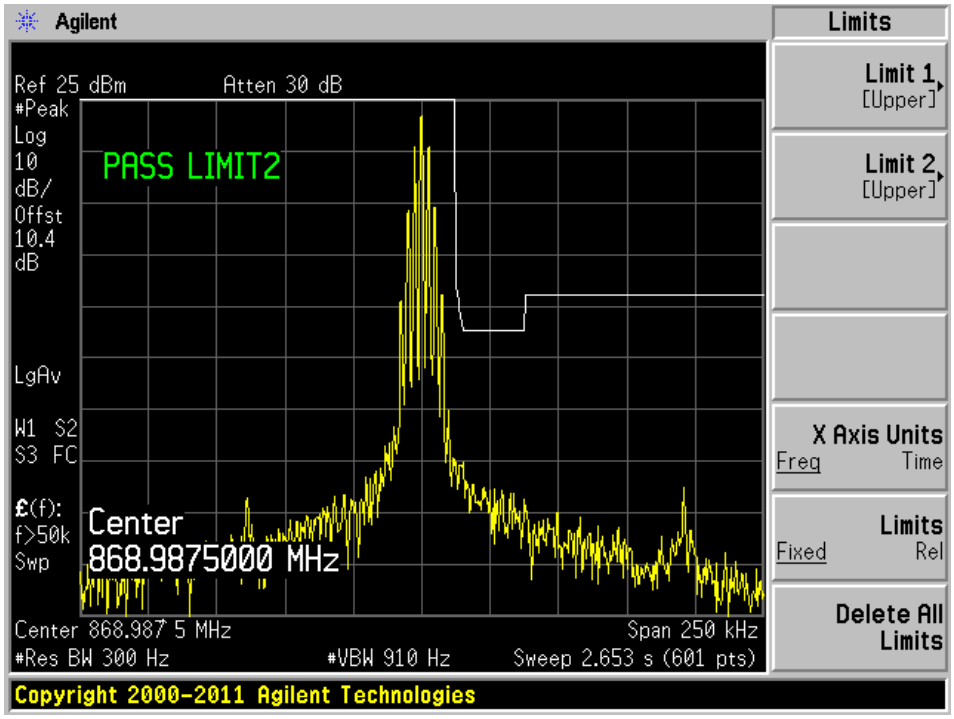


854-869 MHz, FM (25 kHz CS)

Low Channel – 854.0125 MHz



High Channel – 868.9875 MHz



8 FCC §2.1051, §90.210 & §90.221 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

TETRA (809-824 MHz/854-869 MHz):
According to FCC §90.221 (d): On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (Pwatts) dB.

D-LMR & FM (Mask B, 806-824 MHz / 851-869 MHz):
According to FCC §90.210 (b) (3): On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (Pwatts) dB.

D-LMR & C4FM (769-775 MHz/799-805 MHz):
According to FCC §90.543 (c): *Out-of-band emission limit*. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10 log (Pwatts) dB measured in a 100 KHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

8.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz for frequencies below 1 GHz and at 1 MHz for frequencies above 1 GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	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:	23 °C
Relative Humidity:	48.9 %
ATM Pressure:	101.2 kPa

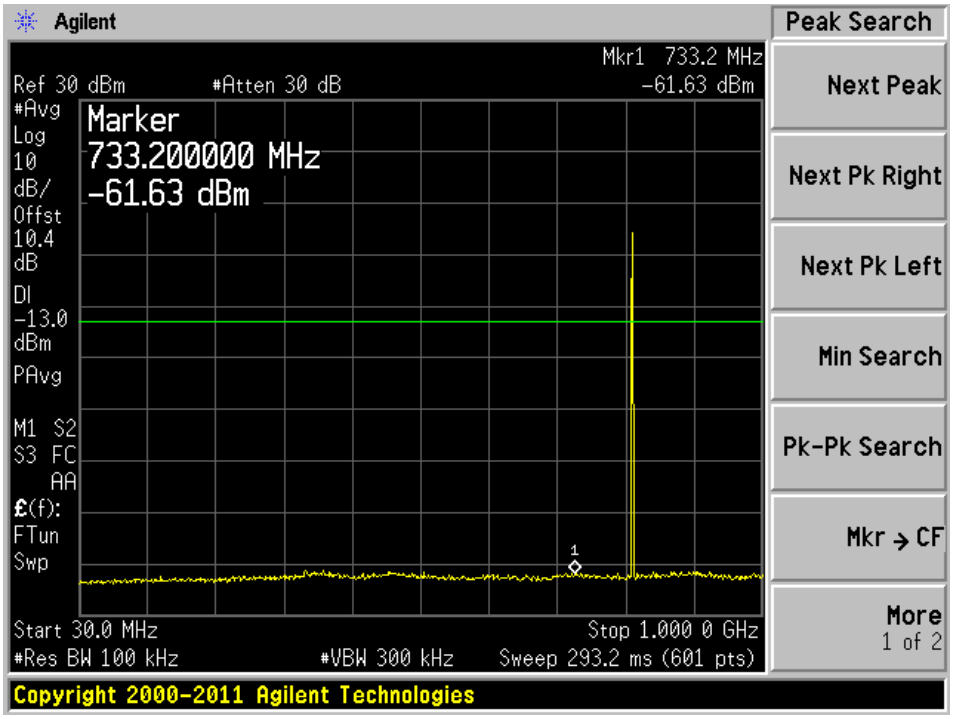
The testing was performed by Ning Ma on 2013-02-19 in the RF Site.

8.5 Test Results

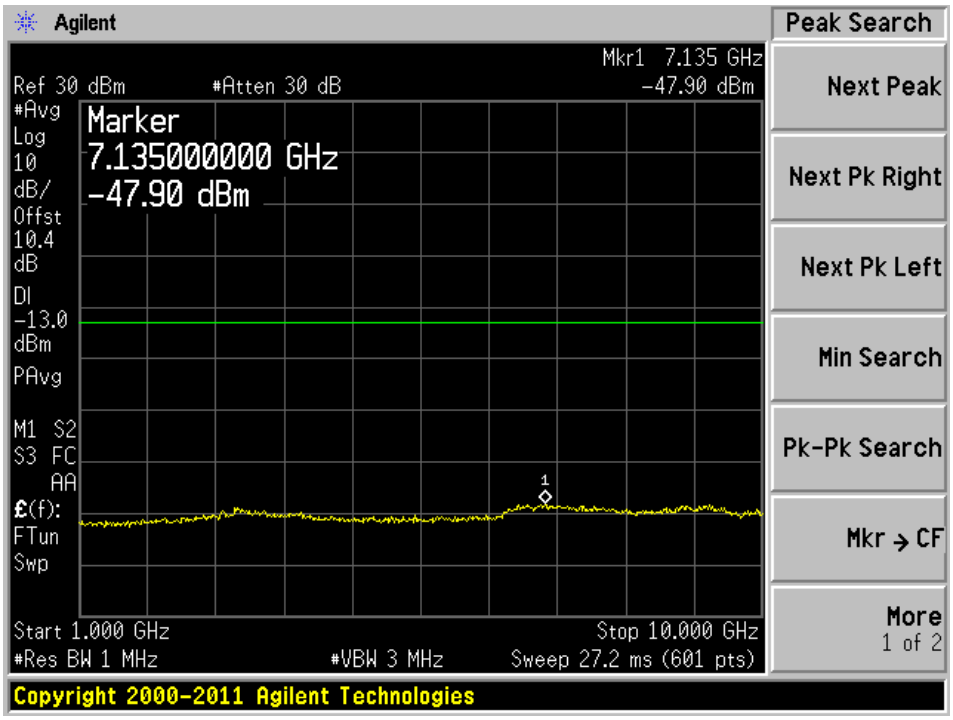
Please refer to the following plots.

TETRA: 809-824 MHz

Middle Channel: 815 MHz, 30MHz – 1GHz

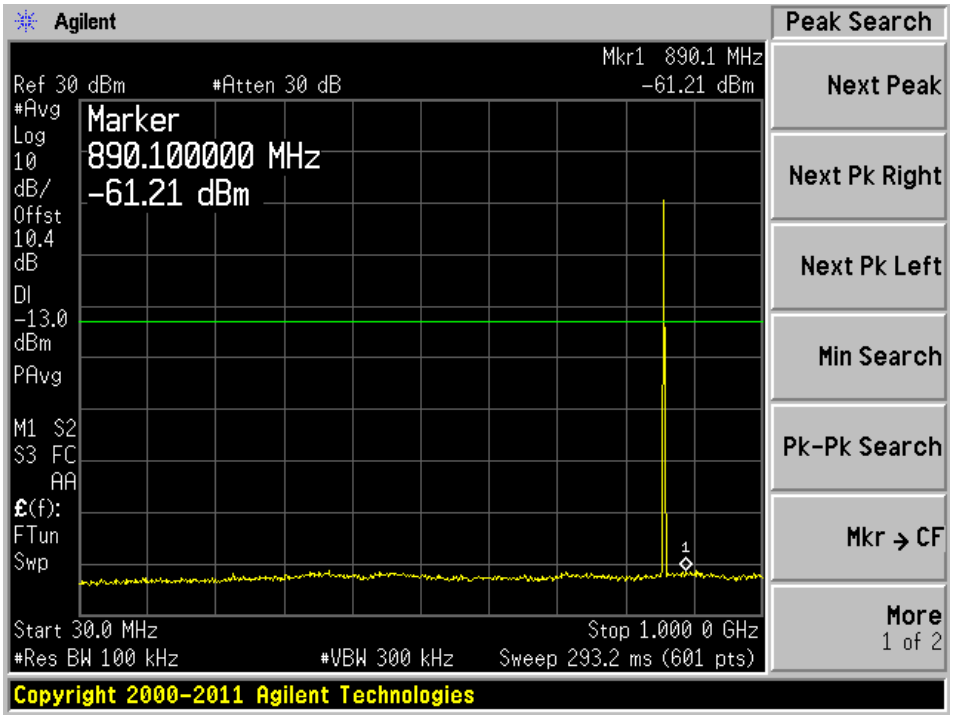


Middle Channel: 815 MHz, 1GHz – 10GHz

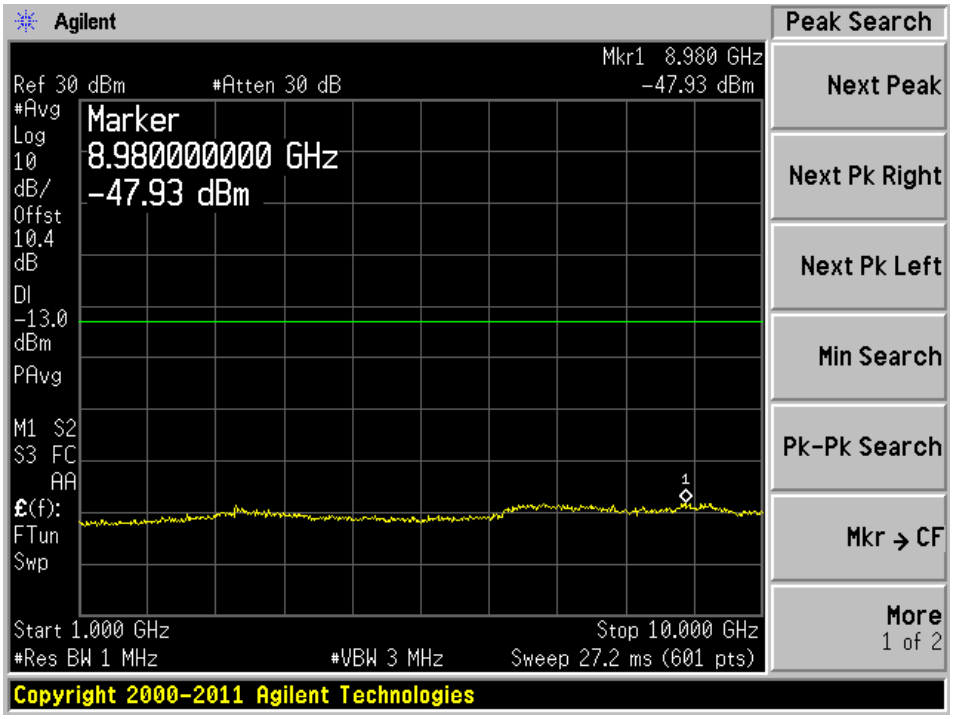


TETRA: 854-869 MHz

Middle Channel: 860 MHz, 30MHz – 1GHz

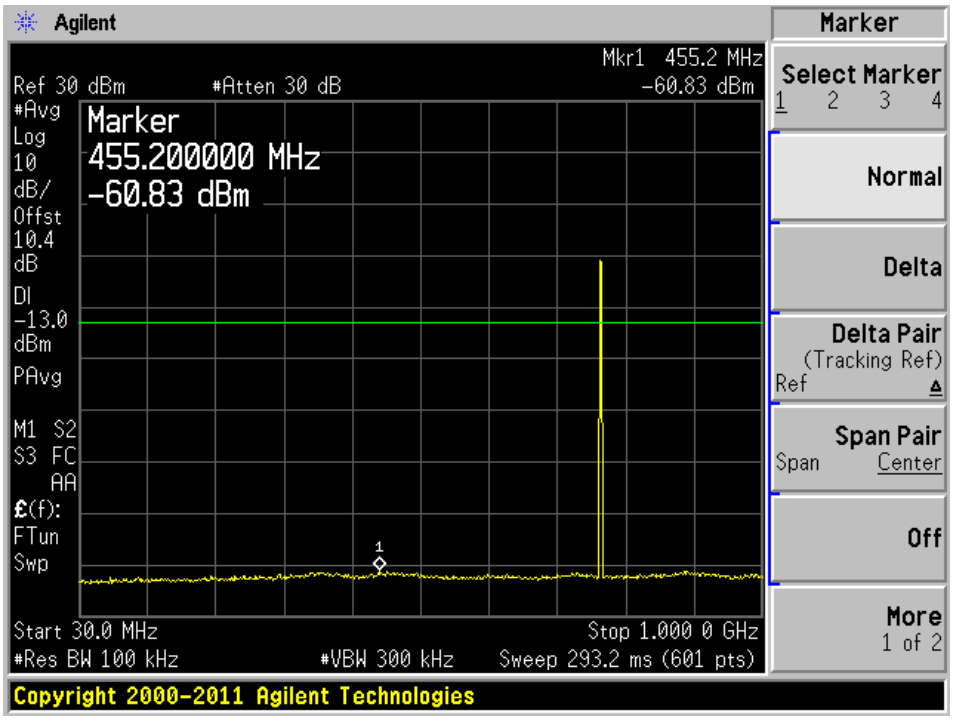


Middle Channel: 860 MHz, 1GHz – 10GHz

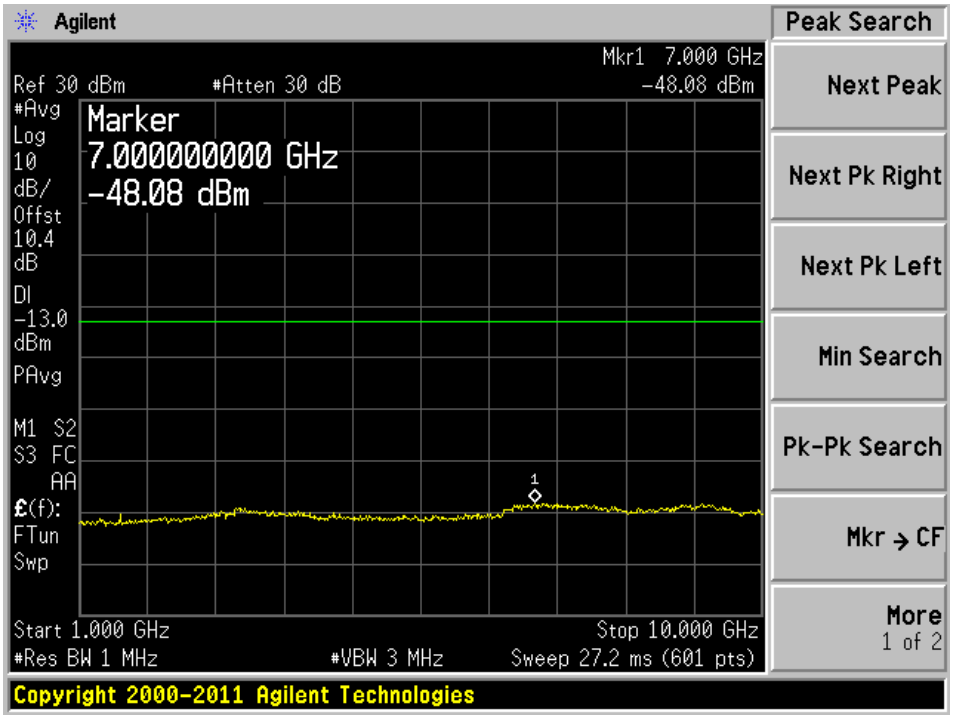


D-LMR: 769-775 MHz

Low Channel: 769.1 MHz, 30MHz – 1GHz

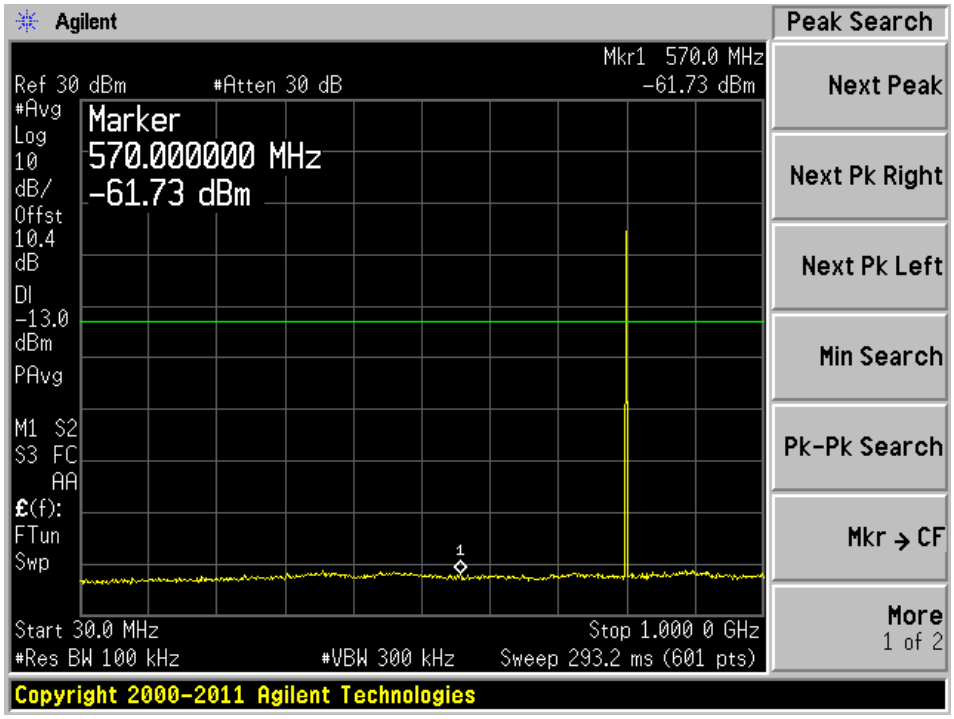


Low Channel: 769.1 MHz, 1GHz – 10GHz

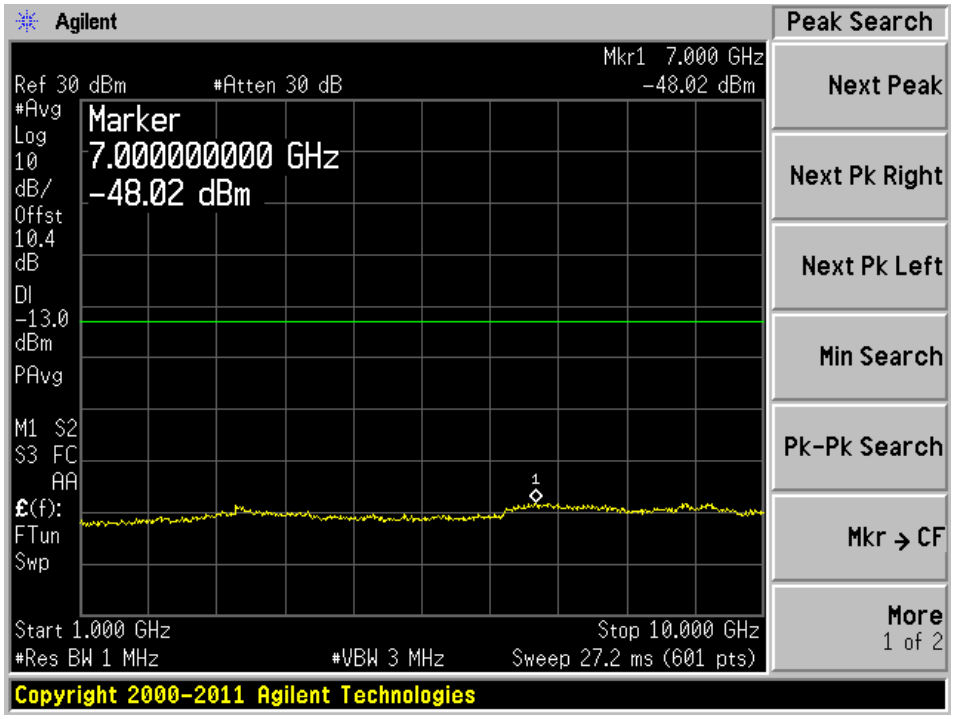


D-LMR: 799-805 MHz

High Channel: 804.9 MHz, 30MHz – 1GHz

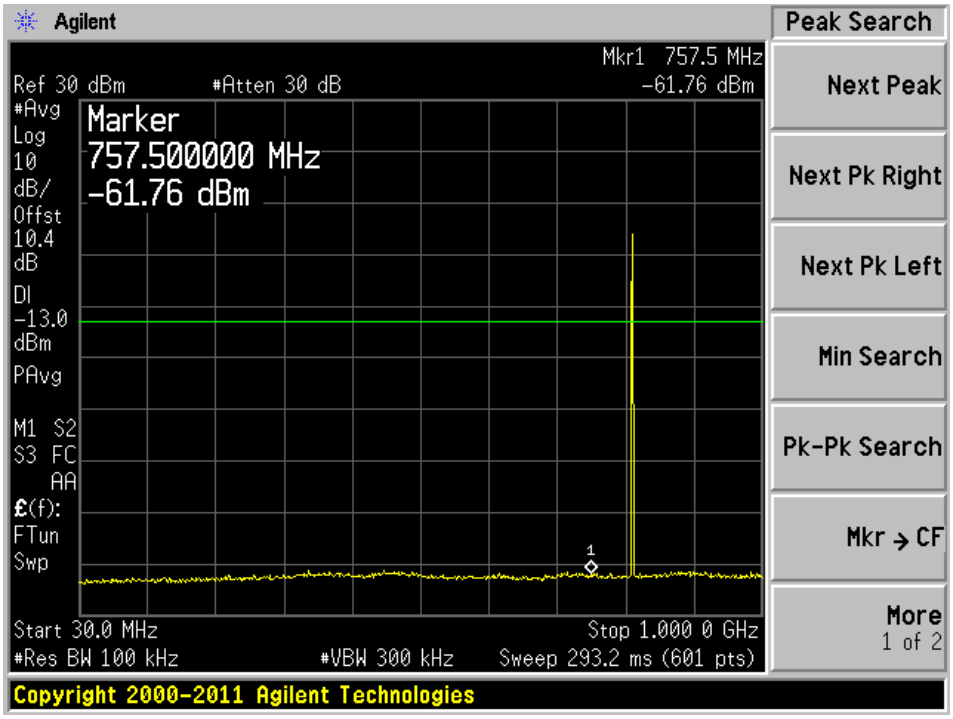


High Channel: 804.9 MHz, 1GHz – 10GHz

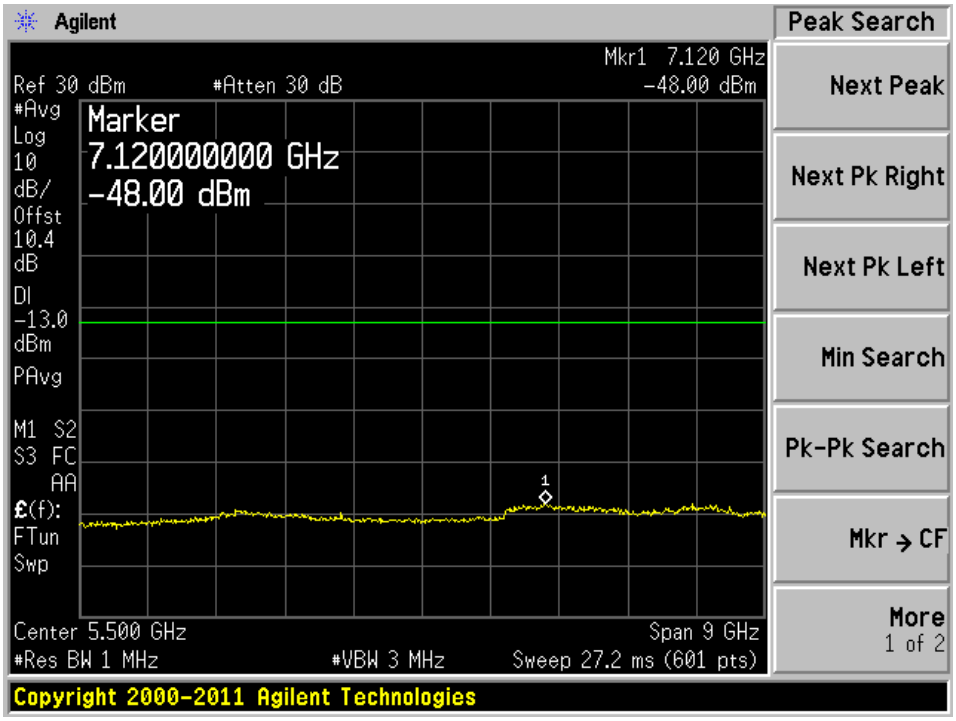


D-LMR: 806-824 MHz

Middle Channel: 815 MHz, 30MHz – 1GHz

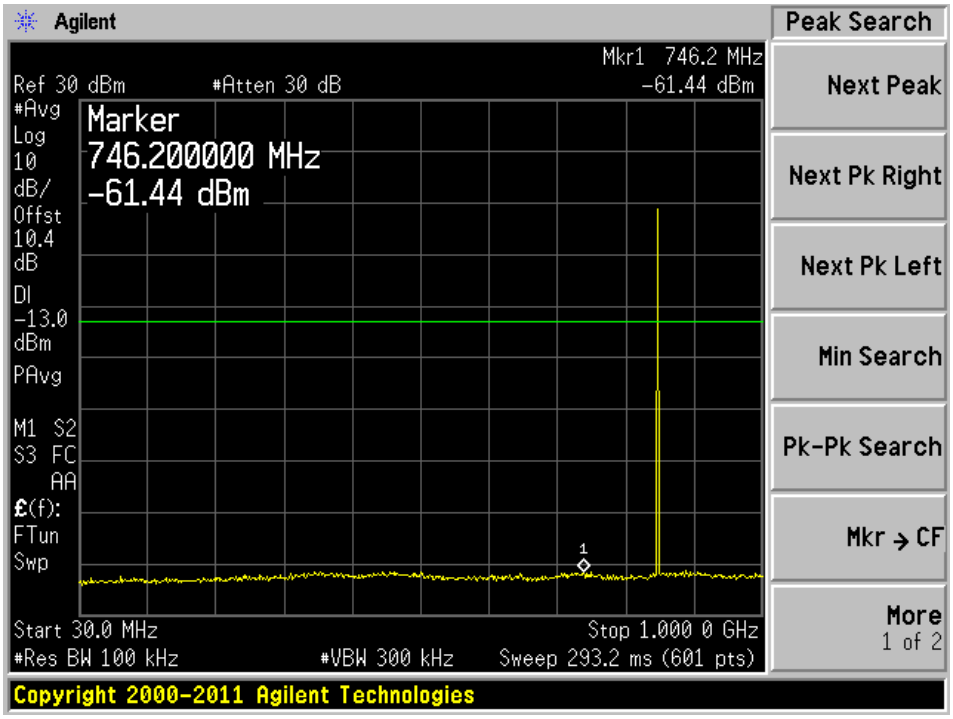


Middle Channel: 815 MHz 1GHz – 10GHz

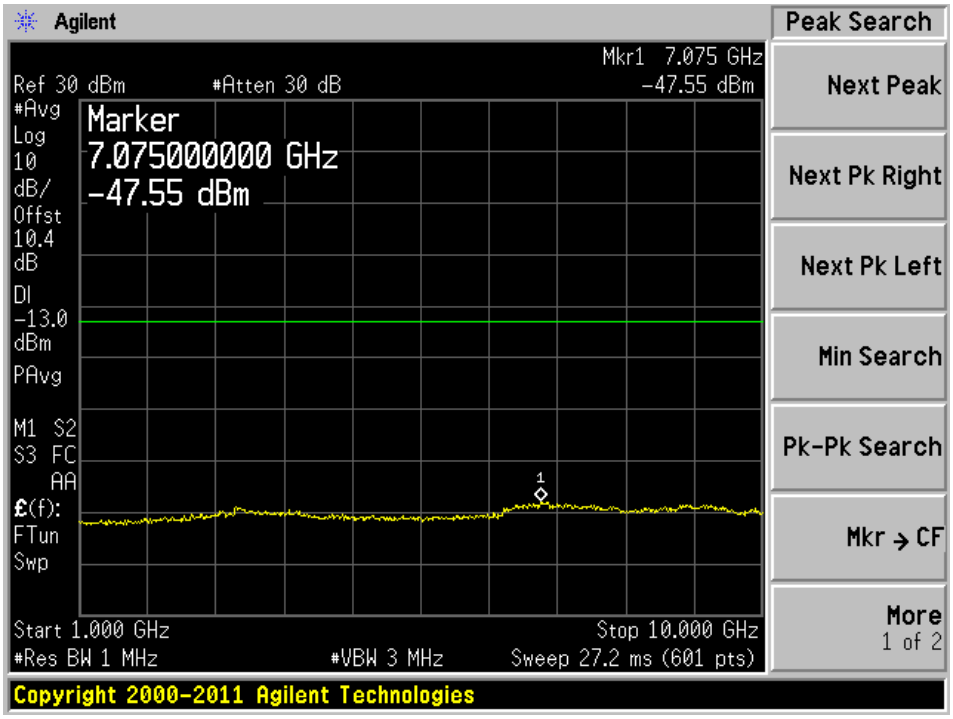


D-LMR: 851-869 MHz

Low Channel: 851.1 MHz, 30MHz – 1GHz

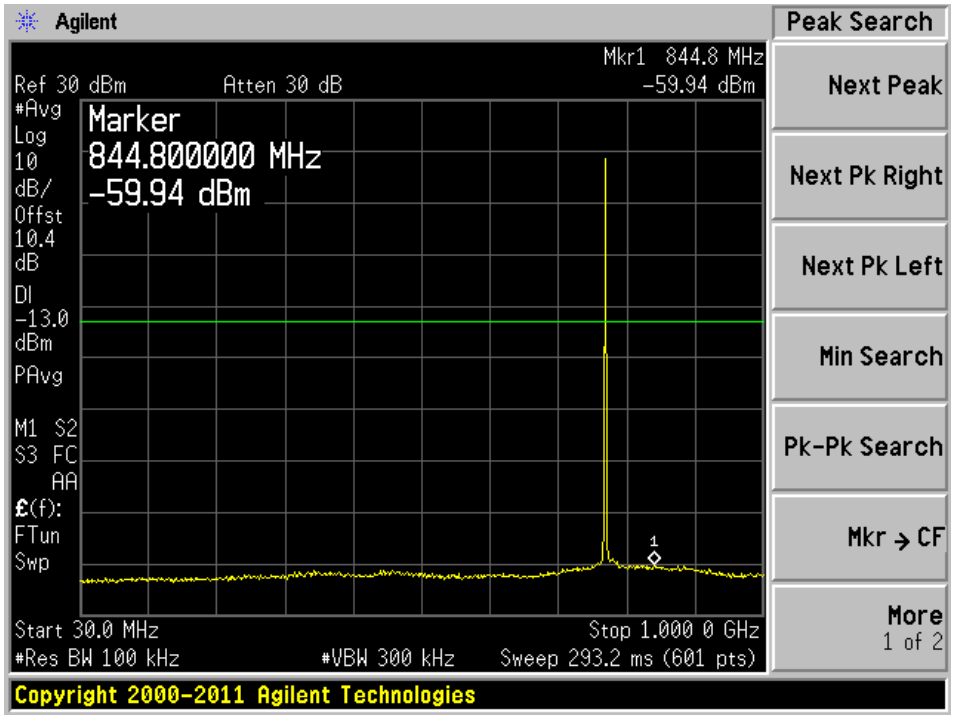


Low Channel: 851.1 MHz, 1GHz – 10GHz

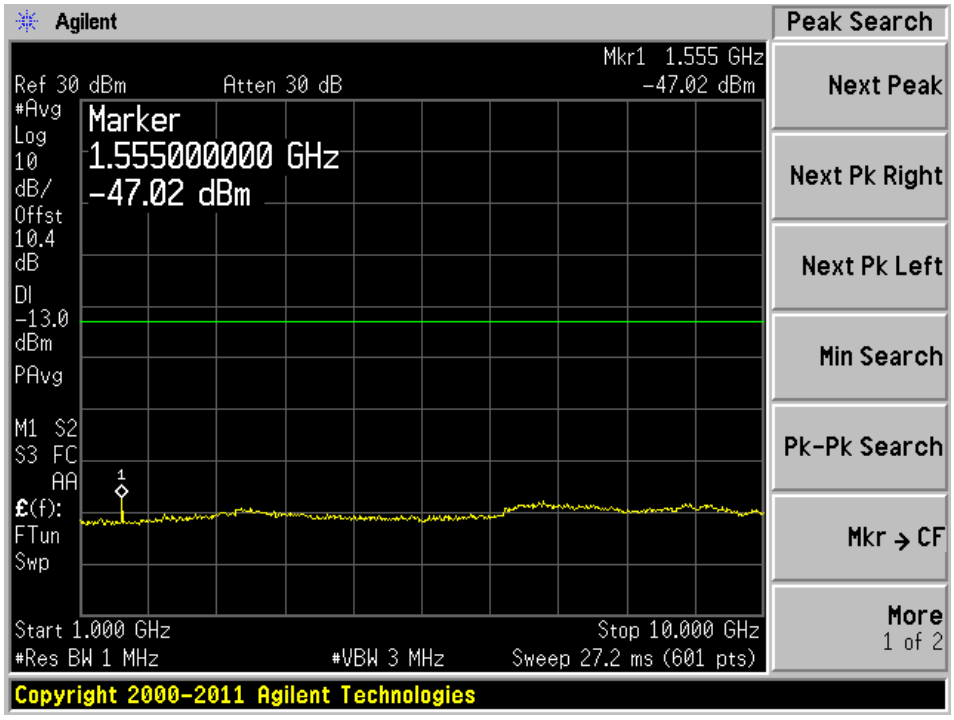


C4FM: 769-775 MHz

High Channel: 774.9 MHz, 30MHz – 1GHz

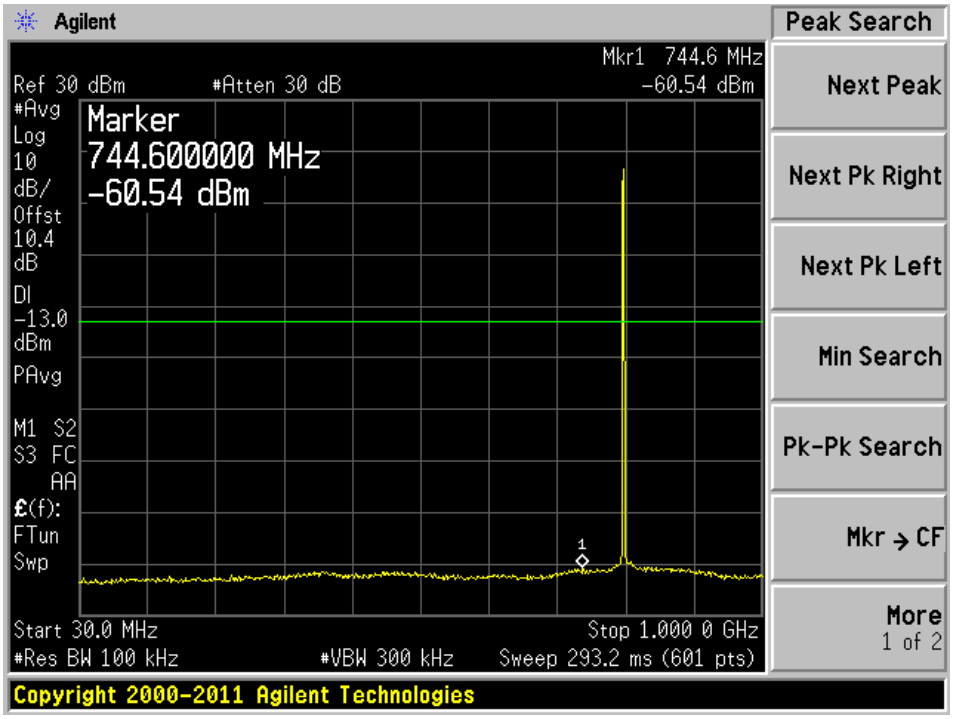


High Channel: 774.9 MHz, 1GHz – 10GHz

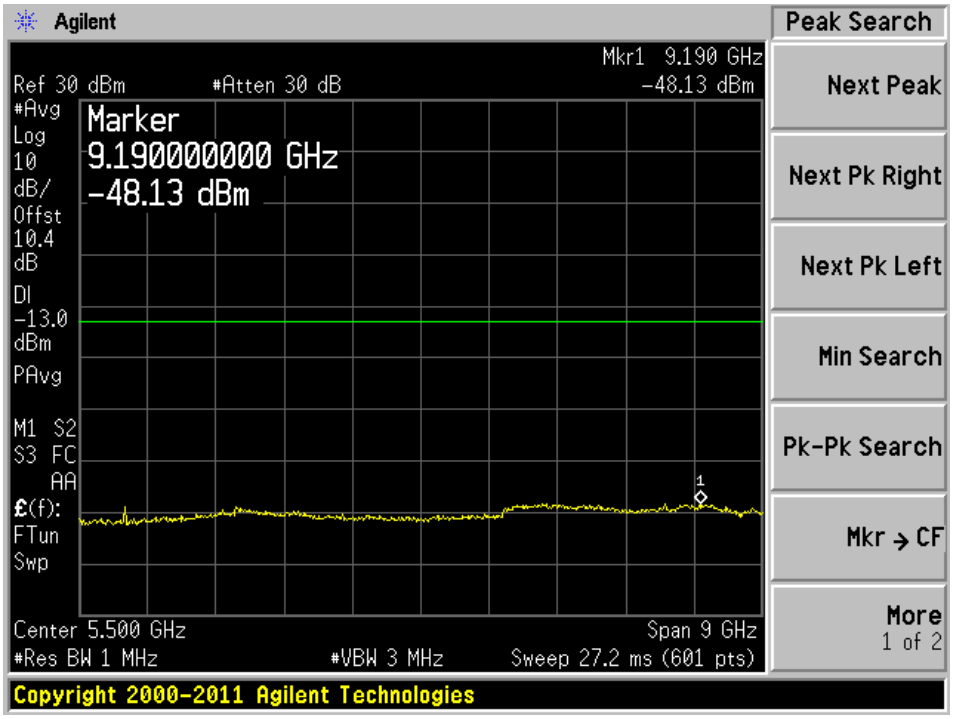


C4FM: 799-805 MHz

Middle Channel: 802 MHz, 30MHz – 1GHz

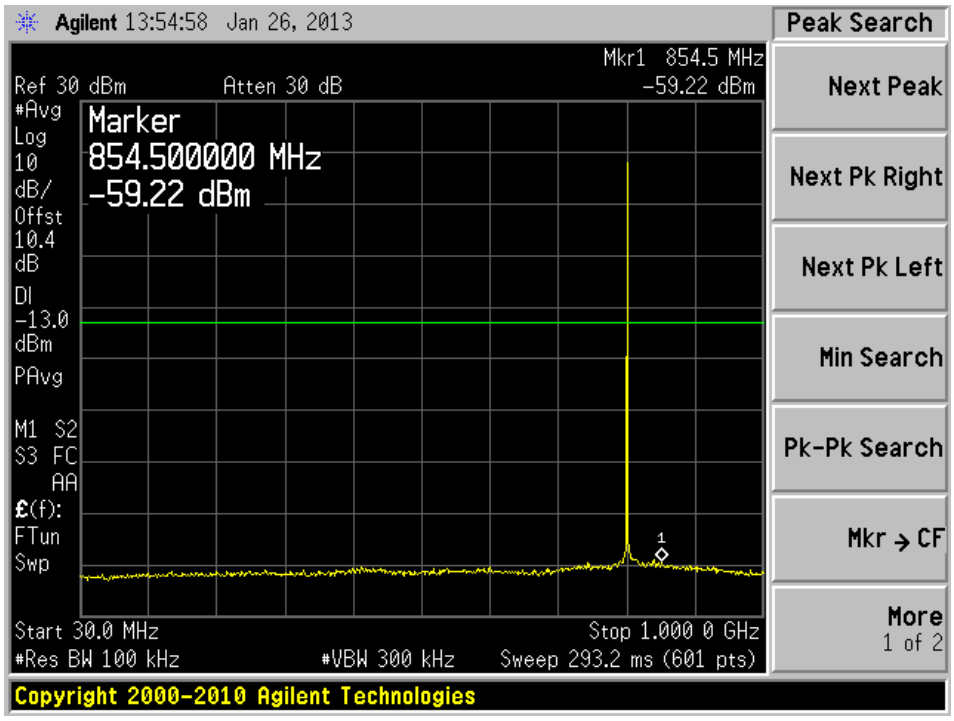


Middle Channel: 802 MHz, 1GHz – 10GHz

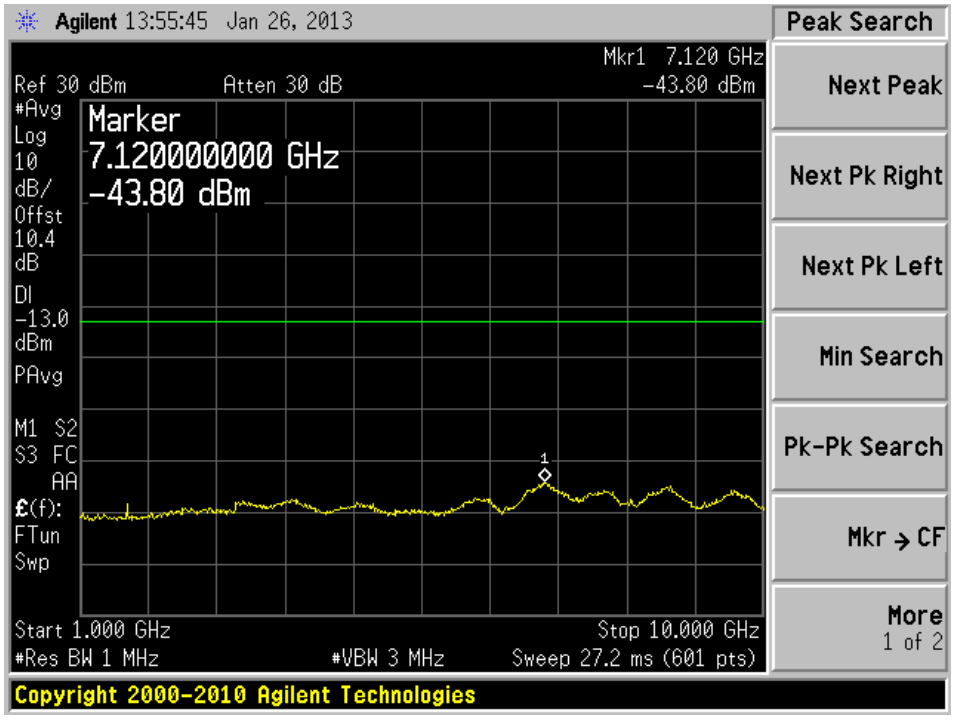


FM: 806-824 MHz (20 kHz Channel Spacing)

Middle Channel: 815 MHz 30MHz – 1GHz

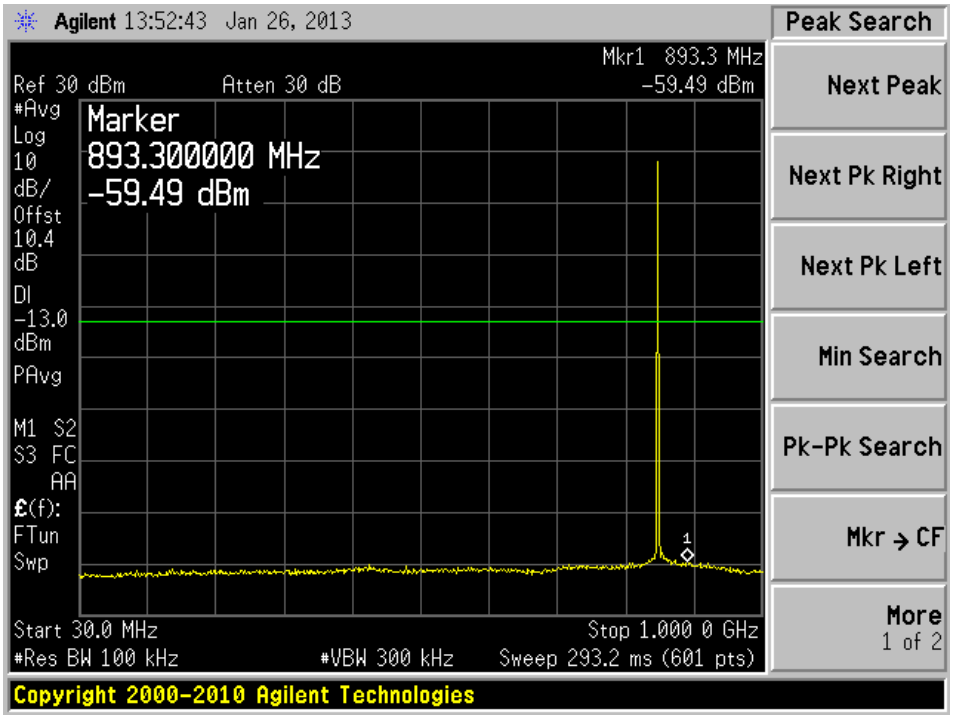


Middle Channel: 815 MHz, 1GHz – 10GHz

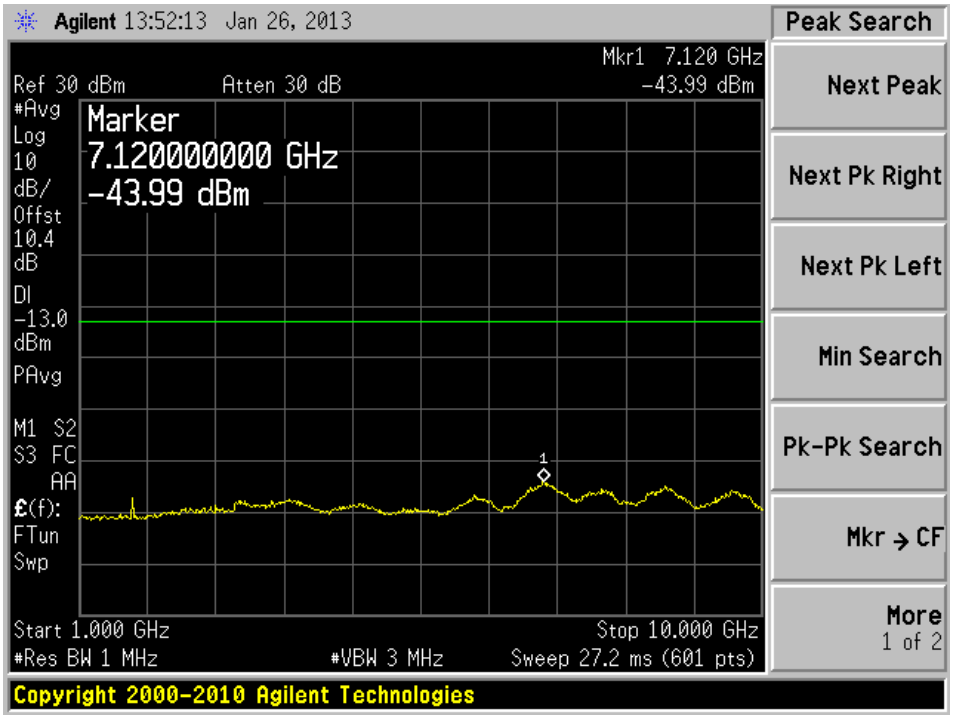


FM: 851-869 MHz (20 kHz Channel Spacing)

Low Channel: 851.1 MHz, 30MHz – 1GHz

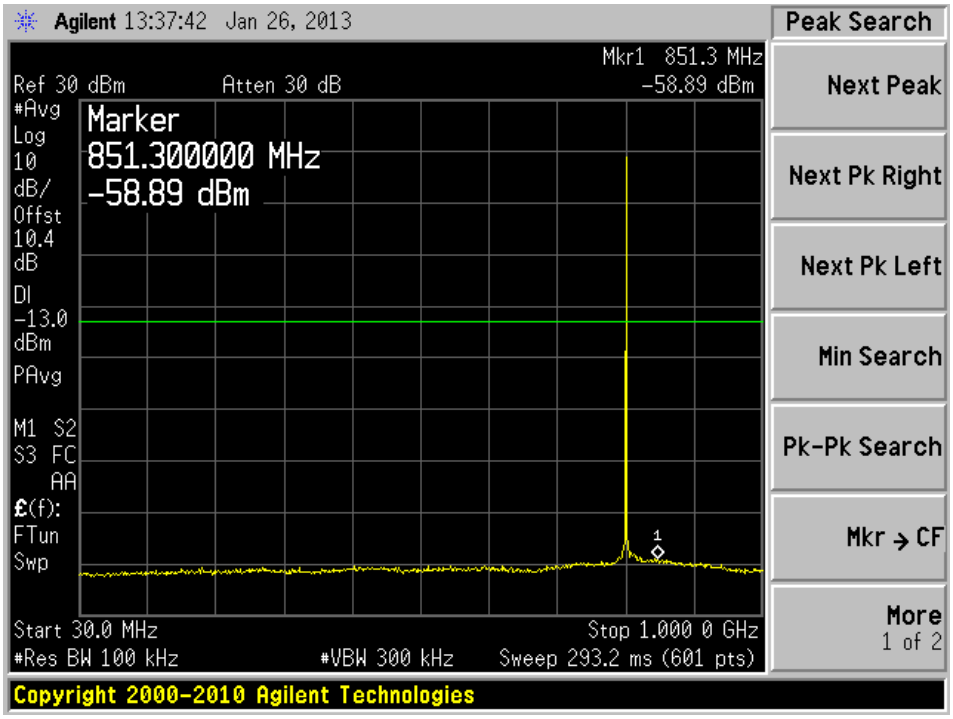


Low Channel: 851.1 MHz, 1GHz – 10GHz

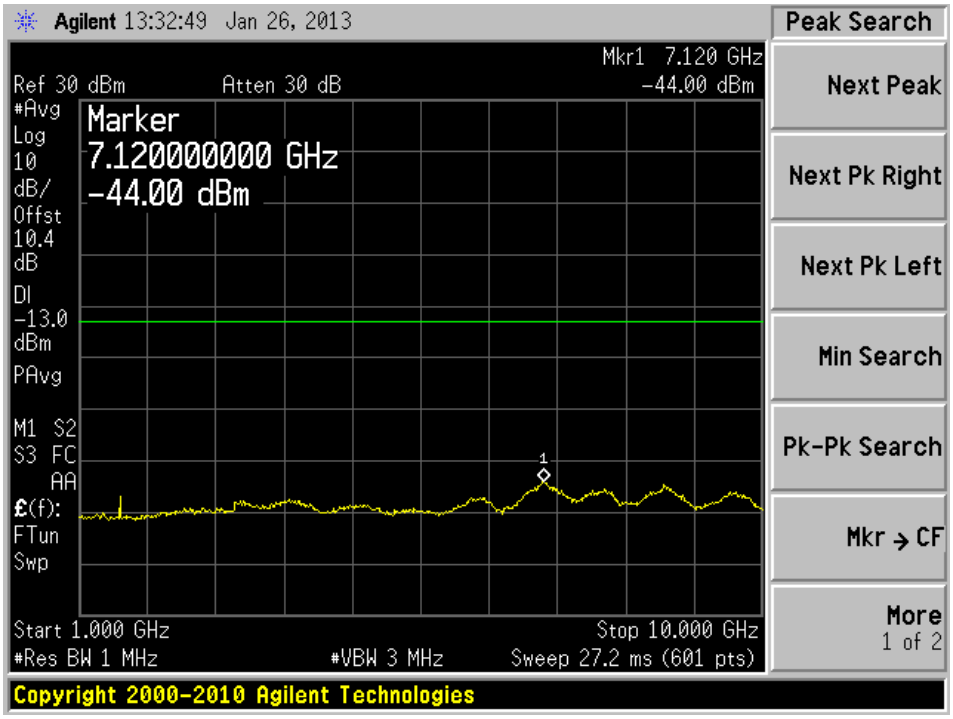


FM: 806-824 MHz (25 kHz Channel Spacing)

Low Channel: 806.1 MHz, 30MHz – 1GHz

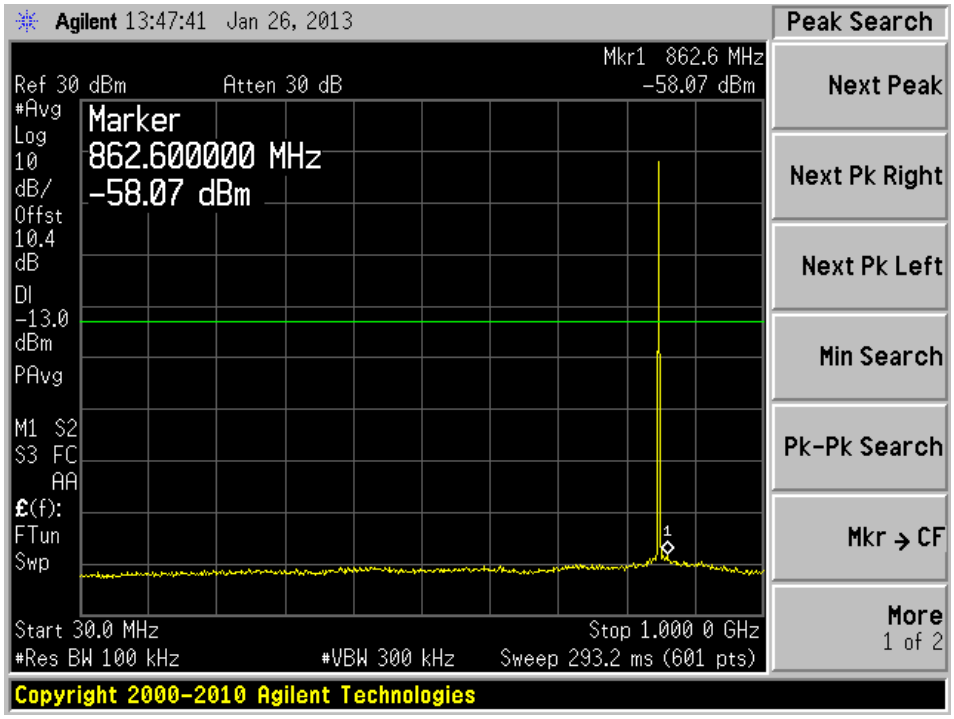


Low Channel: 806.1 MHz, 1GHz – 10GHz

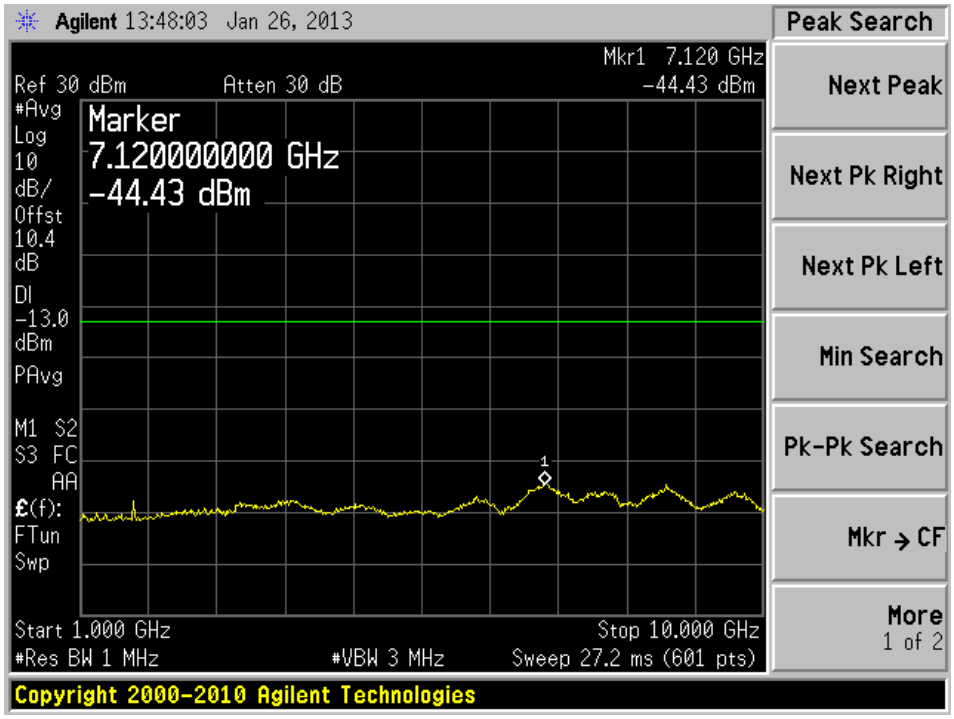


FM: 851-869 MHz (25 kHz channel Spacing)

Middle Channel: 860 MHz, 30MHz – 1GHz



Middle Channel: 860 MHz, 1GHz – 10GHz



9 FCC §2.1055 (d) §90.213 & §90.539 - Frequency Stability

9.1 Applicable Standard

According to FCC §90.213: (a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table.

