



**MOBILE DEVICES BUSINESS**

**PRODUCT SAFETY AND COMPLIANCE  
EMC LABORATORY**

**EMC TEST REPORT**

**Test Report Number** – 23901-1 WLAN

**Report Date** – August 18, 2010

The test results contained herein relate only to the model(s) identified. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

As the responsible EMC Engineer, I hereby declare that the equipment tested as specified in this report conforms to the requirements indicated.

Signature: 

Name: Albert J. Patapack

Title: EMC Engineer

Date: August 18, 2010

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THIS REPORT MUST NOT BE USED TO CLAIM PRODUCT ENDORSEMENT BY A2LA OR ANY AGENCY OF THE U.S. GOVERNMENT.

A2LA Certificate Number: 2518-02

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**Test Report Details**

Tests Performed By: Motorola Mobile Devices business (MDb)  
Product Safety and Compliance Group  
600 North US Hwy 45  
Libertyville, IL 60048  
PH (847) 523-6167 Fax (847) 523-4538  
Motorola MDb FRN: 0004321311  
FCC Registration Number: 316588  
Industry Canada Number: 1090-1

Tests Requested By: Motorola Inc.  
Mobile Devices Business  
600 North US Hwy 45  
Libertyville, IL 60048

Product Type: Cellular Phone

Signaling Capability: GSM 850 & 1900, EDGE 850 & 1900, WCDMA 800  
& 1900, Bluetooth, WLAN

FCC ID: IHDP56LD1

Serial Numbers: 351574040021486

Testing Complete Date: August 17, 2010

**Applicable Standards**

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

  X   Part 15 Subpart C – Intentional Radiators

Applicable Standards: ANSI 63.4 2003, RSS-210 Issue 7

**Summary of Testing**

Test	Test Name	Pass/Fail
1	Spectrum Bandwidth	Pass
2	Peak Power	Pass
3	Power Spectral Density	Pass
4	Spurious RF Conducted Emissions	Pass
5	AC Line Conducted Emissions	Pass

Test	Test Name	Results
1	Spectrum Bandwidth	See plots
2	Peak Power	See plots
3	Power Spectral Density	See tables
4	Spurious RF Conducted Emissions	See plots
5	AC Line Conducted Emissions	See Plots

**General and Special Conditions**

The Cellular Phone hereinafter referred to as the Equipment under Test or EUT was tested using a fully charged battery when applicable. Where a battery could not be used due to the need for a controlled variation of input voltage, an external power supply was utilized.

All testing was done in an indoor controlled environment. The temperature and the relative humidity were maintained within the ANSI C63.4 2003 Standard requirements during the entire duration of testing.

The WLAN conducted power level is measured for all the data rates supported across all modes. The data rate with the higher conducted power level for each mode is evaluated for Conducted and Radiated requirements.

**Equipment and Cable Configurations**

The EUT was tested in a stand-alone configuration that is representative of typical use.

**Measuring Equipment and Calibration Information**

Manufacturer	Equipment Type	Model No.	Serial Number	Calibration Due Date
Rohde & Schwarz	Receiver	ESIB40	100226	4/08/11
Agilent	Signal Analyzer	N9020A	US46470586	12/18/10
Attenuator	Weinschel	AS-6	6675	NCR
Attenuator	Weinschel	AS-6	6677	NCR
ETS	LISN	3810/2NM	0023630	10/05/10
ETS	LISN	3810/2NM	2179	10/06/10

All test equipment was within their calibration date during the time of testing. When equipment went out of calibration during testing it was replaced using a similar piece of calibrated equipment. All these equipments are listed in the equipment list. All equipment is on a one-year calibration cycle.

**Description of WLAN Transmitter**

The EUT offers WLAN as a feature. The WLAN antenna is mounted inside of the EUT. The antenna installation is permanent. For a more thorough description of the functionality please refer to Exhibit 12 of this package.

As a WLAN transmitter, it is designed operate with other WLAN devices as defined by the industrial standard. In this application, the device is battery operated.

**De Facto EIRP Limit – Pursuant 47 CFR 15.247(b)(4); RSS-210 Section A8.4.**

Criterion: The conducted output power limit of 1-watt is based on the use of antennas with directional gains that do not exceed 6 dB<sub>i</sub>. If transmitting antennas of directional gain greater than 6 dB<sub>i</sub> are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dB<sub>i</sub>.

The antenna employed by this transmitter is intended to be omni-directional, and thus will not exhibit directional gain in excess of 6 dB<sub>i</sub>. The conducted power is less than the limits set forth (see elsewhere in this report for details).

## **Measurement Procedures and Data**

### **Spectrum Bandwidth**

CFR 47 Part 15.247

### **Measurement Procedure**

The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

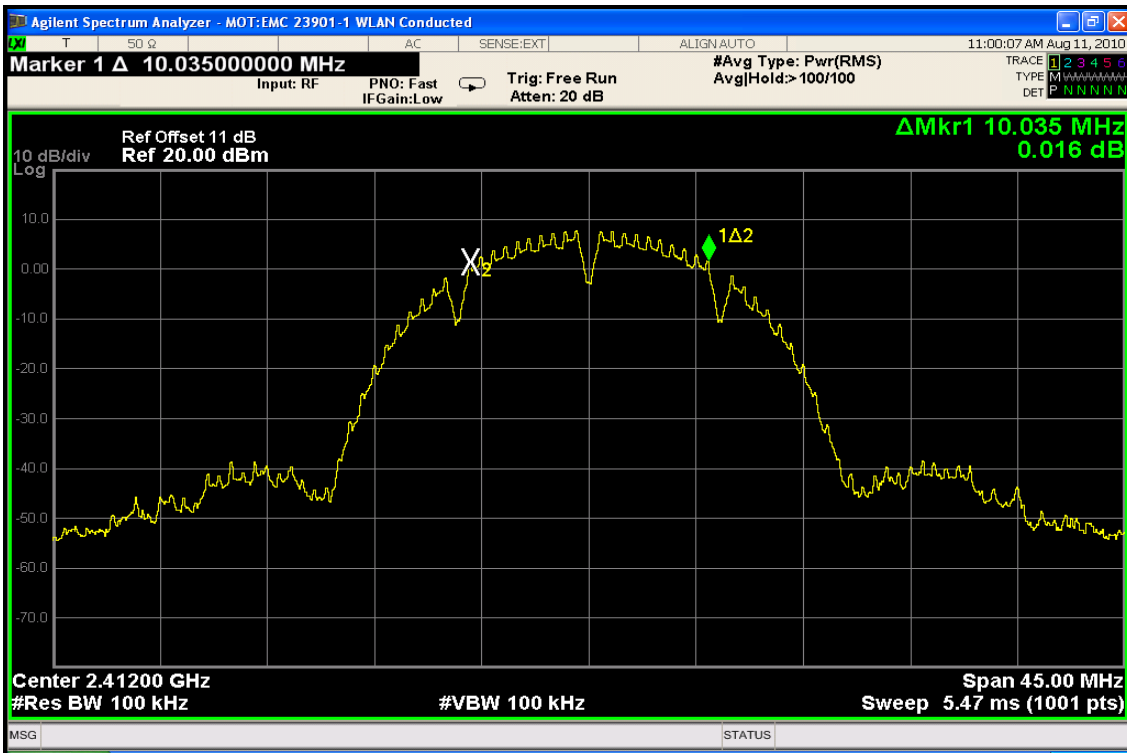
1. RBW  $\geq$  100 kHz
2. VBW  $\geq$  RBW
3. Sweep = auto
4. Detector function = peak
5. Trace = max hold

The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate. The marker-to-peak function was used to set the marker to the peak of the emission. The marker-delta function was used to measure 6 dB down one side of the emission. The marker-delta function and marker was moved to the other side of the emission until it was even with the reference marker. The marker-delta reading at this point was the 6 dB bandwidth of the emission. The same procedure was repeated for 20 dB bandwidth.

