Test Report

IW3702 - 4E - UXK9

Cisco Industrial Wireless 802.11ac Dual Band Access Point

FCC ID: LDKIW3702
IC: 2461B-IW3702

5150-5250 MHz

Antenna Gain 7 dBi

Against the following Specifications:

CFR47 Part 15.407

Cisco Systems
170 West Tasman Drive
San Jose, CA 95134

ACCREDITED

Testing - Certificate Number : 1178-01

Author: Johanna Knudsen
Approved By: See EDCS
Title: See EDCS

This report replaces any previously entered test report under EDCS - 1497903

This test report has been electronically authorized and archived using the CISCO Engineering Document Control system.

Section 1: Overview

1.1 Test Summary

Samples were assessed against the tests detailed in section 3 under the requirements of the following specifications:

Emission	Immunity
CFR47 Part 15.407	N/A

The specifications listed above represent actual tests performed to demonstrate compliance against the specifications and basic standards listed on the front cover of this report. This list is not a one to one match to the front cover for one or more of the following reasons.

1. Basic standards call up many different test phenomena specifications such as the 61000-4-X series. The basic standards define which elements and levels shall be applied from these specifications and as such it is not appropriate to list the individual specifications on the front cover.
2. A Standard listed on the front cover may be required in a particular country but is not appropriate for the particular technologies included in the equipment under test. E.g. You cannot test a DC product to the mains Harmonics requirements in EN61000-3-2. See section 3.2.
3. Test results against a particular standard or specification may be included in a different test report. See section 3.2 for an EDCS reference of this data.
4. Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
5. Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.
6. Testing may have been performed to an equivalent test that satisfies the requirements of the standards and specifications listed on the front cover of the report. See section 3.2.
7. Where radiated emissions testing has been performed to EN55022/CISPR22 the additional requirements of VCCI: V-3/2006.04, EN55022: 1994 +A1/2 and CAN/CSA- CISPR 22-02 have also been evaluated unless otherwise stated.
8. Testing to the requirements of CFR47 Part 15 was performed against the CISPR22 limits. The results are therefore deemed satisfactory evidence of compliance with Industry Canada Interference Causing Equipment Standard ICES-003.
9. Where assessment has been performed to CISPR24, all the applicable test requirements may have not been covered. Refer to the results section for the tests performed.

Notes:

1) Where a specification listed on the front cover of this report has deviations from the basic standards listed above, the additional technical requirements of the specification were also assessed.
2) Where appropriate, Cisco may have substituted a later revision of a basic standard to those referenced in the specification on the front sheet of this test report. This decision was based upon improved test methodology and repeatability and/or where the newer revision represented a more stringent test.
3) Where relevant, testing has been carried out to the requirements of both EN and IEC Specifications. This was possible because of the similarities of the test methods involved and the Cisco EMC test procedures.

Section 2: Assessment Information

2.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on the samples submitted. The testing was performed by and for the use of Cisco systems Inc:

With regard to this assessment, the following points should be noted:

a) The results contained in this report relate only to the items tested and were obtained in the period between the date of the initial assessment and the date of issue of the report. Manufactured products will not necessarily give identical results due to production and measurement tolerances.

b) The apparatus was set up and exercised using the configuration and modes of operation defined in this report only.

c) Where relevant, the apparatus was only assessed using the susceptibility criteria defined in this report and the Test Assessment Plan (TAP).

d) All testing was performed under the following environmental conditions:

Temperature	15°C to 35°C (54°F to 95°F)
Atmospheric Pressure	860mbar to 1060mbar (25.4" to 31.3")
Humidity	10% to 75*%

*[Where applicable] For ESD testing the humidity limits used were 30% to 60% and for EFT/B tests the humidity limits used were 25% to 75%.

e) All AC testing was performed at one or more of the following supply voltages:
110V 60 Hz (+/-20%)
220V 50 Hz (+/-20%)

22.2 Date of testing

4-May-2015 to 29-June-2015

2.3 Report Issue Date

Cisco uses an electronic system to issue, store and control the revision of test reports. This system is called the Engineering Document Control System (EDCS). The actual report issue date is embedded into the original file on EDCS. Any copies of this report, either electronic or paper, that are not on EDCS must be considered uncontrolled

2.4 Testing facilities

This assessment was performed by:

Testing Laboratory

Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

Registration Numbers for Industry Canada

Cisco System Site	Site Identifier
Building P, 5m Chamber	Company #: 2461N-1

Test Engineers

Johanna Knudsen, Vinay Ganji, Chris Blair

2.5 Equipment Assessed (EUT)

IW3702, Cisco Industrial Wireless 802.11ac Dual Band Access Point

2.6 EUT Description

The IW3702 Series Outdoor/Industrial 802.11ac Dual Band Access Point supports the following modes of operation. The modes are further defined in the radio Theory of Operation. The modes included in this report represent the worst case data for all modes.

Non HT/VHT-20, One Antenna, 6 to 54 Mbps
Non HT/VHT-20, Two Antennas, 6 to 54 Mbps
Non HT/VHT-20, Three Antennas, 6 to 54 Mbps
Non HT/VHT-20, Four Antennas, 6 to 54 Mbps

Non HT/VHT-20 Beam Forming, Two Antennas, 6 to 54 Mbps
Non HT/VHT-20 Beam Forming, Three Antennas, 6 to 54 Mbps
Non HT/VHT-20 Beam Forming, Four Antennas, 6 to 54 Mbps

HT/VHT-20, One Antenna, M0 to M7, m0.1 to m9.1
HT/VHT-20, Two Antennas, M0 to M15, m0.1 to m9.2
HT/VHT-20, Three Antennas, M0 to M23, m0.1 to m9.3
HT/VHT-20, Four Antennas, M0 to M23, m0.1 to m9.3

HT/VHT-20 STBC, Two Antennas, M0 to M7, m0.1 to m9.1
HT/VHT-20 STBC, Three Antennas, M0 to M7, m0.1 to m9.1
HT/VHT-20 STBC, Four Antennas, M0 to M7, m0.1 to m9.1

HT/VHT-20 Beam Forming, Two Antennas, M0 to M15, m0.1 to m9.2
HT/VHT-20 Beam Forming, Three Antennas, M0 to M23, m0.1 to m9.3
HT/VHT-20 Beam Forming, Four Antennas, M0 to M23, m0.1 to m9.3

Non HT/VHT-40 Duplicate, One Antenna, 6-54 Mbps
Non HT/VHT-40 Duplicate, Two Antennas, 6-54 Mbps
Non HT/VHT-40 Duplicate, Three Antennas, 6-54 Mbps
Non HT/VHT-40 Duplicate, Four Antennas, 6-54 Mbps

HT/VHT-40, One Antenna, M0 to M7, m0.1 to m9.1
HT/VHT-40, Two Antennas, M0 to M15, m0.1 to m9.2
HT/VHT-40, Three Antennas, M0 to M23, m0.1 to m9.3
HT/VHT-40, Four Antennas, M0 to M23, m0.1 to m9.3

HT/VHT-40 STBC, Two Antennas, M0 to M7, m0.1 to m9.1
HT/VHT-40 STBC, Three Antennas, M0 to M7, m0.1 to m9.1
HT/VHT-40 STBC, Four Antennas, M0 to M7, m0.1 to m9.1

HT/VHT-40 Beam Forming, Two Antennas, M0 to M15, m0.1 to m9.2
HT/VHT-40 Beam Forming, Three Antennas, M0 to M23, m0.1 to m9.3
HT/VHT-40 Beam Forming, Four Antennas, M0 to M23, m0.1 to m9.3

Non VHT-80 Duplicate, One Antenna, 6-54 Mbps
Non VHT-80 Duplicate, Two Antennas, 6-54 Mbps
Non VHT-80 Duplicate, Three Antennas, 6-54 Mbps
Non VHT-80 Duplicate, Four Antennas, 6-54 Mbps

VHT-80, One Antenna, M0 to M7, m0.1 to m9.1
VHT-80, Two Antennas, M0 to M15, m0.1 to m9.2
VHT-80, Three Antennas, M0 to M23, m0.1 to m9.3
VHT-80, Four Antennas, M0 to M23, m0.1 to m9.3

VHT-80 STBC, Two Antennas, M0 to M7, m0.1 to m9.1
VHT-80 STBC, Three Antennas, M0 to M7, m0.1 to m9.1
VHT-80 STBC, Four Antennas, M0 to M7, m0.1 to m9.1

VHT-80 Beam Forming, Two Antennas, M0 to M15, m0.1 to m9.2
VHT-80 Beam Forming, Three Antennas, M0 to M23, m0.1 to m9.3
VHT-80 Beam Forming, Four Antennas, M0 to M23, m0.1 to m9.3

The following antennas are supported by this product series.

The data included in this report represent the antennas in **bold** below.

AIR-ANT2547V-N	**Dual-band 4 dBi (2.4 GHz) 7 dBi (5 GHz) omnidirectional antenna with 1x type N (m) connector (white)**
AIR-ANT2547VG-N	**Dual-band 4 dBi (2.4 GHz) 7 dBi (5 GHz) omnidirectional antenna with 1x type N (m) connector (gray)**
AIR-ANT2513P4M-N	Dual-band 13 dBi (2.4 GHz) 13 dBi (5 GHz) patch antenna with 4x type N (f) connector
AIR-ANT2524V4C-R	Dual-band 2 dBi (2.4 GHz) 4 dBi (5 GHz) omni-directional antenna with 4x RP-TNC (m) connector (indoor only)
AIR-ANT2544V4M-R	Dual-band 4 dBi (2.4 GHz) 4 dBi (5 GHz) omni-directional antenna with 4x RP-TNC (m) connector
AIR-ANT2566P4W-R	Dual-band 6 dBi (2.4 GHz) 6 dBi (5 GHz) patch antenna with 4x RP-TNC (m) connector

Section 4: Sample Details

Note: Each sample was evaluated to ensure that its condition was suitable to be used as a test sample prior to the commencement of testing. Please also refer to the "Justification for worst Case test Configuration" section of this report for further details on the selection of EUT samples.

4.1 Sample Details (Photographs of the test samples, where appropriate can be found in appendix H)

Sample No.	Equipment Details	Part Number	Manufacturer	Hardware Rev.	Firmware Rev.	Software Rev.	Serial Number
S01	IW3702 - 4E - UXK9	68-5584-03	Cisco Systems	03	NA	NA	FOC18486MLL
S02	PWR-IE3000-AC	341-0304-01	Cisco Systems	01	NA	NA	DTM170704Z2
S03	IW3702 - 4E - UXK9	68-5584-04	Cisco Systems	04	NA	NA	FOC19167ZLE
S04	PWR-IE3000-AC	341-0304-01	Cisco Systems	01	NA	NA	DTM160801WH

4.2 System Details

System #	Description	Samples
1	EUT System used for all Conducted testing Image version: flash:/ap3g2-k9w7-mx.newptable_apr30/ap3g2-k9w7-xx.newptable_ap	S01, S02
2	EUT System used for all Radiated testing Image version: flash:/ap3g2-k9w7-mx.newptable_apr30/ap3g2-k9w7-xx.newptable_ap	S03, S04

4.3 Mode of Operation Details

Mode#	Description	Comments
1	Continuous Transmitting	Continuous Transmitting

Emission Test Results

Target Maximum Channel Power

The following table details the maximum supported Total Channel Power for all operating modes.

	Maximum Channel Power (dBm)	
	Frequency (MHz)	
Operating Mode	5180	5240
Non HT-20, 6 to 54 Mbps	15	15
Non HT-20 Beam Forming, 6 to 54 Mbps	12	12
HT-20, M0 to M23, M0.1 to M9.3	15	15
HT-20 STBC, M0 to M7, M0.1 to M9.1	15	15
HT-20 Beam Forming, M0 to M23, M0.1 to M9.3	15	15
	5180/5200	5220/5240
Non HT-40 Duplicate, 6 to 54 Mbps	16	16
HT-40, M0 to M23, M0.1 to M9.3	16	16
HT-40 STBC, M0 to M7, M0.1 to M9.1	16	16
HT-40 Beam Forming, M0 to M23, M0.1 to M9.3	16	16
	5180/5200/5220/5240	
Non HT-80 Duplicate, 6 to 54 Mbps	16	
HT-80, M0 to M23, M0.1 to M9.3	16	
HT-80 STBC, M0 to M7, M0.1 to M9.1	16	
HT-80 Beam Forming, M0 to M23, M0.1 to M9.3	16	

Maximum Channel Power values taken from EDCS# 1237091. Target power settings for individual modes tested taken from EDCS# 1501962.

99% and 26dB Bandwidth

Connect the antenna port(s) to the spectrum analyzer input. Using the spectrum analyzer Channel Bandwidth mode, configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).

KDB used: 789033 D01 General UNII Test Procedures Old Rules v01r04

C) Emission bandwidth

1) Set RBW = approximately 1% of the emission bandwidth.

2) Set the VBW > RBW.

3) Detector = Peak.

4) Trace mode = max hold.

5) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

D) 99 Percent Occupied Bandwidth

The 99-percent occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5 % of the total mean power of the given emission. Measurement of the 99-percent occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in section H)3)d). Measurements of 99-percent occupied bandwidth may also optionally be used in lieu of the 26-dB emission bandwidth to define the minimum frequency range over which the spectrum is integrated when measuring maximum conducted output power as described in section E). However, the 26-dB bandwidth must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with 15.407(a). The following procedure shall be used for measuring (99 %) power bandwidth.

1) Set center frequency to the nominal EUT channel center frequency.

2) Set span = 1.5 times to 5.0 times the OBW.

3) Set RBW = 1 % to 5 % of the OBW

4) Set VBW $\geq 3 \cdot$ RBW

5) Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6) Use the 99 % power bandwidth function of the instrument (if available).

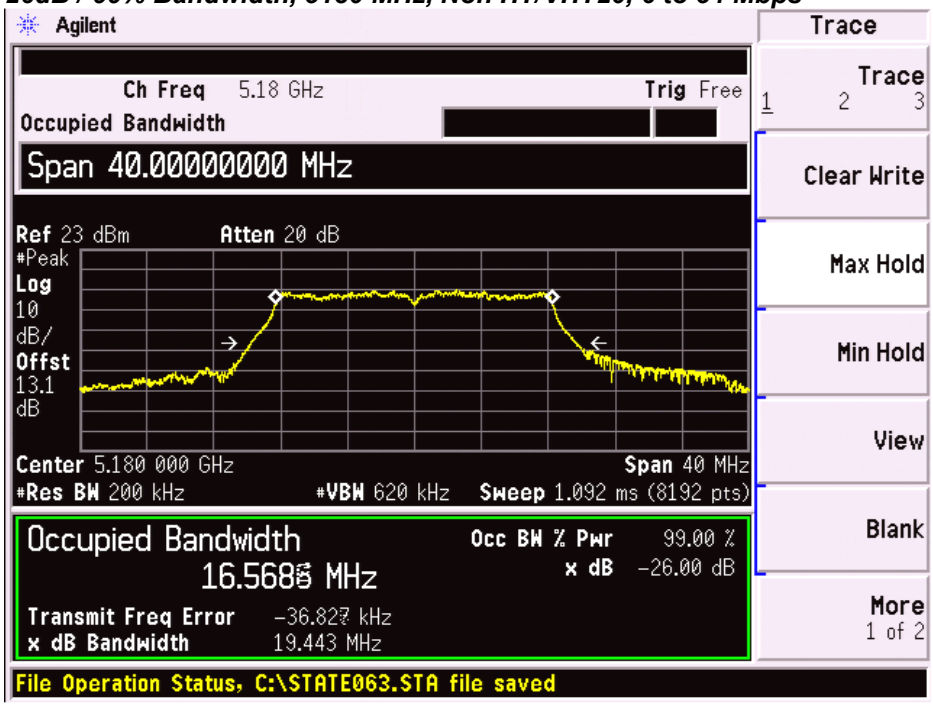
7) If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

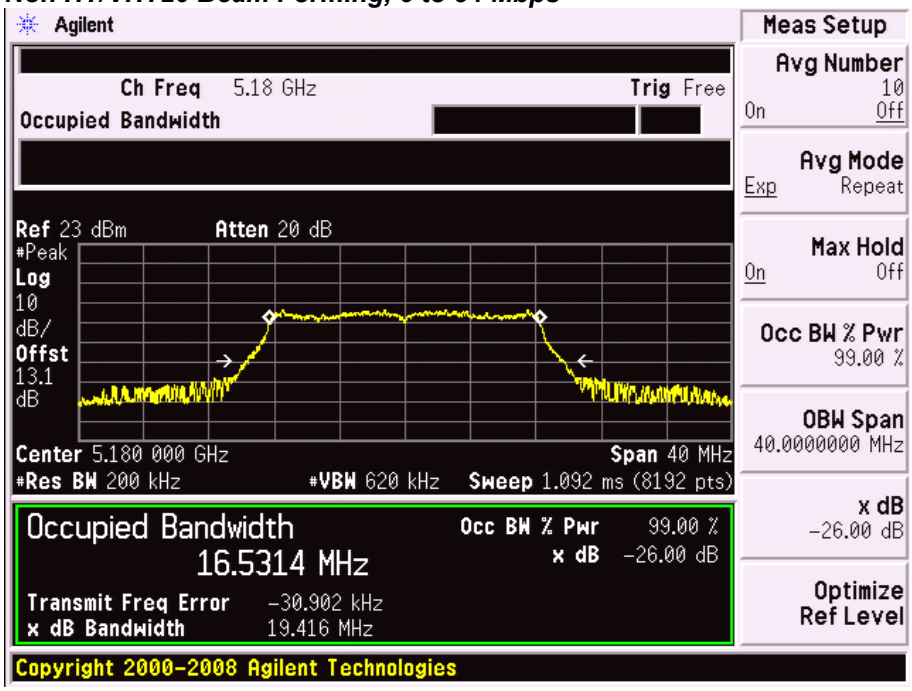
Radio was placed in continuous transmit mode. Peak detection with max hold was utilized.

Frequency (MHz)	Mode	Data Rate (Mbps)	26dB BW (MHz)	99% BW (MHz)
5180	Non HT/VHT20, 6 to 54 Mbps	6	19.443	16.569
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	6	19.416	16.531
	HT/VHT20, M0 to M7, M0.1 to M9.1	M0	19.745	17.602
	HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1	M0	19.704	17.603
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	M0	19.631	17.605
5180/5200	Non HT/VHT40, 6 to 54 Mbps	6	39.971	36.219
	HT/VHT40, M8 to M15, M0.2 to M9.2	M8	40.208	36.102
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	M0	39.934	36.074
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	M0	39.502	36.091
5180/5200 5220/5240	Non HT/VHT80, 6 to 54 Mbps	6	81.713	76.071
	HT/VHT80, M0 to M7, M0.1 to M9.1	M0x1	84.473	76.324
	HT/VHT80, M8 to M15, M0.2 to M9.2	M0x2	83.525	75.949
	HT/VHT80 STBC, M0 to M7, M0.1 to M9.1	M0x1	84.703	76.294
5220/5240	Non HT/VHT40, 6 to 54 Mbps	6	40.828	36.202
	HT/VHT40, M8 to M15, M0.2 to M9.2	M8	39.329	36.067
	HT/VHT40, M16 to M23, M0.3 to M9.3	M16	39.358	36.040
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	M8	39.502	36.095
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	M0	39.763	36.102
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	M8	40.200	36.080
	HT/VHT40 Beam Forming, M16 to M23, M0.3 to M9.3	M16	39.198	36.050
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	M0	39.314	35.977
5240	Non HT/VHT20, 6 to 54 Mbps	6	19.396	16.551
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	6	19.368	16.519
	HT/VHT20, M8 to M15, M0.2 to M9.2	M8	19.769	17.608
	HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2	M8	19.787	17.608
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	M0	19.705	17.612

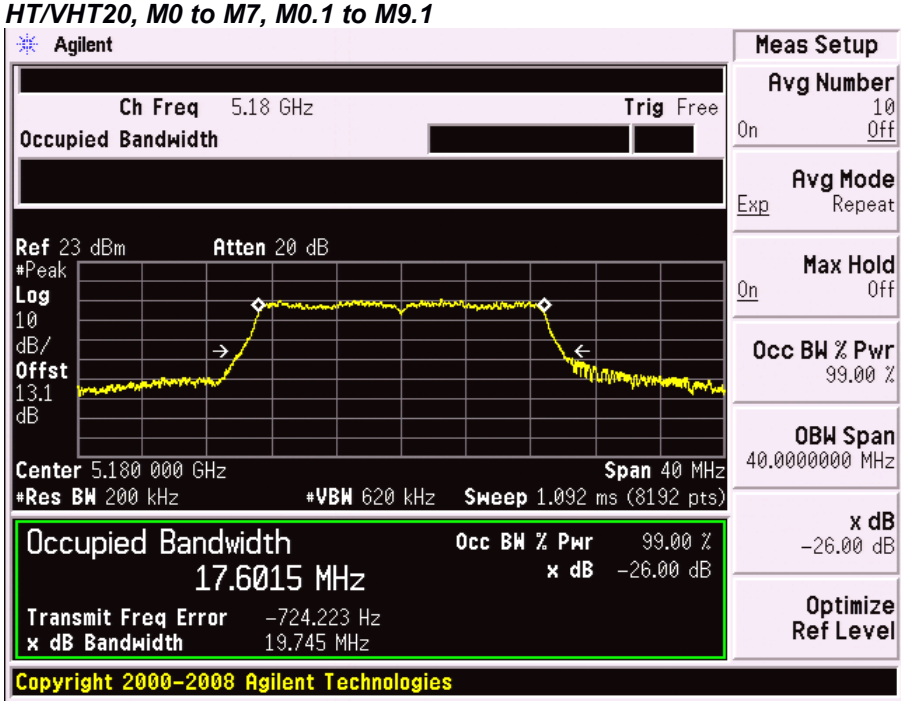
26dB / 99% Bandwidth, 5180 MHz, Non HT/VHT20, 6 to 54 Mbps



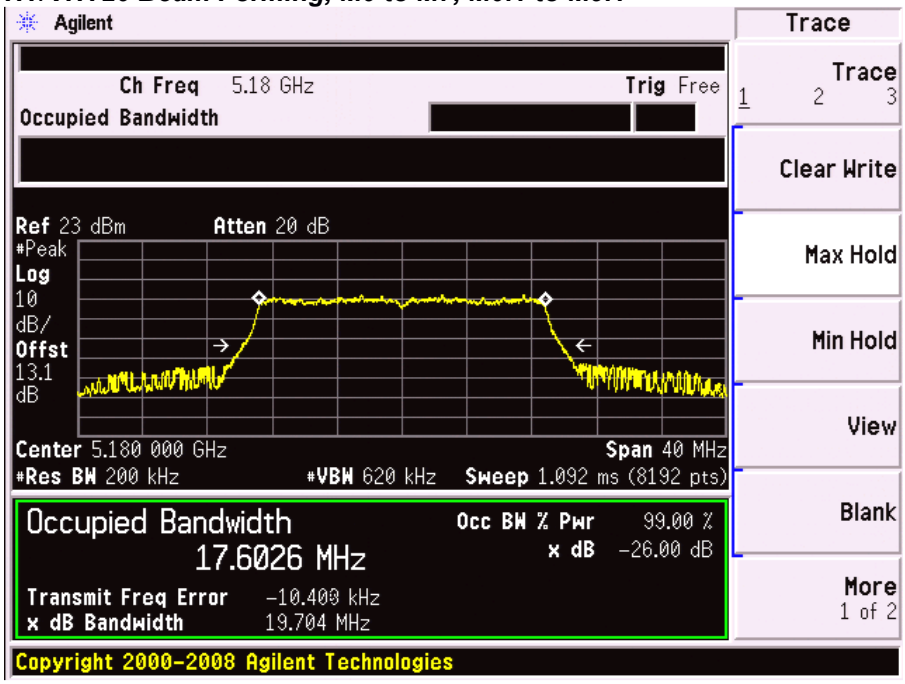
Non HT/VHT20 Beam Forming, 6 to 54 Mbps



HT/VHT20, M0 to M7, M0.1 to M9.1



HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1



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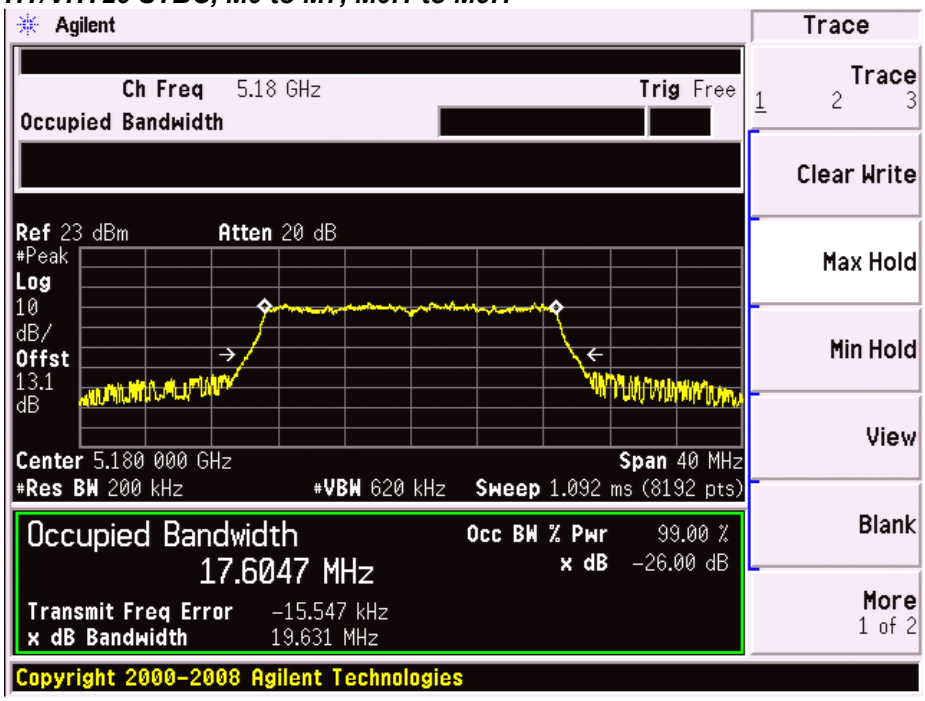
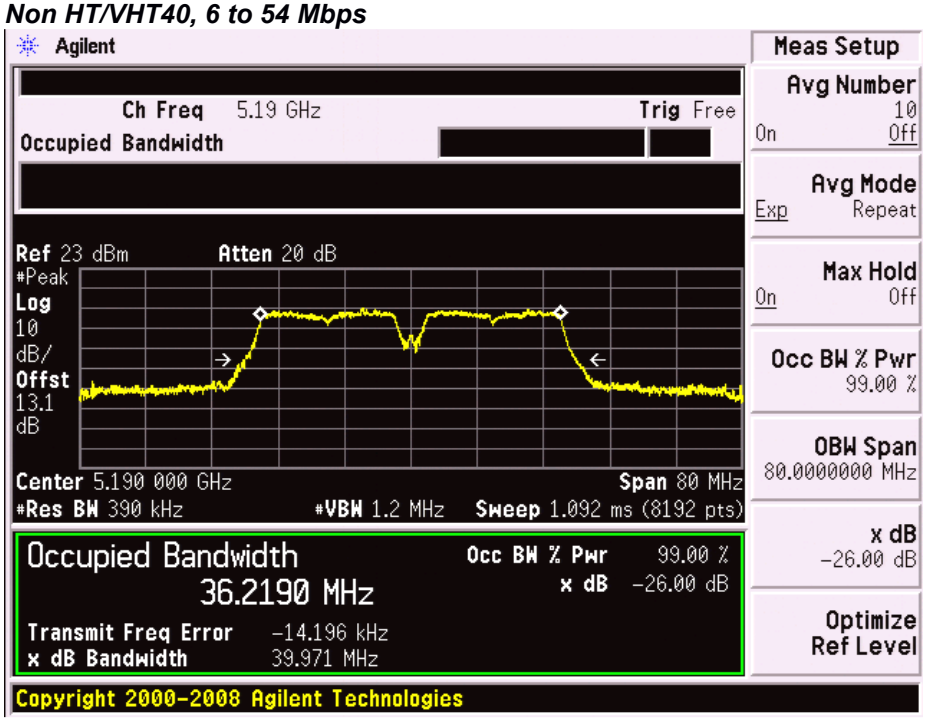
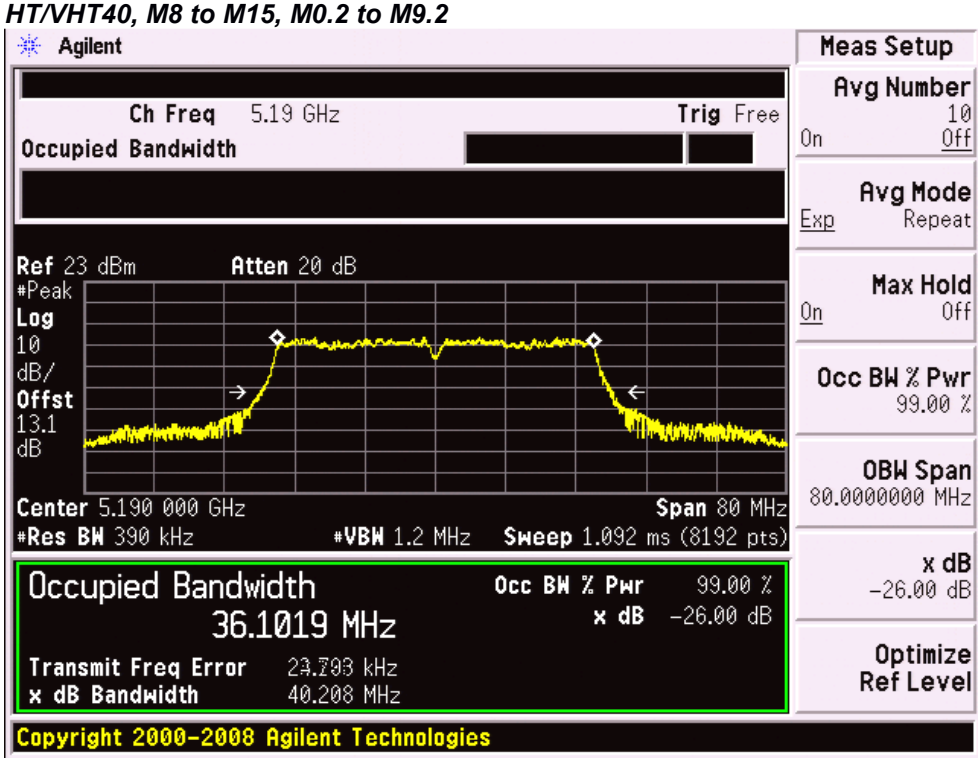


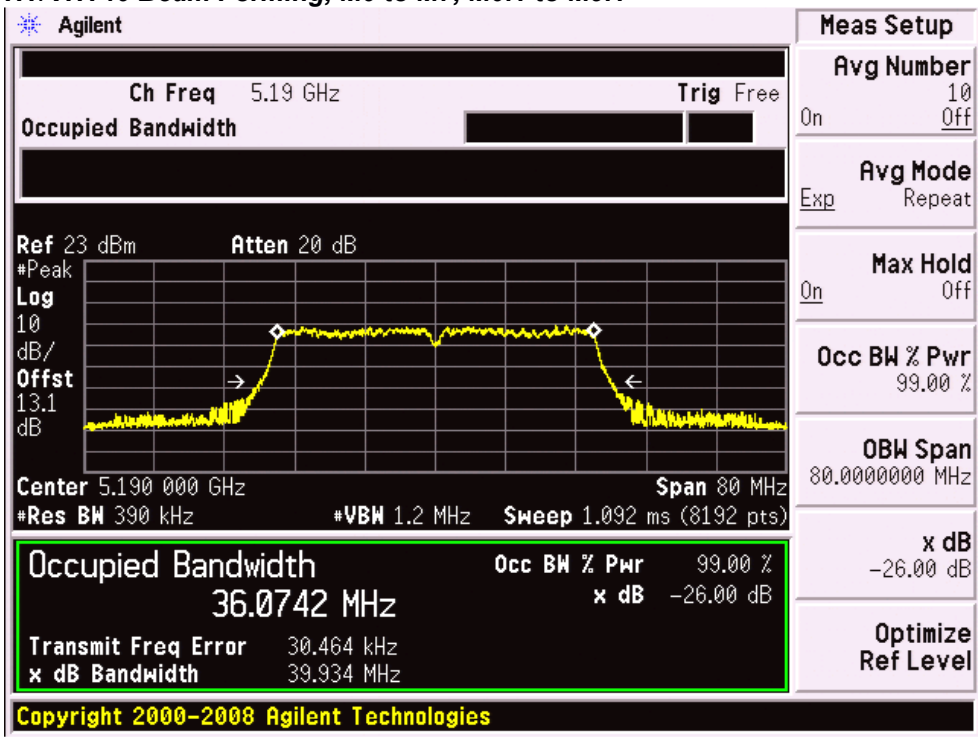
Non HT/VHT40, 6 to 54 Mbps



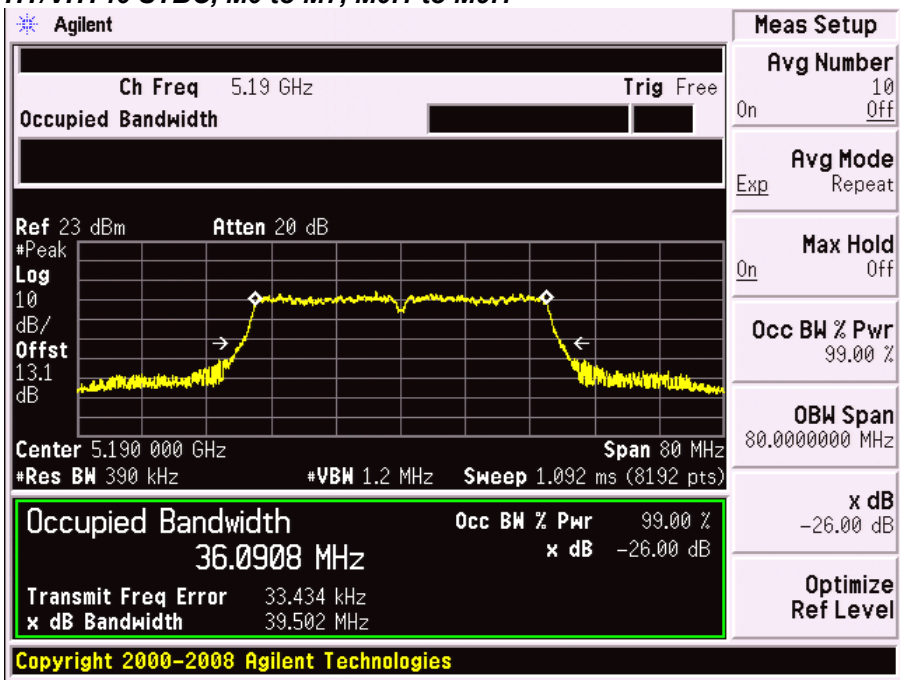
HT/VHT40, M8 to M15, M0.2 to M9.2



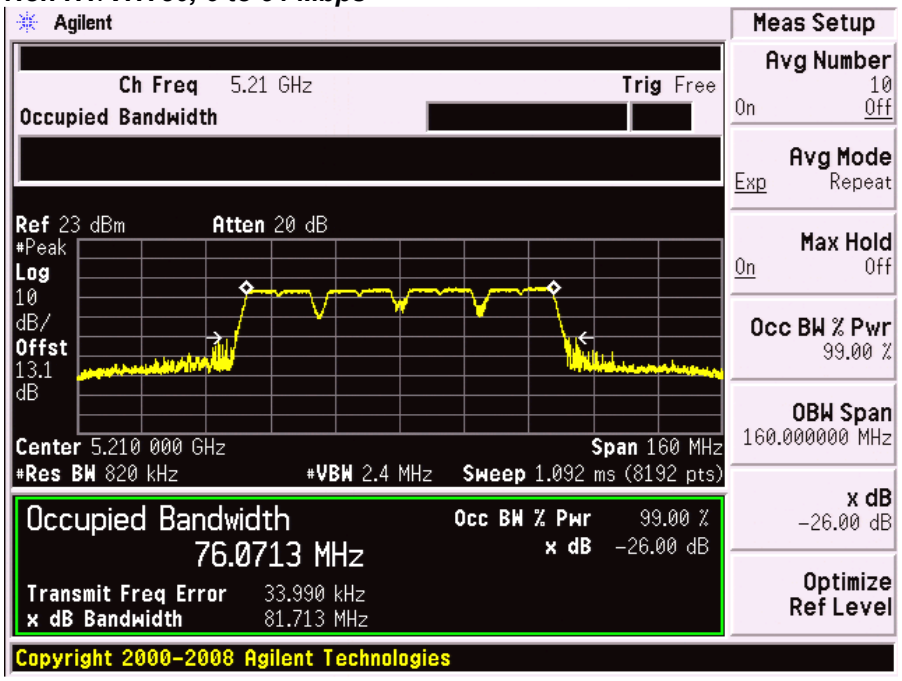
HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1