[Parts per million (ppm)]

Frequency range (MHz)	Fixed and base stations	Mobile stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3] 100	100	200
25-50	20	20	50
72-76	5		50
150-174	[5,11] 5	[6] 5	[4,6] 50
216-220	1.0		1.0
220-222 [12]	0.1	1.5	1.5
421-512	[7,11,14] 2.5	[8] 5	[8] 5
806-809	[14] 1.0	1.5	1.5
809-824	[14] 1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	[14] 0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928 [13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	[9] 300	300	300
Above 2450 [10]			

14 Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

According to FCC §90.539 (c): The frequency stability of mobile, portable, and control transmitters operating in the narrowband segment must be 400 parts per billion or better when AFC is locked to the base station. When AFC is not locked to the base station, the frequency stability must be at least 1.0 ppm for 6.25 kHz, 1.5 ppm for 12.5 kHz (2 channel aggregate), and 2.5 ppm for 25 kHz (4 channel aggregate).

9.2 Test Procedure

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

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Cycle
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 Year
Espec	Temperature Chamber	ESL-4CA	18010	2013-02-07	1 Year

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

9.4 Test Environmental Conditions

FCC Testing:

Temperature:	22 ºC
Relative Humidity:	43 %
ATM Pressure:	101.1 kPa

FCC Testing: The testing was performed by Wei Sun on 2013-02-20 at BACL in the RF Site.

9.5 Test Results

769-775 MHz

Test Environment		Channel Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
Supply Voltage (Vdc)	Temperature (°C)					
Frequency vs. Temperature						
7.4	-30	772	771.999999	-1E-06	-0.0012953	±1.5
	-20	772	771.99982	-0.00018	-0.2331606	±1.5
	-10	772	772.000144	0.000144	0.186528	±1.5
	0	772	772.000101	0.000101	0.1308290	±1.5
	10	772	771.999946	-5.4E-05	-0.0699481	±1.5
	20	772	772.000037	3.7E-05	0.0479274	±1.5
	30	772	772.000149	0.000149	0.1930051	±1.5
	40	772	771.999920	-8E-05	-0.1036269	±1.5
	50	772	771.99929	-0.00071	-0.9196891	±1.5
Frequency vs. Voltage						
8.4	20	772	771.999991	-9E-06	-0.0116580	±1.5
6.3	20	772	771.999948	-5.2E-05	-0.0673575	±1.5

799-805 MHz

Test Environment		Channel Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
Supply Voltage (Vdc)	Temperature (°C)					
Frequency vs. Temperature						
7.4	-30	802	802.000158	0.000158	0.1970075	±1.5
	-20	802	802.000137	0.000137	0.1708229	±1.5
	-10	802	802.000128	0.000128	0.1596010	±1.5
	0	802	802.000147	0.000147	0.1832918	±1.5
	10	802	802.000101	0.000101	0.1259352	±1.5
	20	802	801.999975	-2.5E-05	-0.0311721	±1.5
	30	802	802.000085	8.5E-05	0.1059850	±1.5
	40	802	802.000144	0.000144	0.1795511	±1.5
	50	802	802.000129	0.000129	0.1608479	±1.5
Frequency vs. Voltage						
8.4	20	802	802.000147	0.000147	0.1832918	±1.5
6.3	20	802	801.999956	-4.4E-05	-0.0548628	±1.5

806-824 MHz

Test Environment		Channel Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
Supply Voltage (Vdc)	Temperature (°C)					
Frequency vs. Temperature						
7.4	-30	815	815.000179	0.000179	0.2196319	±1.5
	-20	815	815.000165	0.000165	0.2024540	±1.5
	-10	815	814.999916	-8.4E-05	-0.1030675	±1.5
	0	815	815.000152	0.000152	0.1865031	±1.5
	10	815	815.000034	3.4E-05	0.0417178	±1.5
	20	815	815.000025	2.5E-05	0.0306748	±1.5
	30	815	815.000198	0.000198	0.2429448	±1.5
	40	815	815.000059	5.9E-05	0.0723926	±1.5
	50	815	814.999971	-2.9E-05	-0.0355828	±1.5
Frequency vs. Voltage						
8.4	20	815	814.999915	-8.5E-05	-0.1042945	±1.5
6.3	20	815	815.000137	0.000137	0.1680982	±1.5

851-869 MHz

Test Environment		Channel Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (MHz)	Frequency Error (ppm)	Limit (ppm)
Supply Voltage (Vdc)	Temperature (°C)					
Frequency vs. Temperature						
7.4	-30	860	860.000131	0.000131	0.1523256	±1.5
	-20	860	860.000077	7.7E-05	0.0895349	±1.5
	-10	860	860.000189	0.000189	0.2197674	±1.5
	0	860	859.999941	-5.9E-05	-0.0686047	±1.5
	10	860	860.000044	4.4E-05	0.0511628	±1.5
	20	860	860.000111	0.000111	0.1290698	±1.5
	30	860	859.999917	-8.3E-05	-0.0965116	±1.5
	40	860	860.000157	0.000157	0.1825581	±1.5
	50	860	860.000049	4.9E-05	0.0569767	±1.5
Frequency vs. Voltage						
8.4	20	860	860.000202	0.000202	0.2348837	±1.5
6.3	20	860	860.000141	0.000141	0.1639535	±1.5

10 FCC §2.1053, §90.221, §90.210 & §90.543– Field Strength of Spurious Radiation

10.1 Applicable Standard

TETRA (809-824 MHz/854-869 MHz):

According to FCC §90.221 (d): On any frequency removed from the assigned frequency by more than 75 KHz, the attenuation of any emission must be at least 43 + 10 log (Pwatts) dB.

D-LMR & FM (Mask B, 806-824 MHz/851-869 MHz):

According to FCC §90.210 (b) (3): On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (Pwatts) dB.

D-LMR & C4FM (769-775 MHz/799-805 MHz):

According to FCC §90.543 (c): *Out-of-band emission limit*. On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least 43 + 10 log (Pwatts) dB measured in a 100 KHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

According to FCC §90.543 (f):

For operations in the 763-775 MHz and 793-805 MHz bands, all emissions including harmonics in the band 1559-1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

10.2 Test Procedure

The transmitter was placed on Styrofoam on the turntable, and it was normal transmitting with 50ohm termination 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 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 lg (TXpwr in Watts/0.001) – the absolute level

10.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2012-08-22	2 Year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2012-08-15	1 Year
EMCO	Horn Antenna	3115	9511-4627	2012-10-17	1 Year
Hewlett Packard	Pre-amplifier	8447D	2944A06639	2012-06-09	1 Year
Mini-Circuits	Pre-amplifier	ZVA-183-S	570400946	2012-05-09	1 Year
Eaton	Horn antenna	96001	Mar-07	2012-10-17	1 Year
Agilent	Signal Generator	E4438C	MY45091309	2012-05-03	1 Years

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

10.4 Test Environmental Conditions

Temperature:	16 °C
Relative Humidity:	31 %
ATM Pressure:	101.5 kPa

The testing was performed by Wei Sun on 2013-02-21 in 5 meter chamber 3.

10.5 Test Results

According to the data hereinafter, the EUT complied with the FCC Pt 90 standard's radiated emissions limits, and had a worst case margin of:

Worst Margin: **-2.13 dB** at **1604 MHz** in the **Horizontal** polarization.

Please see following table for detailed results.

769 MHz – 775 MHz, D-LMR, High Power

Low Channel – 769.1 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

769 MHz – 775 MHz, C4FM, High Power

High Channel – 774.9 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

799 MHz – 805 MHz, D-LMR, High Power

High Channel – 804.9 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
1609.8	48.58	171	135	H	1609.8	-49.92	8.5	1.34	-42.76	-40	-2.76
1609.8	46.27	162	188	V	1609.8	-52.23	8.5	1.34	-45.07	-40	-5.07

For emissions in the band 1559-1610 MHz the limit becomes -40 dBm according to §90.543 (f)

799 MHz – 805 MHz, C4FM, High Power

Middle Channel – 802 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
1604	49.33	150	270	H	1604	-49.29	8.5	1.34	-42.13	-40	-2.13
1604	47.89	220	353	V	1604	-50.73	8.5	1.34	-43.57	-40	-3.57

For emissions in the band 1559-1610 MHz the limit becomes -40 dBm according to §90.543 (f)

806 MHz – 824 MHz, D-LMR, High Power

Middle Channel – 815 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

806 MHz – 824 MHz, FM (20 KHz Channel Spacing), High Power

Middle Channel – 815 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

851 MHz – 869 MHz, D-LMR, High Power

Low Channel – 851.1 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

851 MHz – 869 MHz, FM (20 KHz Channel Spacing), High Power

Low Channel – 851.1 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

809 MHz – 824 MHz, TETRA, High Power

Middle Channel – 815 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

854 MHz – 869 MHz, TETRA, High Power

Middle Channel – 860 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

806 MHz – 824 MHz, FM (25 KHz Channel Spacing), High Power

Middle Channel – 806.1 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

851 MHz – 869 MHz, FM (25 KHz Channel Spacing), High Power

Low Channel – 851.1 MHz

Indicated		Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
-	-	-	-	-	-	-	-	-	-	-	-

Note: All emission levels are at the noise floor and/or more than 20 dB below the limit.

11 FCC §2.1049, §90.221 & §90.543 – Adjacent Channel Power

11.1 Applicable Standard

According to FCC §90.221:
(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824/854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices less than 15 watts	Maximum ACP (dBc) for devices 15 watts and above
25 kHz	−55 dBc	−55 dBc
50 kHz	−65 dBc	−65 dBc
75 kHz	−65 dBc	−70 dBc

(2) In any case, no requirement in excess of −36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (Pwatts) dB.

According to FCC §90.543:
Transmitters designed to operate in 769-775 MHz and 799-805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 763-768 MHz and 793-798 MHz bands must meet the emission limitations in (e) of this section.

(a) The adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, "(s)" indicates a swept measurement may be used.

12.5 kHz Mobile Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
9.375	6.25	−40
15.625	6.25	−60
21.875	6.25	−60
37.50	25.00	−60
62.50	25.00	−65
87.50	25.00	−65
150.00	100	−65
250.00	100	−65
350.00	100	−65
>400 to 12 MHz	30 (s)	−75
12 MHz to paired receive band	30 (s)	−75
In the paired receive band	30 (s)	−100

25 kHz Mobile Transmitter ACP Requirements

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)
15.625	6.25	−40
21.875	6.25	−60
37.50	25	−60
62.50	25	−65
87.50	25	−65
150.00	100	−65
250.00	100	−65
350.00	100	−65
>400 kHz to 12 MHz	30 (s)	−75
12 MHz to paired receive band	30 (s)	−75
In the paired receive band	30 (s)	−100

11.2 Test Procedure

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

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	US44300386	2012-09-29	1 Year

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

11.4 Test Environmental Conditions

Temperature:	23 °C
Relative Humidity:	48.1 %
ATM Pressure:	101.1 kPa

The testing was performed by Ning Ma on 2013-02-06 in the RF Site.

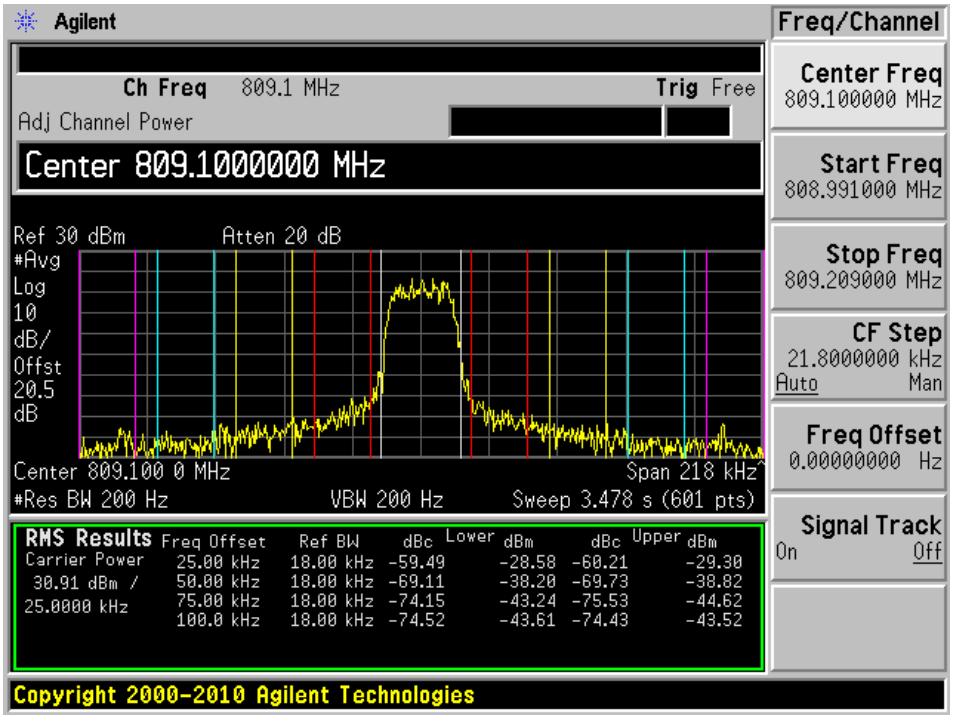
11.5 Test Results

Please refer to the following plots.

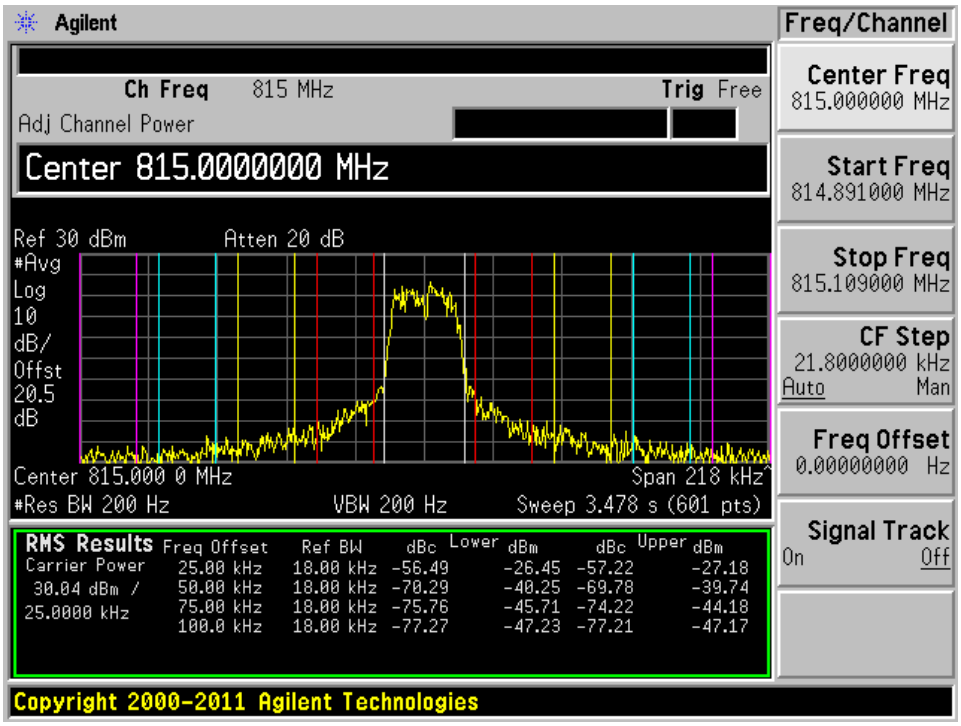
ACP (High Power)

TETRA: 809 MHz – 824 MHz

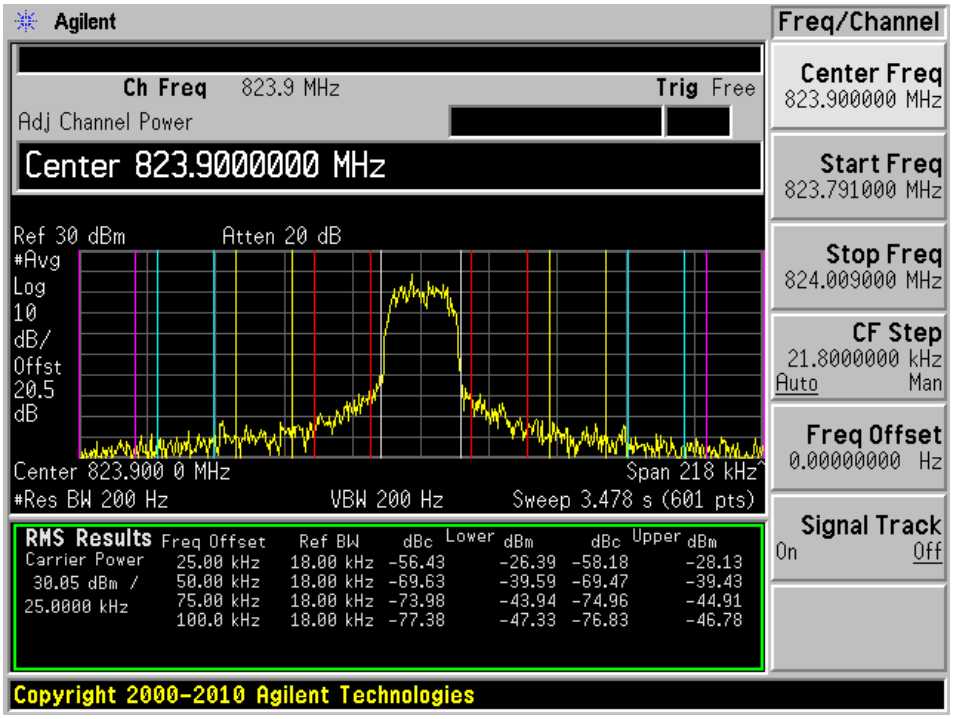
Low Channel – 809.1 MHz



Middle Channel – 815 MHz

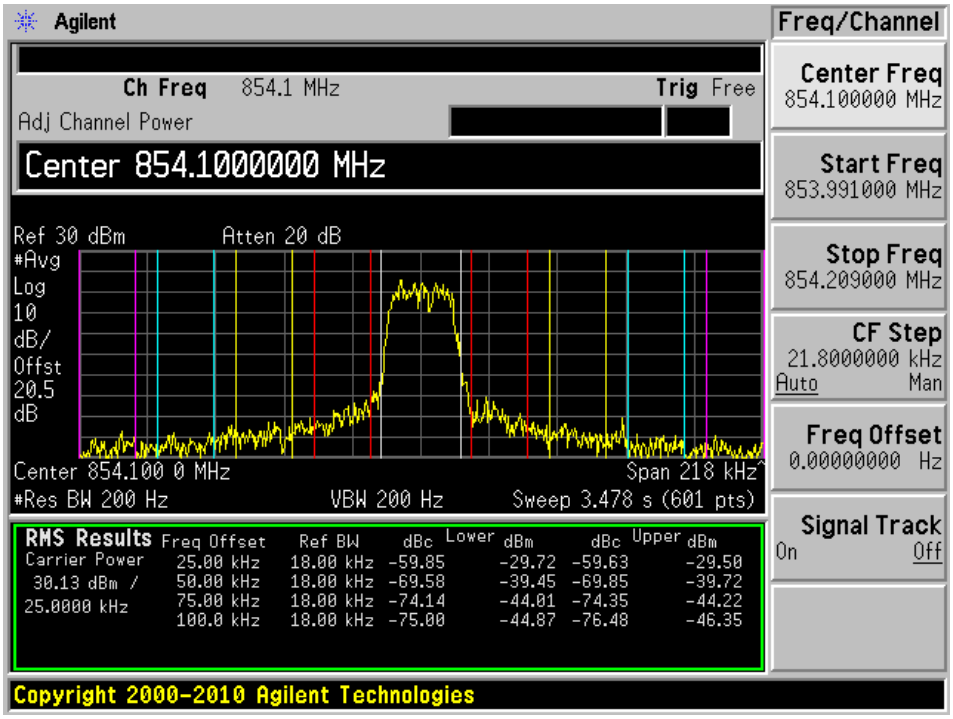


High Channel – 823.9 MHz

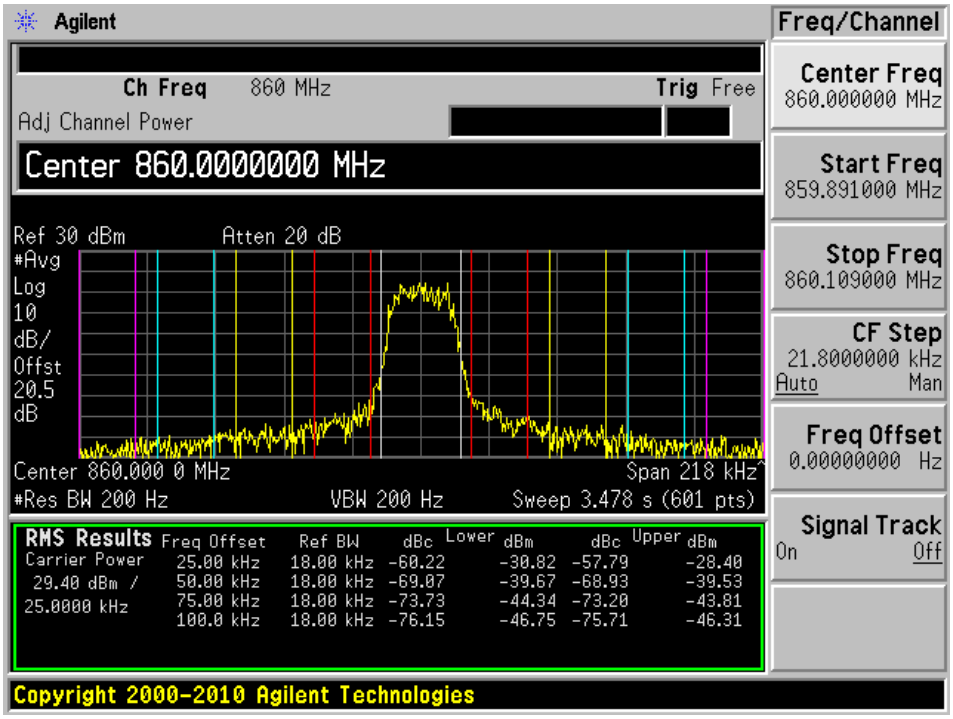


TETRA: 854 MHz – 869 MHz

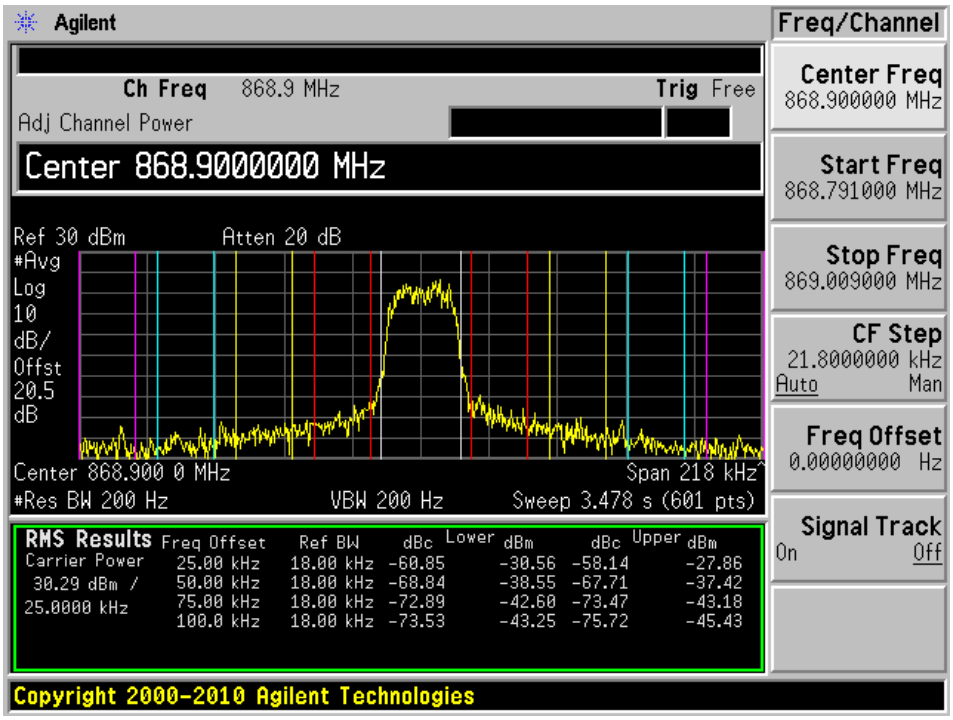
Low Channel – 854.1 MHz



Middle Channel – 860 MHz

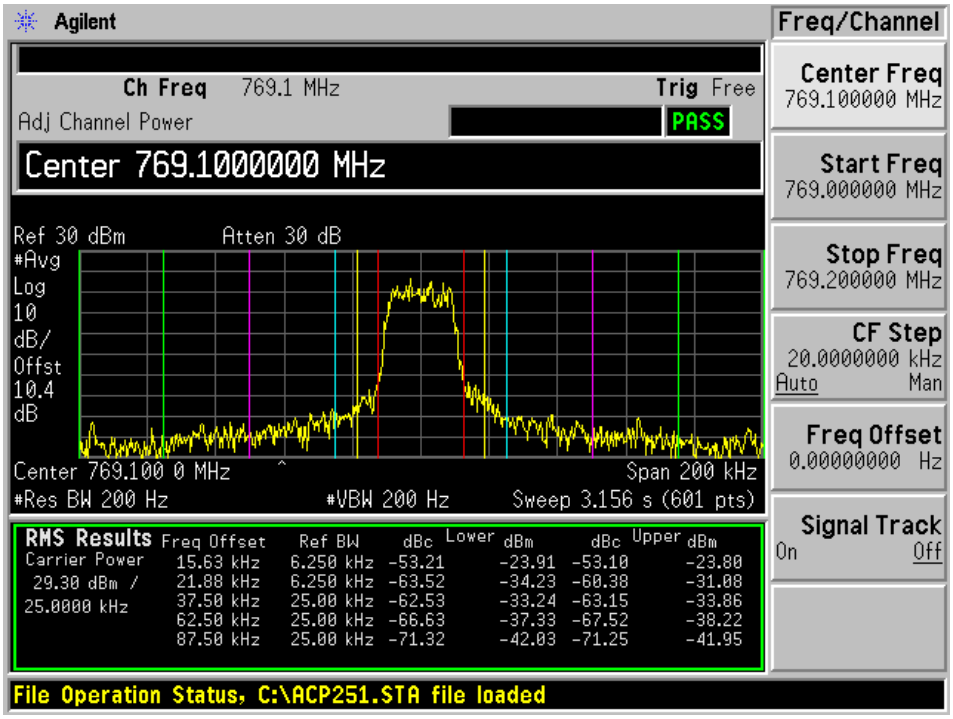


High Channel – 868.9 MHz

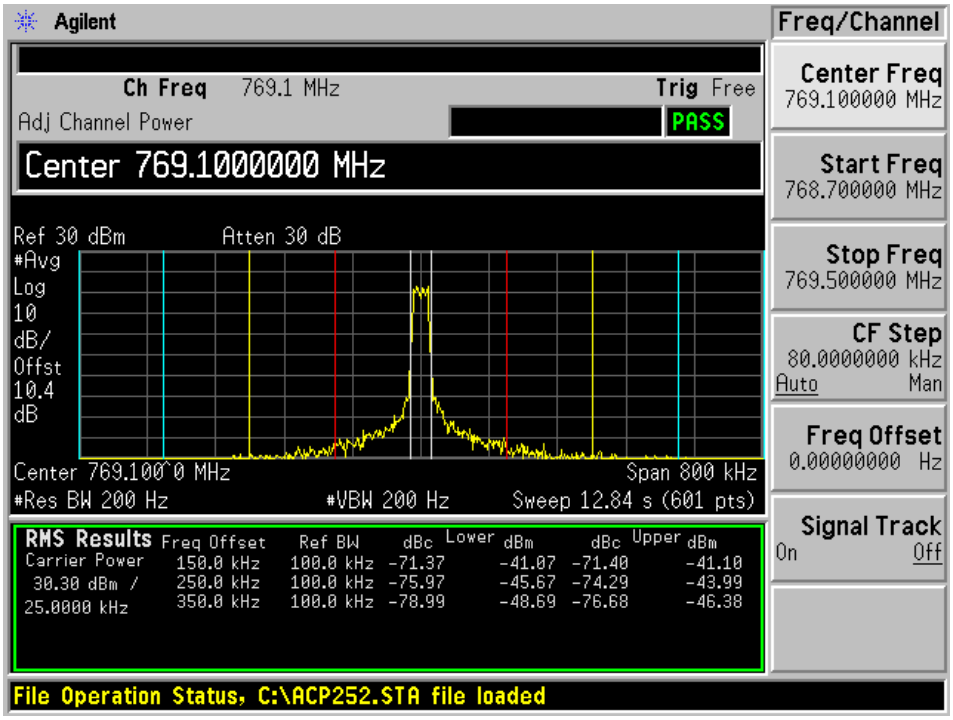


D-LMR: 769 MHz – 775 MHz

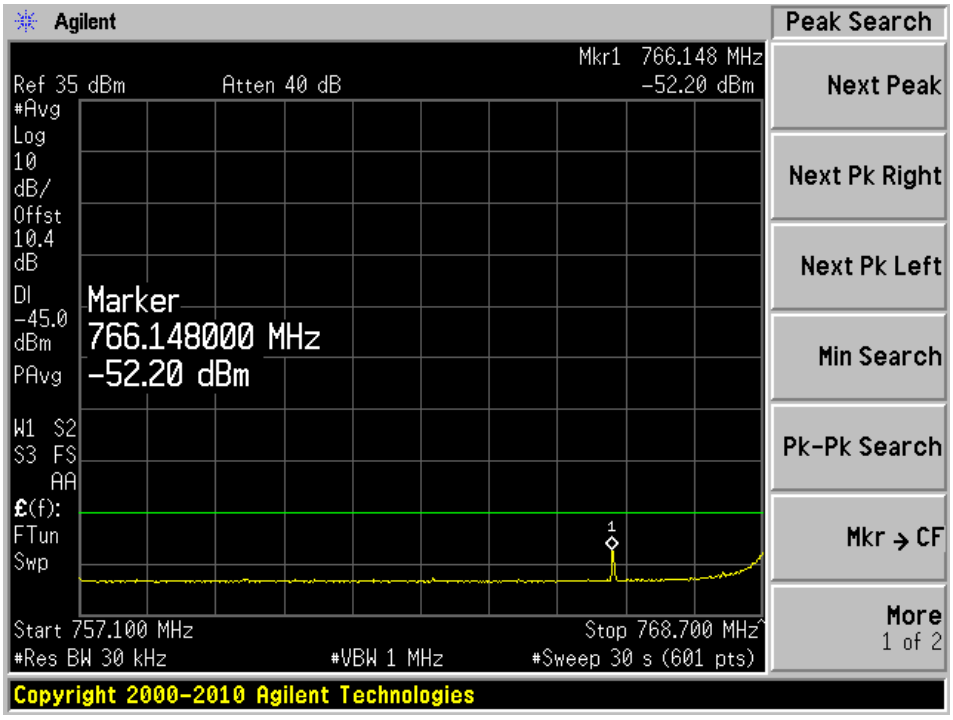
Low Channel – 769.1 MHz



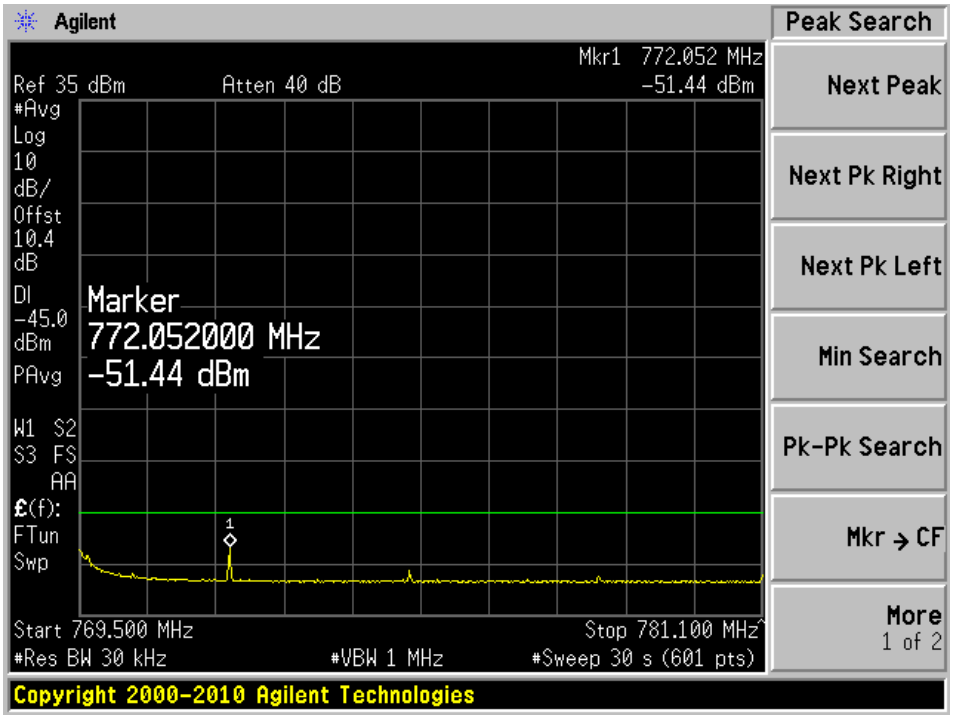
Low Channel – 769.1 MHz



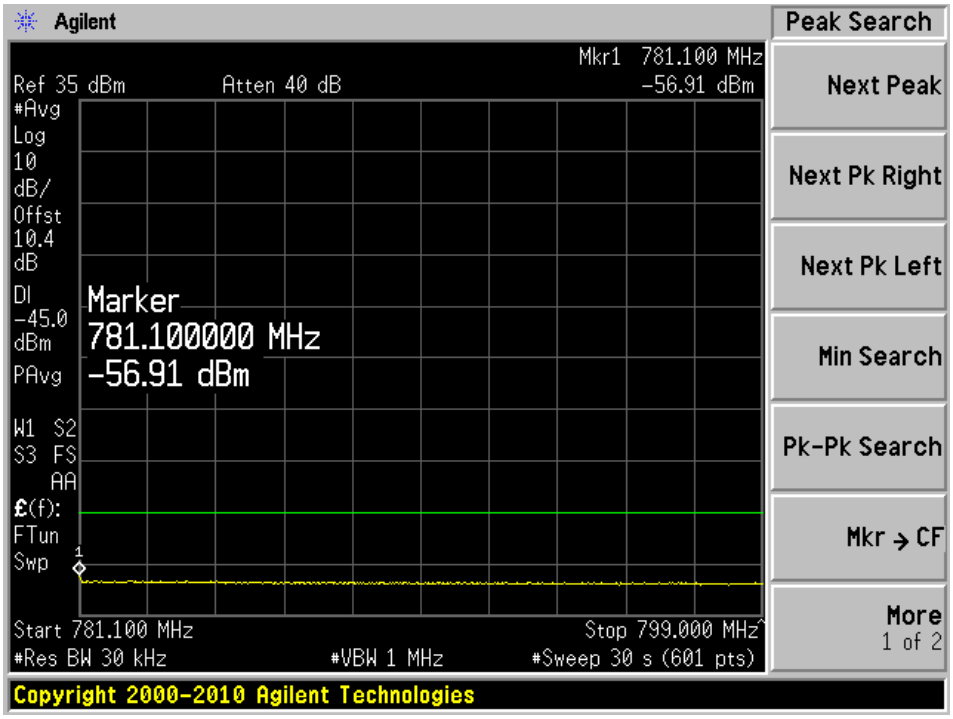
Low Channel – 769.1 MHz (-12MHz to – 400 kHz)



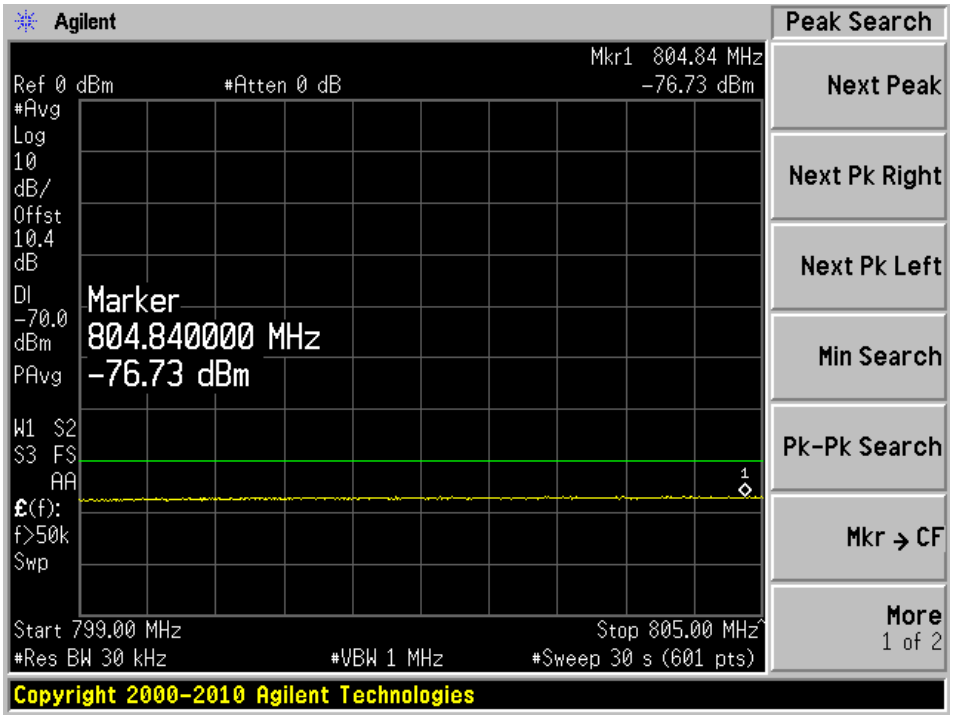
Low Channel – 769.1 MHz (+400 kHz to +12MHz)



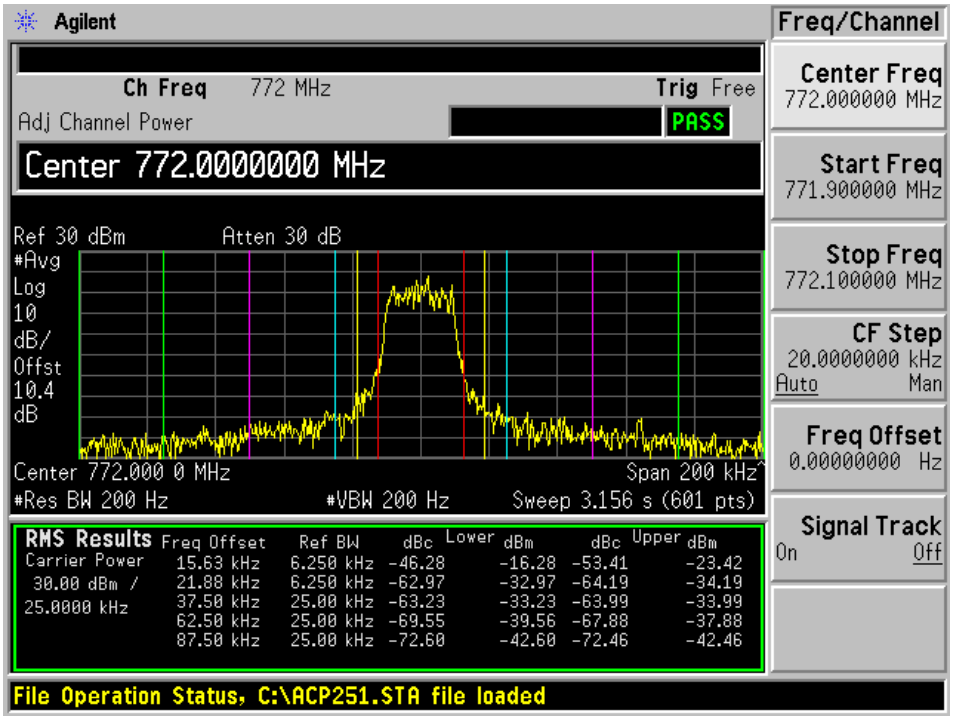
Low Channel – 769.1 MHz (+12MHz to the paired receive band)



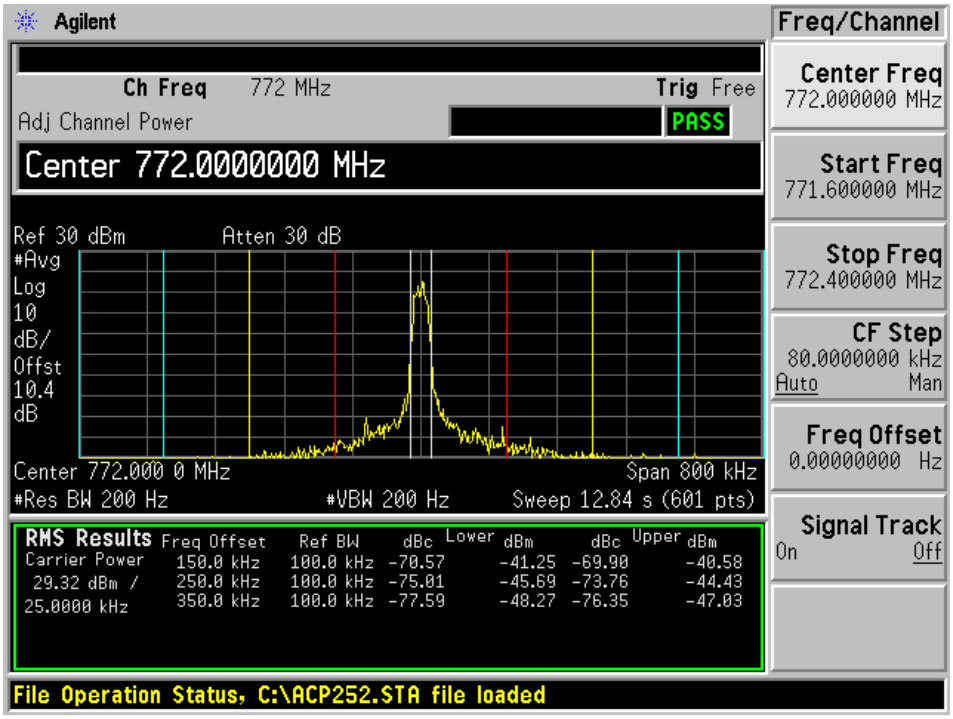
Low Channel – 769.1 MHz (in the paired receive band)



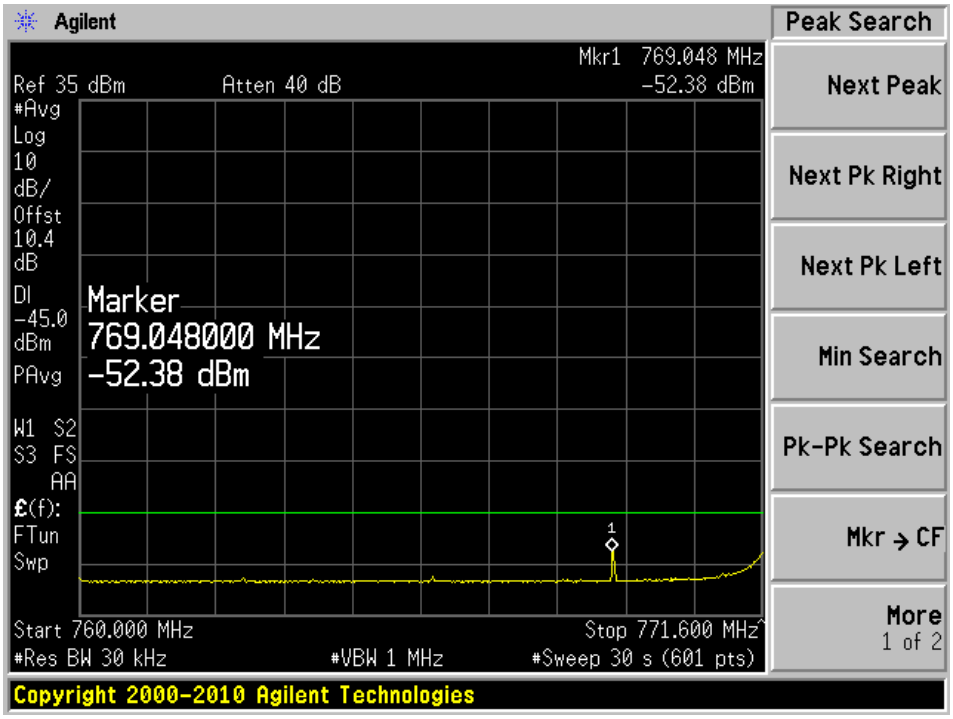
Middle Channel – 772 MHz



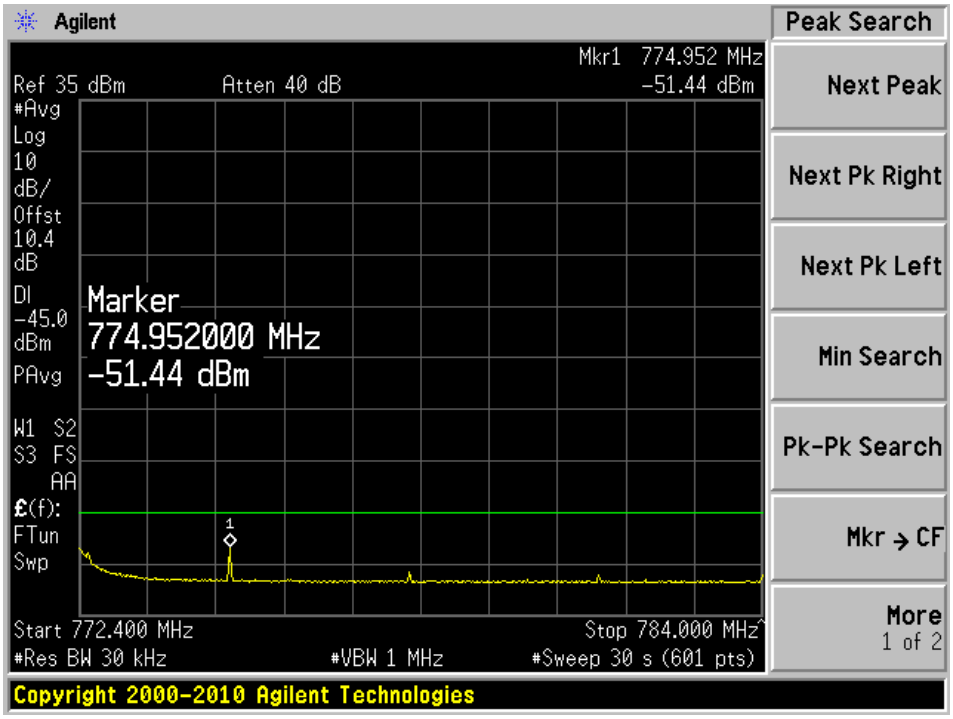
Middle Channel – 772 MHz



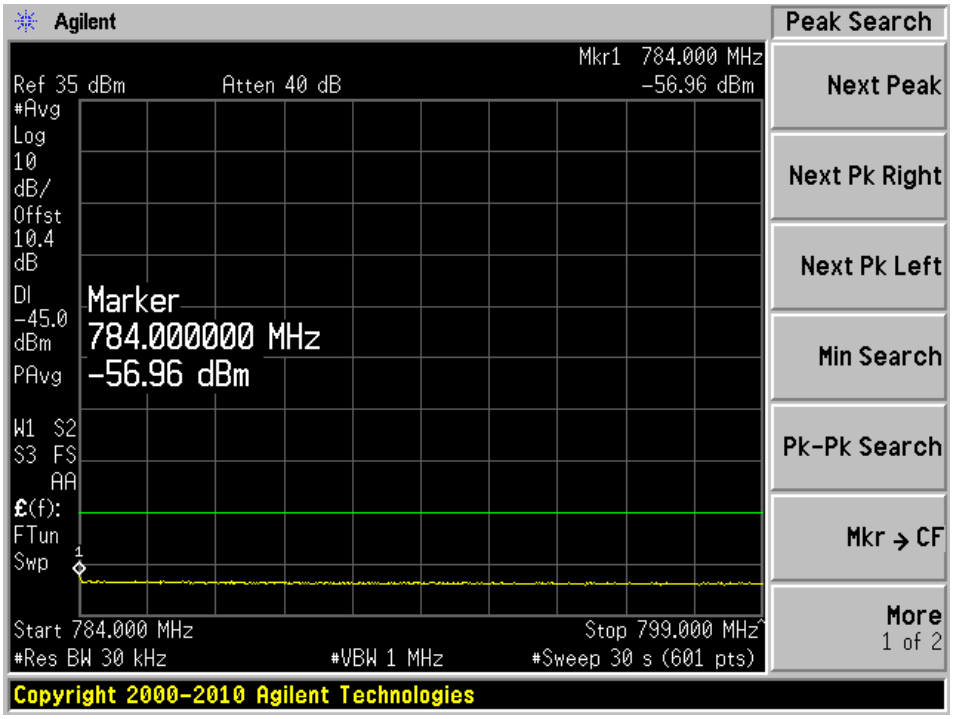
Middle Channel – 772 MHz (-12MHz to - 400 kHz)



