TEST REPORT

Report Number: 100681263MPK-005
Project Number: G100681263
May 25, 2012

Testing performed on the
Wireless Print Server RF Module
Model Number: LEX-M01-005
FCC ID: IYLLEXM01005
IC ID: 2376A-M01005

to
FCC Part 15 Subpart C (15.247)
RSS-210 Issue 8
FCC Part 15, Subpart B
Industry Canada ICES-003

for

Lexmark International, Inc.

Test Performed by:	Test Authorized by:
Intertek	Lexmark International, Inc.
1365 Adams Court	740 New Circle Road, NW F61/004-2
Menlo Park, CA 94025 USA	Lexington, KY 40511, USA

Prepared by: _____ **Date:** May 25, 2012
Krishna K Vemuri

Reviewed by: _____ **Date:** May 25, 2012
Ollie Moyrongr

Report No. 100681263MPK-005

Equipment Under Test:	Wireless Print Server RF Module
Trade Name:	Lexmark International, Inc.
Model No.:	LEX-M01-005
Serial No.:	MPK1204051030-003**,** MPK1204051030-004
Applicant:	Lexmark International, Inc.
Contact:	Mr. Michael Klave
Address:	740 New Circle Road, NW F61/004-2 Lexington, KY 40511
Country	USA
Tel. Number:	(859) 232-3512
Email:	klavem@lexmark.com
Applicable Regulation:	FCC Part 15 Subpart C (15.247) RSS-210 Issue 8 FCC Part 15, Subpart B Industry Canada ICES-003
Date of Test:	April 02 to April 24, 2012

We attest to the accuracy of this report:

Krishna K Vemuri
EMC Senior Staff Engineer

Ollie Moyrong
Engineering Manager

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1.0 Summary of Tests

Test	Reference FCC	Reference RSS	Result
RF Output Power	15.247(b)(3)	A8.4(4)	Complies
6 dB Bandwidth	15.247(a)(2)	A8.2(a)	Complies
Power Density	15.247(e)	A8.2(b)	Complies
Out of Band Antenna Conducted Emission	15.247(d)	A8.5	Complies
Transmitter Radiated Emissions	15.247(d), 15.209, 15.205	A8.5, 2.2	Complies
AC Conducted Emission	15.207	RSS-Gen	Complies
Radiated Emission from Digital Part and Receiver	15.109	ICES-003	Complies
Antenna Requirement	15.203	RSS-Gen	Complies. The EUT uses PCB antenna or unique antenna connector
RF Exposure	15.247(i)	RSS-102	Complies

EUT receive date: April 02, 2012
EUT receive condition: The pre-production version of the EUT was received in good condition with no apparent damage. As declared by the Applicant, it is identical to the production units.
Test start date: April 02, 2012
Test completion date: April 24, 2012
The test results in this report pertain only to the item tested.

2.0 General Information

2.1 Product Description

The Equipment Under Test (EUT) is a Wireless Print Server RF Module, model: LEX-M01-005. It consists of one 2.4 GHz radio and one 5GHz radio, which will be installed in various printer models. This test report covers only the 5GHz radio. A separate test report, report # 100596665LEX-001, covers the 2.4GHz radio band and report # 100681263MPK-001, covers the other 5GHz radio bands (5150 – 5250 MHz, 5250 – 5350 MHz and 5470 – 5725 MHz). The RF Module contains two antenna ports, Antenna Port 1 is PCB antenna and Antenna Port 2 is PCB antenna or external antenna. The EUT can operate with any one of the antenna ports, but they can never operate at the same time.

The EUT supports a wide range of data rates in the 5GHz band:

IEEE 802.11a: 54, 48, 36, 24, 18, 12, 9, 6Mbps
IEEE 802.11n: MCS0, MCS1, MCS2, MCS3, MCS4, MCS5, MCS6, MCS7
Note: in 802.11n HT20 an 802.11n HT40 modes, the nominal bandwidth is 20 MHz and 40 MHz respectively.

Information about the 5GHz radio, installed in the model LEX-M01-005, is presented below:

Applicant	Lexmark International, Inc.
Model No.	LEX-M01-005
FCC Identifier	FCC ID: IYLLEXM01005
IC Identifier	IC ID: 2376A-M01005
Use of Product	Wireless Print Server RF Module
Modulation Technique	OFDM
Rated RF Output	14.5mW or 11.6dBm (average)
Frequency Range	5150 – 5250 MHz 5250 – 5350 MHz 5470 – 5725 MHz 5725 – 5850 MHz
Type of modulation	64-QAM, 16-QAM, QPSK, BPSK
Number of Channel(s)	IEEE 802.11a, IEEE 802.11n HT20 5150 – 5250 MHz 5180MHz, 5200MHz, 5220MHz, 5240MHz 5250 – 5350 MHz 5260MHz, 5280MHz, 5300MHz, 5320MHz 5470 – 5725 MHz 5500MHz, 5520MHz, 5540MHz, 5560MHz, 5580MHz, 5680MHz, 5700MHz 5725 – 5850 MHz 5745MHz, 5765MHz, 5785MHz, 5805MHz, 5825MHz IEEE 802.11n HT40 5150 – 5250 MHz 5190MHz, 5230MHz 5250 – 5350 MHz 5270MHz, 5310MHz 5470 – 5725 MHz 5510MHz, 5550MHz, 5670MHz 5725 – 5850 MHz 5755MHz, 5795MHz
Antenna(s) & Gain	Internal antenna: PCB antenna, 1.8dBi to 5.6dBi peak gain External antenna: Omni-directional, 3dBi to 3.6dBi peak gain, IPEX U.FL connector
Manufacturer Name & Address	Lexmark International, Inc. 740 New Circle Road, NW F61/004-2 Lexington, KY 40511, USA

The EUT supports the following configurations:

Channels in 5150 – 5250 MHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
36	5180	√	X		
38	5190			√	X
40	5200	√	X		
44	5220	√			
46	5230			√	X
48	5240	√	X		

Channels in 5250 – 5350 MHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
52	5260	√	X		
54	5270			√	X
56	5280	√			
60	5300	√	X		
62	5310			√	X
64	5320	√	X		

Channels in 5470 – 5725 MHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
100	5500	√	X		
102	5510			√	X
104	5520	√			
108	5540	√			
110	5550			√	X
112	5560	√			
116	5580	√	X		
134	5670			√	X
136	5680	√			
140	5700	√	X		

Channels in 5725 – 5850 MHz band					
Number	Frequency, MHz	a/n HT20 mode		n HT40 mode	
149	5745	√	X		
151	5755			√	X
153	5765	√			
157	5785	√	X		
159	5795			√	X
161	5805	√			
165	5825	√	X		

List of channels:
√ - available
X - tested

2.2 Related Submittal(s) Grants

None.

2.3 Test Methodology

Antenna conducted measurements were performed according to the procedure “Measurement of Digital Transmission Systems Operating under Section 15.247”.

Both AC mains line-conducted and radiated emissions measurements were performed according to the procedures in ANSI C63.4. Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Data Sheet"** of this Application.

All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The test site used to collect the radiated data is site 1 (10-m semi-anechoic chamber). This test facility and site measurement data have been fully placed on file with the FCC, IC and A2LA accredited.

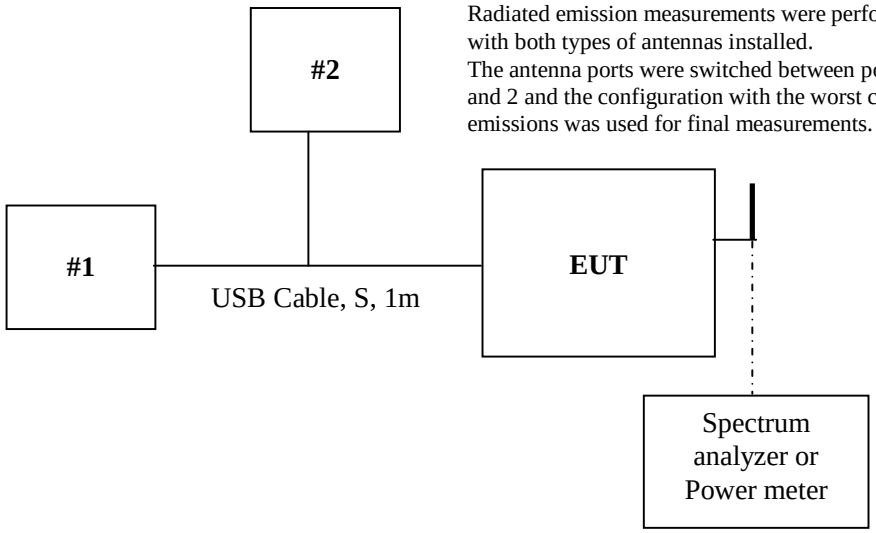
3.0 System Test Configuration

3.1 Support Equipment

Item #	Description	Model No.	Serial No.
1	Compaq Laptop	nc6400	CND7062PVK
2	EXTECH Power Supply	EP-3003	D30030012

3.2 Block Diagram of Test Setup

EUT can be configured with either 2 internal PCB antennas for ports 1 and 2, or with 1 internal PCB antenna on port 1 and 1 external antenna on port 2. Radiated emission measurements were performed with both types of antennas installed.
The antenna ports were switched between ports 1 and 2 and the configuration with the worst case emissions was used for final measurements.



S = Shielded	**F** = With Ferrite
U = Unshielded	**m** = Length in Meters

3.3 Justification

Preliminary testing was performed for all modulation/data rate modes. The following modes, in which the highest power was detected, were selected for final measurements:
OFDM, 6 Mbps – for 802.11a
OFDM, MCS0 – for 802.11n HT20
OFDM, MCS0 – for 802.11n HT40

3.4 Mode of Operation During Test

During transmitter testing, the transmitter was setup to transmit continuously at maximum RF power on low, middle and high channels.

3.5 Modifications Required for Compliance

Intertek installed no modifications during compliance testing in order to bring the product into compliance.

3.6 Additions, Deviations and Exclusions from Standards

No additions, deviations or exclusions from the standard were made.

4.0 Measurement Results

4.1 26-dB Bandwidth, 6-dB Bandwidth and Occupied Bandwidth
FCC Rule 15.247(a)(2)

4.1.1 Requirement

The minimum 6-dB bandwidth shall be at least 500 kHz

4.1.2 Procedure

The Procedure described in the FCC Publication 558074 was used.

The antenna port of the EUT was connected to the input of a spectrum analyzer (SA). For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. A PEAK output reading was taken, a DISPLAY line was drawn 26 dB or 6 dB lower than PEAK level. The 26-dB or 6-dB bandwidth was determined from where the channel output spectrum intersected the display line.

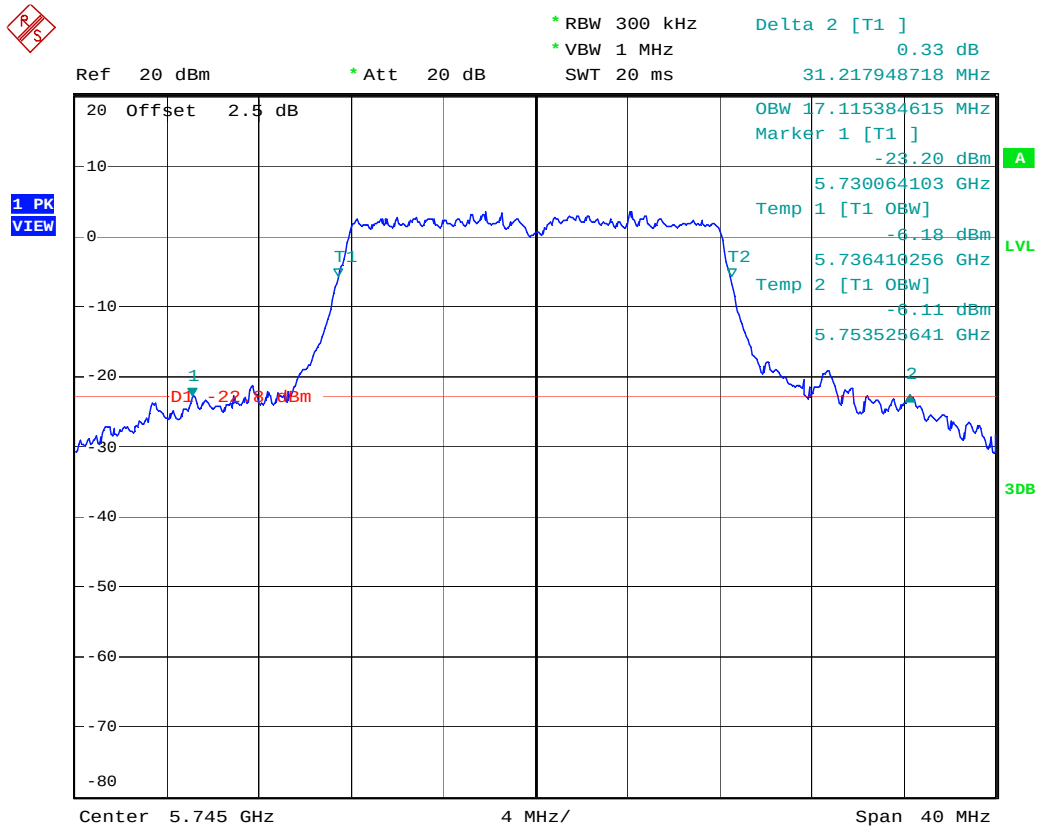
The occupied bandwidth was measured using the built-in spectrum analyzer function for 99% power bandwidth measurement.

4.1.3 Test Result

Channel	Frequency MHz	Standard/ Data rate	26-dB Bandwidth, MHz	Occupied Bandwidth, MHz	6-dB Bandwidth, MHz	Plot #
149	5745	802.11a 6 Mbps	31.2	17.1	16.6	1.1 1.9
		802.11n HT20 MCS0	31.4	18.2	17.9	1.2 1.10
151	5755	802.11n HT40 MCS0	51.2	36.4	36.8	1.7 1.15
157	5785	802.11a 6 Mbps	31.3	17.1	17.9	1.4 1.12
		802.11n HT20 MCS0	32.8	18.2	17.9	1.3 1.11
159	5795	802.11n HT40 MCS0	50.8	36.4	36.8	1.8 1.16
165	5825	802.11a 6 Mbps	28.7	17.1	16.6	1.5 1.13
		802.11n HT20 MCS0	30.2	18.1	17.9	1.6 1.14

On plots 1.1 – 1.16 the 26-dB bandwidth, 6-dB Bandwidth and Occupied Bandwidth are presented.