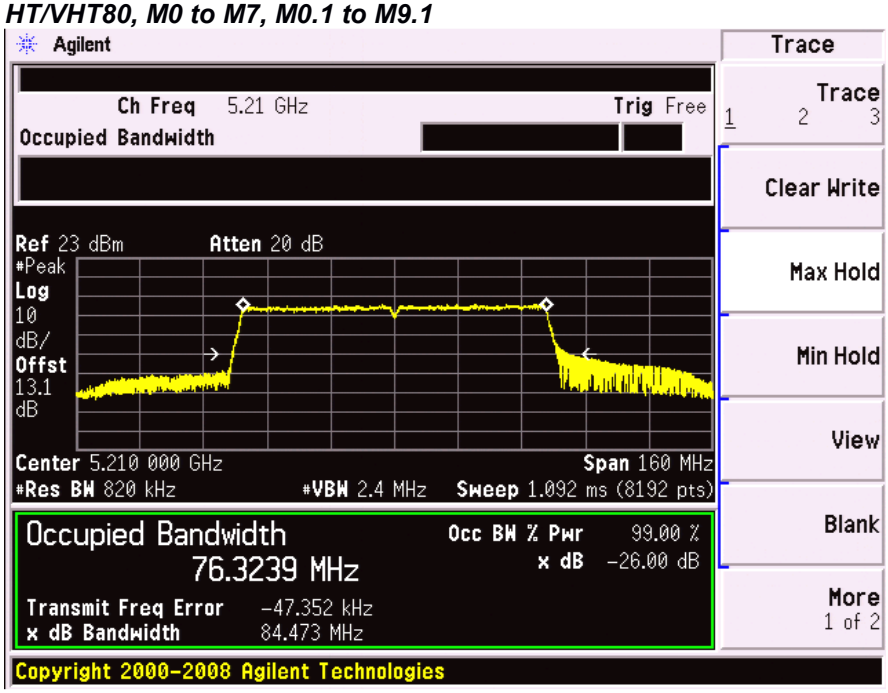
HT/VHT40 STBC, M0 to M7, M0.1 to M9.1



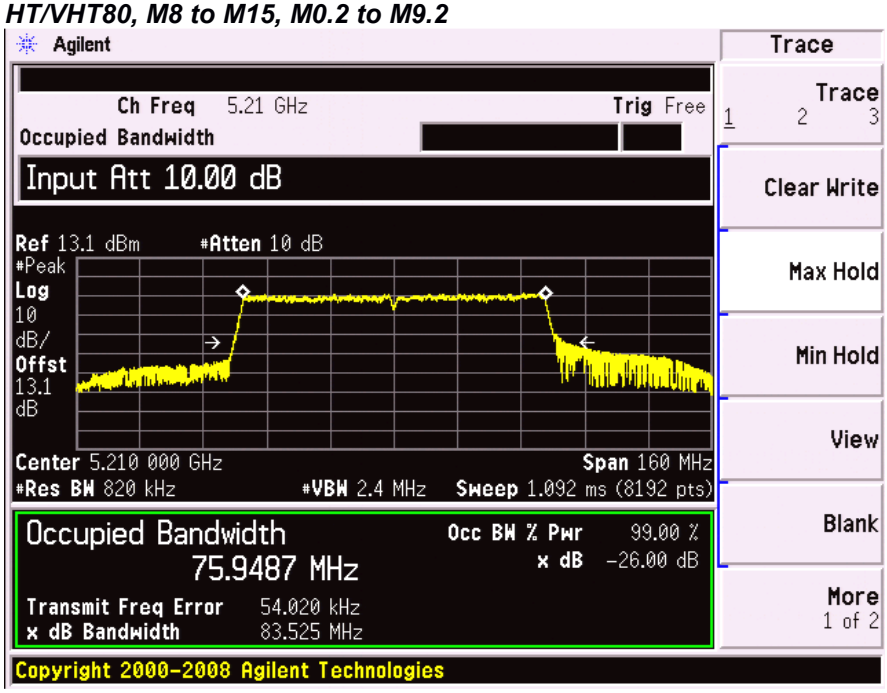
Non HT/VHT80, 6 to 54 Mbps



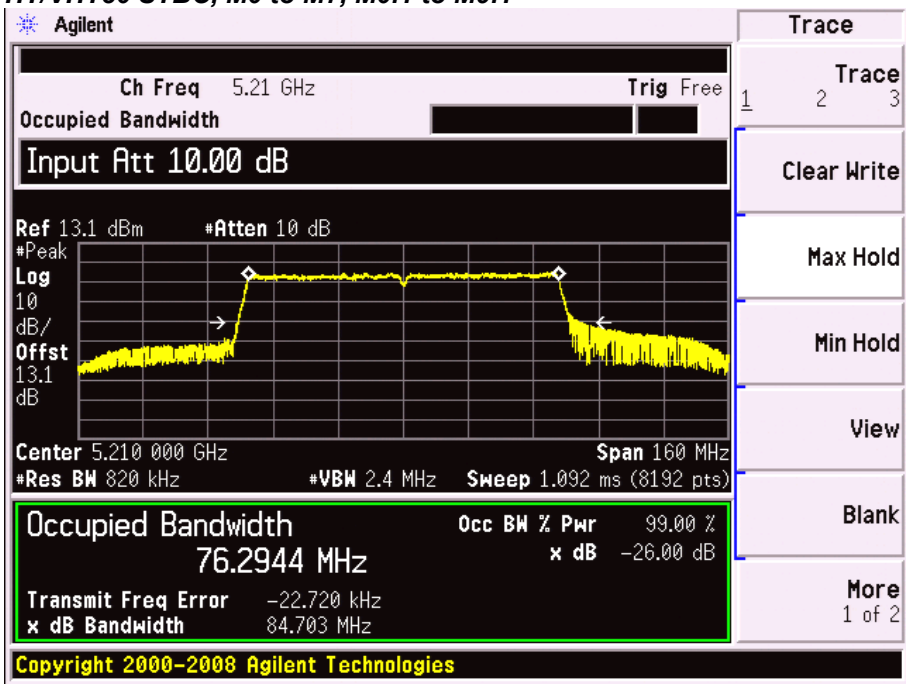
HT/VHT80, M0 to M7, M0.1 to M9.1



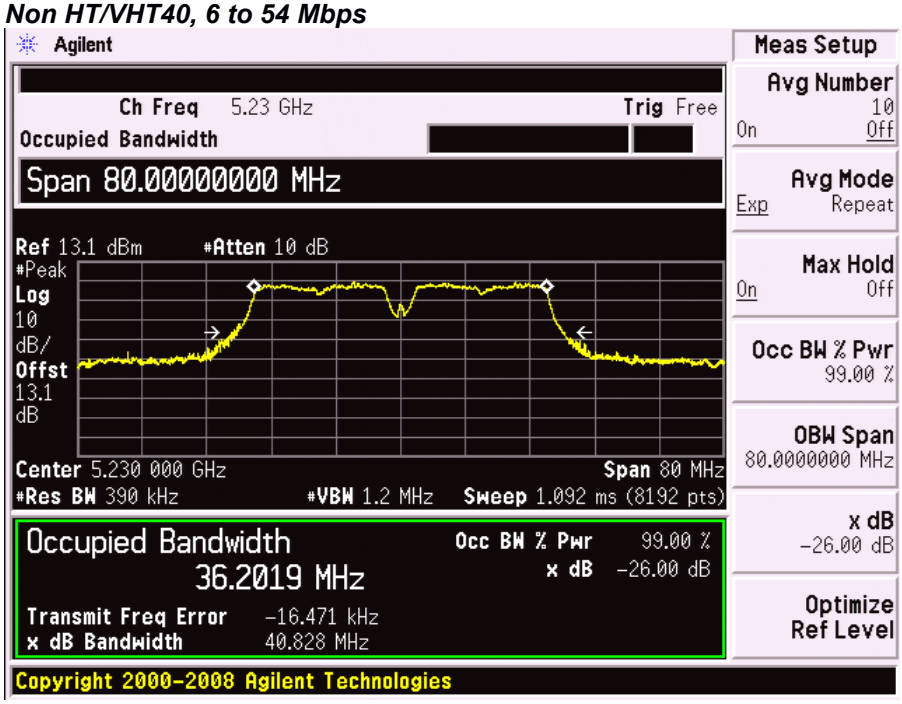
HT/VHT80, M8 to M15, M0.2 to M9.2



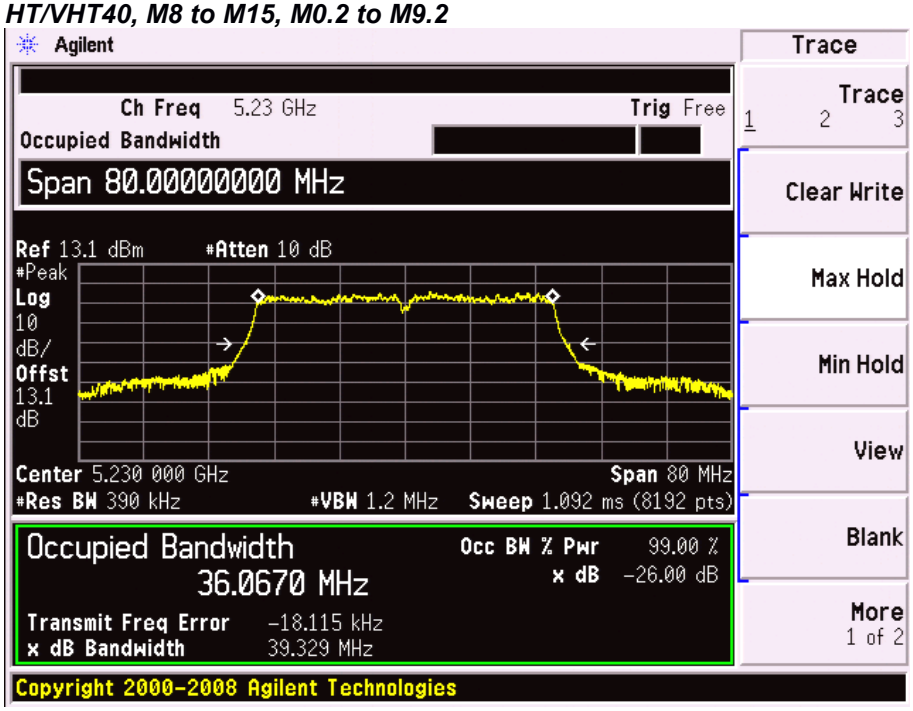
HT/VHT80 STBC, M0 to M7, M0.1 to M9.1



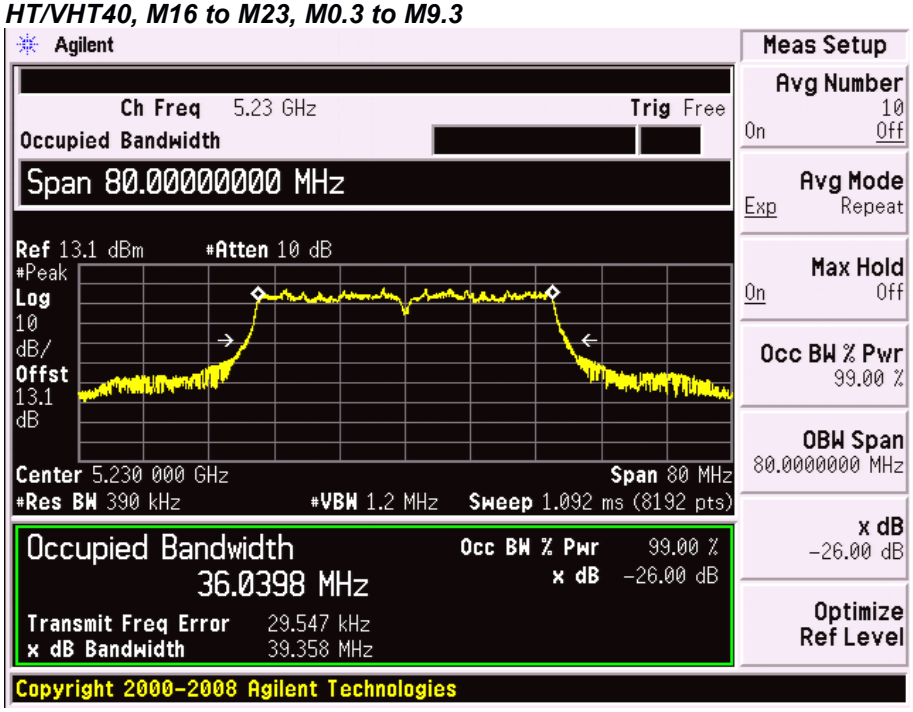
Non HT/VHT40, 6 to 54 Mbps



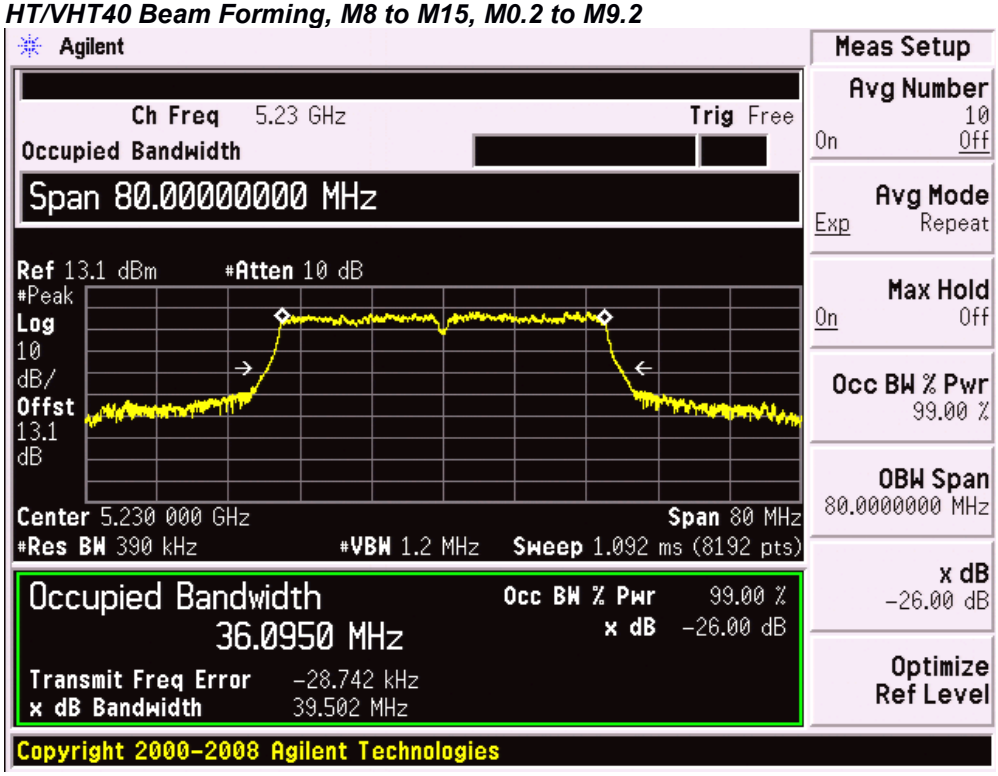
HT/VHT40, M8 to M15, M0.2 to M9.2



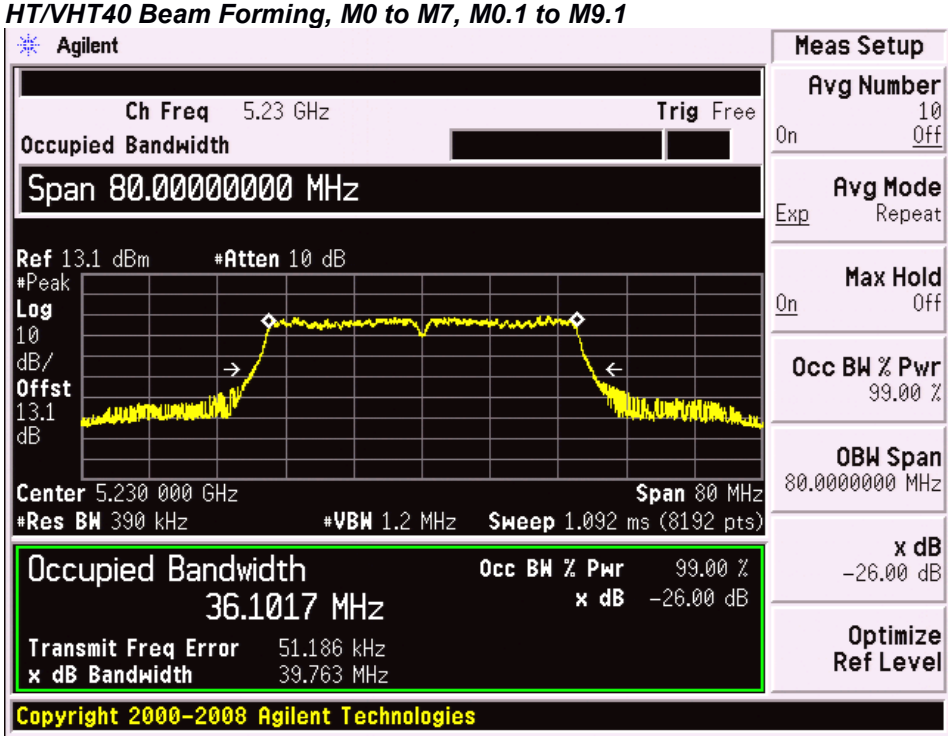
HT/VHT40, M16 to M23, M0.3 to M9.3



HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2



HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1



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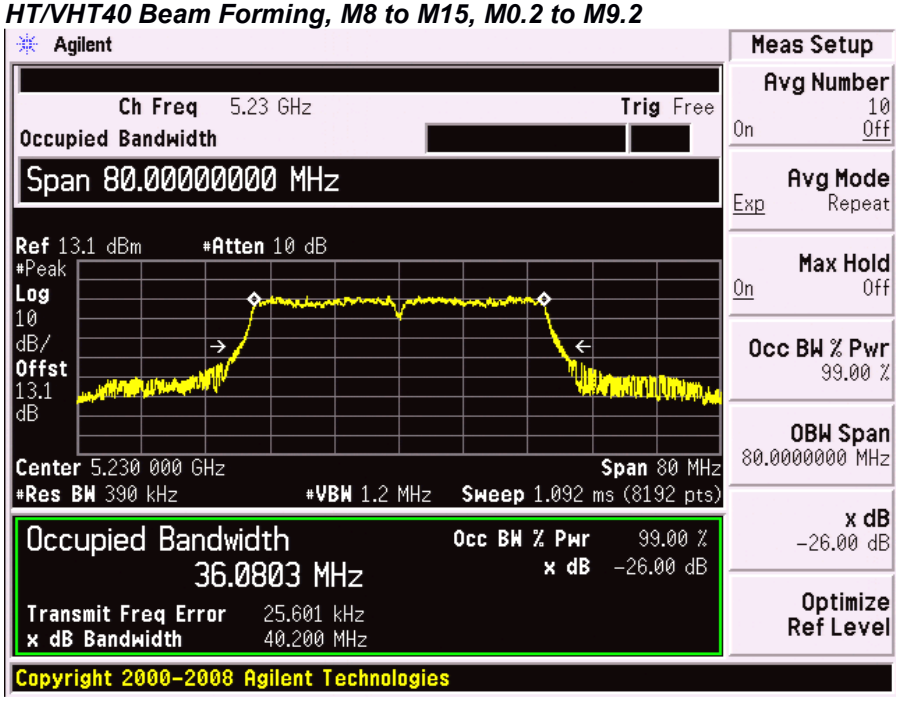

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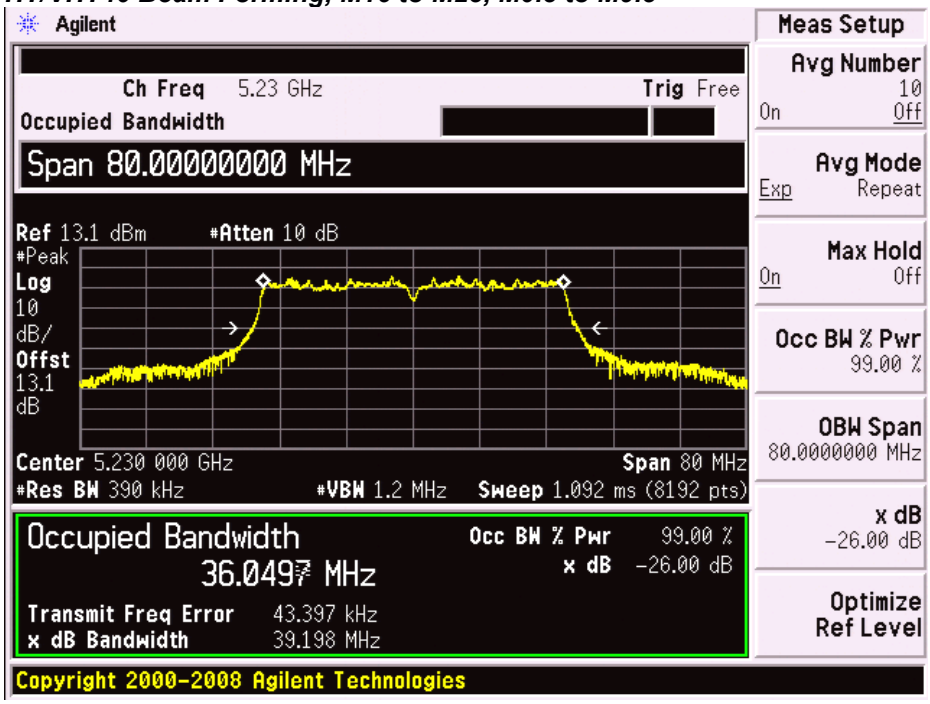
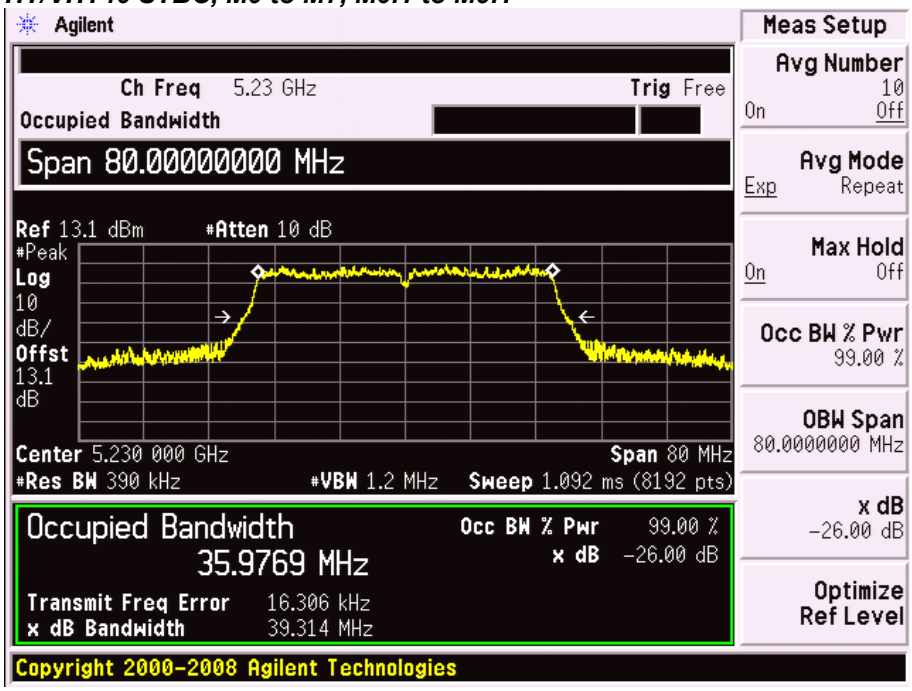
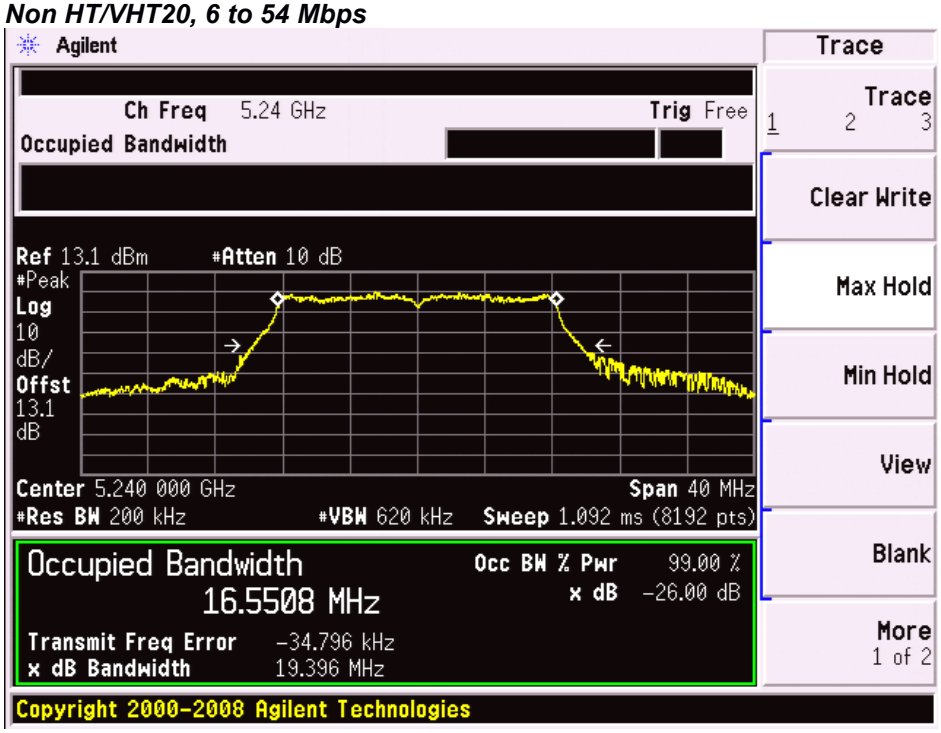


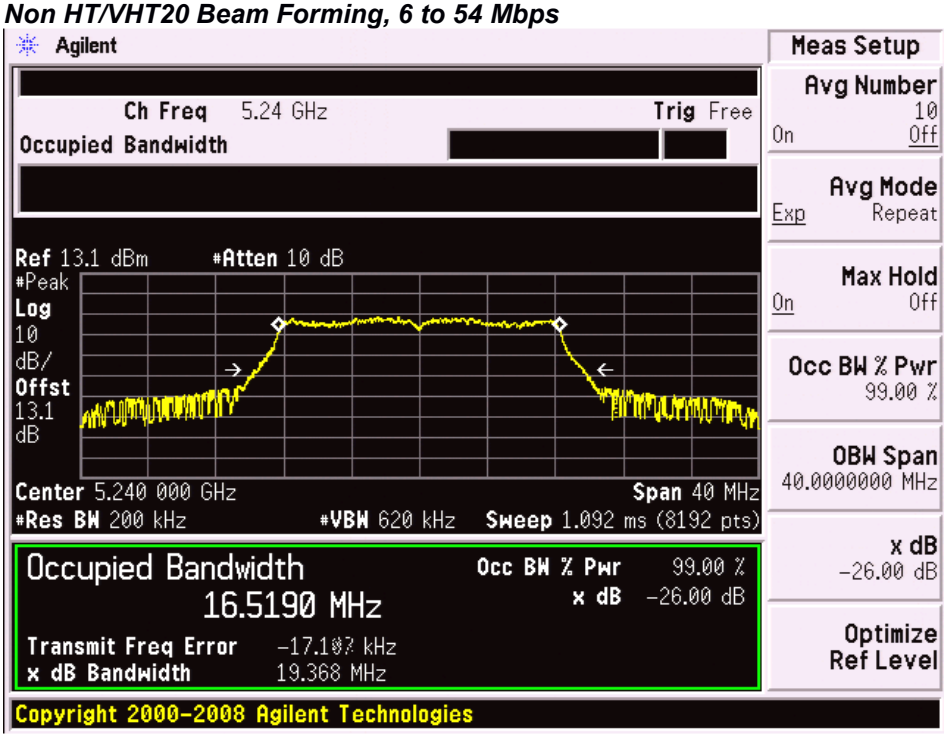
HT/VHT40 STBC, M0 to M7, M0.1 to M9.1



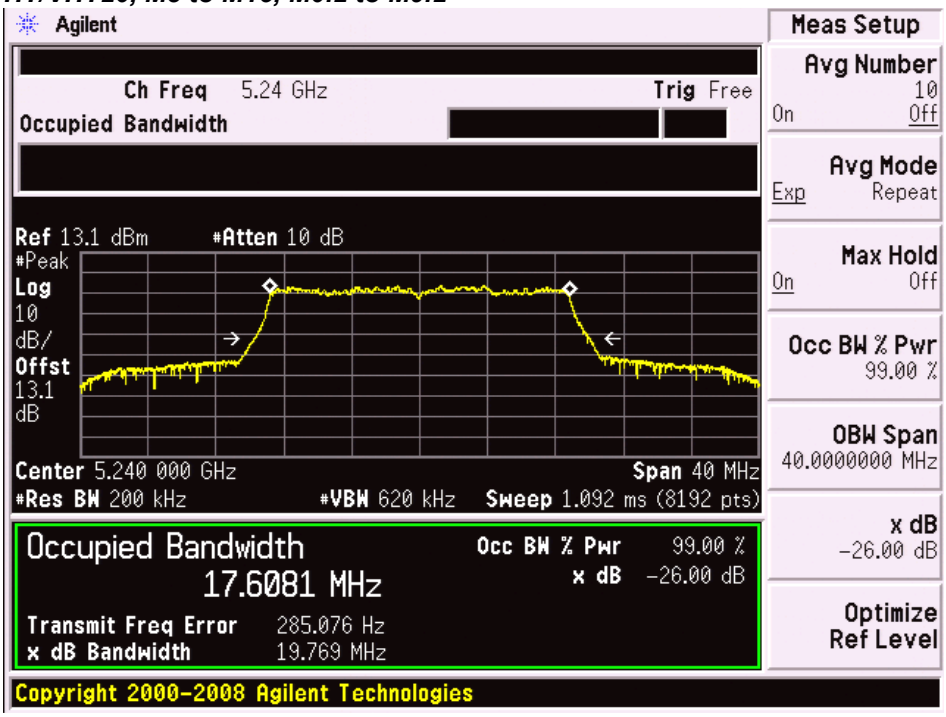
Non HT/VHT20, 6 to 54 Mbps



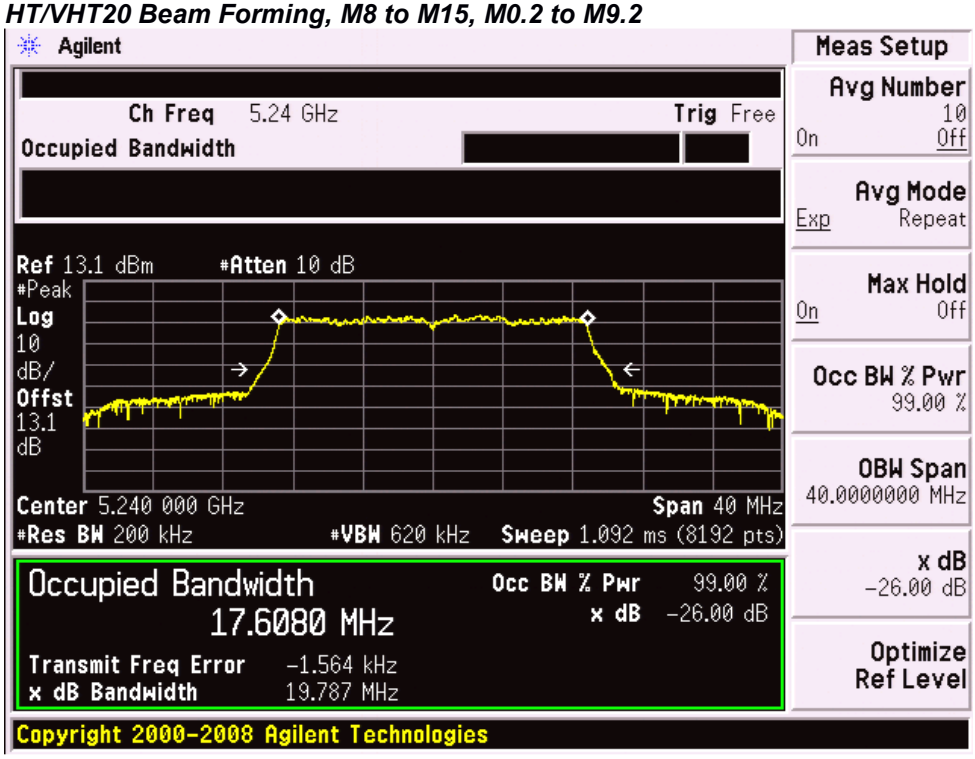
Non HT/VHT20 Beam Forming, 6 to 54 Mbps



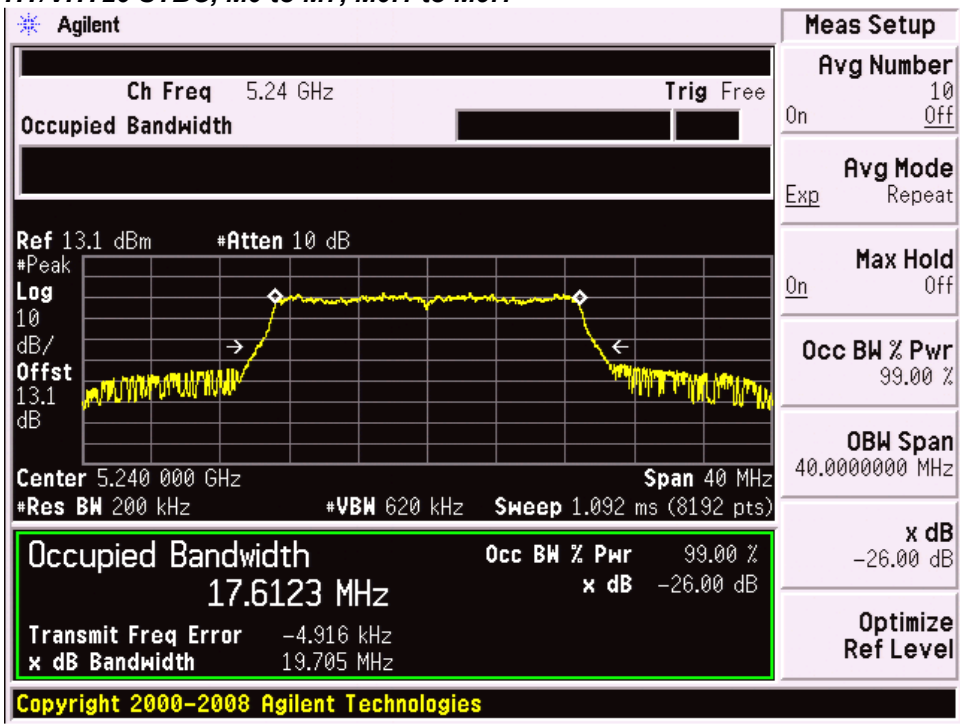
HT/VHT20, M8 to M15, M0.2 to M9.2



HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2



HT/VHT20 STBC, M0 to M7, M0.1 to M9.1



Peak Output Power

15.407: For the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The smallest 26dB bandwidth for all channels is 19.324MHz. The maximum conducted output power is calculated as 4dBm+10*log(19.324MHz) = 16.87dBm. This limit is further reduced to account for the antenna gain. In the case of NonHT20 Beamforming Quad mode, the correlated antenna gain is 13dBi. Thus, the limit for that case is 9.87dBm.

