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EMC Test Report

Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15 Subpart C

Model: VAP2500

IC CERTIFICATION #:	109AS-VAP2500
FCC ID:	ACQ-VAP2500
APPLICANT:	Motorola Mobility 6450 Sequence Drive San Diego, CA 92121
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-3; 2845B-4, 2845B-5, 2845B-7
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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	05-06-2013	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Motorola Mobility model VAP2500, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

ANSI C63.4:2003
FCC DTS Measurement Procedure KDB 558074

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Motorola Mobility model VAP2500 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Motorola Mobility model VAP2500 and therefore apply only to the tested sample. The sample was selected and prepared by Herman Huang of Motorola Mobility.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (5725 –5850 MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses OFDM techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	a: 16.26MHz n20: 17.53MHz n40: 36.27MHz	>500kHz	Complies
15.247 (b)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	802.11a: 28.9 dBm (0.777 Watts) EIRP = 2.964 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
			802.11n20: 28.8 dBm (0.766 Watts) EIRP = 2.921 W Note 1		
			802.11n40: 28.5 dBm (0.702 Watts) EIRP = 2.677 W Note 1		
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	802.11a: -0.7 dBm / 3kHz	Maximum permitted is 8dBm/3kHz	Complies
			802.11n20 0 dBm / 3kHz		
			802.11n40 -1.5 dBm / 3kHz		
15.247(c)	RSS 210 A8.5	Antenna Port Spurious Emissions – 30MHz – 40 GHz	All spurious emissions < -20dBc	< -20dBc	Complies
15.247(c) / 15.209	RSS 210 A8.5 Table 2, 3	Radiated Spurious Emissions 30MHz – 40 GHz	53.5 dBµV/m @ 11572.1 MHz (-0.5 dB)	15.207 in restricted bands, all others < -20dBc	Complies

Note 1: EIRP calculated using antenna gain of 5.8 dBi for the highest EIRP system (correlated data streams).

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antennas	Unique or integral antenna required	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	35.4 dBµV @ 0.406MHz (-12.3 dB) 44.4dBuV @ 0.379MHz (-3.9 dB)	Refer to page 18	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	Refer to user manual	Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 7.1.5	User Manual	Integral antenna	Statement for products with detachable antenna	Complies
-	RSP 100 RSS GEN 4.4.1	99% Bandwidth	a: 19.43 MHz n20: 20.16 MHz n40: 37.14 MHz	Information only	N/A

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Motorola Mobility model VAP2500 is a Video Access Point/Client that is designed to operate either as a wireless access point or wireless client in a network. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120 Volts, 60 Hz, 12VDC/1Amp.

The sample was received on April 16, 2012 and tested on May 14, 22, 23, June 18, 19, 20 and 25, 2012. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Motorola	VAP2500	Video Access Point/Client	M91215YA007D	ACQ-VAP2500
Leader Electronics Inc	MT12-Y120100-A1	I.T.E Power Supply	-	-
Asian Power Device	WA-12M12FU-AFAA	Power supply	-	-

OTHER EUT DETAILS

The EUT operates in the 5 GHz DTS and UNII bands using OFDM modulations (802.11a/n20/n40). It has four integral dipole antennas (5.8 dBi maximum effective antenna gain).

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 3.5 cm wide by 10 cm deep by 14.5 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at National Technical Systems - Silicon Valley.

SUPPORT EQUIPMENT

No local support equipment was used during testing.

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Hewlett Packard	EliteBook 6930p	Laptop	2CE940KDKY	-

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Ethernet	PC Laptop	Cat 5	Unshielded	10
AC Power	AC Mains	2 Wire	Unshielded	2

EUT OPERATION

During emissions testing the EUT was set to continuously transmit on the desired channel at the selected power level.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 3	769238	2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	2845B-4	
Chamber 5	211948	2845B-5	
Chamber 7	A2LA accreditation	2845B-7	

ANSI C63.4:2003 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4:2003.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4:2003. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4:2003 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4:2003.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.4:2003 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4:2003, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

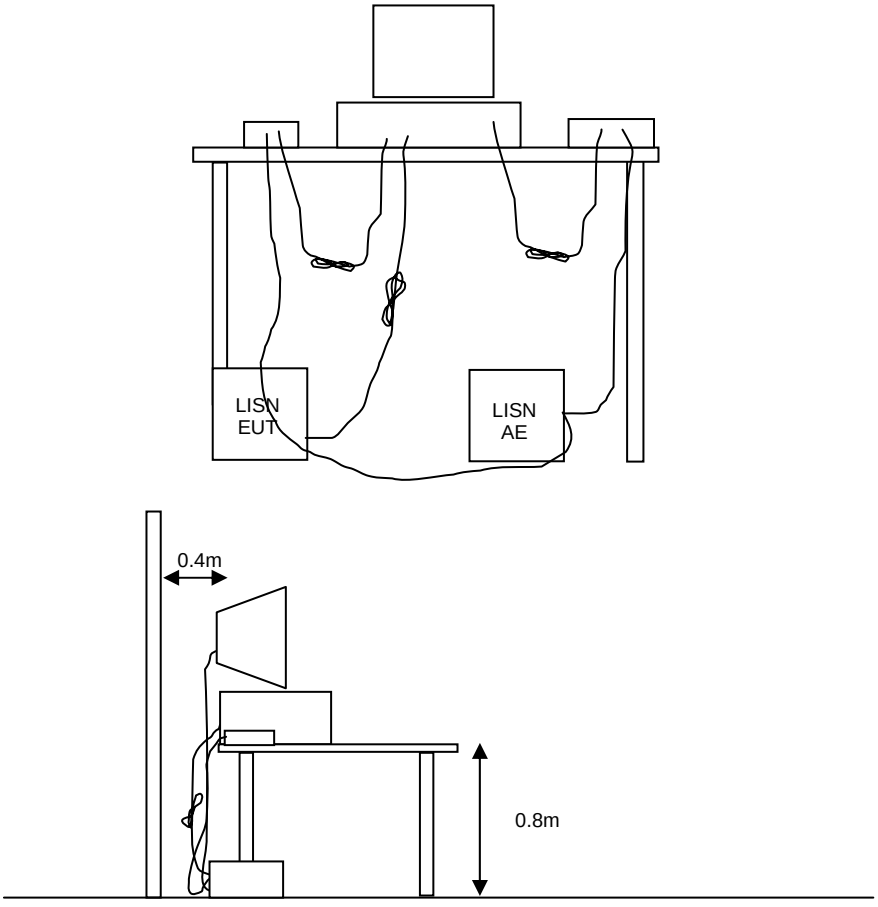


Figure 1 Typical Conducted Emissions Test Configuration

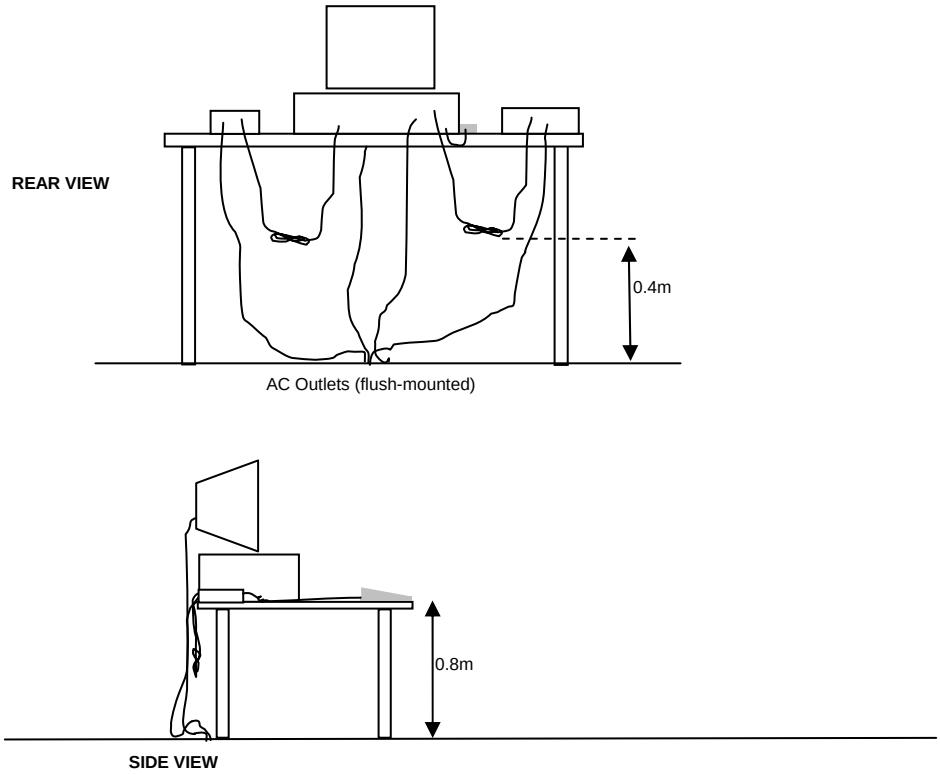
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

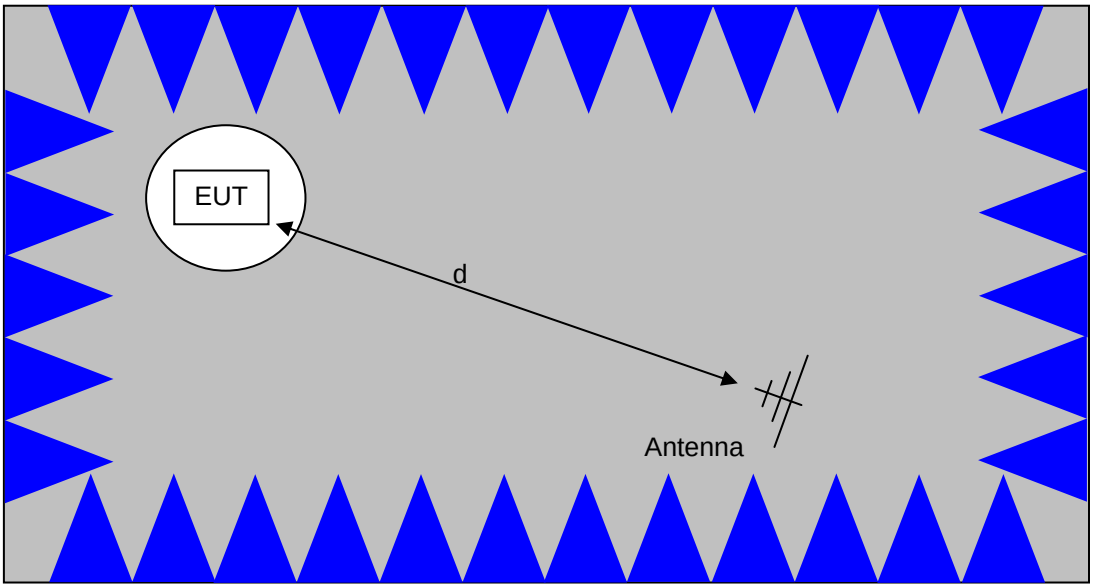
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

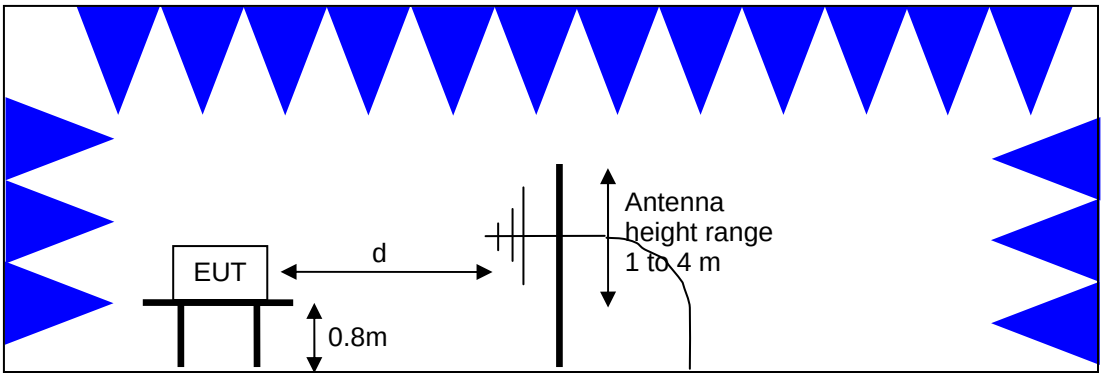


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

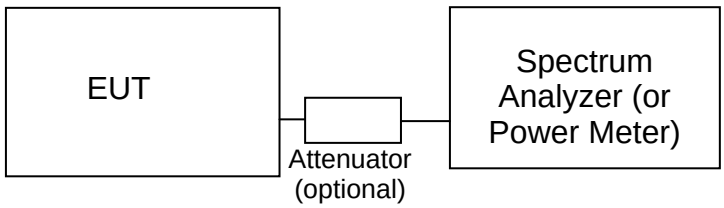
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and National Technical Systems - Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109, RSS 210 Table 2, RSS GEN Table 1 and RSS 310 Table 3. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 1000 - 6,500 MHz, 1-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/2/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/25/2012

Radiated Emissions, 30 - 1,000 MHz, 14-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	5/28/2012
Com-Power Corp.	Preamplifier, 30-1000 MHz	PA-103A	2359	2/14/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	12/9/2012

Conducted Emissions - AC Power Ports, 14-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1594	5/17/2012
Fischer Custom Comm	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	2001	2/15/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	12/9/2012

Radiated Emissions, 1,000 - 10,000 MHz, 14-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/2/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/25/2012
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2239	10/4/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 1000 - 40,000 MHz, 15-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2239	10/4/2012

Radiated Emissions, 1000 - 26,500 MHz, 16-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1681	9/8/2012
Hewlett Packard	Head (Inc W1-W4, 1946, 1947) Purple	84125C	1772	5/1/2013
A.H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	4/17/2013
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	2251	10/11/2012

Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 1000 - 6,500 MHz, 16-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/19/2013
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	6/8/2012

Radiated Emissions, 1000 - 6,500 MHz, 27-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	12/9/2012

Radiated Emissions, 1000 - 40,000 MHz, 21-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/18/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	1729	8/5/2012

Radiated Emissions, 1000 - 40,000 MHz, 22-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/18/2013
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	1729	8/5/2012
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 1000 - 18,000 MHz, 23-May-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/22/2012
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1681	9/8/2012
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/23/2013
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	2241	10/4/2012
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 18,000 - 40,000 MHz, 23-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Head (Inc W1-W4, 1946, 1947) Purple	84125C	1772	5/1/2013
A.H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	4/17/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radio Antenna Port (Power), 29-May-12 to 30-May-12

Manufacturer	Description	Model	Asset #	Cal Due
Anritsu	Anritsu 68347C Signal Generator, 10MHz-20GHz	68347C	1785	11/16/2012
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	2/23/2013

Radio Antenna Port (Power and Spurious Emissions), 18-Jun-12 to 20-Jun-12

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	Power Meter, Single Channel	NRVS	1290	12/5/2012
Rohde & Schwarz	Power Sensor 100 uW - 2 Watts use with 20dB attenuator sn:100059 only	NRV-Z32	1423	9/1/2012
Rohde & Schwarz	Pwr Sensor 300 uW - 30 Watts (+ 25dB pad)	NRV-Z54	1788	7/29/2012
Agilent	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	2/23/2013

Radiated Emissions, 1,000 - 40,000 MHz, 20-Jun-12

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	9/21/2012
Hewlett Packard	Head (Inc flex cable, (1742,1743) Blue	84125C	1620	5/17/2013
Micro-Tronics	Band Reject Filter, 5150-5350 MHz	BRC50703-02	1729	8/5/2012
Micro-Tronics	Band Reject Filter, 5470-5725 MHz	BRC50704-02	1730	8/5/2012
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	11/22/2012
A.H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	5/8/2013
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	7/28/2012

Radiated Emissions, 30 - 1,000 MHz & Conducted Emissions APD Supply, 25-Jun-12

Manufacturer	Description	Model	Asset #	Cal Due
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/6/2012
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	6/4/2014
Fischer Custom Comm	LISN, 25A, 150kHz to 30MHz, 25 Amp,	FCC-LISN-50-25-2-09	2001	2/15/2013
Hewlett Packard	9KHz-1300MHz pre-amp	8447F	2328	5/2/2013

Appendix B Test Data

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Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Emissions Standard(s):	FCC	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Motorola

Model

VAP2500

Date of Last Test: 8/3/2012

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manger:	Christine Krebill
Contact:	Rob Linebarger		
Emissions Standard(s):	FCC	Class:	B
Immunity Standard(s):	-	Environment:	-

Power vs. Data Rate

In normal operating modes the card uses power settings stored on EEPROM to set the output power. For a given nominal output power the actual transmit power is redcued as the data rate increases, therefore testing was performed at the lowest data rate in each mode as this data rate to determine compliance with the requirements at the highest power seting.
The following power measurements were made using an average power meter and the with the device configured in a continuous transmit mode on Chain A at the various data rates in each mode to verify this:

Date of Test: 5/31/2012 Config. Used: 1
Test Engineer: Rafael Varelas Config Change: None
Test Location: FT Lab #4 Host Unit Voltage 120V/60Hz

Using Avg power meter

802.11 DTS 5GHz Chain 1

Mode	Data Rate	Power (dBm)	Power setting	Data Rate Setting
802.11a	6	16.0	17.0	0
	9	15.8		1
	12	15.6		2
	18	15.6		3
	24	15.4		4
	36	15.4		5
	48	15.4		6
	54	15.3		7
802.11n 20MHz	6.5	15.9	17.0	0
	13	15.7		1
	19.5	15.7		2
	26	15.7		3
	39	15.6		4
	52	15.5		5
	58.5	15.4		6
	65	15.3		7
802.11n 40MHz	13.5	15.8	17.0	0
	27	15.7		1
	40.5	15.6		2
	54	15.5		3
	81	15.4		4
	108	15.3		5
	121.5	14.7		6
	135	14.6		7

Note : Power setting - the software power setting used during testing, included for reference only.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Antenna Port Measurements
MIMO and Smart Antenna Systems
Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/18/12~6/20/12
Test Engineer: R. Varelas, J. Cadigal, J. Liu
Test Location: FT Lab 4

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 22.4 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
802.11a						
1	-	-	Output Power	15.247(b)	Pass	28.9 dBm
2	-	-	Power spectral Density (PSD)	15.247(d)	Pass	-0.7 dBm/3kHz
802.11n20						
3	-	-	Output Power	15.247(b)	Pass	28.8 dBm
4	-	-	Power spectral Density (PSD)	15.247(d)	Pass	0 dBm/3kHz
802.11n40						
5	-	-	Output Power	15.247(b)	Pass	28.5 dBm
6	-	-	Power spectral Density (PSD)	15.247(d)	Pass	-1.5 dBm/3kHz

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
All modes						
7	-	-	Minimum 6dB Bandwidth	15.247(a)	Pass	a: 16.26MHz n20: 17.53MHz n40: 36.27MHz
7	-	-	99% Bandwidth	RSS GEN	Pass	a: 18.96MHz n20: 20.03MHz n40: 37.01MHz
8	-	-	Spurious emissions	15.247(b)	Pass	All emissions below the -20dBc limit

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

	Chain 1	Chain 2	Chain 3	Chain 4
Antenna Gain (dBi):	-0.7	1.0	-3.6	1.6

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #1: Output Power

Operating Mode: 802.11a

Transmitted signal on chain is coherent ? Yes

5745 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.2	17.4	17.7	17.7				
Output Power (dBm) Note 1	22.73	22.89	22.92	22.99	28.9 dBm	0.777 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	22.0	23.8	19.3	24.6	34.7 dBm	2.964 W		

5785 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.3	17.4	17.8	17.8				
Output Power (dBm) Note 1	22.55	22.64	22.84	22.98	28.8 dBm	0.754 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	21.9	23.6	19.2	24.6	34.6 dBm	2.878 W		

5825 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.4	17.6	17.7	17.7				
Output Power (dBm) Note 1	22.65	22.8	22.9	23.04	28.9 dBm	0.771 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	22.0	23.8	19.3	24.7	34.7 dBm	2.941 W		

Note 1:	Output power measured using a peak power meter, spurious limit is -20dBc.
Note 2:	As there is coherency between chains the effective antenna gain is the sum of the individual antenna gains and the eirp is the product of the total power and the effective antenna gain
Note 3:	Power setting and average power are for reference only. Average power is the power measured using an average power sensor. Power setting is the power setting used in the test utility.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #2: Power spectral Density

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
18	5745	-7.8	-8.7	-4.3	-7.6	-0.7	8.0	Pass
18	5785	-5.2	-9.3	-8.0	-8.2	-1.4	8.0	Pass
18	5825	-7.8	-8.4	-8.8	-9.5	-2.6	8.0	Pass

Note 1:	Power spectral density measured using RB=3 kHz, VB=10kHz, analyzer with peak detector and with a sweep time set to ensure a dwell time of at least 1 second per 3kHz. The measurement is made at the frequency of PPSD determined from preliminary scans using RB=3kHz using multiple sweeps at a faster rate over the 6dB bandwidth of the signal.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #3: Output Power

Operating Mode: 802.11n20

Transmitted signal on chain is coherent ? Yes

5745 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.3	17.5	17.8	17.8				
Output Power (dBm) Note 1	22.52	22.69	22.85	23	28.8 dBm	0.757 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	21.8	23.6	19.2	24.6	34.6 dBm	2.886 W		

5785 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.3	17.4	17.8	18.0				
Output Power (dBm) Note 1	22.6	22.6	22.86	22.98	28.8 dBm	0.756 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	21.9	23.6	19.2	24.6	34.6 dBm	2.883 W		

5825 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	17.3	17.5	18.0	18.0				
Output Power (dBm) Note 1	22.65	22.68	22.97	22.97	28.8 dBm	0.766 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	22.0	23.6	19.3	24.6	34.7 dBm	2.921 W		

Note 1:	Output power measured using a peak power meter, spurious limit is -20dBc.
Note 2:	As there is coherency between chains the effective antenna gain is the sum of the individual antenna gains and the eirp is the product of the total power and the effective antenna gain
Note 3:	Power setting and average power are for reference only. Average power is the power measured using an average power sensor. Power setting is the power setting used in the test utility.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #4: Power spectral Density

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit dBm/3kHz	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total		
18	5745	-5.5	-8.5	-4.7	-7.9	-0.3	8.0	Pass
18	5785	-4.4	-7.8	-8.8	-4.8	0.0	8.0	Pass
18	5825	-4.3	-5.5	-4.7	-8.5	0.5	8.0	Pass

Note 1:	Power spectral density measured using RB=3 kHz, VB=10kHz, analyzer with peak detector and with a sweep time set to ensure a dwell time of at least 1 second per 3kHz. The measurement is made at the frequency of PPSD determined from preliminary scans using RB=3kHz using multiple sweeps at a faster rate over the 6dB bandwidth of the signal.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #5: Output Power

Operating Mode: 802.11n40

Transmitted signal on chain is coherent ? Yes

5755 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	16.9	17.2	17.5	17.2				
Output Power (dBm) Note 1	22.25	22.22	22.34	22.46	28.3 dBm	0.682 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	21.6	23.2	18.7	24.1	34.2 dBm	2.602 W		

5795 MHz	Chain 1	Chain 2	Chain 3	Chain 4	Total Across All Chains		Limit	
Power Setting	18.0							
Average power Note 3	16.9	17.2	17.5	17.5				
Output Power (dBm) Note 1	22.3	22.4	22.42	22.64	28.5 dBm	0.702 W	30.0 dBm	1.000 W
Antenna Gain (dBi) Note 2	-0.7	1.0	-3.6	1.6	5.8 dBi		Pass	
eirp (dBm) Note 2	21.6	23.4	18.8	24.3	34.3 dBm	2.677 W		

Note 1:	Output power measured using a peak power meter, spurious limit is -20dBc.
Note 2:	As there is coherency between chains the effective antenna gain is the sum of the individual antenna gains and the eirp is the product of the total power and the effective antenna gain
Note 3:	Power setting and average power are for reference only. Average power is the power measured using an average power sensor. Power setting is the power setting used in the test utility.