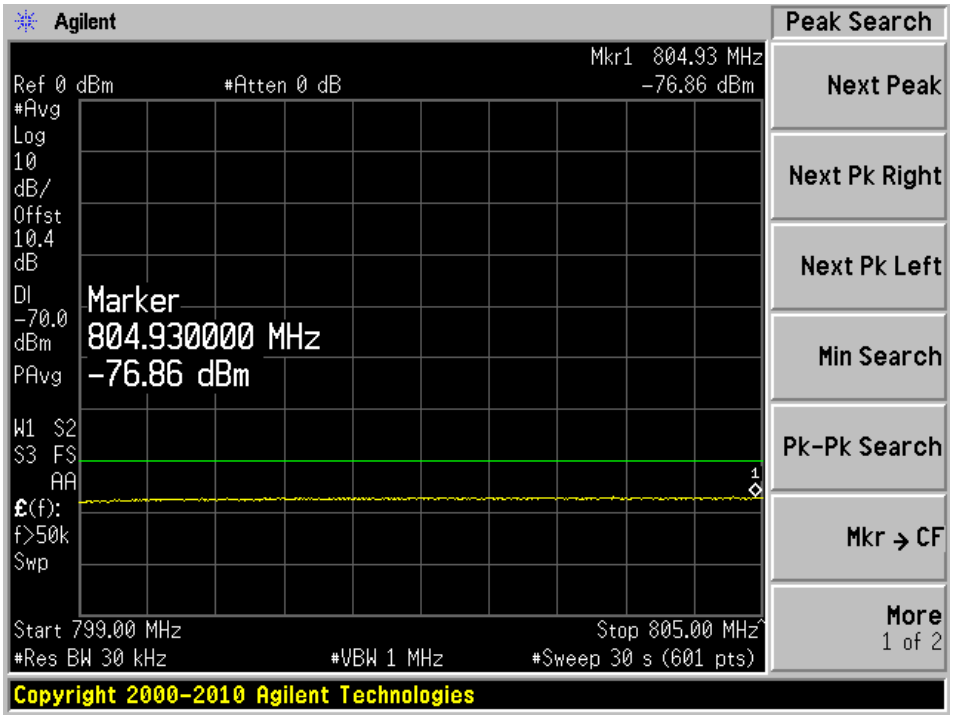
Middle Channel – 772 MHz (+400 kHz to +12MHz)



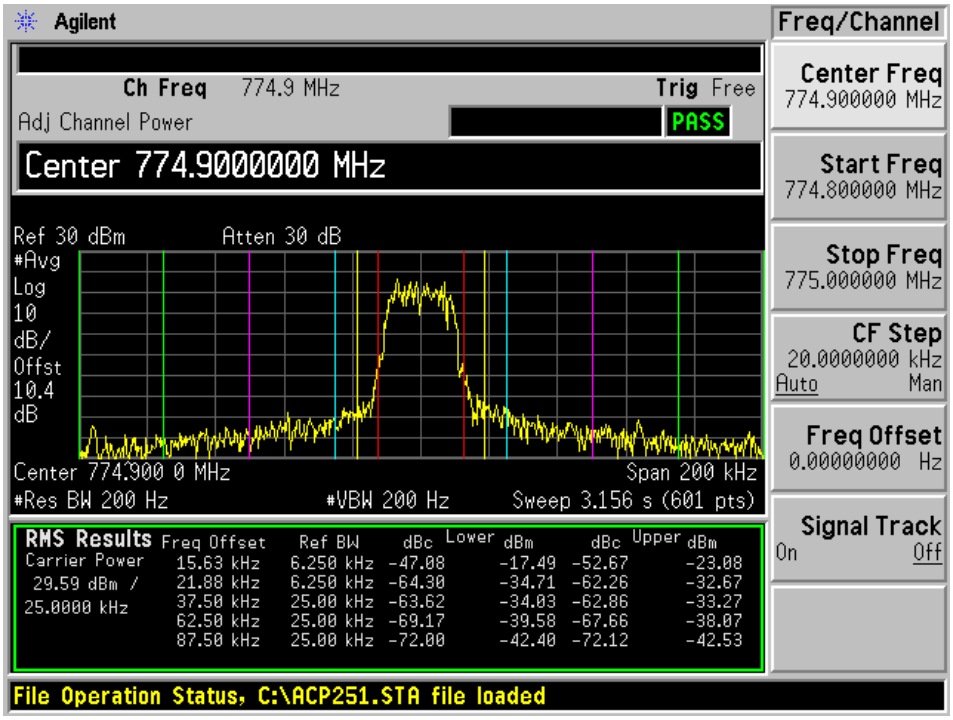
Middle Channel – 772 MHz (+12MHz to the paired receive band)



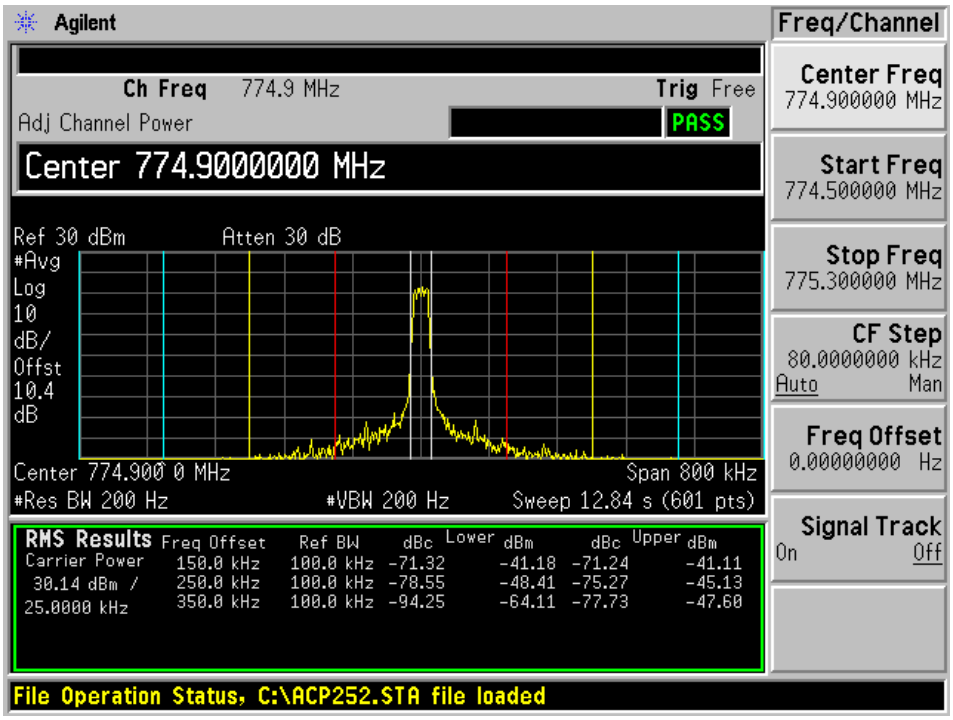
Middle Channel – 772 MHz (in the paired receive band)



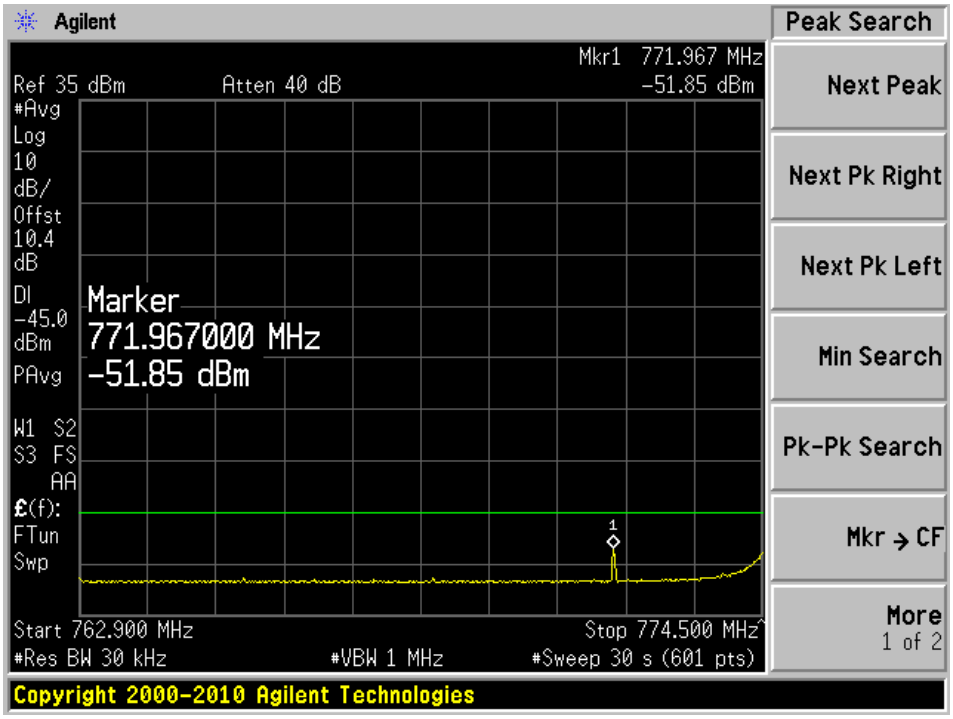
High Channel – 774.9 MHz



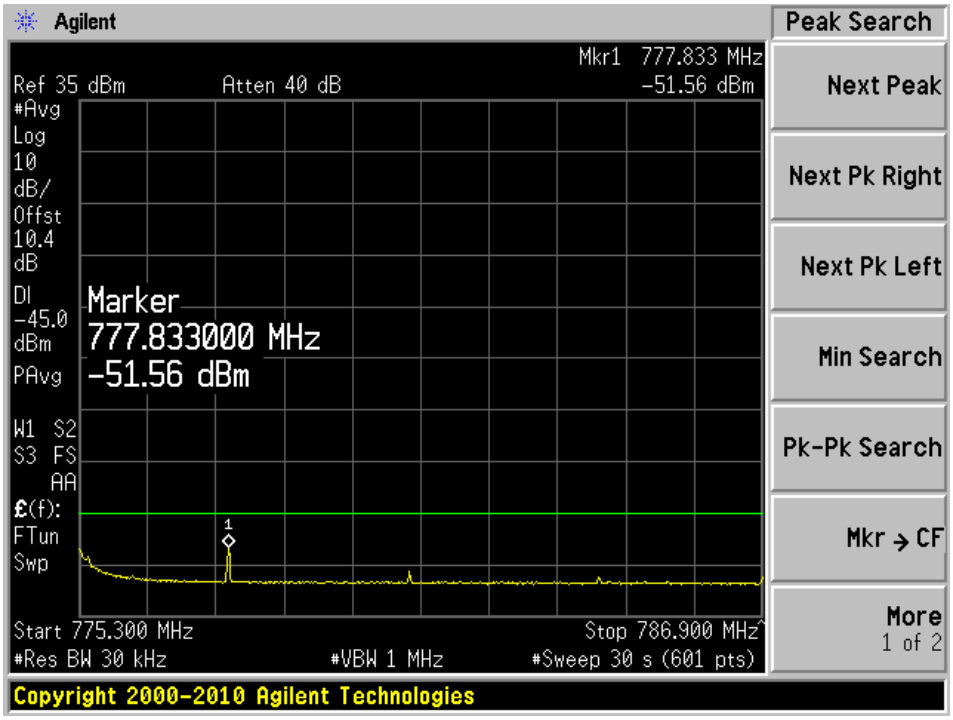
High Channel – 774.9 MHz



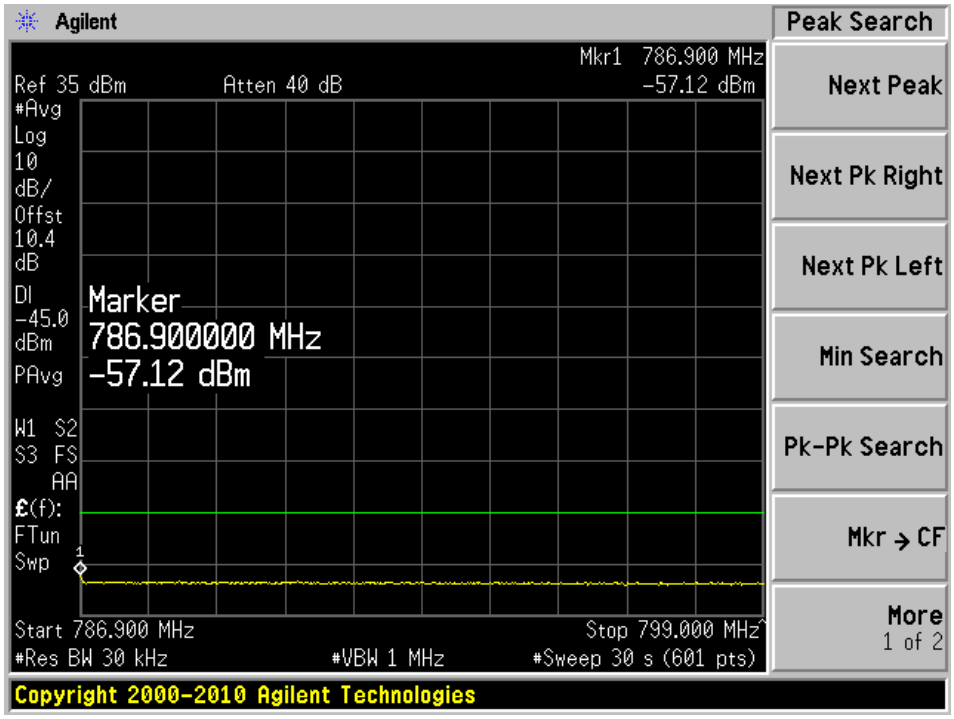
High Channel – 774.9 MHz (-12MHz to – 400 kHz)



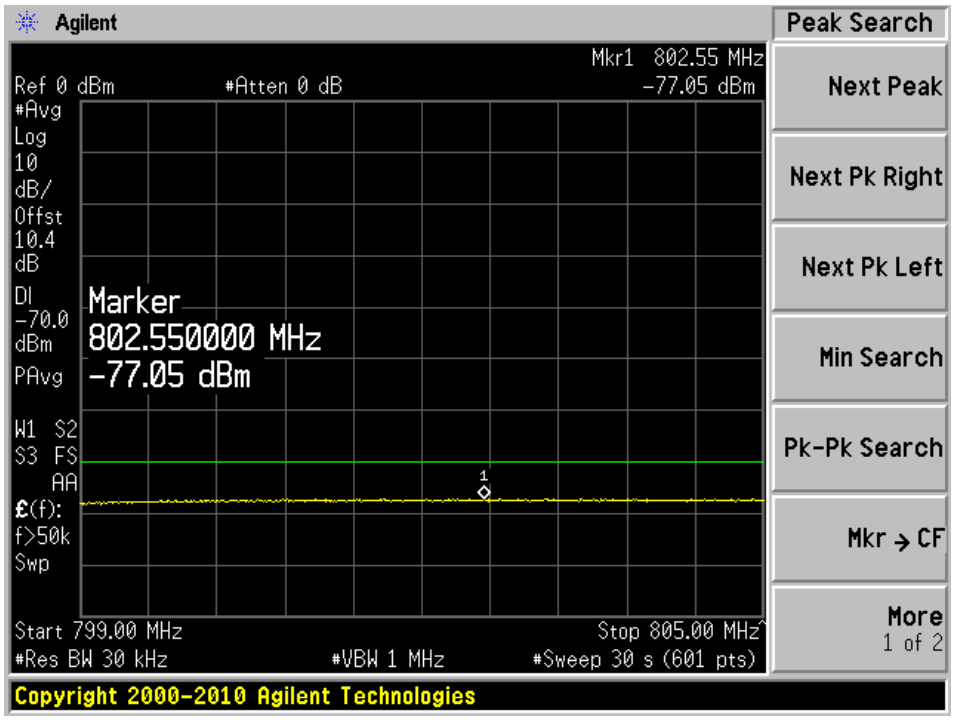
High Channel – 774.9 MHz (+400 kHz to +12MHz)



High Channel – 774.9 MHz (+12MHz to the paired receive band)

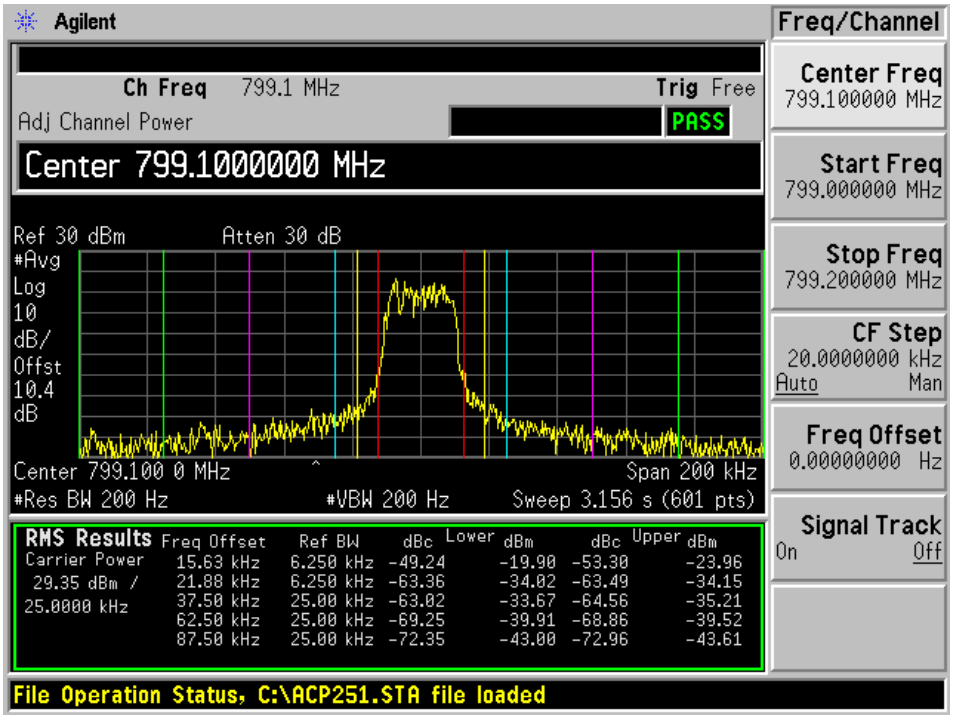


High Channel – 774.9 MHz (in the paired receive band)

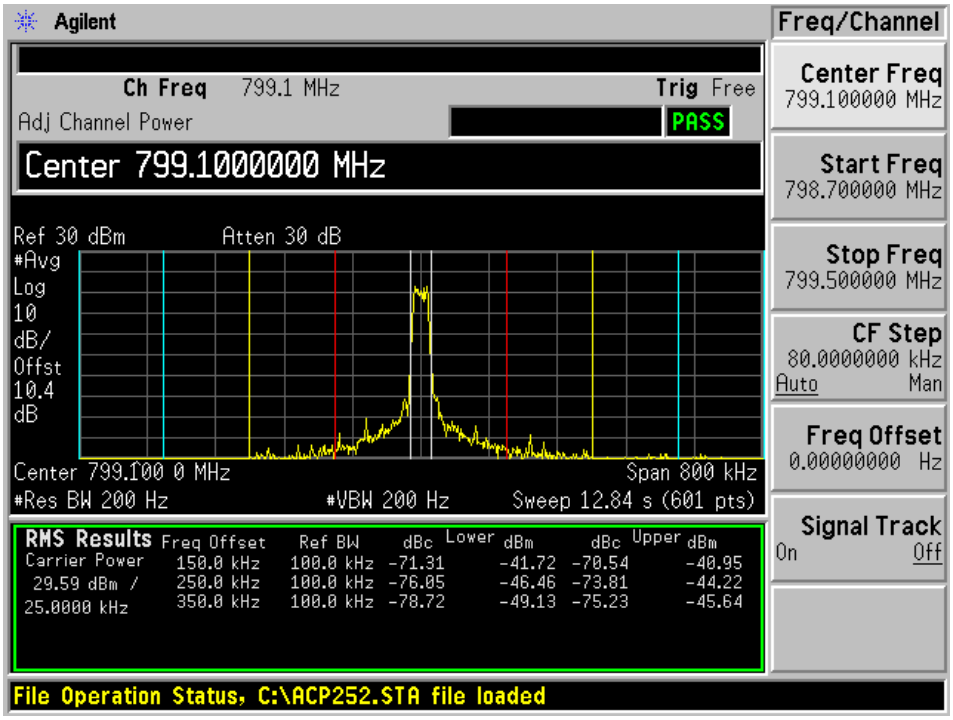


D-LMR: 799 MHz – 805 MHz

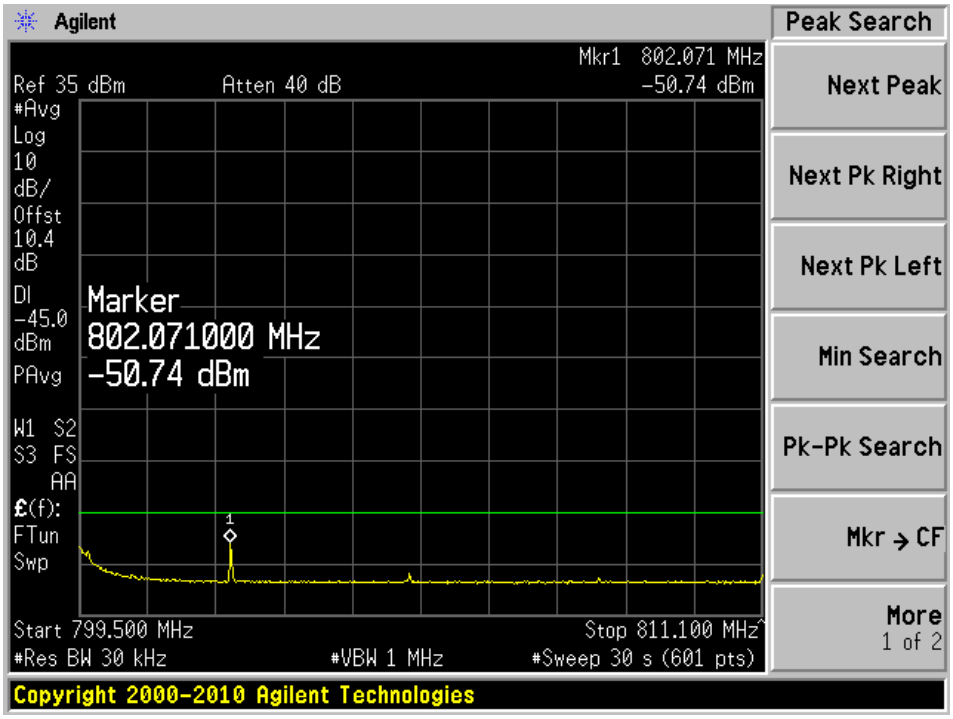
Low Channel – 799.1 MHz



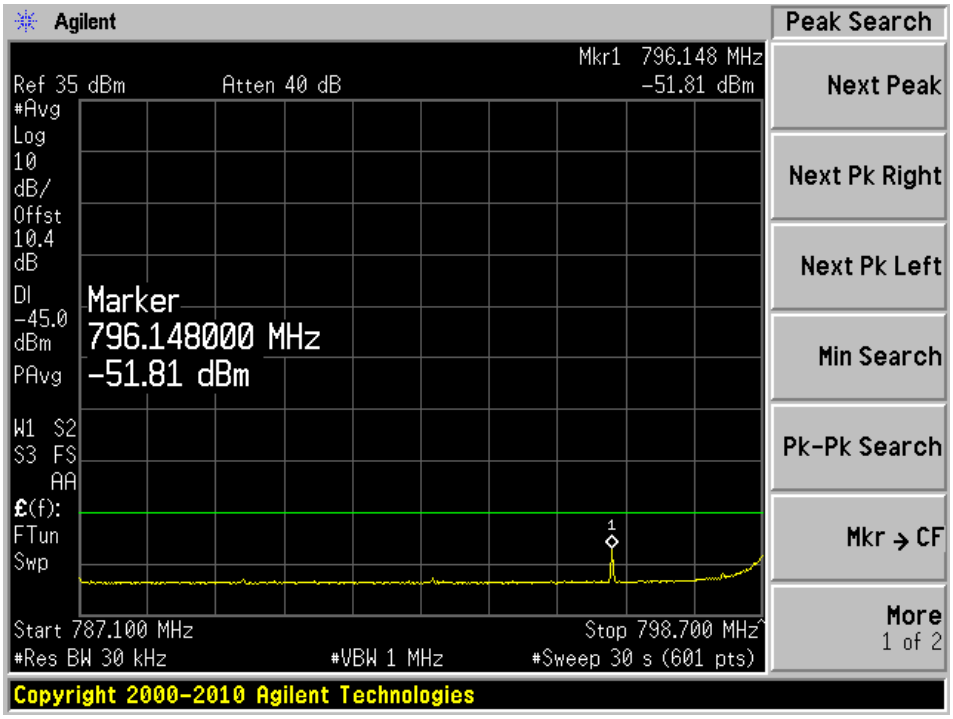
Low Channel – 799.1 MHz



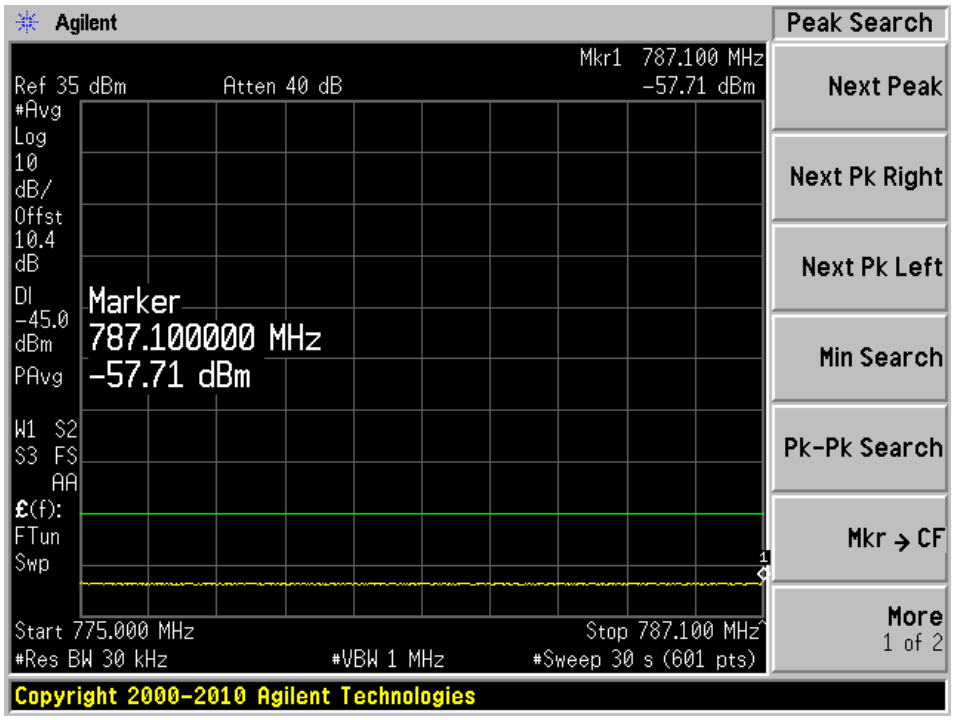
Low Channel – 799.1 MHz (+400 kHz to +12MHz)



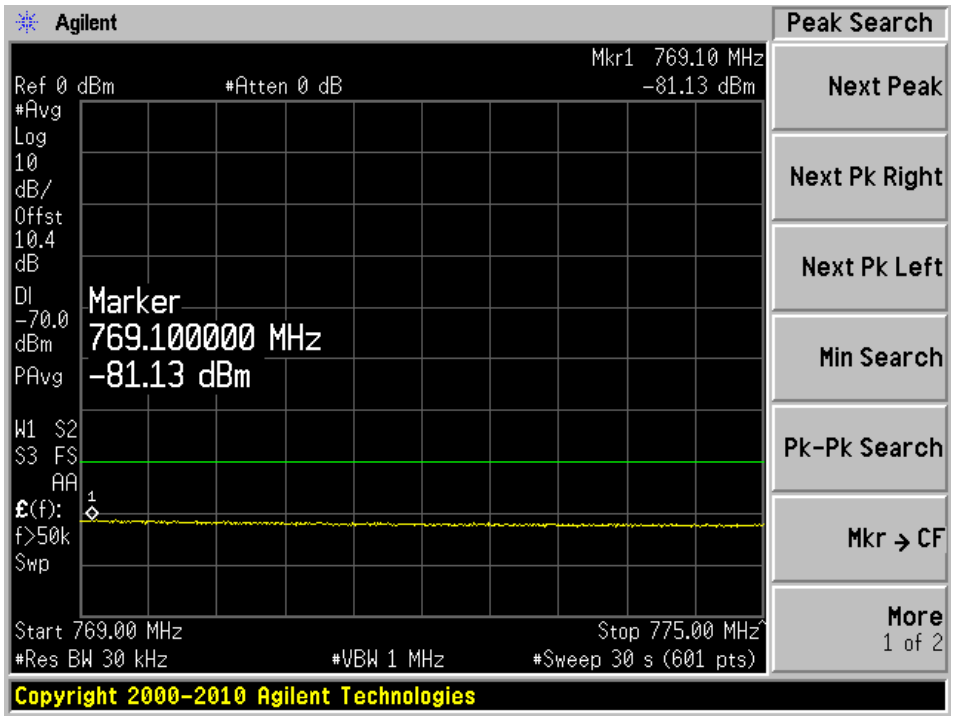
Low Channel – 799.1 MHz (-12MHz to - 400 kHz)



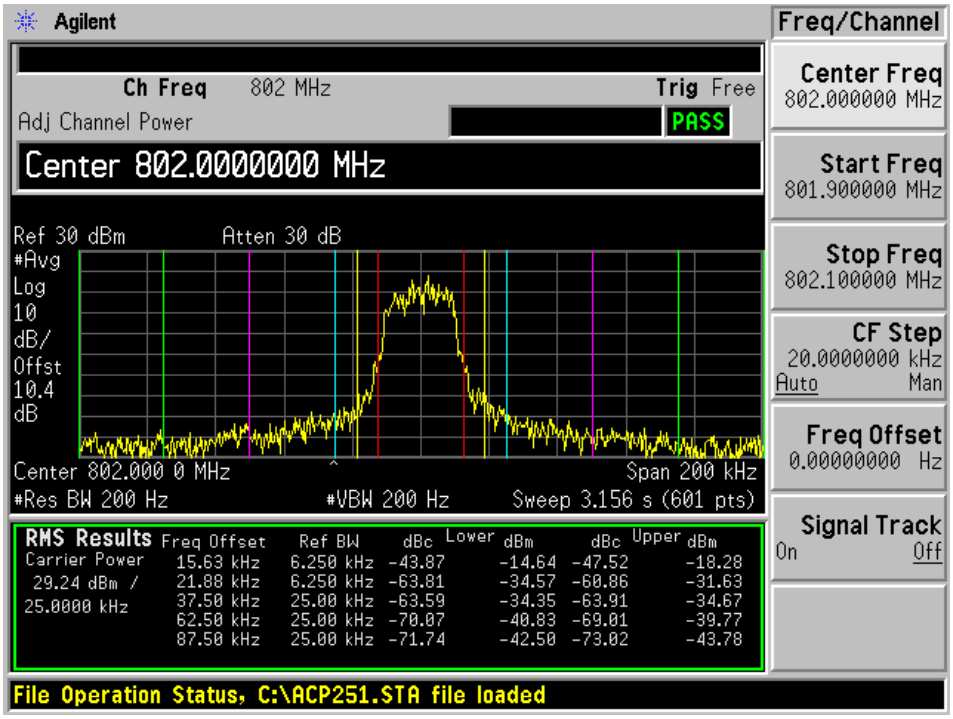
Low Channel – 799.1 MHz (-12MHz to the paired receive band)



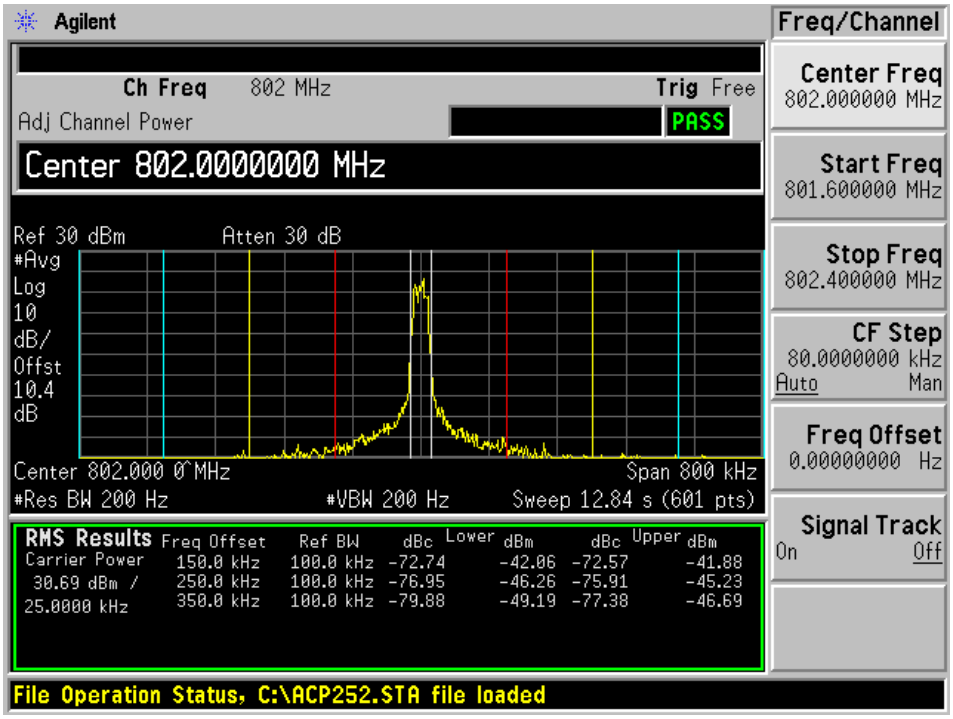
Low Channel – 799.1 MHz (in the paired receive band)



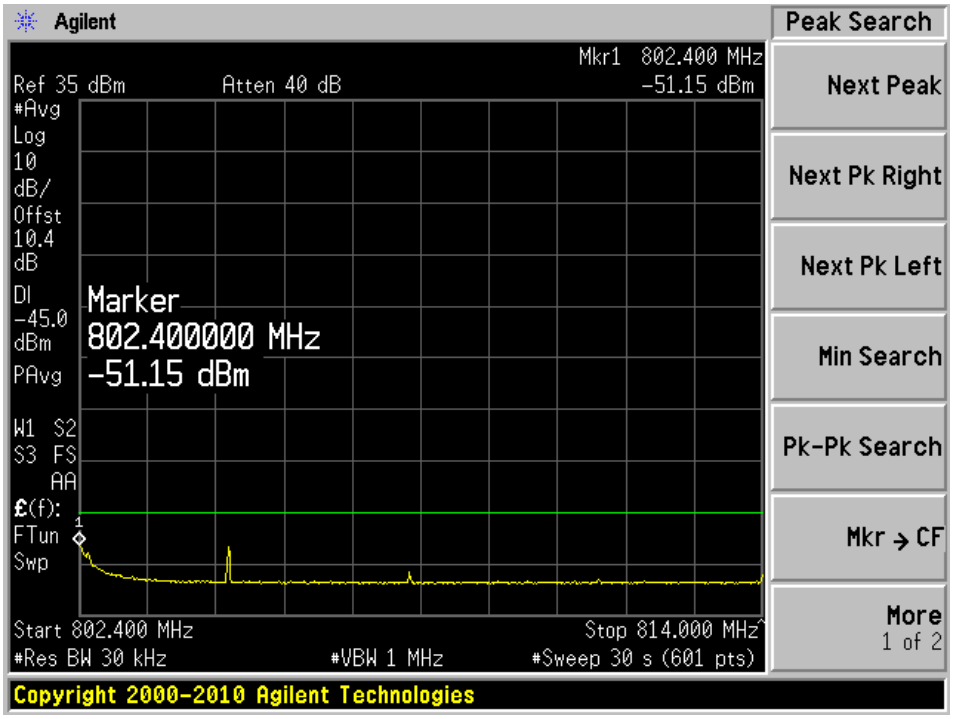
Middle Channel – 802 MHz



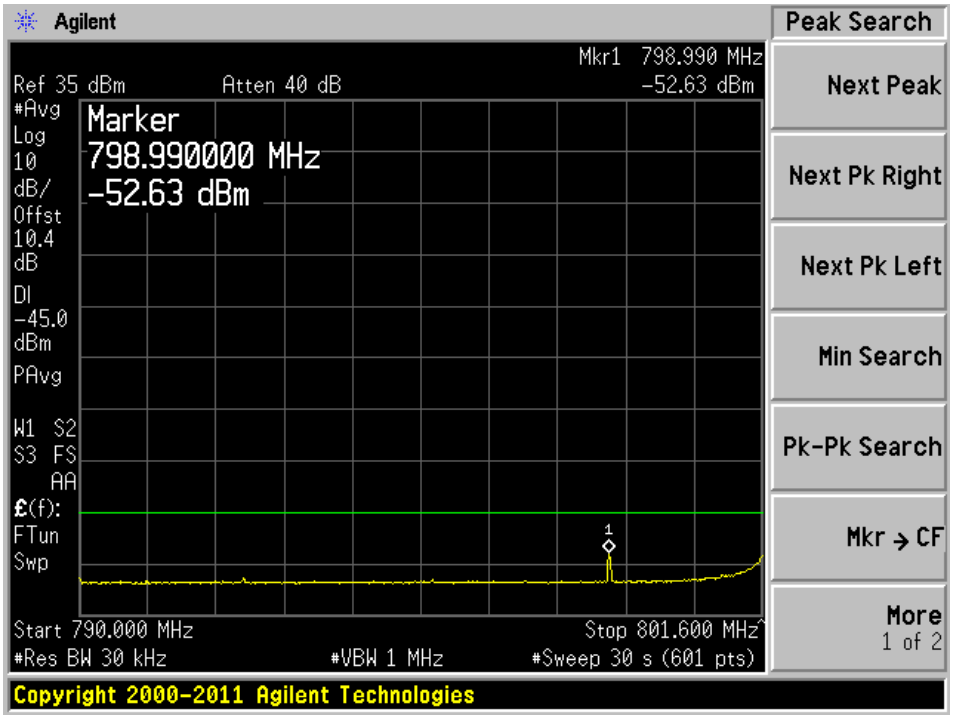
Middle Channel – 802 MHz



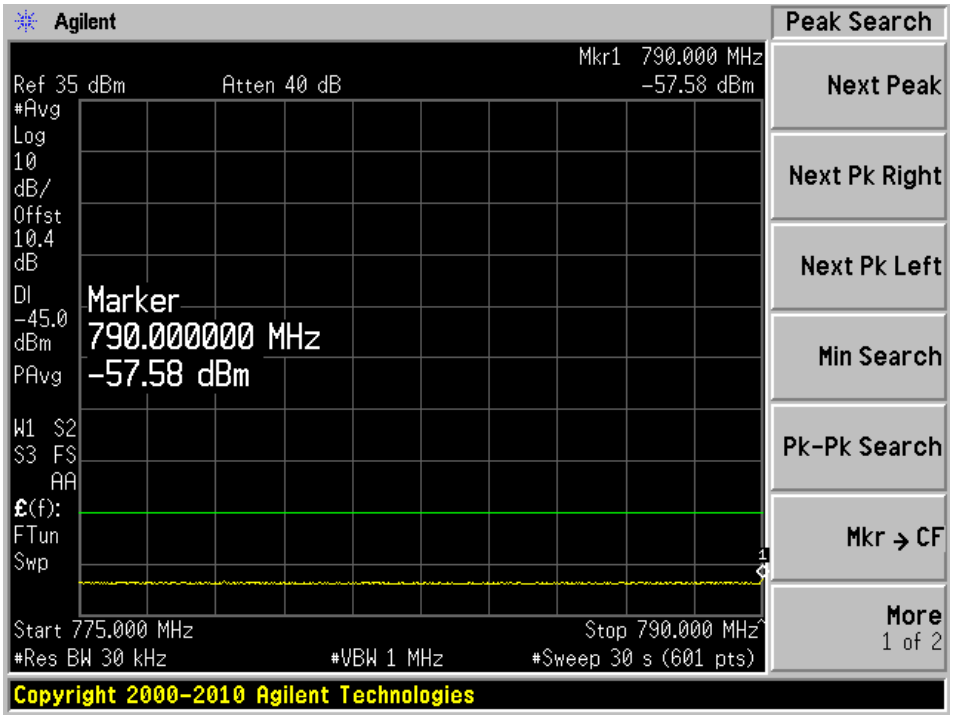
Middle Channel – 802 MHz (+400 kHz to +12MHz)



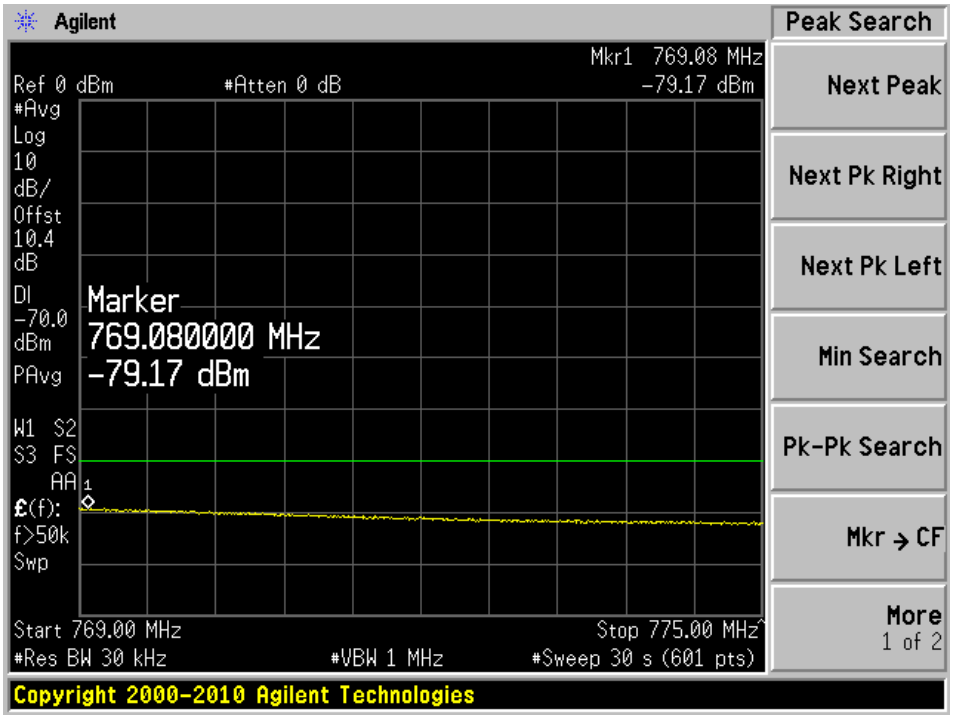
Middle Channel – 802 MHz (-12MHz to – 400 kHz)



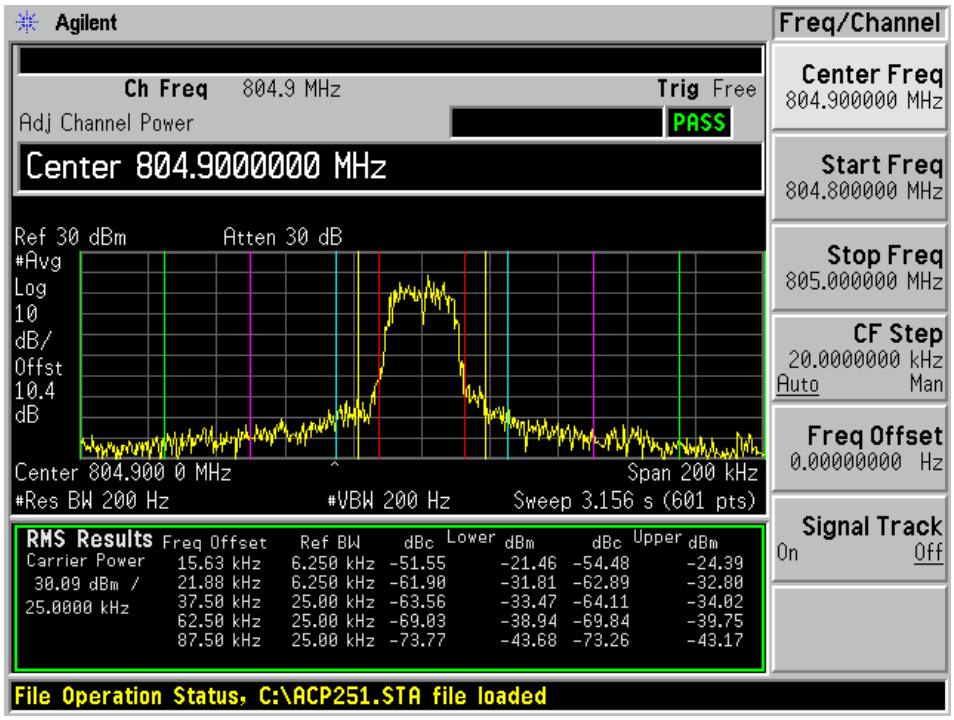
Middle Channel – 802 MHz (-12MHz to the paired receive band)



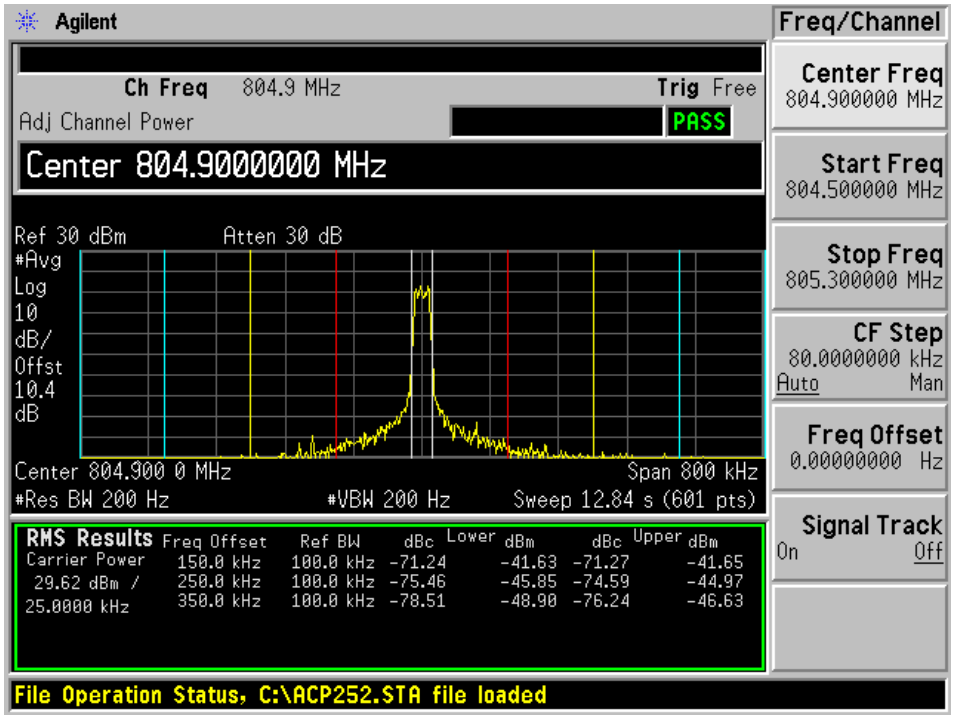
Middle Channel – 802 MHz (in the paired receive band)



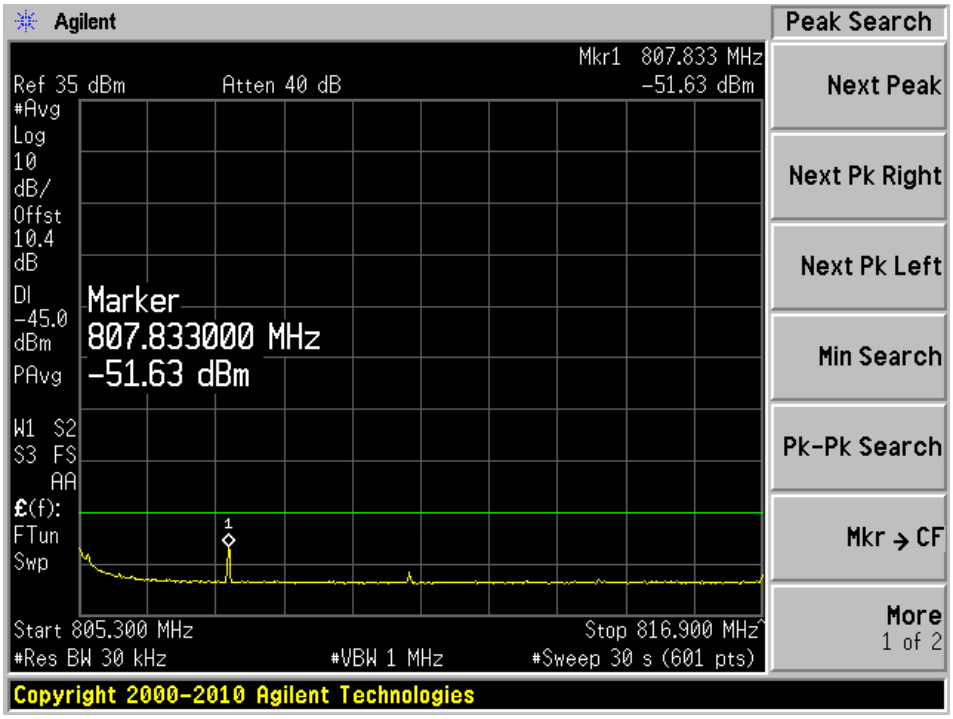
High Channel – 804.9 MHz



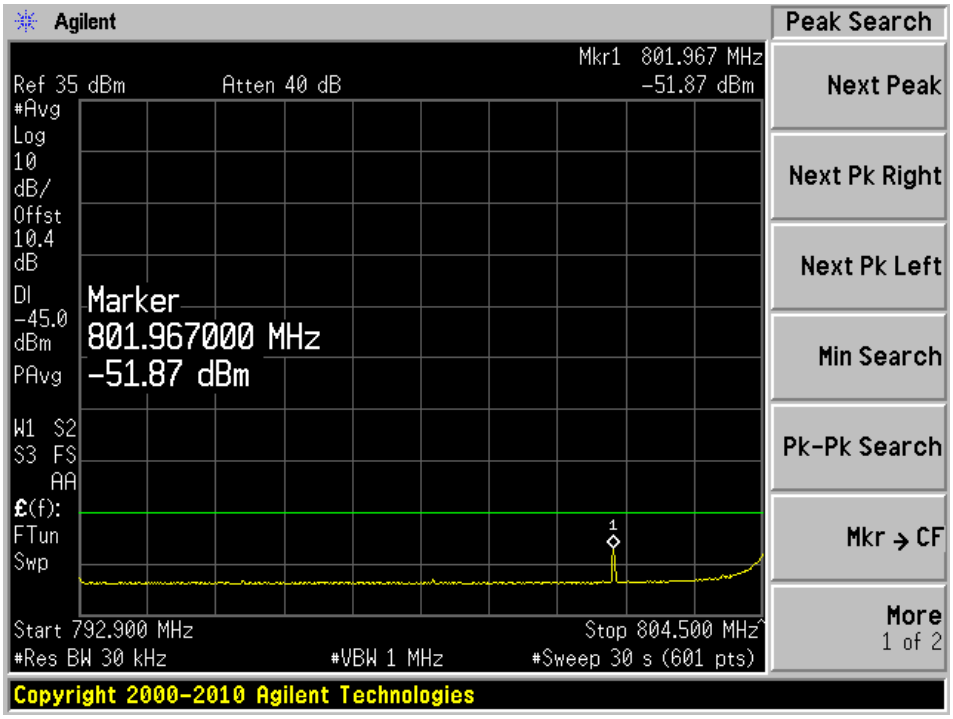
High Channel – 804.9 MHz



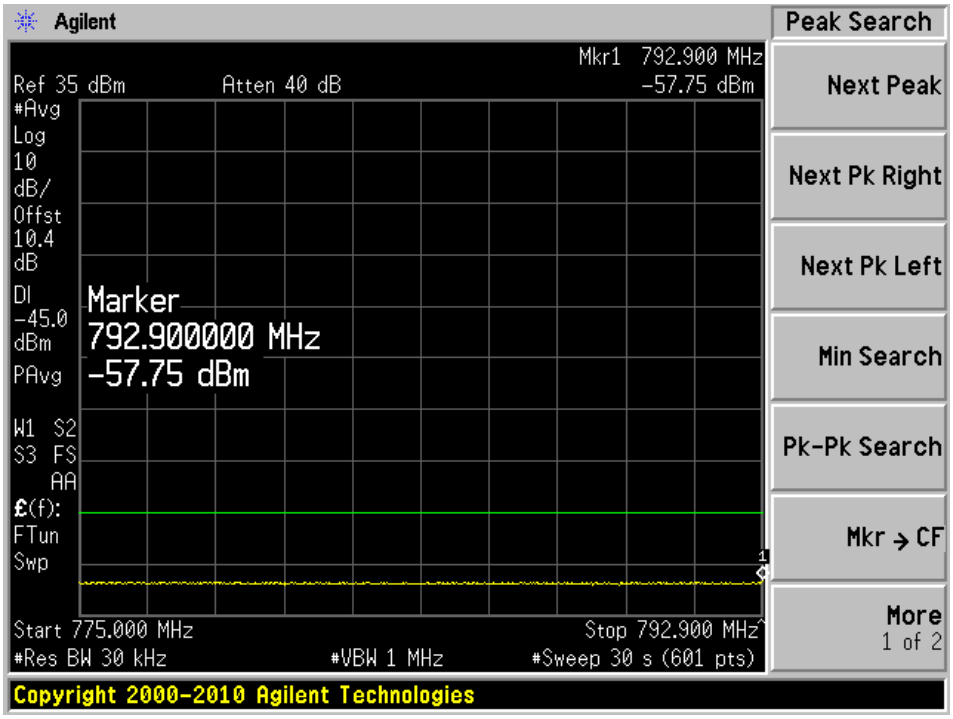
High Channel – 804.9 MHz (+400 kHz to +12MHz)