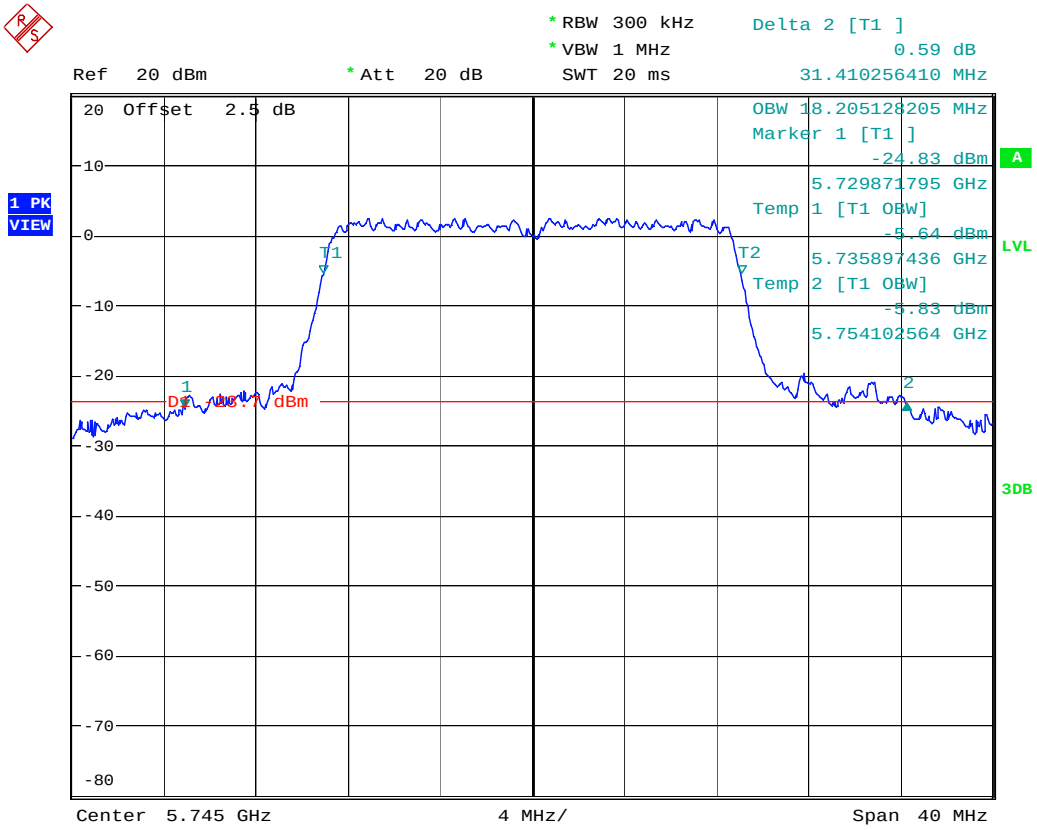
Plot 1. 1



26-dB bandwidth and OBW, 802.11a, 6Mbps

Date: 6.APR.2012 11:37:41

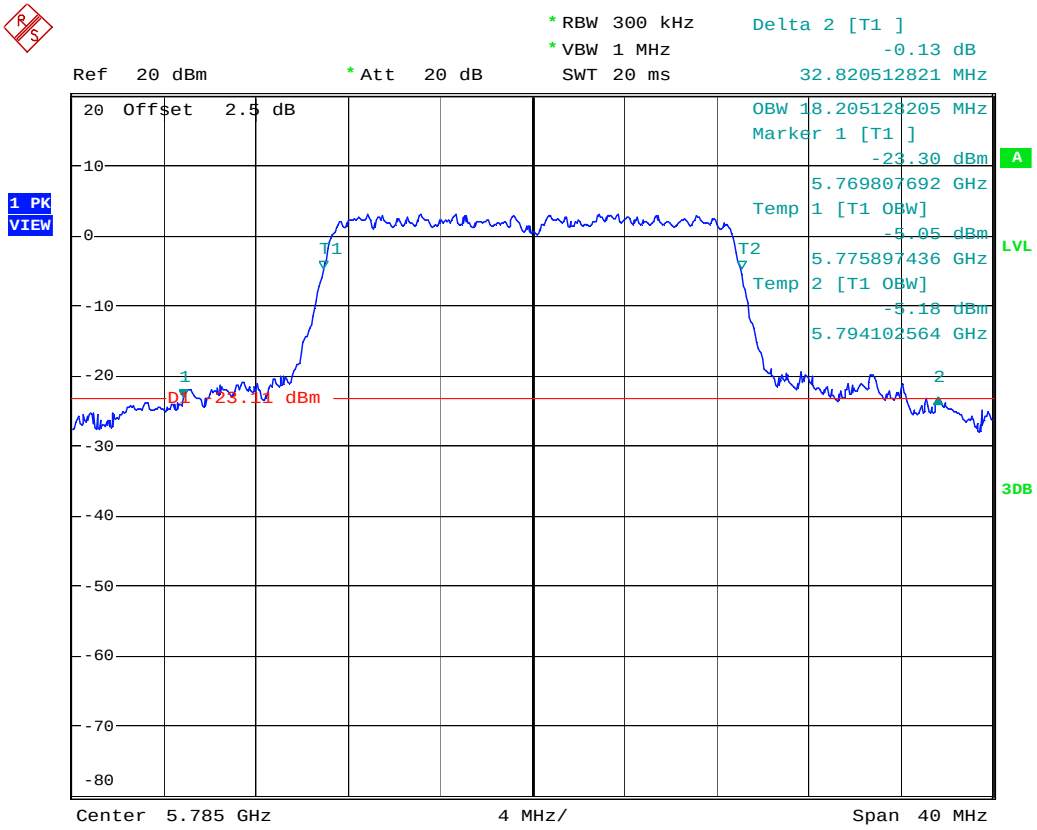
Plot 1. 2



26-dB bandwidth and OBW, 802.11n, HT20, MCS0

Date: 6.APR.2012 11:40:49

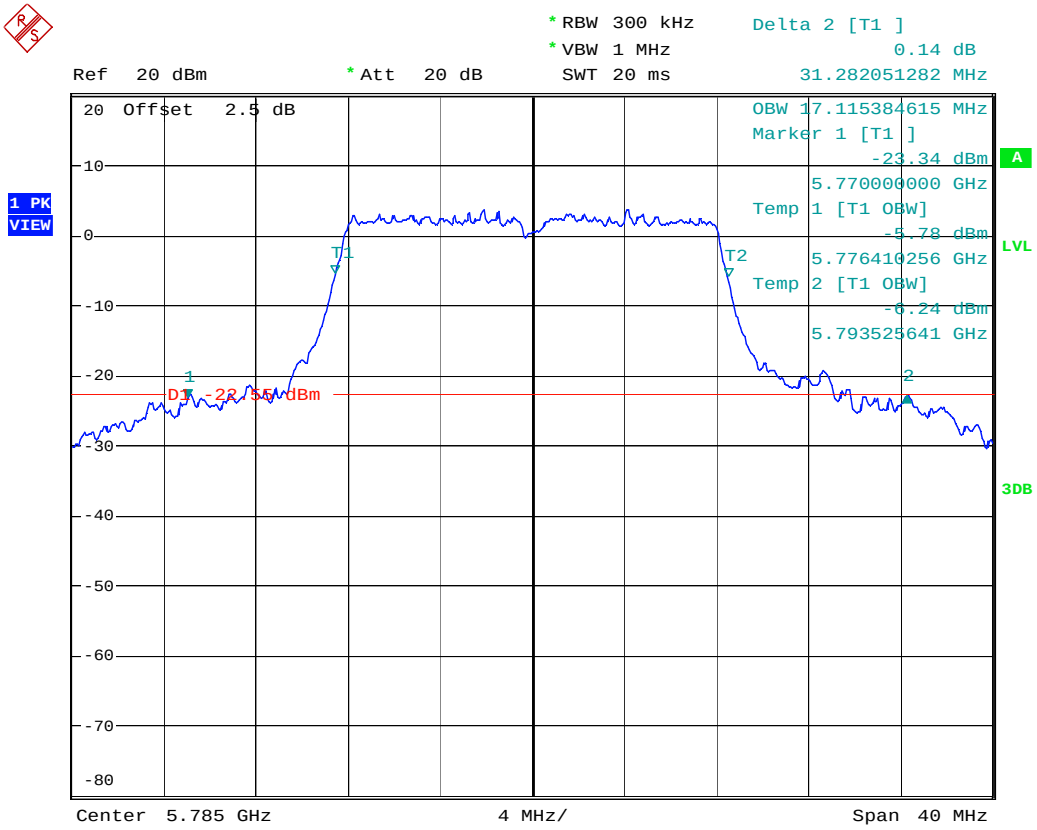
Plot 1. 3



26-dB bandwidth and OBW, 802.11n, HT20, MCS0

Date: 6.APR.2012 11:43:18

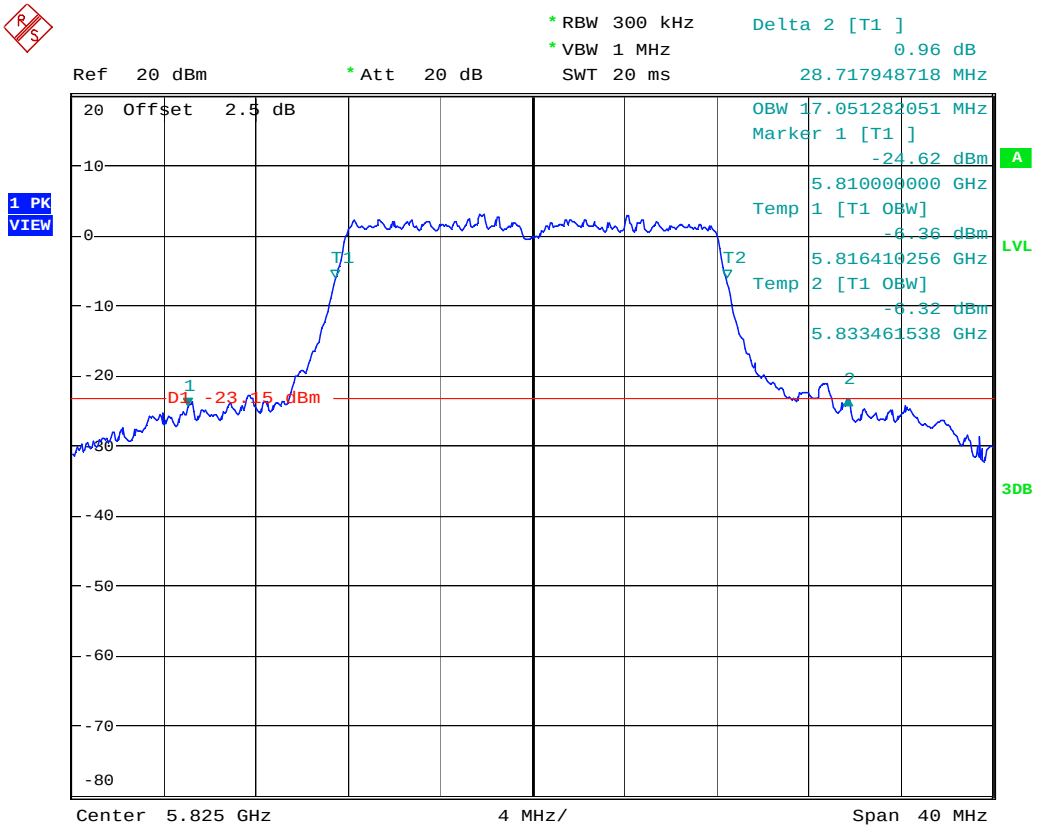
Plot 1. 4



26-dB bandwidth and OBW, 802.11a, 6Mbps

Date: 6.APR.2012 11:44:42

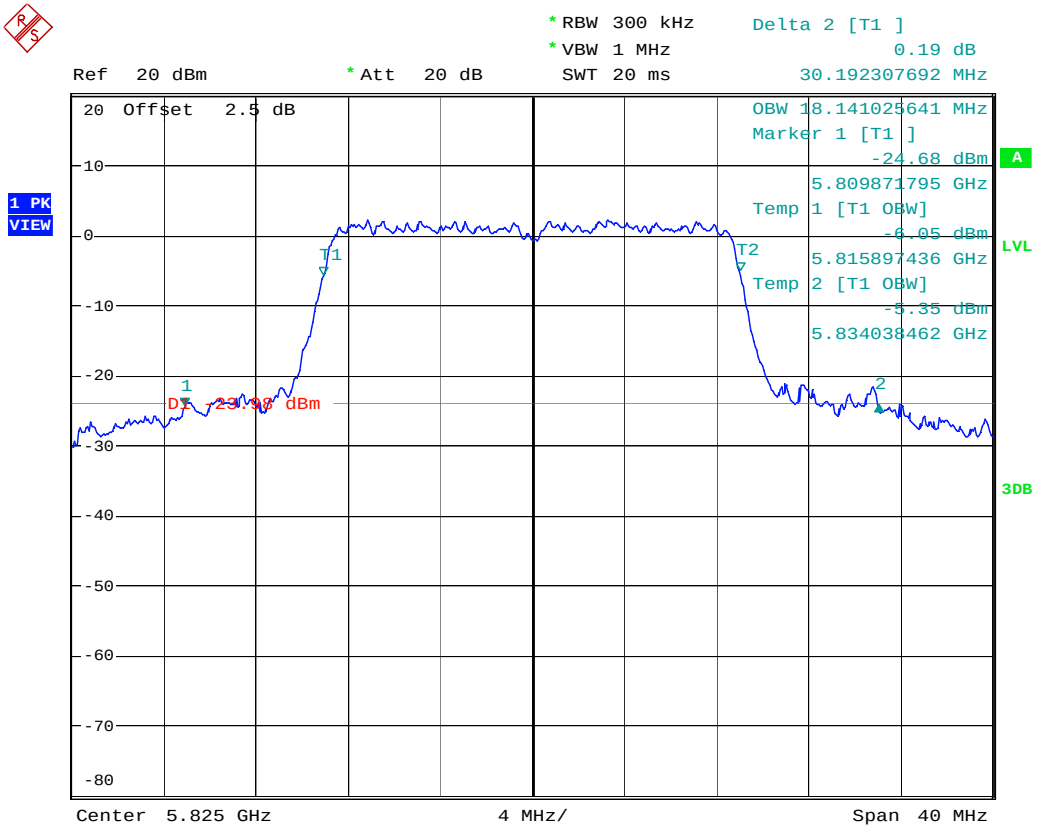
Plot 1. 5



26-dB bandwidth and OBW, 802.11a, 6Mbps

Date: 6.APR.2012 11:46:02

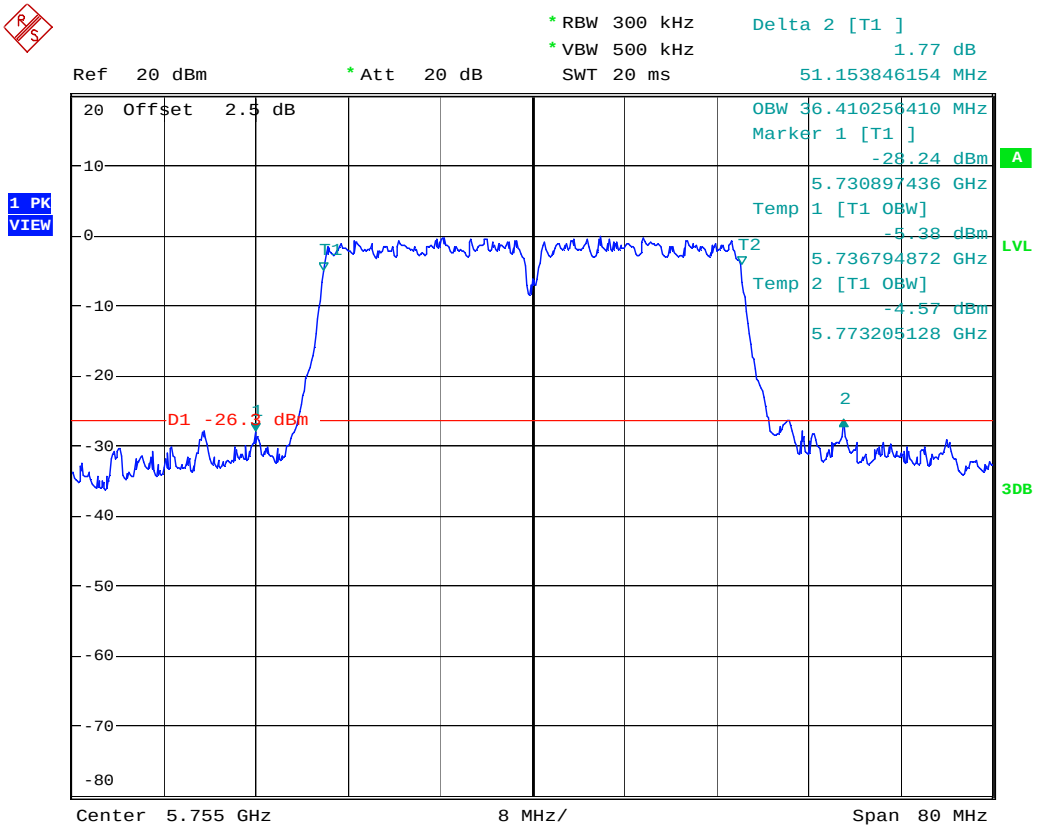
Plot 1. 6



26-dB bandwidth and OBW, 802.11n, HT20, MCS0

Date: 6.APR.2012 11:47:33

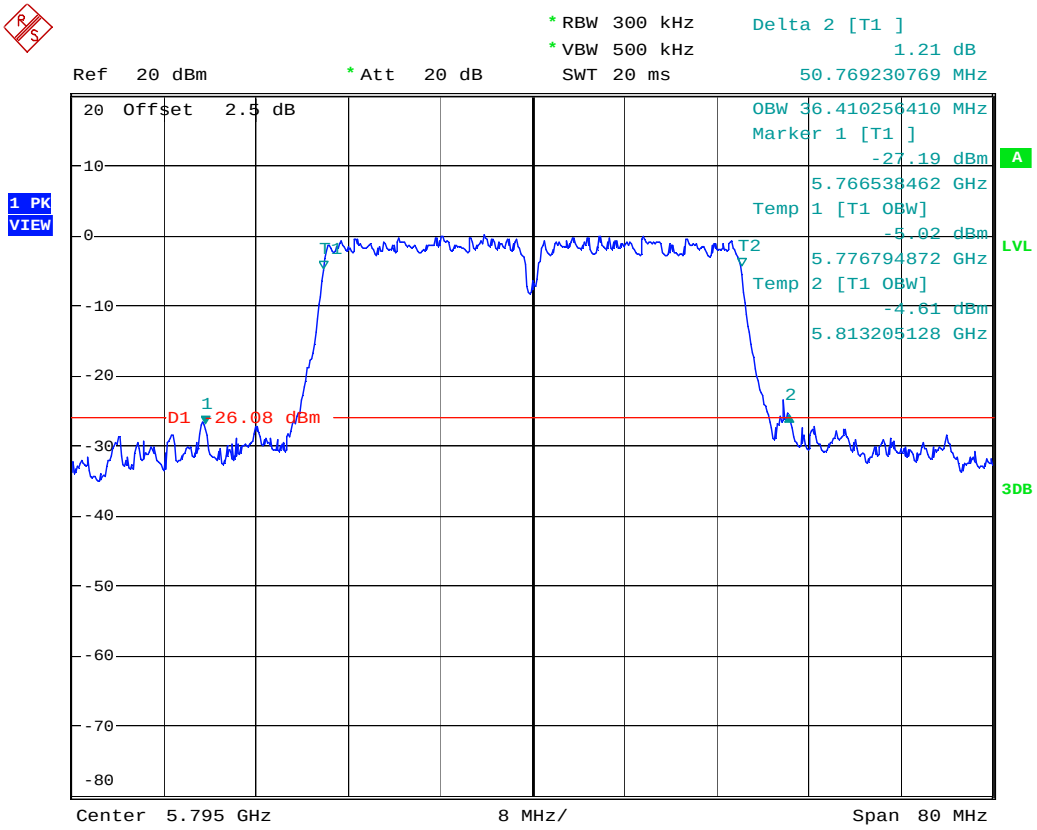
Plot 1. 7



26-dB bandwidth and OBW, 802.11n, HT40, MCS0

Date: 6.APR.2012 12:28:17

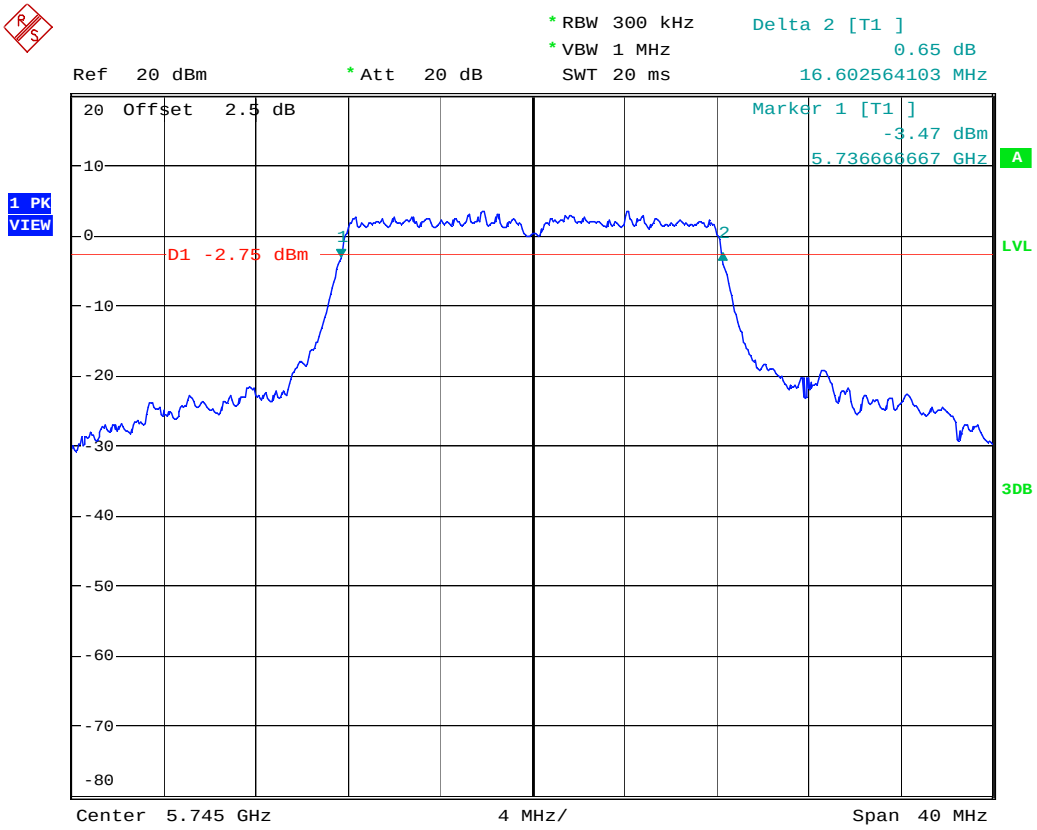
Plot 1. 8



26-dB bandwidth and OBW, 802.11n, HT40, MCS0

Date: 6.APR.2012 12:29:44

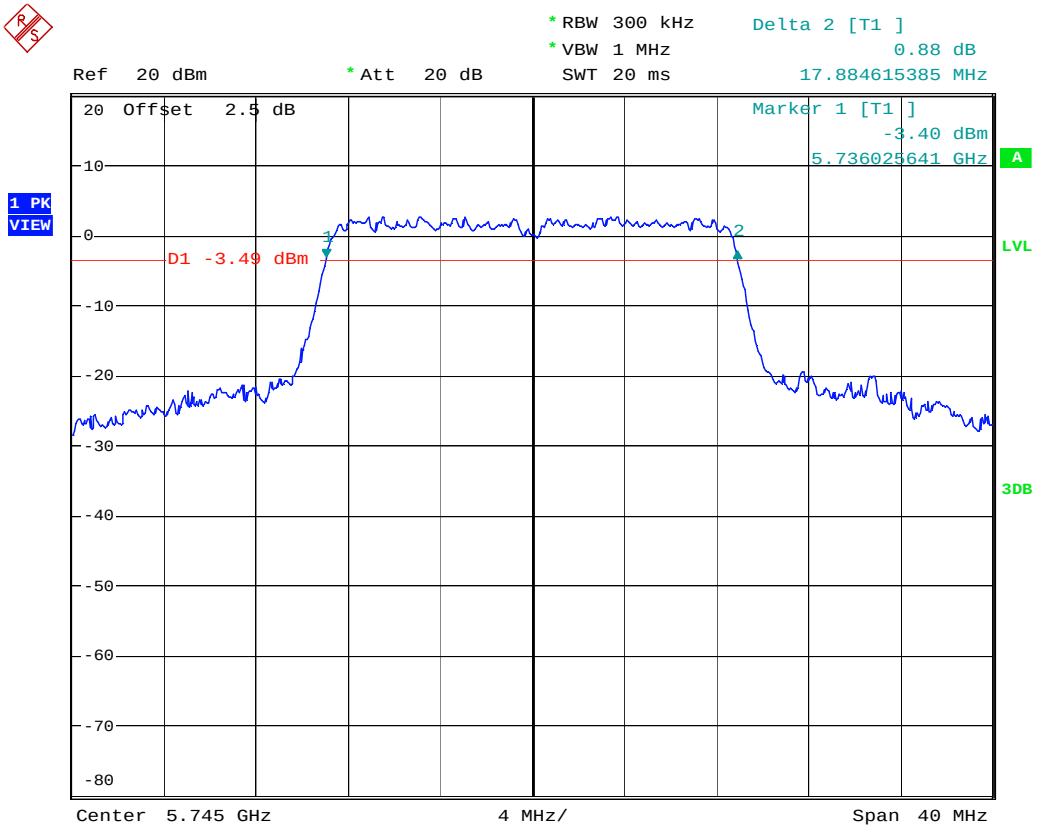
Plot 1. 9



6-dB bandwidth, 802.11a, 6Mbps

Date: 6.APR.2012 13:35:46

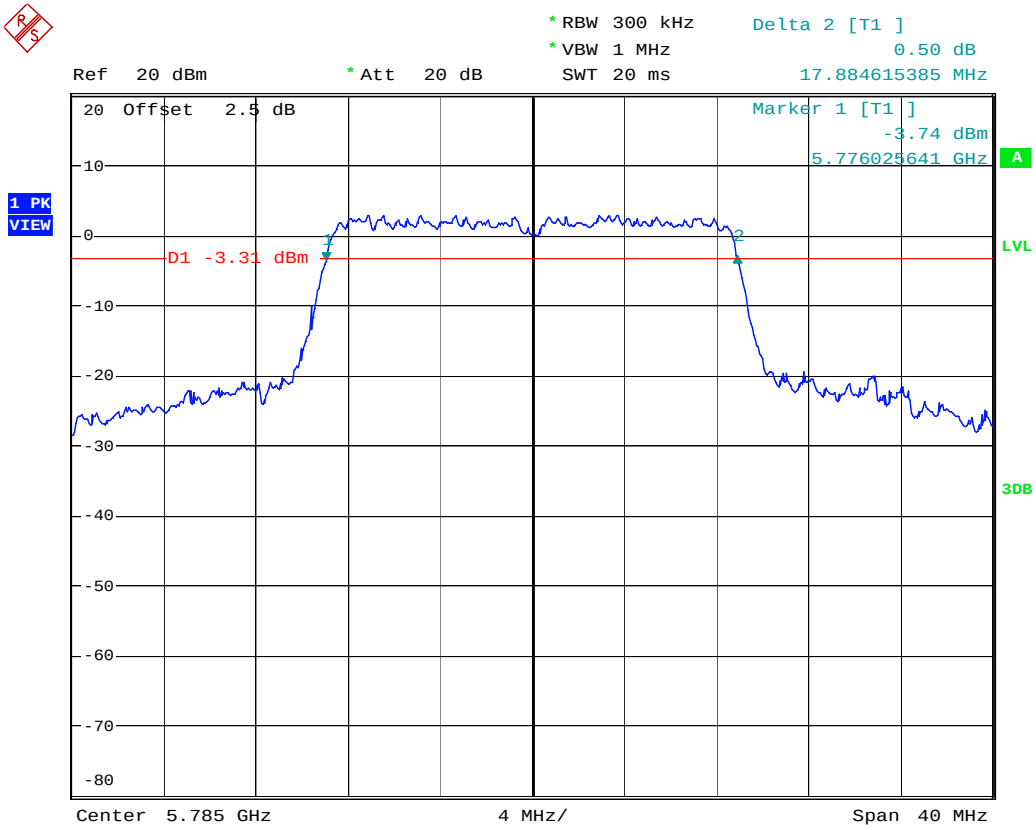