The maximum supported antenna gain is 7dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

The “measure-and-sum technique” is used for measuring in-band transmit power of a device. In the measure-and-sum approach, the conducted emission level is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units.

Method SA-2 from 789033 D01 General UNII Test Procedures Old Rules v01r04 was used.

Method SA-2 (trace averaging across on and off times of the EUT transmissions, followed by duty cycle correction).

(i) Measure the duty cycle, x, of the transmitter output signal as described in section B).

(ii) Set span to encompass the 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(iii) Set RBW = 1 MHz.

(iv) Set VBW ≥ 3 MHz.

(v) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(vi) Sweep time = auto.

(vii) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(viii) Do not use sweep triggering. Allow the sweep to “free run”.

(ix) Trace average at least 100 traces in power averaging (i.e., RMS) mode; however, the number of traces to be averaged shall be increased above 100 as needed to ensure that the average accurately represents the true average over the on and off periods of the transmitter.

(x) Compute power by integrating the spectrum across the 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument’s band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(xi) Add 10 log(1/x), where x is the duty cycle, to the measured power in order to compute the average power during the actual transmission times (because the measurement represents an average over both the on and off times of the transmission). For example, add 10 log(1/0.25) = 6 dB if the duty cycle is 25 percent.

Power Spectral Density

15.407: For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum supported antenna gain is 7dBi. The peak correlated gain for each mode is listed in the table below. See the Theory of Operation for details on the correlated gain for each mode.

The “Measure and add 10 log(N) dB technique”, where N is the number of outputs, is used for measuring in-band Power Spectral Density. With this technique, spectrum measurements are performed at each output of the device, and the quantity 10 log(4) (or 6dB) is added to the worst case spectrum value before comparing to the emission limit.

Test Procedure: follow Power procedure listed above, but also perform a Marker Peak Search function, and record this value as the Power Spectral Density.

Power Results Table

Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Duty Cycle	Tx 1 Max Power (dBm)	Tx 2 Max Power (dBm)	Tx 3 Max Power (dBm)	Tx 4 Max Power (dBm)	Total Tx Channel Power (dBm)	Total TX Channel Power - corrected for duty cycle (dBm)	Limit (dBm)	Margin (dB)
5180	Non HT/VHT20, 6 to 54 Mbps	1	7	99.3	12.58				12.58	12.61	15.89	3.28
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	4	13	99.4	0.61	-2.42	1.05	-1.39	5.71	5.74	9.88	4.15
	HT/VHT20, M0 to M7, M0.1 to M9.1	1	7	99.4	13.53				13.53	13.56	15.95	2.40
	HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1	2	10	99.4	5.58	5.83			8.72	8.74	12.95	4.20
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	3	7	99.4	5.64	5.51	6.18		10.56	10.58	15.93	5.35
5190	Non HT/VHT40, 6 to 54 Mbps	1	7	99.4	12.58				12.58	12.61	16.00	3.39
	HT/VHT40, M8 to M15, M0.2 to M9.2	4	7	97.1	6.6	5.16	5.68	5.23	11.73	11.86	16.00	4.14
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	4	13	98.4	2.34	1.87	1.94	1.41	6.82	6.89	10.00	3.11
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	4	7	98.4	6.55	5.62	6.11	5.41	11.97	12.04	16.00	3.96
5210	Non HT/VHT80, 6 to 54 Mbps	1	7	99.4	8.45				8.45	8.48	16.00	7.52
	HT/VHT80, M0 to M7, M0.1 to M9.1	4	7	95.3	0.6	0.17	0.56	-0.64	6.22	6.43	16.00	9.57
	HT/VHT80 Beam Forming, M8 to M15, M0.2 to M9.2	4	10	92.5	2.31	1.87	2.15	1.13	7.91	8.25	13.00	4.75
	HT/VHT80 STBC, M0 to M7, M0.1 to M9.1	4	7	95.5	8.31	7.43	7.61	6.94	13.62	13.82	16.00	2.18
5220/	Non HT/VHT40, 6 to 54 Mbps	1	7	99.3	13.96				13.96	13.99	16.00	2.01

	HT/VHT40, M8 to M15, M0.2 to M9.2	2	7	97.3	8.39	7.9			11.16	11.28	16.00	4.72
	HT/VHT40, M16 to M23, M0.3 to M9.3	4	7	96.2	8.83	7.2	7.94	7.81	14.01	14.17	16.00	1.83
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	2	7	97.2	11.52	11.03			14.29	14.42	16.00	1.58
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	4	13	98.4	2.59	2.08	2.85	2.22	8.47	8.54	10.00	1.46
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	4	10	97.3	4.68	3.4	4.09	4.13	10.12	10.24	13.00	2.76
	HT/VHT40 Beam Forming, M16 to M23, M0.3 to M9.3	4	8	96.3	6.91	5.08	5.59	5.36	10.88	11.04	15.00	3.96
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	2	7	98.5	11.54	11.18			12.16	12.23	16.00	3.77
5240	Non HT/VHT20, 6 to 54 Mbps	1	7	99.4	12.68				12.68	12.71	15.88	3.17
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	4	13	99.4	0.96	0.1	0.59	-0.01	6.45	6.47	9.87	3.40
	HT/VHT20, M8 to M15, M0.2 to M9.2	3	7	98.5	6.69	5.5	5.15		10.60	10.67	15.96	5.29
	HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2	3	9	98.6	6.61	5.53	5.13		10.57	10.64	10.96	0.33
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	3	7	99.3	5.74	5.63	5.97		10.55	10.58	15.95	5.36

PSD Results Table

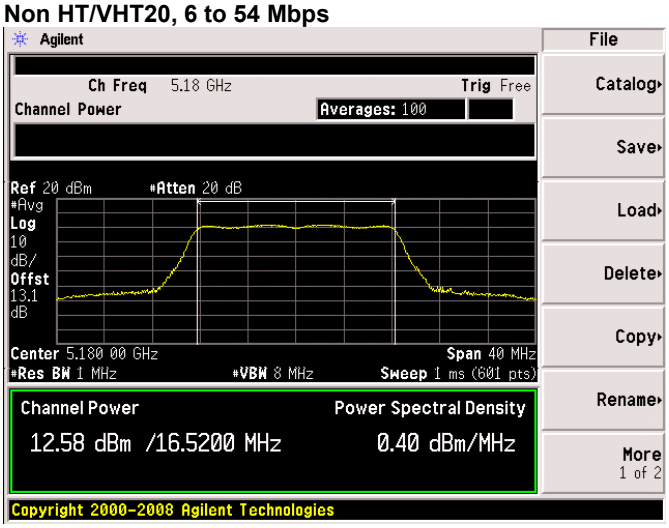
Frequency (MHz)	Mode	Tx Paths	Correlated Antenna Gain (dBi)	Duty Cycle	Tx 1 PSD (dBm/MHz)	Tx 2 PSD (dBm/MHz)	Tx 3 PSD (dBm/MHz)	Tx 4 PSD (dBm/MHz)	Total PSD (dBm/MHz)	Total TX Channel Power – corrected for duty cycle (dBm)	Limit (dBm/MHz)	Margin (dB)
5180	Non HT/VHT20, 6 to 54 Mbps	1	7	99.3	1.745				1.75	1.78	3	1.22
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	4	13	99.4	-9.963	-11.501	-10.531	-10.405	-4.54	-4.52	-3	1.52
	HT/VHT20, M0 to M7, M0.1 to M9.1	1	7	99.4	2.817				2.82	2.84	3	0.16
	HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1	2	10	99.4	-5.196	-4.758			-1.96	-1.94	0	1.94
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	3	9	99.4	-5.33	-5.465	-4.474		-0.30	-0.27	1	1.27
5190	Non HT/VHT40, 6 to 54 Mbps	1	7	99.4	-0.661				-0.66	-0.63	3	3.63
	HT/VHT40, M8 to M15, M0.2 to M9.2	4	10	97.1	-7.067	-8.773	-7.703	-8.126	-1.85	-1.72	0	1.72
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	4	13	98.4	-11.601	-12.391	-11.224	-11.851	-11.40	-11.33	-3	8.33
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	4	10	98.4	-7.496	-8.488	-7.35	-7.917	-1.77	-1.70	0	1.70
5210	Non HT/VHT80, 6 to 54 Mbps	1	7	99.4	-8.311				-8.31	-8.28	3	11.28
	HT/VHT80, M0 to M7, M0.1 to M9.1	4	13	95.3	-17.668	-18.851	-14.955	-17.845	-11.05	-10.84	-3	7.84
	HT/VHT80 Beam Forming, M8 to M15, M0.2 to M9.2	4	10	92.5	-12.69	-13.339	-12.684	-12.825	-6.86	-6.52	0	6.52
	HT/VHT80 STBC, M0 to M7, M0.1 to M9.1	4	10	95.5	-8.557	-9.903	-9.309	-9.667	-3.31	-3.11	0	3.11
5220/ 5240	Non HT/VHT40, 6 to 54 Mbps	1	7	99.3	-1.514				-1.51	-1.48	3	4.48

	HT/VHT40, M8 to M15, M0.2 to M9.2	2	7	97.3	-5.471	-6.244			-2.83	-2.71	3	5.71
	HT/VHT40, M16 to M23, M0.3 to M9.3	4	8	96.2	-4.792	-6.445	-5.822	-5.959	0.31	0.48	2	1.52
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	2	7	97.2	-2.626	-2.799			0.30	0.42	3	2.58
	HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1	4	13	98.4	-11.523	-11.385	-11.349	-11.255	-5.36	-5.29	-3	2.29
	HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2	4	10	97.3	-9.041	-10.628	-8.994	-9.296	-3.42	-3.30	0	3.30
	HT/VHT40 Beam Forming, M16 to M23, M0.3 to M9.3	4	8	96.3	-6.507	-8.753	-8.008	-7.91	-2.57	-2.40	2	4.40
	HT/VHT40 STBC, M0 to M7, M0.1 to M9.1	2	7	98.5	-1.695	-2.834			-1.17	-1.11	3	4.11

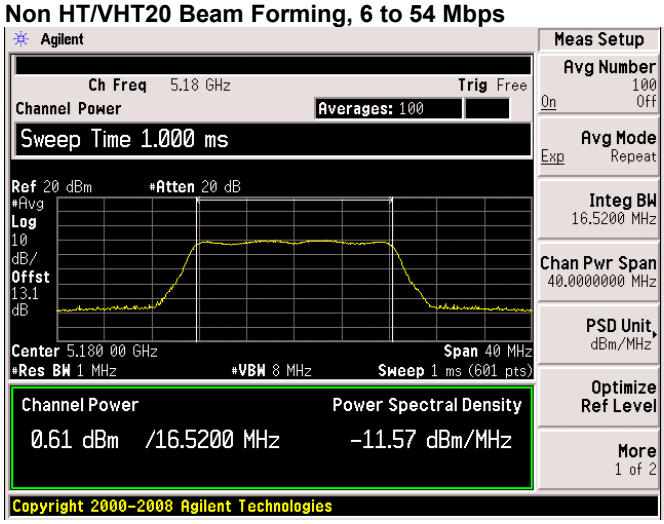
5240	Non HT/VHT20, 6 to 54 Mbps	1	7	99.4	1.891				1.89	1.92	3	1.08
	Non HT/VHT20 Beam Forming, 6 to 54 Mbps	4	13	99.4	-9.447	-9.705	-9.537	-9.267	-3.47	-3.44	-3	0.44
	HT/VHT20, M8 to M15, M0.2 to M9.2	3	9	98.5	-4.158	-5.526	-5.284		-0.18	-0.11	1	1.11
	HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2	3	9	98.6	-4.077	-4.958	-5.151		0.07	0.13	1	0.87
	HT/VHT20 STBC, M0 to M7, M0.1 to M9.1	3	9	99.3	-5.138	-5.425	-4.221		-0.13	-0.10	1	1.10

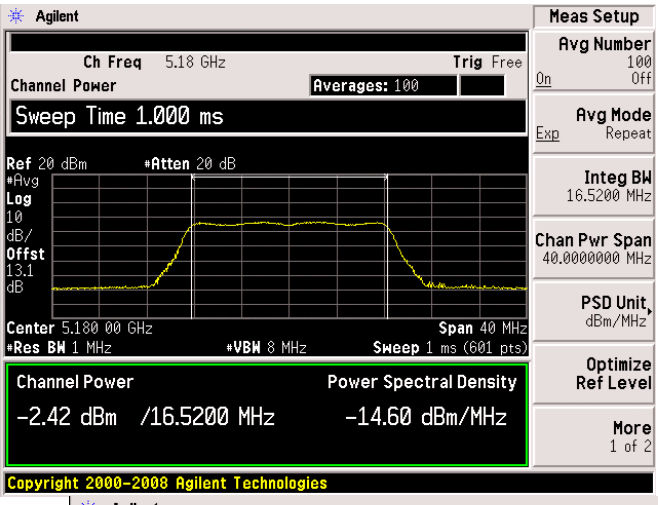
Power Data

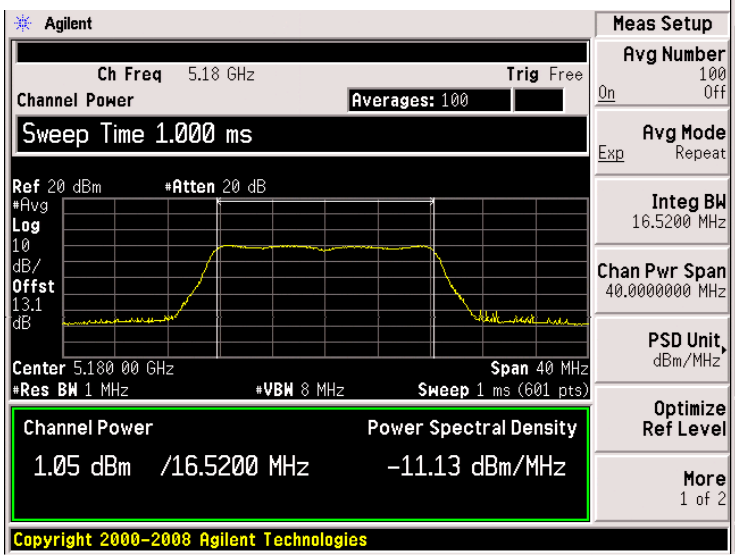
Non HT/VHT20, 6 to 54 Mbps

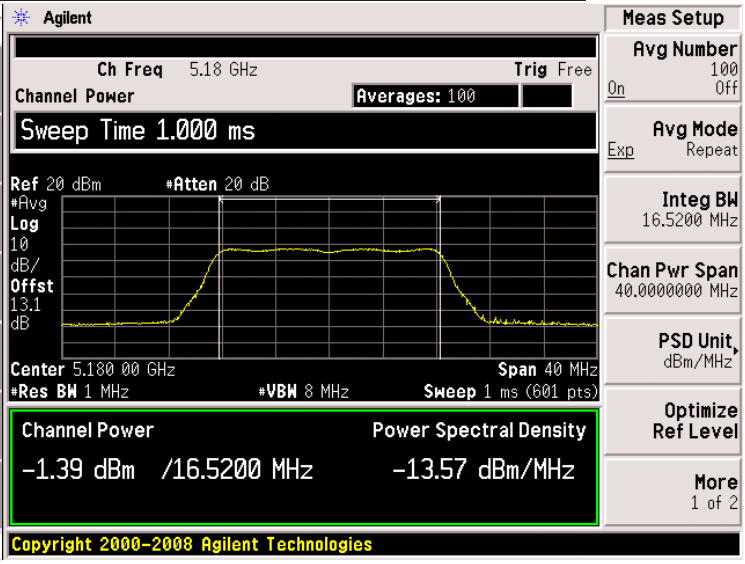


Non HT/VHT20 Beam Forming, 6 to 54 Mbps

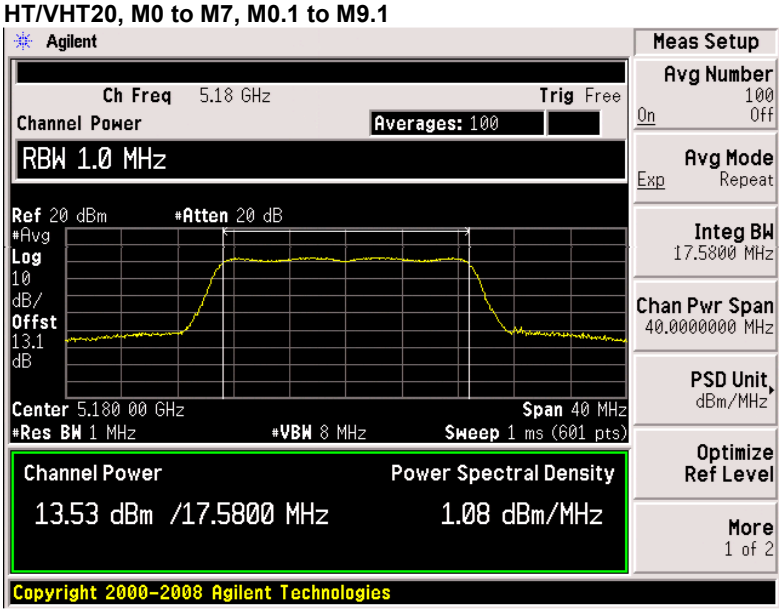




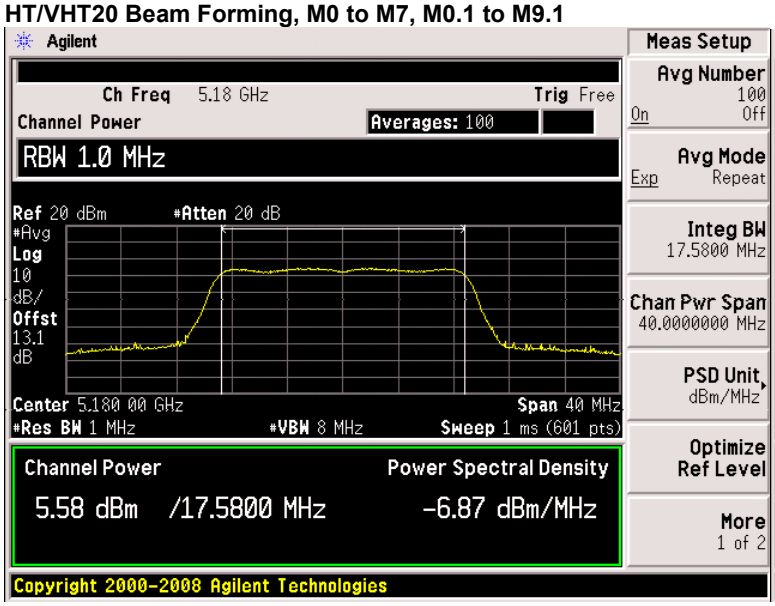


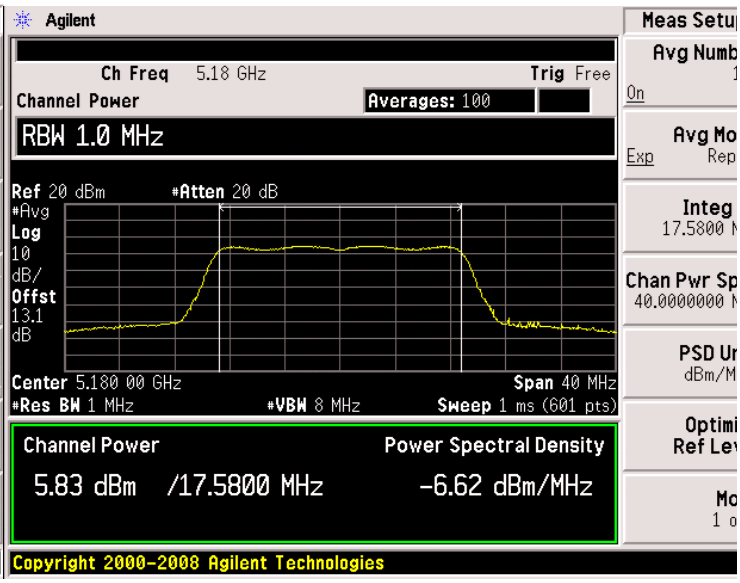


HT/VHT20, M0 to M7, M0.1 to M9.1

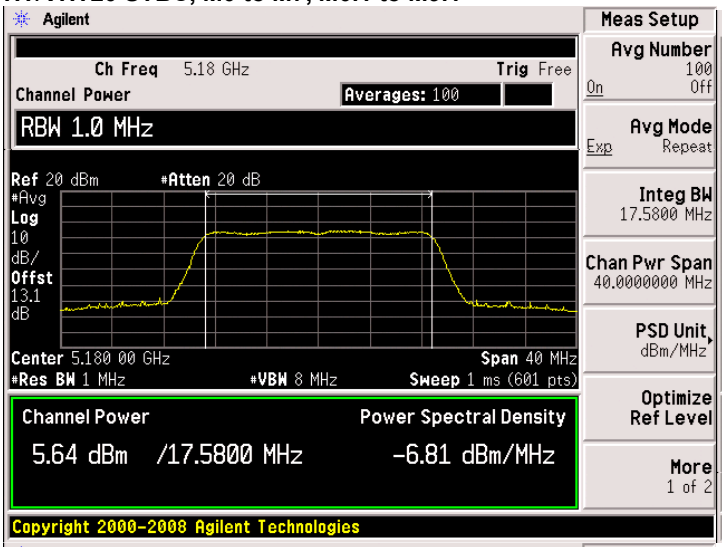


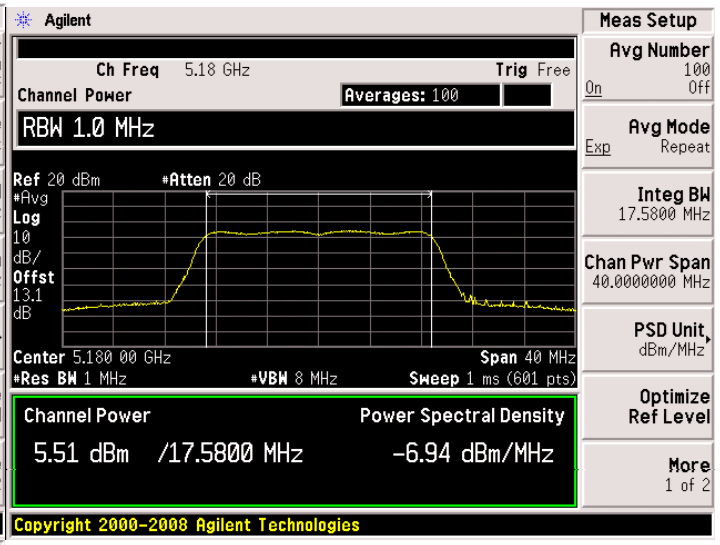
HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1

