FCC TEST REPORT

Test report No.:	EMC- FCC- R0113
FCC ID:	2AAKFMWP1100A
Type of equipment:	WiFi Phone
Model Name:	MWP1100A
Applicant:	Moimstone.co.,Ltd
Max.RF Output Power:	15.78 dBm
FCC Rule Part(s):	FCC Part 15 Subpart C 15.247
Frequency Range:	2 412 MHz ~ 2 462 MHz 5 745 MHz ~ 5 825 MHz
Test result:	Complied

The above equipment was tested by EMC compliance Testing Laboratory for compliance with the requirements of FCC Rules and Regulations.
The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Date of test: June 24, 2013 ~ July 01, 2013

Issued date: July 02, 2013

Tested by: ____________________
SON, MIN GI

Approved by: ____________________.
YU, SANG HOON

480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
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1. Client information

Applicant:	Moimstone.co.,Ltd
Address:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Telephone number:	+82-70-7791-3750
Facsimile number :	+82-31-426-9539
Contact person:	Yoo Deok Jae / nunjoa@moimstone.com

Manufacturer :	Moimstone.co.,Ltd
Address:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA

2. Laboratory information

Address
EMC Compliance Ltd.
480-5 Shin-dong, Yeongtong-gu, Suwon-city, Gyunggi-do, 443-390, Korea
Telephone Number: 82 31 336 9919   Facsimile Number: 82 31 336 4767

Certificate
CBTL Testing Laboratory, KOLAS NO.: 231
FCC Filing No.: 508785
VCCI Registration No.: C-1713, R-1606, T-258
IC Recognition No.:8035A-2

SITE MAP

3. Description of E.U.T.

3.1 Basic description

Applicant :	Moimstone.co.,Ltd
Address of Applicant:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Manufacturer:	Moimstone.co.,Ltd
Address of Manufacturer:	65, Heungan-daero 439 beon-gil, Dongan-gu, Anyang-si, Gyeonggi-do, KOREA
Type of equipment:	WiFi Phone
Basic Model:	MWP1100A
Serial number:	Proto Type

3.2 General description

Communication	802.11b, g, n HT20
Frequency Range	2 412 ~ 2 462 MHz, 5 745 ~ 5 825 MHz
Type of Modulation (Technologies)	64QAM, 16QAM, QPSK, BPSK(OFDM)
Channel capacity	**2.4 GHz** : 11 ch **5.0 GHz** : 4 ch
Antenna Gain	**2.4 GHz** : 0.61 dBi **5.0 GHz** : 1.78 dBi
Type of Antenna	Inverted F ANTENNA
Power supply	DC 3.7 V
Operating temperature	-20 ~ 50 ℃
Dimension	155 mm x 51 mm x 16 mm (W x D x H)

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3.3 Test frequency

For all teset items, the low, middle and high channels of the modes were tested with above worst case data rate.

2400 ~ 2483.5 (MHz) : 802.11b,g,n HT 20

	CH	Frequency
Low frequency	1	2 412MHz
Middle frequency	6	2 437 MHz
High frequency	11	2 462 MHz

5745~5785 (MHz) : 802.11a, an HT20

	CH	Frequency
Low frequency	36	5 745 MHz
Middle frequency	40	5 785 MHz
High frequency	48	5 825 MHz

3.4 Test Voltage

mode	Voltage
Norminal voltage	DC 3.7V

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4. Summary of test results

4.1 Standards & results

Rule Reference	Parameter	Report Section	Test Result
15.203, 15.247(b)(4)	Antenna Requirement	5.1	C
15.247(b)(3)	Maximum Peak Output Power	5.2	C
15.247(e)	Peak Power Spectral Density	5.3	C
15.247(a)(2)	6 dB Channel Bandwidth	5.4	C
15.247(d), 15.205(a), 15.209(a)	Spurious Emission, Band Edge, and Restricted bands	5.5	C
15.207(a)	Conducted Emissions	5.6	NA
15.247(i), 1.1307(b)(1)	RF Exposure	5.7	C

Note: C = complies
NC = Not complies
NT = Not tested
NA = Not Applicable

4.2 Uncertainty

Measurement Item	Combined Standard Uncertainty Uc	Expanded Uncertainty U = KUc (K = 2)
Conducted RF power	± 0.29 dB	± 0.58 dB
Radiated disturbance	30 ㎒ ~ 300 ㎒ : + 2.43 ㏈, - 2.44 ㏈ 300 ㎒~1 000 ㎒ : + 2.49㏈, - 2.50 ㏈ 1 ㎓ ~ 6 ㎓ : + 3.10 ㏈, - 3.10 ㏈ 6 ㎓ ~ 18 ㎓ : + 3.21 ㏈, - 3.27 ㏈	30 ㎒ ~ 300 ㎒ : + 4.86 ㏈, - 4.88 ㏈ 300 ㎒ ~ 1 000 ㎒ + 4.98㏈, - 4.99 ㏈ 1 ㎓ ~ 6 ㎓ : + 6.19 ㏈, - 6.20 ㏈ 6 ㎓ ~ 18 ㎓ : + 6.41 ㏈, - 6.53 ㏈

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5. Test results

5.1 Antenna Requirement

5.1.1 Regulation

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1.2 Result

- Complied

The transmitter has an Inverted F ANTENNA
The total directional peak gain of the antenna does not exceed 6.0 dBi.

	2 412 ~ 2 462 MHz	5 745~5 825 MHz
ANT Gain	0.61	1.78

According to KDB 662911 D01 Multiple Transmitter Output v01r02
- Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

For power spectral density (PSD) measurements on all devices,
Array Gain = 10 log(N_{ANT}/N_{SS}) dB.
For power measurements on IEEE 802.11 devices
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;
Array Gain = 0 dB (i.e., no array gain) for channel widths $\geq$ 40 MHz for any N_{ANT};
Array Gain = 5 log(N_{ANT}/N_{SS}) dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.
For power measurements on all other devices:
Array Gain = 10 log(N_{ANT}/N_{SS}) dB.

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5.2 Maximum Peak Output Power

5.2.1 Regulation

According to §15.247(b)(3), For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.2.2 Measurement Procedure

These test measurement settings are specified in section 9.2.3 of 558074 D01 DTS Meas Guidance.

5.2.2.1 Method AVGPM (Measurement using an RF average power meter):

a) As an alternative to spectrum analyzer or EMI receiver measurements, measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

1) The EUT is configured to transmit continuously, or to transmit with a constant duty factor.

2) At all times when the EUT is transmitting, it shall be transmitting at its maximum power control level.

3) The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

b) If the transmitter does not transmit continuously, measure the duty cycle (x) of the transmitter output signal as described in Section 6.0.

c) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.

d) Adjust the measurement in dBm by adding 10log (1/x), where x is the duty cycle to the measurement result.

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5.2.3 Test Result

-Complied

802.11b

Frequency (MHz)	Average Power (dBm)	C.L (dB)	result (dBm)	Limit (dBm)	Margin (dB)
2 412	14.48	1.30	15.78	30.00	14.22
2 437	13.97	1.32	15.29	30.00	14.71
2 462	13.76	1.31	15.07	30.00	14.93

802.11g

Frequency (MHz)	Average Power (dBm)	C.L (dB)	result (dBm)	Limit (dBm)	Margin (dB)
2 412	10.65	1.30	11.95	30.00	18.05
2 437	10.48	1.32	11.80	30.00	18.20
2 462	10.27	1.31	11.58	30.00	18.42

802.11n HT20

Frequency (MHz)	Average Power (dBm)	C.L (dB)	result (dBm)	Limit (dBm)	Margin (dB)
2 412	10.05	1.30	11.35	30.00	18.65
2 437	9.96	1.32	11.28	30.00	18.72
2 462	9.75	1.31	11.06	30.00	18.94

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the output power.(This device is $N_{ANT} = 4$, Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$)
2. Duty cycle = 100% = 0 dB

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802.11a

Frequency (MHz)	Average Power (dBm)	C.L (dB)	result (dBm)	Limit (dBm)	Margin (dB)
5 745	17.47	2.00	19.47	30.00	10.53
5 785	17.14	2.00	19.14	30.00	10.86
5 825	17.52	2.00	19.52	30.00	10.48

802.11an HT20

Frequency (MHz)	Average Power (dBm)	C.L (dB)	result (dBm)	Limit (dBm)	Margin (dB)
5 745	16.79	2.00	18.79	30.00	11.21
5 785	17.11	2.00	19.11	30.00	10.89
5 825	17.17	2.00	19.17	30.00	10.83

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the output power.(This device is $N_{ANT} = 4$, Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$)
2. Duty cycle = 100% = 0 dB

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5.3 Peak Power Spectral Density

5.3.1 Regulation

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

5.3.2 Measurement Procedure

These test measurement settings are specified in section 10.2 of 558074 D01 DTS Meas Guidance.