Run #6: Power spectral Density

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1					Limit	Result
		Chain 1	Chain 2	Chain 3	Chain 4	Total	dBm/3kHz	
18	5755	-7.8	-9.5	-9.1	-5.2	-1.5	8.0	Pass
18	5795	-5.2	-8.9	-8.8	-9.3	-1.7	8.0	Pass

Note 1:	Power spectral density measured using RB=3 kHz, VB=10kHz, analyzer with peak detector and with a sweep time set to ensure a dwell time of at least 1 second per 3kHz. The measurement is made at the frequency of PPSD determined from preliminary scans using RB=3kHz using multiple sweeps at a faster rate over the 6dB bandwidth of the signal.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #7: Signal Bandwidth

Mode: 802.11a

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz) 6dB	99%
18	5745	100k/1M	16.33	18.96
18	5785	100k/1M	16.40	19.30
18	5825	100k/1M	16.26	19.43

Mode: 802.11n20

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz) 6dB	99%
18	5745	100k/1M	17.53	20.10
18	5785	100k/1M	17.60	20.16
18	5825	100k/1M	17.53	20.03

Mode: 802.11n40

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz) 6dB	99%
18	5755	100k/1M	36.27	37.01
18	5795	100k/1M	36.27	37.14

Note 1:	Measured on a single chain
Note 2:	99% bandwidth measured in accordance with RSS GEN, with RB > 1% of the span and VB > 3xRB

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #8: Out of Band Spurious Emissions

Mode: 802.11a

Power Setting Per Chain #1	#2	#3	#4	Frequency (MHz)	Limit	Result
18	18	18	18	5745	-20dBc	Pass
18	18	18	18	5785	-20dBc	Pass
18	18	18	18	5825	-20dBc	Pass

Mode: 802.11n20

Power Setting Per Chain #1	#2	#3	#4	Frequency (MHz)	Limit	Result
18	18	18	18	5745	-20dBc	Pass
18	18	18	18	5785	-20dBc	Pass
18	18	18	18	5825	-20dBc	Pass

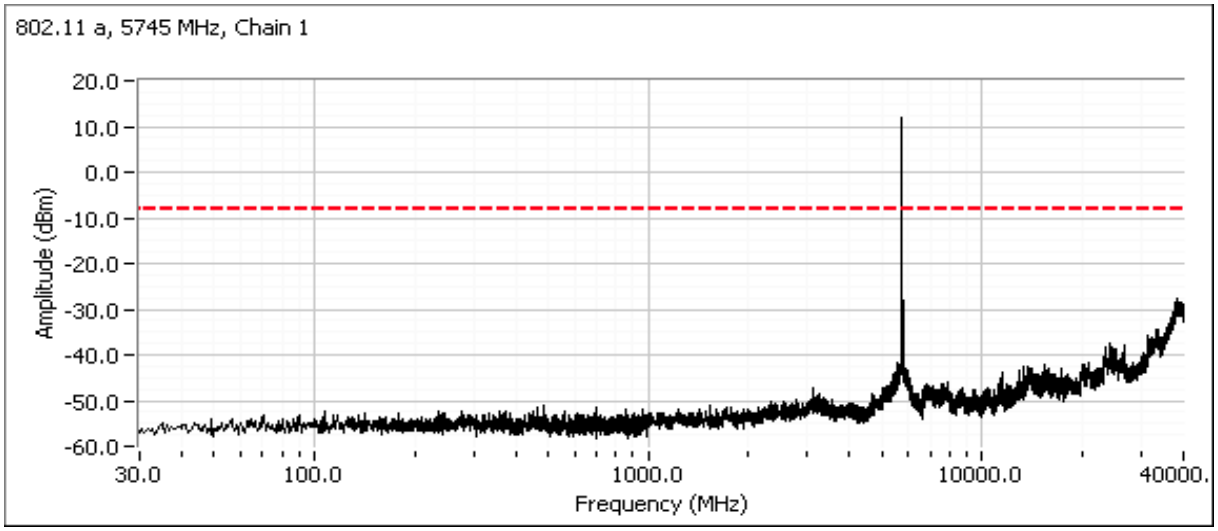
Mode: 802.11n40

Power Setting Per Chain #1	#2	#3	#4	Frequency (MHz)	Limit	Result
18	18	18	18	5755	-20dBc	Pass
18	18	18	18	5795	-20dBc	Pass

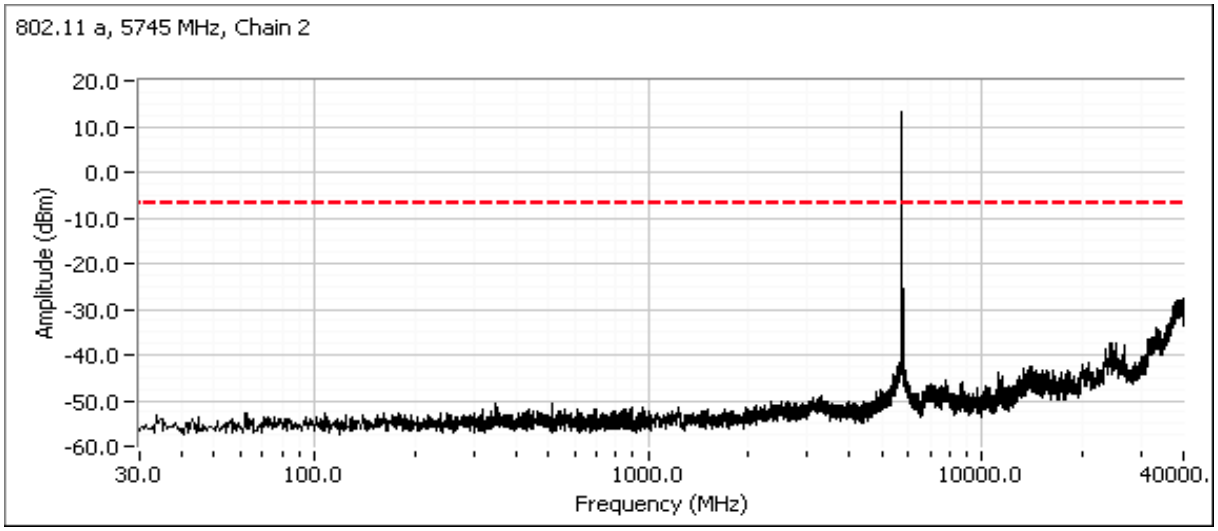
Note 1:	Measured on each chain individually

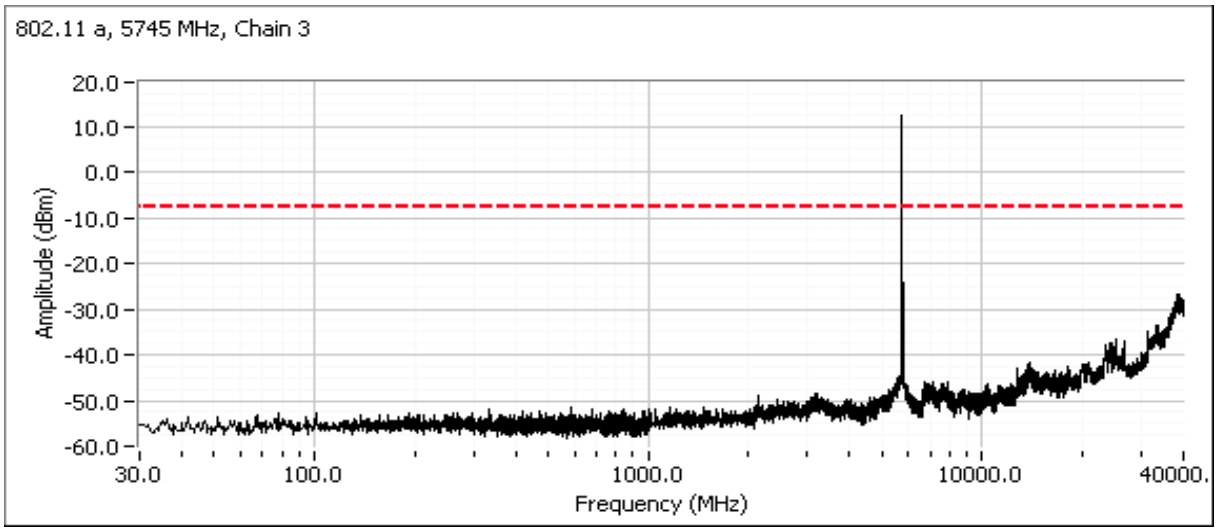
802.11 a

Plots for low channel, power setting(s) = 18

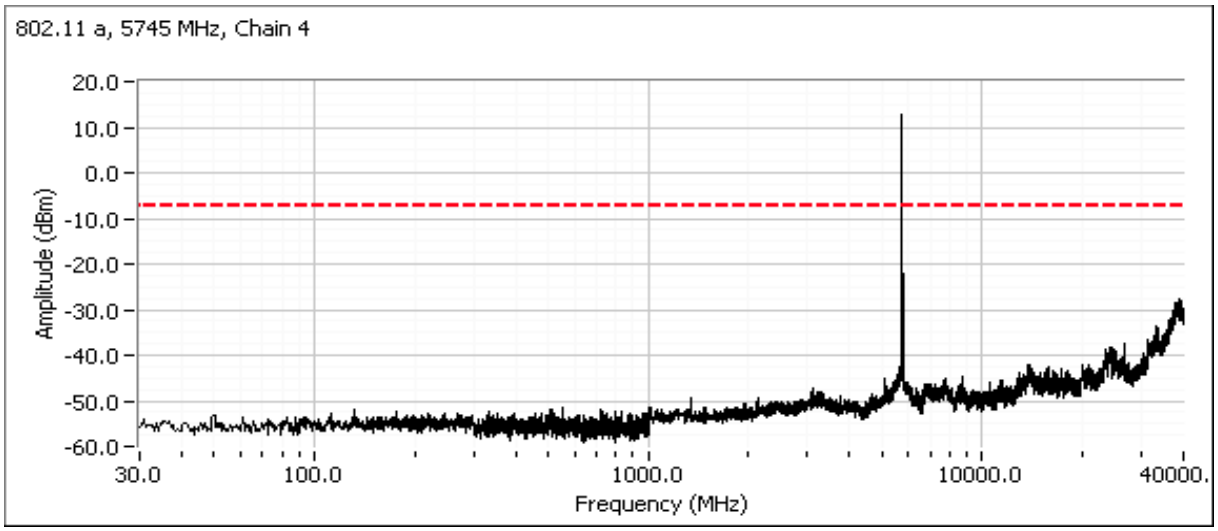


Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



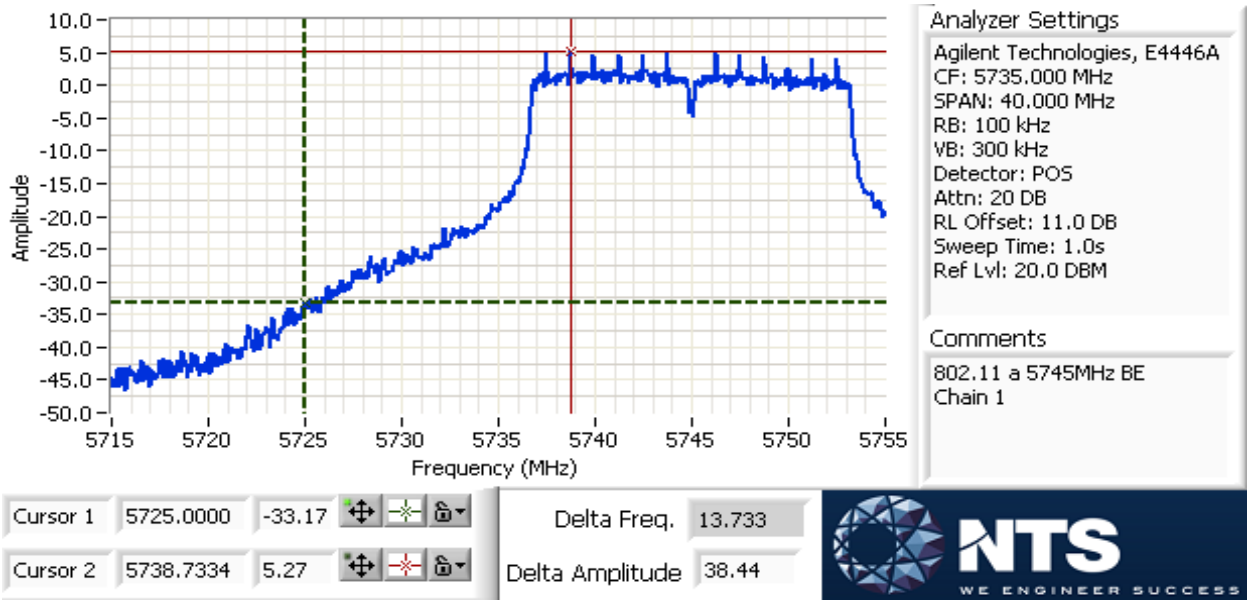


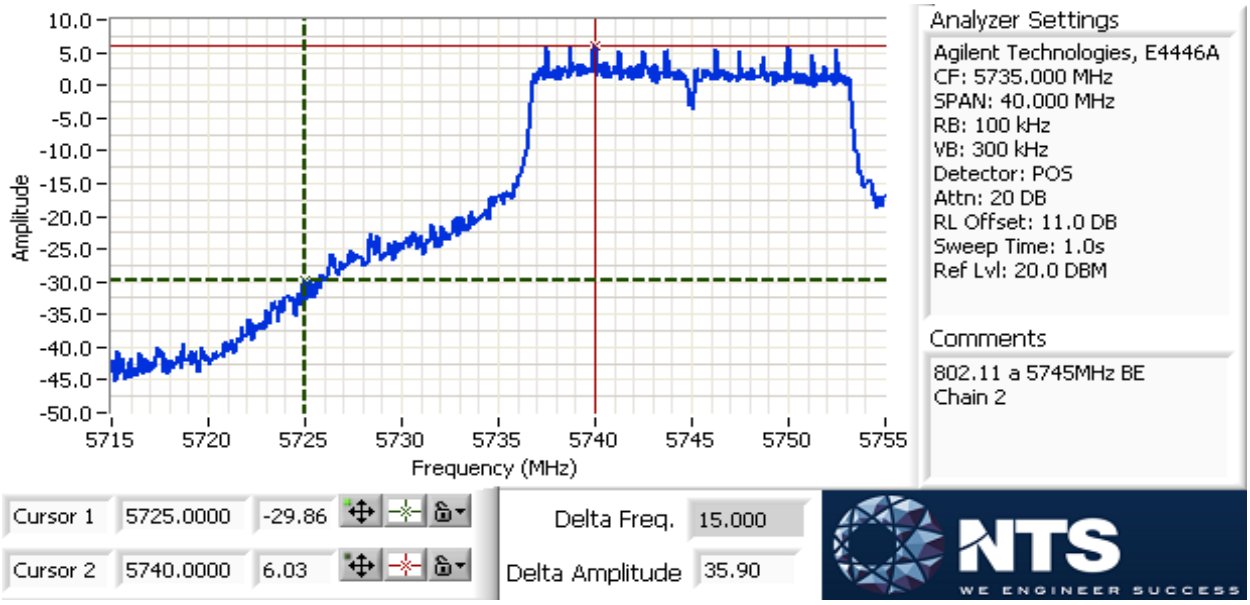
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



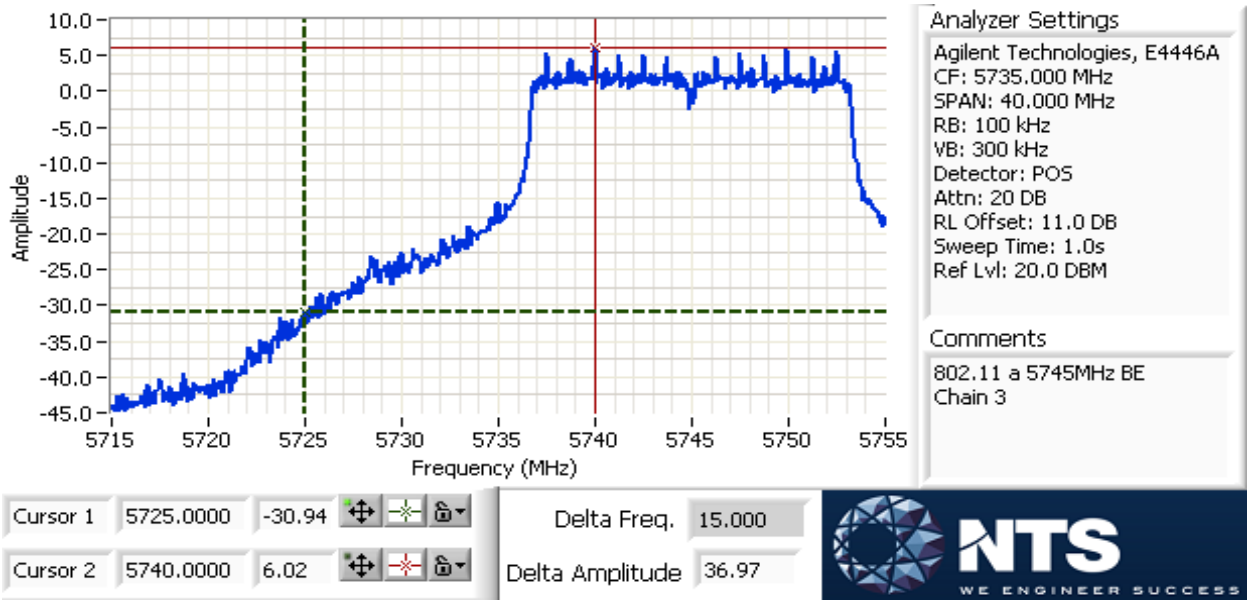
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

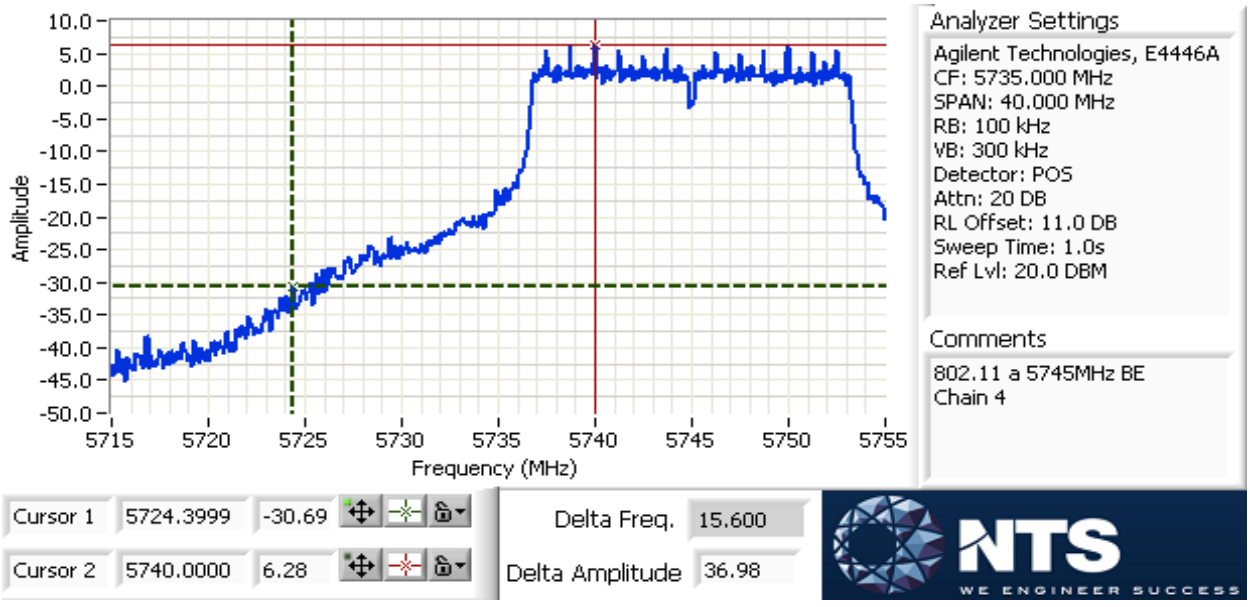
Additional plot from 5715 - 5755 MHz showing compliance with -20dBc at the band edge.





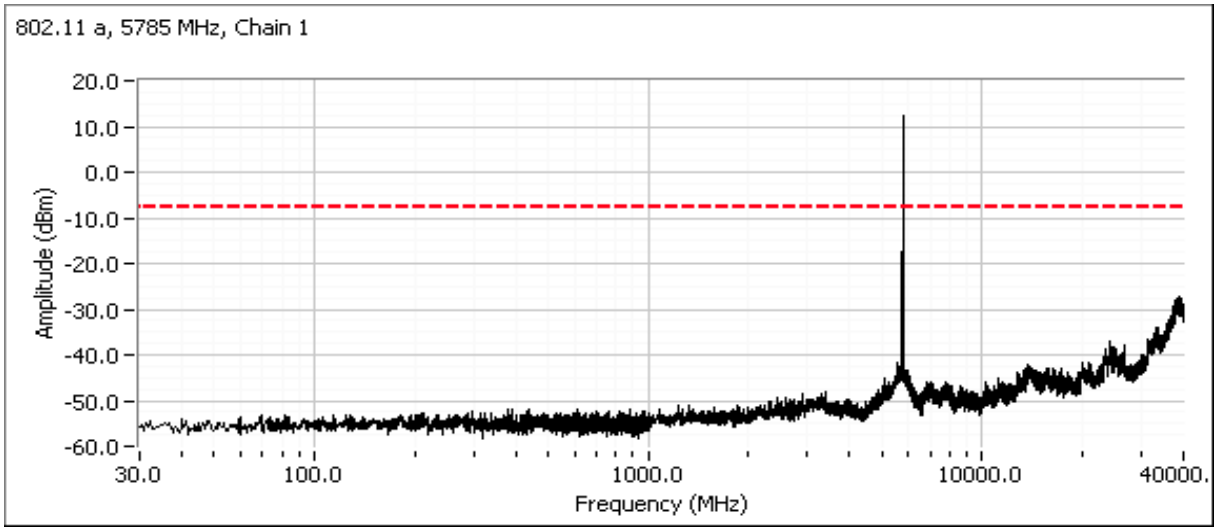
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

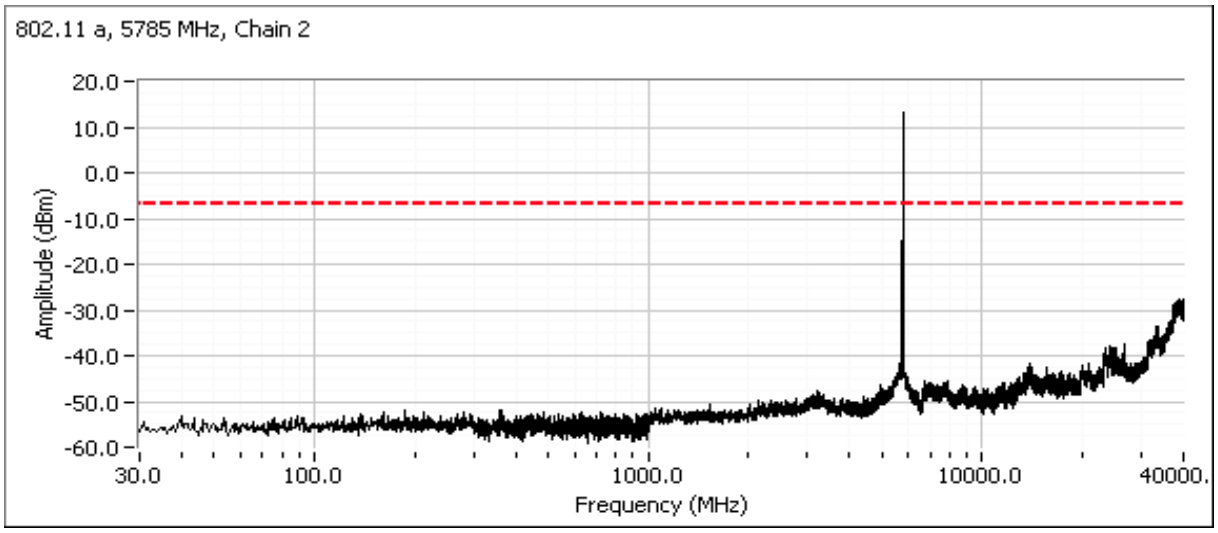




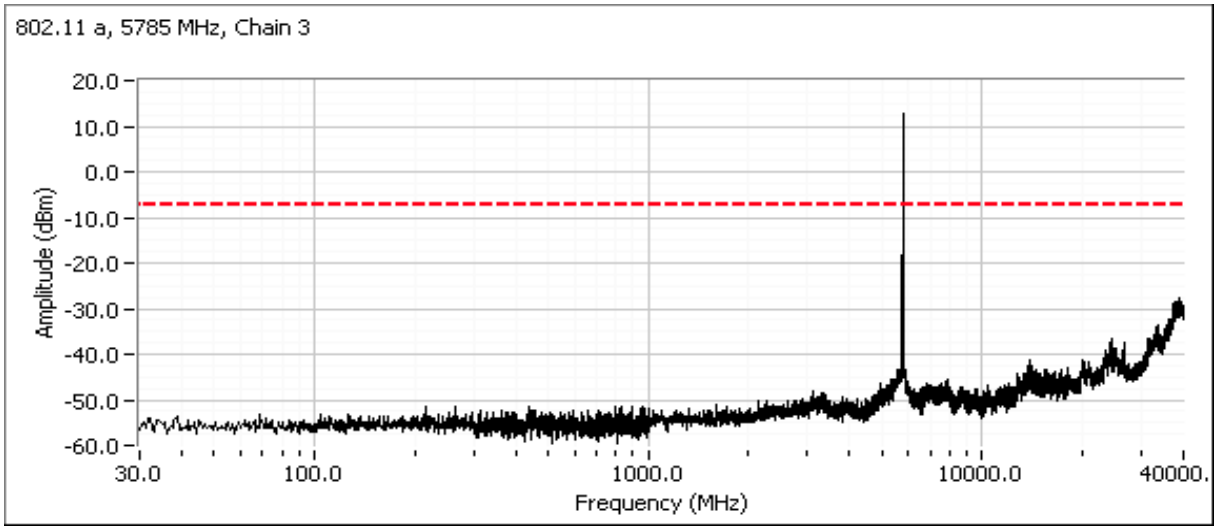
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

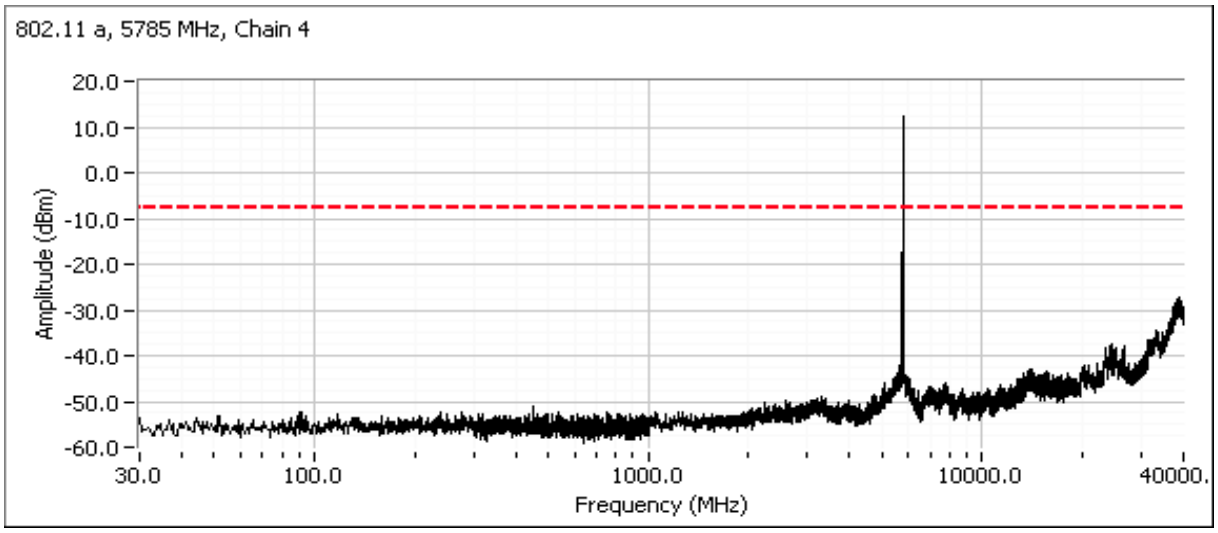
Plots for center channel, power setting(s) = 18