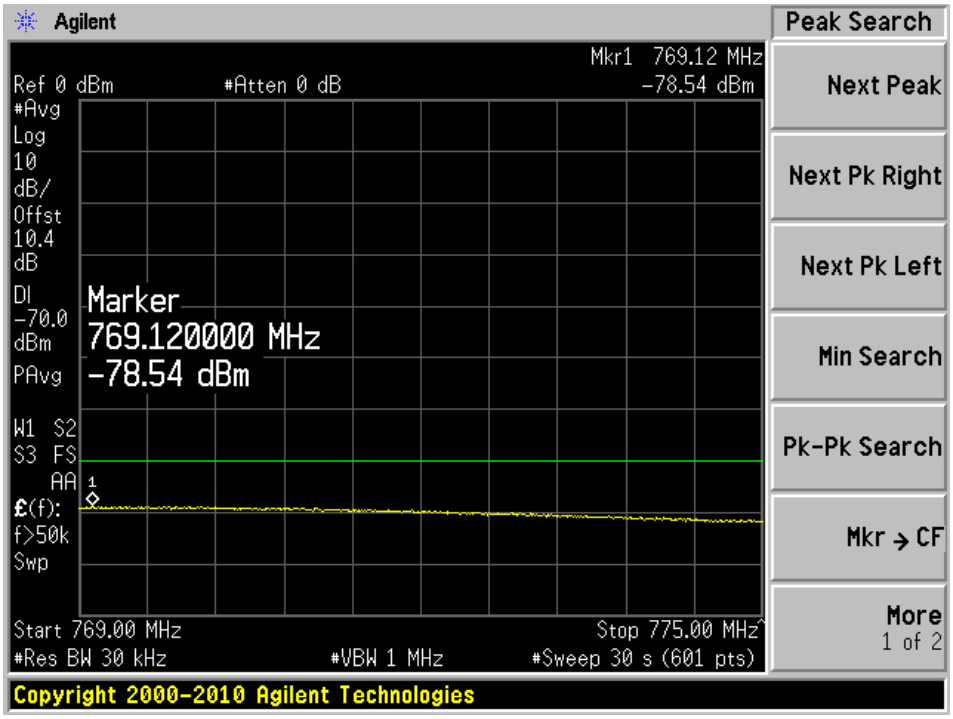
High Channel – 804.9 MHz (-12MHz to – 400 kHz)



High Channel – 804.9 MHz (-12MHz to the paired receive band)

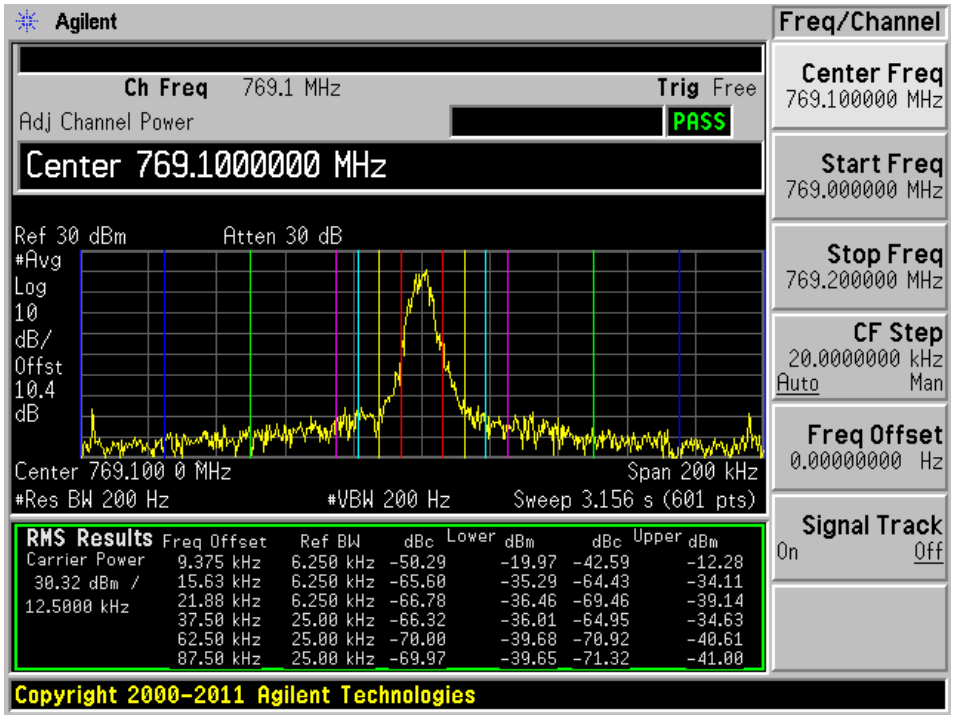


High Channel – 804.9 MHz (in the paired receive band)

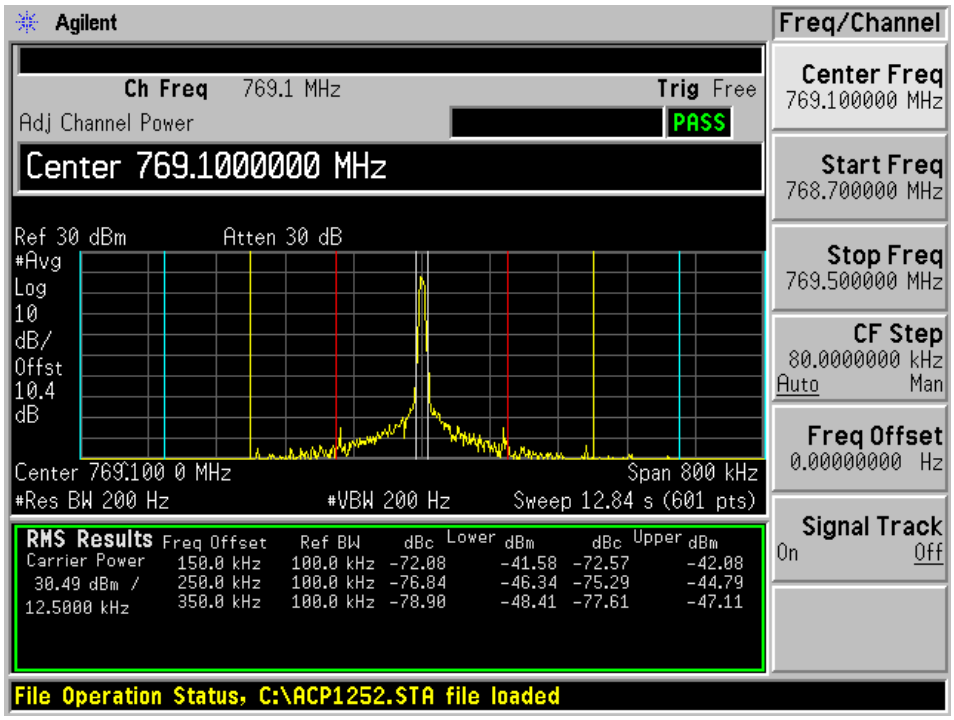


C4FM: 769 MHz – 775 MHz

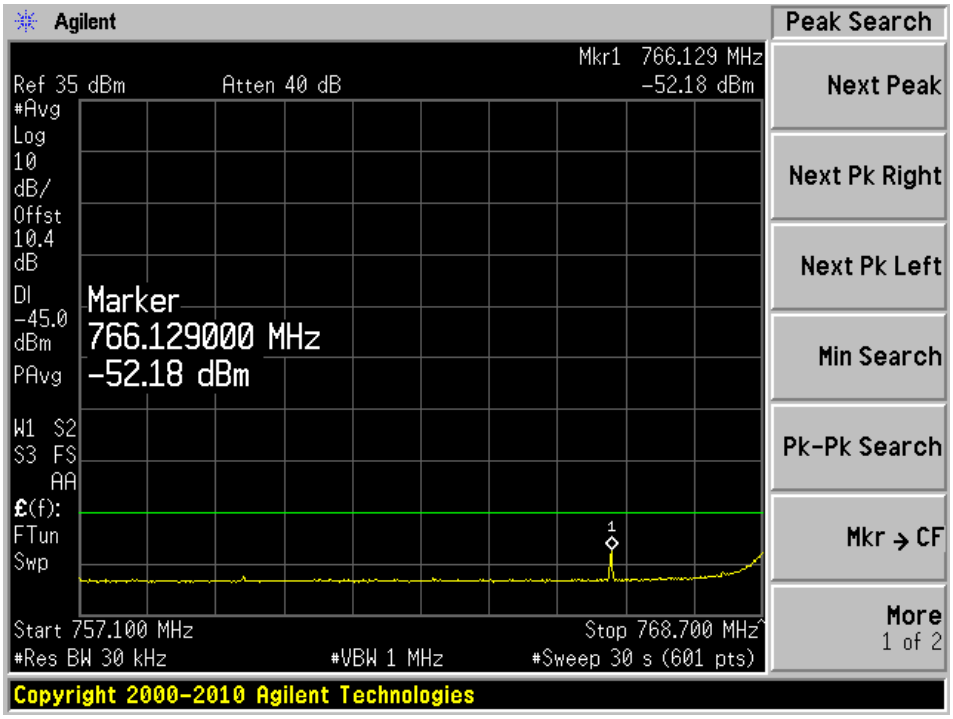
Low Channel – 769.1 MHz



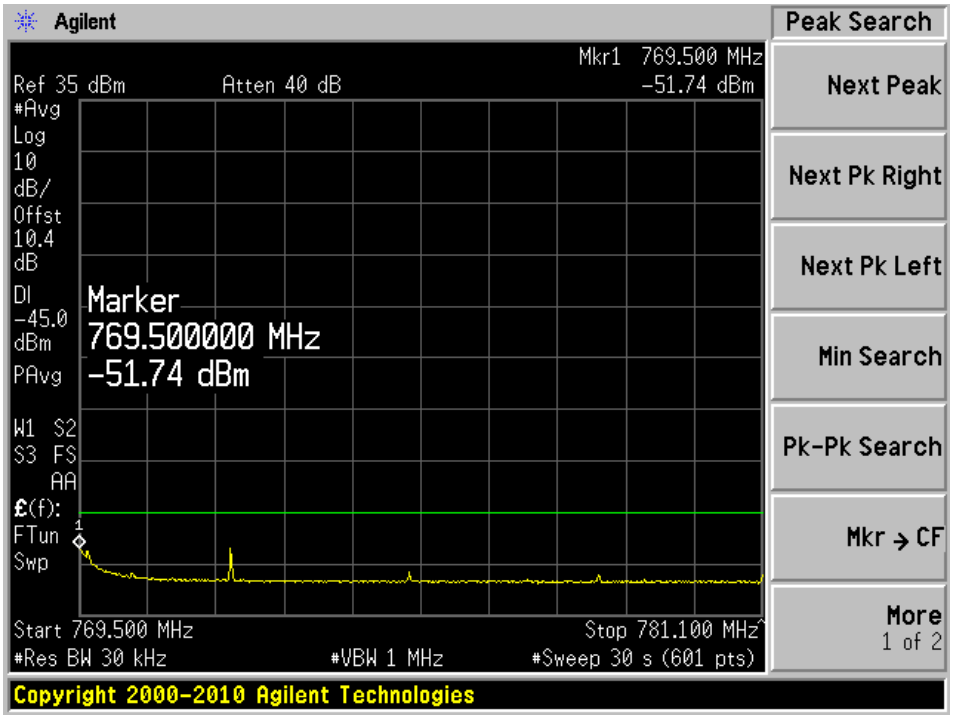
Low Channel – 769.1 MHz



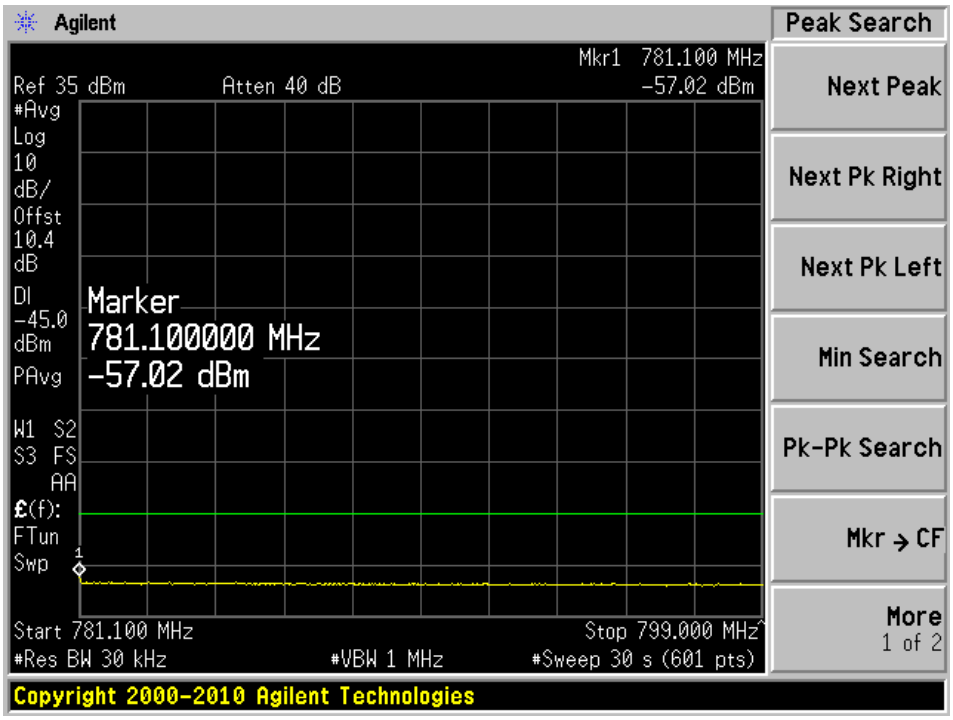
Low Channel – 769.1 MHz (-12MHz to -400 kHz)



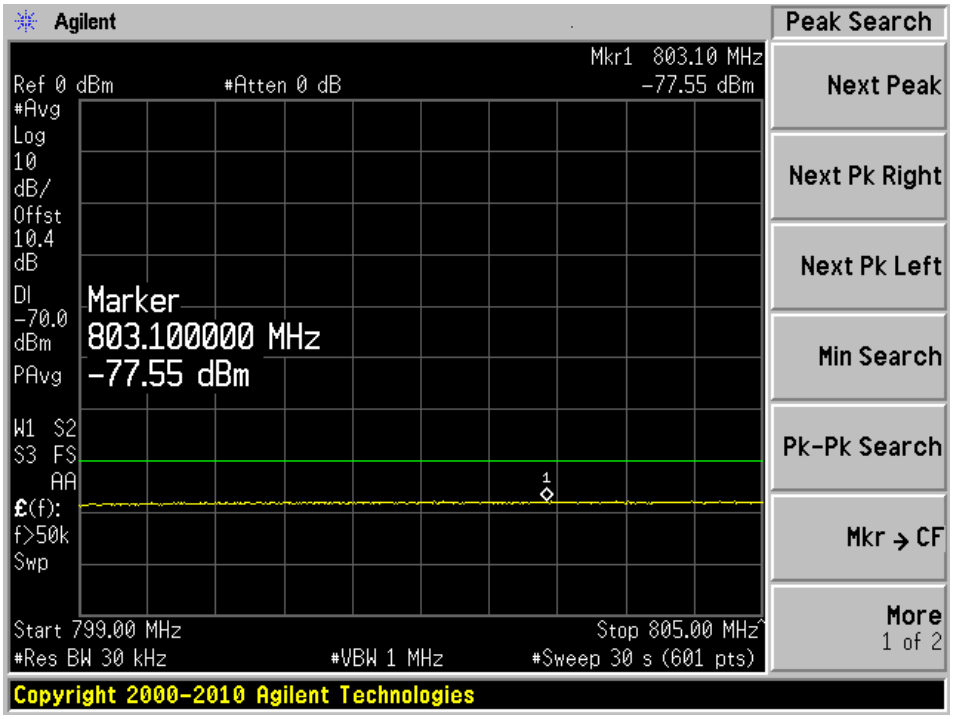
Low Channel – 769.1 MHz (+400 kHz to +12MHz)



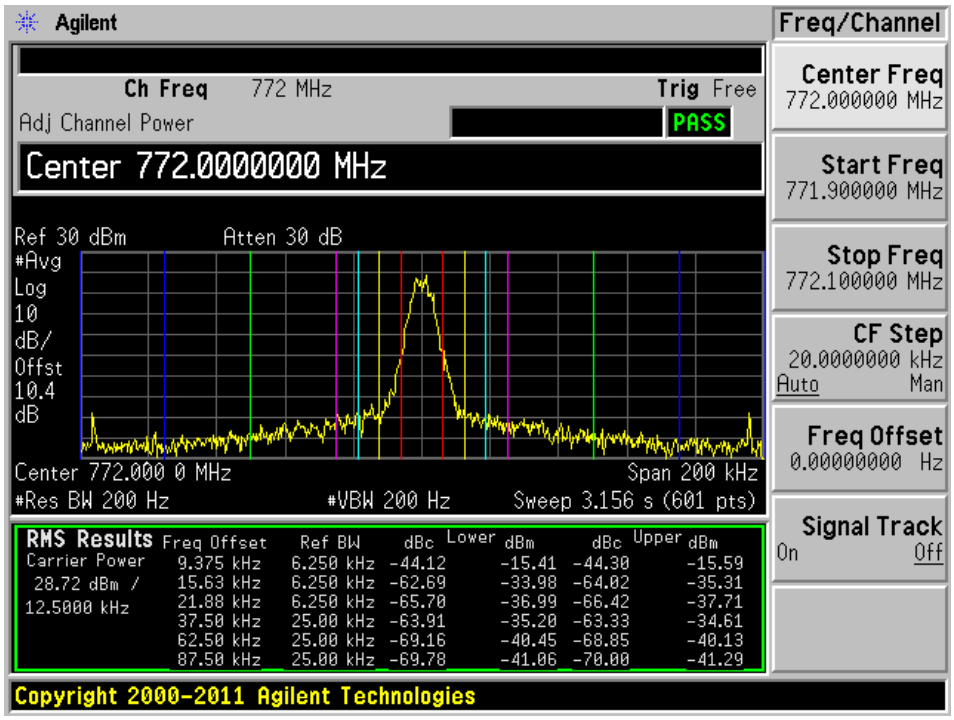
Low Channel – 769.1 MHz (+12MHz to the paired receive band)



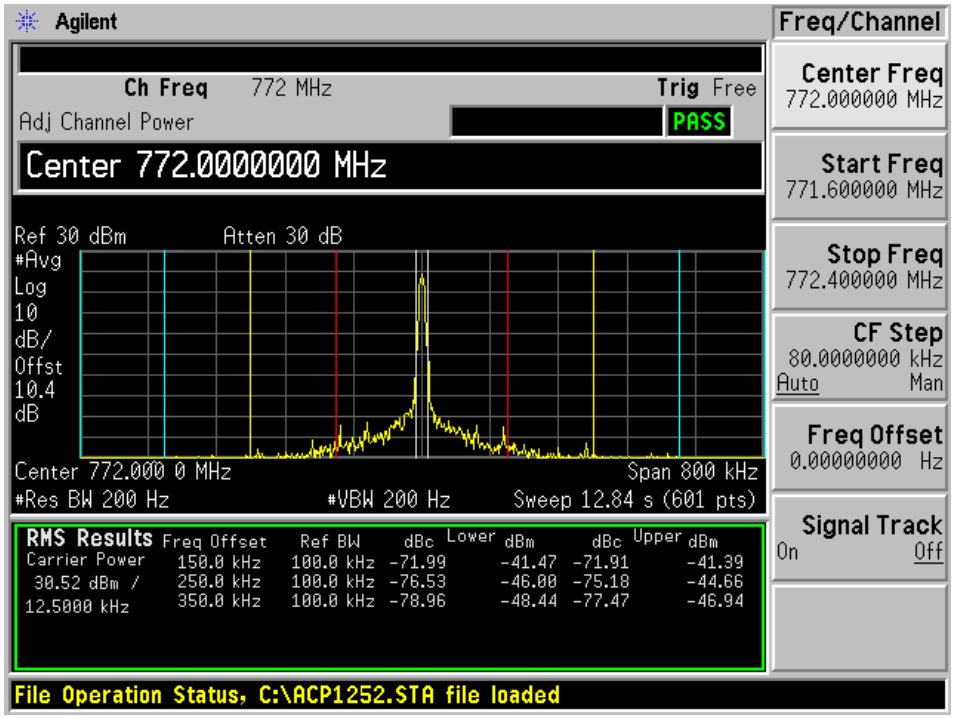
Low Channel – 769.1 MHz (in the paired receive band)



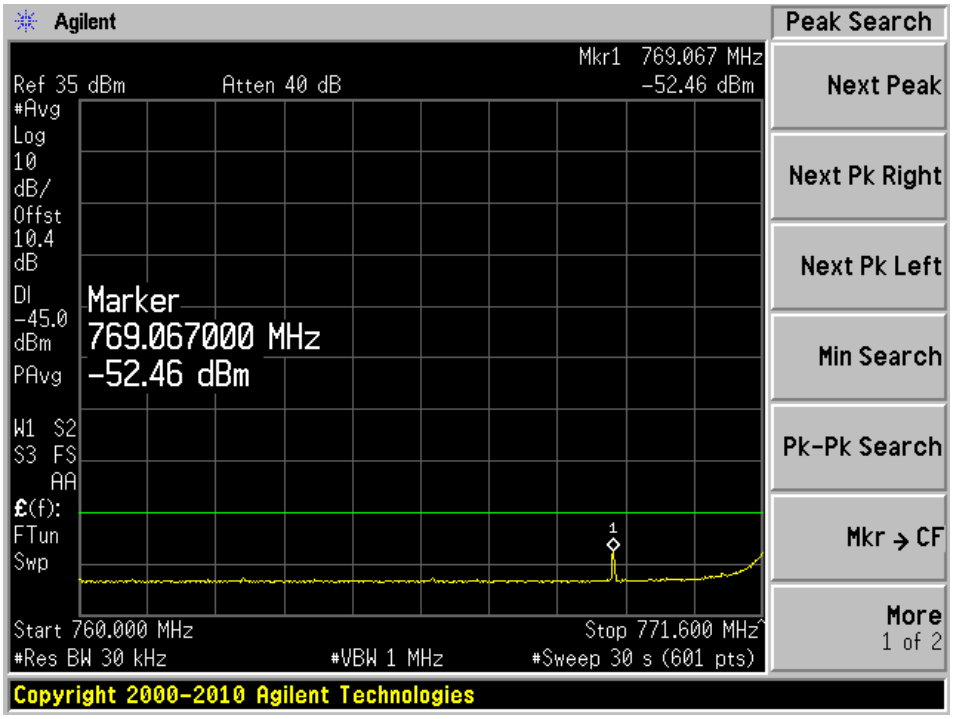
Middle Channel – 772 MHz



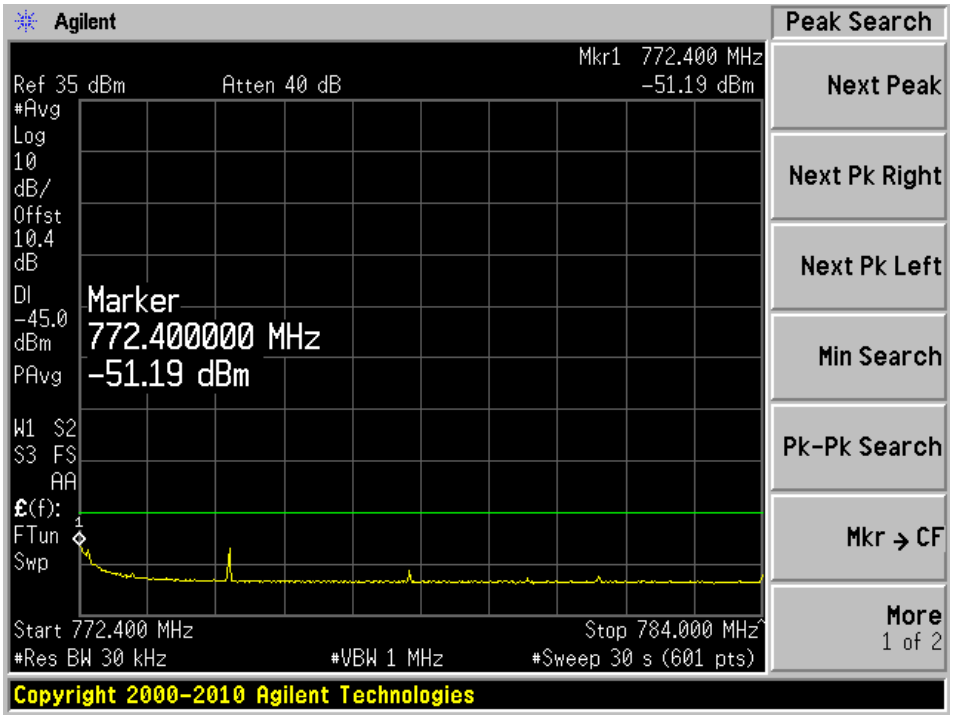
Middle Channel – 772 MHz



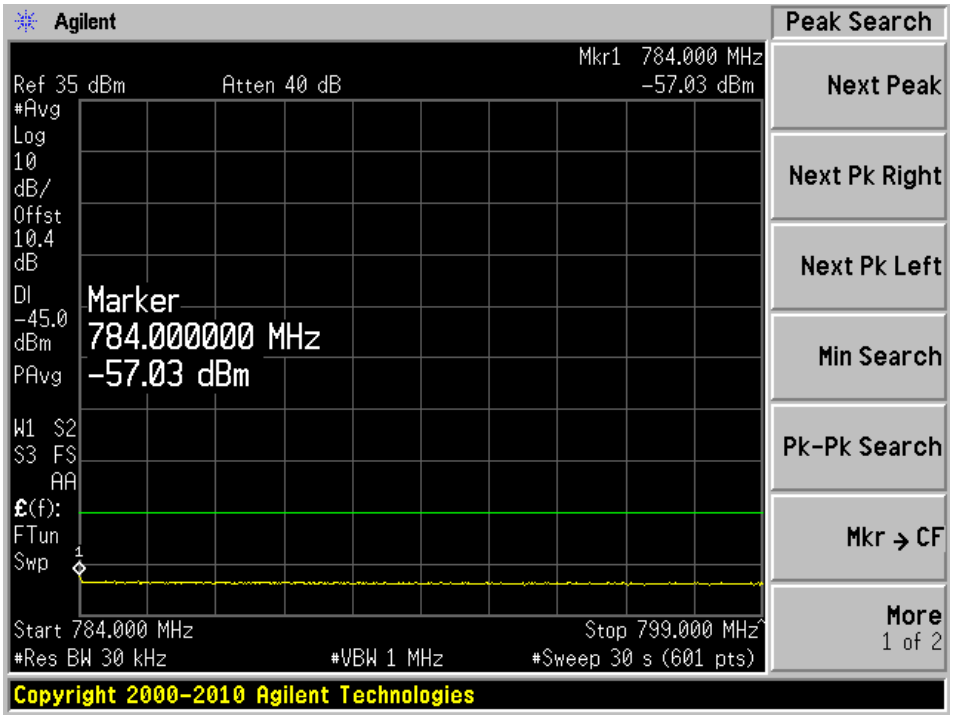
Middle Channel – 772 MHz (-12MHz to – 400 kHz)



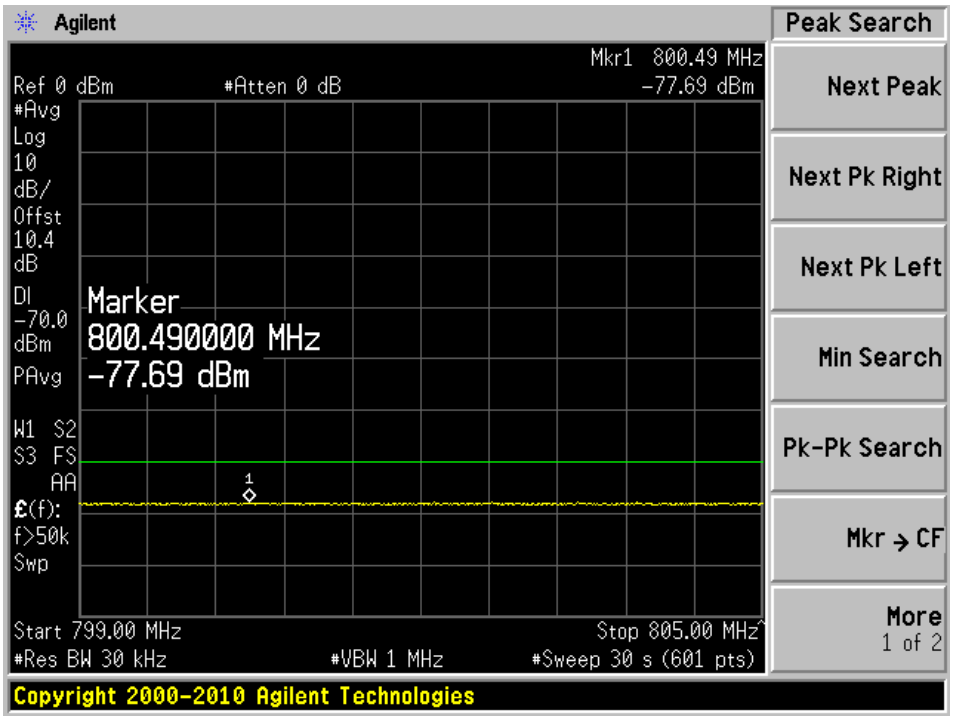
Middle Channel – 772 MHz (+ 400 kHz to +12MHz)



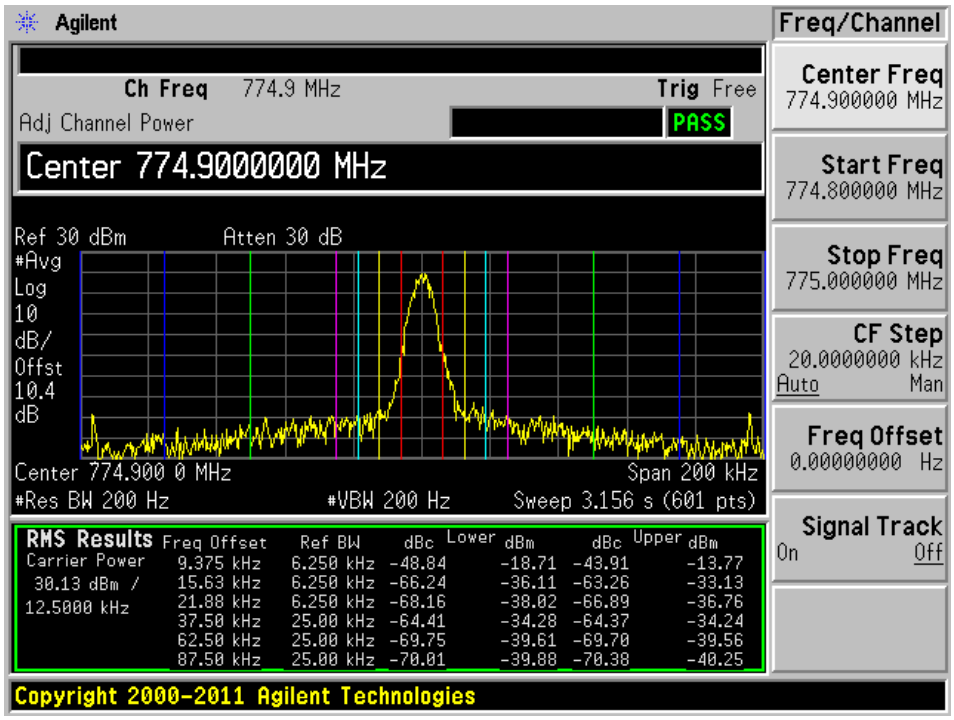
Middle Channel – 772 MHz (+12MHz to the paired receive band)



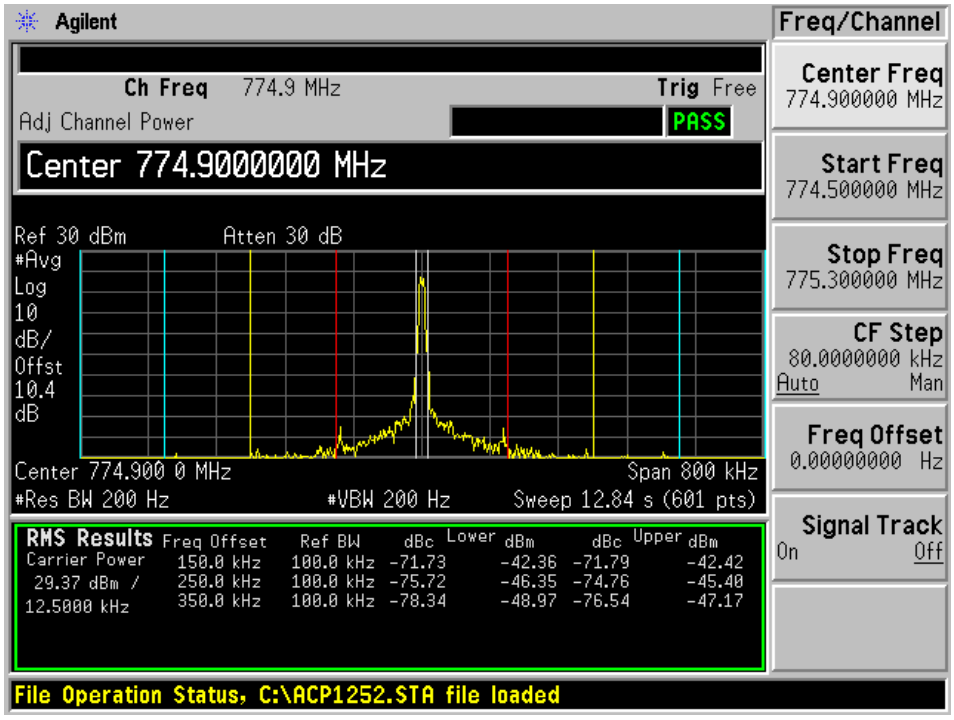
Middle Channel – 772 MHz (in the paired receive band)



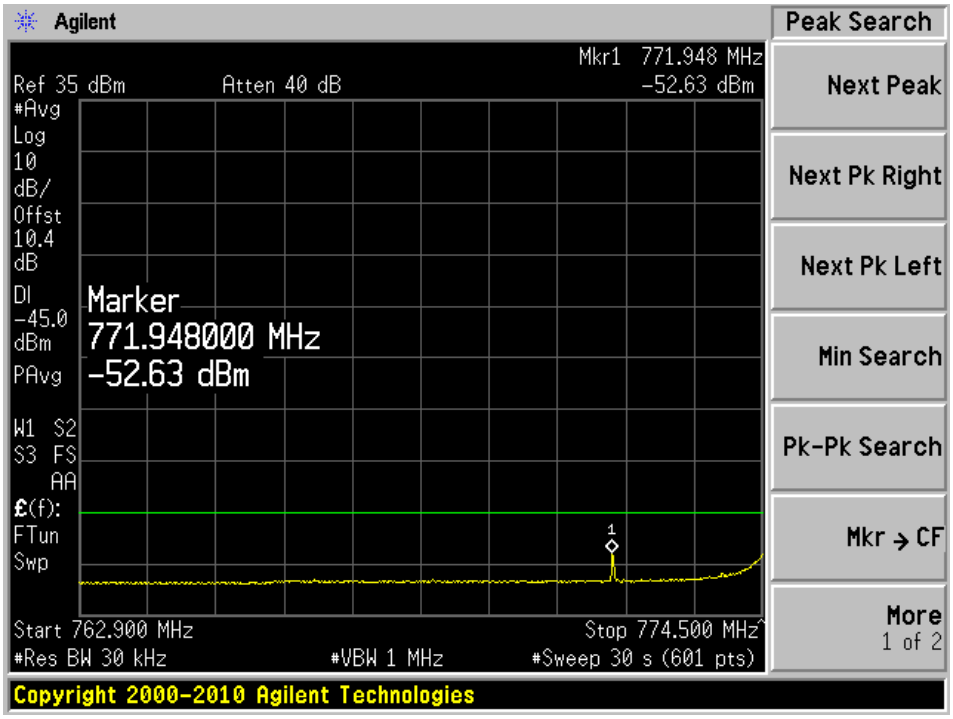
High Channel – 774.9 MHz



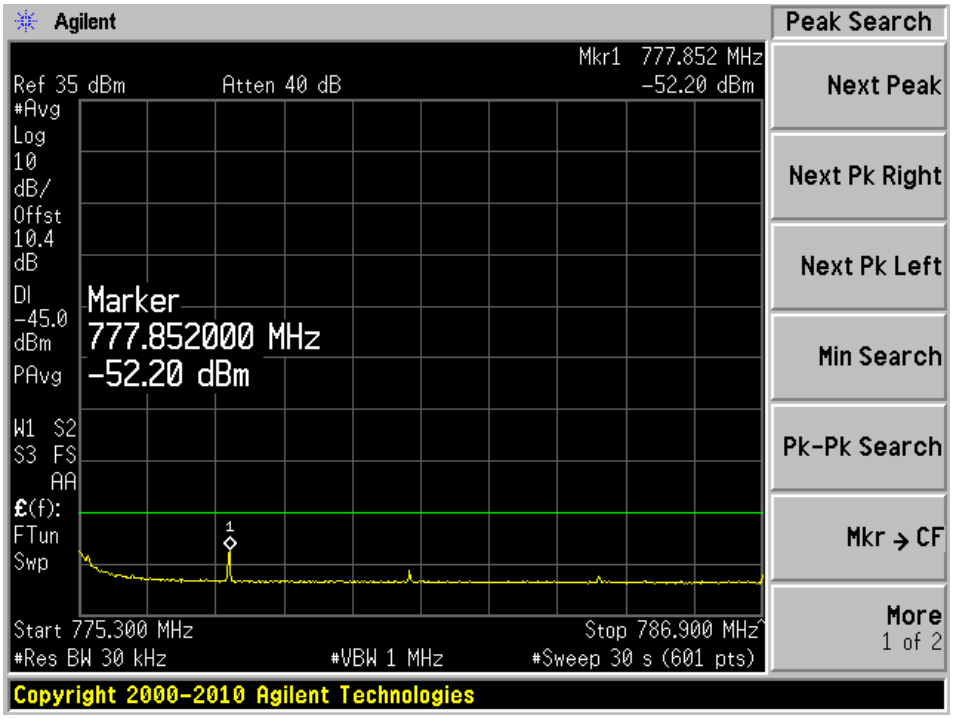
High Channel – 774.9 MHz



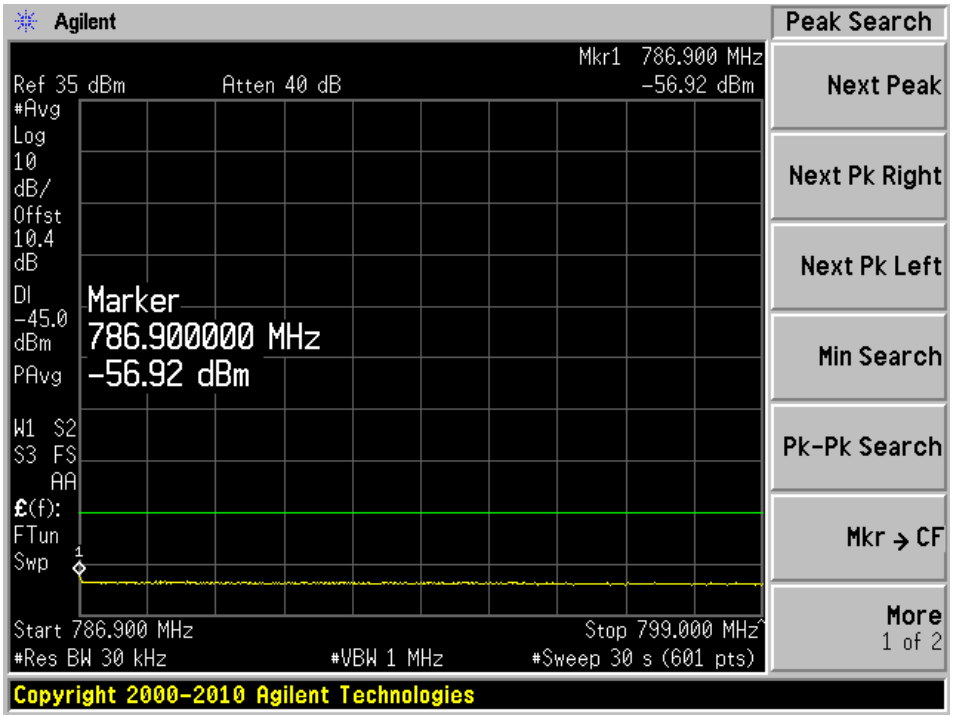
High Channel – 774.9 MHz (-12MHz to - 400 kHz)



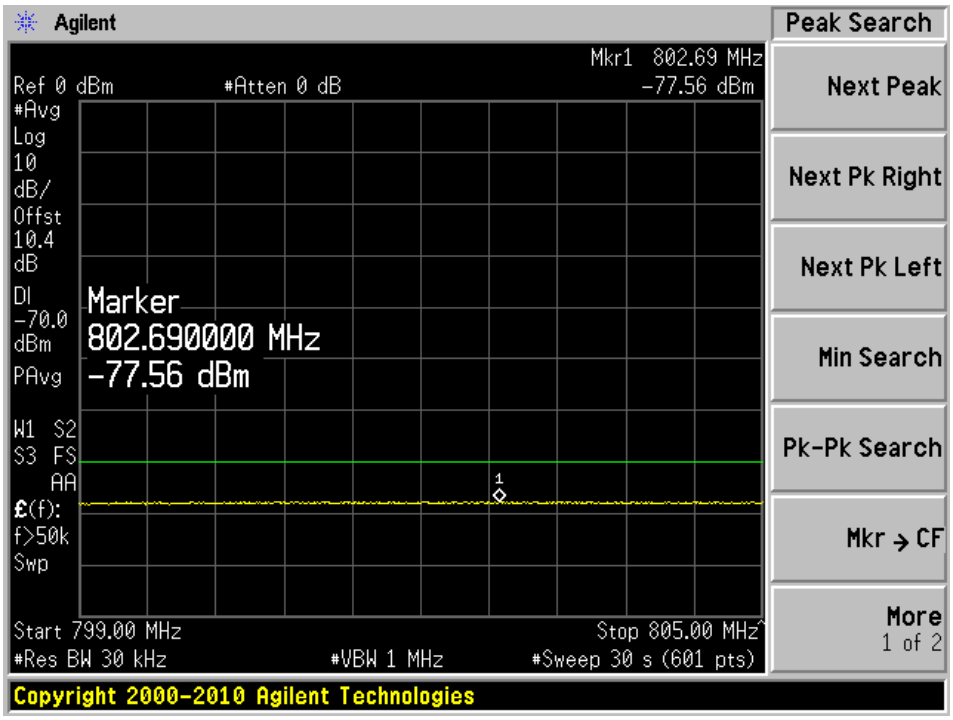
High Channel – 774.9 MHz (+400 kHz to +12MHz)



High Channel – 774.9 MHz (+12MHz to the paired receive band)

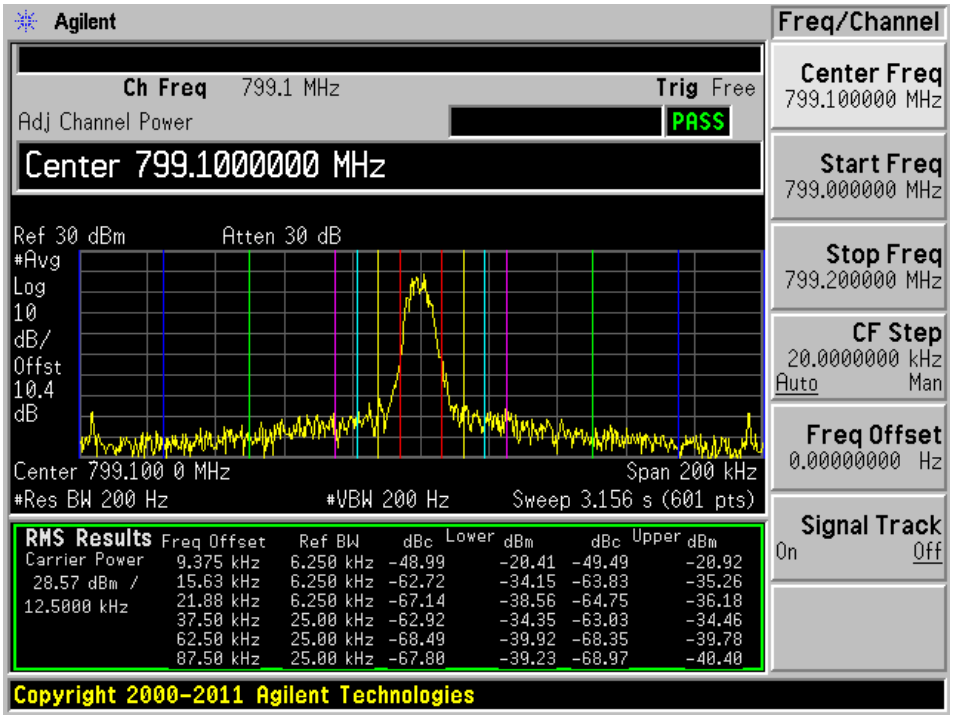


High Channel – 774.9 MHz (in the paired receive band)

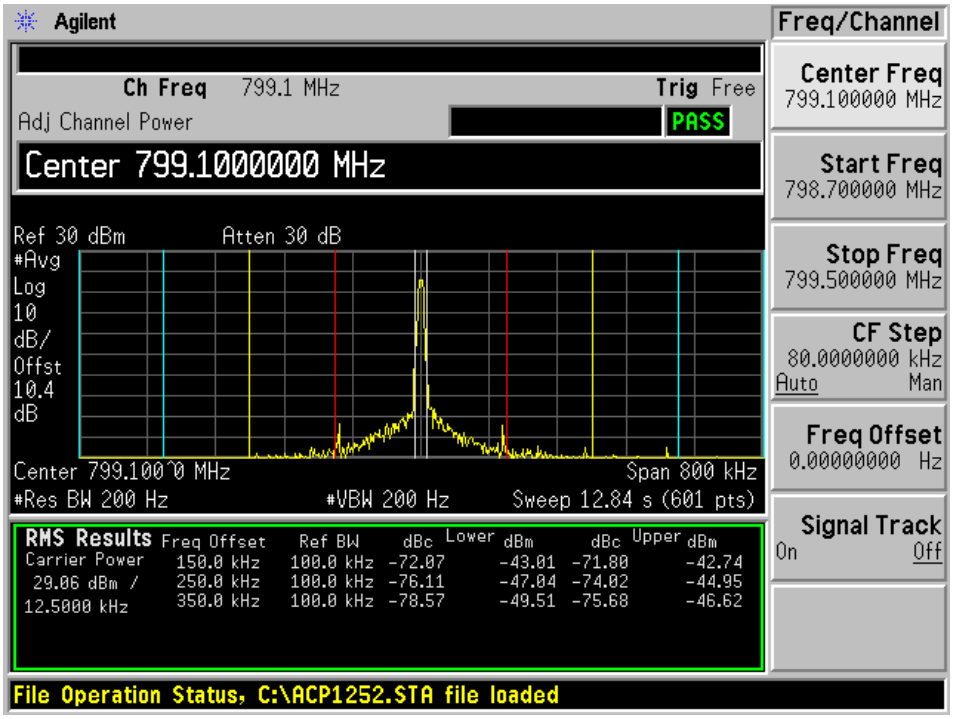


C4FM: 799 MHz – 805 MHz

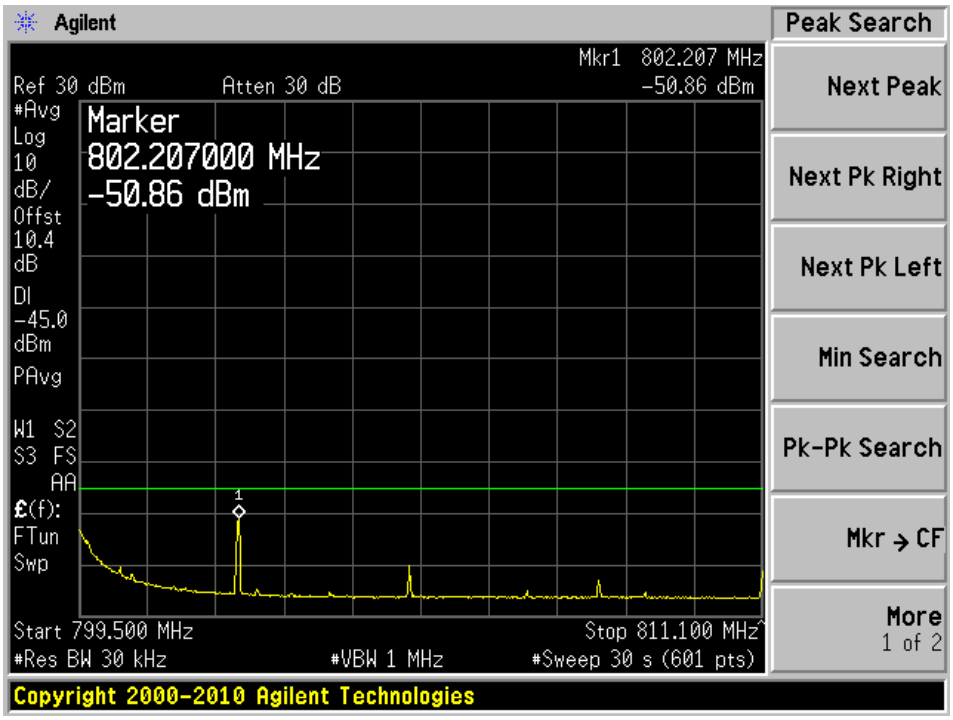
Low Channel – 799.1 MHz



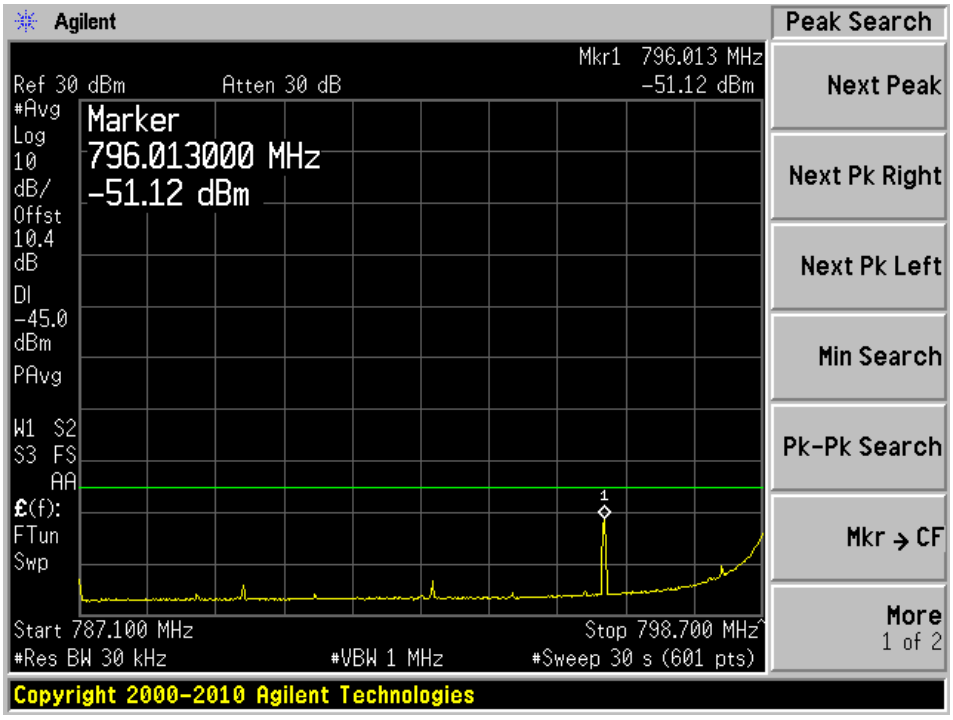
Low Channel – 799.1 MHz



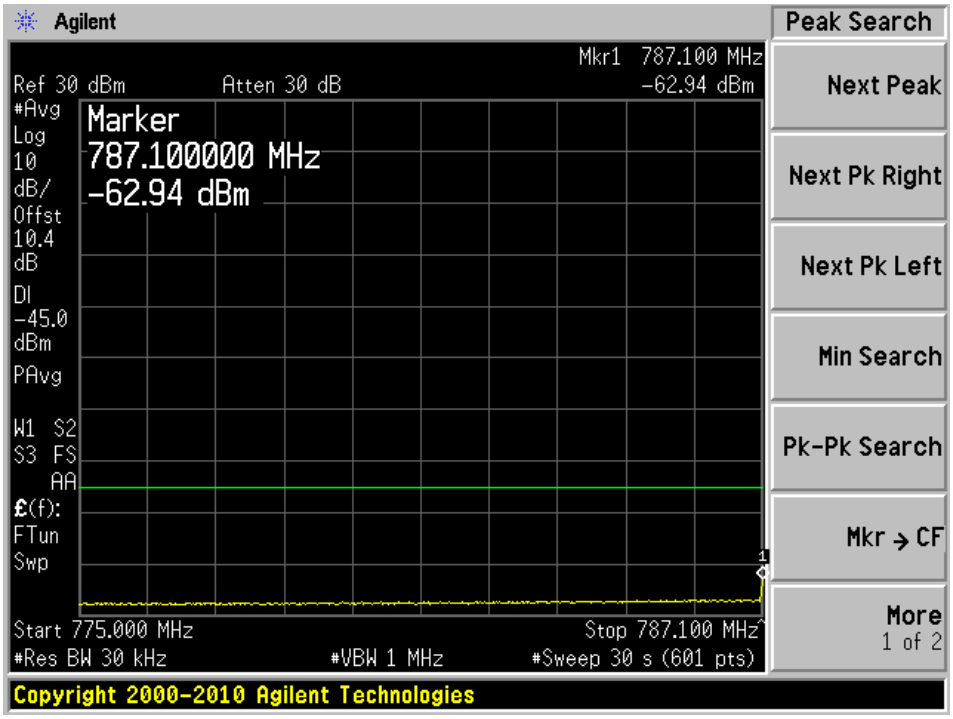
Low Channel – 799.1 MHz (+400 kHz to +12MHz)