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

a) Set analyzer center frequency to DTS channel center frequency.
b) Set the span to 1.5 times the DTS bandwidth.
c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.
j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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5.3.3 Test Result

-Complied

802.11b

Freq (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
2 412	3.61	8.00	4.39
2 437	3.33	8.00	4.67
2 462	3.19	8.00	4.81

802.11g

Freq (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
2 412	-1.77	8.00	9.77
2 437	-0.14	8.00	8.14
2 462	-0.17	8.00	8.17

802.11n HT20

Freq (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
2 412	-1.30	8.00	9.30
2 437	-1.53	8.00	9.53
2 462	-1.63	8.00	9.63

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the Peak Power Spectral Density. (This device is N_{SS} = 4, Array Gain = 10 log(N_{ANT}/N_{SS}) dB = 0.)
2. Duty cycle = 100% = 0

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802.11a

Freq (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5 745	-3.16	8.00	11.16
5 785	-3.46	8.00	11.46
5 825	-3.22	8.00	11.22

802.11an HT20

Freq (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5 745	-4.61	8.00	12.61
5 785	-4.86	8.00	12.86
5 825	-4.31	8.00	12.31

-NOTE:

1. Since the directional gain of the integral antenna declared by the manufacturer does not exceed 6.0 dBi, there was no need to reduce the Peak Power Spectral Density. (This device is N_{SS} = 4, Array Gain = 10 log(N_{ANT}/N_{SS}) dB = 0.)
2. Duty cycle = 100% = 0

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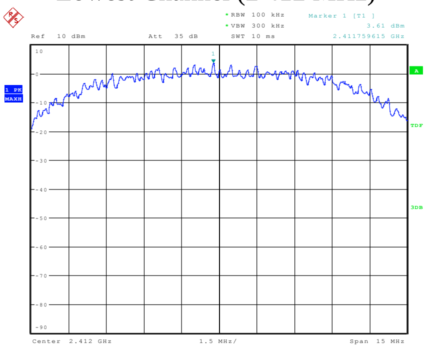
5.3.4 Test Plot

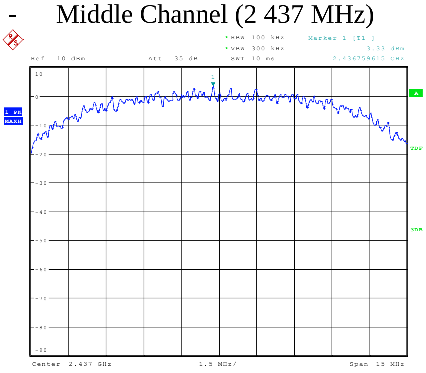
Figure 1. Plot of the Power Density (Conducted)

802.11b

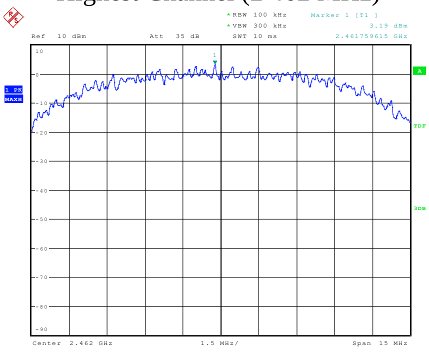
- Lowest Channel (2 412 MHz)



- Middle Channel (2 437 MHz)

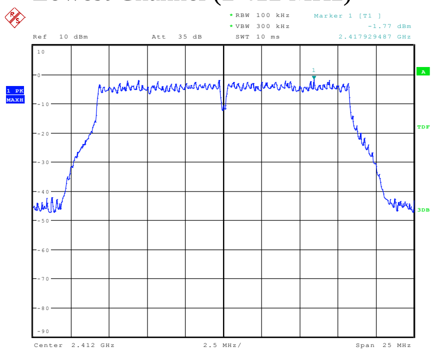


- Highest Channel (2 462 MHz)

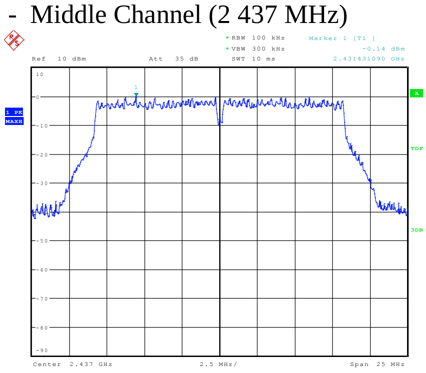


802.11g

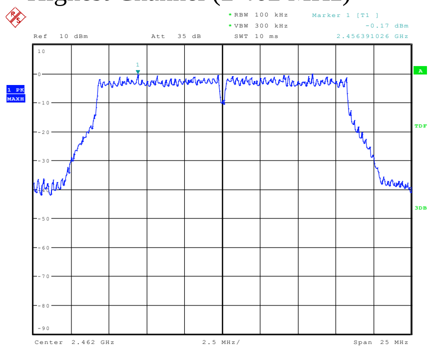
- Lowest Channel (2 412 MHz)



- Middle Channel (2 437 MHz)



- Highest Channel (2 462 MHz)



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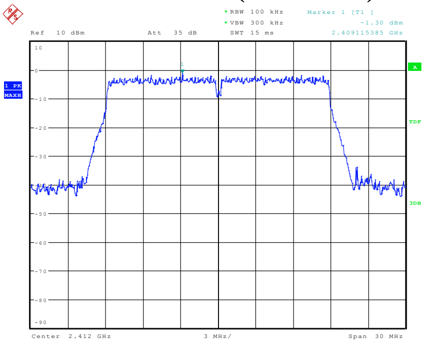
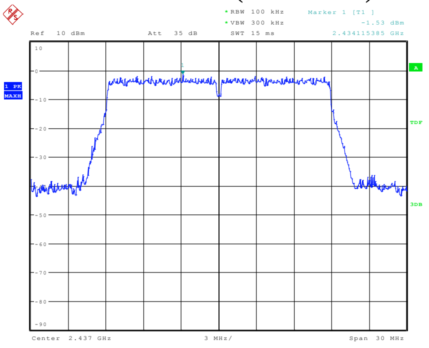
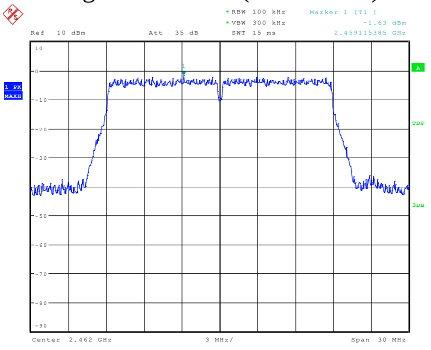
- Lowest Channel (2 412 MHz)



- Middle Channel (2 437 MHz)



- Highest Channel (2 462 MHz)



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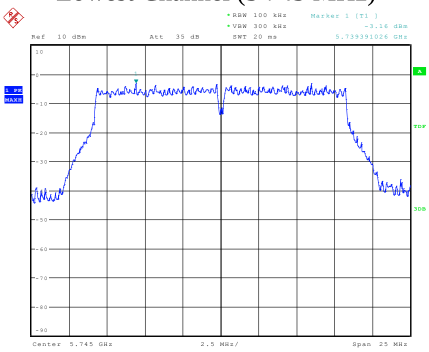
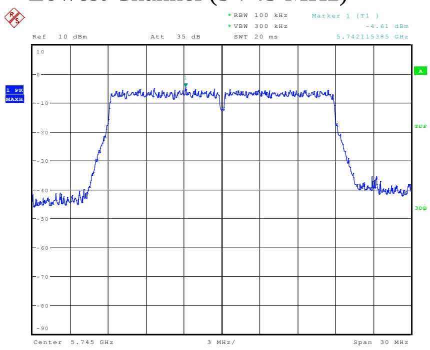
802.11a

- Lowest Channel (5 745 MHz)

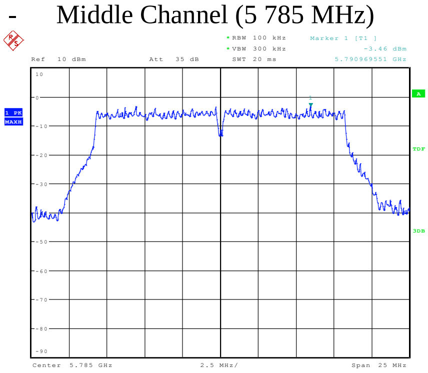


802.11an HT20

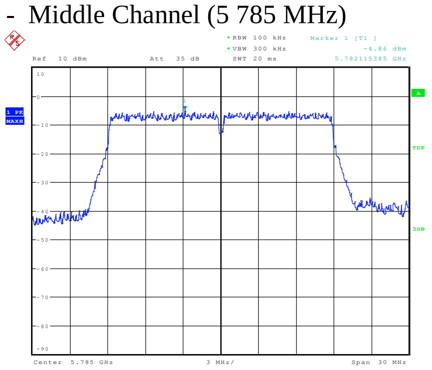
- Lowest Channel (5 745 MHz)