Plot 1. 10



6-dB bandwidth, 802.11n, HT20, MCS0

Date: 6.APR.2012 13:37:27

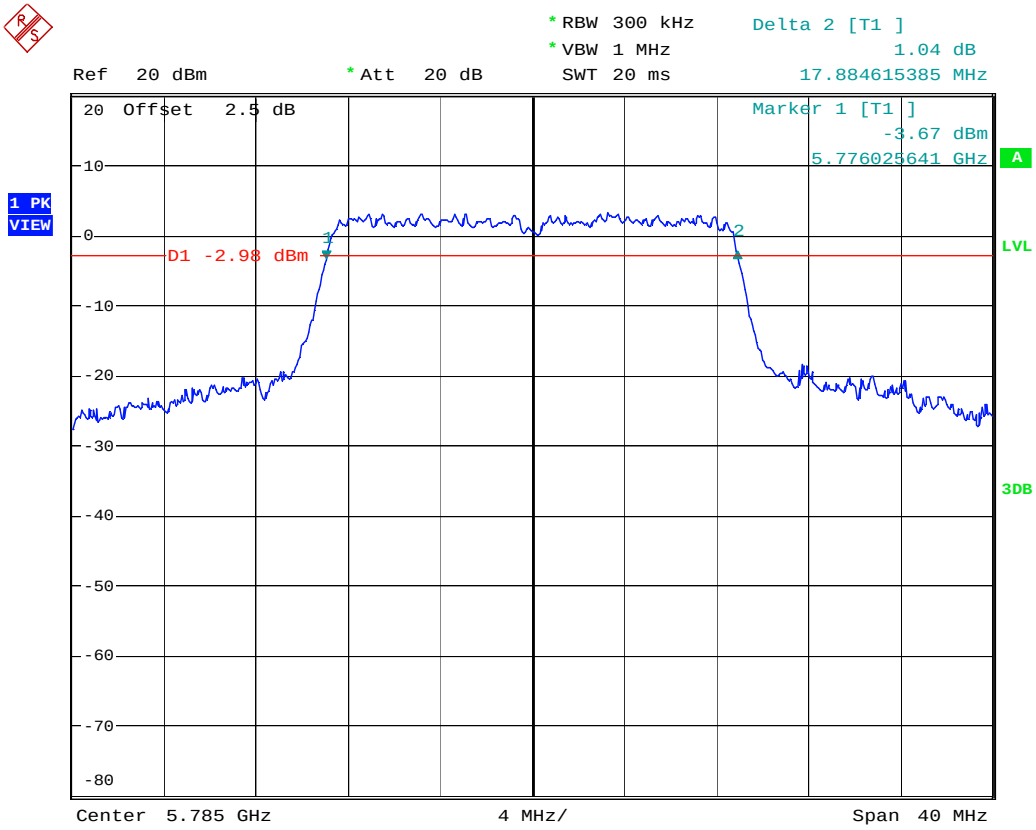
Plot 1. 11



6-dB bandwidth, 802.11n, HT20, MCS0

Date: 6.APR.2012 13:40:50

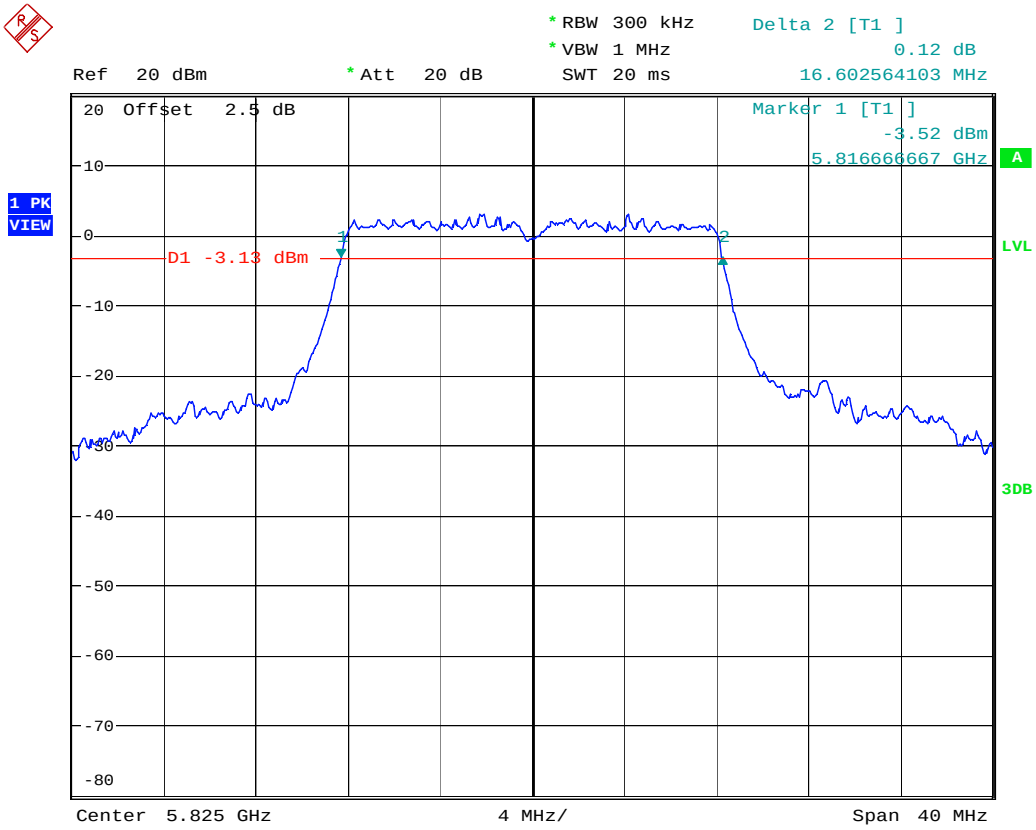
Plot 1. 12



6-dB bandwidth, 802.11a, 6Mbps

Date: 6.APR.2012 13:45:24

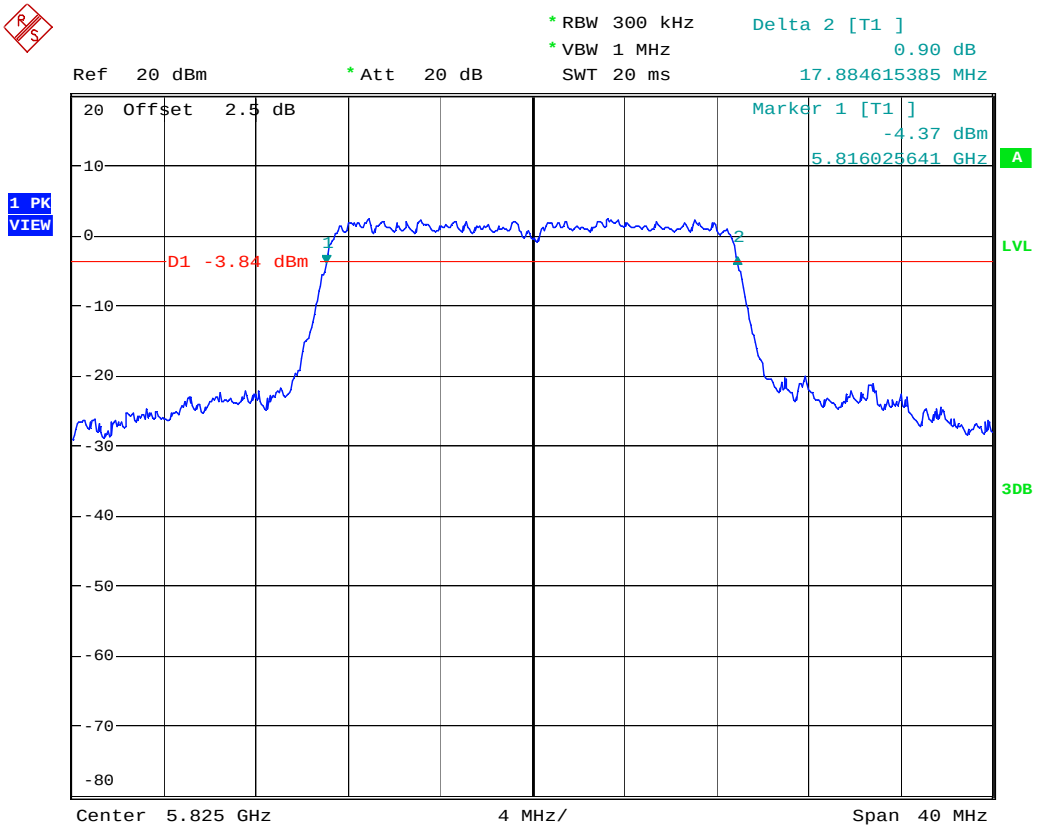
Plot 1. 13



6-dB bandwidth, 802.11a, 6Mbps

Date: 6.APR.2012 13:51:10

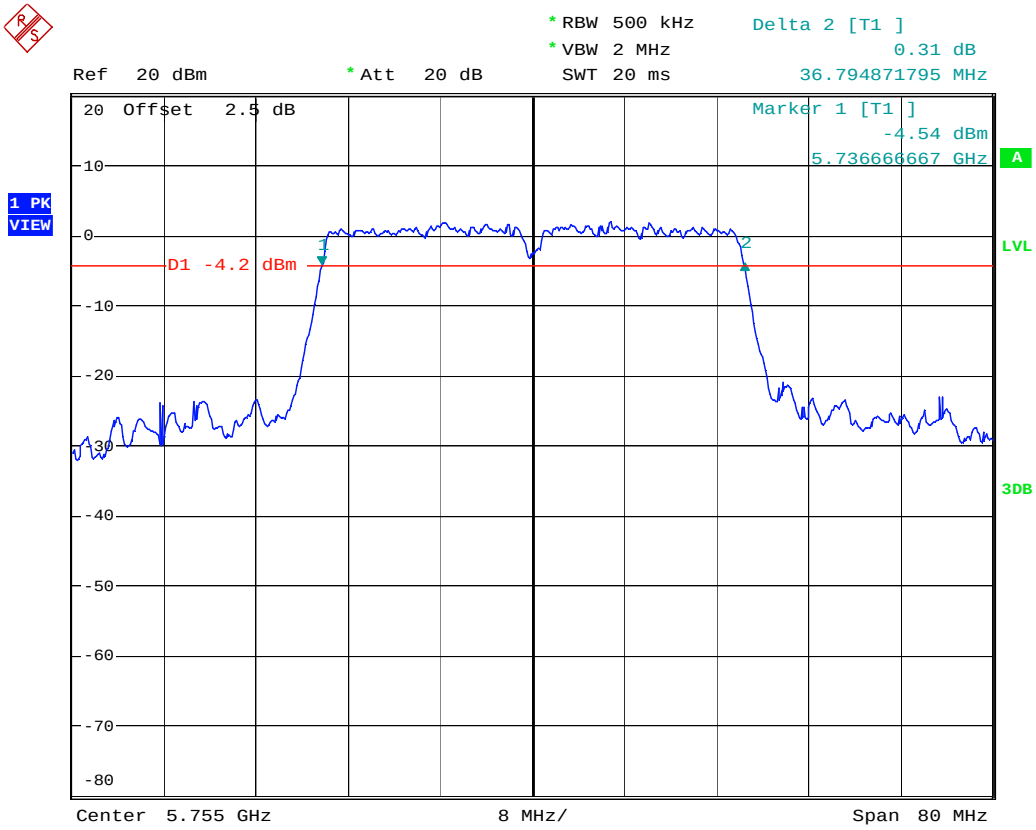
Plot 1. 14



6-dB bandwidth, 802.11n, HT20, MCS0

Date: 6.APR.2012 13:56:22

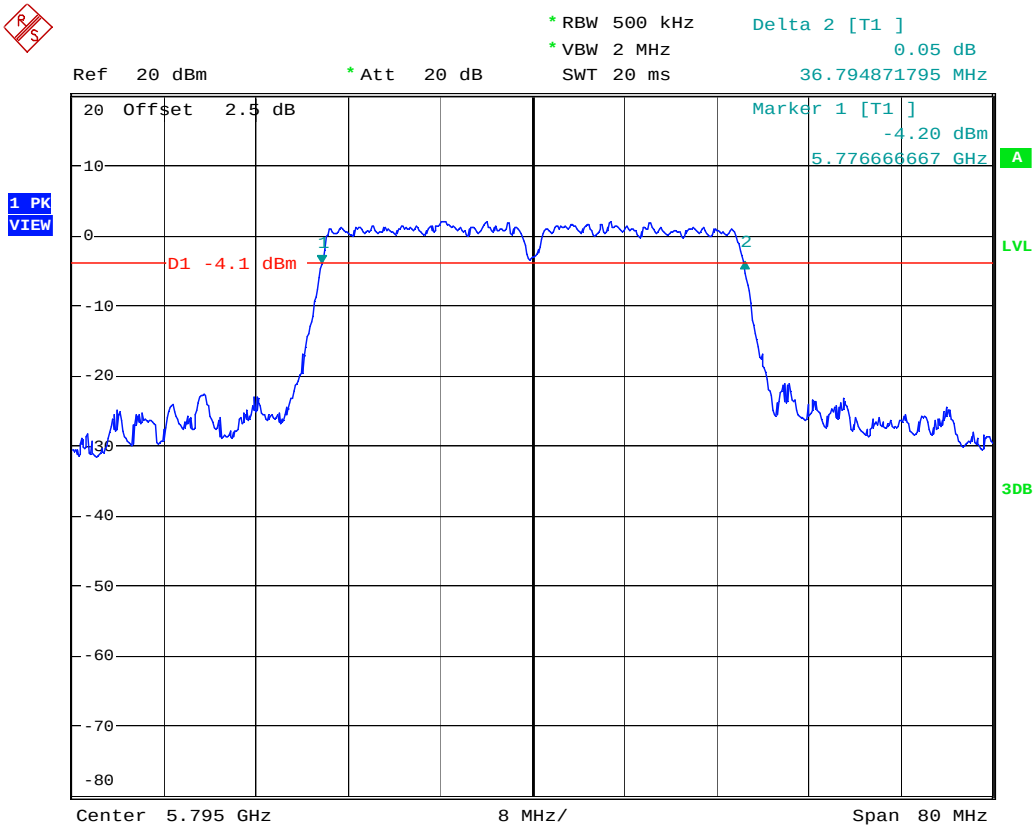
Plot 1. 15



6-dB bandwidth, 802.11n, HT40, MCS0

Date: 6.APR.2012 14:00:34

Plot 1. 16



6-dB bandwidth, 802.11n, HT40, MCS0

Date: 6.APR.2012 14:01:47

4.2 Maximum Conducted Output Power at Antenna Terminals
FCC Rule 15.247(b)(3)

4.2.1 Requirement

For antennas with gains of 6 dBi or less, maximum allowed transmitter output is 1 watt (+30 dBm).
For antennas with gains greater than 6 dBi, transmitter output level must be decreased appropriately, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer/power meter to measure the Maximum Conducted Transmitter Output Power.