### **Measurement Results**

See attached

### 802.11b Mode



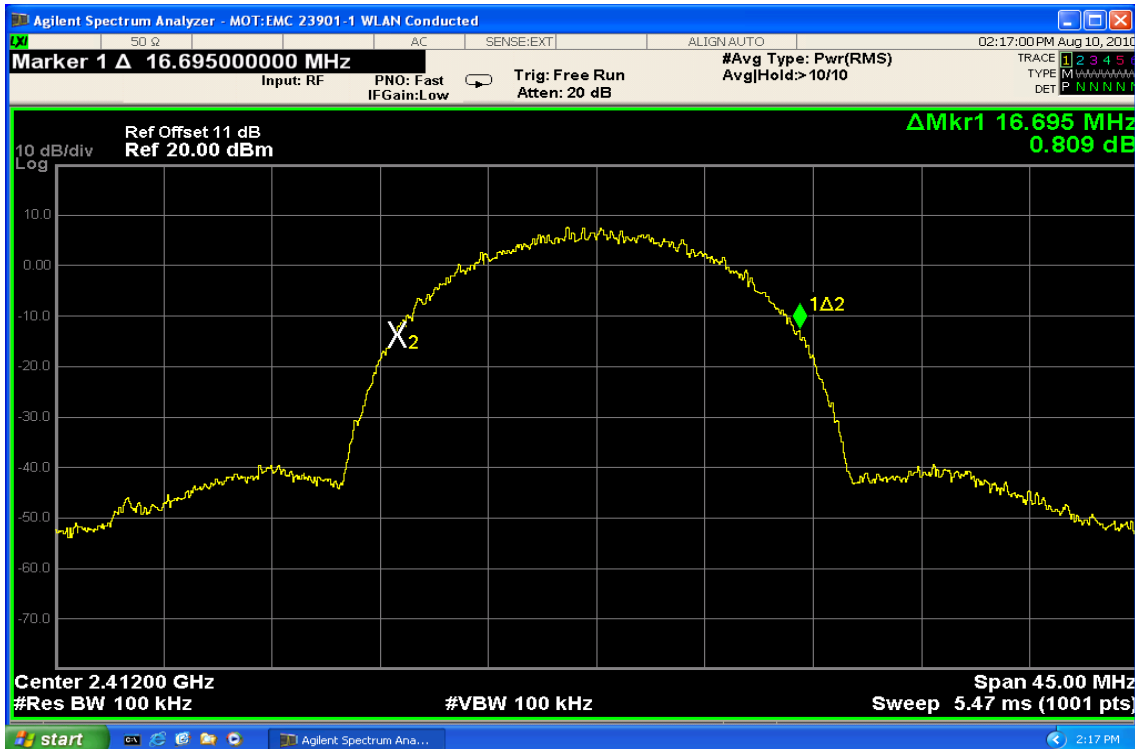
6 dB Bandwidth Channel 1 @ 1 Mbps



6 dB Bandwidth Channel 6 @ 1 Mbps



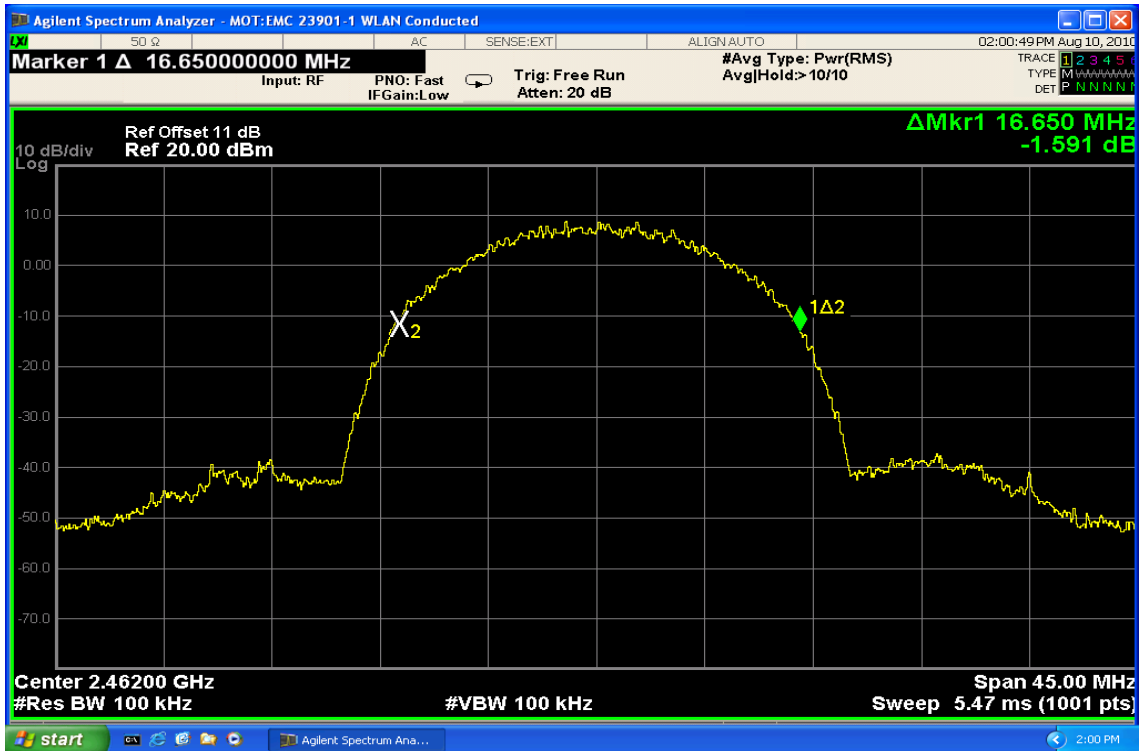
6 dB Bandwidth Channel 11 @ 1 Mbps



20 dB Bandwidth Channel 1 @ 11 Mbps



20 dB Bandwidth Channel 6 @ 11 Mbps

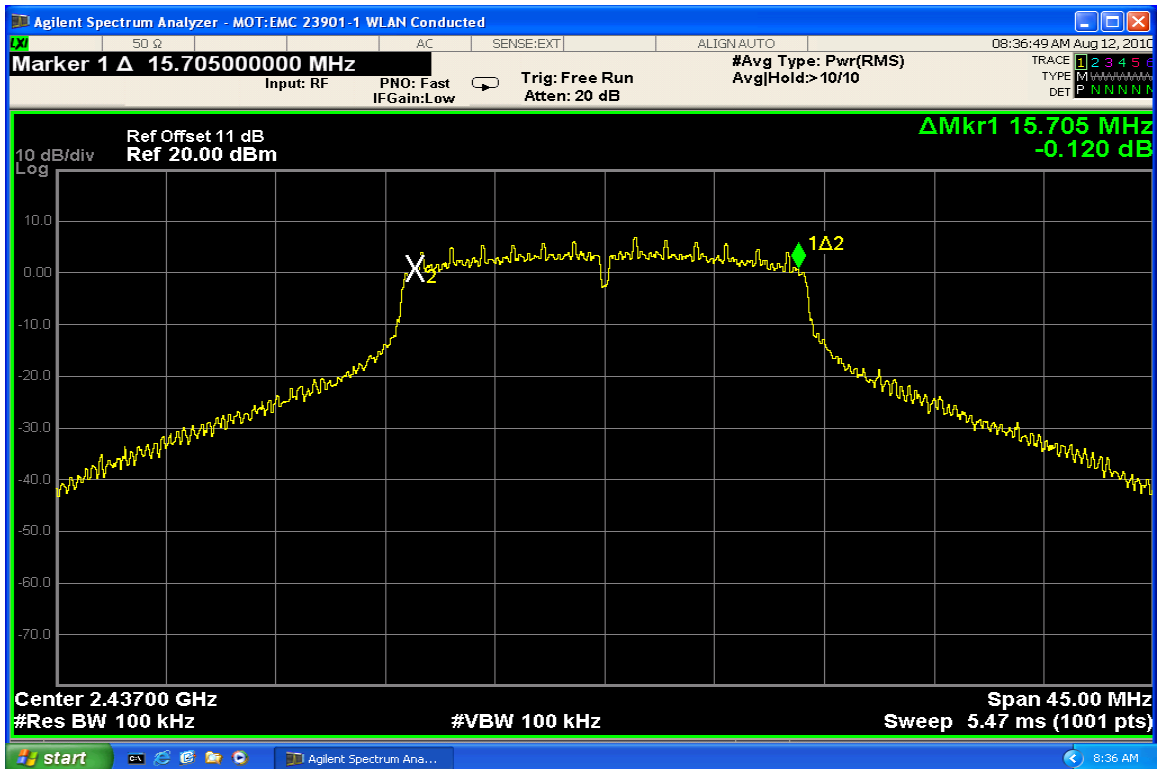


20 dB Bandwidth Channel 11 @ 11 Mbps

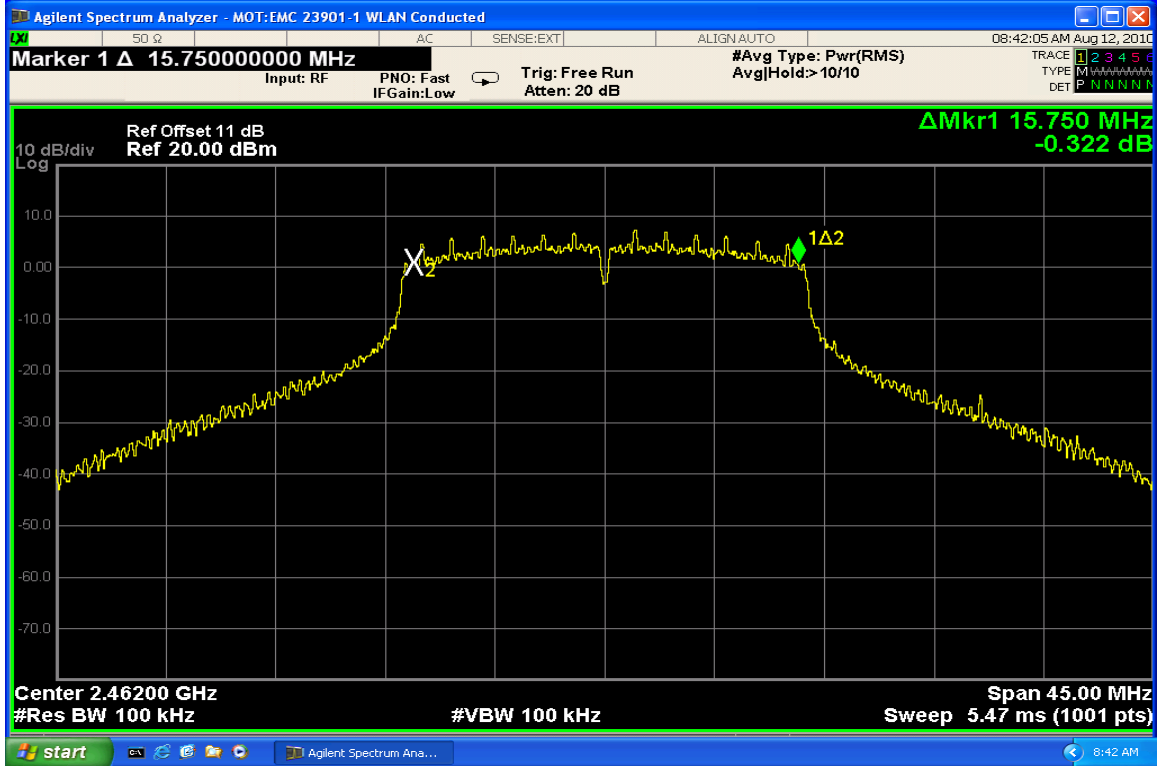
### 802.11g Mode



6 dB Bandwidth Channel 1 @ 6 Mbps



6 dB Bandwidth Channel 6 @ 6 Mbps



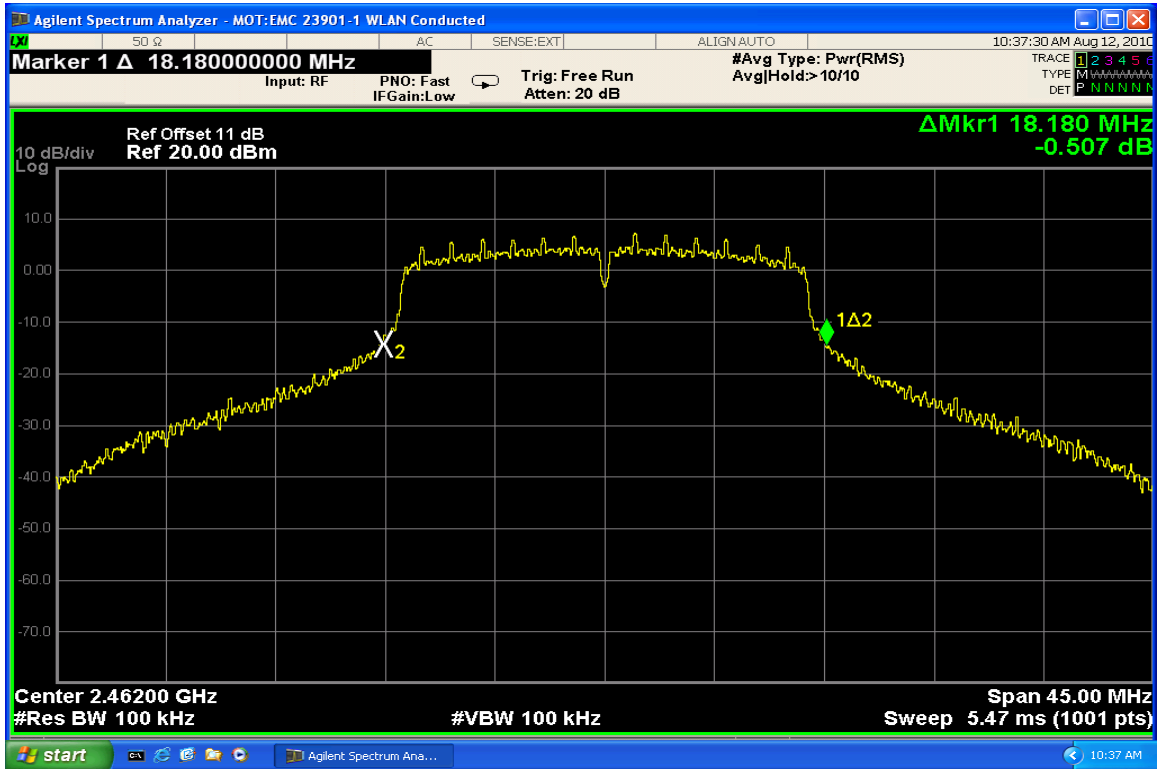
6 dB Bandwidth Channel 11 @ 6 Mbps



20 dB Bandwidth Channel 1 @ 9 Mbps

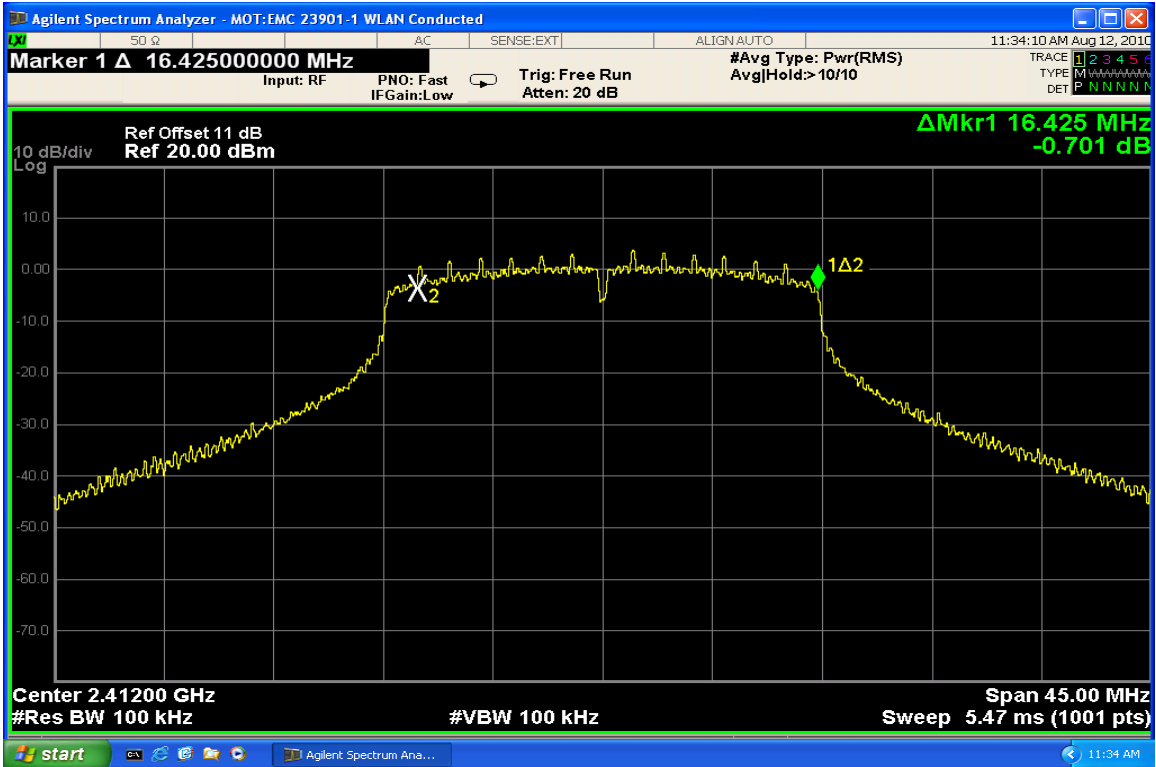


20 dB Bandwidth Channel 6 @ 9 Mbps

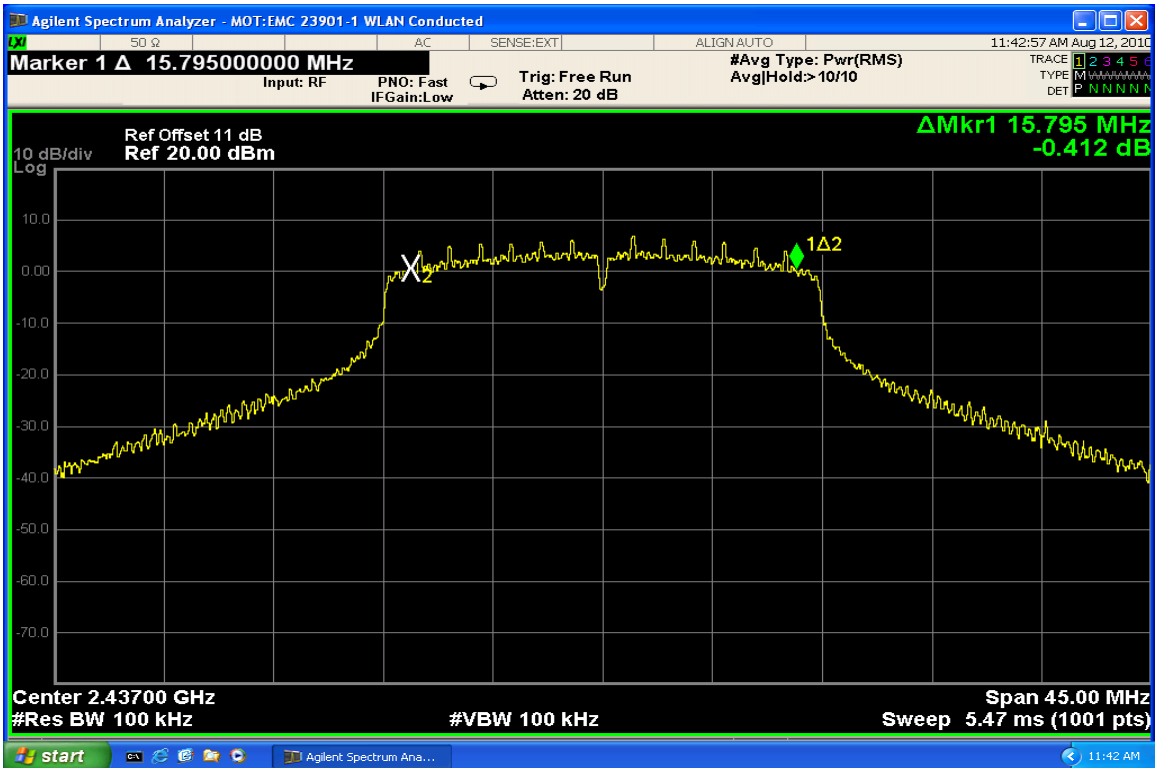


20 dB Bandwidth Channel 11 @ 9 Mbps

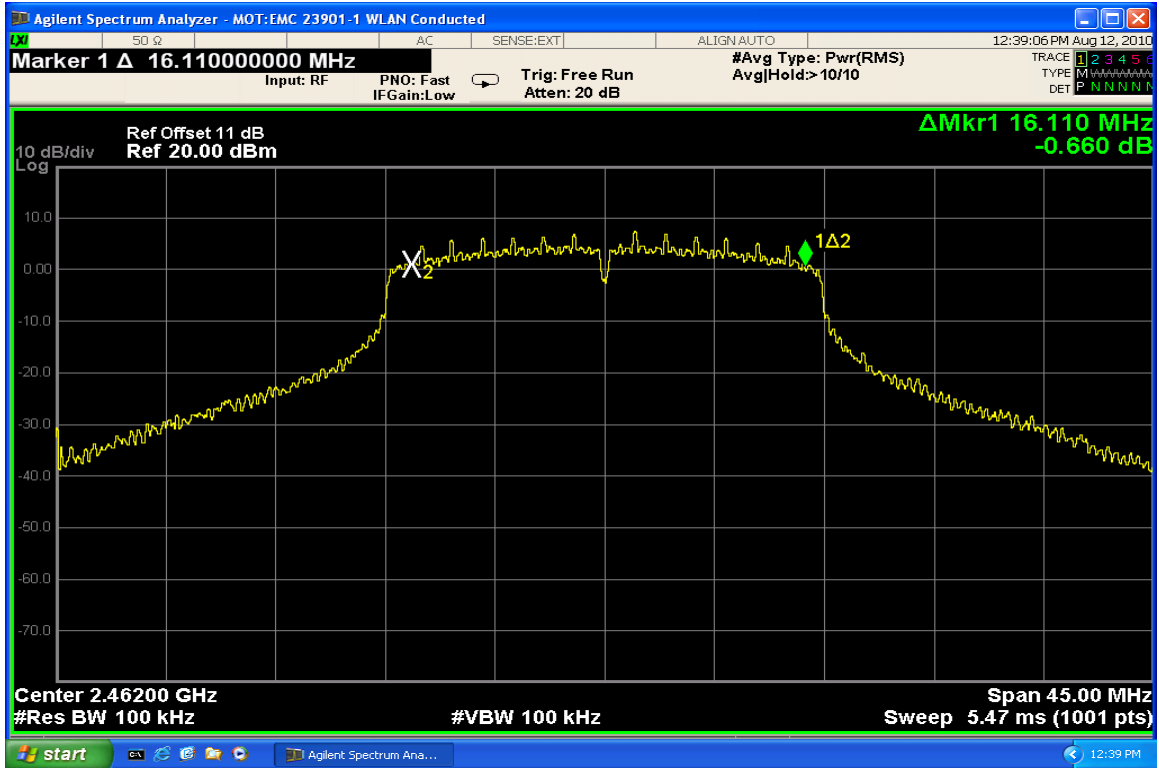
### 802.11n 800ns GI Mode



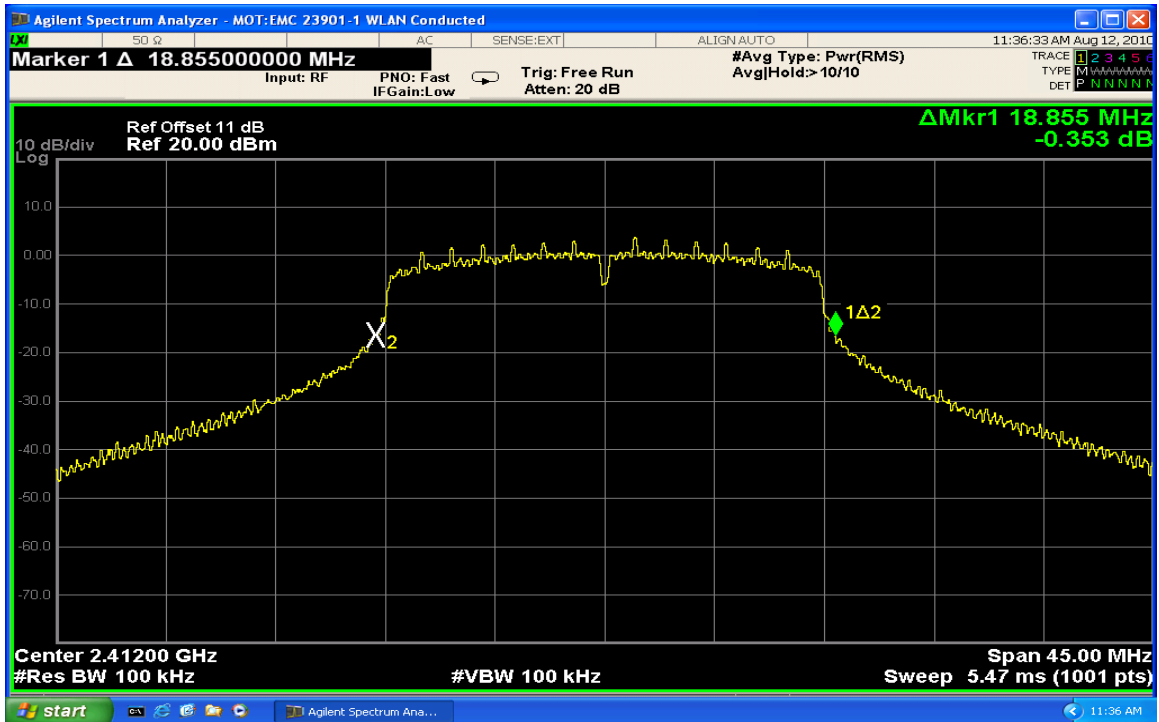
6 dB Bandwidth Channel 1 @ 6.5 Mbps



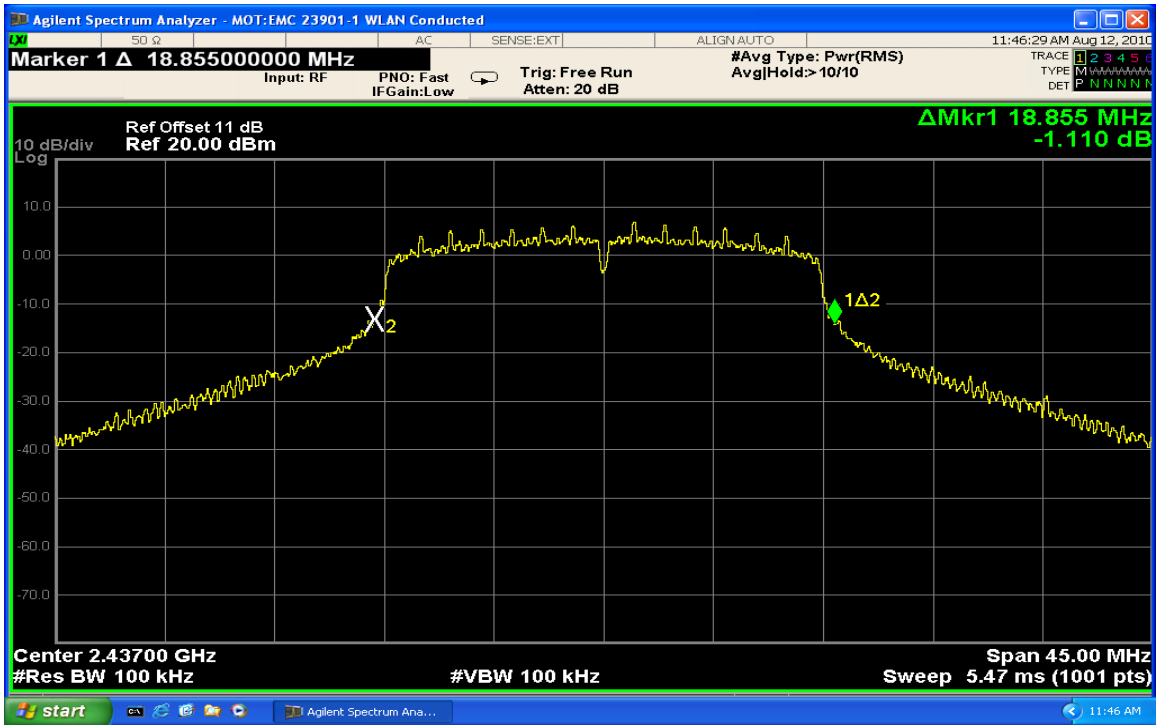
6 dB Bandwidth Channel 6 @ 6.5 Mbps



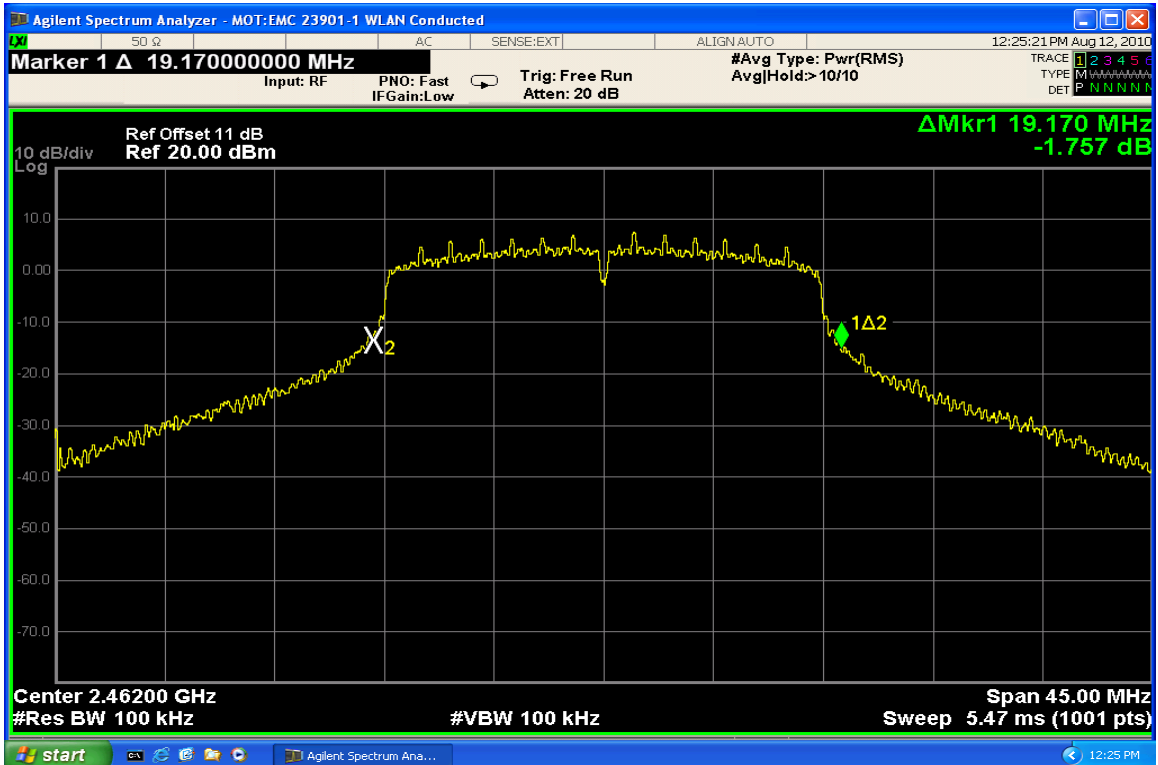
6 dB Bandwidth Channel 11 @ 6.5 Mbps



20 dB Bandwidth Channel 1 @ 6.5 Mbps

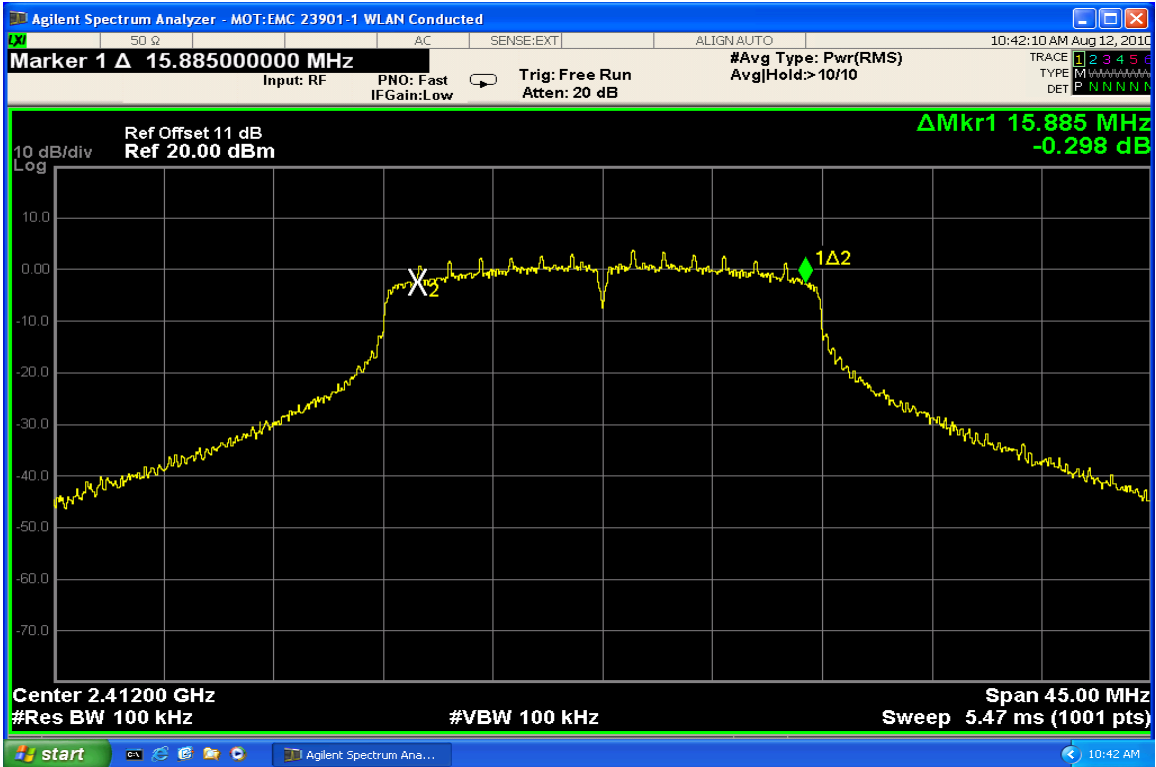


20 dB Bandwidth Channel 6 @ 6.5 Mbps



20 dB Bandwidth Channel 11 @ 6.5 Mbps

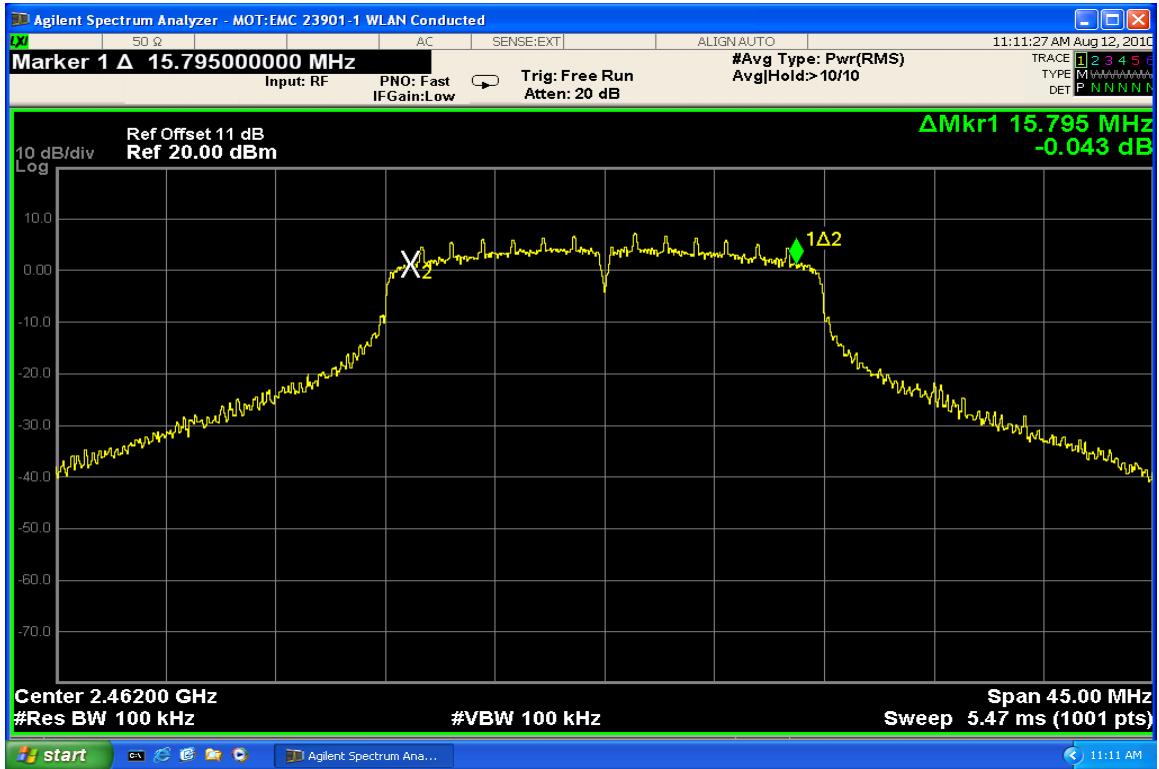
### 802.11n 400ns GI Mode



6 dB Bandwidth Channel 1 @ 7.2 Mbps



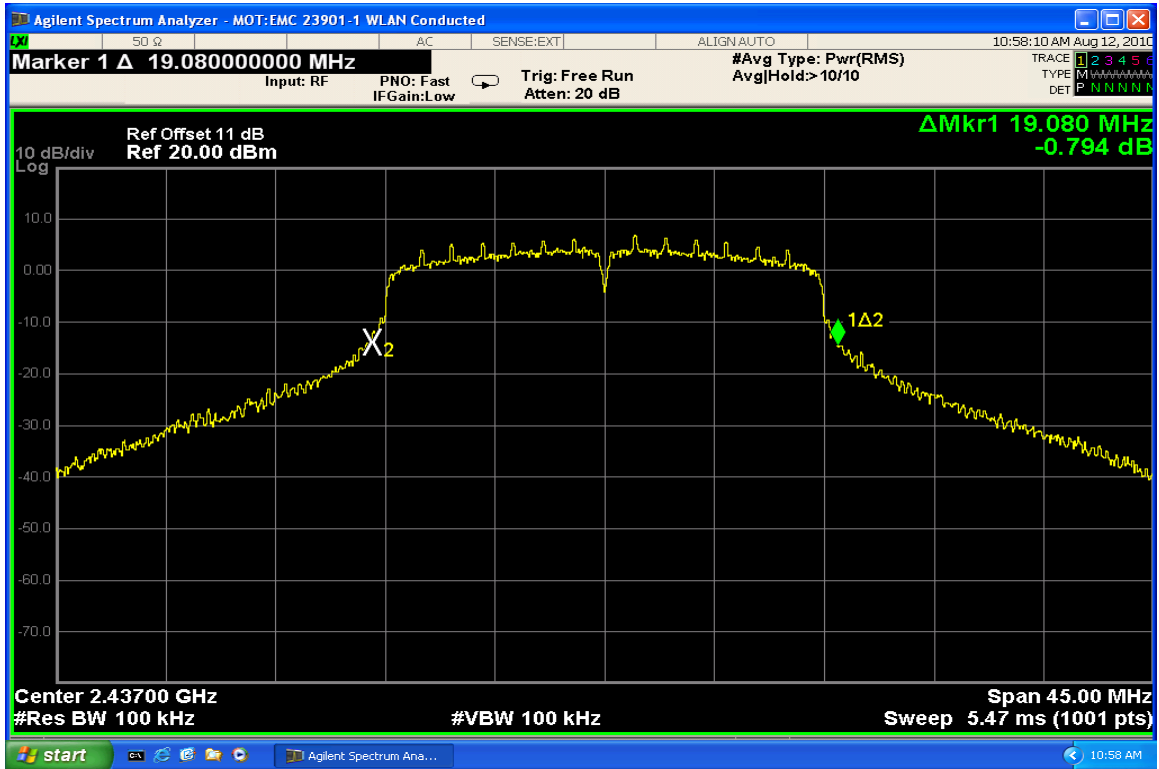
6 dB Bandwidth Channel 6 @ 7.2 Mbps



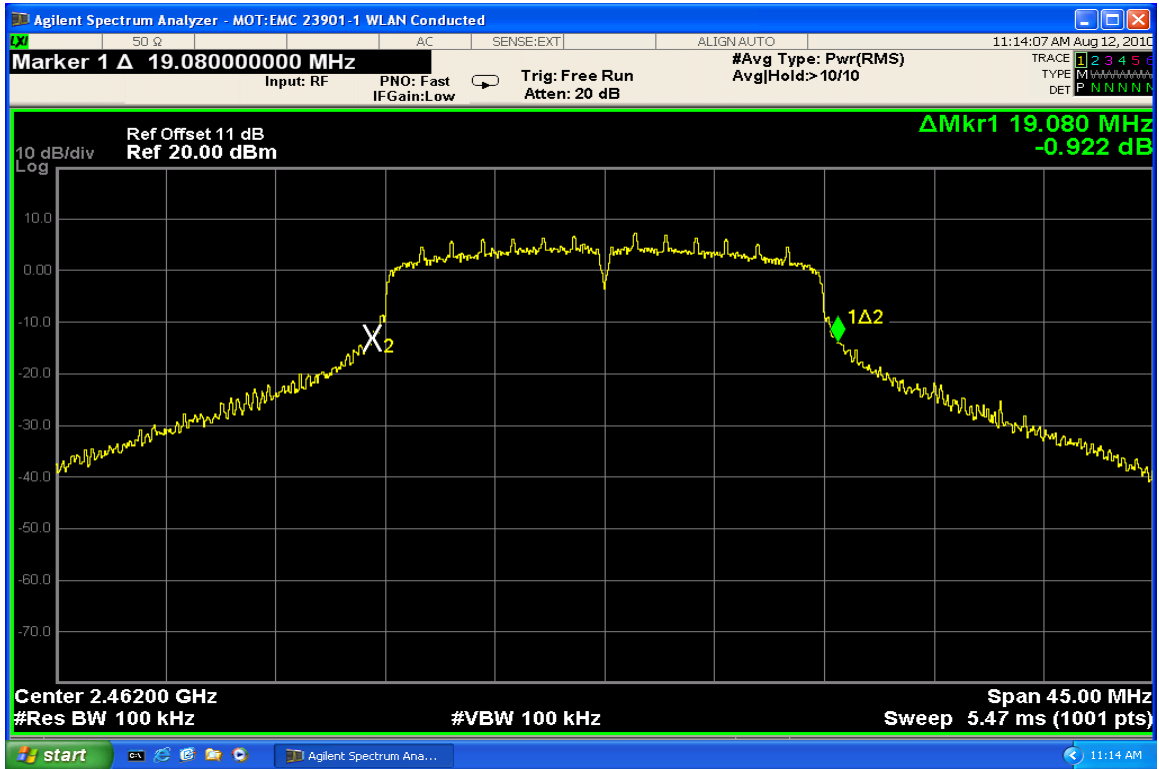
6 dB Bandwidth Channel 11 @ 7.2 Mbps



20 dB Bandwidth Channel 1 @ 7.2 Mbps



20 dB Bandwidth Channel 6 @ 7.2 Mbps



20 dB Bandwidth Channel 11 @ 7.2 Mbps

**PEAK OUTPUT POWER**

CFR 47 Part 15.247

**Measurement Procedure**

The RF output port of the Equipment-Under-Test is directly coupled to the input of the Spectrum analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

**Measurement Results**

See Attached

Channel	Average power (dBm) for <u>802.11b</u> Data Rates			
	1 Mbps	2 Mbps	5.5 Mbps	11 Mbps
1	17.46	17.4	17.23	17.17
6	18.07	18.06	17.95	17.85
11	18.49	18.56	18.32	18.59

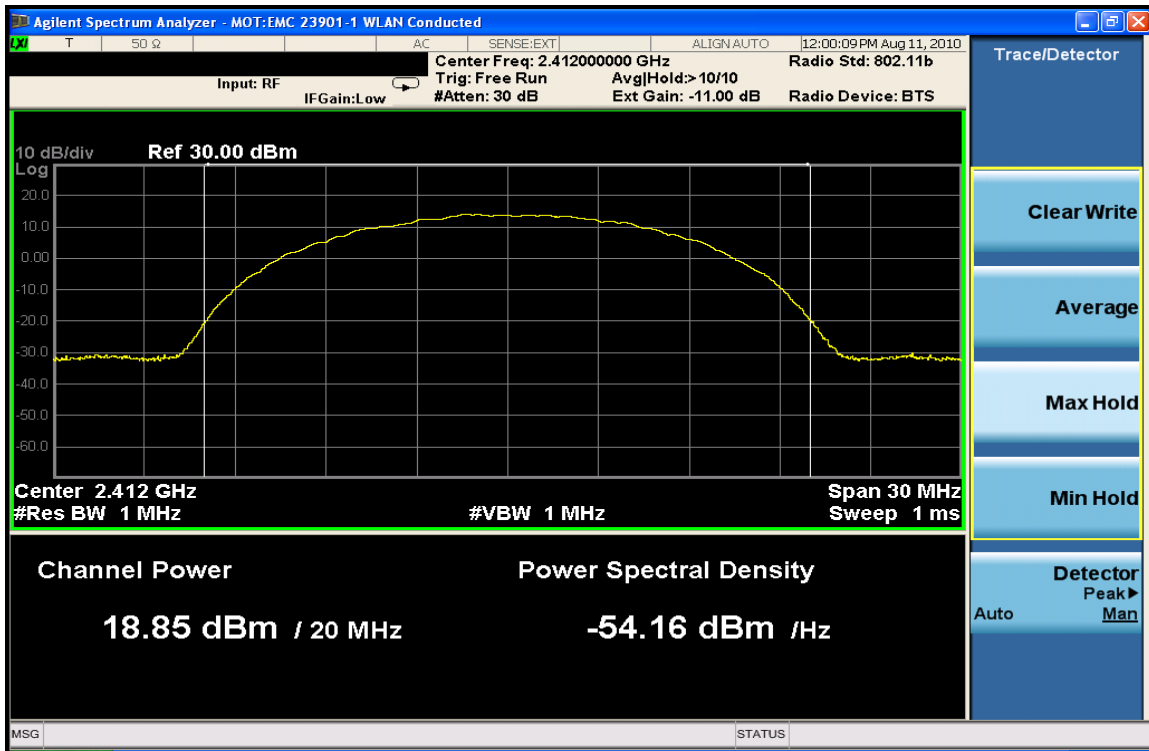
Channel	Average power (dBm) for <u>802.11g</u> Data Rates							
	6 Mbps	9 Mbps	12 Mbps	18 Mbps	24 Mbps	36 Mbps	48 Mbps	54 Mbps
1	14.62	14.32	14.27	14.07	14	13.95	12.43	12.47
6	17.47	17.28	16.87	16.49	14.52	14.68	13.08	13.25
11	17.98	17.83	17.56	17.16	15.3	15.25	13.82	13.84

Channel	Average power (dBm) for <u>802.11n</u> Data Rates							
	20 MHz BW, 400 ns GI							
	7.2 Mbps	14.4 Mbps	21.7 Mbps	28.9 Mbps	43.3 Mbps	57.8 Mbps	65 Mbps	72.2 Mbps
1	14.14	14.24	13.64	13.84	13.68	12.2	12.25	11.35
6	17.06	16.6	16.17	14.55	14.4	12.89	12.94	12.04
11	17.72	17.26	16.8	15.13	15.03	13.51	13.52	12.59

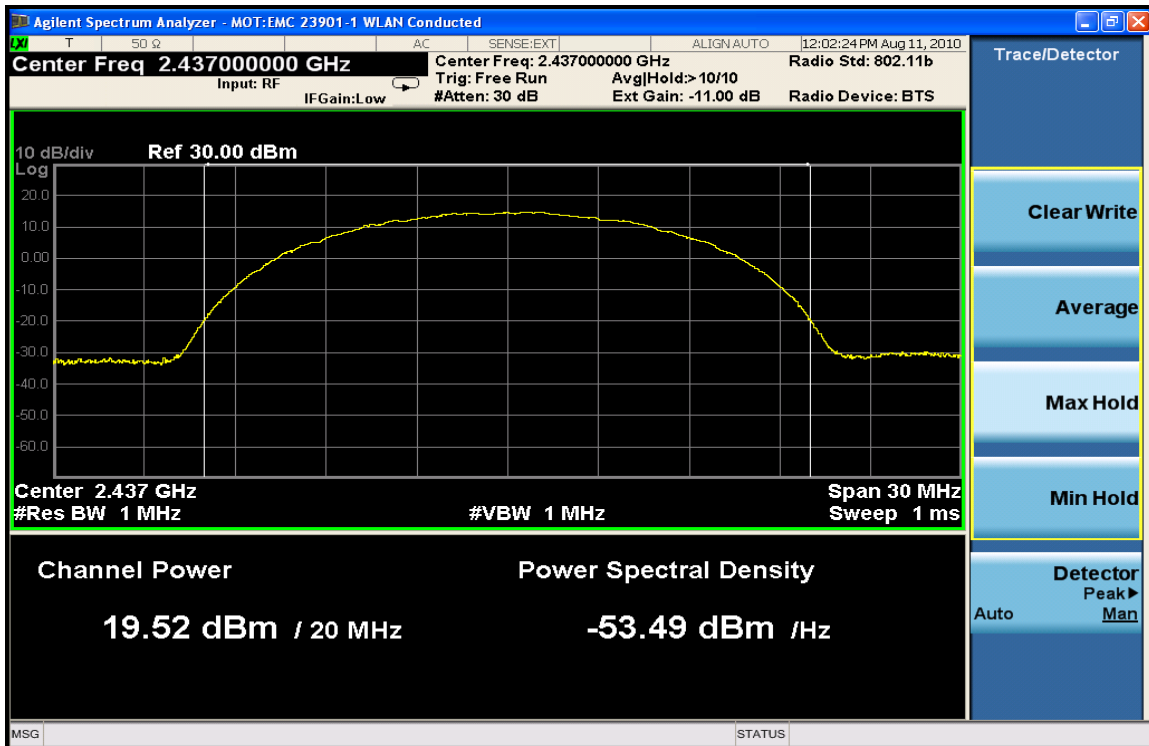
Channel	Average power (dBm) for <u>802.11n</u> Data Rates							
	20 MHz BW, 800 ns GI							
	6.5 Mbps	13 Mbps	19.5 Mbps	26 Mbps	39 Mbps	52 Mbps	58.5 Mbps	65 Mbps
1	14.21	14.24	13.77	13.91	13.81	12.3	12.34	11.47
6	17.1	16.64	16.29	14.58	14.57	13.11	12.97	12.05
11	17.97	17.32	17	15.3	15.21	13.76	13.67	12.89

Based on these initial average power measurements, testing will be performed in 11 Mbps, 9 Mbps and 6.5 & 7.2 Mbps in the “b” “g” and “n” mode respectively.

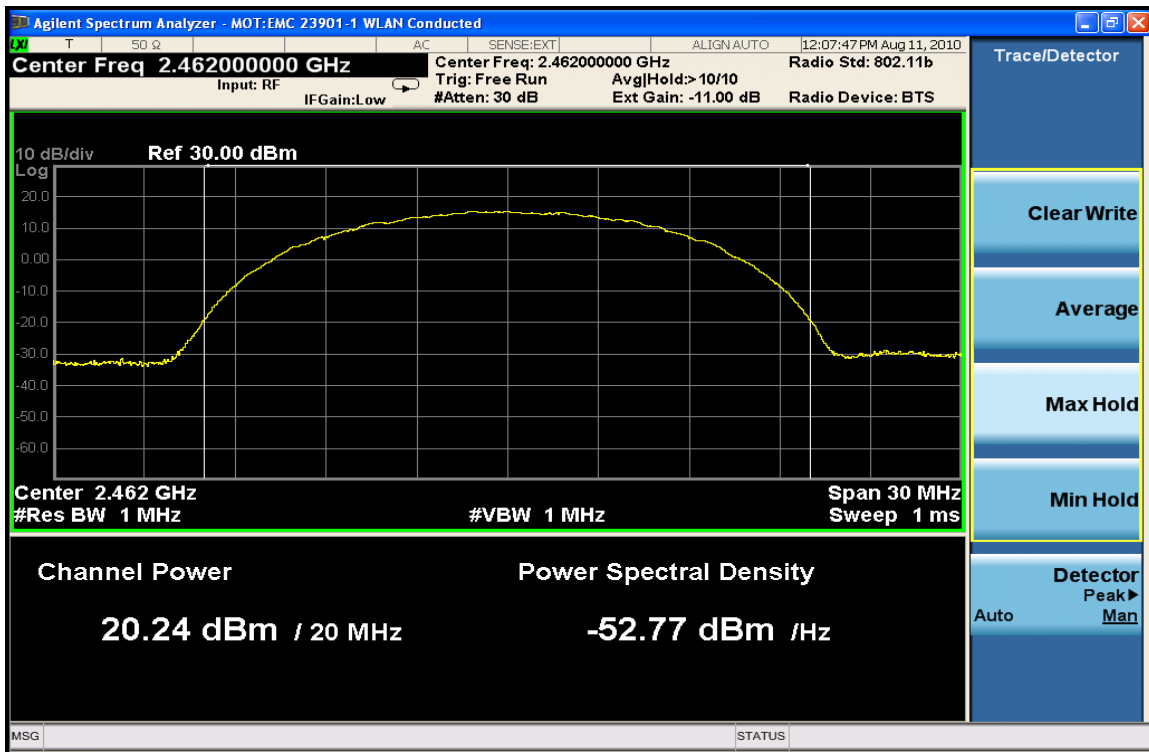
### 802.11b Mode



Max. Power Channel 1 @ 11 Mbps



Max. Power Channel 6 @ 11 Mbps

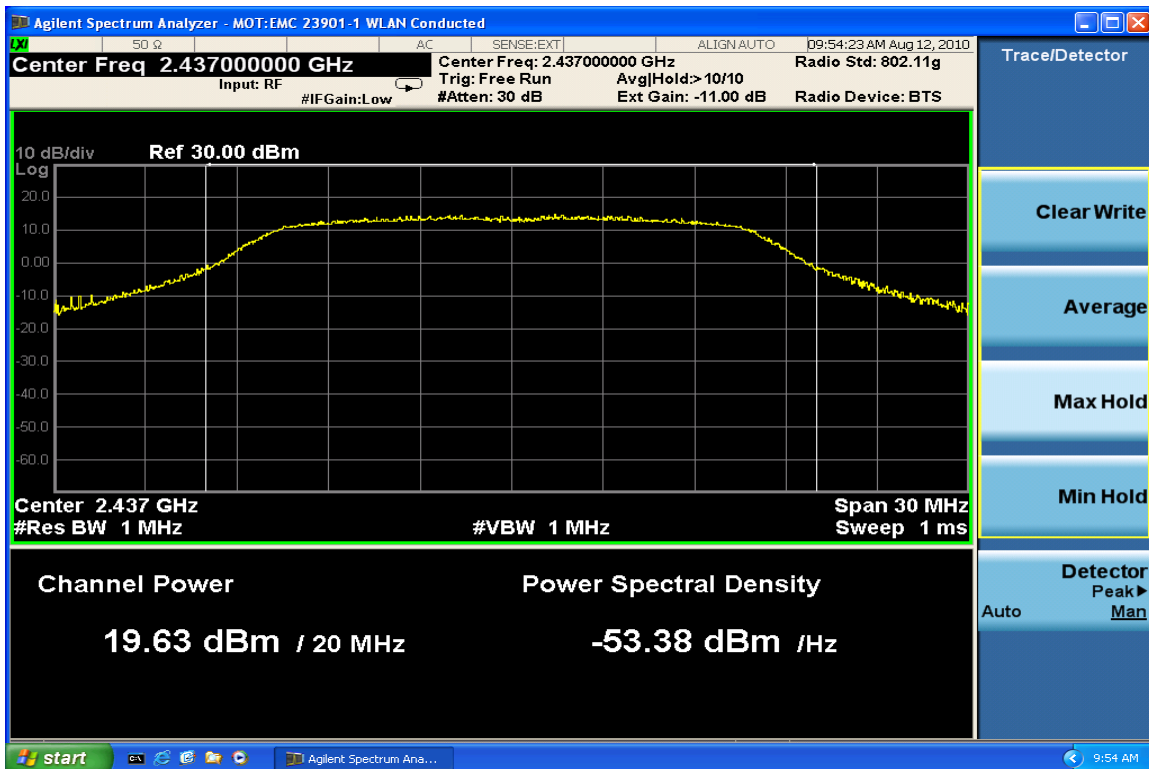


Max. Power Channel 11 @ 11 Mbps

802.11g Mode



Max. Power Channel 1 @ 9 Mbps

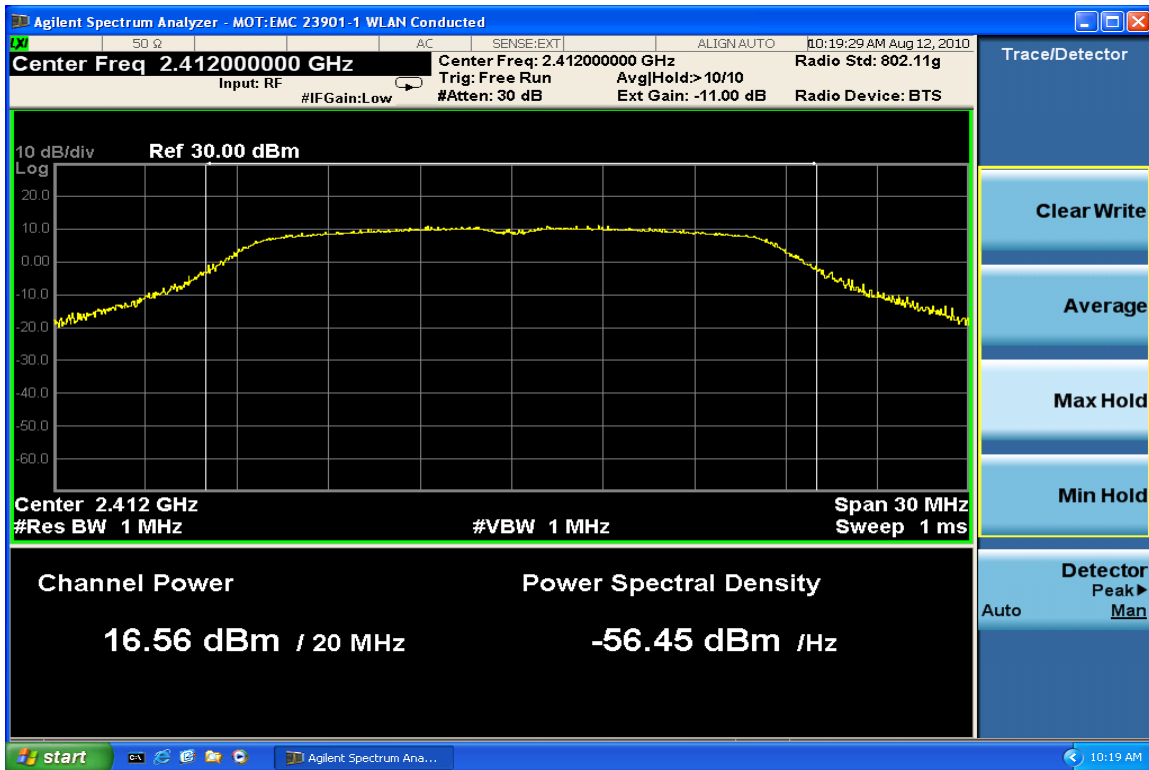


Max. Power Channel 6 @ 9 Mbps

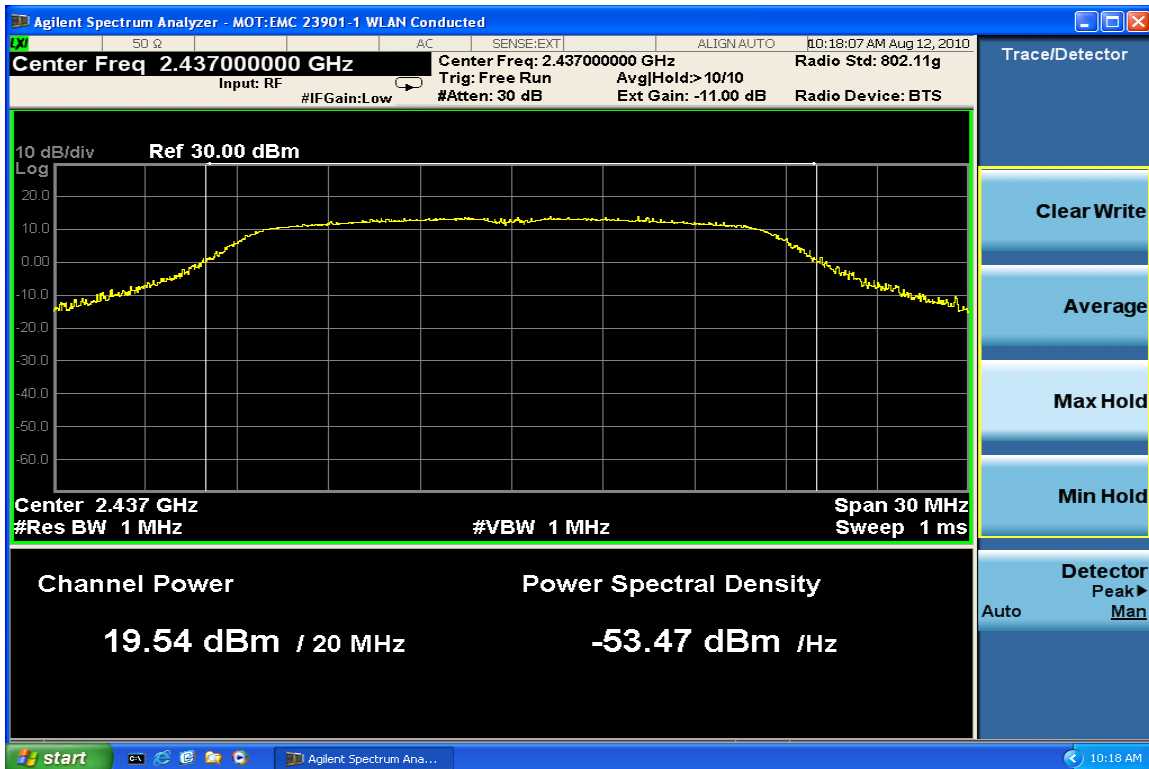


Max. Power Channel 11 @ 9 Mbps

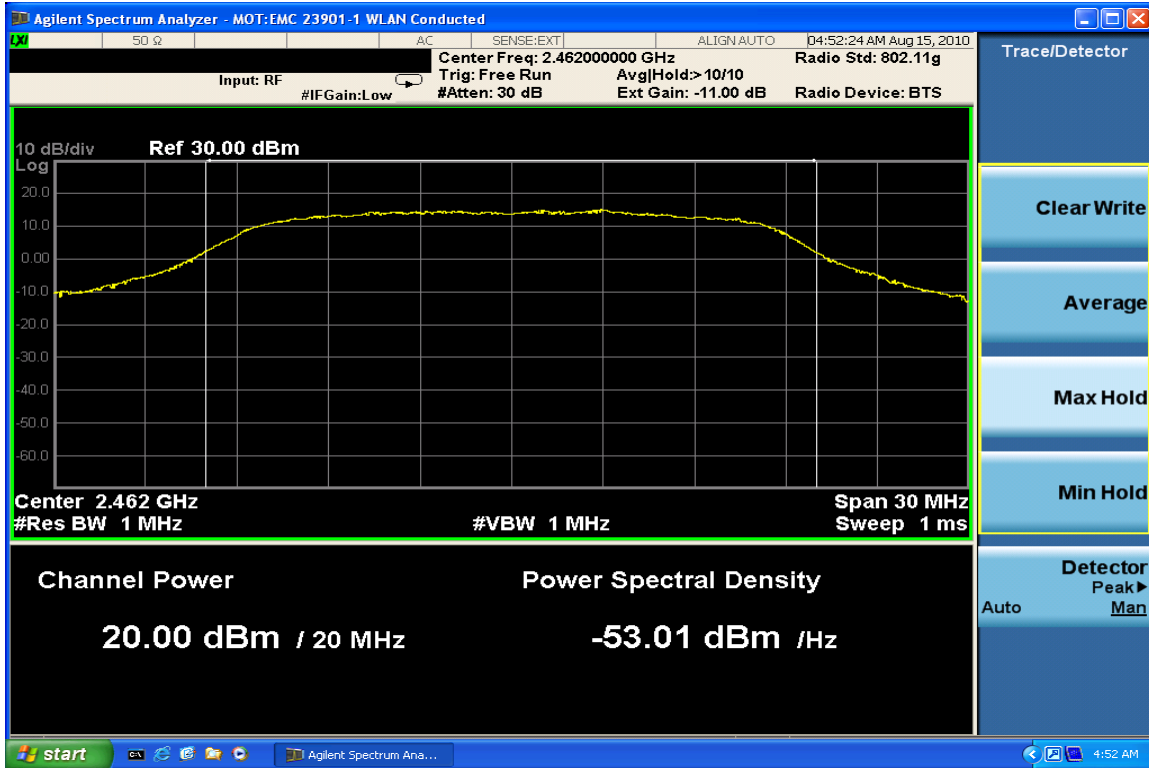
### 802.11n 800ns GI Mode



Max. Power Channel 1 @ 6.5 Mbps

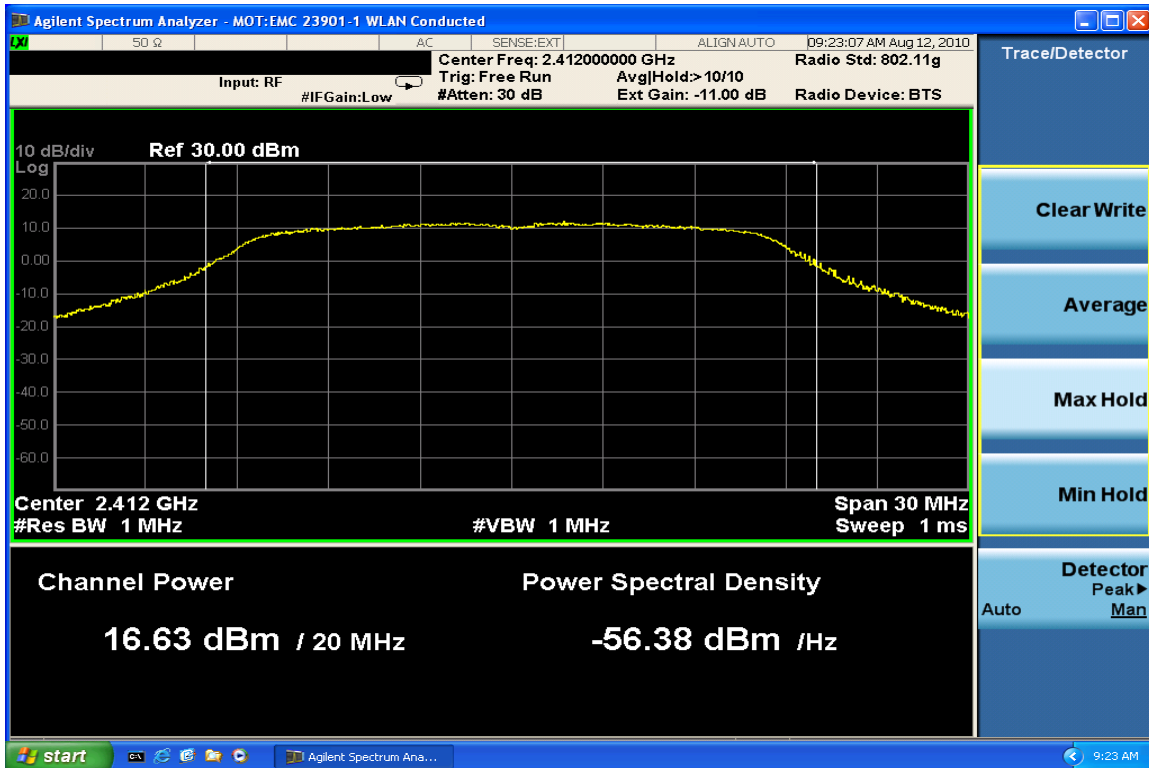


Max. Power Channel 6 @ 6.5 Mbps

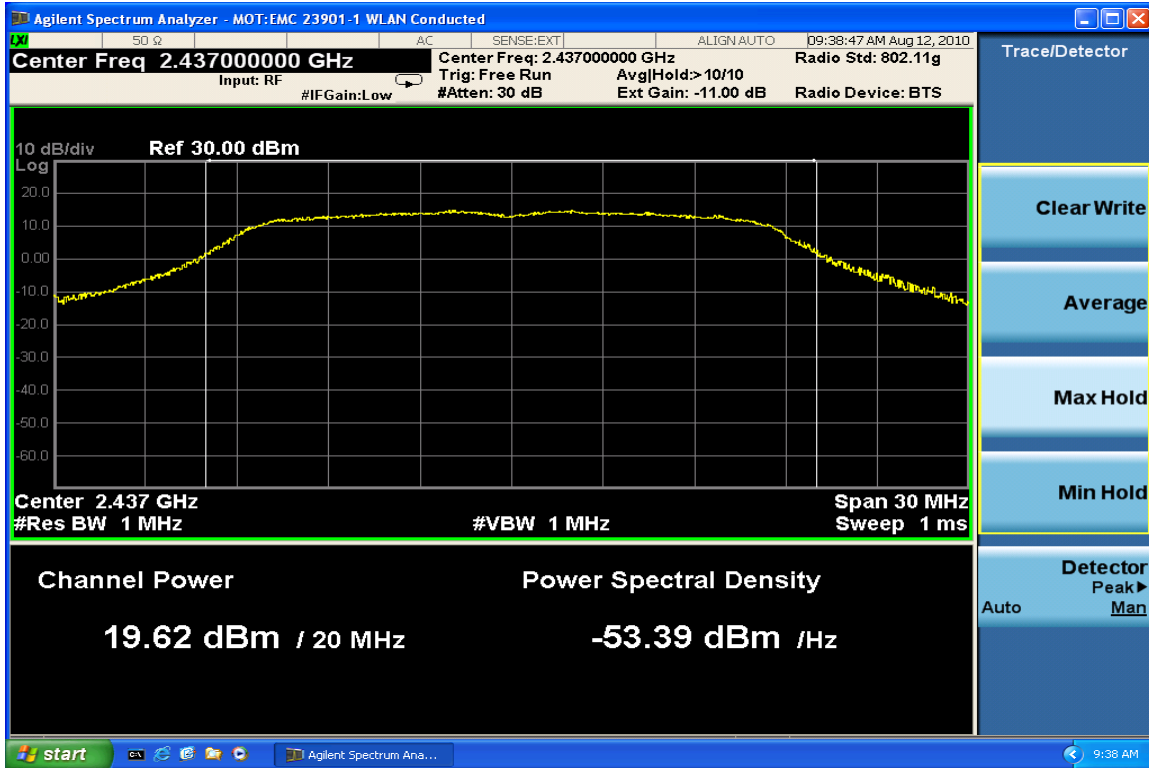


Max. Power Channel 11 @ 6.5 Mbps

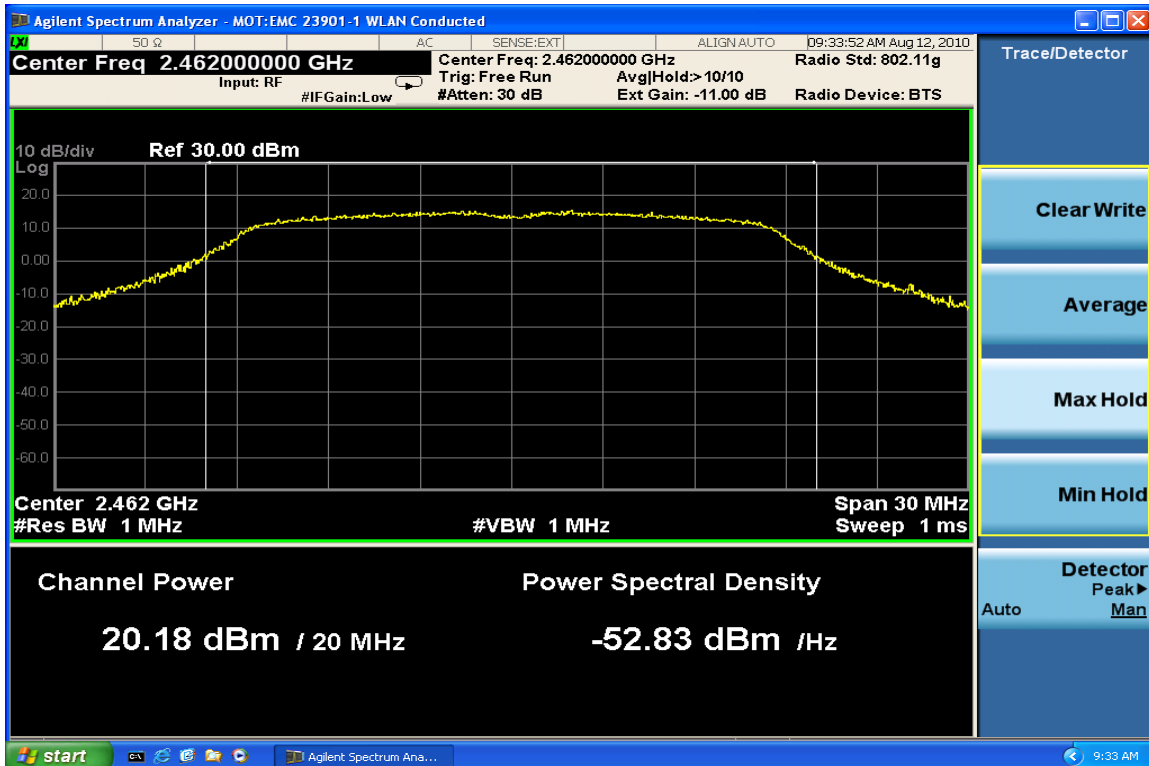
802.11n 400ns GI Mode



Max. Power Channel 1 @ 7.2 Mbps



Max. Power Channel 6 @ 7.2 Mbps



Max. Power Channel 11 @ 7.2 Mbps

**Power Spectral Density**

CFR 47 Part 15.247

**Measurement Procedure**

The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

The WLAN DSSS function of the EUT was enabled. The spectrum analyzer used the following settings:

1. Span = 300 kHz
2. VBW =30 kHz
3. RBW=3 kHz
4. Sweep = 50 ms
5. Detector function = peak
6. Trace = max hold

The trace was allowed to stabilize. The EUT was transmitting at its maximum data rate.