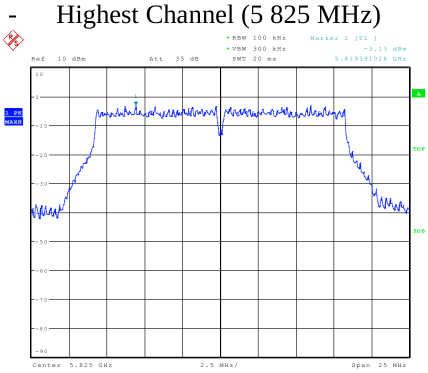
- Middle Channel (5 785 MHz)



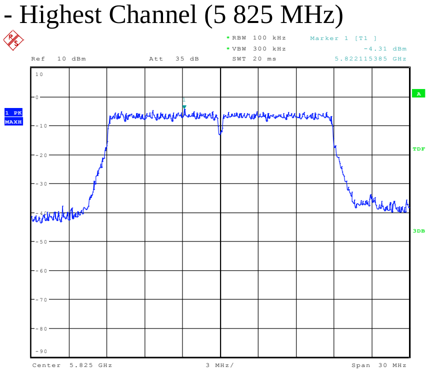
- Middle Channel (5 785 MHz)



- Highest Channel (5 825 MHz)



- Highest Channel (5 825 MHz)



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5.4 6 dB Bandwidth

5.4.1 Regulation

According to §15.247(a)(2) Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4.2 Measurement Procedure

These test measurement settings are specified in section 7.0 of 558074 D01 DTS Meas Guidance.

5.4.2.1 DTS Channel Bandwidth-Option 1

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.4.2.2 DTS Channel Bandwidth Measurement Procedure-Option 2

The automatic bandwidth measurement capability of a spectrum analyzer may be employed using the X dB bandwidth mode with X set to 6 dB, if it implements the functionality described above. When using this capability, care should be taken to ensure that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that may be ≥ 6 dB.

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5.4.3 Test Result

-Complied

802.11b

Channel	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
Low	2 412	10.385	500
Middle	2 437	10.321	500
High	2 462	10.321	500

802.11g

Channel	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
Low	2 412	16.538	500
Middle	2 437	16.538	500
High	2 462	16.538	500

802.11n HT20

Channel	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
Low	2 412	17.788	500
Middle	2 437	17.821	500
High	2 462	17.821	500

-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

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802.11a

Channel	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
Low	2 412	16.538	500
Middle	2 437	16.538	500
High	2 462	16.538	500

802.11an HT20

Channel	Frequency (MHz)	6dB BW (MHz)	Min. Limit (kHz)
Low	2 412	17.821	500
Middle	2 437	17.821	500
High	2 462	17.853	500

-NOTE:

1. We took the insertion loss of the cable loss into consideration within the measuring instrument.

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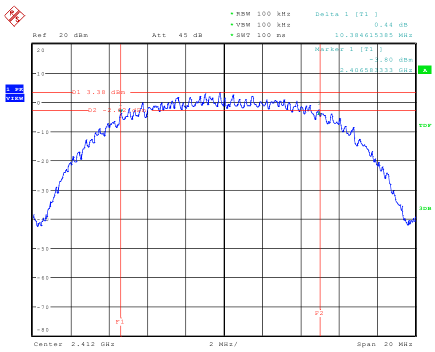
5.4.4 Test Plot

Figure 2. Plot of the 6dB Bandwidth (Conducted)

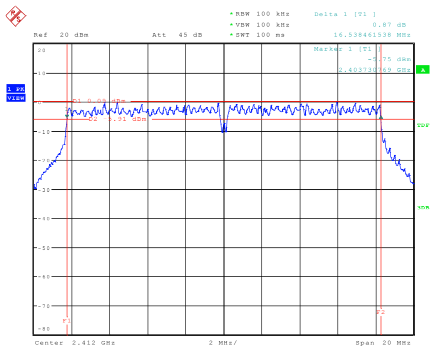
802.11b

- Lowest Channel (2 412 MHz)

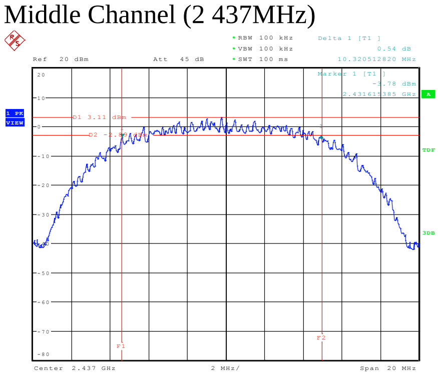


802.11g

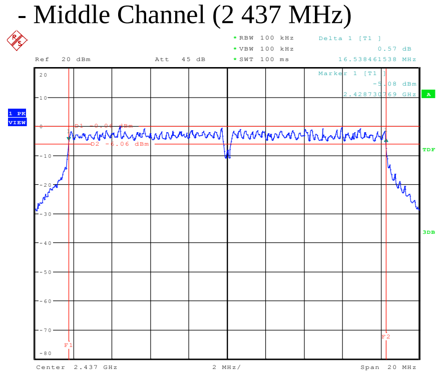
- Lowest Channel (2 412 MHz)



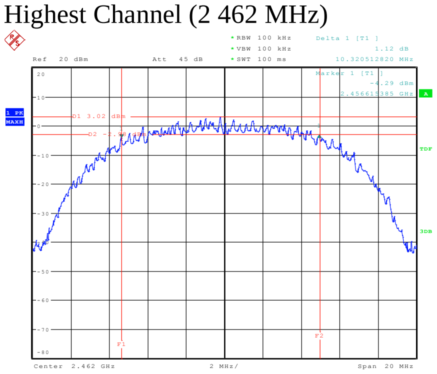
Middle Channel (2 437MHz)



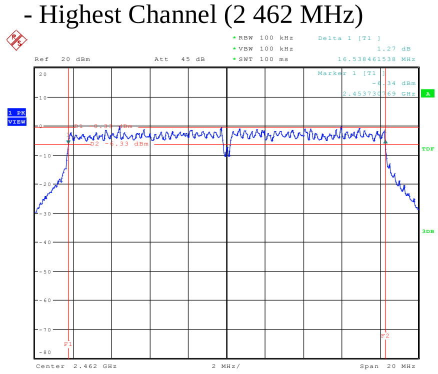
- Middle Channel (2 437 MHz)



Highest Channel (2 462 MHz)



- Highest Channel (2 462 MHz)



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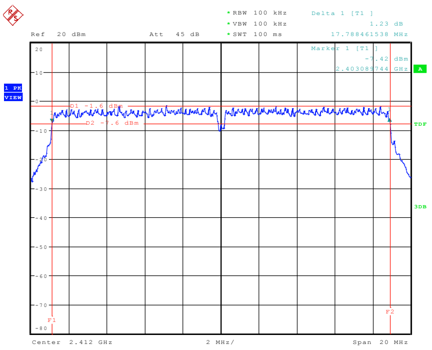
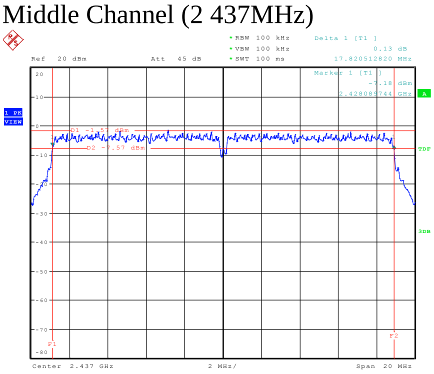
802.11n HT20

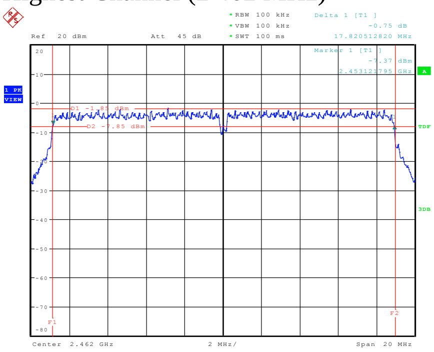
- Lowest Channel (2 412 MHz)



Middle Channel (2 437MHz)



Highest Channel (2 462 MHz)



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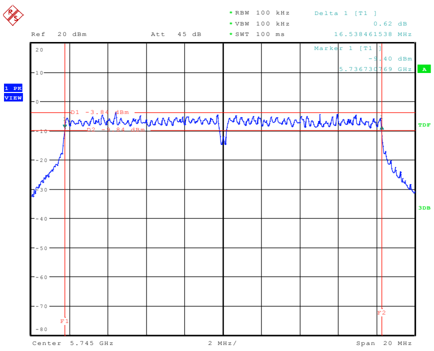
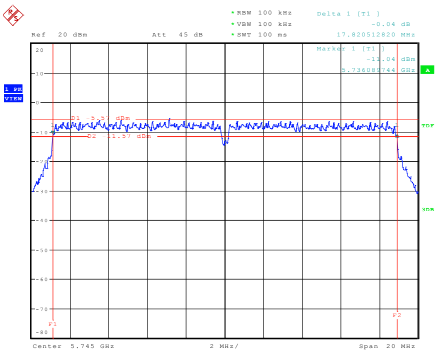
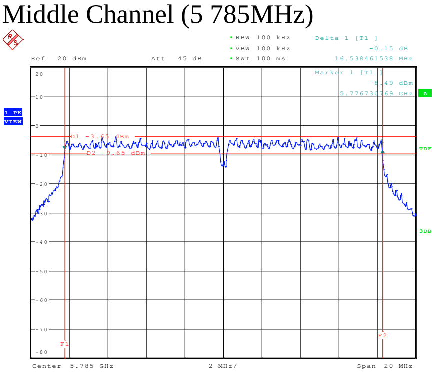
802.11a	802.11an HT20
- Lowest Channel (5 745 MHz)	- Lowest Channel (5 745 MHz)