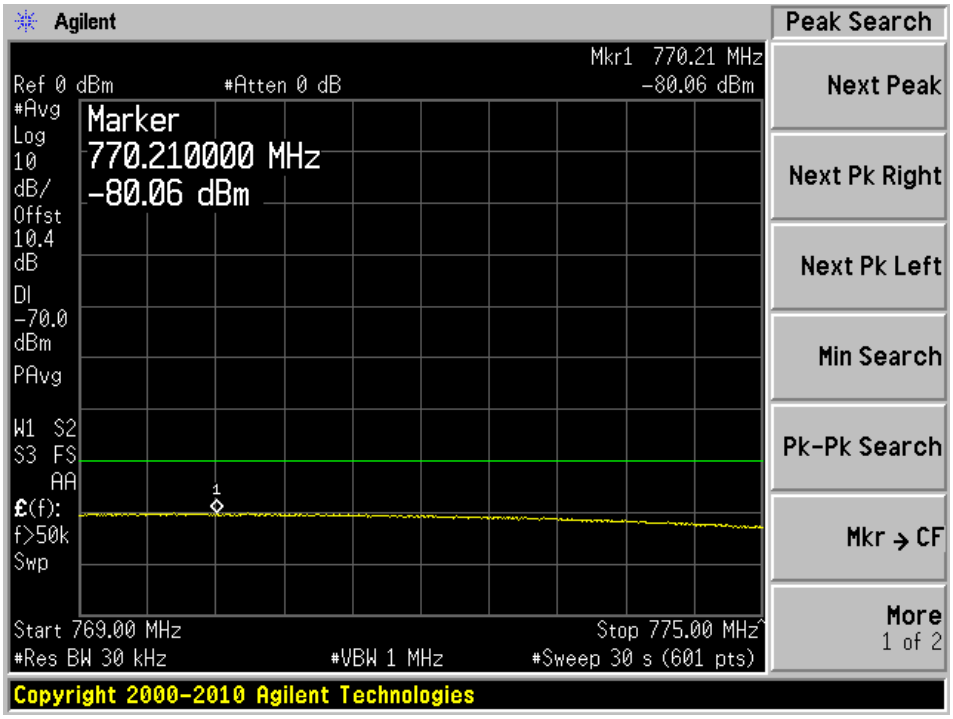
Low Channel – 799.1 MHz (-12MHz to - 400 kHz)



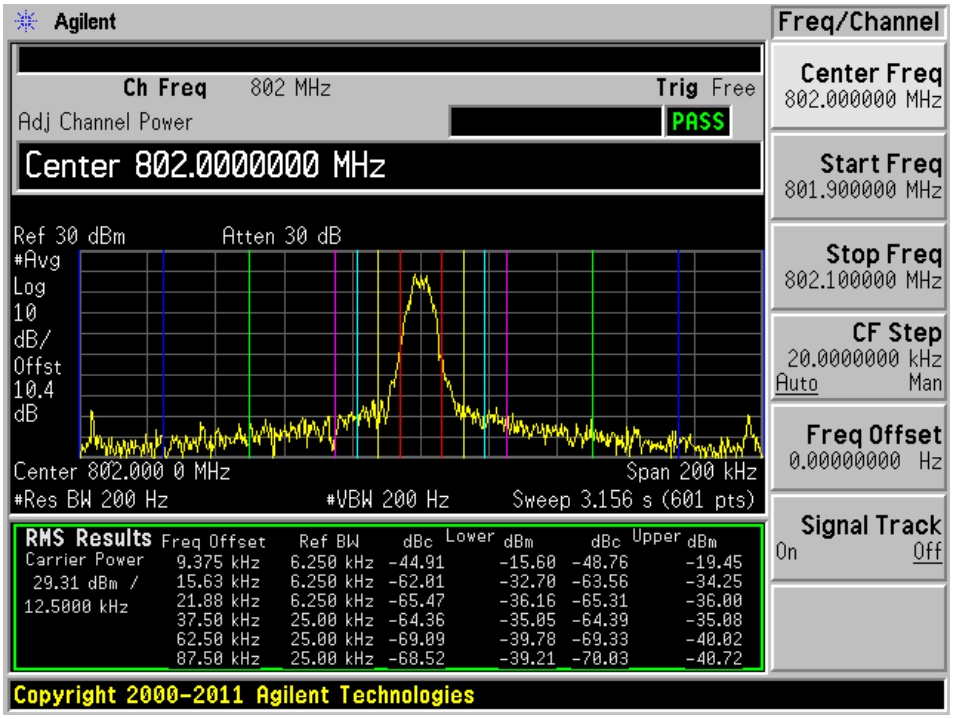
Low Channel – 799.1 MHz (-12MHz to the paired receive band)



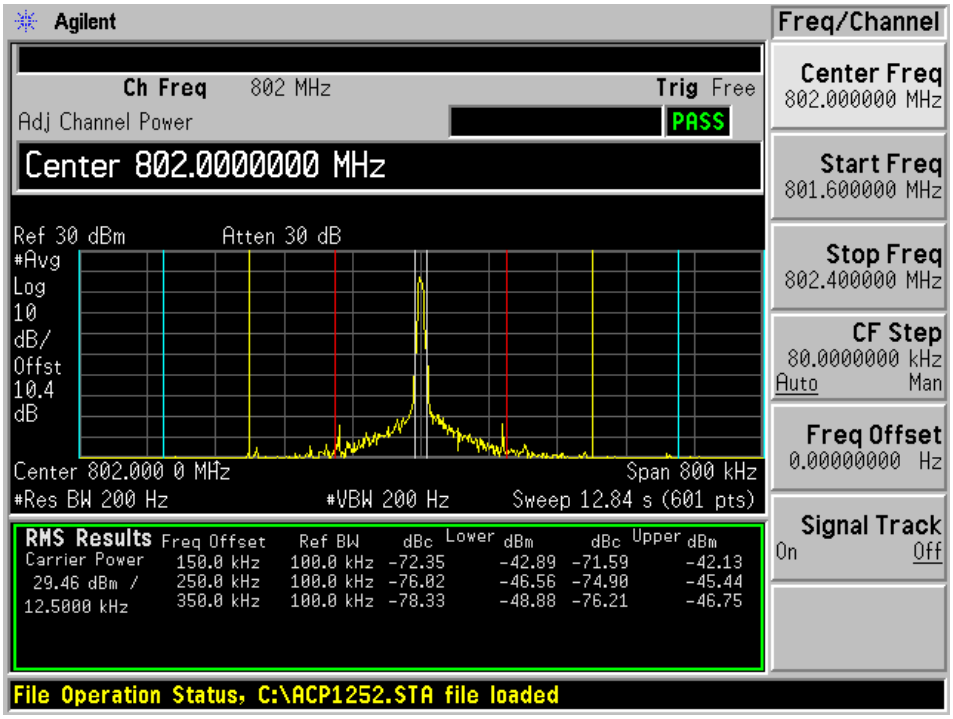
Low Channel – 799.1 MHz (in the paired receive band)



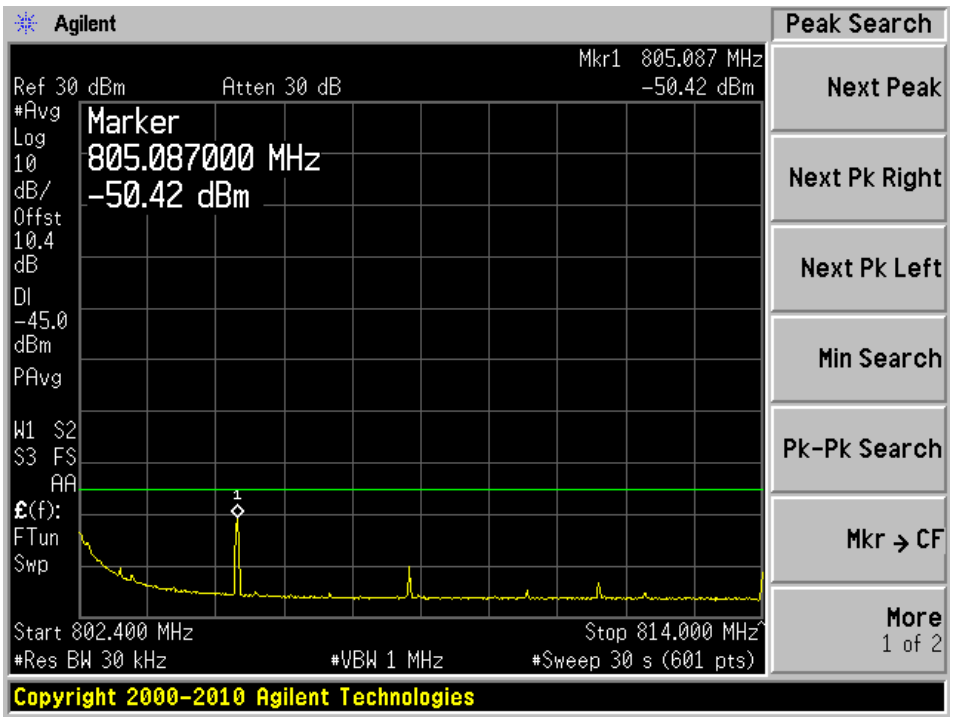
Middle Channel – 802 MHz



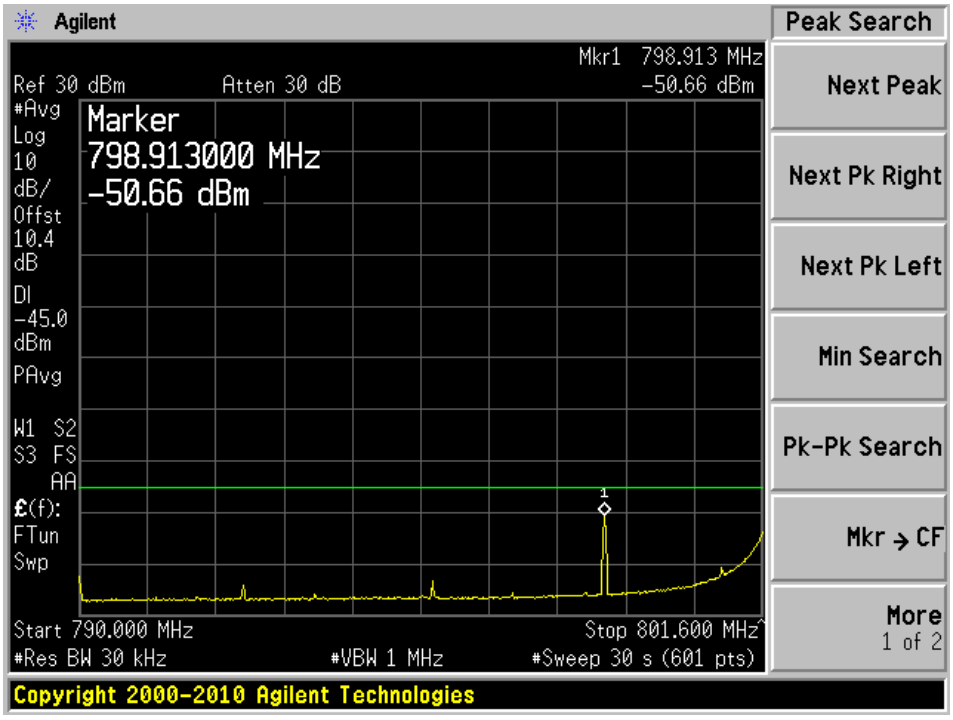
Middle Channel – 802 MHz



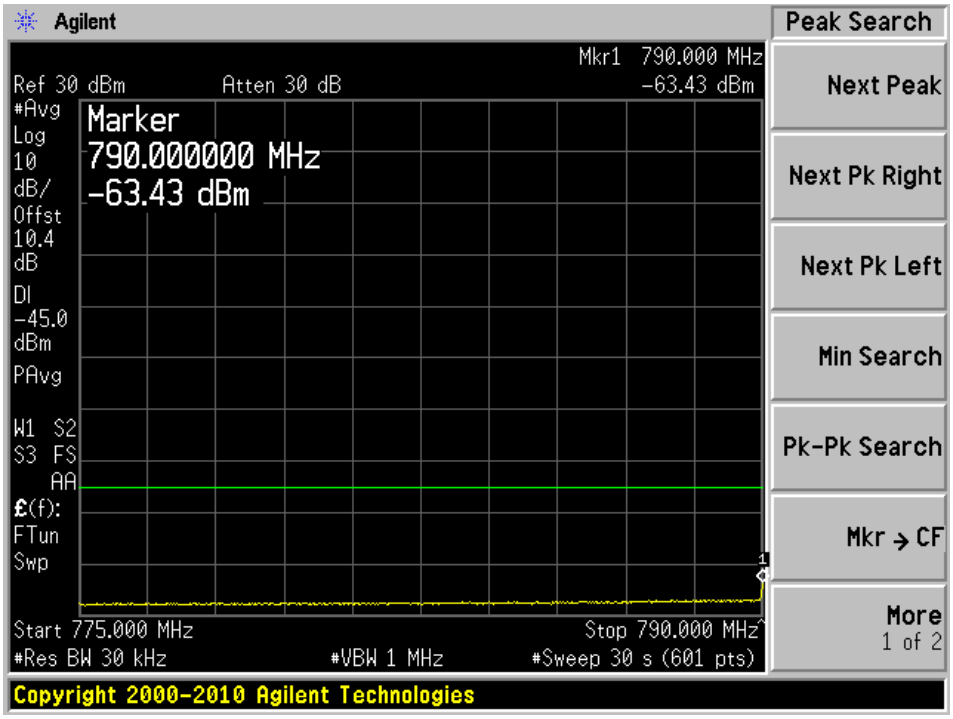
Middle Channel – 802 MHz (+400 kHz to +12MHz)



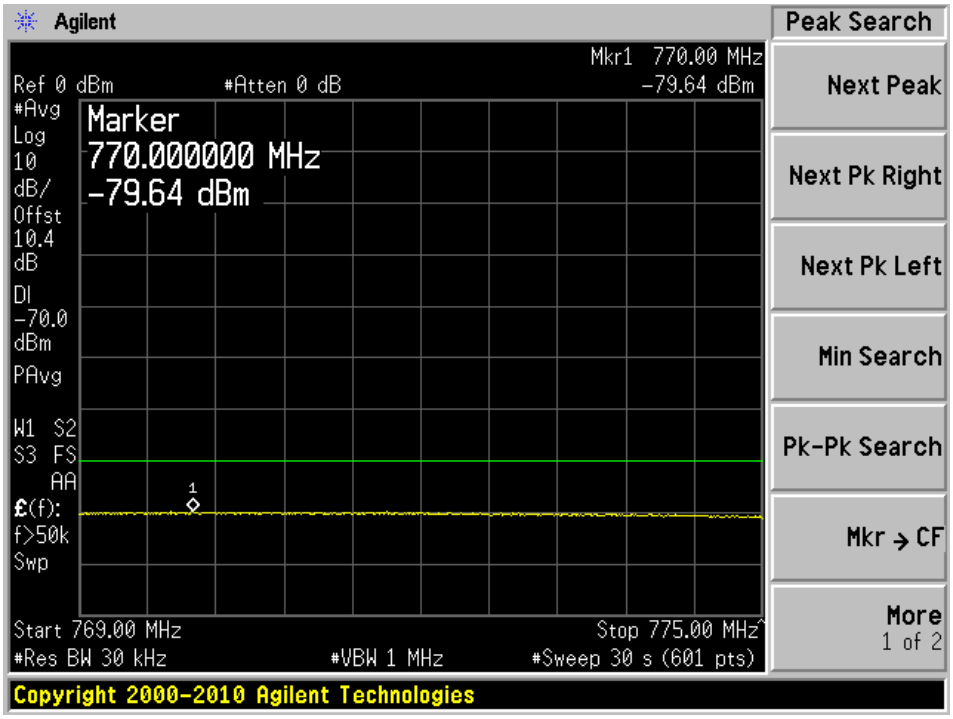
Middle Channel – 802 MHz (-12MHz to - 400 kHz)



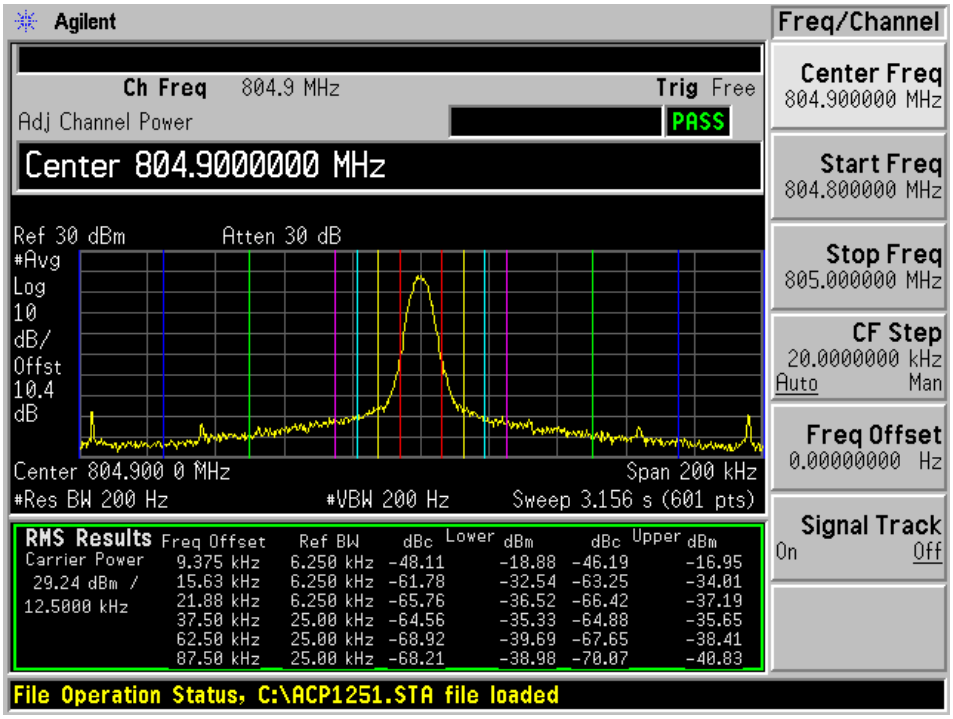
Middle Channel – 802 MHz (-12MHz to the paired receive band)



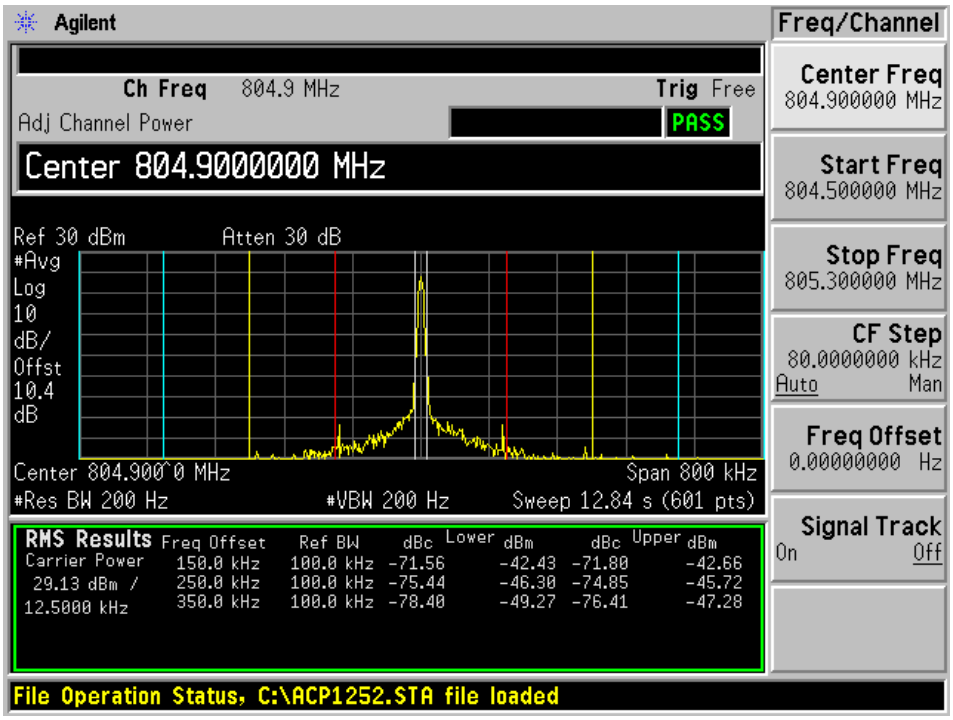
Middle Channel – 802 MHz (in the paired receive band)



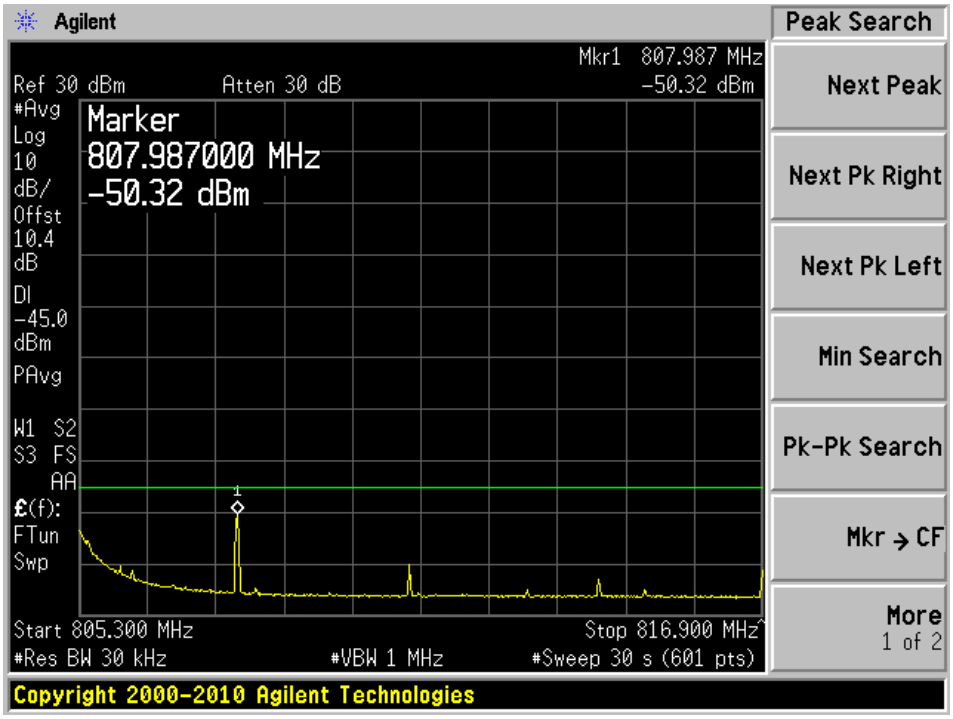
High Channel – 804.9 MHz



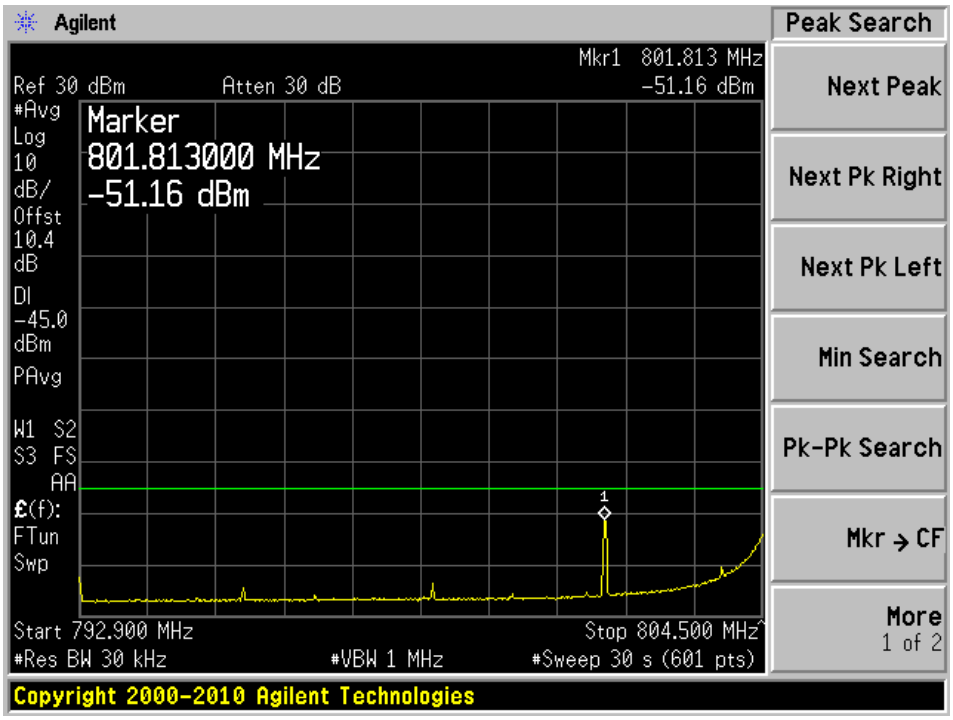
High Channel – 804.9 MHz



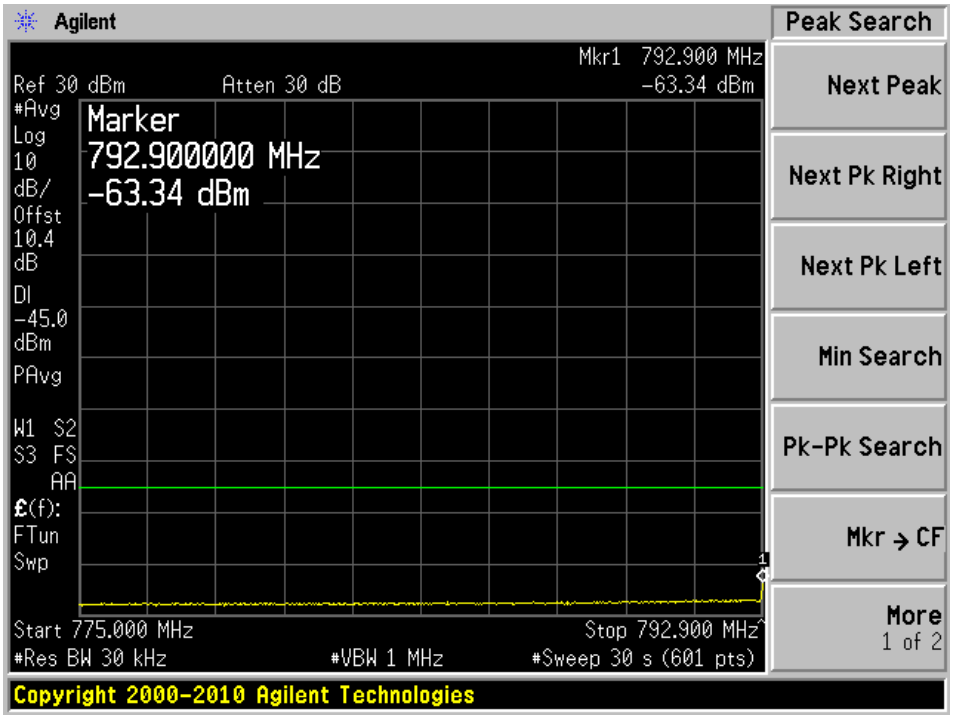
High Channel – 804.9 MHz (+ 400 kHz to +12MHz)



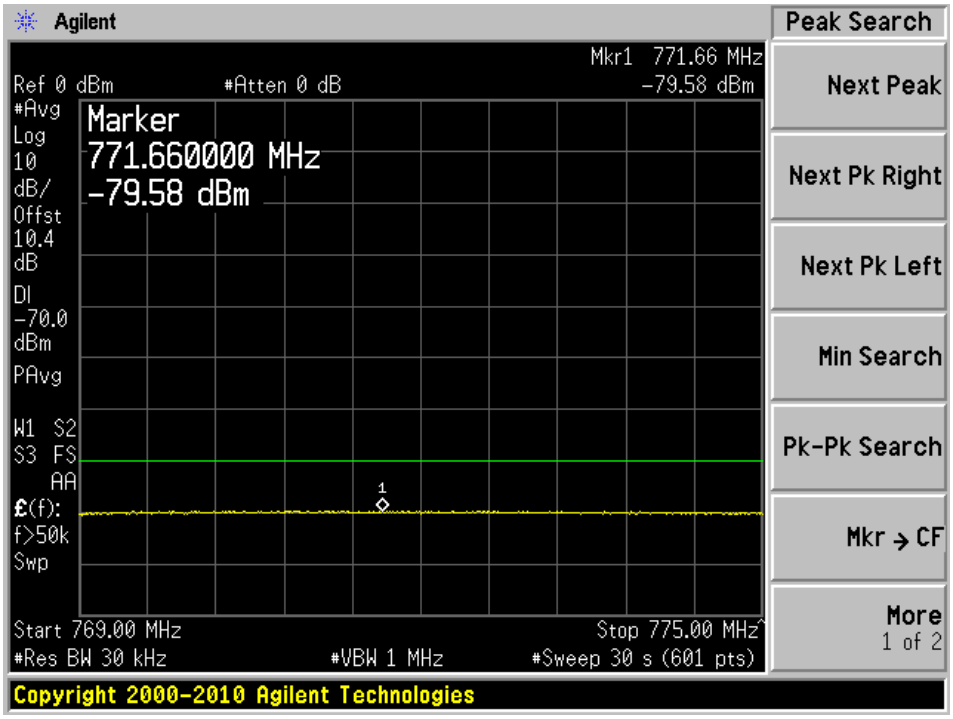
High Channel – 804.9 MHz (-12MHz to – 400 kHz)



High Channel – 804.9 MHz (-12MHz to the paired receive band)



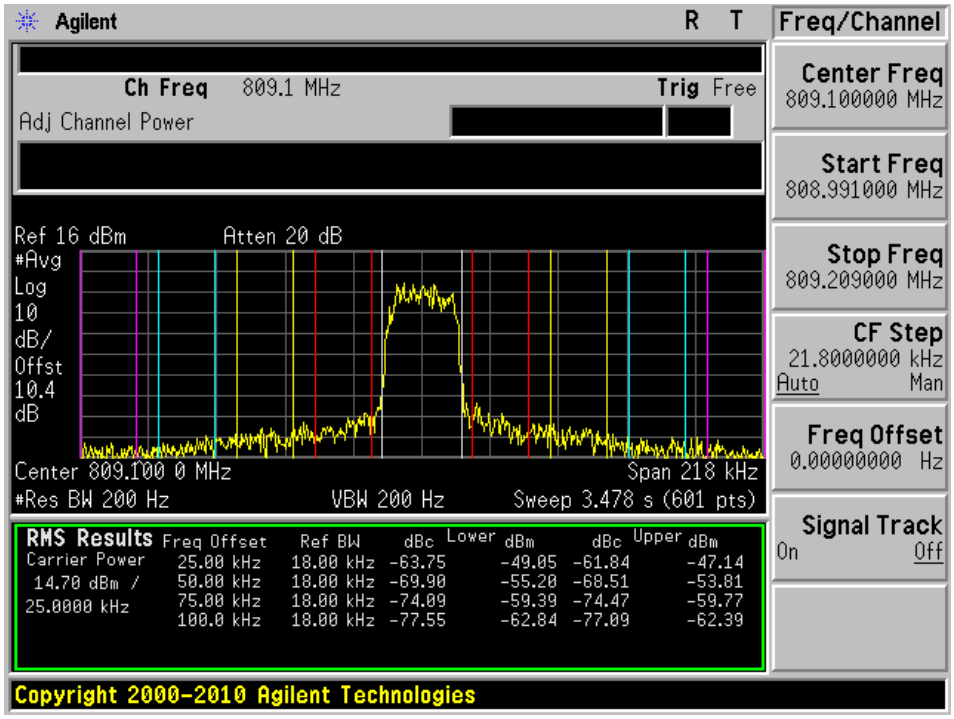
High Channel – 804.9 MHz (in the paired receive band)



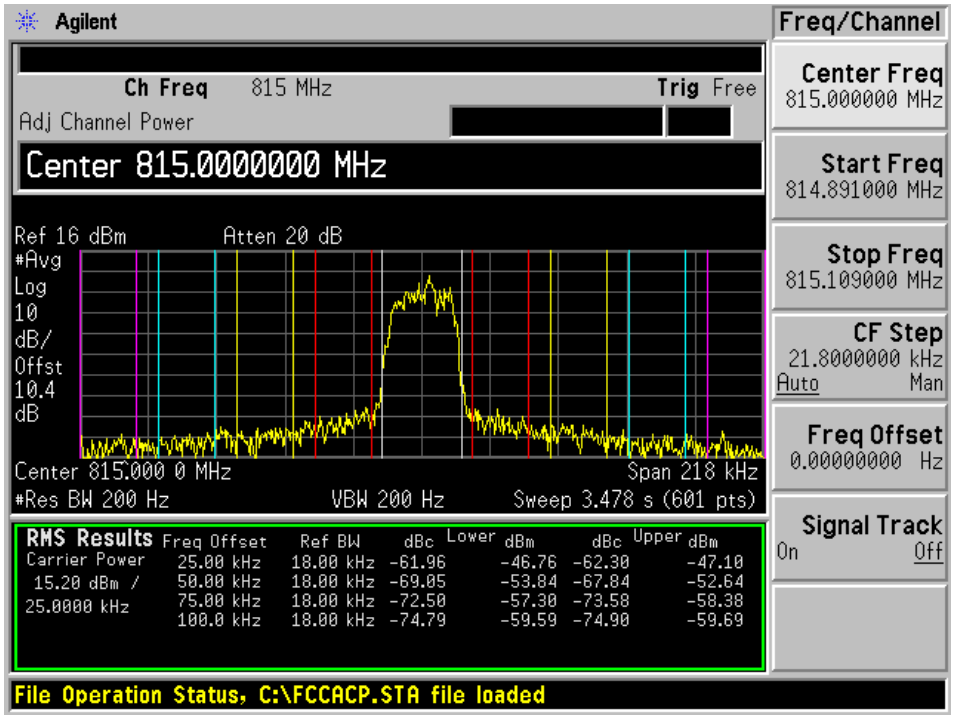
Low Power

TETRA: 809 MHz – 824 MHz

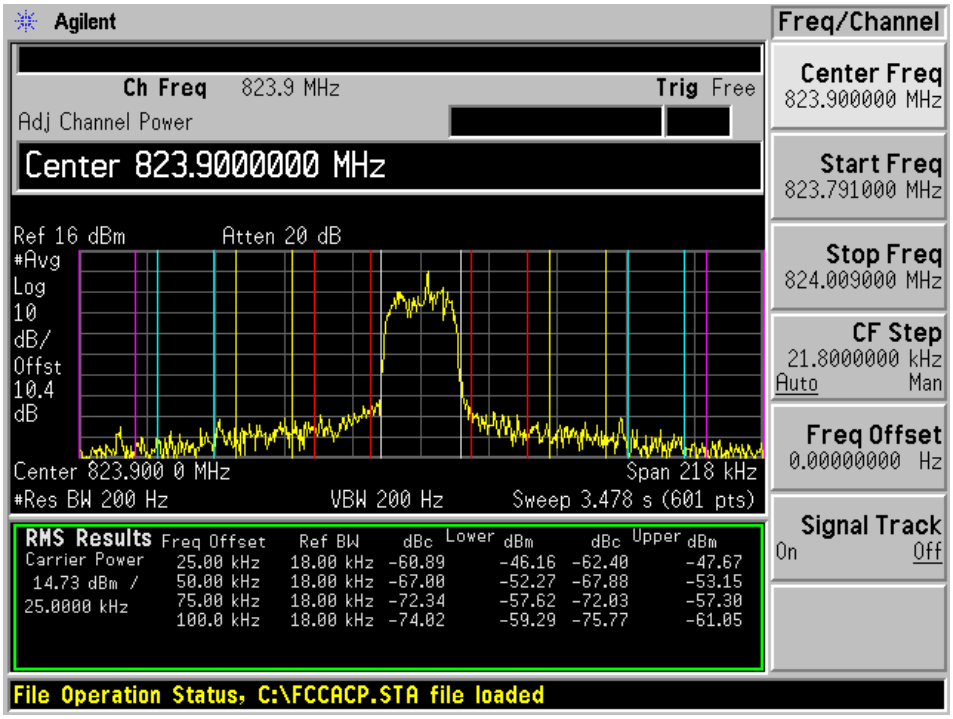
Low Channel – 809.1 MHz



Middle Channel – 815 MHz

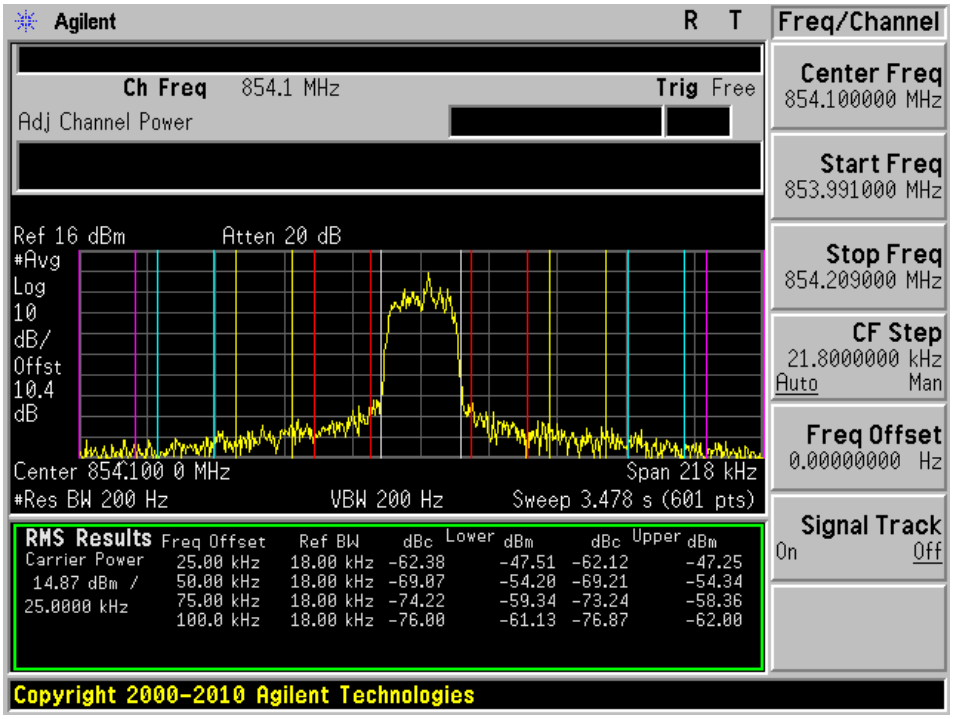


High Channel – 823.9 MHz

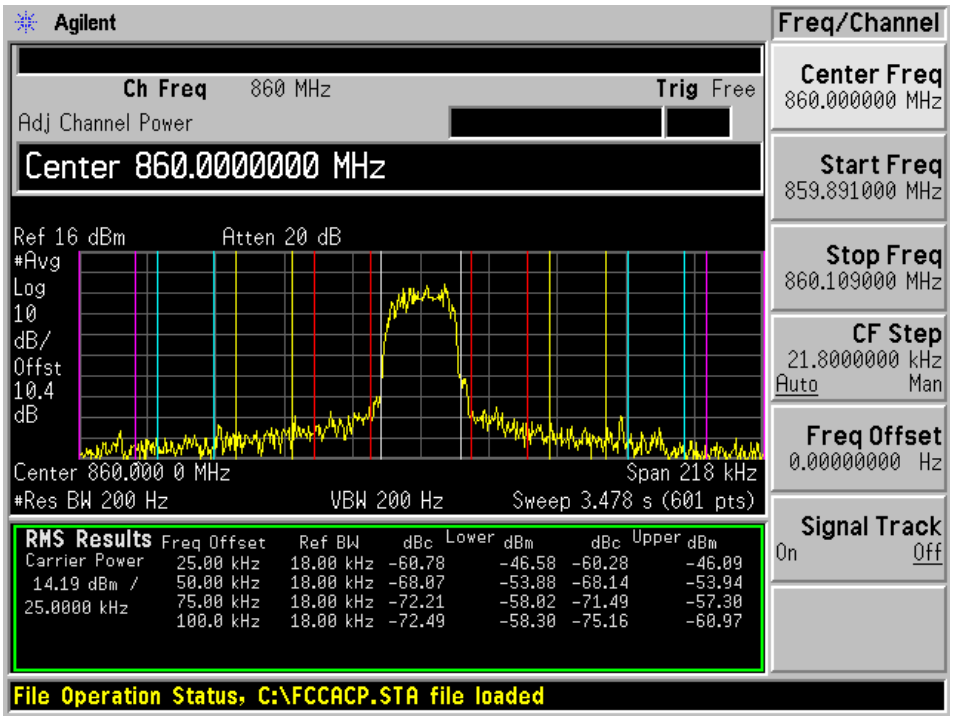


TETRA: 854 MHz – 869 MHz

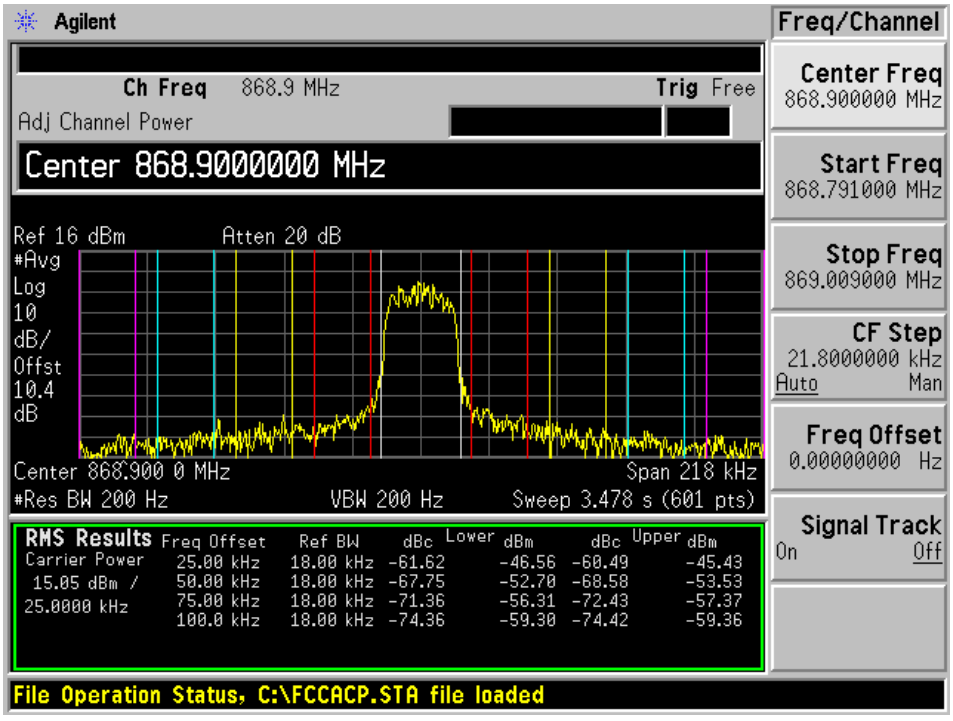
Low Channel – 854.1 MHz



Middle Channel – 860 MHz

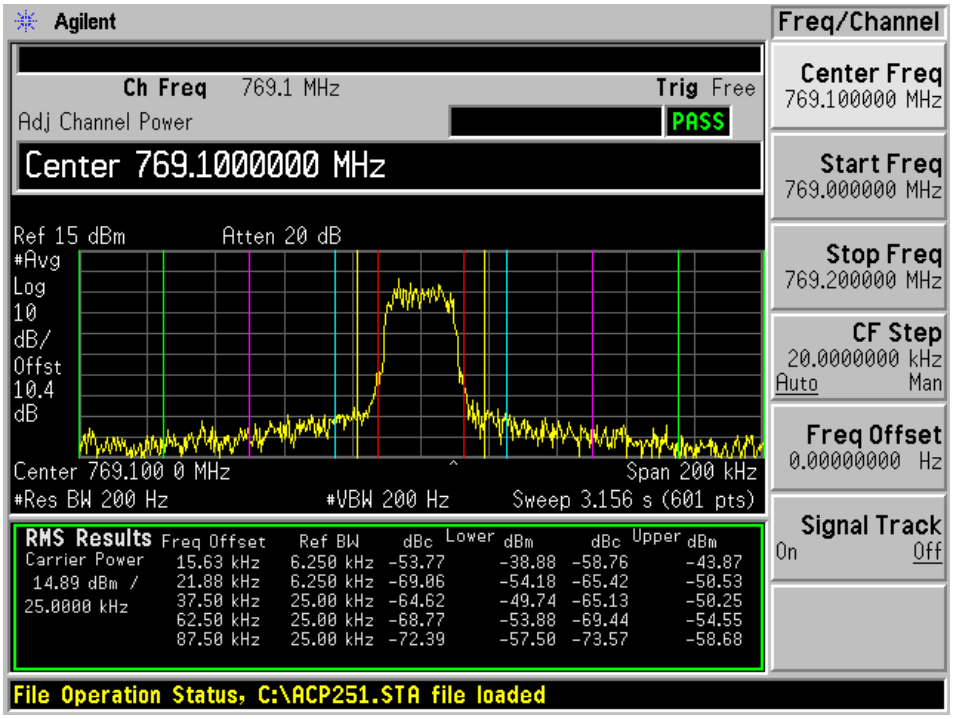


High Channel – 868.9 MHz

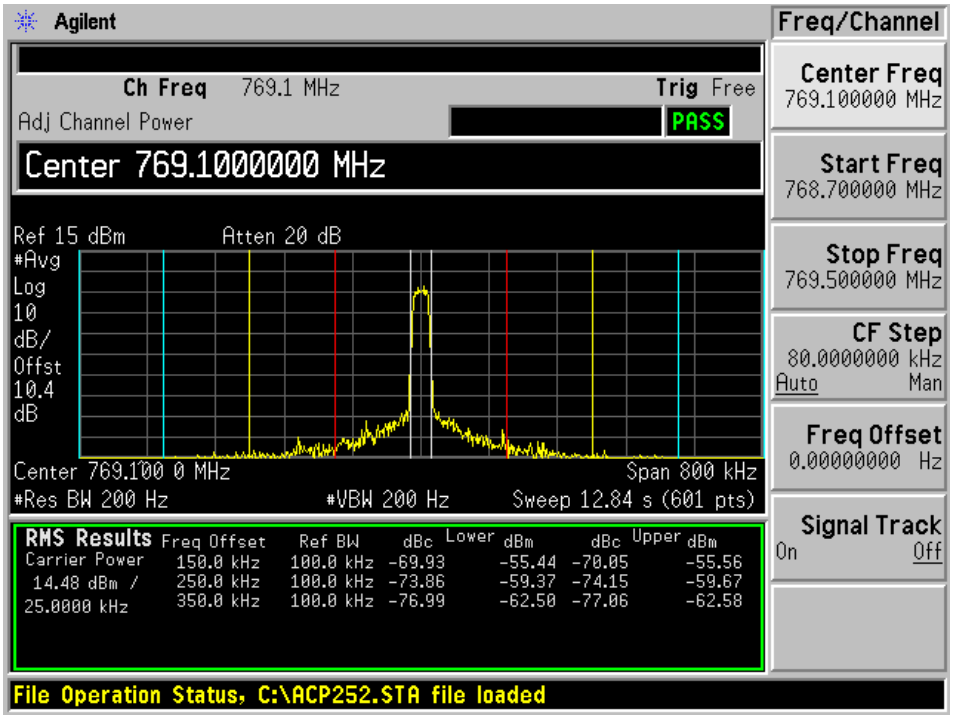


D-LMR: 769 MHz – 775 MHz

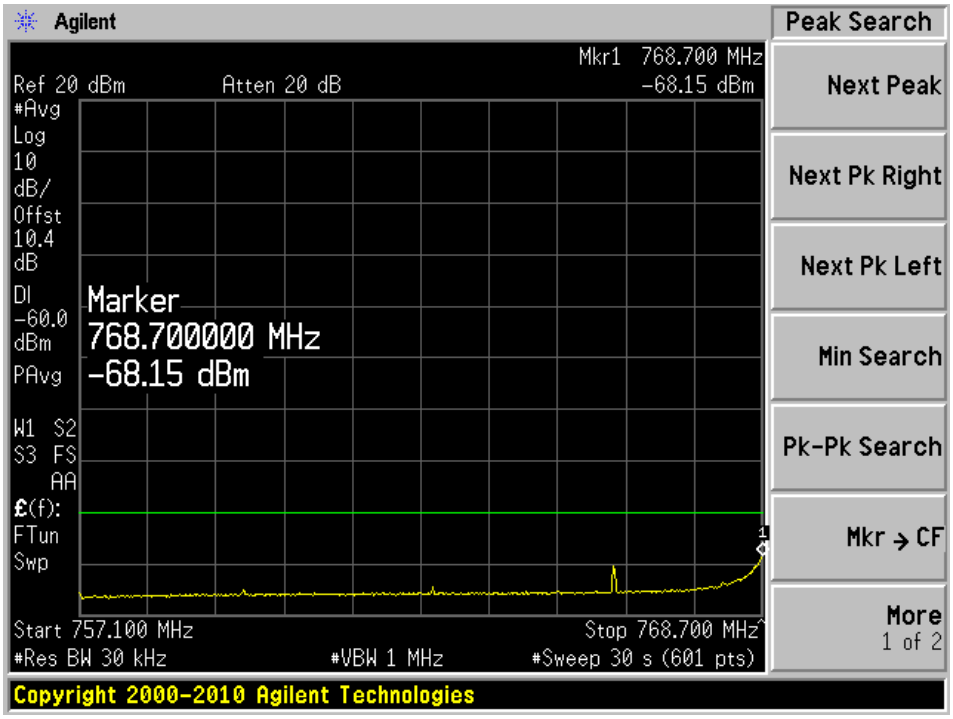
Low Channel – 769.1 MHz



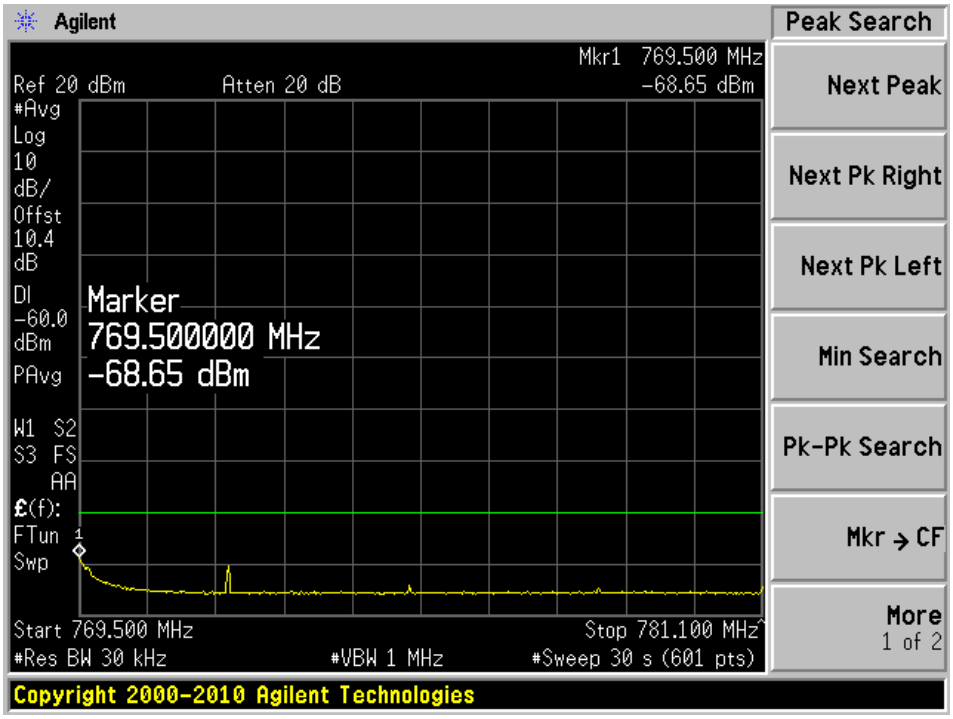
Low Channel – 769.1 MHz



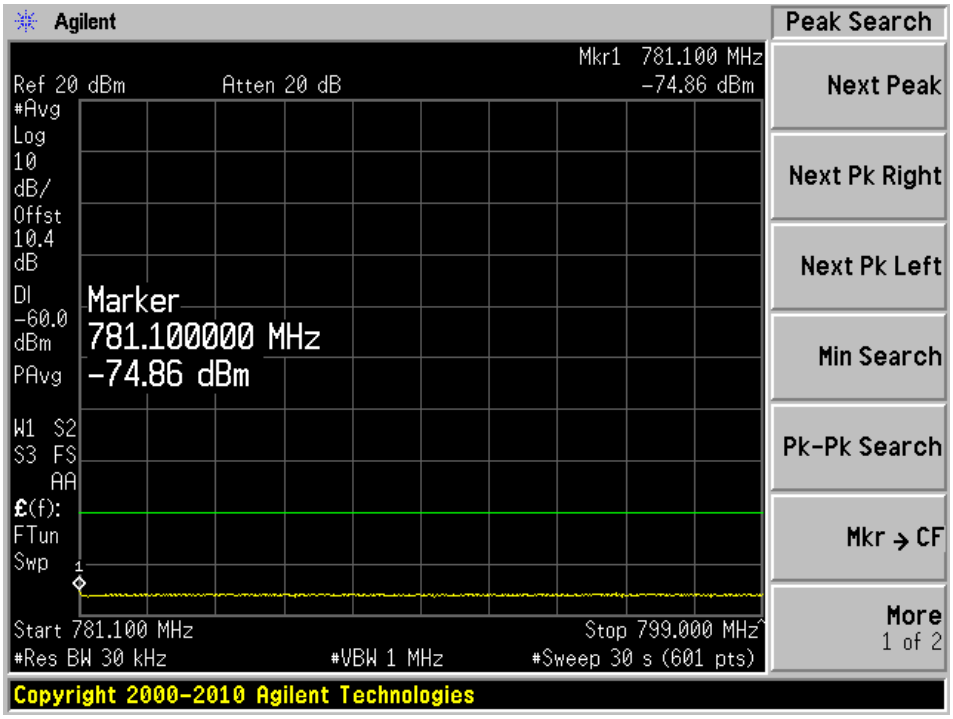
Low Channel – 769.1 MHz (-12MHz to – 400 kHz)



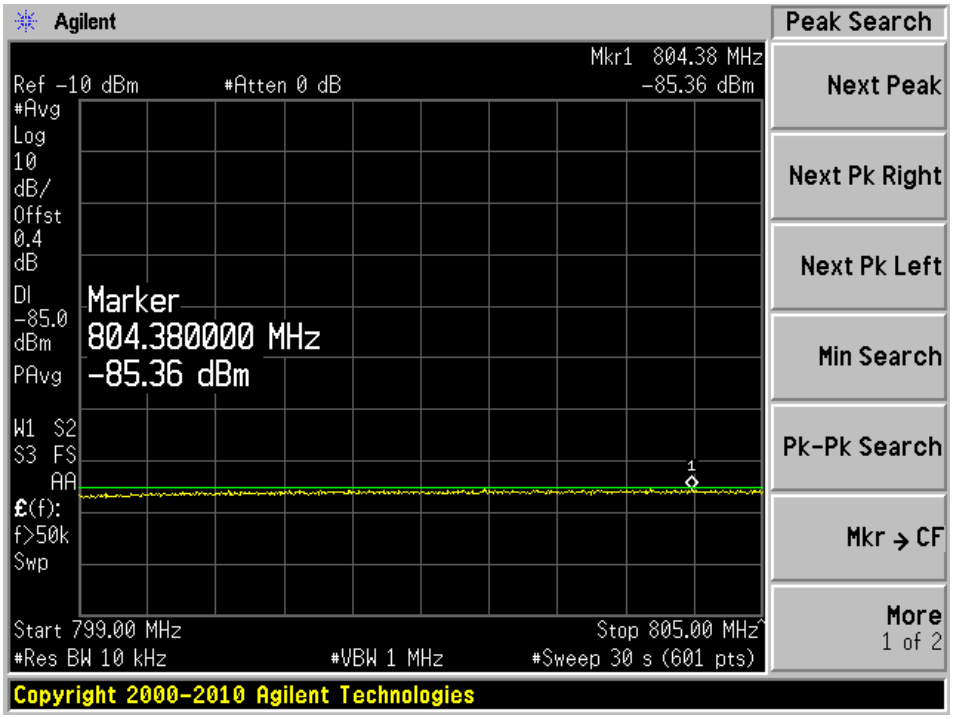
Low Channel – 769.1 MHz (+400 kHz to +12MHz)



Low Channel – 769.1 MHz (+12MHz to the paired receive band)

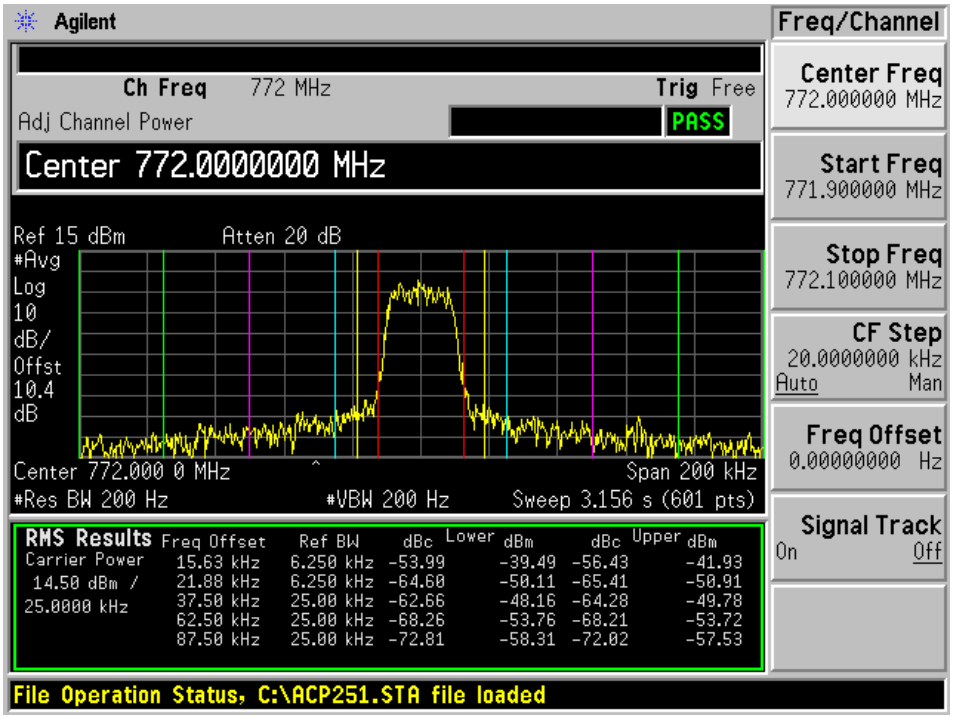


Low Channel – 769.1 MHz (in the paired receive band)

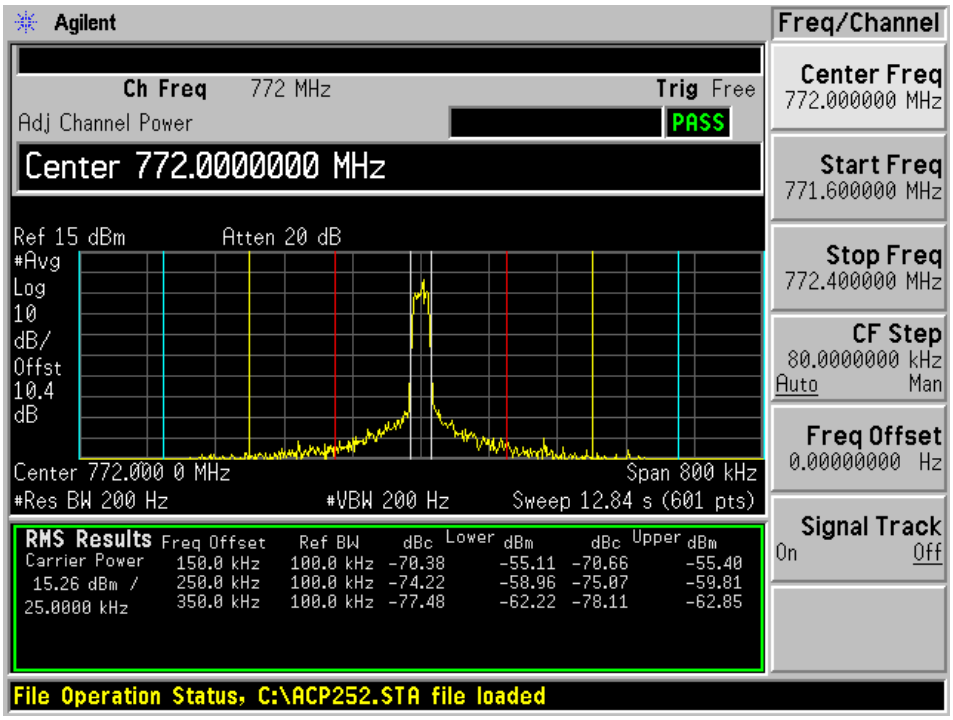


Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 10 kHz to show that no emissions are present.