**Measurement Results**

<b>2412 MHz</b>	<b>2437 MHz</b>	<b>2462 MHz</b>
-14.29 dBm	-14.51 dBm	-12.7 dBm

**802.11 b @ 11 Mbps**

<b>2412 MHz</b>	<b>2437 MHz</b>	<b>2462 MHz</b>
-19.23	-18.26	-17.63

**802.11 g @ 9 Mbps**

<b>2412 MHz</b>	<b>2437MHz</b>	<b>2462MHz</b>
-20.91	-19.67	-19.66

**802.11 n @ 7.2 Mbps**

<b>2412 MHz</b>	<b>2437MHz</b>	<b>2462MHz</b>
-18.69	-16.46	-15.7

**802.11 n @ 6.5 Mbps**

## **SPURIOUS RF CONDUCTED EMISSIONS**

CFR 47 Part 15.247

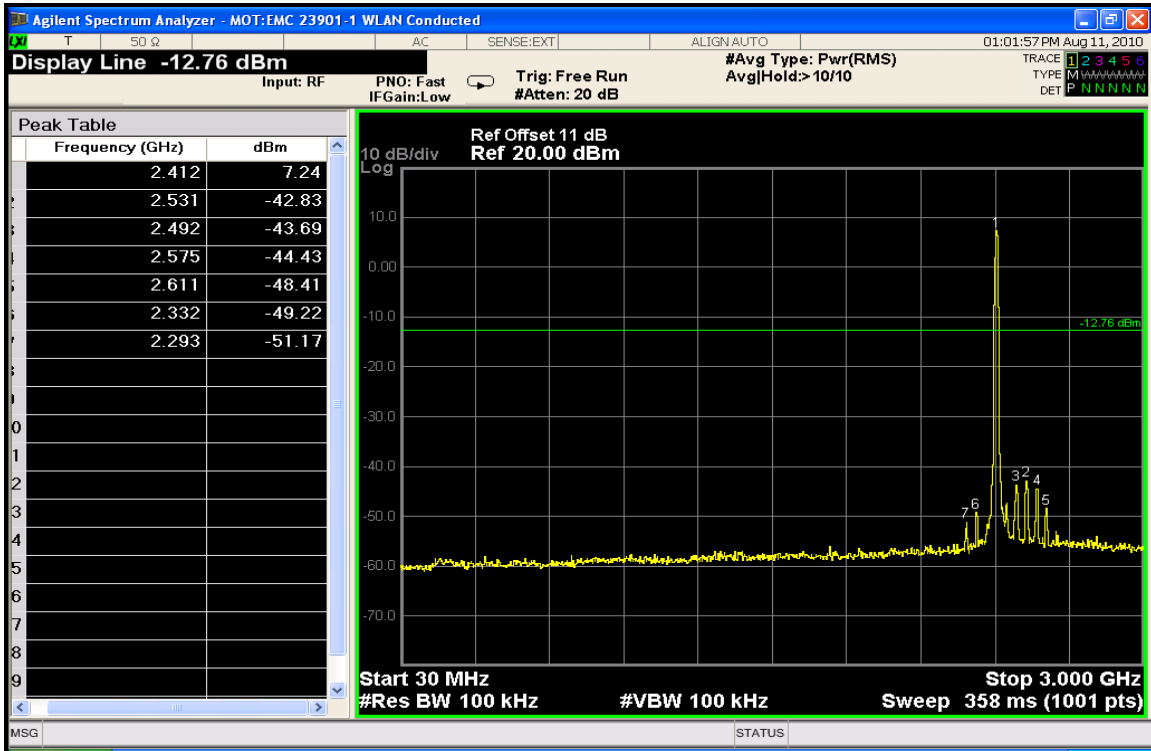
### **Measurement Procedure**

The RF output port of the Equipment-Under-Test is directly coupled to the input of the EMC analyzer through a specialized RF connector and a 10dB passive attenuator. A fully charged battery was used for the supply voltage.

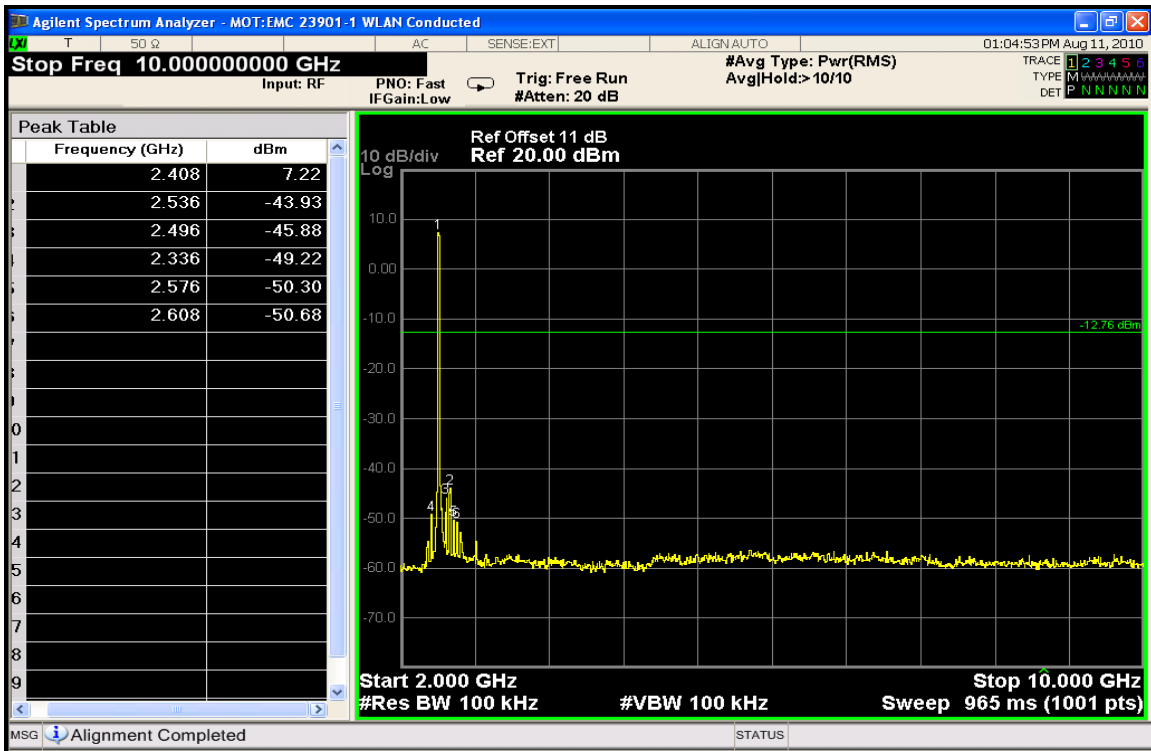
### **Measurement Results**

See attached:

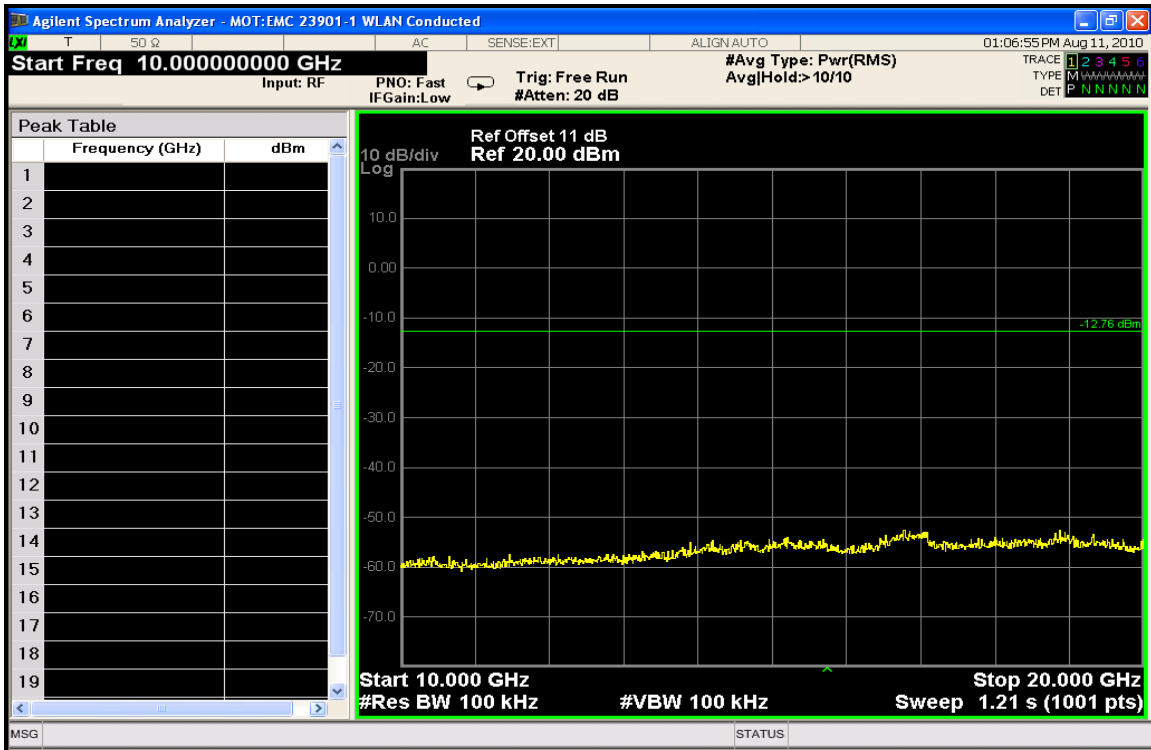
**802.11b @ 11 Mbps**



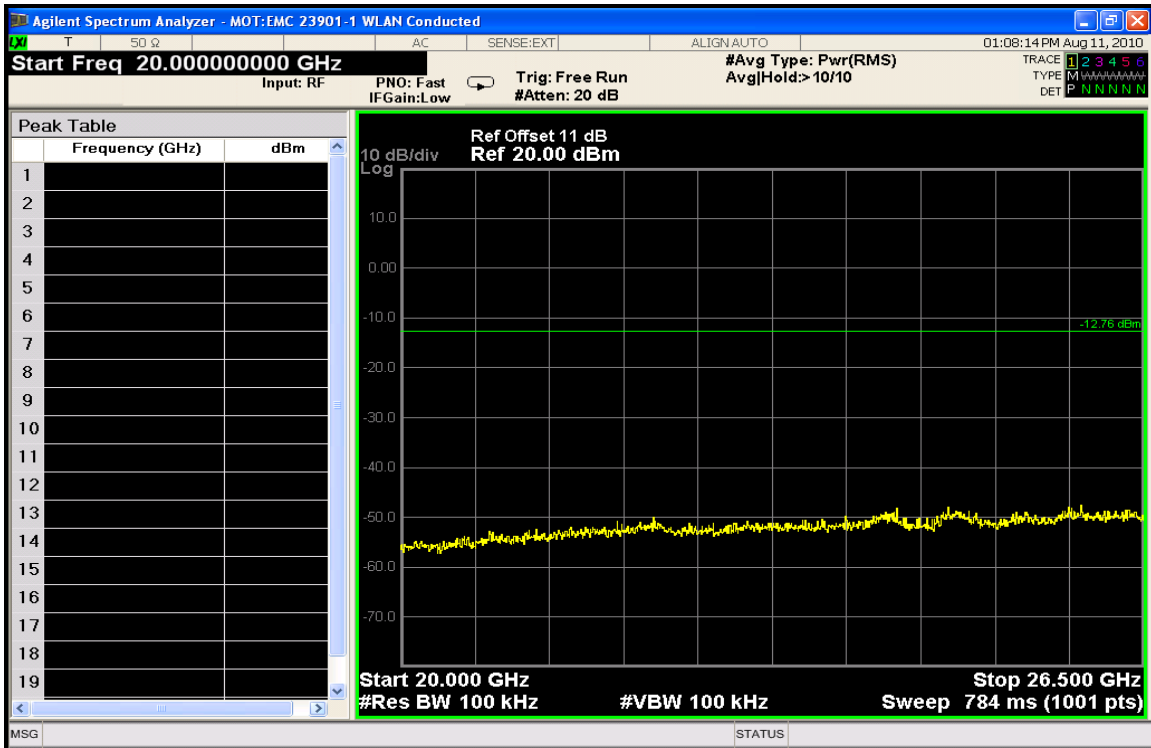
**Conducted Spurious Emissions 30-3000 MHz (Low Channel)**



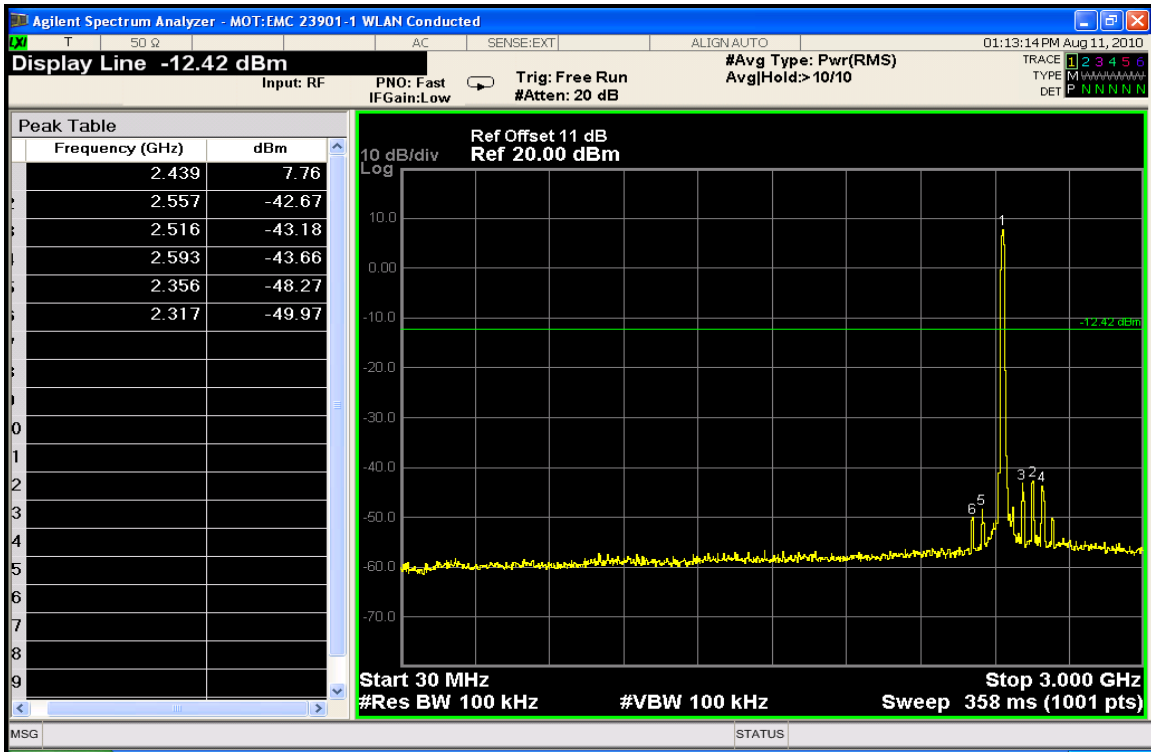
**Conducted Spurious Emissions 2-10 GHz (Low Channel)**



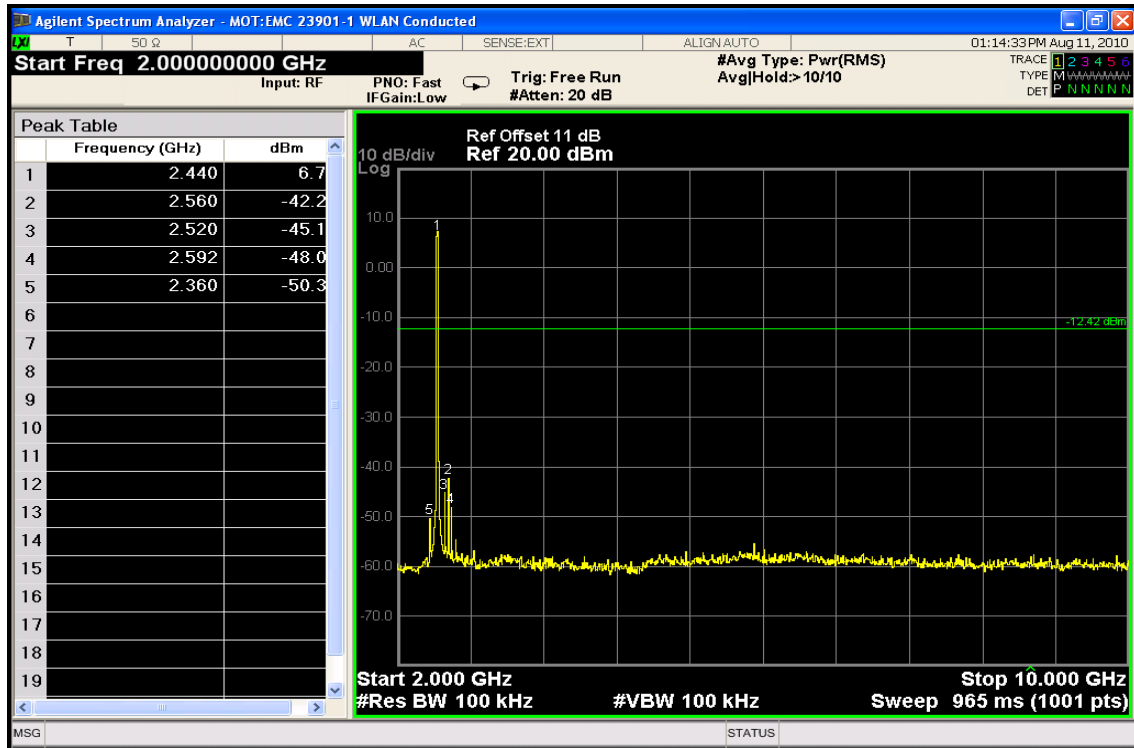
Conducted Spurious Emissions 10-20 GHz (Low Channel)



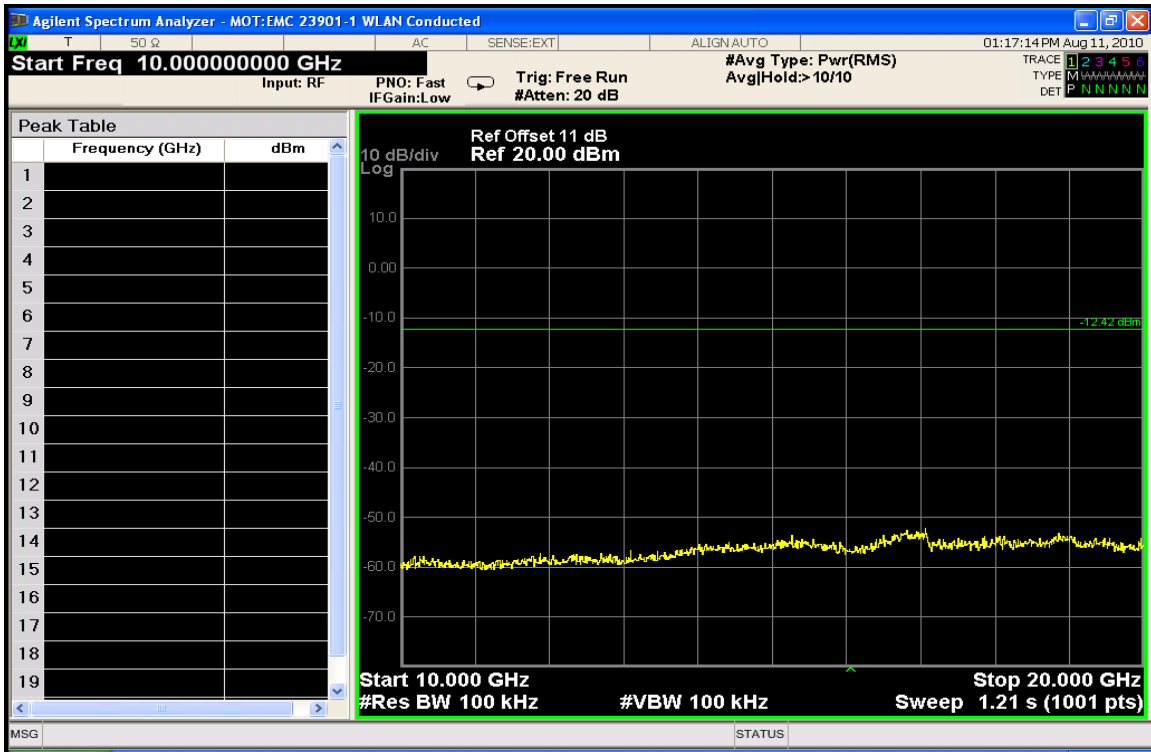
Conducted Spurious Emissions 20-26.5 GHz (Low Channel)



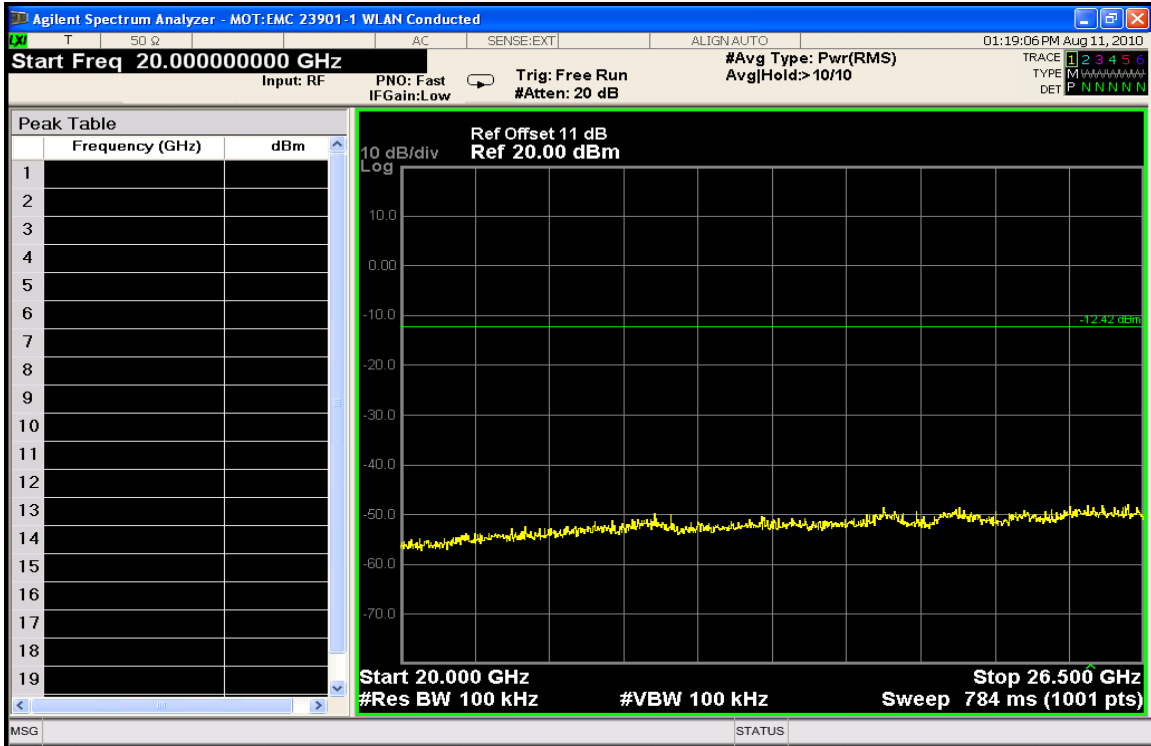
Conducted Spurious Emissions 30-3000 MHz (Mid Channel)



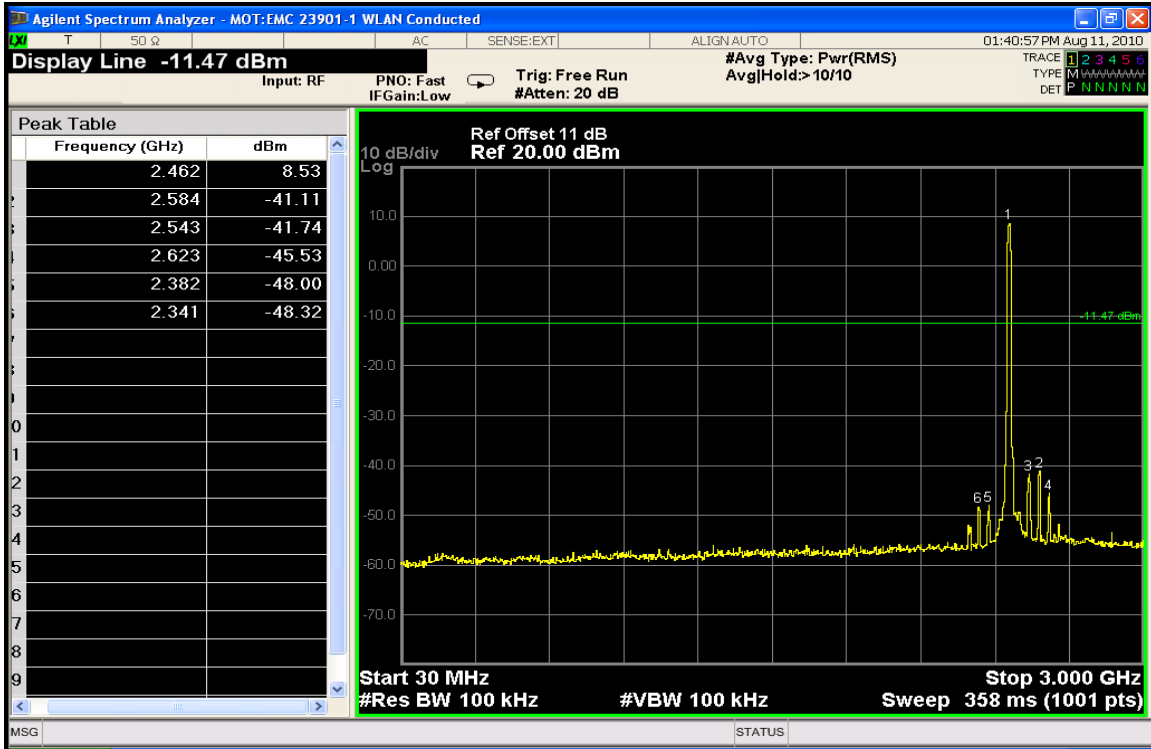
Conducted Spurious Emissions 2-10 GHz (Mid Channel)



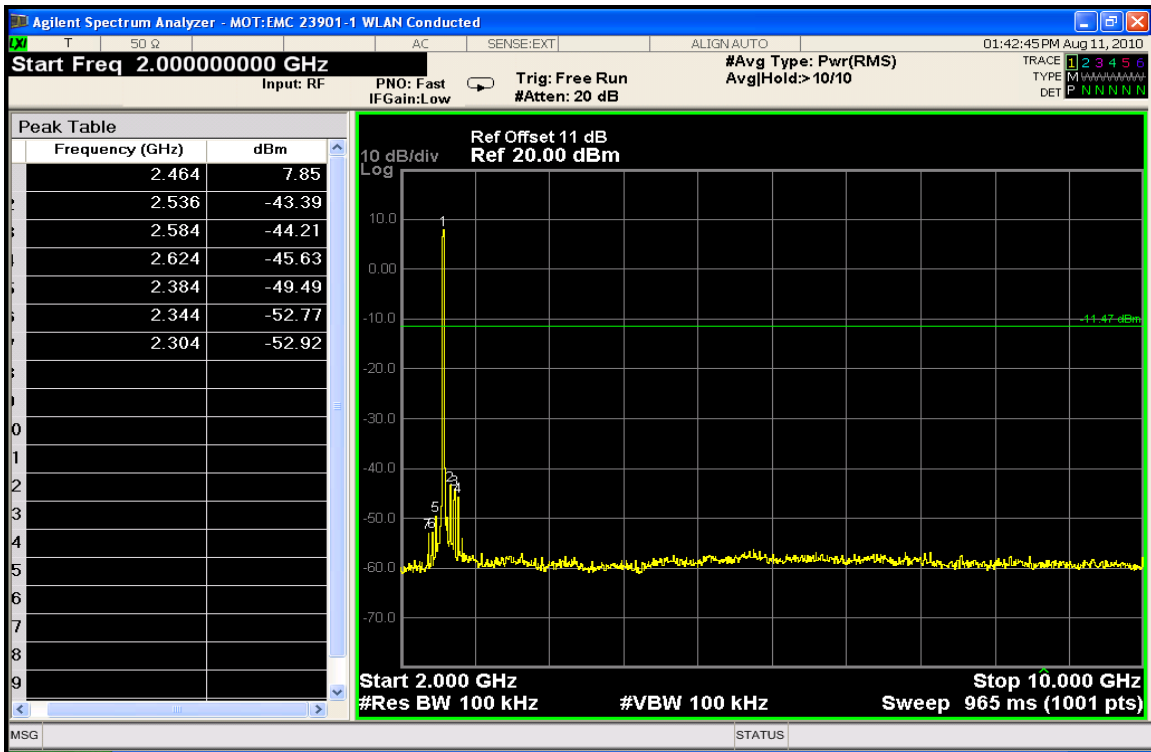
Conducted Spurious Emissions 10-20 GHz (Mid Channel)



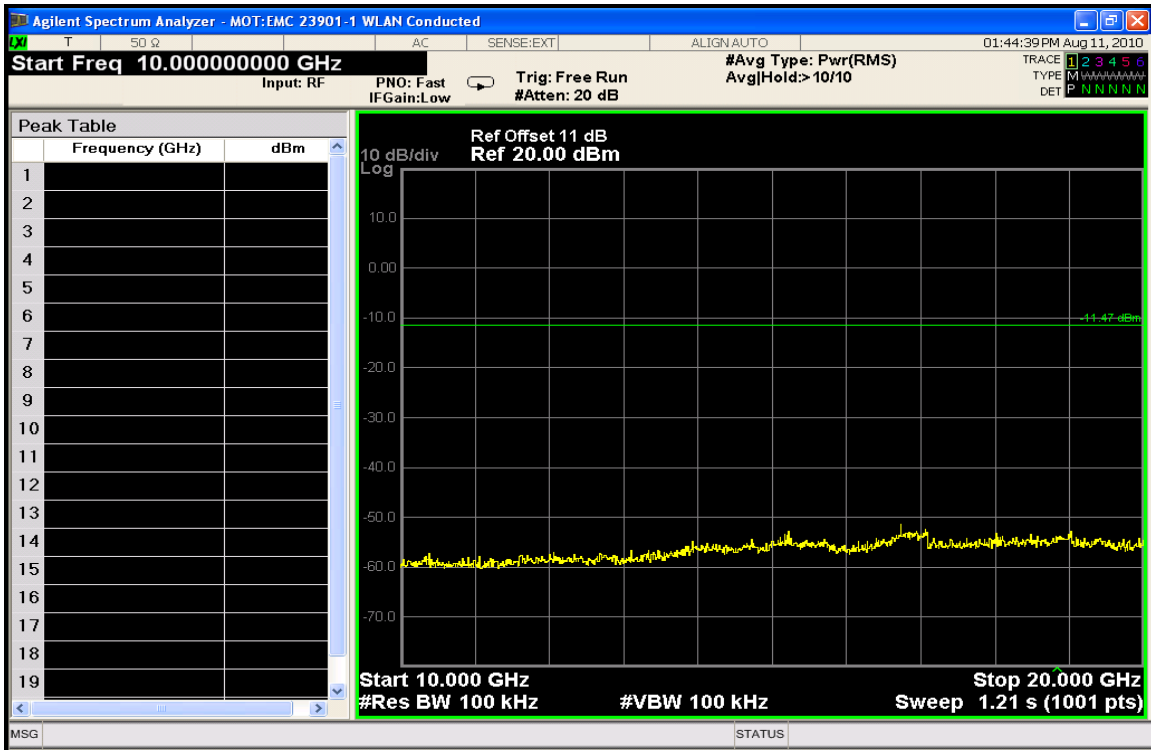
Conducted Spurious Emissions 20-26.5 GHz (Mid Channel)



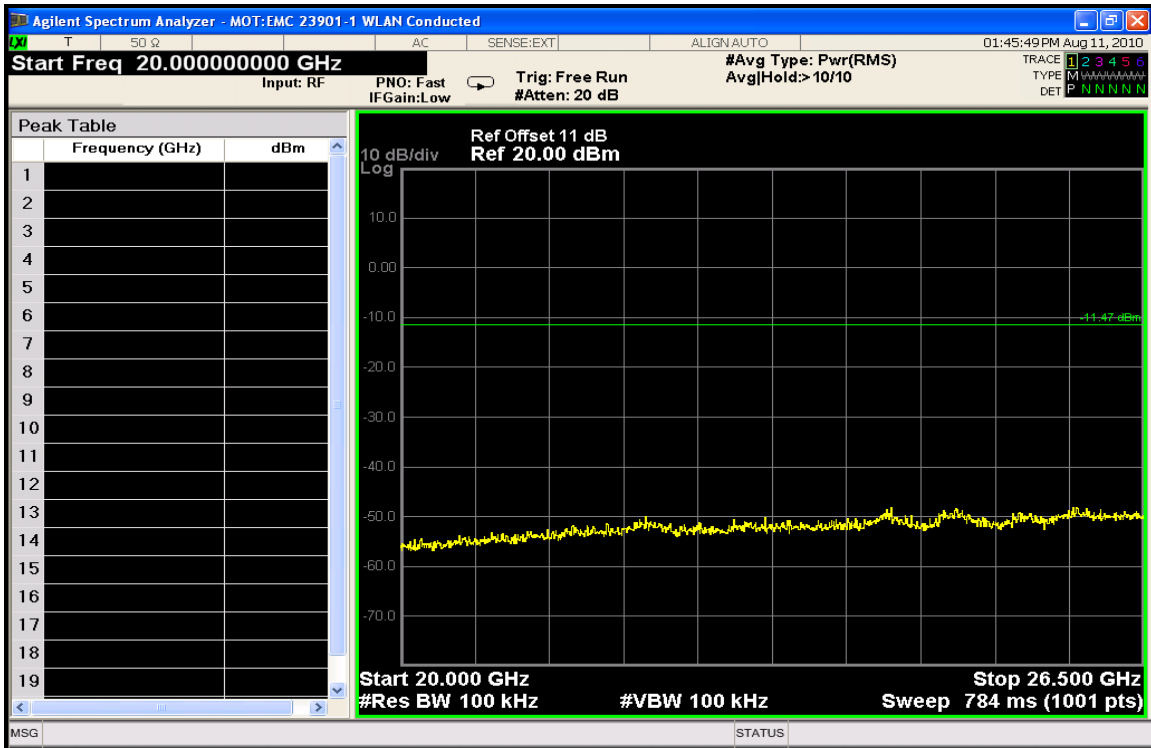
Conducted Spurious Emissions 30-3000 MHz (High Channel)