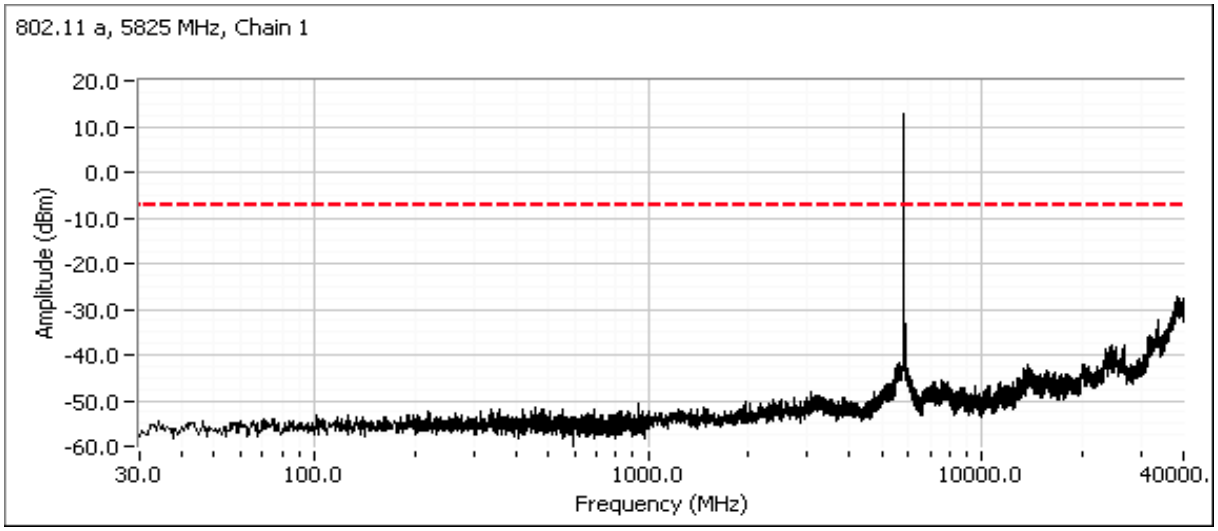
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

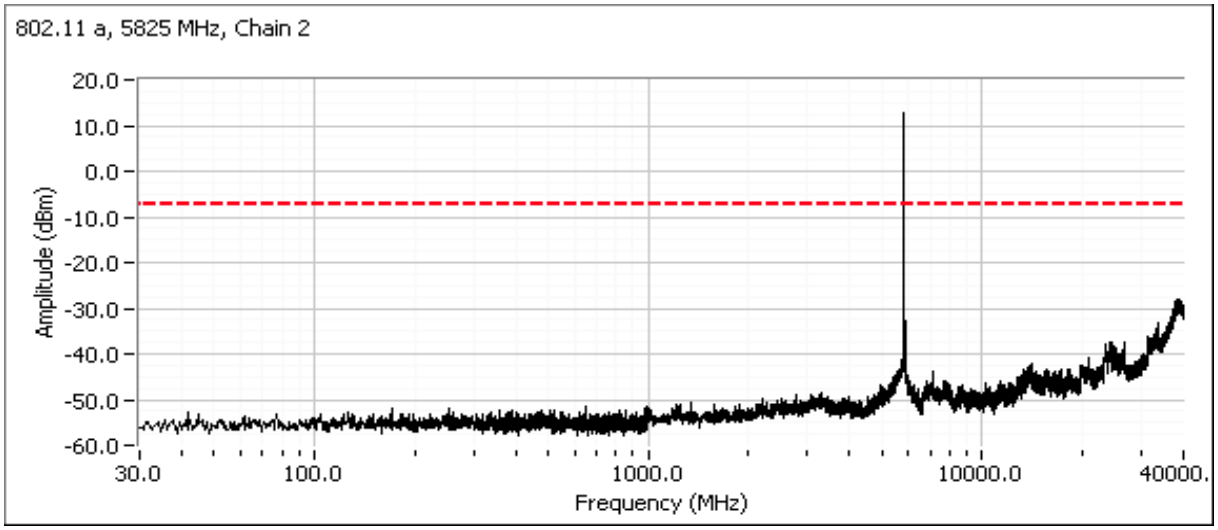




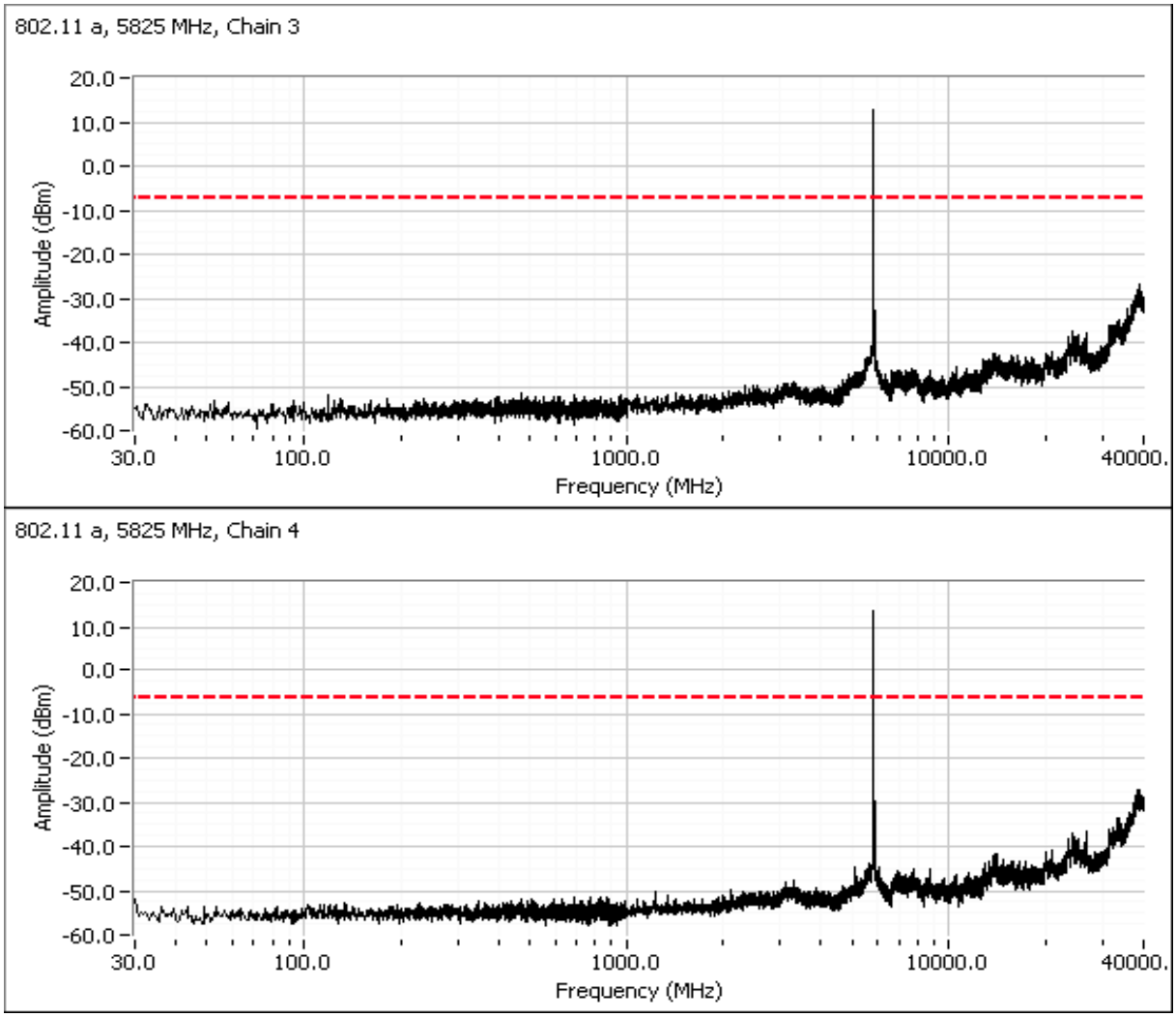
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Plots for high channel, power setting(s) = 18



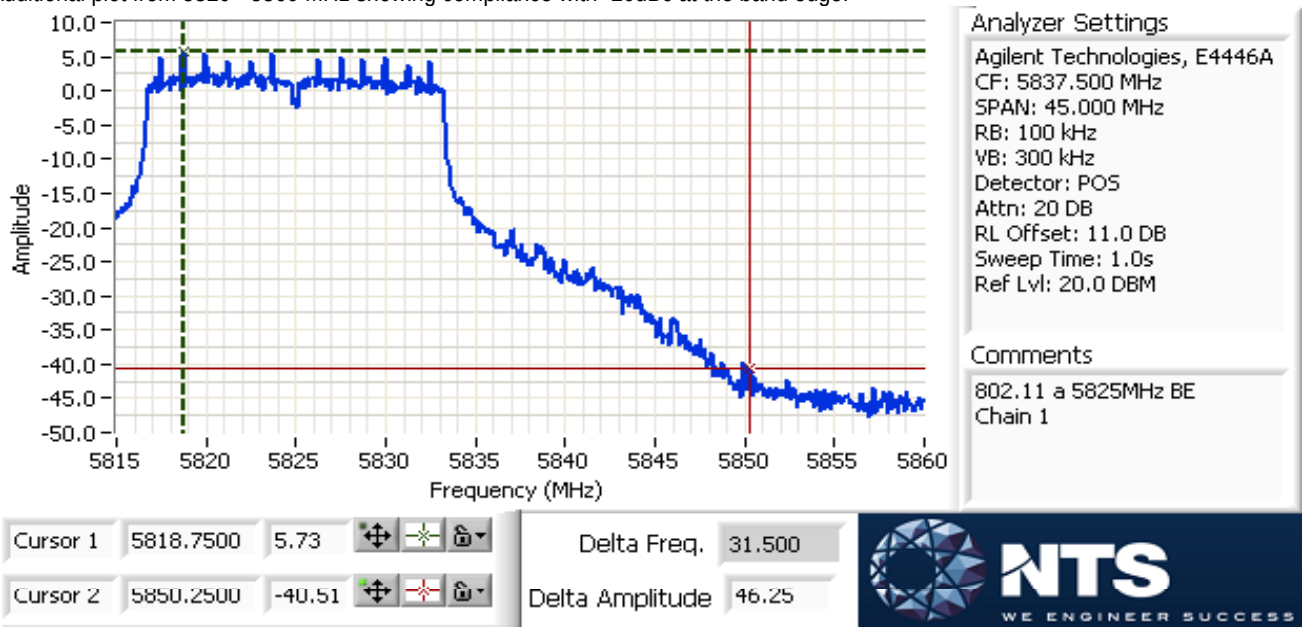


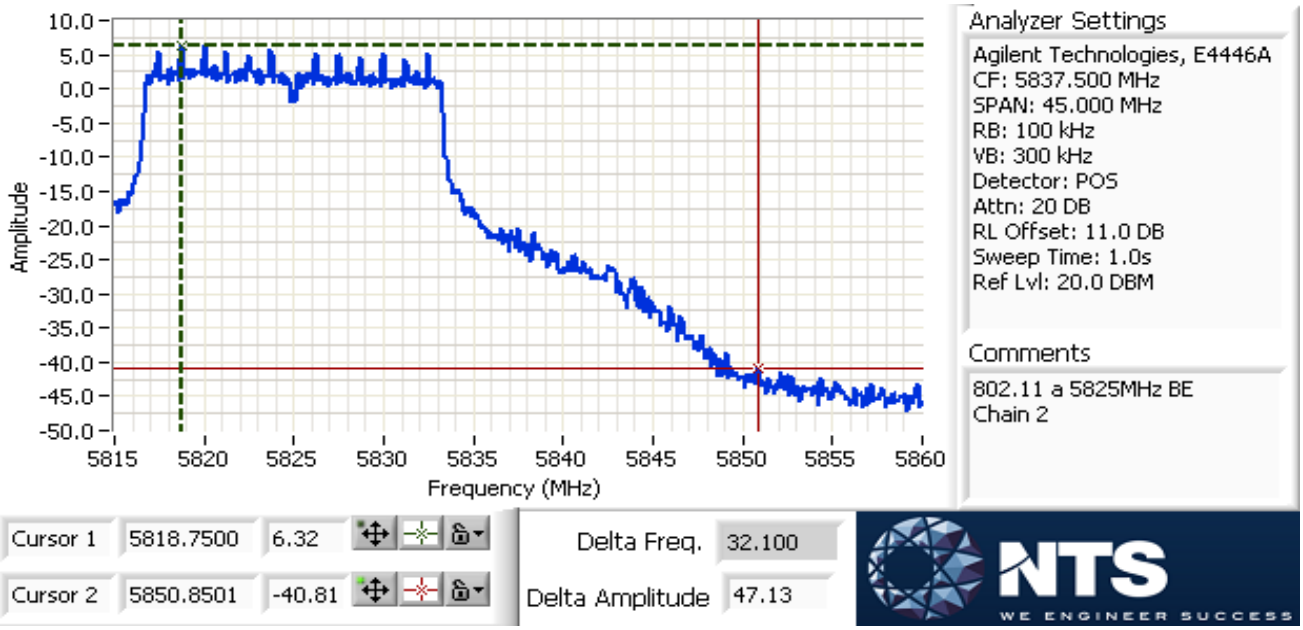
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



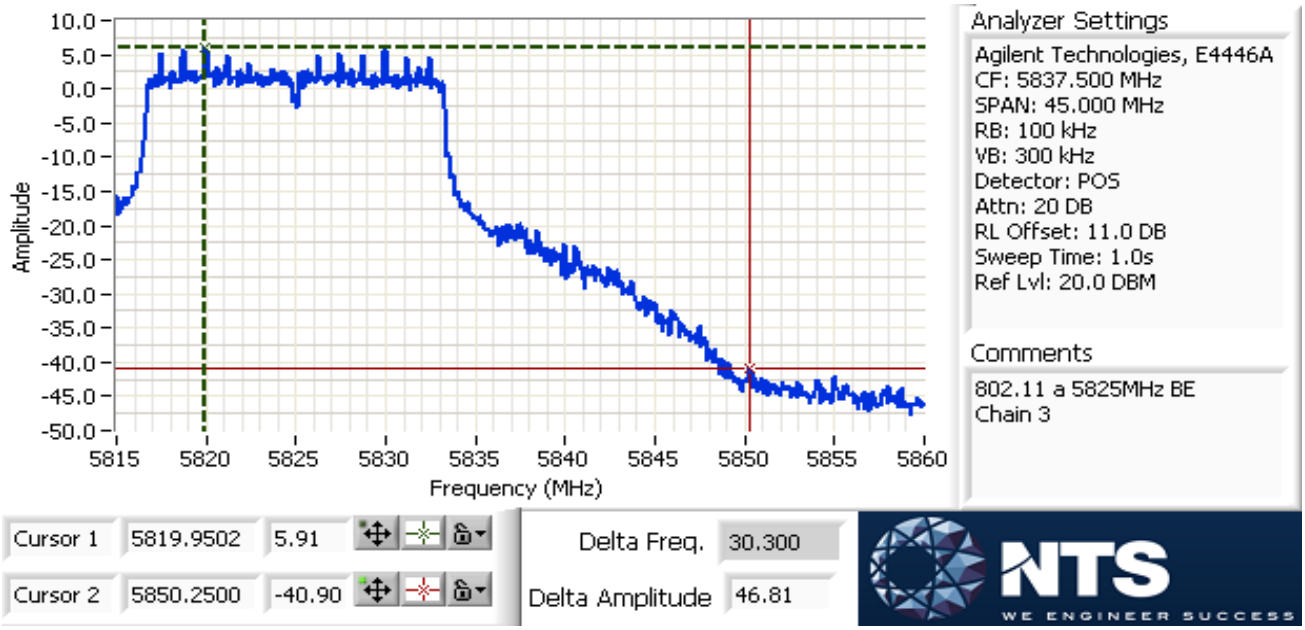
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

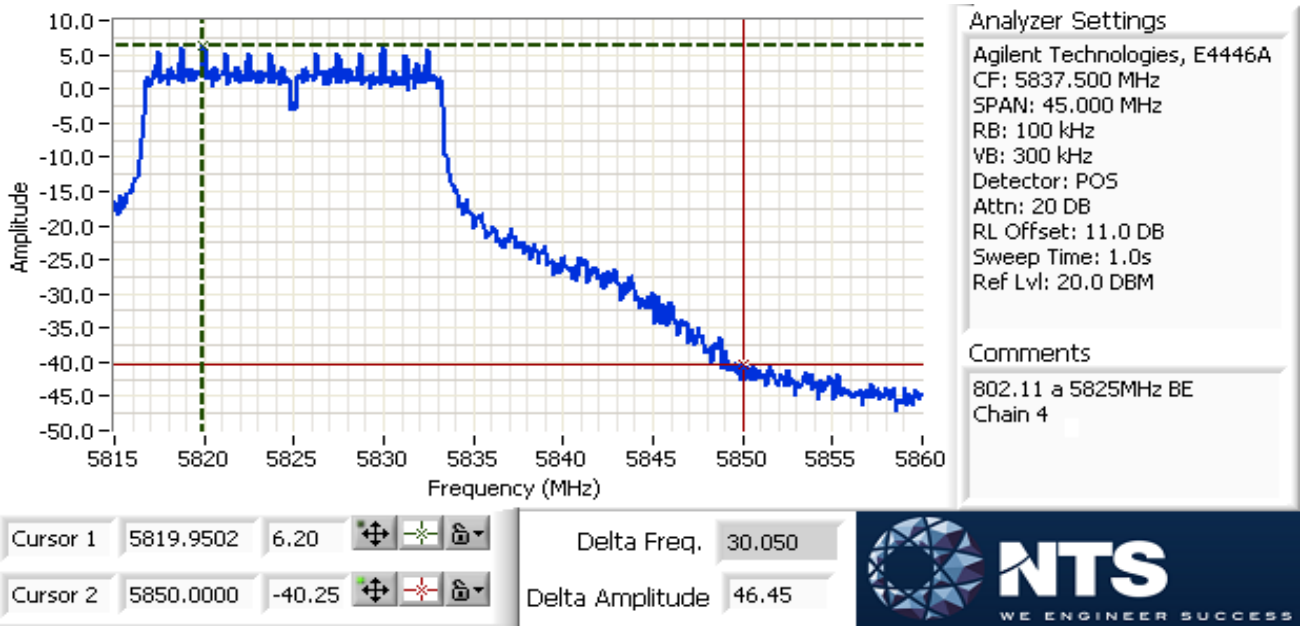
Additional plot from 5820 - 5860 MHz showing compliance with -20dBc at the band edge.





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

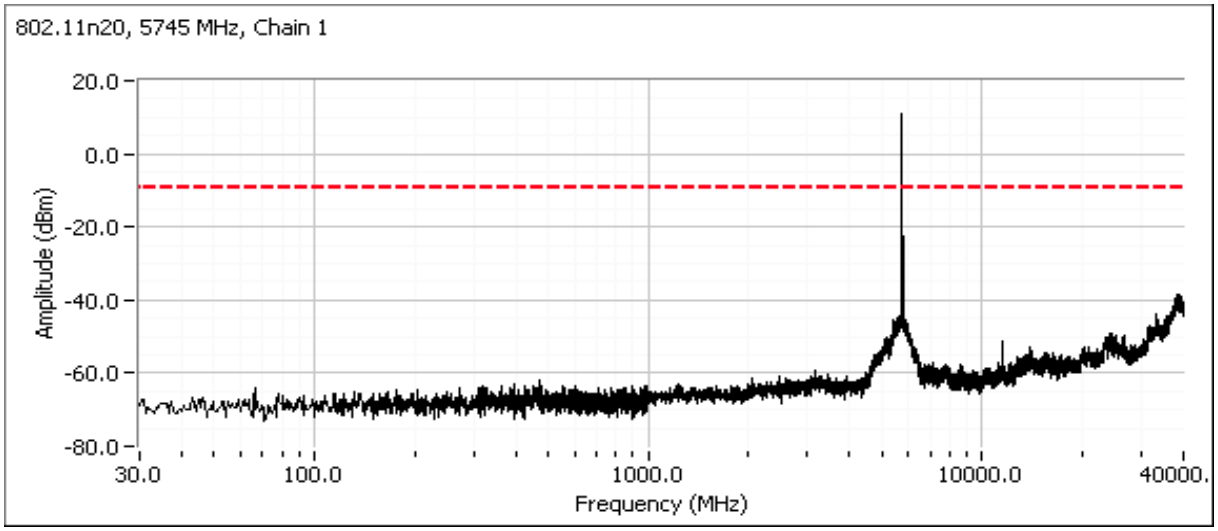


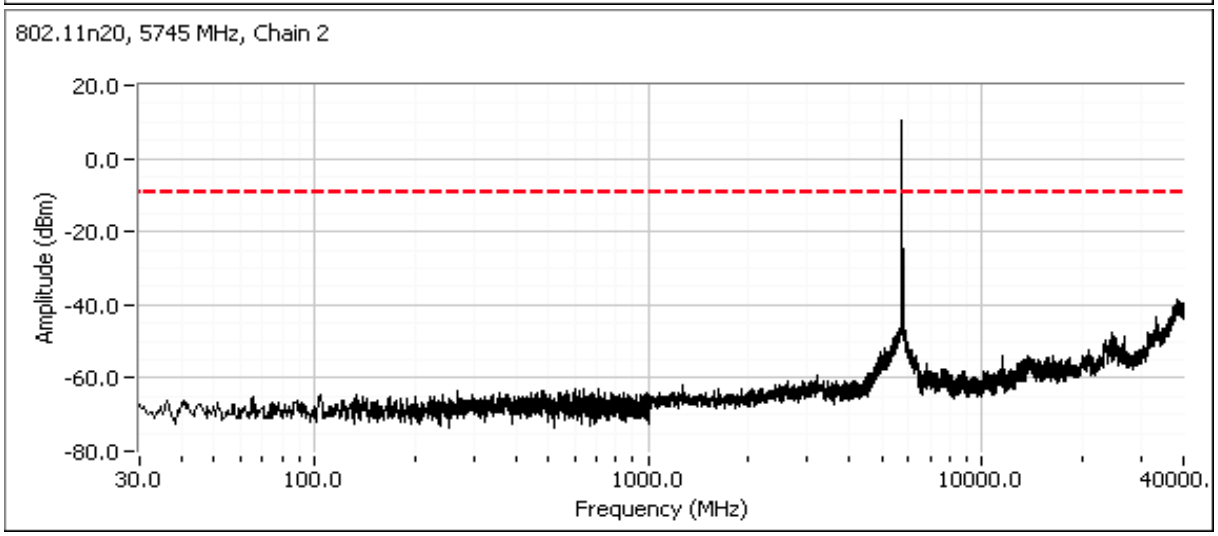


Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

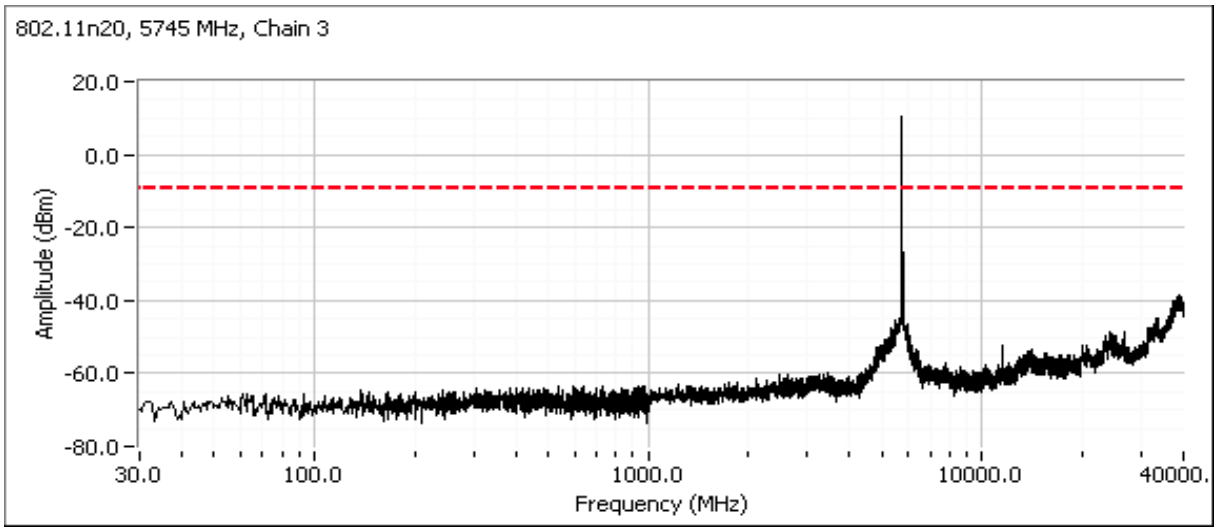
802.11 n20

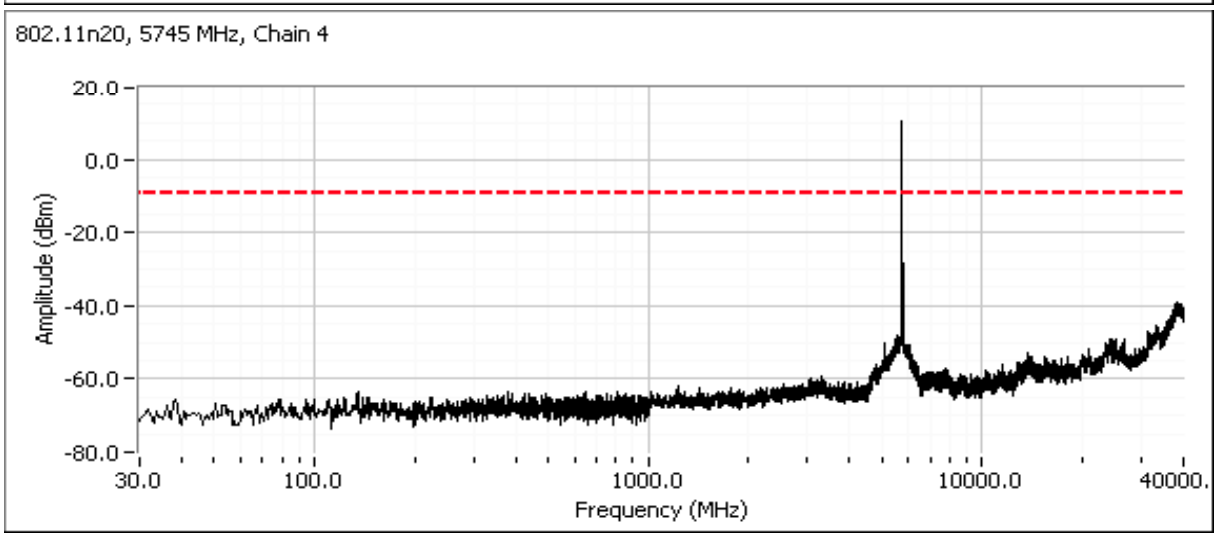
Plots for low channel, power setting(s) = 18