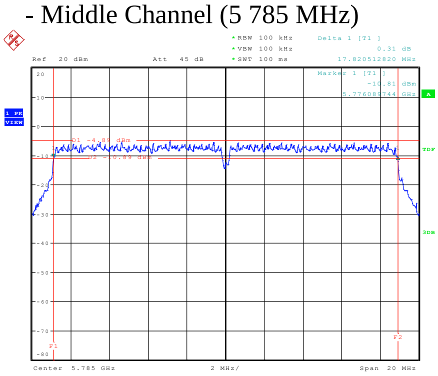




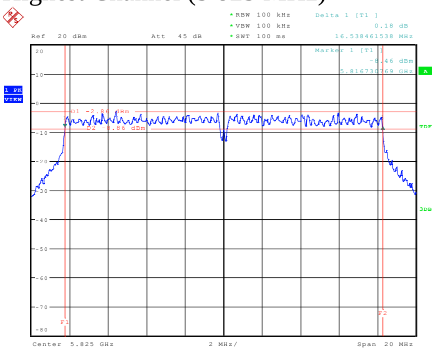
Middle Channel (5 785MHz)



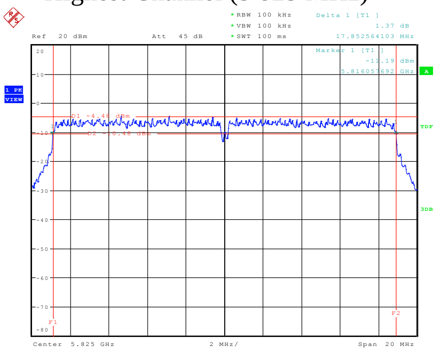
- Middle Channel (5 785 MHz)



Highest Channel (5 825 MHz)



- Highest Channel (5 825 MHz)



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5.5 SPURIOUS EMISSION, BAND EDGE, AND RESTRICTED BANDS

5.5.1 Regulation

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

According to §15.209(a), Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall notexceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (µV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 -1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

** The emission limits shown in the above table are based on measurement instrumentation employing a CISPR quasi-peak detector and above 1000 MHz are based on the average value of measured emissions.

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5.5.2 Measurement Procedure

5.5.2.1 Band-edge Compliance of RF Conducted(or Radiated) Emissions.

5.5.2.1.1 Reference Level Measurement

Establish the reference level by using the peak PSD procedure from Section 9.1 to measure the PSD level in any 100 kHz bandwidth (i.e., set RBW = 100 kHz and VBW ≥ 300 kHz) within the DTS channel bandwidth (the channel found to contain the maximum PSD level can be used to establish the reference level).

5.5.2.1.2 Unwanted Emissions Level Measurement

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW ≥ 300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

5.5.2.2 Conducted Spurious Emissions

Set the spectrum analyzer as follows:

1. Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
2. RBW = 100 kHz
3. VBW ≥ RBW
4. Sweep = auto
5. Detector function = peak
6. Trace = max hold
7. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
8. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

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5.5.2.3 Radiated Spurious Emissions

1. The preliminary and final rdiated measurements were performed to determine the frequency producing the maximum emissions in at a 10m anechoic chamber. The EUT was tested at a distance 3 meters.
2. The EUT was placed on the top of the 0.8-meter height, 1 × 1.5 meter non-metallic table. To find the maximum emission levels, the height of a measuring antenna was changed and the turntable was rotated 360˚.
3. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 9 kHz to 30 MHz using the loop antenna, and from 30 to 1000 MHz using the TRILOG broadband antenna, and from 1 000 MHz to 40 000 MHz using the horn antenna.
4. Each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

- Sample calculation

The field strength is calculated adding the antenna Factor, cable loss and, Antenna pad adding, subtracting the amplifier gain from the measured reading.

**The sample calculation is as follow:

Result = M.R + C.F(A.F + C.L +3 dB Att – A.G)
M.R = Meter Reading
C.F = Correction Factor
A.F = Antenna Factor
C.L = Cable Loss
A.G = Amplifier Gain
3 dB Att = 3 dB Attenuator

If M.R is 30 dB, A.F 12 dB, C.L 5 dB, 3 dB, A.G 35 dB
The result is : 30 + 12 + 5 + 3 – 35 = 15 dB(μV/m)

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5.7.3 Test Result

-complied

1. Band-edge & Conducted Spurious Emissions was shown in figure 3.
   Note: We took the insertion loss of the cable into consideration within the measuring instrument.
2. Band edge compliance of Radiated Emissions(Restricted Bands) was shown in figure 4.
3. Measured value of the Field strength of spurious Emissions (Radiated)

- The Measuring below 30 MHz was detected too small. (More than 20 dB below the limit)

802.11b

Low channel (2 412 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
354.223	120	H	42.8	-6.9	35.9	46.0	10.1
444.433	120	H	39.8	-4.2	35.6	46.0	10.4
921.309	120	H	21.3	6.8	28.1	46.0	17.9
Peak DATA. Emissions above 1GHz							
4 816.75	1 000	V	44.6	-1.4	43.2	74.0	30.8
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 816.75	1 000	V	35.7	-1.4	34.3	54.0	19.7
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

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Middle channel (2 437 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
367.560	120	H	48.1	-6.5	41.6	46.0	4.4
446.979	120	H	42.8	-4.2	38.6	46.0	7.4
880.084	120	H	21.3	5.5	26.8	46.0	19.2
Peak DATA. Emissions above 1GHz							
4 885.75	1 000	V	40.3	-1.0	39.3	74.0	34.7
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 885.75	1 000	V	32.0	-1.0	31.0	54.0	23
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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High channel (2 462 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
349.858	120	H	48.3	-7.0	41.3	46.0	4.7
448.555	120	H	42.7	-4.1	38.6	46.0	7.4
880.084	120	H	21.1	5.5	26.6	46.0	19.4
Peak DATA. Emissions above 1GHz							
4 936.75	1 000	V	38.2	-0.7	37.5	74.0	36.5
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 936.75	1 000	V	37.7	-0.7	37	54.0	17.0
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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802.11g

Low channel (2 412 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
348.645	120	H	41.6	-7.1	34.5	46.0	11.5
453.162	120	H	37.5	-4.0	33.5	46.0	12.5
837.646	120	H	21.5	4.7	26.2	46.0	19.8
Peak DATA. Emissions above 1GHz							
4 825.75	1 000	V	44.5	-1.3	43.2	74.0	30.8
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 825.75	1 000	V	32.8	-1.3	31.5	54.0	22.5
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:

1. This measurement was performed the worst case data were reported.

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Middle channel (2 437 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
352.161	120	H	41.2	-7.0	34.2	46.0	11.8
447.343	120	H	37.1	-4.2	32.9	46.0	13.1
880.084	120	H	21.4	5.5	26.9	46.0	19.1
Peak DATA. Emissions above 1GHz							
4 882.75	1 000	V	42.0	-1.0	41.0	74.0	33.0
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 882.75	1 000	V	31.2	-1.0	30.2	54.0	23.8
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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High channel (2 462 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
346.341	120	H	41.5	-7.1	34.4	46.0	11.6
452.071	120	H	37.6	-4.0	33.6	46.0	12.4
880.084	120	H	21.6	5.5	27.1	46.0	18.9
Peak DATA. Emissions above 1GHz							
4 943.50	1 000	V	42.3	-0.7	41.6	74.0	32.4
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 943.50	1 000	V	32.9	-0.7	32.2	54.0	21.8
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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Low channel (2 412 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
334.216	120	H	36.8	-7.5	29.3	46.0	16.7
453.405	120	H	39.6	-4.0	35.6	46.0	10.4
893.542	120	H	31.2	5.8	37.0	46.0	9.0
Peak DATA. Emissions above 1GHz							
4 825.75	1 000	V	52.0	-1.3	50.7	74.0	23.3
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 825.75	1 000	V	35.6	-1.3	34.3	54.0	19.7
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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Middle channel (2 437 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
345.978	120	H	42.2	-7.1	35.1	46.0	8.2
445.403	120	H	41.6	-4.2	37.4	46.0	9.6
880.084	120	H	29.5	5.5	35.0	46.0	11.0
Peak DATA. Emissions above 1GHz							
4 887.25	1 000	V	50.7	-0.9	49.8	74.0	24.2
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 887.25	1 000	V	36.9	-0.9	36.0	54.0	18.0
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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High channel (2 462 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
348.888	120	H	42.7	-7.0	35.7	46.0	10.3
452.799	120	H	41.2	-4.0	37.2	46.0	8.8
880.084	120	H	28.2	5.5	33.7	46.0	12.3
Peak DATA. Emissions above 1GHz							
4 947.25	1 000	V	50.2	-0.7	49.5	74.0	24.5
Above 5 000.00	**Not Detected**	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
4 947.25	1 000	V	34.6	-0.7	33.9	54.0	20.1
Above 5 000.00	**Not Detected**	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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802.11a