Conducted Spurious Emissions 2-10 GHz (High Channel)

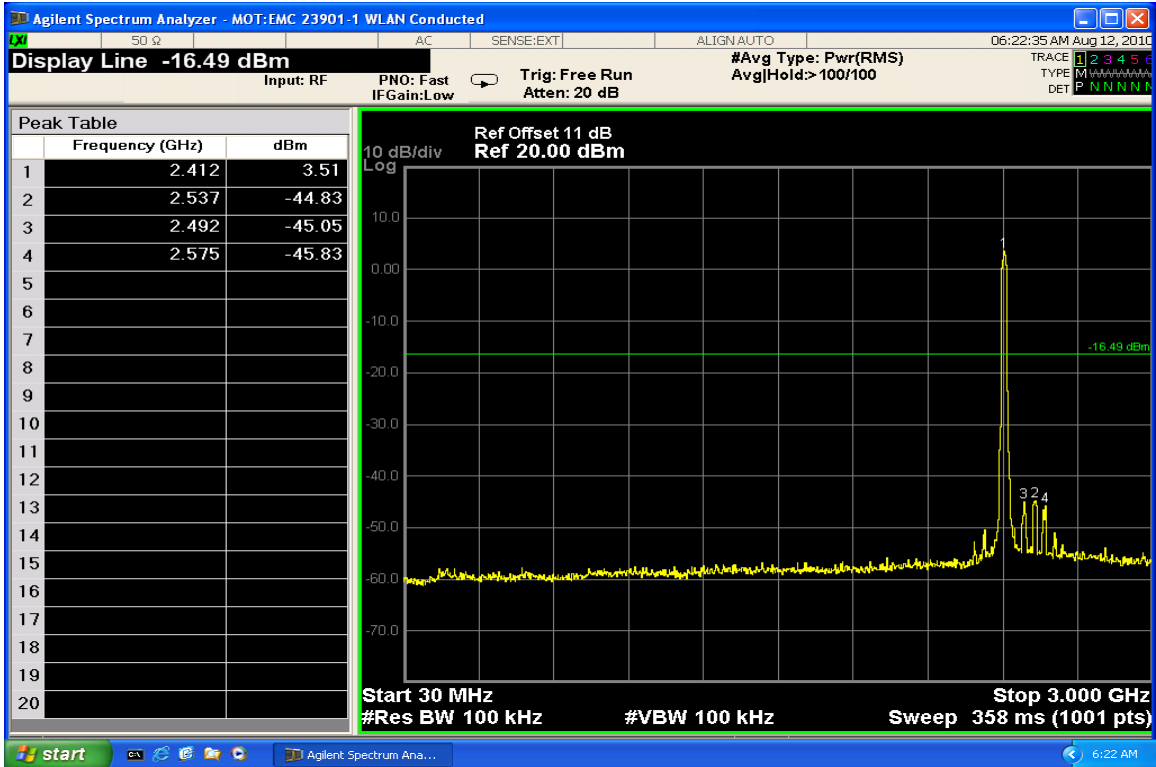


Conducted Spurious Emissions 10-20 GHz (High Channel)

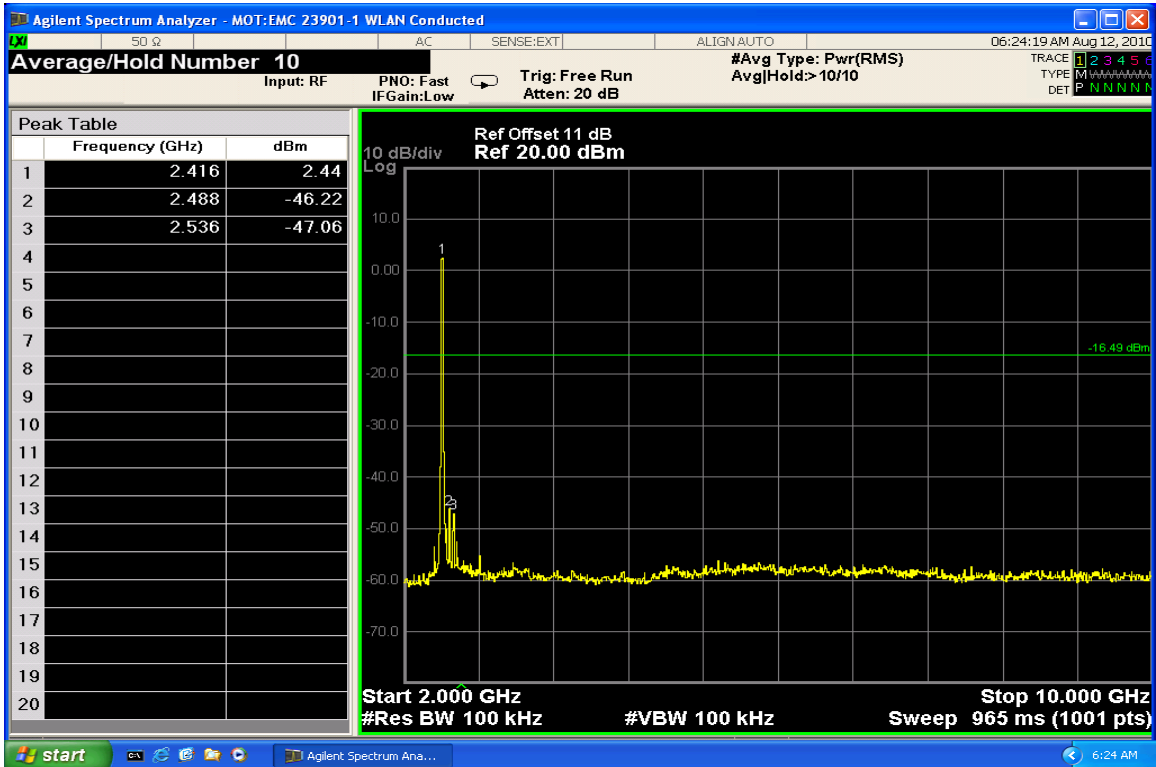


Conducted Spurious Emissions 20-26.5 GHz (High Channel)

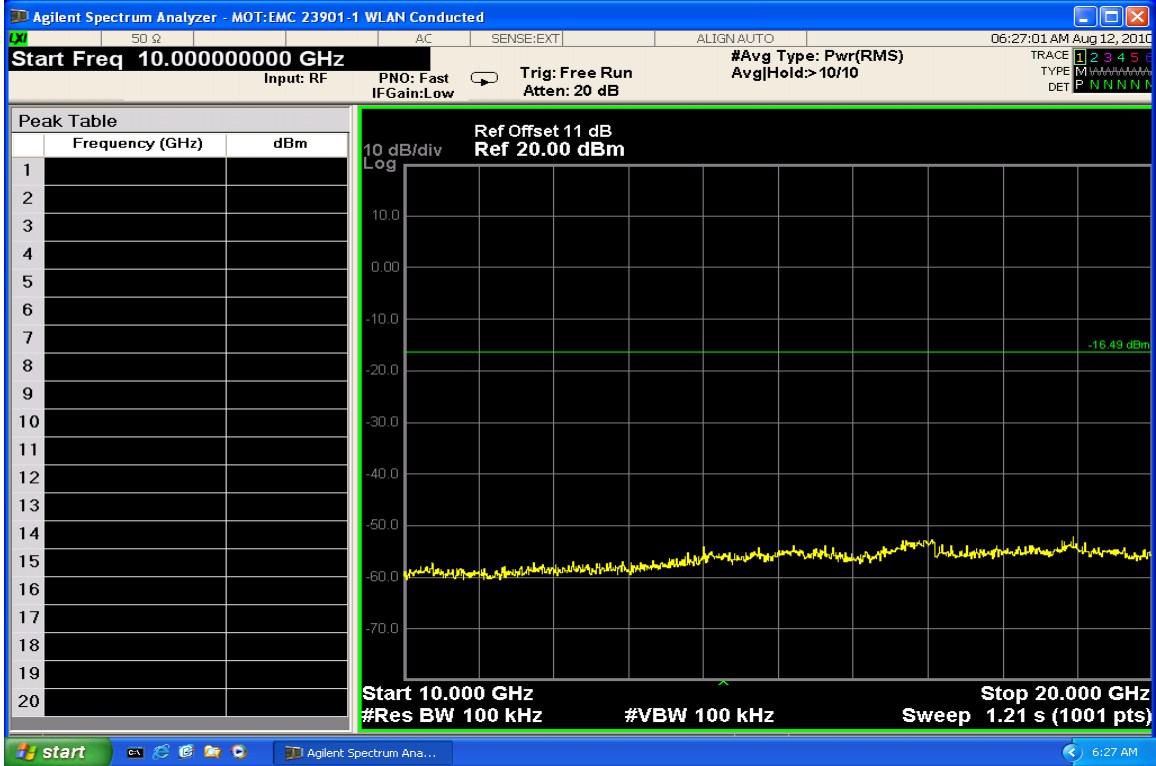
**802.11g @ 9 Mbps**



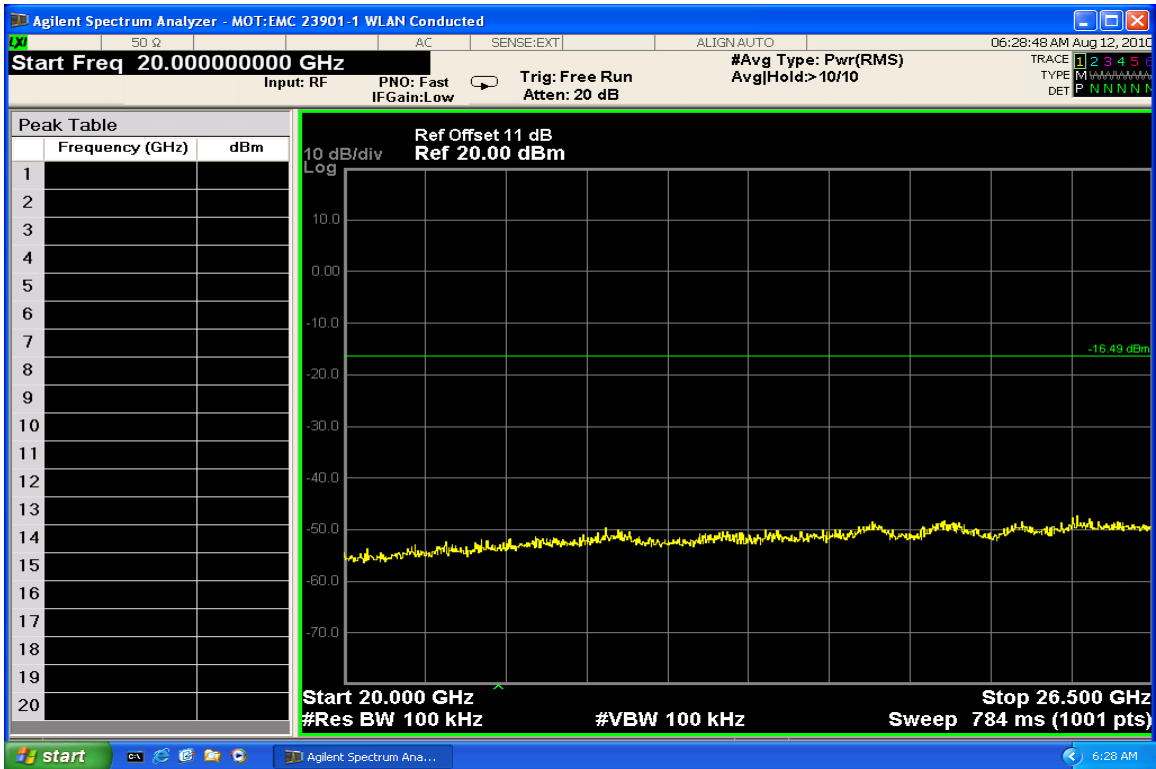
**Conducted Spurious Emissions 30-3000 MHz (Low Channel)**



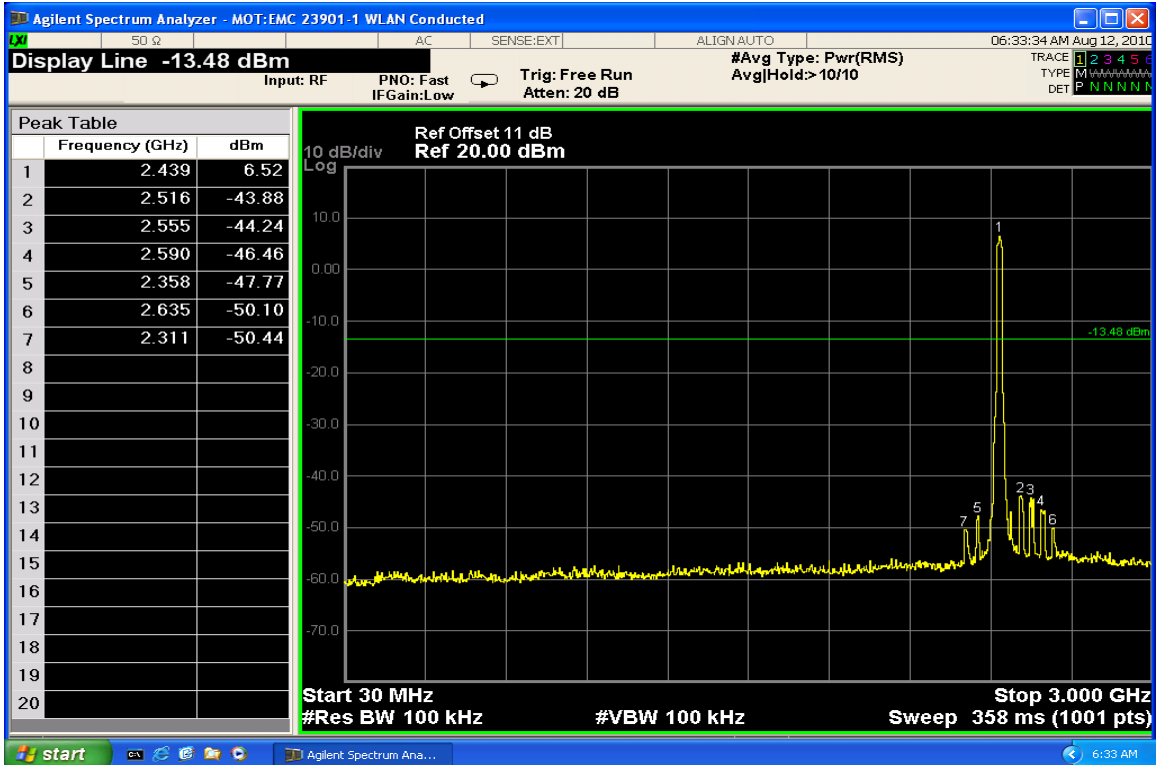
**Conducted Spurious Emissions 2-10 GHz (Low Channel)**



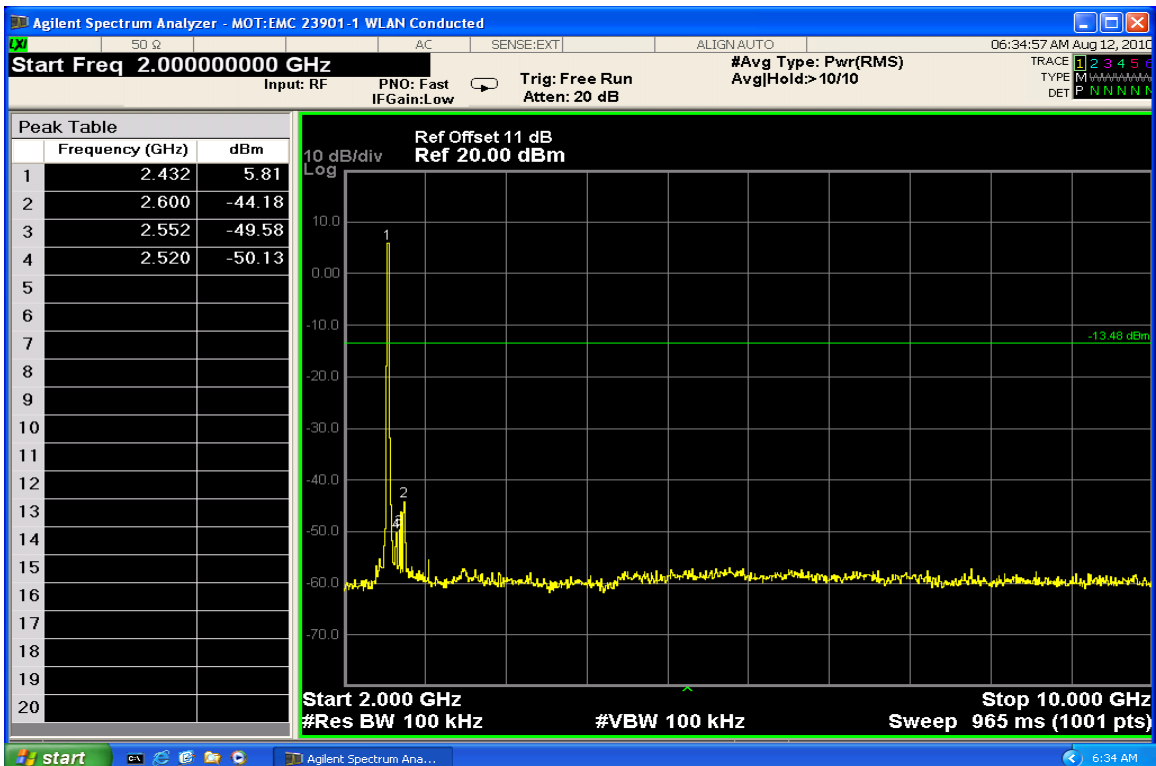
Conducted Spurious Emissions 10-20 GHz (Low Channel)



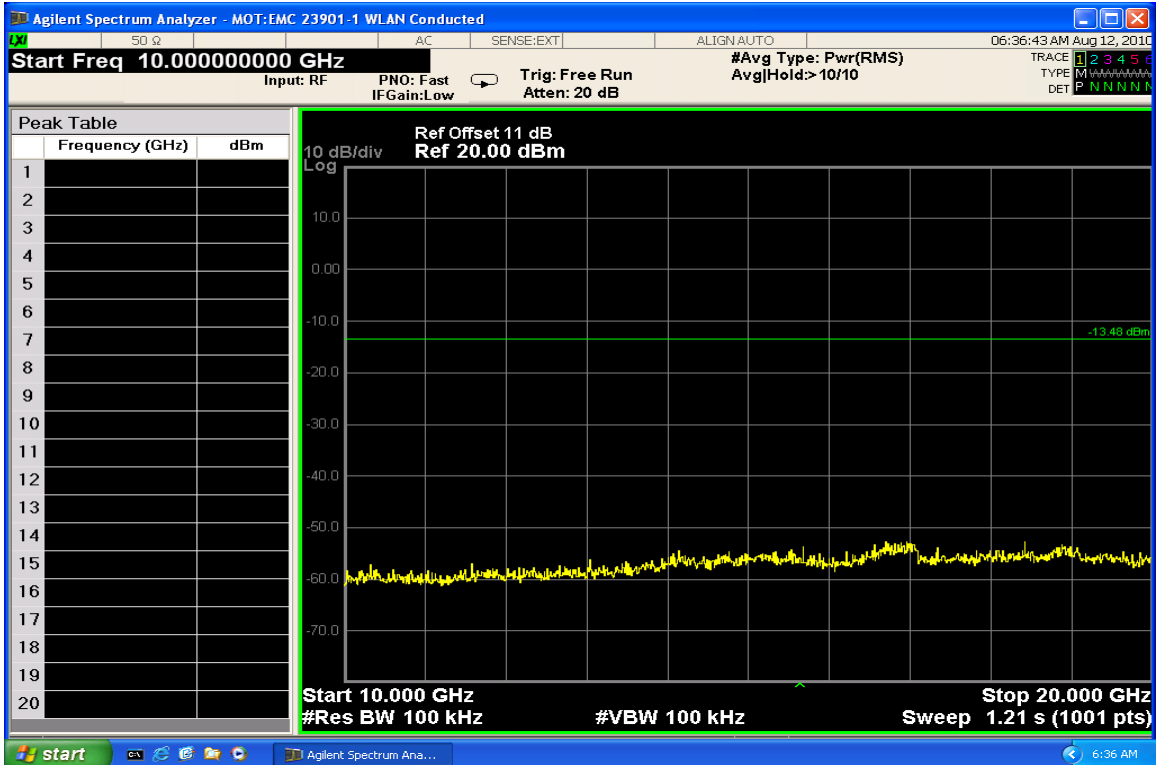
Conducted Spurious Emissions 20-26.5 GHz (Low Channel)



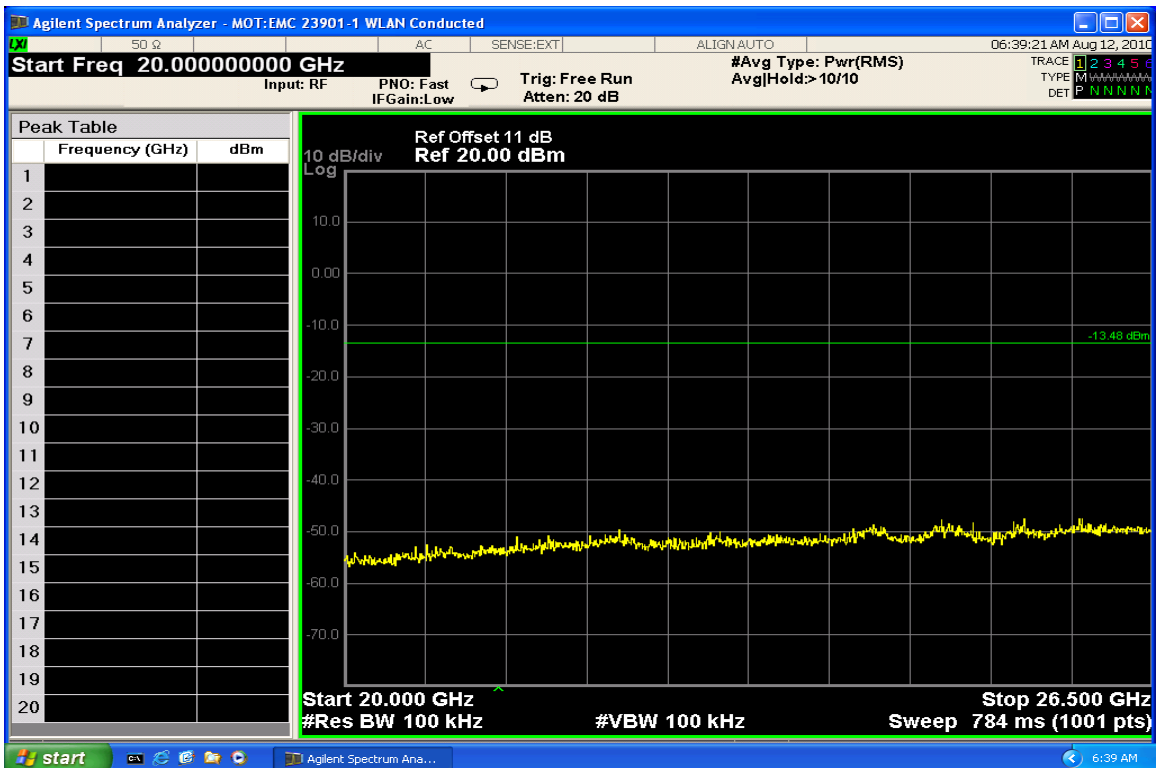
**Conducted Spurious Emissions 30-3000 MHz (Mid Channel)**



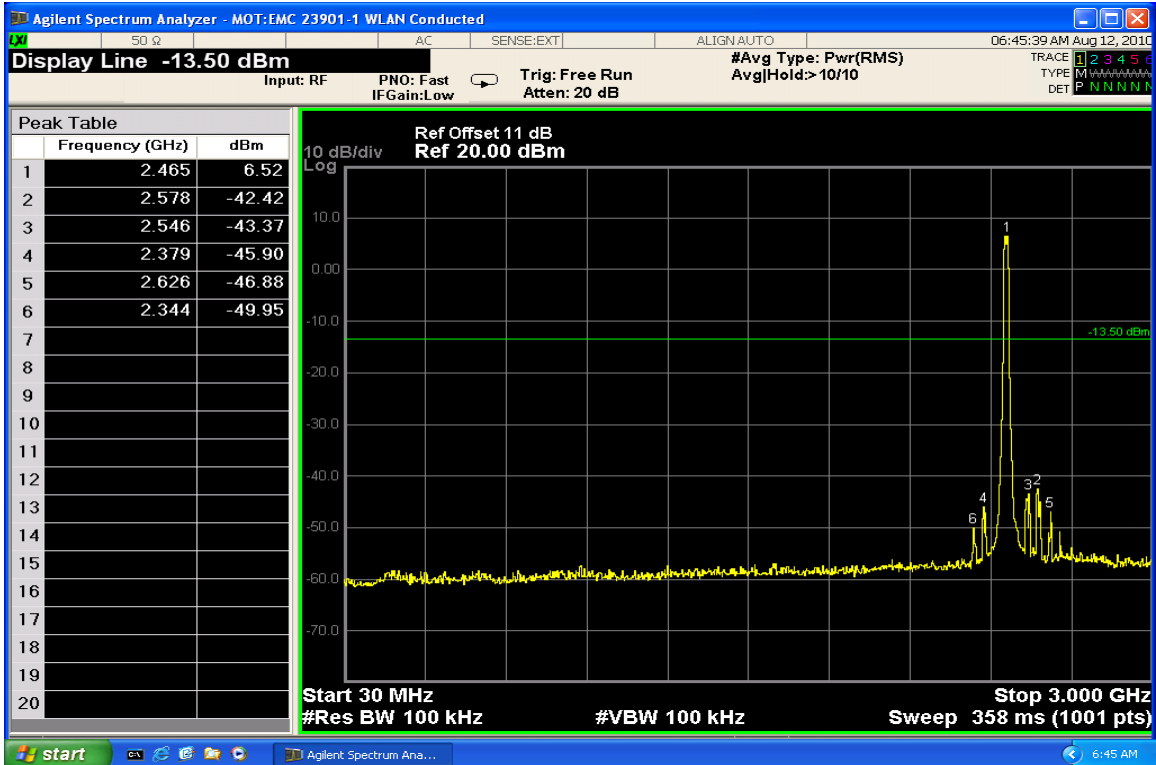
**Conducted Spurious Emissions 2-10 GHz (Mid Channel)**



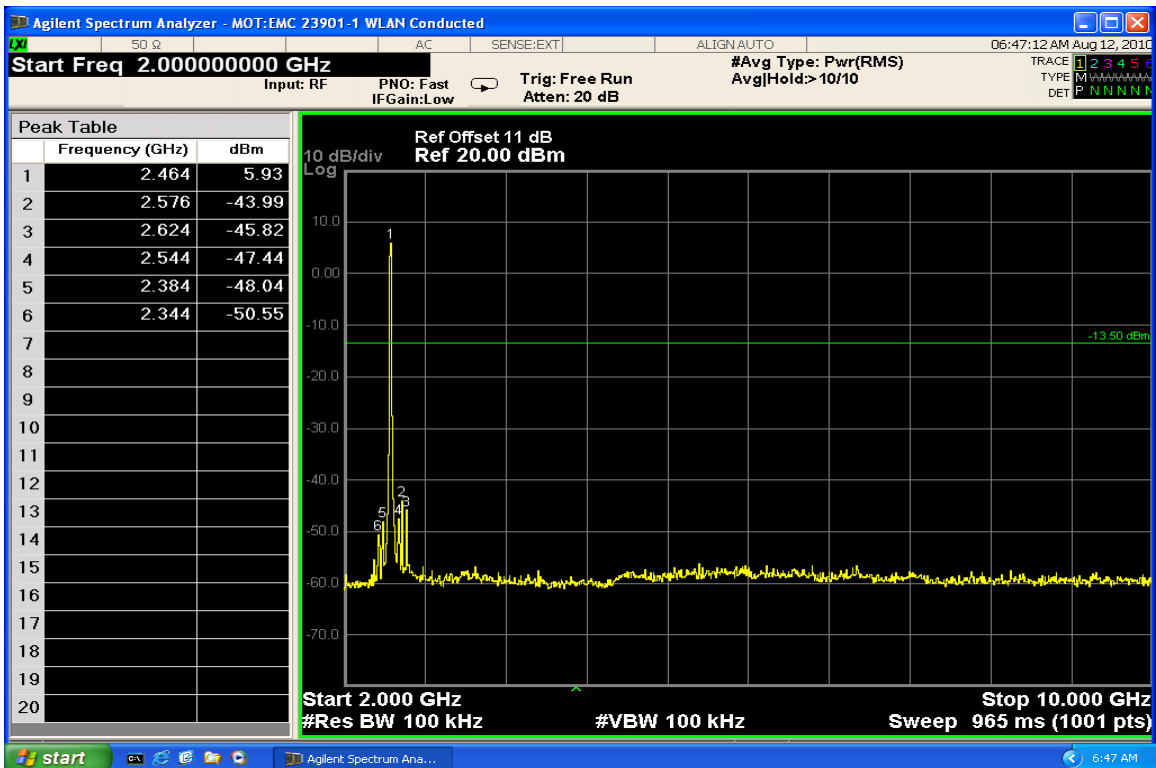
Conducted Spurious Emissions 10-20 GHz (Mid Channel)



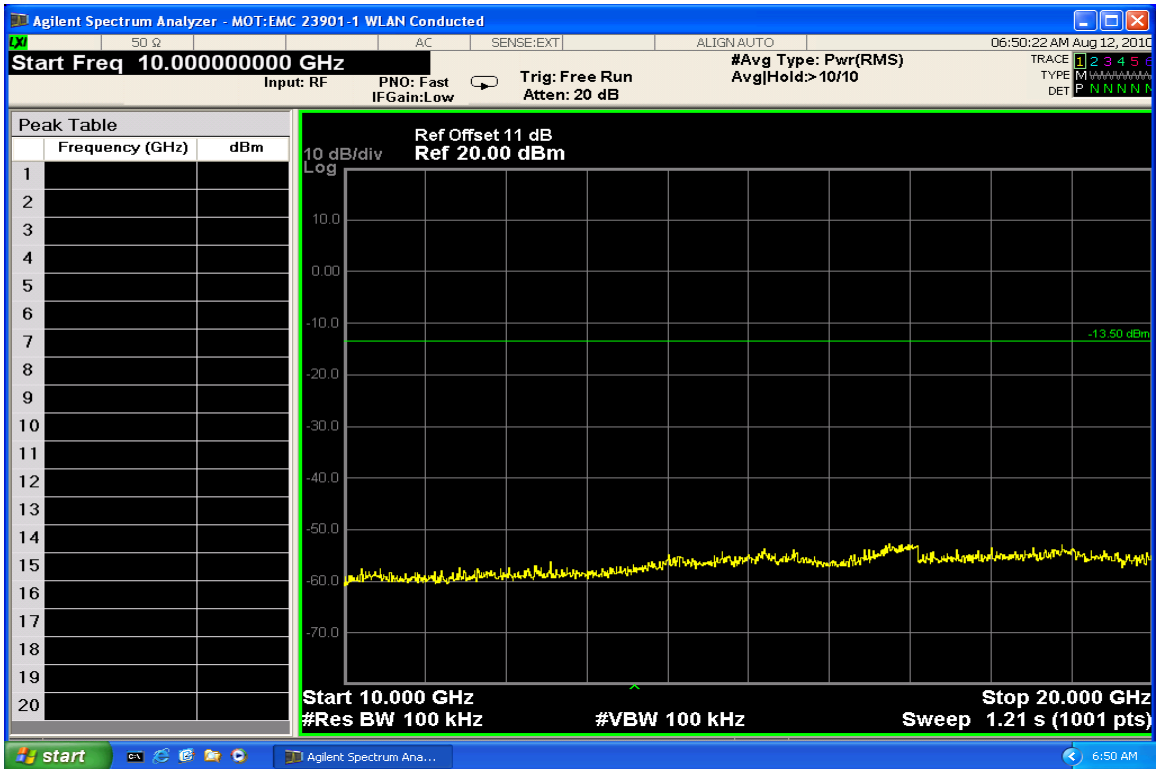
Conducted Spurious Emissions 20-26.5 GHz (Mid Channel)



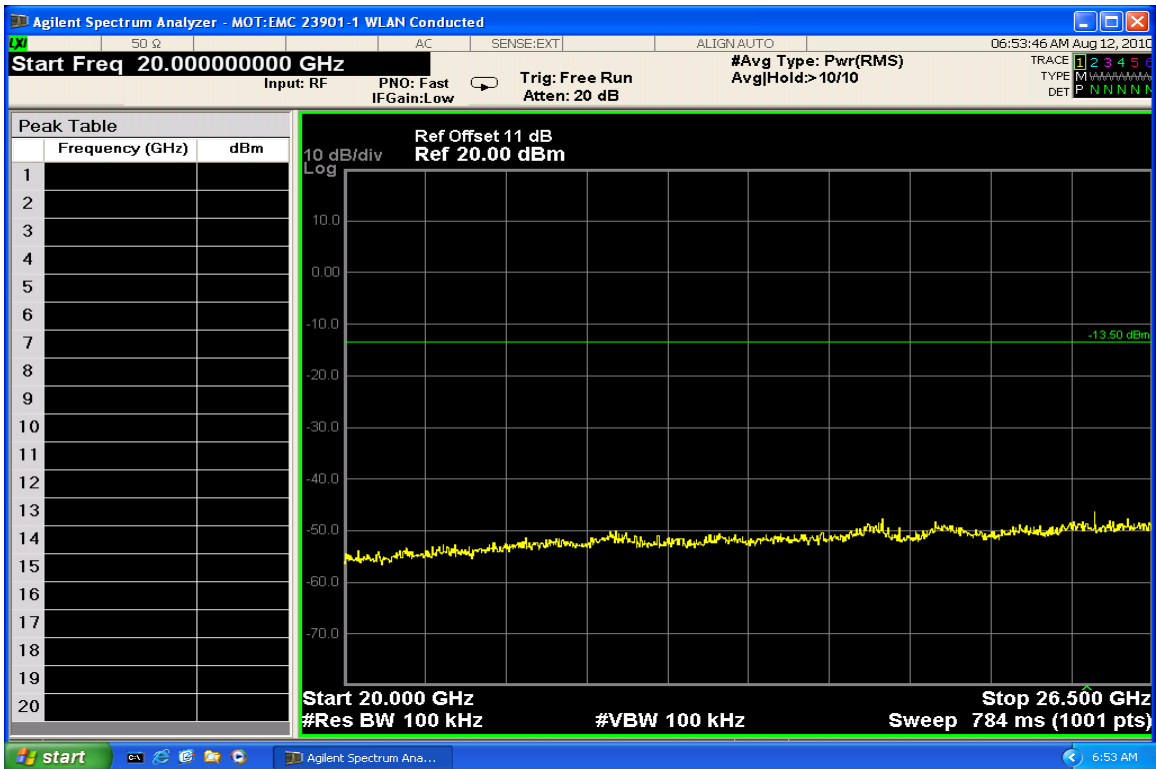
Conducted Spurious Emissions 30-3000 MHz (High Channel)



Conducted Spurious Emissions 2-10 GHz (High Channel)

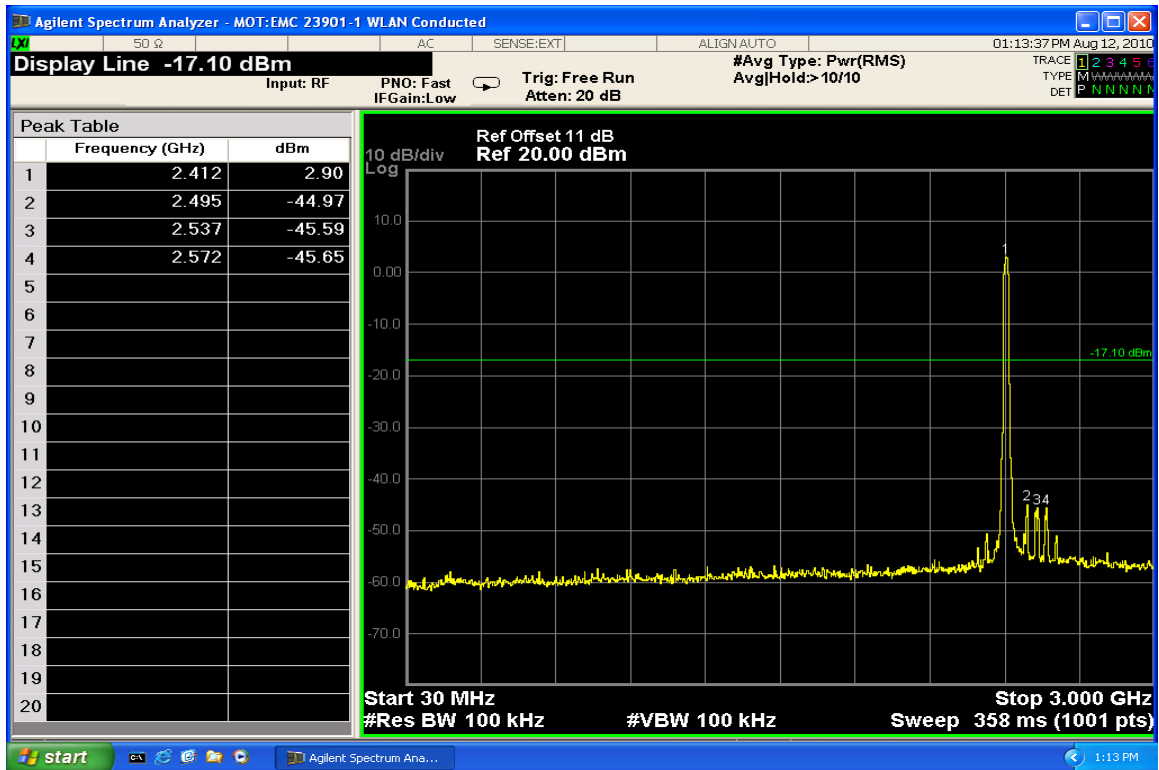


Conducted Spurious Emissions 10-20 GHz (High Channel)