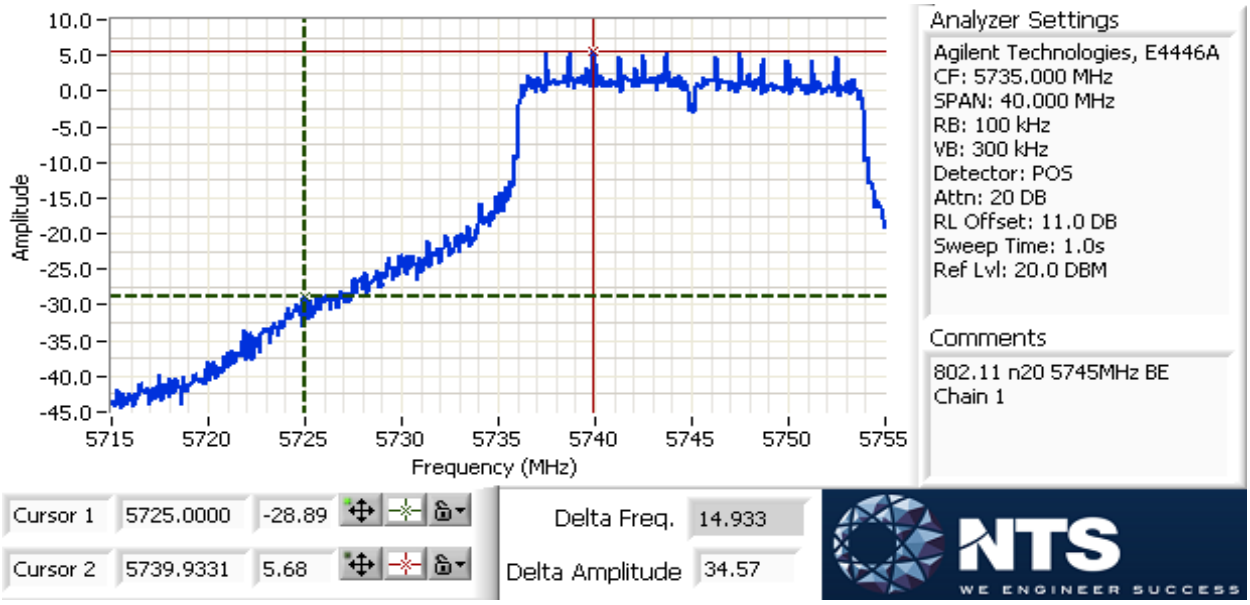
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

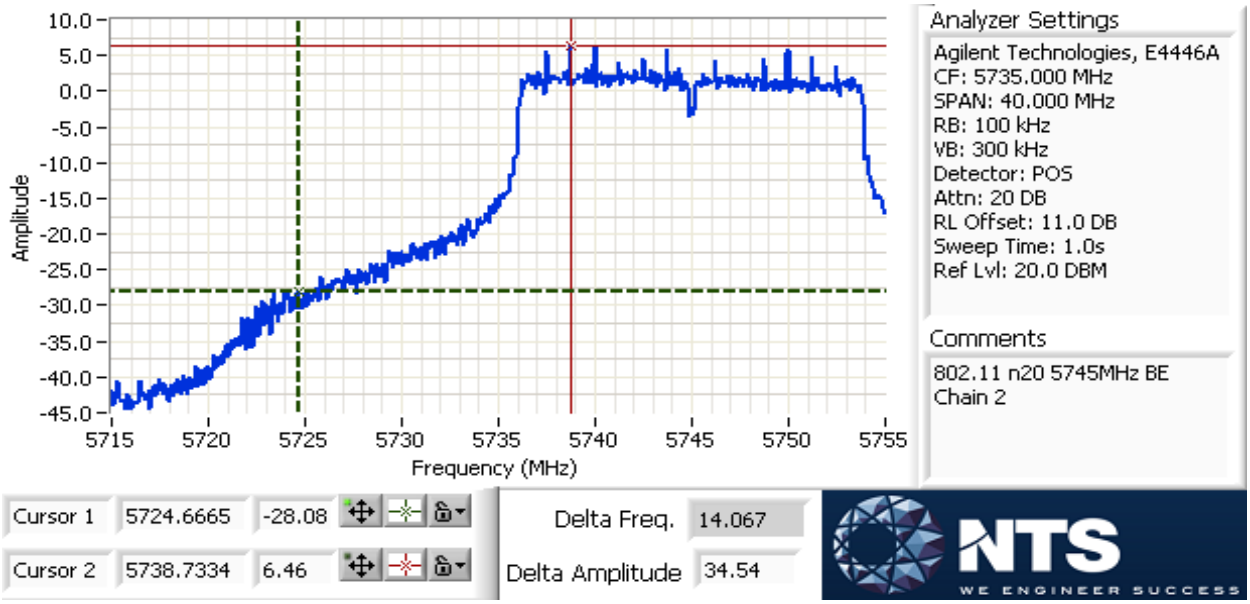




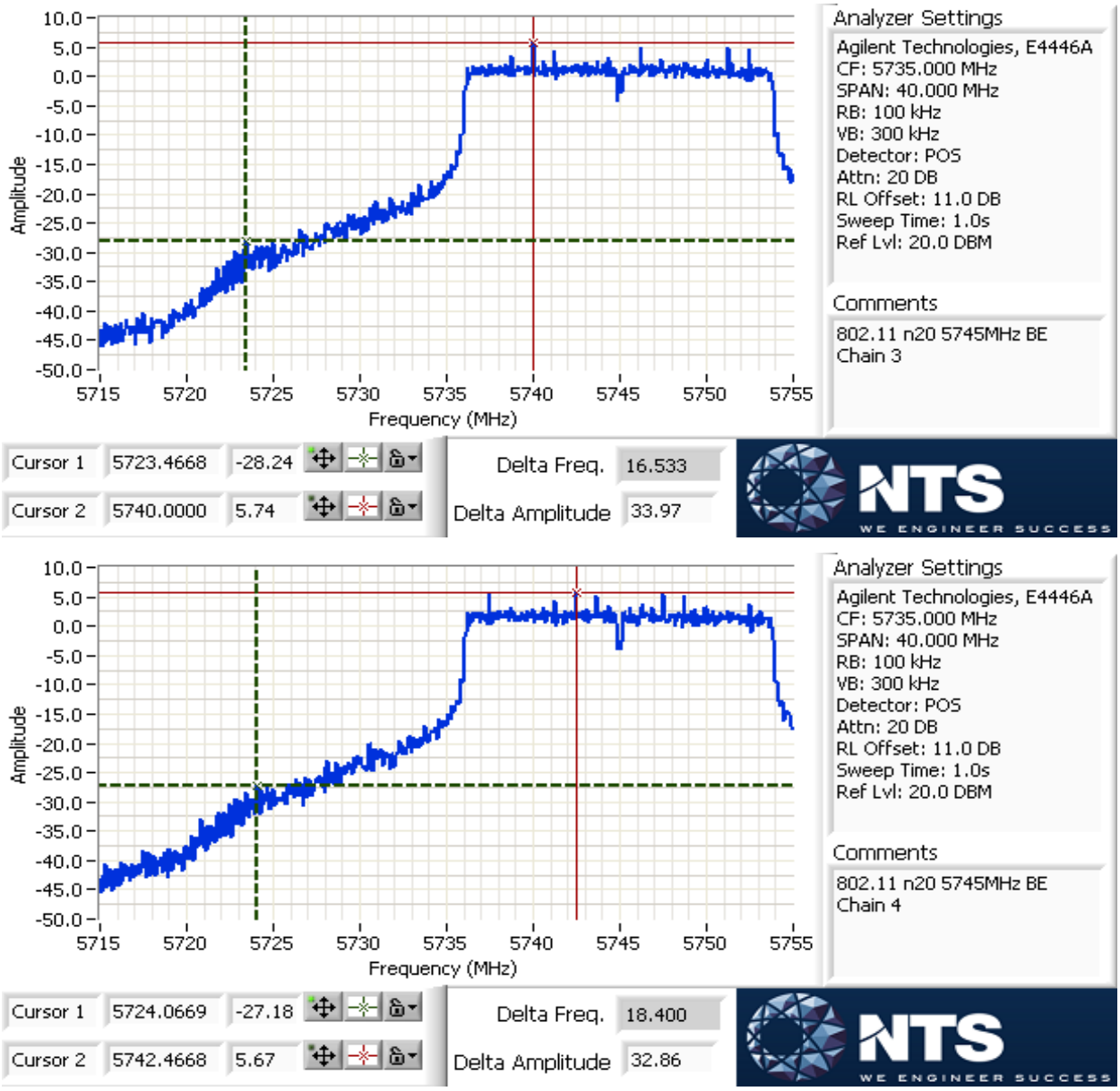
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Additional plot from 5715 - 5755 MHz showing compliance with -20dBc at the band edge.



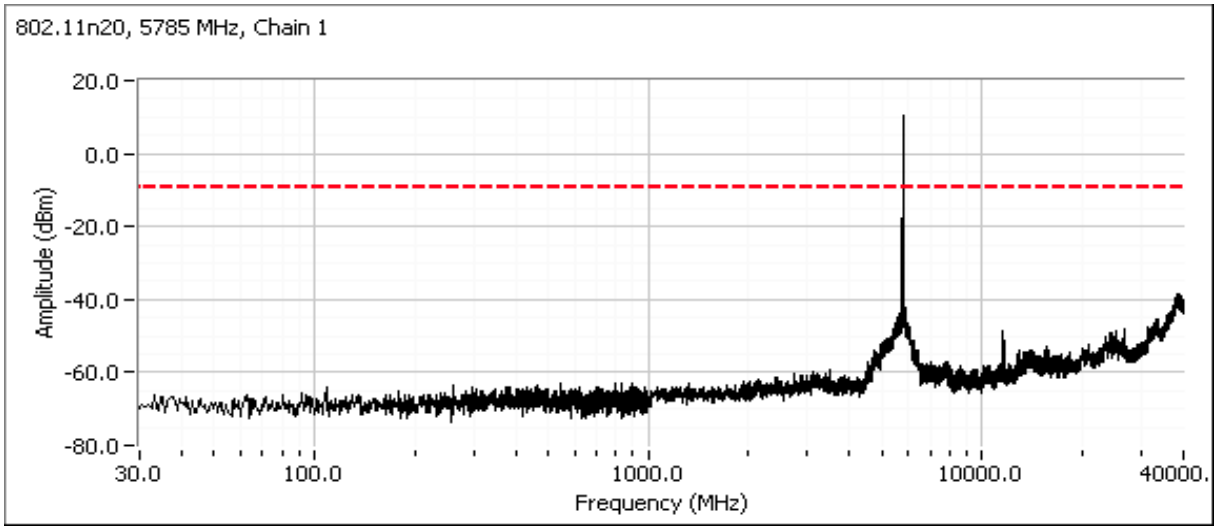


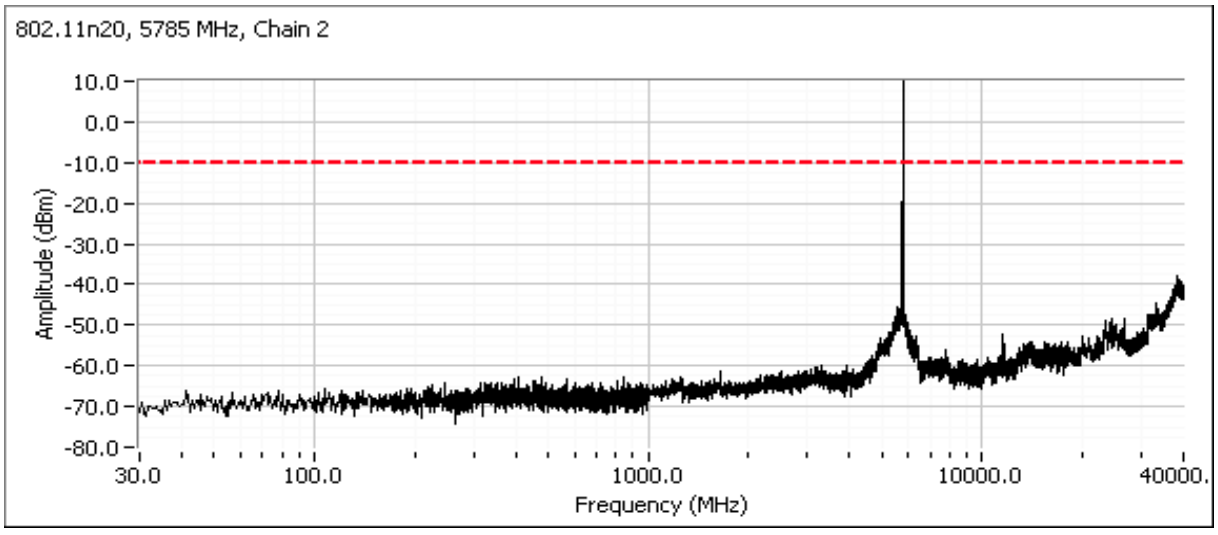
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



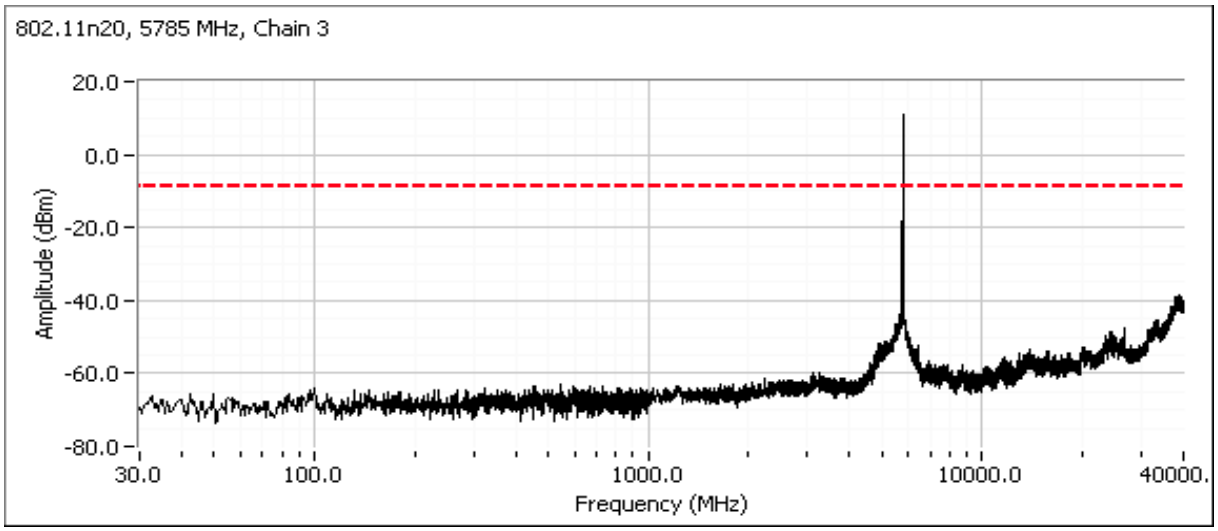
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

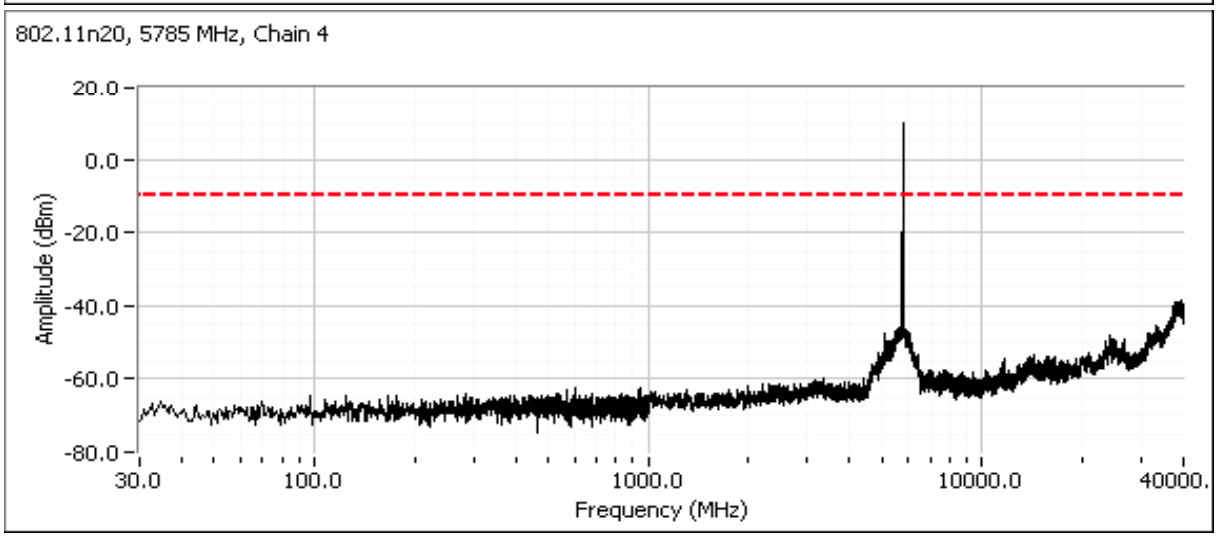
Plots for center channel, power setting(s) = 18





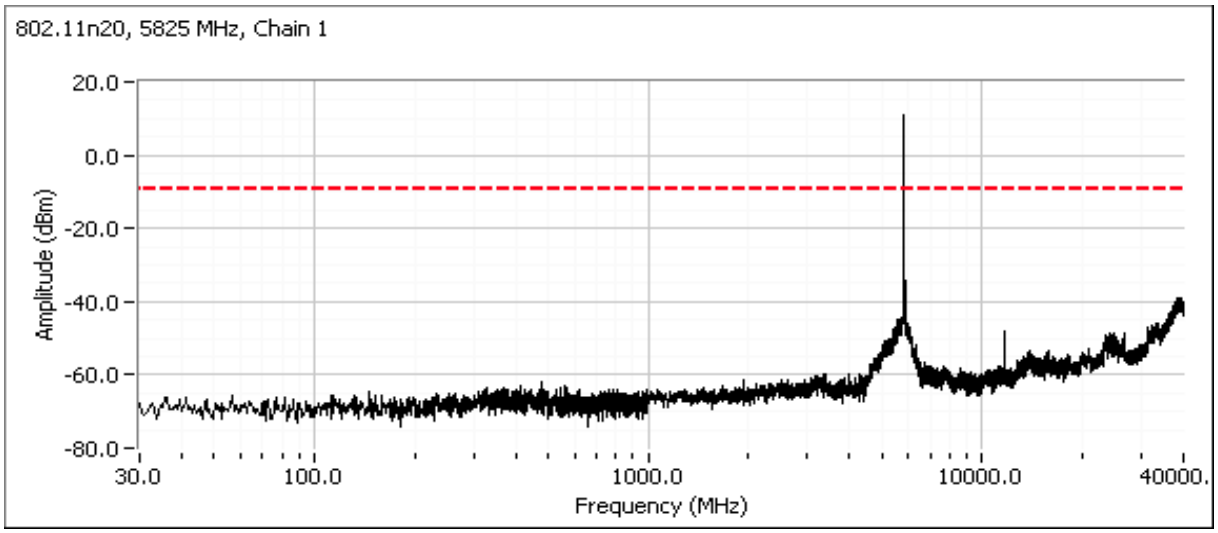
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

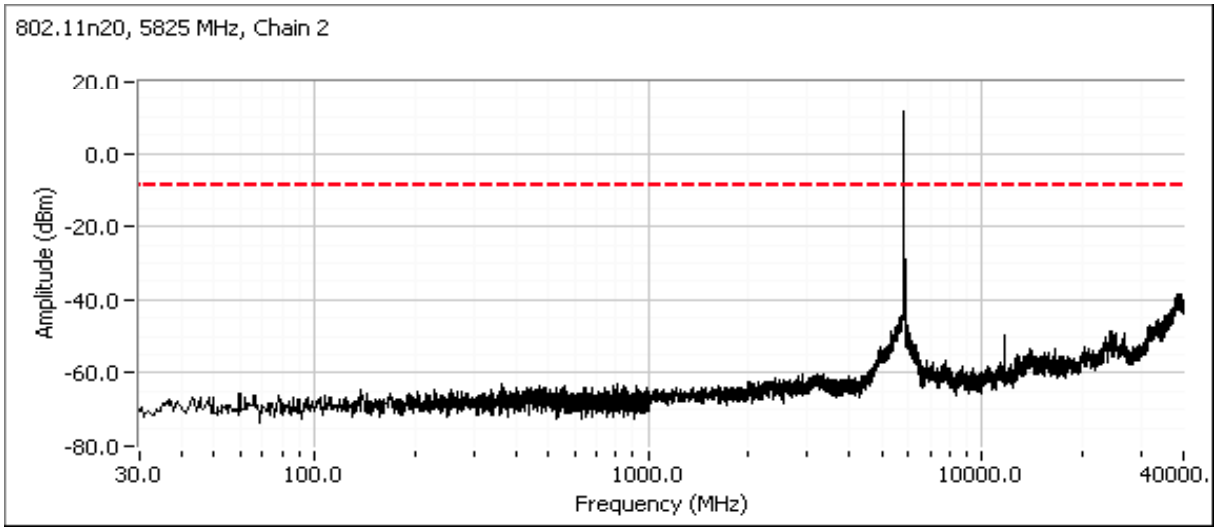




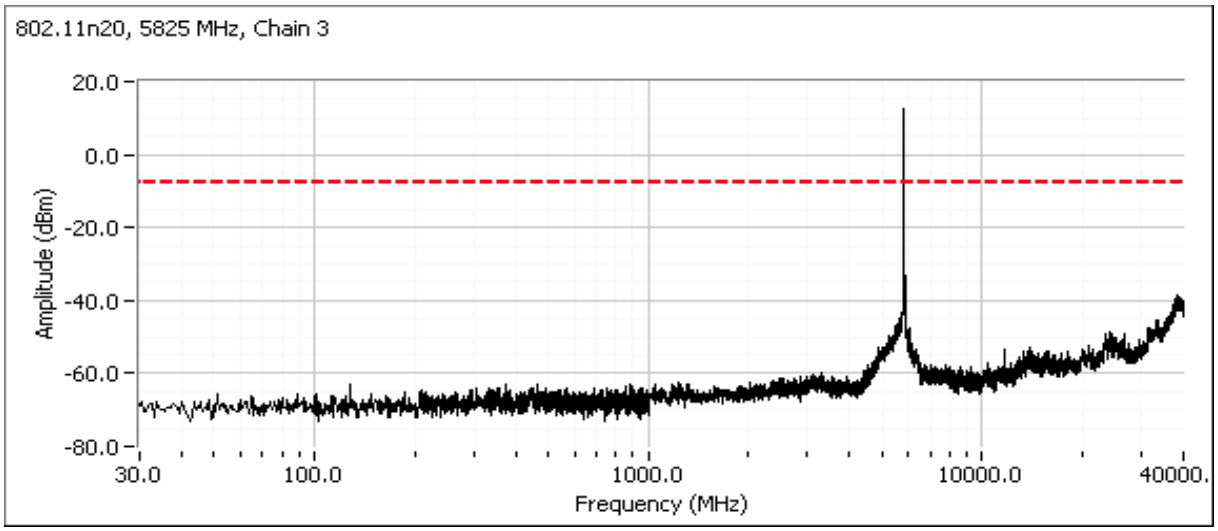
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

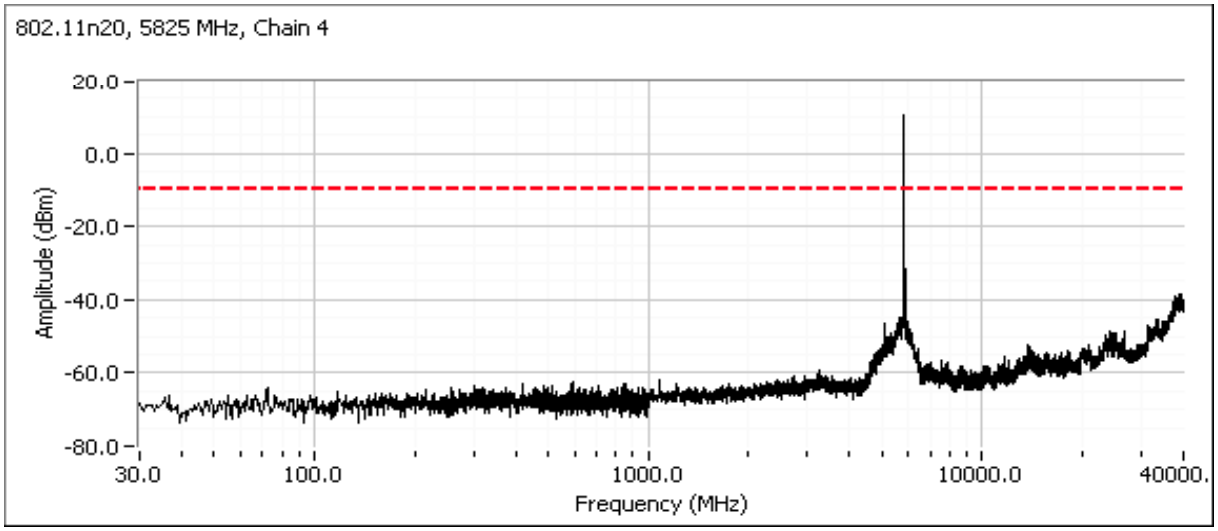
Plots for high channel, power setting(s) = 18