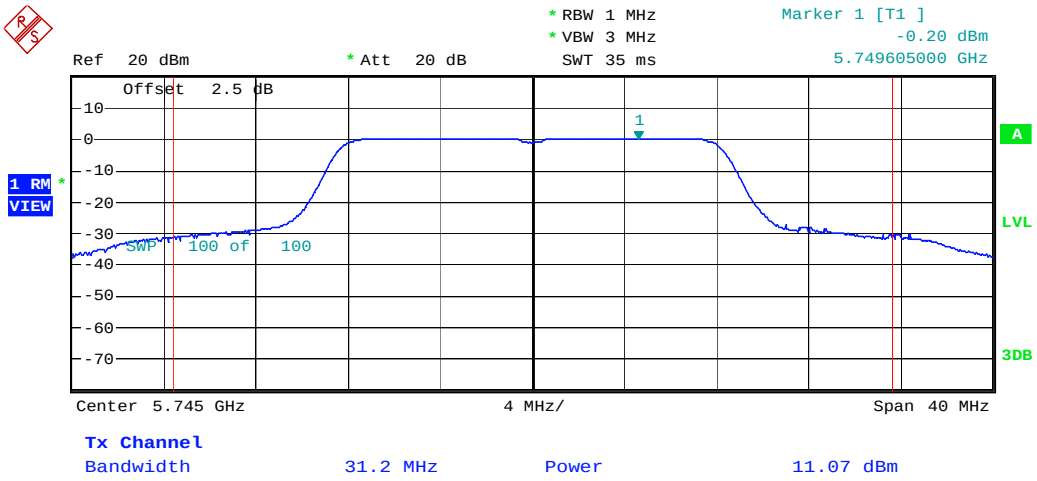
The procedure described in FCC Publication 558074, was used. Specifically, section 7.2.2.2, Option 2 (spectral trace averaging), with RMS detector using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges.

4.3.3 Test Result

Refer to the following plots for the test result:

Frequency (MHz)	Channel	Standard	Data rate Mbps	Conducted power (average) dBm	Conducted power Limit mW	Plot
5745	149	802.11a	6	11.1	12.9	2.1
		802.11n HT20	MCS0	11.1	12.9	2.2
5755	151	802.11n HT40	MCS0	11.2	13.2	2.7
5785	157	802.11a	6	11.4	13.8	2.4
		802.11n HT20	MCS0	11.4	13.8	2.3
5895	159	802.11n HT40	MCS0	11.6	14.5	2.8
5825	165	802.11a	6	10.4	11.0	2.5
		802.11n HT20	MCS0	10.7	11.8	2.6

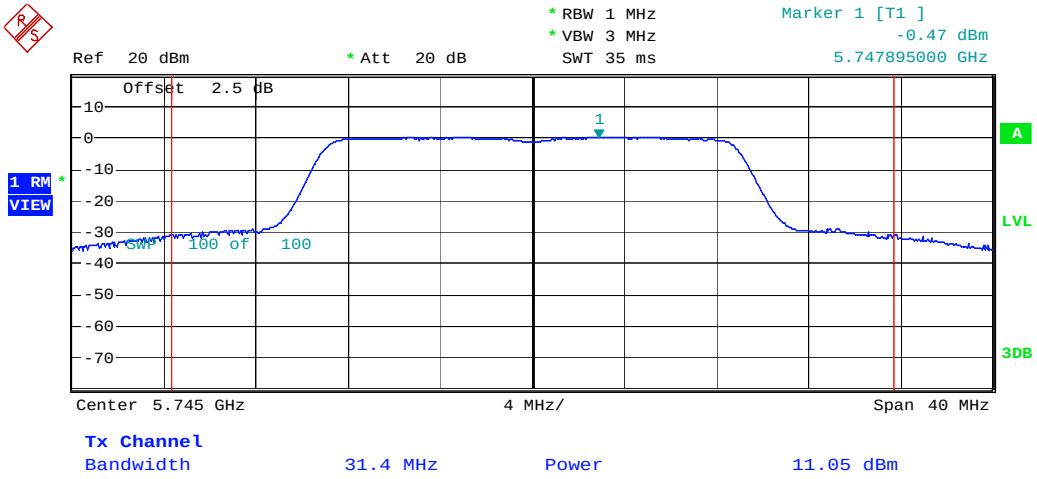
Plot 2. 1



Channel Power, 802.11a, 6Mbps

Date: 6.APR.2012 16:17:23

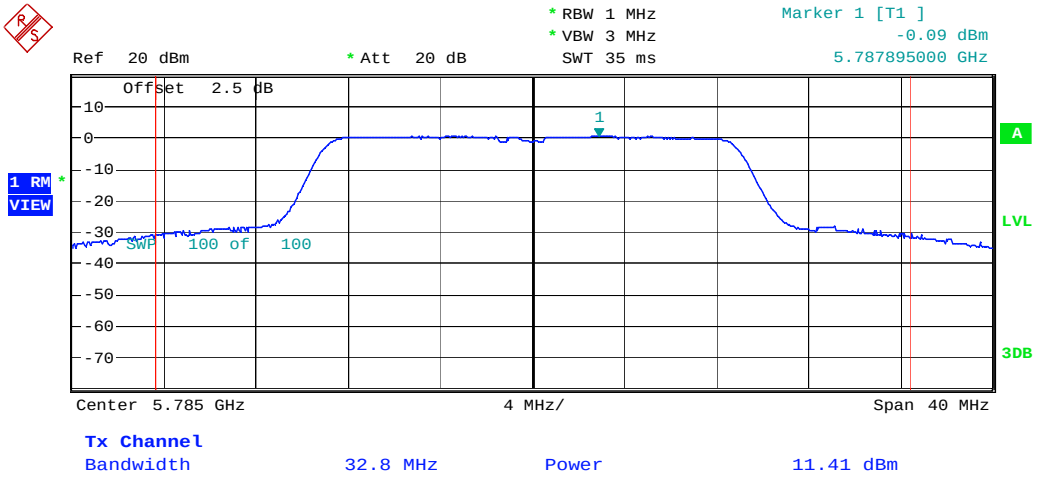
Plot 2. 2



Channel Power, 802.11n, HT20, MCS0

Date: 6.APR.2012 16:18:40

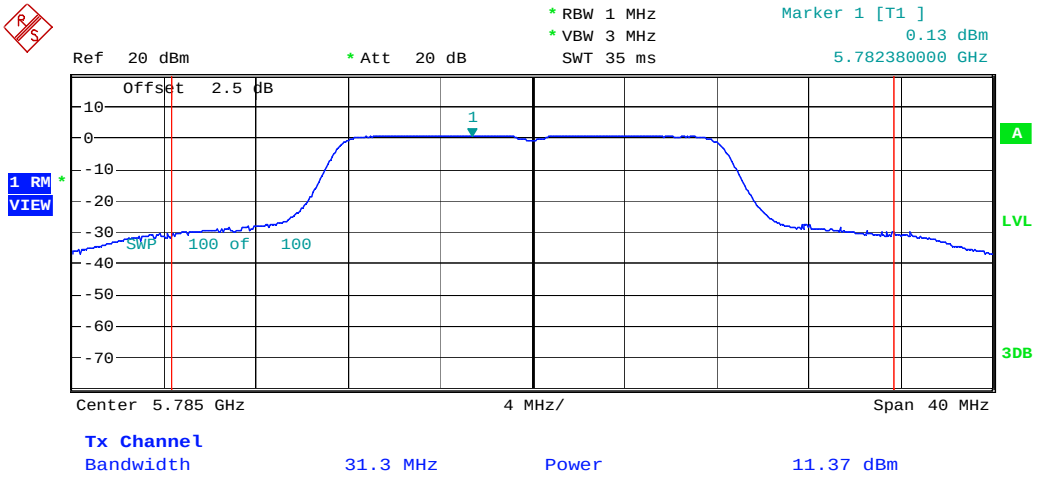
Plot 2. 3



Channel Power, 802.11n, HT20, MCS0

Date: 6.APR.2012 16:21:38

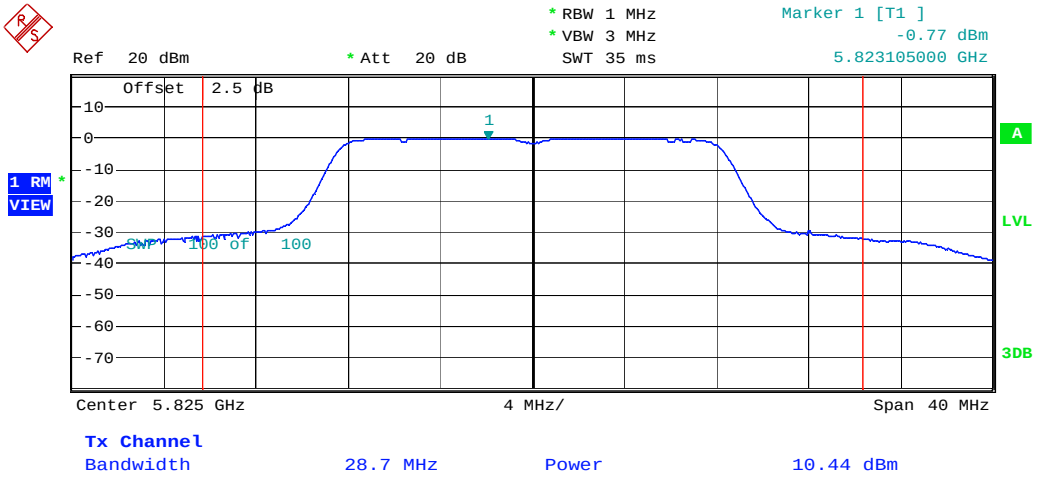
Plot 2. 4



Channel Power, 802.11a, 6Mbps

Date: 6.APR.2012 16:23:34

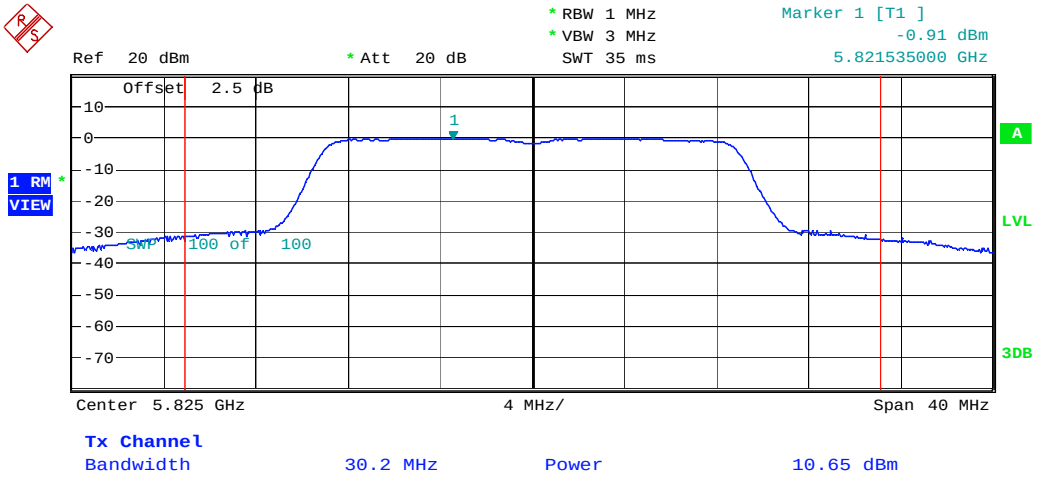
Plot 2. 5



Channel Power, 802.11a, 6Mbps

Date: 6.APR.2012 16:26:48

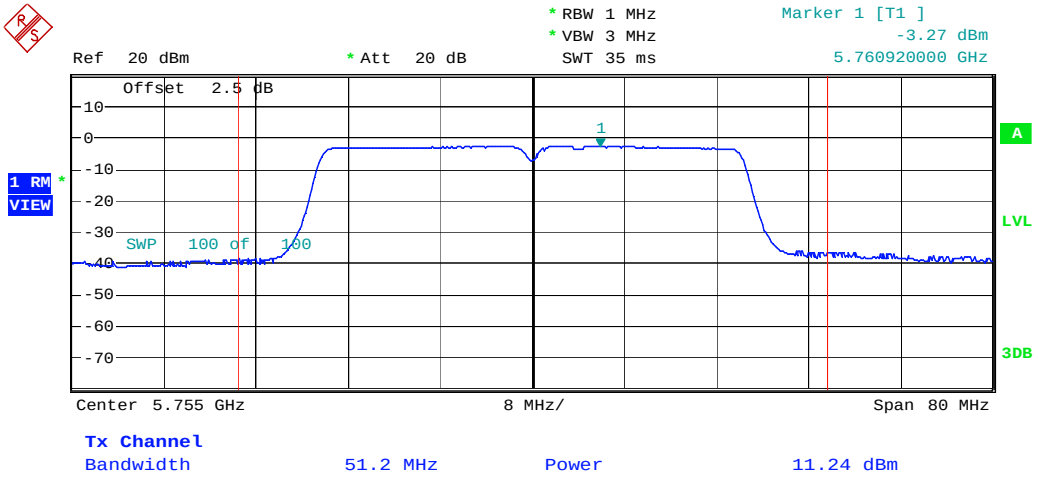
Plot 2. 6



Channel Power, 802.11n, HT20, MCS0

Date: 6.APR.2012 16:29:12

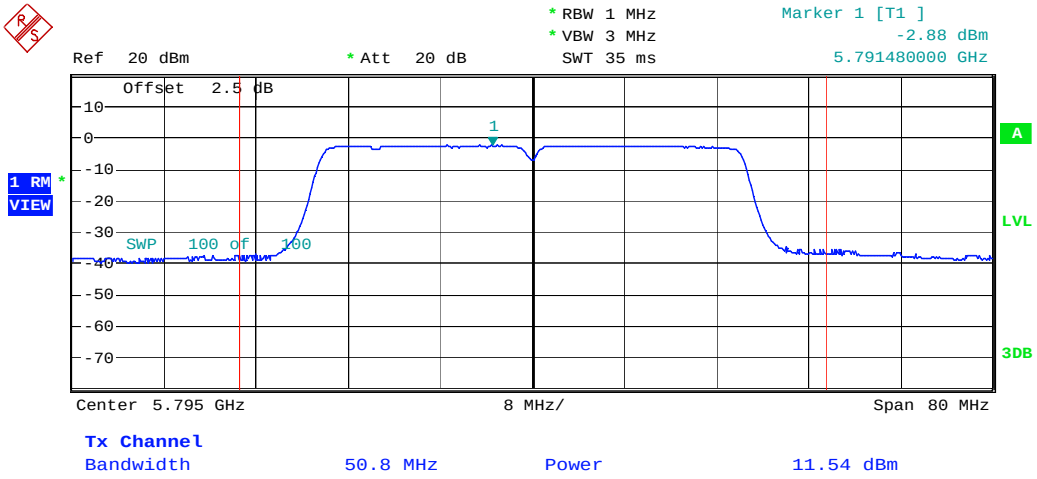
Plot 2. 7



Channel Power, 802.11n, HT40, MCS0

Date: 6.APR.2012 16:43:58

Plot 2. 8



Channel Power, 802.11n, HT40, MCS0

Date: 6.APR.2012 16:45:19

4.3 Power Spectral Density
FCC 15.247 (e)

4.3.1 Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna should not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

4.3.2 Procedure

The antenna port of the EUT was connected to the input of a spectrum analyzer to measure the Transmitter Power Density (PSD).