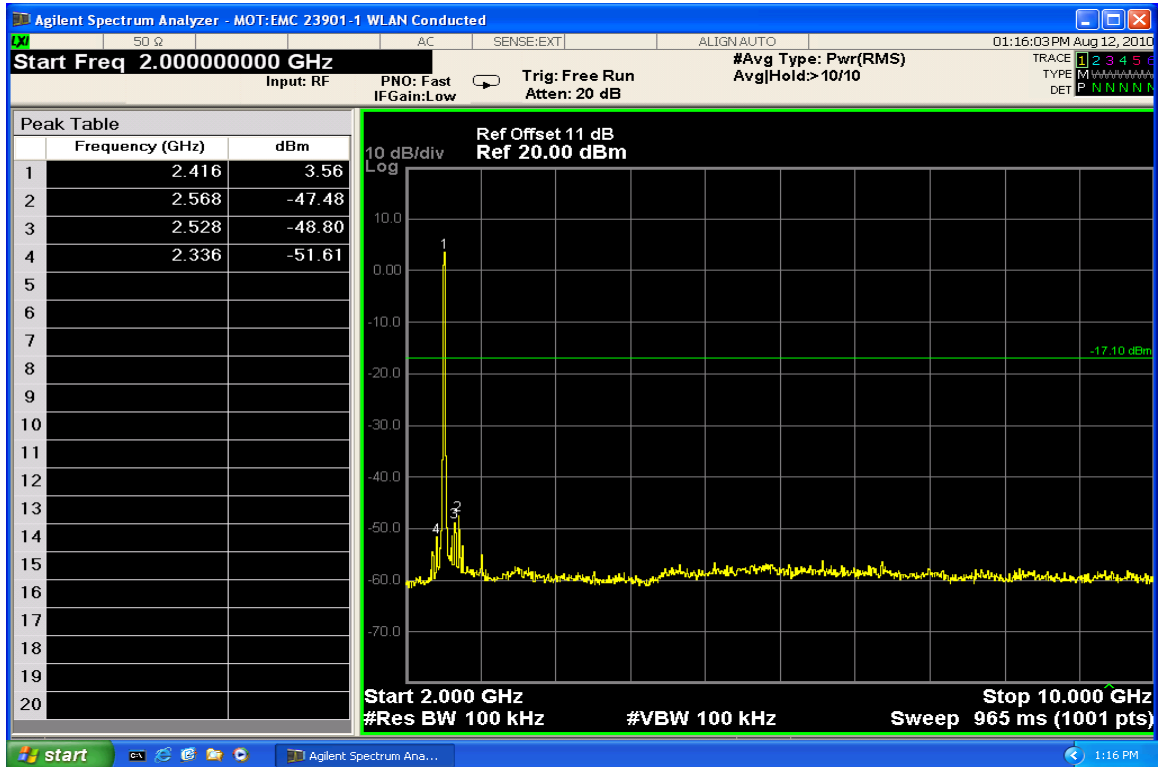


Conducted Spurious Emissions 20-26.5 GHz (High Channel)

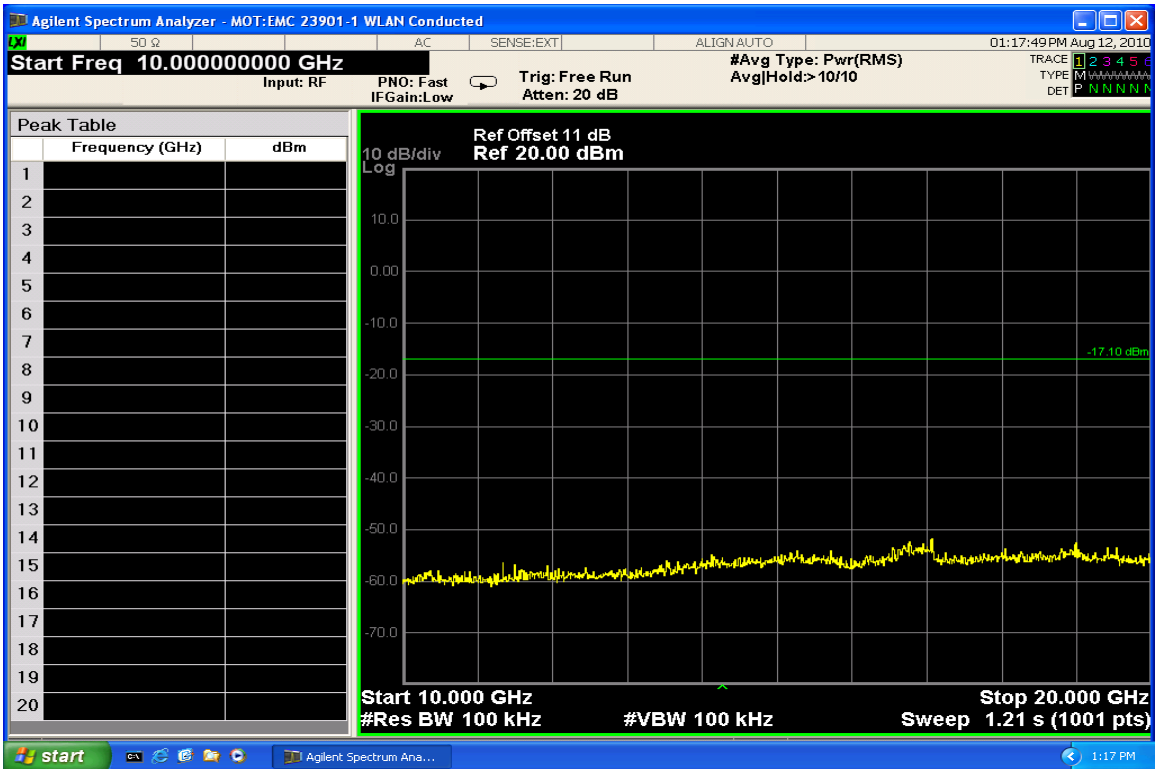
**802.11n 400ns GI @ 7.2Mbps**



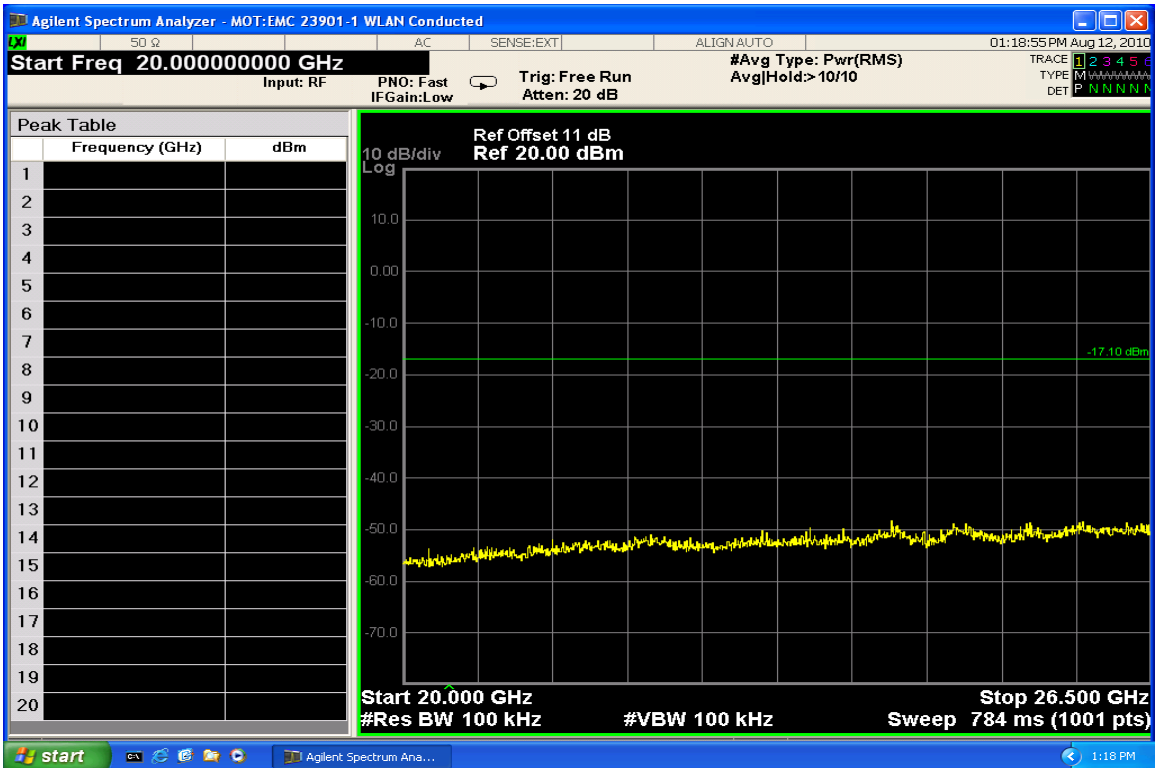
**Conducted Spurious Emissions 30-3000MHz (Low Channel)**



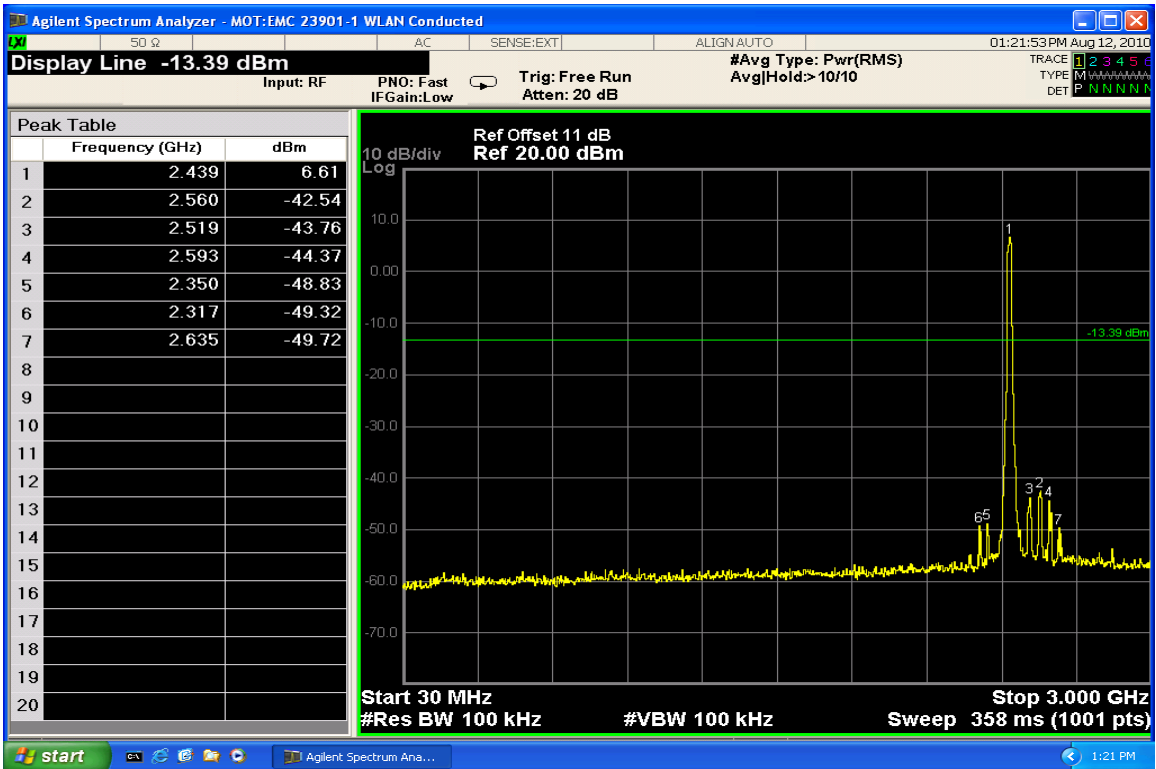
**Conducted Spurious Emissions 2-10GHz (Low Channel)**



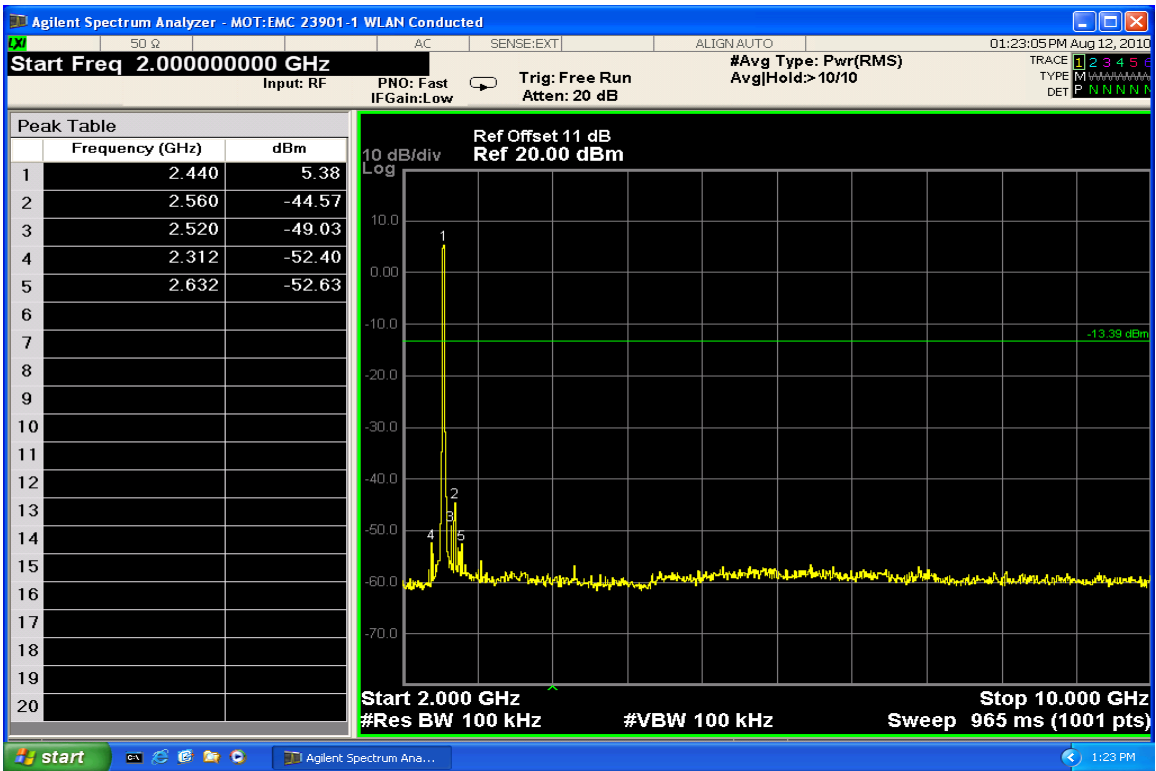
**Conducted Spurious Emissions 10-20GHz (Low Channel)**



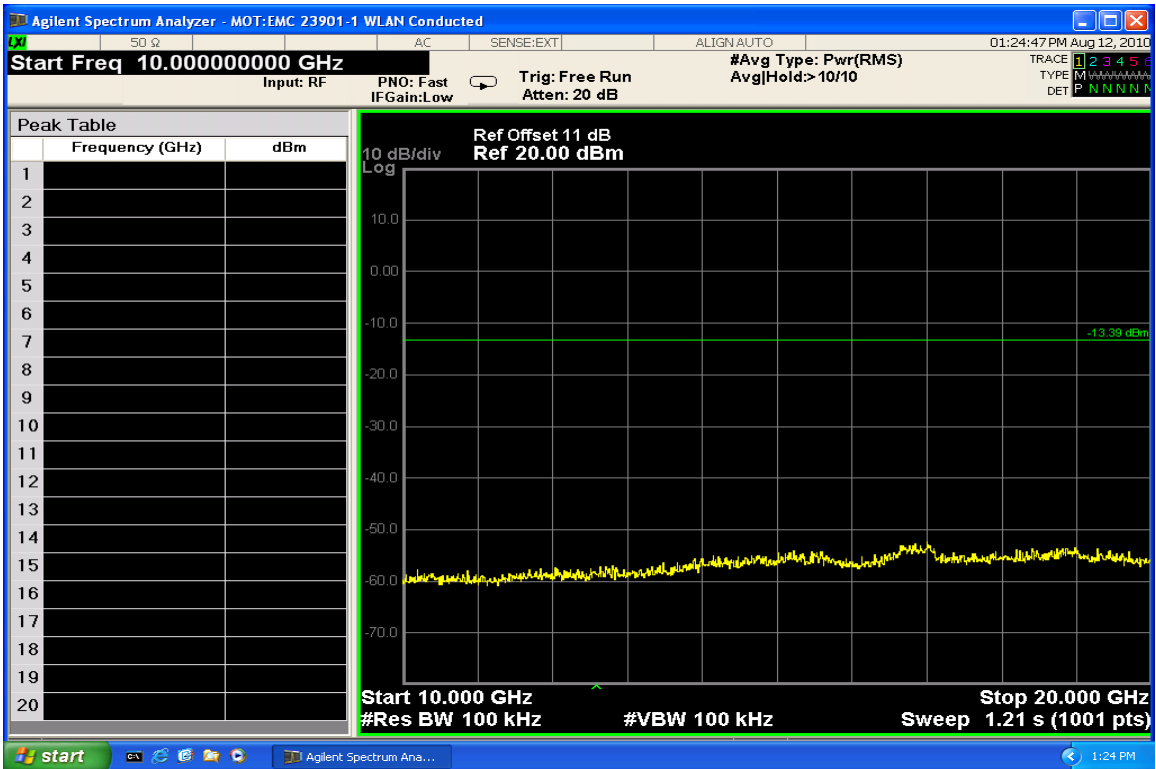
**Conducted Spurious Emissions 20-26.5GHz (Low Channel)**



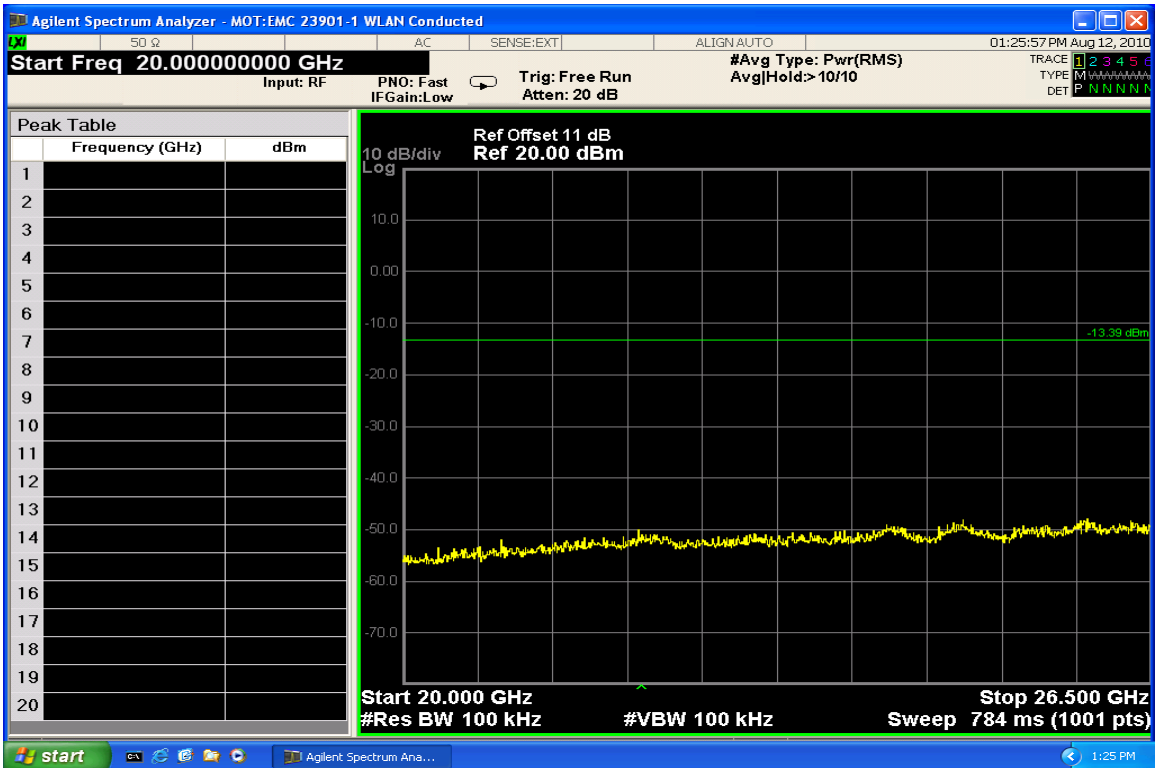
Conducted Spurious Emissions 30-3000MHz (Mid Channel)



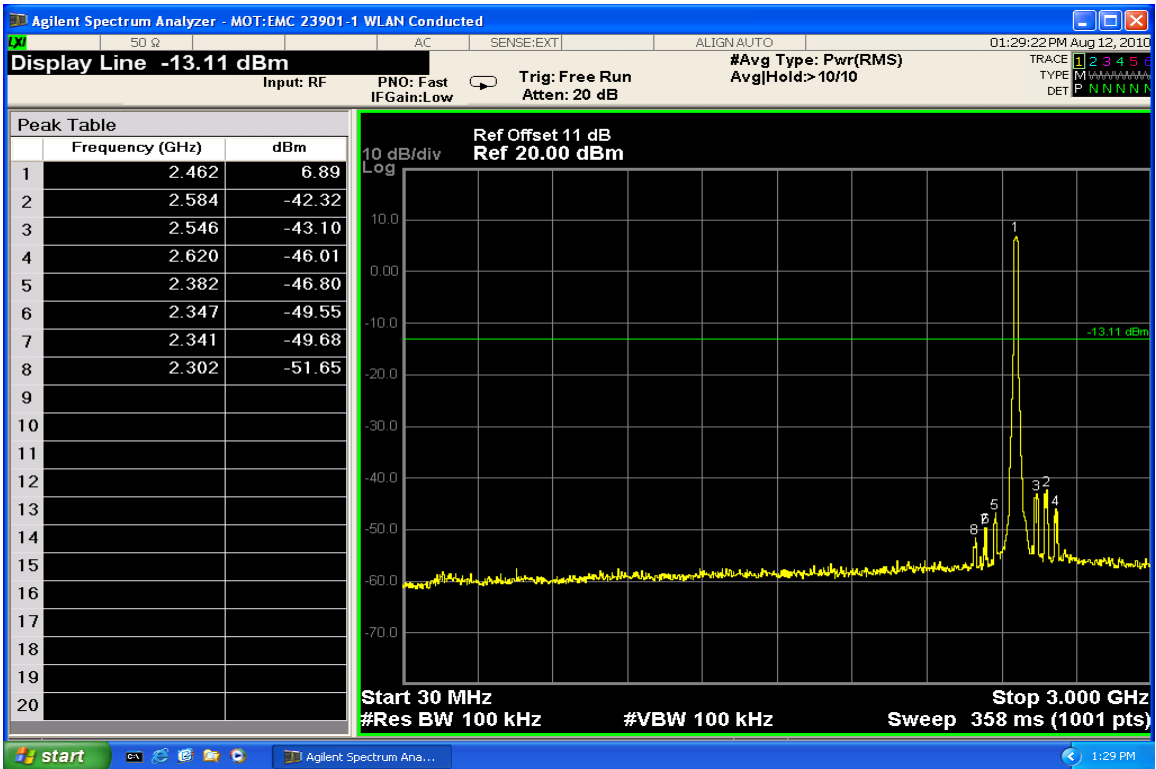
Conducted Spurious Emissions 2-10GHz (Mid Channel)



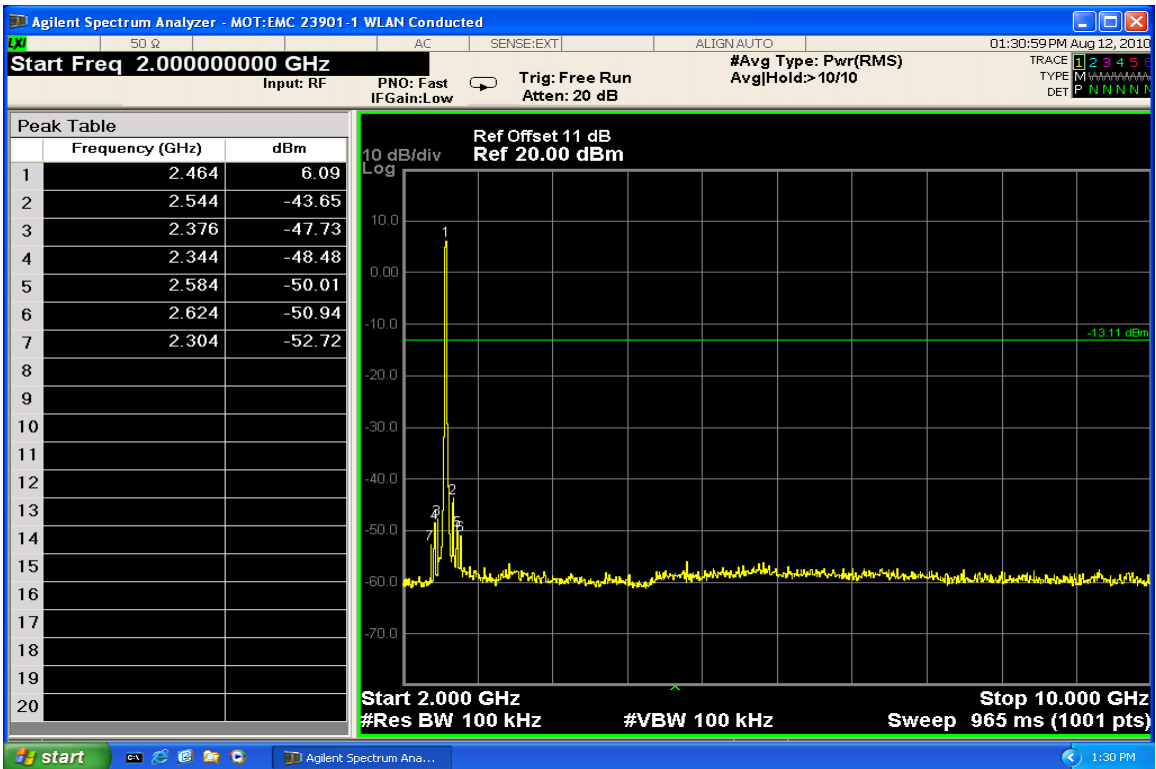
Conducted Spurious Emissions 10-20GHz (Mid Channel)



Conducted Spurious Emissions 20-26.5GHz (Mid Channel)



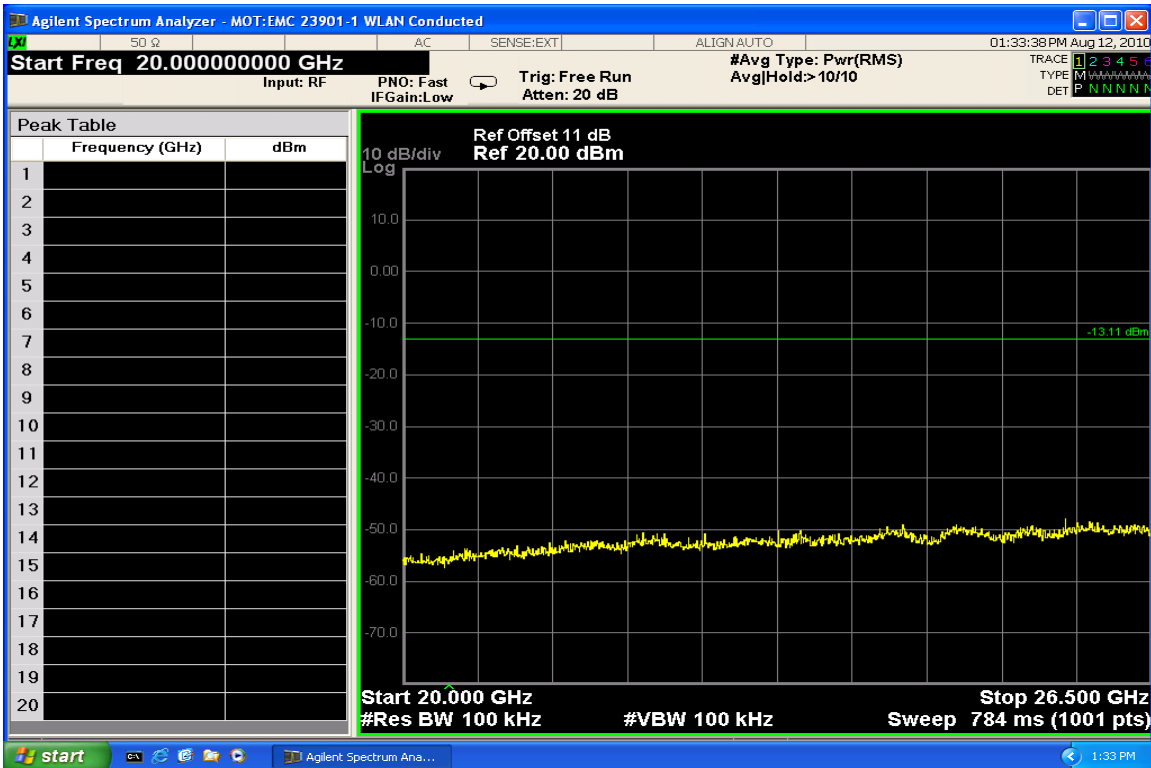
Conducted Spurious Emissions 30-3000MHz (High Channel)



Conducted Spurious Emissions 2-10GHz (High Channel)

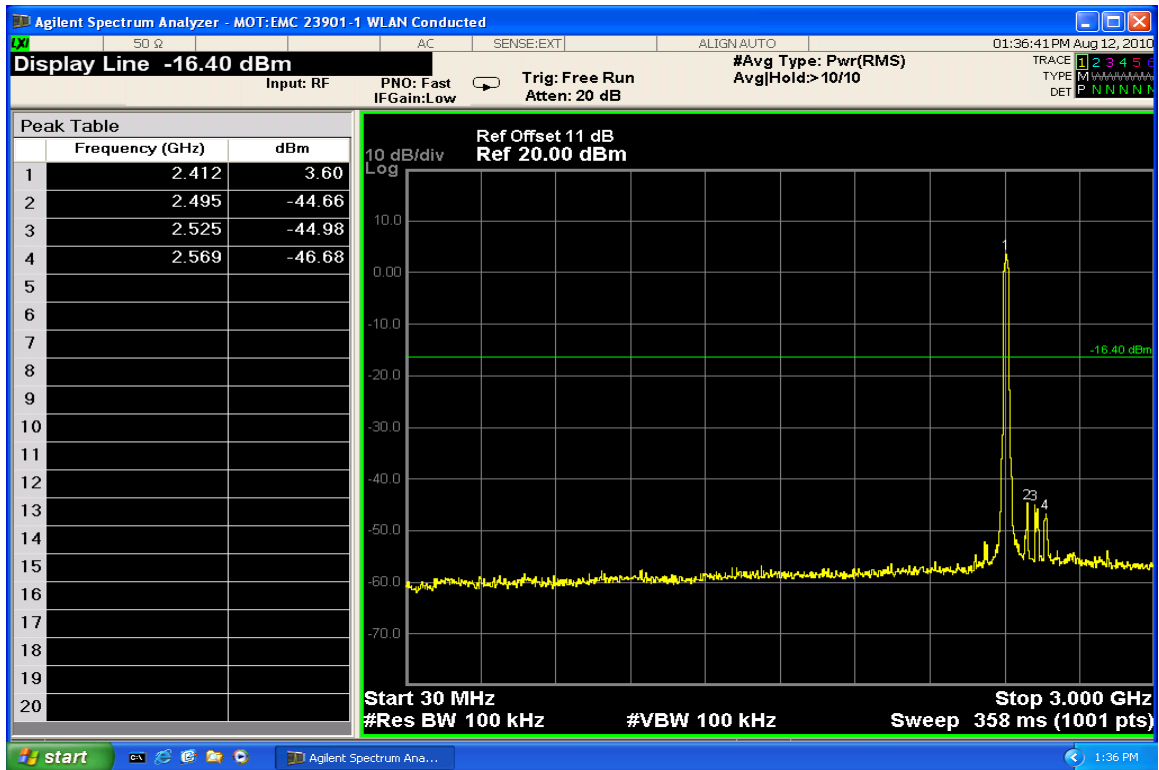


Conducted Spurious Emissions 10-20GHz (High Channel)

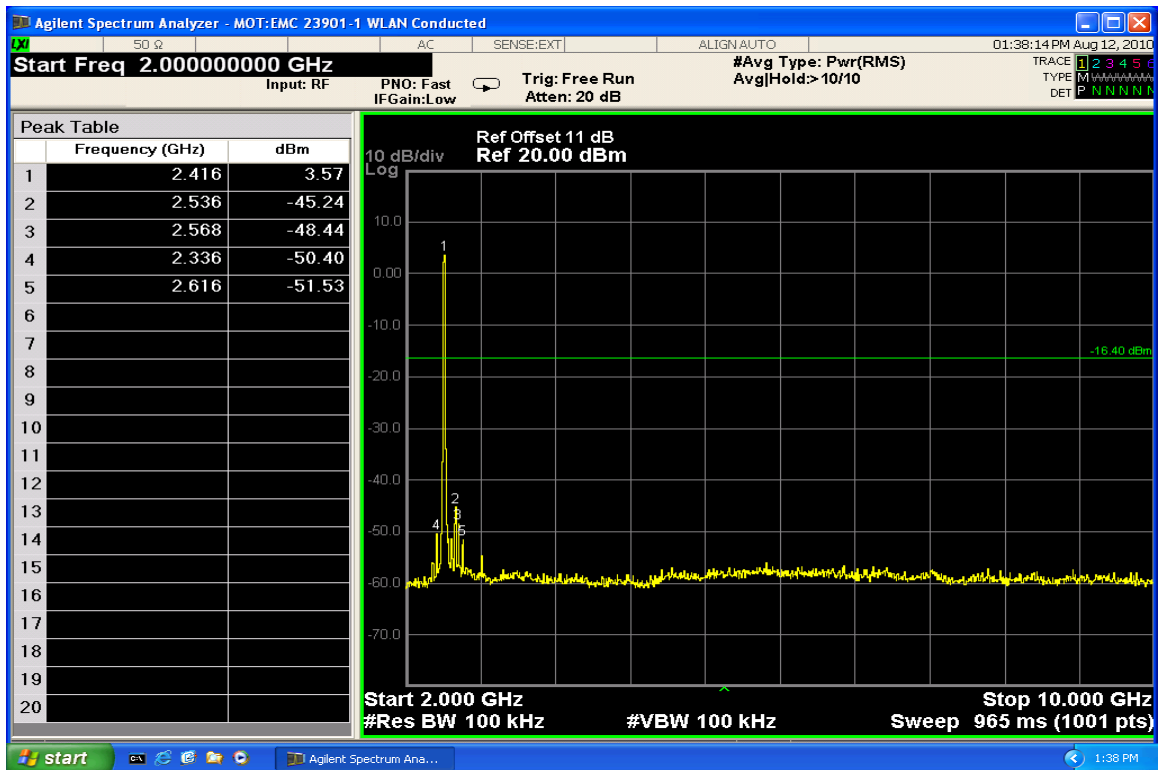


Conducted Spurious Emissions 20-26.5GHz (High Channel)

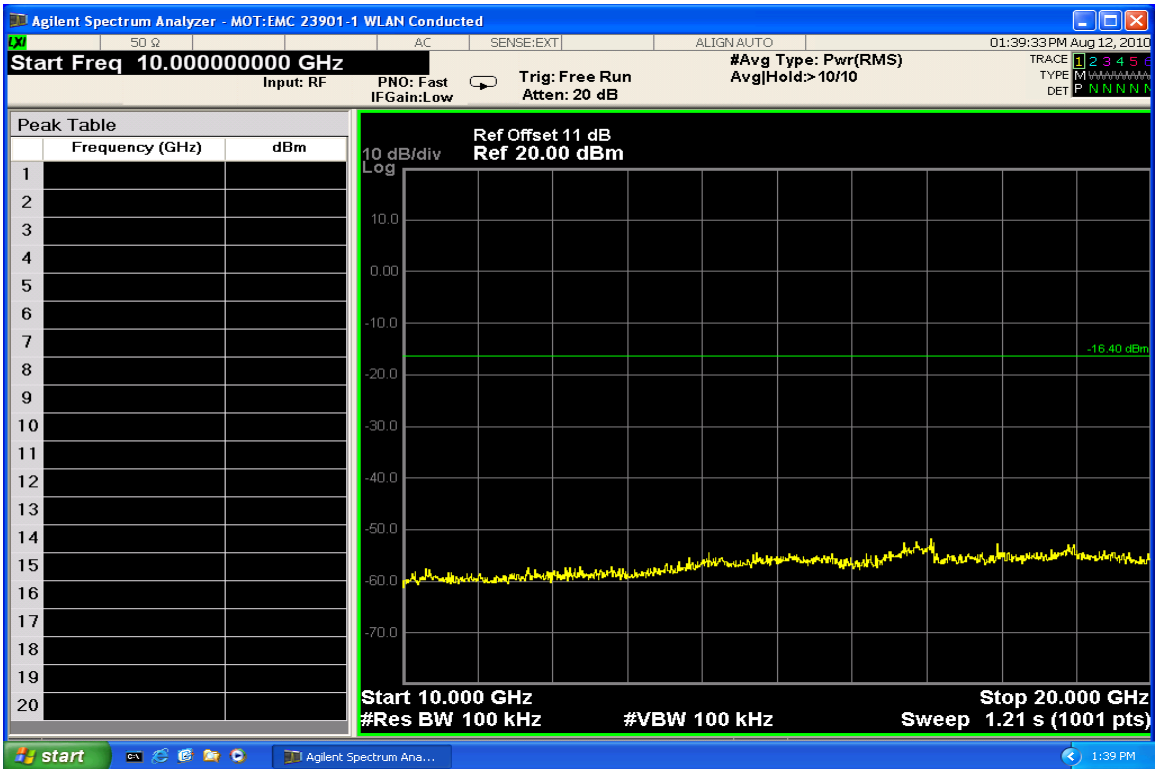
**802.11n 800ns GI @ 6.5 Mbps**



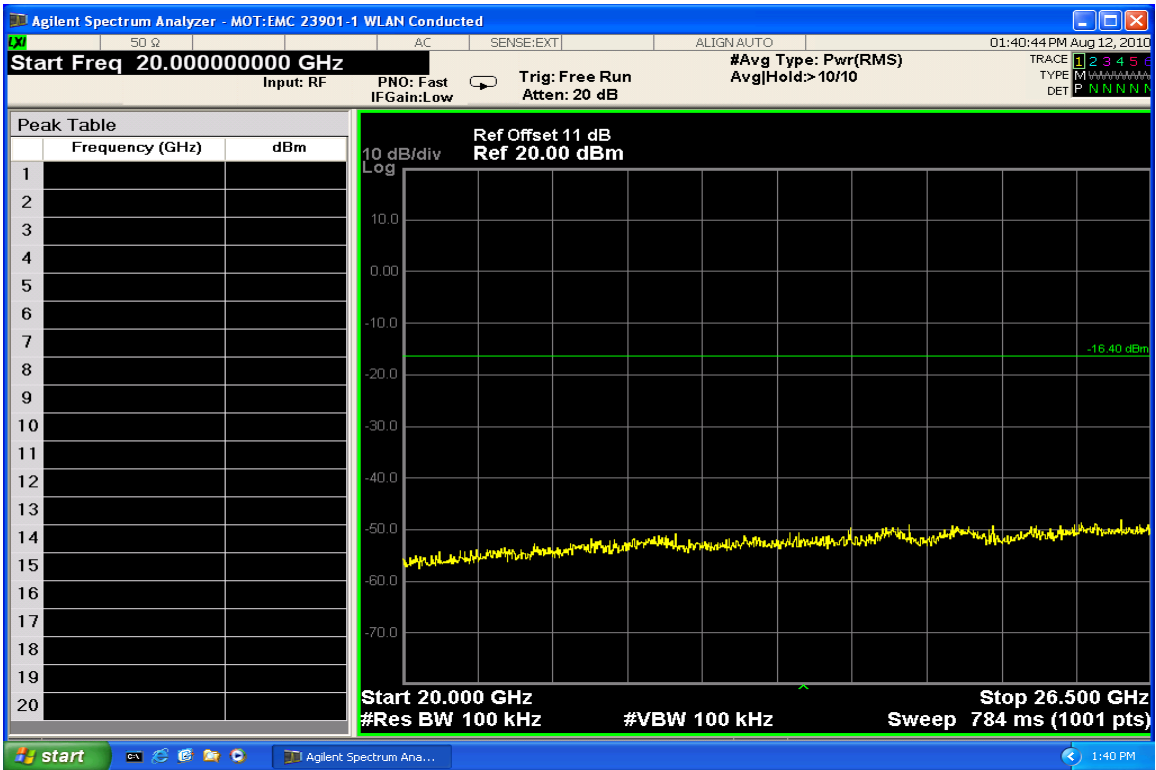
**Conducted Spurious Emissions 30-3000MHz (Low Channel)**