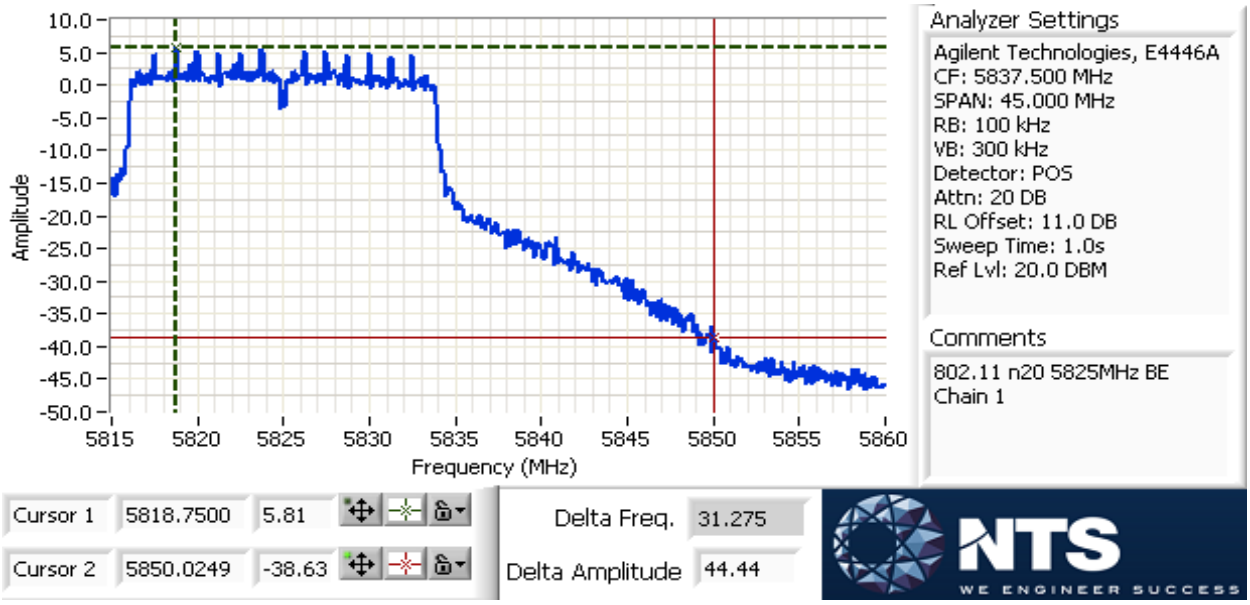
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

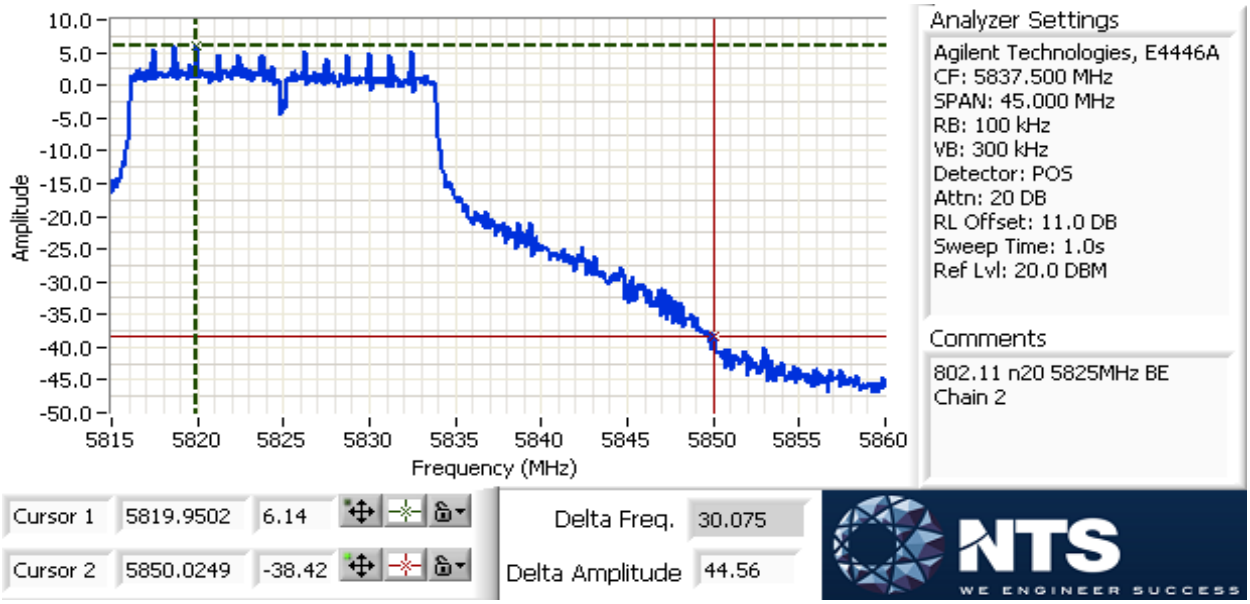




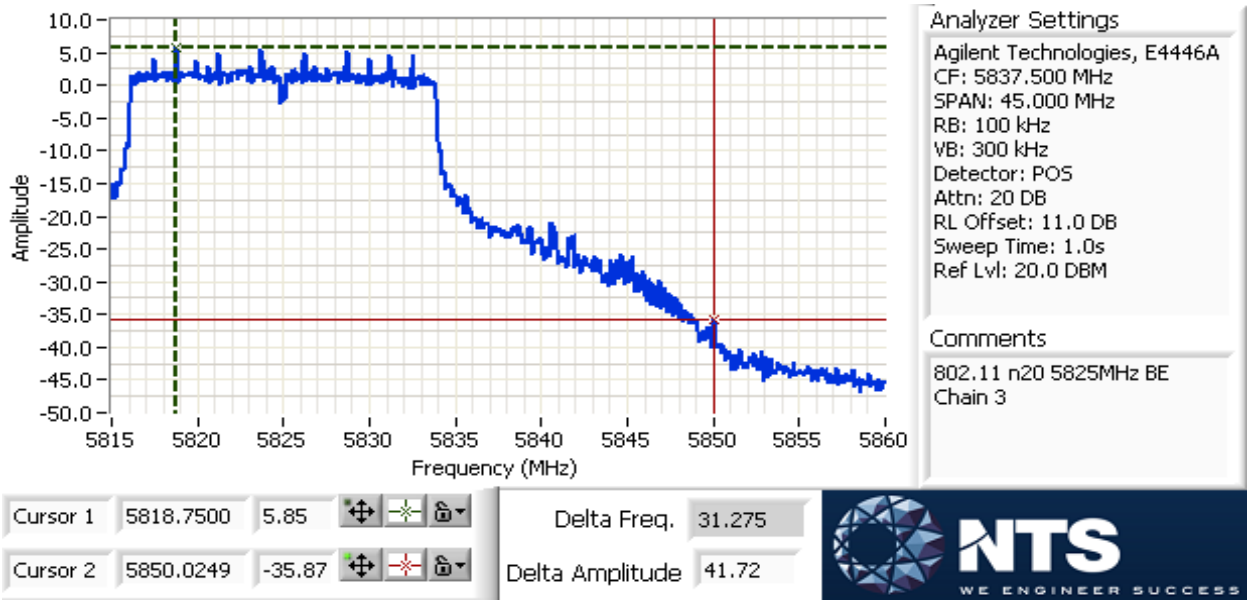
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

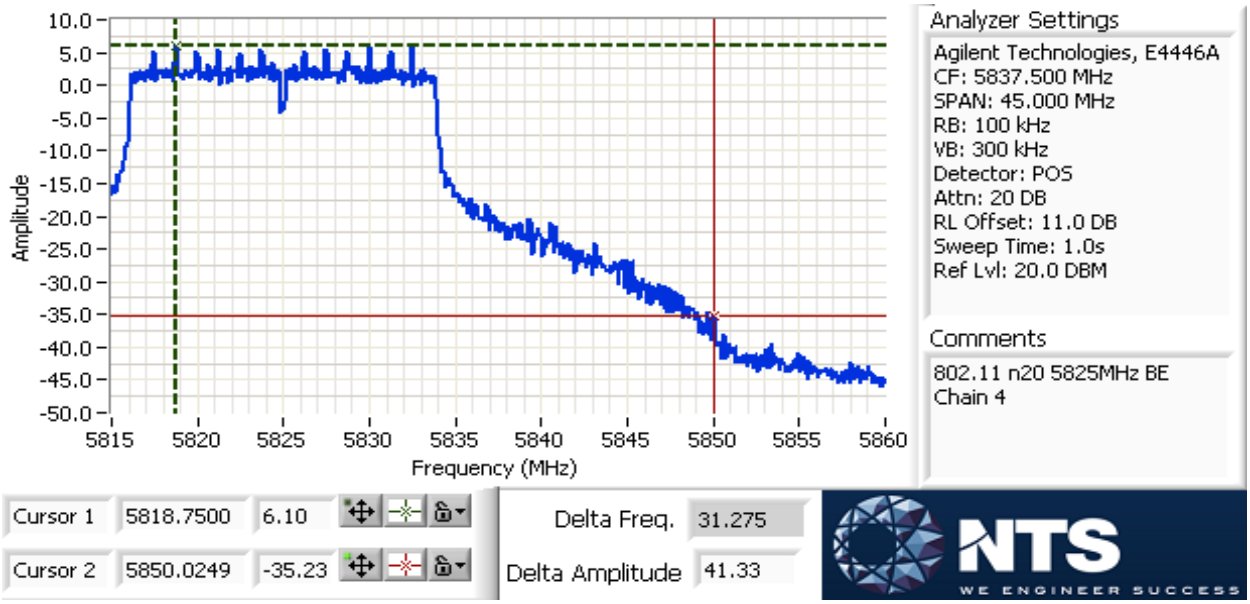
Additional plot from 5820 - 5860 MHz showing compliance with -20dBc at the band edge.





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

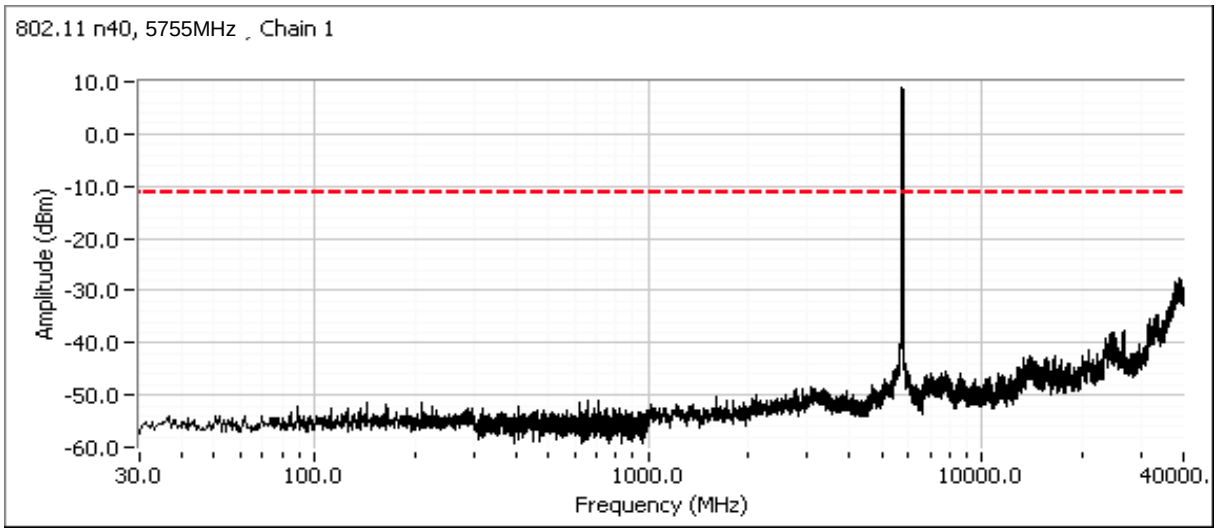


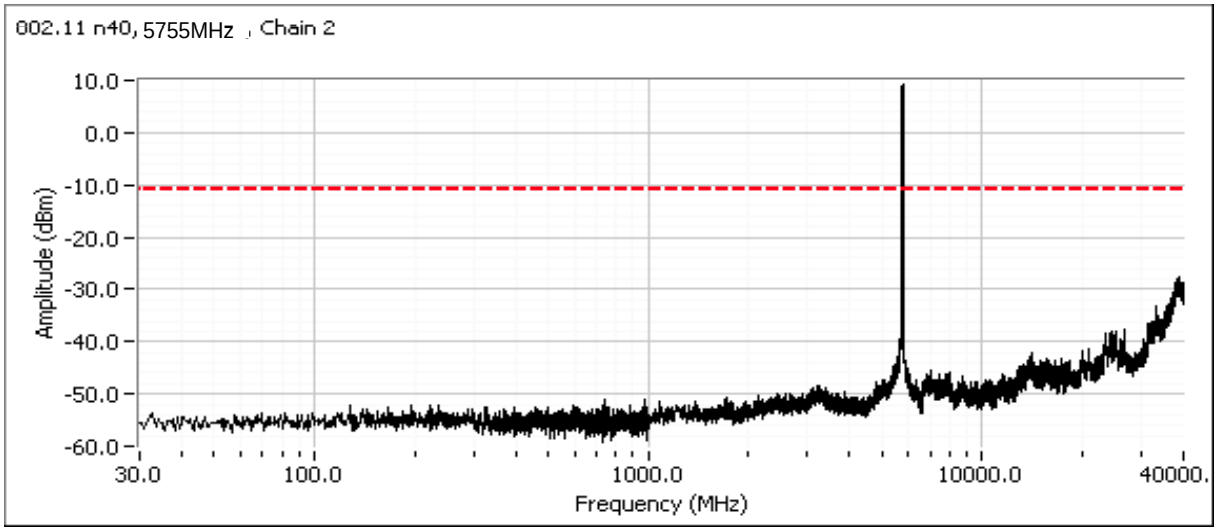


Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

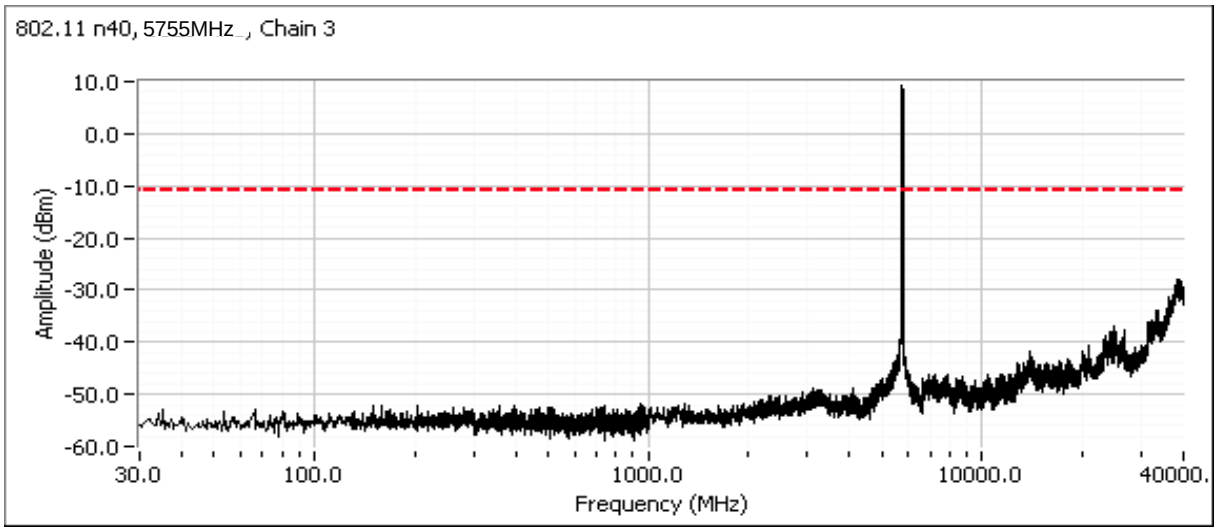
802.11 n40

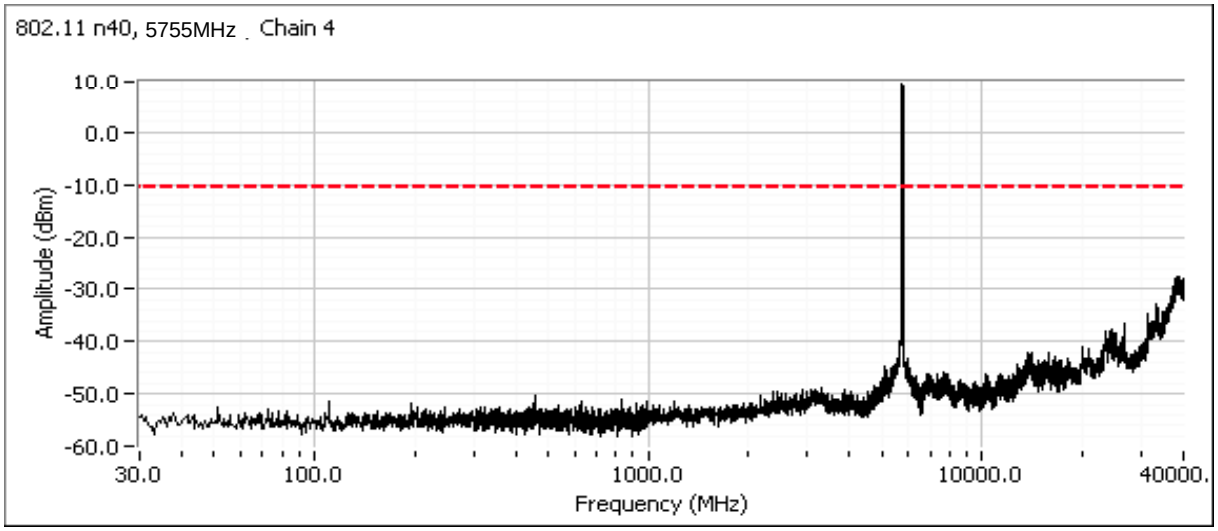
Plots for low channel, power setting(s) = 18





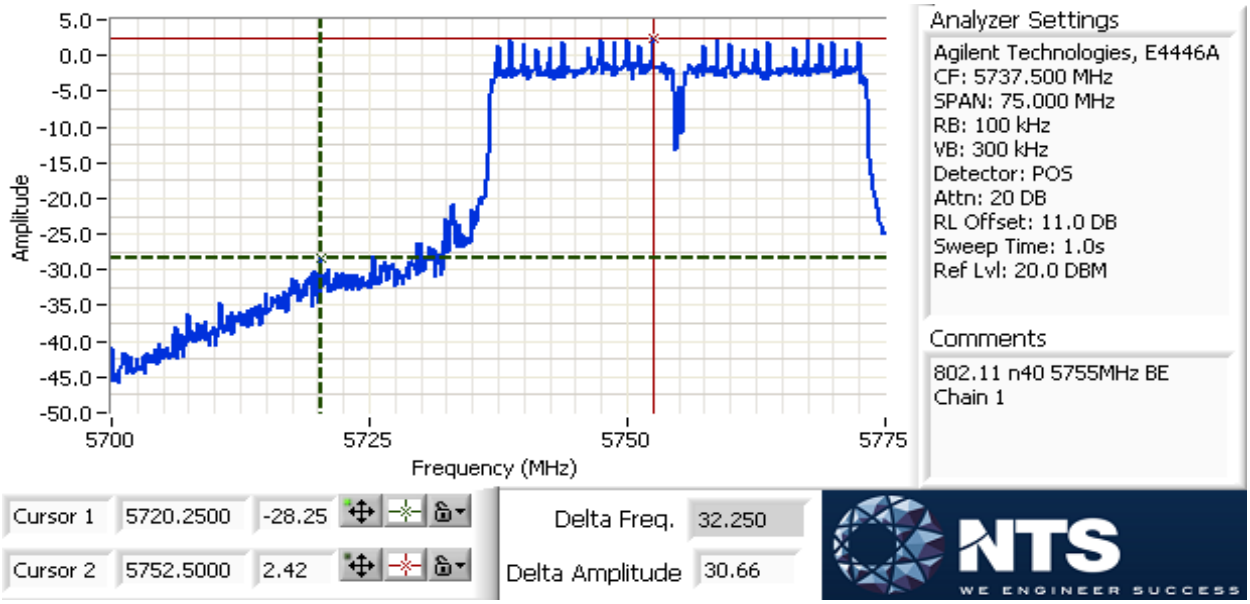
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

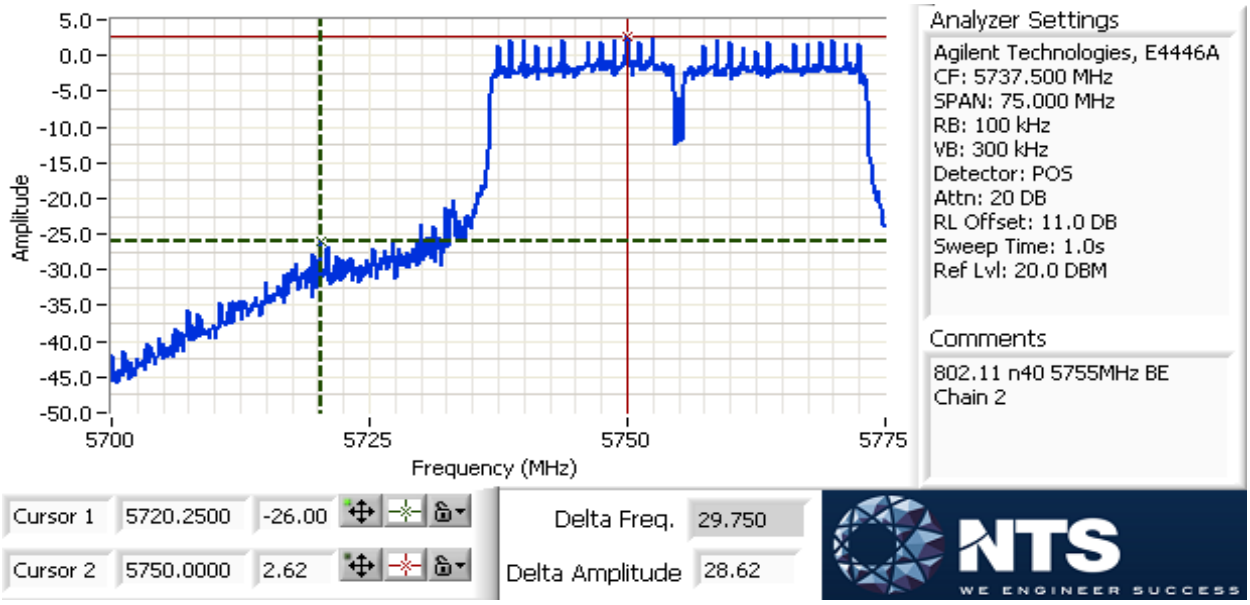




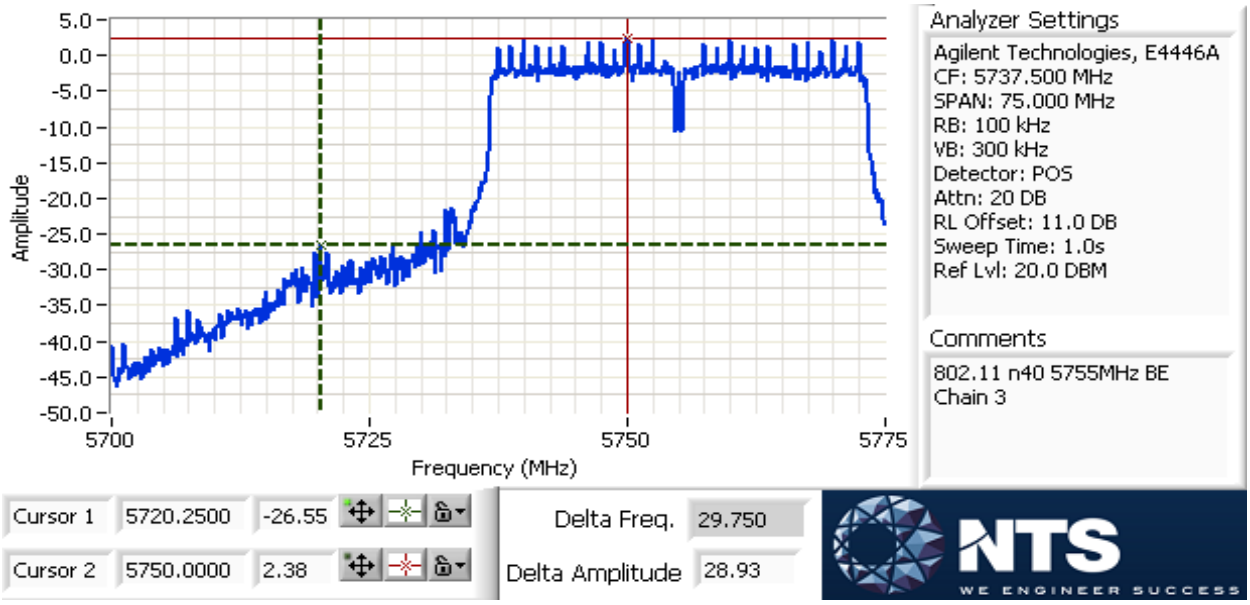
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

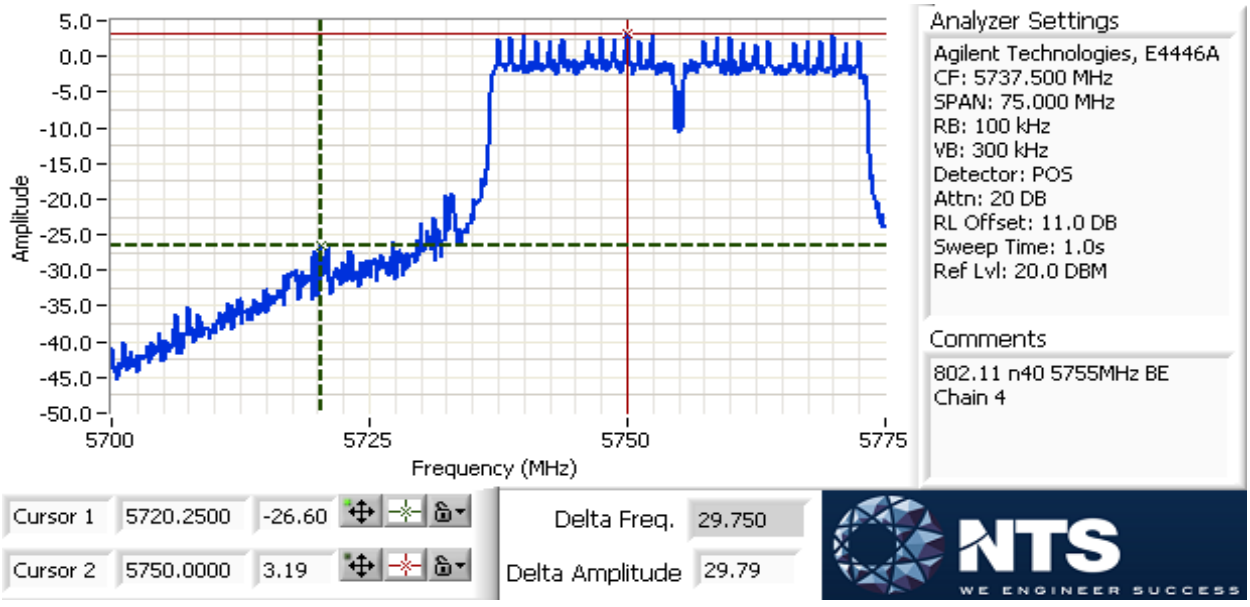
Additional plot from 5715 - 5755 MHz showing compliance with -20dBc at the band edge.