Low channel (5 745 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
320.030	120	H	37.7	-8.0	29.7	46.0	16.3
448.191	120	H	40.3	-4.1	36.2	46.0	9.8
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:

1. This measurement was performed the worst case data were reported.

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Middle channel (5 785 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
332.155	120	H	35.5	-7.6	27.9	46.0	18.1
451.223	120	H	41.5	-4.1	37.4	46.0	8.6
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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High channel (5 825 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
320.030	120	H	37.5	-8.0	29.5	46.0	16.5
453.647	120	H	39.6	-4.0	35.6	46.0	10.4
-	-	-	-	-	-	-	-
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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Low channel (5 745 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
370.713	120	H	40.1	-6.4	33.7	46.0	12.3
444.675	120	H	40.3	-4.2	36.1	46.0	9.9
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:

1. This measurement was performed the worst case data were reported.

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Middle channel (5 785 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
367.075	120	H	40.5	-6.5	34.0	46.0	12.0
444.918	120	H	39.7	-4.2	35.5	46.0	10.5
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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High channel (5 825 MHz)

Frequency [MHz]	Receiver Bandwidth [kHz]	Pol. [V/H]	Reading [dB(μV)]	Factor [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
Quasi-Peak DATA. Emissions below 1GHz							
367.075	120	H	40.5	-6.5	34.0	46.0	12.0
444.918	120	H	39.7	-4.2	35.5	46.0	10.5
-	-	-	-	-	-	-	-
Peak DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-
Average DATA. Emissions above 1GHz							
Not Detected	-	-	-	-	-	-	-

Note:
1. This measurement was performed the worst case data were reported.

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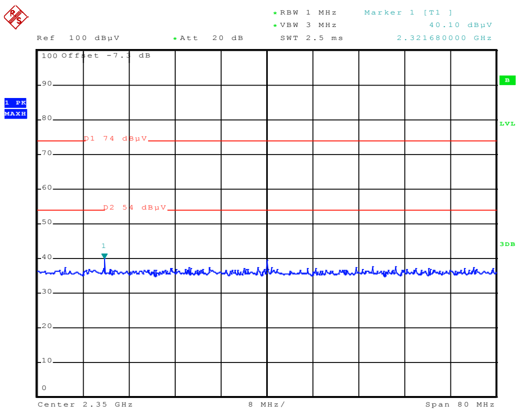
5.6.4 Test Plot

Figure 3. Plot of the Band Edge (Radiated)

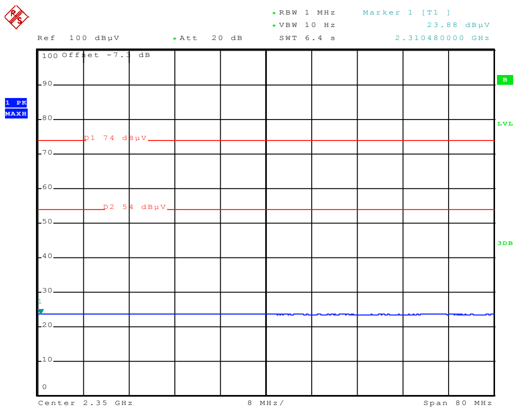
802.11b

- Lowest Channel (2 412 MHz)

PK

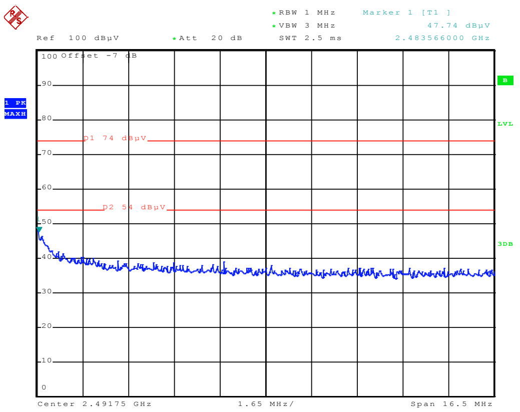


AV

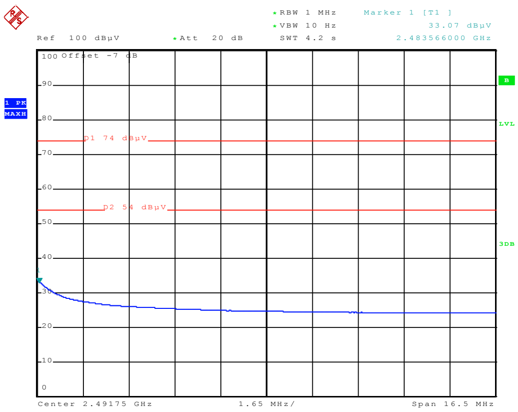


- Highest Channel (2 462 MHz)

PK



AV



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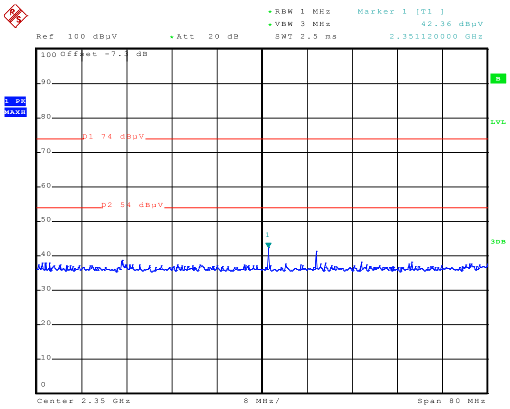
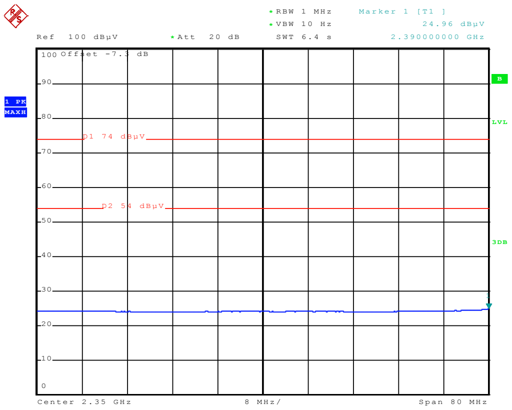
802.11g

- Lowest Channel (2 412 MHz)

PK

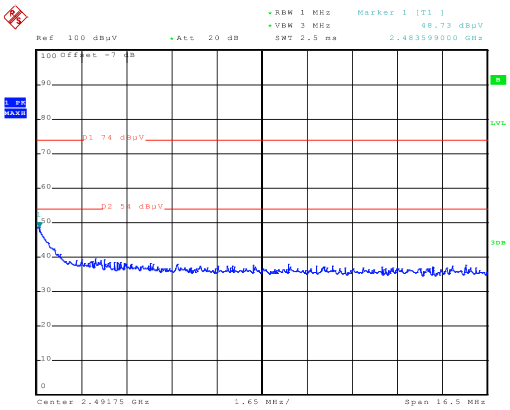


AV

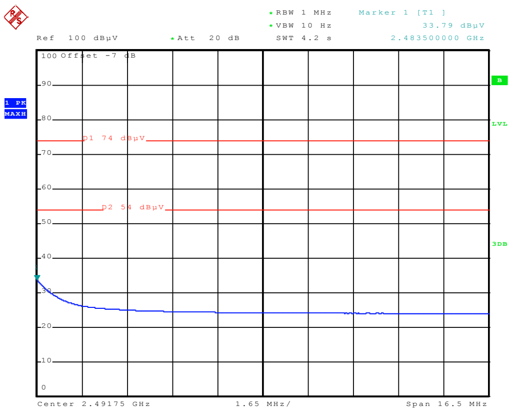


- Highest Channel (2 462 MHz)