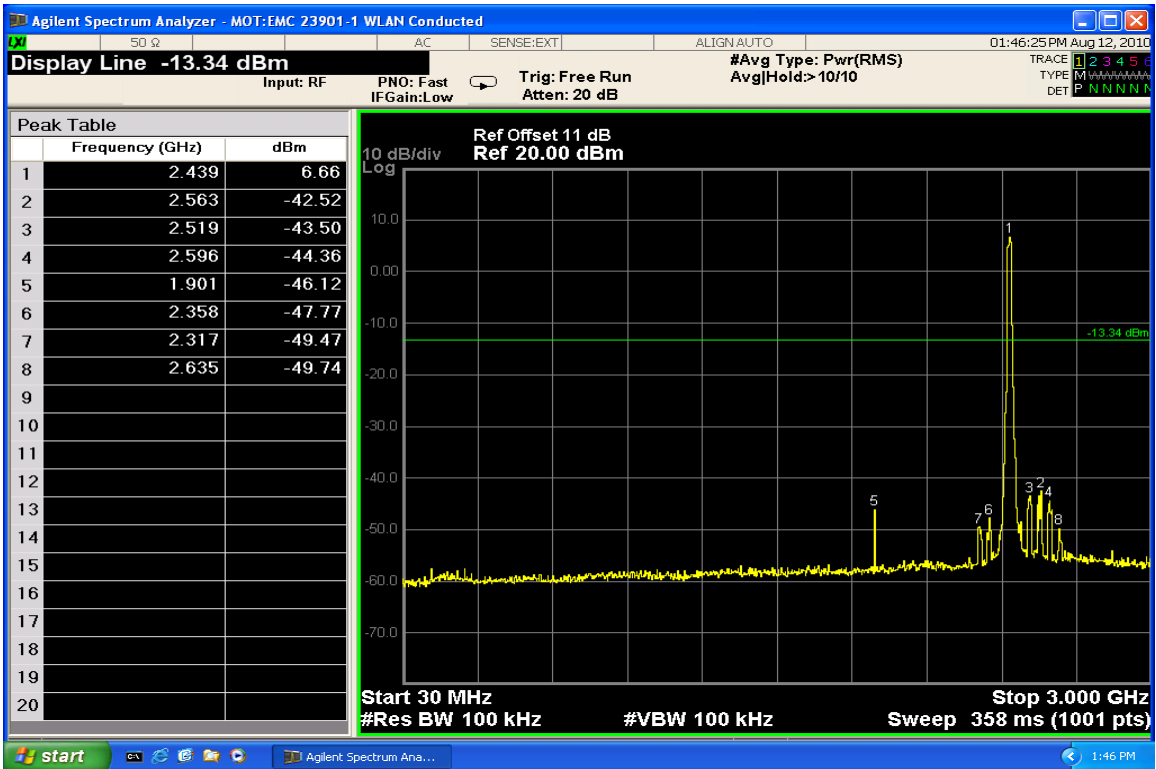
**Conducted Spurious Emissions 2-10GHz (Low Channel)**



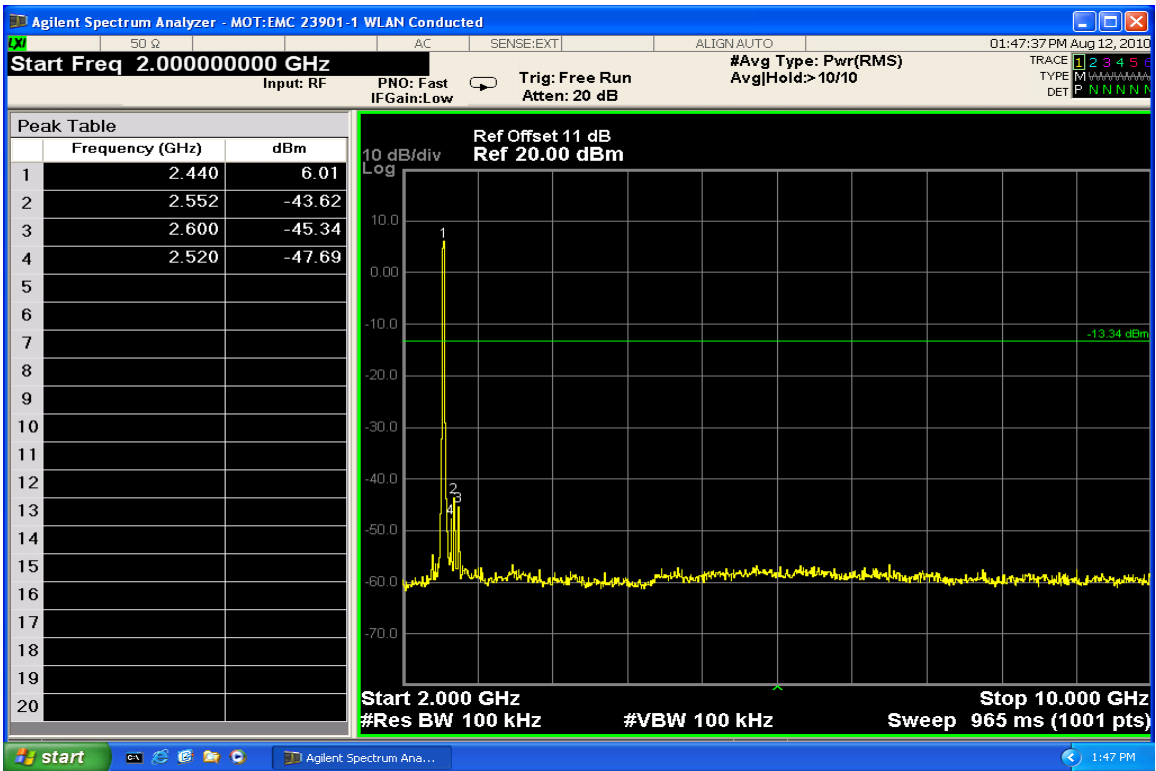
Conducted Spurious Emissions 10-20GHz (Low Channel)



Conducted Spurious Emissions 20-26.5GHz (Low Channel)



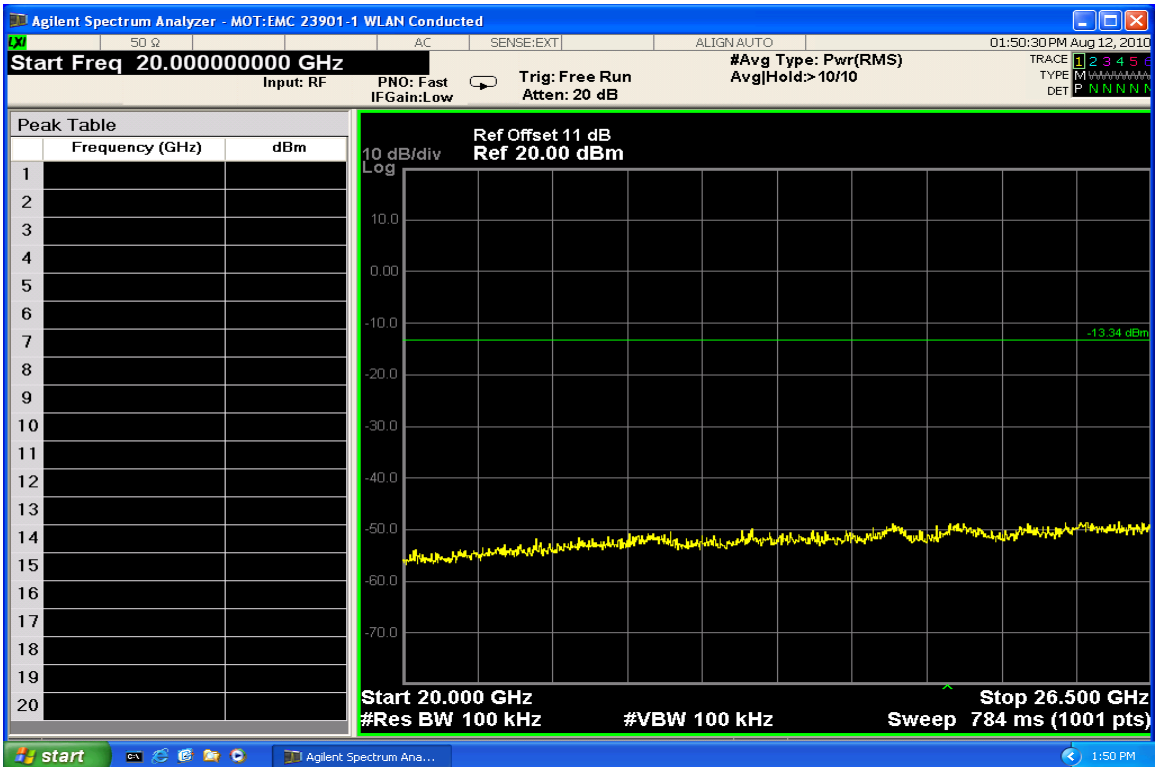
Conducted Spurious Emissions 30-3000MHz (Mid Channel)



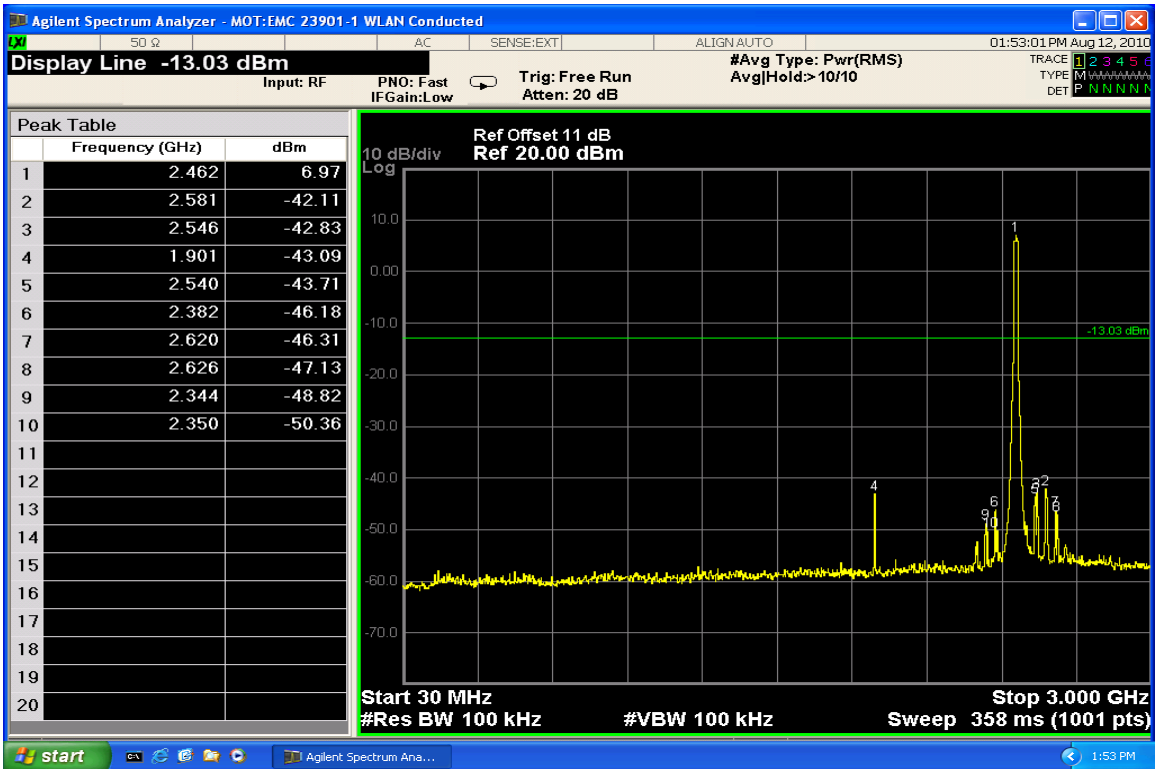
Conducted Spurious Emissions 2-10GHz (Mid Channel)



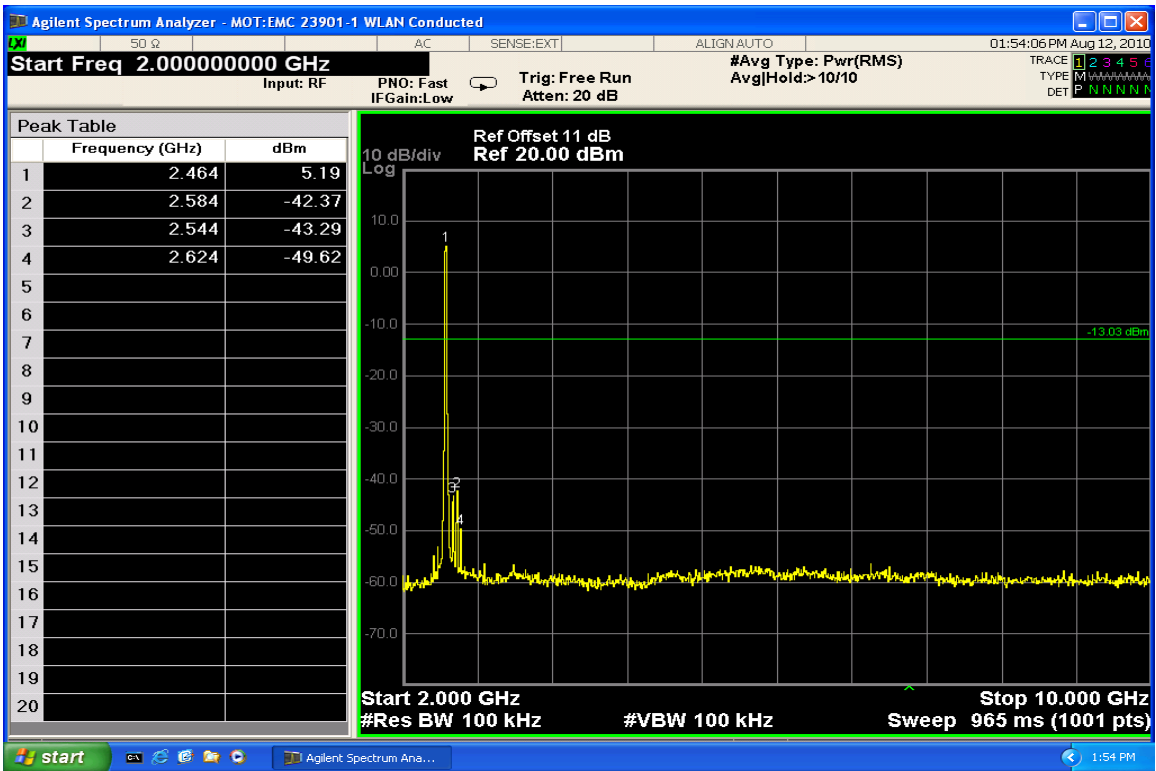
Conducted Spurious Emissions 10-20GHz (Mid Channel)



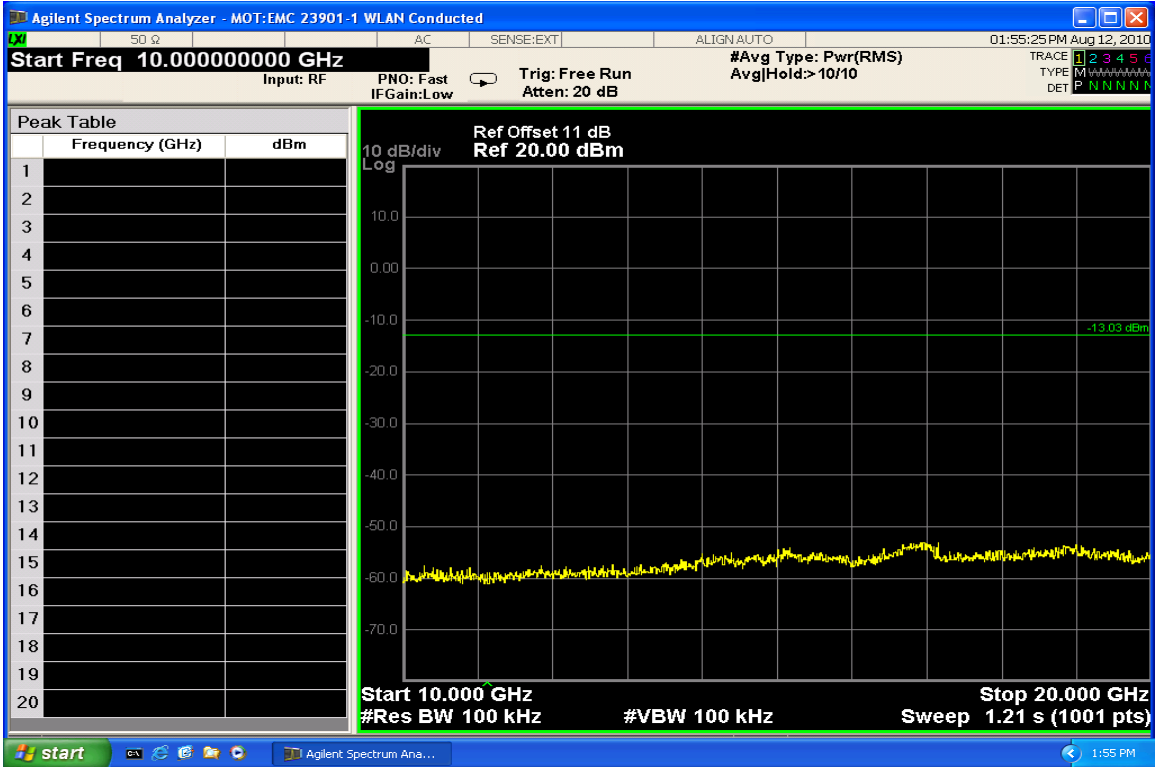
Conducted Spurious Emissions 20-26.5GHz (Mid Channel)



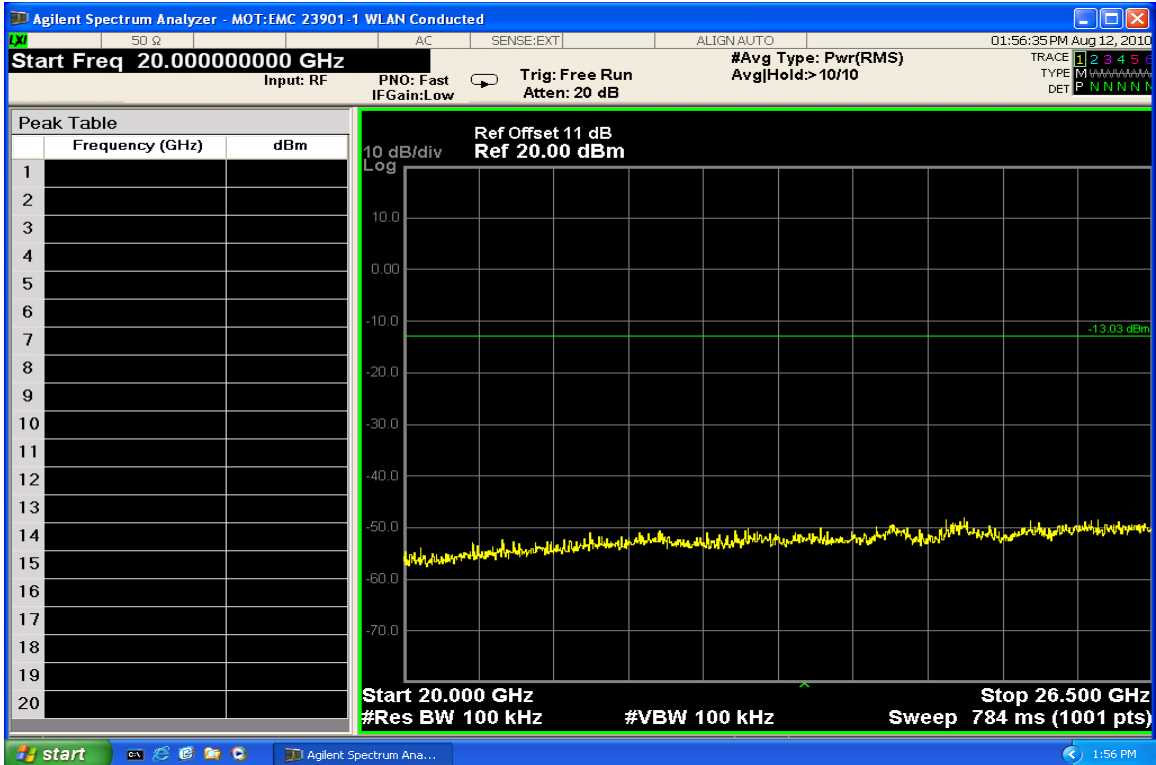
Conducted Spurious Emissions 30-3000MHz (High Channel)



Conducted Spurious Emissions 2-10GHz (High Channel)

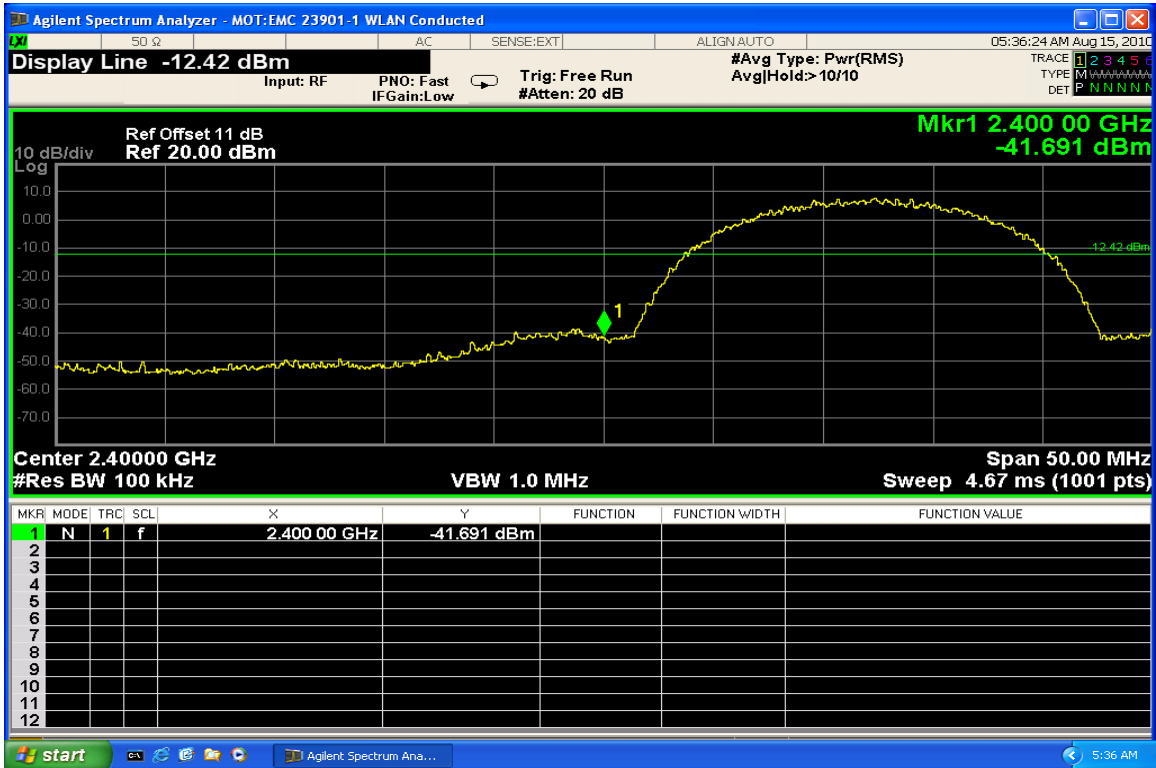


Conducted Spurious Emissions 10-20GHz (High Channel)

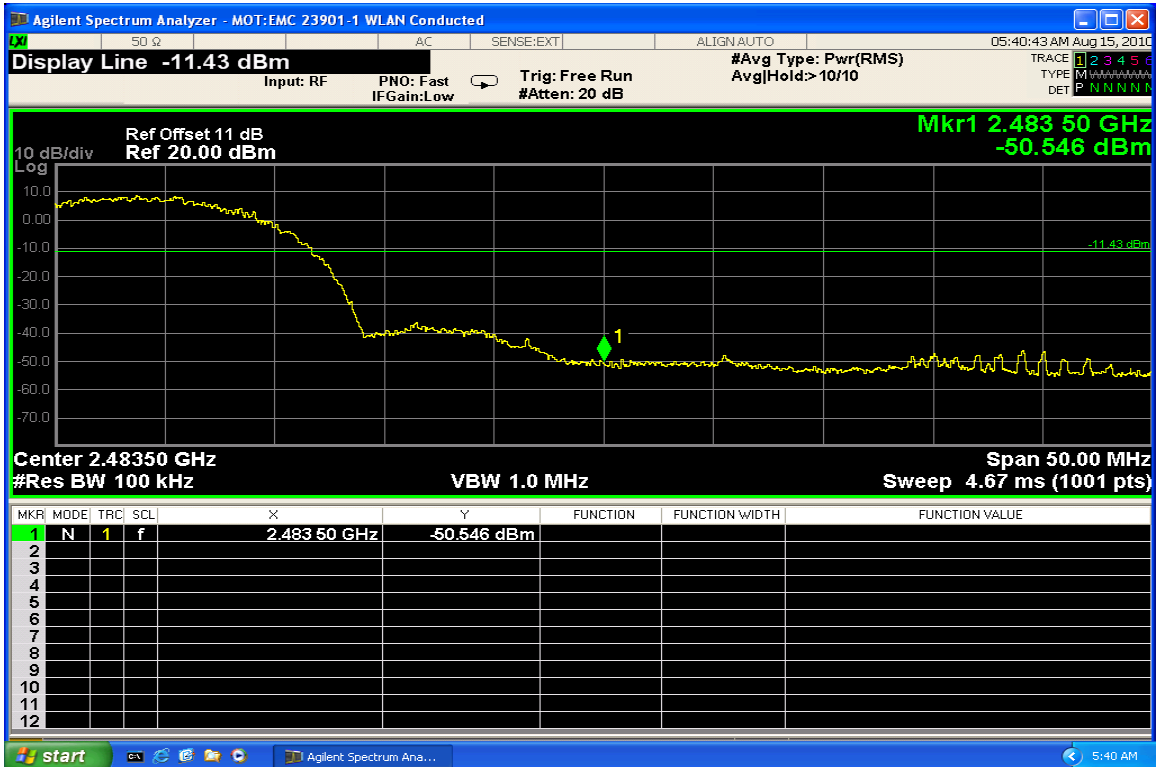


Conducted Spurious Emissions 20-26.5GHz (High Channel)