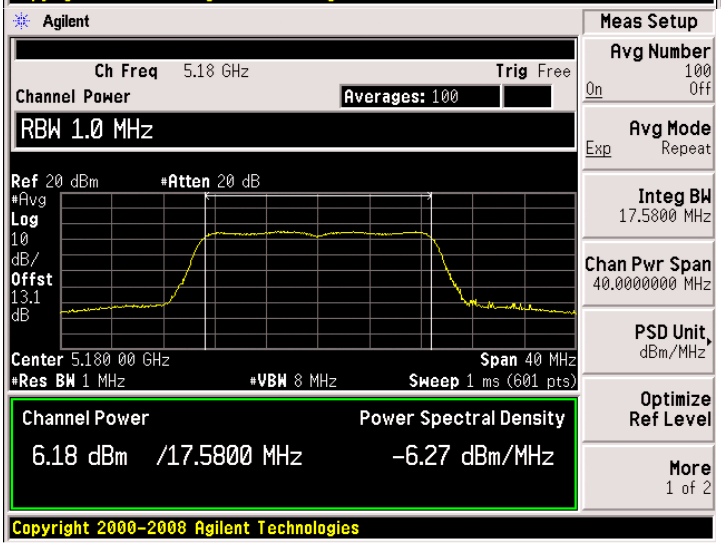




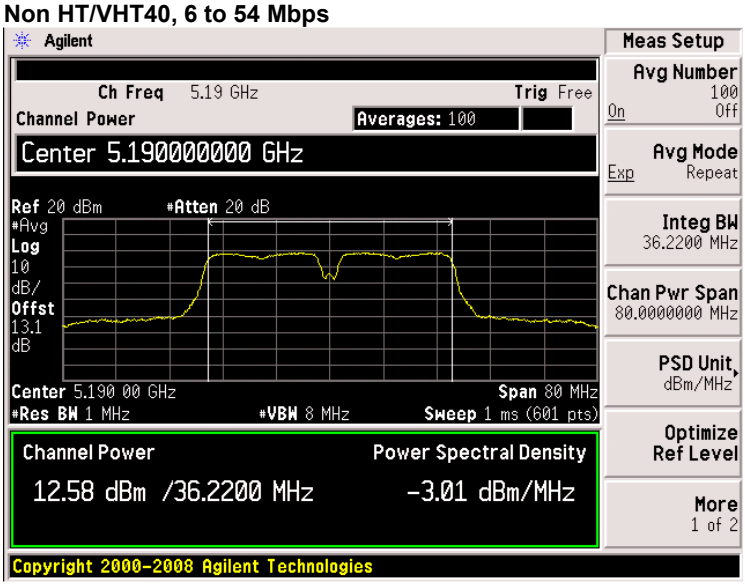
HT/VHT20 STBC, M0 to M7, M0.1 to M9.1



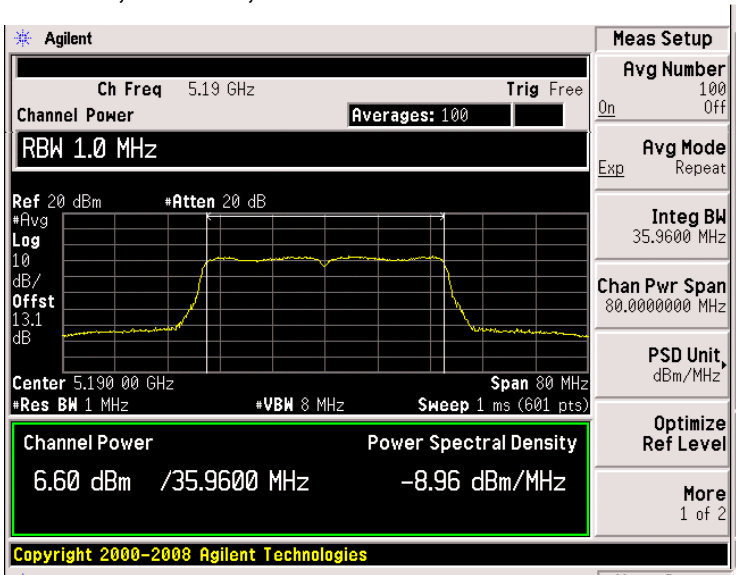


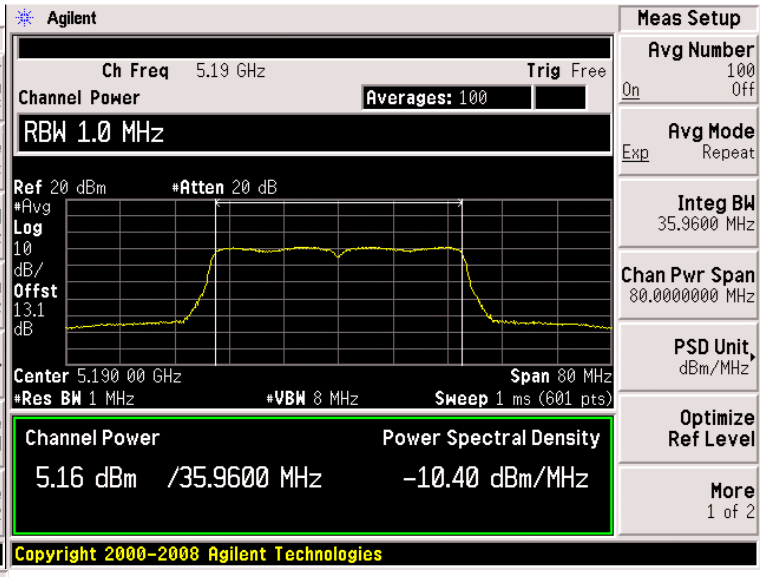


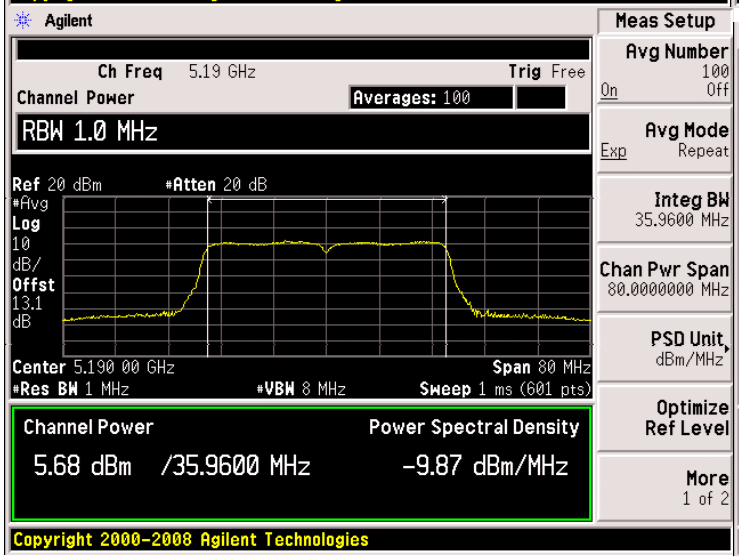
Non HT/VHT40, 6 to 54 Mbps

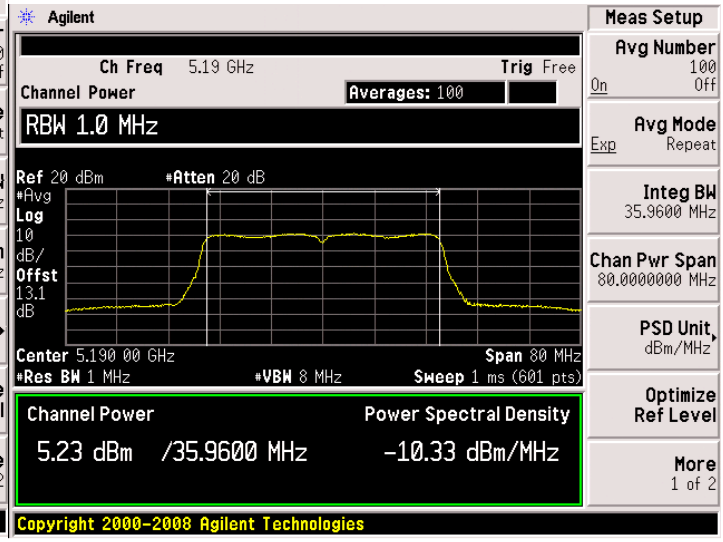


HT/VHT40, M8 to M15, M0.2 to M9.2

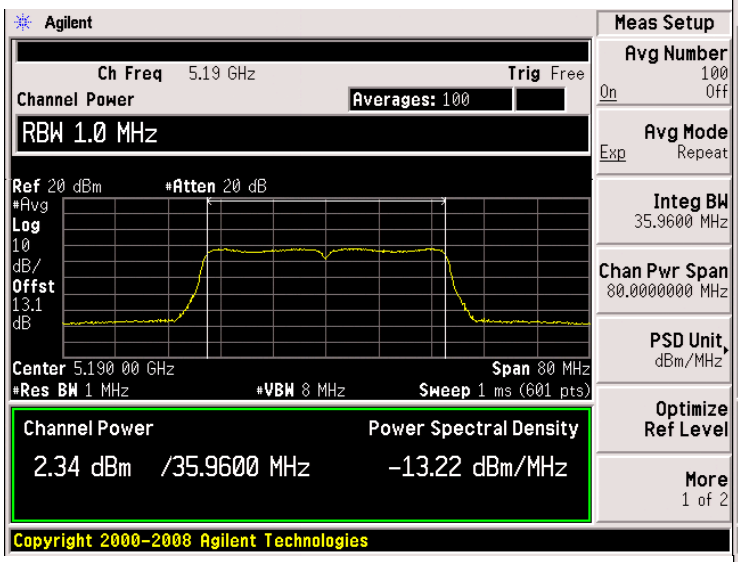


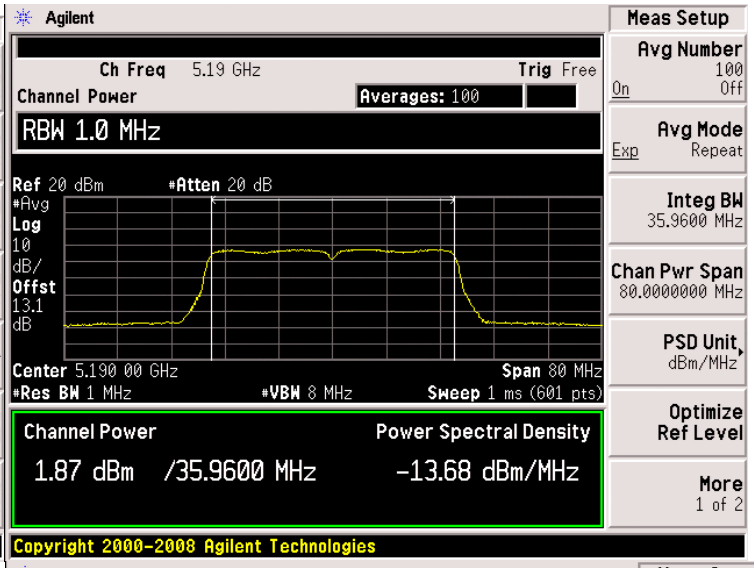


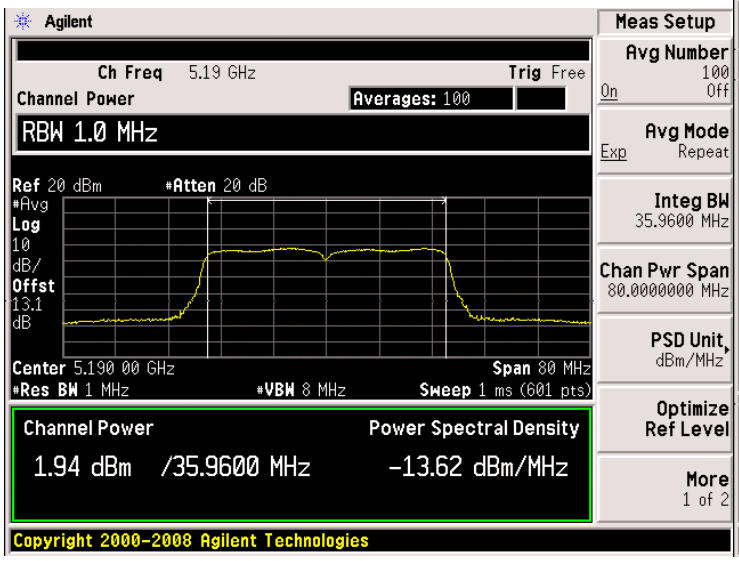


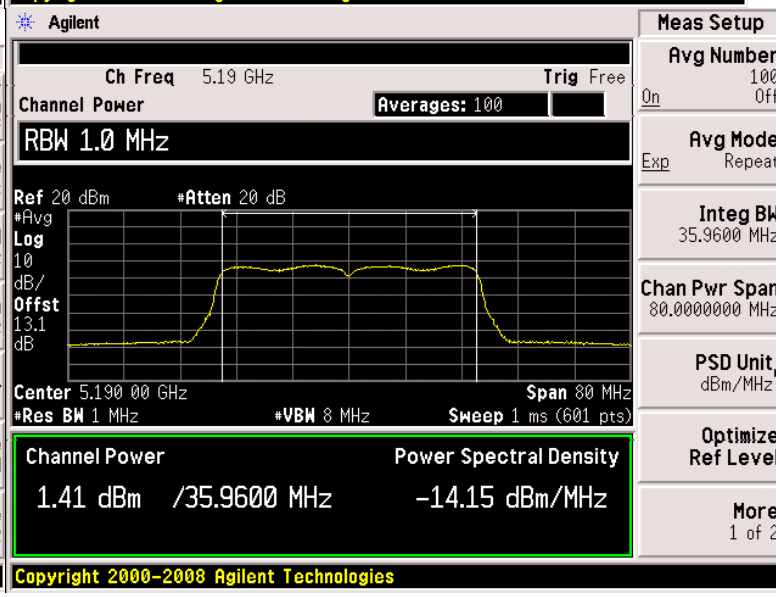


HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1

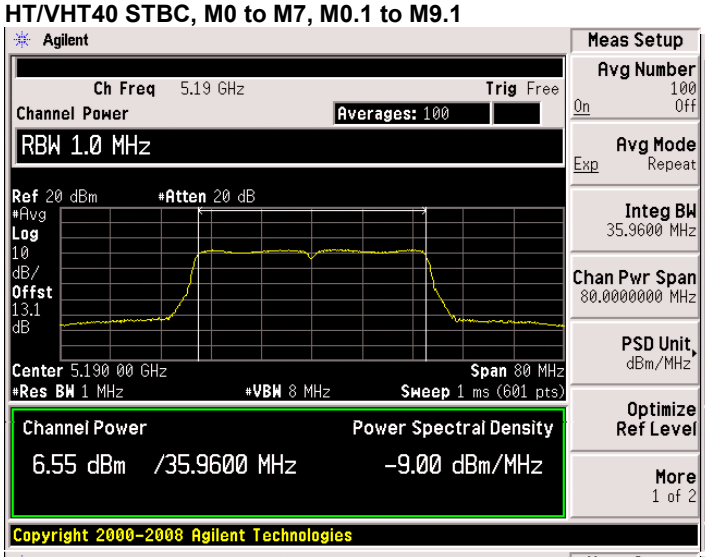


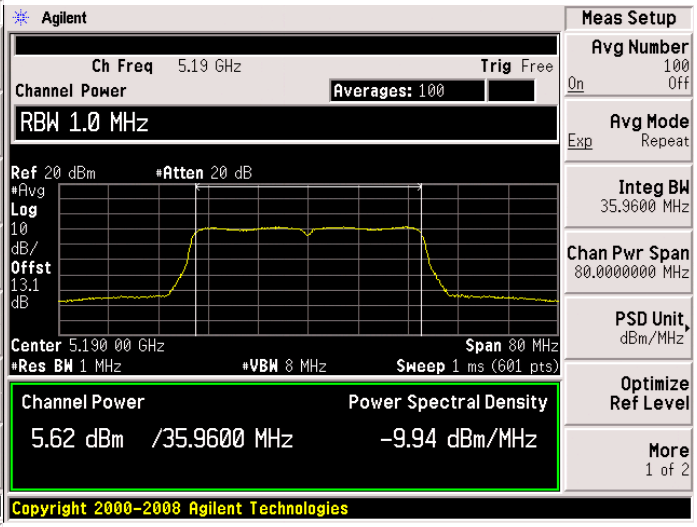


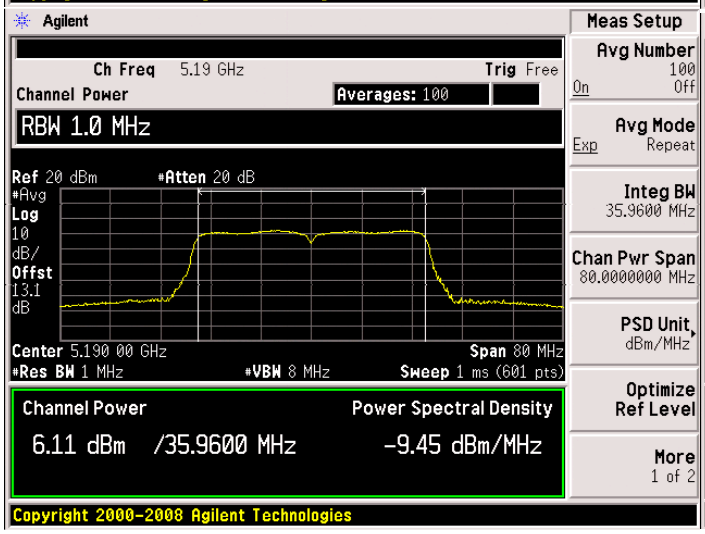


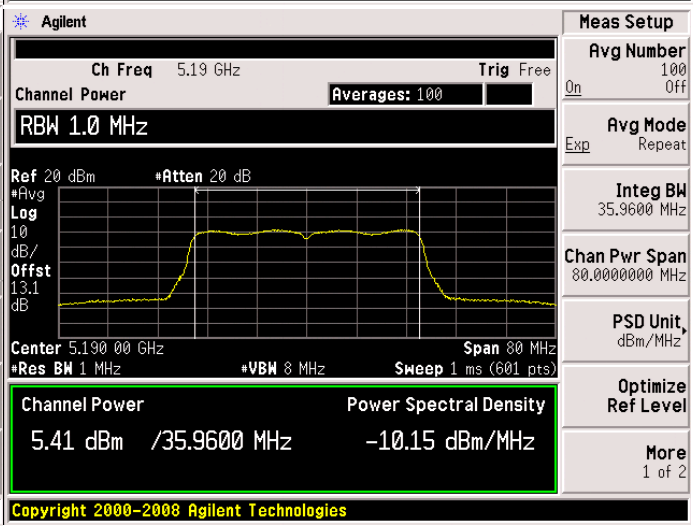


HT/VHT40 STBC, M0 to M7, M0.1 to M9.1

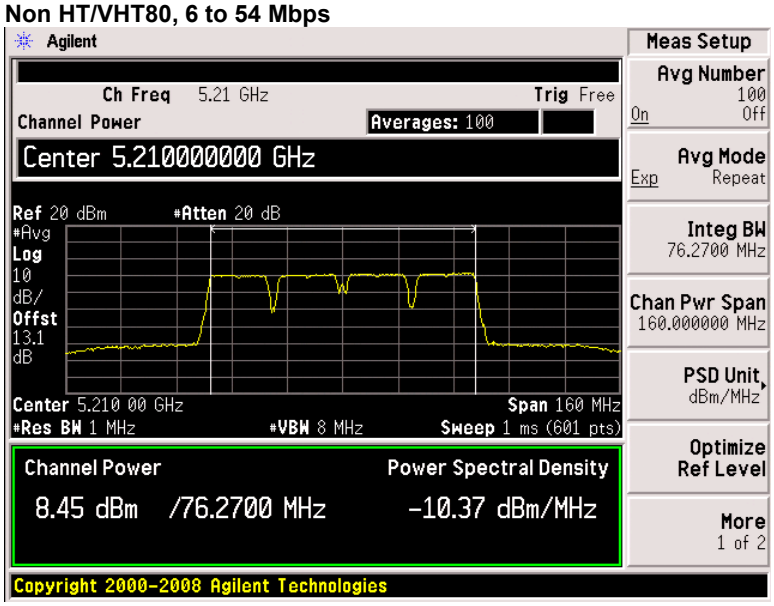




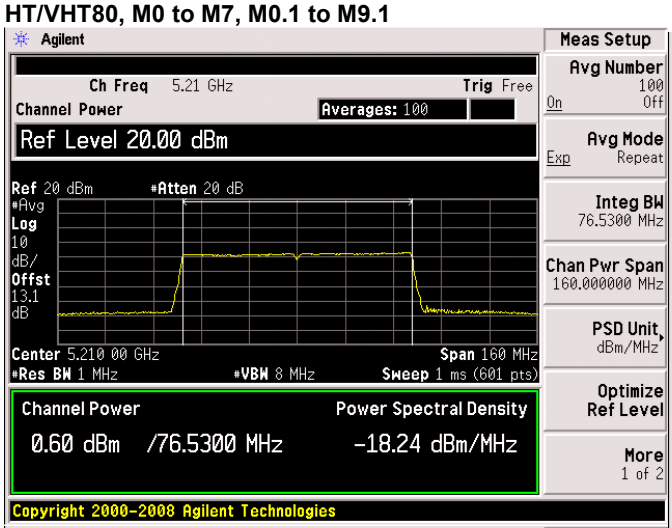


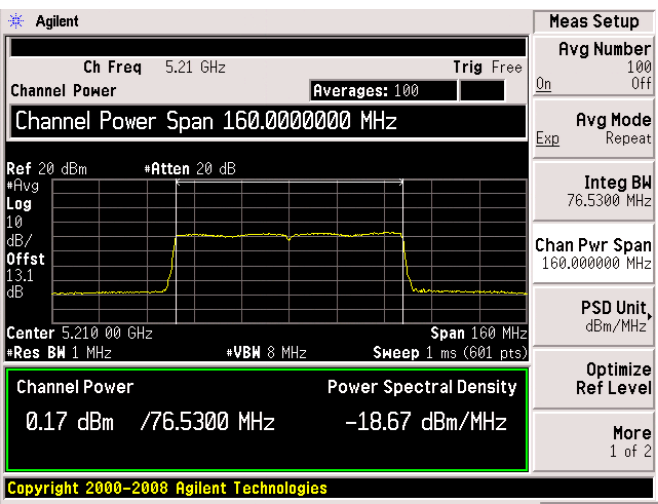


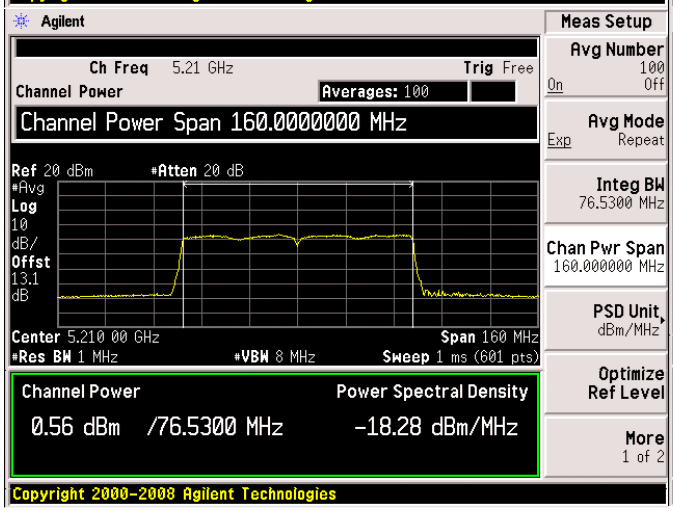
Non HT/VHT80, 6 to 54 Mbps

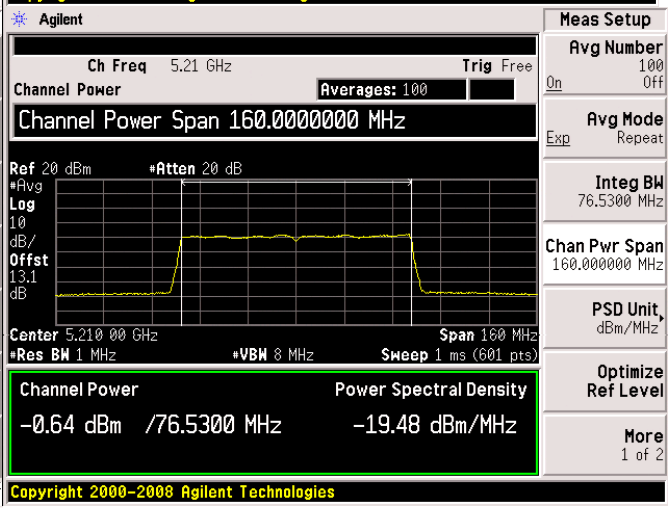


HT/VHT80, M0 to M7, M0.1 to M9.1

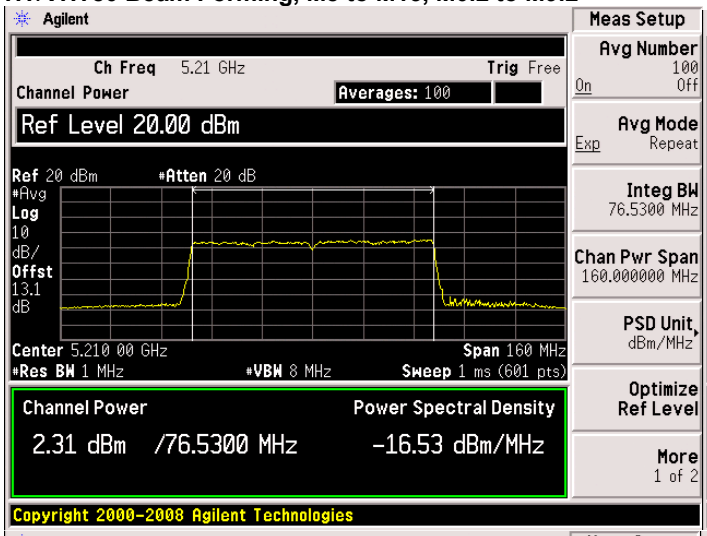


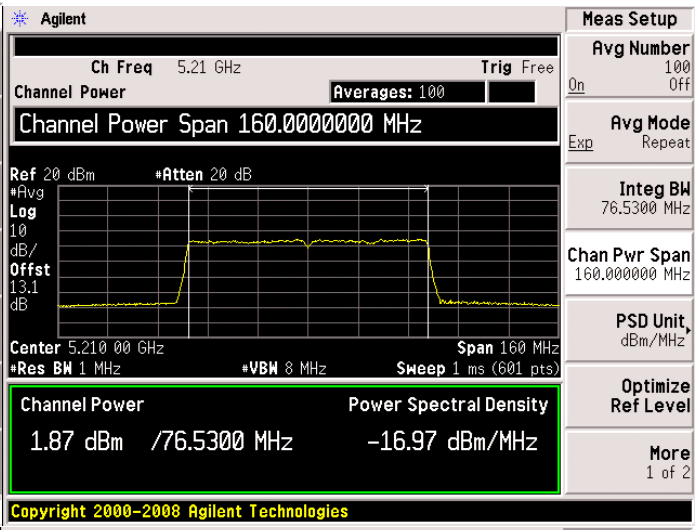


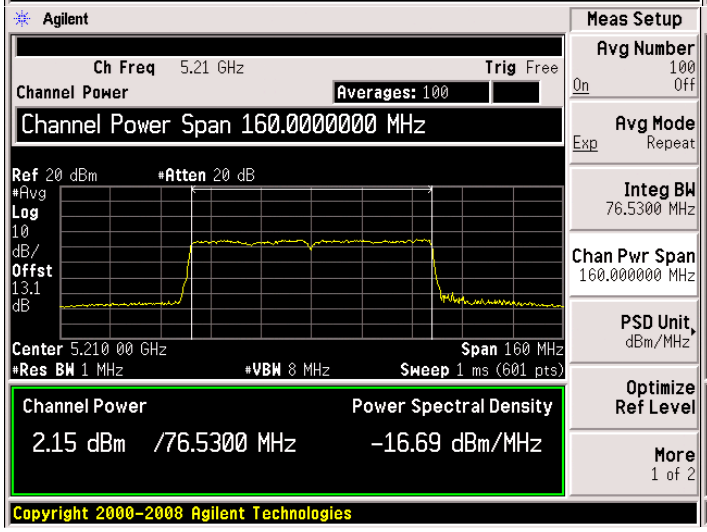


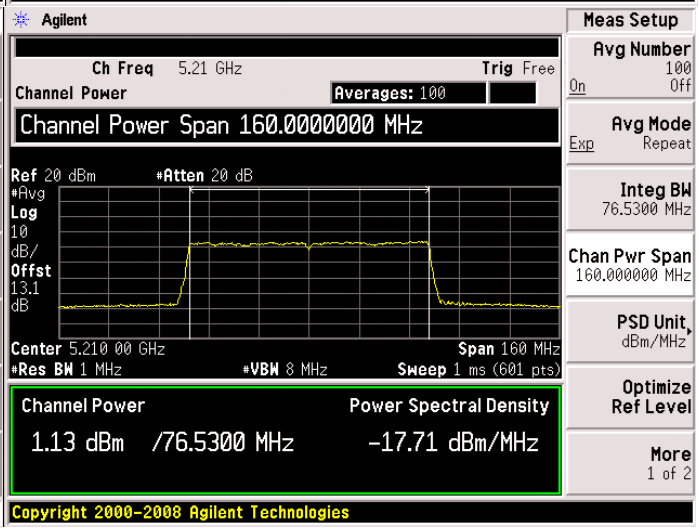


HT/VHT80 Beam Forming, M8 to M15, M0.2 to M9.2

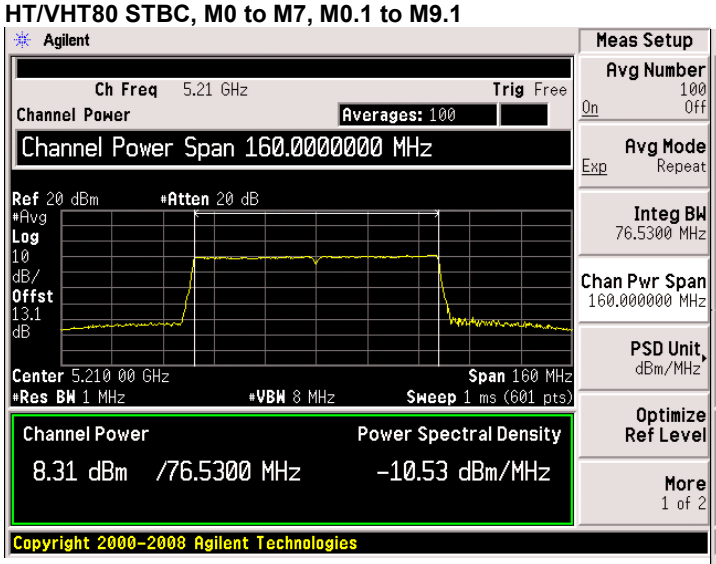


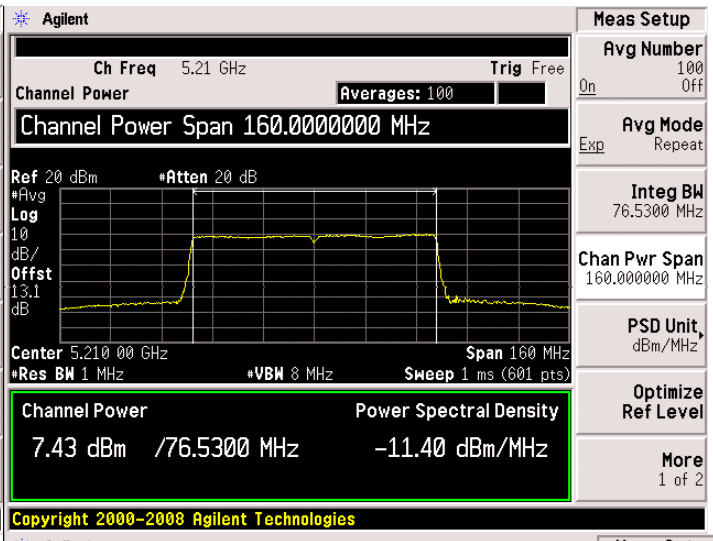


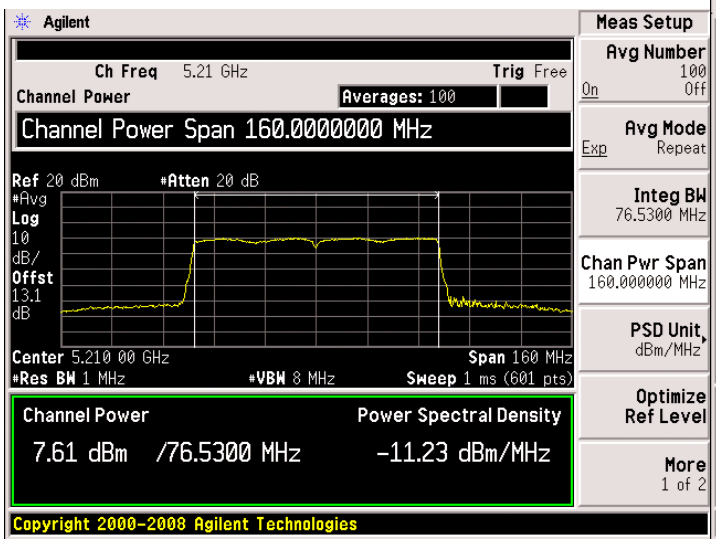


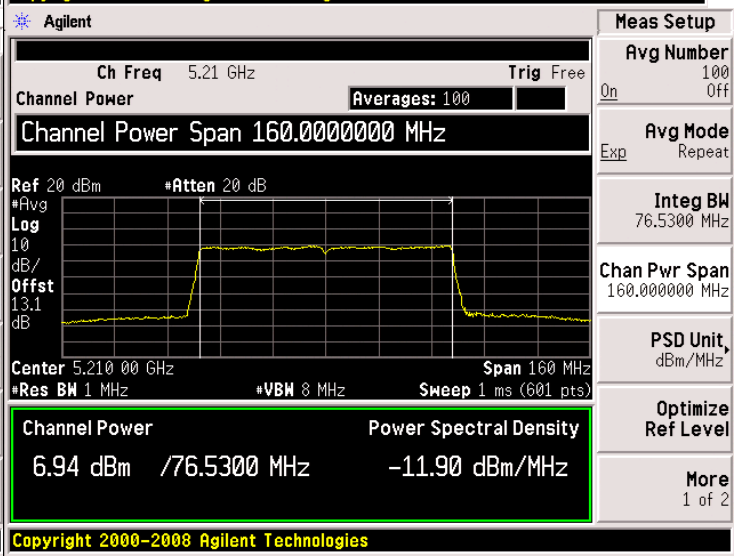


HT/VHT80 STBC, M0 to M7, M0.1 to M9.1

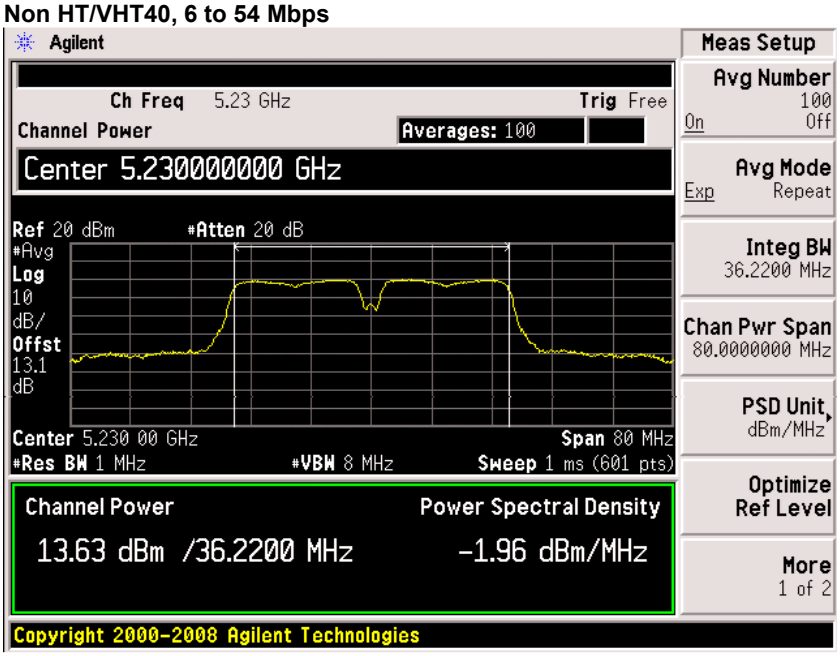




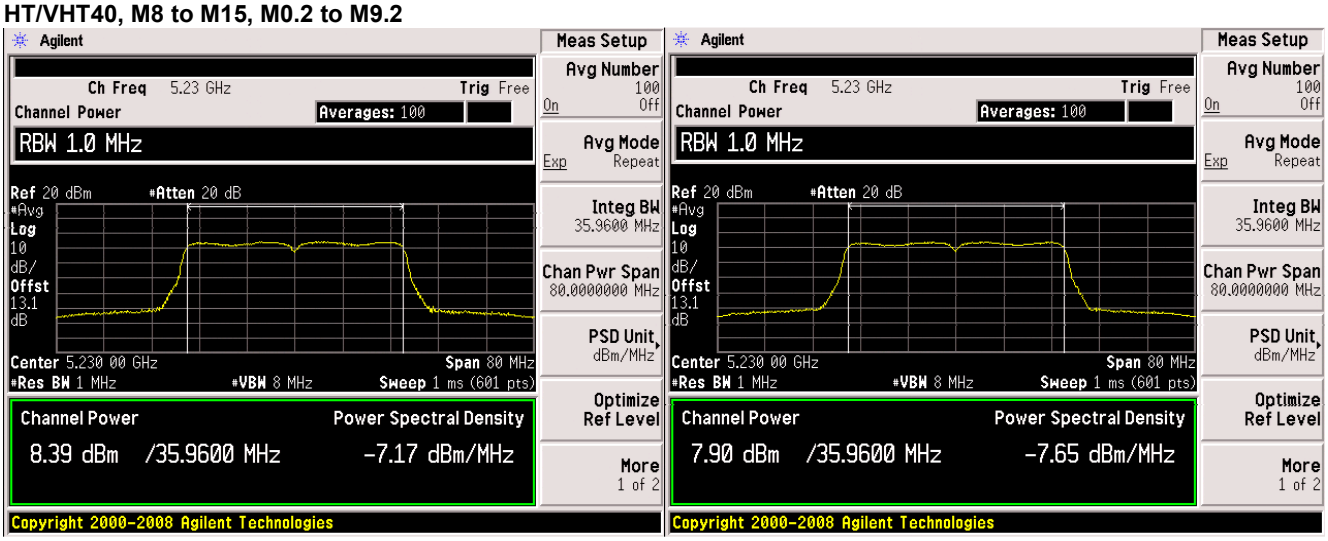




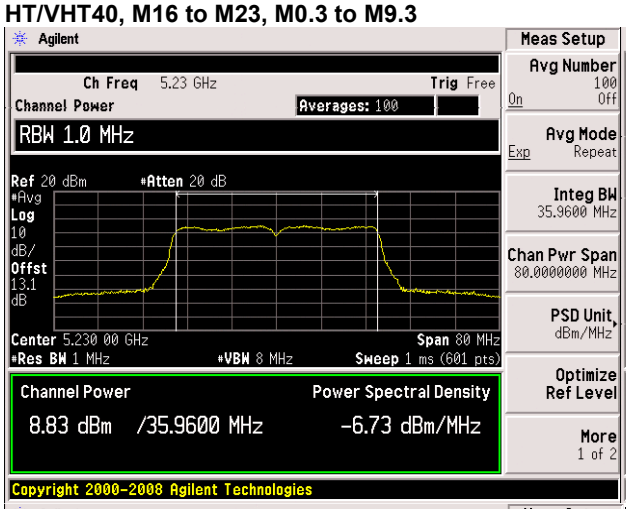
Non HT/VHT40, 6 to 54 Mbps

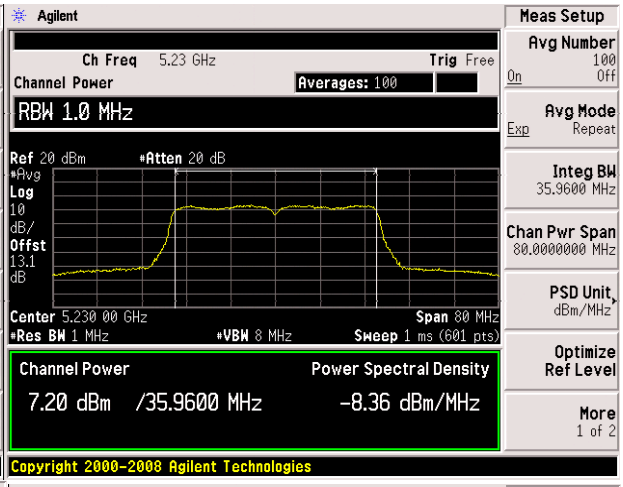


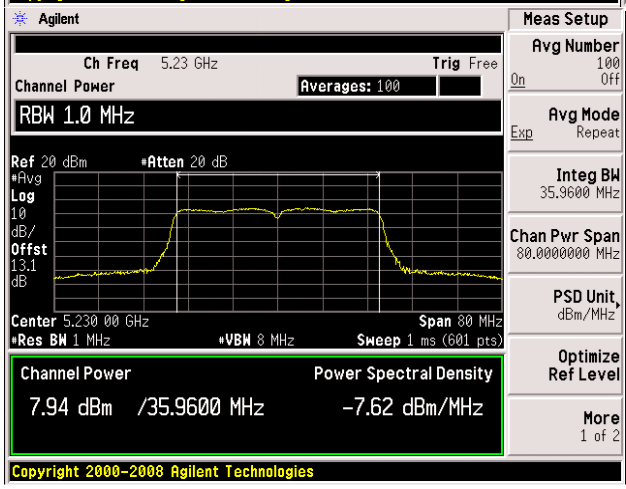
HT/VHT40, M8 to M15, M0.2 to M9.2

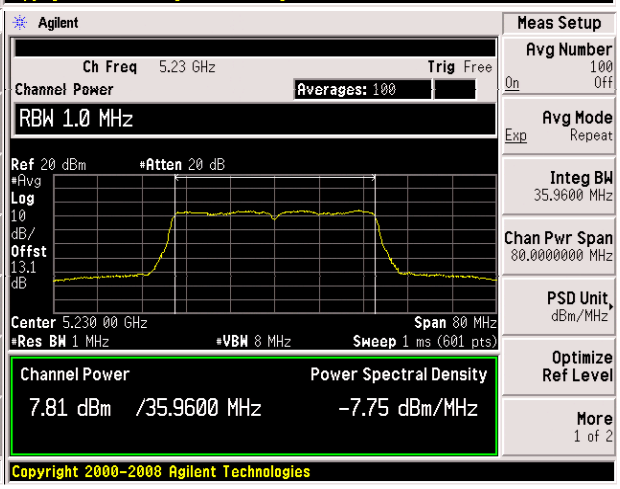


HT/VHT40, M16 to M23, M0.3 to M9.3

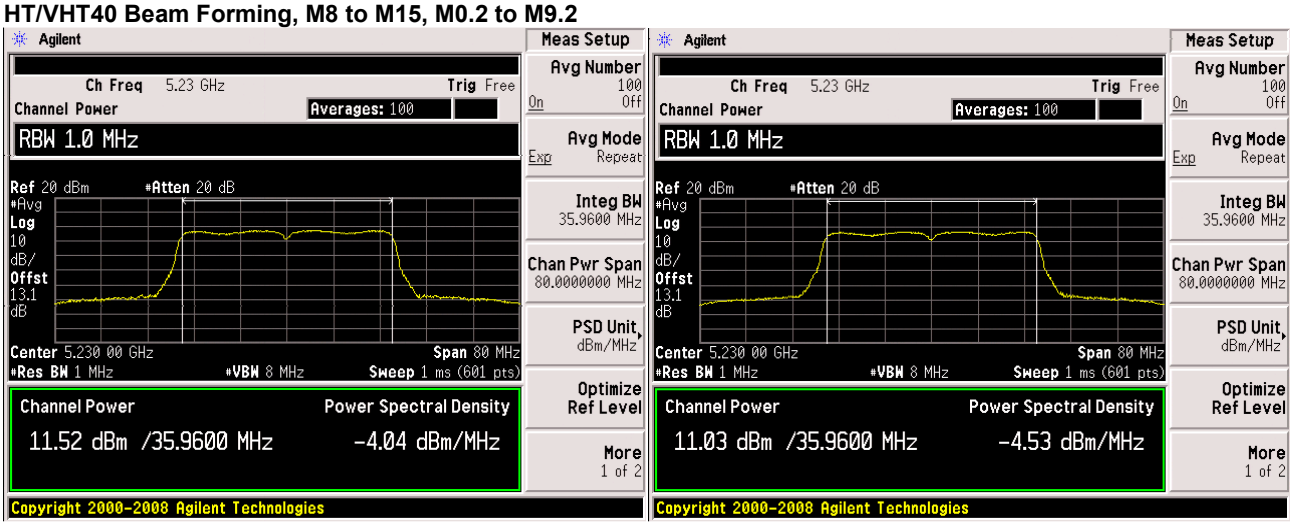




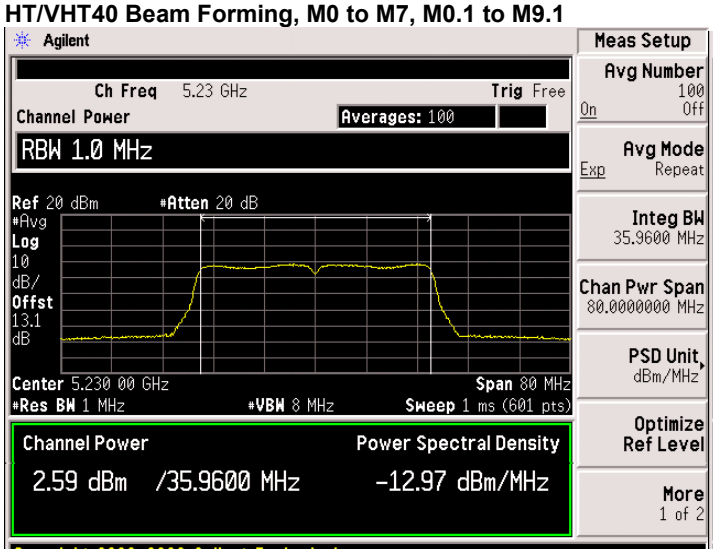


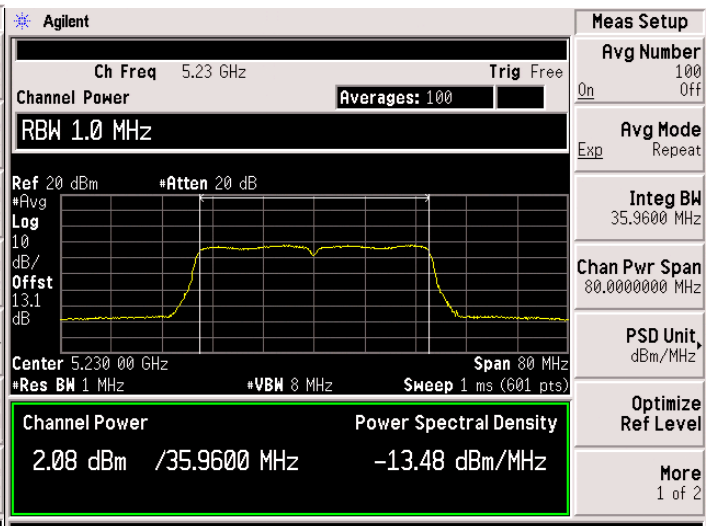


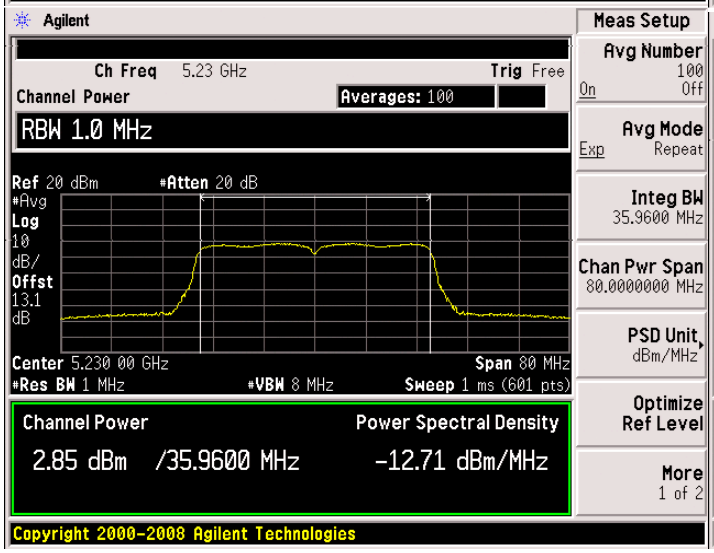
HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2