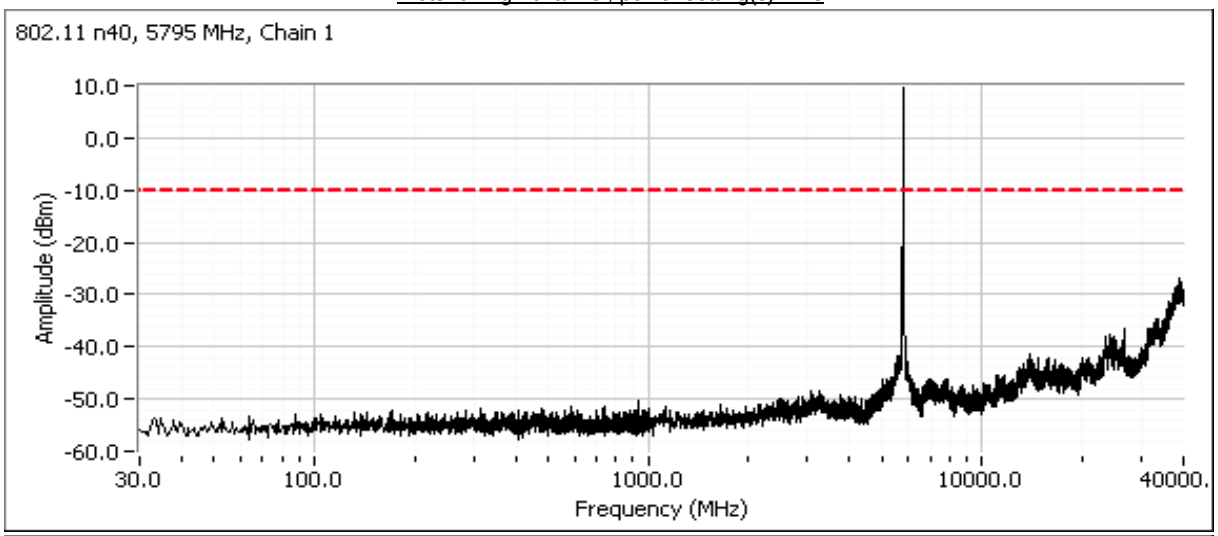
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

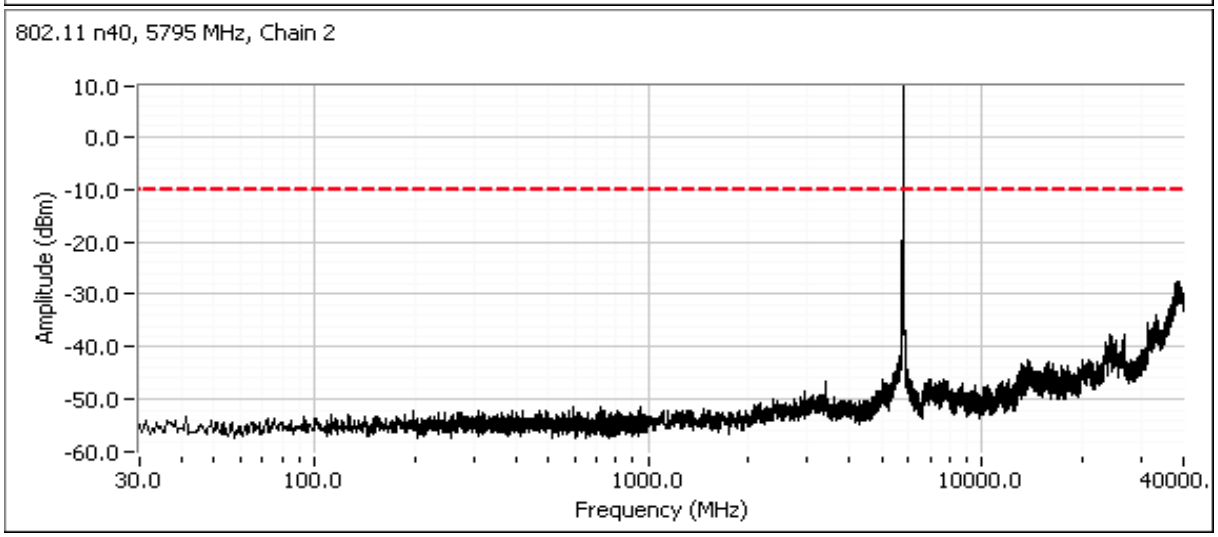




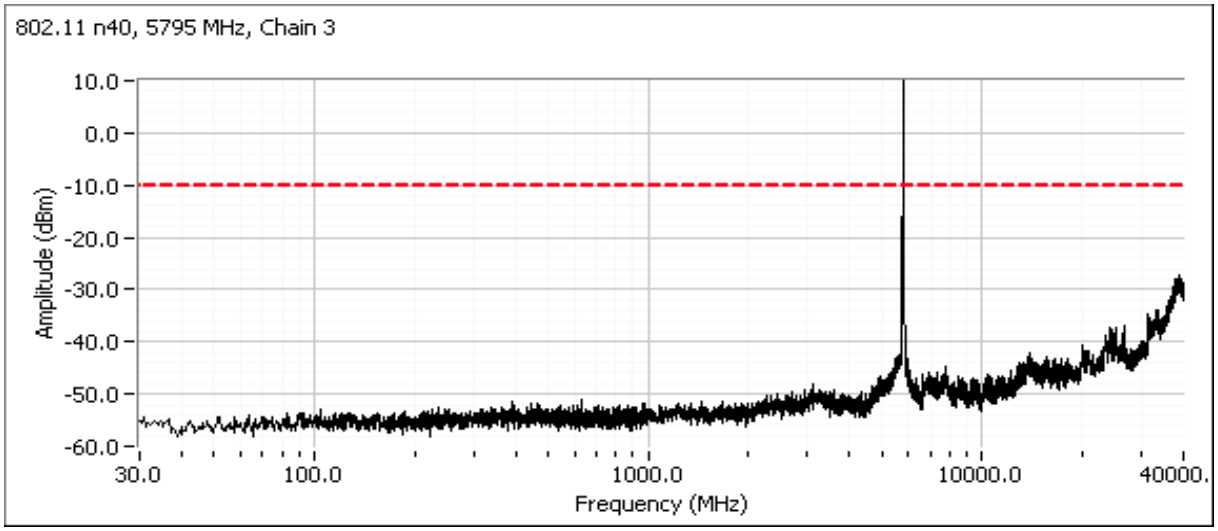
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

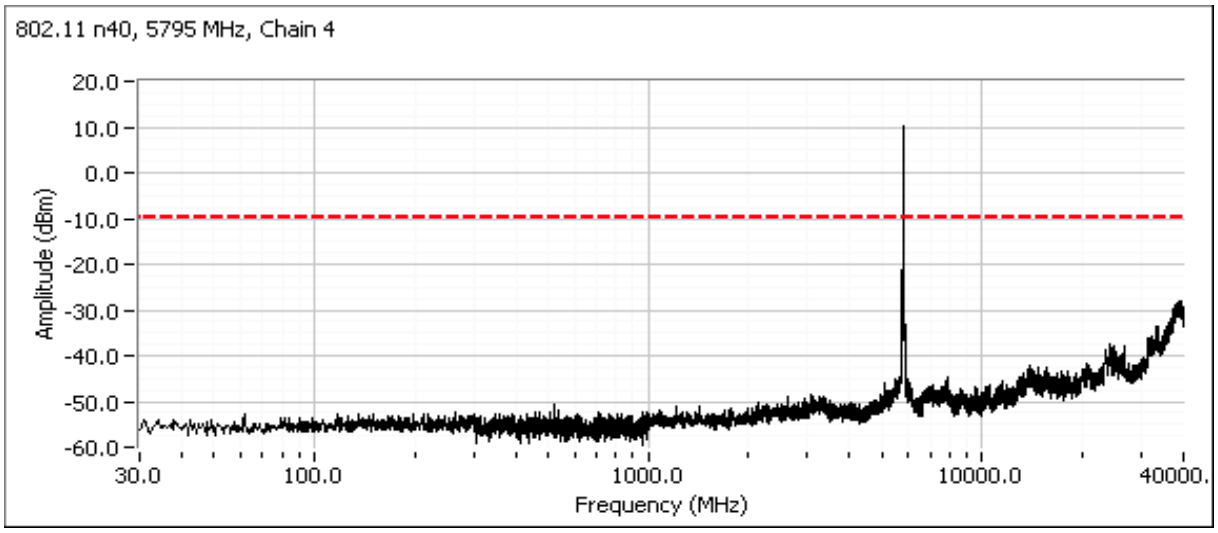
Plots for high channel, power setting(s) = 18





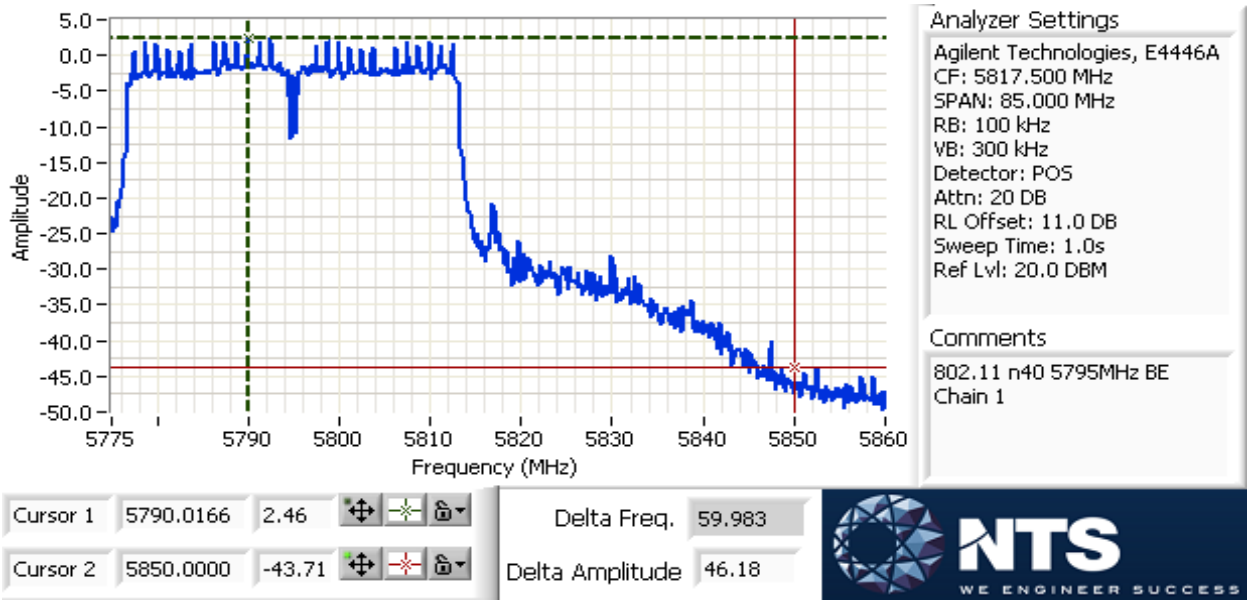
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

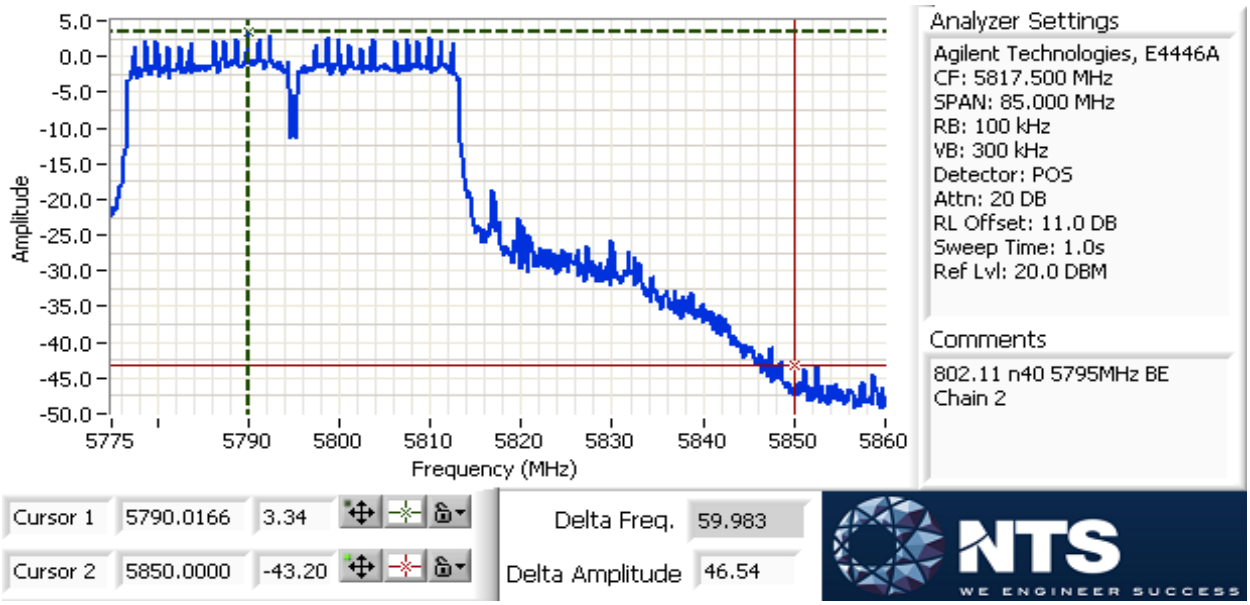




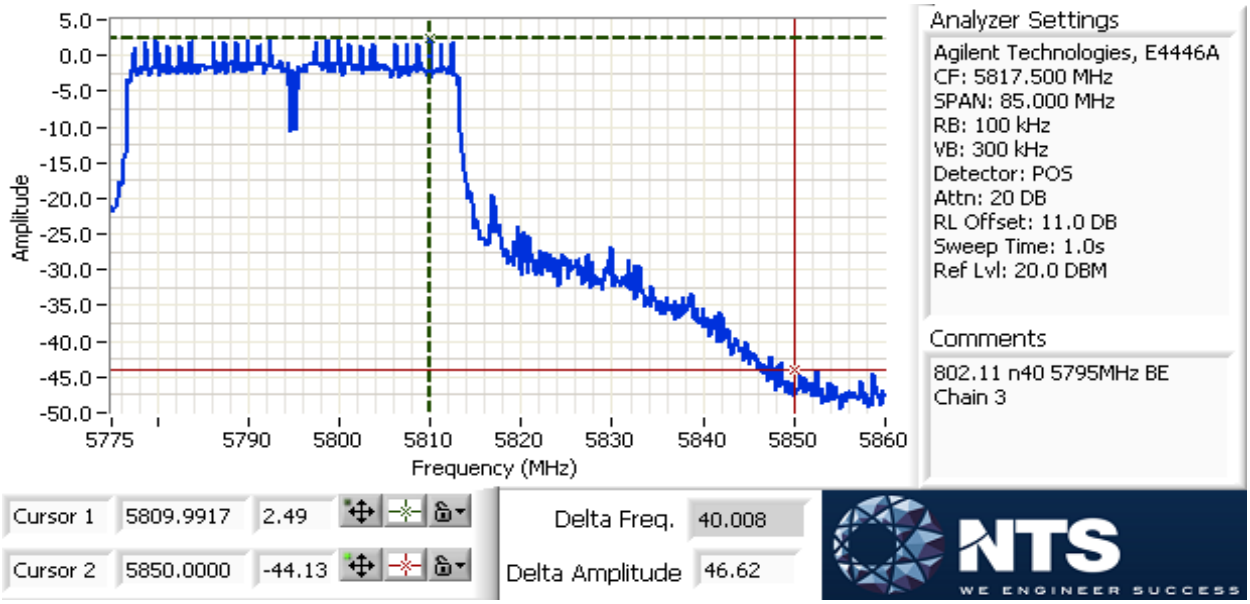
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

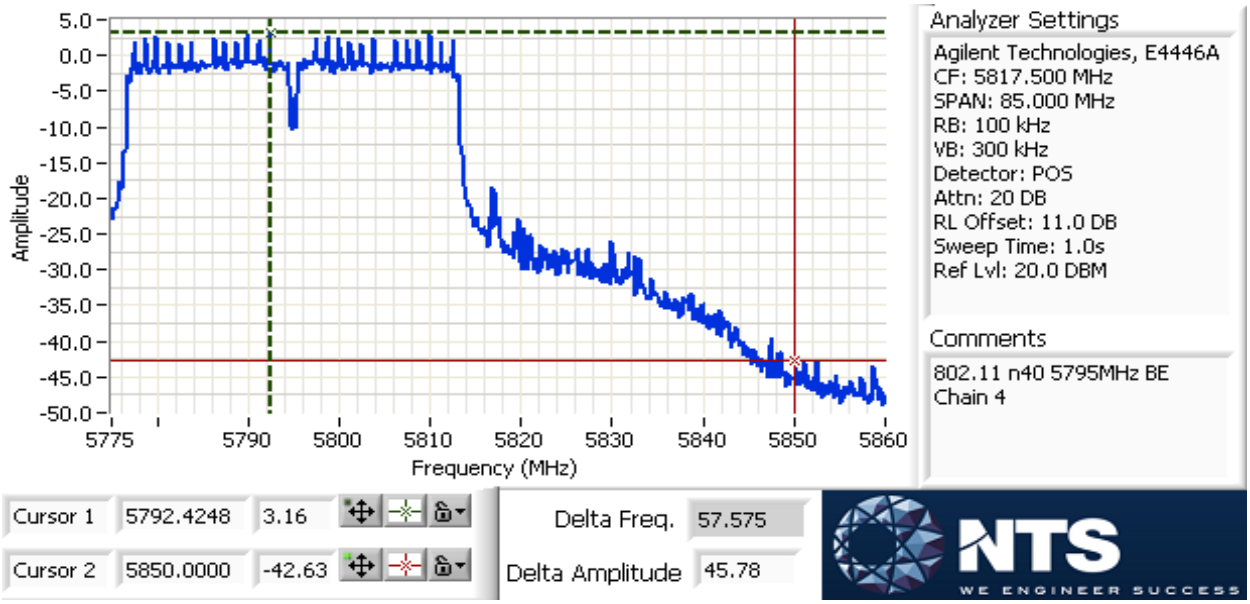
Additional plot from 5820 - 5860 MHz showing compliance with -20dBc at the band edge.





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing. All remote support equipment was located outside the chamber.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 20-22 °C

Rel. Humidity: 30-35 %

Summary of Results - Device Operating in the 5725 - 5850 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
Scans on center channel in all three OFDM modes in each operatintg band were used to determine the worst case.							
Run #1 (5725-5850MHz Band)	802.11a	#157 5785MHz	18.0	23.7	Radiated Emissions 1 - 40 GHz	FCC 15.209 / 15 E	53.5 dBµV/m @ 11572.1 MHz (-0.5 dB)
	802.11n20	#157 5785MHz	18.0	23.7			49.3 dBµV/m @ 5120.0 MHz (-4.7 dB)
	802.11n40	#159 5795MHz	18.0	23.4			48.2 dBµV/m @ 5120.0 MHz (-5.8 dB)
	Worst case mode - top and bottom channels. As the worst case mode was 802.11a evaluated at center channel (5785MHz); therefore, low channel (5745MHz) and high channel (5825MHz) were tested in 802.11a mode.						
	802.11a	#149 5745MHz	18.0	23.6	Radiated Emissions 1 - 40 GHz	FCC 15.209 / 15 E	50.4 dBµV/m @ 5120.0 MHz (-3.6 dB)
		#165 5825MHz	18.0	23.7			45.8 dBµV/m @ 11645.6 MHz (-8.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Antenna: antenna(s) connected

Duty Cycle: 98.4%

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #1: Radiated Spurious Emissions, 1,000 - 40,000 MHz

Date of Test: 5/22/2012 Test Location: FT5

Test Engineer: Rafael Varelas

Software Setting	Power Settings									
	Target (dBm), Chain					Measured (dBm), Chain				
18	A	B	C	D	Total	A	B	C	D	Total
	-	-	-	-		17.4	17.5	17.8	18.0	23.7

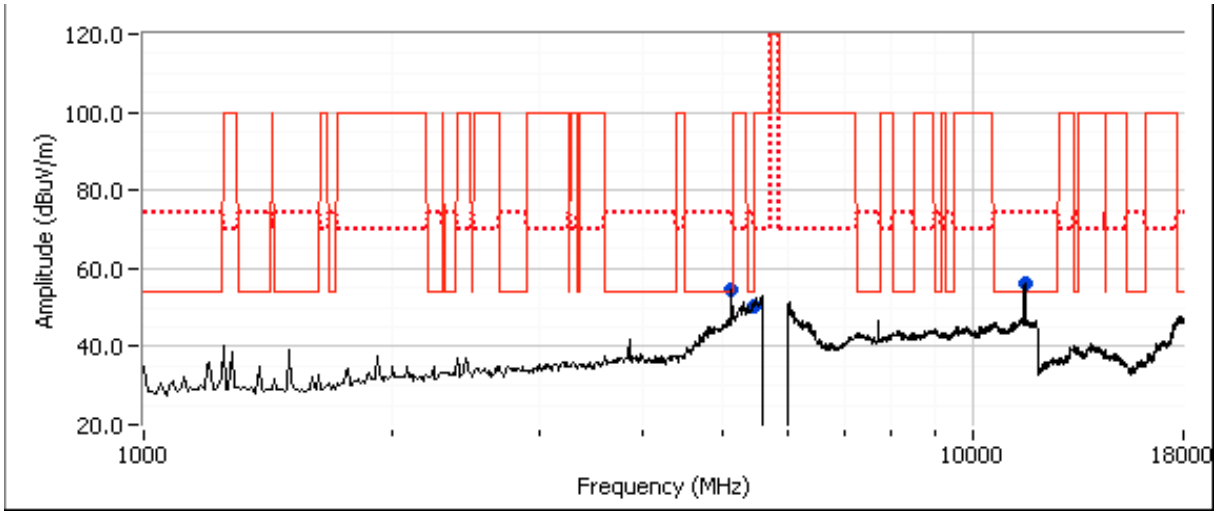
Run #1a: Center Channel @ 5785 MHz, 802.11a

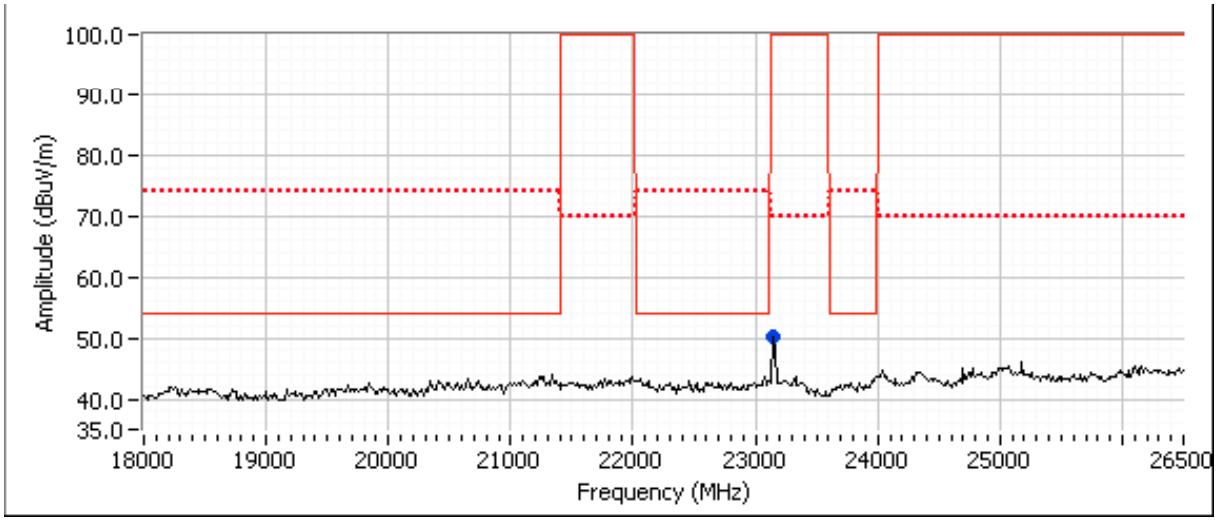
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11572.100	53.5	V	54.0	-0.5	AVG	103	1.3	RB 1 MHz;VB 10 Hz;Peak
11571.900	65.0	V	74.0	-9.0	PK	103	1.3	RB 1 MHz;VB 3 MHz;Peak
5457.880	47.1	V	54.0	-6.9	AVG	195	1.2	RB 1 MHz;VB 10 Hz;Peak
5453.910	58.3	V	74.0	-15.7	PK	195	1.2	RB 1 MHz;VB 3 MHz;Peak
5120.010	50.3	V	54.0	-3.7	AVG	215	1.0	RB 1 MHz;VB 10 Hz;Peak
5119.95	55.9	V	74.0	-18.1	PK	215	1.0	RB 1 MHz;VB 3 MHz;Peak
23142.50	50.1	V	70.0	-19.9	Peak	138	1.0	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	Scans made between 26 - 40GHz with the measurement antenna moved around the device and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

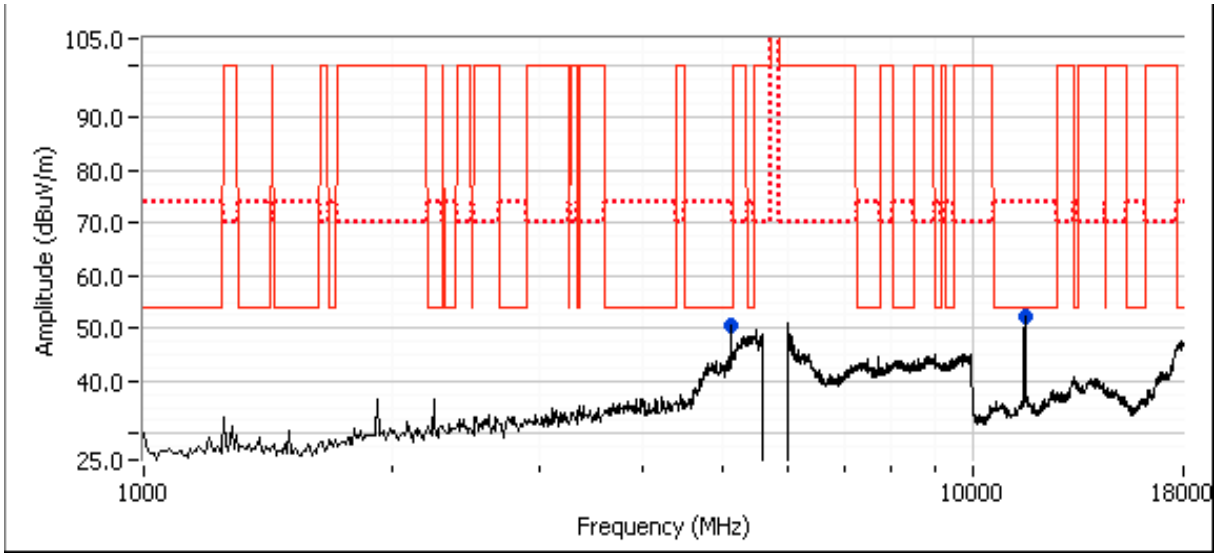
Run #1b: Center Channel @ 5785 MHz, 802.11n 20MHz