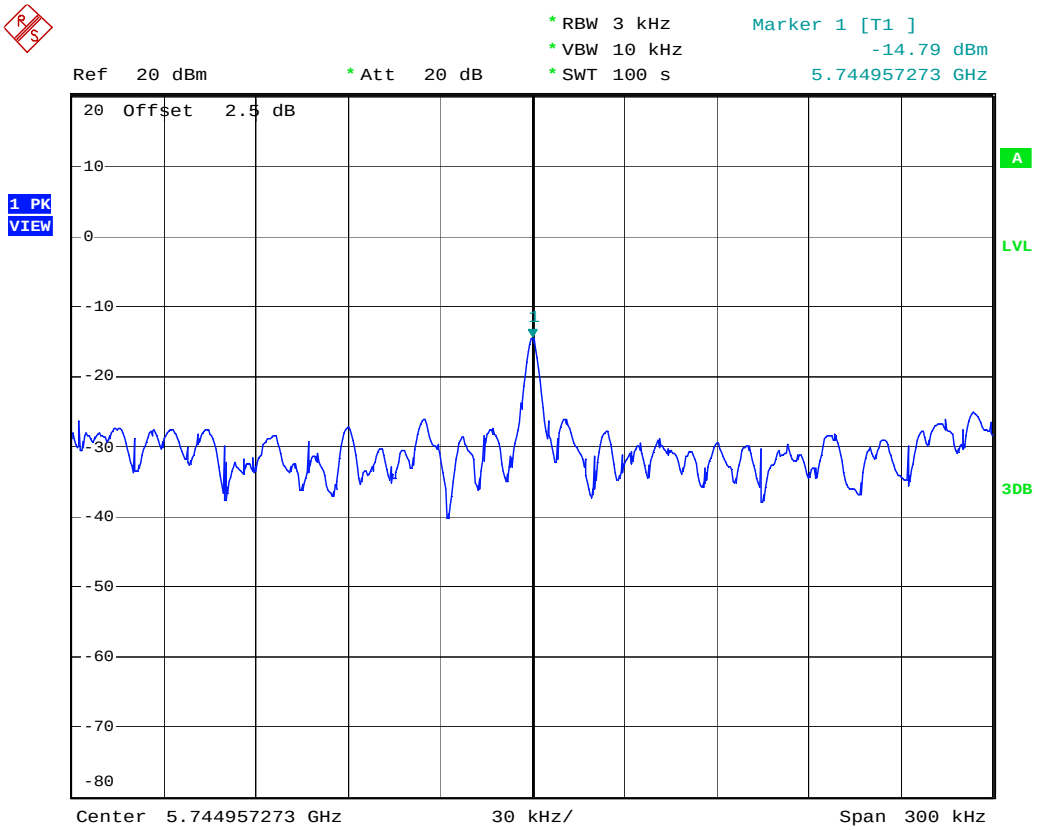
The procedure described in FCC Publication 558074 was used. Specifically, section 7.3.3, Alternative 1 (Peak PSD alternative), with peak detector, spectrum analyzer resolution bandwidth of 3 kHz, span of 300 kHz and sweep time of 100 s.

4.3.3 Test Result

Refer to the following plots for the test result:

Channel	Frequency (MHz)	Standard	Data rate Mbps	PSD (Peak) dBm	PSD Limit dBm	Margin dB	Plot
149	5745	802.11a	6	-14.8	8.0	-22.8	3.1
		802.11n HT20	MCS0	-13.5	8.0	-21.5	3.2
151	5755	802.11n HT40	MCS0	-14.5	8.0	-22.5	3.7
157	5785	802.11a	6	-14.0	8.0	-22.0	3.3
		802.11n HT20	MCS0	-14.7	8.0	-22.7	3.4
159	5895	802.11n HT40	MCS0	-15.2	8.0	-23.2	3.8
165	5825	802.11a	6	-14.1	8.0	-22.1	3.6
		802.11n HT20	MCS0	-13.7	8.0	-21.7	3.5