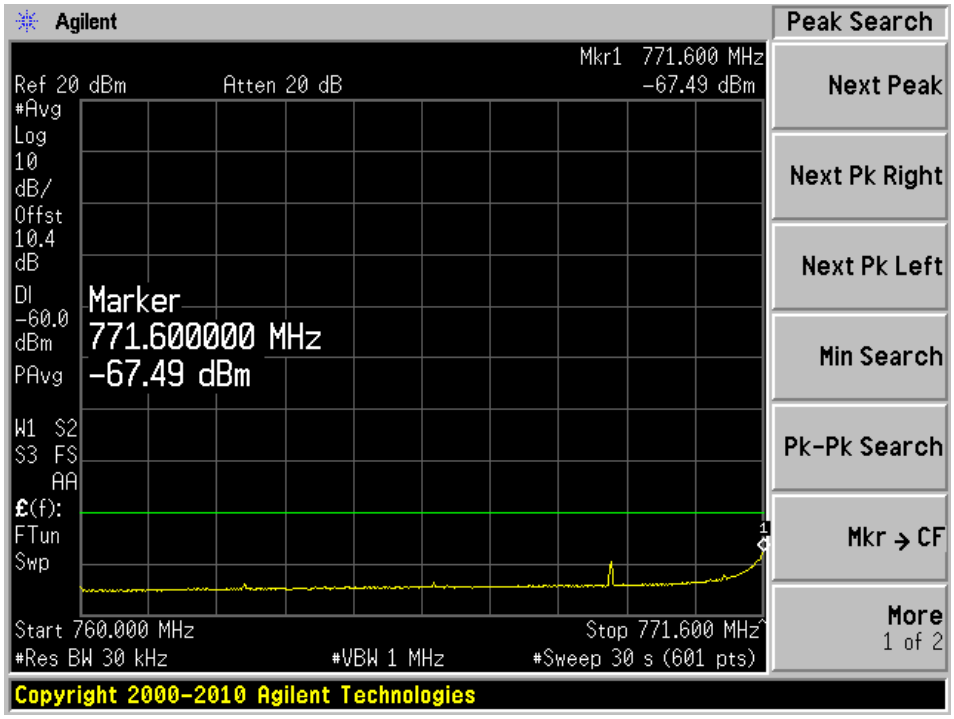
Middle Channel – 772 MHz



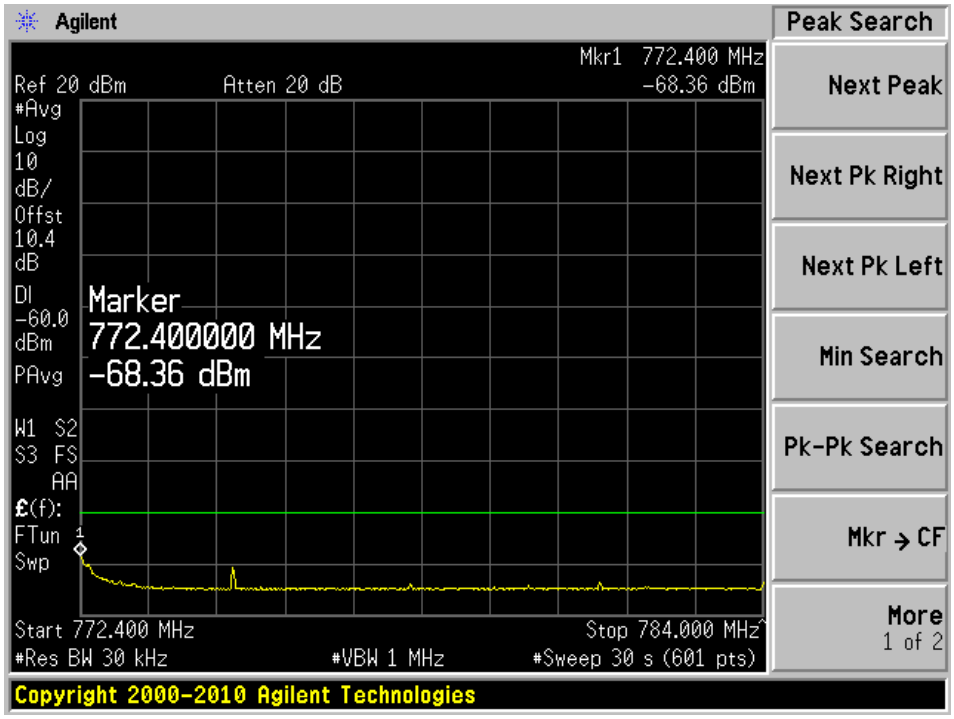
Middle Channel – 772 MHz



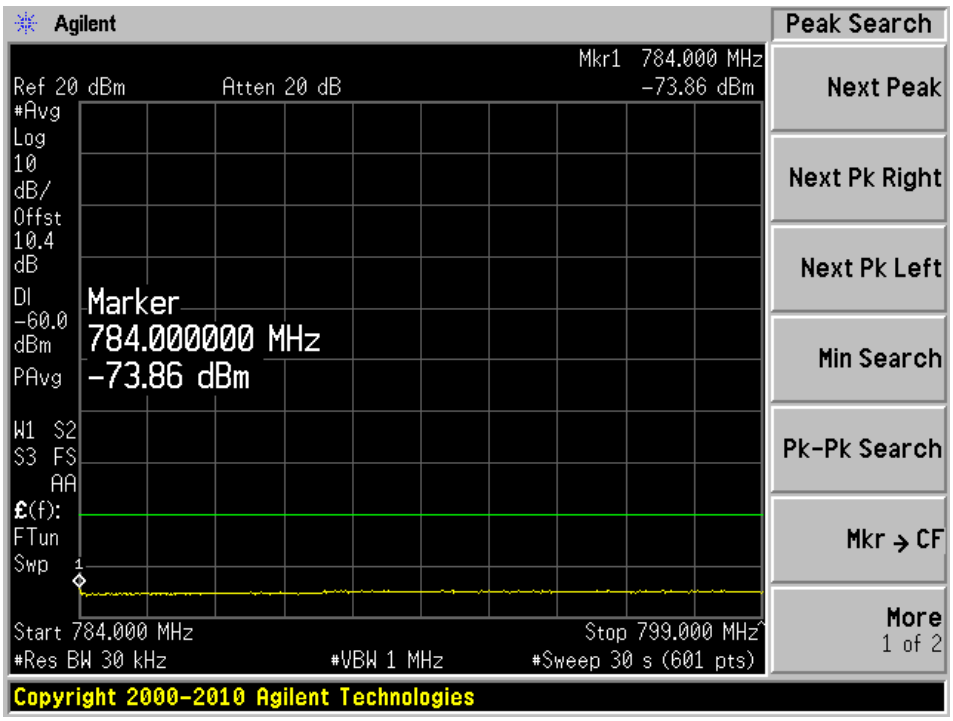
Middle Channel – 772 MHz (-12MHz to - 400 kHz)



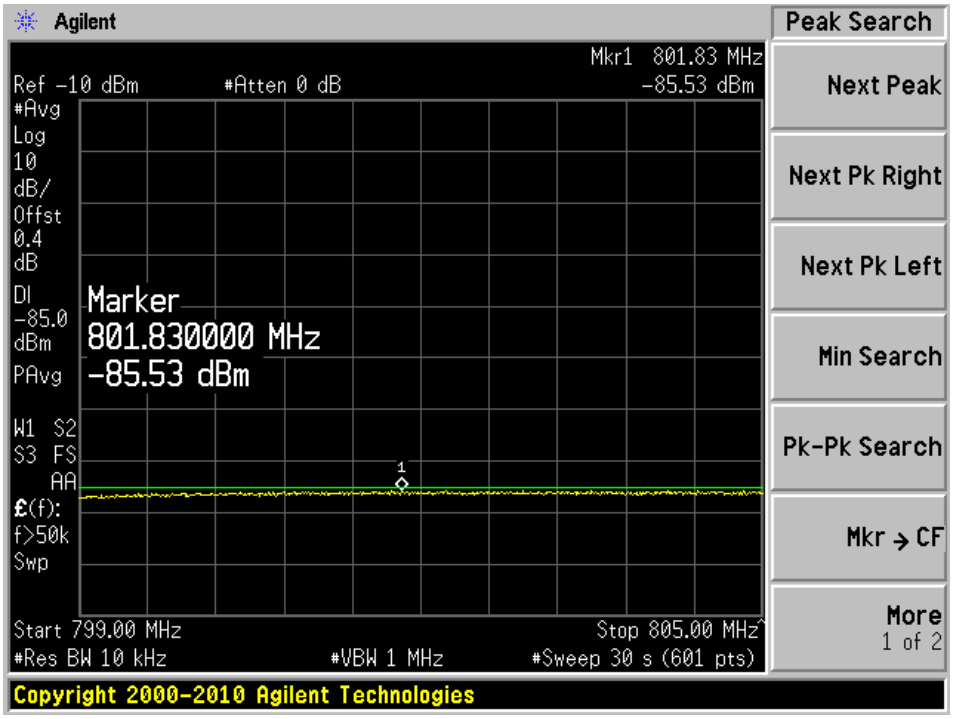
Middle Channel – 772 MHz (+400 kHz to +12MHz)



Middle Channel – 772 MHz (+12MHz to the paired receive band)

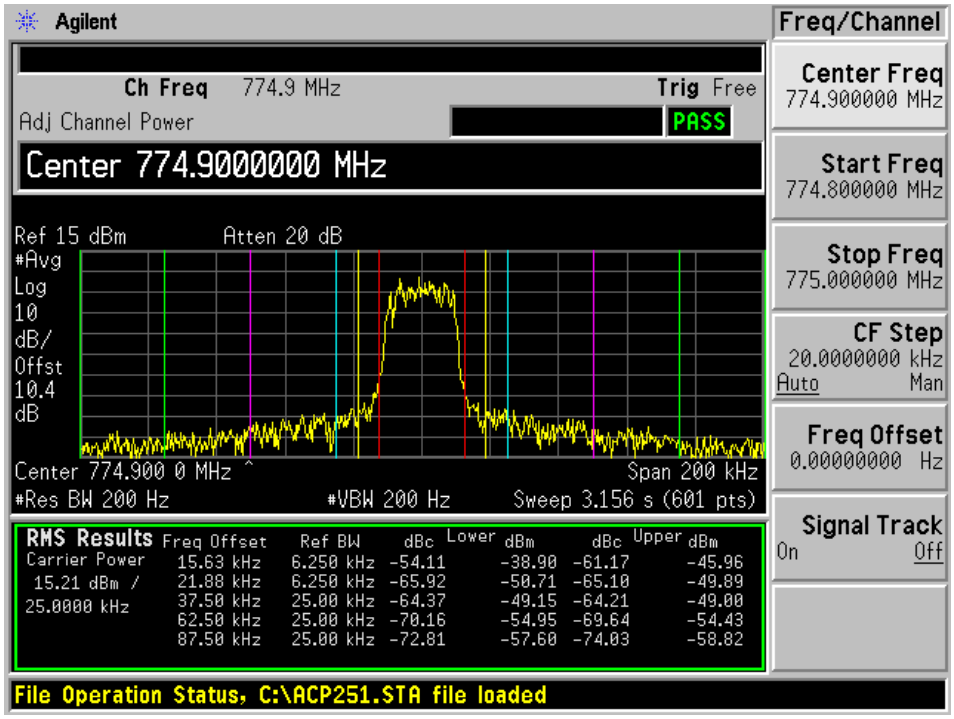


Middle Channel – 772 MHz (in the paired receive band)

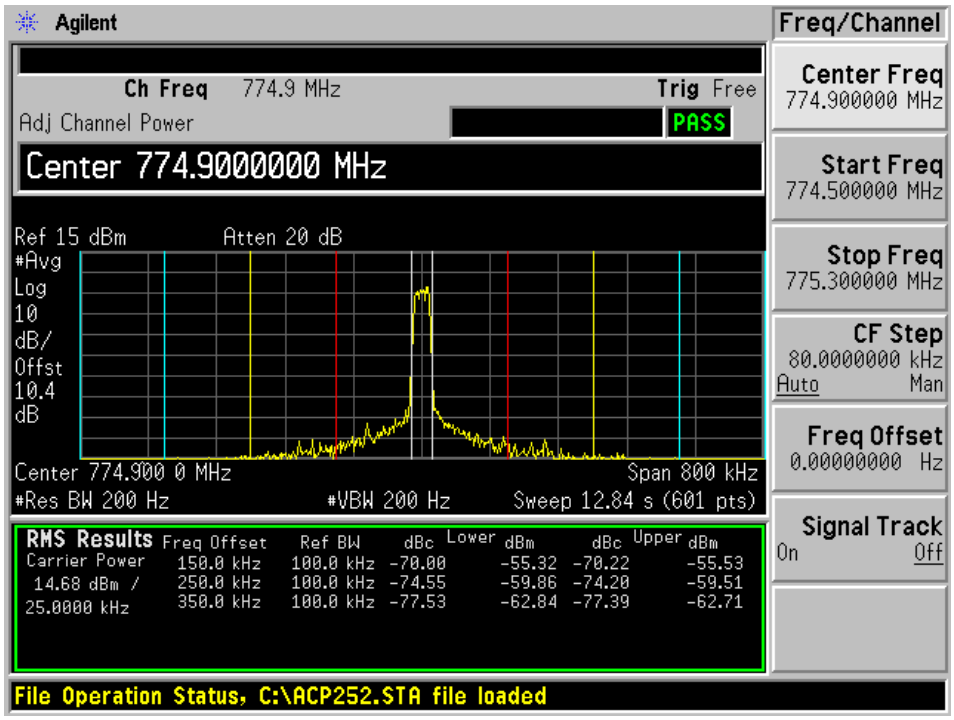


Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 10 kHz to show that no emissions are present.

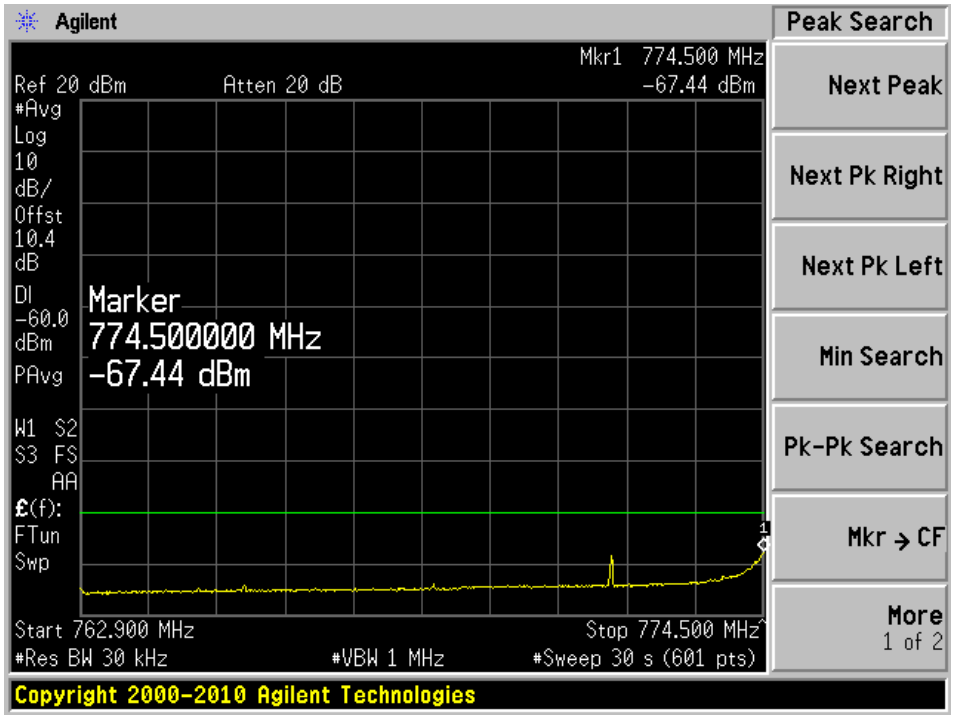
High Channel – 774.9 MHz



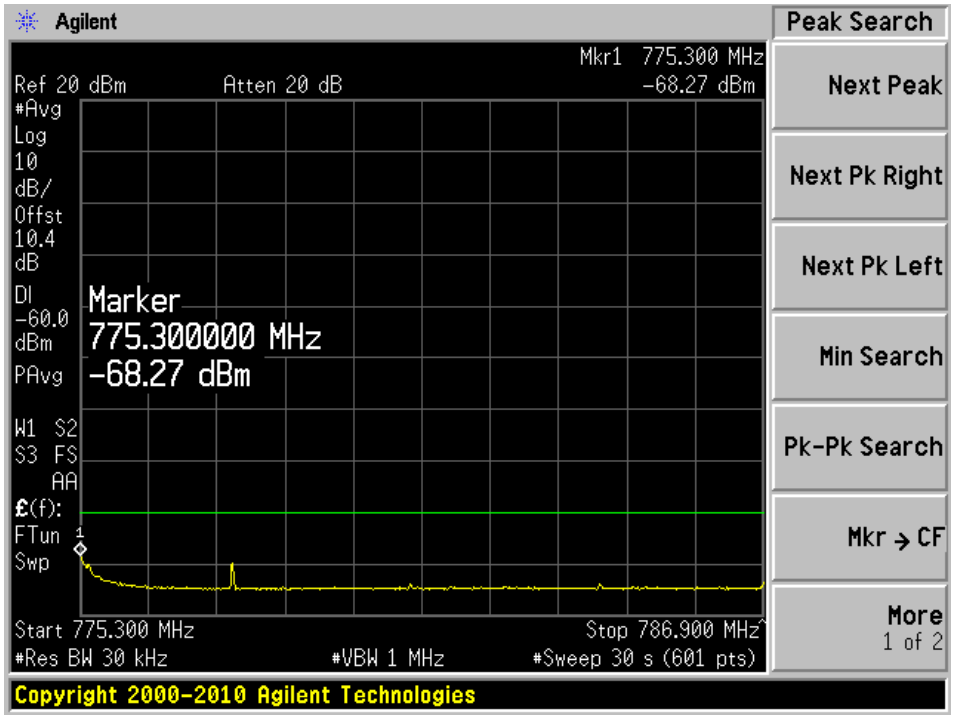
High Channel – 774.9 MHz (150-350)



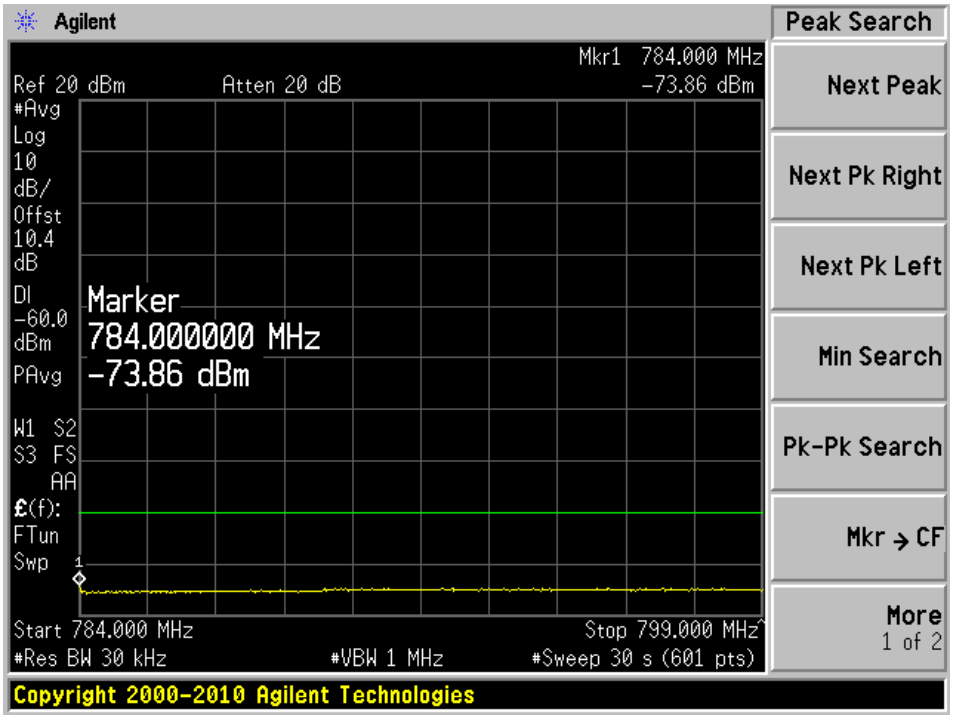
High Channel – 774.9 MHz (-12MHz to – 400 kHz)



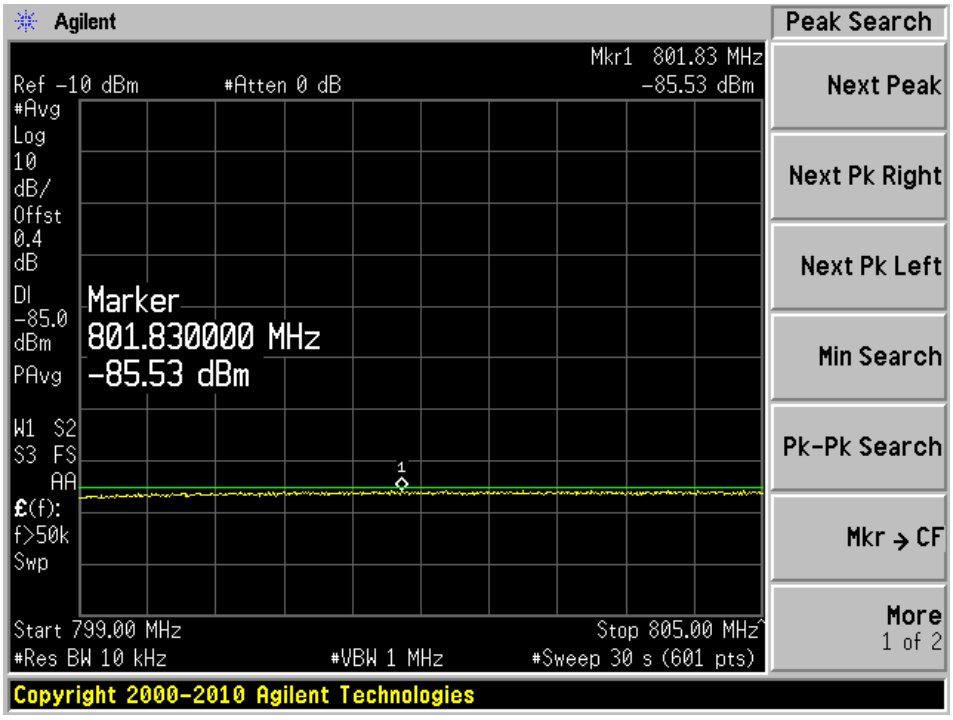
High Channel – 774.9 MHz (+ 400 kHz to +12MHz)



High Channel – 774.9 MHz (+12MHz to the paired receive band)



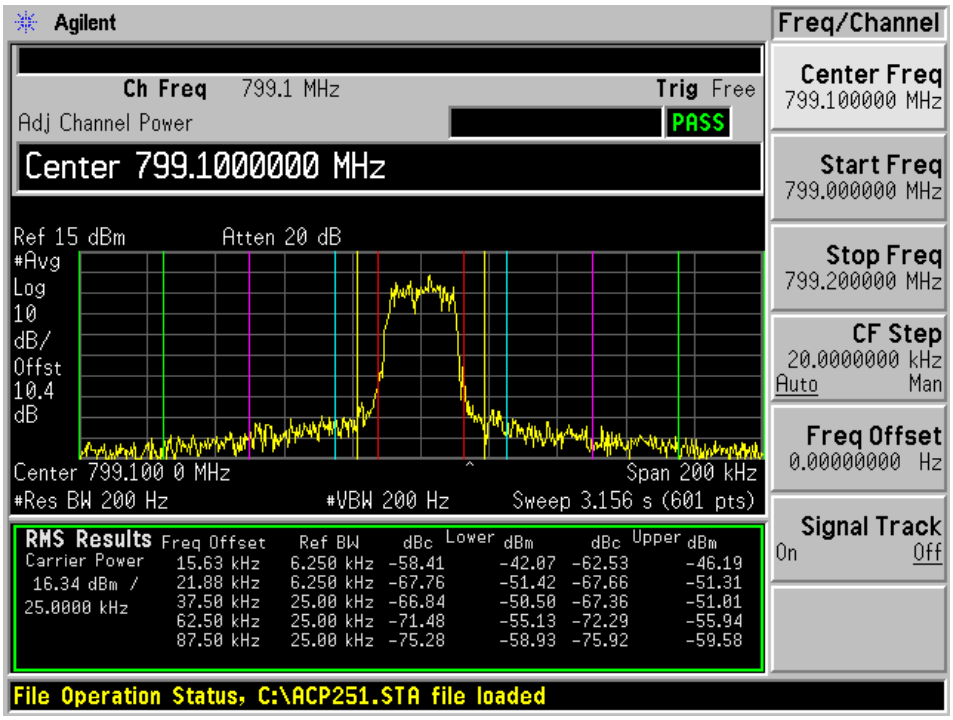
High Channel – 774.9 MHz (in the paired receive band)



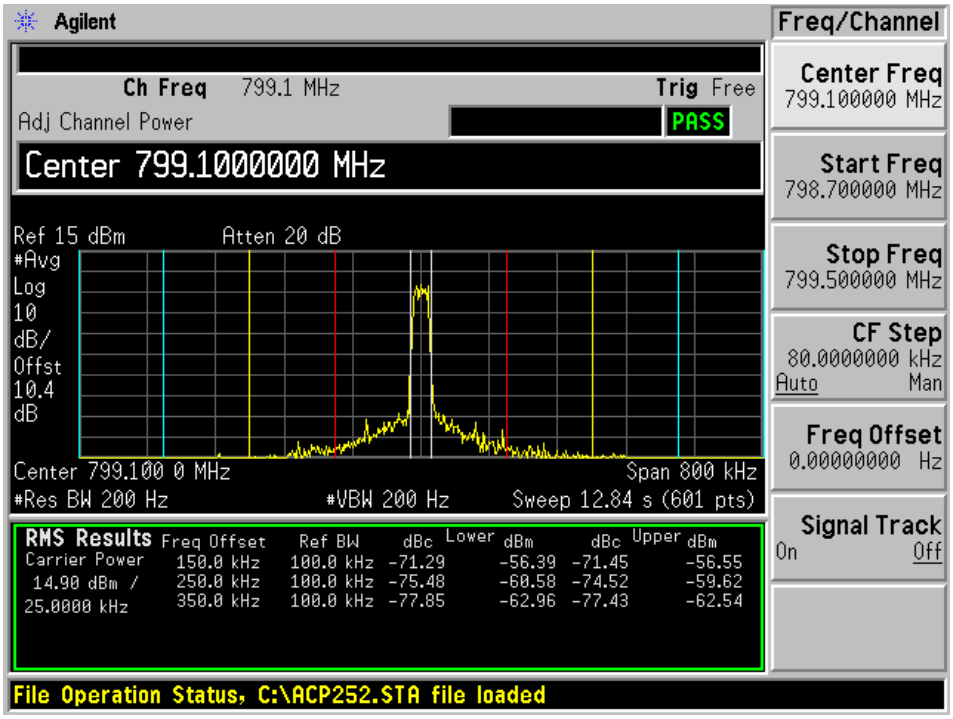
Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 10 kHz to show that no emissions are present.

D-LMR: 799 MHz – 805 MHz

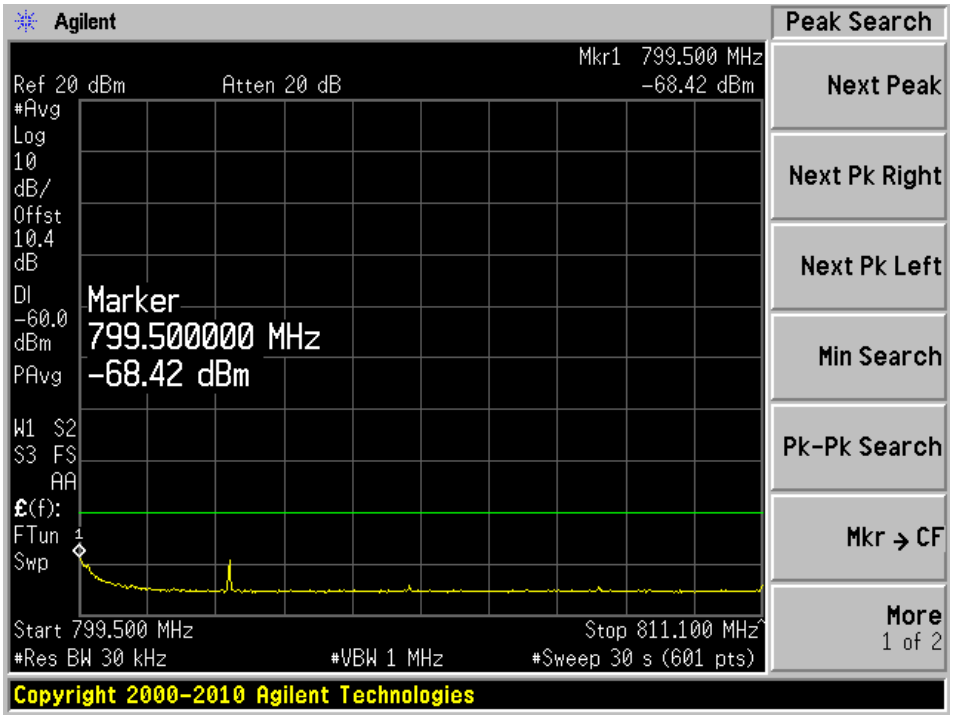
Low Channel – 799.1 MHz



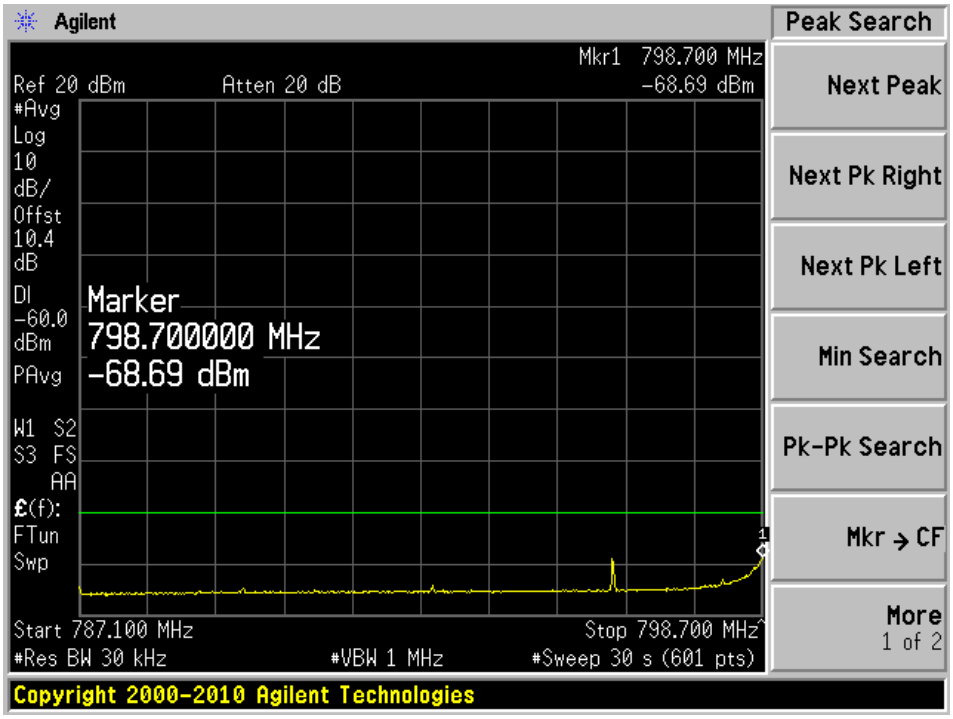
Low Channel – 799.1 MHz



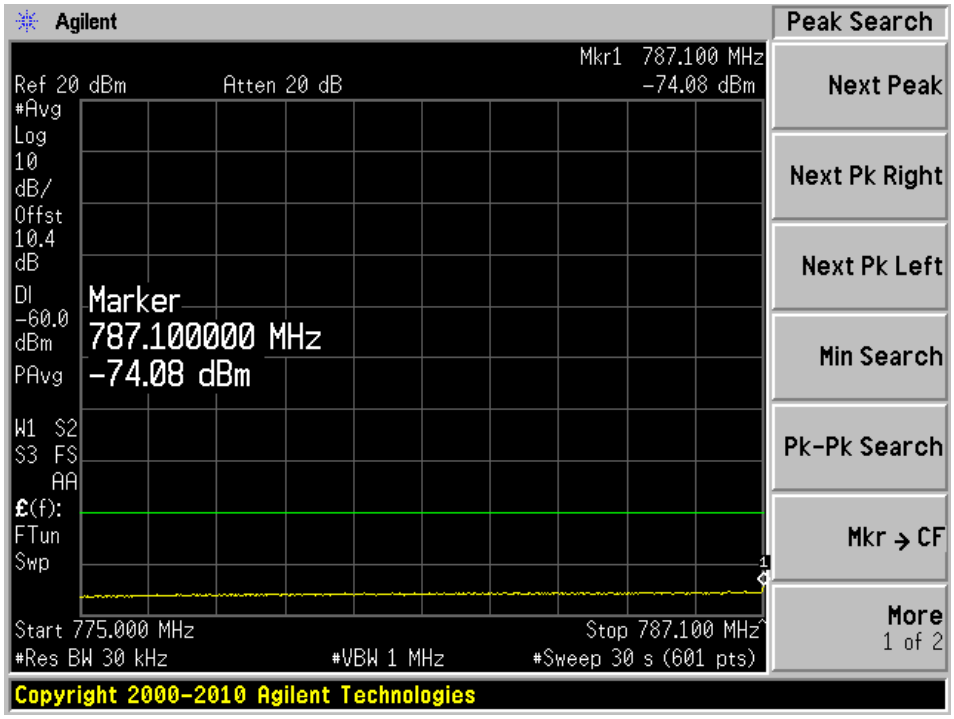
Low Channel – 799.1 MHz (+400 kHz to +12MHz)



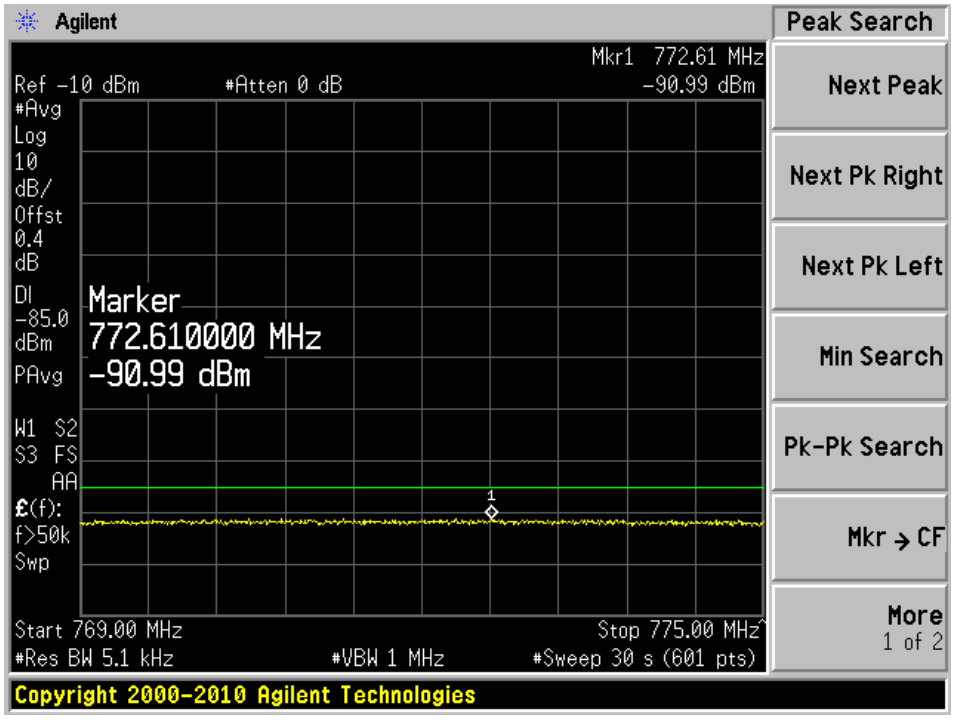
Low Channel – 799.1 MHz (-12MHz to – 400 kHz)



Low Channel – 799.1 MHz (-12MHz to the paired receive band)

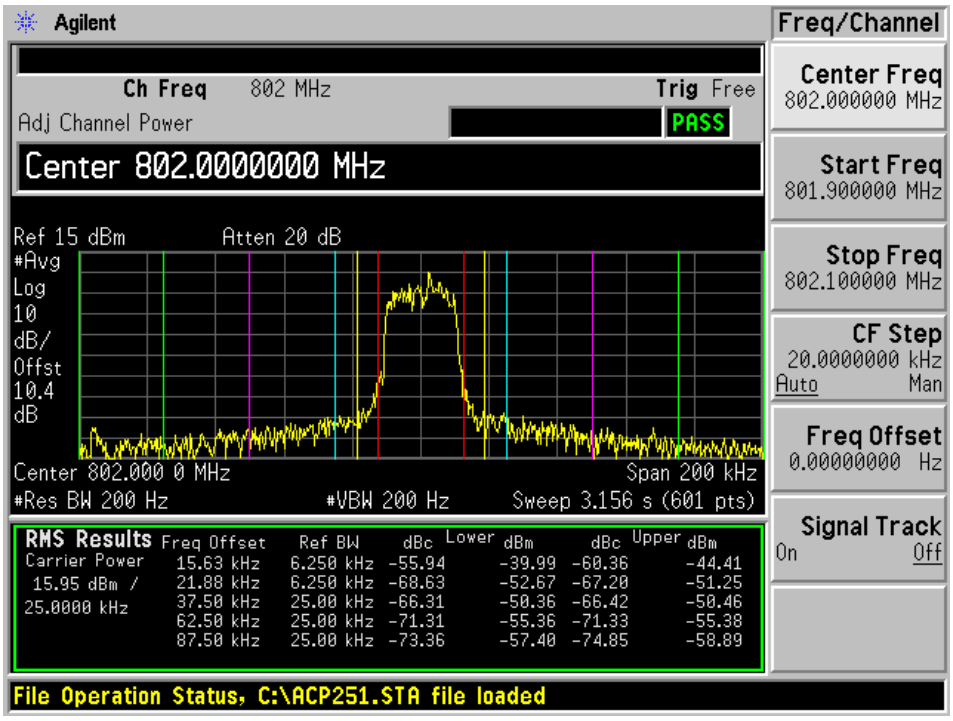


Low Channel – 799.1 MHz (in the paired receive band)

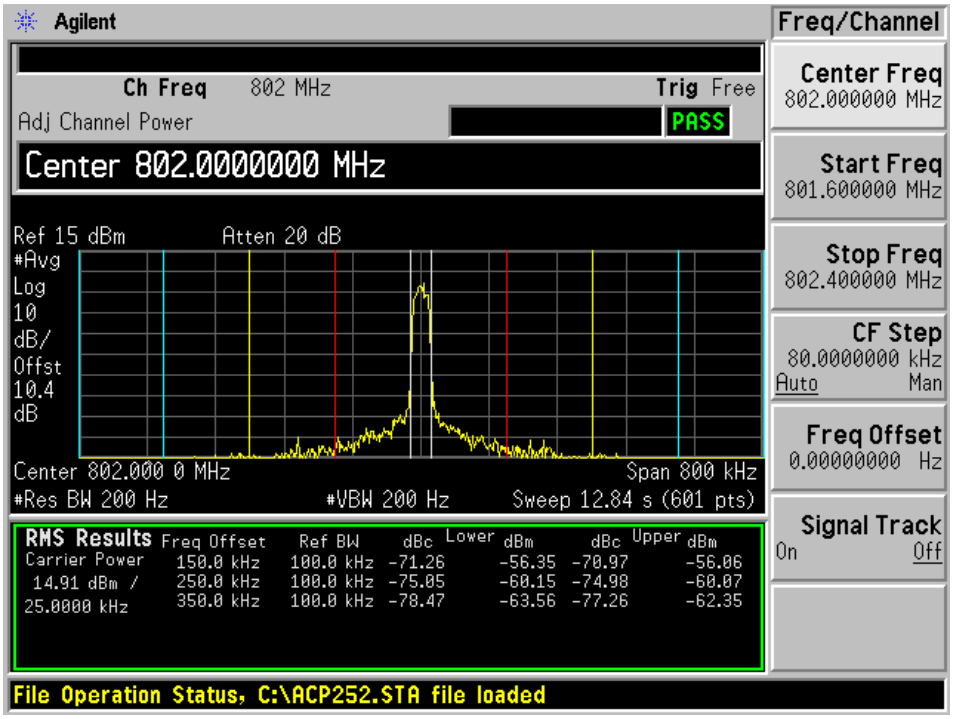


Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 5.1 kHz to show that no emissions are present.