Software Setting	Power Settings									
	Target (dBm), Chain					Measured (dBm), Chain				
18	A	B	C	D	Total	A	B	C	D	Total
	-	-	-	-		17.3	17.4	17.8	18.1	23.7

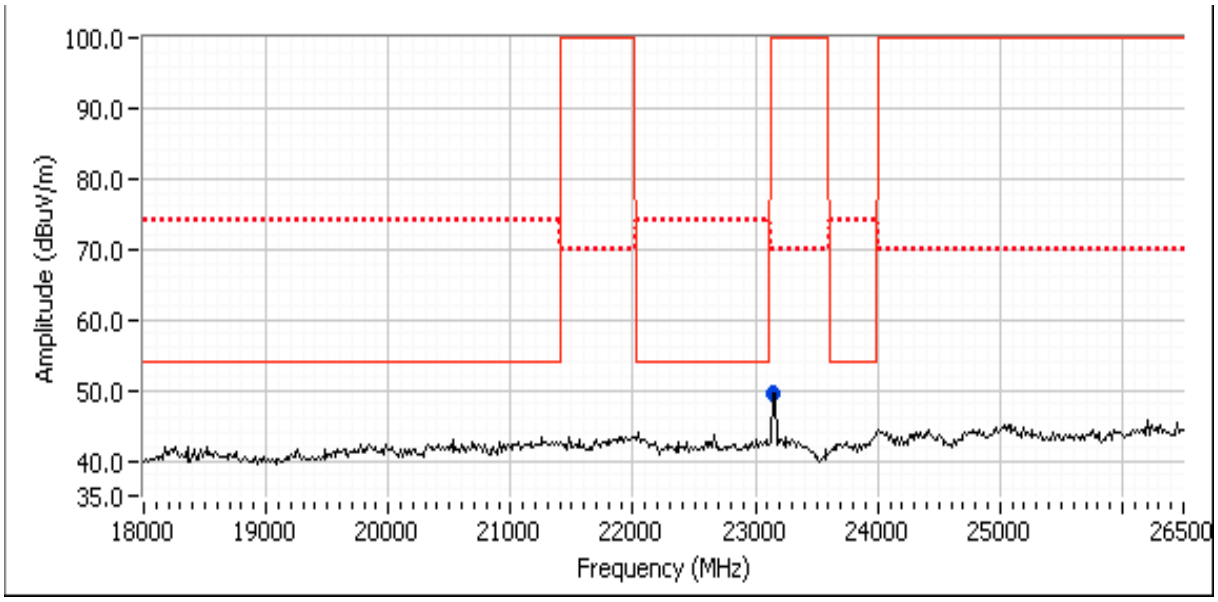
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5120.010	49.3	V	54.0	-4.7	AVG	37	1.0	RB 1 MHz;VB 10 Hz;Peak
11571.130	48.5	V	54.0	-5.5	AVG	124	1.0	RB 1 MHz;VB 10 Hz;Peak
11568.860	60.9	V	74.0	-13.1	PK	124	1.0	RB 1 MHz;VB 3 MHz;Peak
5120.040	58.0	V	74.0	-16.0	PK	37	1.0	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	Scans made between 26 - 40GHz with the measurement antenna moved around the device and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

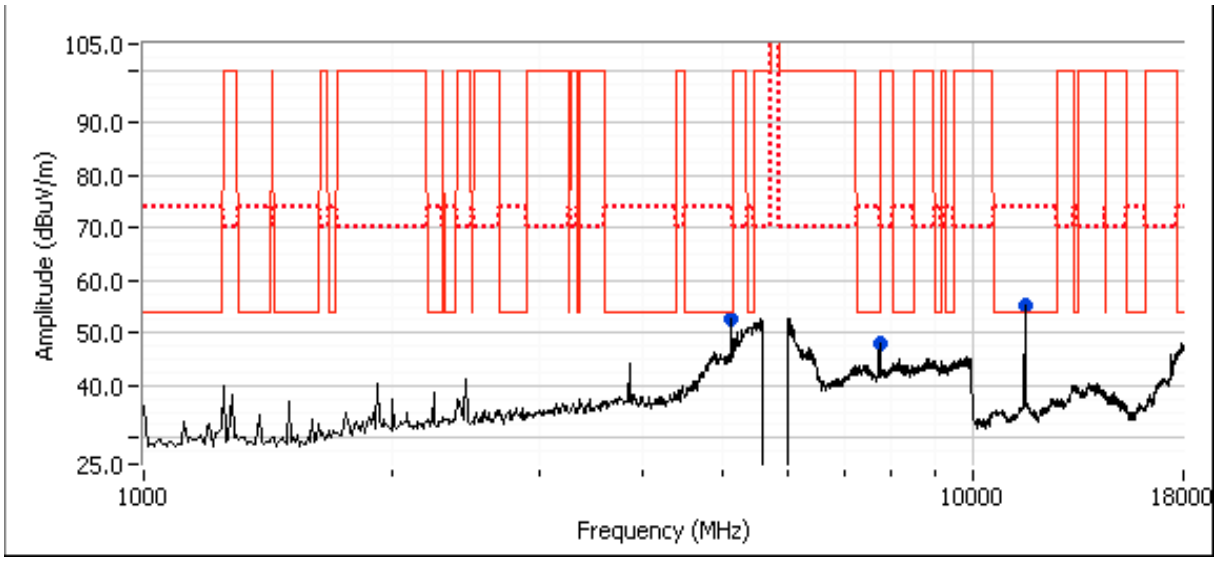
Run #1c: Center Channel @ 5795 MHz, 802.11n 40MHz

Software Setting	Power Settings									
	Target (dBm), Chain					Measured (dBm), Chain				
18	A	B	C	D	Total	A	B	C	D	Total
	-	-	-	-		17.1	17.2	17.5	17.7	23.4

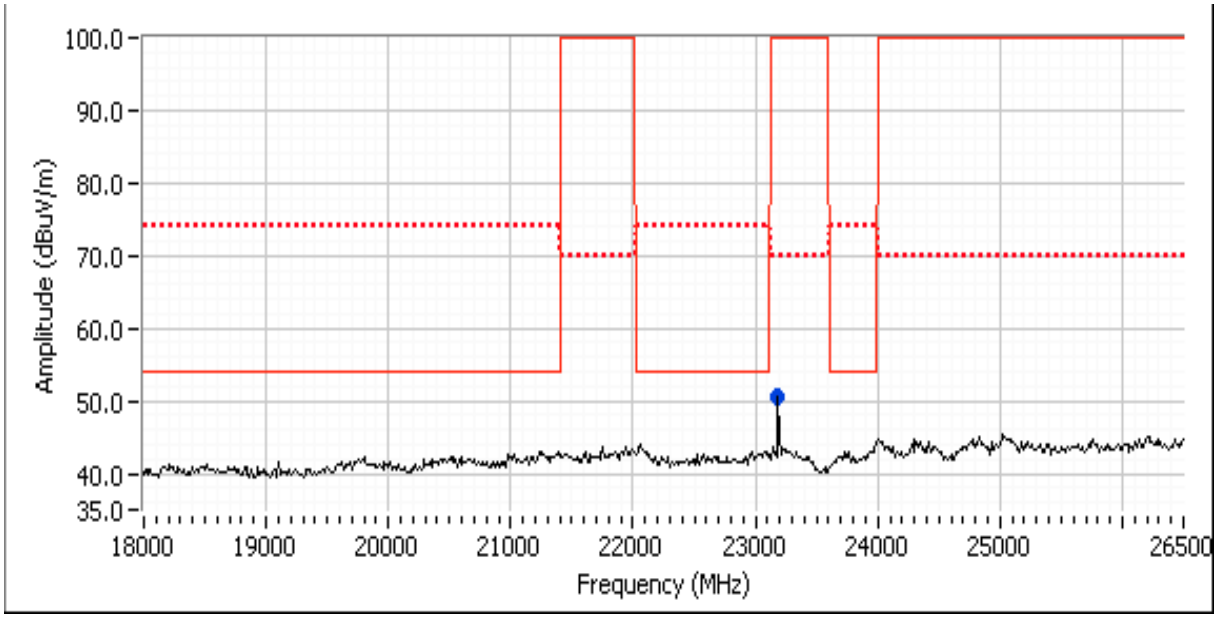
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5119.97	48.2	V	54.0	-5.8	AVG	35	1.0	RB 1 MHz;VB 10 Hz;Peak
11601.14	47.0	V	54.0	-7.0	AVG	124	1.1	RB 1 MHz;VB 10 Hz;Peak
7726.72	45.1	V	54.0	-8.9	AVG	66	1.1	RB 1 MHz;VB 10 Hz;Peak
11585.07	60.5	V	74.0	-13.5	PK	124	1.1	RB 1 MHz;VB 3 MHz;Peak
5119.95	57.0	V	74.0	-17.0	PK	35	1.0	RB 1 MHz;VB 3 MHz;Peak
23180.100	50.6	V	70.0	-19.4	Peak	135	1.0	RB 1 MHz;VB 3 MHz;Peak
23140.05	49.5	V	70.0	-20.5	Peak	130	1.0	RB 1 MHz;VB 3 MHz;Peak
7726.58	53.4	V	74.0	-20.6	PK	66	1.1	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	Scans made between 26 - 40GHz with the measurement antenna moved around the device and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #1c: Low Channel @ 5745 MHz, 802.11a

Date of Test: 5/23/2012 Test Location: FT5

Test Engineer: Joseph Cadigal

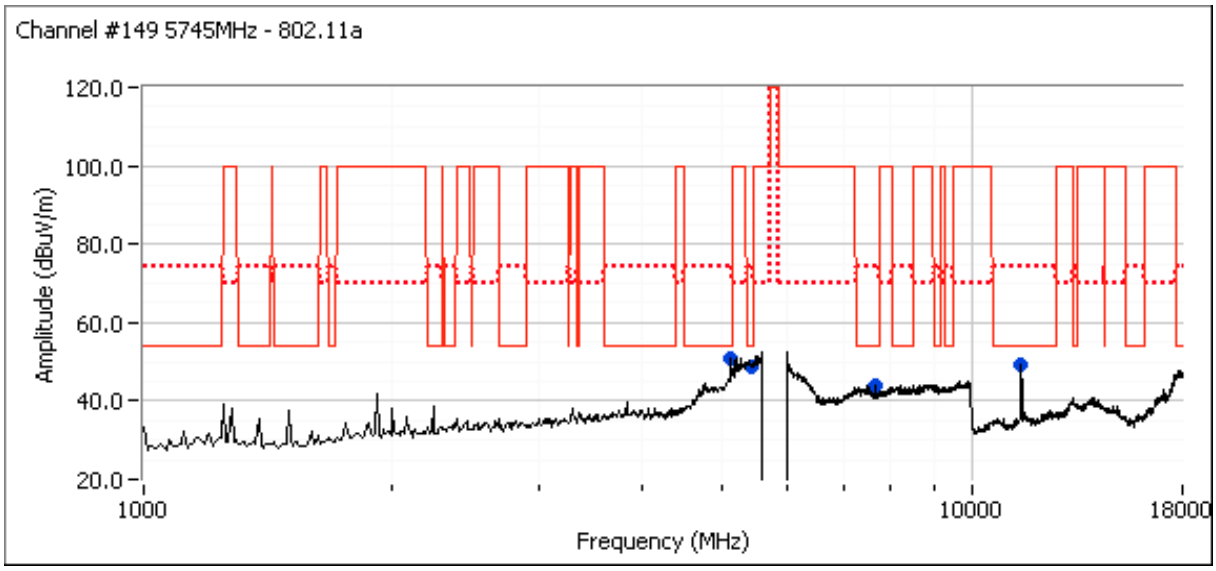
Software Setting	Power Settings									
	Target (dBm), Chain					Measured (dBm), Chain				
18	A	B	C	D	Total	A	B	C	D	Total
	-	-	-	-		17.2	17.4	17.6	17.9	23.6

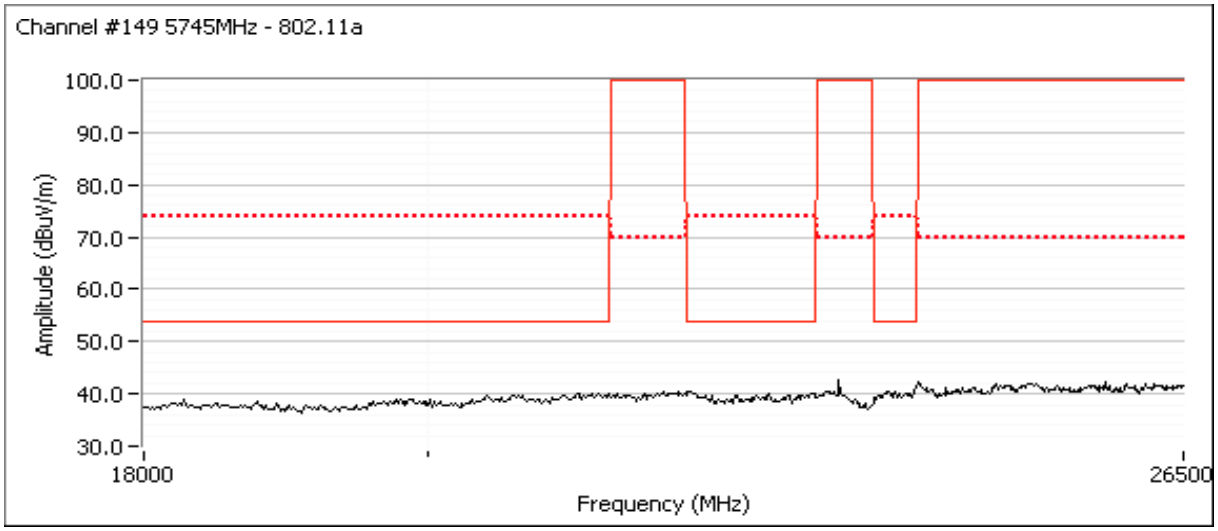
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5119.990	50.4	V	54.0	-3.6	AVG	70	1.0	RB 1 MHz;VB 10 Hz;Peak
5419.280	45.7	V	54.0	-8.3	AVG	166	1.0	RB 1 MHz;VB 10 Hz;Peak
11480.070	42.9	V	54.0	-11.1	AVG	102	1.0	RB 1 MHz;VB 10 Hz;Peak
5418.880	57.3	V	74.0	-16.7	PK	166	1.0	RB 1 MHz;VB 3 MHz;Peak
7659.980	36.9	V	54.0	-17.1	AVG	234	1.5	RB 1 MHz;VB 10 Hz;Peak
5120.250	56.9	V	74.0	-17.1	PK	70	1.0	RB 1 MHz;VB 3 MHz;Peak
11480.600	53.6	V	74.0	-20.4	PK	102	1.0	RB 1 MHz;VB 3 MHz;Peak
7660.120	47.7	V	74.0	-26.3	PK	234	1.5	RB 1 MHz;VB 3 MHz;Peak

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	Scans made between 26 - 40GHz with the measurement antenna moved around the device and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

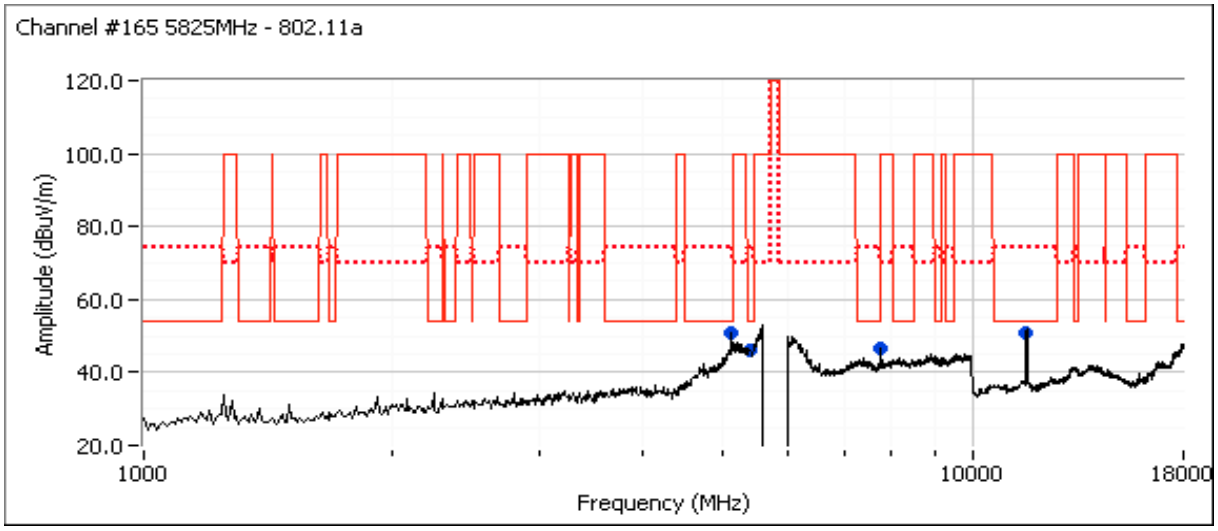
Run #1d: High Channel @ 5825 MHz, 802.11a

Software Setting	Power Settings									
	Target (dBm), Chain					Measured (dBm), Chain				
18	A	B	C	D	Total	A	B	C	D	Total
	-	-	-	-		17.3	17.4	17.8	18.1	23.7

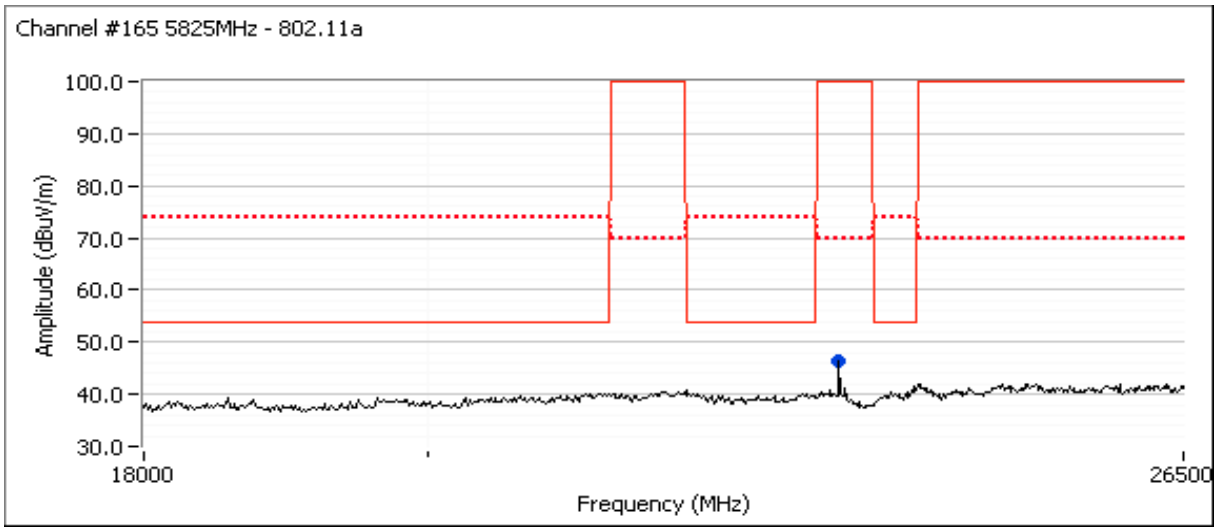
Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
11645.580	45.8	V	54.0	-8.2	AVG	80	1.5	RB 1 MHz;VB 10 Hz;Peak
5120.040	43.9	V	54.0	-10.1	AVG	49	1.0	RB 1 MHz;VB 10 Hz;Peak
5392.360	41.0	V	54.0	-13.0	AVG	49	1.0	RB 1 MHz;VB 10 Hz;Peak
11645.430	56.3	V	74.0	-17.7	PK	80	1.5	RB 1 MHz;VB 3 MHz;Peak
5119.400	53.5	V	74.0	-20.5	PK	49	1.0	RB 1 MHz;VB 3 MHz;Peak
5393.960	52.7	V	74.0	-21.3	PK	49	1.0	RB 1 MHz;VB 3 MHz;Peak
7766.620	48.1	V	70.0	-21.9	PK	103	1.5	RB 1 MHz;VB 3 MHz;Peak
7766.720	37.6	V	100.0	-62.4	AVG	103	1.5	RB 1 MHz;VB 10 Hz;Peak
23312.500	46.3	V	70.0	-23.7	Peak	130	1.0	

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	Scans made between 26 - 40GHz with the measurement antenna moved around the device and its antennas 20-50cm from the device indicated there were no signifcant emissions in this frequency range



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A



Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Radiated Emissions 30-1000 MHz, (FCC 15.247/RSS 210)

(NTS Silicon Valley Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/14/2012
Test Engineer: Jack Liu
Test Location: FT5

Config. Used: 1
Config Change: None
EUT Voltage: 120v/60Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 30 - 1000 MHz	FCC 15.209 / RSS 210	Pass	33.5 dBµV/m @ 54.15 MHz (-6.5 dB)
2	Radiated Emissions 30 - 1000 MHz	FCC 15.209 / RSS 210	Pass	32.8 dBµV/m @ 53.55 MHz (-7.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

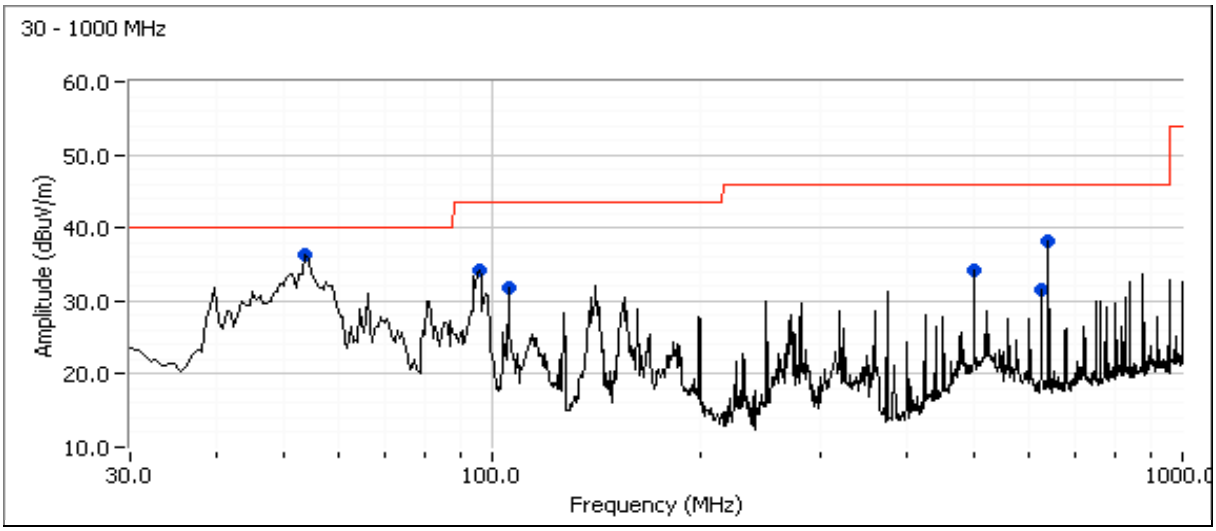
No deviations were made from the requirements of the standard.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz

Configured Radio to Tx, 802.11a 11dBm on each chain (settings 11) on channel 36, Leader Electronics Inc Power Supply

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
54.153	36.2	V	40.0	-3.8	Peak	0	1.0	
95.769	34.2	V	43.5	-9.3	Peak	257	1.0	
105.684	31.8	V	43.5	-11.7	Peak	173	1.0	
499.998	34.1	V	46.0	-11.9	Peak	161	1.0	
624.988	31.5	V	46.0	-14.5	Peak	44	1.0	
640.009	38.1	V	46.0	-7.9	Peak	254	1.0	

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

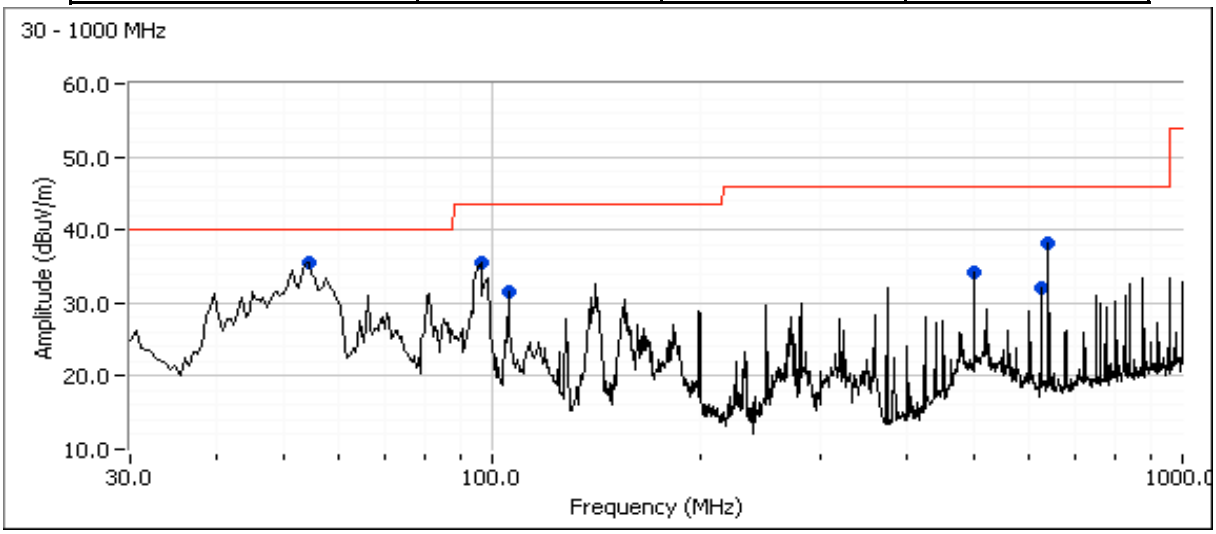
Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
54.153	33.5	V	40.0	-6.5	QP	259	1.0	QP (1.00s)
640.009	37.6	V	46.0	-8.4	QP	255	1.0	QP (1.00s)
95.769	33.4	V	43.5	-10.1	QP	253	1.0	QP (1.00s)
499.998	34.0	V	46.0	-12.0	QP	160	1.0	QP (1.00s)
624.988	31.5	V	46.0	-14.5	QP	43	1.0	QP (1.00s)
105.684	26.5	V	43.5	-17.0	QP	175	1.0	QP (1.00s)