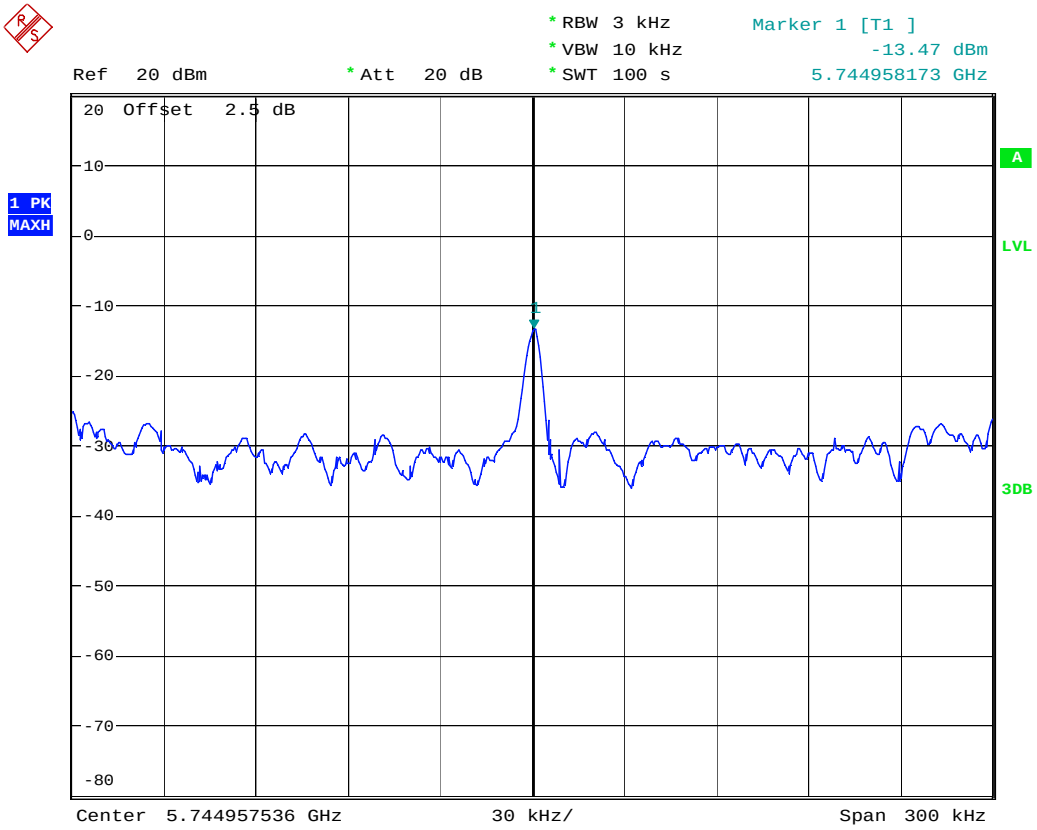
Plot 3. 1



Power spectral density, 802.11a, 6Mbps

Date: 9.APR.2012 09:50:07

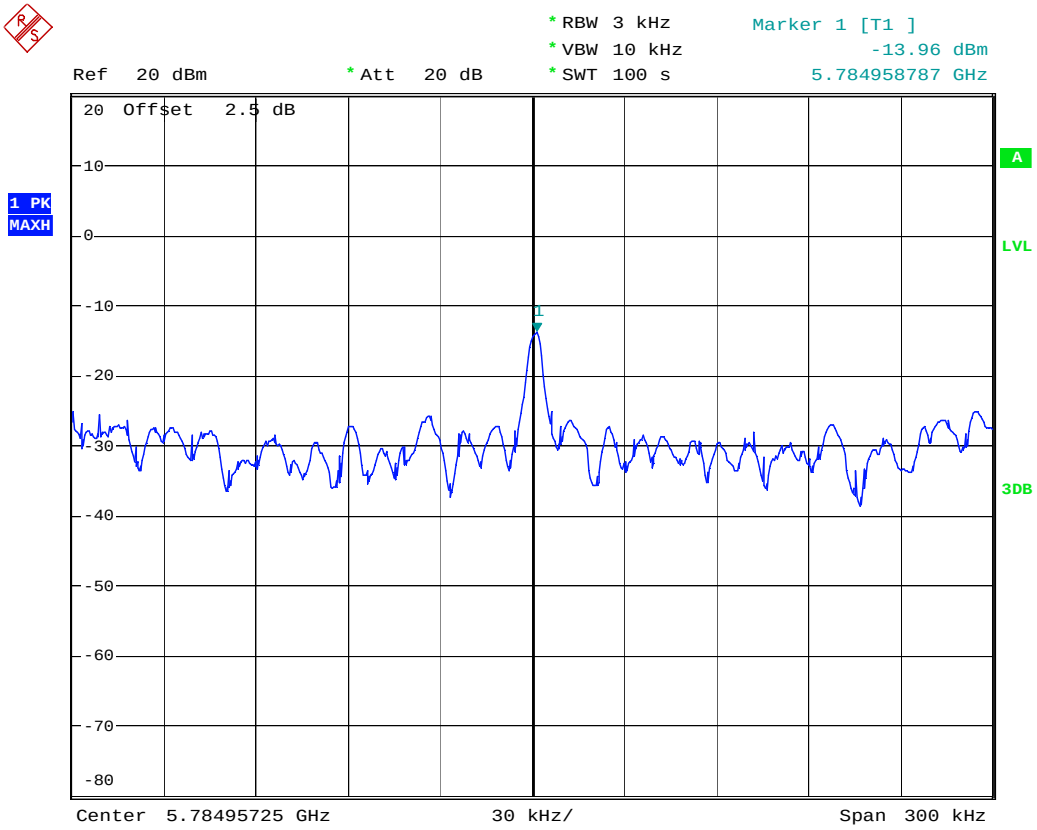
Plot 3. 2



Power spectral density, 802.11n, HT20, MCS0

Date: 9.APR.2012 09:54:34

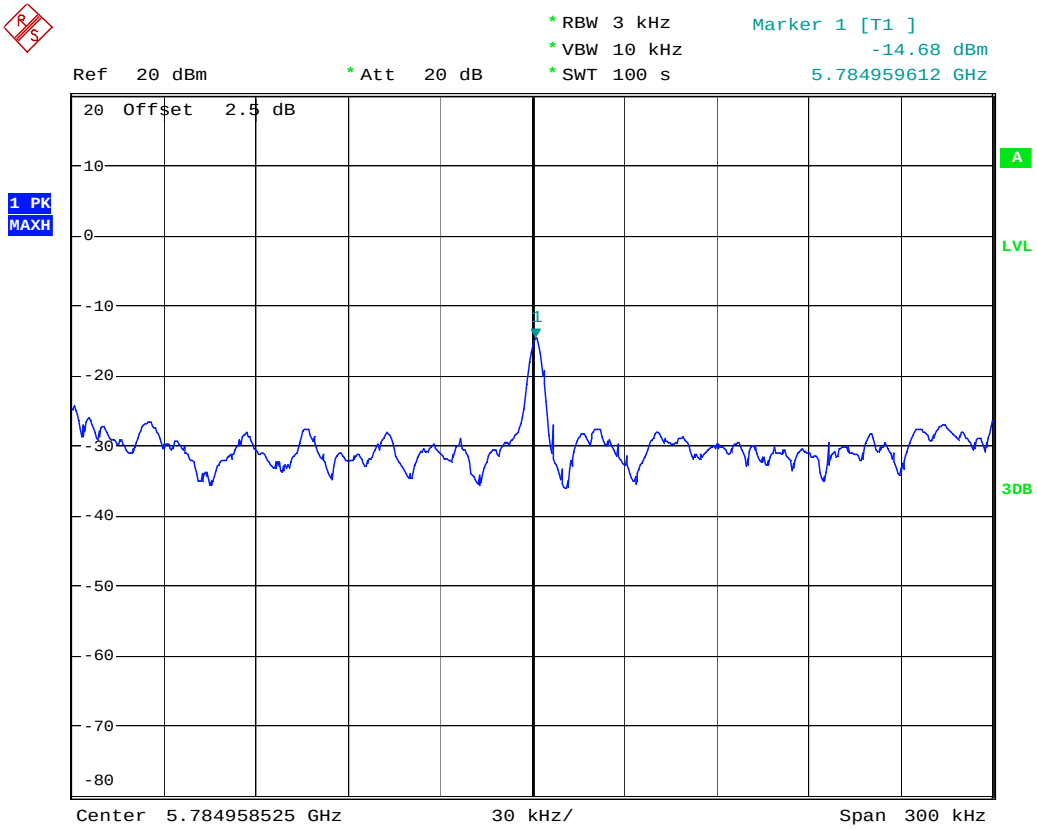
Plot 3. 3



Power spectral density, 802.11a, 6Mbps

Date: 9.APR.2012 09:59:54

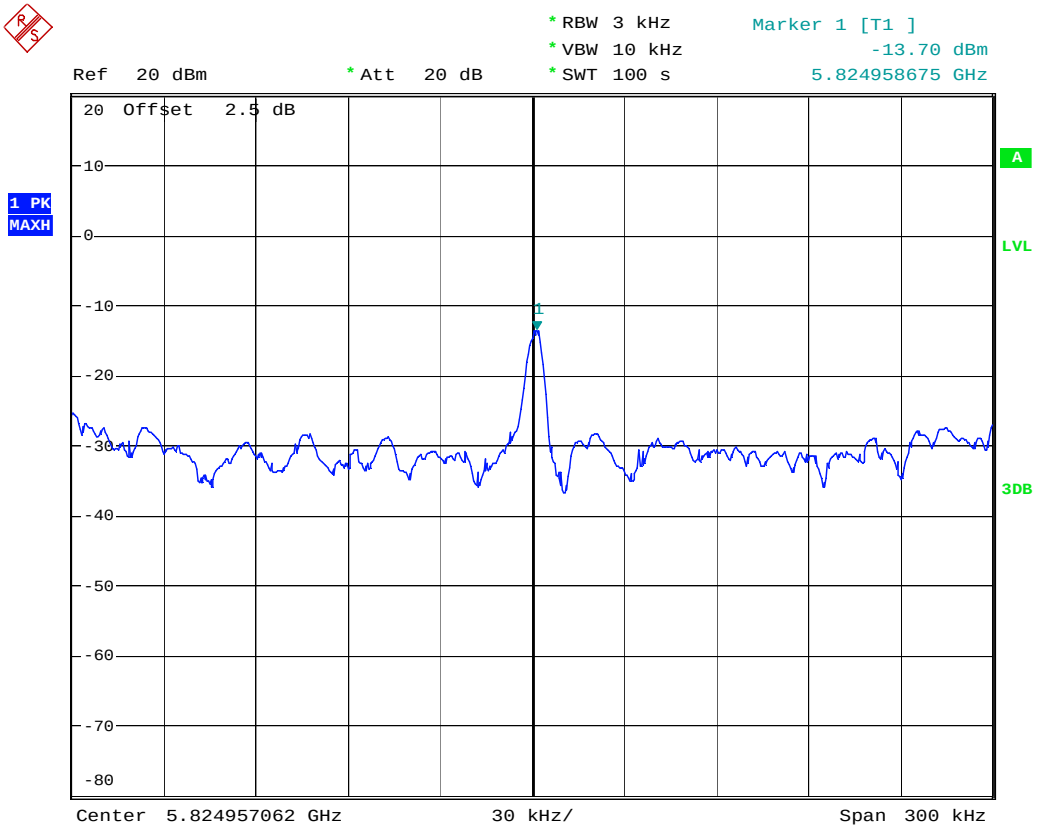
Plot 3. 4



Power spectral density, 802.11n, HT20, MCS0

Date: 9.APR.2012 10:04:47

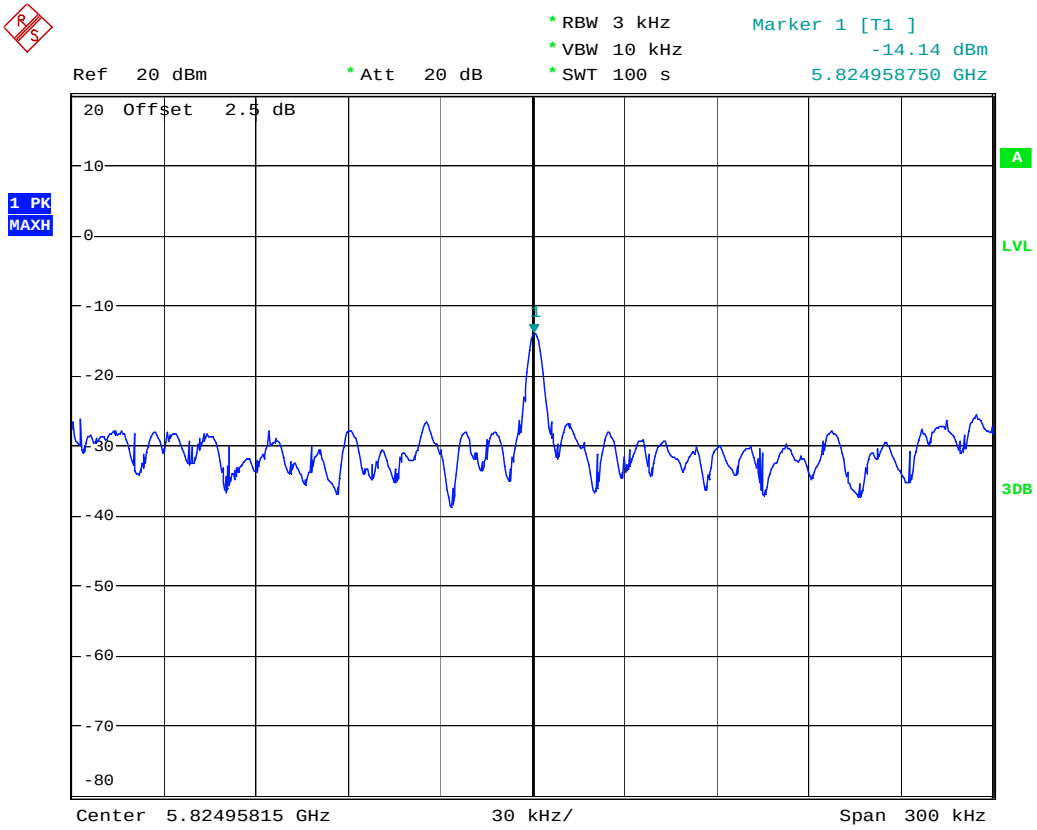
Plot 3. 5



Power spectral density, 802.11n, HT20, MCS0

Date: 9.APR.2012 10:10:26

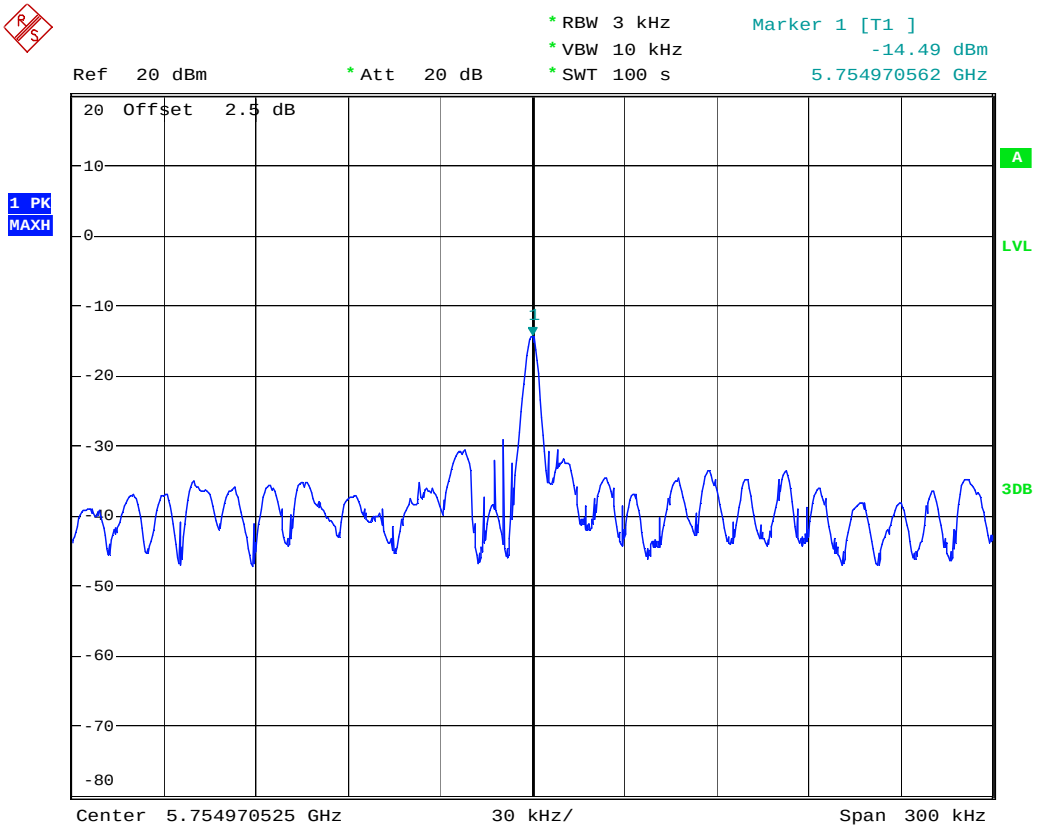
Plot 3. 6



Power spectral density, 802.11a, 6Mbps

Date: 9.APR.2012 10:18:21

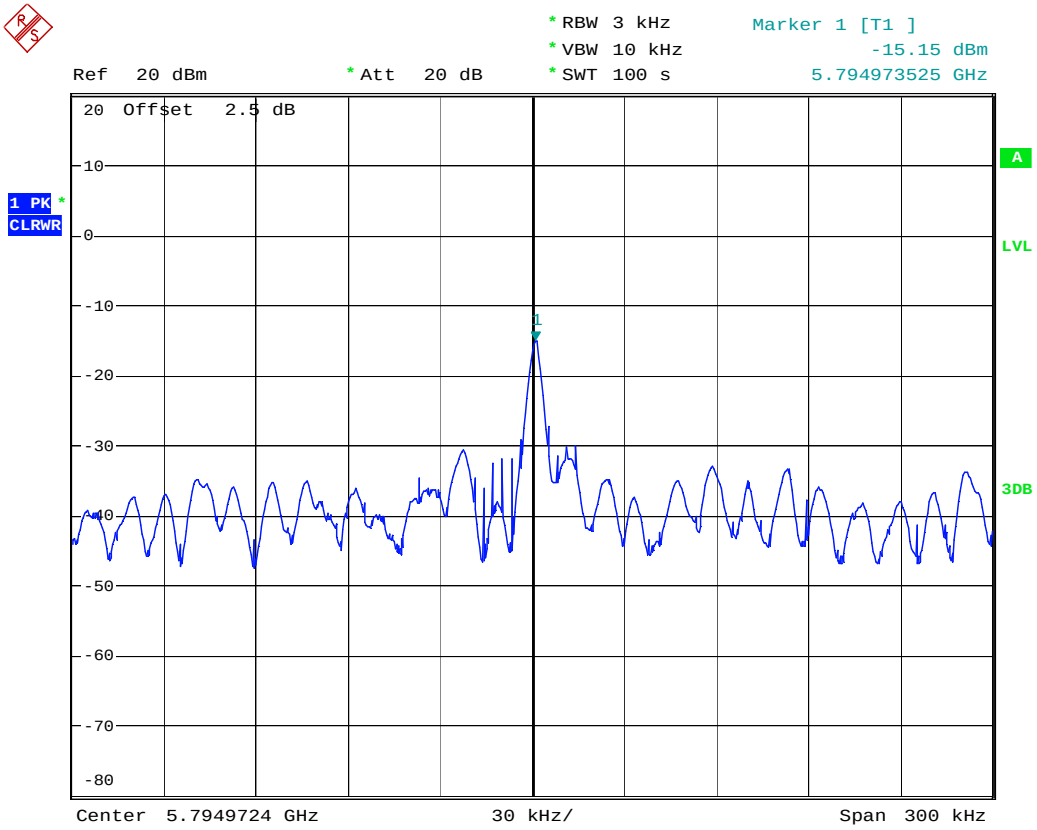
Plot 3. 7



Power spectral density, 802.11n, HT40, MCS0

Date: 9.APR.2012 10:28:20

Plot 3. 8



Power spectral density, 802.11n, HT40, MCS0

Date: 9.APR.2012 10:38:17

4.4 Out-of-Band Conducted Emissions
FCC 15.247(d)

4.4.1 Requirement

In any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.4.2 Procedure

A spectrum analyzer was connected to the antenna port of the transmitter. Analyzer Resolution Bandwidth was set to 100 kHz. For each channel investigated, the in-band and out-of-band emission measurements were performed. The out-of-band emissions were measured from 30 MHz to 40 GHz.

4.4.3 Test Result

Refer to the following plots:

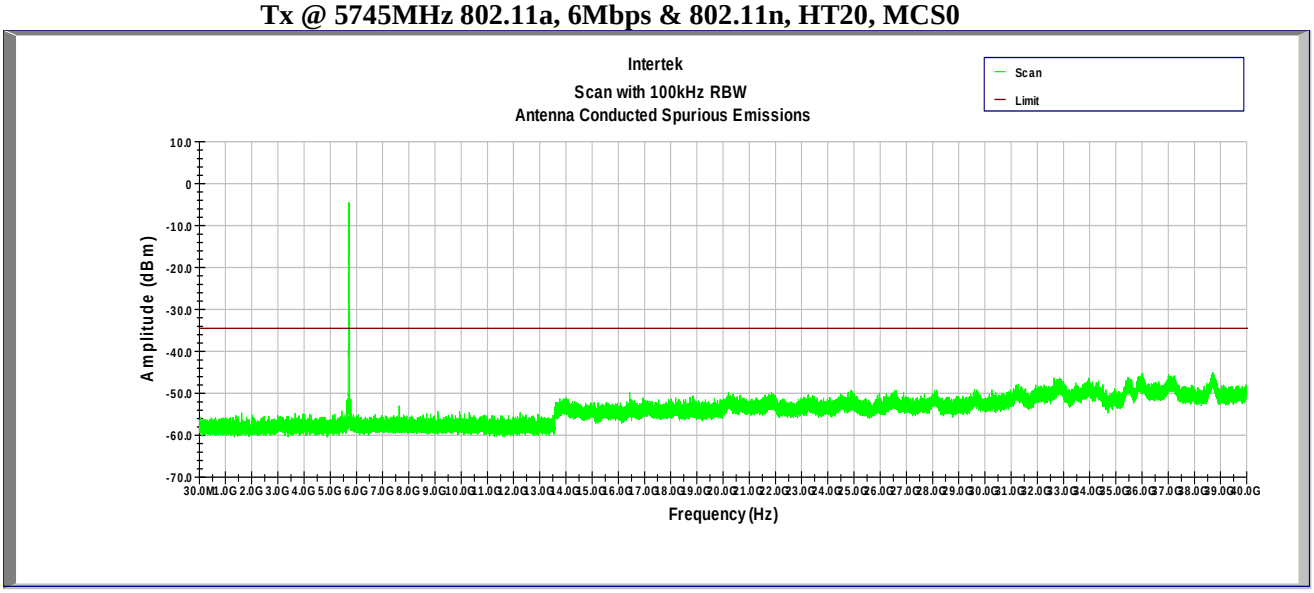
Channel	Frequency (MHz)	Standard	Data rate Mbps	Description	Plot
149	5745	802.11a*	6	Scan 30 MHz – 40 GHz	4.1
		802.11n HT20*	MCS0		
151	5755	802.11n HT40	MCS0	Scan 30 MHz – 40 GHz	4.2
157	5785	802.11a*	6	Scan 30 MHz – 40 GHz	4.3
		802.11n HT20*	MCS0		
159	5895	802.11n HT40	MCS0	Scan 30 MHz – 40 GHz	4.4
165	5825	802.11a*	6	Scan 30 MHz – 40 GHz	4.5
		802.11n HT20*	MCS0		

*Investigation was performed on 802.11a & 802.n HT20 and worst case data was reported.

All out-of-band conducted emissions were attenuated by more than 30 dB.

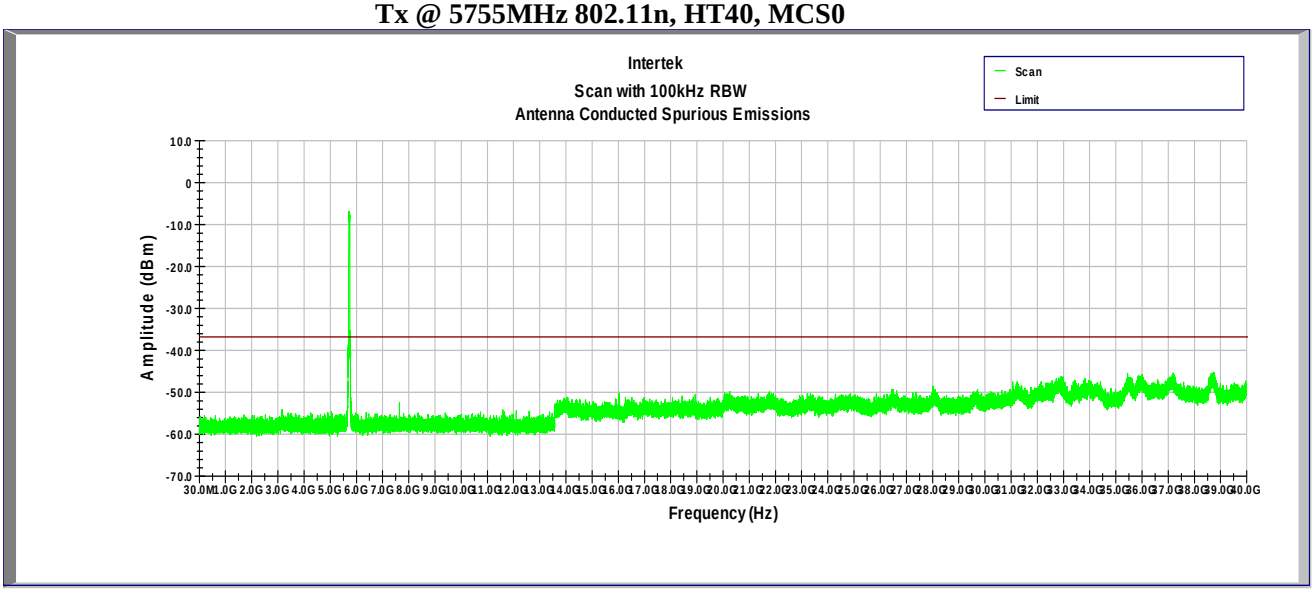
Plot 4.1

Tx @ 5745MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0



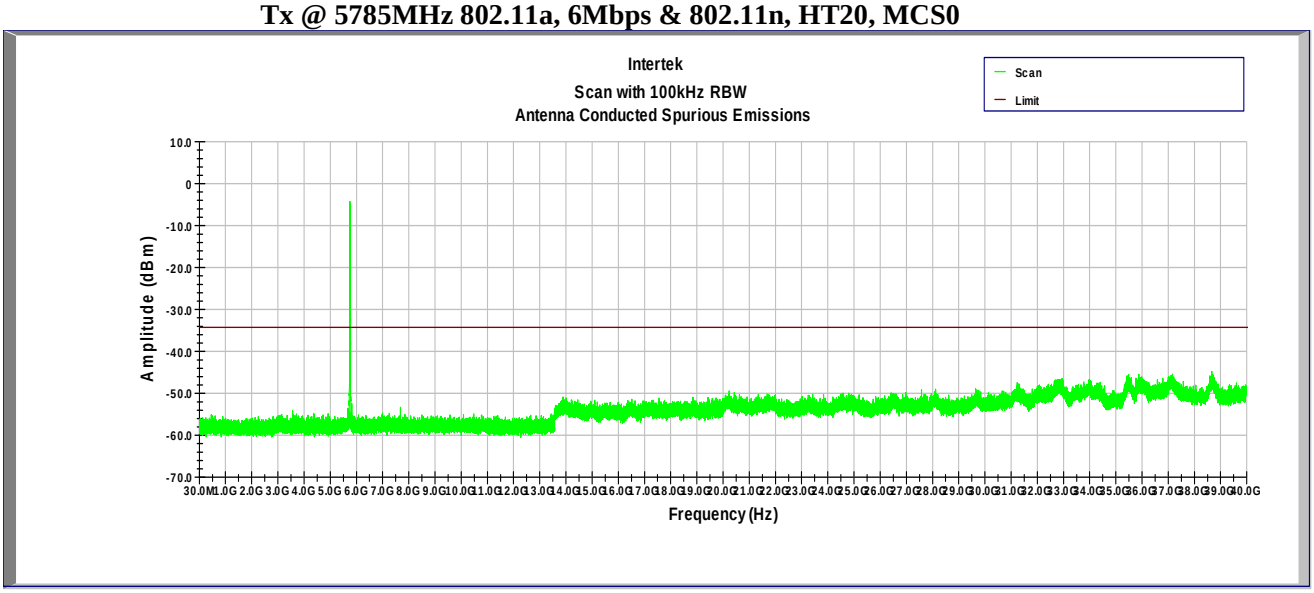
Plot 4.2

Tx @ 5755MHz 802.11n, HT40, MCS0



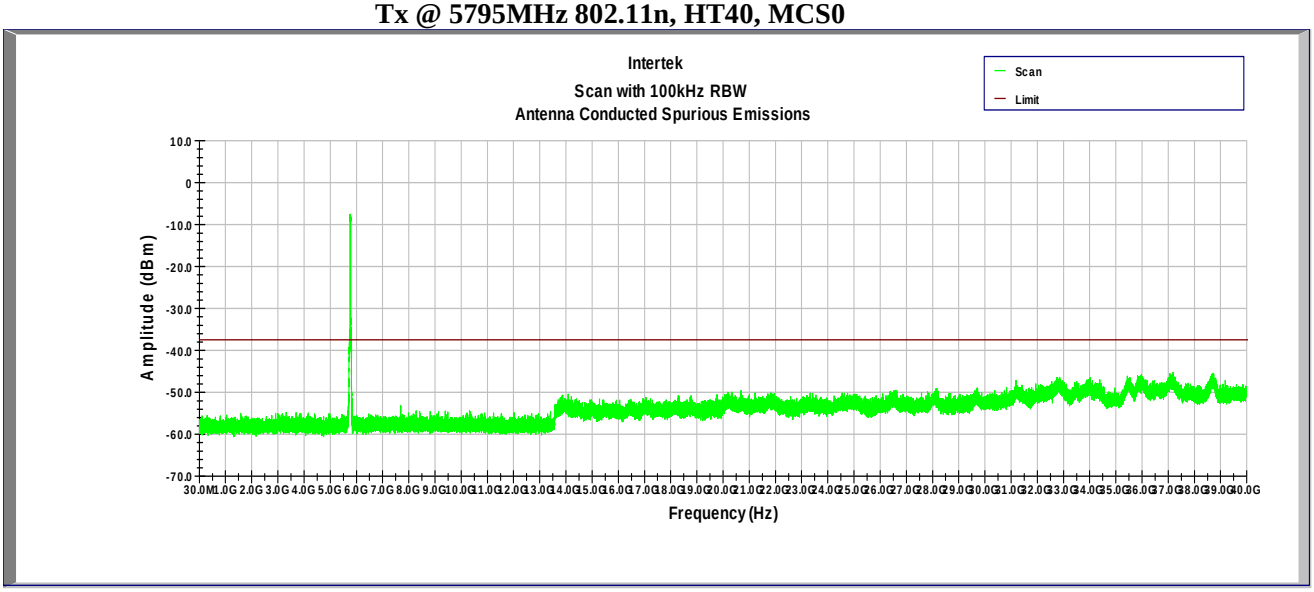
Plot 4.3

Tx @ 5785MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0



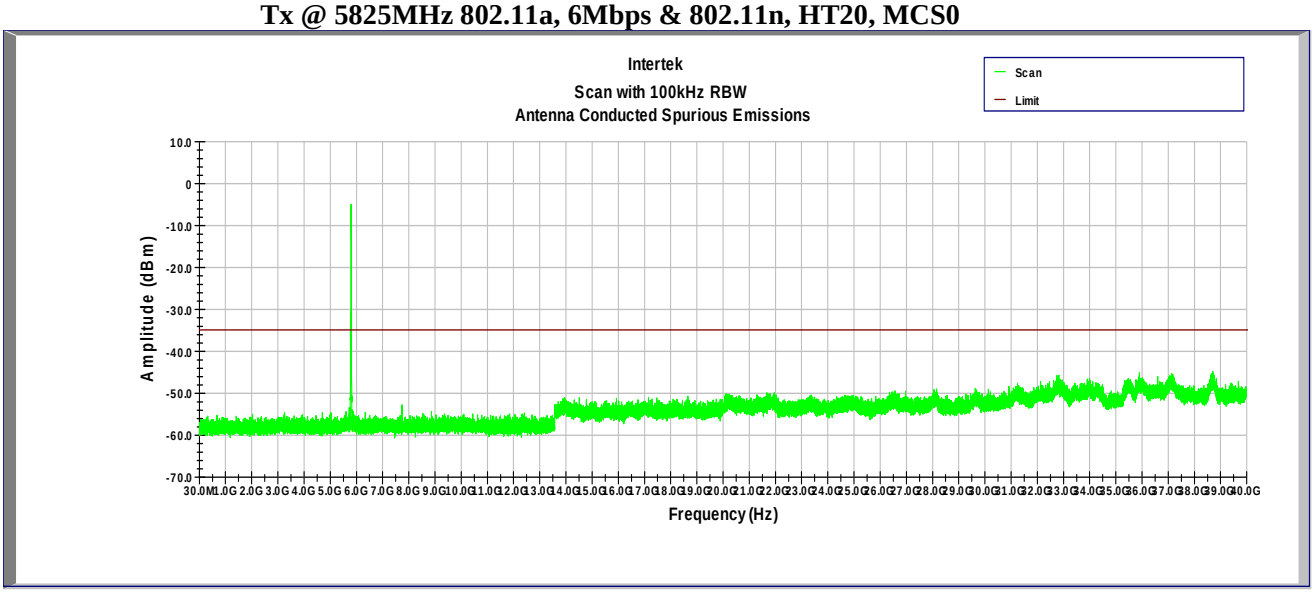
Plot 4.4

Tx @ 5795MHz 802.11n, HT40, MCS0



Plot 4.5

Tx @ 5825MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0



4.5 Transmitter Radiated Emissions
FCC Rule 15.247(d), 15.209, 15.205

4.5.1 Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

4.5.2 Procedure

Radiated emission measurements were performed from 30 MHz to 40,000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz.