**802.11b @ 11 Mbps Band Edge**

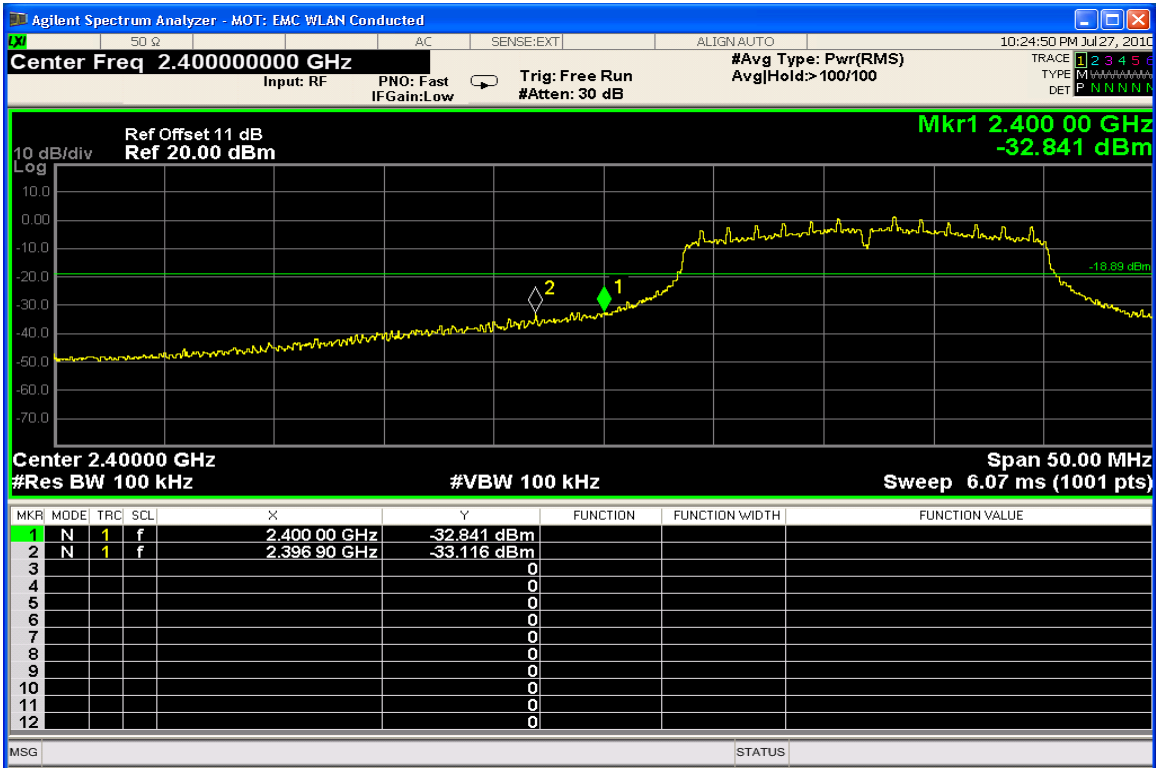


**Channel 1 @ 11 Mbps – Lower Band Edge**

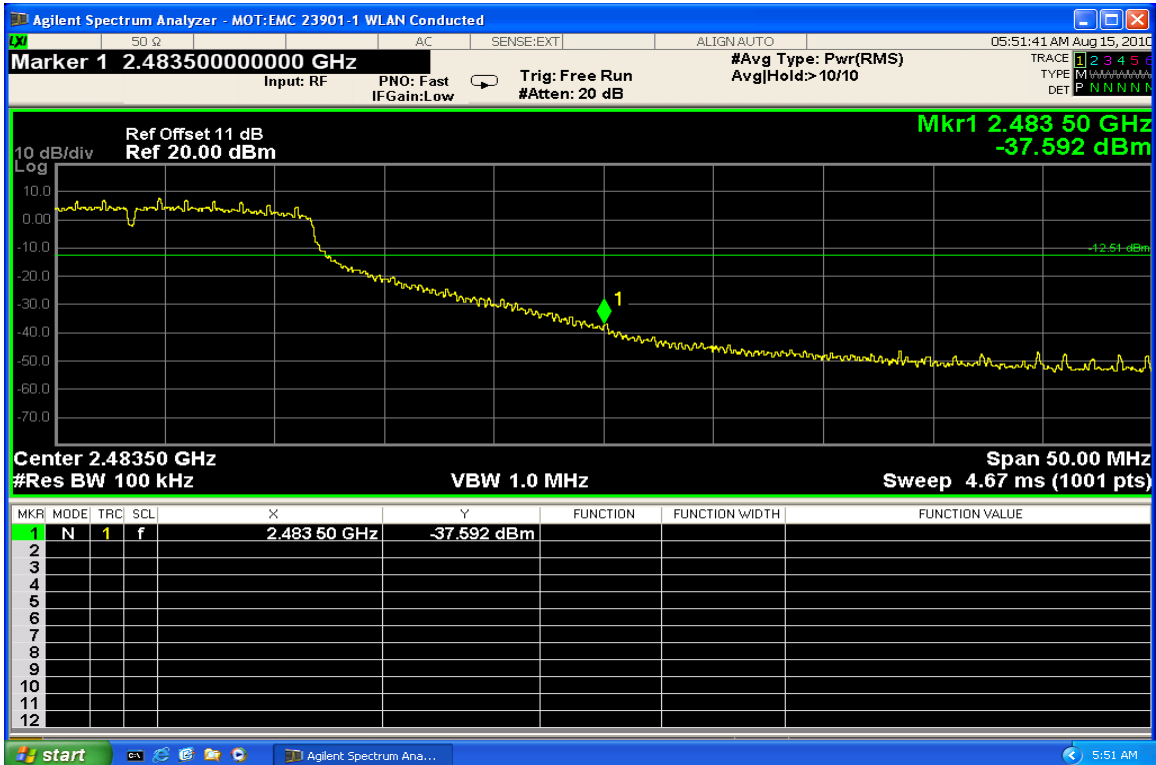


**Channel 11 @ 11 Mbps – Upper Band Edge**

**802.11g @ 9 Mbps Band Edge**

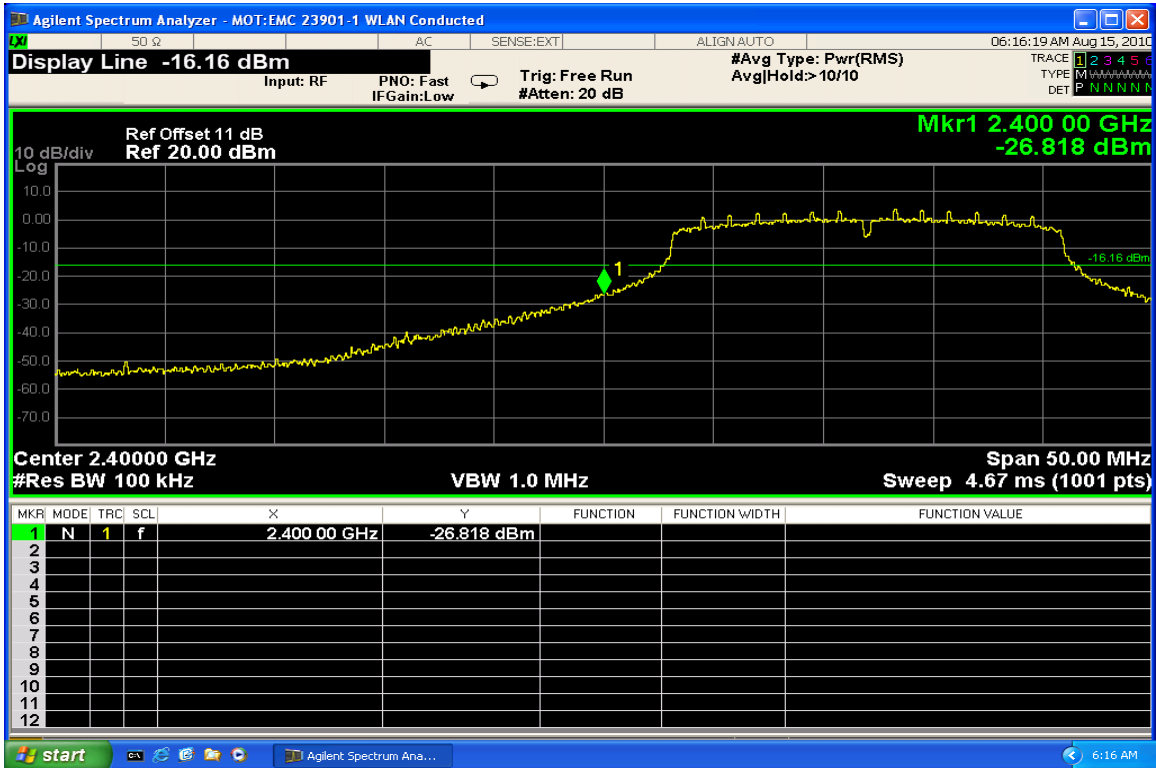


**Channel 1 @ 9 Mbps – Lower Band Edge**

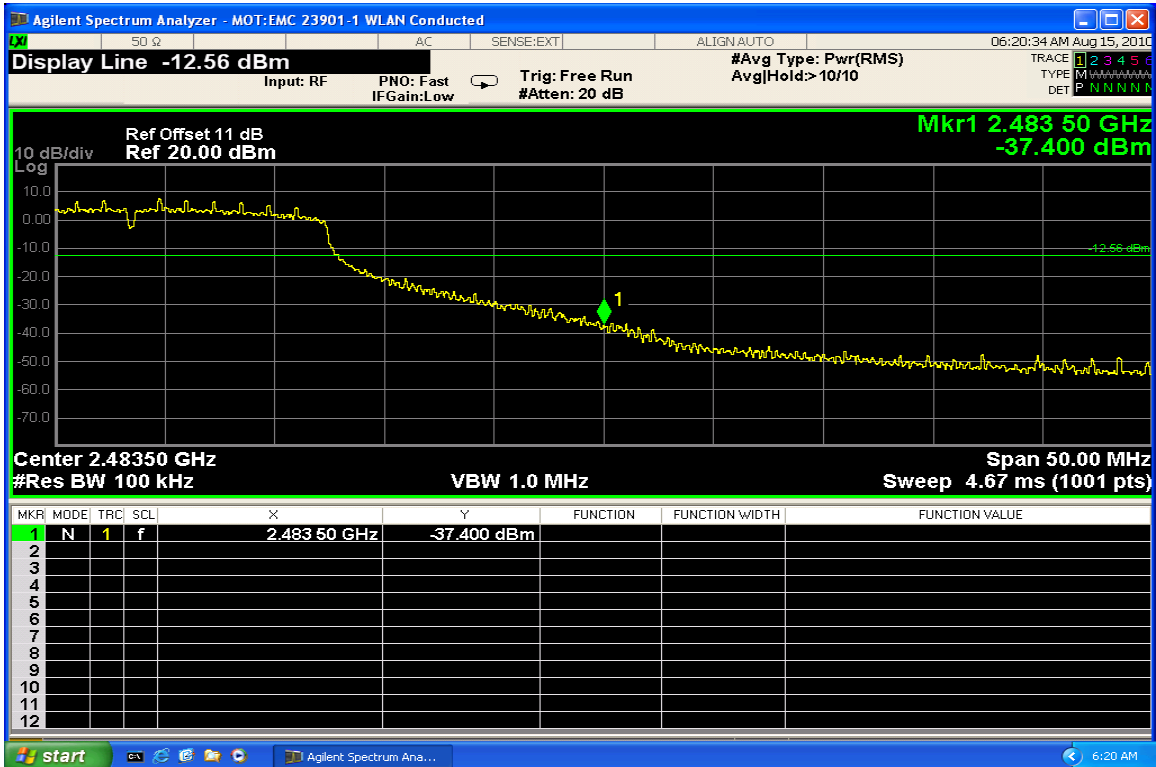


**Channel 11 @ 9 Mbps – Upper Band Edge**

**802.11n 800ns GI @ 6.5 Mbps Band Edge**

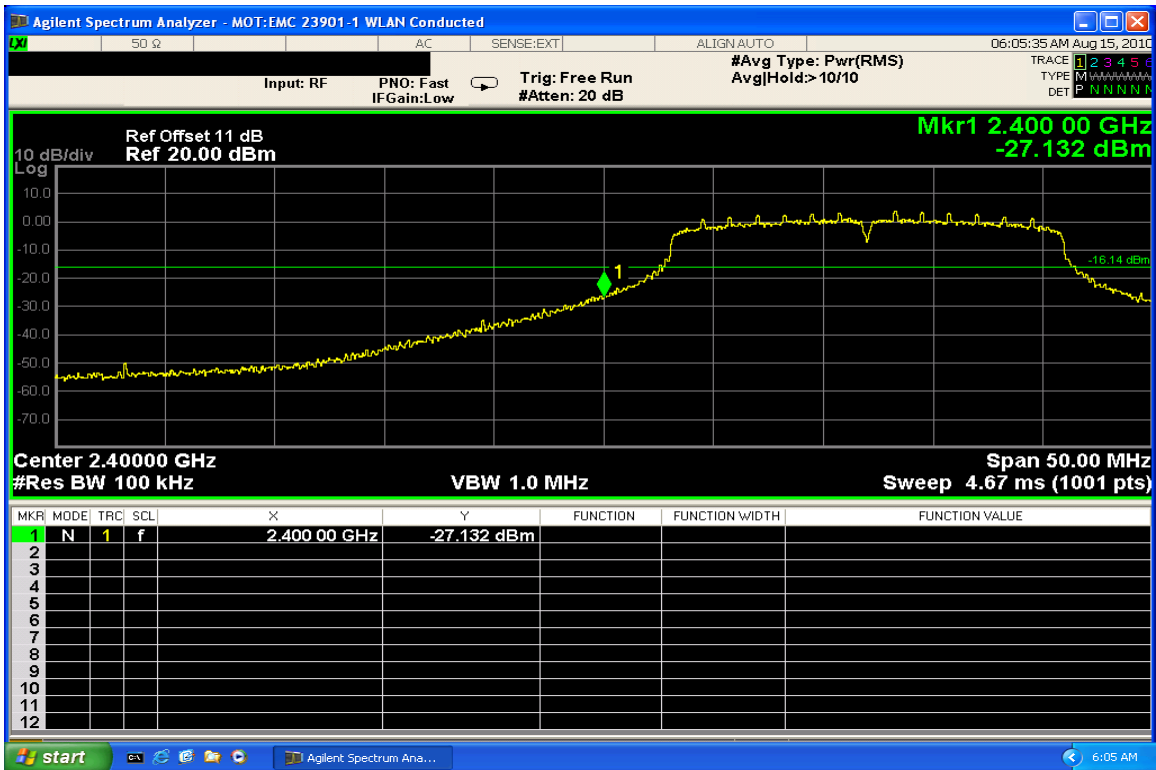


**Channel 1 @ 6.5 Mbps – Lower Band Edge**

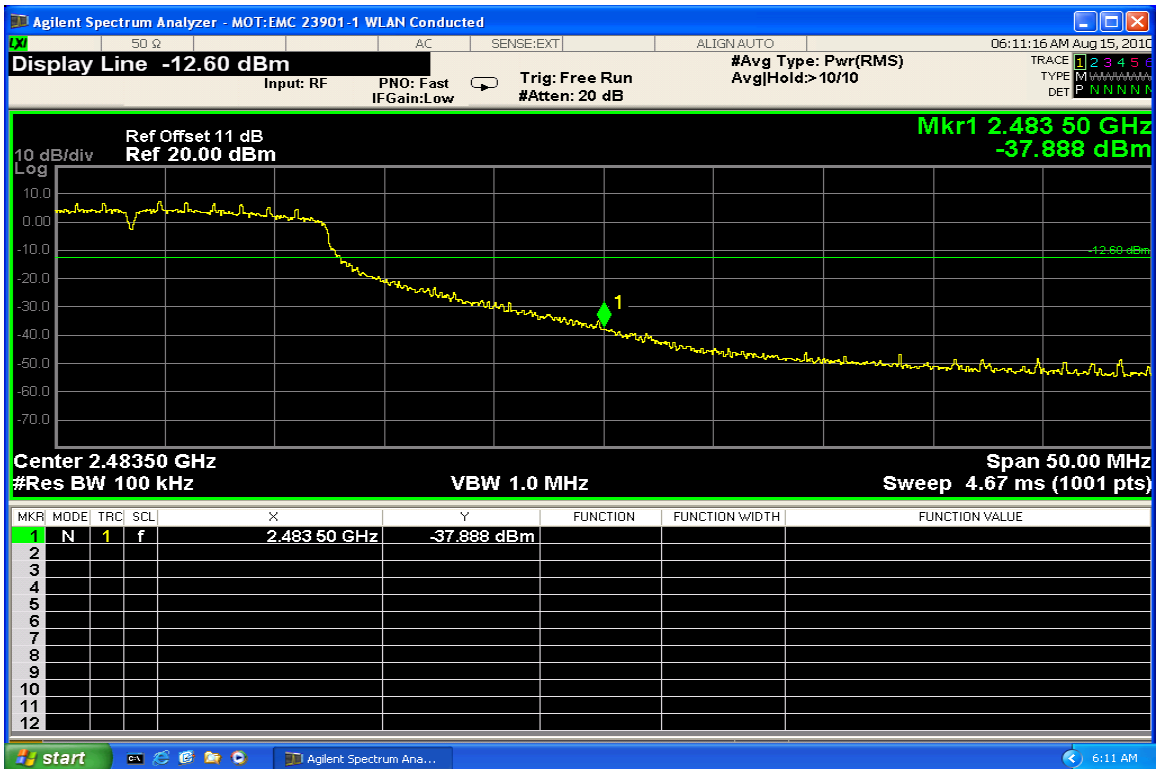


**Channel 11 @ 6.5 Mbps – Upper Band Edge**

**802.11n 400ns GI @ 7.2 Mbps Band Edge**



**Channel 1 @ 7.2 Mbps – Lower Band Edge**



**Channel 11 @ 7.2 Mbps – Upper Band Edge**

**AC LINE CONDUCTED EMISSIONS**

CFR 47 Part 15.207

**Measurement Procedure**

Measured levels of ac power line conducted emission shall be the radio-noise voltage from the line probe or across the 50  $\Omega$  LISN port, where permitted, terminated into a 50  $\Omega$  noise meter, or where permitted or required, the radio-noise current on the power line sensed by a current probe.

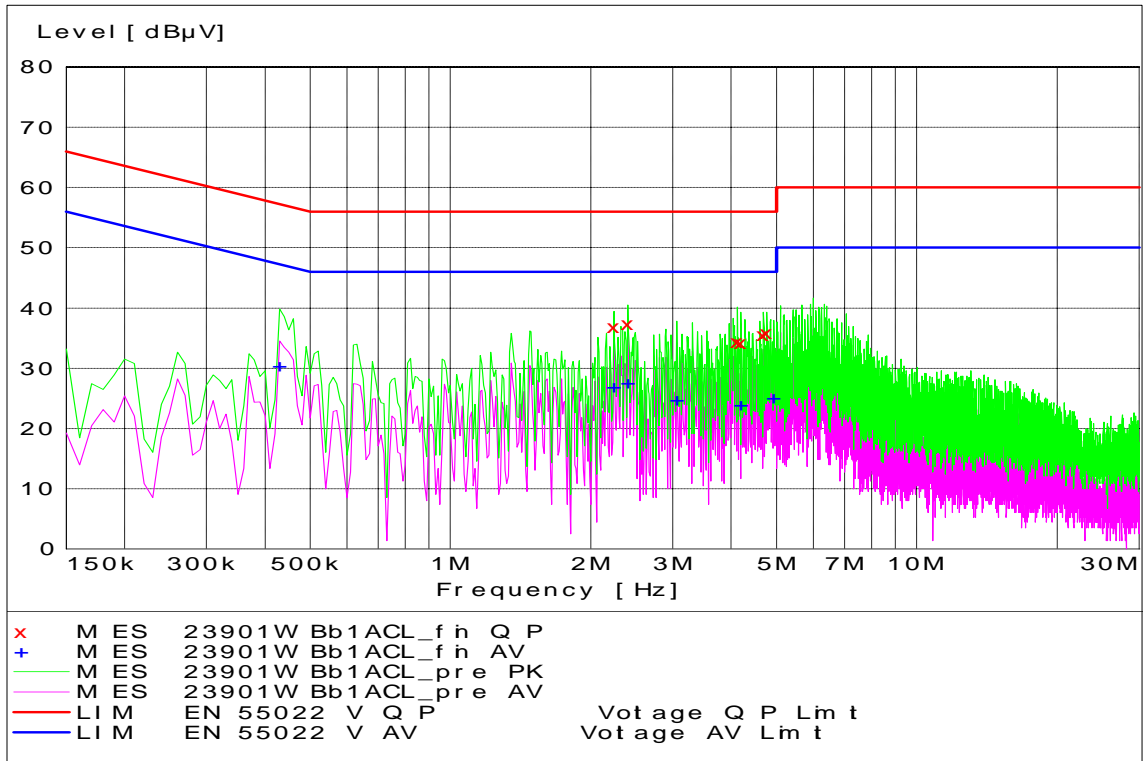
All radio-noise voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord or calibrated extension cord by the use of mating plugs and receptacles on the EUT and LISN. Equipment shall be tested with power cords that are normally supplied using an LISN, the 50  $\Omega$  measuring port is terminated by a 50  $\Omega$  radio-noise meter or a 50  $\Omega$  resistive load. All other ports are terminated in 50  $\Omega$ .

Detectors – Quasi Peak and Average Detector.

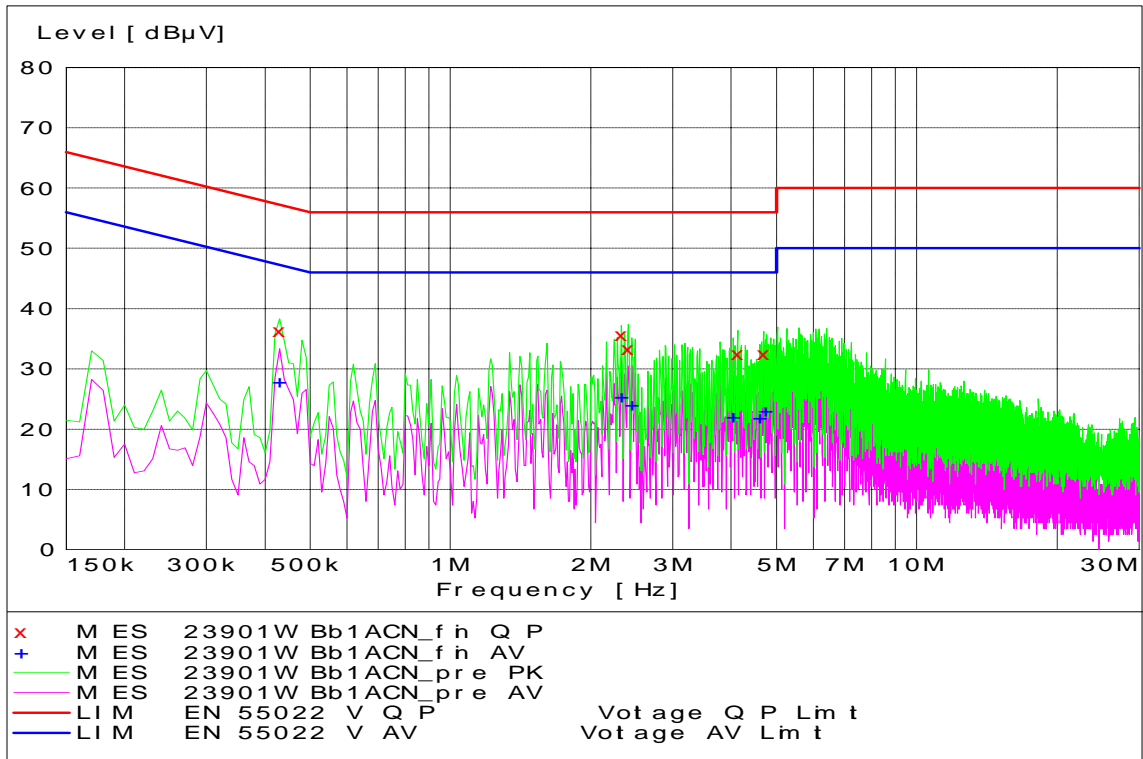
**Measurement Results**

See attached:

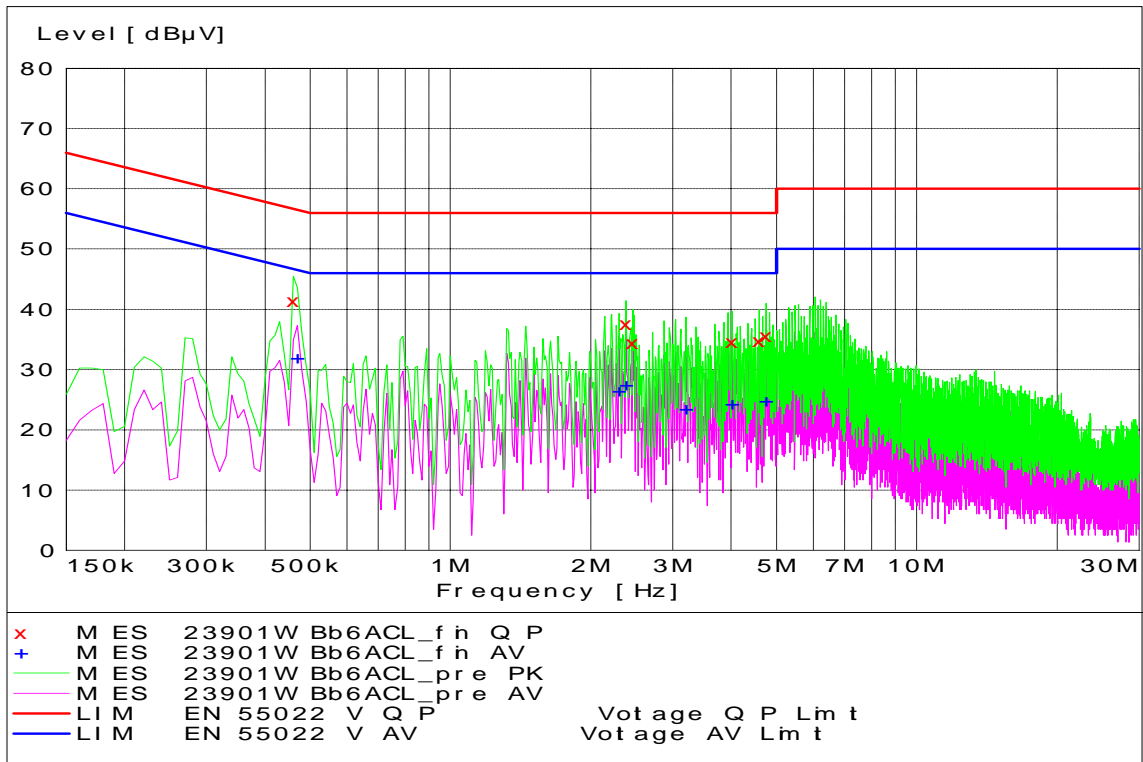
**802.1b @ 11Mbps**



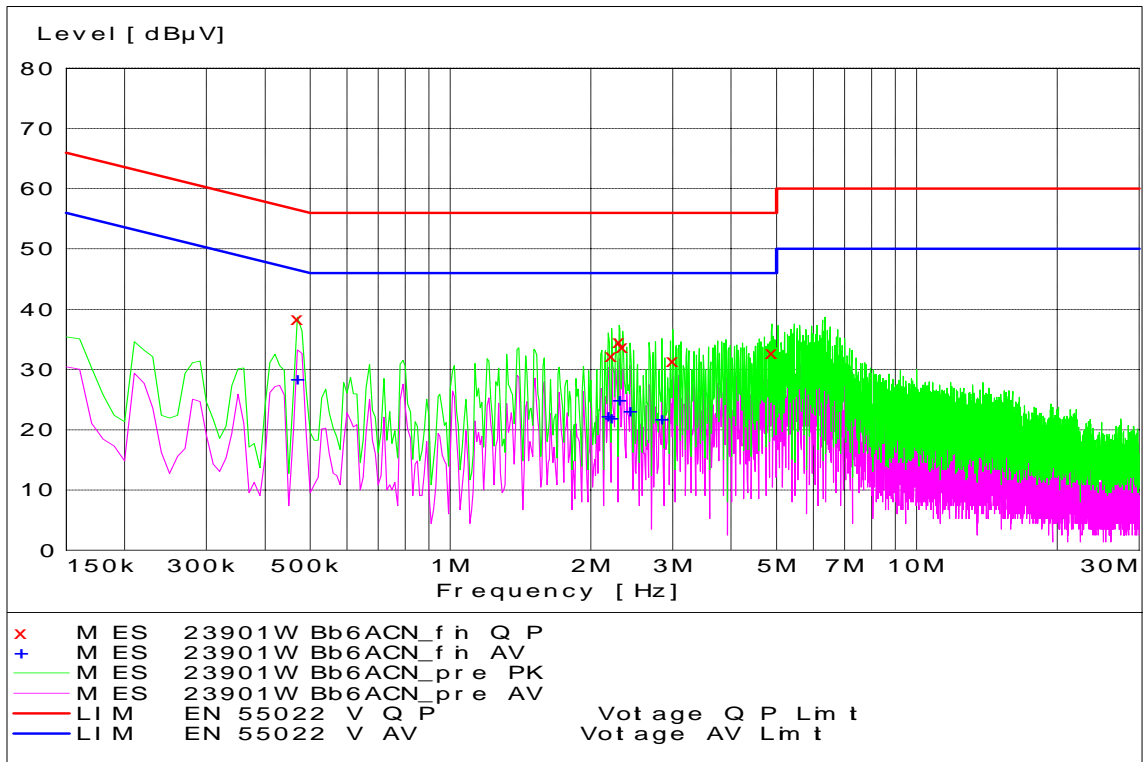
**WLAN Channel 1 - Tx Mode - Line Coupling**



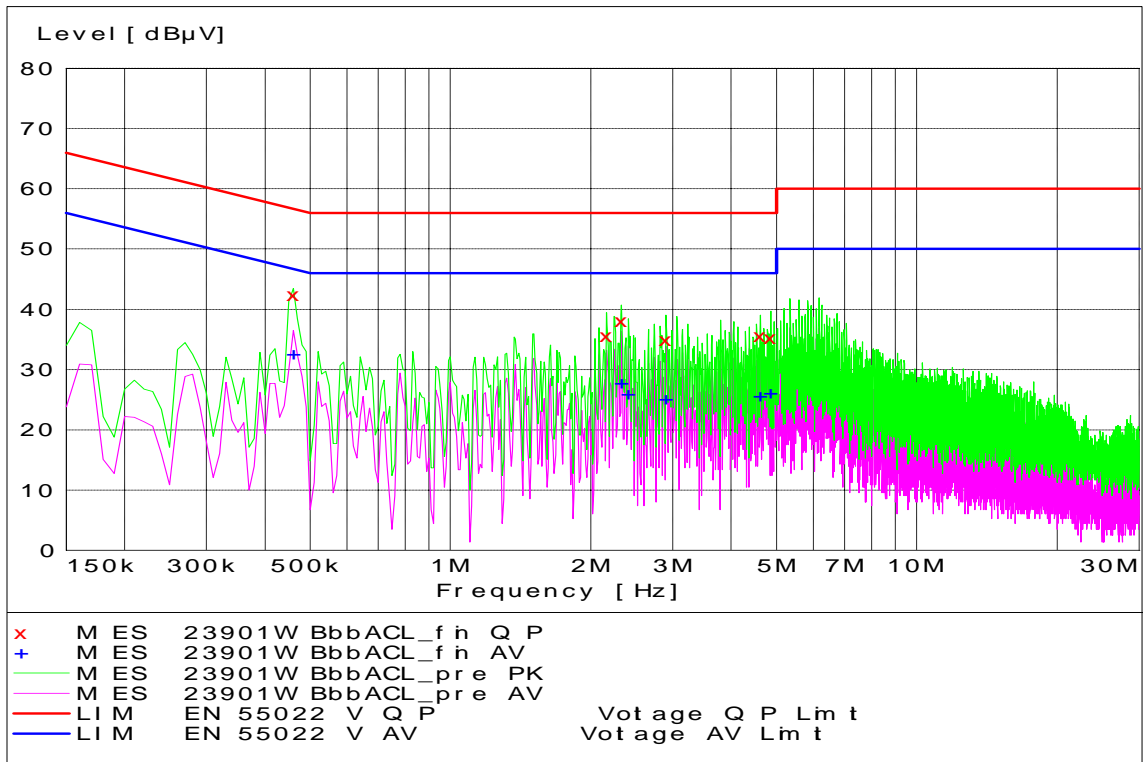
**WLAN Channel 1 - Tx Mode - Neutral Coupling**



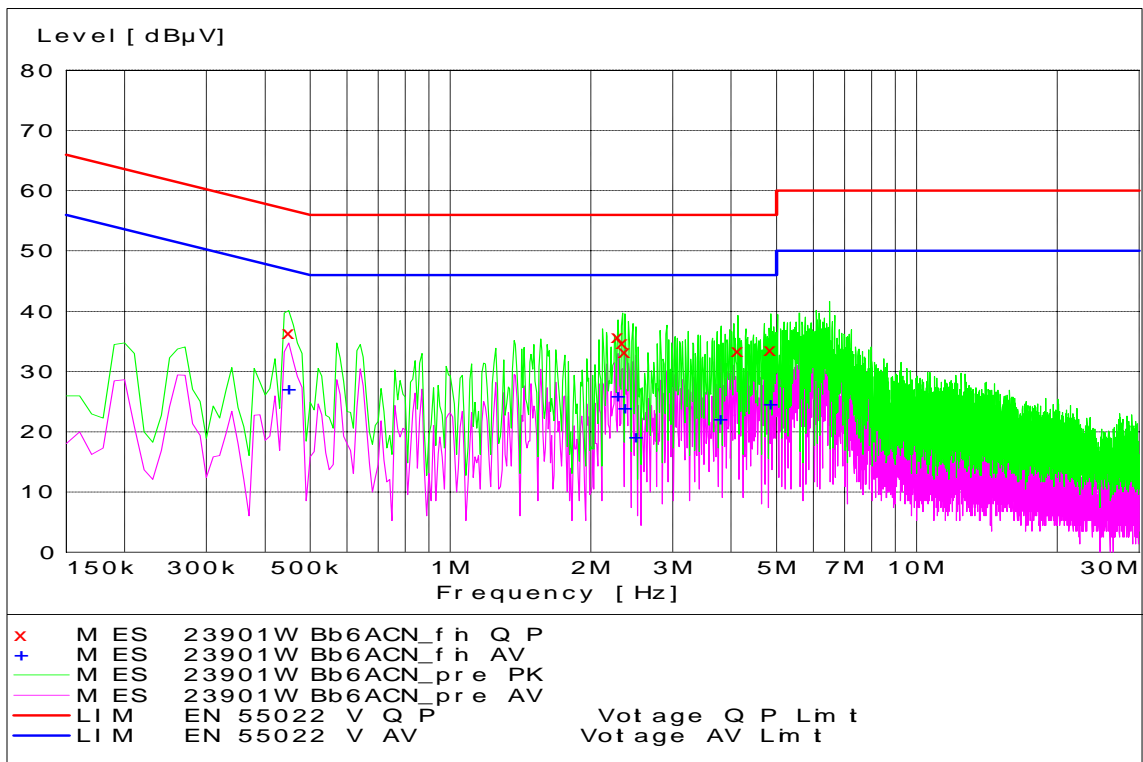
**WLAN Channel 6 - Tx Mode - Line Coupling**



**WLAN Channel 6 - Tx Mode - Neutral Coupling**

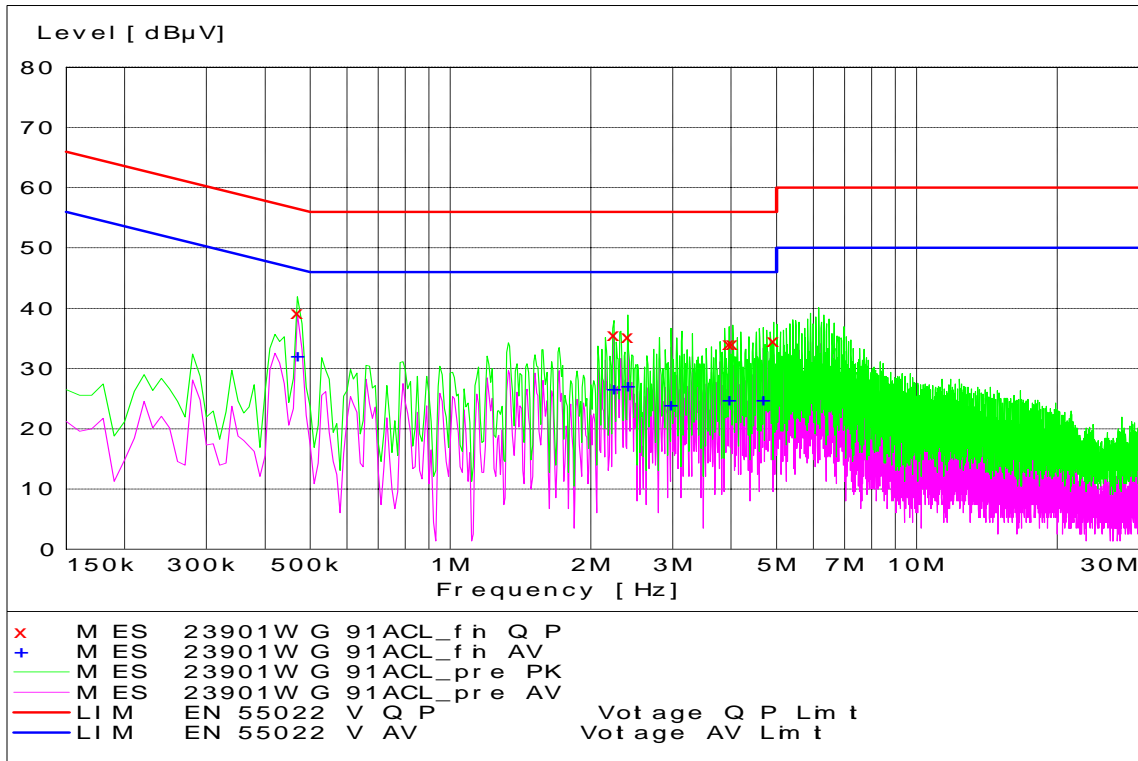


**WLAN Channel 11 - Tx Mode - Line Coupling**

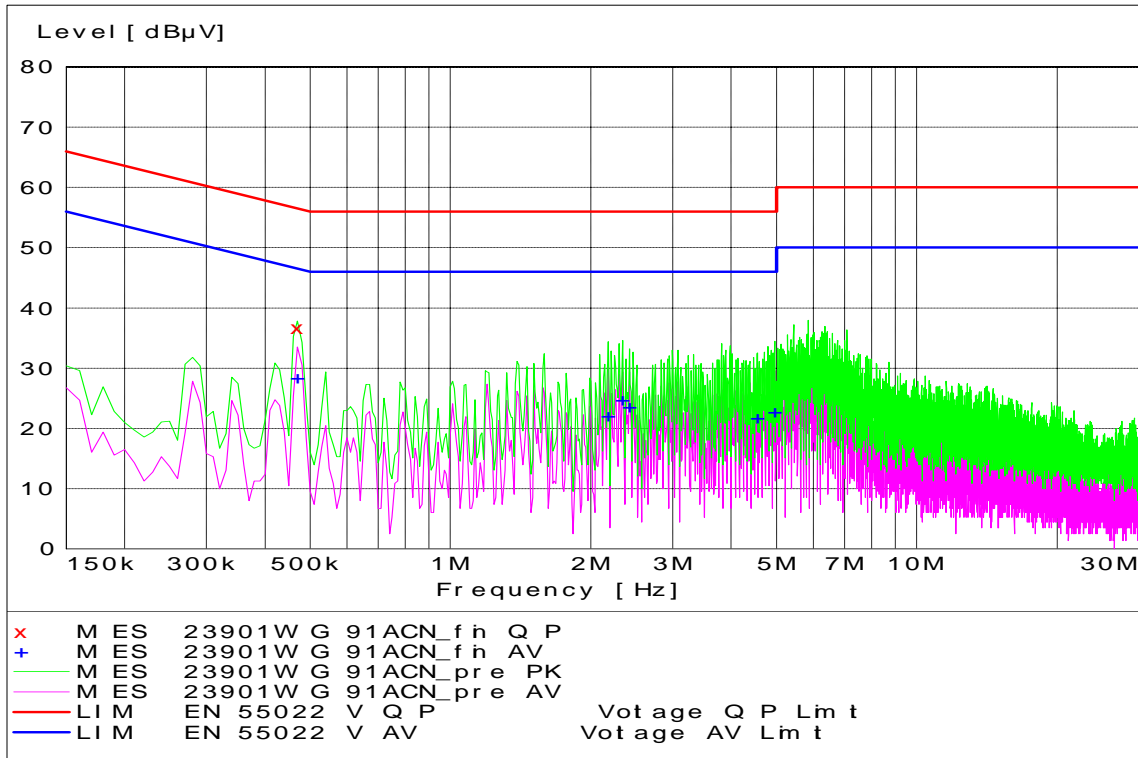


**WLAN Channel 11 - Tx Mode - Neutral Coupling**

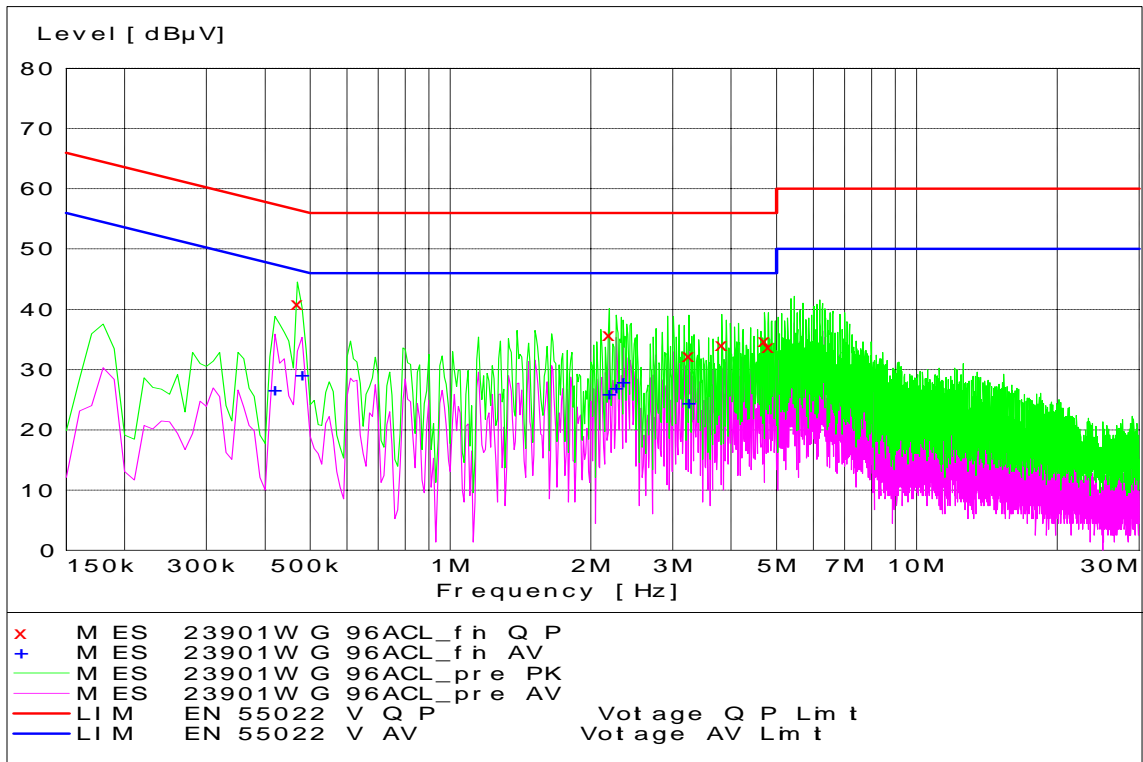
**802.11g @ 9 Mbps**



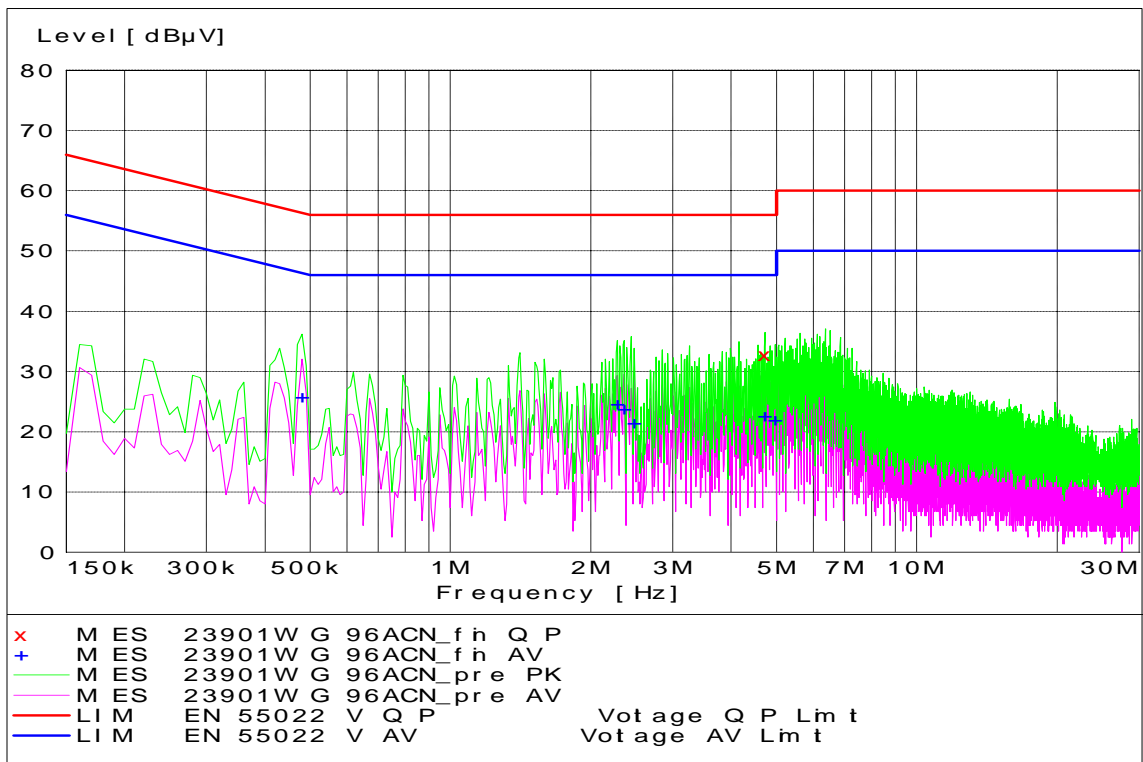
**WLAN Channel 1 - Tx Mode - Line Coupling**



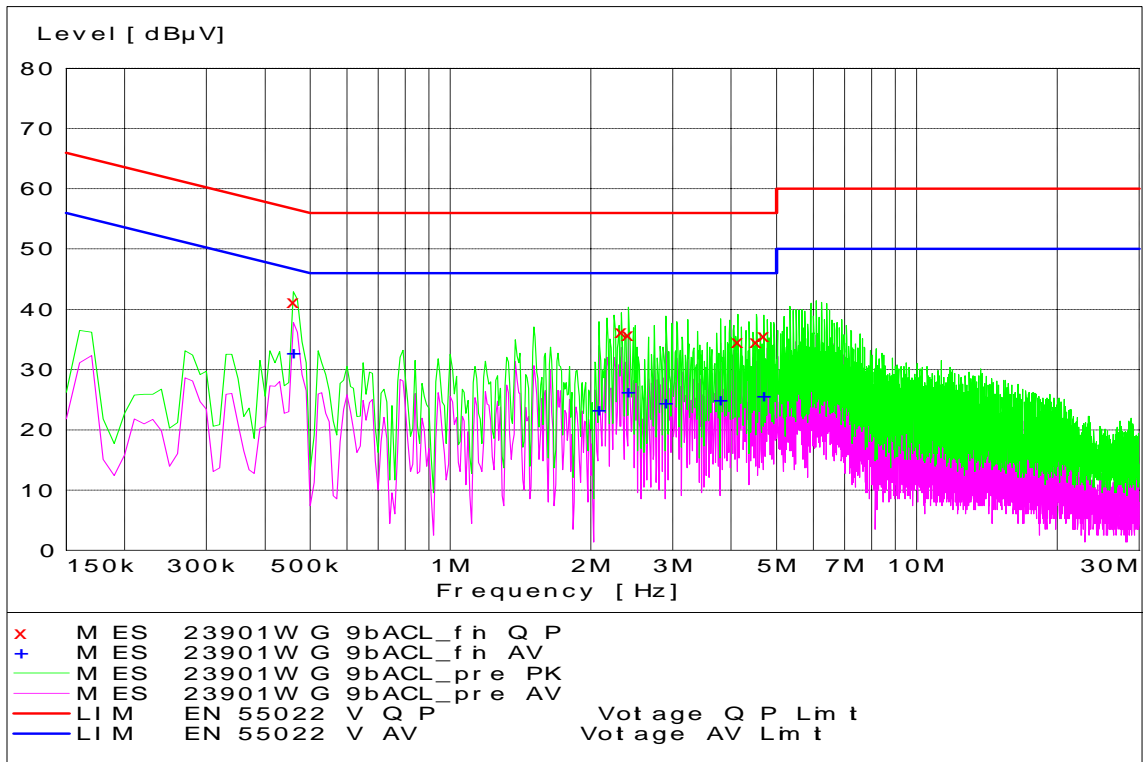
**WLAN Channel 1 - Tx Mode - Neutral Coupling**