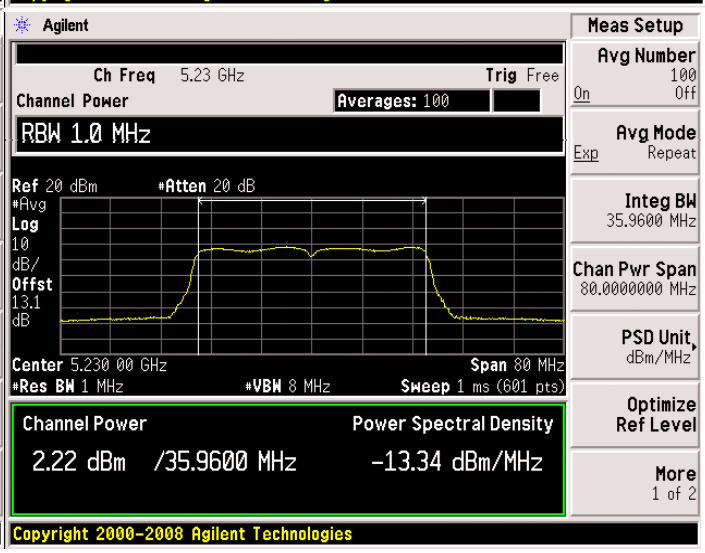


HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1

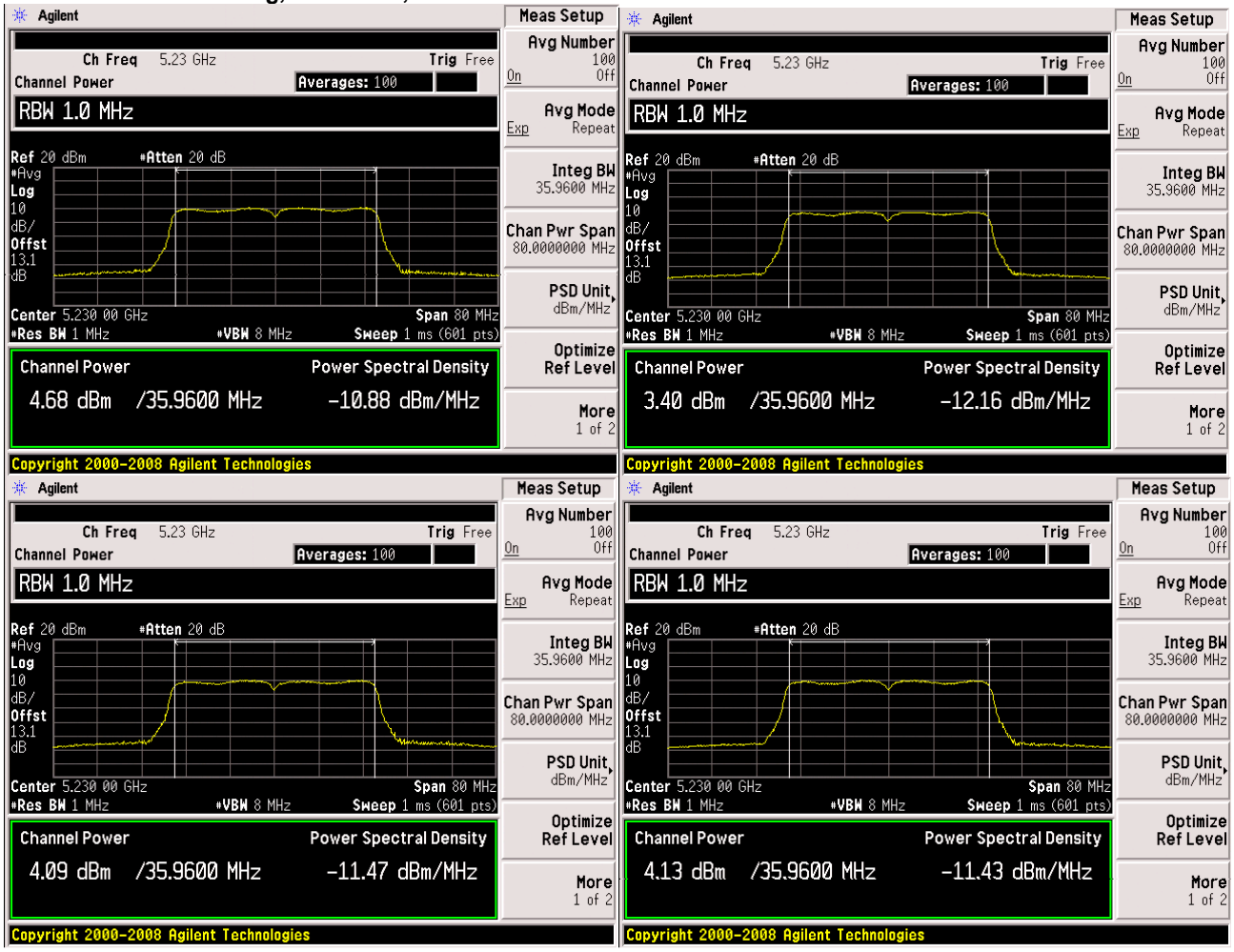




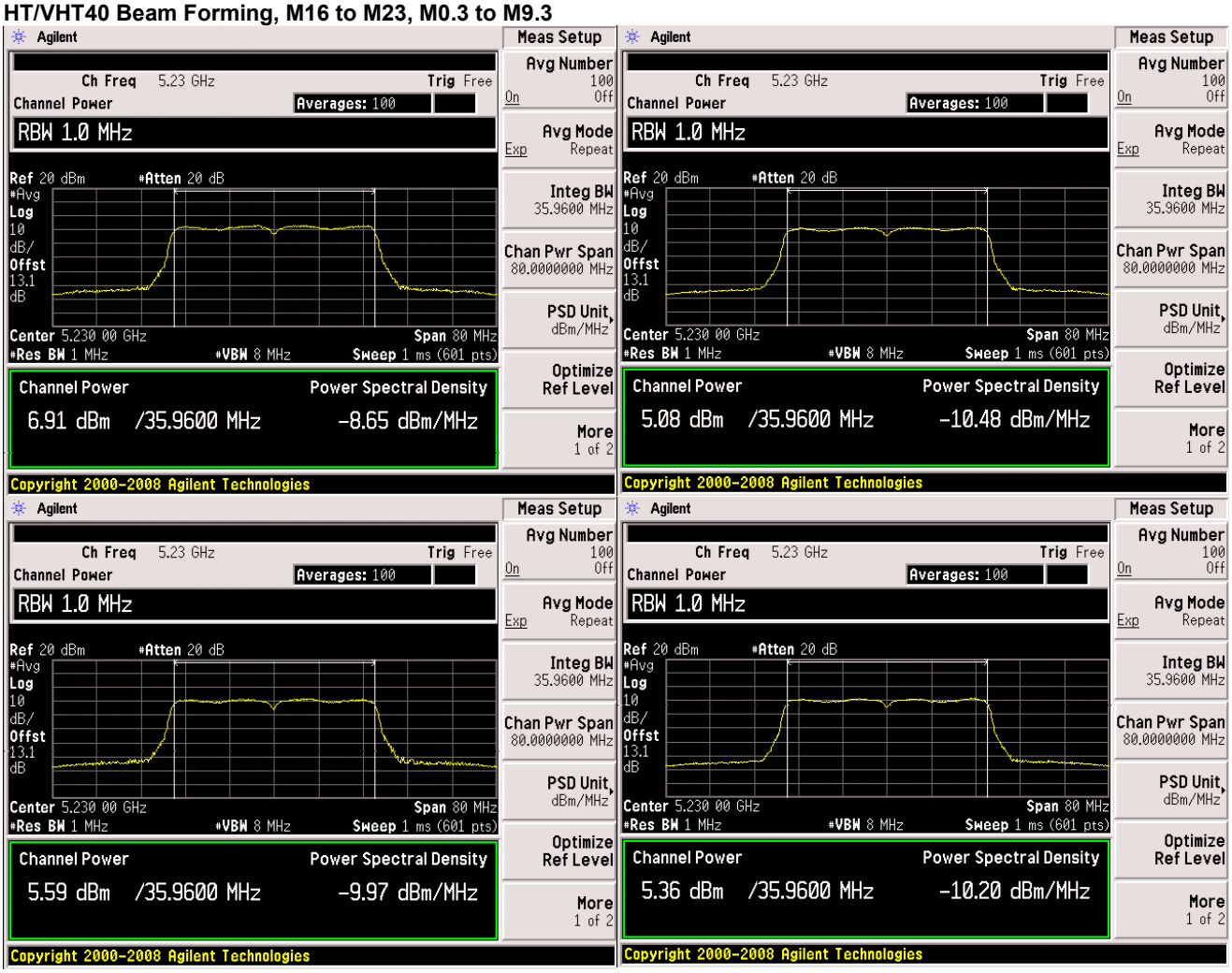




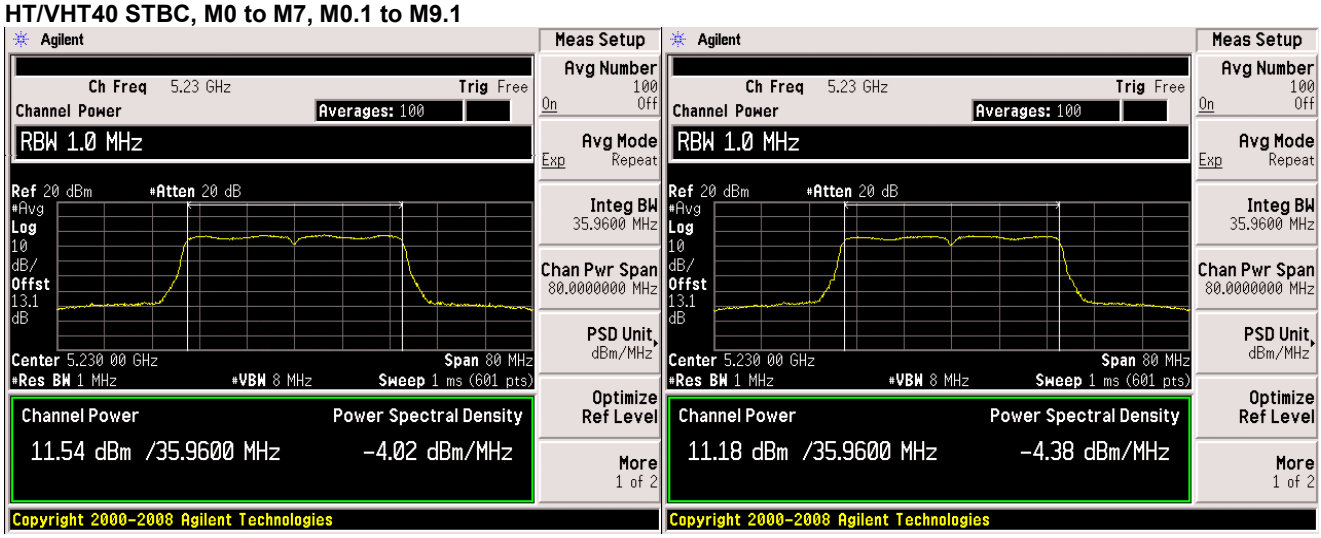
HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2



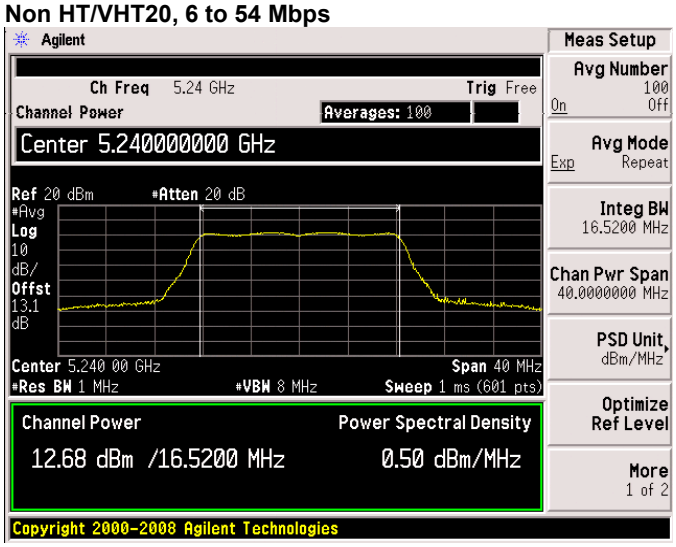
HT/VHT40 Beam Forming, M16 to M23, M0.3 to M9.3



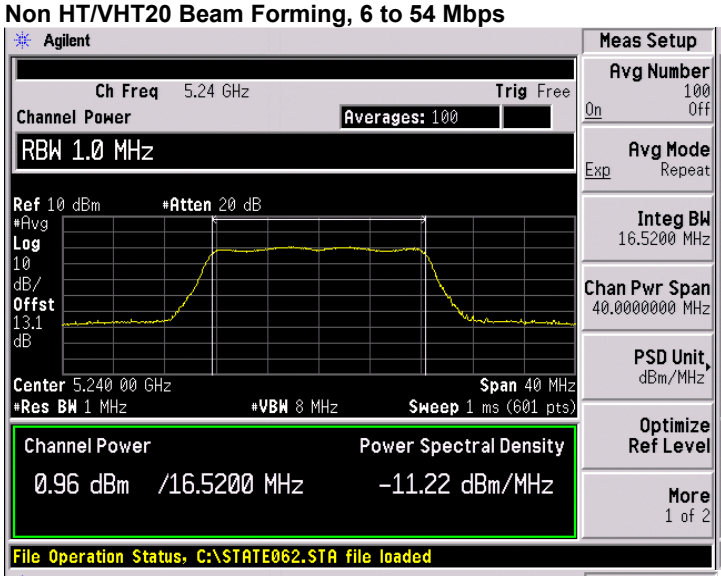
HT/VHT40 STBC, M0 to M7, M0.1 to M9.1

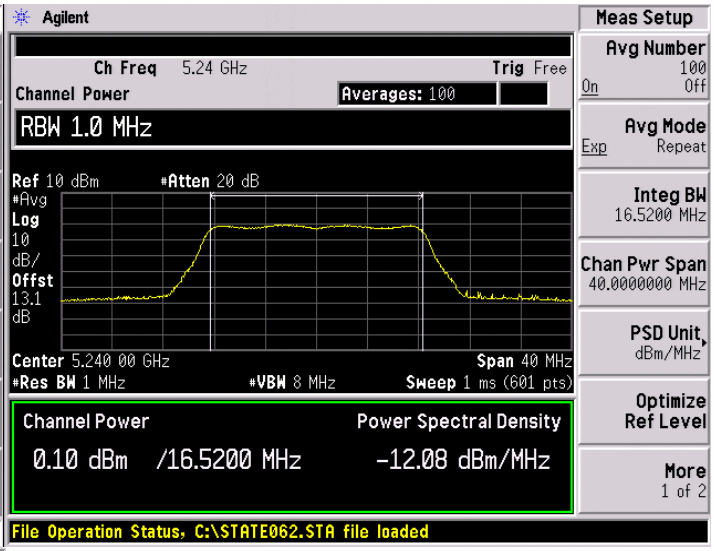


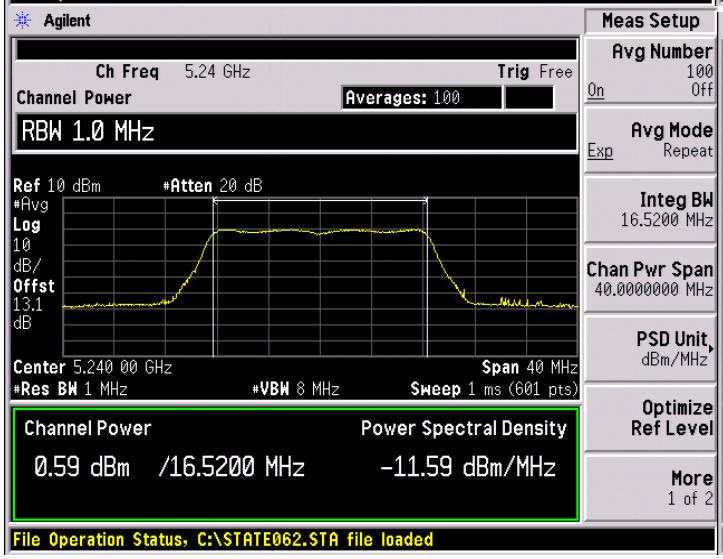
Non HT/VHT20, 6 to 54 Mbps

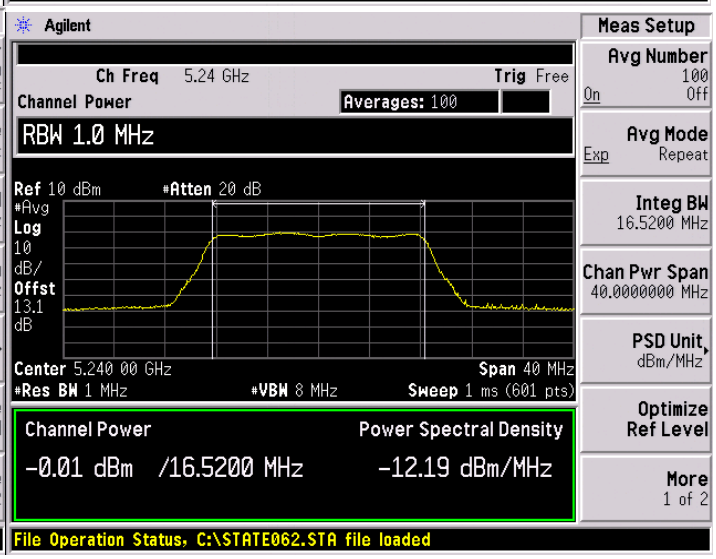


Non HT/VHT20 Beam Forming, 6 to 54 Mbps

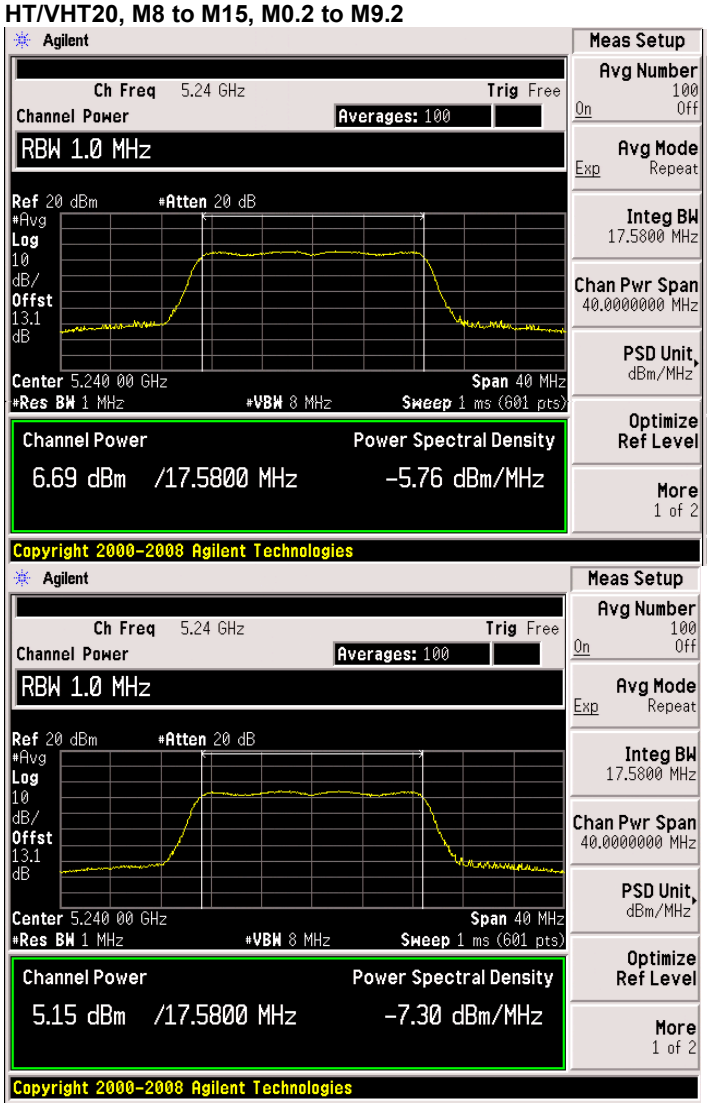


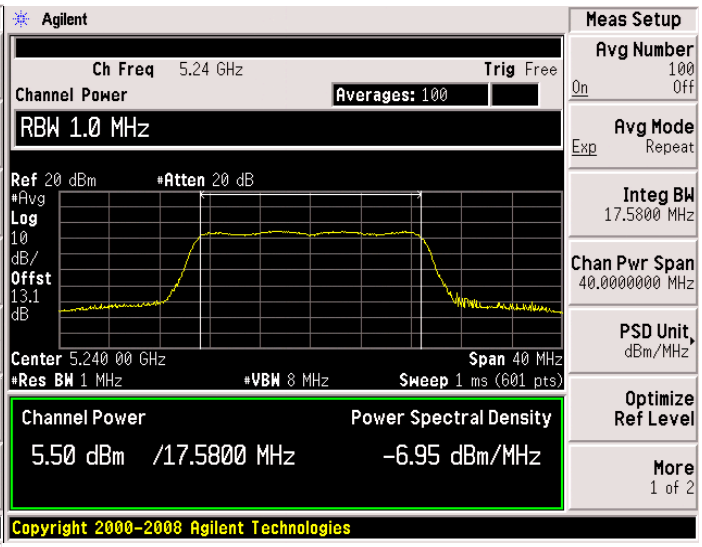




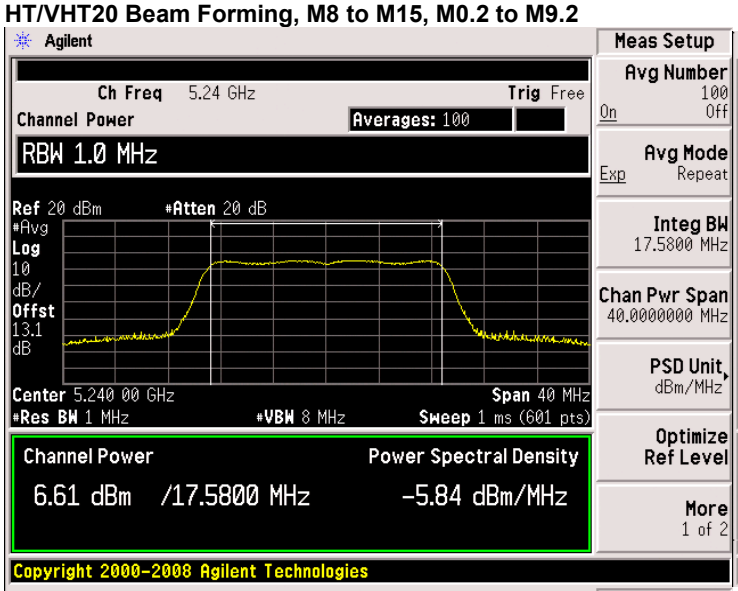


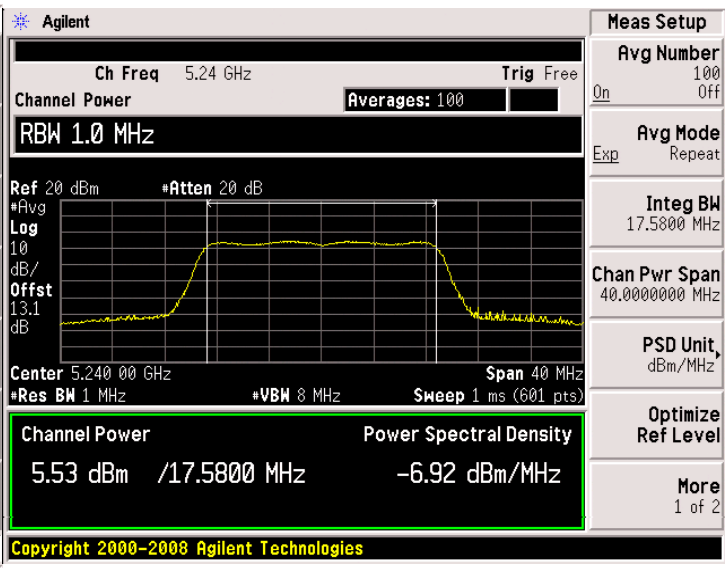
HT/VHT20, M8 to M15, M0.2 to M9.2

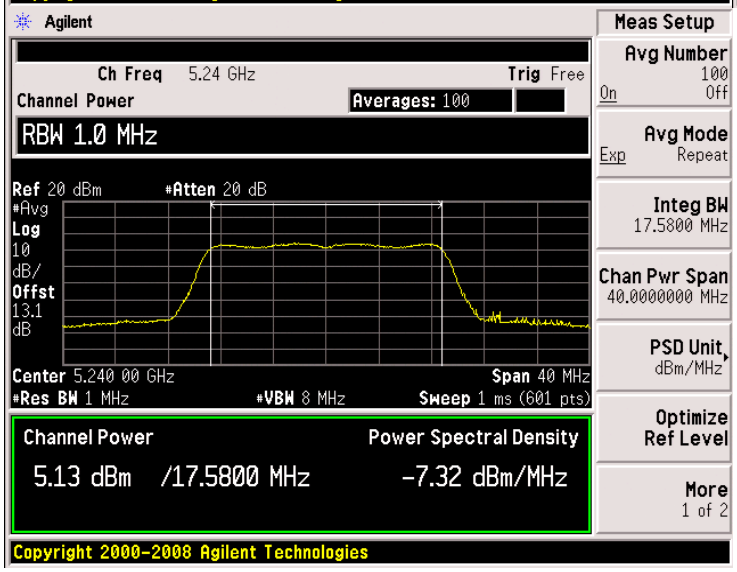




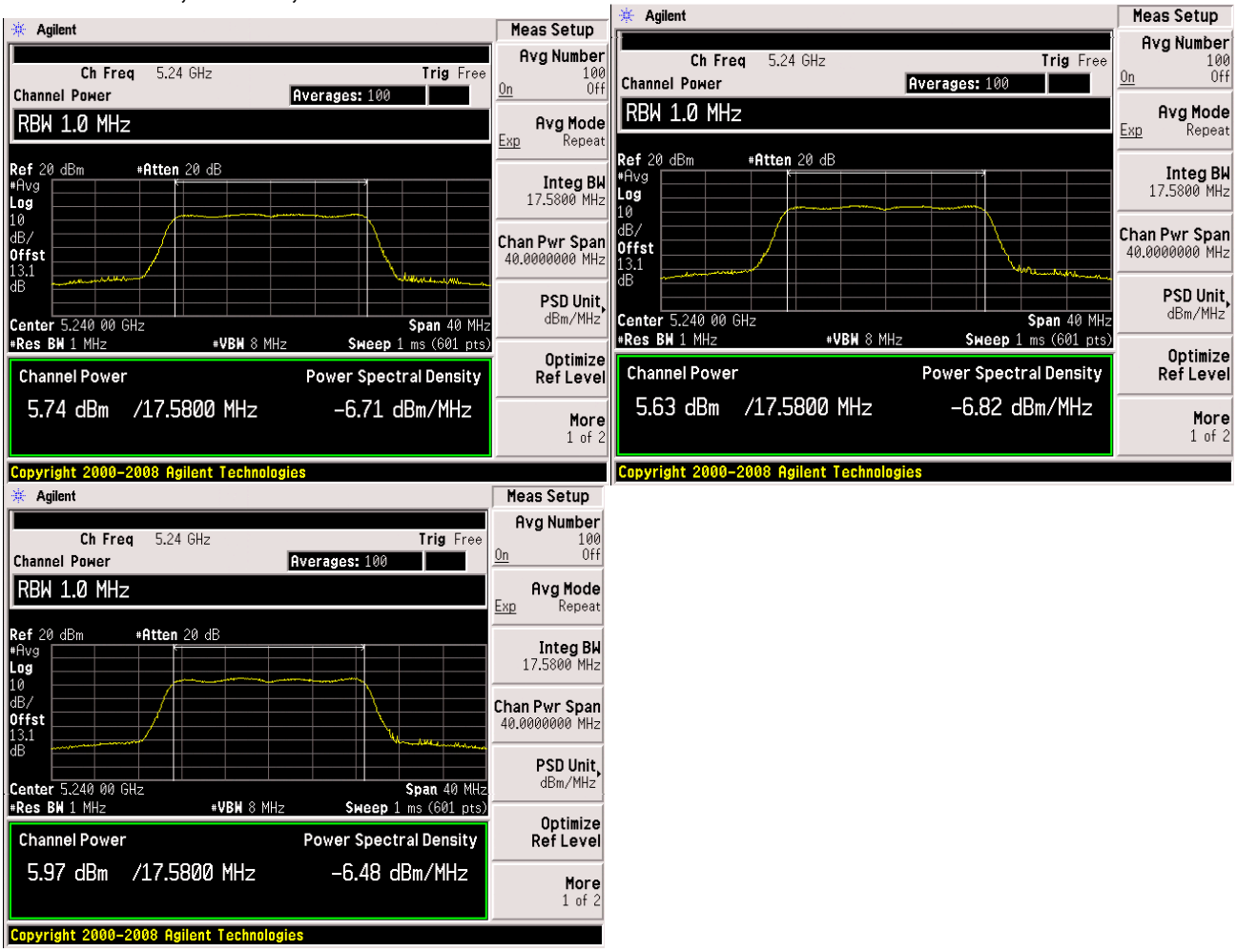
HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2