The EUT is placed on a plastic turntable that is 80 cm in height. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

4.5.3 Field Strength Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude (including preamplifier) in dB(µV); AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(µV) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB(µV/m). This value in dB(µV/m) was converted to its corresponding level in µV/m.
RA = 52.0 dB(µV)
AF = 7.4 dB(1/m)
CF = 1.6 dB
AG = 29.0 dB
FS = 52.0+7.4+1.6-29.0 = 32 dB(µV/m).
Level in µV/m = Common Antilogarithm [(32 dBµV/m)/20] = 39.8 µV/m.

4.5.3 Test Results

The data on the following pages list the significant emission frequencies, the limit and the margin of compliance.

The EUT passed the test by 8.7dB.

Table 5.1

Transmitter Radiated Emissions below 1GHz

Tx @ 5745MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0, w/ internal antenna or external antenna

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.485E+07	14.4	30	-15.6	28.3	32.1	17.5	0.7
2.806E+08	23.2	37	-13.8	40.2	32.0	13.1	2
9.992E+08	22.8	37	-14.2	26.6	30.9	23.3	3.8

Test Mode: Tx @ 5745MHz
Temp: 21C, Humidity: 42%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.647E+07	13.8	30.0	-16.2	28.0	0.7	32.1	17.1
2.782E+08	26.6	37.0	-10.4	43.5	2.0	32.0	13.2
9.838E+08	22.5	37.0	-14.5	26.9	3.7	31.0	22.9

Test Mode: Tx @ 5745MHz
Temp: 21C, Humidity: 42%
Notes: Measurements made at 10 meters distance.

Table 5.2
Transmitter Radiated Emissions below 1GHz
Tx @ 5755MHz 802.11n, HT40, MCS0, w/ internal antenna or external antenna

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.728E+07	13.8	30.0	-16.2	28.0	32.1	17.2	0.7
2.790E+08	22.1	37.0	-14.9	39.0	32.0	13.1	2.0
9.952E+08	22.5	37.0	-14.5	26.1	30.9	23.5	3.8

Test Mode: Tx @ 5755MHz
Temp: 21C, Humidity: 42%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.485E+07	14.6	30.0	-15.4	28.6	0.7	32.1	17.5
2.765E+08	28.1	37.0	-8.9	45.0	1.9	32.0	13.2
9.960E+08	23.2	37.0	-13.8	26.8	3.8	30.9	23.5

Test Mode: Tx @ 5755MHz
Temp: 21C, Humidity: 42%
Notes: Measurements made at 10 meters distance.

Table 5.3

Transmitter Radiated Emissions below 1GHz

Tx @ 5785MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0, w/ internal antenna or external antenna

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.728E+07	14.0	30.0	-16.0	28.2	32.1	17.2	0.7
2.830E+08	24.2	37.0	-12.8	41.3	32.0	12.9	2.0
9.968E+08	23.4	37.0	-13.6	27.1	30.9	23.4	3.8

Test Mode: Tx @ 5785MHz
Temp: 21C, Humidity: 42%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.647E+07	14.9	30.0	-15.1	29.1	0.7	32.1	17.1
2.757E+08	28.3	37.0	-8.7	45.1	1.9	32.0	13.3
9.968E+08	23.0	37.0	-14.0	26.7	3.8	30.9	23.4

Test Mode: Tx @ 5785MHz
Temp: 21C, Humidity: 42%
Notes: Measurements made at 10 meters distance.

Table 5.4
Transmitter Radiated Emissions below 1GHz
Tx @ 5795MHz 802.11n, HT40, MCS0, w/ internal antenna or external antenna

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.728E+07	14.6	30.0	-15.4	28.8	32.1	17.2	0.7
2.814E+08	22.6	37.0	-14.4	39.7	32.0	13.0	2.0
9.976E+08	23.1	37.0	-13.9	26.8	30.9	23.4	3.8

Test Mode: Tx @ 5795MHz
Temp: 21C, Humidity: 42%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.566E+07	14.3	30.0	-15.7	28.5	0.7	32.1	17.2
2.757E+08	25.9	37.0	-11.1	42.7	1.9	32.0	13.3
9.248E+08	23.2	37.0	-13.8	28.8	3.6	31.5	22.3

Test Mode: Tx @ 5795MHz
Temp: 21C, Humidity: 42%
Notes: Measurements made at 10 meters distance.

Table 5.5

Transmitter Radiated Emissions below 1GHz

Tx @ 5825MHz 802.11a, 6Mbps & 802.11n, HT20, MCS0, w/ internal antenna or external antenna

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.700E+07	14.1	30.0	-15.9	28.2	32.1	17.3	0.7
2.798E+08	23.0	37.0	-14.0	39.9	32.0	13.1	2.0
9.935E+08	22.8	37.0	-14.2	26.5	30.9	23.5	3.8

Test Mode: Tx @ 5825MHz
Temp: 21C, Humidity: 42%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

Operator: KK
April 13, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.566E+07	14.2	30.0	-15.8	28.4	0.7	32.1	17.2
1.286E+08	9.7	30.0	-20.3	28.9	1.3	32.0	11.5
2.806E+08	27.3	37.0	-9.7	44.2	2.0	32.0	13.1
9.976E+08	22.8	37.0	-14.2	26.5	3.8	30.9	23.4

Test Mode: Tx @ 5825MHz
Temp: 21C, Humidity: 42%
Notes: Measurements made at 10 meters distance.

Table 5.6
Transmitter Radiated Emissions above 1GHz

Temperature: 22.0 C	Company: Lexmark International, Inc.
Humidity: 49.0 %	Model: LEX-M01-005
Measurement distance: 3 m	Date: April 19, 2012
Configuration: EUT with internal antenna	

Frequency	Detector	SA reading	Corr. Factor	Antenna factor	FS at 3m	FS Limit	Margin
MHz		dB(uV)	dB	dB(1/m)	dB(uV/m)	dB(uV/m)	dB
Ch. 149, 5745 MHz, 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11490	Peak	36.0	-24.5	38.8	50.3	74	-23.7
11490	Average	22.2	-24.5	38.8	36.5	54	-17.5
Ch. 157, 5785 MHz, 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11570	Peak	35.9	-24.5	38.7	50.1	74	-23.9
11570	Average	22.1	-24.5	38.7	36.3	54	-17.7
Ch. 165, 5825 MHz, 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11650	Peak	36.1	-24.3	38.7	50.5	74	-23.5
11650	Average	21.8	-24.3	38.7	36.2	54	-17.8
Ch. 151, 5755 MHz, 802.11n, HT40, MCS0							
11510	Peak	36.2	-24.6	38.8	50.4	74	-23.6
11510	Average	22.4	-24.6	38.8	36.6	54	-17.4
Ch. 159, 5795 MHz, 802.11n, HT40, MCS0							
11590	Peak	35.8	-24.3	38.7	50.2	74	-23.8
11590	Average	22.2	-24.3	38.7	36.6	54	-17.4

a) RBW = 1 MHz, VBW = 1 MHz - for peak measurements
RBW = 1MHz, VBW = 10 Hz - for average measurements
b) Correction Factor: Cable loss + High Pass Filter loss - Pre-amplifier gain
c) FS at 3m = SA reading + Correction Factor + Antenna factor
d) Measurements made at 3 meters distance. Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

Table 5.7
Transmitter Radiated Emissions above 1GHz

Temperature: 22.0 C	Company: Lexmark International, Inc.
Humidity: 49.0 %	Model: LEX-M01-005
Measurement distance: 3 m	Date: April 19, 2012
Configuration: EUT with external antenna	

Frequency	Detector	SA reading	Corr. Factor	Antenna factor	FS at 3m	FS Limit	Margin
MHz		dB(uV)	dB	dB(1/m)	dB(uV/m)	dB(uV/m)	dB
Ch. 149, 5745 MHz, 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11490	Peak	35.5	-24.5	38.8	49.8	74	-24.2
11490	Average	22.3	-24.5	38.8	36.6	54	-17.4
Ch. 157, 5785 MHz, , 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11570	Peak	35.6	-24.5	38.7	49.8	74	-24.2
11570	Average	22.3	-24.5	38.7	36.5	54	-17.5
Ch. 165, 5825 MHz, , 802.11a, 6Mbps & 802.11n, HT20, MCS0							
11650	Peak	35.8	-24.3	38.7	50.2	74	-23.8
11650	Average	22.3	-24.3	38.7	36.7	54	-17.3
Ch. 151, 5755 MHz, 802.11n, HT40, MCS0							
11510	Peak	36	-24.6	38.8	50.2	74	-23.8
11510	Average	22.2	-24.6	38.8	36.4	54	-17.6
Ch. 159, 5795 MHz, 802.11n, HT40, MCS0							
11590	Peak	36.1	-24.3	38.7	50.5	74	-23.5
11590	Average	22.3	-24.3	38.7	36.7	54	-17.3

a) RBW = 1 MHz, VBW = 1 MHz - for peak measurements
RBW = 1MHz, VBW = 10 Hz - for average measurements
b) Correction Factor: Cable loss + High Pass Filter loss - Pre-amplifier gain
c) FS at 3m = SA reading + Correction Factor + Antenna factor
d) Measurements made at 3 meters distance. Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

4.5.4 Test setup photographs

The following photographs show the testing configurations used.

4.5.4 Test setup photographs

4.6 Radiated Emissions from Digital Parts and Receiver
FCC Ref: 15.109

4.6.1 Requirement

Limits for Electromagnetic Radiated Emissions, FCC Section 15.109(b) and ICES 003 *

Frequency (MHz)	Class A at 10m dB(µV/m)	Class B at 3m dB(µV/m)
30-88	39	40.0
88-216	43.5	43.5
216-960	46.4	46.0
Above 960	49.5	54.0

* According to FCC Part 15.109(g) an alternative to the radiated emission limits shown above, digital devices may be shown to comply with the limit of CISPR Pub. 22

4.6.2 Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated disturbance tests followed the guidelines of ANSI C63.4 (2003).

Example Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor to from the measured reading, followed by subtracting the Amplifier Gain (if any) and Distance Correction Factor (if any). The basic equation with a sample calculation is as follows:

FS = RA + AF + CF – PA – DCF

Where FS = Field Strength in dB (µV/m)
RA = Receiver Amplitude (including preamplifier) in dB (µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB (1/m)
AG = Amplifier Gain in dB
DCF=Distance Correction Factor in dB
(Formula: DCF = $20\log_{10}$ (measurement distance/specification distance)

Assume a receiver reading of 52.0 dB (µV) is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB and DCF of 10.5 dB (DCF in this example: $20\log_{10}$ (10/3)) is subtracted, giving field strength of 21.5 dB (µV/m).

RA = 52.0 dB (µV)
AF = 7.4 dB (1/m)
CF = 1.6 dB
AG = 29.0 dB
DCF=10.5 dB
FS = RF + AF + CF – AG – DCF
FS = 52.0 + 7.4 + 1.6 – 29.0 – 10.5
FS = 21.5 dB (µV/m)

4.6.3 Test Results

Radiated emission measurements were performed from 30 MHz to 1000 MHz. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater below 1000 MHz and 1 MHz - above 1000 MHz.

The EUT passed by 12.0dB for Class B.

Table 6.1
Radiated Emissions from Digital Parts and Receiver below 1GHz

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Horizontal)

Operator: KK
April 20, 2012

Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	AG	AF	CF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB(1/m)	dB
3.566E+07	13.9	30.0	-16.1	28.1	32.1	17.2	0.7
1.181E+08	9.8	30.0	-20.2	28.9	32.0	11.7	1.3
2.806E+08	17.6	37.0	-19.4	34.5	32.0	13.1	2.0
9.935E+08	23.3	37.0	-13.7	27.0	30.9	23.5	3.8

Test Mode: Receive Mode
Temp: 23C, Humidity: 49%

Intertek
Radiated Emissions 30 MHz - 1000 MHz
EN55022 Class B (Pk-Vertical)

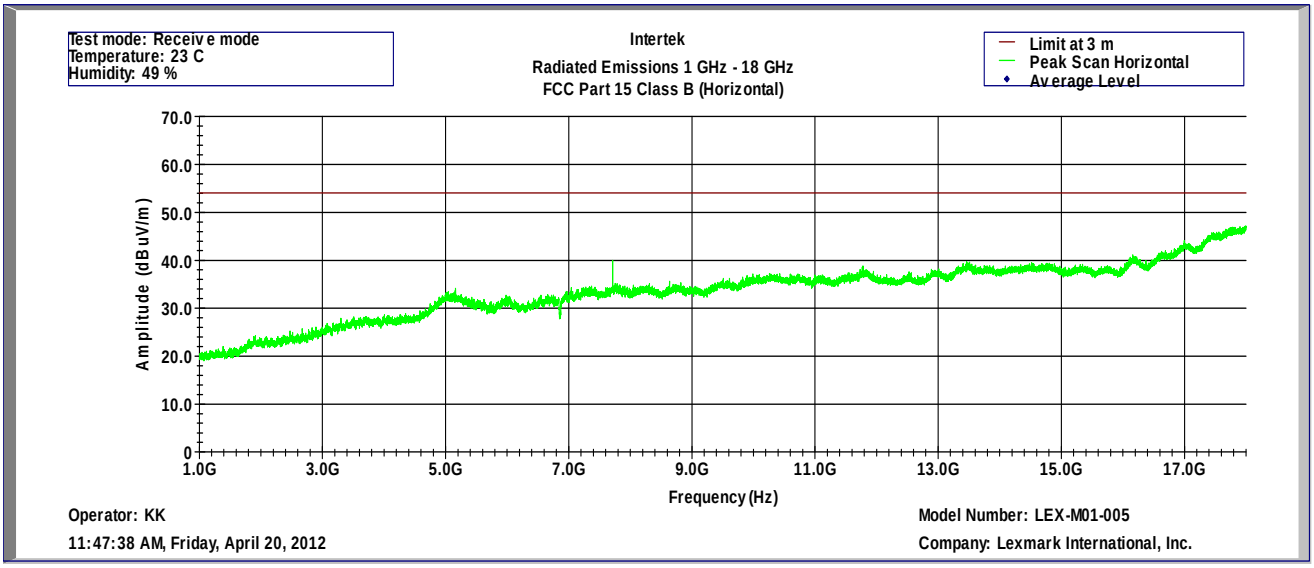
Operator: KK
April 20, 2012

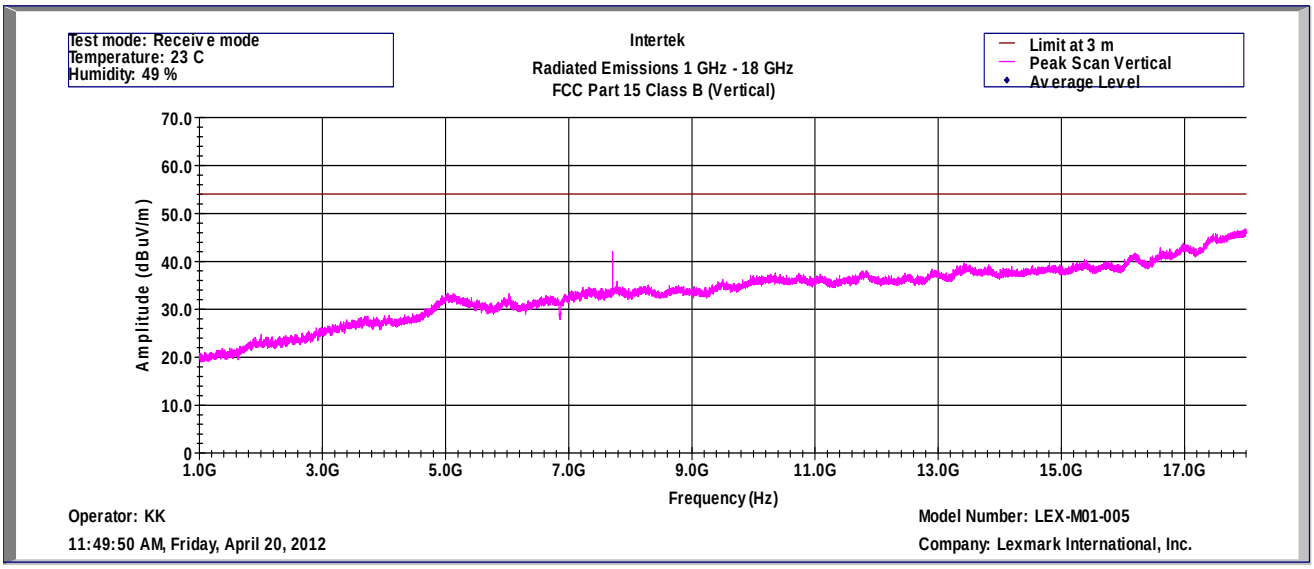
Model Number: LEX-M01-005
Company: Lexmark International, Inc.

Frequency	Peak FS	Limit@10m	Margin	RA	CF	AG	AF
(Hz)	dB(uV)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
3.485E+07	14.3	30.0	-15.7	28.3	0.7	32.1	17.5
2.547E+08	17.5	37.0	-19.5	35.5	1.9	32.0	12.2
9.992E+08	23.4	37.0	-13.6	27.1	3.8	30.9	23.3

Test Mode: Receive Mode
Temp: 23C, Humidity: 49%
Notes: Measurements made at 10 meters distance.