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #2: Preliminary Radiated Emissions, 30 - 1000 MHz

Configured Radio to Tx, 802.11n40 16dBm on each chain (settings 16) on channel 64

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
53.547	35.4	V	40.0	-4.6	Peak	30	1.0	
95.770	35.5	V	43.5	-8.0	Peak	250	1.0	
105.699	31.5	V	43.5	-12.0	Peak	203	1.5	
500.003	34.2	V	46.0	-11.8	Peak	137	1.0	
624.999	32.1	V	46.0	-13.9	Peak	30	1.0	
640.009	38.3	V	46.0	-7.7	Peak	252	1.0	

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
53.547	32.8	V	40.0	-7.2	QP	29	1.0	
640.009	37.6	V	46.0	-8.4	QP	257	1.0	
95.770	31.6	V	43.5	-11.9	QP	211	1.5	
105.699	30.3	V	43.5	-13.2	QP	205	1.5	
500.003	31.0	V	46.0	-15.0	QP	136	1.0	
624.999	29.4	V	46.0	-16.6	QP	29	1.0	

Note:	As the emissions observed below 1GHz were independent of the mode and frequency of the transmitters, additional modes and frequencies were not tested for emissions below 1GHz.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Conducted Emissions(FCC 15.247/RSS 210)

(NTS Silicon Valley Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 5/14/2012
Test Engineer: Jack Liu
Test Location: FT5

Config. Used: 1
Config Change: None
EUT Voltage: 120v/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	RSS 210 / 15.207	Pass	44.4 dBµV @ 0.379 MHz (-3.9 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

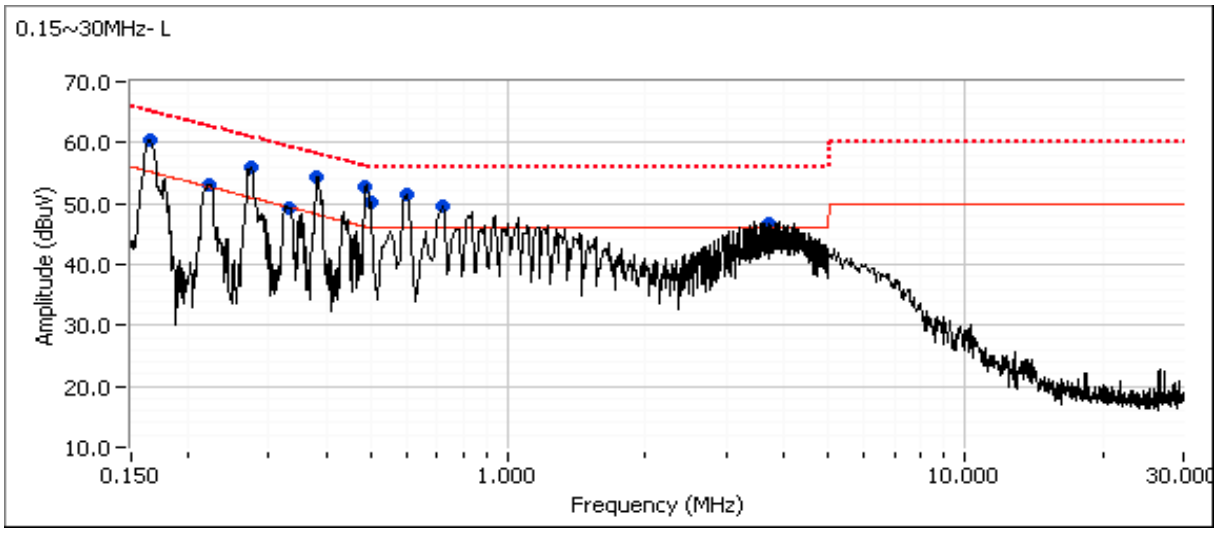
Deviations From The Standard

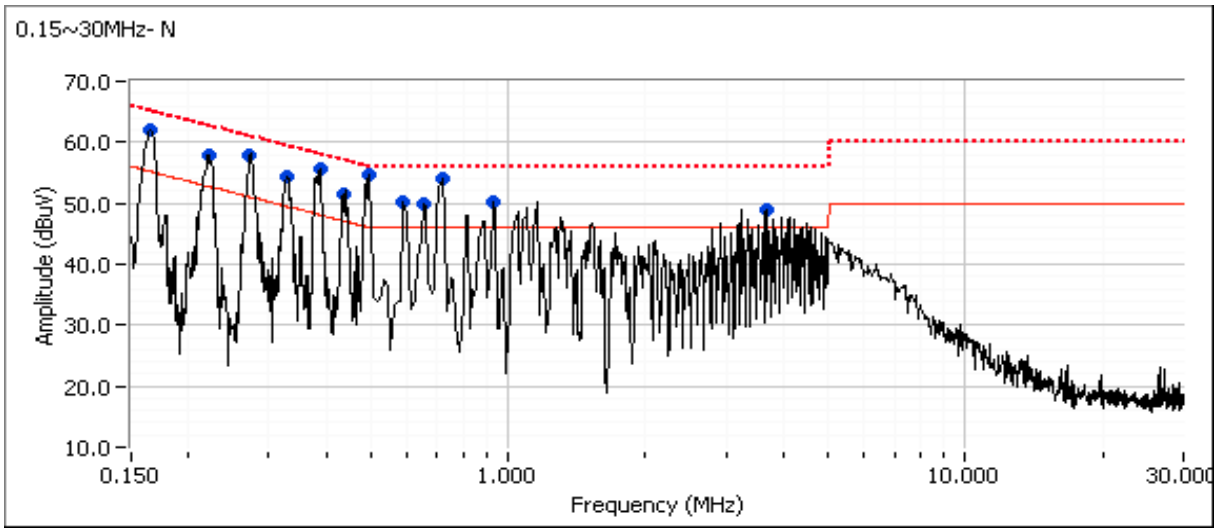
No deviations were made from the requirements of the standard.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz

Leader Electronics Inc Power Supply





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	RSS 210 / 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.163	60.4	Line	55.2	5.2	Peak	
0.218	53.1	Line	52.7	0.4	Peak	
0.272	55.8	Line	51.0	4.8	Peak	
0.332	49.3	Line	49.4	-0.1	Peak	
0.379	54.3	Line	48.2	6.1	Peak	
0.490	52.8	Line	46.2	6.6	Peak	
3.700	46.8	Line	46.0	0.8	Peak	
0.611	51.6	Line	46.0	5.6	Peak	
0.498	50.1	Line	46.0	4.1	Peak	
0.721	49.7	Line	46.0	3.7	Peak	
0.163	61.9	Neutral	55.2	6.7	Peak	
0.219	57.9	Neutral	52.8	5.1	Peak	
0.272	58.0	Neutral	51.0	7.0	Peak	
0.326	54.3	Neutral	49.5	4.8	Peak	
0.386	55.6	Neutral	48.1	7.5	Peak	
0.440	51.5	Neutral	47.1	4.4	Peak	
0.496	54.6	Neutral	46.1	8.5	Peak	
0.708	54.0	Neutral	46.0	8.0	Peak	
0.608	50.0	Neutral	46.0	4.0	Peak	
0.607	50.2	Neutral	46.0	4.2	Peak	
0.936	50.1	Neutral	46.0	4.1	Peak	
3.685	48.8	Neutral	46.0	2.8	Peak	

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Final quasi-peak and average readings

Frequency	Level	AC	RSS 210 / 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.379	44.4	Line	48.3	-3.9	AVG	AVG (0.10s)
0.496	52.0	Neutral	56.1	-4.1	QP	QP (1.00s)
0.271	56.7	Neutral	61.1	-4.4	QP	QP (1.00s)
0.219	48.3	Neutral	52.9	-4.6	AVG	AVG (0.10s)
0.607	51.4	Neutral	56.0	-4.6	QP	QP (1.00s)
0.162	60.6	Neutral	65.4	-4.8	QP	QP (1.00s)
0.272	46.0	Line	51.1	-5.1	AVG	AVG (0.10s)
0.608	50.8	Neutral	56.0	-5.2	QP	QP (1.00s)
0.490	50.7	Line	56.2	-5.5	QP	QP (1.00s)
0.490	40.6	Line	46.2	-5.6	AVG	AVG (0.10s)
0.379	52.7	Line	58.3	-5.6	QP	QP (1.00s)
0.219	57.2	Neutral	62.9	-5.7	QP	QP (1.00s)
0.386	52.3	Neutral	58.1	-5.8	QP	QP (1.00s)
0.163	59.2	Line	65.3	-6.1	QP	QP (1.00s)
0.272	54.8	Line	61.1	-6.3	QP	QP (1.00s)
0.498	49.7	Line	56.0	-6.3	QP	QP (1.00s)
0.326	43.2	Neutral	49.6	-6.4	AVG	AVG (0.10s)
0.326	53.2	Neutral	59.6	-6.4	QP	QP (1.00s)
0.271	44.6	Neutral	51.1	-6.5	AVG	AVG (0.10s)
0.218	46.3	Line	52.9	-6.6	AVG	AVG (0.10s)
0.707	49.2	Neutral	56.0	-6.8	QP	QP (1.00s)
0.163	48.3	Line	55.3	-7.0	AVG	AVG (0.10s)
0.936	48.6	Neutral	56.0	-7.4	QP	QP (1.00s)
0.707	38.4	Neutral	46.0	-7.6	AVG	AVG (0.10s)
0.162	47.6	Neutral	55.4	-7.8	AVG	AVG (0.10s)
0.721	47.6	Line	56.0	-8.4	QP	QP (1.00s)
0.611	47.4	Line	56.0	-8.6	QP	QP (1.00s)
0.440	48.5	Neutral	57.1	-8.6	QP	QP (1.00s)
0.386	37.9	Neutral	48.1	-10.2	AVG	AVG (0.10s)
0.496	35.9	Neutral	46.1	-10.2	AVG	AVG (0.10s)
0.332	48.8	Line	59.4	-10.6	QP	QP (1.00s)
3.685	45.2	Neutral	56.0	-10.8	QP	QP (1.00s)
0.218	51.9	Line	62.9	-11.0	QP	QP (1.00s)
0.607	33.4	Neutral	46.0	-12.6	AVG	AVG (0.10s)
0.440	34.3	Neutral	47.1	-12.8	AVG	AVG (0.10s)
0.608	32.6	Neutral	46.0	-13.4	AVG	AVG (0.10s)
0.498	32.1	Line	46.0	-13.9	AVG	AVG (0.10s)
0.332	35.1	Line	49.4	-14.3	AVG	AVG (0.10s)
3.685	31.0	Neutral	46.0	-15.0	AVG	AVG (0.10s)

continues

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Frequency	Level	AC	RSS 210 / 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.936	29.5	Neutral	46.0	-16.5	AVG	AVG (0.10s)
0.611	28.4	Line	46.0	-17.6	AVG	AVG (0.10s)
0.721	28.0	Line	46.0	-18.0	AVG	AVG (0.10s)
3.700	37.1	Line	56.0	-18.9	QP	QP (1.00s)
3.700	23.5	Line	46.0	-22.5	AVG	AVG (0.10s)

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Radiated Emissions 30-1000 MHz, (FCC 15.247/RSS 210)

(NTS Silicon Valley Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/25/2012
Test Engineer: Michael Findley
Test Location: FT4
Config. Used: 1
Config Change: None
EUT Voltage: 120v/60Hz

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measuremen

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 30 - 1000 MHz	FCC 15.209 / RSS 210	Pass	33.5 dBµV/m @ 55.90 MHz (-6.5 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

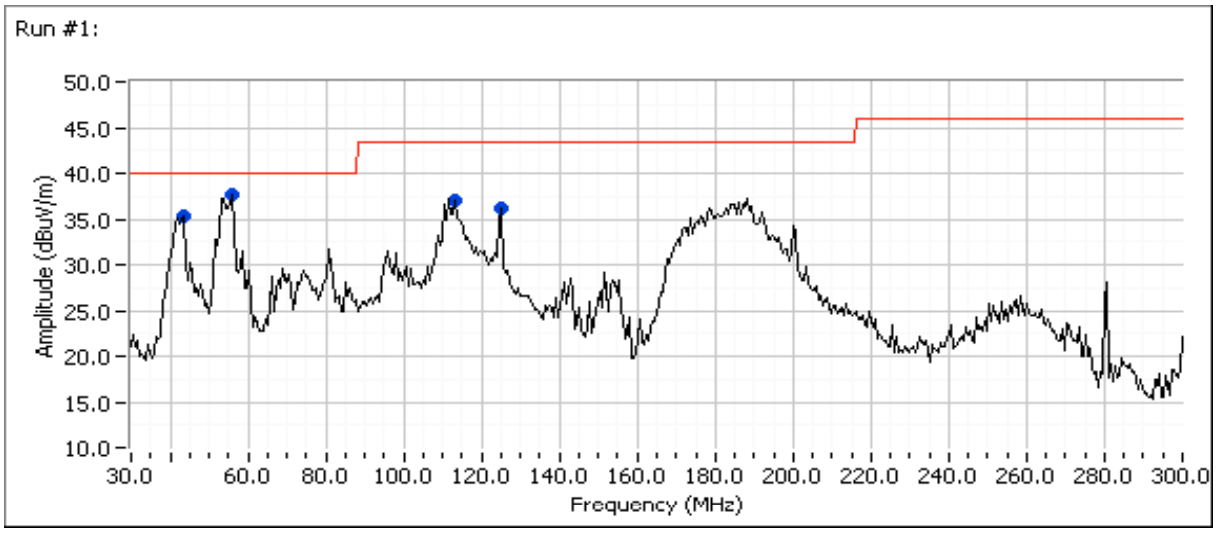
No deviations were made from the requirements of the standard.

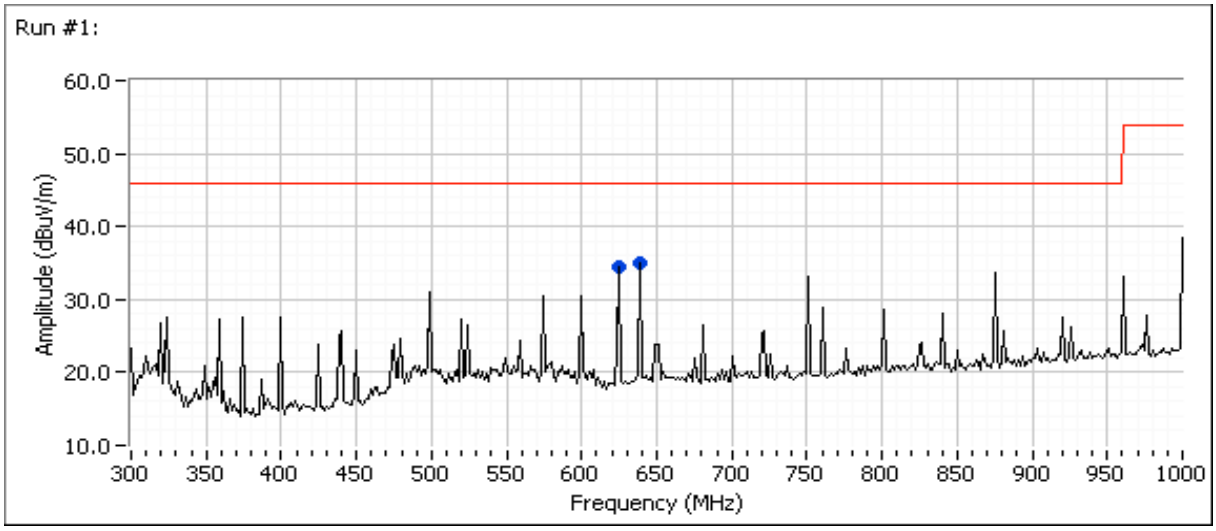
Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz

Configured Radio to Tx, 802.11a, N20, 18dBm on each chain (settings 18) on channel 157, Asian Power Devices Power Supply

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 1000 MHz	3	3	0.0





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	N/A

Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
125.006	36.2	V	43.5	-7.3	Peak	340	1.0	
42.985	35.3	V	40.0	-4.7	Peak	306	1.0	
112.194	37.0	V	43.5	-6.5	Peak	303	1.0	
640.009	35.1	V	46.0	-10.9	Peak	276	1.0	
55.897	37.6	V	40.0	-2.4	Peak	107	1.0	
625.005	34.5	V	46.0	-11.5	Peak	57	1.0	

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	FCC 15.209 / RSS 210		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
55.897	33.5	V	40.0	-6.5	QP	0	1.0	QP (1.00s)
42.985	31.4	V	40.0	-8.6	QP	360	1.0	QP (1.00s)
125.006	34.6	V	43.5	-8.9	QP	341	1.0	QP (1.00s)
112.194	31.1	V	43.5	-12.4	QP	290	1.0	QP (1.00s)
640.009	33.0	V	46.0	-13.0	QP	277	1.0	QP (1.00s)
625.005	32.3	V	46.0	-13.7	QP	64	1.0	QP (1.00s)

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Conducted Emissions(FCC 15.247/RSS 210)

(NTS Silicon Valley Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

Date of Test: 6/25/2012
Test Engineer: Michael Findley
Test Location: FT4
Config. Used: 1
Config Change: None
EUT Voltage: 120v/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power,120V/60Hz	RSS 210 / 15.207	Pass	35.4 dBµV @ 0.406 MHz (-12.3 dB)

Modifications Made During Testing

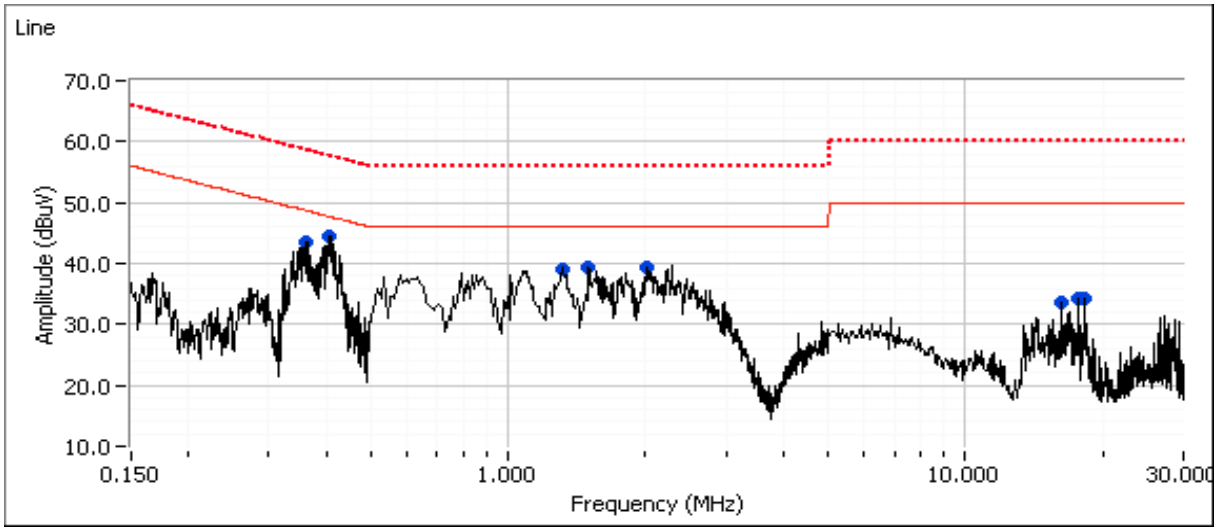
No modifications were made to the EUT during testing

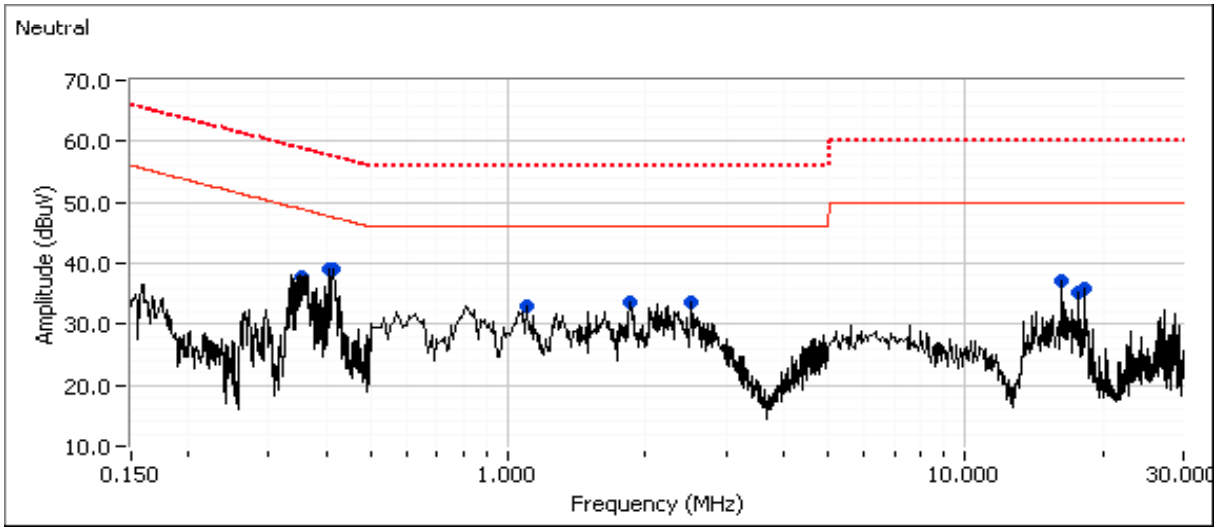
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz
Asian Power Devices Power Supply





Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	RSS 210 / 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.406	44.6	Line 1	47.7	-3.1	Peak	
0.357	43.4	Line 1	48.7	-5.3	Peak	
1.516	39.4	Line 1	46.0	-6.6	Peak	
1.308	39.1	Line 1	46.0	-6.9	Peak	
2.029	39.3	Line 1	46.0	-6.7	Peak	
16.229	33.6	Line 1	50.0	-16.4	Peak	
16.168	33.6	Line 1	50.0	-16.4	Peak	
17.694	34.1	Line 1	50.0	-15.9	Peak	
18.244	34.3	Line 1	50.0	-15.7	Peak	
18.304	34.3	Line 1	50.0	-15.7	Peak	
0.357	37.8	Neutral	48.8	-11.0	Peak	
0.353	37.8	Neutral	48.8	-11.0	Peak	
0.403	39.2	Neutral	47.7	-8.5	Peak	
0.410	38.9	Neutral	47.6	-8.7	Peak	
2.549	33.5	Neutral	46.0	-12.5	Peak	
1.856	33.5	Neutral	46.0	-12.5	Peak	
1.109	33.1	Neutral	46.0	-12.9	Peak	

Client:	Motorola	Job Number:	J87247
Model:	VAP2500	T-Log Number:	T87276
		Account Manager:	Christine Krebill
Contact:	Rob Linebarger		
Standard:	FCC	Class:	B

Final quasi-peak and average readings

Frequency	Level	AC	RSS 210 / 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.406	35.4	Line 1	47.7	-12.3	AVG	AVG (0.10s)
0.357	35.6	Line 1	48.8	-13.2	AVG	AVG (0.10s)
0.406	42.6	Line 1	57.7	-15.1	QP	QP (1.00s)
0.357	42.6	Line 1	58.8	-16.2	QP	QP (1.00s)
1.308	28.2	Line 1	46.0	-17.8	AVG	AVG (0.10s)
0.403	30.0	Neutral	47.8	-17.8	AVG	AVG (0.10s)
0.357	30.0	Neutral	48.8	-18.8	AVG	AVG (0.10s)
0.410	28.8	Neutral	47.6	-18.8	AVG	AVG (0.10s)
0.353	29.8	Neutral	48.9	-19.1	AVG	AVG (0.10s)
2.029	26.4	Line 1	46.0	-19.6	AVG	AVG (0.10s)
0.403	37.8	Neutral	57.8	-20.0	QP	QP (1.00s)
1.308	35.8	Line 1	56.0	-20.2	QP	QP (1.00s)
1.516	25.4	Line 1	46.0	-20.6	AVG	AVG (0.10s)
16.229	29.0	Line 1	50.0	-21.0	AVG	AVG (0.10s)
1.516	35.0	Line 1	56.0	-21.0	QP	QP (1.00s)
0.357	37.8	Neutral	58.8	-21.0	QP	QP (1.00s)
0.410	36.6	Neutral	57.6	-21.0	QP	QP (1.00s)
2.029	34.9	Line 1	56.0	-21.1	QP	QP (1.00s)
0.353	37.6	Neutral	58.9	-21.3	QP	QP (1.00s)
16.168	27.8	Line 1	50.0	-22.2	AVG	AVG (0.10s)
17.694	27.5	Line 1	50.0	-22.5	AVG	AVG (0.10s)
18.244	26.7	Line 1	50.0	-23.3	AVG	AVG (0.10s)
1.109	22.1	Neutral	46.0	-23.9	AVG	AVG (0.10s)
18.304	25.1	Line 1	50.0	-24.9	AVG	AVG (0.10s)
1.856	21.1	Neutral	46.0	-24.9	AVG	AVG (0.10s)
16.229	34.5	Line 1	60.0	-25.5	QP	QP (1.00s)
2.549	19.9	Neutral	46.0	-26.1	AVG	AVG (0.10s)
1.109	29.6	Neutral	56.0	-26.4	QP	QP (1.00s)
16.168	33.4	Line 1	60.0	-26.6	QP	QP (1.00s)
1.856	28.4	Neutral	56.0	-27.6	QP	QP (1.00s)
17.694	32.2	Line 1	60.0	-27.8	QP	QP (1.00s)
18.244	31.4	Line 1	60.0	-28.6	QP	QP (1.00s)
2.549	27.4	Neutral	56.0	-28.6	QP	QP (1.00s)
18.304	29.7	Line 1	60.0	-30.3	QP	QP (1.00s)

End of Report

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