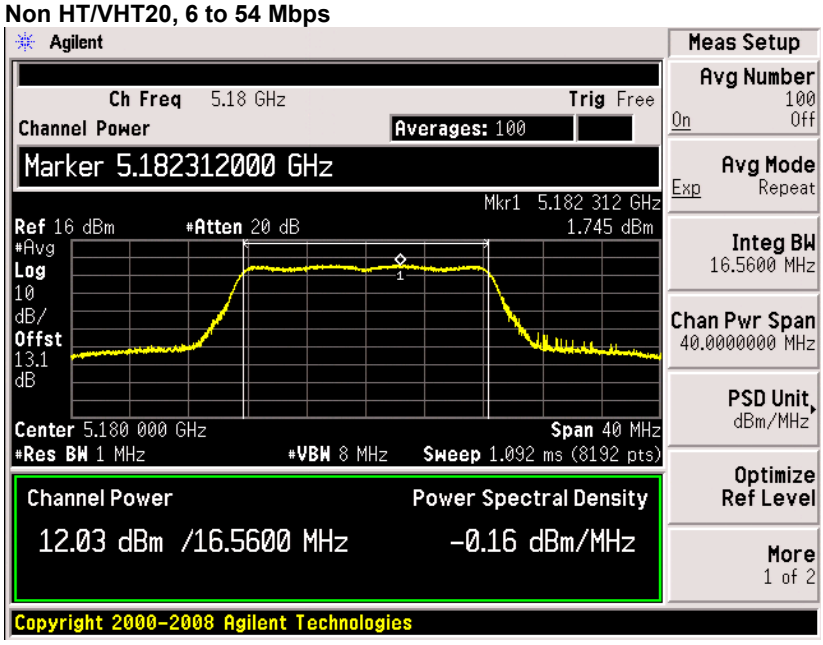


HT/VHT20 STBC, M0 to M7, M0.1 to M9.1

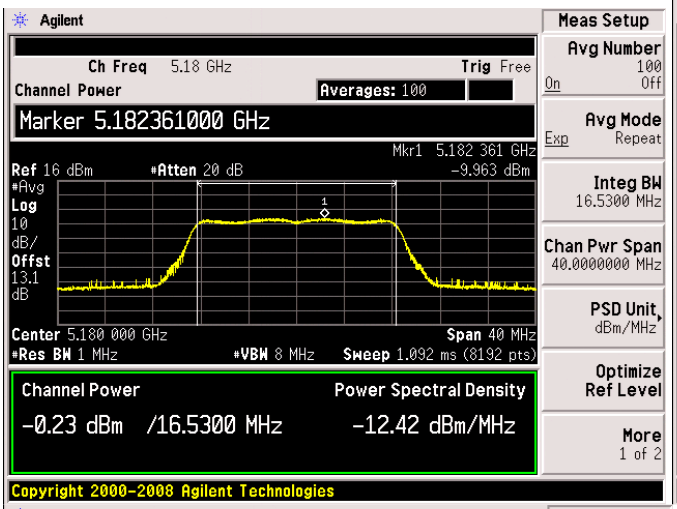


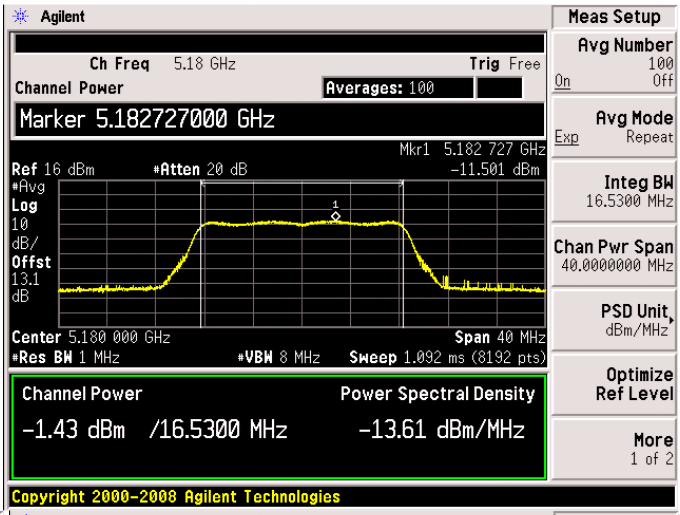
PSD Results

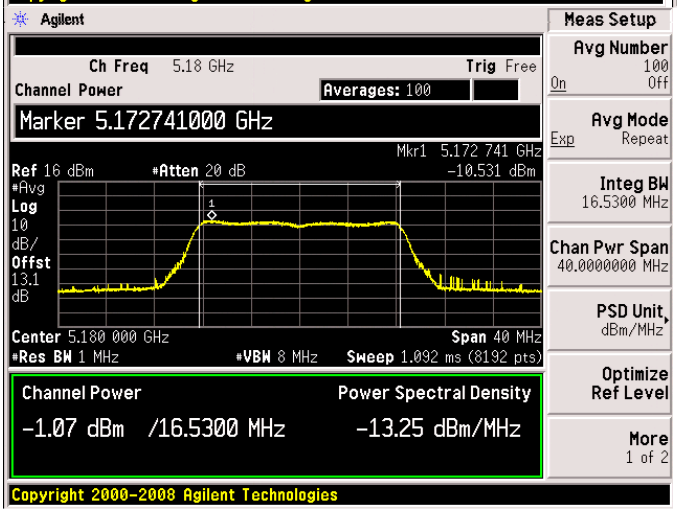
Non HT/VHT20, 6 to 54 Mbps

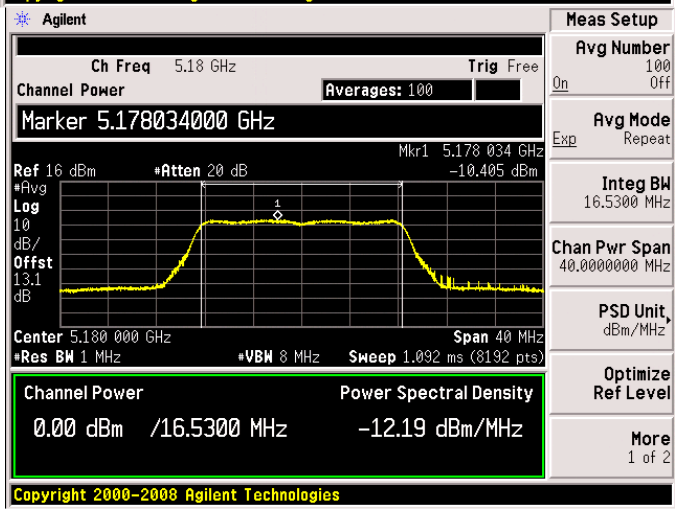


Non HT/VHT20 Beam Forming, 6 to 54 Mbps

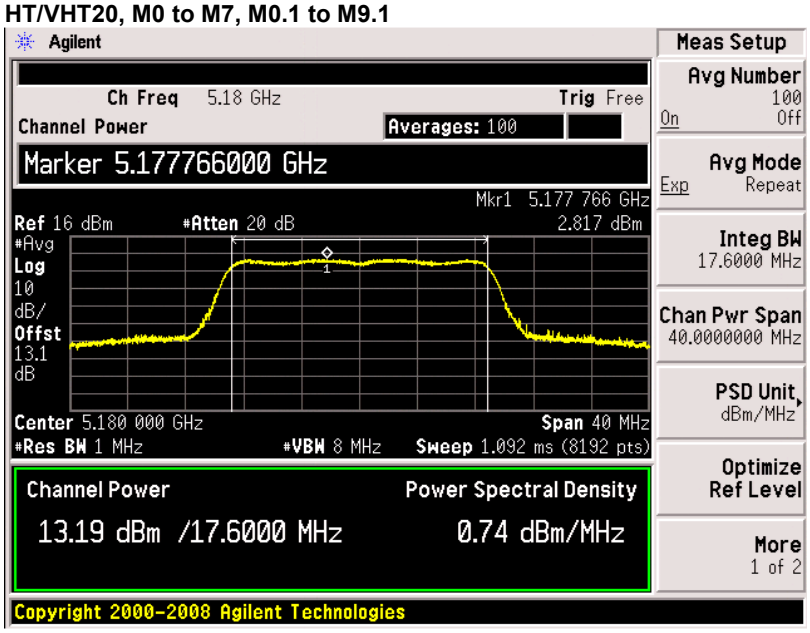




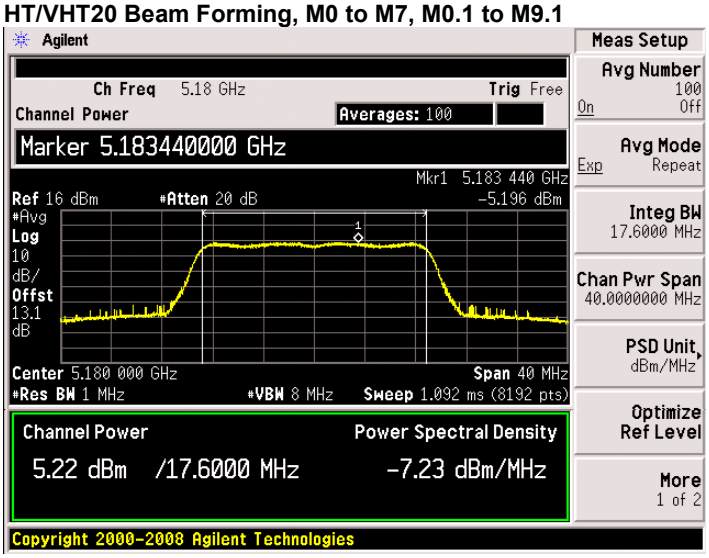


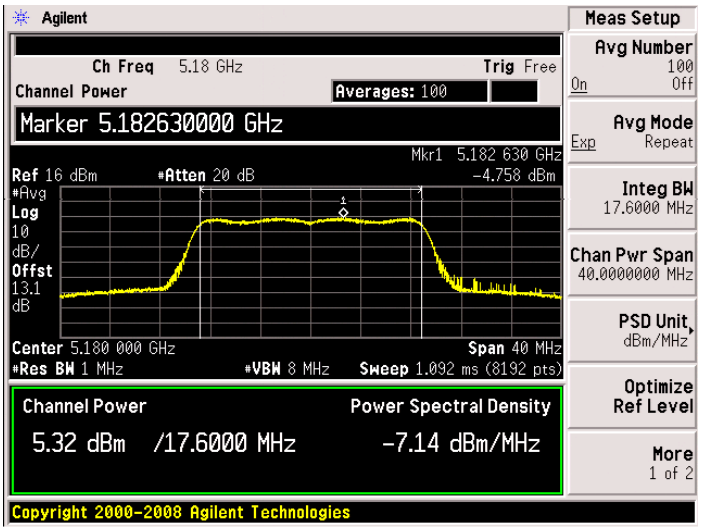


HT/VHT20, M0 to M7, M0.1 to M9.1

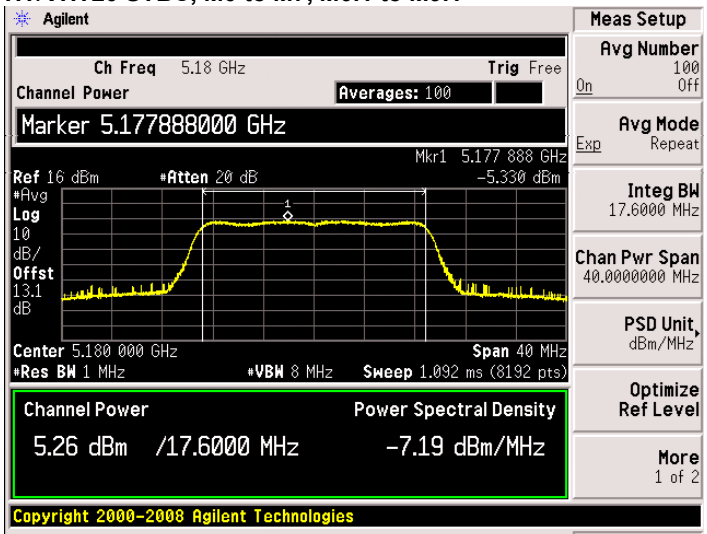


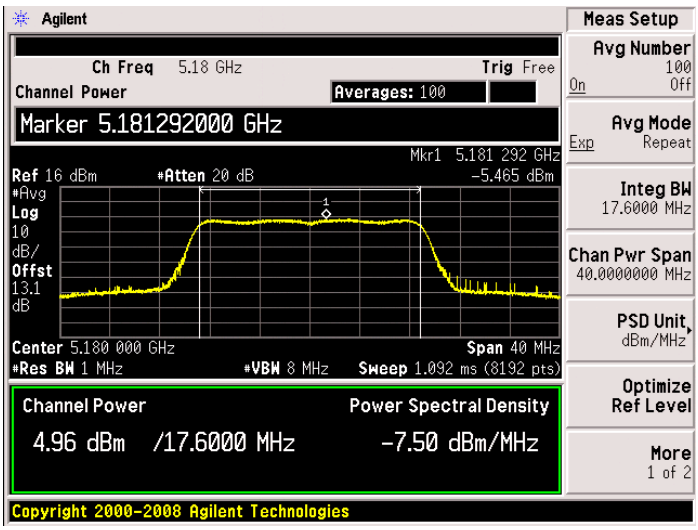
HT/VHT20 Beam Forming, M0 to M7, M0.1 to M9.1