Table 6.2
Radiated Emissions from Digital Parts and Receiver above 1GHz



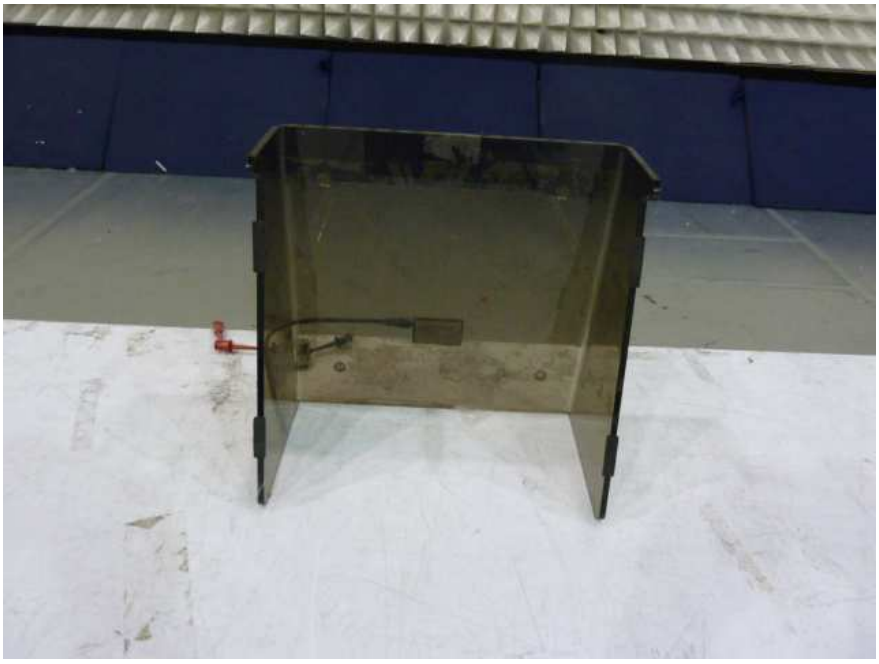


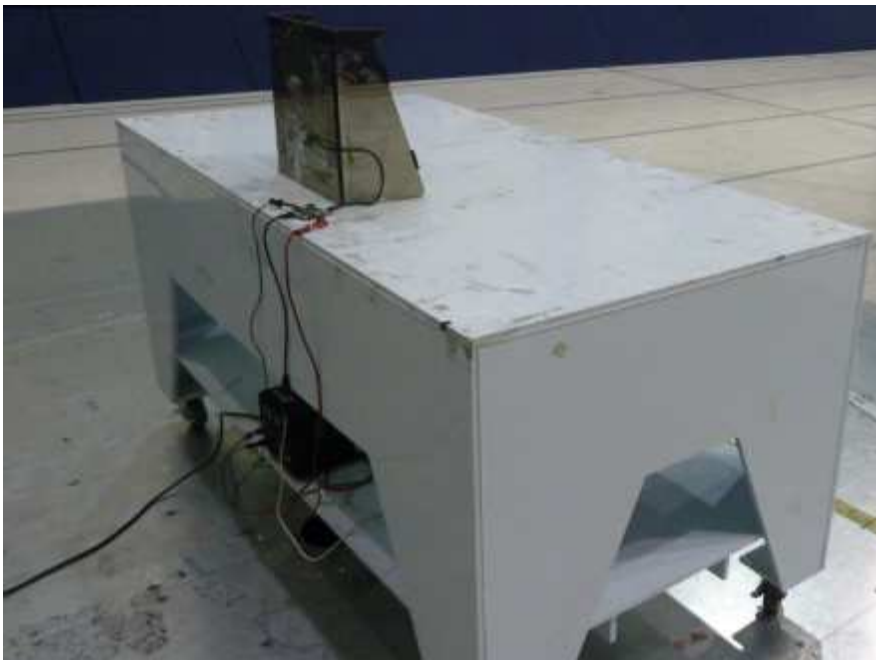
Note: Measurements made at 3 meters distance. Radiated emission measurements were performed up to 40GHz. No other emissions were detected above the noise floor which is at least 10 dB below the limit.

4.6.4 Test setup photographs

The following photographs show the testing configurations used.

4.6.4 Test setup photographs





4.7 AC Line Conducted Emission
FCC 15.207

4.7.1 Requirement

Frequency Band MHz	Class B Limit dB (µV)	
	Quasi-Peak	Average
0.15-0.50	66 to 56 Decreases linearly with the logarithm of the frequency	56 to 46 Decreases linearly with the logarithm of the frequency
0.50-5.00	56	46
5.00-30.00	60	50

Note: At the transition frequency the lower limit applies.

4.7.2 Procedure

Measurements are carried out using quasi-peak and average detector receivers in accordance with CISPR 16. An AMN is required to provide a defined impedance at high frequencies across the power feed at the point of measurement of terminal voltage and also to provide isolation of the circuit under test from the ambient noise on the power lines. An AMN as defined in CISPR 16 shall be used.

The EUT is located so that the distance between the boundary of the EUT and the closest surface of the AMN is 0.8m.

Where a flexible mains cord is provided by the manufacturer, this shall be 1m long or if in excess of 1m, the excess cable is folded back and forth as far as possible so as to form a bundle not exceeding 0.4m in length.

The EUT is arranged and connected with cables terminated in accordance with the product specification.

Conducted disturbance is measured between the phase lead and the reference ground, and between the neutral lead and the reference ground. Both measured values are reported.

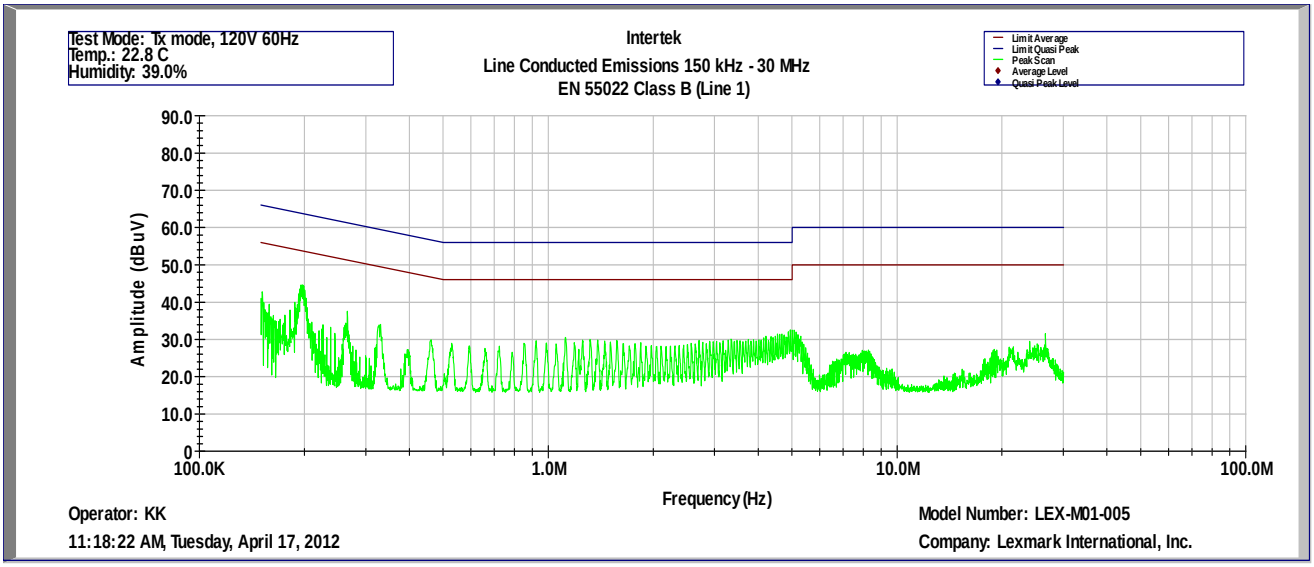
The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. A vertical, metal reference plane is placed 0.4m from the EUT. The vertical metal reference-plane is at least 2m by 2m. The EUT shall be kept at least 0.8m from any other metal surface or other ground plane not being part of the EUT. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for larger EUT.

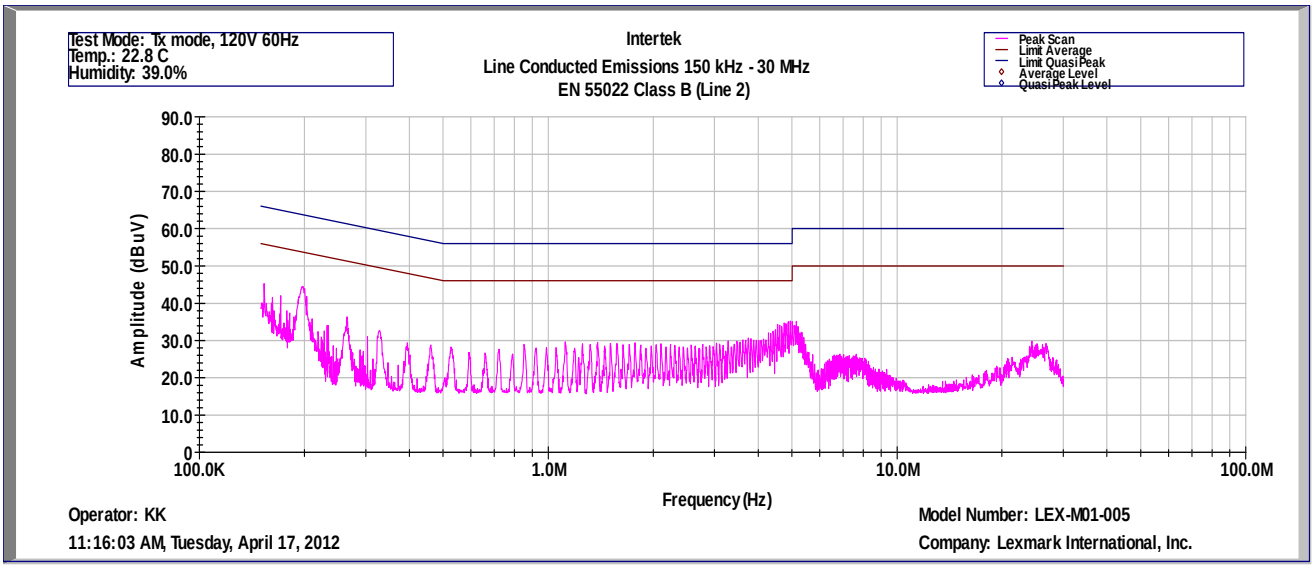
Floor standing EUT are placed on a horizontal metal ground plane and isolated from the ground plane by resting on an insulating material. The metal ground plane extends at least 0.5m beyond the boundaries of the EUT and has minimum dimensions of 2m by 2m.

Equipment setup for conducted disturbance tests followed the guidelines of ANSI C63.4.

4.7.3 Test Result

Conducted Disturbance at AC Mains

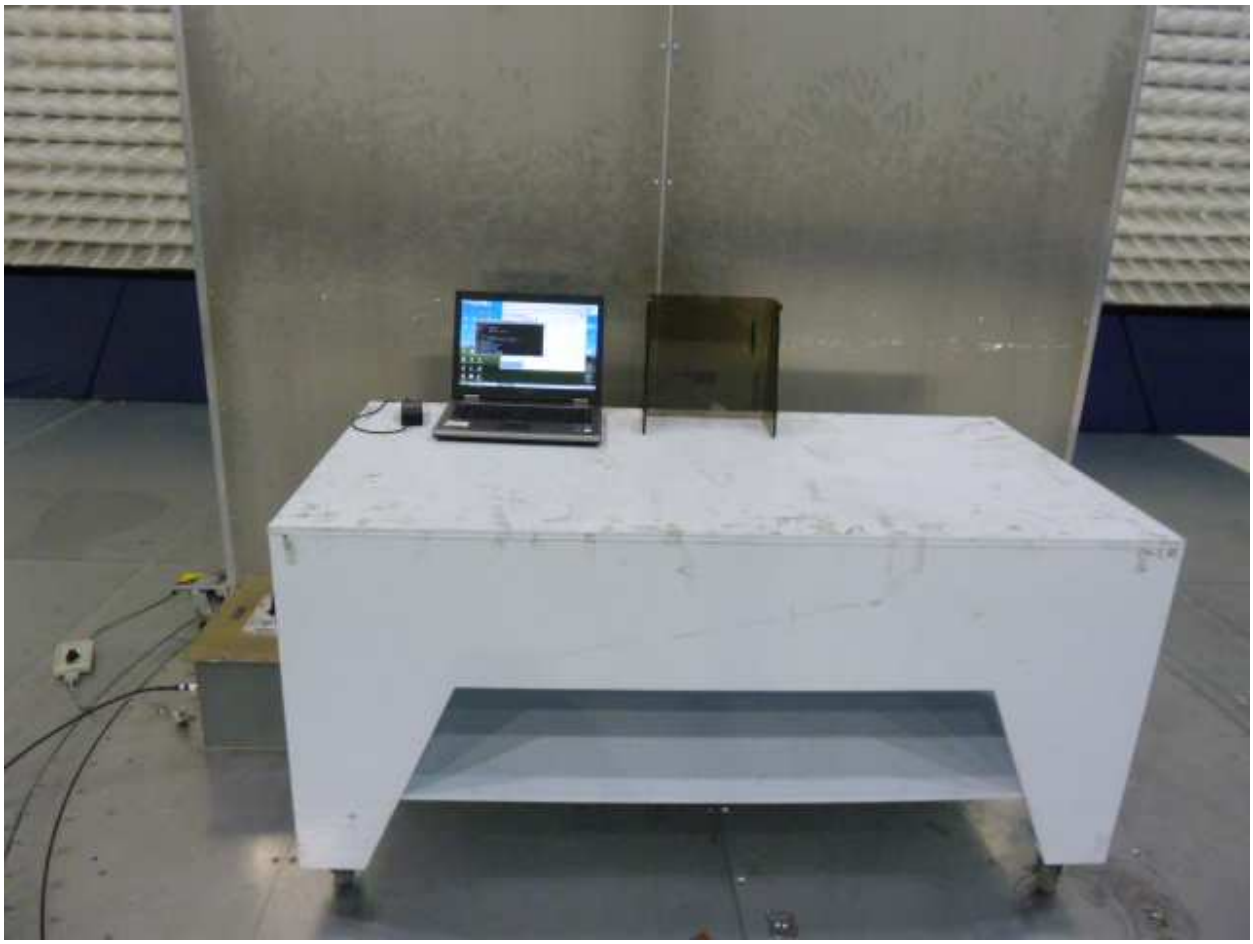




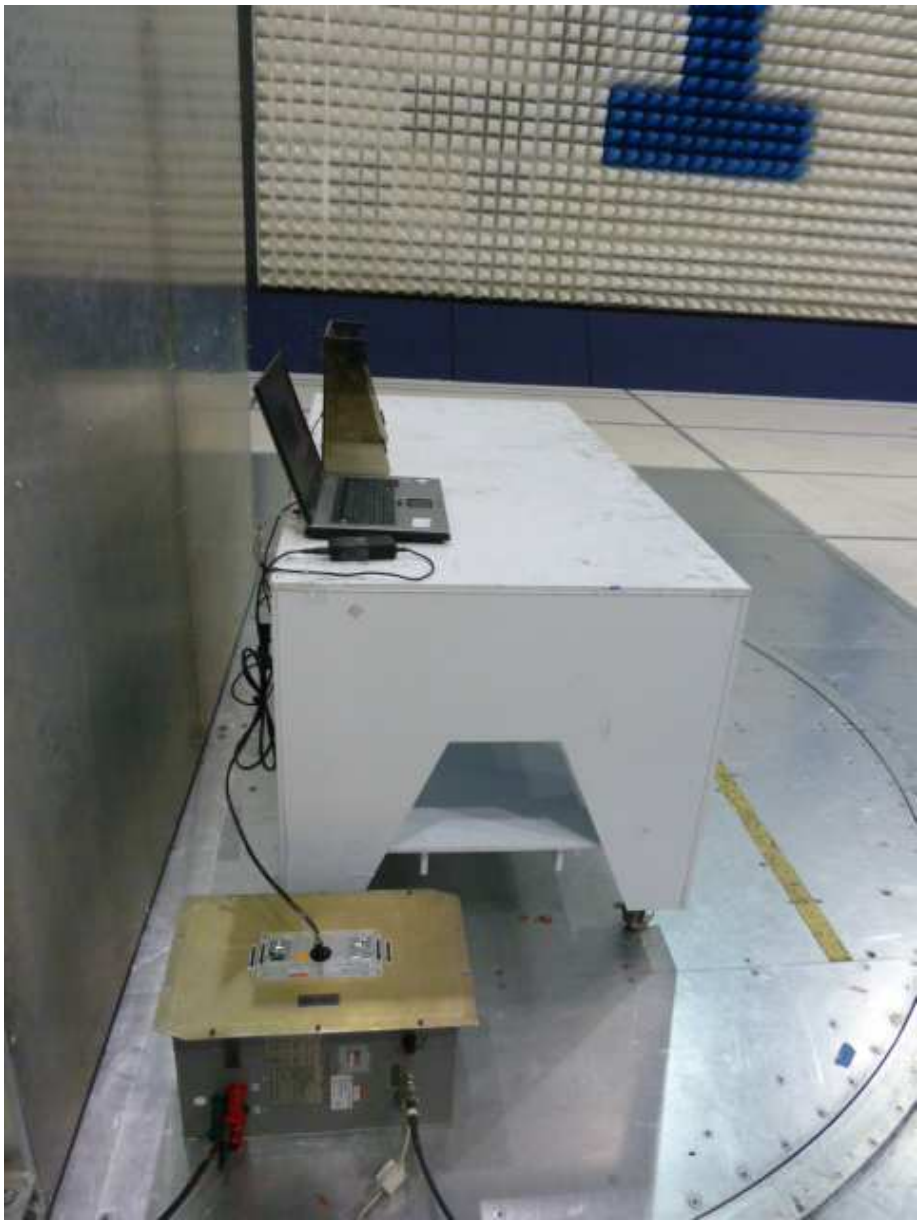
Results	**Complies** by 10.0dB

4.7.4 Test Configuration Photographs

The following photographs show the testing configurations used.



4.7.4 Test Configuration Photographs (continued)



5.0 List of Test Equipment

Measurement equipment used for emission compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	03/09/13
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	03/09/13
Spectrum Analyzer	Rohde&Schwarz	FSU	200482	12	03/22/13
Spectrum Analyzer	Rohde&Schwarz	FSP-40	100030	12	11/09/12
Spectrum Analyzer	Rohde&Schwarz	ESU	100172	12	10/04/12
BI-Log Antenna	ARA	LPB-2513/A	1154	12	07/06/12
Horn Antenna	EMCO	3115	9107-3712	12	11/16/12
Horn Antenna	EMCO	3115	00126795	12	11/03/12
Pyramidal Horn Antenna	EMCO	3160-09	Not Labeled	#	#
Pyramidal Horn Antenna	EMCO	3160-10	Not Labeled	#	#
Pre-Amplifier	Sonoma	310N	293620	12	11/11/12
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	09/01/12
Pre-Amplifier	Miteq	JSD44-18004000-30-5P	1071636	12	05/09/12
Signal Generator	Hewlett Packard	SMR40	100445	12	09/01/12
LISN	FCC	FCC-LISN-50-50-M-H	2012	12	08/28/12

No Calibration required

6.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / G100681263	KK	May 25, 2012	Original document