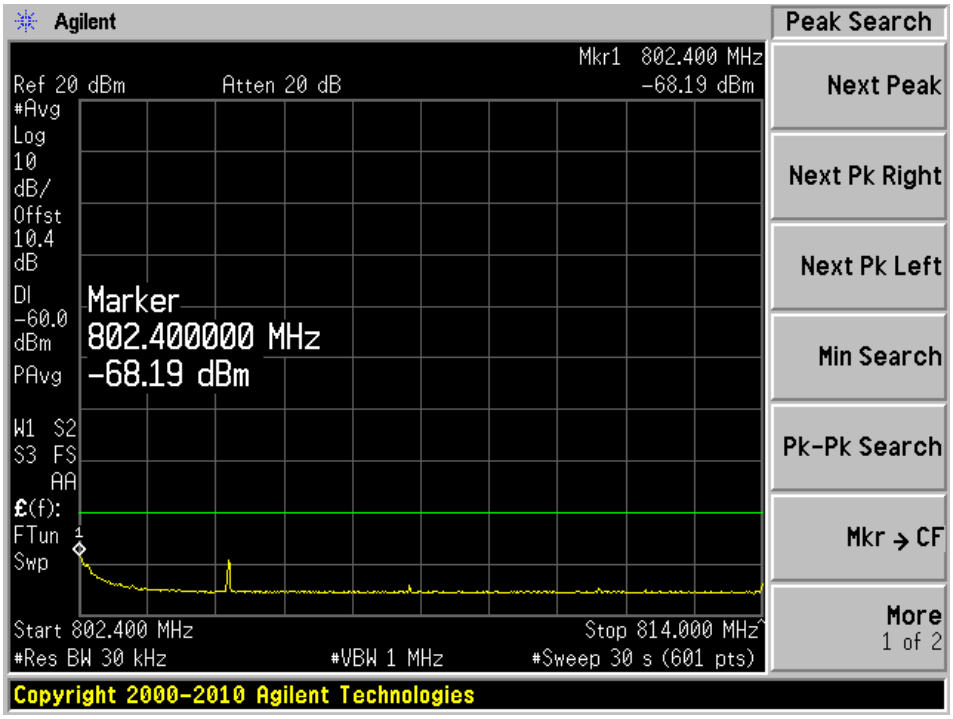
Middle Channel – 802 MHz



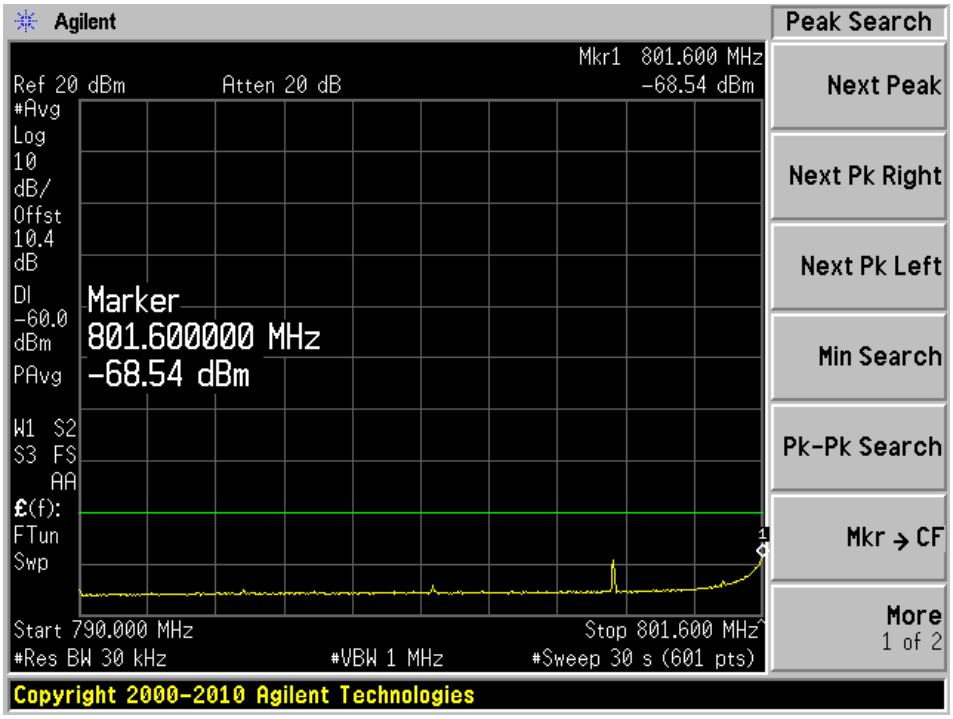
Middle Channel – 802 MHz



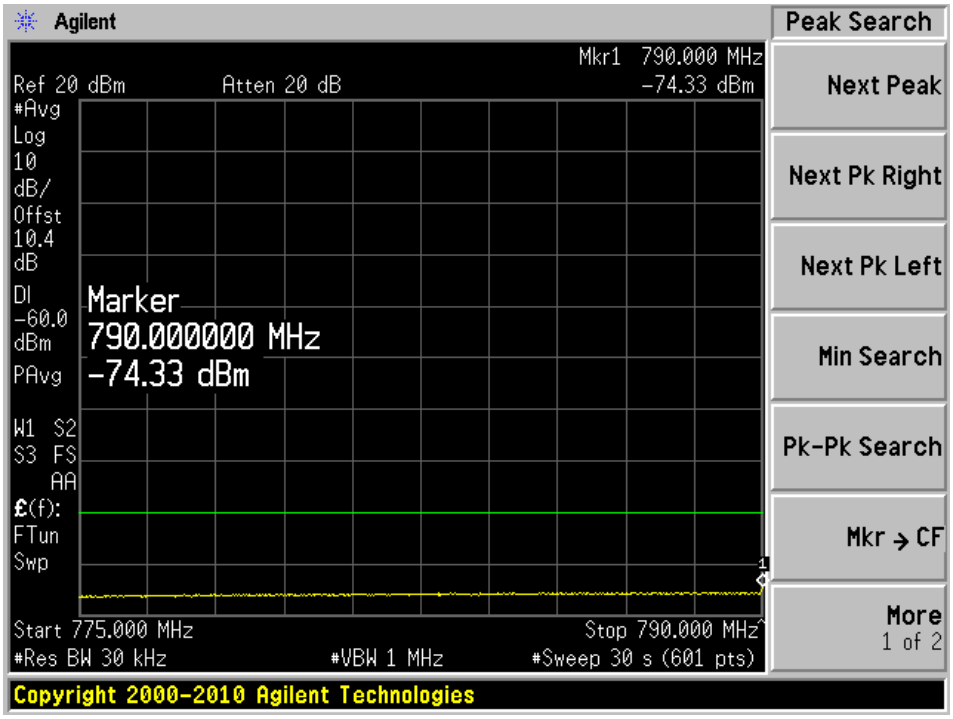
Middle Channel – 802 MHz (+ 400 kHz to +12MHz)



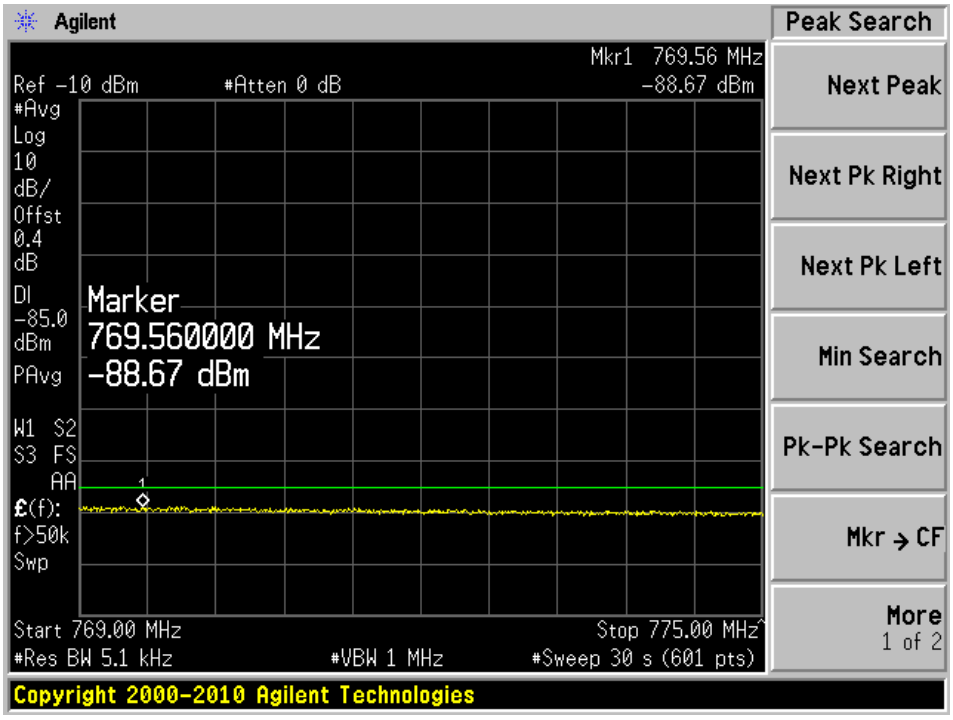
Middle Channel – 802 MHz (-12MHz to – 400 kHz)



Middle Channel – 802 MHz (-12MHz to the paired receive band)

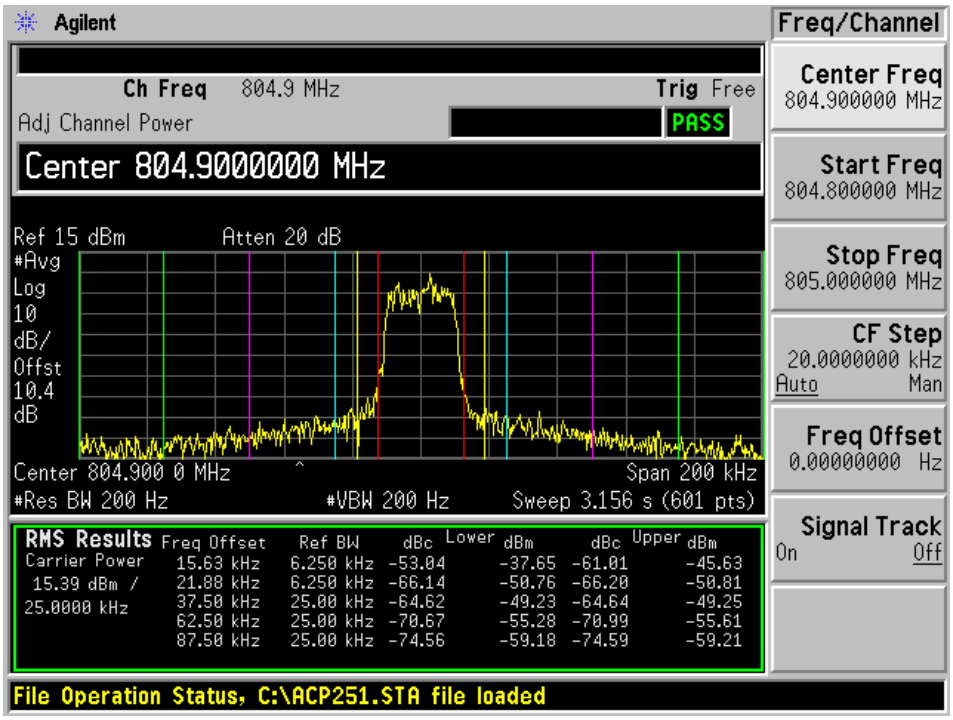


Middle Channel – 802 MHz (in the paired receive band)

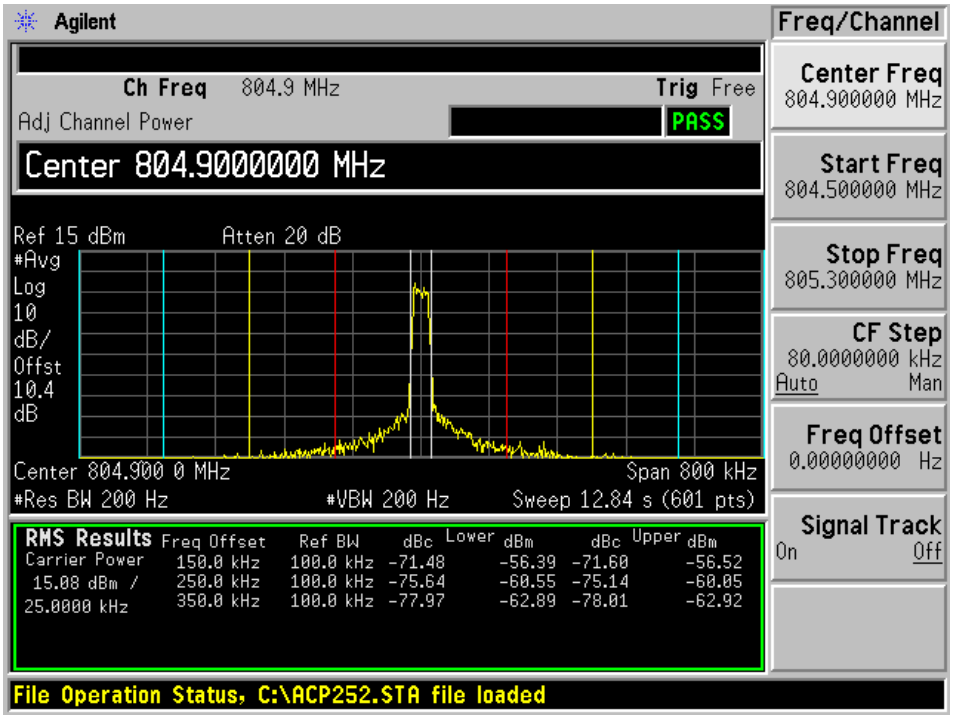


Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 5.1 kHz to show that no emissions are present.

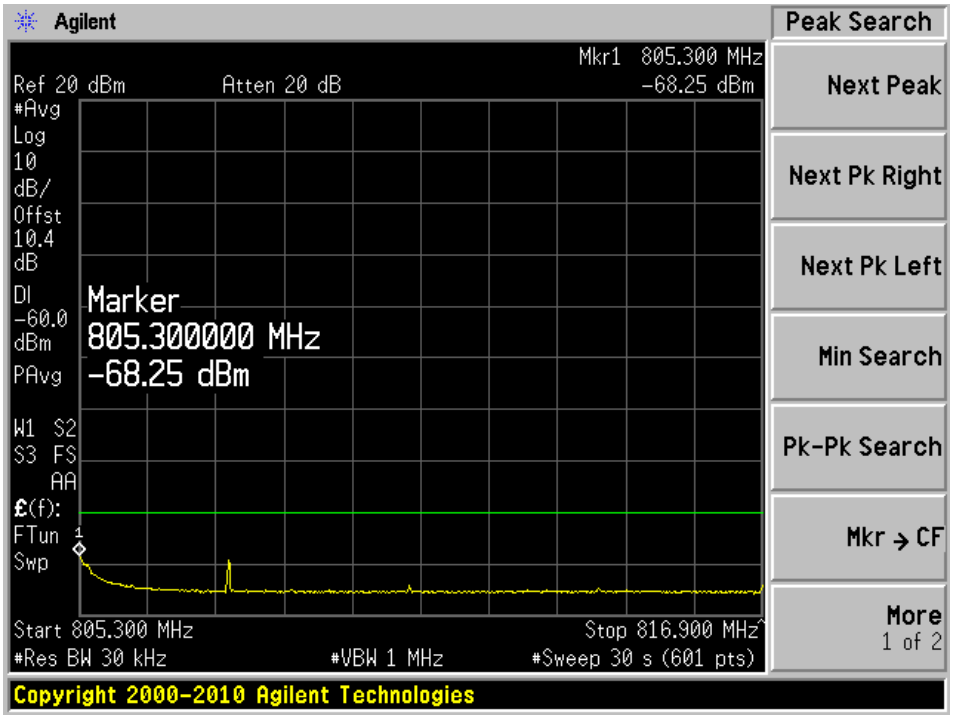
High Channel – 804.9 MHz



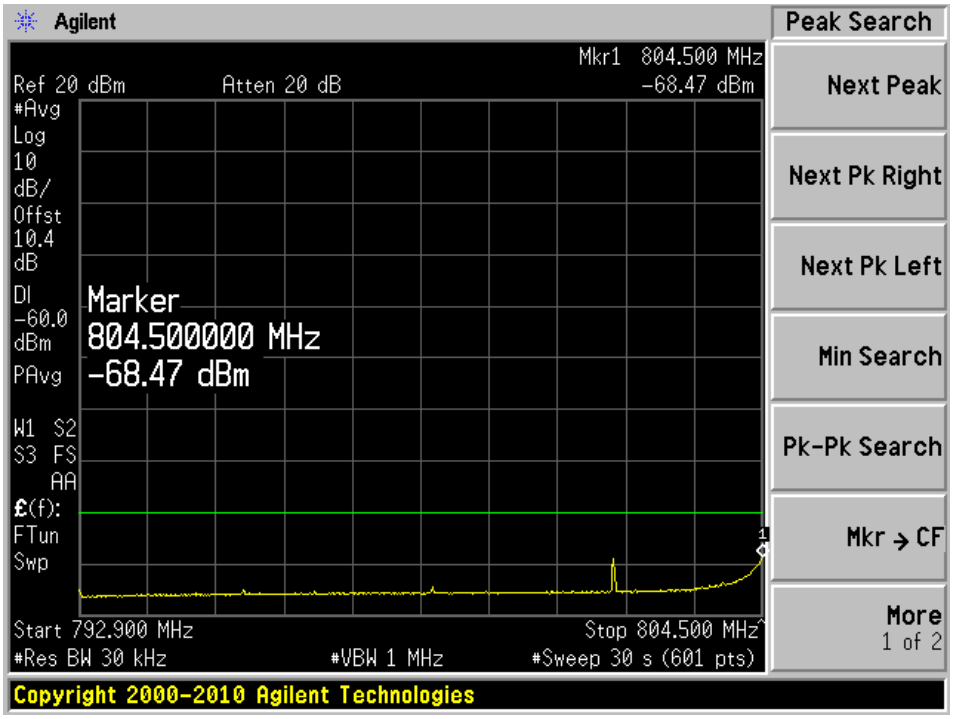
High Channel – 804.9 MHz



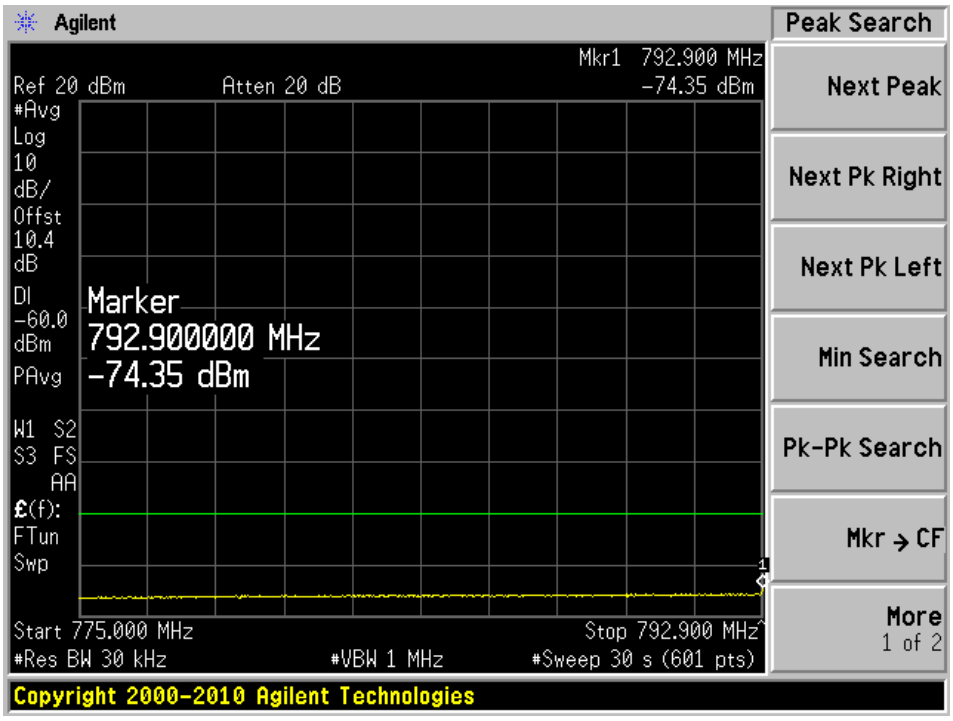
High Channel – 804.9 MHz (+400 kHz to +12MHz)



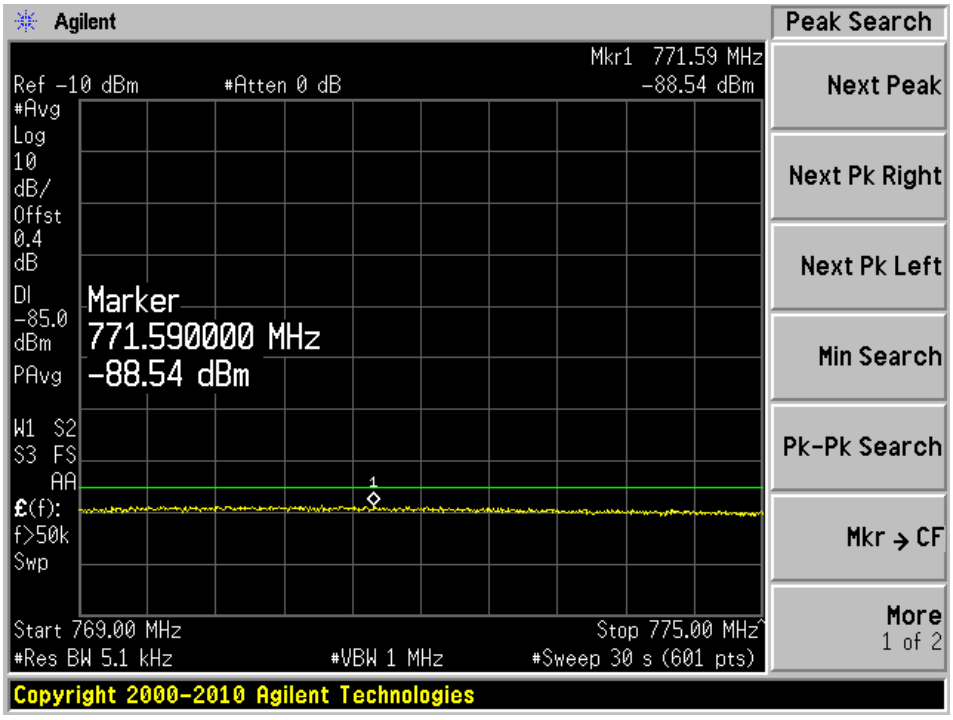
High Channel – 804.9 MHz (-12MHz to – 400 kHz)



High Channel – 804.9 MHz (-12MHz to the paired receive band)



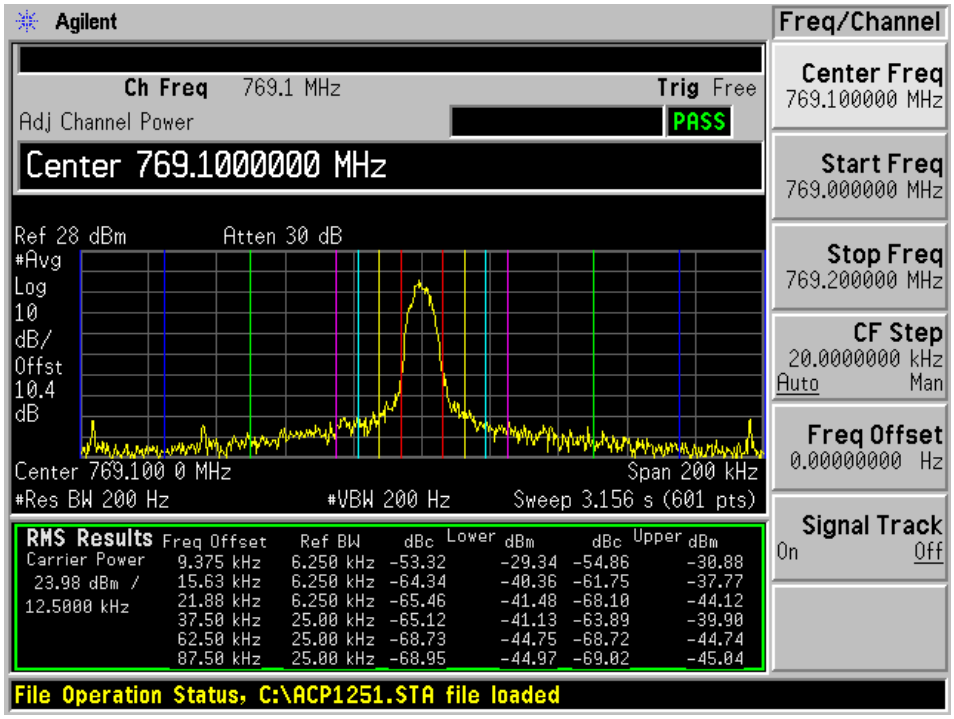
High Channel – 804.9 MHz (in the paired receive band)



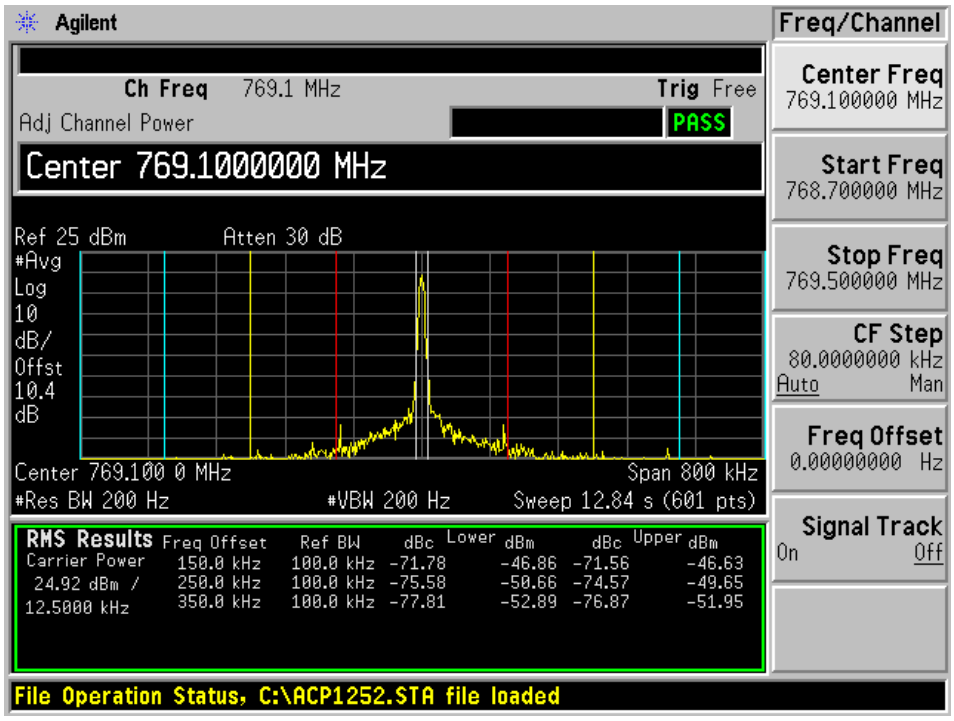
Note: The noise floor is above the limit at 30 kHz, therefore the RBW was reduced to 5.1 kHz to show that no emissions are present.

C4FM: 769 MHz – 775 MHz

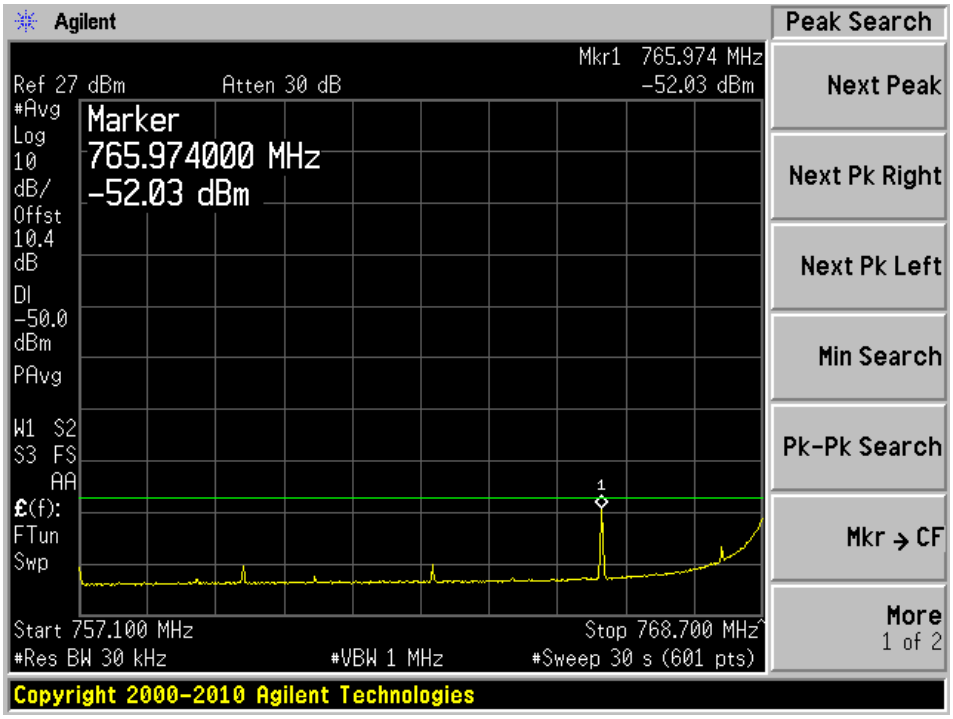
Low Channel – 769.1 MHz



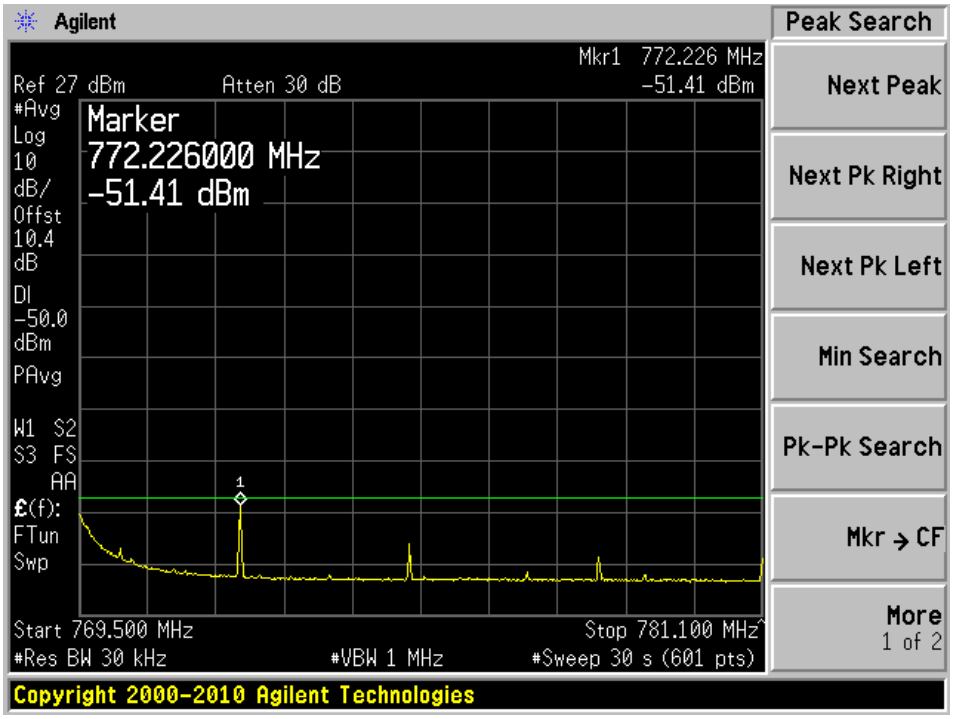
Low Channel – 769.1 MHz



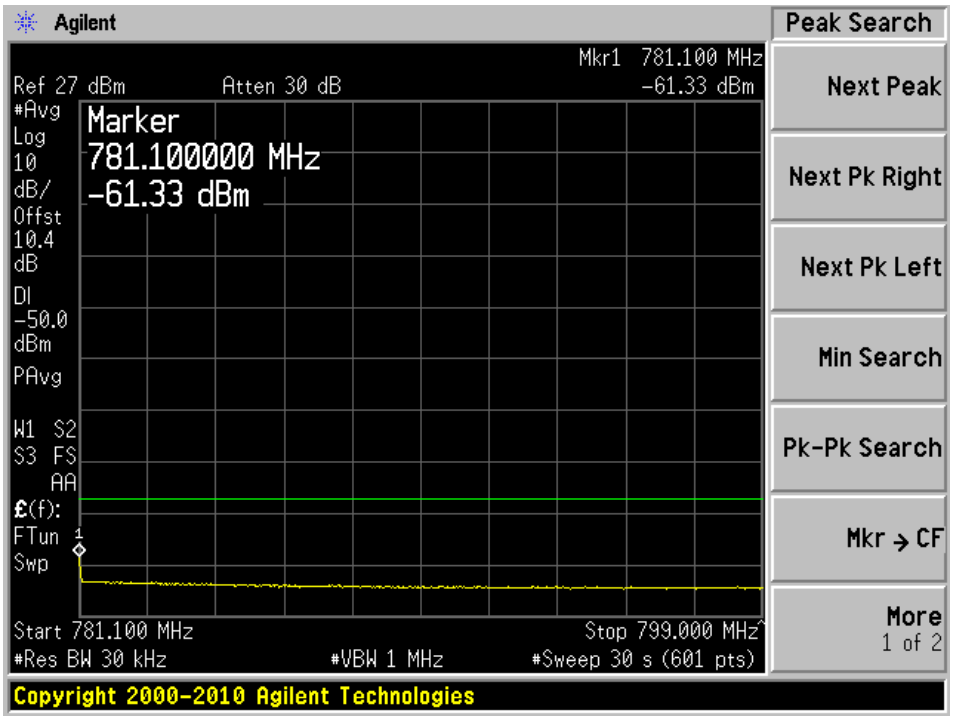
Low Channel – 769.1 MHz (-12MHz to – 400 kHz)



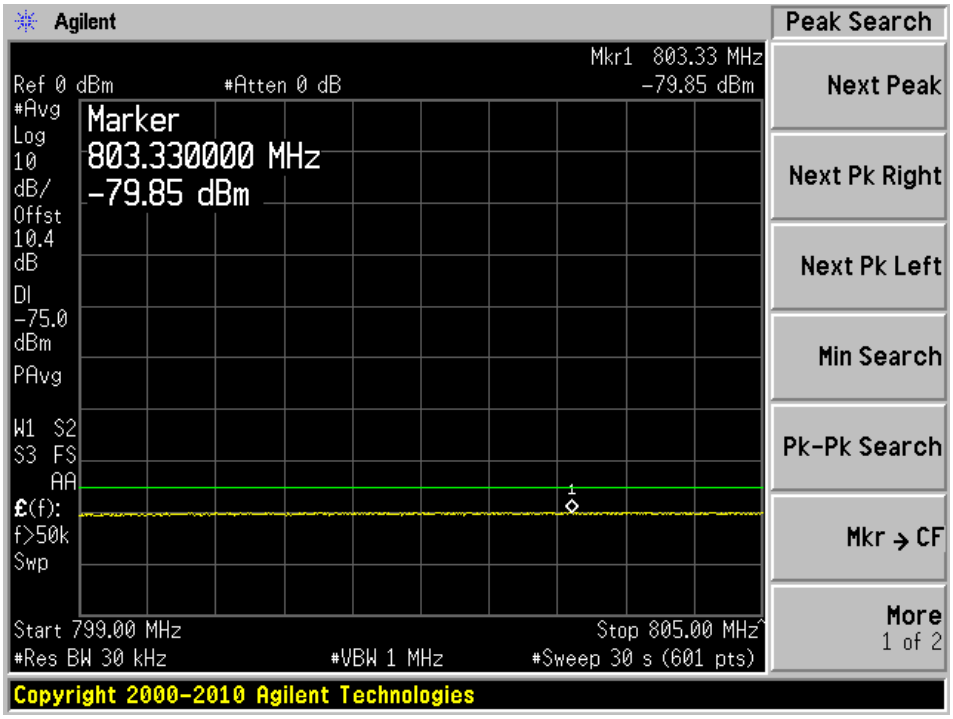
Low Channel – 769.1 MHz (+400 kHz to +12MHz)



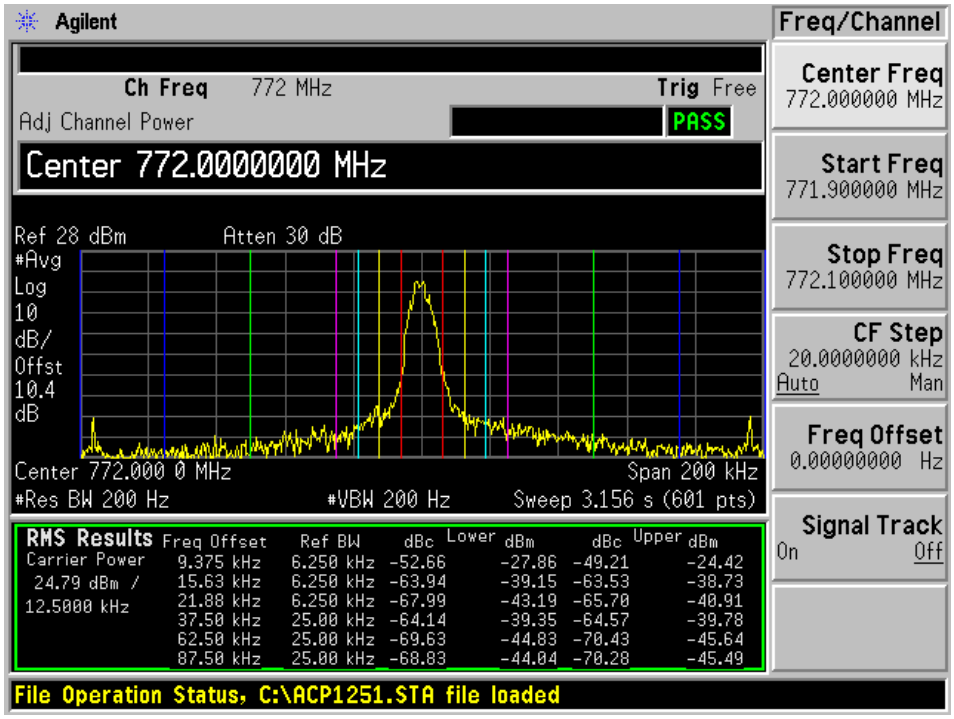
Low Channel – 769.1 MHz (+12MHz to the paired receive band)



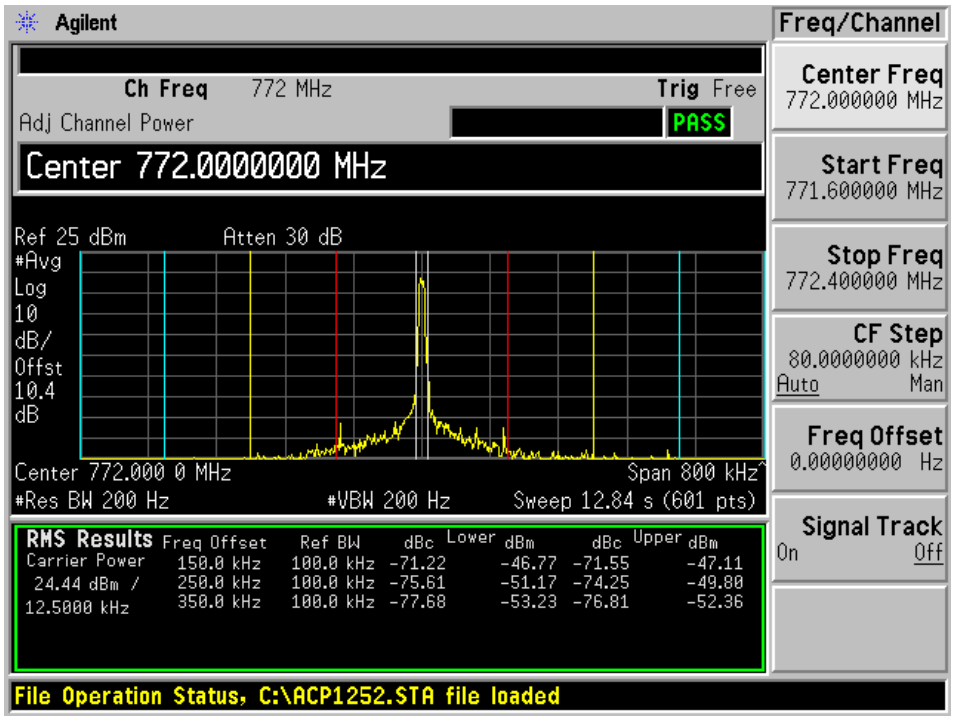
Low Channel – 769.1 MHz (in the paired receive band)



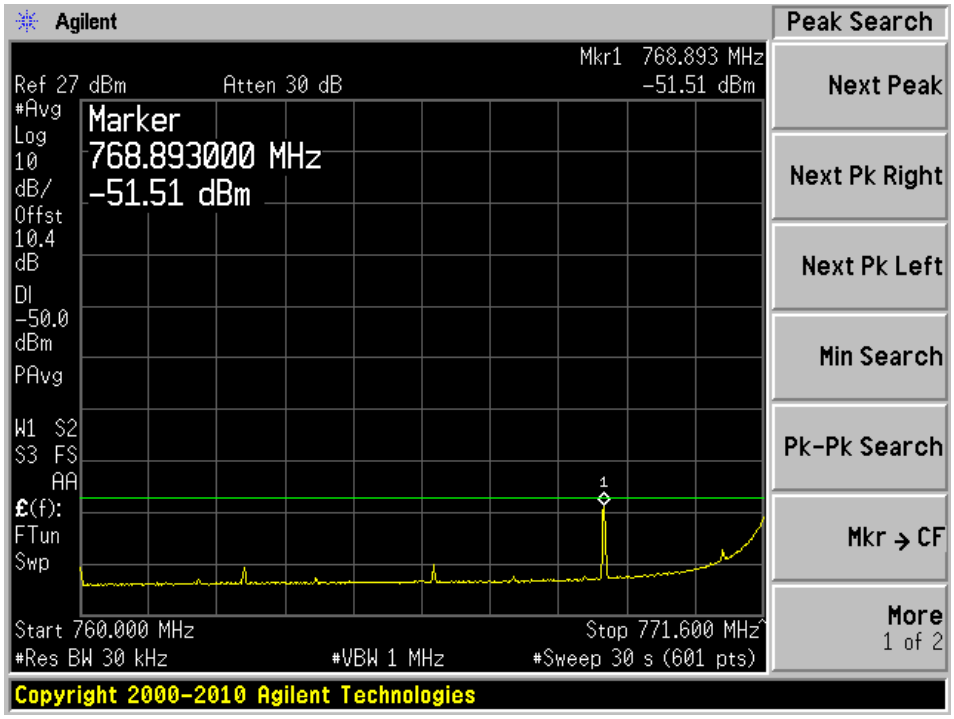
Middle Channel – 772 MHz



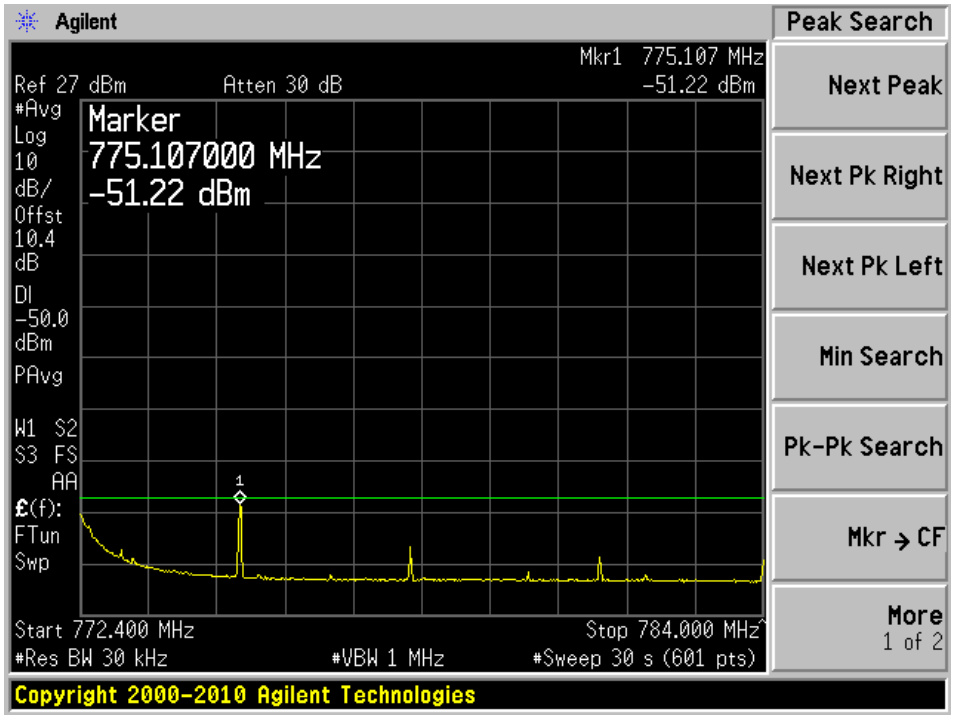
Middle Channel – 772 MHz



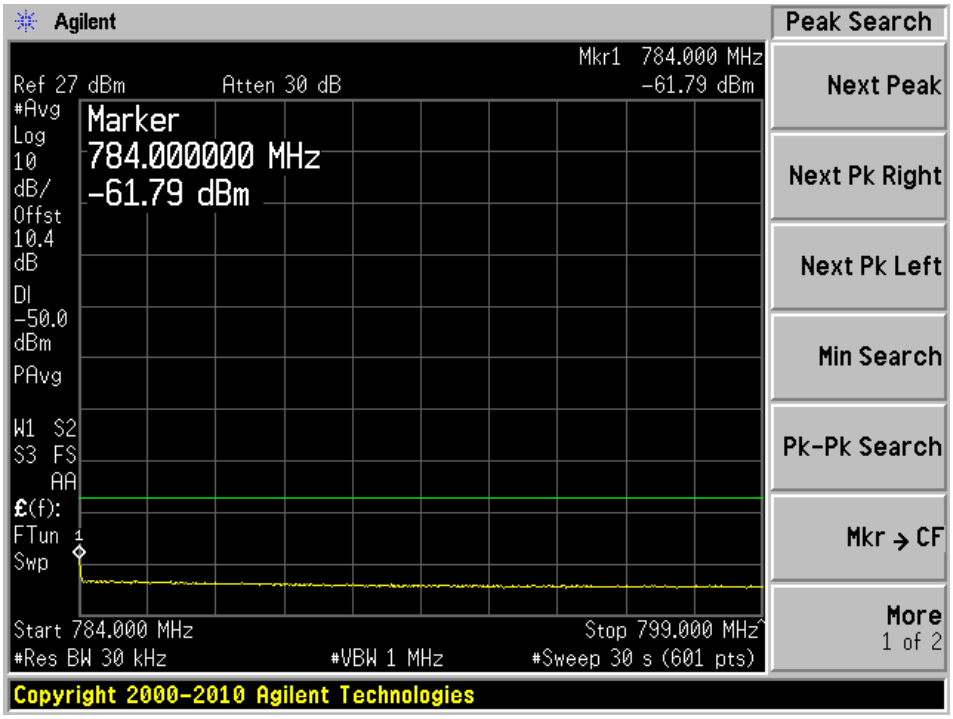
Middle Channel – 772 MHz (-12MHz to – 400 kHz)



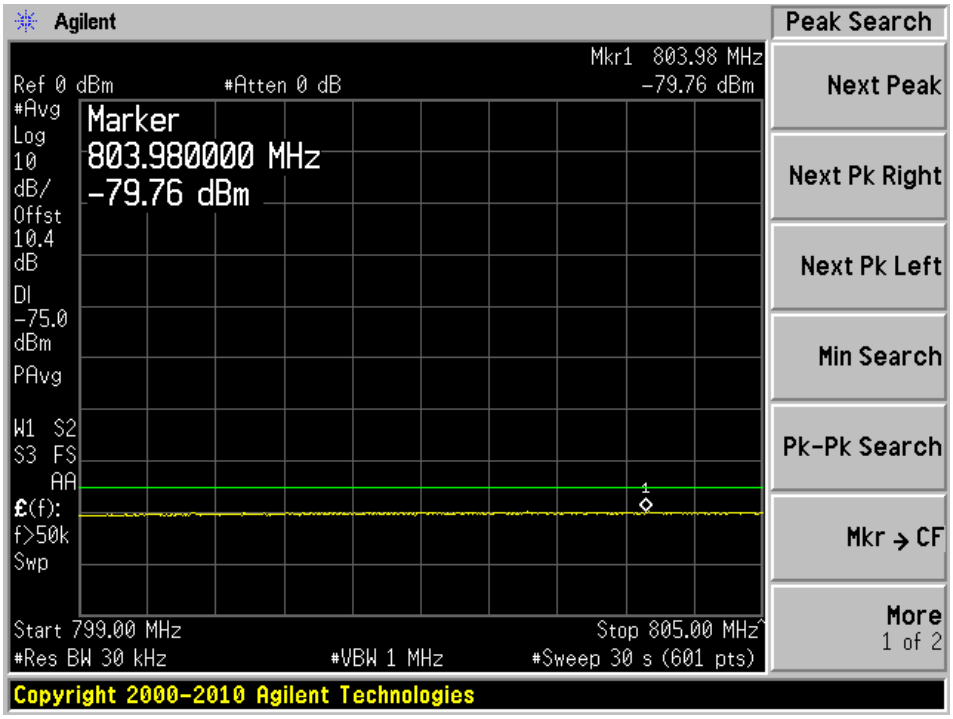
Middle Channel – 772 MHz (+ 400 kHz to +12MHz)



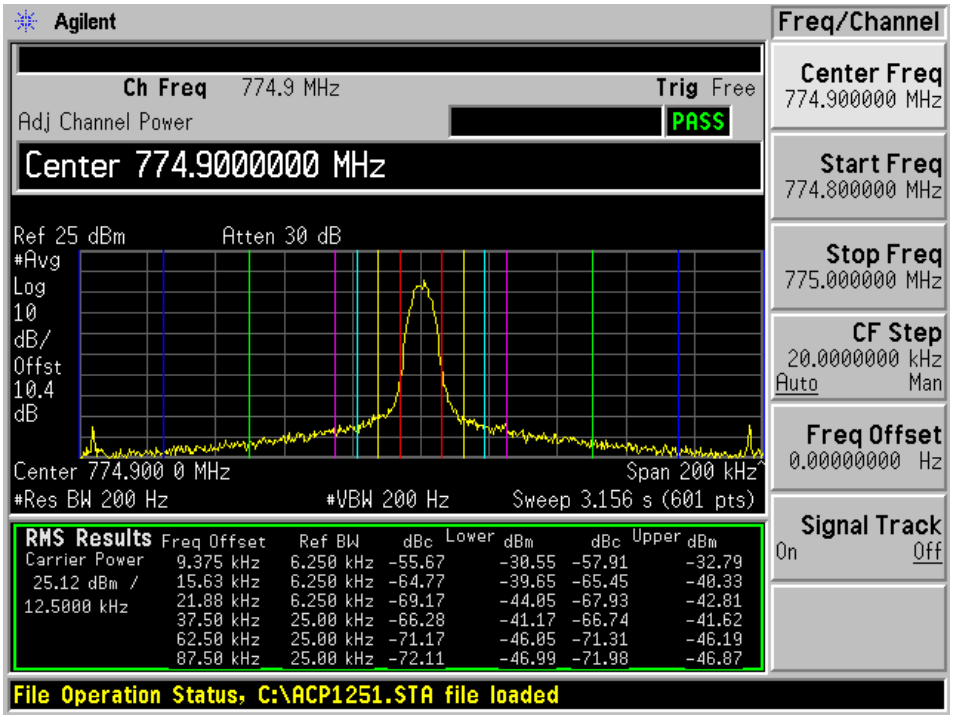
Middle Channel – 772 MHz (+12MHz to the paired receive band)



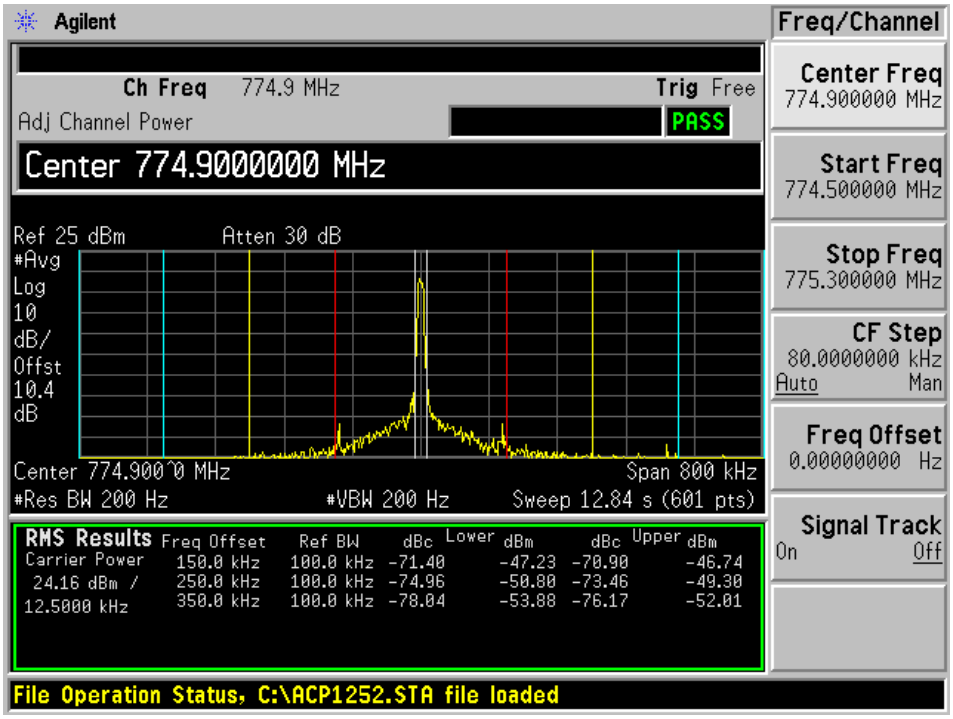
Middle Channel – 772 MHz (in the paired receive band)



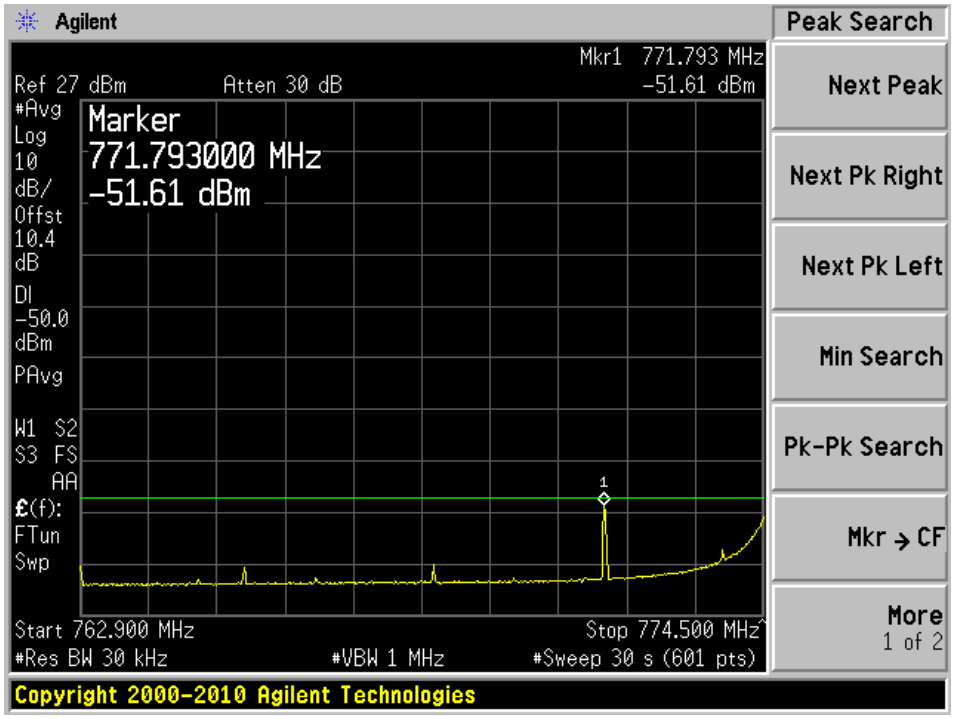
High Channel – 774.9 MHz



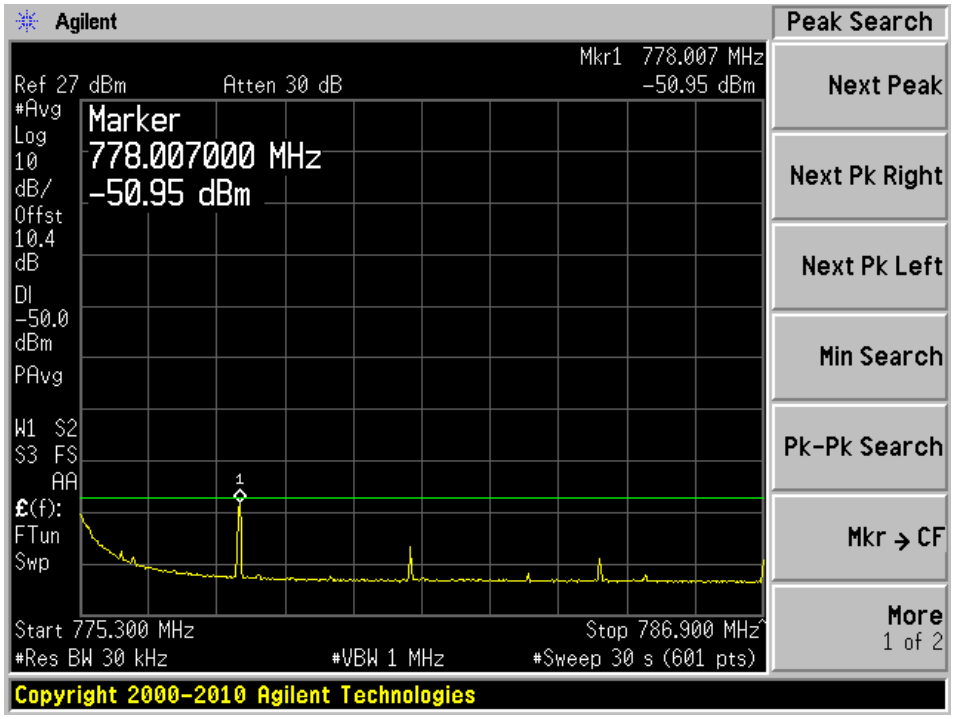
High Channel – 774.9 MHz



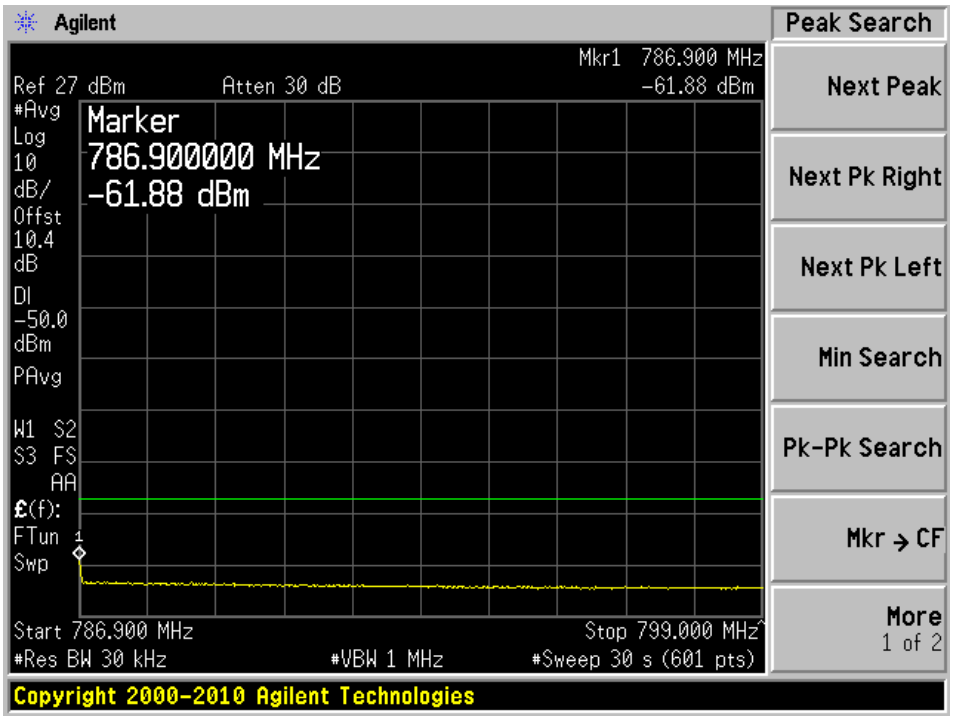
High Channel – 774.9 MHz (-12MHz to – 400 kHz)