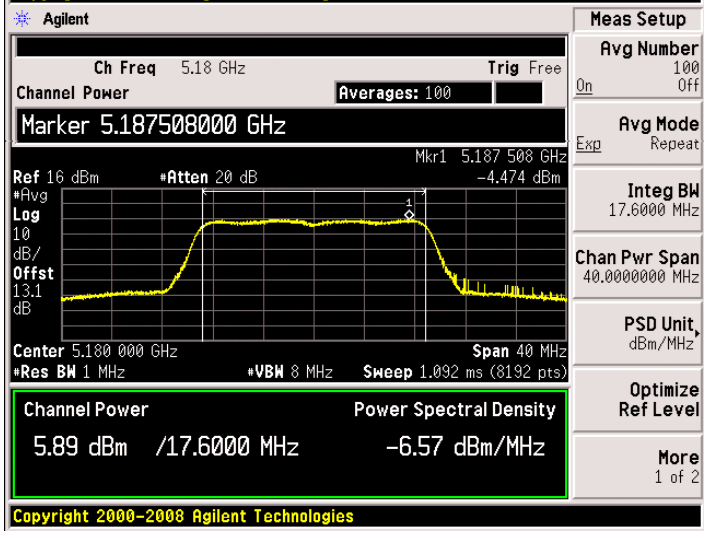




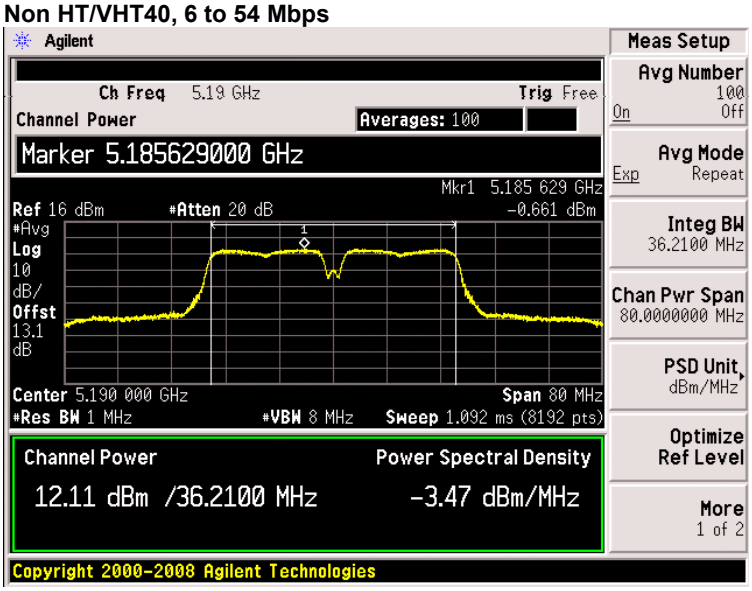
HT/VHT20 STBC, M0 to M7, M0.1 to M9.1



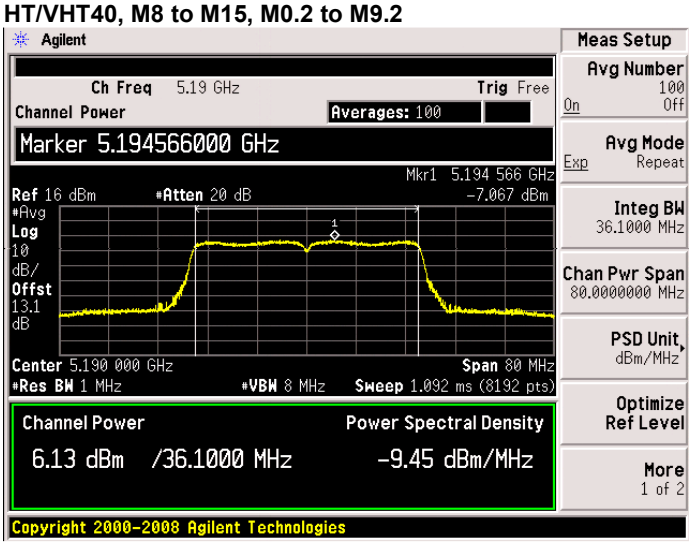


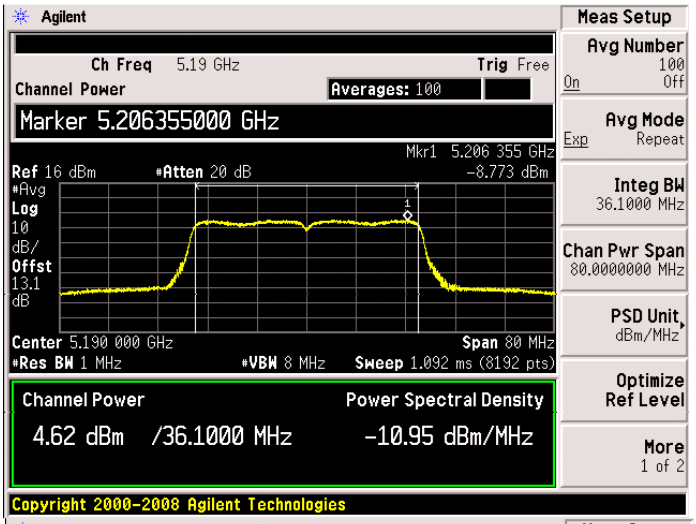


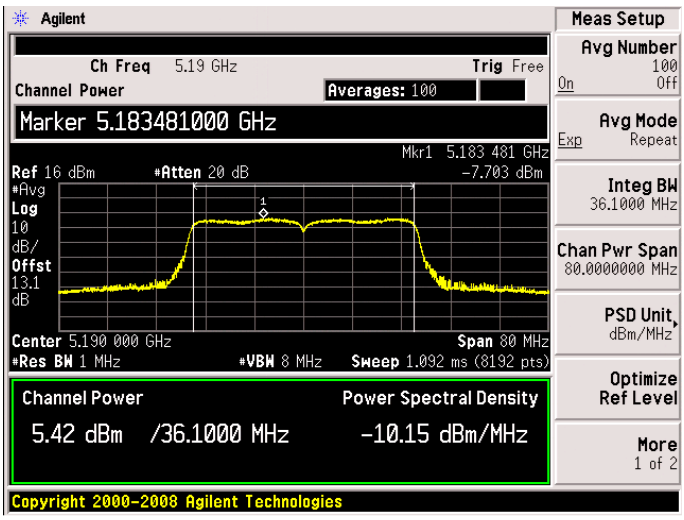
Non HT/VHT40, 6 to 54 Mbps

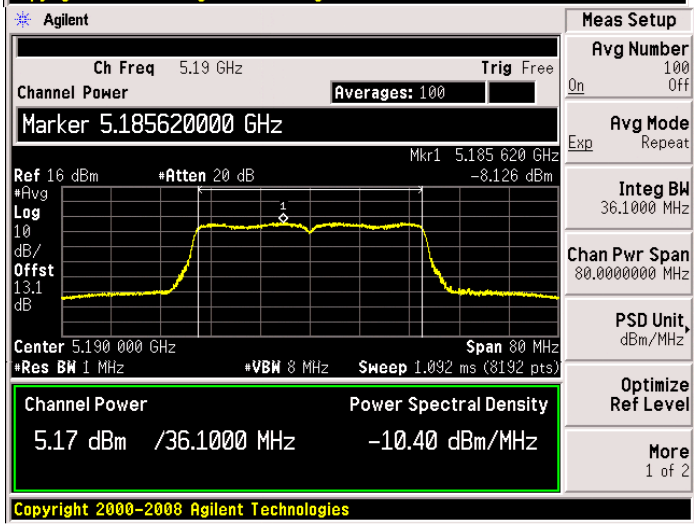


HT/VHT40, M8 to M15, M0.2 to M9.2

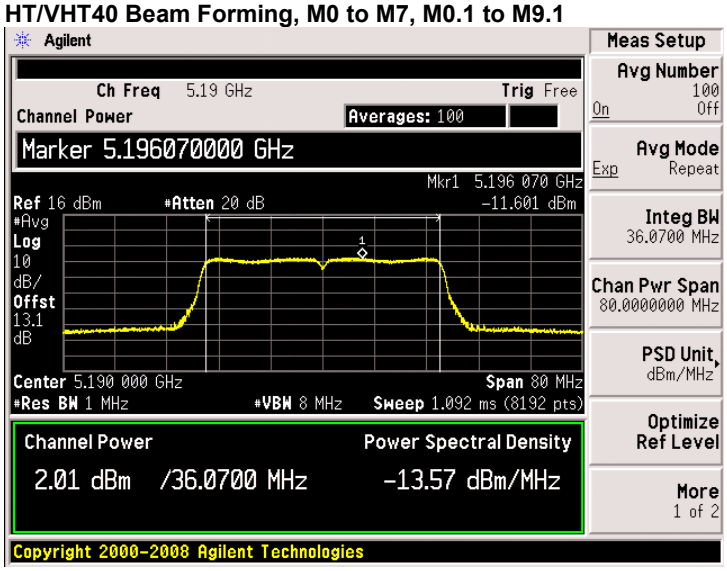


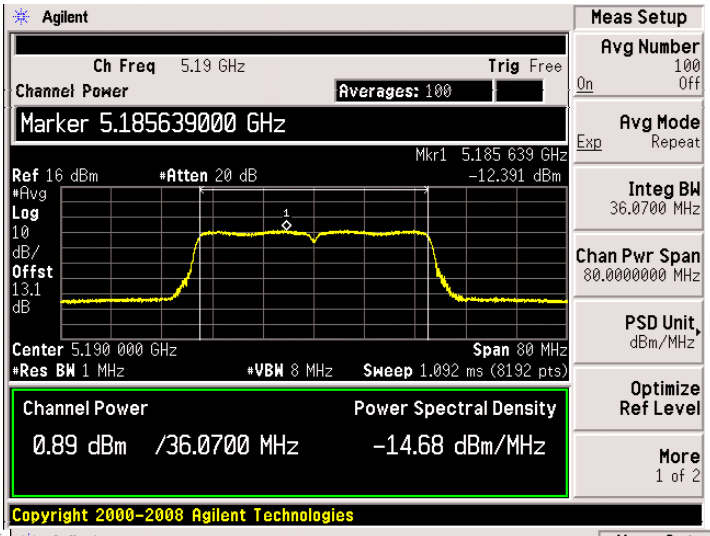


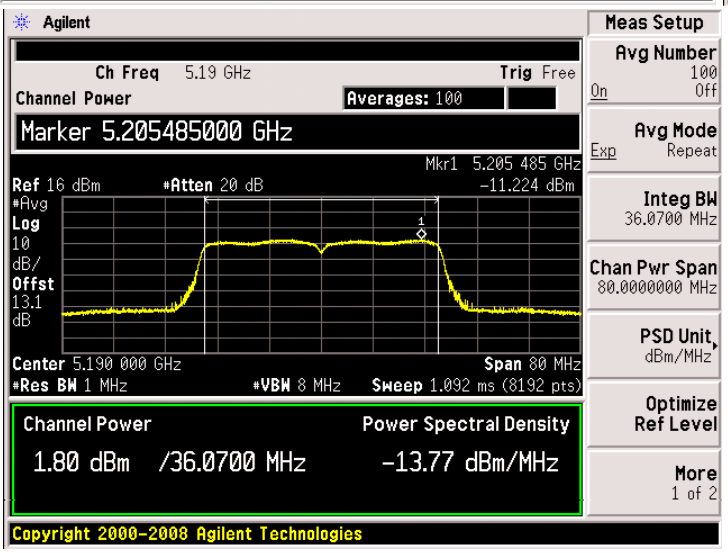


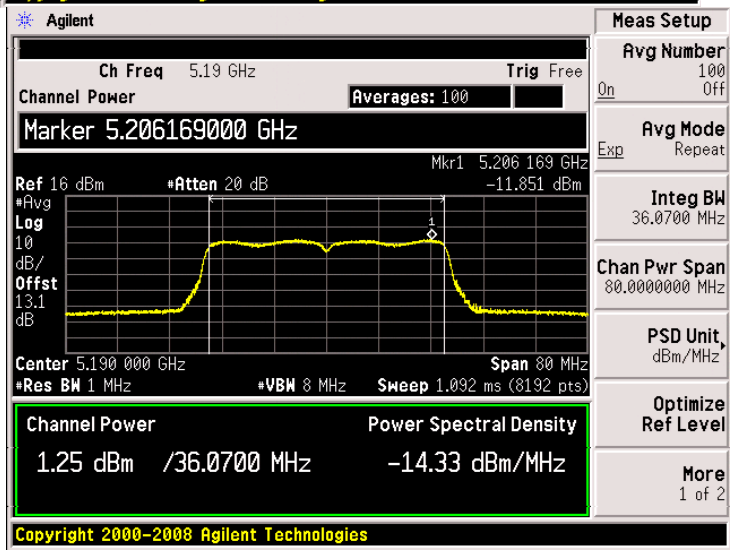


HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1

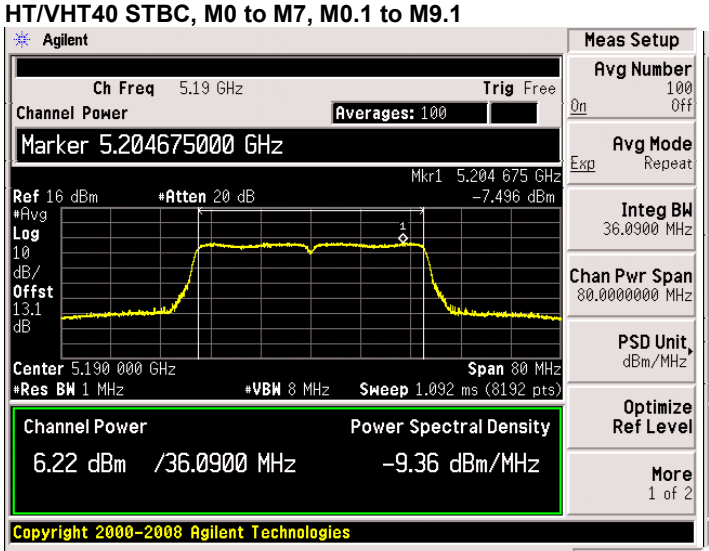


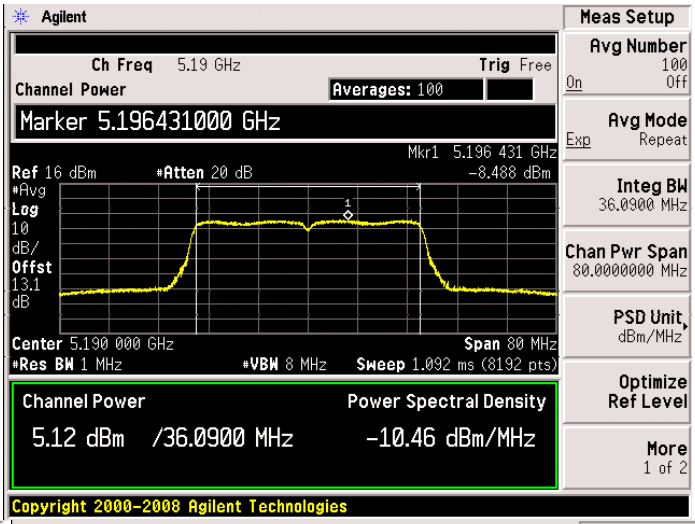


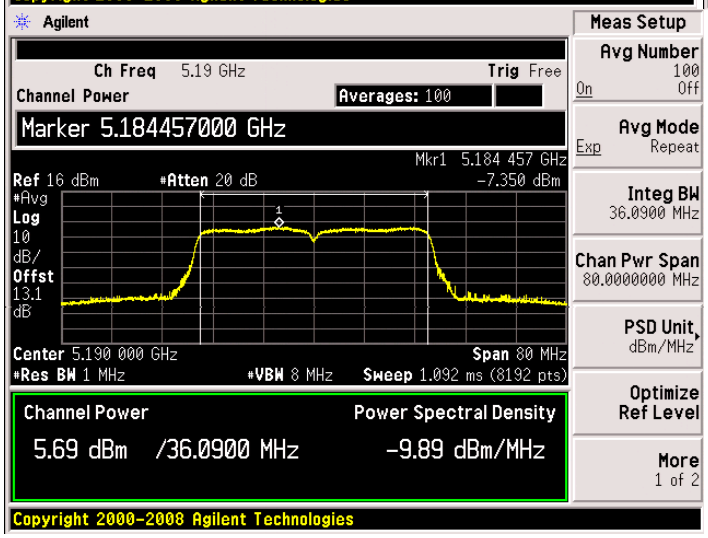


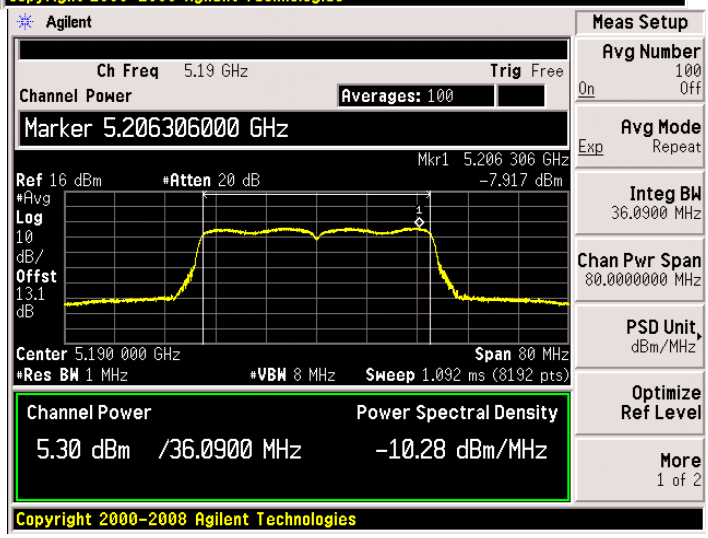


HT/VHT40 STBC, M0 to M7, M0.1 to M9.1

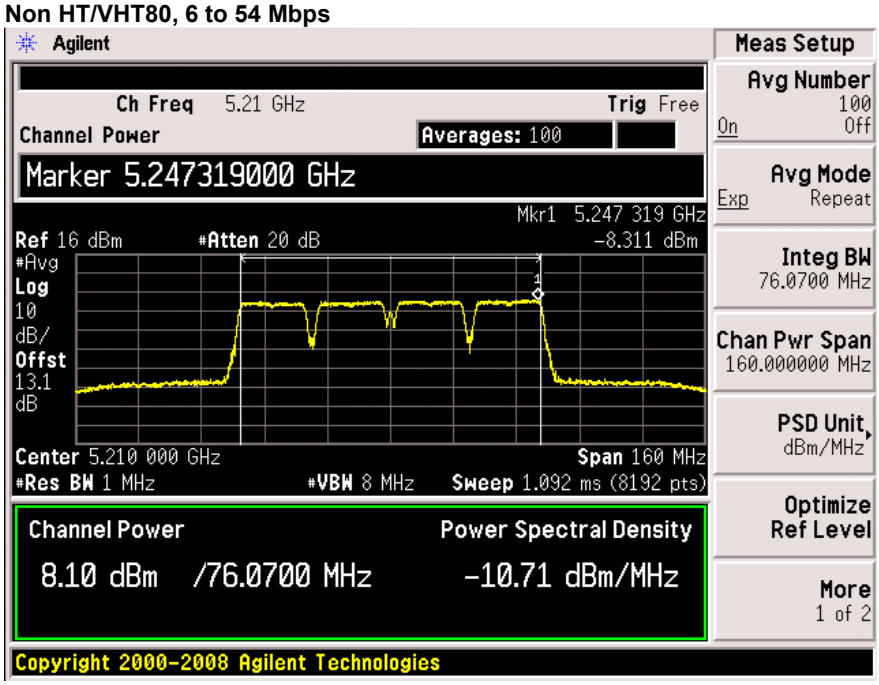




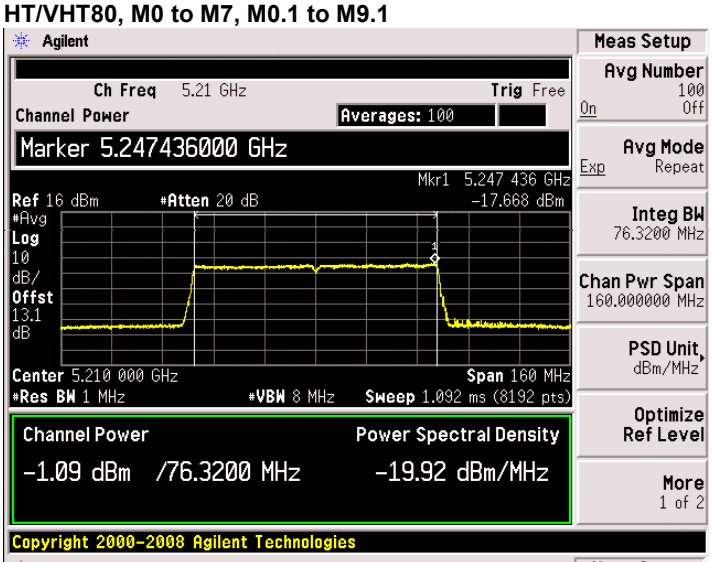


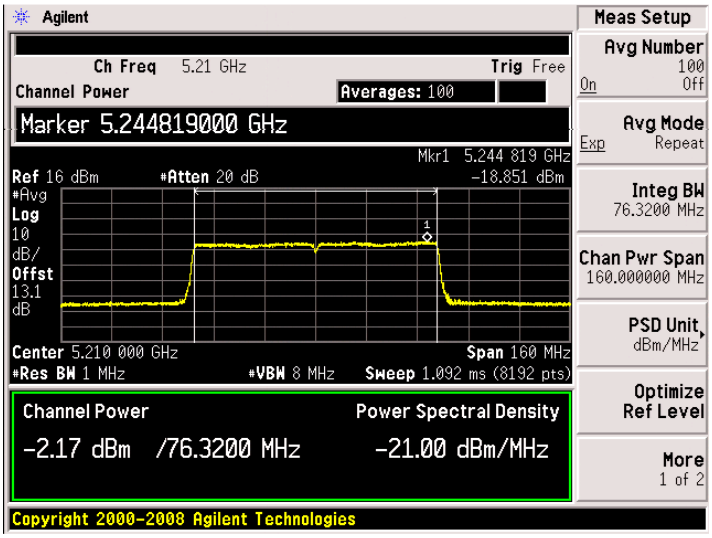


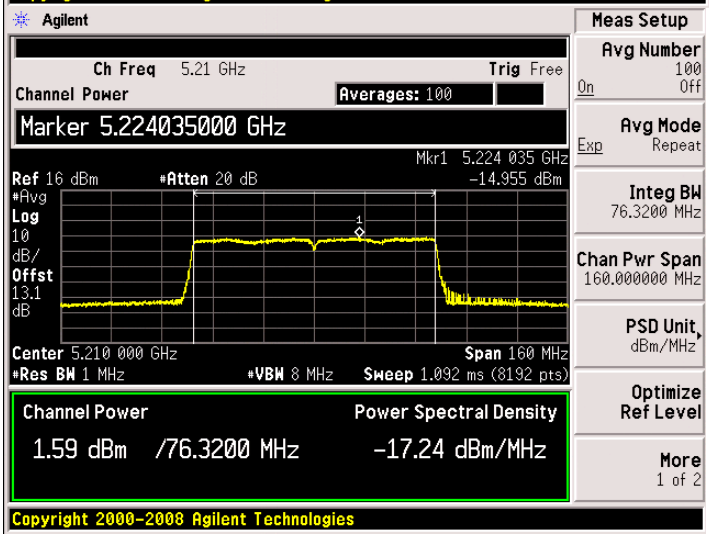
Non HT/VHT80, 6 to 54 Mbps

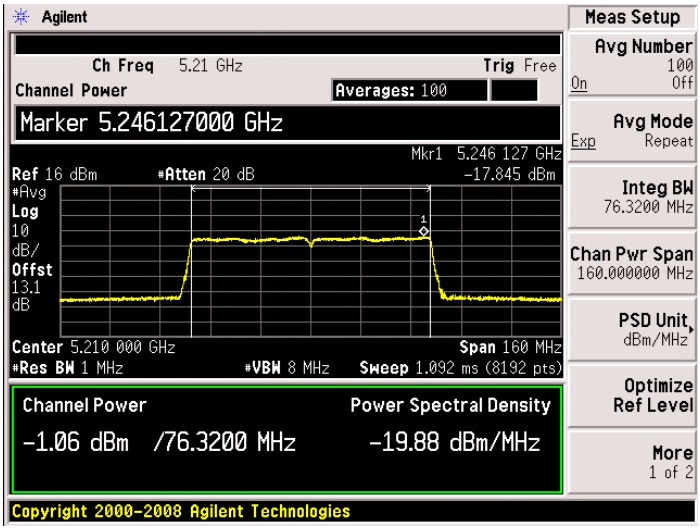


HT/VHT80, M0 to M7, M0.1 to M9.1

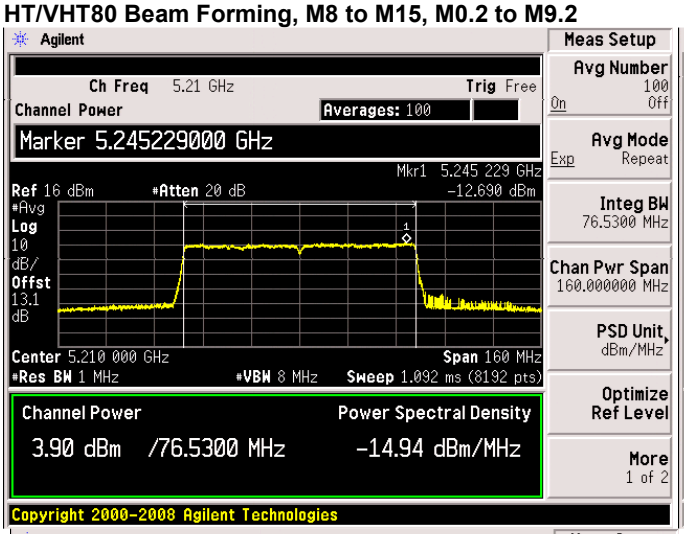


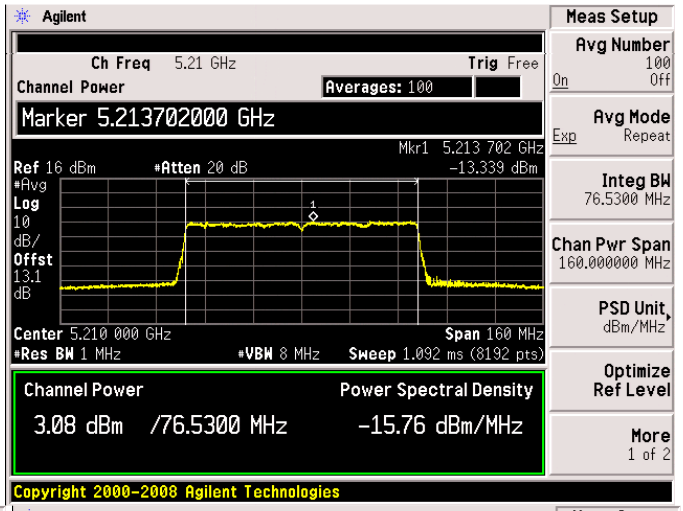


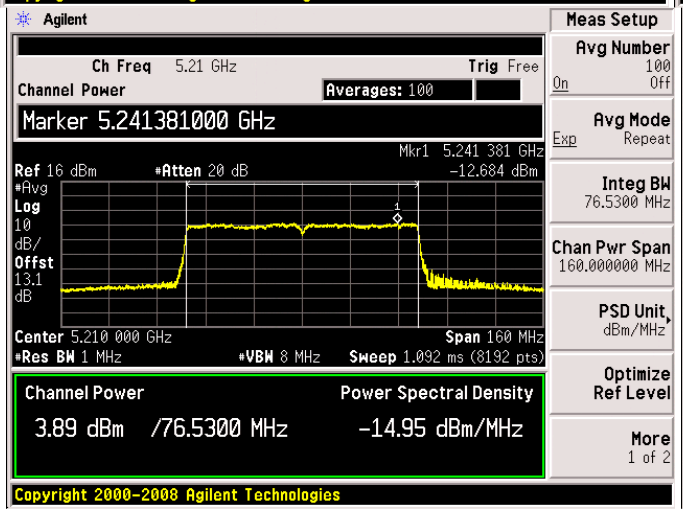


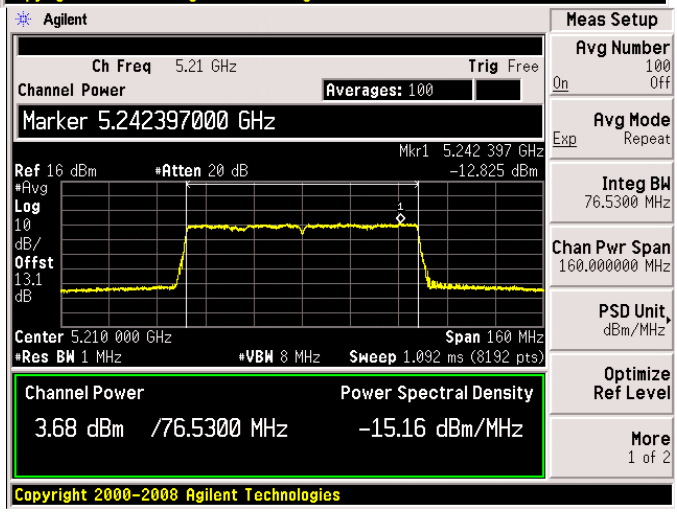


HT/VHT80 Beam Forming, M8 to M15, M0.2 to M9.2

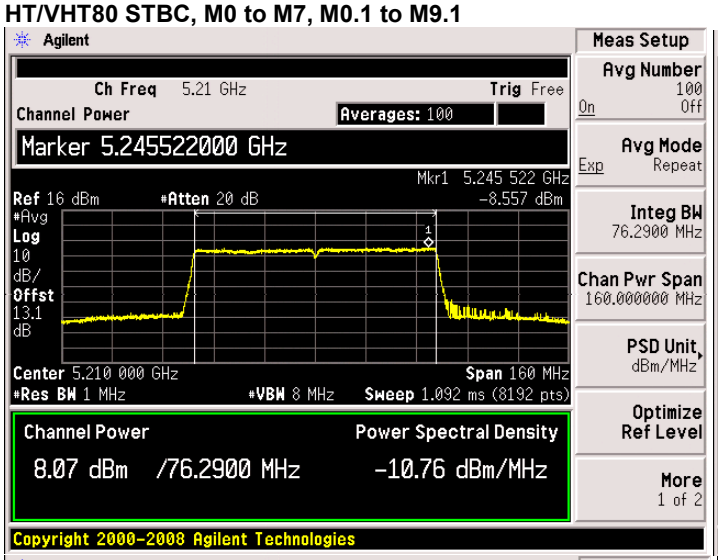


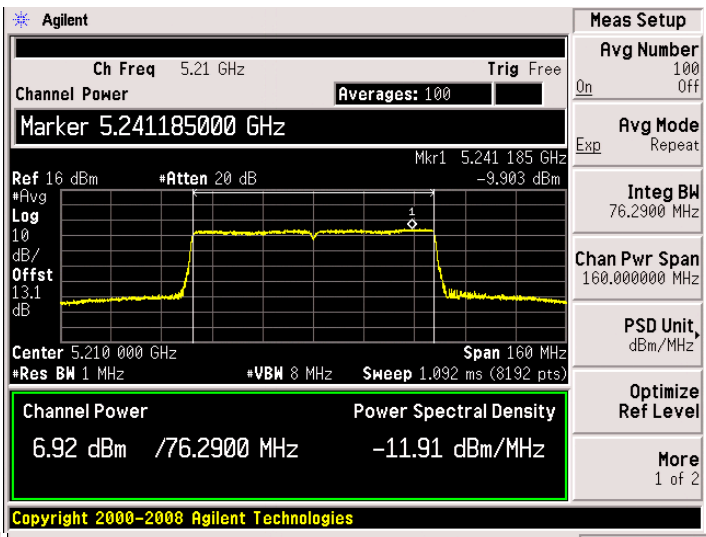


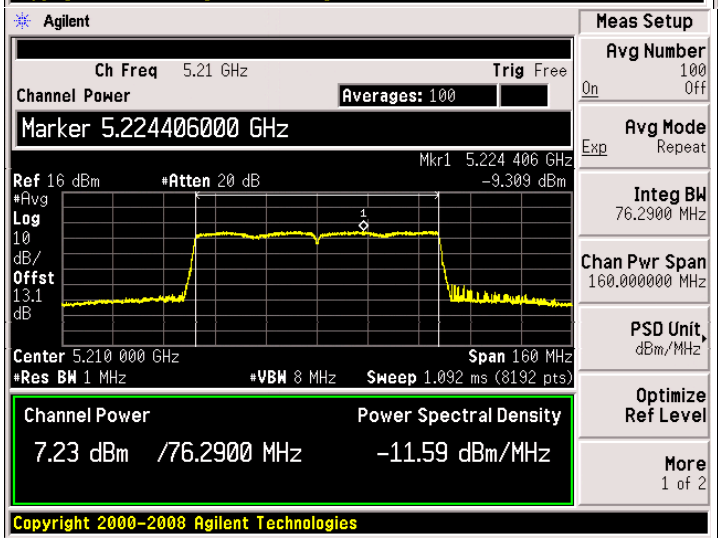


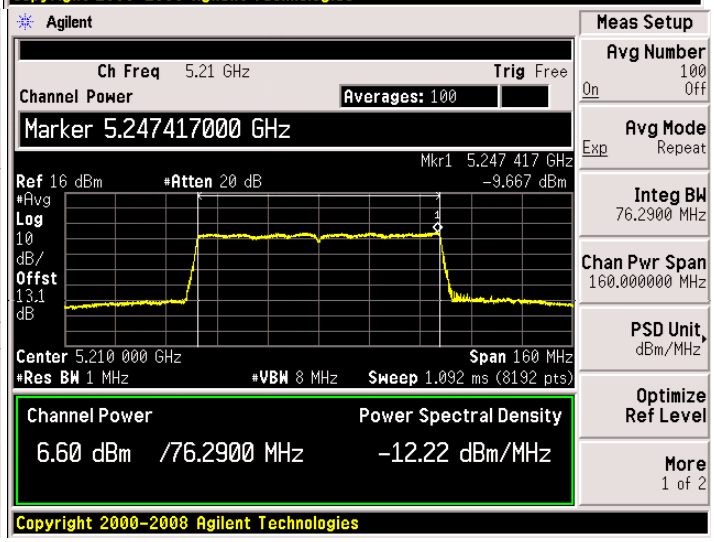


HT/VHT80 STBC, M0 to M7, M0.1 to M9.1

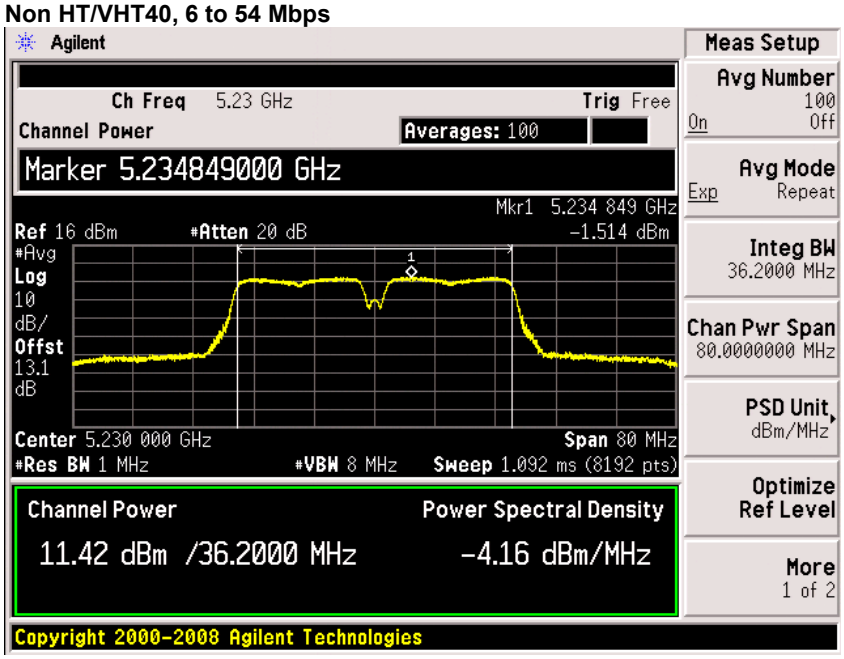




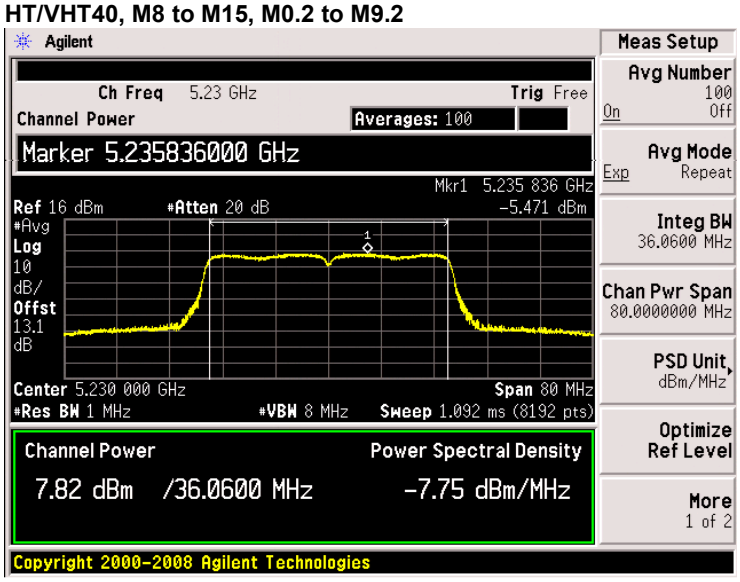


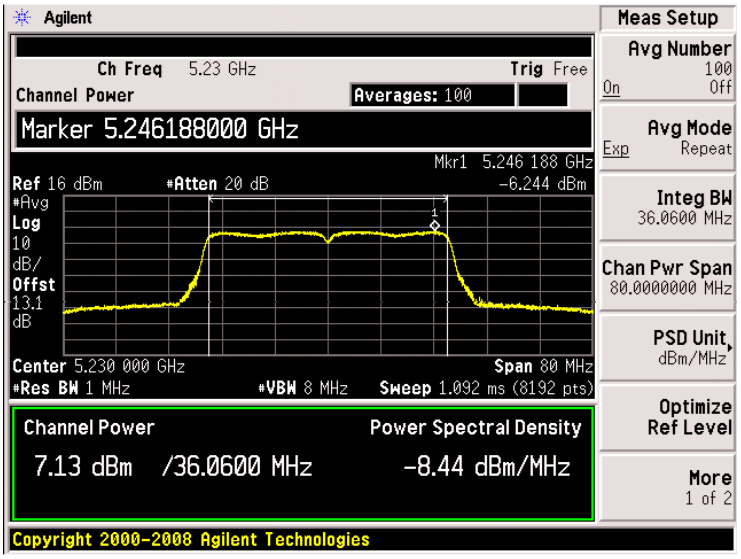


Non HT/VHT40, 6 to 54 Mbps

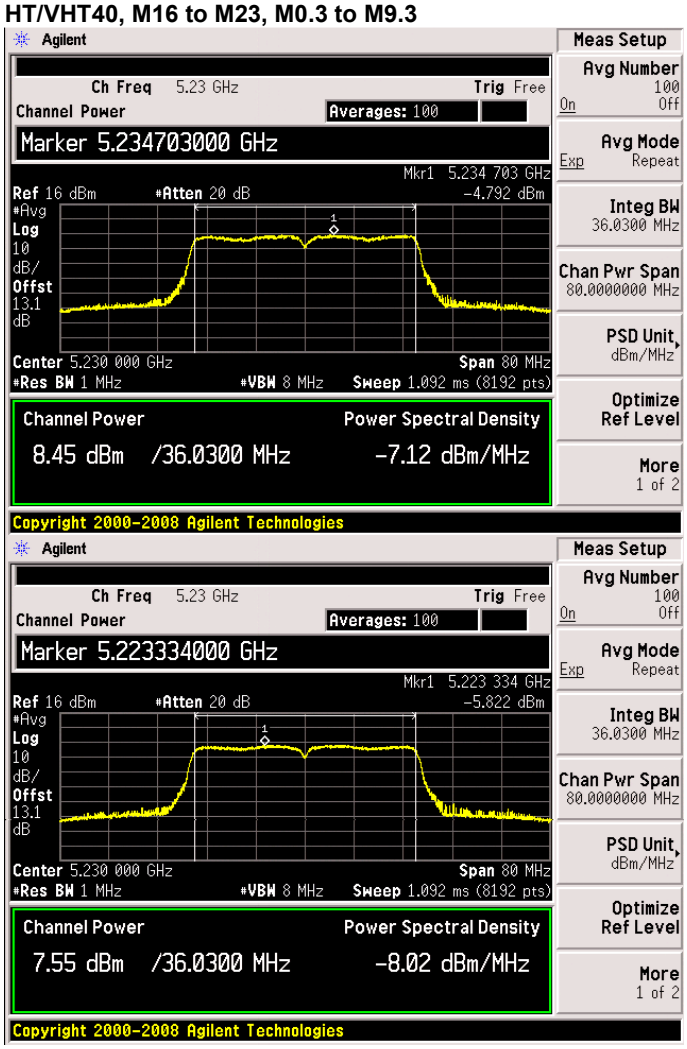


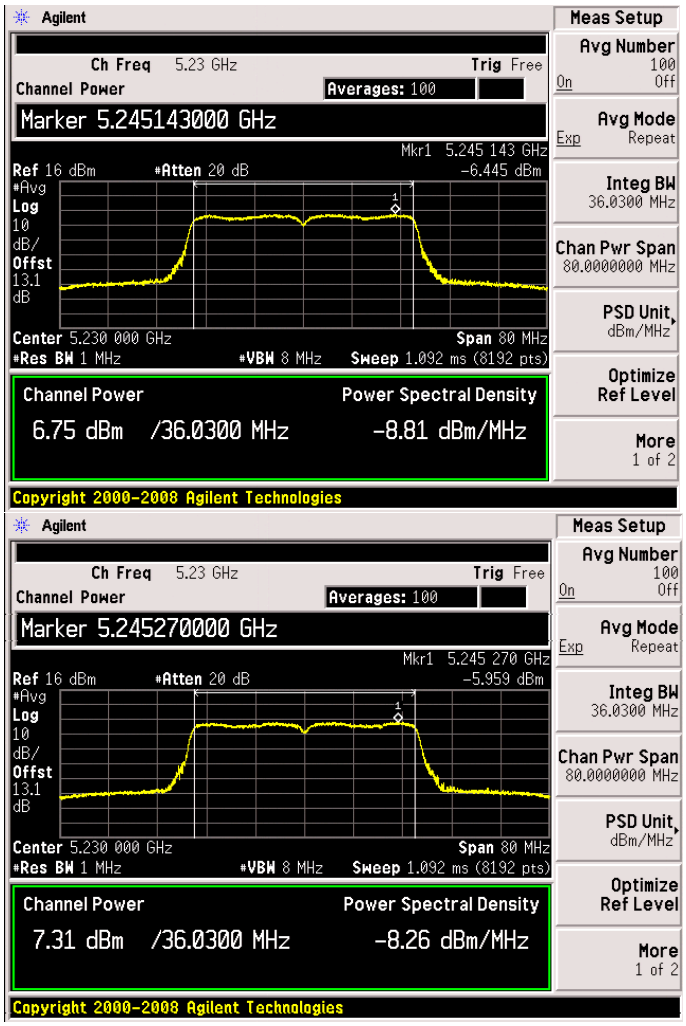
HT/VHT40, M8 to M15, M0.2 to M9.2



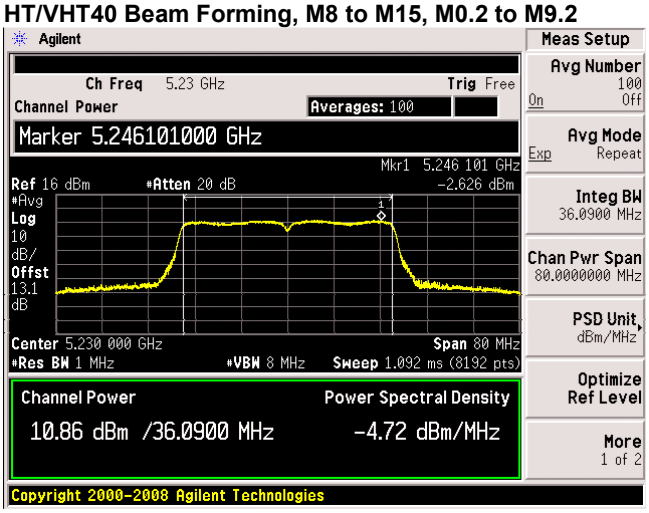


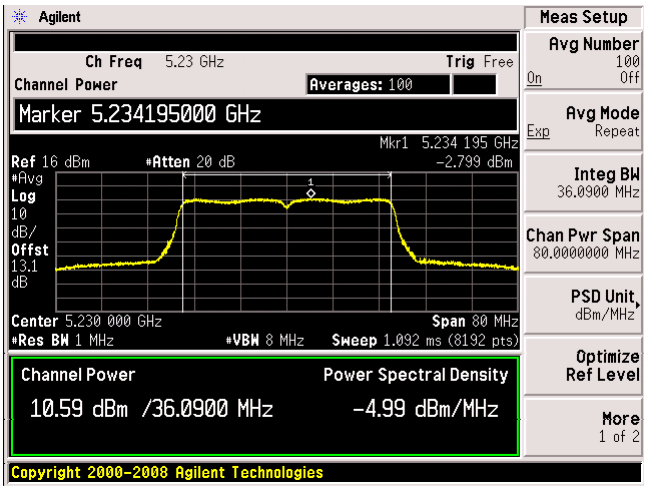
HT/VHT40, M16 to M23, M0.3 to M9.3



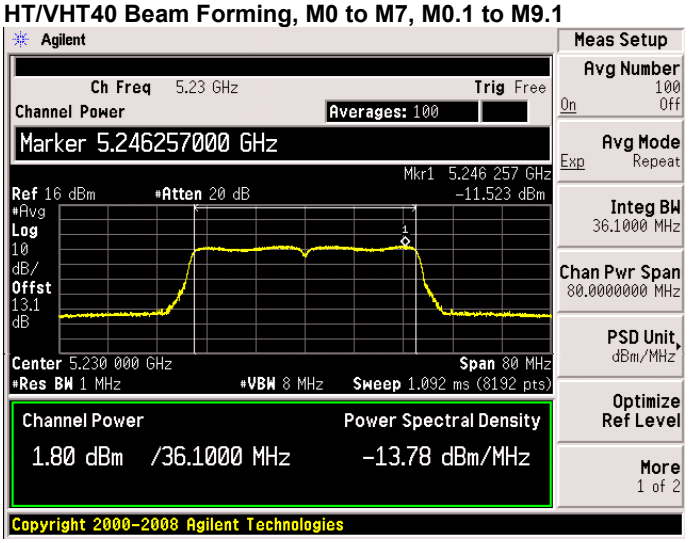


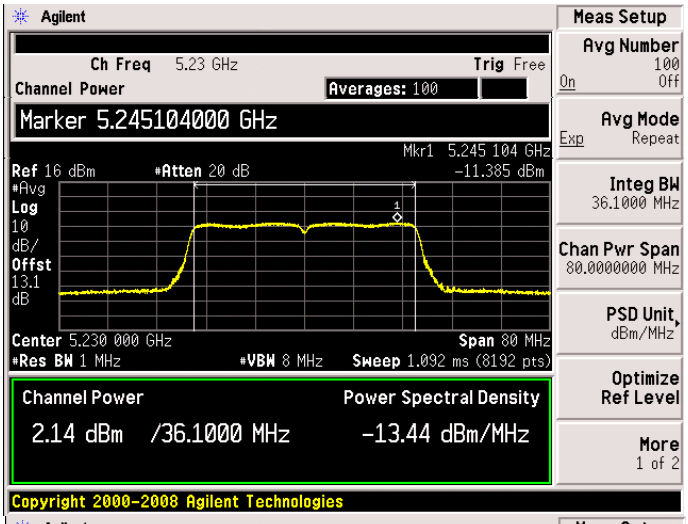
HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2