PK



AV



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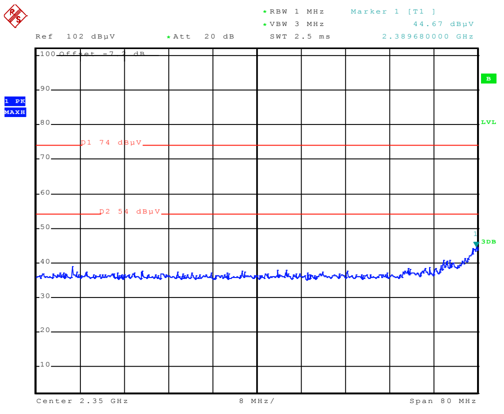
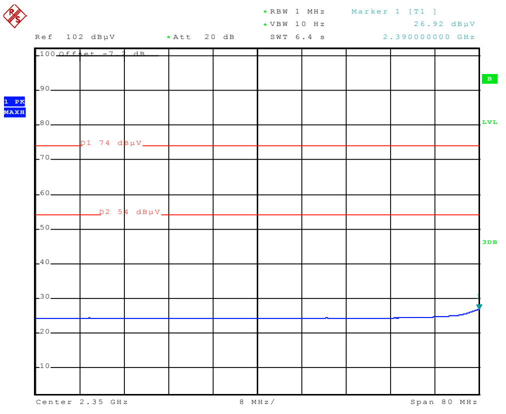
- Lowest Channel (2 412 MHz)

PK

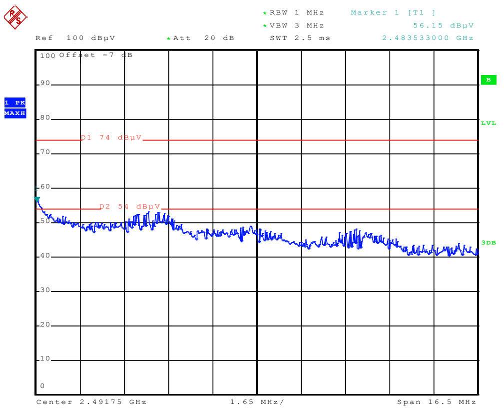


AV

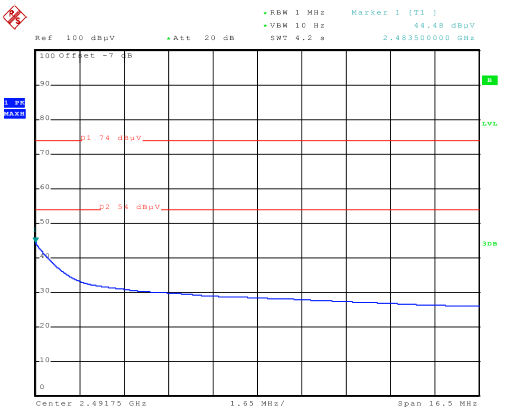


- Highest Channel (2 462 MHz)

PK



AV



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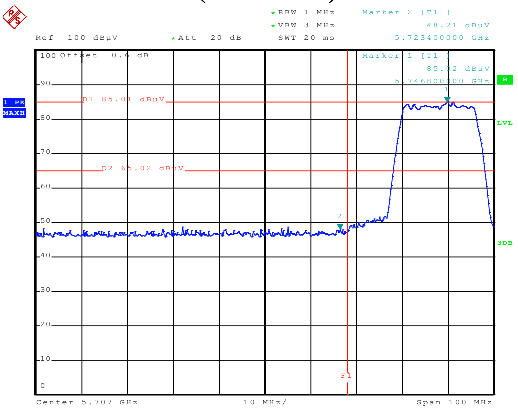
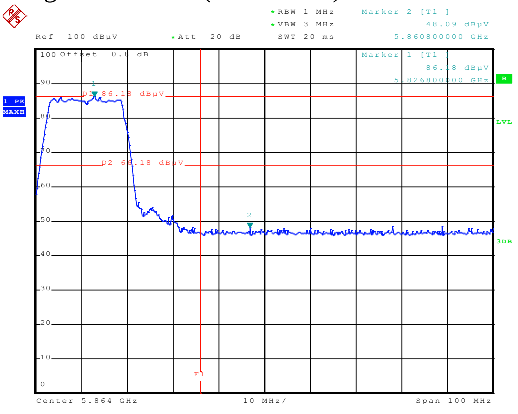
- Lowest Channel (5 745 MHz)



- Highest Channel (5 825 MHz)



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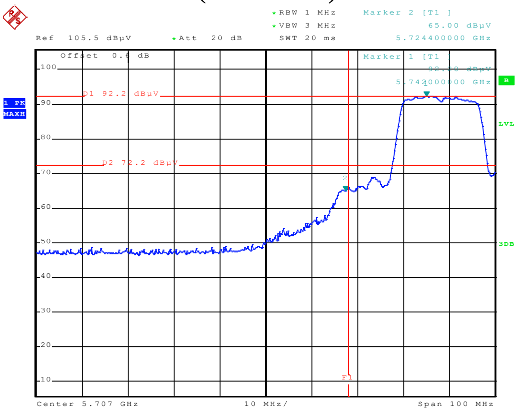
- Lowest Channel (5 745 MHz)



- Highest Channel (5 825 MHz)

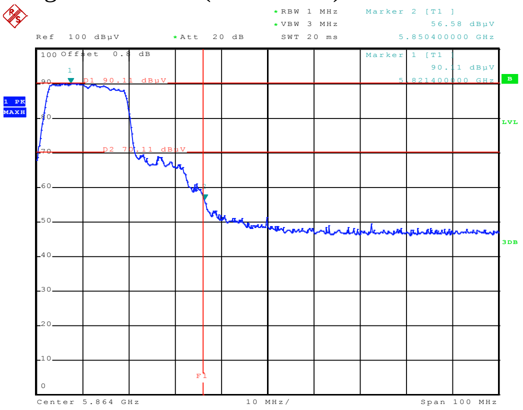


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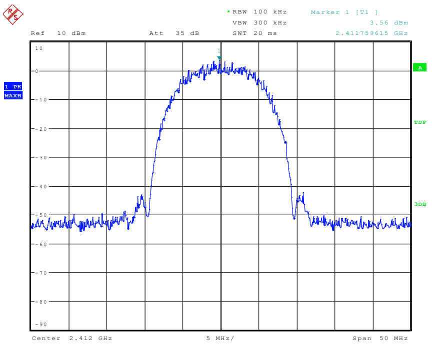
Figure 4. Plot of the Spurious RF conducted emissions

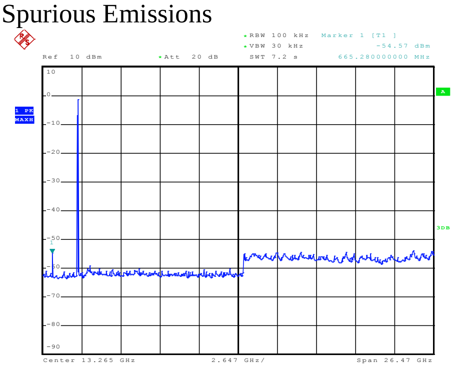
802.11b

Lowest Channel(2 412 MHz)

Reference

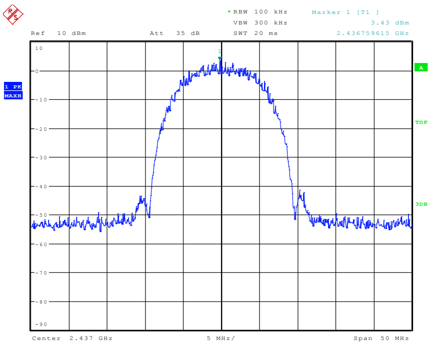


Spurious Emissions

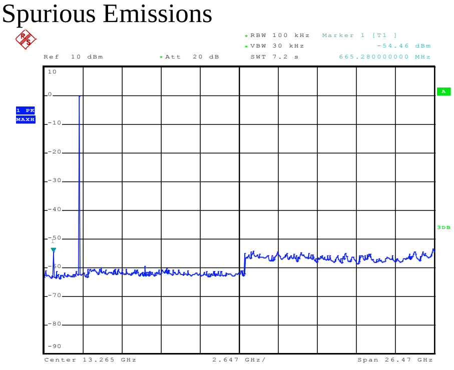


Middle Channel(2 437 MHz)

Reference

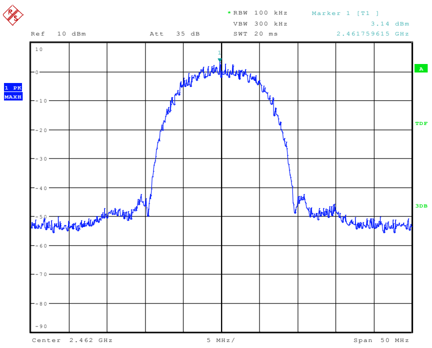


Spurious Emissions

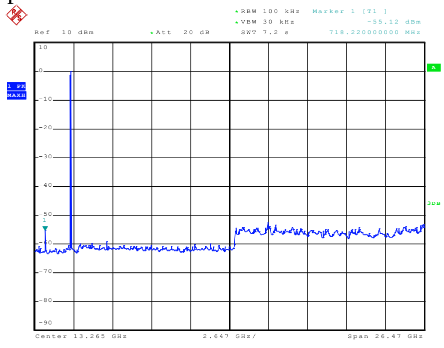


Highest Channel(2 462 MHz)