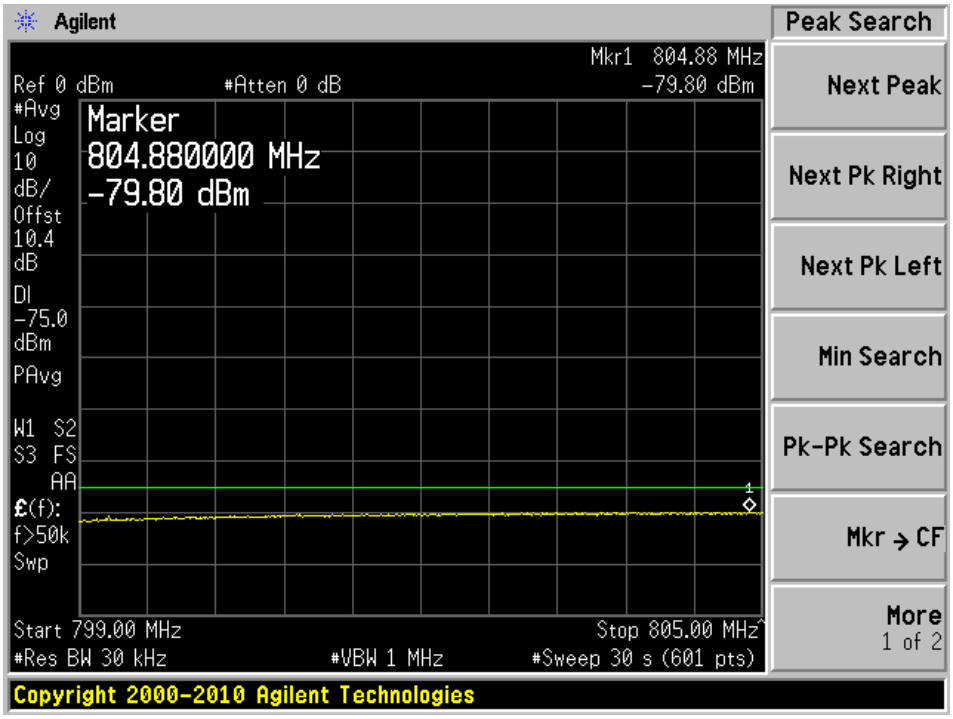
High Channel – 774.9 MHz (+400 kHz to +12MHz)



High Channel – 774.9 MHz (+12MHz to the paired receive band)

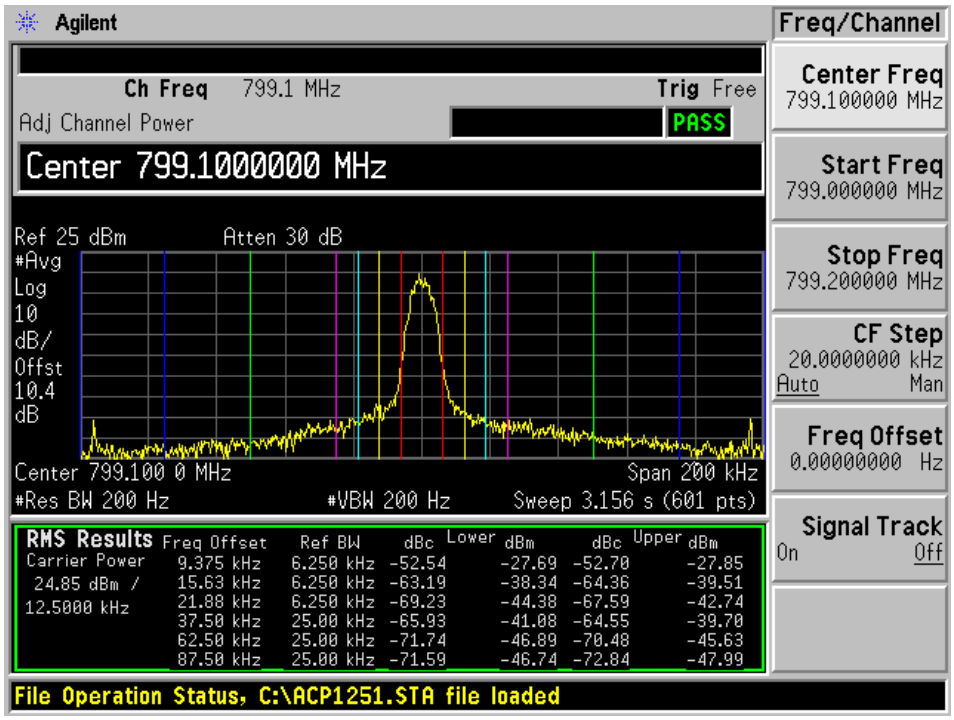


High Channel – 774.9 MHz (in the paired receive band)

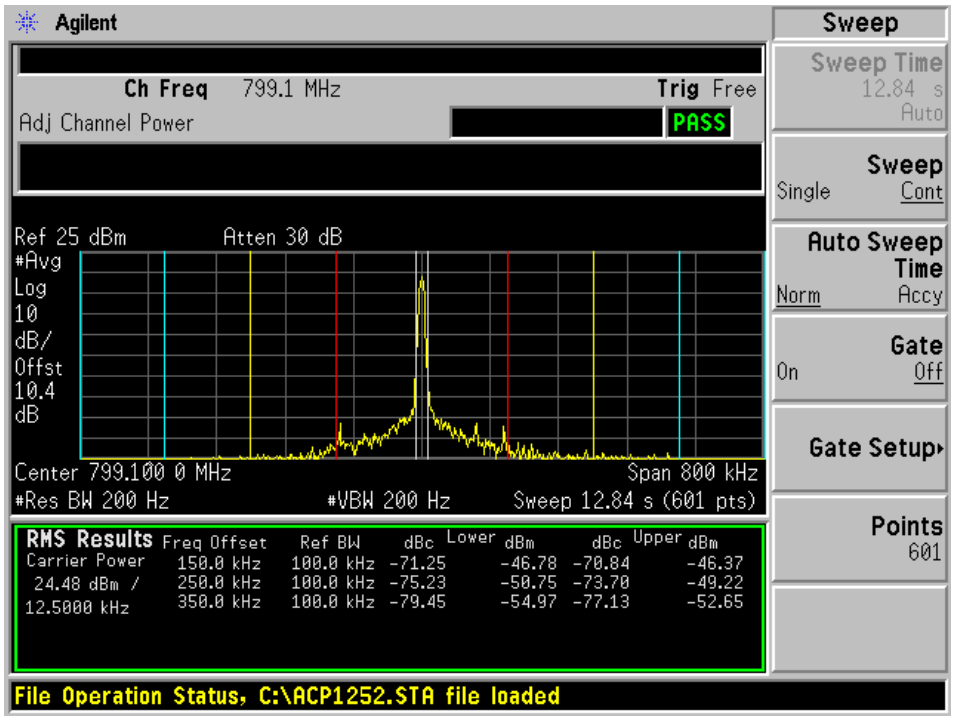


C4FM: 799 MHz – 805 MHz

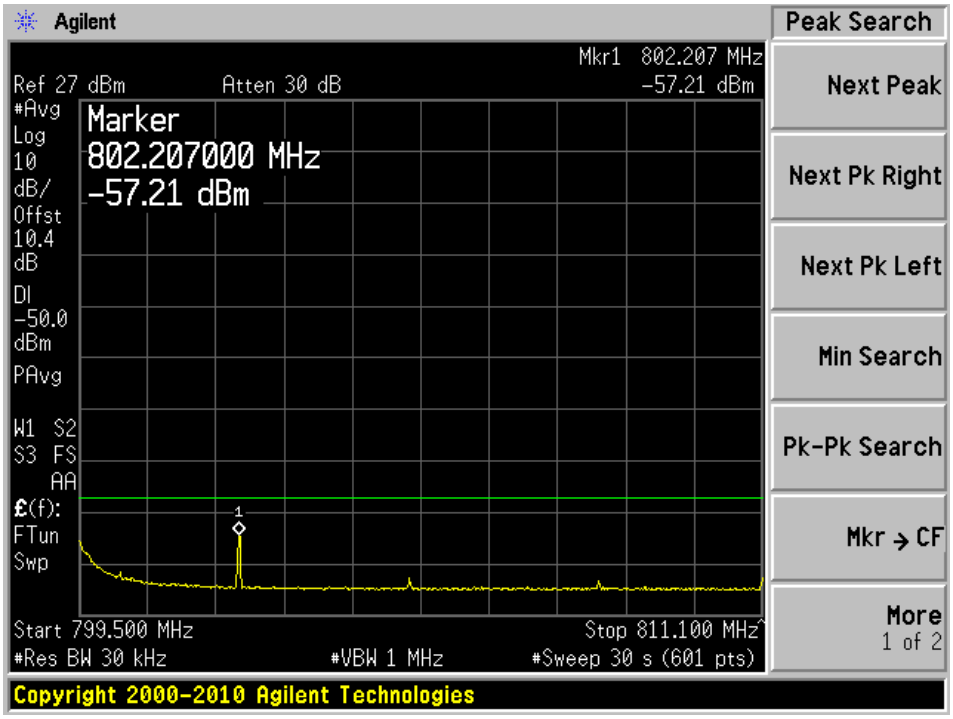
Low Channel – 799.1 MHz



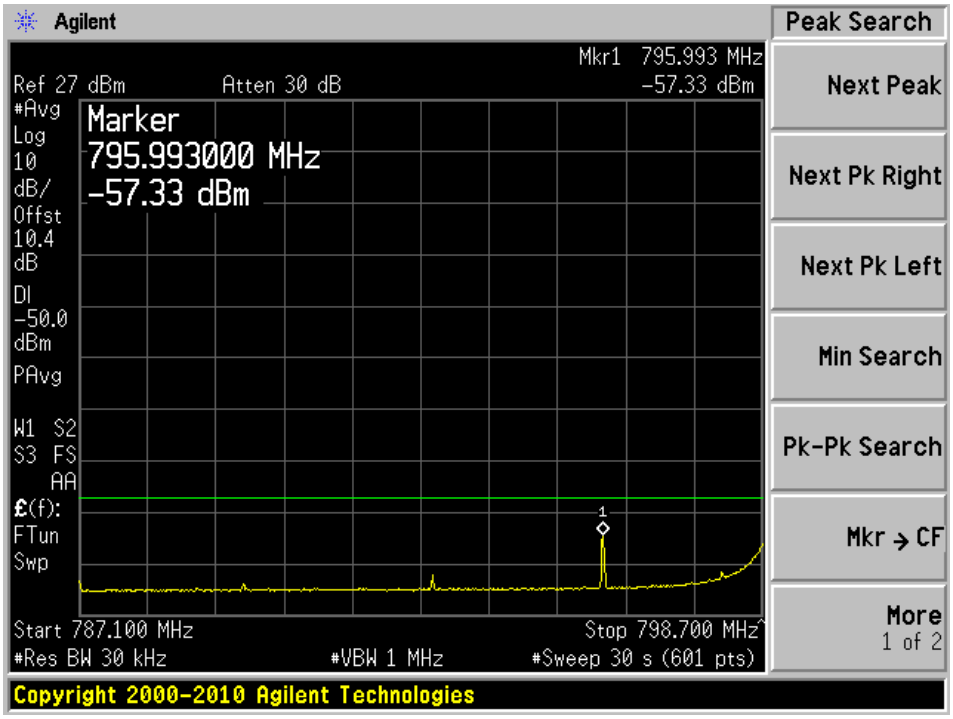
Low Channel – 799.1 MHz



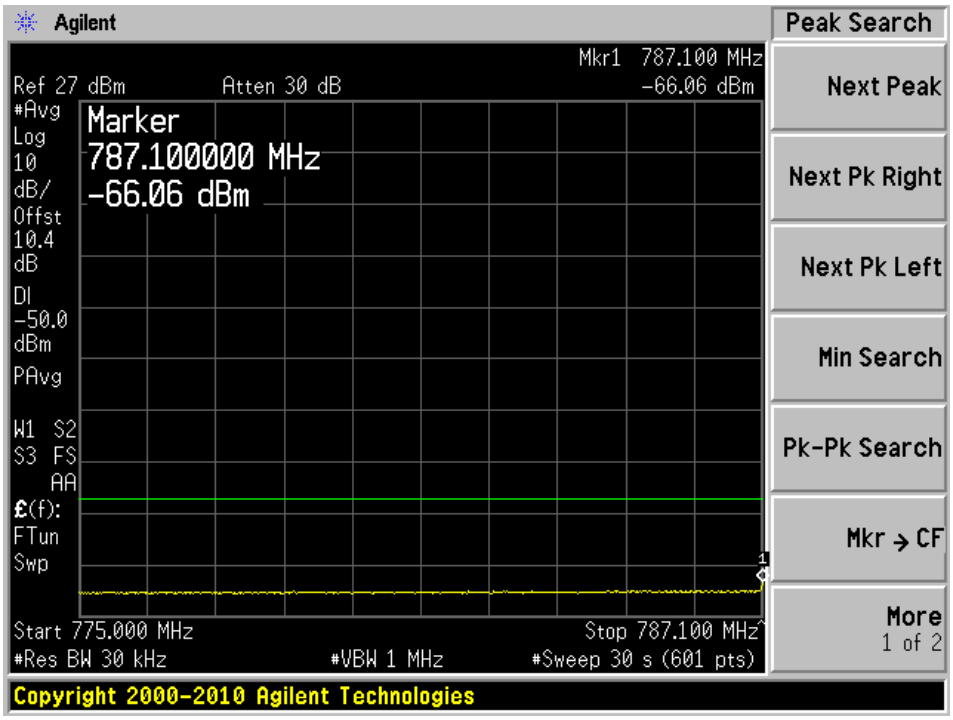
Low Channel – 799.1 MHz (+400 kHz to +12MHz)



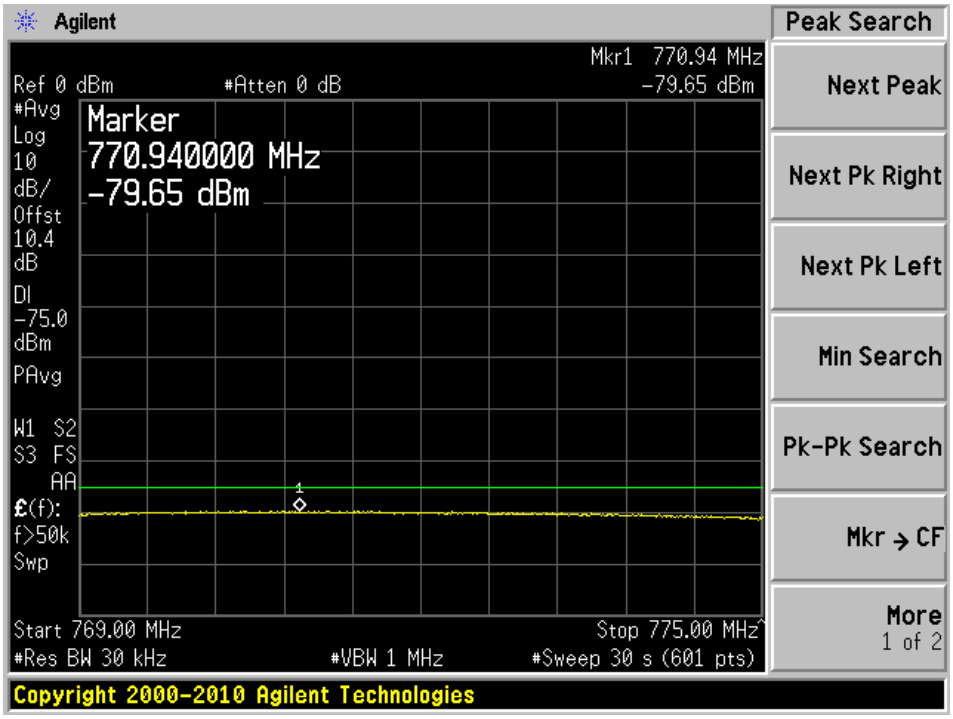
Low Channel – 799.1 MHz (-12MHz to - 400 kHz)



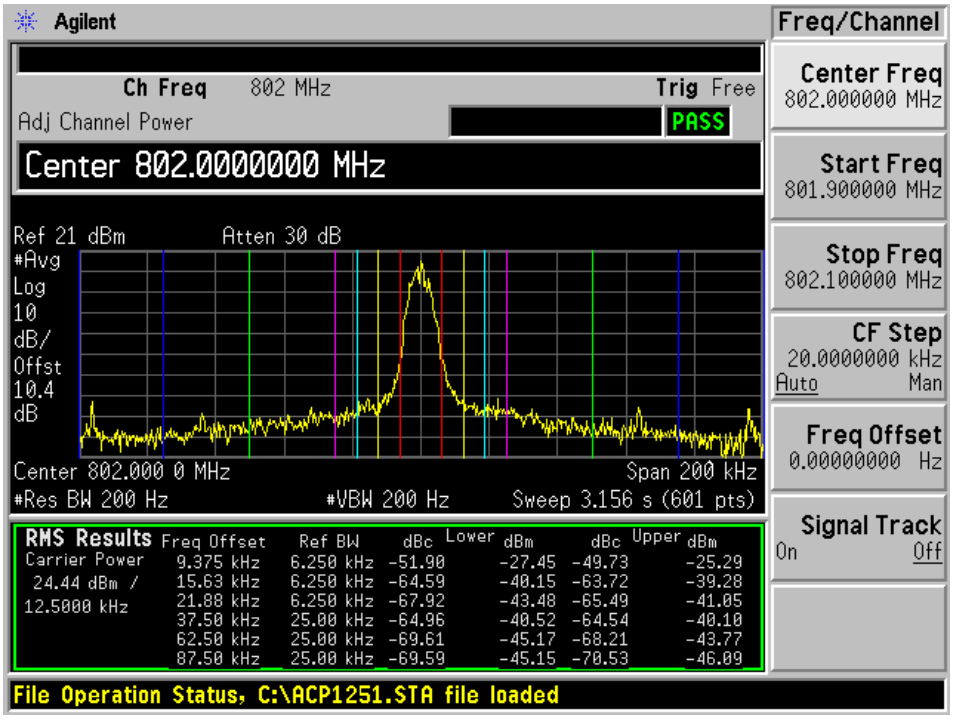
Low Channel – 799.1 MHz (-12MHz to the paired receive band)



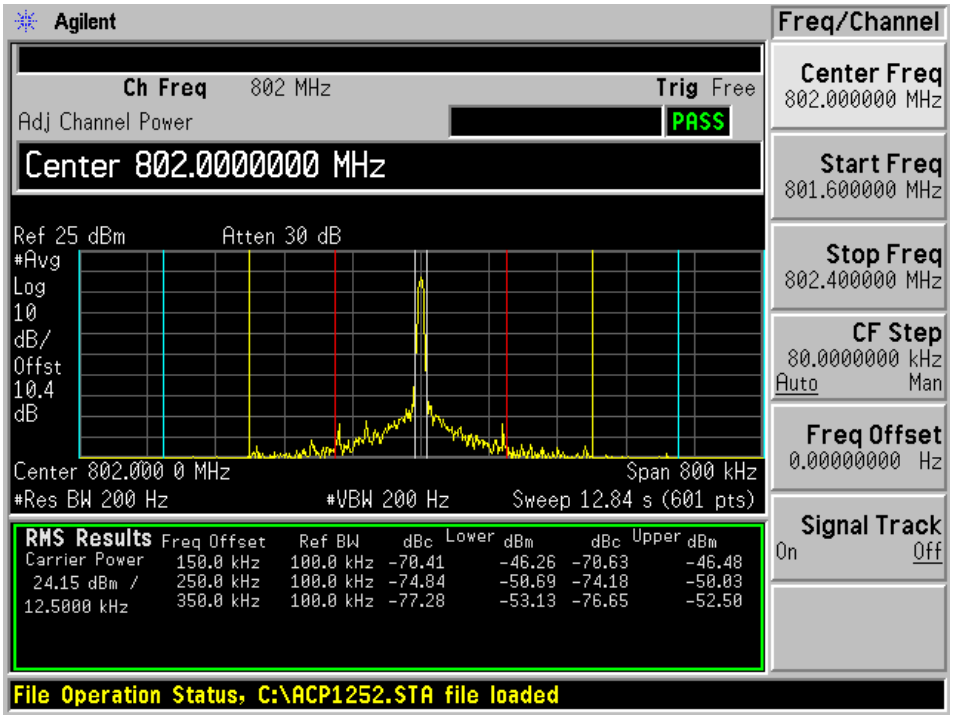
Low Channel – 799.1 MHz (in the paired receive band)



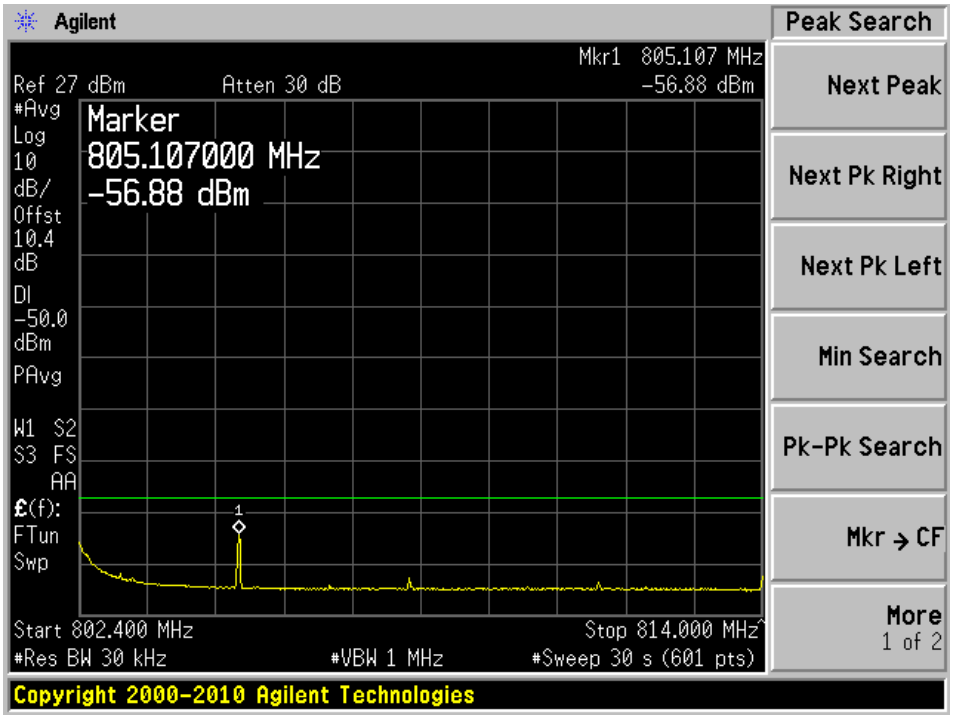
Middle Channel – 802 MHz



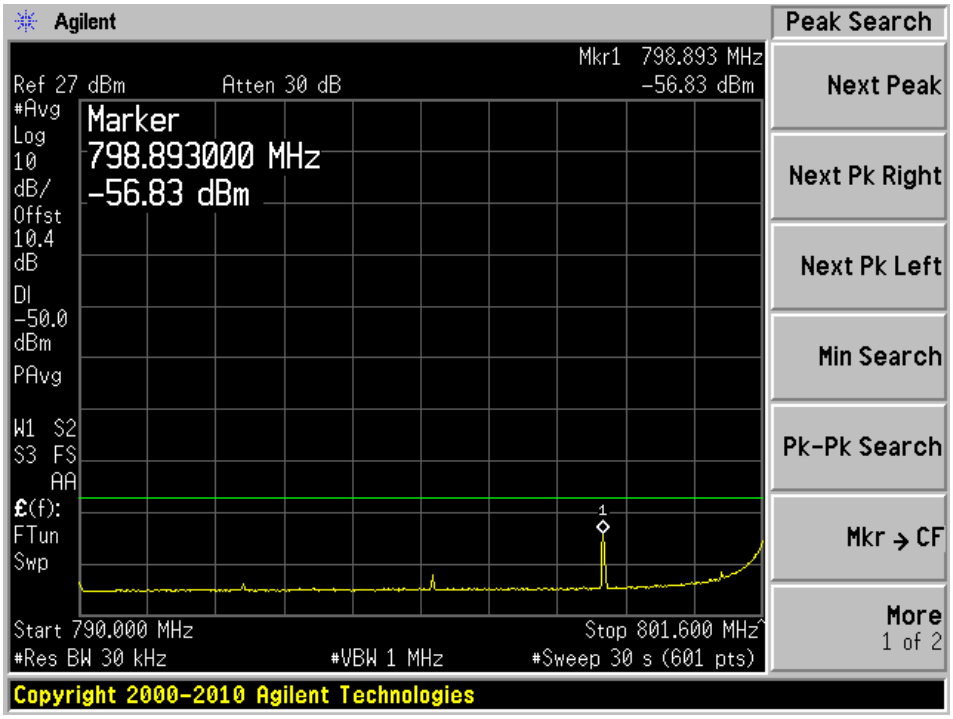
Middle Channel – 802 MHz



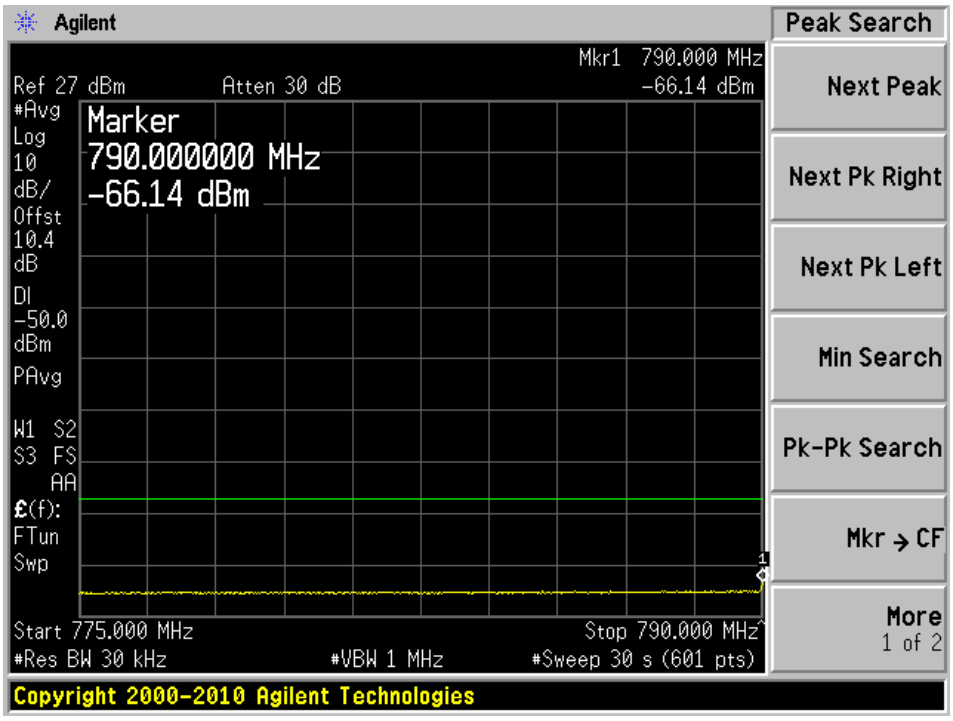
Middle Channel – 802 MHz (+400 kHz to +12MHz)



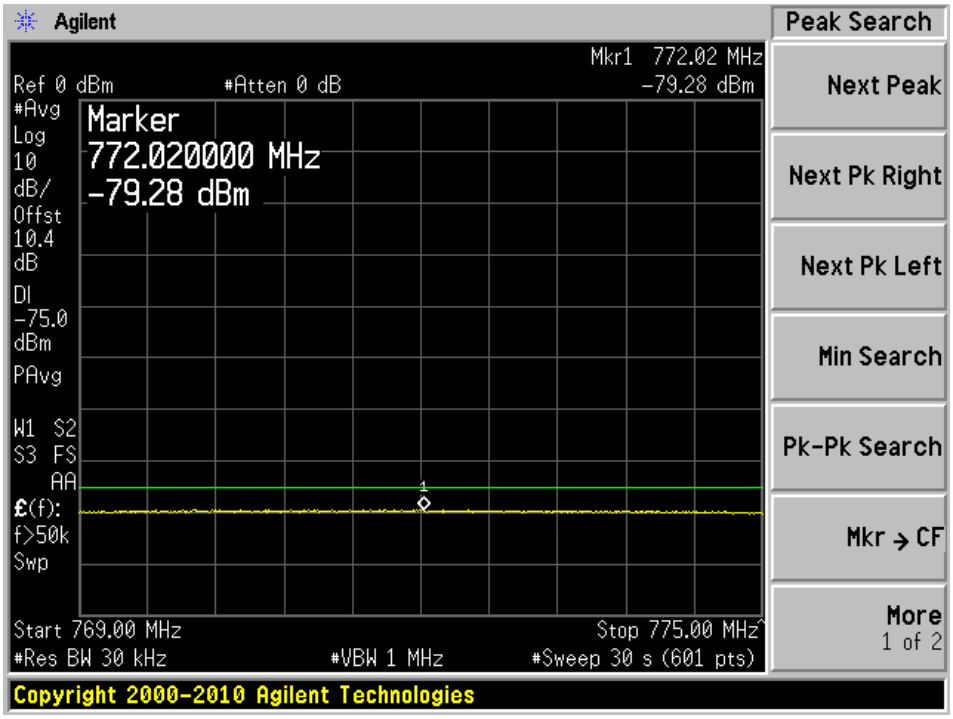
Middle Channel – 802 MHz (-12MHz to - 400 kHz)



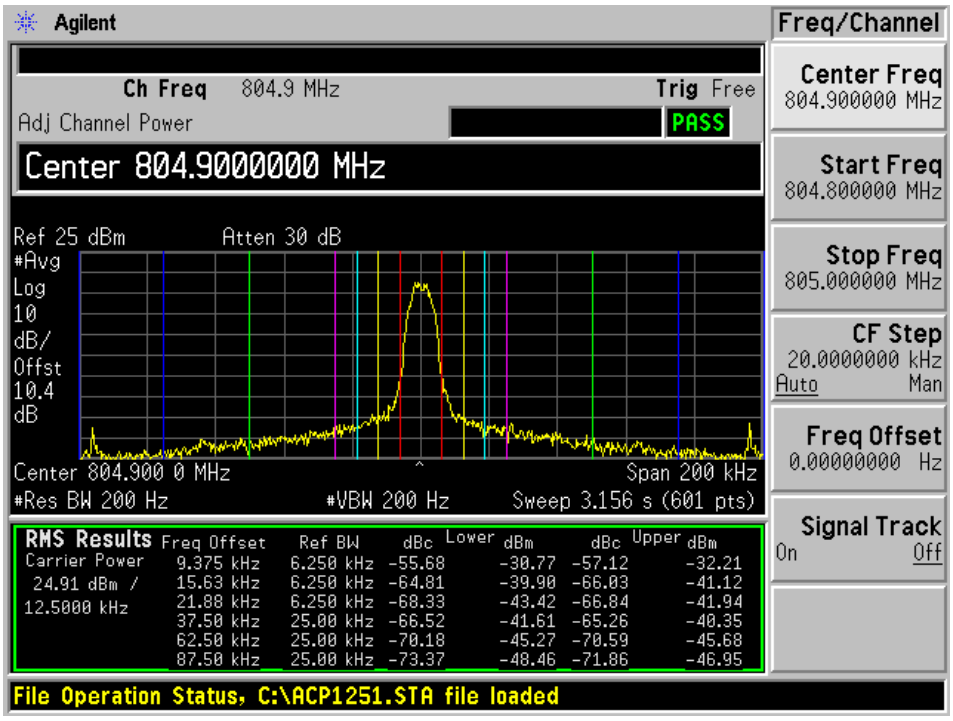
Middle Channel – 802 MHz (-12MHz to the paired receive band)



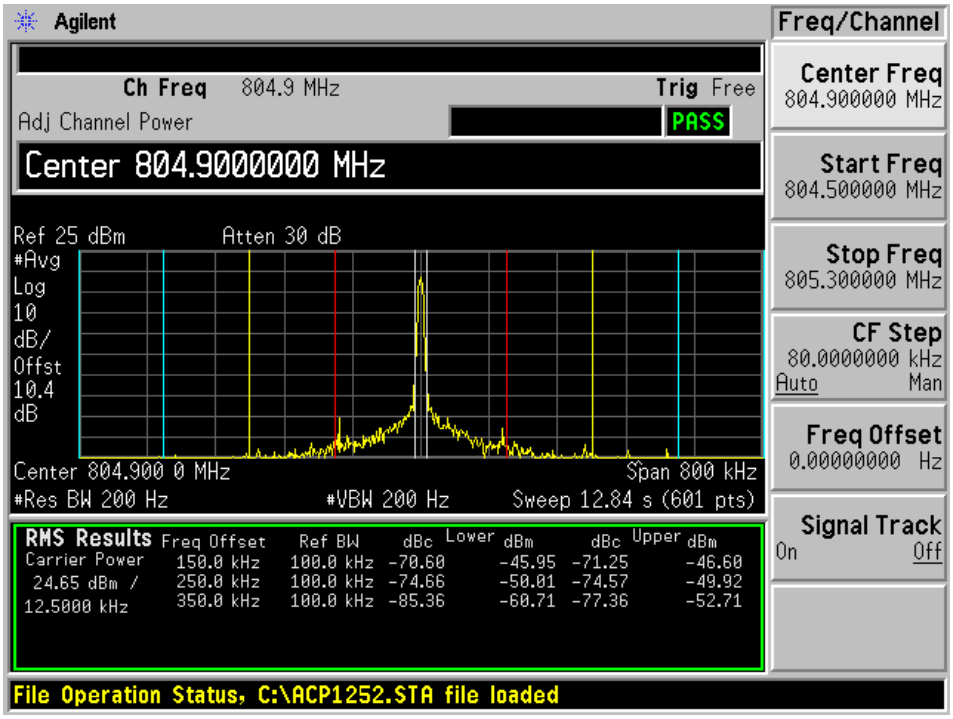
Middle Channel – 802 MHz (in the paired receive band)



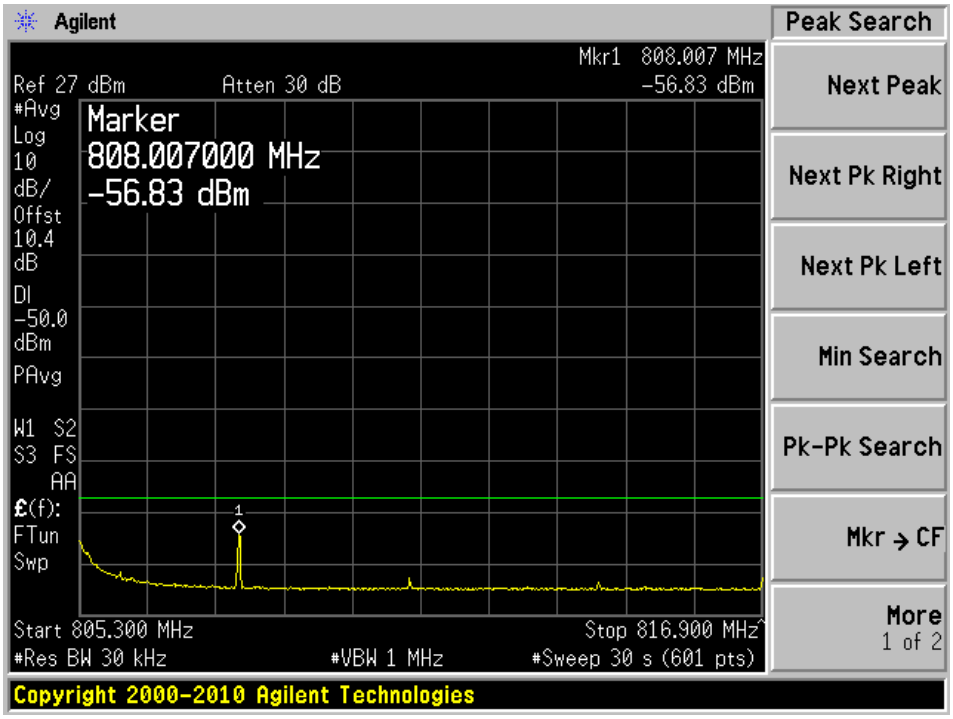
High Channel – 804.9 MHz



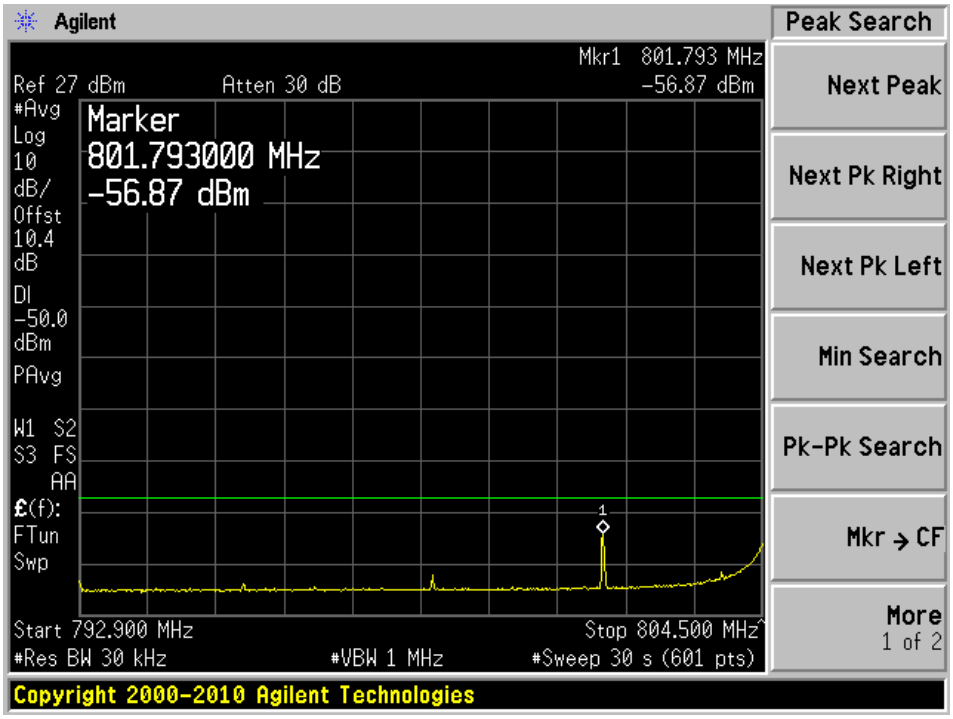
High Channel – 804.9 MHz



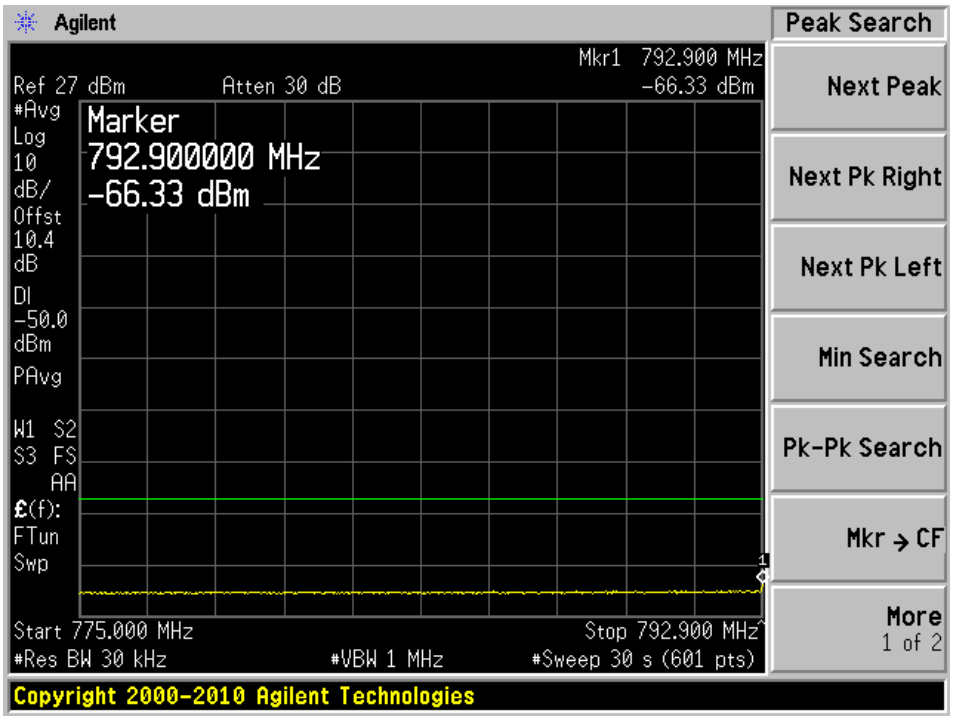
High Channel – 804.9 MHz (+400 kHz to +12MHz)



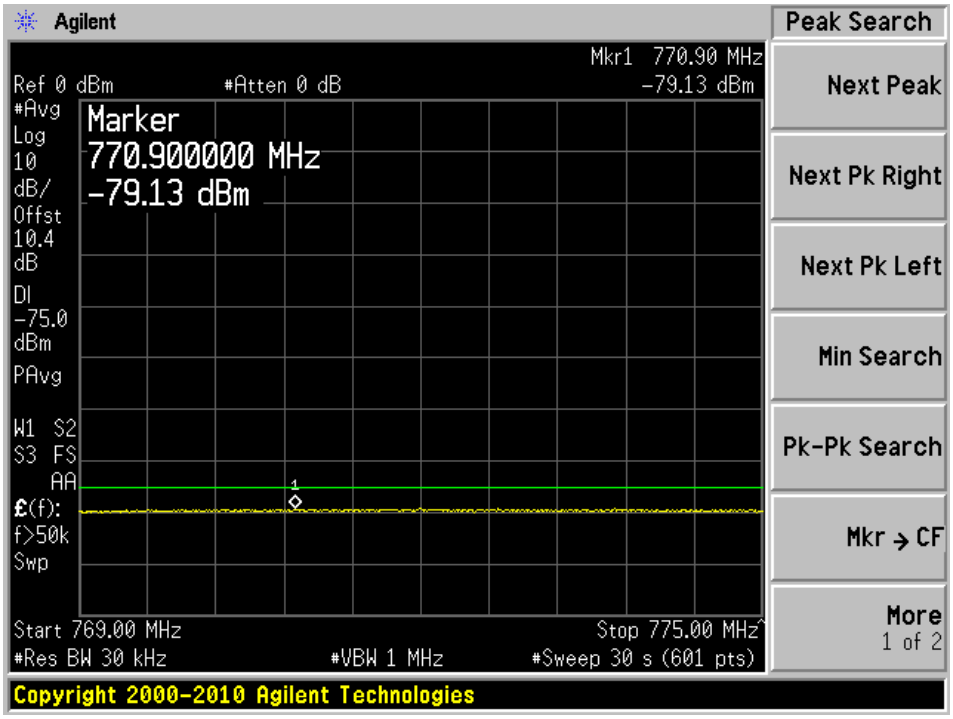
High Channel – 804.9 MHz (-12MHz to – 400 kHz)



High Channel – 804.9 MHz (-12MHz to the paired receive band)



High Channel – 804.9 MHz (in the paired receive band)



12 Exhibit A - FCC Labeling Requirements

12.1 FCC ID Label Requirement

Per FCC Part 2.925, (a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC ID entifier consisting of the two elements in the exact order specified in §2.926. The FCC ID: entifier shall be preceded by the term FCC ID: in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

(b) The grantee code assigned pursuant to paragraph (c) of this section is assigned permanently to applicants/grantees and is valid only for the party specified as the applicant/grantee in the code assignment(s).

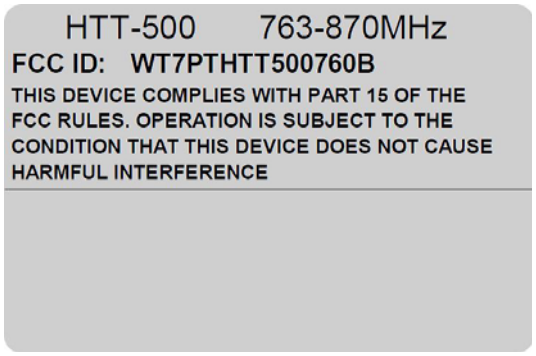
(c) A grantee code will have three characters consisting of Arabic numerals, capital letters, or combination thereof

(d) The equipment product code assigned by the grantee shall consist of a series of Arabic numerals, capital letters or a combination thereof, and may include the dash or hyphen (-). The total of Arabic numerals, capital letters and dashes or hyphens shall not exceed 14 and shall be one which has not been previously used in conjunction with:

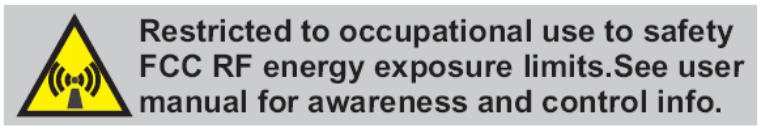
12.2 FCC Label Contents and Location

Label 1

Label 2



Label 3

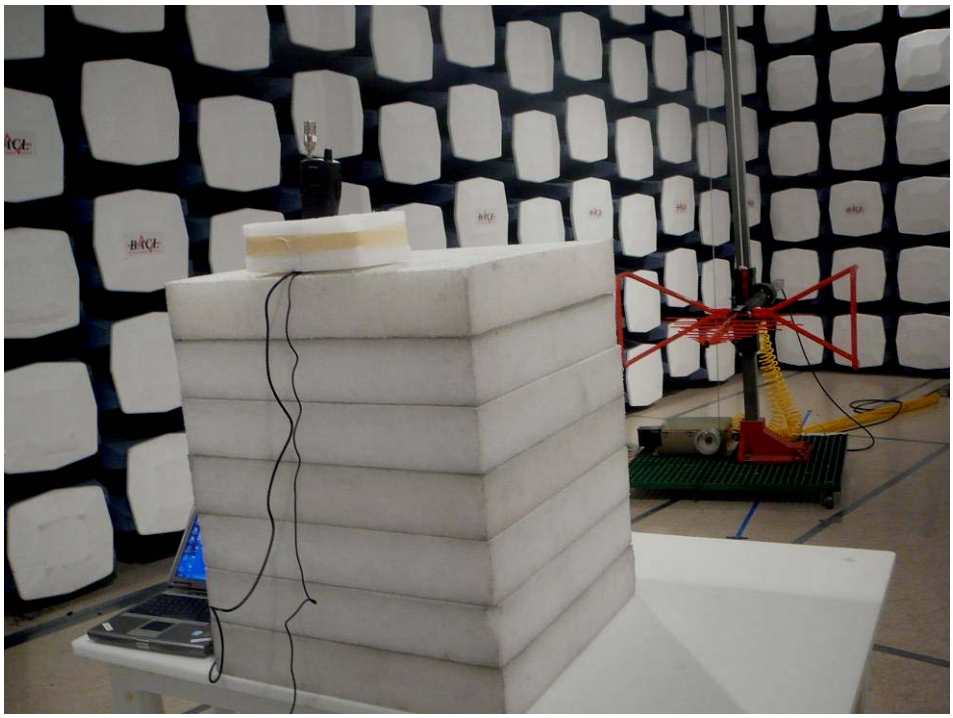


LOCATION OF THE LABELS

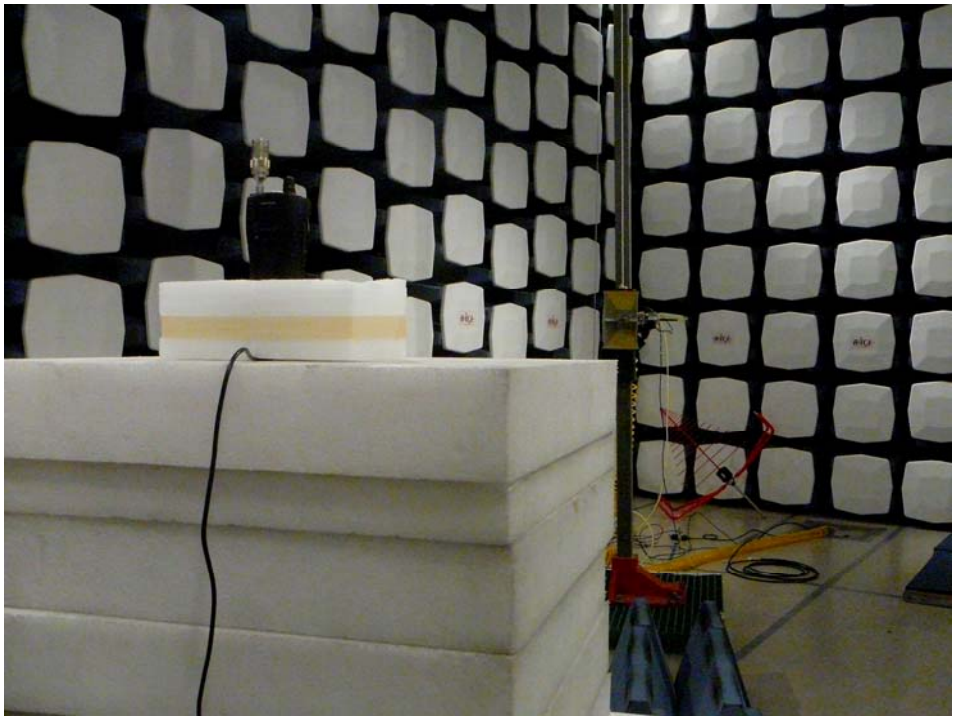
13 Exhibit B - Test Setup Photographs

13.1 Radiated Emission – Front View

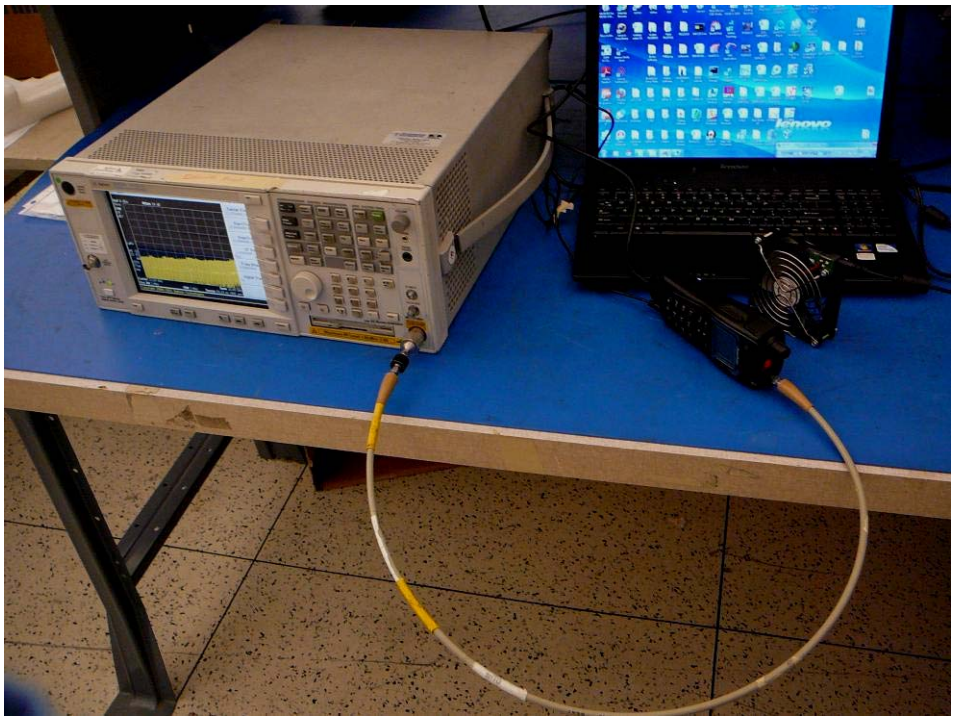
13.2 Radiated Emission below 1 GHz – Rear View



13.3 Radiated Emission above 1 GHz – Rear View



13.4 EUT Bench Testing View



14 Exhibit C - EUT Photographs

14.1 EUT - Front View

14.2 EUT – Back View

14.3 EUT - Top View

14.4 Rear – Bottom View

14.5 EUT - Side View 1

14.6 Rear – Side View 2

--- END OF REPORT ---