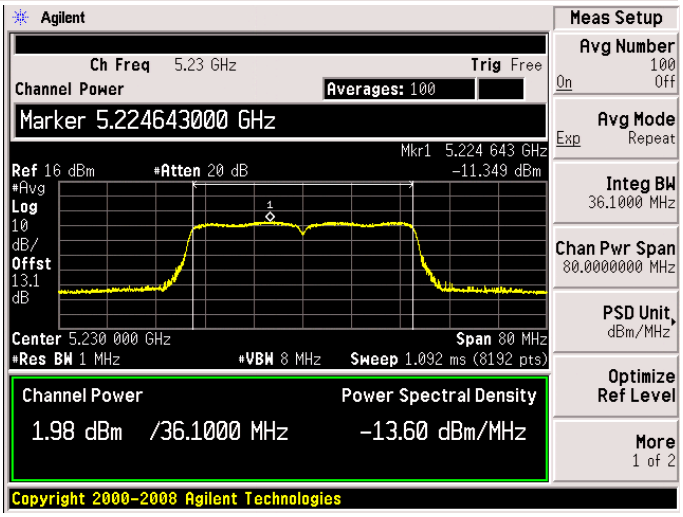


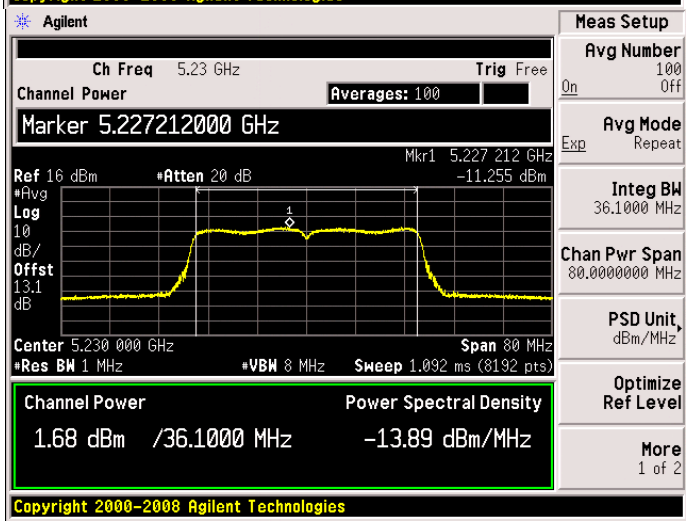


HT/VHT40 Beam Forming, M0 to M7, M0.1 to M9.1

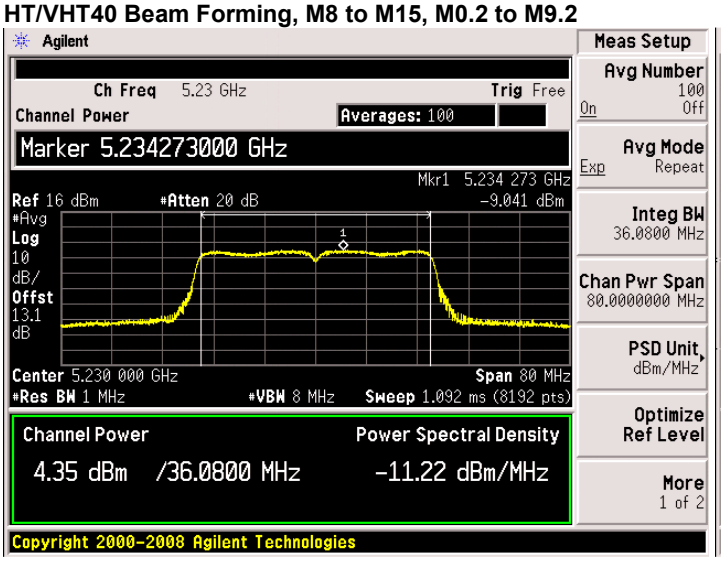


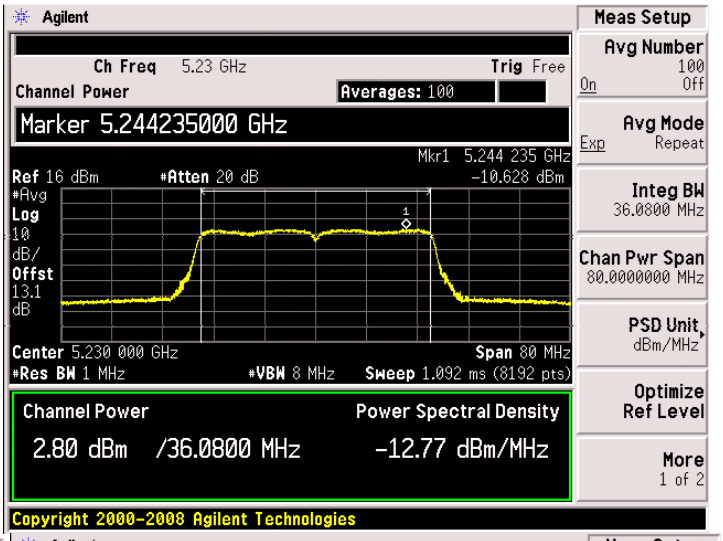


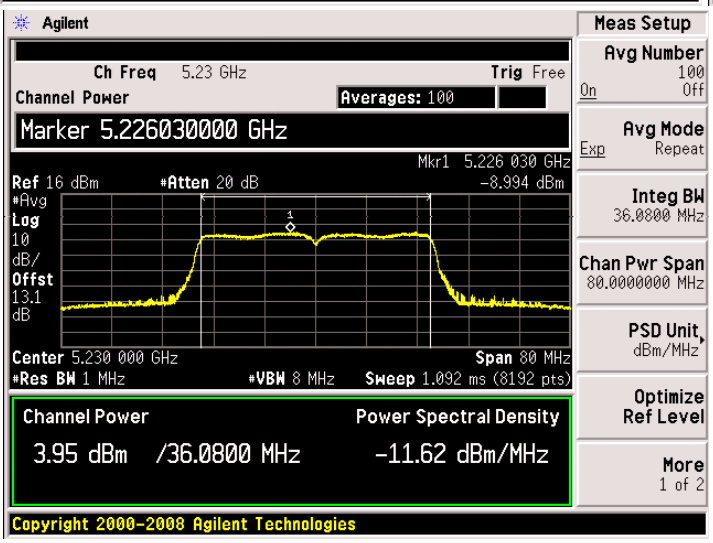


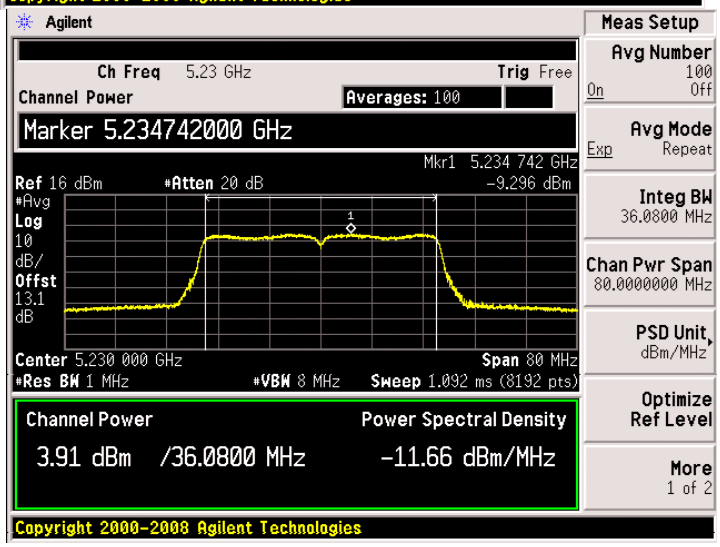


HT/VHT40 Beam Forming, M8 to M15, M0.2 to M9.2

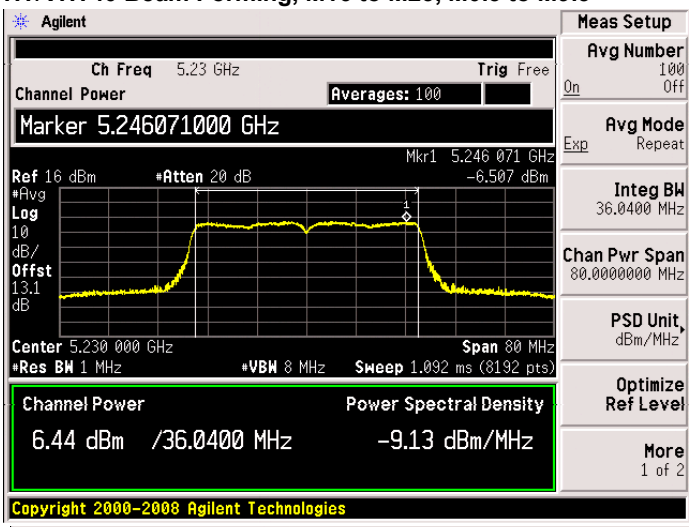


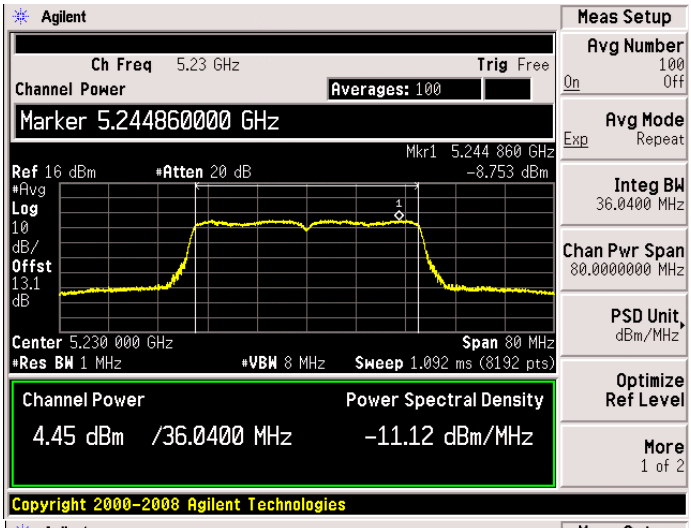


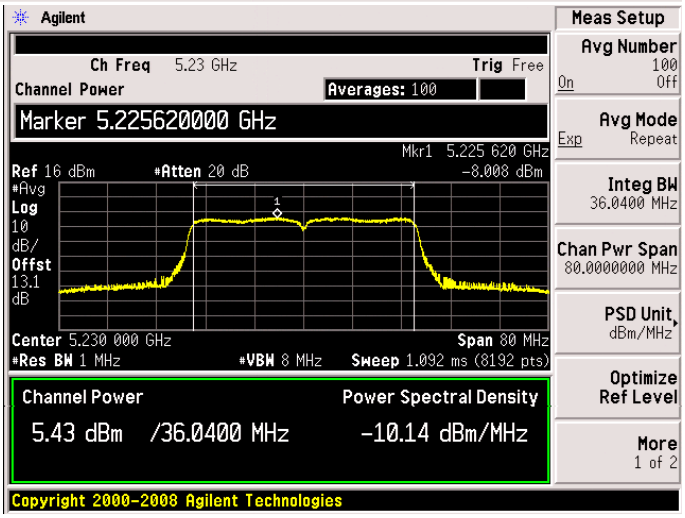


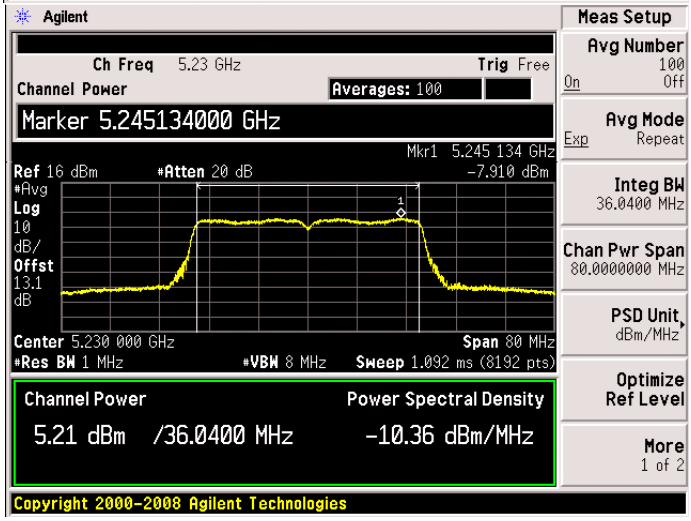


HT/VHT40 Beam Forming, M16 to M23, M0.3 to M9.3

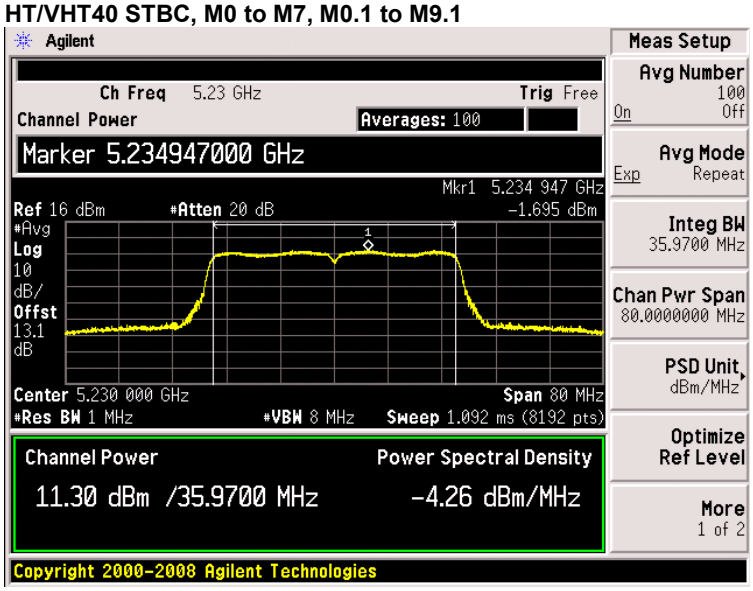


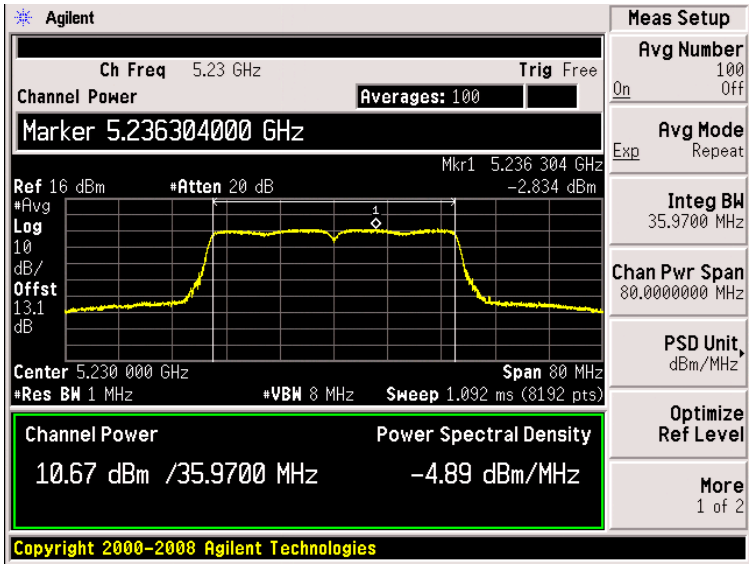




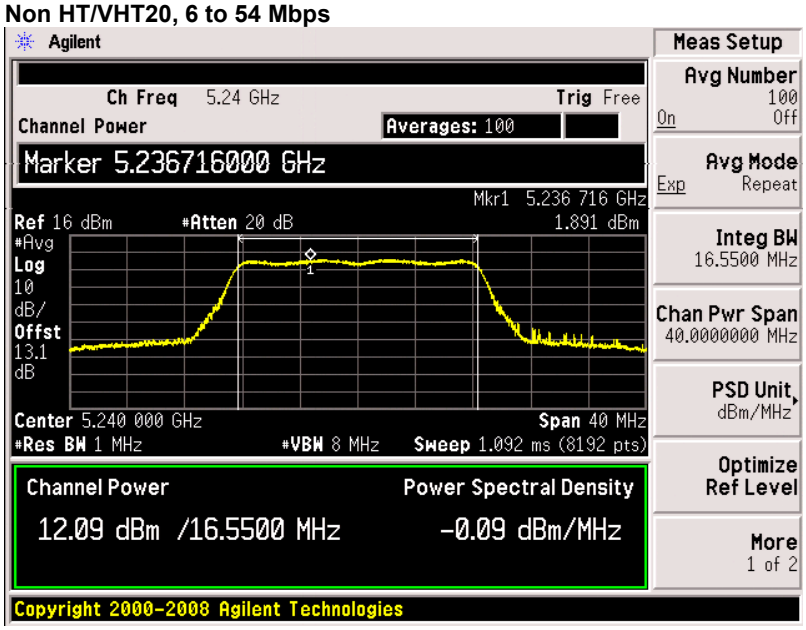


HT/VHT40 STBC, M0 to M7, M0.1 to M9.1

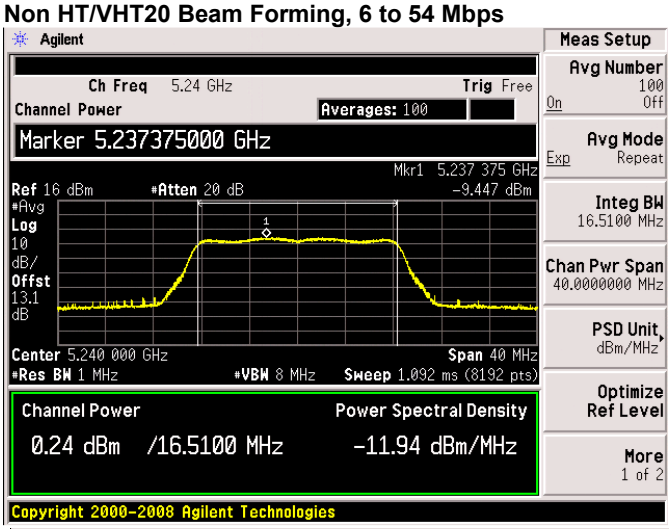


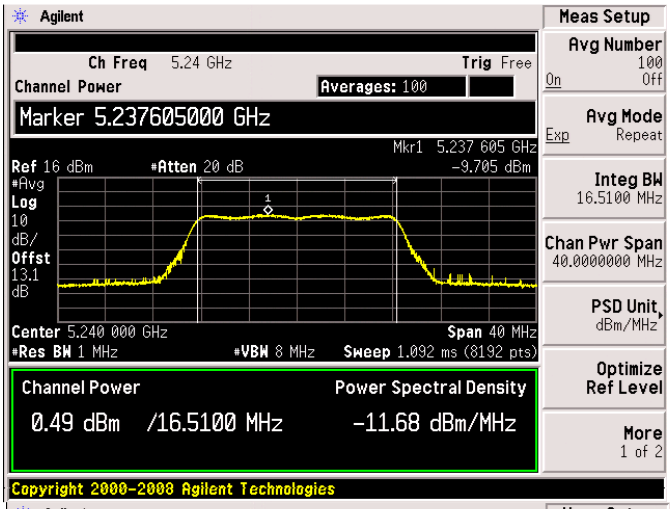


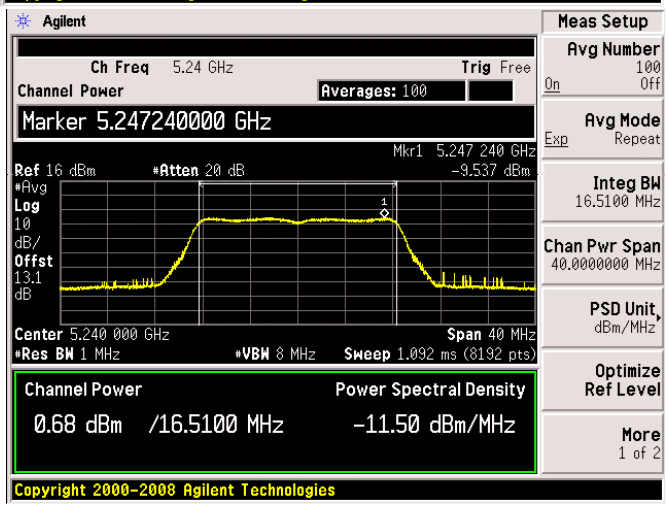
Non HT/VHT20, 6 to 54 Mbps

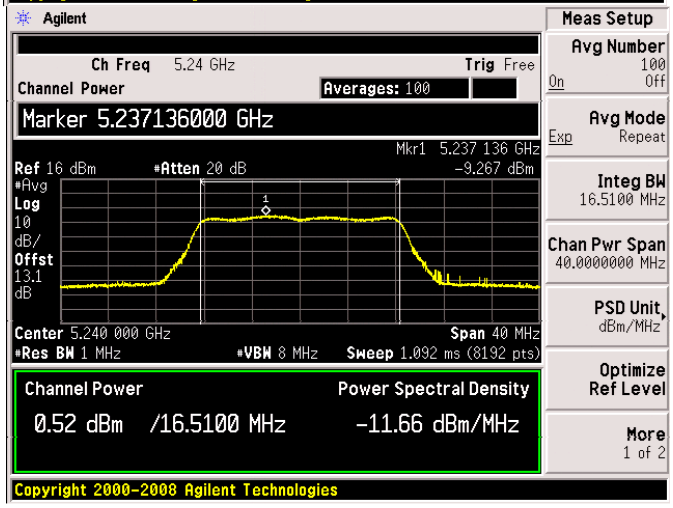


Non HT/VHT20 Beam Forming, 6 to 54 Mbps

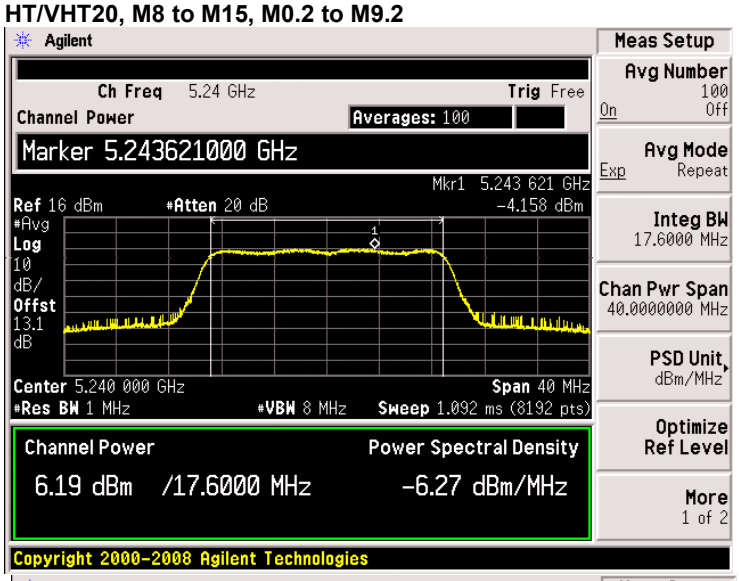


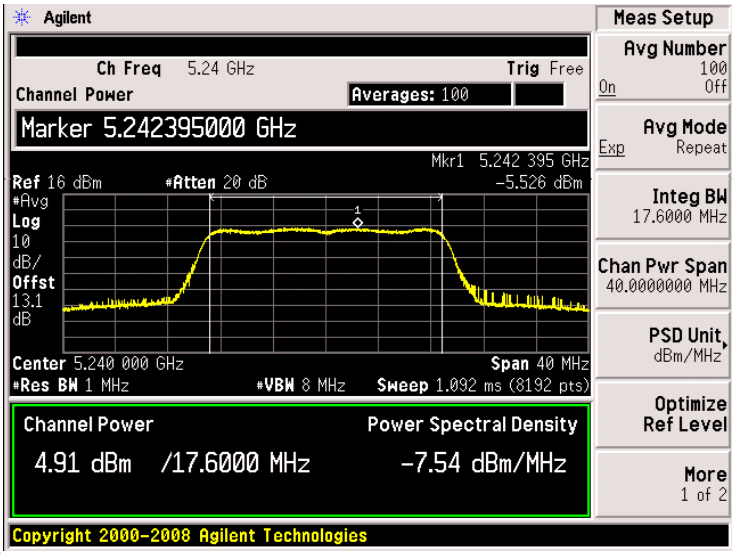


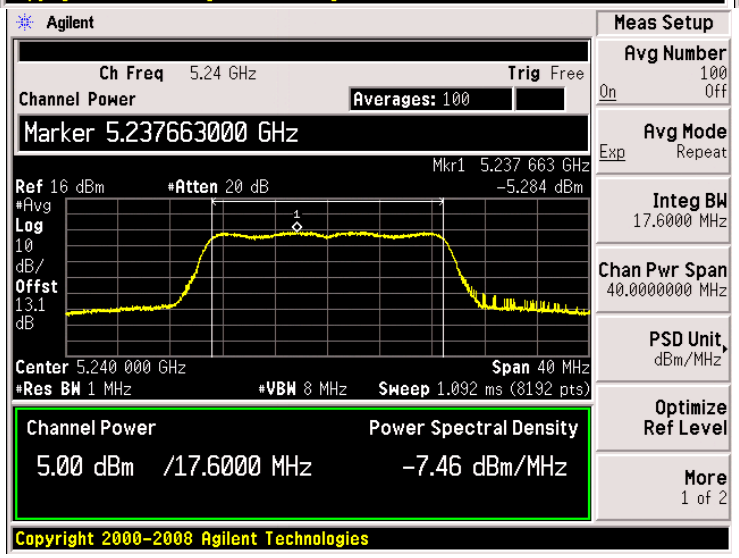




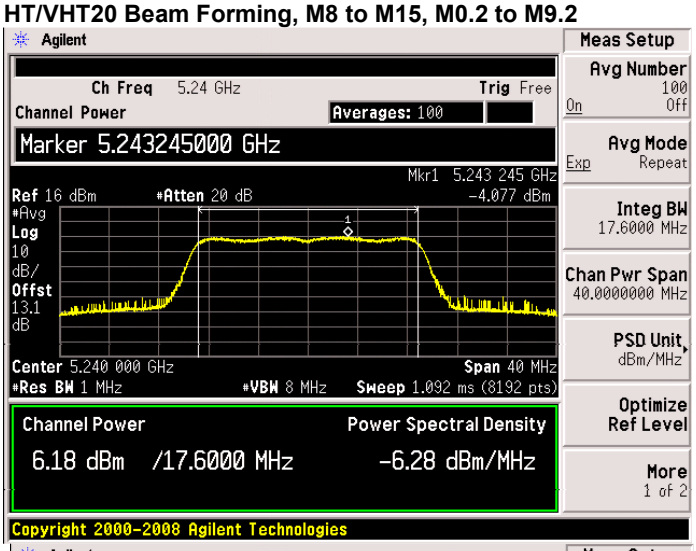
HT/VHT20, M8 to M15, M0.2 to M9.2

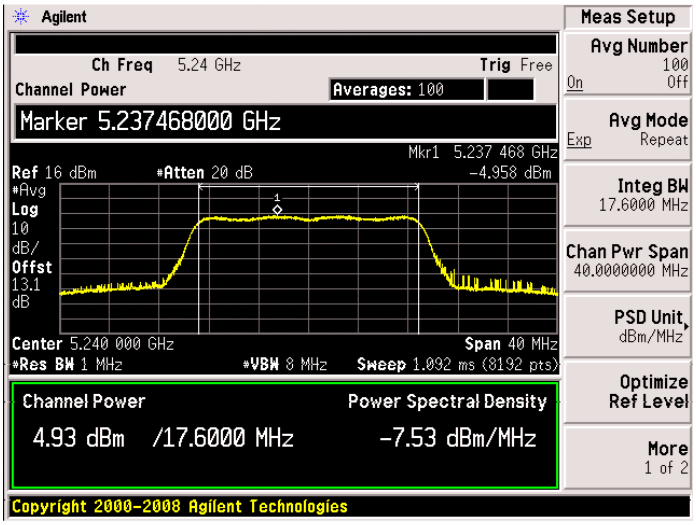


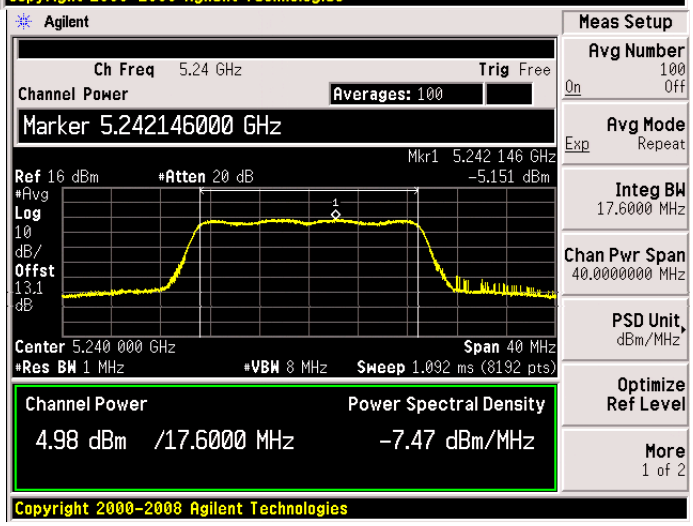




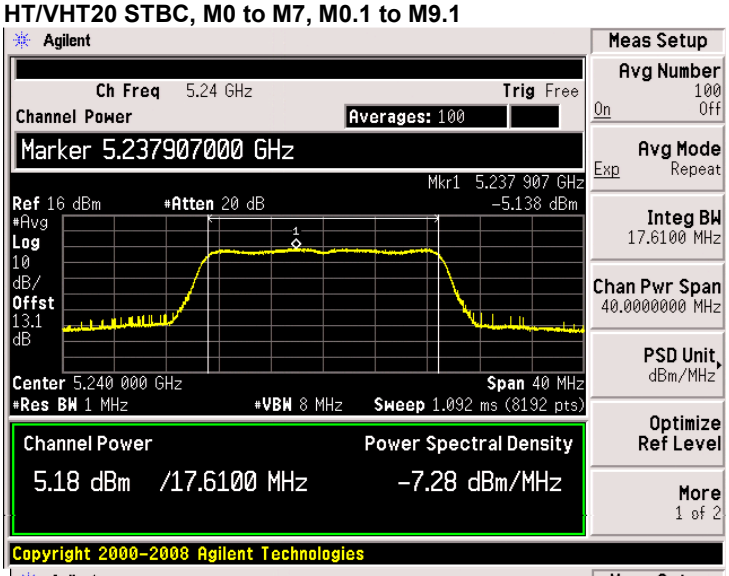
HT/VHT20 Beam Forming, M8 to M15, M0.2 to M9.2

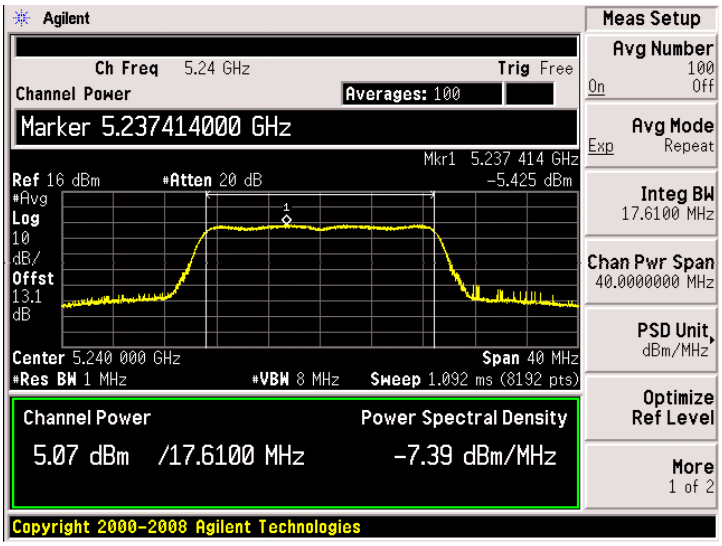


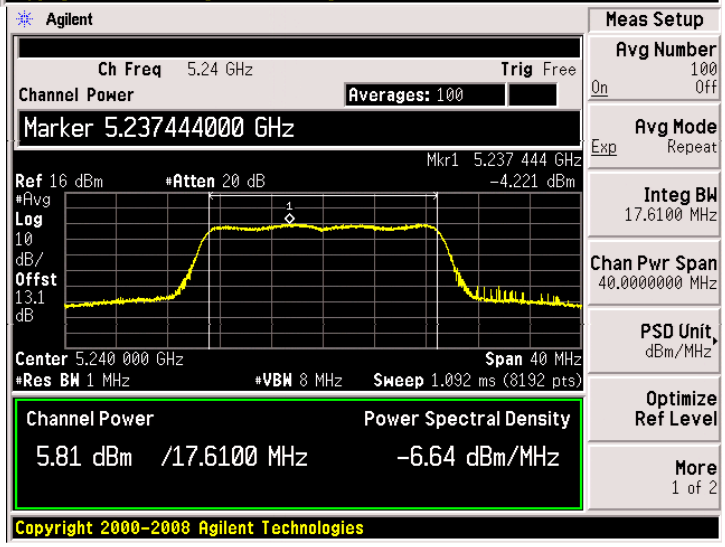




HT/VHT20 STBC, M0 to M7, M0.1 to M9.1







Conducted Spurious Emissions

15.407: For transmitters operating in the 5.15-5.25 GHz band: all emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of -27dBm/MHz.

Connect the antenna port(s) to the spectrum analyzer input. Place the radio in continuous transmit mode. Configure the spectrum analyzer as shown below (be sure to enter all losses between the transmitter output and the spectrum analyzer).

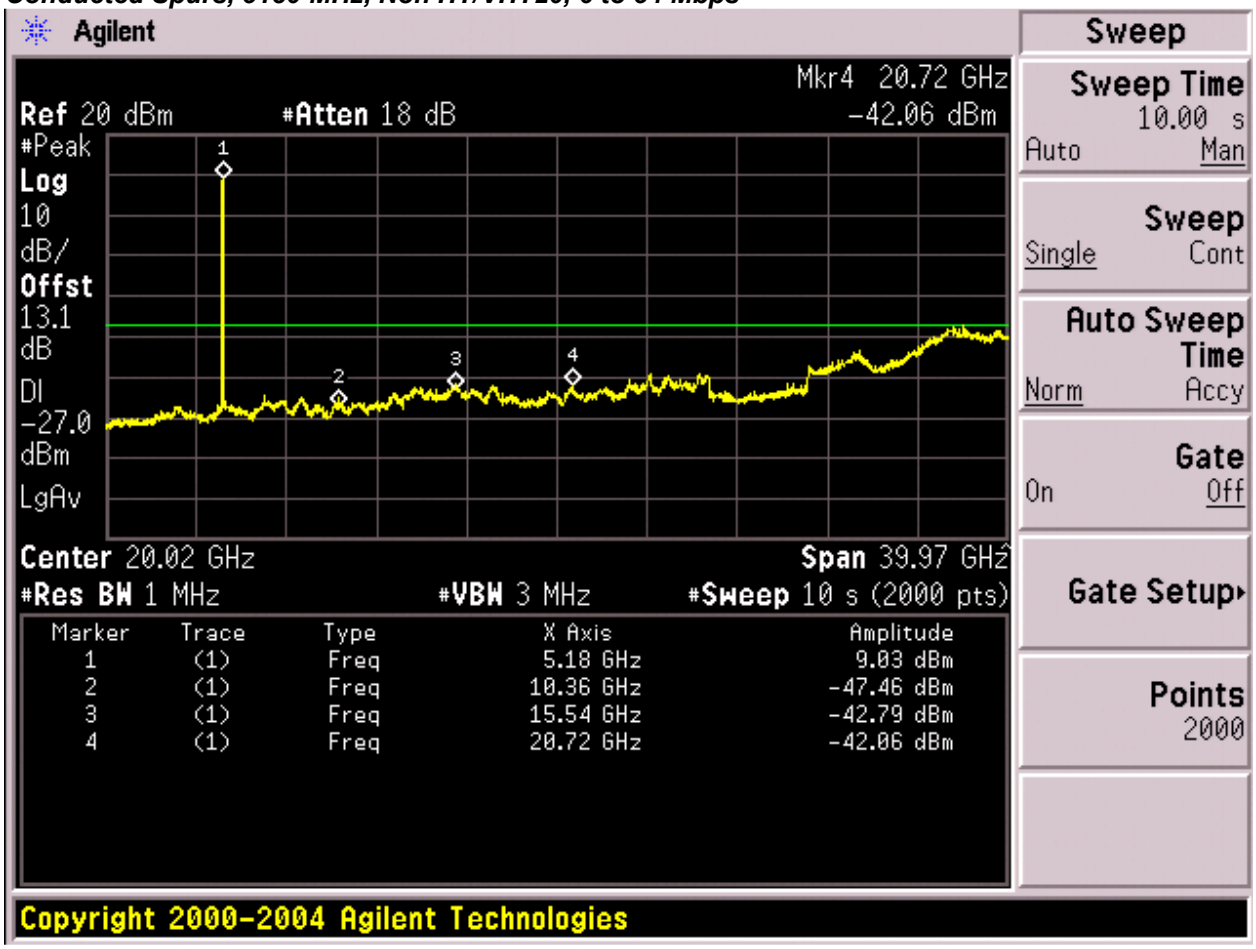
Span:	30 MHz-40 GHz
Reference Level:	20 dBm
Attenuation:	10 dB
Sweep Time:	10 s
Resolution Bandwidth:	1 MHz
Video Bandwidth:	3 MHz
Detector:	Peak
Trace:	Single
Marker:	Peak

Record the marker waveform peak to spur difference

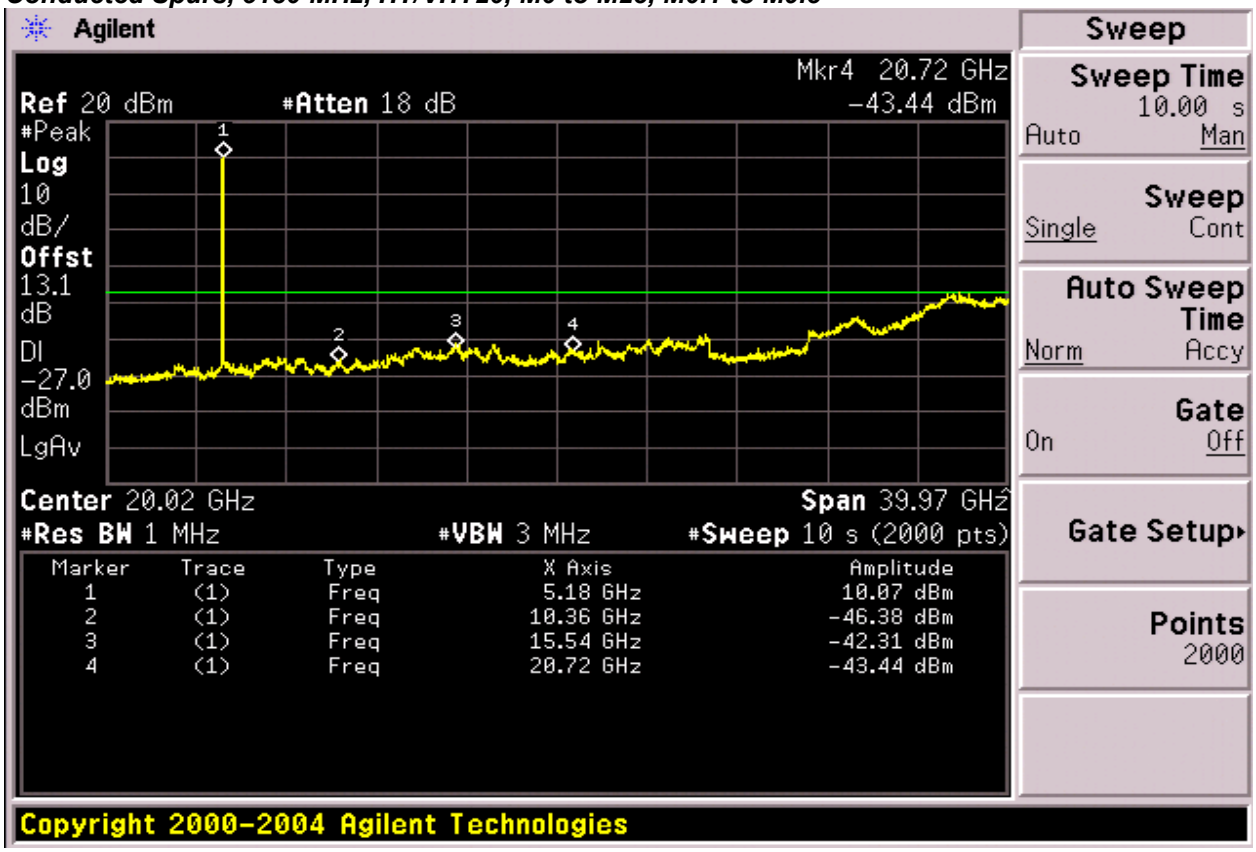
Please note that scans were performed to verify that duty cycle did not have a significant impact on the test results. Also, scans with reduced RBW and VBW settings were performed to verify that no significant emissions were present under the noise floor.

Frequency (MHz)	Mode	Antenna gain (dBi)	Limit (dBm/MHz)	Adjusted Limit (dBm/MHz)	Margin (dBm)
5180	Non HT/VHT20, 6 to 54 Mbps	7	-27	-34	>6dBm
	HT/VHT20, M0 to M23, M0.1 to M9.3	7	-27	-34	>6dBm
5180/5200	Non HT/VHT40, 6 to 54 Mbps	7	-27	-34	>6dBm
	HT/VHT40, M0 to M23, M0.1 to M9.3	7	-27	-34	>6dBm
5180/5200 5220/5240	Non HT/VHT80, 6 to 54 Mbps	7	-27	-34	>6dBm
	HT/VHT80, M0 to M23, M0.1 to M9.3	7	-27	-34	>6dBm
5220/5240	Non HT/VHT40, 6 to 54 Mbps	7	-27	-34	>6dBm
	HT/VHT40, M0 to M23, M0.1 to M9.3	7	-27	-34	>6dBm
5240	Non HT/VHT20, 6 to 54 Mbps	7	-27	-34	>6dBm
	HT/VHT20, M0 to M23, M0.1 to M9.3	7	-27	-34	>6dBm

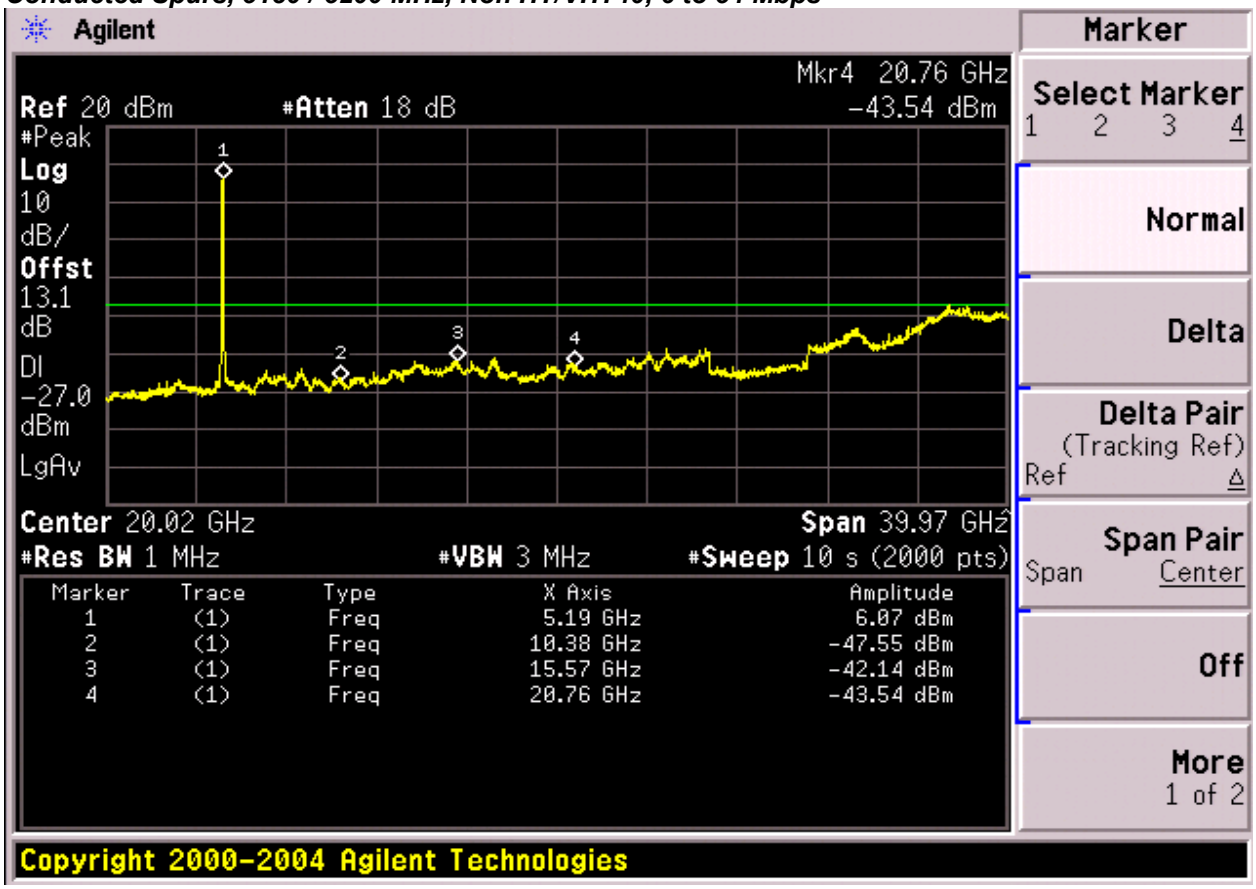
Conducted Spurs, 5180 MHz, Non HT/VHT20, 6 to 54 Mbps



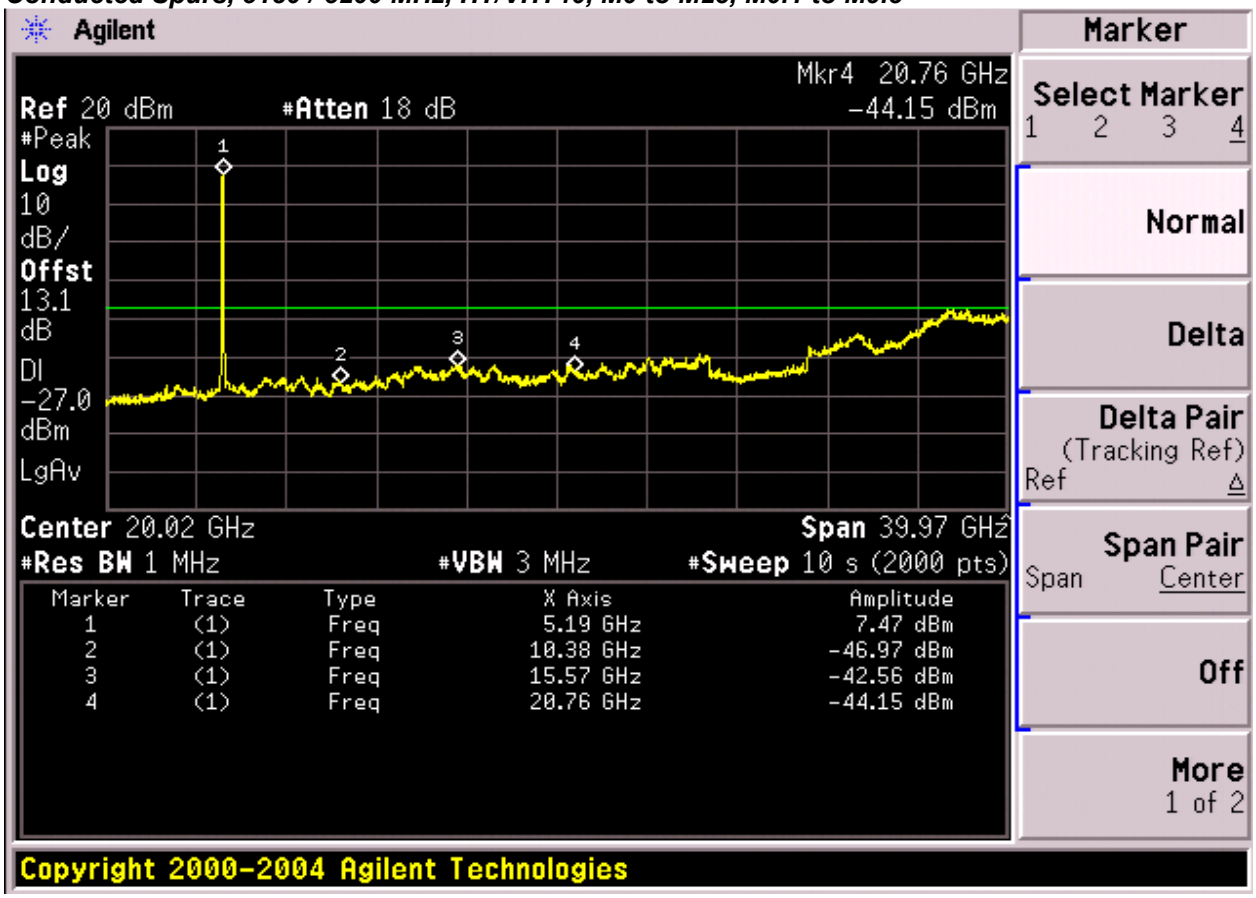
Conducted Spurs, 5180 MHz, HT/VHT20, M0 to M23, M0.1 to M9.3



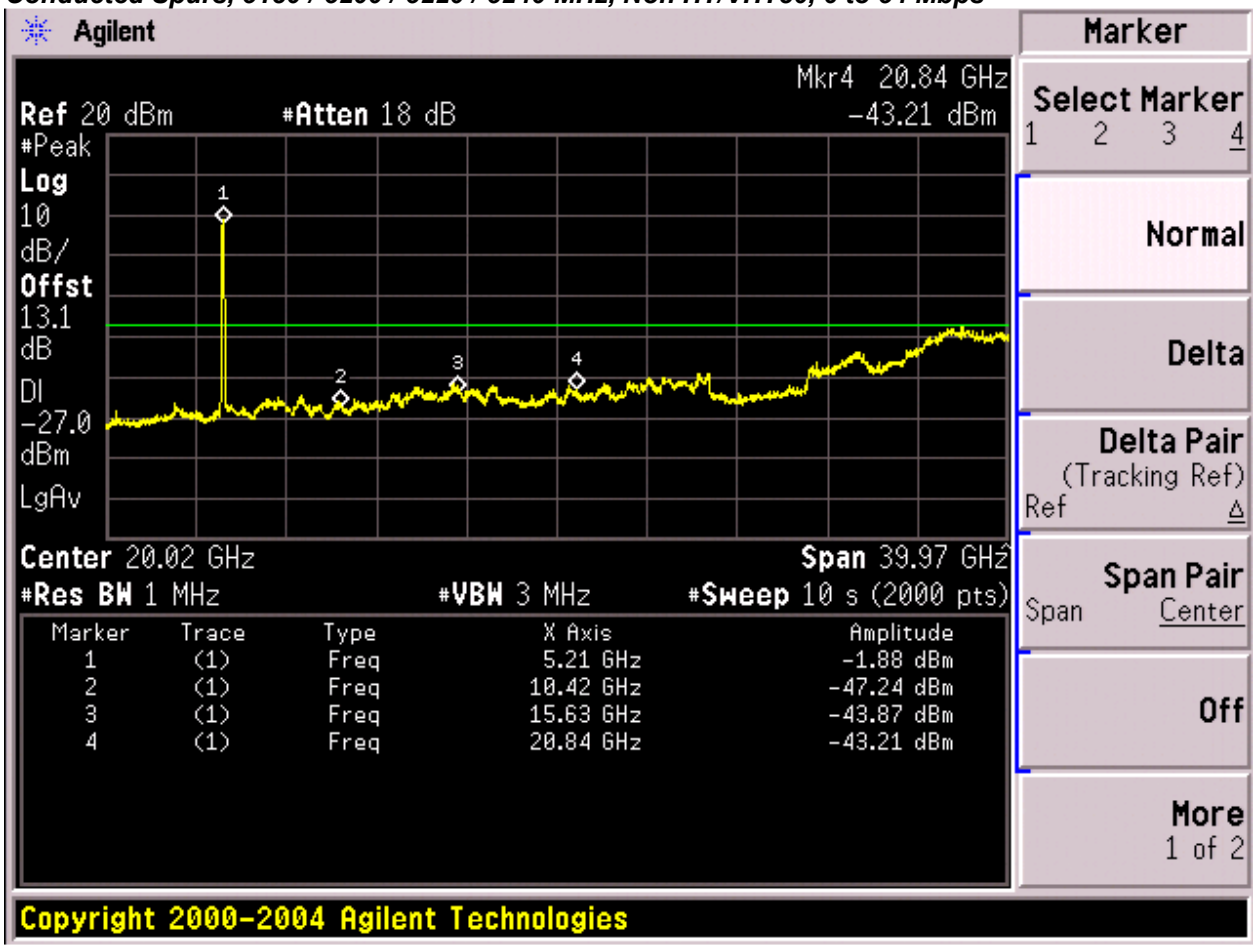
Conducted Spurs, 5180 / 5200 MHz, Non HT/VHT40, 6 to 54 Mbps



Conducted Spurs, 5180 / 5200 MHz, HT/VHT40, M0 to M23, M0.1 to M9.3



Conducted Spurs, 5180 / 5200 / 5220 / 5240 MHz, Non HT/VHT80, 6 to 54 Mbps



Conducted Spurs, 5180 / 5200 / 5220 / 5240 MHz, HT/VHT80, M0 to M23, M0.1 to M9.3