Reference



Spurious Emissions



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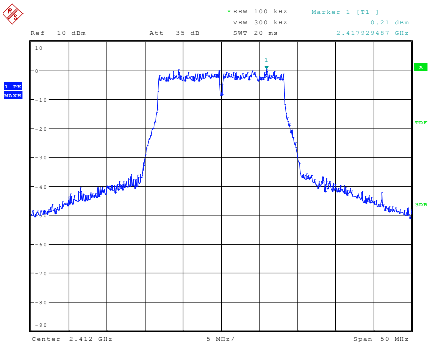
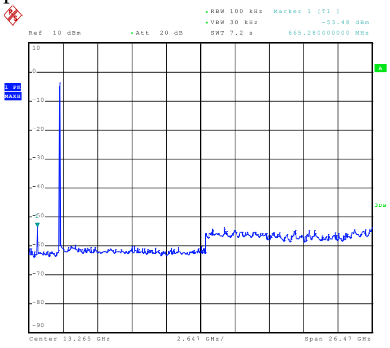
Lowest Channel(2 412 MHz)

Reference

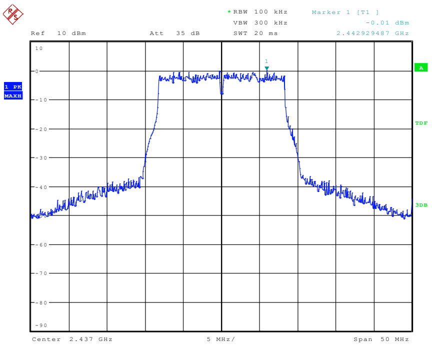


Spurious Emissions

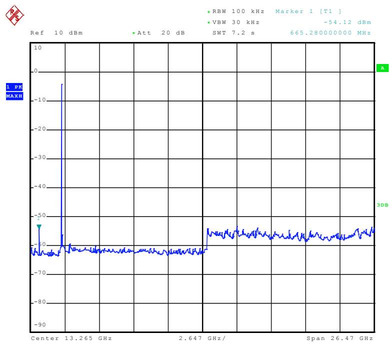


Middle Channel(2 437 MHz)

Reference

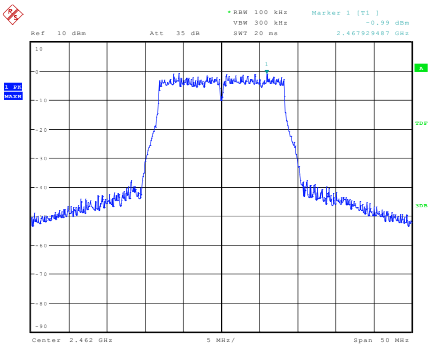


Spurious Emissions

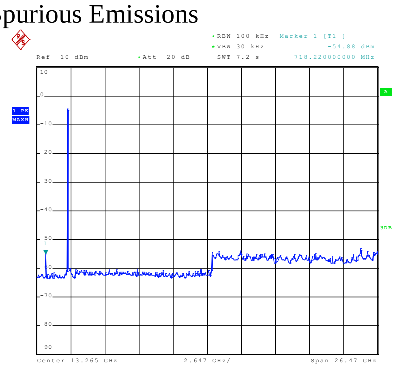


Highest Channel(2 462 MHz)

Reference



Spurious Emissions



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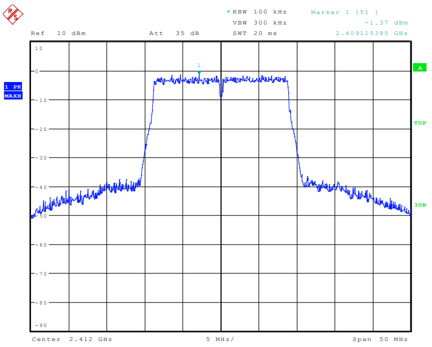
Lowest Channel(2 412 MHz)

Reference



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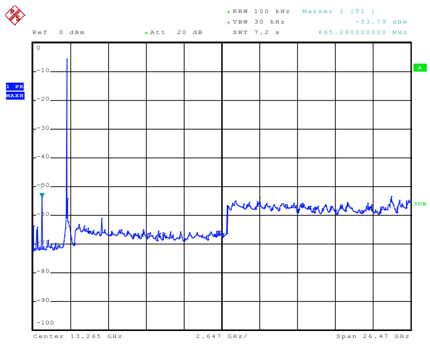
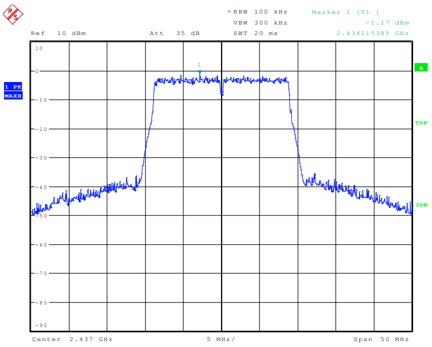
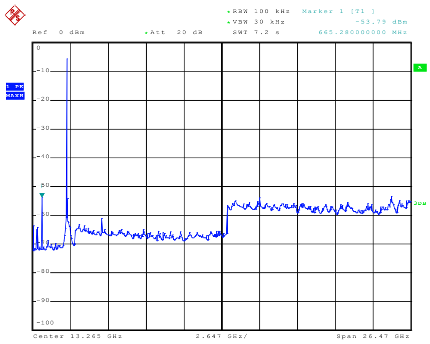


Middle Channel(2 437 MHz)

Reference

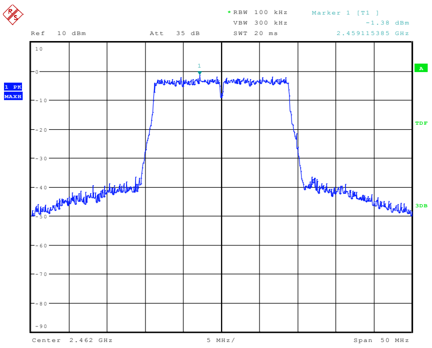


Spurious Emissions

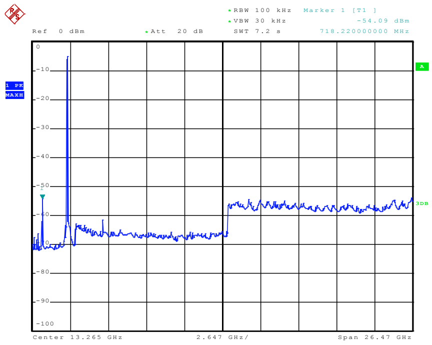


Highest Channel(2 462 MHz)

Reference



Spurious Emissions



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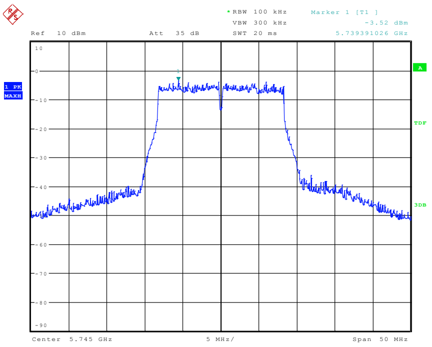
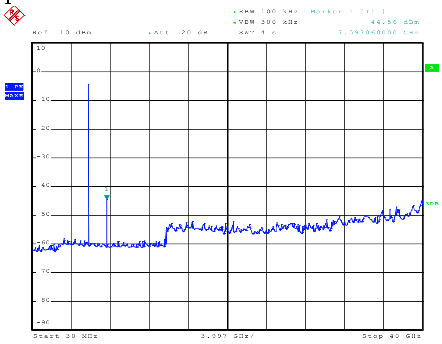
Lowest Channel(2 412 MHz)

Reference

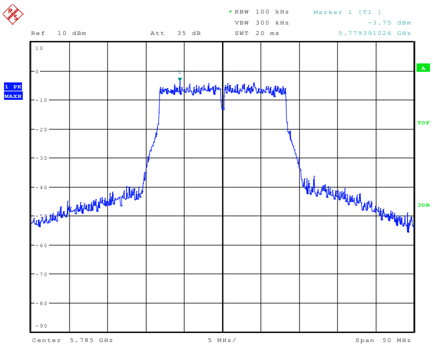


Spurious Emissions

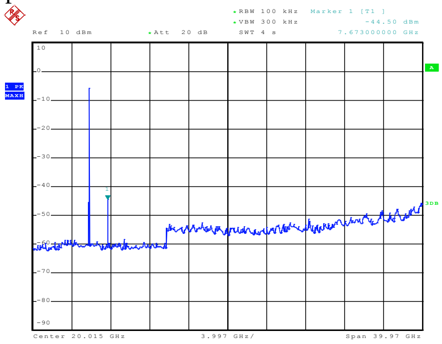


Middle Channel(2 437 MHz)