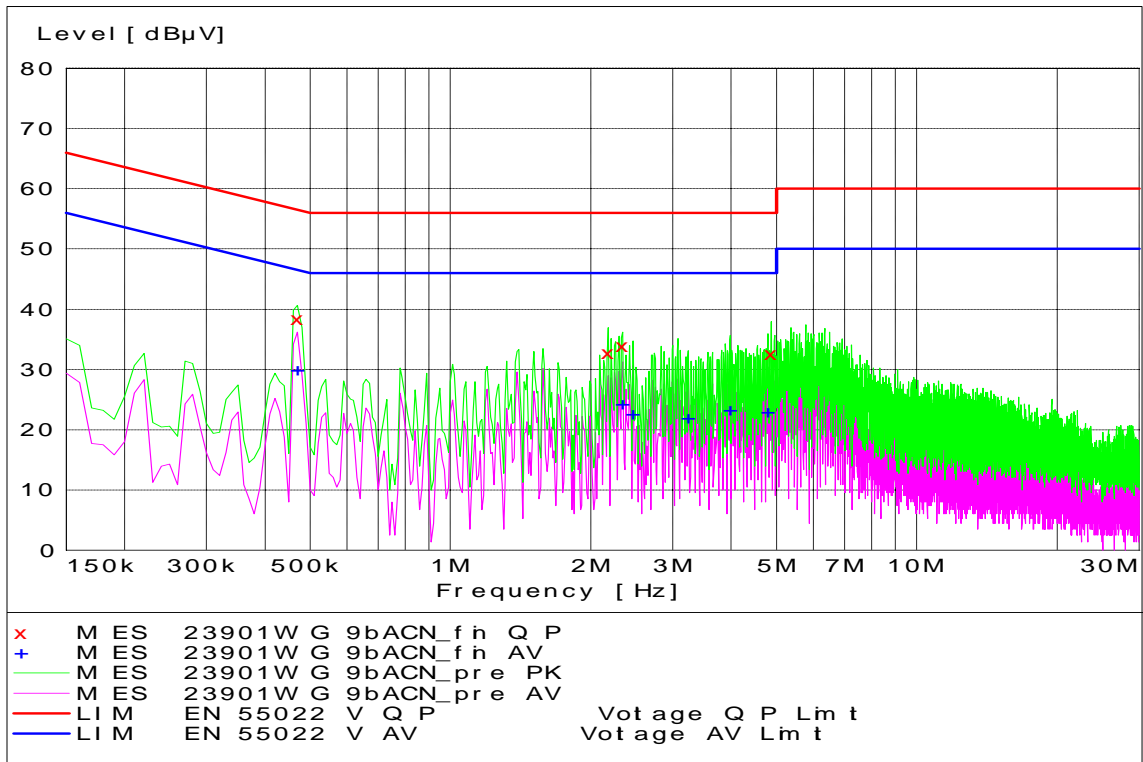
**WLAN Channel 6 - Tx Mode - Line Coupling**



**WLAN Channel 6 - Tx Mode - Neutral Coupling**

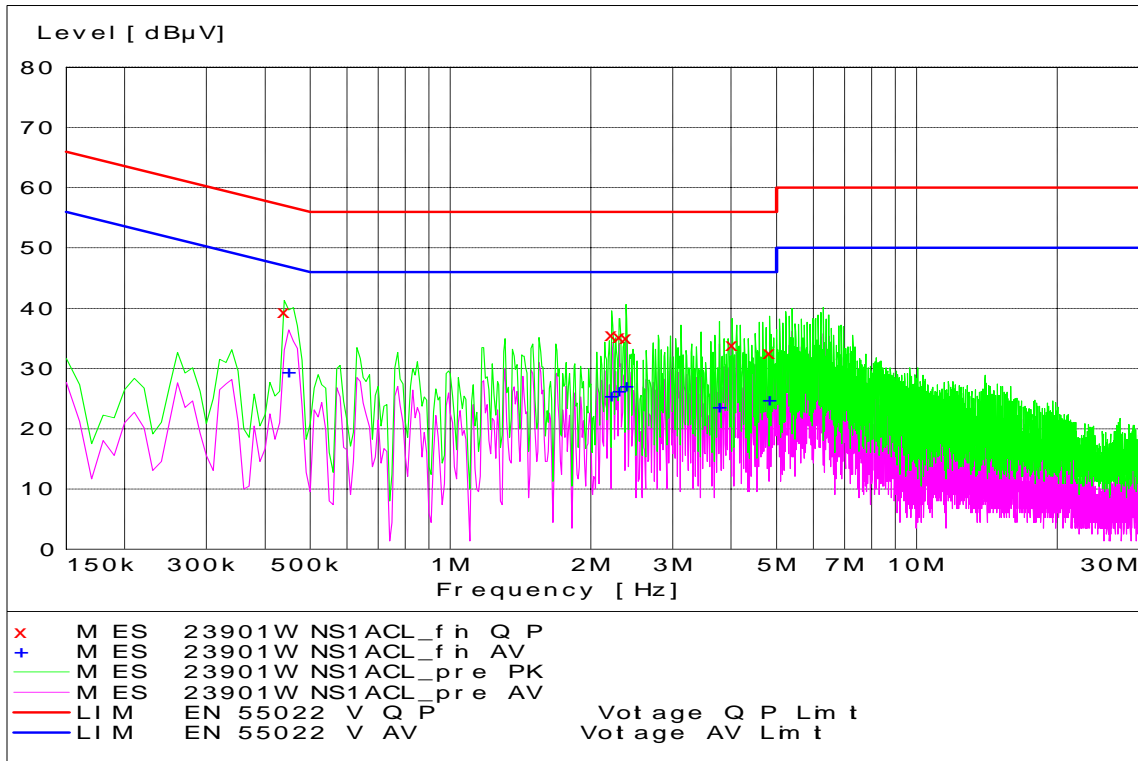


**WLAN Channel 11 - Tx Mode - Line Coupling**

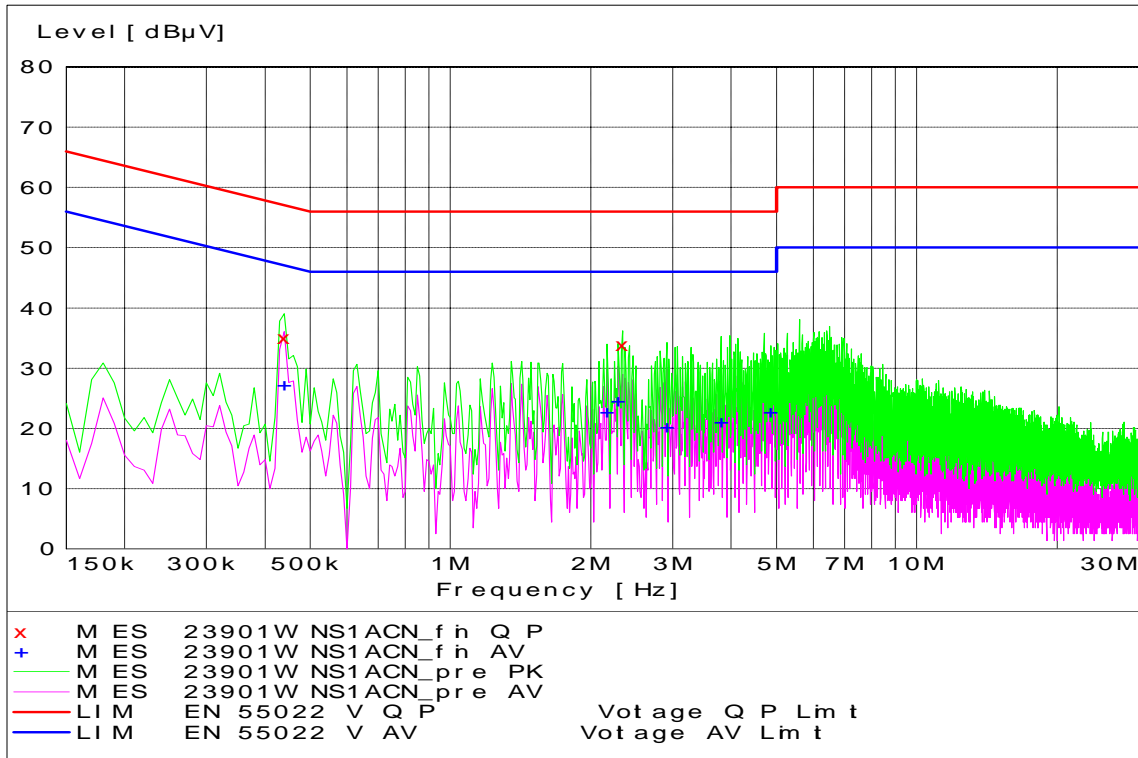


**WLAN Channel 11 - Tx Mode - Neutral Coupling**

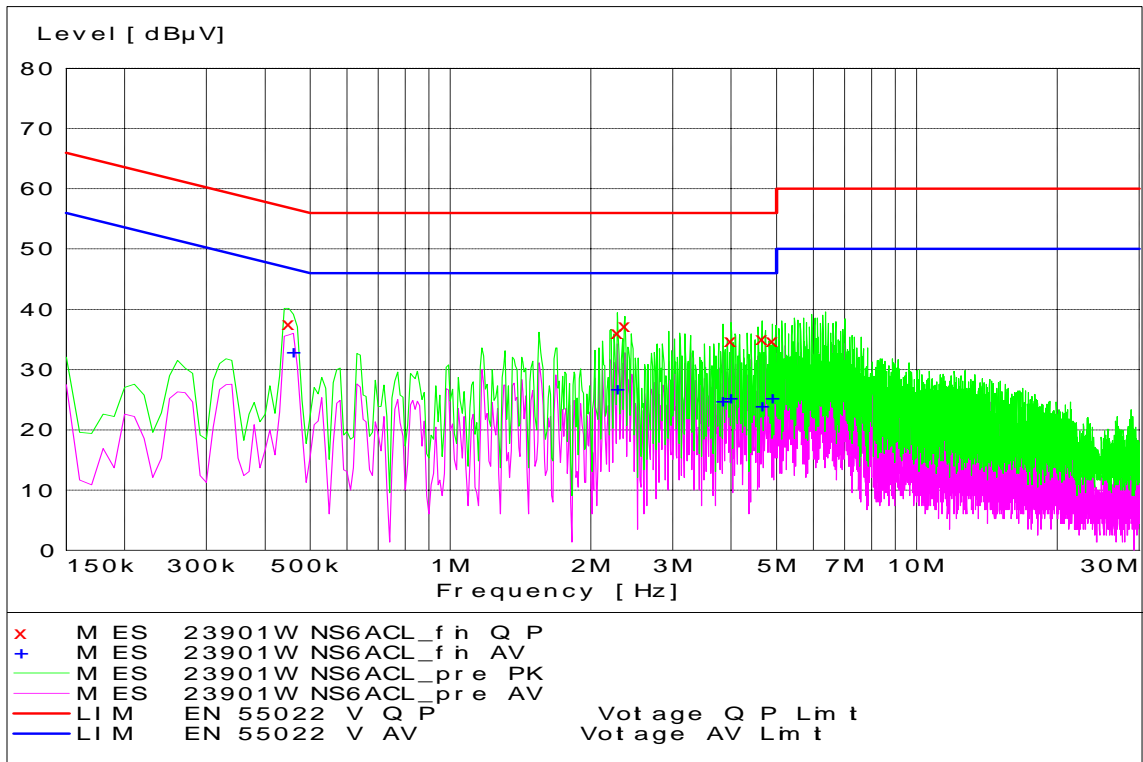
**802.11n 400ns GI @ 7.2 Mbps**



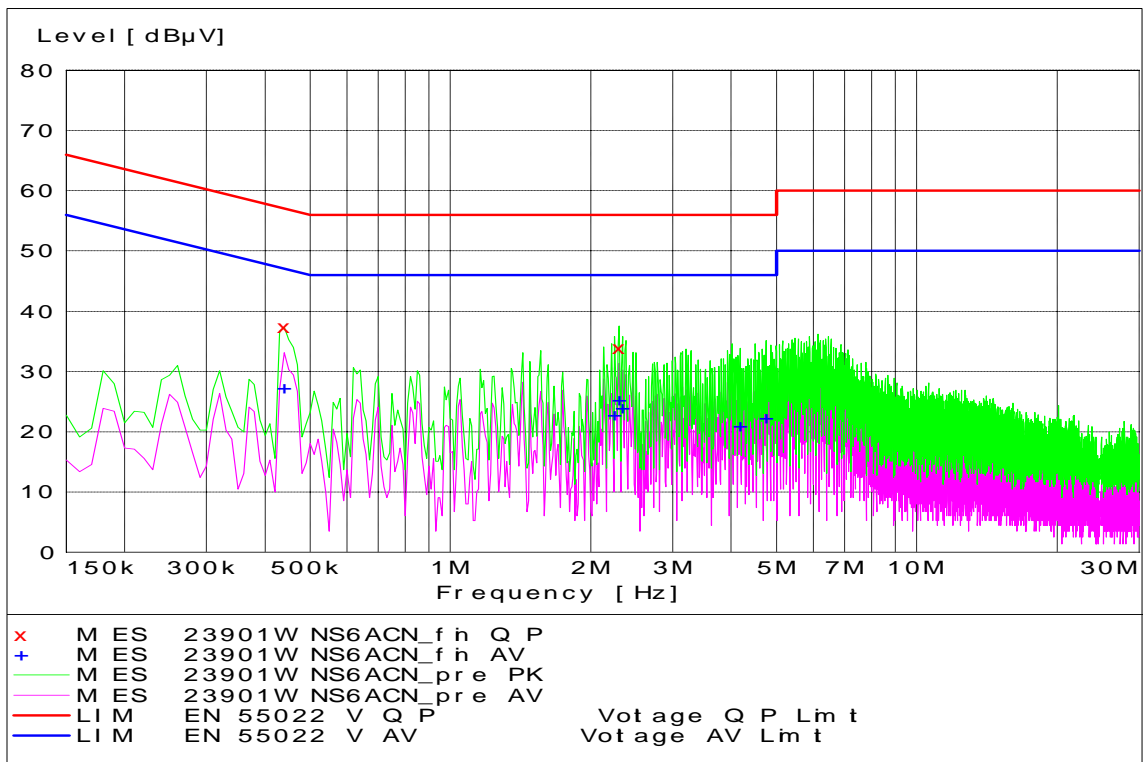
**WLAN Channel 1 - Tx Mode - Line Coupling**



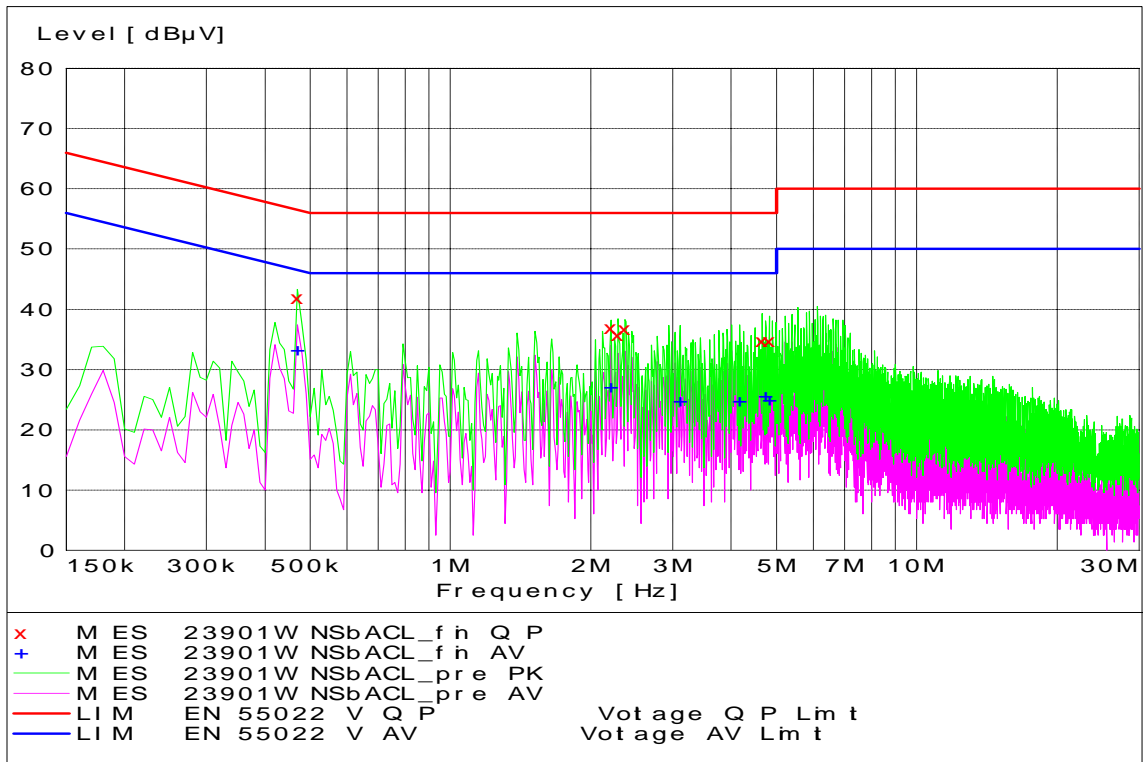
**WLAN Channel 1 - Tx Mode - Neutral Coupling**



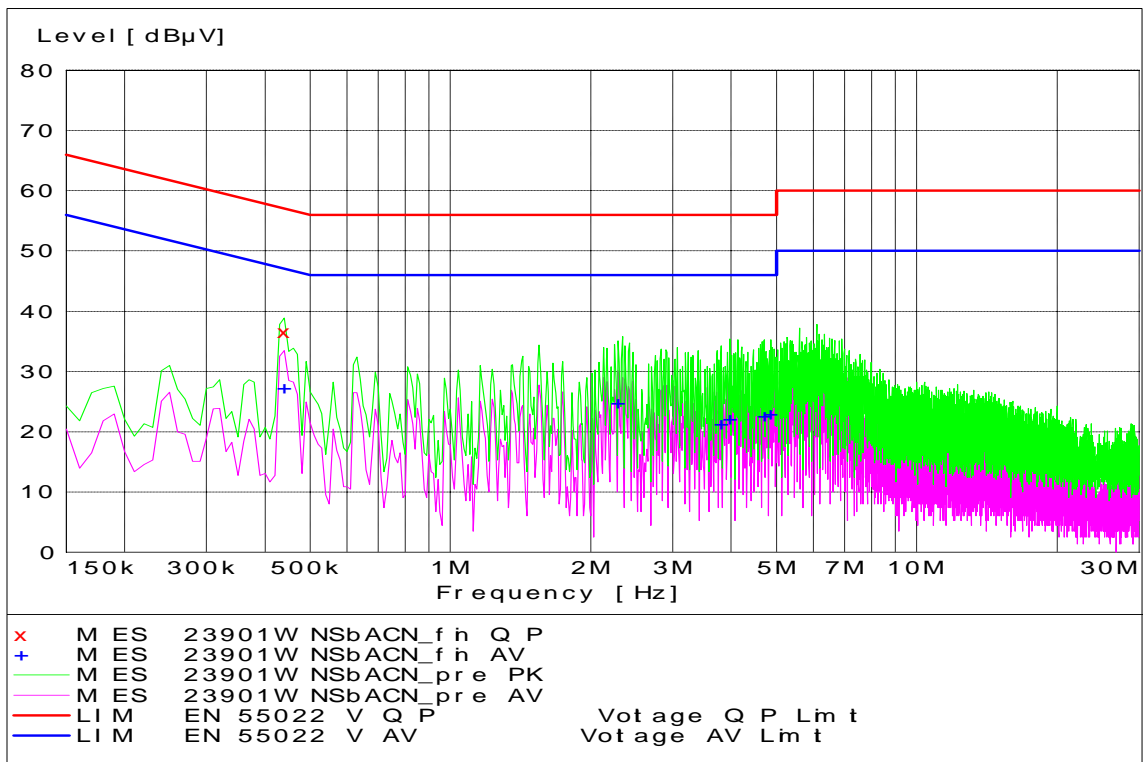
**WLAN Channel 6 - Tx Mode - Line Coupling**



**WLAN Channel 6 - Tx Mode - Neutral Coupling**

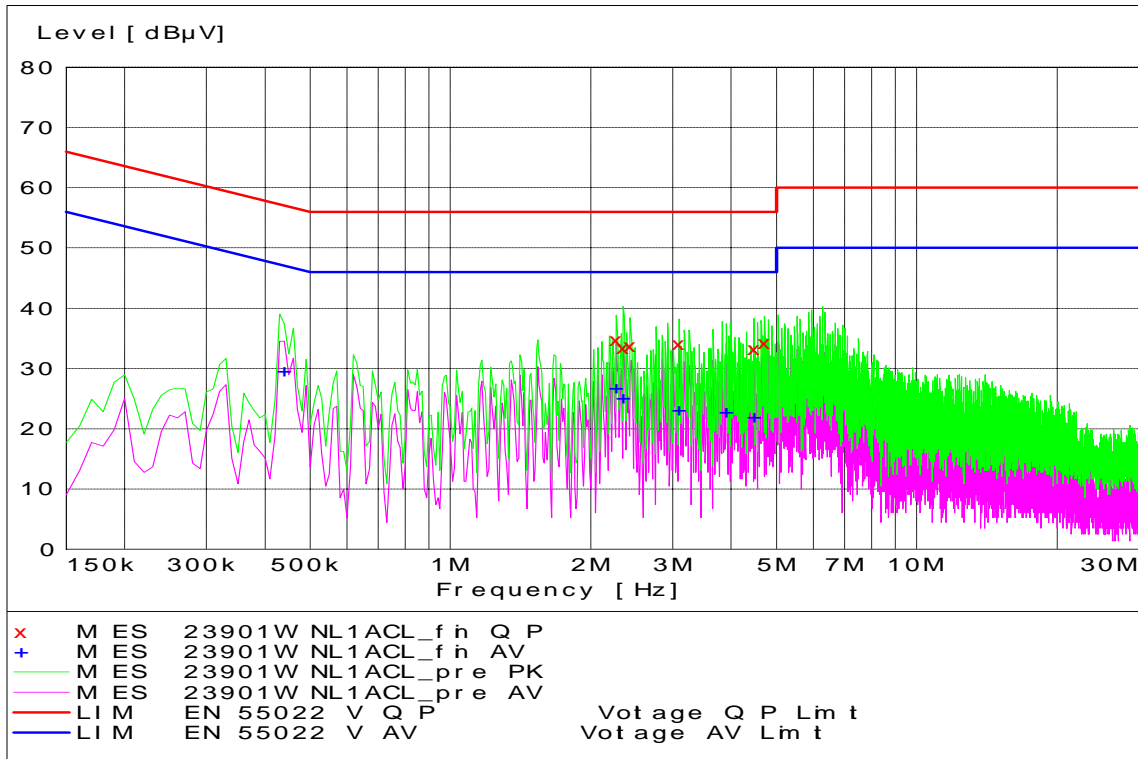


**WLAN Channel 11 - Tx Mode - Line Coupling**

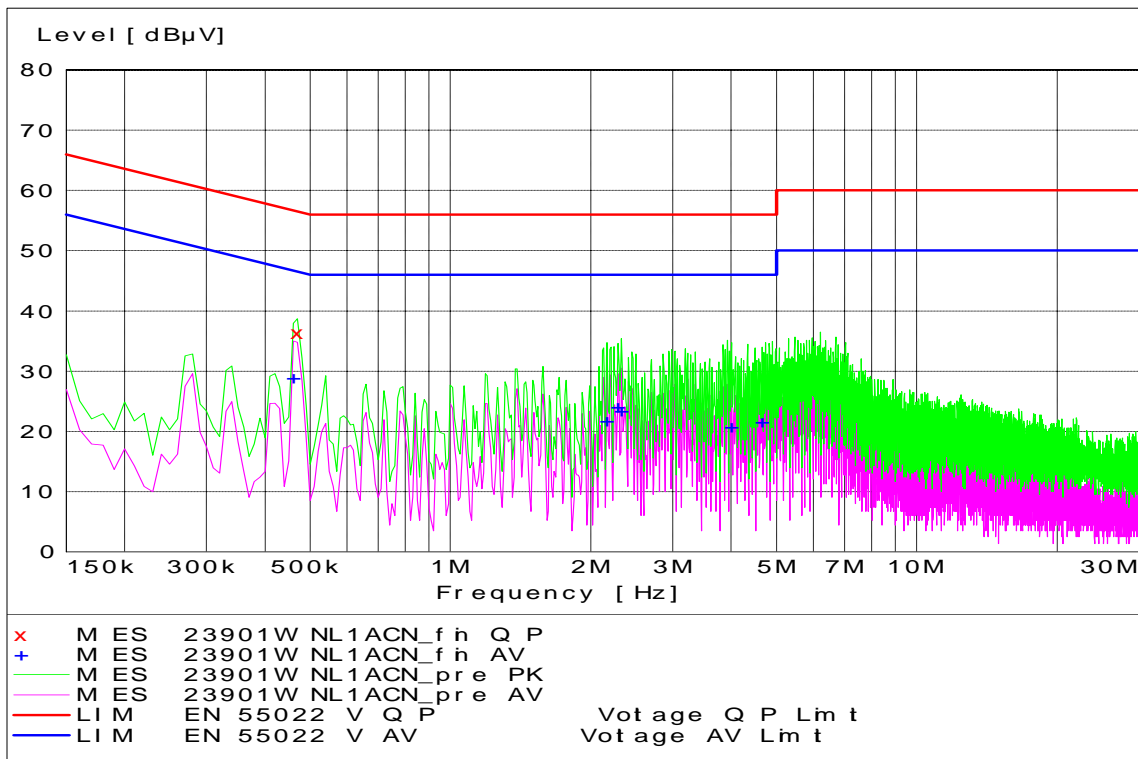


**WLAN Channel 11 - Tx Mode - Neutral Coupling**

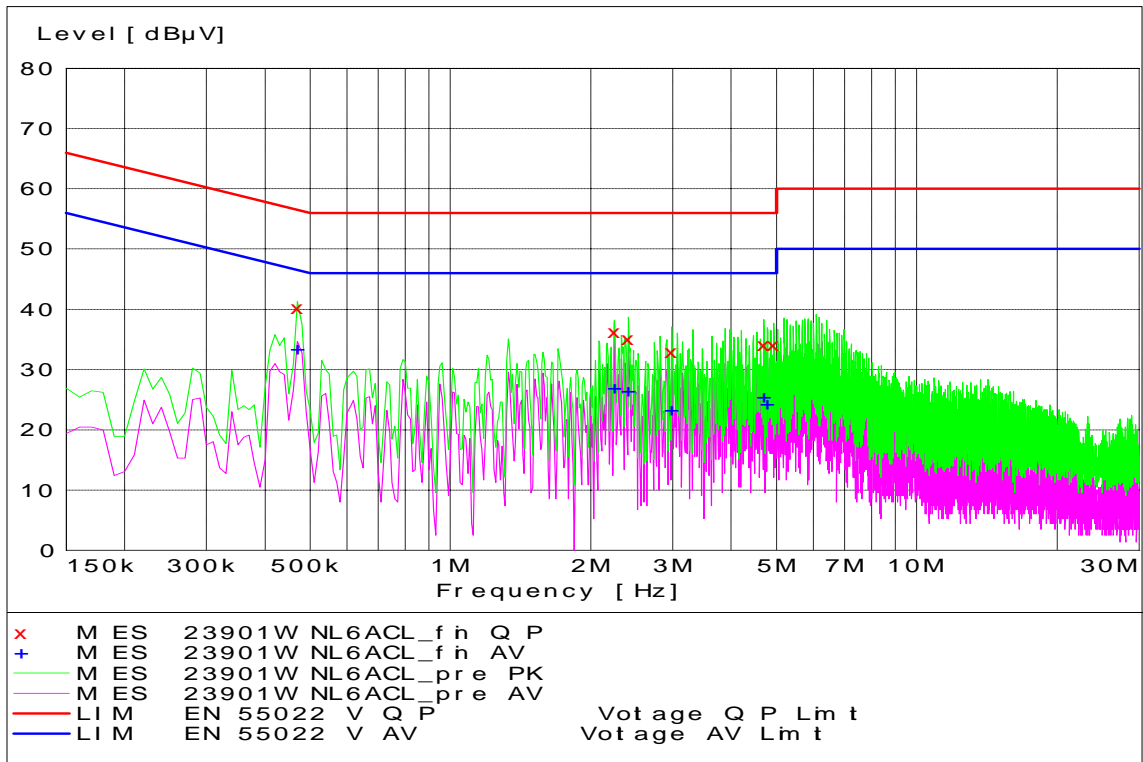
**802.11n 800ns GI @ 6.5 Mbps**



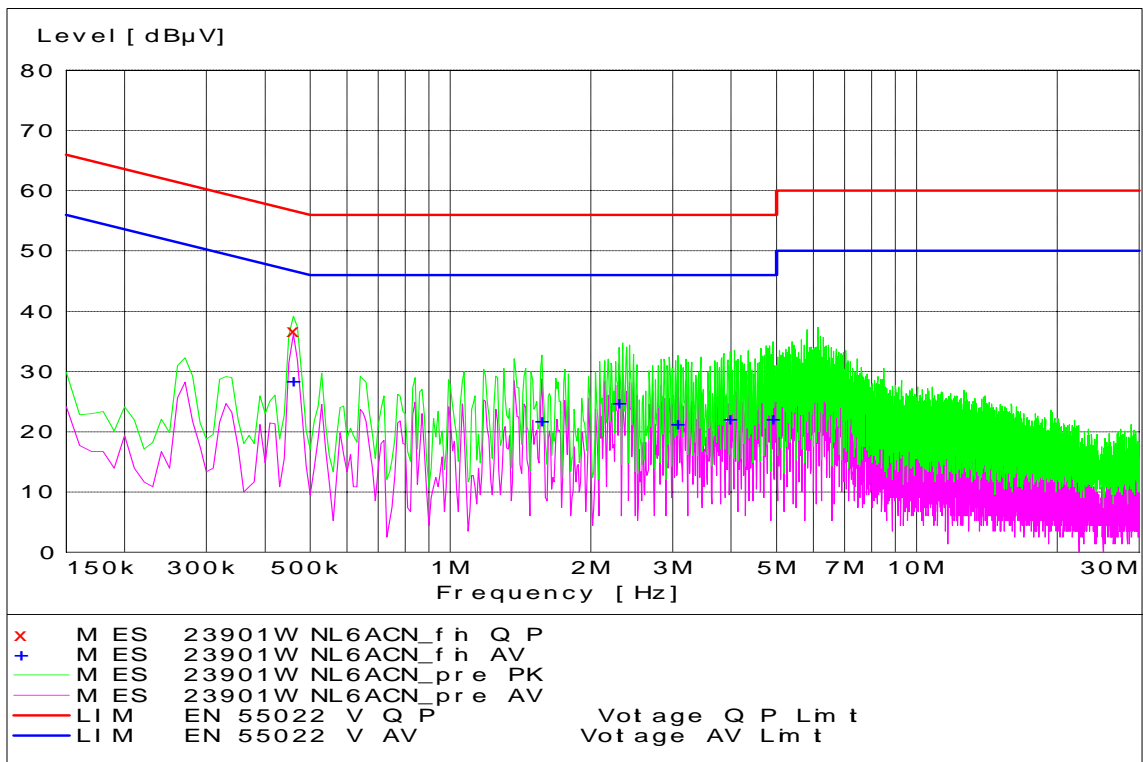
**WLAN Channel 1 - Tx Mode - Line Coupling**



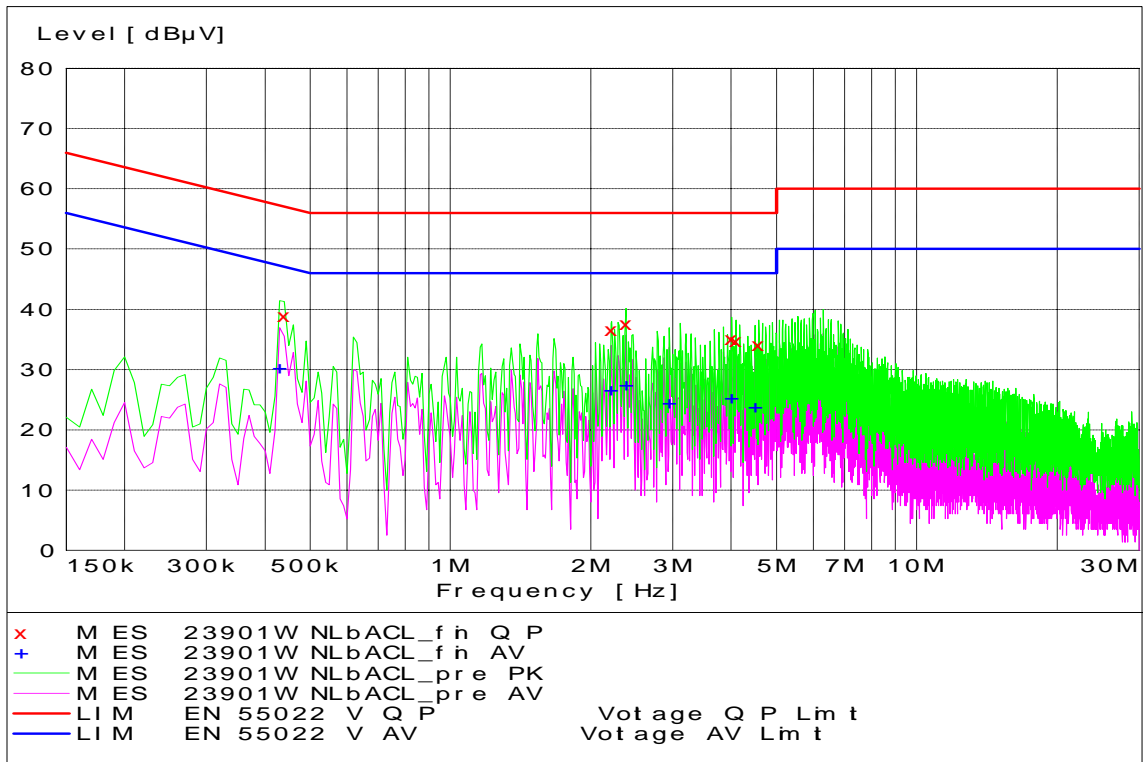
**WLAN Channel 1 - Tx Mode - Neutral Coupling**



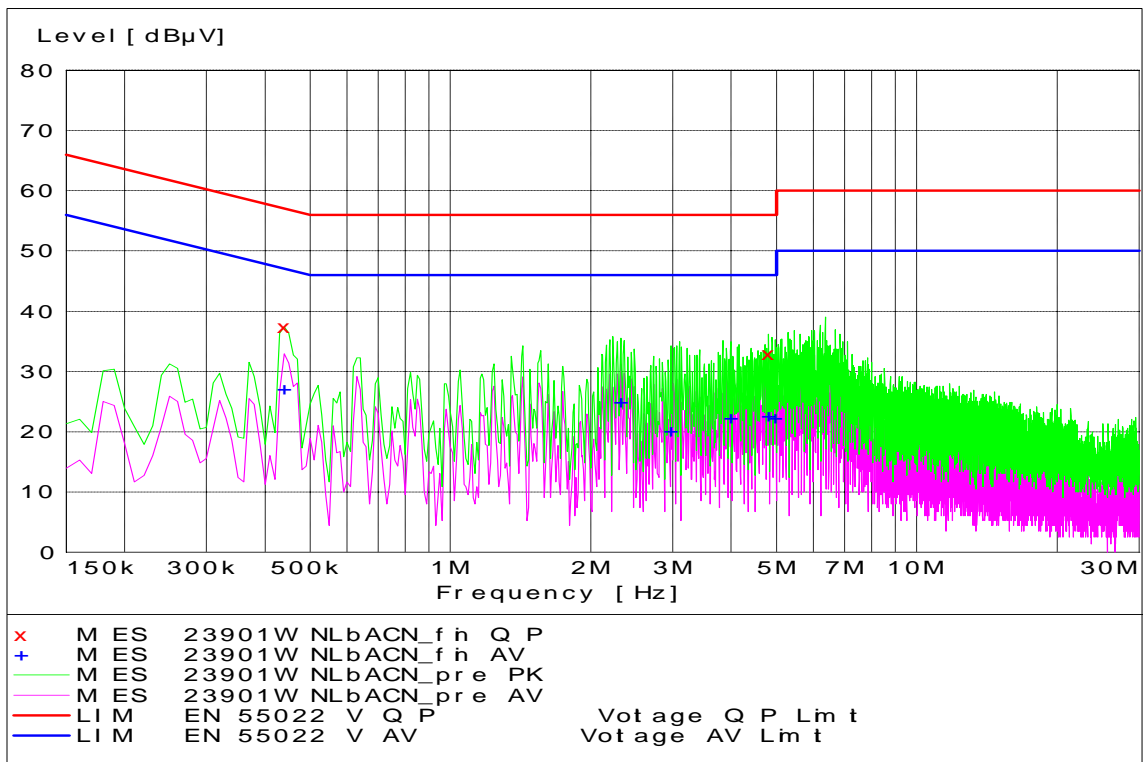
**WLAN Channel 6 - Tx Mode - Line Coupling**



**WLAN Channel 6 - Tx Mode - Neutral Coupling**



**WLAN Channel 11 - Tx Mode - Line Coupling**



**WLAN Channel 11 - Tx Mode - Neutral Coupling**

**End of Test Report**