Reference

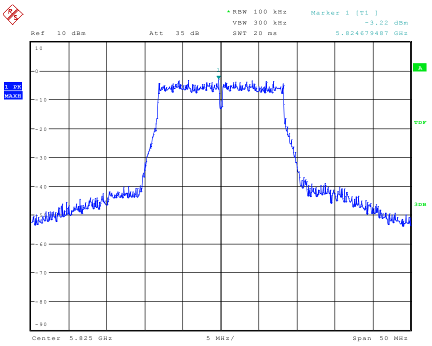


Spurious Emissions

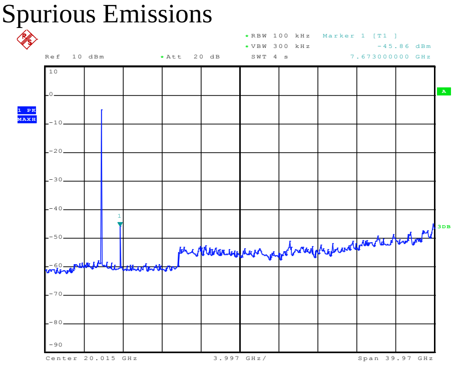


Highest Channel(2 462 MHz)

Reference



Spurious Emissions



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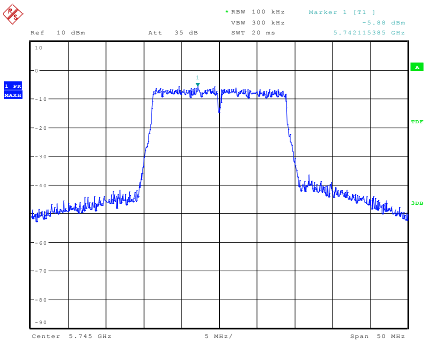
802.11an HT20

Lowest Channel(2 412 MHz)

Reference



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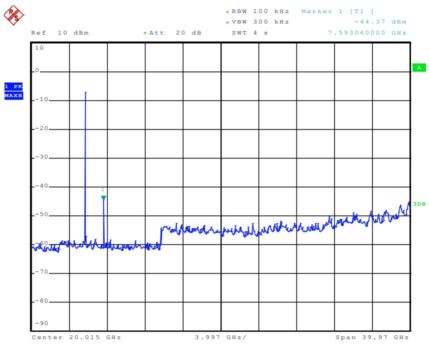
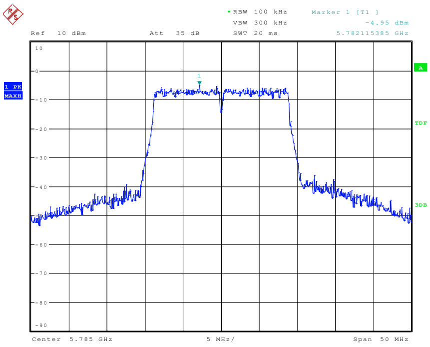
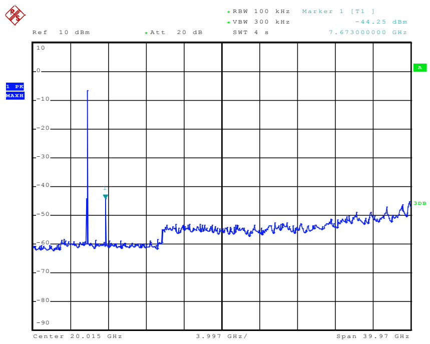


Middle Channel(2 437 MHz)

Reference

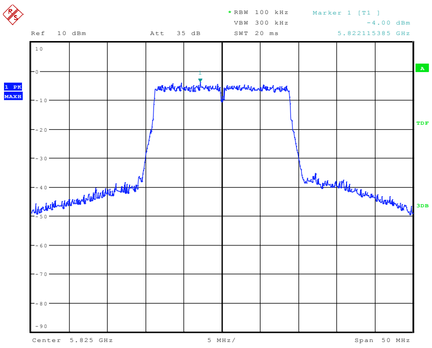


Spurious Emissions

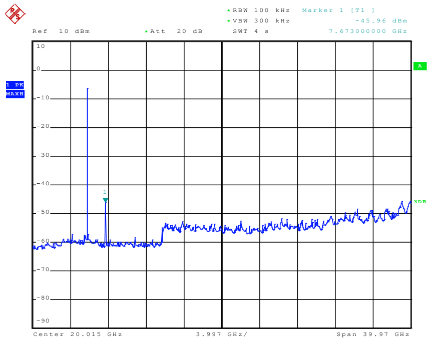


Highest Channel(2 462 MHz)

Reference



Spurious Emissions



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5.6 Conducted Emission

5.6.1 Regulation

According to §15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.5	66 to 56 *	56 to 46 *
0.5 – 5	56	46
5 – 30	60	50

* Decreases with the logarithm of the frequency.

According to §15.107(a), for unintentional device, except for Class A digital devices, line conducted emission limits are the same as the above table.

5.6.2 Measurement Procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a Spectrum Analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to PEAK amplitude within a bandwidth of 10 kHz or to QUASI-PEAK and AVERAGE within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

5.6.3 Test Result

-N/A

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5.7 RF Exposure

5.7.1 Regulation

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this Chapter.

Limits for Maximum Permissive Exposure: RF exposure is calculated.

Frequency Range	Electric Field Strength [V/m]	Magnetic Field Strength [A/m]	Power Density [mW/cm^2]	Averaging Time [minute]
Limits for General Population / Uncontrolled Exposure				
0.3 ~ 1.34	614	1.63	*(100)	30
1.34 ~ 30	824 /f	2.19/f	*(180/f^2)	30
30 ~ 300	27.5	0.073	0.2	30
300 ~ 1500	/	/	f/1500	30
1500 ~ 15000	/	/	1.0	30

*f=frequency in MHz, *= plane-wave equivalent power density*

MPE (Maximum Permissive Exposure) Prediction
Predication of MPE limit at a given distance: Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2 \qquad \left(\Rightarrow R = \sqrt{PG/4\pi S}\right)$$

S=power density [mW/cm^2]
P=Power input to antenna [mW]
G=Power gain of the antenna in the direction of interest relative to an isotropic radiator
R= distance to the center of radiation of the antenna [cm]

5.7.2 RF Exposure Compliance Issue

The information should be included in the user's manual:
This appliance and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter. A minimum separation distance of 20 cm must be maintained between the antenna and the person for this appliance to satisfy the RF exposure requirements.

5.7.3 Result of RF Exposure

-Refer to SAR test report

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6. Test equipment used for test

	Description	Manufacture	Model No.	Serial No.	Next Cal Date.
□	Temp & humidity chamber	Taekwang	TK-04	TK001	13.12.07
□	Temp & humidity chamber	Taekwang	TK-500	TK002	13.09.03
□	Frequency Counter	HP	53150A	US39250565	13.09.04
□	Spectrum Analyzer	Agilent	E4440A	MY46186407	14.06.27
■	Spectrum Analyzer	R & S	FSG13	100051	13.10.23
■	Signal Generator	R & S	SMR40	100007	14.06.27
□	Vector Signal Generator	R & S	SMBV100A	257566	14.01.07
■	Wideband Power Sensor	R & S	NRP-Z81	100677	14.05.06
□	Modulation Analyzer	HP	8901B	3538A05527	13.10.25
□	Audio Analyzer	HP	8903B	3729A19213	13.10.23
□	AC Power Supply	Kikusui	PCR2000W	GB001619	13.10.23
■	DC Power Supply	Tektronix	PS2520G	TW50517	14.03.12
□	DC Power Supply	Tektronix	PS2521G	TW53135	13.10.23
□	Attenuator	HP	8494A	2631A09825	13.10.24
□	Attenuator	HP	8496A	3308A16640	13.10.24
□	Attenuator	BIRD	50-A-MFN-20	0403002	13.10.24
□	Power Divider	Weinschel	1580-1	NX375	13.10.23
□	Power Divider	Weinschel	1580-1	NX380	13.09.09
□	Power Divider	Weinschel	1594	671	13.09.10
□	Power Divider	Krytar	7005265	143244	13.09.03
■	EMI Test Receiver	R&S	ESCI	100710	13.11.06
■	LOOP Antenna	EMCO	EMCO6502	9205-2745	14.05.23
■	BILOG Antenna	Schwarzbeck	VULB 9168	9168-440	13.09.21
■	HORN Antenna	ETS	3115	00086706	13.11.21
■	HORN Antenna	ETS	3116	00086632	13.11.15
■	Amplifier	Sonoma	310N	293004	13.11.06
■	Amplifier	Agilent	8449B	3008A01802	14.05.06
■	Attenuator	HP	8491A	27444	13.11.06
■	Antenna Mast	Innco Systems	MA4000-EP	303	-
■	Turn Table	Innco Systems	DT2000S-1t	079	-
□	Highpass Filter	Wainwright	WHK2.5/ 18G-10SS	61	14.04.12
□	Highpass Filter	Wainwright	WHKX6.5/ 18G-8SS	2	14.06.05
□	Test Receiver	R & S	843276/003	ESHS10	14.06.15
□	LISN	R & S	100267	ESH3-Z5	13.07.05
□	LISN	Schwarzbeck	8121-472	NNLK8121	13.07.13

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